Illicit Discharge Detection and Elimination (IDDE) Plan

Town of Lunenburg, Massachusetts

Prepared June 30, 2019
Revised June 30, 2021

Prepared For:

Town of Lunenburg
17 Main Street
Lunenburg, MA 01462

Prepared By:

Comprehensive Environmental Inc.
41 Main Street
Bolton, MA 01740

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1 Introduction

1.1 IDDE Regulatory Background

This Illicit Discharge Detection and Elimination (IDDE) Plan has been developed by the Town of Lunenburg to address the requirements of the United States Environmental Protection Agency's (EPA's) 2016 National Pollutant Discharge Elimination System (NPDES) General Permit for Stormwater Discharges from Small Municipal Separate Storm Sewer Systems (MS4) in Massachusetts, hereafter referred to as the "2016 MS4 Permit." The 2016 Massachusetts MS4 Permit was signed on April 4, 2016 and has an effective date of July 1, 2018, and more recently updated on December 7, 2020 with an effective date of January 6, 2021. The permit was cosigned by the Massachusetts Department of Environmental Protection (MassDEP) and thus is jointly regulated by EPA and MassDEP.

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

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

Under MCM 3, the permittee is required to implement an IDDE program to systematically find and eliminate sources of non-stormwater discharges to its municipal separate storm sewer system and implement procedures to prevent such discharges. The IDDE program must be recorded in a written (hardcopy or electronic) document. This IDDE Plan has been prepared to address this requirement.

1.2 Illicit Discharges

An "illicit discharge" is any discharge to a MS4 that is not composed entirely of stormwater except non-stormwater discharges pursuant to a NPDES permit and discharges resulting from fire-fighting activities. Illicit discharges may take a variety of forms. Illicit discharges may enter the drainage system through direct or indirect connections. Direct connections may be relatively obvious, such as cross-connections of a sewer service pipe to the storm drain system. Indirect illicit discharges may be more difficult to detect or address, such as a cracked pipe, leaking tank; failing septic systems that discharge untreated sewage to a ditch within the MS4, or a sump pump that discharges contaminated water on an intermittent basis.

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

infrastructure to the modern regulatory environment. Examples of illicit discharges in this category include connected floor drains in old buildings, as well as sanitary sewer overflows that enter the drainage system. Sump pumps legally connected to the storm drain system can also be an illicit discharge if used inappropriately, such as for the disposal of floor wash water or old household products, in many cases due to a lack of understanding on the part of the homeowner. Common illicit discharges can include the following:

- Sanitary wastewater from crushed, cracked, or collapsed pipes or from surcharges;
- Sewer lines from a house, basement, or individual bathroom to a storm drain;
- Overflow or seepage from septic tanks;
- Cross connections between a sewer or combined sewer line and the storm system;
- Commercial vehicle wash wastewater; and/or
- Improper disposal of automobile and household products.

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

Regardless of the intention, when not addressed, illicit discharges can contribute high levels of pollutants, such as heavy metals, toxics, oil, grease, solvents, nutrients, and/or pathogens to surface waters. Thus, the 2016 MS4 Permit requires a program to identify, locate and remove illicit discharges.

1.3 Allowable Non-Stormwater Discharges

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

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

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

1.4 Receiving Waters and Impairments

As part of the 2016 MS4 Permit, communities must implement specific actions and BMPs to address waters with an approved Total Maximum Daily Load (TMDL) as of the issuance date of the permit (April 4, 2016) and to address water quality limited waters, including but not limited to waters listed in categories 4a, 4c, or 5 on the most recent EPA-approved Massachusetts Clean Water Act section 303(d) list or Massachusetts Integrated Report of water under Clean Water Act section 305(b). IDDE requirements include consideration of these waters in the prioritization of IDDE activities and sampling programs. **Table 1-1** lists the "impaired waters" within the boundaries of Lunenburg's regulated area based on the Final 2016 Massachusetts Integrated List of Waters produced by MassDEP every two years[1]. Impaired waters are water bodies that do not meet water quality standards for one or more designated use(s) such as recreation or aquatic habitat.

Table 1-1. Impaired Waters

Waterbody Name	Segment ID and Category		Impairment(s)	Approved TMDL[2]
Mulpus Brook	MA81-37	5	Lack of a Coldwater Assemblage	
Lake Shirley	MA81122	5	(Eurasian Water Milfoil, Myriophyllum spicatum*)	
			(Non-Native Aquatic Plants*)	
			Dissolved Oxygen	
			Harmful Algal Blooms	
			Mercury in Fish Tissue	42399
			Turbidity	
Hickory Hills Lake	MA81031	4a	Mercury in Fish Tissue	33880
Lake Whalom	MA81154	4c	(Eurasian Water Milfoil, Myriophyllum spicatum*)	
			(Non-Native Aquatic Plants*)	

Category 4a Waters – impaired waters with a completed TMDL.
Category 4c Waters – impaired waters where the impairment is not caused by a pollutant. No TMDL required.
Category 5 Waters – impaired waters that require a TMDL.
*TMDL not required (Non-pollutant)

Lunenburg is also subject to phosphorus and bacteria water quality limited waterbody requirements for Nashua River, due to its location within its watershed. Thus, Lunenburg

[1]Note that at the time of preparation of this plan (June 2021), the 2016 303d list is the most up to date finalized 303d List as approved by EPA on December 2019.
[2]"Approved TMDLs" are those that have been approved by EPA as of the date of issuance of the 2016 Permit.

will meet the sampling requirements for phosphorus and bacteria sampling as outlined further below.

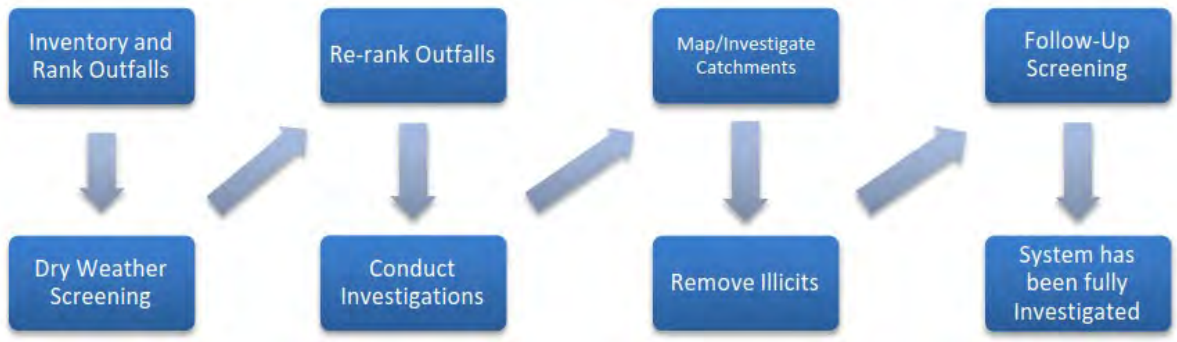
1.5 IDDE Program Purpose, Goals, Framework, and Work Complete

The purpose of this plan is to document the Town's IDDE program and to assist field staff and program staff with the proper identification, reporting, and resolution of pollution problems. A locus map with the regulated Urbanized Area shown is provided as **Figure 1-1** at the end of this section. Note that the entire Town is located within an Urbanized Area, and thus all of Lunenburg is subject to the illicit discharge program requirements.

The goals of the IDDE program are to find and eliminate illicit discharges to the municipal separate storm sewer system and to prevent illicit discharges from happening in the future. The program consists of the following major components as outlined in the 2016 MS4 Permit:

- Legal authority and regulatory mechanism to prohibit illicit discharges and enforce this prohibition;
- Storm system mapping;
- Inventory and ranking of outfalls;
- Dry weather outfall screening;
- Catchment investigations;
- Identification/confirmation of illicit sources;
- Illicit discharge removal;
- Follow-up screening; and
- Employee training.

The general IDDE investigation procedure framework is shown below:



1.6 How to Use this Plan

This plan is intended to be used by Town of Lunenburg staff whose job involves frequent field or site visits, as well as staff responsible for administering the MS4 permit. This will

primarily consist of staff from the Department of Public Works. This plan is divided into several sections and includes the following components:

Section 2 **Authority and Statement of IDDE Responsibilities** – references the Town's legal authority to regulate illicit connections and discharges and identifies Town staff responsible for IDDE Program components.

Section 3 **Stormwater System Mapping** – outlines the procedures for completing required stormwater system mapping, as well as additional recommendations in the 2016 MS4 Permit.

Section 4 **Sanitary Sewer Overflows (SSOs)** – provides an inventory of known SSOs that have discharged to the MS4 and then to waterways within the five (5) years prior to the effective date of the 2016 MS4 Permit, and outlines the procedures for their elimination.

Section 5 **Assessment and Priority Ranking of Outfalls** – assesses and ranks each outfall catchment area for illicit discharge potential. The ranking is used to prioritize IDDE investigations.

Section 6 **Dry Weather Outfall Screening and Sampling** – outlines the procedures for performing outfall screening investigations during dry weather.

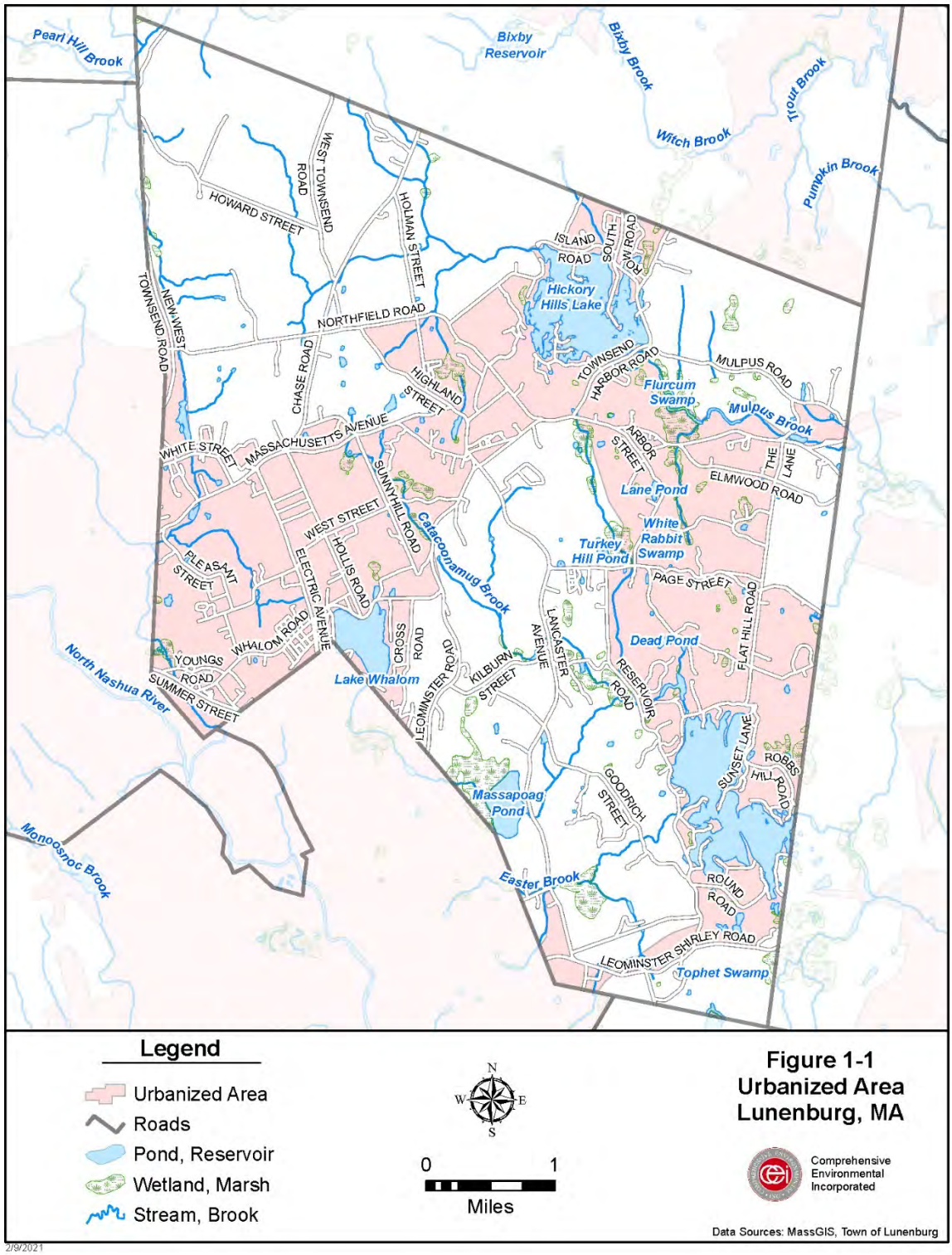
Section 7 **Catchment Investigations** – details various additional investigations used to locate evidence of illicit discharges or SSOs and to isolate and confirm the source of the potential discharge within the outfall catchment area.

Section 8 **Source Investigations** – describes methods for identifying the source of an illicit discharge.

Section 9 **Illicit Discharge Removal** – describes methods for illicit discharge removal, as well as subsequent confirmation screening and discharge prevention.

Section 10 **Training** – details the minimum IDDE training that will be made available to all employees involved in the IDDE program.

Section 11 **Progress Reporting** – outlines the scope of annual progress reports which will evaluate the progress and success of the IDDE program.


Pearl Hill Brook
Bixby Reservoir
Bixby Brook
Witch Brook
Trout Brook
Pumpkin Brook
HOWARD STREET
WEST TOWNSEND ROAD
HOLMAN STREET
TOWNSEND ROAD
NEW WEST
NORTHFIELD ROAD
CHASE ROAD
HIGHLAND STREET
ISLAND ROAD
SOUTH ROAD
Hickory Hills Lake
TOWNSEND HARBOR ROAD
MULPUS ROAD
Flurcum Swamp
Mulpus Brook
WHITE STREET
MASSACHUSETTS AVENUE
SUNNYHILL ROAD
ARBOR STREET
THE LANE
ELMWOOD ROAD
Lane Pond
WEST STREET
Catscoonamug Brook
White Rabbit Swamp
Turkey Hill Pond
PLEASANT STREET
ELECTRIC AVENUE
HOLLIS ROAD
PAGE STREET
FLAT HILL ROAD
Dead Pond
WHALOM ROAD
YOUNGS ROAD
SUMMER STREET
North Nashua River
Lake Whalom
CROSS ROAD
LEOMINSTER ROAD
KILBURN STREET
LANCASTER AVENUE
RESERVOIR ROAD
SUNSET LANE
ROBBS HILL ROAD
GOODRICH STREET
Massapoag Pond
Monoosnoc Brook
Easter Brook
ROUND ROAD
LEOMINSTER SHIRLEY ROAD
Tophet Swamp
Legend
Urbanized Area
Roads
Pond, Reservoir
Wetland, Marsh
Stream, Brook
N
W
E
S
0
1
Miles
Figure 1-1
Urbanized Area
Lunenburg, MA
Comprehensive Environmental Incorporated
Data Sources: MassGIS, Town of Lunenburg
2/9/2021

2 Authority and Statement of IDDE Responsibilities

2.1 Legal Authority

The Town of Lunenburg has adopted an Illicit Discharge Control bylaw under Town Code §204-2: *Discharges to Municipal Storm Sewer System* (https://ecode360.com/33613912) dated November 17, 2020 as required under the 2016 MS4 Permit. A copy of the bylaw is provided in the Stormwater Management Program (SWMP) Plan. This regulatory mechanism provides the Town of Lunenburg with adequate legal authority as required to comply with 2016 MS4 Permit requirements, including:

- Prohibiting illicit discharges and unauthorized discharges to the MS4;
- Investigating suspected illicit discharges;
- Requiring the removal of all such illicit connections;
- Eliminating illicit discharges, including discharges from properties not owned by or controlled by the MS4 that discharge into the MS4 system; and
- Implementing appropriate enforcement procedures and actions.

2.2 Statement of Responsibilities

The Department of Public Works (DPW) is responsible for implementing the IDDE program. The Town Manager or his/her appointed designee has the authority to enforce Town Code §204-2: *Discharges to Municipal Storm Sewer System*. IDDE Program Responsibilities include:

- Drainage system mapping (DPW);
- Determining and inspecting key junction manholes (DPW);
- Catchment delineation and prioritization for field screening (DPW);
- Dry and wet weather outfall investigations where required (DPW);
- Performing systematic catchment investigations (DPW);
- Investigating and eliminating IDDE sources (DPW);
- Enforcing IDDE ordinance requirements (Planning Board);
- Tracking illicit discharge connections and removals for annual reporting (DPW);
- Incorporating IDDE into public education efforts (DPW); and
- Providing annual employee training (DPW).

3 Stormwater System Mapping

The 2016 MS4 Permit requires a detailed storm system map to facilitate identification of key infrastructure, factors influencing proper system operation, and the potential for illicit discharges. The 2016 MS4 Permit requires the storm system map to be developed in two phases as outlined below. The Department of Public Works is responsible for developing the stormwater system mapping pursuant to the 2016 MS4 Permit. The status of Lunenburg's stormwater infrastructure mapping is provided in **Appendix A** along with a copy of the map. The Town of Lunenburg will report on the progress towards completion of the storm system map in each annual report with updates to the stormwater mapping included in **Appendix A**.

3.1 Phase I Mapping

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

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

3.2 Phase II Mapping

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

- Outfall locations (latitude and longitude with a minimum accuracy of +/-30 feet);
- Pipe connectivity;
- Manholes;
- Catch basins;
- Refined catchment delineations. Catchment delineations must be updated to reflect information collected during catchment investigations;
- Municipal sanitary sewer system; and
- Municipal combined sewer system.

Note that Lunenburg has no combined sewer system and thus these mapping components will not apply to the Town's mapping program.

3.3 Additional Recommended Mapping Elements

Although not required, the 2016 MS4 Permit recommends mapping the following items as additional components to the Town of Lunenburg's storm system mapping:

- Storm sewer material, size (pipe diameter), age;
- Sanitary sewer system material, size (pipe diameter), 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;
- Seasonal high-water table elevations impacting sanitary alignments;
- Topography;
- Orthophotography (aerial imagery);
- Alignments, dates and representation of work completed of past investigations; and
- Locations of suspected, confirmed and corrected illicit discharges with dates and flow estimates.

As the Town of Lunenburg's IDDE program progresses through the mapping requirements of the next ten years, the Department of Public Works will assess the feasibility, usefulness, and cost implications of including some or all of the above information into the GIS database. Maps will be updated as additional information is obtained.

4 Sanitary Sewer Overflows (SSOs)

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

The Town of Lunenburg will annually complete an inventory of SSOs that have discharged to the MS4 within the 5 years prior to the effective date of the 2016 MS4 Permit, based on review of available documentation pertaining to SSOs. The SSO inventory is provided in **Appendix B** and will be included in the annual report, including the status of mitigation and corrective measures to address each identified SSO.

5 Assessment and Priority Ranking of Outfalls

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

5.1 Outfall Catchment Delineations

Catchments for each of the MS4 outfalls[3] and interconnections[4] have been delineated based on available topographic contours and mapped drainage infrastructure to define contributing areas for investigation of potential sources of illicit discharges. Initial catchment delineations will be continually refined as additional mapping is completed and to reflect information collected during catchment investigations.

5.2 Outfall and Interconnection Inventory and Initial Ranking

The Department of Public Works completed an initial outfall and interconnection inventory and priority ranking to assess illicit discharge potential based on existing information. The inventory will be updated annually to include data collected in connection with dry weather screening and other relevant inspections and an updated inventory and ranking will be provided in each annual report.

For the ranking, outfalls and interconnections have been classified into one of the following categories:

1. **Problem Outfalls**: Outfalls/interconnections with known or suspected contributions of illicit discharges based on existing information. This includes any outfalls/interconnections where previous screening indicates likely sewer input. 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

[3] **Outfall** means a point source as defined by 40 CFR § 122.2 as the point where the municipal separate storm sewer discharges to waters of the United States. An outfall does not include open conveyances connecting two municipal separate storm sewers or pipes, tunnels or other conveyances that connect segments of the same stream or other waters of the United States and that are used to convey waters of the United States. Culverts longer than a simple road crossing shall be included in the inventory unless the permittee can confirm that they are free of any connections and simply convey waters of the United States.

[4] **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.

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

Note that Problem Catchments are only identified during the initial round of catchment ranking, and no additional catchments should be added to this category. If future evidence indicates that the above pollutant levels may be present, catchments must be ranked at the top of the High Priority Catchments list. Dry weather screening and sampling is not required for Problem Outfalls.

2. **High Priority Outfalls**: Outfalls/interconnections that have not been classified as Problem Outfalls and that contain any of the following characteristics:
    - Discharging to an area of concern to public health due to proximity of public beaches, recreational areas, drinking water supplies or shellfish beds;
    - Past discharge complaints;
    - Discharges exceeding water quality standards for bacteria; ammonia levels ≥ 0.5 mg/l; surfactants greater ≥ 0.25 mg/l;
    - Sites that have a potential to generate pollutants that could contribute to illicit discharges. Examples of these sites include car dealers, car washes, gas stations, garden centers, industrial manufacturing, etc.;
    - Industrial areas >40 years old where the sanitary sewer system is >40 years old;
    - Areas that were once serviced by septic systems that have been converted to sewer;
    - Areas that were once served by a combined sewer system, but have been separated;
    - Septic systems > 30 years old in residential land use and prone to failure;
    - Any river or stream that is culverted for distances greater than a simple road crossing; and
    - Catchment areas draining to waterbody segments impaired for bacteria and pathogens.

3. **Low Priority Outfalls**: Outfalls/interconnections that do not meet any of the problem outfall, high priority outfall, or excluded (below) outfall criteria.

4. **Excluded outfalls**: Outfalls/interconnections with no potential for illicit discharges. 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.

The IDDE prioritization categories, from highest to lowest priority are Problem Outfalls, High Priority Outfalls and Low Priority Outfalls. Excluded Outfalls do not require any investigation. Outfalls that meet criteria in more than one category are automatically assigned the higher of the priority categories. Those within the Problem and High Priority Outfall category are further ranked based on the number of criteria each outfall meets in the

respective category. For example, the more criteria the outfall meets, the higher it is ranked in priority. Refer to **Appendix C** for a tabulated breakdown of the current prioritization (classification and ranking) for each outfall and a map identifying the prioritization by area. The map includes a grid overlay that breaks the Town into sections. The grid overlay is used to prioritize IDDE activities by section of Town (i.e., grid ID), rather than individual outfall, to more efficiently direct inspection activities by area. Classifications and rankings will be updated as additional information is collected.

6 Dry Weather Outfall Screening and Sampling

Dry weather flow is a common indicator of potential illicit connections. The MS4 Permit requires all outfalls/interconnections (excluding Problem and excluded Outfalls) be inspected for the presence of dry weather flow.

The first step for detecting illicit (non-stormwater) connections in MS4s is to physically observe all regulated outfall discharge points in the field during periods of dry weather. Outfall locations are shown on the Town Drainage System Maps provided in **Appendix A**.

Stormwater discharges to culverted streams that cannot be easily accessed (i.e., underground discharge locations) should be inspected at the nearest upstream location (e.g., manhole structure or the last "downstream" catch basin before the outfall pipe).

A comprehensive SOP for Outfall Dry Weather Screening with checklist and forms is included in **Appendix D**. Screening procedures should be implemented starting with High Priority outfalls, followed by Low Priority outfalls, based on the initial priority rankings provided in **Appendix C**. Problem Outfalls do not require screening, rather proceed right to source investigations.

6.1 When to Inspect: Weather Conditions

Dry weather outfall screening and sampling may occur when no more than 0.1 inches of rainfall has occurred in the previous 24-hour period and no significant snow melt is occurring. For purposes of determining dry weather conditions, program staff will use precipitation data from the following sources:

1. Weather Underground, Station KMALUNEN8 in Lunenburg https://www.wunderground.com/weather/us/ma/lunenburg/01462; or
2. NOAA, Station KFIT at the Fitchburg Municipal Airport in Norton https://w1.weather.gov/data/obhistory/KFIT.html

6.2 What to Look For: Physical Characteristics

Illicit discharges can be intermittent or continuous as defined below:

- **Intermittent** – Intermittent discharges are short in duration, lasting only a short time and then disappearing. Examples include:
  - Materials that have been dumped into a storm drain (catch basin) or drainage way, and
  - A floor drain that is connected to the storm sewer.

- **Continuous** – Continuous discharges continue without changing, stopping, or being interrupted. Examples include:

- Sanitary wastewater piping that is cross-connected from a building or sanitary sewer line to the storm sewer, and
- An industrial operational discharge that is not permitted.

Some intermittent illicit discharges may only occur in wet weather or when one part of the system overflows. These flows are generally associated with combined sewer and drainage systems that can back up or bypass diversion structures during heavy flows and discharge wastes to the storm drain system, but can also occur with failing septic systems that pond and discharge through the surface. Illicit discharges can be detected at the stormwater outfall, as evident from unusual debris (e.g. toilet paper), stressed vegetation, sheen, etc.

Physical inspections should include observations for flow, and when flow is not present, for potential signs of intermittent illicit discharges. When flow is present, observations on the presence and severity of odor, color, turbidity and floatables should be made and recorded in accordance with the SOP and checklist in **Appendix D**. Observations for other physical indicators should also be made, under flowing and non-flowing conditions, including the condition of the outfall pipe, deposits or stains in the vicinity of the outfall, abnormal vegetation growth, the quality of any pooled water at the outlet and any benthic growth on the pipe. **Table 6-1** describes various physical observation parameters and what they may indicate.

Table 6-1. Physical Observation Parameters and Likely Flow Sources

Parameter	Observations	Interpretation
Odor	Sewage	Stale sanitary wastewater, especially in pools near outfall
	Sulfur (rotten eggs)	Industries that discharge sulfide compounds or organics (meat packers, canneries, dairies, etc.). Also, could be petroleum related “high – sulfur” fuels
	Rancid-sour	Food preparation facilities (restaurants, hotels, etc.)
	Oil and gas	Petroleum refineries or many facilities associated with vehicle maintenance or petroleum product storage
	Chlorine	Pool discharges, washing activities
	Sweet / Fruity	Washing activities
	Sharp, pungent (chemicals)	Hazardous waste
Color	Yellow	Chemical plants, textile and tanning plants
	Brown	Meat packers, printing plants, metal works, stone and concrete, fertilizers, petroleum refining facilities, construction sites, and glass cutting
	Green	Chemical plants, textile facilities, algae/plankton bloom, antifreeze (fluorescent green), fertilizer
	Red	Meat packers, metal works, iron floc (bacterium)
	Gray	Dairies, food processing, sewage, concrete wash-out
	Red, Purple, Blue, Black	Fabric dyes, inks from paper and cardboard manufacturers

Table 6-1 (continued). Physical Observation Parameters and Likely Flow Sources

Parameter	Observations	Interpretation
Turbidity	Cloudy	Sanitary wastewater, concrete or stone operations, fertilizer facilities, automotive dealers
	Opaque	Food processors, lumber mills, metal operations, pigment plants
Floatable Matter	Oil sheen, grease	Petroleum refineries or storage facilities and vehicle service facilities, restaurants
	Sewage	Sanitary wastewater
Deposits & Stains	Sediment	Construction site erosion
	Oily	Sanitary wastewater
Vegetation	Excessive growth	Food product facilities, fertilizers, farming agricultural use
	Inhibited growth, stressed vegetation	High stormwater flows, beverage facilities, printing plants, metal product facilities, drug manufacturing, petroleum facilities, vehicle service facilities and automobile dealers
Pipe Benthic Growth	Brown	Elevated nutrient level, possibly from sewage or fertilizers
	Orange/Red	High iron and manganese concentration, not typically associated with illicit discharges
	Green	Elevated nutrient level, possibly from sewage or fertilizers
Damage to Outfall Structures	Concrete cracking	Industrial flows, chemicals
	Concrete spalling[1]	
	Peeling paint	
	Metal corrosion	

[1]Concrete spalling: minor cracks and bulges in concrete caused by corrosion of the steel reinforcement inside the concrete.

6.3 What to Sample

If flow is present during a dry weather outfall inspection, a sample will be collected and analyzed for the required permit parameters[5] listed in **Table 6-2**. Field test kits or field instrumentation can be used for all parameters except indicator bacteria and any pollutants of concern. Field kits need to have appropriate detection limits and ranges. **Table 6-2** lists various field test kits and field instruments that can be used for outfall sampling associated with the 2016 MS4 Permit parameters for all waterbodies, other than indicator bacteria and any pollutants of concern.

Table 6-3 lists additional analyses for pollutants of concern in Lunenburg based on the 2016 Integrated List of Waters which must be sampled for select waterbodies. This list will require review and update each time a new list is finalized in Massachusetts. Updates will be

[5]Other potentially useful parameters, although not required by the MS4 Permit, include **fluoride** (indicator of potable water sources in areas where water supplies are fluoridated), **potassium** (high levels may indicate the presence of sanitary wastewater), and **optical brighteners** (indicative of laundry detergents).

maintained in **Appendix D** with the comprehensive SOP for Outfall Dry Weather Screening. Analytic procedures and user's manuals for field test kits and field instrumentation are also provided in **Appendix D**.

Table 6-2. Sampling Parameters and Analysis Methods for All Waterbodies

Analyte or Parameter	Instrumentation (Portable Meter)	Field Test Kit
Ammonia	CHEMetrics™ V-2000 Colorimeter Hach™ DR/890 Colorimeter Hach™ Pocket Colorimeter™ II	CHEMetrics™ K-1410 CHEMetrics™ K-1510 (series) Hach™ NI-SA Hach™ Ammonia Test Strips
Chlorine	CHEMetrics™ V-2000, K-2513 Hach™ Pocket Colorimeter™ II	NA
Conductivity	CHEMetrics™ I-1200 YSI Pro30 YSI EC300A Oakton 450	NA
Salinity	YSI Pro30 YSI EC300A Oakton 450	NA
Indicator Bacteria: *E. coli* (freshwater) or Enterococcus (saline water)	EPA certified laboratory Procedure (40 CFR § 136) Method 1103.1; 1603; Colilert 12 16, Colilert-18 12 15 16; mColiBlue-24 17	NA
Surfactants (Detergents)	CHEMetrics™ I-2017	CHEMetrics™ K-9400 and K-9404 Hach™ DE-2
Temperature	YSI Pro30 YSI EC300A Oakton 450	NA
Pollutants of Concern[6]: See Table 6-3	EPA certified laboratory procedure (40 CFR § 136) See Table 6-3	NA

[6]Where the discharge is directly into a water quality limited water or a water subject to an approved TMDL, samples must be analyzed for the pollutants of concern identified as the cause of the water quality impairment

Table 6-3. Additional Sampling Parameters for Discharges to Impaired Waters

Sample Parameter	Impairment	Impaired Water	Method
BOD5	• DO	• Lake Shirley	Laboratory Analysis: 360.1; 360.2
Dissolved oxygen	• DO	• Lake Shirley	Field Meter or Laboratory Analysis: 365.1; 365.2; 365.3
Escherichia coli	• E.coli	• Nashua River	Laboratory Analysis: 1680; 1681
Total Phosphorus	• Phosphorus • DO	• Nashua River • Lake Shirley	Laboratory Analysis: 365.1; 365.2; 365.3; SM 4500-P-E
Turbidity	• Turbidity	• Lake Shirley	Field Meter or Laboratory Analysis: 160.2; 180.1
Total Suspended Solids	• Turbidity	• Lake Shirley	Field Meter or Laboratory Analysis: 160.2; 180.1

Samples for laboratory analysis must also be stored and preserved in accordance with procedures found in 40 CFR § 136. The SOP in **Appendix D** lists analytical methods, detection limits, hold times, and preservatives for laboratory analysis of dry weather sampling parameters.

6.3.1 Field Equipment

Table 6-4 lists field equipment commonly used for dry weather screening and sampling.

Table 6-4. Field Equipment – Dry Weather Outfall Screening and Sampling

Equipment	Use/Notes
Clipboard	For organization of field sheets and writing surface
Field Sheets	Field sheets for both dry weather inspection and Dry weather sampling should be available with extras
Chain of Custody Forms	To ensure proper handling of all samples
Pens/Pencils/Permanent Markers	For proper labeling
Nitrile Gloves	To protect the sampler as well as the sample from contamination
Flashlight/headlamp w/batteries	For looking in outfalls or manholes, helpful in early mornings as well
Cooler with Ice	For transporting samples to the laboratory
Digital Camera	For documenting field conditions at time of inspection
Personal Protective Equipment (PPE)	Reflective vest, Safety glasses and boots at a minimum
GPS Receiver	For taking spatial location data
Water Quality Sonde	If needed, for sampling conductivity, temperature, pH

Table 6-4 (continued). Field Equipment – Dry Weather Outfall Screening & Sampling

Equipment	Use/Notes
Water Quality Meter	Hand held meter, if available, for testing for various water quality parameters such as ammonia, surfactants and chlorine
Test Kits	Have extra kits on hand to sample more outfalls than are anticipated to be screened in a single day
Label Tape	For labeling sample containers
Sample Containers	Make sure all sample containers are clean. Keep extra sample containers on hand at all times. Make sure there are proper sample containers for what is being sampled for (i.e., bacteria requires sterile containers).
Pry Bar or Pick	For opening catch basins and manholes when necessary
Sandbags	For damming low flows in order to take samples
Small Mallet or Hammer	Helping to free stuck manhole and catch basin covers
Utility Knife	Multiple uses
Measuring Tape	Measuring distances and depth of flow
Safety Cones	Safety
Hand Sanitizer	Disinfectant/decontaminant
Zip Ties/Duct Tape	For making field repairs
Rubber Boots/Waders	For accessing shallow streams/areas
Sampling Pole/Dipper/Sampling Cage	For accessing hard to reach outfalls and manholes

6.4 Interpreting Outfall Sampling Results

Outfall analytical data from dry weather sampling can be used to help identify the major type or source of discharge. **Table 6-5** shows values identified by the U.S. EPA and the Center for Watershed Protection as typical screening values for select parameters. These represent the typical concentration (or value) of each parameter expected to be found in stormwater. Screening values that exceed these benchmarks may indicate illicit discharges. All results will be documented in **Appendix H**.

Table 6-5. Benchmark Field Measurements for Select Parameters

Parameter	Benchmark
Ammonia	>0.5 mg/L
Chlorine	>0.02 mg/L (detectable levels per the 2016 MS4 Permit)
Conductivity	>2,000 µS/cm
Salinity	Reference only, determine type of bacteria analysis
Surfactants	>0.25 mg/L
Temperature	>83°F
Pollutants of Concern	>Applicable water quality criteria

Table 6-5 (continued). Benchmark Field Measurements for Select Parameters

Parameter	Benchmark
Indicator Bacteria[7]: *E.coli* *Enterococcus*	The geometric mean of the five most recent samples taken during the same bathing season shall not exceed: *E.coli*: 126 colonies per 100 ml and no single sample taken during the bathing season shall exceed 235 colonies per 100 ml *Enterococcus:* 33 colonies per 100 ml and no single sample taken during the bathing season shall exceed 61 colonies per 100 ml

Table 6-6 provides a summary on the types of discharge that may be encountered and follow-up actions to be performed. Additional information on next step actions is included in the SOPs in **Appendix E**.

Table 6-6. Outfall Discharge Designation and Follow-Up Action

Type	Description	Action
Obvious Discharge	Outfalls where there is an illicit discharge that do not require sample collection for confirmation (e.g., strong sewage odors, gray sewage water, toilet paper, etc.)	Full source investigation
Suspect Discharge	Flowing outfalls with: 1) high severity on one or more physical indicators and 2) ammonia >0.5 mg/L, surfactants >0.25 mg/L, bacteria >WQ criteria OR ammonia >0.5 mg/L, surfactants >0.25 mg/L, & detectable levels of chlorine	Full source investigation
Potential Discharge	Flowing or non-flowing outfalls with presence of two or more physical indicators	Intermittent flow source investigation
Unlikely Discharge	Non-flowing outfalls with no physical indicators of an illicit discharge	No further action

6.5 Follow-up Ranking of Outfalls and Interconnections

The Town of Lunenburg will update and re-prioritize the initial outfall and interconnection rankings based on information gathered during dry weather screening. The rankings will be updated periodically as dry weather screening information becomes available, but will be completed within three (3) years of the effective date of the permit (July 1, 2021). Outfalls/interconnections where relevant information was found indicating sewer input to the MS4 or sampling results indicating sewer input are highly likely to contain illicit discharges from sanitary sources. Such outfalls/interconnections will be ranked at the top of the High Priority Outfalls category for investigation. Other outfalls and interconnections may be re-ranked based on any new information from the dry weather screening. All results will be documented in **Appendix H**.

[7] Massachusetts Water Quality Standards:
http://www.mass.gov/eea/docs/dep/service/regulations/314cmr04.pdf

7 Catchment Investigations

The 2016 MS4 Permit requires that investigations be performed for all MS4-owned outfall catchment areas regardless of whether flows are observed at the outfall. The catchment area represents the drainage area to the outfall. Catchment investigations must include: 1) a review of mapping and historic plans and records for each catchment to identify system vulnerability factors; 2) a manhole inspection methodology; and 3) procedures to isolate and confirm sources of illicit discharges.

This section outlines a systematic procedure to investigate outfall catchments. All data collected as part of the catchment investigations will be recorded and reported in each annual report.

7.1 Dry Weather Key Junction Structure Inspections

In addition to the outfall screening discussed in Section 6, catchment investigations of key junction manholes must be performed during dry weather conditions. Several important terms related to the dry weather manhole inspection program are defined by the MS4 Permit as follows:

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

- **Key Junction Manholes** are those junction manholes/structures that can represent one or more junction manholes/structures 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/structure as a key junction manhole/structure would not affect the permittee's ability to determine the possible presence of an upstream illicit discharge. A permittee may exclude a junction manhole/structure located upstream from another located in the immediate vicinity or that is serving a drainage alignment with no potential for illicit connections.

Key junction manholes have been identified for Lunenburg's regulated MS4 system and are included on the maps in **Appendix A**. Key junction manholes were identified by first identifying all junction manholes/structures with two or more inlets and then eliminating those that were located in the immediate vicinity of the outfall, in the immediate vicinity of another key junction manhole and those that only received flow from one or two catch basins with no potential for illicit connections.

For all catchments identified for investigation, during dry weather, field crews will systematically inspect key junction manholes for evidence of illicit discharges. A stormwater key junction manhole screening standard operating procedure (SOP) and

checklist is included in **Appendix F**. Screening procedures should be implemented beginning with High Priority Outfalls and ending with Low Priority Outfalls. Problem Outfalls do not require screening, rather proceed right to source investigations (refer to Section 6.0).

7.1.1 When to Inspect

Visual inspections for illicit discharges must occur during dry weather conditions. Dry weather conditions are defined as a minimum of 24 consecutive hours with less than 0.10 inches of rainfall and no significant snow melt is occurring. MS4s are designed to only carry stormwater runoff. If a flow exists at a discharge point during the dry weather inspections, it is identified as a potential illicit discharge.

7.1.2 What to Look For: Physical Characteristics

Each identified key junction manhole must 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). The same observation made for outfalls can also be applied to key junction manhole investigations. Refer to **Table 6-1** in Section 6.0 for parameters and what they mean.

Key junction manholes within the same catchment area can be inspected working from the outfall upstream or working from the most upstream key junction manholes down towards the outfall.

7.1.3 What to Sample

If flow is observed in any manhole, a sample must be collected and analyzed for:

- Ammonia
- Chlorine
- Surfactants

Field kits or instrumentation can be used for these analyses. Where sampling results or visual or olfactory evidence indicate potential illicit discharges or SSOs (refer to **Table 6-5** in Section 6.0), the area draining to the junction manhole must be flagged for further upstream investigation to isolate and confirm sources of illicit discharges in accordance with Section 8.0. 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.

Screening procedures should be implemented beginning with High Priority Catchments and ending with Low Priority Catchments. Problem Outfalls do not require screening and should instead proceed right to source investigations (refer to Section 8). A comprehensive SOP for Key Junction Manhole Dry Weather Screening with checklist and forms are included in **Appendix F.** All results will be documented in **Appendix H**.

7.1.4 Interpreting Key Junction Inspection Results

Where sampling results or visual or olfactory evidence indicate potential illicit discharges or SSOs (**Table 7-1**), the area draining to the junction manhole must be flagged for further upstream investigation to isolate and confirm sources of illicit discharges in accordance with Section 8.0. 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.

Screening procedures should be implemented beginning with High Priority Catchments and ending with Low Priority Catchments. Problem Outfalls do not require screening and should instead proceed right to source investigations (refer to Section 8). A comprehensive SOP for Key Junction Manhole Dry Weather Screening with checklist and forms are included in **Appendix F**. All results will be documented in **Appendix H**.

Table 7-1. Key Junction Discharge Designation and Follow-Up Action

Type	Description	Action
Obvious Discharge	Key junction manholes where there is an illicit discharge that do not require sample collection for confirmation (e.g., strong sewage odors, gray sewage water, toilet paper, etc.)	Full source investigation
Suspect Discharge	Flowing key junction manholes with: 1) high severity on one or more physical indicators and 2) ammonia >0.5 mg/L, surfactants >0.25 mg/L, & detectable levels of chlorine	Full source investigation
Potential Discharge	Flowing or non-flowing key junction manholes with presence of two or more physical indicators	Intermittent flow source investigation
Unlikely Discharge	Non-flowing key junction manholes with no physical indicators of an illicit discharge	No further action

7.2 System Vulnerability Factors and Wet Weather Sampling

Wet weather screening and sampling is required where System Vulnerability Factors (SVFs) exist within a catchment area, including:

- 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 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 that the following SVFs also be considered:

- Sewer pump/lift stations, siphons, or known sanitary sewer restriction 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 or 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).

Wet weather sampling will be performed in accordance with the SOP included in **Appendix G**. The SVF inventory (**Appendix C**) will be updated as new information becomes available and included in the annual report.

