Hazen and Sawyer
24 Federal Street, 5th Floor
Boston, MA 02110 • 617.574.4747

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

June 2020

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List of Acronyms

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

1. Introduction

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

The 2016 MS4 Permit is based on the implementation of six minimum control measures.

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

This Preliminary IDDE Plan addresses minimum control measure 3 and includes a summary of system mapping efforts, prioritization of outfalls for investigation, procedure and timeline for dry- and wet-weather sampling inspections, and training information. This document satisfies the June 30, 2020 submittal milestone requirement in the AO; the document will be reviewed by EPA and revised by the City accordingly. A Final IDDE Plan will be submitted by December 31, 2021, per the associated AO submittal milestone.

1.1 Illicit Discharge Definition

The 2016 MS4 Permit defines an illicit discharge as "any discharge to a municipal separate storm sewer that is not composed entirely of stormwater except discharges pursuant to a NPDES permit (other than the NPDES permit for discharges from the municipal separate storm sewer) and discharges resulting from fire fighting activities." An illicit discharge can be caused by either a direct or indirect connection into a drainage system and an intentional or unintentional action. A direct connection is a physical tie-in to a drainage system such as a cross-connection of a sewer service to a drain line. An indirect connection can be more difficult to identify. Examples of indirect connections include runoff from a commercial vehicle washing operation, the improper use of a sump pump, or seepage of contaminated groundwater into a drain line.

1.1.1 Allowable Non-Stormwater Discharges

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

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

1.2 Receiving Waters

Table 1-1 is a summary of the impaired waters within the City of Somerville that receive stormwater discharges from the MS4, based on the 2014 Massachusetts Integrated List of Waters from MassDEP. The MS4 Permit defines an impaired water as a waterbody that "does not meet one or more of its designated use(s)." A map of the City of Somerville MS4 area and receiving waters are included in **Appendix B**.

Table 1-1: Impaired Receiving Waters

Waterbody Name	Segment ID	Number of Outfalls	Impairments
Alewife Brook	MA71-04	7	Dissolved Oxygen/DO Saturation, Phosphorous, Solids/TSS/Turbidity, E. Coli
Mystic River	MA71-02	5	Dissolved Oxygen/DO Saturation, Phosphorous, Solids/TSS/Turbidity, E. Coli
Mystic River	MA71-03	2	Dissolved Oxygen/DO Saturation

1.3 IDDE Program Goals and Timeline

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

- Legal authority
- Stormwater System Mapping
- Inventory and Ranking of Outfalls
- Dry Weather Outfall Sampling Procedures and Evaluation
- Catchment Investigations
- Illicit Discharge Removal
- Follow Up Sampling
- Employee Training

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

Table 1-2: IDDE Program Implementation Schedule

Milestone	Date
Submit Preliminary IDDE Plan to Regulatory Agencies	June 2020
Perform Training for City of Somerville Staff	July 2020
Perform Outfall Screening and Sampling	July 2020 to December 2021
Perform Catchment Investigations	July 2020 to December 2021
Submit Final IDDE Plan to Regulatory Agencies	December 2021

2. Authority and Statement of IDDE Responsibilities

2.1 Legal Authority

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

2.2 Statement of Responsibilities

The Department of Infrastructure and Asset Management (IAM) is the primary department responsible for implementing and documenting efforts associated with the IDDE program for the City of Somerville. The Department of IAM will evaluate sampling data and complete system mapping efforts. The 311 Service Center is a tool available to residents and can be used to report potential illicit connections. This service is available 24/7 by phone at 311 (617-666-3311 outside Somerville), on the City's website (https://www.somervillema.gov/311), or email (311updates@somervillema.gov). Other departments that will assist with the IDDE program include:

- Water and Sewer
    - Responsibilities include performing outfall sampling and catchment investigation field work. The City of Somerville will provide training to staff in July 2020.

3. Stormwater Mapping and Delineation

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

3.1 Phase I

At present, a preliminary (Phase I) delineation of drainage areas tributary to the MS4 has been completed. By delineating the areas that are tributary to the MS4, the City of Somerville can begin to develop plans to identify sources of illicit discharges within the delineated drainage areas when issued are observed at the outfalls. The Phase I delineation was completed using the City of Somerville's existing sewer and drain system GIS data. The purpose of this section is to describe the methodology used to complete the Phase I delineation.

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

The delineation was performed according to the following process:

1. Identification of all stormwater outfalls in GIS. Outfalls were identified from the "storm discharge point" GIS layer, and labeled with the "facility ID" contained in the attributes.
2. Starting at the drain outfalls, stormwater gravity main piping was traced upstream to determine the mapped extent of the separate drain system.
3. If a connection between the stormwater and combined sewer system was identified, the downstream outfall (CSO) and tributary pipe network was not included in the delineation (since the combined sewer system is not included in the IDDE program).
4. A drainage area boundary was drawn around the stormwater pipe network tributary to each stormwater outfall. The drainage area boundary was drawn by considering the placement of drainage infrastructure (as indicated by GIS), natural boundaries (such as open water, wooded/grassed area, etc.), and artificial boundaries (street, buildings, and other infrastructure).

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

It is also important to note that stormwater gravity mains that recombine with sewer pipes (based on GIS representations) were not included in the delineation, as these pipes are considered part of the combined sewer overflow (CSO) system.

3.2 Phase II

As the IDDE program is further developed and implemented, the drainage area delineation will be updated based on the results of field investigations. Field investigations will verify pipe connectivity (as currently shown in GIS) and be used to refine drainage area boundaries. Field investigation procedures are discussed further in Section 7.

Phase II mapping will include the following elements (in addition to the elements already including in Phase I mapping):

- Refined collection system networks (pipes, manholes, etc.)
    - Sanitary sewer
    - Combined sewer
    - Stormwater
- Refined drainage area delineations reflective of better system understanding from field investigations
- Other relevant information gathered during field investigations (evidence of cross connection, outfall condition, etc.)

4. Sanitary Sewer Overflows

A sanitary sewer overflow (SSO) is the discharge of untreated wastewater from a sanitary sewer to a separate storm sewer system or surface water. SSOs can be caused by blockages, pipe breaks, or system capacity limitations. The City of Somerville has compiled a list of the SSOs that have occurred within the five years prior to the issuance of the 2016 MS4 Permit based on available records.

Pursuant to the 2016 MS4 Permit, the City of Somerville will provide oral notice to the EPA within 24 hours of any known SSO occurrence. Written notice and an updated SSO inventory will be provided to the EPA and MassDEP within five days of becoming aware of the SSO.

Table 4-1 is an inventory of SSOs that have occurred over the past five years.

Table 4-1: SSO Inventory (revised June 2020)

SSO Location	Discharge Statement	Date	Time Start	Time End	Estimated Volume	Description	Mitigation Completed	Mitigation Planned
570 Somerville Ave (Conway Rink aka Veterans Memorial Skating Rink)[1]	Unknown	1/16/2018	2:00 PM	3:00 PM	45 gallons	Frozen force main at pump station.	Yes	Thawing via steam injection

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

5. Prioritization of Outfalls

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

5.1 Preliminary Outfall Drainage Area Delineations

As described in Section 3.1, an initial delineation of drainage areas tributary to MS4 outfalls was completed. This preliminary delineation was completed using GIS data provided by the City of Somerville. Various characteristics of the drainage areas were estimated using publicly available GIS data for the purpose of initial prioritization of outfalls for further field investigations, as described in Section 5.3. It should be noted that the preliminary delineations and drainage area characteristics identified will be refined as field investigations are completed.

5.2 Prioritization Methodology

A numerical scoring system was developed to inform the initial outfall prioritization. This scoring system was developed to account for downstream impacts (in/around receiving waters) and upstream drainage area characteristics that could impact the probability of illicit discharges occurring. **Table 5-1** contains the criteria that were considered for scoring outfalls.

Table 5-1: Scoring System for Initial Outfall Prioritization

Outfall/Drainage Area Criteria	Definition	Data Source	Yes Score	No/Unknown Score
Previous Results Indicate Illicit Discharges?	Previous outfall sampling indicative of the presence of illicit discharges (e.g., sewerage). Existing data showing non-stormwater source is strongly indicative of an ID source.	2019 AO	10	0
Average Infrastructure/Development Age > 20 years?	Aerial imagery indicative of mostly/old existing development without new residential, commercial, or other types of development. Areas with old infrastructure are more likely to have undocumented sources of IDs.	Aerial Imagery	5	1
Outfall Size > 24"?	Somerville GIS records indicate a large outfall (24" or greater). Larger outfalls typically discharge greater amounts of stormwater that could result in impairment of receiving waters.	Somerville GIS (if available)	3	1
Predominantly Residential Land Use?	Aerial imagery indicative of mostly residential land use. In Somerville, residential areas are more likely to be serviced by aging sewer infrastructure that could be the source of an ID.	Aerial Imagery	3	1
Discharge to Area of Public Health Concern?	Outfall discharges to an area near or at a location that could cause a public health concern (e.g., a trail, park, beach, etc.). Outfalls that could have IDs and discharge near recreational areas could compromise public health.	MassGIS	5	0
Tributary Area Size >10 aces?	The size of the (preliminary) delineated drainage area exceeds 10 acres. Outfalls with larger tributary areas have more potential sources of IDs.	Preliminary Drainage Area Delineation	5	1

A higher score corresponds with a higher probability of an outfall/tributary area having an illicit discharge and with a greater risk of negative public health impacts. The highest possible score of 31 points indicates an outfall that should be prioritized for investigations. Outfalls with lower scores should receive a lower priority for field investigations.

5.3 Initial Ranking/Prioritization

Using the scoring system described in Section 5.2, an initial ranking of outfalls/tributary areas was developed to inform IDDE field investigations. As previously indicated, the data used to develop this initial ranking are "desktop level" (not field verified). As field investigations are completed and more accurate information is gathered, the initial ranking will be revised. If additional evidence of illicit discharges is discovered (sampling, visual evidence, odor complaints, etc.) that information will be incorporated and used to revise the initial ranking while field investigations are in progress.

Table 5-2 contains the raw scoring and ranking of each outfall/tributary area. Outfalls are identified by the Facility ID contained in the City's GIS database. The "Score" column contains the raw score each outfall received by summing the score for each criterion. The "Ranking" column ranks each outfall by its

raw score relative to all other outfalls. The "Category" column describes the resulting prioritization of each outfall. An outfall was grouped into one of three priorities as described below:

- **Problem** – Outfalls in this category have known or suspected contributions from illicit discharges based on previous sampling results that indicate likely sewer inputs. These outfalls should be prioritized for IDDE investigations.
- **High Priority –** Outfalls in this category do not have known or suspected contributions from illicit discharges based on previous sampling results, but should be prioritized for IDDE investigations after "Problem" outfalls since this preliminary analysis indicates land uses/characteristics that may be associated with illicit discharges.
- **Low Priority –** Outfalls in this category received a raw score of 15 or less and have a smaller probability of being associated with illicit discharges compared to the other two categories.

The initial ranking will inform preliminary field investigation efforts. IDDE investigations will begin at "problem" outfalls, where sampling results indicate probable sources of illicit discharges. If new sampling data is received or made available, the initial ranking will be revised. As field investigations are completed and system connectivity is better understood, it may be necessary to revise the initial ranking based on drainage areas modifications.

Table 5-2: Initial Outfall Ranking/Prioritization

Outfall/Tributary Area Characteristics			Criteria/Scoring						Category		
Outfall (GIS Facility ID)	Tributary Area Size (acres)	Receiving Water/Inter-connection	Illicit Discharges Indicated Previously	Discharge to Area of Public Health Concern	Predominantly Residential Land Use	Age of Development/ Infrastructure >20 Years	Outfall Size >24"	Tributary Area > 10 Acres?	Score	Ranking	Priority
8	15	Alewife Brook	10	5	3	5	3	5	31	1	Problem Outfall
9	28	Alewife Brook	10	5	3	5	3	5	31	1	Problem Outfall
7	14	Alewife Brook	10	5	3	5	1	5	29	3	Problem Outfall
10	14	Alewife Brook	10	5	3	5	1	5	29	3	Problem Outfall
4	18	Alewife Brook	10	5	3	1	3	5	27	5	Problem Outfall
11	7	Alewife Brook	10	5	3	5	1	1	25	6	Problem Outfall
25	5	Mystic River	10	5	1	5	1	1	23	7	Problem Outfall
31	59	City of Medford	10	0	3	1	1	5	20	8	Problem Outfall
19	15	Mystic River	0	5	3	5	1	5	19	9	High Priority
26	17	Mystic River	0	5	3	5	1	5	19	9	High Priority
21	13	Mystic River	0	5	1	5	1	5	17	11	High Priority
28	5	Mystic River	10	0	3	1	1	1	16	12	Problem Outfall
12	5	Mystic River	0	5	1	5	1	1	13	13	Low Priority
32	41	Mystic River	0	0	1	1	3	5	10	14	Low Priority

6. Dry Weather Outfall Screening and Sampling

Dry weather sampling is an important tool in illicit discharge detection within an MS4. The following summarizes the general sampling procedure and analysis of results.

6.1 Antecedent Conditions

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

6.2 Dry Weather Sampling

6.2.1 Sampling Procedure

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

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

6.2.2 Field Equipment

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

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

Equipment	Use/Notes
Clipboard	For organization of field sheets and writing surface.
Field log books	For documentation/note taking.
Field Sheets (if not using tablet/phone)	Field sheets for both dry weather inspection and dry weather sampling should be available with extras.
Laboratory Specific Chain of Custody Forms	To ensure proper handling of all samples.
Pens/Pencils/Permanent Markers	For proper labeling and notes.
Nitrile Gloves	To protect the sampler as well as the sample from contamination.
Flashlight/headlamp w/batteries	For looking in outfalls or manholes, helpful in early mornings as well.
Cooler with Ice and/or Cold Packs	For transporting samples to the laboratory.
Mobile data collector (phone or tablet)	For collecting dry weather screening and sampling results.
Digital Camera (or phone)	For documenting field conditions at time of inspection.
Personal Protective Equipment (PPE)	Reflective vest, safety glasses and boots at a minimum.
Bug Spray	For protection.
Poison ivy wash (e.g. Tecnu, Zanfel)	For protection.
GPS Receiver (phone/tablet or handheld GPS)	For taking spatial location data.
Handheld Water Quality Meter	For sampling specific conductivity, salinity, temperature and pH.
Ammonia test kits (or strips)	For field testing for ammonia. Have extra kits on hand to sample more outfalls than are anticipated to be screened in a single day.
Chlorine test kits	For field testing for chlorine. Have extra kits on hand to sample more outfalls than are anticipated to be screened in a single day.
Photometer	For chlorine test kit, as needed.
Surfactants (MBAS) test kits	For field testing for surfactants. Have extra kits on hand to sample more outfalls than are anticipated to be screened in a single day.
Disposal Receptacles	Appropriate containers for disposing of used test kits as well as garbage.
Label Tape (or labels provided by laboratory)	For labeling sample containers.
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 120mL containers).
Manhole hook	For opening manholes.

Equipment	Use/Notes
Pry Bar or Pick	For opening catch basins and manholes, when necessary.
Shovel	For opening, propping, prying manholes and catch basins, as necessary.
Sandbags	For damming low flows in order to take samples.
Small Mallet or Hammer	To helping free stuck manhole and catch basin covers.
Utility Knife	Multiple uses.
Measuring Tape	Measuring distances and depth of flow.
Safety Cones	For safety.
Hand Sanitizer	For disinfectant/decontamination.
Zip Ties/Duct Tape	For making field repairs.
Rubber Boots/Waders	For accessing shallow streams/areas.
Paper towels	For cleaning.
Distilled water	For rinsing equipment.
Sampling Pole/Dipper/Sampling Cage	For accessing hard to reach outfalls and manholes.

6.2.3 Sample Collection and Analysis

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

1. At least one day prior to sampling, coordinate with appropriate laboratories to schedule the laboratory analysis. This coordination will include estimated time of sample delivery and estimated number of samples expected.
2. Visit the designated locations for outfall screening in a two-person crew.
3. Prior to the start of sampling, create a trip blank by filling a laboratory provided container with clean bottled water. The trip blank will have its own unique label and will be kept in a cooler with all other samples collected during that sampling event.
4. Upon arrival at an approved sampling location, record all pertinent observations in electronic format. Pertinent observations include, but are not limited to: flow velocity, approximate depth of water, water color, odor, observed floatables, and sediment or debris deposits. Fill out a comments field with any observations which cannot adequately be described using predefined categories on the field form.
5. If using laboratory provided bottle labels, fill out all sampling information on bottle labels and field sheets (if not using mobile data collection device). If writing directly on laboratory provided sample bottles, skip to Step 6.
6. Put on protective gloves (nitrile/latex/other) before sampling.
7. Collect sample with dipper or directly in sample containers. If possible, collect water from the center of flow directly in the sample bottle. Be careful not to disturb sediments.
8. For samples requiring laboratory analyses, open a sterile container provided by the laboratory. Use caution to ensure that only the outside of the container and its cap are handled to prevent contamination. Fill the sterile container with the sampled water and then seal. Take care to confirm that the sample container is sealed properly and does not leak. The container will be

labeled with a unique identifier, the date and time the sample was taken and the analysis that is required.

