

**STORMWATER
MANAGEMENT
PROGRAM**

**Stormwater Management
Program Report**

All Stormwater Documents

Town of Reading

March 2022



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Section 1

MA MS4 General Permit

**United States Environmental Protection Agency (EPA)
National Pollutant Discharge Elimination System (NPDES)**

**GENERAL PERMITS FOR STORMWATER DISCHARGES FROM
SMALL MUNICIPAL SEPARATE STORM SEWER SYSTEMS
IN MASSACHUSETTS
(as modified)**

**AUTHORIZATION TO DISCHARGE UNDER THE
NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM**

In compliance with the provisions of the Clean Water Act (CWA), as amended (33 U.S.C. §1251 *et seq.*), and the Massachusetts Clean Waters Act, as amended (M.G.L. Chap.21 §§ 26-53), any operator of a small municipal separate storm sewer system whose system:

- Is located in the areas described in part 1.1;
- Is eligible for coverage under part 1.2 and part 1.9; and
- Submits a complete and accurate Notice of Intent in accordance with part 1.7 of this permit and EPA issues a written authorization

is authorized to discharge in accordance with the conditions and the requirements set forth herein.

The following appendices are also included as part of these permits:

- Appendix A – Definitions, Abbreviations, and Acronyms;
- Appendix B – Standard permit conditions applicable to all authorized discharges;
- Appendix C – Endangered Species Act Eligibility Guidance;
- Appendix D – National Historic Preservation Act Eligibility Guidance;
- Appendix E – Information required for the Notice of Intent (NOI);
- Appendix F – Requirements for MA Small MS4s Subject to Approved TMDLs;
- Appendix G – Impaired Waters Monitoring Parameter Requirements;
- Appendix H – Requirements related to discharges to certain water quality limited waterbodies;

This modifies parts: 2.0; 2.1; 2.1.1; 2.1.2.a; 2.2.; 2.2.2 (paragraphs 2 and 3); 2.3.3; 2.3.5; 2.3.6; 2.3.7.b; 4.1; 4.4; 5.1.5; 6.5; Appendix F part A.I; Appendix F part A.II; and Appendix H of the permits that became effective on July 1, 2018

These permit modifications become effective on **January 6, 2021**.

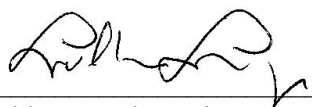
These permits and the authorization to discharge expire at midnight, **June 30, 2022**.

Signed this **7th** day of **December 2020**

Signed this **7th** day of **December 2020**

/S/Signature On File

Ken Moraff, Director
Water Division
United States Environmental Protection Agency
5 Post Office Square – Suite 100
Boston, Massachusetts 02109-3912



Lealdon Langley, Director
Division of Watershed Management
Department of Environmental Protection
One Winter Street
Boston, Massachusetts 02108

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1.0. Introduction

This document consists of three (3) general permits listed in part 1.1. Each general permit is applicable to a particular type of municipal system within Massachusetts. Many of the permit terms and conditions are applicable across all regulated entities, and therefore are presented just once in parts 1-2, part 4, and Appendices A through E. Other conditions are applicable to a particular set of authorized entities; these terms and conditions are included in parts 3, and 5 and Appendices F through H. Throughout the permit, the terms “this permit” or “the permit” will refer to the three general permits.

1.1. Areas of Coverage

This permit covers small municipal separate storm sewer systems (MS4s) located in the Commonwealth of Massachusetts:

- Traditional Cities and Towns (NPDES Permit No. MAR041000)
- State, federal, county and other publicly owned properties (Non-traditional) (MAR042000)
- State transportation agencies (except for MassDOT- Highway Division) (MAR043000)

1.2. Eligibility

The MS4 shall meet the eligibility provisions described in part 1.2.1 and part 1.9 to be eligible for authorization under this permit.

1.2.1. Small MS4s Covered

This permit authorizes the discharge of stormwater from small MS4s as defined at 40 CFR § 122.26(b) (16). This includes MS4s described in 40 CFR §122.32(a) (1) and (a) (2). An MS4 is eligible for coverage under this permit if it is:

- A small MS4 within the Commonwealth of Massachusetts;
- Not a large or medium MS4 as defined in 40 CFR §§122.26(b)(4) or (7);
- Located either fully or partially within an urbanized area as determined by the latest Decennial Census by the Bureau of Census as of the effective date of this permit (the 2010 Census); or
- Located in a geographic area designated by EPA as requiring a permit.

If the small MS4 is not located entirely within an urbanized area, only the portion of the MS4 that is located within the urbanized area is regulated under 40 CFR §122.32(a) (1).

A small municipal separate storm sewer system means all separate storm sewers that are:

- Owned or operated by the United States, a state, city, town, borough, county, parish, district, association, or other public body (created by or pursuant to state law) having jurisdiction over disposal of sewage, industrial wastes, stormwater, or other wastes, including special districts under state law such as a sewer district, flood control district or drainage district, or similar entity, or an Indian tribe or an authorized Indian tribal organization, or a designated and approved management agency under section 208 of the CWA that discharges to waters of the United States.
- Not defined as large or medium municipal separate storm sewer systems pursuant to 40 CFR § 122.26(b) (4) and (b) (7) or designated under 40 CFR § 122.26(a) (1) (v).
- This term includes systems similar to separate storm sewer systems in municipalities such as systems at military bases, large hospitals or prison complexes, and highways

and other thoroughfares. The term does not include separate storm sewers in very discrete areas, such as individual buildings.

1.3. Limitations on Coverage

This permit does not authorize the following:

- a. Stormwater discharges mixed with sources of non-stormwater unless such non-stormwater discharges are:
 - Authorized under a separate NPDES permit; or
 - A non-stormwater discharge as listed in part 1.4.
- b. Stormwater discharges associated with industrial activity as defined in 40 CFR §122.26 (b) (14) (i)-(ix) and (xi).
- c. Stormwater discharges associated with construction activity as defined in 40 CFR §122.26(b) (14) (x) or (b) (15).
- d. Stormwater discharges currently authorized under another NPDES permit, including discharges covered under other regionally issued general permits.
- e. Stormwater discharges or discharge related activities that are likely to adversely affect any species that are listed as endangered or threatened under the Endangered Species Act (ESA) or result in the adverse modification or destruction of habitat that is designated as critical under the ESA. The permittee shall follow the procedures detailed in Appendix C to make a determination regarding eligibility. The permittee shall certify compliance with this provision on the submitted NOI.
- f. Stormwater discharges whose direct or indirect impacts do not prevent or minimize adverse effects on any Essential Fish Habitat.
- g. Stormwater discharges, or implementation of a stormwater management program, which adversely affects properties listed or eligible to be listed on the National Register of Historic Places. The permittee shall follow the procedures detailed in Appendix D to make a determination regarding eligibility. The permittee shall certify compliance with this provision on the submitted NOI.
- h. Stormwater discharges prohibited under 40 CFR § 122.4.
- i. Stormwater discharges to the subsurface subject to state Underground Injection Control (UIC) regulations. Although the permit includes provisions related to infiltration and groundwater recharge, structural controls that dispose of stormwater into the ground may be subject to UIC regulation requirements. Authorization for such discharges shall be obtained from Massachusetts Department of Environmental Protection, Bureau of Resource Protection, Drinking Water Program, Underground Injection Control, One Winter Street, Boston, MA 02108 – phone 617-292-5859.
- j. Any non-traditional MS4 facility that is a “new discharger” as defined in part 5.1.4. and discharges to a waterbody listed in category 5 or 4b on the Massachusetts Integrated Report of waters listed pursuant to Clean Water Act section 303(d) and 305(b) due to nutrients (Total Nitrogen or (Total Phosphorus), metals (Cadmium, Copper, Iron, Lead or Zinc), solids (TSS or Turbidity), bacteria/pathogens (E. Coli, Enterococcus or Fecal Coliform), chloride (Chloride) or oil and grease

(Petroleum Hydrocarbons or Oil and Grease), or discharges to a waterbody with an approved TMDL for any of those pollutants.

1.4. Non-Stormwater Discharges

The following categories of non-stormwater discharges are allowed under this permit *unless* the permittee, EPA, or the MassDEP identifies any category or individual discharge of non-stormwater discharge in part 1.4.a-r as a significant contributor of pollutants to the MS4, then that category or individual discharge is not allowed under part 1.4, but rather shall be deemed an “illicit discharge” under part 2.3.4.1, and the permittee shall address that category or individual discharge as part of the Illicit Discharge Detection and Elimination (IDDE) Program described in part 2.3.4 of this permit.

- a. Water line flushing
- b. Landscape irrigation
- c. Diverted stream flows
- d. Rising ground water
- e. Uncontaminated ground water infiltration (as defined at 40 CFR § 35.2005(20))
- f. Uncontaminated pumped ground water
- g. Discharge from potable water sources
- h. Foundation drains
- i. Air conditioning condensation
- j. Irrigation water, springs
- k. Water from crawl space pumps
- l. Footing drains
- m. Lawn watering
- n. Individual resident car washing
- o. Flows from riparian habitats and wetlands
- p. De-chlorinated swimming pool discharges
- q. Street wash waters
- r. Residential building wash waters without detergents

Discharges or flows from firefighting activities are allowed under this permit need only be addressed where they are identified as significant sources of pollutants to waters of the United States.

1.5. Permit Compliance

Non-compliance with any of the requirements of this permit constitutes a violation of the permit and the CWA and may be grounds for an enforcement action and may result in the imposition of injunctive relief and/or penalties.

1.6. Continuation of this Permit

If this permit is not reissued prior to the expiration date, it will be administratively continued in accordance with the Administrative Procedure Act and remain in force and effect for discharges that were authorized prior to expiration. If a small MS4 was granted permit authorization prior to the expiration date of this permit, it will automatically remain authorized by this permit until the earliest of:

- Authorization under a reissued general permit following timely and appropriate submittal of a complete and accurate NOI requesting authorization to discharge under the reissued permit; or
- Issuance or denial of an individual permit for the MS4’s discharges; or

- Authorization or denial under an alternative general permit.

If the MS4 operator does not submit a timely, appropriate, complete, and accurate NOI requesting authorization to discharge under the reissued permit or a timely request for authorization under an individual or alternative general permit, authorization under this permit will terminate on the due date for the NOI under the reissued permit unless otherwise specified in the reissued permit.

1.7. Obtaining Authorization to Discharge

1.7.1. How to Obtain Authorization to Discharge

To obtain authorization under this permit, a small MS4 shall:

- Be located in the areas listed in part 1.1 of this permit;
- Meet the eligibility requirements in part 1.2 and part 1.9;
- Submit a complete and accurate Notice of Intent (NOI) in accordance with the requirements of part 1.7.2; and
- EPA issues a written authorization.

1.7.2. Notice of Intent

- a. Operators of Small MS4s seeking authorization to discharge under the terms and conditions of this permit shall submit a Notice of Intent that contains the information identified in Appendix E. This includes operators of small MS4s that were previously authorized under the May 1, 2003 small MS4 general permit (MS4-2003 permit).
- b. The NOI shall be signed by an appropriate official (see Appendix B, Subparagraph B.11, Standard Conditions).
- c. The NOI shall contain the following certification: I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, I certify that the information submitted is, to best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Print the name and title of the official, followed by signature and date.

- d. The NOI shall be submitted within 90 days of the effective date of the permit. If EPA notifies an MS4 that it is designated under 40 CFR § 122.32(a) (2) or (b), the NOI shall be submitted within 180 days of receipt of notice unless granted a longer period of time by EPA.

1.7.3. Submission of Notice of Intent

- a. All small MS4s shall submit a complete and accurate Notice of Intent (suggested form in Appendix E) to EPA-Region 1 at the following address:

United States Environmental Protection Agency
Stormwater and Construction Permits Section (OEP06-1)
Five Post Office Square, Suite 100

Boston, MA 02109

Or submitted electronically to EPA at the following email address: stormwater.reports@epa.gov

b. All small MS4s shall also submit a copy of the NOI to the MassDEP at the following address:

Massachusetts Department of Environmental Protection
One Winter Street -5th Floor
Boston, Massachusetts 02108
ATTN: Frederick Civian, Stormwater Coordinator

c. Late notification: A small MS4 is not prohibited from submitting a NOI after the dates provided in part 1.7.2.d. However, if a late NOI is submitted, authorization is only for discharges that occur after permit authorization is granted. EPA and MassDEP reserve the right to take enforcement actions for any unpermitted discharges. All NOIs submitted after December 21, 2020 must be submitted electronically.

1.7.4. Public Notice of NOI and Effective Date of Coverage

a. EPA will provide a public notice and opportunity for comment on the contents of the submitted NOIs. The public comment period will be a minimum of 30 calendar days.

b. Based on a review of a small MS4's NOI or other information, EPA may grant authorization, extend the public comment period, or deny authorization under this permit and require submission of an application for an individual or alternative NPDES permit. (See part 1.8) A small MS4 will be authorized to discharge under the terms and conditions of this permit upon receipt of notice of authorization from EPA.

c. Permittees whose authorization to discharge under the MS4-2003 permit, which expired on May 1, 2008, has been administratively continued in accordance with the Administrative Procedure Act 5 U.S.C. § 558(c) and 40 CFR § 122.6, who wish to obtain coverage under this permit, must submit a new NOI requesting permit coverage in accordance with the requirements of part 1.7 of this permit to EPA within 90 days after the effective date of this permit. Permittees whose authorization to discharge under the expired MS4-2003 permit was administratively continued, who fail to submit a timely, complete and accurate NOI or an application for an individual NPDES permit within 90 days after the effective date of this permit will be considered to be discharging without a permit (see 40 CFR § 122.28(b)(3)(iii)).

1.8. Individual Permits and Alternative General Permits

a. EPA may require a small MS4 to apply for and obtain authorization under either an individual NPDES permit or an alternative NPDES general permit. Any interested person may petition EPA in accordance with the provisions of 40 CFR § 122.26(f) to require a small MS4 to apply for and/or obtain authorization under either an individual NPDES permit or an alternative NPDES general permit. If EPA requires a small MS4 to apply for an individual or alternative NPDES permit, EPA will notify the small MS4 in writing that a permit application is required. This notification will include a brief statement of the reasons for this decision and will provide application information and an application deadline. If a small MS4 is authorized under the MS4-2003 permit or this permit and fails to submit an individual NPDES or an alternative general permit NPDES permit application as required by EPA, then the authorization under the MS4-2003 permit or this permit to the small MS4 is automatically terminated at the end of the date specified by EPA as the deadline

for application submittal. EPA reserves the right to take enforcement action for any unpermitted discharge.

- b. A small MS4 may request to be excluded from this general permit by applying for an individual permit or authorization under an alternative general permit. In such a case, a small MS4 shall submit an individual permit application in accordance with the requirements of 40 CFR § 122.33(b) (2) (i) or § 122.33(b) (2) (ii), with reasons supporting the request, to EPA at the address listed in part 1.7.3 of this permit. The request may be granted by issuance of an individual permit or authorization under an alternative general permit if EPA determines that the reasons stated by the small MS4 are adequate to support the request. (See 40 CFR § 122.28(b) (3)).
- c. When an individual NPDES permit is issued, or a small MS4 is authorized to discharge under an alternative NPDES general permit, authorization under this permit automatically terminates on the effective date of the individual permit or the date of authorization of coverage under the alternative general permit.

1.9. Special Eligibility Determinations

1.9.1. Documentation Regarding Endangered Species

The small MS4 shall certify eligibility regarding endangered species in the NOI required by part 1.7.2. The Stormwater Management Program (SWMP) shall include documentation supporting the permittee's eligibility determination with regard to federal Endangered and Threatened Species and Critical Habitat Protection, including:

- Results of the Appendix C U.S. Fish and Wildlife Service endangered species screening determination; and
- If applicable, a description of the measures the small MS4 shall implement to protect federally listed endangered or threatened species, or critical habitat, including any conditions imposed by the U.S. Fish and Wildlife Service. If a permittee fails to document and implement such measures, the permittee's discharges are ineligible for coverage under this permit.

1.9.2. Documentation Regarding Historic Properties

The small MS4 shall certify eligibility regarding historic properties on the NOI required by part 1.7.2. The SWMP shall include documentation supporting the small MS4's eligibility determination with regard to Historic Properties Preservation, including:

- Information on whether the permittee's stormwater discharges, allowable non-stormwater discharges, or stormwater discharge-related activities would have an effect on a property that is listed or eligible for listing on the National Register of Historic Properties (NRHP);
- Where such effects may occur, any documents received by the permittee or any written agreements the permittee has made with the State Historic Preservation Officer (SHPO), Tribal Historic Preservation Officer (THPO), or other Tribal representative to mitigate those effects;
- Results of the Appendix D historic property screening investigations; and
- If applicable, a description of the measures the permittee shall implement to avoid or minimize adverse impacts on places listed, or eligible for listing, on the NRHP, including any conditions imposed by the SHPO or THPO. If the permittee fails to

document and implement such measures, those discharges are ineligible for coverage under this permit.

1.10. Stormwater Management Program (SWMP)

- a. The permittee shall develop and implement a written (hardcopy or electronic) SWMP. The SWMP shall be signed in accordance with Appendix B, Subsection 11, including the date of signature. A signature and date is required for initial program preparation and for any significant revision to the program, which shall be in writing. The written SWMP shall be completed within one (1) year of the effective date of the permit.

The SWMP is the document used by the permittee to describe and detail the activities and measures that will be implemented to meet the terms and conditions of the permit. The SWMP shall accurately describe the permittees plans and activities. The document should be updated and/or modified during the permit term as the permittee's activities are modified, changed or updated to meet permit conditions during the permit term.

- b. Permittees authorized by the MS4-2003 permit shall modify or update their existing Best Management Practices (BMPs) and measurable goals to meet the terms and conditions of part 2.3 of this permit within one (1) year of the effective date of the permit. These modifications and updates shall be reflected in the written (hardcopy or electronic) SWMP. Permittees authorized by the MS4-2003 permit shall continue to implement their existing SWMP until the program has been updated.

1.10.1. Stormwater Management Program Availability

- a. The permittee shall retain a copy of the current SWMP required by this permit at the office or facility of the person listed as the program contact on the submitted Notice of Intent (NOI). The SWMP shall be immediately available to representatives from EPA, MassDEP, U.S. Fish and Wildlife Service (USFWS) and the National Marine Fisheries Service (NMFS) at the time of an onsite inspection or upon request.
- b. The permittee shall make the SWMP available to the public during normal business hours. The permittee shall also post the SWMP online¹ if the permittee has a website on which to post the SWMP.

1.10.2. Contents and Timelines of the Stormwater Management Program for 2003 permittees

The following information must be included in the SWMP within one (1) year of the permit effective date and updated annually thereafter, as necessary:

- Identification of names and titles of people responsible for program implementation. If a position is currently unfilled, list the title of the position and modify the SWMP with the name once the position is filled;
- Documentation of compliance with part 1.9.1;
- Documentation of compliance with part 1.9.2;

¹ Should a permittee not wish to post mapping information included in the SWMP (see part 1.10.2) on their website for public safety reasons, they must state the reason either with or within the online SWMP and provide how the MS4 mapping information can be obtained. The permittee must retain the entire SWMP, including all completed mapping, at a location where it can be made available to the public during normal business hours.

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- Documentation of authorization of all new or increased discharges granted by MassDEP in compliance with part 2.1.2;
- Listing of all discharges identified pursuant to part 2.1.1 and description of response;
- Description of practices to achieve compliance with part 2.3 (MEP requirements) identified in the permittee's NOI and any updates to those BMPs within the first year;
For each permit condition in part 2.3 identify:
 - The person(s) or department responsible for the measure;
 - The BMPs for the control measure or permit requirement;
 - The measurable goal(s) for each BMP. Each measurable goal shall include milestones and timeframes for its implementation and have a quantity or quality associated with its endpoint. Each goal shall have a measure of assessment associated with it;
- Sanitary Sewer Overflow (SSO) inventory including all of the information required in part 2.3.4.4.b;
- Written IDDE Program pursuant to part 2.3.4.6;
- Written procedures for site inspections and enforcement of sediment and erosion control procedures in accordance with part 2.3.5;
- Description of measures to avoid or minimize impacts to surface public drinking water supply sources. The permittee is also encouraged to include provisions to notify public water supplies in the event of an emergency. Massachusetts Department of Environmental Protection, Bureau of Resource Protection, Drinking Water Program, One Winter Street, Boston, MA 02108 – phone 617.292.5770.
- Description of activities to achieve compliance with part 3.0;
- Annual program evaluation (part 4.1). Update annually and maintain copies.

The following information must be included in the SWMP within two (2) years of the permit effective date and updated annually thereafter, as necessary:

- Listing of all receiving waterbody segments, their classification under the applicable state water quality standards, any impairment(s) and associated pollutant(s) of concern, applicable TMDLs and WLAs, and number of outfalls from the MS4 that discharge to each waterbody. In addition to the receiving water, the permittee shall document in the SWMP all surface public drinking water sources that may be impacted by MS4 discharges;
- Listing of all interconnected MS4s and other separate storm sewer systems receiving a discharge from the permitted MS4, the receiving waterbody segment(s) ultimately receiving the discharge, their classification under the applicable state water quality standards, any impairment(s) and associated pollutant(s) of concern, applicable TMDLs and WLAs, and the number of interconnections;
- Written procedures to require submission of as-built drawings and ensure long term operation and maintenance in accordance with part 2.3.6.a.iii;
- The map of the separate storm sewer system required by part 2.3.4.5.

The following information must be included in the SWMP within four (4) years of the permit effective date and updated annually thereafter, as necessary:

- Report(s) assessing current street design and parking lot guidelines and other local requirements within the municipality that affect the creation of impervious cover.

The following information must be included in the SWMP concurrent with the applicable

deadlines in Appendix F and H and updated annually thereafter, as necessary:

- Description of practices to achieve compliance with part 2.2.1 (TMDL requirements) including:
 - The person(s) or department responsible for the measure;
 - The BMPs for the control measure or permit requirement;
 - The measurable goal(s) for each BMP. Each measurable goal shall include milestones and timeframes for its implementation and have a quantity or quality associated with its endpoint. Each goal must have an associated measure of assessment.
- Description of practices to achieve compliance with part 2.2.2 (discharges to certain water quality limited waters subject to additional requirements) including:
 - The person(s) or department responsible for the measure;
 - The BMPs for the control measure or permit requirement;
 - The measurable goal(s) for each BMP. Each measurable goal shall include milestones and timeframes for its implementation and have a quantity or quality associated with its endpoint. Each goal must have an associated measure of assessment;
- Description of any other practices to achieve compliance with part 2.1 (water quality based requirements)

1.10.3. Contents and Timelines of the Stormwater Management Program for New Permittees

a. Permittees seeking authorization for the first time shall meet all deadlines contained in this permit except the following:

- Timelines for public education requirements in part 2.3.2.c shall be extended by one (1) year and need to include one (1) message to each audience over the permit term;
- The ordinances, by-laws, or other regulatory mechanisms required by parts 2.3.4, 2.3.5 and 2.3.6 shall be completed as soon as possible, but no later than three (3) years from the permit effective date; and
- All other deadlines in part 2.3.4 shall be extended by three (3) years.
- All other deadlines in part 2.3.5, 2.3.6 and 2.3.7 shall be extended by two (2) years.
- All deadlines for discharges to water quality limited waters without a TMDL under part 2.2.2 shall be extended by two (2) years.

b. Contents of the Stormwater Management Program for New Permittees

The following information must be included in the SWMP within one (1) year of the permit effective date and updated annually thereafter, as necessary:

- Identification of names and titles of people responsible for program implementation. If a position is currently unfilled, list the title of the position and modify the SWMP with the name once the position is filled;
- Documentation of compliance with part 1.9.1;
- Documentation of compliance with part 1.9.2;
- Documentation of authorization of all new or increased discharges granted by MassDEP in compliance with part 2.1.2;
- Listing of all discharges identified pursuant to part 2.1.1 and description of response;
- Description of practices to achieve compliance with part 2.3 (MEP requirements)

identified in the permittee's NOI and any updates to those BMPs within the first year;

For each permit condition in part 2.3 identify:

- The person(s) or department responsible for the measure;
 - The BMPs for the control measure or permit requirement;
 - The measurable goal(s) for each BMP. Each measurable goal shall include milestones and timeframes for its implementation and have a quantity or quality associated with its endpoint. Each goal shall have a measure of assessment associated with it;
- Description of measures to avoid or minimize impacts to surface public drinking water supply sources. The permittee is also encouraged to include provisions to notify public water supplies in the event of an emergency. Massachusetts Department of Environmental Protection, Bureau of Resource Protection, Drinking Water Program, One Winter Street, Boston, MA 02108 – phone 617.292.5770. Description of activities to achieve compliance with part 3.0;
 - Annual program evaluation (part 4.1). Update annually and maintain copies.

The following information must be included in the SWMP within three (3) years of the permit effective date and updated annually thereafter, as necessary:

- Written procedures for site inspections and enforcement of sediment and erosion control procedures in accordance with part 2.3.5;

The following information must be included in the SWMP within four (4) years of the permit effective date and updated annually thereafter, as necessary:

- Outfall and interconnection inventory;
- Sanitary Sewer Overflow (SSO) inventory including all of the information required in part 2.3.4.4.b;
- Written IDDE Program pursuant to part 2.3.4.6.
- Written operation and maintenance procedures for municipal activities in part 2.3.7.a.ii;
- Written program detailing the activities and procedures the permittee will implement so that the MS4 infrastructure is maintained in a timely manner to reduce the discharge of pollutants from the MS4 in accordance with part 2.3.7.a.iii.1;
- Written procedures to require submission of as-built drawings and ensure long term operation and maintenance in accordance with part 2.3.6.a.iii;

The following information must be included in the SWMP within five (5) years of the permit effective date and updated annually thereafter, as necessary:

- Phase 1 of the map of the separate storm sewer system required by part 2.3.4.5;
- Listing of all receiving waterbody segments, their classification under the applicable state water quality standards, any impairment(s) and associated pollutant(s) of concern, applicable TMDLs and WLAs, and number of outfalls from the MS4 that discharge to each waterbody. In addition to the receiving water, the permittee shall document in the SWMP all surface public drinking water sources that may be impacted by MS4 discharges;
- Listing of all interconnected MS4s and other separate storm sewer systems receiving a discharge from the permitted MS4, the receiving waterbody segment(s) ultimately receiving the discharge, their classification under the applicable state water quality standards, any impairment(s) and associated pollutant(s) of concern, applicable TMDLs

and WLAs, and the number of interconnections;

The following information must be included in the SWMP within six (6) years of the permit effective date and updated annually thereafter, as necessary:

- Report(s) assessing current street design and parking lot guidelines and other local requirements within the municipality that affect the creation of impervious cover.

The following information must be included in the SWMP concurrent with the applicable deadlines in Appendix F and H (extended by two (2) years) and updated annually thereafter, as necessary:

- Description of practices to achieve compliance with part 2.2.1 (discharges subject to requirements related to approved TMDLs) including:
 - The person(s) or department responsible for the measure;
 - The BMPs for the control measure or permit requirement;
 - The measurable goal(s) for each BMP. Each measurable goal shall include milestones and timeframes for its implementation and have a quantity or quality associated with its endpoint. Each goal must have an associated measure of assessment.
- Description of practices to achieve compliance with part 2.2.2 (discharges to certain water quality limited waters subject to additional requirements) including:
 - The person(s) or department responsible for the measure;
 - The BMPs for the control measure or permit requirement;
 - The measurable goal(s) for each BMP. Each measurable goal shall include milestones and timeframes for its implementation and have a quantity or quality associated with its endpoint. Each goal must have an associated measure of assessment;
- Description of any other practices to achieve compliance with part 2.1 (water quality based requirements).

2.0. Non-Numeric Effluent Limitations

This section includes terms and conditions necessary to reduce the discharge of pollutants from the MS4 to the maximum extent practicable; to protect water quality and to satisfy the appropriate water quality requirements of the Clean Water Act and the Massachusetts Water Quality Standards.

2.1. Water Quality Based Effluent Limitations

Pursuant to Clean Water Act 402(p)(3)(B)(iii), this permit includes provisions to ensure that discharges from the permittee's small MS4 meet applicable water quality standards as set forth in part 2.1.1. below.

2.1.1. Requirement to Meet Water Quality Standards

- a. The permittee's discharges shall meet applicable water quality standards by complying with parts 2.1.1.b and/or 2.1.1.c in accordance with the schedules set forth therein.² Any other

² Applicable water quality standards are the state standards that have been federally approved or promulgated as of the issuance date of this permit and are compiled by EPA at <http://www.epa.gov/waterscience/standards/wqslibrary/>.

discharge of a pollutant that: (i) is not addressed by part 2.1.1.b, part 2.1.1.c, part 2.2.1, and/or part 2.2.2, (ii) is not the result of an illicit discharge subject to part 2.3.4, and (iii) does not meet applicable water quality standards, either independently or in conjunction with other discharges, shall comply with part 2.1.1.d.

- b. If there is a discharge from the MS4 to a waterbody (or its tributaries in some cases) that is subject to an EPA approved or established TMDL identified in part 2.2.1, the permittee is subject to the requirements of part 2.2.1 and Appendix F of this permit and the permittee shall comply with all applicable schedules, alternative schedules and requirements in Appendix F. A permittee's compliance with all applicable requirements and BMP implementation schedules in Appendix F or any alternative schedules applicable to it will constitute compliance with part 2.1.1.a. of the Permit for discharges of pollutants addressed in Appendix F.
- c. If (i) there is a discharge from the MS4 to a waterbody (or its tributaries in some cases) that is water quality limited (see definition in Appendix A) due to nutrients (Total Nitrogen or Total Phosphorus), metals (Cadmium, Copper, Iron, Lead or Zinc), solids (TSS or Turbidity), bacteria/pathogens (E. Coli, Enterococcus or Fecal Coliform), chloride (Chloride) or oil and grease (Petroleum Hydrocarbons or Oil and Grease) and is not subject to an approved TMDL, or (ii) the MS4 is located within a municipality listed in part 2.2.2.a.-b., then the permittee is subject to the requirements of part 2.2.2 and Appendix H of this permit and the permittee shall comply with all applicable schedules and requirements in Appendix H. A permittee's compliance with all applicable requirements and BMP implementation schedules in Appendix H applicable to it will constitute compliance with part 2.1.1.a. of the Permit for discharges of pollutants addressed in Appendix H.
- d. Pursuant to Part 2.1.1.a, upon notice from EPA or MassDEP to the permittee that a discharge of a pollutant from the MS4 that is exceeding applicable water quality standards, the permittee must, within 60 days, remedy the exceedance or eliminate the discharge. However, where such remedy or elimination within 60 days is impracticable, the permittee shall submit to EPA, by the same deadline, a schedule of actions to achieve a remedy or elimination in the shortest time not impracticable. The permittee shall implement such actions on the schedule submitted to EPA and report on progress in its annual reports unless or until EPA takes any other action that effectively replaces the schedule..

2.1.2. Increased Discharges

- a. Any increased discharge, including increased pollutant loading(s) through the MS4 to waters of the United States is subject to Massachusetts antidegradation regulations at 314 CMR 4.04. The permittee shall comply with the provisions of 314 CMR 4.04 including information submittal requirements and obtaining authorization for increased discharges where appropriate³. Any authorization of an increased discharge by MassDEP shall be incorporated into the permittee's SWMP. If an applicable MassDEP approval specifies conditions or requirements related to the increased discharge, such requirements may be independently enforceable under State law and may be adopted into a future permit.
- b. There shall be no increased discharges, including increased pollutant loading(s) from the MS4 to impaired waters listed in categories 5 or 4b on the most recent Massachusetts Integrated Report of waters listed pursuant to Clean Water Act section 303(d) and 305(b) unless the permittee

³ Contact MassDEP for guidance on compliance with 314 CMR 4.04

demonstrates that there is no net increase in loading from the MS4 to the impaired water of the pollutant(s) for which the waterbody is impaired. The permittee may demonstrate compliance with this provision by *either*:

- i. Documenting that the pollutant(s) for which the waterbody is impaired is not present in the MS4's discharge and retaining documentation of this finding with the SWMP; or
 - ii. Documenting that the total load of the pollutant(s) of concern from the MS4 to any impaired portion of the receiving water will not increase as a result of the activity and retaining documentation of this finding in the SWMP. Unless otherwise determined by the Permittee, USEPA or by MassDEP that additional demonstration is necessary, compliance with the requirements of part 2.2.2 and part 2.3.6 of this Permit, including all reporting and documentation requirements, shall be considered as demonstrating no net increase as required by this part.
- c. The requirements of this part are independent of permit conditions requiring reduction in discharges of pollutants as set forth in parts 2.1.1 and 2.2 (water quality based requirements) and 2.3 (requirements to reduce discharge of pollutants to the maximum extent practicable). Permittees remain subject to requirements to reduce the discharge of pollutants from the MS4 as set forth in those parts.

2.2. Discharges to Certain Impaired Waters

The permittee shall identify in the SWMP and Annual Reports all MS4 discharges, including both outfalls and interconnections to other MS4s or other separate storm sewer systems, that:

- Are subject to Total Maximum Daily Load (TMDL) related requirements as identified in part 2.2.1.
- Are subject to additional requirements to protect water quality as identified in part 2.2.2.

The discharge location from an interconnection shall be determined based on the receiving water of the outfall from the interconnected system.

Permittees are subject to the applicable requirements in part 2.2.1, Appendix F, or an approved alternative structural control implementation schedule, and/or the applicable requirements in part 2.2.2, and Appendix H.

2.2.1. Discharges Subject to Requirements Related to an Approved TMDL

- a. "Approved TMDLs" are those that have been approved by EPA as of the date of issuance of this permit.
- b. The MS4s specified below discharge to waters within Massachusetts that are subject to TMDLs, or in some cases, to tributaries of such waters, and shall comply with the requirements of Appendix F, part A. Appendix F identifies, by section, the provisions the permittee shall implement to be consistent with the terms of the approved TMDL. Alternatively, EPA may notify the permittee that an individual permit application is necessary in accordance with part 1.8.a.

- i. The following is a list of municipalities in the Charles River Watershed:

1.

Arlington	Mendon
Ashland	Milford
Bellingham	Millis
Belmont	Natick
Brookline	Needham
Cambridge	Newton
Dedham	Norfolk
Dover	Sherborn
Foxborough	Walpole
Franklin	Waltham
Holliston	Watertown
Hopedale	Wayland
Hopkinton	Wellesley
Lexington	Weston
Lincoln	Westwood
Medfield	Wrentham
Medway	

Permittees that operate regulated MS4s located in municipalities listed above that discharge to the Charles River or its Tributaries shall meet the requirements of Appendix F, part A.I with respect to the reduction of phosphorus discharges from their MS4.

- ii. The following is a list of municipalities that contain a lake or pond subject to an approved lake or pond phosphorus TMDL in the Northern Blackstone Basin, Chicopee Basin, Connecticut Basin, French Basin, Millers Basin or in the watershed of Bare Hill Pond, Flint Pond, Indian Lake, Lake Boon, Lake Quinsigamond, Leesville Pond, Salisbury Pond, Quaboag Pond or Quacumquasit Pond.

1.

Auburn	Millbury
Charlton	Oxford
Dudley	Shrewsbury
Gardner	Spencer
Grafton	Springfield
Granby	Stow
Hadley	Templeton
Harvard	Westminster
Hudson	Winchendon
Leicester	Wilbraham

Ludlow	
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Permittees that operate regulated MS4s in the above municipalities that discharge to waterbodies listed on Table F-6 in Appendix F or their tributaries, and any other MS4 that discharges to waterbodies listed on Table F-6 in Appendix F or their tributaries, shall meet the requirements of Appendix F, part A.II with respect to reduction of phosphorus discharges from their MS4.

iii. The following is a list of municipalities that contain waters subject to an approved TMDL for bacteria or pathogens.

1.

Abington	Marshfield
Acushnet	Mashpee
Andover	Mattapoisett
Avon	Medfield
Barnstable	Medway
Bedford	Melrose
Bellingham	Mendon
Belmont	Milford
Berkley	Millis
Beverly	Milton
Billerica	Nahant
Bourne	Natick
Brewster	Needham
Bridgewater	New Bedford
Brockton	Newton
Brookline	Norfolk
Burlington	North Andover
Cambridge	Norton
Canton	Norwell
Chatham	Norwood
Cohasset	Orleans
Concord	Peabody
Danvers	Pembroke
Dartmouth	Plymouth
Dedham	Raynham
Dennis	Rehoboth
Dighton	Revere
Dover	Rockland
Duxbury	Rockport
East Bridgewater	Salem

Eastham	Sandwich
Essex	Saugus
Everett	Scituate
Fairhaven	Seekonk
Fall River	Sharon
Falmouth	Sherborn
Foxborough	Somerset
Franklin	Stoughton
Freetown	Swampscott
Gloucester	Swansea
Hanover	Taunton
Hanson	Tewksbury
Harwich	Wakefield
Holliston	Walpole
Hopedale	Waltham
Hopkinton	Wareham
Ipswich	Watertown
Kingston	Wellesley
Lawrence	Wellfleet
Lexington	West Bridgewater
Lincoln	Weston
Lynn	Westport
Lynnfield	Westwood
Malden	Whitman
Manchester	Wilmington
Mansfield	Winthrop
Marblehead	Yarmouth
Marion	

The operators of MS4s located in municipalities listed above that discharge to a waterbody segment listed on Table F-8 in Appendix F and any other MS4 that discharges directly to a waterbody segment listed on Table F-8 in Appendix F shall meet the requirements of Appendix F, part A.III with respect to reduction of bacteria/pathogens discharges from their MS4.

- iv. The following is a list of municipalities located on Cape Cod that contain waters subject to an approved TMDL for nitrogen (Total Nitrogen).

1.

Bourne
Barnstable
Chatham
Falmouth

Harwich
Mashpee
Orleans
Yarmouth

Permittees that operate regulated MS4s located in the municipalities above that discharge to waterbodies found on Table F-9 in Appendix F or their tributaries and any other MS4 that discharges to waterbodies found on Table F-9 in Appendix F or their tributaries shall meet the requirements of Appendix F, part A.IV with respect to reduction of nitrogen discharges from their MS4.

- v. The following is a list of municipalities located in the Assabet River Watershed:

- 1.

Acton	Hudson
Berlin	Littleton
Bolton	Marlborough
Boxborough	Maynard
Boylston	Northborough
Carlisle	Shrewsbury
Clinton	Stow
Concord	Westborough
Grafton	Westford
Harvard	

Permittees that operate regulated MS4s located in the municipalities above that discharge to the Assabet River or its tributaries shall meet the requirements of Appendix F part A.V with respect to reduction of phosphorus discharges from their MS4.

- c. The MS4s specified below discharge to waters, or tributaries of waters, that have been identified in an adjacent state’s approved TMDL as being impaired due, in part, to MS4 stormwater discharges in Massachusetts, and shall comply with the requirements of Appendix F, part B. Appendix F identifies, by section, the provisions the permittee shall implement to be consistent with the reasonable assumptions related to Massachusetts MS4 discharges. Alternatively, EPA may notify the permittee that an individual permit application is necessary in accordance with part 1.8.a.

- i. The following is a list of municipalities in Massachusetts located in the watershed of Long Island Sound, which has an approved TMDL for nitrogen (Total Nitrogen).

- 1.

Adams	North Adams
Agawam	Northampton
Amherst	Oxford
Ashburnham	Palmer

Ashby	Paxton
Auburn	Pelham
Belchertown	Pittsfield
Charlton	Richmond
Cheshire	Russell
Chicopee	Rutland
Dalton	South Hadley
Douglas	Southampton
Dudley	Southbridge
East Longmeadow	Southwick
Easthampton	Spencer
Gardner	Springfield
Granby	Sturbridge
Hadley	Sutton
Hampden	Templeton
Hatfield	Ware
Hinsdale	Webster
Holyoke	West Springfield
Lanesborough	Westfield
Leicester	Westhampton
Lenox	Westminster
Longmeadow	Wilbraham
Ludlow	Williamsburg
Millbury	Winchendon
Monson	

Permittees that operate regulated MS4s located in the municipalities above that discharge to a water within the Connecticut River Watershed, the Housatonic River Watershed, or the Thames River Watershed shall meet the requirements of Appendix F part B. I with respect to nitrogen discharges from their MS4.

- ii. The following is a list of municipalities in Massachusetts identified in a TMDL as containing MS4s contributing phosphorus to waterbody segments that have out of state approved TMDLs for phosphorus:

- 1.

Attleboro
North Attleborough
Plainville
Rehoboth
Seekonk
Swansea

Permittees that operate regulated MS4s located in the municipalities above that discharge to a waterbody found on Table F-12 in Appendix F or its tributaries shall meet the requirements of Appendix F part B. II with respect to phosphorus discharges from their MS4.

- iii. The following is a list of municipalities in Massachusetts identified in a TMDL as containing MS4s contributing bacteria/pathogens to waterbody segments that have out of state approved TMDLs for bacteria/pathogens:

- 1.

Attleboro
North Attleborough
Plainville
Rehoboth
Seekonk

Permittees that operate regulated MS4s located in the municipalities above that discharge to a waterbody found on Table F-13 in Appendix F or its tributaries shall meet the requirements of Appendix F part B. III with respect to bacteria/pathogens discharges from their MS4.

- iv. The following is a list of municipalities in Massachusetts identified in a TMDL as containing MS4s contributing metals (cadmium, lead, aluminum iron) to waterbody segments that have out of state approved TMDLs for metals (cadmium, lead, aluminum, iron):

- 1.

Attleboro
North Attleborough
Plainville
Seekonk

Permittees that operate regulated MS4s located in the municipalities above that discharge to a waterbody found on Table F-14 in Appendix F or its tributaries shall meet the requirements of Appendix F part B. IV with respect to metals discharges from their MS4.

2.2.2. Discharges to Certain Water Quality Limited Waters Subject to Additional Requirements

For purposes of this permit, a ‘water quality limited water body’ is any water body that does not meet applicable water quality standards, including but not limited to waters listed in categories 5 or 4b on the Massachusetts Integrated Report of waters listed pursuant to Clean Water Act section 303(d) and 305(b).

If there is a discharge from the MS4 to a water quality limited waterbody where pollutants typically found in stormwater (specifically nutrients (Total Nitrogen or Total Phosphorus), solids (TSS or Turbidity), bacteria/pathogens (E. Coli, Enterococcus or Fecal Coliform), chloride (Chloride), metals (Cadmium, Copper, Iron, Lead or Zinc) and oil and grease (Petroleum Hydrocarbons or Oil and Grease)) are the cause of the impairment and is not subject to part 2.1.1.b for those pollutants, or the MS4 is located in a town listed in part 2.2.2.a.-b, the permittee shall comply with the provisions

in Appendix H applicable to it. Permittees notified by EPA or MassDEP during the permit term that they are discharging to a water quality limited water shall update their SWMP to include measures they must take in accordance with Appendix H.

In the absence of a defined pollutant reduction target and where no approved TMDL has been established as of the issuance date of this permit, this permit part and Appendix H define an iterative approach addressing pollutant reductions to waterbodies where the permittee’s discharge is not meeting applicable water quality standards due to nutrients (Total Nitrogen Total Phosphorus), solids (TSS or Turbidity), bacteria/pathogens (E. Coli, Enterococcus or Fecal Coliform), chloride (Chloride), metals (Cadmium, Copper, Iron, Lead or Zinc) or oil and grease (Petroleum Hydrocarbons or Oil and Grease).

a. Discharges to water quality limited waterbodies where nitrogen (Total Nitrogen) is the cause of the impairment, or their tributaries

i. The requirements of this part are applicable to:

1. Permittees (including traditional and non-traditional MS4s) that own or operate an MS4 in the following municipalities. Discharges from MS4s within these municipalities are to waterbodies that are impaired due to nitrogen (Total Nitrogen), or their tributaries.

Abington	Mattapoisett
Acushnet	Middleborough
Attleboro	New Bedford
Avon	Norton
Barnstable	Peabody
Berkley	Pembroke
Bourne	Plainville
Bridgewater	Plymouth
Brockton	Plympton
Carver	Raynham
Dartmouth	Rehoboth
Dighton	Rochester
East Bridgewater	Salem
Easton	Seekonk
Fairhaven	Sharon
Fall River	Somerset
Foxborough	Stoughton
Freetown	Swansea
Halifax	Taunton
Hanson	Wakefield
Holbrook	Wareham
Kingston	West Bridgewater
Lakeville	Westport

Lynnfield	Whitman
Mansfield	Wrentham
Marion	Yarmouth

2. Any other permittee that, during the permit term, becomes aware that its discharge is to a waterbody that is water quality limited due to nitrogen (Total Nitrogen), or a tributary of such water.
 - ii. Permittees subject to part 2.2.2.a.i above shall meet the requirements of Appendix H part I with respect to the control of nitrogen discharges from their MS4;
 - iii. During development of their Notice of Intent, the permittee may determine that all discharges from the regulated area through their MS4 are outside of a watershed that contains a nitrogen (Total Nitrogen) impairment in a downstream segment. The permittee shall retain all documentation used in this determination as part of their NOI and are relieved from the requirements of part 2.2.2.a.i and Appendix H part I.
- b. Discharges to water quality limited waterbodies where phosphorus (“Total Phosphorus”) is the cause of the impairment, or their tributaries
- i. The requirements of this part are applicable to:
 1. Permittees (including traditional and non-traditional MS4s) that own or operate an MS4 in the following municipalities. Discharges from MS4s within these municipalities are to waterbodies that are impaired due to phosphorus (Total Phosphorus), or their tributaries.

Abington	Lynn
Acushnet	Lynnfield
Andover	Malden
Arlington	Mansfield
Ashburnham	Marlborough
Ashland	Mashpee
Auburn	Medfield
Avon	Medford
Ayer	Melrose
Barnstable	Mendon
Bedford	Methuen
Belchertown	Millbury
Belmont	Millville
Billerica	Milton
Blackstone	North Andover
Bolton	Northbridge
Brewster	Norton

Bridgewater	Norwood
Brockton	Oxford
Burlington	Peabody
Cambridge	Pembroke
Canton	Pepperell
Carlisle	Pittsfield
Carver	Quincy
Chelmsford	Randolph
Chelsea	Reading
Clinton	Revere
Concord	Rockland
Dalton	Salem
Dedham	Scituate
Douglas	Seekonk
Dover	Sharon
Dracut	Shirley
Dunstable	Shrewsbury
East Bridgewater	Somerville
Eastham	Southampton
Easthampton	Spencer
Everett	Springfield
Falmouth	Stoneham
Fitchburg	Stoughton
Foxborough	Sudbury
Framingham	Sutton
Gloucester	Taunton
Grafton	Tewksbury
Granby	Townsend
Groton	Tyngsborough
Halifax	Upton
Hanover	Uxbridge
Hanson	Wakefield
Harvard	Walpole
Haverhill	Wareham
Hinsdale	Watertown
Hopkinton	Wayland
Hudson	West Bridgewater
Lancaster	Westfield

Lawrence	Westminster
Leicester	Westwood
Lenox	Whitman
Leominster	Wilmington
Lexington	Winchendon
Littleton	Winchester
Lowell	Winthrop
Lunenburg	Woburn
Lynn	

2. Any other permittee that, during the permit term, becomes aware that its discharge is to a waterbody that is water quality limited due to phosphorus (“Total Phosphorus”), or to a tributary of such water.
 - ii. The permittees subject to part 2.2.2.b.i. above shall meet all requirements of Appendix H part II with respect to the control of phosphorus discharges from the MS4.
 - iii. During development of their Notice of Intent, the permittee may determine that all discharges from the regulated area through their MS4 are outside of a watershed that contains a phosphorus (“Total Phosphorus”) impairment in a downstream segment. The permittee shall retain all documentation used in this determination as part of their NOI and are relieved from the requirements of part 2.2.2.b.i and Appendix H part II.
- c. Discharges to water quality limited waterbodies where bacteria or pathogens is the cause of the impairment
- i. The requirements of this part are applicable to:
 1. Any MS4 discharge identified by the permittee on their Notice of Intent as discharging directly to an impaired waterbody on the most recent EPA approved Massachusetts 303(d) list where bacteria or pathogens (E. Coli, Enterococcus or Fecal Coliform) is the cause of the impairment.
 2. Any other MS4 that, during the permit term, becomes aware that its discharge is to a waterbody that is water quality limited due to bacteria or pathogens.
 - ii. The permittees subject to part 2.2.2.c.i. shall meet all requirements of Appendix H part III with respect to reduction of bacteria or pathogens discharges from the MS4.
- d. Discharges to water quality limited waterbodies where chloride (Chloride) is the cause of the impairment
- i. The requirements of this part are applicable to:
 1. Any MS4 discharge identified by the permittee on their Notice of Intent as discharging directly to an impaired waterbody on the most recent EPA approved Massachusetts 303(d) list where chloride (Chloride) is the cause of the impairment.

2. Any other MS4 that, during the permit term, becomes aware that its discharge is to a waterbody that is water quality limited due to chloride (Chloride).
- ii. The permittees subject to part 2.2.2.d.i. shall meet all requirements of Appendix H part IV with respect to reduction of chloride discharges from the MS4.
- e. Discharges to water quality limited waterbodies where oil and grease (Petroleum Hydrocarbons or Oil and Grease), solids (TSS or Turbidity) or metals (Cadmium, Copper, Iron, Lead or Zinc) is the cause of the impairment
- i. The requirements of this part are applicable to:
 1. Any MS4 discharge identified by the permittee on their Notice of Intent as discharging directly to an impaired waterbody on the most recent EPA approved Massachusetts 303(d) list where oil and grease, solids or metals (Oil and Grease, Petroleum Hydrocarbons TSS, Turbidity, Cadmium, Copper, Iron, Lead or Zinc) is the cause of the impairment.
 2. Any other MS4 that, during the permit term, becomes aware that its discharge is to a waterbody that is water quality limited due to oil and grease (Petroleum Hydrocarbons or Oil and Grease), solids (TSS or Turbidity) or metals (Cadmium, Copper, Iron, Lead or Zinc).
 - ii. The permittees subject to part 2.2.2.d.i. shall meet all requirements of Appendix H part V with respect to reduction of solids, oil and grease or metals discharges from the MS4.

2.3. Requirements to Reduce Pollutants to the Maximum Extent Practicable (MEP)

The permittee shall reduce the discharge of pollutants from the MS4 to the maximum extent practicable (MEP) as detailed in parts 2.3.2 through 2.3.7.

2.3.1. Control Measures

- a. Permittees authorized under the MS4-2003 permit shall continue to implement their existing SWMPs while updating their SWMPs pursuant to this permit. This permit does not extend the compliance deadlines set forth in the MS4-2003 permit.
- b. Implementation of one or more of the minimum control measures described in parts 2.3.2- 2.3.7 or other permit requirements may be shared with another entity (including another interconnected MS4) or the other entity may fully implement the measure or requirement, if the following requirements are satisfied:
 - The other entity, in fact, implements the control measure.
 - The particular control measure or component thereof undertaken by the other entity is at least as stringent as the corresponding permit requirement.
 - The other entity agrees to implement the control measure on the permittee's behalf. The annual reports must specify that the permittee is relying on another entity to satisfy some of its permit obligations and specify what those obligations are.
 - If the permittee is relying on another governmental entity regulated under 40 CFR §122 to satisfy all of its permit obligations, including the obligation to file annual reports, the permittee shall note that fact in its NOI, but is not required to file annual reports.

- The permittee remains responsible for compliance with all permit obligations if the other entity fails to implement the control measures (or component thereof). The permittee may enter into a legally binding agreement with the other entity regarding the other entity's performance of control measures, but the permittee remains ultimately responsible for permit compliance.

2.3.2. Public Education and Outreach

Objective: The permittee shall implement an education program that includes educational goals based on stormwater issues of significance within the MS4 area. The ultimate objective of a public education program is to increase knowledge and change behavior of the public so that pollutants in stormwater are reduced.

- a. The permittee shall continue to implement the public education program required by the MS4-2003 permit by distributing educational material to the MS4 community. The educational program shall define educational goals, express specific messages, define the targeted audience for each message, and identify responsible parties for program implementation. If appropriate for the target audience, materials may be developed in a language other than English. At a minimum, the program shall provide information concerning the impact of stormwater discharges on water bodies within the community, especially those waters that are impaired or identified as priority waters. The program shall identify steps and/or activities that the public can take to reduce the pollutants in stormwater runoff and their impacts to the environment.
- b. The educational program shall include education and outreach efforts for the following four audiences: (1) residents, (2) businesses, institutions (churches, hospitals), and commercial facilities, (3) developers (construction), and (4) industrial facilities, unless one of these audiences is not present in the MS4 community. In such a situation, the MS4 must document in both the NOI and SWMP which audience is absent from the community and no educational messages are required to that audience.
- c. The permittee shall distribute a minimum of two (2) educational messages over the permit term to each audience identified in part 2.3.2.b. The distribution of materials to each audience shall be spaced at least a year apart. Educational messages may be printed materials such as brochures or newsletters; electronic materials such as websites; mass media such as newspaper articles or public service announcement (radio or cable); targeted workshops on stormwater management, or displays in a public area such as town/city hall. The permittee may use existing materials if they are appropriate for the message the permittee chooses to deliver or the permittee may develop its own educational materials. The permittee may partner with other MS4s, community groups or watershed associations to implement the education program to meet this permit requirement.

Some EPA educational materials are available at: <http://cfpub.epa.gov/npstbx/index.html>.
- d. The permittee shall, at a minimum, consider the topics listed in part 2.3.2.d.i. – iv when developing the outreach/education program. The topics are not exclusive and the permittee shall focus on those topics most relevant to the community.
 - i. Residential program: effects of outdoor activities such as lawn care (use of pesticides, herbicides, and fertilizers and information on Massachusetts Regulation 331 CMR 31 pertaining to proper use of phosphorus containing fertilizers on turf grasses) on water

- quality; benefits of appropriate on-site infiltration of stormwater; effects of automotive work and car washing on water quality; proper disposal of swimming pool water; proper management of pet waste; maintenance of septic systems. If the small MS4 area has areas serviced by septic systems, the permittee shall consider information pertaining to maintenance of septic systems as part of its education program.
- ii. Business/Commercial/Institution program: proper lawn maintenance (use of pesticides, herbicides and fertilizer, and information on Massachusetts Regulation 331 CMR 31 pertaining to proper use of phosphorus containing fertilizers on turf grasses); benefits of appropriate on-site infiltration of stormwater; building maintenance (use of detergents); use of salt or other de-icing and anti-icing materials (minimize their use); proper storage of salt or other de-icing/anti-icing materials (cover/prevent runoff to storm system and contamination to ground water); proper storage of materials (emphasize pollution prevention); proper management of waste materials and dumpsters (cover and pollution prevention); proper management of parking lot surfaces (sweeping); proper car care activities (washing of vehicles and maintenance); and proper disposal of swimming pool water by entities such as motels, hotels, and health and country clubs (discharges must be dechlorinated and otherwise free from pollutants).
 - iii. Developers and Construction: proper sediment and erosion control management practices; information about Low Impact Development (LID) principles and technologies; and information about EPA's construction general permit (CGP). This education can also be a part of the Construction Site Stormwater Runoff Control measure detailed in part 2.3.5.
 - iv. Industrial program: equipment inspection and maintenance; proper storage of industrial materials (emphasize pollution prevention); proper management and disposal of wastes; proper management of dumpsters; minimization of use of salt or other de-icing/anti-icing materials; proper storage of salt or other de-icing/anti-icing materials (cover/prevent runoff to storm system and ground water contamination); benefits of appropriate on-site infiltration of stormwater runoff from areas with low exposure to industrial materials such as roofs or employee parking; proper maintenance of parking lot surfaces (sweeping); and requirements for coverage under EPA's Multi-Sector General Permit.
- e. The program shall show evidence of focused messages for specific audiences as well as evidence that progress toward the defined educational goals of the program has been achieved. The permittee shall identify methods that it will use to evaluate the effectiveness of the educational messages and the overall education program. Any methods used to evaluate the effectiveness of the program shall be tied to the defined goals of the program and the overall objective of changes in behavior and knowledge.
 - f. The permittee shall modify any ineffective messages or distribution techniques for an audience prior to the next scheduled message delivery.
 - g. The permittee shall document in each annual report the messages for each audience; the method of distribution; the measures/methods used to assess the effectiveness of the messages, and the method/measures used to assess the overall effectiveness of the education program.

2.3.3. Public Involvement and Participation

Objective: The permittee shall provide opportunities to engage the public to participate in the review and implementation of the permittee's SWMP.

- a. All public involvement activities shall comply with state public notice requirements (MGL Chapter 30A, Sections 18 – 25 – effective 7/10/2010). The SWMP, all documents submitted to EPA in accordance with Appendix F, and all annual reports shall be available to the public online if the permittee has a website on which to post these documents.
- b. The permittee shall annually provide the public an opportunity to participate in the review and implementation of the SWMP.
- c. The permittee shall report on the activities undertaken to provide public participation opportunities including compliance with part 2.3.3.a. Public participation opportunities pursuant to part 2.3.3.b may include, but are not limited to, websites; hotlines; clean-up teams; monitoring teams; or an advisory committee.

2.3.4 Illicit Discharge Detection and Elimination (IDDE) Program

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

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

2.3.4.1. Definitions and Prohibitions

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

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

An illicit discharge is any discharge to a municipal separate storm sewer that is not composed entirely of stormwater, except discharges pursuant to a NPDES permit (other than the NPDES permit for discharges from the municipal separate storm sewer) and discharges resulting from fire fighting activities.

2.3.4.2. Elimination of Illicit Discharges

- a. Upon detection of an illicit discharge, the permittee shall locate, identify and eliminate the illicit discharge as expeditiously as possible. Upon identification of the illicit source the MS4 notify all responsible parties for any such discharge and require immediate cessation of improper disposal

practices in accordance with its legal authorities. Where elimination of an illicit discharge within 60 days of its identification as an illicit discharge is not possible, the permittee shall establish an expeditious schedule for its elimination and report the dates of identification and schedules for removal in the permittee's annual reports. The permittee shall immediately commence actions necessary for elimination. The permittee shall diligently pursue elimination of all illicit discharges. In the interim, the permittee shall take all reasonable and prudent measures to minimize the discharge of pollutants to and from its MS4.

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

2.3.4.3. Non-Stormwater Discharges

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

2.3.4.4. Sanitary Sewer Overflows

- a. Upon detection of an SSO the permittee shall eliminate it as expeditiously as possible and take interim mitigation measures to minimize the discharge of pollutants to and from its MS4 until elimination is completed.
- b. The permittee shall identify all known locations where SSOs have discharged to the MS4 within the previous five (5) years. This shall include SSOs resulting, during dry or wet weather, from inadequate conveyance capacities, or where interconnectivity of the storm and sanitary sewer infrastructure allows for communication of flow between the systems. Within one (1) year of the effective date of the permit, the permittee shall develop an inventory of all identified SSOs indicating the following information, if available:
 - 1. Location (approximate street crossing/address and receiving water, if any);
 - 2. A clear statement of whether the discharge entered a surface water directly or entered the MS4;
 - 3. Date(s) and time(s) of each known SSO occurrence (i.e., beginning and end of any known discharge);
 - 4. Estimated volume(s) of the occurrence;
 - 5. Description of the occurrence indicating known or suspected cause(s);
 - 6. Mitigation and corrective measures completed with dates implemented; and
 - 7. Mitigation and corrective measures planned with implementation schedules.

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

- c. In accordance with Paragraph B.12 of Appendix B of this permit, upon becoming aware of an SSO to the MS4, the permittee shall provide oral notice to EPA within 24 hours. Additionally, the permittee shall provide written notice to EPA and MassDEP within five (5) days of becoming aware of the SSO occurrence and shall include the information in the updated inventory. The notice shall contain all of the information listed in part 2.3.4.4.b. Where common notification requirements for SSOs are

included in multiple NPDES permits issued to a permittee, a single notification may be made to EPA as directed in the permittee's wastewater or CSO NPDES permit and constitutes compliance with this part.

- d. The permittee shall include and update the SSO inventory in its annual report, including the status of mitigation and corrective measures implemented by the permittee to address each SSO identified pursuant to this part.
- e. The period between detection and elimination of a discharge from the SSO to the MS4 is not a grace period. Discharges from an MS4 that are mixed with an SSO are not authorized by this Permit (part 1.3.a) and remain unlawful until eliminated.

2.3.4.5. System mapping

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

- a. Phase I: The system map shall be updated within two (2) years of the permit effective date to include the following information:
 - Outfalls and receiving waters (required by MS4-2003 permit)
 - Open channel conveyances (swales, ditches, etc.)
 - Interconnections with other MS4s and other storm sewer systems
 - Municipally-owned stormwater treatment structures (e.g., detention and retention basins, infiltration systems, bioretention areas, water quality swales, gross particle separators, oil/water separators, or other proprietary systems)
 - Waterbodies identified by name and indication of all use impairments as identified on the most recent EPA approved Massachusetts Integrated List of waters report pursuant to Clean Water Act section 303(d) and 305(b)
 - Initial catchment delineations. Any available system data and topographic information may be used to produce initial catchment delineations. For the purpose of this permit, a catchment is the area that drains to an individual outfall or interconnection.
- b. Phase II: The system map shall be updated annually as the following information becomes available during implementation of catchment investigation procedures in part 2.3.4.8. This information must be included in the map for all outfalls within ten (10) years of the permit effective date:
 - Outfall spatial location (latitude and longitude with a minimum accuracy of +/-30 feet)
 - Pipes
 - Manholes
 - Catch basins
 - Refined catchment delineations. Catchment delineations shall be updated to reflect information collected during catchment investigations
 - Municipal sanitary sewer system (if available)
 - Municipal combined sewer system (if applicable).

- c. Recommended elements to be included in the system map as information becomes available:
- Storm sewer material, size (pipe diameter) and age
 - Sanitary sewer system material, size (pipe diameter) and age
 - Privately-owned stormwater treatment structures
 - Where a municipal sanitary sewer system exists, properties known or suspected to be served by a septic system, especially in high-density urban areas
 - Area where the permittee's MS4 has received or could receive flow from septic system discharges (e.g., areas with poor soils, or high ground water elevations unsuitable for conventional subsurface disposal systems)
 - Seasonal high water table elevations impacting sanitary alignments
 - Topography
 - Orthophotography
 - Alignments, dates and representation of work completed (with legend) of past illicit discharge investigations (e.g., flow isolation, dye testing, CCTV)
 - Locations of suspected, confirmed and corrected illicit discharges (with dates and flow estimates).
- d. The mapping may be produced by hand or through computer-aided methods (e.g. GIS). The required scale and detail of the map shall be appropriate to facilitate a rapid understanding of the system by the permittee, EPA and the state. In addition, the mapping shall serve as a planning tool for the implementation and phasing of the IDDE program and demonstration of the extent of complete and planned investigations and corrections. The permittee shall update the mapping as necessary to reflect newly discovered information and required corrections or modifications.
- e. The permittee shall report on the progress towards the completion of the system map in each annual report.

2.3.4.6. Written Illicit Discharge Detection and Elimination Program

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

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

- a. The written (hardcopy or electronic) IDDE program shall include a reference or citation of the authority the permittee will use to implement all aspects of the IDDE program.
- b. Statement of IDDE Program Responsibilities - The permittee shall establish a written (hardcopy or electronic) statement that clearly identifies responsibilities with regard to eliminating illicit discharges. The statement shall identify the lead municipal agency(ies) or department(s) responsible for implementing the IDDE Program as well as any other agencies or departments that may have responsibilities for aspects of the program (e.g., board of health responsibilities for overseeing septic system construction; sanitary sewer system staff; inspectional services for enforcing plumbing codes;

town counsel responsibilities in enforcement actions, etc.). Where multiple departments and agencies have responsibilities with respect to the IDDE program specific areas of responsibility shall be defined and processes for coordination and data sharing shall be established and documented.

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

2.3.4.7. Assessment and Priority Ranking of Outfalls/Interconnections

The permittee shall assess and priority rank the outfalls in terms of their potential to have illicit discharges and SSOs and the related public health significance. This ranking will determine the priority order for screening of outfalls and interconnections pursuant to part 2.3.4.7.b, catchment investigations for evidence of illicit discharges and SSOs pursuant to part 2.3.4.8, and provides the basis for determining permit milestones of this part.

- a) Outfall/Interconnection Inventory and Initial Ranking:

An initial outfall and interconnection inventory and priority ranking to assess illicit discharge potential based on existing information shall be completed within one (1) year from the effective date of the permit; an updated inventory and ranking will be provided in each annual report thereafter. The inventory shall be updated annually to include data collected in connection with the dry weather screening and other relevant inspections conducted by the permittee.
- i. The outfall and interconnection inventory will identify each outfall and interconnection discharging from the MS4, record its location and condition, and provide a framework for tracking inspections, screenings and other activities under the permittee’s IDDE program.
 - An outfall means a point source as defined by 40 CFR § 122.2 as the point where the municipal separate storm sewer discharges to waters of the United States. An outfall does not include open conveyances connecting two municipal separate storm sewers or pipes, tunnels or other conveyances that connect segments of the same stream or other waters of the United States and that are used to convey waters of the United States. (40 CFR § 122.26(b)(9)). However, it is strongly recommended that a permittee inspect all accessible portions of the system as part of this process. Culverts longer than a simple road crossing shall be included in the inventory unless the permittee can confirm that they are free of any connections and simply convey waters of the United States.
 - An interconnection means the point (excluding sheet flow over impervious surfaces) where the permittee’s MS4 discharges to another MS4 or other storm sewer system, through which the discharge is conveyed to waters of the United States or to another storm sewer system and eventually to a water of the United States.
- ii. The permittee shall classify each of the permittee’s outfalls and interconnections into one of the following categories:
 - Problem Outfalls: Outfalls/interconnections with known or suspected contributions of illicit discharges based on existing information shall be designated as Problem Outfalls. This shall

include any outfalls/interconnections where previous screening indicates likely sewer input.⁴ Problem Outfalls need not be screened pursuant to part 2.3.4.7.b.

- High Priority Outfalls: Outfalls/interconnections that have not been classified as Problem Outfalls and that are:
 - discharging to an area of concern to public health due to proximity of public beaches, recreational areas, drinking water supplies or shellfish beds;
 - determined by the permittee as high priority based on the characteristics listed below or other available information;
 - Low Priority Outfalls: Outfalls/interconnections determined by the permittee as low priority based on the characteristics listed below or other available information.
 - Excluded outfalls: Outfalls/interconnections with no potential for illicit discharges may be excluded from the IDDE program. This category is limited to roadway drainage in undeveloped areas with no dwellings and no sanitary sewers; drainage for athletic fields, parks or undeveloped green space and associated parking without services; cross-country drainage alignments (that neither cross nor are in proximity to sanitary sewer alignments) through undeveloped land.
- iii. The permittee shall priority rank outfalls into the categories above (except for excluded outfalls), based on the following characteristics of the defined initial catchment area where information is available:
- Past discharge complaints and reports.
 - Poor receiving water quality- the following guidelines are recommended to identify waters as having a high illicit discharge potential: exceeding water quality standards for bacteria; ammonia levels above 0.5 mg/l; surfactants levels greater than or equal to 0.25 mg/l.
 - Density of generating sites- Generating sites are those places, including institutional, municipal, commercial, or industrial sites, with a potential to generate pollutants that could contribute to illicit discharges. Examples of these sites include, but are not limited to, car dealers; car washes; gas stations; garden centers; and industrial manufacturing areas.
 - Age of development and infrastructure – Industrial areas greater than 40 years old and areas where the sanitary sewer system is more than 40 years old will probably have a high illicit discharge potential. Developments 20 years or younger will probably have a low illicit discharge potential.
 - Sewer conversion – contributing catchment areas that were once serviced by septic systems, but have been converted to sewer connections may have a high illicit discharge potential.
 - Historic combined sewer systems – contributing areas that were once serviced by a combined sewer system, but have been separated may have a high illicit discharge potential.
 - Surrounding density of aging septic systems – Septic systems thirty years or older in residential land use areas are prone to have failures and may have a high illicit discharge potential.
 - Culverted streams – any river or stream that is culverted for distances greater than a simple roadway crossing may have a high illicit discharge potential.
 - Water quality limited waterbodies that receive a discharge from the MS4 or waters with approved TMDLs applicable to the permittee, where illicit discharges have the potential to

⁴ Likely sewer input indicators are any of the following:

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

contain the pollutant identified as the cause of the water quality impairment.

- The permittee may also consider additional relevant characteristics, including location-specific characteristics; if so, the permittee shall include the additional characteristics in its written (hardcopy or electronic) IDDE program.

b) Dry Weather Outfall and Interconnection Screening and Sampling

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

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

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

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

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

iii. Screening requirements: For each outfall/interconnection:

1. The permittee shall record all of the following information and include it in the outfall/interconnection inventory and priority ranking:

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

2. If an outfall/interconnection is inaccessible or submerged, the permittee shall proceed to the first accessible upstream manhole or structure for the observation and sampling and report the location with the screening results.

3. If no flow is observed, but evidence of illicit flow exists, the permittee shall revisit the

outfall during dry weather within one week of the initial observation, if practicable, to perform a second dry weather screening and sample any observed flow (proceed as in iv. below).

4. Where dry weather flow is found at an outfall/interconnection, at least one (1) sample shall be collected, and:
 - a) Samples shall be analyzed at a minimum for:
 - ammonia,
 - chlorine,
 - conductivity,
 - salinity,
 - *E. coli* (freshwater receiving water) or enterococcus (saline or brackish receiving water),
 - surfactants (such as MBAS),
 - temperature, and
 - pollutants of concern⁵
 - b) All analyses with the exception of indicator bacteria and pollutants of concern can be performed with field test kits or field instrumentation and are not subject to 40 CFR part 136 requirements. Sampling for bacteria and pollutants of concern shall be conducted using the analytical methods found in 40 CFR §136, or alternative methods approved by EPA in accordance with the procedures in 40 CFR §136. Sampling for ammonia and surfactants must use sufficiently sensitive methods to detect those parameters at or below the threshold indicator concentrations of 0.5 mg/L for ammonia and 0.25 mg/L for surfactants. Sampling for residual chlorine must use a method with a detection limit of 0.02 mg/L or 20 ug/L.
- iv. The permittee may rely on screening conducted under the MS4-2003 permit, pursuant to an EPA enforcement action, or by the state or EPA to the extent that it meets the requirements of part 2.3.4.7.b.iii.4. All data shall be reported in each annual report. Permittees that have conducted substantially equivalent monitoring to that required by part 2.3.4.7.b as part of an EPA enforcement action can request an exemption from the requirements of part 2.3.4.7.b by submitting a written request to EPA and retaining exemption approval from EPA as part of the SWMP. Until the permittee receives formal written approval of the exemption from part 2.3.4.7.b from EPA the permittee remains subject to all requirements of part 2.3.4.7.b.
- v. The permittee shall submit all screening data used in compliance with this part in its Annual Report.
- c) Follow-up ranking of outfalls and interconnections:
 - i. The permittee's outfall and interconnection ranking (2.3.4.7.a) shall be updated to reprioritize outfalls and interconnections based on information gathered during dry weather screening (part 2.3.4.7.b).

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

- ii. Outfalls/interconnections where relevant information was found indicating sewer input to the MS4 or sampling results indicating sewer input⁶ shall be considered highly likely to contain illicit discharges from sanitary sources, and such outfalls/interconnections shall be ranked at the top of the High Priority Outfalls category for investigation. At this time, permittees may choose to rank other outfalls and interconnections based on any new information from the dry weather screening.
- iii. The ranking can be updated continuously as dry weather screening information becomes available, but shall be completed within three (3) years of the effective date of the permit.

2.3.4.8. Catchment Investigations

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

a. Timelines:

- A written catchment investigation procedure shall be developed within 18 months of the permit effective date in accordance with the requirements of part 2.3.4.8.b below.
- Investigations of catchments associated with Problem Outfalls shall begin no later than two (2) years from the permit effective date.
- Investigations of catchments associated with High and Low Priority Outfalls shall follow the ranking of outfalls updated in part 2.3.4.7.c.
- Investigations of catchments associated with Problem Outfalls shall be completed within seven (7) years of the permit effective date
- Investigations of catchments where any information gathered on the outfall/interconnection identifies sewer input⁷ shall be completed within seven (7) years of the permit effective date.
- Investigations of catchments associated with all High- and Low-Priority Outfalls shall be completed within ten (10) years of the permit effective date.

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

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

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

⁶ Likely sewer input indicators are any of the following:

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

⁷ Likely sewer input indicators are any of the following:

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

vulnerability factors within each catchment.

- ii. **Includes a manhole inspection methodology** that shall describe a storm drain network investigation that involves systematically and progressively observing, sampling (as required below) and evaluating key junction manholes (see definition in Appendix A) in the MS4 to determine the approximate location of suspected illicit discharges or SSOs. The manhole inspection methodology may either start from the outfall and work up the system or start from the upper parts of the catchment and work down the system or be a combination of both practices. Either method must, at a minimum, include an investigation of each key junction manhole within the MS4, even where no evidence of an illicit discharge is observed at the outfall. The manhole inspection methodology must describe the method the permittee will use. The manhole inspection methodology shall include procedures for dry and wet weather investigations.
 - iii. **Establishes procedures to isolate and confirm sources of illicit discharges** where manhole investigations or other physical evidence or screening has identified that MS4 alignments are influenced by illicit discharges or SSOs. These shall include isolation of the drainage area for implementation of more detailed investigations, inspection of additional manholes along the alignment to refine the location of potential contaminant sources, and methods such as sandbagging key junction manhole inlets, targeted internal plumbing inspections, dye testing, video inspections, or smoke testing to isolate and confirm the sources.
- c. Requirements for each catchment investigation associated with an outfall/interconnection:
- i. For each catchment being investigated, the permittee shall review relevant mapping and historic plans and records gathered in accordance with Part 2.3.4.8.b.i. This review shall be used to identify areas within the catchment with higher potential for illicit connections. The permittee shall identify and record the presence of any of the following specific **System Vulnerability Factors (SVFs)**:
 - History of SSOs, including, but not limited to, those resulting from wet weather, high water table, or fat/oil/grease blockages;
 - Common or twin-invert manholes serving storm and sanitary sewer alignments;
 - Common trench construction serving both storm and sanitary sewer alignments;
 - Crossings of storm and sanitary sewer alignments where the sanitary system is shallower than the storm drain system;
 - Sanitary sewer alignments known or suspected to have been constructed with an underdrain system;
 - Inadequate sanitary sewer level of service (LOS) resulting in regular surcharging, customer back-ups, or frequent customer complaints;
 - Areas formerly served by combined sewer systems;
 - Sanitary sewer infrastructure defects such as leaking service laterals, cracked, broken, or offset sanitary infrastructure, directly piped connections between storm drain and sanitary sewer infrastructure, or other vulnerability factors identified through Inflow/Infiltration Analyses, Sanitary Sewer Evaluation Surveys, or other infrastructure investigations.

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

- Sewer pump/lift stations, siphons, or known sanitary sewer restrictions where power/equipment failures or blockages could readily result in SSOs;
- Any sanitary sewer and storm drain infrastructure greater than 40 years old;

- Widespread code-required septic system upgrades required at property transfers (indicative of inadequate soils, water table separation, or other physical constraints of the area rather than poor owner maintenance);
- History of multiple Board of Health actions addressing widespread septic system failures (indicative of inadequate soils, water table separation, or other physical constraints of the area rather than poor owner maintenance);

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

- ii. For each catchment, the permittee must inspect key junction manholes and gather catchment information on the locations of MS4 pipes, manholes, and the extent of the contributing catchment.
 1. For all catchments
 - a) Infrastructure information shall be incorporated into the permittee's mapping required at part 2.3.4.5; the permittee will refine their catchment delineation based on the field investigation where appropriate.
 - b) The SVF inventory for the catchment will be updated based on information obtained during the inspection, including common (twin invert) manholes, directly piped connections between storm drains and sanitary sewer infrastructure, common weir walls, sanitary sewer underdrain connections and other structural vulnerabilities where sanitary discharges could enter the storm drain system during wet weather.
 - 1) **Where a minimum of one (1) SVF is identified based on previous information or the investigation, a wet weather investigation must be conducted at the associated outfall (see below).**
 - c) During dry weather, key junction manholes⁸ shall be opened and inspected systematically for visual and olfactory evidence of illicit connections (e.g., excrement, toilet paper, gray filamentous bacterial growth, or sanitary products present).
 - 1) If flow is observed, the permittee shall sample the flow at a minimum for ammonia, chlorine and surfactants and can use field kits for these analyses.
 - 2) Where sampling results or visual or olfactory evidence indicate potential illicit discharges or SSOs, the area draining to the junction manhole shall be flagged for further upstream investigation.
 - d) Key junction and subsequent manhole investigations will proceed until the location of suspected illicit discharges or SSOs can be isolated to a pipe segment between two manholes. If no evidence of an illicit discharge is found, catchment investigations will be considered complete upon completion of key junction manhole sampling.
 2. For all catchments with a minimum of one (1) SVF identified
 - a) The permittee shall meet the requirements above for dry weather screening
 - b) The permittee shall inspect and sample under wet weather conditions to the extent necessary to determine whether wet weather-induced high flows in sanitary sewers or high groundwater in areas served by septic systems result in discharges of sanitary flow to the

⁸ Where catchments do not contain junction manholes, the dry weather screening and sampling shall be considered as meeting the manhole inspection requirement. In these catchments, dry weather screenings that indicate potential presence of illicit discharges shall be further investigated pursuant to part 2.3.4.8.d. Investigations in these catchments may be considered complete where dry weather screening reveals no flow; no evidence of illicit discharges or SSOs is indicated through sampling results or visual or olfactory means; and no wet weather System Vulnerability Factors are identified.

MS4.

- 1) The permittee shall conduct at least one wet weather screening and sampling at the outfall that includes the same parameters required during dry weather screening, part 2.3.4.7.b.iii.4.
 - 2) Wet weather sampling and screening shall proceed during or after a storm event of sufficient depth or intensity to produce a stormwater discharge. EPA strongly recommends sampling during the spring (March through June) when groundwater levels are relatively high.
 - 3) The permit does not require a minimum rainfall event prior to wet weather screening. However, permittees may incorporate provisions that assist in targeting such discharges, including avoiding sampling during the initial period of discharge (“first flush”) and/or identifying minimum storm event intensities likely to trigger sanitary sewer interconnections.
- c) This sampling can be done upon completion of any dry weather investigation but must be completed before the catchment investigation is marked as complete.
- iii. All data collected as part of the dry and wet weather catchment investigations shall be recorded and reported in each annual report.
- d. Identification/Confirmation of illicit source
Where the source of an illicit discharge has been approximated between two manholes in the permittee’s MS4, the permittee shall isolate and identify/confirm the source of the illicit discharge using more detailed methods identified in their written procedure (2.3.4.8.b.iii). For outfalls that contained evidence of an illicit discharge, catchment investigations will be considered complete upon confirmation of all illicit sources.
- e. Illicit discharge removal
When the specific source of an illicit discharge is identified, the permittee shall exercise its authority as necessary to require its removal pursuant to part 2.3.4.2 or 2.3.4.3.
- i. For each confirmed source the permittee shall include in the annual report the following information:
 - the location of the discharge and its source(s);
 - a description of the discharge;
 - the method of discovery;
 - date of discovery;
 - date of elimination, mitigation or enforcement action OR planned corrective measures and a schedule for completing the illicit discharge removal; and
 - estimate of the volume of flow removed.
 - ii. Within one year of removal of all identified illicit discharges within a catchment area, confirmatory outfall or interconnection screening shall be conducted. The confirmatory screening shall be conducted in dry weather unless System Vulnerability Factors have been identified, in which case both dry weather and wet weather confirmatory screening shall be conducted. If confirmatory screening indicates evidence of additional illicit discharges, the catchment shall be scheduled for additional investigation.

2.3.4.9. Indicators of IDDE Program Progress

The permittee shall define or describe indicators for tracking program success and evaluate and report on the overall effectiveness of the IDDE program in each annual report. At a minimum the permittee shall document in each annual report:

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

2.3.4.10 Ongoing Screening

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

2.3.4.11 Training

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

2.3.5. Construction Site Stormwater Runoff Control

Objective: The objective of an effective construction stormwater runoff control program is to minimize or eliminate erosion and maintain sediment on site so that it is not transported in stormwater and allowed to discharge to a water of the U.S through the permittee's MS4. The construction site stormwater runoff control program required by this permit is a separate and distinct program from EPA's Construction General Permit in that the former is implemented by the MS4 operator to ensure that runoff from construction sites discharging to the MS4 are controlled consistent with the MS4's applicable requirements, whereas the latter is implemented by construction site operators to comply with the terms and conditions of EPA's permit (<https://www.epa.gov/npdes/2017-construction-general-permit-cgp>).

- a. Permittees shall implement and enforce a program to reduce pollutants in any stormwater runoff discharged to the MS4 from all construction activities that result in a land disturbance of greater than or equal to one acre within the regulated area. The permittee's program shall include disturbances less than one acre if that disturbance is part of a larger common plan of development or sale that would disturb one or more acres. Permittees authorized under the MS4-2003 permit shall continue to implement and enforce their existing program and modify as necessary to meet the requirements of this part.
- b. The permittee does not need to apply its construction program requirements to projects that receive a waiver from EPA under the provisions of 40 CFR § 122.26(b) (15) (i).

- c. The permittee shall develop and implement a construction site runoff control program that includes the elements in Paragraphs i. through iii. of this part:
- i. An ordinance or regulatory mechanism that requires the use of sediment and erosion control practices at construction sites. In addition to addressing sediment and erosion control, the ordinance must include controls for other wastes on construction sites such as demolition debris, litter and sanitary wastes. The ordinance or regulatory mechanisms shall provide that the permittee may, to the extent authorized by law, impose sanctions to ensure compliance with the local program. Development of an ordinance or other regulatory mechanism was a requirement of the MS4-2003 permit (See part II.B.4 and part IV.B.4). The ordinance or other regulatory mechanism required by the MS4-2003 permit shall have been effective by May 1, 2008.
 - ii. Written (hardcopy or electronic) procedures for site plan review, site inspections and enforcement of sediment and erosion control measures by the permittee. If not already existing, these procedures shall be completed within one (1) year from the effective date of the permit.
 1. The site plan review procedure shall include:
 - a pre-construction review by the permittee of the site design, the planned operations at the construction site, planned BMPs during the construction phase, and the planned BMPs to be used to manage runoff created after development;
 - consideration of potential water quality impacts;
 - procedures for the receipt and consideration of information submitted by the public; and
 - evaluating the incorporation of Low Impact Development (LID) site planning and design strategies, unless such practices are infeasible.
 2. The site inspection and enforcement procedures shall include:
 - who is responsible for site inspections and the necessary qualifications for performing inspections, as well as who has authority to implement enforcement procedures;
 - the requirement that inspections of BMPs occur during construction of BMPs as well as after construction of BMPs to ensure they are working as described in the approved plans
 - the use of mandated inspection forms, if appropriate; and
 - procedure for tracking the number of site reviews, inspections, and enforcement actions. This tracking information shall be included as part of each annual report required by part 4.4.
 - iii. Requirements for construction site operators performing land disturbance activities within the MS4 jurisdiction that result in stormwater discharges to the MS4 to implement a sediment and erosion control program that includes BMPs appropriate for the conditions at the construction site. The program may include references to the requirements of EPA's Construction General Permit (including the development of a SWPPP) to the extent they are consistent with the program requirements of this part. The program may include references to BMP design standards in state manuals, such as the 2008 Massachusetts Stormwater Handbook⁹, or design standards developed by the

⁹ The handbook is available at: <https://www.mass.gov/guides/massachusetts-stormwater-handbook-and-stormwater-standards>

MS4. EPA supports and encourages the use of design standards in local programs. Examples of appropriate sediment and erosion control measures for construction sites include local requirements to:

1. Minimize the amount of disturbed area and protect natural resources;
2. Stabilize sites when projects are complete or operations have temporarily ceased;
3. Protect slopes on the construction site;
4. Protect all storm drain inlets and armor all newly constructed outlets;
5. Use perimeter controls at the site;
6. Stabilize construction site entrances and exits to prevent off-site tracking;
7. Control wastes that may be discharged, including but not limited to, discarded building materials, concrete truck wash out, chemicals, litter, and sanitary wastes (these wastes may not be discharged to the MS4); and
8. Inspect stormwater controls at consistent intervals.

2.3.6. Stormwater Management in New Development and Redevelopment (Post Construction Stormwater Management)

Objective: The objective of this control measure is to reduce the discharge of pollutants found in stormwater through the retention or treatment of stormwater after construction on new or redeveloped sites. For the purposes of this part (2.3.6.), the following definitions apply:

site is defined as the area extent of construction activities, including but not limited to the creation of new impervious cover and improvement of existing impervious cover (e.g. repaving not covered by 2.3.6.a.ii.4.b.)

new development is defined as any construction activities or land alteration resulting in total earth disturbances equal to or greater than 1 acre (or activities that are part of a larger common plan of development disturbing greater than 1 acre) on an area that has not previously been developed to include impervious cover.

redevelopment is defined as any construction, land alteration, or improvement of impervious surfaces resulting in total earth disturbances equal to or greater than 1 acre (or activities that are part of a larger common plan of development disturbing greater than 1 acre) that does not meet the definition of new development (see above).

- a. Permittees shall develop, implement, and enforce a program to address post-construction stormwater runoff from all new development and redevelopment sites that disturb one or more acres and discharge into the permittees MS4 at a minimum. Permittees authorized under the MS4-2003 permit shall continue to implement and enforce their program and modify as necessary to meet the requirements of this part.
 - i. The permittee's new development/ redevelopment program shall include sites less than one acre if the site is part of a larger common plan of development or redevelopment which disturbs one or more acre.

- ii. The permittee shall develop or modify, as appropriate, an ordinance or other regulatory mechanism within three (3) years of the effective date of the permit to contain provisions that are at least as stringent as the following:
 1. Low Impact Development (LID) site planning and design strategies must be implemented unless infeasible in order to reduce the discharge of stormwater from development sites..
 2. Stormwater management systems design shall be consistent with, or more stringent than, the requirements of the 2008 Massachusetts Stormwater Handbook.
:
 3. Stormwater management systems on new development shall be designed to meet an average annual pollutant removal equivalent to 90% of the average annual load of Total Suspended Solids (TSS) related to the total post-construction impervious area on the site AND 60% of the average annual load of Total Phosphorus (TP) related to the total post-construction impervious surface area on the site¹⁰.
 - a) Average annual pollutant removal requirements in 2.3.6.a.ii.3 are achieved through one of the following methods:
 1. installing BMPs that meet the pollutant removal percentages based on calculations developed consistent with EPA Region 1's BMP Accounting and Tracking Tool (2016) or other BMP performance evaluation tool provided by EPA Region 1, where available. If EPA Region 1 tools do not address the planned or installed BMP performance, then any federally or State-approved BMP design guidance or performance standards (e.g., State stormwater handbooks and design guidance manuals) may be used to calculate BMP performance; or
 2. retaining the volume of runoff equivalent to, or greater than, one (1.0) inch multiplied by the total post-construction impervious surface area on the new development site; or
 3. meeting a combination of retention and treatment that achieves the above standards; or
 4. utilizing offsite mitigation that meets the above standards within the same USGS HUC12 as the new development site.
 4. Stormwater management systems on redevelopment sites shall be designed to meet an average annual pollutant removal equivalent to 80% of the average annual post-construction load of Total Suspended Solids (TSS) related to the total post-construction impervious area on the site AND 50% of the average annual load of Total Phosphorus (TP) related to the total post-construction impervious surface area on the site¹¹.
 - a) Average annual pollutant removal requirements in 2.3.6.a.ii.4 above are

¹⁰ Pollutant removal is calculated based on average annual loading and not on the basis of any individual storm event

¹¹ Pollutant removal is calculated based on average annual loading and not on the basis of any individual storm event

achieved through one of the following methods:

1. installing BMPs that meet the pollutant removal percentages based on calculations developed consistent with EPA Region 1's BMP Accounting and Tracking Tool (2016) or other BMP performance evaluation tool provided by EPA Region 1, where available. If EPA Region 1 tools do not address the planned or installed BMP performance, then any federally or State-approved BMP design guidance or performance standards (e.g., State stormwater handbooks and design guidance manuals) may be used to calculate BMP performance; or
2. retaining the volume of runoff equivalent to, or greater than, 0.8 inch multiplied by the total post-construction impervious surface area on the redeveloped site; or
3. meeting a combination of retention and treatment that achieves the above standards; or
4. utilizing offsite mitigation that meets the above standards within the same USGS HUC12 as the redevelopment site.

- b) Redevelopment activities that are exclusively limited to maintenance and improvement of existing roadways, (including widening less than a single lane, adding shoulders, correcting substandard intersections, improving existing drainage systems, and repaving projects) shall improve existing conditions unless infeasible and are exempt from part 2.3.6.a.ii.4. Roadway widening or improvements that increase the amount of impervious area on the redevelopment site by greater than or equal to a single lane width shall meet the requirements of part 2.3.6.a.ii.4..

iii. The permittee shall require, at a minimum, the submission of as-built drawings no later than two (2) years after completion of construction projects. The as-built drawings must depict all on site controls, both structural and non-structural, designed to manage the stormwater associated with the completed site (post construction stormwater management). The new development/redevelopment program shall have procedures to ensure adequate long-term operation and maintenance of stormwater management practices that are put in place after the completion of a construction project. These procedures may include the use of dedicated funds or escrow accounts for development projects or the acceptance of ownership by the permittee of all privately owned BMPs. These procedures may also include the development of maintenance contracts between the owner of the BMP and the permittee. Alternatively, these procedures may include the submission of an annual certification documenting the work that has been done over the last 12 months to properly operate and maintain the stormwater control measures. The procedures to require submission of as-built drawings and ensure long term operation and maintenance shall be a part of the SWMP. The permittee shall report in the annual report on the measures that the permittee has utilized to meet this requirement.

- b. Within four (4) years of the effective date of this permit, the permittee shall develop a report assessing current street design and parking lot guidelines and other local requirements that affect

the creation of impervious cover. This assessment shall be used to provide information to allow the permittee to determine if changes to design standards for streets and parking lots can be made to support low impact design options. If the assessment indicates that changes can be made, the assessment shall include recommendations and proposed schedules to incorporate policies and standards into relevant documents and procedures to minimize impervious cover attributable to parking areas and street designs. The permittee shall implement all recommendations, in accordance with the schedules, contained in the assessment. The local planning board and local transportation board should be involved in this assessment. This assessment shall be part of the SWMP. The permittee shall report in each annual report on the status of this assessment including any planned or completed changes to local regulations and guidelines.

- c. Within four (4) years from the effective date of the permit, the permittee shall develop a report assessing existing local regulations to determine the feasibility of making, at a minimum, the following practices allowable when appropriate site conditions exist:
 - i. Green roofs;
 - ii. Infiltration practices such as rain gardens, curb extensions, planter gardens, porous and pervious pavements, and other designs to manage stormwater using landscaping and structured or augmented soils; and
 - iii. Water harvesting devices such as rain barrels and cisterns, and the use of stormwater for non-potable uses.

The assessment should indicate if the practices are allowed in the MS4 jurisdiction and under what circumstances are they allowed. If the practices are not allowed, the permittee shall determine what hinders the use of these practices, what changes in local regulations may be made to make them allowable, and provide a schedule for implementation of recommendations. The permittee shall implement all recommendations, in accordance with the schedules, contained in the assessment. The permittee shall report in each annual report on its findings and progress towards making the practices allowable. (Information available at:

<http://www.epa.gov/region1/npdes/stormwater/assets/pdf/AddressingBarrier2LID.pdf> and <http://www.mapc.org/resources/low-impact-dev-toolkit/local-codes-lid>)

- d. Four (4) years from the effective date of this permit, the permittee shall identify a minimum of 5 permittee-owned properties that could potentially be modified or retrofitted with BMPs designed to reduce the frequency, volume, and pollutant loads of stormwater discharges to and from its MS4 through the reduction of impervious area. Properties and infrastructure for consideration shall include those with the potential for reduction of on-site impervious area (IA) as well as those that could provide reduction of off-site IA. At a minimum, the permittee shall consider municipal properties with significant impervious cover (including parking lots, buildings, and maintenance yards) that could be modified or retrofitted. MS4 infrastructure to be considered includes existing street right-of-ways, outfalls and conventional stormwater conveyances and controls (including swales and detention practices) that could be readily modified or retrofitted to provide reduction in frequency, volume or pollutant loads of such discharges through reduction of impervious cover.

In determining the potential for modifying or retrofitting particular properties, the permittee shall consider factors such as access for maintenance purposes; subsurface geology; depth to water table; proximity to aquifers and subsurface infrastructure including sanitary sewers and septic systems; and opportunities for public use and education. In determining its priority ranking, the permittee shall consider factors such as schedules for planned capital improvements to storm and

sanitary sewer infrastructure and paving projects; current storm sewer level of service; and control of discharges to water quality limited waters, first or second order streams, public swimming beaches, drinking water supply sources and shellfish growing areas.

Beginning with the fifth year annual report and in each subsequent annual report, the permittee shall identify additional permittee owned sites and infrastructure that could be retrofitted such that the permittee maintains a minimum of 5 sites in their inventory, until such a time as when the permittee has less than 5 sites remaining. In addition, the permittee shall report on all properties that have been modified or retrofitted with BMPs to mitigate IA that were inventoried in accordance with this part. The permittee may also include in its annual report non-MS4 owned property that has been modified or retrofitted with BMPs to mitigate IA.

2.3.7. Good House Keeping and Pollution Prevention for Permittee Owned Operations

Objective: The permittee shall implement an operations and maintenance program for permittee-owned operations that has a goal of preventing or reducing pollutant runoff and protecting water quality from all permittee-owned operations.

a. Operations and Maintenance Programs

- i. Within two (2) years from the effective date of the permit, the permittee shall develop, if not already developed, written (hardcopy or electronic) operations and maintenance procedures for the municipal activities listed below in part 2.3.7.a.ii. These written procedures shall be included as part of the SWMP.
- ii. Within two (2) year of the effective date of this permit, the permittee shall develop an inventory of all permittee owned facilities within the categories listed below. The permittee shall review this inventory annually and update as necessary.
 1. Parks and open space: Establish procedures to address the proper use, storage, and disposal of pesticides, herbicides, and fertilizers including minimizing the use of these products and using only in accordance manufacturer's instruction. Evaluate lawn maintenance and landscaping activities to ensure practices are protective of water quality. Protective practices include reduced mowing frequencies, proper disposal of lawn clippings, and use of alternative landscaping materials (e.g., drought resistant planting). Establish pet waste handling collection and disposal locations at all parks and open space where pets are permitted, including the placing of proper signage concerning the proper collection and disposal of pet waste. Establish procedures to address waterfowl congregation areas where appropriate to reduce waterfowl droppings from entering the MS4. Establish procedures for management of trash containers at parks and open space (scheduled cleanings; sufficient number). Establish procedures to address erosion or poor vegetative cover when the permittee becomes aware of it; especially if the erosion is within 50 feet of a surface water.
 2. Buildings and facilities where pollutants are exposed to stormwater runoff: This includes schools (to the extent they are permittee-owned or operated), town offices, police, and fire stations, municipal pools and parking garages and other permittee-owned or operated buildings or facilities. Evaluate the use, storage, and disposal of petroleum products and other potential stormwater pollutants. Provide employee training as necessary so that those responsible for handling these products know proper procedures. Ensure that Spill Prevention Plans are

in place, if applicable, and coordinate with the fire department as necessary. Develop management procedures for dumpsters and other waste management equipment. Sweep parking lots and keep areas surrounding the facilities clean to reduce runoff of pollutants.

3. Vehicles and Equipment: Establish procedures for the storage of permittee vehicles. Vehicles with fluid leaks shall be stored indoors or containment shall be provided until repaired. Evaluate fueling areas owned or operated by the permittee. If possible, place fueling areas under cover in order to minimize exposure. Establish procedures to ensure that vehicle wash waters are not discharged to the municipal storm sewer system or to surface waters. This permit does not authorize such discharges.

iii. Infrastructure Operations and Maintenance

1. The permittee shall establish within two (2) year of the effective date of the permit a written (hardcopy or electronic) program detailing the activities and procedures the permittee will implement so that the MS4 infrastructure is maintained in a timely manner to reduce the discharge of pollutants from the MS4. If the permittee has an existing program to maintain its MS4 infrastructure in a timely manner to reduce or eliminate the discharge of pollutants from the MS4, the permittee shall document the program in the SWMP.
2. The permittee shall optimize routine inspections, cleaning and maintenance of catch basins such that the following conditions are met:
 - Prioritize inspection and maintenance for catch basins located near construction activities (roadway construction, residential, commercial, or industrial development or redevelopment). Clean catch basins in such areas more frequently if inspection and maintenance activities indicate excessive sediment or debris loadings.
 - Establish a schedule with a goal that the frequency of routine cleaning will ensure that no catch basin at anytime will be more than 50 percent full.
 - If a catch basin sump is more than 50 percent full during two consecutive routine inspections/cleaning events, the permittee shall document that finding, investigate the contributing drainage area for sources of excessive sediment loading, and to the extent practicable, abate contributing sources. The permittee shall describe any actions taken in its annual report.
 - For the purposes of this part, an excessive sediment or debris loading is a catch basin sump more than 50 percent full. A catch basin sump is more than 50 percent full if the contents within the sump exceed one half the distance between the bottom interior of the catch basin to the invert of the deepest outlet of the catch basin.
 - The permittee shall document in the SWMP and in the first annual report its plan for optimizing catch basin cleaning, inspection plans, or its schedule for gathering information to develop the optimization plan. Documentation shall include metrics and other information used to reach the determination that the established plan for cleaning and maintenance is optimal for the MS4. The permittee shall keep a log of catch basins cleaned or inspected.

- The permittee shall report in each annual report the total number of catch basins, number inspected, number cleaned, and the total volume or mass of material removed from all catch basins.
3. The permittee shall establish and implement procedures for sweeping and/or cleaning streets, and permittee-owned parking lots. All streets with the exception of rural uncurbed roads with no catch basins or high speed limited access highways shall be swept and/or cleaned a minimum of once per year in the spring (following winter activities such as sanding). The procedures shall also include more frequent sweeping of targeted areas determined by the permittee on the basis of pollutant load reduction potential, based on inspections, pollutant loads, catch basin cleaning or inspection results, land use, water quality limited or TMDL waters or other relevant factors as determined by the permittee. The permittee shall report in each annual report the number of miles cleaned or the volume or mass of material removed.

For rural uncurbed roadways with no catch basins and limited access highways, the permittee shall either meet the minimum frequencies above, or develop and implement an inspection, documentation and targeted sweeping plan within two (2) years of the effective date of the permit, and submit such plan with its year one annual report.

4. The permittee shall ensure proper storage of catch basin cleanings and street sweepings prior to disposal or reuse such that they do not discharge to receiving waters. These materials should be managed in compliance with current MassDEP policies:
- For catch basin cleanings:
<http://www.mass.gov/eea/agencies/massdep/recycle/regulations/management-of-catch-basin-cleanings.html>
 - For street sweepings:
<http://www.mass.gov/eea/docs/dep/recycle/laws/stsweep.pdf>.
5. The permittee shall establish and implement procedures for winter road maintenance including the use and storage of salt and sand; minimize the use of sodium chloride and other salts, and evaluate opportunities for use of alternative materials; and ensure that snow disposal activities do not result in disposal of snow into waters of the United States. For purposes of this MS4 Permit, salt shall mean any chloride-containing material used to treat paved surfaces for deicing, including sodium chloride, calcium chloride, magnesium chloride, and brine solutions.
6. The permittee shall establish and implement inspection and maintenance frequencies and procedures for all stormwater treatment structures such as water quality swales, retention/detention basins, infiltration structures, proprietary treatment devices or other similar structures. All permittee-owned stormwater treatment structures (excluding catch basins) shall be inspected annually at a minimum.

- iv. The permittee shall report in the annual report on the status of the inventory required by this part and any subsequent updates; the status of the O&M programs for the permittee-owned facilities and activities in part 2.3.7.a.ii; and the maintenance activities associated with each.
- v. The permittee shall keep a written (hardcopy or electronic) record of all required activities including but not limited to maintenance activities, inspections and training required by part 2.3.7.a. The permittee shall maintain, consistent with part 4.2.a, all records associated with maintenance and inspection activities required by part 2.3.7.a.

b. Stormwater Pollution Prevention Plan (SWPPP)

The permittee shall develop and fully implement a SWPPP for each of the following permittee-owned or operated facilities: maintenance garages, public works yards, transfer stations, and other waste handling facilities where pollutants are exposed to stormwater as determined by the permittee. If facilities are located at the same property, the permittee may develop one SWPPP for the entire property. The SWPPP is a separate and different document from the SWMP required in part 1.10. A SWPPP does not need to be developed for a facility if the permittee has either developed a SWPPP or received a no exposure certification for the discharge under the Multi-Sector General Permit or the discharge is authorized under another NPDES permit.

- i. No later than two (2) years from the effective date of the permit, the permittee shall develop and implement a written (hardcopy or electronic) SWPPP for the facilities described above. The SWPPP shall be signed in accordance with the signatory requirements of Appendix B – Subparagraph 11.
- ii. The SWPPP shall contain the following elements:
 - 1. Pollution Prevention Team
Identify the staff on the team, by name and title. If the position is unstaffed, the title of the position should be included and the SWPPP updated when the position is filled. The role of the team is to develop, implement, maintain, and revise, as necessary, the SWPPP for the facility.
 - 2. Description of the facility and identification of potential pollutant sources
The SWPPP shall include a map of the facility and a description of the activities that occur at the facility. The map shall show the location of the stormwater outfalls, receiving waters, and any structural controls. Identify all activities that occur at the facility and the potential pollutants associated with each activity including the location of any floor drains. These may be included as part of the inventory required by part 2.3.7.a.
 - 3. Identification of stormwater controls
The permittee shall select, design, install, and implement the control measures detailed in paragraph 4 below to prevent or reduce the discharge of pollutants from the permittee owned facility.

The selection, design, installation, and implementation of the control measures shall be in accordance with good engineering practices and manufacturer's specifications. The permittee shall also take all reasonable steps to control or

address the quality of discharges from the site that may not originate at the facility.

If the discharge from the facility is to a water quality limited water and the facility has the potential to discharge the pollutant identified as causing the water quality limitation, the permittee shall identify the control measures that will be used to address this pollutant at the facility so that the discharge meets applicable water quality standards.

4. The SWPPP shall include the following management practices:
 - a) Minimize or Prevent Exposure: The permittee shall to the extent practicable either locate materials and activities inside, or protect them with storm-resistant coverings in order to prevent exposure to rain, snow, snowmelt and runoff (although significant enlargement of impervious surface area is not recommended). Materials do not need to be enclosed or covered if stormwater runoff from affected areas will not be discharged directly or indirectly to surface waters or to the MS4 or if discharges are authorized under another NPDES permit.
 - b) Good Housekeeping: The permittee shall keep clean all exposed areas that are potential sources of pollutants, using such measures as sweeping at regular intervals. Ensure that trash containers are closed when not in use, keep storage areas well swept and free from leaking or damaged containers; and store leaking vehicles needing repair indoors.
 - c) Preventative Maintenance: The permittee shall regularly inspect, test, maintain, and repair all equipment and systems to avoid situations that may result in leaks, spills, and other releases of pollutants in stormwater to receiving waters. Inspections shall occur at a minimum once per quarter.
 - d) Spill Prevention and Response: The permittee shall minimize the potential for leaks, spills, and other releases that may be exposed to stormwater and develop plans for effective response to such spills if or when they occur. At a minimum, the permittee shall have procedures that include:
 - Preventive measures such as barriers between material storage and traffic areas, secondary containment provisions, and procedures for material storage and handling.
 - Response procedures that include notification of appropriate facility personnel, emergency agencies, and regulatory agencies, and procedures for stopping, containing, and cleaning up leaks, spills and other releases. Measures for cleaning up hazardous material spills or leaks shall be consistent with applicable Resource Conservation and Recovery Act (RCRA) regulations at 40 CFR section 264 and 40 CFR section 265. Employees

who may cause, detect, or respond to a spill or leak shall be trained in these procedures and have necessary spill response equipment available. If possible, one of these individuals should be a member of the Pollution Prevention Team; and

- Contact information for individuals and agencies that shall be notified in the event of a leak, spill, or other release. Where a leak, spill, or other release containing a hazardous substance or oil in an amount equal to or in excess of a reportable quantity established under 40 CFR section 110, 40 CFR section 117, or 40 CFR section 302, occurs during a 24-hour period, the permittee shall notify the National Response Center (NRC) at (800) 424-8802 in accordance with the requirements of 40 CFR section 110, 40 CFR section 117, and 40 CFR section 302 as soon as the permittee has knowledge of the discharge. State or local requirements may necessitate reporting spills or discharges to local emergency, public health or drinking water supply agencies, and owners of public drinking water supplies. Contact information shall be in locations that are readily accessible and available.
- e) Erosion and Sediment Control: The permittee shall use structural and non-structural control measures at the facility to stabilize and contain runoff from exposed areas and to minimize or eliminate onsite erosion and sedimentation. Efforts to achieve this may include the use of flow velocity dissipation devices at discharge locations and within outfall channels where necessary to reduce erosion.
- f) Management of Runoff: The permittee shall manage stormwater runoff from the facility to prevent or reduce the discharge of pollutants. This may include management practices which divert runoff from areas that are potential sources of pollutants, contain runoff in such areas, or reuse, infiltrate or treat stormwater to reduce the discharge of pollutants.
- g) Salt Storage Piles or Piles Containing Salt: For storage piles of salt or piles containing salt used for deicing or other purposes (including maintenance of paved surfaces) for which the discharge during precipitation events discharges to the permittee's MS4, any other storm sewer system, or to a Water of the US, the permittee shall prevent exposure of the storage pile to precipitation by enclosing or covering the storage piles. Such piles shall be enclosed or covered within two (2) years of the permit effective date. The permittee shall implement appropriate measures (e.g., good housekeeping, diversions, containment) to minimize exposure resulting from adding to or removing materials from the pile. The permittee is encouraged to store piles in such a manner as not to impact surface water resources, ground water resources, recharge areas, and wells.
- h) Employee Training: The permittee shall regularly train employees who work in areas where materials or activities are exposed to stormwater, or who are responsible for implementing activities identified in the SWPPP

(e.g., inspectors, maintenance personnel), including all members of the Pollution Prevention Team. Training shall cover both the specific components and scope of the SWPPP and the control measures required under this part, including spill response, good housekeeping, material management practices, any best management practice operation and maintenance, etc. EPA recommends annual training.

The permittee shall document the following information for each training:

- The training date, title and training duration;
 - List of municipal attendees;
 - Subjects covered during training
- i) Maintenance of Control Measures: The permittee shall maintain all control measures, required by this permit in effective operating condition. The permittee shall keep documentation onsite that describes procedures and a regular schedule for preventative maintenance of all control measures and discussions of back-up practices in place should a runoff event occur while a control measure is off-line. Nonstructural control measures shall also be diligently maintained (e.g., spill response supplies available, personnel trained).

iii. The permittee shall conduct the following inspections:

1. Site Inspections: Inspect all areas that are exposed to stormwater and all stormwater control measures. Inspections shall be conducted at least once each calendar quarter. More frequent inspections may be required if significant activities are exposed to stormwater. Inspections shall be performed when the facility is in operation. At least one of the quarterly inspections shall occur during a period when a stormwater discharge is occurring.

The permittee shall document the following information for each facility inspection:

- The inspection date and time;
- The name of the inspector;
- Weather information and a description of any discharge occurring at the time of the inspection;
- Identification of any previously unidentified discharges from the site;
- Any control measures needing maintenance or repair;
- Any failed control measures that need replacement.
- Any SWPPP changes required as a result of the inspection.

If during the inspections, or any other time, the permittee identifies control measures that need repair or are not operating effectively, the permittee shall repair or replace them before the next anticipated storm event if possible, or as soon as practicable following that storm event. In the interim, the permittee shall have back-up measures in place.

The permittee shall report the findings from the Site Inspections in the annual report.

- iv. The permittee must keep a written (hardcopy or electronic) record of all required activities including but not limited to maintenance, inspections, and training required by part 2.3.7.b. The permittee shall maintain all records associated with the development and implementation of the SWPPP required by this part consistent with the requirements of part 4.2.

3.0. Additional Requirements for Discharges to Surface Drinking Water Supplies and Their Tributaries

- a. Permittees which discharge to public surface drinking water supply sources (Class A and Class B surface waters used for drinking water) or their tributaries should consider these waters a priority in the implementation of the SWMP.
- b. Permittees should provide pretreatment and spill control measures to stormwater discharges to public drinking water supply sources or their tributaries to the extent feasible.
- c. Direct discharges to Class A waters should be avoided to the extent feasible.

4.0. Program Evaluation, Record Keeping, and Reporting

4.1. Program Evaluation

- a. The permittee shall annually self-evaluate its compliance with the terms and conditions of this permit and submit each self-evaluation in the Annual Report. The permittee shall also maintain the annual evaluation documentation as part of the SWMP.
- b. The permittee shall evaluate the appropriateness of the selected BMPs in achieving the objectives of each control measure and the defined measurable goals. Where a BMP is found to be ineffective the permittee shall change BMPs in accordance with the provisions below. In addition, permittees may augment or change BMPs at any time following the provisions below:
 - Changes adding (but not subtracting or replacing) components or controls may be made at any time.
 - Changes replacing an ineffective or infeasible BMP specifically identified in the SWMP with an alternative BMP may be made as long as the basis for the changes is documented in the SWMP by, at a minimum:
 - An analysis of why the BMP is ineffective or infeasible;
 - Expectations on the effectiveness of the replacement BMP; and
 - An analysis of why the replacement BMP is expected to achieve the defined goals of the BMP to be replaced.

The permittee shall indicate BMP modifications along with a brief explanation of the modification in each Annual Report.

- c. EPA or MassDEP may request the permittee to add, modify, repair, replace or change BMPs or other measures described in the annual reports as needed to satisfy the conditions of this permit.

Any changes requested by EPA or MassDEP will be in writing and may set forth the schedule for the permittee to develop the changes and may offer the permittee the opportunity to propose alternative program changes to satisfy the permit conditions..

4.2. Record Keeping

- a. The permittee shall keep all records required by this permit for a period of at least five years. EPA may extend this period at any time. Records include information used in the development of any written (hardcopy or electronic) program required by this permit, any monitoring results, copies of reports, records of screening, follow-up and elimination of illicit discharges; maintenance records; inspection records; and data used in the development of the notice of intent, SWMP, SWPPP, and annual reports. This list provides examples of records that should be maintained, but is not all inclusive.
- b. Records other than those required to be included in the annual report, part 4.4, shall be submitted only when requested by the EPA or the MassDEP.
- c. The permittee shall make the records relating to this permit, including the written (hardcopy or electronic) stormwater management program, available to the public. The public may view the records during normal business hours. The permittee may charge a reasonable fee for copying requests. The permittee is encouraged to satisfy this requirement by posting records online.

4.3. Outfall Monitoring Reporting

- a. The permittee shall monitor and sample its outfalls at a minimum through sampling and testing at the frequency and locations required in connection with IDDE screening under part 2.3.4.7.b. and 2.3.4.8.c.ii.2. The monitoring program may also include additional outfall and interconnection monitoring as determined by the permittee in connection with assessment of SWMP effectiveness pursuant to part 4.1; evaluation of discharges to water quality limited waters pursuant to part 2.2; assessment of BMP effectiveness pursuant to part 2.2 or 2.3; or otherwise.
- b. The permittee shall document all monitoring results each year in the annual report. The report shall include the date, outfall or interconnection identifier, location, weather conditions at time of sampling, precipitation in previous 48 hours, field screening parameter results, and results of all analyses. The annual report shall include all of this information and data for the current reporting period and for the entire permit period.
- c. The permittee shall also include in the annual report results from any other stormwater or receiving water quality monitoring or studies conducted during the reporting period where that data is being used by the permittee to inform permit compliance or program effectiveness. If such monitoring or studies were conducted on behalf of the permittee, or if monitoring or studies conducted by other entities were reported to the permittee, a brief description of the type of information gathered or received shall be included in the annual report(s) covering the time period(s) the information was received.

4.4. Annual Reports

- a. The permittee shall submit annual reports each year of the permit term. The reporting period will be a one year period commencing on the permit effective date, and subsequent anniversaries thereof, except that the first annual report under this permit shall also cover the period from May 1, [year of

final permit effective date] to the permit effective date. The annual report is due ninety days from the close of each reporting period.

b. The annual reports shall contain the following information:

- i. A self-assessment review of compliance with the permit terms and conditions.
- ii. An assessment of the appropriateness of the selected BMPs.
- iii. The status of any plans or activities required by part 2.1 and/ or part 2.2, including:
 - Identification of all discharges that do not meet applicable water quality standards;
 - For discharges subject to TMDL related requirements, identification of specific BMPs used to address the pollutant identified as the cause of impairment and assessment of the BMPs effectiveness at controlling the pollutant (part 2.2.1. and Appendix F) and any deliverables required by Appendix F;
 - For discharges to water quality limited waters a description of each BMP required by Appendix H and any deliverables required by Appendix H.
- iv. An assessment of the progress towards achieving the measurable goals and objectives of each control measure in part 2.3 including:
 - Evaluation of the public education program including a description of the targeted messages for each audience; method of distribution and dates of distribution; methods used to evaluate the program; and any changes to the program.
 - Description of the activities used to promote public participation including documentation of compliance with state public notice regulations.
 - Description of the activities related to implementation of the IDDE program including: status of the map; status and results of the illicit discharge potential ranking and assessment; identification of problem catchments; status of all protocols described in part 2.3.4.(program responsibilities and systematic procedure); number and identifier of catchments evaluated; number and identifier of outfalls screened; number of illicit discharges located; number of illicit discharges removed; gallons of flow removed; identification of tracking indicators and measures of progress based on those indicators; and employee training.
 - Evaluation of the construction runoff management including number of project plans reviewed; number of inspections; and number of enforcement actions.
 - Evaluation of stormwater management for new development and redevelopment including status of ordinance development (2.3.6.a.ii.), review and status of the street design assessment(2.3.6.b.), assessments to barriers to green infrastructure (2.3.6.c), and retrofit inventory status (2.3.6.d.)
 - Status of the O&M Programs required by part 2.3.7.a.
 - Status of SWPPP required by part 2.3.7.b. including inspection results.
 - Any additional reporting requirements in part 3.0.

- v. All outfall screening and monitoring data collected by or on behalf of the permittee during the reporting period and cumulative for the permit term, including but not limited to all data collected pursuant to part 2.3.4. The permittee shall also provide a description of any additional monitoring data received by the permittee during the reporting period.
- vi. Description of activities for the next reporting cycle.
- vii. Description of any changes in identified BMPs or measurable goals.
- viii. Description of activities undertaken by any entity contracted for achieving any measurable goal or implementing any control measure.

c. Reports shall be submitted to EPA at the following address:

United State Environmental Protection Agency
Stormwater and Construction Permits Section (OEP06-1)
Five Post Office Square, Suite 100
Boston, MA 02109

Massachusetts Department of Environmental Protection
One Winter Street – 5th Floor
Boston, MA 02108
ATTN: Frederick Civian

Or submitted electronically to EPA at the following email address: stormwater.reports@epa.gov. After December 21, 2020 all Annual Reports must be submitted electronically.

5.0. Non-Traditional MS4s

Non-traditional MS4s are MS4s owned and operated by the Commonwealth of Massachusetts, counties or other public agencies within the Commonwealth of Massachusetts, and properties owned and operated by the United States (Federal Facilities) within the Commonwealth of Massachusetts. This part addresses all non-traditional MS4s except MS4s that are owned or operated by transportation agencies, which are addressed in part 6.0 below.

5.1. Requirements for Non-Traditional MS4s

All requirements and conditions of parts 1 – 4 above apply to all Non-traditional MS4s, except as specifically provided below:

5.1.1. Public education

For the purpose of this permit, the audiences for a Non-traditional MS4 include the employees, clients and customers (including students at education MS4s), visitors to the property, tenants, long term contractors and any other contractors working at the facility where the MS4 is located. The permittee may use some of the educational topics included in part 2.3.2.d. as appropriate, or may focus on topics specific to the MS4. The permittee shall document the educational topics for each target audience in the SWMP and annual reports.

5.1.2. Ordinances and regulatory mechanisms

Some Non-traditional MS4s may not have authority to enact an ordinance, by-law, or other regulatory mechanisms. MS4s without the authority to enact an ordinance shall ensure that written policies or procedures are in place to address the requirements of part 2.3.4.5., part 2.3.4.6 and part 2.3.6.a.

5.1.3. Assessment of Regulations

Non-traditional MS4s do not need to meet the requirements of part 2.3.6.c.

5.1.4. New Dischargers

New MS4 facilities are subject to additional water quality-based requirements if they fall within the definition of “new discharger” under 40 CFR § 122.2: “A new discharger is any building, structure, facility or installation (a) from which there is or may be a ‘discharge of pollutants’ (b) that did not commence the ‘discharge of pollutants’ at a particular ‘site’ prior to August 13, 1979; (c) which is not a ‘new source’; and (d) which never received a finally effective NPDES permit for discharges at that ‘site.’ The term “site” is defined in § 122.2 to mean “the land or water area where any ‘facility or activity’ is physically located or conducted including adjacent land used in connection with the facility or activity.”

Consistent with these definitions, a Non-traditional MS4 is a “new discharger” if it discharges stormwater from a new facility with an entirely new separate storm sewer system that is not physically located on the same or adjacent land as an existing facility and associated system operated by the same MS4.

Any Non-traditional MS4 facility that is a “new discharger” and discharges to a waterbody listed in category 5 or 4b on the Massachusetts Integrated Report of waters listed pursuant to Clean Water Act section 303(d) and 305(b) due to nutrients (Total Nitrogen or Total Phosphorus), metals (Cadmium, Copper, Iron, Lead or Zinc), solids (TSS or Turbidity), bacteria/pathogens (E. Coli, Enterococcus or Fecal Coliform), chloride (Chloride) or oil and grease (Petroleum Hydrocarbons or Oil and Grease), or discharges to a waterbody with an approved TMDL for any of those pollutants, is not eligible for coverage under this permit and shall apply for an individual permit.

Any Non-traditional MS4 facility that is a “new discharger” and discharges to a waterbody that is in attainment is subject to Massachusetts antidegradation regulations at 314 CMR 4.04. The permittee shall comply with the provisions of 314 CMR 4.04 including information submittal requirements and obtaining authorization for new discharges where appropriate¹². Any authorization of new discharges by MassDEP shall be incorporated into the permittee's SWMP. If an applicable MassDEP approval specifies additional conditions or requirements, then those requirements are incorporated into this permit by reference. The permittee must comply with all such requirements.

5.1.5 Dischargers Subject to Appendix F Part A.I

Those dischargers not identified in Appendix F Table F-2 or Table F-3 discharging to waterbodies in the Charles River Watershed or to an MS4 that discharges to a waterbody in the Charles River Watershed shall coordinate with the municipality in which they are located to facilitate compliance

¹² Contact MassDEP for guidance on compliance with 314 CMR 4.04

with the phosphorus reduction applicable to the municipality. In each annual report the permittee shall indicate planned phosphorus reduction activities on site and coordination progress with the municipality. In addition, the year 4 annual report shall contain the following information:

- a. Estimated current impervious area of permittee owned property,
- b. Land Use information for permittee owned property,
- c. Phosphorus removal in pounds per year for any structural BMP owned by the permittee, calculated in accordance with Appendix F Attachment 3
- d. Date of last maintenance activity for all structural BMPs for which phosphorus removal is calculated

6.0 Requirements for MS4s Owned or Operated by Transportation Agencies

This part applies to all MS4s owned or operated by any state or federal transportation agency (except Massachusetts Department of Transportation –MassDOT- Highway Division, which is subject to a separate individual permit). All requirements and conditions of this permit apply with the following exceptions:

6.1 Public education

For the purpose of this permit, the audiences for a transportation agency education program include the general public (users of the roadways), employees, and any contractors working at the location. The permittee may use some of the educational topics included in part 2.3.2.d. as appropriate, or may focus on topics specific to the agency. The permittee shall document the educational topics for each target audience.

6.2 Ordinances and regulatory mechanisms

The transportation agency may not have authority to enact an ordinance, by-law or other regulatory mechanisms. The agency shall ensure that written agency policies or procedures are in place to address the requirements of part 2.3.4.5., part 2.3.4.6 and part 2.3.6.a.

6.3 Assessment of regulations

Non-traditional MS4s do not need to meet the requirements of part 2.3.6.c.

6.4 New Dischargers

New MS4 facilities are subject to additional water quality-based requirements if they fall within the definition of “new dischargers” under 40 CFR § 122.2: “A new discharger is any building, structure, facility or installation (a) from which there is or may be a ‘discharge of pollutants’ (b) that did not commence the ‘discharge of pollutants’ at a particular ‘site’ prior to August 13, 1979; (c) which is not a ‘new source’; and (d) which never received a finally effective NPDES permit for discharges at that ‘site.’ The term “site” is defined in § 122.2 to mean “the land or water area where any ‘facility or activity’ is physically located or conducted including adjacent land used in connection with the facility or activity.”

Consistent with these definitions, a new transportation MS4 is a “new discharger” if it discharges stormwater from a new facility with an entirely new separate storm sewer system that is not physically located on the same or adjacent land as an existing facility and associated system operated by the same MS4.

Any transportation MS4 facility that is a “new discharger” and discharges to a waterbody listed as impaired in category 5 or 4b on the Massachusetts Integrated Report of waters listed pursuant to Clean Water Act section 303(d) and 305(b) due to nutrients (Total Nitrogen or Total Phosphorus), metals (Cadmium, Copper, Iron, Lead or Zinc), solids (TSS or Turbidity), bacteria/pathogens (E. Coli, Enterococcus or Fecal Coliform), chloride

(Chloride) or oil and grease (Petroleum Hydrocarbons or Oil and Grease), or discharges to a waterbody with an approved TMDL for any of those pollutants, is not eligible for coverage under this permit and shall apply for an individual permit.

Any transportation MS4 facility that is a “new discharger” and discharges to a waterbody that is in attainment is subject to Massachusetts antidegradation regulations at 314 CMR 4.04. The permittee shall comply with the provisions of 314 CMR 4.04 including information submittal requirements and obtaining authorization for new discharges where appropriate¹³. Any authorization of new discharges by MassDEP shall be incorporated into the permittee's SWMP. If an applicable MassDEP approval specifies additional conditions or requirements, then those requirements are incorporated into this permit by reference. The permittee must comply with all such requirements.

6.5 Dischargers Subject to Appendix F Part A.I

Those dischargers not identified in Appendix F Table F-2 or Table F-3 discharging to waterbodies in the Charles River Watershed or to an MS4 that discharges to a waterbody in the Charles River Watershed shall coordinate with the municipality in which they are located to facilitate compliance with the phosphorus reduction applicable to the municipality. In each annual report the permittee shall indicate planned phosphorus reduction activities on site and coordination progress with the municipality. In addition, the year 4 annual report shall contain the following information:

- a. Estimated current impervious area of permittee owned property,
- b. Land Use information for permittee owned property,
- c. Phosphorus removal in pounds per year for any structural BMP owned by the permittee, calculated in accordance with Appendix F Attachment 3,
- d. Date of last maintenance activity for all structural BMPs for which phosphorus removal is calculated

¹³ Contact MassDEP for guidance on compliance with 314 CMR 4.04

Section 2

Annual Reports

- Year 1
- Year 2
- Year 3

Year 1 Annual Report
Massachusetts Small MS4 General Permit
Reporting Period: May 1, 2018-June 30, 2019

Please DO NOT attach any documents to this form. Instead, attach all requested documents to an email when submitting the form

Unless otherwise noted, all fields are required to be filled out. If a field is left blank, it will be assumed the requirement or task has not been completed.

Part I: Contact Information

Name of Municipality or Organization:

EPA NPDES Permit Number:

Primary MS4 Program Manager Contact Information

Name: Title:

Street Address Line 1:

Street Address Line 2:

City: State: Zip Code:

Email: Phone Number:

Fax Number:

Stormwater Management Program (SWMP) Information

SWMP Location (web address):

Date SWMP was Last Updated:

If the SWMP is not available on the web please provide the physical address and an explanation of why it is not posted on the web:

Part II: Self Assessment

First, in the box below, select the impairment(s) and/or TMDL(s) that are applicable to your MS4.

Impairment(s)

- Bacteria/Pathogens Chloride Nitrogen Phosphorus
 Solids/ Oil/ Grease (Hydrocarbons)/ Metals

TMDL(s)

- In State:* Assabet River Phosphorus Bacteria and Pathogen Cape Cod Nitrogen
 Charles River Watershed Phosphorus Lake and Pond Phosphorus

- Out of State:* Bacteria/Pathogens Metals Nitrogen Phosphorus

Clear Impairments and TMDLs

Next, check off all requirements below that have been completed. **By checking each box you are certifying that you have completed that permit requirement fully.** If you have not completed a requirement leave the box unchecked. Additional information will be requested in later sections.

Year 1 Requirements

- Develop and begin public education and outreach program
 Identify and develop inventory of all known locations where SSOs have discharged to the MS4 in the last 5 years
 - The SSO inventory is attached to the email submission
 - The SSO inventory can be found at the following website: Develop written IDDE plan including a procedure for screening and sampling outfalls
 IDDE ordinance complete
 Identify each outfall and interconnection discharging from MS4, classify into the relevant category, and priority rank each catchment for investigation
 - The priority ranking of outfalls/interconnections is attached to the email submission
 - The priority ranking of outfalls/interconnections can be found at the following website: Construction/ Erosion and Sediment Control (ESC) ordinance complete
 Develop written procedures for site inspections and enforcement of sediment and erosion control measures
 Develop written procedures for site plan review
 Keep a log of catch basins cleaned or inspected
 Complete inspection of all stormwater treatment structures

Annual Requirements

- Annual opportunity for public participation in review and implementation of SWMP
- Comply with State Public Notice requirements
- Keep records relating to the permit available for 5 years and make available to the public
- Properly store and dispose of catch basin cleanings and street sweepings so they do not discharge to receiving waters
- Annual training to employees involved in IDDE program
- All curbed roadways have been swept a minimum of one time per year

Bacteria/ Pathogens (Combination of Impaired Waters Requirements and TMDL Requirements as Applicable)

Annual Requirements

*Public Education and Outreach**

- Annual message encouraging the proper management of pet waste, including noting any existing ordinances where appropriate
- Permittee or its agents disseminate educational material to dog owners at the time of issuance or renewal of dog license, or other appropriate time
- Provide information to owners of septic systems about proper maintenance in any catchment that discharges to a water body impaired for bacteria

** Public education messages can be combined with other public education requirements as applicable (see Appendix H and F for more information)*

Chloride

Annual Requirements

Public Education and Outreach

- Include an annual message in November/ December to private road salt applicators and commercial industrial site owners on the proper storage and application rates of winter deicing material, along with the steps that can be taken to minimize salt use and protect local waterbodies

Nitrogen (Combination of Impaired Waters Requirements and TMDL Requirements as Applicable)

Annual Requirements

*Public Education and Outreach**

- Distribute an annual message in the spring (April/May) that encourages the proper use and disposal of grass clippings and encourages the proper use of slow-release fertilizers
- Distribute an annual message in the summer (June/July) encouraging the proper management of pet waste, including noting any existing ordinances where appropriate
- Distribute an annual message in the fall (August/September/October) encouraging the proper disposal of leaf litter

** Public education messages can be combined with other public education requirements as applicable (see Appendix H and F for more information)*

Good Housekeeping and Pollution Prevention for Permittee Owned Operations

- Increase street sweeping frequency of all municipal owned streets and parking lots subject to Permit part 2.3.7.a.iii.(c) to a minimum of two times per year (spring and fall)

Potential structural BMPs

- Any structural BMPs listed in Table 3 of Attachment 1 to Appendix H already existing or installed in the regulated area by the permittee or its agents shall be tracked and the permittee shall estimate the
- nitrogen removal by the BMP consistent with Attachment 1 to Appendix H. Document the BMP type, total area treated by the BMP, the design storage volume of the BMP and the estimated nitrogen removed in mass per year by the BMP in each each annual report

Phosphorus (Combination of Impaired Waters Requirements and TMDL Requirements as Applicable)

Annual Requirements

*Public Education and Outreach**

- Distribute an annual message in the spring (April/May) that encourages the proper use and disposal of grass clippings and encourages the proper use of slow-release and phosphorus-free fertilizers
- Distribute an annual message in the summer (June/July) encouraging the proper management of pet waste, including noting any existing ordinances where appropriate
- Distribute an annual message in the fall (August/September/October) encouraging the proper disposal of leaf litter

** Public education messages can be combined with other public education requirements as applicable (see Appendix H and F for more information)*

Good Housekeeping and Pollution Prevention for Permittee Owned Operations

- Increase street sweeping frequency of all municipal owned streets and parking lots subject to Permit part 2.3.7.a.iii.(c) to a minimum of two times per year (spring and fall)

Potential structural BMPs

- Any structural BMPs listed in Attachment 3 to Appendix F already existing or installed in the regulated area by the permittee or its agents shall be tracked and the permittee shall estimate the phosphorus
- removal by the BMP consistent with Attachment 1 to Appendix H. Document the BMP type, total area treated by the BMP, the design storage volume of the BMP and the estimated phosphorus removed in mass per year by the BMP in each each annual report

Solids, Oil and Grease (Hydrocarbons), or Metals

Annual Requirements

Good Housekeeping and Pollution Prevention for Permittee Owned Operations

- Increase street sweeping frequency of all municipal owned streets and parking lots to a schedule to target areas with potential for high pollutant loads
- Prioritize inspection and maintenance for catch basins to ensure that no sump shall be more than 50 percent full; Clean catch basins more frequently if inspection and maintenance activities indicate excessive sediment or debris loadings

Charles River Watershed Phosphorus TMDL

- Begin Phase 1 Phosphorus Control Plan (PCP)

Lake and Pond Phosphorus TMDL

- Begin Phase 1 Lake Phosphorus Control Plan (LPCP)

Use the box below to input additional details on any unchecked boxes above or any additional information you would like to share as part of your self assessment:

The Engineering Department and Public Works in the Town of Reading has revamped their website to accommodate the new annual requirements. While some messages are still to come on various social media networks, they are always available online at <https://www.readingma.gov/storm-water-division> as well as in our office. In addition to work done in our community we are also engaged members of the Mystic River Stormwater Collaborative and disseminate all of their publications as well to our residents. The outfall sampling program this year will serve as a blueprint to removing any further illicit discharges that are discovered.

Part III: Receiving Waters/Impaired Waters/TMDL

Have you made any changes to your lists of receiving waters, outfalls, or impairments since the NOI was submitted?

Yes No

If yes, describe below, including any relevant impairments or TMDLs:

Part IV: Minimum Control Measures

Please fill out all of the metrics below. If applicable, include in the description who completed the task if completed by a third party.

MCM1: Public Education

Number of educational messages completed during the reporting period:

Below, report on the educational messages completed during the first year. For the measurable goal(s) please describe the method/measures used to assess the overall effectiveness of the educational program.

BMP:[1-1 Brochures and Pamphlets]

Message Description and Distribution Method:

The stormwater webpage (<https://www.readingma.gov/storm-water-division>) was updated to include all of the public outreach and educational messages contained in the NOI in one central location, including the formerly proposed BMP 1-2 "Stormwater Information and FAQ".

Targeted Audience:

Responsible Department/Parties:

Measurable Goal(s):

Central location on website for all public outreach and educational messages completed. This includes direct links to the NPDES EPA webpage, Mystic River Stormwater Assoc., the SWMP and all educational messages.

Message Date(s):

Message Completed for: Appendix F Requirements Appendix H Requirements

Was this message different than what was proposed in your NOI? Yes No

If yes, describe why the change was made:

BMP:[1-2; Web page and Social Media Posts]

Message Description and Distribution Method:

This section summarizes the messages on the Towns' facebook and social media. The first message was to remind residents to keep gutter lines and catch basins clear of debris and dispose of any leaf litter with your yard waste during scheduled curbside leaf collection. A reminder for spring leaf collection was posted in March as well as a message about street sweeping. Notices about rain barrel was sent out in the Spring which the Town has a rebate for residents who are interested in stormwater conservation. In June a message about stormwater awareness from the Mystic River Assoc. regarding grass clippings disposal was sent out as well as link to their website with additional information

Targeted Audience:

Responsible Department/Parties:

Measurable Goal(s):

Received 18 likes and 1 share. Used current pictures taken around town as an example of issues when leaves enter the storm drains and catch basins. The spring leaf collection reminder received 6 likes 1 comment and 4 shares on facebook as well. Street sweeping received 13 likes, and the grass clippings post received 2 likes and 1 share.

Message Date(s): 10/25/2019 ; 3/19/2019; 3/27/2019; April 2019; 6/25/2019

Message Completed for: Appendix F Requirements Appendix H Requirements

Was this message different than what was proposed in your NOI? Yes No

If yes, describe why the change was made:

The website was improved to provide additional information, the Stormwater Information and FAQ's are still available, but additional pages have been set up for "Public Education and Outreach" to put all materials in one central location. BMP 1-1 and 1-2 have been slightly modified to be more effective and concise.

BMP:[1-3- Stormwater Sampling Program Newspaper Article]

Message Description and Distribution Method:

The Reading Daily Times Chronicle ran a front page article above the fold on the Stormwater sampling event on August 24th 2018. The article also discussed the MS4 permit and the Towns SWMP.

Targeted Audience: Residents

Responsible Department/Parties: Engineering

Measurable Goal(s):

The message was sent out via the newspaper. It did not receive any feedback or engagement.

Message Date(s): 8/24/2018

Message Completed for: Appendix F Requirements Appendix H Requirements

Was this message different than what was proposed in your NOI? Yes No

If yes, describe why the change was made:

BMP:[1-4; Mystic River Stormwater Association]

Message Description and Distribution Method:

Continued involvement with Mystic River Watershed Association including posting of their educational videos including the "Think Blue" campaign in June of 2018 and LID Stormwater Pollution PSA in April of 2019.

Targeted Audience: Residents

Responsible Department/Parties:

Measurable Goal(s):

Message Date(s):

Message Completed for: Appendix F Requirements Appendix H Requirements

Was this message different than what was proposed in your NOI? Yes No

If yes, describe why the change was made:

BMP:[1-5 School Curriculum and Education]

Message Description and Distribution Method:

Targeted Audience:

Responsible Department/Parties:

Measurable Goal(s):

Message Date(s):

Message Completed for: Appendix F Requirements Appendix H Requirements

Was this message different than what was proposed in your NOI? Yes No

If yes, describe why the change was made:

MCM2: Public Participation

Describe the opportunity provided for public involvement in the development of the Stormwater Management Program (SWMP) during the reporting period:

The SWMP was not completed until mid June, combined with a very busy construction season we were not able to yet hold a public meeting. The SWMP has been uploaded on our website and has not yet received any feedback or input from the public. Any comments or revisions received will be incorporated into the document.

Was this opportunity different than what was proposed in your NOI? Yes No

Describe any other public involvement or participation opportunities conducted during the reporting period:

We have a dedicated stormwater hotline available anytime for discussion or to report any issues or violations in Town.

MCM3: Illicit Discharge Detection and Elimination (IDDE)

Sanitary Sewer Overflows (SSOs)

Below, report on the number of SSOs identified in the MS4 system and removed during this reporting period.

Number of SSOs identified:

Number of SSOs removed:

Below, report on the total number of SSOs identified in the MS4 system and removed to date. At a minimum, report SSOs identified since 2013.

Total number of SSOs identified:

Total number of SSOs removed:

MS4 System Mapping

Describe the status of your MS4 map, including any progress made during the reporting period:

Complete. Outfall mapping will be updated as needed.

Screening of Outfalls/Interconnections

If conducted, please submit any outfall monitoring results from this reporting period. Outfall monitoring results should include the date, outfall/interconnection identifier, location, weather conditions at time of sampling, precipitation in previous 48 hours, field screening parameter results, and results from all analyses.

- The outfall screening data is attached to the email submission
- The outfall screening data can be found at the following website:

Below, report on the number of outfalls/interconnections screened during this reporting period.

Number of outfalls screened:

Below, report on the percent of total outfalls/ interconnections screened to date.

Percent of total outfalls screened:

Catchment Investigations

If conducted, please submit all data collected during this reporting period as part of the dry and wet weather investigations. Also include the presence or absence of System Vulnerability Factors for each catchment.

- The catchment investigation data is attached to the email submission
- The catchment investigation data can be found at the following website:

Below, report on the number of catchment investigations completed during this reporting period.

Number of catchment investigations completed this reporting period:

Below, report on the percent of catchments investigated to date.

Percent of total catchments investigated:

Optional: Provide any additional information for clarity regarding the catchment investigations below:

IDDE Progress

If illicit discharges were found, please submit a document describing work conducted over this reporting period, and cumulative to date, including location source; description of the discharge; method of discovery; date of discovery; and date of elimination, mitigation, or enforcement OR planned corrective measures and schedule of removal.

- The illicit discharge removal report is attached to the email submission
- The illicit discharge removal report can be found at the following website:

Below, report on the number of illicit discharges identified and removed, along with the volume of sewage removed during this reporting period.

Number of illicit discharges identified:

Number of illicit discharges removed:

Estimated volume of sewage removed: [UNITS]

Below, report on the total number of illicit discharges identified and removed to date. At a minimum, report on the number of illicit discharges identified and removed since the effective date of the permit.

Total number of illicit discharges identified:

Total number of illicit discharges removed:

Optional: Provide any additional information for clarity regarding illicit discharges identified, removed, or planned to be removed below:

There have been no illicit discharges identified during the permit period. Problem outfalls will be investigated as necessary after the outfall sampling program is completed.

Employee Training

Describe the frequency and type of employee training conducted during the reporting period:

The Engineering and DPW departments are well versed in noting illicit discharges, the field work for IDDE investigations is given to a subconsultant. A formalized training program is in development.

MCM4: Construction Site Stormwater Runoff Control

Below, report on the construction site plan reviews, inspections, and enforcement actions completed during this reporting period.

Number of site plan reviews completed:

Number of inspections completed:

Number of enforcement actions taken:

MCM5: Post-Construction Stormwater Management in New Development and Redevelopment

Ordinance Development

Describe the status of the post-construction ordinance required to be complete in year 2 of the permit term:

Completed, Subdivision Regulations 7.4.4 - Storm Drainage

As-built Drawings

Describe the status of the measures the MS4 has utilized to require the submission of as-built drawings and ensure long term operation and maintenance of completed construction sites required to be complete in year 2 of the permit term:

As-builts are required as well as operations and maintenance plans for any stormwater devices.

Street Design and Parking Lots Report

Describe the status of the street design and parking lots assessment due in year 4 of the permit term, including any planned or completed changes to local regulations and guidelines:

In progress.

Green Infrastructure Report

Describe the status of the green infrastructure report due in year 4 of the permit term, including the findings and progress towards making the practice allowable:

Green infrastructure is encouraged throughout Town as well as required in the aquifer protection district. During this reporting period numerous stormwater infiltration systems were reviewed and installed.

Retrofit Properties Inventory

Describe the status of the inventory, due in year 4 of the permit term, of permittee-owned properties that could be modified or retrofitted with BMPs to mitigate impervious areas and report on any properties that have been modified or retrofitted:

One property, the Joshua Eaton Elementary school was retrofitted with a stormwater infiltration system during this reporting period. A leaching catch basin was added at the Killam during this reporting period as well.

MCM6: Good Housekeeping**Catch Basin Cleaning**

Describe the status of the catch basin cleaning optimization plan:

The Town has developed a mobile application to track catch basin inspections and cleaning.

If complete, attach the catch basin cleaning optimization plan or the schedule to gather information to develop the optimization plan:

- The catch basin cleaning optimization plan or schedule is attached to the email submission
- The catch basin cleaning optimization plan or schedule can be found at the following website:

<https://readingma.maps.arcgis.com/apps/dashboard/index.html#/bae703db718f4b95ab40997faf5b97cd>

Below, report on the number of catch basins inspected and cleaned, along with the total volume of material removed from the catch basins during this reporting period.

Number of catch basins inspected:

Number of catch basins cleaned:

Total volume or mass of material removed from all catch basins:

Below, report on the total number of catch basins in the MS4 system, if known.

Total number of catch basins:

If applicable:

Report on the actions taken if a catch basin sump is more than 50% full during two consecutive routine inspections/cleaning events:

N/A has not occurred. The 3,365 catch basins reported above includes private systems, which will be revised for the next permit term.

Street Sweeping

Describe the status of the written procedures for sweeping streets and municipal-owned lots:

All streets, lots and municipal facilities in Town are swept in the spring as well as the fall. With approximately 110 miles of roadway in town that results in nearly 440 miles of street sweeping annually.

Report on street sweeping completed during the reporting period using one of the three metrics below.

Number of miles cleaned:

Volume of material removed: [UNITS]

Weight of material removed: [UNITS]

If applicable:

For rural uncurbed roadways with no catch basins, describe the progress of the inspection, documentation, and targeted sweeping plan:

All streets are swept regardless of existing drainage infrastructure.

Winter Road Maintenance

Describe the status of the written procedures for winter road maintenance including the storage of salt and sand:

The Town no longer uses sand on its roadways. Generally, will pre-treat with salt, and continue to use salt during any snow event. When the temperature decreases to a point where salt is no longer effective (20 degrees) the town mixes the salt with a calcium chloride solution, which aids in the melting process. The salt is stored in a covered garage.

Inventory of Permittee-Owned Properties

Describe the status of the inventory, due in year 2 of the permit term, of permittee-owned properties, including parks and open spaces, buildings and facilities, and vehicles and equipment, and include any updates:

In progress

O&M Procedures for Parks and Open Spaces, Buildings and Facilities, and Vehicles and Equipment

Describe the status of the operation and maintenance procedures, due in year 2 of the permit term, of permittee-owned properties (parks and open spaces, buildings and facilities, vehicles and equipment) and include maintenance activities associated with each:

In progress

Stormwater Pollution Prevention Plan (SWPPP)

Describe the status of any SWPPP, due in year 2 of the permit term, for permittee-owned or operated facilities including maintenance garages, public works yards, transfer stations, and other waste handling facilities where pollutants are exposed to stormwater:

SWPP completed for Reading Municipal Light Department and three substations in 2016.

Below, report on the number of site inspections for facilities that require a SWPPP completed during this reporting period.

Number of site inspections completed:

Describe any corrective actions taken at a facility with a SWPPP:

N/A

O&M Procedures for Stormwater Treatment Structures

Describe the status of the written procedure for stormwater treatment structure maintenance:

In progress

Additional Information

Monitoring or Study Results

Results from any other stormwater or receiving water quality monitoring or studies conducted during the reporting period not otherwise mentioned above, where the data is being used to inform permit compliance or permit effectiveness must be attached.

- Not applicable
- The results from additional reports or studies are attached to the email submission
- The results from additional reports or studies can be found at the following website(s):

If such monitoring or studies were conducted on your behalf or if monitoring or studies conducted by other entities were reported to you, a brief description of the type of information gathered or received shall be described below:

Phosphorus Sampling was completed for outfalls within the Aberjona River Watershed.

Additional Information

Optional: Enter any additional information relevant to your stormwater management program implementation during the reporting period. Include any BMP modifications made by the MS4 if not already discussed above:

The Town of Reading has established a Stormwater Enterprise Fund which is dedicated to funding and improving stormwater issues within Town dating back to 2006. This has allowed the Town to be proactive in regards to its stormwater management.

Activities Planned for Next Reporting Period

Please confirm that your SWMP has been, or will be, updated to comply with all applicable permit requirements including but not limited to the year 2 requirements summarized below. (Note: impaired waters and TMDL requirements are not listed below)

Yes, I agree

- Complete system mapping Phase I
- Begin investigations of catchments associated with Problem Outfalls
- Develop or modify an ordinance or other regulatory mechanism for post-construction stormwater runoff from new development and redevelopment
- Establish and implement written procedures to require the submission of as-built drawings no later than two years after the completion of construction projects
- Develop, if not already developed, written operations and maintenance procedures
- Develop an inventory of all permittee owned facilities in the categories of parks and open space, buildings and facilities, and vehicles and equipment; review annually and update as necessary
- Establish a written program detailing the activities and procedures the permittee will implement so that the MS4 infrastructure is maintained in a timely manner
- Develop and implement a written SWPPP for maintenance garages, public works yards, transfer stations, and other waste handling facilities where pollutants are exposed to stormwater
- Enclose or cover storage piles of salt or piles containing salt used for deicing or other purposes
- Develop, if not already developed, written procedures for sweeping streets and municipal-owned lots
- Develop, if not already developed, written procedures for winter road maintenance including storage of salt and sand
- Develop, if not already developed, a schedule for catch basin cleaning
- Develop, if not already developed, a written procedure for stormwater treatment structure maintenance
- Develop a written catchment investigation procedure (*18 months*)

Annual Requirements

- Annual report submitted and available to the public
- Annual opportunity for public participation in review and implementation of SWMP
- Keep records relating to the permit available for 5 years and make available to the public
- Properly store and dispose of catch basin cleanings and street sweepings so they do not discharge to receiving waters
- Annual training to employees involved in IDDE program
- Update inventory of all known locations where SSOs have discharged to the MS4 in the last 5 years
- Continue public education and outreach program
- Update outfall and interconnection inventory and priority ranking and include data collected in connection with the dry weather screening and other relevant inspections conducted
- Implement IDDE program
- Review site plans of construction sites as part of the construction stormwater runoff control program
- Conduct site inspection of construction sites as necessary
- Inspect and maintain stormwater treatment structures
- Log catch basins cleaned or inspected
- Sweep all uncurbed streets at least annually

Provide any additional details on activities planned for permit year 2 below:

The Town intends on meeting the requirements of the permit for year 2.



Part V: Certification of Small MS4 Annual Report 2019

40 CFR 144.32(d) Certification

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, I certify that the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Name: Title:

Signature: Date:

[Signatory may be a duly authorized representative]

Year 2 Annual Report
Massachusetts Small MS4 General Permit
Reporting Period: July 1, 2019-June 30, 2020

Please DO NOT attach any documents to this form. Instead, attach all requested documents to an email when submitting the form

Unless otherwise noted, all fields are required to be filled out. If a field is left blank, it will be assumed the requirement or task has not been completed. Please ONLY report on activities between July 1, 2019 and June 30, 2020 unless otherwise requested.

Part I: Contact Information

Name of Municipality or Organization:

EPA NPDES Permit Number:

Primary MS4 Program Manager Contact Information

Name:

Title:

Street Address Line 1:

Street Address Line 2:

City:

State:

Zip Code:

Email:

Phone Number:

Stormwater Management Program (SWMP) Information

SWMP Location (web address):

Date SWMP was Last Updated:

If the SWMP is not available on the web please provide the physical address:

Part II: Self-Assessment

First, in the box below, select the impairment(s) and/or TMDL(s) that are applicable to your MS4. Make sure you are referring to the most recent EPA approved Section 303(d) Impaired Waters List which can be found here: <https://www.epa.gov/tmdl/region-1-impaired-waters-and-303d-lists-state>

Impairment(s)			
<input checked="" type="checkbox"/> Bacteria/Pathogens	<input type="checkbox"/> Chloride	<input type="checkbox"/> Nitrogen	<input checked="" type="checkbox"/> Phosphorus
<input checked="" type="checkbox"/> Solids/ Oil/ Grease (Hydrocarbons)/ Metals			
TMDL(s)			
<i>In State:</i>	<input type="checkbox"/> Assabet River Phosphorus	<input type="checkbox"/> Bacteria and Pathogen	<input type="checkbox"/> Cape Cod Nitrogen
	<input type="checkbox"/> Charles River Watershed Phosphorus	<input type="checkbox"/> Lake and Pond Phosphorus	
<i>Out of State:</i>	<input type="checkbox"/> Bacteria/Pathogens	<input type="checkbox"/> Metals	<input type="checkbox"/> Nitrogen
			<input type="checkbox"/> Phosphorus
			Clear Impairments and TMDLs

Next, check off all requirements below that have been completed. **By checking each box you are certifying that you have completed that permit requirement fully.** If you have not completed a requirement leave the box unchecked. Additional information will be requested in later sections.

