



Illicit Discharge Detection and Elimination Plan DRAFT

Wayland, Massachusetts

EPA NPDES Permit Number: BRPWM08A

PREPARED BY:



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TABLE OF CONTENTS

<u>Section</u>	<u>Page</u>
1 INTRODUCTION.....	1
1.1 MS4 Program.....	1
1.2 Illicit Discharges.....	1
1.3 Allowable Non-Stormwater Discharges.....	2
1.4 Receiving Waters and Impairments.....	3
1.5 IDDE Program Goals, Framework, and timeline.....	4
1.6 Work Completed To Date.....	5
2 IDDE RESPONSIBILITIES.....	7
2.1 Legal Authority.....	7
2.2 Responsible Teams.....	7
2.3 Proposed Coordination Efforts.....	7
3 TOWN OF WAYLAND STORMWATER MAPPING.....	8
3.1 Mapping Updates.....	8
3.2 IDDE Mapping Requirements: Phase 1.....	8
3.3 IDDE Mapping Requirements: Phase 2.....	8
3.4 Outfall Inventory.....	9
3.4.1 Permit Year 2 Outfall Inventory Update.....	9
4 SANITARY SEWER OVERFLOWS (SSOs).....	10
5 ASSESSMENT AND RANKING OF OUTFALLS AND INTERCONNECTIONS.....	12
5.1 Outfall Catchment Delineations.....	12
5.2 Classify and Rank Outfalls.....	12
5.2.1 Problem Outfalls.....	13
5.2.2 High Priority Outfalls.....	14
5.2.3 Low Priority Outfalls.....	14
5.2.4 Excluded Outfalls.....	15
5.3 Preliminary Outfall Ranking.....	15
6 DRY WEATHER SCREENING AND SAMPLING.....	16
6.1 Weather Conditions.....	16
6.2 Dry Weather Screening/Sampling Procedure.....	16
6.2.1 General Procedure.....	16
6.2.2 Field Equipment.....	18
6.2.3 Sample Collection and Analysis.....	19
6.3 Interpreting Outfall Sampling Results.....	22
6.4 Follow-Up Ranking of Outfalls and Interconnections.....	23
7 CATCHMENT INVESTIGATIONS.....	24
7.1 System Vulnerability Factors.....	24
7.2 Dry Weather Manhole Inspections.....	27
7.3 Wet Weather Outfall Sampling.....	28
7.4 Source Isolation and Confirmation.....	29

7.4.1	Sandbagging	29
7.4.2	Dye Testing	30
7.4.3	CCTV Inspections	30
7.5	Illicit Discharge Removal.....	30
7.5.1	Confirmatory Outfall Screening.....	31
7.6	Ongoing Screening	31
8	TRAINING.....	32
9	PROGRESS REPORTING.....	33
10	REFERENCES.....	34

TABLES

1	Impaired Waters Wayland, Massachusetts
2	IDDE Program Implementation Timeline
3	MS4 Categorization Scenarios
4	Sanitary Sewer Overflow Inventory
5	Overview of Outfall Categorization
6	Outfall Observations and Possible Sources
7	Field Equipment – Dry Weather Outfall Screening and Sampling
8	Field Sampling Analyses
9	Sampling Parameters and Analysis Methods
10	Required Analytical Methods, Detection Limits, Hold Times, and Preservatives
11	IDDE Schedule for Completion of Catchment Investigations
12	Outfall Catchment System Vulnerability Factor (SVF) Inventory

FIGURES

1	IDDE Investigation Procedure Framework
2	IDDE Plan Training for DPW Staff June 2019

APPENDICES

A.	Legal Authority
B.	Storm Sewer System Mapping
C.	NSP Outfall Inventory and Prioritization Tool
D.	Preliminary Outfall Ranking
E.	Inspection Field Forms and Sampling Procedures
F.	Analytical Testing Methods – Impaired Waters
G.	IDDE Employee Training Record

Definitions

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

Catch basin: A chamber or well, usually built to the curb line of a street that allows surface water to discharge into a storm water drain.

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

Discharge of Pollutants: The addition of any pollutant or combination of pollutants into the municipal storm drain system or into the waters of the United States or Commonwealth from any source.

Groundwater: Water beneath the surface of the ground.

Illicit Connection: A surface or subsurface drain or conveyance, which allows an illicit discharge into the municipal storm drain system, including without limitation sewage, process wastewater, or wash water and any connections from indoor drains, sinks, or toilets, regardless of whether said connection was previously allowed, permitted, or approved before the effective date of bylaws enacted to prohibit such discharges.

Illicit Discharge: Direct or indirect discharge to the municipal storm drain system that is not composed entirely of stormwater, except as exempted by the EPA's Phase II regulations.

Manhole – Sewer system structure typically made from brick, concrete block, or monolithic concrete sections. Manholes have solid covers that do not accept runoff like a catch basin. Manholes within a storm sewer system are installed typically at bends in pipe runs, every 300 feet to 400 feet within a storm sewer pipe run, intersections of two or more pipe runs, and at the ends of pipe runs. Manholes allow for the cleaning and inspection of storm sewer systems. Manholes are typically 'fed' stormwater by catch basins and upstream storm sewer pipes.

Junction Manhole – Under the 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.

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

National Pollutant Discharge Elimination System (NPDES) Stormwater Discharge Permit: A permit issued by United States Environmental Protection Agency or jointly with the Commonwealth of Massachusetts that authorizes the discharge of pollutants to waters of the United States.

Non-Stormwater Discharge: Discharge to the municipal storm drain system not composed entirely of stormwater.

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

Pollutants shall include without limitation:

- (1) paints, varnishes, and solvents;
- (2) oil and other automotive fluids;
- (3) non-hazardous liquid and solid wastes and yard wastes;
- (4) refuse, rubbish, garbage, litter, or other discarded or abandoned objects, , accumulations and floatables;
- (5) pesticides, herbicides, and fertilizers;
- (6) hazardous materials and wastes; sewage, fecal coliform and pathogens;
- (7) dissolved and particulate metals;
- (8) animal wastes;
- (9) rock; sand; salt, soils;
- (10) construction wastes and residues;
- (11) and noxious or offensive matter of any kind.

Stormwater: Runoff from precipitation or snow melt.

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

Outfall – means a point source where a municipal separate storm sewer discharges to waters of the United States. *Point source* means a discernible, confined, and discrete conveyance, including but not limited to, any pipe, ditch, channel, tunnel, conduit, (also bridge drains); this term does not include return flows from irrigated agriculture or agricultural storm water runoff.

Storm sewer - A sewer that carries only surface runoff, street wash, and snow melt from the land. In a separate sewer system, storm sewers are separate from those that carry domestic and commercial wastewater (sanitary sewers).

Acronyms

BMP – Best Management Practice

USEPA – United States Environmental Protection Agency

GIS – Geographic Information System

GPS – Global Positioning System

IDDE – Illicit Discharge Detection and Elimination

MassDEP – Massachusetts Department of Environmental Protection

MassDOT – Massachusetts Department of Transportation

MS4 – Municipal Separate Storm Sewer System

NOI – Notice of Intent

NPDES – National Pollutant Discharge Elimination System

SWMP – Storm Water Management Plan

1 INTRODUCTION

1.1 MS4 PROGRAM

This Illicit Discharge Detection and Elimination (IDDE) Plan has been developed by the Town of Wayland 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, except for 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.

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 wash water or old household products, in many cases due to a lack of understanding on the part of the homeowner.

Elimination of some discharges may require substantial costs and efforts, such as funding and designing a project to reconnect sanitary sewer laterals. Others, such as improving self-policing of dog waste management, can be accomplished by outreach in conjunction with the minimal additional cost of dog waste bins and the municipal commitment to disposal of collected materials on a regular basis.

Regardless of the intention, when not addressed, illicit discharges can contribute high levels of pollutants, such as heavy metals, toxics, oil, grease, solvents, nutrients, and pathogens to surface waters.

1.3 ALLOWABLE NON-STORMWATER DISCHARGES

The following categories of non-stormwater discharges are allowed under the MS4 Permit unless the permittee, USEPA 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 in 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 the 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 lists the “impaired waters” within the boundaries of Wayland’s regulated area based on the 2016 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. Two waterbodies, Lake Cochituate (MA82125) and Sudbury River (MA82A-03), have bacteria/pathogen impairments, which means that outfalls discharging to either of these two waterbodies will automatically be ranked as a High Priority as discussed in Section 5.

Table 1: Impaired Waters Wayland, Massachusetts

Water Body Name	Segment ID	Category	Impairment(s)	Associated Approved TMDL
Dudley Pond	MA82029	5	(Eurasian Water Milfoil, Myriophyllum spicatum*), (Non-Native Aquatic Plants*), Dissolved Oxygen, Turbidity	N/A
Heard Pond	MA82058	5	(Non-Native Aquatic Plants*), Algae, Mercury in Fish Tissue, Transparency/Clarity	N/A
Hop Brook	MA82A-06	5	Dissolved Oxygen, Nutrient/Eutrophication Biological Indicators, Phosphorus (Total)	N/A
Lake Cochituate	MA82125	5	(Eurasian Water Milfoil, Myriophyllum spicatum*), (Non-Native Aquatic Plants*), Enterococcus, Dissolved Oxygen, PCB in Fish Tissue	N/A
Lake Cochituate	MA82020	5	(Eurasian Water Milfoil, Myriophyllum spicatum*), Dissolved Oxygen, PCB in Fish Tissue	N/A
Sudbury River	MA82A-04	5	(Non-Native Aquatic Plants*), Mercury in Fish Tissue	N/A
Sudbury River	MA82A-03	5	E. Coli, Mercury in Fish tissue	N/A

Category 4a Waters – impaired water bodies with a completed Total Maximum Daily Load (TMDL).

Category 4c Waters – impaired water bodies where the impairment is not caused by a pollutant. No TMDL required.

Category 5 Waters – impaired water bodies that require a TMDL.

“Approved TMDLs” are those that have been approved by EPA as of the date of issuance of the 2016 MS4 Permit.

*TMDL not required (non-pollutant)

1.5 IDDE PROGRAM GOALS, FRAMEWORK, AND TIMELINE

The goals of the IDDE program are to find and eliminate illicit discharges to the 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,
- Follow-up screening, and
- Employee training.

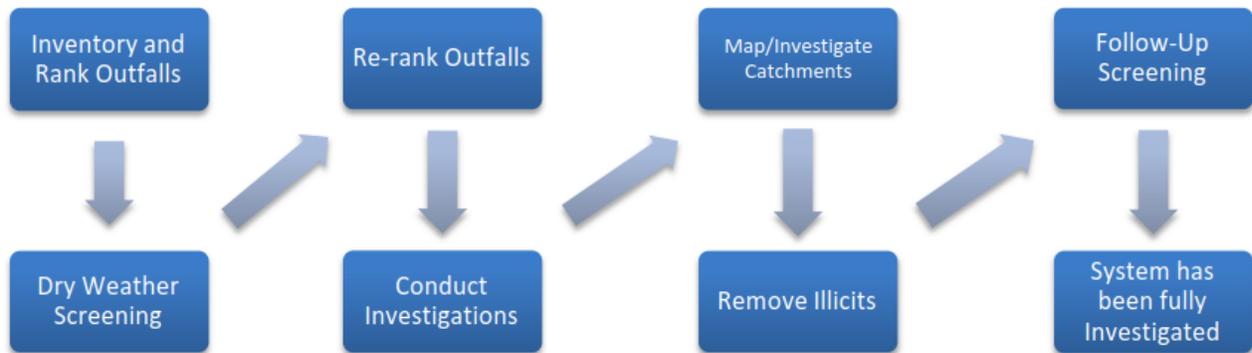
The required timeline for implementing the IDDE program is shown in **Table 2**, along with the Town of Wayland’s current status for each requirement. The IDDE investigation procedure framework is shown in Figure 1-1.

Table 2: IDDE Program Implementation Timeline

IDDE Program Requirement	Completion Date from Effective Date of Permit						Status
	1 Year	1.5 Years	2 Years	3 Years	7 Years	10 Years	
Written IDDE Program Plan	X						Completed
SSO Inventory	X						Completed
Written Catchment Investigation Procedure		X					Completed
Phase I Mapping			X				Completed
Phase II Mapping						X	In progress
IDDE Regulatory Mechanism or By-law (if not already in place)	X						In progress
Dry Weather Outfall Screening				X			In progress
Follow-up Ranking of Outfalls and Interconnections				X			Not started

IDDE Program Requirement	Completion Date from Effective Date of Permit						Status
	1 Year	1.5 Years	2 Years	3 Years	7 Years	10 Years	
Catchment Investigations – Problem Outfalls					X		Not started
Catchment Investigations – all Problem, High and Low Priority Outfalls						X	Not started

Figure 1: IDDE Investigation Procedure Framework



1.6 WORK COMPLETED TO DATE

The 2003 MS4 Permit required each MS4 community to develop a plan to detect illicit discharges using a combination of storm system mapping, adopting a regulatory mechanism to prohibit illicit discharges and enforce this prohibition, and identifying tools and methods to investigate suspected illicit discharges. Each MS4 community was also required to define how confirmed discharges would be eliminated and how the removal would be documented.

The Town of Wayland has completed the following IDDE program activities consistent with the 2003 MS4 Permit requirements:

- Developed a map of outfalls and receiving waters.
- Developed an IDDE bylaw or regulatory mechanism, with anticipated update in 2020
- Developed procedures for locating illicit discharges (i.e., visual screening of outfalls for dry weather discharges, dye testing, CCTV).
- Developed procedures for locating the source of the discharge.
- Developed procedures for removal of the source of an illicit discharge.

- Developed procedures for documenting actions and evaluating impacts on the storm sewer system subsequent to removal.

In addition to the 2003 MS4 Permit requirements, other IDDE-related activities that have been completed include:

- SSO inventory
- Additional storm system mapping, including the locations of catch basins, manholes and pipe connectivity

2 IDDE RESPONSIBILITIES

2.1 LEGAL AUTHORITY

The Town of Wayland has adopted a Stormwater and Land Disturbance By-Law (By-Law), Chapter 193 (Revised April 6, 2015) to define illicit discharges. A copy of the Bylaw is provided in **Appendix A**. While the By-Law defines illicit discharges, updated language is required to address the following:

- 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.

Wayland is currently reviewing their by-law and working to amend it to fully support the IDDE plan.

2.2 RESPONSIBLE TEAMS

The Department of Public Works (DPW) will be the lead agency in charge of implementing the IDDE program as stated here and in the By-Law included in **Appendix A**. The DPW will be responsible for administering all aspects of the IDDE program and will ask for input from other departments.

2.3 PROPOSED COORDINATION EFFORTS

The Stormwater Management Program Team, as described in the Stormwater Management Plan, will coordinate the Town-wide efforts for adherence to the permit. The DPW employees will be appropriately trained to complete field inspection including dry weather screening and sampling and catchment investigations. Other Town departments such as the Board of Health and the Building Department will assist with providing relevant records. If there is a need for enforcement action, the DPW will work directly with the Board of Selectmen. When the current By-Law is updated, the regulatory chain of command will be updated to include all responsible parties.

3 TOWN OF WAYLAND STORMWATER MAPPING

3.1 MAPPING UPDATES

The Town of Wayland originally developed mapping of its stormwater system to meet the mapping requirements of the 2003 MS4 Permit. An updated map, which included updated GIS data, was included in the Notice of Intent (NOI) submitted to EPA in September 2018. Since the NOI map submission, the DPW has been updating and improving the GIS data to include drainage pipes, catch basins, manholes, and updated outfall information. A copy of the existing storm sewer system map, which uses GIS data as of June 2019, is provided in **Appendix B**. This map contains all of the requirements of the Phase 1 Map as described below.

The 2016 MS4 Permit requires the storm sewer system map to be updated in two phases as outlined below. The DPW's GIS Coordinator is responsible for updating the stormwater system mapping pursuant to the 2016 MS4 Permit. The Town of Wayland will report on the progress towards completion of the storm sewer system map in each annual report. Updates to the stormwater mapping will be included in **Appendix B**.

3.2 IDDE MAPPING REQUIREMENTS: PHASE 1

Phase 1 of the mapping must be completed within two years of the permit's effective date, containing the following information:

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

3.3 IDDE MAPPING REQUIREMENTS: PHASE 2

Phase II mapping must be completed within ten (10) years of the effective date of the permit (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).

3.4 **OUTFALL INVENTORY**

The Town of Wayland spent time and effort since the permit became effective to update the MS4 system map. The outfalls included in this IDDE Plan are based on analysis of the most recent GIS data from June 2019. The June 2019 inventory included a total of 228 outfalls, which represented a significant increase since the NOI submission in 2018. However, the Town spent additional time and effort since June 2019 to analyze these outfalls and determine which are part of the MS4 system.

3.4.1 **Permit Year 2 Outfall Inventory Update**

These 228 outfalls were reviewed via ArcMap. Their MS4 status was determined using the guidance in Table 3. If their status could not be determined (signified as “unknown” below), they were flagged for field investigations and maintained on the MS4 list. In the future, as more information becomes available and the Town conducts field investigations to confirm whether these are MS4 outfalls, their status will be updated in accordingly in the outfall inventory.

The 228 outfalls identified and reviewed were categorized into the following three categories:

- 51 Non-MS4 Outfalls
- 167 MS4 Outfalls
- 10 Outfalls with unknown MS4 status.

The 10 unknown outfalls are included in the inventory to be conservative, and they will be removed as applicable during field investigations. Based on this analysis, this IDDE Plan documents the requirements for the **177 outfalls** that are listed as both MS4 and unknown.

Table 3 MS4 Categorization Scenarios

Example Scenario	Categorization	Rationale
Outfall discharging to isolated wetland	Non-MS4	Not discharging to a water of US or MA
Outfall discharge becomes non-point flow before or is across a flow barrier from a jurisdictional water	Non-MS4	Not a point source discharge

Example Scenario	Categorization	Rationale
Outfall discharging not directly to water, but discharges to top of bank or flow otherwise expected to discharge to jurisdictional water/wetland	MS4	Outfall likely to create channelized flow to water of US/MA
Outfall is actually a culvert pipe that connects water bodies	Not an Outfall	Does not discharge stormwater to a water body

4 SANITARY SEWER OVERFLOWS (SSO_s)

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.

The Town of Wayland has completed an inventory of SSOs that have discharged to the MS4 within the five (5) years prior to the effective date of the 2016 MS4 Permit, based on review of available documentation pertaining to SSOs (**Table 4**). The inventory includes all SSOs that occurred during wet or dry weather resulting from inadequate conveyance capacities or where interconnectivity of the storm and sanitary sewer infrastructure allows for transfer of flow between systems.

Upon detection of an SSO, the Town of Wayland 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 will provide verbal notice to EPA within 24 hours and written notice to EPA and MassDEP within five (5) days.

The inventory in **Table 4** will be updated by the DPW when 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.

Table 4: Sanitary Sewer Overflow Inventory

SSO Location ¹	Discharge Statement ²	Date ³	Time Start ³	Time End ³	Estimated Volume ⁴	Description ⁵	Mitigation Completed ⁶	Mitigation Planned ⁷
292 Boston Post Road, Wayland, MA 01778	Discharge to paved surface, private catch basin	October 19, 2016	3:40 PM	5:20 PM	3000 gallons	Equipment failure	Repairs completed	
268 Boston Post Road, Wayland, MA 01778*	Discharge to paved surface, MassDOT catch basin	March 13, 2017	Unknown	Unknown	Unknown	Leak from monitoring well installation	Repairs completed	
19 Pelham Island Road, Wayland, MA 01778*	Discharge to paved surface	April 14, 2017	Unknown	Unknown	Unknown	Back-up to private pump station	Unknown	
19 Pelham Island Road, Wayland, MA 01778*	Discharge to paved surface	June 29, 2017	Unknown	9:00 AM	<50 gallons	Back-up to private pump station	Check valve in service replaced	
Town Center Wastewater Treatment Plant, 185 Elissa Avenue Wayland, MA 01778	Discharge to infiltration basin at plant	January 27 and 28, 2018	Not constant 1/27 8:00 AM	Not constant 1/28 12:00 PM	750 gallons	Failure of private user plumbing, leading to excessive influent flows	Modified plant operational criteria to allow for increased influent flows to be processed	
Town Center Wastewater Treatment Plant, 185 Elissa Avenue Wayland, MA 01778	Discharge to infiltration basin at plant	November 3, 2018	3:30 PM	3:40 PM	<500 gallons	Power spike tripped electrical equipment. Pumping equipment did not restart	Electrical equipment was reprogrammed to allow for equipment to restart	
267 Boston Post Road, Wayland, MA	Discharge to trench	May 8, 2019	11:00 PM	11:01 PM	10 gallons	Construction of water main disturbed service connection.	Repair made to sewer service.	

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 RANKING OF OUTFALLS AND INTERCONNECTIONS

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 outfall¹ or interconnection². The catchments for each of the MS4 outfalls will be delineated to define contributing areas for investigation of potential sources of illicit discharges. Catchments can be 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 CLASSIFY AND RANK OUTFALLS

The 2016 MS4 Permit, Part 2.3.4.7.a, specifies the four categories in which all the MS4 outfalls should be categorized and the characteristics that can help make that determination, as shown in **Table 5**.

To rank the MS4 outfall, the following information was used:

- the Town’s existing outfall GIS data,
- conversations with Town’s staff,
- Neponset Stormwater Partnership (NSP) IDDE Outfall Inventory and Prioritization Tool (the Outfall Tool).

The Outfall Tool is a Microsoft Excel spreadsheet that ranks outfalls, and their respective catchments, based on criteria pulled directly from the Permit. Some fields in the spreadsheet were filled using GIS, while others were filled using local knowledge of the stormwater system

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.

and the Town. The outfall prioritization was completed by following the methods and procedures detailed in NSP’s Instructions and Background Outfall Inventory and Prioritization Tool (**Appendix C**).

Several changes were made to the Outfall Tool to accommodate information available and specific to Wayland:

- The formula for determining the priority category was adjusted because all the outfalls in Wayland were categorized as High priority before the adjustment
- A new column was added to capture outfalls that discharge into the two waterbodies in Wayland impaired for bacteria or pathogens. Outfalls discharging in Sudbury River (MA82A-03) and Lake Cochituate (MA82125) were automatically categorized as High Priority outfalls.
- A new column was added to capture outfalls in Zone I and Zone II protection areas. Outfalls in Zone I or Zone II areas were automatically categorized as High Priority outfalls.

The results of the outfall classification are summarized in **Table 5** and discussed below.

Table 5: Overview of Outfall Categorization

Category	Description	Quantity of Outfalls in Category
PROBLEM	Known or suspected illicit discharge. This designation is given to any outfall where non-stormwater discharge is suspected from the dry weather inspections (or prior reports).	None
HIGH	High potential for illicit discharge / High priority for investigation.	104
LOW	Low potential for illicit discharge / Low priority for investigation.	73
EXCLUDED	No potential for illicit discharge / No needed investigation.	None

Under the 2016 MS4 Permit requirements, Wayland is required to complete dry weather screening of all High and Low Priority Outfalls and ranking of outfalls by the end of Year 3.

5.2.1 Problem Outfalls

Problem outfalls are determined based on currently available outfall information and institutional knowledge about the existence of an illicit discharge. As described by Section 2.3.4.7.a.ii of the MS4 Permit, Problem outfall indicators include:

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

All Problem outfalls represent an illicit discharge which must be immediately eliminated. The screening process to confirm an illicit discharge is included in Section 6. If a discharge cannot be eliminated within 60 days, the Town of Wayland is required to establish an elimination schedule, as well as record the progress in its annual reports. 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.

Wayland currently has **no Problem** outfall(s).

5.2.2 High Priority Outfalls

High Priority outfalls are outfalls that have a higher likelihood of contributing to an illicit discharge. All High Priority outfalls must be screened within the first three years of the Permit effective date, following the procedures detailed in Section 6.

Outfalls that drain to impaired waterbodies, are near public recreational areas, or are near drinking water wells are considered to have a high priority in the IDDE ranking. This means that they have a higher likelihood of contributing an illicit discharge. Additionally, the following factors must be considered (although not all may apply) when classifying an outfall as a High Priority Outfall:

- Past discharge complaints or reports
- Poor receiving water quality
- Density of generating sites, such as institutional, municipal, commercial, or industrial sites with potential to generate pollutants that could contribute to illicit discharges- for example: car dealers, car washes, garage/gas stations, garden centers, industrial manufacturing, residential areas with swimming pools
- Age of surrounding development and infrastructure
- Sewer conversion from septic areas
- Historic combined sewer areas
- Surrounding density of aging septic system
- Long stretches of culverted streams
- Water quality limited waterbodies or waters with approved TMDLs that receive a discharge from the MS4
- Any additional characteristics that the Town considers relevant.

104 outfalls in Wayland are classified as **High Priority** outfalls because they either discharge into a waterbody impaired for bacteria/pathogens, are in a Zone I or Zone II protection area, are within 100 meters from recreational areas, or are within 500 meters from a public beach. The Town of Wayland will start the dry weather screening process with these High priority outfalls.

5.2.3 Low Priority Outfalls

Low priority outfalls are the remaining outfalls with a chance for illicit discharge, but that are not classified as High or Problem outfalls based on the available data. There are currently **73**

Low Priority outfalls in the Town. Most of these outfalls will be screened after the High priority outfalls, but not later than July 30, 2021.

5.2.4 Excluded Outfalls

Any outfall with no potential for illicit discharge is considered an Excluded outfall and does not need to be considered as a part of the IDDE Plan. This category includes outfalls leading to roadway drainage in undeveloped areas, athletic field drainage, undeveloped green space or parking without services, or alignments through undeveloped land. Wayland has **no Excluded** outfalls.

5.3 PRELIMINARY OUTFALL RANKING

The Outfall Tool can sort the records in the spreadsheet either by priority category or dry weather screening priority. For this IDDE Plan, the latter was chosen to help Wayland target outfall screening and sampling by stream reach. This will allow field crews to proceed quickly down the length of one stream and ensures that each day's samples will need to be tested by the same parameters based on the stream's impairments. The Preliminary Outfall Ranking is included in **Appendix D**.

6 DRY WEATHER SCREENING AND SAMPLING

According to the Permit, all outfalls and interconnections (except for Problem and Excluded Outfalls) need to be inspected for the presence of dry weather flow within three (3) years of the permit effective date. Using the outfall ranking discussed in Section 5, and working from High to Low priority, the Town will screen, and sample where appropriate, all High and Low priority outfalls before July 2021. The presence of dry weather flow can be a strong indicator of an illicit connection, and this screening is a logical starting point for identifying potential areas of concern.