7.2.1 When to Sample: Wet Weather Conditions

Where a minimum of one System Vulnerability Factor (SVF) is identified based on previous information or the catchment investigation, one wet weather screening and sampling event shall be performed at the outlet. A comprehensive SOP for Catchment Wet Weather Sampling with checklist and forms are included in **Appendix G**, however inspections will generally proceed as follows:

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

2. Wet weather sampling will occur during or after a storm event of sufficient depth or intensity to produce a stormwater discharge at the outfall. There is no specific rainfall amount that will trigger sampling, although minimum storm event intensities that are likely to trigger sanitary sewer interconnections are preferred. To the extent feasible, sampling should occur during the spring (March through June) when groundwater levels are relatively high.

3. If wet weather outfall sampling indicates a potential illicit discharge, then additional wet weather source sampling will be performed, as warranted, or source isolation and confirmation procedures will be followed as described in Section 8.

4. If wet weather outfall sampling does not identify evidence of illicit discharges, and no evidence of an illicit discharge is found during dry weather manhole inspections, catchment investigations will be considered complete.

7.2.2 What to Sample: Wet Weather Conditions

Samples collected during wet weather investigations should be analyzed for:

- Ammonia
- Chlorine
- Conductivity
- Salinity
- E.coli (freshwater receiving water) or enterococcus (saline or brackish receiving water)
- Surfactants (such as MBAS)
- Temperature
- Pollutants of concern – where the discharge is directly into a water quality limited water or a water subject to an approved TMDL, the sample shall be analyzed for the pollutant(s) of concern identified as the cause of the impairment

All analyses, with the exception of indicator bacteria can be performed with field test kits or field instrumentation. Refer to **Table 6-6** in Section 6.0 for additional details on acceptable concentrations that can be used to assess potential illicit discharges from Lunenburg's MS4. All results will be documented in **Appendix H**.

7.2.3 Interpreting Wet Weather Sampling Results

Wet weather sampling results can be compared to the benchmark values in **Table 6-5**. Screening values that exceed these benchmarks may be indicative of pollution and/or illicit discharges that warrant further investigation. In the case of wet weather sampling, low to moderate levels of bacteria may be associated with wildlife or domestic animal feces, rather than an illicit connection. Similarly, slight exceedances of ammonia benchmarks may also be caused by natural conditions. However, evidence of surfactants and/or chlorine are more likely to be attributed to man-made sources. All data collected during preparation of the IDDE Plan and throughout the catchment investigation process, including information on the surrounding land uses, visual and olfactory observations during dry and wet weather screening, age and history of surrounding septic tanks and/or sewer, storm characteristics, and water quality data should be considered in determining the potential presence of an illicit discharge and the steps for investigation.

Exceedances of one or more parameters by substantial amounts (e.g., an order of magnitude) may be indicative of an illicit discharge and a follow-up round of wet weather sampling should be performed. If additional samples deliver similar results, additional manhole sampling should be completed during wet weather in an attempt to "bracket" a potential source to confirm the presence or absence of an illicit discharge. All results will be documented in **Appendix H**.

8 Source Investigations

Once an illicit discharge is identified at an outfall or manhole, further investigation is necessary to identify the specific point where the illicit discharge comes from (source). The objective of a source investigation is to trace the path of an illicit discharge from the outfall or manhole to the upstream source.

The following methods may be used in isolating and confirming the source of illicit discharges

- Field Reviews;
- Sandbagging;
- Smoke Testing;
- Dye Testing;
- CCTV/Video Inspections;
- Optical Brightener Monitoring; and
- IDDE Canines.

Public notification is an important aspect of a detailed source investigation program. Prior to smoke testing, dye testing, or TV inspections, the Department of Public Works will notify property owners in the affected area. These methods are described in more detail below.

8.1 Field Reviews

Reviewing the drainage system and land uses within contributing catchment areas is the first and perhaps the most efficient method for identifying the source of an illicit discharge. It is important for field crews to observe the land use and activities around the upgradient drainage system to determine if there are any obvious sources of the illicit discharge, as a quick review of nearby land uses and activities may reveal the source immediately. In addition, field crews can simply follow the non-stormwater discharge if it is flowing by tracing the drainage system such as manholes and connecting drainage pipes (refer to SOP in **Appendix E**). Sampling these upgradient connections may also indicate where the source is located. However, some cases may require additional methods, such as sandbagging, dye testing, smoke testing, or television inspection as discussed below, if a flow cannot be traced due to blind connections or complicated drainage networks.

8.2 Sandbagging

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

appropriate durations of dry weather and the need for multiple trips to each manhole makes this method both time-consuming and somewhat limiting.

8.3 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).

To be most effective, pipes may need to be plugged to prevent smoke from easily escaping through manholes, catch basins, or daylight areas. If a cross connection exists, smoke should appear from the building's sanitary sewer vent at the roof. The smoke should not affect residents since nearly all sanitary sewer systems have a trap to prevent odors from backing up into the house; however, residents with respiratory conditions may need to be monitored or evacuated from the area of testing to ensure safety during testing. In many cases, smoke testing should only be used once an unknown pipe is identified. The individual pipe can be plugged and filled with smoke while workers look for signs of smoke at nearby buildings or facilities.

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. This notification presents a good opportunity to involve the public as observers during the smoke test and to educate local residents about stormwater, allowable non-stormwater discharges and illicit discharges. Providing the public with an opportunity to participate in the illicit discharge source investigation will promote IDDE efforts and awareness throughout town.

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. Note that 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.

8.4 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.

A team of two or more people is needed to perform dye testing (ideally, all with two-way radios). One person is inside the building, while the others are stationed at the appropriate

storm sewer and sanitary sewer manholes (which should be opened) and/or outfalls. The person inside the building adds dye into a plumbing fixture (i.e., toilet or sink) and runs a sufficient amount of water to move the dye through the plumbing system. The person inside the building then radios to the outside crew that the dye has been dropped, and the outside crew watches for the dye in the storm sewer and sanitary sewer, recording the presence or absence of the dye.

The test can be relatively quick (about 30 minutes per test), effective (results are usually definitive), and inexpensive. Dye testing is best used when the likely source of an illicit discharge has been narrowed down to a few specific houses or businesses. Successful Tips for dye testing are provided in **Table 8-1**.

8.5 CCTV/Video Inspection

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

8.6 Optical Brightener Monitoring

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

8.7 IDDE Canines

Dogs specifically trained to smell human related sewage are becoming a cost-effective way to isolate and identify sources of illicit discharges. While not widespread at the moment, the use of IDDE canines is growing as is their accuracy. The use of IDDE canines is not recommended as a standalone practice for source identification; rather it is recommended as a tool to supplement other conventional methods, such as dye testing, in order to fully verify sources of illicit discharges.

Table 8-1. Tips for Successful Dye Testing

Dye Selection

- Green and liquid dyes are the easiest to see.
- Dye test strips can be a good alternative for residential or some commercial applications. (Liquid can leave a permanent stain).
- Check the sanitary sewer before using dyes to get a "base color." In some cases, (e.g., a print shop with a permitted discharge to the sanitary sewer), the sewage may have an existing color that would mask a dye.
- Choose two dye colors, and alternate between them when testing multiple fixtures.

Selecting Fixtures to Test

- Check the plumbing plan for the site to isolate fixtures that are separately connected.
- For industrial facilities, check most floor drains (these are often misdirected).
- For plumbing fixtures, test a representative fixture (e.g., a bathroom sink).
- Test some locations separately (e.g., washing machines and floor drains), which may be misdirected.
- If conducting dye investigations on multiple floors, start from the basement and work your way up.
- At all fixtures, make sure to flush with plenty of water to ensure that the dye moves through the system.

Selecting a Sewer Manhole for Observations

- Pick the closest manhole possible to make observations (typically a sewer lateral).
- If this is not possible, choose the nearest downstream manhole.

Communications Between Crew Members

- The individual conducting the dye testing calls in to the field person to report the color dye used, and when it is dropped into the system.
- The field person then calls back when dye is observed in the manhole.
- If dye is not observed (e.g., after two separate flushes have occurred), dye testing is halted until the dye appears.

Locating Missing Dye

- The investigation is not complete until the dye is found. Some reasons for dye not appearing include:
- The building is actually hooked up to a septic system.
- The sewer line is clogged.
- There is a leak in the sewer line or lateral pipe.

Source: Center for Watershed Protection. Illicit Discharge Detection and Elimination, A Guidance Manual for Program Development and Technical Assessments. October 2004.

9 Illicit Discharge Removal

When the specific source of an illicit discharge is identified, the Town of Lunenburg will exercise its authority as necessary to require its removal. The Department of Public Works will collect relevant documentation and records to pursue illicit discharge removal through voluntary elimination or legal enforcement.

9.1 Removal Options

9.1.1 Voluntary Elimination

The voluntary elimination of illicit discharges is strongly encouraged. Through voluntary elimination, the responsible party of an illicit discharge can be contacted directly and informed about the incident. A responsible Town official should make this contact after an illicit discharge has been identified and verified. When a responsible party is contacted, the following information should be provided:

- Details on the identification and verification process;
- Information on the actions that should be implemented to correct the problem and the schedule for performing them; and
- Potential support and incentives that the Town can offer as a result of the voluntary approach.

This approach is the quickest and provides an opportunity for the responsible party to correct the problem in a cost-effective manner, versus a legal enforcement obligation, which is discussed below.

9.1.2 Legal Enforcement

Legal enforcement action may be necessary to completely eliminate illicit discharges in the Town, particularly those that have significant cost implications. Lunenburg has established legal authority for enforcement of IDDE requirements as outlined in Town Code §204-2: *Discharges to Municipal Storm Sewer System* dated November 17, 2020 as required under the 2016 MS4 Permit. This regulatory mechanism in part allows for enforcement of the regulations, orders, violation notices, and enforcement orders, and may pursue civil and criminal remedies for such violations.

9.2 Reporting

All illicit discharge information should be recorded on the Illicit Discharge Tracking Form in **Appendix H** for each location, with overall actions recorded in the Illicit Discharge Log provided in **Appendix H**. The illicit discharge will be removed within sixty (60) days of its confirmation where possible, otherwise a schedule will be established for its elimination with dates and schedules identified in the MS4 annual report. The annual report will also include the status of IDDE investigation and removal activities including the following information for each confirmed source:

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

9.3 Confirmatory Outfall Screening

Confirmatory outfall screening will be completed within one year of removal of all identified illicit discharges within a catchment area and include confirmatory outfall or interconnection screening. The confirmatory screening will be conducted in dry weather unless System Vulnerability Factors have been identified, in which case both dry weather and wet weather confirmatory screening will be conducted. Procedures will follow those outlined earlier in this chapter and in the appendices of this IDDE Plan. If confirmatory screening indicates evidence of additional illicit discharges, the catchment will be scheduled for additional investigation.

9.4 Ongoing Screening

Upon completion of all catchment investigations and illicit discharge removal and confirmation (if necessary), each outfall or interconnection will be re-prioritized for screening, as needed, and scheduled for ongoing screening once every five years. Ongoing screening will consist of dry weather screening and sampling consistent with the procedures described in Section 6 of this plan. Ongoing wet weather screening and sampling will also be conducted at outfalls where wet weather screening was required due to System Vulnerability Factors and will be conducted in accordance with the procedures described in Section 7.2. All sampling results will be reported in the annual report.

9.5 IDDE Prevention

Preventing future illicit discharges is also critically important. Prevention of illicit discharges is achieved through education, outreach, and advocacy. Education and advocacy programs that identify where and when possible illicit discharges and connections occur are good long-term prevention activities. The following activities can be used to help prevent illicit discharges to the drainage system:

- Integrate IDDE information into public education and outreach components;
- Encourage awareness and promote stewardship of the storm drain system in neighborhoods, emphasizing the cause and effect relationship between non-stormwater inputs to the drainage system and water quality of receiving waters;
- Utilize the annual IDDE program evaluation results to promote and support the program throughout the Town; and
- Use the Town's website and provide a phone number for citizens to report suspected illicit discharges.

10 Training

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

11 Progress Reporting

11.1 Program Activity and Timeline

A summary of the required IDDE activities and timelines are provided below. Note that as of completion of this IDDE Plan, Lunenburg is in noncompliance with some of EPA's required timelines; however, is actively working on bringing its program up to date. A proposed schedule is also provided below.

Activity	Timeline
Sanitary Sewer Overflow Inventory	Completed by June 30, 2019 (N/A – no sewer)
Initial Catchment Ranking	Completed by June 30, 2019
Mapping:	
• Outfalls and Interconnections	Completed by June 30, 2020
• Initial Catchment Delineation	Completed by June 30, 2020
• Remaining Mapping	To be Completed by June 30, 2028
Dry Weather Outfall Inspections	Completed by June 30, 2021
Catchment Investigations:	
• Problem Catchments	Begin by July 1, 2020 (N/A – no Problems) Completed by June 30, 2025 (N/A – no Problems)
• All w/Potential Illicit Discharges	Complete by June 30, 2025 (N/A)
• All Outfalls Complete	Complete by June 30, 2028
Source Investigation	As soon as sampling results indicating an illicit discharge are obtained and evaluated
Source Elimination	Within 60 days of its identification or, if not possible, in accordance with schedule established by the Town of Lunenburg (refer to Section 9)
Confirmatory Samples	Within 1 year of illicit discharge elimination
Follow-Up Screening	Reprioritize and resample all outfalls for weather conditions as per the first round within 5 years
Employee Training	Perform annually
Recordkeeping	At all times for all activities

11.2 Annual Recordkeeping

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

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

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

Appendix A

Stormwater System Mapping

Status of Stormwater System Mapping as of June 2021

Requirement Summary	Status
Phase I – Must be Complete by July 1, 2020	
1. Outfalls and receiving waters	Complete
2. Open channel conveyances	Ongoing
3. Interconnections with other MS4s	Ongoing but largely complete
4. Municipally owned structural BMPs	Complete
5. Waterbody names and impairments	Complete
6. Initial catchment delineations by topography	Complete
Phase II – Must be Complete by July 1, 2028	
1. Outfalls with spatial accuracy +/-30 feet	Complete
2. Pipe connectivity	Ongoing, partially complete
3. Manholes	Ongoing but largely complete
4. Catch basins	Ongoing but largely complete
5. Refined catchment delineations	Ongoing
6. Municipal sanitary system	Not Complete
7. Municipal combined sewer system	Not Applicable

Additional outfalls may be found while completing the field inspections and should be added to the drainage map, and ranking and monitored.

Stormwater Infrastructure Map
Lunenburg, MA

Comprehensive Environmental Incorporated

N
W E
S

0 0.5 1
Miles

Data source: MassGIS, Town of Lunenburg

Legend

- Outfalls
- Catch Basin
- Leaching Catch Basin
- Drainage Manhole
- Detention or Infiltration Basin
- Inlet
- Dry Well
- Culvert
- Detention Basin
- Infiltration Basin
- Swale
- Drainage Pipe
- Sewer Pipes
- Lake, Pond, Reservoir
- Wetland, Marsh, Swamp
- Stream, Brook
- Non-Urban Area

2/1/2021

Stormwater Master Tile Map
Lunenburg, MA

Comprehensive Environmental Incorporated

N
W E
S

0 0.5 1
Miles

Data source: MassGIS, Town of Lunenburg

Legend

- Outfalls
- Catch Basin
- Leaching Catch Basin
- Drainage Manhole
- Detention or Infiltration Basin
- Inlet
- Dry Well
- Culvert
- Detention Basin
- Infiltration Basin
- Swale
- Drainage Pipe
- Sewer Pipes
- Lake, Pond, Reservoir
- Wetland, Marsh, Swamp
- Stream, Brook
- Non-Urban Area

2/1/2021

ASHBY
TOWNSEND
FITCHBURG
LEOMINSTER
SHIRLEY
LANCASTER
NEW WEST TOWNSEND ROAD
BOUCHER ROAD
HOWARD STREET
WEST TOWNSEND ROAD
CHASE ROAD
HOLMAN STREET
STAGECOACH ROAD
NORTHFIELD ROAD
PENINSULA DRIVE
MULPUS ROAD
HUNTING HILL ROAD
BEAL STREET
OAK AVENUE
MASSACHUSETTS AVENUE
HOLLIS ROAD
RILEY ROAD
WHITING STREET
ROLLING ACRES ROAD
ARBOR STREET
THE LANE
FLAT HILL ROAD
WEST STREET
SUNNYHILL ROAD
PAGE STREET
RESERVOIR ROAD
PRATT STREET
CAROUSEL LANE
LAUREL LANE
YOUNGS ROAD
CROSS ROAD
KILBURN STREET
LANCASTER AVENUE
LEOMINSTER ROAD
GOODRICH STREET
FLYNN ROAD
GIBSON STREET
A1 A8 A9 A10
B1 B6 B7 B8 B9 B10
C1 C4 C5 C6 C7 C8 C9 C10
D1 D2 D3 D4 D5 D6 D7 D8 D9 D10 D11 D12 D13
E1 E2 E3 E4 E5 E6 E7 E9 E10 E11 E12
F1 F2 F3 F4 F5 F6 F9 F10 F11 F12
G1 G2 G3 G4 G5 G9 G10 G11 G12 G13
H1 H2 H3 H5 H9 H10 H11 H12
I10 I11 I12
J8 J10 J11 J12
K8 K9 K10 K11 K12
L8 L9

Legend

Prioritized Outfalls
Ranking:
- 4
- 3
- 2
- 1
- Low Priority
- Outfalls not in the Urbanized Area

Prioritized Tiles
Ranking:
- High
- Medium
- Low
- Lake, Pond, Reservoir
- Wetland, Marsh, Swamp
- Stream, Brook

N W E S

0 1
Miles

Note: Higher priority outfalls are ranked 1-4 with 4 being the highest priority

Stormwater Map with Prioritized Outfalls Lunenburg, MA

Comprehensive Environmental Incorporated

Data Sources: MassGIS, Town of Lunenburg, CEI

10/17/2019

- Outfalls
- Key Junction
- Manhole
- Catch Basin
- Detention/Infiltration Basin
- Inlet
- Dry Well
- Culvert
- Drainage Pipes
- Pond, Reservoir
- Wetland, Marsh
- Stream, Brook
- Catchments
- Non-Urbanized Area

N

Stormwater Map

Lunenburg, MA

0 200 400 600

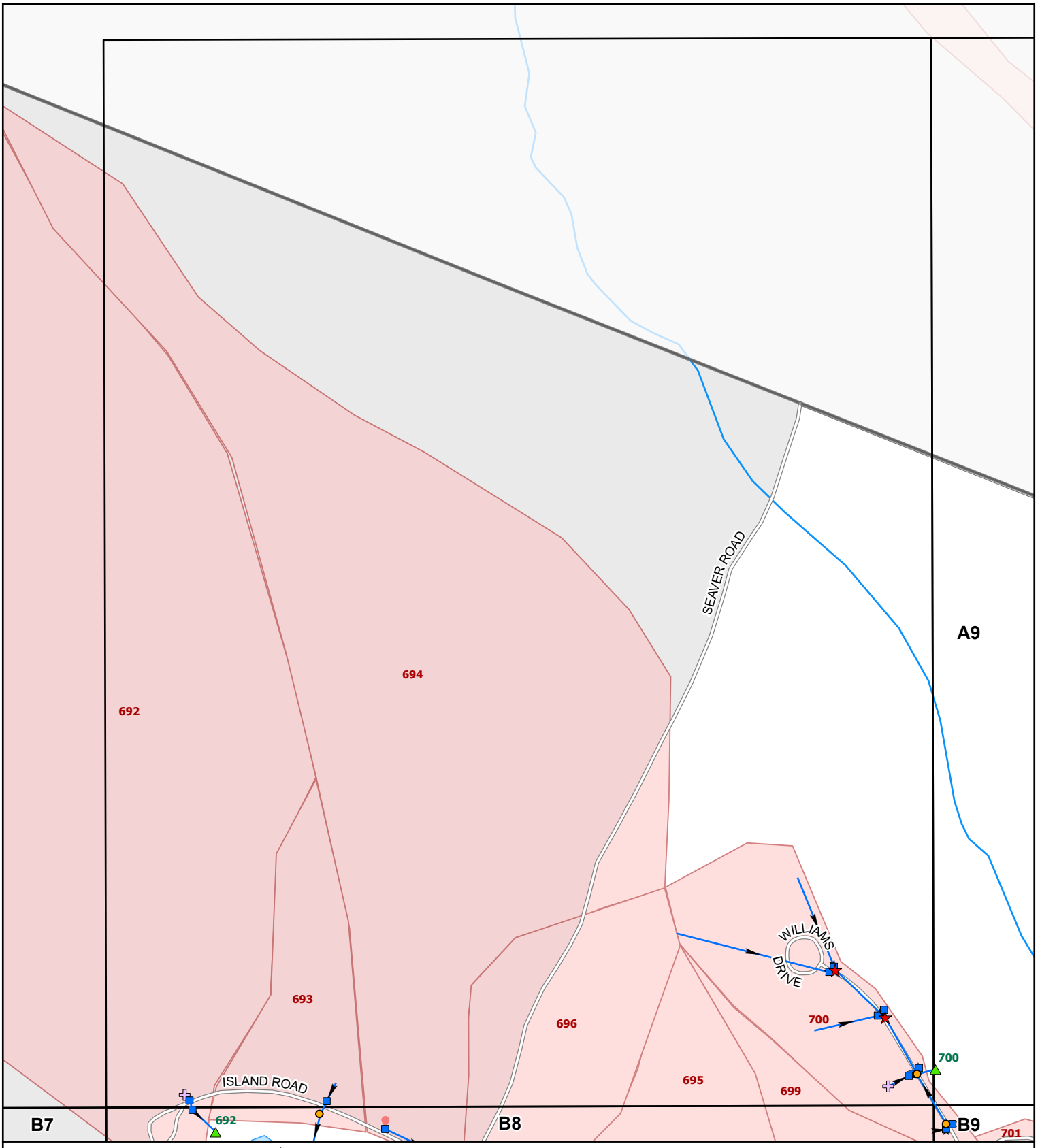
Feet

Data Sources: MassGIS, Town of Lunenburg

Map A1

Comprehensive Environmental Incorporated

2/1/2021



- Outfalls
- Key Junction
- Manhole
- Catch Basin
- Detention/Infiltration Basin
- Inlet
- Dry Well
- Culvert
- Drainage Pipes
- Pond, Reservoir
- Wetland, Marsh
- Stream, Brook
- Catchments
- Non-Urbanized Area

N

Stormwater Map

Lunenburg, MA

0 200 400 600

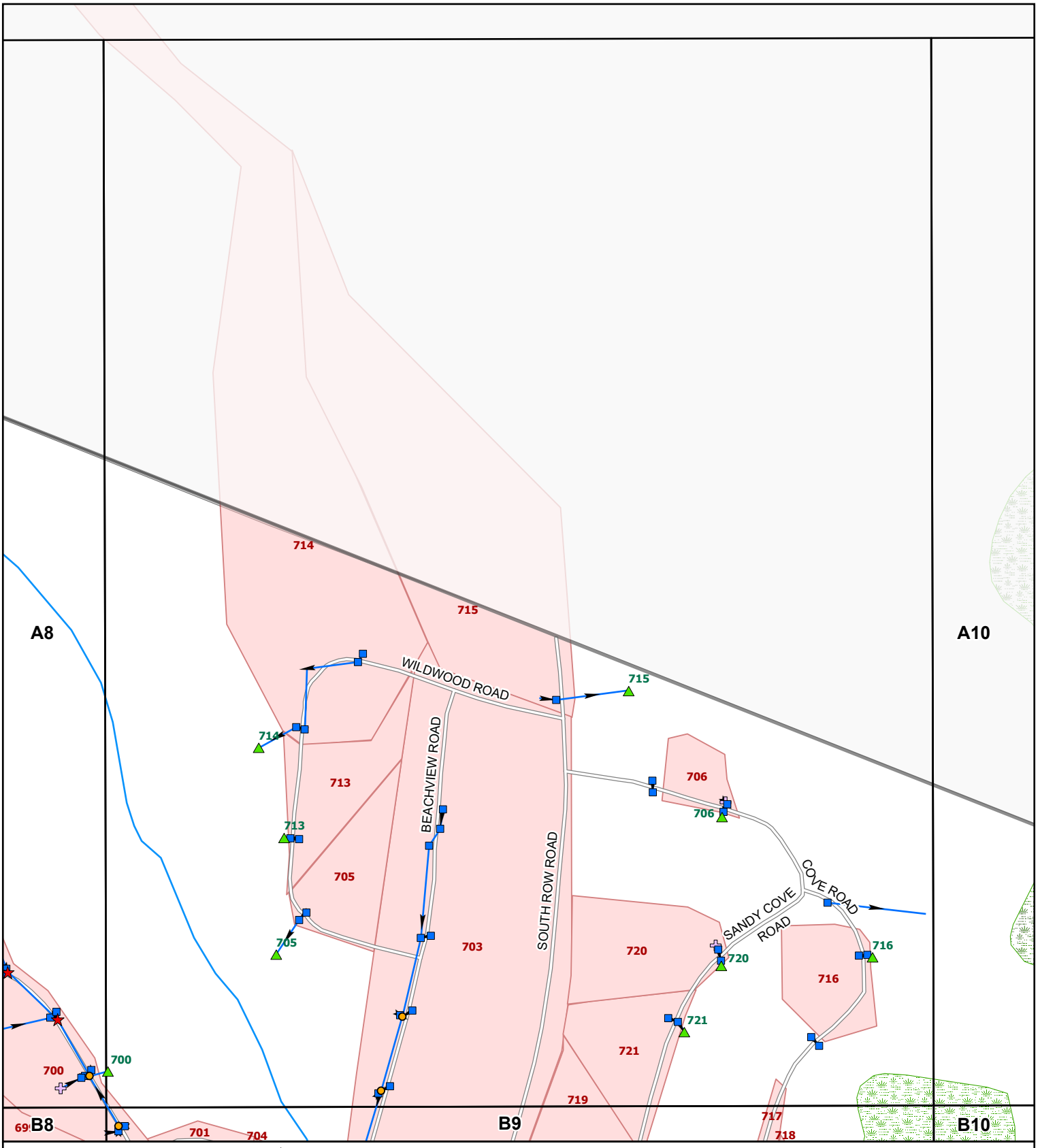
Feet

Data Sources: MassGIS, Town of Lunenburg

Map A8

Comprehensive Environmental Incorporated

2/1/2021



Stormwater Map

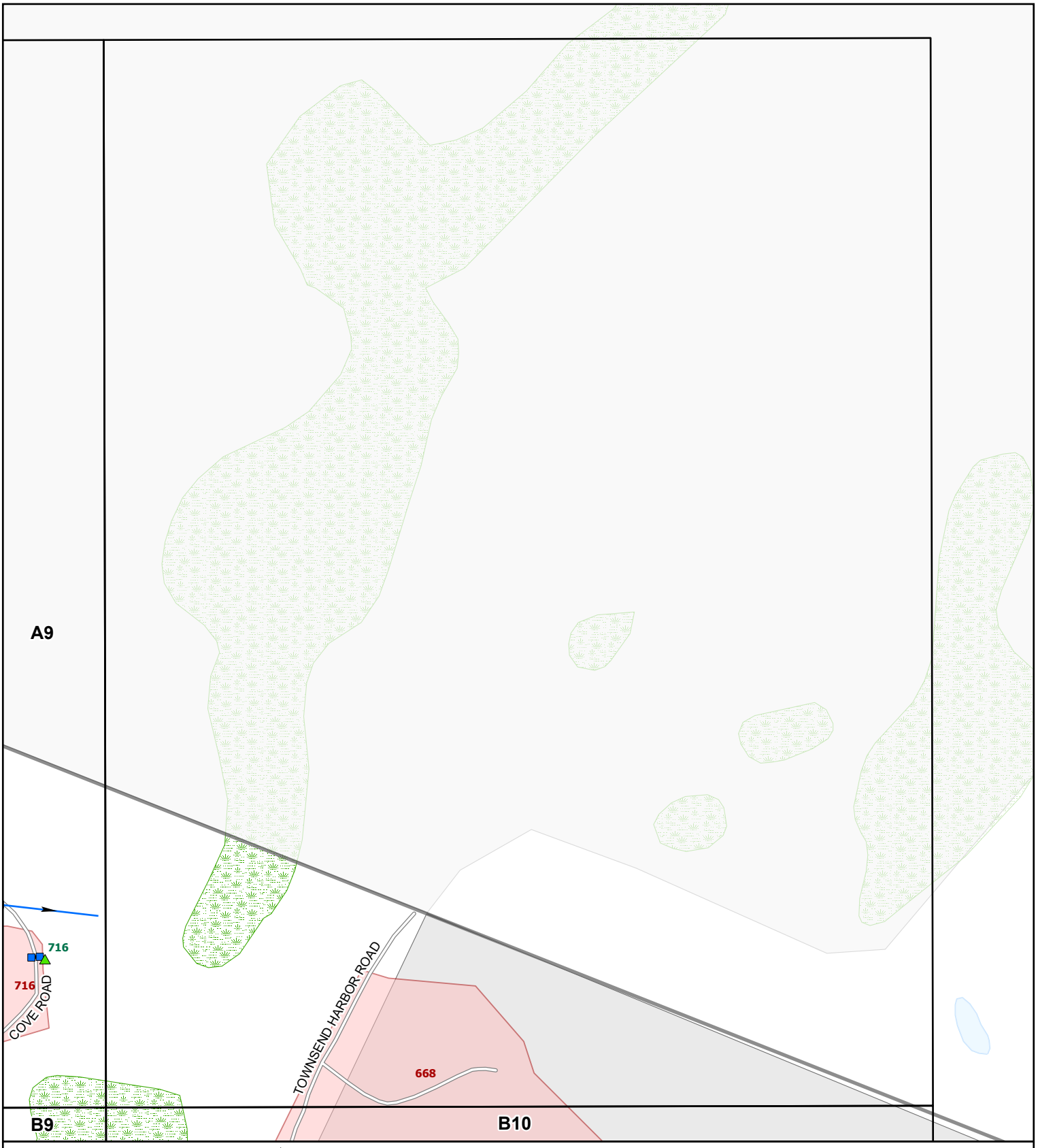
Lunenburg, MA

Map A9

Data Sources: MassGIS, Town of Lunenburg

Comprehensive Environmental Incorporated

2/1/2021



- Outfalls
- Key Junction
- Manhoole
- Catch Basin
- Detention/Infiltration Basin
- Inlet
- Dry Well
- Culvert
- Drainage Pipes
- Pond, Reservoir
- Wetland, Marsh
- Stream, Brook
- Catchments
- Non-Urbanized Area

N

Stormwater Map

Lunenburg, MA

0 200 400 600

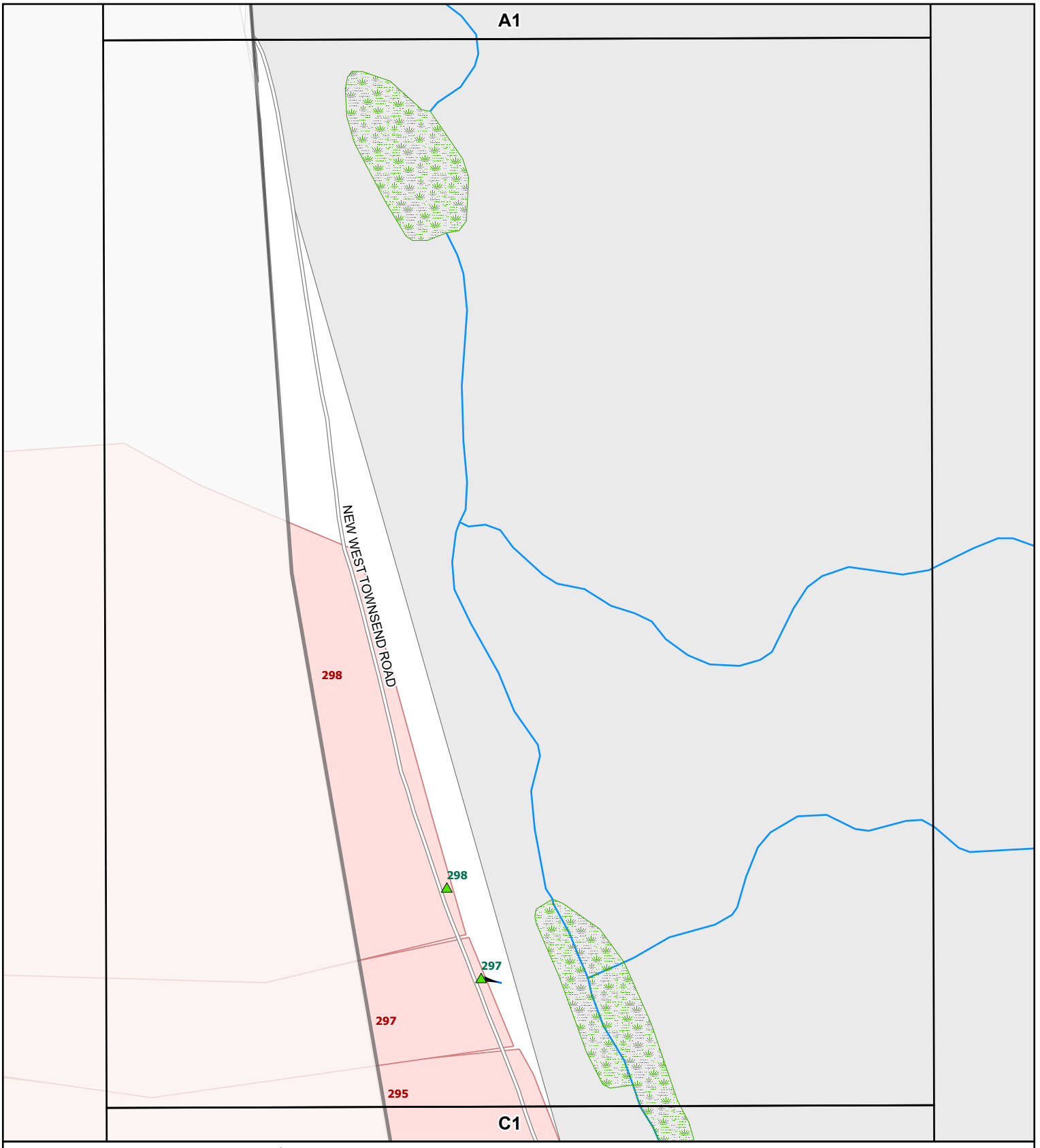
Feet

Data Sources: MassGIS, Town of Lunenburg

Map A10

Comprehensive Environmental Incorporated

2/1/2021



Outfalls
Key Junction
Manhole
Catch Basin
Detention/Infiltration Basin
Inlet
Dry Well

Culvert
Drainage Pipes
Pond, Reservoir
Wetland, Marsh
Stream, Brook
Catchments
Non-Urbanized Area

N

Stormwater Map

Lunenburg, MA

0 200 400 600

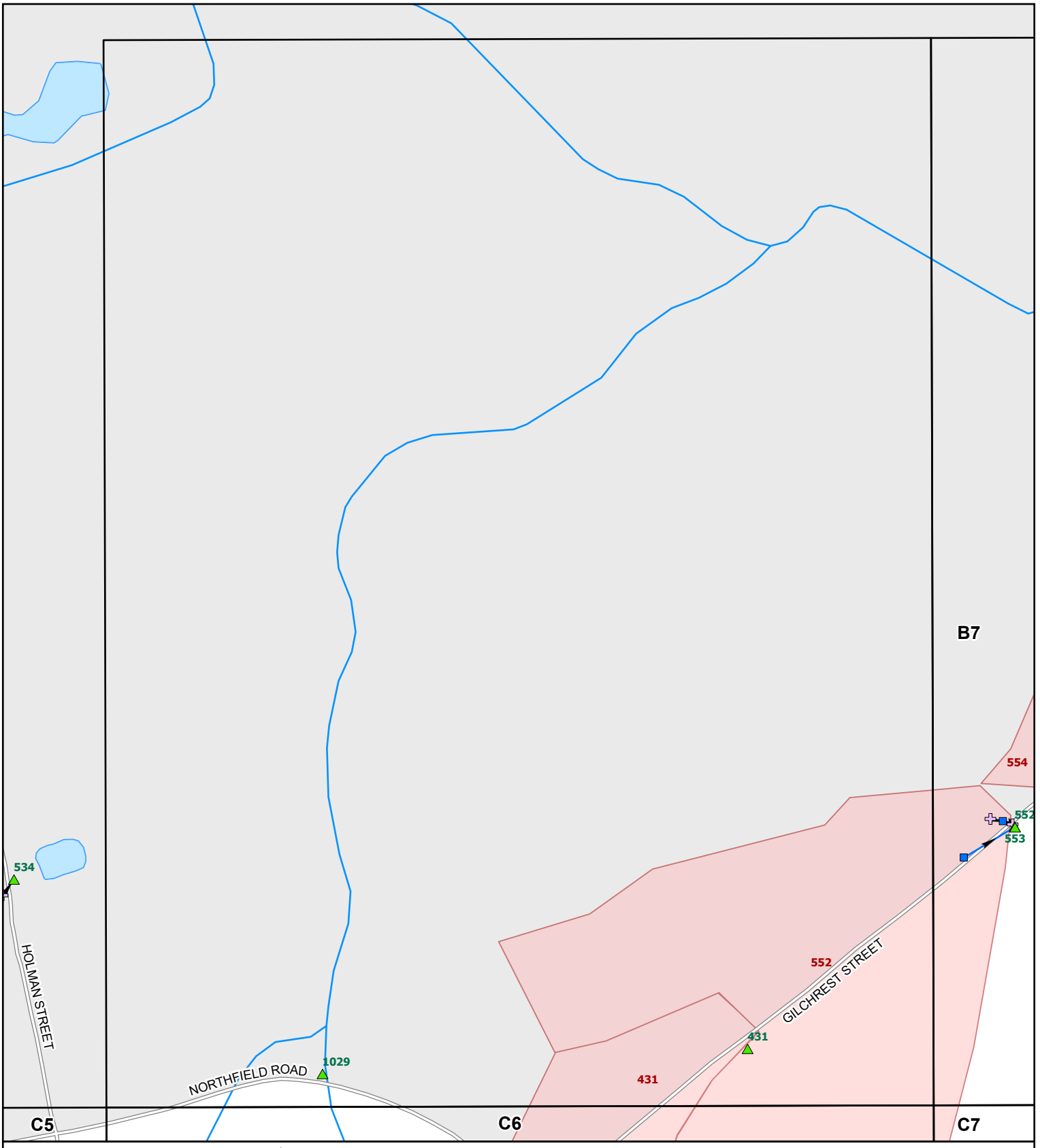
Feet

Data Sources: MassGIS, Town of Lunenburg

Map B1

Comprehensive Environmental Incorporated

2/1/2021



- Outfalls
- Key Junction
- Manhole
- Catch Basin
- Detention/Infiltration Basin
- Inlet
- Dry Well
- Culvert
- Drainage Pipes
- Pond, Reservoir
- Wetland, Marsh
- Stream, Brook
- Catchments
- Non-Urbanized Area