9. If a dipper is required, a clean grab container will be placed in the approximate middle of observed flow. After the container has been filled, retrieve and swirl its contents to ensure that all surfaces of the container are covered and rinsed thoroughly and then dumped out downstream of the sampling location. Follow this method for a total of three times, ensuring that the grab container is fully rinsed.
10. Use grab container a fourth time to collect a final sample for analysis.
11. Place laboratory sample containers for bacteria and pollutants of concern into a cooler filled with ice.
12. Fill out chain-of-custody (COC) form for laboratory samples including the unique identifier, date, time, sample matrix, sampler's initials, and required test information. The COC will remain with the samples at all times.
13. Conduct in-situ field tests using the remaining water in the grab container. Use test kits, test strips and field meter (rinse similar to dipper) for most parameters (See **Table 6-2).** All results will be recorded.
14. Samples for laboratory analysis will remain on ice until they are accepted by the laboratory. Samples must be analyzed within specific hold times for each parameter.
15. Upon completion of all sampling, or portion of sampling as the 8-hour bacteria hold time allows, the samples will be delivered to the laboratory. The samples must be signed over to the laboratory using the COC. Retain a carbon copy of the COC while the original will remain with the samples.
16. Dispose of used test kit ampules properly.
17. Decontaminate all testing personnel and equipment.

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

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

Table 6-2: 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, I-2001 Hach™ Pocket Colorimeter™ II	NA
Conductivity	CHEMetrics™ I-1200 YSI Pro30 YSI EC300A Oakton 450 Oakton PCTSTestr 50	NA
Temperature	YSI Pro30 YSI EC300A Oakton 450 Oakton PCTSTestr 50	NA
Salinity	YSI Pro30 YSI EC300A Oakton 450 Oakton PCTSTestr 50	NA
Temperature	YSI Pro30 YSI EC300A Oakton 450 Oakton PCTSTestr 50	NA
Indicator Bacteria: *E. coli* (freshwater) or Enterococcus (saline water)	EPA certified laboratory procedure (40 CFR § 136)	NA
Pollutants of Concern[1]	EPA certified laboratory procedure (40 CFR § 136)	NA

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

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

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

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

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

SM = Standard Methods

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

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

Documents and Records:

Data quality objectives are as follows:

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

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

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

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

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

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

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

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

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

Table 6-4 Analytical References and Quality Control Goals

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

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

6.3 Dry Weather Sampling Results and Follow-Up

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

Table 6-5: Benchmark Field Measurements

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

7. Catchment Investigations

Initial dry weather sampling of stormwater outfalls is scheduled to take place over the summer of 2020. Catchment investigations will be conducted based on the findings of the dry weather screening of stormwater outfalls. This section provides a summary of the procedure to locate illicit discharges through catchment investigations.

7.1 System Vulnerability Factors

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

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

As part of the catchment investigations, SVFs will be identified and recorded in **Table 7-1**. Wet weather sampling will be conducted at the outfall of catchments with at least one (1) identified SVF.

Table 7-1 System Vulnerability Factor Inventory (revised X/X/XXXX)

Outfall ID	Receiving Water	History of SSOs	Common or Twin Invert Manholes	Common Trench Construction	Storm/Sanitary Crossing where Sanitary is Above	Inadequate Sanitary Level of Service	Formerly Combined Sewer	Sanitary Infrastructure Defects
X[1]	XXX	Yes/No	Yes/No	Yes/No	Yes/No	Yes/No	Yes/No	Yes/No

[1]Table to be completed in future documents

7.2 Dry Weather Manhole Inspections

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

7.3 Wet Weather Outfall Screening and Sampling

1. Complete procedure for all outfalls. Data gathering and field inspection of key junction manholes should be complete for a catchment before moving to investigation of SVFs.
2. Conduct wet weather screening. The purpose of these inspections is to sample during wet weather to determine whether wet weather induced high flows in sanitary sewers or high groundwater in areas served by septic systems result in discharges of sanitary flow to the MS4.

Conduct at least one wet weather screening and sampling at the outfall that includes the following parameters (see MS4 permit p. 36 for details). EPA recommends sampling during Spring when groundwater levels are relatively high.

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

There is no required minimum rainfall event for wet weather screening as long as runoff is produced but avoid screening during initial discharge period (“first flush”).

7.4 Source Confirmation

If the potential presence of an illicit discharge is observed during dry weather screening of an outfall, follow the procedure detailed in this section. In general, the process of identifying, tracing, and locating an illicit discharge will follow the flow shown in **Figure 7-1**.

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

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

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

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

These methods are described in more detail in this section.

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

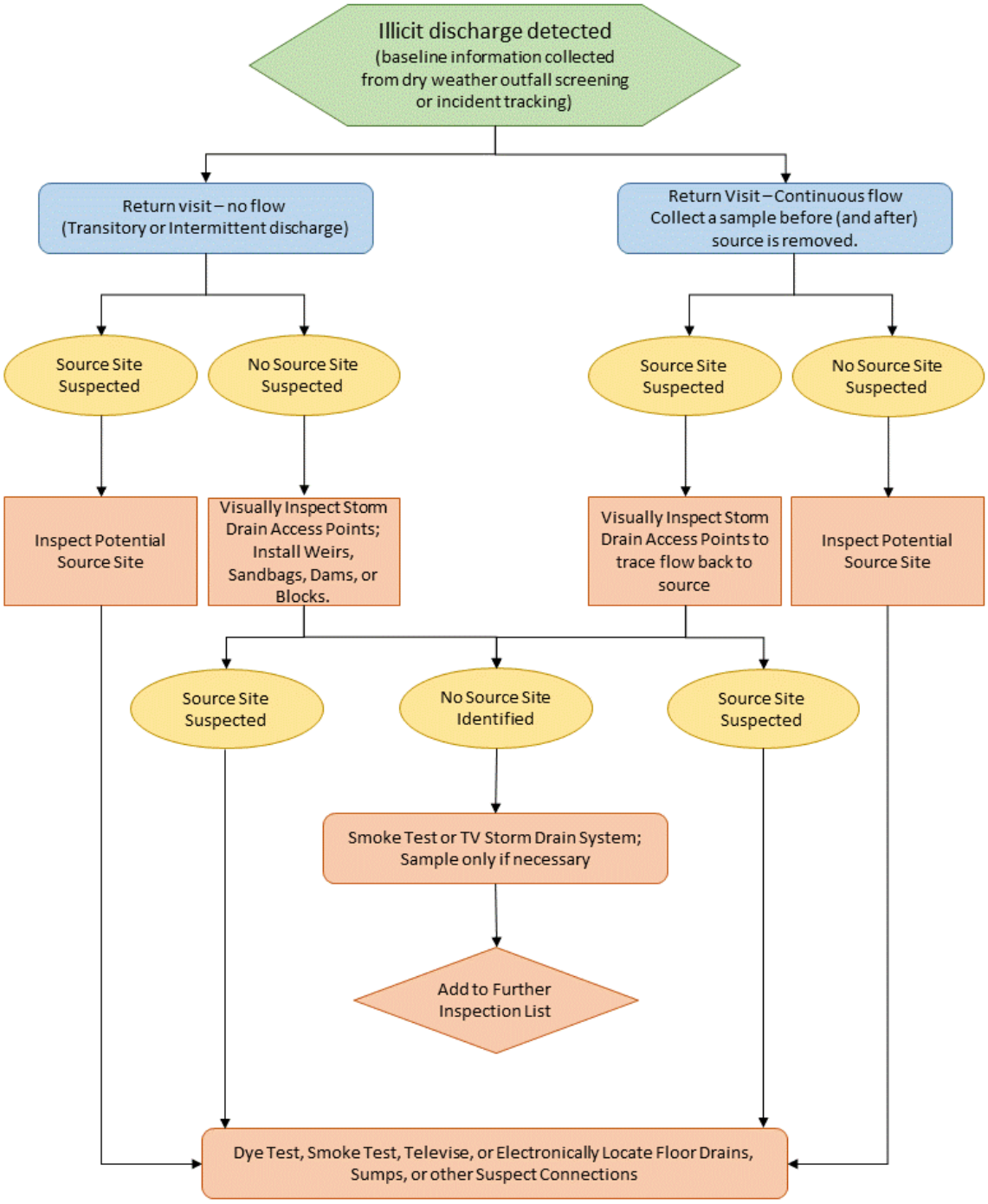


Figure 7-1 : Flow Chart to Select Tracing Techniques (Courtesy of CMRSC SOP 10)

7.4.1 Sandbagging

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

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

7.4.2 Smoke Testing

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

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

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

7.4.3 Dye Testing

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

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

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

The test can be relatively quick (typically less than 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.

7.4.4 CCTV/Video Inspection

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

7.4.5 Optical Brightener Monitoring

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

7.5 Illicit Discharge Removal and Abatement

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

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

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

illicit connection and outline the legal ramifications per the City of Somerville's ordinance.
    - If the property owner has not removed the illicit discharge within 90 days from the date of verification or effective date, another letter will be sent. This letter will notify the owner of the fines to be applied to the water and sewer bill and outline the next steps the City of Somerville will take if the illicit connection is not removed. If action is taken, the City of Somerville will report enforcement actions taken.
- If investigation determines infrastructure repair will not eliminate the illicit discharge, the City will implement appropriate green infrastructure/low impact development best management practices as defined in the AO.

7.5.1 Follow Up Outfall Screening

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

8. Training

The City of Somerville will hold an annual training for employees involved in the IDDE program. The training will include an office and field component and focus on how to identify illicit discharges and SSOs. The employee training is scheduled to occur July 2020.

9. Future Reporting

The City of Somerville will continue to implement and develop an IDDE program in compliance with the 2016 General Permit and Administrative Order. A final plan will be completed and submitted on December 31, 2021.

An annual report will record program activities and progress. In compliance with the 2016 General Permit, indicators of program progress will be measured with the following:

- the number of SSOs and illicit discharges identified and removed
- the number and percent of outfall catchments evaluated per the catchment investigation procedure
- all dry and wet weather sampling results
- volume of sewage removed

Appendix A: City of Somerville Ordinance

CITY OF SOMERVILLE
ORDINANCE NO. 2020-11
In City Council May 14, 2020

Be it ordained by the City Council, in session assembled, that Articles VI and VII of Chapter 11 of the Code of Ordinances of the City of Somerville are hereby replaced with the following, to read as follows:

ARTICLE VI. - DIVISION OF ENGINEERING

Sec. 11-140. Definitions.

Abutter means the owner(s) of land abutting the activity.

Applicant means any person, individual, partnership, association, firm company, corporation, trust, authority, agency, department, or political subdivision of the Commonwealth of Massachusetts or the federal government to the extent permitted by law requesting a stormwater management permit for proposed land disturbances.

Appurtenances means items which are tributary to the city's wastewater or storm drainage systems, including, but not limited to, grease traps, oil traps, and particle separators.

Best management practice means an activity, procedure, restraint, or structural improvement that helps to reduce the quantity or improve the quality of stormwater runoff.

CFR means Code of Federal Regulations.

City means the City of Somerville including all authorized agents thereof.

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

Clearing means any activity that removes the vegetative surface cover.

CMR means Code of Massachusetts Regulations.

Combined sewer means a sewer pipe or conduit designed to receive both sewage and stormwater.

Common sewer (or main drain) means any sanitary sewer, combined sewer, or storm drain laid in any land, or street, or way, public or private, opened or proposed to be opened for public travel and accommodation, for the purpose of draining more than one lot or building.

Development means the modification of land to accommodate a new use or expansion of use, usually involving construction.

Discharges means any liquid, vapor, or solid material(s) introduced into the municipal sanitary sewerage system, whether intentionally or unintentionally, including, but not limited to, leaks, spills, leaching, and pouring.

Discharge of pollutants means the addition from any source of any pollutant or combination of pollutants into the municipal storm drainage system or into the waters of the United States or Commonwealth of Massachusetts from any source.

Effluent means a discharge of pollutants into the environment or to a sewer system, whether or not treated.

Erosion means 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.

Floatables means any oil, fat, or grease (originating from any animal, vegetable, petroleum product, or any other hydrocarbon) in a physical state that will allow for separation from wastewater by gravity.

Garbage means solid wastes from the domestic and commercial preparation, cooking, and dispensing of food and from the handling, storage, and sale of produce.

Grading means changing the level or shape of the ground surface.

Groundwater means water beneath the surface of the ground.

Illicit connection means a surface or subsurface drain or conveyance which allows an illicit discharge into the municipal storm drainage 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 this article.
Illicit discharge means direct or indirect discharge to the municipal storm drainage system that is not composed entirely of stormwater, except as exempted in § 25-23 of this article.
Impervious surface means any material or structure on or above the ground that prevents water infiltrating the underlying soil, including without limitation, roads, paved parking lots, sidewalks and rooftops.
Industrial wastes means the liquid wastes from industrial manufacturing processes, trade, or business as distinct from sanitary sewage.
Infiltration means water other than wastewater that enters a sewer system (including sewer service connections and foundation drains) from the ground through means which include, but are not limited to, defective pipes, pipe joints, connections, or manholes. Infiltration does not include, and is distinguished from inflow.
Infiltration/inflow means the quantity of water from both infiltration and inflow without distinguishing the source.
Inflow means water other than sanitary flow that enters a sewer system (including sewer service connections) from sources which include, but are not limited to, roof leaders, cellar drains, yard drains, area drains, drains from springs and swampy areas, manhole covers, cross connections between storm sewers and sanitary sewers, catch basins, cooling towers, storm waters, surface runoff, street wash waters, or drainage. Inflow does not include, and is distinguished from infiltration.
Land disturbance means any action that causes a change in the position, location, or arrangement of soil, sand, rock, gravel, or similar earth material.
MWRA means the Massachusetts Water Resource Authority.
Municipal separate storm sewer system (MS4) or *Municipal storm system* means 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 city and discharging via an outfall to a surrounding waterway.
National pollutant discharge elimination system (NPDES) stormwater discharge permit means a permit issued by the United States Environmental Protection Agency or jointly with the Commonwealth of Massachusetts that authorizes the discharge of pollutants to waters of the United States.
Nonstormwater discharge means discharge to the municipal storm drainage system not composed entirely of stormwater.
Owner means a person with a legal or equitable interest in property.
Person means an individual, partnership, association, firm, company, trust, corporation, agency, authority, department or political subdivision of the Commonwealth of Massachusetts or the federal government, to the extent permitted by law, and any officer, employee, or agent of such person.
Point source means any discernible, confined, and discrete conveyance, including but not limited to any pipe, ditch, channel, tunnel, conduit, well, discrete fissure, or container from which pollutants are or may be discharged.
Pollutant means 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 of Massachusetts and/or the United States. Pollutants shall include, without limitation:

(a) Paints, varnishes, and solvents;
(b) Oil and other automotive fluids
(c) Nonhazardous liquid and solid wastes and yard wastes;
(d) Refuse, rubbish, garbage, litter, or other discarded or abandoned objects, ordinances, accumulations and floatables

(e) Pesticides, herbicides, and fertilizers;
(f) Hazardous materials and wastes; sewage, fecal coliform and pathogens;
(g) Dissolved and particulate metals;
(h) Animal wastes;
(i) Rock, sand, salt, soils;
(j) Construction wastes and residues; and
(k) Noxious or offensive matter of any kind.

Pre-construction means all activity in preparation for construction.

Private combined sewer means a combined sewer which is not owned by the city or the MWRA. Private combined sewers include, but are not limited to, Building Drains means Combined (as defined by 248 CMR 10.03), building combined sewer laterals and manholes located on private property and not located within an easement held by the city or other public agencies, and the connection from a private combined sewer to the public wastewater system.

Private sanitary sewer means a sanitary sewer that is not owned by the city or the MWRA. Private sanitary sewers include, but are not limited to, Building Drains means Sanitary (as defined by 248 CMR 10.03), building sanitary sewer laterals and manholes located on private property and not located within an easement held by the city or other public agencies, and the connection from a private sanitary sewer to the public wastewater system.

Private storm drain means a Storm Drain that is not owned by the city. Private Storm Drains include, but are not limited to, Building Drains means Storm (as defined by 248 CMR 10.03), building storm Drain laterals, catch basins and manholes located on private property and not located within an easement held by the city and other public agencies, and the connection from a private storm Drain to the public storm drainage system.

Private sewer or drain means any private combined sewer, private sanitary sewer, or private storm drain.

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

Public combined sewer means a combined sewer that is owned by the city or the MWRA or any of their successors.