6.1 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 closest National Weather Service Station, which is located at Heard Farm – Pelham Island in Wayland (KMAWAYLA4). If Heard Farm – Pelham Road is not available or not reporting current weather data, the Town will use Nobscot in Framingham (KMAFRAMI57) as a backup.

6.2 DRY WEATHER SCREENING/SAMPLING PROCEDURE

6.2.1 General Procedure

The dry weather outfall inspection and sampling procedure consists of the following general steps:

1. Identify outfall(s) to be screened/sampled based on initial outfall inventory and priority ranking.
2. Acquire the necessary staff, mapping, and field equipment (see **Table 7** for list of potential field equipment).
3. Conduct the outfall inspection during dry weather:
 - a. Mark and photograph the outfall.
 - b. Record the inspection information and outfall characteristics (see form in **Appendix E**).
 - c. 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.
4. If flow is observed, sample and test in accordance with the procedures described in the following sections and **Appendix E**. At a minimum, the flow will be sampled and tested for the following minimum parameters:

<input type="checkbox"/> Temperature	<input type="checkbox"/> Surfactants (as MBAS)
<input type="checkbox"/> Conductivity	<input type="checkbox"/> Ammonia
<input type="checkbox"/> Turbidity	<input type="checkbox"/> Chlorine
<input type="checkbox"/> E. coli (freshwater receiving water) or enterococcus (if saline or brackish receiving water)	

Note: If the discharge is directly into an impaired water (see Table 1), then the flow must also be tested for the pollutants identified as causing the impairment for that water body (e.g., metals, nitrogen, phosphorus, oil and grease, etc.)- see Appendix F for requirements for Impaired Water testing.

5. 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.
6. Input results from screening and sampling into spreadsheet/database. Include pertinent information in the outfall/interconnection inventory and priority ranking.
7. Include all screening data in the Annual Report.

Dry weather flow is a strong indicator of illicit discharges, but it is not the only physical sign of potential illicit connections. Taking careful note of the conditions around the outfall is critical to finding non-stormwater discharges. Illicit discharges can be intermittent or sporadic. Other indicators of past flow may be present even if there is no active dry weather flow at the time of the field visit. **Table 6** is still a helpful reminder for understanding confusing field observations. This table, originally adapted from Pitt et al. 1993, was modified for the Town’s use in 2019.

Table 6: Outfall Observations and Possible Sources

Parameter	Observations	Possible Reason/Source
Odor	Sewage	Stale sanitary wastewater, especially pooled near outfall
	Sulfur (rotten eggs)	Industries discharge sulfide components or organics (meat packers, canneries, dairies, etc.). Also, could be petroleum related "high-sulfur" fuels.
	Rancid-sour	Food preparation facilities (restaurants, hotels, etc.)
	Oil and gas	Petroleum refineries or many facilities associated with vehicle maintenance or petroleum product storage
	Chlorine	Residential pool, or drinking water, likely not recurrent
Color	Yellow	Chemical plants, textile and tanning plants

Parameter	Observations	Possible Reason/Source
	Brown	Meat packers, printing plants, metal works, stone and concrete, fertilizers, and petroleum refining facilities.
	Green	Chemical plants, textile facilities
	Red	Metal packers, metal works
	Gray	Dairies, and sewage
Turbidity	Cloudy	Sanitary wastewater, concrete or stone operations, fertilizer facilities, and automotive dealers
	Opaque	Food processors, lumber mills, metal operations, pigment plants
Floatable Matter	Oil sheen, grease	Petroleum refineries or storage facilities and vehicle service facilities, and restaurants
	Sewage/toilet paper	Sanitary wastewater
	Soap/bubbles	Sanitary wastewater
Deposits and Stains	Sediment	Construction site erosion
	Oily	Sanitary wastewater
Vegetation	Excessive Growth	Food product facilities, fertilizers, farming agricultural use.
	Inhibited growth, stressed vegetation	High stormwater flows, beverage facilities, printing plants, metal product facilities, drug manufacturing, petroleum facilities, vehicle service facilities and automobile dealers
Damage to Outfall Structures	Concrete cracking	Industrial flows, chemicals
	Concrete spalling	
	Peeling paint	
	Metal corrosion	

6.2.2 Field Equipment

Table 7 lists field equipment commonly used for dry weather outfall screening and sampling.

Table 7: Field Equipment – Dry Weather Outfall Screening and Sampling

Equipment	Use/Notes
Clipboard	For organization of field sheets and writing surface
Field Sheets	Field sheets for both dry weather inspection and Dry weather sampling should be available with extras
Chain of Custody Forms	To ensure proper handling of all samples
Pens/Pencils/Permanent Markers	For proper labeling

Equipment	Use/Notes
Nitrile Gloves	To protect the sampler as well as the sample from contamination
Flashlight/headlamp w/batteries	For looking in outfalls or manholes, helpful in early mornings as well
Cooler with Ice	For transporting samples to the laboratory
Digital Camera	For documenting field conditions at time of inspection
Personal Protective Equipment (PPE)	Reflective vest, Safety glasses and boots at a minimum
GPS Receiver	For taking spatial location data
Water Quality Sonde	If needed, for sampling conductivity, temperature, pH
Water Quality Meter	Hand held meter, if available, for testing for various water quality parameters such as ammonia, surfactants and chlorine
Test Kits	Have extra kits on hand to sample more outfalls than are anticipated to be screened in a single day
Label Tape	For labeling sample containers
Sample Containers	Make sure all sample containers are clean. Keep extra sample containers on hand at all times. Make sure there are proper sample containers for what is being sampled for (i.e., bacteria require sterile containers).
Pry Bar or Pick	For opening catch basins and manholes when necessary
Sandbags	For damming low flows in order to take samples
Small Mallet or Hammer	Helping to free stuck manhole and catch basin covers
Utility Knife	Multiple uses
Measuring Tape	Measuring distances and depth of flow
Safety Cones	Safety
Hand Sanitizer	Disinfectant/decontaminant
Zip Ties/Duct Tape	For making field repairs
Rubber Boots/Waders	For accessing shallow streams/areas
Sampling Pole/Dipper/Sampling Cage	For accessing hard to reach outfalls and manholes

6.2.3 Sample Collection and Analysis

If flow is present during a dry weather outfall inspection, a sample will be collected and analyzed for the minimum parameters and pollutants of concern³. All analyses except for indicator bacteria and pollutants of concern can be completed in the field. In Wayland, the pollutants of concern include:

- **Phosphorus:** Hop Brook,
- **Turbidity:** Dudley Pond,

³ 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).

- **Enterococcus:** Lake Cochituate (MA82125),
- **E. Coli:** Sudbury River (MA82A-03),
- **Dissolved oxygen:** Dudley Pond, Hop Brook, Lake Cochituate (MA82125 and MA82020),
- **Algae:** Heard Pond,
- **Transparency/Clarity:** Heard Pond.

The general procedure for collection of outfall samples is as follows:

1. Fill out all sample information on sample bottles and field sheets.
2. Put on protective gloves (nitrile/latex/other) before sampling.
3. 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.
4. If using a dipper or other device, triple rinse the device with distilled water and then in water to be sampled (not for bacteria sampling).
5. Use test strips, test kits, and field meters (rinse similar to dipper) for most parameters (see **Table 8** and **Table 9**).
6. Place laboratory samples on ice for analysis of bacteria and pollutants of concern.
7. Fill out chain-of-custody form for laboratory samples.
8. Coordinate laboratory pick-up or deliver samples directly to selected laboratory.
9. Dispose of used test strips and test kit ampules properly.
10. Decontaminate all testing personnel and equipment.

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

Table 7 summarizes the sampling needs for parameters to be analyzed in the field. The threshold indicator value is included in the permit as an indicator of a potential illicit connection.

Table 8: Field Sampling Analyses

Field Sampling & Analysis				
Sampling Parameter	Sampling Container	Volume	Method	Threshold Indicator
Ammonia	Glass or plastic	Enough volume to submerge probe/strip	WQ Meter/Test Kit	0.5 mg/L
Chlorine			WQ Meter	0.02 mg/L
Conductivity			WQ Meter	--
Salinity			WQ Meter	--
Surfactants			WQ Meter/Test Kit	0.25 mg/L
Water Temperature			WQ Meter	--

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 9** lists various field test kits and field instruments that can be used for outfall sampling associated with the 2016 MS4 Permit parameters, other than indicator bacteria and any pollutants of concern. Analytic procedures and user’s manuals for field test kits and field instrumentation are provided in **Appendix E**.

Table 9: Sampling Parameters and Analysis Methods

Analyte or Parameter	Instrumentation (Portable Meter)	Field Test Kit
Ammonia	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)	CHEMetrics™ I-2017	CHEMetrics™ K-9400 and K-9404 Hach™ DE-2
Chlorine	CHEMetrics™ V-2000, K-2513 Hach™ Pocket Colorimeter™ II	NA
Conductivity	CHEMetrics™ I-1200 YSI Pro30 YSI EC300A Oakton 450	NA
Temperature	YSI Pro30 YSI EC300A Oakton 450	NA
Salinity	YSI Pro30 YSI EC300A Oakton 450	NA

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 § 136.⁴ Samples for laboratory analysis must also be stored and preserved in accordance with procedures found in 40 CFR § 136. The pollutants of concern in Wayland include phosphorus, E. coli, turbidity, and enterococcus.

Table 10 lists analytical methods, detection limits, hold times, and preservatives for laboratory analysis of dry weather sampling parameters. Although all parameters are included in this table, it should be noted that laboratory analysis is not required for ammonia, surfactants, chlorine, temperature, specific conductance, and salinity, if field instrumentation or test kits in Table 6-4 are used.

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

Table 10: 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 ≤6°C, H ₂ SO ₄ to pH <2, No preservative required if analyzed immediately
Surfactants	SM: 5540-C	0.01 mg/L	48 hours	Cool ≤6°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 µs/cm	28 days	Cool ≤6°C
Salinity	SM: 2520	-	28 days	Cool ≤6°C
Indicator Bacteria: E. Coli	EPA 1603; SM 9221B, 9221F, 9223B	1 cfu/100 mL; 2 MPN/100 mL	6 hours	Cool ≤ 10°C, 0.0008% Na ₂ S ₂ O ₃
Pollutants of Concern				
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 ≤6°C, H ₂ SO ₄ to pH <2
Turbidity	EPA: 180.1 SM: 2130 B-2011	EPA: 0.02 NTU	48 hours	Cool ≤4°C,
E. coli	EPA 1603; SM 9221B, 9221F, 9223B	1 cfu/100 mL; 2 MPN/100 mL	6 hours	Cool ≤ 10°C, 0.0008% Na ₂ S ₂ O ₃
Enterococcus	EPA: 1600 SM: 9230 C Other: Enterolert®	EPA: 1 cfu/100mL SM: 1 MPN/100mL Other: 1 MPN/100mL	8 hours	Cool ≤10°C, 0.0008% Na ₂ S ₂ O ₃

SM = Standard Methods

6.3 INTERPRETING OUTFALL SAMPLING RESULTS

Based on the results collected, the Town will determine if there are potential illicit connections from sanitary sources. An illicit sanitary source is likely if outfall sample results include the following values:

- Ammonia ≥ 0.5 mg/L
 - Surfactants ≥ 0.25 mg/L, AND
 - Bacteria > 235 cfu/mL for swimming or > 410 cfu/mL for other waters
- Or
- Ammonia ≥ 0.5 mg/L
 - Surfactants ≥ 0.25 mg/L, AND
 - Detectable levels of chlorine (> 0.2 mg/L)

Additionally, conductivity above 2,000 $\mu\text{S}/\text{cm}$ indicates the potential for an illicit connection.

Based on the dry weather screening results, the Town will continue to update its ranking and further investigate potential connections through catchment investigations.

6.4 FOLLOW-UP RANKING OF OUTFALLS AND INTERCONNECTIONS

The Town of Wayland 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, and 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 investigation. Other outfalls and interconnections may be re-ranked based on any new information from the dry weather screening.

7 CATCHMENT INVESTIGATIONS

Once stormwater outfalls with evidence of illicit discharges have been identified, various methods can be used to trace the source of the potential discharge within the outfall catchment area. Catchment investigation techniques include but are not limited to review of maps, historic plans, and records; manhole observation; dry and wet weather sampling; video inspection; 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.

Catchments are investigated in order of priority, with catchments draining to Problem Outfalls investigated first, followed by High Priority and then Low Priority Outfalls. Within each category the catchments are investigated in the order they are ranked. Work can be ongoing in multiple catchments simultaneously to expedite the process. **Table 11** provides a schedule for completion of catchment investigations.

Table 11: IDDE Schedule for Completion of Catchment Investigations

Parameter	Start	Complete
Problem Catchments	No later than 2 years from permit effective date	Within 7 years of permit effective date
Catchments with sewer input identified at outfall ¹	No permit requirement	Within 7 years of permit effective date
All Catchments	No permit requirement	Within 10 years of permit effective date

¹Likely sewer input indicators are any of the following:

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

All data collected as part of the catchment investigations will be recorded and reported in each annual report.

7.1 SYSTEM VULNERABILITY FACTORS

The DPW 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 failures.

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 than 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 than poor owner maintenance).

An SVF inventory will be documented for each catchment (see **Table 12**), retained as part of this IDDE Plan, and included in the annual report.

Table 12: Outfall Catchment System Vulnerability Factor (SVF) Inventory

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

Presence/Absence Evaluation Criteria:

- 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 than 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 than poor owner maintenance)

7.2 DRY WEATHER MANHOLE INSPECTIONS

The Town of Wayland 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 DPW 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.

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 junction manhole as a key junction manhole would not affect the permittee's ability to determine the possible presence of an upstream illicit discharge. A permittee may exclude a junction manhole located upstream from another located in the immediate vicinity or that is serving a drainage alignment with no potential for illicit connections.

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

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

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

For most catchments, manhole inspections will proceed from the 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 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 E**.
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 6. 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 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. The DPW will be responsible for implementing the wet weather outfall sampling program and making updates as necessary.

These 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 discharge of sanitary flow to the MS4.

Wet weather outfall sampling will proceed as follows:

1. At least one wet weather sample will be collected at the outfall for the same parameters required during dry weather screening.
2. 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.

3. 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 7.4.
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.

7.4 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

These are all options that Wayland can rely on. However, sandbagging, dye testing, and CCTV inspections if necessary will be utilized first. Any homeowners or businesses that will be impacted by these investigations will be notified prior to starting.

These methods are described in the sections below. Public notification is an important aspect of a detailed source investigation program. Prior to dye testing or CCTV inspections, the DPW will notify property owners in the affected area.

7.4.1 Sandbagging

This technique can be particularly useful when attempting to isolate intermittent illicit discharges or those with very little perceptible flow. The technique involves placing sandbags or similar barriers (e.g., caulking, weirs/plates, or other temporary barriers) within 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.

7.4.2 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. It is important to inform residents and business owners before dye testing is performed. Police, fire, and local public health staff should also be notified prior to testing in preparation for 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.

7.4.3 CCTV Inspections

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.

7.5 ILLICIT DISCHARGE REMOVAL

When the specific source of an illicit discharge is identified, Wayland will exercise its authority as necessary to require its removal within 60 days. 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.

7.5.1 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.

7.6 ONGOING SCREENING

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

8 TRAINING

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 personnel and their function within the framework of the IDDE program. A training attendance sign-in sheet is provided in **Appendix G**. Training records will also be maintained in **Appendix G**. The frequency and type of training will be included in the annual report.

Figure 2 IDDE Plan Staff Training for DPW Staff June 2019



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.

10 REFERENCES

General Permits for Stormwater Discharges from Small Municipal Separate Storm Sewer Systems in Massachusetts. United States Environmental Protection Agency issued April 4, 2016.

Illicit Discharge Detection and Elimination (IDDE) Plan Template. Central Massachusetts Regional Stormwater Coalition, June 30, 2016.

Massachusetts Year 2016 Integrated List of Waters, Final Listing of the Condition of Massachusetts' Waters Pursuant to Sections 305(b), 314 and 303(d) of the Clean Water Act. Massachusetts Department of Environmental Protection, January, 2020.

Instructions and Background Outfall Inventory and Prioritization Tool, Neponset River Partnership, March 2019

APPENDIX A

Legal Authority

Chapter 193. Stormwater and Land Disturbance

[HISTORY: Adopted by the Annual Town Meeting of the Town of Wayland 4-10-2008 by Art. 25; amended in its entirety by the Annual Town Meeting 4-6-2015 by Art. 19. Subsequent amendments noted where applicable.]

GENERAL REFERENCES

Wetlands and water resources protection — See Ch. **194**.

Zoning — See Ch. **198**.

Aquifer Protection District — See Ch. **198**, Art. 16.

Site plan review and approval — See Ch. **302**.

Subdivision of land — See Ch. **303**.

§ 193-1. Purposes and objectives.

A. The purpose of this chapter is to:

- (1) Protect the quantity and quality of water recharge to the Town's water supply aquifers;
- (2) Protect cold water fisheries and other designated outstanding water resources from discharges of toxic pollutants, nutrients, and temperature changes;
- (3) Protect and enhance wildlife habitat;
- (4) Protect streams, rivers, and private property from additional flood damage from changed flow patterns.

B. This chapter seeks to implement these goals through the following objectives:

- (1) Complement and expand upon the requirements of state and federal statutes and regulations relating to stormwater and illicit discharges;
- (2) Establish provisions for long-term responsibility for and maintenance of structural stormwater control facilities/devices and nonstructural stormwater management practices to ensure they continue to function as designed, are maintained, and pose no threat to public safety;
- (3) Ensure that soil erosion control measures, sedimentation control measures and stormwater runoff control practices are incorporated into the site planning and design process and are implemented and maintained;
- (4) Require that new development and redevelopment maintain the pre-development hydrologic characteristics in the post-development state as nearly as practicable in order to reduce flooding, stream bank erosion, and non-point source pollution, to maintain the integrity of stream channels and aquatic habitats and to provide protection from property damage.
- (5) Establish minimum design criteria for the protection of properties and aquatic resources downstream from land development and land conversion activities from damages due to increases in volume, velocity, frequency, duration and peak flow rate of stormwater runoff; establish minimum design criteria for BMP measures to minimize point and non-point source pollution from stormwater runoff which would otherwise degrade water quality;

- (6) Control the volume and rate of stormwater runoff resulting from land disturbance activities; establish minimum post-development stormwater management standards and design criteria for the regulation and control of stormwater runoff quantity and quality; establish minimum design criteria for the protection of properties and aquatic resources downstream from land development, redevelopment and land conversion activities from damages due to increases in volume, velocity, frequency, duration and peak flow rate of stormwater runoff;
 - (7) Establish minimum design criteria for BMP measures to minimize point and non-point source pollution from stormwater runoff which would otherwise degrade water quality;
 - (8) Require that there be no increase in post-development discharge from storm drainage systems or any other changes in post-development conditions that alter the post-development watershed boundaries;
 - (9) Require that all catch basin discharge points or other point source discharge points shall be designed with structures to disperse stormwater energy;
 - (10) Encourage the use of non-structural stormwater management and low-impact stormwater site design standards such as reducing impervious cover and the preservation of open space and other natural areas;
 - (11) Require practices to control waste such as discarded building materials, truck washouts, chemicals, litter and sanitary waste at construction sites that may cause adverse impacts to water quality;
 - (12) Ensure compliance with the provisions of this bylaw through inspection, monitoring and enforcement;
 - (13) Establish provisions to ensure there is an adequate funding mechanism, including a performance guarantee, for the proper review, inspection and long-term maintenance of stormwater facilities implemented as part of this chapter;
 - (14) Establish administrative procedures and fees for the submission, review, approval or disapproval of stormwater management plans, and for the inspection of approved active projects, and long-term follow up.
- C. Nothing in this chapter is intended to replace the requirements of Chapter **194** of the Town Code, the Town's Wetlands and Water Resources Bylaw, or any other bylaw that may be adopted by the Town.

§ 193-2. Definitions.

The following definitions shall apply in the interpretation and implementation of this chapter.

ALTER

Shall include, but is not limited to, one or more of the following actions upon areas described in this bylaw:

- A. The removal, excavation or dredging of soil, sand, gravel or aggregate material of any kind;
- B. The changing of pre-existing drainage characteristics, flushing characteristics, salinity distribution, sedimentation patterns, flow patterns and flood storage retention areas;
- C. The drainage or disturbance of the water level or water table; the dumping, discharging or filling with any material or drainage which could degrade the water quality;
- D. The driving of piles; erection of buildings or structures of any kind;
- E. The placing of obstructions, including docks and piers, whether or not they interfere with the flow of water;
- F. The destruction of plant life, including the cutting of trees;

- G. The changing of water temperature, biochemical oxygen demand and other natural characteristics of the receiving water;
- H. Any activity, change or work which pollutes or degrades the quality of any stream, body of water, wetland, buffer zone, or water resource area, whether located in or out of the Town of Wayland;
- I. The flowage of water, piped or otherwise channelized, through irrigation or other unnatural means into or onto any wetlands, buffer zones, and related water resources.

AUTHORIZED ENFORCEMENT AGENT

The Wayland Conservation Commission, hereinafter the Commission, its employees or agents designated to enforce this chapter.

BEST MANAGEMENT PRACTICE (BMP)

Structural, nonstructural and managerial techniques that are recognized to be the most effective and practical means to prevent and/or reduce increases in stormwater volumes and flows, reduce point source and non-point source pollution, and promote stormwater quality and protection of the environment.

- A. Structural BMPs are devices that are engineered and constructed to provide temporary storage and treatment of stormwater runoff.
- B. Nonstructural BMPs use natural measures to reduce pollution levels, do not require extensive construction efforts, and/or promote pollutant reduction by eliminating the pollutant source.

BETTER SITE DESIGN

Site design approaches and techniques that can reduce a site's impact on the watershed through the use of nonstructural stormwater management practices. Better site design includes conserving and protecting natural areas and open space, reducing impervious cover, and using natural features for stormwater management.

CLEARING

Any activity that removes the vegetative surface cover.

CONSTRUCTION AND WASTE MATERIALS

Excess or discarded building or site materials, including but not limited to concrete truck washout, chemicals, litter and sanitary waste at construction sites that may adversely impact water quality.

DEVELOPMENT

The modification of land to accommodate a new use or expansion of an existing use, usually involving construction.

DISCHARGE

A general outflow term including flow from a pipe into a stream, or from a stream to a body of water.

- A. **DISCHARGE POINT**
The outlet of a pipe or a particular location along a stream.
- B. **DISCHARGE (FLOW) RATE**
Volume of water passing a particular point in a given time.
- C. **DISCHARGE (FLOW) VOLUME**
Includes both sheet runoff and point source discharges from pipes or stream channels.

EROSION

The wearing away of the land surface by natural or artificial forces such as wind, water, ice, gravity, or vehicle traffic and the subsequent detachment and transportation of soil particles.

EROSION AND SEDIMENTATION CONTROL PLAN

A document containing narrative, drawings and details developed by a qualified professional engineer (PE) or a Certified Professional in Erosion and Sedimentation Control (CPESC), which includes best management

practices, or equivalent measures designed to control surface runoff, erosion and sedimentation during pre-construction and construction related land disturbance activities.

ILLICIT DISCHARGE

Any direct or indirect discharge to the municipal separate storm sewer system and municipal storm drain system that is not composed entirely of stormwater, except for projects exempted by this bylaw or regulations issued thereunder. The term does not include a discharge in compliance with an NPDES stormwater discharge permit or resulting from fire-fighting activities.

IMPERVIOUS SURFACE

Any material or structure on or above the ground that prevents water infiltration to the underlying soils. "Impervious surface" includes without limitation roads, paved parking lots, sidewalks, stone patios, decking, and rooftops.

INFILTRATION

The movement of water downward into the soil. Infiltration is important to replenishing the groundwater.

LAND-DISTURBING ACTIVITY

Any activity including clearing, the removal of trees and other vegetation that causes a change in the position or location of soil, sand, rock, gravel, or similar earth material.

LAND USE CONVERSION ACTIVITY

Any activity which will measurably change the ability of a ground surface area to absorb water or will change existing surface drainage patterns.

LOCAL GENERAL PERMIT

Work permitted by right under this chapter, providing that there is an approved erosion and sediment control plan for the land-disturbing activity.

MASSACHUSETTS STORMWATER MANAGEMENT POLICY

The policy issued by the Department of Environmental Protection, and as amended, that coordinates the requirements prescribed by state regulations promulgated under the authority of the Massachusetts Wetlands Protection Act, MGL c. 131, § 40, and the Massachusetts Clean Waters Act, MGL c. 21, §§ 23 through 56.

MUNICIPAL SEPARATE STORM SEWER SYSTEM (MS4) or MUNICIPAL STORM DRAIN SYSTEM

The system of conveyances designed or used for collecting or conveying stormwater, including any road with a drainage system, street, gutter, curb, inlet, piped storm drain, pumping facility, retention or detention basin, natural or man-made or altered drainage channel, reservoir, and other drainage structure that together comprise the storm drainage system owned or operated by the Town of Wayland.

NATURAL VEGETATED STATE

Ground covers of native plants species and other trees, shrubs, and/or grasses that are not mowed more than twice a year.

NEW DEVELOPMENT

Any construction or land disturbance of a parcel of land that is currently in a natural vegetated state and does not contain alteration by man-made activities.

NON-POINT SOURCE POLLUTION

Pollution from many diffuse sources caused by rainfall or snowmelt moving over and through the ground. As the runoff moves, it picks up and carries away natural and human-made pollutants, finally depositing them into water resource areas.

NPDES PERMIT

National Pollutant Discharge Elimination System, a permit program of the Clean Water Act administered by the Environmental Protection Agency, Region I, for the Commonwealth of Massachusetts.

OPERATION AND MAINTENANCE PLAN (O & M) PLAN

A plan setting up the functional, financial, and organizational mechanisms for the ongoing operation and maintenance of a stormwater management system to ensure that it continues to function as designed.

OUTFALL

A pipe or conduit discharging water.

OWNER

A person with a legal or equitable interest in property.

POST-DEVELOPMENT

The conditions that reasonably may be expected or anticipated to exist after completion of the land development activity on a specific site or tract of land. Post-development refers to the phase of a new development or redevelopment project after completion and does not refer to the construction phase of the project.

PRE-CONSTRUCTION

All activity in preparation for construction.

RECHARGE

The replenishment of underground water reserves.

REDEVELOPMENT

Any ground surface disturbing construction, alteration, demolition, or improvement of a parcel of land that currently lacks a natural vegetated state and contains alterations by man-made activities.

RUNOFF

Water from precipitation, rainfall, snowmelt, or irrigation, which flows broadly over the ground surface as opposed to a channel. Also called "stormwater runoff" or "direct runoff."