Year 2 Requirements

- Completed Phase I of system mapping
- Developed a written catchment investigation procedure and added the procedure to the SWMP
- Developed written procedures to require the submission of as-built drawings and ensure the long term operation and maintenance of completed construction sites and added these procedures to the SWMP
- Enclosed or covered storage piles of salt or piles containing salt used for deicing or other purposes
- Developed written operations and maintenance procedures for parks and open space, buildings and facilities, and vehicles and equipment and added these procedures to the SWMP
- Developed an inventory of all permittee owned facilities in the categories of parks and open space, buildings and facilities, and vehicles and equipment and added this inventory to the SWMP
- Completed a written program for MS4 infrastructure maintenance to reduce the discharge of pollutants
- Developed written SWPPPs, included in the SWMP, for all of the following permittee owned or
- operated facilities: maintenance garages, public works yards, transfer stations, and other waste handling facilities where pollutants are exposed to stormwater

Optional: If you would like to describe progress made on any incomplete requirements listed above, provide any additional information, and/or if any of the above year 2 requirements could not be completed due to the impacts of COVID-19, please identify the requirement that could not be completed, any actions taken to attempt to complete the requirement, and reason the requirement could not be completed below:

Annual Requirements

- Provided an opportunity for public participation in review and implementation of SWMP and complied with State Public Notice requirements
- Kept records relating to the permit available for 5 years and made available to the public
- The SSO inventory has been updated, including the status of mitigation and corrective measures implemented
- This is not applicable because we do not have sanitary sewer
 - This is not applicable because we did not find any new SSOs
 - The updated SSO inventory is attached to the email submission
 - The updated SSO inventory can be found at the following website:
-
- Properly stored and disposed of catch basin cleanings and street sweepings so they did not discharge to receiving waters
- Provided training to employees involved in IDDE program within the reporting period
- All curbed roadways were swept at least once within the reporting period
- Updated outfall and interconnection inventory and priority ranking as needed

Optional: If you would like to describe progress made on any incomplete requirements listed above, provide any additional information, and/or if any of the above annual requirements could not be completed due to the impacts of COVID-19, please identify the requirement that could not be completed, any actions taken to attempt to complete the requirement, and reason the requirement could not be completed below:

We intended to hold a public meeting this past spring to present the SWMP and receive feedback but that was not possible due to COVID-19.

Bacteria/ Pathogens (Combination of Impaired Waters Requirements and TMDL Requirements as Applicable)Annual Requirements*Public Education and Outreach**

- Annual message was distributed encouraging the proper management of pet waste, including noting any existing ordinances where appropriate
- Permittee or its agents disseminated educational material to dog owners at the time of issuance or renewal of dog license, or other appropriate time
- Provided information to owners of septic systems about proper maintenance in any catchment that discharges to a water body impaired for bacteria

** Public education messages can be combined with other public education requirements as applicable (see Appendix H and F for more information)*

Optional: If you would like to describe progress made on any incomplete requirements listed above or provide any additional details, please use the box below:

The messages for dog licenses and septic system owners are being designed for next year.

Phosphorus (Combination of Impaired Waters Requirements and TMDL Requirements as Applicable)

Annual Requirements

*Public Education and Outreach**

- Distributed an annual message in the spring (April/May) encouraging the proper use and disposal of grass clippings and encouraging the proper use of slow-release and phosphorus-free fertilizers
- Distributed an annual message in the summer (June/July) encouraging the proper management of pet waste, including noting any existing ordinances where appropriate
- Distributed an annual message in the fall (August/September/October) encouraging the proper disposal of leaf litter

* *Public education messages can be combined with other public education requirements as applicable (see Appendix H and F for more information)*

Good Housekeeping and Pollution Prevention for Permittee Owned Operations

- Increased street sweeping frequency of all municipal owned streets and parking lots subject to Permit part 2.3.7.a.iii.(c) to a minimum of two times per year (spring and fall)

Potential structural BMPs

- Any structural BMPs already existing or installed in the regulated area by the permittee or its agents was tracked and the phosphorus removal by the BMP was estimated consistent with Attachment 3 to Appendix F. The BMP type, total area treated by the BMP, the design storage volume of the BMP and the estimated phosphorus removed in mass per year by the BMP were documented.

- The BMP information is attached to the email submission
- The BMP information can be found at the following website:

Optional: If you would like to describe progress made on any incomplete requirements listed above or provide any additional details, please use the box below:

The Town is working through the calculations for Phosphorous removal and will be available during the next permit term.

Solids, Oil and Grease (Hydrocarbons), or Metals

Annual Requirements

Good Housekeeping and Pollution Prevention for Permittee Owned Operations

- Increased street sweeping frequency of all municipal owned streets and parking lots to a schedule that targets areas with potential for high pollutant loads
- Prioritized inspection and maintenance for catch basins to ensure that no sump shall be more than 50 percent full; Cleaned catch basins more frequently if inspection and maintenance activities indicated excessive sediment or debris loadings

Optional: If you would like to describe progress made on any incomplete requirements listed above or provide any additional details, please use the box below:

The Town has developed a mobile application to track catch basin cleaning status and material removed in

real time.

Optional: Use the box below to provide any additional information you would like to share as part of your self-assessment:

Part III: Receiving Waters/Impaired Waters/TMDL

Have you made any changes to your lists of receiving waters, outfalls, or impairments since the NOI was submitted?

- Yes
- No

If yes, describe below, including any relevant impairments or TMDLs:

Outfall inspections have been completed, an updated inventory shall be expected during the next reporting period. The Town will work with our consultant to update the ownership via GIS.

Part IV: Minimum Control Measures

Please fill out all of the metrics below. If applicable, include in the description who completed the task if completed by a third party.

MCM1: Public Education

Number of educational messages completed during this reporting period:

Below, report on the educational messages completed during this reporting period. For the measurable goal(s) please describe the method/measures used to assess the overall effectiveness of the educational program.

BMP:Joshua Eaton Stormwater Eduation

Message Description and Distribution Method:

Facebook post detailing the DPW and Engineering departments installation of a series of Cultech Infiltration systems to reduce flooding at an elementary school.

Targeted Audience:

Responsible Department/Parties:

Measurable Goal(s):

Report on interesting projects on behalf of Engineering and educate the public about stormwater management best practices via Facebook. The post reached 1,366 people 144 engagements, 22 likes, 2 clicks and 2 comments.

Message Date(s):

Message Completed for: Appendix F Requirements Appendix H Requirements

Was this message different than what was proposed in your NOI? Yes No

If yes, describe why the change was made:

BMP:Fowl Water Video

Message Description and Distribution Method:

Message for residents on the importance of clean runoff produce by ThinkBlue Massachusetts via Facebook.

Targeted Audience:

Responsible Department/Parties:

Measurable Goal(s):

The post reached 387 people. It was linked on the facebook so could not capture views on youtube.

Message Date(s): 9/10/2019

Message Completed for: Appendix F Requirements Appendix H Requirements

Was this message different than what was proposed in your NOI? Yes No

If yes, describe why the change was made:

BMP:Put a Lid on It

Message Description and Distribution Method:

Put a lid on your dumpster via the mystic river watershed association collaborative.

Targeted Audience: Businesses, institutions and commercial facilities

Responsible Department/Parties: Engineering

Measurable Goal(s):

The post reached 861 people, 15 engagements, 3 likes, 12 clicks.

Message Date(s):

Message Completed for: Appendix F Requirements Appendix H Requirements

Was this message different than what was proposed in your NOI? Yes No

If yes, describe why the change was made:

BMP:Clean up After Dogs

Message Description and Distribution Method:

Two messages sent in early May after staff had noticed more people walking dogs and dog waste than a typical summer.

Targeted Audience: Residents

Responsible Department/Parties: Engineering

Measurable Goal(s):

The two messages combined for 2,409 reached, 238 engagements, 51 likes, 187 clicks and 5 comments. The first post was out most viewed or engaged post of the year. As a whole we reached an audience of over 5,000 people for the year

Message Date(s): 5/8/2020 and 5/11/2020

Message Completed for: Appendix F Requirements Appendix H Requirements

Was this message different than what was proposed in your NOI? Yes No

If yes, describe why the change was made:

[Empty text box for describing changes]

Add an Educational Message

MCM2: Public Participation

Describe the opportunity provided for public involvement in the development of the Stormwater Management Program (SWMP) during this reporting period:

During the pandemic it has been difficult to set meetings for public involvement. We plan to hold a meeting once we believe people will feel safe to attend.

Was this opportunity different than what was proposed in your NOI? Yes No

Describe any other public involvement or participation opportunities conducted during this reporting period:

[Empty text box for describing other public involvement opportunities]

MCM3: Illicit Discharge Detection and Elimination (IDDE)

Sanitary Sewer Overflows (SSOs)

Check off the box below if the statement is true.

This SSO section is NOT applicable because we DO NOT have sanitary sewer

Below, report on the number of SSOs identified in the MS4 system and removed during this reporting period.

Number of SSOs identified:

Number of SSOs removed:

MS4 System Mapping

Below, check all that apply.

The following elements of the Phase I map have been completed:

- Outfalls and receiving waters
- Open channel conveyances
- Interconnections
- Municipally-owned stormwater treatment structures
- Waterbodies identified by name and indication of all use impairments
- Initial catchment delineations

Optional: Describe any additional progress you made on your map during this reporting period or provide additional status information regarding your map:

Initial catchment delineations have been created for all outfalls with sampling results above the threshold.

Screening of Outfalls/Interconnections

If conducted, please submit any outfall monitoring results from this reporting period. Outfall monitoring results should include the date, outfall/interconnection identifier, location, weather conditions at time of sampling, precipitation in previous 48 hours, field screening parameter results, and results from all analyses.

- The outfall screening data is attached to the email submission
- The outfall screening data can be found at the following website:

Below, report on the number of outfalls/interconnections screened during this reporting period.

Number of outfalls screened:

Catchment Investigations

If conducted, please submit all data collected during this reporting period as part of the dry and wet weather investigations. Also include the presence or absence of System Vulnerability Factors for each catchment.

- The catchment investigation data is attached to the email submission
- The catchment investigation data can be found at the following website:

Below, report on the number of catchment investigations completed during this reporting period.

Number of catchment investigations completed this reporting period:

Below, report on the percent of catchments investigated to date.

Percent of total catchments investigated:

Optional: Provide any additional information for clarity regarding the catchment investigations below:

Drainage structures have been confirmed during previous reporting periods and reflected in the GIS.

Catchments with outfalls above the limits have been investigated during the Year 3 term last summer and will be added to the next Annual Report.

IDDE Progress

If illicit discharges were found, please submit a document describing work conducted over this reporting period, and cumulative to date, including location source; description of the discharge; method of discovery; date of discovery; and date of elimination, mitigation, or enforcement OR planned corrective measures and schedule of removal.

- The illicit discharge removal report is attached to the email submission
- The illicit discharge removal report can be found at the following website:

Below, report on the number of illicit discharges identified and removed, along with the volume of sewage removed during this reporting period.

Number of illicit discharges identified:

Number of illicit discharges removed:

Estimated volume of sewage removed: gallons/day

Below, report on the total number of illicit discharges identified and removed to date. At a minimum, report on the number of illicit discharges identified and removed since the effective date of the permit (July 1, 2018).

Total number of illicit discharges identified:

Total number of illicit discharges removed:

Optional: Provide any additional information for clarity regarding illicit discharges identified, removed, or planned to be removed below:

A total of 16 outfalls with pollutants above the threshold have been followed up on in September 2020 and their catchments delineated. We believe we are close to narrowing down an issue at our biggest problem outfall.

Employee Training

Describe the frequency and type of employee training conducted during the reporting period:

A power point presentation was given to DPW staff before the pandemic started.

MCM4: Construction Site Stormwater Runoff Control

Below, report on the construction site plan reviews, inspections, and enforcement actions completed during this reporting period.

Number of site plan reviews completed: 6

Number of inspections completed: 6

Number of enforcement actions taken: 0

Optional: Enter any additional information relevant to construction site plan reviews, inspections, and enforcement actions:

Full site plan reviews with the Planning Board totaled 6. However, a review of stormwater conditions is required within our aquifer protection zone which account for a much larger number.

MCM5: Post-Construction Stormwater Management in New Development and Redevelopment

Ordinance or Regulatory Mechanism

Below, select the option that describes your ordinance or regulatory mechanism progress.

- Bylaw, ordinance, or regulations are updated and adopted consistent with permit requirements
- Bylaw, ordinance, or regulations are updated consistent with permit requirements but are not yet adopted
- Bylaw, ordinance, or regulations have not been updated or adopted

As-built Drawings

Describe the measures the MS4 has utilized to require the submission of as-built drawings and ensure long term operation and maintenance of completed construction sites:

As built drawings and maintenance records for stormwater infrastructure are due by January 15th every year.

Street Design and Parking Lots Report

Describe the status of the street design and parking lots assessment due in year 4 of the permit term, including any planned or completed changes to local regulations and guidelines:

Impervious cover is limited and regulated within the Aquifer Protection District, currently there is no assessment for the rest of the Town. The Town has been utilizing infiltrating catch basins as part of our paving program.

Green Infrastructure Report

Describe the status of the green infrastructure report due in year 4 of the permit term, including the findings and progress towards making the practice allowable:

Infiltration is often required for building within the Aquifer Protection District, many of these other practices are allowable already in Town.

Retrofit Properties Inventory

Describe the status of the inventory, due in year 4 of the permit term, of permittee-owned properties that could be modified or retrofitted with BMPs to mitigate impervious areas and report on any properties that have been modified or retrofitted:

One of the properties identified has already been retrofitted and installed. The remaining properties will be identified by year 4 of the permit term.

MCM6: Good Housekeeping

Catch Basin Cleaning

Below, report on the number of catch basins inspected and cleaned, along with the total volume of material removed from the catch basins during this reporting period.

Number of catch basins inspected:

Number of catch basins cleaned:

Total volume or mass of material removed from all catch basins:

Below, report on the total number of catch basins in the MS4 system.

Total number of catch basins:

If applicable:

Report on the actions taken if a catch basin sump is more than 50% full during two consecutive routine inspections/cleaning events:

N/A. The above count for catch basins includes private systems which are not maintained by the Town. A more accurate count will be provided.

Street Sweeping

Report on street sweeping completed during this reporting period using one of the three metrics below.

- Number of miles cleaned:
- Volume of material removed: [Select Units]
- Weight of material removed: [Select Units]

O&M Procedures and Inventory of Permittee-Owned Properties

Below, check all that apply.

The following permittee-owned properties have been inventoried:

- Parks and open spaces
- Buildings and facilities
- Vehicles and equipment

The following O&M procedures for permittee-owned properties have been completed:

- Parks and open spaces
- Buildings and facilities
- Vehicles and equipment

Stormwater Pollution Prevention Plan (SWPPP)

Below, report on the number of site inspections for facilities that require a SWPPP completed during this reporting period.

Number of site inspections completed:

Describe any corrective actions taken at a facility with a SWPPP:

Additional Information

Monitoring or Study Results

Results from any other stormwater or receiving water quality monitoring or studies conducted during the reporting period not otherwise mentioned above, where the data is being used to inform permit compliance or permit effectiveness must be attached.

- Not applicable
- The results from additional reports or studies are attached to the email submission
- The results from additional reports or studies can be found at the following website(s):

If such monitoring or studies were conducted on your behalf or if monitoring or studies conducted by other entities were reported to you, a brief description of the type of information gathered or received shall be described below:

--

Additional Information

Optional: Enter any additional information relevant to your stormwater management program implementation during the reporting period. Include any BMP modifications made by the MS4 if not already discussed above:

The Town had the pleasure of working with EPA and DEP along with other communities as part of the Mystic River Watershed focus group. The working group was very informative and will allow the Town to use the lessons learned to improve our stormwater management. We also are members of the Mystic River Watershed Association which meets quarterly.

COVID-19 Impacts

Optional: If any of the above year 2 requirements could not be completed due to the impacts of COVID-19, please identify the requirement that could not be completed, any actions taken to attempt to complete the requirement, and reason the requirement could not be completed below:

The biggest issue for the Town is holding a public meeting, or getting people to attend a meeting. Additionally, IDDE was difficult as we did not allow for two people in the same vehicle for much of the summer.

Activities Planned for Next Reporting Period

Please confirm that your SWMP has been, or will be, updated to comply with all applicable permit requirements including but not limited to the year 3 requirements summarized below. (Note: impaired waters and TMDL requirements are not listed below)

Yes, I agree

- Inspect all outfalls/ interconnections (excluding Problem and Excluded outfalls) for the presence of dry weather flow
- Complete follow-up ranking as dry weather screening becomes available

Annual Requirements

- Annual report submitted and available to the public
- Annual opportunity for public participation in review and implementation of SWMP
- Keep records relating to the permit available for 5 years and make available to the public
- Properly store and dispose of catch basin cleanings and street sweepings so they do not discharge to receiving waters
- Annual training to employees involved in IDDE program
- Update inventory of all known locations where SSOs have discharged to the MS4
- Continue public education and outreach program
- Update outfall and interconnection inventory and priority ranking and include data collected in

- connection with the dry weather screening and other relevant inspections conducted
- Implement IDDE program
- Review site plans of construction sites as part of the construction stormwater runoff control program
- Conduct site inspection of construction sites as necessary
- Inspect and maintain stormwater treatment structures
- Log catch basins cleaned or inspected
- Sweep all uncurbed streets at least annually
- Continue investigations of catchments associated with Problem Outfalls
- Review inventory of all permittee owned facilities in the categories of parks and open space, buildings and facilities, and vehicles and equipment; update if necessary

Provide any additional details on activities planned for permit year 3 below:

The Town intends to meet the requirements for permit term year 3.

Part V: Certification of Small MS4 Annual Report 2020

40 CFR 144.32(d) Certification

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, I certify that the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Name:

Title:

Signature: 

Date:

[Signatory may be a duly authorized representative]

Year 3 Annual Report
Massachusetts Small MS4 General Permit
Reporting Period: July 1, 2020-June 30, 2021

Please DO NOT attach any documents to this form. Instead, attach all requested documents to an email when submitting the form

Unless otherwise noted, all fields are required to be filled out. If a field is left blank, it will be assumed the requirement or task has not been completed. Please ONLY report on activities between July 1, 2020 and June 30, 2021 unless otherwise requested.

Part I: Contact Information

Name of Municipality or Organization:

EPA NPDES Permit Number:

Primary MS4 Program Manager Contact Information

Name:

Title:

Street Address Line 1:

Street Address Line 2:

City:

State:

Zip Code:

Email:

Phone Number:

Stormwater Management Program (SWMP) Information

SWMP Location (web address):

Date SWMP was Last Updated:

If the SWMP is not available on the web please provide the physical address:

Part II: Self-Assessment

First, in the box below, select the impairment(s) and/or TMDL(s) that are applicable to your MS4. Make sure you are referring to the most recent EPA approved Section 303(d) Impaired Waters List which can be found here: <https://www.epa.gov/tmdl/region-1-impaired-waters-and-303d-lists-state>

Impairment(s)

Bacteria/Pathogens
 Chloride
 Nitrogen
 Phosphorus
 Solids/ Oil/ Grease (Hydrocarbons)/ Metals

TMDL(s)

In State:
 Assabet River Phosphorus
 Bacteria and Pathogen
 Cape Cod Nitrogen
 Charles River Watershed Phosphorus
 Lake and Pond Phosphorus

Out of State:
 Bacteria/Pathogens
 Metals
 Nitrogen
 Phosphorus

Clear Impairments and TMDLs

Next, check off all requirements below that have been completed. **By checking each box you are certifying that you have completed that permit requirement fully.** If you have not completed a requirement leave the box unchecked. Additional information will be requested in later sections.

Year 3 Requirements

- Inspected and screened all outfalls/interconnections (excluding Problem and Excluded outfalls)
- Updated outfall/interconnection priority ranking based on the information collected during the dry weather inspections as necessary
- Post-construction bylaw, ordinance, or other regulatory mechanism was updated and adopted consistent with permit requirements

Optional: If you would like to describe progress made on any incomplete requirements listed above, provide any additional information, and/or if any of the above year 3 requirements could not be completed due to the impacts of COVID-19, please identify the requirement that could not be completed, any actions taken to attempt to complete the requirement, and reason the requirement could not be completed below:

Public meeting has not been held on SWMP review and implementation.

Annual Requirements

- Provided an opportunity for public participation in review and implementation of SWMP and complied with State Public Notice requirements
- Kept records relating to the permit available for 5 years and made available to the public
- The SSO inventory has been updated, including the status of mitigation and corrective measures implemented
 - This is not applicable because we do not have sanitary sewer
 - This is not applicable because we did not find any new SSOs

- The updated SSO inventory is attached to the email submission
- The updated SSO inventory can be found at the following website:

- Properly stored and disposed of catch basin cleanings and street sweepings so they did not discharge to receiving waters
- Provided training to employees involved in IDDE program within the reporting period
- All curbed roadways were swept at least once within the reporting period
- Updated system map due in year 2 as necessary
- Enclosed all road salt storage piles or facilities and implemented winter road maintenance procedures to minimize the use of road salt
- Implemented SWPPPs for all permittee owned or operated maintenance garages, public works yards, transfer stations, and other waste handling facilities
- Updated inventory of all permittee owned facilities as necessary
- O&M programs for all permittee owned facilities have been completed and updated as necessary
- Implemented all maintenance procedures for permittee owned facilities in accordance with O&M programs
- Implemented program for MS4 infrastructure maintenance to reduce the discharge of pollutants
- Inspected all permittee owned treatment structures (excluding catch basins)

Optional: If you would like to describe progress made on any incomplete requirements listed above, provide any additional information, and/or if any of the above annual requirements could not be completed due to the impacts of COVID-19, please identify the requirement that could not be completed, any actions taken to attempt to complete the requirement, and reason the requirement could not be completed below:

Indoor employee training was paused for a large portion of the year. We will resume during the next reporting period.

Bacteria/ Pathogens (Combination of Impaired Waters Requirements and TMDL Requirements as Applicable)

Annual Requirements

*Public Education and Outreach**

- Annual message was distributed encouraging the proper management of pet waste, including noting any existing ordinances where appropriate
- Permittee or its agents disseminated educational material to dog owners at the time of issuance or renewal of dog license, or other appropriate time
- Provided information to owners of septic systems about proper maintenance in any catchment that discharges to a water body impaired for bacteria

** Public education messages can be combined with other public education requirements as applicable (see Appendix H and F for more information)*

Optional: If you would like to describe progress made on any incomplete requirements listed above or provide any additional details, please use the box below:

The SWMP will be updated for the next reporting period.

Phosphorus (Combination of Impaired Waters Requirements and TMDL Requirements as Applicable)

Annual Requirements

*Public Education and Outreach**

- Distributed an annual message in the spring (April/May) encouraging the proper use and disposal of grass clippings and encouraging the proper use of slow-release and phosphorus-free fertilizers
- Distributed an annual message in the summer (June/July) encouraging the proper management of pet waste, including noting any existing ordinances where appropriate
- Distributed an annual message in the fall (August/September/October) encouraging the proper disposal of leaf litter

* *Public education messages can be combined with other public education requirements as applicable (see Appendix H and F for more information)*

Good Housekeeping and Pollution Prevention for Permittee Owned Operations

- Increased street sweeping frequency of all municipal owned streets and parking lots subject to Permit part 2.3.7.a.iii.(c) to a minimum of two times per year (spring and fall)

Potential structural BMPs

Any structural BMPs already existing or installed in the regulated area by the permittee or its agents was tracked and the phosphorus removal by the BMP was estimated consistent with Attachment 3 to Appendix F. The BMP type, total area treated by the BMP, the design storage volume of the BMP and the estimated phosphorus removed in mass per year by the BMP were documented.

- The BMP information is attached to the email submission
- The BMP information can be found at the following website:

Optional: If you would like to describe progress made on any incomplete requirements listed above or provide any additional details, please use the box below:

The phosphorus removal calculations are not yet complete. The Town of Reading has started to keep an inventory of such structures but have not yet completed the calculations.

Solids, Oil and Grease (Hydrocarbons), or Metals

Annual Requirements

Good Housekeeping and Pollution Prevention for Permittee Owned Operations

- Increased street sweeping frequency of all municipal owned streets and parking lots to a schedule that targets areas with potential for high pollutant loads
- Prioritized inspection and maintenance for catch basins to ensure that no sump shall be more than 50 percent full; Cleaned catch basins more frequently if inspection and maintenance activities indicated excessive sediment or debris loadings

Optional: If you would like to describe progress made on any incomplete requirements listed above or provide any additional details, please use the box below:

Optional: Use the box below to provide any additional information you would like to share as part of your self-assessment:

Part III: Receiving Waters/Impaired Waters/TMDL

Have you made any changes to your lists of receiving waters, outfalls, or impairments since the NOI was submitted?

- Yes
- No

If yes, describe below, including any relevant impairments or TMDLs:

Part IV: Minimum Control Measures

Please fill out all of the metrics below. If applicable, include in the description who completed the task if completed by a third party.

MCM1: Public Education

Number of educational messages completed during this reporting period: 6

Below, report on the educational messages completed during this reporting period. For the measurable goal(s) please describe the method/measures used to assess the overall effectiveness of the educational program.

BMP: Proper Lawn Care

Message Description and Distribution Method:

Facebook post regarding proper lawn clipping management and removal.

Targeted Audience: Residents, Businesses

Responsible Department/Parties: Engineering

Measurable Goal(s):

Total Reach 1,808 users; 161 engagements; 24 likes; 137 clicks; 1 share.

Message Date(s): 7/28/2020

Message Completed for: Appendix F Requirements Appendix H Requirements

Was this message different than what was proposed in your NOI? Yes No

If yes, describe why the change was made:

BMP: Proper Pet Disposal

Message Description and Distribution Method:

Reminder to please clean up after your pet

Targeted Audience: Residents

Responsible Department/Parties: Engineering

Measurable Goal(s):

Total Reach 2,859 214 engagements; 20 likes; 176 clicks; 2 comments; 3 shares; Second message had a reach of 1,119 ; 61 engagements; 8 likes ; 4 shares.

Message Date(s): 8/17/2020; 6/10/2021

Message Completed for: Appendix F Requirements Appendix H Requirements

Was this message different than what was proposed in your NOI? Yes No

If yes, describe why the change was made:

BMP:Leaf Litter

Message Description and Distribution Method:

Message to residents asking to clean gutter lines and catch basins from leaves before heavy rains. This reduces flooding and phosphorus loading to rivers and streams.

Targeted Audience: Residents

Responsible Department/Parties: Engineering

Measurable Goal(s):

Total Reach 1331 ; 123 engagements; 24 likes; 1 comments

Message Date(s): 10/16/2020

Message Completed for: Appendix F Requirements Appendix H Requirements

Was this message different than what was proposed in your NOI? Yes No

If yes, describe why the change was made:

BMP:Keep Catch Bains Clear

Message Description and Distribution Method:

Message sent out during winter to clear catch basins, getting residents on board here helps with phosphorus in the summer and fall as well as salt in the winter.

Targeted Audience: Residents

Responsible Department/Parties: Engineering

Measurable Goal(s):

Total Reach 1011; 20 engagements; 10 likes; 2 shares

Message Date(s): 12/21/2020

Message Completed for: Appendix F Requirements Appendix H Requirements

Was this message different than what was proposed in your NOI? Yes No

If yes, describe why the change was made:

BMP:Street Sweeping and Catch Basin Cleaning

Message Description and Distribution Method:

Reminder to not dispose of anything into a storm drain.

Targeted Audience: Residents

Responsible Department/Parties: Engineering

Measurable Goal(s):

Total Reach 2041; 114 engagements; 9 likes; 2 shares

Message Date(s): 03/24/2021

Message Completed for: Appendix F Requirements Appendix H Requirements

Was this message different than what was proposed in your NOI? Yes No

If yes, describe why the change was made:

BMP:Mystic River Watershed and Think Blue

Message Description and Distribution Method:

We partner with the Mystic River Watershed and Think Blue MA to distribute additional public messages.

Targeted Audience: Residents

Responsible Department/Parties: Engineering

Measurable Goal(s):

Facebook and google impressions are first collected then distributed as a percent of the population of the watershed. Using this methodology the Town of Reading accounts for approximately 6,000 views on facebook and instagram ; and 4,500 impressions on youtube. The ads have a post survey which indicates great success.

Message Date(s): Spring 2021

Message Completed for: Appendix F Requirements Appendix H Requirements

Was this message different than what was proposed in your NOI? Yes No

If yes, describe why the change was made:

Add an Educational Message

MCM2: Public Participation

Describe the opportunity provided for public involvement in the development of the Stormwater Management Program (SWMP) **during this reporting period:**

In part due to the pandemic, we did not have any public meetings regarding the SWMP this reporting period. We are now currently working with a consultant to update our SWMP and update all of our public facing documents and materials and should have a much better product for the public to comment on and review in our next annual report.

Was this opportunity different than what was proposed in your NOI? Yes No

Describe any other public involvement or participation opportunities conducted **during this reporting period:**

MCM3: Illicit Discharge Detection and Elimination (IDDE)

Sanitary Sewer Overflows (SSOs)

Check off the box below if the statement is true.

This SSO section is NOT applicable because we DO NOT have sanitary sewer

Below, report on the number of SSOs identified in the MS4 system and removed **during this reporting period.**

Number of SSOs identified:

Number of SSOs removed:

MS4 System Mapping

Optional: Provide additional status information regarding your map:

System mapping is complete and will be updated as necessary.

Screening of Outfalls/Interconnections

If conducted, please submit any outfall monitoring results from this reporting period. Outfall monitoring results should include the date, outfall/interconnection identifier, location, weather conditions at time of sampling, precipitation in previous 48 hours, field screening parameter results, and results from all analyses. Please also include the updated inventory and ranking of outfalls/interconnections based on monitoring results.

- No outfalls were inspected
- The outfall screening data is attached to the email submission
- The outfall screening data can be found at the following website:

*Below, report on the number of outfalls/interconnections screened **during this reporting period.***

Number of outfalls screened:

*Below, report on the percent of outfalls/interconnections screened **to date.***

Percent of outfalls screened:

Optional: Provide additional information regarding your outfall/interconnection screening:

All outfalls (287) have been attempted. A total of 19 outfalls are likely submerged, or need additional work to be located. We will continue to work towards 100% and refining our outfall totals.

Catchment Investigations

If conducted, please submit all data collected during this reporting period as part of the dry and wet weather investigations. Also include the presence or absence of System Vulnerability Factors for each catchment.

- No catchment investigations were conducted
- The catchment investigation data is attached to the email submission
- The catchment investigation data can be found at the following website:

*Below, report on the number of catchment investigations completed **during this reporting period.***

Number of catchment investigations completed this reporting period:

*Below, report on the percent of catchments investigated **to date.***

Percent of total catchments investigated:

Optional: Provide any additional information for clarity regarding the catchment investigations below:

Catchment investigations have been established to confirm drainage in the field to improve the GIS mapping.

Catchment delineations have also been completed. A review of problem outfall catchments is underway.

IDDE Progress

If illicit discharges were found, please submit a document describing work conducted over this reporting period, and cumulative to date, including location source; description of the discharge; method of discovery; date of discovery; and date of elimination, mitigation, or enforcement OR planned corrective measures and schedule of removal.

- No illicit discharges were found
- The illicit discharge removal report is attached to the email submission
- The illicit discharge removal report can be found at the following website:

See below

*Below, report on the number of illicit discharges identified and removed, along with the volume of sewage removed **during this reporting period.***

Number of illicit discharges identified: 1

Number of illicit discharges removed: 0

Estimated volume of sewage removed: 0 gallons/day

*Below, report on the total number of illicit discharges identified and removed to date. At a minimum, report on the number of illicit discharges identified and removed **since the effective date of the permit (July 1, 2018).***

Total number of illicit discharges identified: 1

Total number of illicit discharges removed: 0

Optional: Provide any additional information for clarity regarding illicit discharges identified, removed, or planned to be removed below:

Through IDDE a broken water main discharging approximately 1,000 gallons/day of drinking water was located. The break has since been removed and will be accounted for during the next reporting period.

Employee Training

Describe the frequency and type of employee training conducted **during this reporting period:**

Employee training was not conducted.

MCM4: Construction Site Stormwater Runoff Control

*Below, report on the construction site plan reviews, inspections, and enforcement actions completed **during this reporting period.***

Number of site plan reviews completed: 14

Number of inspections completed: 14

Number of enforcement actions taken: 0

Optional: Enter any additional information relevant to construction site plan reviews, inspections, and enforcement actions:

Site plan reviews does not account for individual lots or conservation hearings.

MCM5: Post-Construction Stormwater Management in New Development and Redevelopment

As-built Drawings

Below, report on the number of as-built drawings received during this reporting period.

Number of as-built drawings received: 3

Optional: Enter any additional information relevant to the submission of as-built drawings:

As-built drawings are required as part of our process.

Street Design and Parking Lots Report

Describe the status of the street design and parking lots assessment due in year 4 of the permit term, including any planned or completed changes to local regulations and guidelines:

We have met with technical experts regarding green infrastructure improvements to street layouts and parking lots.

Green Infrastructure Report

Describe the status of the green infrastructure report due in year 4 of the permit term, including the findings and progress towards making the practice allowable:

We have met with technical experts regarding green infrastructure improvements to street layouts and parking lots. The practice is allowable and will be utilized.

Retrofit Properties Inventory

Describe the status of the inventory, due in year 4 of the permit term, of permittee-owned properties that could be modified or retrofitted with BMPs to mitigate impervious areas and report on any properties that have been modified or retrofitted:

Two properties have already been retrofitted (Joshua Eaton school and Killiam School) , additional properties will be included in the next report.

MCM6: Good Housekeeping

Catch Basin Cleaning

*Below, report on the number of catch basins inspected and cleaned, along with the total volume of material removed from the catch basins **during this reporting period.***

Number of catch basins inspected:

Number of catch basins cleaned:

Total volume or mass of material removed from all catch basins: tons

Below, report on the total number of catch basins in the MS4 system.

Total number of catch basins:

If applicable:

Report on the actions taken if a catch basin sump is more than 50% full during two consecutive routine inspections/cleaning events:

Street Sweeping

*Report on street sweeping completed **during this reporting period** using one of the three metrics below.*

Number of miles cleaned:

Volume of material removed: [Select Units]

Weight of material removed: [Select Units]

Stormwater Pollution Prevention Plan (SWPPP)

*Below, report on the number of site inspections for facilities that require a SWPPP completed **during this reporting period.***

Number of site inspections completed: 0

Describe any corrective actions taken at a facility with a SWPPP:

[Empty text box for corrective actions]

Additional Information

Monitoring or Study Results

Results from any other stormwater or receiving water quality monitoring or studies conducted during the reporting period not otherwise mentioned above, where the data is being used to inform permit compliance or permit effectiveness must be attached.

- Not applicable
- The results from additional reports or studies are attached to the email submission
- The results from additional reports or studies can be found at the following website(s):

[Empty text box for website(s)]

If such monitoring or studies were conducted on your behalf or if monitoring or studies conducted by other entities were reported to you, a brief description of the type of information gathered or received shall be described below:

[Empty text box for description of information]

Additional Information

Optional: Enter any additional information relevant to your stormwater management program implementation during the reporting period. Include any BMP modifications made by the MS4 if not already discussed above:

[Empty text box for additional information]

COVID-19 Impacts

Optional: If any of the above year 3 requirements could not be completed due to the impacts of COVID-19, please identify the requirement that could not be completed, any actions taken to attempt to complete the requirement, and reason the requirement could not be completed below:

[Empty text box for COVID-19 impacts]

Activities Planned for Next Reporting Period

Please confirm that your SWMP has been, or will be, updated to comply with all applicable permit requirements including but not limited to the year 4 requirements summarized below. (Note: impaired waters and TMDL requirements are not listed below)

Yes, I agree

- Develop a report assessing current street design and parking lot guidelines and other local requirements within the municipality that affect the creation of impervious cover
- Develop a report assessing existing local regulations to determine the feasibility of making green infrastructure practices allowable when appropriate site conditions exist
- Identify a minimum of 5 permittee-owned properties that could potentially be modified or retrofitted with BMPs to reduce impervious areas

Annual Requirements

- Annual report submitted and available to the public
- Annual opportunity for public participation in review and implementation of SWMP
- Keep records relating to the permit available for 5 years and make available to the public
- Properly store and dispose of catch basin cleanings and street sweepings so they do not discharge to receiving waters
- Annual training to employees involved in IDDE program
- Update inventory of all known locations where SSOs have discharged to the MS4
- Continue public education and outreach program
- Update outfall and interconnection inventory and priority ranking and include data collected in connection with the dry weather screening and other relevant inspections conducted
- Implement IDDE program
- Review site plans of construction sites as part of the construction stormwater runoff control program
- Conduct site inspection of construction sites as necessary
- Inspect and maintain stormwater treatment structures
- Log catch basins cleaned or inspected
- Sweep all curbed streets at least annually
- Continue investigations of catchments associated with Problem Outfalls
- Implemented SWPPPs for all permittee owned or operated maintenance garages, public works yards, transfer stations, and other waste handling facilities
- Review inventory of all permittee owned facilities in the categories of parks and open space, buildings and facilities, and vehicles and equipment; update if necessary
- Review O&M programs for all permittee owned facilities; update if necessary
- Implement all maintenance procedures for permittee owned facilities in accordance with O&M programs
- Implement program for MS4 infrastructure maintenance to reduce the discharge of pollutants
- Enclose all road salt storage piles or facilities and implemented winter road maintenance procedures to minimize the use of road salt
- Review as-built drawings for new and redevelopment to ensure compliance with post construction bylaws, regulations, or regulatory mechanism consistent with permit requirements

- Inspect all permittee owned treatment structures (excluding catch basins)

Provide any additional details on activities planned for permit year 4 below:

The Town intends to meet the permit requirements for year 4.

Part V: Certification of Small MS4 Annual Report 2021

40 CFR 144.32(d) Certification

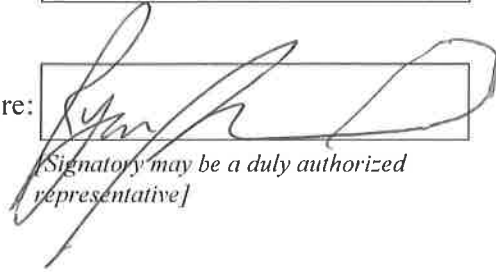
I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, I certify that the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Name:

Ryan Percival

Title: Town Engineer

Signature:



[Signatory may be a duly authorized representative]

Date: 09/28/21

Section 3

Stormwater Management Program (SWMP), 2019

Stormwater Management Program (SWMP)

Town of Reading

16 Lowell Street MA 01867

EPA NPDES Permit Number *MAR041056*

Certification

Authorized Representative (Optional): All reports, including SWPPPs, inspection reports, annual reports, monitoring reports, reports on training and other information required by this permit must be signed by a person described in Appendix B, Subsection 11.A or by a duly authorized representative of that person in accordance with Appendix B, Subsection 11.B. If there is an authorized representative to sign MS4 reports, there must be a signed and dated written authorization.

The authorization letter is:

- Attached to this document (document name listed below)

SWMP Attachment - Authorization Letter

- Publicly available at the website below

“I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gathered and evaluated the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.”

Printed Name *Robert W. LeLacheur Jr.*

Signature _____

Date

[Click Here for Revisions](#)

Background

Stormwater Regulation

The Stormwater Phase II Final Rule was promulgated in 1999 and was the next step after the 1987 Phase I Rule in EPA's effort to preserve, protect, and improve the Nation's water resources from polluted stormwater runoff. The Phase II program expands the Phase I program by requiring additional operators of MS4s in urbanized areas and operators of small construction sites, through the use of NPDES permits, to implement programs and practices to control polluted stormwater runoff. Phase II is intended to further reduce adverse impacts to water quality and aquatic habitat by instituting the use of controls on the unregulated sources of stormwater discharges that have the greatest likelihood of causing continued environmental degradation. Under the Phase II rule all MS4s with stormwater discharges from Census designated Urbanized Area are required to seek NPDES permit coverage for those stormwater discharges.

Permit Program Background

On May 1, 2003, EPA Region 1 issued its Final General Permit for Stormwater Discharges from Small Municipal Separate Storm Sewer Systems (2003 small MS4 permit) consistent with the Phase II rule. The 2003 small MS4 permit covered "traditional" (i.e., cities and towns) and "non-traditional" (i.e., Federal and state agencies) MS4 Operators located in the states of Massachusetts and New Hampshire. This permit expired on May 1, 2008 but remained in effect until operators were authorized under the 2016 MS4 general permit, which became effective on July 1, 2018.

Stormwater Management Program (SWMP)

The SWMP describes and details the activities and measures that will be implemented to meet the terms and conditions of the permit. The SWMP accurately describes the permittees plans and activities. The document should be updated and/or modified during the permit term as the permittee's activities are modified, changed or updated to meet permit conditions during the permit term. The main elements of the stormwater management program are (1) a public education program in order to affect public behavior causing stormwater pollution, (2) an opportunity for the public to participate and provide comments on the stormwater program (3) a program to effectively find and eliminate illicit discharges within the MS4 (4) a program to effectively control construction site stormwater discharges to the MS4 (5) a program to ensure that stormwater from development projects entering the MS4 is adequately controlled by the construction of stormwater controls, and (6) a good housekeeping program to ensure that stormwater pollution sources on municipal properties and from municipal operations are minimized.

Town Specific MS4 Background (optional)

N/A

Small MS4 Authorization

The NOI was submitted on

The NOI can be found at the following (document name or web address):

Authorization to Discharge was granted on

The Authorization Letter can be found (document name or web address):

Stormwater Management Program Team

SWMP Team Coordinator

Name	<input type="text" value="Ryan Percival, P.E."/>	Title	<input type="text" value="Town Engineer"/>
Department	<input type="text" value="Engineering"/>		
Phone Number	<input type="text" value="(781)-942-9092"/>	Email	<input type="text" value="rpercival@ci.reading.ma.us"/>
Responsibilities	<input type="text"/>		

SWMP Team

Name	<input type="text"/>	Title	<input type="text"/>
Department	<input type="text"/>		
Phone Number	<input type="text"/>	Email	<input type="text"/>
Responsibilities	<input type="text"/>		

Name	<input type="text"/>	Title	<input type="text"/>
Department	<input type="text"/>		
Phone Number	<input type="text"/>	Email	<input type="text"/>
Responsibilities	<input type="text"/>		

Receiving Waters

The following table lists all receiving waters, impairments and number of outfalls discharging to each waterbody segment.

OR

The information can be found in the following document or at the following web address:

--

Waterbody segment that receives flow from the MS4	Number of outfalls into receiving water segment	Chloride	Chlorophyll-a	Dissolved Oxygen/ DO Saturation	Nitrogen	Oil & Grease/ PAH	Phosphorus	Solids/ TSS/Turbidity	E. coli	Enterococcus	Other pollutant(s) causing impairments
<i>Ipswich River (MA92-06)</i>	43	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	-Mercury in fish tissue -Low flow alterations
<i>Aberjona River (MA71-01)</i>	78	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	-Arsenic -Ammonia (un-ionized) -Aquatic Macroinvertebrate Bioassessments
<i>Bear Meadow Brook (MA92-07)</i>	71	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Not Assessed
<i>Walker Brook</i>	95	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Not Assessed
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[Click here to lengthen table](#)

Eligibility: Endangered Species and Historic Properties

*Reminder: The proper consultations and updates to the SWMP must be conducted for construction projects related to your permit compliance where Construction General Permit (CGP) coverage, which requires its own endangered species and history preservation determination, is NOT being obtained.

Attachments:

- The results of Appendix C U.S. Fish and Wildlife Service endangered species screening determination
- The results of the Appendix D historic property screening investigations
- If applicable, any documents from the State Historic Preservation Officer (SHPO), Tribal Historic Preservation Officer (THPO), or other Tribal representative to mitigate effects

These attachments are required within one year of the permit effective date and are:

- Attached to this document (document names listed below)

SWMP Attachment - USFWS Approval Letter

- Publicly available at the website listed below

Under what criterion did permittee determine eligibility for ESA?

- Criterion A Criterion B Criterion C

Under what criterion did permittee determine eligibility for Historic Properties?

- Criterion A Criterion B Criterion C

Below add any additional measures for structural controls that you're required to do through consultation with U.S. Fish and Wildlife Service (if applicable):

During the course of the permit term, if a structural BMP is planned and not identified in the Notice of Intent, consultation will be re-initiated with the USFWS as necessary.

Below add any additional measures taken to avoid or minimize adverse impacts on places listed, or eligible for listing, on the NRHP, including any conditions imposed by the SHPO or THPO (if applicable):

N/A

MCM 1

Public Education and Outreach

Permit Part 2.3.2

Objective: The permittee shall implement an education program that includes educational goals based on stormwater issues of significance within the MS4 area. The ultimate objective of a public education program is to increase knowledge and change behavior of the public so that the pollutants in stormwater are reduced.

Examples and Templates:

Other templates relevant to MCM 1 can be found here:

BMP: Brochures/Pamphlets

BMP Number (Optional) 1-1

Document Name and/or Web Address: *"Clean Stormwater Checklist"*
"Make a Splash"
"Public Awareness Pamphlet"
"Fall Clean Up Flyer"
"Pet Waste Flyer"
"Clean Catchbasins Flyer"
"Car Washing Flyer"
(<https://www.readingma.gov/storm-water-division/pages/storm-water-information-faqs>)

Description:
Update and produce educational materials available online and in Town Hall

Targeted Audience: *Residents*

Responsible Department/Parties: *Engineering*

Measurable Goal(s):
Compilation of education materials

Message Date(s): *2017*

BMP: Web Page

BMP Number (Optional) 1-2

Document Name and/or Web Address: *"Storm Water Information & FAQ's"*
(<https://www.readingma.gov/storm-water-division/pages/storm-water-information-faqs>)

Description:
Notices and updates regarding stormwater quality and sampling events.

Targeted Audience: *Residents, Businesses, institutions and commercial facilities*

Responsible Department/Parties: *Engineering*

Measurable Goal(s):
Keep residents informed and up to date

Message Date(s):

2017

BMP: Newspaper Articles/Press Releases

BMP Number (Optional) 1-3

Document Name and/or Web Address: *"Stormwater Outfall Sampling Program 2018"*
(<https://www.readingma.gov/engineering-division/slideshows/npdes-stormwater-management-program>) +

Description:

Notices and updates regarding outfall sampling program

Targeted Audience: *Developers (construction)*

Responsible Department/Parties: *Engineering*

Measurable Goal(s):

Distribute notice for outfall sampling and stormwater sampling results

Message Date(s): *2017*

BMP: Videos

BMP Number (Optional) 1-4

Document Name and/or Web Address: *To be determined*

Description:

Continue involvement with Mystic River Watershed Association

Targeted Audience: *Residents*

Responsible Department/Parties: *Engineering*

Measurable Goal(s):

Produce or distribute video(s) for social media and website

Message Date(s): *2018*

BMP Number (Optional) 1-5

Document Name and/or Web Address: *To be determined*

Description:

Stormwater displays at Friends and Family Day and Library Day

Targeted Audience: *Residents*

Responsible Department/Parties: *Engineering*

Measurable Goal(s):

Establish stormwater display

Message Date(s): *2017*

BMP: School Curricula/Programs

BMP Number (Optional) 1-6

Document Name and/or Web Address: *To be determined*

Description:

Stormwater presentation at Middle School

Targeted Audience: *School children*

Responsible Department/Parties: *Engineering*

Measurable Goal(s):

Continue presentation and engagement in schools

Message Date(s): *2017*

BMP: Brochures/Pamphlets

BMP Number (Optional) 1-7

Document Name and/or Web Address: *To be determined*

Description:

Develop educational pamphlet

Targeted Audience:

Responsible Department/Parties:

Measurable Goal(s):

Message Date(s):

BMP: Web Page

BMP Number (Optional)

Document Name and/or Web Address:

Description:

Targeted Audience:

Responsible Department/Parties:

Measurable Goal(s):

Message Date(s):

BMP:

BMP Number (Optional)

Document Name and/or Web Address:

Description:

Targeted Audience:

Responsible Department/Parties:

Measurable Goal(s):

Message Date(s):

BMP:[BMP name here]

BMP Number (Optional) _____

Document Name and/or Web Address:

Description:

Targeted Audience:

Responsible Department/Parties:

Measurable Goal(s):

Message Date(s):

BMP:[BMP name here]

BMP Number (Optional) _____

Document Name and/or Web Address:

Description:

Targeted Audience:

Responsible Department/Parties:

Measurable Goal(s):

Message Date(s):

Add BMP

MCM 2

Public Involvement and Participation

Permit Part 2.3.3

Objective: The permittee shall provide opportunities to engage the public to participate in the review and implementation of the permittee's SWMP.

BMP: Public Review of Stormwater Management Program

BMP Number (Optional) 2-1

Location of Plan and/or Web Address: *To be determined*

Responsible Department/Parties: *Engineering*

Measurable Goal(s):
Continually update and review stormwater management plan

BMP: Public Participation in Stormwater Management Program Development

BMP Number (Optional) 2-2

Description:
Questions and Answer Session

Responsible Department/Parties: *Engineering*

Measurable Goal(s):
Annual public input provided.

BMP: Public Participation

BMP Number (Optional) 2-3

Document Name and/or Web Address: *To be determined*

Description:
Stormwater Questionnaire

Responsible Department/Parties: *Engineering*

Measurable Goal(s):
Questionnaire in which responses are tracked to determine baseline knowledge

BMP: Public Participation

BMP Number (Optional) 2-4

Document Name and/or Web Address: +

Description:

Responsible Department/Parties:

Measurable Goal(s):

BMP: Public Participation

BMP Number (Optional) 2-5

Document Name and/or Web Address: +

Description:

Responsible Department/Parties:

Measurable Goal(s):

Add BMP

MCM 3

Illicit Discharge Detection and Elimination (IDDE) Program

Permit Part 2.3.4

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

Examples and Templates:

Other templates relevant to IDDE can be found here:

BMP: IDDE Legal Authority

BMP Number (Optional) 3-1

Completed (by May 1, 2008)

Ordinances Link or Reference: https://www.readingma.gov/sites/readingma/files/uploads/2018-05_general_bylaw.pdf +

Department Responsible for Enforcement:

BMP: Sanitary Sewer Overflow (SSO) Inventory

BMP Number (Optional) 3-2

Completed (by year 1)

Document Name and/or Web Address:

Description:

Responsible Department/Parties:

Measurable Goal(s):

SSO Reporting:

In the event of an overflow or bypass, a notification must be reported within 24 hours by phone to MassDEP, EPA, and other relevant parties. Follow up the verbal notification with a written report following MassDEP's Sanitary Sewer Overflow (SSO)/Bypass notification form within 5 calendar days of the time you become aware of the overflow, bypass, or backup.

The MassDEP contacts are:
 Northeast Region (978) 694-3215
 205B Lowell Street
 Wilmington, MA 01887
 Central Region (508) 792-7650
 8 New Bond Street
 Worcester, MA 01606
 Southeast Region (508) 946-2750
 20 Riverside Drive
 Lakeville, MA 02347
 Western Region (413) 784-1100
 436 Dwight Street
 Springfield, MA 01103
 24-hour Emergency Line 1-888-304-1133

The EPA contacts are:
 EPA New England (617) 918-1510
 5 Post Office Square
 Boston, MA 02109

BMP: Map of Storm Sewer System

BMP Number (Optional) 3-3 **Phase I Completed** (by year 2) **Phase II Completed** (by year 10)

Document Location and/or Web Address: SWMP Attachment - Storm sewer map

Description:
Create map and updated during IDDE program completion.

Responsible Department/Parties: Engineering

Measurable Goal(s):
Storm sewer map is currently completed will be continually updated as needed. (Requirement: Map 100% of outfalls and receiving waters, open channel conveyances, interconnections with other MS4s and other storm sewer systems, municipally-owned stormwater treatment structures, waterbodies identified by name and indication of all use impairments, and initial catchment delineations within 2 years of the permit's effective date. Map 100% of outfall spatial locations, pipes, manholes, catch basins, refined catchment delineations, municipal sanitary sewer system (if available), and municipal combined sewer system (if applicable) within 10 years of the permit's effective date.)

BMP: IDDE Program

BMP Number (Optional) 3-4 **Written Document Completed** (by year 1)

Document Name and/or Web Address: To be determined

Description:
Create written IDDE program.

Responsible Department/Parties:

Measurable Goal(s):

Review existing written IDDE program.

The outfall/interconnection inventory and initial ranking and the dry weather outfall and interconnection screening and sampling results can be found:

2018 Reading MS4 Dry Weather Sampling Program

BMP: Employee Training

BMP Number (Optional) 3-5

Description:

Train employees on IDDE implementation

Responsible Department/Parties:

Measurable Goal(s):

Training occurs on annually.

BMP: Implement IDDE program

BMP Number (Optional) 3-6

Completed

Document Name and/or Web Address:

Description:

Implement catchment investigations according to program and permit conditions.

Responsible Department/Parties:

Measurable Goal(s):

Upstream IDDE investigations have been undertaken since 2012 as follow up to outfall sampling, including catchment investigations.

BMP Number (Optional) 3-7

Completed

Document Name and/or Web Address:

Description:

Conduct in accordance with outfall screening procedure and permit conditions

Responsible Department/Parties:

Measurable Goal(s):

Dry weather outfall screening has been performed in 2012 as well as 2018.

BMP: Ongoing screening

BMP Number (Optional) 3-8

Completed

Document Name and/or Web Address:

Description:

Conduct dry weather and wet weather screening (as necessary).

Responsible Department/Parties:

Measurable Goal(s):

Continue outfall screening upon completing of outfall sampling program as required.

BMP: Outfall and interconnection ranking

BMP Number (Optional) 3-9

Completed

Document Name and/or Web Address:

Description:

Prioritize Outfalls

Responsible Department/Parties:

Measurable Goal(s):

Completed within three years effective date of permit.

Add BMP

MCM 4

Construction Site Stormwater Runoff Control

Permit Part 2.3.5

Objective: The objective of an effective construction stormwater runoff control program is to minimize or eliminate erosion and maintain sediment on site so that it is not transported in stormwater and allowed to discharge to a water of the U.S. through the permittee's MS4.

Examples and Templates:

Examples and templates relevant to MCM 4, including model ordinances and site inspection templates, can be found here:

BMP: Sediment and Erosion Control Ordinance

BMP Number (Optional) 4-1

Completed (by May 1, 2008)

Ordinances Link or Reference: *Reading General Bylaw, Section 7.9 - Stormwater Management and Erosion Control*
(https://www.readingma.gov/sites/readingma/files/uploads/2018-05_general_bylaw.pdf)

Department Responsible for Enforcement: *Engineering*

BMP: Site Plan Review Procedures

BMP Number (Optional) 4-2

Written procedures completed (by year 1)

Document Name and/or Web Address: *Stormwater Management and Erosion Control Procedures*
(https://www.readingma.gov/sites/readingma/files/uploads/stormwater_procedures_-_formatted_08-28-17_0.pdf)

Description:

Complete written procedures of site plan review and begin implementation plan.

Responsible Department/Parties: *Engineering*

Measurable Goal(s):

Complete within 1 year of effective date of permit.

BMP: Site Inspections and Enforcement of Sediment and Erosion Control Measures Procedures

BMP Number (Optional) 4-3

Completed (by year 1)

Document Name and/or Web Address: *To be determined*

Description:

Complete written procedures of site inspections and enforcement procedures.

Responsible Department/Parties: *Engineering*

Measurable Goal(s):

Complete within 1 year of effective date of permit.

BMP: Waste Control

BMP Number (Optional) 4-4

Completed

Document Name and/or Web Address: *Reading General Bylaw, Section 7.9 - Stormwater Management and Erosion Control*
(https://www.readingma.gov/sites/readingma/files/uploads/2018-05_general_bylaw.pdf)

Description:

Adoption of requirements to control wastes, including but not limited to, discard building materials, concrete truck wash out, chemicals, litter, and sanitary wastes.

Responsible Department/Parties: *Engineering*

Measurable Goal(s):

Complete within 1 year of effective date of permit.

Add BMP

MCM 5

Post Construction Stormwater Management in New Development and Redevelopment

Permit Part 2.3.6

Objective: The objective of an effective post construction stormwater management program is to reduce the discharge of pollutants found in stormwater to the MS4 through the retention or treatment of stormwater after construction on new or redeveloped sites and to ensure proper maintenance of installed stormwater controls.

Examples and Templates:

Examples and templates relevant to MCM 5, including model ordinances and bylaw review templates and guidance can be found here:

BMP: Post-Construction Ordinance

BMP Number (Optional) 5-1

Completed (by year 2)

Town Ordinances Link or Reference:

Department Responsible for Enforcement:

BMP: Street Design and Parking Lot Guidelines Report

BMP Number (Optional) 5-2

Completed (by year 4)

Document Name and/or Web Address:

Description:

Develop a report assessing requirements that affect the creation of impervious cover. The assessment will help determine if changes to design standards for streets and lots can be modified to support low impact design options.

Responsible Department/Parties:

Measurable Goal(s):

Complete 4 years after effective date of permit and implement recommendations of report.

BMP: Green Infrastructure Report

BMP Number (Optional) 5-3

Completed (by year 4)

Document Name and/or Web Address:

Description:

Develop a report assessing existing local regulations to determine the feasibility of making green infrastructure practices allowable when appropriate site conditions exist.

Responsible Department/Parties:

Measurable Goal(s):

Complete 4 years after effective date of permit and implement recommendations of report.

BMP: List of Municipal Retrofit Opportunities

BMP Number (Optional) 5-4

Completed (by year 4)

Document Name and/or Web Address: *To be determined*

Description:

Identify at least 5 permittee-owned properties that could be modified or retrofitted with BMPs to reduce impervious areas and update annually.

Responsible Department/Parties: *Engineering*

Measurable Goal(s):

Complete within 4 years after effective date of permit and report annually on retrofitted properties.

BMP: As-built blanks for on-site stormwater control

BMP Number (Optional) 5-5

Completed

Document Name and/or Web Address: *To be determined*

Description:

The procedures to require submission of as-built drawings and ensure long term operation and maintenance will be a part of the SWMP.

Responsible Department/Parties: *Engineering*

Measurable Goal(s):

Require submission of as-built plans for completed projects within two years of construction.

BMP: Ensure any stormwater controls of management practices for new development and development 

BMP Number (Optional) 5-6

Completed

Document Name and/or Web Address: *Stormwater Management and Erosion Control Regulations (https://www.readingma.gov/sites/readingma/files/uploads/stormwater_regulations_-_formatted_08-28-17.pdf)* 

Description:

Adoption, amendment, or modification of a regulatory mechanism to meet permit requirements.

Responsible Department/Parties: *Engineering*

Measurable Goal(s):

Complete 2 years after effective date of permit.

BMP: Auuifer Protection District

BMP Number (Optional) 5-7

Completed

Document Name and/or Web Address: *Reading Zoning Bylaw 10.3 - Auuifer Protect District*
(https://www.readingma.gov/sites/readingma/files/uploads/2018-05/zoning_bylaw.pdf)

Description:

The auuifer protection district promotes and ensures quality drinking water by promoting stormwater recharge.

Responsible Department/Parties: *Engineering*

Measurable Goal(s):

Ongoing, as necessary.

BMP: Stormwater Enterprise Fund

BMP Number (Optional) 5-8

Completed

Document Name and/or Web Address: *<https://www.readingma.gov/collector/pages/storm-water-faqs>*

Description:

The Town of Reading established the stormwater enterprise fund to provide a dedicated and adequate source of funding for stormwater alternatives.

Responsible Department/Parties: *DPW Operations*

Measurable Goal(s):

Operations

Add BMP

MCM 6

Good Housekeeping and Pollution Prevention for Permittee Owned Operations

Permit Part 2.3.7

Objective: The permittee shall implement an operations and maintenance program for permittee-owned operations that has a goal of preventing or reducing pollutant runoff and protecting water quality from all permittee-owned operations.

Examples and Templates:

Examples and templates relevant to MCM 6, including SOP templates for catch basin cleaning, street sweeping, vehicle maintenance, parks and open space management, winter deicing, and Stormwater Pollution Prevention Plans can be found here:

PERMITTEE OWNED FACILITIES

BMP: Parks and Open Spaces Operations and Maintenance Procedures

BMP Number (Optional) 6-1

Written Document Completed (by year 2)

Document Name and/or Web Address:

Description:

Create written O&M procedures including all requirements contained in 2.3.7.a.ii for parks and open spaces.

Responsible Department/Parties:

Measurable Goal(s):

Complete 2 years after effective date of permit and implement annually.

Properties List (Optional):

To be determined

BMP: Buildings and Facilities Operations and Maintenance Procedures

BMP Number (Optional) 6-2

Written Document Completed (by year 2)

Document Name and/or Web Address:

Description:

Create written O&M procedures including all requirements contained in 2.3.7.a.ii for buildings and facilities.

Responsible Department/Parties:

Measurable Goal(s):

Complete 2 years after effective date of permit and implement annually.

Properties List (Optional):

To be determined

BMP: Vehicles and Equipment Operations and Maintenance Procedures

BMP Number (Optional) 6-3

Written Document Completed (by year 2)

Document Name and/or Web Address:

To be determined

Description:

Create written O&M procedures including all requirements contained in 2.3.7.a.ii for vehicles and equipment.

Responsible Department/Parties: Engineering

Measurable Goal(s):

Complete 2 years after effective date of permit and implement annually.

Properties List (Optional):

To be determined

INFRASTRUCTURE

BMP: Infrastructure Operations and Maintenance Procedures

BMP Number (Optional) 6-4

Written Procedure Completed (by year 2)

Document Name and/or Web Address: To be determined

Description:

Establish and implement program for repair and rehabilitation of MS4 infrastructure.

Responsible Department/Parties: Engineering

Measurable Goal(s):

Complete 2 years after effective date of permit.

BMP: Catch Basin Cleaning Program

BMP Number (Optional) 6-5

Written Procedure Completed (by year 1)

Document Name and/or Web Address: To be determined

Description:

Establish schedule for catch basin cleaning such that each catch basin is no more than 50% full and clean catch basins on that schedule.

Responsible Department/Parties: DPW Operations

Measurable Goal(s):

All catch basins are cleaned in accordance to the document above such that no catch basin is more than 50% full at any given time.

BMP: Street Sweeping Program

BMP Number (Optional) 6-6

Written Procedure Completed (by year 1)

Document Name and/or Web Address:

Town of Reading Street Sweeping
(<https://www.readingma.gov/highway-division/pages/street-sweeping>)

Description:

Sweep all streets and permittee-owned parking lots in accordance with permit conditions.

Responsible Department/Parties: *DPW Operations*

Measurable Goal(s):

Annually sweep 100% of all streets and 50% of all municipal parking lots in accordance with the schedule listed above.

BMP: Winter Road Maintenance Program

BMP Number (Optional) 6-7

Written Procedure Completed (by year 1)

Document Name and/or Web Address:

Town of Reading Snow and Ice Guidelines
(<https://www.readingma.gov/highway-division/pages/snow-emergency-guidelines>)

Description:

Establish and implement a program to minimize the use of road salt.

Responsible Department/Parties: *DPW Operations*

Measurable Goal(s):

Evaluate at least one salt/chloride alternative for use in the municipality.
Implement salt use optimization during deicing season.

BMP: Stormwater Treatment Structures Inspection and Maintenance Procedures

BMP Number (Optional) 6-8

Completed (by year 1)

Document Name and/or Web Address:

To be determined

Description:

To be determined

Responsible Department/Parties:

Measurable Goal(s):

Inspect and maintain 100% of treatment structures to ensure proper function.

BMP: SWPPP

BMP Number (Optional) 6-9

Completed (by year 2)

Document Name and/or Web Address:

Description:

Create SWPPPs for maintenance garages, transfer stations, and other waste-handling facilities

Responsible Department/Parties:

Measurable Goal(s):

Develop and implement SWPPPs for 100% of facilities.

BMP:Inventory all permittee-owned parks & open spaces, buildings & facilities, & vehicles & equipment

BMP Number (Optional) 6-10

Completed

Document Name and/or Web Address:

Description:

Create inventory

Responsible Department/Parties:

Measurable Goal(s):

Complete 2 years after effective date of permit and implement annually.

Add BMP

Annual Evaluation

Year 1 Annual Report

Document Name and/or Web Address:

Year 2 Annual Report

Document Name and/or Web Address:

Year 3 Annual Report

Document Name and/or Web Address:

Year 4 Annual Report

Document Name and/or Web Address:

Year 5 Annual Report

Document Name and/or Web Address:

Year X Annual Report

Document Name and/or Web Address:

Add a Year

TMDLs and Water Quality Limited Waters

Select the applicable Impairment(s) and/or TMDL(s).

Impairment(s)

- Bacteria/Pathogens Chloride Nitrogen Phosphorus
 Solids/oil/grease (hydrocarbons)/metals

TMDL(s)

In State:

- Assabet River Phosphorus Bacteria and Pathogen Cape Cod Nitrogen
 Charles River Watershed Phosphorus Lake and Pond Phosphorus

Out of State:

- Bacteria and Pathogen Metals Nitrogen Phosphorus

Clear Impairments and TMDLs

Phosphorus

Combination of Impaired Waters Requirements and TMDL Requirements as Applicable

Applicable Receiving Waterbody(ies)	TMDL Name (if applicable)	Add/Delete Row
<i>Aberjona River (MA71-01)</i>	<i>N/A</i>	<input type="button" value="+"/> <input type="button" value="-"/>

Annual Requirements Beginning Year 1

Public Education and Outreach

(Public education messages can be combined with other public education requirements as applicable (see Appendix H and F for more information))

 Distribute an annual message in the spring (April/May) that encourages the proper use and disposal of grass clippings and encourages the proper use of slow-release and phosphorus-free fertilizers

The relevant BMP number(s) listed above in the Stormwater Management Program OR the description of implementation actions and document location(s) are:

BMP 1-1: Brochures/Pamphlets - Public Awareness Pamphlet
(<https://www.readingma.gov/sites/readingma/files/file/file/publicawarnesspamphlet.pdf>)

 Distribute an annual message in the summer (June/July) encouraging the proper management of pet waste, including noting any existing ordinances where appropriate

The relevant BMP number(s) listed above in the Stormwater Management Program OR the description of implementation actions and document location(s) are:

BMP 1-1: Brochures/Pamphlets - Pet Waste Flyer
(<https://www.readingma.gov/sites/readingma/files/file/file/petwasteflyer.pdf>)

 Distribute an annual message in the fall (August/September/October) encouraging the proper disposal of leaf litter

The relevant BMP number(s) listed above in the Stormwater Management Program OR the description of implementation actions and document location(s) are:

BMP 1-1: Brochures/Pamphlets - Fall Cleanup Flyer
(<https://www.readingma.gov/sites/readingma/files/file/file/fallcleanupflyer.pdf>)

Good Housekeeping and Pollution Prevention for Permittee Owned Operations

Increase street sweeping frequency of all municipal owned streets and parking lots subject to Permit part 2.3.7.a.iii.(c) to a minimum of two times per year (spring and fall)

The relevant BMP number(s) listed above in the Stormwater Management Program OR the description of implementation actions and document location(s) are:

BMP 6-6: Street sweeping program

Establish procedures to properly manage grass cuttings and leaf litter on permittee property, including prohibiting blowing organic waste materials onto adjacent impervious surfaces

The relevant BMP number(s) listed above in the Stormwater Management Program OR the description of implementation actions and document location(s) are:

To be determined

Stormwater Management in New Development and Redevelopment

Retrofit inventory and priority ranking under 2.3.6.1.b. shall include consideration of BMPs to reduce phosphorus discharges

The relevant BMP number(s) listed above in the Stormwater Management Program OR the description of implementation actions and document location(s) are:

To be determined

Phosphorus Reduction Tracking BMP

Any structural BMPs listed in Table 3 of Attachment 1 to Appendix H already existing or installed in the regulated area by the permittee or its agents shall be tracked and the permittee shall estimate the phosphorus removal by the BMP consistent with Attachment 1 to Appendix H.

The BMP type, total area treated by the BMP, the design storage volume of the BMP and the estimated phosphorus removed in pass per year by the BMP is found in the following document or website and is updated yearly at a minimum:

Tree well: Randall Road (1)

Requirements Due by Year 2

Stormwater Management in New Development and Redevelopment

The requirement for adoption/amendment of the permittee's ordinance or other regulatory mechanism shall include a requirement that new development and redevelopment stormwater management BMPs be optimized for phosphorus removal
The relevant BMP number(s) listed above in the Stormwater Management Program OR the description of implementation actions and document location(s) are:

Town of Reading Subdivision Regulations - 7.4.4 - Storm Drainage

Requirements Due by Year 4

Complete a Phosphorus Source Identification Report

The document name (if attached) and/or web address is/are:

Phosphorus Identification Source Report

Stormwater Management in New Development and Redevelopment

Retrofit inventory and priority ranking under 2.3.6.1.b. shall include consideration of BMPs that infiltrate stormwater where feasible

The relevant BMP number(s) listed above in the Stormwater Management Program OR the description of implementation actions and document location(s) are:

BMP 5-4: List of municipal retrofit opportunities

Requirements Due by Year 5

Potential Structural BMPs

Evaluate all permittee-owned properties identified as presenting retrofit opportunities or areas for structural BMP installation under Permit part 2.3.6.d.ii or identified in the Phosphorus Source Identification Report that are within the drainage area of the impaired water or its tributaries

The relevant BMP number(s) listed above in the Stormwater Management Program OR the description of implementation actions and document location(s) are:

To be determined

Complete a listing of planned structural BMPs and a plan and schedule for implementation

The relevant BMP number(s) listed above in the Stormwater Management Program OR the description of implementation actions and document location(s) are:

To be determined

Section 4

SWMP Report, March 2022



Town of Reading
Engineering Division



Stormwater Management Program (SWMP) Report



March 2022

Prepared with assistance
from CDM Smith

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Town of Reading

Stormwater Management Program

Purpose

The purpose of this report is to provide the residents of the Town of Reading a summary of the Town's efforts relating to prevent stormwater pollution and compliance with the Environmental Protection Agency's (EPA) National Pollution Discharge Elimination System (NPDES) Stormwater General Permit. While the Town's efforts are compiled in a Stormwater Management Program (SWMP) template provided by EPA for Massachusetts permit holders, this SWMP report is written to provide a more comprehensive understanding to the residents of the Town's stormwater management. The completed EPA SWMP template to fulfill permit requirements can be found on the Town of Reading's website [here](#). This report is not intended to fulfill any regulation requirements.

The Town of Reading's SWMP consists of the following components:

- Public Education,
- Illicit Discharge Detection,
- Mapping,
- Outfall Inspections,
- Construction Site Runoff Control, and
- Good House Keeping Practices.

All of these components will prevent stormwater pollution in the Town of Reading and a cleaner environment as a whole for our future.

We welcome your questions and feedback on this SWMP report and the Town of Reading's efforts for stormwater pollution prevention. Contact information for Town of Reading Engineering Department can be found in **Section 6** or on the website [here](#).

See something to report to the Town?
Scan the QR code to email us!

stormwatertips@ci.reading.ma.us



1.0 Introduction to Stormwater

1.1 What is Stormwater?

Stormwater is water that falls from the sky as rain, hail, or melting snow and drains into the municipal drain system, such as catch basins or drainage swales that eventually lead to a wetland or body of water, such as a lake, stream, river, or ocean.

1.2 What is a Drainage System?

As shown in **Figure 1-1**, the storm drainage system is a series of catch basins, and drainage swales that collect and direct runoff from streets, driveways, sidewalks, parking lots, and vegetated land surfaces. Stormwater moving through the drainage system network of pipes and swales, flows into bodies of water such as lakes, streams, rivers, and oceans. The Town of Reading’s storm drainage system drains into four different receiving watersheds: the Ipswich River,

Aberjona River, Saugus River, and Walkers Brook. Reading is situated at the headwaters of these three rivers which, after flowing through several communities, eventually discharge into the Atlantic Ocean.

2.0 General Information

2.1 Background

The Department of Public Works Engineering Division is currently working on implementing its Stormwater Management Program to implement programs and practices to control polluted stormwater runoff.

Commonly Used Acronyms

Acronym	Definition
NPDES	National Pollutant Discharge Elimination System
MS4	Municipal Separate Storm Sewer System
SWMP	Stormwater Management Program
DPW	Department of Public Works
EPA	Environmental Protection Agency

Stormwater Structures

Catch Basin



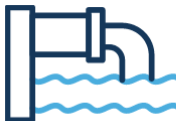
A grated chamber or inlet designed to collect rain water which includes systems to collect debris and sediment and prevent the clogging of stormwater systems.

Drain Manhole



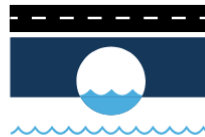
A covered opening in a street which provides access for cleaning and repairing of a stormwater system. (Typically connecting two other stormwater drainage structures.)

Outfall



Any outlet pipe that discharges to open waters: a drainage ditch, wetland, detention pond, river, lake or ocean.

Culvert



A pipe of any size that diverts water to flow under a roadway or other land including streams and brooks.

Drainage Ditch/Swale



A stream or waterway that collects rain water and/or is connected to the town stormwater drainage system.

Town of Reading

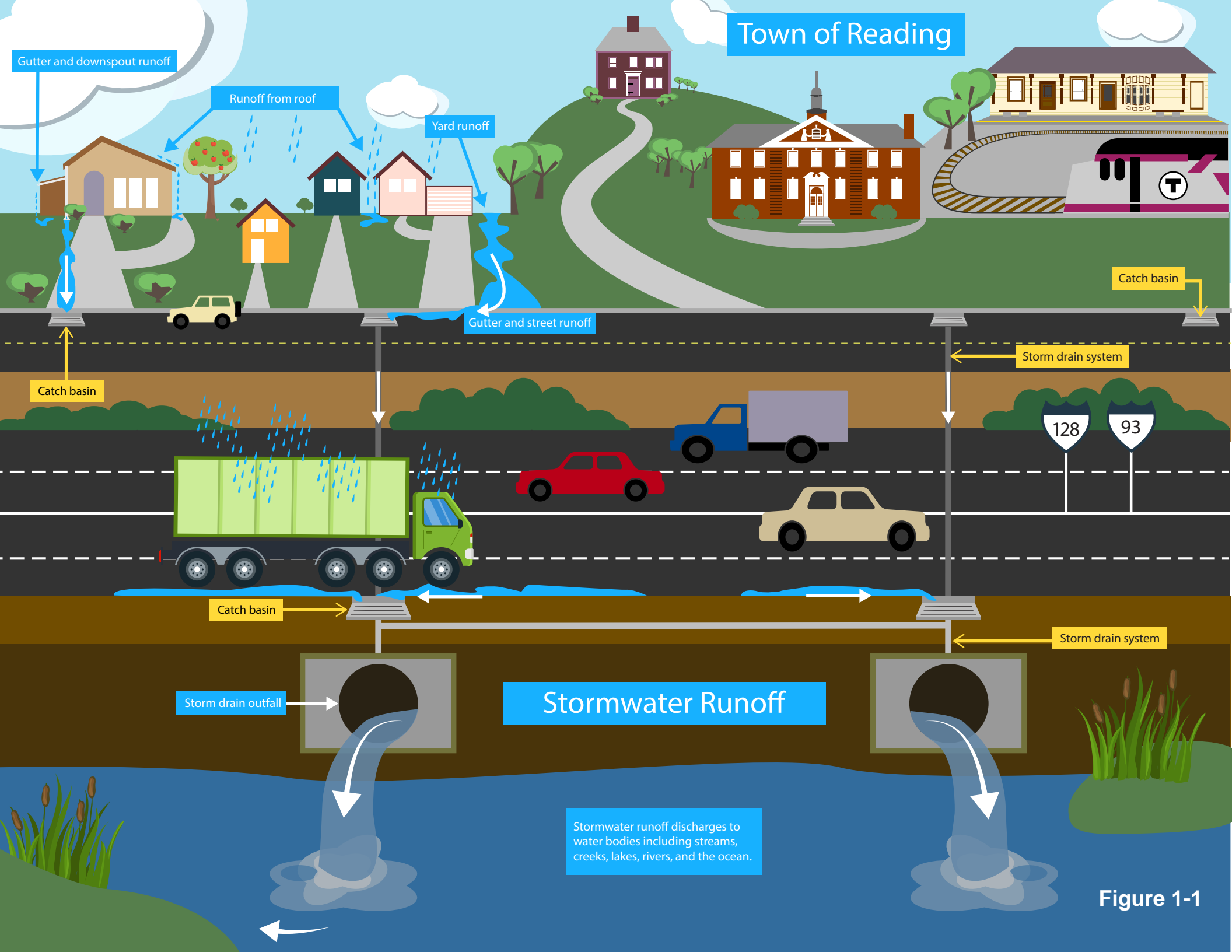


Figure 1-1

The Town of Reading is required to comply with the NPDES Stormwater General Permit established by the United States EPA under the Stormwater Phase II Final Rule. This permit required the Town to develop a Stormwater Management Program (SWMP) that reduces the discharge of pollutants to the storm drain system and waterways.

The Town of Reading's stormwater discharges are regulated under a Small Municipal Separate Storm Sewer System (MS4) Permit, which is required by the NPDES Phase II Stormwater Program. EPA's NPDES categorizes MS4's in three sizes: "small," "medium," and "large", assignment of which is based on the population of the incorporated place or county; Reading is designated as a Small MS4.

The Town of Reading submitted a Notice of Intent (NOI) on September 26, 2018. This can be viewed [here](#).

The town of Reading's Authorization to Discharge, received on March 5, 2019, can be viewed [here](#).

To read more about NPDES Phase II Stormwater please see the EPA's website [here](#).

Sections 3 through 8 describe the six Minimum Control Measures (MCMs) that are detailed in Section 2.3 in the General Permit and required by the SWMP. Each MCM has several Best Management Practices (BMPs) that the Town should meet to satisfy the requirements of the Permit.

2.2 Stormwater Enterprise Fund

The Town established the Stormwater Enterprise Fund (SWEF) to provide a dedicated and adequate source of funding for their stormwater management program. Stormwater fee revenue is used to fund employees and capital needs to perform

stream and drainage maintenance activities by the Department of Public Works (DPW). Stormwater fees also fund capital expenditures for drainage system mapping (Geographic Information System (GIS) layer), illicit discharge detection, and general drainage system infrastructure improvements.

2.3 Impacted Waterbodies

The four receiving waters from the Town of Reading are the following:

- Ipswich River (MA92-06)
- Aberjona River (MA71-01)
- Bear Meadow Brook (MA92-07) / Saugus River
- Walkers Brook

The watersheds for each of these receiving waters are shown on **Figure 2-1**. Detailed maps of the stormwater system are available upon request from the Engineering Department. The Aberjona River flows into the Mystic River. Both the Ipswich River and the Aberjona River have other pollutants causing their impairments. Based on the information documented by the DEP, the four local waterbodies are classified to be impaired due to the following issues:

- The Ipswich River's water quality is impacted by mercury in fish tissue and low flow alterations.
- The water quality in the Aberjona is affected by arsenic, ammonia, and aquatic macroinvertebrate bioassessments.

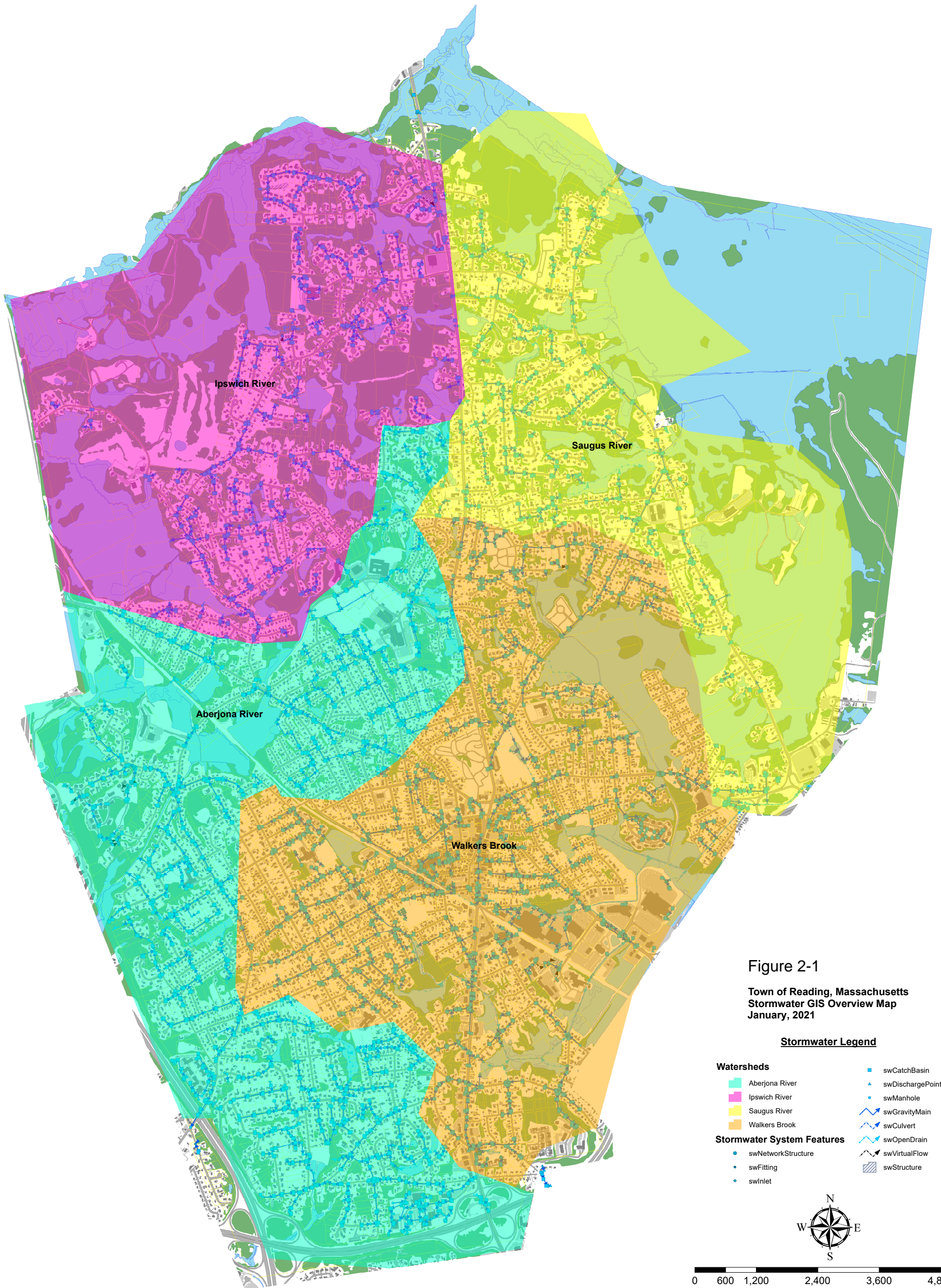


Figure 2-1

Town of Reading, Massachusetts
 Stormwater GIS Overview Map
 January, 2021

Stormwater Legend

- | | |
|--|--|
| Watersheds | |
| ■ Aberjona River | ■ swCatchBasin |
| ■ Ipswich River | ▲ swDischargePoint |
| ■ Saugus River | ● swManhole |
| ■ Walkers Brook | — swGravityMain |
| | — swCulvert |
| | — swOpenDrain |
| Stormwater System Features | — swVirtualFlow |
| ● swNetworkStructure | ▨ swStructure |
| ● swFitting | |
| ● swInlet | |



0 600 1,200 2,400 3,600 4,800 Feet

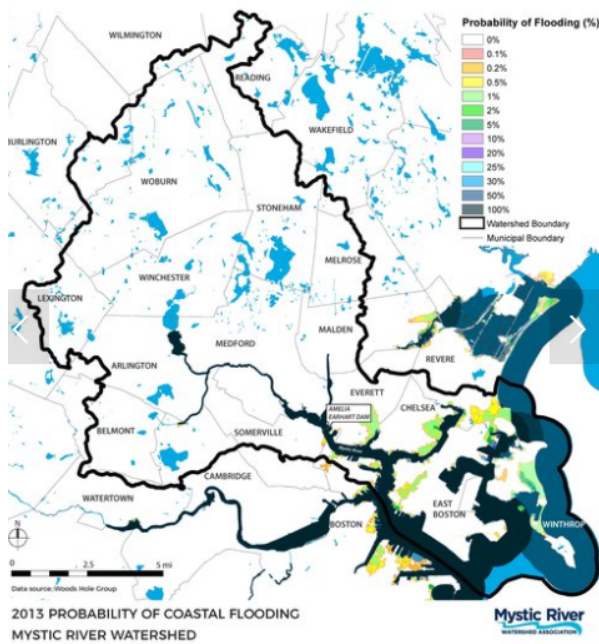
1 in = 600 ft

The below table outlines the specific impairment parameters monitored by DEP in each waterbody:

Waterbody	Outfalls	Impairment
Ipswich River	43	<ul style="list-style-type: none"> Dissolved Oxygen / DO Saturation
Aberjona River	78	<ul style="list-style-type: none"> Dissolved Oxygen/DO Saturation Phosphorus Solids/TSS/ Turbidity E. coli
Bear Meadow	71	Not assessed
Walkers Brook	95	Not assessed

2.4 The Mystic River Watershed Association

The Town of Reading is part of the Mystic River Watershed Association Stormwater Collaborative. The main goal of the Collaborative is to reduce stormwater pollution.



2.5 Endangered Species and Historic Properties

The results of the U.S. Fish and Wildlife (USFWS) endangered species screening determination and the historic property screening investigations are available upon request. Criterion C was used for the endangered species and Criterion A for the historic properties.

During the course of the SWMP MS4 permit term, if a structural BMP is planned and not identified in the Notice of Intent, consultation will be re-initiated with the USFWS as necessary.

3.0 Management Practices

The SWMP MS4 permit (the Permit), requires the Town to implement stormwater control measures across various categories to comprehensively manage their drainage system as follows:

- Public Education and Outreach
- Public Involvement and Participation
- Illicit Discharge Detection and Elimination (IDDE) Program
- Construction Site Stormwater Runoff Control
- Post-Construction Stormwater Management in New Development and Redevelopment
- Good Housekeeping and Pollution Prevention for Permittee-Owned Operations

The following sections discuss the objectives of each of these categories, the requirements of the Permit, and what the Town has done to date.

3.1 Public Education and Outreach

Objective

As part of the public education portion of the Permit, Reading implements public education programs to provide information about common stormwater problems and pollutants to help citizens work collaboratively with the town to prevent stormwater pollution.

Permit Requirements

Following is a summary of the Public Education and Outreach requirements in the MS4 Permit:

- The permittee shall distribute educational material to the community. The following four audiences should be targeted in the program, if they are all present within the community:
 - Residents;
 - Businesses, institutions (churches, hospitals), and commercial facilities;
 - Developers (construction), and;
 - Industrial facilities.
- The permittee shall distribute a minimum of two educational messages over the Permit term as specified in their permit.
- Specific topics that should be considered are listed in Section 2.3.2.d.i. – iv in the Permit.
- The program shall show evidence that progress towards the goals has been accomplished. Messages that were ineffective should be modified.
- The permittee shall document the messages in each annual report.

Further details about the requirements of the Public Outreach and Education portion of the Permit can be found [here](#).

The Town's Efforts to Date

The Town of Reading is primarily residential, and many of the public outreach efforts are focused on messages for homeowners. The Town has distributed messages about proper management of pet waste, car washing best practices, and leaf disposal. Materials are available online and in Town Hall.

The Town created a stormwater display that has been presented at the Friends and Family Day and Library Day. In addition, the Town Engineering Department makes presentations at the Middle School about preventing stormwater pollution.

Public notices and updates regarding stormwater quality and sampling events are posted on the website and in newspapers as the events occur, as shown [here](#). More information about stormwater sampling events conducted by the Town is described in Section 6.

As outlined in Section 2.4, the Town is an active member of the Mystic River Watershed Association, and commonly uses pamphlets and brochures from the group to distribute to residents in the Town. The Town focuses on spreading messages relevant to the current season.

Because the Aberjona River is impaired for phosphorus, the Town encourages the proper:

- Use and disposal of grass clippings,
- Use of slow-release and phosphorus-free fertilizers,
- Management of pet waste
- Disposal of leaf litter.

These public outreach documents can be found [here](#).

3.2 Public Involvement and Participation

Objective

Reading provides opportunities to engage the public to participate in the review and implementation of the Town's SWMP.

Permit Requirements

The following are a few requirements of the public involvement and participation section of the Permit:

- All public involvement activities will comply with state public notices.
- The SWMP shall be available to the public online. The Permittee shall provide an opportunity to participate in the review and implementation of the SWMP.
- All public participation activities shall be documented and reported.

The Town's Efforts to Date

Previously the Town had a stormwater hotline (781-942-NOW1) for residents to report any stormwater-related problems; however, it became less widely used and therefore is no longer in use. The Town has shifted to using electronic communications such as email to allow residents a convenient way to report stormwater-related problems.

Scan this QR code with your mobile device to auto generate an email or simply create a new email and type in the below address:



stormwatertips@ci.reading.ma.us

Additionally, the Town has the full SWMP posted on their website [here](#) and welcomes public input on the SWMP document, which can be submitted by clicking [here](#) to provide any questions/comments.

Also, household hazardous waste and used oil collection days are typically held twice a year. The collection dates are announced on the Town's website and social media.

3.3 Illicit Discharge Detection and Elimination (IDDE) Program

Objective

The Town implements an IDDE sampling program to find and eliminate sources of non-stormwater discharges to its drainage system and implement procedures to prevent such discharges. Example non-stormwater discharges include sewer or wastewater piped from residences and commercial and industrial buildings. Such connections are defined as illicit, and should be directed to the sanitary sewer, to not pollute the stormwater drainage system and the receiving waterbodies.

Permit Requirements

The main purpose of the IDDE program is to identify and remove sewerage from the drain system, which is accomplished by preventing SSO's and illicit discharges. Sanitary sewer overflows can occur if a municipal sewer system surcharges causing an overflow out of sewer manhole covers and into the streets and catch basins. An illicit discharge is defined in the Permit 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 firefighting activities." An example of which would be if a residence's main sewer line or even a small

separate basement fixture was connected to, or pumped into, a drainage system instead of the sewer system.

Details about what the IDDE program should include are detailed in the Permit instructions [here](#) in Section 2.3.4.

IDDE Legal Authority

The Town of Reading's IDDE legal authority is established in the Town of Reading Bylaw 8.12, located [here](#), with enforcement covered by the Department of Public Works (DPW).

SSO Inventory

The Town of Reading maintains an SSO inventory in accordance with the Permit conditions.

The following SSO information is required to be tracked and reported annually:

- the location,
- a clear statement of whether the discharge entered a surface water directly or entered the MS4,
- date(s) and time(s) of each known SSO occurrence,
- estimated volume(s) of the occurrence,
- description of the occurrence indicating known or suspected cause(s),
- mitigation and corrective measures completed with dates implemented,
- and mitigation and corrective measures planned with implementation schedules.

Map of Stormwater System

The Town of Reading maintains a Geographic Information System (GIS) map of the stormwater system. Figure 2-1 provides an

overview of the map along with the watersheds. In addition to mapping outfalls, receiving waters, open channel conveyances, interconnections, treatment structures and waterbodies, the Town has completed initial catchment delineations. A catchment is defined as the land area draining to a single outfall or interconnection.

Within 10 years of the Permit's effective date, the Town will map 100 percent of outfall special locations, pipes, manholes, catch basins, refined catchment delineations, and the municipal sanitary sewer system.

Sampling Programs

The IDDE program execution follows a written procedure, with IDDE training completed by Reading Engineering Department annually. As required, sampling is performed during both dry and wet weather. Dry-weather sampling is conducted to identify illicit connections to the stormwater system. The goal of wet-weather sampling is to identify any pollutants washed into the system during rain events. If anything is detected during either sampling event, procedures dictate how the results and/or catchment are investigated further. The overall goal of the sampling programs is to track and eliminate pollutants through investigation of the catchment (connected catch basins, manholes and pipes) that lead to the outfall.

Many of the 300 Town-owned outfalls are within easements on private property. The Town has hired engineering consultants to assist with many of the outfall investigations. If a stormwater outfall is located on your property, or an abutting property you may see an engineer looking to gain access to the outfall. These outfalls are typically along waterbodies and in the back of most properties. The consultants assigned to this work, will wear company logo safety gear,

carry photo identification and a letter of explanation of the work as well as notify Reading Engineering and Police of their work. If you have any questions, please contact Reading Engineering. Please click [here](#) for more information on the Town's upcoming sampling programs.

The most recent MS4 permit became effective July 1, 2018. This permit allows and regulates stormwater discharges to various receiving waterbodies in the Town. The Town concluded their first sampling event in 2018, where all Town-owned stormwater outfalls were inspected and sampled. Based on the 2018 sampling program, outfalls were prioritized for follow-up work depending on the sample results. Based on that prioritization, follow-up sampling was conducted from 2019 through 2021, including catchment investigations and dry-weather screening. The 2022 sampling program will include wet-weather sampling and continued catchment investigations.

3.4 Construction Site Stormwater Runoff Control

Objective

Reading implements a construction stormwater runoff control program to minimize or eliminate erosion and maintain sediment on-site so that it is not transported in stormwater.

Permit Requirements

The following is a summary of some of the construction site stormwater runoff control requirements for this section of the Permit:

- Any contractors working in the Town must develop a plan for the sediment and erosion control at construction sites in accordance with the Town of Reading's General Bylaws described in further detail below. The details of what needs to be included in the plan

are outlined in Section 2.3.5 of the [General Permit](#).

- The Town must develop ordinances for sediment and erosion control, and other wastes/pollutants on construction sites.

The Town's Efforts to Date

Stormwater management and erosion control regulations can be found in Section 7.9 in the Town of Reading's [General Bylaws](#). This section also includes requirements to control wastes/pollution created during construction activities such as discarded building materials, concrete truck washout, chemicals, litter, and sanitary wastes. Written site inspection and enforcement procedures are in Section 7.9.9 of the bylaws.

The Town has site plan review procedures detailed in the [Stormwater Management and Erosion Control regulations](#) document dated August 28, 2017.

3.5 Post-Construction Stormwater Management in New Development and Redevelopment

Objective

Reading reduces the discharge of pollutants found in stormwater through the retention or treatment of stormwater after construction on new or redeveloped sites.

Permit Requirements

The following is a summary of the post-construction stormwater management in new development and redevelopment requirements of this section of the Permit:

- The Town must develop a plan to address post-construction stormwater runoff. Details about the necessary requirements for this are in 2.3.6.a in the [General Permit](#).

- Within four years, the Town shall develop a document with street design and parking lot guidelines.
- Within four years, the Town shall develop a report determining the feasibility of the following practices:
 - Green roofs
 - Infiltration practices (rain gardens, planter gardens, etc.)
 - Water harvesting devices
- Within four years, the Town shall identify five Town-owned properties to be retrofitted with these BMPs.

The Town's Efforts to Date

The Town has a post-construction ordinance in the [Subdivision Regulations](#) 7.4.4.

As mentioned in Section 3.4, the Town has Stormwater Management and Control Regulations, which can be viewed [here](#).

Reading [Zoning Bylaw](#) 10.3 is the Aquifer Protection District. This bylaw promotes and provides quality drinking water by promoting stormwater recharge.

As mentioned in Section 2.2, the Town of Reading has a SWEF to provide a dedicated and adequate source of funding for the Town's stormwater management program.

3.6 Good Housekeeping and Pollution Prevention for Permittee-Owned Operations

Objective

Reading shall implement an operations and maintenance program for Town-owned operations with the goal of preventing or reducing pollutant runoff and protecting water quality from all Town-owned operations.

Permit Requirements

Following is a summary of the good housekeeping and pollution prevention for permittee-owned operations requirements of this section of the Permit:

- Develop a list of all Town-owned facilities outlined in Section 2.3.7.ii of the [General Permit](#).
- The Town shall establish a program of the activities and procedures to maintain the drainage structures in the Town. This includes activities such as cleaning catch basins.
- The Town shall establish practices to minimize use of road salt and sand.

The Town's Efforts to Date

Reading regularly inspects and cleans the catch basins in their system. The Town conducts approximately 375 miles of street sweeping each year and more information can be found [here](#). Street sweeping frequency is increased due to the phosphorus impairment in the Aberjona River watershed.

Reading does not use sand on its roadways. Generally, the Town will pre-treat with salt, and continue to use salt during any snow event. When the temperature decreases to a point where salt is no longer effective (20 degrees) the Town mixes the salt with a calcium chloride solution, which aids in the melting process. The salt is stored in a covered garage. The Town of Reading Snow and Ice Guidelines can be found [here](#).

Reading has developed Stormwater Pollution Prevent Plans (SWPPPs) for the DPW facility and the Reading Municipal Light Department (RMLD) facility. The SWPPP describes the management practices and controls that are implemented at the facility to reduce the potential for the discharge of pollutants in the stormwater.

4.0 What Can Residents Do?

Residents of the Town of Reading should remember C.O.P.:

- **C**olor
- **O**dor
- **P**ollutants

If a resident sees/smells one of these near catch basins or other drainage structure, they should report it using this email in Section 4.4.

4.1 Color

The colors of concern for a surface water are white, orange (rust color), soap suds, oil sheen, paint, or any unusual colors.



4.2 Odor

Please report any odors such as ammonia, sulfur (rotten egg), gasoline, paint solvents, sewage, chlorine, or fertilizers emitting from catch basins, drainage ditches, outfalls, or waterways.



4.3 Pollutants

If you observe any of the following, please contact us: trash, motor oils, antifreeze, household chemicals, paints, chlorine, detergents, soaps, grass clippings, leaves, sweeping, construction materials, pet excrement, or insecticides.



4.4 Stormwater Email

If you see a problem with a stormwater structure, please report it by emailing the following address. Scan the QR code below with a mobile device to automatically generate an email or create a new email and manually type in the below address.:

stormwatertips@ci.reading.ma.us



In the email, please include the following:

- The address/location.
- Detailed description of the problem (ex: soap suds around the catch basin and flowing into the catch basin).
- Date that the problem was noticed. If the problem was noticed over the span of several days, please include the approximate dates.

- Pictures.

The Town of Reading Engineering Department values your help and will work to resolve the problem accordingly. Thank you for your efforts in protecting the Town's stormwater!

The old stormwater hotline (781-942-NOW1) is no longer active. The best way to report any stormwater problems or observations are to send an email the address listed above.

4.5 Other Resident Best Practices

In addition to watching for C.O.P., the following are a few steps you can take to reduce stormwater pollution:

- Remove debris such as trash, leaves and grass clipping away from catch basins, drainage ditches and waterways.
- Do not sweep your driveway sand/sediment into the catch basin; it is not for garbage disposal and will not pass the solids.
- Do not dump household waste such as paint, cleaning products, motor oils, antifreeze, pet excrement, yard waste or any other hazardous material into catch basins, drainage ditches and waterways.
- Dispose of hazardous waste properly with the Town's Household Hazardous Materials Collection Program.
- Dispose of pet waste in the trash.
- Minimize the use of fertilizers near catch basins, drainage ditches and waterways.
- Whenever possible use environmentally friendly,

biodegradable products when cleaning outside.

- Do not drain chemically treated swimming pools into catch basins or drainage ditches. Pool water should be held until chlorine levels are acceptable enough to discharge to catch basins or drainage ditches.
- If you wash your car at home, wash it on the lawn to encourage infiltration and use environmentally friendly safe products.

5.0 What Can Businesses Do?

Businesses can follow several of the same steps that residents take to prevent stormwater pollution. These include the following:

- Remove debris such as trash, leaves and grass clipping away from catch basins, drainage ditches and waterways.
- Do not dump business waste such as paint, cleaning products, motor oils, antifreeze, pet excrement, sand, yard waste or any other hazardous material into catch basins, drainage ditches and waterways.
- Dispose of hazardous waste properly.

6.0 The Town of Reading Engineering Department

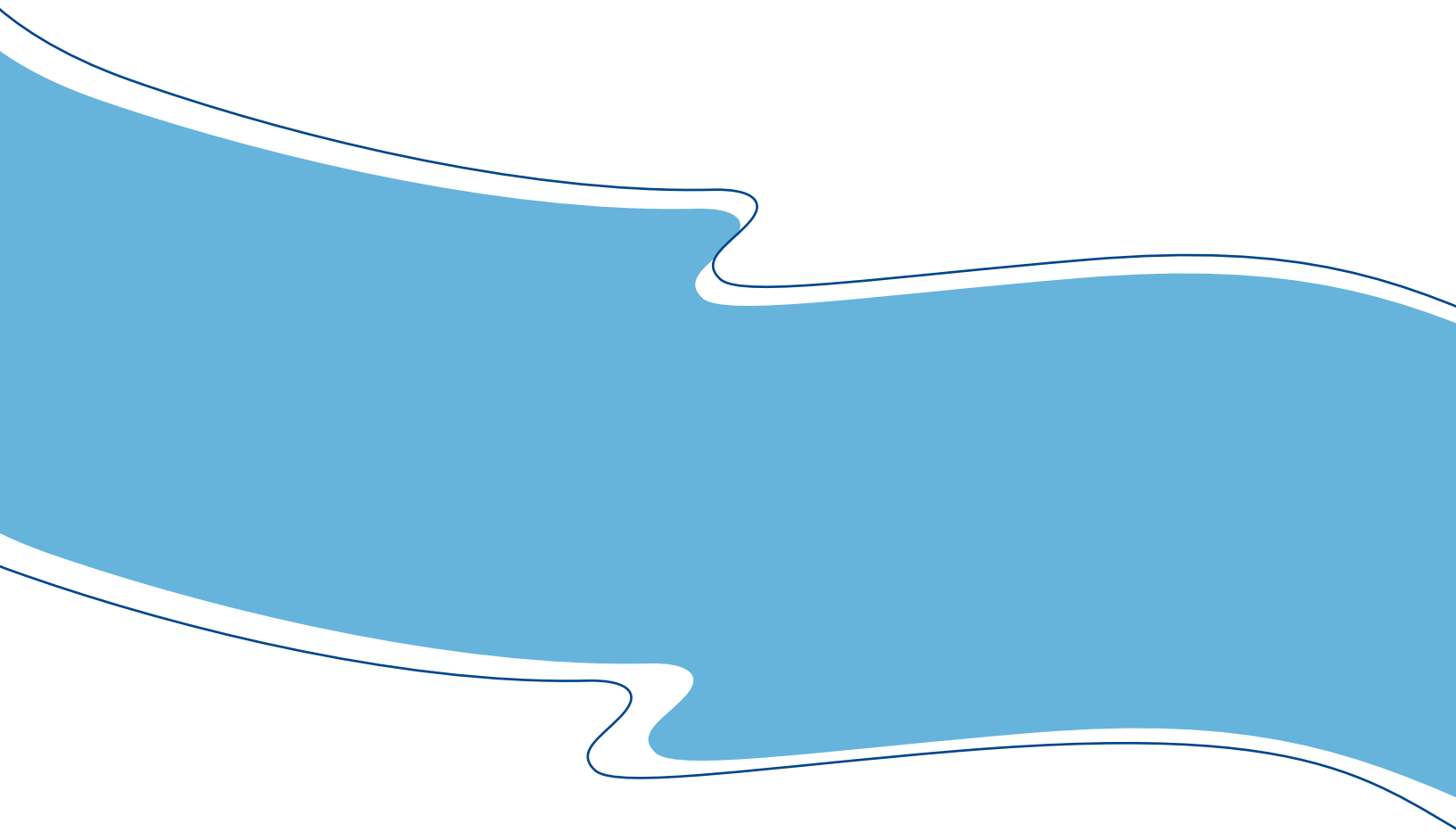
Contact information for the Town of Reading Engineering Department is shown below, along with the SWMP Team Coordinator:

Contact Information	
Hours of Operation:	Mon, Wed & Thurs: 7:30 am to 5:15 pm Tues: 7:30 am to 6:45 pm Friday: Closed
Phone:	(781) 942-9082
Fax:	(781) 942-5441
Address:	Engineering Department Town Hall 16 Lowell Street Reading, MA 01867 United States
SWMP Team Coordinator:	Ryan Percival, P.E., Town Engineer rpercival@ci.reading.ma.us (781) 942-9082

7.0 Annual Reports

The following annual reports completed for permit compliance will be posted on the Reading website soon. They include the:

- Year 1 Annual Report
- Year 2 Annual Report
- Year 3 Annual Report



Section 5

Stormwater Pollution Prevention Plans (SWPPs)

- **Department of Public Works Facility, May 2016**
- **Reading Municipal Light Department Facility, May 2016**

**STORMWATER
POLLUTION
PREVENTION
PLAN**

**Department of Public Works Facility
at 75 Newcrossing Road**
Town of Reading, Massachusetts

Town of Reading
16 Lowell Street
Reading, MA 01867

May 2016



Town of Reading, Massachusetts
Department of Public Works
2016 Massachusetts Small MS4 General Permit – Appendix B.11
Signatory Requirements

SWPPP Certification

CERTIFICATION STATEMENT

“I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gathered and evaluated the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.”

Print name and title: _____

Signature: _____ **Date:** _____

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Section 1

Site Description and Contact Information

1.1 Purpose

This Stormwater Pollution Prevention Plan (SWPPP) has been developed for the Town of Reading (Town) for the Department of Public Works (DPW) facility located at 75 Newcrossing Road. The SWPPP describes the management practices and controls that are implemented at the facility to reduce the potential for the discharge of pollutants in stormwater.

1.2 Regulatory Background

The first wave of stormwater regulations (Phase I) was published on November 16, 1990, and called for stormwater permits under the Clean Water Act's National Pollutant Discharge Elimination System (NPDES) program. Municipalities with separate storm sewer systems (MS4s) and populations of over 100,000 and certain industries that discharged to MS4s or directly to waters of the United States were covered by the Phase I regulations. Stormwater discharges associated with industrial activity owned or operated by municipalities were temporarily exempted from NPDES permitting requirements of Phase I due to provisions within the Intermodal Surface Transportation and Efficiency Act (ISTEA) of 1991.

The second wave of stormwater regulations (Phase II) was published in the Federal Register on December 8, 1999 and required NPDES permits for small MS4s (populations fewer than 100,000) as well as for previously exempted municipal industrial activities. On May 1, 2003, EPA Region 1 issued its Final General Permit for Stormwater Discharges From Small Municipal Separate Storm Sewer Systems (2003 Small MS4 Permit) that covers "traditional" (i.e., cities and towns) and "non-traditional" (i.e., Federal and state agencies) MS4 Operators located in the states of Massachusetts and New Hampshire.

During 2008 to 2010 EPA issued three separate draft Small MS4 General permits to replace the 2003 Small MS4 permit. Several public hearings were held and comment period ended March 11, 2011. The 2014 Draft Massachusetts Small MS4 General Permit was released for public comment on September 30, 2014 and the comment period ended February 27, 2015.

The 2016 Massachusetts Small MS4 General Permit was signed April 4, 2016 and will become effective July 1, 2017. The final permit reflects modifications to the 2014 draft small MS4 general permit released for comment on September 30, 2014 and replaces the 2003 small MS4 general permit for MS4 operators within the Commonwealth of Massachusetts.

The Phase II Rule defines a small MS4 stormwater management program as a program comprising six elements that, when implemented in concert, are expected to result in significant reductions of pollutants discharged to receiving waterbodies. The six MS4 program elements, termed "minimum control measures," are as follows:

1. Public Education and Outreach
2. Public Participation and Involvement

3. Illicit Discharge Detection and Elimination (IDDE) Program
4. Construction Site Stormwater Runoff Control
5. Stormwater Management in New Development and Redevelopment
6. Good Housekeeping and Pollution Prevention

Per the Section 2.3.7.b of the 2016 permit, municipalities must develop a SWPPP for maintenance garages, public works facilities, transfer stations and other waste handling facilities as part of the Good Housekeeping and Pollution Prevention control measure. The SWPPPs are required to be implemented no later than two years from the effective date of the permit.

1.3 General Pollution Prevention Plan Requirements

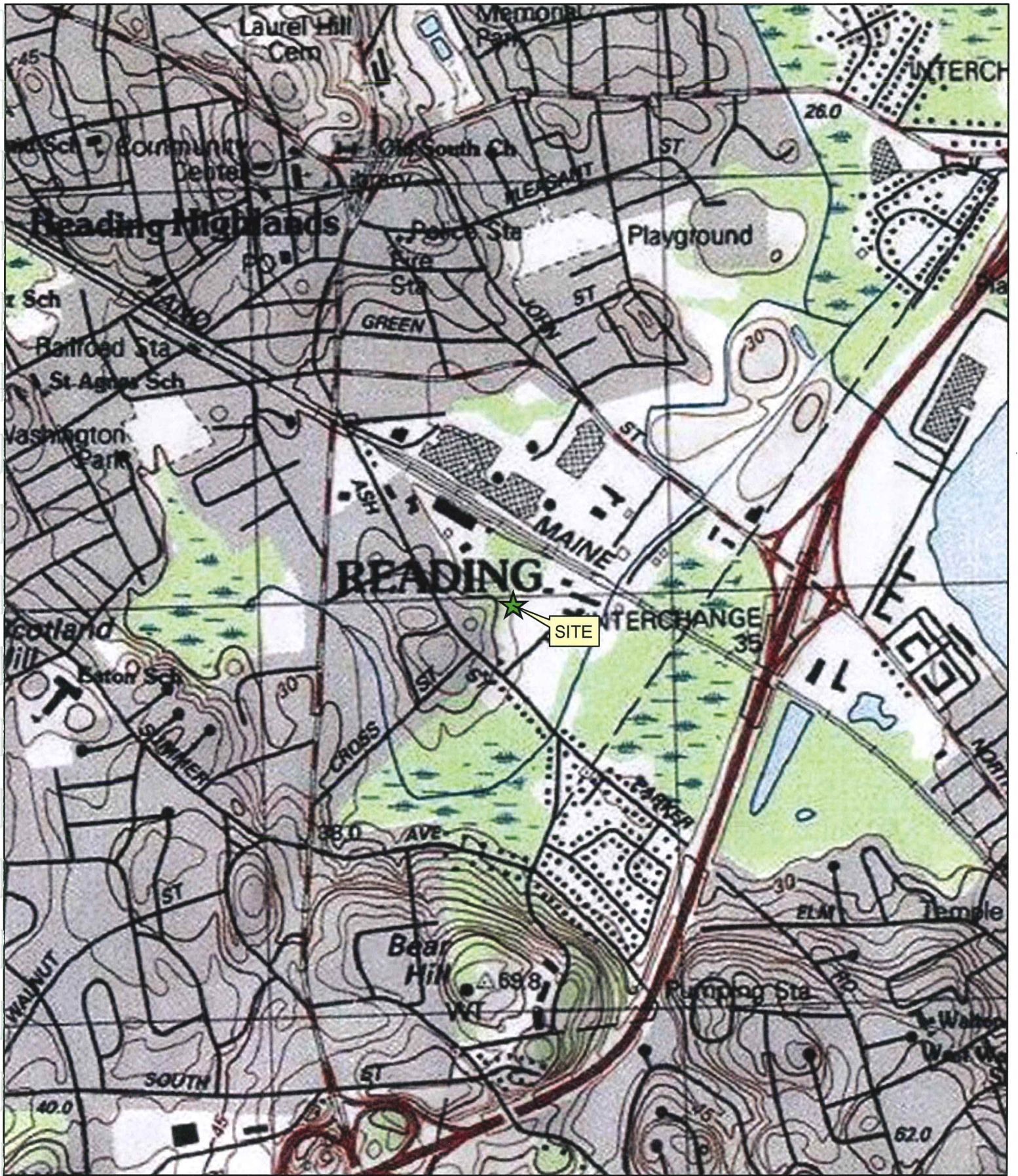
The baseline requirements for a SWPPP include:

1. The development of a **Pollution Prevention Team** to prepare the plan and assist the facility manager in its implementation.
2. The assessment and description of **Potential Pollution Sources**, including a comparison of the site's drainage characteristics to material storage, fueling, or other areas of industrial activity.
3. The development of **Measures and Controls**, including pollution prevention measures, best management practices, and other controls for the facility.
4. The development of an **Employee Training** program on how to incorporate pollution prevention/good housekeeping techniques into municipal operations.
5. A description of the **Inspections and Monitoring** to be conducted at the facility.

1.4 Site Description

The Town of Reading's Public Works Department is responsible for all endeavors relating to planning, designing, operating, maintaining, and managing public ways, park lands, open space, public grounds, town cemeteries, recreation programs, water distribution systems, sewer collection systems, and the collection and disposal of solid waste. The Department also provides engineering support services and motor equipment maintenance services to all town departments.

The DPW facility is located at 75 Newcrossing Road and comprises approximately 6 acres. The facility is bordered by light industrial properties to the northeast and northwest and residential properties to the south and west. A site locus map is provided as **Figure 1-1**. **Figure 1-2** is a site plan of the facility. The DPW garage is located in the western portion of the property. The building is approximately 34,000 square feet in size and houses vehicle and equipment maintenance areas, a shop area and office space in the northwest portion of the building, and a large vehicle storage area in the southwestern portion of the building. All floor drains in the service bays and storage areas have been connected to an existing oil/water separator that discharges to the sanitary sewer system.



Reading DPW Garage
 75 Newcrossing Road
 Reading, Massachusetts

Figure 1-1
 Site Locus Plan



0 500 1,000
 Feet

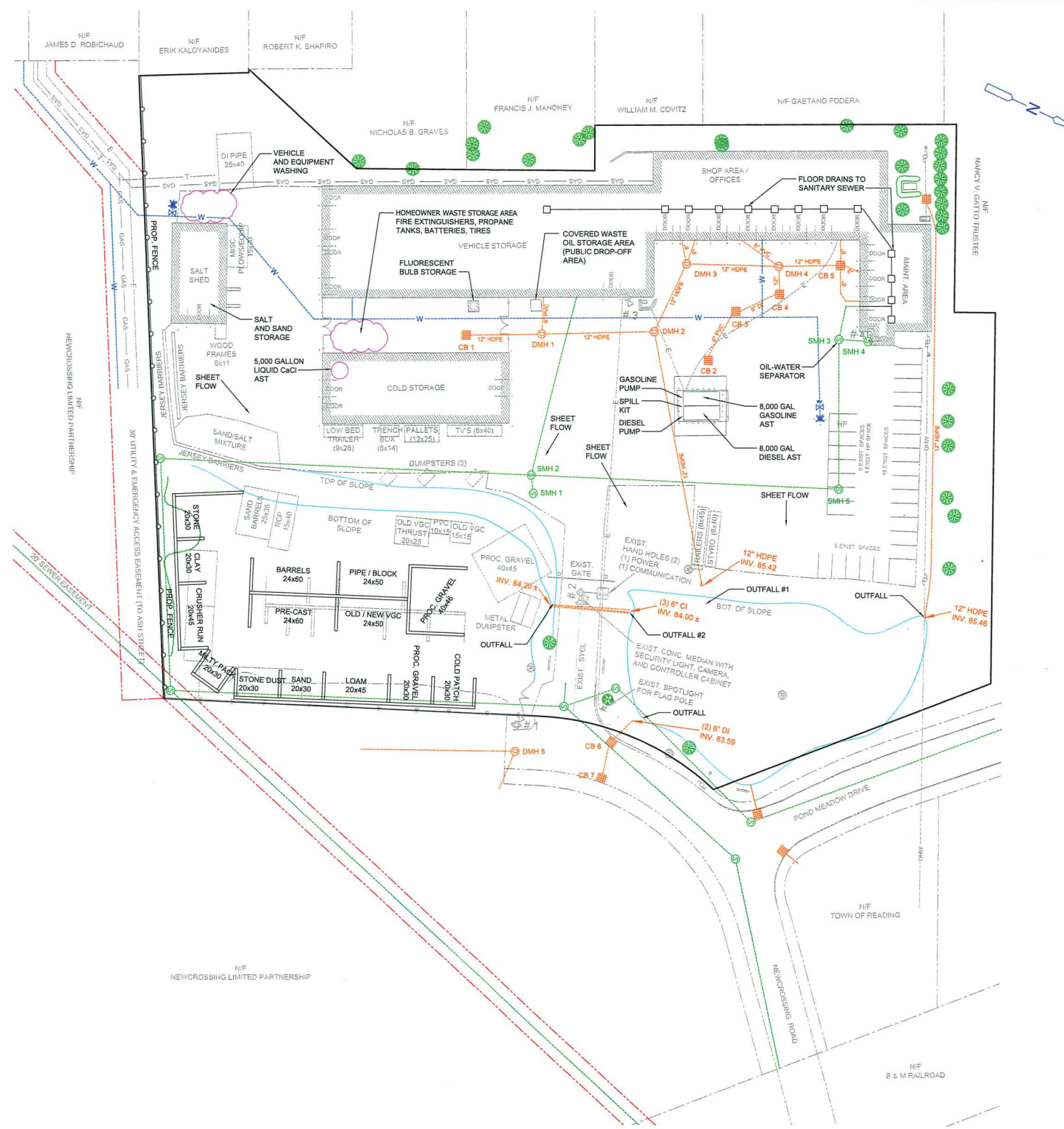
1" = 1,000'

Basemap: USGS 7.5-minute Topographic Quadsheet
 Source: ESRI ArcGIS Online, NGS Topo US
 Coord. System: NAD83 Mass. State Plane Mainland (meters)



UTILITY INFORMATION

DMH 1 RIM ELEV. 91.48 6" INV. IN 88.35 12" INV. IN 87.93 12" INV. OUT 87.91	CB 1 RIM ELEV. 90.89 12" INV. OUT 88.15	SMH 1 RIM ELEV. 89.75 8" INV. OUT 84.97
DMH 2 RIM ELEV. 91.31 12" INV. IN 86.71 12" INV. IN 86.72 12" INV. OUT 86.68	CB 2 RIM ELEV. 90.84 6" INV. OUT 88.80	SMH 2 RIM ELEV. 89.58 8" INV. IN 84.15 6" INV. IN 84.70 8" INV. OUT 84.05
DMH 3 RIM ELEV. 91.58 6" INV. IN 87.58 6" INV. IN 87.73 12" INV. IN 87.26 12" INV. OUT 87.16	CB 3 RIM ELEV. 90.91 6" INV. IN 88.83 6" INV. OUT 88.32	SMH 3 RIM ELEV. 90.90 6" INV. IN 85.12 6" INV. IN 85.14 6" INV. IN 85.18 8" INV. OUT 85.10
DMH 4 RIM ELEV. 91.56 6" INV. IN 87.91 12" INV. IN 87.70 12" INV. OUT 87.64	CB 4 RIM ELEV. 91.04 12" INV. OUT 87.59	SMH 4 RIM ELEV. 90.66 4" INV. IN 88.56 6" INV. IN 85.28 6" INV. OUT 85.26 (TOP OF WATER AT BAFFLE)
	CB 5 RIM ELEV. 91.60 6" INV. IN 88.60 6" INV. IN 87.91 12" INV. IN 88.60 12" INV. OUT 88.43	SMH 5 RIM ELEV. 88.90 8" INV. IN 85.07 8" INV. OUT 85.00
	CB 6 RIM ELEV. 85.01 12" INV. IN (2) 6" INV. OUT 84.18	



LEGEND:

- EXISTING WATER MAIN
- EXISTING SEWER MAIN
- EXISTING DRAINAGE
- EXISTING GAS MAIN
- EXISTING UNDERGROUND ELECTRIC
- EXISTING CONTOUR
- EXISTING FENCE
- EXISTING EDGE OF PAVEMENT
- EXISTING OVERHEAD WIRES
- EXISTING MONITORING WELL
- EXISTING HEAD WALL
- EXISTING ELEC. POLE
- EXISTING ELEC. POLE/W LIGHT
- EXISTING HYDRANT
- EXISTING TREE
- PROPOSED SECURITY CAMERA
- PROPOSED OVERHEAD LIGHT
- PROPOSED SPOT LIGHT
- PROPOSED HAND HOLE
- PROPOSED SECURITY GATE
- PROPOSED UNDERGROUND ELECTRIC



REVISION DATE:
FEB. 13, 2012
APR. 10, 2012

TOWN OF READING DEPARTMENT OF PUBLIC WORKS		
SCALE: 1" = 40'	APPROVED BY: G.J.Z	DRAWN BY: C.C.
DATE: SEPT. 20, 2011		
PUBLIC WORKS FACILITY		
SITE PLAN	FIGURE 1-2	

A fueling station is located in the central portion of the facility. The fuel island consist of two pumps, adjacent to two 8,000-gallon above ground storage tanks (ASTs). One storage tank contains unleaded gasoline and the other diesel fuel. The fuel pumps are operated on a double card system to identify the operator and the vehicle and have an automatic shut off system. The tanks are situated on a concrete pad with containment rings along the perimeter. A spill kit is located at the fuel pumps.

A deicing material storage area is located on the southwest portion of the property. The storage shed is approximately 3,000 square feet and houses salt and sand. Salted sand is stored outside of the facility during the winter season.

A third building, approximately 7,000 square feet in size, is located in the central portion of the property and is used for cold storage. A 5,000-gallon aboveground plastic storage tank is located in the southwest portion of the building which contains liquid calcium chloride used in deicing operations.

The eastern portion of the property is utilized for storage of bulk construction materials, including processed gravel, cold patch, stone, sand, loam, crusher run, clay, stone dust, and milty pack.

1.5 Endangered Species and Historic Places Certification

Based on a review of Federally listed endangered and threatened species (“listed species”) and designated critical habitat, no endangered or threatened species or the designated critical habitat are likely to occur in proximity to the stormwater discharge or discharge related activities at the Reading DPW. Based on a review of the National Register of Historic Places, stormwater discharges and allowable non-stormwater discharges at the Reading DPW facility do not have the potential to have an effect on historic properties.

1.6 Pollution Prevention Team

The Town of Reading Department of Public Works is responsible for implementing and complying with this SWPPP through the Pollution Prevention Team. The Pollution Prevention Team is responsible for developing and implementing the SWPPP, maintaining and revising or amending the SWPPP, maintaining control measures and making all necessary corrective actions. The Pollution Prevention Team will implement control measures to improve stormwater quality. The managers and team members and their responsibilities are outlined in **Table 1-1**.

The responsibilities of the Pollution Prevention Team Leader are to coordinate all phases of the SWPPP development, coordinate the employee training program, arrange for inspections and monitoring and maintain compliance with the SWPPP.

The Spill Coordinator is responsible for developing and implementing spill response procedures.

The team members’ responsibilities include assisting the Team Leader with his/her duties, implementing and maintaining control measures for the preventive maintenance program, and ensuring good housekeeping practices are followed. All team members are also spill response team members. They must ensure that all spills and leaks are cleaned up promptly and report spills to the Spill Coordinator immediately.

Table 1-1 Pollution Prevention Team

SWPPP Team Member	Title	Phone Number	Responsibilities
Team Leader	Town Engineer	(781) 942-9082	Coordinate all phases of SWPPP development, coordinate employee training programs, maintain all records, oversee inspections and monitoring.
Spill Coordinator	Highway Supervisor	(781) 942-9092	Develop and implement spill response procedures.
Member	Town of Reading Engineering Staff	(781) 942-9082	Oversee the implementation of preventative maintenance and good housekeeping, respond to emergency situations, conduct inspections and monitoring.
Member	Town of Reading Engineering Staff	(781) 942-9082	Oversee the implementation of preventative maintenance and good housekeeping, respond to emergency situations, conduct inspections and monitoring.

1.7 Keeping the SWPPP Current

The SWPPP shall be kept current and reviewed on at least an annual basis. The plan shall be amended whenever there is a change at the site affecting the potential to cause pollution, or the control measures listed in the SWPPP fail to adequately protect against pollution. The SWPPP shall be amended to address sources or potential sources of pollution identified during the site inspections or monitoring events.

Section 2

Description of Pollutant Sources

This section of the SWPPP describes activities, materials, and physical features of the facility that may contribute pollutants to stormwater runoff or, during periods of dry weather, result in pollutant discharges into the stormwater drainage systems. An assessment of stormwater pollution sources will support efforts to identify and set priorities for necessary changes in materials, materials management practices, or site features, as well as the selection of appropriate structural/nonstructural controls.

2.1 Drainage Description

All of the stormwater at the Department of Public Works (DPW) facility drains to the detention basin located on the northeast portion of the property. A series of catch basins are located to the northeast of the DPW garage and discharge stormwater from this area via Outfall #1. Stormwater from the construction material storage area in the western portion of the site flows via the culvert under the DPW driveway and discharges to the detention basin via Outfall #2. Stormwater in the southeastern portion of the property travels via sheet flow to the northeast to a vegetated swale and discharges to the detention basin via Outfall #2. Two additional outfalls discharge stormwater from off site to the detention basin.

2.2 Inventory of Exposed Materials and Summary of Potential Pollutant Sources

This section provides an inventory of materials exposed to stormwater. This inventory was prepared based on the site inspection conducted by CDM Smith on October 2, 2012. A summary of the stormwater materials inventory including materials that are exposed to rainfall as a result of storage, loading, unloading, and transfer operations is provided in **Table 2-1** and discussed below.

2.2.1 Vehicle and Equipment Maintenance

Repairs and maintenance to Town vehicles are performed at the maintenance garage. All repairs are performed inside the enclosed garage to prevent direct stormwater contact. Spill cleanup material is stored inside the garage. All floor drains in the service bays and storage areas have been connected to an existing oil/water separator that discharges to the sanitary sewer system. The area surrounding the building is paved, with drainage directed to catch basins. Vehicle and equipment maintenance work often requires the handling and storage of various materials including paints, solvents, battery acid, fuel additives, oils, and hydraulic fluid. Wastes are containerized by class and stored indoors until properly disposed of off site.

2.2.2 Vehicle and Equipment Fueling Area

Vehicle and equipment fueling is conducted at the pumping station located in the central portion of the facility. The pumping station is comprised of two 8,000-gallon aboveground storage tanks (ASTs) of gasoline and diesel fuel. The fuel pumps are operated on a double card system to identify the operator and the vehicle and have an automatic shutoff system. The tanks are situated on a concrete pad with containment rings along the perimeter. A spill kit is located at the fuel pumps. Of particular

**Table 2-1
Town of Reading
DPW Facility
Exposed Materials Inventory**

Material	Purpose/Description	Location	Quantity Stored	Likelihood of Contact with Stormwater	Past Significant Spills or Leaks
Gasoline	Vehicle fuel, AST	Fuel pump	8,000 gal	Possible during fueling	No
Diesel Fuel	Vehicle fuel, AST	Fuel pump	8,000 gal	Possible during fueling	No
Waste Oil	Homeowner waste	Between the northwest corner of the cold storage building and the DPW garage	400 gal	Possible, partially exposed to weather	No
Fuel/Oil	Generator	Behind the northwest corner of the DPW garage	165 gal	Low	No
Sand	Road traction	Salt shed	NA	Low, stored indoors	No
Salt	Road deicing	Salt shed	800 ton	Low, stored indoors	No
Sand/Salt Mixture	Road deicing	Northeast of Salt shed	200 ton*	Yes, exposed to weather	No
Liquid CaCl	Road deicing	Southwest corner of cold storage building	5,000 gal	Possible during transfer	No
Soapy Water	From washing vehicles and equipment	Rear of salt shed	NA	Yes, exposed to weather	No
Used Batteries	Homeowner waste	Between the southeast corner of the DPW garage and the cold storage building	Varies	Yes, exposed to weather	No
Used Fire Extinguishers	Homeowner waste	Between the southeast corner of the DPW garage and the cold storage building	Varies	Yes, exposed to weather	No
Used Propane Tanks	Homeowner waste	Between the southeast corner of the DPW garage and the cold storage building	Varies	Yes, exposed to weather	No
Tires	Homeowner waste	Between the southeast corner of the DPW garage and the cold storage building	Varies	Yes, exposed to weather	No
Solid Waste Dumpsters	Facility solid waste	East of cold storage building	3-10 cys	Yes, exposed to weather	No
Bulk Construction Materials	Town construction projects	Eastern portion of property	14475 sf	Yes, exposed to weather	No
Scrap Metal Roll off Dumpster	Town construction waste and misc metals	Eastern portion of property	20 cyd	Yes, exposed to weather	No
Styrofoam Box Container	Homeowner waste	Between the northwest corner of the cold storage building and the DPW garage	45 cyd	No, enclosed	No

Notes:

* stored outside during winter, at close of season moved into salt shed

concern during fueling of vehicles and equipment is overfilling. Vehicles should not be “topped off” especially in warmer months when thermal expansion of fuel can occur. Potential pollutants from vehicle and equipment fueling are gasoline, oil and coolant.

2.2.3 Salt Storage Shed

The Town of Reading uses a sand/salt mixture and liquid calcium chloride for road deicing. The salt storage shed is located in the southwestern portion of the site. Salt is stored in the rear of the shed and sand is stored in the front portion of the shed. The salt shed is not large enough to accommodate loading and unloading operations; therefore, during the winter season, a sand/salt mixture is stored outside the shed and is exposed to stormwater. Calcium chloride is stored in a 5,000-gallon polypropylene storage tank in the southwest corner of the cold storage building. The tank is equipped with a pump for filling the trucks. Potential pollutant sources associated with road deicing activities are solids and salt.

2.2.4 Vehicle Washing Area

Vehicle washing is conducted outdoors to the rear of the salt storage shed. Currently washwater is not contained; however, there are no catch basins in the immediate vicinity of the area. Wash water runs off as sheet flow to a vegetated area and ultimately to the detention basin. Solids and debris that remain following washing are stockpiled. Potential pollutant sources associated with vehicle washing are gasoline, oils, coolant, solids and surfactants.

2.2.5 Homeowner Waste Storage Area

The DPW facility accepts homeowner waste materials including: waste oil, fire extinguishers, batteries, fluorescent light bulbs, propane tanks, tires and televisions. Waste oil is stored in an AST equipped with secondary containment and covered by a wooden overhang. The fluorescent light bulbs are stored in a small enclosed storage shed. The remaining materials are stored outside between the southeast corner of the DPW Garage and the cold storage building and are exposed to stormwater. All materials are properly disposed of off site on a regular basis.

2.2.6 Bulk Material Storage Area

The eastern portion of the property is utilized for storage of construction materials, including processed gravel, cold patch, stone, sand, loam, crusher run, clay, stone dust, and milty pack. The loading and unloading of construction materials is a potential pollutant source of sediment and any fluids dripped by the equipment.

2.2.7 Solid Waste Storage

Three solid waste storage containers are located east of the cold storage building at the top of the slope. Solid waste containers should be covered and inspected regularly for leaks and overfilling. Potential pollutants from solid waste containers include oil and grease, petroleum hydrocarbon residues and debris.

2.3 Spills and Leaks

CDM Smith reviewed the Massachusetts Department of Environmental Protection (MassDEP) Waste Site Database to identify available records for the DPW Facility. The MassDEP database did not contain records associated with 75 Newcrossing Road. There have been no significant spills or chronic leaks at the DPW facility in the past 3 years.

2.4 Non-Stormwater Discharges

Discharges of all non-stormwater flows are prohibited, except flows from fire fighting activities and certain flows described below, as long as they are described in this plan:

- Discharges from fire fighting activity;
- Fire hydrant flushing;
- Potable water sources, including water line flushings;
- Irrigation drainage;
- Uncontaminated groundwater discharges such as from foundation drains and footings;
- Lawn watering;
- Routine external building washdown without detergents; and,
- Pavement wash waters where spills or leaks of hazardous materials have not occurred (unless all spilled material has been removed, and where detergents are not used).

Section 3

Stormwater Measures and Controls

This section describes the Best Management Practices (BMPs) to be implemented to eliminate or reduce stormwater pollution. BMPs are measures, practices, and controls designed to reduce contaminant loading to stormwater from specific activities. BMPs may be:

- Procedural, such as training in spill response procedures;
- Structural, such as vegetated swales or oil/water separators; or
- Administrative, such as record keeping.

3.1 Good Housekeeping

Good housekeeping is important to reduce the inadvertent discharge of pollutants in stormwater runoff. Impacts to stormwater will be reduced by following the list of good housekeeping measures below:

- Catch basins shall be inspected and cleaned at least annually.
- Paved areas shall be swept at least semi-annually.
- Spills shall be immediately contained and cleaned up with absorbent material.
- All spills occurring during addition or removal of material from the salt shed shall be promptly swept up. Salt shall be swept up after loading and unloading operations.
- No drums shall be stored outdoors.
- All changing of fluids shall be done indoors with proper ventilation.
- Covers on dumpsters shall be kept closed when not loading or unloading.
- Drip pans shall be used when changing fluids. Waste fluids are to be properly managed and disposed of.
- Spigots or funnels shall be used to minimize drips or leaks when transferring fluids.
- Oily wastes shall be kept separate from other wastes, especially solvents.
- Dirty rags shall be stored in a covered, labeled container.
- Spent radiator coolants (antifreeze) shall be kept in a covered container.
- Hydraulic equipment shall be kept in good repair and drips shall be cleaned up promptly.

- Storage areas shall be designated with conspicuous signs. Proper storage instructions shall be posted at all times in an open and conspicuous location. During employee training these storage areas and storage instructions shall be discussed.
- Storage areas shall be located away from the storm drain system.
- Stockpiled material shall be kept in a neat, orderly manner at all times.
- Remove excess stored materials.

3.2 Preventative Maintenance

Preventative maintenance is the timely inspection and maintenance of stormwater management devices. It includes the inspection, testing, and maintenance of facility equipment and systems to uncover conditions that could cause breakdowns or failures resulting in discharges of pollutants to surface waters.

- Oil/water separators shall be inspected and cleaned at least once per year by a certified waste hauler.
- All structures, including catch basins, paved ditches, swales, pipe outlets, and stormwater manholes will be inspected annually and cleaned when necessary.
- The fueling area shall be inspected for signs of spills or leaks. Hoses and fittings shall be inspected regularly. Formally, the fueling area shall be inspected monthly. After fueling vehicles or equipment, inspect the area to ensure that no spills or leaks occurred during fueling. If a spill or leak did occur, follow the steps outlined in the Spill Prevention and Response Procedures section.
- Aboveground storage tanks shall be inspected regularly for signs of corrosion or leaks.
- Hydraulic equipment shall be kept in good repair to prevent leaks.
- Equipment shall be inspected, tested, and maintained to reduce the potential of leaky equipment becoming a pollutant source. Any equipment that could break or malfunction and cause pollutants to reach the storm drain system will be checked.

3.3 Sediment and Erosion Control

Bulk construction materials are stored in a vegetated area and surrounded by concrete stacking blocks.

3.4 Management of Stormwater Runoff

All runoff from the site flows to the detention basin located in the northeast portion of the property which provides peak flow attenuation and water quality treatment by settling solids.

3.5 Recommended BMPs

The following additional BMPs are recommended at the Reading DPW Facility:

- Evaluate options for moving vehicle and equipment washing operations indoors to the maintenance garage where floor drains are connected to the oil/water separator. Wash water runoff should not contribute to stormwater runoff.
- Evaluate options for providing cover for materials at the homeowner waste storage area that are currently exposed to precipitation.
- Evaluate options for storing the salted sand mixture under cover.
- Remove excess materials that are currently exposed to stormwater.
- Conduct disposal of wastes on a frequency that reduces storage times.

3.6 Spill Prevention and Response Procedures

The following is a list of spill prevention and response procedures to be practiced at this facility. The measures outlined here are not intended to supersede the requirements of any spill prevention control and countermeasure plans that may be in place for the facility.

1. Spill cleanup equipment is available at the fuel pumps and within the DPW garage and includes spill mats, brooms, shovels, absorbent material, and containers.
2. The Pollution Prevention Team Leader and the Spill Coordinator will be advised immediately of all spills of hazardous or Massachusetts-regulated materials, regardless of quantity.
3. The spill will be evaluated to determine the necessary response. If there is a health hazard or fire or explosion potential, 911 shall be called immediately. For spills of 10 gallons or more, notify MassDEP Emergency Response at 888-304-1133 (24-hr).
4. Any spill will be contained as close to the source as possible with a dike of absorbent materials from the emergency spill kit (such as socks, pads, pillows, or “pigs”). Additional dikes will be constructed to protect swales or other stormwater conveyances or streams. Spill mats will protect any other stormwater structures such as catch basins.
5. All waste material shall be disposed of properly, including used absorbent materials.
6. Spill response kits will be kept up to date and fully stocked at all times.
7. Minimize the amount of materials kept at the site. Rotate chemicals to use the older containers first, reducing wasted chemicals that expire and the chance of container failure.
8. Keep containers closed and sealed except when filling or emptying. Be sure to re-close the container after adding or removing chemical or waste.

3.7 Employee Training

In accordance with Section 2.3.7.b.11.h, employees who work in areas where materials or activities are exposed to stormwater, or who are responsible for implementing activities identified in the SWPPP (e.g., inspectors, maintenance personnel), including all members of the Pollution Prevention Team should be trained on an annual basis. Training shall cover both the specific components and scope of the SWPPP and the control measures including spill response, good housekeeping, material management practices, any best management practice operation and maintenance, etc.

Attendance logs are required to be kept and applicable stormwater issues must be covered. The sign-off sheet for each training session signed by all employees and the supervising member of the pollution prevention team are required to be kept with the SWPPP. An employee training log is provided in **Appendix A**. An example training agenda is provided herein.

3.7.1 Example Training Agenda

- A. The Pollution Prevention Plan
 - i. **What it is** – *The Plan is an outline of potential sources of stormwater pollution and methods of reducing or eliminating that pollution.*
 - ii. **What it contains** – *The Plan emphasizes good housekeeping measures, preventative maintenance, spill prevention and response, and location of potential pollution sources.*
 - iii. **Why it is important** – *Pollution from stormwater runoff and storm drains is the primary source of pollution to many of Massachusetts' waters. Many stormwater pollutants are extremely toxic to fish and devastating to their habitats.*
 - iv. **Pollution Prevention Team** – *The team will be introduced, explaining that they are continually looking to avoid pollution to the storm drain system and stormwater runoff and appreciate input and assistance.*
- B. Discussion of the stormwater system
 - i. *Location of the DPW facility storm drain structures*
 - ii. *Receiving water of the storm system – noting the receiving water stresses the importance of keeping pollutants out of the storm drain.*
- C. Review spill prevention and response procedures
 - i. *Review general good housekeeping practices, including used oil and spent solvent management, fueling procedures, deicing material management, and waste storage and disposal.*

Section 4

Inspections and Monitoring

4.1 Inspections

Quarterly facility inspections shall be conducted quarterly of all areas of the facility where activities or materials are exposed to stormwater and of all stormwater control measures. The inspections shall include:

- Visual inspection of material handling areas and other potential sources of pollution identified in the SWPPP for evidence of, or the potential for, pollutants entering the stormwater drainage system.
- Visual inspection of structural stormwater management measures, erosion control measures, and other structural pollution prevention measures.
- Visual inspection of spill response equipment.

At least one inspection shall be conducted during a a period where a stormwater discharge is occurring. The inspections shall be performed using the inspection form provided in **Appendix A**. Inspection records shall be maintained with the SWPPP. The forms may be recorded and filed on paper. The Town may wish to incorporate this into an electronic mobile device collection form in the future.

If during the inspections, or any other event or observation, control measures are identified that are not operating effectively, the Permittee shall repair or replace them before the enxt anticipated storm event if possible, or as soon as practicable following that storm event.

4.2 Stormwater Visual Assessments

Stormwater discharges shall be visually examined on a quarterly basis during a rain event. The visual assessment must be made:

- Of a sample in a clean clear glass, or plastic container, and examined in a well-lit area;
- On samples collected within the first 30 minutes of an actual discharge from a storm event. If it is not possible to collect the sample within the first 30 minutes of discharge, the sample must be collected as soon as practicable after the first 30 minutes and documentation must be provided explainin why it was not possible to take samples within the first 30 minutes. In the case of snowmelt, samples must be taken during a period with a measurable discharge from the site; and
- For storm events, on discharges that occur at least 72 hours (3 days) from the previous discharge. The 72-hour (3-day) storm interval does not apply if it is documented that less than a 72-hour (3-day) interval is representative for local storm events during the sampling period.

Grab samples shall be collected from the outfalls and examined for odor, as well as the following visual water quality characteristics:

- Color;
- Clarity;
- Floating solids;
- Settled solids;
- Suspended solids;
- Foam;
- Oil sheen; and
- Other obvious indicators of stormwater pollution.

If the results of the odor and visual assessment of the stormwater outfall discharge indicate that the control measures are inadequate or not operating properly (e.g. oily sheen, floating or suspended solids, color, odor, etc.), the Town shall review and revise the control measures to ensure that the condition is eliminated.

A checklist for stormwater visual assessments is provided in **Appendix A**. The sampling personnel shall use this form to document the sampling information, and the results must be kept with the SWPPP.

Appendix A

Recordkeeping Forms

- Employee Training Log
- Stormwater Quarterly Facility Inspection Report
- Quarterly Visual Assessment Report

Annual Employee Training Log

Training Date:	
Training Title:	
Description of Topics Covered:	
Trainer:	
Employee(s) trained	Employee signature

CERTIFICATION STATEMENT

"I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gathered and evaluated the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations."

Print name and title: _____

Signature: _____ **Date:** _____

Stormwater Quarterly Facility Inspection Report

General Information			
Facility Name			
Date of Inspection		Start/End Time	
Inspector's Name(s)			
Inspector's Title(s)			
Inspector's Contact Information			
Weather Information			
Weather at time of this inspection?			
<input type="checkbox"/> Clear <input type="checkbox"/> Cloudy <input type="checkbox"/> Rain <input type="checkbox"/> Sleet <input type="checkbox"/> Fog <input type="checkbox"/> Snow <input type="checkbox"/> High Winds <input type="checkbox"/> Other: _____ Temperature: _____			
Have any previously unidentified discharges of pollutants occurred since the last inspection? <input type="checkbox"/> Yes <input type="checkbox"/> No If yes, describe:			
Are there any discharges occurring at the time of inspection? <input type="checkbox"/> Yes <input type="checkbox"/> No If yes, describe:			

Control Measures

- Number the structural stormwater control measures identified in your SWPPP on your site map and list them below (add as many control measures as are implemented on-site). Carry a copy of the numbered site map with you during your inspections. This list will ensure that you are inspecting all required control measures at your facility.
- Describe corrective actions initiated, date completed, and note the person that completed the work in the Corrective Action Log.

	Structural Control Measure	Control Measure is Operating Effectively?	If No, In Need of Maintenance, Repair, or Replacement?	Corrective Action Needed and Notes (identify needed maintenance and repairs, or any failed control measures that need replacement)
1	Oil/Water Separator	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Maintenance <input type="checkbox"/> Repair <input type="checkbox"/> Replacement	
2	Catch Basins	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Maintenance <input type="checkbox"/> Repair <input type="checkbox"/> Replacement	
3	Outfalls	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Maintenance <input type="checkbox"/> Repair <input type="checkbox"/> Replacement	
4	Detention Basin	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Maintenance <input type="checkbox"/> Repair <input type="checkbox"/> Replacement	
5		<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Maintenance <input type="checkbox"/> Repair <input type="checkbox"/> Replacement	
6		<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Maintenance <input type="checkbox"/> Repair <input type="checkbox"/> Replacement	
7		<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Maintenance <input type="checkbox"/> Repair <input type="checkbox"/> Replacement	

Areas of Industrial Materials or Activities exposed to stormwater

Below are some general areas that should be assessed during routine inspections. Customize this list as needed for the specific types of industrial materials or activities at your facility.

	Area/Activity	Inspected?	Controls Adequate (appropriate, effective, and operating)?	Corrective Action Needed and Notes
1	Bulk material loading/unloading and storage areas	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No	
2	Fueling area	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No	
3	Salt/sand storage area	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No	
4	Outdoor vehicle and equipment washing area	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No	
5	Solid waste handling area	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No	
6	CaCl handling area	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No	
7	Homeowner waste storage area	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No	
8	Waste oil storage area	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No	
9	Non-stormwater/ illicit connections	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No	
10		<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No	
11		<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No	
12		<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No	

Non-Compliance

Describe any incidents of non-compliance observed and not described above:

Additional Control Measures

Describe any additional control measures needed to comply with the permit requirements:

Notes

Use this space for any additional notes or observations from the inspection:

CERTIFICATION STATEMENT

"I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gathered and evaluated the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations."

Print name and title: _____

Signature: _____ **Date:** _____

Quarterly Visual Assessment Report

Quarterly Visual Assessment Form

Name of Facility: _____ Outfall Name: _____

Person(s)/Title(s) collecting sample: _____

Person(s)/Title(s) examining sample: _____

Date & Time Discharge Began: _____ Date & Time Sample Collected: _____

Nature of Discharge: Rainfall Snowmelt

If rainfall: Rainfall Amount: _ _ inches Previous Storm Ended > 72 hours Yes No* (explain):
 Before Start of This Storm? _____

Parameter

Color None Other (describe): _____

Odor None Musty Sewage Sulfur Sour Petroleum/Gas _____
 Solvents Other (describe): _____

Clarity Clear Slightly Cloudy Cloudy Opaque Other _____

Floating Solids No Yes (describe): _____

Settled Solids** No Yes (describe): _____

Suspended Solids No Yes (describe): _____

Foam (gently shake sample) No Yes (describe): _____

Oil Sheen None Flecks Globs Sheen Slick
 Other (describe): _____

Other Obvious Indicators No Yes (describe):
 of Stormwater Pollution _____

* The 72-hour interval can be waived when the previous storm did not yield a measurable discharge or if you are able to document (attach applicable documentation) that less than a 72-hour interval is representative of local storm events during the sampling period.

** Observe for settled solids after allowing the sample to sit for approximately one-half hour.

Detail any concerns, additional comments, descriptions of pictures taken, and any corrective actions taken below (attach additional sheets as necessary).

CERTIFICATION STATEMENT

“I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gathered and evaluated the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.”

Print name and title: _____

Signature: _____ **Date:** _____

STORMWATER POLLUTION PREVENTION PLAN

**Reading Municipal Light Department
at 230 Ash Street and Three Substations**
Town of Reading, Massachusetts

Town of Reading
16 Lowell Street
Reading, MA 01867

May 2016



Town of Reading, Massachusetts
Municipal Light Department
2016 Massachusetts Small MS4 General Permit – Appendix B.11
Signatory Requirements

SWPPP Certification

CERTIFICATION STATEMENT

“I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gathered and evaluated the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.”

Print name and title: _____

Signature: _____ **Date:** _____

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Section 1

Site Description and Contact Information

1.1 Purpose

This Stormwater Pollution Prevention Plan (SWPPP) has been developed for the Town of Reading (Town) for the Reading Municipal Light Department (RMLD). The RMLD currently operates four substations including:

Substation #1: At RMLD Headquarters, 230 Ash Street, Reading

Substation #2 was formerly a substation located at 600R Main Street, Lynnfield. All of the equipment has been removed in and the site is currently vacant. This station is not included in this SWPPP.

Substation #3: 166R Chestnut St., North Reading

Substation #4: 45 Causeway Road, Reading

Substation #5: 165 Wildwood Street, Wilmington

The SWPPP describes the management practices and controls that are required to be implemented at each of the substations to reduce the potential for the discharge of pollutants in stormwater.

1.2 Regulatory Background

The first wave of stormwater regulations (Phase I) was published on November 16, 1990, and called for stormwater permits under the Clean Water Act's National Pollutant Discharge Elimination System (NPDES) program. Municipalities with separate storm sewer systems (MS4s) and populations of over 100,000 and certain industries that discharged to MS4s or directly to waters of the United States were covered by the Phase I regulations. Stormwater discharges associated with industrial activity owned or operated by municipalities were temporarily exempted from NPDES permitting requirements of Phase I due to provisions within the Intermodal Surface Transportation and Efficiency Act (ISTEA) of 1991.

The second wave of stormwater regulations (Phase II) was published in the Federal Register on December 8, 1999 and required NPDES permits for small MS4s (populations fewer than 100,000) as well as for previously exempted municipal industrial activities. On May 1, 2003, EPA Region 1 issued its Final General Permit for Stormwater Discharges From Small Municipal Separate Storm Sewer Systems (2003 Small MS4 Permit) that covers "traditional" (i.e., cities and towns) and "non-traditional" (i.e., Federal and state agencies) MS4 Operators located in the states of Massachusetts and New Hampshire.

During 2008 to 2010, EPA issued three separate draft Small MS4 General permits to replace the 2003 Small MS4 permit. Several public hearings were held and comment period ended March 11, 2011. The 2014 Draft Massachusetts Small MS4 General Permit was released for public comment on September 30, 2014 and the comment period ended February 27, 2015.

The 2016 Massachusetts Small MS4 General Permit was signed April 4, 2016 and will become effective July 1, 2017. The final permit reflects modifications to the 2014 draft small MS4 general permit released for comment on September 30, 2014 and replaces the 2003 small MS4 general permit for MS4 operators within the Commonwealth of Massachusetts.

The Phase II Rule defines a small MS4 stormwater management program as a program comprising six elements that, when implemented in concert, are expected to result in significant reductions of pollutants discharged to receiving waterbodies. The six MS4 program elements, termed “minimum control measures,” are as follows:

1. Public Education and Outreach
2. Public Participation/Involvement
3. Illicit Discharge Detection and Elimination
4. Construction Site Runoff Control
5. Post-Construction Runoff Control
6. Pollution Prevention/Good Housekeeping

Per the Section 2.3.7.b of the 2016 permit, municipalities must develop a SWPPP for maintenance garages, public works facilities, transfer stations and other waste handling facilities as part of the Good Housekeeping and Pollution Prevention control measure. The SWPPPs are required to be implemented no later than two years from the effective date of the permit. This SWPPP has also been prepared in accordance with the Spill Prevention, Control, and Countermeasure (SPCC) Plans for Substations #1 and #4.

1.3 General Pollution Prevention Plan Requirements

The baseline requirements for a SWPPP include:

1. The development of a **Pollution Prevention Team** to prepare the plan and assist the facility manager in its implementation.
2. The assessment and description of **Potential Pollution Sources**, including a comparison of the site's drainage characteristics to material storage, fueling, or other areas of industrial activity.
3. The development of **Measures and Controls**, including pollution prevention measures, best management practices, and other controls for the facility.
4. The development of an **Employee Training** program on how to incorporate pollution prevention/good housekeeping techniques into municipal operations.
5. The plan also must describe the **Inspections and Monitoring** to be conducted at the facility.