Public sanitary sewer means a sanitary sewer which is owned by the city or the MWRA or any of their successors.

Public storm drain means a Storm Drain that is owned by the city.

Recharge means the process by which groundwater is replenished by precipitation through the percolation of runoff and surface water through the soil.

Redevelopment means development, rehabilitation, expansion, demolition, or phased projects that disturb the ground surface or increase the impervious area on previously developed sites.

Replacement means expenditures for obtaining and installing equipment, accessories, or appurtenances which are necessary during the useful life of the treatment works to maintain the capacity and performance which such works were designed and constructed. The term "operation and maintenance" includes replacement.

Runoff means rainfall, snowmelt, or irrigation water flowing over the ground surface.

Sanitary sewage means liquid and water-carried human and domestic wastes from buildings, exclusive of ground-, storm- and surface water, industrial wastes, uncontaminated cooling water, and uncontaminated industrial process water.

Sanitary sewer means a sewer which carries sewage and to which stormwaters, surface waters, and groundwaters are not intentionally admitted.

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

Sedimentation means the process or act of deposition of sediment.

Sewage means a combination of the water-carried wastes from residences, business buildings, institutions, and industrial establishments, together with such groundwaters, surface waters, and stormwaters as may be present.
Site means any lot or parcel of land or area of property where land disturbances are, were, or will be performed.
Soil means any earth, sand, rock, gravel, or similar material.
Storm drain means a pipe or conduit that carries surface water, stormwater and groundwater or runoff and is exclusive of sanitary sewage.
Stormwater means water resulting from rainfall or other precipitation that runs off surfaces during or after a storm.
Stormwater management plan means a plan required as part of the application for a stormwater management permit.
Stream means a body of running water, including brooks, creeks, and other water courses, which moves in a definite channel in the ground due to a hydraulic gradient. A portion of a stream may be naturally obscured or flow through a culvert or beneath a bridge. A stream's flow may be intermittent (i.e., does not flow throughout the year) or perennial.
Toxic or hazardous material or waste means any material which, because of its quantity, concentration, chemical, corrosive, flammable, reactive, toxic, infectious or radioactive characteristics, either separately or in combination with any substance or substances, constitutes a present or potential threat to human health, safety, or welfare or to the environment. Toxic or hazardous materials include any synthetic organic chemical, petroleum product, heavy metal, radioactive or infectious waste, acid and alkali, and any substance defined as "toxic" or "hazardous" under MGL c. 21C and c. 21E and the regulations at 310 CMR 30.00 and 310 CMR 40.00 et seq.
User means any person or entity, whether or not physically located within the city, who discharges or causes or permits the discharge of wastewater into the city's sanitary sewers, storm drains, or interceptors owned by MWRA located within the city. Such person or entity is not limited to the owner of the property from which the offending discharge is made.
User charge means a charge levied on users of the treatment works for the cost of operation of said works in accordance with Section 204(b) of the Clean Water Act.
Watercourse means a channel in which a flow of water occurs either continuously or intermittently.
Waters of the Commonwealth of Massachusetts means all waters within the jurisdiction of the Commonwealth of Massachusetts, including, without limitation, rivers, streams, lakes, ponds, springs, impoundments, estuaries, wetlands, coastal waters, and groundwater.
Wastewater means sanitary sewage, together with any groundwater, stormwater and surface water that may be present.
Wastewater system means the devices, equipment or works used in transportation, pumping, storage, treatment, recycling or reclamation of wastewater or in the disposal of the effluent.
Wetlands means coastal and freshwater wetlands, including wet meadows, marshes, swamps, and bogs, as defined and determined pursuant to MGL c. 131, § 40 and 310 CMR 10.00 et seq.

Sec. 11-141. - City engineer duties.

(a) *Generally.* The city engineer shall make such surveys, plans, estimates and descriptions, and he or she shall perform all other such services, and impart such information concerning any department of the city's affairs, properly relating to the office of the city engineer, as may be required of him or her by the mayor, the city council or any committee thereof, or any board of officers of the city. He or she shall be consulted in relation to public improvements of every kind when the advice of a civil engineer would be of service.

(b) *Descriptions of certain lands.* The city engineer shall furnish to the city treasurer and collector of taxes, whenever requested, an accurate description in writing of the locations and boundaries of all lands which may become liable to sale for nonpayment of sewer, sidewalk or other betterment assessments.

(c) *Custodian of all plans.* The city engineer shall have the charge of all plans of every kind, not especially belonging to other departments, and shall keep the same properly classified and indexed and he or she may make such rules concerning the taking of plans from his or her office as he or she may deem necessary to ensure their safety.

(d) *Information on streets.* The city engineer shall give to all applicants, so far as the files and records of his or her office will permit, any information they may desire as to the lines and grades of streets on which their estates are situated, or upon which they intend to build and all information of this character furnished to owners of estates, or persons representing them or to those intending to build, shall be without charge.

(e) *Annual report.* The city engineer shall annually, in the month of January, present to the city council a report in relation to his or her division, showing the number of persons employed, the detailed expenses of the department, the general nature of the work, the property under his or her charge, the condition of all structures under his or her supervision that are in process of construction or that have been completed during the previous year, and such other general information in relation to the same as he or she may deem expedient.

Sec. 11-142. - Pipes, sewer, conduit, poles or other structures on, above, or under streets.

(a) No gas pipe, sewer, conduit, street railway tract, pole, or any other structure, except wires, whether belonging to the city or to any individual or corporation, shall be placed upon, beneath or above any street, unless a plan showing the proposed location thereof shall have first been deposited with the city engineer, and such location approved by him or her or authorized by the city council. Upon the completion of work approved or authorized as aforesaid a final plan shall be filed with the city engineer, showing the accurate location and manner of construction.

(b) Any person violating the foregoing provision shall be subject to a penalty in accordance with section 1-11 and shall remove such structure if required so to do by the city engineer, or the city engineer may cause the same to be removed.

Sec. 11-143. - Excavating streets and other public places.

(a) *Street opening permit.* No person, except one authorized to do so as an employee of the city, shall dig up any street or other public place unless said person first obtains a written permit therefore from the commissioner of public works or the city engineer, and unless such permit is at all times in the possession of some person actually engaged in or supervising such digging, which permit shall be exhibited to any police officer of the city whenever said officer shall demand to see the same. Such permits for the purpose of laying or repairing drains shall be issued by the city engineer, and for all other purposes by the commissioner of public works, who shall grant such permits subject to the conditions set forth below and on such further terms as they may deem expedient.

(b) *Notification requirement.* No permit to allow the excavation of a public way shall be issued by the commissioner of public works or the city engineer until the following notification requirements have been provided by the applicant for said street opening permit.

(1) *Written notice to abutting property owners and residents.* The applicant must give written notification of its "street opening permit" application to abutters within 300 feet of the location in which the opening is proposed. The notification must be mailed by certified mail with return receipt at least seven days before the street opening permit is issued and must contain a description of the work to be performed, start date, contact personnel with telephone number and expected length of project.

(2) *Posting the application.*

a. The applicant is responsible for ensuring that notice of proposed street opening is posted continuously in a publicly visible place at the location for at least seven days prior to the issuance of the street opening permit. Such notice shall be on a form prepared by public works department.

b. The applicant, through the city clerk's office, shall post notice of the proposed street opening in city hall for at least seven days prior to the issuance of the street opening permit.

(3) *Affidavit of compliance.* An affidavit of compliance with the notice and posting requirements of this section including copies of certified mail return receipts must be submitted to the commissioner of public works or the city engineer before the street opening permit may be issued.

(c) *Emergency street opening.* The above notification requirements may be waived by the commissioner of public works or the city engineer in the event of an emergency street opening. An "emergency" shall exist only when the public health and safety is threatened as determined by the commissioner of public works or city engineer. A written notice of emergency shall be made to commissioner of public works or city engineer.

Sec. 11-144. - Openings in streets.

(a) No person shall make or maintain, or allow to be made or maintained, any vault, coal-hole or other opening in or under a street without permission from the city council.

(b) The opening of a coal-hole shall be circular and not more than 18 inches in diameter and furnished with a cover of iron having a rough upper surface. Such cover shall be kept securely fastened at all times when the coal-hole is not used, and shall be supplied with iron rods at least two feet in length fitting closely to the side of the opening and projecting downwards, so that the cover can be lifted perpendicularly, but cannot be tipped or easily removed from the opening, or shall be provided with such other safety device as the commissioner of public works shall require.

(c) The location, size, shape, and manner of construction of such vault, coal-hole, or other opening, and the material to be used therefor, shall be stated in such permission, or if not so stated, shall be subject to the approval in writing of the commissioner of public works.

Sec. 11-145. - Stormwater runoff.

On any lot in the City of Somerville, no impervious surface shall be constructed, expanded or altered such that it generates an increase in stormwater runoff onto adjacent lots or any public or private right-of-way.

Sec. 11-146. Managing Adverse Impacts of Stormwater Runoff

(a) *Purpose; objectives; statutory authority; conflicts with NPDES permit.*

(1) The purpose of this section is to implement the requirements of the National Pollutant Discharge Elimination System (NPDES) General Permit for stormwater discharges from small municipal separate storm sewer systems issued by the U.S. Environmental Protection Agency; protect the public health, safety and welfare of Somerville residents; protect the natural resources, water bodies, groundwater resources, environment and municipal facilities of the city; satisfy the appropriate water quality requirements of the Federal Clean Water Act; eliminate or reduce the adverse effects of soil erosion and sedimentation as a result of land-disturbing activities; manage stormwater runoff to minimize adverse impacts to the city, its residents and the environment; and establish the legal authority to ensure compliance with the provisions of this section through inspection, monitoring and enforcement.

(2) The Site Construction Permit establishes stormwater management standards for the final conditions that result from development and redevelopment projects to minimize adverse impacts off site and downstream which would be borne by abutters, residents, and the general public. In addition, the Site Construction Permit establishes stormwater management standards for land disturbances that have harmful impacts of soil erosion and sedimentation.

(3) The objectives of this ordinance are to:

a. require practices to control the flow of stormwater from new and redeveloped sites in order to prevent flooding, erosion, and adverse impacts to water quality.
b. protect groundwater and surface water from degradation.
c. promote groundwater recharge and infiltration.
d. prevent pollutants from entering the city's municipal separate storm sewer system (MS4) and to minimize discharge of pollutants from the MS4.
e. ensure adequate long-term operation and maintenance of stormwater best management practices so that they work as designed.
f. require practices that eliminate soil erosion and sedimentation and control the volume and rate of stormwater runoff resulting from land disturbances.
g. ensure that soil erosion and sediment control measures and stormwater runoff control practices are incorporated into the site planning and design process and are implemented and maintained.
h. require practices to control waste such as discarded building materials, concrete truck washout, chemicals, litter, and sanitary waste at the construction site that may cause adverse impacts to water quality.
i. comply with state and federal statutes and regulations relating to stormwater discharges.
j. establish the city's legal authority to ensure compliance with the provisions of this ordinance, through inspection, monitoring, and enforcement.

(4) This section is adopted under authority granted by the Home Rule Amendments of the Massachusetts Constitution, the Massachusetts Home Rule statutes, and the regulations of the Federal Clean Water Act found at 40 CFR 122.34. The provisions of this section shall apply to all property owners in the city and to users where applicable.

(5) To the extent this section conflicts with the requirements of the NPDES General Permit, the terms and conditions of the permit shall apply.

(b) *Applicability.*

(1) No person may undertake a construction activity, including clearing, grading, paving, and excavation, that results in a land disturbance that could potentially increase runoff or introduce pollutants to the city's storm drainage system without a site construction permit from the city engineer. Construction activity does not include routine maintenance that is performed to maintain the original line and grade, hydraulic capacity, or the original purpose of the site.

(2) *Exemptions.*

a. The construction of fencing that will not substantially alter existing terrain or drainage patterns;
b. Construction of utilities other than drainage (gas, electric, telephone, etc.) which will not alter terrain or drainage patterns;
c. Projects permitted and approved by the City of Somerville prior to the effective date of this section; and
d. Emergency work to protect life, limb, or property.

(c) *Administration.*

(1) The city engineer shall administer, implement, and enforce this ordinance. Any powers granted to or duties imposed upon the city engineer may be delegated in writing by the city engineer to its employees and agents.

(2) Rules and regulations. The rules and regulations governing the issuance of a site construction permit shall be determined and published by the city engineer, and may be revised from time to time. The city engineer shall provide the city council with the rules and regulations on or before January 1 of each year, and whenever the rules and regulations are revised. The rules and regulations may include a de minimis exemption

for minor work performed, at the discretion of the city engineer in consultation with the city council.

(d) *Permits, fees, and procedures.* Permits, fees, and procedures shall be defined and included as part of the rules and regulations promulgated as required in this ordinance.

(e) *Waivers.* The city engineer may waive strict compliance with any requirement of this section or the rules and regulations promulgated hereunder, where such action is allowed by federal, state and local statutes and/or regulations; is in the public interest; is not inconsistent with the purpose and intent of this section, and the waiver would be for a small-scale project with de minimis impacts. Any applicant may submit a written request to be granted such a waiver. Such a request shall be accompanied by an explanation or documentation supporting the waiver request and demonstrating that strict application of the section does not further the purposes or objectives of the section.

(f) *Performance guarantee.* The city engineer shall require from the applicant a surety or cash bond, or other means of security acceptable to the city treasurer, prior to the issuance of any building permit for the construction of a development requiring a stormwater management facility. The amount of the security shall not be less than the total estimated construction cost of the stormwater management facility. The bond so required in this section shall include provisions relative to forfeiture for failure to complete work specified in the approved stormwater management plan, compliance with all of the provisions of this section and other applicable laws and regulations, and any time limitations. The bond shall not be fully released without a final inspection of the completed work by the city engineer, submission of "as-built" plans, and certification of completion by the city engineer of the stormwater management facilities being in compliance with the approved plan and the provisions of this section.

(g) *Enforcement.*

(1) The city engineer shall enforce this section and any regulation, decision, permit or order issued under this section and may pursue all civil and criminal remedies for violations of their provisions.

(2) If, in the estimation of the city engineer, corrective work is required to protect the environment, and the property owner fails to perform said corrective work within a reasonable period of time as set by the city engineer, he or she may order the same to be performed by a party to be determined by it, and the property owner shall be required to reimburse the city for all costs incurred. These costs will be in addition to the fines described below.

(3) *Penalties.* In addition to the other means of enforcement otherwise available for violations of this section, including, but not limited to, where applicable, the provisions of Section 1-11 of the Code of Ordinances, violations may be penalized, as provided by MGL c. 40, § 21D, pursuant to the noncriminal disposition provisions of Section 1-11(b) of the Code of Ordinances. Each day a violation continues shall constitute a separate offense. If the property owner violates more than one provision of this section or any condition of an approval issued hereunder, each provision or condition so violated shall constitute a separate offense. Fines issued and costs assessed shall constitute a municipal lien upon the property and shall accrue interest as provided by applicable law. To the extent permitted by state law, or if authorized by the owner or other party in control of the property, the city engineer, its agents, officers, and employees may enter upon privately owned property for the purpose of performing its duties and may make or cause to be made such examinations, surveys or sampling as the city engineer deems reasonably necessary to enforce the provisions of this section. In the alternative, whoever violates any provision of this ordinance may be penalized by indictment or on complaint brought in the District Court. The penalty shall be three hundred dollars for each offense. Each day on which any violation exists shall be deemed a separate offense.

ARTICLE VII. – SEWERS

DIVISION 1. - GENERALLY

Sec. 11-155. Definitions.
For the purposes of this Article, the definitions provided for in Section 11-140 of the Code of Ordinances are incorporated herein by reference.

Sec. 11-156. - Common sewers.
No common sewer shall be laid or shall be connected with any existing common sewer except by the city.

Sec. 11-157. - Sewer specifications.
Main drains or common sewers, which shall be ordered by the city council to be made, shall be laid in such places and manner and shall be made of such materials and dimensions as the city engineer shall determine, unless the city council shall otherwise specially direct.

Sec. 11-158. – Private sewer or drain specifications.
Every private sewer or drain which enters into any common sewer shall be built of such size and materials, in such place and direction, at such grade, and in such manner as shall be satisfactory to the city engineer, and with a due observance of all regulations of the board of health, so far as applicable thereto.

Sec. 11-159. - Plans of sewers and drains.
The city engineer shall make accurate plans of all main drains and common sewers, showing their location, depth, and the materials of which they are made, and their size, shape, thickness, and manner of construction; also all existing connections with said sewers and all future connections as they are made.

Sec. 11-160. - Catch basin locations.
The location of all catch basins shall be under the direction of the city engineer.

Sec. 11-161. - Report of main drain and common sewer costs.
The city engineer shall keep an accurate account of the cost of each main drain or common sewer constructed, and make report thereof to the city council.