A. RUNOFF VOLUME

The total volume of water that occurs as direct runoff from a given rainfall event.

B. RUNOFF RATE

The volume of water passing a particular point in a given period of time, often expressed as cubic feet per second.

C. TOTAL RUNOFF

Includes both sheet or non-point runoff (water flowing over the ground and point sources from stream channels/pipes).

SEDIMENT

Mineral or organic soil material that is transported by wind or water from its origin to another location; the product of erosion processes.

SEDIMENTATION

The process or act of deposition of sediment.

SITE

Any lot or parcel of land or area of property where land-disturbing activities are, were, or will be performed.

SLOPE

The incline of a ground surface expressed as a ratio of horizontal distance to vertical distance.

SOIL

Any earth, sand, rock, gravel, or similar material.

STABILIZATION

The use, singly or in combination, of mechanical, structural, or vegetative methods, to prevent or retard erosion.

STORMWATER

Runoff from precipitation or snowmelt, surface water and drainage.

STORMWATER MANAGEMENT AND LAND DISTURBANCE PERMIT (SMLDP)

The permit issued following a review of an application, plans, calculations and other supporting documents, which is designed to protect the environment of the Town of Wayland from deleterious effects of uncontrolled and untreated stormwater runoff.

STRIP

Any activity that removes vegetative ground surface cover, including, but not limited to, tree removal, clearing, grubbing, and storage or removal of topsoil.

TOTAL SUSPENDED SOLIDS (TSS)

A measure of the sediments in a unit volume of water. Small particles of mineral and organic matter that are suspended within water runoff. TSS does not include sediment fractions larger than two millimeters in size.

VERNAL POOL

Any confined basin or depression not occurring in existing lawns, gardens, landscaped areas, or driveways, which normally holds water for a minimum of two continuous months during the spring and/or summer, contains at least 200 cubic feet of water at some time during most years, is free of adult predatory fish populations, and provides essential breeding and rearing habitat functions for amphibian, reptile, or other vernal pool community species. In addition this definition, shall include any vernal pool certified by the Natural Heritage and Endangered Species Program (NHESP) of the Massachusetts Division of Fisheries and Wildlife.

WATERCOURSE

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

WATERS OF THE COMMONWEALTH

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

WAYLAND'S WETLANDS AND WATER RESOURCES PROTECTION BYLAW

Chapter 194 of the Town Code.

WETLAND RESOURCE AREA

Areas specified in the Massachusetts Wetlands Protection Act and/or in Wayland's Wetlands and Water Resources Bylaw.

WETLANDS

Wet meadows, marshes, swamps, bogs, and other areas where groundwater, flowing or standing surface water or ice provide a significant part of the supporting substrate for a hydrophilic plant community, or emergent and submergent plant communities in inland waters.

§ 193-3. Authority.

This chapter is adopted under authority granted by the Home Rule Amendment of the Massachusetts Constitution.

§ 193-4. Applicability.

- A. This chapter shall apply to all new development and redevelopment within the Town of Wayland, including, but not limited to, site plan applications, subdivision applications, grading applications, land use conversion applications, any activity that is likely to result in an increased amount of stormwater runoff or pollutants flowing from a parcel of land, or any activity that is likely to alter the drainage characteristics of a parcel of land, unless exempt pursuant to § 193-4B of this chapter. An SMLDP shall be required for all new development and redevelopment regulated by this chapter.
- B. Exemptions. No person shall alter land within the Town of Wayland without having obtained an SMLDP for the property, except for the following activities:
- (1) Any activity disturbing an area less than 5,000 square feet; or 10% of the lot area, whichever is less;
 - (2) Any activity creating new impervious surface or increasing existing impervious surfaces less than a total of 500 square feet;
 - (3) Normal maintenance and improvement of land in agricultural use as defined in 310 CMR 10.04 and MGL c. 40A, § 3;
 - (4) Construction and repair of septic systems when required and approved by the Board of Health for the protection of public health and in compliance with Massachusetts Title V requirements, providing no other local permit is needed and the applicant has implemented a soil erosion plan that includes the use of sediment barriers, temporary and permanent soil stabilization specifications, and containment of erodible materials;
 - (5) Projects wholly within the jurisdiction of the Commission and requiring an Order of Conditions pursuant to the Wetlands Protection Act and/or a wetlands permit pursuant to Chapter 194 of the Town Code;
 - (6) Construction activities associated with utilities (gas, water, electric, telephone, fiber-optic cable) other than drainage, which will not permanently alter terrain, ground cover or drainage patterns;
 - (7) Emergency repairs to any stormwater management facility or practice that poses a threat to public health or public safety or as deemed necessary by the Commission;
 - (8) Any work or projects for which all necessary approvals and permits have been issued prior to the effective date of this chapter;
 - (9) Construction or reconstruction of an existing stonewall and all other retaining walls less than 12 feet in length that will not deter drainage or runoff;
 - (10) The construction of any fence that will not alter existing terrain or drainage patterns;
 - (11) The repair or replacement of an existing roof of a single-family dwelling;
 - (12) Municipal activities for public safety or public health such as water line flushing, street sweeping and dye testing, provided notification is given to the Authorized Enforcement Agency.

§ 193-5. Administration.

- A. The Conservation Commission shall administer and implement this chapter.
- B. Stormwater and land disturbance regulations. The Commission may adopt, and periodically amend, rules and regulations relating to the terms, conditions, definitions, enforcement, fees (including application, inspection and/or consultant), procedures and administration of this chapter by majority vote of the Commission, after conducting a public hearing to receive comments on any proposed revisions. Such hearing date shall be advertised in a newspaper of general local circulation, at least seven days prior to the hearing date. After public notice and public hearing, the Commission may promulgate rules and regulations

to effectuate the purposes of this bylaw. Failure of the Commission to promulgate such rules and regulations shall not act to suspend or invalidate the effect of this chapter.

- C. Waiver: The Commission may waive strict compliance with any requirement of this chapter or the rules and regulations promulgated hereafter, where such action:
- (1) Is allowed by federal, state and local statutes and/or regulations;
 - (2) Is in the public interest; and
 - (3) Is not inconsistent with the purpose and objectives of this chapter.

§ 193-6. Procedures.

Permit procedures and requirements shall be defined and included as part of any rules and regulations promulgated as permitted under § 193-5 of this law.

§ 193-7. Enforcement.

The authorized enforcement agent shall enforce this chapter, regulations, orders, violation notices, and enforcement orders, and may pursue all civil (noncriminal) and criminal remedies for such violations.

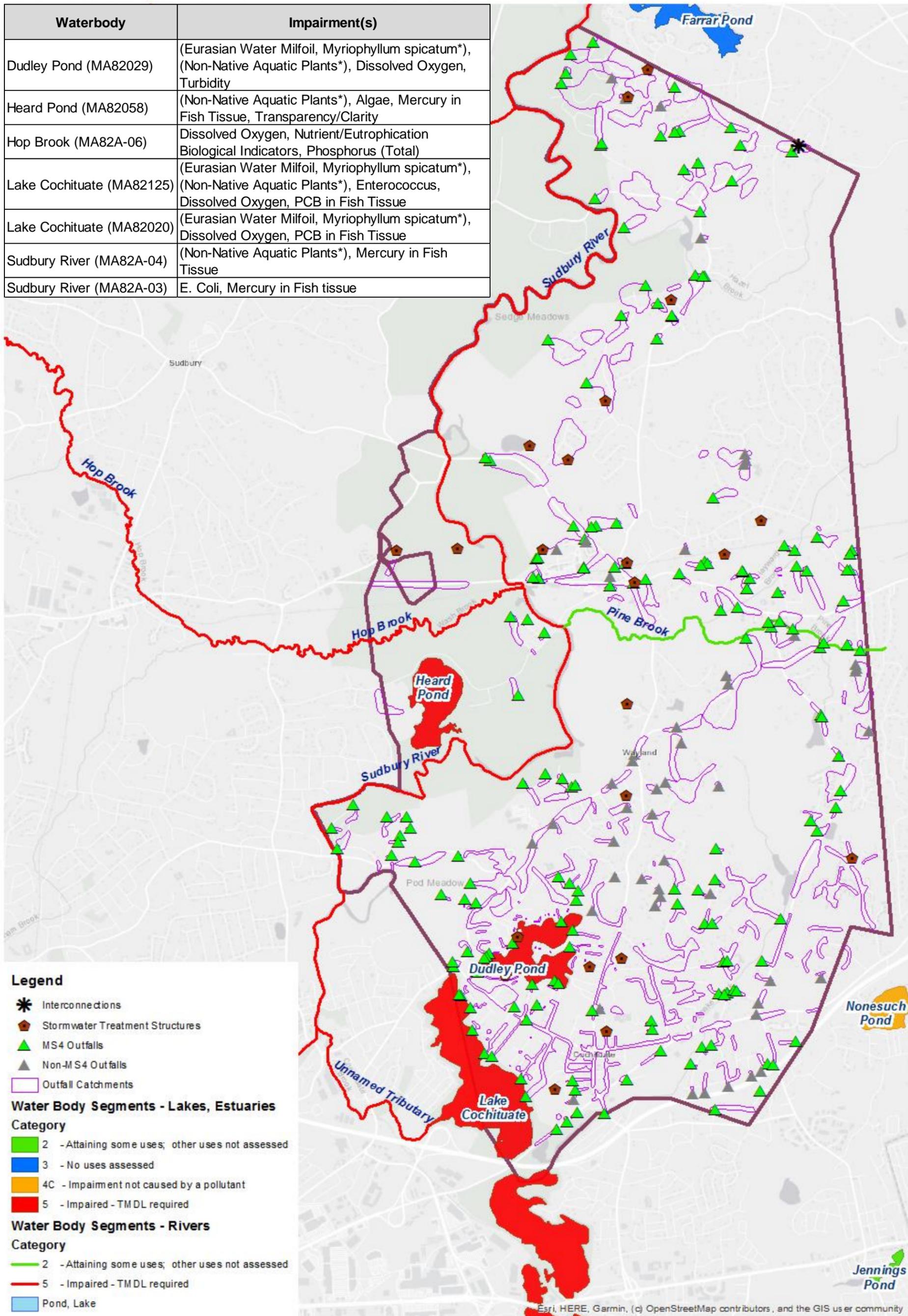
§ 193-8. Severability.

The invalidity of any section, provision, paragraph, sentence, or clause of this chapter shall not invalidate any section, provision, paragraph, sentence, or clause thereof, nor shall it invalidate any permit or determination that previously has been issued.

APPENDIX B

Storm Sewer System Mapping

Waterbody	Impairment(s)
Dudley Pond (MA82029)	(Eurasian Water Milfoil, Myriophyllum spicatum*), (Non-Native Aquatic Plants*), Dissolved Oxygen, Turbidity
Heard Pond (MA82058)	(Non-Native Aquatic Plants*), Algae, Mercury in Fish Tissue, Transparency/Clarity
Hop Brook (MA82A-06)	Dissolved Oxygen, Nutrient/Eutrophication Biological Indicators, Phosphorus (Total)
Lake Cochituate (MA82125)	(Eurasian Water Milfoil, Myriophyllum spicatum*), (Non-Native Aquatic Plants*), Enterococcus, Dissolved Oxygen, PCB in Fish Tissue
Lake Cochituate (MA82020)	(Eurasian Water Milfoil, Myriophyllum spicatum*), Dissolved Oxygen, PCB in Fish Tissue
Sudbury River (MA82A-04)	(Non-Native Aquatic Plants*), Mercury in Fish Tissue
Sudbury River (MA82A-03)	E. Coli, Mercury in Fish tissue



Legend

- * Interconnections
- Stormwater Treatment Structures
- MS4 Outfalls
- Non-MS4 Outfalls
- Outfall Catchments

Water Body Segments - Lakes, Estuaries

Category

- 2 - Attaining some uses; other uses not assessed
- 3 - No uses assessed
- 4C - Impairment not caused by a pollutant
- 5 - Impaired - TMDL required

Water Body Segments - Rivers

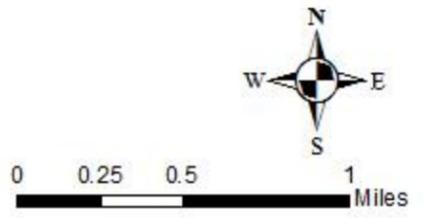
Category

- 2 - Attaining some uses; other uses not assessed
- 5 - Impaired - TMDL required

Pond, Lake



Storm Sewer System Map Town of Wayland, MA



APPENDIX C

NSP Outfall Inventory and Prioritization Tool



Instructions and Background Outfall Inventory and Prioritization Tool

Version 2

March 21, 2019

Change Log

Final V1: Original version of the instructions and the tool, now deprecated.

Final V2: Major reorganization of instructions document to correspond with IDDE Plan procedures as outlined in NSP IDDE SWMP. Changes were too extensive to be tracked using track changes. Important modifications were also made to the tool itself, though these were less extensive than changes to the instructions.

Table of Contents

Introduction.....	1
Credits	1
Prerequisites and Technical Support	1
Phase I: Preliminary Outfall Inventory and Ranking	2
Phase I, Step 1: Complete Information in Infrastructure and Investigation Section	3
Phase 1, Step 2: Catchment Composition Score	4
Phase 1, Step 3: Receiving Water Score	5
Phase 1, Step 4: Preliminary Outfall Score and Priority Ranking:	6
Phase I, Step 6: Sort by Priority Outfall Ranking and Save a Snapshot	6
Phase I. Step 7: Sort Outfalls by Waterbody to Determine Order of Dry Weather Screening	7
Phase II: Update the Outfall Tool to Reflect Progress of Dry or Wet Weather Outfall Screening	7
Phase II, Step 1: Document Progress in Completing Dry Weather Outfall Screening	7
Phase II, Step 2: Document Progress in Completing Wet Weather Outfall Screening	8
Phase II, Step 3: Document Problem Catchment Investigation & Illicit Elimination	8
Phase II, Step 4: Annual Reporting and Follow Up Outfall Ranking	8
Phase III: Catchment Investigation & Discharge Elimination	8
Phase III, Step 1: Track Progress of Catchment Investigations and Schedule Wet Weather Investigations or Discharge Elimination as Needed	9
Phase III, Step 2: Annual Reporting	9
Description of All Spreadsheet Fields and Tabs	9

Introduction

The 2016 Final Massachusetts Small MS4 General Permit requires that permittees undertake five major tasks for Illicit Discharge Detection and Elimination (IDDE):

- 1) Initial ranking of outfalls and interconnections
- 2) Dry weather outfall and interconnection screening
- 3) Follow up ranking of outfalls and interconnections
- 4) Dry weather catchment investigation
- 5) Wet weather outfall screening and catchment investigation (only if applicable)

The Neponset Stormwater Partnership (NSP) Model IDDE Program Document and Stormwater Management Program (the model IDDE SWMP) provides a detailed description of the steps and tasks involved in the IDDE process. If you have not done so already, we recommend that you review that document to familiarize yourself with the steps and tasks involved.

The Neponset Stormwater Partnership (NSP) IDDE Outfall Inventory and Prioritization Tool (“the Outfall Tool” or “the Tool”) is intended to help communities plan, document, and report on their IDDE work at various key stages by providing a framework for ranking and tracking outfalls and their associated catchments.

This document provides instructions for using the Outfall Tool. A brief description of each field in the Outfall Tool is included at the end of the document.

The NSP Outfall Tool is distributed as an unlocked MS Excel spreadsheet. While we describe our suggested approach to using the Outfall Tool below, communities are welcome to modify the Tool in any way they see fit to adapt it to their own approach.

Credits

The NSP Outfall Tool was developed through a cooperative effort by the Neponset River Watershed Association (NepRWA) and the Metropolitan Area Planning Council (MAPC) using funds provided by NSP member communities as well as MetroFuture Technical Assistance Grant Funds from the MAPC.

Prerequisites and Technical Support

In order to use the NSP Outfall Tool, several prerequisites need to be in place:

- The catchment area associated with each of your drain outfalls needs to be delineated. For most members of the NSP, this work has already been completed using the MAPC catchment delineation methodology. Your initial catchment delineation does not need to be perfect. You can update and refine it as you complete your catchment investigation work.
- Key attributes about land uses in your catchments should be extracted from available GIS data. For most NSP towns, this work has already been completed by the MAPC.
- Available receiving water quality data should be assembled. This has already been done for several of the NSP towns by NepRWA.

NepRWA will prepare a template of the NSP Outfall Tool that is pre-populated with the above data for participating NSP towns upon request.

Technical support on setting up and using the NSP Outfall Tool or guidance for pre-populating data within the prioritization is available for NSP member communities from NepRWA and/or the MAPC. Please contact stormwater@neponset.org to request assistance.

Excel Tips:

- The spreadsheet includes two “macros” that allow you to sort the sheet in specific ways just by clicking a button. In order for this to work you will need to choose “enable active content” when you open the file.
- Selected columns and rows have been “grouped” to make it easy to expand or hide sections of the form. This makes it easier to navigate the wide spreadsheet. Just click the + or – buttons in the top margin to expand or contract groups of columns.
- The spreadsheet uses named ranges of rows to do some calculations. The area in black at the far bottom of the spreadsheet is outside the named ranges. To avoid breaking the calculations, if you need to add rows, insert them above the bottom of the named ranges (i.e. in the white rows not the black area).
- Data in the yellow row right below the field headings contains examples of what should go in the corresponding fields. You may need to click the + in the left margin to expand this row.
- Where a column contains a calculation, it has been given a background color to highlight this fact.
- Depending on how your particular copy of the tool is setup, data in the catchment score area may be linked to the raw data extracted from GIS which is stored on a separate tab of the workbook. If applicable this information will remain linked even if you sort the rows on the main worksheet.
- At the end of this document, we describe the intended use of each field in the spreadsheet.

Phase I: Preliminary Outfall Inventory and Ranking

The preliminary outfall inventory and ranking must be prepared by the end of permit year 1 (6/30/19). The goals of the preliminary inventory and ranking are to collect and organize available information about outfalls and catchments, recognizing that this information may be somewhat limited at the beginning of the IDDE process. Using this information, during Phase I you will:

- Identify known “problem” outfalls that will bypass dry weather screening and go directly to catchment investigation.
- Prepare a preliminary ranking of your outfalls into the categories of “high priority”, “low priority,” and “excluded,” as a first indication of the order in which their associated catchments will be investigated.
- Group outfalls by stream to determine the order of dry-weather screening (recommended but not required).
- Flag any catchments with already known system vulnerability factors that will require wet weather screening.

The Outfall Tool helps you to rank the outfalls and interconnections based on three broad categories of information:

- “Infrastructure and investigation data” provided by the Town
- “Catchment composition data” extracted from GIS
- “Receiving water quality data” assembled from available sources

Available information for each of the three categories is used to develop category scores. The weighted average of the category scores is used to calculate each outfall or interconnection’s final score. The final scores are then used to rank each of the outfalls as excluded, problem, high, or low priority. Finally, the outfalls are then grouped by stream segment and the stream segments are ranked to determine the order of dry weather outfall screening.

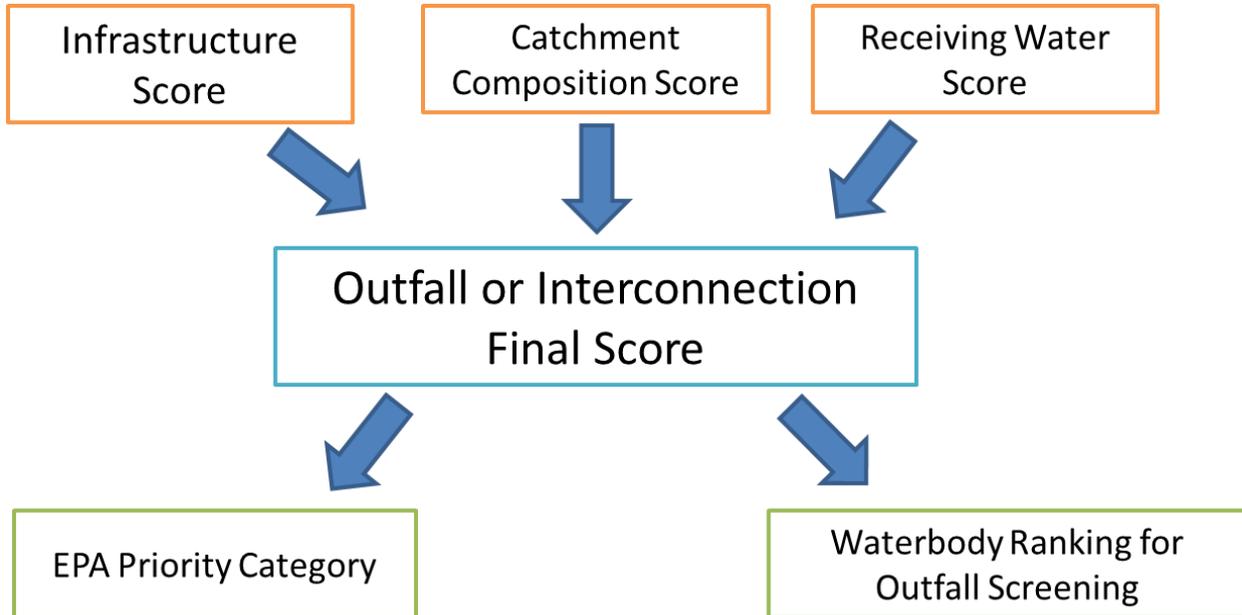


Figure 1: IDDE PT General Schema- The three category scores are used to generate the outfall or interconnection final scores which are then used to generate the two major outputs: the EPA priority category and the waterbody ranking for outfall screening.

Phase I, Step 1: Complete Information in Infrastructure and Investigation Section

The infrastructure and investigation category score is largely based on permittee knowledge and existing records. Town records, GIS data, and institutional knowledge from long-time staff members should be assembled and reviewed in preparation for filling in this portion of the tool. During this initial phase, you may have only limited available information to enter in this section of the tool, which is fine.

The information in this section is required by section 2.3.4.7.a.ii-iii and 2.4.3.8.c.i of the permit. You may want to review these sections of the permit if you have any questions about what to enter.

For each outfall, put a “1” or a “0” in each column in this section. A “1” denotes presence and “0” denotes absence. The infrastructure and investigation category score for each outfall is calculated by taking the sum of each of the above scores, dividing it by the number of factors in the category and multiplying that number by 100.

The fields in this section are fairly self-explanatory. They include:

- Known or suspected problems. Entering a “1” automatically categorizes the outfall as a “problem.” If you found sewage indicators during 2003 screening, enter a “1” here unless your 2003 screening fully meets the 2016 screening requirements, in which case enter it under the column for “Sewage indicators found during 2016 dry screening.”

- Past complaints. Entering a “1” automatically categorizes the outfall as a “problem.”
- Sewage indicators found during 2016 dry screening. Entering a “1” automatically categorizes the outfall as a “problem.” If no screening that meets all the 2016 MS4 Permit screening requirements has occurred yet, leave this field blank for now. If you enter a value in this field, we recommend also updating the “date outfall screening completed” field to the far right of the spreadsheet at the same time.
- Catchments with past septic to sewer conversion or combined sewer separation.
- Outfalls that discharge to culverted stream longer than a street crossing.
- High density of aging septic systems. The permit does not define what constitutes “high” density so make your own determination.
- One or more system vulnerability factors (as defined in the MS4 permit 2.4.3.8.c.i). Even if there are multiple system vulnerability factors only enter “1” in this field. Entering a “1” automatically flags the field for wet weather screening. Refer to the NSP model SWMP or the permit for a discussion of required and recommended system vulnerability factors.
- Sewage Indicators Found During WET Screening. Entering a “1” automatically categorizes the outfall as a “problem.”

The NSP Outfall Tool is designed to be used on an ongoing basis through all the different stages of the IDDE process. As such some fields, especially in the infrastructure section of the tool, will be left blank during the early portion of the IDDE process when information is not available, and may be filled in later or may have their values revised later, as new information is discovered. As described further below, we therefore recommend maintaining a “working” copy of the tool and periodically making “archive” or static PDF copies of the Tool at certain stages of the process to serve as a snapshot in time.

Phase 1, Step 2: Catchment Composition Score

For NSP communities using the tool, this section of the form will be pre-filled for you. The catchment composition category score is calculated using the density of the following:

- Catchment area (acres)
- Number of Medium Loading Businesses
- Number of High Loading Businesses
- Number of Houses (20-40 years old)
- Number of Houses (>40 years old)
- Length of Sewer Pipes in Catchment (Miles)

The information in this section is required by section 2.3.4.7.a.ii-iii of the permit. You may want to review this section of the permit if you have any questions about what is included here.

These data were generated using ArcGIS and the MAPC developed methodology¹. These data can be updated as land uses change through time by following the MAPC methodology.

Raw sub-scores in this category are normalized to a scale of 0 to 1 by dividing each value by the maximum value for that component. The final catchment composition category score is calculated by taking the average of the normalized commercial, residential, and sewer pipe sub-scores.

¹ Metropolitan Area Planning Council. “MS4 Outfall Catchment Calculator.”
<https://github.com/MAPC/stormwater-toolkit>

Phase 1, Step 3: Receiving Water Score

The receiving water category score is calculated from two main components, the receiving water use score and the receiving water quality score. For NSP communities using the tool, this section of the form will be pre-filled for you.

Receiving Water Use Score

The receiving water USE score is based on whether an outfall discharges to or near an area of concern to public health due to proximity of:

- Discharge to Public Beach, Shellfish or Recreational areas. For NSP communities, this information has been pre-filled by NepRWA and MAPC based on a combination of GIS and local knowledge. Communities should review this information and update it based on your own local knowledge.
- Discharge to Surface Water Supply Area. There are no surface drinking water supplies in NSP communities, so this field has been pre-filled with “0.”

A combination of MassGIS layers and local knowledge are used to determine if an outfall is within an area of concern to public health. Any outfalls within 500 meters of a public beach, drinking water supply or a shell fish bed, and any outfalls within 100 meters of recreational area. Recreational areas include known areas of more intensive recreational water contact such as canoe launches. These setbacks and the meaning of “recreational areas” are not specified in the MS4 permit. Outfalls within and area of concern are marked with a “1” all others are marked “0.”

If any of the above waterway-uses are present the outfall is automatically classified as a high priority (i.e. marking an outfall as a “1” makes it high priority automatically).

Receiving Water Quality Score

Each receiving water body was evaluated for:

- The number of stormwater related impairments from the MassDEP 303d List
- Average instream *E. coli* concentration where available

A list of the water quality impairments for each water body was compiled by NepRWA using the Massachusetts year 2014 Integrated List of Waters. For purposes of the Outfall Tool, any impairments that require additional monitoring under the 2016 MS4 permit are considered “stormwater-related.”