N

Stormwater Map

Lunenburg, MA

0 200 400 600

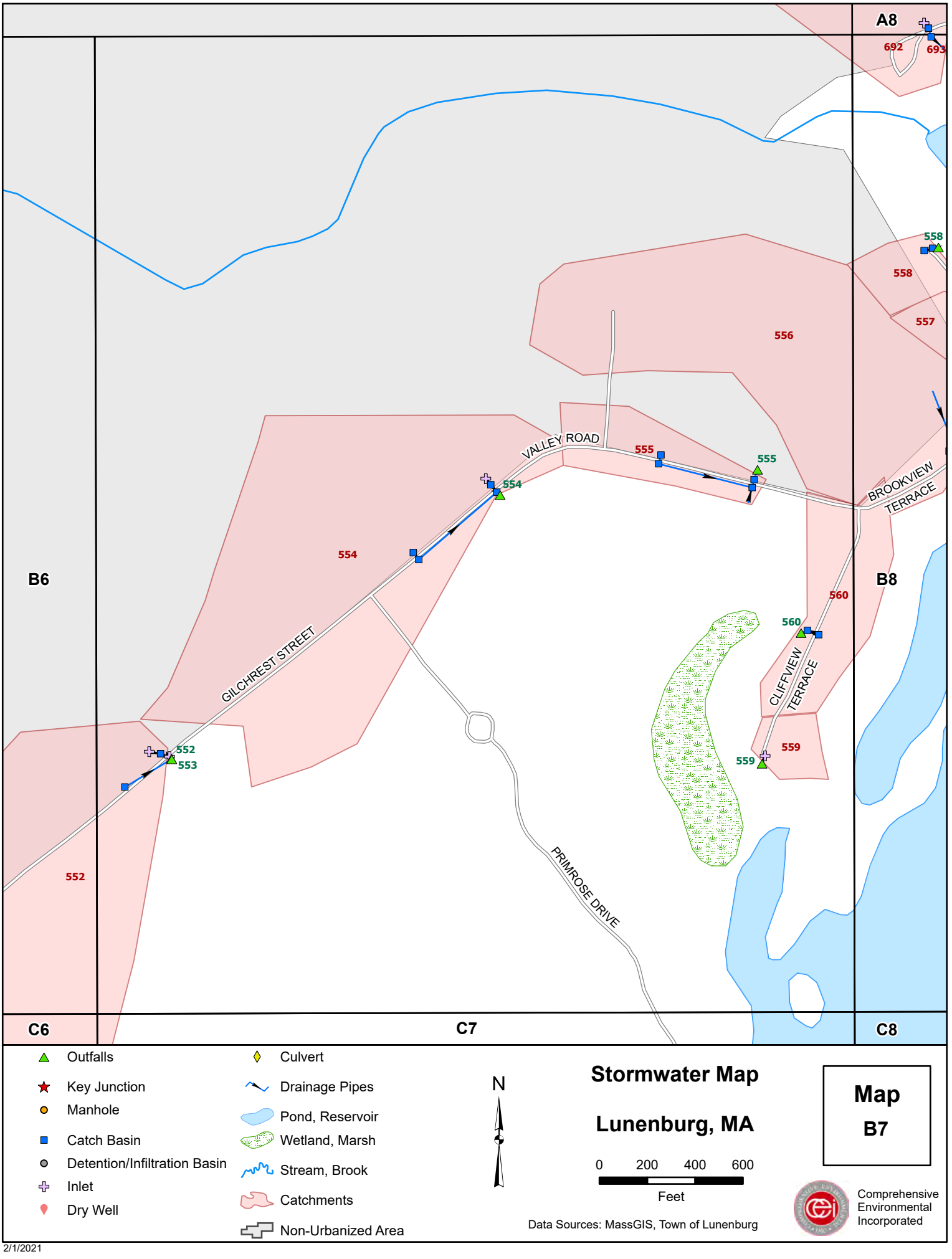
Feet

Data Sources: MassGIS, Town of Lunenburg

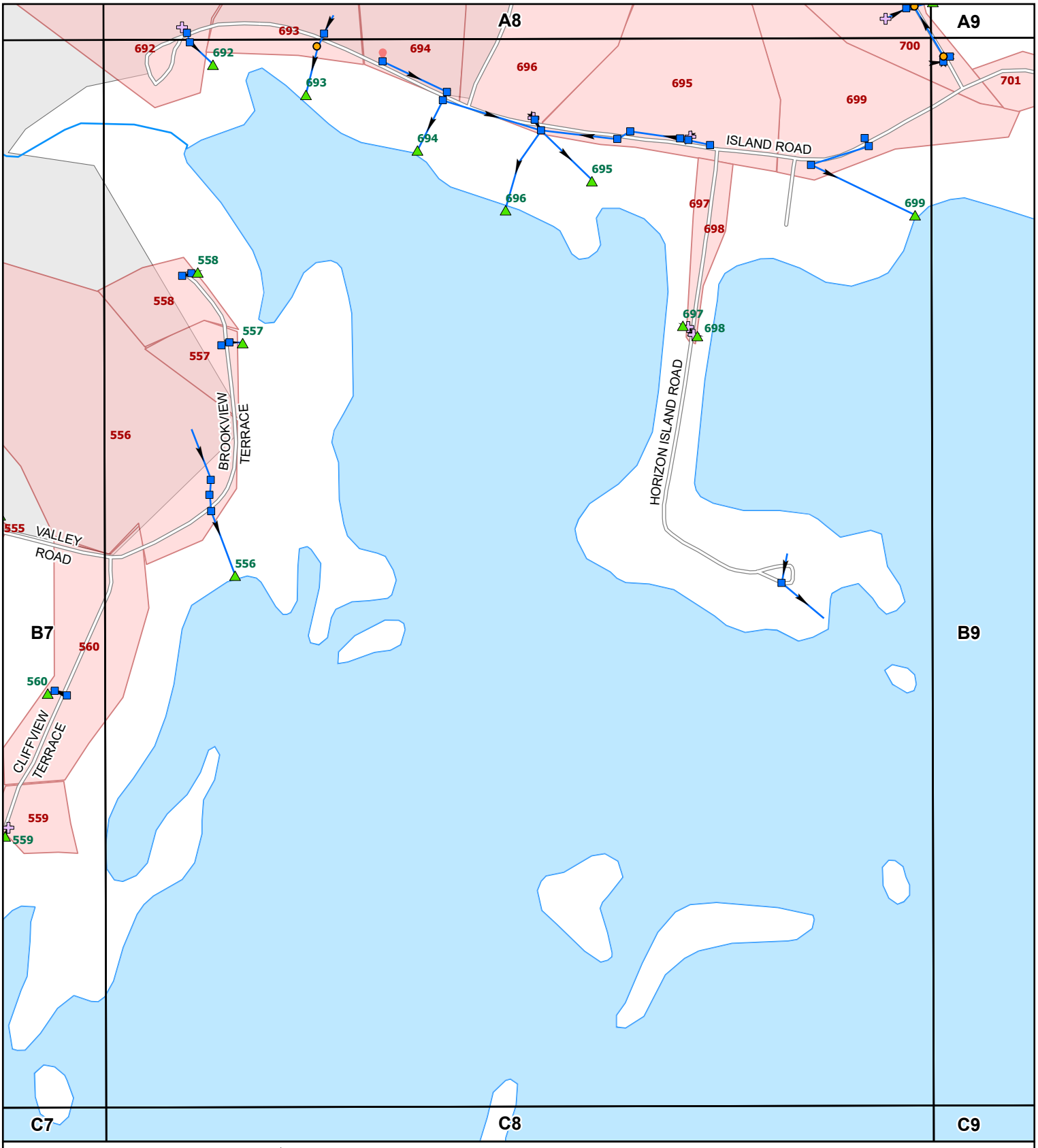
Map B6

Comprehensive Environmental Incorporated

2/1/2021


A8
B6
B8
C6
C7
C8
692
693
558
557
556
554
555
552
553
559
560
VALLEY ROAD
BROOKVIEW TERRACE
GILCHREST STREET
CLIFFVIEW TERRACE
PRIMROSE DRIVE
Outfalls
Key Junction
Manhole
Catch Basin
Detention/Infiltration Basin
Inlet
Dry Well
Culvert
Drainage Pipes
Pond, Reservoir
Wetland, Marsh
Stream, Brook
Catchments
Non-Urbanized Area
N
0 200 400 600
Feet
Stormwater Map
Lunenburg, MA
Map
B7
Data Sources: MassGIS, Town of Lunenburg
Comprehensive Environmental Incorporated

2/1/2021



Outfalls
Key Junction
Manhole
Catch Basin
Detention/Infiltration Basin
Inlet
Dry Well
Culvert
Drainage Pipes
Pond, Reservoir
Wetland, Marsh
Stream, Brook
Catchments
Non-Urbanized Area

N

Stormwater Map

Lunenburg, MA

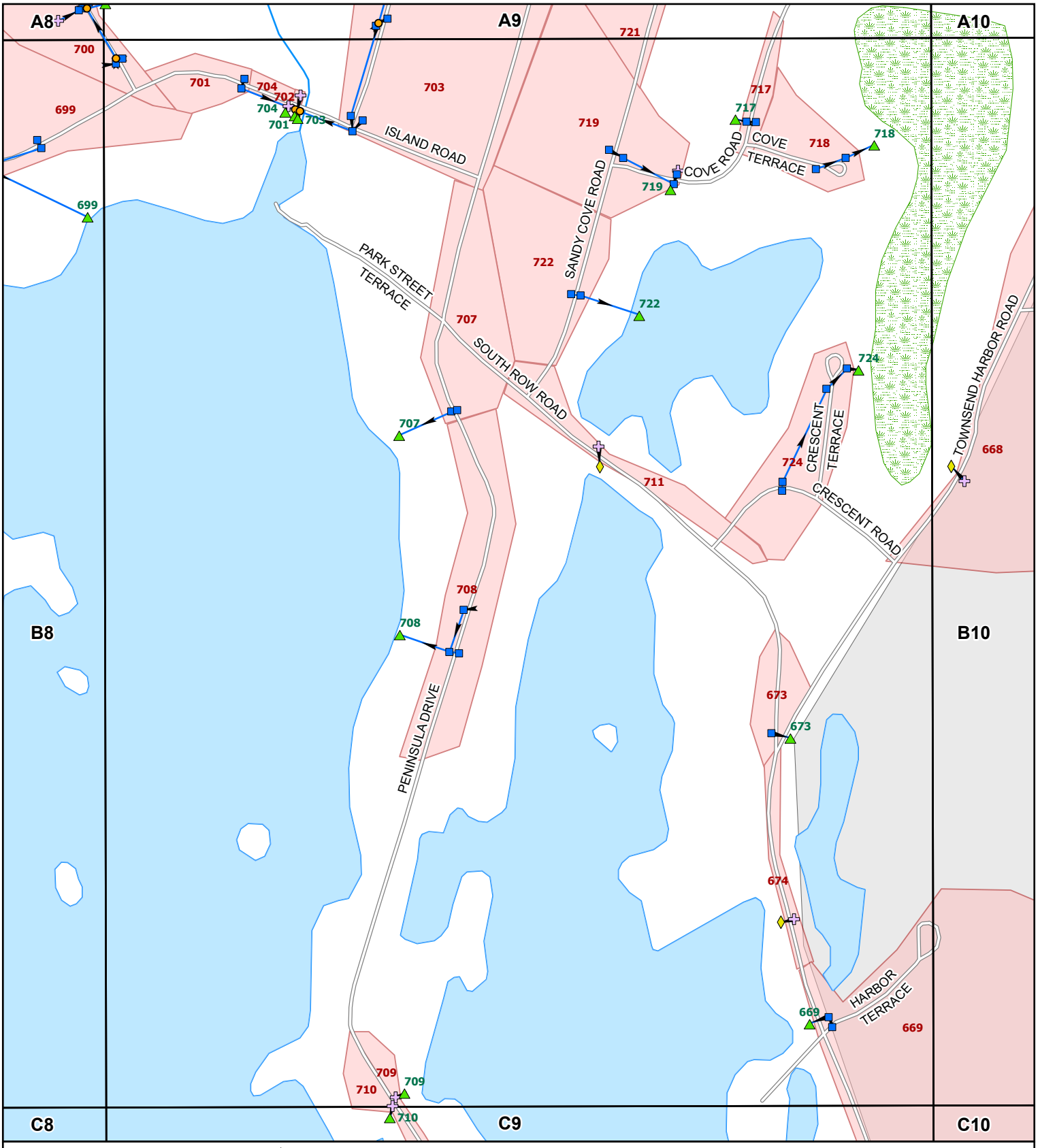
0 200 400 600
Feet

Data Sources: MassGIS, Town of Lunenburg

Map B8

Comprehensive Environmental Incorporated

2/1/2021



- Outfalls
- Key Junction
- Manhole
- Catch Basin
- Detention/Infiltration Basin
- Inlet
- Dry Well
- Culvert
- Drainage Pipes
- Pond, Reservoir
- Wetland, Marsh
- Stream, Brook
- Catchments
- Non-Urbanized Area

N

Stormwater Map

Lunenburg, MA

0 200 400 600

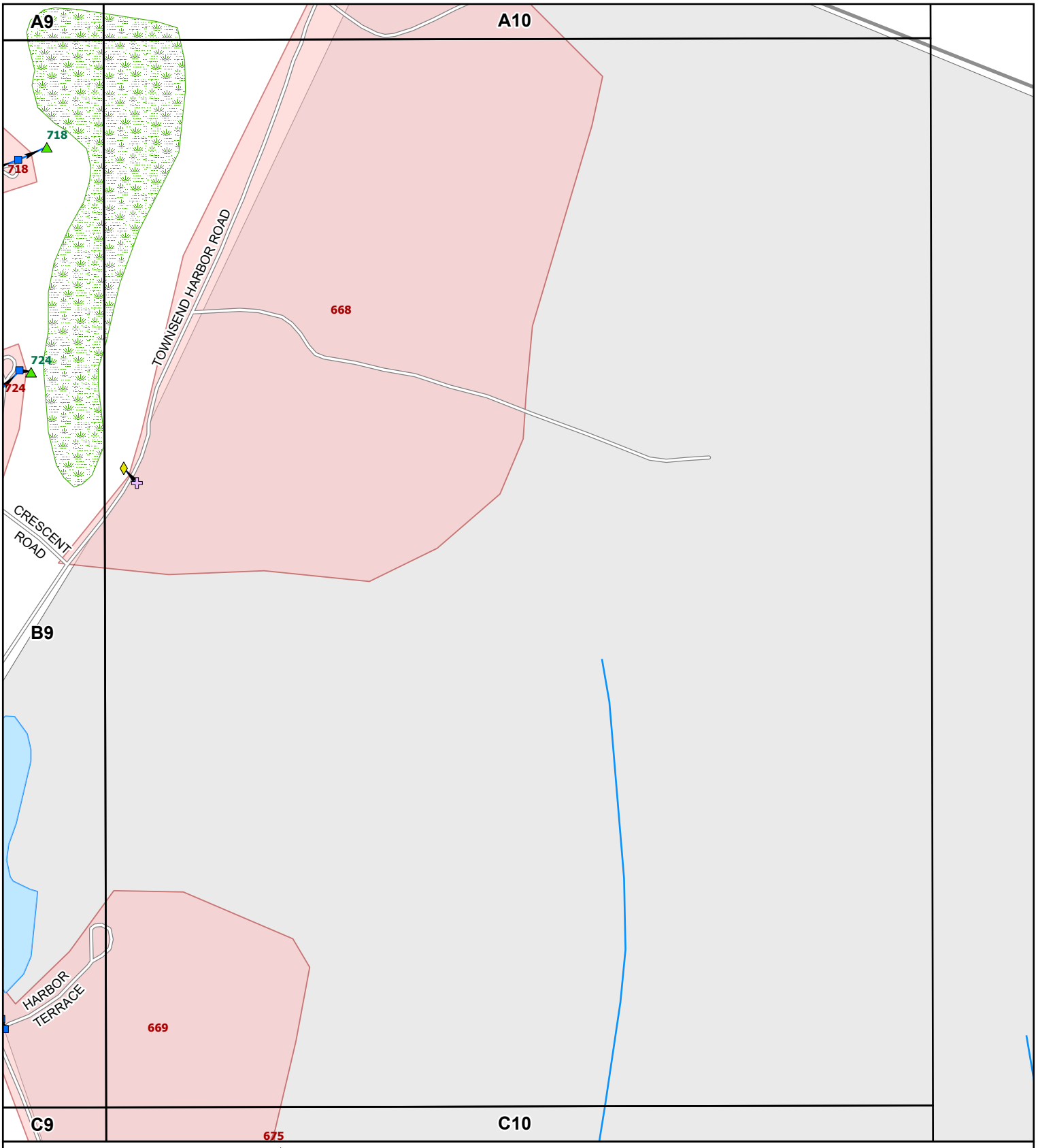
Feet

Data Sources: MassGIS, Town of Lunenburg

Map B9

Comprehensive Environmental Incorporated

2/1/2021



Outfalls
Key Junction
Manhole
Catch Basin
Detention/Infiltration Basin
Inlet
Dry Well
Culvert
Drainage Pipes
Pond, Reservoir
Wetland, Marsh
Stream, Brook
Catchments
Non-Urbanized Area

N

Stormwater Map

Lunenburg, MA

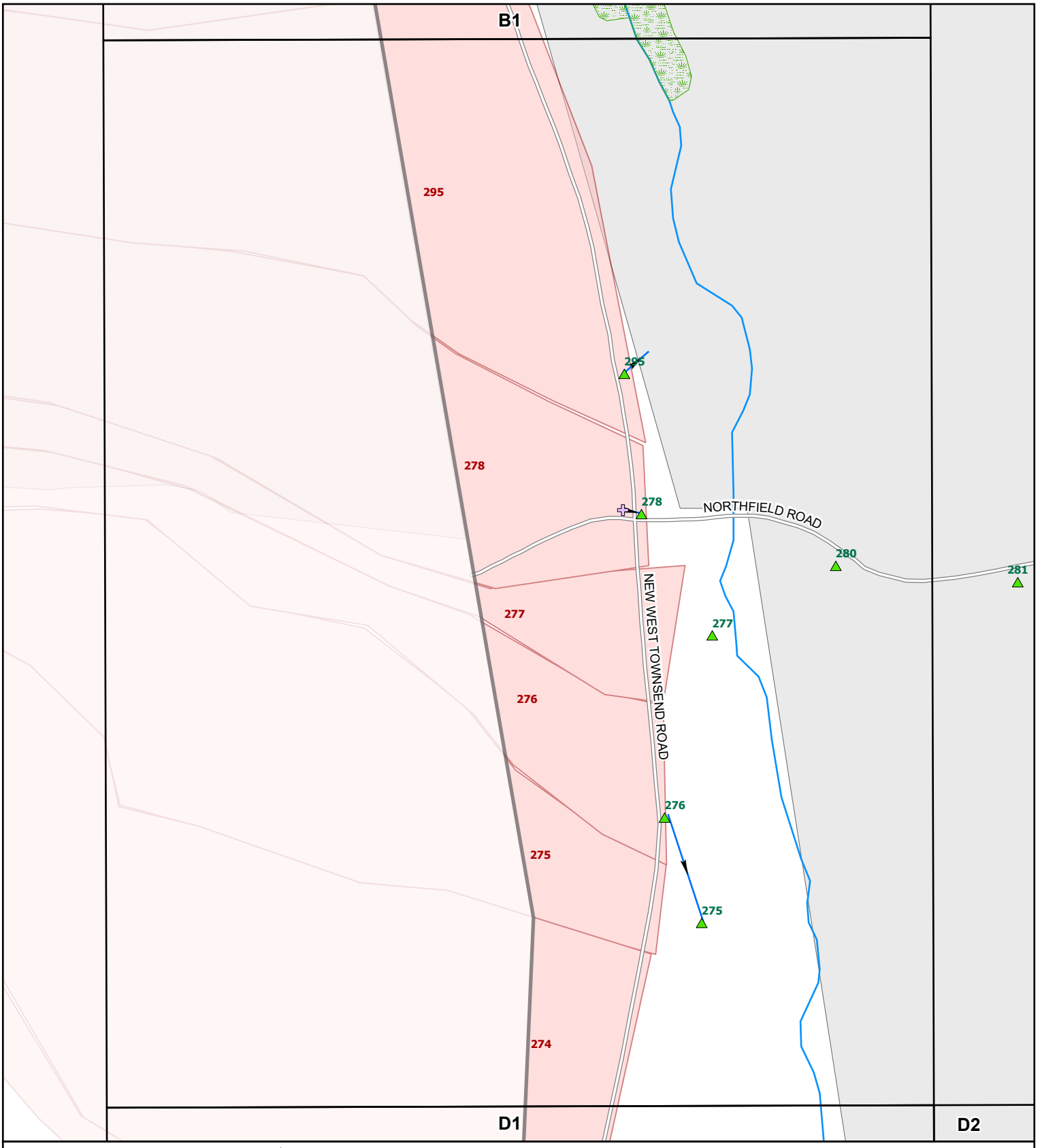
0 200 400 600
Feet

Data Sources: MassGIS, Town of Lunenburg

Map B10

Comprehensive Environmental Incorporated

2/1/2021



- Outfalls
- Key Junction
- Manhole
- Catch Basin
- Detention/Infiltration Basin
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- Dry Well
- Culvert
- Drainage Pipes
- Pond, Reservoir
- Wetland, Marsh
- Stream, Brook
- Catchments
- Non-Urbanized Area

N

Stormwater Map

Lunenburg, MA

0 200 400 600

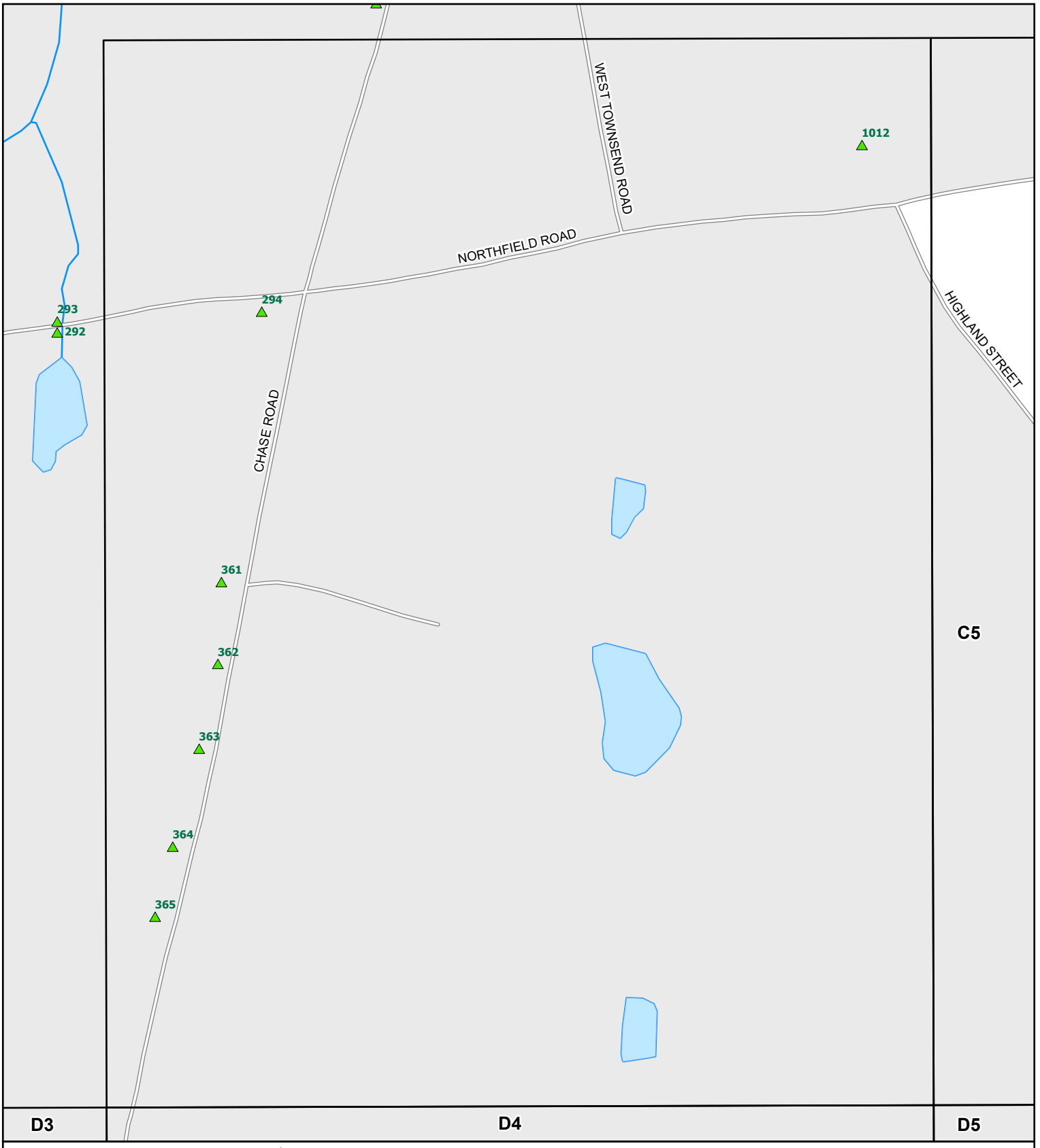
Feet

Data Sources: MassGIS, Town of Lunenburg

Map C1

Comprehensive Environmental Incorporated

2/1/2021



- Outfalls
- Key Junction
- Manhole
- Catch Basin
- Detention/Infiltration Basin
- Inlet
- Dry Well
- Culvert
- Drainage Pipes
- Pond, Reservoir
- Wetland, Marsh
- Stream, Brook
- Catchments
- Non-Urbanized Area

N

Stormwater Map

Lunenburg, MA

0 200 400 600

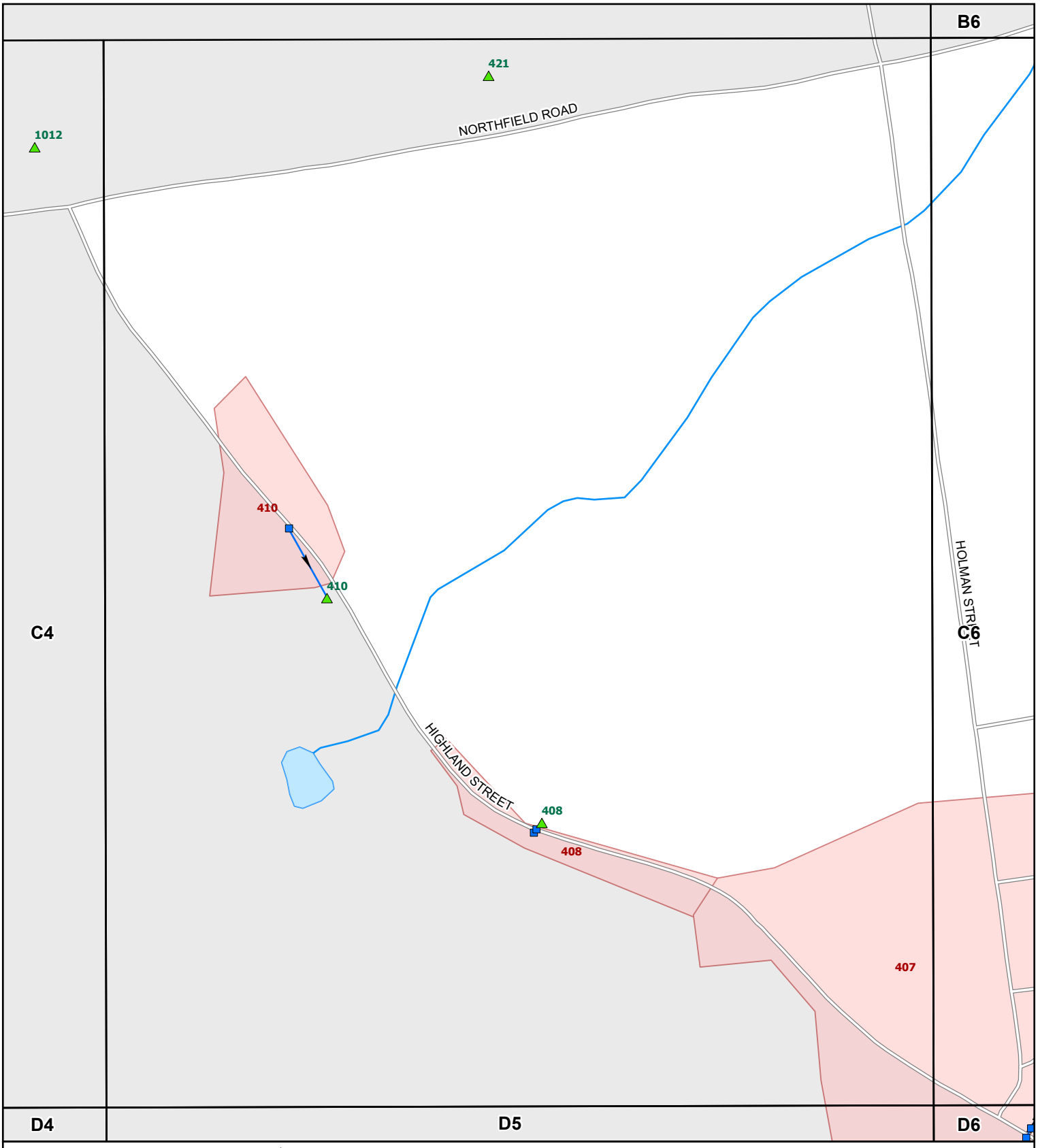
Feet

Data Sources: MassGIS, Town of Lunenburg

Map C4

Comprehensive Environmental Incorporated

2/1/2021



- Outfalls
- Key Junction
- Manhole
- Catch Basin
- Detention/Infiltration Basin
- Inlet
- Dry Well
- Culvert
- Drainage Pipes
- Pond, Reservoir
- Wetland, Marsh
- Stream, Brook
- Catchments
- Non-Urbanized Area

N

Stormwater Map

Lunenburg, MA

0 200 400 600

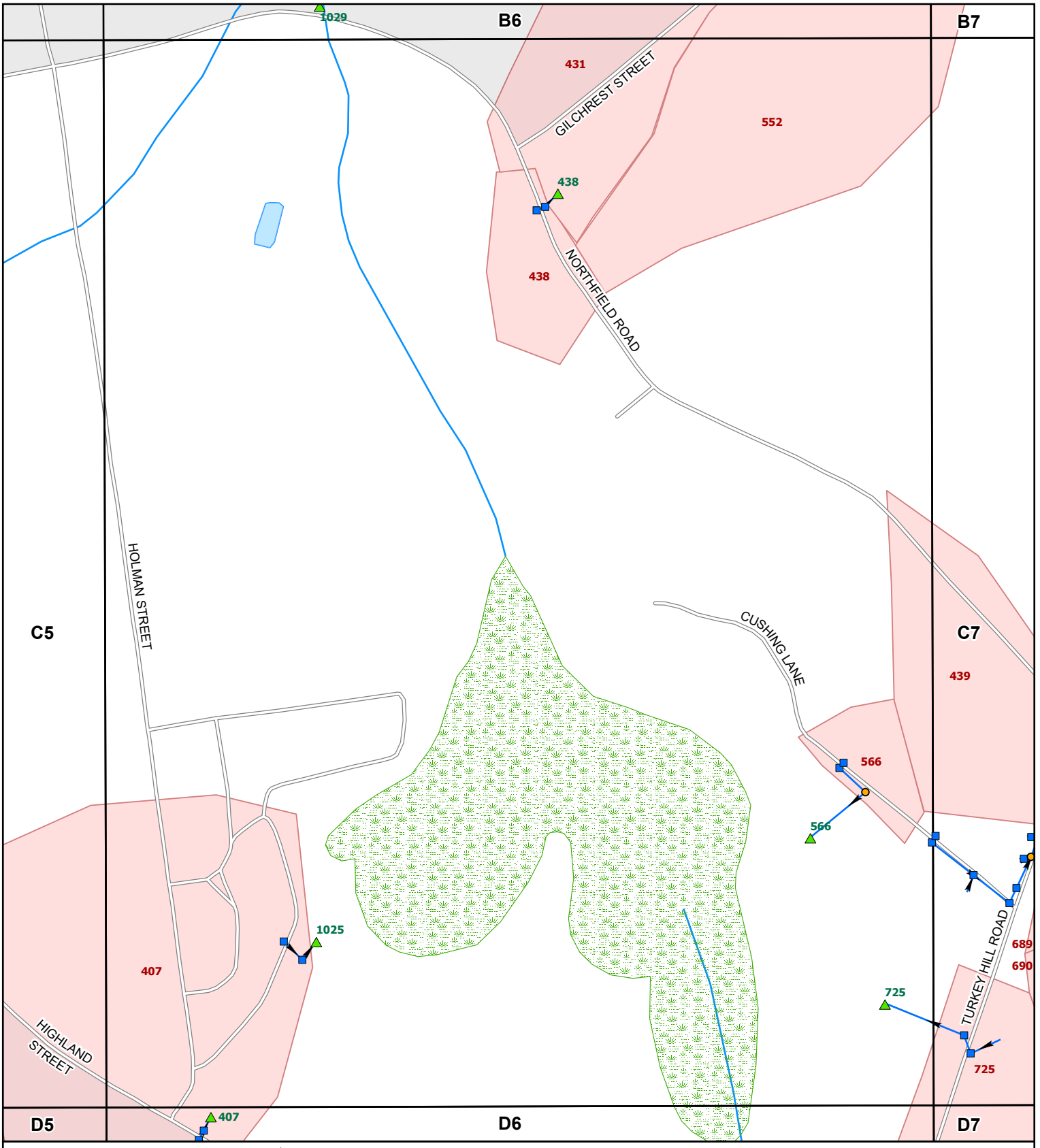
Feet

Data Sources: MassGIS, Town of Lunenburg

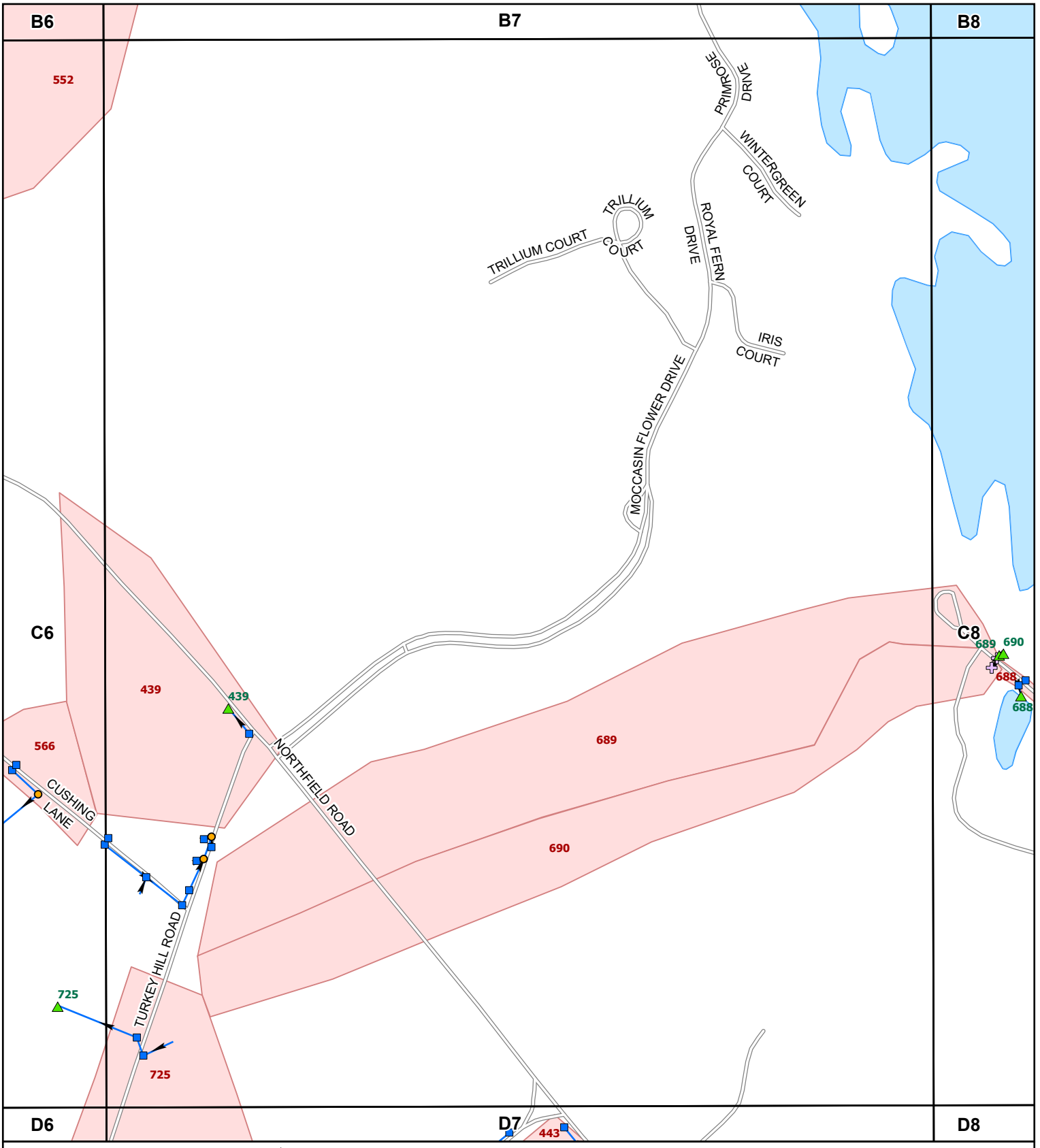
Map C5

Comprehensive Environmental Incorporated

2/1/2021


B6
B7
C5
C7
D5
D6
D7
1029
431
552
438
438
GILCHREST STREET
NORTHFIELD ROAD
HOLMAN STREET
CUSHING LANE
439
566
566
1025
407
407
689
690
725
725
TURKEY HILL ROAD
HIGHLAND STREET
Outfalls
Key Junction
Manhole
Catch Basin
Detention/Infiltration Basin
Inlet
Dry Well
Culvert
Drainage Pipes
Pond, Reservoir
Wetland, Marsh
Stream, Brook
Catchments
Non-Urbanized Area
N
Stormwater Map
Lunenburg, MA
0 200 400 600
Feet
Data Sources: MassGIS, Town of Lunenburg
Map
C6
Comprehensive
Environmental
Incorporated

2/1/2021



Outfalls
Key Junction
Manhole
Catch Basin
Detention/Infiltration Basin
Inlet
Dry Well
Culvert
Drainage Pipes
Pond, Reservoir
Wetland, Marsh
Stream, Brook
Catchments
Non-Urbanized Area

N

Stormwater Map

Lunenburg, MA

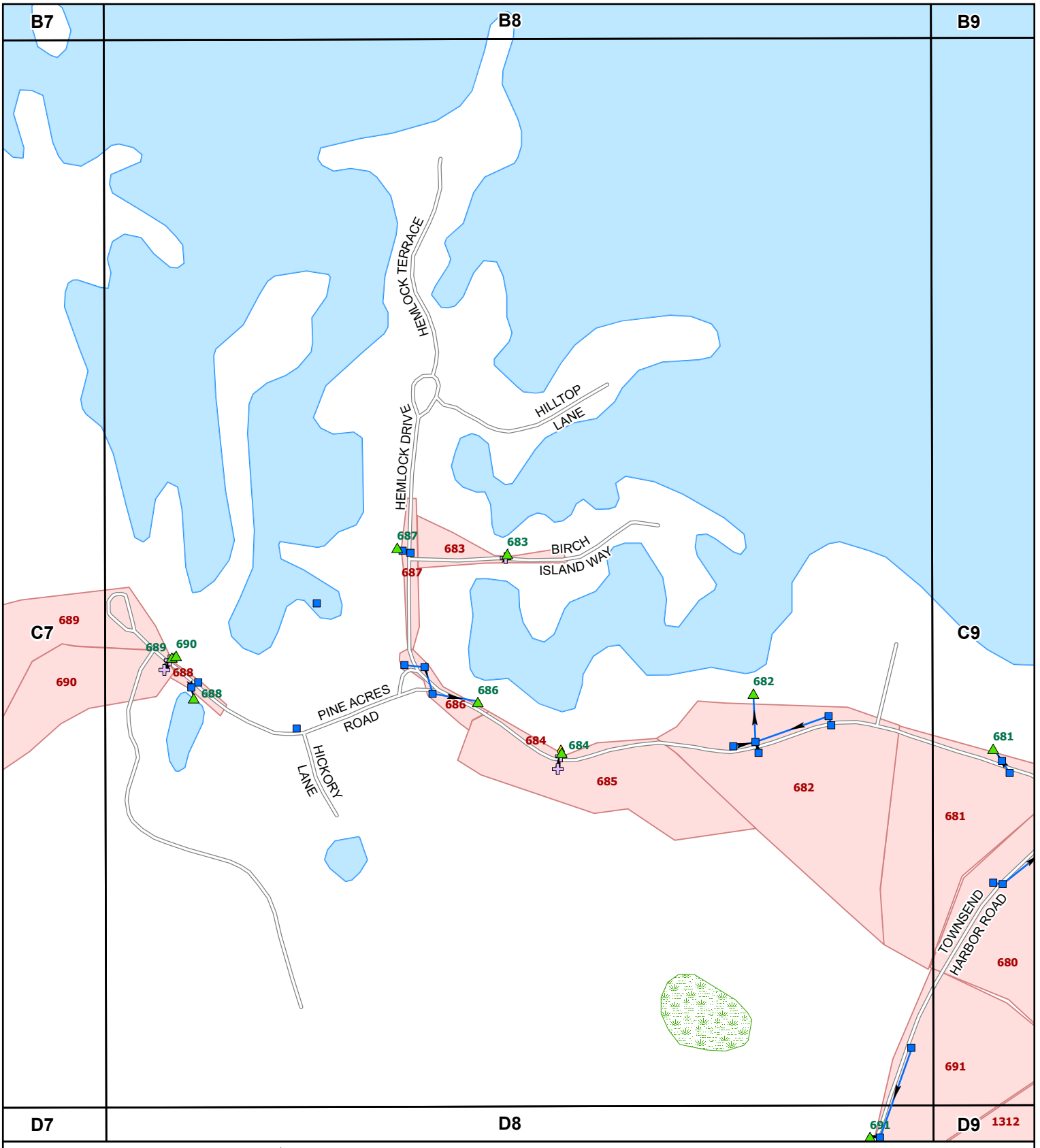
0 200 400 600
Feet

Data Sources: MassGIS, Town of Lunenburg

Map C7

Comprehensive Environmental Incorporated

2/1/2021



- Outfalls
- Key Junction
- Manhole
- Catch Basin
- Detention/Infiltration Basin
- Inlet
- Dry Well
- Culvert
- Drainage Pipes
- Pond, Reservoir
- Wetland, Marsh
- Stream, Brook
- Catchments
- Non-Urbanized Area

N

Stormwater Map

Lunenburg, MA

0 200 400 600

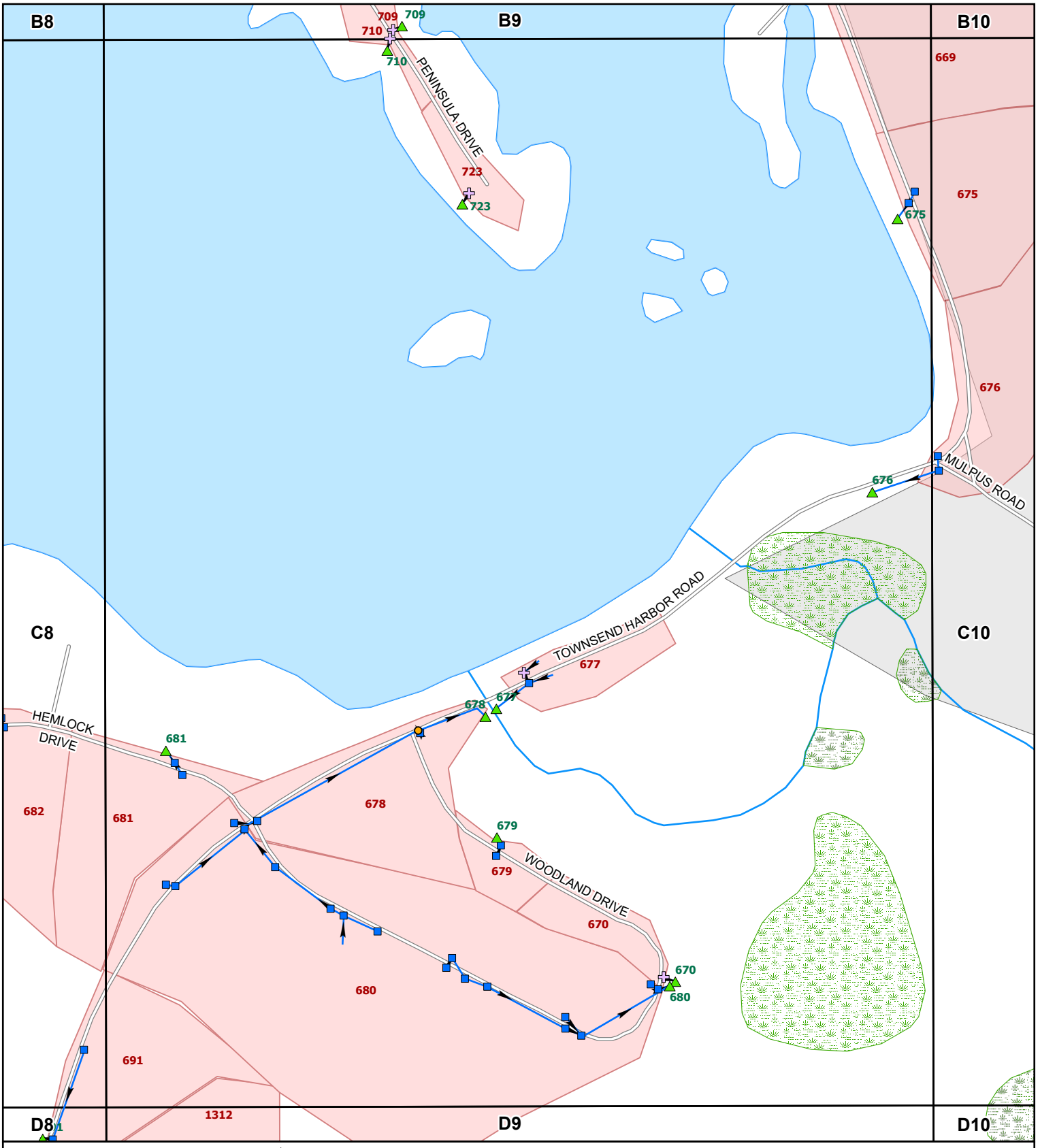
Feet

Data Sources: MassGIS, Town of Lunenburg

Map C8

Comprehensive Environmental Incorporated

2/1/2021



- Outfalls
- Key Junction
- Manhole
- Catch Basin
- Detention/Infiltration Basin
- Inlet
- Dry Well
- Culvert
- Drainage Pipes
- Pond, Reservoir
- Wetland, Marsh
- Stream, Brook
- Catchments
- Non-Urbanized Area