1.4 Site Description

1.4.1 Substation #1

Substation #1 is located in a mixed industrial and residential area within the Town of Reading at 230 Ash Street. The site is abutted by residential lots to the northwest and southeast, MBTA rail line to the

northeast, and Ash Street to the southwest. A site locus map is provided as **Figure 1-1**. **Figure 1-2** is a site plan of the facility. It should be noted that this SWPPP also includes the storage of oil-filled electrical equipment at the Barbas Building located at 232 Ash Street, approximately 125 east of the control building. For the purposes of this SWPPP, RMLD Substation #1 includes both the 226 Ash Street and 232 Ash Street properties.

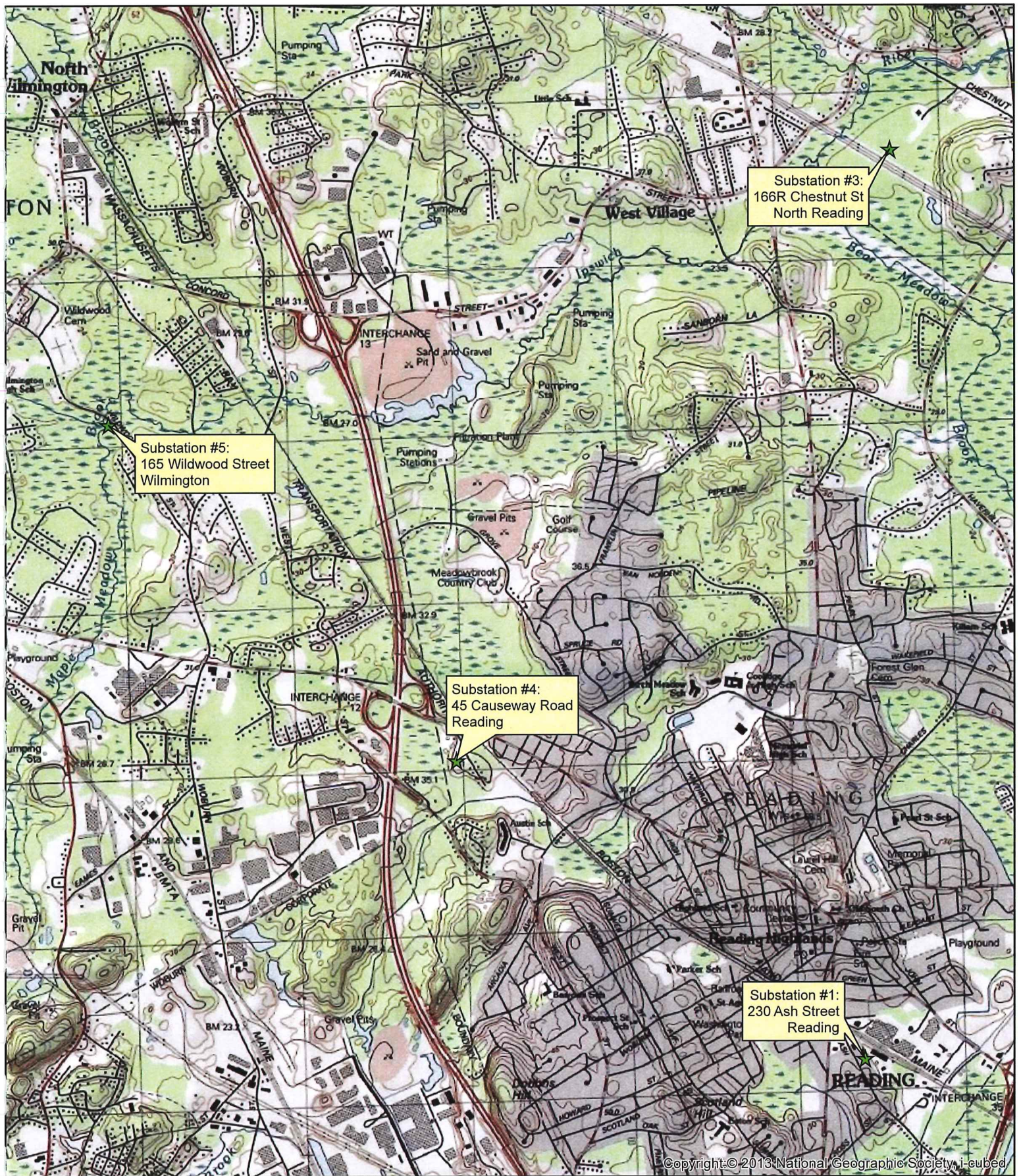
Two transformers are associated with the RMLD Substation #1 control building (i.e. 226 Ash Street), which is located within the RMLD property. The control building is bounded by a small parking area and RMLD maintenance building to the northwest, parking area and RMLD office building to the southwest, parking area and the Barbas building to the northeast, and Ash Street to the southwest.

The two active transformers (Transformer A and Transformer B) are concrete pad-mounted and located in a graveled, fenced and secured area on the northwest side of the control building. Additionally, the control building is utilized to store 55-gallon containers of virgin transformer oil and miscellaneous oil containing transformer units for repair. A self-contained emergency generator and associated 200-gallon aboveground storage tank (AST) containing No.2 fuel oil is located adjacent to the control building.

One floor drain is located within the first floor and an additional floor drain and stormwater sump is located within the southwestern portion of the basement level of the control building. Both structures could be impacted by a non-typical large release of oil. The use of spill pallets for a portion of the stored drums and the use of drain mat blockers on the existing floor drains serves as passive secondary containment.

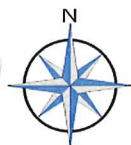
The Barbas building is located immediately east of the control building at 232 Ash Street and a portion of the building is rented by RMLD from the owners of the 232 Ash Street property. The Barbas building is bounded by commercial properties to the east and west, by the RMLD control building to the south and MBTA rail line to the north. Access to the Barbas building is restricted by a locked entry.

One floor drain is located in the southwestern extent of the Barbas building, adjacent to the main entry way to the portion of the building utilized by RMLD. This floor drain is located approximately 20 feet south of oil-filled electrical equipment. There is no discernable pitch to the floor within the building. The floor drain could be impacted by a non-typical large release of oil; however, the vast majority of the oil-filled electrical equipment stored in the Barbas building is located farther north and east of the floor drain and the containers stored closest to the floor drain are of lower volume (generally less than 50 gallons per container).



Reading Municipal Light Department
 230 Ash Street
 Reading, Massachusetts

Figure 1-1
 Site Locus Plan



0 1,250 2,500
 Feet
 1" = 2,500'

Basemap: USGS 7.5-minute Topographic Quadsheet
 Source: ESRI ArcGIS Online, NGS Topo US
 Coord. System: NAD83 Mass. State Plane Mainland (meters)



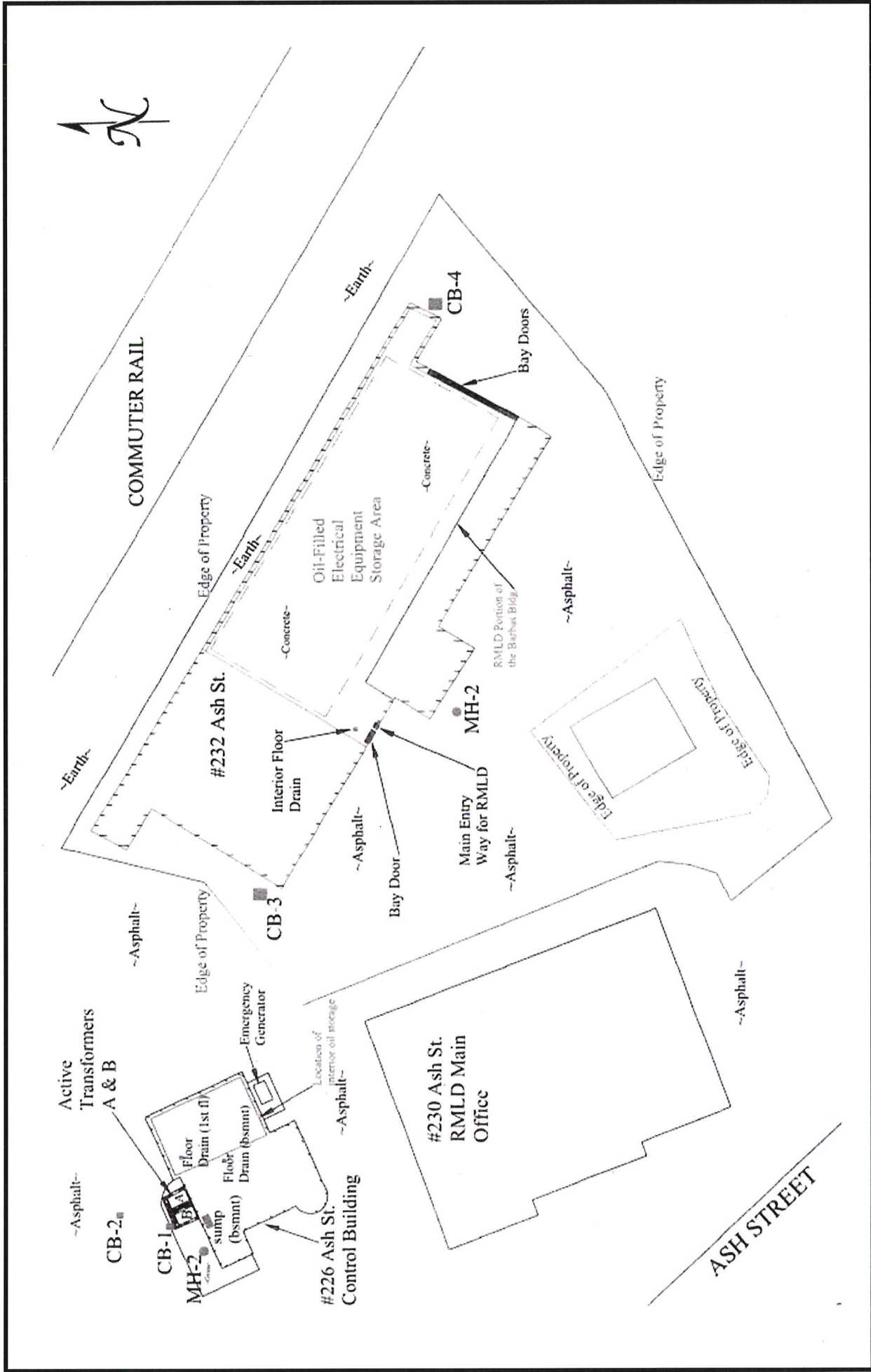


Figure 1-2
Site Plan

RMLD Substation #1
232 Ash Street
Reading, Massachusetts

1.4.2 Substation #3

Substation #3 is located at the rear of the Spindler DPW complex in North Reading at 166R Chestnut St as shown on Figure 1-1. **Figure 1-3** is an aerial photo of the facility. The site is surrounded by undeveloped woodlands and the Ipswich River is located approximately 1,000 feet to the west. RMLD currently maintains two transformers at Substation #3. The equipment is located on concrete pads, surrounded by a crushed gravel base encompassed in an impervious curbing. The site is surrounded by a locked fence.

1.4.3 Substation #4

Substation #4 is located in a mixed residential and commercial area within the Town of Reading at 45 Causeway Road as shown on Figure 1-1. The site is abutted by residential lots to the northwest and southeast, undeveloped woodlands and the Wilmington, Massachusetts town line to the southwest, and Causeway Road to the northeast. Overhead electrical lines serve the site from the northeast and southwest. A Massachusetts Highway Department facility is located approximately three lots north of the site.

RMLD currently maintains a total of five active transformers at the site (designated Transformer A through Transformer E) as shown on **Figure 1-4**. In addition, RMLD is temporarily storing an inactive transformer (Transformer A-New) at the site that will replace the current Transformer A as part of ongoing facility upgrades. Subsequently, the current Transformer A will be relocated to the northeastern corner of the site (designated Spare Transformer Storage Area) within a self contained oil containment structure (currently under construction), as a spare transformer. The control building is bounded to the east by a paved area, beyond which is Causeway Road; to the north by a limited area of pavement, beyond which is the Spare Transformer Storage Area (currently under construction); to the west by the concrete pad mounted Transformers A and B, beyond which is a large crushed gravel base area containing Transformers D and E; and to the south by concrete pad mounted Transformer C and the subsurface passive secondary containment structures that are currently under construction.

The five active transformers and one inactive transformer are all located within the fenced perimeter of Substation #4. Transformers A, B and C are located on concrete pads surrounded by a crushed gravel base encompassed in an impervious curbing. Transformers D and E are located west of Transformers A, B and C on concrete pads surrounded by an extensive crushed gravel base.

A passive secondary containment system constructed at Transformers A, B and C includes an impermeable barrier below and at the limits of the crushed gravel base(s) and 6-inch polyvinyl chloride (PVC) drain lines surrounding each transformer that drain stormwater to two subsurface containment structures and pump chamber equipped with automated sensors and alarms.

1.4.4 Substation #5

Substation #5 is located in a wooded area in Wilmington at 165 Wildwood Street as shown on Figure 1-1. **Figure 1-5** is an aerial photo of the facility. The closest residential development is located 500 feet to the southeast. RMLD currently maintains two transformers at Substation #5. The equipment is located on concrete pads, surrounded by a crushed gravel base with impervious curbing along the southwestern perimeter. The site is surrounded by a locked fence.

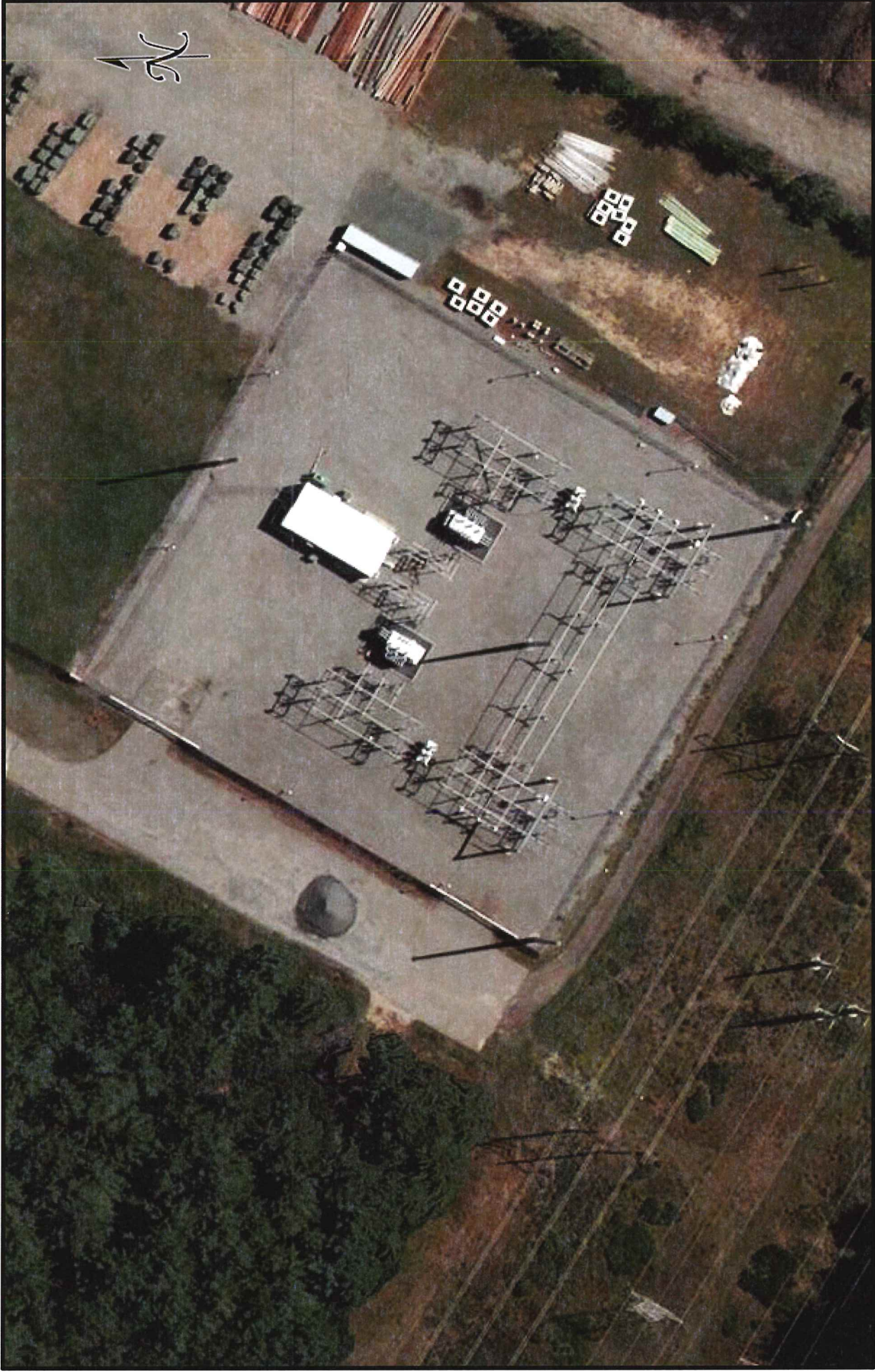
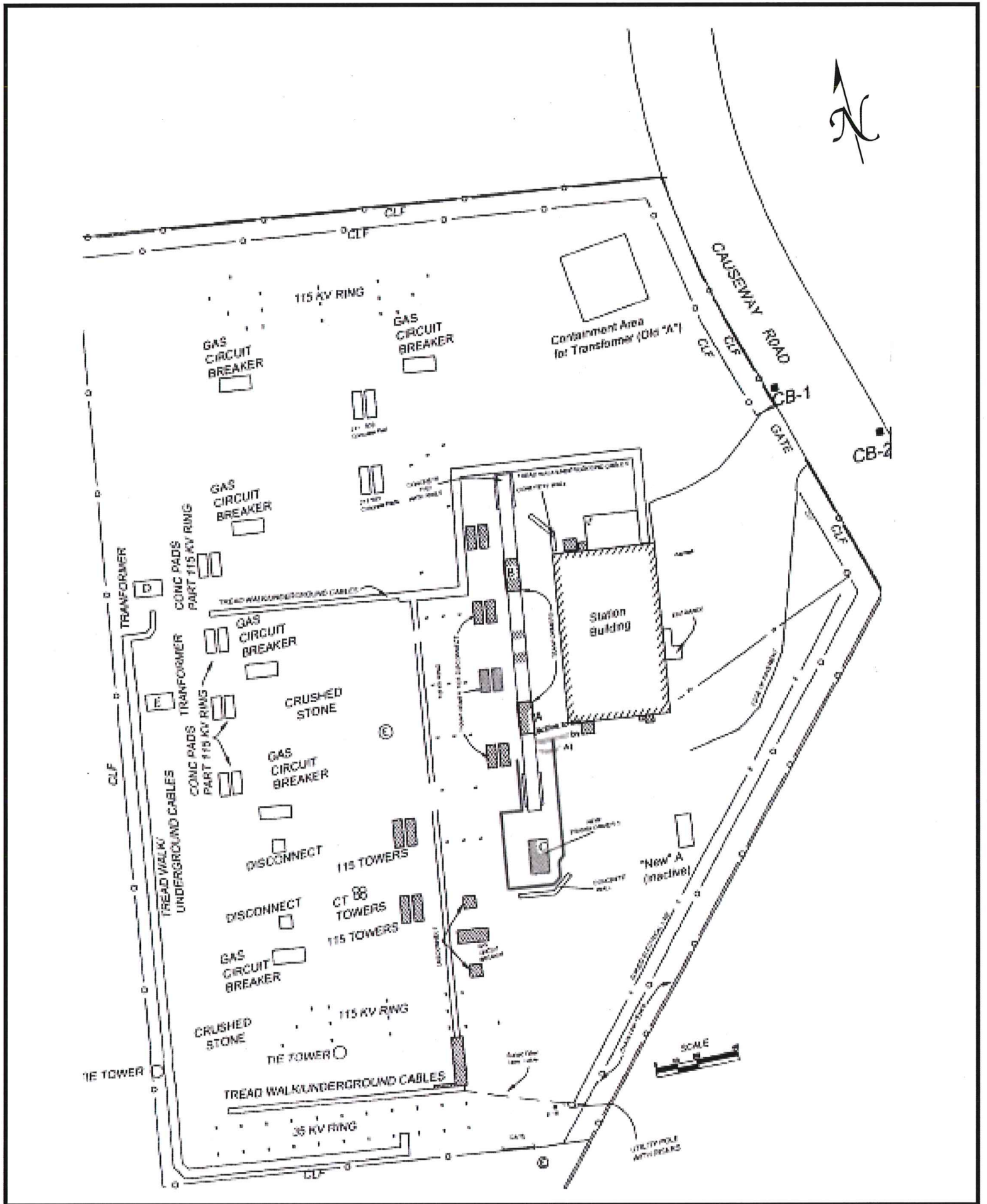


Figure 1-3
Site Plan

RMLD Substation #3
166R Chestnut Street
North Reading, Massachusetts



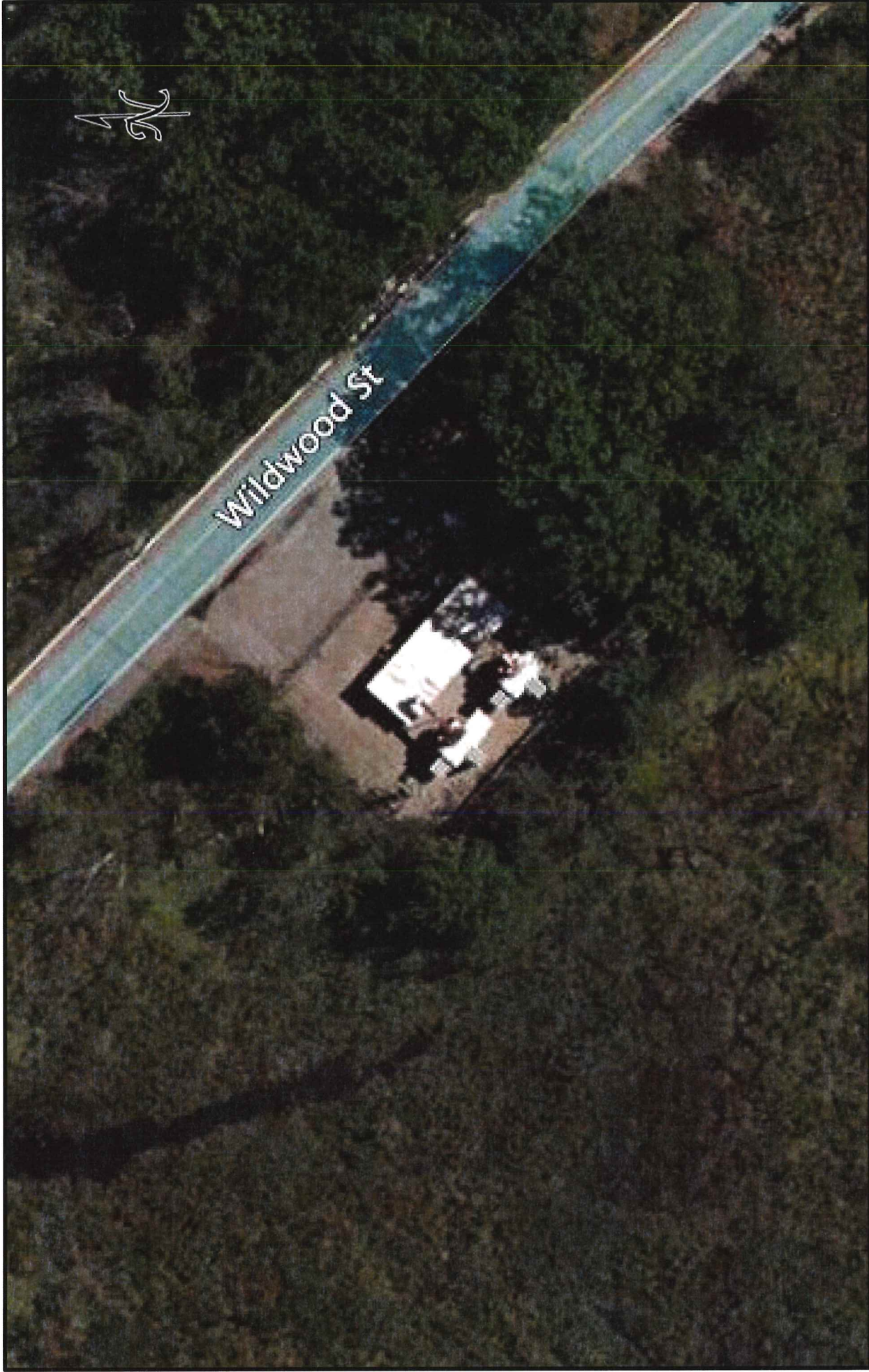


Figure 1-5
Site Plan

RMLD Substation #5
165 Wildwood Street
Wilmington, Massachusetts

1.5 Endangered Species and Historic Places Certification

Based on a review of Federally listed endangered and threatened species (“listed species”) and designated critical habitat, no endangered or threatened species or the designated critical habitat are likely to occur in proximity to the stormwater discharge or discharge related activities at the RMLD Substations. Based on a review of the National Register of Historic Places, stormwater discharges and allowable non-stormwater discharges at the RMLD Substation facilities do not have the potential to have an effect on historic properties.

1.6 Pollution Prevention Team

The RMLD is responsible for implementing and complying with this SWPPP through the Pollution Prevention Team. The Pollution Prevention Team is responsible for developing and implementing the SWPPP, maintaining and revising or amending the SWPPP, maintaining control measures and making all necessary corrective actions. The Pollution Prevention Team will implement control measures to improve stormwater quality. The managers and team members and their responsibilities are outlined in **Table 1-1**.

The responsibilities of the Pollution Prevention Team Leader are to coordinate all phases of the SWPPP development, coordinate the employee training program, arrange for inspections and monitoring and maintain compliance with the SWPPP.

The Spill Coordinator is responsible for developing and implementing spill response procedures.

The team members’ responsibilities include assisting the Project Management Specialist with his/her duties, implementing and maintaining control measures for the preventive maintenance program, and ensuring good housekeeping practices are followed. All team members are also spill response members. They must ensure that all spills and leaks are cleaned up promptly and report spills to the spill coordinator immediately.

Table 1-1 Pollution Prevention Team

SWPPP Team Member	Title	Phone Number	Responsibilities
Team Leader	Town Engineer	(781) 942-9082	Coordinate all phases of SWPPP development, coordinate employee training programs, maintain all records, oversee inspections and monitoring.
Spill Coordinator	Station Manager	(781) 944-1340	Develop and implement spill response procedures.
Member	RMLD Engineering Staff	(781) 942-9082	Oversee the implementation of preventative maintenance and good housekeeping, respond to emergency situations, conduct inspections and monitoring.
Member	RMLD Engineering Staff	(781) 942-9082	Oversee the implementation of preventative maintenance and good housekeeping, respond to emergency situations, conduct inspections and monitoring.

1.7 Keeping the SWPPP Current

The SWPPP shall be kept current and reviewed on at least an annual basis. The plan shall be amended whenever there is a change at the site affecting the potential to cause pollution or the control measures listed in the SWPPP fail to adequately protect against pollution. The SWPPP shall be amended to address sources or potential sources of pollution identified during the site inspections or monitoring events.

Section 2

Description of Pollutant Sources

This section of the SWPPP describes activities, materials, and physical features of the facility that may contribute pollutants to stormwater runoff or, during periods of dry weather, result in pollutant discharges into the stormwater drainage systems. An assessment of stormwater pollution sources will support efforts to identify and set priorities for necessary changes in materials, materials management practices, or site features, as well as the selection of appropriate structural/nonstructural controls.

2.1 Drainage Description

2.1.1 Substation #1

The site is relatively flat and surrounded by paved parking surfaces, roadways and a commuter rail. The active transformer area slopes gently away from the control building towards the parking area. Surrounding drainage is limited to four catch basins (CB-1 through CB-4) and two stormwater manholes (MH-1 and MH-2). CB-1, CB-2 and MH-1 are located adjacent to the control building. CB-3, CB-4 and MH-2 are located adjacent to the Barbas building.

CB-1 is located within a grassed area between the active transformer area and abutting asphalt parking lot and is connected to CB-2. CB-2 is located within the asphalt parking lot northwest of the active transformers. MH-1 is located within a grassed area southwest of the active transformer area. The area between the graveled active transformer storage/grassed area and the abutting asphalt parking lot is divided by impervious curbing.

CB-3 is located within the asphalt pavement abutting the western extent of the Barbas building and CB-4 is located within the asphalt pavement abutting the northeastern extent of the Barbas building. MH-2 is located at the front center of the building. With respect to the Barbas building, CB-4 is the closest exterior drainage feature to the oil-filled electrical equipment that is staged in the western portion of the building.

The nearest surface water body to the site is a small unnamed stream located approximately 0.2 miles south of the facility which accepts stormwater from the site.

2.1.2 Substation #3

The substation site is relatively flat, entirely covered by crushed gravel and surrounded by a chain link fence. The site is immediately surrounded by grassed areas to the north, east, and south, and a gravel road to the west. There are no visible catch basins on the substation site. Storm water is contained within the gravel base. The Ipswich River is located approximately 1,000 feet to the west of the facility.

2.1.3 Substation #4

The site is relatively flat. Limited paved areas exist north and east of the control building. A small grassed area is located at the far northeastern extent of the site. The remaining areas of the site are predominantly covered in a crushed gravel base. With the exception of Causeway Road immediately

northeast, the limits of the site are surrounded by vegetated surfaces. Storm water runoff from the control-building roof and paved surface generally flows by sheet flow in a westerly direction to the vegetated areas. There are no storm water catch basins or structures visible on the site. The nearest storm water structures are two catch basins directly outside the facility gate (northeastern side of facility), on Causeway Road. The nearest surface water body to the site is the Aberjona River located approximately 0.25 miles south of the facility.

2.1.4 Substation #5

The substation site is relatively flat, entirely covered by crushed gravel and surrounded by a chain link fence. A paved parking area is located to the northeast along Wildwood Road. Storm water is contained within the gravel base. There are no visible catch basins on the substation site. Maple Meadow Brook is located approximately 100 feet to the southwest of the facility.

2.2 Inventory of Exposed Materials and Summary of Potential Pollutant Sources

This section provides an inventory of materials exposed to stormwater. This inventory was prepared based on the site inspection conducted by CDM Smith on October 2, 2012 as well as from information provided in the SPCC Plan for Substation #1. A summary of the stormwater materials inventory including materials that are exposed to rainfall as a result of storage, loading, unloading, and transfer operations is provided in **Table 2-1** and discussed below.

2.2.1 Substation #1

2.2.1.1 Active Transformer Area

The two active transformers (Transformer A and Transformer B) are concrete pad-mounted and located in a graveled, fenced and secured area on the northwest side of the control building. The transformers are surrounded by an area of crushed gravel, bordered by a grassed median on the northern side on the control building. The approximately 540 cubic feet of crushed gravel serves as passive secondary containment with a storage capacity of approximately 1,350 gallons. The transformer oil contained within the oil-filled equipment is utilized as an insulating and cooling medium and is not consumed. As such, there is minimal handling/transferring of transformer oil, reducing the probability of a spill. The potential pollutant associated with the transformers is transformer oil.

2.2.1.2 Emergency Generator

The 200-gallon # 2 fuel oil filled emergency generator AST at Substation #1 is located adjacent to the eastern exterior of the control building and this fuel is used for consumptive uses. However, the fuel within the AST associated with this generator is only used in emergency situations. As such, there is only minimal handling/transferring of diesel fuel. The generator is situated on a concrete pad surrounded by a limited area of crushed gravel and a grassed median. There are no storm drains or surface waters located in the immediate vicinity of the emergency generator. The potential pollutant associated with the emergency generator is #2 fuel oil.

2.2.1.3 Exterior Storage of Inactive Transformers

Inactive transformers are stored outdoors at various locations throughout the property. No secondary containment is provided and the transformers are exposed to stormwater. The potential pollutant associated with the transformers is transformer oil.

Table 2-1
 Town of Reading
 Municipal Light District
 Exposed Materials Inventory

Material	Purpose/Description	Location	Quantity Stored	Likelihood of Contact with Stormwater	Past Significant Spills or Leaks
Substation #1					
230 Ash Street, Reading					
Transformer Oil	Two Active Transformers (A&B)	NW side of control building	2,165 gal (each)	Low	No
Transformer Oil	Inactive Transformers	Stored outdoors throughout property	55 gal (each)	Low	No
Diesel Fuel	Emergency Generator	SE side of control building	200 gal	Low	No
Substation #3					
166R Chestnut Street, N. Reading					
Transformer Oil	Two Active Transformers	Central portion of site		Low	No
Substation #4					
45 Causeway Road, Reading					
Transformer Oil	One Active Transformer (A)	W side of station building	8,607 gal	Low	No
Transformer Oil	Two Active Transformers (B&C)	SW side of station building	6,820 gal (each)	Low	No
Transformer Oil	Two Active Transformers (D&E)	W boundary site	5,743 gal (each)	Low	No
Transformer Oil	New (Inactive) Transformer (A-new)	NE corner of site	6820 gal	Low	No
Substation #5					
165 Wildwood Street, Wilmington					
Transformer Oil	Two Active Transformers	SW portion of site		Low	No

RMLD was forwarded this table for completion. At the time of printing, the data were not returned by RMLD yet, but can be added in the future once returned.
 - Lisa Gove

2.2.1.4 Deicing Activities

Minimal sanding and salting of pavement occurs during the winter. Sand and salt are stored indoors. Potential pollutant sources associated with parking lot deicing activities are solids and salt.

2.2.1.5 Solid Waste Storage

Three solid waste storage containers are located east of the cold storage building at the top of the slope. Solid waste containers should be covered and inspected regularly for leaks and overfilling. Potential pollutants from solid waste containers include oil and grease, petroleum hydrocarbon residues and debris.

2.2.1.6 Material Handling Areas

The main delivery/shipment area for RMLD is a level paved area on the north side of the control building. The most likely release scenario is a spill during delivery or a transfer of oil from a container. Any spills resulting from oil shipments in this area would likely flow to the exterior asphalt pavement or to the concrete floor of the building interior.

2.2.2 Substation #3

2.2.2.1 Active Transformer Area

The two active transformers are concrete pad-mounted and located in a graveled, fenced and secured area. The crushed gravel serves as passive secondary containment. The transformer oil contained within the oil-filled equipment is utilized as an insulating and cooling medium and is not consumed. As such, there is minimal handling/transferring of transformer oil, reducing the probability of a spill. The potential pollutant associated with the transformers is transformer oil.

2.2.3 Substation #4

2.2.3.1 Active Transformers

Transformers A, B and C are surrounded by a crushed gravel base contained within an impervious concrete curbing, which discharges to a subsurface passive secondary containment structure south of Transformer C. The approximately 1,400 cubic feet of crushed gravel serves as passive secondary containment with a storage capacity of approximately 3,500 gallons.

Transformers D and E are surrounded by an extensive crushed gravel base, bordered by vegetative areas to the north, west and south and Transformers A, B and C to the east. The approximately 29,000 cubic feet of crushed gravel serves as passive secondary containment with a storage capacity greater 110% of the volume of oil in either transformer in this location. As such a release from either transformer in this location could be contained within the crushed gravel base.

The substation is completely fenced and is lighted at night which reduces the potential for vandalism. Access to the control building is restricted by locked entry.

The transformer oil contained within the oil-filled equipment is utilized as an insulating and cooling medium and is not consumed. As such, there is minimal handling/transferring of transformer oil, reducing the probability of a spill.

2.2.3.2 Inactive Transformer

The one inactive transformer (Transformer A-New) is currently located south of the Substation #4 control building in a temporary storage location. RMLD indicates that transformer A-New will be installed in the current location of Transformer A and Transformer A will subsequently be

relocated to the Spare Transformer Storage Area as part of the facility upgrades. The inactive transformer is entirely aboveground and is temporarily being stored on crib works set upon a crushed gravel/earthen base until relocation/activation. Transformer A-New has a capacity of approximately 6,820 gallons.

Transformers A-New is surrounded by a crushed gravel/earthen base that slopes westerly toward Transformer C and an extensive crushed gravel base. The crushed gravel base west of Transformer A-New serves as passive secondary containment.

2.2.4 Substation #5

2.2.4.1 Active Transformer Area

The two active transformers are concrete pad-mounted and located in a graveled, fenced and secured area. The crushed gravel serves as passive secondary containment. The transformer oil contained within the oil-filled equipment is utilized as an insulating and cooling medium and is not consumed. As such, there is minimal handling/transferring of transformer oil, reducing the probability of a spill. The potential pollutant associated with the transformers is transformer oil.

2.3 Spills and Leaks

CDM Smith reviewed the Massachusetts Department of Environmental Protection (MassDEP) Waste Site Database to identify available records for the RMLD substations. The MassDEP database did not contain records associated with the 230 Ash Street, 166R Chestnut Street, or 165 Wildwood Street properties.

The MassDEP database contained records associated with the 232 Ash Street property that contains the Barbas building, a portion of which is utilized by RMLD for the storage of inactive oil-filled electrical equipment. Release Tracking Number (RTN) 3-0001378 was issued by the MassDEP to the Yankee Food Company in 1990 for the detection of poly chlorinated biphenyls (PCB) at the site related to a transformer UST. Following the submission of a Phase II Comprehensive Site Assessment in April of 1999, a Class A-2 Response Action Outcome (RAO) Statement was submitted to the MA DEP for RTN 3-0001378 in October of 1999.

Two RTNs have been issued for the detection of PCBs associated with Substation #4 located 45 Causeway Road. During soil excavation efforts conducted as part of the planned upgrade activities to Substation #4 2009, PCBs were measured in soil in excess of the Reportable Concentration (RC) for category RCS-1 in two separate stockpiles that had been staged south of the Substation #4 control building on RMLD property near West Street and on the adjacent property located at 571 West Street. MassDEP issued RTNs 3-28717 and 3-28999 for the two releases.

Impacted soil was removed from both sites under Release Abatement Measures and Response Action Outcomes were submitted in 2011 for RTN 3-28999 and 2012 for RTN 3-28717, respectively.

No other significant spills have occurred at the substation sites in the past three years.

2.4 Non-Stormwater Discharges

Discharges of all non-stormwater flows are prohibited, except flows from fire fighting activities and certain flows described below, as long as they are described in this plan:

- Discharges from the cooling water towers;
- Discharges from building sumps;
- Discharges from fire fighting activity;
- Fire hydrant flushing;
- Potable water sources including water line flushings;
- Irrigation drainage;
- Uncontaminated groundwater discharges such as from foundation drains and footings;
- Lawn watering;
- Routine external building washdown without detergents
- Pavement wash waters where spills or leaks of hazardous materials have not occurred (unless all spilled material has been removed and where detergents are not used;

Section 3

Stormwater Measures and Controls

This section describes the Best Management Practices (BMPs) to be implemented to eliminate or reduce stormwater pollution. BMPs are measures, practices, and controls designed to reduce contaminant loading to stormwater from specific activities. BMPs may be:

- Procedural, such as training in spill response procedures;
- Structural, such as vegetated swales or oil/water separators; or
- Administrative, such as record keeping.

3.1 Good Housekeeping

Good housekeeping is important to reduce the inadvertent discharge of pollutants in stormwater runoff. Impacts to stormwater will be reduced by following the list of good housekeeping measures below:

- Catch basins shall be inspected and cleaned at least annually.
- Paved areas shall be swept at least semi-annually.
- Spills shall be immediately contained and cleaned up with absorbent material.
- All spills occurring during addition or removal of material from the salt shed shall be promptly swept up. Salt shall be swept up after loading and unloading operations.
- No drums shall be stored outdoors.
- All changing of fluids shall be done indoors with proper ventilation.
- Covers on dumpsters shall be kept closed when not loading or unloading.
- Drip pans shall be used when changing fluids. Waste fluids are to be properly managed and disposed of.
- Spigots or funnels shall be used to minimize drips or leaks when transferring fluids.
- Oily wastes shall be kept separate from other wastes, especially solvents.
- Dirty rags shall be stored in a covered, labeled container.
- Spent radiator coolants (antifreeze) shall be kept in a covered container.
- Hydraulic equipment shall be kept in good repair and drips shall be cleaned up promptly.
- Storage areas shall be designated with conspicuous signs. Proper storage instructions shall be posted at all times in an open and conspicuous location. During employee training these storage areas and storage instructions shall be discussed.

- Storage areas shall be located away from the storm drain system.
- Stockpiled material shall be kept in a neat, orderly manner at all times.
- Remove excess stored materials.

3.2 Preventative Maintenance

Preventative maintenance is the timely inspection and maintenance of stormwater management devices. It includes the inspection, testing, and maintenance of facility equipment and systems to uncover conditions that could cause breakdowns or failures resulting in discharges of pollutants to surface waters.

- Transformers and associated equipment should be inspected for corrosion and should be kept in good repair.
- Aboveground storage tanks shall be inspected regularly for signs of corrosion or leaks.
- Inspect and maintain gravel bedding, concrete berms and fencing.
- All structures, including catch basins, paved ditches, swales, pipe outlets, and stormwater manholes will be inspected annually and cleaned when necessary.

3.3 Sediment and Erosion Control

The primary method of soil stabilization at the substation facilities is the use of gravel bedding and concrete berms. This surface treatment dissipates the energy of falling raindrops and minimizes detachment and transport of sediment. Most facility site runoff is retained on site.

3.4 Management of Stormwater Runoff

With the exception of substation #1, most stormwater from the RMLD substations is infiltrated onsite via concrete bedding material. Substation #1 is predominantly paved with the exception of the transformer areas. Catch basins on the 230 Ash Street property drain to a small unnamed stream located approximately 0.2 miles south of the facility.

3.5 Recommended BMPs

The following additional BMPs are recommended at the RMLD substation facilities:

- Relocate transformers awaiting repair to indoor storage.
- Remove, or relocate to indoor storage, any excess materials that are currently exposed to stormwater.

3.6 Spill Prevention and Response Procedures

The following is a list of spill prevention and response procedures to be practiced at this facility. The measures outlined here are not intended to supersede the requirements of any spill prevention control and countermeasure plans that may be in place for the facility.

1. Spill cleanup equipment is available at the fuel pumps and within the DPW garage and includes spill mats, brooms, shovels, absorbent material, and containers.
2. The Pollution Prevention Team Leader and the Spill Coordinator will be advised immediately of all spills of hazardous or Massachusetts-regulated materials, regardless of quantity.
3. The spill will be evaluated to determine the necessary response. If there is a health hazard or fire or explosion potential, 911 shall be called immediately. For spills of 10 gallons or more, notify MassDEP Emergency Response at 888-304-1133 (24-hr).
4. Any spill will be contained as close to the source as possible with a dike of absorbent materials from the emergency spill kit (such as socks, pads, pillows, or “pigs”). Additional dikes will be constructed to protect swales or other stormwater conveyances or streams. Spill mats will protect any other stormwater structures such as catch basins.
5. All waste material shall be disposed of properly, including used absorbent materials.
6. Spill response kits will be kept up to date and fully stocked at all times.
7. Minimize the amount of materials kept at the site. Rotate chemicals to use the older containers first, reducing wasted chemicals that expire and the chance of container failure.
8. Keep containers closed and sealed except when filling or emptying. Be sure to re-close the container after adding or removing chemical or waste.

3.7 Employee Training

In accordance with Section 2.3.7.b.11.h, employees who work in areas where materials or activities are exposed to stormwater, or who are responsible for implementing activities identified in the SWPPP (e.g., inspectors, maintenance personnel), including all members of the Pollution Prevention Team should be trained on an annual basis. Training shall cover both the specific components and scope of the SWPPP and the control measures including spill response, good housekeeping, material management practices, any best management practice operation and maintenance, etc.

Attendance logs are required to be kept and applicable stormwater issues must be covered. The sign-off sheet for each training session signed by all employees and the supervising member of the pollution prevention team are required to be kept with the SWPPP. An employee training log is provided in **Appendix A**. An example training agenda is provided herein.

3.7.1 Example Training Agenda

- A. The Pollution Prevention Plan
 - i. **What it is** – *The Plan is an outline of potential sources of stormwater pollution and methods of reducing or eliminating that pollution.*
 - ii. **What it contains** – *The Plan emphasizes good housekeeping measures, preventative maintenance, spill prevention and response, and location of potential pollution sources.*
 - iii. **Why it is important** – *Pollution from stormwater runoff and storm drains is the primary source of pollution to many of Massachusetts' waters. Many stormwater pollutants are extremely toxic to fish and devastating to their habitats.*
 - iv. **Pollution Prevention Team** – *The team will be introduced, explaining that they are continually looking to avoid pollution to the storm drain system and stormwater runoff and appreciate input and assistance.*
- B. Discussion of the stormwater system
 - i. *Location of the RMLD facility storm drain structures*
 - ii. *Receiving water of the storm system – noting the receiving water stresses the importance of keeping pollutants out of the storm drain.*
- C. Review spill prevention and response procedures
 - i. *Review general good housekeeping practices, including used oil and spent solvent management, fueling procedures, deicing material management, and waste storage and disposal.*

Section 4

Inspections and Monitoring

4.1 Inspections

Quarterly facility inspections shall be conducted quarterly of all areas of the facility where activities or materials are exposed to stormwater and of all stormwater control measures. The inspections shall include:

- Visual inspection of material handling areas and other potential sources of pollution identified in the SWPPP for evidence of, or the potential for, pollutants entering the stormwater drainage system.
- Visual inspection of structural stormwater management measures, erosion control measures, and other structural pollution prevention measures.
- Visual inspection of spill response equipment.

At least one inspection shall be conducted during a a period where a stormwater discharge is occurring. The inspections shall be performed using the inspection form provided in **Appendix A**. Inspection records shall be maintained with the SWPPP. The forms may be recorded and filed on paper. The Town may wish to incorporate this into an electronic mobile device collection form in the future.

If during the inspections, or any other event or observation, control measures are identified that are not operating effectively, the Permittee shall repair or replace them before the enxt anticipated storm event if possible, or as soon as practicable following that storm event.

4.2 Stormwater Visual Assessments

Stormwater discharges shall be visually examined on a quarterly basis during a rain event. The visual assessment must be made:

- Of a sample in a clean clear glass, or plastic container, and examined in a well-lit area;
- On samples collected within the first 30 minutes of an actual discharge from a storm event. If it is not possible to collect the sample within the first 30 minutes of discharge, the sample must be collected as soon as practicable after the first 30 minutes and documentation must be provided explainin why it was not possible to take samples within the first 30 minutes. In the case of snowmelt, samples must be taken during a period with a measurable discharge from the site; and
- For storm events, on discharges that occur at least 72 hours (3 days) from the previous discharge. The 72-hour (3-day) storm interval does not apply if it is documented that less than a 72-hour (3-day) interval is representative for local storm events during the sampling period.

Grab samples shall be collected from the outfalls and examined for odor, as well as the following visual water quality characteristics:

- Color;
- Clarity;
- Floating solids;
- Settled solids;
- Suspended solids;
- Foam;
- Oil sheen; and
- Other obvious indicators of stormwater pollution.

If the results of the odor and visual assessment of the stormwater outfall discharge indicate that the control measures are inadequate or not operating properly (e.g. oily sheen, floating or suspended solids, color, odor, etc.), the Town shall review and revise the control measures to ensure that the condition is eliminated.

A checklist for stormwater visual assessments is provided in **Appendix A**. The sampling personnel shall use this form to document the sampling information, and the results must be kept with the SWPPP.

Appendix A

Recordkeeping Forms

- Employee Training Log
- Quarterly Facility Inspection
- Quarterly Visual Assessment Report

Annual Employee Training Log

Training Date:	
Training Title:	
Description of Topics Covered:	
Trainer:	
Employee(s) trained	Employee signature

CERTIFICATION STATEMENT

“I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gathered and evaluated the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.”

Print name and title: _____

Signature: _____ **Date:** _____

Stormwater Quarterly Facility Inspection Report

General Information			
Facility Name			
Date of Inspection		Start/End Time	
Inspector's Name(s)			
Inspector's Title(s)			
Inspector's Contact Information			
Weather Information			
Weather at time of this inspection?			
<input type="checkbox"/> Clear <input type="checkbox"/> Cloudy <input type="checkbox"/> Rain <input type="checkbox"/> Sleet <input type="checkbox"/> Fog <input type="checkbox"/> Snow <input type="checkbox"/> High Winds <input type="checkbox"/> Other: _____ Temperature: _____			
Have any previously unidentified discharges of pollutants occurred since the last inspection? <input type="checkbox"/> Yes <input type="checkbox"/> No If yes, describe:			
Are there any discharges occurring at the time of inspection? <input type="checkbox"/> Yes <input type="checkbox"/> No If yes, describe:			

Control Measures

- Number the structural stormwater control measures identified in your SWPPP on your site map and list them below (add as many control measures as are implemented on-site). Carry a copy of the numbered site map with you during your inspections. This list will ensure that you are inspecting all required control measures at your facility.
- Describe corrective actions initiated, date completed, and note the person that completed the work in the Corrective Action Log.

	Structural Control Measure	Control Measure is Operating Effectively?	If No, In Need of Maintenance, Repair, or Replacement?	Corrective Action Needed and Notes (identify needed maintenance and repairs, or any failed control measures that need replacement)
1	Gravel Bedding	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Maintenance <input type="checkbox"/> Repair <input type="checkbox"/> Replacement	
2	Concrete Berms	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Maintenance <input type="checkbox"/> Repair <input type="checkbox"/> Replacement	
3	Chain Link Fence	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Maintenance <input type="checkbox"/> Repair <input type="checkbox"/> Replacement	
4	Spill Kit	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Maintenance <input type="checkbox"/> Repair <input type="checkbox"/> Replacement	
5		<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Maintenance <input type="checkbox"/> Repair <input type="checkbox"/> Replacement	
6		<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Maintenance <input type="checkbox"/> Repair <input type="checkbox"/> Replacement	
7		<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Maintenance <input type="checkbox"/> Repair <input type="checkbox"/> Replacement	

Areas of Industrial Materials or Activities exposed to stormwater

Below are some general areas that should be assessed during routine inspections. Customize this list as needed for the specific types of industrial materials or activities at your facility.

	Area/Activity	Inspected?	Controls Adequate (appropriate, effective, and operating)?	Corrective Action Needed and Notes
1	Transformers and Associated Equipment	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No	
2	Inactive Equipment Storage	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No	
3		<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No	
4		<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No	
5		<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No	
6		<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No	
7		<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No	
8		<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No	
9		<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No	
10		<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No	
11		<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No	
12		<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No	

Non-Compliance

Describe any incidents of non-compliance observed and not described above:

Additional Control Measures

Describe any additional control measures needed to comply with the permit requirements:

Notes

Use this space for any additional notes or observations from the inspection:

CERTIFICATION STATEMENT

"I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gathered and evaluated the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations."

Print name and title: _____

Signature: _____ **Date:** _____

Quarterly Visual Assessment Reports

Quarterly Visual Assessment Form

Name of Facility: _____ Outfall/Sample Location Name: _____

Person(s)/Title(s) collecting sample: _____

Person(s)/Title(s) examining sample: _____

Date & Time Discharge Began: _____ Date & Time Sample Collected: _____

Nature of Discharge: Rainfall Snowmelt

If rainfall: Rainfall Amount: _ _ inches Previous Storm Ended > 72 hours Yes No* (explain):
Before Start of This Storm?

Parameter

Color None Other (describe): _____

Odor None Musty Sewage Sulfur Sour Petroleum/Gas _____
 Solvents Other (describe): _____

Clarity Clear Slightly Cloudy Cloudy Opaque Other _____

Floating Solids No Yes (describe): _____

Settled Solids** No Yes (describe): _____

Suspended Solids No Yes (describe): _____

Foam (gently shake sample) No Yes (describe): _____

Oil Sheen None Flecks Globs Sheen Slick
 Other (describe): _____

Other Obvious Indicators No Yes (describe): _____
of Stormwater Pollution

* The 72-hour interval can be waived when the previous storm did not yield a measurable discharge or if you are able to document (attach applicable documentation) that less than a 72-hour interval is representative of local storm events during the sampling period.

** Observe for settled solids after allowing the sample to sit for approximately one-half hour.

Detail any concerns, additional comments, descriptions of pictures taken, and any corrective actions taken below (attach additional sheets as necessary).

CERTIFICATION STATEMENT

“I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gathered and evaluated the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.”

Print name and title: _____

Signature: _____ **Date:** _____

Section 6

Investigation Memoranda and Reports

- **Illicit Discharge Detection and Elimination (IDDE) Investigations Report, May 25, 2016**
- **2018 Reading MS4 Outfall Dry Weather Sampling Program, September 6, 2019**
- **2021 Reading MS4 Outfall Dry Weather Sampling and Catchment Investigation Program, September 15, 2021**

**Illicit Discharge Detection
and Elimination (IDDE)**
Investigations

REPORT



Town of Reading,
Massachusetts

Field Work 2012-2013
Report Printed May 2016

May 25, 2016

**CDM
Smith**

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Executive Summary

This IDDE Study was conducted by CDM Smith under the Stormwater GIS and MS4 Permit Assistance Agreement, dated December 8, 2011. Field work was conducted in 2012 and 2013 and summarized herein. The goal of this work was to search for, identify, and eliminate wastewater contamination (illicit flows) that may be entering the surface waters of Reading via the municipal stormwater system. By actively removing illicit flows from the municipal drainage system, the Town of Reading initiated this effort proactively ahead of the final issuance of the regulations set forth in the Massachusetts MS4 General Stormwater Permit. The IDDE work performed by CDM Smith for this study is summarized in Table ES-1.

**Table ES-1
Summary of IDDE Work in 2012-2013**

Item	Number
Total number of Reading pipe outlets	450
- Number of stormwater outfalls	374
- Number of culvert outlets	76
Total number of IDDE investigations (by CDM Smith 2012-2013)	182
- Number of investigated outfalls	164
- Number of investigated non-outfalls (manholes and catch basins)	18
Total number of locations that tested positive for any of the primary pollutants	13
- Number of outfalls tested positive for any of the primary pollutants	11
- Number of non-outfalls tested positive for any of the primary pollutants	2
Total number of locations CDM Smith tested for E. coli	23
- Number of outfalls tested for E. coli	10
- Number of non-outfalls tested for E. coli	13
Number of outfalls where CDM Smith performed upstream investigations	4
Number of outfalls determined to have illicit sources	0
Number of outfalls we suggest Reading keep an eye on	5

The new MS4 General Stormwater Permit was issued in April, 2016. The final permit reflects modifications to the 2014 draft small MS4 general permit and replaces the 2003 small MS4 general permit. The descriptions of the changes between the past and present permits are summarized in Table ES-2 while the full regulations for IDDE Program can be found on the U.S. Environmental Protection Agency's website.

(<https://www3.epa.gov/region1/npdes/stormwater/ma/2016fpd/final-2016-ma-sms4-gp.pdf>)

CDM Smith is available to meet with the Town of Reading to decide the most appropriate steps to assist in meeting these new permit requirements.


**Table ES-2
MA 2016 Small MS4 Permit Changes for IDDE Program**

Permit Requirement	Impact	Implementation Schedule	Status
Ordinance to prohibit non-stormwater discharges must be in place	Complete ordinance approval process	Beginning of permit term	Town of Reading Bylaw/Ordinance planned for fall Town Meeting
Prepare inventory of all identified Sanitary Sewer Overflows (SSOs)	Develop an inventory of all identified SSOs	By end of Year 1	N/A – no SSOs. Any future SSO will be documented and notified
Develop a map of the entire stormwater system	Complete stormwater system map in two phases. Phase I includes outfalls, receiving waters, open channel conveyances, interconnections with other MS4s and other stormwater sewer systems, and municipally-owned stormwater treatment structures, waterbodies, and initial catchment delineations. Phase II includes outfall spatial locations, pipes, manholes, catch basins, refined catchment delineations, and municipal sanitary and combined sewer systems.	Phase I by end of Year 1 Phase II by end of Year 10	Mapping developed under GIS program. Refined catchment delineations to be completed under next steps.
Complete an initial outfall and interconnection inventory and initial priority ranking	Perform outfall and interconnection inventory and priority ranking to assess illicit discharge potential. Update annually based on field investigations. Outfalls shall be classified as “excluded,” “problem,” “high priority,” or “low priority.”	Initial inventory and ranking by end of Year 1, and annually thereafter	This IDDE report and investigation was conducted under the 2003 permit requirements. Some changes in the 2016 requirements may require Reading to do additional investigations and / or request a waiver to use existing test over new requirements. Reading to discuss further details with CDM Smith.
Establish written protocol that identifies responsibilities for eliminating illicit discharges	Review current protocol for eliminating illicit discharges for consistency with new permit requirements and then formalize with a written procedure	By end of Year 1	Town is working to define specific Responsibilities
Develop a written catchment investigation procedure, for locating and removing illicit discharges	Review current procedure for locating and removing illicit discharges for consistency with new permit requirements and formalize with written procedure	Within 18 months of the permit effective date	Protocol is attached as Appendix B

**Table ES-2 (Cont'd)
MA 2016 Small MS4 Permit Changes for IDDE Program**

Permit Requirement	Impact	Implementation Schedule	Status
Perform investigations of catchments to each outfall to identify potential illicit discharges	Complete catchment investigation procedure for Problem outfalls Complete catchment investigation procedure for outfalls with sampling results indicating an illicit connection. Complete catchment investigation procedure for problem, high and low priority outfalls	Begin no later than 2 years from effective date of permit and complete within 7 years of permit effective date Complete within 7 years of permit effective date Complete within 10 years of permit effective date	Complete
Train employees annually about IDDE Program	Provide annual training and document in Annual Report	Annually, beginning Year 1	To be completed in next steps
Establish an outfall and interconnection screening and sampling procedure to be included in the IDDE Program	Prepare an outfall and interconnection screening and sampling procedure	By end of Year 1	Protocol is attached as appendix B
Perform dry weather screening and sampling (where flowing) of every MS4 outfall and interconnection (except Excluded and Problem Outfalls)	Complete dry weather screening	By end of Year 3. Municipality may rely on previous sampling under MS4 2003 permit.	Complete
Perform wet weather screening in the spring only for those catchments that indicate the presence of one or more System Vulnerability Factors (as listed in the permit)	Perform wet weather screening for catchments based on System Vulnerability Factors	Must complete as part of the Catchment Investigation Procedure in order for a catchment to be marked as "complete."	To be completed in next steps
For impaired waters, implementation of control measures to meet the TMDL's or address water quality impairments.	Implement control measures to meet TMDL load allocations or address water quality problems and document progress in Annual Reports.	Annually, beginning in Year 1	To be completed in next steps

LEGEND

 Revised requirements from 2016 Permit

The scope of this IDDE project included expanding data collection to include downtown Reading and the predominantly commercial zones to the east of the downtown (encompassing approximately 25% of the town's stormwater infrastructure), and, secondly, to update the data collected in 2009. Specifically, the project included the following components:

1. Drainage Mapping and GIS Data
 - a. Town-wide mapping was created through the building of a complete stormwater GIS.
2. Outfall Screening
 - a. Individual outfalls were screened for indicators of primary pollutants during dry weather.
3. Upstream Investigations
 - a. Once a reach of drainage was identified to contain a source of the illicit wastewater flow, the reach is then isolated for subsequent dye testing in an attempt to pin-point the source of the flow.

Screening Results

During the field screening, 13 outfalls were identified as flowing and were tested for ammonia, surfactants, pH, temperature, and conductivity. Of the outfalls tested, four registered elevated test kit results and/or displayed visual evidence of contamination. These outfalls were selected for a follow up round of screening involving E. coli sampling. An overview map of screening results is provided in Figure 2 of Section 2.

IDDE Results

As a follow-up to the outfall screening program, upstream Illicit Discharge Detection and Elimination (IDDE) investigations were conducted on four drainage systems. These investigations resulted in the isolation of several drainage reaches where E. coli presence originated or spiked within each drainage system. The maps in Figures 3–6 of Section 3 illustrate the results of the IDDE investigations at the Summer Avenue, Washington Street, Gould Street, Mount Vernon Street, and Walnut Street systems.

Next Steps

The new MS4 General Stormwater Permit was issued in April, 2016. These requirements, summarized in Table ES-1, will required Reading to continue progress on MS4 activities, including:

1. Updating the Town wide mapping that was developed under the GIS program. Refined catchment delineations need to be completed in the next phase of work.
2. Enacting a Town Wide ordinance that prohibits non stormwater discharges to the drain system.

- a. The Town is planning on completing this ordinance at the 2016 fall town meeting.
3. Preparation of an inventory of all SSO's.
 - a. At this time Reading has no documented SSO's. Any future SSO's will be documented and DEP will be promptly notified.
4. Initiation and maintenance of an annual employee training program.
5. Maintenance, on an annual basis, of the outfall and interconnection inventory.
6. Adjust priority ranking of the systems outfalls and interconnections on an annual basis.
7. Performance of wet weather screening in the spring only for those catchments that indicate the presence of one or more System Vulnerability Factors (as listed in the permit).
8. Implementation of control measures to meet TMDL's or address any water quality impairments.
9. Prepare the annual MS4 status and update report.

Section 1

Introduction

This IDDE Study was conducted by CDM Smith under the Stormwater GIS and MS4 Permit Assistance Agreement, dated December 8, 2011. Field work was conducted in 2012 and 2013 and is summarized herein. The goal of this work was to search for, identify, and eliminate wastewater contamination (illicit flows) that may be entering the surface waters of Reading via the municipal stormwater system. By actively removing illicit flows from the municipal drainage system, the Town of Reading initiated this effort proactively ahead of the final issuance of the regulations set forth in the Massachusetts MS4 General Stormwater Permit (Reading is in the jurisdiction of the Northern Coastal watershed).

Prior to the 2012 field investigations, the Town of Reading conducted as part of its stormwater management program, dry weather outfall screening and upstream investigations on a portion of the Town's stormwater outfalls. CDM Smith completed the remainder of the Town. The Town's stormwater management program also includes public education, mapping updates, stormwater bylaws, and good housekeeping practices.

This report focuses on the results of the dry weather outfall screening program and the associated upstream Illicit Discharge Detection and Elimination (IDDE) investigations conducted by CDM Smith during the field investigation portion of the program in the Fall of 2012 and Spring of 2013.

The IDDE work performed by CDM Smith for this study is summarized in Table 1.

Table 1
Summary of IDDE Work in 2012-2013

Item	Number
Total number of Reading pipe outlets	450
- Number of stormwater outfalls	374
- Number of culvert outlets	76
Total number of IDDE investigations (by CDM Smith 2012-2013)	182
- Number of investigated outfalls	164
- Number of investigated non-outfalls (manholes and catch basins)	18
Total number of locations that tested positive for any of the primary pollutants	13
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Total number of locations CDM Smith tested for E. coli	23
- Number of outfalls tested for E. coli	10
- Number of non-outfalls tested for E. coli	13
Number of outfalls where CDM Smith performed upstream investigations	4
Number of outfalls determined to have illicit sources	0
Number of outfalls we suggest Reading keep an eye on	5

1.1 MS4 General Stormwater Permit

During 2008 – 2010 EPA issued three separate draft Small MS4 General permits to replace the 2003 Small MS4 permit. Several public hearings were held and comment period ended March 11, 2011. The 2014 Draft Massachusetts Small MS4 General Permit was released for public comment on September 30, 2014 and the comment period ended February 27, 2015. The 2016 Massachusetts Small MS4 General Permit was signed April 4, 2016 and will become effective July 1, 2017. The final permit reflects modifications to the 2014 draft small MS4 general permit released for comment on September 30, 2014 and replaces the 2003 small MS4 general permit for MS4 operators within the Commonwealth of Massachusetts.

The Phase II Rule of the permit defines a small MS4 stormwater management program as a program comprising six elements that, when implemented in concert, are expected to result in significant reductions of pollutants discharged to receiving waterbodies. The six MS4 program elements, termed “minimum control measures,” are as follows:

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

Per the Section 2.3.4.6 of the 2016 permit, municipalities must complete the written IDDE program within one year of the effective date of the permit, and the system map must be updated within 2 years of the permit effective date and then annually thereafter. An annual report must be prepared that document the following:

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

In addition, it should be noted that not all requirements under the minimum control measures were met by the Town of Reading since this IDDE investigation was completed under the guidance of the 2003 permit and does not necessarily meet all of the requirements of the 2016 permit. These items include:

- Public education and outreach
- New wet weather screening for catchments based on System Vulnerability Factors
- Phosphorus sampling for a municipality’s water quality impalement requirements

The descriptions of the changes between the past and present permits are summarized in Table 2 while the full regulations for IDDE Program can be found on the U.S. Environmental Protection Agency’s website. (<https://www3.epa.gov/region1/npdes/stormwater/ma/2016fpd/final-2016-ma-sms4-gp.pdf>)

CDM Smith is available to meet with the Town of Reading to decide the most appropriate steps to assist in meeting these new permit requirements.

Table 2
MA 2016 Small MS4 Permit Changes for IDDE Program

Permit Requirement	Impact	Implementation Schedule	Status
Ordinance to prohibit non-stormwater discharges must be in place	Complete ordinance approval process	Beginning of permit term	Town of Reading Bylaw/Ordinance planned for fall Town Meeting
Prepare inventory of all identified Sanitary Sewer Overflows (SSOs)	Develop an inventory of all identified SSOs	By end of Year 1	N/A – no SSOs. Any future SSO will be documented and notified
Develop a map of the entire stormwater system	Complete stormwater system map in two phases. Phase I includes outfalls, receiving waters, open channel conveyances, interconnections with other MS4s and other stormwater sewer systems, and municipally-owned stormwater treatment structures, waterbodies, and initial catchment delineations. Phase II includes outfall spatial locations, pipes, manholes, catch basins, refined catchment delineations, and municipal sanitary and combined sewer systems.	Phase I by end of Year 1 Phase II by end of Year 10	Mapping developed under GIS program. Refined catchment delineations to be completed under next steps
Complete an initial outfall and interconnection inventory and initial priority ranking	Perform outfall and interconnection inventory and priority ranking to assess illicit discharge potential. Update annually based on field investigations. Outfalls shall be classified as “excluded,” “problem,” “high priority,” or “low priority.”	Initial inventory and ranking by end of Year 1, and annually thereafter	This IDDE report and investigation was conducted under the 2003 permit requirements. Some changes in the 2016 requirements may require Reading to do additional investigations and / or request a waiver to use existing test over new requirements. Reading to discuss further details with CDM Smith.
Establish written protocol that identifies responsibilities for eliminating illicit discharges	Review current protocol for eliminating illicit discharges for consistency with new permit requirements and then formalize with a written procedure	By end of Year 1	Town is working to define specific Responsibilities
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Table 2 (Cont'd)
MA 2016 Small MS4 Permit Changes for IDDE Program

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Train employees annually about IDDE Program	Provide annual training and document in Annual Report	Annually, beginning Year 1	To be completed in next steps
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Perform wet weather screening in the spring only for those catchments that indicate the presence of one or more System Vulnerability Factors (as listed in the permit)	Perform wet weather screening for catchments based on System Vulnerability Factors	Must complete as part of the Catchment Investigation Procedure in order for a catchment to be marked as "complete."	To be completed in next steps
For impaired waters, implementation of control measures to meet the TMDL's or address water quality impairments.	Implement control measures to meet TMDL load allocations or address water quality problems and document progress in Annual Reports.	Annually, beginning in Year 1	To be completed in next steps

LEGEND

 Revised requirements from 2016 Permit

1.2 Reading Water Courses and Outfalls Summary

In 2008, Reading identified roughly 250 town stormwater outfalls, mostly in the residential and more rural areas of town. The scope of this IDDE project included expanding data collection to include downtown Reading and the predominantly commercial zones to the east of the downtown (encompassing approximately 25% of the town's stormwater infrastructure), and, secondly, to update the data collected in 2009.

As shown in Figure 1, the Town of Reading has several water courses that receive stormwater from the municipal system in the downtown and commercial areas. Bodies of interest include Walkers Brook, the Cross Street Channel, the Bolton Street Channel, and the Pleasant Street Channel. These water courses accumulate flow as they link various conservation and wetland areas in town and eventually combine into a single stream before entering Wakefield at the Rt. 129 rotary. Stormwater outfalls located on or near these water bodies were the primary focus of this program, and number of outlets and discharges are summarized in Table 3.

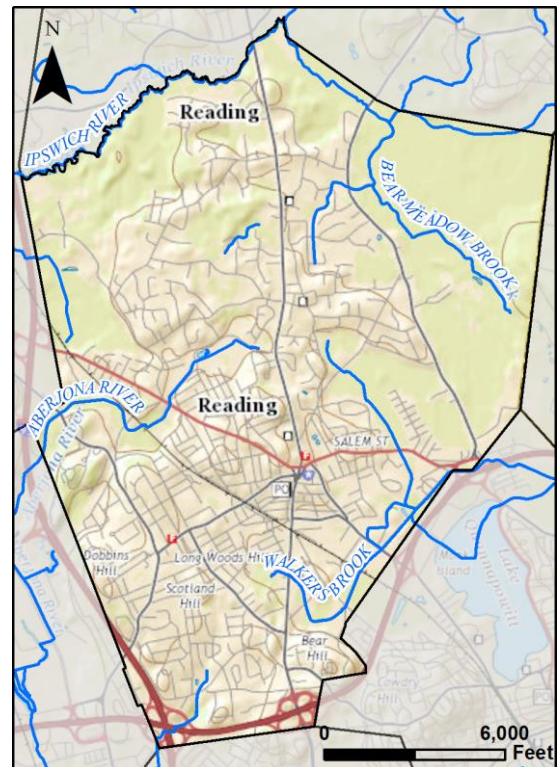


Figure 1
Water Courses in the Town of Reading

Table 3
Number of Outfalls in the Town of Reading Based on GIS Database

Number of Outfalls	Amount
Number of Pipe Outlets	450
Number of Discharges	374

1.3 Program Description and Methodology

1.3.1 Drainage Mapping and GIS Data

Town-wide mapping was created through the building of a complete stormwater GIS. Using the newly created maps, the field team identified and efficiently located stormwater outfalls while field verifying and refining GIS data on structure locations and attributes. Because the Town's prior GIS drainage information included both private and municipal infrastructure, CDM Smith field staff also collected ownership data for each structure in the study area during the site visits. Efforts were made to catalog and screen all outfalls regardless of ownership.

1.3.2 Outfall Screening

The first step in the Town's program was to screen individual outfalls for indicators of primary pollutants during dry weather, a time when there should be no flow or minimal baseflow

discharging from the outfalls. An outfall is defined as a point source for end-of-the-line municipal drainage that is hydraulically connected to any Waters of the United States.

The screening process includes locating an outfall with a global positioning system (GPS), inspecting for the presence of dry weather flow, photographing the structure for condition assessment, and adding the structure to a spreadsheet that includes all of the outfall screening results. Information about each outfall was documented including:

- Outfall Location
- Flow Conditions
- Screening Results (as needed)
- Presence / Visual evidence of sewage (as needed)
- Date of inspection
- General Comments
- Overall Condition

Initial outfall screening was conducted when antecedent dry weather conditions of at least 48 hours were met; dry weather was defined as less than 0.1 inch of rain during the preceding 48 hour period. In most cases, screening was conducted with at least 72 hours of antecedent dry weather.

In the event that an outfall was observed to be flowing in dry weather, field staff sampled the discharge for the following primary pollutant parameters:

- **Ammonia:** A constituent of urine, ammonia (urea) is a major component of wastewater and is only found in very small concentration in natural waters. Elevated ammonia levels (above 0.5 mg/L) are a good indication of sewage contamination.
- **Surfactants (detergents):** Detergents enter the sanitary sewer system through sinks and showers and are found in significant concentrations in wastewater. While detergents can enter the MS4 system via catch basins from activities like car washing, when found in significant concentrations (above 0.25 mg/L) and paired with the presence of ammonia, they are a strong indicator of wastewater contamination.
- **Temperature:** Typically, groundwater discharging from outfalls during dry weather does not differ in temperature from one outfall to the next or to the receiving water body on any given day. A significantly warmer discharge relative to the surrounding area can be an indication of sewage contamination.
- **pH:** Significant variations in pH values from dry weather flow and local receiving waters would be another indication that the flow may be contaminated with wastewater.
- **Specific Conductivity:** The measure of water's ability to conduct electricity (resistance) is an indirect way of measuring the amount of metals in the water. Outfalls discharging unusually high amounts of metals, sometimes as much as an order of magnitude higher, would be cause for further investigation.

- **Bacterial:** Escherichia coli (E. coli) is the definitive indicator for sewage presence in dry weather flow when discharging to a freshwater receiving body. Outfalls that registered positive results for the above parameters during initial screening were identified for E. coli sampling during a second round of screening. Outfalls found to be discharging elevated levels of E. coli (>235 CFU/100mL) triggered IDDE investigations in the upstream drainage system.

1.3.3 Upstream Investigation

The upstream investigations consist of structure-by-structure inspection and E. coli sampling as reflected in the Town's written protocol for IDDE investigations. (See Appendix B) The written protocol was adapted from several Boston Water and Sewer Commission publications, which are considered to be leading reference documents for IDDE procedures in municipal MS4 systems.

Once a reach of drainage has been identified to contain a source of the illicit wastewater flow, the reach is then isolated for subsequent dye testing in an attempt to pin-point the source of the flow. Oftentimes the source of the illicit wastewater flow is a cracked pipe, sewer service defect, or direct connection from a property to the drainage system. If dye testing fails to yield a definitive result, the drain system is closed circuit television (CCTV) inspected in an attempt to determine the source of the flow.

Once a point source is positively identified, the Town is notified of the nature and location of the source to be mitigated. Finally, follow-up E. coli testing is performed after the mitigation work is complete to confirm elimination of the illicit flow to the receiving water body.

Section 2

Screening Results

A total of 182 outfall screenings were performed in 2012 and 2013. A summary of outfall inspection statistics are included in Table 1. The complete results of the field screening are presented in Appendix A. Screened outfalls were placed into one of three categories: flowing, dry or submerged. Partially or fully submerged outfalls are defined as either a pipe below the waterline of its receiving body or a manhole where the water line is above the effluent pipe. In such cases, it is not possible to obtain a quality sample from the outfall without the potential for cross contamination from the receiving body (due to the lack of free flowing discharge). When an outfall was found to be submerged, CDM Smith field staff attempted to sample from the next upstream structure. If the upstream structure was also partially submerged, the staff would need to return to that outfall at a later date when the receiving water level was lower. If an outfall and its upstream structure were found to be submerged upon the second visit, the outfall was assessed on visual inspection alone.

During the field screening, 13 outfalls were identified as flowing and were tested for ammonia, surfactants, pH, temperature, and conductivity. Of the outfalls tested, four registered elevated test kit results and/or displayed visual evidence of contamination. These outfalls were selected for a follow up round of screening involving E. coli sampling. An overview map of screening results is provided in Figure 2. All E. coli testing results are shown in Table 4.

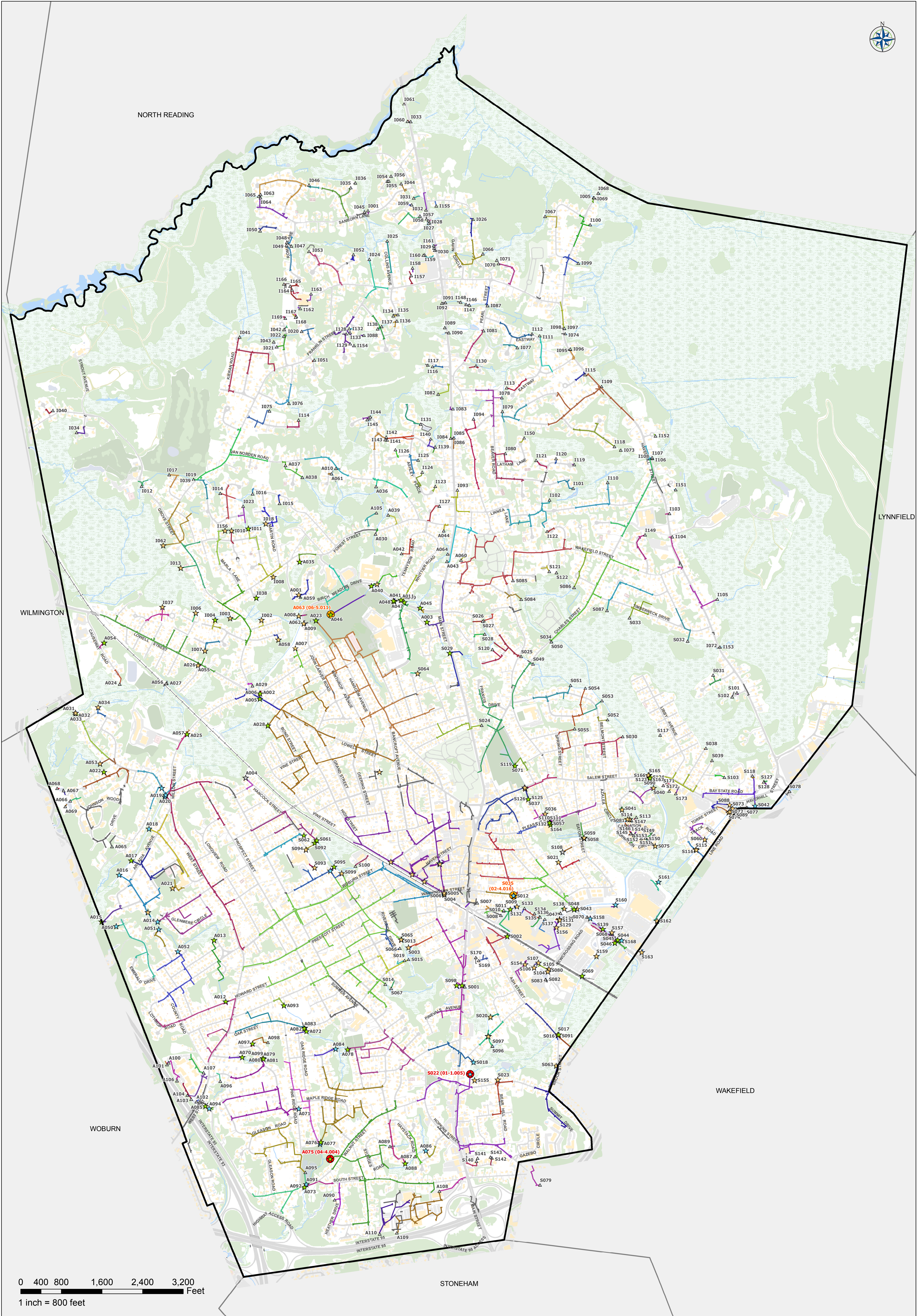
From the field testing results, the following drainage subsystems were identified as discharging stormwater containing contaminants above the surface water quality limit:

- System *S022* near Summer Avenue
- System *S006* near Mount Vernon Street
- System *S035* near Washington Street
- System *A075* near Walnut Street

One additional system was identified during IDDE investigation as having a potential surface water runoff issue from a nearby farm:

- System *A063* near Birch Meadow Park

Follow-up testing returned E. coli results that did not exceed the water quality limit. This subsystem should be monitored during wet weather events to determine if the surface water impairment has the potential to reach the drainage system.



0 400 800 1,600 2,400 3,200
 1 inch = 800 feet

- Legend**
- Inspected Outfalls
 - ★ Flowing (27)
 - ★ Partially Submerged (64)
 - ★ Dry (85)
 - ★ Cannot Locate (2)
 - Elevated Sample
 - Positive Sample
 - △ Other Drainage Outlet

Figure 2
 Town of Reading, Massachusetts
 Stormwater Outfall Dry Weather Screening
 2012 - 2013



Table 4
E. coli Results for Outfalls Registering Positive Test Kits

GIS System ID	Unique GPS ID	Original ID	GIS Facility ID	Date Sampled	Location Description	E. coli (CFU/100mL)	Comments	Flowing	Dry	Partially Submerged	Ammonia (ppm)	Surfactants (ppm)	Temp. (°C)	pH	Sp. Conductivity (µs)
S022-i001		SA-Inlet	swIN-22	5/2/2013	Summer Avenue- Behind Sam's Bistro	28	Background E. Coli	X							
S022-m006		SA-3	swMH-392	5/2/2013	Summer Avenue	18	Halfway to Summer Avenue possible source	X							
S022-c003		SA- 2	swCB-2927	5/2/2013	Summer Avenue 175/177	6500	Heavy E. Coli at suspect source	X							
S022-c019		SA-11	swCB-698	5/2/2013	Summer Avenue	43	At outfall	X							
S006-c043		GS-5	swCB-347	5/2/2013	Gould Street	< 1	Clean	X							
S006-m014		GS-2	swMH-135	5/2/2013	Gould Street	1400	Moderate E. Coli from underdrain. Underdrain cannot be capped.	X							
S006-c041		GS-6	swCB-349	5/2/2013	Gould Street	150	Clean	X							
A020	04-1.012	1-12	swDIS-76	7/8/2013	West Street at Willow Street	96	Cleared the line. Map 24	X							
A019-m001	04-1.013	1-13	swMH-733	7/8/2013	West Street at Willow Street	7.4	Cleared the line, map 24, very long reach. Always flowing but below water quality limit	X							
	04-2.010	2-10		7/8/2013	MH at 13 Temple Street	24	Cleared the line on Map 40, also check connectivity here. Outfall goes to culvert	X			0.25	0.25	19.5	7.3	925
A018	04-2.013	2-13	swDIS-74	7/8/2013	35 Arcadia Avenue	44	Cleared the line on MAP 31. Connectivity could be cleaned up, only one outgoing line to outfall	X							
A017	04-2.014	2-14	swDIS-73	7/8/2013	77 Arcadia Avenue	56	Cleared the line, connectivity is incorrect here , lost tracer die between upstream MH and outfall MAP 31	X							
A052	04-3.003	3-3.2	swDIS-228	7/8/2013	Randall Road #32	5	Cleared the line on MAP 46 and MAP 47	X							
A050	04-3.005	3-5	swDIS-226	7/8/2013	County Road #194	68	Cleared the line on MAP 42.	X							
A071	04-4.003	4-3	swDIS-64	7/8/2013	Pine Ridge Road #94	57	Cleared the line on MAP 61	X							
A075	04-4.004	4-4	swDIS-61	7/8/2013	Walnut Street #149	650	Possible E. Coli issue here, needs further investigation. Open manhole junction on map 74	X							
A087-i001	04-4.005	4-5		7/8/2013	Haystack Road #29	15.0	Cleared the line	X							
	04-4.006	4-6		7/8/2013	Haystack Road #29	23.0	Cleared the line	X							
A075	04-4.004	4-4	swDIS-61	8/7/2013	Walnut Street #149	440.00	Outfall located on Walnut Street, picks up flow from wetland, could have source in system	X							
A063	06-5.011	5-11	swDIS-307	8/7/2013	Birch Meadow Park	64.00	Line cleared at the head of the Aberjona River. Manhole smelled like sewage on previous trip. Monitor this location	X							
S022-c003		SA-2		8/7/2013	Summer Avenue 175/177	25,000	Suspect source has once again picked up, immediate action should be taken. Sample from 2 CB in parking lot	X							
		SA-2.1		8/7/2013	Summer Avenue after 175/177	24,000	Same line as the above SA-2 but this location is at the manhole in the street just before the outfall	X							
		4-4.2		8/7/2013	Sturges Road #74	47.00	Background E. Coli found in wetland that drains to 4-4 shows possible issue at 4-4	X							

Legend
Positive E. coli sample
Possible E. coli issue

Section 3

IDDE Results

As a follow-up to the outfall screening program, upstream Illicit Discharge Detection and Elimination (IDDE) investigations were conducted on four drainage systems. These investigations resulted in the isolation of several drainage reaches where *E. coli* presence originated or spiked within each drainage system. The maps in Figures 3 through 6 illustrate the results of the IDDE investigations at the Summer Avenue, Washington Street, Gould Street, Mount Vernon Street, and Walnut Street systems.

3.1 Summer Avenue

On May 2nd, 2013, CDM Smith staff began to investigate the source of illicit flows to a channelized stream within a conservation area bounded by Summer Avenue, Cross Street, Ash Street and Brook Street. This stream and the wetland within the conservation area are tributary to Walkers Brook. Figure 3 illustrates the results of the investigation on Summer Avenue. Contaminated dry weather flow was consistently observed discharging from a 30-in concrete pipe.

After isolating a reach of drain extending cross-country from Route 28 to Summer Avenue, dye testing was performed on the morning of May 29th, 2013, on two properties suspected to be sources of illicit flow. The sewer tie cards for these properties, 503/507 Summer Avenue and 173/175 Main Street, were reviewed to ensure that the service connections crossed the isolated drain reach. The tie cards are shown in Figure 7, demonstrating the approximate location of the isolated drain reach.

The field team set two dye observation points – one on the drain line downstream of the crossing at *S022-c003* and one on the downstream sewer – to verify the direction of flow and proper connection of the house services. No dye was observed in the drain line after 40 minutes of observation. However, growth, indicated by white cloudiness in the stream, was observed at this time in the invert of the drain, which is indicative of sewage presence. A potential explanation of the negative dye test is that the rain soaked-ground did not allow swift migration of the dye through the soil to the drain. Alternatively, the source of the contaminated flow may be through a defect on the main line sewer.

Dye was also inserted into a sewer manhole well upstream of the suspected drain intrusion point. Again, *S022-c003* was observed for dye, but results were negative, possibly due to the same saturated ground condition. The field team recommends CCTV inspection of this drain line and/or CCTV inspection of the mainline sewer and the service to 173/175 Main Street. This sewer service is accessed through a clean-out in the driveway and is considered to be the most likely source of the illicit flow, despite the negative dye test.

3.2 Gould Street and Washington Street

Two locations with positive *E. coli* tests originating back to the sampling conducted in 2012 are shown in Figure 4 and Figure 5, as *S006-c007* on Gould Street and *S035* on Washington Street. They are known to have underdrains contributing to the poor water quality conditions.

The Gould Street manhole location *S006-c007* was first tested for *E. coli* in October, 2012 and was found to have moderate levels of *E. coli* (approximately 920 CFU/100mL). This location was retested in May, 2013 and *E. coli* levels were found to have risen to 1,400 CFU/100mL. Upon further review of the original sewer as-built plans, it was discovered that the *E. coli* was originating at an upstream underdrain location manhole *S006-m014* on Mount Vernon Street. It is recommended that the underdrain be plugged and abandoned on Mount Vernon Street to stop the migration of *E. coli* downstream into the drainage system. We do not believe that the underdrain located on Washington Street can be capped at this time.

The Washington Street system was cleared of any illicit flow within the system via 48-hour sandbag tests from the furthest upstream branches to *S035-m001* where the presence of *E. coli* was detected in a steady and heavy flow from a 6-inch cast iron pipe with a flap valve. This pipe was traced back to a previously unmapped manhole on the Town's drainage plans, labeled *S035-m002*. Town sewer record drawings indicated that this manhole was the discharge point for a large network of sewer underdrains serving the central and western portion of Town, extending westward from this point, passing the commuter rail station, and discharging at outfall *S012*.

3.3 Mount Vernon Street

A 6-inch cast iron pipe was found discharging to *S006-m014*. The small, but steady amount of flow (constant trickle) contained elevated levels of *E. coli*. The pipe entered the manhole from an angle, suggesting it originated from 10 Mount Vernon Street. This property was dye tested on the morning of May 29th. Dye was detected in the downstream sewer manhole, but no dye was observed in the suspect pipe.

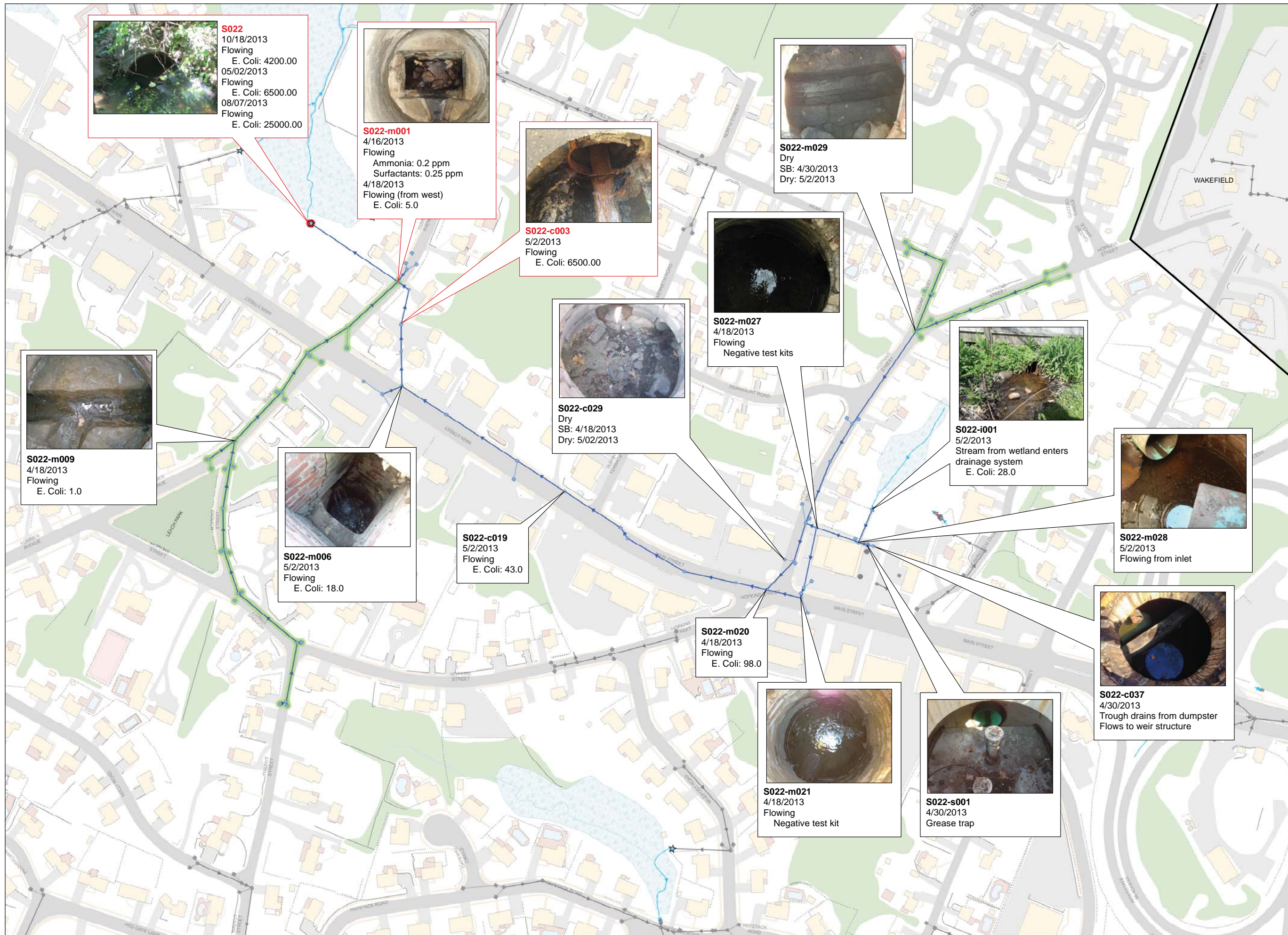
Upon further review of the original sewer as-built plans, it was discovered that the pipe was in fact another underdrain discharge point. Figure 8 displays the profile view of the underdrain discharge to the drainage system. Unlike the Washington Street underdrain, this pipe has not displayed heavy flow at any time and may be able to be plugged and abandoned to stop the migration of *E. coli* to the drain.

3.4 Walnut Street

One Walnut Street outfall had elevated *E. coli* measurements and may require further investigation. This outfall daylights behind the house located at #179 Walnut Street. This system conveys water from an inlet behind Old Farm Road to the Sturges Park creek. As shown in Figure 6, *E. coli* readings registered 650 CFU/100mL in July, 2013 and 440 CFU/100mL in August, 2013. Because measurements are only marginally above the recommended levels, no corrective actions are required at this time, but the locations should continue to be monitored.



Figure 3
2013 IDDE
Investigation
Summer Avenue
Outfall S022



- Legend**
- Inspected Outfalls
 - ★ Flowing
 - ★ Partially Submerged
 - ★ Dry
 - ★ Cannot Locate
 - E. coli Test - Elevated
 - E. coli Test - Positive
 - Stormwater System
 - ▲ Outfall
 - ◆ Inlet
 - Manhole
 - Catch Basin
 - Other Structure
 - Gravity Main
 - - Underdrain
 - Catch Basin Lateral
 - Culvert
 - Open Drain
 - Testing Results
 - Cleared System
 - "SB" = Sandbagged

0 50 100 200 Feet
1 inch = 100 feet





Figure 4
2013 IDDE
Investigation

Mount Vernon and
Gould Street

Outfalls S0026-c007
and S006-m014

Legend

Inspected Outfalls

- ★ Flowing
- ★ Partially Submerged
- ★ Dry
- ★ Cannot Locate
- E. coli Test - Elevated
- E. coli Test - Positive

Stormwater System

- ▲ Outfall
- ◆ Inlet
- Manhole
- Catch Basin
- Other Structure
- Gravity Main
- Underdrain
- Catch Basin Lateral
- Culvert
- Open Drain

Testing Results

- Cleared System
- "SB" = Sandbagged



0 37.5 75 150 Feet
1 inch = 75 feet

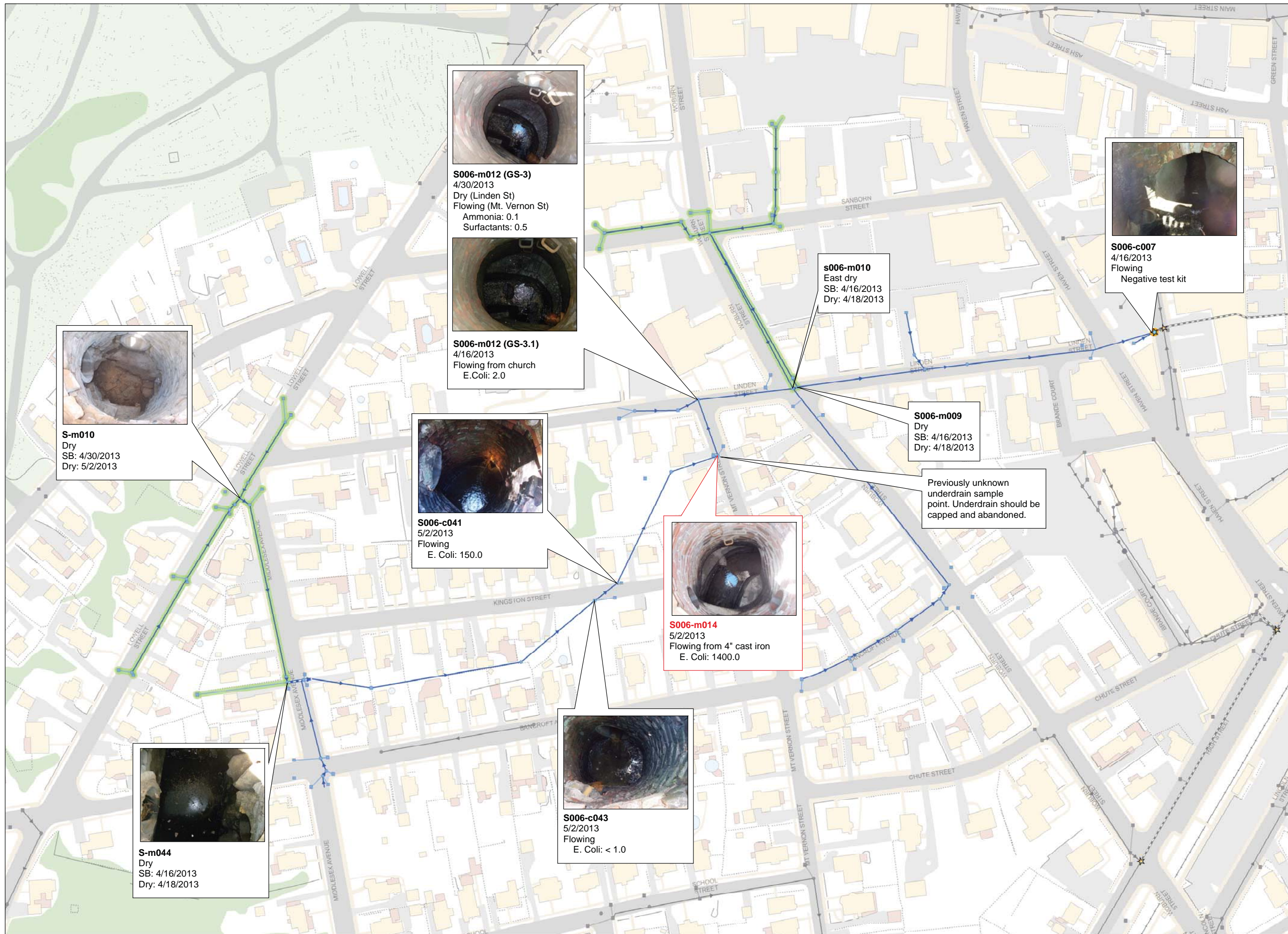
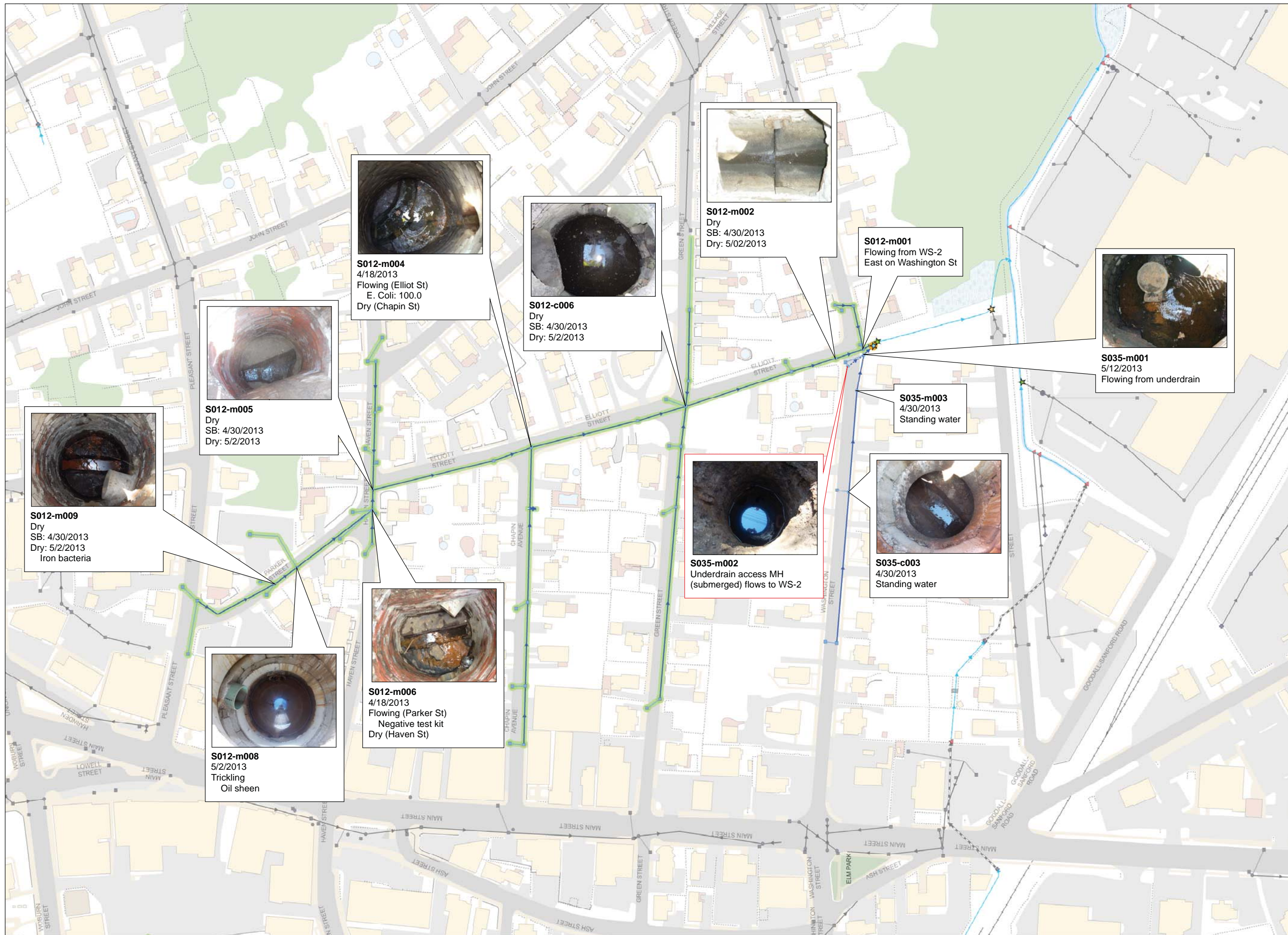




Figure 5
2013 IDDE
Investigation
Washington Street
Outfall S035



S012-m004
4/18/2013
Flowing (Elliot St)
E. Coli: 100.0
Dry (Chapin St)



S012-c006
Dry
SB: 4/30/2013
Dry: 5/2/2013



S012-m002
Dry
SB: 4/30/2013
Dry: 5/02/2013

S012-m001
Flowing from WS-2
East on Washington St



S035-m001
5/12/2013
Flowing from underdrain



S012-m005
Dry
SB: 4/30/2013
Dry: 5/2/2013



S012-m009
Dry
SB: 4/30/2013
Dry: 5/2/2013
Iron bacteria



S035-m002
Underdrain access MH
(submerged) flows to WS-2



S035-c003
4/30/2013
Standing water

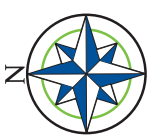


S012-m006
4/18/2013
Flowing (Parker St)
Negative test kit
Dry (Haven St)



S012-m008
5/2/2013
Trickling
Oil sheen

- Legend**
- Inspected Outfalls
 - ★ Flowing
 - ☆ Partially Submerged
 - ☆ Dry
 - ☆ Cannot Locate
 - E. coli Test - Elevated
 - E. coli Test - Positive
 - Stormwater System
 - ▲ Outfall
 - ◆ Inlet
 - Manhole
 - Catch Basin
 - Other Structure
 - Gravity Main
 - - Underdrain
 - - Catch Basin Lateral
 - Culvert
 - Open Drain
 - Testing Results
 - Cleared System
 - "SB" = Sandbagged

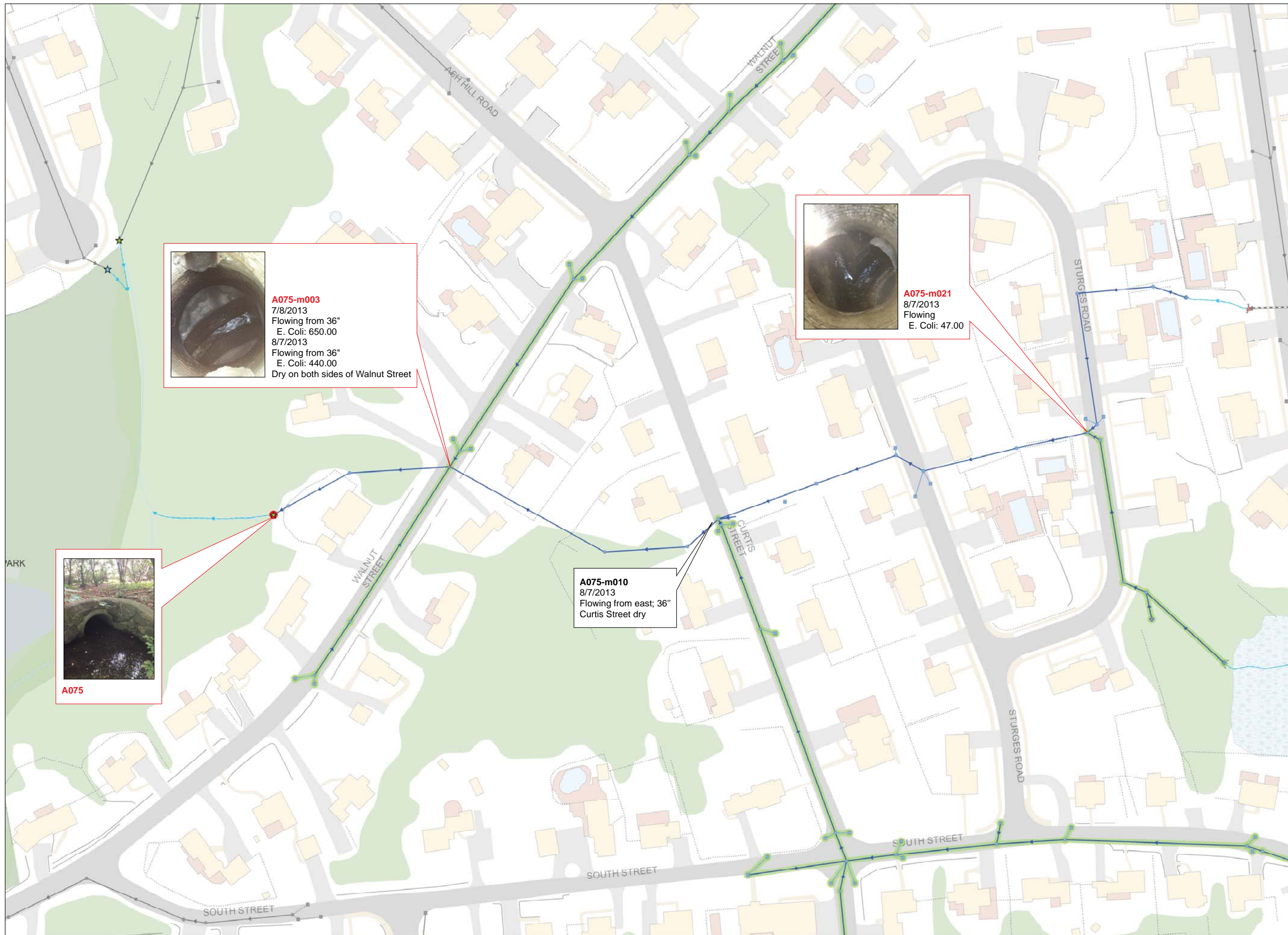


0 37.5 75 150 Feet
1 inch = 75 feet





Figure 6
2013 IDDE
Investigation
Walnut Street
Outfall 0A075



Legend

- Inspected Outfalls
 - ★ Flowing
 - ★ Partially Submerged
 - ★ Dry
 - ★ Cannot Locate
 - E. coli Test - Elevated
 - E. coli Test - Positive
- Stormwater System
 - ▲ Outfall
 - ◆ Inlet
 - Manhole
 - Catch Basin
 - Other Structure
 - Gravity Main
 - Underdrain
 - Catch Basin Lateral
 - Culvert
 - Open Drain
- Testing Results
 - Cleared System
 - "SB" = Sandbagged



0 25 50 100 Feet
1 inch = 50 feet



Figure 7

Tie Cards of 173-175 Main Street

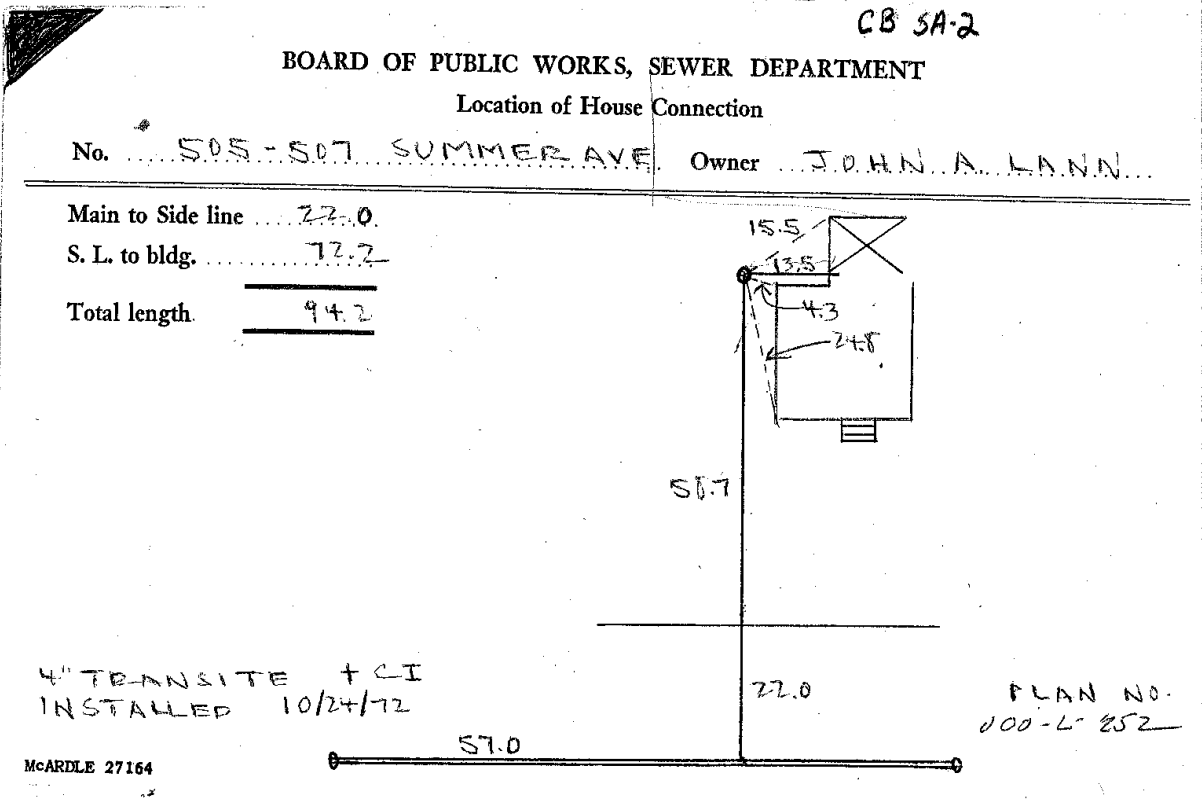
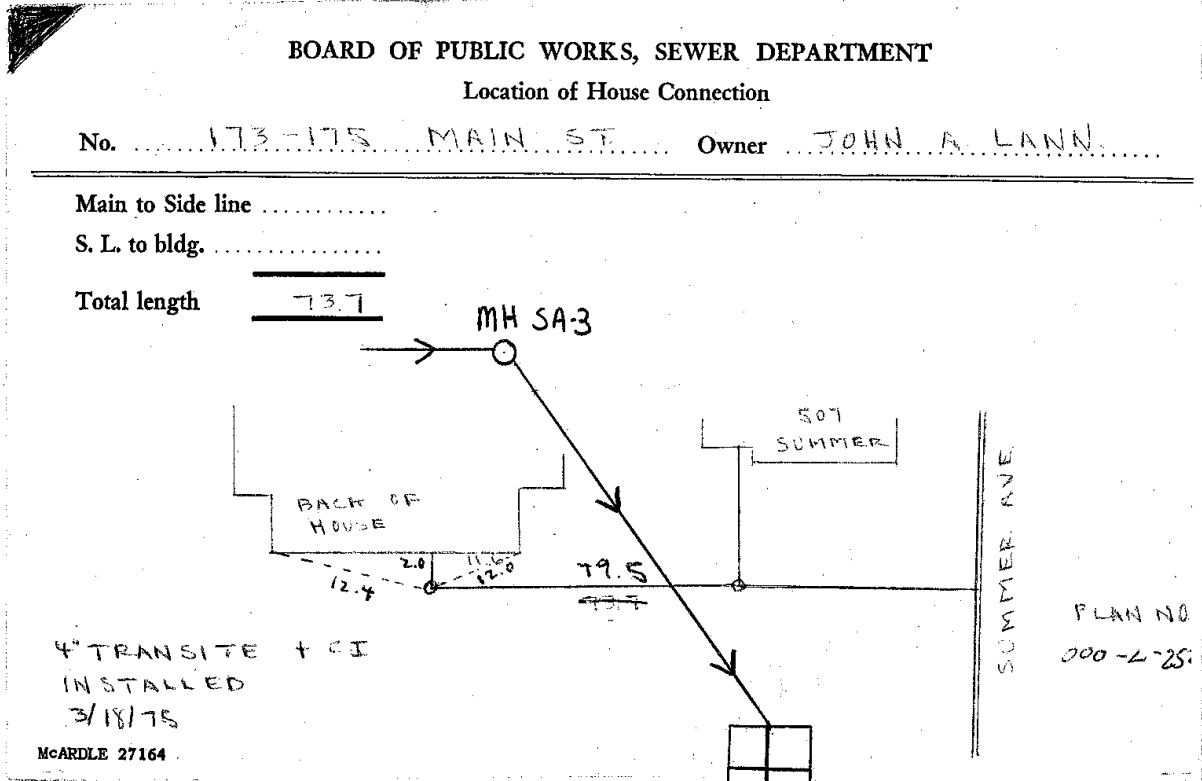
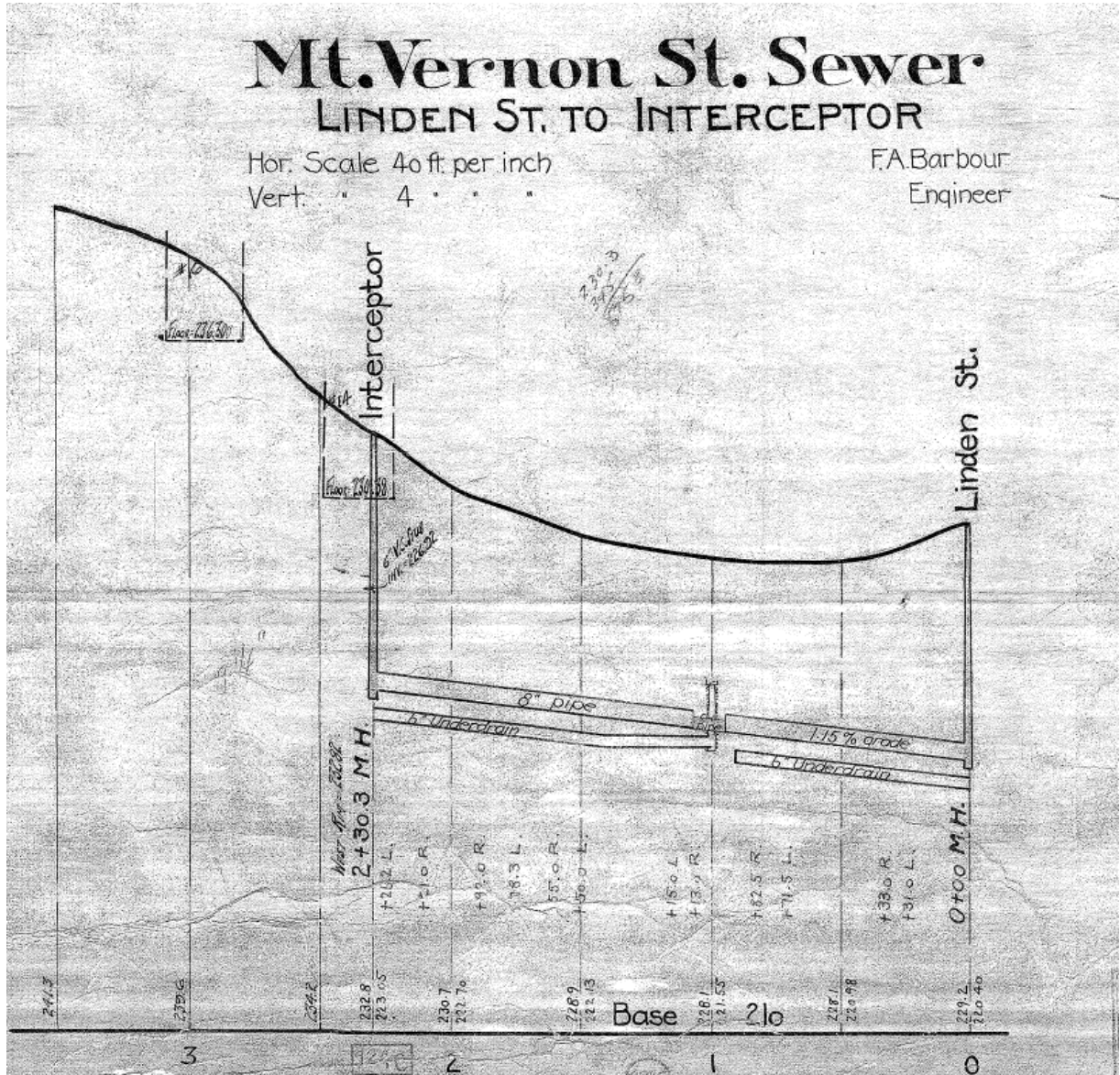


Figure 8

Mount Vernon Street Sewer: Underdrain Connection Profile



Appendix A
Table A – All Outfall Screening Results

**Appendix A
Outfall Screening Results**

GIS System ID	Unique GPS ID	Original ID	GIS Facility ID	Date Inspected	Location Description	Flowing	Dry	Partially Submerged	Ammonia (ppm)	Surfactants (ppm)	Temp. (°C)	pH	Sp. Conductivity (µs)	Pipe Size	Material	Outlet Type	Comments
S016	01-1.002	1-2	swDIS-16	8/13/2012	Brook Street at Ash		X							15"	Concrete	Block/Concrete HW	Concrete block headwall, the headwall is being undermined by erosion. Discharges directly to brook
S091	01-1.003	1-3	swDIS-195	8/13/2012	Brook Street at Ash 2			X						Unknown	Unknown	Stone HW	Field stone and concrete headwall; pipe fully submerged in brook. Upstream manhole submerged
S023	01-1.004	1-4	swDIS-58	8/13/2012	Summer at Bear Hill		X							12"	Concrete	No HW	Concrete pipe with splash pad; rip rap channel; No headwall; good condition
S022	01-1.005	1-5	swDIS-56	8/13/2012	Summer Street #512	X			2.0	0.5	23.6	7.5	1150	30"	Concrete	Channelized Stream	No headwall; Stone and concrete channelized stream. Last pipe section fell off; white growth observed in channel; stream is cloudy
S155	01-1.006	1-6	swDIS-405	8/13/2012	Summer at #518		X							12"	HDPE	No HW	Not in GIS, 12-in HDPE with splash pad and some riprap behind #518
S018	01-1.007	1-7	swDIS-18	8/13/2012	Cross Street #13	X			0.0	Trace	21.5	7.04	800	24"	Concrete	Earthen Channel	Concrete pipe to earthen channel; no HW; Observed dry, then observed a large and sustained flush of clear water; neg. tk.
S097-f001	01-1.008	1-8	swFT-16	8/13/2012	Cross Street #39		X							12"	Concrete	Culvert	Concrete pipe punches into side of culvert (at manhole); no access; upstream MH dry
S097-c001	01-1.009	1-9	swCB-2898	8/13/2012	Cross Street #51		X							18"	Unknown	Culvert	Concrete pipe punches into culvert at catch basin. No access to pipe; Upstream MH dry; NO PICTURE
S020	01-1.010	1-10	swDIS-20	8/13/2012	Sheckleford #45		X							15"	PVC	Earthen Channel	PVC pipe with no headwall; under plank of wood behind fence behind yard. Discharges to dirt channel
S098	01-1.011	1-11	swDIS-202	8/13/2012	Perkin Street Bank of America			X						12"	Concrete	Stone HW	Single catch basin system; discharges to treatment wetland; CB is dry
S002	01-1.012	1-12	swDIS-2	8/13/2012	Ash Street Light Depot			X						24"	Clay	No HW	Partially submerged pipe (scour at outfall results in permanent puddle) to dry earthen channel. Upstream MH partially submerged
S132	01-1.013	1-13	swDIS-371	8/13/2012	Bolton Street at Furniture House			X						18'	HDPE	No HW	Takes flow from stormceptor unit in parking lot; discharges directly to stream; upstream MH is stormceptor
S009	01-1.014	1-14	swDIS-9	8/13/2012	Bolton Street (dead end)		X							12"	Concrete	No HW	Discharges directly to stream; pipe has is cracked at top; fair condition
S156	01-2.001	2-1	swDIS-406	8/21/2012	General Way (Market Basket)		X							8"	PVC	No HW	PVC pipe to rip rap then grass swale at minimum slope; discharges to treatment wetland under bridge
S130	01-2.002	2-2	swDIS-369	8/21/2012	General Way (Market Basket)			X						12"	HDPE	Flared End	Partially submerged HDPE pipe to treatment wetland; not flowing; invert at water elevation; upstream CB dry
S131	01-2.003	2-3	swDIS-370	8/21/2012	General Way (Market Basket)		X							12"	HDPE	Flared End	Discharges to treatment wetland with a HDPE flared end
S129	01-2.004	2-4	swDIS-368	8/21/2012	General Way (Market Basket)		X							24"	HDPE	Flared End	Largest Pipe to treatment wetland with a flared HDPE end

Legend			
Elevated Test Kit Results (>0.5 mg/L for Ammonia and >0.25 mg/L for Surfactants)			
Positive Test Kit Results (≤0.5 mg/L for Ammonia and ≤0.25 mg/L for Surfactants)			
Private System			
CNL	Cannot locate	CMP	Corrugated Metal Pipe
CB	Catch Basin	RCP	Reinforced Concrete Pipe
MH	Manhole	PVC	Polyvinly Chloride
HW	Headwall		

**Appendix A (Cont'd)
Outfall Screening Results**

GIS System ID	Unique GPS ID	Original ID	GIS Facility ID	Date Inspected	Location Description	Flowing	Dry	Partially Submerged	Ammonia (ppm)	Surfactants (ppm)	Temp. (°C)	pH	Sp. Conductivity (µs)	Pipe Size	Material	Outlet Type	Comments
S138	01-2.005	2-5	swDIS-377	8/21/2012	General Way (Market Basket)		X							12"	HDPE	Flared End	Pipe has HDPE flared end and outfalls to a small wetland and grass swale
S043	01-2.006	2-6	swDIS-52	8/21/2012	Walker Brook Drive @ Stop N Shop		X							12"	Iron	Concrete HW	Pipe is at the bottom of a concrete headwall and outlets to the brook
S048-f003	01-2.007	2-7	swFT-115	8/21/2012	Walker Brook Drive @ Stop N Shop			X						MH	MH	Culvert	Drain punches into culvert with no available access; Upstream manhole dry
S157	01-2.008	2-8	swDIS-407	8/21/2012	Walker Brook Drive @ Chilis		X							12"	Concrete	No HW	Pipe in rip rap to earthen channel which leads to walkers brook
S158	01-2.009	2-9	swDIS-408	8/21/2012	Walker Brook Drive @ Starbucks	X			0	0.25	-	7.2	110	15"	HDPE	Retaining Wall	Pipe in Block retaining wall; pipe dripping; neg tk
S139	01-2.010	2-10	swDIS-378	8/21/2012	Walker Brook Drive @ Driveway			X						12"	Concrete	Flared End	Partially submerged at walkers brook; not flowing with concrete flared end; upstream MH dry
S168	01-2.011	2-11	swDIS-419	8/21/2012	Walker Brook Drive @ Chilis	X			0.0	0.0	-	-	-	24"	Concrete	Concrete HW	Pipe in headwall to rip-rap area then flows to walkers brook; some groundwater flow observed from pipe joint; neg tk
S044	01-2.012	2-12	swDIS-53	8/21/2012	Walker Brook Drive @ Chilis			X						N/A	HDPE	-	Fully submerged in brook; upstream MH in Walker Brook Drive fully submerged; not flowing; NO PICTURE
S046	01-2.013	2-13	swDIS-55	8/21/2012	Walker Brook Drive @ Chilis			X						N/A	-	-	Fully submerged in brook; upstream MH partially submerged; not flowing; NO PICTURE
S159	01-2.014	2-14	swDIS-409	8/21/2012	Walker Brook @ Keurig		X							18"	Concrete	Stone HW	Large flared end surrounded by stone wall from parking lot directly into walkers brook
S069	01-2.015	2-15	swDIS-129	8/21/2012	Walker Brook behind Keurig			X						18"	Concrete	Stone HW	Nearly full pipe with flared end from parking lot directly into walkers brook
S160	01-2.016	2-16	swDIS-410	8/21/2012	Walker Brook @ Home Depot	X			0.2	Trace	24.5	7.17	700	24"	Concrete	Concrete WW	Concrete wingwall with flap gate in slope behind fence and retaining wall behind Home Depot to walkers brook
S161	01-2.017	2-17	swDIS-411	8/21/2012	Walker Brook @ Jordans	X			0.2	0.25	24.1	7	1400	4"	PVC	Concrete WW	Outfall is at bottom of 30 foot retaining wall, samples were taken from 1 of 2 3-in PVC pipes, also has an 18" HDPE from stormceptor
S162	01-2.018	2-18	swDIS-412	8/21/2012	Walker Brook Drive @ Home Depot		X							18"	Concrete	Concrete WW	Outfall on side of home depot; at bottom of retaining wall in giant concrete headwall in wetland; invert wet but not flowing
S163	01-2.019	2-19	swDIS-413	8/21/2012	Walker Brook Drive Honda Dealer		X							8"	PVC	No HW	PVC pipe partially buried; from grass swale into bushes next to car dealership
S105	01-2.020	2-20	swDIS-312	8/21/2012	New Crossings @ Pond Meadow		X							-	-	No HW	Unknown size and material; buried under sediment; single catch basin system; CB dry; near DPW; NO PICTURE
S104	01-2.021	2-21	swDIS-311	8/21/2012	New Crossings @ Pond Meadow		X							12"	Concrete	No HW	Pipe next to culvert under pond meadow; dry; poor condition; single catch basin system; 50% buried
S107	01-2.022	2-22	swDIS-314	8/21/2012	Pond Meadow Drive		X							12"	Concrete	Flared End	Pipe with flared to natural wetland, tree roots could present problem in future

Legend			
Elevated Test Kit Results (>0.5 mg/L for Ammonia and >0.25 mg/L for Surfactants)			
Positive Test Kit Results (≤0.5 mg/L for Ammonia and ≤0.25 mg/L for Surfactants)			
Private System			
CNL	Cannot locate	CMP	Corrugated Metal Pipe
CB	Catch Basin	RCP	Reinforced Concrete Pipe
MH	Manhole	PVC	Polyvinly Chloride
HW	Headwall		

**Appendix A (Cont'd)
Outfall Screening Results**

GIS System ID	Unique GPS ID	Original ID	GIS Facility ID	Date Inspected	Location Description	Flowing	Dry	Partially Submerged	Ammonia (ppm)	Surfactants (ppm)	Temp. (°C)	pH	Sp. Conductivity (µs)	Pipe Size	Material	Outlet Type	Comments
S106	01-2.023	2-23	swDIS-313	8/21/2012	Pond Meadow Drive		X							-	-	-	Could not locate, upstream manhole dry
S154	01-2.024	2-24	swDIS-404	8/21/2012	Reading Health		X							12"	Concrete	Flared End	70% full of sediment; discharges into a wetland area
S089	01-3.003	3-3	swDIS-354	8/30/2012	Line Road		X							12"	Concrete	Concrete HW	Off of Line Road, 60% filled with sediment
S074	01-3.004	3-4	swDIS-352	8/30/2012	Line Rd behind Cumberland Farms		X							12"	Concrete	Concrete HW	Drainage from parking lot; discharges directly to brook, scour protection on sides of brook
S072	01-3.005	3-5	swDIS-350	8/30/2012	Line Rd behind Cumberland Farms		X							12"	Concrete	Concrete HW	Outfall about culvert; single catch basin system; discharges directly to brook
S073	01-3.006	3-6	swDIS-351	8/30/2012	Line Road		X							12"	Concrete	Concrete HW	Outfall above culvert; single catch basin system; discharges directly to stream
S058	01-3.007	3-7	swDIS-43	8/30/2012	Eaton Street		X							12"	Iron	Culvert	Pipe is built into the culvert, located under the road discharges directly to brook
S059	01-3.008	3-8	swDIS-44	8/30/2012	Eaton Street		X							12"	Iron	No HW	Pipe located next to the concrete culvert discharges directly to brook
S108	01-3.009	3-9	swDIS-315	8/30/2012	Elm Street									-	-	-	Could not locate, potentially buried in conservation area; upstream MH dry; NO PICTURE
S057	01-3.010	3-10	swDIS-42	8/30/2012	Pleasant Street @ Walkers Brook			X						18"	Concrete	Stone HW	Pipe partially submerged, furthest right when facing HW; upstream MH dry
S056	01-3.011	3-11	swDIS-41	8/30/2012	Pleasant Street @ Walkers Brook			X						24"	CMP	Stone HW	Pipe is actually high level outlet for culvert; not an outfall. Culvert consists of triple barrel CMP and this high level CMP
S112	01-3.012	3-12	swDIS-319	8/30/2012	Pleasant Street @ Walkers Brook			X						12"	Concrete	Stone HW	Pipe, partially submerged at brook level, second from the left when facing HW, upstream MH dry
S164	01-3.013	3-13	swDIS-414	8/30/2012	Pleasant Street @ Walkers Brook			X						8"	Iron	Stone HW	Pipe, partially submerged at brook level, single catch basin system; CB dry
	01-3.014	3-14		8/30/2012	Pleasant Street @ Walkers Brook			X						6"	PVC	No HW	Pipe is partially submerged at creek elevation, upstream CB had wet invert, not enough to sample, takes drainage from building
S036	01-3.015	3-15	swDIS-45	8/30/2012	Osborne Street behind #5		X							18"	Concrete	Block HW	Pipe in CMU headwall with bar rack; leads to brook
S126	01-3.016	3-16	swDIS-359	8/30/2012	Osborne Street at end			X						24"	Concrete	Concrete WW	Pipe in culvert wing wall
S126-f002	01-3.017	3-17	swFT-89	8/30/2012	Salem Street		X							15"	RCP	Manhole	MH outlet discharges to culvert; dry with two incoming pipes, both dry
S037-m001	01-3.018	3-18	swMH-337	8/30/2012	Salem Street		X							12"	Iron	Culvert/MH	Pipe discharges to MH on culvert; cannot see pipe outlet to culvert; upstream CB in busy street; NO PICTURE
S119	01-3.019	3-19	swDIS-327	8/30/2012	Harrison Street			X						12"	Concrete	Block HW	Pipe in concrete and block HW; upstream MH dry
S114	01-3.020	3-20	swDIS-321	8/30/2012	Azalea Circle behind #2 Carnation Cir		X							24"	Concrete	Flared End	Pipe with large flared end; discharges to detention basin; basin has outlet structure to wetland

Legend			
Elevated Test Kit Results (>0.5 mg/L for Ammonia and >0.25 mg/L for Surfactants)			
Positive Test Kit Results (≤0.5 mg/L for Ammonia and ≤0.25 mg/L for Surfactants)			
Private System			
CNL	Cannot locate	CMP	Corrugated Metal Pipe
CB	Catch Basin	RCP	Reinforced Concrete Pipe
MH	Manhole	PVC	Polyvinly Chloride
HW	Headwall		

**Appendix A (Cont'd)
Outfall Screening Results**

GIS System ID	Unique GPS ID	Original ID	GIS Facility ID	Date Inspected	Location Description	Flowing	Dry	Partially Submerged	Ammonia (ppm)	Surfactants (ppm)	Temp. (°C)	pH	Sp. Conductivity (µs)	Pipe Size	Material	Outlet Type	Comments
S081	01-3.021	3-21	swDIS-418	8/30/2012	Azalea Circle behind #2 Carnation Cir		X							24"	Concrete	Flared End	Pipe with large flared end is dry, Sediment buildup; discharges to detention basin
S041	01-3.022	3-22	swDIS-50	8/30/2012	Arrow Circle (at end)		X							12"	Concrete	Concrete HW	Pipe located in concrete headwall, discharges to wetland
S165	01-3.023	3-23	swDIS-415	8/30/2012	Salem Street @ unnamed brook		X							12"	Concrete	-	Pipe next to culvert (to the left when looking upstream) discharges directly to creek on upstream side of culvert
S166	01-3.024	3-24	swDIS-416	8/30/2012	Salem Street @ unnamed brook		X							12"	Concrete	Stone HW	Pipe in stone and concrete headwall; upstream side of culvert
S063	02-1.001	1-1	swDIS-207	8/13/2012	Brook Street		X							Unknown	Concrete	-	Outfall filled in with dirt; upstream MH is also clogged with excessive dirt. Concrete pipe in MH (unknown size) completely filled in
S060	02-3.001	3-1	swDIS-324	8/30/2012	Harvest Road		X							12"	Concrete	Culvert	Outfall under bridge, cast into culvert wall, discharges directly to Walker's brook
S115	02-3.002	3-2	swDIS-322	8/30/2012	Track Street		X							12"	Concrete	Culvert	Outfall under bridge, cast into culvert wall, on northwest side of road; discharges directly to walkers brook
S042	02-4.001	4-1	swDIS-51	9/12/2012	Across Route 129 and 95 Rotary	X			Trace	0.25	19.9	7.7	620	18"	Concrete	Concrete HW	Concrete Pipe flowing steadily to Walkers Brook with outfall for RT 95 across brook; neg tk
S088	02-4.002	4-2	swDIS-353	9/12/2012	Salem Street at Cumberland Farms		X							12"	Concrete	Concrete HW	Outfall dry but two foot deep scour pool holding water and sediment
S116	02-4.003	4-3	swDIS-323	9/12/2012	Track Road		X							12"	Concrete	Culvert HW	Outfall under bridge across from 3-2 in culvert wall
S075	02-4.004	4-4	swDIS-132	9/12/2012	Carnation Circle behind 16C		X							24"	Concrete	Flared End	Large dry flared end to mild slope and rip-rap which leads to a wetland
S167	02-4.005	4-5	swDIS-417	9/12/2012	Salem Street @ unnamed brook			X						18"	Concrete	Concrete and Block slope	Partially Submerged at brook elevation. Concrete and Granite armored slope protection in good condition; upstream MH in busy street
S124	02-4.006	4-6	swDIS-357	9/12/2012	Salem Street @ unnamed brook			X						-	-	Granite Block	Pipe is recessed under granite blocks which are unstable; partially submerged at brook level; no signs of flow; upstream MH in busy street
S040	02-4.007	4-7	swDIS-49	9/12/2012	Johanna Drive behind # 50		X							12"	Concrete	Concrete HW	Outfall in conc HW well above brook elevation, large scour pool
S004	02-4.008	4-8	swDIS-4	9/12/2012	Washington and High St			X						12"	Concrete	Stone HW	Outfall in stone wall of channelized stream; upstream MH dry
S005	02-4.009	4-9	swDIS-5	9/12/2012	Washington and High St		X							12"	VCP	Culvert	Outfall under the bridge on the right side is a single source catch basin
S006-f010	02-4.010	4-10	swFT-27	9/12/2012	Washington and High St		X							36"	Tile	Culvert	Outfall 50-ft in culvert (under Washington street) invert was wet but not flowing; upstream MH dry on 10/18/12
S006-c007	02-4.011	4-11	swCB-1716	9/12/2012	Gould Street at E.M.I.		X							10"	Clay	Catch Basin	Pipe in CB that also contains 4-12

Legend			
Elevated Test Kit Results (>0.5 mg/L for Ammonia and >0.25 mg/L for Surfactants)			
Positive Test Kit Results (≤0.5 mg/L for Ammonia and ≤0.25 mg/L for Surfactants)			
Private System			
CNL	Cannot locate	CMP	Corrugated Metal Pipe
CB	Catch Basin	RCP	Reinforced Concrete Pipe
MH	Manhole	PVC	Polyvinly Chloride
HW	Headwall		

**Appendix A (Cont'd)
Outfall Screening Results**

GIS System ID	Unique GPS ID	Original ID	GIS Facility ID	Date Inspected	Location Description	Flowing	Dry	Partially Submerged	Ammonia (ppm)	Surfactants (ppm)	Temp. (°C)	pH	Sp. Conductivity (µs)	Pipe Size	Material	Outlet Type	Comments
S006-c007	02-4.012	4-12	swCB-1716	9/12/2012	Gould Street at E.M.I.	X			0.2	Trace	23.2	7.5	1070	36"	RCP	Catch Basin	Clear water discharging into CB from 36" pipe; positive ammonia test, steady flow
S006-m001	02-4.013	4-13	swMH-104	9/12/2012	Gould Street		X							12"	Concrete	Manhole	In manhole in Gould street which contains 4-14
S006-m001	02-4.014	4-14	swMH-104	9/12/2012	Gould Street		X							12"	Concrete	Manhole	Manhole in middle of Gould street is on the left side if you are looking at EMI
S012	02-4.015	4-15	swDIS-12	9/12/2012	Washington and Elliot Street			X						12"	Clay	Fieldstone Channel	Pipe is underwater in brook and completely buried in sediment; only top of pipe visible; upstream MH dry
S035	02-4.016	4-16	swDIS-362	9/12/2012	Washington and Elliot Street	X			0.2	0.25	19.6	6.8	1025	24"	Concrete	Fieldstone HW	Steady flow from main outfall in concrete and field stone head wall sample taken from upstream manhole
S021	02-4.017	4-17	swDIS-21	9/12/2012	Green Street #154		X							12"	Concrete	No HW	Pipe at bottom of slope under rocks; minimal rip rap to channel and conservation area
S065	02-4.018	4-18	swDIS-125	9/12/2012	Warren Street	X			0.3	0.25	20	7.05	870	30"	Concrete	Fieldstone HW	Slowly flowing, upstream sample taken from manhole in street; outfall at brook level; is source of brook; brook has flow
S013	02-4.019	4-19	swDIS-13	9/12/2012	Warren Street		X							12"	Concrete	Fieldstone HW	Outfall dripping; cleared several dog waste plastic bags from pipe; 10/18/12 dry; still evidence of dog waste
S003	02-4.020	4-20	swDIS-3	9/12/2012	Maple Street Corner		X							12"	VCP	No HW	Outfall located in dry steam bed; 80% full of sediment; noted numerous dog waste plastic bags in the dry creek bed
S006-m016	03-5.001	5-1	swMH-121	10/18/2012	High Street at Chute		X							20" x 15"	CMP	Culvert / MH	Elliptical CMP into clay tile culvert at MH @ Chute and High
S006-m016	03-5.002	5-2	swMH-121	10/18/2012	High Street at Chute		X							20"	CMP	Culvert/ MH	Circular CMP pipe into clay tile culvert; in same MH as 5-1
S001-m001	03-5.003	5-3	swMH-12	10/18/2012	Route 28 at Bank of America			X						12"	Clay	Culvert/ MH	Punches into side of box culvert from north at Brook level. Upstream Catch Basin dry
S001-m001	03-5.004	5-4	swMH-12	10/18/2012	Route 28 at Bank of America			X						12"	Clay	Culvert/ MH	Punches into side of box culvert from south at Brook level. Upstream Catch Basin dry
S006-m005	03-5.005	5-5	swMH-45	10/18/2012	High Street at Green Street		X							10"	Clay	Culvert/ MH	No access to "outfall" observed downstream manhole in culvert which was dry
S006-m041	03-5.006	5-6	swMH-122	10/18/2012	High Street at Woburn Street		X							12"	Clay	Culvert/ MH	Pipe coming from Woburn street
S006-m041	03-5.007	5-7	swMH-122	10/18/2012	High Street at Woburn Street		X							30"	Tile	Culvert/ MH	Pipe coming from high street
A054	04-1.001	1-1	swDIS-232	6/5/2013	Causeway Road #52			X						12"	Concrete	Flared End	Tree roots are blocking the outlet creating standing water issues at the outfall
I037	04-1.002	1-2	swDIS-233	6/5/2013	Causeway Road #36		X							18"	Concrete	Flared End	Field stone headwall to concrete channelized stream , retaining wall in poor condition and collapsing
A055	04-1.003	1-3	swDIS-234	6/5/2013	Plymouth Street at Lowell Street		X							12"	Concrete	Concrete HW	Pipe discharges four feet above stream in concrete fieldstone headwall, single catch basin tributary, outfall is right most pipe in picture

Legend			
Elevated Test Kit Results (>0.5 mg/L for Ammonia and >0.25 mg/L for Surfactants)			
Positive Test Kit Results (≤0.5 mg/L for Ammonia and ≤0.25 mg/L for Surfactants)			
Private System			
CNL	Cannot locate	CMP	Corrugated Metal Pipe
CB	Catch Basin	RCP	Reinforced Concrete Pipe
MH	Manhole	PVC	Polyvinly Chloride
HW	Headwall		

**Appendix A (Cont'd)
Outfall Screening Results**

GIS System ID	Unique GPS ID	Original ID	GIS Facility ID	Date Inspected	Location Description	Flowing	Dry	Partially Submerged	Ammonia (ppm)	Surfactants (ppm)	Temp. (°C)	pH	Sp. Conductivity (µs)	Pipe Size	Material	Outlet Type	Comments
I007	04-1.004	1-4	swDIS-90	6/5/2013	Laurel Lane #360		X							12"	PVC	Earthen Channel	Cinder blocks at headwall, flows to earthen channel behind 357 Lowell then to culvert at outfall 1-3, pipe is partially buried and discharges to backyard area
A034	04-1.005	1-5	swDIS-100	6/5/2013	Catherine Road #22		X							12"	Concrete	Pipe	No headwall or channel, pit has formed from scouring of the earth at the outfall. Offset joints exposed near outfall, pipe is being undermined by erosion as the last section is exposed
A031	04-1.006	1-6	swDIS-97	6/5/2013	West Street #555			X						18"	Concrete	Concrete HW	Pipe on the right at culvert discharges to natural stream with water backfilling into pipe from stream
A032	04-1.007	1-7	swDIS-98	6/5/2013	West Street #555		X							10"	Concrete	Concrete HW	Pipe is slightly elevated in concrete headwall on the right side, discharges into natural stream
A033	04-1.008	1-8	swDIS-99	6/5/2013	West Street #555		X							12"	Concrete	Concrete HW	Left most pipe in the concrete headwall, discharges to natural stream. Pipe appears to be damp but no flow is present.
A053	04-1.009	1-9	swDIS-231	6/5/2013	West Street #500		X							12"	Concrete	No HW	Pipe discharges to stream which only receives wet weather flow.
A022	04-1.010	1-10	swDIS-230	6/5/2013	Enos Circle #15			X						24"	Concrete	Fieldstone HW	Fairly new looking fieldstone headwall behind #15 discharges to rip-rap at the outfall which then outlets to treatment wetland area
A019	04-1.011	1-11	swDIS-75	6/5/2013	West Street at Willow Street	X			.5*	0.5	17.2	6.75	728	66"	Concrete	Fieldstone HW	Large culvert directs flow to natural stream with noticeable soap suds and odor issues. Sample water is yellow-brown may throw off ammonia reading
A020	04-1.012	1-12	swDIS-76	6/5/2013	West Street at Willow Street	X			0.0	0	16.1	7.2	585	36"	Concrete	Fieldstone HW	Clear water with steady flow coming from pipe, also water flowing out of headwall below pipe, possible break in the line with groundwater intrusion or possible break inside the headwall should be further examined
A019-m001	04-1.013	1-13	swMH-733	6/5/2013	West Street at Willow Street	X			0	0.25	15.2	6.57	1317	15"	Concrete	Manhole	Manhole taps directly into culvert where sample was taken, steady clear flow observed. Upstream manhole however is dry. GIS is incorrect somewhere on this street and further work should be done at this location to decipher where flow is coming from.
A019-m002	04-1.013.1	1-13.1	swMH-736	6/5/2013	1-13.1	X			0	0.5	15.6	6.75	825	24"	Concrete	Manhole	Trickling flow but not enough to sample, flow picks up between here and 1-13. Needs further investigation
A057	04-1.014	1-14	swDIS-236	6/5/2013	Willow Street #84			X						UNK	UNK	Concrete HW	Water level is nearly overflowing concrete headwall, algal growth observed in standing water, can't locate discharge point, oil sheen on top of standing water possibly 5' deep
A002	04-1.015	1-15	swDIS-208	6/5/2013	Intervale Terrace #7			X						UNK	UNK	Culvert	Two catch basins discharge under culvert, cannot access outfall. Upstream catch basin clogged with debris

Legend			
Elevated Test Kit Results (>0.5 mg/L for Ammonia and >0.25 mg/L for Surfactants)			
Positive Test Kit Results (≤0.5 mg/L for Ammonia and ≤0.25 mg/L for Surfactants)			
Private System			
CNL	Cannot locate	CMP	Corrugated Metal Pipe
CB	Catch Basin	RCP	Reinforced Concrete Pipe
MH	Manhole	PVC	Polyvinly Chloride
HW	Headwall		

**Appendix A (Cont'd)
Outfall Screening Results**

GIS System ID	Unique GPS ID	Original ID	GIS Facility ID	Date Inspected	Location Description	Flowing	Dry	Partially Submerged	Ammonia (ppm)	Surfactants (ppm)	Temp. (°C)	pH	Sp. Conductivity (µs)	Pipe Size	Material	Outlet Type	Comments
A005	04-1.016	1-16	swDIS-80	6/5/2013	Lowell Street #237			X						UNK	UNK	Culvert	Concrete box culvert has two outfalls from both directions on Lowell Street, police detail needed to open upstream manholes
A028	04-2.001	2-1	swDIS-95	6/17/2013	42 Bond Street			X						24"	Concrete	Earthen Channel	Pipe has access manhole structure above ground five feet behind in decent condition. Pipe is submerged halfway in channel but no flow from outfall
A004	04-2.002	2-2	swDIS-77	6/17/2013	88 Hancock Street									UNK	UNK	Earthen Channel	Could not locate outfall, possibly buried under stonewall used as GPS reference
S094	04-2.003	2-3	swDIS-198	6/17/2013	4 Morgan Park		X							12"	Concrete	Flared End	Pipe empties into catch basin network, is dry and filled with leaves from fall, likely doesn't receive much flow
S062	04-2.004	2-4	swDIS-79	6/17/2013	4 Morgan Park			X						24"	Concrete	Pipe	Pipe is in fieldstone headwall submerged in an earthen channel. Some flow observed but too submerged to sample. Upstream CB also submerged
S092	04-2.005	2-5	swDIS-196	6/17/2013	Behind Walter Parker School			X						12"	Concrete	Pipe	Some flow observed but not enough to sample, grease/ oil noted by field crew. Pipe is halfway submerged and debris are damming up the channel
S061	04-2.006	2-6	swDIS-78	6/17/2013	36 Frank D Tunner Apartments			X						24"	Concrete	Pipe with Fieldstone HW	Pipe is halfway submerged, empties into stream located behind turf field at the elementary school. Headwall is in fine condition
S093	04-2.007	2-7	swDIS-197	6/17/2013	Behind Walter Parker School		X							12"	Concrete	Flared End	Pipe discharges to an open channel to CB which likely daylights at outfall 2-6
S095	04-2.008	2-8	swDIS-199	6/17/2013	23 Temple Street			X						12"	Concrete	Pipe	Pipe discharges to earthen channel, sediment and debris built up damming the outfall. Small amount of flow, sample taken at upstream CB
S099	04-2.009	2-9	swDIS-363	6/17/2013	15 Temple Street		X							12"	PVC	Pipe in Culvert	Pipe breaks into right side of culvert about 15 feet inside, behind 15 temple street. Line is dry but the culvert may have some internal damage.
	04-2.010	2-10		6/17/2013	MH at 13 Temple Street	X			0.0	Trace				24"	Pipe	Manhole	Flowing from Temple street, field sample inconclusive. Flowing from 24".
S099-m002	04-2.011	2-11	swMH-1257	6/17/2013	MH at 23 Temple Street	X			0.0	Trace				12"	Pipe	Manhole	Also flowing from Temple street, however not enough to sample. Should sandbag this location or check back for e coli
	04-2.012	2-12		6/17/2013	23 Cape Cod Avenue		X							12"	Concrete	Pipe	Fed from two catch basins, channel very dry likely doesn't receive much flow. Leaves clogging splash area
A018	04-2.013	2-13	swDIS-74	6/17/2013	35 Arcadia Avenue	X			0	0.25	19.3	7.59	1333	18"	Concrete	Flared End RCP	Steady flow, major structural damage to pipe mouth , concrete falling away from pipe
A017	04-2.014	2-14	swDIS-73	6/17/2013	77 Arcadia Avenue			X						12"	Concrete	Flared End	Empties to stream with some armor stone around outfall, flowing but is too submerged from the stream to sample. Outfall has asphalt splash guard in natural stream bed to prevent scouring

Legend			
Elevated Test Kit Results (>0.5 mg/L for Ammonia and >0.25 mg/L for Surfactants)			
Positive Test Kit Results (≤0.5 mg/L for Ammonia and ≤0.25 mg/L for Surfactants)			
Private System			
CNL	Cannot locate	CMP	Corrugated Metal Pipe
CB	Catch Basin	RCP	Reinforced Concrete Pipe
MH	Manhole	PVC	Polyvinly Chloride
HW	Headwall		

**Appendix A (Cont'd)
Outfall Screening Results**

GIS System ID	Unique GPS ID	Original ID	GIS Facility ID	Date Inspected	Location Description	Flowing	Dry	Partially Submerged	Ammonia (ppm)	Surfactants (ppm)	Temp. (°C)	pH	Sp. Conductivity (µs)	Pipe Size	Material	Outlet Type	Comments
A016	04-2.015	2-15	swDIS-72	6/17/2013	97 Arcadia Avenue	X			0	Trace	18.6	7.34	1270	36"	RCP	Flared End	Possibly flowing to stream but is also submerged too much from stream to take sample. Large pipe with flared end is discharging along with stream bed
A021	04-2.016	2-16	swDIS-229	6/17/2013	Barrows Elementary School		X							12"	Concrete	Flared End	Armor stone splash pit at pipe mouth, empties to series of small channels that take flow downhill away from school
A014	04-2.017	2-17	swDIS-70	6/17/2013	65 Winslow Road	X			0	0				15"	Concrete	Flared End	Fieldstone headwall , heavy flow to rocky channel. The pipe configuration on GIS is incorrect here and needs to be corrected. The homeowner at 65 also complained about surface flooding in the past, the catch basins do not direct flow to the outfall behind the property
A016-c011	04-3.001	3-1	swCB-1228	6/24/2013	Monroe Avenue - Across from #35		X							12"	Concrete	Pipe	In network structure, single catch basin tributary, above culvert outlet, heavy flow from culvert no flow at the outfall
A015	04-3.002	3-2	swDIS-71	6/24/2013	End of Arnold Avenue			X						12"	Concrete	Pipe	Empties into wetland, low flow out of natural stream, protrudes 1' out from rock headwall. Outfall is completely submerged.
A052	04-3.003	3-3	swDIS-228	6/24/2013	Randall Road #32	X			0	Trace	15.9	6.55	939	24"	Concrete	Pipe	Natural rocky stream, some bubbles observed in stream, flowing coming from upstream manhole where picture is taken
A051	04-3.004	3-4	swDIS-227	6/24/2013	Lisa Lane #33	X			0	Trace	19.5	6.97	907	12"	Concrete	Flared End	Open joint 4' upstream of outlet, pipe end in very poor condition, structurally unsound, appears to have been crushed by a falling tree
A050	04-3.005	3-5	swDIS-226	6/24/2013	County Road #194	X			Trace	Trace	16.6	6.28	2340	30"	Concrete	Flared End	Empties into rocky stream, foam at pipe mouth, water slightly cloudy when tested
A013	04-3.006	3-6	swDIS-69	6/24/2013	Coolidge Road #21			X						24"	Concrete	Pipe	Field stone headwall to earthen channel, yard waste and debris are littering the stream outlet
A012	04-3.007	3-7	swDIS-67	6/24/2013	Howard Street #119			X						15"	PVC (Corrugated)	Pipe	Stone headwall to earthen channel, oil sheen on surface. Pipe is 3/4 submerged with standing water
A093	04-3.008	3-8	swDIS-68	6/24/2013	Scotland Road #62			X						12"	Concrete	Pipe	Outlets to earthen channel, water ponding due to blockage
A082	04-3.009	3-9	swDIS-218	6/24/2013	Oak Street - West of #62 (behind fence)		X							18"	Concrete	Pipe	In concrete and field stone headwall, good condition. This pipe is above the stream elevation and on the right side of the headwall
A083	04-3.010	3-10	swDIS-217	6/24/2013	Oak Street - West of #62 (behind fence)			X						24"	Concrete	Pipe	In concrete and field stone headwall, small flow observable, not testable because it is partially submerged
A072	04-3.011	3-11	swDIS-63	6/24/2013	Oak Street - Behind #62 (into stream)			X						15"	Concrete	Pipe	To earthen channel just 25 feet downstream of the concrete channel housing 3-9 and 3-10.