The average instream *E. coli* concentration is based on available ambient water quality data collected by Massachusetts Department of Environmental Protection, and/or the Neponset River Watershed Association. It is important to note that we do not have *E. coli* data for every waterbody. This was not an attempt to raise the priority of certain waterbodies, but is instead the result of a lack of available data. Waterbodies lacking any available data are scored as “1” in an attempt to minimize scoring bias on the basis of data availability. Any additional data which the Town may have access to can be added to this section by following the scoring scheme below. Note that if no data is available, you should enter “unknown” or another text string rather than leaving this field blank.

Table 1: Receiving Water Scoring Scheme

“Stormwater Related” Impairments Score		Dry Weather <i>E. coli</i> Score	
Score	Number of Impairments	Score	<i>E. coli</i> Concentration
0	No Impairments	0	<235 cfu/100mL
1	1-2 Impairment(s)	1	235-500 cfu/100mL or No Data Available
2	3-4 Impairments	2	> 500 cfu/100mL
3	≥ 5 Impairments		

The total receiving water quality score is calculated by taking the sum of the individual factors scores and dividing them by 7 (the maximum score possible).

Phase 1, Step 4: Preliminary Outfall Score and Priority Ranking:

The final overall score for each outfall and interconnection is automatically calculated by the Outfall Tool as data is filled in. The Tool uses a weighted average of the three category scores (infrastructure, catchment and water quality) to determine the final overall score. By default, the formulas in the NSP Outfall Tool weights each category equally. However, this weighting is not dictated by the permit, and the scores can be weighted as you see fit by editing the excel formula in the “final score” column.

As data is filled in for all outfalls (i.e. rows) in the Tool, the Tool automatically calculates the “EPA Priority Rank” using the formula contained in the field of the same name.

The formula determines outfall priority ranks based on two tests:

1) The 2016 MS4 permit defines certain attributes that if present automatically rank an outfall or interconnection as a problem or high priority. Outfalls or interconnections with these attributes are automatically ranked accordingly. These characteristics are described above and include

- Known or suspected problems, past complaints, sewage indicators in dry or wet screening.
- Outfalls near beaches, recreation areas, drinking water sources and shellfish beds.

2) Where these “automatic” attributes aren’t present, outfalls and interconnections are ranked according to their final score. By default, the NSP Outfall Tool ranks outfalls and interconnections that have final scores that are above the median score as “high priority,” and those with scores below the median as “low.” However, this approach is not dictated by the permit, and one may adjust this approach by modifying the formula in the “EPA Priority Ranking” column.

Investigation of ALL catchments must be completed by permit year 10, irrespective of priority rank. As such, defining an outfall as “high” or “low” priority has effectively no regulatory meaning. Problem outfalls do not need to undergo dry weather outfall screening, and must begin catchment investigation by the end of year two (6/30/20) and must be complete by the end of year seven.

Phase I, Step 6: Sort by Priority Outfall Ranking and Save a Snapshot

Sort the records in the spreadsheet first by “EPA Priority Category” and then by “Final Outfall Score.” The Tool includes a button titled “Sort for Catchments” at the top of the “Ranking Output” section that allows you to easily execute the recommended sort order.

At this point the sorted content of the tool represents your “Preliminary Outfall Ranking” which is due 6/20/19, and needs to be included in your year one annual report.

To permanently capture your Preliminary Outfall Ranking, we recommend that you save a copy of the workbook under a new name such as “Preliminary Outfall Ranking INSERT DATE Archive,” and that you also save a copy of the spreadsheet as a PDF by choosing “Save As” and selecting the .PDF file format option in the dropdown list right below the filename field. You may want to collapse or expand different sections of the form so that it fits on the page more easily.

Phase I. Step 7: Sort Outfalls by Waterbody to Determine Order of Dry Weather Screening

In order to increase dry weather outfall screening efficiency, the NSP SWMP suggests that outfall screening take place by stream reach. This will allow field crews to proceed quickly down the length of one stream, rather than moving from place to place to check on outfalls scattered across the town. This approach also ensures that each day's samples will need to be tested for the same parameters based on stream impairments. However, this recommended approach is not required by the permit.

In order to determine which stream segments should be screened first, the Outfall Tool calculates the number of high priority outfalls found on each stream reach (MassDEP AU ID). This value is found in the "Waterbody Ranking for Outfall Screening" column.

To determine which stream or waterbody should be screened first, simply re-sort the sheet first by "Waterbody Ranking for Outfall Screening" and then by "MassDEP Stream Segment ID" and lastly by the Town's outfall ID code. This will group the outfalls by stream, in order of priority. Again, the Outfall Tool provides a button named "Sort For Dry Screen" to make it easy to execute this sort order.

For planning purposes, we recommend that you then fill in a value in the "Date, Month or Year Dry Outfall Screening Scheduled" column, and review the overall number of outfalls to be covered during various time periods to balance the program workload.

Note that you may want to undertake some further manual sorting and re-ordering to accommodate any outfalls that don't have an MassDEP Stream Segment, or other irregularities. You can refine your dry weather screening plan, by adjusting the value in the "Date, Month or Year Dry Outfall Screening Scheduled" field and re-sorting the sheet on that column.

At this point, you should save snapshot copy of the spreadsheet or a PDF to document your justification for the order in which you decided perform dry weather screening on your streams and waterways.

Phase II: Update the Outfall Tool to Reflect Progress of Dry or Wet Weather Outfall Screening

The next phase of the overall IDDE process is to conduct dry weather outfall screening and inspection. Generally, Phase II begins once Phase I is completed, and must be finished by the end of permit year three (see caveats below). During this period, you may also be conducting wet weather outfall screening (if any) on outfalls with known system vulnerability factors, and documenting the progress of catchment investigation and repair for any problem outfalls. You need to report on your progress in each of these areas in each annual report during this period.

Note: once dry weather outfall screening has begun there is no need to revise your planned schedule for which streams will be screened first.

Phase II, Step 1: Document Progress in Completing Dry Weather Outfall Screening

The dry weather outfall screening will generate extensive records from individual outfall field inspection forms to lab test results and other materials. During this phase, the Outfall Tool provides a convenient way to summarize and report your overall progress.

As you complete dry weather screenings, update the working copy of your Outfall Tool by filling in the following fields:

- Date Dry Outfall Screening Completed. Located on the far right in the “Tracking” section of the sheet. Fill in the date that dry weather inspection/screening was completed on each outfall.
- Sewage Indicators Found During Dry Screening. Located in the “Infrastructure” section of the Tool. Fill in a “1” if sewage indicators were found and a “0” if they were not found. Leave this blank until you have completed the dry screening for the 2016 permit.

As you fill in this information, the outfall ranking scores will automatically update themselves.

Phase II, Step 2: Document Progress in Completing Wet Weather Outfall Screening

The permit does not require that wet weather screening be completed until the deadline for catchment investigation (i.e. year 10). However, where system vulnerability factors are known in advance of catchment investigation, we recommend completing wet weather outfall screening in advance of catchment investigation.

Irrespective of when you complete wet weather outfall screening, you should summarize your progress in this area by updating the “Date WET Outfall Screening Completed” field and simultaneously entering a “1” or “0” in the field for “Sewage Indicators Found During WET Screening,” located in the infrastructure section of the form.

Phase II, Step 3: Document Problem Catchment Investigation & Illicit Elimination

In the event that you have known problem outfalls, you will likely begin catchment investigation on them while dry weather screening is still ongoing, and you may identify and even eliminate illicit discharges during this period. If so, use the appropriate fields in the program tracking section of the form to summarize this work. Catchment investigation for problem outfalls must begin during permit year two (ending 6/30/20) and be complete by the end of permit year seven.

Phase II, Step 4: Annual Reporting and Follow Up Outfall Ranking

During Phase II you should update the Outfall Tool on an ongoing basis as you complete your IDDE work as described above. As you do so, catchment scores and EPA outfall categories will be automatically updated on a continuous basis. Re-sort the Outfall Tool using the sort for catchments button and make a PDF of the Outfall Tool and/or an Excel archive copy of the Tool to include in each annual report. At a minimum, you must submit the “follow up ranking of outfalls” by the end of permit year three (6/30/21).

Phase III: Catchment Investigation & Discharge Elimination

The last major phase of the overall IDDE process is catchment investigation. During this phase you will conduct internal inspections of junction manholes in all outfall catchments (except excluded outfalls) beginning with problem catchments and working your way down from high priority to low priority based on your follow up ranking of outfalls.

EPA assumes that during this phase, you may discover previously unknown system vulnerability factors, in which case, wet weather screening and wet weather catchment investigation will also need to be conducted as described in the NSP model SWMP. Refer to the model IDDE SWMP or the permit (section 2.4.3.8.c.i) for a discussion of required and recommended system vulnerability factors.

During Phase III, the NSP Outfall Tool can be used to summarize, track and report on your progress in each of these tasks.

Phase III, Step 1: Track Progress of Catchment Investigations and Schedule Wet Weather Investigations or Discharge Elimination as Needed

As you complete your catchment investigations, use the Outfall Tool to track your work by updating the following fields in the “Program Tracking” section of the tool on a continuous basis and at least annually:

- Date Catchment Investig. Scheduled
- Date WET Outfall Screening Scheduled
- Date WET Outfall Screening Completed
- Date Catchment Investig. Completed
- Catchment Investig. Status
- Date Illicit Discharge Source Confirmed
- Est. Illicit Discharge Volume (GPD)
- Date Illicit Discharge Elimination Scheduled
- Date Illicit Discharge Elimination Completed

At the same time, you should also update the “Infrastructure” section of the tool with newly discovered information including:

- System Vulnerability Factors Present in Catchment
- Sewage Indicators Found During WET Screening

Phase III, Step 2: Annual Reporting

During Phase III you should update the Outfall Tool on an ongoing basis and at least annually as you complete your IDDE work. Re-sort the Outfall Tool using the “sort for catchment” button and make a PDF of the Outfall Tool and/or an Excel archive copy of the Tool to include in each annual report.

Description of All Spreadsheet Fields and Tabs

Outfall Information Section

This section contains general identification information about each outfall and its corresponding receiving water. For NSP members this section has been pre-filled based on town mapping data but will need to be updated if new outfalls are discovered during field missions.

Owner – In most cases this will be the town that owns the outfall or interconnection

MassDEP Stream Segment – The Massachusetts DEP Assessment Unit ID (AU ID) for the receiving water body.

Waterbody Name – The name of the receiving waterbody. You can also put brief notes in this field.

Excluded Outfall? – Enter “1” if outfall is excluded. An outfall is excluded from screening if it meets the qualifications defined in section 2.3.4.7.a. ii. If the reason for exclusion is because the outfall is not waters of the US or not town-owned (see NSP Model IDDE SWMP), update the remarks field and/or the owner field as needed. Entering a “1” automatically sets the “EPA priority category” to “excluded.”

Outfall ID – Each outfall should have a unique identifier for data tracking purposes. This number is generated from the town’s system mapping or outfall database.

Infrastructure and Investigation Data Section

This section contains information based on previous reports, town knowledge, and infrastructure investigations. The “Sewage Indicators Found” and “System Vulnerability Factors Present” sections need to be updated on an ongoing basis as outfall screening and catchment investigations provide new data.

Known or Suspected Problem? Including 2003 MS4 screening – This indicates whether or not there is evidence of an illicit discharge from outfall screening or reports prior to the 2016 MS4 permit. If sewage indicators were found during screening under the 2003 permit, enter a “1” here. Entering a “1” automatically sets the EPA priority category to “Problem.” If a problem was found during 2003 screening, fixed, and then confirmed clean, enter a “0” and add a comment in the notes field.

Past Discharge Complaints or Reports? – This section indicates if the outfall has past complaints of discharges from citizens or environmental groups (hot spot reports), or the catchment has past complaints of backups or SSOs. Entering a “1” automatically sets the EPA priority category to “Problem.”

Sewage Indicators Found during 2016 MS4 DRY Screening – This section indicates if sewage indicators were found for an outfall during DRY WEATHER screening for the 2016 MS4 Permit. This needs to be updated regularly once dry screening begins. Entering a “1” automatically sets the EPA priority category to “Problem.” This field should be left blank until 2016 screening for the outfall is completed.

Septic to Sewer Conversion or CSO Separation in Catchment? – Indicates whether or not there have historically been areas in the catchment converted from septic to sewer, or if areas in the catchment were formerly served by a combined sewer system which has been separated.

Discharges to Culverted Stream Longer Than Street Crossing? – Indicates an outfall that discharges to a culverted stream. Do not include outfalls that discharge to a simple road crossing culvert. Enter “1” if the outfall discharges inside a long culvert, otherwise enter “0”.

High Density of Aging Septic Systems? – Indicates an outfall whose catchment includes a high density of aging septic systems. The permit does not define what constitutes a “high” density. Enter a “1” if the catchment has an unusual number of failed septic systems, otherwise enter “0”.

System Vulnerability Factors Present – This indicates that there are system vulnerability factors (SVFs) in the catchment. The list of required and optional SVFs can be found in the NSP model IDDE SWMP or in section 2.3.4.8.c.i. of the MS4 Permit. This should be initially filled out based on town knowledge and available records (which may be limited at first), and then updated regularly as new information is discovered through the catchment investigation process. Enter a “1” if there are known SVFs, otherwise enter “0”.

Sewage Indicators Found during WET Screening – This section indicates if sewage indicators were found for an outfall during WET WEATHER screening for the 2016 MS4 Permit. If no wet weather screening has been performed, leave it blank. This field should be updated regularly once wet screening (if any) begins. Enter “1” if sewage indicators were found, enter “0” if they were not. Entering a “1” automatically sets the EPA priority category to “Problem.” A wet weather catchment investigation is then also required.

Infrastructure Score – The infrastructure score is a measure of how likely an outfall will have an illicit discharge based on prior investigations and existing infrastructure. The infrastructure score for each outfall is calculated by taking the average of the component scores in this section multiplied by 100.

Catchment Composition Section

The catchment composition section assesses the potential for a catchment to have an illicit discharge in it based on the types of land use and infrastructure within the catchment. These data were generated using the MAPC “MS4 Outfall Catchment Calculator” method documentation for [which can be found on the NSP member resources page](#) HERE or refer to the full documentation and [GIS tools on GitHub](#). For NSP communities, this section will be pre-filled.

Catchment area (acres) – The size of the catchment associated with a specific outfall in acres from GIS.

Number of Medium Loading Businesses – The number of businesses within the catchment that have medium risk of having an associated illicit discharge according to The Center for Watershed Protection².

Number of High Loading Businesses – The number of businesses within the catchment that have a high risk of having an associated illicit discharge according to The Center for Watershed Protection².

Raw Generating Site Score (Businesses) – A weighted risk score based on the following formula ((Number of Medium loading businesses*5) + (Number of High loading businesses*10)). The permit does not define “density” so this specific approach is not required.

Normalized Generating Site Score (Businesses) – Divides the raw business generating site score by the maximum business generating score to normalize the values so they can be combined into a total catchment score.

Number of Houses (20-40 years old) – The number of houses within the catchment that have a medium risk of have an associated illicit discharge based on house age.

Number of Houses (>40 years old) – The number of houses within the catchment that have a high risk of have an associated illicit discharge based on house age.

Raw Generating Site Score (Residential) – A weighted risk score based on the following formula ((Number of 20-40 year old homes*5) + (Number of older than 40 year old Homes*10)). The permit does not define “density” so this specific approach is not required.

Normalized Generating Site Score (Residential) – Divides the raw residential generating site score by the maximum residential generating site score to normalize the values so they can be combined into a total catchment score.

Length of Sewer Pipes in Catchment (Miles) – The amount of sewerage within the catchment based on total length of pipe

Normalized Sewer Pipe Score – The length of sewer pipe in the catchment divided by the catchment area further divided by the maximum length of sewer pipes in catchment. The permit does not define “density” so this specific approach is not required.

² Environmental Protection Agency. “Illicit Discharge Detection and Elimination: A Guidance Manual for Program Development and Technical Assessments.” http://cfpub2.epa.gov/npdes/docs.cfm?program_id=6&view=allprog&sort=name#iddmanual Last Updated on October 1, 2004.

Catchment Score – This score is an estimate of the probability that an outfall will have an illicit discharge based on the composition of its catchment. The catchment score for each outfall is calculated by taking the average of the component scores in this section multiplied by 100.

Receiving Water Section

This section contains information about the uses and pollution level of the waterway to which each outfall discharges. The information for this section is based on MassGIS data, ambient water quality data, and local knowledge.

Discharge to Pub Beach, Shellfish or Rec – Indicates whether the outfall discharges within a close proximity of a public beach, recreation area, or shellfish bed. A 500-meter buffer around public beaches, drinking water supplies, and shellfish beds was used, and a 100-meter buffer around boat/canoe launches was used. The public beach and recreation area GIS layer should be supplemented with town knowledge.

Discharge to Surface Water Supply Area – This indicates whether or not the outfall discharges to a surface water supply.

Dry Weather E. coli Concentration – The average dry weather concentration of E. coli in the waterbody to which the outfall discharges. Based on data available from MassDEP, the Neponset River Watershed Association or other sources where available. This information should be pre-filled for NSP member communities and should be reviewed and updated with any additional local knowledge. Note if there is no data for an outfall's receiving water you should enter "unknown" or another text string rather than leaving this field blank so that the E. coli score column will be set to "1" rather than blank.

Dry Weather E.coli Score – This section is a score based on the average concentration of *E.coli* bacteria for each receiving waterbody. Not every water body has available *E.coli* data. To reduce the bias that would be created if a stream lacks E.coli data, all outfalls without data are stored as a "1".

Stormwater Related Impairments – This section reflects whether or not the receiving waterbody has stormwater related impairments. The numerical value in this field is a score based on how many impairments the waterbody has. An impairment is considered stormwater related if EPA requires additional monitoring for it. This information is pre-filled for NSP member communities or can be found in each community's NOI.

Receiving Water Score – The receiving water score is an estimate of the likelihood that an outfall contains an illicit discharge and the risk it poses to human health based on the recreational uses and quality of the receiving water. This score is calculated by taking average of the component scores multiplied by 100.

Ranking Output

The ranking output section contains the final score and the various rankings based on those scores. It also indicates whether an outfall requires additional wet weather screening. We recommend that outfall screenings be conducted according to stream rank. The order of catchment investigations should proceed with problem outfalls first, then high priority, etc sub-sorted by highest final outfall score first.

Final Outfall Score – The final outfall score is the overall score each outfall receives based on its three component scores (Infrastructure and Investigation, Catchment Composition, and Receiving Water).

EPA Priority Category – The EPA Priority Category is based either on the presence or absence of certain criteria or the final outfall score. Outfalls with final outfall scores greater than the median score are considered high priority and those with lesser values are considered low priority.

Number of High Priority Outfalls – A count of the number of high priority outfalls in the AU ID of the current outfall. In effect this field groups the outfalls by AU ID and is used to determine the order of outfall screening.

Stream Ranking for Outfall Screening – The stream ranking is how we recommend you prioritize outfall screening in order to maximize dry weather outfall screening efficiency in the field. This section ranks the receiving waterbodies by the number of high priority outfalls they contain with #1 being the highest rank.

Wet Weather Screening Required – Indicates whether or not wet weather screening will be required based on the presence or absence of system vulnerability factors in the catchment as indicated in the infrastructure section of the form.

Program Tracking

This section allows for easy tracking of screening and investigation progress and needs to be updated regularly.

Date DRY Outfall Screening Scheduled – Use this field to organize your work by entering a specific date, a year or other indicator of when the work is planned. Should be scheduled according to the EPA priority ranks and stream rank starting with high priority outfalls. Note that the results of the screening (i.e. clean or polluted) are summarized by updating the “screening” field in the infrastructure section of the form.

Date DRY Outfall Screening Completed – Enter the actual date that screening was marked complete.

Date WET Outfall Screening Scheduled -- Enter a specific date, a year or other indicator of when the wet weather screening is planned. If wet weather screening is not required, leave field blank.

Date WET Outfall Screening Completed -- Enter the actual date that screening was marked complete.

Date Catchment Investig. Scheduled -- Enter a specific date, a year or other indicator of when the investigation is scheduled to begin. Catchment investigations should begin with problem outfalls, and proceed according to catchment score through High Priority and Low Priority.

Date Catchment Investig. Completed -- Enter the actual date that investigation was marked complete.

Catchment Investigation Status – Once catchment investigation has begun, enter a short code of your own choice that summarizes the status of the investigation. We suggest the following scheme:

- “Ongoing.” Investigation started but not yet completed.
- “Ongoing, Awaiting Repairs.” Problems discovered during investigation, and remaining junction manholes cannot be inspected until upstream repairs are implemented.
- “Complete.” Catchment is complete with no outstanding issues.

- “Complete, Inconclusive.” Outfall shows sewage indicators and all junction manholes inspected in dry (and where applicable wet) weather, but source not found. Will need to be scheduled for further investigation.
- “Complete, Awaiting Repairs.” All junction manholes inspected, problems were found and are awaiting repair.

Date Illicit Discharge Source Confirmed – If illicit discharge was found, enter the date the source was confirmed. If no illicit discharge in catchment, leave blank.

Est. Illicit Discharge Volume (GPD) – If illicit discharge was found, enter the estimated volume of discharge in gallons per day. If no illicit discharge in catchment, leave blank.

Date Illicit Discharge Elimination Scheduled -- If illicit discharge was found, source isolated, and repair plan developed, enter the estimated date, month or year when you expect the repair to be implemented. If no illicit discharge in catchment, leave blank.

Date Illicit Discharge Elimination Completed – Enter the date on which you confirmed that the illicit discharge had been eliminated. If no illicit discharge in catchment, leave blank.

Year Ongoing Outfall Screening Scheduled – Once catchment investigation has been completed, indicate the year in which ongoing outfall screening has been scheduled (every 5 years). Otherwise leave blank.

Remarks – This is a place to record any notes related to an outfall and its investigations.

APPENDIX D

Preliminary Outfall Ranking

Outfall Info					Receiving Water				Ranking Output					
Owner	MassDEP Stream Segment (AU ID)	Waterbody Name	Excluded Outfall?	Outfall ID	Discharge to Pub Beach, Shellfish or Rec	Discharge to Bacteria/ Pathogen Impaired Waterbody	Discharge to Zone I and Zone II	Stormwater Related Impairments	Receiving Water Score	Final Outfall Score	EPA Priority Category	Number of High Priority Outfalls	Waterbody Ranking for Dry Outfall Screening	Wet Weather Screening Required?
Name of owner	MA73030	"Lake Anywhere"	1 or 0 (1=auto excluded)	Your Unique Outfall ID #	1 or 0 (1=auto high)	1 or 0 (1=auto high)	1 or 0 (1=auto high)	0= no impair, 1= 1-2 impair, 2= 3-5 impair, 3 = >5 impair	Calculated	Calculated	Calculated	Calculated	Calculated	Calculated
Wayland		SNAKE BROOK	0	503	1	0	0	0	0.167	0.05556	High	27	1	no
Wayland		HAZEL BROOK	0	3121	1	0	1	0	0.333	0.11111	High	27	1	no
Wayland		HAZEL BROOK	0	3172	0	0	1	0	0.167	0.05556	High	27	1	no
Wayland		HAZEL BROOK	0	3173	1	0	1	0	0.333	0.11111	High	27	1	no
Wayland		HAZEL BROOK	0	3174	1	0	1	0	0.333	0.11111	High	27	1	no
Wayland		HAZEL BROOK	0	3196	0	0	1	0	0.167	0.05556	High	27	1	no
Wayland		HAZEL BROOK	0	3197	0	0	1	0	0.167	0.05556	High	27	1	no
Wayland		HAZEL BROOK	0	3198	0	0	1	0	0.167	0.05556	High	27	1	no
Wayland		HAZEL BROOK	0	3202	0	0	1	0	0.167	0.05556	High	27	1	no
Wayland		TROUT BROOK	0	3219	0	0	1	0	0.167	0.05556	High	27	1	no
Wayland		TROUT BROOK	0	3230	0	0	1	0	0.167	0.05556	High	27	1	no
Wayland		TROUT BROOK	0	3269	1	0	1	0	0.333	0.11111	High	27	1	no
Wayland		HAZEL BROOK	0	3271	1	0	1	0	0.333	0.11111	High	27	1	no
Wayland		TROUT BROOK	0	3280	1	0	1	0	0.333	0.11111	High	27	1	no
Wayland		HAYWARD BROOK	0	3394	1	0	0	0	0.167	0.05556	High	27	1	no
Wayland		HAYWARD BROOK	0	3395	1	0	0	0	0.167	0.05556	High	27	1	no
Wayland		TROUT BROOK	0	3505	1	0	0	0	0.167	0.05556	High	27	1	no
Wayland		TROUT BROOK	0	3506	1	0	0	0	0.167	0.05556	High	27	1	no
Wayland		TROUT BROOK	0	3516	0	0	1	0	0.167	0.05556	High	27	1	no
Wayland		TROUT BROOK	0	3530	1	0	0	0	0.167	0.05556	High	27	1	no
Wayland		TROUT BROOK	0	3535	1	0	0	0	0.167	0.05556	High	27	1	no
Wayland		TROUT BROOK	0	3577	0	0	1	0	0.167	0.05556	High	27	1	no
Wayland		TROUT BROOK	0	3629	0	0	1	0	0.167	0.05556	High	27	1	no
Wayland		TROUT BROOK	0	3633	0	0	1	0	0.167	0.05556	High	27	1	no
Wayland		TROUT BROOK	0	3646	0	0	1	0	0.167	0.05556	High	27	1	no
Wayland		TROUT BROOK	0	3653	0	0	1	0	0.167	0.05556	High	27	1	no
Wayland		TROUT BROOK	0	3679	1	0	1	0	0.333	0.11111	High	27	1	no
Wayland	MA82A-03	SUDBURY RIVER-LOWER	0	52	0	1	1	1	0.500	0.16667	High	25	2	no
Wayland	MA82A-03	SUDBURY RIVER-LOWER	0	58	0	1	1	1	0.500	0.16667	High	25	2	no
Wayland	MA82A-03	SUDBURY RIVER-LOWER	0	1516	0	1	1	1	0.500	0.16667	High	25	2	no
Wayland	MA82A-03	SUDBURY RIVER-LOWER	0	1543	0	1	1	1	0.500	0.16667	High	25	2	no
Wayland	MA82A-03	SUDBURY RIVER-LOWER	0	1552	1	1	1	1	0.667	0.22222	High	25	2	no
Wayland	MA82A-03	SUDBURY RIVER-LOWER	0	1556	1	1	1	1	0.667	0.22222	High	25	2	no
Wayland	MA82A-03	SUDBURY RIVER-LOWER	0	1559	0	1	1	1	0.500	0.16667	High	25	2	no
Wayland	MA82A-03	SUDBURY RIVER-LOWER	0	1572	0	1	1	1	0.500	0.16667	High	25	2	no
Wayland	MA82A-03	SUDBURY RIVER-LOWER	0	1578	1	1	1	1	0.667	0.22222	High	25	2	no
Wayland	MA82A-03	SUDBURY RIVER-LOWER	0	1586	1	1	1	1	0.667	0.22222	High	25	2	no
Wayland	MA82A-03	SUDBURY RIVER-LOWER	0	2297	0	1	1	1	0.500	0.16667	High	25	2	no
Wayland	MA82A-03	SUDBURY RIVER-LOWER	0	2299	1	1	1	1	0.667	0.22222	High	25	2	no
Wayland	MA82A-03	SUDBURY RIVER-LOWER	0	2304	0	1	1	1	0.500	0.16667	High	25	2	no
Wayland	MA82A-03	SUDBURY RIVER-LOWER	0	2312	1	1	1	1	0.667	0.22222	High	25	2	no
Wayland	MA82A-03	SUDBURY RIVER-LOWER	0	2329	1	1	1	1	0.667	0.22222	High	25	2	no
Wayland	MA82A-03	SUDBURY RIVER-LOWER	0	2386	0	1	1	1	0.500	0.16667	High	25	2	no