N

Stormwater Map

Lunenburg, MA

0 200 400 600

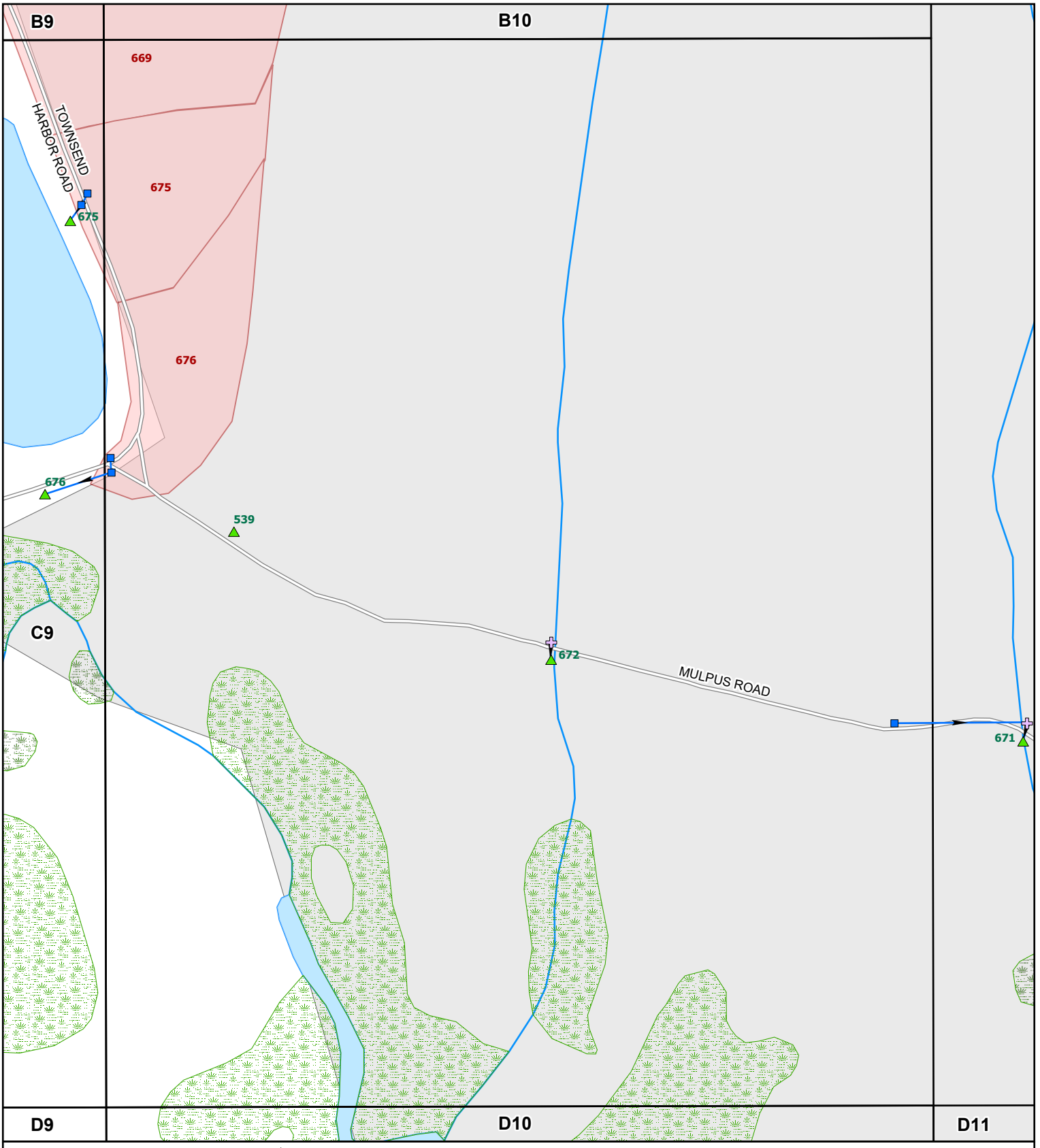
Feet

Data Sources: MassGIS, Town of Lunenburg

Map C9

Comprehensive Environmental Incorporated

2/1/2021



- Outfalls
- Key Junction
- Manhole
- Catch Basin
- Detention/Infiltration Basin
- Inlet
- Dry Well
- Culvert
- Drainage Pipes
- Pond, Reservoir
- Wetland, Marsh
- Stream, Brook
- Catchments
- Non-Urbanized Area

N

Stormwater Map

Lunenburg, MA

0 200 400 600

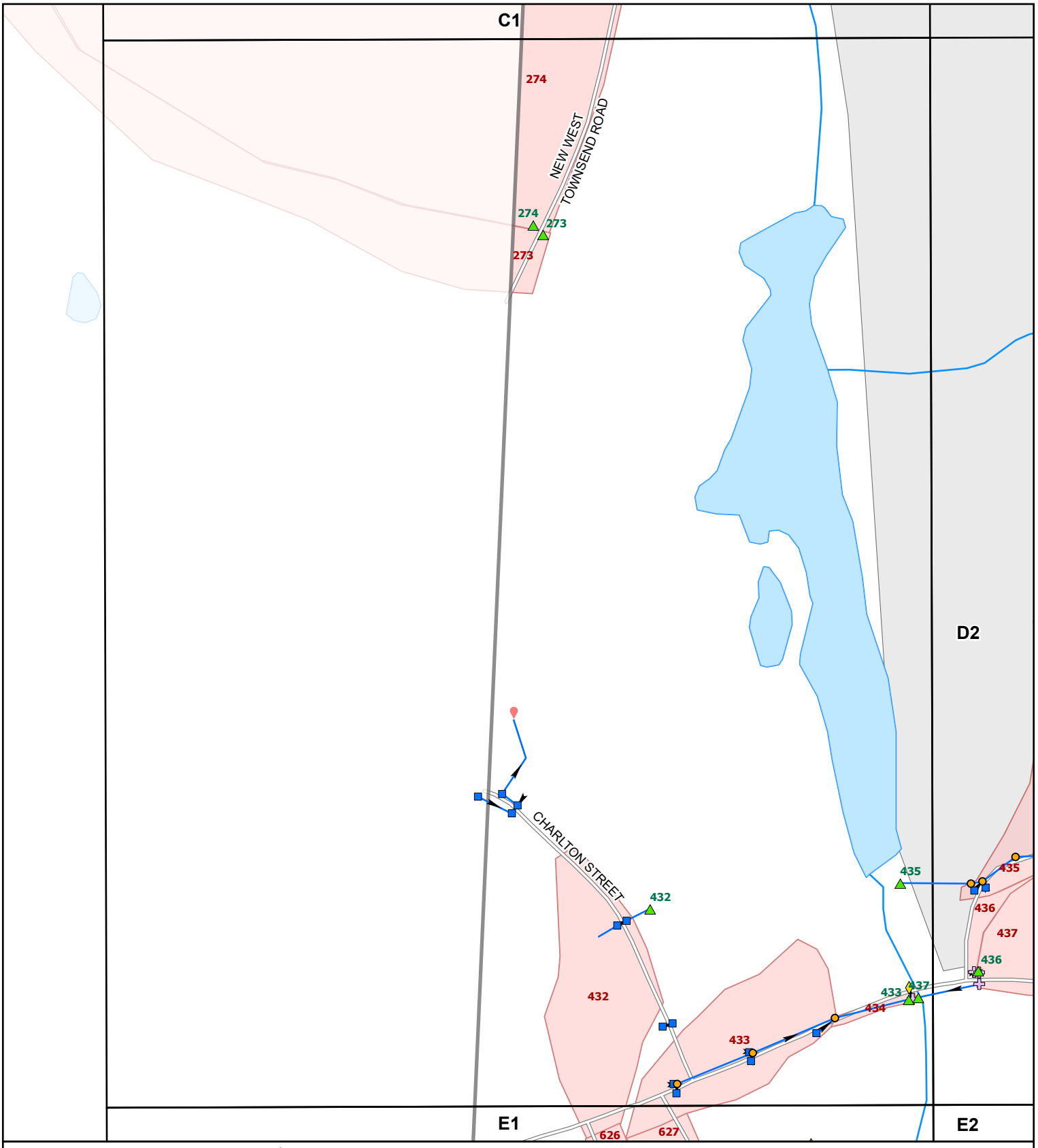
Feet

Data Sources: MassGIS, Town of Lunenburg

Map C10

Comprehensive Environmental Incorporated

2/1/2021



Outfalls
Key Junction
Manhole
Catch Basin
Detention/Infiltration Basin
Inlet
Dry Well
Culvert
Drainage Pipes
Pond, Reservoir
Wetland, Marsh
Stream, Brook
Catchments
Non-Urbanized Area

N

Stormwater Map

Lunenburg, MA

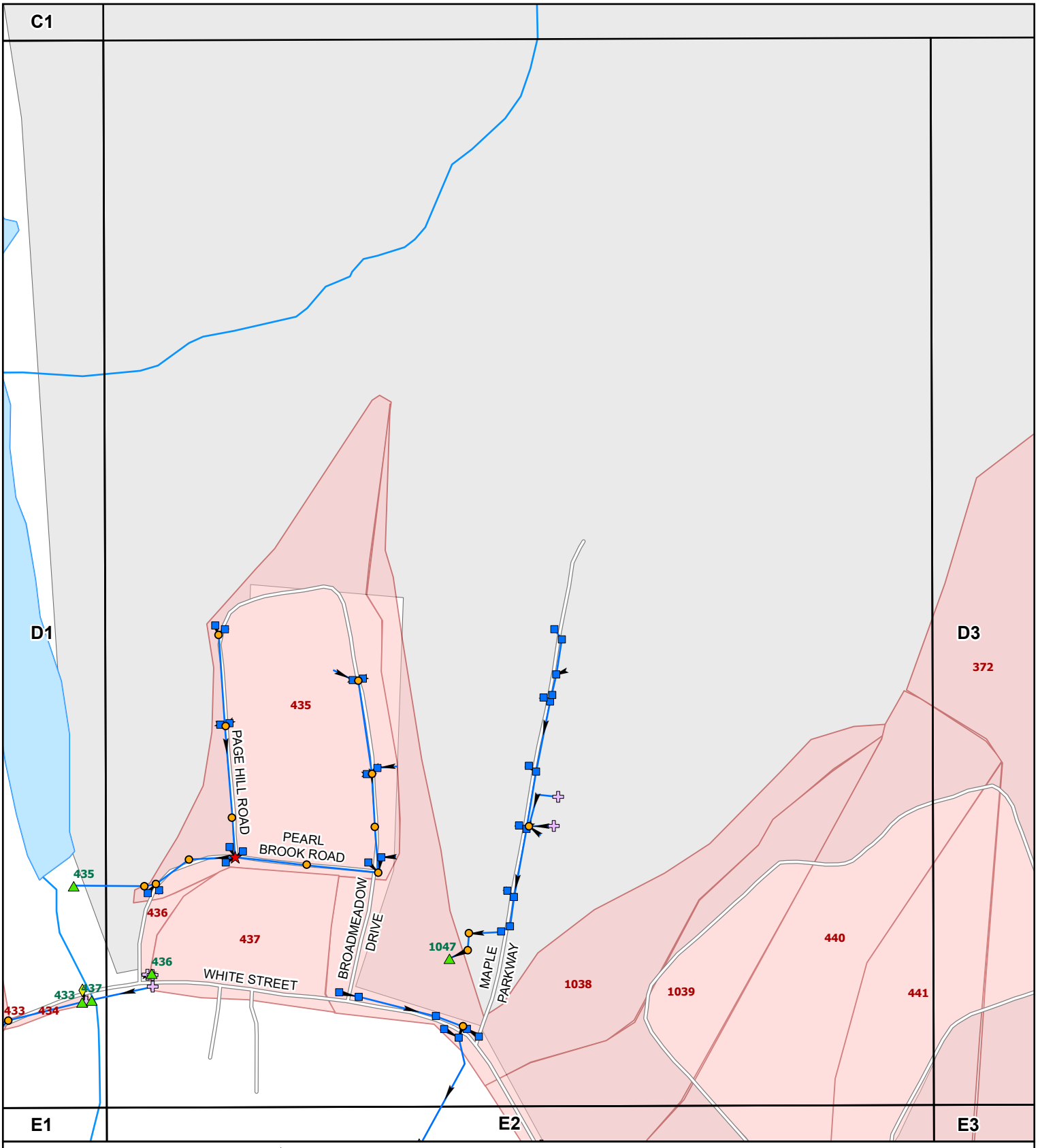
0 200 400 600
Feet

Data Sources: MassGIS, Town of Lunenburg

Map D1

Comprehensive Environmental Incorporated

2/1/2021



- Outfalls
- Key Junction
- Manhole
- Catch Basin
- Detention/Infiltration Basin
- Inlet
- Dry Well
- Culvert
- Drainage Pipes
- Pond, Reservoir
- Wetland, Marsh
- Stream, Brook
- Catchments
- Non-Urbanized Area

N

Stormwater Map

Lunenburg, MA

0 200 400 600

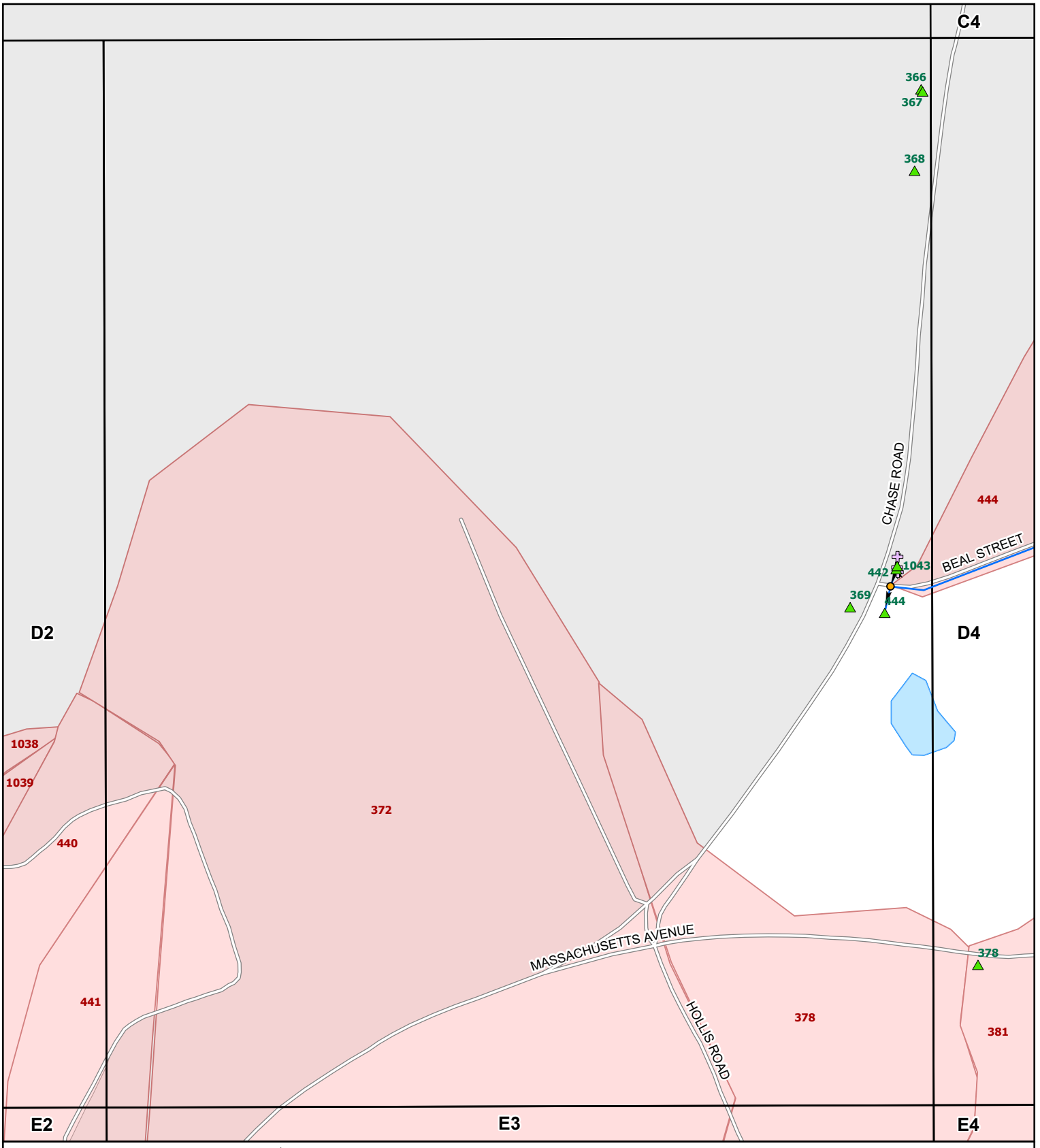
Feet

Data Sources: MassGIS, Town of Lunenburg

Map D2

Comprehensive Environmental Incorporated

2/1/2021



- Outfalls
- Key Junction
- Manhole
- Catch Basin
- Detention/Infiltration Basin
- Inlet
- Dry Well
- Culvert
- Drainage Pipes
- Pond, Reservoir
- Wetland, Marsh
- Stream, Brook
- Catchments
- Non-Urbanized Area

N

Stormwater Map

Lunenburg, MA

0 200 400 600

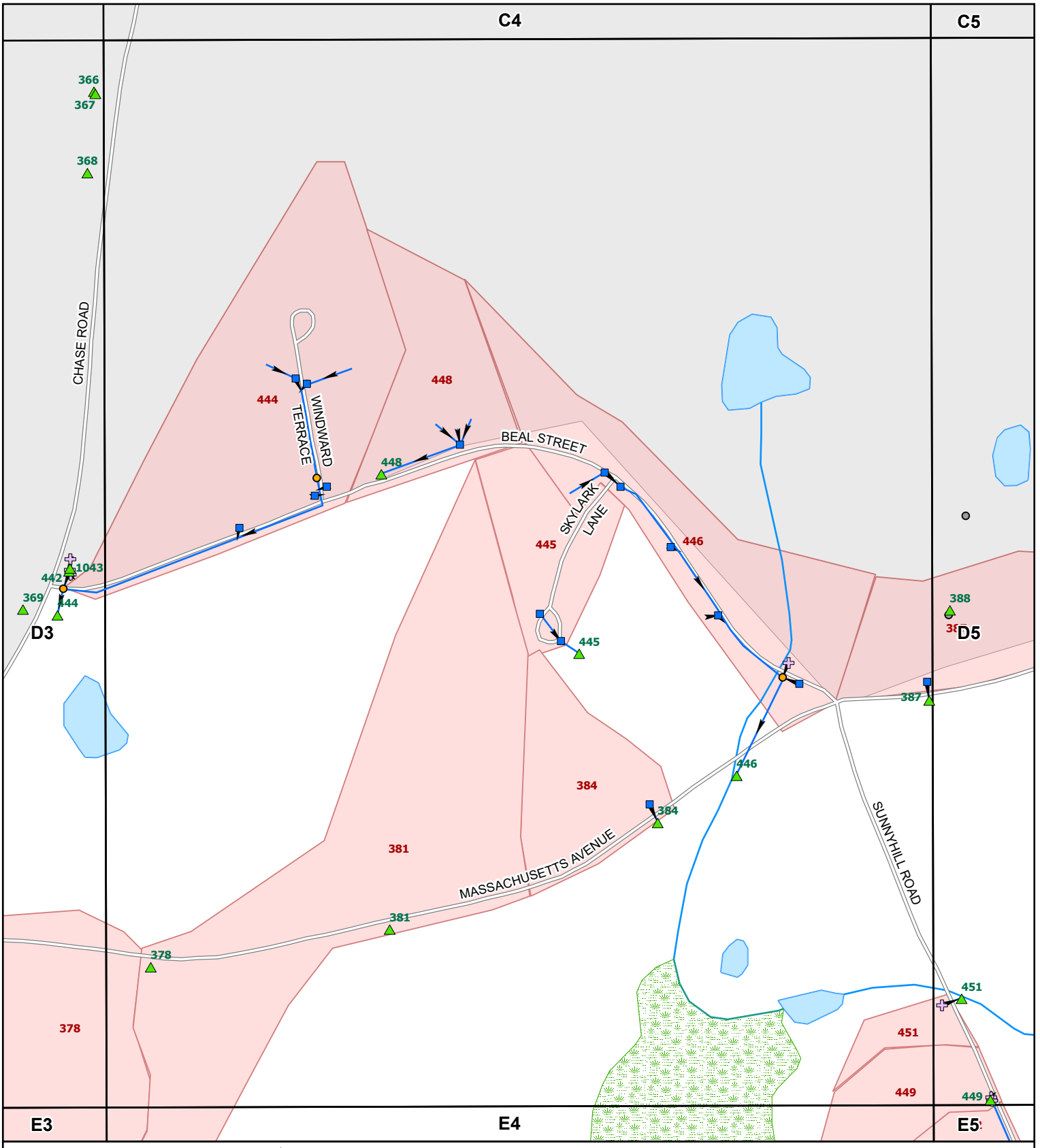
Feet

Data Sources: MassGIS, Town of Lunenburg

Map D3

Comprehensive Environmental Incorporated

2/1/2021



Outfalls
Key Junction
Manhole
Catch Basin
Detention/Infiltration Basin
Inlet
Dry Well

Culvert
Drainage Pipes
Pond, Reservoir
Wetland, Marsh
Stream, Brook
Catchments
Non-Urbanized Area

N

Stormwater Map

Lunenburg, MA

0 200 400 600

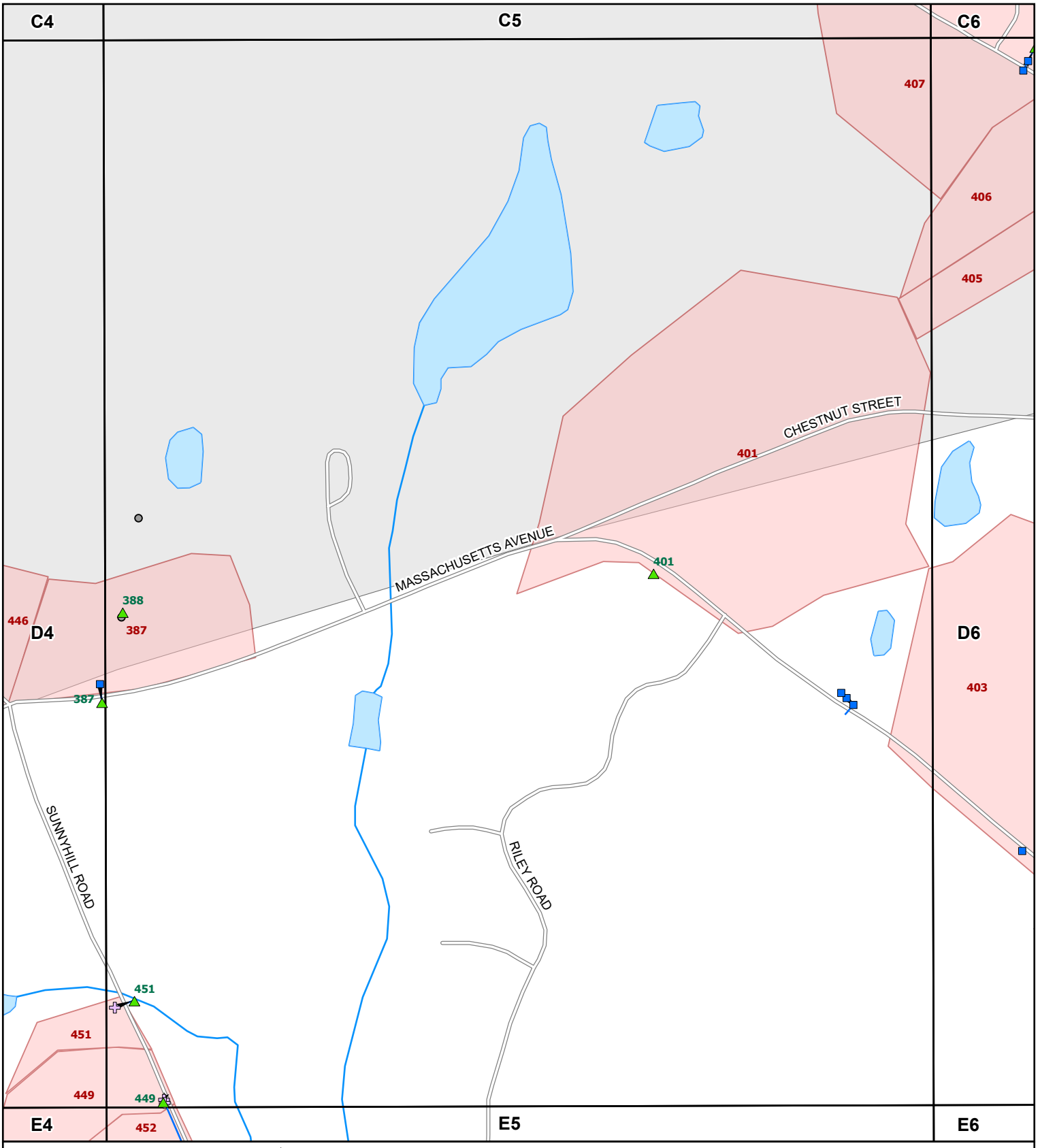
Feet

Data Sources: MassGIS, Town of Lunenburg

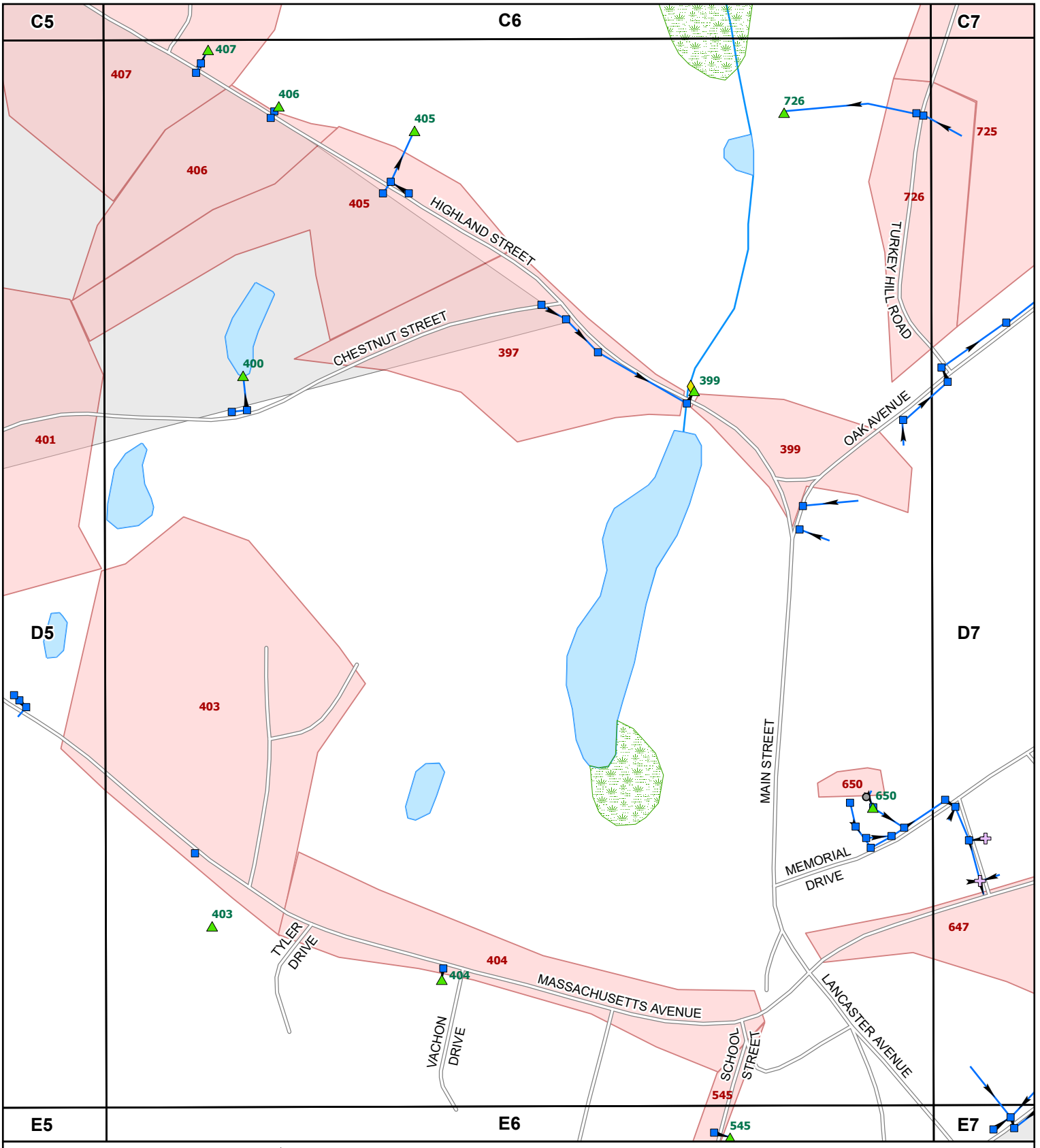
Map D4

Comprehensive Environmental Incorporated

2/1/2021


C4
C5
C6
D4
D5
D6
E4
E5
E6
CHESTNUT STREET
MASSACHUSETTS AVENUE
SUNNYHILL ROAD
RILEY ROAD
401
403
405
406
407
387
388
446
449
451
452
Outfalls
Key Junction
Manhole
Catch Basin
Detention/Infiltration Basin
Inlet
Dry Well
Culvert
Drainage Pipes
Pond, Reservoir
Wetland, Marsh
Stream, Brook
Catchments
Non-Urbanized Area
N
Stormwater Map
Lunenburg, MA
0 200 400 600
Feet
Data Sources: MassGIS, Town of Lunenburg
Map
D5
Comprehensive
Environmental
Incorporated

2/1/2021



Outfalls
Key Junction
Manhole
Catch Basin
Detention/Infiltration Basin
Inlet
Dry Well
Culvert
Drainage Pipes
Pond, Reservoir
Wetland, Marsh
Stream, Brook
Catchments
Non-Urbanized Area

N

Stormwater Map

Lunenburg, MA

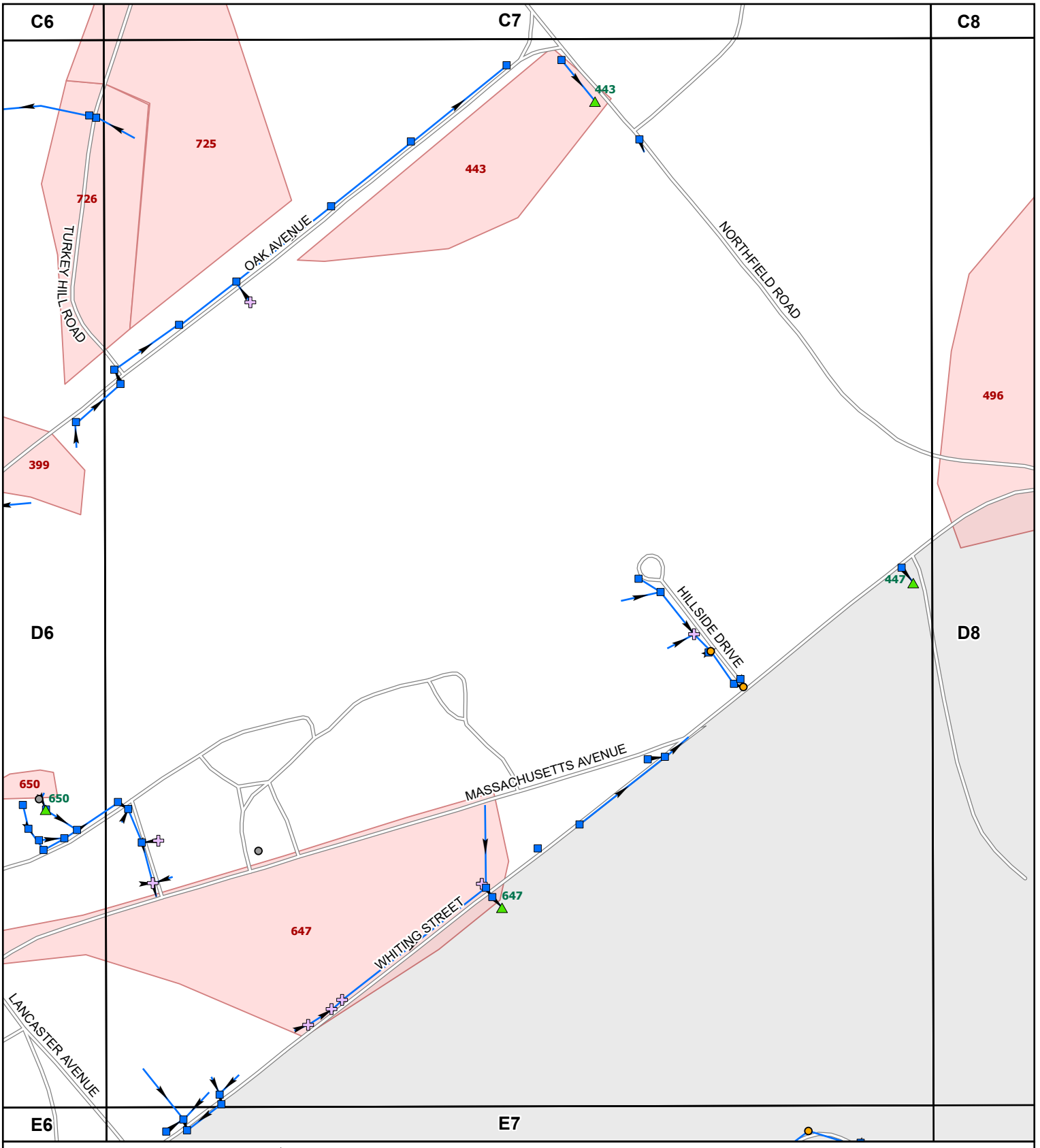
0 200 400 600
Feet

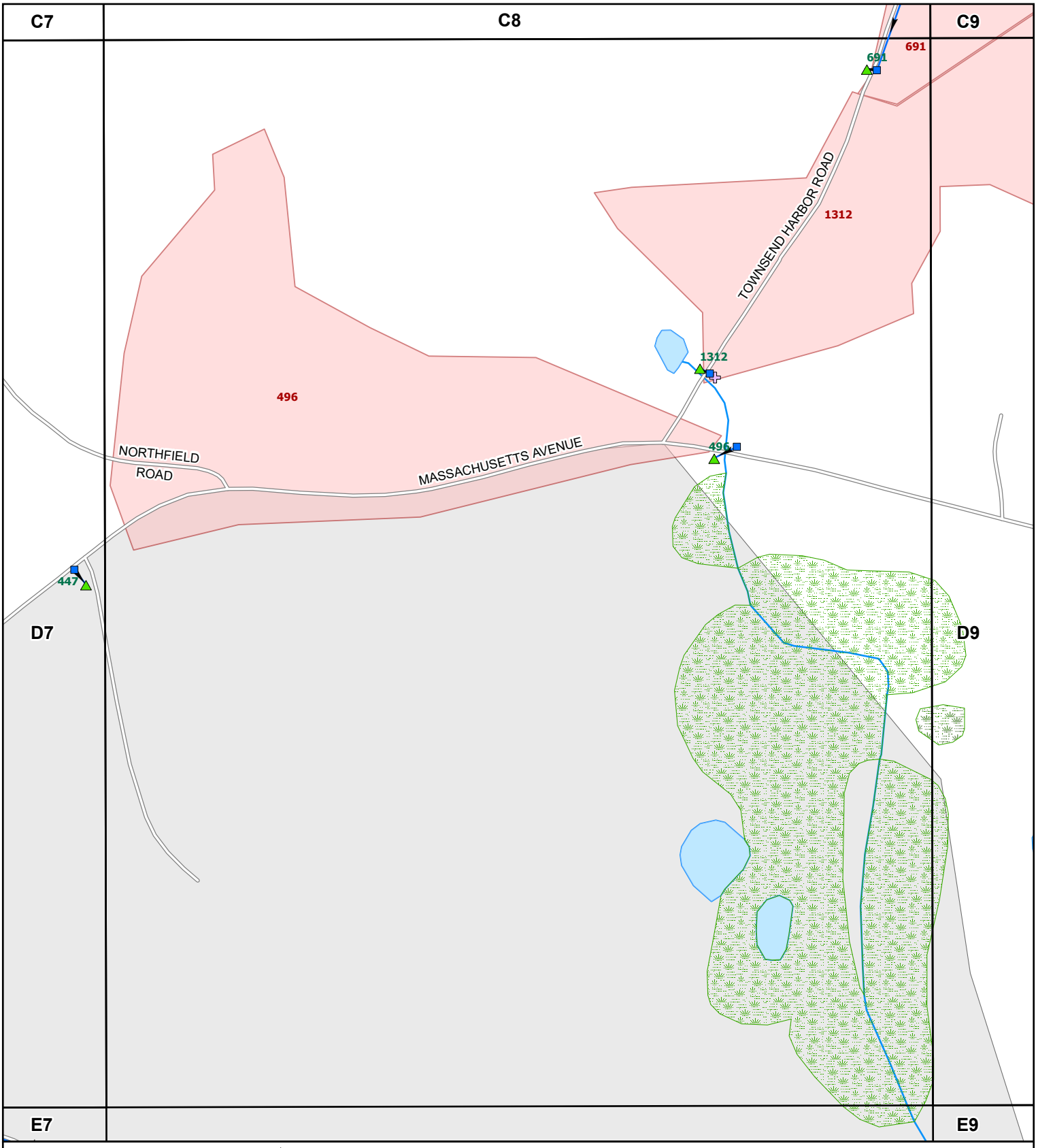
Data Sources: MassGIS, Town of Lunenburg

Map D6

Comprehensive Environmental Incorporated

2/1/2021


C6
C7
C8
D6
D8
E6
E7
725
726
443
399
496
647
650
TURKEY HILL ROAD
OAK AVENUE
NORTHFIELD ROAD
HILLSIDE DRIVE
MASSACHUSETTS AVENUE
WHITING STREET
LANCASTER AVENUE
Outfalls
Key Junction
Manhole
Catch Basin
Detention/Infiltration Basin
Inlet
Dry Well
Culvert
Drainage Pipes
Pond, Reservoir
Wetland, Marsh
Stream, Brook
Catchments
Non-Urbanized Area
N
Stormwater Map
Lunenburg, MA
0 200 400 600
Feet
Data Sources: MassGIS, Town of Lunenburg
Map
D7
Comprehensive Environmental Incorporated
2/1/2021



- Outfalls
- Key Junction
- Manhole
- Catch Basin
- Detention/Infiltration Basin
- Inlet
- Dry Well
- Culvert
- Drainage Pipes
- Pond, Reservoir
- Wetland, Marsh
- Stream, Brook
- Catchments
- Non-Urbanized Area