Legend			
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Positive Test Kit Results (≤0.5 mg/L for Ammonia and ≤0.25 mg/L for Surfactants)			
Private System			
CNL	Cannot locate	CMP	Corrugated Metal Pipe
CB	Catch Basin	RCP	Reinforced Concrete Pipe
MH	Manhole	PVC	Polyvinly Chloride
HW	Headwall		

**Appendix A (Cont'd)
Outfall Screening Results**

GIS System ID	Unique GPS ID	Original ID	GIS Facility ID	Date Inspected	Location Description	Flowing	Dry	Partially Submerged	Ammonia (ppm)	Surfactants (ppm)	Temp. (°C)	pH	Sp. Conductivity (µs)	Pipe Size	Material	Outlet Type	Comments
A084	04-3.012	3-12	swDIS-216	6/24/2013	Indian Tree Lane #47	X			0	0	16.9	6.12	7.69	12"	Concrete	Pipe	Empties to pool in wetland/marsh area, stead flow, clear water likely groundwater . All test kits are negative
A078	04-3.013	3-13	swDIS-57	6/24/2013	Indiana Avenue - behind elementary school			X						24"	VCP	Pipe	Fully submerged, heavy debris/trash in splash zone, removed shopping cart from splash zone, pipe mouth badly damaged/broken
A070	04-3.014	3-14	swDIS-65	6/24/2013	Countryside Lane #31			X						12"	Concrete	Pipe	Empties to wetland/flooded grass area, resident commented that it was once a riprap channel, but filled with silt and sediment over time and grew over with grass/vegetation, fully flooded, previous complaints of flooding, needs some conveyance system
A094	04-3.015	3-15	swDIS-66	6/24/2013	South Street #15	X			0	0				12"	Concrete	Pipe	Concrete headwall empties to earthen channel with some armor stone; evidence of iron producing bacteria; slow, steady trickle
A085	04-3.016	3-16	swDIS-215	6/24/2013	South Street at West Avenue			X						12"	Concrete	Pipe	Concrete headwall; labeled as an inlet in GIS, but is much too low to be an inlet - seems to be an outlet for the upstream manhole; dye tested - inconclusive due to low flow
A099	04-3.017	3-17	swDIS-222	6/24/2013	Avalon Road - Across from #80			X						12"	Concrete	Pipe	Field stone headwall outlets to natural wetland, right-most pipe of 4 pipes in headwall (when facing headwall outlet pipes)
A079	04-3.018	3-18	swDIS-221	6/24/2013	Avalon Road - Across from #80			X						18"	Concrete	Pipe	Field stone headwall outlets to natural wetland, left-most pipe of 4 pipes in headwall (when facing headwall outlet pipes)
A097	04-3.019	3-19	swDIS-224	6/24/2013	Avalon Road # 97			X						15"	Concrete	Flared End	Empties to natural wetland or network structure. This only receives flow from two catch basins but is still flowing, high groundwater may be the issue.
A076	04-4.001	4-1	swDIS-60	7/8/2013	Hemlock Road #47	X			0	Trace	19.2	7.1	700	12"	Concrete	Pipe	Concrete pipe with steady clear flow to field stone scour pad. Some concrete and field stone being used as armor and slope. Pipe drains wetland on Pine Ridge Road
A077	04-4.002	4-2	swDIS-59	7/8/2013	Hemlock Road #47			X						48"	Concrete	Pipe	Partially submerged pipe which becomes the beginning of a natural stream. Pipe acts as a culvert but there is also an outfall at this location as it is the end of a line. Receives flow from Balsam Road inlet
A071	04-4.003	4-3	swDIS-64	7/8/2013	Pine Ridge Road #94	X			Trace	0				24"	Concrete	Pipe	Concrete pipe with trickling flow has field stone scour pad and bank protection. E coli sample taken at this location.

Legend			
Elevated Test Kit Results (>0.5 mg/L for Ammonia and >0.25 mg/L for Surfactants)			
Positive Test Kit Results (≤0.5 mg/L for Ammonia and ≤0.25 mg/L for Surfactants)			
Private System			
CNL	Cannot locate	CMP	Corrugated Metal Pipe
CB	Catch Basin	RCP	Reinforced Concrete Pipe
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Outfall Screening Results**

GIS System ID	Unique GPS ID	Original ID	GIS Facility ID	Date Inspected	Location Description	Flowing	Dry	Partially Submerged	Ammonia (ppm)	Surfactants (ppm)	Temp. (°C)	pH	Sp. Conductivity (µs)	Pipe Size	Material	Outlet Type	Comments
A075	04-4.004	4-4	swDIS-61	7/8/2013	Walnut Street #149			X						36"	Concrete	Concrete HW	Pipe is halfway submerged from a concrete and field stone headwall which receives flow from inlet on Old Farm Road wetland. E Coli sample taken upstream at manhole 4-4.1
	04-4.005	4-5		7/8/2013	Haystack Road #29	X			Trace	Trace				12"	Concrete	Pipe	Pipe incoming from Haystack Road is trickling and also shows signs of iron bacteria in pipe. E coli sample taken at the manhole for the north part of the line on Haystack road south line on hemlock road.
	04-4.006	4-6		7/8/2013	Haystack Road #29	X			Trace	Trace				12"	Concrete	Pipe	Upstream manhole checked for south section of haystack road towards milepost road of iron bacteria present, e coli sample taken
A086	04-4.007	4-7	swDIS-214	7/8/2013	Milepost Road #16	X			0	0	18.7	7.25	920	15"	Concrete	Flared End	Large flared end concrete pipe flowing but not enough to sample. Flows directly to natural stream, some discoloration possible iron bacteria present. Upstream manhole checked and dry
A091	04-4.008	4-8	swDIS-209	7/8/2013	South Street #117	X			0	0	18.4	7.15	1010	12"	Concrete	Concrete HW	Outfall is flowing but not enough to sample. Located next to the culvert on South street at Sturges Park
A092	04-4.009	4-9	swDIS-203	7/8/2013	South Street #61			X						18"	Concrete	Fieldstone HW	Smaller pipe on the left side of the fieldstone and concrete headwall which also contains a culvert. Partially submerged due to the natural stream and flow from the culvert.
A088	04-4.010	4-10	swDIS-212	7/8/2013	Sturgess #61			X						21"	Concrete	Flared End	Large flared end concrete pipe partially submerged in channel that leads to natural steam
A023	05-6.001	6-1	swDIS-85	8/7/2013	Birch Meadow Drive			X						30"	Concrete	Pipe	Pipe is partially submerged at stream in birch meadow park.
A007	05-6.002	6-2	swDIS-82	8/7/2013	33 Woodland Street		X							12"	Concrete	Fieldstone HW	Flows to eastern channel in fieldstone headwall. The elevation at the end of the pipe is greater than the outlet, could cause backflow and ponding issues.
A058	05-6.003	6-3	swDIS-237	8/7/2013	29 Criterion Street		X							12"	Concrete	Flared End	Pipe is half filled with sediments, drains to wooded area from a two catch basin system
I002	05-6.004	6-4	swDIS-86	8/7/2013	12 Heinze Street		X							12"	Concrete	Pipe	Pipe is 3/4 full of sediment. At the end of the pipe there is a missing section that wraps 3/4 around for the final two feet.
I003	05-6.005	6-5	swDIS-87	8/7/2013	100 Grove Street		X							12"	Cast Iron	Pipe	Drains to earthen channel and wetland area with rocks for scour protection and splash guard. Piece of pipe missing from bottom section.
I004	05-6.006	6-6	swDIS-88	8/7/2013	43 Mark Avenue			X						12"	Concrete	Pipe	Drains to earthen channel at higher elevation than outlet. Grate included to keep possible debris from entering wetland

Legend			
Elevated Test Kit Results (>0.5 mg/L for Ammonia and >0.25 mg/L for Surfactants)			
Positive Test Kit Results (≤0.5 mg/L for Ammonia and ≤0.25 mg/L for Surfactants)			
Private System			
CNL	Cannot locate	CMP	Corrugated Metal Pipe
CB	Catch Basin	RCP	Reinforced Concrete Pipe
MH	Manhole	PVC	Polyvinly Chloride
HW	Headwall		

**Appendix A (Cont'd)
Outfall Screening Results**

GIS System ID	Unique GPS ID	Original ID	GIS Facility ID	Date Inspected	Location Description	Flowing	Dry	Partially Submerged	Ammonia (ppm)	Surfactants (ppm)	Temp. (°C)	pH	Sp. Conductivity (µs)	Pipe Size	Material	Outlet Type	Comments
I006	05-6.007	6-7	swDIS-89	8/7/2013	12 Margaret Road		X							CNL	UNK	UNK	No GPS point was taken because the pipe outlet could not be located in heavily vegetated area. The drainage lines were dry
I008	05-6.008	6-8	swDIS-101	8/7/2013	224 Forest Street		X							18"	Concrete	Flared End	Discharges into earthen channel and ultimately to wetland area
I038	05-6.009	6-9	swDIS-238	8/7/2013	10 Johnson Circle			X						6"	PVC	Pipe	Pipe narrows down from 8" to 6" PVC at outlet. Receives flow from 4 CB's at the end of the street and stores water in 10' high cement structure which contained some weirs and flow control
I013	05-6.010	6-10	swDIS-106	8/7/2013	170 Grove Street		X							12"	Concrete	Pipe	End of pipe section missing and damaged, exposed rebar for final three feet.
I062	05-6.011	6-11	swDIS-365	8/7/2013	209 Grove Street		X							24"	Concrete	Flared End	Some ponding at the rock dam that is in place to slow down the flow to the wetlands
I156	05-6.012	6-12	swDIS-102	8/7/2013	79 Marla Lane		X							21"	Concrete	Pipe	Flows directly to earthen channel, half filled with sediment
I010	05-6.013	6-13	swDIS-103	8/7/2013	58 Spruce Street		X							12"	Concrete	Pipe	Flows directly to stream
I011	05-6.014	6-14	swDIS-104	8/7/2013	72 Spruce Road			X						18"	Concrete	Pipe	Flows directly to stream, there are some concrete debris blocking the outfall as well as some standing water.
I018	05-6.015	6-15	swDIS-111	8/7/2013	46 Martin Road		X							36"	Concrete	Pipe	Large concrete pipe is the yard of homeowner with a fieldstone headwall preventing flooding in the backyard. Flows to earthen channel then to wetland.
A035	05-6.016	6-16	swDIS-108	8/7/2013	184 Forest Street			X						12"	Concrete	Pipe	Heavy grass has grown over outfall and is overtaking pipe outlet. Partially submerged in backyard to wetland area
S029	06-5.001	5-1	swDIS-28	8/1/2013	Main Street #917			X						18"	Concrete	Concrete HW	Pooled water at the outlet of the pipe and concrete headwall to channelized stream with some armor stone channel protection.
S064	06-5.002	5-2	swDIS-304	8/1/2013	Chestnut Street #43		X							12"	Concrete	Flared End	Discharges into wooded area and natural conveyance system. Pipe outlet is located under resident's fence and timber retaining wall.
A045	06-5.003	5-3	swDIS-165	8/1/2013	Birch Meadow			X						30"	Concrete	Concrete HW	Drains wetland across street with through channelized stream. Channelized stream has fieldstone headwall for bank protection.
A003	06-5.004	5-4	swDIS-27	8/1/2013	Hillside Street #11			X						24"	Concrete	Flared End	Flowing, but not enough to sample, upstream manhole not checked for flow.
A049	06-5.005	5-5	swDIS-183	8/1/2013	Birch Meadow- Reading H.S. Entrance			X						12"	Concrete	Concrete HW	Outfall has ponding issues at the concrete headwall with 2' of water. Receives flow from HS, could be a new outfall that flows to culvert which crosses street back to HS.

Legend			
Elevated Test Kit Results (>0.5 mg/L for Ammonia and >0.25 mg/L for Surfactants)			
Positive Test Kit Results (≤0.5 mg/L for Ammonia and ≤0.25 mg/L for Surfactants)			
Private System			
CNL	Cannot locate	CMP	Corrugated Metal Pipe
CB	Catch Basin	RCP	Reinforced Concrete Pipe
MH	Manhole	PVC	Polyvinly Chloride
HW	Headwall		

**Appendix A (Cont'd)
Outfall Screening Results**

GIS System ID	Unique GPS ID	Original ID	GIS Facility ID	Date Inspected	Location Description	Flowing	Dry	Partially Submerged	Ammonia (ppm)	Surfactants (ppm)	Temp. (°C)	pH	Sp. Conductivity (µs)	Pipe Size	Material	Outlet Type	Comments
A041	06-5.006	5-6	swDIS-161	8/1/2013	Birch Meadow- Reading H.S. Entrance			X						12"	Concrete	Pipe	Partially submerged pipe due to stream elevation with tree roots beginning to undermine structure. Culverted upstream and downstream.
A047	06-5.007	5-7	swDIS-181	8/1/2013	High School - Near Track field			X						24"	Concrete	Concrete HW	Probably old abandoned line that is not included on GIS. Should investigate upstream to determine if outlet still receives flow
A048	06-5.008	5-8	swDIS-182	8/1/2013	High School - Near Track field			X						12"	Concrete	Flared End	Outfall is partially submerged at stream elevation, just a two catch basin outfall from Birch Meadow
A040	06-5.009	5-9	swDIS-305	8/1/2013	Coolidge Middle School- Across Street			X						30"	Concrete	Fieldstone HW	Definite orange bacteria where the fieldstone headwall meets the stream. There are extensive GIS edits to make at this location.
A040-s001	06-5.010	5-10	swNT-40	8/1/2013	Coolidge Middle School- Parking lot		X							24"	Concrete	Manhole	Both 30" lines that are behind the school do not exist and need to be removed. The stormceptor receives flow from the neighborhood next to the school and likely discharges at 5-9.
A063	06-5.011	5-11	swDIS-307	8/1/2013	Birch Meadow Park			X	>1	Trace	22.5	6.51	1258	15"	Concrete	Fieldstone HW	Pipe outlet is flowing but completely submerged so upstream sample taken at MH 5-11.1. Definite odor issues at every upstream manhole , smells like horse manure, and water quality also appears sub-par.
A008	06-5.012	5-12	swDIS-83	8/1/2013	Birch Meadow Drive		X							18"	Concrete	Pipe	Only drainage relief for low spot or wetlands across the street at birch meadow park, likely doesn't receive much flow. Used to be part of some type of conveyance system that dried up to the outfall at 5-11.
A062	06-5.013	5-13	swDIS-306	8/1/2013	Birch Meadow Drive #110		X							12"	Concrete	Fieldstone HW	Single catch basin and manhole to outfall where 58" CMP daylights across Birch Meadow Drive. Located at the bottom of the fieldstone headwall with bank protection.
A001	06-5.014	5-14	swDIS-420	8/1/2013	Estate Lane #8		X							12"	Concrete	Large Concrete Structure	Concrete structure acts as a large dam or retaining wall. Outfall is on the left side if coming from Rice Street, this outfall may be connected to the network structure that is bolted down.

Legend			
Elevated Test Kit Results (>0.5 mg/L for Ammonia and >0.25 mg/L for Surfactants)			
Positive Test Kit Results (≤0.5 mg/L for Ammonia and ≤0.25 mg/L for Surfactants)			
Private System			
CNL	Cannot locate	CMP	Corrugated Metal Pipe
CB	Catch Basin	RCP	Reinforced Concrete Pipe
MH	Manhole	PVC	Polyvinly Chloride
HW	Headwall		

Appendix B
Town of Reading's Protocol for
IDDE Investigation

Town of Reading



Phase 2 Stormwater Management Plan

Illicit Discharge Detection and Elimination (IDDE) Procedure

Updated May 15, 2012

Phase I – Mapping

Mapping should serve as a planning tool for the implementation and phasing of investigations, and demonstrate the extent of completed and planned investigations and corrections, and other related capital projects. CDM Smith will be providing mapping of the entire drainage system for Reading. Individual system maps will be developed with subcatchments and subsystems represented thematically (e.g. by color) with legends and schedules of testing / investigation results. Mapping will be updated as necessary to reflect newly discovered information, corrections or modifications, and progress made during the investigation.

Phase II - Drainage Area Investigations Criteria

1. Outreach Program /Public Notification of Dye Testing

Residents and building owners located within subject investigation area will be notified of the scope and schedule of field work being conducted in the area such as outfall sampling and upstream IDDE activities. Notification should include general information such as anticipated dates of the work, identification of field staff (DPW staff, private consultant, etc.), and contact information for inquiries.

Once a reach of drainage has been isolated for dye testing and the potential need to gain access to private residences or businesses has been identified, a second notification to property owners will be required. Notification of property owners through a letter, door hanger, or otherwise will be required to gain entry to their property to inspect plumbing fixtures. Assessors records and GIS

information will provide property owner identification. A sample dye test notification letter is attached at the end of this document for reference.

2. Infrastructure cleaning requirements

To facilitate investigations, storm drain infrastructure will be evaluated for the need to be cleaned to remove debris or blockages that could compromise investigations. Such material should be removed to the extent possible by the Town prior to investigations; however, some cleaning may occur concurrently as problems manifest themselves (i.e. dog waste should be cleaned from catch basins and excessive leaves and yard waste should be removed from the system prior to any investigation).

3. Dry weather criteria

In order to limit or remove the influence of stormwater-generated flows on the monitoring program, antecedent dry weather criteria need to be established. For this project, the dry weather criteria will be to wait two (2) days after cessation of a precipitation event prior to monitoring activities. Any successive IDDE investigations performed by the Town should also require at least 2 days of dry weather in advance of field activities in order to limit the amount of flow in the system.

Phase III - Investigations Methodology

1. Manhole inspection and flow monitoring

When an outfall is confirmed to have elevated levels of E. coli, an upstream IDDE investigation shall be initiated. A preliminary assessment to determine the extents of the investigation should be performed prior to IDDE procedures. Using GIS maps, a junction manhole shall be selected approximately bisecting the drainage network associated with the outfall. This manhole shall be sampled and inspected for visual evidence to determine if illicit flows are present in the system upstream of the selected manhole. If illicit flow is present in the selected manhole, the process should be repeated at a second observation manhole approximately $\frac{3}{4}$ of the way upstream from the outfall. Alternately, should the first observation manhole be free of illicit flows, the second observation manhole should be located $\frac{1}{4}$ of the way upstream from the manhole and the process repeated. This preliminary effort will identify the extent to which the following IDDE procedure should be implemented and whether any large catchment areas can be eliminated from further investigation up-front.

For all areas remaining after the preliminary assessment, the following procedure will be implemented. Beginning at the uppermost significant junction manhole(s) [see Figure 1] within each tributary area, drainage manholes are opened and first inspected for *visual evidence* of contamination. Where flow is observed and determined to be contaminated through visual observation (e.g. excrement or toilet paper present) or through the field monitoring process described below, the tributary storm sewer alignment is isolated for investigation (e.g. dye testing, CCTV). No additional downstream manhole inspections are performed unless the observed flow is determined to be uncontaminated or until all upstream illicit connections are identified and removed.

Where flow is not observed in a junction manhole, all inlets to the structure are partially dammed for the next 48 hours **when no precipitation is forecasted**. Inlets are dammed by blocking a minimal percentage (approximately 20% +/- depending on pipe slope) of the pipe diameter at the invert using **sandbags**, weirs/plates, or other temporary barriers (See Figure 2). The manholes are thereafter re-inspected (prior to any precipitation or snow melt) for the capture of periodic or intermittent flows behind any of the inlet dams. The same visual observations and field testing are completed on any captured flow, and where contamination is identified, abatement is completed prior to inspecting downstream manholes. If after 48 hours no flow is captured, it is determined that there are no illicit connections in the upstream section and the investigation should proceed to the next downstream junction manhole. The sandbagging procedure is effective for isolating up to **1000 ft of drain pipe**. After 1,000 ft, additional sandbags should be placed on non-junction manholes to further isolate reaches of drain pipe suspected of discharging illicit flows. Sandbags utilized for isolating more than 1,000 ft of pipe may be ineffective.

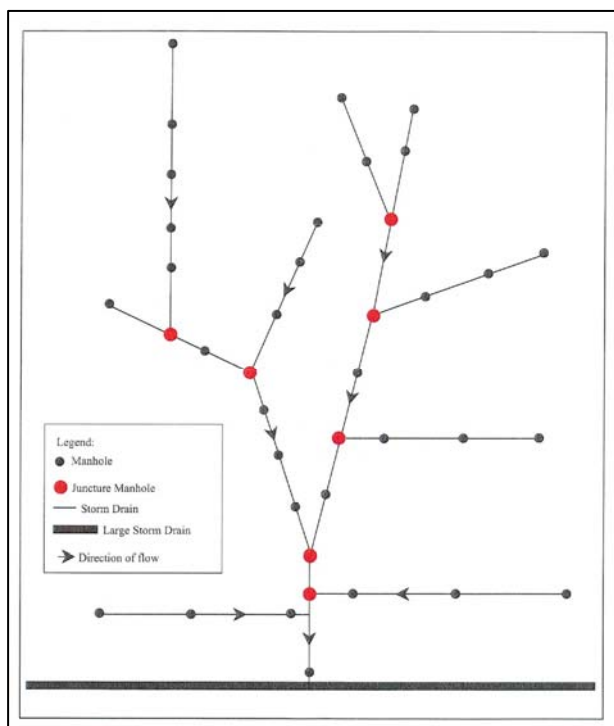


Figure 1: Junction Manholes

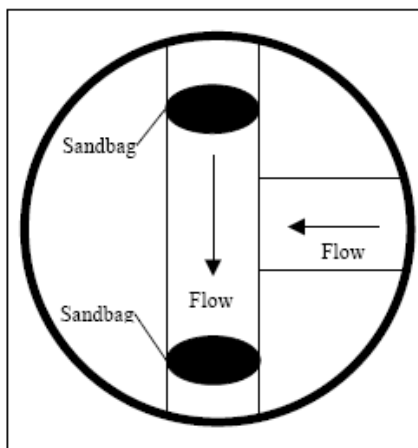
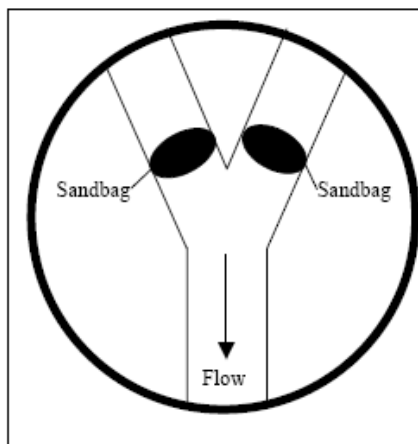


Figure 2: Sandbag Configuration

Where flow is observed and does not demonstrate obvious olfactory or visual evidence of contamination, samples are collected and analyzed with field instruments (ammonia, detergents, and pH readings) along with laboratory analysis [E. Coli], if necessary, to determine the likely prominent source of the flow. Measured values can then be compared with historic benchmark values (if available). The table below indicates typical ranges for ammonia, surfactants, and E. coli levels encountered at stormwater outfalls during dry weather sampling and can be referred to for guidance in prioritizing IDDE investigations. If field results show an absence of all indicators, it is determined that there are no illicit connections in the upstream section and the investigation should proceed to the next downstream junction manhole.

A flow chart of this complete procedure may be found at the end of this text (See Figure 3).

Table 1 Contaminant Ranges by Outfall Size

Outfall Size	6-24 inch			24-48 inch			> 48 inch		
	High	Medium	Low	High	Medium	Low	High	Medium	Low
E. coli (CFU/100mL)	>350	350-100	<100	>1,000	1,000-500	<500	>3,500	3,500-1,000	<1,000
Ammonia (mg/l)	>0.3	0.3-0.2	0.1	>0.5	0.5-0.3	0.2	>0.6	0.6-0.4	0.3
Surfactants (mg/l)	>0.5	0.5	0.25	>.75	0.75	0.5	>1.0	1.0-0.75	0.75-0.5

2. Isolation and confirmation of illicit sources

Where field monitoring has identified drain reaches influenced by sanitary flows or washwaters, the tributary area is isolated for implementation of more detailed investigations. Additional manholes along the tributary alignment are inspected to refine the location of potential contamination sources (e.g. ideally a single reach of drain between two manholes). Manholes upstream are opened and inspected until an uncontaminated manhole is identified. The buildings between the uncontaminated manhole and the downstream contaminated manhole are identified as possible sources of illicit inflow. Residents and businesses are notified by mail that their buildings / houses will be dye tested to determine if their sanitary sewer service connection is to a storm drain or sewer. (See attached Dye Test Notification mailer.) Internal plumbing inspections and /or dye testing (or CCTV) inspections are then employed to more efficiently confirm discrete flow sources.

4. Post-Removal confirmation

After completing the removal of illicit discharges from a subdrainage area and before beginning the investigation of downstream areas, the subdrainage area is re-inspected to verify corrections. Depending on the extent and timing of corrections, verification monitoring can be done at the initial junction manhole or the closest downstream manhole to each correction. Verification is accomplished by using the same visual inspection, field monitoring, and damming techniques as described above.

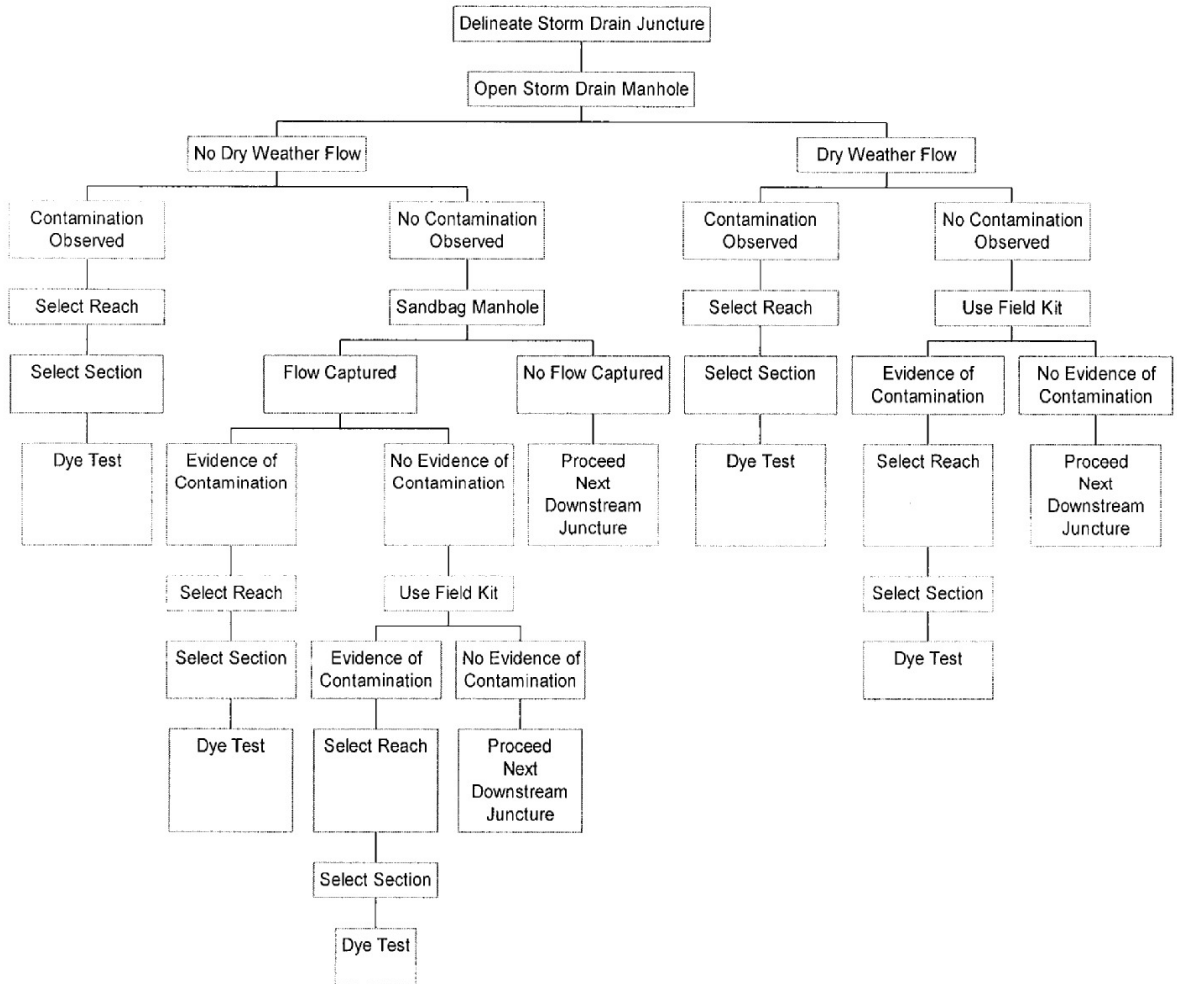
REFERENCES & FIGURE CREDITS

Boston Water and Sewer Commission. Stony Brook Illegal Connection Investigation, 1999-2001. Earth Tech, Inc. Field reports and research.

Jewell, Charlie. A Systematic Methodology for the Identification and Remediation of Illegal Connections. 2001. Boston Water and Sewer Commission.

Boston Water and Sewer Commission. Stony Brook Sewer System Study. Camp Dresser & Mckee Inc. August 1997.

Figure 3: Manhole Investigation Diagram





Town of Reading

Illicit Discharge Detection & Elimination Program

Dear Resident,

The Town of Reading is currently conducting a Town-wide illicit discharge detection and elimination program. The goal of this program is to identify sources of contamination in the Town's storm drain system resulting from improperly connected or aging sewer services and cross connections. Storm drains in the Town of Reading discharge directly to streams, wetlands, and lakes within the town and the surrounding communities. Sanitary sewer connections to the storm drain system are inappropriate and violate U.S. Environmental Protection Agency (EPA) and Town of Reading regulations. Eliminating these connections is essential to the health of the entire community, and is a priority for the Public Works Department.

Your property's sanitary sewer pipe could be inadvertently connected to the drain system or damaged due to aging infrastructure. The Town of Reading's consultant, CDM Smith will be conducting dye testing in your neighborhood over the next few days. Dye testing is a quick and proven way to determine if building connections to the municipal sewer are functioning properly.

Dye testing will occur on Day, Month XXth from 7:30 to 10:30am.

You may schedule a dye test time at your convenience. Please contact Mike Nelson of CDM Smith at 617-452-6558 to schedule an appointment time.

If you choose not to have a scheduled time please make sure an appropriate member of the household is home to accommodate staff during this time frame. Your participation in this program is essential to its success.

You may direct any questions about this program to:

Mike Nelson, P.E.
CDM Smith
(617) 452-6558
Nelsonmv@cdmsmith.com

or

George Zambouras, P.E.
Town Engineer
Town of Reading
(781) 942-9082
Email@email.com



Memorandum

To: Ryan Percival, PE

From: Rob Musci, PE

Date: September 6, 2019

Subject: 2018 Reading MS4 Outfall Dry Weather Sampling Program

CDM Smith and the Town of Reading, Massachusetts (the Town) developed an outfall sampling program in accordance with the United States Environmental Protection Agency Region 1 (USEPA) issued General Permits (Permit) for Stormwater Discharges from Small Municipal Storm Sewer Systems (MS4) in Massachusetts. The Permit was issued April 4, 2016 with an effective date of July 1, 2018. The Permit requires dry weather sampling to be completed at all outfalls and interconnections by June 30, 2021. To comply with the permit and gain a clearer understanding of their system, The Town performed their dry weather sampling program during the first year of their Permit.

This memo summarizes the Town's 2018 dry weather outfall screening activities including a summary of the permit requirements related to dry weather outfall screening, development and results of the field program, and next steps. The Town has been proactive in implementing its dry weather outfall screening program and is ahead of the permit requirements.

MS4 Dry Weather Permit Requirements

The Permit requires that the dry weather sampling program include an inventory of all Town owned outfalls, a program for screening and sampling outfalls, and a ranking of all Town owned outfalls/interconnections (outfall) based on the sampling data.

Outfall Inventory and Review

The Town completed their outfall inventory by reviewing each discharge point included in their geographic information system (GIS) and confirming that the asset met the permit definition for an outfall. The GIS inventory was also helpful in determining if the Town owned any stormwater infrastructure (i.e. catch basins, pipelines, etc.) upstream of an outfall under otherwise private ownership (owned by others). This is an important item because the Town is only responsible for permit compliance of Town owned portion of any stormwater collection system. Outfalls owned by others are not subject to the Town's General Permit; but the Town owned infrastructure upstream of such outfalls do require the town to identify a sampling location at the "property" line (also known in the permit as an ***interconnection point***).

After the Town reviewed and categorized each discharge point (as either an outfall or interconnection point), they further reviewed each collection system to determine if it had at least one upstream System Vulnerability Factor (SVF) as defined in the Permit. The SVF allow the town to categorize outfalls or interconnection points that are more prone to illicit discharges. The Permit lists the following SVF criteria:

- History of Sanitary Sewer Overflows (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.

If an outfall or interconnection¹ point does not have any SVF's, then the Permit states that the outfall or interconnection point is "excluded" from the outfall screening or sampling programs. **Table 1** below summarizes the number of known sampling locations, excluded outfalls, and non-town owned outfalls within Town Limits.

Table 1. Summary of Outfalls by Discharge Location

Type of Discharge Locations	Number of Locations
Town Owned MS4 Sampling Locations	282
Town Owned Excluded Outfalls	12
Non-Town Owned Outfalls within Municipal Limits	36
Total	330

¹ For the purpose of this memo, both outfalls and interconnection points will only be referred to as "outfalls".

The Town reviewed each of the 282 Town owned sampling locations and confirmed each location had a unique identifier and that the spatial location was included within the Town's GIS. The Town confirmed each location has the watershed identified, the dimensions/shape/material of the discharge location identified within its GIS. This information was then confirmed as part of the Town's field program completed by CDM Smith.

Dry Weather Outfall Screening & Sampling Program Development

The Permit requires the Town to develop an outfall screening and sampling procedure. The procedure must cover: sample collection, use of field kits, storage and conveyance of samples, and field data collection and storage as well as provisions for weather conditions and for specific screening requirements. In addition to the standard MS4 sampling requirements (required of all permit holders) for ammonia, surfactants, chlorine, and bacteria, Reading specifically is also required to sample for phosphorus at all outfalls with dry weather flow upstream of the Aberjona River (MA71-01).

In preparation of Reading's dry weather screening procedure document, CDM Smith included: a list of equipment to organize the day prior to the inspections, equipment calibration instructions, procedures for inspecting and sampling each outfall, and some tips on typical visuals/odors encountered during inspections. The final draft Town of Reading Outfall Screening and Sampling Procedure is included in **Appendix A**.

Dry Weather Outfall Field Program

Project Kickoff Meeting

The field program was kicked off on July 17, 2018. At the kick off meeting, CDM Smith and Town officials discussed the following:

- General outfall screening procedures,
- The Town's phosphorus sampling requirements (Reading Specific Requirement),
- Overall schedule including antecedent rainfall conditions,
- Outfall inventory,
- Outfall mapping, and
- Field sheet use in conjunction with an electronic tablet data collection application.

Public Outreach

The Town placed a press release on the cover of the Reading Daily Times Chronicle alerting residents that town employees, or consultants working for the Town, would be performing stormwater sampling and may need to pass through private property/residents' back yards to access Town owned infrastructure. Additionally, this outreach provided some general education on the new Permit and general good housekeeping tips for residents in relation to stormwater

discharges. This outreach proved useful during multiple occasions when residents came out and talked to field crews. The residents stated they had read the article and were generally aware of the overall program. Some residents wanted to better understand how the inspections were performed and some wanted additional information on the sampling and inspection program.

Tablet Application Development

Based on our firm's experience with outfall sampling programs, CDM Smith proposed the use of electronic field data collection for best efficiency. Working with their GIS department's consultant, CDM Smith created a tablet based field application utilizing ERSI's collector tool that would link to a central database containing all of the relevant project information. The application utilized data input fields to meet the requirements of the permit, including Town specific requirements. For the 2018 field work, the tablets were not equipped with a mobile device data plan, because it was considered more cost effective to physically connect the devices to a computer with internet access at the end of each field day for upload. Daily uploads were used to move the data from the field inspection tablet to the GIS database. PDFs of the inspection forms were also developed as a back-up plan, in case issues arose in the field (i.e. lack of power or other equipment failure). Example blank field forms are included in **Appendix B**.

Dry Weather Outfall Screening & Sampling Program Implementation

All 282 town owned outfalls were slated to be inspected or sampled during nine days of field work. The Permit requires, all sampling events must have an antecedent condition of 48-hours of dry weather (i.e. less than 0.1-inches of rainfall) prior to outfall inspection. The Town wanted to increase this requirement to 72-hours to ensure groundwater, sump pumps, and other sources of rainfall derived flow had ceased prior to inspections. Due to consistent, and at times heavy rain in the fall of 2018 with few dry periods, the field program was delayed over 45 calendar days. Outfall samples were taken from August 27 through October 10, 2018².

Table 2 below summarizes the inspection status of all outfalls. The Town was planning to perform follow up inspection of the 11 outfalls that could not be located during the winter season. The Town was also planning to determine a safe upstream sampling location for each of the 18 outfalls with access issues. A total of 42 Town owned outfalls had dry weather flow out of the 253 completed inspections.

² 0.03-inches of rainfall occurred within 72-hours of the October 9 & 10 sampling events; the remaining events had 0.00-inches of rainfall according to the local weather underground rain gauge located at Beverly Municipal Station.

Table 2. Dry Weather Outfall Inspection Status

Type of Discharge Locations	Number of Locations
Outfall Screening Complete, Outfall Dry	211
Outfall Screening Complete, Outfall Flowing	42
Could Not Access Outfall	18
Could Not Locate Outfall	11
Total	282

Each of the 42 flowing outfalls were sampled for ammonia, chlorine, conductivity, salinity, E. coli, surfactants, and temperature. Dry weather flow within the Aberjona River was also sampled for phosphorus. The E. coli and phosphorus samples were sent to a lab, the remaining analyses were performed with field kits, as identified in the field procedure available in **Appendix A**. Outfalls with exceedances of ammonia **AND** surfactants, with **EITHER** chlorine or bacteria are considered *Problem Outfalls* based on the terms of the current Permit. The Town had five outfalls that are considered Problem Outfalls. The outfall system identifier, GIS ID (facility identifier), watershed and location are summarized in **Table 3** below. **Table 4** summarizes the analytical results for each of the target parameters at the five problem outfalls, with exceedances shown in **bold** text. The remaining outfall sampling results are included in **Appendix C**.

Table 3. List of Problem Outfalls

System Identifier	Facility Identifier	Watershed	Location
A017	swDS-73	Aberjona	77 Arcadia Ave
A033	swDS-99	Aberjona	555 West St. (3)
I014	swDS-107	Ipswich	25 Deborah Dr.
S013	swDS-13	Saugus	48 Warren Ave. (2)
S060	swDS-324	Saugus	7 Harvest Rd.

Table 4. List of Analytical Results from Problem Outfalls

System Identifier	Ammonia (mg/L)	Surfactants (mg/L)	Bacteria (MPN/100 mL)	Chlorine (mg/L)
A017	0.50	0.50	43	1.50
A033	4.00	1.50	180,000	0.00
I014	0.75	0.25	230	0.05
S013	2.00	0.25	14,000	0.00
S060	1.25	1.50	520	0.30

The Permit requires that catchment inspections of known Problem Outfalls take place within the first two years of the permit. These outfalls were not known to be problematic outfalls at the time of the permit issuance but were discovered in 2018. Now that they are better understood and officially classified as a problem, these five outfalls are public health concerns and warrant more

extensive inspections upstream of the outfall. It is recommended these five outfall investigations be expedited by the Town.

Additional Analysis Not Required Under the MS4 Permit.

Though not required by the permit, the remaining outfall sampling data was reviewed to identify all outfalls that had an excessive exceedance for at least one parameter. This analysis did not include the problem outfalls, as they are already recommended for expedited investigation and inspection. The guidelines used in this analysis are summarized below in **Table 5**. These guidelines are based on historical inspections performed by CDM Smith and are not necessarily specific to any USEPA or MassDEP Guidance Document. The outfalls that fall under the guidance in **Table 5** should be considered a Town of Reading defined high priority and therefore should be prioritized for upstream catchment inspections following the inspection of the problem outfalls.

Table 5. Single Level Parameter Exceedances

Analytical Parameter	Exceedance Value
Ammonia	>1.0 mg/L
Surfactants	>1.0 mg/L
E. Coli	> 5,000 MPN/100 mL
Chlorine	>0.5 mg/L

Similar to the above Tables 3 and 4, **Table 6** summarizes the outfall system identifier, GIS ID (facility identifier), watershed and location for High Priority Outfalls. **Table 7** summarizes the analytical results for each of the target parameters at the five High Priority Outfalls, with individual Permit parameter exceedances shown in **bold text** and the guideline excessive exceedances shown in **RED**. **Figure 1** below shows soap suds (surfactants) directly downstream of two high priority outfalls. The sampling results for all outfalls are included in **Appendix C**.

Table 6. List of High Priority Outfalls

System Identifier	Facility Identifier	Watershed	Location
A020	swDS-61	Aberjona	155 Walnut St.
A023	swDS-85	Aberjona	Behind Morton Field End of Hanscom Ave
A075	swDS-76	Aberjona	404 West St.
I003	swDS-87	Ipswich	Behind 100 Grove St.

Table 7. List of Analytical Results from High Priority Outfalls

System Identifier	Ammonia (mg/L)	Surfactants (mg/L)	Bacteria (MPN/100 mL)	Chlorine (mg/L)
A020	0.25	0.50	<1	1.00
A023	0.25	2.00	210	0.20
A075	0.00	0.25	13,000	0.02
I003	0.00	1.50	320	0.09
I062	0.00	3.00	<1	2.20



Figure 1. Soap suds identified at I062 (left) and I003 (right), Both are High Priority Outfalls

Field Sampling for Phosphorus

The Permit requires that outfalls discharging to the Aberjona River be sampled for phosphorus (in addition the other standard MS4 sampling parameters). Of the 42 outfalls that were flowing, 17 were upstream of the Aberjona River. The Permit does not give guidance for which discharges should be flagged for follow up inspections. Discussions with CDM Smith water quality experts

indicate that dry weather flow with phosphorus above 0.05 mg/L are likely to be impacted by an external influence such as extraneous wastewater flow. **Table 8** below lists the results of the phosphorus sampling including: the outfall system identifier, GIS ID (facility identifier), location and phosphorus level. **Red** values in table are considered to be problem outfalls as noted in Table 3. **Bold** values are shown on outfalls that were already flagged as high priority outfalls in table 6. Phosphorus levels above 0.05 mg/L are underlined.

Table 8. Phosphorus Analytical Results from Abjerona River Watershed Outfalls

System Identifier	Facility Identifier	Location	Phosphorus (mg/L)
A014	swDS-70	65 Glenmere Cir.	0.024
A016	swDS-72	91 Arcadia Ave.	0.030
A017	swDS-73	77 Arcadia Ave	<u>0.222</u>
A018	swDS-74	35 Arcadia Ave	0.047
A020	swDS-76	404 West St.	0.030
A023	swDS-85	Behind Morton Field End of Hanscom Ave	0.049
A030	swDS-204	66 Forest St.	<u>0.076</u>
A033	swDS-99	555 West St. (3)	<u>0.555</u>
A050	swDS-226	194 County Rd	<u>0.111</u>
A051	swDS-227	33 Lisa Lane	0.024
A052	swDS-228	32 Randall Rd.	<u>0.063</u>
A073	swDS-62	189 South St.	0.039
A075	swDS-61	155 Walnut St.	0.016
A076	swDS-60	47 Hemlock Rd.	0.014
A077	swDS-59	42 Hemlock Rd.	0.016
A083	swDS-217	8 Oak Ridge Rd.	0.019
A087	swDS-213	28 Haystack Rd.	0.038

Comparison of 2018 Outfall Sampling Results with Historic Results

Of the 29 outfalls that were flowing during the 2012 and 2013 dry weather outfall inspection programs, only 12 outfalls were identified as flowing during the 2018 program. A summary comparison of the outfalls with dry weather flow from 2012 or 2013 is included below in **Table 9**. None of the outfalls flowing in 2012 or 2013 are considered to show likely influence of sewage based on the 2018 sampling data, though one outfall, A020, showed excessive chlorine in the 2018 sample. The comparison of analytical sampling results for 2012/2013 with the 2018 outfall program are included in **Appendix D**.

Table 9. 2018 Inspection Status of Outfalls with Dry Weather Flow in 2012/2013

2018 Outfall Inspection Status	Number of Locations
Outfall Screening Complete, Outfall Dry	7
Outfall Screening Complete, Outfall Flowing	12
Could Not Access Outfall	2
Removed Outfall for Ownership/Excluded	8
Total	29

MS4 Permit Next Steps

Dry Weather Sampling

Significant progress was achieved in 2018 with only 29 outfalls inspections unable to be performed. **Appendix E** states why each individual outfall was not inspected. **Table 10** summarizes this data. It is recommended the Town address the impairments listed, so that the inspections maybe performed in 2019.

Table 10. Summary of Non-Screened Outfalls

Outfall Inspection Impairment	Number of Locations
Access Issue – Safety	13
Access Issue – Safety / O&M (i.e. overgrowth)	5
Could Not Locate	11
Total	29

Recommended GIS Edits

It is recommended that the Town update its GIS to include the outfall prioritizations included in this document, by adding an attribute to each outfall that identifies it as either an: excluded outfall, problem outfall, high priority outfall, or low priority outfall. The low priority outfalls are all the remaining outfalls that were not listed as excluded, problem, or high priority outfalls.

Catchment Inspections

The Town is required to develop a written catchment investigation procedure within 18 months of the effective date of the permit (December 31, 2019). Catchment investigations of all non-excluded Town owned outfalls is required by tenth year of the effective date of the permit (June 30,2028). The Catchment investigation is an upstream inspection where key junction manholes are inspected for dry weather flow. If dry weather flow is present, the Town is required, at a minimum, to sample for ammonia, surfactants, and chlorine. Sandbagging is not required in the permit but should be considered by the Town to help eliminate areas of potential illicit discharges. The Town is required to **begin** the catchment inspection of the Problem Outfalls within 2 years of the effective date of the permit (June 30, 2020) and to complete the inspection of problem outfalls within 7 years of the effective permit date (June 30, 2025).

Phosphorus Requirements

Appendix H of the Permit lays out the full requirements for watersheds with a phosphorus impairment. For the Town this includes all of the Town owned outfalls that are tributary to the Aberjona River. The requirements for the Town are summarized in **Table 11**.

Table 11. Key Phosphorus Requirements for the Aberjona River Watershed

Permit Requirement	Due Date
Public Outreach – Grass Clippings/fertilizers	Annually in March/April
Public Outreach – Pet Waste	Annually in June/July
Public Outreach – Disposal of Leaf Litter	Annually in August/ September/October
(Re)Development SW Management – BMPs Optimized for Phosphorus Removal	June 30, 2020
Phosphorus Source Identification Report	June 30, 2022
Inventory All Permittee Owned Properties for Structural BMP Installation	June 30, 2023
Install One Structural BMP (Historic Phosphorus BMPs Count)	June 30, 2024

Key MS4 Permit Dates in 2019/2020

Appendix F includes a summary from the USEPA MS4 Permit Submittals/Deadlines due by June 30, 2019. Not included in the table are any additional requirements that the Town noted in their Notice of Intent which may include specific public education outreach. Additional documents included in **Appendix F** are an IDDE implementation timeline developed by the USEPA and a general Permit schedule of due dates developed by CDM Smith.

Appendices

Appendix A – Dry Weather Outfall Sampling Procedure

Appendix B – Blank Outfall Inspection / Field Forms.

Appendix C – Summary of 2018 Reading Dry Weather Outfall Sampling Results

Appendix D – Comparison of 2012/2013 Dry Weather Sampling with 2018 Sampling Program

Appendix E – Impairments of Non-Screened MS4 Outfalls

Appendix F – MS4 Schedule of Submittals/Deadlines

cc: Lisa Gove, PE

Appendix A

Dry Weather Outfall Sampling Procedure

Dry-Weather Outfall Sampling Program – READING, MA

Sample Collection/Field Analysis Procedures

This document outlines the procedures to be followed prior to and during inspections of stormwater outfalls (and stormwater system manholes or other access points for the IDDE Program) to ensure that they are inspected properly and that dry-weather flow samples, and any laboratory samples for follow up tests, are done appropriately.

Pre-Inspection/Pre-Sampling Procedures

1. Before beginning outfall inspections, check that the following equipment is available and ready for use.
 - Monitoring Test Kits (CHEMets Ammonia & Surfactants kits and Hach Chlorine colorimetric test kit) including an adequate supply of all reagents for the day
 - Field Test Meters (Extech EC500 “ExStik” or YSI Meter) and buffer solutions
 - Gloves
 - Paper Towels/Rags
 - Distilled Water (for rinsing equipment after sampling)
 - Sampling Cup
 - Extendable Pole (to attach sampling cup if necessary)
 - Bucket and 25 feet of rope to take samples from deeper manholes
 - Sample Bottles or Graduated cylinders
 - Ruler/Tape Measure
 - Permanent marker for bottle labels
 - Camera
 - Maps
 - Safety cones or other city required safety gear for vehicles parked on the side of the road
 - Safety vests and safety glasses for each person
 - Copies of the Stormwater Asset Inspection Form (2-pages)
 - Laboratory Custody Sheets
 - iPad or similar electronic tablet
 - Bug spray, poison ivy repellants/cleansers
2. At the start of each field day, the field meter should be calibrated. The calibration should be checked periodically (at least once) during the day. If the reading is different than the test solution, this should be recorded on a meter calibration record sheet. Custody sheets and laboratory sample bottles for any lab testing need to be available on days when these samples will be collected.
3. Before the first use or after storage, the ExStik (for pH, temperature, and conductivity) needs to be soaked in tap water for 10 minutes. The device should be calibrated with a pH 7 buffer solution first, then calibrated with a buffer solution closest to the expected pH value of the solution or material to be tested.
4. Locate outfalls (or manholes) to be inspected for the day on map (or by GPS coordinates). Prepare a route to efficiently locate as many outfalls (or inspect as many manholes) as possible.
5. Prior to inspection and sampling of any outfall or manhole, ensure there has been a minimum 48-hour period of dry-weather after any rainfall of more than 0.1 inches.

6. Make sure that the sample collection cups and buckets are all thoroughly rinsed with distilled water to avoid cross-contamination.

Outfall Inspection & Dry-Weather Flow Sampling Procedures

1. Observe the outfall (or MS4 Asset) condition and record a description of the pipe material, shape, diameter, any damage, or deposits/stains on the Stormwater Asset Inspection Form. Record the date, time, weather, and who is performing the inspection.
2. Take a photograph of the outfall. If an upstream sampling location is used, then take a photograph of the upstream structure and a photograph showing why the outfall could not be used (i.e. safety, access, submerged, etc). Photographs of the surrounding area should be taken as well to help identify the area and any observations. Identify photographs by number so that they are differentiated.
3. Thoroughly complete the Outfall Inspection Form.
4. If outfall/MS4 Asset has dry-weather flow, then observe and characterize the flow and complete Outfall Sampling Form.
5. A minimum 48-hour antecedent dry weather period must be observed before inspections or field/laboratory sampling is performed. Field observations shall be recorded and field testing for ammonia, surfactants, and chlorine residual must be completed for every bacteria sample collected in the field for laboratory analyses.
6. Sample Collection and Analysis for Ammonia
 - Begin sample collection by putting on the protective gloves.

- Collect a sample of the outfall flow using the sampling cup or bucket. Pour this flow out downstream of the sample location, and repeat. Utilize the extendable pole if necessary to collect the sample. Obtain at least 200 mL of flowing water, if possible.
- Open the kit and locate the reaction tube, reagent ampoule, reaction mixing tube and cap, and comparator ampoule.
- Rinse the sample cup with the sample to be tested, and then fill it to the 20 mL mark with the sample (Figure 1).
- Add 4 drops of A-1404 Stabilizer Solution (Figure 2).
- Add 4 drops of A-1405 Catalyzer Solution (green) (Figure 2).
- Add 4 drops of A-1406 Activator Solution (blue) (Figure 2)
- Immediately place the CHEMet ampoule, tip first, into the sample cup. Stir briefly to mix the contents of the cup, then snap the tip to allow the contents to drain into the reaction tube (Figure 3).

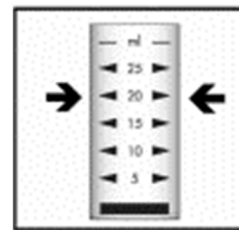


Figure 1

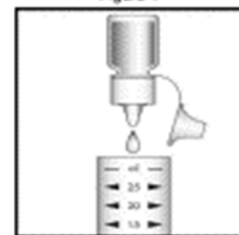


Figure 2

- To mix the ampoule, invert it several times, allowing the bubble to travel from end to end.
- Cap the reaction tube and shake it vigorously for 30 seconds. Allow the tube to stand undisturbed for 1 minute.
- Dry the ampoule and wait 5 minutes for color development.
- Obtain a test results by placing the ampoule between the color standards until the best color match is found (Figure 4).

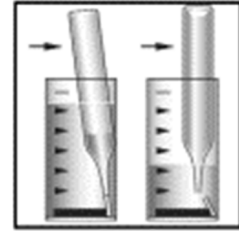


Figure 3

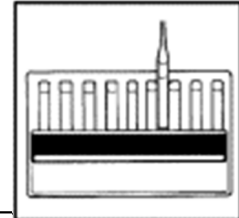
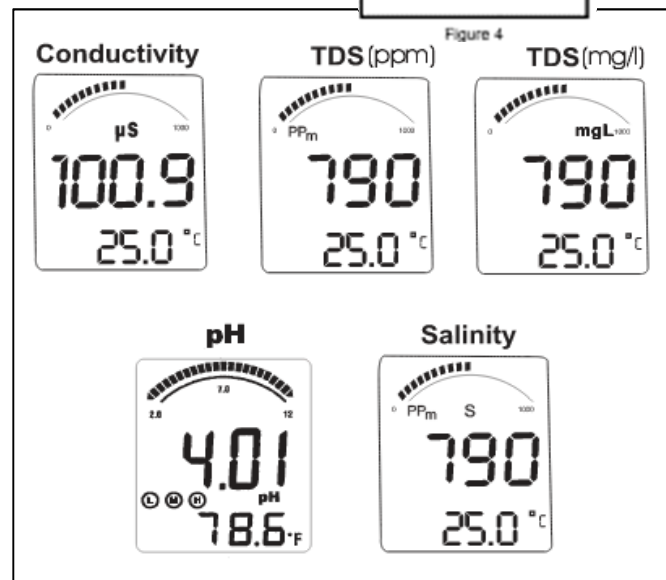


Figure 4

7. Sample Collection and Analysis for Field Parameters and Bacteria Sample Collection

- Collect a sample of the outfall flow using the sampling cup or bucket. Utilize the extendable pole if necessary to collect the sample. Obtain at least 50-100 mL of flowing water, if possible.
- First, the sample will be evaluated using the EC500 ExStik field meter to take measurements for pH, temperature, and specific conductivity. See graphic below for a display example.

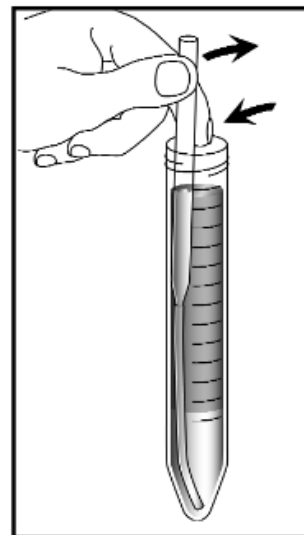
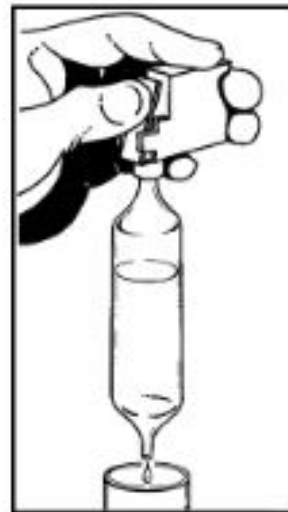


EC500 ExStik Panel

- Remove the cap from the bottom of the ExStik to expose the electrode.
- Press the ON button. “SELF CAL” will appear on the display during the turn-on diagnostics.
- Insert the electrode into the sample making sure that the electrode is completely submersed.
- Slowly stir the solution with the electrode to remove air bubbles.
- To obtain parameter measurements, depress and hold the MODE/HOLD key for 2 seconds to scroll to the desired parameter. The display will begin to scroll through the units: **µS** (for conductivity); **pH**; **ppm S** (for salinity); **ppm** (for TDS); **mg/l** (for TDS). Let go of the button to stop the scroll, push again to advance to the next reading.

8. Use the CHEMets K9400 test kit to measure surfactants (detergents) in the sample.

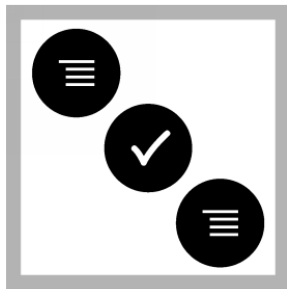
- Open the kit and locate the reaction tube, reagent ampoule, reaction mixing tube and cap, and comparator ampoule.
- Rinse the reaction tube with the sample to be tested, and then fill it to the 5 mL mark with the sample.
- While holding the double-tipped ampoule (containing the blue reagent) in a vertical position, snap the upper tip using the tip breaking tool.
- Invert the reagent ampoule and position the open end over the reaction tube. Snap the upper tip to allow the contents to drain into the reaction tube (see diagram on right).
- Cap the reaction tube and shake it vigorously for 30 seconds. Allow the tube to stand undisturbed for 1 minute.
- Make sure that the flexible tubing is firmly attached to the CHEMets comparator ampoule tip.
- Insert the CHEMets comparator ampoule (tubing first) along the side of the reaction tube making sure that the end of the flexible tubing is at the bottom of the tube and below the blue reagent level.
- Break the tip of the CHEMets ampoule by gently pressing it against the side of the reaction tube. The ampoule should draw in fluid only from the organic phase (bottom layer). See diagram to the right.
- When filling is complete, remove the CHEMets comparator ampoule from the reaction tube.
- Remove the flexible tubing from the CHEMets comparator ampoule and wipe all liquid from the exterior of the ampoule. Place an ampoule cap firmly onto the tip of the CHEMets comparator ampoule. Invert the comparator ampoule several times, allowing the bubble to travel from end to end.
- Obtain a test result by placing the comparator 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 and record the concentration of surfactants.



9. The HACH pocket colormetric scale for chlorine residual has reagents that must be used with the water quality sample to allow the machine to determine the colormetric chlorine residual. The procedure is to insert a blank in the machine to zero out the scale and then to insert the sample with a reagent for the pocket machine to determine the chlorine residual.
- Begin sample collection by putting on the protective gloves.
 - Zero out the instrument (Figures 1 – 7 below)

- Collect a sample of the outfall flow using the sampling cup or bucket. Pour this flow out downstream of the sample location, and repeat. Utilize the extendable pole if necessary to collect the sample. Obtain at least 200 mL of flowing water, if possible.
- Open the kit and locate the sample cell, powder pillows, and colorimeter.
- Rinse the sample cup with the sample to be tested, and then fill it to the 10 mL mark with the sample (Figure 8).
- Add one 10 mL DPD Total Chlorine Reagent Powder Pillow (Figure 9).
- Close the sample cell and shake vigorously for 20 seconds (Figure 10).
- Clean the outside of the sample cell (Figure 11)
- Insert the sample cell into the colorimeter and record the result (Figure 12).

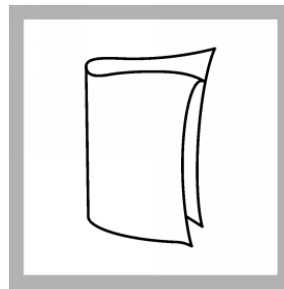
Powder pillow procedure



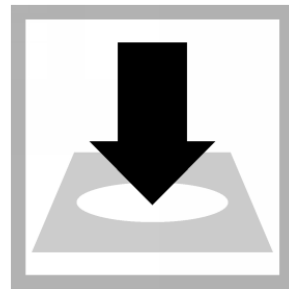
1. Set the instrument to low range (LR). Refer to the instrument documentation.



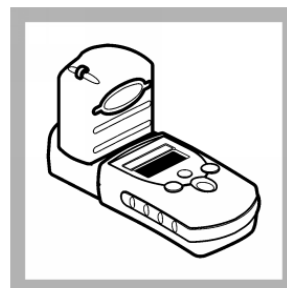
2. **Prepare the blank:** Fill a sample cell to the 10-mL mark with sample. Close the sample cell.



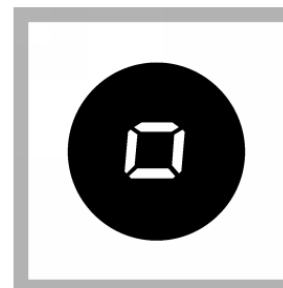
3. Clean the blank sample cell.



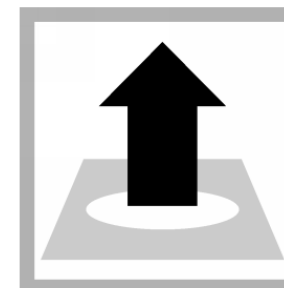
4. Insert the blank into the cell holder. Point the diamond mark on the sample cell toward the keypad.



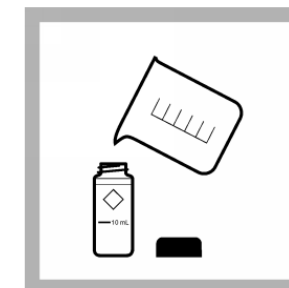
5. Install the instrument cap over the cell holder.



6. Push **ZERO**. The display shows "0.00".



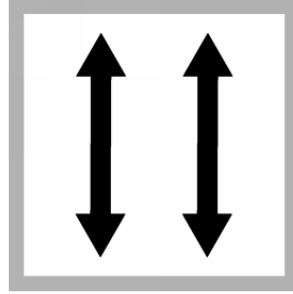
7. Remove the sample cell from the cell holder.



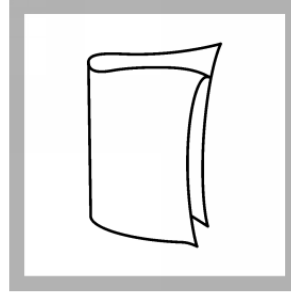
8. **Prepare the sample:** Fill a second sample cell to the 10-mL mark with sample.



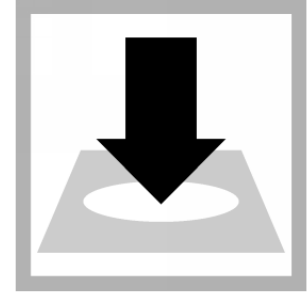
9. Add one 10-mL DPD Free Chlorine Reagent Powder Pillow or one 10-mL DPD Total Chlorine Reagent Powder Pillow to the second sample cell.



10. Close the sample cell. Shake the sample cell for about **20 seconds** to dissolve the reagent. Undissolved powder will not affect accuracy. A pink color will show if chlorine is in the sample.



11. Clean the prepared sample cell.



12. Free chlorine measurement: Within 1 minute of the reagent addition, insert the prepared sample into the cell holder. Point the diamond mark on the sample cell toward the keypad. Go to step [15](#).

10. Collect an additional 100 mL sample to send to the laboratory for bacteria testing (E. Coli).

Please note that dry-weather flow samples to be sent to the laboratory will be collected on a regular basis during each day (either once or twice a day as arranged with the laboratory). Field crews should coordinate sample collection with the laboratory pick-up times to make sure that laboratory analysis hold-time of 6 hours between sample collection and the start of analyses for E. Coli and Enterococcus are not exceeded for any one sample. The Town will be sending the collected samples for bacteria to an outside lab. The lab must be notified the day before field crews are sampling so the samples can be pick up by a carrier. The pickup times are typically scheduled for 11:00 AM and 3:00 PM to coordinate with times that the lab will start the analyses. Notify the lab the day before sampling is to be conducted as these samples are time sensitive, the required analysis E.coli, which must be done within 6-hours. Bacteria sampling should occur no earlier than 7:00 AM.

A minimum of a 48-hour dry weather period should be observed before any bacteria samples are collected.

Bacteria collection procedures:

- Transfer dry-weather flow from the outfall sampling cup into the sterile sample bottles supplied by the laboratory. Fill the sample bottle to the fill line on the bottle (100 mL minimum).
- Fill out the information on the sample bottle to note date and time of sample, sample location, person taking the sample, and ensure that the right analytical test will be performed on the sample at the laboratory.
- Complete the Chain of Custody form.
- Put the sample(s) on ice in a cooler.
- Coordinate with laboratory to collect the samples or plan to drop them off at the laboratory.

11. Make sure that the sample collection cups and buckets are all thoroughly rinsed with distilled water to avoid cross-contamination after each sample round.

12. Collect an additional 500 mL sample to send to the laboratory for Phosphorus testing (SM-4500).

Please note that dry-weather flow samples to be sent to the laboratory will be collected on a regular basis during each day (either once or twice a day as arranged with the laboratory). The Town will be sending the collected samples for phosphorus to an outside lab. The lab must be notified the day before field crews are sampling so the samples can be pick up by a carrier. The pickup times are typically scheduled for 11:00 AM and 3:00 PM to coordinate with times that the lab will start the analyses. The phosphorus samples have a hold time up to 28 days.

A minimum of a 48-hour dry weather period should be observed before any lab samples are collected.

Bacteria collection procedures:

- Transfer dry-weather flow from the outfall sampling cup into the sterile sample bottles supplied by the laboratory. Fill the sample bottle to the fill line on the bottle (500 mL minimum).
 - Fill out the information on the sample bottle to note date and time of sample, sample location, person taking the sample, and ensure that the right analytical test will be performed on the sample at the laboratory.
 - Complete the Chain of Custody form.
 - Put the sample(s) on ice in a cooler.
 - Coordinate with laboratory to collect the samples or plan to drop them off at the laboratory.
13. Make sure that the sample collection cups and buckets are all thoroughly rinsed with distilled water to avoid cross-contamination after each sample round.

Field Observation Assistance

(adapted from the North Central Texas IDDE Field Investigation Guide, 2011)

To help with the visual or odor characterizations, collect a sample of the discharge in a clear test tube or sampling bottle. Avoiding an assessment of water color by looking directly into the waterway is important as water depth, substrate composition, aquatic plants, and sky conditions can all influence your perception of the water color.

Color	Possible Sources
Tan to light brown	<ul style="list-style-type: none">• Suspended sediments common after rainfall• Runoff from construction, roads, agricultural/range land• Soil erosion caused by vegetation removal
Pea green, bright green, yellow, brown, brown-green, brown-yellow, blue-green	<ul style="list-style-type: none">• Algae or plankton bloom - color depends on type of algae or plankton• Sewage, fertilizer runoff, vehicle wash water
Tea/coffee	<ul style="list-style-type: none">• Dissolved or decaying organic matter from soil or leaves. Commonly associated with tree overhangs, woodlands, or swampy areas
Milky white	<ul style="list-style-type: none">• Paint, lime, milk, grease, concrete, swimming pool filter backwash
Milky or dirty dishwater gray	<ul style="list-style-type: none">• Gray water or wastewater, musty odor present
Milky gray-black	<ul style="list-style-type: none">• Raw sewage discharge or other oxygen- demanding waste (rotten egg or hydrogen sulfide odor may be present)
Clear black	<ul style="list-style-type: none">• Caused from turnover of oxygen- depleted waters or sulfuric acid spill
Dark red, purple, blue, black	<ul style="list-style-type: none">• Fabric dyes, inks from paper and cardboard manufacturers
Orange-red	<ul style="list-style-type: none">• Leachate from iron deposits• Deposits on stream beds often associated with oil well operations
White crusty deposits	<ul style="list-style-type: none">• Common in dry/arid areas or during periods of low rainfall where evaporation of water leaves behind salt deposits• Also found in association with brine water discharge from oil production areas (a petroleum odor or an oily sheen may be present along banks)
Other (describe)	

Odors can be better characterized in a sample that can be held closer to the nose. However, never inhale the air directly off the top of a sample as many potential contaminants are harmful to nasal membranes and lung tissue. Hold the sample bottle about six inches away from your nose. Use your free hand to fan the scent to your nose. Make sure that the origin of the odor is at the outfall. Sometimes shrubs, trash, or even spray paint used to mark the outfalls can confuse the nose.

	Odor	General Causes
1	Rotten eggs/hydrogen sulfide (septic)	<ul style="list-style-type: none"> • Raw sewage, decomposing organic matter, lack of oxygen
2	Chlorine	<ul style="list-style-type: none"> • Wastewater treatment plant discharges, swimming pool overflow,
3	Sharp, pungent odor	<ul style="list-style-type: none"> • Chemicals or pesticides
4	Musty odor	<ul style="list-style-type: none"> • Presence of raw or partially treated sewage, livestock
5	Gasoline, petroleum	<ul style="list-style-type: none"> • Industrial discharge, illegal dumping of wastes, waste
6	Sweet, fruity	<ul style="list-style-type: none"> • Commercial wash water, wastewater
7	Other (describe)	

Sewage, Sheens & Surface Scum can indicate potential sources of contamination.

- Contaminated flows may contain floatable solids or liquids. Sewage, oil sheen, and suds/foam are examples of floatable indicators. Trash and debris, although more typically known as “floatables,” are not generally indicators of illicit flow.
- Sheens can be naturally-produced or synthetic; oil sheens are often mistaken for naturally-produced sheen.
- Sheen from bacteria forms a sheet-like film that breaks if disturbed.
- Suds should be rated based on their foaminess and staying power.
- Suds that travel several feet before breaking up should be considered as a possible illicit discharge.
- In some cases, foam and suds can give off an odor.
- A strong organic or sewage-like odor can indicate a sanitary sewer leak or overflow.
- A fragrant or sweet smelling odor can indicate the presence of laundry water or similar wash waters.

Ammonia CHEMets® Kit

K-1420/R-1402: 0 - 4 & 0 - 80 ppm N

0 - 4 ppm Test Procedure

1. Fill the sample cup to the 20 mL mark with the sample to be tested. Fig. 1
2. Add 4 drops of A-1404 Stabilizer Solution. Fig. 2
3. Add 4 drops of A-1405 Catalyzer Solution (green). Fig. 2
4. Add 4 drops of A-1406 Activator Solution (blue). Fig. 2
5. **Immediately** place the CHEMets ampoule, tip first, into the sample cup. Stir briefly to mix the contents of the cup, then snap the tip. The ampoule will fill leaving a bubble for mixing. Fig. 3
6. To mix the ampoule, invert it several times, allowing the bubble to travel from end to end.
7. Dry the ampoule and wait **5 minutes** for color development.

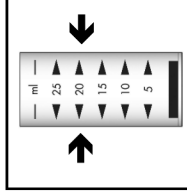


Figure 1

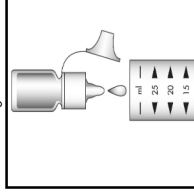


Figure 2

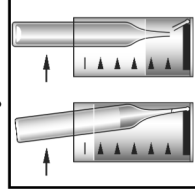


Figure 3

8. Obtain a test result by placing the ampoule between the color standards until the best color match is found. Fig. 4

NOTE: Use the concentration scale on the comparator label that corresponds to the range of the test procedure being used.

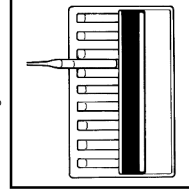


Figure 4

0 - 80 ppm Test Procedure

1. Using the syringe provided, obtain **1.0 mL** of the sample to be tested and dispense it into the empty sample cup.
2. Dilute the contents of the sample cup to the **20 mL** mark with distilled water.
3. Perform the 0 - 4 ppm Test Procedure, beginning with Step 2.

Test Method

The Ammonia CHEMets®¹ test kit employs the Hydroxybenzyl alcohol (HBA) chemistry.² Free ammonia reacts with hypochlorite to form monochloramine. Monochloramine reacts with HBA, in the presence of sodium nitro-ferricyanide, to form a green colored complex. This test method measures the sum of free ammonia and monochloramine. High levels of ammonia can produce false low or off color test results. Dilute the sample if the ammonia concentration is suspected to significantly exceed the test range.

1. CHEMets is a registered trademark of CHEMetrics, Inc. U.S. Patent No. 3,634,038
2. Krom, Michael D., Spectrophotometric Determination of Ammonia: A study of a Modified Berthelot Reduction Using Salicylate and Dichloroisocyanurate, *The Analyst*, V105 pp. 305-316, 1980.

Safety Information

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

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



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. 2

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 CHEMets ampoule tip.
6. Insert the CHEMets 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 CHEMets 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 CHEMets assembly from the reaction tube.
8. Remove the flexible tubing from the CHEMets ampoule and wipe all liquid from the exterior of the ampoule. Place an ampoule cap firmly onto the tip of the CHEMets ampoule. Invert the ampoule several times, allowing the bubble to travel from end to end.

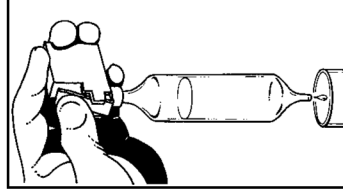


Figure 1

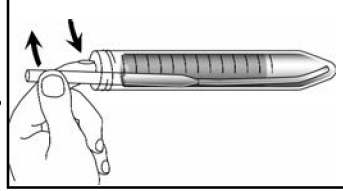


Figure 2

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



Figure 3

Tip Breaker

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

Test Method

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

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

Safety Information

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



Simplicity in Water Analysis

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Feb. 18, Rev. 10

Chlorine, Free and Total, Low Range

DOC316.53.01450

USEPA DPD Method¹

Method 8021 (free) 8167 (total)

0.02 to 2.00 mg/L Cl₂ (LR)

Powder Pillows or AccuVac[®] Ampuls

Scope and application: For testing residual chlorine and chloramines in water, wastewater, estuary water and seawater; USEPA-accepted for reporting for drinking and wastewater analyses.² This product has not been evaluated to test for chlorine and chloramines in medical applications in the United States.

¹ Adapted from Standard Methods for the Examination of Water and Wastewater.

² Procedure is equivalent to USEPA and Standard Method 4500-Cl G for drinking water and wastewater analysis.



Test preparation

Before starting

Analyze the samples immediately. The samples cannot be preserved for later analysis.

Always do tests in sample cells or AccuVac[®] Ampuls. Do not put the instrument in the sample or pour the sample into the cell holder.

Make sure that the sample cells are clean and there are no scratches where the light passes through them.

Rinse the sample cell and cap with the sample three times before the sample cell is filled.

Make sure that there are no fingerprints or liquid on the external surface of the sample cells or AccuVac[®] Ampuls. Wipe with a lint-free cloth before measurement.

Cold waters can cause condensation on the sample cell or bubbles in the sample cell during color development. Examine the sample cell for condensation or bubbles. Remove condensation with a lint-free cloth. Invert the sample cell to remove bubbles.

Install the instrument cap over the cell holder before ZERO or READ is pushed.

After the test, immediately empty and rinse the sample cell. Rinse the sample cell and cap three times with deionized water.

Do not use the same sample cells for free and total chlorine. If trace iodide from the total chlorine reagent is carried over into the free chlorine determination, monochloramine will interfere. It is best to use separate, dedicated sample cells for free and total chlorine measurements.

If the test result is over-range, or if the sample temporarily turns yellow after the reagent addition, dilute the sample with a known volume of high quality, chlorine demand-free water and do the test again. Some loss of chlorine may occur due to the dilution. Multiply the result by the dilution factor. Additional methods are available to measure chlorine without dilution.

For the best results, measure the reagent blank value for each new lot of reagent. Replace the sample with deionized water in the test procedure to determine the reagent blank value. Subtract the reagent blank value from the sample results.

The AccuVac Ampul Snapper makes AccuVac Ampul tests easier to do. The AccuVac Ampul Snapper keeps the broken tip of the ampul, prevents exposure to the sample and provides controlled conditions for filling the ampule.

An AccuVac Ampul for Blanks can be used to zero the instrument in the AccuVac test procedure.

The SwifTest Dispenser for Free Chlorine or Total Chlorine can be used in place of the powder pillow in the test procedures. One dispensation equals one powder pillow for 10-mL samples.

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

Dispose of reacted solutions according to local, state and federal regulations. Refer to the Safety Data Sheets for disposal information for unused reagents. Refer to the environmental, health and safety staff for your facility and/or local regulatory agencies for further disposal information.

Items to collect

Powder pillows

Description	Quantity
Chlorine, Free: DPD Free Chlorine Reagent Powder Pillows, 10-mL	1
Chlorine, Total: DPD Total Chlorine Reagent Powder Pillows, 10-mL	1
Sample cells, 25-mm (10 mL)	2

Refer to [Consumables and replacement items](#) on page 7 for order information.

AccuVac Ampuls

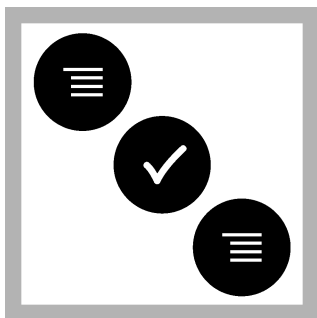
Description	Quantity
Chlorine, Free: DPD Free Chlorine Reagent AccuVac Ampuls	1
Chlorine, Total: DPD Total Chlorine Reagent AccuVac Ampuls	1
Beaker, 50-mL	1
Stopper for 18-mm tubes and AccuVac Ampuls	1
Sample cells, 25-mm (10 mL)	1

Refer to [Consumables and replacement items](#) on page 7 for order information.

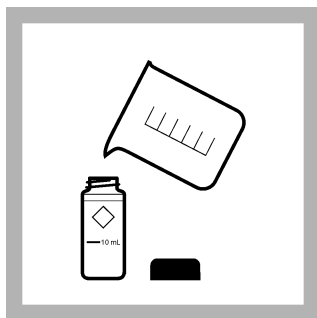
Sample collection

- Analyze the samples immediately. The samples cannot be preserved for later analysis.
- Chlorine is a strong oxidizing agent and is unstable in natural waters. Chlorine reacts quickly with various inorganic compounds and more slowly with organic compounds. Many factors, including reactant concentrations, sunlight, pH, temperature and salinity influence the decomposition of chlorine in water.
- Collect samples in clean glass bottles. Do not use plastic containers because these can have a large chlorine demand.
- Pretreat glass sample containers to remove chlorine demand. Soak the containers in a weak bleach solution (1 mL commercial bleach to 1 liter of deionized water) for at least 1 hour. Rinse fully with deionized or distilled water. If sample containers are rinsed fully with deionized or distilled water after use, only occasional pretreatment is necessary.
- Make sure to get a representative sample. If the sample is taken from a spigot or faucet, let the water flow for at least 5 minutes. Let the container overflow with the sample several times and then put the cap on the sample container so that there is no headspace (air) above the sample.

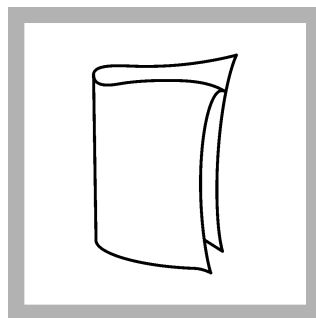
Powder pillow procedure



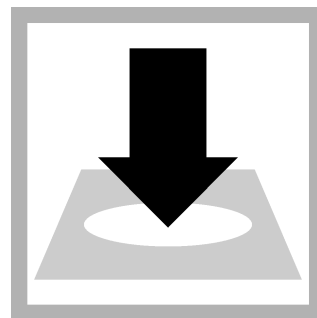
1. Set the instrument to low range (LR). Refer to the instrument documentation.



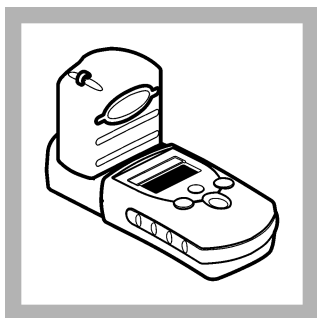
2. **Prepare the blank:** Fill a sample cell to the 10-mL mark with sample. Close the sample cell.



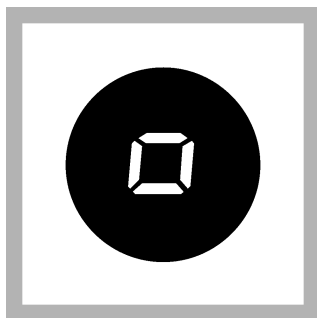
3. Clean the blank sample cell.



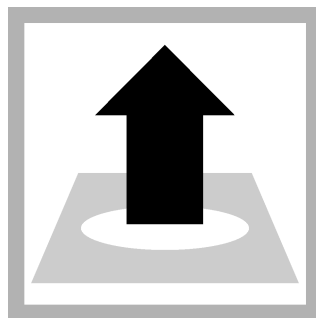
4. Insert the blank into the cell holder. Point the diamond mark on the sample cell toward the keypad.



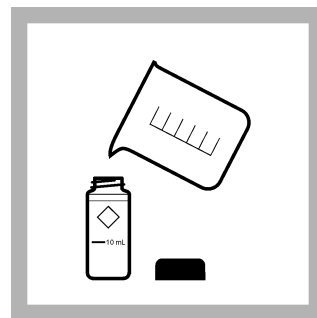
5. Install the instrument cap over the cell holder.



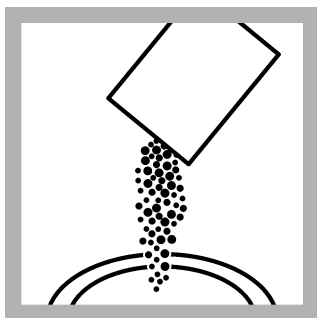
6. Push **ZERO**. The display shows "0.00".



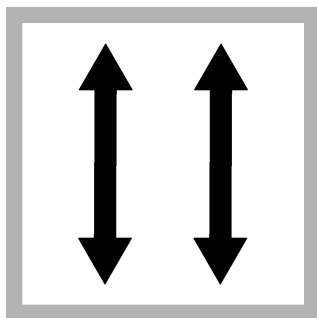
7. Remove the sample cell from the cell holder.



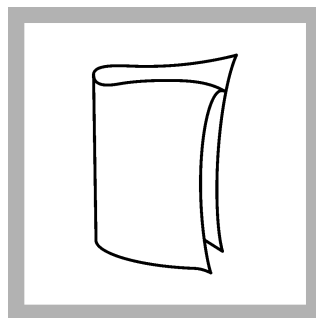
8. **Prepare the sample:** Fill a second sample cell to the 10-mL mark with sample.



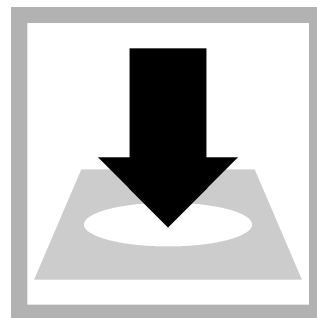
9. Add one 10-mL DPD Free Chlorine Reagent Powder Pillow or one 10-mL DPD Total Chlorine Reagent Powder Pillow to the second sample cell.



10. Close the sample cell. Shake the sample cell for about **20 seconds** to dissolve the reagent. Undissolved powder will not affect accuracy.
A pink color will show if chlorine is in the sample.



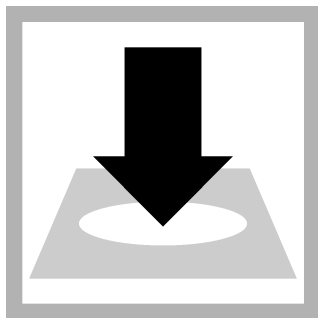
11. Clean the prepared sample cell.



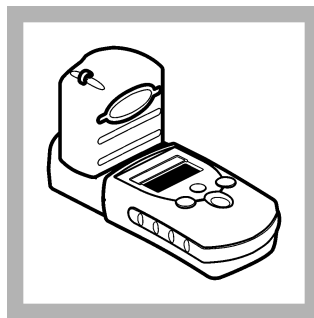
12. **Free chlorine measurement:** Within 1 minute of the reagent addition, insert the prepared sample into the cell holder. Point the diamond mark on the sample cell toward the keypad.
Go to step [15](#).



13. Set and start a timer for 3 minutes. A 3-minute reaction time starts.



14. Total chlorine measurement: After 3 minutes and within 6 minutes of the reagent addition, insert the prepared sample into the cell holder. Point the diamond mark on the sample cell toward the keypad.

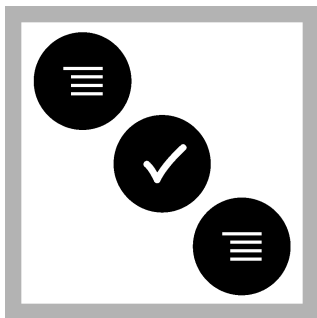


15. Install the instrument cap over the cell holder.

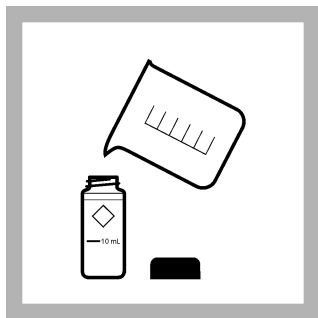


16. Push **READ**. Results show in mg/L Cl_2 .

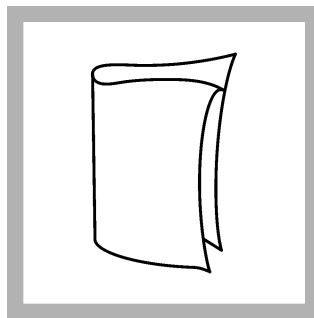
AccuVac[®] Ampul procedure



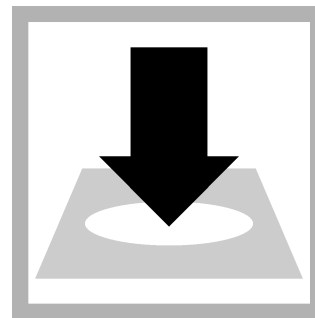
1. Set the instrument to low range (LR). Refer to the instrument documentation.



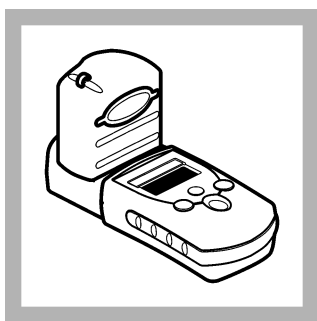
2. Prepare the blank: Fill a sample cell to the 10-mL mark with sample. Close the sample cell.



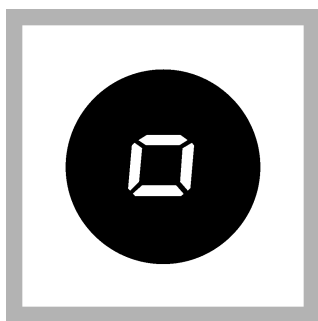
3. Clean the blank sample cell.



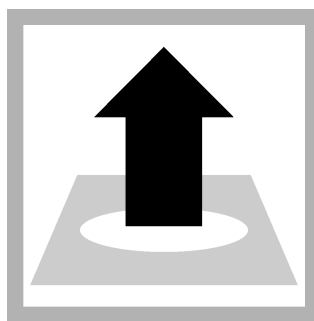
4. Insert the blank into the cell holder. Point the diamond mark on the sample cell toward the keypad.



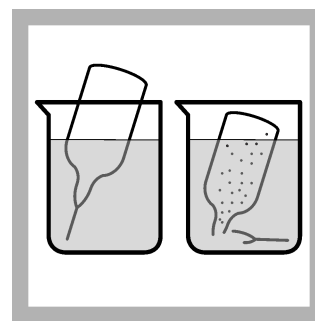
5. Install the instrument cap over the cell holder.



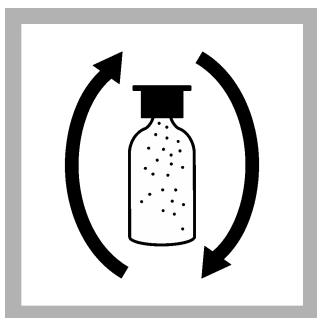
6. Push **ZERO**. The display shows "0.00".



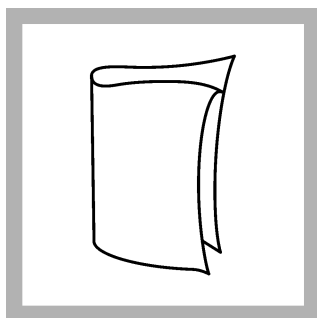
7. Remove the sample cell from the cell holder.



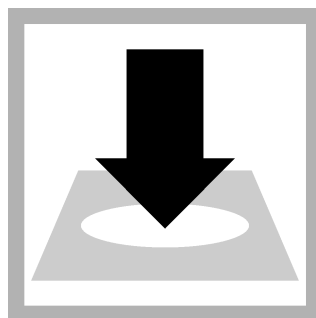
8. Prepare the sample: Collect at least 40 mL of sample in a 50-mL beaker. Fill a DPD Free Chlorine Reagent AccuVac Ampul or a DPD Total Chlorine Reagent AccuVac Ampul with sample. Keep the tip immersed while the AccuVac Ampul fills completely.



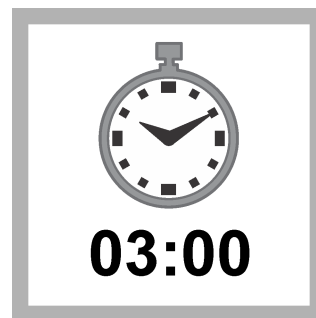
9. Quickly invert the AccuVac Ampul several times to mix.



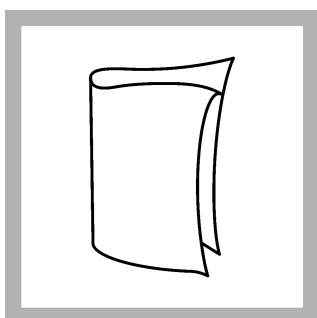
10. Clean the AccuVac Ampul.



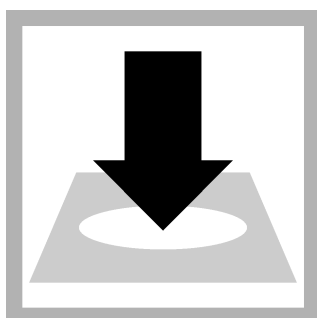
11. Free chlorine measurement: Within 1 minute of the reagent addition, insert the prepared sample AccuVac Ampul into the cell holder.
Go to step 15.



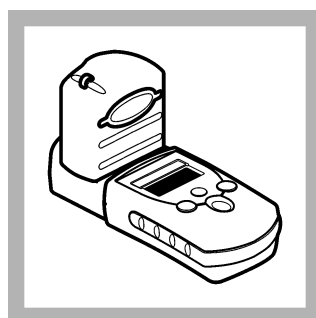
12. Set and start a timer for 3 minutes. A 3-minute reaction time starts.



13. When the timer expires, clean the prepared sample cell.



14. Total chlorine measurement: Within 6 minutes of the reagent addition, insert the prepared sample AccuVac Ampul into the cell holder.



15. Install the instrument cap over the cell holder.



16. Push **READ**. Results show in mg/L Cl₂.

Interferences

Interfering substance	Interference level
Acidity	More than 150 mg/L CaCO ₃ . The full color may not develop or the color may fade instantly. Adjust to pH 6–7 with 1 N Sodium Hydroxide. Measure the amount to add on a separate sample aliquot, then add the same amount to the sample that is tested. Correct the test result for the dilution from the volume addition.
Alkalinity	More than 250 mg/L CaCO ₃ . The full color may not develop or the color may fade instantly. Adjust to pH 6–7 with 1 N Sulfuric Acid. Measure the amount to add on a separate sample aliquot, then add the same amount to the sample that is tested. Correct the test result for the dilution from the volume addition.
Bromine, Br ₂	Positive interference at all levels
Chlorine Dioxide, ClO ₂	Positive interference at all levels
Inorganic chloramines	Positive interference at all levels
Chloramines, organic	May interfere
Hardness	No effect at less than 1000 mg/L as CaCO ₃

Interfering substance	Interference level
Manganese, Oxidized (Mn ⁴⁺ , Mn ⁷⁺) or Chromium, Oxidized (Cr ⁶⁺)	Pre-treat the sample as follows: <ol style="list-style-type: none"> 1. Adjust the sample pH to 6–7. 2. Add 3 drops of Potassium Iodide (30-g/L) to 10 mL of sample. 3. Mix and wait 1 minute. 4. Add 3 drops of Sodium Arsenite (5-g/L) and mix. 5. Use the test procedure to measure the concentration of the treated sample. 6. Subtract this result from the result without the treatment to obtain the correct chlorine concentration.
Monochloramine	Causes a gradual drift to higher readings. When read within 1 minute after reagent addition, 3 mg/L monochloramine causes less than a 0.1 mg/L increase in the reading.
Ozone	Positive interference at all levels
Peroxides	May interfere
Highly buffered samples or extreme sample pH	Can prevent the correct pH adjustment (of the sample) by the reagents. Sample pretreatment may be necessary. Adjust to pH 6–7 with acid (Sulfuric Acid, 1 N) or base (Sodium Hydroxide, 1 N). Correct the test result for the dilution caused by the volume additions.

Pollution prevention and waste management

If sodium arsenite was added to the sample for manganese or chromium interferences, the reacted samples will contain arsenic and must be disposed of as a hazardous waste. Dispose of reacted solutions according to local, state and federal regulations. must be disposed of as a hazardous waste. Dispose of reacted solutions according to local, state and federal regulations.

Accuracy check

Standard additions method

Use the standard additions method to validate the test procedure, reagents and instrument and to find if there is an interference in the sample.

Items to collect:

- Chlorine Standard Solution, 2-mL PourRite[®] Ampule, 25–30 mg/L (use mg/L on label)
 - Ampule breaker
 - Pipet, TenSette[®], 0.1–1.0 mL and tips
1. Prepare three spiked samples: use the TenSette pipet to add 0.1 mL, 0.2 mL and 0.3 mL of the standard solution, respectively, to three 10-mL portions of fresh sample. Mix well.
Note: For AccuVac[®] Ampuls, add 0.4 mL, 0.8 mL and 1.2 mL of the standard solution to three 50-mL portions of fresh sample.
 2. Use the test procedure to measure the concentration of each of the spiked samples. Start with the smallest sample spike. Measure each of the spiked samples in the instrument.
 3. Compare the expected result to the actual result. The expected increase in the chlorine concentration is the Cl₂ mg/L concentration from the label of the standard solution multiplied by 0.1 mL for every 10 mL of standard solution added.

Standard solution method

If the Standard Calibration Adjust feature is used to adjust the calibration curve of the Pocket Colorimeter II, the concentration of the chlorine standard must be between 0.50 and 1.50 mg/L chlorine for the LR procedure.

Verification of on-line analyzers

This procedure can be used to meet the requirements of USEPA Method 334.0 - Determination of Residual Chlorine in Drinking Water Using an On-line Chlorine Analyzer.

The procedure and requirements for compliance with EPA Method 334.0 can be downloaded directly from <http://www.hach.com/method334>.

Method performance

The method performance data that follows was derived from laboratory tests that were measured on a Pocket Colorimeter II during ideal test conditions. Users can get different results under different test conditions.

Precision (95% confidence interval)
1.00 ± 0.05 mg/L Cl ₂

Summary of method

Chlorine can be in water as free chlorine and as combined chlorine. Both forms can be in the same solution and can be determined together as total chlorine. Free chlorine is in a solution as hypochlorous acid or hypochlorite ion. Combined chlorine represents a combination of chlorine-containing compounds, including monochloramine, dichloramine, nitrogen trichloride and other chloro derivatives. The combined chlorine oxidizes iodide (I⁻) to iodine (I₂). The iodine and free chlorine reacts with DPD (N,N-diethyl-p-phenylenediamine) to form a red solution. The color intensity is proportional to the chlorine concentration. To determine the concentration of combined chlorine, complete a free chlorine test and a total chlorine test. Subtract the results of the free chlorine test from the total chlorine test to get the combined chlorine concentration.

Consumables and replacement items

Required reagents

Description	Quantity/test	Unit	Item no.
DPD Free Chlorine Reagent Powder Pillow, 10 mL	1	100/pkg	2105569
DPD Total Chlorine Reagent Powder Pillow, 10 mL	1	100/pkg	2105669
OR			
DPD Free Chlorine Reagent AccuVac [®] Ampul	1	25/pkg	2502025
DPD Total Chlorine Reagent AccuVac [®] Ampul	1	25/pkg	2503025

Required apparatus (powder pillows)

Description	Quantity/test	Unit	Item no.
Sample cells, 10-mL round, 25 mm x 60 mm	2	6/pkg	2427606

Required apparatus (AccuVac Ampul)

Description	Quantity/Test	Unit	Item no.
Sample cell, 10-mL round, 25 mm x 60 mm	1	6/pkg	2427606
Beaker, 50 mL	1	each	50041H
Stoppers for 18-mm tubes and AccuVac Ampuls	2	6/pkg	173106

Recommended standards and apparatus

Description	Unit	Item no.
Chlorine Standard Solution, 2-mL PourRite [®] Ampules, 25–30 mg/L	20/pkg	2630020
PourRite [®] Ampule Breaker, 2-mL	each	2484600

Optional reagents and apparatus

Description	Unit	Item no.
AccuVac [®] Ampul Snapper	each	2405200
Mixing cylinder, graduated, 25-mL	each	2088640
Potassium Iodide, 30-g/L	100 mL	34332
Sodium Arsenite, 5-g/L	100 mL	104732
Sodium Hydroxide Standard Solution, 1.0 N	100 mL MDB	104532
Sulfuric Acid Standard Solution, 1 N	100 mL MDB	127032
Pipet, TenSette [®] , 0.1–1.0 mL	each	1970001
Pipet tips for TenSette [®] Pipet, 0.1–1.0 mL	50/pkg	2185696
Pipet tips for TenSette [®] Pipet, 0.1–1.0 mL	1000/pkg	2185628
Paper, pH, 0–14 pH range	100/pkg	2601300
DPD Free Chlorine Reagent Powder Pillows, 10 mL	1000/pkg	2105528
DPD Total Chlorine Reagent Powder Pillows, 10 mL	1000/pkg	2105628
SwifTest [™] dispenser for free chlorine ¹	each	2802300
SwifTest [™] dispenser for total chlorine ²	each	2802400
DPD Free Chlorine Reagent, 10-mL, SwifTest [™] Dispenser refill vial	250 tests	2105560
DPD Total Chlorine Reagent, 10-mL, SwifTest [™] Dispenser refill vial	250 tests	2105660
SpecCheck [™] Secondary Standard Kit, Chlorine DPD, 0–2.0 mg/L Set	each	2635300
Water, organic-free	500 mL	2641549

¹ Includes one vial of 2105560 for 250 tests.

² Includes one vial of 2105660 for 250 tests.



FOR TECHNICAL ASSISTANCE, PRICE INFORMATION AND ORDERING:
 In the U.S.A. – Call toll-free 800-227-4224
 Outside the U.S.A. – Contact the HACH office or distributor serving you.
 On the Worldwide Web – www.hach.com; E-mail – techhelp@hach.com

HACH COMPANY
 WORLD HEADQUARTERS
 Telephone: (970) 669-3050
 FAX: (970) 669-2932

Ammonia CHEMets® Kit

K-1420/R-1402: 0 - 4 & 0 - 80 ppm N

0 - 4 ppm Test Procedure

1. Fill the sample cup to the 20 mL mark with the sample to be tested. Fig. 1
2. Add 4 drops of A-1404 Stabilizer Solution. Fig. 2
3. Add 4 drops of A-1405 Catalyzer Solution (green). Fig. 2
4. Add 4 drops of A-1406 Activator Solution (blue). Fig. 2
5. **Immediately** place the CHEMets ampoule, tip first, into the sample cup. Stir briefly to mix the contents of the cup, then snap the tip. The ampoule will fill leaving a bubble for mixing. Fig. 3
6. To mix the ampoule, invert it several times, allowing the bubble to travel from end to end.
7. Dry the ampoule and wait **5 minutes** for color development.

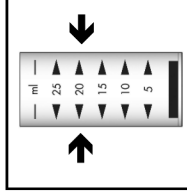


Figure 1

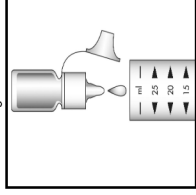


Figure 2

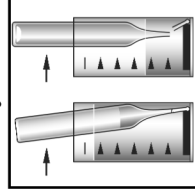


Figure 3

8. Obtain a test result by placing the ampoule between the color standards until the best color match is found. Fig. 4

NOTE: Use the concentration scale on the comparator label that corresponds to the range of the test procedure being used.

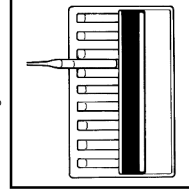


Figure 4

0 - 80 ppm Test Procedure

1. Using the syringe provided, obtain **1.0 mL** of the sample to be tested and dispense it into the empty sample cup.
2. Dilute the contents of the sample cup to the **20 mL** mark with distilled water.
3. Perform the 0 - 4 ppm Test Procedure, beginning with Step 2.

Test Method

The Ammonia CHEMets®¹ test kit employs the Hydroxybenzyl alcohol (HBA) chemistry.² Free ammonia reacts with hypochlorite to form monochloramine. Monochloramine reacts with HBA, in the presence of sodium nitro-ferricyanide, to form a green colored complex. This test method measures the sum of free ammonia and monochloramine. High levels of ammonia can produce false low or off color test results. Dilute the sample if the ammonia concentration is suspected to significantly exceed the test range.

1. CHEMets is a registered trademark of CHEMetrics, Inc. U.S. Patent No. 3,634,038
2. Krom, Michael D., Spectrophotometric Determination of Ammonia: A study of a Modified Berthelot Reduction Using Salicylate and Dichloroisocyanurate, *The Analyst*, V105 pp. 305-316, 1980.

Safety Information

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

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



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. 2

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 CHEMets ampoule tip.
6. Insert the CHEMets 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 CHEMets 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 CHEMets assembly from the reaction tube.
8. Remove the flexible tubing from the CHEMets ampoule and wipe all liquid from the exterior of the ampoule. Place an ampoule cap firmly onto the tip of the CHEMets ampoule. Invert the ampoule several times, allowing the bubble to travel from end to end.

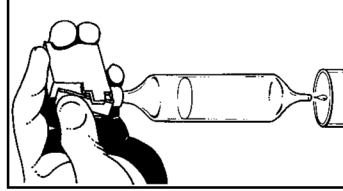


Figure 1

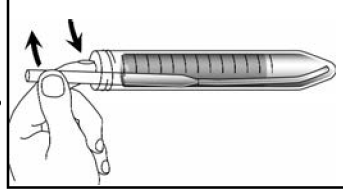


Figure 2

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

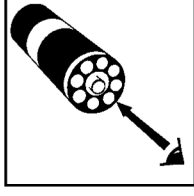


Figure 3

Tip Breaker

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

Test Method

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

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

Safety Information

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



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Feb. 18, Rev. 10

Chlorine, Free and Total, Low Range

DOC316.53.01450

USEPA DPD Method¹

Method 8021 (free) 8167 (total)

0.02 to 2.00 mg/L Cl₂ (LR)

Powder Pillows or AccuVac[®] Ampuls

Scope and application: For testing residual chlorine and chloramines in water, wastewater, estuary water and seawater; USEPA-accepted for reporting for drinking and wastewater analyses.² This product has not been evaluated to test for chlorine and chloramines in medical applications in the United States.

¹ Adapted from Standard Methods for the Examination of Water and Wastewater.

² Procedure is equivalent to USEPA and Standard Method 4500-Cl G for drinking water and wastewater analysis.



Test preparation

Before starting

Analyze the samples immediately. The samples cannot be preserved for later analysis.

Always do tests in sample cells or AccuVac[®] Ampuls. Do not put the instrument in the sample or pour the sample into the cell holder.

Make sure that the sample cells are clean and there are no scratches where the light passes through them.

Rinse the sample cell and cap with the sample three times before the sample cell is filled.

Make sure that there are no fingerprints or liquid on the external surface of the sample cells or AccuVac[®] Ampuls. Wipe with a lint-free cloth before measurement.

Cold waters can cause condensation on the sample cell or bubbles in the sample cell during color development. Examine the sample cell for condensation or bubbles. Remove condensation with a lint-free cloth. Invert the sample cell to remove bubbles.

Install the instrument cap over the cell holder before ZERO or READ is pushed.

After the test, immediately empty and rinse the sample cell. Rinse the sample cell and cap three times with deionized water.

Do not use the same sample cells for free and total chlorine. If trace iodide from the total chlorine reagent is carried over into the free chlorine determination, monochloramine will interfere. It is best to use separate, dedicated sample cells for free and total chlorine measurements.

If the test result is over-range, or if the sample temporarily turns yellow after the reagent addition, dilute the sample with a known volume of high quality, chlorine demand-free water and do the test again. Some loss of chlorine may occur due to the dilution. Multiply the result by the dilution factor. Additional methods are available to measure chlorine without dilution.

For the best results, measure the reagent blank value for each new lot of reagent. Replace the sample with deionized water in the test procedure to determine the reagent blank value. Subtract the reagent blank value from the sample results.

The AccuVac Ampul Snapper makes AccuVac Ampul tests easier to do. The AccuVac Ampul Snapper keeps the broken tip of the ampul, prevents exposure to the sample and provides controlled conditions for filling the ampule.

An AccuVac Ampul for Blanks can be used to zero the instrument in the AccuVac test procedure.

The SwifTest Dispenser for Free Chlorine or Total Chlorine can be used in place of the powder pillow in the test procedures. One dispensation equals one powder pillow for 10-mL samples.

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

Dispose of reacted solutions according to local, state and federal regulations. Refer to the Safety Data Sheets for disposal information for unused reagents. Refer to the environmental, health and safety staff for your facility and/or local regulatory agencies for further disposal information.

Items to collect

Powder pillows

Description	Quantity
Chlorine, Free: DPD Free Chlorine Reagent Powder Pillows, 10-mL	1
Chlorine, Total: DPD Total Chlorine Reagent Powder Pillows, 10-mL	1
Sample cells, 25-mm (10 mL)	2

Refer to [Consumables and replacement items](#) on page 7 for order information.

AccuVac Ampuls

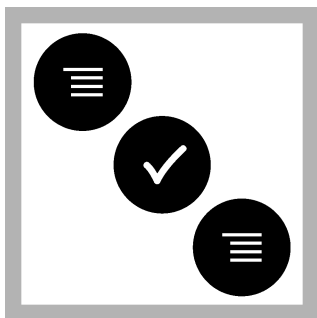
Description	Quantity
Chlorine, Free: DPD Free Chlorine Reagent AccuVac Ampuls	1
Chlorine, Total: DPD Total Chlorine Reagent AccuVac Ampuls	1
Beaker, 50-mL	1
Stopper for 18-mm tubes and AccuVac Ampuls	1
Sample cells, 25-mm (10 mL)	1

Refer to [Consumables and replacement items](#) on page 7 for order information.

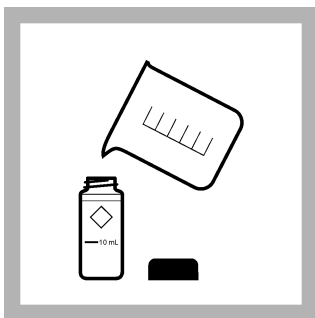
Sample collection

- Analyze the samples immediately. The samples cannot be preserved for later analysis.
- Chlorine is a strong oxidizing agent and is unstable in natural waters. Chlorine reacts quickly with various inorganic compounds and more slowly with organic compounds. Many factors, including reactant concentrations, sunlight, pH, temperature and salinity influence the decomposition of chlorine in water.
- Collect samples in clean glass bottles. Do not use plastic containers because these can have a large chlorine demand.
- Pretreat glass sample containers to remove chlorine demand. Soak the containers in a weak bleach solution (1 mL commercial bleach to 1 liter of deionized water) for at least 1 hour. Rinse fully with deionized or distilled water. If sample containers are rinsed fully with deionized or distilled water after use, only occasional pretreatment is necessary.
- Make sure to get a representative sample. If the sample is taken from a spigot or faucet, let the water flow for at least 5 minutes. Let the container overflow with the sample several times and then put the cap on the sample container so that there is no headspace (air) above the sample.

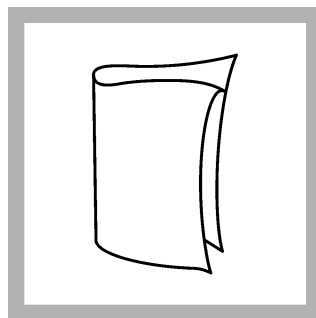
Powder pillow procedure



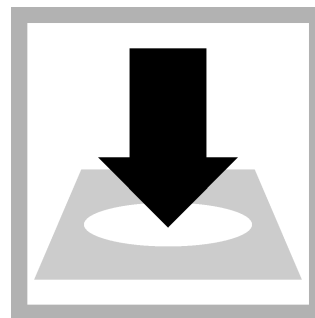
1. Set the instrument to low range (LR). Refer to the instrument documentation.



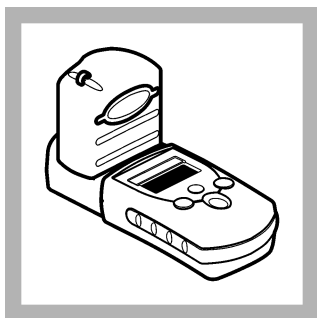
2. **Prepare the blank:** Fill a sample cell to the 10-mL mark with sample. Close the sample cell.



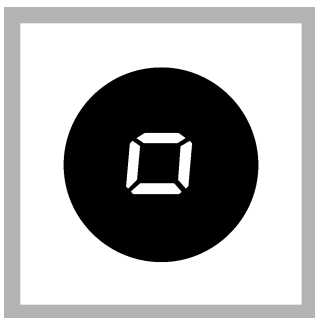
3. Clean the blank sample cell.



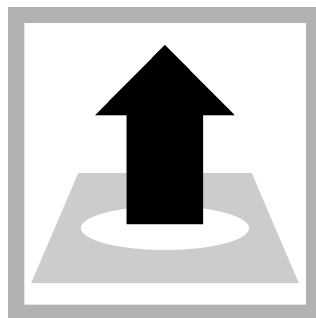
4. Insert the blank into the cell holder. Point the diamond mark on the sample cell toward the keypad.



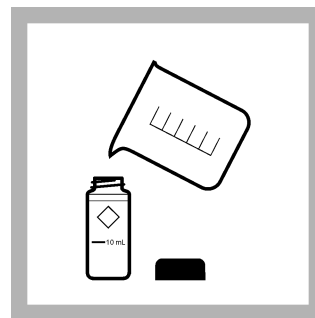
5. Install the instrument cap over the cell holder.



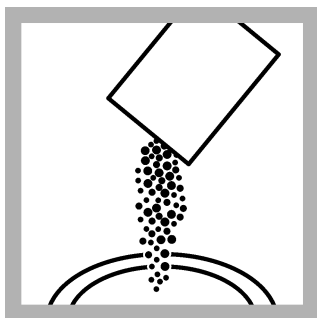
6. Push **ZERO**. The display shows "0.00".



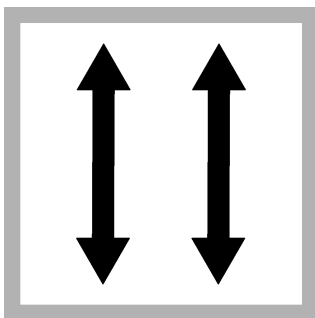
7. Remove the sample cell from the cell holder.



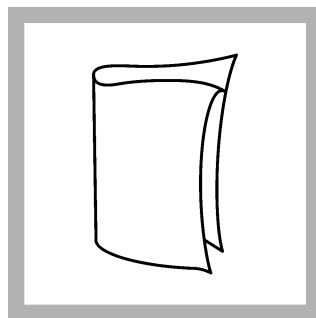
8. **Prepare the sample:** Fill a second sample cell to the 10-mL mark with sample.



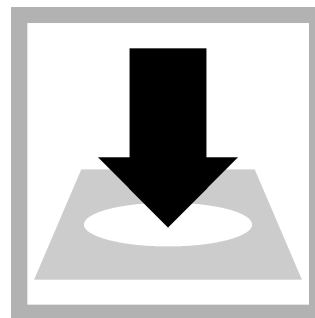
9. Add one 10-mL DPD Free Chlorine Reagent Powder Pillow or one 10-mL DPD Total Chlorine Reagent Powder Pillow to the second sample cell.



10. Close the sample cell. Shake the sample cell for about **20 seconds** to dissolve the reagent. Undissolved powder will not affect accuracy.
A pink color will show if chlorine is in the sample.



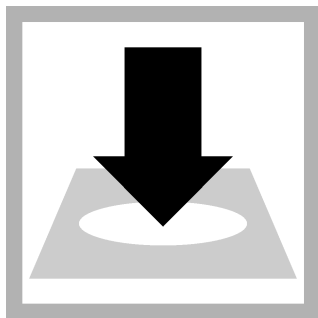
11. Clean the prepared sample cell.



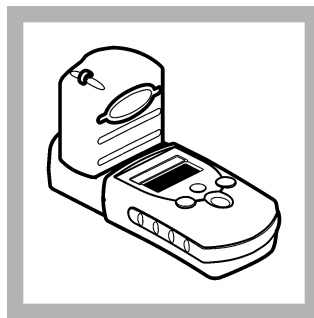
12. **Free chlorine measurement:** Within 1 minute of the reagent addition, insert the prepared sample into the cell holder. Point the diamond mark on the sample cell toward the keypad.
Go to step 15.



13. Set and start a timer for 3 minutes. A 3-minute reaction time starts.



14. Total chlorine measurement: After 3 minutes and within 6 minutes of the reagent addition, insert the prepared sample into the cell holder. Point the diamond mark on the sample cell toward the keypad.

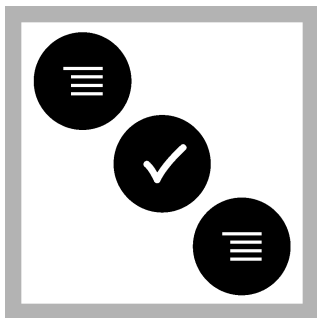


15. Install the instrument cap over the cell holder.

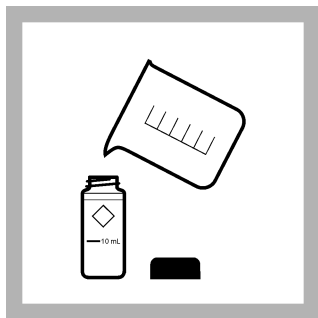


16. Push **READ**. Results show in mg/L Cl_2 .

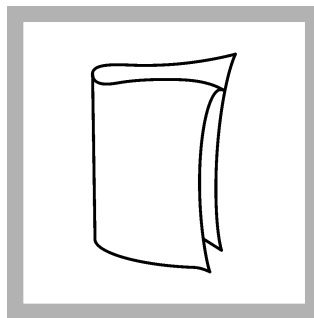
AccuVac[®] Ampul procedure



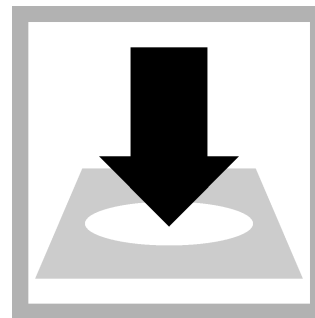
1. Set the instrument to low range (LR). Refer to the instrument documentation.



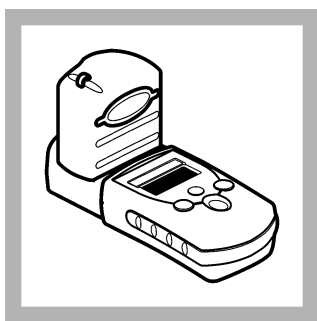
2. Prepare the blank: Fill a sample cell to the 10-mL mark with sample. Close the sample cell.



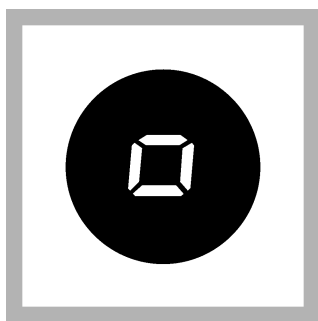
3. Clean the blank sample cell.



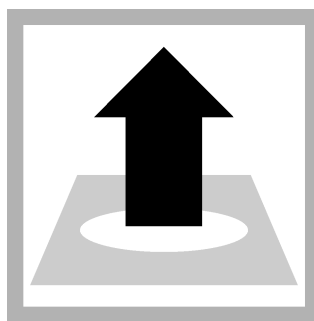
4. Insert the blank into the cell holder. Point the diamond mark on the sample cell toward the keypad.



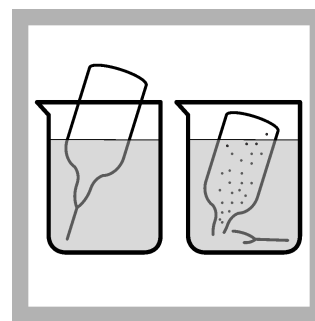
5. Install the instrument cap over the cell holder.



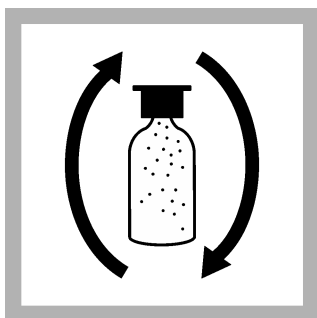
6. Push **ZERO**. The display shows "0.00".



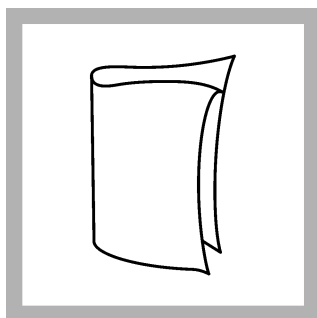
7. Remove the sample cell from the cell holder.



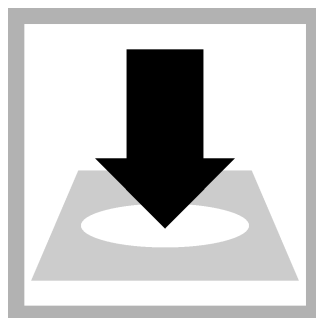
8. Prepare the sample: Collect at least 40 mL of sample in a 50-mL beaker. Fill a DPD Free Chlorine Reagent AccuVac Ampul or a DPD Total Chlorine Reagent AccuVac Ampul with sample. Keep the tip immersed while the AccuVac Ampul fills completely.



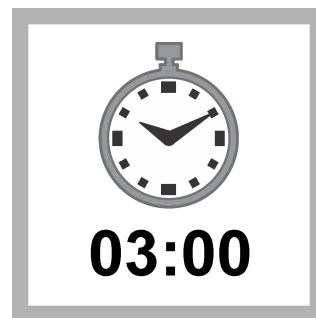
9. Quickly invert the AccuVac Ampul several times to mix.



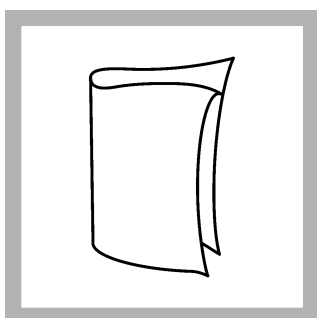
10. Clean the AccuVac Ampul.



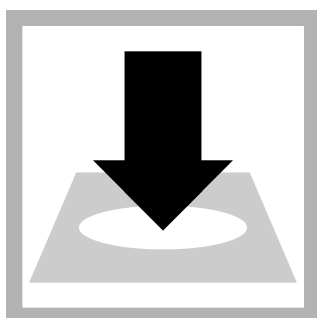
11. Free chlorine measurement: Within 1 minute of the reagent addition, insert the prepared sample AccuVac Ampul into the cell holder.
Go to step 15.



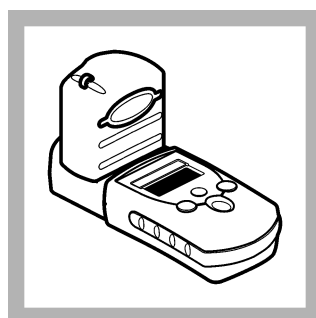
12. Set and start a timer for 3 minutes. A 3-minute reaction time starts.



13. When the timer expires, clean the prepared sample cell.



14. Total chlorine measurement: Within 6 minutes of the reagent addition, insert the prepared sample AccuVac Ampul into the cell holder.



15. Install the instrument cap over the cell holder.



16. Push **READ**. Results show in mg/L Cl₂.

Interferences

Interfering substance	Interference level
Acidity	More than 150 mg/L CaCO ₃ . The full color may not develop or the color may fade instantly. Adjust to pH 6–7 with 1 N Sodium Hydroxide. Measure the amount to add on a separate sample aliquot, then add the same amount to the sample that is tested. Correct the test result for the dilution from the volume addition.
Alkalinity	More than 250 mg/L CaCO ₃ . The full color may not develop or the color may fade instantly. Adjust to pH 6–7 with 1 N Sulfuric Acid. Measure the amount to add on a separate sample aliquot, then add the same amount to the sample that is tested. Correct the test result for the dilution from the volume addition.
Bromine, Br ₂	Positive interference at all levels
Chlorine Dioxide, ClO ₂	Positive interference at all levels
Inorganic chloramines	Positive interference at all levels
Chloramines, organic	May interfere
Hardness	No effect at less than 1000 mg/L as CaCO ₃

Interfering substance	Interference level
Manganese, Oxidized (Mn ⁴⁺ , Mn ⁷⁺) or Chromium, Oxidized (Cr ⁶⁺)	Pre-treat the sample as follows: <ol style="list-style-type: none"> 1. Adjust the sample pH to 6–7. 2. Add 3 drops of Potassium Iodide (30-g/L) to 10 mL of sample. 3. Mix and wait 1 minute. 4. Add 3 drops of Sodium Arsenite (5-g/L) and mix. 5. Use the test procedure to measure the concentration of the treated sample. 6. Subtract this result from the result without the treatment to obtain the correct chlorine concentration.
Monochloramine	Causes a gradual drift to higher readings. When read within 1 minute after reagent addition, 3 mg/L monochloramine causes less than a 0.1 mg/L increase in the reading.
Ozone	Positive interference at all levels
Peroxides	May interfere
Highly buffered samples or extreme sample pH	Can prevent the correct pH adjustment (of the sample) by the reagents. Sample pretreatment may be necessary. Adjust to pH 6–7 with acid (Sulfuric Acid, 1 N) or base (Sodium Hydroxide, 1 N). Correct the test result for the dilution caused by the volume additions.

Pollution prevention and waste management

If sodium arsenite was added to the sample for manganese or chromium interferences, the reacted samples will contain arsenic and must be disposed of as a hazardous waste. Dispose of reacted solutions according to local, state and federal regulations. must be disposed of as a hazardous waste. Dispose of reacted solutions according to local, state and federal regulations.

Accuracy check

Standard additions method

Use the standard additions method to validate the test procedure, reagents and instrument and to find if there is an interference in the sample.

Items to collect:

- Chlorine Standard Solution, 2-mL PourRite[®] Ampule, 25–30 mg/L (use mg/L on label)
 - Ampule breaker
 - Pipet, TenSette[®], 0.1–1.0 mL and tips
1. Prepare three spiked samples: use the TenSette pipet to add 0.1 mL, 0.2 mL and 0.3 mL of the standard solution, respectively, to three 10-mL portions of fresh sample. Mix well.
Note: For AccuVac[®] Ampuls, add 0.4 mL, 0.8 mL and 1.2 mL of the standard solution to three 50-mL portions of fresh sample.
 2. Use the test procedure to measure the concentration of each of the spiked samples. Start with the smallest sample spike. Measure each of the spiked samples in the instrument.
 3. Compare the expected result to the actual result. The expected increase in the chlorine concentration is the Cl₂ mg/L concentration from the label of the standard solution multiplied by 0.1 mL for every 10 mL of standard solution added.

Standard solution method

If the Standard Calibration Adjust feature is used to adjust the calibration curve of the Pocket Colorimeter II, the concentration of the chlorine standard must be between 0.50 and 1.50 mg/L chlorine for the LR procedure.

Verification of on-line analyzers

This procedure can be used to meet the requirements of USEPA Method 334.0 - Determination of Residual Chlorine in Drinking Water Using an On-line Chlorine Analyzer.

The procedure and requirements for compliance with EPA Method 334.0 can be downloaded directly from <http://www.hach.com/method334>.

Method performance

The method performance data that follows was derived from laboratory tests that were measured on a Pocket Colorimeter II during ideal test conditions. Users can get different results under different test conditions.

Precision (95% confidence interval)
1.00 ± 0.05 mg/L Cl ₂

Summary of method

Chlorine can be in water as free chlorine and as combined chlorine. Both forms can be in the same solution and can be determined together as total chlorine. Free chlorine is in a solution as hypochlorous acid or hypochlorite ion. Combined chlorine represents a combination of chlorine-containing compounds, including monochloramine, dichloramine, nitrogen trichloride and other chloro derivatives. The combined chlorine oxidizes iodide (I⁻) to iodine (I₂). The iodine and free chlorine reacts with DPD (N,N-diethyl-p-phenylenediamine) to form a red solution. The color intensity is proportional to the chlorine concentration. To determine the concentration of combined chlorine, complete a free chlorine test and a total chlorine test. Subtract the results of the free chlorine test from the total chlorine test to get the combined chlorine concentration.

Consumables and replacement items

Required reagents

Description	Quantity/test	Unit	Item no.
DPD Free Chlorine Reagent Powder Pillow, 10 mL	1	100/pkg	2105569
DPD Total Chlorine Reagent Powder Pillow, 10 mL	1	100/pkg	2105669
OR			
DPD Free Chlorine Reagent AccuVac [®] Ampul	1	25/pkg	2502025
DPD Total Chlorine Reagent AccuVac [®] Ampul	1	25/pkg	2503025

Required apparatus (powder pillows)

Description	Quantity/test	Unit	Item no.
Sample cells, 10-mL round, 25 mm x 60 mm	2	6/pkg	2427606

Required apparatus (AccuVac Ampul)

Description	Quantity/Test	Unit	Item no.
Sample cell, 10-mL round, 25 mm x 60 mm	1	6/pkg	2427606
Beaker, 50 mL	1	each	50041H
Stoppers for 18-mm tubes and AccuVac Ampuls	2	6/pkg	173106

Recommended standards and apparatus

Description	Unit	Item no.
Chlorine Standard Solution, 2-mL PourRite [®] Ampules, 25–30 mg/L	20/pkg	2630020
PourRite [®] Ampule Breaker, 2-mL	each	2484600

Optional reagents and apparatus

Description	Unit	Item no.
AccuVac [®] Ampul Snapper	each	2405200
Mixing cylinder, graduated, 25-mL	each	2088640
Potassium Iodide, 30-g/L	100 mL	34332
Sodium Arsenite, 5-g/L	100 mL	104732
Sodium Hydroxide Standard Solution, 1.0 N	100 mL MDB	104532
Sulfuric Acid Standard Solution, 1 N	100 mL MDB	127032
Pipet, TenSette [®] , 0.1–1.0 mL	each	1970001
Pipet tips for TenSette [®] Pipet, 0.1–1.0 mL	50/pkg	2185696
Pipet tips for TenSette [®] Pipet, 0.1–1.0 mL	1000/pkg	2185628
Paper, pH, 0–14 pH range	100/pkg	2601300
DPD Free Chlorine Reagent Powder Pillows, 10 mL	1000/pkg	2105528
DPD Total Chlorine Reagent Powder Pillows, 10 mL	1000/pkg	2105628
SwifTest [™] dispenser for free chlorine ¹	each	2802300
SwifTest [™] dispenser for total chlorine ²	each	2802400
DPD Free Chlorine Reagent, 10-mL, SwifTest [™] Dispenser refill vial	250 tests	2105560
DPD Total Chlorine Reagent, 10-mL, SwifTest [™] Dispenser refill vial	250 tests	2105660
SpecCheck [™] Secondary Standard Kit, Chlorine DPD, 0–2.0 mg/L Set	each	2635300
Water, organic-free	500 mL	2641549

¹ Includes one vial of 2105560 for 250 tests.

² Includes one vial of 2105660 for 250 tests.



FOR TECHNICAL ASSISTANCE, PRICE INFORMATION AND ORDERING:
 In the U.S.A. – Call toll-free 800-227-4224
 Outside the U.S.A. – Contact the HACH office or distributor serving you.
 On the Worldwide Web – www.hach.com; E-mail – techhelp@hach.com

HACH COMPANY
 WORLD HEADQUARTERS
 Telephone: (970) 669-3050
 FAX: (970) 669-2932

Appendix B

Blank Outfall Inspection and Sampling Forms

Reading, MA Outfall Inspection

Inspection Information:

Outfall ID: _____ Inspector: _____

Inspection Date: _____ Correctly Mapped: Yes No

Outfall Description:

Location Description: _____

Major Watershed: *Aberjona* *Ipswich* *Saugus* Other: _____

Pipe Material:

<i>Asbestos Cement</i>	<i>Cast Iron</i>	<i>Corrugated Metal</i>
<i>Concrete</i>	<i>Ductile Iron</i>	<i>High Density Polyethylene</i>
<i>Perforated PVC</i>	<i>Polyvinyl Chloride</i>	<i>Reinforced Concrete</i>
<i>Stone</i>	<i>Unknown</i>	<i>Vitrified Clay</i>
Other: _____		

Pipe Shape:

<i>Circular</i>	<i>Arch</i>	<i>Box Culvert</i>	<i>Elliptical</i>
<i>Horseshoe</i>	<i>Oblong</i>	<i>Rectangular</i>	<i>Trapezoidal</i>
<i>Triangular</i>	<i>Unknown</i>		
Other: _____			

Pipe Diameter (in): _____

Condition:

<i>Excellent</i>	<i>Very Good</i>	<i>Good</i>	<i>Fair</i>
<i>Poor</i>	<i>Very Poor</i>	<i>Unknown</i>	

Defects:

<i>None</i>	<i>Cracked</i>	<i>Eroded</i>	<i>Exposed Steel</i>
Other: _____			

Erosion: Yes No

Reading, MA Outfall Inspection

Outfall Description (cont):

Headwall:	<i>Yes</i>	<i>No</i>	<i>Unknown</i>		
Headwall Material:	<i>None</i>		<i>Concrete</i>	<i>Brick</i>	<i>Block</i>
	<i>Other:</i>	_____			
Flared End Section:	<i>Yes</i>	<i>No</i>	<i>Unknown</i>		
Flared End Section Material:	<i>None</i>		<i>Concrete</i>	<i>Metal</i>	
	<i>Plastic</i>		<i>Other:</i>	_____	
Wingwall:	<i>Yes</i>	<i>No</i>	<i>Unknown</i>		
Wingwall Material:	<i>None</i>		<i>Concrete</i>	<i>Brick</i>	<i>Metal</i>
	<i>Plastic</i>		<i>Other:</i>	_____	

Inspection Notes:

Inspection Comments: _____

Inspection Status: *Outfall Screening Completed, No Dry Flow*
Outfall Screening, Dry Weather Sampling Completed
Not an Outfall *Excluded Outfall* *Could Not Locate*
Access Issue - DPW Required (ie, gate) *Access Issue - Safety*
Access Issue - O&M (ie, overgrown)

Photo Information: _____

Reading, MA Outfall Dry Weather Inspection

Inspection Information:							
Outfall ID: _____	Inspector: _____						
Reason for Inspection:	<i>Initial Inspection</i>		<i>Followup Inspection</i>				
	<i>Illicit Connection Removal</i>						
Prioritization:	<i>High</i>	<i>Medium</i>	<i>Low</i>				
Inspection Date:	_____						
Dry Weather Flow:							
Last Rainfall Event Date:	_____						
Dry Weather Flow:	<i>No + no sign of dry weather flow</i>						
	<i>No + signs of dry weather flow</i>						
	<i>Yes</i>						
Flow Type:	<i>Drip</i>	<i>Trickle</i>		<i>Moderate</i>		<i>Substantial</i>	
Water Depth (in):	<i>0</i>	<i>0.5</i>	<i>1</i>	<i>1.5</i>	<i>2</i>	<i>2.5</i>	<i>3</i>
	<i>3.5</i>	<i>4</i>	<i>4.5</i>	<i>5</i>	<i>5.5</i>	<i>6+</i>	<i>Submerged</i>
Visual Inspection:							
Odor:	<i>None</i>		<i>Sewage</i>		<i>Sulfur (rotten egg)</i>		
	<i>Rancid (sour)</i>		<i>Oil/Gas</i>		<i>Chlorine (laundry, pool)</i>		
	<i>Sweet/Fruity</i>		<i>Sharp/Pungent</i>		<i>Other: _____</i>		
Color:	<i>None</i>		<i>Yellow</i>		<i>Brown</i>		<i>Green</i>
	<i>Red</i>		<i>Gray</i>		<i>Red, Purple, Blue, Black</i>		
	<i>Iron Staining</i>		<i>Other: _____</i>				
Turbidity:	<i>Clear</i>		<i>Cloudy</i>		<i>Opaque</i>		
	<i>Other: _____</i>						

Reading, MA Outfall Dry Weather Inspection

Visual Inspection (cont):

Floatables - Soap Suds:	<i>Yes</i>	<i>No</i>	
Floatables - Toilet Paper/Sewage:	<i>Yes</i>	<i>No</i>	
Floatables - Trash:	<i>Yes</i>	<i>No</i>	
Floatables - Other:	_____		
Deposits and Stains - Sediment:	<i>Yes</i>	<i>No</i>	
Deposits and Stains - Oily:	<i>Yes</i>	<i>No</i>	
Oil Sheen:	<i>Yes</i>	<i>No</i>	
Vegetation:	<i>None</i>	<i>Excessive Growth</i>	<i>Inhibited/Stressed Growth</i>
Scum:	<i>Yes</i>	<i>No</i>	
Pipe Benthic Growth:	<i>None</i>	<i>Brown</i>	<i>Orange/Red</i> <i>Green</i>

Probe and Field Test Kits:

Sampling Location: *Outfall* *Upstream Manhole* *Upstream Catch Basin*
 Other: _____

Temperature (deg C): _____ pH: _____

Conductivity (uS/cm): _____ Salinity (mg/L): _____

Chlorine (mg/L): _____ Ammonia (mg/L): _____

Surfactants (mg/L): _____ Total Phosphorus: _____

Bacteria (cfu/100mL): _____

Reading, MA Outfall Dry Weather Inspection

Inspection Notes:

Inspection Comments:

Next Steps:

- None*
- Catchment Investigation (High Priority)*
- Catchment Investigation (Medium Priority)*
- Catchment Investigatin (Low Priority)*
- Dry Weather Flow*
- Wet Weather Flow*

Photo Information:

Appendix C

Summary of 2018 Reading Dry Weather Outfall Sampling Results

Appendix C - Summary of 2018 Reading Dry Weather Outfall Sampling Analytical Results

Outfall ID	Outfall ID (2)	Date of Sample	Temperature (deg C)	pH	Conductivity (uS/cm)	Salinity (mg/L)	E. Coli (MPN/100 ml)	Phosphorus (mg/l)	Chlorine (mg/L)	Ammonia (mg/L)	Surfactants (mg/L)	Likely Influence of Sewage
A014	swDS-70	9/6/2018	23.0	6.78	694	0.35	77	0.02	0.00	0.00	0.50	NO
A016	swDS-72	9/6/2018	20.1	6.58	897	0.49	650	0.03	0.00	0.00	0.25	NO
A017	swDS-73	10/10/2018	22.8	6.03	1,415	0.75	43	0.22	1.52	0.50	0.50	YES
A018	swDS-74	9/6/2018	24.9	7.17	1,139	0.56	1	0.05	0.00	0.00	0.25	NO
A020	swDS-76	9/17/2018	22.0	7.00	448	0.23	<1	0.03	1.00	0.25	0.50	NO
A023	swDS-85	10/9/2018	16.5	5.89	1,913	1.18	210	0.05	0.20	0.25	2.00	NO
A030	swDS-204	10/9/2018	17.0	6.38	575	0.33	350	0.08	0.03	0.00	0.50	NO
A033	swDS-99	9/17/2018	22.9	6.13	815	0.43	180,000	0.56	0.00	4.00	1.50	YES
A050	swDS-226	9/5/2018	21.8	5.17	2,840	1.49	10	0.11	0.07	0.00	0.50	NO
A051	swDS-227	9/5/2018	24.0	ERROR ²	1,092	0.55	6	0.02	0.01	0.00	0.25	NO
A052	swDS-228	9/5/2018	23.3	6.55	1,097	0.56	6	0.06	0.03	0.00	0.25	NO
A073	swDS-62	9/5/2018	23.0	7.11	756	0.38	69	0.04	0.07	0.00	0.25	NO
A075	swDS-61	9/5/2018	18.3	7.18	1,180	0.68	13,000	0.02	0.02	0.00	0.25	NO
A076	swDS-60	9/5/2018	20.4	7.10	1,073	0.53	2,400	0.01	0.00	0.00	0.25	NO
A077	swDS-59	9/5/2018	19.1	7.25	1,037	0.51	550	0.02	0.00	0.00	0.25	NO
A083	swDS-217	8/28/2018	17.4	6.36	821	0.48	46	0.02	0.00	0.00	0.25	NO
A087	swDS-213	9/5/2018	23.8	6.83	1,782	0.90	250	0.04	0.00	0.00	0.25	NO
I003	swDS-87	10/9/2018	18.8	6.20	1,420	0.80	320	N/A	0.09	0.00	1.50	NO
I014	swDS-107	8/28/2018	24.4	7.02	858	0.42	230	N/A	0.05	0.75	0.25	YES
I017	swDS-241	9/17/2018	21.7	6.97	772	0.40	2,900	N/A	0.02	0.00	0.25	NO
I019 ¹	swDS-112	9/17/2018	20.3	7.13	768	0.42	340	N/A	0.04	0.25	0.25	NO
I025	swDS-138	8/28/2018	24.7	7.73	667	677.00	71	N/A	0.02	0.00	0.25	NO
I039 ¹	swDS-240	9/17/2018	20.3	7.13	768	0.42	340	N/A	0.04	0.25	0.25	NO
I062	swDS-365	10/9/2018	19.0	6.16	522	0.29	<1	N/A	2.20	0.00	3.00	NO
I067	swDS-148	8/29/2018	28.9	6.55	21	0.01	15	N/A	0.00	0.00	0.25	NO
I102	swDS-180	10/10/2018	18.8	5.93	900	0.51	35	N/A	0.03	0.00	0.25	NO
I139	swDS-293	8/30/2018	20.5	6.64	673	0.34	32	N/A	0.03	0.00	0.25	NO
S001	swDS-1	8/29/2018	27.9	7.04	1,078	0.50	1,400	N/A	0.00	0.25	0.50	NO
S005	swDS-5	8/29/2018	0.5	6.95	1,260	0.72	3,200	N/A	0.00	0.25	0.50	NO
S008	swDS-8	8/27/2018	27.5	7.39	1,603	0.76	2,400	N/A	0.00	0.00	0.50	NO
S013	swDS-13	8/28/2018	18.6	6.64	812	0.46	14,000	N/A	0.00	2.00	0.25	YES
S014	swDS-14	10/10/2018	29.9	5.88	1,888	1.02	26	N/A	0.02	0.00	0.50	NO
S022	swDS-56	8/27/2018	23.3	7.36	1,559	0.81	1,300	N/A	0.30	0.25	0.00	NO
S033	swDS-32	8/30/2018	21.9	7.02	498	0.26	45	N/A	0.00	0.00	0.50	NO
S035	swDS-362	8/27/2018	24.3	6.71	1,272	0.64	1,600	N/A	0.00	0.00	0.25	NO
S048	swDS-124	8/27/2018	19.9	7.05	1,278	0.71	1,000	N/A	0.00	0.00	0.50	NO
S049	swDS-34	8/29/2018	26.6	7.17	670	0.31	690	N/A	0.00	0.00	0.25	NO
S056	swDS-41	8/29/2018	20.3	6.70	996	0.54	1,600	N/A	0.00	0.00	0.50	NO
S060	swDS-324	8/30/2018	25.1	6.79	1,044	0.51	520	N/A	0.30	1.25	1.50	YES
S065	swDS-125	8/28/2018	18.7	6.73	810	0.45	3,200	N/A	0.00	0.25	0.25	NO
S085	swDS-185	8/30/2018	23.8	7.01	621	0.31	2,400	N/A	0.00	0.00	0.25	NO
S087	swDS-190	8/30/2018	24.1	6.96	637	0.31	72	N/A	0.00	0.00	0.50	NO

- 1) A composite Sample was taken of I019 & I039 due to the surcharged condition of the outfall
 2) ERROR was noted for a pH data point that was outside the possible scale

 Problem Outfall
 High Priority Outfall

Bolded Values are Based on the Below Thresholds

pH (threshold: less than or equal to 5, greater than or equal to 9)
 Conductivity (uS/cm - threshold: greater than or equal to 2,000 uS/cm)
 Chlorine (mg/L - threshold: greater than or equal to 0.02 mg/L)

Ammonia (mg/L - threshold: greater than or equal to 0.50 mg/L)
 Surfactants (mg/L - threshold: greater than or equal to 0.25 mg/L)
 E. Coli (MPN/100 mL - threshold: greater than 235 MPN/ 100 mL)

Appendix D

Comparison of 2012/2013 Dry Weather Sampling with 2018 Sampling Program

Appendix D - Comparison of 2012/2013 Dry Weather Sampling with 2018 Outfall Sampling Program

Outfall ID	Location	2012/2013 Dry Weather Outfall Sampling Results (Flowing Only)							2018 Dry Weather Outfall Sampling Results (Flowing Only)							
		Date of Sample	Temperature (deg C)	pH	Conductivity (uS/cm)	E. Coli (MPN/100 ml)	Ammonia (mg/L)	Surfactants (mg/L)	Date of Sample	Temperature (deg C)	pH	Conductivity (uS/cm)	E. Coli (MPN/100 ml)	Chlorine (mg/L)	Ammonia (mg/L)	Surfactants (mg/L)
A014	65 Winslow Road	6/17/2013					0	0	9/6/2018	23.03	6.78	694	77	0.00	0.00	0.50
A016	97 Arcadia Avenue	6/17/2013	18.6	7.34	1270		0	Trace	9/6/2018	20.14	6.58	897	650	0.00	0.00	0.25
A018	35 Arcadia Avenue	6/17/2013	19.3	7.59	1333	44	0	0.25	9/6/2018	24.92	7.17	1,139	1	0.00	0.00	0.25
A019	West Street at Willow Street	6/5/2013	17.2	6.75	728		0.5	0.5	Access Issues							
A020	West Street at Willow Street	6/5/2013	16.1	7.2	585	96	0.0	0	9/17/2018	22.02	7.00	448	<1	1.00	0.25	0.50
A050	County Road #194	6/24/2013	16.6	6.28	2340	68	Trace	Trace	9/5/2018	21.75	5.17	2,840	10	0.07	0.00	0.50
A051	Lisa Lane #33	6/24/2013	19.5	6.97	907		0	Trace	9/5/2018	23.98	ERROR ¹	1,092	6	0.01	0.00	0.25
A052	Randall Road #32	6/24/2013	15.9	6.55	939	5.2	0	Trace	9/5/2018	23.29	6.55	1,097	6	0.03	0.00	0.25
A071	Pine Ridge Road #94	7/8/2013				57	Trace	0	Outfall Screening Completed, No Dry Flow							
A076	Hemlock Road #47	7/8/2013	19.2	7.1	700		0	Trace	9/5/2018	20.41	7.10	1,073	2,400	0.00	0.00	0.25
A084	Indian Tree Lane #47	6/24/2013	16.9	6.12	7.69		0	0	Outfall Screening Completed, No Dry Flow							
A086	Milepost Road #16	7/8/2013	18.7	7.25	920		0	0	Outfall Screening Completed, No Dry Flow							
A087	Haystack Road #29	7/8/2013				15	Trace	Trace	9/5/2018	23.83	6.83	1,782	250	0.00	0.00	0.25
A091	South Street #117	7/8/2013	18.4	7.15	1010		0	0	Outfall Screening Completed, No Dry Flow							
A094	South Street #15	6/24/2013					0	0	Outfall Screening Completed, No Dry Flow							
S018	Cross Street #13	8/13/2012	21.5	7.04	800		0.0	Trace	Outfall Screening Completed, No Dry Flow							
S022	Summer Street #512	8/13/2012	23.6	7.5	1150	4200	2.0	0.5	8/27/2018	23.30	7.36	1,559	1,300	0.30	0.25	0.00
S035	Washington and Elliot Street	9/12/2012	19.6	6.8	1025	870	0.2	0.25	8/27/2018	24.30	6.71	1,272	1,600	0.00	0.00	0.25
S042	Across Route 129 and 95 Rotary	9/12/2012	19.9	7.7	620		Trace	0.25	Access Issues							
S065	Warren Street	9/12/2012	20	7.05	870	Submerged	0.3	0.25	8/28/2018	18.70	6.73	810	3,200	0.00	0.25	0.25
S099	MH at 13 Temple Street	6/17/2013				24	0.0	Trace	Outfall Screening Completed, No Dry Flow							
S158	Walker Brook Drive @ Starbucks	8/21/2012	-	7.2	110		0	0.25	Excluded Outfall							
N/A	Gould Street at E.M.I.	9/12/2012	23.2	7.5	1070	920	0.2	Trace	Removed Outfall							
N/A	MH at 23 Temple Street	6/17/2013					0.0	Trace	Removed Outfall							
N/A	Walker Brook @ Home Depot	8/21/2012	24.5	7.17	700		0.2	Trace	Removed Outfall							
N/A	Walker Brook @ Jordans	8/21/2012	24.1	7	1400	<1	0.2	0.25	Removed Outfall							
N/A	Walker Brook Drive @ Chilis	8/21/2012	-	-	-		0.0	0.0	Removed Outfall							
N/A	West Street at Willow Street	6/5/2013	15.2	6.57	1317		0	0.25	Removed Outfall							
N/A	1-13.1	6/5/2013	15.6	6.75	825		0	0.5	Removed Outfall							

1) ERROR was noted for a pH data point that was outside the possible scale

Bolded Values are Based on the Below Thresholds

pH (threshold: less than or equal to 5, greater than or equal to 9)

Conductivity (uS/cm - threshold: greater than or equal to 2,000 uS/cm)

Chlorine (mg/L - threshold: greater than or equal to 0.02 mg/L)

Problem Outfall
 High Priority Outfall

Ammonia (mg/L - threshold: greater than or equal to 0.50 mg/L)

Surfactants (mg/L - threshold: greater than or equal to 0.25 mg/L)

E. Coli (MPN/100 mL - threshold: greater than 235 MPN/ 100 mL)

Appendix E

List of Uninspected MS4 Outfalls

Appendix E - Unscreened Outfalls

System Identifier	Facility Identifier	Inspection Status
A005	swDS-80	Access Issue - Safety
A019	swDS-75	Access Issue - Safety
A025	swDS-92	Access Issue - Safety
A045	swDS-165	Access Issue - Safety
A049	swDS-183	Access Issue - Safety
A057	swDS-236	Access Issue - Safety
I083	swDS-151	Access Issue - Safety
S029	swDS-28	Access Issue - Safety
S037	swDS-46	Access Issue - Safety
S042	swDS-51	Access Issue - Safety
S044	swDS-53	Access Issue - Safety
S046	swDS-55	Access Issue - Safety
S126	swDS-359	Access Issue - Safety
A015	swDS-71	Access Issue - O&M
A078	swDS-57	Access Issue - O&M
I098	swDS-174	Access Issue - O&M
I109	swDS-194	Access Issue - O&M
S063	swDS-207	Access Issue - O&M
A002	swDS-208	Could Not Locate
I006	swDS-89	Could Not Locate
I031	swDS-145	Could Not Locate
I103	swDS-187	Could Not Locate
I127	swDS-274	Could Not Locate
S004	swDS-4	Could Not Locate
S006	swDS-6	Could Not Locate
S011	swDS-11	Could Not Locate
S015	swDS-15	Could Not Locate
S108	swDS-315	Could Not Locate
S117	swDS-325	Could Not Locate

Summary	
Could Not Locate	11
Access Issue - Safety	13
Access Issue - O&M	5
Total	29

Appendix F

MS4 Schedule of Submittals/Deadlines



STORMWATER

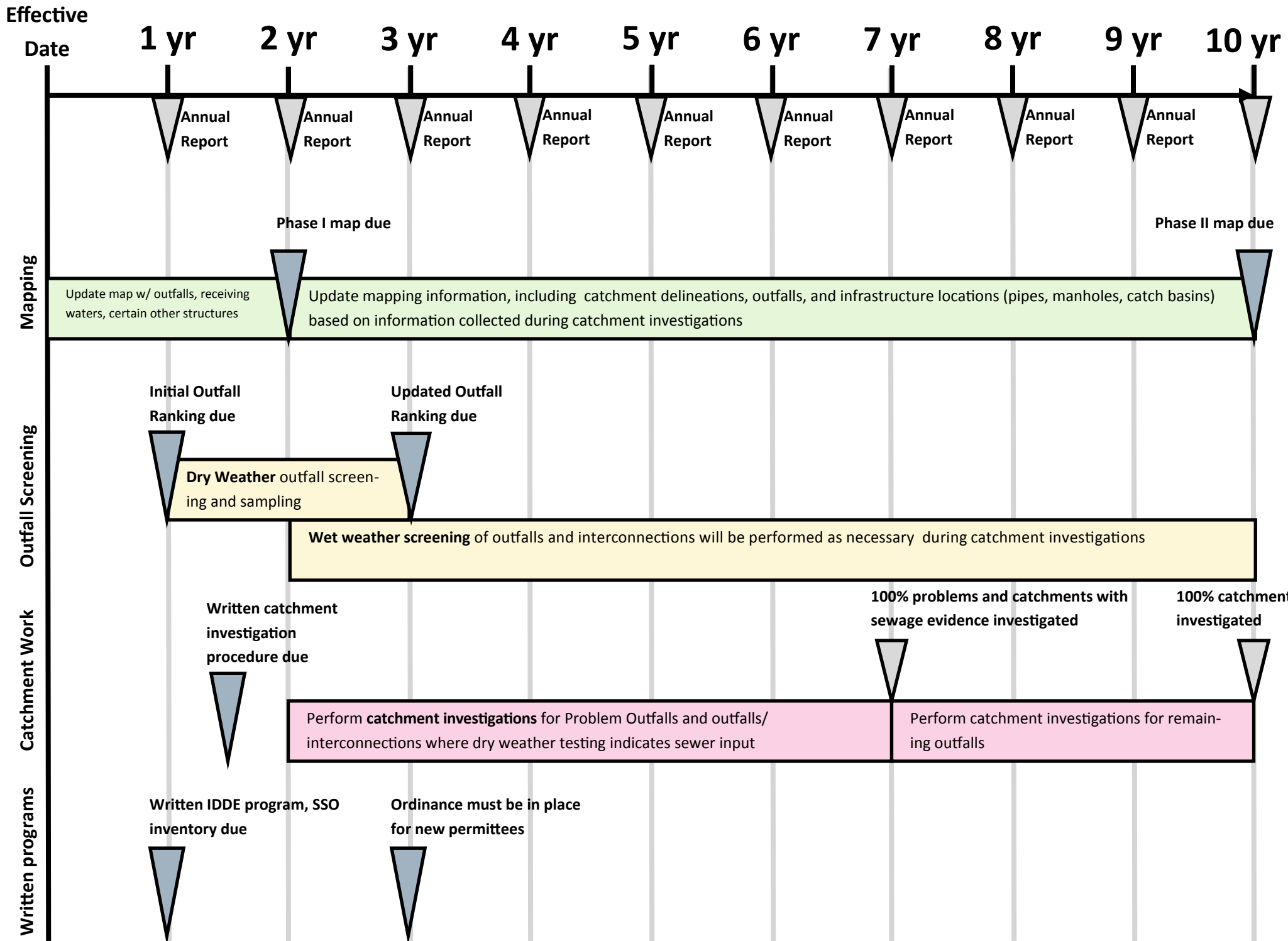
Stormwater Management

Massachusetts MS4 Permit, First Year Requirements

U.S. EPA | STORMWATER OUTREACH IN MASSACHUSETTS

Completion Due Date	Requirement	Task	Permit section for reference
10/1/2018	Notice of Intent (NOI)	Prepare and Submit NOI for Permit Coverage 90 days from the permit effective date.	Appendix E
6/30/2019	Prepare Stormwater Management Plan (SWMP)	Develop/update written SWMP.	1.10.a & 1.10.2
6/30/2019	Illicit Discharge Detection and Elimination (IDDE)	Complete written IDDE procedures and rank outfalls for IDDE investigation. Document Sanitary Sewer Overflows to the MS4 during the past 5 years.	2.3.4.6 & 2.3.4.7 2.3.4.4.b
6/30/2019	Construction Site Runoff Control	Create written procedures for inspecting construction sites for proper sediment controls and conducting site plan reviews.	2.3.5
6/30/2019	Catch Basin Cleaning	Develop and implement a catch basin cleaning schedule with a goal of ensuring no catch basin is more than 50% full. Document catch basins inspected and cleaned, including total mass removed and proper disposal.	2.3.7.a.iii.2
6/30/2019	Street Sweeping	Sweep streets (rural and uncurbed exceptions apply) a minimum of once a year in the spring. Each annual report shall include number of miles cleaned and volume or mass of material removed.	2.3.7.a.iii.3
6/30/2019	Winter Road Maintenance	Develop and implement winter road maintenance procedures including use and storage of salt and sand, minimize the use of salts, ensure that snow is not disposed into waters.	2.3.7.a.iii.5
6/30/2019	Stormwater infrastructure maintenance	Inspect all stormwater treatment structures (excluding catch basins) at least annually and conduct maintenance as necessary.	2.3.7.a.iii.6

<https://www.epa.gov/npdes-permits/massachusetts-small-ms4-general-permit>





Memorandum

To: Ryan Percival, P.E., Town Engineer
Alex Rozycki, P.E., Sr. Civil Engineer

From: Anne Malenfant, P.E., PMP
Tom Waterfield
Denise Prussen

Date: September 15, 2021

Subject: 2021 Reading MS4 Outfall Dry Weather Sampling & Catchment Investigation Program

CDM Smith and the Town of Reading, Massachusetts (Town) developed a 2021 dry-weather outfall sampling and catchment investigation program in accordance with the United States Environmental Protection Agency Region 1 (USEPA) issued General Permits (Permit) for Stormwater Discharges from Small Municipal Storm Sewer Systems (MS4) in Massachusetts. The Permit (found in **Attachment G**) was issued April 4, 2016 with an effective date of July 1, 2018. This Permit requires dry-weather sampling to be completed at all MS4 outfalls and interconnections by June 30, 2021. However, to comply with the permit and to gain a clearer understanding of their system, the Town performed their dry-weather sampling program during the first year of their Permit (2018). The dry weather sampling for this period (2021) was categorized as follow up sampling to see how parameter levels have changed since 2018 and to prioritize locations for catchment investigations.