Outfall Info					Receiving Water				Ranking Output					
Owner	MassDEP Stream Segment (AU ID)	Waterbody Name	Excluded Outfall?	Outfall ID	Discharge to Pub Beach, Shellfish or Rec	Discharge to Bacteria/ Pathogen Impaired Waterbody	Discharge to Zone I and Zone II	Stormwater Related Impairments	Receiving Water Score	Final Outfall Score	EPA Priority Category	Number of High Priority Outfalls	Waterbody Ranking for Dry Outfall Screening	Wet Weather Screening Required?
Name of owner	MA73030	"Lake Anywhere"	1 or 0 (1=auto excluded)	Your Unique Outfall ID #	1 or 0 (1=auto high)	1 or 0 (1=auto high)	1 or 0 (1=auto high)	0= no impair, 1= 1-2 impair, 2= 3-5 impair, 3 = >5 impair	Calculated	Calculated	Calculated	Calculated	Calculated	Calculated
Wayland	MA82A-03	SUDBURY RIVER-LOWER	0	2388	0	1	1	1	0.500	0.16667	High	25	2	no
Wayland	MA82A-03	SUDBURY RIVER-LOWER	0	2389	0	1	1	1	0.500	0.16667	High	25	2	no
Wayland	MA82A-03	SUDBURY RIVER-LOWER	0	2403	0	1	1	1	0.500	0.16667	High	25	2	no
Wayland	MA82A-03	SUDBURY RIVER-LOWER	0	2426	1	1	1	1	0.667	0.22222	High	25	2	no
Wayland	MA82A-03	SUDBURY RIVER-LOWER	0	2437	1	1	1	1	0.667	0.22222	High	25	2	no
Wayland	MA82A-03	SUDBURY RIVER-LOWER	0	2440	0	1	1	1	0.500	0.16667	High	25	2	no
Wayland	MA82A-03	SUDBURY RIVER-LOWER	0	2951	0	1	0	1	0.333	0.11111	High	25	2	no
Wayland	MA82A-03	SUDBURY RIVER-LOWER	0	2967	0	1	0	1	0.333	0.11111	High	25	2	no
Wayland	MA82A-03	SUDBURY RIVER-LOWER	0	2970	0	1	0	1	0.333	0.11111	High	25	2	no
Wayland	MA82029	DUDLEY POND	0	70	1	0	1	3	0.833	0.27778	High	17	3	no
Wayland	MA82029	DUDLEY POND	0	71	0	0	1	3	0.667	0.22222	High	17	3	no
Wayland	MA82029	DUDLEY POND	0	76	0	0	1	3	0.667	0.22222	High	17	3	no
Wayland	MA82029	DUDLEY POND	0	84	0	0	1	3	0.667	0.22222	High	17	3	no
Wayland	MA82029	DUDLEY POND	0	88	0	0	1	3	0.667	0.22222	High	17	3	no
Wayland	MA82029	DUDLEY POND	0	1099	1	0	1	3	0.833	0.27778	High	17	3	no
Wayland	MA82029	DUDLEY POND	0	1211	0	0	1	3	0.667	0.22222	High	17	3	no
Wayland	MA82029	DUDLEY POND	0	1213	0	0	1	3	0.667	0.22222	High	17	3	no
Wayland	MA82029	DUDLEY POND	0	1259	0	0	1	3	0.667	0.22222	High	17	3	no
Wayland	MA82029	DUDLEY POND	0	1383	0	0	1	3	0.667	0.22222	High	17	3	no
Wayland	MA82029	DUDLEY POND	0	1459	0	0	1	3	0.667	0.22222	High	17	3	no
Wayland	MA82029	DUDLEY POND	0	1465	0	0	1	3	0.667	0.22222	High	17	3	no
Wayland	MA82029	DUDLEY POND	0	2206	0	0	1	3	0.667	0.22222	High	17	3	no
Wayland	MA82029	DUDLEY POND	0	2215	0	0	1	3	0.667	0.22222	High	17	3	no
Wayland	MA82029	DUDLEY POND	0	2216	0	0	1	3	0.667	0.22222	High	17	3	no
Wayland	MA82029	DUDLEY POND	0	2217	0	0	1	3	0.667	0.22222	High	17	3	no
Wayland	MA82029	DUDLEY POND	0	2379	1	0	1	3	0.833	0.27778	High	17	3	no
Wayland	MA82020	LAKE COCHITUATE-UPPER	0	29	1	0	0	2	0.500	0.16667	High	12	4	no
Wayland	MA82020	LAKE COCHITUATE-UPPER	0	65	1	0	1	2	0.667	0.22222	High	12	4	no
Wayland	MA82020	LAKE COCHITUATE-UPPER	0	172	0	0	0	2	0.333	0.11111	Low	12	4	no
Wayland	MA82020	LAKE COCHITUATE-UPPER	0	183	0	0	0	2	0.333	0.11111	Low	12	4	no
Wayland	MA82020	LAKE COCHITUATE-UPPER	0	194	0	0	0	2	0.333	0.11111	Low	12	4	no
Wayland	MA82020	LAKE COCHITUATE-UPPER	0	204	1	0	0	2	0.500	0.16667	High	12	4	no
Wayland	MA82020	LAKE COCHITUATE-UPPER	0	205	1	0	0	2	0.500	0.16667	High	12	4	no
Wayland	MA82020	LAKE COCHITUATE-UPPER	0	311	1	0	0	2	0.500	0.16667	High	12	4	no
Wayland	MA82020	LAKE COCHITUATE-UPPER	0	463	1	0	0	2	0.500	0.16667	High	12	4	no
Wayland	MA82020	LAKE COCHITUATE-UPPER	0	1125	0	0	0	2	0.333	0.11111	Low	12	4	no
Wayland	MA82020	LAKE COCHITUATE-UPPER	0	1134	1	0	0	2	0.500	0.16667	High	12	4	no
Wayland	MA82020	LAKE COCHITUATE-UPPER	0	1135	1	0	0	2	0.500	0.16667	High	12	4	no
Wayland	MA82020	LAKE COCHITUATE-UPPER	0	1168	1	0	0	2	0.500	0.16667	High	12	4	no
Wayland	MA82020	LAKE COCHITUATE-UPPER	0	1182	1	0	0	2	0.500	0.16667	High	12	4	no
Wayland	MA82020	LAKE COCHITUATE-UPPER	0	1190	1	0	0	2	0.500	0.16667	High	12	4	no
Wayland	MA82A-04	SUDBURY RIVER-UPPER	0	1830	0	0	1	1	0.333	0.11111	High	12	4	no
Wayland	MA82A-04	SUDBURY RIVER-UPPER	0	1888	0	0	1	1	0.333	0.11111	High	12	4	no

Outfall Info					Receiving Water				Ranking Output					
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Name of owner	MA73030	"Lake Anywhere"	1 or 0 (1=auto excluded)	Your Unique Outfall ID #	1 or 0 (1=auto high)	1 or 0 (1=auto high)	1 or 0 (1=auto high)	0= no impair, 1= 1-2 impair, 2= 3-5 impair, 3 = >5 impair	Calculated	Calculated	Calculated	Calculated	Calculated	Calculated
Wayland	MA82A-04	SUDBURY RIVER-UPPER	0	1889	0	0	1	1	0.333	0.11111	High	12	4	no
Wayland	MA82A-04	SUDBURY RIVER-UPPER	0	1891	0	0	1	1	0.333	0.11111	High	12	4	no
Wayland	MA82A-04	SUDBURY RIVER-UPPER	0	2012	0	0	1	1	0.333	0.11111	High	12	4	no
Wayland	MA82020	LAKE COCHITUATE-UPPER	0	2031	0	0	0	2	0.333	0.11111	Low	12	4	no
Wayland	MA82A-04	SUDBURY RIVER-UPPER	0	2059	0	0	1	1	0.333	0.11111	High	12	4	no
Wayland	MA82020	LAKE COCHITUATE-UPPER	0	2383	1	0	0	2	0.500	0.16667	High	12	4	no
Wayland	MA82A-04	SUDBURY RIVER-UPPER	0	2999	0	0	1	1	0.333	0.11111	High	12	4	no
Wayland	MA82A-04	SUDBURY RIVER-UPPER	0	3039	1	0	1	1	0.500	0.16667	High	12	4	no
Wayland	MA82A-04	SUDBURY RIVER-UPPER	0	3040	0	0	1	1	0.333	0.11111	High	12	4	no
Wayland	MA82A-04	SUDBURY RIVER-UPPER	0	3089	0	0	1	1	0.333	0.11111	High	12	4	no
Wayland	MA82A-04	SUDBURY RIVER-UPPER	0	3150	1	0	1	1	0.500	0.16667	High	12	4	no
Wayland	MA82A-04	SUDBURY RIVER-UPPER	0	3161	1	0	1	1	0.500	0.16667	High	12	4	no
Wayland	MA82A-14	PINE BROOK	0	1856	0	0	1	0	0.167	0.05556	High	5	5	no
Wayland	MA82A-14	PINE BROOK	0	1857	0	0	1	0	0.167	0.05556	High	5	5	no
Wayland	MA82A-14	PINE BROOK	0	3013	0	0	1	0	0.167	0.05556	High	5	5	no
Wayland	MA82A-14	PINE BROOK	0	3015	0	0	1	0	0.167	0.05556	High	5	5	no
Wayland	MA82A-14	PINE BROOK	0	3017	0	0	1	0	0.167	0.05556	High	5	5	no
Wayland	MA82A-20	MILL BROOK	0	2844	0	0	1	0	0.167	0.05556	High	4	6	no
Wayland	MA82A-20	MILL BROOK	0	2881	0	0	1	0	0.167	0.05556	High	4	6	no
Wayland	MA82A-20	MILL BROOK	0	2986	0	0	1	0	0.167	0.05556	High	4	6	no
Wayland	MA82A-20	MILL BROOK	0	3164	0	0	1	0	0.167	0.05556	High	4	6	no
Wayland	MA82125	LAKE COCHITUATE-LOWER	0	202	1	1	0	3	0.833	0.27778	High	1	7	no
Wayland	MA82A-06	HOP BROOK	0	2964	1	0	0	2	0.500	0.16667	High	1	7	no
Wayland		SNAKE BROOK	0	241	0	0	0	0	0.000	0.00000	Low	27		no
Wayland		SNAKE BROOK	0	257	0	0	0	0	0.000	0.00000	Low	27		no
Wayland		SNAKE BROOK	0	261	0	0	0	0	0.000	0.00000	Low	27		no
Wayland		WILLOW BROOK	0	555	0	0	0	0	0.000	0.00000	Low	27		no
Wayland		SNAKE BROOK	0	599	0	0	0	0	0.000	0.00000	Low	27		no
Wayland		SNAKE BROOK	0	600	0	0	0	0	0.000	0.00000	Low	27		no
Wayland		WILLOW BROOK	0	604	0	0	0	0	0.000	0.00000	Low	27		no
Wayland		WILLOW BROOK	0	623	0	0	0	0	0.000	0.00000	Low	27		no
Wayland		WILLOW BROOK	0	627	0	0	0	0	0.000	0.00000	Low	27		no
Wayland		SNAKE BROOK	0	677	0	0	0	0	0.000	0.00000	Low	27		no
Wayland		SNAKE BROOK	0	972	0	0	0	0	0.000	0.00000	Low	27		no
Wayland		SNAKE BROOK	0	973	0	0	0	0	0.000	0.00000	Low	27		no
Wayland		SNAKE BROOK	0	975	0	0	0	0	0.000	0.00000	Low	27		no
Wayland		SNAKE BROOK	0	978	0	0	0	0	0.000	0.00000	Low	27		no
Wayland		SNAKE BROOK	0	979	0	0	0	0	0.000	0.00000	Low	27		no
Wayland		SNAKE BROOK	0	1605	0	0	0	0	0.000	0.00000	Low	27		no
Wayland		SNAKE BROOK	0	1620	0	0	0	0	0.000	0.00000	Low	27		no
Wayland		SNAKE BROOK	0	1685	0	0	0	0	0.000	0.00000	Low	27		no
Wayland		SNAKE BROOK	0	1689	0	0	0	0	0.000	0.00000	Low	27		no
Wayland		SNAKE BROOK	0	1698	0	0	0	0	0.000	0.00000	Low	27		no

Outfall Info					Receiving Water				Ranking Output					
Owner	MassDEP Stream Segment (AU ID)	Waterbody Name	Excluded Outfall?	Outfall ID	Discharge to Pub Beach, Shellfish or Rec	Discharge to Bacteria/ Pathogen Impaired Waterbody	Discharge to Zone I and Zone II	Stormwater Related Impairments	Receiving Water Score	Final Outfall Score	EPA Priority Category	Number of High Priority Outfalls	Waterbody Ranking for Dry Outfall Screening	Wet Weather Screening Required?
Name of owner	MA73030	"Lake Anywhere"	1 or 0 (1=auto excluded)	Your Unique Outfall ID #	1 or 0 (1=auto high)	1 or 0 (1=auto high)	1 or 0 (1=auto high)	0= no impair, 1= 1-2 impair, 2= 3-5 impair, 3 = >5 impair	Calculated	Calculated	Calculated	Calculated	Calculated	Calculated
Wayland		SNAKE BROOK	0	1715	0	0	0	0	0.000	0.00000	Low	27		no
Wayland		SNAKE BROOK	0	1721	0	0	0	0	0.000	0.00000	Low	27		no
Wayland		SNAKE BROOK	0	1741	0	0	0	0	0.000	0.00000	Low	27		no
Wayland		SNAKE BROOK	0	1755	0	0	0	0	0.000	0.00000	Low	27		no
Wayland	MA82A-14	PINE BROOK	0	1771	0	0	0	0	0.000	0.00000	Low	5		no
Wayland		WILLOW BROOK	0	2032	0	0	0	0	0.000	0.00000	Low	27		no
Wayland		SNAKE BROOK	0	2033	0	0	0	0	0.000	0.00000	Low	27		no
Wayland		SNAKE BROOK	0	2106	0	0	0	0	0.000	0.00000	Low	27		no
Wayland		SNAKE BROOK	0	2110	0	0	0	0	0.000	0.00000	Low	27		no
Wayland		SNAKE BROOK	0	2149	0	0	0	0	0.000	0.00000	Low	27		no
Wayland		SNAKE BROOK	0	2170	0	0	0	0	0.000	0.00000	Low	27		no
Wayland		SNAKE BROOK	0	2174	0	0	0	0	0.000	0.00000	Low	27		no
Wayland		SNAKE BROOK	0	2180	0	0	0	0	0.000	0.00000	Low	27		no
Wayland	MA82A-14	PINE BROOK	0	2637	0	0	0	0	0.000	0.00000	Low	5		no
Wayland	MA82A-14	PINE BROOK	0	2640	0	0	0	0	0.000	0.00000	Low	5		no
Wayland	MA82A-14	PINE BROOK	0	2652	0	0	0	0	0.000	0.00000	Low	5		no
Wayland	MA82A-14	PINE BROOK	0	2657	0	0	0	0	0.000	0.00000	Low	5		no
Wayland	MA82A-14	PINE BROOK	0	2668	0	0	0	0	0.000	0.00000	Low	5		no
Wayland	MA82A-14	PINE BROOK	0	2672	0	0	0	0	0.000	0.00000	Low	5		no
Wayland		HAYWARD BROOK	0	2679	0	0	0	0	0.000	0.00000	Low	27		no
Wayland	MA82A-14	PINE BROOK	0	2730	0	0	0	0	0.000	0.00000	Low	5		no
Wayland	MA82A-14	PINE BROOK	0	2738	0	0	0	0	0.000	0.00000	Low	5		no
Wayland	MA82A-14	PINE BROOK	0	2742	0	0	0	0	0.000	0.00000	Low	5		no
Wayland	MA82A-14	PINE BROOK	0	2745	0	0	0	0	0.000	0.00000	Low	5		no
Wayland	MA82A-14	PINE BROOK	0	2761	0	0	0	0	0.000	0.00000	Low	5		no
Wayland	MA82A-14	PINE BROOK	0	2785	0	0	0	0	0.000	0.00000	Low	5		no
Wayland		HAYWARD BROOK	0	2794	0	0	0	0	0.000	0.00000	Low	27		no
Wayland	MA82A-20	MILL BROOK	0	2798	0	0	0	0	0.000	0.00000	Low	4		no
Wayland	MA82A-20	MILL BROOK	0	2883	0	0	0	0	0.000	0.00000	Low	4		no
Wayland		HAZEL BROOK	0	3209	0	0	0	0	0.000	0.00000	Low	27		no
Wayland		HAYWARD BROOK	0	3329	0	0	0	0	0.000	0.00000	Low	27		no
Wayland		HAYWARD BROOK	0	3333	0	0	0	0	0.000	0.00000	Low	27		no
Wayland		HAYWARD BROOK	0	3343	0	0	0	0	0.000	0.00000	Low	27		no
Wayland		HAYWARD BROOK	0	3344	0	0	0	0	0.000	0.00000	Low	27		no
Wayland		HAYWARD BROOK	0	3356	0	0	0	0	0.000	0.00000	Low	27		no
Wayland		HAYWARD BROOK	0	3373	0	0	0	0	0.000	0.00000	Low	27		no
Wayland		HAYWARD BROOK	0	3378	0	0	0	0	0.000	0.00000	Low	27		no
Wayland		HAYWARD BROOK	0	3385	0	0	0	0	0.000	0.00000	Low	27		no
Wayland		HAYWARD BROOK	0	3386	0	0	0	0	0.000	0.00000	Low	27		no
Wayland		HAYWARD BROOK	0	3391	0	0	0	0	0.000	0.00000	Low	27		no
Wayland		HAYWARD BROOK	0	3404	0	0	0	0	0.000	0.00000	Low	27		no
Wayland		HAYWARD BROOK	0	3408	0	0	0	0	0.000	0.00000	Low	27		no
Wayland		HAYWARD BROOK	0	3409	0	0	0	0	0.000	0.00000	Low	27		no

Outfall Info					Receiving Water				Ranking Output					
Owner	MassDEP Stream Segment (AU ID)	Waterbody Name	Excluded Outfall?	Outfall ID	Discharge to Pub Beach, Shellfish or Rec	Discharge to Bacteria/ Pathogen Impaired Waterbody	Discharge to Zone I and Zone II	Stormwater Related Impairments	Receiving Water Score	Final Outfall Score	EPA Priority Category	Number of High Priority Outfalls	Waterbody Ranking for Dry Outfall Screening	Wet Weather Screening Required?
Name of owner	MA73030	"Lake Anywhere"	1 or 0 (1=auto excluded)	Your Unique Outfall ID #	1 or 0 (1=auto high)	1 or 0 (1=auto high)	1 or 0 (1=auto high)	0= no impair, 1= 1-2 impair, 2= 3-5 impair, 3 = >5 impair	Calculated	Calculated	Calculated	Calculated	Calculated	Calculated
Wayland		HAYWARD BROOK	0	3417	0	0	0	0	0.000	0.00000	Low	27		no
Wayland		HAYWARD BROOK	0	3424	0	0	0	0	0.000	0.00000	Low	27		no
Wayland		HAYWARD BROOK	0	3425	0	0	0	0	0.000	0.00000	Low	27		no
Wayland		HAZEL BROOK	0	3663	0	0	0	0	0.000	0.00000	Low	27		no
Wayland	MA82A-20	MILL BROOK	0	3708	0	0	0	0	0.000	0.00000	Low	4		no

APPENDIX E

Inspection Field Forms and Sampling Procedures

OUTFALL INVENTORY FIELD SHEET

Section 1: Background Data

City/Town:	Street:	Tax Map #:	Outfall ID: OF-
Owner: <input type="checkbox"/> City <input type="checkbox"/> State <input type="checkbox"/> Private <input type="checkbox"/> Other: _____		Nearest House/Utility Pole #:	
Today's date:		Time (Military):	
Investigators:		Form completed by:	
Temperature (°F):	Rainfall (in.): Last 24 hours:		Last 48 hours:
Northing:	Easting:	GPS Unit:	GPS LMK #:
Rim Elevation:		Invert Elevation:	
Elevation Datum:		Receiving Water:	
Camera:		Photo #s: -- Take 1 Upstream (head on) and 1 Downstream view	
Land Use in Drainage Area (Check all that apply):			
<input type="checkbox"/> Industrial		<input type="checkbox"/> Open Space	
<input type="checkbox"/> Urban Residential		<input type="checkbox"/> Institutional	
<input type="checkbox"/> Suburban Residential		Other: _____	
<input type="checkbox"/> Commercial		Known Industries: _____	
Notes (e.g., origin of outfall, if known):			

Section 2: Outfall Description

TYPE	MATERIAL	SHAPE	DIMENSIONS (IN.)	SUBMERGED
<input type="checkbox"/> Closed Pipe	<input type="checkbox"/> RCP <input type="checkbox"/> CMP <input type="checkbox"/> PVC <input type="checkbox"/> HDPE <input type="checkbox"/> Steel <input type="checkbox"/> Other: _____	<input type="checkbox"/> Circular <input type="checkbox"/> Single <input type="checkbox"/> Elliptical <input type="checkbox"/> Double <input type="checkbox"/> Box <input type="checkbox"/> Triple <input type="checkbox"/> Other: _____ <input type="checkbox"/> Other: _____	Diameter/Dimensions: _____	In Water: <input type="checkbox"/> No <input type="checkbox"/> Partially <input type="checkbox"/> Fully With Sediment: <input type="checkbox"/> No <input type="checkbox"/> Partially <input type="checkbox"/> Fully
<input type="checkbox"/> Open drainage	<input type="checkbox"/> Concrete <input type="checkbox"/> Pavement/Scupper <input type="checkbox"/> Earthen <input type="checkbox"/> rip-rap <input type="checkbox"/> Other: _____	<input type="checkbox"/> Trapezoid <input type="checkbox"/> Parabolic <input type="checkbox"/> Other: _____	Depth: _____ Top Width: _____ Bottom Width: _____	
Flow Present?	<input type="checkbox"/> Yes <input type="checkbox"/> No <i>If No, Skip to Section 3. If Yes, Notify Town and continue field reconnaissance.</i>			
Flow Description (If present)	<input type="checkbox"/> Trickle <input type="checkbox"/> Moderate <input type="checkbox"/> Substantial		Flow Direction (If Present):	

Section 3: Sketch

Outfall Inventory Field Sheet

Section 4: Physical Indicators for Flowing Outfalls Only

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

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

Section 5: Physical Indicators for Both Flowing and Non-Flowing Outfalls

Are physical indicators that are not related to flow present? Yes No *(If No, Skip to Section 6)*

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

Section 6: Potential for Illicit Discharge

<input type="checkbox"/> Unlikely <input type="checkbox"/> Potential (presence of two or more indicators) <input type="checkbox"/> Suspect (one or more indicators with a severity of 3) <input type="checkbox"/> Obvious

Section 7: Any Non-Illicit Discharge Concerns (e.g., trash or needed infrastructure repairs)?



Ammonia Nitrogen Test Kit

NI-SA (2428700)

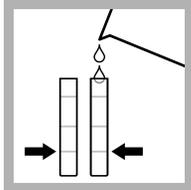
DOC326.98.00007

Test preparation

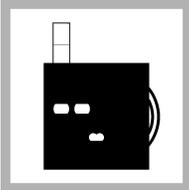
CAUTION: Review the Safety Data Sheets (MSDS/SDS) for the chemicals that are used. Use the recommended personal protective equipment.

- Put the color disc on the center pin in the color comparator box (numbers to the front).
- Use sunlight or a lamp as a light source to find the color match with the color comparator box.
- Rinse the tubes with sample before the test. Rinse the tubes with deionized water after the test.
- If the color match is between two segments, use the value that is in the middle of the two segments.
- If the color disc becomes wet internally, pull apart the flat plastic sides to open the color disc. Remove the thin inner disc. Dry all parts with a soft cloth. Assemble when fully dry.
- To verify the test accuracy, use a standard solution as the sample.
- This test kit is for seawater. If used for brackish or fresh water, the test kit gives a higher than actual value. The error in brackish water is usually less than 10%. The error in low salinity or fresh water is a maximum 16%.
- This test is very sensitive to contamination. Try to get the same result on a second test. Fully rinse the tubes with fresh sample before the second test. The reagents clean the tubes during the first test.
- To increase the range of this test to 4 mg/L NH₃-N, dilute the sample as follows. Use a 3-mL syringe to add 2.5 mL of sample to each tube. Dilute the sample to the 5-mL mark with deionized water. Use the diluted sample in the test procedure and multiply the result by 2.

Test procedure—Ammonia-nitrogen (0–2.0 mg/L NH₃-N)



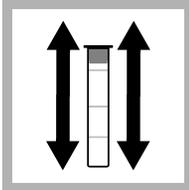
1. Fill two tubes to the first line (5 mL) with sample.



2. Put one tube into the left opening of the color comparator box.



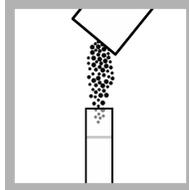
3. Add one Ammonia Salicylate Reagent Powder Pillow to the second tube.