N

Stormwater Map

Lunenburg, MA

0 200 400 600

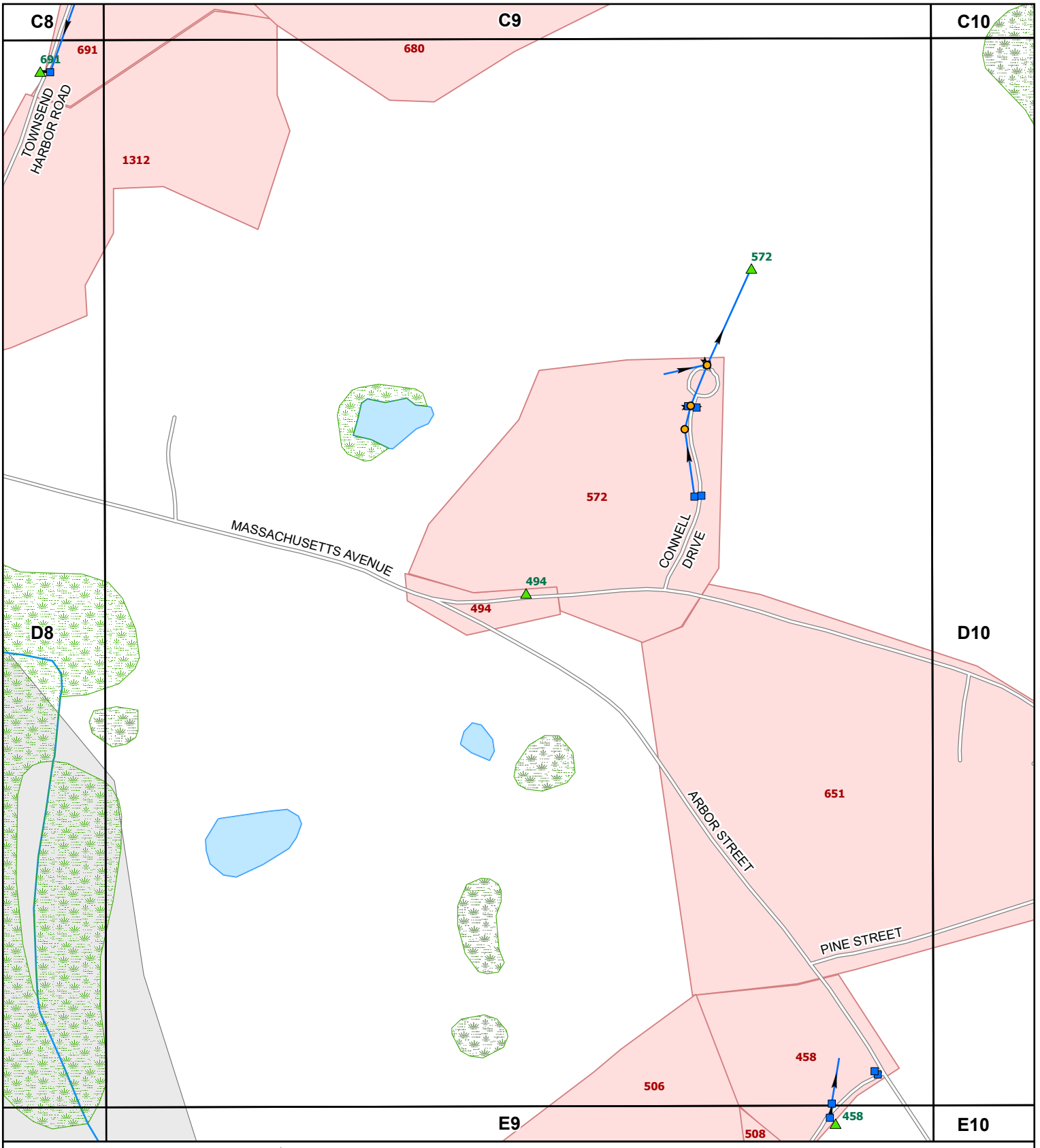
Feet

Data Sources: MassGIS, Town of Lunenburg

Map D8

Comprehensive Environmental Incorporated

2/1/2021



- Outfalls
- Key Junction
- Manhole
- Catch Basin
- Detention/Infiltration Basin
- Inlet
- Dry Well
- Culvert
- Drainage Pipes
- Pond, Reservoir
- Wetland, Marsh
- Stream, Brook
- Catchments
- Non-Urbanized Area

N

Stormwater Map

Lunenburg, MA

0 200 400 600

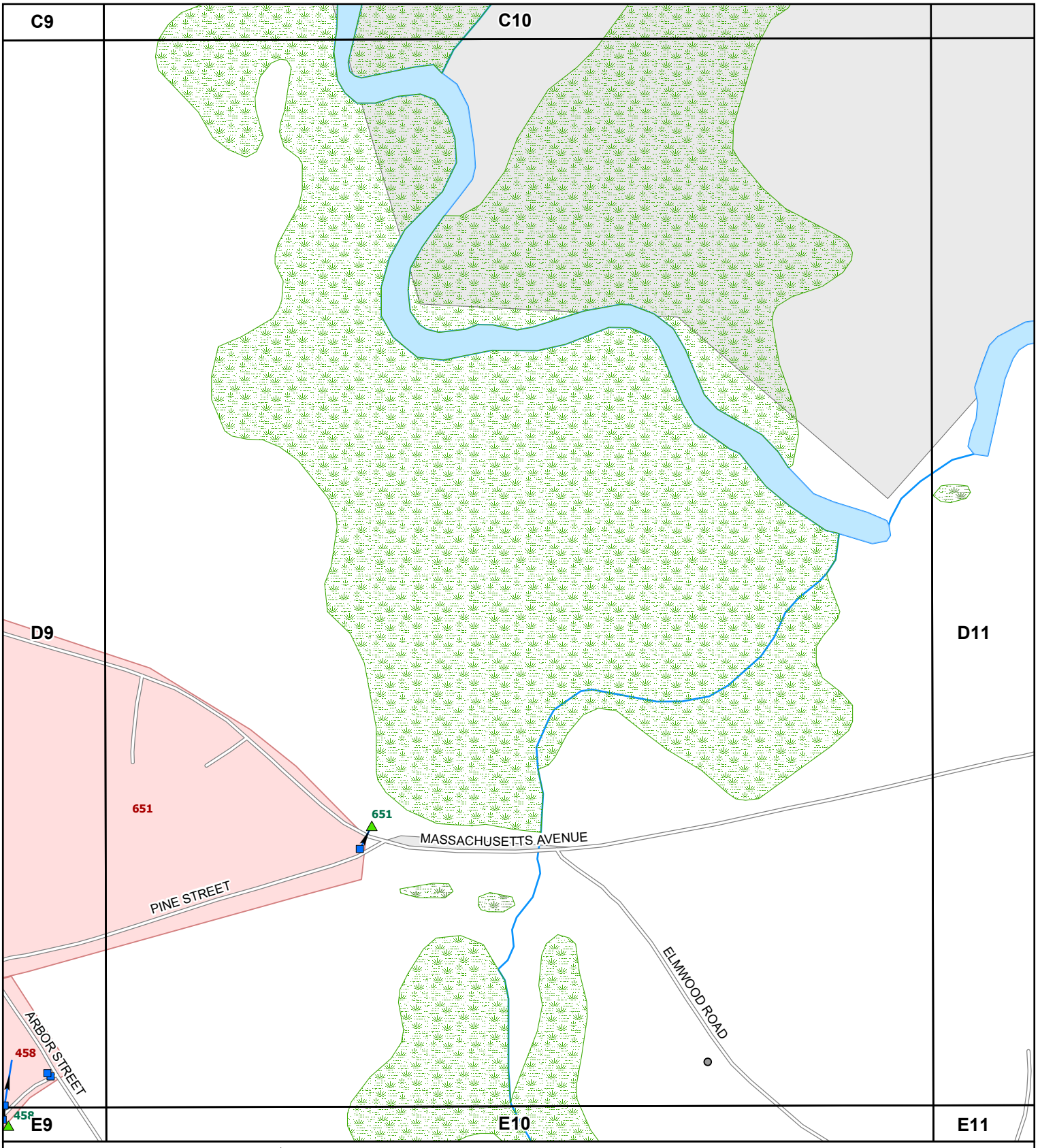
Feet

Data Sources: MassGIS, Town of Lunenburg

Map D9

Comprehensive Environmental Incorporated

2/1/2021



- Outfalls
- Key Junction
- Manhole
- Catch Basin
- Detention/Infiltration Basin
- Inlet
- Dry Well
- Culvert
- Drainage Pipes
- Pond, Reservoir
- Wetland, Marsh
- Stream, Brook
- Catchments
- Non-Urbanized Area

N

Stormwater Map

Lunenburg, MA

0 200 400 600

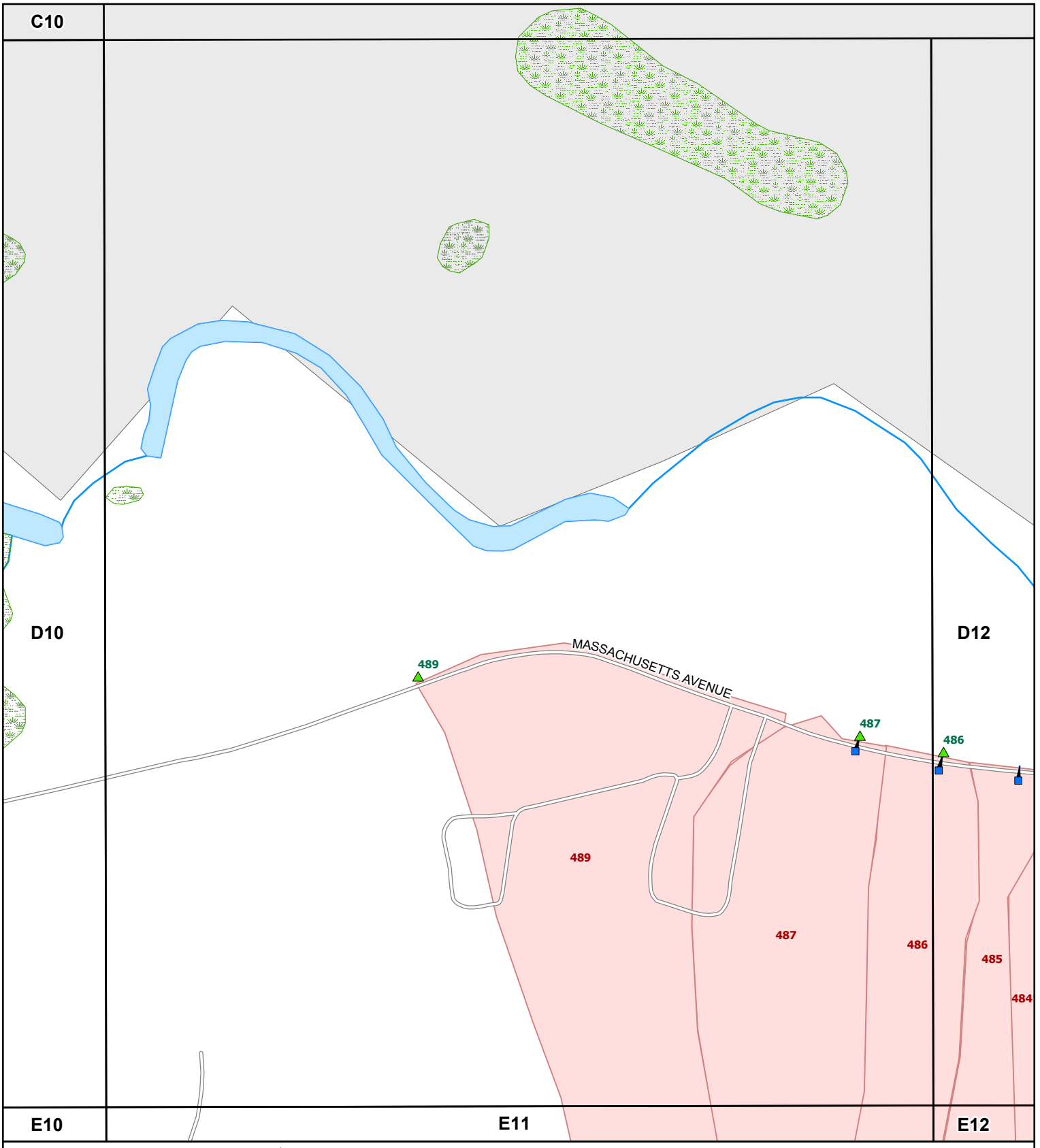
Feet

Data Sources: MassGIS, Town of Lunenburg

Map D10

Comprehensive Environmental Incorporated

2/1/2021



- Outfalls
- Key Junction
- Manhole
- Catch Basin
- Detention/Infiltration Basin
- Inlet
- Dry Well
- Culvert
- Drainage Pipes
- Pond, Reservoir
- Wetland, Marsh
- Stream, Brook
- Catchments
- Non-Urbanized Area

N

Stormwater Map

Lunenburg, MA

0 200 400 600

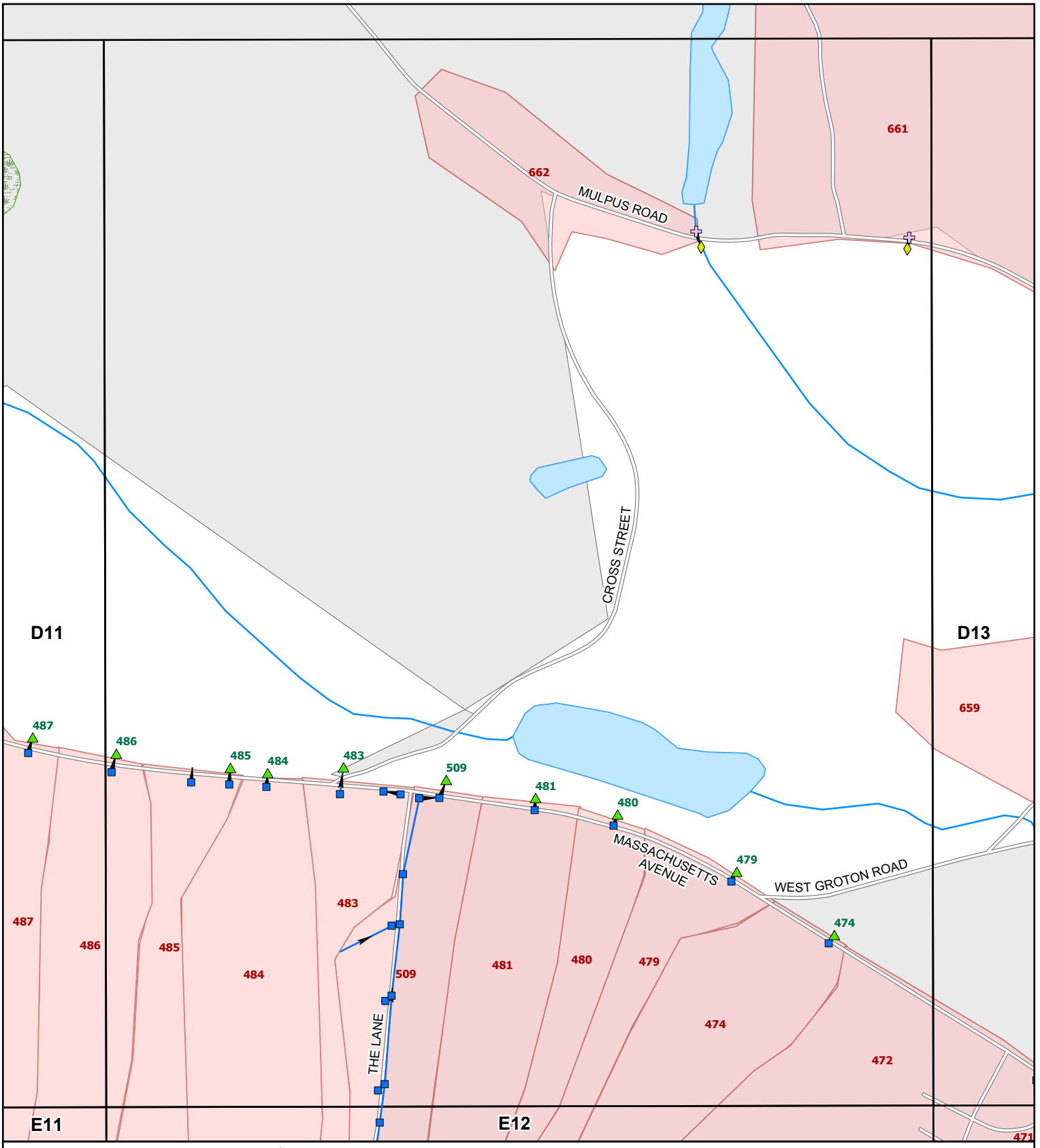
Feet

Data Sources: MassGIS, Town of Lunenburg

Map D11

Comprehensive Environmental Incorporated

2/1/2021



- Outfalls
- Key Junction
- Manhole
- Catch Basin
- Detention/Infiltration Basin
- Inlet
- Dry Well
- Culvert
- Drainage Pipes
- Pond, Reservoir
- Wetland, Marsh
- Stream, Brook
- Catchments
- Non-Urbanized Area

N

Stormwater Map

Lunenburg, MA

0 200 400 600

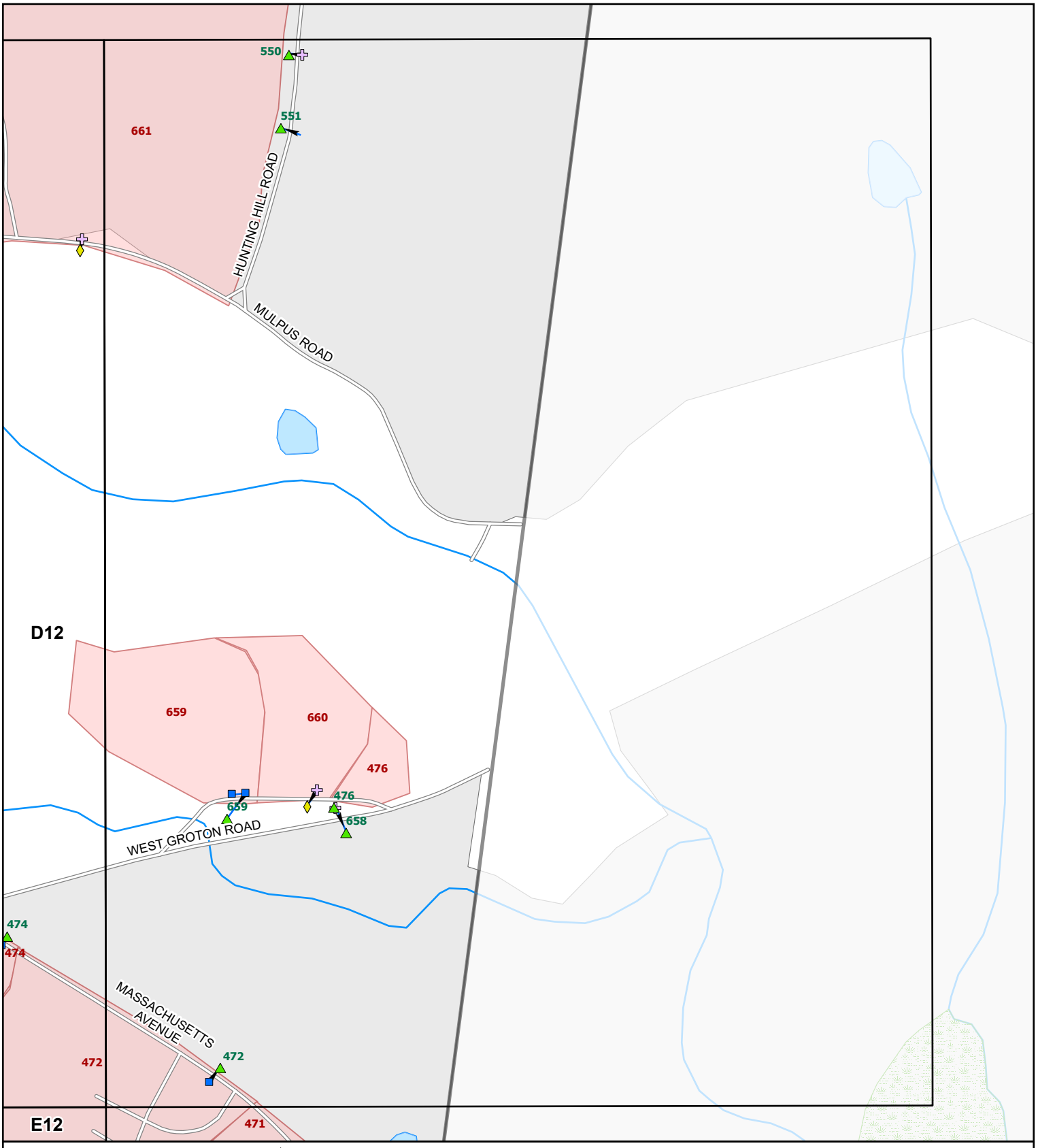
Feet

Data Sources: MassGIS, Town of Lunenburg

Map D12

Comprehensive Environmental Incorporated

2/1/2021



- Outfalls
- Key Junction
- Manhole
- Catch Basin
- Detention/Infiltration Basin
- Inlet
- Dry Well
- Culvert
- Drainage Pipes
- Pond, Reservoir
- Wetland, Marsh
- Stream, Brook
- Catchments
- Non-Urbanized Area

N

Stormwater Map

Lunenburg, MA

0 200 400 600

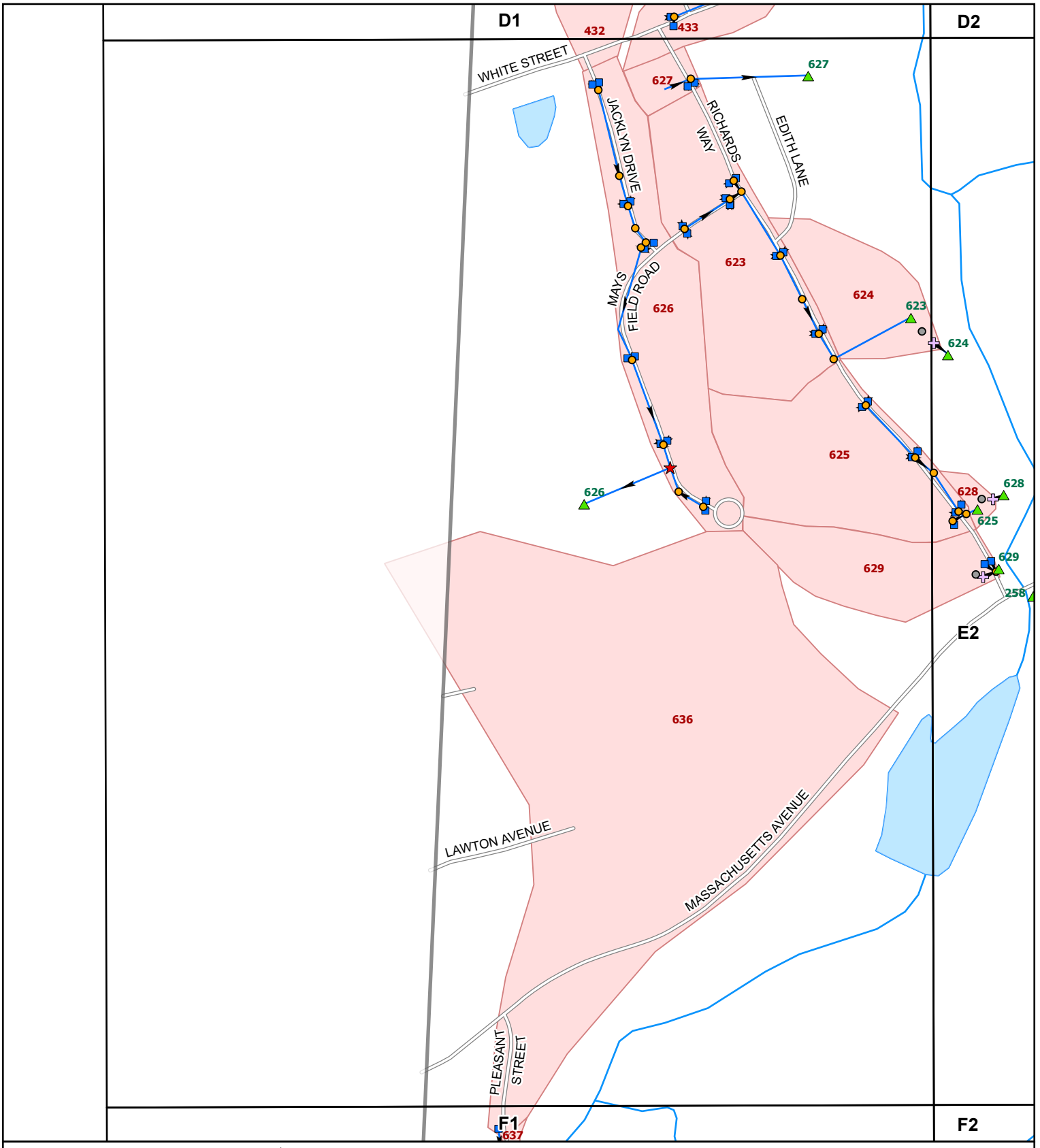
Feet

Data Sources: MassGIS, Town of Lunenburg

Map D13

Comprehensive Environmental Incorporated

2/1/2021



- Outfalls
- Key Junction
- Manhole
- Catch Basin
- Detention/Infiltration Basin
- Inlet
- Dry Well
- Culvert
- Drainage Pipes
- Pond, Reservoir
- Wetland, Marsh
- Stream, Brook
- Catchments
- Non-Urbanized Area

N

Stormwater Map

Lunenburg, MA

0 200 400 600

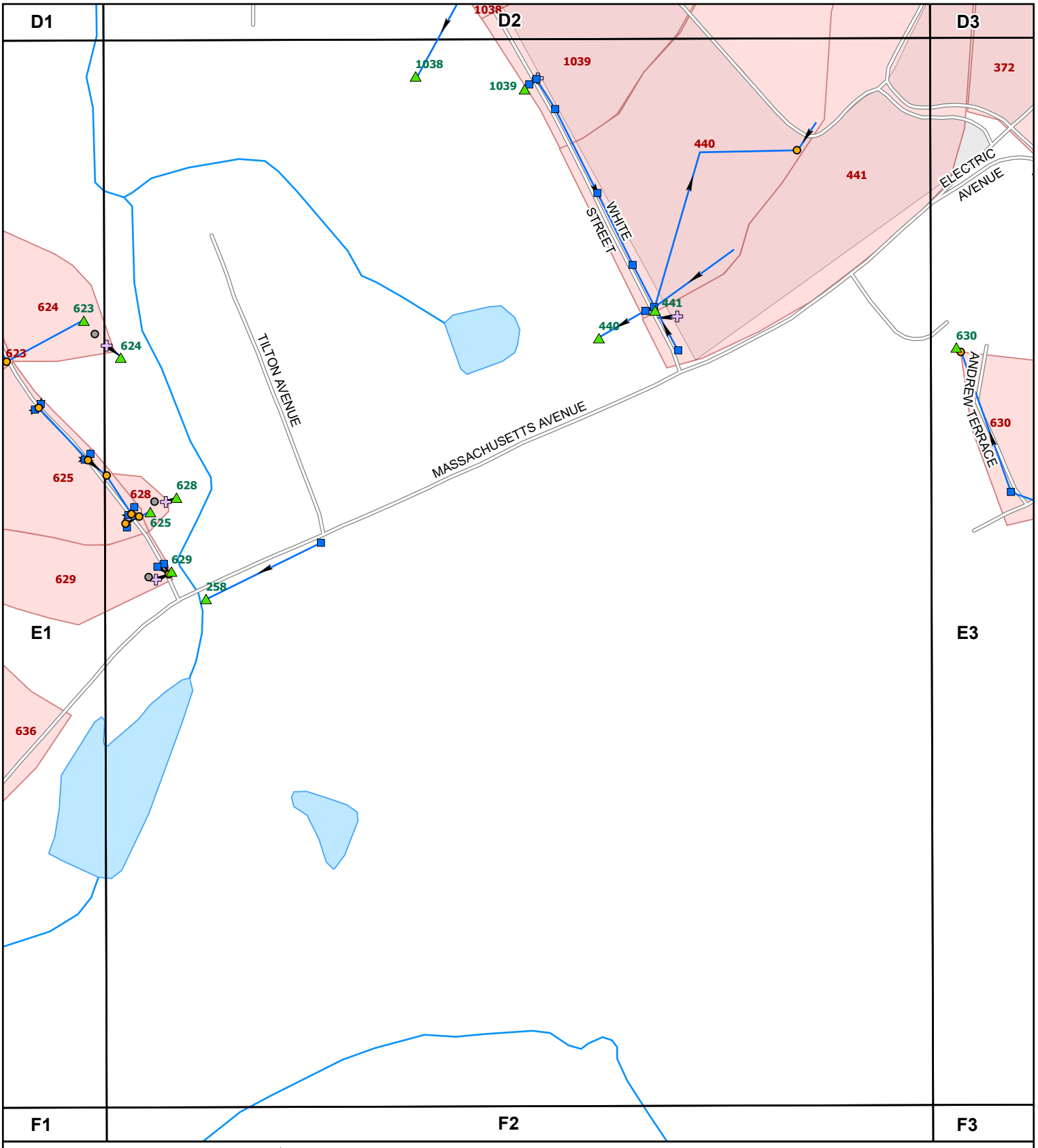
Feet

Data Sources: MassGIS, Town of Lunenburg

Map E1

Comprehensive Environmental Incorporated

2/1/2021



- Outfalls
- Key Junction
- Manhole
- Catch Basin
- Detention/Infiltration Basin
- Inlet
- Dry Well
- Culvert
- Drainage Pipes
- Pond, Reservoir
- Wetland, Marsh
- Stream, Brook
- Catchments
- Non-Urbanized Area

N

Stormwater Map

Lunenburg, MA

0 200 400 600

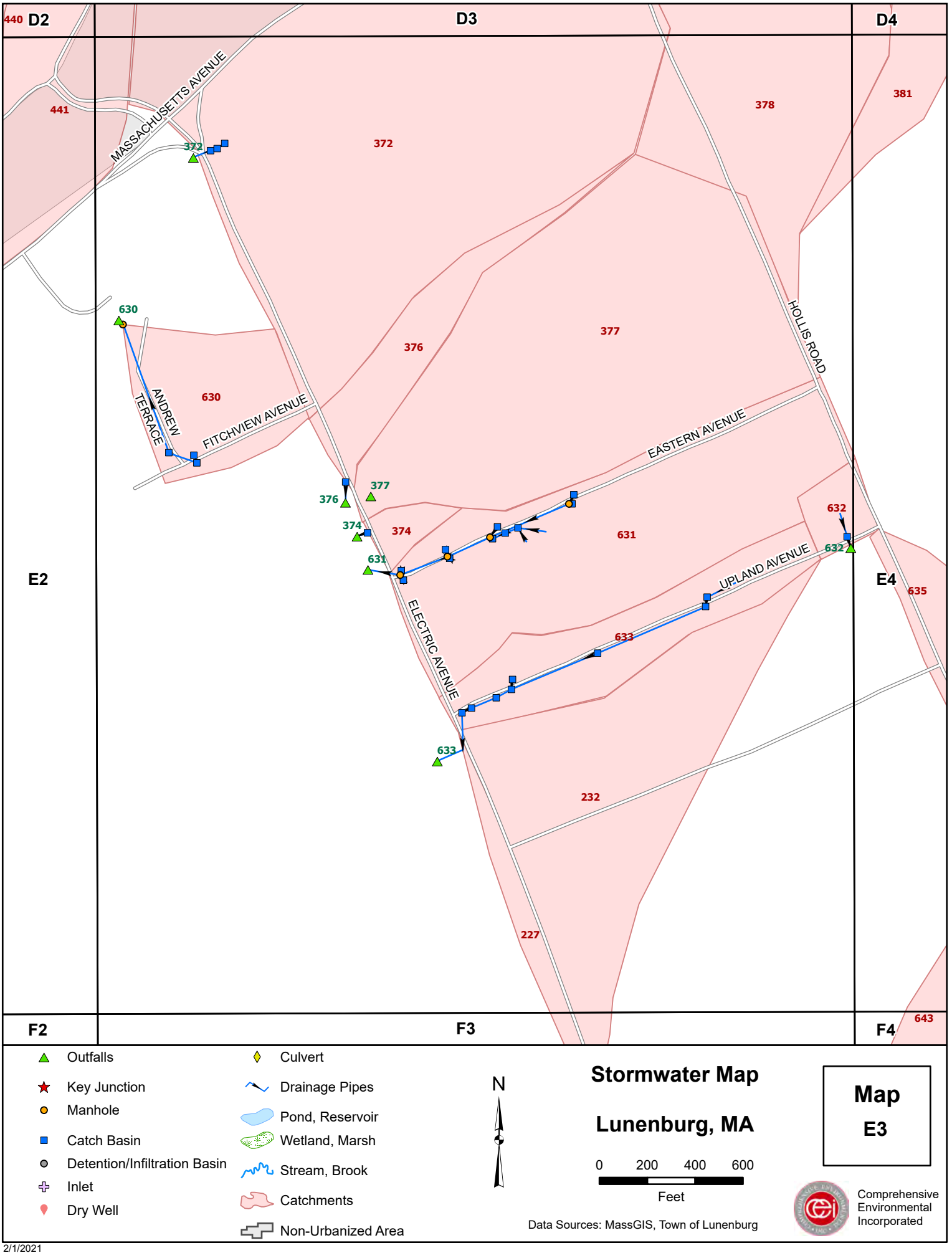
Feet

Data Sources: MassGIS, Town of Lunenburg

Map E2

Comprehensive Environmental Incorporated

2/1/2021



Outfalls
Key Junction
Manhole
Catch Basin
Detention/Infiltration Basin
Inlet
Dry Well
Culvert
Drainage Pipes
Pond, Reservoir
Wetland, Marsh
Stream, Brook
Catchments
Non-Urbanized Area

N

Stormwater Map

Lunenburg, MA

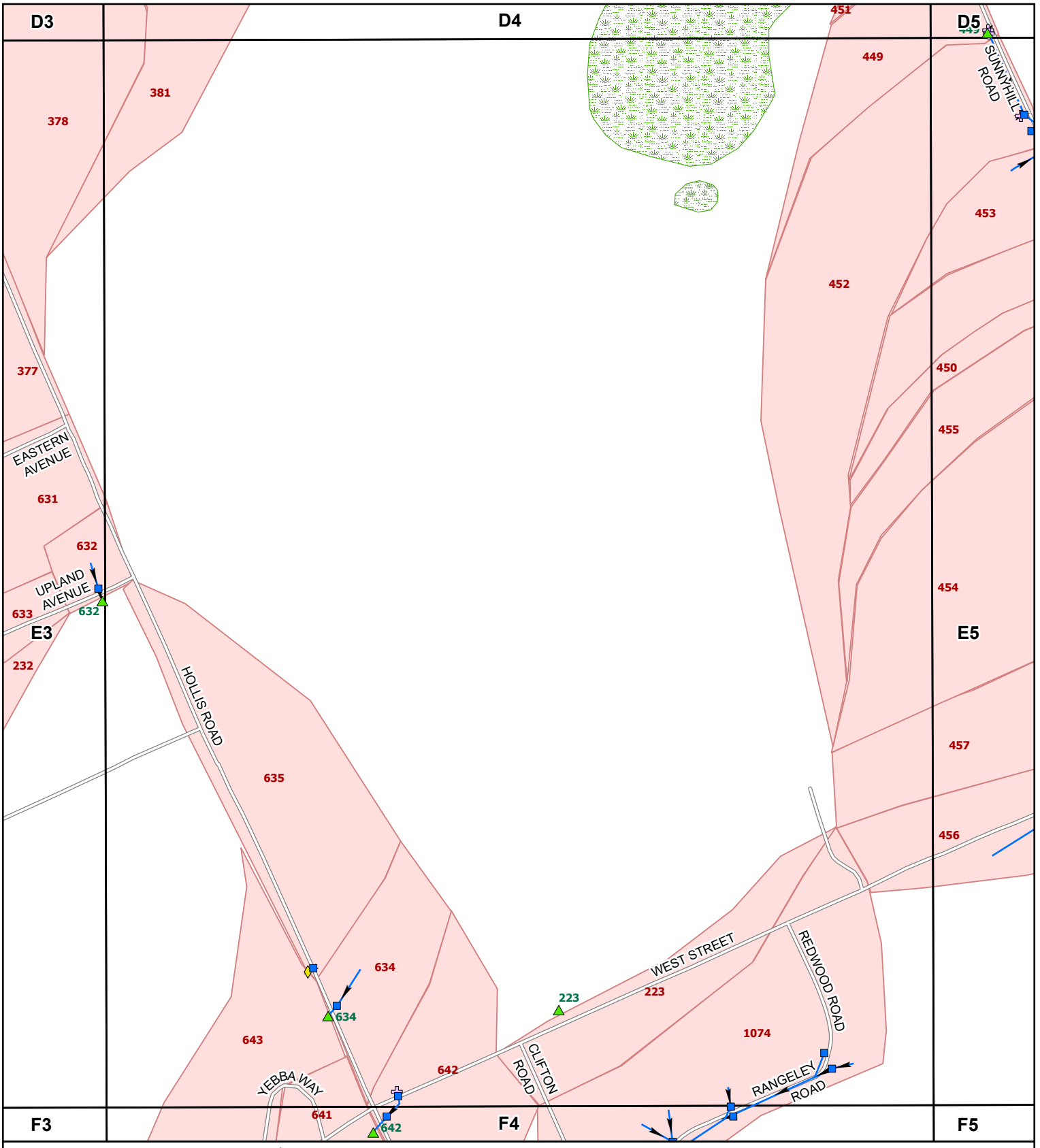
0 200 400 600
Feet

Data Sources: MassGIS, Town of Lunenburg

Map E3

Comprehensive Environmental Incorporated

2/1/2021



Outfalls
Key Junction
Manhole
Catch Basin
Detention/Infiltration Basin
Inlet
Dry Well
Culvert
Drainage Pipes
Pond, Reservoir
Wetland, Marsh
Stream, Brook
Catchments
Non-Urbanized Area

N

Stormwater Map

Lunenburg, MA

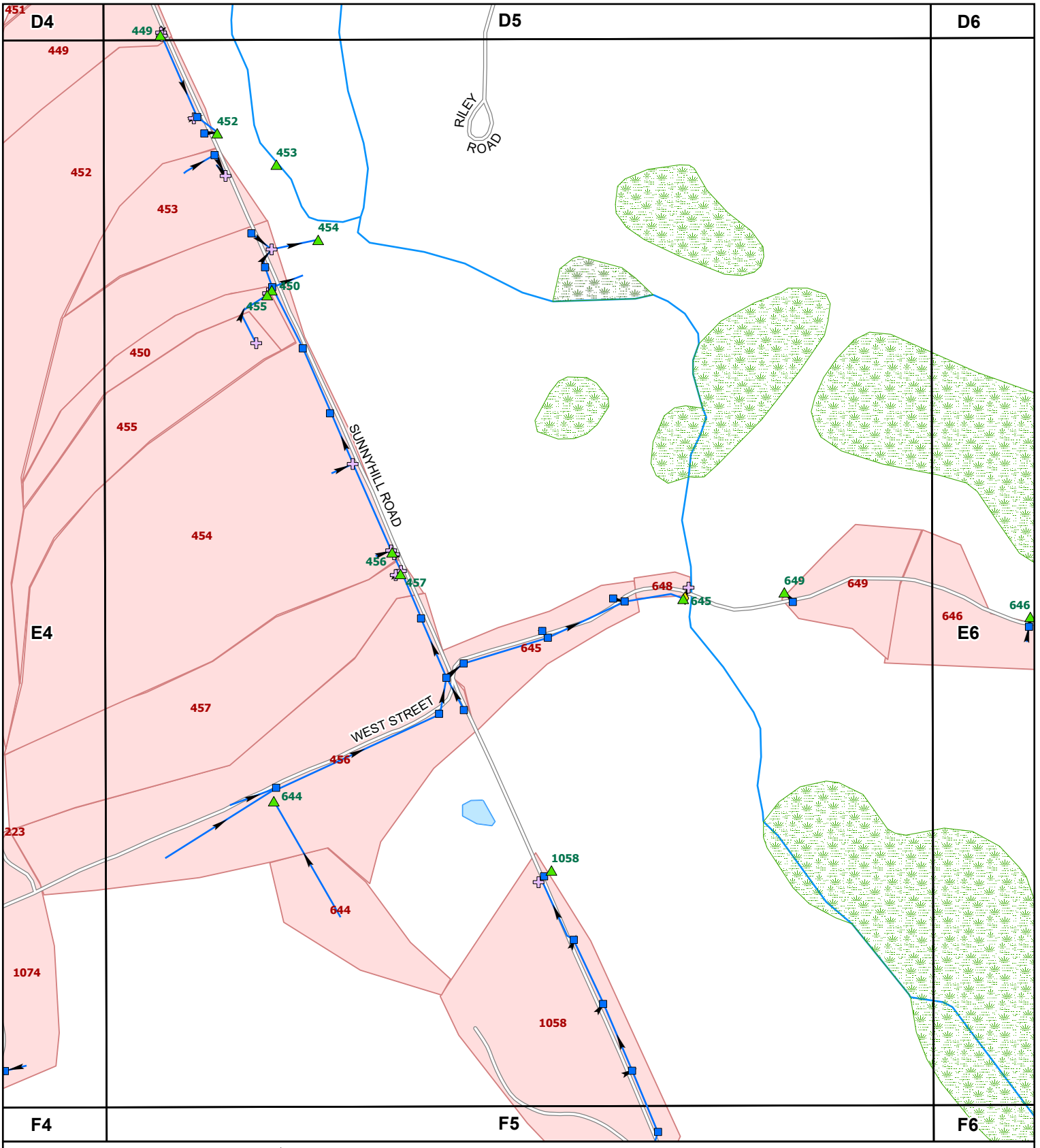
0 200 400 600
Feet

Data Sources: MassGIS, Town of Lunenburg

Map E4

Comprehensive Environmental Incorporated

2/1/2021



Outfalls
Key Junction
Manhole
Catch Basin
Detention/Infiltration Basin
Inlet
Dry Well
Culvert
Drainage Pipes
Pond, Reservoir
Wetland, Marsh
Stream, Brook
Catchments
Non-Urbanized Area