This memorandum summarizes the Town's 2021 dry-weather outfall sampling program, catchment investigations, and next steps. The Town has been proactive in implementing its dry-weather outfall screening program and is generally ahead of the permit requirements.

Dry-Weather MS4 Outfall Field Inspection Program

Dry-Weather Sampling – Outfall Selection

Based on the 2018 outfall screening and sampling results, Reading identified 18 Town-owned MS4 outfalls for follow-up dry weather sampling as shown below in **Table 1**. Of these 18, five are problem outfalls and 13 are high priority outfalls. *Problem Outfalls* are defined as outfalls exceeding the following parameters: ammonia levels ≥ 0.5 mg/L, surfactant levels ≥ 0.25 mg/L, E. coli levels ≥ 235 cfu/100 mL or “detectable” chlorine. *High Priority Outfalls* are those that discharge to an area with public health concerns or anecdotal knowledge supplied by the Town.

Table 1 – Outfalls Identified for the 2021 Sampling Program based on 2018 Results

Outfall ID	Outfall ID (2)	Date of Sample	Phosphorus (mg/L)	E. Coli (cfu/100 ml)	Chlorine (mg/L)	Ammonia (mg/L)	Surfactants (mg/L)
A017	swDS-73	10/10/2018	0.222	43	1.52	0.5	0.5
A033	swDS-99	9/17/2018	0.555	180,000	0.00	4	1.5
I014	swDS-107	8/28/2018	N/A	230	0.05	0.75	0.25
S013	swDS-13	8/28/2018	N/A	14,000	0.00	2	0.25
S060	swDS-324	8/30/2018	N/A	520	0.30	1.25	1.5
A075	swDS-61	9/5/2018	0.016	13,000	0.02	0	0.25
A076	swDS-60	9/5/2018	0.014	2,400	0.00	0	0.25
S005	swDS-5	8/29/2018	N/A	3,200	0.00	0.3	0.5
I017	swDS-241	9/17/2018	N/A	2,900	0.02	0	0.25
S001	swDS-1	8/29/2018	N/A	1,400	0.00	0.25	0.5
S008	swDS-8	8/27/20118	N/A	2,400	0.00	0	0.5
S035	swDS-362	8/27/20118	N/A	1,600	0.00	0	0.25
S048	swDS-124	8/27/20118	N/A	1,000	0.00	0	0.5
S056	swDS-41	8/29/2018	N/A	1,600	0.00	0	0.5
S065	swDS-125	8/28/2018	N/A	3,200	0.00	0.25	0.25
S085	swDS-185	8/30/2018	N/A	2,400	0.00	0	0.25
S049	swDS-34	8/29/2018	N/A	690	0.00	0	0.25
S022	swDS-56	8/27/20118	N/A	1,300	0.30	0.25	0

Project Kickoff Meeting

The field program was kicked off on May 11th, 2021. At the kickoff meeting, CDM Smith and the Town discussed the following:

- General outfall screening procedures,
- Sampling kit purchases,
- The Town’s phosphorus sampling requirements for outfalls in the Aberjona River watershed,
- Overall schedule including antecedent rainfall conditions,
- Outfall inventory,
- Outfall mapping, and
- Field sheet use in conjunction with an electronic tablet data collection application.

In current and past sampling programs, CDM Smith utilized an efficient ArcGIS application to record/track field data and photos georeferenced to the City's GIS mapping. **Figure 1** below is a screenshot of the App outfall inspection form and GIS mapping adapted to Reading's drainage system.

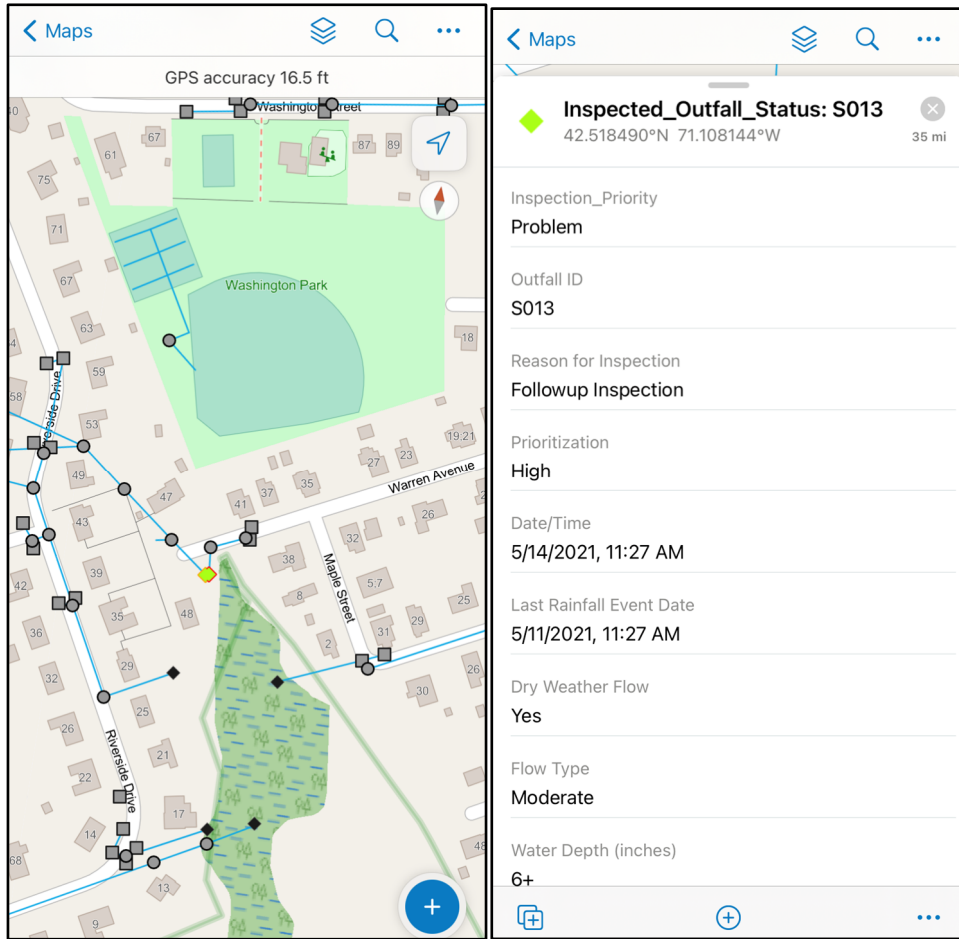


Figure 1 - Reading Mobile iPad Application developed for MS4 Outfall Inspections

Dry-Weather Outfall Sampling Results

The Permit requires that all sampling events must have an antecedent condition of 24-hours of dry weather (i.e., less than 0.1-inches of rainfall) prior to outfall inspection. The Town increased this requirement to 72-hours to ensure groundwater, sump pumps, and other sources of rainfall derived flow had ceased prior to inspections. May and June 2021 were a relatively wet spring with sporadic rain events, making scheduling dry-weather field work challenging. 14 of the 18 outfalls had dry-weather flow, as shown below in **Table 2**. Inspections of the outfalls were spread over the following four full days:

- 5/14/2021
- 5/20/2021
- 6/18/2021
- 6/22/2021

Table 2 – Problem and High Priority Outfalls

System Identifier	Facility Identifier	Watershed	Location	Flowing
Problem Outfalls				
A017	swDS-73	Aberjona	77 Arcadia Avenue	Yes
A033	swDS-99	Aberjona	555 West Street (3)	Yes
I014	swDS-107	Ipswich	25 Deborah Drive	Yes
S013	swDS-13	Saugus	48 Warren Avenue (2)	Yes
S060	swDS-324	Saugus	7 Harvest Road	Yes
High Priority Outfalls				
A075	swDS-61	Aberjona	155 Walnut Street	Yes
A076	swDS-60	Aberjona	47 Hemlock Road	Yes
S005	swDS-5	Saugus	132 Washington Street	No
I017	swDS-241	Ipswich	30 Meadow Brook Lane	Yes
S001	swDS-1	Saugus	285 Main Street	Yes
S008	swDS-8	Saugus	30 Bolton Street	Yes
S035	swDS-362	Saugus	203 Washington Street	No
S048	swDS-124	Saugus	25 Walkers Brook Drive	No
S056	swDS-41	Saugus	170 Pleasant Street	Yes
S065	swDS-125	Saugus	48 Warren Avenue	Yes
S085	swDS-185	Saugus	11 Baker Road	Yes
S049	swDS-34	Saugus	127 Charles Street	No
S022	swDS-56	Saugus	512 Summer Avenue	Yes

The 14 flowing outfalls were sampled for the following parameters:

- Ammonia
- Chlorine
- Conductivity
- Salinity
- E. coli
- Surfactants
- pH
- Temperature.

The Permit requires that outfalls discharging to the Aberjona River also be sampled for phosphorus. E. coli and phosphorus samples were sent to a lab and the remaining analyses were performed with field kits, as identified in the field procedure available in **Attachment D**. The outfall system identifier, GIS ID (facility identifier), watershed, and location for the five problem outfalls and the 13 high priority outfalls are summarized in **Table 3** below. Outfalls discharging to the Aberjona River have a system identifier that begins with the letter “A”.

The criteria in the MS4 Permit for whether sampling results indicate likely sewer input is stated as follows:

“Likely sewer input indicators are any of the following:

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

Table 3 summarizes the analytical results for each of the target parameters at five problem outfalls and the 13 high priority outfalls, with exceedances shown in **bold** text. Although all five of the problem outfalls had dry-weather flow, there was no olfactory or visual evidence of sewage. However, 3 outfalls had ammonia levels ≥ 0.5 mg/L and surfactant levels ≥ 0.25 mg/L. Of these 3, two had elevated phosphorus levels but only one had elevated bacteria levels. Of the remaining 2 problem outfalls, both had surfactant levels ≥ 0.25 mg/L and detectable levels of chlorine, but ammonia levels were less than or equal to 0.25 mg/L.

Although 9 out of the 13 high priority outfalls had dry-weather flow, there was no olfactory or visual evidence of sewage. However, 1 outfall had ammonia levels ≥ 0.5 mg/L, surfactant levels ≥ 0.25 mg/L and elevated bacteria levels; 4 outfalls had detectable chlorine and surfactant levels ≥ 0.25 mg/L; and 3 outfalls had surfactant levels ≥ 0.25 mg/L with elevated bacteria levels while one of these three had detectable chlorine.

Though not required by the Permit, the Town requested one additional location be inspected and sampled. This location is a catch basin at 178 Main Street with a system and facility identifier of

Ryan Percival, P.E. & Alex Rozycki, P.E.
September 15, 2021
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S022-c006 and swCB-2701, respectively, and is part of the S022 outfall delineation. The results of the sampling, with exceedances in bold, are as follows:

- Ammonia - 0.25 mg/L
- **Surfactants - 0.25 mg/L**
- **Chlorine - 0.30 mg/L**
- E. coli - 3 col/100 mL



Table 3 – Results of the 2021 Sampling Program

Outfall ID	Outfall ID (2)	Date of Sample	Temperature	pH	Conductivity (uS/cm)	Phosphorus (mg/L)	E. Coli (col/100 mL)	Chlorine (mg/L)	Ammonia (mg/L)	Surfactants (mg/L)
Problem Outfalls										
A017	swDS-73	5/14/2021	14.3	6.47	1483	0.092	33	0.00	1.0	0.25
A033	swDS-99	5/14/2021	14.9	6.48	1201	0.116	5	0.00	0.75	0.50
I014	swDS-107	5/14/2021	16.4	6.62	573	N/A	31	0.30	0.25	0.25
S013	swDS-13	5/14/2021	16.4	6.75	732	N/A	640	0.00	0.5	0.25
S060	swDS-324	5/14/2021	15.5	6.51	1524	N/A	5	0.10	0.25	0.5
High Priority Outfalls										
A075	swDS-61	5/14/2021	19.5	6.94	1020	0.037	1,100	0.20	0.25	0.25
A076	swDS-60	5/14/2021	16.3	6.84	832	ND	39	0.10	0.00	0.25
S005	swDS-5	5/20/2021	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
I017	swDS-241	5/14/2021	17.9	6.97	724	N/A	68	0.30	0.25	0.25
S001	swDS-1	5/20/2021	15.7	7.17	737	N/A	1,200	0.00	0.00	0.50
S008	swDS-8	5/20/2021	17.2	7.29	1305	N/A	3,400	0.00	0.00	1.00
S035	swDS-362	5/20/2021	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
S048	swDS-124	5/20/2021	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
S056	swDS-41	5/20/2021	19.0	7.20	1931	N/A	620	0.00	0.50	0.50
S065	swDS-125	5/14/2021	18.5	6.48	642	N/A	76	0.20	0.25	0.25
S085	swDS-185	5/14/2021	17.2	6.89	668	N/A	26	0.10	0.00	0.25
S049	swDS-34	5/14/2021	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
S022	swDS-56	5/20/2021	17.7	6.95	1483	N/A	72	0.00	0.00	1.00
Upstream Investigations										
S022-c006*	swCB-2701	5/14/2021	15.8	6.48	1654	N/A	3	0.30	0.25	0.25

Notes:

Bolded values are based on the following thresholds:

Chlorine (mg/L) - threshold: greater than or equal to 0.02 mg/L

Ammonia (mg/L) - threshold: greater than or equal to 0.50 mg/L

Surfactants (mg/L) - threshold: greater than or equal to 0.25 mg/L

E. Coli (col/100 mL) - threshold: greater than or equal to 235 col/100 mL

Attachment A contains figures that depict the location of the outfalls and summarize the sampling results. Photos of the outfalls that were flowing during inspection (excluding Outfall S085 as the outfall was submerged and a sample was taken at an upstream manhole) are shown below in **Figures 2 – 14**.



Figure 2 - Outfall A017



Figure 3 - Outfall A033



Figure 4 - Outfall I014



Figure 5 - Outfall S013



Figure 6 - Outfall S060



Figure 7 - Outfall A075



Figure 8 - Outfall A076



Figure 9 - Outfall I017



Figure 10 - Outfall S001



Figure 11 - Outfall S008



Figure 12 - Outfall S056



Figure 13 - Outfall S065



Figure 14 - Outfall S022

2021 Outfall Sampling Conclusions & Next Steps

After analyzing the results from the dry weather sampling, the four outfalls shown in **Table 4** were selected for follow-up catchment investigations. Catchment investigations allow for the identification of illicit connections that are likely contributing to the dry-weather flow and exceedance of parameters identified in previous sections.

Table 4 - Outfalls Selected for Follow-up Catchment Investigation

Outfall ID	Outfall ID (2)	Date of Sample	Phosphorus (mg/L)	E. Coli (col/100 mL)	Chlorine (mg/L)	Ammonia (mg/L)	Surfactants (mg/L)
A017	swDS-73	5/14/2021	0.092	33	0.00	1.0	0.25
S013	swDS-13	5/14/2021	N/A	640	0.00	0.5	0.25
S056	swDS-41	5/20/2021	N/A	620	0.00	0.50	0.50
S022	swDS-56	5/20/2021	N/A	72	0.00	0.00	1.00

Dry-Weather Catchment Investigations

The Town was required to begin the catchment inspection of the Problem and High Priority Outfalls within 2 years of the effective date of the permit (June 30, 2020) and to complete the inspection of problem and high priority outfalls within 7 years of the effective permit date (June 30, 2025). Catchment investigations of all non-excluded outfalls is required by tenth year of the effective date of the permit (June 30, 2028). As mentioned in the previous section, the Town used the results of

the 2021 dry-weather outfall sampling program to identify which Problem and High Priority Outfalls would be the focus of this year’s catchment investigations.

The Town follows the protocols established in their standard operating procedures (**Attachment E**) as well as their Illicit Discharge Detection and Elimination (IDDE) Procedure (**Attachment F**) for catchment investigations. The catchment investigation is an upstream inspection where key junction manholes are inspected for dry weather flow. If dry weather flow is present, the Town is required, at a minimum, to sample for ammonia, surfactants, and chlorine. Sandbagging is not required in the permit but should be considered by the Town to help eliminate areas of potential illicit discharges.

Following the identification of the catchment investigation outfalls, CDM Smith and the Town worked together to specify the junction manholes to inspect and sample if dry-weather flow is present. The maps provided by the Town as a basis of the catchment investigations are provided in **Attachment C**.

Attachment B contains figures that depict the location and summarize the sampling results of the outfalls, upstream manholes, and upstream catch basins.

The results of the catchment investigation for Outfall A017 are shown below in **Table 5**. Outfall A017 had light flow and was sampled for all parameters. Manhole A017-m002 had standing water only and no flow so it was not sampled. Manhole A017-m005 had no flow. Manhole A-m023 had heavy flow and the GIS mapping was confirmed. Manhole A018-m011 could not be opened in the field.

Table 5 – Outfall A017

System Identifier	Date	Flow Status	Ammonia (mg/L)	Surfactants (mg/L)	Chlorine (mg/L)	E. coli (col/100 mL)	Total Phosphorus (mg/L)
A017	06/18/2021	Flowing	0.25	0.25	0	110	0.032
A017-m002	06/18/2021	Submerged	-	-	-	-	-
A017-m005	06/18/2021	Dry	-	-	-	-	-
A-m023	06/18/2021	Flowing	0	0.25	0.6	ND	0.015
A018-m011	06/18/2021	Could not open	-	-	-	-	-

The results of the catchment investigation for Outfall S056 are shown below in **Table 6**. Outfall S056 was not flowing. Manholes S056-m003, S056-m004, and S056-m005 had no flow. Catch basin S056-c003 had intermittent flow coming from a pipe leading from 154 Pleasant Street. This intermittent flow was sampled. Further investigation is suggested at this location.

Table 6 – Outfall S056

System Identifier	Date	Flow Status	Ammonia (mg/L)	Surfactants (mg/L)	Chlorine (mg/L)	E. coli (col/100 mL)	Total Phosphorus (mg/L)
S056	06/18/2021	No flow	-	-	-	-	-
S056-m003	06/18/2021	No flow	-	-	-	-	-
S056-m004	06/18/2021	No flow	-	-	-	-	-
S056-c003	06/18/2021	Flowing	0	>3.0	1	ND	-
S056-m005	06/18/2021	No flow	-	-	-	-	-

The results of the catchment investigation for Outfall S013 are shown below in **Table 7**. Outfall S013 was flowing and sampled for all parameters. It was noted that the uppermost manhole (S013-m008) had heavy flow and field tests identified elevated levels of ammonia, surfactants, and E. coli. The presence of chlorine indicates a potential water main leak. The Town investigated further (including CCTV inspection), noting that there were only two manholes and four catch basins upstream, and identified a water main leak as the likely source of the flow. The elevated ammonia, surfactants, and E. coli levels need to be investigated further.

Manholes S013-m003 and S013-m048 could not be located in the field. Manhole S013-m005 was located but could not be opened in the field. Manhole S013-m016 had standing water and could not be sampled.

Table 7 – Outfall S013

System Identifier	Date	Flow Status	Ammonia (mg/L)	Surfactants (mg/L)	Chlorine (mg/L)	E. coli (col/100 mL)	Total Phosphorus (mg/L)
S013	06/22/2021	Flowing	0.75	0.25	0.1	6,700	-
S013-m003	06/22/2021	Could not locate	-	-	-	-	-
S013-m005	06/22/2021	Could not open	-	-	-	-	-
S013-m008	06/22/2021	Flowing	2-3	0.5	0.4	4,300	-
S013-m016	06/22/2021	Standing water	-	-	-	-	-
S013-c027	06/22/2021	Flowing	0.75	0.25	>1.0	3	-
S013-m049	06/22/2021	Flowing	0.75	0.25	2	ND	-
S013-m048	06/22/2021	Could not locate	-	-	-	-	-

The results of Outfall S022 investigation are shown below in **Table 8**. Outfall S022 was investigated at request of the Town. Outfall S022 had heavy flow and was sampled. Catch basin S022-c008 had a

crack and was unable to be opened in the field. However, it was determined there is no connection between catch basins S022-c006 and S022-c008 or between catch basins S022-c006 and S022-c009. There is heavy flow coming downhill and into manhole S022-m006.

Table 8 – Outfall S022

System Identifier	Date	Flow Status	Ammonia (mg/L)	Surfactants (mg/L)	Chlorine (mg/L)	E. coli (col/100 mL)	Total Phosphorus (mg/L)
S022	06/18/2021	Flowing	0.25	0.25	0	210	-
S022-c006	06/18/2021	Flowing	0	0.5	0	260	-

2021 IDDE Catchment Investigations Conclusions and Recommendations

Based on the results of the catchment investigations, the following conclusions and recommendations are presented below:

- For Outfall S013, there was a water main leak between manholes m008 and m016. The water main leak was removed. The area should be revisited and resampled.
- The intermittent flow from S056-c003 appeared to be from 154 Pleasant Street was checked by the Town. The sump pump is not an apparent illicit connection. This should continue to be monitored.
- The heavy flow coming downhill into S022-m006 should be investigated further upstream. Upstream sampling should be performed to further investigate any potential illicit connections. Potential interconnections with the MassDOT system should be investigated as well.

Attachments

Attachment A – 2021 Dry Weather Outfall Sampling Figures

Attachment B – 2021 IDDE Catchment Investigation Figures

Attachment C – 2021 Reading Catchment Investigation Overview

Attachment D – Dry Weather Outfall Sampling Procedure

Attachment E – Catchment Investigation Standard Operating Procedures

Attachment F – Town of Reading IDDE Procedure (May 2012)

Attachment G – MA MS4 General Permit

cc: Lisa Gove, P.E., CDM Smith

Attachment A

2021 Dry Weather Outfall Sampling Figures



Figure 1
2021 Dry Weather
Outfall Sampling



I017
5/14/2021
Substantial flow
E. Coli: 68
Chlorine: 0.30 mg/l
Surfactants: 0.25 mg/l

I014
5/14/2021
Flowing
Slight yellow/tan tint.
E. Coli: 31
Chlorine: 0.30 mg/l
Surfactants: 0.25 mg/l

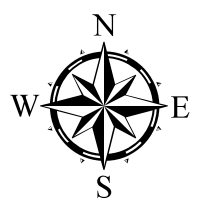
S085
5/14/2021
Partially submerged in water,
flow at upstream manhole
E. Coli: 26
Chlorine: 0.10 mg/l
Ammonia: 0.25 mg/l

S049
5/14/2021
Dry, no flow

A033
5/14/2021
Slight flow, almost stagnant.
Could not access upstream manhole.
Total Phosphorus: 0.116 mg/l
E. Coli: 5
Ammonia: 0.75 mg/l
Surfactants: 0.50 mg/l

Legend

- ★ Could not locate
- ★ Dry
- ★ Flowing
- ★ Submerged
- swInlet
- swCatchBasin
- swManhole
- swOutfall
- swCulvert
- swOpenDrain
- swGravityMain
- Structure
- Road
- READING
- Other Towns

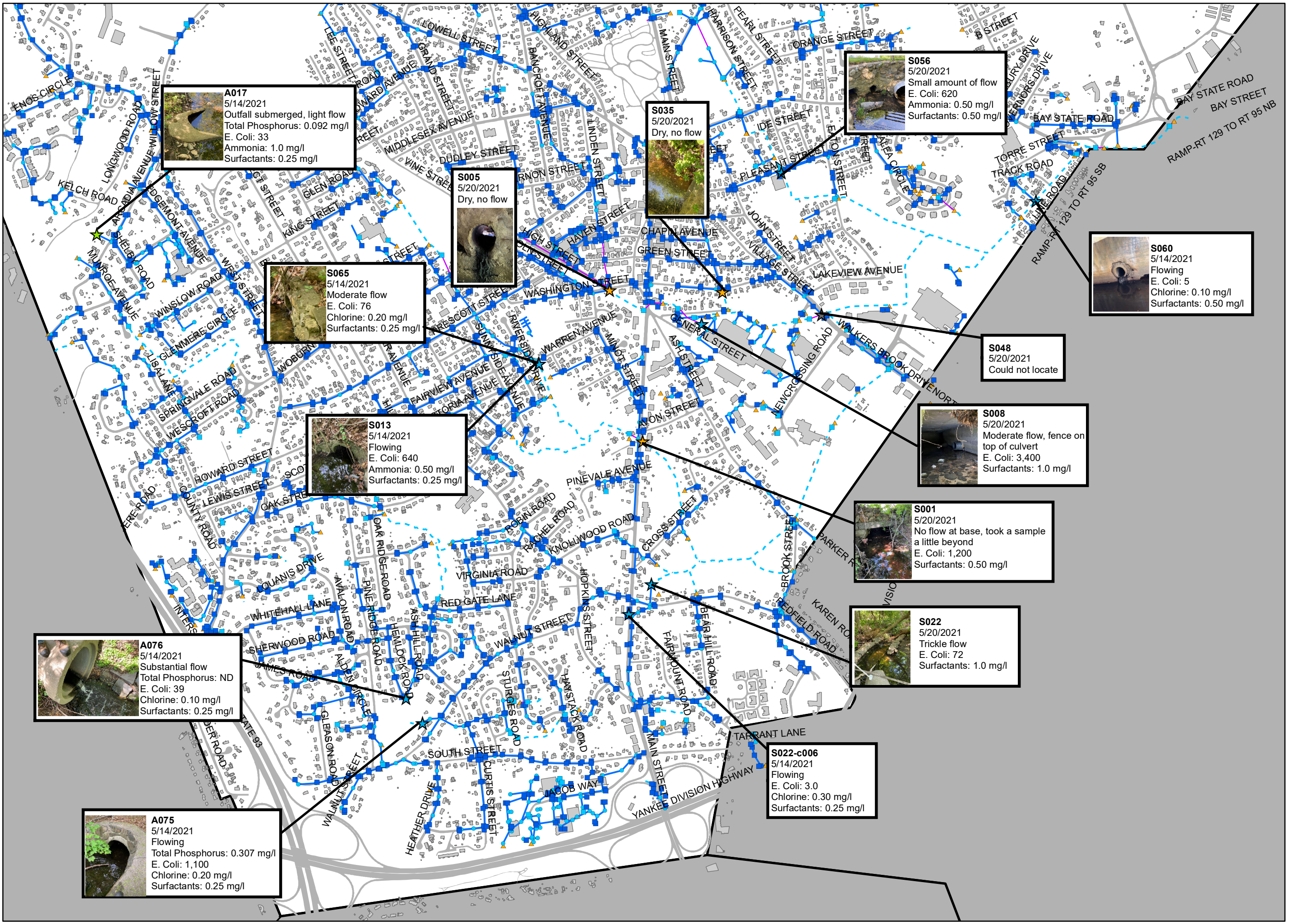


0 250 500 1,000
Feet

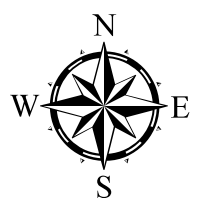




Figure 2
2021 Dry Weather
Outfall Sampling



- Legend**
- ★ Could not locate
 - ★ Dry
 - ★ Flowing
 - ★ Submerged
 - swInlet
 - swCatchBasin
 - swManhole
 - ▲ swOutfall
 - swCulvert
 - - - swOpenDrain
 - swGravityMain
 - 1 Ft
 - 10 Ft
 - Structure
 - Road
 - READING
 - Other Towns



0 370 740 1,480 Feet



Attachment B

2021 IDDE Catchment Investigation Figures



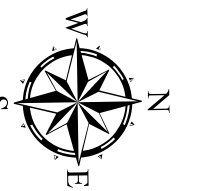
S056
2021 IDDE
Catchment Investigation

Legend

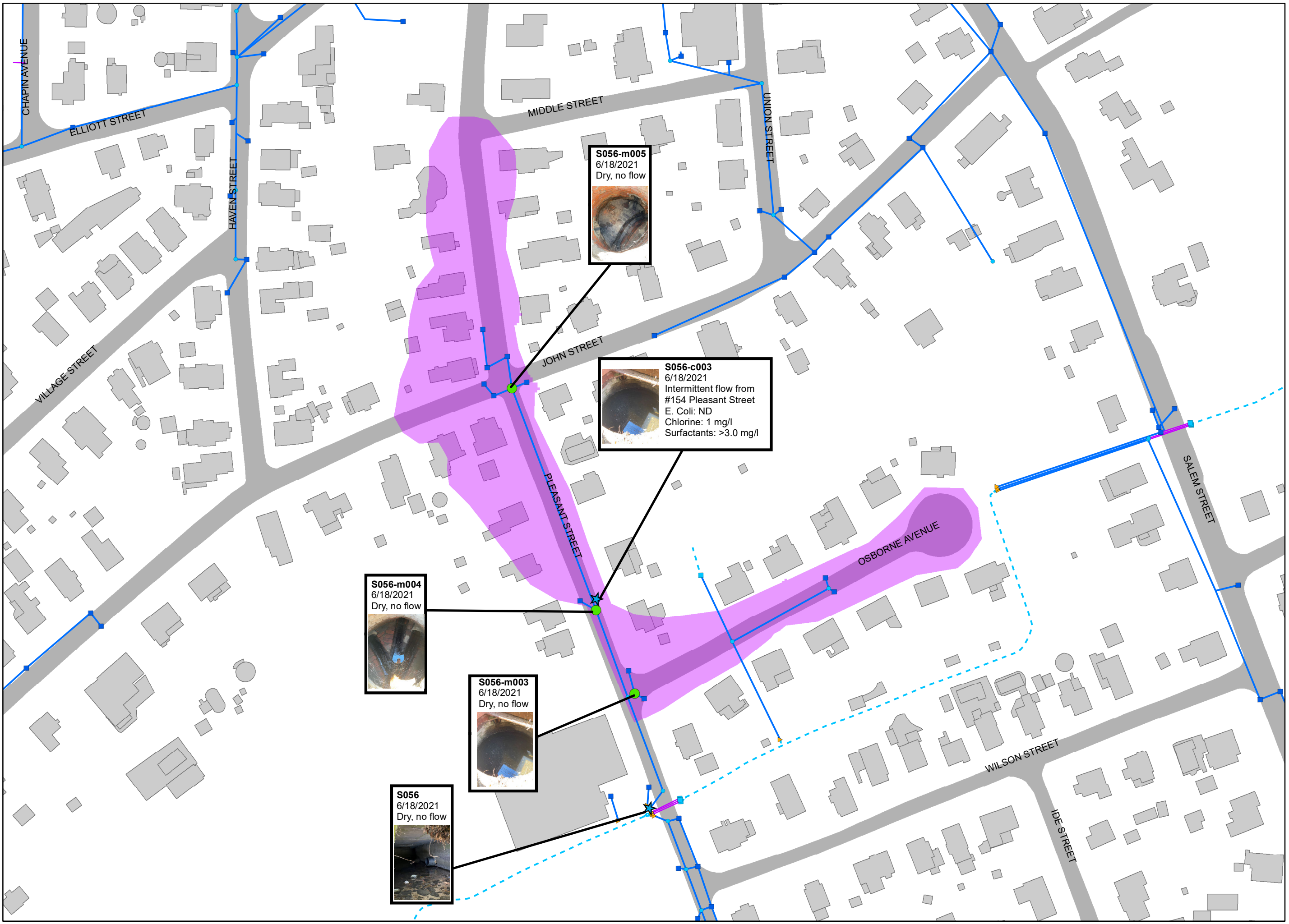
- ★ Could not locate
- ★ Dry
- ★ Flowing
- ★ Submerged

Inspected MH

- Could not be opened
- Could not locate
- Dry
- Flowing
- Stagnant
- swInlet
- swCatchBasin
- swManhole
- ▲ swOutfall
- swCulvert
- - - swOpenDrain
- swGravityMain
- A017 swDS-73
- A033 swDS-99
- S008 swDS-8 1
- S008 swDS-8 2
- S008 swDS-8 3
- S008 swDS-8 4
- S013 swDS-13
- S022
- S056 swDS-41
- Structure
- Road
- READING
- Other Towns



70 35 0 70 Feet





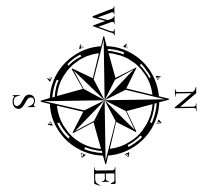
A017
2021 IDDE
Catchment Investigation

Legend

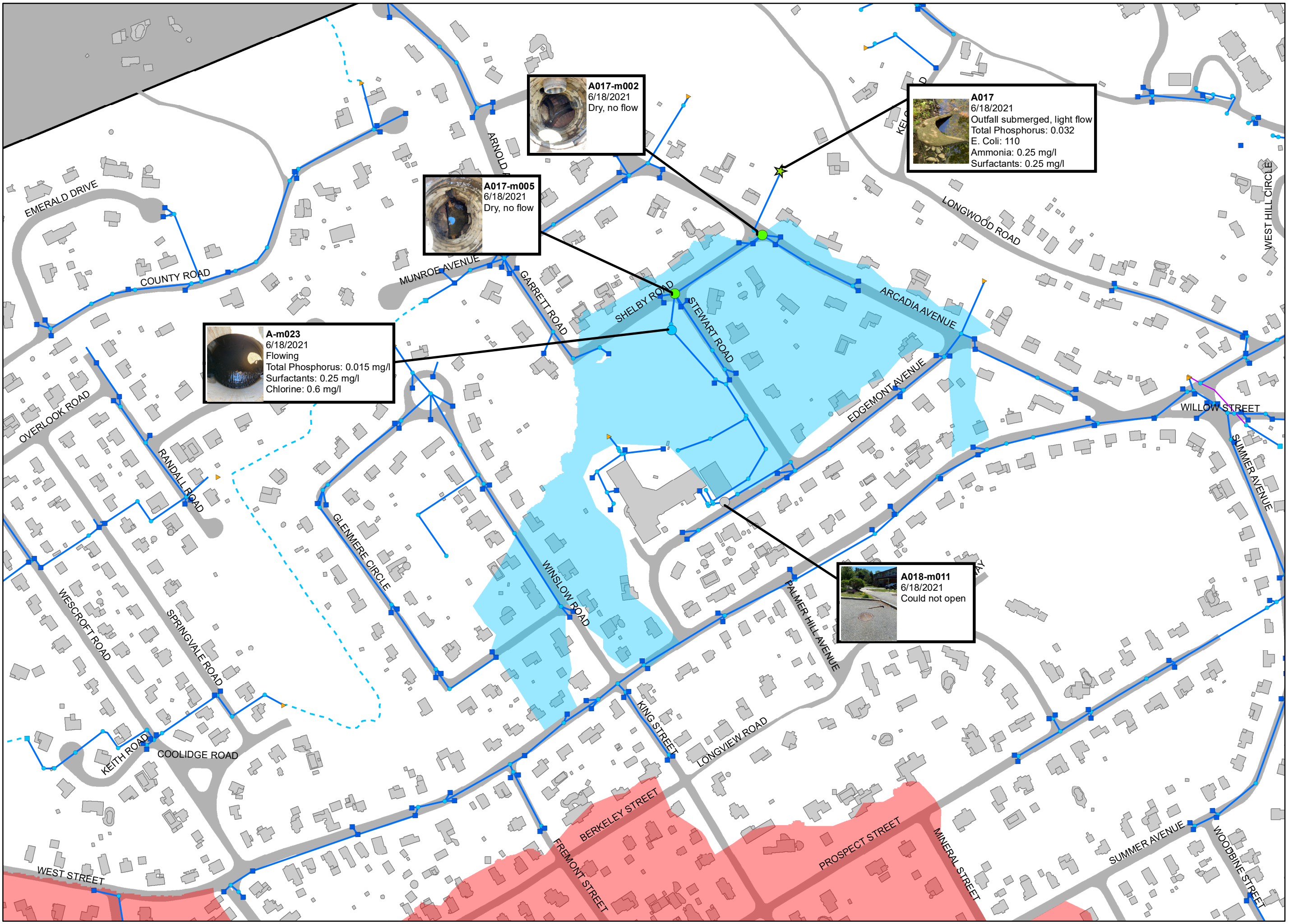
- ★ Could not locate
- ★ Dry
- ★ Flowing
- ★ Submerged

Inspected MH

- Could not be opened
- Could not locate
- Dry
- Flowing
- Stagnant
- swInlet
- swCatchBasin
- swManhole
- ▲ swOutfall
- swCulvert
- - - swOpenDrain
- swGravityMain
- A017 swDS-73
- A033 swDS-99
- S008 swDS-8 1
- S008 swDS-8 2
- S008 swDS-8 3
- S008 swDS-8 4
- S013 swDS-13
- S022
- S056 swDS-41
- Structure
- Road
- READING
- Other Towns



0 95 190 380
Feet



A017-m002
6/18/2021
Dry, no flow

A017-m005
6/18/2021
Dry, no flow

A017
6/18/2021
Outfall submerged, light flow
Total Phosphorus: 0.032
E. Coli: 110
Ammonia: 0.25 mg/l
Surfactants: 0.25 mg/l

A-m023
6/18/2021
Flowing
Total Phosphorus: 0.015 mg/l
Surfactants: 0.25 mg/l
Chlorine: 0.6 mg/l

A018-m011
6/18/2021
Could not open



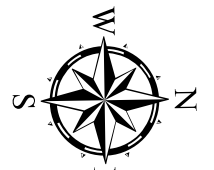
S013
2021 IDDE
Catchment Investigation

Legend

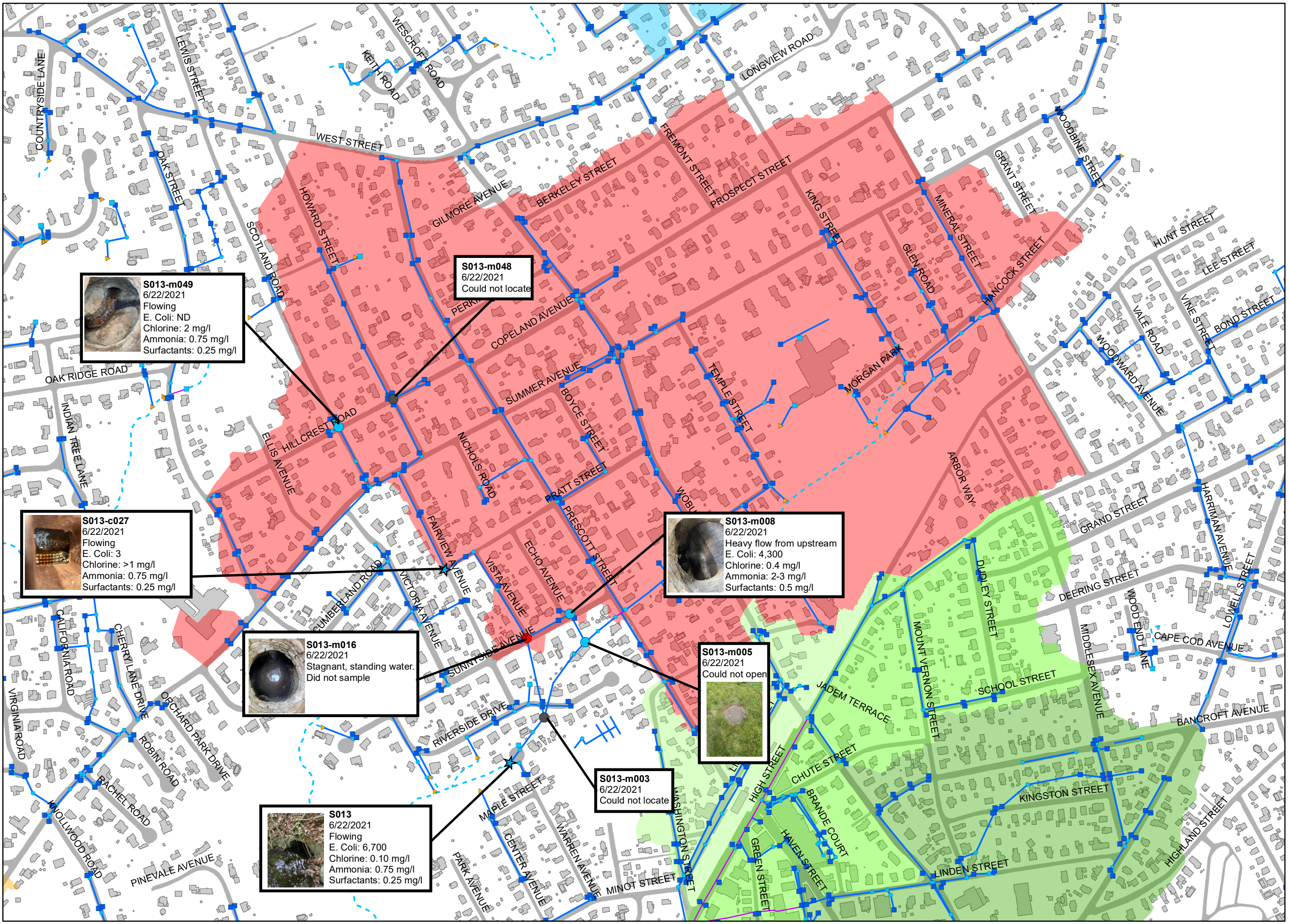
- ★ Could not locate
- ★ Dry
- ★ Flowing
- ★ Submerged

Inspected MH

- Could not be opened
- Could not locate
- Dry
- Flowing
- Stagnant
- swInlet
- swCatchBasin
- swManhole
- swOutfall
- swCulvert
- swOpenDrain
- swGravityMain
- A017 swDS-73
- A033 swDS-99
- S008 swDS-8 1
- S008 swDS-8 2
- S008 swDS-8 3
- S008 swDS-8 4
- S013 swDS-13
- S022
- S056 swDS-41
- Structure
- Road
- READING
- Other Towns



0 200 400
Feet



S013-m049
6/22/2021
Flowing
E. Coli: ND
Chlorine: 2 mg/l
Ammonia: 0.75 mg/l
Surfactants: 0.25 mg/l

S013-m048
6/22/2021
Could not locate

S013-c027
6/22/2021
Flowing
E. Coli: 3
Chlorine: >1 mg/l
Ammonia: 0.75 mg/l
Surfactants: 0.25 mg/l

S013-m008
6/22/2021
Heavy flow from upstream
E. Coli: 4,300
Chlorine: 0.4 mg/l
Ammonia: 2-3 mg/l
Surfactants: 0.5 mg/l

S013-m016
6/22/2021
Stagnant, standing water.
Did not sample

S013-m005
6/22/2021
Could not open

S013
6/22/2021
Flowing
E. Coli: 6,700
Chlorine: 0.10 mg/l
Ammonia: 0.75 mg/l
Surfactants: 0.25 mg/l

S013-m003
6/22/2021
Could not locate



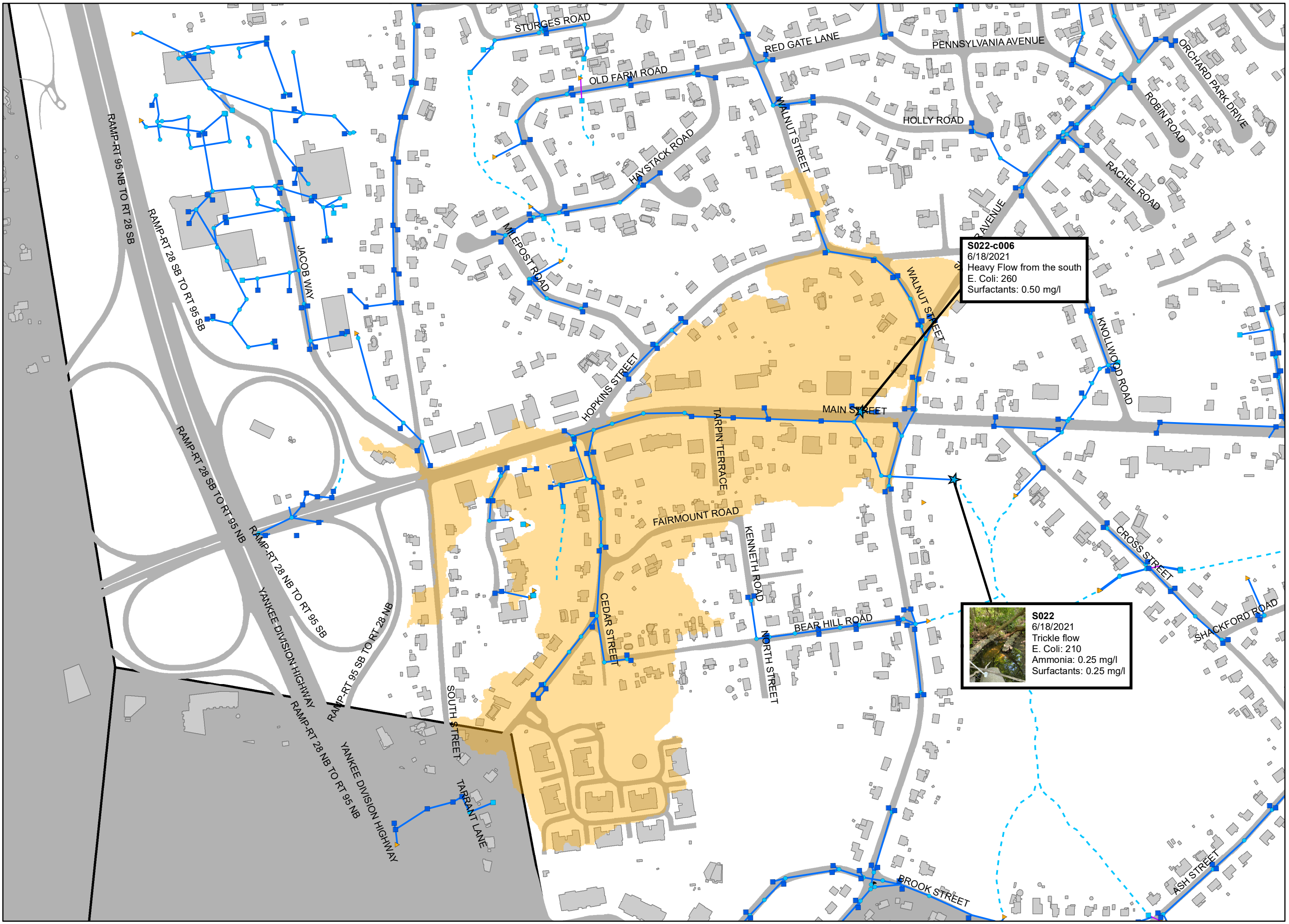
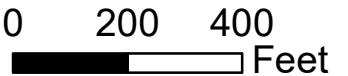
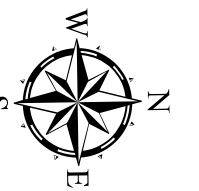
S022
2021 IDDE
Catchment Investigation

Legend

- ★ Could not locate
- ★ Dry
- ★ Flowing
- ★ Submerged

Inspected MH

- Could not be opened
- Could not locate
- Dry
- Flowing
- Stagnant
- swInlet
- swCatchBasin
- swManhole
- ▲ swOutfall
- swCulvert
- - - swOpenDrain
- swGravityMain
- A017 swDS-73
- A033 swDS-99
- S008 swDS-8 1
- S008 swDS-8 2
- S008 swDS-8 3
- S008 swDS-8 4
- S013 swDS-13
- S022
- S056 swDS-41
- Structure
- Road
- READING
- Other Towns

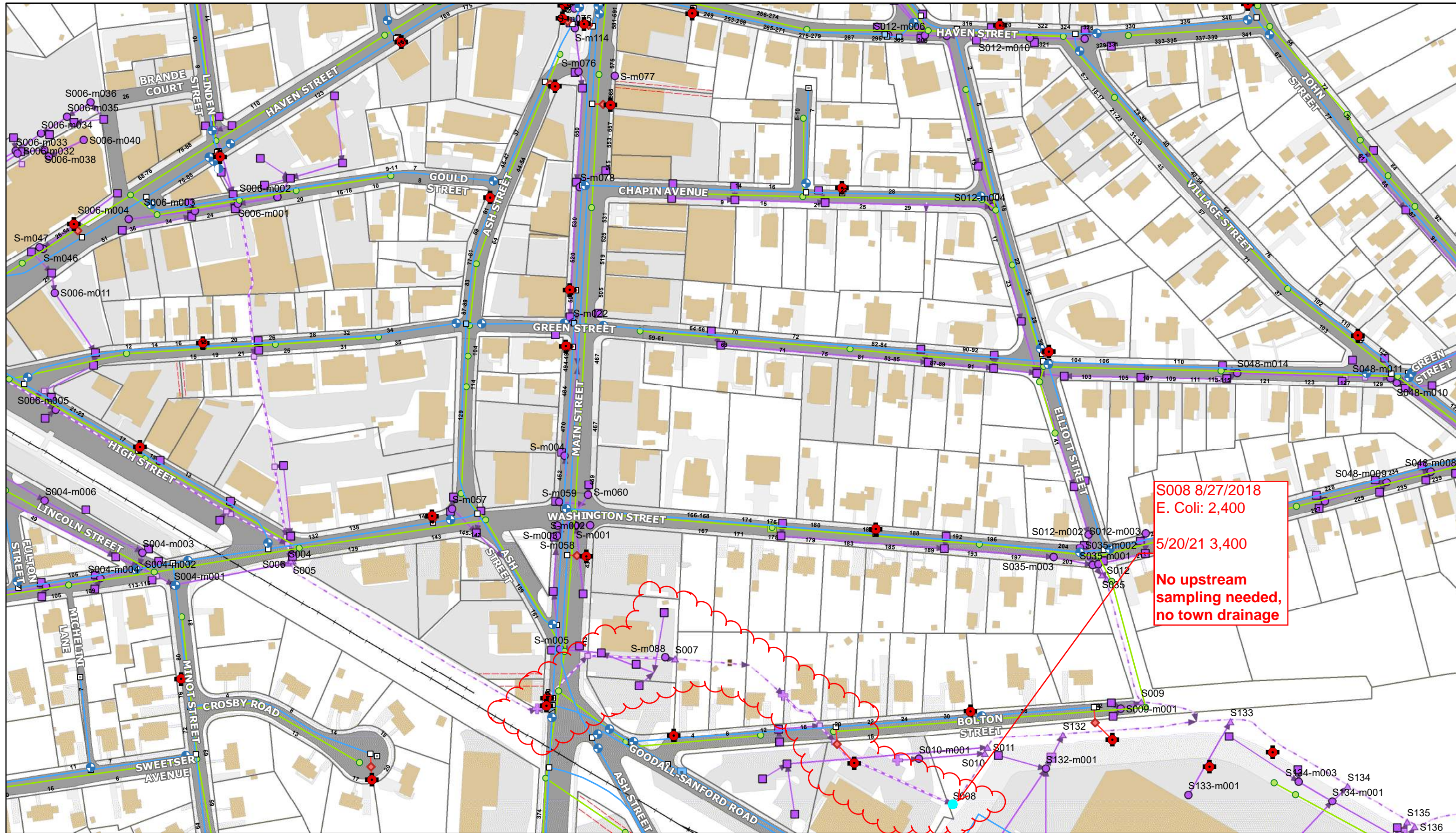


S022-c006
6/18/2021
Heavy Flow from the south
E. Coli: 260
Surfactants: 0.50 mg/l

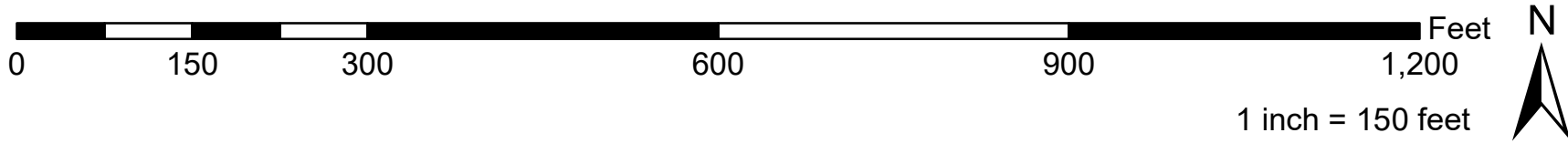
S022
6/18/2021
Trickle flow
E. Coli: 210
Ammonia: 0.25 mg/l
Surfactants: 0.25 mg/l

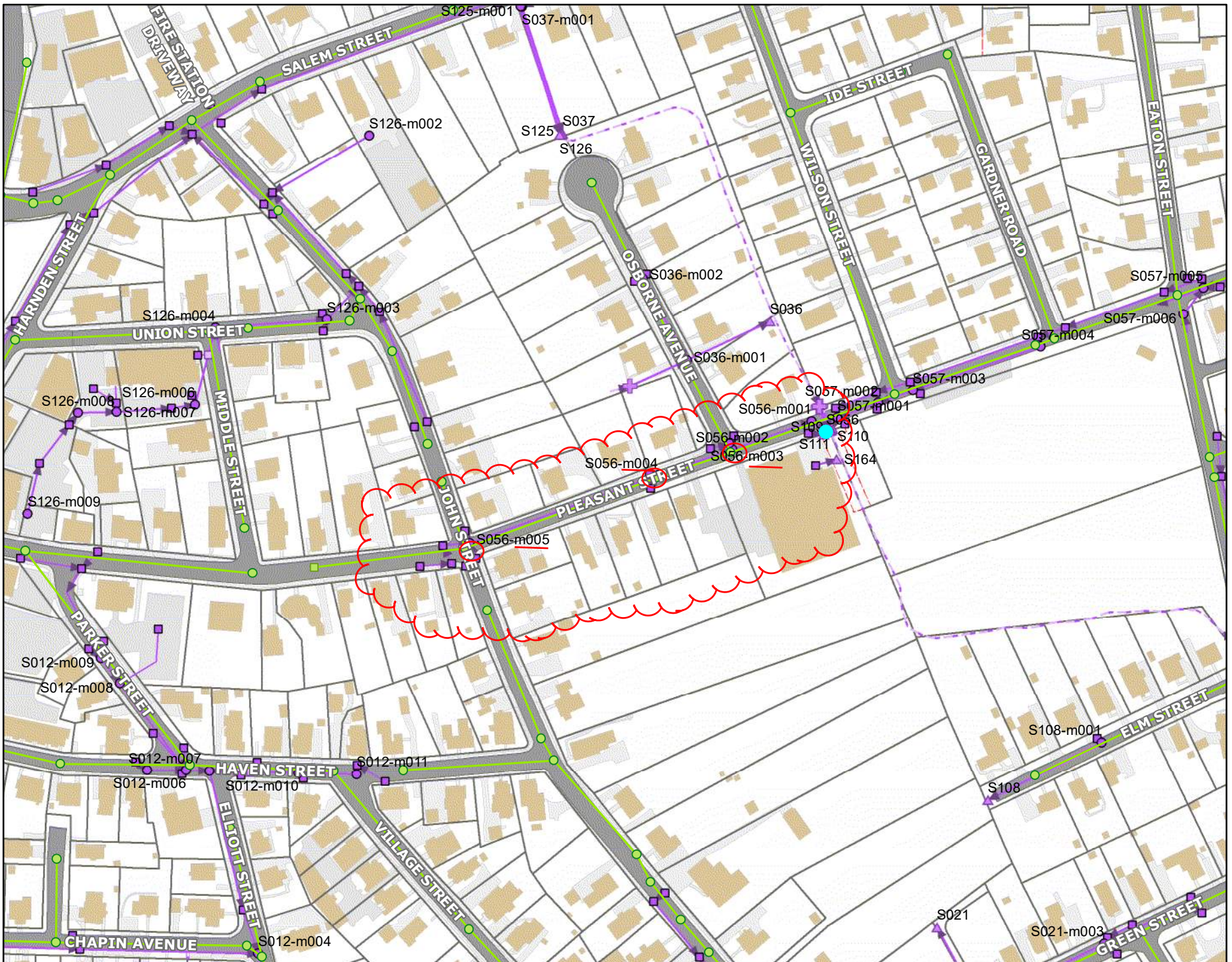
Attachment C

2021 Reading Catchment Investigation Overview

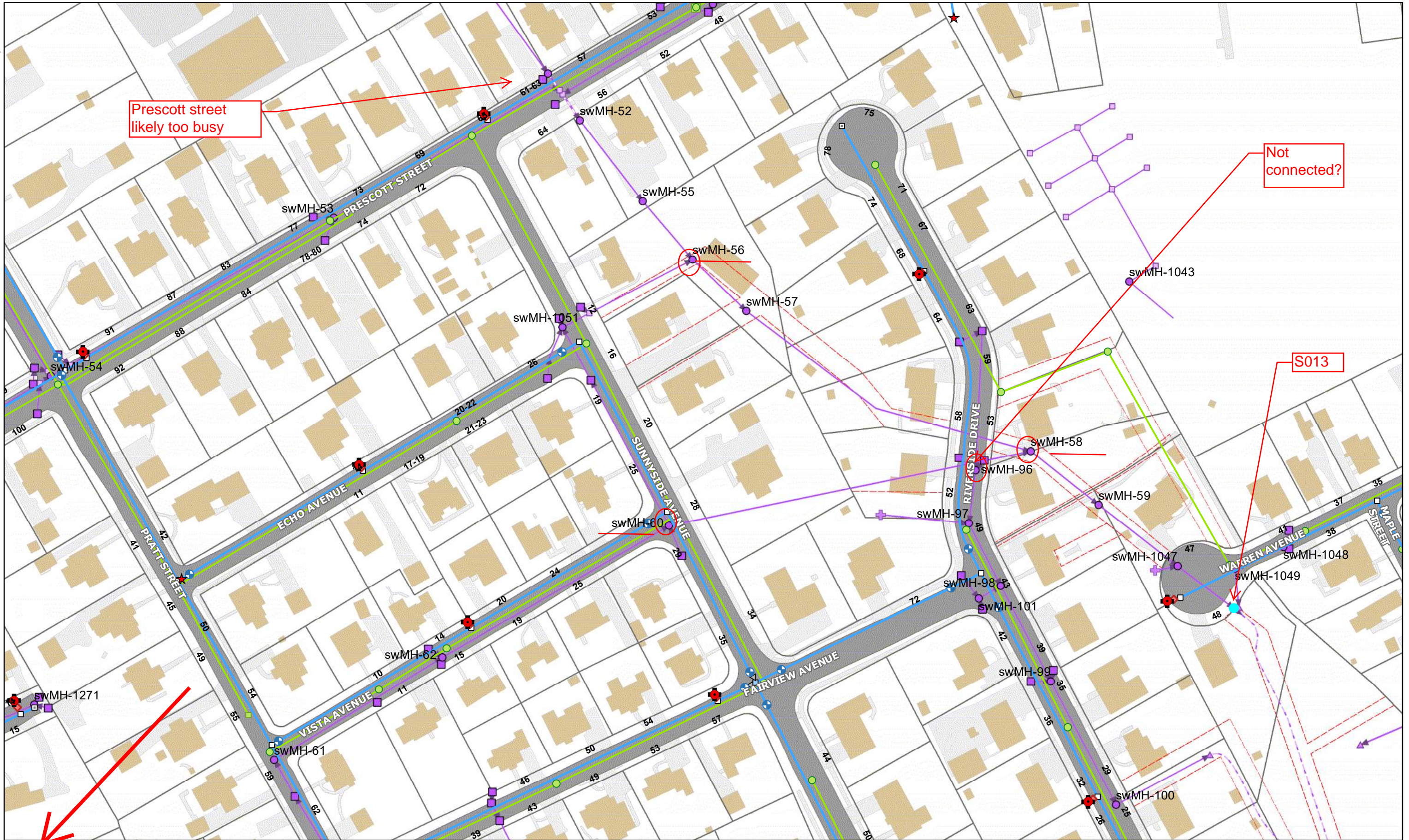


S008 8/27/2018
E. Coli: 2,400
5/20/21 3,400
No upstream
sampling needed,
no town drainage



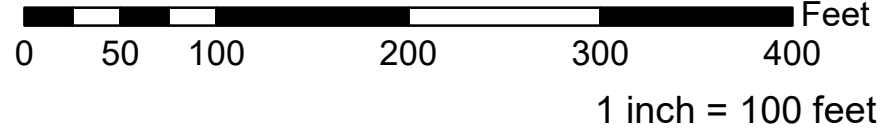


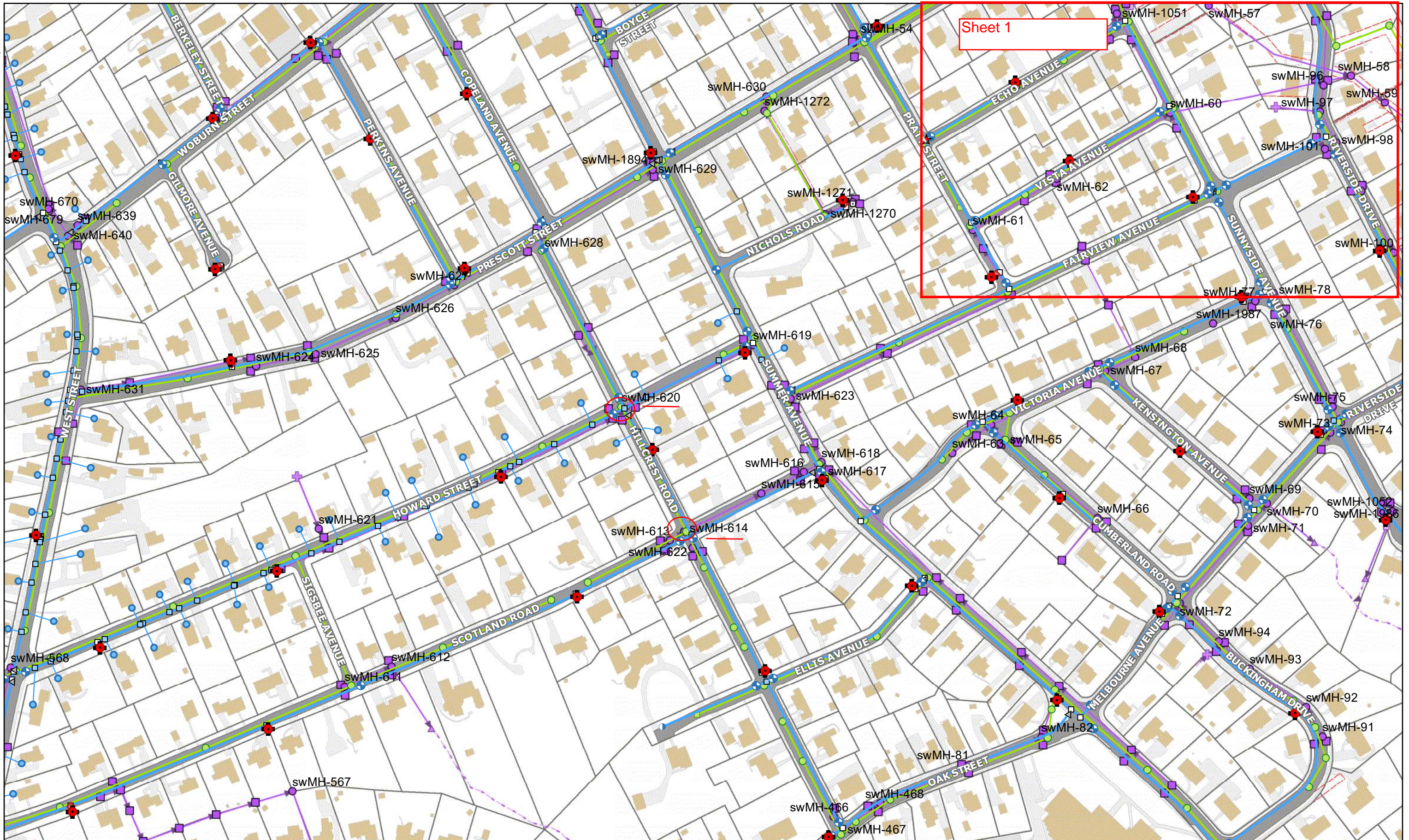
1 inch = 200 feet



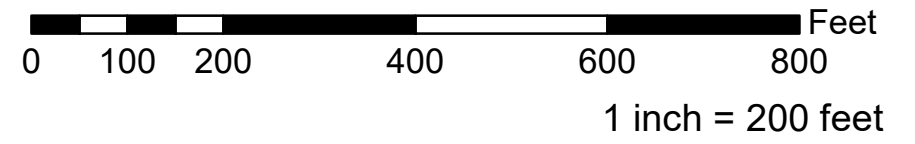
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Warren Ave S013 1 of 2

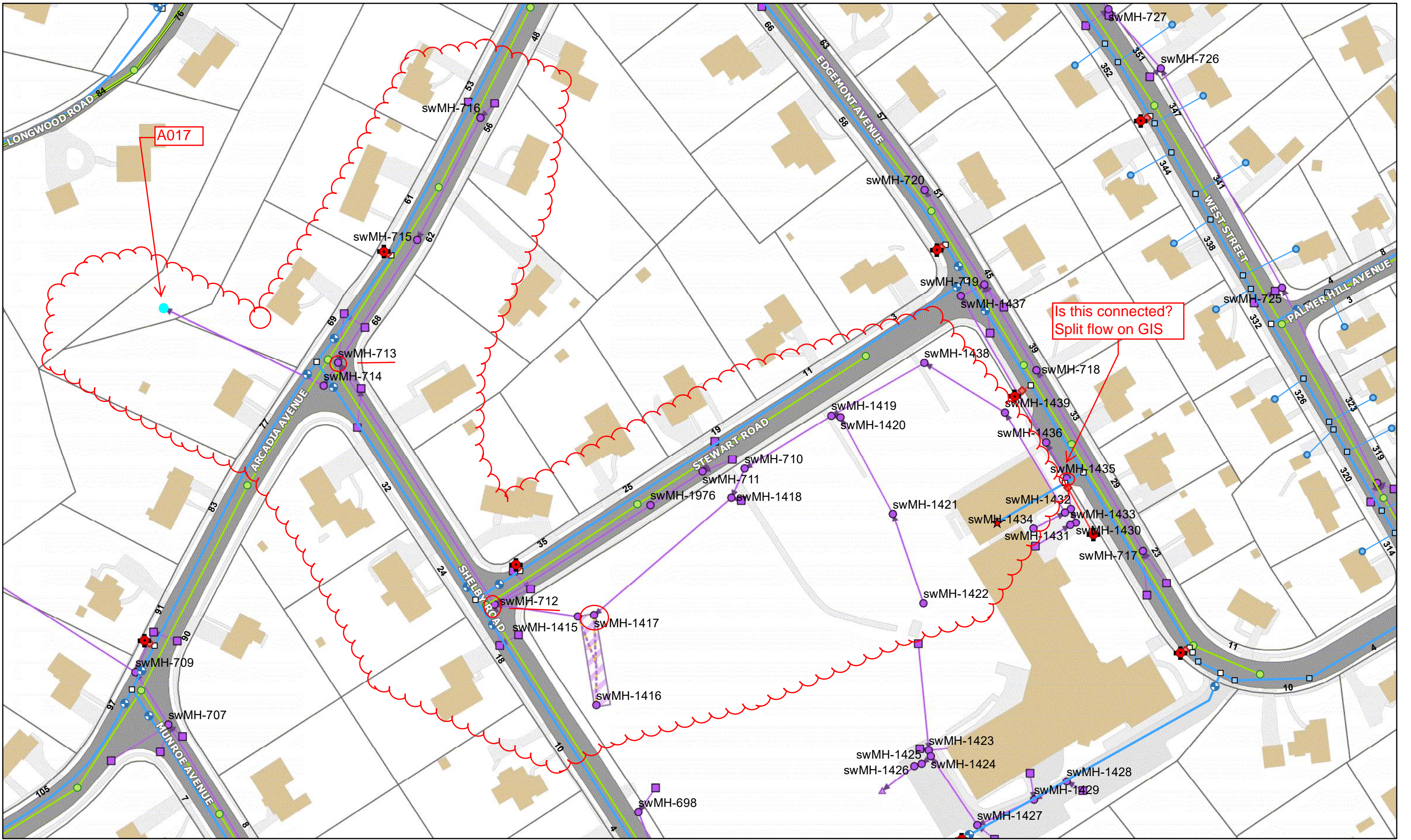




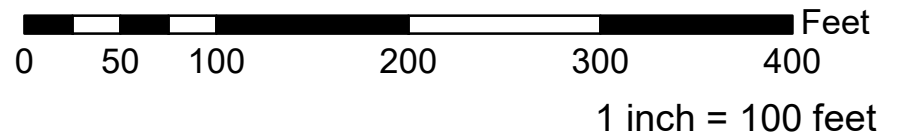
Sheet 1





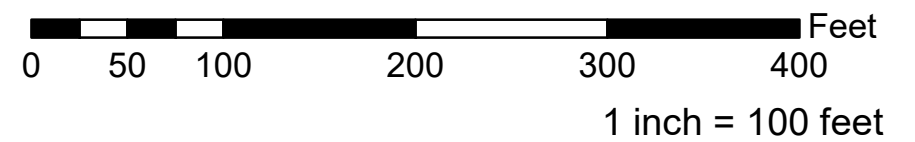


Is this connected?
Split flow on GIS





If safe, please map out connections to these catch basin I believe it was flowing pretty heavy last time.



Attachment D

Dry Weather Outfall Sampling Procedure

Dry-Weather Outfall Sampling Program – READING, MA

Sample Collection/Field Analysis Procedures

This document outlines the procedures to be followed prior to and during inspections of stormwater outfalls (and stormwater system manholes or other access points for the IDDE Program) to ensure that they are inspected properly and that dry-weather flow samples, and any laboratory samples for follow up tests, are done appropriately.

Pre-Inspection/Pre-Sampling Procedures

1. Before beginning outfall inspections, check that the following equipment is available and ready for use.
 - Monitoring Test Kits (CHEMets Ammonia & Surfactants kits and Hach Chlorine colorimetric test kit) including an adequate supply of all reagents for the day
 - Field Test Meters (Extech EC500 “ExStik” or YSI Meter) and buffer solutions
 - Gloves
 - Paper Towels/Rags
 - Distilled Water (for rinsing equipment after sampling)
 - Sampling Cup
 - Extendable Pole (to attach sampling cup if necessary)
 - Bucket and 25 feet of rope to take samples from deeper manholes
 - Sample Bottles or Graduated cylinders
 - Ruler/Tape Measure
 - Permanent marker for bottle labels
 - Camera
 - Maps
 - Safety cones or other city required safety gear for vehicles parked on the side of the road
 - Safety vests and safety glasses for each person
 - Copies of the Stormwater Asset Inspection Form (2-pages)
 - Laboratory Custody Sheets
 - iPad or similar electronic tablet
 - Bug spray, poison ivy repellants/cleansers
2. At the start of each field day, the field meter should be calibrated. The calibration should be checked periodically (at least once) during the day. If the reading is different than the test solution, this should be recorded on a meter calibration record sheet. Custody sheets and laboratory sample bottles for any lab testing need to be available on days when these samples will be collected.
3. Before the first use or after storage, the ExStik (for pH, temperature, and conductivity) needs to be soaked in tap water for 10 minutes. The device should be calibrated with a pH 7 buffer solution first, then calibrated with a buffer solution closest to the expected pH value of the solution or material to be tested.
4. Locate outfalls (or manholes) to be inspected for the day on map (or by GPS coordinates). Prepare a route to efficiently locate as many outfalls (or inspect as many manholes) as possible.
5. Prior to inspection and sampling of any outfall or manhole, ensure there has been a minimum 48-hour period of dry-weather after any rainfall of more than 0.1 inches.

6. Make sure that the sample collection cups and buckets are all thoroughly rinsed with distilled water to avoid cross-contamination.

Outfall Inspection & Dry-Weather Flow Sampling Procedures

1. Observe the outfall (or MS4 Asset) condition and record a description of the pipe material, shape, diameter, any damage, or deposits/stains on the Stormwater Asset Inspection Form. Record the date, time, weather, and who is performing the inspection.
2. Take a photograph of the outfall. If an upstream sampling location is used, then take a photograph of the upstream structure and a photograph showing why the outfall could not be used (i.e. safety, access, submerged, etc). Photographs of the surrounding area should be taken as well to help identify the area and any observations. Identify photographs by number so that they are differentiated.
3. Thoroughly complete the Outfall Inspection Form.
4. If outfall/MS4 Asset has dry-weather flow, then observe and characterize the flow and complete Outfall Sampling Form.
5. A minimum 48-hour antecedent dry weather period must be observed before inspections or field/laboratory sampling is performed. Field observations shall be recorded and field testing for ammonia, surfactants, and chlorine residual must be completed for every bacteria sample collected in the field for laboratory analyses.
6. Sample Collection and Analysis for Ammonia
 - Begin sample collection by putting on the protective gloves.

- Collect a sample of the outfall flow using the sampling cup or bucket. Pour this flow out downstream of the sample location, and repeat. Utilize the extendable pole if necessary to collect the sample. Obtain at least 200 mL of flowing water, if possible.
- Open the kit and locate the reaction tube, reagent ampoule, reaction mixing tube and cap, and comparator ampoule.
- Rinse the sample cup with the sample to be tested, and then fill it to the 20 mL mark with the sample (Figure 1).
- Add 4 drops of A-1404 Stabilizer Solution (Figure 2).
- Add 4 drops of A-1405 Catalyzer Solution (green) (Figure 2).
- Add 4 drops of A-1406 Activator Solution (blue) (Figure 2)
- Immediately place the CHEMet ampoule, tip first, into the sample cup. Stir briefly to mix the contents of the cup, then snap the tip to allow the contents to drain into the reaction tube (Figure 3).

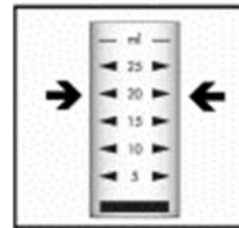


Figure 1



Figure 2

- To mix the ampoule, invert it several times, allowing the bubble to travel from end to end.
- Cap the reaction tube and shake it vigorously for 30 seconds. Allow the tube to stand undisturbed for 1 minute.
- Dry the ampoule and wait 5 minutes for color development.
- Obtain a test results by placing the ampoule between the color standards until the best color match is found (Figure 4).

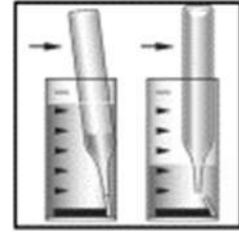


Figure 3

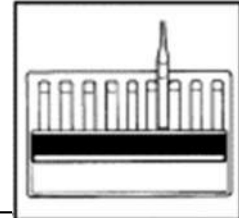
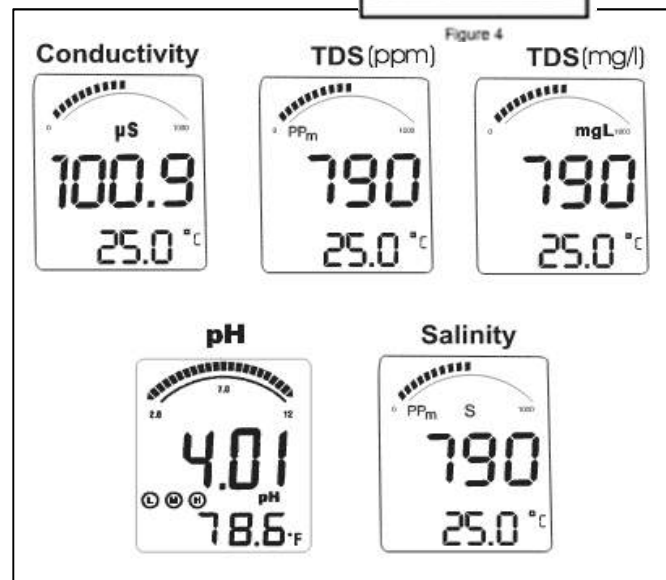


Figure 4

7. Sample Collection and Analysis for Field Parameters and Bacteria Sample Collection

- Collect a sample of the outfall flow using the sampling cup or bucket. Utilize the extendable pole if necessary to collect the sample. Obtain at least 50-100 mL of flowing water, if possible.
- First, the sample will be evaluated using the EC500 ExStik field meter to take measurements for pH, temperature, and specific conductivity. See graphic below for a display example.

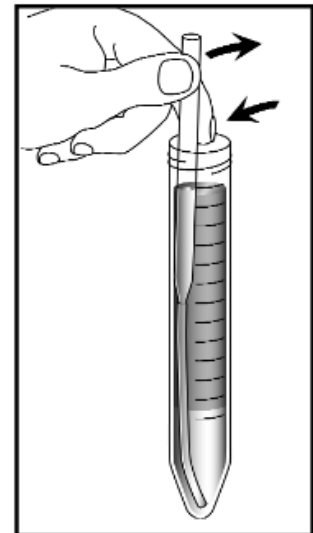
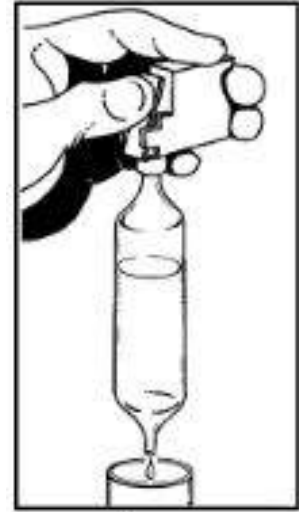


EC500 ExStik Panel

- Remove the cap from the bottom of the ExStik to expose the electrode.
- Press the ON button. “SELF CAL” will appear on the display during the turn-on diagnostics.
- Insert the electrode into the sample making sure that the electrode is completely submersed.
- Slowly stir the solution with the electrode to remove air bubbles.
- To obtain parameter measurements, depress and hold the MODE/HOLD key for 2 seconds to scroll to the desired parameter. The display will begin to scroll through the units: **µS** (for conductivity); **pH**; **ppm S** (for salinity); **ppm** (for TDS); **mg/l** (for TDS). Let go of the button to stop the scroll, push again to advance to the next reading.

8. Use the CHEMets K9400 test kit to measure surfactants (detergents) in the sample.

- Open the kit and locate the reaction tube, reagent ampoule, reaction mixing tube and cap, and comparator ampoule.
- Rinse the reaction tube with the sample to be tested, and then fill it to the 5 mL mark with the sample.
- While holding the double-tipped ampoule (containing the blue reagent) in a vertical position, snap the upper tip using the tip breaking tool.
- Invert the reagent ampoule and position the open end over the reaction tube. Snap the upper tip to allow the contents to drain into the reaction tube (see diagram on right).
- Cap the reaction tube and shake it vigorously for 30 seconds. Allow the tube to stand undisturbed for 1 minute.
- Make sure that the flexible tubing is firmly attached to the CHEMets comparator ampoule tip.
- Insert the CHEMets comparator ampoule (tubing first) along the side of the reaction tube making sure that the end of the flexible tubing is at the bottom of the tube and below the blue reagent level.
- Break the tip of the CHEMets ampoule by gently pressing it against the side of the reaction tube. The ampoule should draw in fluid only from the organic phase (bottom layer). See diagram to the right.
- When filling is complete, remove the CHEMets comparator ampoule from the reaction tube.
- Remove the flexible tubing from the CHEMets comparator ampoule and wipe all liquid from the exterior of the ampoule. Place an ampoule cap firmly onto the tip of the CHEMets comparator ampoule. Invert the comparator ampoule several times, allowing the bubble to travel from end to end.
- Obtain a test result by placing the comparator 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 and record the concentration of surfactants.



9. The HACH pocket colormetric scale for chlorine residual has reagents that must be used with the water quality sample to allow the machine to determine the colormetric chlorine residual. The procedure is to insert a blank in the machine to zero out the scale and then to insert the sample with a reagent for the pocket machine to determine the chlorine residual.
- Begin sample collection by putting on the protective gloves.
 - Zero out the instrument (Figures 1 – 7 below)

- Collect a sample of the outfall flow using the sampling cup or bucket. Pour this flow out downstream of the sample location, and repeat. Utilize the extendable pole if necessary to collect the sample. Obtain at least 200 mL of flowing water, if possible.
- Open the kit and locate the sample cell, powder pillows, and colorimeter.
- Rinse the sample cup with the sample to be tested, and then fill it to the 10 mL mark with the sample (Figure 8).
- Add one 10 mL DPD Total Chlorine Reagent Powder Pillow (Figure 9).
- Close the sample cell and shake vigorously for 20 seconds (Figure 10).
- Clean the outside of the sample cell (Figure 11)
- Insert the sample cell into the colorimeter and record the result (Figure 12).

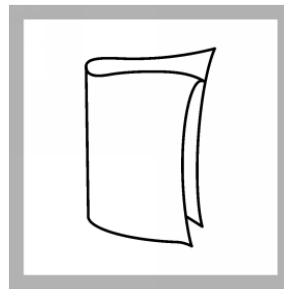
Powder pillow procedure



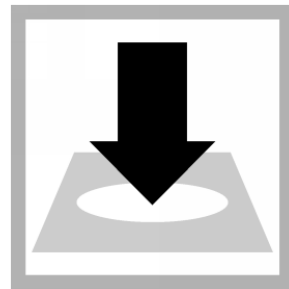
1. Set the instrument to low range (LR). Refer to the instrument documentation.



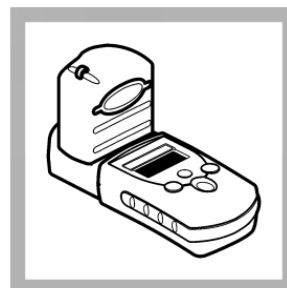
2. **Prepare the blank:** Fill a sample cell to the 10-mL mark with sample. Close the sample cell.



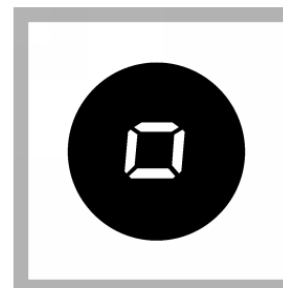
3. Clean the blank sample cell.



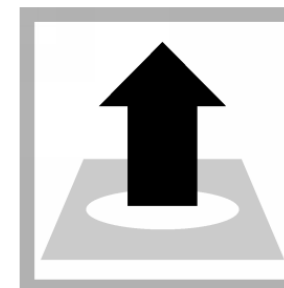
4. Insert the blank into the cell holder. Point the diamond mark on the sample cell toward the keypad.



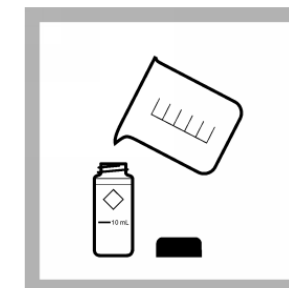
5. Install the instrument cap over the cell holder.



6. Push **ZERO**. The display shows "0.00".



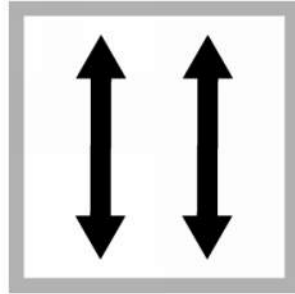
7. Remove the sample cell from the cell holder.



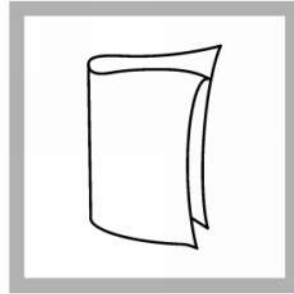
8. **Prepare the sample:** Fill a second sample cell to the 10-mL mark with sample.



9. Add one 10-mL DPD Free Chlorine Reagent Powder Pillow or one 10-mL DPD Total Chlorine Reagent Powder Pillow to the second sample cell.



10. Close the sample cell. Shake the sample cell for about **20 seconds** to dissolve the reagent. Undissolved powder will not affect accuracy. A pink color will show if chlorine is in the sample.



11. Clean the prepared sample cell.



12. Free chlorine measurement: Within 1 minute of the reagent addition, insert the prepared sample into the cell holder. Point the diamond mark on the sample cell toward the keypad. Go to step [15](#).

10. Collect an additional 100 mL sample to send to the laboratory for bacteria testing (E. Coli).

Please note that dry-weather flow samples to be sent to the laboratory will be collected on a regular basis during each day (either once or twice a day as arranged with the laboratory). Field crews should coordinate sample collection with the laboratory pick-up times to make sure that laboratory analysis hold-time of 6 hours between sample collection and the start of analyses for E. Coli and Enterococcus are not exceeded for any one sample. The Town will be sending the collected samples for bacteria to an outside lab. The lab must be notified the day before field crews are sampling so the samples can be pick up by a carrier. The pickup times are typically scheduled for 11:00 AM and 3:00 PM to coordinate with times that the lab will start the analyses. Notify the lab the day before sampling is to be conducted as these samples are time sensitive, the required analysis E.coli, which must be done within 6-hours. Bacteria sampling should occur no earlier than 7:00 AM.

A minimum of a 48-hour dry weather period should be observed before any bacteria samples are collected.

Bacteria collection procedures:

- Transfer dry-weather flow from the outfall sampling cup into the sterile sample bottles supplied by the laboratory. Fill the sample bottle to the fill line on the bottle (100 mL minimum).
- Fill out the information on the sample bottle to note date and time of sample, sample location, person taking the sample, and ensure that the right analytical test will be performed on the sample at the laboratory.
- Complete the Chain of Custody form.
- Put the sample(s) on ice in a cooler.
- Coordinate with laboratory to collect the samples or plan to drop them off at the laboratory.

11. Make sure that the sample collection cups and buckets are all thoroughly rinsed with distilled water to avoid cross-contamination after each sample round.

12. Collect an additional 500 mL sample to send to the laboratory for Phosphorus testing (SM-4500).

Please note that dry-weather flow samples to be sent to the laboratory will be collected on a regular basis during each day (either once or twice a day as arranged with the laboratory). The Town will be sending the collected samples for phosphorus to an outside lab. The lab must be notified the day before field crews are sampling so the samples can be pick up by a carrier. The pickup times are typically scheduled for 11:00 AM and 3:00 PM to coordinate with times that the lab will start the analyses. The phosphorus samples have a hold time up to 28 days.

A minimum of a 48-hour dry weather period should be observed before any lab samples are collected.

Bacteria collection procedures:

- Transfer dry-weather flow from the outfall sampling cup into the sterile sample bottles supplied by the laboratory. Fill the sample bottle to the fill line on the bottle (500 mL minimum).
 - Fill out the information on the sample bottle to note date and time of sample, sample location, person taking the sample, and ensure that the right analytical test will be performed on the sample at the laboratory.
 - Complete the Chain of Custody form.
 - Put the sample(s) on ice in a cooler.
 - Coordinate with laboratory to collect the samples or plan to drop them off at the laboratory.
13. Make sure that the sample collection cups and buckets are all thoroughly rinsed with distilled water to avoid cross-contamination after each sample round.

Field Observation Assistance

(adapted from the North Central Texas IDDE Field Investigation Guide, 2011)

To help with the visual or odor characterizations, collect a sample of the discharge in a clear test tube or sampling bottle. Avoiding an assessment of water color by looking directly into the waterway is important as water depth, substrate composition, aquatic plants, and sky conditions can all influence your perception of the water color.

Color	Possible Sources
Tan to light brown	<ul style="list-style-type: none">• Suspended sediments common after rainfall• Runoff from construction, roads, agricultural/range land• Soil erosion caused by vegetation removal
Pea green, bright green, yellow, brown, brown-green, brown-yellow, blue-green	<ul style="list-style-type: none">• Algae or plankton bloom - color depends on type of algae or plankton• Sewage, fertilizer runoff, vehicle wash water
Tea/coffee	<ul style="list-style-type: none">• Dissolved or decaying organic matter from soil or leaves. Commonly associated with tree overhangs, woodlands, or swampy areas
Milky white	<ul style="list-style-type: none">• Paint, lime, milk, grease, concrete, swimming pool filter backwash
Milky or dirty dishwater gray	<ul style="list-style-type: none">• Gray water or wastewater, musty odor present
Milky gray-black	<ul style="list-style-type: none">• Raw sewage discharge or other oxygen- demanding waste (rotten egg or hydrogen sulfide odor may be present)
Clear black	<ul style="list-style-type: none">• Caused from turnover of oxygen- depleted waters or sulfuric acid spill
Dark red, purple, blue, black	<ul style="list-style-type: none">• Fabric dyes, inks from paper and cardboard manufacturers
Orange-red	<ul style="list-style-type: none">• Leachate from iron deposits• Deposits on stream beds often associated with oil well operations
White crusty deposits	<ul style="list-style-type: none">• Common in dry/arid areas or during periods of low rainfall where evaporation of water leaves behind salt deposits• Also found in association with brine water discharge from oil production areas (a petroleum odor or an oily sheen may be present along banks)
Other (describe)	

Odors can be better characterized in a sample that can be held closer to the nose. However, never inhale the air directly off the top of a sample as many potential contaminants are harmful to nasal membranes and lung tissue. Hold the sample bottle about six inches away from your nose. Use your free hand to fan the scent to your nose. Make sure that the origin of the odor is at the outfall. Sometimes shrubs, trash, or even spray paint used to mark the outfalls can confuse the nose.

	Odor	General Causes
1	Rotten eggs/hydrogen sulfide (septic)	<ul style="list-style-type: none"> Raw sewage, decomposing organic matter, lack of oxygen
2	Chlorine	<ul style="list-style-type: none"> Wastewater treatment plant discharges, swimming pool overflow,
3	Sharp, pungent odor	<ul style="list-style-type: none"> Chemicals or pesticides
4	Musty odor	<ul style="list-style-type: none"> Presence of raw or partially treated sewage, livestock
5	Gasoline, petroleum	<ul style="list-style-type: none"> Industrial discharge, illegal dumping of wastes, waste
6	Sweet, fruity	<ul style="list-style-type: none"> Commercial wash water, wastewater
7	Other (describe)	

Sewage, Sheens & Surface Scum can indicate potential sources of contamination.

- Contaminated flows may contain floatable solids or liquids. Sewage, oil sheen, and suds/foam are examples of floatable indicators. Trash and debris, although more typically known as “floatables,” are not generally indicators of illicit flow.
- Sheens can be naturally-produced or synthetic; oil sheens are often mistaken for naturally-produced sheen.
- Sheen from bacteria forms a sheet-like film that breaks if disturbed.
- Suds should be rated based on their foaminess and staying power.
- Suds that travel several feet before breaking up should be considered as a possible illicit discharge.
- In some cases, foam and suds can give off an odor.
- A strong organic or sewage-like odor can indicate a sanitary sewer leak or overflow.
- A fragrant or sweet smelling odor can indicate the presence of laundry water or similar wash waters.

Ammonia CHEMets® Kit

K-1420/R-1402: 0 - 4 & 0 - 80 ppm N

0 - 4 ppm Test Procedure

1. Fill the sample cup to the 20 mL mark with the sample to be tested. Fig. 1
2. Add 4 drops of A-1404 Stabilizer Solution. Fig. 2
3. Add 4 drops of A-1405 Catalyzer Solution (green). Fig. 2
4. Add 4 drops of A-1406 Activator Solution (blue). Fig. 2
5. **Immediately** place the CHEMets ampoule, tip first, into the sample cup. Stir briefly to mix the contents of the cup, then snap the tip. The ampoule will fill leaving a bubble for mixing. Fig. 3
6. To mix the ampoule, invert it several times, allowing the bubble to travel from end to end.
7. Dry the ampoule and wait **5 minutes** for color development.

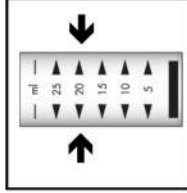


Figure 1

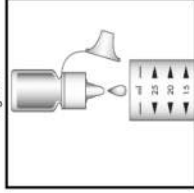


Figure 2

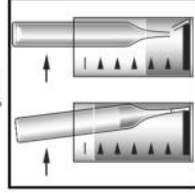


Figure 3

8. Obtain a test result by placing the ampoule between the color standards until the best color match is found. Fig. 4

NOTE: Use the concentration scale on the comparator label that corresponds to the range of the test procedure being used.

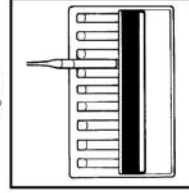


Figure 4

0 - 80 ppm Test Procedure

1. Using the syringe provided, obtain **1.0 mL** of the sample to be tested and dispense it into the empty sample cup.
2. Dilute the contents of the sample cup to the **20 mL** mark with distilled water.
3. Perform the 0 - 4 ppm Test Procedure, beginning with Step 2.

Test Method

The Ammonia CHEMets®¹ test kit employs the Hydroxybenzyl alcohol (HBA) chemistry.² Free ammonia reacts with hypochlorite to form monochloramine. Monochloramine reacts with HBA, in the presence of sodium nitro-ferricyanide, to form a green colored complex. This test method measures the sum of free ammonia and monochloramine. High levels of ammonia can produce false low or off color test results. Dilute the sample if the ammonia concentration is suspected to significantly exceed the test range.

1. CHEMets is a registered trademark of CHEMetrics, Inc. U.S. Patent No. 3,634,038
2. Krom, Michael D., Spectrophotometric Determination of Ammonia: A study of a Modified Berthelot Reduction Using Salicylate and Dichloroisocyanurate, *The Analyst*, V105 pp. 305-316, 1980.

Safety Information

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

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



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. 2

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 CHEMets ampoule tip.
6. Insert the CHEMets 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 CHEMets 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 CHEMets assembly from the reaction tube.
8. Remove the flexible tubing from the CHEMets ampoule and wipe all liquid from the exterior of the ampoule. Place an ampoule cap firmly onto the tip of the CHEMets ampoule. Invert the ampoule several times, allowing the bubble to travel from end to end.

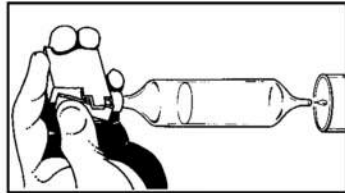


Figure 1

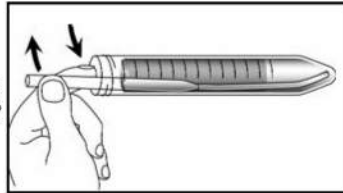


Figure 2

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



Figure 3

Tip Breaker

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

Test Method

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

1. CHEMets is a registered trademark of CHEMetics, 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.



Simplicity in Water Analysis

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Feb. 18, Rev. 10

Chlorine, Free and Total, Low Range

DOC316.53.01450

USEPA DPD Method¹

Method 8021 (free) 8167 (total)

0.02 to 2.00 mg/L Cl₂ (LR)

Powder Pillows or AccuVac[®] Ampuls

Scope and application: For testing residual chlorine and chloramines in water, wastewater, estuary water and seawater; USEPA-accepted for reporting for drinking and wastewater analyses.² This product has not been evaluated to test for chlorine and chloramines in medical applications in the United States.

¹ Adapted from Standard Methods for the Examination of Water and Wastewater.

² Procedure is equivalent to USEPA and Standard Method 4500-Cl G for drinking water and wastewater analysis.



Test preparation

Before starting

Analyze the samples immediately. The samples cannot be preserved for later analysis.

Always do tests in sample cells or AccuVac[®] Ampuls. Do not put the instrument in the sample or pour the sample into the cell holder.

Make sure that the sample cells are clean and there are no scratches where the light passes through them.

Rinse the sample cell and cap with the sample three times before the sample cell is filled.

Make sure that there are no fingerprints or liquid on the external surface of the sample cells or AccuVac[®] Ampuls. Wipe with a lint-free cloth before measurement.

Cold waters can cause condensation on the sample cell or bubbles in the sample cell during color development. Examine the sample cell for condensation or bubbles. Remove condensation with a lint-free cloth. Invert the sample cell to remove bubbles.

Install the instrument cap over the cell holder before ZERO or READ is pushed.

After the test, immediately empty and rinse the sample cell. Rinse the sample cell and cap three times with deionized water.

Do not use the same sample cells for free and total chlorine. If trace iodide from the total chlorine reagent is carried over into the free chlorine determination, monochloramine will interfere. It is best to use separate, dedicated sample cells for free and total chlorine measurements.

If the test result is over-range, or if the sample temporarily turns yellow after the reagent addition, dilute the sample with a known volume of high quality, chlorine demand-free water and do the test again. Some loss of chlorine may occur due to the dilution. Multiply the result by the dilution factor. Additional methods are available to measure chlorine without dilution.

For the best results, measure the reagent blank value for each new lot of reagent. Replace the sample with deionized water in the test procedure to determine the reagent blank value. Subtract the reagent blank value from the sample results.

The AccuVac Ampul Snapper makes AccuVac Ampul tests easier to do. The AccuVac Ampul Snapper keeps the broken tip of the ampul, prevents exposure to the sample and provides controlled conditions for filling the ampule.

An AccuVac Ampul for Blanks can be used to zero the instrument in the AccuVac test procedure.

The SwifTest Dispenser for Free Chlorine or Total Chlorine can be used in place of the powder pillow in the test procedures. One dispensation equals one powder pillow for 10-mL samples.

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

Dispose of reacted solutions according to local, state and federal regulations. Refer to the Safety Data Sheets for disposal information for unused reagents. Refer to the environmental, health and safety staff for your facility and/or local regulatory agencies for further disposal information.

Items to collect

Powder pillows

Description	Quantity
Chlorine, Free: DPD Free Chlorine Reagent Powder Pillows, 10-mL	1
Chlorine, Total: DPD Total Chlorine Reagent Powder Pillows, 10-mL	1
Sample cells, 25-mm (10 mL)	2

Refer to [Consumables and replacement items](#) on page 7 for order information.

AccuVac Ampuls

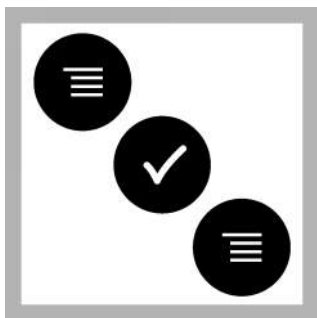
Description	Quantity
Chlorine, Free: DPD Free Chlorine Reagent AccuVac Ampuls	1
Chlorine, Total: DPD Total Chlorine Reagent AccuVac Ampuls	1
Beaker, 50-mL	1
Stopper for 18-mm tubes and AccuVac Ampuls	1
Sample cells, 25-mm (10 mL)	1

Refer to [Consumables and replacement items](#) on page 7 for order information.

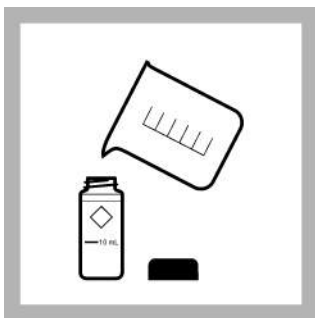
Sample collection

- Analyze the samples immediately. The samples cannot be preserved for later analysis.
- Chlorine is a strong oxidizing agent and is unstable in natural waters. Chlorine reacts quickly with various inorganic compounds and more slowly with organic compounds. Many factors, including reactant concentrations, sunlight, pH, temperature and salinity influence the decomposition of chlorine in water.
- Collect samples in clean glass bottles. Do not use plastic containers because these can have a large chlorine demand.
- Pretreat glass sample containers to remove chlorine demand. Soak the containers in a weak bleach solution (1 mL commercial bleach to 1 liter of deionized water) for at least 1 hour. Rinse fully with deionized or distilled water. If sample containers are rinsed fully with deionized or distilled water after use, only occasional pretreatment is necessary.
- Make sure to get a representative sample. If the sample is taken from a spigot or faucet, let the water flow for at least 5 minutes. Let the container overflow with the sample several times and then put the cap on the sample container so that there is no headspace (air) above the sample.

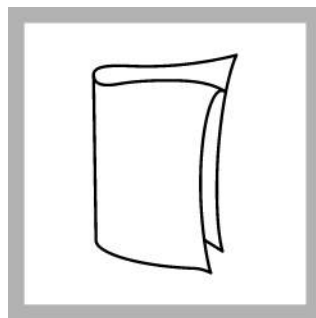
Powder pillow procedure



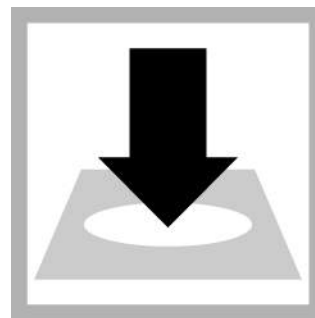
1. Set the instrument to low range (LR). Refer to the instrument documentation.



2. **Prepare the blank:** Fill a sample cell to the 10-mL mark with sample. Close the sample cell.



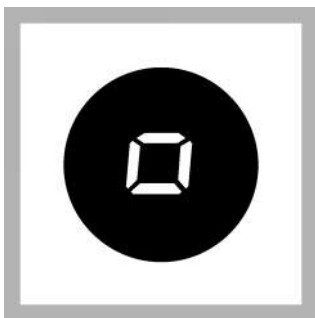
3. Clean the blank sample cell.



4. Insert the blank into the cell holder. Point the diamond mark on the sample cell toward the keypad.



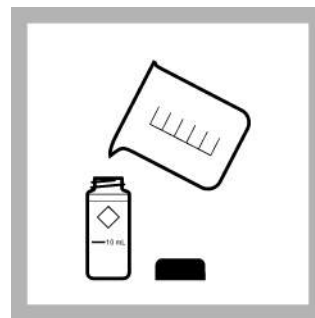
5. Install the instrument cap over the cell holder.



6. Push **ZERO**. The display shows "0.00".



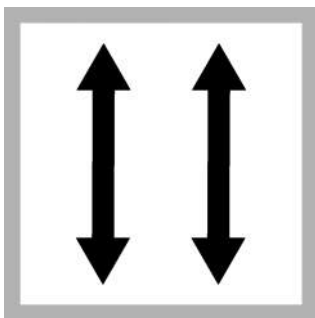
7. Remove the sample cell from the cell holder.



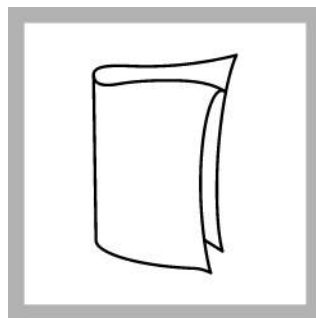
8. **Prepare the sample:** Fill a second sample cell to the 10-mL mark with sample.



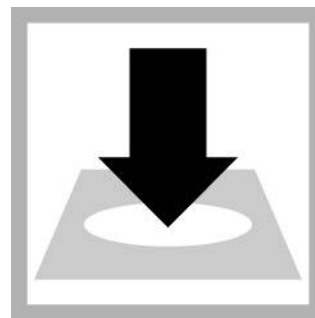
9. Add one 10-mL DPD Free Chlorine Reagent Powder Pillow or one 10-mL DPD Total Chlorine Reagent Powder Pillow to the second sample cell.



10. Close the sample cell. Shake the sample cell for about **20 seconds** to dissolve the reagent. Undissolved powder will not affect accuracy.
A pink color will show if chlorine is in the sample.



11. Clean the prepared sample cell.



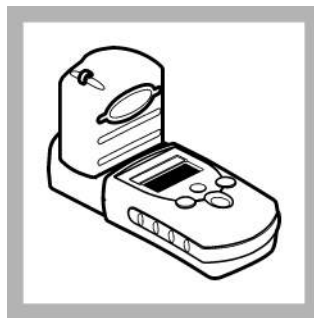
12. **Free chlorine measurement:** Within 1 minute of the reagent addition, insert the prepared sample into the cell holder. Point the diamond mark on the sample cell toward the keypad.
Go to step [15](#).



13. Set and start a timer for 3 minutes. A 3-minute reaction time starts.



14. **Total chlorine measurement:** After 3 minutes and within 6 minutes of the reagent addition, insert the prepared sample into the cell holder. Point the diamond mark on the sample cell toward the keypad.



15. Install the instrument cap over the cell holder.



16. Push **READ**. Results show in mg/L Cl_2 .

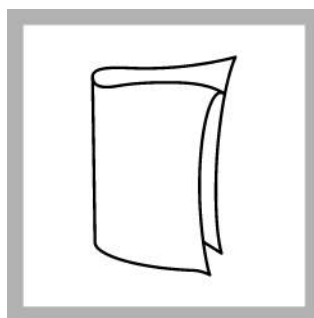
AccuVac[®] Ampul procedure



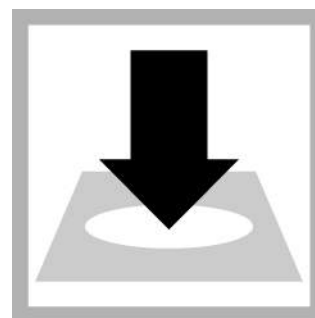
1. Set the instrument to low range (LR). Refer to the instrument documentation.



2. **Prepare the blank:** Fill a sample cell to the 10-mL mark with sample. Close the sample cell.



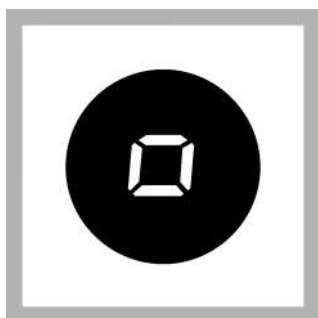
3. Clean the blank sample cell.



4. Insert the blank into the cell holder. Point the diamond mark on the sample cell toward the keypad.



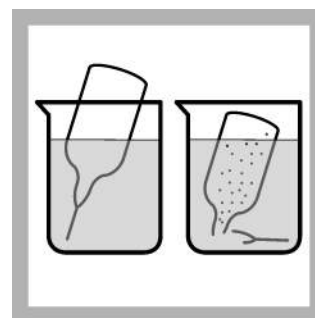
5. Install the instrument cap over the cell holder.



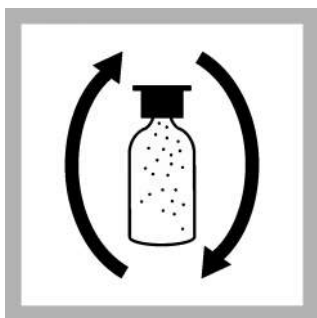
6. Push **ZERO**. The display shows "0.00".



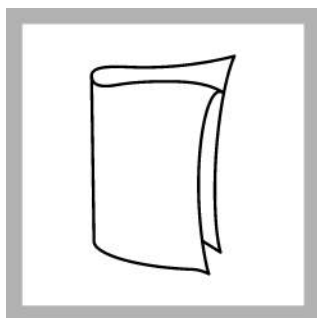
7. Remove the sample cell from the cell holder.



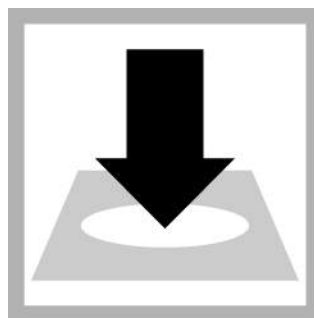
8. **Prepare the sample:** Collect at least 40 mL of sample in a 50-mL beaker. Fill a DPD Free Chlorine Reagent AccuVac Ampul or a DPD Total Chlorine Reagent AccuVac Ampul with sample. Keep the tip immersed while the AccuVac Ampul fills completely.



9. Quickly invert the AccuVac Ampul several times to mix.



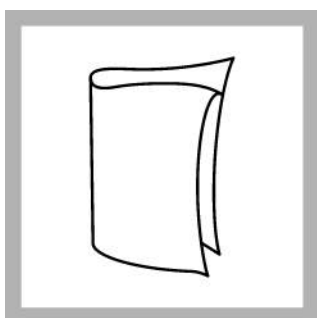
10. Clean the AccuVac Ampul.



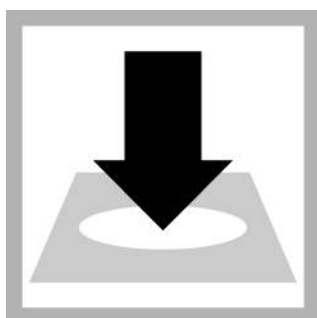
11. Free chlorine measurement: Within 1 minute of the reagent addition, insert the prepared sample AccuVac Ampul into the cell holder.
Go to step 15.



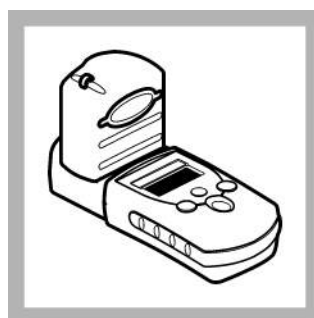
12. Set and start a timer for 3 minutes. A 3-minute reaction time starts.



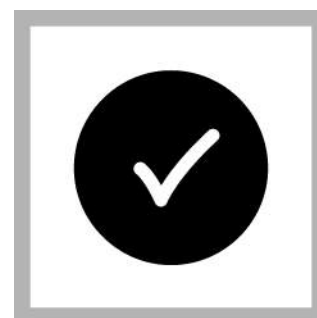
13. When the timer expires, clean the prepared sample cell.



14. Total chlorine measurement: Within 6 minutes of the reagent addition, insert the prepared sample AccuVac Ampul into the cell holder.



15. Install the instrument cap over the cell holder.



16. Push **READ**. Results show in mg/L Cl₂.

Interferences

Interfering substance	Interference level
Acidity	More than 150 mg/L CaCO ₃ . The full color may not develop or the color may fade instantly. Adjust to pH 6–7 with 1 N Sodium Hydroxide. Measure the amount to add on a separate sample aliquot, then add the same amount to the sample that is tested. Correct the test result for the dilution from the volume addition.
Alkalinity	More than 250 mg/L CaCO ₃ . The full color may not develop or the color may fade instantly. Adjust to pH 6–7 with 1 N Sulfuric Acid. Measure the amount to add on a separate sample aliquot, then add the same amount to the sample that is tested. Correct the test result for the dilution from the volume addition.
Bromine, Br ₂	Positive interference at all levels
Chlorine Dioxide, ClO ₂	Positive interference at all levels
Inorganic chloramines	Positive interference at all levels
Chloramines, organic	May interfere
Hardness	No effect at less than 1000 mg/L as CaCO ₃

Interfering substance	Interference level
Manganese, Oxidized (Mn ⁴⁺ , Mn ⁷⁺) or Chromium, Oxidized (Cr ⁶⁺)	Pre-treat the sample as follows: <ol style="list-style-type: none"> 1. Adjust the sample pH to 6–7. 2. Add 3 drops of Potassium Iodide (30-g/L) to 10 mL of sample. 3. Mix and wait 1 minute. 4. Add 3 drops of Sodium Arsenite (5-g/L) and mix. 5. Use the test procedure to measure the concentration of the treated sample. 6. Subtract this result from the result without the treatment to obtain the correct chlorine concentration.
Monochloramine	Causes a gradual drift to higher readings. When read within 1 minute after reagent addition, 3 mg/L monochloramine causes less than a 0.1 mg/L increase in the reading.
Ozone	Positive interference at all levels
Peroxides	May interfere
Highly buffered samples or extreme sample pH	Can prevent the correct pH adjustment (of the sample) by the reagents. Sample pretreatment may be necessary. Adjust to pH 6–7 with acid (Sulfuric Acid, 1 N) or base (Sodium Hydroxide, 1 N). Correct the test result for the dilution caused by the volume additions.

Pollution prevention and waste management

If sodium arsenite was added to the sample for manganese or chromium interferences, the reacted samples will contain arsenic and must be disposed of as a hazardous waste. Dispose of reacted solutions according to local, state and federal regulations. must be disposed of as a hazardous waste. Dispose of reacted solutions according to local, state and federal regulations.

Accuracy check

Standard additions method

Use the standard additions method to validate the test procedure, reagents and instrument and to find if there is an interference in the sample.

Items to collect:

- Chlorine Standard Solution, 2-mL PourRite[®] Ampule, 25–30 mg/L (use mg/L on label)
 - Ampule breaker
 - Pipet, TenSette[®], 0.1–1.0 mL and tips
1. Prepare three spiked samples: use the TenSette pipet to add 0.1 mL, 0.2 mL and 0.3 mL of the standard solution, respectively, to three 10-mL portions of fresh sample. Mix well.
Note: For AccuVac[®] Ampuls, add 0.4 mL, 0.8 mL and 1.2 mL of the standard solution to three 50-mL portions of fresh sample.
 2. Use the test procedure to measure the concentration of each of the spiked samples. Start with the smallest sample spike. Measure each of the spiked samples in the instrument.
 3. Compare the expected result to the actual result. The expected increase in the chlorine concentration is the Cl₂ mg/L concentration from the label of the standard solution multiplied by 0.1 mL for every 10 mL of standard solution added.

Standard solution method

If the Standard Calibration Adjust feature is used to adjust the calibration curve of the Pocket Colorimeter II, the concentration of the chlorine standard must be between 0.50 and 1.50 mg/L chlorine for the LR procedure.

Verification of on-line analyzers

This procedure can be used to meet the requirements of USEPA Method 334.0 - Determination of Residual Chlorine in Drinking Water Using an On-line Chlorine Analyzer.

The procedure and requirements for compliance with EPA Method 334.0 can be downloaded directly from <http://www.hach.com/method334>.

Method performance

The method performance data that follows was derived from laboratory tests that were measured on a Pocket Colorimeter II during ideal test conditions. Users can get different results under different test conditions.

Precision (95% confidence interval)
1.00 ± 0.05 mg/L Cl ₂

Summary of method

Chlorine can be in water as free chlorine and as combined chlorine. Both forms can be in the same solution and can be determined together as total chlorine. Free chlorine is in a solution as hypochlorous acid or hypochlorite ion. Combined chlorine represents a combination of chlorine-containing compounds, including monochloramine, dichloramine, nitrogen trichloride and other chloro derivatives. The combined chlorine oxidizes iodide (I⁻) to iodine (I₂). The iodine and free chlorine reacts with DPD (N,N-diethyl-p-phenylenediamine) to form a red solution. The color intensity is proportional to the chlorine concentration. To determine the concentration of combined chlorine, complete a free chlorine test and a total chlorine test. Subtract the results of the free chlorine test from the total chlorine test to get the combined chlorine concentration.

Consumables and replacement items

Required reagents

Description	Quantity/test	Unit	Item no.
DPD Free Chlorine Reagent Powder Pillow, 10 mL	1	100/pkg	2105569
DPD Total Chlorine Reagent Powder Pillow, 10 mL	1	100/pkg	2105669
OR			
DPD Free Chlorine Reagent AccuVac [®] Ampul	1	25/pkg	2502025
DPD Total Chlorine Reagent AccuVac [®] Ampul	1	25/pkg	2503025

Required apparatus (powder pillows)

Description	Quantity/test	Unit	Item no.
Sample cells, 10-mL round, 25 mm x 60 mm	2	6/pkg	2427606

Required apparatus (AccuVac Ampul)

Description	Quantity/Test	Unit	Item no.
Sample cell, 10-mL round, 25 mm x 60 mm	1	6/pkg	2427606
Beaker, 50 mL	1	each	50041H
Stoppers for 18-mm tubes and AccuVac Ampuls	2	6/pkg	173106

Recommended standards and apparatus

Description	Unit	Item no.
Chlorine Standard Solution, 2-mL PourRite [®] Ampules, 25–30 mg/L	20/pkg	2630020
PourRite [®] Ampule Breaker, 2-mL	each	2484600

Optional reagents and apparatus

Description	Unit	Item no.
AccuVac [®] Ampul Snapper	each	2405200
Mixing cylinder, graduated, 25-mL	each	2088640
Potassium Iodide, 30-g/L	100 mL	34332
Sodium Arsenite, 5-g/L	100 mL	104732
Sodium Hydroxide Standard Solution, 1.0 N	100 mL MDB	104532
Sulfuric Acid Standard Solution, 1 N	100 mL MDB	127032
Pipet, TenSette [®] , 0.1–1.0 mL	each	1970001
Pipet tips for TenSette [®] Pipet, 0.1–1.0 mL	50/pkg	2185696
Pipet tips for TenSette [®] Pipet, 0.1–1.0 mL	1000/pkg	2185628
Paper, pH, 0–14 pH range	100/pkg	2601300
DPD Free Chlorine Reagent Powder Pillows, 10 mL	1000/pkg	2105528
DPD Total Chlorine Reagent Powder Pillows, 10 mL	1000/pkg	2105628
SwifTest [™] dispenser for free chlorine ¹	each	2802300
SwifTest [™] dispenser for total chlorine ²	each	2802400
DPD Free Chlorine Reagent, 10-mL, SwifTest [™] Dispenser refill vial	250 tests	2105560
DPD Total Chlorine Reagent, 10-mL, SwifTest [™] Dispenser refill vial	250 tests	2105660
SpecCheck [™] Secondary Standard Kit, Chlorine DPD, 0–2.0 mg/L Set	each	2635300
Water, organic-free	500 mL	2641549

¹ Includes one vial of 2105560 for 250 tests.

² Includes one vial of 2105660 for 250 tests.



FOR TECHNICAL ASSISTANCE, PRICE INFORMATION AND ORDERING:
 In the U.S.A. – Call toll-free 800-227-4224
 Outside the U.S.A. – Contact the HACH office or distributor serving you.
 On the Worldwide Web – www.hach.com; E-mail – techhelp@hach.com

HACH COMPANY
 WORLD HEADQUARTERS
 Telephone: (970) 669-3050
 FAX: (970) 669-2932

Ammonia CHEMets® Kit

K-1420/R-1402: 0 - 4 & 0 - 80 ppm N

0 - 4 ppm Test Procedure

1. Fill the sample cup to the 20 mL mark with the sample to be tested. Fig. 1
2. Add 4 drops of A-1404 Stabilizer Solution. Fig. 2
3. Add 4 drops of A-1405 Catalyzer Solution (green). Fig. 2
4. Add 4 drops of A-1406 Activator Solution (blue). Fig. 2
5. **Immediately** place the CHEMets ampoule, tip first, into the sample cup. Stir briefly to mix the contents of the cup, then snap the tip. The ampoule will fill leaving a bubble for mixing. Fig. 3
6. To mix the ampoule, invert it several times, allowing the bubble to travel from end to end.
7. Dry the ampoule and wait **5 minutes** for color development.

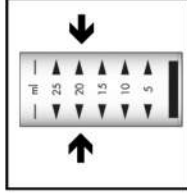


Figure 1

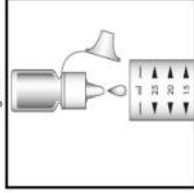


Figure 2

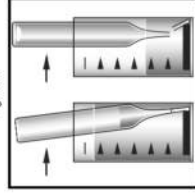


Figure 3

8. Obtain a test result by placing the ampoule between the color standards until the best color match is found. Fig. 4

NOTE: Use the concentration scale on the comparator label that corresponds to the range of the test procedure being used.

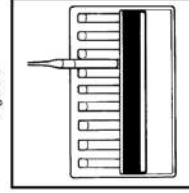


Figure 4

0 - 80 ppm Test Procedure

1. Using the syringe provided, obtain **1.0 mL** of the sample to be tested and dispense it into the empty sample cup.
2. Dilute the contents of the sample cup to the **20 mL** mark with distilled water.
3. Perform the 0 - 4 ppm Test Procedure, beginning with Step 2.

Test Method

The Ammonia CHEMets®¹ test kit employs the Hydroxybenzyl alcohol (HBA) chemistry.² Free ammonia reacts with hypochlorite to form monochloramine. Monochloramine reacts with HBA, in the presence of sodium nitro-ferricyanide, to form a green colored complex. This test method measures the sum of free ammonia and monochloramine. High levels of ammonia can produce false low or off color test results. Dilute the sample if the ammonia concentration is suspected to significantly exceed the test range.

1. CHEMets is a registered trademark of CHEMetrics, Inc. U.S. Patent No. 3,634,038
2. Krom, Michael D., Spectrophotometric Determination of Ammonia: A study of a Modified Berthelot Reduction Using Salicylate and Dichloroisocyanurate, *The Analyst*, V105 pp. 305-316, 1980.

Safety Information

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

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



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. 2

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 CHEMets ampoule tip.
6. Insert the CHEMets 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 CHEMets 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 CHEMets assembly from the reaction tube.
8. Remove the flexible tubing from the CHEMets ampoule and wipe all liquid from the exterior of the ampoule. Place an ampoule cap firmly onto the tip of the CHEMets ampoule. Invert the ampoule several times, allowing the bubble to travel from end to end.

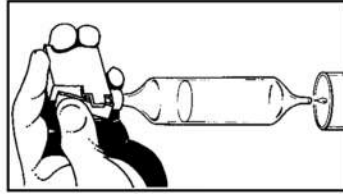


Figure 1

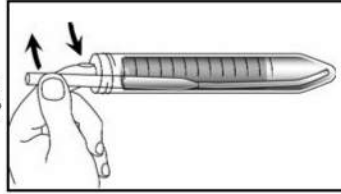


Figure 2

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



Figure 3

Tip Breaker

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

Test Method

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

1. CHEMets is a registered trademark of CHEMetics, 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.



Simplicity in Water Analysis

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Feb. 18, Rev. 10

Chlorine, Free and Total, Low Range

DOC316.53.01450

USEPA DPD Method¹

Method 8021 (free) 8167 (total)

0.02 to 2.00 mg/L Cl₂ (LR)

Powder Pillows or AccuVac[®] Ampuls

Scope and application: For testing residual chlorine and chloramines in water, wastewater, estuary water and seawater; USEPA-accepted for reporting for drinking and wastewater analyses.² This product has not been evaluated to test for chlorine and chloramines in medical applications in the United States.

¹ Adapted from Standard Methods for the Examination of Water and Wastewater.

² Procedure is equivalent to USEPA and Standard Method 4500-Cl G for drinking water and wastewater analysis.



Test preparation

Before starting

Analyze the samples immediately. The samples cannot be preserved for later analysis.

Always do tests in sample cells or AccuVac[®] Ampuls. Do not put the instrument in the sample or pour the sample into the cell holder.

Make sure that the sample cells are clean and there are no scratches where the light passes through them.

Rinse the sample cell and cap with the sample three times before the sample cell is filled.

Make sure that there are no fingerprints or liquid on the external surface of the sample cells or AccuVac[®] Ampuls. Wipe with a lint-free cloth before measurement.

Cold waters can cause condensation on the sample cell or bubbles in the sample cell during color development. Examine the sample cell for condensation or bubbles. Remove condensation with a lint-free cloth. Invert the sample cell to remove bubbles.

Install the instrument cap over the cell holder before ZERO or READ is pushed.

After the test, immediately empty and rinse the sample cell. Rinse the sample cell and cap three times with deionized water.

Do not use the same sample cells for free and total chlorine. If trace iodide from the total chlorine reagent is carried over into the free chlorine determination, monochloramine will interfere. It is best to use separate, dedicated sample cells for free and total chlorine measurements.

If the test result is over-range, or if the sample temporarily turns yellow after the reagent addition, dilute the sample with a known volume of high quality, chlorine demand-free water and do the test again. Some loss of chlorine may occur due to the dilution. Multiply the result by the dilution factor. Additional methods are available to measure chlorine without dilution.

For the best results, measure the reagent blank value for each new lot of reagent. Replace the sample with deionized water in the test procedure to determine the reagent blank value. Subtract the reagent blank value from the sample results.

The AccuVac Ampul Snapper makes AccuVac Ampul tests easier to do. The AccuVac Ampul Snapper keeps the broken tip of the ampul, prevents exposure to the sample and provides controlled conditions for filling the ampule.

An AccuVac Ampul for Blanks can be used to zero the instrument in the AccuVac test procedure.

The SwifTest Dispenser for Free Chlorine or Total Chlorine can be used in place of the powder pillow in the test procedures. One dispensation equals one powder pillow for 10-mL samples.

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

Dispose of reacted solutions according to local, state and federal regulations. Refer to the Safety Data Sheets for disposal information for unused reagents. Refer to the environmental, health and safety staff for your facility and/or local regulatory agencies for further disposal information.

Items to collect

Powder pillows

Description	Quantity
Chlorine, Free: DPD Free Chlorine Reagent Powder Pillows, 10-mL	1
Chlorine, Total: DPD Total Chlorine Reagent Powder Pillows, 10-mL	1
Sample cells, 25-mm (10 mL)	2

Refer to [Consumables and replacement items](#) on page 7 for order information.

AccuVac Ampuls

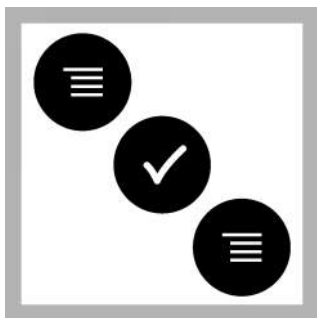
Description	Quantity
Chlorine, Free: DPD Free Chlorine Reagent AccuVac Ampuls	1
Chlorine, Total: DPD Total Chlorine Reagent AccuVac Ampuls	1
Beaker, 50-mL	1
Stopper for 18-mm tubes and AccuVac Ampuls	1
Sample cells, 25-mm (10 mL)	1

Refer to [Consumables and replacement items](#) on page 7 for order information.

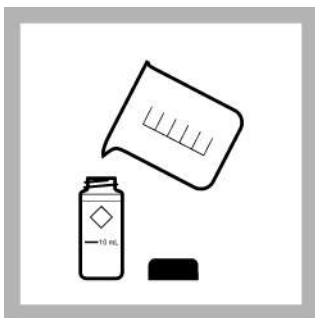
Sample collection

- Analyze the samples immediately. The samples cannot be preserved for later analysis.
- Chlorine is a strong oxidizing agent and is unstable in natural waters. Chlorine reacts quickly with various inorganic compounds and more slowly with organic compounds. Many factors, including reactant concentrations, sunlight, pH, temperature and salinity influence the decomposition of chlorine in water.
- Collect samples in clean glass bottles. Do not use plastic containers because these can have a large chlorine demand.
- Pretreat glass sample containers to remove chlorine demand. Soak the containers in a weak bleach solution (1 mL commercial bleach to 1 liter of deionized water) for at least 1 hour. Rinse fully with deionized or distilled water. If sample containers are rinsed fully with deionized or distilled water after use, only occasional pretreatment is necessary.
- Make sure to get a representative sample. If the sample is taken from a spigot or faucet, let the water flow for at least 5 minutes. Let the container overflow with the sample several times and then put the cap on the sample container so that there is no headspace (air) above the sample.

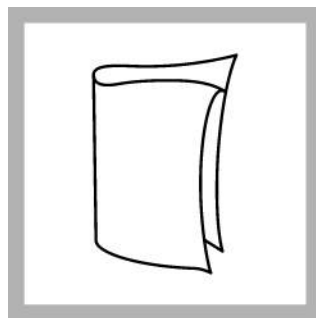
Powder pillow procedure



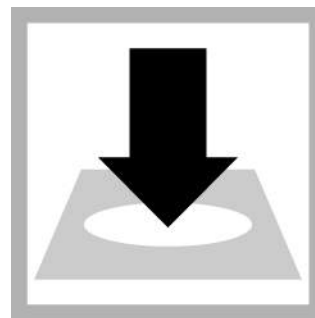
1. Set the instrument to low range (LR). Refer to the instrument documentation.



2. **Prepare the blank:** Fill a sample cell to the 10-mL mark with sample. Close the sample cell.



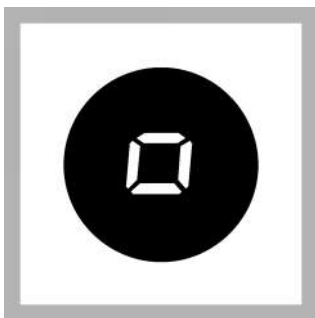
3. Clean the blank sample cell.



4. Insert the blank into the cell holder. Point the diamond mark on the sample cell toward the keypad.



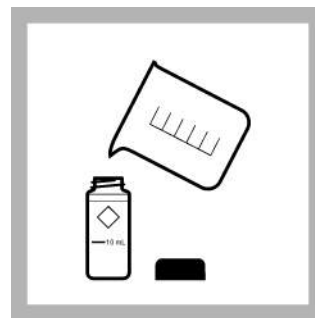
5. Install the instrument cap over the cell holder.



6. Push **ZERO**. The display shows "0.00".



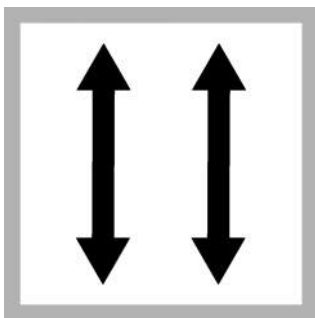
7. Remove the sample cell from the cell holder.



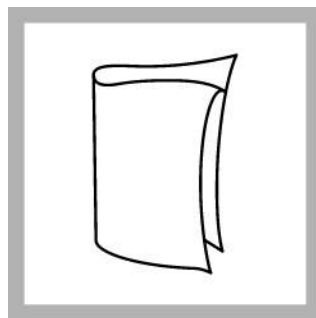
8. **Prepare the sample:** Fill a second sample cell to the 10-mL mark with sample.



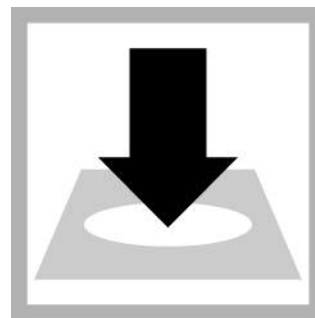
9. Add one 10-mL DPD Free Chlorine Reagent Powder Pillow or one 10-mL DPD Total Chlorine Reagent Powder Pillow to the second sample cell.



10. Close the sample cell. Shake the sample cell for about **20 seconds** to dissolve the reagent. Undissolved powder will not affect accuracy.
A pink color will show if chlorine is in the sample.



11. Clean the prepared sample cell.



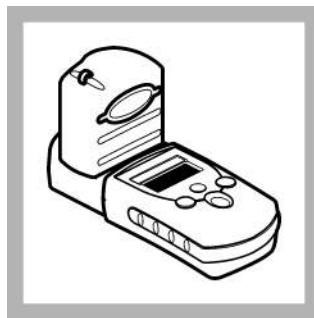
12. **Free chlorine measurement:** Within 1 minute of the reagent addition, insert the prepared sample into the cell holder. Point the diamond mark on the sample cell toward the keypad.
Go to step [15](#).



13. Set and start a timer for 3 minutes. A 3-minute reaction time starts.



14. **Total chlorine measurement:** After 3 minutes and within 6 minutes of the reagent addition, insert the prepared sample into the cell holder. Point the diamond mark on the sample cell toward the keypad.



15. Install the instrument cap over the cell holder.



16. Push **READ**. Results show in mg/L Cl_2 .

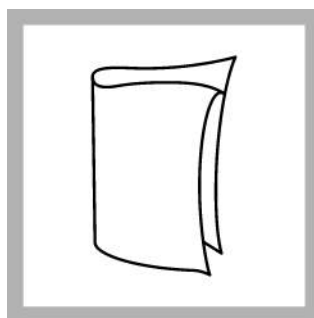
AccuVac[®] Ampul procedure



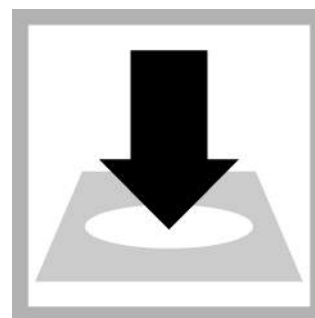
1. Set the instrument to low range (LR). Refer to the instrument documentation.



2. **Prepare the blank:** Fill a sample cell to the 10-mL mark with sample. Close the sample cell.



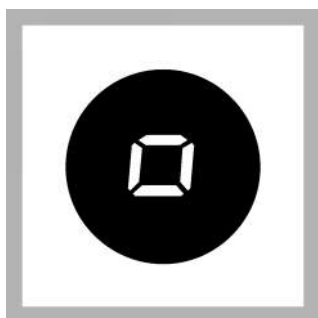
3. Clean the blank sample cell.



4. Insert the blank into the cell holder. Point the diamond mark on the sample cell toward the keypad.



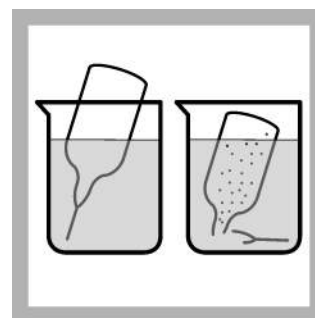
5. Install the instrument cap over the cell holder.



6. Push **ZERO**. The display shows "0.00".



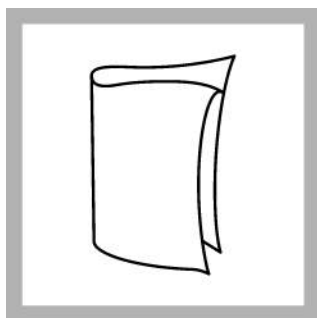
7. Remove the sample cell from the cell holder.



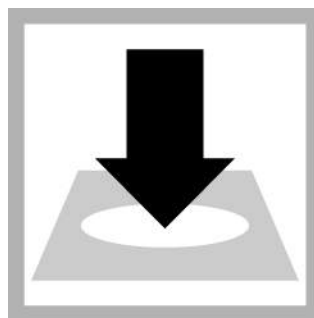
8. **Prepare the sample:** Collect at least 40 mL of sample in a 50-mL beaker. Fill a DPD Free Chlorine Reagent AccuVac Ampul or a DPD Total Chlorine Reagent AccuVac Ampul with sample. Keep the tip immersed while the AccuVac Ampul fills completely.



9. Quickly invert the AccuVac Ampul several times to mix.



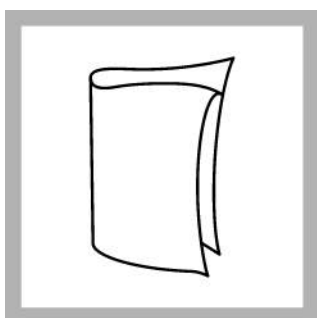
10. Clean the AccuVac Ampul.



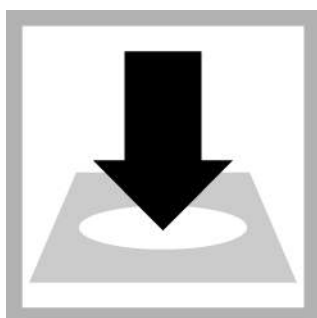
11. Free chlorine measurement: Within 1 minute of the reagent addition, insert the prepared sample AccuVac Ampul into the cell holder.
Go to step 15.



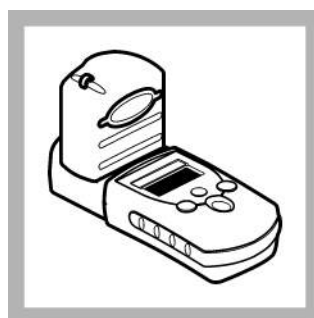
12. Set and start a timer for 3 minutes. A 3-minute reaction time starts.



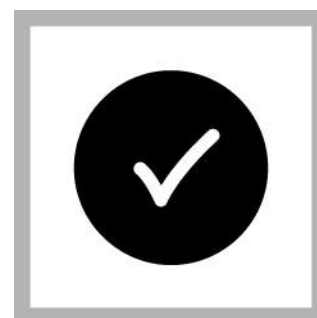
13. When the timer expires, clean the prepared sample cell.



14. Total chlorine measurement: Within 6 minutes of the reagent addition, insert the prepared sample AccuVac Ampul into the cell holder.



15. Install the instrument cap over the cell holder.



16. Push **READ**. Results show in mg/L Cl₂.

Interferences

Interfering substance	Interference level
Acidity	More than 150 mg/L CaCO ₃ . The full color may not develop or the color may fade instantly. Adjust to pH 6–7 with 1 N Sodium Hydroxide. Measure the amount to add on a separate sample aliquot, then add the same amount to the sample that is tested. Correct the test result for the dilution from the volume addition.
Alkalinity	More than 250 mg/L CaCO ₃ . The full color may not develop or the color may fade instantly. Adjust to pH 6–7 with 1 N Sulfuric Acid. Measure the amount to add on a separate sample aliquot, then add the same amount to the sample that is tested. Correct the test result for the dilution from the volume addition.
Bromine, Br ₂	Positive interference at all levels
Chlorine Dioxide, ClO ₂	Positive interference at all levels
Inorganic chloramines	Positive interference at all levels
Chloramines, organic	May interfere
Hardness	No effect at less than 1000 mg/L as CaCO ₃

Interfering substance	Interference level
Manganese, Oxidized (Mn ⁴⁺ , Mn ⁷⁺) or Chromium, Oxidized (Cr ⁶⁺)	Pre-treat the sample as follows: <ol style="list-style-type: none"> 1. Adjust the sample pH to 6–7. 2. Add 3 drops of Potassium Iodide (30-g/L) to 10 mL of sample. 3. Mix and wait 1 minute. 4. Add 3 drops of Sodium Arsenite (5-g/L) and mix. 5. Use the test procedure to measure the concentration of the treated sample. 6. Subtract this result from the result without the treatment to obtain the correct chlorine concentration.
Monochloramine	Causes a gradual drift to higher readings. When read within 1 minute after reagent addition, 3 mg/L monochloramine causes less than a 0.1 mg/L increase in the reading.
Ozone	Positive interference at all levels
Peroxides	May interfere
Highly buffered samples or extreme sample pH	Can prevent the correct pH adjustment (of the sample) by the reagents. Sample pretreatment may be necessary. Adjust to pH 6–7 with acid (Sulfuric Acid, 1 N) or base (Sodium Hydroxide, 1 N). Correct the test result for the dilution caused by the volume additions.

Pollution prevention and waste management

If sodium arsenite was added to the sample for manganese or chromium interferences, the reacted samples will contain arsenic and must be disposed of as a hazardous waste. Dispose of reacted solutions according to local, state and federal regulations. must be disposed of as a hazardous waste. Dispose of reacted solutions according to local, state and federal regulations.

Accuracy check

Standard additions method

Use the standard additions method to validate the test procedure, reagents and instrument and to find if there is an interference in the sample.

Items to collect:

- Chlorine Standard Solution, 2-mL PourRite[®] Ampule, 25–30 mg/L (use mg/L on label)
 - Ampule breaker
 - Pipet, TenSette[®], 0.1–1.0 mL and tips
1. Prepare three spiked samples: use the TenSette pipet to add 0.1 mL, 0.2 mL and 0.3 mL of the standard solution, respectively, to three 10-mL portions of fresh sample. Mix well.
Note: For AccuVac[®] Ampuls, add 0.4 mL, 0.8 mL and 1.2 mL of the standard solution to three 50-mL portions of fresh sample.
 2. Use the test procedure to measure the concentration of each of the spiked samples. Start with the smallest sample spike. Measure each of the spiked samples in the instrument.
 3. Compare the expected result to the actual result. The expected increase in the chlorine concentration is the Cl₂ mg/L concentration from the label of the standard solution multiplied by 0.1 mL for every 10 mL of standard solution added.

Standard solution method

If the Standard Calibration Adjust feature is used to adjust the calibration curve of the Pocket Colorimeter II, the concentration of the chlorine standard must be between 0.50 and 1.50 mg/L chlorine for the LR procedure.

Verification of on-line analyzers

This procedure can be used to meet the requirements of USEPA Method 334.0 - Determination of Residual Chlorine in Drinking Water Using an On-line Chlorine Analyzer.

The procedure and requirements for compliance with EPA Method 334.0 can be downloaded directly from <http://www.hach.com/method334>.

Method performance

The method performance data that follows was derived from laboratory tests that were measured on a Pocket Colorimeter II during ideal test conditions. Users can get different results under different test conditions.

Precision (95% confidence interval)
1.00 ± 0.05 mg/L Cl ₂

Summary of method

Chlorine can be in water as free chlorine and as combined chlorine. Both forms can be in the same solution and can be determined together as total chlorine. Free chlorine is in a solution as hypochlorous acid or hypochlorite ion. Combined chlorine represents a combination of chlorine-containing compounds, including monochloramine, dichloramine, nitrogen trichloride and other chloro derivatives. The combined chlorine oxidizes iodide (I⁻) to iodine (I₂). The iodine and free chlorine reacts with DPD (N,N-diethyl-p-phenylenediamine) to form a red solution. The color intensity is proportional to the chlorine concentration. To determine the concentration of combined chlorine, complete a free chlorine test and a total chlorine test. Subtract the results of the free chlorine test from the total chlorine test to get the combined chlorine concentration.