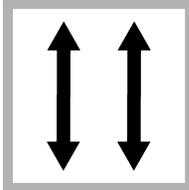
4. Put a stopper on the tube. Shake until the powder fully dissolves.



5. Wait 3 minutes.



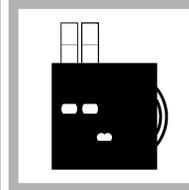
6. Add one Ammonia Cyanurate Reagent Powder Pillow to the same tube. Put a stopper on the tube.



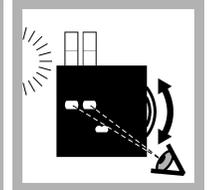
7. Shake until the powder fully dissolves.



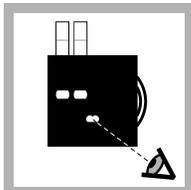
8. Wait 15 minutes. A green color develops.



9. Put the second tube into the color comparator box.



10. Hold the color comparator box in front of a light source. Turn the color disc to find the color match.



11. Read the result in mg/L in the scale window.

Replacement items

Description	Unit	Item no.
Ammonia Salicylate Reagent Powder Pillows, 5 mL	50/pkg	2395266
Ammonia Cyanurate Reagent Powder Pillows, 5 mL	50/pkg	2395466
Color disc, ammonia nitrogen, salicylate, 0–2.0 mg/L	each	9261300
Color comparator box	each	173200
Glass viewing tubes, glass, 18 mm	6/pkg	173006
Stoppers for 18-mm glass tubes and AccuVac Ampuls	6/pkg	173106

Optional items

Description	Unit	Item no.
Nitrogen ammonia standard solution, 1.0 mg/L NH ₃ -N	500 mL	189149
Water, deionized	500 mL	27249
Syringe, Luer-Lok® Tip, 3 mL	each	4321300

Calculate the mg/L NH₃ and mg/L NH₄⁺

Ammonia in water is in the form of the ammonium ion (NH₄⁺) and un-ionized ammonia (NH₃). NH₃ is toxic to fish. [Table 1](#) shows that the percent of NH₃ increases as the pH and temperature increase. This test kit measures both NH₄⁺ and NH₃ as ammonia nitrogen (NH₃-N).

To calculate the mg/L NH₃ in the sample, refer to [Table 1](#) and the equation that follows.

$$\text{mg/L NH}_3 = ((\text{mg/L NH}_3\text{-N} \times \text{percent NH}_3 \text{ from Table 1}) \div 100) \times 1.2$$

Example: The test result was 1.6 mg/L NH₃-N. The sample pH was 7.6 and the sample temperature was 16 °C. The mg/L NH₃ is $((1.6 \times 1.16) \div 100) \times 1.2 = 0.02 \text{ mg/L NH}_3$.

To calculate the mg/L NH₄⁺ in the sample, refer to [Table 1](#) and the equation that follows.

$$\text{mg/L NH}_4^+ = ((\text{mg/L NH}_3\text{-N} \times (100 - \text{percent NH}_3 \text{ from Table 1})) \div 100) \times 1.3$$

Example: The test result was 1.6 mg/L NH₃-N. The sample pH was 7.6 and the sample temperature was 16 °C. The mg/L NH₄⁺ is $((1.6 \times (100 - 1.16)) \div 100) \times 1.3 = 2.056 \text{ mg/L NH}_4^+$.

Table 1 Percent of NH₃ in water

pH	16 °C	18 °C	20 °C	22 °C	24 °C	26 °C	28 °C	30 °C	32 °C
7.0	0.29	0.34	0.39	0.46	0.52	0.60	0.69	0.80	0.91
7.2	0.46	0.54	0.62	0.82	0.83	0.96	1.10	1.26	1.44
7.4	0.73	0.85	0.98	1.14	1.31	1.50	1.73	1.98	2.26
7.6	1.16	1.34	1.55	1.79	2.06	2.36	2.71	3.10	3.53
7.8	1.82	2.11	2.44	2.81	3.22	3.70	4.23	4.82	5.48
8.0	2.86	3.30	3.81	4.38	5.02	5.74	6.54	7.43	8.42
8.2	4.45	5.14	5.90	6.76	7.72	8.80	9.98	11.29	12.72
8.4	6.88	7.90	9.04	10.31	11.71	13.26	14.95	16.78	18.77
8.6	10.48	11.97	13.61	15.41	17.37	19.50	21.78	24.22	26.80
8.8	15.66	17.73	19.98	22.41	25.00	27.74	30.62	33.62	36.72
9.0	22.73	25.46	28.36	31.40	34.56	37.83	41.16	44.53	47.91
9.2	31.80	35.12	38.55	42.04	45.57	49.09	52.58	55.99	59.31
9.4	42.49	46.18	49.85	53.48	57.02	60.45	63.73	66.85	69.79
9.6	53.94	57.62	61.17	64.56	67.77	70.78	73.58	76.17	78.55
9.8	64.99	68.31	71.40	74.28	76.92	79.33	81.53	83.51	85.30
10.0	74.63	77.35	79.83	82.07	84.08	85.88	87.49	88.92	90.19
10.2	82.34	84.41	86.25	87.88	89.33	90.60	91.73	92.71	93.58



Detergents CHEMets Kit

K-9400/R-9400: 0 - 3 ppm

Test Procedure

1. Rinse the reaction tube with the sample to be tested, and then fill it to the 5 mL mark with the sample.
2. While holding the double-tipped ampoule in a vertical position, snap the upper tip using the tip breaking tool (fig. 1).
3. Invert the ampoule and position the open end over the reaction tube. Snap the upper tip and allow the contents to drain into the reaction tube (fig. 1).
4. Cap the reaction tube and shake it vigorously for **30 seconds**. Allow the tube to stand undisturbed for **1 minute**.
5. Make sure that the flexible tubing is firmly attached to the CHEMet ampoule tip.
6. Insert the CHEMet assembly (tubing first) into the reaction tube making sure that the end of the flexible tubing is at the bottom of the tube. Break the tip of the CHEMet ampoule by gently pressing it against the side of the reaction tube (fig. 2). The ampoule should draw in fluid only from the organic phase (bottom layer).
7. When filling is complete, remove the CHEMet assembly from the reaction tube.
8. Remove the flexible tubing from the CHEMet ampoule and wipe all liquid from the exterior of the ampoule. Place an ampoule cap firmly onto the tip of the CHEMet ampoule. Invert the ampoule several times, allowing the bubble to travel from end to end.

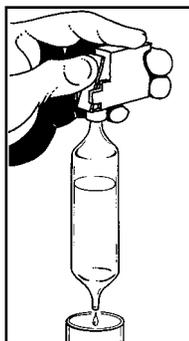


Figure 1

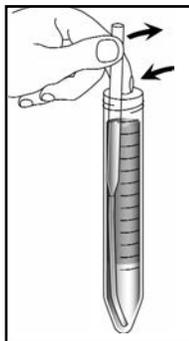


Figure 2

9. Obtain a test result by placing the ampoule, flat end first, into the comparator. Hold the comparator up toward a source of light and view from the bottom. Rotate the comparator until the best color match is found (fig. 3).

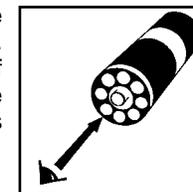


Figure 3

Tip Breaker

The tip breaker opens for easy disposal of the glass tips (pull lever away from body of tip breaker or pull open the side wall). The tip breaker will work most effectively if the tips are emptied out frequently.

Test Method

The Detergents CHEMets^{®1} test kit employs the methylene blue extraction method^{2,3,4}. Anionic detergents react with methylene blue to form a blue complex that is extracted into an immiscible organic solvent. The intensity of the blue color is directly related to the concentration of "methylene blue active substances (MBAS)" in the sample. Anionic detergents are one of the most prominent methylene blue active substances. Test results are expressed in ppm (mg/Liter) linear alkylbenzene sulfonate (equivalent weight 325).

1. CHEMets is a registered trademark of CHEMetrics, Inc. U.S. Patent No. 3,634,038
2. APHA Standard Methods, 22nd ed., Method 5540 C - 2000
3. EPA Methods for Chemical Analysis of Water and Wastes, Method 425.1 (1983)
4. ASTM D 2330-02, Methylene Blue Active Substances

Safety Information

Read SDS (available at www.chemetrics.com) before performing this test procedure. Wear safety glasses and protective gloves.



www.chemetrics.com
4295 Catlett Road, Midland, VA 22728 U.S.A.
Phone: (800) 356-3072; Fax: (540) 788-4856
E-Mail: orders@chemetrics.com

Feb. 18, Rev. 10

CHLORINE, TOTAL, Low Range (0 to 2.00 mg/L Cl₂)

For water, wastewater and seawater

DPD Method* USEPA accepted (powder pillows only)**

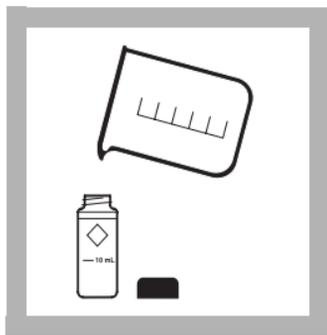
Measuring Hints

If the sample temporarily turns yellow after reagent addition or the display shows overrange (flashing **2.20** in display), dilute a fresh sample and repeat the test. A slight loss of chlorine may occur because of the dilution. Multiply the result by the appropriate dilution factor.

* Adapted from *Standard Methods for the Examination of Water and Wastewater*.

** Procedure is equivalent to USEPA method 330.5 for wastewater and Standard Method 4500-Cl G for drinking water.

CHLORINE, TOTAL, Low Range, continued



1. Fill a 10-mL cell to the 10-mL line with sample. Cap.

Note: Samples must be analyzed immediately and cannot be preserved for later analysis.

Note: Be sure the instrument is in the low range mode. See page 37.



2. Add the contents of one DPD Total Chlorine Powder Pillow to the sample cell (the prepared sample). Cap and gently shake for 20 seconds.

Note: Gently shaking dissipates bubbles which may form in samples containing dissolved gases.

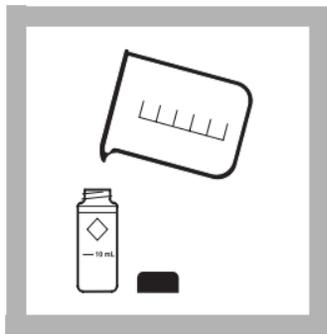


3. Wait 3 minutes. During this period, proceed with steps 4–8.

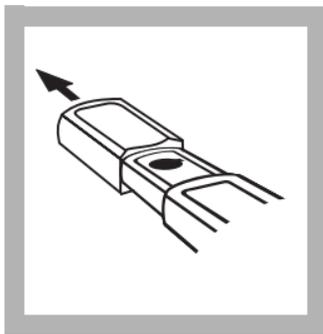
Note: A pink color will form if chlorine is present.

Note: Accuracy is not affected by undissolved powder.

CHLORINE, TOTAL, Low Range, continued

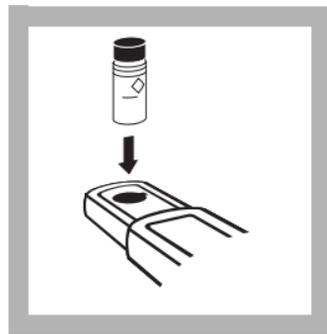


4. Fill a 10-mL sample cell to the 10-mL line with sample (the blank). Cap.



5. Remove the instrument cap.

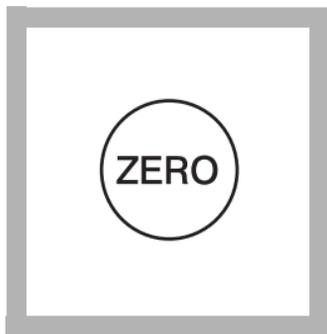
Note: For best results, zero the instrument and read the sample under the same lighting conditions.



6. Place the blank in the cell holder, with the diamond mark facing you. Tightly cover the cell with the instrument cap (flat side should face the back of the instrument).

Note: Wipe liquid off sample cells.

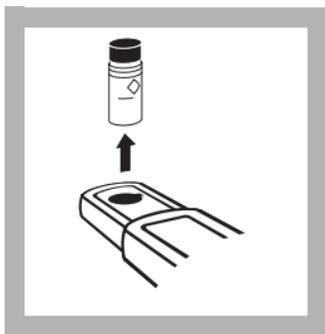
CHLORINE, TOTAL, Low Range, continued



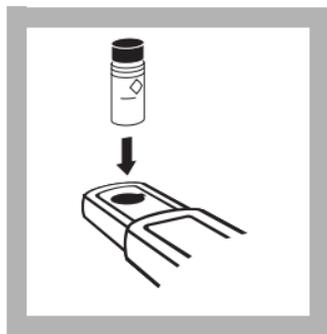
7. Press: ZERO

The instrument will turn on and the display will show - - - followed by **0.00**.

Note: The instrument automatically shuts off after 1 minute and stores the last zero in memory. Press **READ** to complete the analysis.



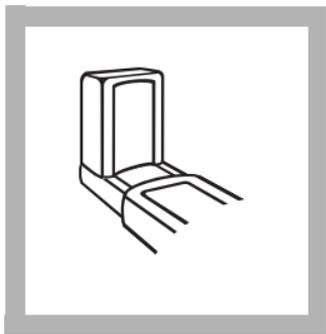
8. Remove the cell from the cell holder.



9. Within 3 minutes after the 3-minute reaction period, place the prepared sample in the cell holder.

Note: Wipe liquid off sample cells.

CHLORINE, TOTAL, Low Range, continued



10. Cover the cell with instrument cap.



11. Press: **READ**

The instrument will show - - - followed by the result in mg/L total chlorine.

Note: *If the sample temporarily turns yellow after reagent addition or shows overrange (flashing 2.20), dilute a fresh sample and repeat the test. Some loss of chlorine may occur. Multiply the result by the dilution factor.*

CHLORINE, TOTAL, Low Range, continued

Using AccuVac® Ampuls



1. Fill a 10-mL sample cell to the 10-mL line with sample (the blank). Cap. Collect at least 40 mL of sample in a 50-mL beaker.

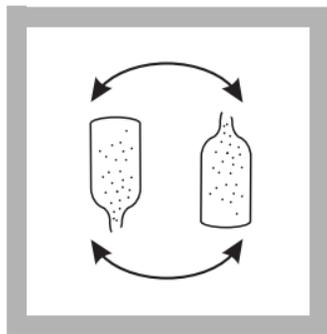
Note: Samples must be analyzed immediately and cannot be preserved for later analysis.



2. Fill a DPD Total Chlorine Reagent AccuVac Ampul with sample (the prepared sample).

Note: Keep the tip immersed until the ampule fills completely.

Note: Be sure the instrument is in low range. See page 37.



3. Quickly invert the ampule several times to mix. Wipe off any liquid or fingerprints.

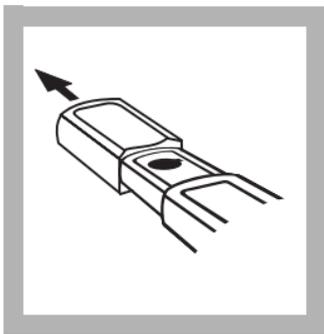
Note: A pink color will develop if chlorine is present.

Note: Accuracy is not affected by undissolved powder.

CHLORINE, TOTAL, Low Range, continued

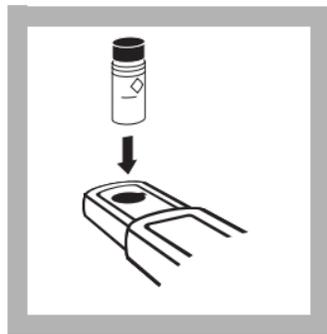


4. Wait 3 minutes. During this period, proceed with steps 5–8.



5. Remove the instrument cap.

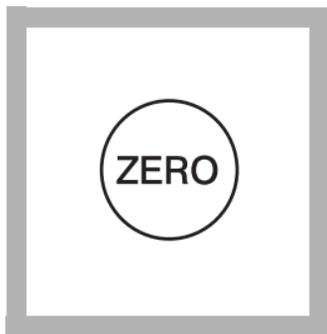
Note: For best results, zero and read the sample measurements under the same lighting conditions.



6. Place the blank in the cell holder with the diamond mark facing you. Tightly cover the cell with the instrument cap (flat side should face the back of the instrument).

Note: Wipe liquid off sample cells.

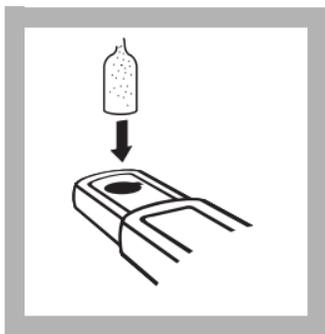
CHLORINE, TOTAL, Low Range, continued



7. Press: ZERO

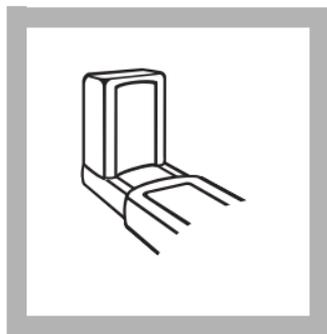
The instrument will turn on and the display will show - - - then **0.00**.

Note: The instrument automatically shuts off after 1 minute and stores the last zero in memory. Press **READ** to complete the analysis.



8. Within 3 minutes after the 3-minute reaction period, place the prepared sample in the cell holder.

Note: Wipe liquid off sample cells.



9. Cover the ampule with the instrument cap.

CHLORINE, TOTAL, Low Range, continued



10. Press: **READ**

The instrument will show
- - - followed by the result
in mg/L total chlorine.

Note: *If the sample temporarily turns yellow after reagent addition or shows overrange (flashing 2.20), dilute a fresh sample and repeat the test. Some loss of chlorine may occur. Multiply the result by the dilution factor.*

CHLORINE, TOTAL, Low Range, continued

Accuracy Check

Standard Additions Method

- a. Snap the neck off a Chlorine Standard Solution Voluette® Ampule.
- b. Use a TenSette® pipet to add 0.1, 0.2, and 0.3 mL of standard to three 25-mL samples. Swirl gently to mix. (For AccuVac Ampuls, use 50-mL beakers.)
- c. Analyze a 10-mL aliquot of each sample as described in the procedure. Each 0.1 mL of standard will cause an incremental increase in chlorine, the exact value depends on the concentration of the Voluette ampule standard. Check the certificate enclosed with the Voluette ampules for this value.
- d. If these increases do not occur, call Hach at 800-227-4224. Outside the United States, contact the Hach office or distributor serving you.

Interferences

Samples containing more than the 250 mg/L alkalinity or 150 mg/L acidity as CaCO_3 may inhibit full color development, or the color may fade instantly. Neutralize these samples to pH 6–7 with 1 N Sulfuric Acid or 1 N Sodium Hydroxide. Determine the

CHLORINE, TOTAL, Low Range, continued

amount required on a separate 10-mL sample. Add the same amount to the sample to be tested. Correct for the additional volume.

Bromine, iodine, ozone and oxidized forms of manganese and chromium may also react and read as chlorine.

To compensate for the effects of manganese (Mn^{4+}) or chromium (Cr^{6+}), adjust the pH to 6–7 as described above. To a 25-mL sample, add 3 drops of 30 g/L Potassium Iodide Solution, mix, and wait one minute. Add 3 drops of 5 g/L Sodium Arsenite and mix. If chromium is present, allow exactly the same reaction period with DPD for both analyses. Subtract the result of this test from the original analysis to obtain the accurate chlorine concentration.

DPD Total Chlorine Reagent Powder Pillows and AccuVac Ampuls contain a buffer formulation that withstands high levels (at least 1000 mg/L) of hardness without interference.

CHLORINE, TOTAL, Low Range, continued

REQUIRED REAGENTS

Description	Unit	Cat. No.
DPD Total Chlorine Reagent Powder Pillows	100/pkg.....	21056-69
or		
DPD Total Chlorine Reagent AccuVac [®] Ampuls.....	25/pkg.....	25030-25

REQUIRED APPARATUS (AccuVac[®] Ampuls)

Beaker, 50 mL.....	each.....	500-41
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OPTIONAL REAGENTS

Chlorine Standard Solution Voluette [®]		
Ampules, 50-75 mg/L, 10 mL.....	16/pkg.....	14268-10
Chlorine Standards, secondary, Specv [™] ,		
0.0, 0.2, 0.8, and 1.5 mg/L	4/set.....	26353-00
DPD Total Chlorine Reagent w/dispensing cap	250 tests.....	21056-29
Potassium Iodide Solution, 30 g/L.....	100 mL MDB*	343-32
Sodium Arsenite Solution, 5 g/L	100 mL MDB.....	1047-32
Sodium Hydroxide Standard Solution, 1 N	100 mL MDB.....	1045-32
Sulfuric Acid Standard Solution, 1 N	100 mL MDB.....	1270-32
Water, deionized	4 L.....	272-56

* Marked Dropper Bottle

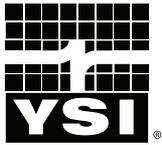
CHLORINE, TOTAL, Low Range, continued

OPTIONAL APPARATUS

Description	Unit	Cat. No.
AccuVac® Snapper Kit.....	each	24052-00
Batteries, AAA, alkaline.....	4/pkg	46743-00
Caps for 10-mL sample cells.....	12/pkg	24018-12
Cylinder, graduated, 25 mL, poly.....	each	1081-40
Cylinder, graduated, 100 mL, PMP.....	each	2172-42
sens <i>ion</i> ™ I Basic Portable pH Meter, with electrode	each	51700-10
Pipet, TenSette®, 0.1 to 1.0 mL.....	each	19700-01
Pipet Tips, For 19700-01 TenSette®.....	50/pkg	21856-96
Sample Cells, 10-mL with screw caps.....	6/pkg	24276-06

REPLACEMENT PARTS

Instrument Cap/light shield	each	46704-00
Instrument Manual.....	each	46760-88



Pro30



USER MANUAL

English

CONTENTS

Warranty	i
Introduction	1
Getting Started	1
Initial Inspection.....	1
Battery Installation	1
Key Pad	2
Connecting the Probe/Cable Assembly to the Instrument.....	3
Run Screen.....	4
Backlight	5
Powering Off	5
Navigation.....	5
First Power On	5
System Setup Menu.....	6
Audio	7
Contrast	7
Conductivity Units (Cond. Units).....	8
Conductivity Auto Stable (Cond. Auto Stable).....	9
Temperature Units	9
Specific Conductance Reference Temperature (SPC Ref. Temp.).....	10
Specific Conductance Temperature Coefficient (SPC %/°C).....	10
TDS Constant	10
Language.....	11
Auto Shutoff	11
Cell Constant.....	11
Resetting the System Setup Menu to Factory Default.....	12
Calibration	12
Temperature.....	12
Conductivity Calibration	12

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Taking Measurements.....	15
Saving and Viewing Data	15
Saving Data.....	16
Viewing and Erasing Saved Data - Data Mode.....	16
Care, Maintenance and Storage	19
General Maintenance	19
Sensor Maintenance.....	19
Sensor Storage	20
Troubleshooting	20
Specifications.....	22
Accessories / Part Numbers	23
Declaration of Conformity.....	24
Recycling.....	25
Battery Disposal.....	25
Contact Information.....	26
Ordering and Technical Support.....	26
Service Information	26

WARRANTY

The YSI Professional 30 instrument (Pro30) is warranted for three (3) years from date of purchase by the end user against defects in materials and workmanship, exclusive of batteries and any damage caused by defective batteries. Pro30 cable/probe assemblies are warranted for two (2) years from date of purchase by the end user against defects in material and workmanship. Pro30 instruments & cables are warranted for 90 days from date of purchase by the end user against defects in material and workmanship when purchased by rental agencies for rental purposes. Within the warranty period, YSI will repair or replace, at its sole discretion, free of charge, any product that YSI determines to be covered by this warranty.

To exercise this warranty, call your local YSI representative, or contact YSI Customer Service in Yellow Springs, Ohio at +1 937 767-7241, 800-897-4151 or visit www.YSI.com for a Product Return Form. Send the product and proof of purchase, transportation prepaid, to the Authorized Service Center selected by YSI. Repair or replacement will be made and the product returned, transportation prepaid. Repaired or replaced products are warranted for the balance of the original warranty period, or at least 90 days from date of repair or replacement.

LIMITATION OF WARRANTY

This Warranty does not apply to any YSI product damage or failure caused by:

1. Failure to install, operate or use the product in accordance with YSI's written instructions;
2. Abuse or misuse of the product;
3. Failure to maintain the product in accordance with YSI's written instructions or standard industry procedure;
4. Any improper repairs to the product;
5. Use by you of defective or improper components or parts in servicing or repairing the product;
6. Modification of the product in any way not expressly authorized by YSI.

THIS WARRANTY IS IN LIEU OF ALL OTHER WARRANTIES, EXPRESSED OR IMPLIED, INCLUDING ANY WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. YSI'S LIABILITY UNDER THIS WARRANTY IS LIMITED TO REPAIR OR REPLACEMENT OF THE PRODUCT, AND THIS SHALL BE YOUR SOLE AND EXCLUSIVE REMEDY FOR ANY DEFECTIVE PRODUCT COVERED BY THIS WARRANTY. IN NO EVENT SHALL YSI BE LIABLE FOR ANY SPECIAL, INDIRECT, INCIDENTAL OR CONSEQUENTIAL DAMAGES RESULTING FROM ANY DEFECTIVE PRODUCT COVERED BY THIS WARRANTY.

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INTRODUCTION

Thank you for purchasing the YSI Pro30, an instrument from the YSI *Professional Series* product family. The Pro30 measures conductivity and temperature in water. The Pro30 features an impact resistant and waterproof (IP-67) case, a rugged MS-8 (military-spec) cable connector, backlit display, user-selectable sensor options, 50 data set memory, internal barometer and a rubber over-mold case.

The Pro30 provides valuable instructions and prompts near the bottom of the display that will guide you through operation and use. However, reading the entire manual is recommended for a better understanding of the instrument's features.



The Pro30 cannot communicate to a PC via a Pro Series communications saddle. Connecting the Pro30 to a communication saddle may cause erratic instrument behavior.

GETTING STARTED

INITIAL INSPECTION

Carefully unpack the instrument and accessories and inspect for damage. Compare received parts with items on the packing list. If any parts or materials are damaged or missing, contact YSI Customer Service at 800-897-4151 (+1 937 767-7241) or the authorized YSI distributor from whom the instrument was purchased.

BATTERY INSTALLATION

The instrument requires 2 alkaline C-cell batteries. Under normal conditions, the average battery life is 425 hours at room temperature without using the back light. A battery symbol  will blink in the lower, left corner of the display to indicate low batteries when approximately 1 hour of battery life remains.