N

Stormwater Map

Lunenburg, MA

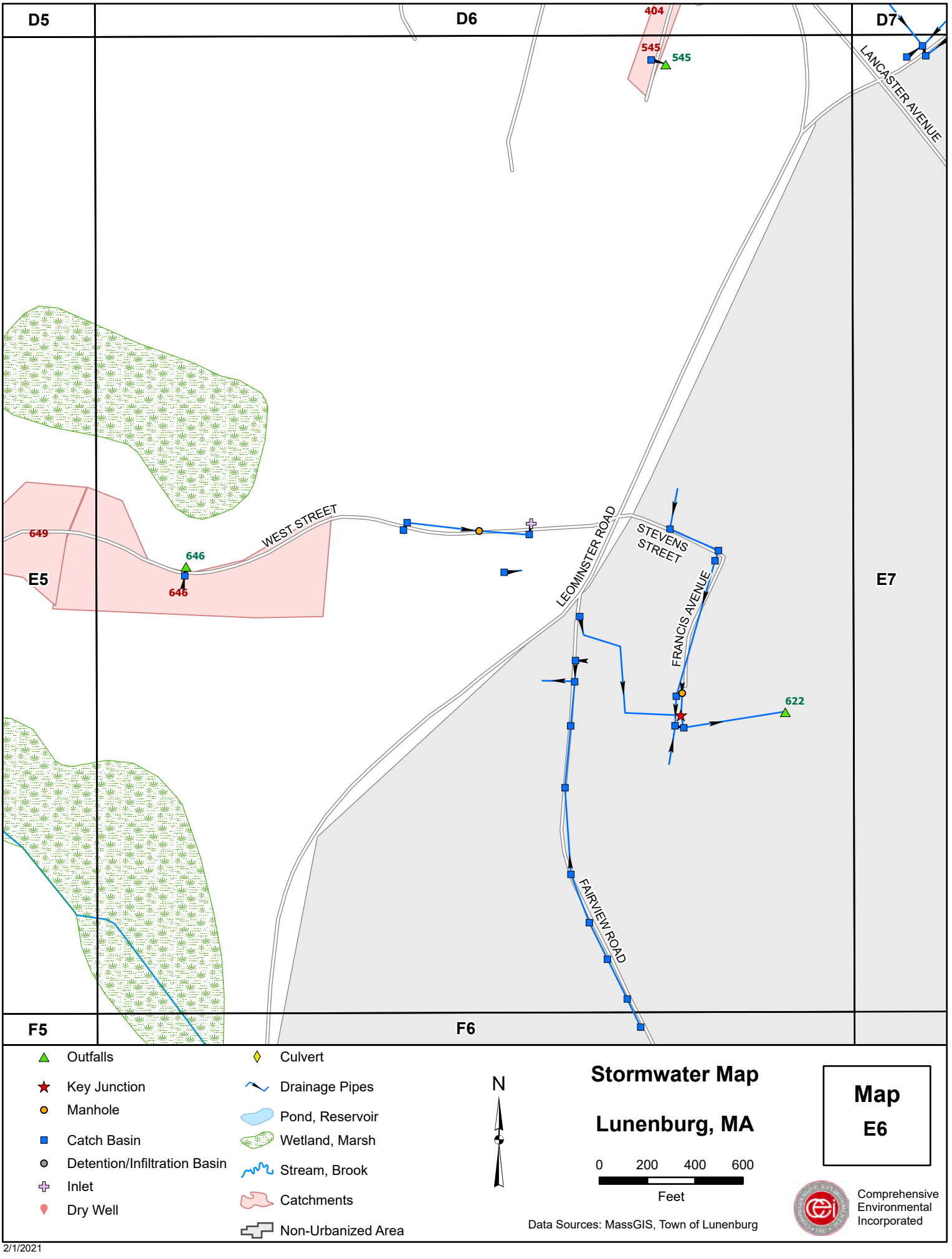
0 200 400 600
Feet

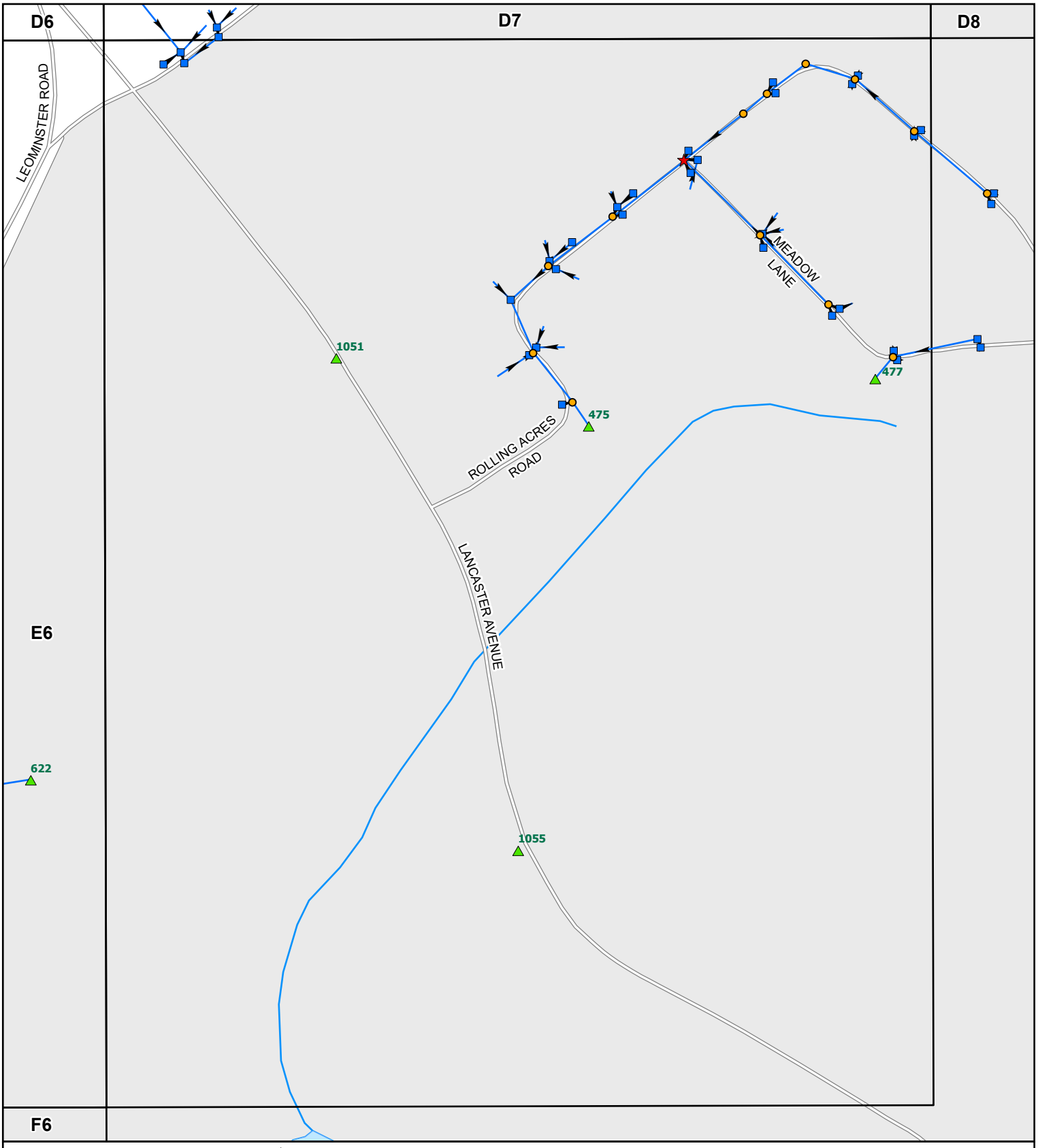
Data Sources: MassGIS, Town of Lunenburg

Map E5

Comprehensive Environmental Incorporated

2/1/2021


D5
D6
D7
E5
E7
F5
F6
404
545
545
649
646
646
622
WEST STREET
LEOMINSTER ROAD
STEVENS STREET
FRANCIS AVENUE
FAIRVIEW ROAD
LANCASTER AVENUE
Outfalls
Key Junction
Manhole
Catch Basin
Detention/Infiltration Basin
Inlet
Dry Well
Culvert
Drainage Pipes
Pond, Reservoir
Wetland, Marsh
Stream, Brook
Catchments
Non-Urbanized Area
N
Stormwater Map
Lunenburg, MA
0 200 400 600
Feet
Data Sources: MassGIS, Town of Lunenburg
Map
E6
Comprehensive Environmental Incorporated
2/1/2021



- Outfalls
- Key Junction
- Manhole
- Catch Basin
- Detention/Infiltration Basin
- Inlet
- Dry Well
- Culvert
- Drainage Pipes
- Pond, Reservoir
- Wetland, Marsh
- Stream, Brook
- Catchments
- Non-Urbanized Area

N

Stormwater Map

Lunenburg, MA

0 200 400 600

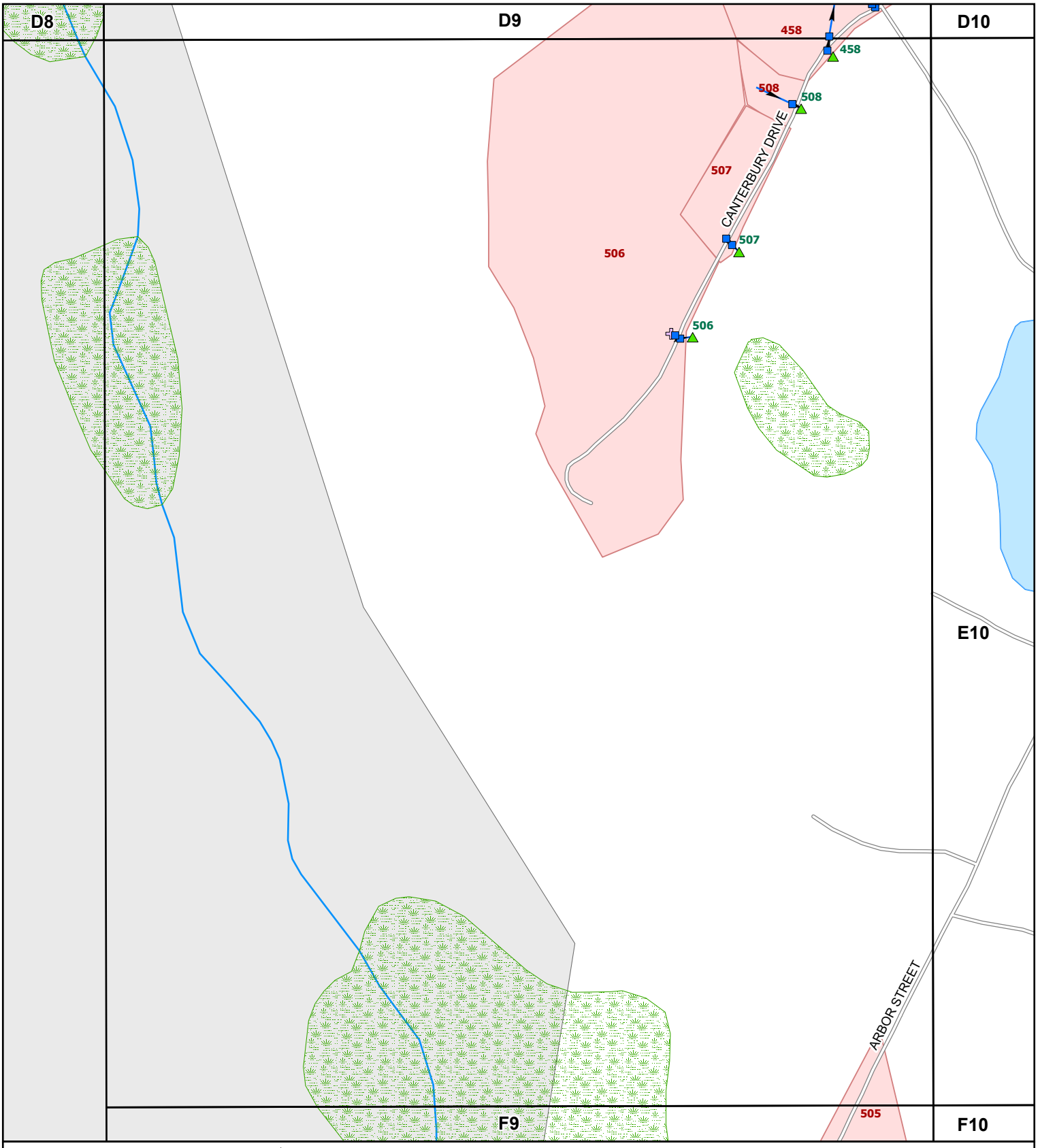
Feet

Data Sources: MassGIS, Town of Lunenburg

Map E7

Comprehensive Environmental Incorporated

2/1/2021



- Outfalls
- Key Junction
- Manhole
- Catch Basin
- Detention/Infiltration Basin
- Inlet
- Dry Well
- Culvert
- Drainage Pipes
- Pond, Reservoir
- Wetland, Marsh
- Stream, Brook
- Catchments
- Non-Urbanized Area

N

Stormwater Map

Lunenburg, MA

0 200 400 600

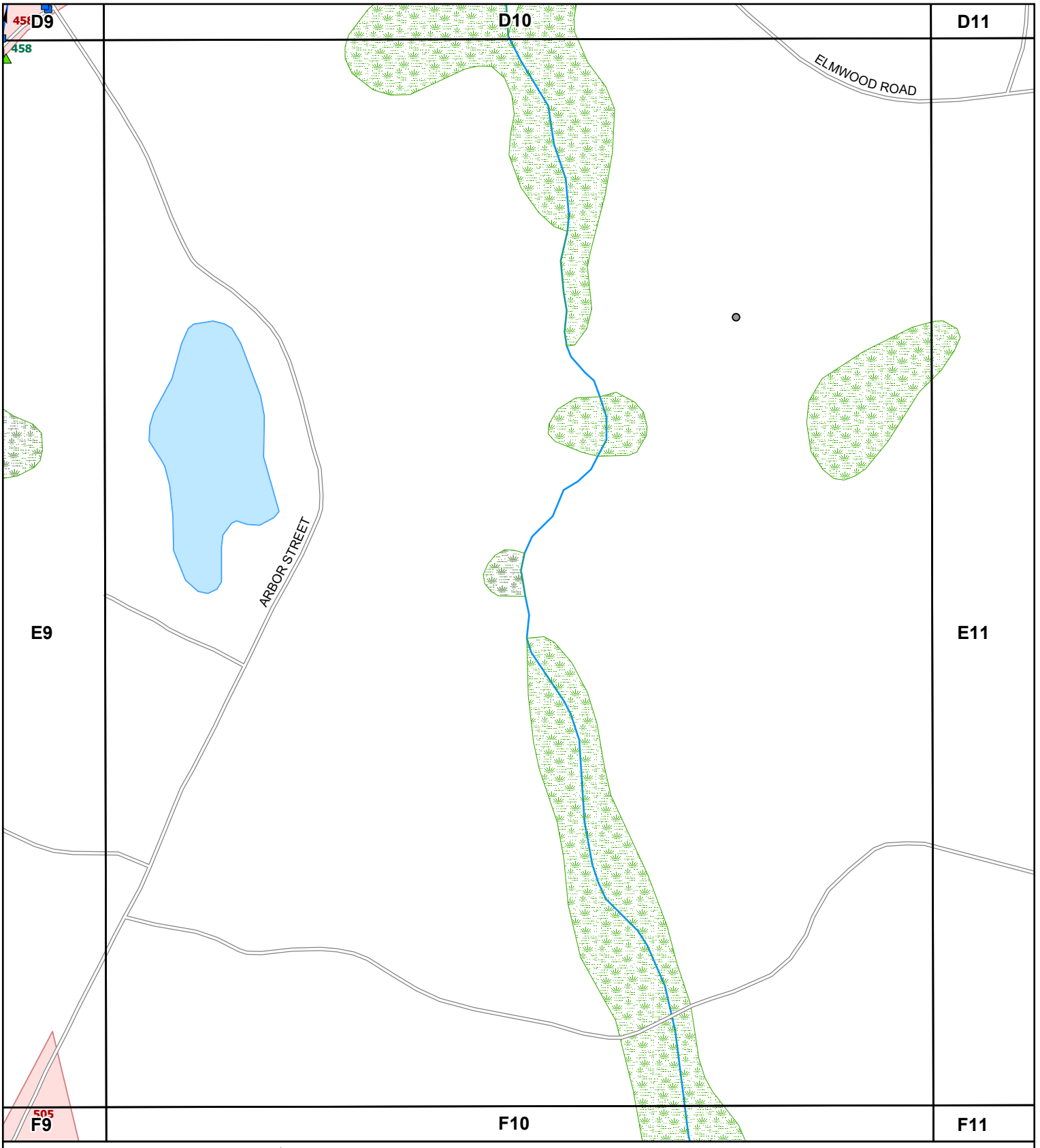
Feet

Data Sources: MassGIS, Town of Lunenburg

Map E9

Comprehensive Environmental Incorporated

2/1/2021



- Outfalls
- Key Junction
- Manhole
- Catch Basin
- Detention/Infiltration Basin
- Inlet
- Dry Well
- Culvert
- Drainage Pipes
- Pond, Reservoir
- Wetland, Marsh
- Stream, Brook
- Catchments
- Non-Urbanized Area

N

Stormwater Map

Lunenburg, MA

0 200 400 600

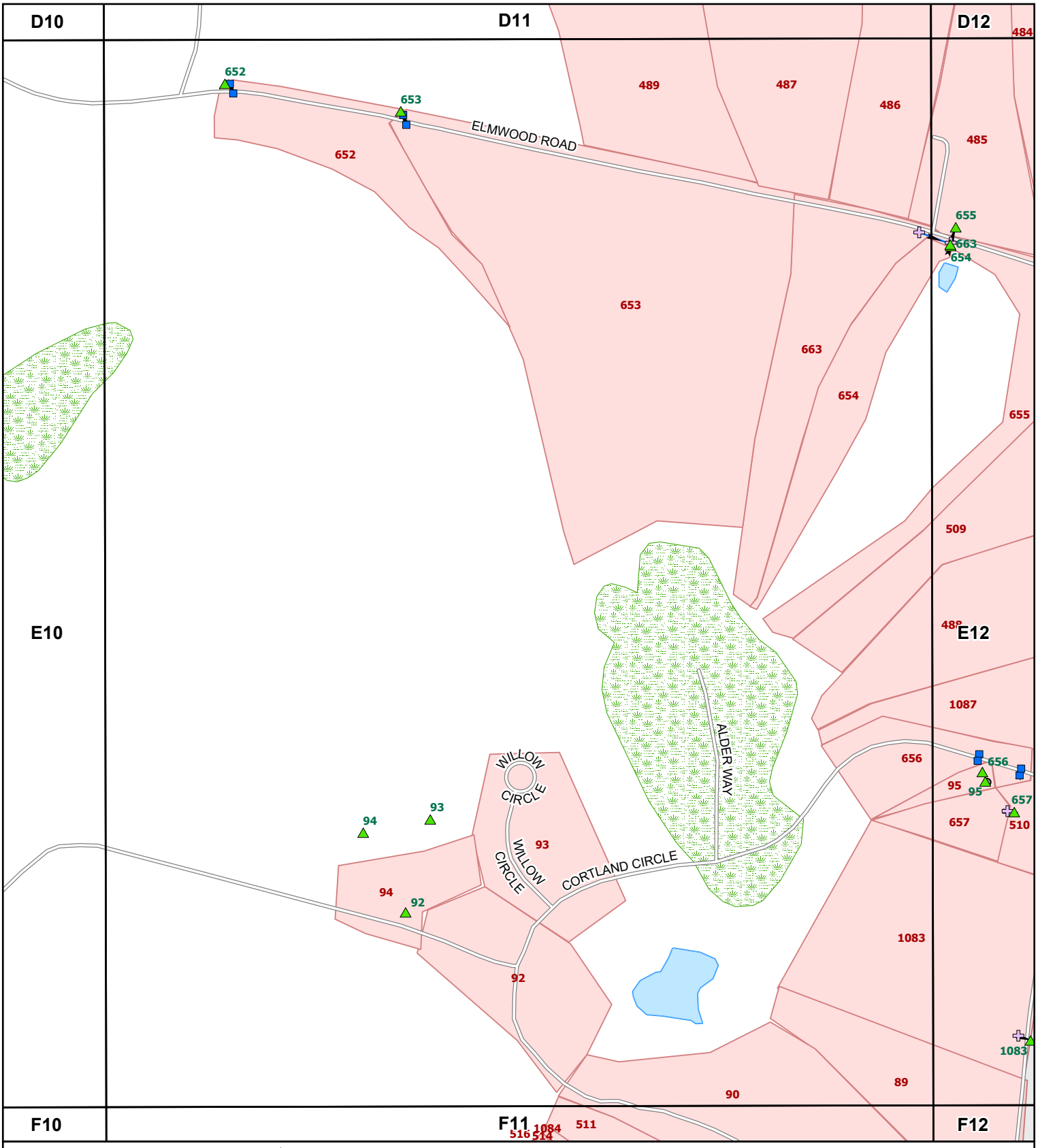
Feet

Data Sources: MassGIS, Town of Lunenburg

Map E10

Comprehensive Environmental Incorporated

2/1/2021



- Outfalls
- Key Junction
- Manhole
- Catch Basin
- Detention/Infiltration Basin
- Inlet
- Dry Well
- Culvert
- Drainage Pipes
- Pond, Reservoir
- Wetland, Marsh
- Stream, Brook
- Catchments
- Non-Urbanized Area

N

Stormwater Map

Lunenburg, MA

0 200 400 600

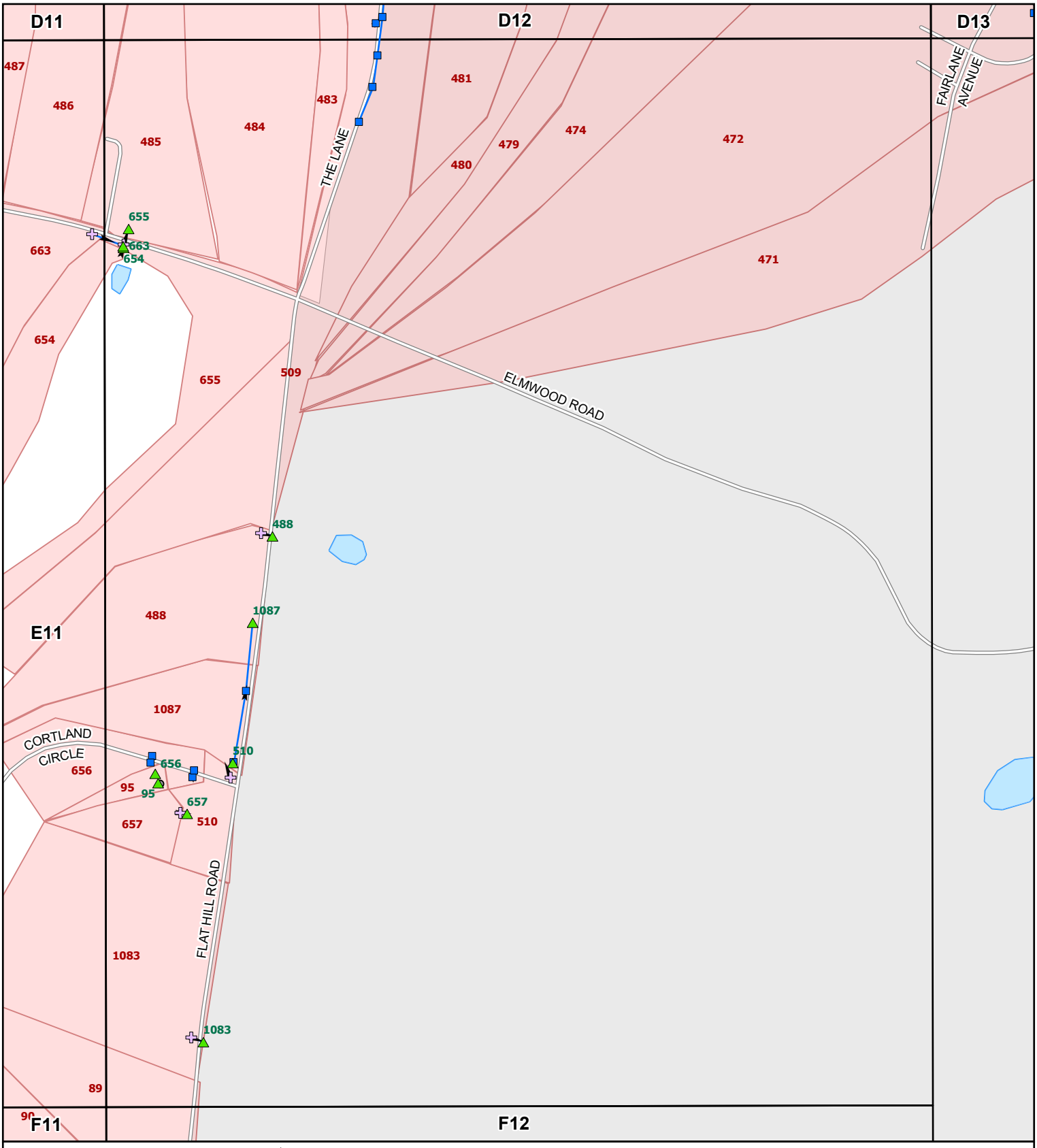
Feet

Data Sources: MassGIS, Town of Lunenburg

Map E11

Comprehensive Environmental Incorporated

2/1/2021



- Outfalls
- Key Junction
- Manhole
- Catch Basin
- Detention/Infiltration Basin
- Inlet
- Dry Well
- Culvert
- Drainage Pipes
- Pond, Reservoir
- Wetland, Marsh
- Stream, Brook
- Catchments
- Non-Urbanized Area

N

Stormwater Map

Lunenburg, MA

0 200 400 600

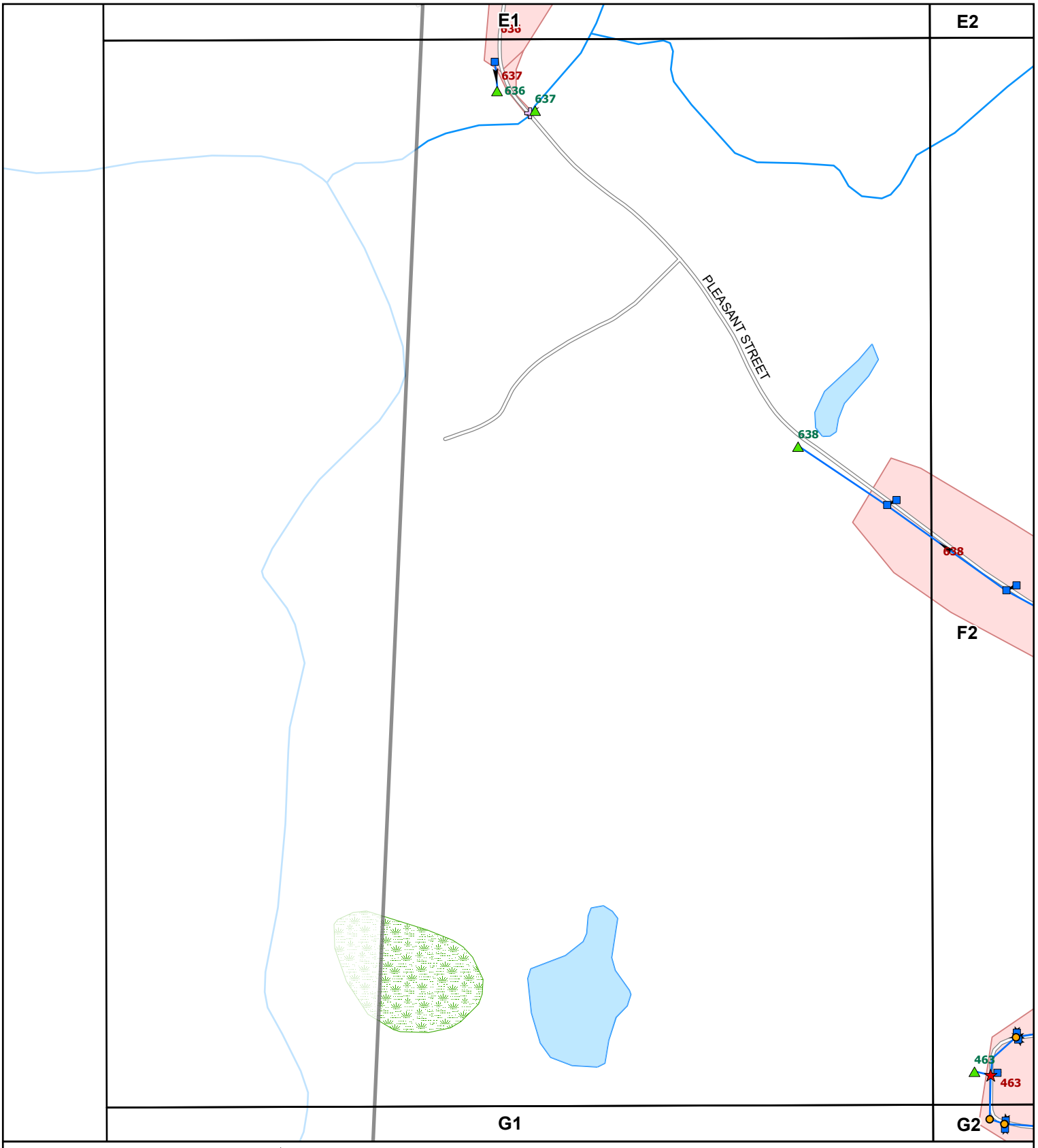
Feet

Data Sources: MassGIS, Town of Lunenburg

Map E12

Comprehensive Environmental Incorporated

2/1/2021



- Outfalls
- Key Junction
- Manhole
- Catch Basin
- Detention/Infiltration Basin
- Inlet
- Dry Well
- Culvert
- Drainage Pipes
- Pond, Reservoir
- Wetland, Marsh
- Stream, Brook
- Catchments
- Non-Urbanized Area

N

Stormwater Map

Lunenburg, MA

0 200 400 600

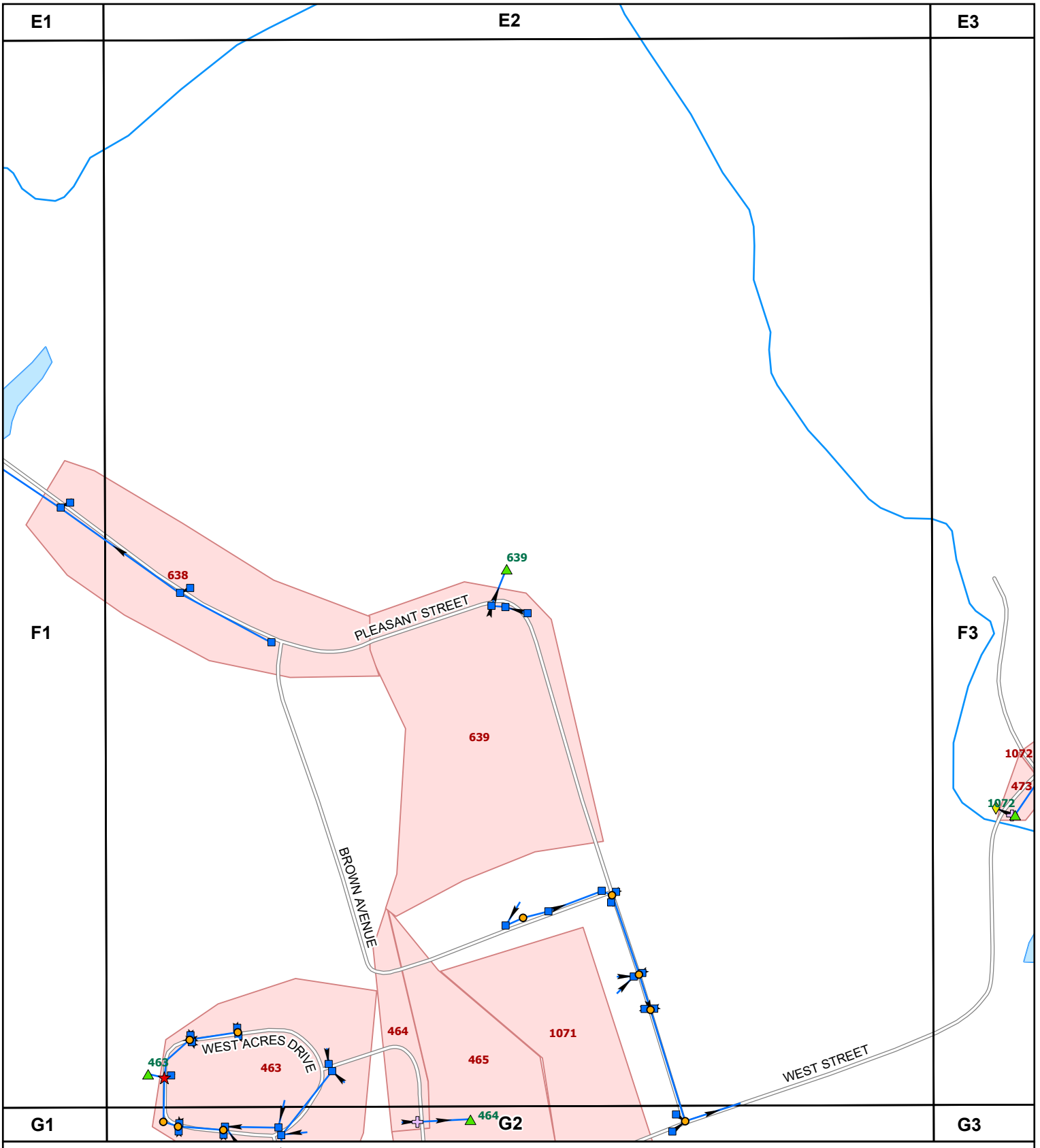
Feet

Data Sources: MassGIS, Town of Lunenburg

Map F1

Comprehensive Environmental Incorporated

2/1/2021



- Outfalls
- Key Junction
- Manhole
- Catch Basin
- Detention/Infiltration Basin
- Inlet
- Dry Well
- Culvert
- Drainage Pipes
- Pond, Reservoir
- Wetland, Marsh
- Stream, Brook
- Catchments
- Non-Urbanized Area

N

Stormwater Map

Lunenburg, MA

0 200 400 600

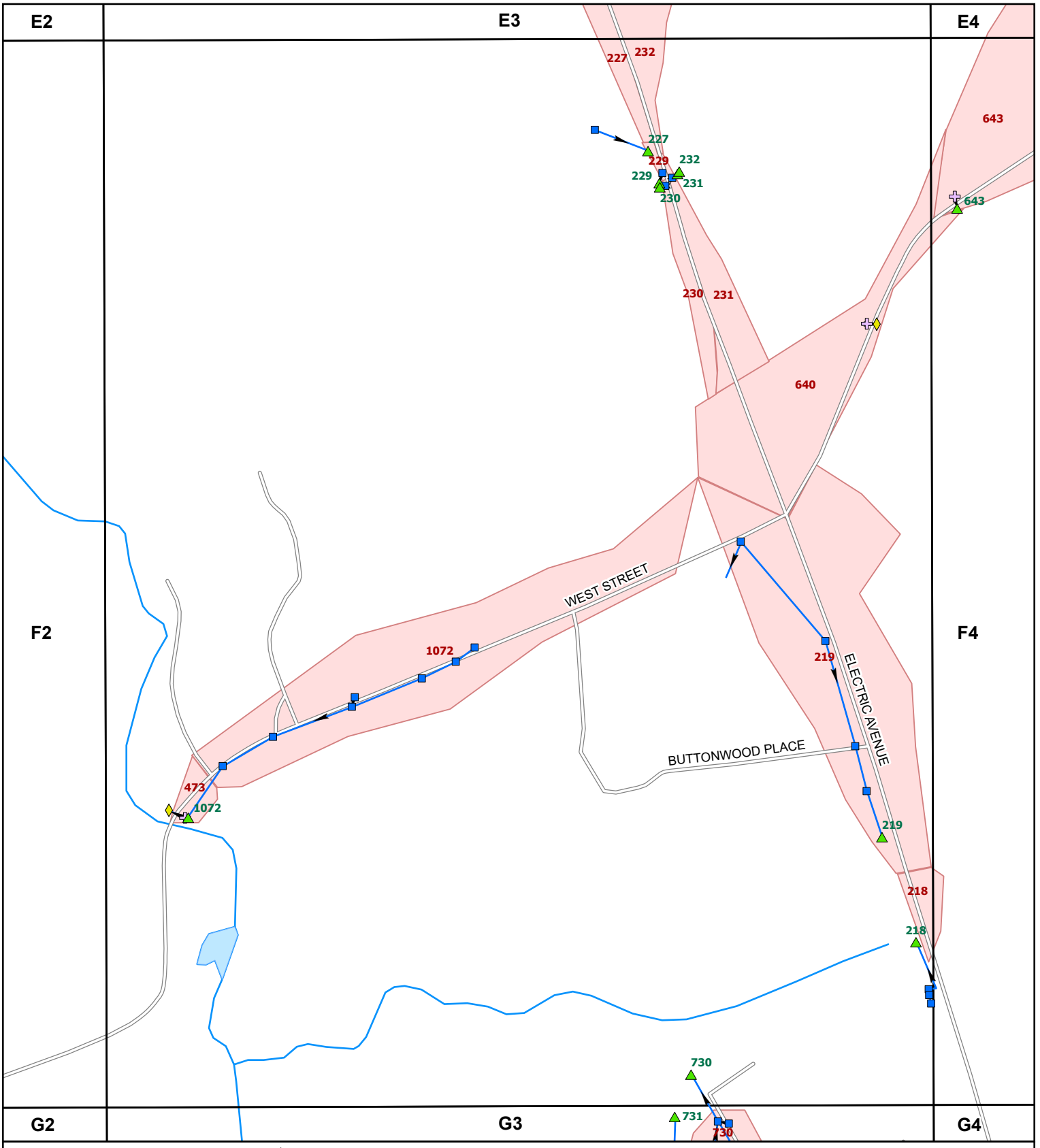
Feet

Data Sources: MassGIS, Town of Lunenburg

Map F2

Comprehensive Environmental Incorporated

2/1/2021



Outfalls
Key Junction
Manhole
Catch Basin
Detention/Infiltration Basin
Inlet
Dry Well
Culvert
Drainage Pipes
Pond, Reservoir
Wetland, Marsh
Stream, Brook
Catchments
Non-Urbanized Area

N

Stormwater Map

Lunenburg, MA

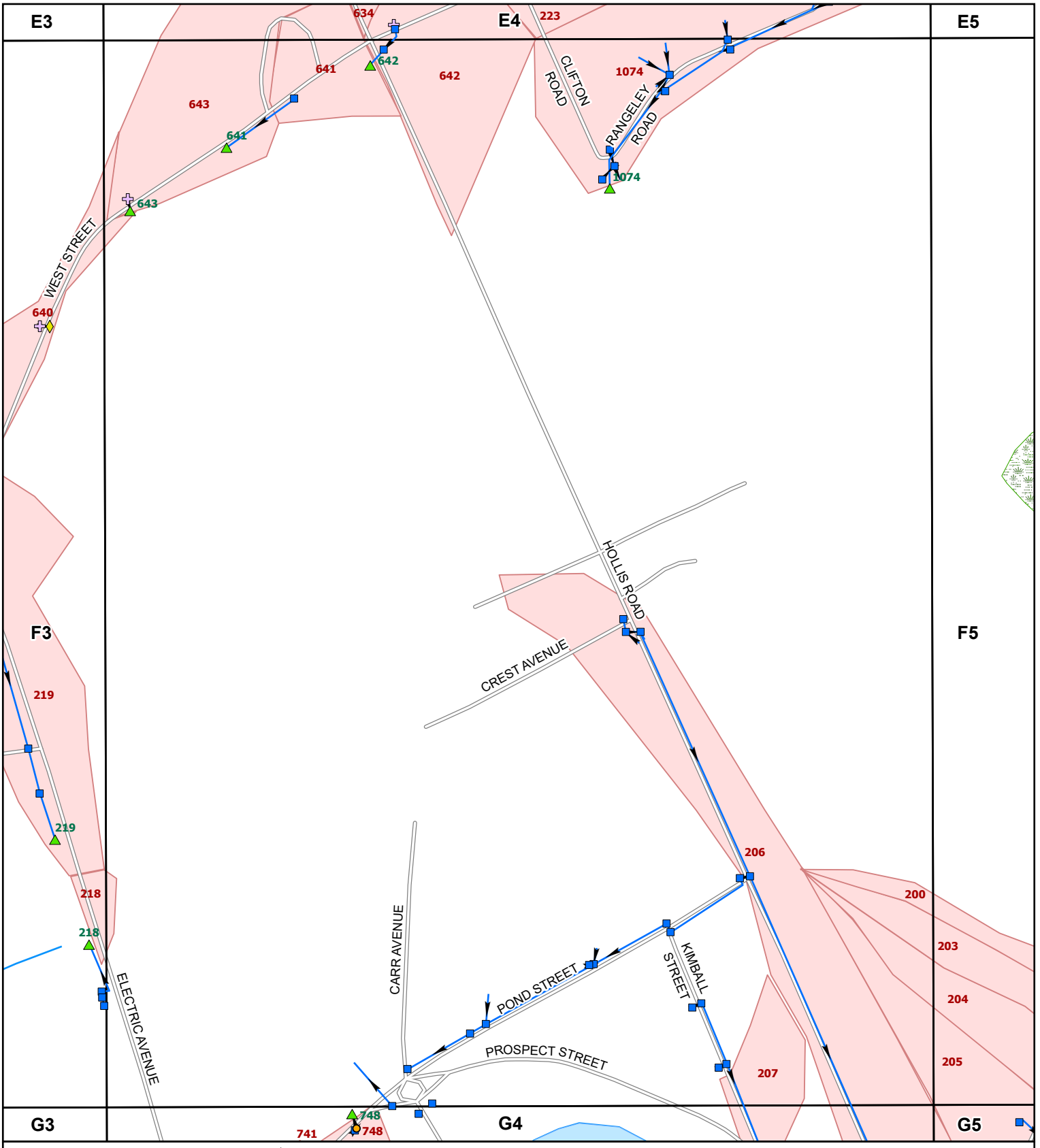
0 200 400 600
Feet

Data Sources: MassGIS, Town of Lunenburg

Map F3

Comprehensive Environmental Incorporated

2/1/2021



- Outfalls
- Key Junction
- Manhole
- Catch Basin
- Detention/Infiltration Basin
- Inlet
- Dry Well
- Culvert
- Drainage Pipes
- Pond, Reservoir
- Wetland, Marsh
- Stream, Brook
- Catchments
- Non-Urbanized Area