Consumables and replacement items

Required reagents

Description	Quantity/test	Unit	Item no.
DPD Free Chlorine Reagent Powder Pillow, 10 mL	1	100/pkg	2105569
DPD Total Chlorine Reagent Powder Pillow, 10 mL	1	100/pkg	2105669
OR			
DPD Free Chlorine Reagent AccuVac [®] Ampul	1	25/pkg	2502025
DPD Total Chlorine Reagent AccuVac [®] Ampul	1	25/pkg	2503025

Required apparatus (powder pillows)

Description	Quantity/test	Unit	Item no.
Sample cells, 10-mL round, 25 mm x 60 mm	2	6/pkg	2427606

Required apparatus (AccuVac Ampul)

Description	Quantity/Test	Unit	Item no.
Sample cell, 10-mL round, 25 mm x 60 mm	1	6/pkg	2427606
Beaker, 50 mL	1	each	50041H
Stoppers for 18-mm tubes and AccuVac Ampuls	2	6/pkg	173106

Recommended standards and apparatus

Description	Unit	Item no.
Chlorine Standard Solution, 2-mL PourRite [®] Ampules, 25–30 mg/L	20/pkg	2630020
PourRite [®] Ampule Breaker, 2-mL	each	2484600

Optional reagents and apparatus

Description	Unit	Item no.
AccuVac® Ampul Snapper	each	2405200
Mixing cylinder, graduated, 25-mL	each	2088640
Potassium Iodide, 30-g/L	100 mL	34332
Sodium Arsenite, 5-g/L	100 mL	104732
Sodium Hydroxide Standard Solution, 1.0 N	100 mL MDB	104532
Sulfuric Acid Standard Solution, 1 N	100 mL MDB	127032
Pipet, TenSette®, 0.1–1.0 mL	each	1970001
Pipet tips for TenSette® Pipet, 0.1–1.0 mL	50/pkg	2185696
Pipet tips for TenSette® Pipet, 0.1–1.0 mL	1000/pkg	2185628
Paper, pH, 0–14 pH range	100/pkg	2601300
DPD Free Chlorine Reagent Powder Pillows, 10 mL	1000/pkg	2105528
DPD Total Chlorine Reagent Powder Pillows, 10 mL	1000/pkg	2105628
SwifTest™ dispenser for free chlorine ¹	each	2802300
SwifTest™ dispenser for total chlorine ²	each	2802400
DPD Free Chlorine Reagent, 10-mL, SwifTest™ Dispenser refill vial	250 tests	2105560
DPD Total Chlorine Reagent, 10-mL, SwifTest™ Dispenser refill vial	250 tests	2105660
SpecCheck™ Secondary Standard Kit, Chlorine DPD, 0–2.0 mg/L Set	each	2635300
Water, organic-free	500 mL	2641549

¹ Includes one vial of 2105560 for 250 tests.

² Includes one vial of 2105660 for 250 tests.



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 In the U.S.A. – Call toll-free 800-227-4224
 Outside the U.S.A. – Contact the HACH office or distributor serving you.
 On the Worldwide Web – www.hach.com; E-mail – techhelp@hach.com

HACH COMPANY
 WORLD HEADQUARTERS
 Telephone: (970) 669-3050
 FAX: (970) 669-2932

Attachment E

Catchment Investigation Standard Operating Procedures

Standard Operating Procedure

Catchment Investigations – Dry-Weather Manhole Inspections

The following standard operating procedure (SOP) is for dry-weather manhole inspections that are included as part of the catchment investigations under the Illicit Discharge Detection and Elimination (IDDE) program. The objective of this SOP is to determine the approximate location of suspected illicit discharges. For additional details and information on the overall program, refer to the City of Beverly's IDDE Plan.

Safety

Special care should be taken throughout all investigation and sampling efforts to maintain safe operating procedures at all times. Health and safety plans are developed for each project and should be referred to for proper health and safety protocol. Special consideration should be taken when performing the following:

- Take care when accessing manholes. Drainage structures (manholes, catch basins, etc.) are typically located in or directly adjacent to roadways with varying vehicular traffic. Additionally, some structures may be in heavily wooded areas, on steep slopes, or near environmental hazards (poison ivy, stinging insects, biting animals, etc.) or man-made hazards (fences, hostile dogs, etc.). Do not access structures in the center of roadways during times of heavy vehicular traffic (if needed, a police escort shall be utilized). Do not enter a confined space without the correct preparation and permits.
- Take care when opening manholes. Covers and grates on drainage structures (manholes, catch basins, etc.) are typically extremely heavy. Care, appropriate tools and personal protective equipment (described in the health and safety plans) should be utilized during opening of such structures. Once the cover or grate is lifted, pay close attention to "openings" in the roadway or surface to avoid fall hazards. Do not leave open structures unattended. Do not open structures that would require more than ordinary effort.
- Take care when opening lab bottles, as some may contain a preservative that is crucial to achieving accurate results and that may be toxic to skin exposure. Carefully read the label of each lab bottle prior to opening.

When to Perform Inspections

Dry-weather manhole inspections shall proceed only when no more than 0.1 inch of rainfall has occurred in the previous 24-hour period and no significant snow melt is occurring.

For the purpose of determining dry-weather conditions, program staff will use precipitation data from the following source:

- Beverly Municipal Airport (KBVY):
<https://forecast.weather.gov/MapClick.php?CityName=Beverly+Farmsandstate=MAandsite=BOXandtextField1=42.5639andtextField2=-70.8111ande=0#.XvnWiihKjoE>

Key Terms

1. **Junction Manholes:** 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.
2. **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.

General Procedure

The general procedure for dry-weather manhole inspections is as follows:

1. Prioritize the order drainage systems will be investigated based on the most recent version of the outfall priority list.
2. Acquire the necessary staff, mapping, and field equipment (See **Table 1** for list of field equipment).
3. Conduct the manhole inspection during dry weather.
4. Conduct the manhole inspection in one of two ways (or a combination of both):
 - a. By working progressively up from the outfall and inspecting key junction manholes along the way, or
 - b. By working progressively down from the upper parts of the catchment toward the outfall.
5. Open manholes and inspect for visual and olfactory evidence of illicit connections.
6. If flow is observed, collect a sample and analyze at a minimum for ammonia, chlorine, and surfactants.
7. Where sampling results or visual or olfactory evidence indicate potential illicit discharges or SSOs, the area draining to the junction manhole will be flagged for further upstream manhole investigation and/or isolation and confirmation of sources.

8. Subsequent key junction manhole inspections will proceed until the location of suspected illicit discharges or SSOs can be isolated to a pipe segment between two manholes.
9. If no evidence of an illicit discharge is found, catchment investigations will be considered complete upon completion of key junction manhole sampling.

Pre-Inspection Checklist

Prior to conducting dry-weather manhole inspections, perform the following tasks:

- Check that all members of the field crew have read relevant SOPs and Health and Safety documents, and are familiar with using sampling equipment.
- Verify that all members are familiar with the site inspection area.
- Verify the condition of all inspection equipment and check that calibration has been performed.
- Check that equipment has been fully charged and backup chargers/batteries are available (e.g., water quality sondes, GPS unit, tablet, flash light, cell phones, two-way radios).
- Obtain laboratory analysis sample bottles, labels, and chain of custody forms.
- Fill out chain of custody forms and bottle labels with default information.
- Verify that adequate field test kit refills are available. Reorder in advance to maintain adequate stock.
- Compile and distribute inspection equipment to field crews at least one day before the sampling event.
- Coordinate with the police department to arrange police details (if necessary).
- Notify laboratory to arrange pickups or drop-offs of samples (if necessary).
- Buy perishables immediately prior to inspection (e.g., ice).

Equipment List

Table 1 lists field equipment used for sandbagging and corresponding sampling (if necessary).

**Table 1
Field Equipment List**

Equipment (Per 2-Person Team)		Individual Team Members	
	Field Log Book		Form of Identification
	Sandbags		Safety Vest
	Plumbers Putty		Steel-Toed Boots
	Hand-Held Pump		Safety Glasses
	Measuring tape		Time Keeping Device
	Flashlight		
	Sampling Rod		
	Latex Gloves	Team Leader (to distribute to teams)	
	Shovel and Pickaxe or J-Hook		Tablets/iPads
	Safety Cones		GPS Receiver
	Pens and Sharpies and Waterproof pens		Chain of Custody Forms
	Paper Towels		Extra Sampling Kits and Laboratory Bottles
	Trash Bags		
	Hand Sanitizer	Prior to Start of Sampling	
	Zip Ties/Duct Tape		Ice
	Bucket (for carrying supplies)		De-Ionized water
	Health and Safety Plan		
	Ammonia Kit		
	Surfactant Kit		
	Chlorine Kit		
	Water Quality Sonde		
	Empty Plastic Jugs (for kit disposal)		
	IDDE Plan		
	Property Owner Notification Letter		
	Cooler		
	Pre-labeled sampling bottles		
	Site Map		
	Rope		

Dry-Weather Manhole Inspections

The specific methodology for manhole inspections for a given catchment is as follows:

1. Identify the catchment area that will be investigated based on the outfall priority list.
2. Gather all relevant mapping and information pertinent to the catchment.

3. Identify key junction manholes within the catchment areas.
4. Decide if the inspection will start at the upstream or downstream end of the system. For most catchments, manhole inspections will proceed from the outfall moving up into the system. However, the decision to move up or down the system depends on the nature of the drainage system and the surrounding land use and the availability of information on the catchment and drainage system. Moving up the system can begin immediately when an illicit discharge is detected at an outfall, and only a map of the storm drain system is required. Moving down the system requires more advance preparation and reliable drainage system information on the upstream segments of the storm drain system, but may be more efficient if the sources of illicit discharges are believed to be located in the upstream portions of the catchment area. Once a manhole inspection methodology has been selected, investigations will continue systematically through the catchment.
5. Drive or walk to the first key junction manhole. Obtain permission from owners prior to accessing manholes through private property. If permission cannot be obtained, seek alternate routes to access the manhole. If working in the middle of a busy roadway, implement proper traffic controls.
6. Open each key junction manhole. Pay special attention to roadway and environmental hazards.
7. Inspect the key junction manhole for visual and olfactory evidence of illicit connections.
8. If flow is observed, a sample will be collected and analyzed at a minimum for ammonia, chlorine, and surfactants (indicator sampling). Field kits can be used for these analyses. Sampling and analysis will be in accordance with procedures outlined in **Section 6** of the IDDE Plan and **Appendix G – Outfall Inspection and Dry-Weather Screening Standard Operating Procedures**. Additional indicator sampling may assist in determining potential sources (e.g., bacteria for sanitary flows, conductivity to detect tidal backwater, etc.).
9. If no flow is observed at the time of inspection, there are two possible options for moving forward:
 - a. **If visual or olfactory evidence of illicit connection was not observed** – Rule out the upstream network as a potential source of illicit discharge.
 - b. **If visual or olfactory evidence of illicit connection was observed** - Place sandbags in the inlet(s) of the manhole and revisit the site within 48 hours of dry weather. If present, take a water quality sample from flow that builds up behind sandbags. If no flow is observed, rule out the upstream network as a potential source of illicit discharge.
10. If sampling results, visual observations, and/or olfactory evidence indicate potential illicit discharges or SSOs, flag the area draining to the key junction manhole for further investigations and/or isolation and confirmation of sources.

11. Document all observations, notes, and sampling results in the tablet after each key junction manhole is inspected.
12. Visit each key junction manhole until all key junction manholes are inspected in the catchment.
13. If no evidence of an illicit discharge is found, catchment investigations will be considered complete upon completion of key junction manhole sampling.

Dry-Weather Manhole Results Analysis and Follow-Up

Once a potential illicit discharge has been identified between two key junction manholes, follow-up investigations may be needed to further narrow down the source's location.

An example scenario is shown below on Figure 1. Key Junction Manholes 1 and 3 showed evidence of an illicit discharge. Since Key Junction Manhole 6 does not show evidence of illicit discharge, the source is most likely located between manholes 3 and 6. Therefore, manholes 4 and 5 should be investigated. The results of the investigation should narrow down the location to between two manholes. For example, if there is no evidence of illicit discharges in manhole 4, the source can be presumed to be within the pipe between manhole 4 and Key Junction Manhole 3.

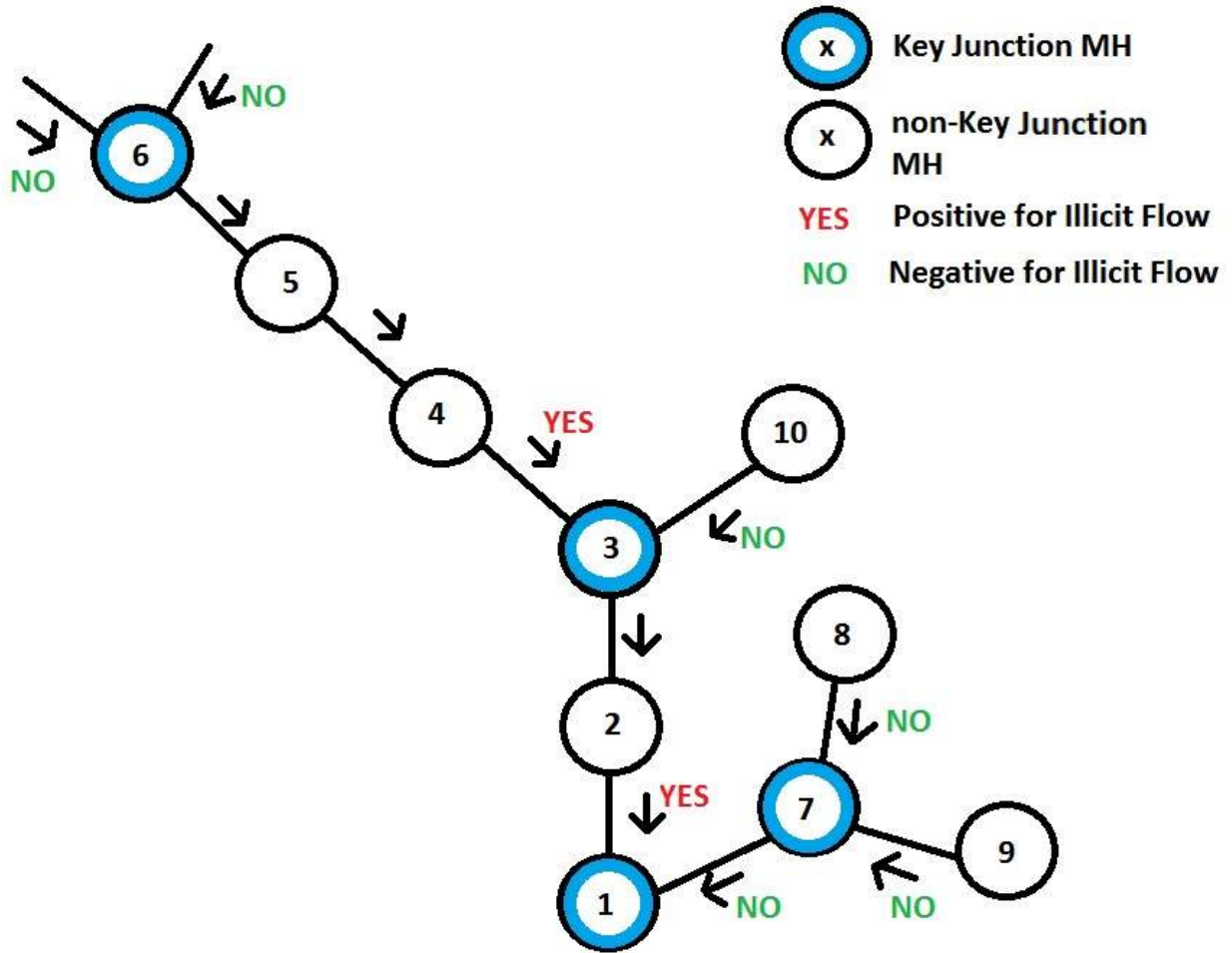


Figure 1 Example Follow-Up Dry-Weather Manhole Investigation

The following provides the next step procedure for catchments that showed evidence of illicit connections in key junction manholes:

1. Identify key junction manholes that showed positive results for illicit flow.
2. Start the follow-up investigation at the further upstream key junction manhole that tested positive for illicit flow.
3. Systematically investigate manholes between key junction manholes, looking for signs of illicit flow. Stop investigation once a potential source has been isolated between two manholes.
4. Conduct source isolation techniques (e.g., dye testing, CCTV) to identify the exact source location.

Standard Operating Procedure – Illicit Discharge Source Isolation and Confirmation

The following SOPs are for the varying techniques that could be used to confirm the location of illicit discharges between two manholes. Specifically, this includes the following inspection options:

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

Isolation and confirmation activities come after a dry-weather manhole investigation, which isolates the location of a potential illicit discharge between two manholes. The objective of these investigations is to confirm the exact location of illicit sources so they may be eliminated. Refer to the City of Beverly Illicit Discharge Detection and Elimination Plan for additional details and information on the overall program.

Safety

Special care should be taken throughout all investigation and sampling efforts to maintain safe operating procedures at all times. Health and safety plans are developed for each project and should be referred to for proper health and safety protocol. Special consideration should be taken when performing the following:

- Take care when accessing manholes. Drainage structures (manholes, catch basins, etc.) are typically located in or directly adjacent to roadways with varying vehicular traffic. Additionally, some structures may be in heavily wooded areas, on steep slopes, or near environmental (poison ivy, stinging insects, biting animals, etc.) or manmade (fences, hostile dogs, etc.) hazards. Do not access structures in the center of roadways during times of heavy vehicular traffic (if needed, a police escort will be utilized). Do not enter a confined space without the correct preparation and permits.
- Take care when opening manholes. Drainage structures (manholes, catch basins, etc.) covers and grates are typically extremely heavy. Care, appropriate tools and personal protective equipment (described in health and safety procedures) should be utilized during opening of such structures. Once the cover or grate is lifted, pay close attention to “openings” in the roadway or surface to avoid fall hazards. Do not leave open structures unattended. Do not open structures that would require more than ordinary effort.

General Procedure

The inspection technique used and corresponding procedure consist of the following general steps:

1. Source isolation investigations will be performed based on the results of dry-weather manhole inspections. However, if any information is received (e.g., from citizens, businesses, government agency) that indicates approximate locations of illicit sources, a source isolation investigation may be warranted.
2. Determine the appropriate source isolation method, based on descriptions provided in this SOP.

3. Acquire the necessary staff, mapping, and field equipment relevant for each inspection technique

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.

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 provide safety during testing.

When to Perform Inspections

Smoke testing shall only be performed when proper public notification (residents, businesses, police, and fire departments) is implemented in the area. Proper public notification for smoke testing is designated as two business days.

Pre-Inspection Checklist

Prior to conducting smoke testing inspections, check that the following is performed:

- Issue public notices two days in advance of smoke testing and include the following information:
 - Name, Contractor Name, City Contact Person
 - Purpose of test
 - Place of test
 - Areas suspected to be affected
 - Starting date of test
 - Expected length of test
- Check that all members of the field crew have read relevant Standard Operating Procedures and Health and Safety documents, and are familiar with illicit source- confirmation techniques.
- Verify all members understand the site inspection area.
- Verify that adequate materials are present for smoke testing.
- Verify the condition of all inspection equipment and check that calibration has been performed.

General Procedure

The general procedure for smoke testing is as follows:

1. Drive or walk to site inspection location. Obtain permission from owners prior to accessing inspection area through private property. If permission cannot be obtained, seek alternate routes to access the inspection site.

2. If working in the middle of a busy roadway, implement proper traffic controls.
3. Open the manhole where testing is being conducted. Pay special attention to roadway and environmental hazards.
4. Plug known outlets and inlets for both the upstream and downstream manholes.
5. Follow the manufacturer's specifications for use of each smoke source chosen (i.e., smoke candles shall be lit and lowered by bucket into the manhole).
6. Follow the manufacturer's specifications for the use of the smoke blower.
7. Observe free smoke escaping above ground. The most common situations that indicate illicit connections are as follows:
 - a. Smoke is observed rising from internal plumbing (surrounding facilities)
 - b. Smoke is observed rising from sewer vent
 - c. Smoke is observed rising from sewer manholes
8. Always complete smoke tests one manhole a time.
9. Record results of the smoke testing.
10. In the event smoke is observed from a nearby drainage structure (i.e., catch basin, dry well, Bradley top, etc.) confirm that all inlets are plugged. Note that storm drain piping is often "directly-connected" and that this could be the reason for the observed smoke.
11. In the event no smoke is observed, Closed Circuit Television (CCTV) inspection into the pipe may be warranted.
12. Once all tests are complete, remove all plugs and other equipment that may impede drainage flow.

Smoke Testing Results Analysis and Follow-Up

If the smoke testing is successful and identifies the presence of an illicit connection, further investigations with CCTV and/or dye testing may be warranted. Once the connection has been confirmed, the removal of the connection should be enforced.

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.

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 its presence in local surface waters.

The test can be relatively quick (about 30 minutes per test), effective (results are usually definitive), and inexpensive. Dye testing is best used when the likely source of an illicit discharge has been narrowed down to a few specific houses or businesses.

When to Perform Inspections

Dye testing shall only be performed when proper public notification (residents, businesses, police, and fire departments) is implemented in the area. Proper public notification for dye testing is designated as two business days. Additionally, due to the nature of the test, in most cases proper approval from the owner of the site being accessed is needed.

Pre-Inspection Checklist

Prior to conducting dye testing site inspections, check that the following is performed:

- Issue public notices two days in advance of dye testing to facilities that may need to be entered. The following information will be included on each public notice.
 - Name, Department, Contact Information
 - Purpose of test
 - Place of test
 - Starting date of test
 - Expected length of test
- Check that all members of the field crew have read relevant SOPs and Health and Safety documents, and are familiar with illicit source confirmation techniques.
- Verify all members understand the site inspection area (i.e., review site inspections maps and surrounding storm sewer and sewer infrastructure).
- Verify that adequate materials are present for the dye tests.
- Verify the condition of all inspection equipment.

General Procedure

The general procedure for dye testing is as follows:

1. Drive or walk to site inspection location. Obtain permission from owners prior to accessing inspection area through private property. If permission cannot be obtained, seek alternate routes to access the inspection site.
2. If access to a facility is needed, obtain permission to access possible areas where illicit connections may be connected to the storm drain (i.e., floor drains, toilet, sink, etc.) If access to a

facility is refused, the team will continue to other scheduled investigations and note the refusal in a dye test form and to a supervisor.

3. Team Member 1 shall remain at the facility, Team Member 2 shall head to the downstream manhole.
4. If working in the middle of a busy roadway, implement proper traffic controls.
5. Open the manhole. Pay special attention to roadway and environmental hazards.
6. Team Member 2 will communicate via two-way radio that Team Member 1 may discharge dye into to the system.
7. Flush dye according to the manufacturer's specification for best results (i.e., how much, how long, etc.). If porcelain structures are dye tested, check that tablets or charcoal are wrapped in tissue before depositing.
8. Team Member 1 will notify Team Member 2 when the dye is discharged. Team Member 2 will observe flow in the downstream manhole and indicate whether dye is observed.
9. Give the dye at least one hour to flow to the downstream manhole.
10. If dye is observed, the area will be marked for illicit connection elimination.
11. In the event no dye is observed:
 - a. Check that the manhole being observed is directly downgradient of the site.
 - b. Check other storm drains in the area.
 - c. If no other alternative, CCTV inspection into the pipe segment may be warranted.
12. Regardless if dye is observed or not observed, all structures in all suspected facilities should be tested. Many times, a single utility may be incorrectly connected to a storm drain line. Actively inventory and "mark-off" structures as they are tested.
13. For each facility inspected, note results and comments on the tablet.
14. Once each facility has had all structures tested, check that tested areas are left as they were when the team entered.
15. Close the manhole. Pay special attention to roadway and environmental hazards.

CCTV/ Video Inspections

CCTV/video inspections involve the use of mobile video cameras that are guided remotely through storm 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.

It is recommended that CCTV inspections shall be carried according to the CCTV operator's standard operating procedures.

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. It is recommended that that optical brightener monitoring (OBM) shall be carried out in accordance with the *Center for Watershed Protection's Illicit Discharge Detection and Elimination Manual (October 2004)*.

OBM traps are another tool that crews can use to gain insight into the "history" of an outfall without being physically present. OBM traps can be fabricated and installed using a variety of techniques and materials. All configurations involve an absorbent, unbleached cotton pad or fabric swatch and a holding or anchoring device such as a wire mesh trap or a section of small diameter (e.g., 2-inch) PVC pipe. Traps are anchored to the inside of outfalls at the invert using wire or monofilament that is secured to the pipe itself or rocks used as temporary weights. Field crews retrieve the OBM traps after they have been deployed for 48 hours of dry weather, and place them under a long wave fluorescent ultraviolet light or "black light" that will indicate if they have been exposed to detergents.

Although OBM traps appear useful in detecting some intermittent discharges, research performed for the IDDE Manual found that OBM traps only pick up the most contaminated discharges, and the detergent level needed to produce a "hit" was roughly similar to pure washwater from a washing machine. Consequently, OBM traps may be best suited as a simple indicator of presence or absence of intermittent flow or to detect the most concentrated flows. OBM traps need to be retrieved before runoff occurs from the outfalls, which will contaminate the trap or wash it away.

IDDE Canines

IDDE canines are dogs that are specifically trained to smell human sewage. Each dog adopts a way to alert their human handler if there is a positive hit for sewage. The use of IDDE canines is not recommended as a standalone practice for source identification; rather it is recommended as a tool to supplement other conventional methods, such as dye testing, in order to fully verify sources of illicit discharges.

It is recommended that canine inspections be carried out according to the IDDE Canine vendor's SOPs.

Attachment F

Town of Reading IDDE Procedure (May 2021)

Town of Reading



Phase 2 Stormwater Management Plan

Illicit Discharge Detection and Elimination (IDDE) Procedure

Updated May 15, 2012

Phase I – Mapping

Mapping should serve as a planning tool for the implementation and phasing of investigations, and demonstrate the extent of completed and planned investigations and corrections, and other related capital projects. CDM Smith will be providing mapping of the entire drainage system for Reading. Individual system maps will be developed with subcatchments and subsystems represented thematically (e.g. by color) with legends and schedules of testing / investigation results. Mapping will be updated as necessary to reflect newly discovered information, corrections or modifications, and progress made during the investigation.

Phase II - Drainage Area Investigations Criteria

1. Outreach Program /Public Notification of Dye Testing

Residents and building owners located within subject investigation area will be notified of the scope and schedule of field work being conducted in the area such as outfall sampling and upstream IDDE activities. Notification should include general information such as anticipated dates of the work, identification of field staff (DPW staff, private consultant, etc.), and contact information for inquiries.

Once a reach of drainage has been isolated for dye testing and the potential need to gain access to private residences or businesses has been identified, a second notification to property owners will be required. Notification of property owners through a letter, door hanger, or otherwise will be required to gain entry to their property to inspect plumbing fixtures. Assessors records and GIS

information will provide property owner identification. A sample dye test notification letter is attached at the end of this document for reference.

2. Infrastructure cleaning requirements

To facilitate investigations, storm drain infrastructure will be evaluated for the need to be cleaned to remove debris or blockages that could compromise investigations. Such material should be removed to the extent possible by the Town prior to investigations; however, some cleaning may occur concurrently as problems manifest themselves (i.e. dog waste should be cleaned from catch basins and excessive leaves and yard waste should be removed from the system prior to any investigation).

3. Dry weather criteria

In order to limit or remove the influence of stormwater-generated flows on the monitoring program, antecedent dry weather criteria need to be established. For this project, the dry weather criteria will be to wait two (2) days after cessation of a precipitation event prior to monitoring activities. Any successive IDDE investigations performed by the Town should also require at least 2 days of dry weather in advance of field activities in order to limit the amount of flow in the system.

Phase III - Investigations Methodology

1. Manhole inspection and flow monitoring

When an outfall is confirmed to have elevated levels of E. coli, an upstream IDDE investigation shall be initiated. A preliminary assessment to determine the extents of the investigation should be performed prior to IDDE procedures. Using GIS maps, a junction manhole shall be selected approximately bisecting the drainage network associated with the outfall. This manhole shall be sampled and inspected for visual evidence to determine if illicit flows are present in the system upstream of the selected manhole. If illicit flow is present in the selected manhole, the process should be repeated at a second observation manhole approximately $\frac{3}{4}$ of the way upstream from the outfall. Alternately, should the first observation manhole be free of illicit flows, the second observation manhole should be located $\frac{1}{4}$ of the way upstream from the manhole and the process repeated. This preliminary effort will identify the extent to which the following IDDE procedure should be implemented and whether any large catchment areas can be eliminated from further investigation up-front.

For all areas remaining after the preliminary assessment, the following procedure will be implemented. Beginning at the uppermost significant junction manhole(s) [see Figure 1] within each tributary area, drainage manholes are opened and first inspected for *visual evidence* of contamination. Where flow is observed and determined to be contaminated through visual observation (e.g. excrement or toilet paper present) or through the field monitoring process described below, the tributary storm sewer alignment is isolated for investigation (e.g. dye testing, CCTV). No additional downstream manhole inspections are performed unless the observed flow is determined to be uncontaminated or until all upstream illicit connections are identified and removed.

Where flow is not observed in a junction manhole, all inlets to the structure are partially dammed for the next 48 hours **when no precipitation is forecasted**. Inlets are dammed by blocking a minimal percentage (approximately 20% +/- depending on pipe slope) of the pipe diameter at the invert using **sandbags**, weirs/plates, or other temporary barriers (See Figure 2). The manholes are thereafter re-inspected (prior to any precipitation or snow melt) for the capture of periodic or intermittent flows behind any of the inlet dams. The same visual observations and field testing are completed on any captured flow, and where contamination is identified, abatement is completed prior to inspecting downstream manholes. If after 48 hours no flow is captured, it is determined that there are no illicit connections in the upstream section and the investigation should proceed to the next downstream junction manhole. The sandbagging procedure is effective for isolating up to **1000 ft of drain pipe**. After 1,000 ft, additional sandbags should be placed on non-junction manholes to further isolate reaches of drain pipe suspected of discharging illicit flows. Sandbags utilized for isolating more than 1,000 ft of pipe may be ineffective.

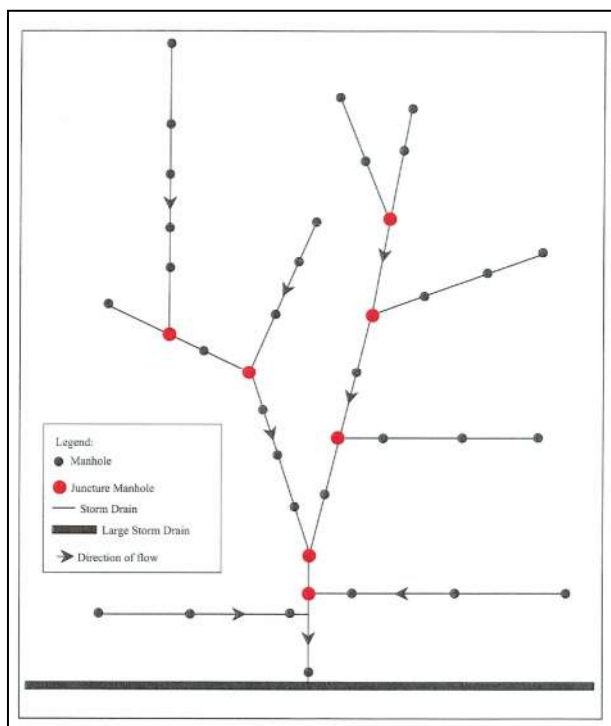


Figure 1: Junction Manholes

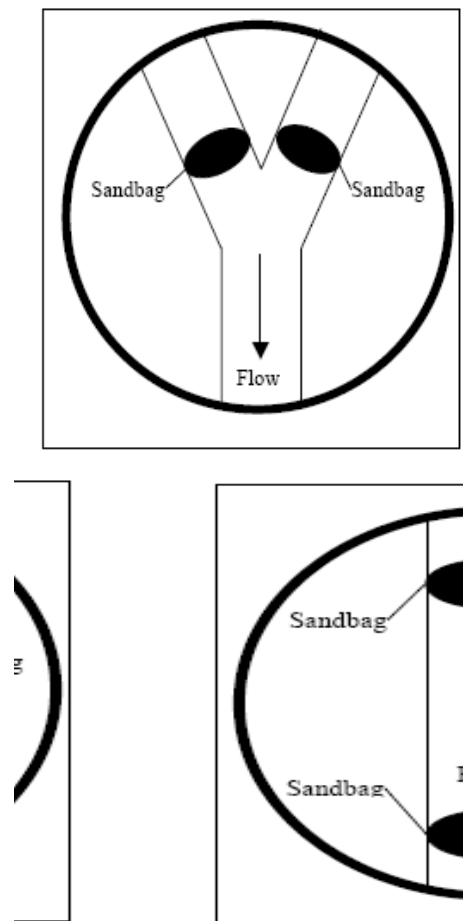


Figure 2: Sandbag Configuration

Where flow is observed and does not demonstrate obvious olfactory or visual evidence of contamination, samples are collected and analyzed with field instruments (ammonia, detergents, and pH readings) along with laboratory analysis [E. Coli], if necessary, to determine the likely prominent source of the flow. Measured values can then be compared with historic benchmark values (if available). The table below indicates typical ranges for ammonia, surfactants, and E. coli levels encountered at stormwater outfalls during dry weather sampling and can be referred to for guidance in prioritizing IDDE investigations. If field results show an absence of all indicators, it is determined that there are no illicit connections in the upstream section and the investigation should proceed to the next downstream junction manhole.

A flow chart of this complete procedure may be found at the end of this text (See Figure 3).

Table 1 Contaminant Ranges by Outfall Size

Outfall Size	6-24 inch			24-48 inch			> 48 inch		
	High	Medium	Low	High	Medium	Low	High	Medium	Low
E. coli (CFU/100mL)	>350	350-100	<100	>1,000	1,000-500	<500	>3,500	3,500-1,000	<1,000
Ammonia (mg/l)	>0.3	0.3-0.2	0.1	>0.5	0.5-0.3	0.2	>0.6	0.6-0.4	0.3
Surfactants (mg/l)	>0.5	0.5	0.25	>.75	0.75	0.5	>1.0	1.0-0.75	0.75-0.5

2. Isolation and confirmation of illicit sources

Where field monitoring has identified drain reaches influenced by sanitary flows or washwaters, the tributary area is isolated for implementation of more detailed investigations. Additional manholes along the tributary alignment are inspected to refine the location of potential contamination sources (e.g. ideally a single reach of drain between two manholes). Manholes upstream are opened and inspected until an uncontaminated manhole is identified. The buildings between the uncontaminated manhole and the downstream contaminated manhole are identified as possible sources of illicit inflow. Residents and businesses are notified by mail that their buildings / houses will be dye tested to determine if their sanitary sewer service connection is to a storm drain or sewer. (See attached Dye Test Notification mailer.) Internal plumbing inspections and /or dye testing (or CCTV) inspections are then employed to more efficiently confirm discrete flow sources.

4. Post-Removal confirmation

After completing the removal of illicit discharges from a subdrainage area and before beginning the investigation of downstream areas, the subdrainage area is re-inspected to verify corrections. Depending on the extent and timing of corrections, verification monitoring can be done at the initial junction manhole or the closest downstream manhole to each correction. Verification is accomplished by using the same visual inspection, field monitoring, and damming techniques as described above.

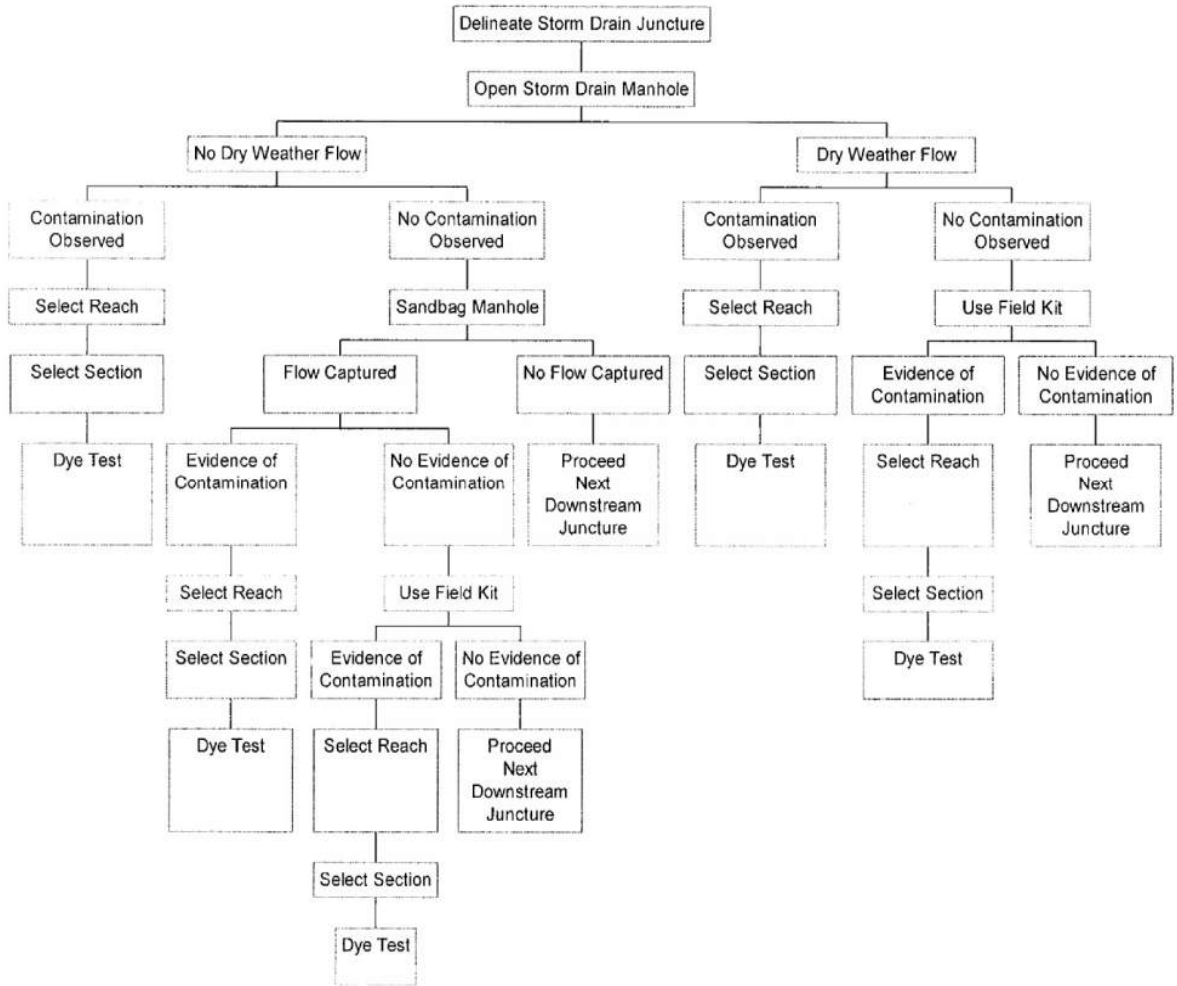
REFERENCES & FIGURE CREDITS

Boston Water and Sewer Commission. Stony Brook Illegal Connection Investigation, 1999-2001. Earth Tech, Inc. Field reports and research.

Jewell, Charlie. A Systematic Methodology for the Identification and Remediation of Illegal Connections. 2001. Boston Water and Sewer Commission.

Boston Water and Sewer Commission. Stony Brook Sewer System Study. Camp Dresser & Mckee Inc. August 1997.

Figure 3: Manhole Investigation Diagram



Attachment G

MA MS4 General Permit

**United States Environmental Protection Agency (EPA)
National Pollutant Discharge Elimination System (NPDES)**

**GENERAL PERMITS FOR STORMWATER DISCHARGES FROM
SMALL MUNICIPAL SEPARATE STORM SEWER SYSTEMS
IN MASSACHUSETTS
(as modified)**

**AUTHORIZATION TO DISCHARGE UNDER THE
NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM**

In compliance with the provisions of the Clean Water Act (CWA), as amended (33 U.S.C. §1251 *et seq.*), and the Massachusetts Clean Waters Act, as amended (M.G.L. Chap.21 §§ 26-53), any operator of a small municipal separate storm sewer system whose system:

- Is located in the areas described in part 1.1;
- Is eligible for coverage under part 1.2 and part 1.9; and
- Submits a complete and accurate Notice of Intent in accordance with part 1.7 of this permit and EPA issues a written authorization

is authorized to discharge in accordance with the conditions and the requirements set forth herein.

The following appendices are also included as part of these permits:

- Appendix A – Definitions, Abbreviations, and Acronyms;
- Appendix B – Standard permit conditions applicable to all authorized discharges;
- Appendix C – Endangered Species Act Eligibility Guidance;
- Appendix D – National Historic Preservation Act Eligibility Guidance;
- Appendix E – Information required for the Notice of Intent (NOI);
- Appendix F – Requirements for MA Small MS4s Subject to Approved TMDLs;
- Appendix G – Impaired Waters Monitoring Parameter Requirements;
- Appendix H – Requirements related to discharges to certain water quality limited waterbodies;

This modifies parts: 2.0; 2.1; 2.1.1; 2.1.2.a; 2.2.; 2.2.2 (paragraphs 2 and 3); 2.3.3; 2.3.5; 2.3.6; 2.3.7.b; 4.1; 4.4; 5.1.5; 6.5; Appendix F part A.I; Appendix F part A.II; and Appendix H of the permits that became effective on July 1, 2018

These permit modifications become effective on **January 6, 2021**.

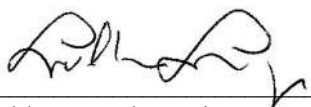
These permits and the authorization to discharge expire at midnight, **June 30, 2022**.

Signed this **7th** day of **December 2020**

Signed this **7th** day of **December 2020**

/S/Signature On File

Ken Moraff, Director
Water Division
United States Environmental Protection Agency
5 Post Office Square – Suite 100
Boston, Massachusetts 02109-3912



Lealdon Langley, Director
Division of Watershed Management
Department of Environmental Protection
One Winter Street
Boston, Massachusetts 02108

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1.0. Introduction

This document consists of three (3) general permits listed in part 1.1. Each general permit is applicable to a particular type of municipal system within Massachusetts. Many of the permit terms and conditions are applicable across all regulated entities, and therefore are presented just once in parts 1-2, part 4, and Appendices A through E. Other conditions are applicable to a particular set of authorized entities; these terms and conditions are included in parts 3, and 5 and Appendices F through H. Throughout the permit, the terms “this permit” or “the permit” will refer to the three general permits.

1.1. Areas of Coverage

This permit covers small municipal separate storm sewer systems (MS4s) located in the Commonwealth of Massachusetts:

- Traditional Cities and Towns (NPDES Permit No. MAR041000)
- State, federal, county and other publicly owned properties (Non-traditional) (MAR042000)
- State transportation agencies (except for MassDOT- Highway Division) (MAR043000)

1.2. Eligibility

The MS4 shall meet the eligibility provisions described in part 1.2.1 and part 1.9 to be eligible for authorization under this permit.

1.2.1. Small MS4s Covered

This permit authorizes the discharge of stormwater from small MS4s as defined at 40 CFR § 122.26(b) (16). This includes MS4s described in 40 CFR §122.32(a) (1) and (a) (2). An MS4 is eligible for coverage under this permit if it is:

- A small MS4 within the Commonwealth of Massachusetts;
- Not a large or medium MS4 as defined in 40 CFR §§122.26(b)(4) or (7);
- Located either fully or partially within an urbanized area as determined by the latest Decennial Census by the Bureau of Census as of the effective date of this permit (the 2010 Census); or
- Located in a geographic area designated by EPA as requiring a permit.

If the small MS4 is not located entirely within an urbanized area, only the portion of the MS4 that is located within the urbanized area is regulated under 40 CFR §122.32(a) (1).

A small municipal separate storm sewer system means all separate storm sewers that are:

- Owned or operated by the United States, a state, city, town, borough, county, parish, district, association, or other public body (created by or pursuant to state law) having jurisdiction over disposal of sewage, industrial wastes, stormwater, or other wastes, including special districts under state law such as a sewer district, flood control district or drainage district, or similar entity, or an Indian tribe or an authorized Indian tribal organization, or a designated and approved management agency under section 208 of the CWA that discharges to waters of the United States.
- Not defined as large or medium municipal separate storm sewer systems pursuant to 40 CFR § 122.26(b) (4) and (b) (7) or designated under 40 CFR § 122.26(a) (1) (v).
- This term includes systems similar to separate storm sewer systems in municipalities such as systems at military bases, large hospitals or prison complexes, and highways

and other thoroughfares. The term does not include separate storm sewers in very discrete areas, such as individual buildings.

1.3. Limitations on Coverage

This permit does not authorize the following:

- a. Stormwater discharges mixed with sources of non-stormwater unless such non-stormwater discharges are:
 - Authorized under a separate NPDES permit; or
 - A non-stormwater discharge as listed in part 1.4.
- b. Stormwater discharges associated with industrial activity as defined in 40 CFR §122.26 (b) (14) (i)-(ix) and (xi).
- c. Stormwater discharges associated with construction activity as defined in 40 CFR §122.26(b) (14) (x) or (b) (15).
- d. Stormwater discharges currently authorized under another NPDES permit, including discharges covered under other regionally issued general permits.
- e. Stormwater discharges or discharge related activities that are likely to adversely affect any species that are listed as endangered or threatened under the Endangered Species Act (ESA) or result in the adverse modification or destruction of habitat that is designated as critical under the ESA. The permittee shall follow the procedures detailed in Appendix C to make a determination regarding eligibility. The permittee shall certify compliance with this provision on the submitted NOI.
- f. Stormwater discharges whose direct or indirect impacts do not prevent or minimize adverse effects on any Essential Fish Habitat.
- g. Stormwater discharges, or implementation of a stormwater management program, which adversely affects properties listed or eligible to be listed on the National Register of Historic Places. The permittee shall follow the procedures detailed in Appendix D to make a determination regarding eligibility. The permittee shall certify compliance with this provision on the submitted NOI.
- h. Stormwater discharges prohibited under 40 CFR § 122.4.
- i. Stormwater discharges to the subsurface subject to state Underground Injection Control (UIC) regulations. Although the permit includes provisions related to infiltration and groundwater recharge, structural controls that dispose of stormwater into the ground may be subject to UIC regulation requirements. Authorization for such discharges shall be obtained from Massachusetts Department of Environmental Protection, Bureau of Resource Protection, Drinking Water Program, Underground Injection Control, One Winter Street, Boston, MA 02108 – phone 617-292-5859.
- j. Any non-traditional MS4 facility that is a “new discharger” as defined in part 5.1.4. and discharges to a waterbody listed in category 5 or 4b on the Massachusetts Integrated Report of waters listed pursuant to Clean Water Act section 303(d) and 305(b) due to nutrients (Total Nitrogen or (Total Phosphorus), metals (Cadmium, Copper, Iron, Lead or Zinc), solids (TSS or Turbidity), bacteria/pathogens (E. Coli, Enterococcus or Fecal Coliform), chloride (Chloride) or oil and grease

(Petroleum Hydrocarbons or Oil and Grease), or discharges to a waterbody with an approved TMDL for any of those pollutants.

1.4. Non-Stormwater Discharges

The following categories of non-stormwater discharges are allowed under this permit *unless* the permittee, EPA, or the MassDEP identifies any category or individual discharge of non-stormwater discharge in part 1.4.a-r as a significant contributor of pollutants to the MS4, then that category or individual discharge is not allowed under part 1.4, but rather shall be deemed an “illicit discharge” under part 2.3.4.1, and the permittee shall address that category or individual discharge as part of the Illicit Discharge Detection and Elimination (IDDE) Program described in part 2.3.4 of this permit.

- a. Water line flushing
- b. Landscape irrigation
- c. Diverted stream flows
- d. Rising ground water
- e. Uncontaminated ground water infiltration (as defined at 40 CFR § 35.2005(20))
- f. Uncontaminated pumped ground water
- g. Discharge from potable water sources
- h. Foundation drains
- i. Air conditioning condensation
- j. Irrigation water, springs
- k. Water from crawl space pumps
- l. Footing drains
- m. Lawn watering
- n. Individual resident car washing
- o. Flows from riparian habitats and wetlands
- p. De-chlorinated swimming pool discharges
- q. Street wash waters
- r. Residential building wash waters without detergents

Discharges or flows from firefighting activities are allowed under this permit need only be addressed where they are identified as significant sources of pollutants to waters of the United States.

1.5. Permit Compliance

Non-compliance with any of the requirements of this permit constitutes a violation of the permit and the CWA and may be grounds for an enforcement action and may result in the imposition of injunctive relief and/or penalties.

1.6. Continuation of this Permit

If this permit is not reissued prior to the expiration date, it will be administratively continued in accordance with the Administrative Procedure Act and remain in force and effect for discharges that were authorized prior to expiration. If a small MS4 was granted permit authorization prior to the expiration date of this permit, it will automatically remain authorized by this permit until the earliest of:

- Authorization under a reissued general permit following timely and appropriate submittal of a complete and accurate NOI requesting authorization to discharge under the reissued permit; or
- Issuance or denial of an individual permit for the MS4’s discharges; or

- Authorization or denial under an alternative general permit.

If the MS4 operator does not submit a timely, appropriate, complete, and accurate NOI requesting authorization to discharge under the reissued permit or a timely request for authorization under an individual or alternative general permit, authorization under this permit will terminate on the due date for the NOI under the reissued permit unless otherwise specified in the reissued permit.

1.7. Obtaining Authorization to Discharge

1.7.1. How to Obtain Authorization to Discharge

To obtain authorization under this permit, a small MS4 shall:

- Be located in the areas listed in part 1.1 of this permit;
- Meet the eligibility requirements in part 1.2 and part 1.9;
- Submit a complete and accurate Notice of Intent (NOI) in accordance with the requirements of part 1.7.2; and
- EPA issues a written authorization.

1.7.2. Notice of Intent

- a. Operators of Small MS4s seeking authorization to discharge under the terms and conditions of this permit shall submit a Notice of Intent that contains the information identified in Appendix E. This includes operators of small MS4s that were previously authorized under the May 1, 2003 small MS4 general permit (MS4-2003 permit).
- b. The NOI shall be signed by an appropriate official (see Appendix B, Subparagraph B.11, Standard Conditions).
- c. The NOI shall contain the following certification: I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, I certify that the information submitted is, to best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Print the name and title of the official, followed by signature and date.

- d. The NOI shall be submitted within 90 days of the effective date of the permit. If EPA notifies an MS4 that it is designated under 40 CFR § 122.32(a) (2) or (b), the NOI shall be submitted within 180 days of receipt of notice unless granted a longer period of time by EPA.

1.7.3. Submission of Notice of Intent

- a. All small MS4s shall submit a complete and accurate Notice of Intent (suggested form in Appendix E) to EPA-Region 1 at the following address:

United States Environmental Protection Agency
Stormwater and Construction Permits Section (OEP06-1)
Five Post Office Square, Suite 100

Boston, MA 02109

Or submitted electronically to EPA at the following email address: stormwater.reports@epa.gov

b. All small MS4s shall also submit a copy of the NOI to the MassDEP at the following address:

Massachusetts Department of Environmental Protection
One Winter Street -5th Floor
Boston, Massachusetts 02108
ATTN: Frederick Civian, Stormwater Coordinator

c. Late notification: A small MS4 is not prohibited from submitting a NOI after the dates provided in part 1.7.2.d. However, if a late NOI is submitted, authorization is only for discharges that occur after permit authorization is granted. EPA and MassDEP reserve the right to take enforcement actions for any unpermitted discharges. All NOIs submitted after December 21, 2020 must be submitted electronically.

1.7.4. Public Notice of NOI and Effective Date of Coverage

a. EPA will provide a public notice and opportunity for comment on the contents of the submitted NOIs. The public comment period will be a minimum of 30 calendar days.

b. Based on a review of a small MS4's NOI or other information, EPA may grant authorization, extend the public comment period, or deny authorization under this permit and require submission of an application for an individual or alternative NPDES permit. (See part 1.8) A small MS4 will be authorized to discharge under the terms and conditions of this permit upon receipt of notice of authorization from EPA.

c. Permittees whose authorization to discharge under the MS4-2003 permit, which expired on May 1, 2008, has been administratively continued in accordance with the Administrative Procedure Act 5 U.S.C. § 558(c) and 40 CFR § 122.6, who wish to obtain coverage under this permit, must submit a new NOI requesting permit coverage in accordance with the requirements of part 1.7 of this permit to EPA within 90 days after the effective date of this permit. Permittees whose authorization to discharge under the expired MS4-2003 permit was administratively continued, who fail to submit a timely, complete and accurate NOI or an application for an individual NPDES permit within 90 days after the effective date of this permit will be considered to be discharging without a permit (see 40 CFR § 122.28(b)(3)(iii)).

1.8. Individual Permits and Alternative General Permits

a. EPA may require a small MS4 to apply for and obtain authorization under either an individual NPDES permit or an alternative NPDES general permit. Any interested person may petition EPA in accordance with the provisions of 40 CFR § 122.26(f) to require a small MS4 to apply for and/or obtain authorization under either an individual NPDES permit or an alternative NPDES general permit. If EPA requires a small MS4 to apply for an individual or alternative NPDES permit, EPA will notify the small MS4 in writing that a permit application is required. This notification will include a brief statement of the reasons for this decision and will provide application information and an application deadline. If a small MS4 is authorized under the MS4-2003 permit or this permit and fails to submit an individual NPDES or an alternative general permit NPDES permit application as required by EPA, then the authorization under the MS4-2003 permit or this permit to the small MS4 is automatically terminated at the end of the date specified by EPA as the deadline

for application submittal. EPA reserves the right to take enforcement action for any unpermitted discharge.

- b. A small MS4 may request to be excluded from this general permit by applying for an individual permit or authorization under an alternative general permit. In such a case, a small MS4 shall submit an individual permit application in accordance with the requirements of 40 CFR § 122.33(b) (2) (i) or § 122.33(b) (2) (ii), with reasons supporting the request, to EPA at the address listed in part 1.7.3 of this permit. The request may be granted by issuance of an individual permit or authorization under an alternative general permit if EPA determines that the reasons stated by the small MS4 are adequate to support the request. (See 40 CFR § 122.28(b) (3)).
- c. When an individual NPDES permit is issued, or a small MS4 is authorized to discharge under an alternative NPDES general permit, authorization under this permit automatically terminates on the effective date of the individual permit or the date of authorization of coverage under the alternative general permit.

1.9. Special Eligibility Determinations

1.9.1. Documentation Regarding Endangered Species

The small MS4 shall certify eligibility regarding endangered species in the NOI required by part 1.7.2. The Stormwater Management Program (SWMP) shall include documentation supporting the permittee's eligibility determination with regard to federal Endangered and Threatened Species and Critical Habitat Protection, including:

- Results of the Appendix C U.S. Fish and Wildlife Service endangered species screening determination; and
- If applicable, a description of the measures the small MS4 shall implement to protect federally listed endangered or threatened species, or critical habitat, including any conditions imposed by the U.S. Fish and Wildlife Service. If a permittee fails to document and implement such measures, the permittee's discharges are ineligible for coverage under this permit.

1.9.2. Documentation Regarding Historic Properties

The small MS4 shall certify eligibility regarding historic properties on the NOI required by part 1.7.2. The SWMP shall include documentation supporting the small MS4's eligibility determination with regard to Historic Properties Preservation, including:

- Information on whether the permittee's stormwater discharges, allowable non-stormwater discharges, or stormwater discharge-related activities would have an effect on a property that is listed or eligible for listing on the National Register of Historic Properties (NRHP);
- Where such effects may occur, any documents received by the permittee or any written agreements the permittee has made with the State Historic Preservation Officer (SHPO), Tribal Historic Preservation Officer (THPO), or other Tribal representative to mitigate those effects;
- Results of the Appendix D historic property screening investigations; and
- If applicable, a description of the measures the permittee shall implement to avoid or minimize adverse impacts on places listed, or eligible for listing, on the NRHP, including any conditions imposed by the SHPO or THPO. If the permittee fails to

document and implement such measures, those discharges are ineligible for coverage under this permit.

1.10. Stormwater Management Program (SWMP)

- a. The permittee shall develop and implement a written (hardcopy or electronic) SWMP. The SWMP shall be signed in accordance with Appendix B, Subsection 11, including the date of signature. A signature and date is required for initial program preparation and for any significant revision to the program, which shall be in writing. The written SWMP shall be completed within one (1) year of the effective date of the permit.

The SWMP is the document used by the permittee to describe and detail the activities and measures that will be implemented to meet the terms and conditions of the permit. The SWMP shall accurately describe the permittees plans and activities. The document should be updated and/or modified during the permit term as the permittee's activities are modified, changed or updated to meet permit conditions during the permit term.

- b. Permittees authorized by the MS4-2003 permit shall modify or update their existing Best Management Practices (BMPs) and measurable goals to meet the terms and conditions of part 2.3 of this permit within one (1) year of the effective date of the permit. These modifications and updates shall be reflected in the written (hardcopy or electronic) SWMP. Permittees authorized by the MS4-2003 permit shall continue to implement their existing SWMP until the program has been updated.

1.10.1. Stormwater Management Program Availability

- a. The permittee shall retain a copy of the current SWMP required by this permit at the office or facility of the person listed as the program contact on the submitted Notice of Intent (NOI). The SWMP shall be immediately available to representatives from EPA, MassDEP, U.S. Fish and Wildlife Service (USFWS) and the National Marine Fisheries Service (NMFS) at the time of an onsite inspection or upon request.
- b. The permittee shall make the SWMP available to the public during normal business hours. The permittee shall also post the SWMP online¹ if the permittee has a website on which to post the SWMP.

1.10.2. Contents and Timelines of the Stormwater Management Program for 2003 permittees

The following information must be included in the SWMP within one (1) year of the permit effective date and updated annually thereafter, as necessary:

- Identification of names and titles of people responsible for program implementation. If a position is currently unfilled, list the title of the position and modify the SWMP with the name once the position is filled;
- Documentation of compliance with part 1.9.1;
- Documentation of compliance with part 1.9.2;

¹ Should a permittee not wish to post mapping information included in the SWMP (see part 1.10.2) on their website for public safety reasons, they must state the reason either with or within the online SWMP and provide how the MS4 mapping information can be obtained. The permittee must retain the entire SWMP, including all completed mapping, at a location where it can be made available to the public during normal business hours.

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- Documentation of authorization of all new or increased discharges granted by MassDEP in compliance with part 2.1.2;
- Listing of all discharges identified pursuant to part 2.1.1 and description of response;
- Description of practices to achieve compliance with part 2.3 (MEP requirements) identified in the permittee's NOI and any updates to those BMPs within the first year;
For each permit condition in part 2.3 identify:
 - The person(s) or department responsible for the measure;
 - The BMPs for the control measure or permit requirement;
 - The measurable goal(s) for each BMP. Each measurable goal shall include milestones and timeframes for its implementation and have a quantity or quality associated with its endpoint. Each goal shall have a measure of assessment associated with it;
- Sanitary Sewer Overflow (SSO) inventory including all of the information required in part 2.3.4.4.b;
- Written IDDE Program pursuant to part 2.3.4.6;
- Written procedures for site inspections and enforcement of sediment and erosion control procedures in accordance with part 2.3.5;
- Description of measures to avoid or minimize impacts to surface public drinking water supply sources. The permittee is also encouraged to include provisions to notify public water supplies in the event of an emergency. Massachusetts Department of Environmental Protection, Bureau of Resource Protection, Drinking Water Program, One Winter Street, Boston, MA 02108 – phone 617.292.5770.
- Description of activities to achieve compliance with part 3.0;
- Annual program evaluation (part 4.1). Update annually and maintain copies.

The following information must be included in the SWMP within two (2) years of the permit effective date and updated annually thereafter, as necessary:

- Listing of all receiving waterbody segments, their classification under the applicable state water quality standards, any impairment(s) and associated pollutant(s) of concern, applicable TMDLs and WLAs, and number of outfalls from the MS4 that discharge to each waterbody. In addition to the receiving water, the permittee shall document in the SWMP all surface public drinking water sources that may be impacted by MS4 discharges;
- Listing of all interconnected MS4s and other separate storm sewer systems receiving a discharge from the permitted MS4, the receiving waterbody segment(s) ultimately receiving the discharge, their classification under the applicable state water quality standards, any impairment(s) and associated pollutant(s) of concern, applicable TMDLs and WLAs, and the number of interconnections;
- Written procedures to require submission of as-built drawings and ensure long term operation and maintenance in accordance with part 2.3.6.a.iii;
- The map of the separate storm sewer system required by part 2.3.4.5.

The following information must be included in the SWMP within four (4) years of the permit effective date and updated annually thereafter, as necessary:

- Report(s) assessing current street design and parking lot guidelines and other local requirements within the municipality that affect the creation of impervious cover.

The following information must be included in the SWMP concurrent with the applicable

deadlines in Appendix F and H and updated annually thereafter, as necessary:

- Description of practices to achieve compliance with part 2.2.1 (TMDL requirements) including:
 - The person(s) or department responsible for the measure;
 - The BMPs for the control measure or permit requirement;
 - The measurable goal(s) for each BMP. Each measurable goal shall include milestones and timeframes for its implementation and have a quantity or quality associated with its endpoint. Each goal must have an associated measure of assessment.
- Description of practices to achieve compliance with part 2.2.2 (discharges to certain water quality limited waters subject to additional requirements) including:
 - The person(s) or department responsible for the measure;
 - The BMPs for the control measure or permit requirement;
 - The measurable goal(s) for each BMP. Each measurable goal shall include milestones and timeframes for its implementation and have a quantity or quality associated with its endpoint. Each goal must have an associated measure of assessment;
- Description of any other practices to achieve compliance with part 2.1 (water quality based requirements)

1.10.3. Contents and Timelines of the Stormwater Management Program for New Permittees

a. Permittees seeking authorization for the first time shall meet all deadlines contained in this permit except the following:

- Timelines for public education requirements in part 2.3.2.c shall be extended by one (1) year and need to include one (1) message to each audience over the permit term;
- The ordinances, by-laws, or other regulatory mechanisms required by parts 2.3.4, 2.3.5 and 2.3.6 shall be completed as soon as possible, but no later than three (3) years from the permit effective date; and
- All other deadlines in part 2.3.4 shall be extended by three (3) years.
- All other deadlines in part 2.3.5, 2.3.6 and 2.3.7 shall be extended by two (2) years.
- All deadlines for discharges to water quality limited waters without a TMDL under part 2.2.2 shall be extended by two (2) years.

b. Contents of the Stormwater Management Program for New Permittees

The following information must be included in the SWMP within one (1) year of the permit effective date and updated annually thereafter, as necessary:

- Identification of names and titles of people responsible for program implementation. If a position is currently unfilled, list the title of the position and modify the SWMP with the name once the position is filled;
- Documentation of compliance with part 1.9.1;
- Documentation of compliance with part 1.9.2;
- Documentation of authorization of all new or increased discharges granted by MassDEP in compliance with part 2.1.2;
- Listing of all discharges identified pursuant to part 2.1.1 and description of response;
- Description of practices to achieve compliance with part 2.3 (MEP requirements)

identified in the permittee's NOI and any updates to those BMPs within the first year;

For each permit condition in part 2.3 identify:

- The person(s) or department responsible for the measure;
 - The BMPs for the control measure or permit requirement;
 - The measurable goal(s) for each BMP. Each measurable goal shall include milestones and timeframes for its implementation and have a quantity or quality associated with its endpoint. Each goal shall have a measure of assessment associated with it;
- Description of measures to avoid or minimize impacts to surface public drinking water supply sources. The permittee is also encouraged to include provisions to notify public water supplies in the event of an emergency. Massachusetts Department of Environmental Protection, Bureau of Resource Protection, Drinking Water Program, One Winter Street, Boston, MA 02108 – phone 617.292.5770. Description of activities to achieve compliance with part 3.0;
 - Annual program evaluation (part 4.1). Update annually and maintain copies.

The following information must be included in the SWMP within three (3) years of the permit effective date and updated annually thereafter, as necessary:

- Written procedures for site inspections and enforcement of sediment and erosion control procedures in accordance with part 2.3.5;

The following information must be included in the SWMP within four (4) years of the permit effective date and updated annually thereafter, as necessary:

- Outfall and interconnection inventory;
- Sanitary Sewer Overflow (SSO) inventory including all of the information required in part 2.3.4.4.b;
- Written IDDE Program pursuant to part 2.3.4.6.
- Written operation and maintenance procedures for municipal activities in part 2.3.7.a.ii;
- Written program detailing the activities and procedures the permittee will implement so that the MS4 infrastructure is maintained in a timely manner to reduce the discharge of pollutants from the MS4 in accordance with part 2.3.7.a.iii.1;
- Written procedures to require submission of as-built drawings and ensure long term operation and maintenance in accordance with part 2.3.6.a.iii;

The following information must be included in the SWMP within five (5) years of the permit effective date and updated annually thereafter, as necessary:

- Phase 1 of the map of the separate storm sewer system required by part 2.3.4.5;
- Listing of all receiving waterbody segments, their classification under the applicable state water quality standards, any impairment(s) and associated pollutant(s) of concern, applicable TMDLs and WLAs, and number of outfalls from the MS4 that discharge to each waterbody. In addition to the receiving water, the permittee shall document in the SWMP all surface public drinking water sources that may be impacted by MS4 discharges;
- Listing of all interconnected MS4s and other separate storm sewer systems receiving a discharge from the permitted MS4, the receiving waterbody segment(s) ultimately receiving the discharge, their classification under the applicable state water quality standards, any impairment(s) and associated pollutant(s) of concern, applicable TMDLs

and WLAs, and the number of interconnections;

The following information must be included in the SWMP within six (6) years of the permit effective date and updated annually thereafter, as necessary:

- Report(s) assessing current street design and parking lot guidelines and other local requirements within the municipality that affect the creation of impervious cover.

The following information must be included in the SWMP concurrent with the applicable deadlines in Appendix F and H (extended by two (2) years) and updated annually thereafter, as necessary:

- Description of practices to achieve compliance with part 2.2.1 (discharges subject to requirements related to approved TMDLs) including:
 - The person(s) or department responsible for the measure;
 - The BMPs for the control measure or permit requirement;
 - The measurable goal(s) for each BMP. Each measurable goal shall include milestones and timeframes for its implementation and have a quantity or quality associated with its endpoint. Each goal must have an associated measure of assessment.
- Description of practices to achieve compliance with part 2.2.2 (discharges to certain water quality limited waters subject to additional requirements) including:
 - The person(s) or department responsible for the measure;
 - The BMPs for the control measure or permit requirement;
 - The measurable goal(s) for each BMP. Each measurable goal shall include milestones and timeframes for its implementation and have a quantity or quality associated with its endpoint. Each goal must have an associated measure of assessment;
- Description of any other practices to achieve compliance with part 2.1 (water quality based requirements).

2.0. Non-Numeric Effluent Limitations

This section includes terms and conditions necessary to reduce the discharge of pollutants from the MS4 to the maximum extent practicable; to protect water quality and to satisfy the appropriate water quality requirements of the Clean Water Act and the Massachusetts Water Quality Standards.

2.1. Water Quality Based Effluent Limitations

Pursuant to Clean Water Act 402(p)(3)(B)(iii), this permit includes provisions to ensure that discharges from the permittee's small MS4 meet applicable water quality standards as set forth in part 2.1.1. below.

2.1.1. Requirement to Meet Water Quality Standards

- a. The permittee's discharges shall meet applicable water quality standards by complying with parts 2.1.1.b and/or 2.1.1.c in accordance with the schedules set forth therein.² Any other

² Applicable water quality standards are the state standards that have been federally approved or promulgated as of the issuance date of this permit and are compiled by EPA at <http://www.epa.gov/waterscience/standards/wqslibrary/>.

discharge of a pollutant that: (i) is not addressed by part 2.1.1.b, part 2.1.1.c, part 2.2.1, and/or part 2.2.2, (ii) is not the result of an illicit discharge subject to part 2.3.4, and (iii) does not meet applicable water quality standards, either independently or in conjunction with other discharges, shall comply with part 2.1.1.d.

- b. If there is a discharge from the MS4 to a waterbody (or its tributaries in some cases) that is subject to an EPA approved or established TMDL identified in part 2.2.1, the permittee is subject to the requirements of part 2.2.1 and Appendix F of this permit and the permittee shall comply with all applicable schedules, alternative schedules and requirements in Appendix F. A permittee's compliance with all applicable requirements and BMP implementation schedules in Appendix F or any alternative schedules applicable to it will constitute compliance with part 2.1.1.a. of the Permit for discharges of pollutants addressed in Appendix F.
- c. If (i) there is a discharge from the MS4 to a waterbody (or its tributaries in some cases) that is water quality limited (see definition in Appendix A) due to nutrients (Total Nitrogen or Total Phosphorus), metals (Cadmium, Copper, Iron, Lead or Zinc), solids (TSS or Turbidity), bacteria/pathogens (E. Coli, Enterococcus or Fecal Coliform), chloride (Chloride) or oil and grease (Petroleum Hydrocarbons or Oil and Grease) and is not subject to an approved TMDL, or (ii) the MS4 is located within a municipality listed in part 2.2.2.a.-b., then the permittee is subject to the requirements of part 2.2.2 and Appendix H of this permit and the permittee shall comply with all applicable schedules and requirements in Appendix H. A permittee's compliance with all applicable requirements and BMP implementation schedules in Appendix H applicable to it will constitute compliance with part 2.1.1.a. of the Permit for discharges of pollutants addressed in Appendix H.
- d. Pursuant to Part 2.1.1.a, upon notice from EPA or MassDEP to the permittee that a discharge of a pollutant from the MS4 that is exceeding applicable water quality standards, the permittee must, within 60 days, remedy the exceedance or eliminate the discharge. However, where such remedy or elimination within 60 days is impracticable, the permittee shall submit to EPA, by the same deadline, a schedule of actions to achieve a remedy or elimination in the shortest time not impracticable. The permittee shall implement such actions on the schedule submitted to EPA and report on progress in its annual reports unless or until EPA takes any other action that effectively replaces the schedule..

2.1.2. Increased Discharges

- a. Any increased discharge, including increased pollutant loading(s) through the MS4 to waters of the United States is subject to Massachusetts antidegradation regulations at 314 CMR 4.04. The permittee shall comply with the provisions of 314 CMR 4.04 including information submittal requirements and obtaining authorization for increased discharges where appropriate³. Any authorization of an increased discharge by MassDEP shall be incorporated into the permittee's SWMP. If an applicable MassDEP approval specifies conditions or requirements related to the increased discharge, such requirements may be independently enforceable under State law and may be adopted into a future permit.
- b. There shall be no increased discharges, including increased pollutant loading(s) from the MS4 to impaired waters listed in categories 5 or 4b on the most recent Massachusetts Integrated Report of waters listed pursuant to Clean Water Act section 303(d) and 305(b) unless the permittee

³ Contact MassDEP for guidance on compliance with 314 CMR 4.04

demonstrates that there is no net increase in loading from the MS4 to the impaired water of the pollutant(s) for which the waterbody is impaired. The permittee may demonstrate compliance with this provision by *either*:

- i. Documenting that the pollutant(s) for which the waterbody is impaired is not present in the MS4's discharge and retaining documentation of this finding with the SWMP; or
 - ii. Documenting that the total load of the pollutant(s) of concern from the MS4 to any impaired portion of the receiving water will not increase as a result of the activity and retaining documentation of this finding in the SWMP. Unless otherwise determined by the Permittee, USEPA or by MassDEP that additional demonstration is necessary, compliance with the requirements of part 2.2.2 and part 2.3.6 of this Permit, including all reporting and documentation requirements, shall be considered as demonstrating no net increase as required by this part.
- c. The requirements of this part are independent of permit conditions requiring reduction in discharges of pollutants as set forth in parts 2.1.1 and 2.2 (water quality based requirements) and 2.3 (requirements to reduce discharge of pollutants to the maximum extent practicable). Permittees remain subject to requirements to reduce the discharge of pollutants from the MS4 as set forth in those parts.

2.2. Discharges to Certain Impaired Waters

The permittee shall identify in the SWMP and Annual Reports all MS4 discharges, including both outfalls and interconnections to other MS4s or other separate storm sewer systems, that:

- Are subject to Total Maximum Daily Load (TMDL) related requirements as identified in part 2.2.1.
- Are subject to additional requirements to protect water quality as identified in part 2.2.2.

The discharge location from an interconnection shall be determined based on the receiving water of the outfall from the interconnected system.

Permittees are subject to the applicable requirements in part 2.2.1, Appendix F, or an approved alternative structural control implementation schedule, and/or the applicable requirements in part 2.2.2, and Appendix H.

2.2.1. Discharges Subject to Requirements Related to an Approved TMDL

- a. "Approved TMDLs" are those that have been approved by EPA as of the date of issuance of this permit.
- b. The MS4s specified below discharge to waters within Massachusetts that are subject to TMDLs, or in some cases, to tributaries of such waters, and shall comply with the requirements of Appendix F, part A. Appendix F identifies, by section, the provisions the permittee shall implement to be consistent with the terms of the approved TMDL. Alternatively, EPA may notify the permittee that an individual permit application is necessary in accordance with part 1.8.a.

- i. The following is a list of municipalities in the Charles River Watershed:

1.

Arlington	Mendon
Ashland	Milford
Bellingham	Millis
Belmont	Natick
Brookline	Needham
Cambridge	Newton
Dedham	Norfolk
Dover	Sherborn
Foxborough	Walpole
Franklin	Waltham
Holliston	Watertown
Hopedale	Wayland
Hopkinton	Wellesley
Lexington	Weston
Lincoln	Westwood
Medfield	Wrentham
Medway	

Permittees that operate regulated MS4s located in municipalities listed above that discharge to the Charles River or its Tributaries shall meet the requirements of Appendix F, part A.I with respect to the reduction of phosphorus discharges from their MS4.

- ii. The following is a list of municipalities that contain a lake or pond subject to an approved lake or pond phosphorus TMDL in the Northern Blackstone Basin, Chicopee Basin, Connecticut Basin, French Basin, Millers Basin or in the watershed of Bare Hill Pond, Flint Pond, Indian Lake, Lake Boon, Lake Quinsigamond, Leesville Pond, Salisbury Pond, Quaboag Pond or Quacumquasit Pond.

1.

Auburn	Millbury
Charlton	Oxford
Dudley	Shrewsbury
Gardner	Spencer
Grafton	Springfield
Granby	Stow
Hadley	Templeton
Harvard	Westminster
Hudson	Winchendon
Leicester	Wilbraham

Ludlow	
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Permittees that operate regulated MS4s in the above municipalities that discharge to waterbodies listed on Table F-6 in Appendix F or their tributaries, and any other MS4 that discharges to waterbodies listed on Table F-6 in Appendix F or their tributaries, shall meet the requirements of Appendix F, part A.II with respect to reduction of phosphorus discharges from their MS4.

iii. The following is a list of municipalities that contain waters subject to an approved TMDL for bacteria or pathogens.

1.

Abington	Marshfield
Acushnet	Mashpee
Andover	Mattapoisett
Avon	Medfield
Barnstable	Medway
Bedford	Melrose
Bellingham	Mendon
Belmont	Milford
Berkley	Millis
Beverly	Milton
Billerica	Nahant
Bourne	Natick
Brewster	Needham
Bridgewater	New Bedford
Brockton	Newton
Brookline	Norfolk
Burlington	North Andover
Cambridge	Norton
Canton	Norwell
Chatham	Norwood
Cohasset	Orleans
Concord	Peabody
Danvers	Pembroke
Dartmouth	Plymouth
Dedham	Raynham
Dennis	Rehoboth
Dighton	Revere
Dover	Rockland
Duxbury	Rockport
East Bridgewater	Salem

Eastham	Sandwich
Essex	Saugus
Everett	Scituate
Fairhaven	Seekonk
Fall River	Sharon
Falmouth	Sherborn
Foxborough	Somerset
Franklin	Stoughton
Freetown	Swampscott
Gloucester	Swansea
Hanover	Taunton
Hanson	Tewksbury
Harwich	Wakefield
Holliston	Walpole
Hopedale	Waltham
Hopkinton	Wareham
Ipswich	Watertown
Kingston	Wellesley
Lawrence	Wellfleet
Lexington	West Bridgewater
Lincoln	Weston
Lynn	Westport
Lynnfield	Westwood
Malden	Whitman
Manchester	Wilmington
Mansfield	Winthrop
Marblehead	Yarmouth
Marion	

The operators of MS4s located in municipalities listed above that discharge to a waterbody segment listed on Table F-8 in Appendix F and any other MS4 that discharges directly to a waterbody segment listed on Table F-8 in Appendix F shall meet the requirements of Appendix F, part A.III with respect to reduction of bacteria/pathogens discharges from their MS4.

- iv. The following is a list of municipalities located on Cape Cod that contain waters subject to an approved TMDL for nitrogen (Total Nitrogen).

1.

Bourne
Barnstable
Chatham
Falmouth

Harwich
Mashpee
Orleans
Yarmouth

Permittees that operate regulated MS4s located in the municipalities above that discharge to waterbodies found on Table F-9 in Appendix F or their tributaries and any other MS4 that discharges to waterbodies found on Table F-9 in Appendix F or their tributaries shall meet the requirements of Appendix F, part A.IV with respect to reduction of nitrogen discharges from their MS4.

- v. The following is a list of municipalities located in the Assabet River Watershed:

- 1.

Acton	Hudson
Berlin	Littleton
Bolton	Marlborough
Boxborough	Maynard
Boylston	Northborough
Carlisle	Shrewsbury
Clinton	Stow
Concord	Westborough
Grafton	Westford
Harvard	

Permittees that operate regulated MS4s located in the municipalities above that discharge to the Assabet River or its tributaries shall meet the requirements of Appendix F part A.V with respect to reduction of phosphorus discharges from their MS4.

- c. The MS4s specified below discharge to waters, or tributaries of waters, that have been identified in an adjacent state’s approved TMDL as being impaired due, in part, to MS4 stormwater discharges in Massachusetts, and shall comply with the requirements of Appendix F, part B. Appendix F identifies, by section, the provisions the permittee shall implement to be consistent with the reasonable assumptions related to Massachusetts MS4 discharges. Alternatively, EPA may notify the permittee that an individual permit application is necessary in accordance with part 1.8.a.

- i. The following is a list of municipalities in Massachusetts located in the watershed of Long Island Sound, which has an approved TMDL for nitrogen (Total Nitrogen).

- 1.

Adams	North Adams
Agawam	Northampton
Amherst	Oxford
Ashburnham	Palmer

Ashby	Paxton
Auburn	Pelham
Belchertown	Pittsfield
Charlton	Richmond
Cheshire	Russell
Chicopee	Rutland
Dalton	South Hadley
Douglas	Southampton
Dudley	Southbridge
East Longmeadow	Southwick
Easthampton	Spencer
Gardner	Springfield
Granby	Sturbridge
Hadley	Sutton
Hampden	Templeton
Hatfield	Ware
Hinsdale	Webster
Holyoke	West Springfield
Lanesborough	Westfield
Leicester	Westhampton
Lenox	Westminster
Longmeadow	Wilbraham
Ludlow	Williamsburg
Millbury	Winchendon
Monson	

Permittees that operate regulated MS4s located in the municipalities above that discharge to a water within the Connecticut River Watershed, the Housatonic River Watershed, or the Thames River Watershed shall meet the requirements of Appendix F part B. I with respect to nitrogen discharges from their MS4.

- ii. The following is a list of municipalities in Massachusetts identified in a TMDL as containing MS4s contributing phosphorus to waterbody segments that have out of state approved TMDLs for phosphorus:

- 1.

Attleboro
North Attleborough
Plainville
Rehoboth
Seekonk
Swansea

Permittees that operate regulated MS4s located in the municipalities above that discharge to a waterbody found on Table F-12 in Appendix F or its tributaries shall meet the requirements of Appendix F part B. II with respect to phosphorus discharges from their MS4.

- iii. The following is a list of municipalities in Massachusetts identified in a TMDL as containing MS4s contributing bacteria/pathogens to waterbody segments that have out of state approved TMDLs for bacteria/pathogens:

1.

Attleboro
North Attleborough
Plainville
Rehoboth
Seekonk

Permittees that operate regulated MS4s located in the municipalities above that discharge to a waterbody found on Table F-13 in Appendix F or its tributaries shall meet the requirements of Appendix F part B. III with respect to bacteria/pathogens discharges from their MS4.

- iv. The following is a list of municipalities in Massachusetts identified in a TMDL as containing MS4s contributing metals (cadmium, lead, aluminum iron) to waterbody segments that have out of state approved TMDLs for metals (cadmium, lead, aluminum, iron):

1.

Attleboro
North Attleborough
Plainville
Seekonk

Permittees that operate regulated MS4s located in the municipalities above that discharge to a waterbody found on Table F-14 in Appendix F or its tributaries shall meet the requirements of Appendix F part B. IV with respect to metals discharges from their MS4.

2.2.2. Discharges to Certain Water Quality Limited Waters Subject to Additional Requirements

For purposes of this permit, a ‘water quality limited water body’ is any water body that does not meet applicable water quality standards, including but not limited to waters listed in categories 5 or 4b on the Massachusetts Integrated Report of waters listed pursuant to Clean Water Act section 303(d) and 305(b).

If there is a discharge from the MS4 to a water quality limited waterbody where pollutants typically found in stormwater (specifically nutrients (Total Nitrogen or Total Phosphorus), solids (TSS or Turbidity), bacteria/pathogens (E. Coli, Enterococcus or Fecal Coliform), chloride (Chloride), metals (Cadmium, Copper, Iron, Lead or Zinc) and oil and grease (Petroleum Hydrocarbons or Oil and Grease)) are the cause of the impairment and is not subject to part 2.1.1.b for those pollutants, or the MS4 is located in a town listed in part 2.2.2.a.-b, the permittee shall comply with the provisions

in Appendix H applicable to it. Permittees notified by EPA or MassDEP during the permit term that they are discharging to a water quality limited water shall update their SWMP to include measures they must take in accordance with Appendix H.

In the absence of a defined pollutant reduction target and where no approved TMDL has been established as of the issuance date of this permit, this permit part and Appendix H define an iterative approach addressing pollutant reductions to waterbodies where the permittee’s discharge is not meeting applicable water quality standards due to nutrients (Total Nitrogen Total Phosphorus), solids (TSS or Turbidity), bacteria/pathogens (E. Coli, Enterococcus or Fecal Coliform), chloride (Chloride), metals (Cadmium, Copper, Iron, Lead or Zinc) or oil and grease (Petroleum Hydrocarbons or Oil and Grease).

a. Discharges to water quality limited waterbodies where nitrogen (Total Nitrogen) is the cause of the impairment, or their tributaries

i. The requirements of this part are applicable to:

1. Permittees (including traditional and non-traditional MS4s) that own or operate an MS4 in the following municipalities. Discharges from MS4s within these municipalities are to waterbodies that are impaired due to nitrogen (Total Nitrogen), or their tributaries.

Abington	Mattapoisett
Acushnet	Middleborough
Attleboro	New Bedford
Avon	Norton
Barnstable	Peabody
Berkley	Pembroke
Bourne	Plainville
Bridgewater	Plymouth
Brockton	Plympton
Carver	Raynham
Dartmouth	Rehoboth
Dighton	Rochester
East Bridgewater	Salem
Easton	Seekonk
Fairhaven	Sharon
Fall River	Somerset
Foxborough	Stoughton
Freetown	Swansea
Halifax	Taunton
Hanson	Wakefield
Holbrook	Wareham
Kingston	West Bridgewater
Lakeville	Westport

Lynnfield	Whitman
Mansfield	Wrentham
Marion	Yarmouth

2. Any other permittee that, during the permit term, becomes aware that its discharge is to a waterbody that is water quality limited due to nitrogen (Total Nitrogen), or a tributary of such water.
 - ii. Permittees subject to part 2.2.2.a.i above shall meet the requirements of Appendix H part I with respect to the control of nitrogen discharges from their MS4;
 - iii. During development of their Notice of Intent, the permittee may determine that all discharges from the regulated area through their MS4 are outside of a watershed that contains a nitrogen (Total Nitrogen) impairment in a downstream segment. The permittee shall retain all documentation used in this determination as part of their NOI and are relieved from the requirements of part 2.2.2.a.i and Appendix H part I.
- b. Discharges to water quality limited waterbodies where phosphorus (“Total Phosphorus”) is the cause of the impairment, or their tributaries
- i. The requirements of this part are applicable to:
 1. Permittees (including traditional and non-traditional MS4s) that own or operate an MS4 in the following municipalities. Discharges from MS4s within these municipalities are to waterbodies that are impaired due to phosphorus (Total Phosphorus), or their tributaries.

Abington	Lynn
Acushnet	Lynnfield
Andover	Malden
Arlington	Mansfield
Ashburnham	Marlborough
Ashland	Mashpee
Auburn	Medfield
Avon	Medford
Ayer	Melrose
Barnstable	Mendon
Bedford	Methuen
Belchertown	Millbury
Belmont	Millville
Billerica	Milton
Blackstone	North Andover
Bolton	Northbridge
Brewster	Norton

Bridgewater	Norwood
Brockton	Oxford
Burlington	Peabody
Cambridge	Pembroke
Canton	Pepperell
Carlisle	Pittsfield
Carver	Quincy
Chelmsford	Randolph
Chelsea	Reading
Clinton	Revere
Concord	Rockland
Dalton	Salem
Dedham	Scituate
Douglas	Seekonk
Dover	Sharon
Dracut	Shirley
Dunstable	Shrewsbury
East Bridgewater	Somerville
Eastham	Southampton
Easthampton	Spencer
Everett	Springfield
Falmouth	Stoneham
Fitchburg	Stoughton
Foxborough	Sudbury
Framingham	Sutton
Gloucester	Taunton
Grafton	Tewksbury
Granby	Townsend
Groton	Tyngsborough
Halifax	Upton
Hanover	Uxbridge
Hanson	Wakefield
Harvard	Walpole
Haverhill	Wareham
Hinsdale	Watertown
Hopkinton	Wayland
Hudson	West Bridgewater
Lancaster	Westfield

Lawrence	Westminster
Leicester	Westwood
Lenox	Whitman
Leominster	Wilmington
Lexington	Winchendon
Littleton	Winchester
Lowell	Winthrop
Lunenburg	Woburn
Lynn	

2. Any other permittee that, during the permit term, becomes aware that its discharge is to a waterbody that is water quality limited due to phosphorus (“Total Phosphorus”), or to a tributary of such water.
 - ii. The permittees subject to part 2.2.2.b.i. above shall meet all requirements of Appendix H part II with respect to the control of phosphorus discharges from the MS4.
 - iii. During development of their Notice of Intent, the permittee may determine that all discharges from the regulated area through their MS4 are outside of a watershed that contains a phosphorus (“Total Phosphorus”) impairment in a downstream segment. The permittee shall retain all documentation used in this determination as part of their NOI and are relieved from the requirements of part 2.2.2.b.i and Appendix H part II.
- c. Discharges to water quality limited waterbodies where bacteria or pathogens is the cause of the impairment
- i. The requirements of this part are applicable to:
 1. Any MS4 discharge identified by the permittee on their Notice of Intent as discharging directly to an impaired waterbody on the most recent EPA approved Massachusetts 303(d) list where bacteria or pathogens (E. Coli, Enterococcus or Fecal Coliform) is the cause of the impairment.
 2. Any other MS4 that, during the permit term, becomes aware that its discharge is to a waterbody that is water quality limited due to bacteria or pathogens.
 - ii. The permittees subject to part 2.2.2.c.i. shall meet all requirements of Appendix H part III with respect to reduction of bacteria or pathogens discharges from the MS4.
- d. Discharges to water quality limited waterbodies where chloride (Chloride) is the cause of the impairment
- i. The requirements of this part are applicable to:
 1. Any MS4 discharge identified by the permittee on their Notice of Intent as discharging directly to an impaired waterbody on the most recent EPA approved Massachusetts 303(d) list where chloride (Chloride) is the cause of the impairment.

2. Any other MS4 that, during the permit term, becomes aware that its discharge is to a waterbody that is water quality limited due to chloride (Chloride).
- ii. The permittees subject to part 2.2.2.d.i. shall meet all requirements of Appendix H part IV with respect to reduction of chloride discharges from the MS4.
- e. Discharges to water quality limited waterbodies where oil and grease (Petroleum Hydrocarbons or Oil and Grease), solids (TSS or Turbidity) or metals (Cadmium, Copper, Iron, Lead or Zinc) is the cause of the impairment
- i. The requirements of this part are applicable to:
 1. Any MS4 discharge identified by the permittee on their Notice of Intent as discharging directly to an impaired waterbody on the most recent EPA approved Massachusetts 303(d) list where oil and grease, solids or metals (Oil and Grease, Petroleum Hydrocarbons TSS, Turbidity, Cadmium, Copper, Iron, Lead or Zinc) is the cause of the impairment.
 2. Any other MS4 that, during the permit term, becomes aware that its discharge is to a waterbody that is water quality limited due to oil and grease (Petroleum Hydrocarbons or Oil and Grease), solids (TSS or Turbidity) or metals (Cadmium, Copper, Iron, Lead or Zinc).
 - ii. The permittees subject to part 2.2.2.d.i. shall meet all requirements of Appendix H part V with respect to reduction of solids, oil and grease or metals discharges from the MS4.

2.3. Requirements to Reduce Pollutants to the Maximum Extent Practicable (MEP)

The permittee shall reduce the discharge of pollutants from the MS4 to the maximum extent practicable (MEP) as detailed in parts 2.3.2 through 2.3.7.

2.3.1. Control Measures

- a. Permittees authorized under the MS4-2003 permit shall continue to implement their existing SWMPs while updating their SWMPs pursuant to this permit. This permit does not extend the compliance deadlines set forth in the MS4-2003 permit.
- b. Implementation of one or more of the minimum control measures described in parts 2.3.2- 2.3.7 or other permit requirements may be shared with another entity (including another interconnected MS4) or the other entity may fully implement the measure or requirement, if the following requirements are satisfied:
 - The other entity, in fact, implements the control measure.
 - The particular control measure or component thereof undertaken by the other entity is at least as stringent as the corresponding permit requirement.
 - The other entity agrees to implement the control measure on the permittee's behalf. The annual reports must specify that the permittee is relying on another entity to satisfy some of its permit obligations and specify what those obligations are.
 - If the permittee is relying on another governmental entity regulated under 40 CFR §122 to satisfy all of its permit obligations, including the obligation to file annual reports, the permittee shall note that fact in its NOI, but is not required to file annual reports.

- The permittee remains responsible for compliance with all permit obligations if the other entity fails to implement the control measures (or component thereof). The permittee may enter into a legally binding agreement with the other entity regarding the other entity's performance of control measures, but the permittee remains ultimately responsible for permit compliance.

2.3.2. Public Education and Outreach

Objective: The permittee shall implement an education program that includes educational goals based on stormwater issues of significance within the MS4 area. The ultimate objective of a public education program is to increase knowledge and change behavior of the public so that pollutants in stormwater are reduced.

- a. The permittee shall continue to implement the public education program required by the MS4-2003 permit by distributing educational material to the MS4 community. The educational program shall define educational goals, express specific messages, define the targeted audience for each message, and identify responsible parties for program implementation. If appropriate for the target audience, materials may be developed in a language other than English. At a minimum, the program shall provide information concerning the impact of stormwater discharges on water bodies within the community, especially those waters that are impaired or identified as priority waters. The program shall identify steps and/or activities that the public can take to reduce the pollutants in stormwater runoff and their impacts to the environment.
- b. The educational program shall include education and outreach efforts for the following four audiences: (1) residents, (2) businesses, institutions (churches, hospitals), and commercial facilities, (3) developers (construction), and (4) industrial facilities, unless one of these audiences is not present in the MS4 community. In such a situation, the MS4 must document in both the NOI and SWMP which audience is absent from the community and no educational messages are required to that audience.
- c. The permittee shall distribute a minimum of two (2) educational messages over the permit term to each audience identified in part 2.3.2.b. The distribution of materials to each audience shall be spaced at least a year apart. Educational messages may be printed materials such as brochures or newsletters; electronic materials such as websites; mass media such as newspaper articles or public service announcement (radio or cable); targeted workshops on stormwater management, or displays in a public area such as town/city hall. The permittee may use existing materials if they are appropriate for the message the permittee chooses to deliver or the permittee may develop its own educational materials. The permittee may partner with other MS4s, community groups or watershed associations to implement the education program to meet this permit requirement.

Some EPA educational materials are available at: <http://cfpub.epa.gov/npstbx/index.html>.
- d. The permittee shall, at a minimum, consider the topics listed in part 2.3.2.d.i. – iv when developing the outreach/education program. The topics are not exclusive and the permittee shall focus on those topics most relevant to the community.
 - i. Residential program: effects of outdoor activities such as lawn care (use of pesticides, herbicides, and fertilizers and information on Massachusetts Regulation 331 CMR 31 pertaining to proper use of phosphorus containing fertilizers on turf grasses) on water

quality; benefits of appropriate on-site infiltration of stormwater; effects of automotive work and car washing on water quality; proper disposal of swimming pool water; proper management of pet waste; maintenance of septic systems. If the small MS4 area has areas serviced by septic systems, the permittee shall consider information pertaining to maintenance of septic systems as part of its education program.

- ii. Business/Commercial/Institution program: proper lawn maintenance (use of pesticides, herbicides and fertilizer, and information on Massachusetts Regulation 331 CMR 31 pertaining to proper use of phosphorus containing fertilizers on turf grasses); benefits of appropriate on-site infiltration of stormwater; building maintenance (use of detergents); use of salt or other de-icing and anti-icing materials (minimize their use); proper storage of salt or other de-icing/anti-icing materials (cover/prevent runoff to storm system and contamination to ground water); proper storage of materials (emphasize pollution prevention); proper management of waste materials and dumpsters (cover and pollution prevention); proper management of parking lot surfaces (sweeping); proper car care activities (washing of vehicles and maintenance); and proper disposal of swimming pool water by entities such as motels, hotels, and health and country clubs (discharges must be dechlorinated and otherwise free from pollutants).
 - iii. Developers and Construction: proper sediment and erosion control management practices; information about Low Impact Development (LID) principles and technologies; and information about EPA's construction general permit (CGP). This education can also be a part of the Construction Site Stormwater Runoff Control measure detailed in part 2.3.5.
 - iv. Industrial program: equipment inspection and maintenance; proper storage of industrial materials (emphasize pollution prevention); proper management and disposal of wastes; proper management of dumpsters; minimization of use of salt or other de-icing/anti-icing materials; proper storage of salt or other de-icing/anti-icing materials (cover/prevent runoff to storm system and ground water contamination); benefits of appropriate on-site infiltration of stormwater runoff from areas with low exposure to industrial materials such as roofs or employee parking; proper maintenance of parking lot surfaces (sweeping); and requirements for coverage under EPA's Multi-Sector General Permit.
- e. The program shall show evidence of focused messages for specific audiences as well as evidence that progress toward the defined educational goals of the program has been achieved. The permittee shall identify methods that it will use to evaluate the effectiveness of the educational messages and the overall education program. Any methods used to evaluate the effectiveness of the program shall be tied to the defined goals of the program and the overall objective of changes in behavior and knowledge.
 - f. The permittee shall modify any ineffective messages or distribution techniques for an audience prior to the next scheduled message delivery.
 - g. The permittee shall document in each annual report the messages for each audience; the method of distribution; the measures/methods used to assess the effectiveness of the messages, and the method/measures used to assess the overall effectiveness of the education program.

2.3.3. Public Involvement and Participation

Objective: The permittee shall provide opportunities to engage the public to participate in the review and implementation of the permittee's SWMP.

- a. All public involvement activities shall comply with state public notice requirements (MGL Chapter 30A, Sections 18 – 25 – effective 7/10/2010). The SWMP, all documents submitted to EPA in accordance with Appendix F, and all annual reports shall be available to the public online if the permittee has a website on which to post these documents.
- b. The permittee shall annually provide the public an opportunity to participate in the review and implementation of the SWMP.
- c. The permittee shall report on the activities undertaken to provide public participation opportunities including compliance with part 2.3.3.a. Public participation opportunities pursuant to part 2.3.3.b may include, but are not limited to, websites; hotlines; clean-up teams; monitoring teams; or an advisory committee.

2.3.4 Illicit Discharge Detection and Elimination (IDDE) Program

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

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

2.3.4.1. Definitions and Prohibitions

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

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

An illicit discharge is any discharge to a municipal separate storm sewer that is not composed entirely of stormwater, except discharges pursuant to a NPDES permit (other than the NPDES permit for discharges from the municipal separate storm sewer) and discharges resulting from fire fighting activities.

2.3.4.2. Elimination of Illicit Discharges

- a. Upon detection of an illicit discharge, the permittee shall locate, identify and eliminate the illicit discharge as expeditiously as possible. Upon identification of the illicit source the MS4 notify all responsible parties for any such discharge and require immediate cessation of improper disposal

practices in accordance with its legal authorities. Where elimination of an illicit discharge within 60 days of its identification as an illicit discharge is not possible, the permittee shall establish an expeditious schedule for its elimination and report the dates of identification and schedules for removal in the permittee's annual reports. The permittee shall immediately commence actions necessary for elimination. The permittee shall diligently pursue elimination of all illicit discharges. In the interim, the permittee shall take all reasonable and prudent measures to minimize the discharge of pollutants to and from its MS4.

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

2.3.4.3. Non-Stormwater Discharges

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

2.3.4.4. Sanitary Sewer Overflows

- a. Upon detection of an SSO the permittee shall eliminate it as expeditiously as possible and take interim mitigation measures to minimize the discharge of pollutants to and from its MS4 until elimination is completed.
- b. The permittee shall identify all known locations where SSOs have discharged to the MS4 within the previous five (5) years. This shall include SSOs resulting, during dry or wet weather, from inadequate conveyance capacities, or where interconnectivity of the storm and sanitary sewer infrastructure allows for communication of flow between the systems. Within one (1) year of the effective date of the permit, the permittee shall develop an inventory of all identified SSOs indicating the following information, if available:
 - 1. Location (approximate street crossing/address and receiving water, if any);
 - 2. A clear statement of whether the discharge entered a surface water directly or entered the MS4;
 - 3. Date(s) and time(s) of each known SSO occurrence (i.e., beginning and end of any known discharge);
 - 4. Estimated volume(s) of the occurrence;
 - 5. Description of the occurrence indicating known or suspected cause(s);
 - 6. Mitigation and corrective measures completed with dates implemented; and
 - 7. Mitigation and corrective measures planned with implementation schedules.

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

- c. In accordance with Paragraph B.12 of Appendix B of this permit, upon becoming aware of an SSO to the MS4, the permittee shall provide oral notice to EPA within 24 hours. Additionally, the permittee shall provide written notice to EPA and MassDEP within five (5) days of becoming aware of the SSO occurrence and shall include the information in the updated inventory. The notice shall contain all of the information listed in part 2.3.4.4.b. Where common notification requirements for SSOs are

included in multiple NPDES permits issued to a permittee, a single notification may be made to EPA as directed in the permittee's wastewater or CSO NPDES permit and constitutes compliance with this part.

- d. The permittee shall include and update the SSO inventory in its annual report, including the status of mitigation and corrective measures implemented by the permittee to address each SSO identified pursuant to this part.
- e. The period between detection and elimination of a discharge from the SSO to the MS4 is not a grace period. Discharges from an MS4 that are mixed with an SSO are not authorized by this Permit (part 1.3.a) and remain unlawful until eliminated.

2.3.4.5. System mapping

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

- a. Phase I: The system map shall be updated within two (2) years of the permit effective date to include the following information:
 - Outfalls and receiving waters (required by MS4-2003 permit)
 - Open channel conveyances (swales, ditches, etc.)
 - Interconnections with other MS4s and other storm sewer systems
 - Municipally-owned stormwater treatment structures (e.g., detention and retention basins, infiltration systems, bioretention areas, water quality swales, gross particle separators, oil/water separators, or other proprietary systems)
 - Waterbodies identified by name and indication of all use impairments as identified on the most recent EPA approved Massachusetts Integrated List of waters report pursuant to Clean Water Act section 303(d) and 305(b)
 - Initial catchment delineations. Any available system data and topographic information may be used to produce initial catchment delineations. For the purpose of this permit, a catchment is the area that drains to an individual outfall or interconnection.
- b. Phase II: The system map shall be updated annually as the following information becomes available during implementation of catchment investigation procedures in part 2.3.4.8. This information must be included in the map for all outfalls within ten (10) years of the permit effective date:
 - Outfall spatial location (latitude and longitude with a minimum accuracy of +/-30 feet)
 - Pipes
 - Manholes
 - Catch basins
 - Refined catchment delineations. Catchment delineations shall be updated to reflect information collected during catchment investigations
 - Municipal sanitary sewer system (if available)
 - Municipal combined sewer system (if applicable).

- c. Recommended elements to be included in the system map as information becomes available:
- Storm sewer material, size (pipe diameter) and age
 - Sanitary sewer system material, size (pipe diameter) and age
 - Privately-owned stormwater treatment structures
 - Where a municipal sanitary sewer system exists, properties known or suspected to be served by a septic system, especially in high-density urban areas
 - Area where the permittee's MS4 has received or could receive flow from septic system discharges (e.g., areas with poor soils, or high ground water elevations unsuitable for conventional subsurface disposal systems)
 - Seasonal high water table elevations impacting sanitary alignments
 - Topography
 - Orthophotography
 - Alignments, dates and representation of work completed (with legend) of past illicit discharge investigations (e.g., flow isolation, dye testing, CCTV)
 - Locations of suspected, confirmed and corrected illicit discharges (with dates and flow estimates).
- d. The mapping may be produced by hand or through computer-aided methods (e.g. GIS). The required scale and detail of the map shall be appropriate to facilitate a rapid understanding of the system by the permittee, EPA and the state. In addition, the mapping shall serve as a planning tool for the implementation and phasing of the IDDE program and demonstration of the extent of complete and planned investigations and corrections. The permittee shall update the mapping as necessary to reflect newly discovered information and required corrections or modifications.
- e. The permittee shall report on the progress towards the completion of the system map in each annual report.

2.3.4.6. Written Illicit Discharge Detection and Elimination Program

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

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

- a. The written (hardcopy or electronic) IDDE program shall include a reference or citation of the authority the permittee will use to implement all aspects of the IDDE program.
- b. Statement of IDDE Program Responsibilities - The permittee shall establish a written (hardcopy or electronic) statement that clearly identifies responsibilities with regard to eliminating illicit discharges. The statement shall identify the lead municipal agency(ies) or department(s) responsible for implementing the IDDE Program as well as any other agencies or departments that may have responsibilities for aspects of the program (e.g., board of health responsibilities for overseeing septic system construction; sanitary sewer system staff; inspectional services for enforcing plumbing codes;

town counsel responsibilities in enforcement actions, etc.). Where multiple departments and agencies have responsibilities with respect to the IDDE program specific areas of responsibility shall be defined and processes for coordination and data sharing shall be established and documented.

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

2.3.4.7. Assessment and Priority Ranking of Outfalls/Interconnections

The permittee shall assess and priority rank the outfalls in terms of their potential to have illicit discharges and SSOs and the related public health significance. This ranking will determine the priority order for screening of outfalls and interconnections pursuant to part 2.3.4.7.b, catchment investigations for evidence of illicit discharges and SSOs pursuant to part 2.3.4.8, and provides the basis for determining permit milestones of this part.

- a) Outfall/Interconnection Inventory and Initial Ranking:

An initial outfall and interconnection inventory and priority ranking to assess illicit discharge potential based on existing information shall be completed within one (1) year from the effective date of the permit; an updated inventory and ranking will be provided in each annual report thereafter. The inventory shall be updated annually to include data collected in connection with the dry weather screening and other relevant inspections conducted by the permittee.
- i. The outfall and interconnection inventory will identify each outfall and interconnection discharging from the MS4, record its location and condition, and provide a framework for tracking inspections, screenings and other activities under the permittee’s IDDE program.
 - An outfall means a point source as defined by 40 CFR § 122.2 as the point where the municipal separate storm sewer discharges to waters of the United States. An outfall does not include open conveyances connecting two municipal separate storm sewers or pipes, tunnels or other conveyances that connect segments of the same stream or other waters of the United States and that are used to convey waters of the United States. (40 CFR § 122.26(b)(9)). However, it is strongly recommended that a permittee inspect all accessible portions of the system as part of this process. Culverts longer than a simple road crossing shall be included in the inventory unless the permittee can confirm that they are free of any connections and simply convey waters of the United States.
 - An interconnection means the point (excluding sheet flow over impervious surfaces) where the permittee’s MS4 discharges to another MS4 or other storm sewer system, through which the discharge is conveyed to waters of the United States or to another storm sewer system and eventually to a water of the United States.
- ii. The permittee shall classify each of the permittee’s outfalls and interconnections into one of the following categories:
 - Problem Outfalls: Outfalls/interconnections with known or suspected contributions of illicit discharges based on existing information shall be designated as Problem Outfalls. This shall

include any outfalls/interconnections where previous screening indicates likely sewer input.⁴ Problem Outfalls need not be screened pursuant to part 2.3.4.7.b.

- High Priority Outfalls: Outfalls/interconnections that have not been classified as Problem Outfalls and that are:
 - discharging to an area of concern to public health due to proximity of public beaches, recreational areas, drinking water supplies or shellfish beds;
 - determined by the permittee as high priority based on the characteristics listed below or other available information;
 - Low Priority Outfalls: Outfalls/interconnections determined by the permittee as low priority based on the characteristics listed below or other available information.
 - Excluded outfalls: Outfalls/interconnections with no potential for illicit discharges may be excluded from the IDDE program. This category is limited to roadway drainage in undeveloped areas with no dwellings and no sanitary sewers; drainage for athletic fields, parks or undeveloped green space and associated parking without services; cross-country drainage alignments (that neither cross nor are in proximity to sanitary sewer alignments) through undeveloped land.
- iii. The permittee shall priority rank outfalls into the categories above (except for excluded outfalls), based on the following characteristics of the defined initial catchment area where information is available:
- Past discharge complaints and reports.
 - Poor receiving water quality- the following guidelines are recommended to identify waters as having a high illicit discharge potential: exceeding water quality standards for bacteria; ammonia levels above 0.5 mg/l; surfactants levels greater than or equal to 0.25 mg/l.
 - Density of generating sites- Generating sites are those places, including institutional, municipal, commercial, or industrial sites, with a potential to generate pollutants that could contribute to illicit discharges. Examples of these sites include, but are not limited to, car dealers; car washes; gas stations; garden centers; and industrial manufacturing areas.
 - Age of development and infrastructure – Industrial areas greater than 40 years old and areas where the sanitary sewer system is more than 40 years old will probably have a high illicit discharge potential. Developments 20 years or younger will probably have a low illicit discharge potential.
 - Sewer conversion – contributing catchment areas that were once serviced by septic systems, but have been converted to sewer connections may have a high illicit discharge potential.
 - Historic combined sewer systems – contributing areas that were once serviced by a combined sewer system, but have been separated may have a high illicit discharge potential.
 - Surrounding density of aging septic systems – Septic systems thirty years or older in residential land use areas are prone to have failures and may have a high illicit discharge potential.
 - Culverted streams – any river or stream that is culverted for distances greater than a simple roadway crossing may have a high illicit discharge potential.
 - Water quality limited waterbodies that receive a discharge from the MS4 or waters with approved TMDLs applicable to the permittee, where illicit discharges have the potential to

⁴ Likely sewer input indicators are any of the following:

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

contain the pollutant identified as the cause of the water quality impairment.

- The permittee may also consider additional relevant characteristics, including location-specific characteristics; if so, the permittee shall include the additional characteristics in its written (hardcopy or electronic) IDDE program.

b) Dry Weather Outfall and Interconnection Screening and Sampling

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

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

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

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

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

iii. Screening requirements: For each outfall/interconnection:

1. The permittee shall record all of the following information and include it in the outfall/interconnection inventory and priority ranking:

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

2. If an outfall/interconnection is inaccessible or submerged, the permittee shall proceed to the first accessible upstream manhole or structure for the observation and sampling and report the location with the screening results.

3. If no flow is observed, but evidence of illicit flow exists, the permittee shall revisit the

outfall during dry weather within one week of the initial observation, if practicable, to perform a second dry weather screening and sample any observed flow (proceed as in iv. below).

4. Where dry weather flow is found at an outfall/interconnection, at least one (1) sample shall be collected, and:
 - a) Samples shall be analyzed at a minimum for:
 - ammonia,
 - chlorine,
 - conductivity,
 - salinity,
 - *E. coli* (freshwater receiving water) or enterococcus (saline or brackish receiving water),
 - surfactants (such as MBAS),
 - temperature, and
 - pollutants of concern⁵
 - b) All analyses with the exception of indicator bacteria and pollutants of concern can be performed with field test kits or field instrumentation and are not subject to 40 CFR part 136 requirements. Sampling for bacteria and pollutants of concern shall be conducted using the analytical methods found in 40 CFR §136, or alternative methods approved by EPA in accordance with the procedures in 40 CFR §136. Sampling for ammonia and surfactants must use sufficiently sensitive methods to detect those parameters at or below the threshold indicator concentrations of 0.5 mg/L for ammonia and 0.25 mg/L for surfactants. Sampling for residual chlorine must use a method with a detection limit of 0.02 mg/L or 20 ug/L.
- iv. The permittee may rely on screening conducted under the MS4-2003 permit, pursuant to an EPA enforcement action, or by the state or EPA to the extent that it meets the requirements of part 2.3.4.7.b.iii.4. All data shall be reported in each annual report. Permittees that have conducted substantially equivalent monitoring to that required by part 2.3.4.7.b as part of an EPA enforcement action can request an exemption from the requirements of part 2.3.4.7.b by submitting a written request to EPA and retaining exemption approval from EPA as part of the SWMP. Until the permittee receives formal written approval of the exemption from part 2.3.4.7.b from EPA the permittee remains subject to all requirements of part 2.3.4.7.b.
- v. The permittee shall submit all screening data used in compliance with this part in its Annual Report.
- c) Follow-up ranking of outfalls and interconnections:
 - i. The permittee's outfall and interconnection ranking (2.3.4.7.a) shall be updated to reprioritize outfalls and interconnections based on information gathered during dry weather screening (part 2.3.4.7.b).

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

- ii. Outfalls/interconnections where relevant information was found indicating sewer input to the MS4 or sampling results indicating sewer input⁶ shall be considered highly likely to contain illicit discharges from sanitary sources, and such outfalls/interconnections shall be ranked at the top of the High Priority Outfalls category for investigation. At this time, permittees may choose to rank other outfalls and interconnections based on any new information from the dry weather screening.
- iii. The ranking can be updated continuously as dry weather screening information becomes available, but shall be completed within three (3) years of the effective date of the permit.

2.3.4.8. Catchment Investigations

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

a. Timelines:

- A written catchment investigation procedure shall be developed within 18 months of the permit effective date in accordance with the requirements of part 2.3.4.8.b below.
- Investigations of catchments associated with Problem Outfalls shall begin no later than two (2) years from the permit effective date.
- Investigations of catchments associated with High and Low Priority Outfalls shall follow the ranking of outfalls updated in part 2.3.4.7.c.
- Investigations of catchments associated with Problem Outfalls shall be completed within seven (7) years of the permit effective date
- Investigations of catchments where any information gathered on the outfall/interconnection identifies sewer input⁷ shall be completed within seven (7) years of the permit effective date.
- Investigations of catchments associated with all High- and Low-Priority Outfalls shall be completed within ten (10) years of the permit effective date.

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

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

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

⁶ Likely sewer input indicators are any of the following:

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

⁷ Likely sewer input indicators are any of the following:

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

vulnerability factors within each catchment.

- ii. **Includes a manhole inspection methodology** that shall describe a storm drain network investigation that involves systematically and progressively observing, sampling (as required below) and evaluating key junction manholes (see definition in Appendix A) in the MS4 to determine the approximate location of suspected illicit discharges or SSOs. The manhole inspection methodology may either start from the outfall and work up the system or start from the upper parts of the catchment and work down the system or be a combination of both practices. Either method must, at a minimum, include an investigation of each key junction manhole within the MS4, even where no evidence of an illicit discharge is observed at the outfall. The manhole inspection methodology must describe the method the permittee will use. The manhole inspection methodology shall include procedures for dry and wet weather investigations.
 - iii. **Establishes procedures to isolate and confirm sources of illicit discharges** where manhole investigations or other physical evidence or screening has identified that MS4 alignments are influenced by illicit discharges or SSOs. These shall include isolation of the drainage area for implementation of more detailed investigations, inspection of additional manholes along the alignment to refine the location of potential contaminant sources, and methods such as sandbagging key junction manhole inlets, targeted internal plumbing inspections, dye testing, video inspections, or smoke testing to isolate and confirm the sources.
- c. Requirements for each catchment investigation associated with an outfall/interconnection:
- i. For each catchment being investigated, the permittee shall review relevant mapping and historic plans and records gathered in accordance with Part 2.3.4.8.b.i. This review shall be used to identify areas within the catchment with higher potential for illicit connections. The permittee shall identify and record the presence of any of the following specific **System Vulnerability Factors (SVFs)**:
 - History of SSOs, including, but not limited to, those resulting from wet weather, high water table, or fat/oil/grease blockages;
 - Common or twin-invert manholes serving storm and sanitary sewer alignments;
 - Common trench construction serving both storm and sanitary sewer alignments;
 - Crossings of storm and sanitary sewer alignments where the sanitary system is shallower than the storm drain system;
 - Sanitary sewer alignments known or suspected to have been constructed with an underdrain system;
 - Inadequate sanitary sewer level of service (LOS) resulting in regular surcharging, customer back-ups, or frequent customer complaints;
 - Areas formerly served by combined sewer systems;
 - Sanitary sewer infrastructure defects such as leaking service laterals, cracked, broken, or offset sanitary infrastructure, directly piped connections between storm drain and sanitary sewer infrastructure, or other vulnerability factors identified through Inflow/Infiltration Analyses, Sanitary Sewer Evaluation Surveys, or other infrastructure investigations.

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

- Sewer pump/lift stations, siphons, or known sanitary sewer restrictions where power/equipment failures or blockages could readily result in SSOs;
- Any sanitary sewer and storm drain infrastructure greater than 40 years old;

- Widespread code-required septic system upgrades required at property transfers (indicative of inadequate soils, water table separation, or other physical constraints of the area rather than poor owner maintenance);
- History of multiple Board of Health actions addressing widespread septic system failures (indicative of inadequate soils, water table separation, or other physical constraints of the area rather than poor owner maintenance);

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

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

1. For all catchments

- a) Infrastructure information shall be incorporated into the permittee's mapping required at part 2.3.4.5; the permittee will refine their catchment delineation based on the field investigation where appropriate.
- b) The SVF inventory for the catchment will be updated based on information obtained during the inspection, including common (twin invert) manholes, directly piped connections between storm drains and sanitary sewer infrastructure, common weir walls, sanitary sewer underdrain connections and other structural vulnerabilities where sanitary discharges could enter the storm drain system during wet weather.
 - 1) **Where a minimum of one (1) SVF is identified based on previous information or the investigation, a wet weather investigation must be conducted at the associated outfall (see below).**
- c) During dry weather, key junction manholes⁸ shall be opened and inspected systematically for visual and olfactory evidence of illicit connections (e.g., excrement, toilet paper, gray filamentous bacterial growth, or sanitary products present).
 - 1) If flow is observed, the permittee shall sample the flow at a minimum for ammonia, chlorine and surfactants and can use field kits for these analyses.
 - 2) Where sampling results or visual or olfactory evidence indicate potential illicit discharges or SSOs, the area draining to the junction manhole shall be flagged for further upstream investigation.
- d) Key junction and subsequent manhole investigations will proceed until the location of suspected illicit discharges or SSOs can be isolated to a pipe segment between two manholes. If no evidence of an illicit discharge is found, catchment investigations will be considered complete upon completion of key junction manhole sampling.

2. For all catchments with a minimum of one (1) SVF identified

- a) The permittee shall meet the requirements above for dry weather screening
- b) The permittee shall inspect and sample under wet weather conditions to the extent necessary to determine whether wet weather-induced high flows in sanitary sewers or high groundwater in areas served by septic systems result in discharges of sanitary flow to the

⁸ Where catchments do not contain junction manholes, the dry weather screening and sampling shall be considered as meeting the manhole inspection requirement. In these catchments, dry weather screenings that indicate potential presence of illicit discharges shall be further investigated pursuant to part 2.3.4.8.d. Investigations in these catchments may be considered complete where dry weather screening reveals no flow; no evidence of illicit discharges or SSOs is indicated through sampling results or visual or olfactory means; and no wet weather System Vulnerability Factors are identified.

MS4.

- 1) The permittee shall conduct at least one wet weather screening and sampling at the outfall that includes the same parameters required during dry weather screening, part 2.3.4.7.b.iii.4.
 - 2) Wet weather sampling and screening shall proceed during or after a storm event of sufficient depth or intensity to produce a stormwater discharge. EPA strongly recommends sampling during the spring (March through June) when groundwater levels are relatively high.
 - 3) The permit does not require a minimum rainfall event prior to wet weather screening. However, permittees may incorporate provisions that assist in targeting such discharges, including avoiding sampling during the initial period of discharge (“first flush”) and/or identifying minimum storm event intensities likely to trigger sanitary sewer interconnections.
- c) This sampling can be done upon completion of any dry weather investigation but must be completed before the catchment investigation is marked as complete.
- iii. All data collected as part of the dry and wet weather catchment investigations shall be recorded and reported in each annual report.
- d. Identification/Confirmation of illicit source
Where the source of an illicit discharge has been approximated between two manholes in the permittee’s MS4, the permittee shall isolate and identify/confirm the source of the illicit discharge using more detailed methods identified in their written procedure (2.3.4.8.b.iii). For outfalls that contained evidence of an illicit discharge, catchment investigations will be considered complete upon confirmation of all illicit sources.
- e. Illicit discharge removal
When the specific source of an illicit discharge is identified, the permittee shall exercise its authority as necessary to require its removal pursuant to part 2.3.4.2 or 2.3.4.3.
- i. For each confirmed source the permittee shall include in the annual report the following information:
 - the location of the discharge and its source(s);
 - a description of the discharge;
 - the method of discovery;
 - date of discovery;
 - date of elimination, mitigation or enforcement action OR planned corrective measures and a schedule for completing the illicit discharge removal; and
 - estimate of the volume of flow removed.
 - ii. Within one year of removal of all identified illicit discharges within a catchment area, confirmatory outfall or interconnection screening shall be conducted. The confirmatory screening shall be conducted in dry weather unless System Vulnerability Factors have been identified, in which case both dry weather and wet weather confirmatory screening shall be conducted. If confirmatory screening indicates evidence of additional illicit discharges, the catchment shall be scheduled for additional investigation.

2.3.4.9. Indicators of IDDE Program Progress

The permittee shall define or describe indicators for tracking program success and evaluate and report on the overall effectiveness of the IDDE program in each annual report. At a minimum the permittee shall document in each annual report:

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

2.3.4.10 Ongoing Screening

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

2.3.4.11 Training

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

2.3.5. Construction Site Stormwater Runoff Control

Objective: The objective of an effective construction stormwater runoff control program is to minimize or eliminate erosion and maintain sediment on site so that it is not transported in stormwater and allowed to discharge to a water of the U.S through the permittee's MS4. The construction site stormwater runoff control program required by this permit is a separate and distinct program from EPA's Construction General Permit in that the former is implemented by the MS4 operator to ensure that runoff from construction sites discharging to the MS4 are controlled consistent with the MS4's applicable requirements, whereas the latter is implemented by construction site operators to comply with the terms and conditions of EPA's permit (<https://www.epa.gov/npdes/2017-construction-general-permit-cgp>).

- a. Permittees shall implement and enforce a program to reduce pollutants in any stormwater runoff discharged to the MS4 from all construction activities that result in a land disturbance of greater than or equal to one acre within the regulated area. The permittee's program shall include disturbances less than one acre if that disturbance is part of a larger common plan of development or sale that would disturb one or more acres. Permittees authorized under the MS4-2003 permit shall continue to implement and enforce their existing program and modify as necessary to meet the requirements of this part.
- b. The permittee does not need to apply its construction program requirements to projects that receive a waiver from EPA under the provisions of 40 CFR § 122.26(b) (15) (i).

- c. The permittee shall develop and implement a construction site runoff control program that includes the elements in Paragraphs i. through iii. of this part:
- i. An ordinance or regulatory mechanism that requires the use of sediment and erosion control practices at construction sites. In addition to addressing sediment and erosion control, the ordinance must include controls for other wastes on construction sites such as demolition debris, litter and sanitary wastes. The ordinance or regulatory mechanisms shall provide that the permittee may, to the extent authorized by law, impose sanctions to ensure compliance with the local program. Development of an ordinance or other regulatory mechanism was a requirement of the MS4-2003 permit (See part II.B.4 and part IV.B.4). The ordinance or other regulatory mechanism required by the MS4-2003 permit shall have been effective by May 1, 2008.
 - ii. Written (hardcopy or electronic) procedures for site plan review, site inspections and enforcement of sediment and erosion control measures by the permittee. If not already existing, these procedures shall be completed within one (1) year from the effective date of the permit.
 1. The site plan review procedure shall include:
 - a pre-construction review by the permittee of the site design, the planned operations at the construction site, planned BMPs during the construction phase, and the planned BMPs to be used to manage runoff created after development;
 - consideration of potential water quality impacts;
 - procedures for the receipt and consideration of information submitted by the public; and
 - evaluating the incorporation of Low Impact Development (LID) site planning and design strategies, unless such practices are infeasible.
 2. The site inspection and enforcement procedures shall include:
 - who is responsible for site inspections and the necessary qualifications for performing inspections, as well as who has authority to implement enforcement procedures;
 - the requirement that inspections of BMPs occur during construction of BMPs as well as after construction of BMPs to ensure they are working as described in the approved plans
 - the use of mandated inspection forms, if appropriate; and
 - procedure for tracking the number of site reviews, inspections, and enforcement actions. This tracking information shall be included as part of each annual report required by part 4.4.
 - iii. Requirements for construction site operators performing land disturbance activities within the MS4 jurisdiction that result in stormwater discharges to the MS4 to implement a sediment and erosion control program that includes BMPs appropriate for the conditions at the construction site. The program may include references to the requirements of EPA's Construction General Permit (including the development of a SWPPP) to the extent they are consistent with the program requirements of this part. The program may include references to BMP design standards in state manuals, such as the 2008 Massachusetts Stormwater Handbook⁹, or design standards developed by the

⁹ The handbook is available at: <https://www.mass.gov/guides/massachusetts-stormwater-handbook-and-stormwater-standards>

MS4. EPA supports and encourages the use of design standards in local programs. Examples of appropriate sediment and erosion control measures for construction sites include local requirements to:

1. Minimize the amount of disturbed area and protect natural resources;
2. Stabilize sites when projects are complete or operations have temporarily ceased;
3. Protect slopes on the construction site;
4. Protect all storm drain inlets and armor all newly constructed outlets;
5. Use perimeter controls at the site;
6. Stabilize construction site entrances and exits to prevent off-site tracking;
7. Control wastes that may be discharged, including but not limited to, discarded building materials, concrete truck wash out, chemicals, litter, and sanitary wastes (these wastes may not be discharged to the MS4); and
8. Inspect stormwater controls at consistent intervals.

2.3.6. Stormwater Management in New Development and Redevelopment (Post Construction Stormwater Management)

Objective: The objective of this control measure is to reduce the discharge of pollutants found in stormwater through the retention or treatment of stormwater after construction on new or redeveloped sites. For the purposes of this part (2.3.6.), the following definitions apply:

site is defined as the area extent of construction activities, including but not limited to the creation of new impervious cover and improvement of existing impervious cover (e.g. repaving not covered by 2.3.6.a.ii.4.b.)

new development is defined as any construction activities or land alteration resulting in total earth disturbances equal to or greater than 1 acre (or activities that are part of a larger common plan of development disturbing greater than 1 acre) on an area that has not previously been developed to include impervious cover.

redevelopment is defined as any construction, land alteration, or improvement of impervious surfaces resulting in total earth disturbances equal to or greater than 1 acre (or activities that are part of a larger common plan of development disturbing greater than 1 acre) that does not meet the definition of new development (see above).

- a. Permittees shall develop, implement, and enforce a program to address post-construction stormwater runoff from all new development and redevelopment sites that disturb one or more acres and discharge into the permittees MS4 at a minimum. Permittees authorized under the MS4-2003 permit shall continue to implement and enforce their program and modify as necessary to meet the requirements of this part.
 - i. The permittee's new development/ redevelopment program shall include sites less than one acre if the site is part of a larger common plan of development or redevelopment which disturbs one or more acre.

- ii. The permittee shall develop or modify, as appropriate, an ordinance or other regulatory mechanism within three (3) years of the effective date of the permit to contain provisions that are at least as stringent as the following:
 1. Low Impact Development (LID) site planning and design strategies must be implemented unless infeasible in order to reduce the discharge of stormwater from development sites..
 2. Stormwater management systems design shall be consistent with, or more stringent than, the requirements of the 2008 Massachusetts Stormwater Handbook.
:
 3. Stormwater management systems on new development shall be designed to meet an average annual pollutant removal equivalent to 90% of the average annual load of Total Suspended Solids (TSS) related to the total post-construction impervious area on the site AND 60% of the average annual load of Total Phosphorus (TP) related to the total post-construction impervious surface area on the site¹⁰.
 - a) Average annual pollutant removal requirements in 2.3.6.a.ii.3 are achieved through one of the following methods:
 1. installing BMPs that meet the pollutant removal percentages based on calculations developed consistent with EPA Region 1's BMP Accounting and Tracking Tool (2016) or other BMP performance evaluation tool provided by EPA Region 1, where available. If EPA Region 1 tools do not address the planned or installed BMP performance, then any federally or State-approved BMP design guidance or performance standards (e.g., State stormwater handbooks and design guidance manuals) may be used to calculate BMP performance; or
 2. retaining the volume of runoff equivalent to, or greater than, one (1.0) inch multiplied by the total post-construction impervious surface area on the new development site; or
 3. meeting a combination of retention and treatment that achieves the above standards; or
 4. utilizing offsite mitigation that meets the above standards within the same USGS HUC12 as the new development site.
 4. Stormwater management systems on redevelopment sites shall be designed to meet an average annual pollutant removal equivalent to 80% of the average annual post-construction load of Total Suspended Solids (TSS) related to the total post-construction impervious area on the site AND 50% of the average annual load of Total Phosphorus (TP) related to the total post-construction impervious surface area on the site¹¹.
 - a) Average annual pollutant removal requirements in 2.3.6.a.ii.4 above are

¹⁰ Pollutant removal is calculated based on average annual loading and not on the basis of any individual storm event

¹¹ Pollutant removal is calculated based on average annual loading and not on the basis of any individual storm event

achieved through one of the following methods:

1. installing BMPs that meet the pollutant removal percentages based on calculations developed consistent with EPA Region 1's BMP Accounting and Tracking Tool (2016) or other BMP performance evaluation tool provided by EPA Region 1, where available. If EPA Region 1 tools do not address the planned or installed BMP performance, then any federally or State-approved BMP design guidance or performance standards (e.g., State stormwater handbooks and design guidance manuals) may be used to calculate BMP performance; or
2. retaining the volume of runoff equivalent to, or greater than, 0.8 inch multiplied by the total post-construction impervious surface area on the redeveloped site; or
3. meeting a combination of retention and treatment that achieves the above standards; or
4. utilizing offsite mitigation that meets the above standards within the same USGS HUC12 as the redevelopment site.

- b) Redevelopment activities that are exclusively limited to maintenance and improvement of existing roadways, (including widening less than a single lane, adding shoulders, correcting substandard intersections, improving existing drainage systems, and repaving projects) shall improve existing conditions unless infeasible and are exempt from part 2.3.6.a.ii.4. Roadway widening or improvements that increase the amount of impervious area on the redevelopment site by greater than or equal to a single lane width shall meet the requirements of part 2.3.6.a.ii.4..

iii. The permittee shall require, at a minimum, the submission of as-built drawings no later than two (2) years after completion of construction projects. The as-built drawings must depict all on site controls, both structural and non-structural, designed to manage the stormwater associated with the completed site (post construction stormwater management). The new development/redevelopment program shall have procedures to ensure adequate long-term operation and maintenance of stormwater management practices that are put in place after the completion of a construction project. These procedures may include the use of dedicated funds or escrow accounts for development projects or the acceptance of ownership by the permittee of all privately owned BMPs. These procedures may also include the development of maintenance contracts between the owner of the BMP and the permittee. Alternatively, these procedures may include the submission of an annual certification documenting the work that has been done over the last 12 months to properly operate and maintain the stormwater control measures. The procedures to require submission of as-built drawings and ensure long term operation and maintenance shall be a part of the SWMP. The permittee shall report in the annual report on the measures that the permittee has utilized to meet this requirement.

- b. Within four (4) years of the effective date of this permit, the permittee shall develop a report assessing current street design and parking lot guidelines and other local requirements that affect

the creation of impervious cover. This assessment shall be used to provide information to allow the permittee to determine if changes to design standards for streets and parking lots can be made to support low impact design options. If the assessment indicates that changes can be made, the assessment shall include recommendations and proposed schedules to incorporate policies and standards into relevant documents and procedures to minimize impervious cover attributable to parking areas and street designs. The permittee shall implement all recommendations, in accordance with the schedules, contained in the assessment. The local planning board and local transportation board should be involved in this assessment. This assessment shall be part of the SWMP. The permittee shall report in each annual report on the status of this assessment including any planned or completed changes to local regulations and guidelines.

- c. Within four (4) years from the effective date of the permit, the permittee shall develop a report assessing existing local regulations to determine the feasibility of making, at a minimum, the following practices allowable when appropriate site conditions exist:
 - i. Green roofs;
 - ii. Infiltration practices such as rain gardens, curb extensions, planter gardens, porous and pervious pavements, and other designs to manage stormwater using landscaping and structured or augmented soils; and
 - iii. Water harvesting devices such as rain barrels and cisterns, and the use of stormwater for non-potable uses.

The assessment should indicate if the practices are allowed in the MS4 jurisdiction and under what circumstances are they allowed. If the practices are not allowed, the permittee shall determine what hinders the use of these practices, what changes in local regulations may be made to make them allowable, and provide a schedule for implementation of recommendations. The permittee shall implement all recommendations, in accordance with the schedules, contained in the assessment. The permittee shall report in each annual report on its findings and progress towards making the practices allowable. (Information available at:

<http://www.epa.gov/region1/npdes/stormwater/assets/pdf/AddressingBarrier2LID.pdf> and <http://www.mapc.org/resources/low-impact-dev-toolkit/local-codes-lid>)

- d. Four (4) years from the effective date of this permit, the permittee shall identify a minimum of 5 permittee-owned properties that could potentially be modified or retrofitted with BMPs designed to reduce the frequency, volume, and pollutant loads of stormwater discharges to and from its MS4 through the reduction of impervious area. Properties and infrastructure for consideration shall include those with the potential for reduction of on-site impervious area (IA) as well as those that could provide reduction of off-site IA. At a minimum, the permittee shall consider municipal properties with significant impervious cover (including parking lots, buildings, and maintenance yards) that could be modified or retrofitted. MS4 infrastructure to be considered includes existing street right-of-ways, outfalls and conventional stormwater conveyances and controls (including swales and detention practices) that could be readily modified or retrofitted to provide reduction in frequency, volume or pollutant loads of such discharges through reduction of impervious cover.

In determining the potential for modifying or retrofitting particular properties, the permittee shall consider factors such as access for maintenance purposes; subsurface geology; depth to water table; proximity to aquifers and subsurface infrastructure including sanitary sewers and septic systems; and opportunities for public use and education. In determining its priority ranking, the permittee shall consider factors such as schedules for planned capital improvements to storm and

sanitary sewer infrastructure and paving projects; current storm sewer level of service; and control of discharges to water quality limited waters, first or second order streams, public swimming beaches, drinking water supply sources and shellfish growing areas.

Beginning with the fifth year annual report and in each subsequent annual report, the permittee shall identify additional permittee owned sites and infrastructure that could be retrofitted such that the permittee maintains a minimum of 5 sites in their inventory, until such a time as when the permittee has less than 5 sites remaining. In addition, the permittee shall report on all properties that have been modified or retrofitted with BMPs to mitigate IA that were inventoried in accordance with this part. The permittee may also include in its annual report non-MS4 owned property that has been modified or retrofitted with BMPs to mitigate IA.

2.3.7. Good House Keeping and Pollution Prevention for Permittee Owned Operations

Objective: The permittee shall implement an operations and maintenance program for permittee-owned operations that has a goal of preventing or reducing pollutant runoff and protecting water quality from all permittee-owned operations.

a. Operations and Maintenance Programs

- i. Within two (2) years from the effective date of the permit, the permittee shall develop, if not already developed, written (hardcopy or electronic) operations and maintenance procedures for the municipal activities listed below in part 2.3.7.a.ii. These written procedures shall be included as part of the SWMP.
- ii. Within two (2) year of the effective date of this permit, the permittee shall develop an inventory of all permittee owned facilities within the categories listed below. The permittee shall review this inventory annually and update as necessary.
 1. Parks and open space: Establish procedures to address the proper use, storage, and disposal of pesticides, herbicides, and fertilizers including minimizing the use of these products and using only in accordance manufacturer's instruction. Evaluate lawn maintenance and landscaping activities to ensure practices are protective of water quality. Protective practices include reduced mowing frequencies, proper disposal of lawn clippings, and use of alternative landscaping materials (e.g., drought resistant planting). Establish pet waste handling collection and disposal locations at all parks and open space where pets are permitted, including the placing of proper signage concerning the proper collection and disposal of pet waste. Establish procedures to address waterfowl congregation areas where appropriate to reduce waterfowl droppings from entering the MS4. Establish procedures for management of trash containers at parks and open space (scheduled cleanings; sufficient number). Establish procedures to address erosion or poor vegetative cover when the permittee becomes aware of it; especially if the erosion is within 50 feet of a surface water.
 2. Buildings and facilities where pollutants are exposed to stormwater runoff: This includes schools (to the extent they are permittee-owned or operated), town offices, police, and fire stations, municipal pools and parking garages and other permittee-owned or operated buildings or facilities. Evaluate the use, storage, and disposal of petroleum products and other potential stormwater pollutants. Provide employee training as necessary so that those responsible for handling these products know proper procedures. Ensure that Spill Prevention Plans are

in place, if applicable, and coordinate with the fire department as necessary. Develop management procedures for dumpsters and other waste management equipment. Sweep parking lots and keep areas surrounding the facilities clean to reduce runoff of pollutants.

3. Vehicles and Equipment: Establish procedures for the storage of permittee vehicles. Vehicles with fluid leaks shall be stored indoors or containment shall be provided until repaired. Evaluate fueling areas owned or operated by the permittee. If possible, place fueling areas under cover in order to minimize exposure. Establish procedures to ensure that vehicle wash waters are not discharged to the municipal storm sewer system or to surface waters. This permit does not authorize such discharges.

iii. Infrastructure Operations and Maintenance

1. The permittee shall establish within two (2) year of the effective date of the permit a written (hardcopy or electronic) program detailing the activities and procedures the permittee will implement so that the MS4 infrastructure is maintained in a timely manner to reduce the discharge of pollutants from the MS4. If the permittee has an existing program to maintain its MS4 infrastructure in a timely manner to reduce or eliminate the discharge of pollutants from the MS4, the permittee shall document the program in the SWMP.
2. The permittee shall optimize routine inspections, cleaning and maintenance of catch basins such that the following conditions are met:
 - Prioritize inspection and maintenance for catch basins located near construction activities (roadway construction, residential, commercial, or industrial development or redevelopment). Clean catch basins in such areas more frequently if inspection and maintenance activities indicate excessive sediment or debris loadings.
 - Establish a schedule with a goal that the frequency of routine cleaning will ensure that no catch basin at anytime will be more than 50 percent full.
 - If a catch basin sump is more than 50 percent full during two consecutive routine inspections/cleaning events, the permittee shall document that finding, investigate the contributing drainage area for sources of excessive sediment loading, and to the extent practicable, abate contributing sources. The permittee shall describe any actions taken in its annual report.
 - For the purposes of this part, an excessive sediment or debris loading is a catch basin sump more than 50 percent full. A catch basin sump is more than 50 percent full if the contents within the sump exceed one half the distance between the bottom interior of the catch basin to the invert of the deepest outlet of the catch basin.
 - The permittee shall document in the SWMP and in the first annual report its plan for optimizing catch basin cleaning, inspection plans, or its schedule for gathering information to develop the optimization plan. Documentation shall include metrics and other information used to reach the determination that the established plan for cleaning and maintenance is optimal for the MS4. The permittee shall keep a log of catch basins cleaned or inspected.

- The permittee shall report in each annual report the total number of catch basins, number inspected, number cleaned, and the total volume or mass of material removed from all catch basins.
3. The permittee shall establish and implement procedures for sweeping and/or cleaning streets, and permittee-owned parking lots. All streets with the exception of rural uncurbed roads with no catch basins or high speed limited access highways shall be swept and/or cleaned a minimum of once per year in the spring (following winter activities such as sanding). The procedures shall also include more frequent sweeping of targeted areas determined by the permittee on the basis of pollutant load reduction potential, based on inspections, pollutant loads, catch basin cleaning or inspection results, land use, water quality limited or TMDL waters or other relevant factors as determined by the permittee. The permittee shall report in each annual report the number of miles cleaned or the volume or mass of material removed.

For rural uncurbed roadways with no catch basins and limited access highways, the permittee shall either meet the minimum frequencies above, or develop and implement an inspection, documentation and targeted sweeping plan within two (2) years of the effective date of the permit, and submit such plan with its year one annual report.

4. The permittee shall ensure proper storage of catch basin cleanings and street sweepings prior to disposal or reuse such that they do not discharge to receiving waters. These materials should be managed in compliance with current MassDEP policies:
- For catch basin cleanings:
<http://www.mass.gov/eea/agencies/massdep/recycle/regulations/management-of-catch-basin-cleanings.html>
 - For street sweepings:
<http://www.mass.gov/eea/docs/dep/recycle/laws/stsweep.pdf>.
5. The permittee shall establish and implement procedures for winter road maintenance including the use and storage of salt and sand; minimize the use of sodium chloride and other salts, and evaluate opportunities for use of alternative materials; and ensure that snow disposal activities do not result in disposal of snow into waters of the United States. For purposes of this MS4 Permit, salt shall mean any chloride-containing material used to treat paved surfaces for deicing, including sodium chloride, calcium chloride, magnesium chloride, and brine solutions.
6. The permittee shall establish and implement inspection and maintenance frequencies and procedures for all stormwater treatment structures such as water quality swales, retention/detention basins, infiltration structures, proprietary treatment devices or other similar structures. All permittee-owned stormwater treatment structures (excluding catch basins) shall be inspected annually at a minimum.

- iv. The permittee shall report in the annual report on the status of the inventory required by this part and any subsequent updates; the status of the O&M programs for the permittee-owned facilities and activities in part 2.3.7.a.ii; and the maintenance activities associated with each.
- v. The permittee shall keep a written (hardcopy or electronic) record of all required activities including but not limited to maintenance activities, inspections and training required by part 2.3.7.a. The permittee shall maintain, consistent with part 4.2.a, all records associated with maintenance and inspection activities required by part 2.3.7.a.

b. Stormwater Pollution Prevention Plan (SWPPP)

The permittee shall develop and fully implement a SWPPP for each of the following permittee-owned or operated facilities: maintenance garages, public works yards, transfer stations, and other waste handling facilities where pollutants are exposed to stormwater as determined by the permittee. If facilities are located at the same property, the permittee may develop one SWPPP for the entire property. The SWPPP is a separate and different document from the SWMP required in part 1.10. A SWPPP does not need to be developed for a facility if the permittee has either developed a SWPPP or received a no exposure certification for the discharge under the Multi-Sector General Permit or the discharge is authorized under another NPDES permit.

- i. No later than two (2) years from the effective date of the permit, the permittee shall develop and implement a written (hardcopy or electronic) SWPPP for the facilities described above. The SWPPP shall be signed in accordance with the signatory requirements of Appendix B – Subparagraph 11.
- ii. The SWPPP shall contain the following elements:
 - 1. Pollution Prevention Team
Identify the staff on the team, by name and title. If the position is unstaffed, the title of the position should be included and the SWPPP updated when the position is filled. The role of the team is to develop, implement, maintain, and revise, as necessary, the SWPPP for the facility.
 - 2. Description of the facility and identification of potential pollutant sources
The SWPPP shall include a map of the facility and a description of the activities that occur at the facility. The map shall show the location of the stormwater outfalls, receiving waters, and any structural controls. Identify all activities that occur at the facility and the potential pollutants associated with each activity including the location of any floor drains. These may be included as part of the inventory required by part 2.3.7.a.
 - 3. Identification of stormwater controls
The permittee shall select, design, install, and implement the control measures detailed in paragraph 4 below to prevent or reduce the discharge of pollutants from the permittee owned facility.

The selection, design, installation, and implementation of the control measures shall be in accordance with good engineering practices and manufacturer's specifications. The permittee shall also take all reasonable steps to control or

address the quality of discharges from the site that may not originate at the facility.

If the discharge from the facility is to a water quality limited water and the facility has the potential to discharge the pollutant identified as causing the water quality limitation, the permittee shall identify the control measures that will be used to address this pollutant at the facility so that the discharge meets applicable water quality standards.

4. The SWPPP shall include the following management practices:
 - a) Minimize or Prevent Exposure: The permittee shall to the extent practicable either locate materials and activities inside, or protect them with storm-resistant coverings in order to prevent exposure to rain, snow, snowmelt and runoff (although significant enlargement of impervious surface area is not recommended). Materials do not need to be enclosed or covered if stormwater runoff from affected areas will not be discharged directly or indirectly to surface waters or to the MS4 or if discharges are authorized under another NPDES permit.
 - b) Good Housekeeping: The permittee shall keep clean all exposed areas that are potential sources of pollutants, using such measures as sweeping at regular intervals. Ensure that trash containers are closed when not in use, keep storage areas well swept and free from leaking or damaged containers; and store leaking vehicles needing repair indoors.
 - c) Preventative Maintenance: The permittee shall regularly inspect, test, maintain, and repair all equipment and systems to avoid situations that may result in leaks, spills, and other releases of pollutants in stormwater to receiving waters. Inspections shall occur at a minimum once per quarter.
 - d) Spill Prevention and Response: The permittee shall minimize the potential for leaks, spills, and other releases that may be exposed to stormwater and develop plans for effective response to such spills if or when they occur. At a minimum, the permittee shall have procedures that include:
 - Preventive measures such as barriers between material storage and traffic areas, secondary containment provisions, and procedures for material storage and handling.
 - Response procedures that include notification of appropriate facility personnel, emergency agencies, and regulatory agencies, and procedures for stopping, containing, and cleaning up leaks, spills and other releases. Measures for cleaning up hazardous material spills or leaks shall be consistent with applicable Resource Conservation and Recovery Act (RCRA) regulations at 40 CFR section 264 and 40 CFR section 265. Employees

who may cause, detect, or respond to a spill or leak shall be trained in these procedures and have necessary spill response equipment available. If possible, one of these individuals should be a member of the Pollution Prevention Team; and

- Contact information for individuals and agencies that shall be notified in the event of a leak, spill, or other release. Where a leak, spill, or other release containing a hazardous substance or oil in an amount equal to or in excess of a reportable quantity established under 40 CFR section 110, 40 CFR section 117, or 40 CFR section 302, occurs during a 24-hour period, the permittee shall notify the National Response Center (NRC) at (800) 424-8802 in accordance with the requirements of 40 CFR section 110, 40 CFR section 117, and 40 CFR section 302 as soon as the permittee has knowledge of the discharge. State or local requirements may necessitate reporting spills or discharges to local emergency, public health or drinking water supply agencies, and owners of public drinking water supplies. Contact information shall be in locations that are readily accessible and available.
- e) Erosion and Sediment Control: The permittee shall use structural and non-structural control measures at the facility to stabilize and contain runoff from exposed areas and to minimize or eliminate onsite erosion and sedimentation. Efforts to achieve this may include the use of flow velocity dissipation devices at discharge locations and within outfall channels where necessary to reduce erosion.
- f) Management of Runoff: The permittee shall manage stormwater runoff from the facility to prevent or reduce the discharge of pollutants. This may include management practices which divert runoff from areas that are potential sources of pollutants, contain runoff in such areas, or reuse, infiltrate or treat stormwater to reduce the discharge of pollutants.
- g) Salt Storage Piles or Piles Containing Salt: For storage piles of salt or piles containing salt used for deicing or other purposes (including maintenance of paved surfaces) for which the discharge during precipitation events discharges to the permittee's MS4, any other storm sewer system, or to a Water of the US, the permittee shall prevent exposure of the storage pile to precipitation by enclosing or covering the storage piles. Such piles shall be enclosed or covered within two (2) years of the permit effective date. The permittee shall implement appropriate measures (e.g., good housekeeping, diversions, containment) to minimize exposure resulting from adding to or removing materials from the pile. The permittee is encouraged to store piles in such a manner as not to impact surface water resources, ground water resources, recharge areas, and wells.
- h) Employee Training: The permittee shall regularly train employees who work in areas where materials or activities are exposed to stormwater, or who are responsible for implementing activities identified in the SWPPP

(e.g., inspectors, maintenance personnel), including all members of the Pollution Prevention Team. Training shall cover both the specific components and scope of the SWPPP and the control measures required under this part, including spill response, good housekeeping, material management practices, any best management practice operation and maintenance, etc. EPA recommends annual training.

The permittee shall document the following information for each training:

- The training date, title and training duration;
 - List of municipal attendees;
 - Subjects covered during training
- i) Maintenance of Control Measures: The permittee shall maintain all control measures, required by this permit in effective operating condition. The permittee shall keep documentation onsite that describes procedures and a regular schedule for preventative maintenance of all control measures and discussions of back-up practices in place should a runoff event occur while a control measure is off-line. Nonstructural control measures shall also be diligently maintained (e.g., spill response supplies available, personnel trained).

iii. The permittee shall conduct the following inspections:

1. Site Inspections: Inspect all areas that are exposed to stormwater and all stormwater control measures. Inspections shall be conducted at least once each calendar quarter. More frequent inspections may be required if significant activities are exposed to stormwater. Inspections shall be performed when the facility is in operation. At least one of the quarterly inspections shall occur during a period when a stormwater discharge is occurring.

The permittee shall document the following information for each facility inspection:

- The inspection date and time;
- The name of the inspector;
- Weather information and a description of any discharge occurring at the time of the inspection;
- Identification of any previously unidentified discharges from the site;
- Any control measures needing maintenance or repair;
- Any failed control measures that need replacement.
- Any SWPPP changes required as a result of the inspection.

If during the inspections, or any other time, the permittee identifies control measures that need repair or are not operating effectively, the permittee shall repair or replace them before the next anticipated storm event if possible, or as soon as practicable following that storm event. In the interim, the permittee shall have back-up measures in place.

The permittee shall report the findings from the Site Inspections in the annual report.

- iv. The permittee must keep a written (hardcopy or electronic) record of all required activities including but not limited to maintenance, inspections, and training required by part 2.3.7.b. The permittee shall maintain all records associated with the development and implementation of the SWPPP required by this part consistent with the requirements of part 4.2.

3.0. Additional Requirements for Discharges to Surface Drinking Water Supplies and Their Tributaries

- a. Permittees which discharge to public surface drinking water supply sources (Class A and Class B surface waters used for drinking water) or their tributaries should consider these waters a priority in the implementation of the SWMP.
- b. Permittees should provide pretreatment and spill control measures to stormwater discharges to public drinking water supply sources or their tributaries to the extent feasible.
- c. Direct discharges to Class A waters should be avoided to the extent feasible.

4.0. Program Evaluation, Record Keeping, and Reporting

4.1. Program Evaluation

- a. The permittee shall annually self-evaluate its compliance with the terms and conditions of this permit and submit each self-evaluation in the Annual Report. The permittee shall also maintain the annual evaluation documentation as part of the SWMP.
- b. The permittee shall evaluate the appropriateness of the selected BMPs in achieving the objectives of each control measure and the defined measurable goals. Where a BMP is found to be ineffective the permittee shall change BMPs in accordance with the provisions below. In addition, permittees may augment or change BMPs at any time following the provisions below:
 - Changes adding (but not subtracting or replacing) components or controls may be made at any time.
 - Changes replacing an ineffective or infeasible BMP specifically identified in the SWMP with an alternative BMP may be made as long as the basis for the changes is documented in the SWMP by, at a minimum:
 - An analysis of why the BMP is ineffective or infeasible;
 - Expectations on the effectiveness of the replacement BMP; and
 - An analysis of why the replacement BMP is expected to achieve the defined goals of the BMP to be replaced.

The permittee shall indicate BMP modifications along with a brief explanation of the modification in each Annual Report.

- c. EPA or MassDEP may request the permittee to add, modify, repair, replace or change BMPs or other measures described in the annual reports as needed to satisfy the conditions of this permit.

Any changes requested by EPA or MassDEP will be in writing and may set forth the schedule for the permittee to develop the changes and may offer the permittee the opportunity to propose alternative program changes to satisfy the permit conditions..

4.2. Record Keeping

- a. The permittee shall keep all records required by this permit for a period of at least five years. EPA may extend this period at any time. Records include information used in the development of any written (hardcopy or electronic) program required by this permit, any monitoring results, copies of reports, records of screening, follow-up and elimination of illicit discharges; maintenance records; inspection records; and data used in the development of the notice of intent, SWMP, SWPPP, and annual reports. This list provides examples of records that should be maintained, but is not all inclusive.
- b. Records other than those required to be included in the annual report, part 4.4, shall be submitted only when requested by the EPA or the MassDEP.
- c. The permittee shall make the records relating to this permit, including the written (hardcopy or electronic) stormwater management program, available to the public. The public may view the records during normal business hours. The permittee may charge a reasonable fee for copying requests. The permittee is encouraged to satisfy this requirement by posting records online.