To install or replace the batteries:

1. Turn the instrument off and flip over to view the battery cover on the back.
2. Unscrew the four captive battery cover screws.
3. Remove the battery cover and remove the old batteries if necessary.
4. Install the new batteries, ensuring correct polarity alignment (figure 1).

- Place the battery cover on the back of the instrument and tighten the four screws. Do not over-tighten.

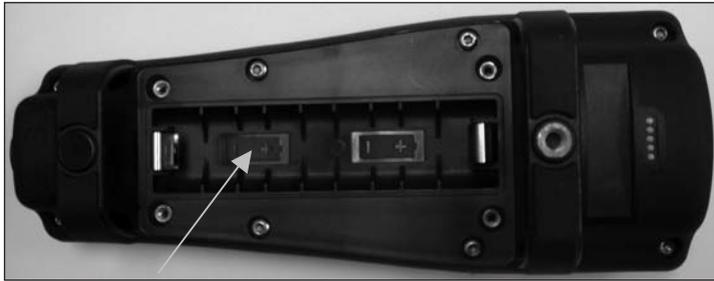


Figure 1. Pro30 with battery cover removed. Notice battery symbols indicating polarities.

i The waterproof instrument case is sealed at the factory and is not to be opened, except by authorized service technicians. Do not attempt to separate the two halves of the instrument case as this may damage the instrument, break the waterproof seal, and will void the warranty.

KEY PAD

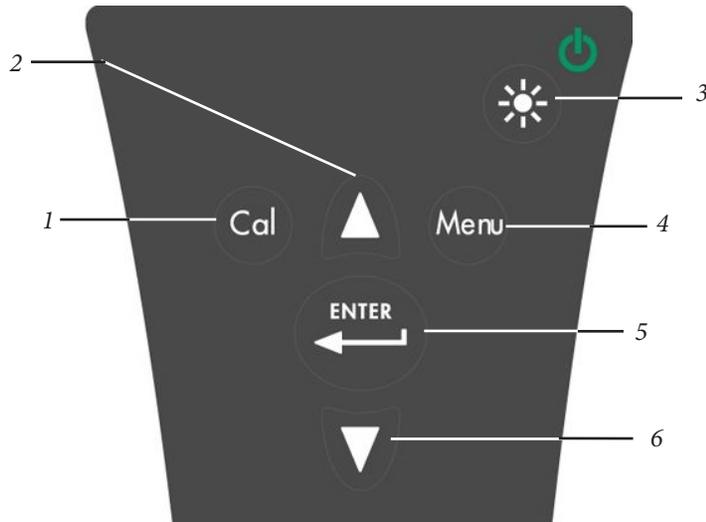


Figure 2, Keypad

Number	Key	Description
1		Calibrate Press and hold for 3 seconds to calibrate. Opens Calibrate menu from the Run screen.
2		Up Arrow Use to navigate through menus, to navigate through box options along the bottom of the Run screen and to increase numerical inputs.
3		Power and Backlight Press once to turn instrument on. Press a second time to turn backlight on. Press a third time to turn backlight off. Press and hold for 3 seconds to turn instrument off.
4		Menu Use to enter the System Setup menu from the Run screen.
5		Enter Press to confirm entries and selections.
6		Down Arrow Use to navigate through menus, to navigate through box options at the bottom of the Run screen and to decrease numerical inputs.

CONNECTING THE PROBE/CABLE ASSEMBLY TO THE INSTRUMENT

The conductivity and temperature sensors are integral to the cable assembly; therefore, they cannot be removed from the cable.

To connect the cable, align the keys on the cable connector to the slots on the instrument connector. Push together firmly and then twist the outer ring until it locks into place (figure 3). This connection is water-proof.



Figure 3, Note the keyed connector.

RUN SCREEN

Press the power/backlight key  to turn the instrument on. The instrument will run through a self test and briefly display a splash screen with system information before displaying the main Run screen (figure 4). The first time the Pro30 is turned on, it will prompt you to select a language; see the First Power On section of this manual for more information.

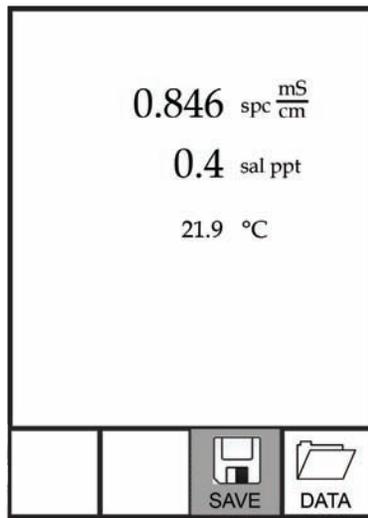


Figure 4, Run screen.

BACKLIGHT

Once the instrument is powered on, pressing the power/backlight key  will turn on the display backlight. The backlight will remain on until the key is pressed again or after two minutes of not pressing any key on the keypad.

POWERING OFF

To turn the instrument off, press and hold the power/backlight key  for three seconds.

NAVIGATION

The up  and down  arrow keys allow you to navigate through the functions of the Pro30.

NAVIGATING THE RUN SCREEN

When in the Run screen, the up  and down  arrow keys will move the highlighted box along the bottom options. Once a box is highlighted, press enter to access the highlighted option.

Description of Run screen box functions from left to right:

Option	Description
 SAVE	Highlight and press enter to save displayed data to memory.
 DATA	Highlight and press enter to view and/or erase saved data.

NAVIGATING THE SYSTEM SETUP MENU

When in the System Setup menu, the up and down arrow keys will move the highlighted bar up and down the system setup options. See the System Setup menu section of this manual for more information about these options.

FIRST POWER ON

The instrument will step through an initial language configuration when powered on for the first time. Use the up or down arrow keys to highlight the

appropriate language then press enter to confirm (figure 5). If an incorrect language is selected, it may be changed in the System Setup menu.

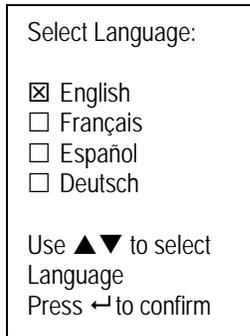


Figure 5, Select language.

After selecting a language, the Run screen will be displayed. The next time the instrument is powered up, the Run screen will display immediately after the splash screen.

SYSTEM SETUP MENU

Press the menu  key to access the System Setup menu. The System Setup menu contains multiple screens that are notated as 'pages'. The current page is indicated near the bottom of the display (figure 6).

Use the up and down arrow keys to scroll through menu options and menu pages.

EXITING THE SYSTEM SETUP MENU

To exit the System Setup menu, press the down arrow key until the ESC - Exit box is highlighted, then press enter to return to the Run screen.

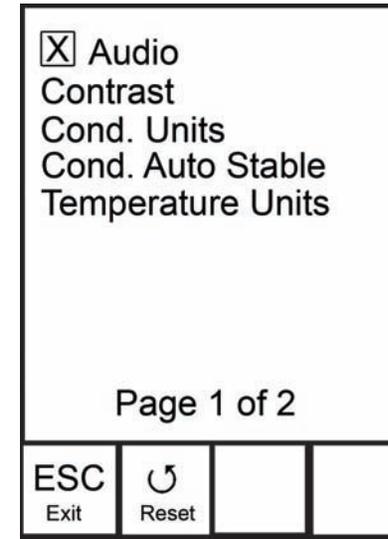


Figure 6, page 1 of System Setup menu. Audio is enabled.

AUDIO

Audio can be enabled or disabled by using the up or down arrow keys to highlight Audio and pressing enter. When enabled, there will be an 'X' in the box next to Audio.

When Audio is enabled, the Pro30 will beep twice to indicate stability when Auto Stable is enabled. The instrument will also beep when a key is pressed. When Audio is disabled, the Pro30 will not beep.

CONTRAST

To adjust the display Contrast, use the up or down arrow keys to highlight Contrast, then press enter. Next, use the up or down arrow keys to adjust the contrast. The up arrow key will darken the contrast and the down arrow key will lighten the contrast. After adjusting the contrast, press enter to save and exit the Contrast adjustment option.

EMERGENCY CONTRAST ADJUSTMENT

If necessary, there is an alternate method of adjusting the contrast. To adjust the contrast, press and hold the menu key, then press the up arrow key to darken the contrast or press the down arrow key to lighten the contrast.

CONDUCTIVITY UNITS (COND. UNITS)

Highlight Cond. Units (Conductivity Units) and press enter to open a submenu that allows you to select the conductivity units to be displayed on the Run screen. Highlight a unit and press enter to enable or disable it. An enabled conductivity unit will have an 'X' in the box next to it. Highlight the ESC-Exit box along the bottom of the display and press enter to save any changes and to close the conductivity units submenu.

There are seven options for displaying conductivity. Only four units can be enabled at the same time:

- COND-mS/cm displays conductivity in milliSiemens per centimeter.
- COND-uS/cm displays conductivity in microSiemens per centimeter.
- SPC-mS/cm displays Specific Conductance in milliSiemens per centimeter. Specific Conductance is temperature compensated conductivity.
- SPC-uS/cm displays Specific Conductance in microSiemens per centimeter. Specific Conductance is temperature compensated conductivity.
- Sal ppt displays salinity in parts per thousand. The salinity reading is calculated from the instrument's conductivity and temperature values using algorithms found in *Standard Methods for the Examination of Water and Wastewater*.
- TDS g/L displays Total Dissolved Solids in grams per liter. TDS is calculated from conductivity and temperature using a user-selectable TDS constant.
- TDS mg/L displays Total Dissolved Solids in milligrams per liter. TDS is calculated from conductivity and temperature using a user-selectable TDS constant.

Note: 1 milliSiemen = 1,000 microSiemens.

SPECIFIC CONDUCTANCE

The conductivity of a sample is highly dependent on temperature, varying as much as 3% for each change of one degree Celsius (temperature coefficient = 3%/°C). In addition, the temperature coefficient itself varies with the nature of the ionic species present in the sample. Therefore, it is useful to compensate for this temperature dependence in order to quickly compare conductivity readings taken at different temperatures.

The Pro30 can display non-temperature compensated conductivity as well as temperature compensated Specific Conductance. If Specific Conductance is selected, the Pro30 uses the temperature and conductivity values associated with

each measurement to calculate a specific conductance value compensated to a user selected reference temperature, see below. Additionally, the user can select the temperature coefficient from 0% to 4%.

Using the Pro30's default reference temperature and temperature coefficient (25 °C and 1.91%), the calculation is carried out as follows:

$$\text{Specific Conductance (25°C)} = \frac{\text{Conductivity of sample}}{1 + 0.0191 * (T - 25)}$$

T = Temperature of the sample in °C

CONDUCTIVITY AUTO STABLE (COND. AUTO STABLE)

Auto Stable utilizes preset values to indicate when a reading is stable. The preset values are adjustable in the System Setup menu. The user can input a % change in readings (0.0 to 1.9) over 'x' amount of time in seconds (3-19).

Highlight Cond. Auto Stable, then press enter to open the submenu.

Use the up or down arrow keys to highlight the % change or seconds (secs) input field, then press enter to make the highlighted field adjustable. Use the up or down arrow keys to adjust the selected value, then press enter to confirm changes. Once you have confirmed any changes, highlight the ESC-Exit box along the bottom of the display and press enter to close the Auto Stable submenu.

To disable Auto Stable, set the % Change input to 0.0.

When Auto Stable is enabled, an AS symbol will display next to the reading on the Run screen and blink during stabilization. When the dissolved oxygen and/or conductivity reading stabilizes based on the Auto Stable settings, the AS symbol will display steadily and the instrument will beep twice if Audio is turned on.

TEMPERATURE UNITS

Highlight Temperature Units and press enter to open a submenu that allows you to change the temperature units displayed on the Run screen. Highlight the desired unit (Celsius or Fahrenheit) and press enter to enable. The enabled temperature unit will have an 'X' in the box next to it. Only one unit may be enabled at a time. Highlight the ESC-Exit box and press enter to save any changes and to close the Temperature Units submenu.

SPECIFIC CONDUCTANCE REFERENCE TEMPERATURE (SPC REF. TEMP.)

SPC Ref. Temp. (Specific Conductance Reference Temperature) is the reference temperature used to calculate Specific Conductance. The reference temperature range is 15 and 25 °C. The default value is 25 °C.

To change the reference temperature, highlight SPC Ref. Temp. and press enter to open the submenu. With the reference temperature highlighted, press enter to make the field adjustable. Next, use the up or down arrow key to increase or decrease the value. Press enter to save the new reference temperature. Next, highlight the ESC-Exit box and press enter to close the submenu.

SPECIFIC CONDUCTANCE TEMPERATURE COEFFICIENT (SPC %/°C)

SPC %/°C (Specific Conductance Temperature Coefficient) is the temperature coefficient used to calculate Specific Conductance. The coefficient range is 0.00 to 4.00. The default value is 1.91% which is based on KCl standards.

To change the temperature coefficient, highlight SPC %/°C and press enter to open the submenu. With the temperature coefficient highlighted, press enter to make the field adjustable. Next, use the up or down arrow key to increase or decrease the value. Press enter to save the new coefficient. Next, highlight the ESC-Exit box and press enter to close the submenu.

TDS CONSTANT

TDS Constant is a multiplier used to calculate an estimated TDS (Total Dissolved Solids) value from conductivity. The multiplier is used to convert Specific Conductance in mS/cm to TDS in g/L. The Pro30's default value is 0.65. This multiplier is highly dependent on the nature of the ionic species present in the water sample. To be assured of moderate accuracy for the conversion, you must determine a multiplier for the water at your sampling site. Use the following procedure to determine the multiplier for a specific sample:

1. Determine the specific conductance of a water sample from the site;
2. Filter a sample of water from the site;
3. Completely evaporate the water from a carefully measured volume of the filtered sample to yield a dry solid;
4. Accurately weigh the remaining solid;
5. Divide the weight of the solid (in grams) by the volume of water used (in liters) to yield the TDS value in g/L for this site;
6. Divide the TDS value in g/L by the specific conductance of the water in mS/cm to yield the conversion multiplier. Be certain to use the correct units.

If the nature of the ionic species at the site changes between sampling studies, the TDS values will be in error. TDS cannot be calculated accurately from specific conductance unless the make-up of the chemical species in the water remains constant.

To change the TDS Constant in the Pro30, highlight TDS Constant and press enter to open the submenu. With the TDS Constant highlighted, press enter to make the field adjustable. Next, use the up or down arrow key to increase or decrease the value. The input range is 0.30 to 1.00. Press enter to save the new TDS Constant. Next, highlight the ESC-Exit box and press enter to close the submenu.

LANGUAGE

Highlight Language and press enter to open a submenu that allows you to change the language. Highlight the desired language (English, Spanish, German, or French) and press enter to enable. The enabled language will have an 'X' in the box next to it. Highlight ESC-Exit box and press enter to save any changes and to close the Language submenu.

The text in the boxes along the bottom of the Run screen will always be displayed in English regardless of the language enabled in the System Setup menu.

AUTO SHUTOFF

Auto Shutoff allows you to set the instrument to turn off automatically after a period of time. Use the up or down arrow keys to highlight Auto Shutoff, then press enter to open the submenu. Press enter while the minute field is highlighted to make it adjustable. Next, use the up or down arrow keys to adjust the shut off time from 0 to 60 minutes. Press enter to save the new shutoff time. Next, highlight the ESC-Exit box and press enter to close the submenu.

To disable Auto Shutoff, set the Time in Minutes to 0 (zero).

CELL CONSTANT

The Cell Constant displays the cell constant of the conductivity cell. The cell constant is calculated and updated each time a conductivity calibration is performed. The cell constant range is 4.0 to 6.0. Resetting the System Menu resets the cell constant to 5.0.

RESETTING THE SYSTEM SETUP MENU TO FACTORY DEFAULT

To reset the Pro30 settings to factory default, press the down arrow key while in the System Setup menu until the Reset -  box is highlighted, then press enter. The instrument will ask you to confirm the reset. Highlight Yes and press enter to continue with the reset or highlight No and press enter to cancel the reset. A Factory Reset will not affect data saved in the instrument's memory.

The following will be set in the Pro30 after performing a reset:

<i>Parameter</i>	<i>Reset Defaults</i>
Audio	On
Contrast	Set to mid range
Conductivity Units	cond uS/cm, spc mS/cm, spc uS/cm and sal ppt
Conductivity Auto Stable	Off (0.0 % Change and 10 seconds)
SPC Reference Temperature	25°C
SPC Temperature Coefficient	1.91%/°C
TDS Constant	0.65
Temperature Units	°C
Language	English
Auto Shutoff	30 minutes
Conductivity Cell Constant	Cell constant reset to 5.0*

*It is recommended to perform a Conductivity calibration after performing a reset.

CALIBRATION

TEMPERATURE

All Pro30 cables have built-in temperature sensors. Temperature calibration is not required nor is it available.

CONDUCTIVITY CALIBRATION

Ensure the conductivity sensor is clean and dry before performing a conductivity, specific conductance or salinity calibration.



It is not necessary to calibrate conductivity, specific conductance and salinity. Calibrating one of these parameters will simultaneously calibrate the others. YSI recommends calibrating specific conductance for greatest ease.

CALIBRATING SPECIFIC (SP.) CONDUCTANCE OR CONDUCTIVITY

Note: When calibrating Specific Conductance, the Pro30 uses the factory default values for the Specific Conductance Reference Temperature and the Specific Conductance Temperature Coefficient regardless of what is configured in the System Setup Menu. The default value for the Reference Temperature is 25°C and the default value for the Temperature Coefficient is 1.91%/°C. It is important to note that the Temperature Coefficient of a calibration solution is dependent on the contents of the solution. Therefore, YSI recommends using a traceable calibration solution made of KCl (potassium chloride) when calibrating Specific Conductance since these solutions typically have a Temperature Coefficient of 1.91%/°C. Additionally, be sure to enter the value of the solution as it is listed for 25°C when calibrating Specific Conductance.

1. Fill a clean container (i.e. plastic cup or glass beaker) with fresh, traceable conductivity calibration solution and place the sensor into the solution. The solution must cover the holes of the conductivity sensor that are closest to the cable (figure 7). Ensure the entire conductivity sensor is submerged in the solution or the instrument will read approximately half the expected value. Gently move the probe up and down to remove any air bubbles from the conductivity sensor.

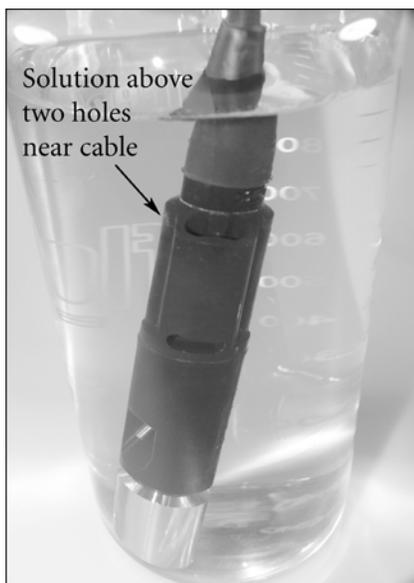


Figure 7, solution above two holes near cable.

2. Turn the instrument on and allow the conductivity and temperature readings to stabilize. Press and hold the Cal key for 3 seconds. Highlight Conductivity and press enter. Next, highlight the desired calibration method, Sp. Conductance or Conductivity, and press enter.
3. Highlight the units you wish to calibrate, either uS/cm or mS/cm, and press enter. 1 mS = 1,000 uS. Next, use the up or down arrow key to adjust the value on the display to match the value of the conductivity calibration solution. If calibrating conductivity, it is necessary to look up the value of the solution at the current temperature and enter that value into the Pro30. Most conductivity solutions are labeled with a value at 25°C. If calibrating specific conductance, enter the value listed for 25°C. Depressing either the up or down arrow key for 5 seconds will move the changing digit one place to the left. The Pro30 will remember the entered calibration value and display it the next time a conductivity calibration is performed.
4. Press enter to complete the calibration. Or, press Cal to cancel the calibration and return to the Run screen.
5. 'Calibration Successful' will display for a few seconds to indicate a successful calibration and then the instrument will return to the Run screen.
6. If the calibration is unsuccessful, an error message will display on the screen. Press the Cal key to exit the calibration error message and return to the Run screen. See the Troubleshooting guide for possible solutions.

CALIBRATING IN SALINITY

1. Fill a clean container (i.e. plastic cup or glass beaker) with fresh, traceable salinity calibration solution and place the sensor into the solution. The solution must cover the holes of the conductivity sensor that are closest to the cable (figure 7). Ensure the entire conductivity sensor is submerged in the solution or the instrument will read approximately half the expected value. Gently move the probe up and down to remove any air bubbles from the conductivity sensor.
2. Turn the instrument on and allow the conductivity and temperature readings to stabilize. Press and hold the Cal key for 3 seconds. Highlight Conductivity and press enter. Next, highlight Salinity and press enter.
3. Use the up or down arrow key to adjust the value on the display to match the value of the salinity solution. Depressing either the up or down arrow key for 5 seconds will move the changing digit one place to the left. The Pro30 will remember the entered calibration value and display it the next time a salinity calibration is performed.
4. Press enter to complete the calibration. Or, press Cal to cancel the calibration and return to the Run screen.
5. 'Calibration Successful' will display for a few seconds to indicate a successful calibration and then the instrument will return to the Run screen.
6. If the calibration is unsuccessful, an error message will display on the screen. Press the Cal key to exit the calibration error message and return to the Run screen. See the Troubleshooting guide for possible solutions.

TAKING MEASUREMENTS

Before taking measurements, be sure the instrument has been calibrated to ensure the most accurate readings. Place the probe in the sample to be measured and give the probe a quick shake to release any air bubbles. Be sure the conductivity sensor is completely submerged in the sample. The two holes near the cable should be covered by the sample for accurate conductivity readings (figure 7). Allow the temperature readings to stabilize.

SAVING AND VIEWING DATA

The Pro30 can store 50 data sets in non-volatile memory for later viewing. A data set includes the values currently on the display, i.e. temperature, dissolved oxygen and two conductivity parameters. Each data point is referenced with a data set number, 01 through 50.

SAVING DATA



The Pro30 can not communicate to a PC via a Pro Series communications saddle. Connecting the Pro30 to a communication saddle may cause erratic instrument behavior.

From the Run screen, use the up or down arrow keys to highlight the Save box and press enter to save the current readings. The instrument will indicate the data set is saved and display the saved data set's number (figure 8).

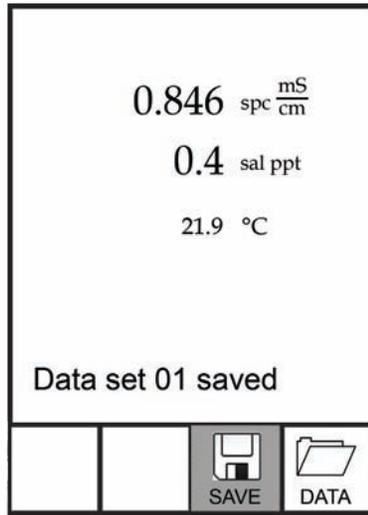


Figure 8, data set saved.

The instrument will display 'Memory Full' if all 50 data sets have been saved and you attempt to save another data set.

VIEWING AND ERASING SAVED DATA - DATA MODE

Data mode allows you to view and erase saved data. From the Run screen, use the up or down arrow keys to highlight Data and press enter to access Data mode. Note that the function boxes at the bottom of the display are different in Data mode (figure 9).

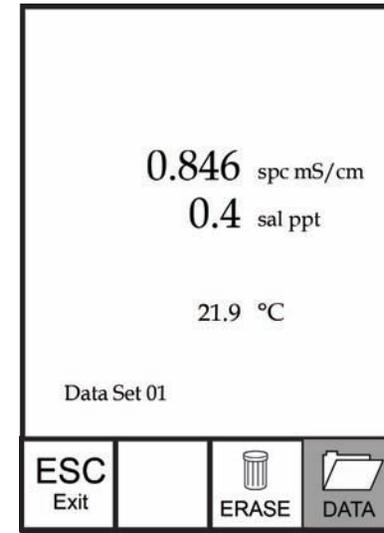


Figure 9, Data mode.

VIEWING DATA

Once in Data mode, use the up and down arrow keys to view saved data sets in sequential order or press enter to access the bottom functions. After accessing the bottom functions, highlight the Data box and press enter to regain access to viewing data. The data set displayed is indicated by the data set number, 01 through 50.

ERASING DATA

While viewing saved data, press the enter key to access the function boxes at the bottom of the display. Next, use the up or down arrow keys to highlight Erase, then press enter. The instrument will give you the option to erase one data set or all data sets (figure 10).

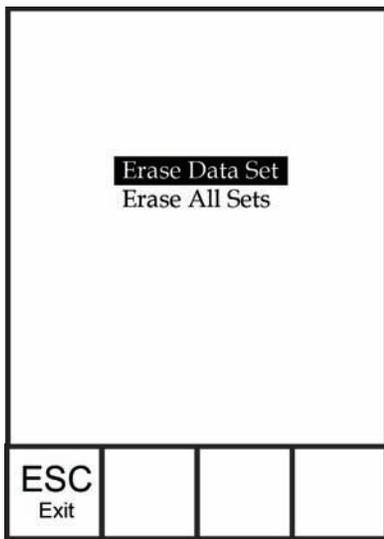


Figure 10, Erase data mode.

Use the up or down arrow key to select Erase Data Set, Erase All Sets or the ESC-Exit function box, then press enter to confirm.

Select ESC-Exit and press enter to exit Erase mode without erasing any data.

Select Erase Data Set and press enter to erase the data set that was displayed before entering Erase mode. For example, if data set 12 was displayed before entering erase mode, and Erase Data Set is selected, Data Set 12 will be erased from memory and the data sets AFTER that number will move up to keep them sequential. For example, if there are 15 records and number 12 is erased then 13 becomes 12, 14 becomes 13, and 15 becomes 14. The instrument will return to Data mode after erasing one data set.

Select Erase All Data Sets and press enter to clear the Pro30 memory and return to Data mode.

EXITING DATA MODE

While in Data mode, press enter to access the bottom functions. Next, highlight the ESC-Exit box and press enter to return to the Run screen.

CARE, MAINTENANCE AND STORAGE

This section describes the proper procedures for care, maintenance and storage of the instrument. The goal is to maximize their lifetime and minimize downtime associated with improper instrument usage.

GENERAL MAINTENANCE

GENERAL MAINTENANCE - GASKET

The instrument utilizes a gasket as a seal to prevent water from entering the battery compartment. Following the recommended procedures will help keep the instrument functioning properly.