Sec. 11-162. - Sewer assessments.
The city council shall make assessments for all main drains or common sewers heretofore constructed or reconstructed by the city, the expenses of which have not already been assessed and collected, in the same manner as for those which may hereafter be constructed; and the city engineer shall render all the services and perform all the duties in regard to the main drains or common sewers heretofore constructed the expenses of which have not already been assessed and collected, which he or she is required to render and perform in regard to those hereafter to be constructed. The city council shall deliver a list of such assessments, when made, to the collector of taxes, for collection.

Sec. 11-163. - Exemptions for sewer assessments.
No estate, to the owner of which permission has been or may be given to construct private sewers or drains for such estate, shall by reason of the construction of such private sewers or drains be exempt from any assessment lawfully imposed for constructing common sewers in its vicinity.

Sec. 11-164. - Sewer user charges.
(a) *User charges.*
(1) *Established.* Charges for sewer service shall be established by the superintendent of the water and sewer department, subject to the approval of the mayor and city council. Prior

to setting the new sewer service charge, the water and sewer superintendent shall conduct a public hearing on the proposed charge no later than May 15 of any given year with notice of any new charges provided to the city council at least 14 days prior to the public hearing. Any proposed new charges shall be provided to the city council on or before June 1 of any given year for its review and approval. Charges may be adjusted, subsequent to initial approval by the superintendent, with the approval of the mayor and city council, without the necessity of a public hearing, to reflect any changes in any charge assessed to the city by any governmental body or agency of the commonwealth. If any such adjustment results in a lower charge than previously set, the new charge shall take effect immediately upon approval by the mayor and city council. If such adjusted charge is higher than otherwise set, the new charge shall take effect no sooner than 30 days after approval by the mayor and city council. Failure to hold a public hearing or provide the proposed charges to the board for its review on or before June 1 as required above shall prohibit the city from increasing charges.

(2) *Method of assessment.* Rates shall be established based upon a uniform rate per 100 cubic feet of water consumed. At a user's option and expense, assessments may be made on continuously metered sewage flow, or upon water sales to activities resulting in a discharge to the sewer. Said assessments shall be made pursuant to readings obtained from metering devices approved by the commissioner. For users whose bill is based upon metered sewage, the rate shall be 1.11 times the rate established for those whose bill is based upon metered water. Where water consumption data is not available, bills for sewer services shall be based upon estimated consumption, as determined by the commissioner.

(3) *Payment.* Bills for sewer service shall be rendered a minimum of two per year and a maximum of six per year for commercial and four per year for residential and are due and payable within 45 days. Interest shall accrue on bills not paid within 45 days from the date of mailing at the rate established by Section 57 of Chapter 93 of the General Laws.

(b) *Appeals.* Persons aggrieved of bills rendered pursuant to subsection (b) of this section shall have the following rights of appeal:

(1) *Notification.* Within the time frame allowed for payment of said bills, the aggrieved party shall notify the commissioner that said bill is contested. The notification shall include an explanation as to why the bill is contested, and should provide the commissioner with such information as is necessary to determine the validity of the claim. The commissioner may prescribe such forms as are necessary to expedite this process.

(2) *Resolution.* Upon receipt of an appeal, the commissioner shall act upon same as quickly as possible and shall inform the claimant in writing of the result of the investigations. The determination of the commissioner shall also be transmitted to the treasurer who shall take the following action:

a. For first claims and claims found to be valid, the date of billing shall be revised to the date of the commissioner's determinations. Revised charges shall then be due and payable as is specified in subsection (b)(3) of this section.

b. For second and subsequent claims found to be invalid, the date of billing shall be as originally issued, and charges and interest shall be computed as specified in subsection (b)(3) of this section.

(c) *Tax liens of overdue charges.* Charges for sewer use which are overdue and uncontested shall become a tax lien as is provided in Sections 16A through 16F of Chapter 83 of the General Laws.

(d) *Increases restricted.* The superintendent of the water division shall prepare and submit to the city council on or before April 1, 1984, a plan for the installation of water meters in each residence, business, industrial or other location where no meter currently exists. Said plan shall provide for the complete metering of water services in the city by December 31, 1986. The superintendent of the water division shall submit to the city council on or before December 8 in each year of the installation period, a statement, signed under the penalties of perjury, that not less than one-third

of the total number of unmetered services existing on December 8, 1984, have been installed during such year. If the total number of water meters out of service in any year next succeeding the end of the installation period on December 31, 1986, exceeds 500 meters, then no sewer rate increase shall be authorized or approved under subsection (b)(1) or (b)(2) of this section, without additional approval of the city council.

Sec. 11-165. – Stormwater.

(a) All stormwater, except as hereinafter otherwise provided, shall be excluded directly or indirectly from any combined sewers, sanitary sewers, and/or storm drains that discharge to combined sewers. Stormwater may only discharge to the Municipal Separate Storm Sewer System. The locations of the Municipal Separate Storm Sewer System in the city will be determined and published by the city engineer.

(b) The city engineer may, with the approval of the mayor, whenever in the judgment of the city engineer the exigencies of the case so require, give notice to the owner or agent of any premises situated in any part of the city so to change the drainage system thereof, within a reasonable time, specified in such notice, that no roof water, surface water or other drainage matter, except sewage, shall flow from said premises, directly or indirectly, into any public sewer which is used for conducting house drainage into the metropolitan sewerage systems; and such owner or agent shall, within the time specified in such notice, make such changes in said drainage system as may be necessary to comply with such notice. No person shall cause or allow such roof water, surface water, or other drainage matter to enter, directly or indirectly, any public sewer, in violation of the foregoing provisions of this section.

(c) Any private sewer or drain, maintained in violation of any of the provisions of this section, whether in an existing building or one hereafter erected, shall forthwith be changed so as to conform thereto, and may, by order of the city council, or by order of the city engineer when in his or her judgment immediate action is required, be cut off and disconnected or otherwise disposed of until such provisions are complied with in a manner satisfactory to him or her.

(d) The city engineer, except as hereinafter otherwise provided, shall not grant a permit to enter any private sewer or drain into any such main drain or common sewer, or into any other private sewer or drain which connects, immediately or ultimately, with any such main drain or common sewer, unless it shall appear to his or her satisfaction that such private sewer or drain, for which such permit to enter is required, and will not conduct any roof water, surface water, or other drainage matter, in violation of the provisions of this section. Before any such permit is granted, he or she may require to be cut off or disconnected or may himself or herself cut off or disconnect from the private sewer or drain for which such permit to enter is required, any private sewer or drain which does not conform to the provisions of this section.

(e) The city engineer may in special cases for good cause shown, and subject to the approval of the mayor, grant written permission to enter any private sewer or drain contrary to the provisions of this section for such length of time and upon such condition as he or she may deem advisable.

Sec. 11-166. – Main drain or common sewer work.

No person shall cut into, interfere with or obstruct a main drain or common sewer, or shall enter, or attempt to enter, a private or other drain or sewer therein, or into any private drain connecting with any main drain or common sewer, except in accordance with a permit in writing from the city engineer.

Sec. 11-167. - Interference with sewers.

(a) No water pipe, gas pipe or other structure shall be so laid in a street as to obstruct or interfere with a common sewer or the maintenance thereof.

(b) If any water pipe, gas pipe or other structure interferes with or obstructs any existing common sewer or the maintenance thereof, or the construction or maintenance of any common sewer which the city council may hereafter order to make, the department of the city, corporation or

person maintaining the same shall, upon notice from the city engineer, at once remove or change such pipe or other structure in such manner as he or she may direct, and upon failure so to do he or she may make such removal or change, and the cost thereof shall be paid by such department, corporation or person to the city.

Sec. 11-168. - Drain layers and work on common sewers.
No one shall employ any person other than a licensed drain layer to perform any work opening into a common sewer for the purpose of connecting a private sewer or drain therewith, and the repairs of every private sewer or drain laid from any house, building, cellar or land to such common sewer, and every opening into such drain, and all openings and excavations in any street for the purpose of constructing or repairing any private drain.

Sec. 11-169. – Private sewers or drains subject to tidewater.
No private sewer or drain connecting with a common sewer subject to the action of tidewater shall be constructed without a plug or clapper sufficient to prevent completely the reflux of drainage matter, storm or tidewater.

Sec. 11-170. - Substances prohibited from common sewers.
No exhaust from a steam engine and no blowoff from a steam boiler shall be connected with any common sewer or private sewer or drain. No gasoline or other explosive or inflammable substance shall be caused or allowed to enter directly or indirectly any common sewer or private sewer or drain.

DIVISION 2. - INFILTRATION AND INFLOW MITIGATION

Sec. 11-172. - Infiltration and inflow mitigation.
Any person or entity changing, altering, repairing, adding to or improving property in any way that may impact the City of Somerville sewer system, or any person or entity proposing to add additional wastewater to an existing sewer connection, or any person or entity establishing a new connection to the city's common sewer system shall be required to mitigate infiltration/inflow entering the city's common sewer system. Said person or entity shall be subject to payment of a fee established by the city engineer to mitigate infiltration/inflow. In the alternative, subject to approval of both the city engineer and city council, said person or entity may complete repairs, alterations or improvements to the city's main drain and common sewer system to eliminate infiltration/inflow in accordance with plans and calculations approved by the city engineer. Such calculations shall include an administrative and oversight fee payable to the city in connection with the work to be performed. In the event a connection is subject to conditions issued by the Massachusetts Department of Environmental Protection, the Massachusetts Environmental Policy Act Unit or the Massachusetts Water Resources Authority as part of a state or regional permitting process requiring the removal of infiltration/inflow prior to connection, said removal of infiltration/inflow shall be credited toward complying with the requirements of this ordinance.
The mitigation requirements, fee schedule and methodology for calculating mitigation and fees, shall be determined and published by the city engineer, and may be revised from time to time. The city engineer shall provide the city council with the mitigation requirements, fee schedule and methodology for calculating mitigation and fees on or before January 1 of each year, and whenever the fee schedule and/or methodologies are revised. The city engineer shall adopt rules and regulations setting forth the mitigation requirements, fee schedule and methodology for calculating mitigation and fees. The mitigation requirements may include a de minimis exemption for minor work performed, at the discretion of the city engineer in consultation with the city council.

DIVISION 3. - ILLICIT DISCHARGES TO STORM DRAINAGE SYSTEM

Sec. 11-176. - Illicit discharges to storm drainage system.

(a) *Purpose.*

(1) Increased and contaminated stormwater runoff is a major cause of impairment of water quality and flow into waterways; alteration or destruction of aquatic and wildlife habitat; and flooding.

(2) Regulation of illicit connections and discharges to the municipal storm drainage system is necessary for the protection of the city's water bodies and groundwater and to safeguard the public health, safety, welfare and the environment.

(3) The objectives of this division are:

a. To prevent pollutants from entering the city's municipal separate storm sewer system (MS4);

b. To prohibit illicit connections and unauthorized discharges to the MS4;

c. To require the removal of all such illicit connections;

b. To comply with state and federal statutes and regulations relating to stormwater discharges; and

c. To establish the legal authority to ensure compliance with the provisions of this division through inspection, monitoring, and enforcement.

(b) *Applicability.* This division shall apply to flows entering the municipal storm drainage system. The provisions of this division shall take precedence over any conflicting provisions of the general ordinances.

(c) *Authority.* This division is adopted under the authority granted by the Home Rule Amendment of the Massachusetts Constitution and the Home Rule Procedures Act and pursuant to MGL c. 83, §§ 1, 10, and 16, as amended by St. 2004, c. 149, §§ 135 to 140, and the regulations of the federal Clean Water Act found at 40 CFR 122.34.

(d) *Responsibility for administration.* The city engineer shall administer, implement and enforce this division and any rules and regulations adopted thereunder. Any powers granted to or duties imposed upon the city engineer may be delegated in writing by the city engineer to employees or agents of the city engineer.

(e) *Regulations.* The city engineer may promulgate rules and regulations to effectuate the purposes of this division. Failure by the city engineer to promulgate such rules and regulations shall not have the effect of suspending or invalidating this division.

(f) *Prohibited activities.*

(1) A person is considered to be in violation of this division if they connect a line conveying sewage and/or wastewater to the municipal storm drain system or, once detected, allows such a connection to continue.

(2) *Illicit discharges.* No person shall dump, discharge, cause or allow to be discharged any pollutant or nonstormwater discharge into the municipal separate storm sewer system (MS4), into a watercourse, or into the waters of the Commonwealth of Massachusetts.

(3) *Illicit connections.* No person shall construct, use, allow, maintain or continue any illicit connection to the municipal storm drainage system, regardless of whether the connection was permissible under applicable law, regulation or custom at the time of connection.

(4) *Obstruction of municipal storm drainage system.* No person shall obstruct or interfere with the normal flow of stormwater into or out of the municipal storm drainage system without prior written approval from the city engineer.

(g) *Exemptions.* The following nonstormwater discharges or flows are exempt from the prohibition of nonstormwater, provided that the source is not a significant contributor of a pollutant to the municipal storm drainage system:

(1) Municipal water line flushing;

(2) Uncontaminated groundwater or uncontaminated pumped groundwater;

(3) Water from exterior foundation drains footing drains, crawl space pumps or air conditioning condensation;

(4) Water from sump pumps and other pumps that remove flow from basements, except that this provision excludes water contaminated by sewage;
(5) Water discharge from irrigation or watering of lawns, trees, landscaping and gardens;
(6) Water from property management activities, including washing walkways, patios, house siding, windows or similar property management activities, provided that no detergents are used in conducting such activities;
(7) Discharge from dechlorinated swimming pool water (less than one ppm of chlorine or bromine), provided that the pool is not drained in a manner designed to flood or otherwise adversely affect neighboring or downstream properties;
(8) Consolidated public works ice, snow and street sweeping management operations;
(9) Flow resulting from fire-fighting activities;
(10) Dye testing, provided that written notification is given to the engineering department two business days prior to the time of the test;
(11) Maintenance or replacement of existing landscaping, gardens or lawn areas;
(12) Construction of fencing that will not substantially alter existing terrain or drainage patterns;
(13) Construction of utilities other than drainage (for example, gas, water, electric, telephone, etc.) which will not alter terrain or drainage patterns;
(14) Projects that commenced prior to the effective date of this division, provided that they are completed within one year from such effective date;
(15) Natural flow from riparian habitats and wetlands;
(16) Springs;
(17) Diverted stream flow;
(18) Rising groundwater;
(19) Nonstormwater discharge permitted under an NPDES permit or a surface water discharge permit, waiver, or waste discharge order administered under the authority of the United States Environmental Protection Agency or the Department of Environmental Protection, provided that the discharge is in full compliance with the requirements of the permit, waiver, or order and applicable laws and regulations; and
(20) Discharge for which advanced written approval is received from the city engineer as necessary to protect public health, safety, welfare or the environment.

(h) *Emergency suspension of municipal stormwater drain access.*
(1) The city engineer may suspend municipal storm drainage system access to any person or property without prior written notice when such suspension is necessary to stop an actual or threatened discharge of pollutants that presents imminent risk of harm to the public health, safety, welfare or the environment.
(2) No person shall reinstate municipal storm drain system access to premises terminated pursuant to this section without the prior inspection and approval of the engineering department. An unapproved reinstatement shall constitute a violation of this section.
(3) In the event any person fails to comply with an emergency suspension order or reinstates access in violation of this section, the city engineer may take all reasonable steps to prevent or minimize harm to the public health, safety, welfare or the environment.

(i) *Notification of spills.* Notwithstanding other requirements of local, state or federal law, as soon as a person responsible for a property or responsible for emergency response for a facility or operation has information of any known or suspected release of materials which may result in discharge of pollutants to the municipal drainage system or waters of the Commonwealth of Massachusetts or United States, said person shall take necessary steps to ensure the discovery, containment and cleanup of the release. In the event of such a release of hazardous materials, said person shall also immediately notify emergency response officials of the occurrence by calling E911. In the event of a release of nonhazardous materials, said person shall notify the

Engineering Division in person, by phone or by email no later than 4:00 p.m. of the next business day.

(j) *Enforcement.*

(1) The city engineer or appointed designee shall enforce this division and any regulations promulgated hereunder and may issue and prosecute violation notices and enforcement orders and may pursue all civil and criminal remedies for violations hereunder.

(2) *Civil relief.* The city engineer may seek injunctive relief in a court of competent jurisdiction to restrain a person from continued violations of the provisions of this division and the regulations promulgated hereunder or of any notices, order or written approvals or to compel said person to abate or remediate the violation(s).

(3) *Orders.* The city engineer or an authorized agent of the city engineer may issue a written order to enforce the provisions of this division or the regulations thereunder, which may include:

a. Elimination of illicit connections or discharges to the MS4;

b. Performance of monitoring, analyses, and reporting;

c. That unlawful discharges, practices, or operations shall cease and desist; and

d. Remediation of contamination in connection therewith.