N

Stormwater Map

Lunenburg, MA

0 200 400 600

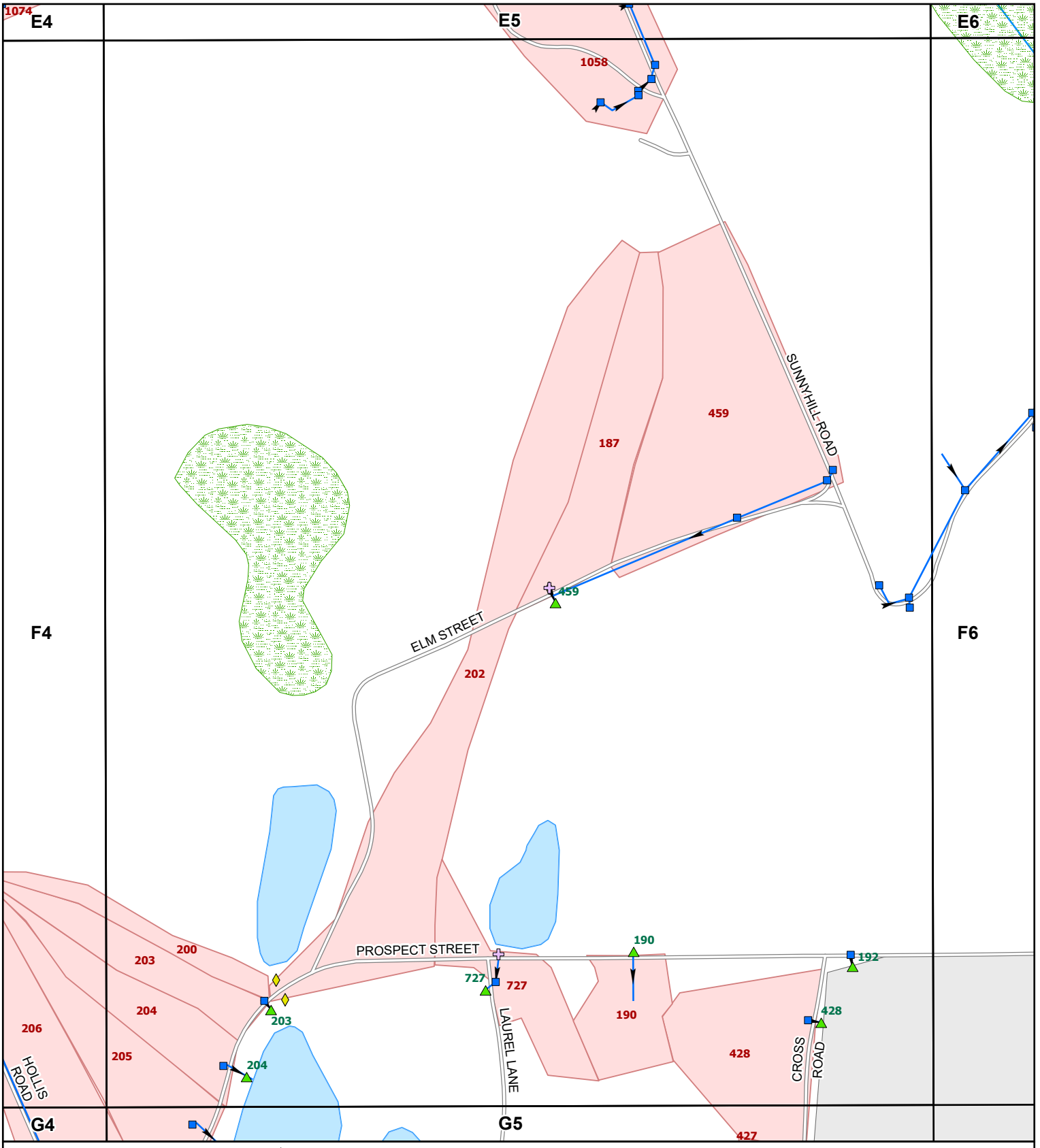
Feet

Data Sources: MassGIS, Town of Lunenburg

Map F4

Comprehensive Environmental Incorporated

2/1/2021



- Outfalls
- Key Junction
- Manhole
- Catch Basin
- Detention/Infiltration Basin
- Inlet
- Dry Well
- Culvert
- Drainage Pipes
- Pond, Reservoir
- Wetland, Marsh
- Stream, Brook
- Catchments
- Non-Urbanized Area

N

Stormwater Map

Lunenburg, MA

0 200 400 600

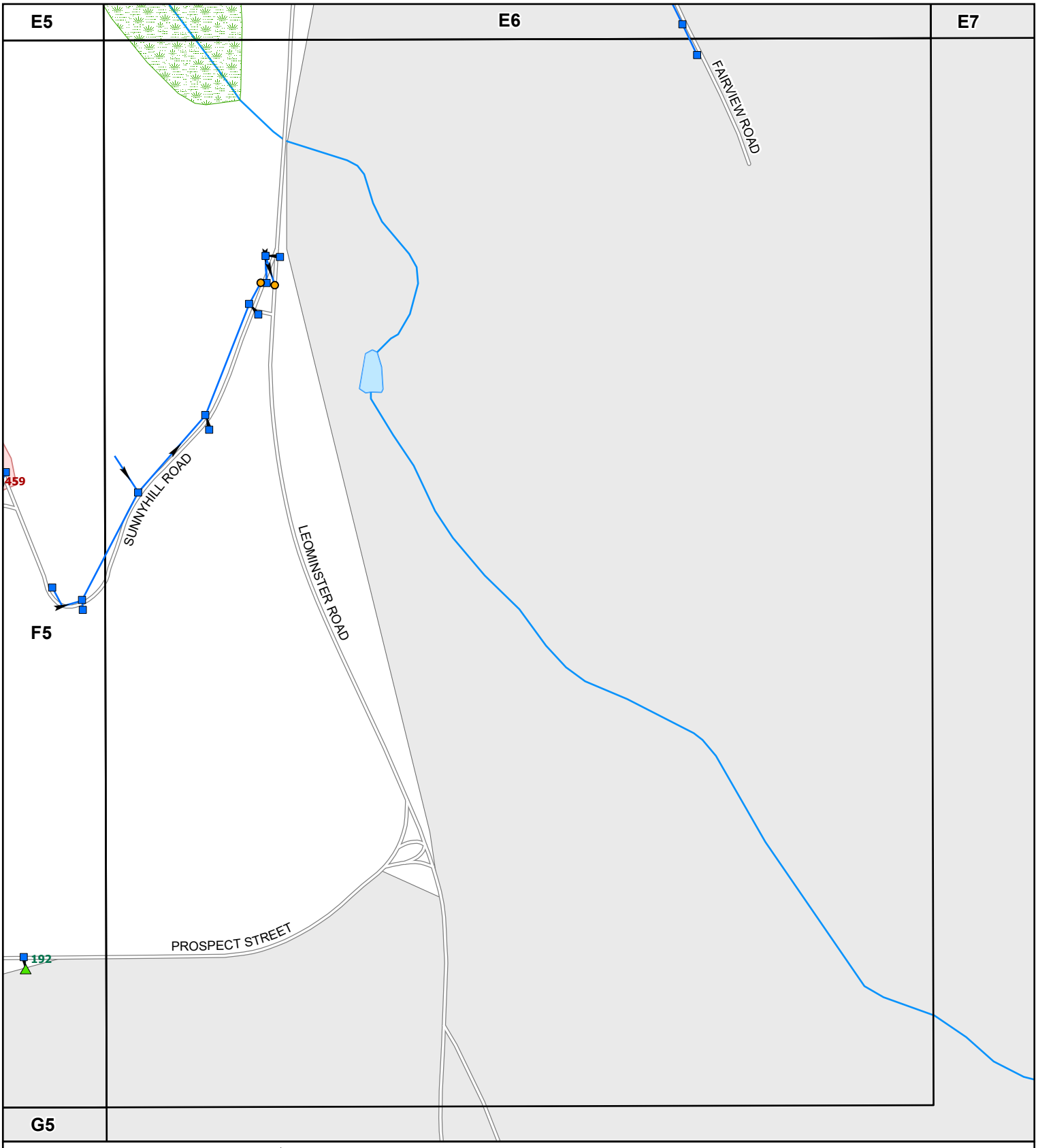
Feet

Data Sources: MassGIS, Town of Lunenburg

Map F5

Comprehensive Environmental Incorporated

2/1/2021



- Outfalls
- Key Junction
- Manhole
- Catch Basin
- Detention/Infiltration Basin
- Inlet
- Dry Well
- Culvert
- Drainage Pipes
- Pond, Reservoir
- Wetland, Marsh
- Stream, Brook
- Catchments
- Non-Urbanized Area

N

Stormwater Map

Lunenburg, MA

0 200 400 600

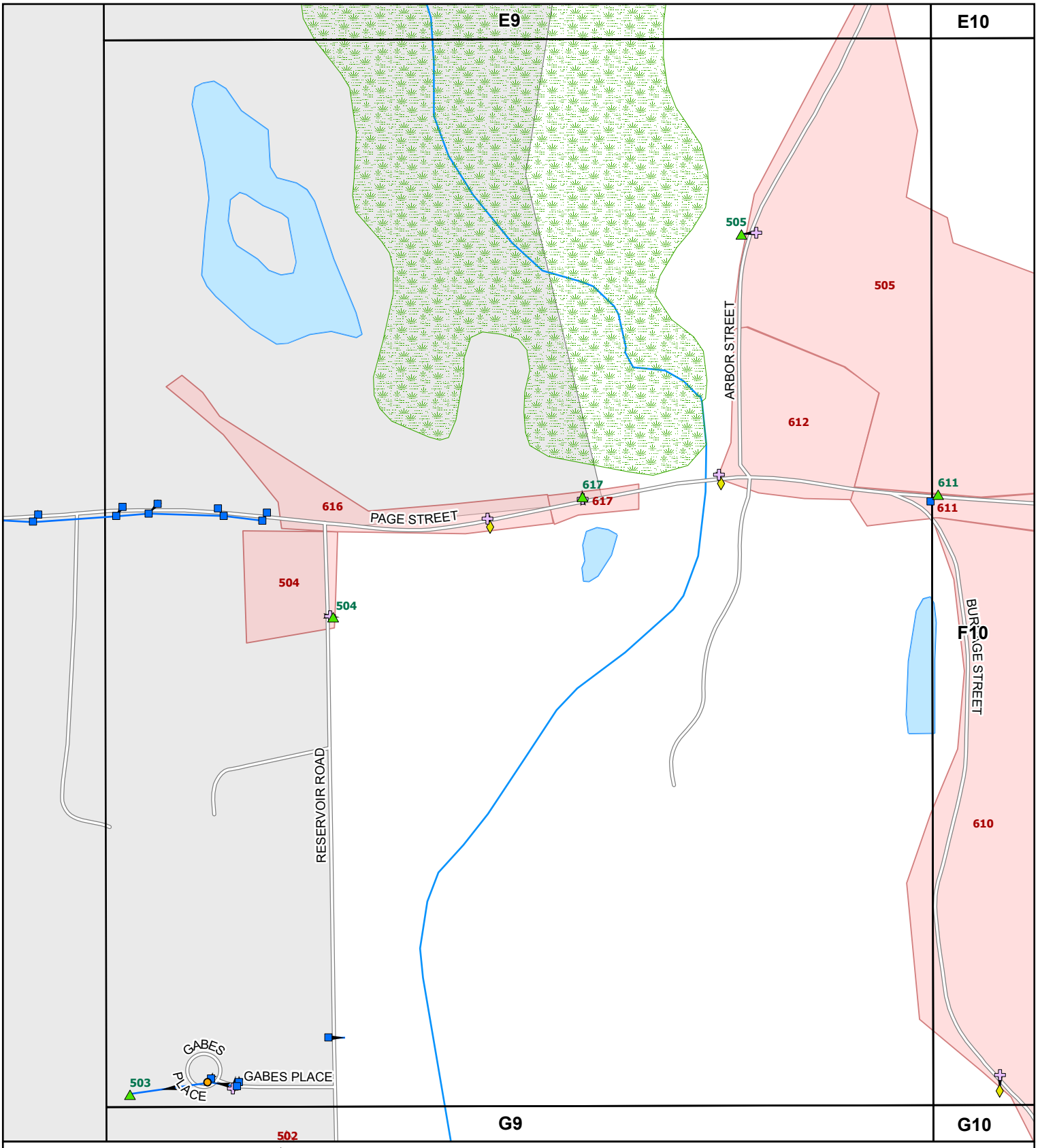
Feet

Data Sources: MassGIS, Town of Lunenburg

Map F6

Comprehensive Environmental Incorporated

2/1/2021



- Outfalls
- Key Junction
- Manhole
- Catch Basin
- Detention/Infiltration Basin
- Inlet
- Dry Well
- Culvert
- Drainage Pipes
- Pond, Reservoir
- Wetland, Marsh
- Stream, Brook
- Catchments
- Non-Urbanized Area

N

Stormwater Map

Lunenburg, MA

0 200 400 600

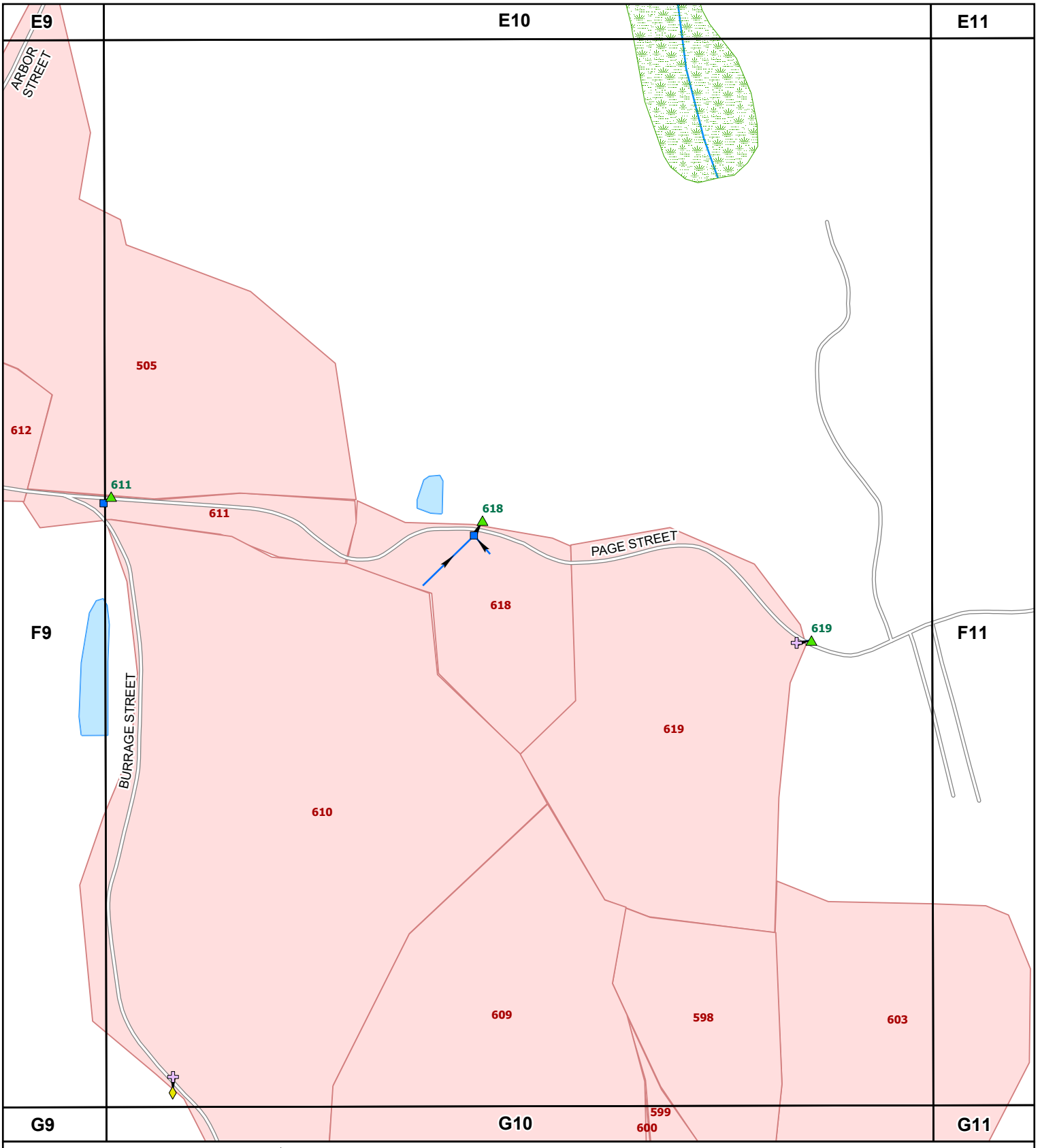
Feet

Data Sources: MassGIS, Town of Lunenburg

Map F9

Comprehensive Environmental Incorporated

2/1/2021



Outfalls
Key Junction
Manhole
Catch Basin
Detention/Infiltration Basin
Inlet
Dry Well
Culvert
Drainage Pipes
Pond, Reservoir
Wetland, Marsh
Stream, Brook
Catchments
Non-Urbanized Area

N

Stormwater Map

Lunenburg, MA

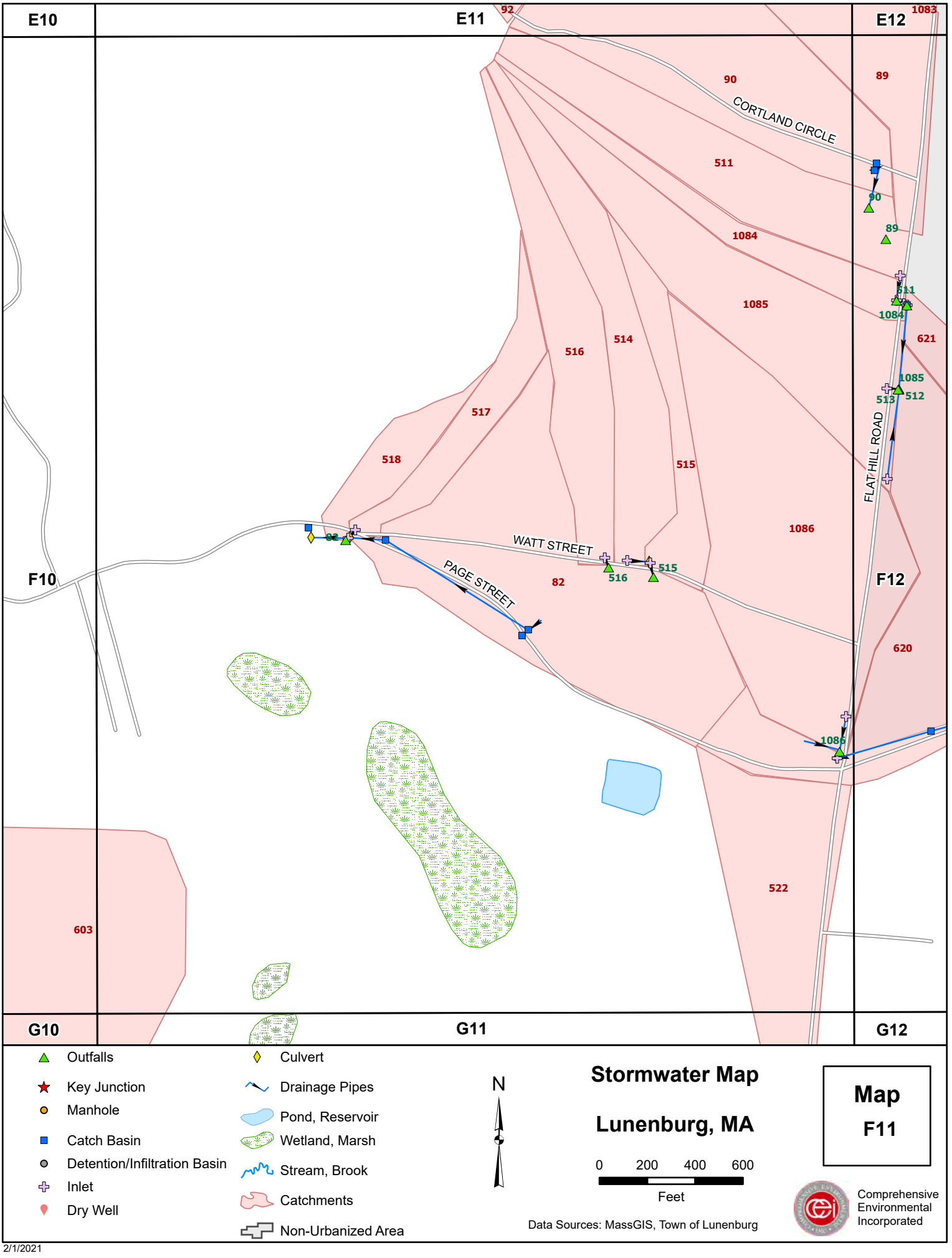
0 200 400 600
Feet

Data Sources: MassGIS, Town of Lunenburg

Map F10

Comprehensive Environmental Incorporated

2/1/2021



Stormwater Map

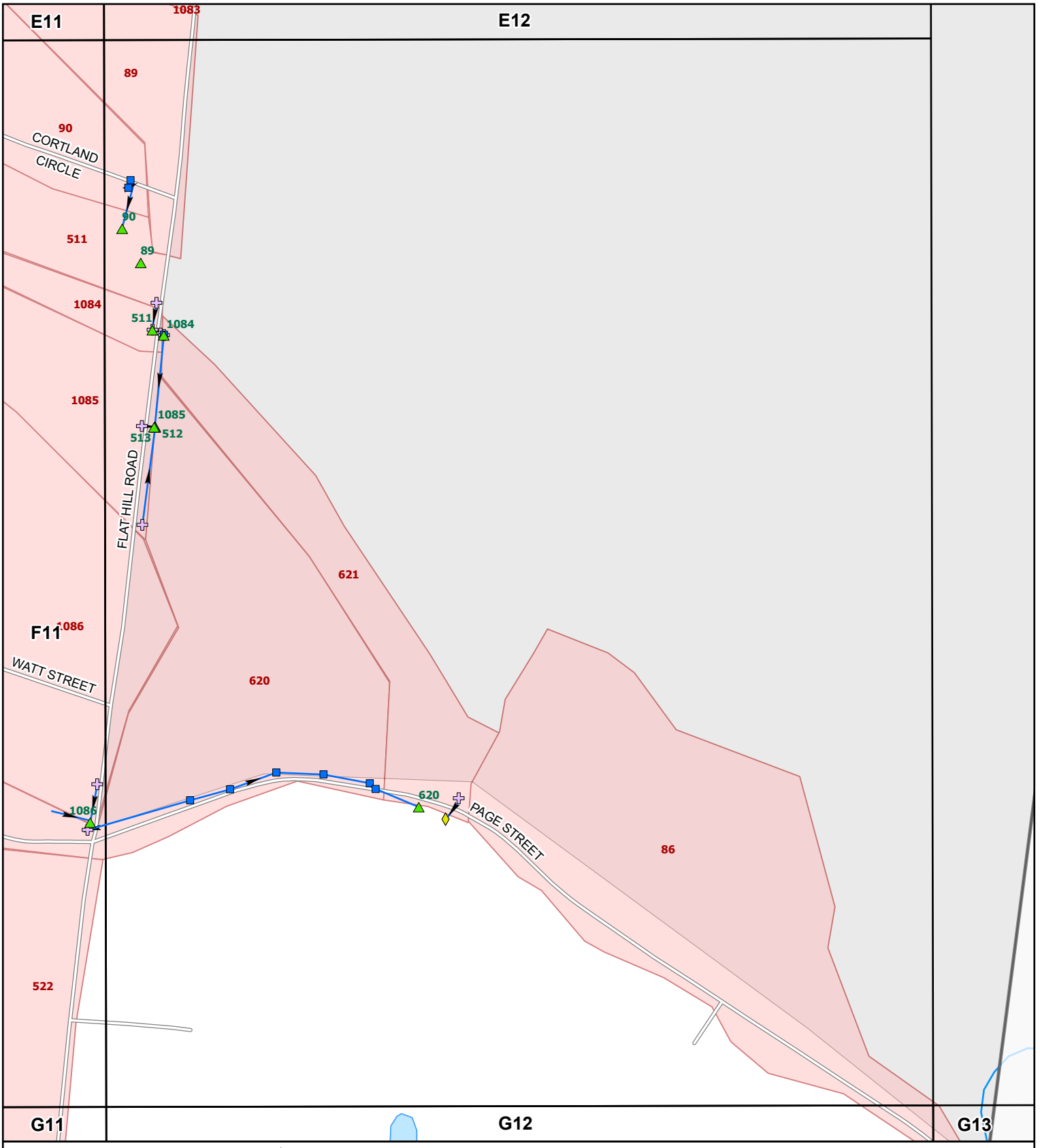
Lunenburg, MA

Map F11

Data Sources: MassGIS, Town of Lunenburg

Comprehensive Environmental Incorporated

2/1/2021



- Outfalls
- Key Junction
- Manhole
- Catch Basin
- Detention/Infiltration Basin
- Inlet
- Dry Well
- Culvert
- Drainage Pipes
- Pond, Reservoir
- Wetland, Marsh
- Stream, Brook
- Catchments
- Non-Urbanized Area

N

Stormwater Map

Lunenburg, MA

0 200 400 600

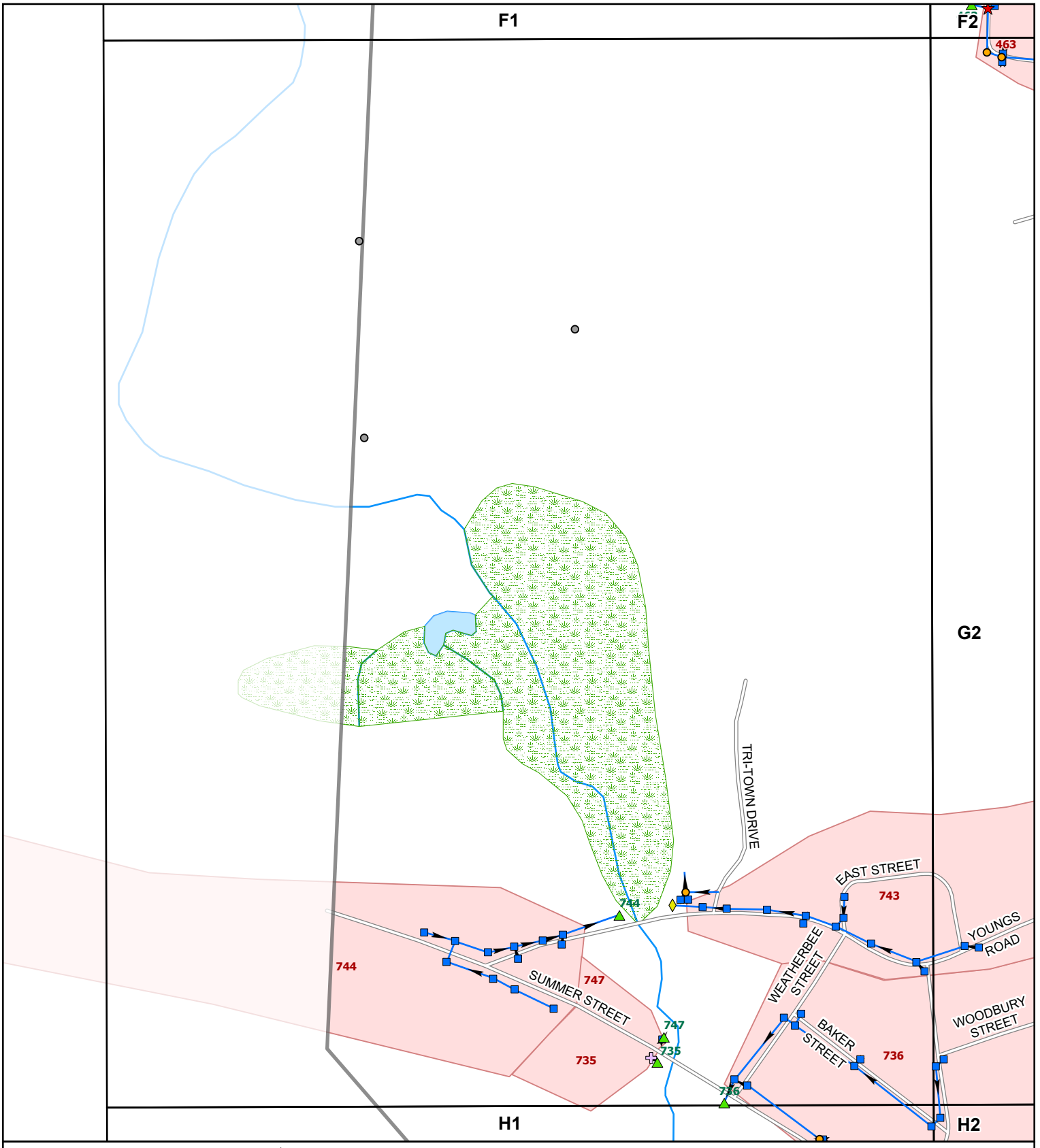
Feet

Data Sources: MassGIS, Town of Lunenburg

Map F12

Comprehensive Environmental Incorporated

2/1/2021



- Outfalls
- Key Junction
- Manhole
- Catch Basin
- Detention/Infiltration Basin
- Inlet
- Dry Well
- Culvert
- Drainage Pipes
- Pond, Reservoir
- Wetland, Marsh
- Stream, Brook
- Catchments
- Non-Urbanized Area

N

Stormwater Map

Lunenburg, MA

0 200 400 600

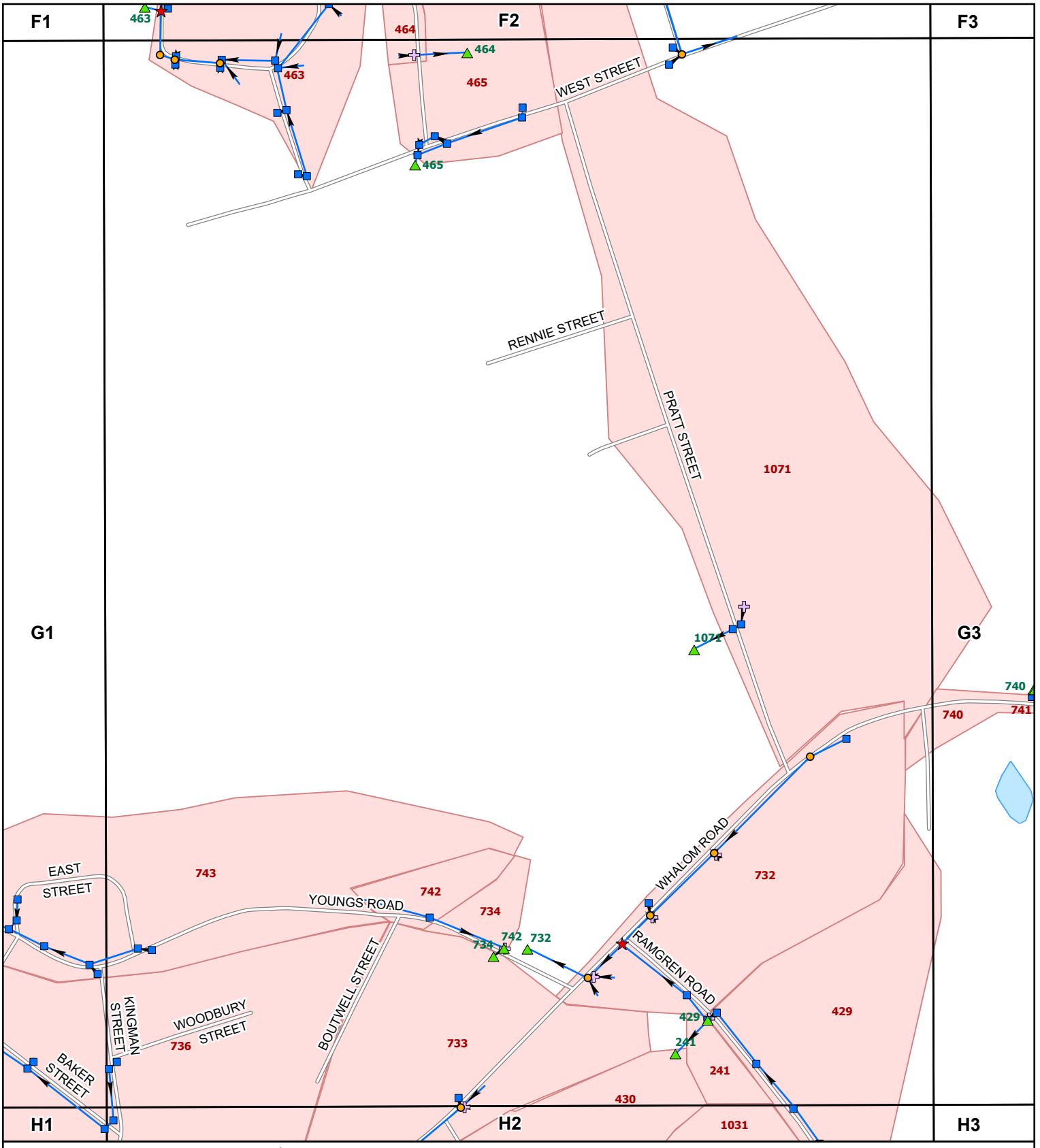
Feet

Data Sources: MassGIS, Town of Lunenburg

Map G1

Comprehensive Environmental Incorporated

2/1/2021



- Outfalls
- Key Junction
- Manhole
- Catch Basin
- Detention/Infiltration Basin
- Inlet
- Dry Well
- Culvert
- Drainage Pipes
- Pond, Reservoir
- Wetland, Marsh
- Stream, Brook
- Catchments
- Non-Urbanized Area

N

Stormwater Map

Lunenburg, MA

0 200 400 600

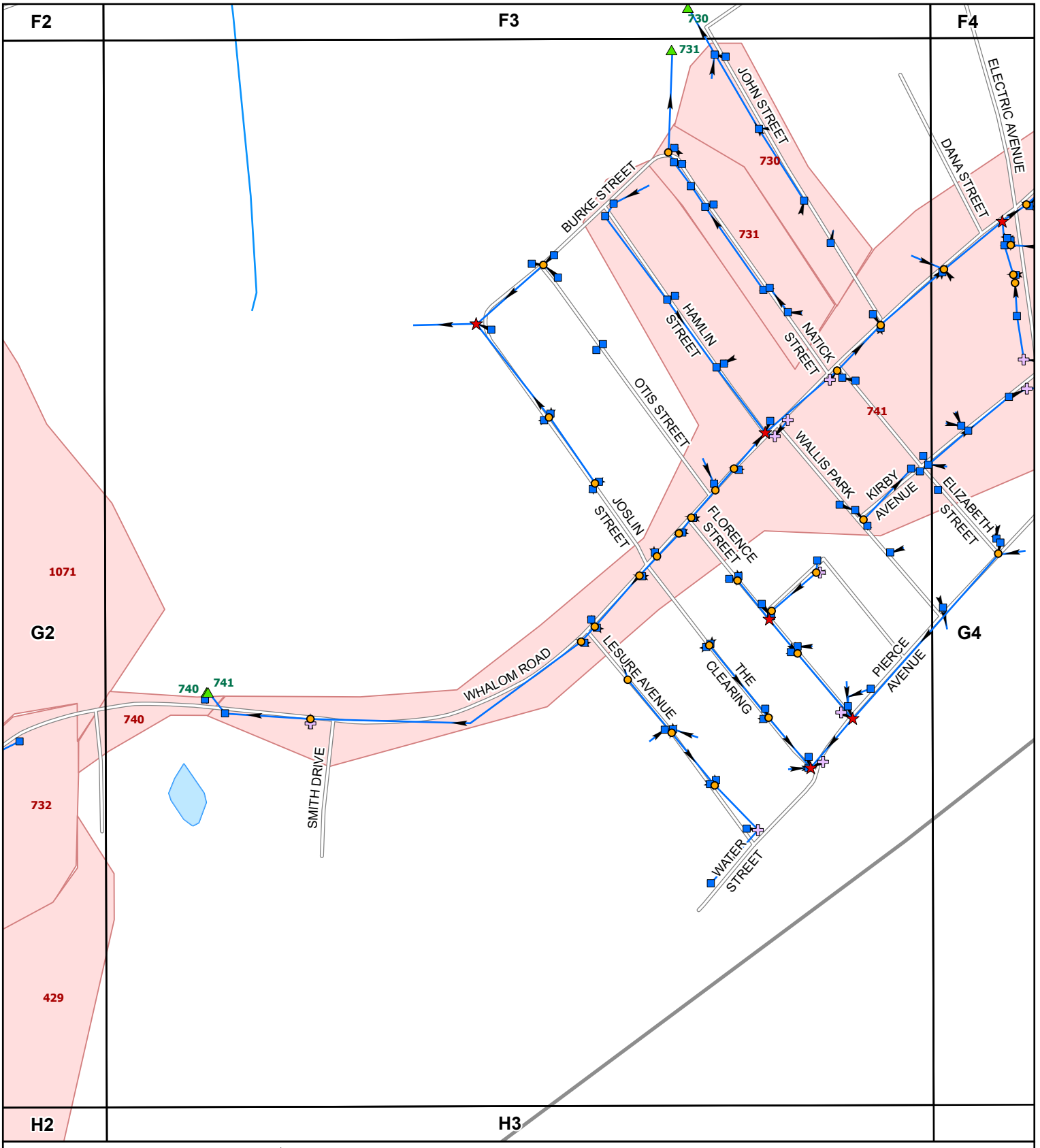
Feet

Data Sources: MassGIS, Town of Lunenburg

Map G2

Comprehensive Environmental Incorporated

2/1/2021



Outfalls
Key Junction
Manhole
Catch Basin
Detention/Infiltration Basin
Inlet
Dry Well
Culvert
Drainage Pipes
Pond, Reservoir
Wetland, Marsh
Stream, Brook
Catchments
Non-Urbanized Area

N

Stormwater Map

Lunenburg, MA

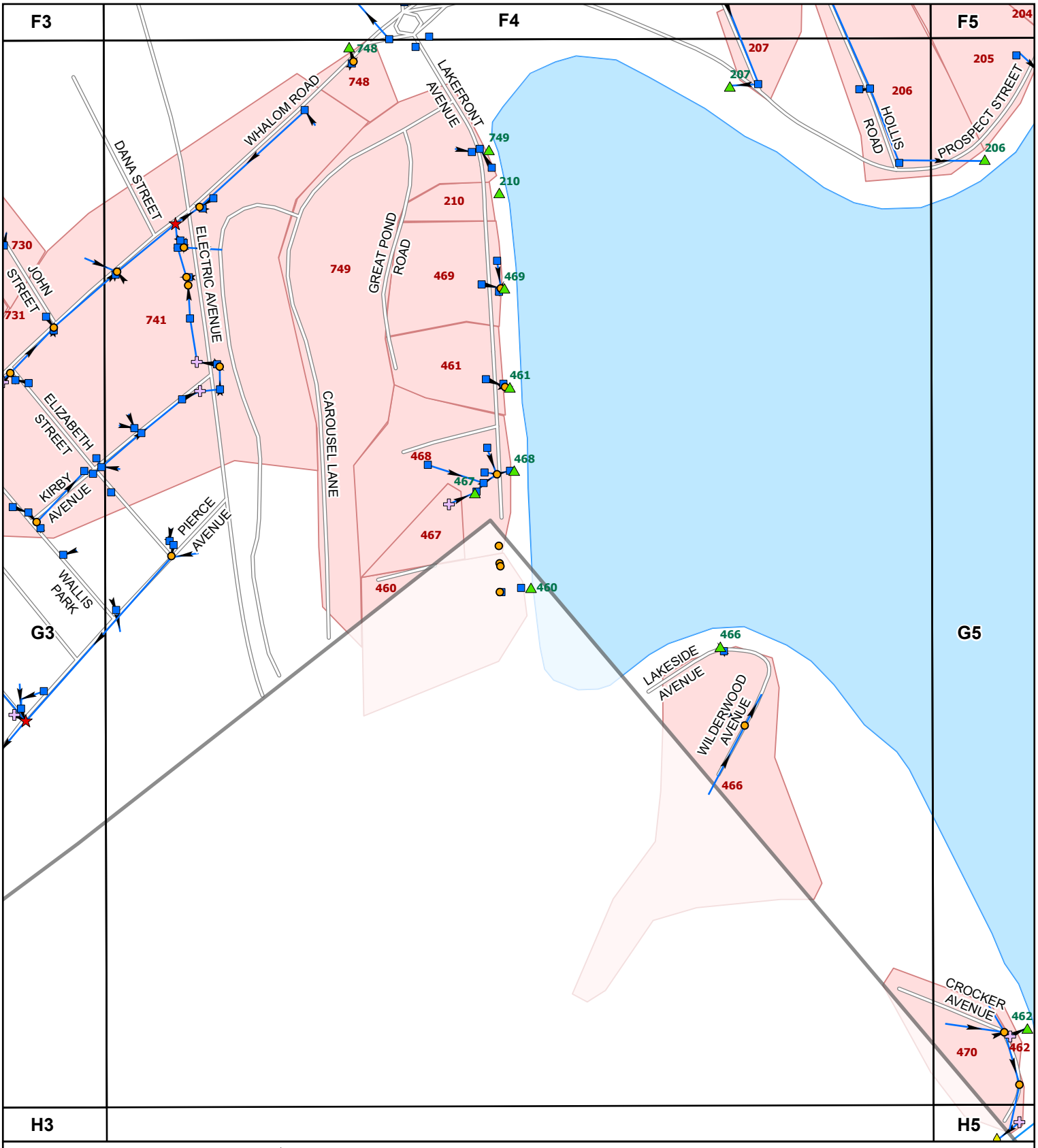
0 200 400 600
Feet

Data Sources: MassGIS, Town of Lunenburg

Map G3

Comprehensive Environmental Incorporated

2/1/2021



- Outfalls
- Key Junction
- Manhole
- Catch Basin
- Detention/Infiltration Basin
- Inlet
- Dry Well
- Culvert
- Drainage Pipes
- Pond, Reservoir
- Wetland, Marsh
- Stream, Brook
- Catchments
- Non-Urbanized Area