4.3. Outfall Monitoring Reporting

- a. The permittee shall monitor and sample its outfalls at a minimum through sampling and testing at the frequency and locations required in connection with IDDE screening under part 2.3.4.7.b. and 2.3.4.8.c.ii.2. The monitoring program may also include additional outfall and interconnection monitoring as determined by the permittee in connection with assessment of SWMP effectiveness pursuant to part 4.1; evaluation of discharges to water quality limited waters pursuant to part 2.2; assessment of BMP effectiveness pursuant to part 2.2 or 2.3; or otherwise.
- b. The permittee shall document all monitoring results each year in the annual report. The report shall include the date, outfall or interconnection identifier, location, weather conditions at time of sampling, precipitation in previous 48 hours, field screening parameter results, and results of all analyses. The annual report shall include all of this information and data for the current reporting period and for the entire permit period.
- c. The permittee shall also include in the annual report results from any other stormwater or receiving water quality monitoring or studies conducted during the reporting period where that data is being used by the permittee to inform permit compliance or program effectiveness. If such monitoring or studies were conducted on behalf of the permittee, or if monitoring or studies conducted by other entities were reported to the permittee, a brief description of the type of information gathered or received shall be included in the annual report(s) covering the time period(s) the information was received.

4.4. Annual Reports

- a. The permittee shall submit annual reports each year of the permit term. The reporting period will be a one year period commencing on the permit effective date, and subsequent anniversaries thereof, except that the first annual report under this permit shall also cover the period from May 1, [year of

final permit effective date] to the permit effective date. The annual report is due ninety days from the close of each reporting period.

b. The annual reports shall contain the following information:

- i. A self-assessment review of compliance with the permit terms and conditions.
- ii. An assessment of the appropriateness of the selected BMPs.
- iii. The status of any plans or activities required by part 2.1 and/ or part 2.2, including:
 - Identification of all discharges that do not meet applicable water quality standards;
 - For discharges subject to TMDL related requirements, identification of specific BMPs used to address the pollutant identified as the cause of impairment and assessment of the BMPs effectiveness at controlling the pollutant (part 2.2.1. and Appendix F) and any deliverables required by Appendix F;
 - For discharges to water quality limited waters a description of each BMP required by Appendix H and any deliverables required by Appendix H.
- iv. An assessment of the progress towards achieving the measurable goals and objectives of each control measure in part 2.3 including:
 - Evaluation of the public education program including a description of the targeted messages for each audience; method of distribution and dates of distribution; methods used to evaluate the program; and any changes to the program.
 - Description of the activities used to promote public participation including documentation of compliance with state public notice regulations.
 - Description of the activities related to implementation of the IDDE program including: status of the map; status and results of the illicit discharge potential ranking and assessment; identification of problem catchments; status of all protocols described in part 2.3.4.(program responsibilities and systematic procedure); number and identifier of catchments evaluated; number and identifier of outfalls screened; number of illicit discharges located; number of illicit discharges removed; gallons of flow removed; identification of tracking indicators and measures of progress based on those indicators; and employee training.
 - Evaluation of the construction runoff management including number of project plans reviewed; number of inspections; and number of enforcement actions.
 - Evaluation of stormwater management for new development and redevelopment including status of ordinance development (2.3.6.a.ii.), review and status of the street design assessment(2.3.6.b.), assessments to barriers to green infrastructure (2.3.6.c), and retrofit inventory status (2.3.6.d.)
 - Status of the O&M Programs required by part 2.3.7.a.
 - Status of SWPPP required by part 2.3.7.b. including inspection results.
 - Any additional reporting requirements in part 3.0.

- v. All outfall screening and monitoring data collected by or on behalf of the permittee during the reporting period and cumulative for the permit term, including but not limited to all data collected pursuant to part 2.3.4. The permittee shall also provide a description of any additional monitoring data received by the permittee during the reporting period.
- vi. Description of activities for the next reporting cycle.
- vii. Description of any changes in identified BMPs or measurable goals.
- viii. Description of activities undertaken by any entity contracted for achieving any measurable goal or implementing any control measure.

c. Reports shall be submitted to EPA at the following address:

United State Environmental Protection Agency
Stormwater and Construction Permits Section (OEP06-1)
Five Post Office Square, Suite 100
Boston, MA 02109

Massachusetts Department of Environmental Protection
One Winter Street – 5th Floor
Boston, MA 02108
ATTN: Frederick Civian

Or submitted electronically to EPA at the following email address: stormwater.reports@epa.gov. After December 21, 2020 all Annual Reports must be submitted electronically.

5.0. Non-Traditional MS4s

Non-traditional MS4s are MS4s owned and operated by the Commonwealth of Massachusetts, counties or other public agencies within the Commonwealth of Massachusetts, and properties owned and operated by the United States (Federal Facilities) within the Commonwealth of Massachusetts. This part addresses all non-traditional MS4s except MS4s that are owned or operated by transportation agencies, which are addressed in part 6.0 below.

5.1. Requirements for Non-Traditional MS4s

All requirements and conditions of parts 1 – 4 above apply to all Non-traditional MS4s, except as specifically provided below:

5.1.1. Public education

For the purpose of this permit, the audiences for a Non-traditional MS4 include the employees, clients and customers (including students at education MS4s), visitors to the property, tenants, long term contractors and any other contractors working at the facility where the MS4 is located. The permittee may use some of the educational topics included in part 2.3.2.d. as appropriate, or may focus on topics specific to the MS4. The permittee shall document the educational topics for each target audience in the SWMP and annual reports.

5.1.2. Ordinances and regulatory mechanisms

Some Non-traditional MS4s may not have authority to enact an ordinance, by-law, or other regulatory mechanisms. MS4s without the authority to enact an ordinance shall ensure that written policies or procedures are in place to address the requirements of part 2.3.4.5., part 2.3.4.6 and part 2.3.6.a.

5.1.3. Assessment of Regulations

Non-traditional MS4s do not need to meet the requirements of part 2.3.6.c.

5.1.4. New Dischargers

New MS4 facilities are subject to additional water quality-based requirements if they fall within the definition of “new discharger” under 40 CFR § 122.2: “A new discharger is any building, structure, facility or installation (a) from which there is or may be a ‘discharge of pollutants’ (b) that did not commence the ‘discharge of pollutants’ at a particular ‘site’ prior to August 13, 1979; (c) which is not a ‘new source’; and (d) which never received a finally effective NPDES permit for discharges at that ‘site.’ The term “site” is defined in § 122.2 to mean “the land or water area where any ‘facility or activity’ is physically located or conducted including adjacent land used in connection with the facility or activity.”

Consistent with these definitions, a Non-traditional MS4 is a “new discharger” if it discharges stormwater from a new facility with an entirely new separate storm sewer system that is not physically located on the same or adjacent land as an existing facility and associated system operated by the same MS4.

Any Non-traditional MS4 facility that is a “new discharger” and discharges to a waterbody listed in category 5 or 4b on the Massachusetts Integrated Report of waters listed pursuant to Clean Water Act section 303(d) and 305(b) due to nutrients (Total Nitrogen or Total Phosphorus), metals (Cadmium, Copper, Iron, Lead or Zinc), solids (TSS or Turbidity), bacteria/pathogens (E. Coli, Enterococcus or Fecal Coliform), chloride (Chloride) or oil and grease (Petroleum Hydrocarbons or Oil and Grease), or discharges to a waterbody with an approved TMDL for any of those pollutants, is not eligible for coverage under this permit and shall apply for an individual permit.

Any Non-traditional MS4 facility that is a “new discharger” and discharges to a waterbody that is in attainment is subject to Massachusetts antidegradation regulations at 314 CMR 4.04. The permittee shall comply with the provisions of 314 CMR 4.04 including information submittal requirements and obtaining authorization for new discharges where appropriate¹². Any authorization of new discharges by MassDEP shall be incorporated into the permittee's SWMP. If an applicable MassDEP approval specifies additional conditions or requirements, then those requirements are incorporated into this permit by reference. The permittee must comply with all such requirements.

5.1.5 Dischargers Subject to Appendix F Part A.I

Those dischargers not identified in Appendix F Table F-2 or Table F-3 discharging to waterbodies in the Charles River Watershed or to an MS4 that discharges to a waterbody in the Charles River Watershed shall coordinate with the municipality in which they are located to facilitate compliance

¹² Contact MassDEP for guidance on compliance with 314 CMR 4.04

with the phosphorus reduction applicable to the municipality. In each annual report the permittee shall indicate planned phosphorus reduction activities on site and coordination progress with the municipality. In addition, the year 4 annual report shall contain the following information:

- a. Estimated current impervious area of permittee owned property,
- b. Land Use information for permittee owned property,
- c. Phosphorus removal in pounds per year for any structural BMP owned by the permittee, calculated in accordance with Appendix F Attachment 3
- d. Date of last maintenance activity for all structural BMPs for which phosphorus removal is calculated

6.0 Requirements for MS4s Owned or Operated by Transportation Agencies

This part applies to all MS4s owned or operated by any state or federal transportation agency (except Massachusetts Department of Transportation –MassDOT- Highway Division, which is subject to a separate individual permit). All requirements and conditions of this permit apply with the following exceptions:

6.1 Public education

For the purpose of this permit, the audiences for a transportation agency education program include the general public (users of the roadways), employees, and any contractors working at the location. The permittee may use some of the educational topics included in part 2.3.2.d. as appropriate, or may focus on topics specific to the agency. The permittee shall document the educational topics for each target audience.

6.2 Ordinances and regulatory mechanisms

The transportation agency may not have authority to enact an ordinance, by-law or other regulatory mechanisms. The agency shall ensure that written agency policies or procedures are in place to address the requirements of part 2.3.4.5., part 2.3.4.6 and part 2.3.6.a.

6.3 Assessment of regulations

Non-traditional MS4s do not need to meet the requirements of part 2.3.6.c.

6.4 New Dischargers

New MS4 facilities are subject to additional water quality-based requirements if they fall within the definition of “new dischargers” under 40 CFR § 122.2: “A new discharger is any building, structure, facility or installation (a) from which there is or may be a ‘discharge of pollutants’ (b) that did not commence the ‘discharge of pollutants’ at a particular ‘site’ prior to August 13, 1979; (c) which is not a ‘new source’; and (d) which never received a finally effective NPDES permit for discharges at that ‘site.’ The term “site” is defined in § 122.2 to mean “the land or water area where any ‘facility or activity’ is physically located or conducted including adjacent land used in connection with the facility or activity.”

Consistent with these definitions, a new transportation MS4 is a “new discharger” if it discharges stormwater from a new facility with an entirely new separate storm sewer system that is not physically located on the same or adjacent land as an existing facility and associated system operated by the same MS4.

Any transportation MS4 facility that is a “new discharger” and discharges to a waterbody listed as impaired in category 5 or 4b on the Massachusetts Integrated Report of waters listed pursuant to Clean Water Act section 303(d) and 305(b) due to nutrients (Total Nitrogen or Total Phosphorus), metals (Cadmium, Copper, Iron, Lead or Zinc), solids (TSS or Turbidity), bacteria/pathogens (E. Coli, Enterococcus or Fecal Coliform), chloride

(Chloride) or oil and grease (Petroleum Hydrocarbons or Oil and Grease), or discharges to a waterbody with an approved TMDL for any of those pollutants, is not eligible for coverage under this permit and shall apply for an individual permit.

Any transportation MS4 facility that is a “new discharger” and discharges to a waterbody that is in attainment is subject to Massachusetts antidegradation regulations at 314 CMR 4.04. The permittee shall comply with the provisions of 314 CMR 4.04 including information submittal requirements and obtaining authorization for new discharges where appropriate¹³. Any authorization of new discharges by MassDEP shall be incorporated into the permittee's SWMP. If an applicable MassDEP approval specifies additional conditions or requirements, then those requirements are incorporated into this permit by reference. The permittee must comply with all such requirements.

6.5 Dischargers Subject to Appendix F Part A.I

Those dischargers not identified in Appendix F Table F-2 or Table F-3 discharging to waterbodies in the Charles River Watershed or to an MS4 that discharges to a waterbody in the Charles River Watershed shall coordinate with the municipality in which they are located to facilitate compliance with the phosphorus reduction applicable to the municipality. In each annual report the permittee shall indicate planned phosphorus reduction activities on site and coordination progress with the municipality. In addition, the year 4 annual report shall contain the following information:

- a. Estimated current impervious area of permittee owned property,
- b. Land Use information for permittee owned property,
- c. Phosphorus removal in pounds per year for any structural BMP owned by the permittee, calculated in accordance with Appendix F Attachment 3,
- d. Date of last maintenance activity for all structural BMPs for which phosphorus removal is calculated

¹³ Contact MassDEP for guidance on compliance with 314 CMR 4.04

CDM Smith can help you with your Massachusetts MS4 Permit



Your permit begins July 1, 2018 and will include the following requirements

Task	Year 1	Year 2	Year 3	Year 4	Year 5
Prepare NOI					
Submit NOI (within 90 days of issuance of permit)					
Document SSOs during the past 5 years					
Update Stormwater Management Program (SWMP)					
Complete initial outfall and interconnection inventory and prioritize outfalls					
Develop outfall and interconnection screening and sampling procedures					
Develop written procedure for construction site inspections					
Develop written procedure for site plan review					
Develop written IDDE program					
Develop written catchment investigation procedure					
Inventory municipal facilities (parks, buildings, vehicles, etc.)					
Develop municipal infrastructure repair/rehab program					
Evaluate O&M procedures and revise/edit					
Review SWPPPs and revise/edit					
Develop SWPPPs for non-MSGP facilities					
Amend ordinances for new development and redevelopment					
Perform dry-weather outfall inspections (sample if flow present) by end of year 3					
Evaluate and report on street and parking design					
Evaluate and report on LID design standards					
Prepare GIS map of drainage system					
Distribute 8 public educational messages over permit term					
Evaluate effectiveness of public educational messages annually					
Provide public comment period on Stormwater Management Program					
Train employees on IDDE					
Implement control measures to meet TMDL allocations and impaired water requirements					
Develop and implement winter road maintenance procedures					
Implement program to inspect and maintain storm drain systems and stormwater treatment structures					
Clean and maintain catch basins with goal of no more than 50% full; document volume/mass removed					
Sweep municipally-owned streets and parking lots in spring; document volume/mass removed					
Submit Year 1 Annual Report, and SWMP	X				
Update outfalls and interconnection inventory and priority ranking					
Perform IDDE investigations in catchments					
Perform wet-weather sampling at outfalls and MS4 interconnections as part of catchment investigation procedure (only outfalls with "System Vulnerability Factors")					
Field screen MS4 interconnections (sample if flow present)					
Submit Year 2 Annual Report		X			
Submit Year 3 Annual Report			X		
Submit Year 4 Annual Report				X	
Identify at least 5 municipally-owned properties that can be retrofitted with BMPs and maintain 5 sites on list					
Submit Year 5 Annual Report					X

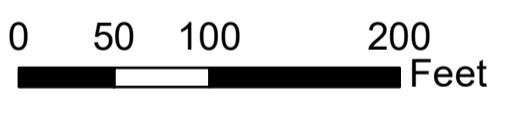
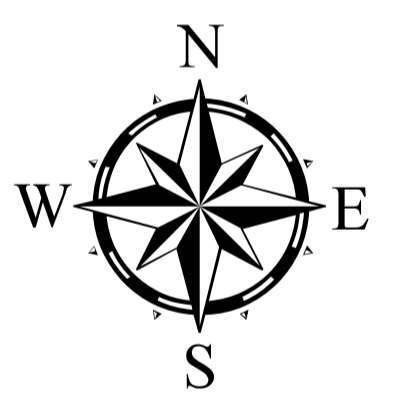
Section 7

Initial Catchment Delineation Maps, September 2021

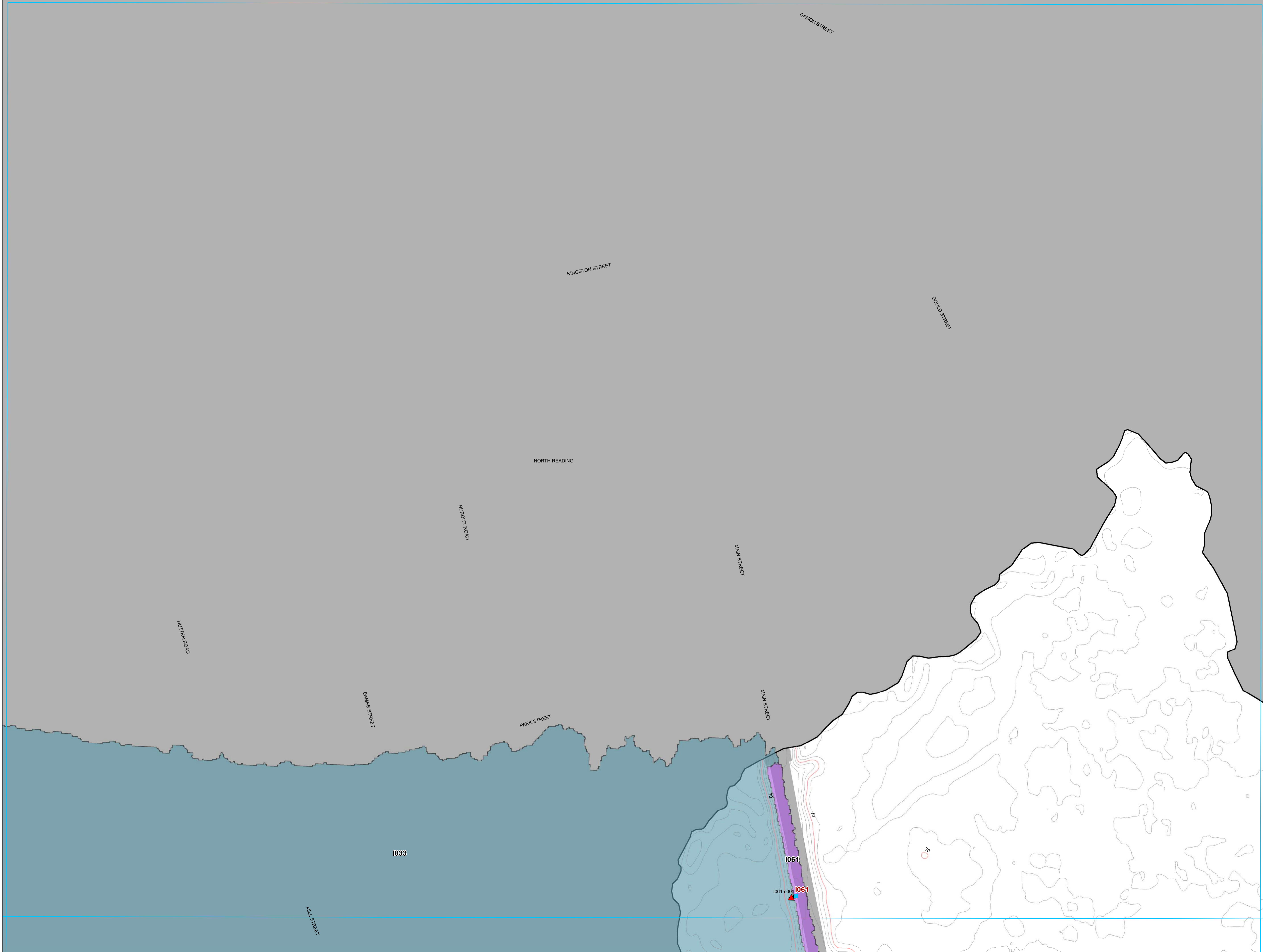
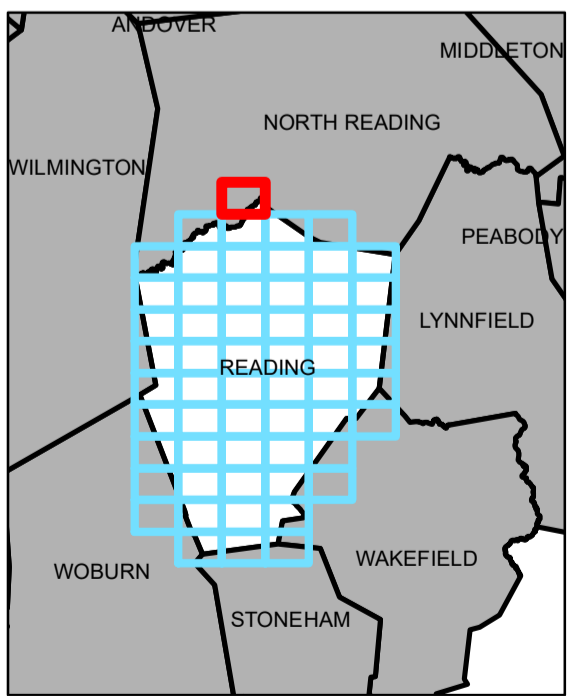


Legend

- Atlas Grid
- swDischargePoint
- swInlet
- swCatchBasin
- swManhole
- swPressurizedMain
- swOpenDrain
- swCulvert
- swGravityMain
- 1 Ft
- 10 Ft
- Atlas Grid



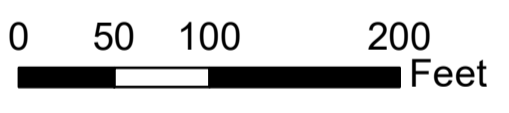
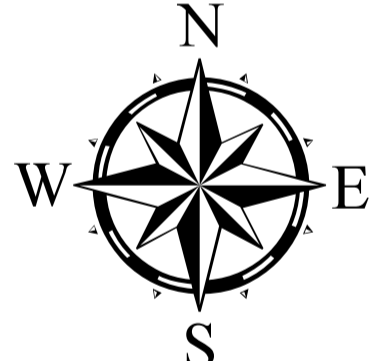
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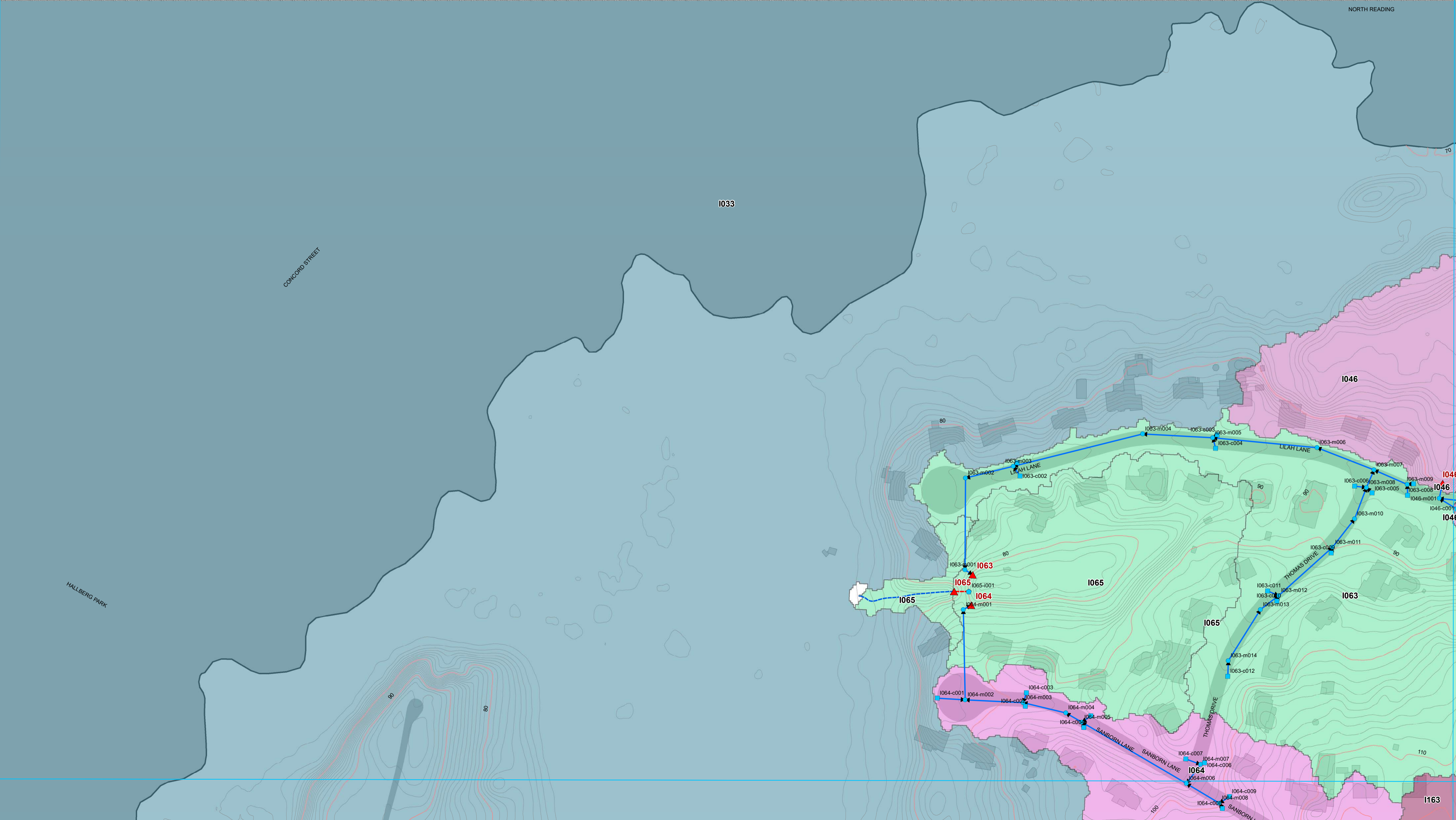
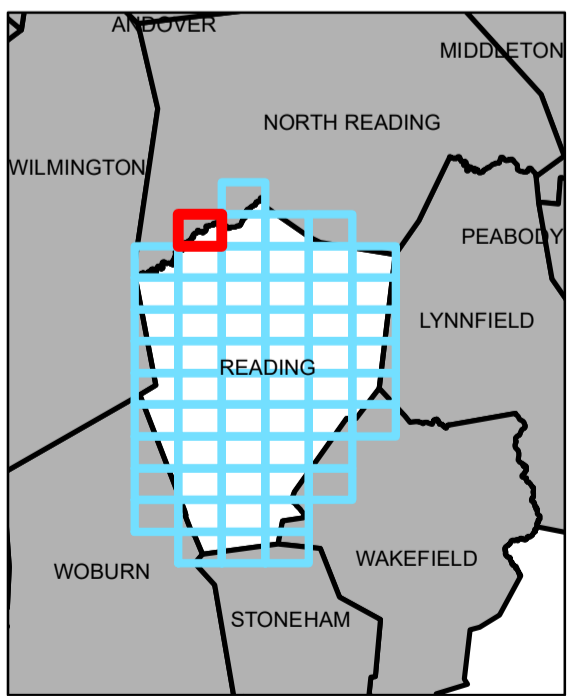


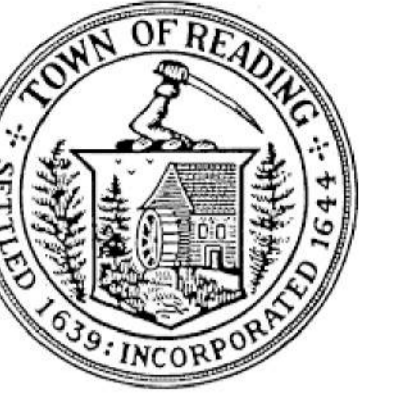
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- 1 Ft
- 10 Ft
- Atlas Grid



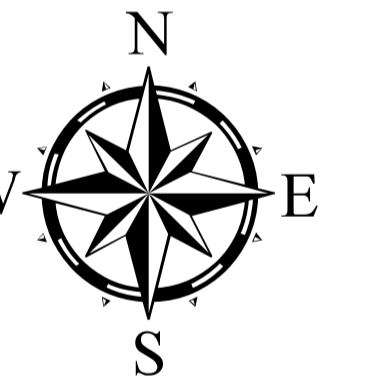
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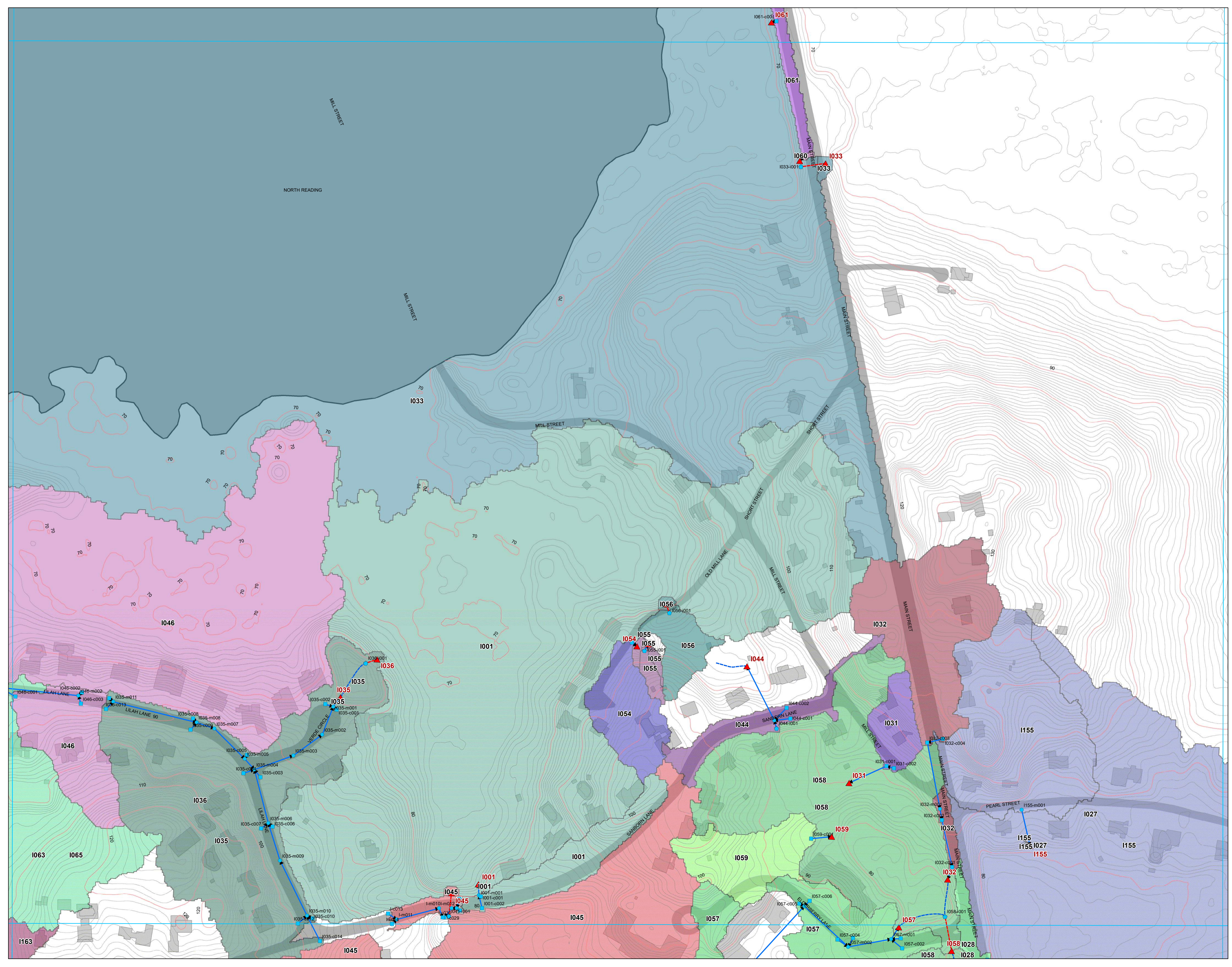
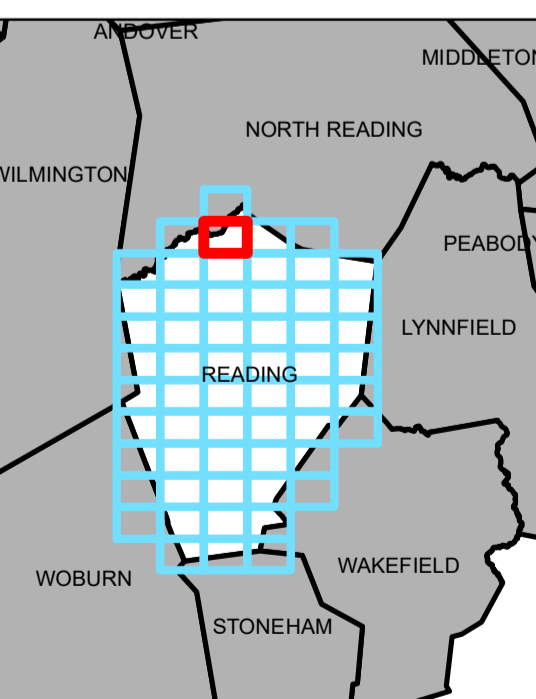
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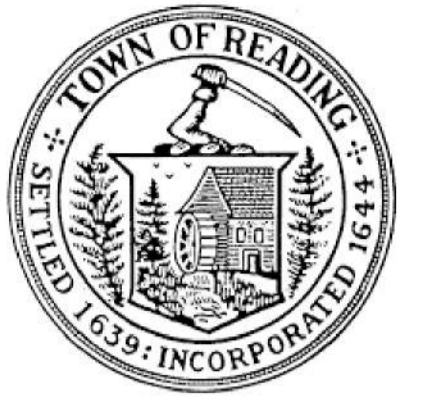
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- swCulvert
- swGravityMain
- 1 Ft
- 10 Ft
- Atlas Grid



0 50 100 200 Feet

1 inch = 100 feet





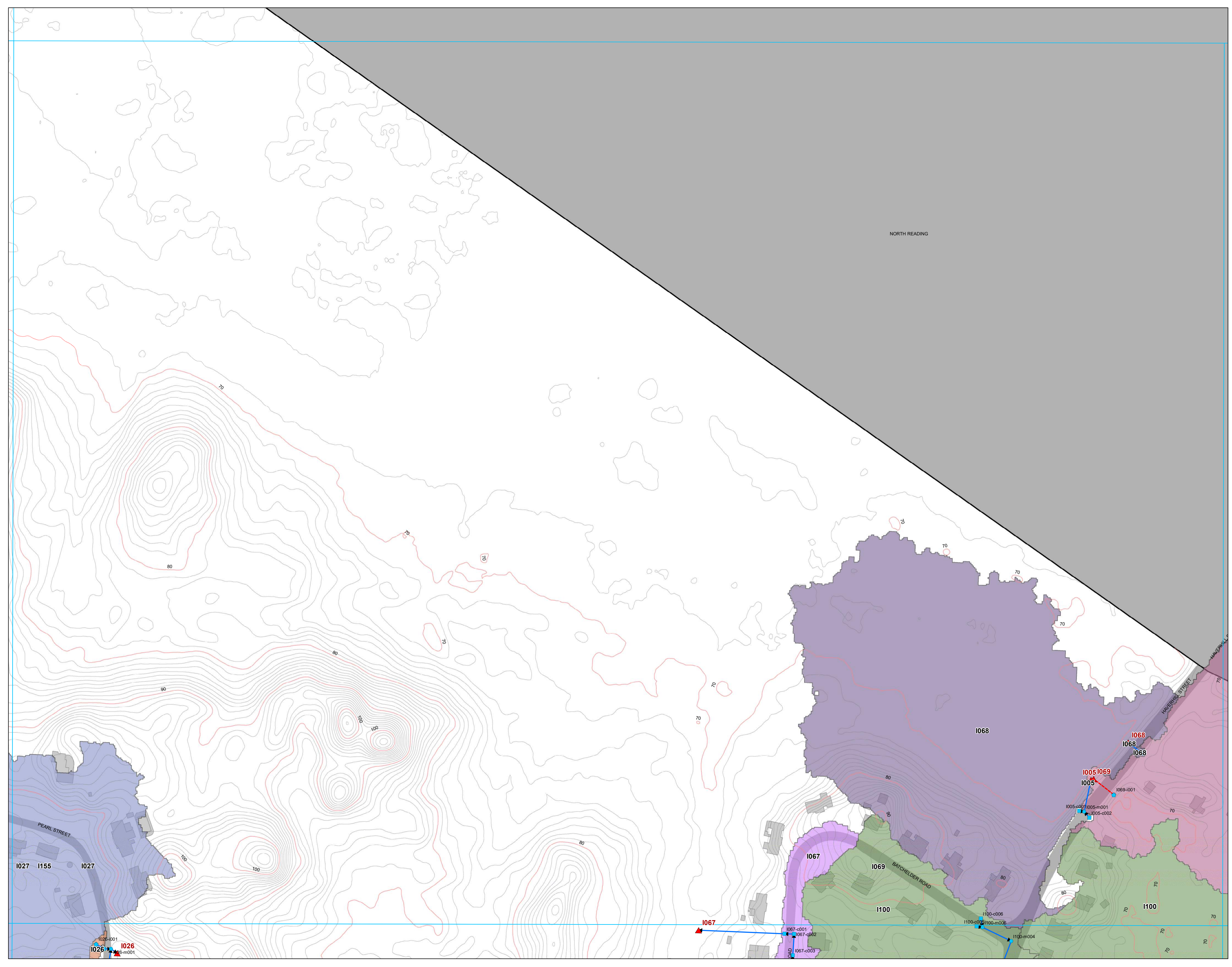
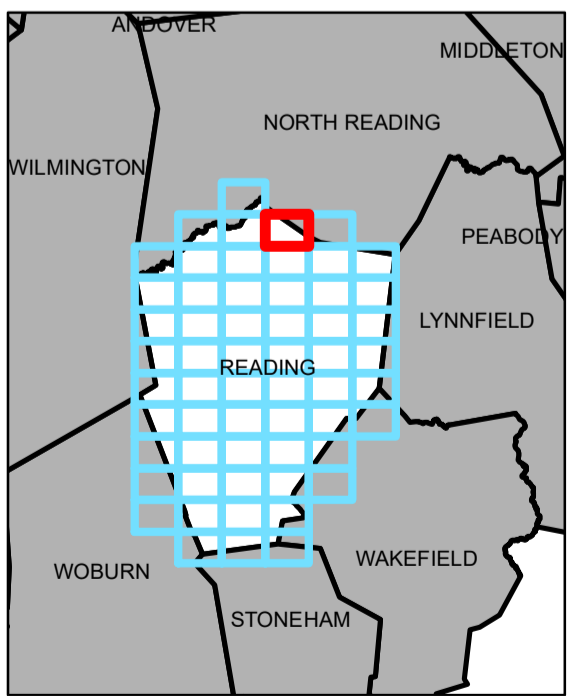
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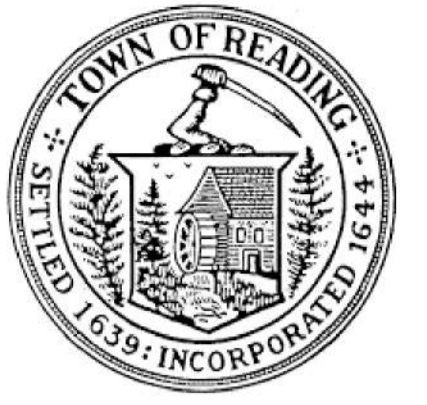
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- 10 Ft
- Atlas Grid














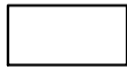
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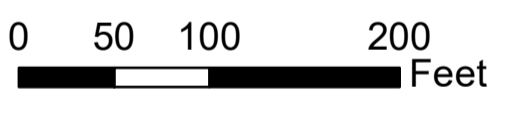
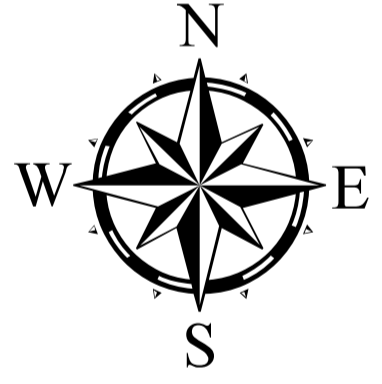
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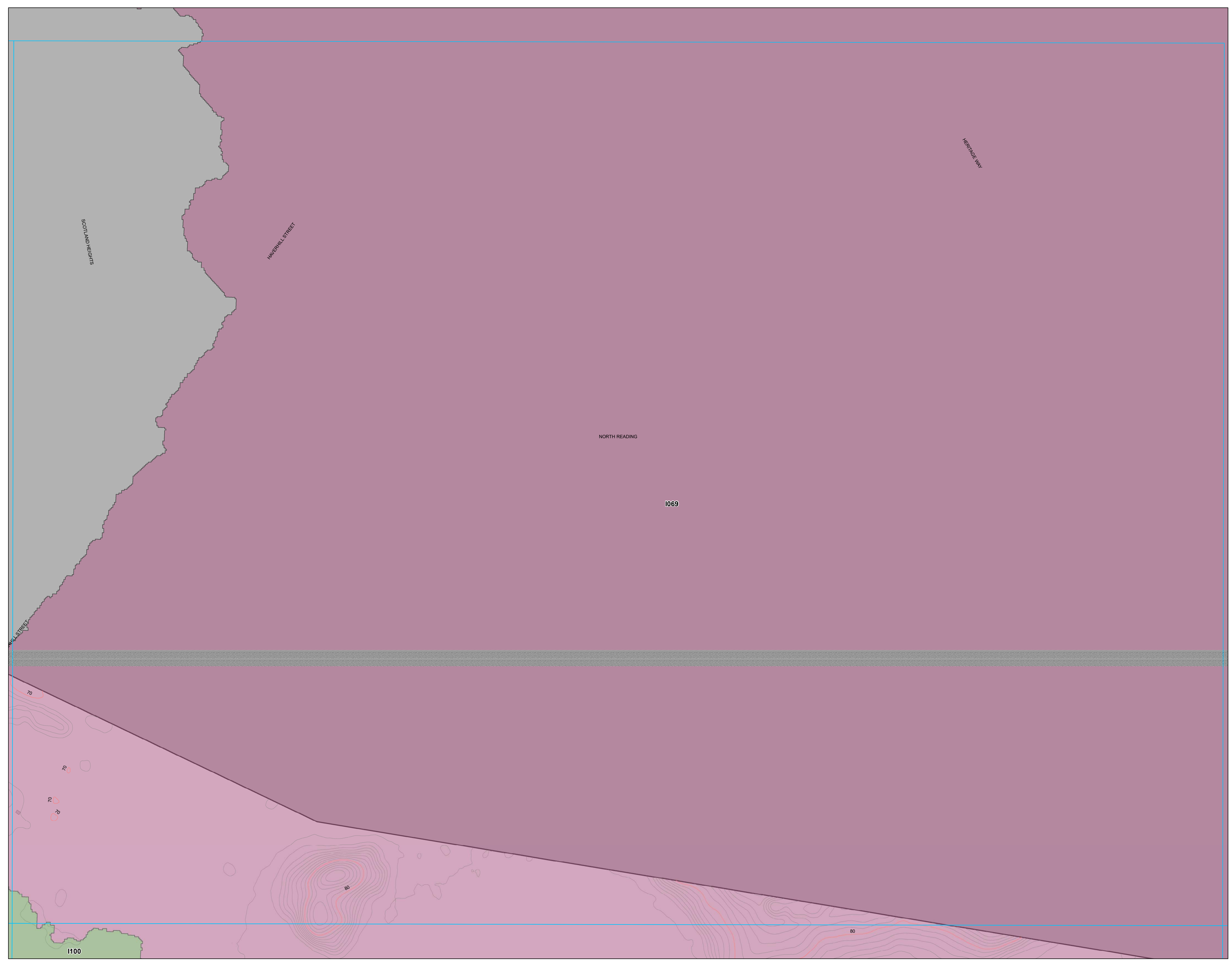
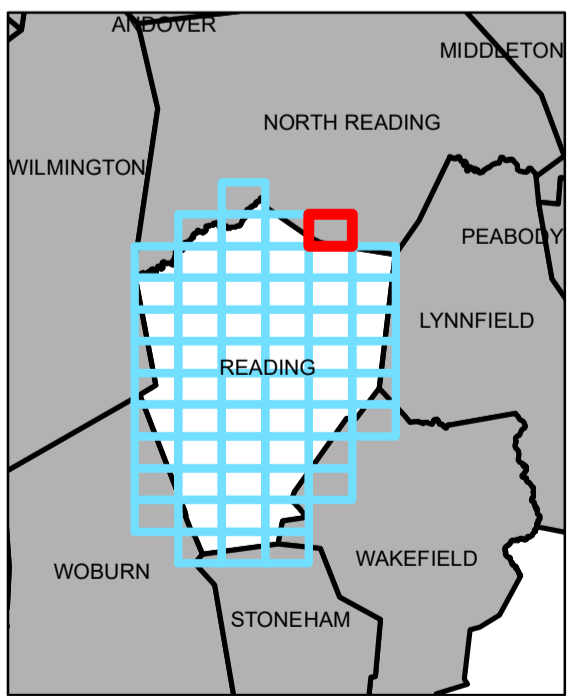


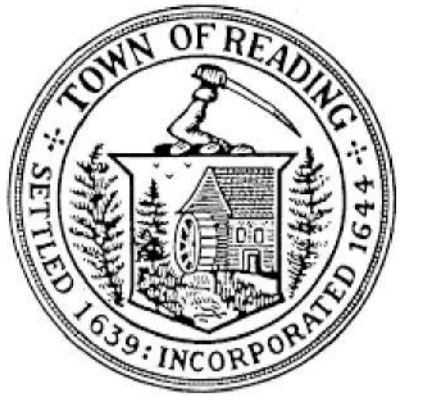
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-  swCatchBasin
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-  swCulvert
-  swGravityMain
-  1 Ft
-  10 Ft
-  Atlas Grid












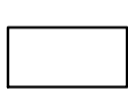


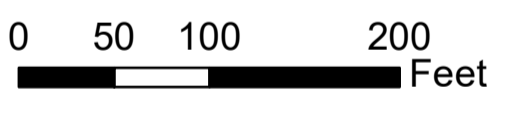
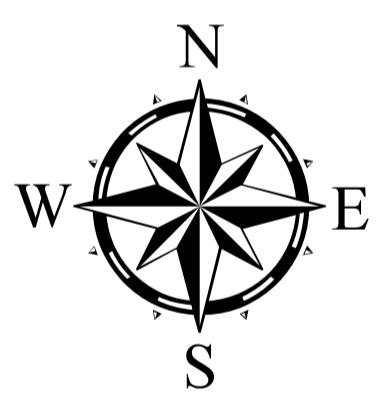
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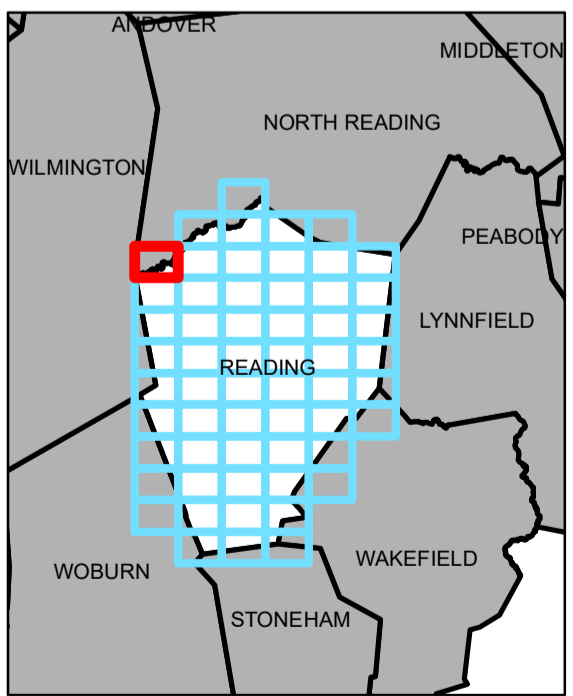


Legend

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-  10 Ft
-  Atlas Grid



1 inch = 100 feet



WILMINGTON

WILMINGTON

NORTH READING

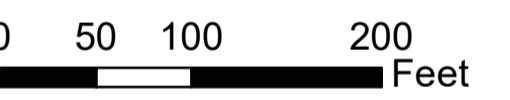
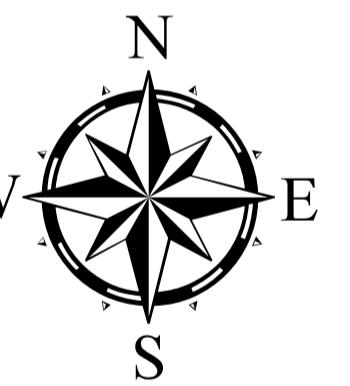
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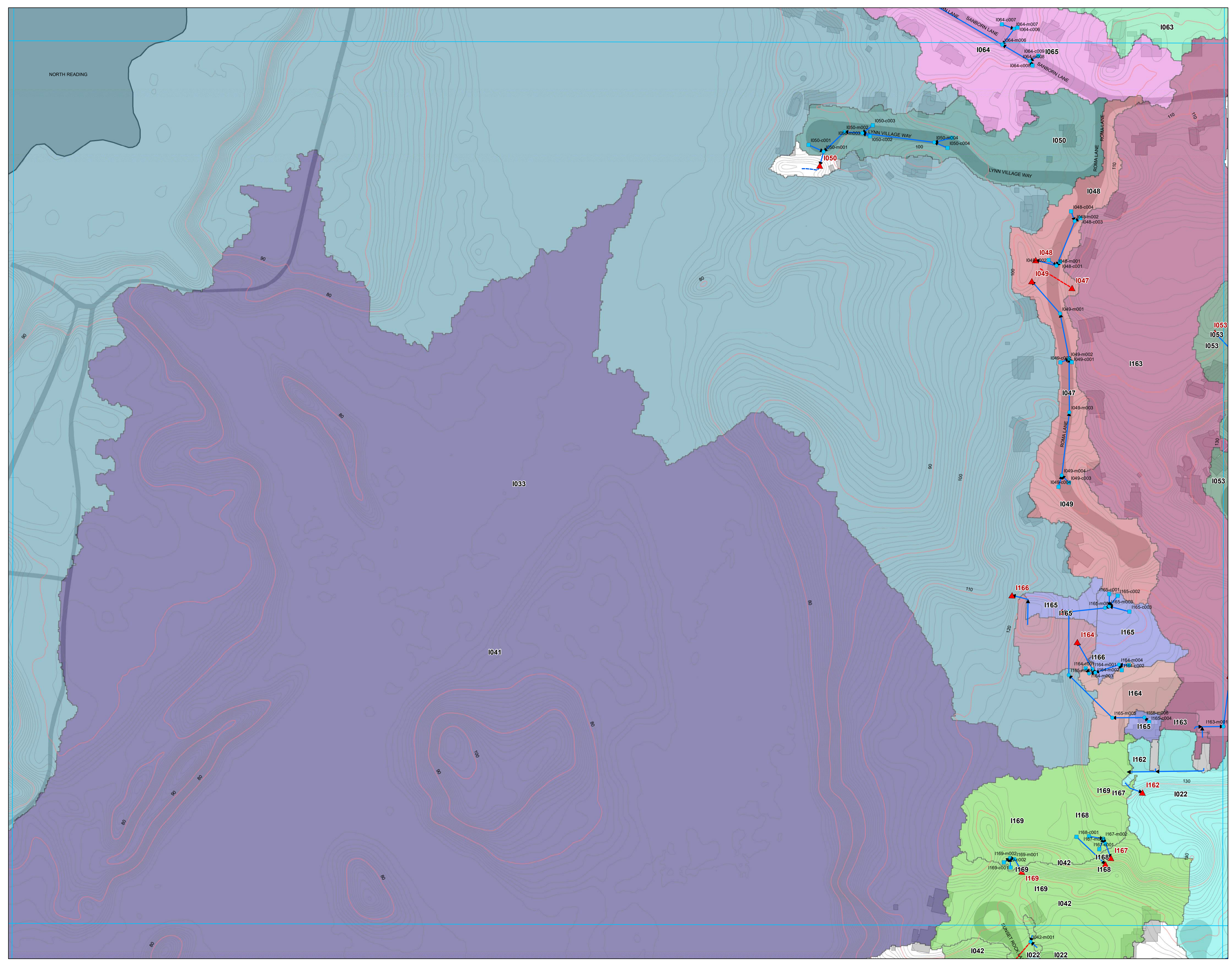
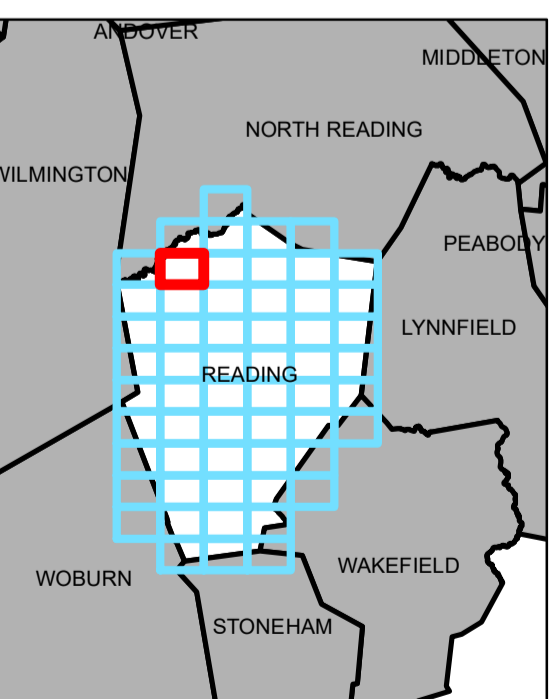


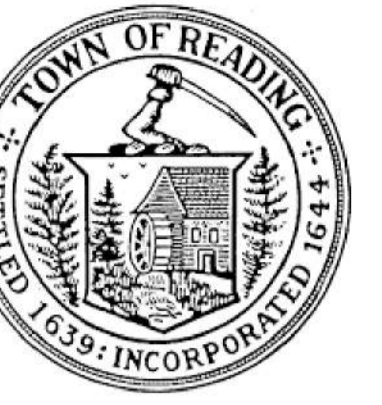
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- 10 Ft
- Atlas Grid



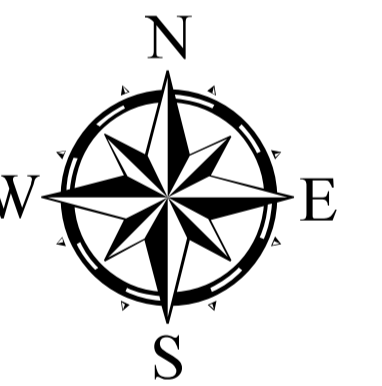
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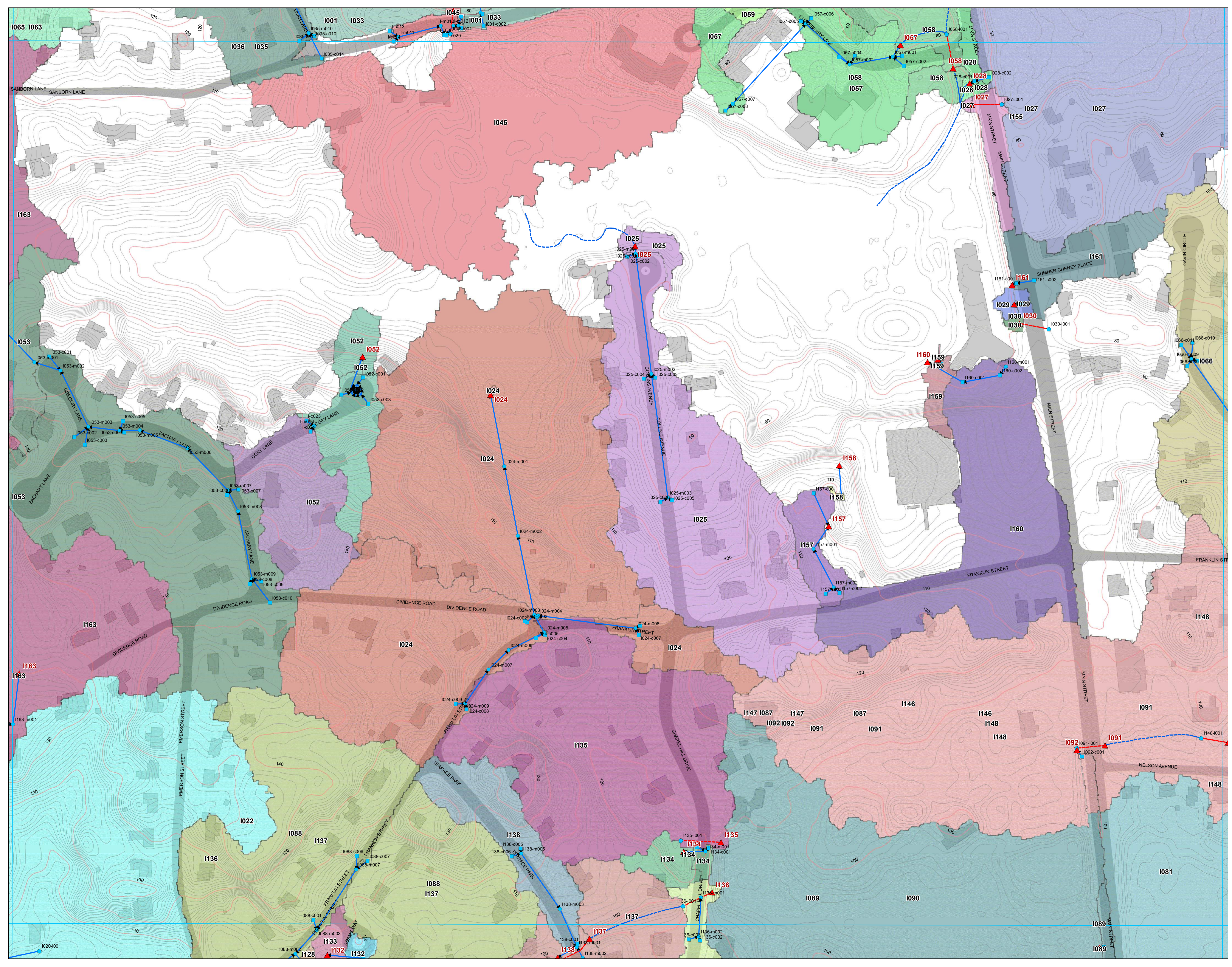
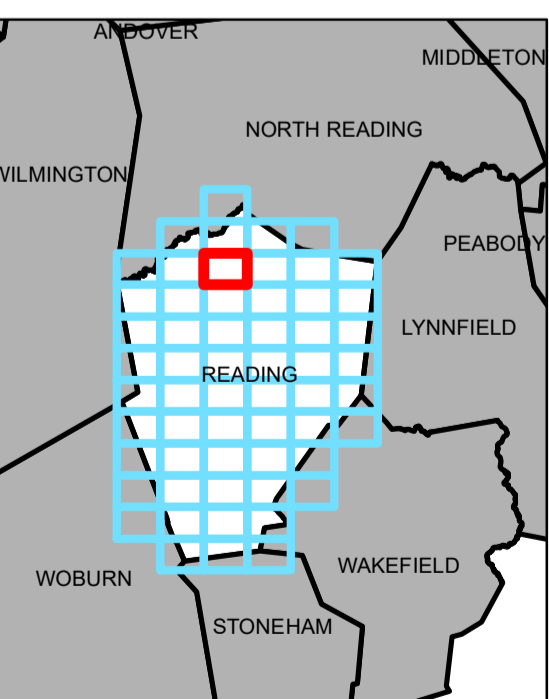
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- 10 Ft
- Atlas Grid



0 50 100 200 Feet

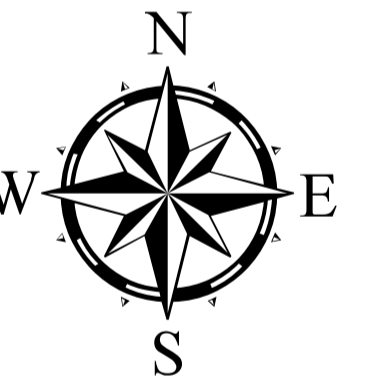
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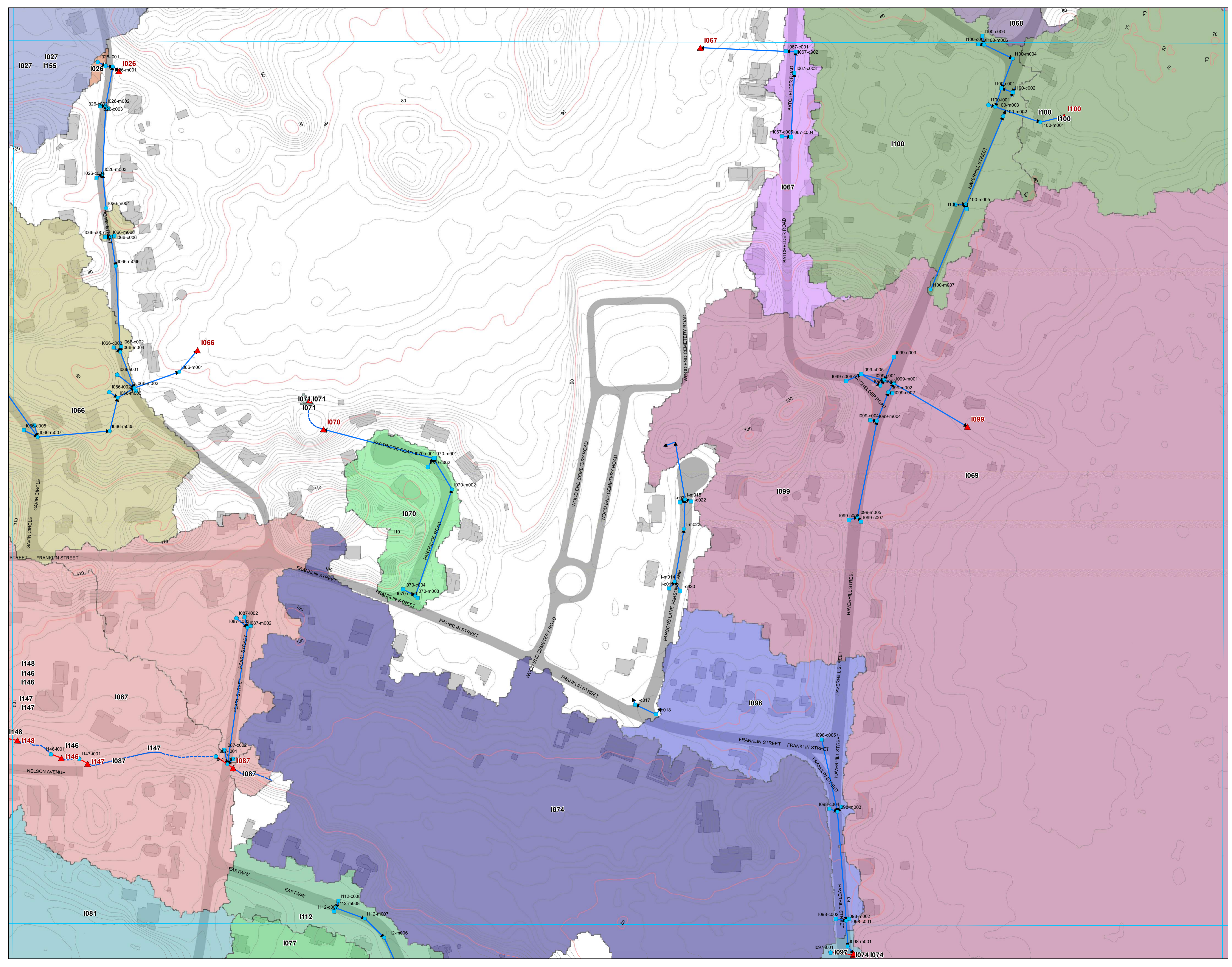
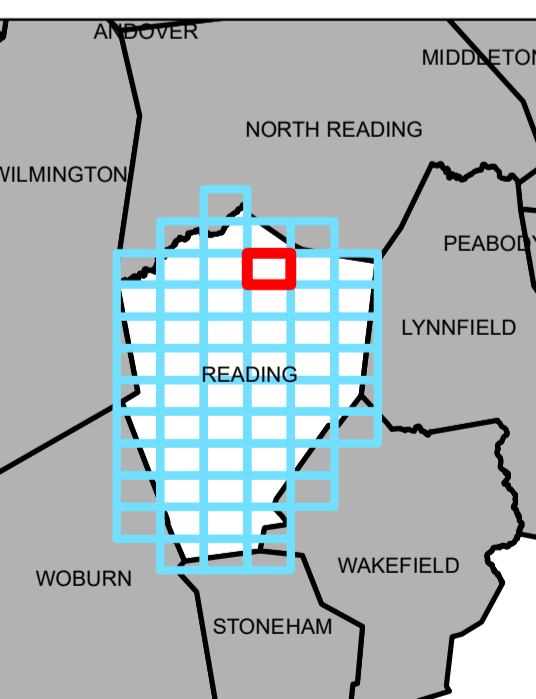
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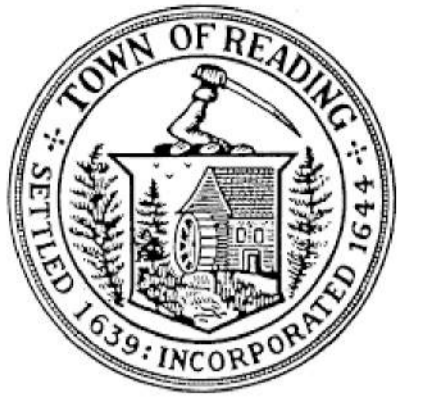
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- Atlas Grid














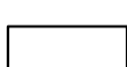
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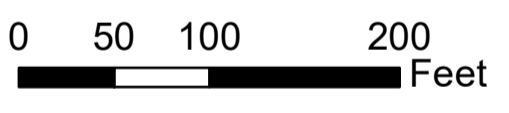
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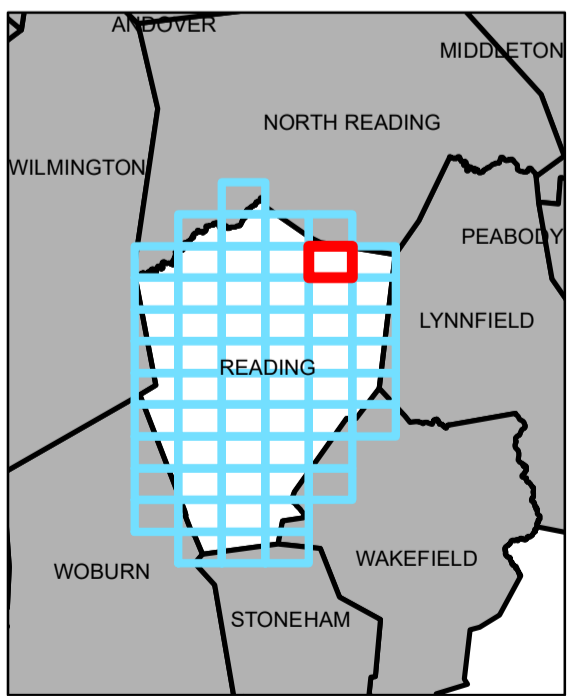


Legend

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-  swInlet
-  swCatchBasin
-  swManhole
-  swPressurizedMain
-  swOpenDrain
-  swCulvert
-  swGravityMain
-  1 Ft
-  10 Ft
-  Atlas Grid



1 inch = 100 feet

















2021 Catchment Mapping

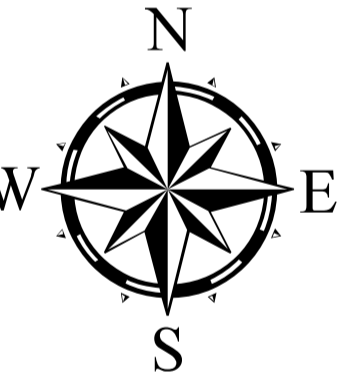
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Legend

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-  swPressurizedMain
-  swOpenDrain
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-  1 Ft
-  10 Ft
-  Atlas Grid



1 inch = 100 feet



NORTH READING

1069

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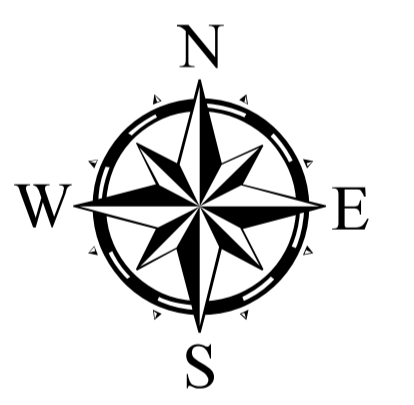
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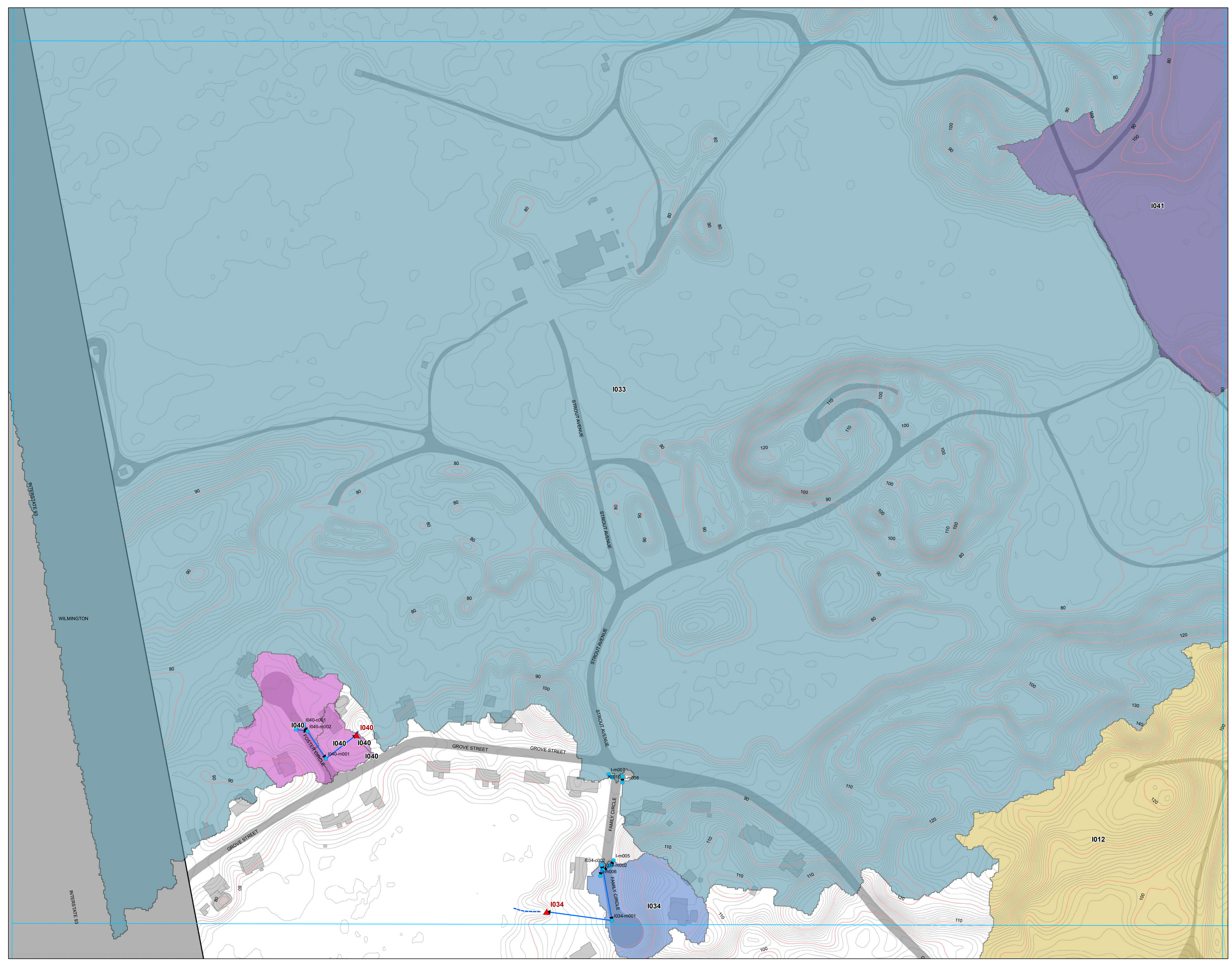
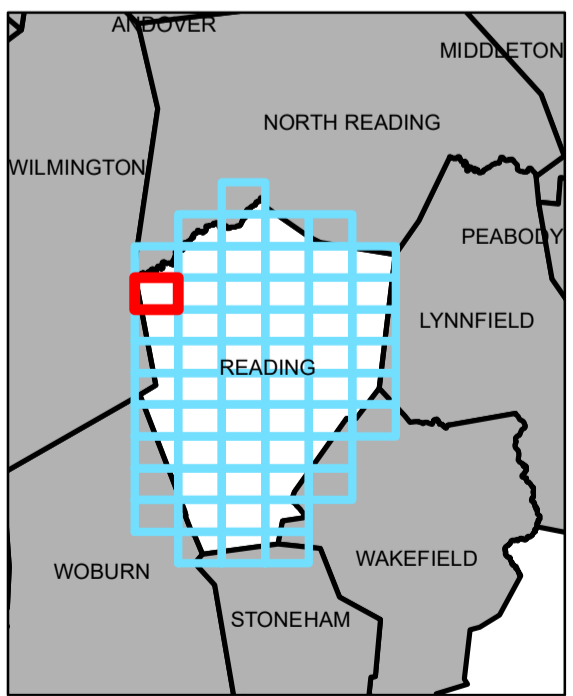
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- swGravityMain
- 1 Ft
- 10 Ft
- Atlas Grid



0 50 100 200 Feet

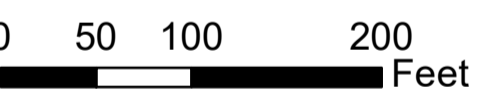
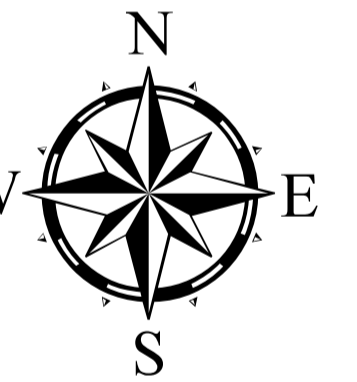
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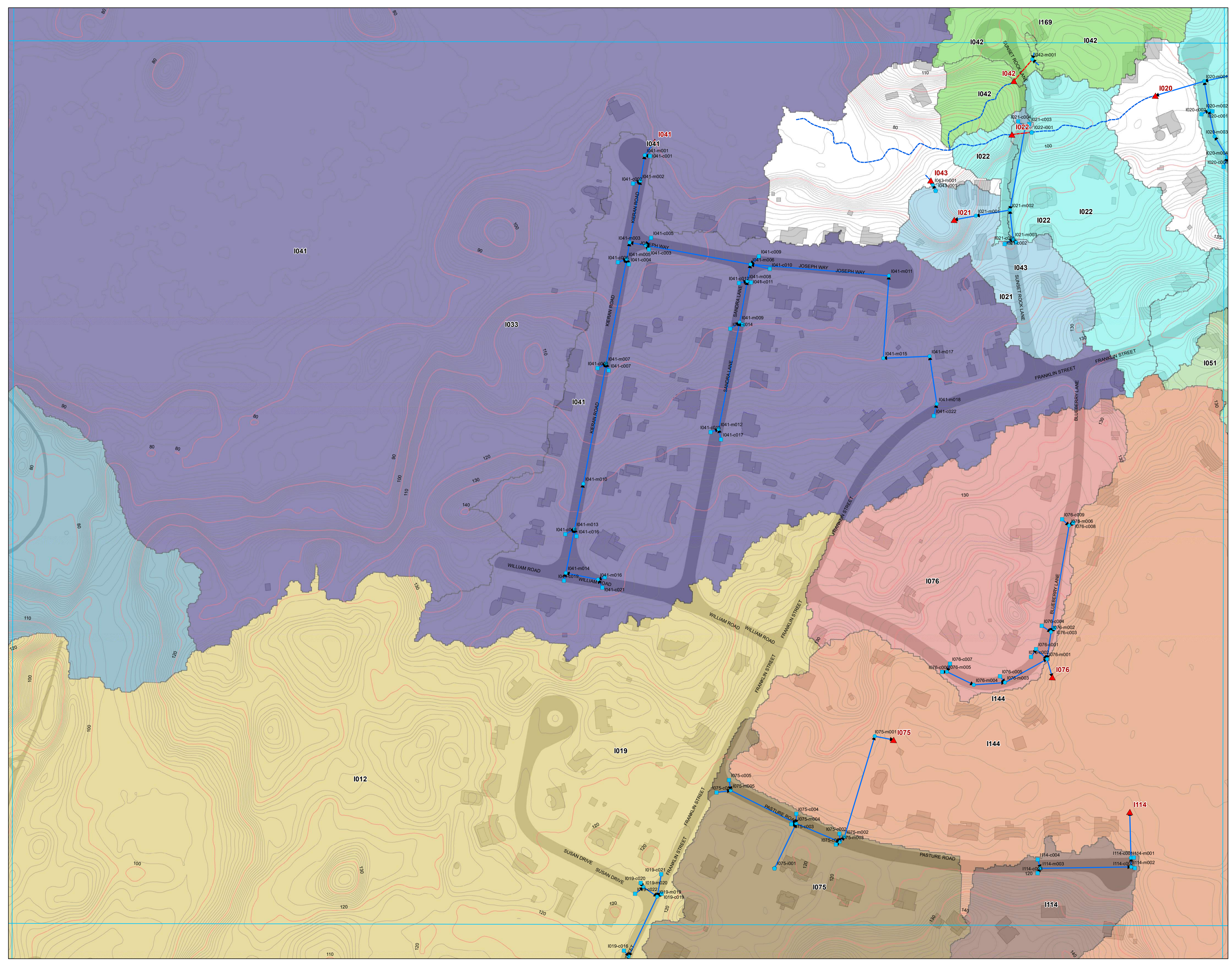
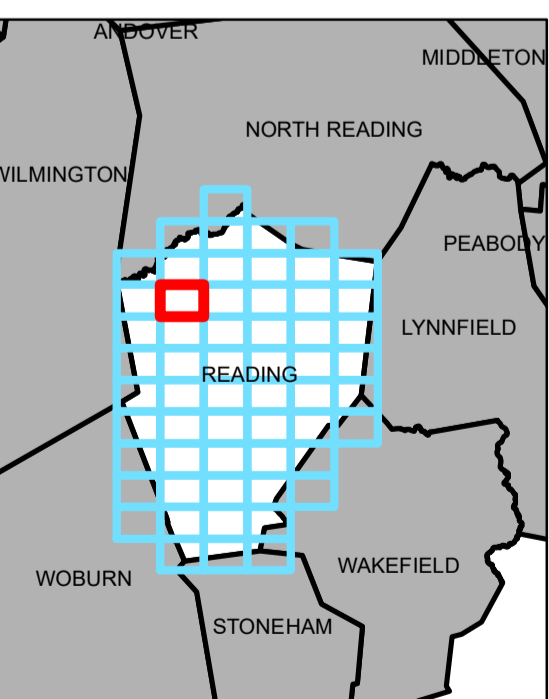


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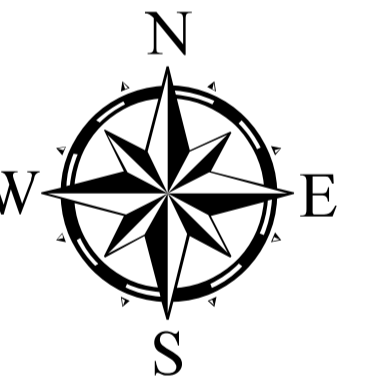
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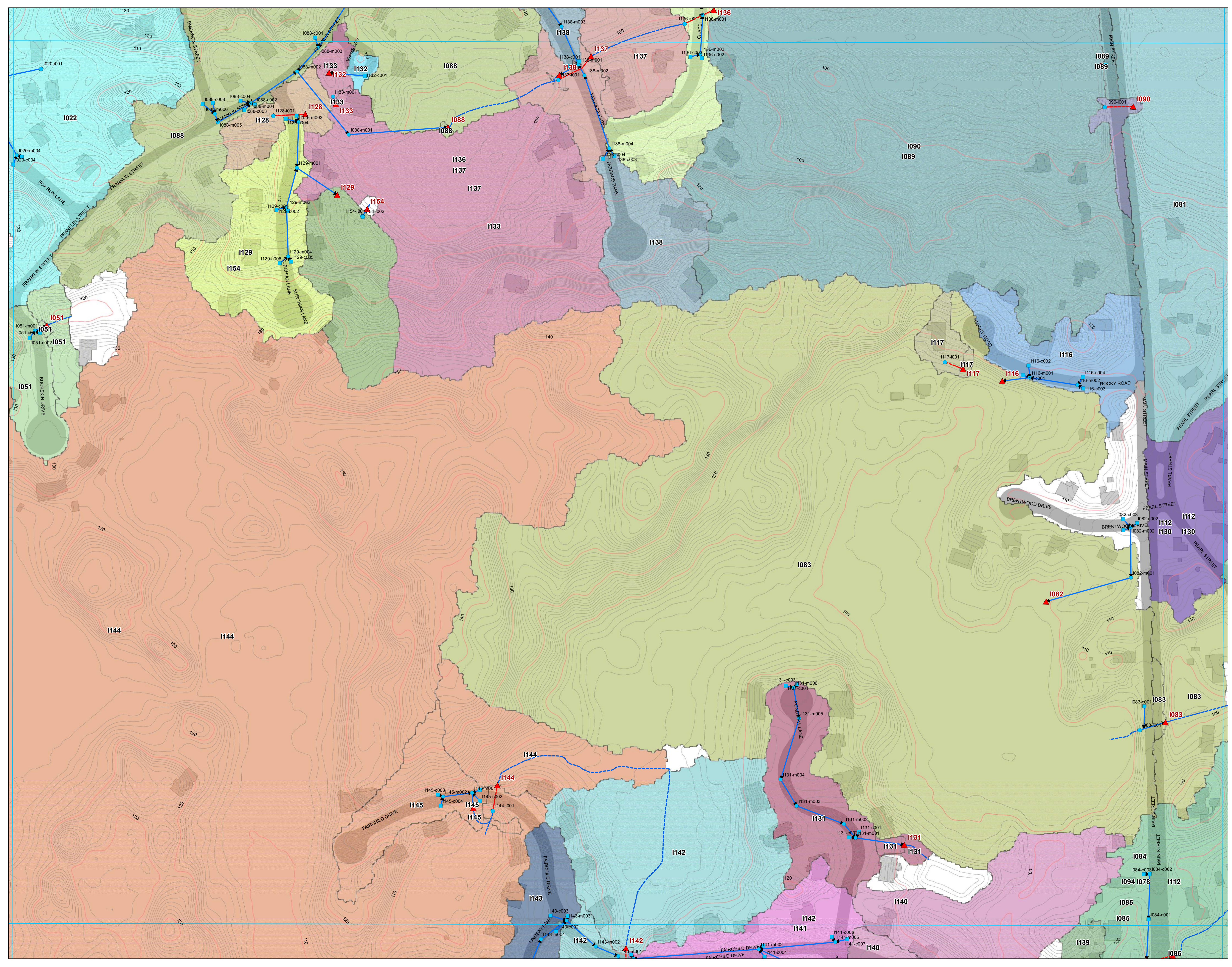
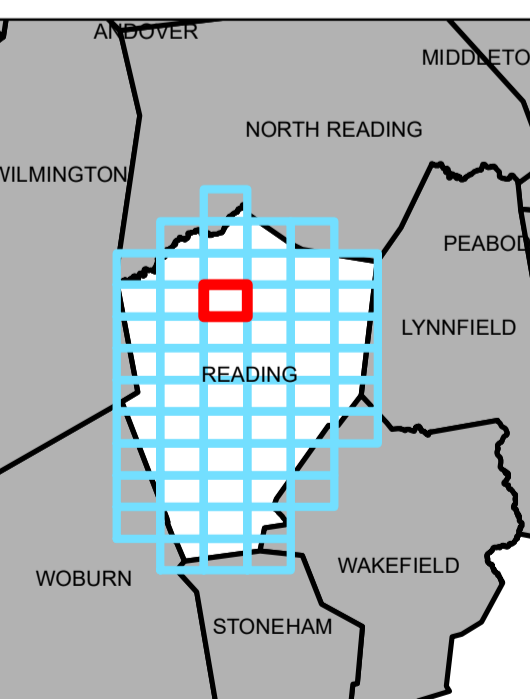
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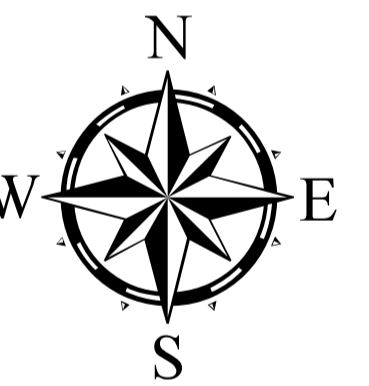
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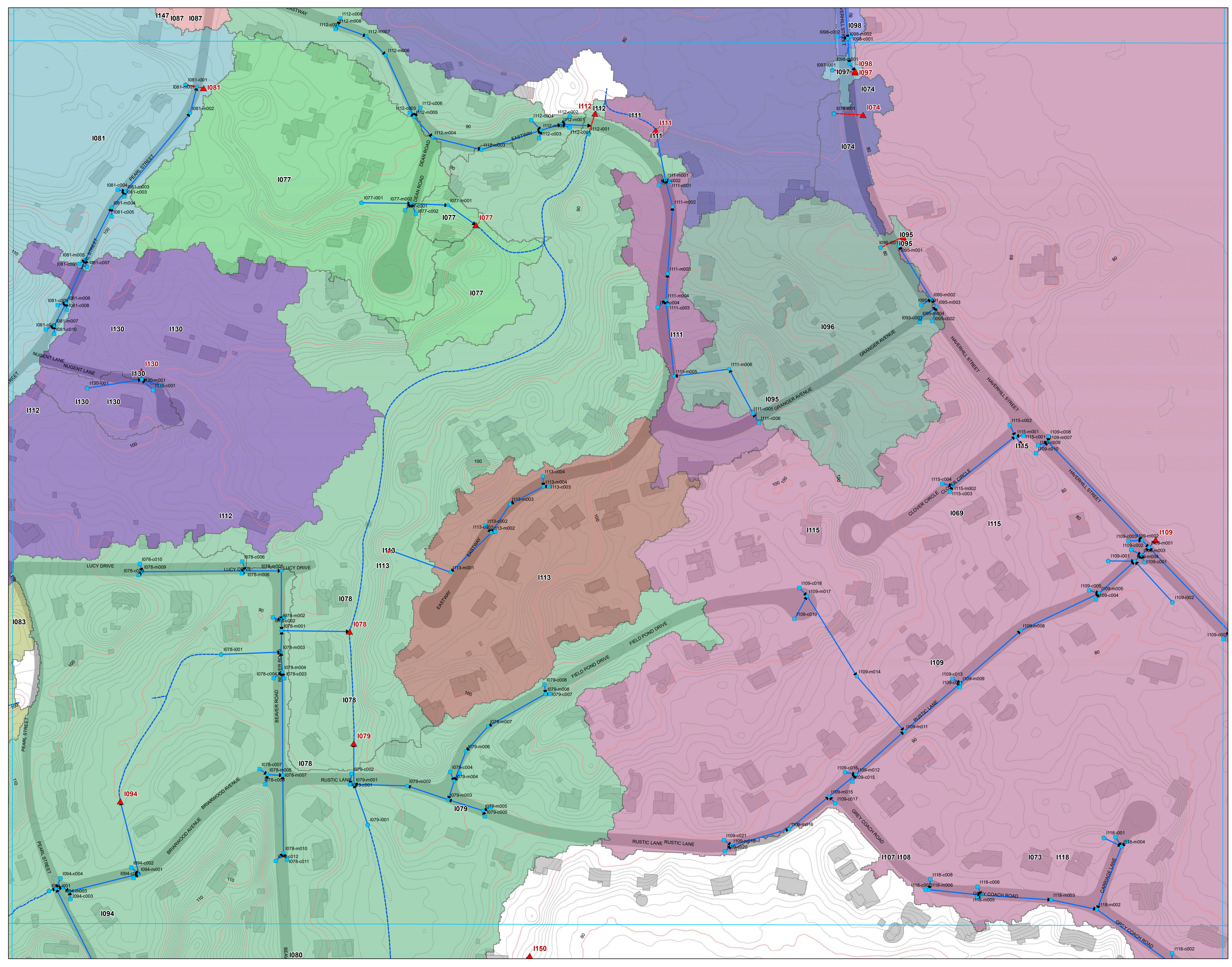
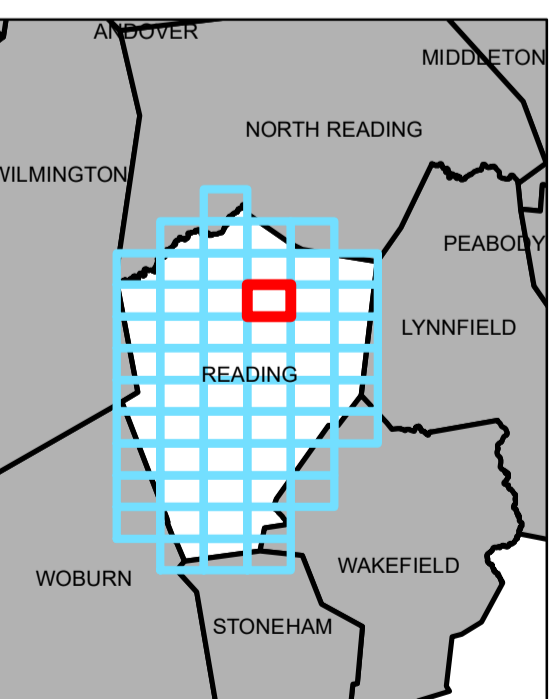
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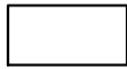
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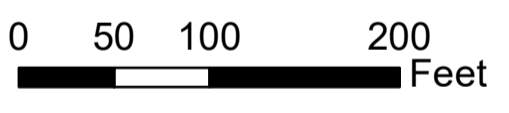
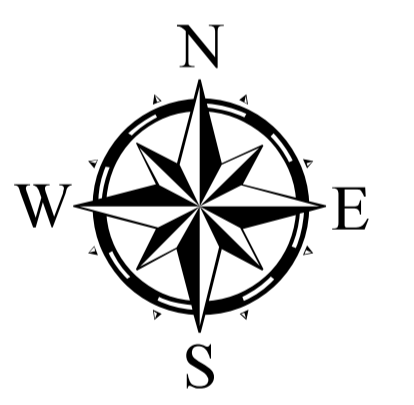
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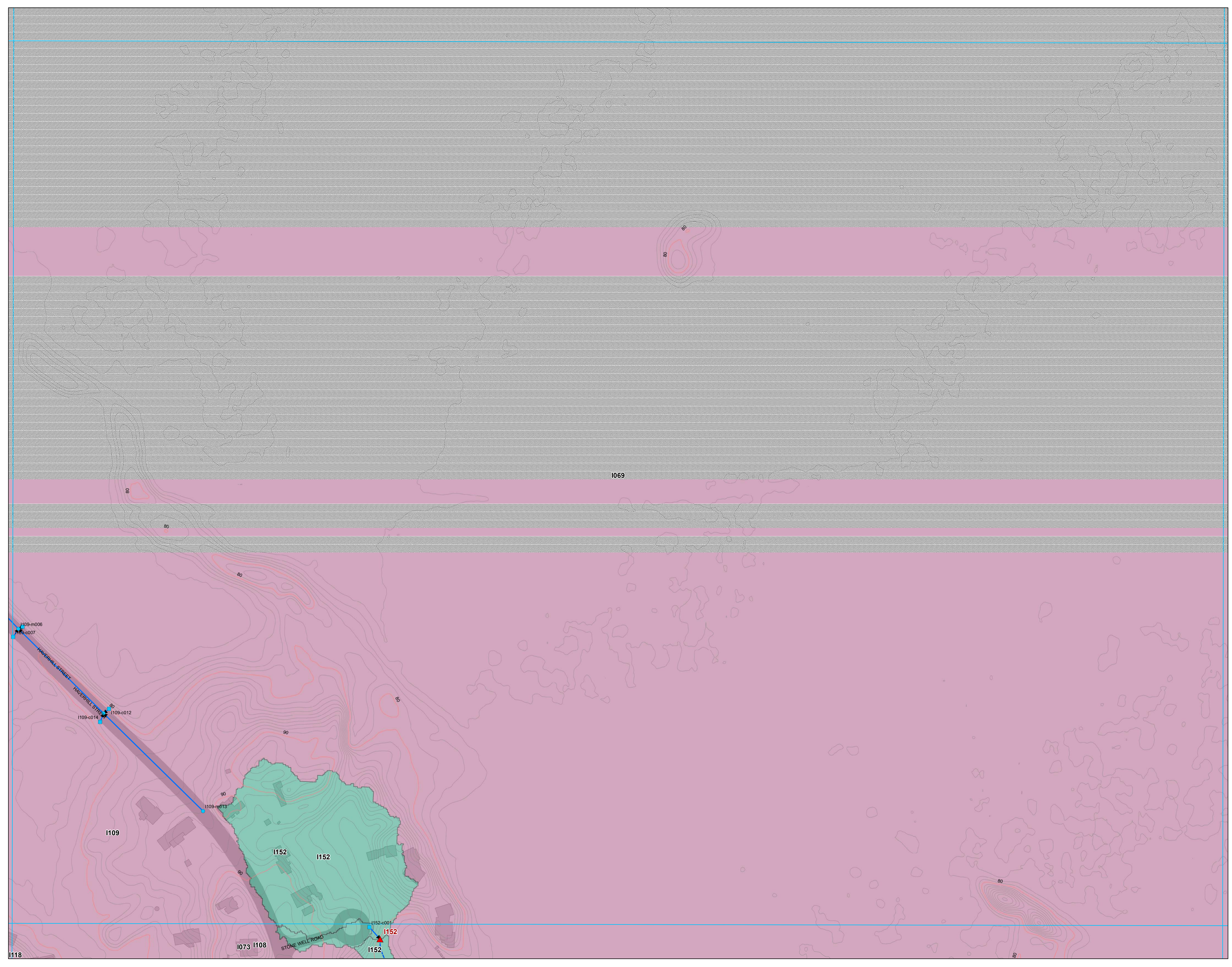
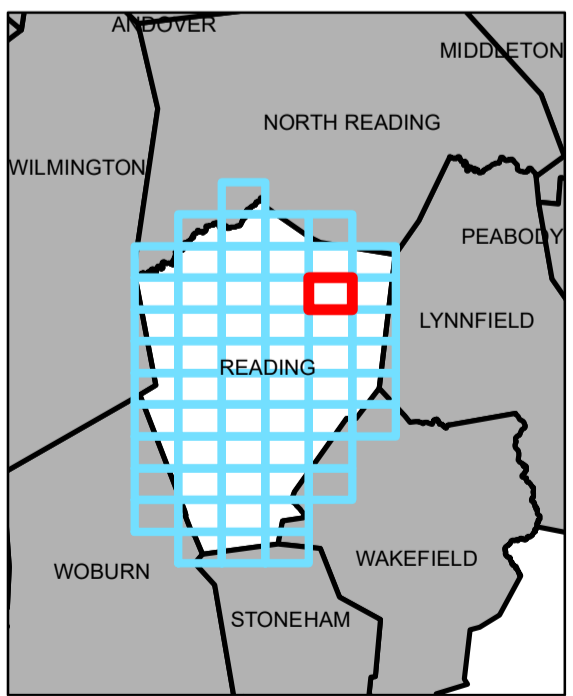


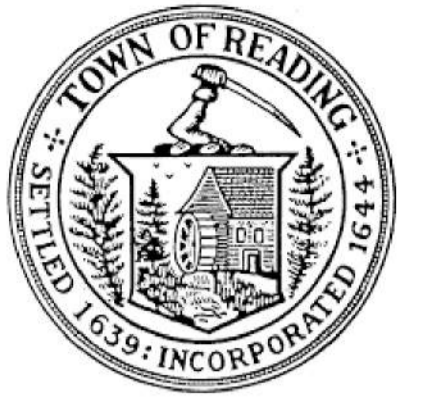
Legend

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-  swGravityMain
-  1 Ft
-  10 Ft
-  Atlas Grid












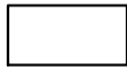


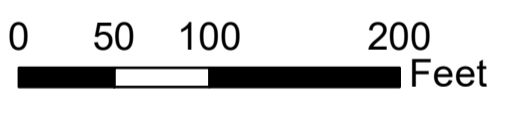
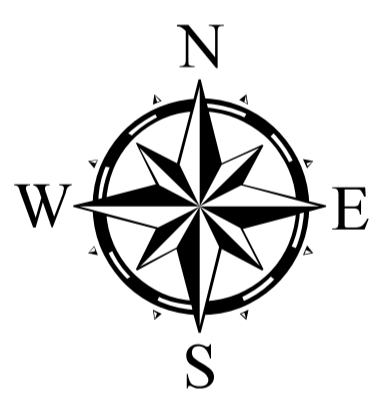
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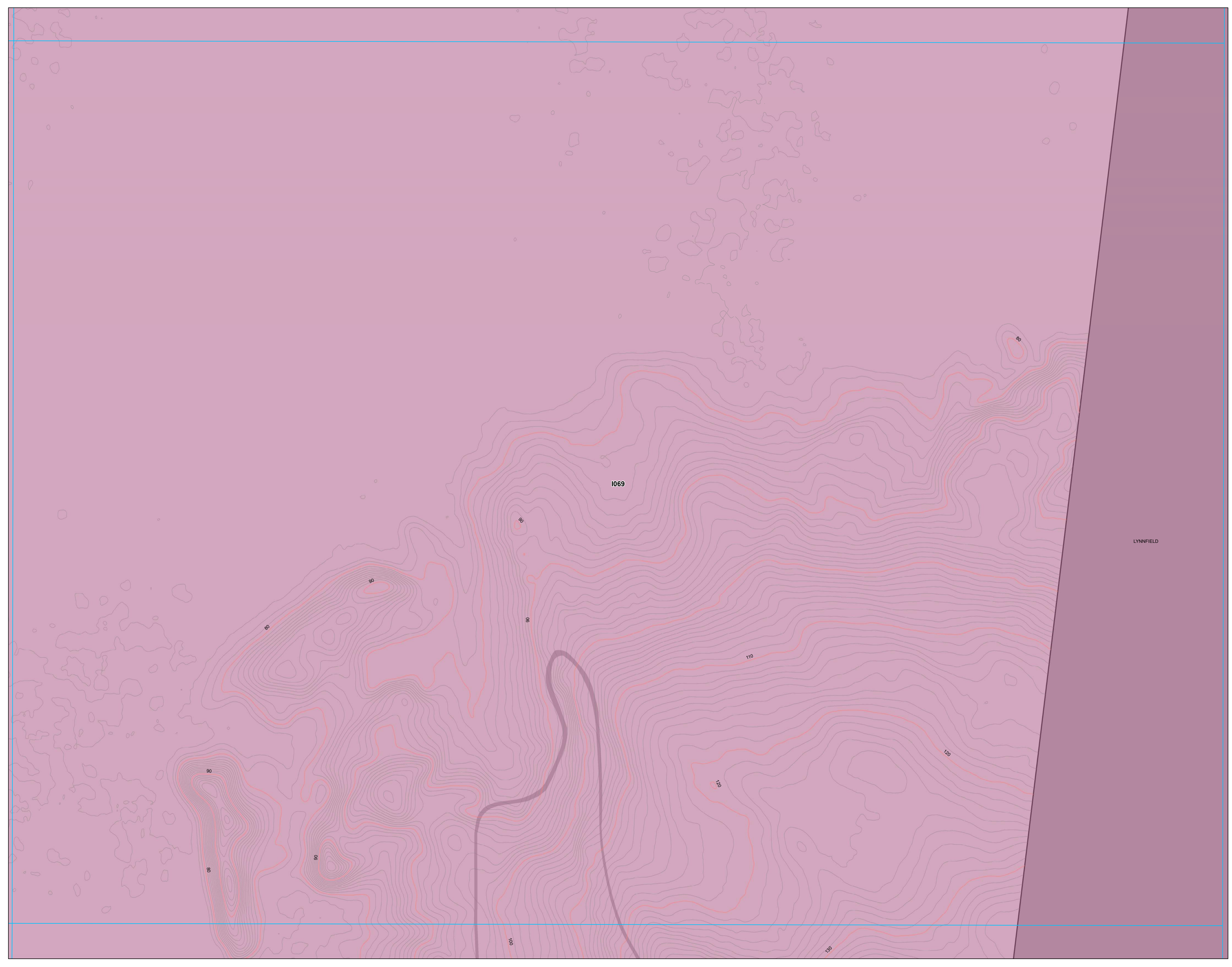
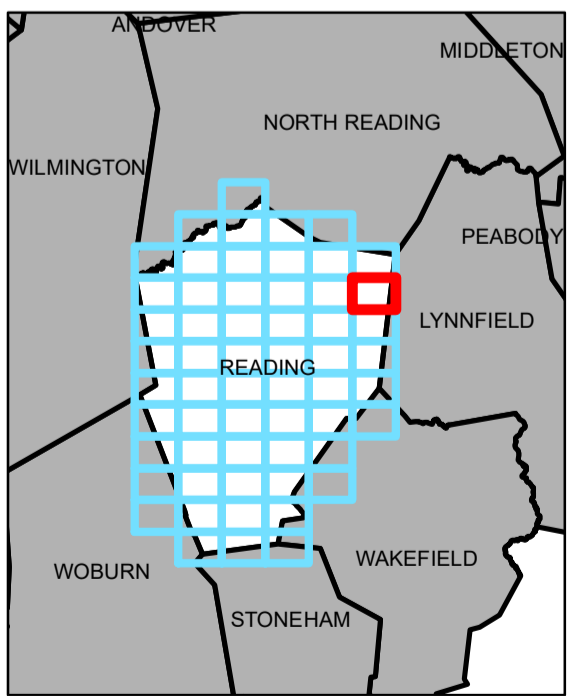


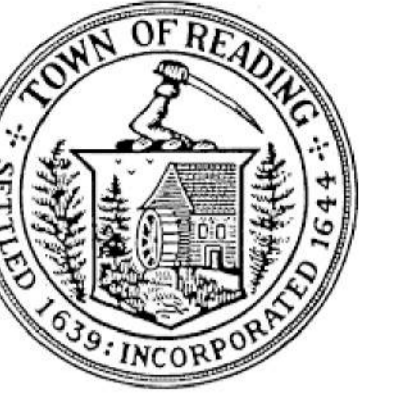
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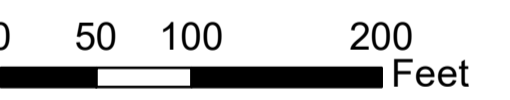
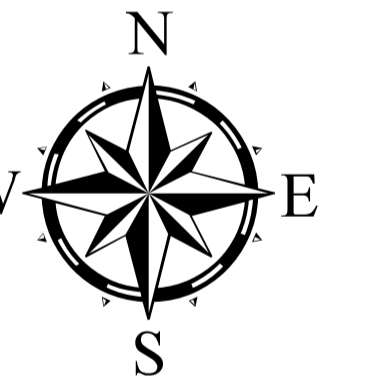
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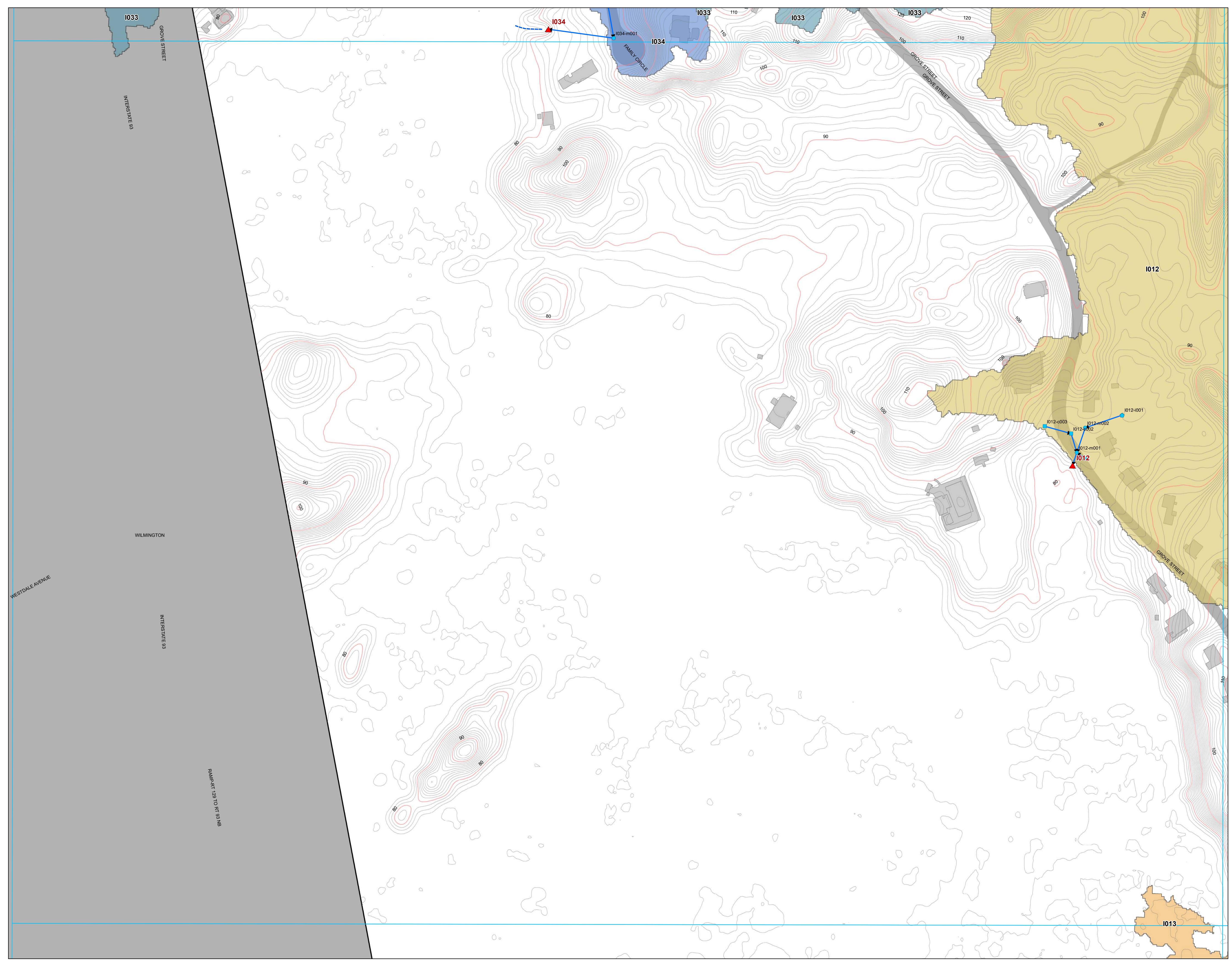


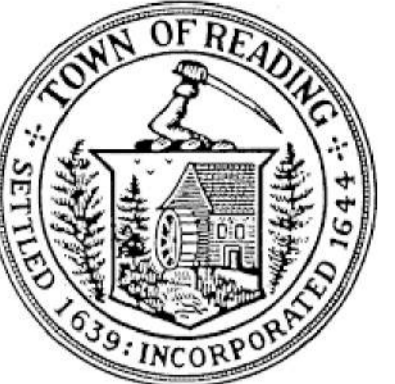
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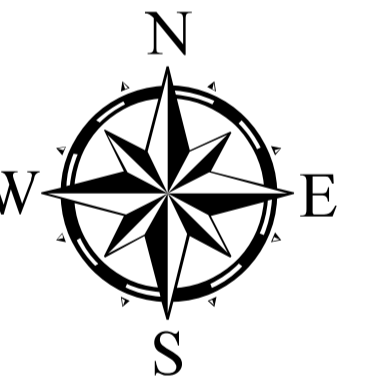
1 inch = 100 feet





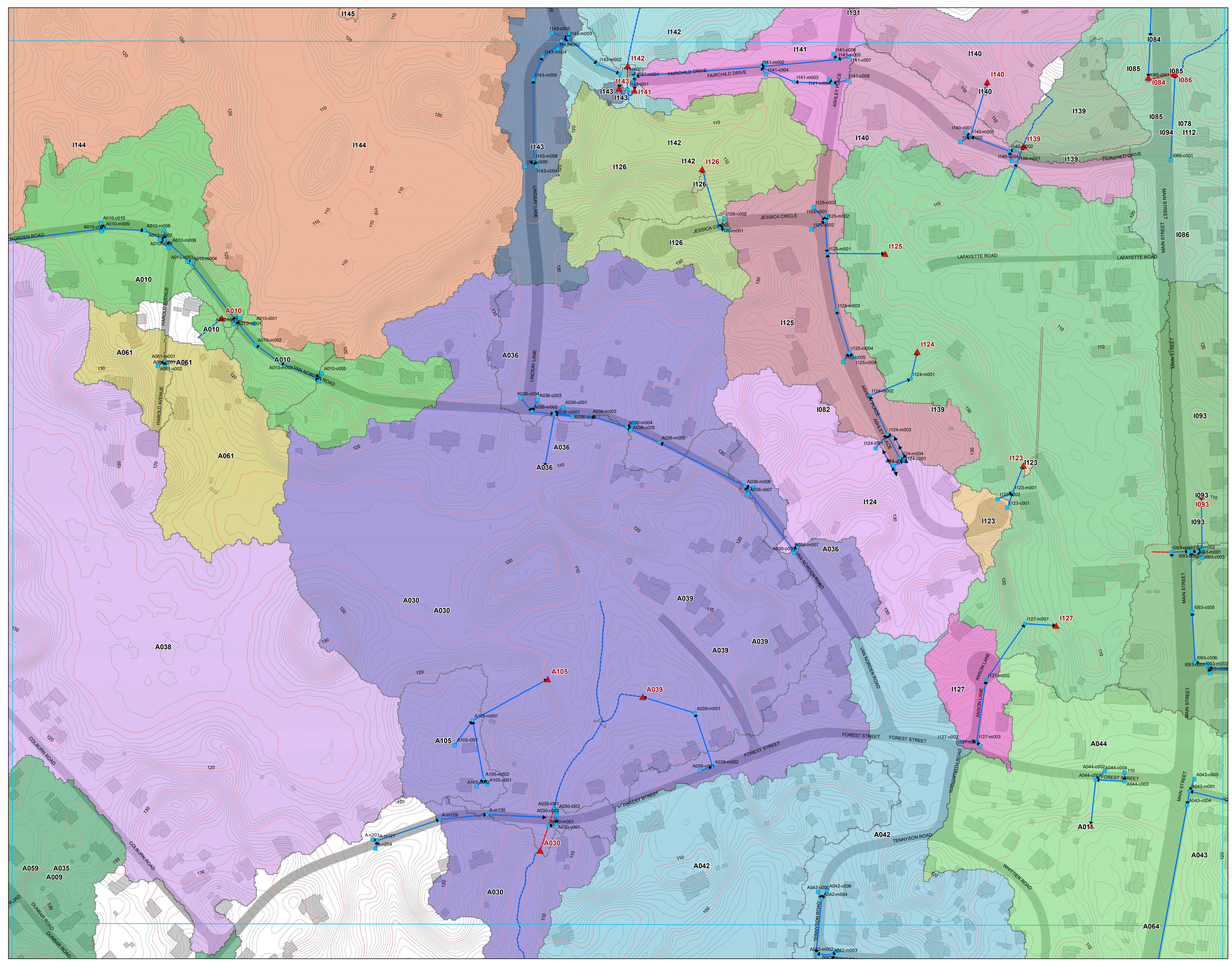
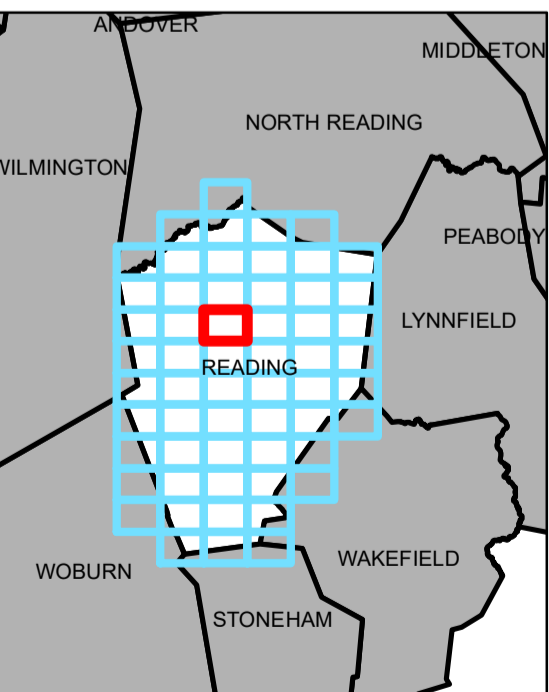
Legend

- Atlas Grid
- swDischargePoint
- swInlet
- swCatchBasin
- swManhole
- swPressurizedMain
- swOpenDrain
- swCulvert
- swGravityMain
- 1 Ft
- 10 Ft
- Atlas Grid



0 50 100 200 Feet

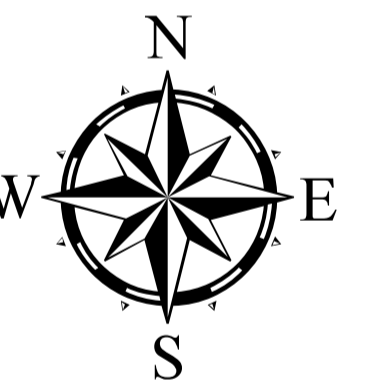
1 inch = 100 feet





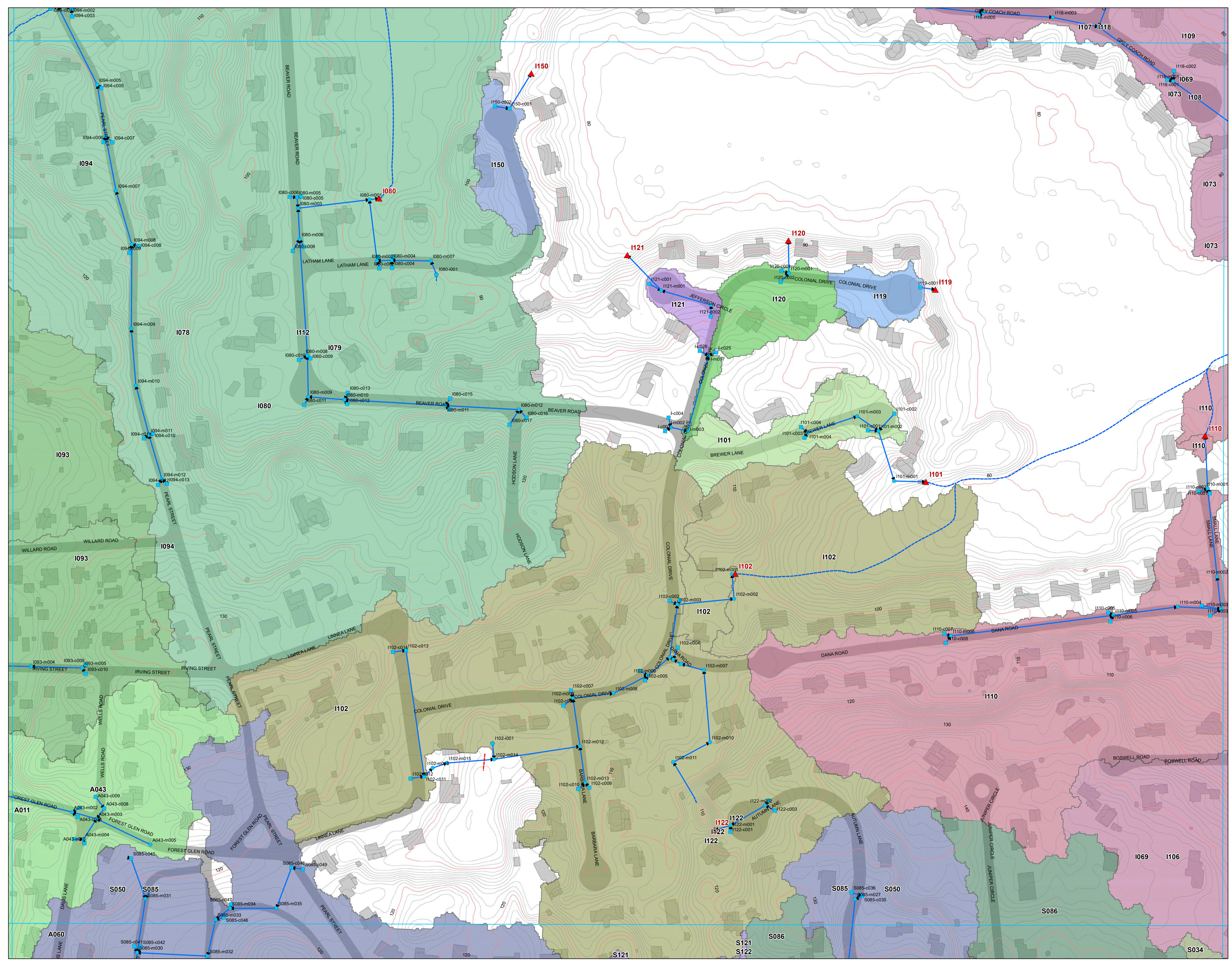
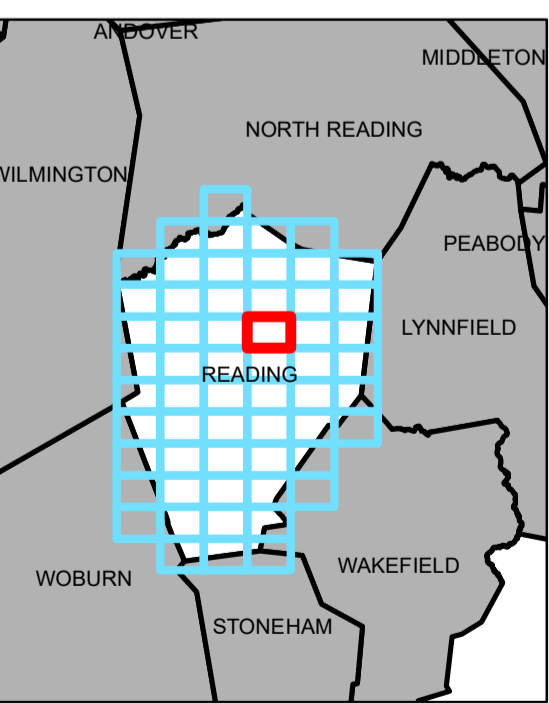
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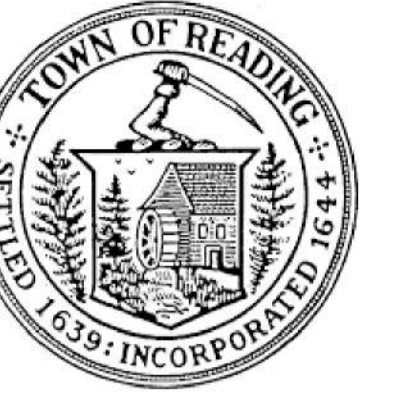
- Atlas Grid
- swDischargePoint
- swInlet
- swCatchBasin
- swManhole
- swPressurizedMain
- swOpenDrain
- swCulvert
- swGravityMain
- 1 Ft
- 10 Ft
- Atlas Grid



0 50 100 200 Feet

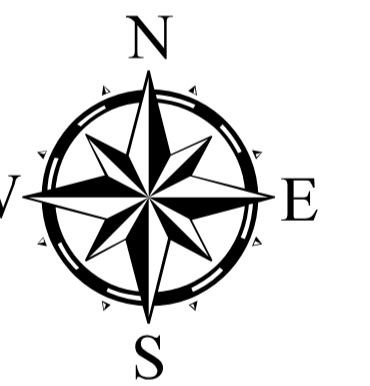
1 inch = 100 feet





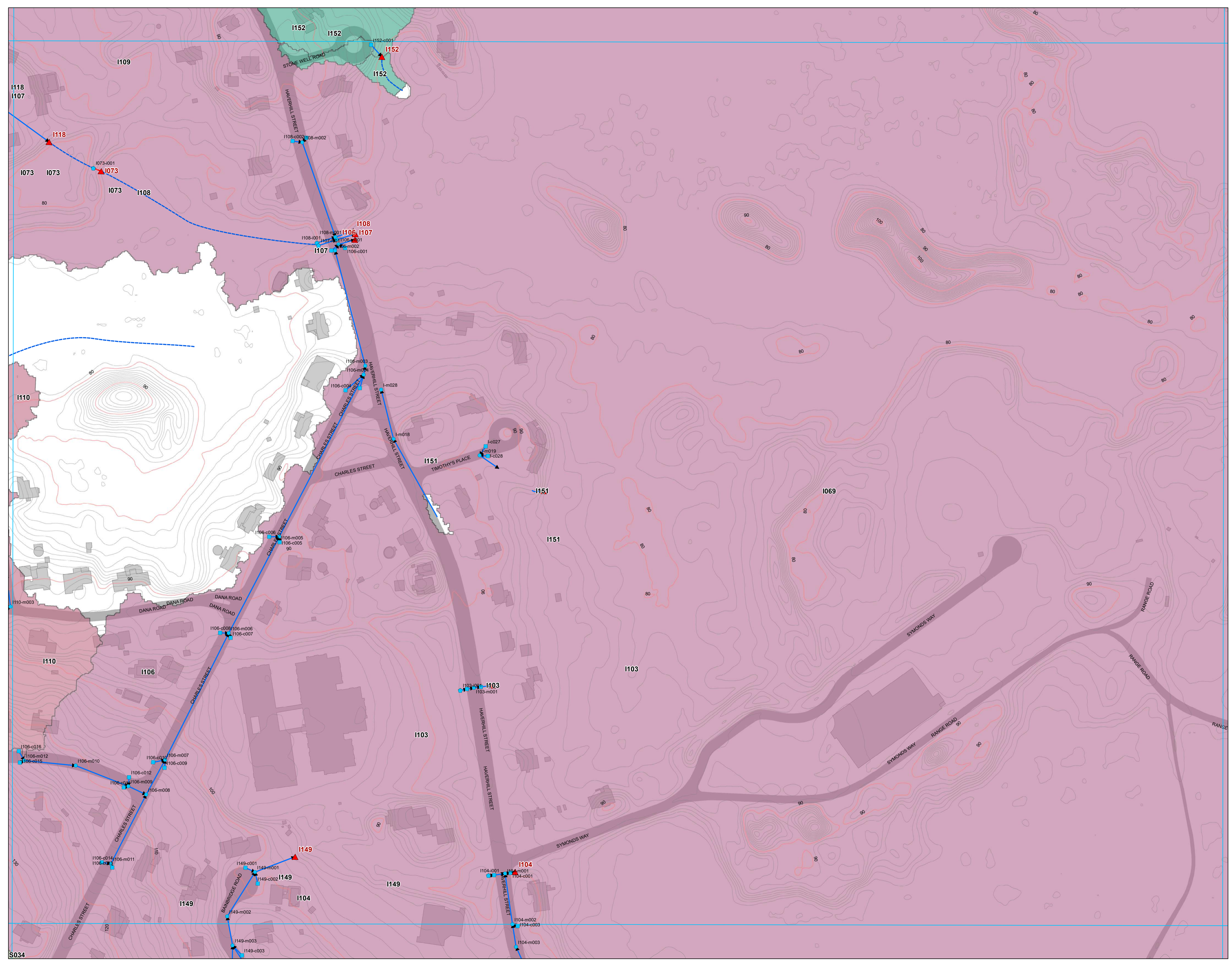
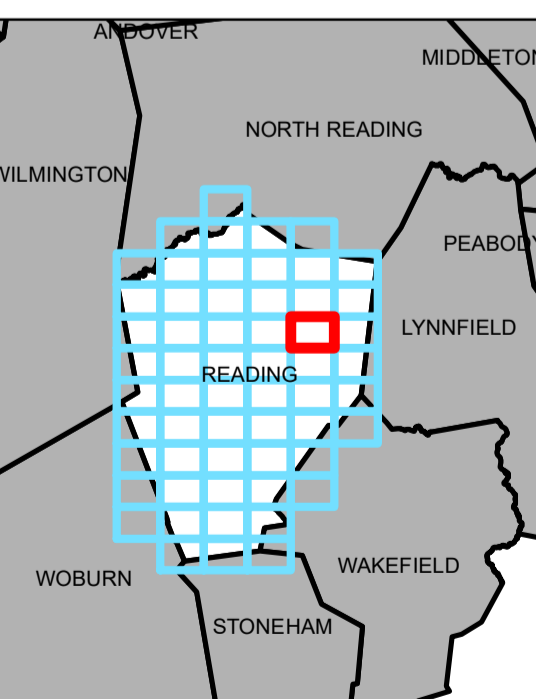
Legend

- Atlas Grid
- swDischargePoint
- swInlet
- swCatchBasin
- swManhole
- swPressurizedMain
- swOpenDrain
- swCulvert
- swGravityMain
- 1 Ft
- 10 Ft
- Atlas Grid














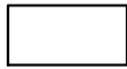
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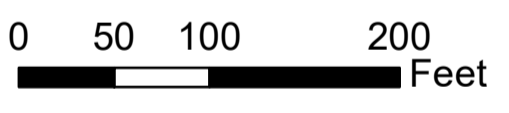
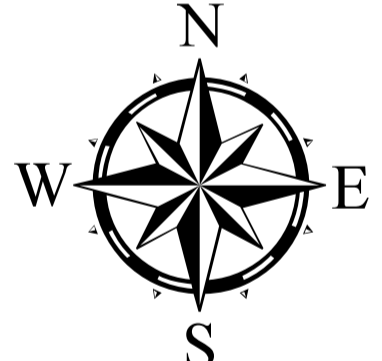
1 inch = 100 feet



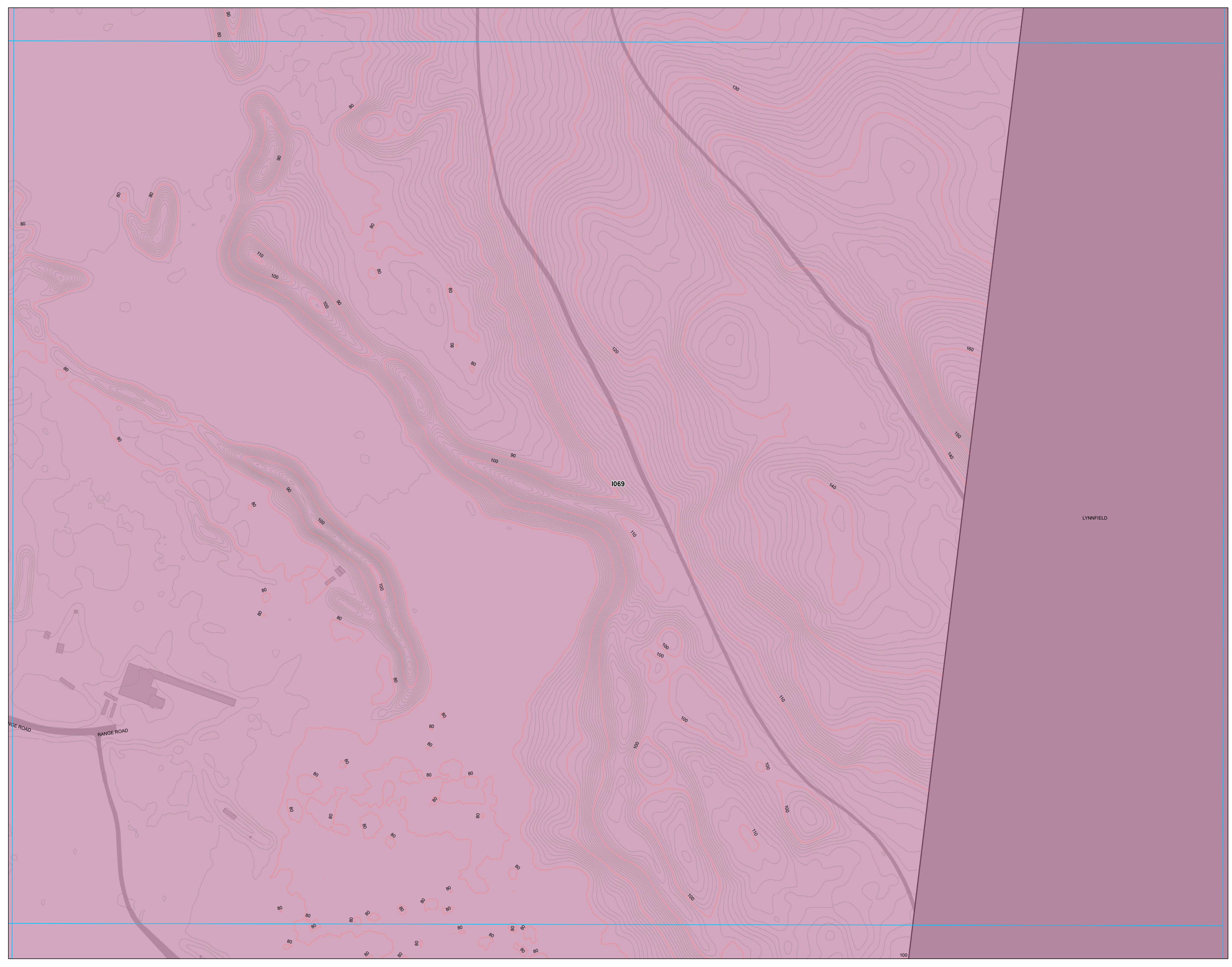
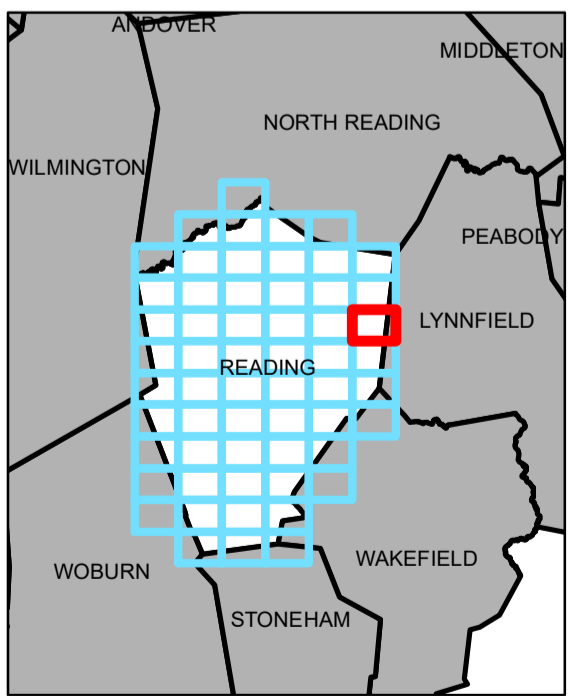


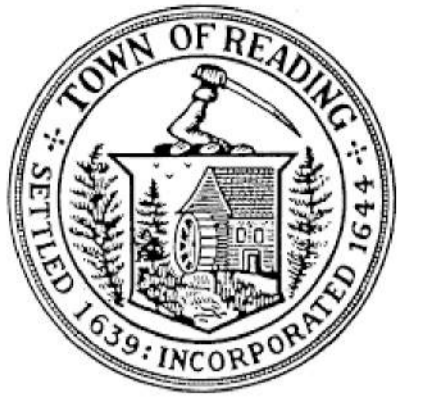
Legend

-  Atlas Grid
-  swDischargePoint
-  swInlet
-  swCatchBasin
-  swManhole
-  swPressurizedMain
-  swOpenDrain
-  swCulvert
-  swGravityMain
-  1 Ft
-  10 Ft
-  Atlas Grid



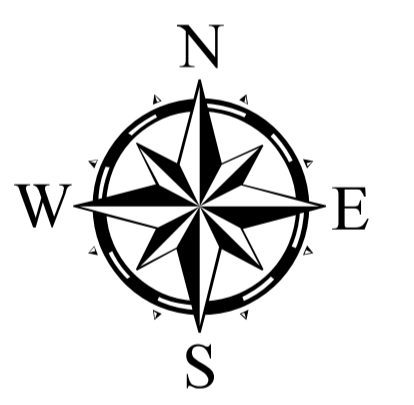
1 inch = 100 feet





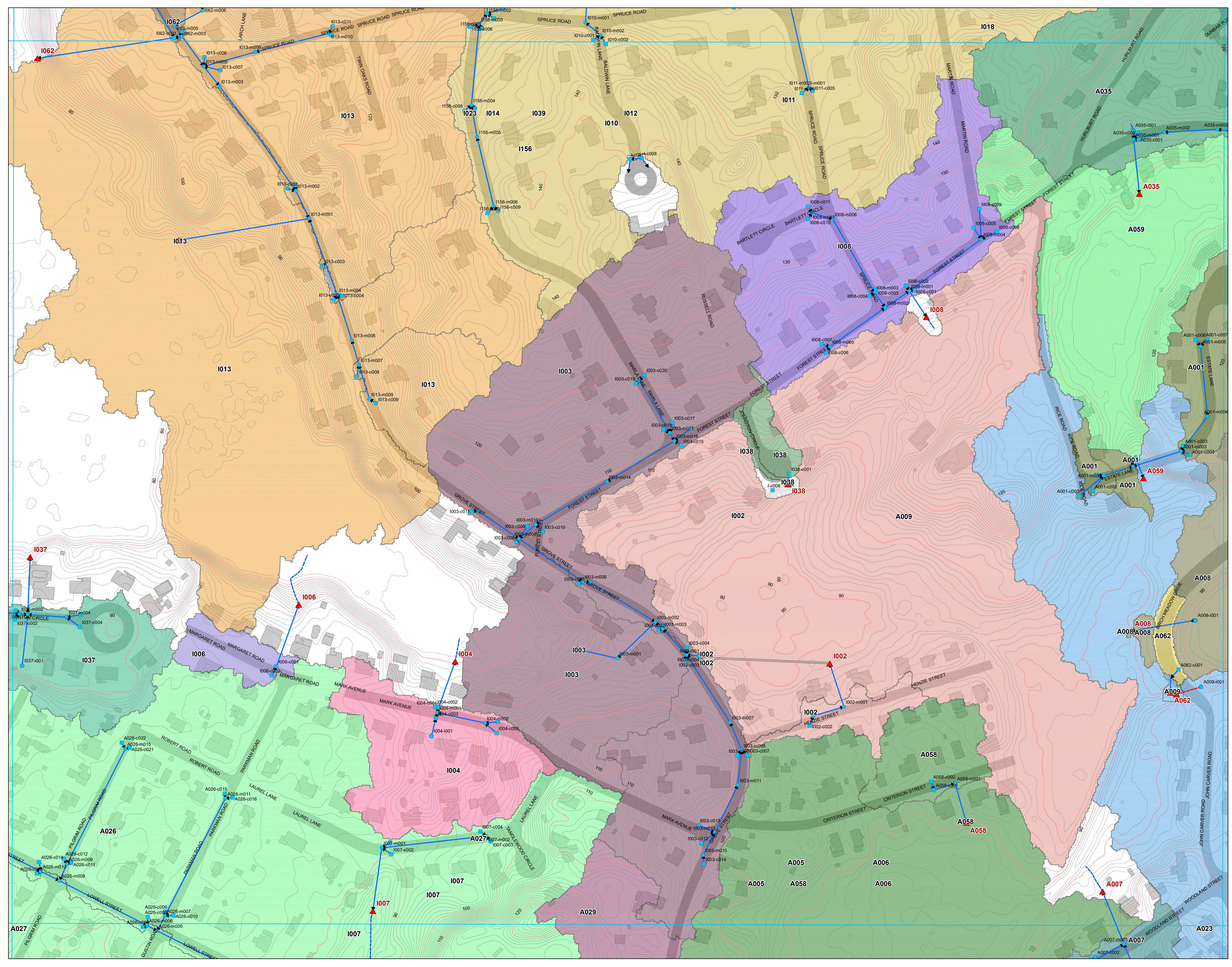
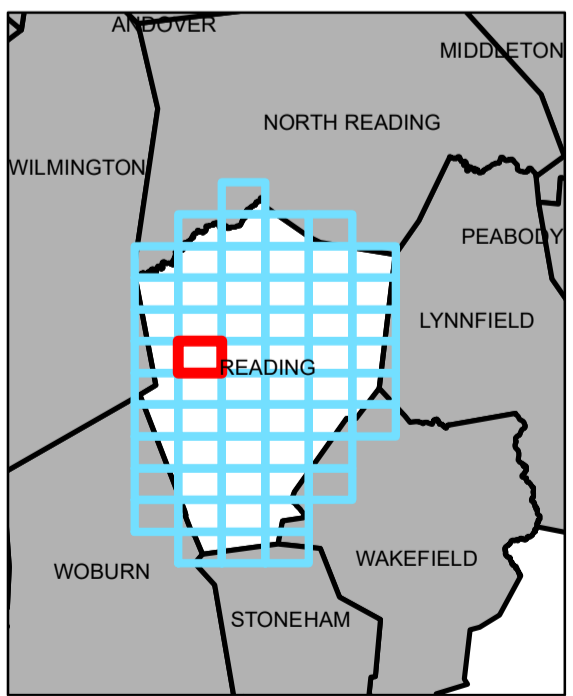
Legend

- Atlas Grid
- swDischargePoint
- swInlet
- swCatchBasin
- swManhole
- swPressurizedMain
- swOpenDrain
- swCulvert
- swGravityMain
- 1 Ft
- 10 Ft
- Atlas Grid



0 50 100 200 Feet

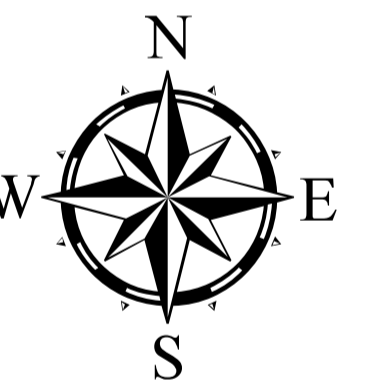
1 inch = 100 feet





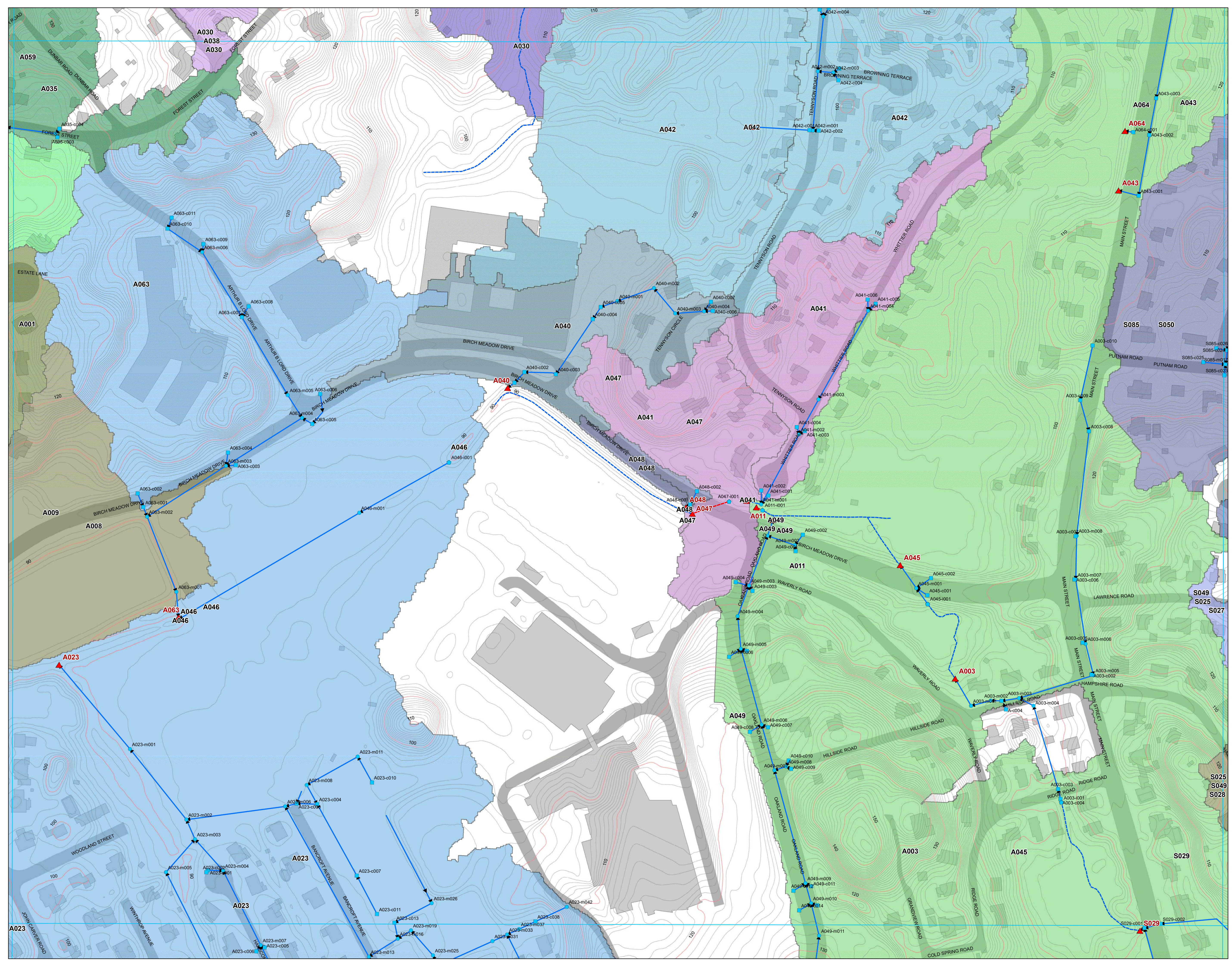
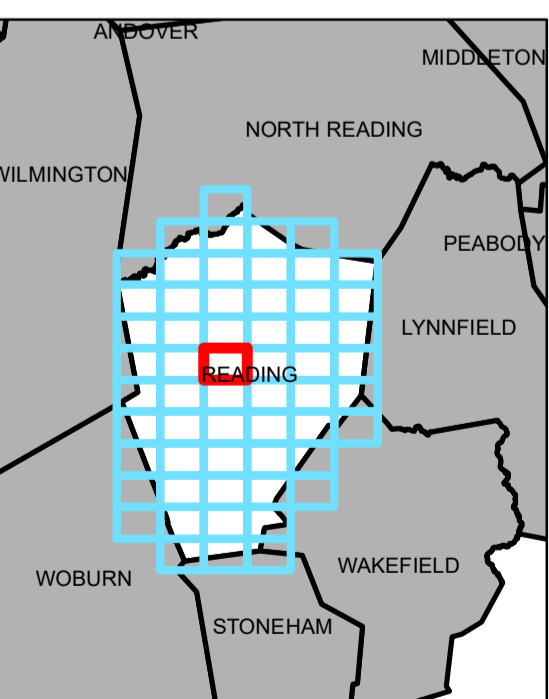
Legend

- Atlas Grid
- swDischargePoint
- swInlet
- swCatchBasin
- swManhole
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- swOpenDrain
- swCulvert
- swGravityMain
- 1 Ft
- 10 Ft
- Atlas Grid



0 50 100 200 Feet

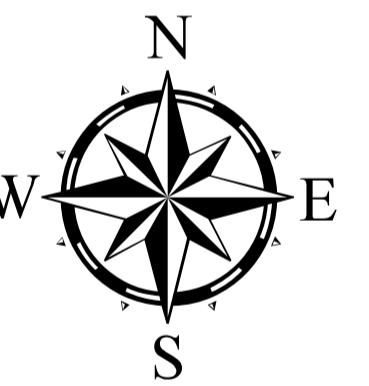
1 inch = 100 feet





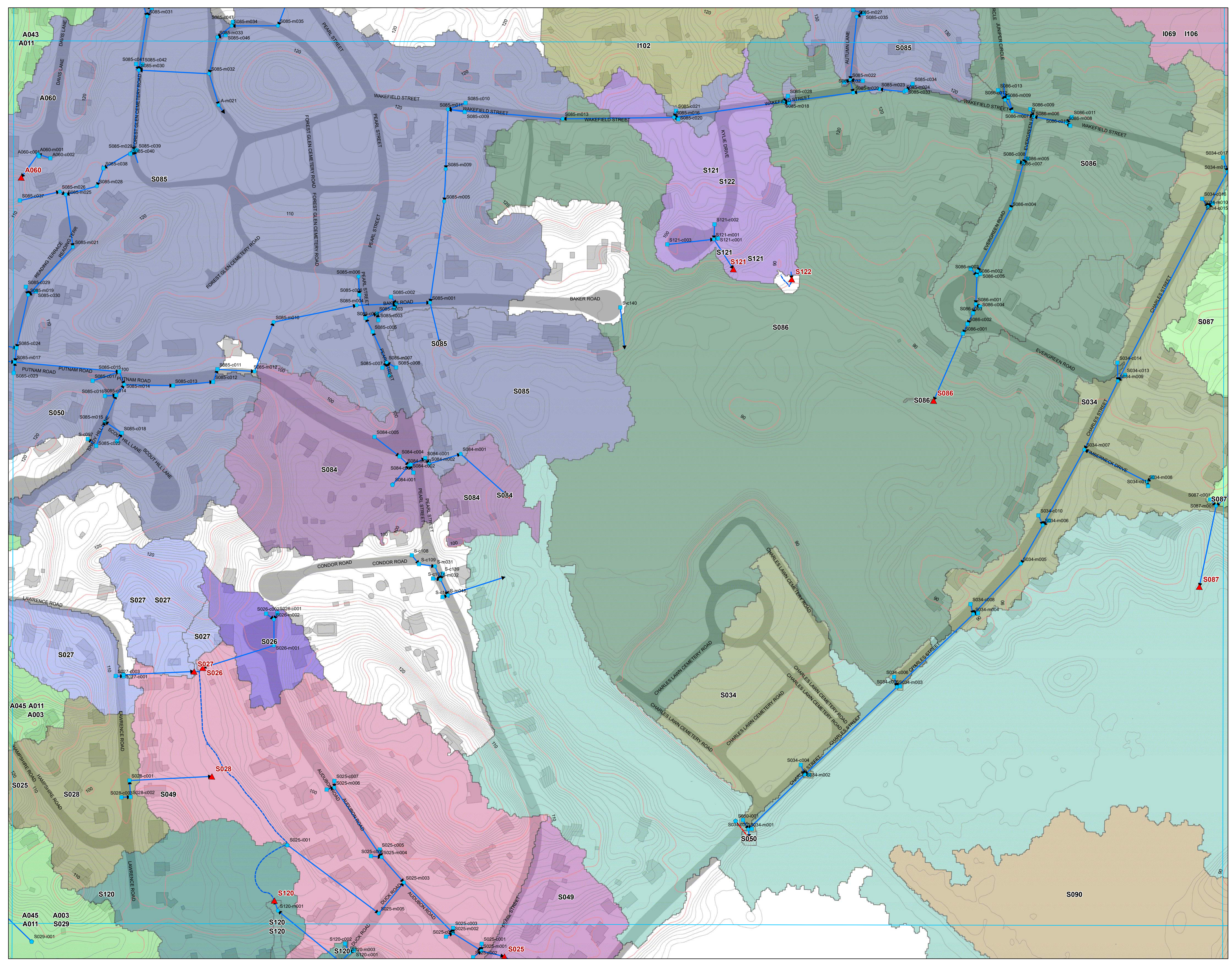
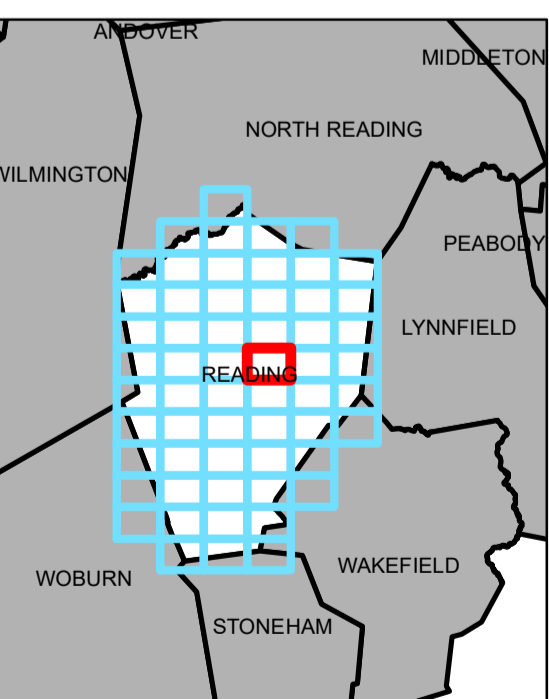
Legend

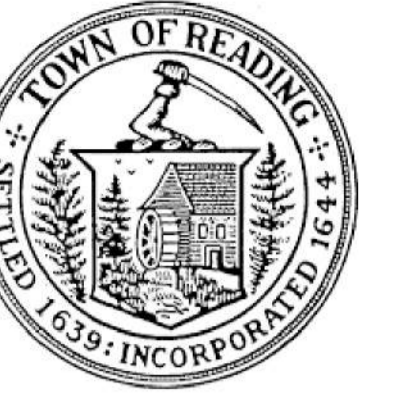
- Atlas Grid
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- swCulvert
- swGravityMain
- 1 Ft
- 10 Ft
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0 50 100 200 Feet