(4) If the city engineer determines that abatement or remediation of contamination is required, the order described in Section J.3. above shall set forth deadlines in accordance with the city's NPDES General Permit by which such abatement or remediation must be completed. Said order shall further advise that, should the violator or property owner fail to abate or perform remediation within the specified deadlines in accordance with the city's NPDES General Permit, the city may, at its option, undertake such work or cause the work to be performed, and expenses thereof shall be charged to the violator.
If a violator fails to comply with the order, the city may cause the work to be performed, and charge the owner of the property and place a lien against the property for expenses incurred, provided any entry onto private property pursuant to this provision is consistent with the Constitutions of the United States and Commonwealth of Massachusetts. In the event of an emergency, however, the city engineer may require immediate compliance with an order and may take all necessary action to secure compliance with this ordinance. Within 30 days after completing all measures necessary to abate the violation or to perform remediation, the city engineer shall issue a bill for all expenses incurred by the city in performing the work. The bill shall provide that all expenses are due and payable within 30 days. The violator or property owner may file a written objection to the bill within 30 days of receipt. If the amount due is not received by the expiration of the time in which to file a written objection, if no written objection is filed, or within 30 days following a decision of the city engineer affirming or reducing the bill, if a written objection is filed, the costs shall become a special assessment against the property owner and shall constitute a lien on the owner's property for the amount of said costs. Interest shall accrue in accordance with G.L. c. 59, s. 57.

(5) *Violations.* It is unlawful for any owner or occupant of real property to fail to comply with the requirements of this section or any order of the city engineer enforcing the requirements of this section. The provisions of this section may be enforced by the city engineer by a noncriminal disposition pursuant to G. L. c. 40, s. 21D. Each violation of a provision of this section is a separate and distinct offense and in a case of a continuing violation, each day that the violation continues constitutes a separate offense. Any person, firm, corporation, association or other entity violating any provision of this division shall be punished in accordance with Section 1-11 of this Code. Any interested person may request, in writing, a hearing before a municipal hearing officer to contest the issuance of a fine, as provided in Chapter 106 of the Acts of 2008. The imposition of penalties herein prescribed shall not preclude the city from instituting other remedies to

abate violations of this ordinances as permitted by law, including, but not limited to criminal proceedings, application for equitable relief, or receivership proceedings.

(6) *Entry to perform duties under this division.* To the extent permitted by state law, or if authorized by the owner or other party in control of the property, the city engineer, its agents, officers, and employees may enter upon privately owned property for the purpose of performing their duties under this division and associated regulations and may make or cause to be made such examinations, surveys or sampling as the city engineer deems reasonably necessary.

(7) *Appeals.* The decisions or orders of the city engineer shall be final. Further relief shall be to a court of competent jurisdiction.

(8) *Remedies not exclusive.* The remedies listed in this division are not exclusive of any other remedies available under any applicable federal, state or local law.

(k) *Transitional provisions.* Residential property owners shall have 90 days from the effective date of this division to comply with its provisions, provided that good cause is shown for the failure to comply during that period.

Be it further ordained by the City Council, Section 1-11(b) of the Code of Ordinances is hereby amended, by adding the following:

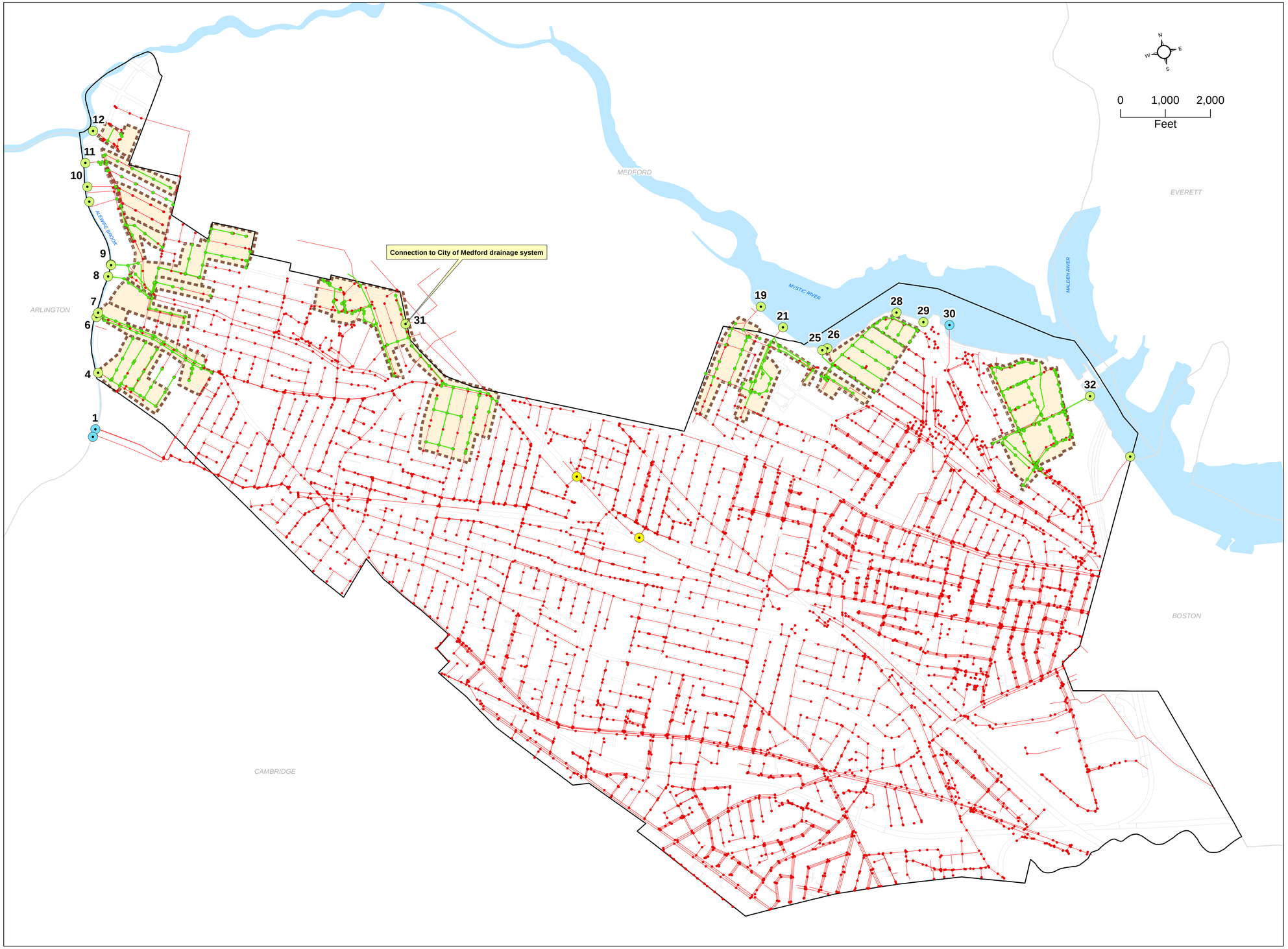
Offense	Fine	Enforcing Personnel
Illicit Discharge (Sec. 11-146)	1st offense: warning 2nd offense: $100 3rd & subsequent offense: $300	City Engineer
Stormwater Management (Sec. 11-176)	1st offense: warning 2nd offense: $100 3rd & subsequent offense: $300	City Engineer

APPROVED:

Matthew McLaughlin 3rd

President
City Council

Appendix B: City of Somerville Phase I System Map



CITY OF SOMERVILLE STORMWATER MANAGEMENT

- Storm Discharge Points
- CSO Outfalls
- MBTA Connections
- Stormwater Manholes
- Sanitary and Combined Manholes
- Separate Stormwater Drainage System
- Sanitary and Combined Sewer System
- Separate Drainage Area

<u>Alewife Brook Use Impairments*:</u>
Phosphorus
E. Coli
TSS
Copper and Lead

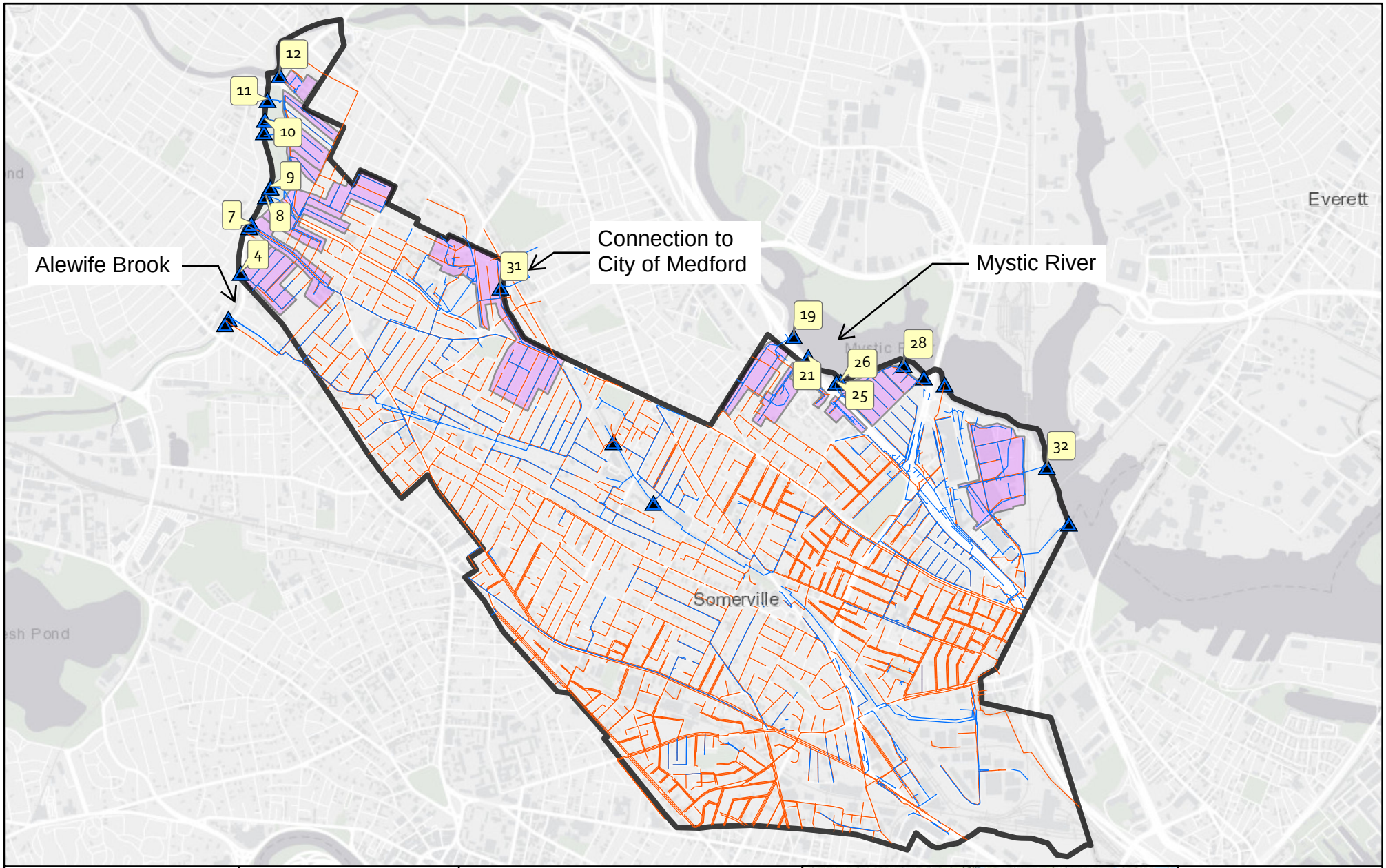
<u>Mystic River Use Impairments*:</u>
Phosphorus
E. Coli
Fecal Coliform
Petroleum Hydrocarbons
TSS
Copper and Lead

**Impairments as identified in the EPA approved Massachusetts Integrated List of waters report pursuant to Clean Water Act section 303(d) and 305(b).*

Date: June 15, 2020

City of Somerville
Infrastructure & Asset Management
1 Franey Rd
Somerville, MA 02145

C:\GIS\Projects\Somerville\Engineering\Stormwater Map\mxd\StormwaterMap_36x24.mxd 2020-06-15 KJJ



CITY OF SOMERVILLE

DRAFT DELINEATION

OVERVIEW

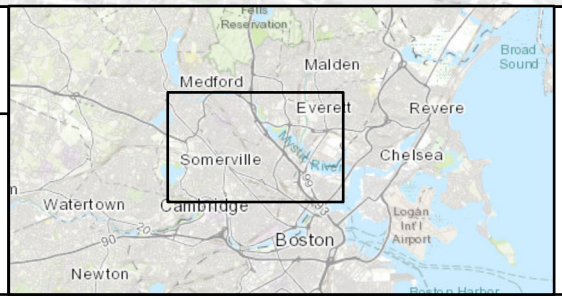
JUNE 2020

Hazen

N

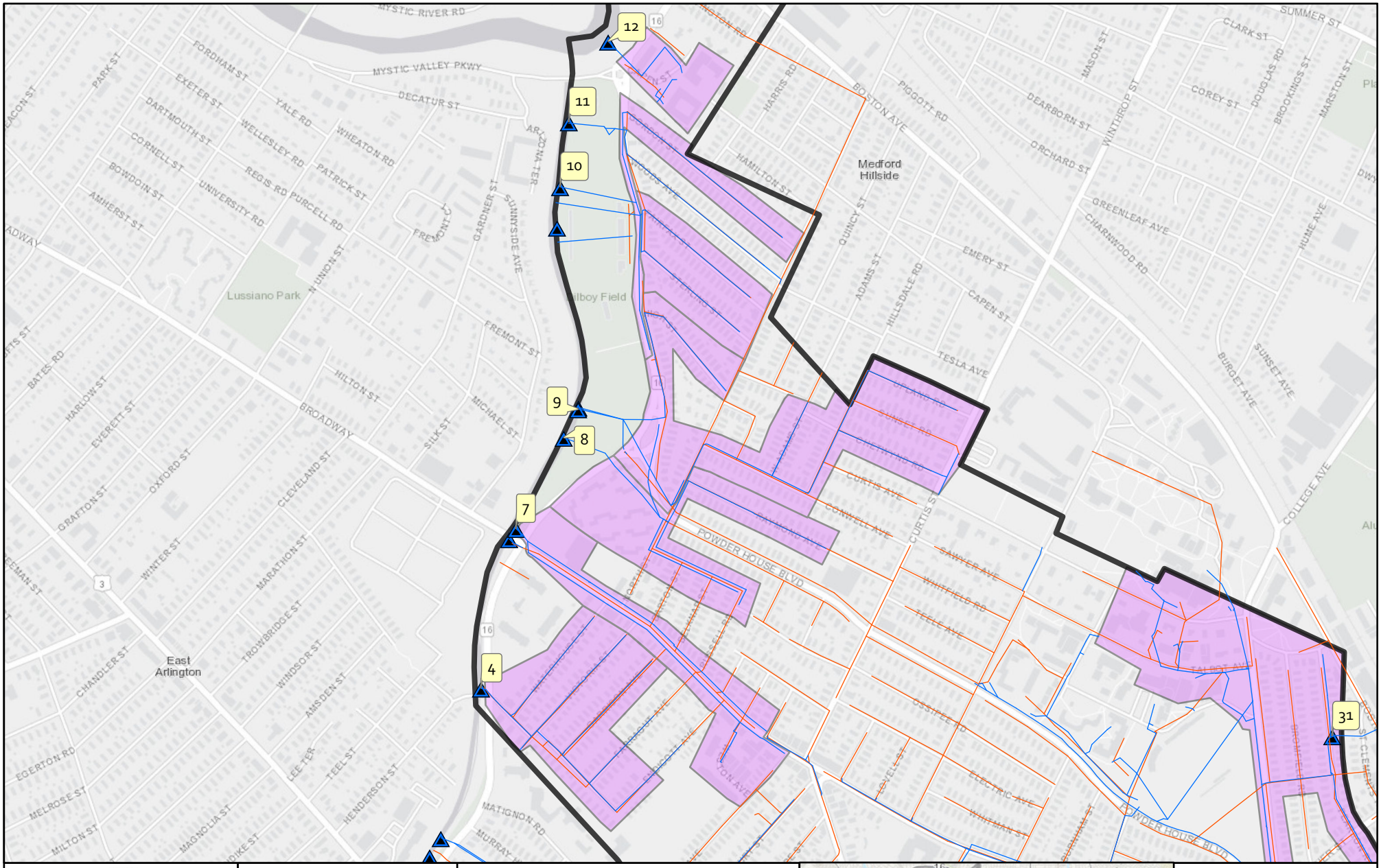
0 0.2 0.4 Miles

Note: This map depicts a preliminary delineation of separated drainage areas (not tributary to the CSS) as of June 2020. The drainage areas shown are based on available GIS data and are subject to change pending field investigations