If the gasket and sealing surfaces are not maintained properly, it is possible that water can enter the battery compartment. If water enters this area, it can severely damage the battery terminals causing loss of battery power and corrosion to the battery terminals. Therefore, when the battery compartment lid is removed, the gasket that provides the seal should be carefully inspected for contamination (i.e. debris, grit, etc.) and cleaned with water and mild detergent if necessary.

SENSOR MAINTENANCE

SENSOR MAINTENANCE - TEMPERATURE

You must keep the temperature sensor free of build up. Other than that, no additional maintenance is required. A toothbrush can be used to scrub the temperature sensor if needed.

SENSOR MAINTENANCE - CONDUCTIVITY

The openings that allow sample access to the conductivity electrodes should be cleaned regularly. The small cleaning brush included in the Maintenance Kit is intended for this purpose. Dip the brush in clean water and insert it into each hole 10 to 12 times. In the event that deposits have formed on the electrodes, it may be necessary to use a mild detergent (laboratory grade soap or bathroom foaming tile cleaner) with the brush. Rinse thoroughly with clean water, then check the response and accuracy of the conductivity cell with a calibration solution.

SENSOR STORAGE

SHORT AND LONG TERM STORAGE

For both short and long term storage, the conductivity sensor should be stored clean and dry.

Remove the batteries from the instrument when storing it for long periods of time (>30 days).

Long Term Storage Temperature: -5 to 70°C (23 to 158°F)

TROUBLESHOOTING

<i>Symptom</i>	<i>Possible Solution</i>
Instrument will not turn on, a battery symbol appears, or “Critical Shutdown” displays on the screen.	<ol style="list-style-type: none"> 1. Low battery voltage, replace batteries. 2. Batteries installed incorrectly, check battery polarity. 3. Return system for service.
Temperature values display Over or Undr on Run screen.	<ol style="list-style-type: none"> 1. Sample temperature is less than -5° C or more than +55°C. Increase or decrease the sample temperature to bring within the allowable range. 2. Contact YSI Tech Support.
Instrument will not calibrate the Conductivity sensor; instrument displays “Calibration Over”, “Calibration Under”, or “Unstable Reading” during calibration.	<ol style="list-style-type: none"> 1. Ensure the conductivity sensor is clean. Follow the cleaning procedures in the Care, Maintenance and Storage section of this manual. 2. Verify the calibration solution is above the two holes near the cable, see figure 8. 3. Verify the calibration solution is not expired or contaminated. Try a new bottle of solution. 4. Ensure you are entering in the correct value for the solution according to the measurement units. 1 mS = 1,000 uS. 5. Allow sufficient stabilization time for conductivity and temperature AND wait at least 3 seconds before confirming a calibration. 6. Contact YSI Tech Support.

<i>Symptom</i>	<i>Possible Solution</i>
Conductivity readings are inaccurate.	<ol style="list-style-type: none"> 1. Ensure the conductivity sensor is clean. Follow the cleaning procedures in the Care, Maintenance and Storage section of this manual. 2. Verify the sample is above the two holes near the cable, see figure 8. 3. Verify calibration. 4. Verify temperature readings are accurate. 5. Verify the correct units are setup in the System Setup menu, i.e. uS vs mS and Conductivity vs. Specific Conductance. 6. Contact YSI Tech Support.
Conductivity values display Over or Undr on Run screen.	<ol style="list-style-type: none"> 1. Ensure the conductivity sensor is clean. Follow the cleaning procedures in the Care, Maintenance and Storage section of this manual. 2. Verify the sample is above the two holes near the cable, see figure 8 3. Verify calibration. 4. Verify temperature readings are accurate. 5. Sample conductivity is outside the measurement range of the instrument, i.e. 0-200 mS. 6. Contact YSI Tech Support.

SPECIFICATIONS

These specifications represent typical performance and are subject to change without notice. For the latest product specification information, please visit YSI's website at www.ysi.com or contact YSI Tech Support.

<i>Parameter</i>	<i>Range</i>	<i>Resolution</i>	<i>Accuracy</i>
Temperature	-5 to 55°C	0.1°C	± 0.2°C
Conductivity	0-500 uS/cm 0-5 mS/cm 0-50 mS/cm 0-200 mS/cm (auto ranging)	0.0001 to 0.1 mS/cm; 0.1 to 0 uS/cm (range dependent)	Instrument only: ± 0.5% of the reading or 1 uS/cm, whichever is greater. Instrument with 1 or 4 meter cables: ± 1.0% of the reading or 1 uS/cm, whichever is greater. Instrument with 10, 20, or 30 meter cables: ± 2.0% of the reading or 1 uS/cm, whichever is greater.
Salinity	0 to 70 ppt	0.1 ppt	± 1.0% of the reading or ± 0.1 ppt, whichever is greater.
Total Dissolved Solids (TDS)	0 to 100 g/L. TDS Constant range: 0.3 to 1.00 (0.65 default)	0.0001 to 0.1 g/L (range dependent)	Dependent on accuracy of temperature, conductivity and TDS Constant.

ACCESSORIES / PART NUMBERS

<i>Part Number</i>	<i>Description</i>
6050030	Pro30 Instrument
60530-1, -4, -10, -20, or -30	1, 4, 10, 20, 30-meter cable assembly*
603077	Flow cell
603056	Flow cell mounting spike
603075	Carrying case, soft-sided
603074	Carrying case, hard-sided
603069	Belt clip
063517	Ultra clamp for instrument
063507	Tripod for instrument
603062	Cable management kit, included with all cables longer than 1 meter.
605978	Cable weight, 4.9 oz, stackable
603070	Shoulder strap
060907	Conductivity Calibration Solution, 1,000 µS/cm. 1 box of 8 pints.
060911	Conductivity Calibration Solution, 10,000 µS/cm. 1 box of 8 pints.
060660	Conductivity Calibration Solution, 50,000 µS/cm. 1 box of 8 pints.
065274	Conductivity Calibration Solution, 100,000 µS/cm. 1 box of 8 pints.

*All cables include a temperature and conductivity sensor.

DECLARATION OF CONFORMITY

The undersigned hereby declares on behalf of the named manufacturer under our sole responsibility that the listed product conforms to the requirements for the listed European Council Directive(s) and carries the CE mark accordingly.

<i>Manufacturer:</i>	YSI Incorporated 1725 Brannum Lane Yellow Springs, OH 45387 USA
<i>Product Name:</i>	Pro30 Water Quality Instrument
<i>Model Numbers</i>	
<i>Instrument/Accessory:</i>	Pro30 (6050030)
<i>Probe/Cable Assemblies:</i>	60530-1, -4, -10, -20, and -30
<i>Conforms to the following:</i>	
<i>Directives:</i>	IEC 61326-1:2005 RoHS 2002/95/EC WEEE 2002/96/EC IP-67 Protection per ANSI/IEC 60529-2004
<i>Harmonized Standards:</i>	<ul style="list-style-type: none"> EN61326-1:2006 (IEC 61326-1:2005) Basic Immunity
<i>Supplementary Information:</i>	All performance met the operation criteria as follows: 1. ESD, IEC 61000-4-2:2001, Performance Criterion B 2. Radiated Immunity, IEC 61000-4-3, Performance Criterion A 3. Electrical Fast Transient (EFT), IEC 61000-4-4:2004, +Corr. 1:2006 + Corr. 2:2007, Performance Criterion B 4. Radio Frequency, Continuous Conducted Immunity, IEC61000-4-6, Performance Criterion A 5. Radiated Emissions, EN 61326-1:2006 (IEC61326-1:2005) Class B
<i>Authorized EU Representative</i>	YSI Hydrodata Ltd Unit 2 Focal Point, Lacerta Court, Works Road Letchworth, Hertfordshire, SG6 1FJ UK



Signed: Lisa M. Abel
Title: Director of Quality

Date: 27 June 2011

RECYCLING

YSI is committed to reducing the environmental footprint in the course of doing business. Even though materials reduction is the ultimate goal, we know there must be a concerted effort to responsibly deal with materials after they've served a long, productive life-cycle. YSI's recycling program ensures that old equipment is processed in an environmentally friendly way, reducing the amount of materials going to landfills.

- Printed Circuit Boards are sent to facilities that process and reclaim as much material for recycling as possible.
- Plastics enter a material recycling process and are not incinerated or sent to landfills.
- Batteries are removed and sent to battery recyclers for dedicated metals.

When the time comes for you to recycle, follow the easy steps outlined at www.yisi.com.

BATTERY DISPOSAL

The Pro30 is powered by alkaline batteries which the user must remove and dispose of when the batteries no longer power the instrument. Disposal requirements vary by country and region, and users are expected to understand and follow the battery disposal requirements for their specific locale.

CONTACT INFORMATION

ORDERING AND TECHNICAL SUPPORT

Telephone: 800 897 4151 (USA)
+1 937 767 7241 (Globally)
Monday through Friday, 8:00 AM to 5:00 ET

Fax: +1 937 767 9353 (orders)
+1 937 767 1058 (technical support)

Email: environmental@ysi.com
Mail: YSI Incorporated
1725 Brannum Lane
Yellow Springs, OH 45387 USA

Internet: www.ysi.com

When placing an order please have the following available:

- 1.) YSI account number (if available)
- 2.) Name and phone number
- 3.) Purchase Order or Credit Card number
- 4.) Model Number or brief description
- 5.) Billing and shipping addresses
- 6.) Quantity

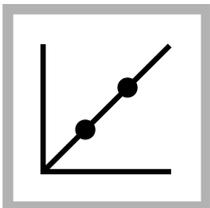
SERVICE INFORMATION

YSI has authorized service centers throughout the United States and Internationally. For the nearest service center information, please visit www.ysi.com and click 'Support' or contact YSI Technical Support directly at 800-897-4151 (+1 937-767-7241).

When returning a product for service, include the Product Return form with cleaning certification. The form must be completely filled out for a YSI Service Center to accept the instrument for service. The form may be downloaded from www.ysi.com by clicking on the 'Support'.

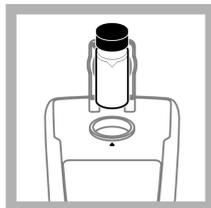
Item # 606082
Rev A
Drawing # A606082
July 2011

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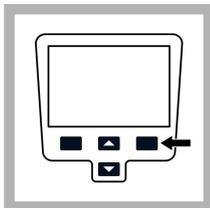


1. Push the **CALIBRATION** key to enter the Calibration mode. Follow the instructions on the display.

Note: Gently invert each standard before inserting the standard.



2. Insert the 20 NTU StablCal Standard and close the lid.
Note: The standard to be inserted is bordered.

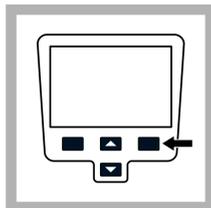


3. Push **Read**. The display shows Stabilizing and then shows the result.

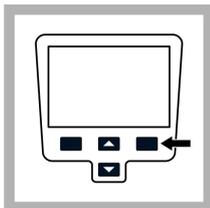


4. Repeat Step 2 and 3 with the 100 NTU and 800 NTU StablCal Standard.

Note: Push **Done** to complete a 2 point calibration.



5. Push **Done** to review the calibration details.



6. Push **Store** to save the results. After a calibration is complete, the meter automatically goes into the Verify Cal mode. Refer to [Calibration verification \(Verify Cal\)](#) on page 16.

Turbidity measurement

⚠ WARNING

Potential explosion and fire hazard. This turbidimeter is designed for water based samples. Do not measure solvent or combustible based samples.

Readings can be taken with the Normal reading mode, Signal Average mode or in the Rapidly Settling Turbidity mode. Refer to [Reading modes](#) on page 16 for more information. For accurate turbidity readings use clean sample cells and remove air bubbles (degassing).

Measurement notes

Proper measurement techniques are important in minimizing the effects of instrument variation, stray light and air bubbles. Use the following measurement notes for proper measurements.

Instrument

- Make sure that the meter is placed on a level, stationary surface during the measurement.
Note: Do not hold the meter in the hand during measurement.
- Always close the sample compartment lid during measurement, calibration and storage.
- Remove sample cell and batteries from the instrument if the instrument is stored for an extended time period (more than a month).
- Keep the sample compartment lid closed to prevent the entry of dust and dirt.

Sample cells

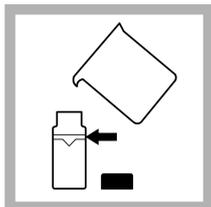
- Always cap the sample cell to prevent spillage of the sample into the instrument.
- Always use clean sample cells in good condition. Dirty, scratched or damaged cells can cause inaccurate readings.
- Make sure that cold samples do not "fog" the sample cell.
- Store sample cells filled with distilled or deionized water and cap tightly.

Measurement

- Measure samples immediately to prevent temperature changes and settling. Before a measurement is taken, always make sure that the sample is homogeneous throughout.
- Avoid sample dilution when possible.
- Avoid operation in direct sunlight.

Turbidity measurement procedure

Note: Before a measurement is taken, always make sure that the sample is homogeneous throughout.



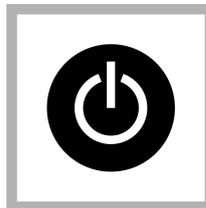
1. Collect a representative sample in a clean container. Fill a sample cell to the line (about 15 mL). Take care to handle the sample cell by the top. Cap the cell.



2. Wipe the cell with a soft, lint-free cloth to remove water spots and fingerprints.

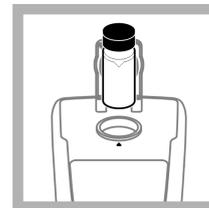


3. Apply a thin film of silicone oil. Wipe with a soft cloth to obtain an even film over the entire surface ([Apply silicone oil to a sample cell](#) on page 17).

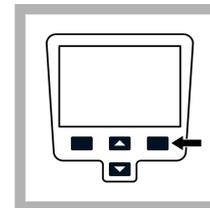


4. Push the **Power** key to turn the meter on. Place the instrument on a flat, sturdy surface.

Note: Do not hold the instrument while making measurements.



5. Gently invert and then insert the sample cell in the instrument cell compartment so the diamond or orientation mark aligns with the raised orientation mark in front of the cell compartment. Close the lid.



6. Push **Read**. The display shows Stabilizing then the turbidity in NTU (FNU). The result is shown and stored automatically ([Refer to Data management](#) on page 11)

Data management

About stored data

The following types of data are stored in the data log:

- Reading Log: stores automatically each time a sample reading is taken (500 records).
- Calibration Log: stores only when **Store** is selected at the end of a calibration (25 records).
- Verify Cal Log: stores only after **Done** is selected at the end of a verification calibration (250 records).

When the data log becomes full, the oldest data point is deleted when more data is added to the log.

View data log

The data log contains Reading Log, Calibration Log and Verify Cal log. All logs can be sorted by date.



MANHOLE INSPECTION FORM

Fill out form,
>Save to file<
Click Update
button =
Fills Summary
line page 2 &
Clears Form

Manhole ID:

Inspection Date:

Inspector:

Street Name:

Nearest Address #:

Manhole Depth:

Overall Rating (1 to 5):
(1=new ... 5=failing)

Inflow Infiltration Rate:
(0=none ... 5=gusher)

Conditions: Dry Wet Standing Water Frozen

MH DETAILS

Location:	Material:	MH Cover size:	MH Barrel size:	Direction Effluent:
Roadway <input type="checkbox"/>	Brick <input type="checkbox"/>	22" <input type="checkbox"/>	48" <input type="checkbox"/>	NW)
Gutter <input type="checkbox"/>	Block <input type="checkbox"/>	24" <input type="checkbox"/>	60" <input type="checkbox"/>	
Paved Alley <input type="checkbox"/>	Concrete <input type="checkbox"/>	30" <input type="checkbox"/>	Other (below) <input type="checkbox"/>	# of Influent: <input type="text"/>
Unpaved Alley <input type="checkbox"/>	Lined <input type="checkbox"/>	36" <input type="checkbox"/>	<input type="checkbox"/>	
Easement <input type="checkbox"/>	Other <input type="checkbox"/>	Other (describe) <input type="text"/>	<input type="checkbox"/>	
Other (describe) <input type="text"/>				

CONDITION

Cover:	Ring & Frame	Cone & Riser:	Barrel:	Rungs:
Serviceable <input type="checkbox"/>	Serviceable <input type="checkbox"/>	Serviceable <input type="checkbox"/>	Serviceable <input type="checkbox"/>	Serviceable <input type="checkbox"/>
Loose <input type="checkbox"/>	Loose <input type="checkbox"/>	Cracked/Broken <input type="checkbox"/>	Cracked/Broken <input type="checkbox"/>	Unsafe <input type="checkbox"/>
Below Grade <input type="checkbox"/>	Displaced <input type="checkbox"/>	Corroded <input type="checkbox"/>	Corroded <input type="checkbox"/>	Missing any <input type="checkbox"/>
Damaged <input type="checkbox"/>	Missing Grout <input type="checkbox"/>	Misaligned <input type="checkbox"/>	Misaligned <input type="checkbox"/>	Corroded <input type="checkbox"/>
Sealed <input type="checkbox"/>	Raise <input type="checkbox"/>	Infiltration <input type="checkbox"/>	Infiltration <input type="checkbox"/>	N/A - no rungs <input type="checkbox"/>
Holes (# of holes) <input type="text"/>	Lower <input type="checkbox"/>	Roots at Joints <input type="checkbox"/>	Roots at Joints <input type="checkbox"/>	

Bench:	Channel:
Serviceable <input type="checkbox"/>	Serviceable <input type="checkbox"/>
Cracked/Broken <input type="checkbox"/>	Obstructed <input type="checkbox"/>
Bad base joint <input type="checkbox"/>	Bad joints <input type="checkbox"/>
	Roots at connection <input type="checkbox"/>

Hydraulics

Indications of Surcharge?:	Issues:
None <input type="checkbox"/>	Grease <input type="checkbox"/>
Minor <input type="checkbox"/>	Debris <input type="checkbox"/>
Yes, need followup <input type="checkbox"/>	Silt <input type="checkbox"/>
	Infiltration, if yes, note below <input type="text"/>
	(None, Minor, Some, Excessive) <input type="text"/>

Describe Flow:
Steady <input type="checkbox"/>
Pulsing <input type="checkbox"/>
Turbulent <input type="checkbox"/>
Surcharging <input type="checkbox"/>
Sluggish <input type="checkbox"/>

COMMENTS:

APPENDIX F

Analytical Testing Methods – Impaired Waters

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

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

Sedimentation/Siltation	Total Suspended Solids	160.2
Bottom Deposits	Total Suspended Solids	160.2
Color	NMR	---
pH, High	pH	150.2
pH, Low	pH	150.2
Taste and Odor	NMR	---
Temperature, water	NMR	---
Salinity	Specific Conductance	120.1
Enterococcus	Enterococcus	1106.1; 1600; Enterolert® 12 22.
Escherichia coli	E. coli	1103.1; 1603; Colilert® 12 16, Colilert-18® 12 15 16.; mColiBlue- 24®17.
Fecal Coliform	Fecal Coliform	1680; 1681
Organic Enrichment (Sewage) Biological Indicators	Enterococcus (marine waters) or E. coli (freshwater)	1106.1; 1600
Debris/Floatables/Trash	NMR	or
Foam/Flocs/Scum/Oil Slicks	Contact MassDEP	1103.1; 1603
Oil and Grease	Oil and Grease	---
Chlorophyll-a	Total Phosphorus (freshwater)	---
	Total Nitrogen (marine waters)	1664
Nutrient/Eutrophication Biological Indicators	Total Phosphorus (freshwater)	365.1; 365.2; 365.3
	Total Nitrogen (marine waters)	351.1/351.2 + 353.2
Dissolved oxygen saturation / Oxygen, Dissolved	Dissolved Oxygen	365.1; 365.2; 365.3
	Temperature	351.1/351.2 + 353.2
	BOD ₅	360.1; 360.2
	Total Phosphorus (freshwater)	SM-2550
	Total Nitrogen (marine waters)	SM-5210
Excess Algal Growth	Total Phosphorus (freshwater)	365.1; 365.2; 365.3
	Total Nitrogen (marine waters)	351.1/351.2 + 353.2
Aquatic Plants (Macrophytes)	NMR	---

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

Notes:

NMR” indicates no monitoring required

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

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

APPENDIX G

IDDE Employee Training Record

Illicit Discharge Detection & Elimination (IDDE) Guide



A stormwater outfall discharging stormwater runoff during a wet weather (rainfall) event.



A stormwater outfall during dry weather conditions (between rain events). No flow is observed.

What is the MS4 Permit?

To comply with U.S. Clean Water Act, the Town of Wayland is subject to the NPDES Municipal Separate Stormwater System (MS4) Permit. The MS4 Permit, administered by the U.S. Environmental Protection Agency (US EPA), regulates what communities can discharge into the rivers, lakes, and ponds.

What is the IDDE Program?

Illicit Discharge Detection & Elimination (IDDE) is the process by which a municipality served by a separate stormwater permit maintains the integrity of its stormwater drainage network, ensuring that only stormwater runoff is being conveyed through pipes and outfall structures to water bodies.



Sudbury River



Lake Cochituate



Dudley Pond

What is an Illicit Discharge?

Illicit Discharges are *“any discharge to an MS4 that is not composed entirely of stormwater.”*

There are a variety of different sources of Illicit Discharges, for example:

- improper pipe connections (i.e., sanitary sewer or non-stormwater discharges) into the MS4 by residential or commercial uses;
- Sanitary Sewer Overflow (SSO) events;
- leakage and seepage (often referred to Inflow + Infiltration, or “I&I”);
- other sources of cross-contamination; or
- improper disposal and/or wash-off of substances into catch basins.

How will I be able to identify an Illicit Discharge?

- ❖ **During dry weather:** Illicit Discharges are most easily identifiable during dry weather conditions (i.e., between rain events). MS4 pipes and outfalls typically do not convey flow during dry weather. The presence of flow or questionable deposits or stains makes it easy to detect Illicit Discharges and their sources. Some outfalls have flow year-round because they are in high groundwater table locations.



- ❖ **During wet weather:** Illicit Discharges may also be identified during wet weather conditions by looking for specific characteristics at or near the outfalls. For instance, specific odors (such as sewage or “rotten egg” smells), discolorations, turbidity (poor clarity), floatable matter (i.e., oil sheen, grease, soap/bubbles), outfall structure damage, or impacts on vegetation (e.g. bare patches, overgrowth, spot algal blooms) are indicators of a potential illicit connection.



For additional guidance, refer to the *IDDE Field Assessment – Companion Sheet*

What is my role in the IDDE program, and how can I help ensure its success?

A proper IDDE program requires regular **inspection** of stormwater outfalls, **identification** of non-compliant conditions, and the **elimination** of Illicit Discharges. To achieve IDDE program goals, quality observation, timely feedback, and follow-up with key IDDE program personnel is required. Key tasks include:

- Document any unusual flows or characteristics with time-stamped photos, location of outfall, and detailed description of observation(s). Include potential source(s) of discharge, if known.
- Notify the Stormwater Management Plan Team Coordinator: **Paul Brinkman** (508-358-3672; pbrinkman@wayland.ma.us) **on the same day as observation.**
- Help sample the dry or wet weather flow, as necessary.



Illicit Discharge Detection & Elimination (IDDE)

Field Assessment – Companion Sheet

Sample Outfall Observations and Possible Sources

Indicator	Observations	Possible Reason/Source
Odor <i>"The area near the outfall smells like..."</i>	Sewage	Sanitary wastewater
	Sulfur (rotten eggs)	Industries (meat packers, canneries, dairies, etc.), or petroleum refineries
	Rancid-sour	Food prep facilities (restaurants, hotels, etc.)
	Oil and gas	Petroleum refineries or vehicle maintenance or product storage facilities
	Chlorine	Residential pool, or drinking water
Color <i>"The color of flow discharged from outfall is..."</i>	Yellow	Chemical plants, textile and tanning plants
	Brown	Meat packers, printing, construction materials, fertilizers, petroleum refining
	Green	Chemical plants, textile facilities
	Red	Metal packers, metal works
	Gray	Dairies, and sewage
Turbidity (clarity) <i>"The clarity of flow discharged from outfall is..."</i>	Cloudy	Sanitary wastewater, construction materials, fertilizers, automotive facilities
	Opaque	Food processors, lumber mills, metal operations, pigment plants
Floatable Matter <i>"Flow discharged from outfall is carrying..."</i>	Oil sheen, grease (rainbow-colored)	Petroleum refineries or storage facilities, automotive facilities, and restaurants
	Sewage	Sanitary wastewater
	Soap/bubbles	Sanitary wastewater
Deposits and Stains <i>"Discharges from outfall have left behind..."</i>	Sediment (excess)	Construction site erosion (stormwater runoff typically conveys fine - or dissolved - sediment; excessive amounts may indicate non-compliant controls for nearby construction activity)
	Oily residue	Sanitary wastewater
Other	Damage to outfall, or impacts on vegetation	From industrial flows, fertilizers, chemicals, automotive or other refining



Between rainfall events, it may be possible to detect Illicit Discharges from non-stormwater sources by the presence of dry weather flow, or questionable deposits, stains, or odors. During wet weather, the table (above) may aid in determining the source.



Contact Stormwater Management Plan Team Coordinator, Paul Brinkman (508-358-3672) on the same day as Illicit Discharge observation to report conditions. For additional information, refer to the IDDE Plan.

Wayland DPW

M54 Staff Training Session

25-Jun-19

Print Name

Sign Name

Ryan S
 Michael Wilson
 Scott Perry
 Larry Merrill
 John Rumsey
 Joey Phillip
 Peter Zani
 Derek Bonner
 Jeremy Mori
 Tristan Ng
 Chris Blaire
 OLIVER AHEARNE
 Mike Rumsey
~~MICHAEL BARNES~~
 Michael Jones
 Aaron Stone
 Joel Collins
 Steve Moschella
 Don Gemme
 Kyle Cone
 Jake Perry
 JIMMY GAZZANIGA
 Norcissa Babou
 JACOB BARRY SR.
 Bill Kane
 Ed
 Bill Chantland
 Joe Doucette
 Tom Halder

[Handwritten signatures]
 Ryan
 Michael Wilson
 Scott Perry
 Larry Merrill
 John Rumsey
 Joey Phillip
 Peter Zani
 Derek Bonner
 Jeremy Mori
 Tristan Ng
 Chris Blaire
 OLIVER AHEARNE
 Mike Rumsey
~~MICHAEL BARNES~~
 Michael Jones
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 Joel Collins
 Steve Moschella
 Don Gemme
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 Jimmy Gazzaniga
 Norcissa Babou
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 Bill Kane
 Ed
 Bill Chantland
 Joe Doucette
 Tom Halder