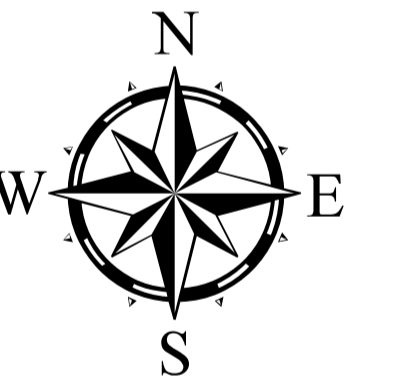
1 inch = 100 feet





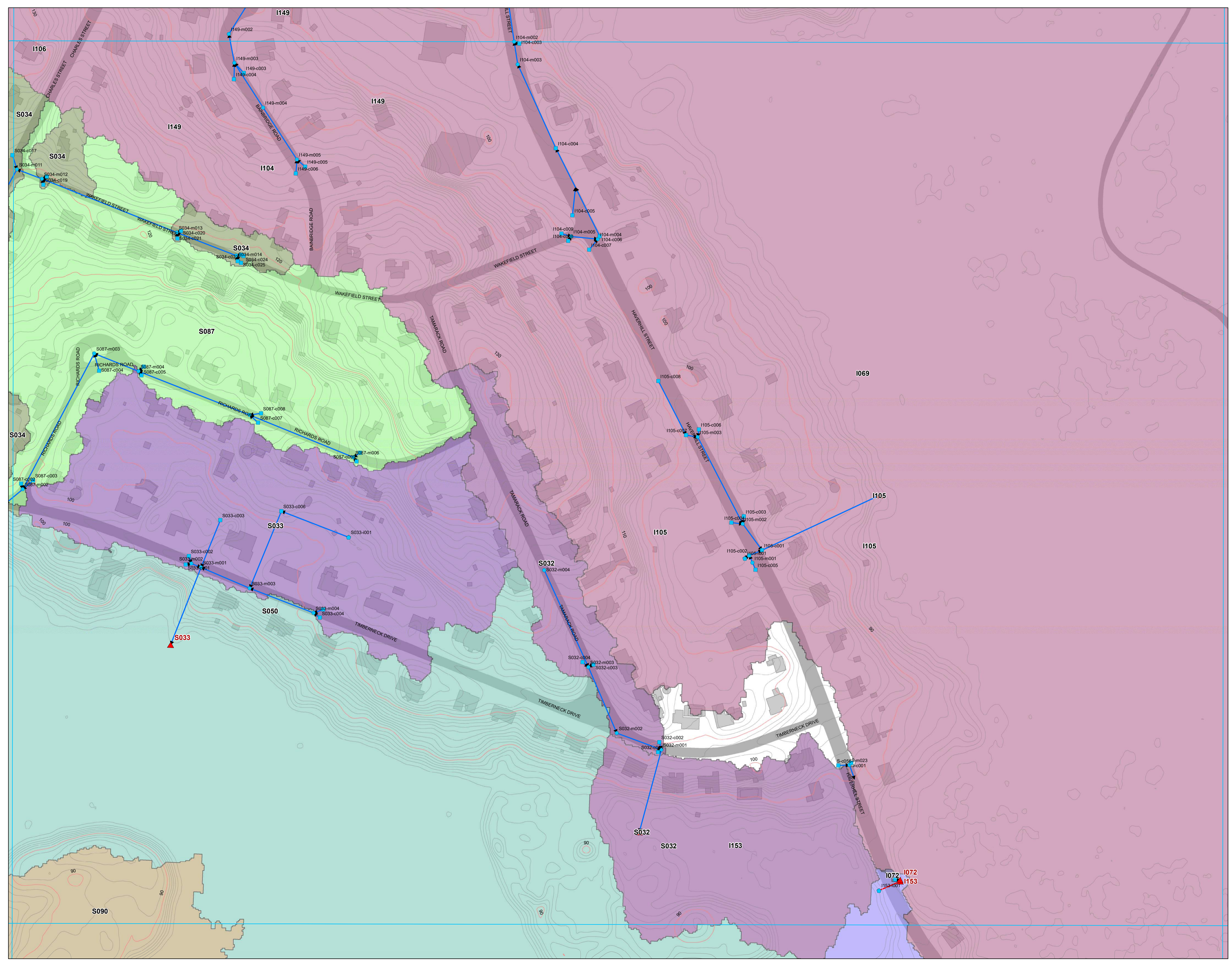
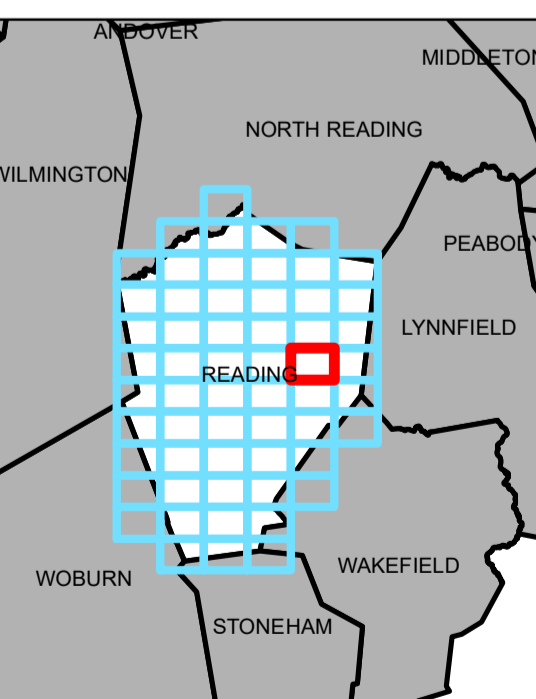
Legend

- Atlas Grid
- swDischargePoint
- swInlet
- swCatchBasin
- swManhole
- swPressurizedMain
- swOpenDrain
- swCulvert
- swGravityMain
- 1 Ft
- 10 Ft
- Atlas Grid



0 50 100 200 Feet

1 inch = 100 feet





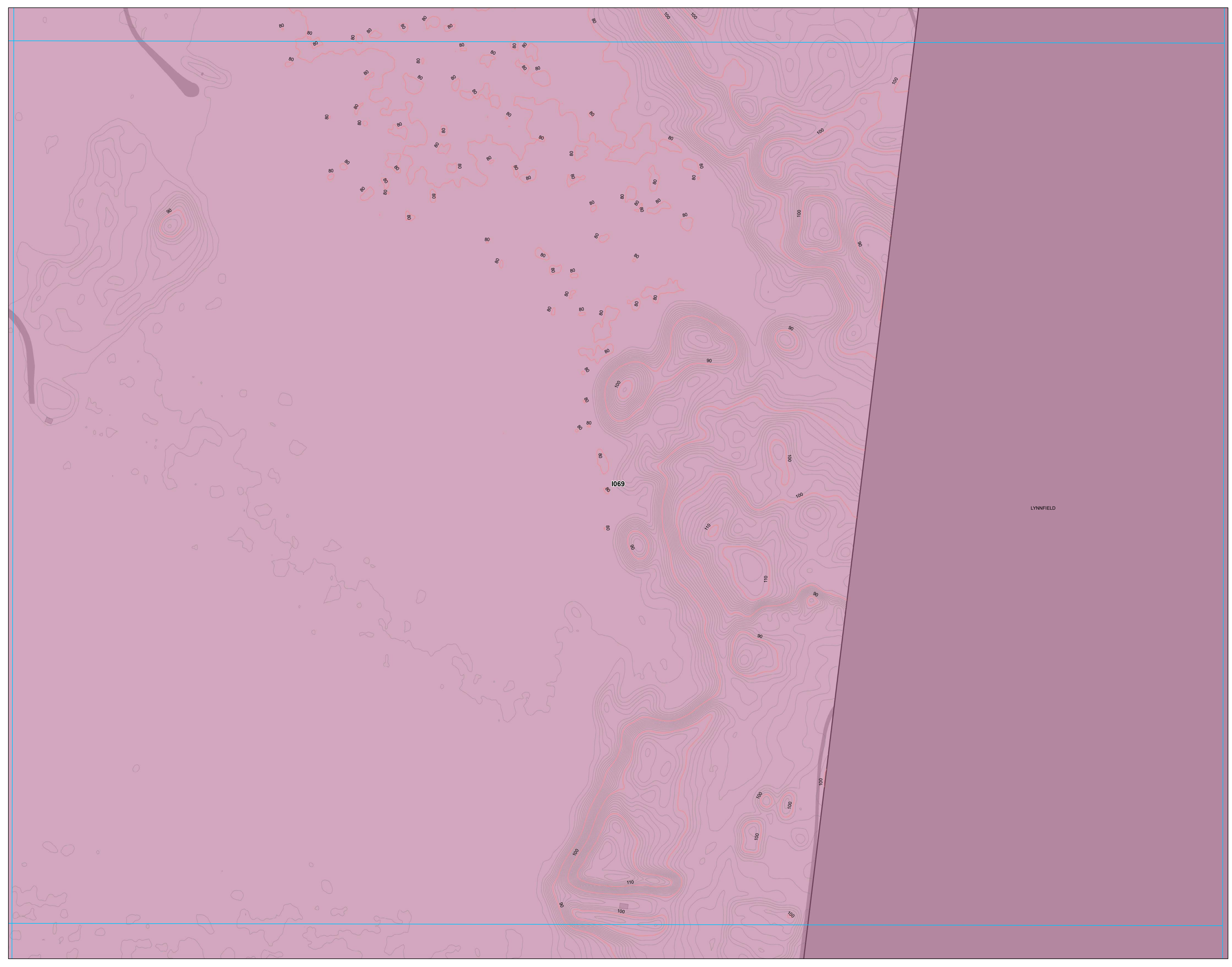
Legend

- Atlas Grid
- swDischargePoint
- swInlet
- swCatchBasin
- swManhole
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- swOpenDrain
- swCulvert
- swGravityMain
- 1 Ft
- 10 Ft
- Atlas Grid



0 50 100 200 Feet

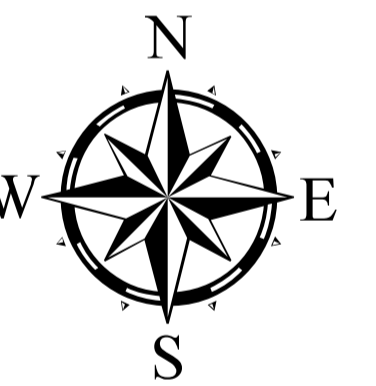
1 inch = 100 feet





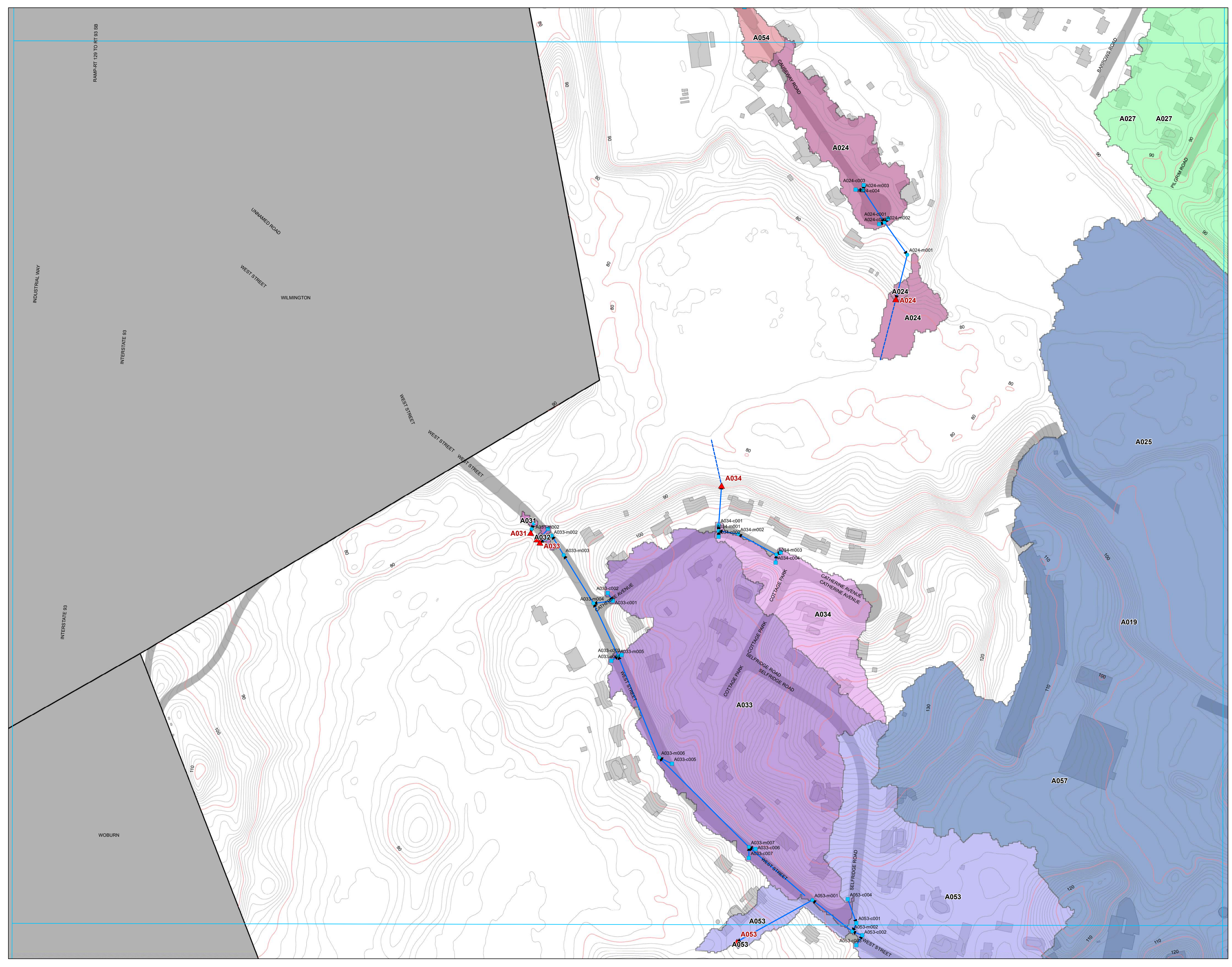
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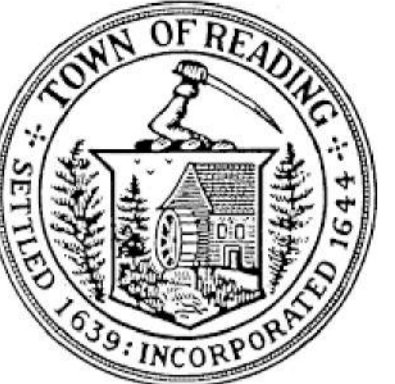
- Atlas Grid
- swDischargePoint
- swInlet
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- swGravityMain
- 1 Ft
- 10 Ft
- Atlas Grid



0 50 100 200 Feet

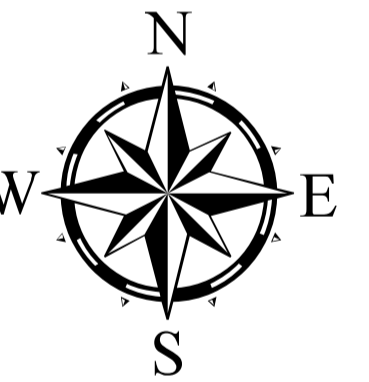
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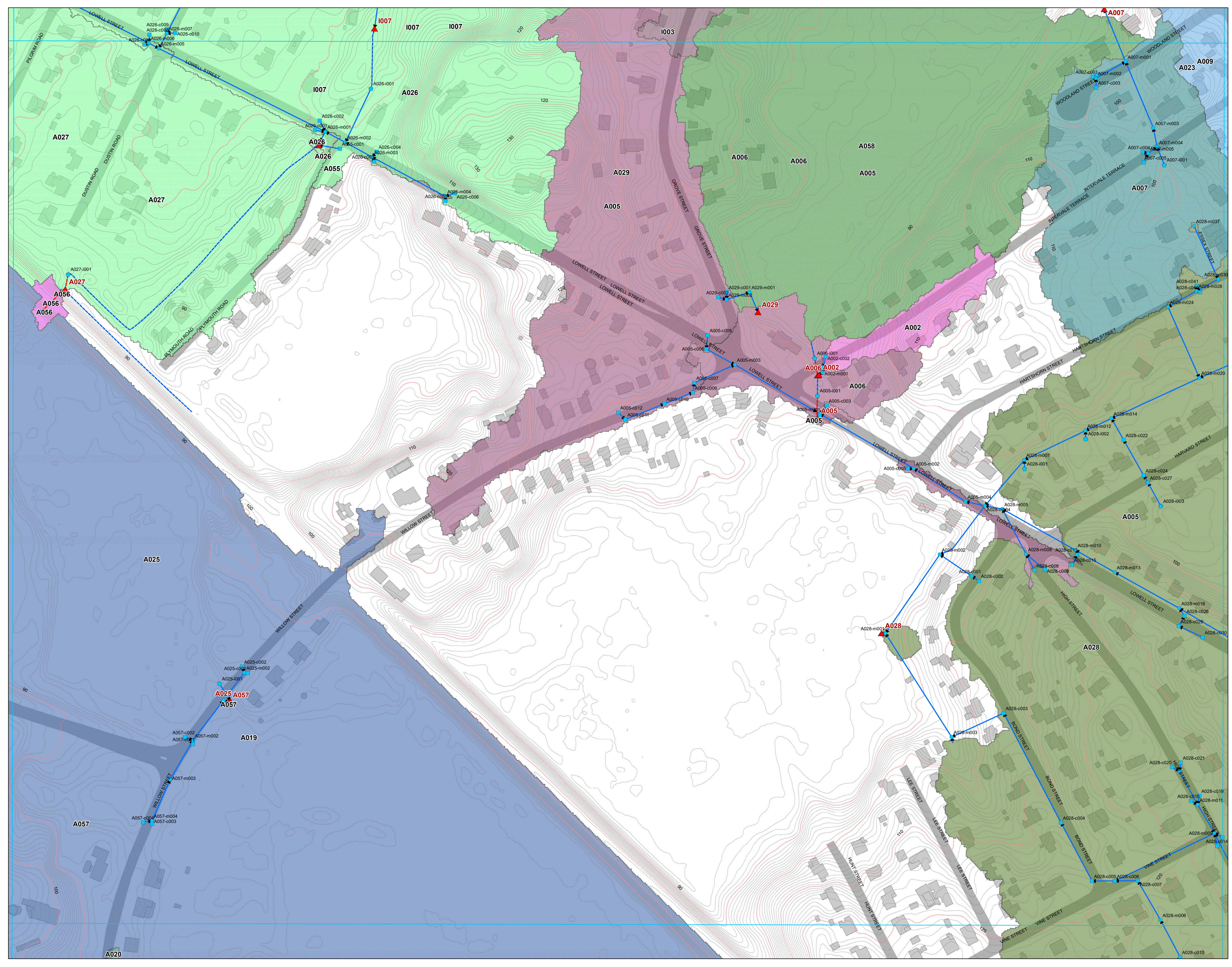
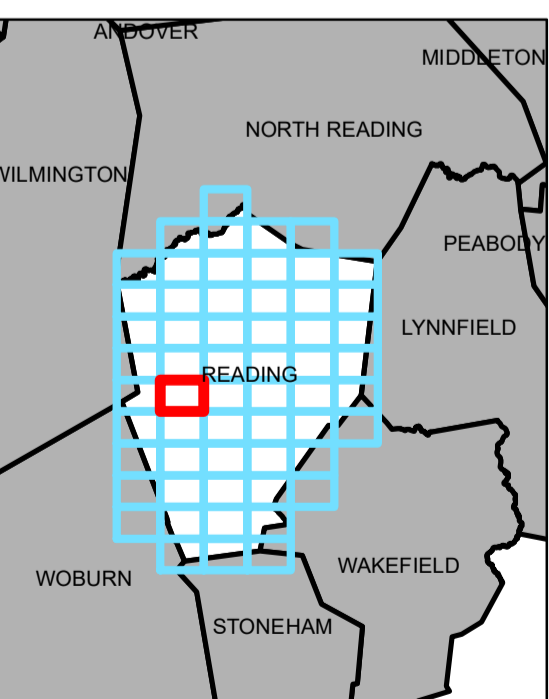
Legend

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- swDischargePoint
- swInlet
- swCatchBasin
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- swCulvert
- swGravityMain
- 1 Ft
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- Atlas Grid



0 50 100 200 Feet

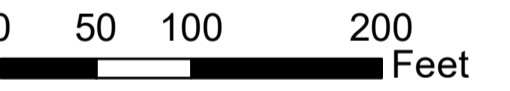
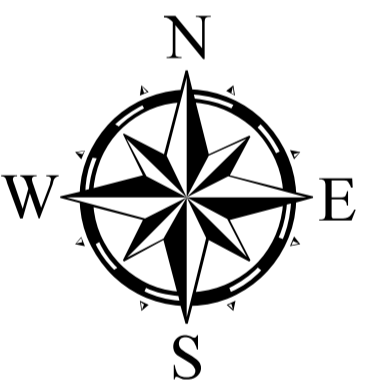
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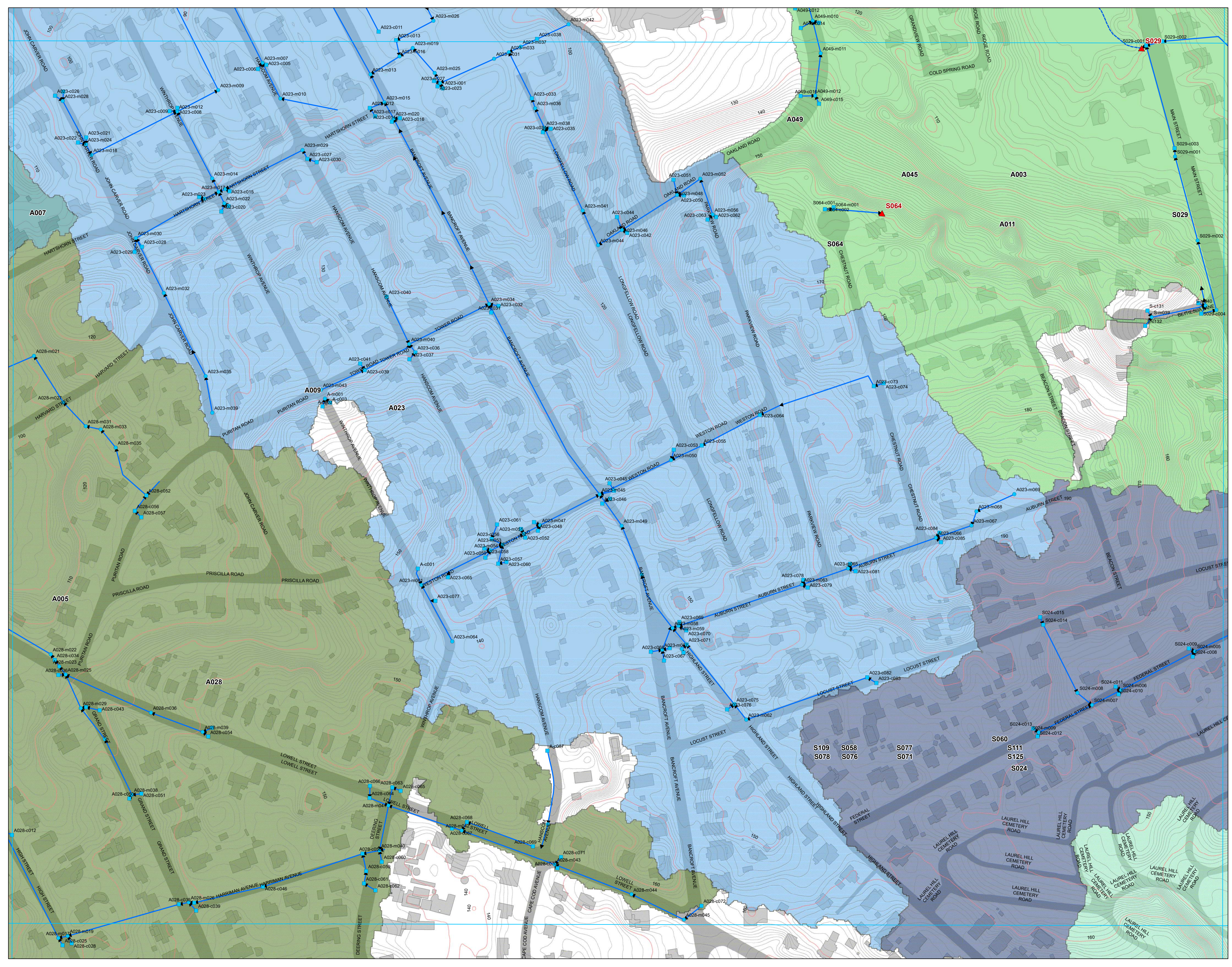
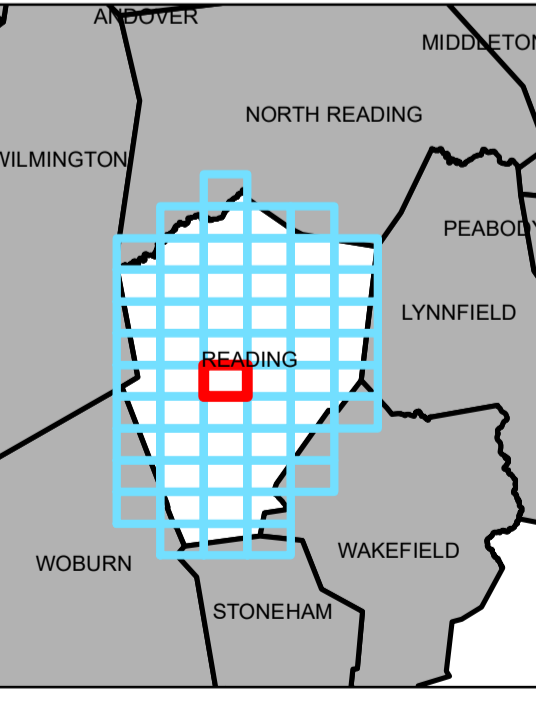


Legend

- Atlas Grid
- swDischargePoint
- swInlet
- swCatchBasin
- swManhole
- swPressurizedMain
- swOpenDrain
- swCulvert
- swGravityMain
- 1 Ft
- 10 Ft
- Atlas Grid



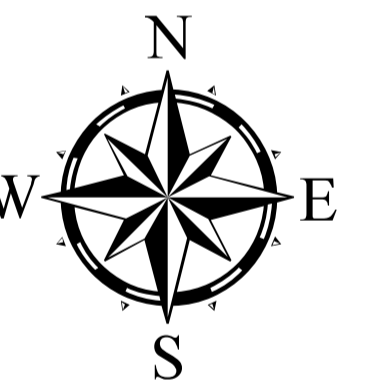
1 inch = 100 feet





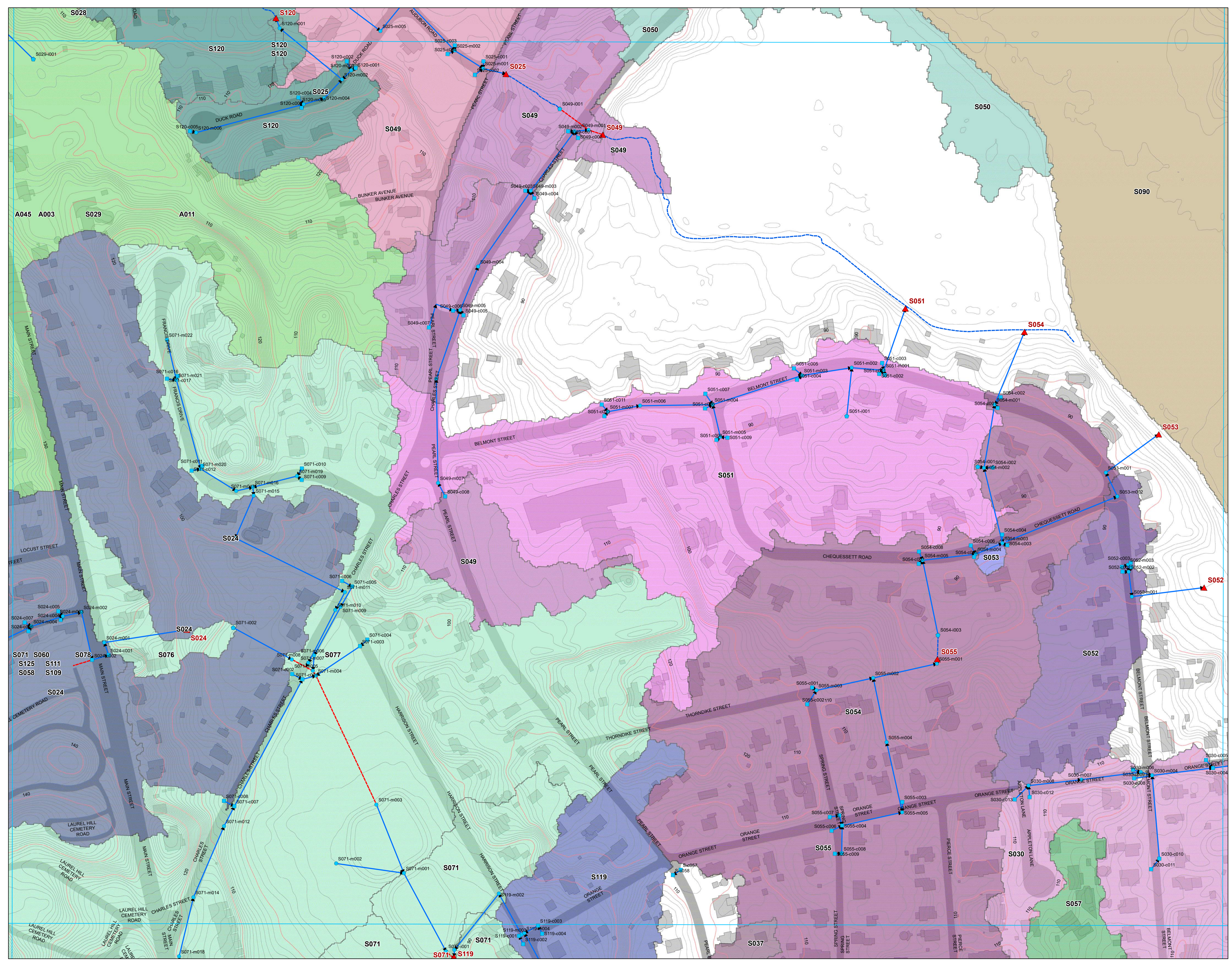
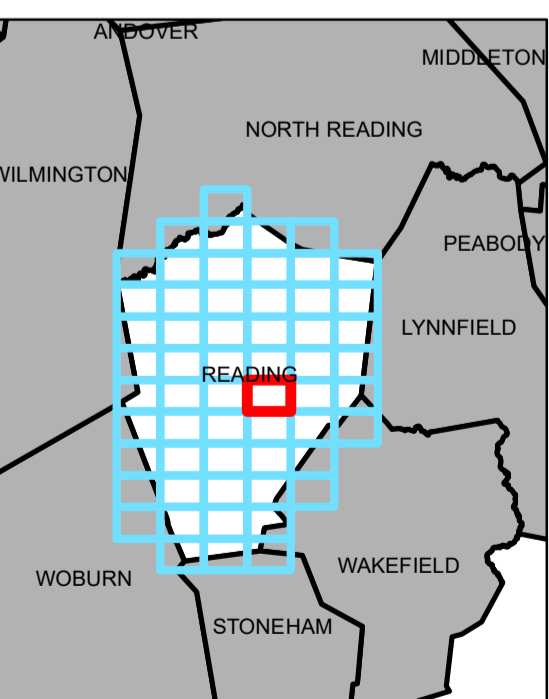
Legend

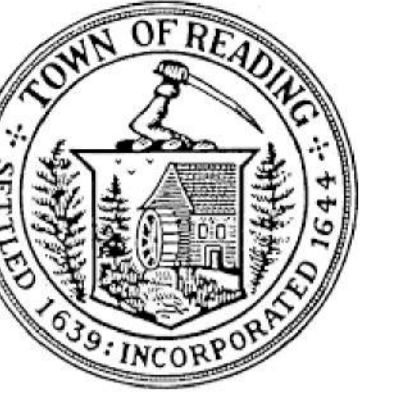
- Atlas Grid
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- swGravityMain
- 1 Ft
- 10 Ft
- Atlas Grid



0 50 100 200 Feet

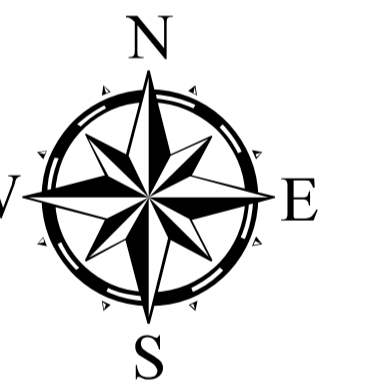
1 inch = 100 feet





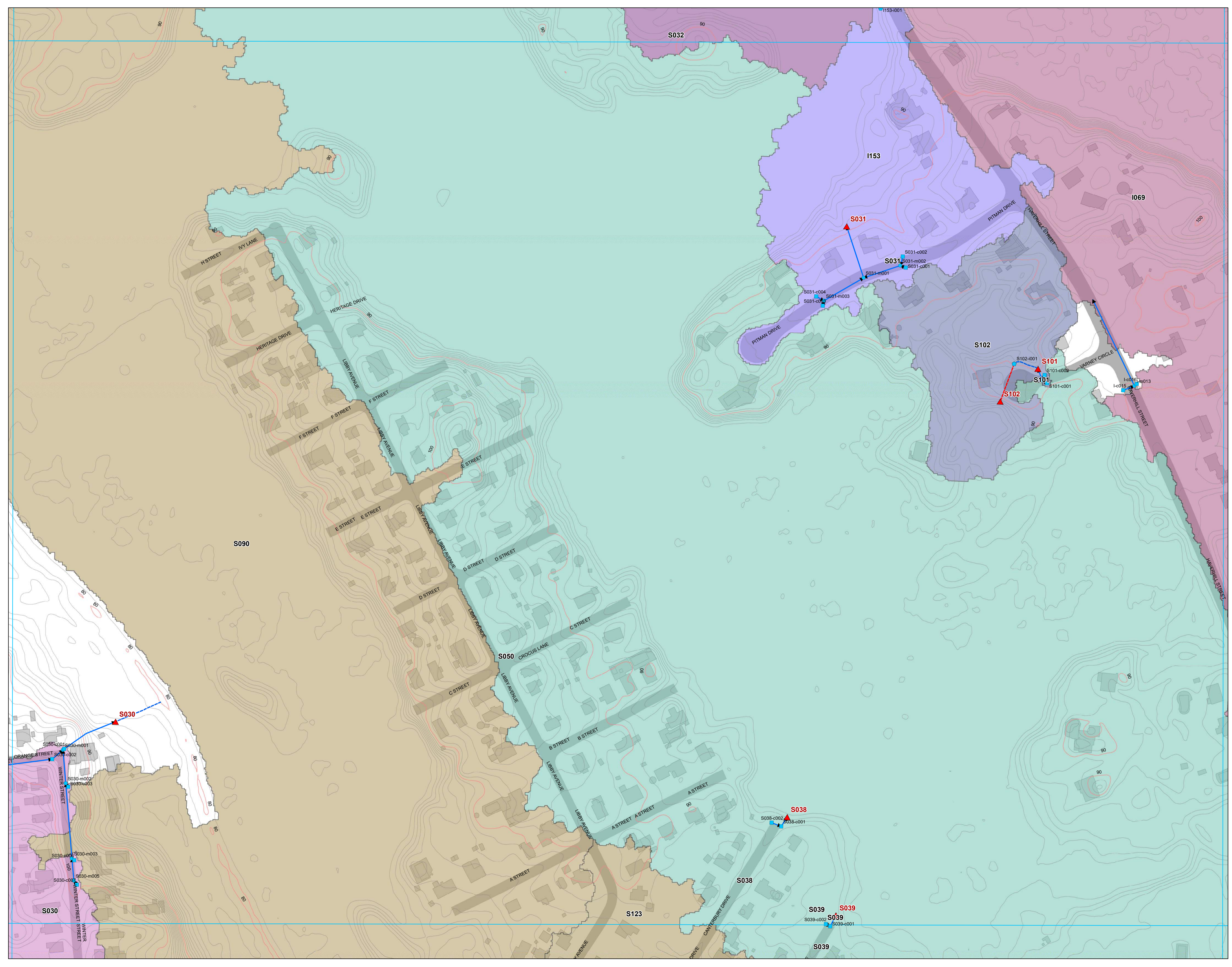
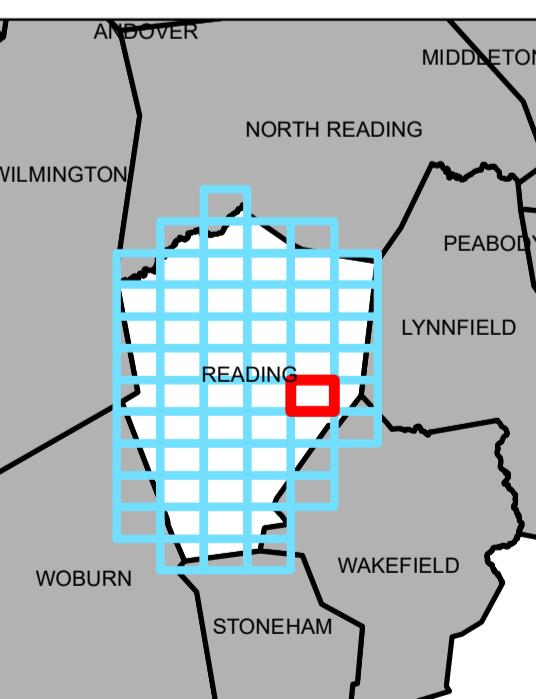
Legend

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- 1 Ft
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0 50 100 200 Feet

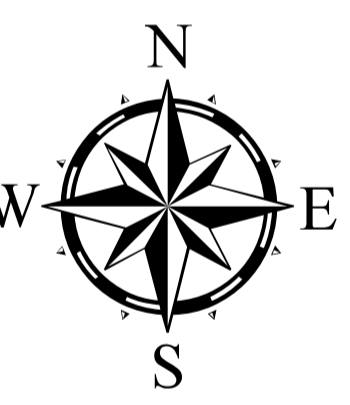
1 inch = 100 feet





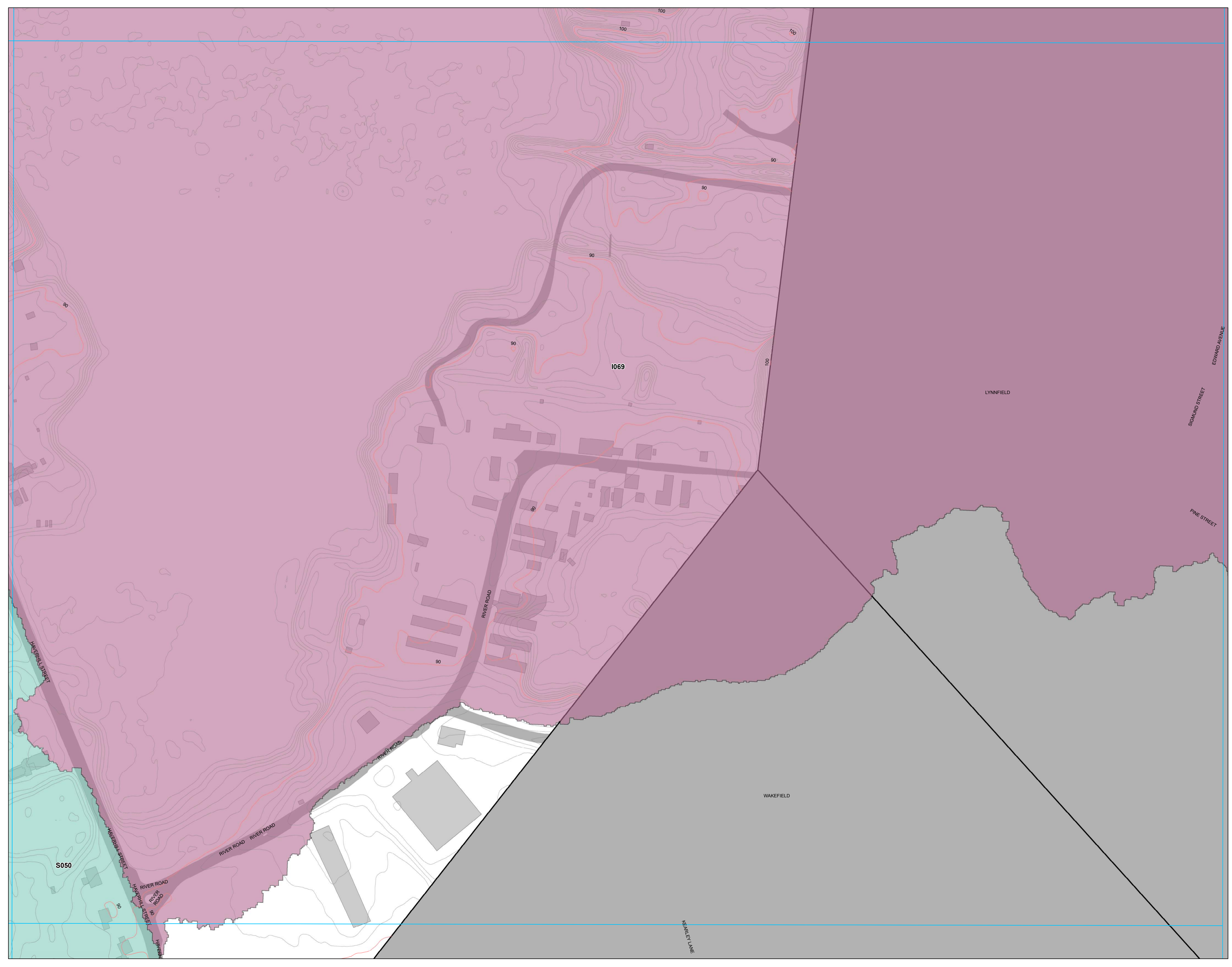
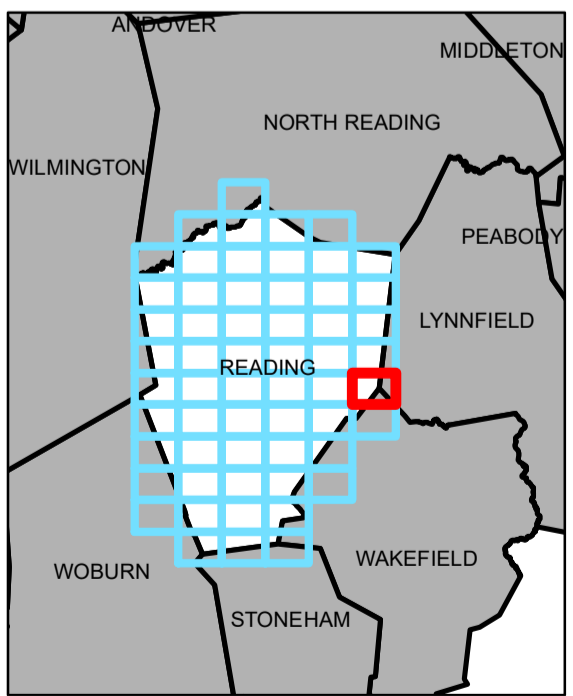
Legend

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0 50 100 200 Feet

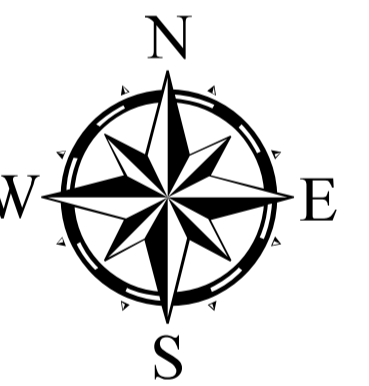
1 inch = 100 feet





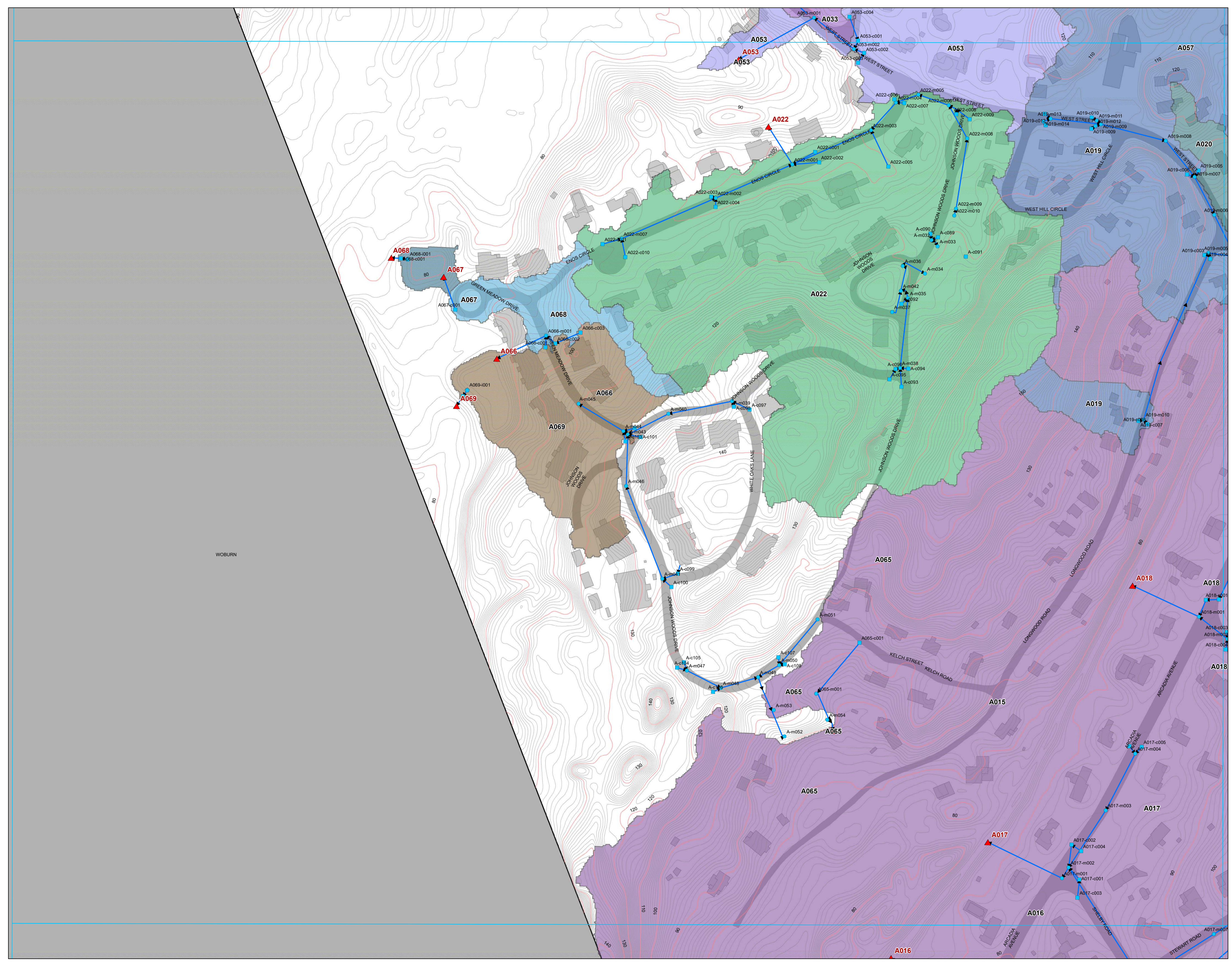
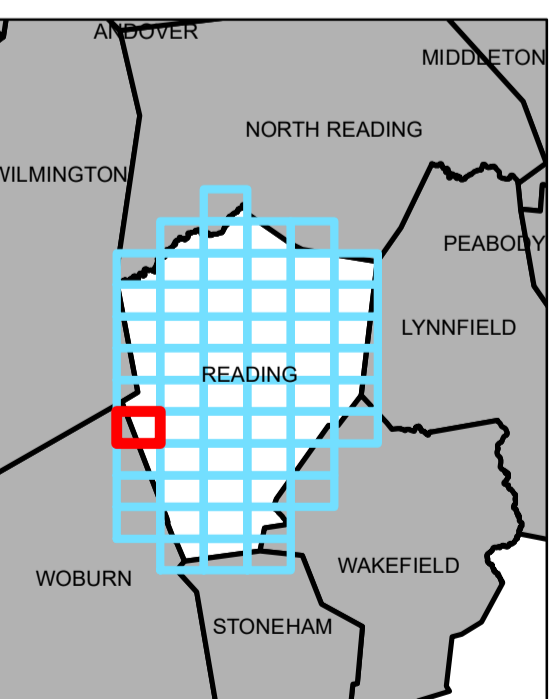
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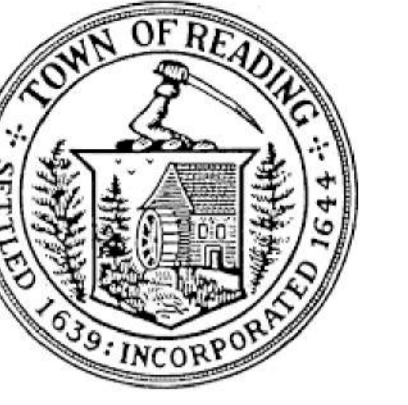
- Atlas Grid
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- swCulvert
- swGravityMain
- 1 Ft
- 10 Ft
- Atlas Grid



0 50 100 200 Feet

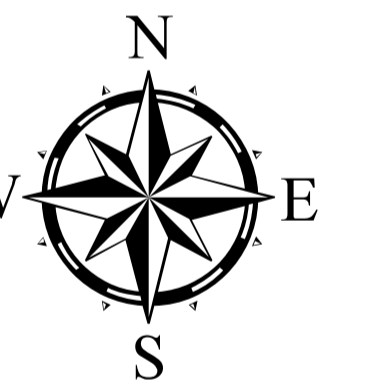
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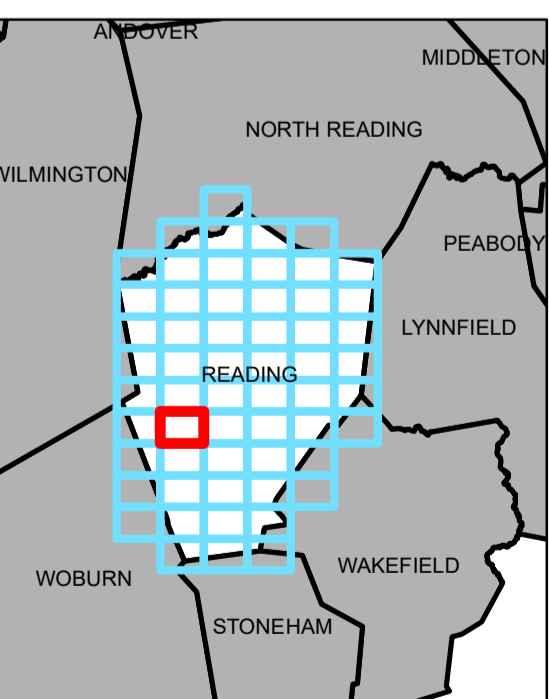
Legend

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- swDischargePoint
- swInlet
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0 50 100 200 Feet

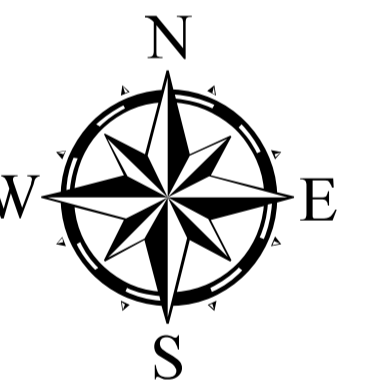
1 inch = 100 feet





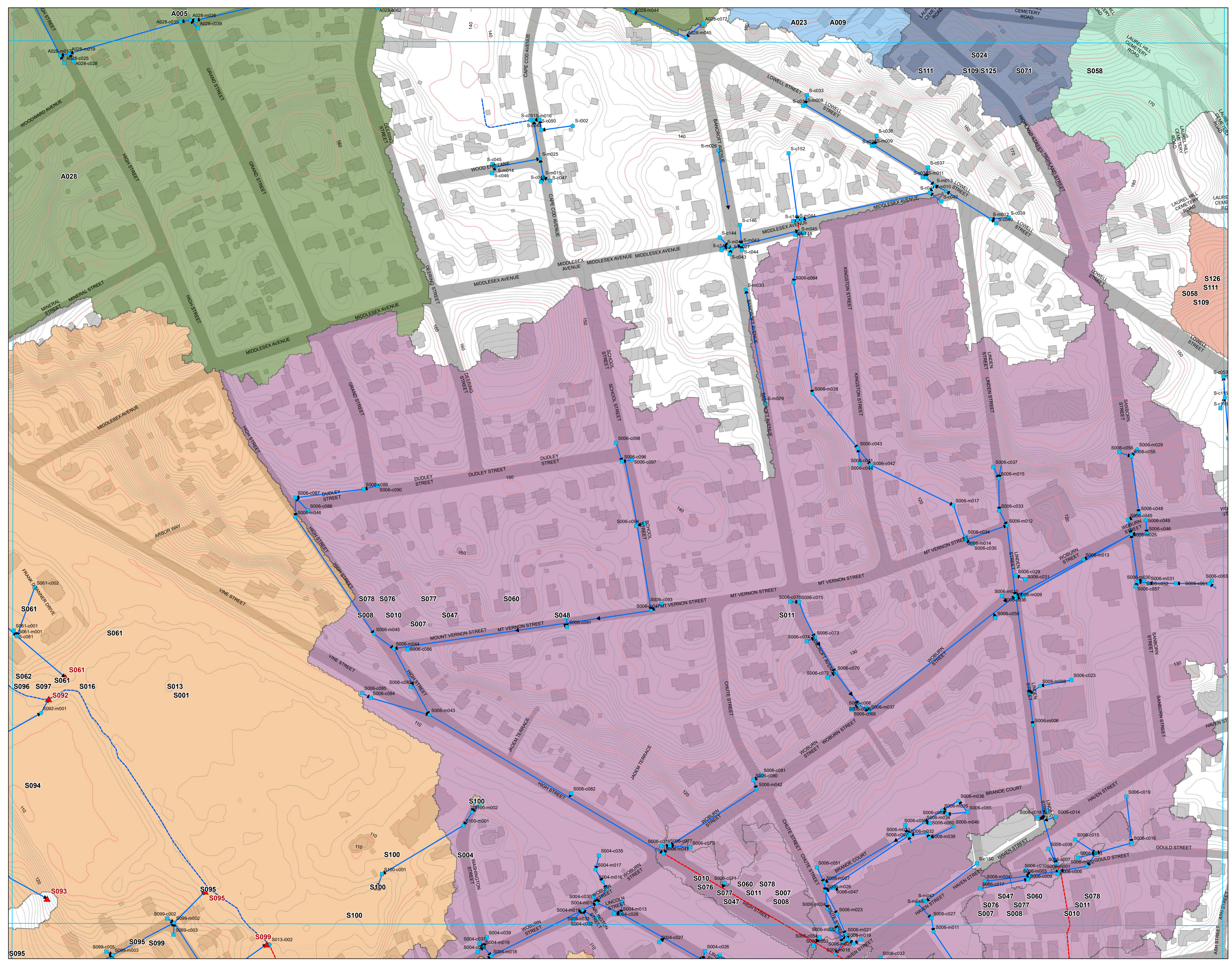
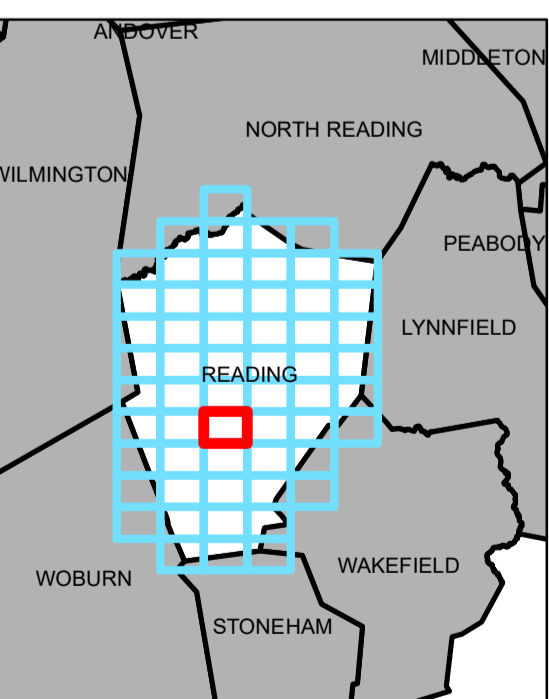
Legend

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0 50 100 200 Feet

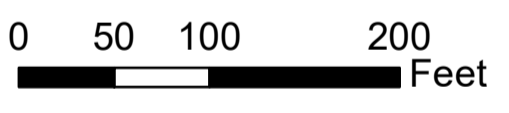
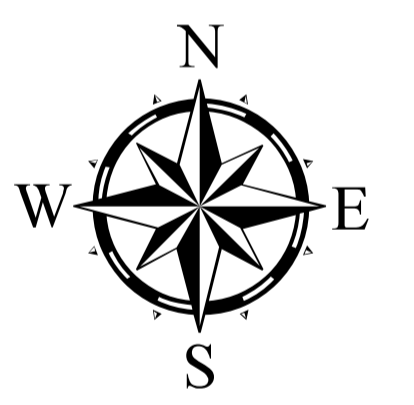
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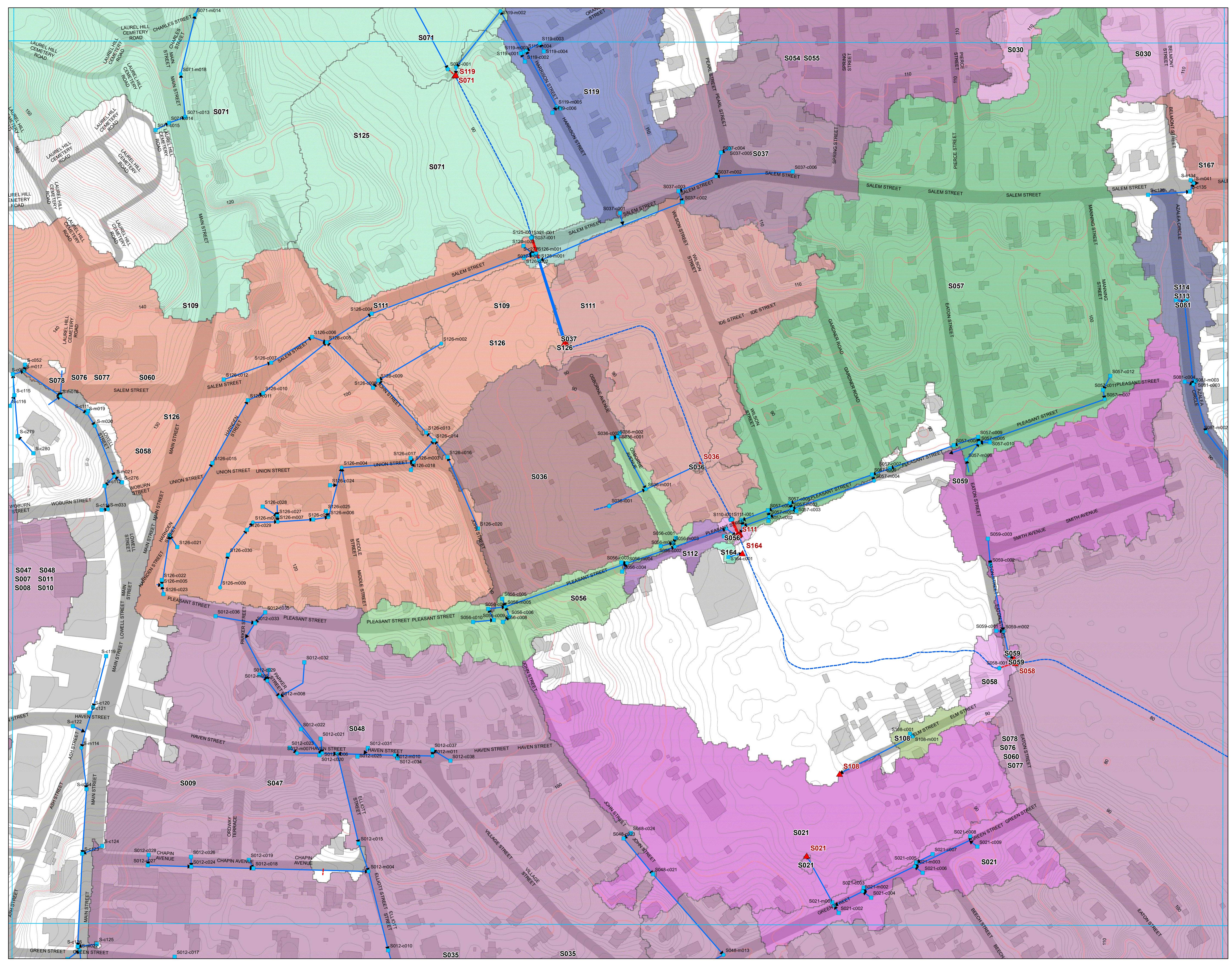
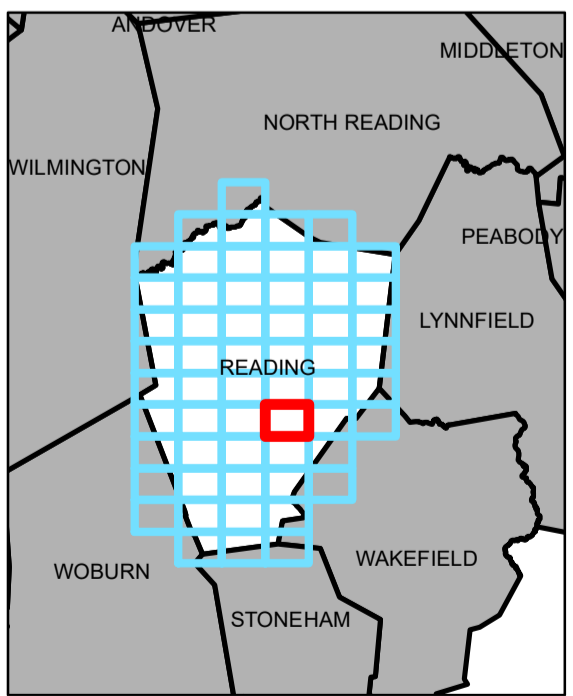


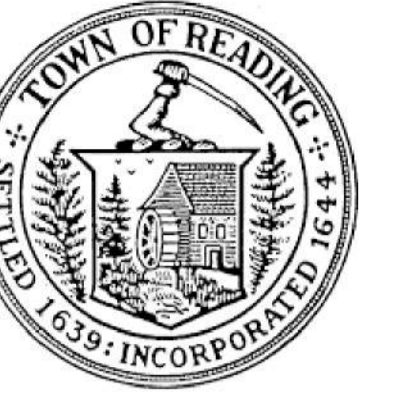
Legend

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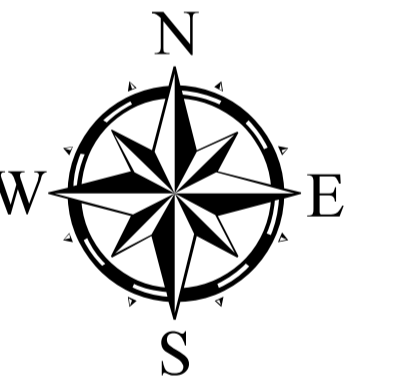
1 inch = 100 feet





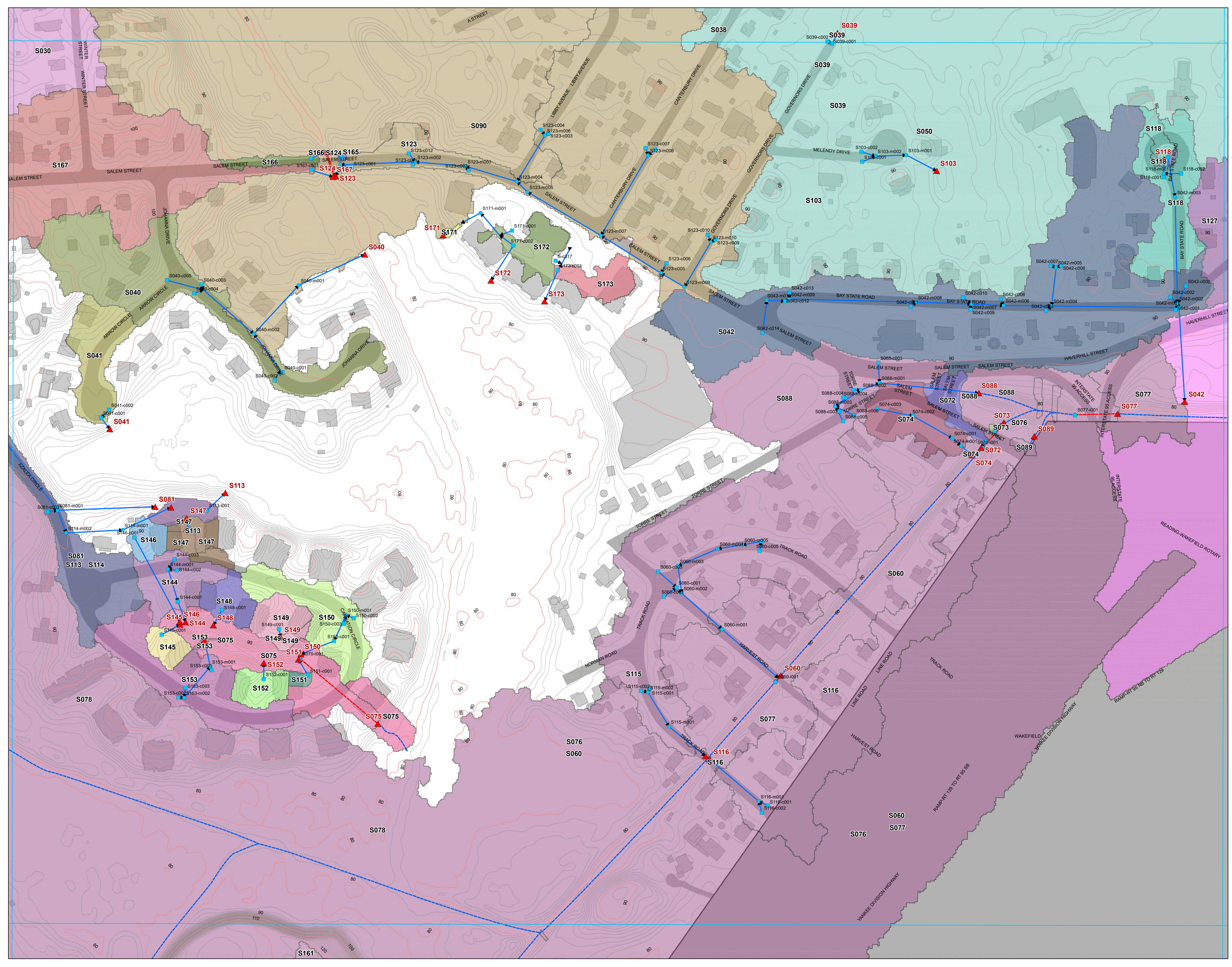
Legend

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0 50 100 200 Feet

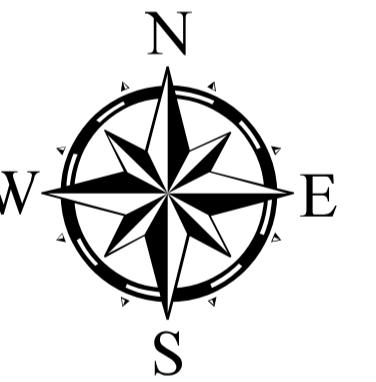
1 inch = 100 feet





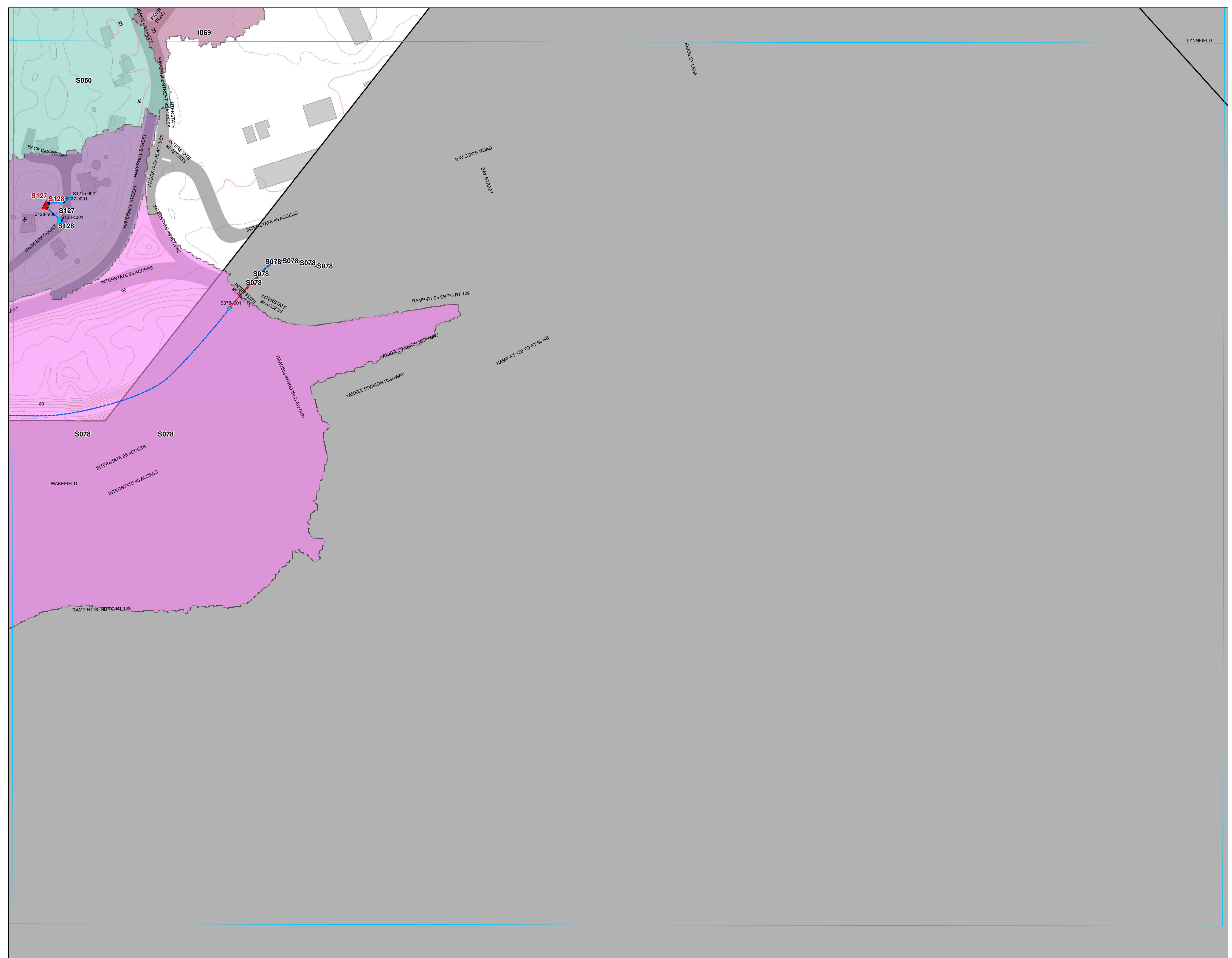
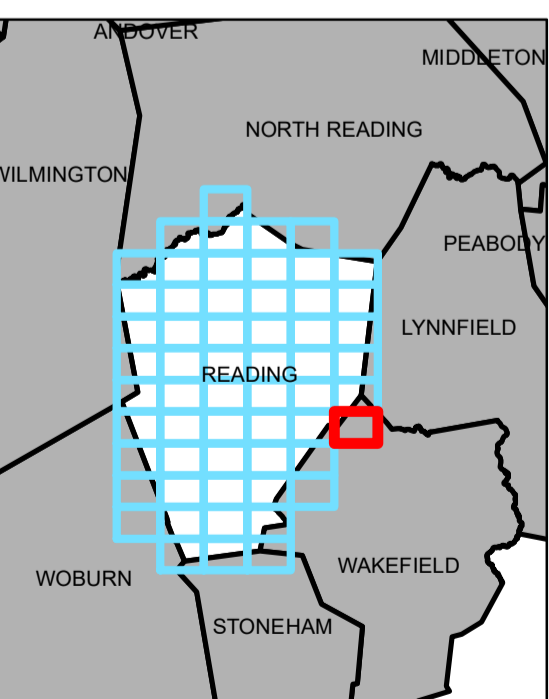
Legend

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- swCulvert
- swGravityMain
- 1 Ft
- 10 Ft
- Atlas Grid



0 50 100 200 Feet

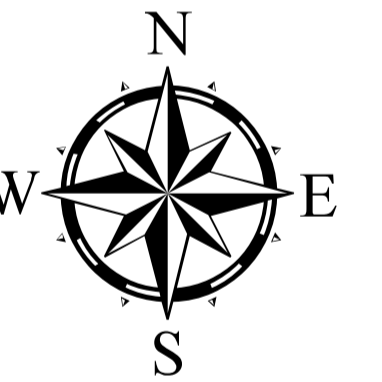
1 inch = 100 feet





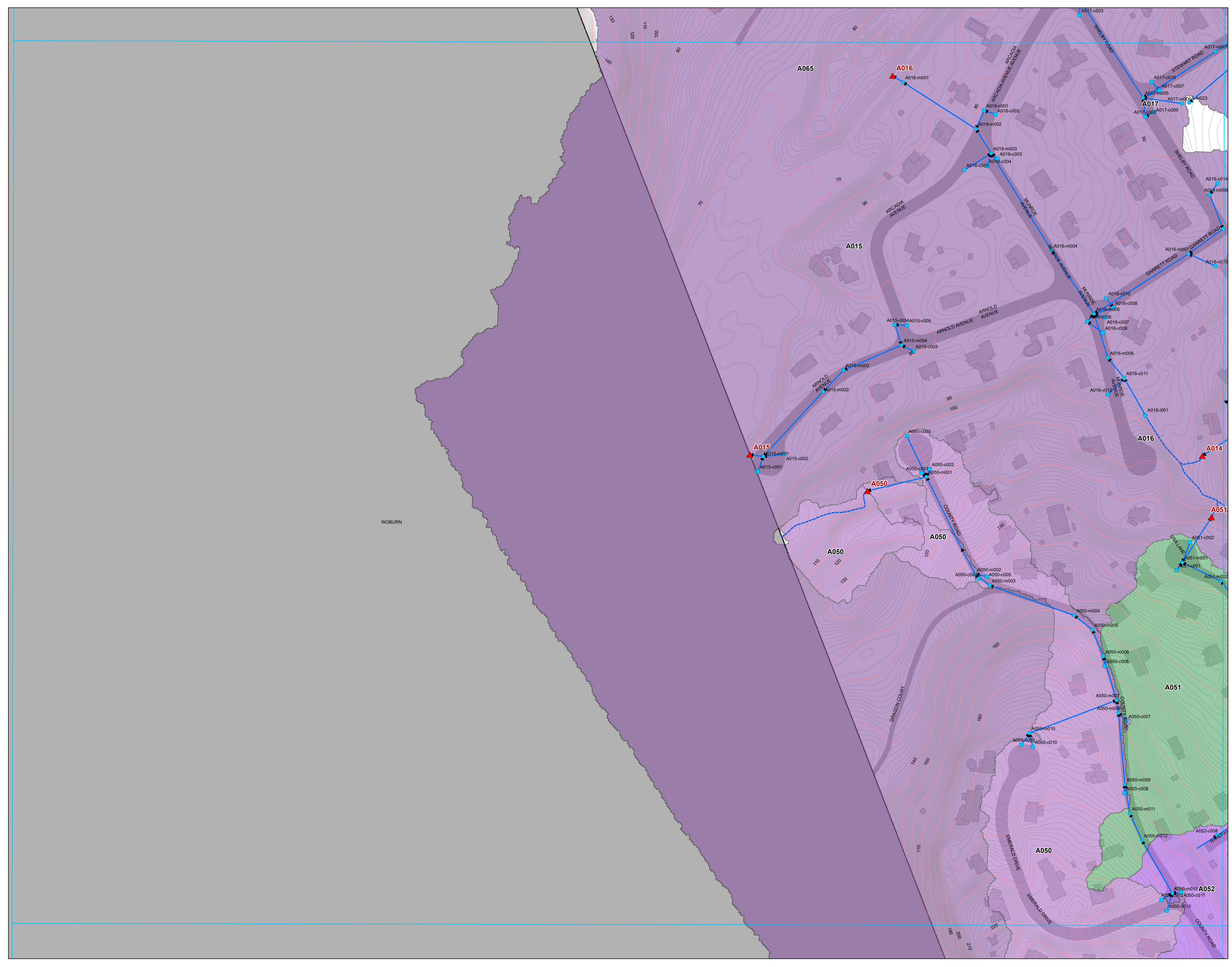
Legend

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- swInlet
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- swManhole
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- Atlas Grid



0 50 100 200 Feet

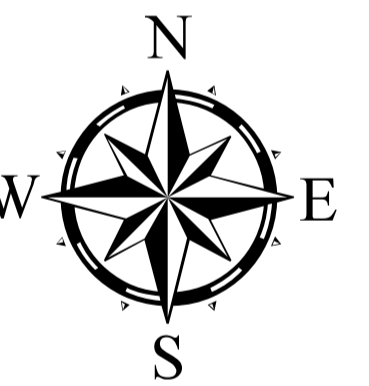
1 inch = 100 feet





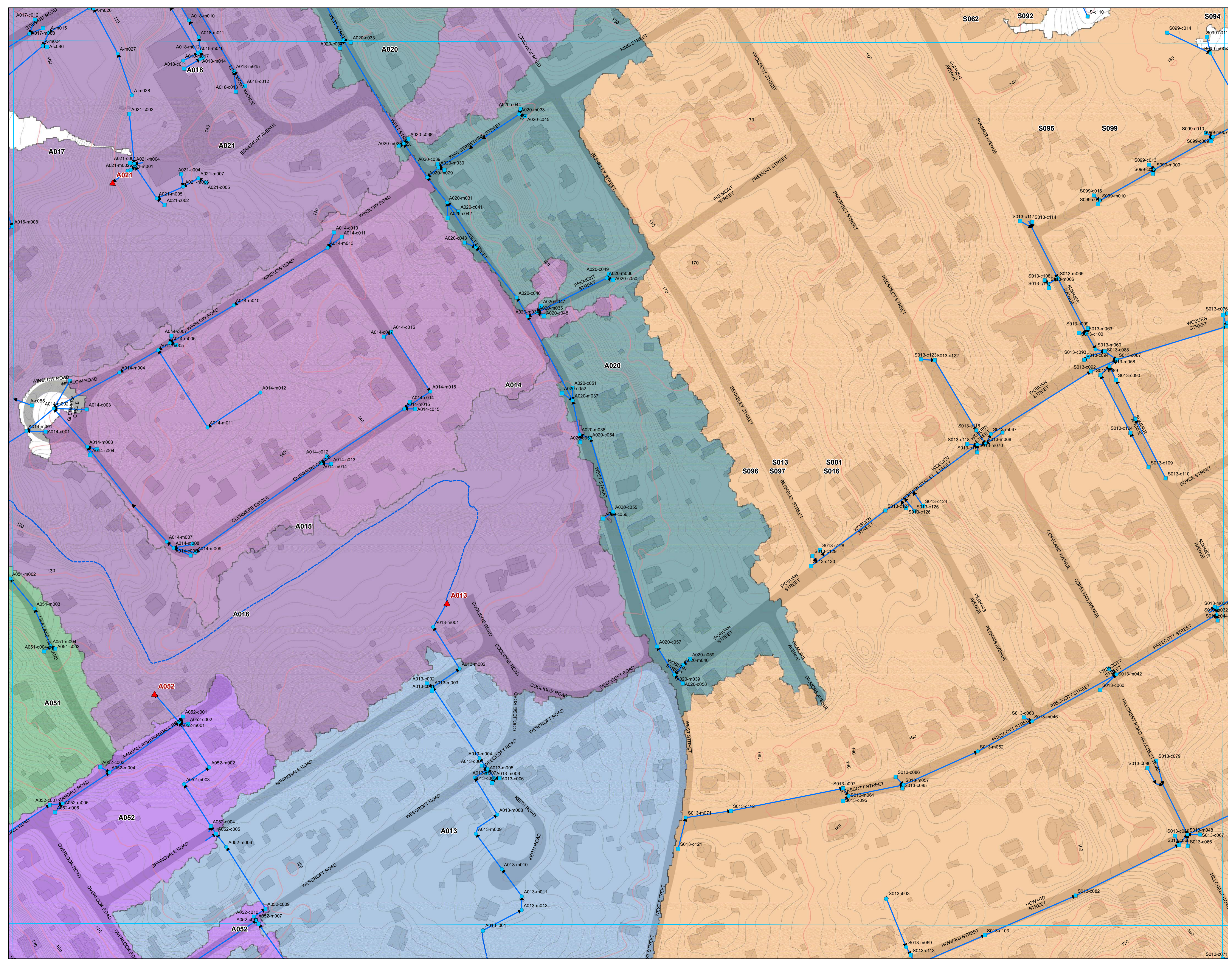
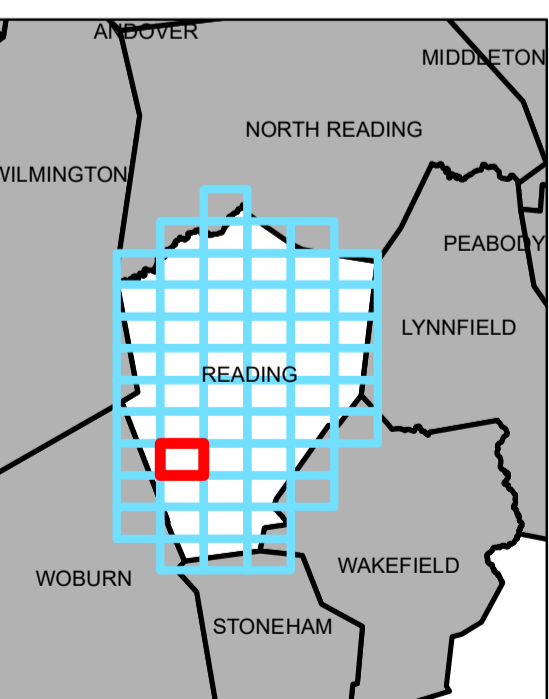
Legend

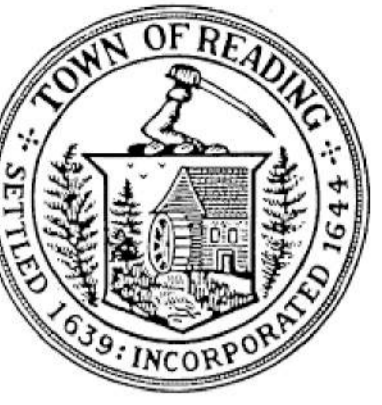
- Atlas Grid
- swDischargePoint
- swInlet
- swCatchBasin
- swManhole
- swPressurizedMain
- swOpenDrain
- swCulvert
- swGravityMain
- 1 Ft
- 10 Ft
- Atlas Grid



0 50 100 200 Feet

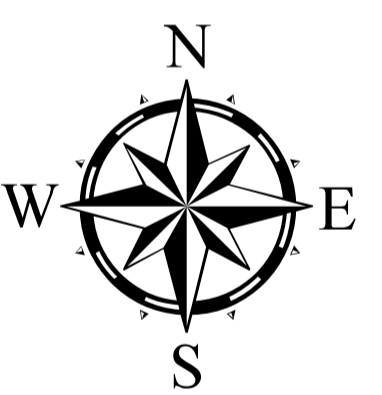
1 inch = 100 feet





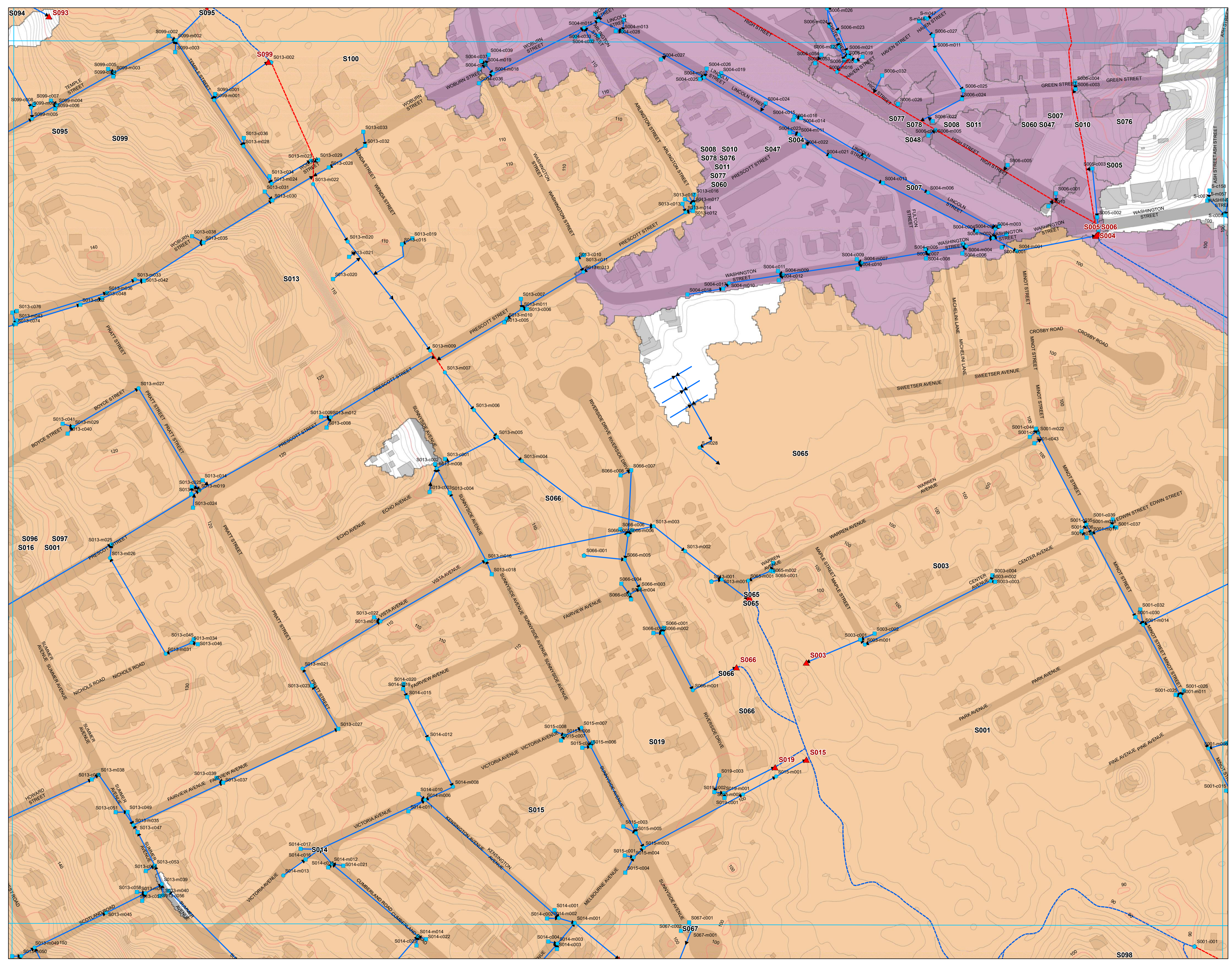
Legend

- Atlas Grid
- swDischargePoint
- swInlet
- swCatchBasin
- swManhole
- swPressurizedMain
- swOpenDrain
- swCulvert
- swGravityMain
- 1 Ft
- 10 Ft
- Atlas Grid



0 50 100 200 Feet

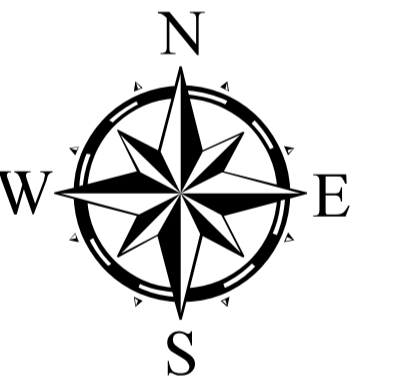
1 inch = 100 feet





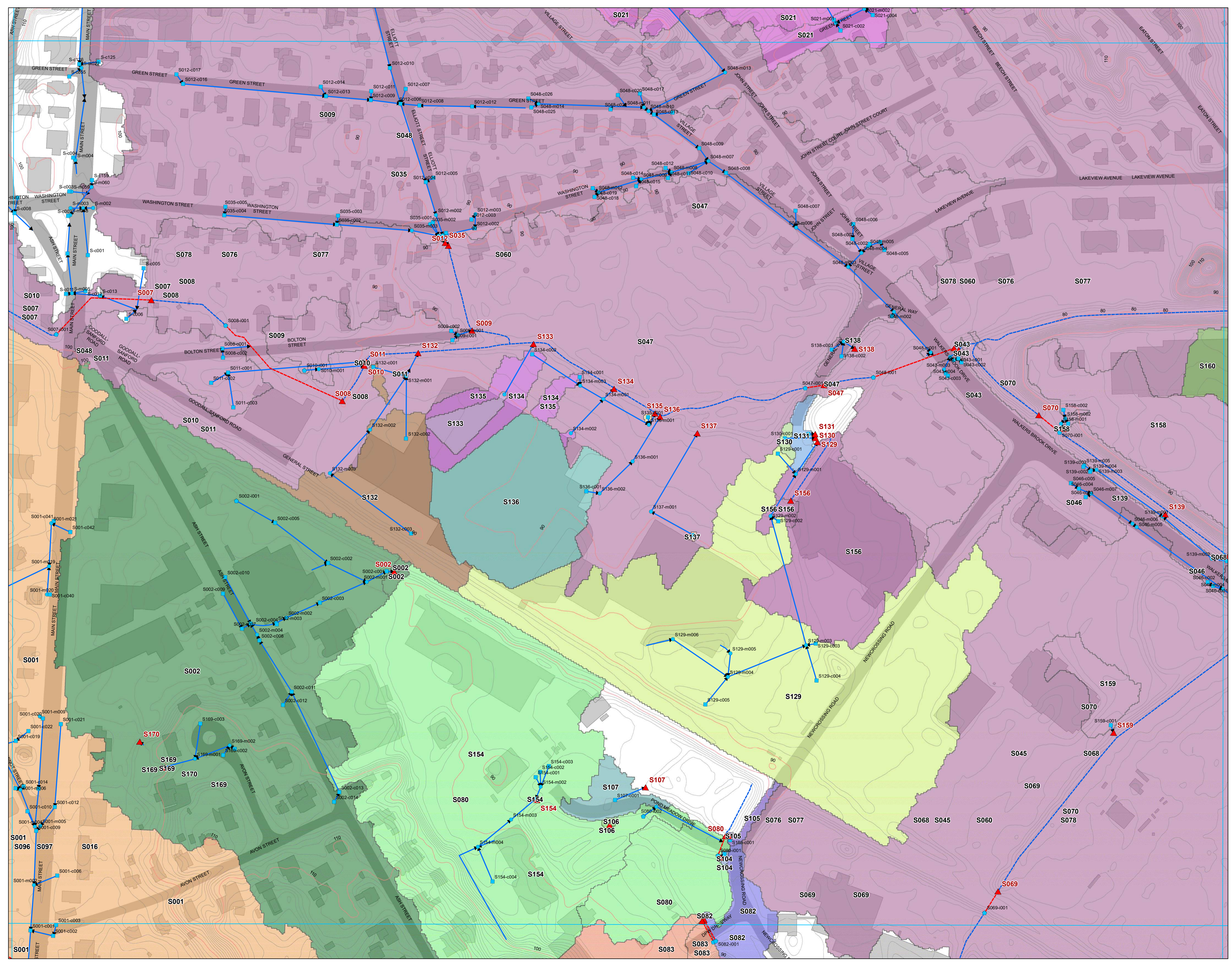
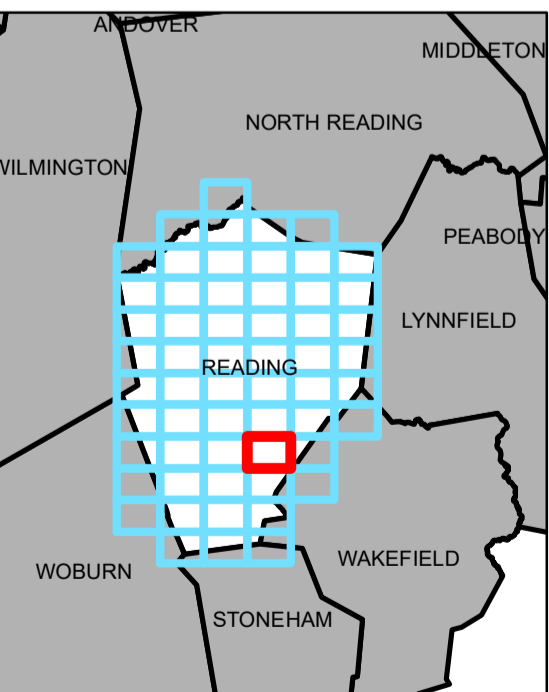
Legend

- Atlas Grid
- swDischargePoint
- swInlet
- swCatchBasin
- swManhole
- swPressurizedMain
- swOpenDrain
- swCulvert
- swGravityMain
- 1 Ft
- 10 Ft
- Atlas Grid



0 50 100 200 Feet

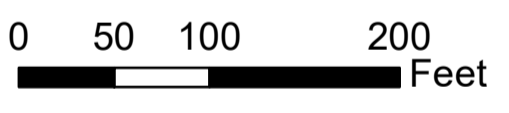
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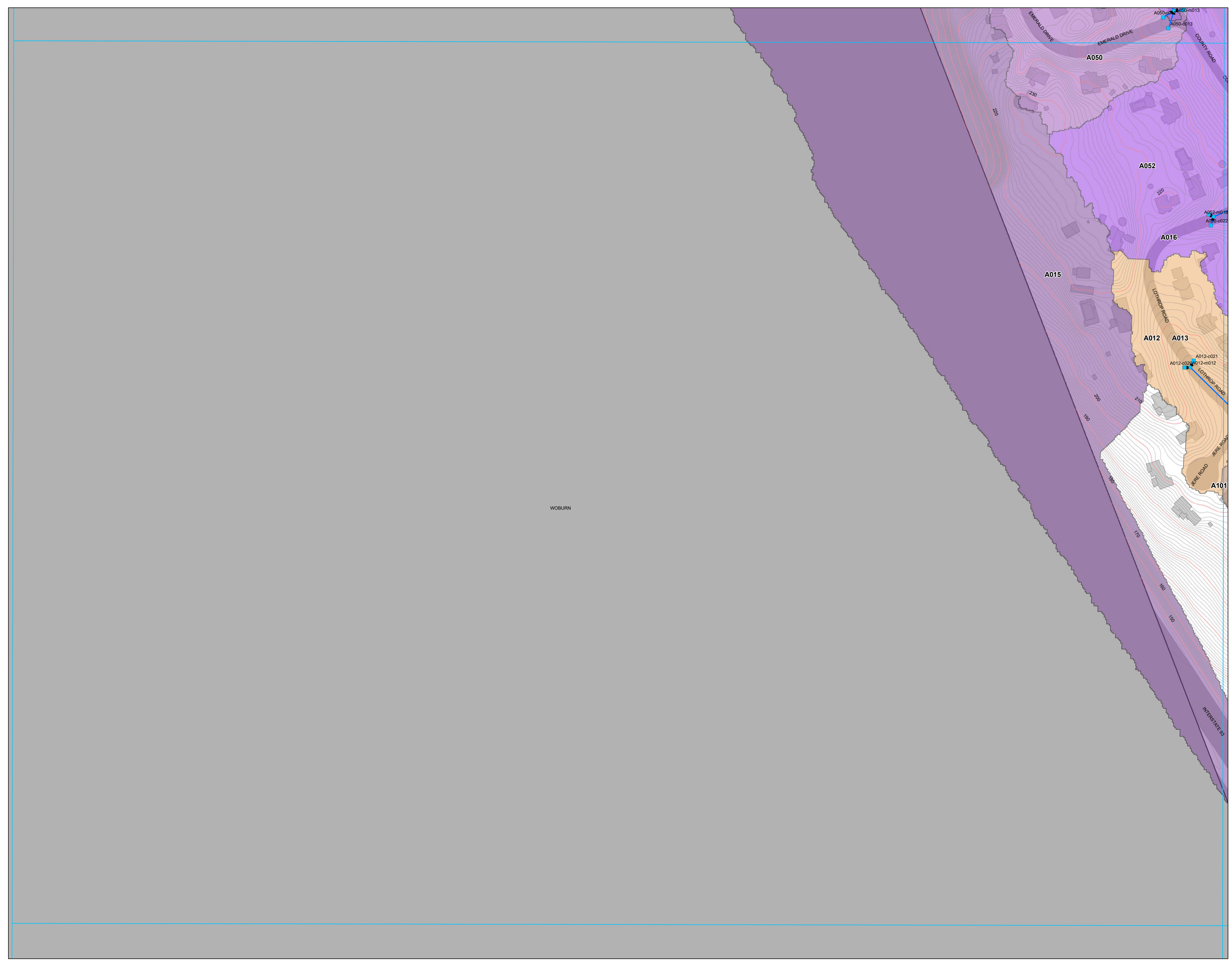
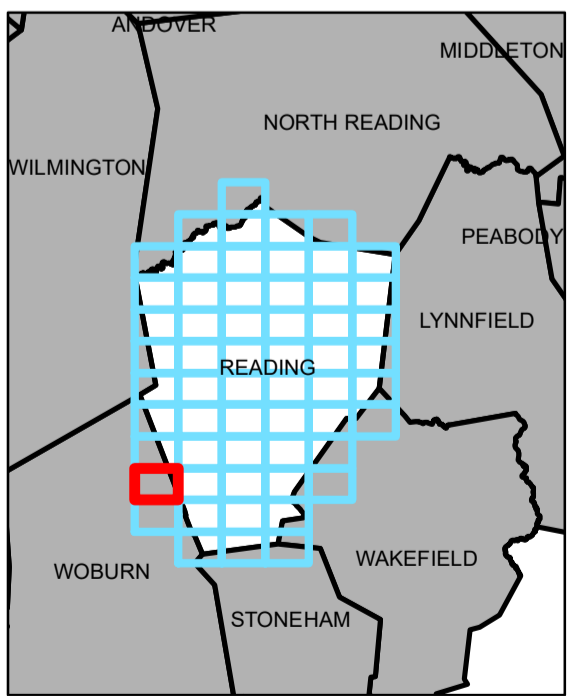


Legend

- Atlas Grid
- swDischargePoint
- swInlet
- swCatchBasin
- swManhole
- swPressurizedMain
- swOpenDrain
- swCulvert
- swGravityMain
- 1 Ft
- 10 Ft
- Atlas Grid



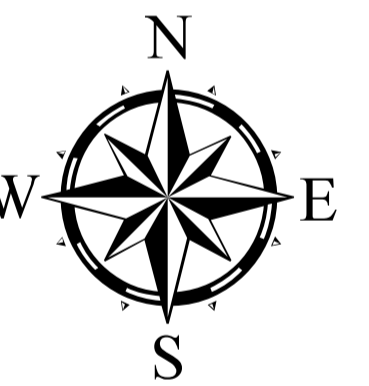
1 inch = 100 feet





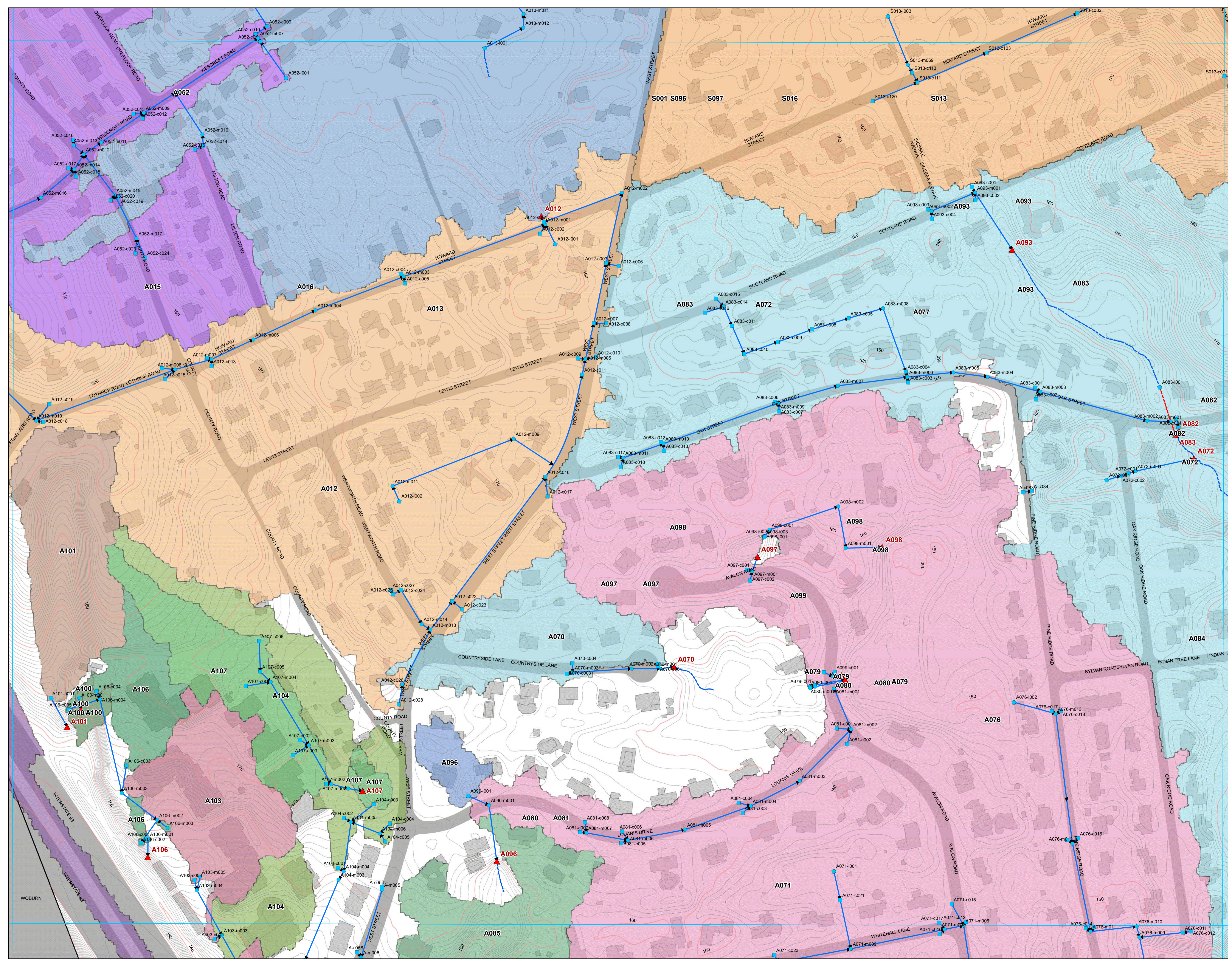
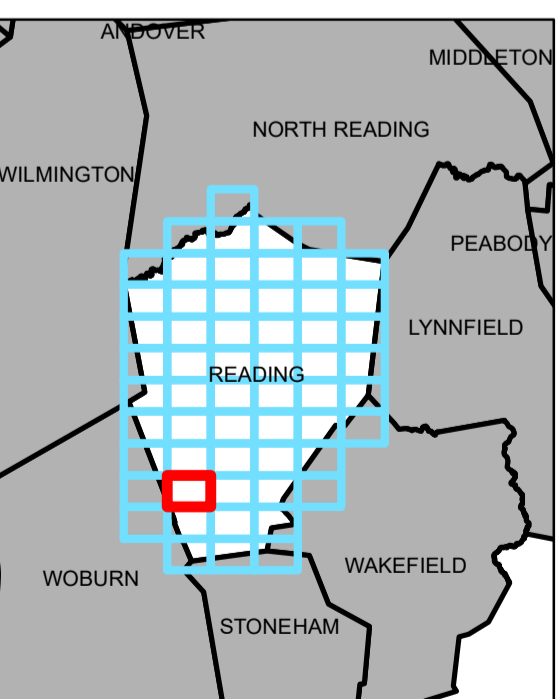
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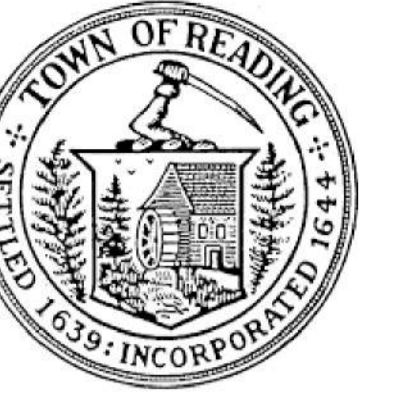
- Atlas Grid
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- swCatchBasin
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- swCulvert
- swGravityMain
- 1 Ft
- 10 Ft
- Atlas Grid



0 50 100 200 Feet

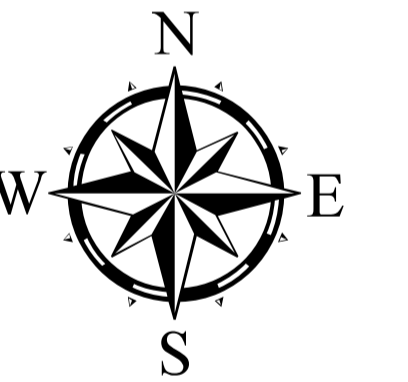
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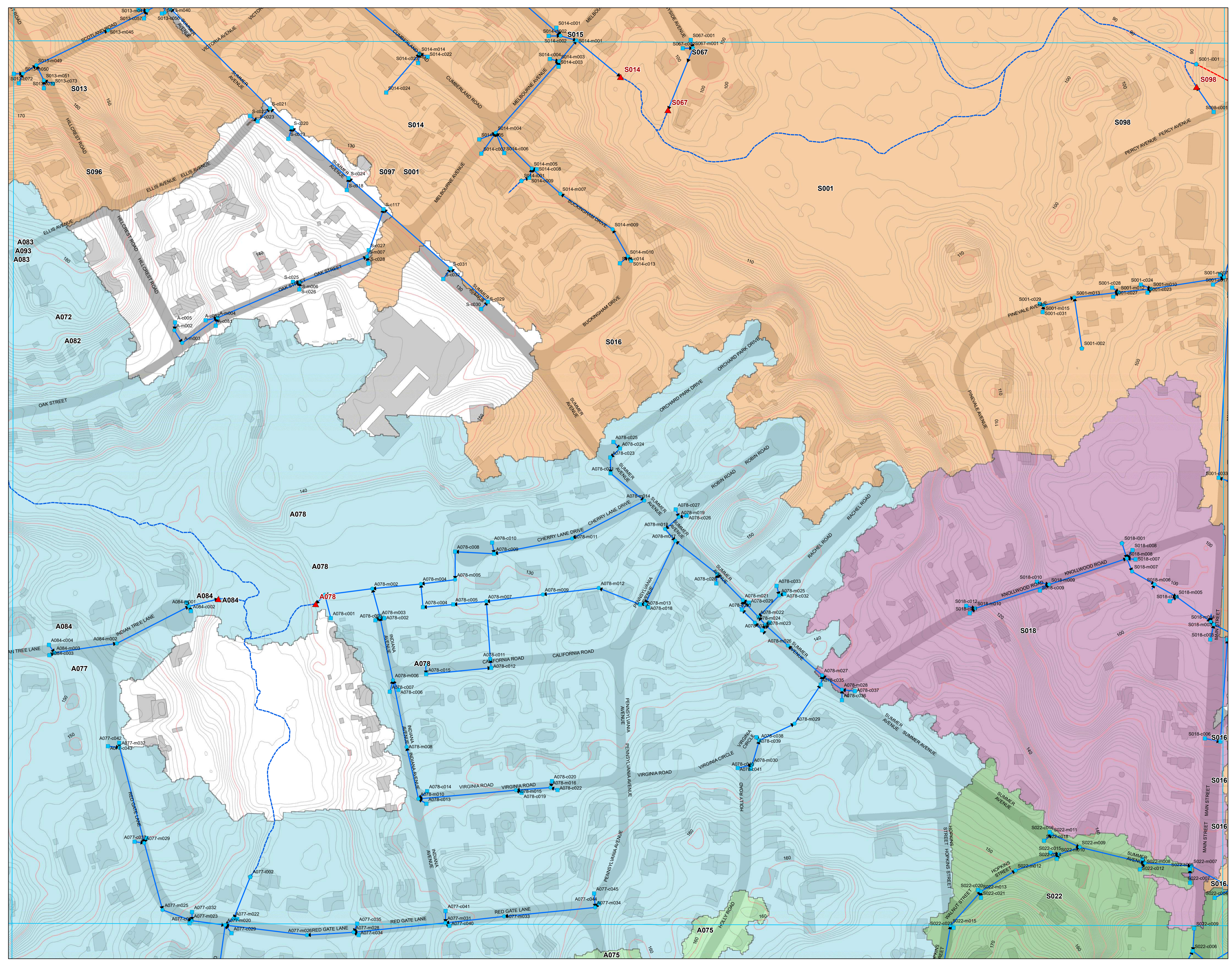
Legend

- Atlas Grid
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- swInlet
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- swManhole
- swPressurizedMain
- swOpenDrain
- swCulvert
- swGravityMain
- 1 Ft
- 10 Ft
- Atlas Grid













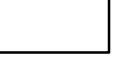

0 50 100 200 Feet

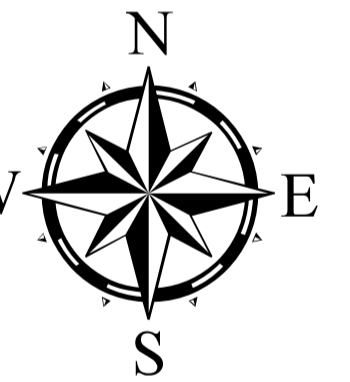
1 inch = 100 feet





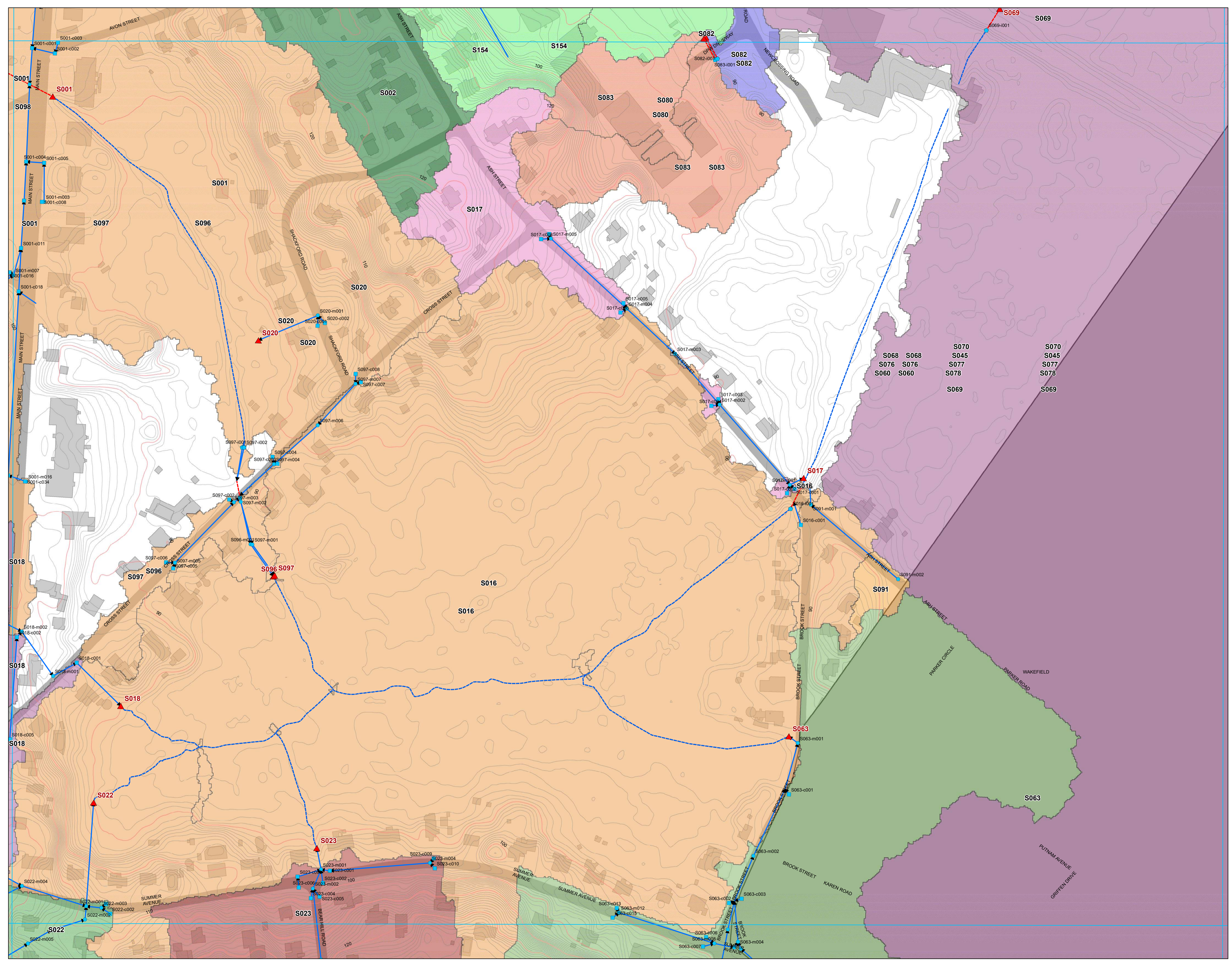
Legend

-  Atlas Grid
-  swDischargePoint
-  swInlet
-  swCatchBasin
-  swManhole
-  swPressurizedMain
-  swOpenDrain
-  swCulvert
-  swGravityMain
-  1 Ft
-  10 Ft
-  Atlas Grid



0 50 100 200 Feet

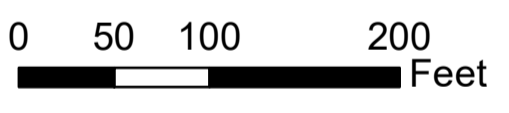
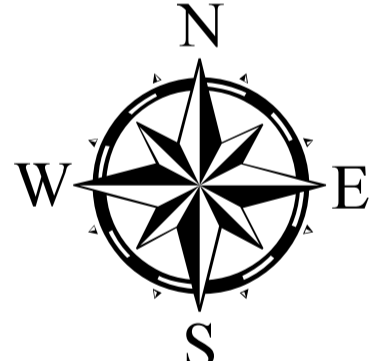
1 inch = 100 feet



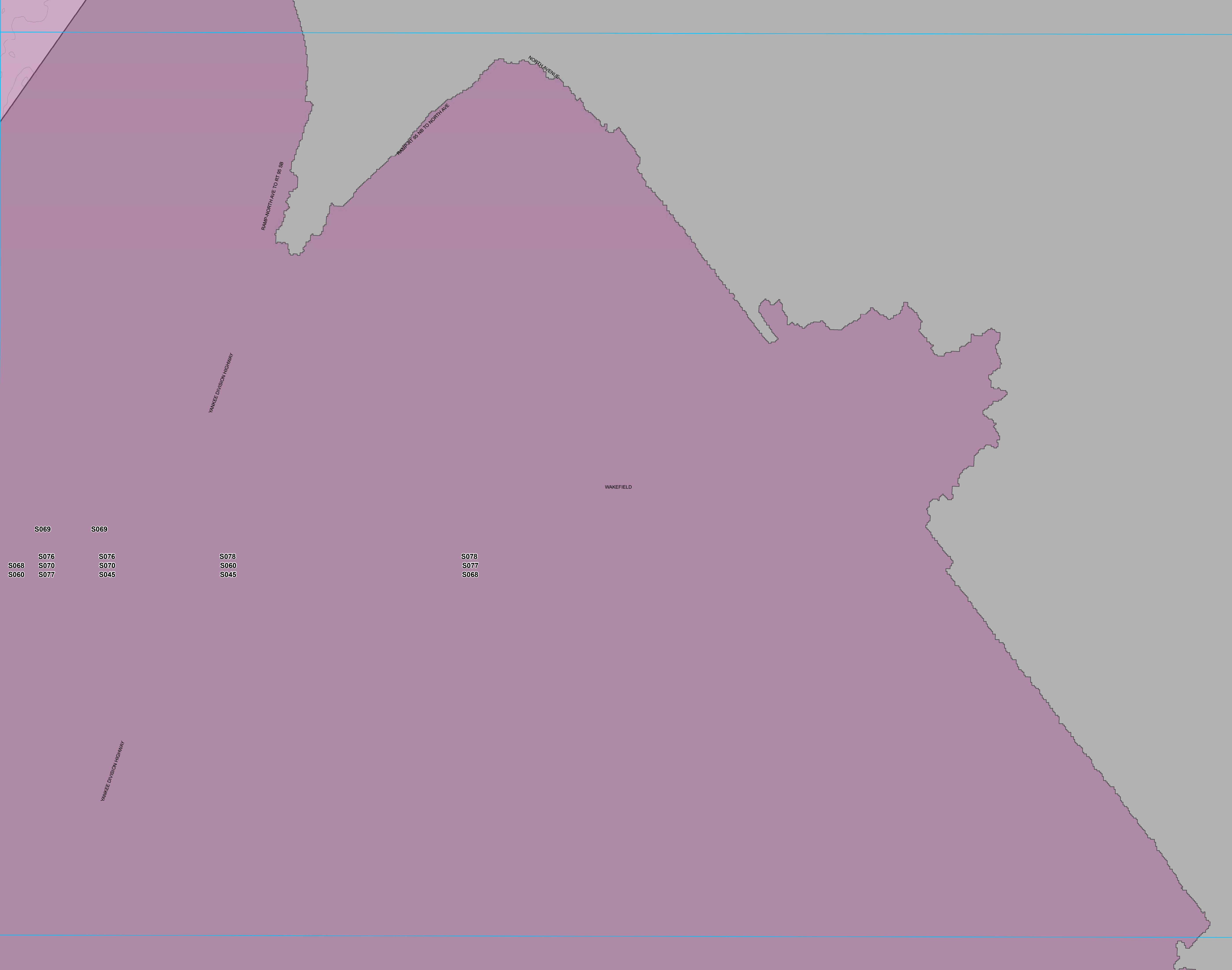
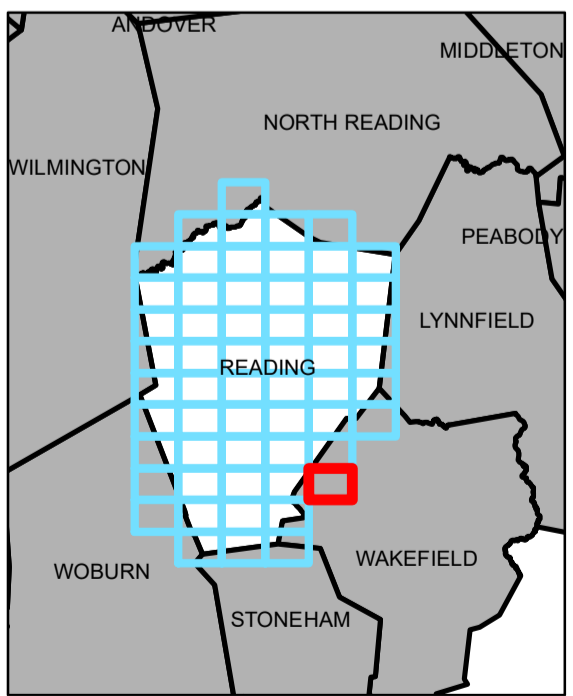


Legend

- Atlas Grid
- swDischargePoint
- swInlet
- swCatchBasin
- swManhole
- swPressurizedMain
- swOpenDrain
- swCulvert
- swGravityMain
- 1 Ft
- 10 Ft
- Atlas Grid



1 inch = 100 feet



S069	S069			
S076	S076	S078	S078	
S068 S070	S070	S060	S077	
S060 S077	S045	S045	S068	















2021 Catchment Mapping

Date: 9/15/2021

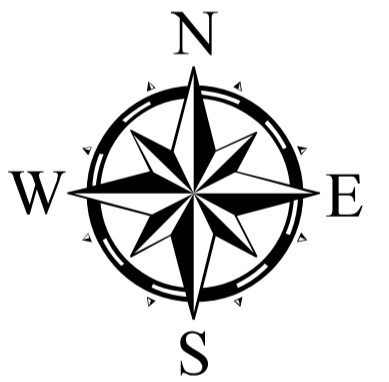
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Page Name: K1

Legend

-  Atlas Grid
-  swDischargePoint
-  swInlet
-  swCatchBasin
-  swManhole
-  swPressurizedMain
-  swOpenDrain
-  swCulvert
-  swGravityMain
-  1 Ft
-  10 Ft
-  Atlas Grid

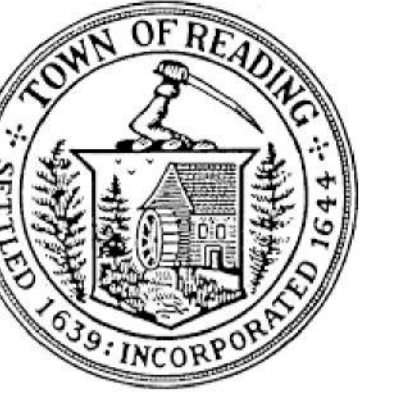
WOBURN



0 50 100 200 Feet

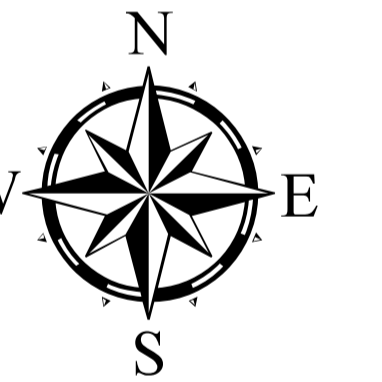
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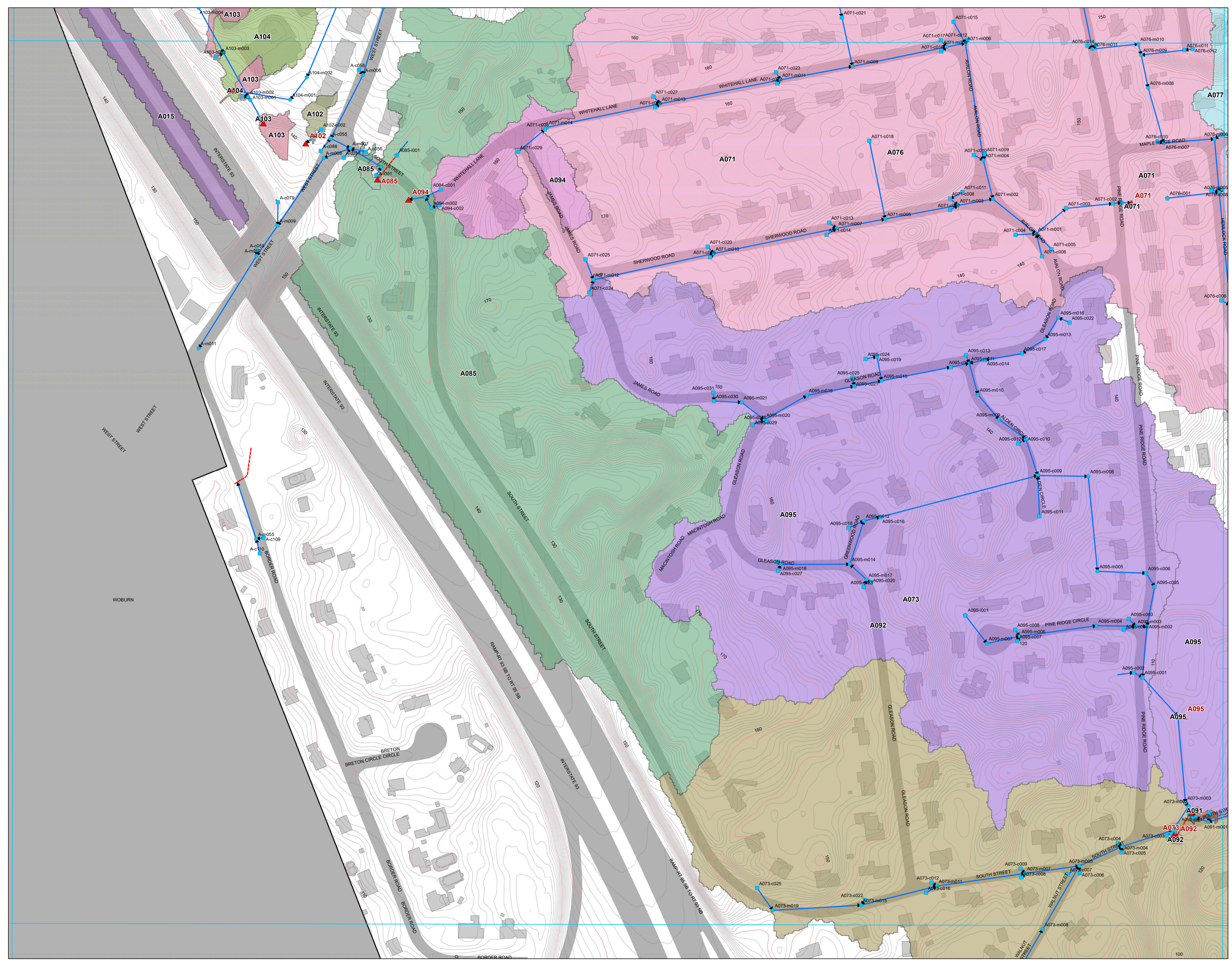
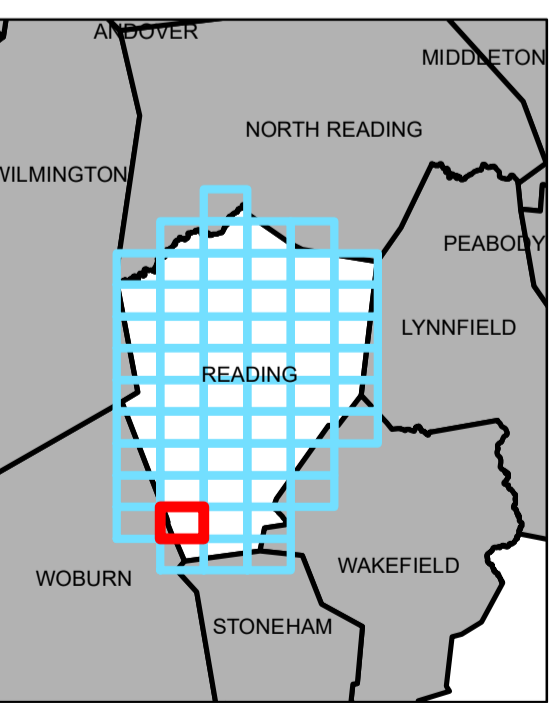
Legend

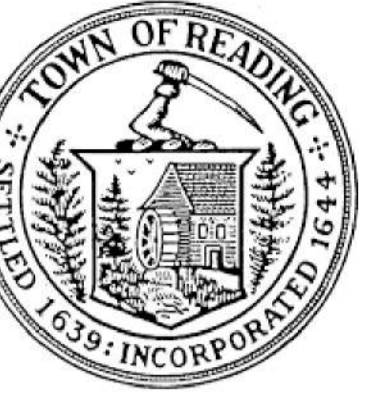
- Atlas Grid
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- swInlet
- swCatchBasin
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- swOpenDrain
- swCulvert
- swGravityMain
- 1 Ft
- 10 Ft
- Atlas Grid



0 50 100 200 Feet

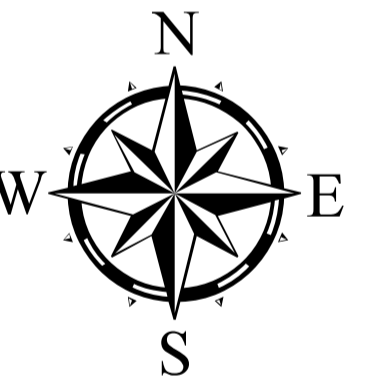
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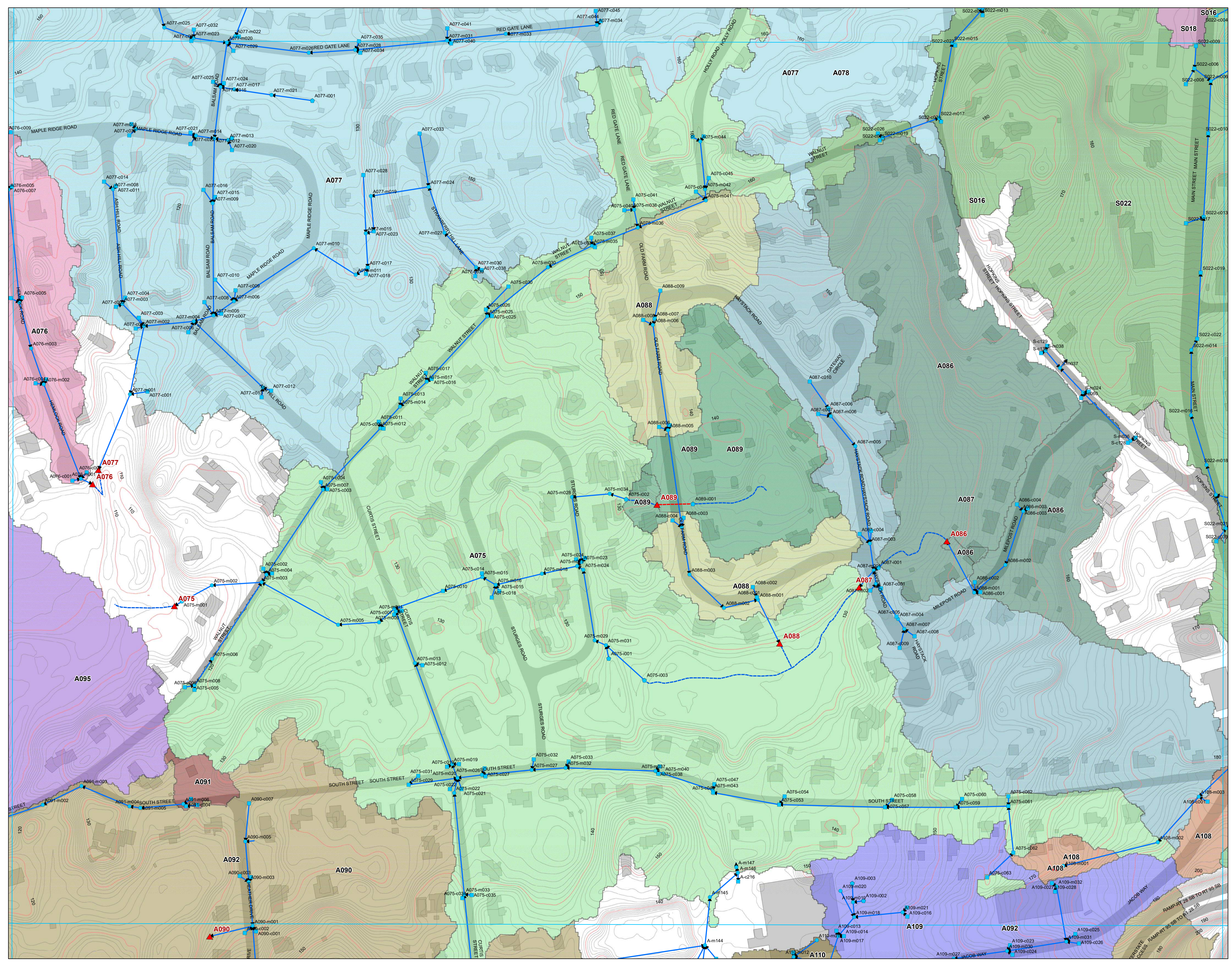
Legend

- Atlas Grid
- swDischargePoint
- swInlet
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- swGravityMain
- 1 Ft
- 10 Ft
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0 50 100 200 Feet

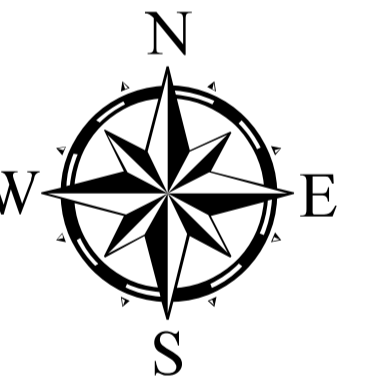
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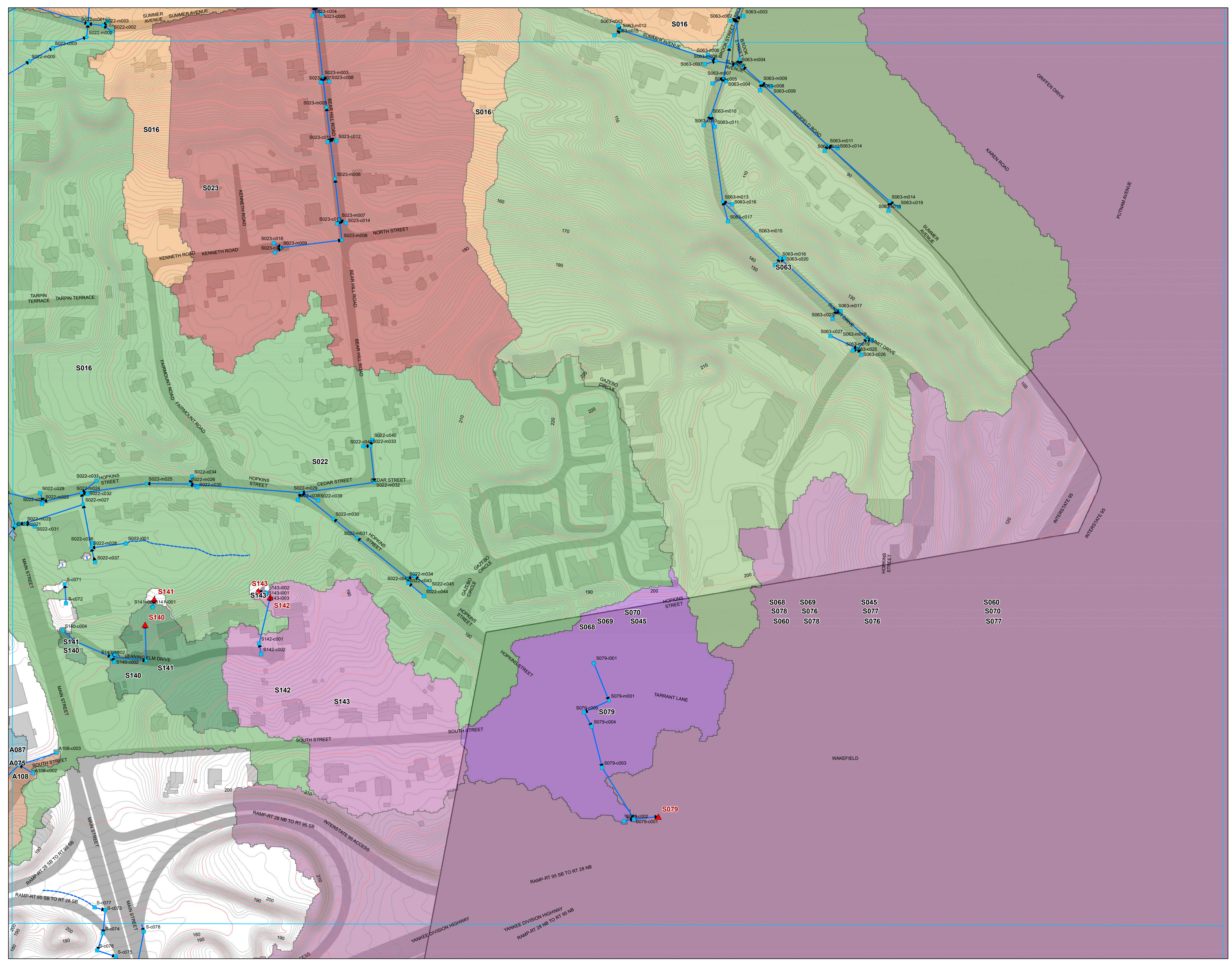
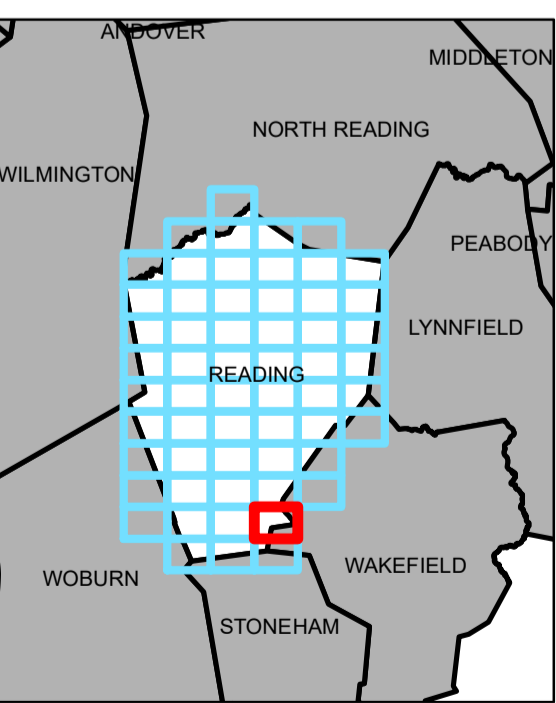
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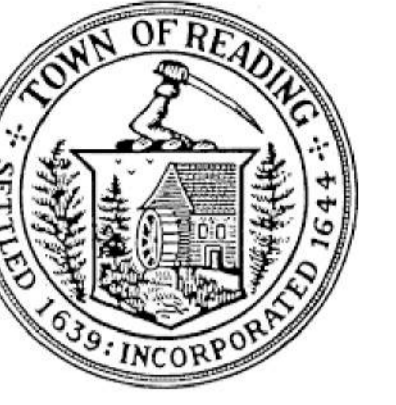
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- 1 Ft
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- Atlas Grid



0 50 100 200 Feet

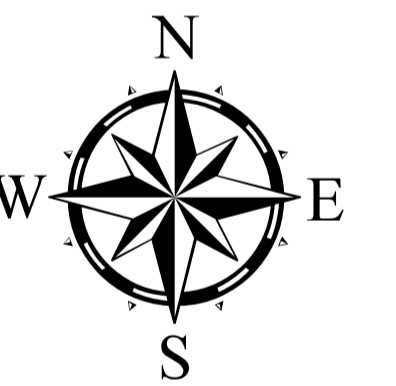
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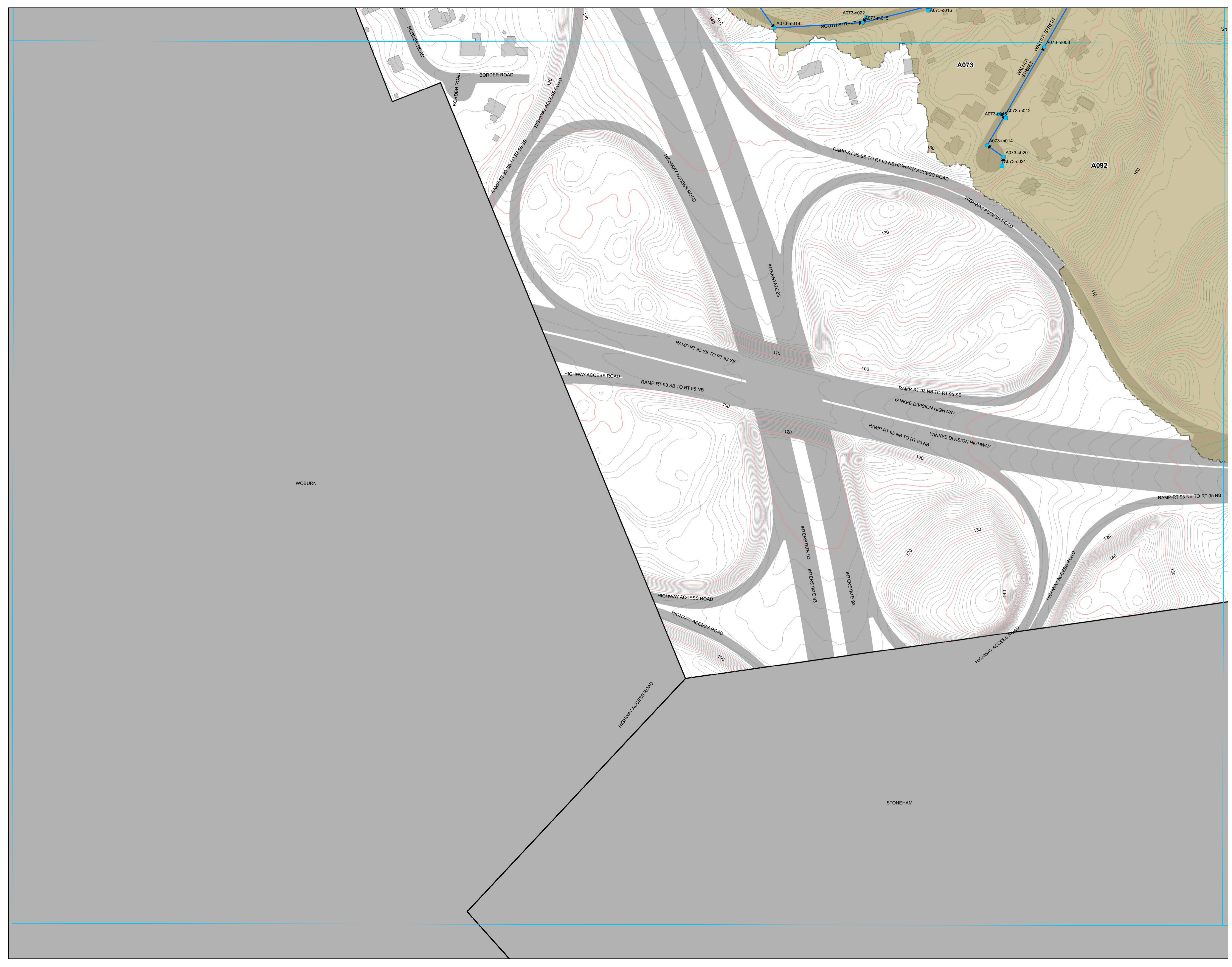
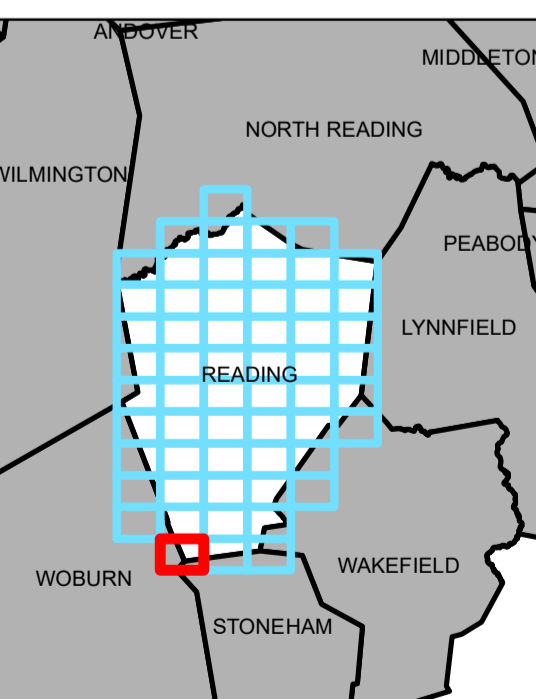
Legend

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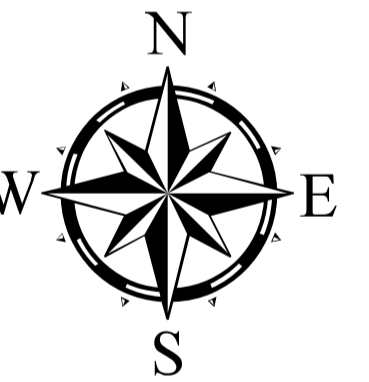
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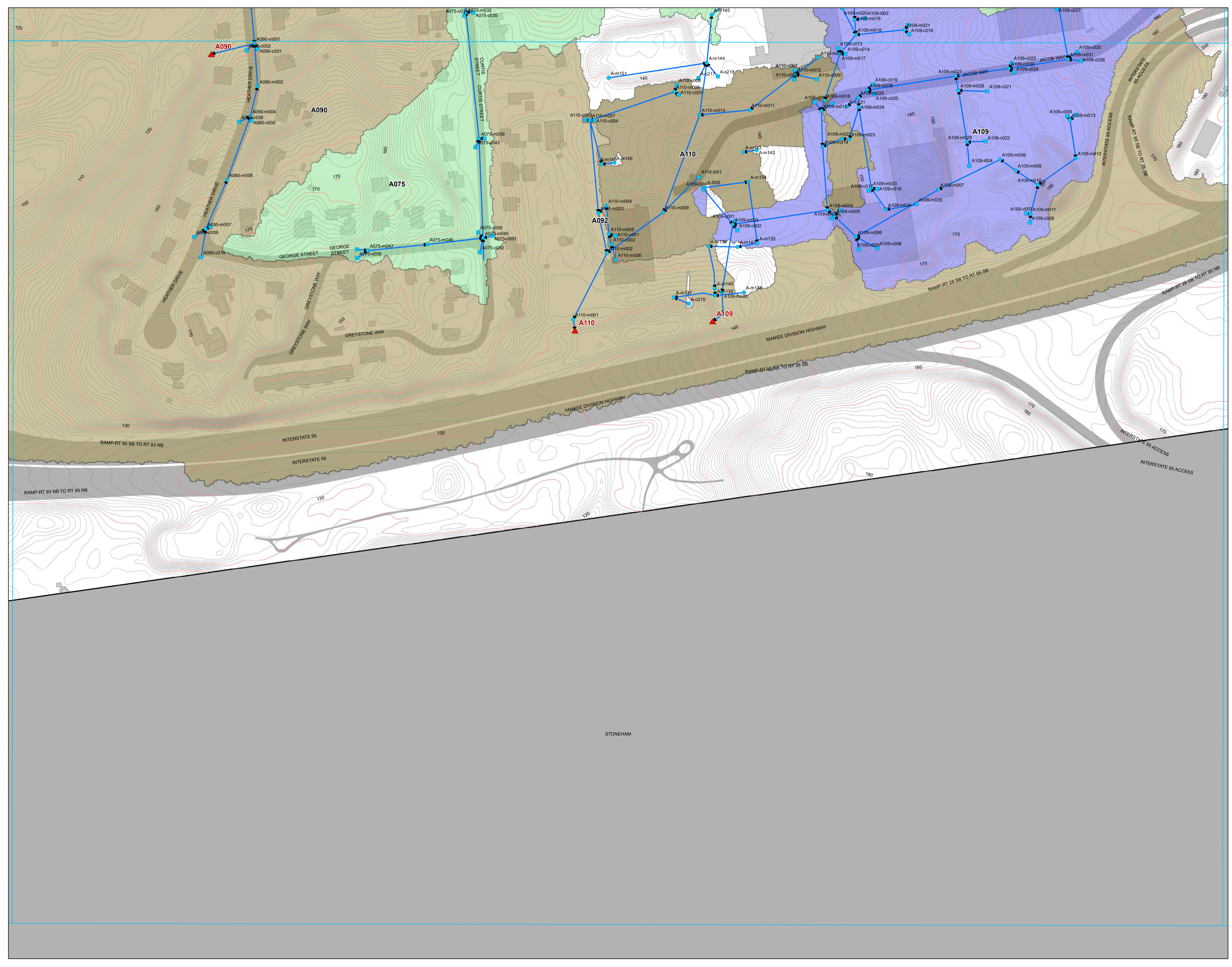
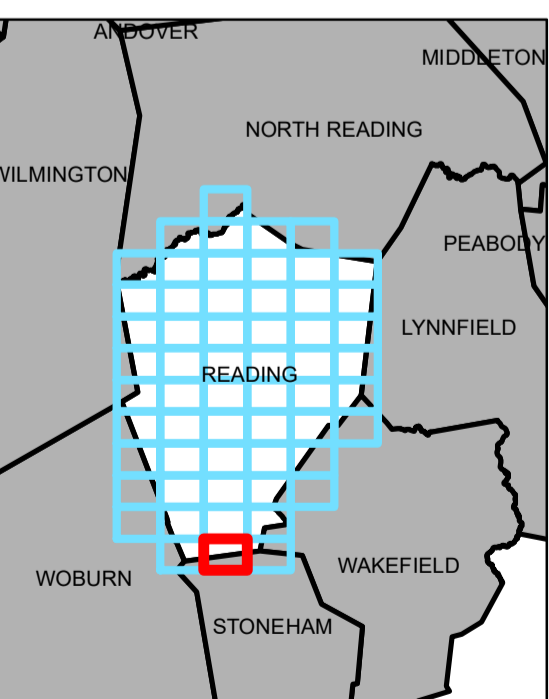
Legend

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1 inch = 100 feet

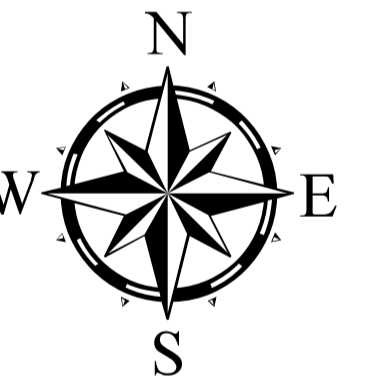






Legend

- Atlas Grid
- swDischargePoint
- swInlet
- swCatchBasin
- swManhole
- swPressurizedMain
- swOpenDrain
- swCulvert
- swGravityMain
- 1 Ft
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- Atlas Grid



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1 inch = 100 feet