Legend

- Sewer Gravity Main
- Stormwater Gravity Main
- Storm Discharge Points
- Separated Drainage Area
- City of Somerville Boundary



CITY OF SOMERVILLE

DRAFT DELINEATION

DISCHARGE POINTS:
4, 7, 8, 9, 10, 11, 12

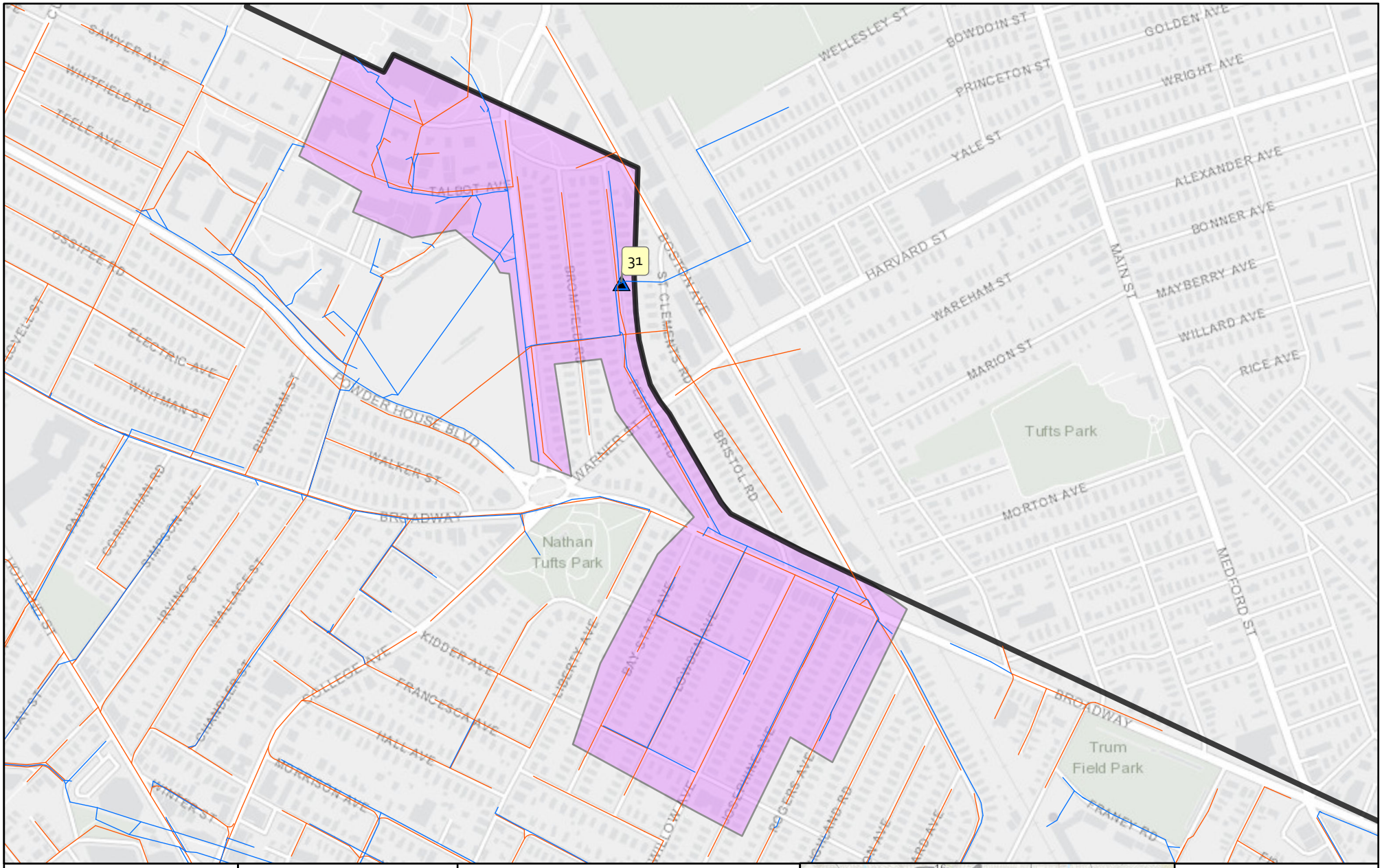
JUNE 2020

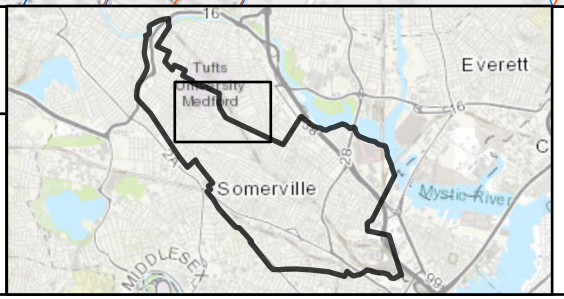
Hazen

Note: This map depicts a preliminary delineation of separated drainage areas (not tributary to the CSS) as of June 2020. The drainage areas shown are based on available GIS data and are subject to change pending field investigations

Legend

- Sewer Gravity Main
- Stormwater Gravity Main
- Storm Discharge Points
- Separated Drainage Area
- City of Somerville Boundary





CITY OF SOMERVILLE

DRAFT DELINEATION

DISCHARGE POINT: 31

JUNE 2020

N

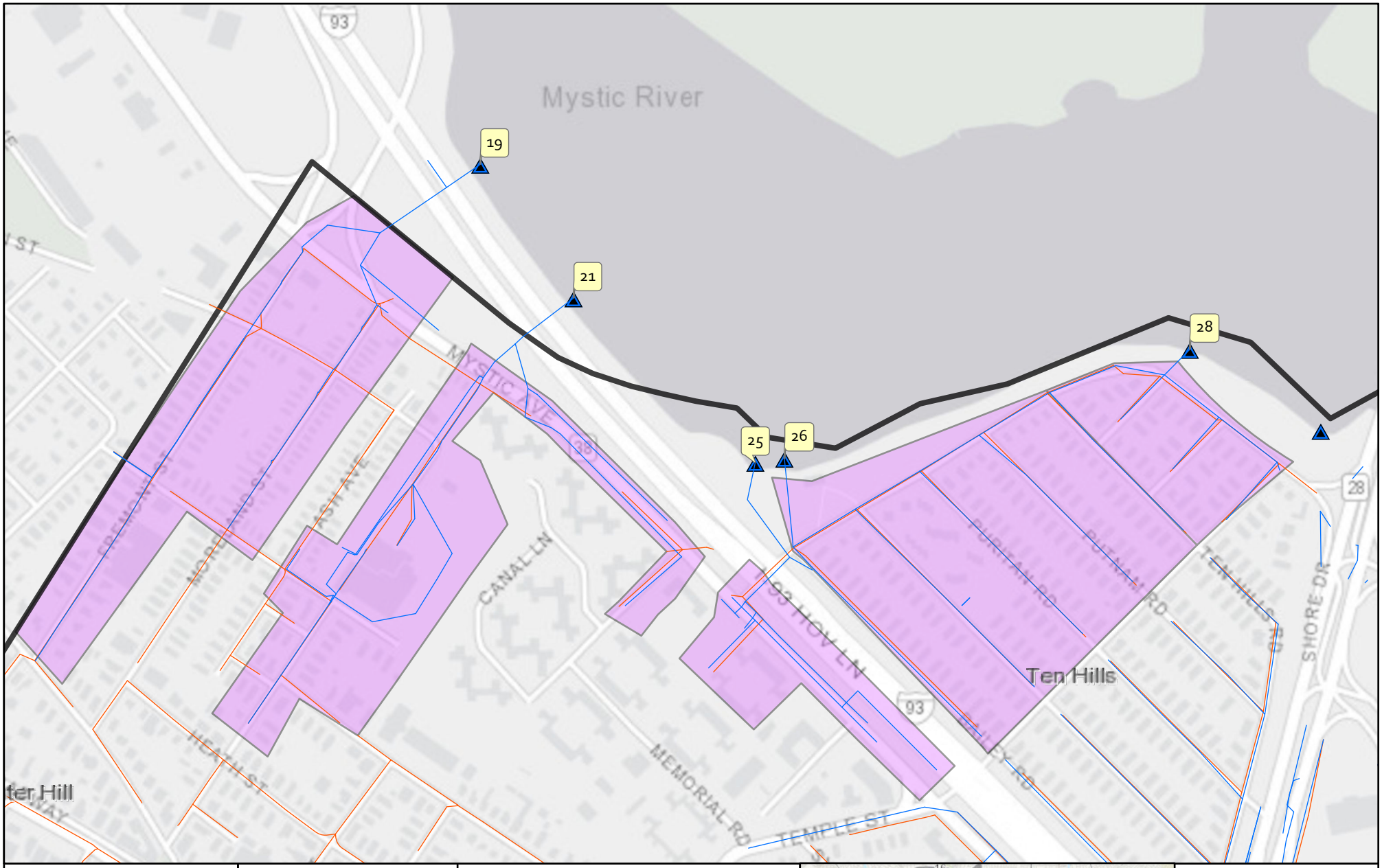
0 0.05 0.1 Miles

Note: This map depicts a preliminary delineation of separated drainage areas (not tributary to the CSS) as of June 2020. The drainage areas shown are based on available GIS data and are subject to change pending field investigations

Hazen

Legend

- Sewer Gravity Main
- Stormwater Gravity Main
- Storm Discharge Points
- Separated Drainage Area
- City of Somerville Boundary



CITY OF SOMERVILLE

DRAFT DELINEATION

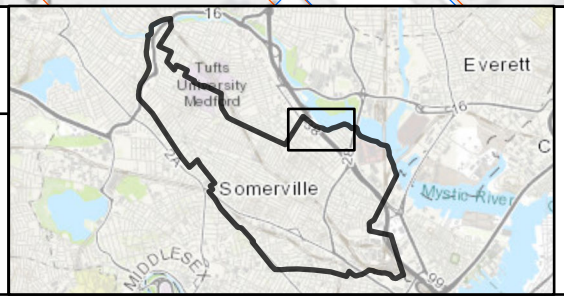
DISCHARGE POINTS:
19, 21, 25, 26, 28

JUNE 2020

N

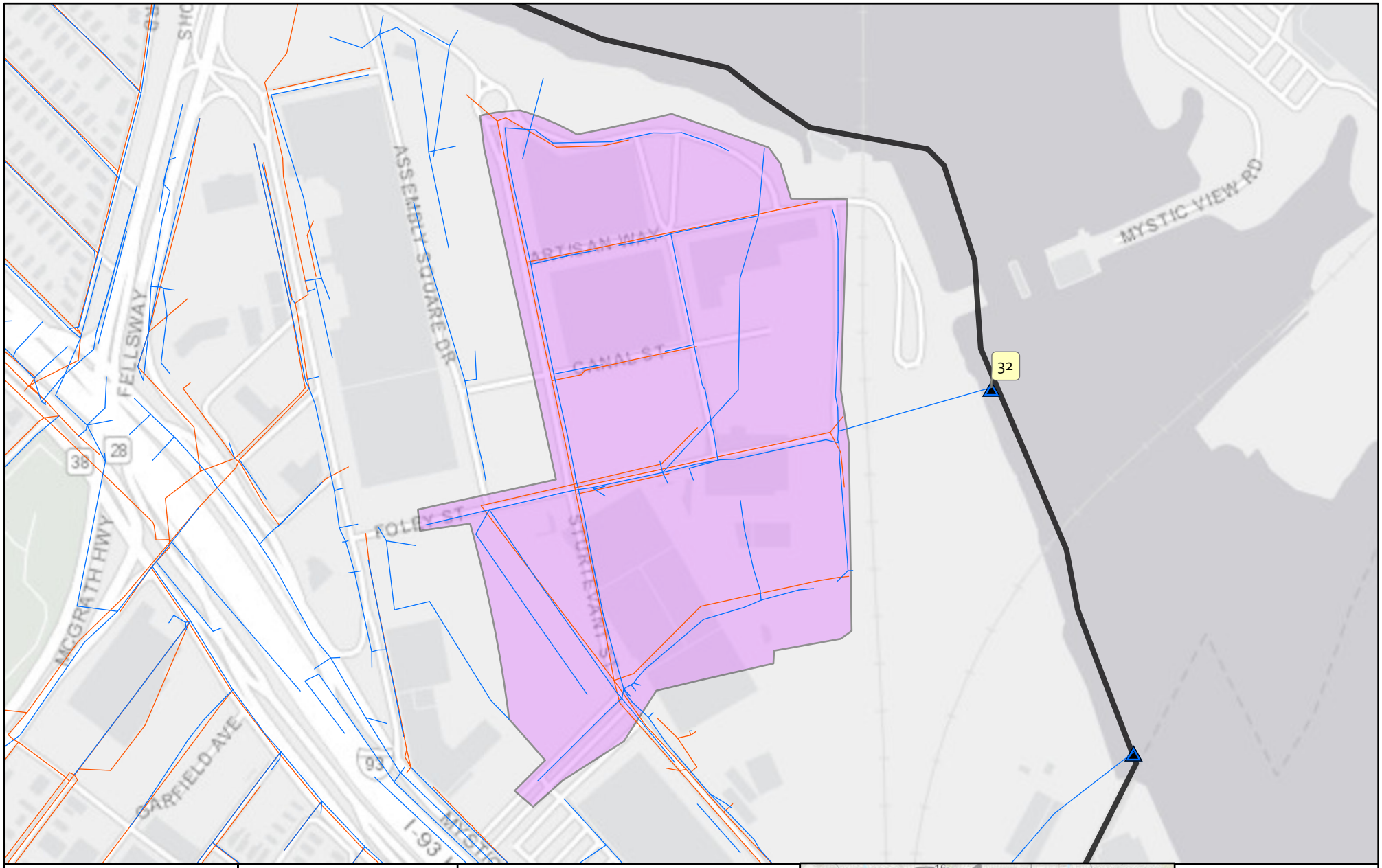
0 0.03 0.06 Miles

Note: This map depicts a preliminary delineation of separated drainage areas (not tributary to the CSS) as of June 2020. The drainage areas shown are based on available GIS data and are subject to change pending field investigations



Legend

- Sewer Gravity Main
- Stormwater Gravity Main
- Storm Discharge Points
- Separated Drainage Area
- City of Somerville Boundary



MUNICIPAL FREEDOM GIVES NATIONAL STRENGTH
SOMERVILLE, MASS.

Hazen

CITY OF SOMERVILLE

DRAFT DELINEATION

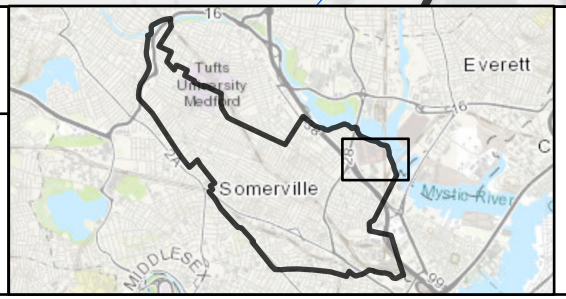
DISCHARGE POINT: 32

JUNE 2020

N

0 0.03 0.06 Miles

Note: This map depicts a preliminary delineation of separated drainage areas (not tributary to the CSS) as of June 2020. The drainage areas shown are based on available GIS data and are subject to change pending field investigations



Legend

- Sewer Gravity Main
- Stormwater Gravity Main
- Storm Discharge Points
- Separated Drainage Area
- City of Somerville Boundary

Appendix C: Field Test Kits and Instrumentation Manuals

Chlorine SAM

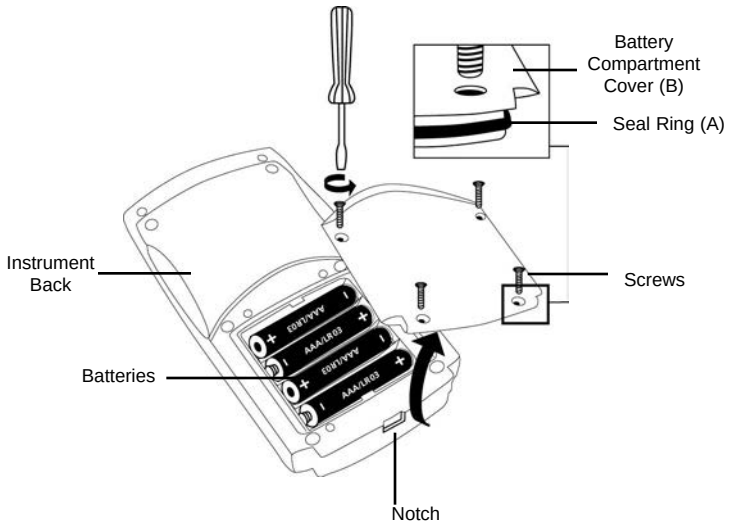
I-2001

0 to 5.00
PPM (mg/Liter)

CHEMetrics

Simplicity in Water Analysis

Battery Replacement



To ensure that the instrument is waterproof:

- seal ring (A) must be in position
- battery compartment cover (B) must be fixed with the four screws

To Set Zero

1. Press the Power key.
2. The display will show "CL".
3. Insert the ZERO ampoule (supplied in Vacu-vials® kit), flat end first, into the sample cell compartment (with mild downward pressure), making sure that it is fully seated.
4. Place the light shield over the ZERO ampoule.
5. Press the Zero/Test key. The "CL" symbol will flash for approximately 8 seconds, then the display will show "0.0.0".

To Make a Measurement

1. Follow the Test Procedure in the Chlorine Vacu-vials test kit (Cat. # K-2513).
2. Insert the resulting Chlorine Vacu-vial ampoule, flat end first, into the sample cell compartment (with mild downward pressure), making sure that it is fully seated.
3. Place the light shield over the test ampoule.
4. Press the Zero/Test key. The "CL" symbol will flash for approximately 3 seconds, then the sample test result will appear in the display as ppm (mg/Liter).

Operating Tips

- Upon startup, the photometer automatically proceeds to the zeroing process. Every time the photometer powers on, it must be re-zeroed.
- To re-zero the photometer, it must be turned off and back on again.
- A series of readings can be taken without re-zeroing, as long as the photometer stays on during the series.
- Protect photometer from extreme humidity, corrosive fumes and dusty areas. Store in a cool, dry place.
- Remove the batteries when photometer is not in use.
- Press the **!** key to turn the display back light on or off.
- When moving the photometer from one temperature extreme to another, wait at least 10 minutes before use to allow photometer to come to temperature equilibrium.
- Contamination of the optics in the sample chamber will result in incorrect measurements. The windows in the sample chamber should be checked at regular intervals and cleaned as necessary. Use a soft moist cloth or cotton swab for cleaning purposes.
- If the sample cell adapter has been removed, it must be replaced with proper orientation, aligning the triangle on the adapter with the triangle on the photometer.
- The SAM calibration is factory set and the LED should not change under normal use conditions. However, it is good quality protocol to routinely verify the performance of any LED photometer. A verification kit (Cat. No I-0003) that can be used to verify the performance of this photometer is sold separately.

Displays and Troubleshooting

E01: Light absorption too great (dirty optics)
E20/E21: Too much light reaching detector
E22 or Battery Icon: Battery should be replaced
E27/E28/E29: Instrument zeroed incorrectly, misaligned adapter, vial not properly seated, dirty optics or failing light source.
Hi/E03: Measuring range exceeded or excessive turbidity
Lo: Test result has a negative value (less than 0 ppm)

Specifications

Auto Shutoff: After 15 minutes of non-use
Optics: 530 nm LED/interference filter and photosensor in transparent sample chamber
Operating Temp.: 5 to 40°C (41 to 104°F)
Battery: 4 AAA batteries (approx. 5,000 tests or 17 hours)
Waterproof: Floating, IP68 (1 hour at 0.1 meter)
Wavelength Accuracy: ± 1 nm
Photometric Accuracy: 3% full scale (T = 20 - 25° C / 68 - 77° F)
Photometric Resolution: 0.01 A
Ambient Conditions: Temperature 5 - 40° C / 41 - 104° F
Rel. humidity 30 - 90 % (non-condensing)
CE: Certificate of Declaration of CE-Conformity available upon request.

Menu Selection

Setting Date and Time

Upon initial start-up, the SAM will display "Set", "dAtE", and "YYYY", then a 4 digit number. Proceed to Step 4 in the procedure below to set the date and time, or power the instrument off and on again to bypass this process. At any time that the time and/or data need to be reset, follow steps 1-6 of the procedure below.

1. Press the Mode key and hold. Turn the instrument on by pressing and releasing the Power key. Once three decimal points appear in the display, release the Mode key. The display will show "di 5".
2. Press and release the ! key until the display shows arrows in the upper right and lower left corners of the display, pointing to "Time" and "Date".
3. Press the Mode key. "Set", "dAtE" will briefly appear in the display.
4. Date and time settings are displayed in the following order: Year ("YYYY"), Month ("MM"), Day ("dd"), Hour ("hh"), Minutes ("mm"). Increase the displayed value for each setting by pressing the Mode key or decrease the value by pressing the Zero/Test key until the desired value is displayed.
5. Press the ! key to save the displayed value and to proceed to the next setting.
6. After setting the minutes, press the ! key. The display will flash "iS" "SEt" and then will return to the measurement mode.

Recall of Stored Data

The SAM photometer automatically stores the last 15 data sets. To recall stored data:

1. Press the Mode key and hold. Turn the instrument on by pressing and releasing the Power key. Once three decimal points appear in the display, release the Mode key. The display will show "di 5".
   Note: If the instrument is already on, press and hold the ! key for at least 4 seconds and release to access the stored data.
2. Press the Mode key. The photometer will display the stored data sets in the following format:
   a. Sample Number: nXX (e.g. n15, n14, … n1)
   b. Year: XXXX (e.g. 2017)
   c. Date: mm.dd (e.g. 03.15)
   d. Time: hh.mm (e.g. 12:05)
   e. Analyte
   f. Result
3. Press the Zero/Test key to repeat the current data set.
4. Press the Mode key to proceed to the next data set.
5. Press the ! key to return to the measurement mode.

Chlorine Vacu-vials® Kit

K-2513: 0 - 5.00 ppm (Prog. # 32)

K-2523: 0 - 5.00 ppm (Prog. # 32 or 33)

Instrument Set-up

For CHEMetrics photometers, follow the **Setup and Measurement Procedures** in the operator's manual.

For spectrophotometers, follow the manufacturer's instructions to set the wavelength to 515 nm and to zero the instrument using the ZERO ampoule supplied.

Safety Information

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

Free Chlorine Procedure

1. Fill the sample cup to the 25 mL mark with the sample to be tested (fig 1).
2. Place the Vacu-vial ampoule, tip first, into the sample cup. Snap the tip. The ampoule will fill leaving a bubble for mixing (fig 2).
3. To mix the ampoule, invert it several times, allowing the bubble to travel from end to end. Tap the bottom of the ampoule on a hard surface to cause any tiny bubbles that have collected on the ampoule wall to rise to the top of the liquid in the ampoule.
4. Dry the ampoule and wait **1 minute** for color development.
5. Insert the Vacu-vial ampoule into the photometer, flat end first, and obtain a reading in ppm (mg/Liter) chlorine (Cl_2).

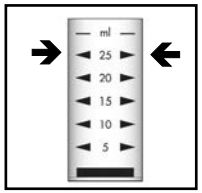


Figure 1

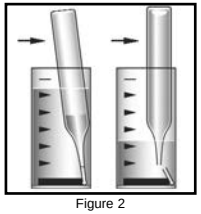


Figure 2

NOTE: **If using a spectrophotometer** that is not pre-calibrated for CHEMetrics products, then use the **equation below** or the **Concentration Calculator** found under the Support tab at *www.chemetrics.com*.

$$ppm = 0.50\ (abs)^2 + 3.54\ (abs) - 0.02$$

Total Chlorine Procedure (K-2513 only)

1. Add 5 drops of A-2500 Activator Solution to the empty sample cup.
2. Fill the sample cup to the 25 mL mark with the sample to be tested.
3. Immediately perform the **Free Chlorine Procedure** starting with Step 2.

Test Method

The Chlorine Vacu-vials®[1] test kit employs the DPD chemistry.[2,3] Free chlorine oxidizes DPD (N,N-diethyl-p-phenylenediamine) to form a pink colored species in direct proportion to the chlorine concentration. Other halogens, ozone and halogenating agents will produce high test results. Chlorine at concentrations significantly above the test range may prevent proper color development causing low test results.

K-2513 only: Total chlorine, the sum of free and combined chlorine, is determined by adding an excess of potassium iodide to the sample. Chloramines (combined chlorine) oxidize the iodide to iodine. The iodine then oxidizes DPD to the pink colored species.

1. Vacu-vials is a registered trademark of CHEMetrics, Inc. U.S. Patent No. 3,634,038
2. APHA Standard Methods, 22nd ed., Method 4500-Cl G - 2000
3. EPA Methods for Chemical Analysis of Water and Wastes, Method 330.5 (1983)

Visit www.chemetrics.com to view product demonstration videos.
Always follow the test procedure above to perform a test.

CHEMetrics
Simplicity in Water Analysis

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. 23

Ammonia CHEMets® Kit

K-1510/R-1501: 0 - 1 & 1 - 10 ppm N

Safety Information

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

Non-Seawater Test Procedure

1. Fill the sample cup to the 25 mL mark with the sample to be tested (fig. 1).
2. Add 2 drops of A-1500 Stabilizer Solution (fig. 2). Stir to mix the contents of the cup.
3. Place the CHEMet ampoule, tip first, into the sample cup. Snap the tip. The ampoule will fill leaving a bubble for mixing (fig. 3).
4. To mix the ampoule, invert it several times, allowing the bubble to travel from end to end.
5. Dry the ampoule and wait **1 minute** for color development.
6. Obtain a test result using the appropriate comparator.
   a. **Low Range Comparator (fig. 4):** Place 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.

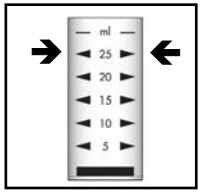


Figure 1


Figure 2

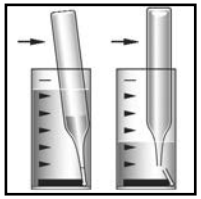


Figure 3


Figure 4

   b. **High Range Comparator (fig. 5):** Place the ampoule between the color standards until the best color match is found.

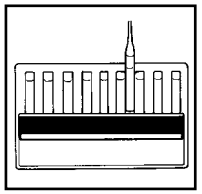


Figure 5

Seawater Test Procedure

1. Using the syringe, add 1.0 mL of A-1501 Stabilizer Solution to the sample cup.
2. Fill the sample cup to the 25 mL mark with the seawater sample to be tested (fig 1).
3. Perform the Test Procedure above, beginning with Step 3.

Test Method

The Ammonia CHEMets®[1] test kit employs direct nesslerization.[2,3] In a strongly alkaline solution, ammonia reacts with Nessler Reagent (K_2HgI_4) to produce a yellow-colored complex in direct proportion to the ammonia concentration.

This method is applicable to drinking water, clean surface water, good quality nitrified wastewater effluent and seawater. Other types of samples may require a preliminary distillation step. Ketones, alcohols, and aldehydes may cause off-color test results. Glycine and hydrazine will cause high test results. Aromatic and aliphatic amines, iron, sulfide, calcium and magnesium may cause turbidity.

1. CHEMets is a registered trademark of CHEMetrics, Inc. U.S. Patent No. 3,634,038
2. APHA Standard Methods, 18th ed., Method 4500-NH_3 C - 1988
3. ASTM D 1426 - 08, Ammonia Nitrogen in Water, Test Method A

Visit www.chemetrics.com to view product demonstration videos.
Always follow the test procedure above to perform a test.

CHEMetrics
Simplicity in Water Analysis

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. 13

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.

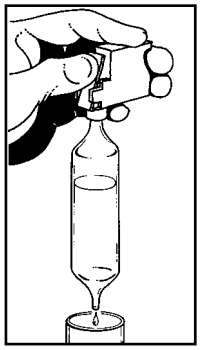


Figure 1

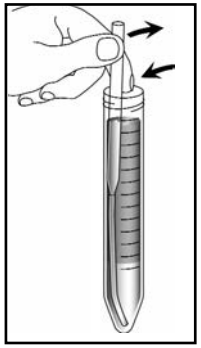


Figure 2

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.
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).

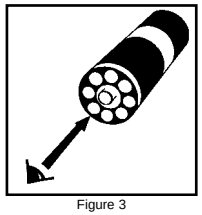


Figure 3

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.

CHEMetrics

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E-Mail: orders@chemetrics.com

Feb. 18, Rev. 10

Appendix D: Oakton Multi-Parameter PCTSTestr 50 Series Calibration Procedure

Operating Instructions

OAKTON®

PCTSTestr™ 50 Pocket Tester

CE

Applications

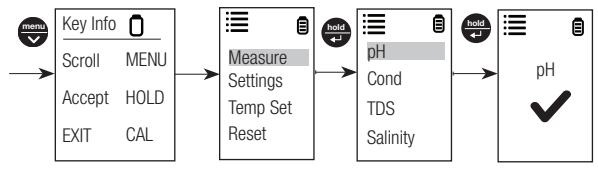
- Agriculture
- Aquaculture
- Aquariums and fish farms
- Boiler blow-down
- Car washes
- Drinking water
- Ecology
- Electroplating rinse tanks
- Food sectors
- Hydroponics
- Labs
- Printing industry
- Swimming pools
- Verification of reverse osmosis system operation
- Water and waste-water treatment

Getting Started

The PCTSTestr 50 Pocket Tester has been factory calibrated and usually works well out of the box. However, after extended periods of non-use, it is best to remove the sensor cap and soak the sensor in warm tap water for 10 minutes or so. Prior to taking the measurements, periodic calibration with certified standards is recommended for best accuracy.

Measurement Parameter Setting

1. Press ON/OFF (⏻) to power on the tester.
2. Press MENU/∨ to enter setup window. Press HOLD/↵ to select Measure. The display shows pH, Cond, TDS and Salinity.
3. Scroll down by pressing MENU/∨ to toggle between pH, Cond, TDS and Salinity. Press HOLD/↵ to select pH.
4. The display shows the selected parameter with a ✔.

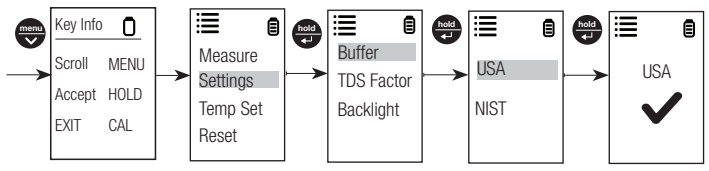


pH Buffer Set Selection

PCTSTestr 50 Pocket Tester features USA (pH 4.01, pH 7.00 and pH 10.01) or NIST (pH 4.01, pH 6.86, and pH 9.18) standards. Select either one to suit your requirements.

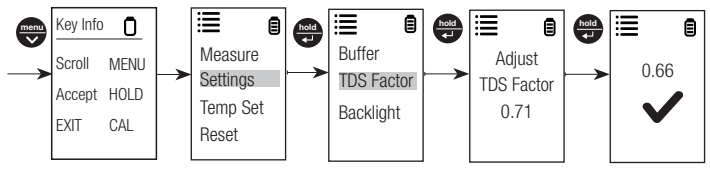
1. Press MENU/∨ to enter setup window. Press HOLD/↵ to select Settings. The display shows Buffer, TDS Factor and Backlight.

2. Press HOLD/↵ to select Buffer. Display shows USA and NIST.
3. Press HOLD/↵ to select USA or scroll down by pressing MENU/∨ to toggle between the two buffer standards.
4. The display shows the selected buffer standard with a ✔.



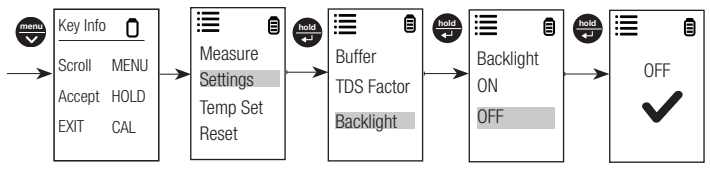
TDS Factor Setting

1. Press MENU/∨ to enter setup window. Scroll down by pressing MENU/∨ to select Settings.
2. Press HOLD/↵ to select Settings. The display shows Buffer, TDS Factor and Backlight.
3. Scroll down by pressing MENU/∨ to toggle between the Buffer, TDS Factor and Backlight. Press HOLD/↵ to select the TDS Factor.
4. Press HOLD/↵ to select the default TDS factory setting or MENU/∨ to adjust the setting.
5. Press HOLD/↵ to confirm the selection of the setting. The display shows the selected value (TDS factor) with a ✔.



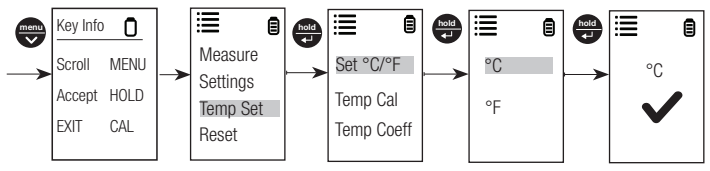
Backlight Settings

1. Press MENU/∨ to enter setup window. Scroll down by pressing MENU/∨ to select Settings.
2. Press HOLD/↵ to select Settings. The display shows Buffer, TDS Factor and Backlight.
3. Scroll down by pressing MENU/∨ to toggle between Buffer, TDS Factor and Backlight. Press HOLD/↵ to select Backlight.
4. The display shows ON and OFF. Scroll down by pressing MENU/∨ to toggle between ON and OFF. Backlight ON increases readability in low-light conditions.
5. Press HOLD/↵ to select the desired backlight option. The display shows the selected backlight option with a ✔.



Temperature Settings

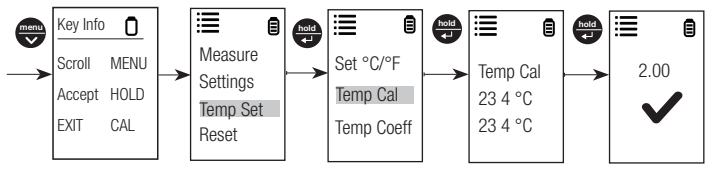
1. Press MENU/∨ to enter setup window. Scroll down by pressing MENU/∨ to select Temp Set. Press HOLD/↵ to select Temp Set. The display shows Set °C/°F, Temp Cal and Temp Coeff.
2. Press HOLD/↵ to select Set °C/°F. Scroll down by pressing MENU/∨ to toggle between °C and °F.
3. Press HOLD/↵ to select temperature unit. The display shows the selected temperature setting with a ✔.



Temperature Calibration

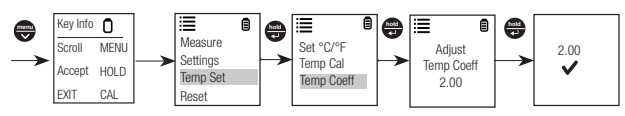
1. Press MENU/∨ to enter setup window. Scroll down by pressing MENU/∨ to select Temp Set.
2. Press HOLD/↵ to select Temp Set. The display shows Set °C/°F, Temp Cal and Temp Coeff.
3. Scroll down by pressing MENU/∨ to toggle between Set °C/°F, Temp Cal and Temp Coeff. Press HOLD/↵ to select Temp Cal.
4. The lower display shows the current measured temperature reading based on the last set offset and the upper display shows the current measured temperature reading based on factory default calibration.
5. Dip the tester into a solution of known temperature and allow time for the built-in temperature sensor to stabilize.
6. Press MENU/∨ to adjust the temperature value or press the HOLD/↵ to confirm the calibrated value as the new temperature value of the solution.

Note: To exit this program without confirming the calibration, press CAL/ESC.



Temperature Coefficient

1. Pres MENU/∨ to enter setup window. Scroll down by pressing MENU/∨ to select Temp Set.
2. Press HOLD/↵ to select Temp Set. The display shows Set °C/°F, Temp Cal and Temp Coeff.
3. Scroll down by pressing MENU/∨ to toggle between Set °C/°F, Temp Cal and Temp Coeff.
4. Press HOLD/↵ to select Temp Coeff or MENU/∨ to adjust the Temp Coeff.
5. Press HOLD/↵ to confirm the Temp Coeff value. The new value is automatically confirmed with a ✔.



pH Calibration

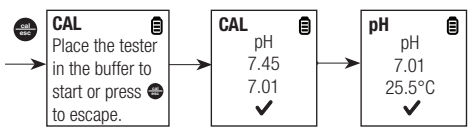
Calibration should be done regularly, recommended once a week. Calibrate up to three points using either the USA or the NIST buffer set standards.

1. Press ON/OFF (⏻) to power on the tester if needed.
2. Dip electrode about 2 cm to 3 cm into the pH standard buffer solution.
3. Stir gently and press CAL/ESC to enter calibration mode. The CAL indicator will be displayed. The upper display will show the measured reading based on the last calibration while the lower display will indicate the pH standard buffer solution.

Note: To abort calibration, press CAL/ESC to escape.

4. Allow about 2 minutes for the tester reading to stabilize. The timer icon blinks during this time. Once the reading is stabilized, the timer stops blinking. Automatic confirmation happens when the buffer is found and the display returned to measurement window with reading calibrated to pH standard buffer solution.
5. Repeat with other buffers if necessary. Rinse electrode before dipping into next buffer.

Note: The calibration mode allows you to perform up to three calibration points. Calibration is automatically confirmed with the buffer identification. No user interaction is required after starting the calibration by pressing CAL/ESC.

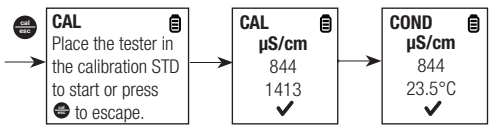


Calibration for Conductivity, TDS, or Salinity

For best results, periodic calibration with an accurate standard is recommended prior to measurement. Use the calibration standard value that is close to your intended sample value. The tester will retain one calibration value in each mode (conductivity, TDS, salinity) when the instrument is powered off. The conductivity value can be calibrated automatically or manually, while the TDS & salinity values require manual calibration. The tester will begin in the measurement mode that was used when it was powered off. See "Measurement Parameter Setting" to change the desired parameter.

Automatic Calibration for Conductivity

1. Remove the cap and press ON/OFF (⏻) to power on.
2. Dip the sensor in at least 30 mm of calibration standard.
3. Stir gently and press CAL/ESC to begin the calibration.
4. The display will show CAL followed by the default value. CAL is indicated on the display during calibration mode.
5. If the reading is within the calibration range of the automatically recognized standards; 80 (84 µS/cm), 1410 (1413 µS/cm), or 12.90 (12.88 mS/cm), the ✔ icon is displayed when the automatic calibration standard value has been detected.
6. Press HOLD/↵ to accept the auto conductivity standard and finish the calibration.
7. Display returns to Measurement window.



Manual Calibration

When the conductivity reading is outside calibration range of the automatic conductivity standards or when TDS or salinity is used, the tester will require manual adjustment.

1. Repeat steps 1 to 4 from "Automatic Calibration for Conductivity".
2. Press MENU/∨ to manually adjust the value to the desired reading.

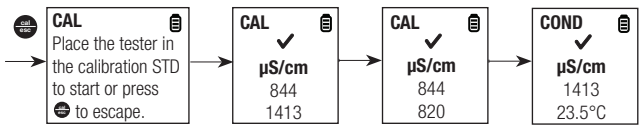
Note: The adjustment will decrease only, however the adjustment will eventually cycle to the highest available value after decreasing by 40% of the initial value.

3. Press HOLD/↵ to accept and finish the calibration when the desired value is selected.

Note: To abort calibration, press CAL/ESC to escape.

4. Once the calibration is finished and user has accepted the changes, measurement window will now show the calibrated reading.

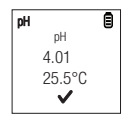
Note: The auto conductivity standards are 84 µS/cm, 1413 µS/cm & 12.88 mS/cm.



Measurement

1. Press ON/OFF (⏻) to power on the tester if needed.
2. Dip the electrode in about 2 cm to 3 cm into the test solution. Stir and let the reading stabilize. The timer icon will blink during this time. Once the reading is stabilized, the timer stops blinking and ✔ will appear to indicate the stability of the reading.

CAUTION: Testing dry samples is not accurate and can lead to sensor damage or breakage. Soils must be wet and free of particulates that may scratch the glass sensor. Excessive force into dry samples can cause glass breakage.

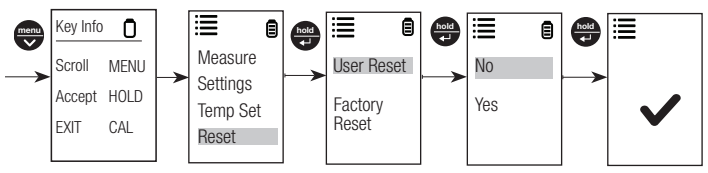


3. Note the value or press HOLD/↵ to freeze the reading. To release the reading, press HOLD/↵ again.
4. Press ON/OFF (⏻) for 3 seconds to turn off tester. If you do not press a button for 8.5 minutes, the tester will automatically shut off to conserve batteries.

User Reset

Reset to the user's default settings by using the User Reset function. Buffer selection and user temperature calibration are not affected by the user reset function.

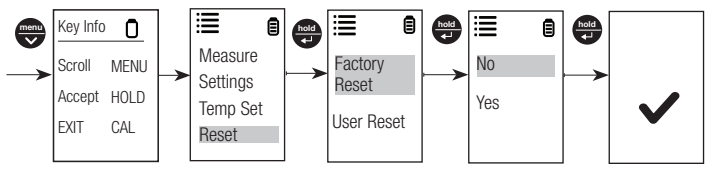
1. Press MENU/∨ to enter setup window. Scroll down by pressing MENU/∨ to select Reset. Press HOLD/↵ to select Reset. The display shows User Reset and Factory Reset.
2. Press HOLD/↵ to select User Reset.
3. The display automatically shows No and Yes. Scroll down by pressing MENU/∨ to toggle between No and Yes.
4. Press HOLD/↵ to confirm either No or Yes. The display shows the User Reset option with a ✔.



Factory Reset

Reset to the Factory Default Settings by using the Factory Reset function.

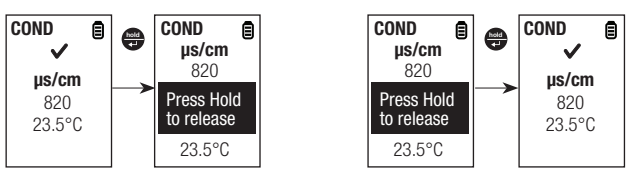
1. Press MENU/v to enter setup window. Scroll down by pressing MENU/v to select Reset. Press HOLD/↵ to select Reset. The display shows User Reset and Factory Reset.
2. Scroll down by pressing MENU/v to toggle between the resets. Press HOLD/↵ to select Factory Reset.
3. The display automatically shows No and Yes. Scroll down by pressing MENU/v to toggle between No and Yes.
4. Press HOLD/↵ to confirm either No or Yes. The display shows the Factory Reset option with a ✔.



HOLD Function

This feature lets you freeze the display for a delayed observation.

1. Press HOLD/↵ button to freeze the measurement.
2. Press HOLD/↵ again to release the measurement.



Sensor Maintenance

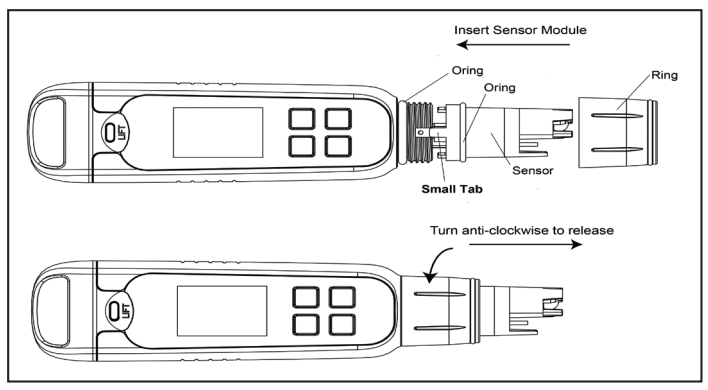
1. Always keep the sensor electrodes clean. Rinse the electrodes with de-ionized water and wipe them dry with clean cloth before storing with its protective cap. For cup type electrodes, remove the white plastic cup and insert to thoroughly clean viscous solutions. **Note:** Never scratch electrodes with a hard substance.
2. For better performance, soak the electrode in alcohol for 10 to 15 minutes and rinse with de-ionized water before starting any measurement process. This is to remove dirt and oil stains on the electrode, which may affect the accuracy of the measurements.

Sensor Replacement

You can replace the sensor module at a fraction of the cost of a new tester. When the tester fails to calibrate or gives fluctuating readings in calibration standards, you need to change the electrode.

1. With dry hands, grip the ring with sensor facing you. Twist the ring counterclockwise. Save the ring for later use.
2. Pull the old sensor module away from the tester.
3. Align the four tabs on the new module so that they match the four slots on the tester.
4. Gently push the module onto the slots to sit it in position. Push the smaller O-ring fully onto the new sensor module. Push the other O-ring over the module and thread it into place by firmly twisting clockwise.

Note: It is necessary that you recalibrate your tester prior to measurement after a sensor replacement.



Replacing the Batteries

The PCTSTestr 50 Pocket Tester uses four AAA 1.5 V batteries.

1. To remove the battery cover, see Figure 1. Clear the front catch and then the back catch, before sliding the cover off.
2. To remove the battery plate, push the center tab towards the front of the tester as shown in Figure 2. Once unlocked, remove the plate to access the batteries.
3. Invert the tester upside down to remove the batteries. Each side uses two AAA batteries. Orient each battery with positive terminal facing downward.
4. To lock the battery place, align the small tabs (Figure 3) into the guide ribs on the housing and then press down. See Figure 4.

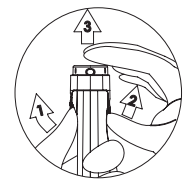


Fig. 1: Removing battery cover

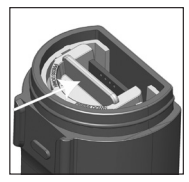


Fig. 2: Push to unlock

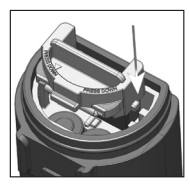


Fig. 3: Align tabs


Fig. 4: Push down to lock

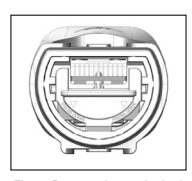


Fig. 5: Battery plate unlocked

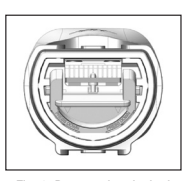


Fig. 6: Battery plate locked

Warranty

This instrument is supplied with a warranty against manufacturing defects for a period of one year from the date of purchase.

Return of Items

Authorization must be obtained from your distributor before returning items for any reason. When applying for authorization, please include information regarding the reason the item(s) are to be returned.

We reserve the right to make improvements in design, construction and appearance of products without notice. Prices are subject to change without notice.

Self-Diagnostic Messages

🔋	Batteries are weak and need replacement soon.
stable error	Appears when calibration is attempted but the reading is not yet stable. Wait for the reading to stabilize or manually confirm the calibration by pressing enter.
buffer error	The buffer is outside of the calibration range.
slope error	The 2nd and 3rd calibration point is not within 80% to 120% slope range.
over range	The reading is above the measuring range of tester.
under range	The reading is below the measuring range of tester.

Specifications

Specifications	PCTSTestr 50
pH	
pH range	–1.00 to 15.00 pH
Resolution	0.01 pH
Relative accuracy	±0.01 pH
Calibration points	Up to 3 points
Buffer set standard selection	USA: 4.01/7.00/10.01 NIST: 4.01/6.86/9.18
Calibration window	±1.00 pH
Calibration type	Point to point
Conductivity	
Conductivity range	0.0 to 200.0 µS, 200 to 2000 µS, 2.00 to 20.00 mS
Resolution	0.1 µS, 1 µS, 0.01 mS
Relative accuracy	±1% full scale
Normalization temperature	25.0ºC (77ºF)
Temperature co-efficient	0.0% to 10.0%
Calibration points	Up to 3 points
TDS	
TDS range	0.0 to 100.0 ppm, 100 to 1000 ppm, 0.10 to 10.00 ppt (TDS factor 0.5)
Resolution	0.1 ppm, 1 ppm, 0.01 ppt
Relative accuracy	±1% full scale
Calibration points	Up to 3 points
TDS factor	0.40 to 1.00 (selectable)
Salinity	
Salinity range	0.00 to 10.00 ppt
Resolution	0.10 ppt
Relative accuracy	±1% full scale
Calibration points	1

Specifications (cont.)	PCTSTestr 50
Temperature	
Temperature range	0 to 60°C (32.0 to 140.0°F)
Temperature resolution	0.1°C / 0.1°F
Temperature accuracy	From 0 to 50ºC (±0.5°C / ±0.9°F + 1 LSD); from 50 to 60°C (±1.0ºC / ±1.8°F + 1 LSD)
Temperature compensation	Yes (Automatic Temperature Compensation)
General	
Display	Graphics, dot matrix 80 x 100 pixel
Backlight	Yes, selectable (30 sec from last key press)
Auto off	8.5 minutes (from last key press)
Reset	User / Factory
Power requirement	Four AAA 1.5 V batteries
Battery life	>150 hours
Water proofing	IP67
Regulatory certifications	CE, FCC
Environmental Operating Conditions	
Ambient operating temperature	5 to 45°C / 41 to 113°F
Relative humidity	5% to 85% noncondensing
Storage temperature	–20 to 60°C / –4 to 140°F
Storage humidity	5% to 85% noncondensing

Accessories

Ordering Code	Product Description
35634-35	PCTSTestr 50 pocket tester with case, lanyard, and batteries
35634-37	Replacement sensor module for PCTSTestr 50
35634-09	Replacement sensor cap
09376-00	Replacement alkaline batteries; AAA, 1.5 V. Pack of 12
17101-45	NIST-traceable calibration with data for pocket testers

OAKTON® INSTRUMENTS

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