N

Stormwater Map

Lunenburg, MA

0 200 400 600

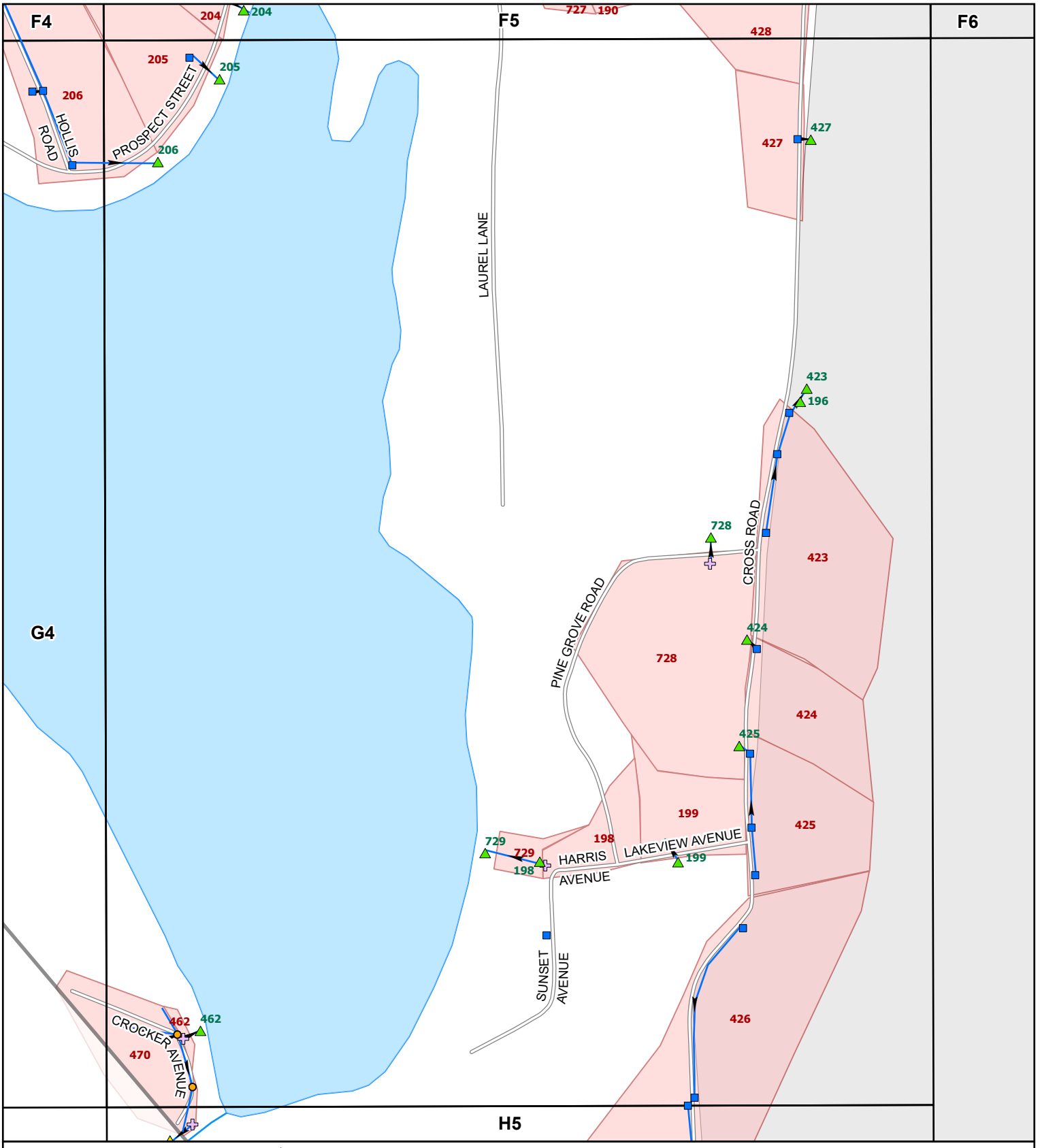
Feet

Data Sources: MassGIS, Town of Lunenburg

Map G4

Comprehensive Environmental Incorporated

2/1/2021



- Outfalls
- Key Junction
- Manhole
- Catch Basin
- Detention/Infiltration Basin
- Inlet
- Dry Well
- Culvert
- Drainage Pipes
- Pond, Reservoir
- Wetland, Marsh
- Stream, Brook
- Catchments
- Non-Urbanized Area

N

Stormwater Map

Lunenburg, MA

0 200 400 600

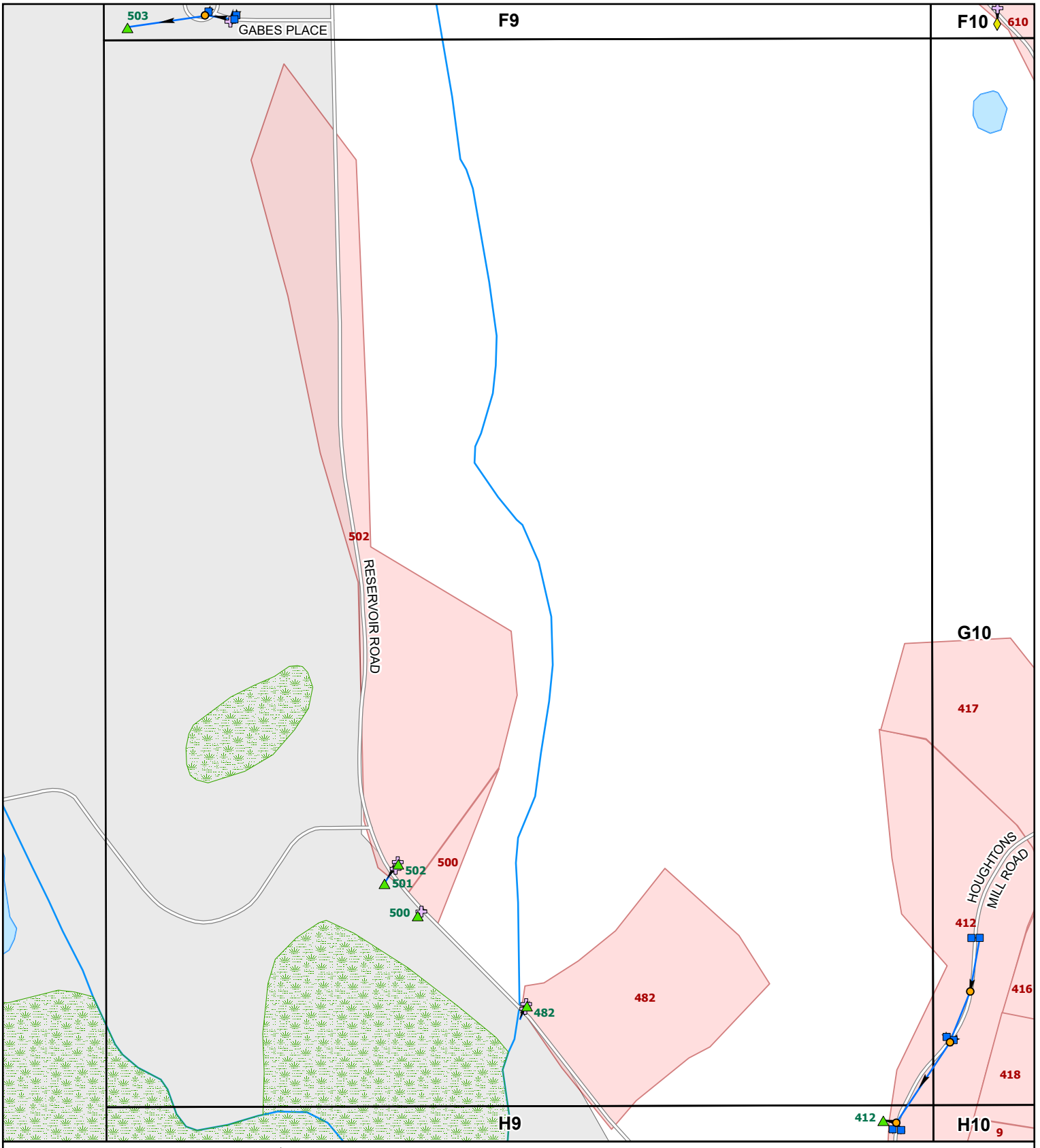
Feet

Data Sources: MassGIS, Town of Lunenburg

Map G5

Comprehensive Environmental Incorporated

2/1/2021



- Outfalls
- Key Junction
- Manhoe
- Catch Basin
- Detention/Infiltration Basin
- Inlet
- Dry Well
- Culvert
- Drainage Pipes
- Pond, Reservoir
- Wetland, Marsh
- Stream, Brook
- Catchments
- Non-Urbanized Area

N

Stormwater Map

Lunenburg, MA

0 200 400 600

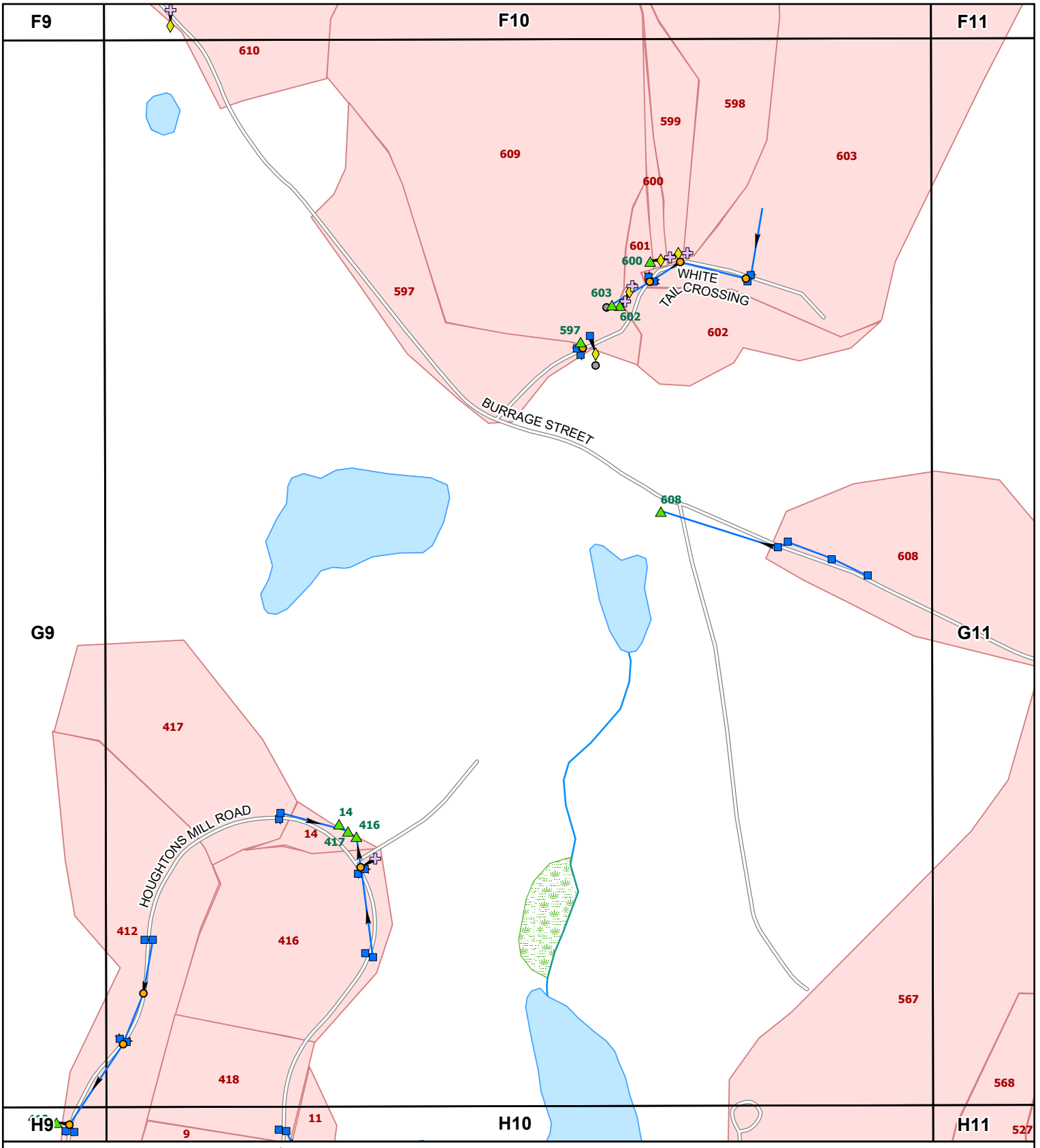
Feet

Data Sources: MassGIS, Town of Lunenburg

Map G9

Comprehensive Environmental Incorporated

2/1/2021



- Outfalls
- Key Junction
- Manhole
- Catch Basin
- Detention/Infiltration Basin
- Inlet
- Dry Well
- Culvert
- Drainage Pipes
- Pond, Reservoir
- Wetland, Marsh
- Stream, Brook
- Catchments
- Non-Urbanized Area

N

Stormwater Map

Lunenburg, MA

0 200 400 600

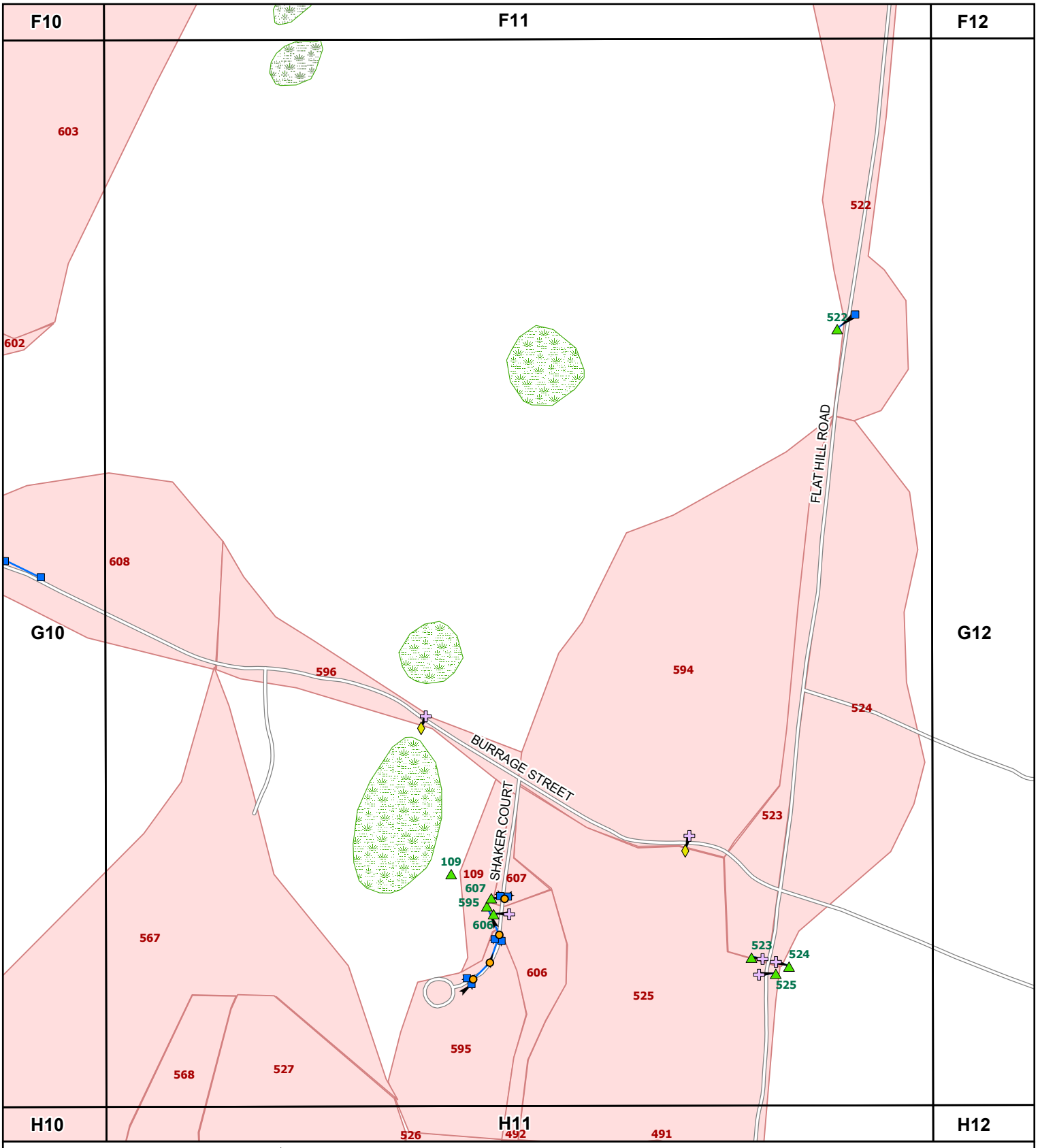
Feet

Data Sources: MassGIS, Town of Lunenburg

Map G10

Comprehensive Environmental Incorporated

2/1/2021



- Outfalls
- Key Junction
- Manhole
- Catch Basin
- Detention/Infiltration Basin
- Inlet
- Dry Well
- Culvert
- Drainage Pipes
- Pond, Reservoir
- Wetland, Marsh
- Stream, Brook
- Catchments
- Non-Urbanized Area

N

Stormwater Map

Lunenburg, MA

0 200 400 600

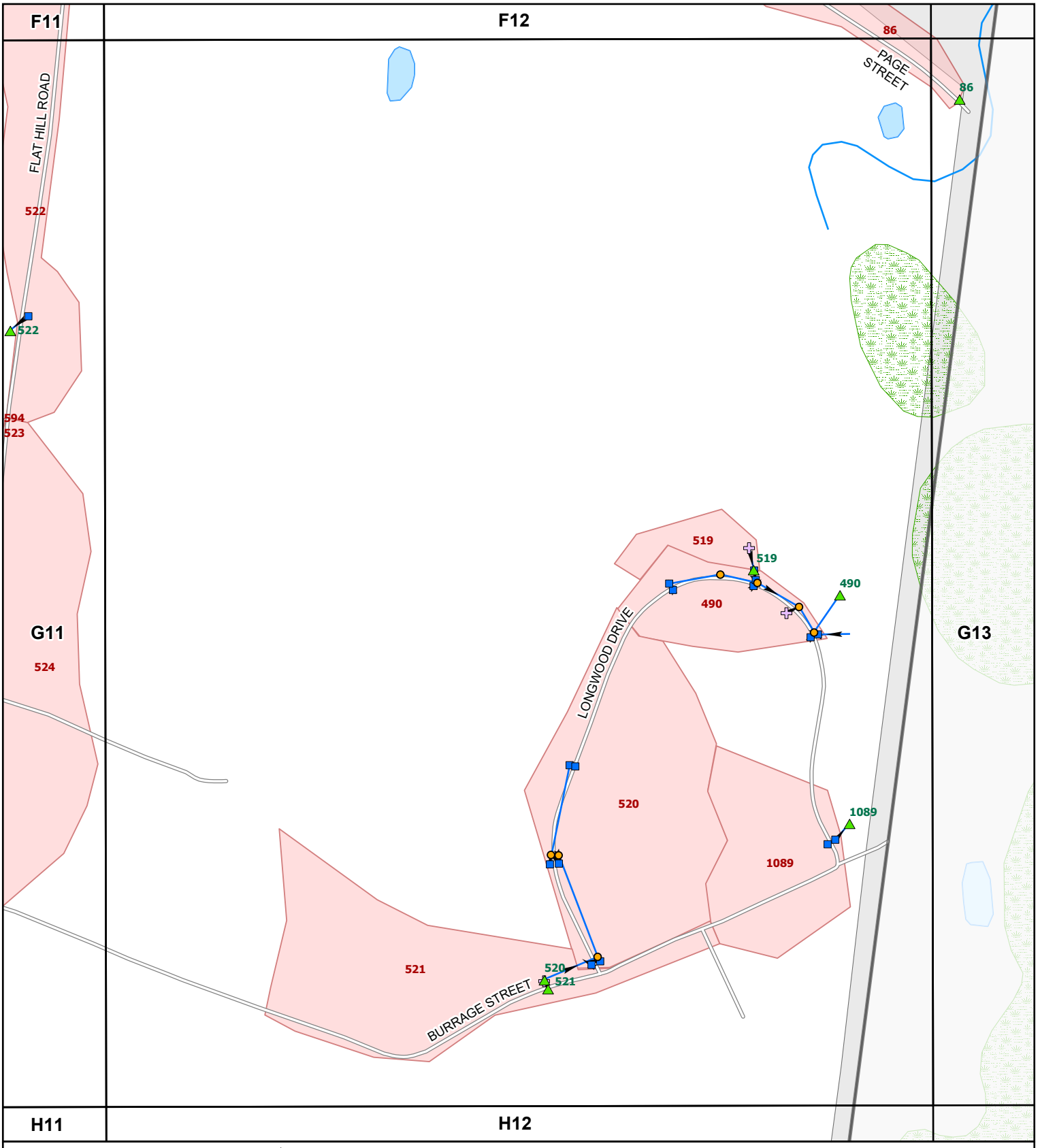
Feet

Data Sources: MassGIS, Town of Lunenburg

Map G11

Comprehensive Environmental Incorporated

2/1/2021



- Outfalls
- Key Junction
- Manhole
- Catch Basin
- Detention/Infiltration Basin
- Inlet
- Dry Well
- Culvert
- Drainage Pipes
- Pond, Reservoir
- Wetland, Marsh
- Stream, Brook
- Catchments
- Non-Urbanized Area

N

Stormwater Map

Lunenburg, MA

0 200 400 600

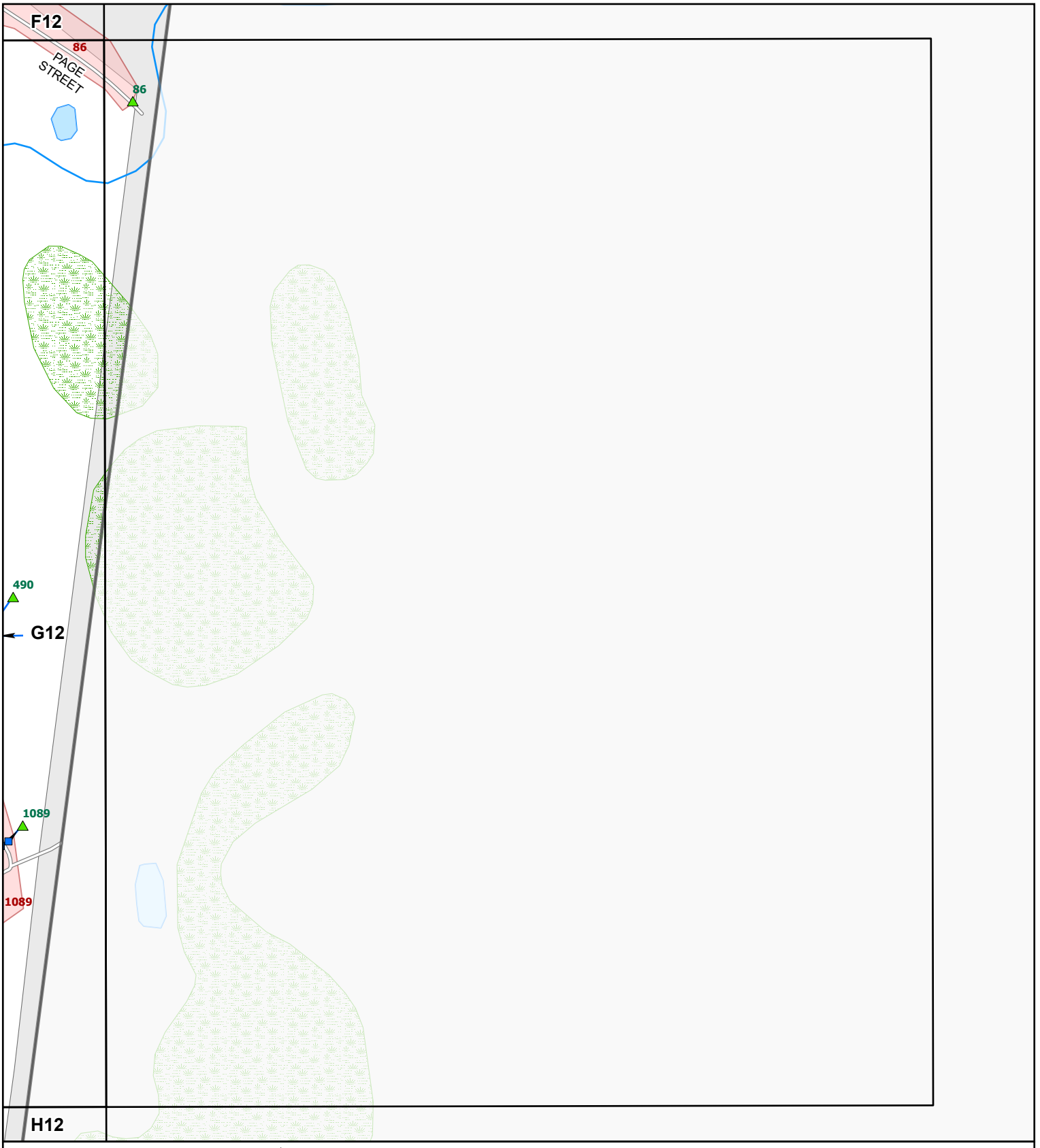
Feet

Data Sources: MassGIS, Town of Lunenburg

Map G12

Comprehensive Environmental Incorporated

2/1/2021



- Outfalls
- Key Junction
- Manhole
- Catch Basin
- Detention/Infiltration Basin
- Inlet
- Dry Well
- Culvert
- Drainage Pipes
- Pond, Reservoir
- Wetland, Marsh
- Stream, Brook
- Catchments
- Non-Urbanized Area

N

Stormwater Map

Lunenburg, MA

0 200 400 600

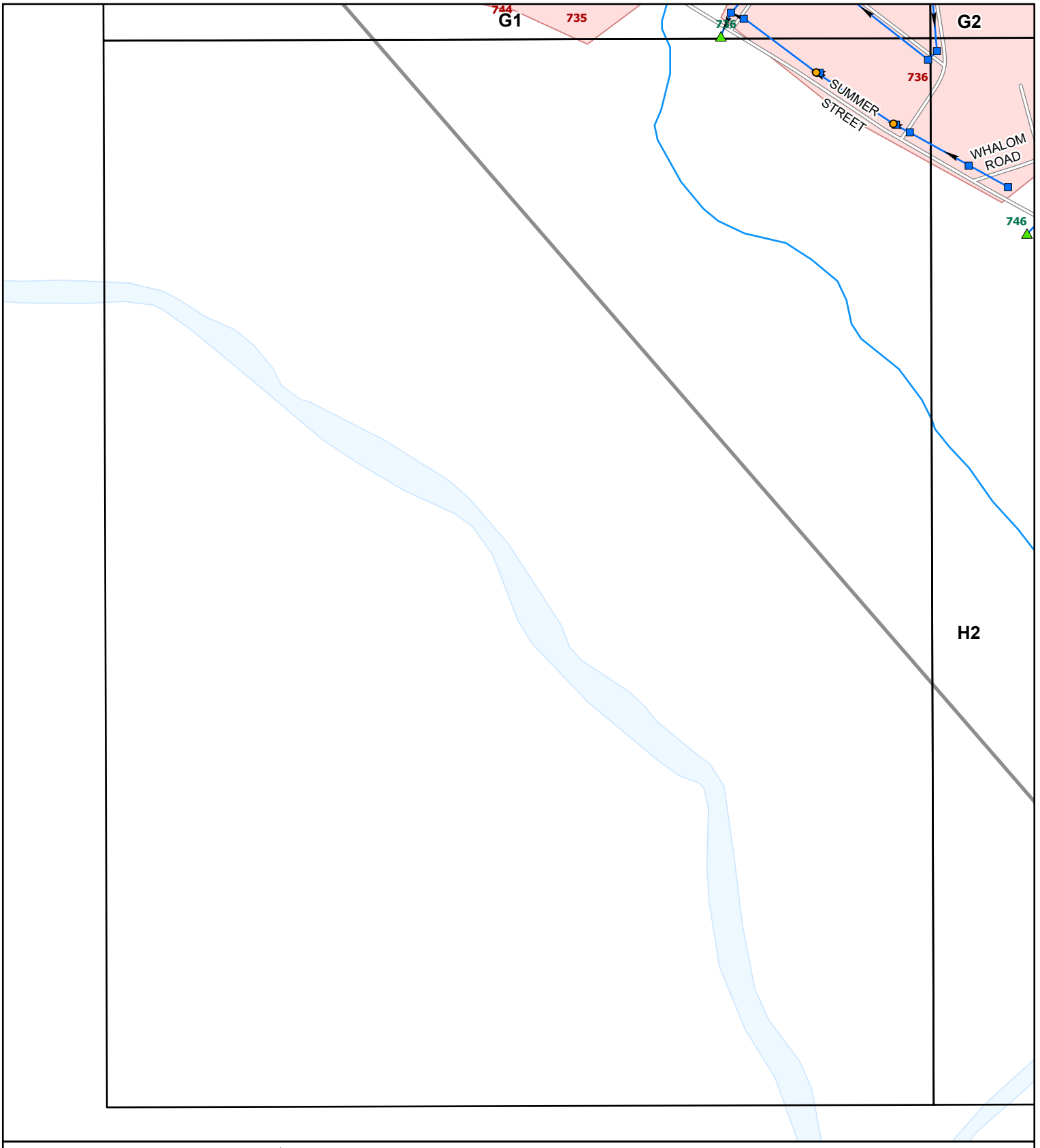
Feet

Data Sources: MassGIS, Town of Lunenburg

Map G13

Comprehensive Environmental Incorporated

2/1/2021



- Outfalls
- Key Junction
- Manhole
- Catch Basin
- Detention/Infiltration Basin
- Inlet
- Dry Well
- Culvert
- Drainage Pipes
- Pond, Reservoir
- Wetland, Marsh
- Stream, Brook
- Catchments
- Non-Urbanized Area

N

Stormwater Map

Lunenburg, MA

0 200 400 600

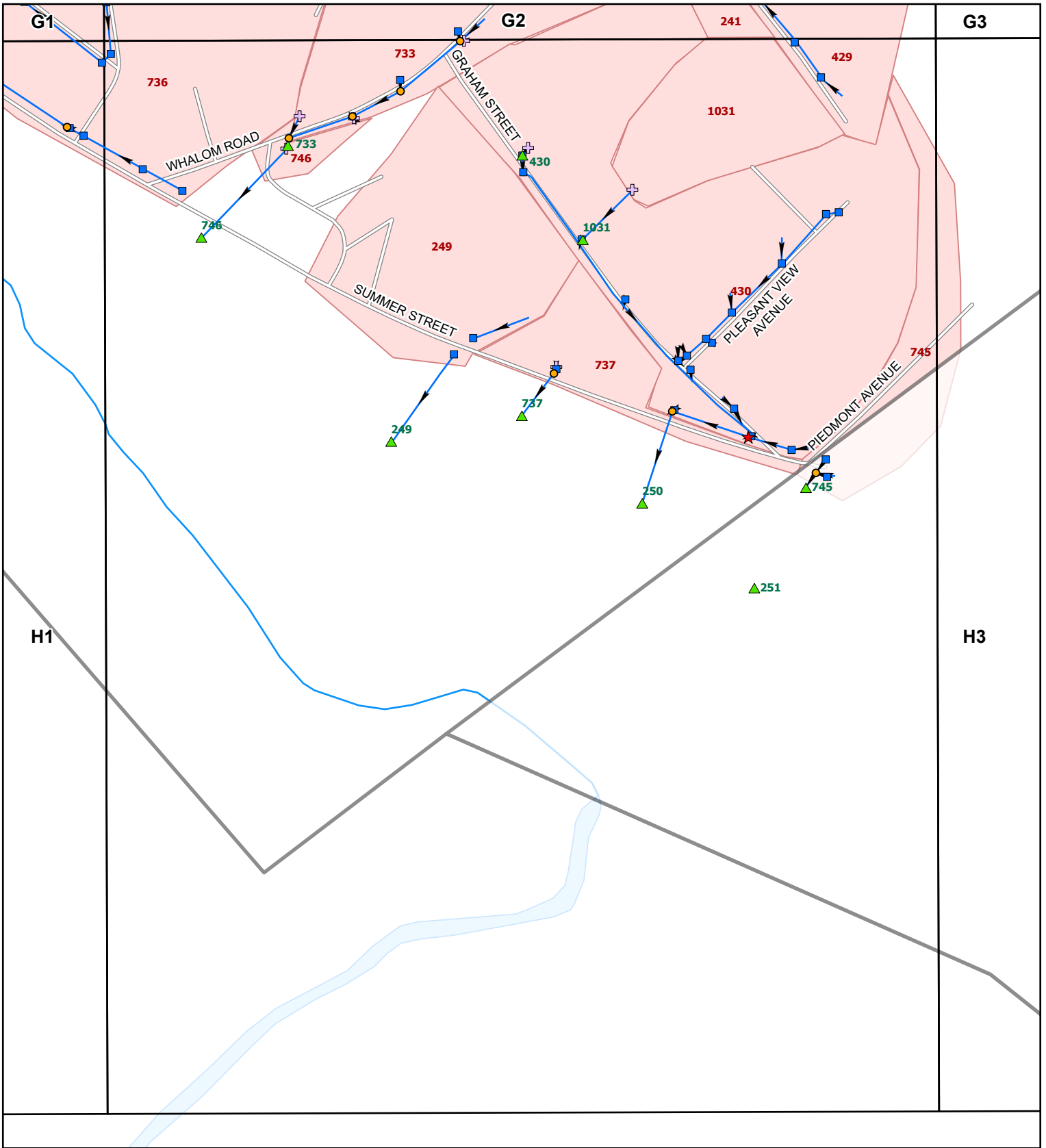
Feet

Data Sources: MassGIS, Town of Lunenburg

Map H1

Comprehensive Environmental Incorporated

2/1/2021



- Outfalls
- Key Junction
- Manhole
- Catch Basin
- Detention/Infiltration Basin
- Inlet
- Dry Well
- Culvert
- Drainage Pipes
- Pond, Reservoir
- Wetland, Marsh
- Stream, Brook
- Catchments
- Non-Urbanized Area

N

Stormwater Map

Lunenburg, MA

0 200 400 600

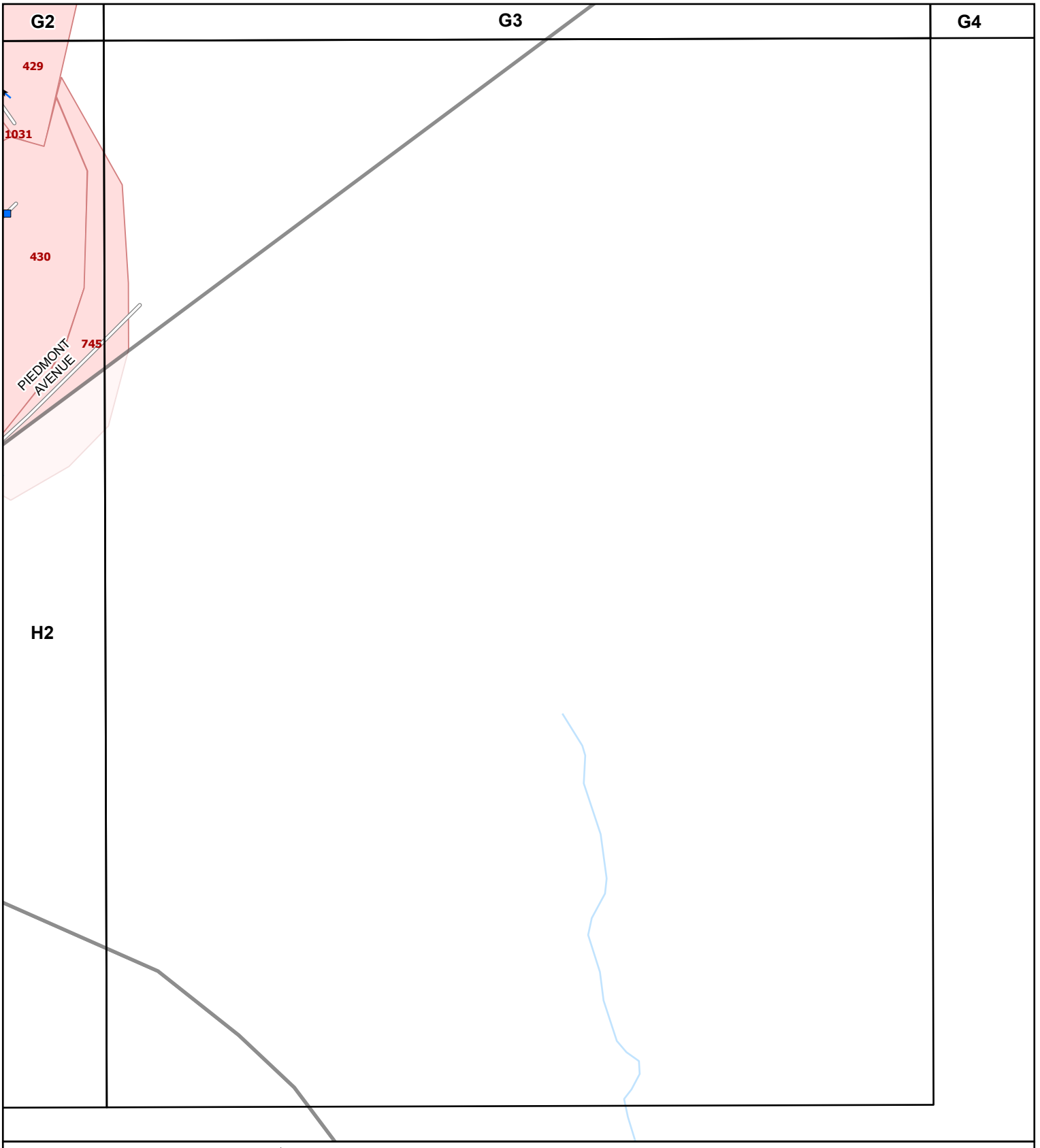
Feet

Data Sources: MassGIS, Town of Lunenburg

Map H2

Comprehensive Environmental Incorporated

2/1/2021



- Outfalls
- Key Junction
- Manhole
- Catch Basin
- Detention/Infiltration Basin
- Inlet
- Dry Well
- Culvert
- Drainage Pipes
- Pond, Reservoir
- Wetland, Marsh
- Stream, Brook
- Catchments
- Non-Urbanized Area

N

Stormwater Map

Lunenburg, MA

0 200 400 600

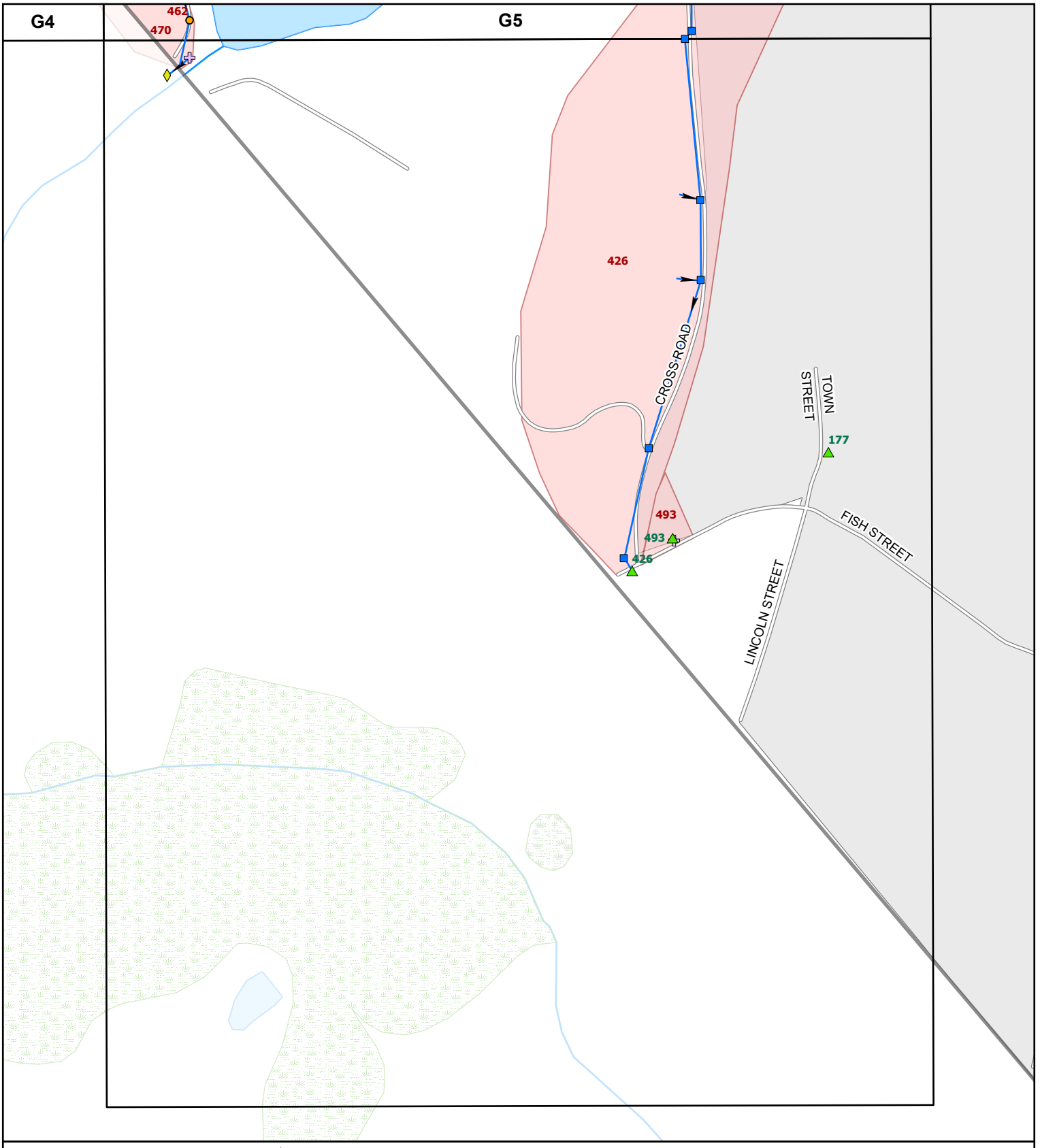
Feet

Data Sources: MassGIS, Town of Lunenburg

Map H3

Comprehensive Environmental Incorporated

2/1/2021



Outfalls
Key Junction
Manhole
Catch Basin
Detention/Infiltration Basin
Inlet
Dry Well
Culvert
Drainage Pipes
Pond, Reservoir
Wetland, Marsh
Stream, Brook
Catchments
Non-Urbanized Area

N

Stormwater Map

Lunenburg, MA

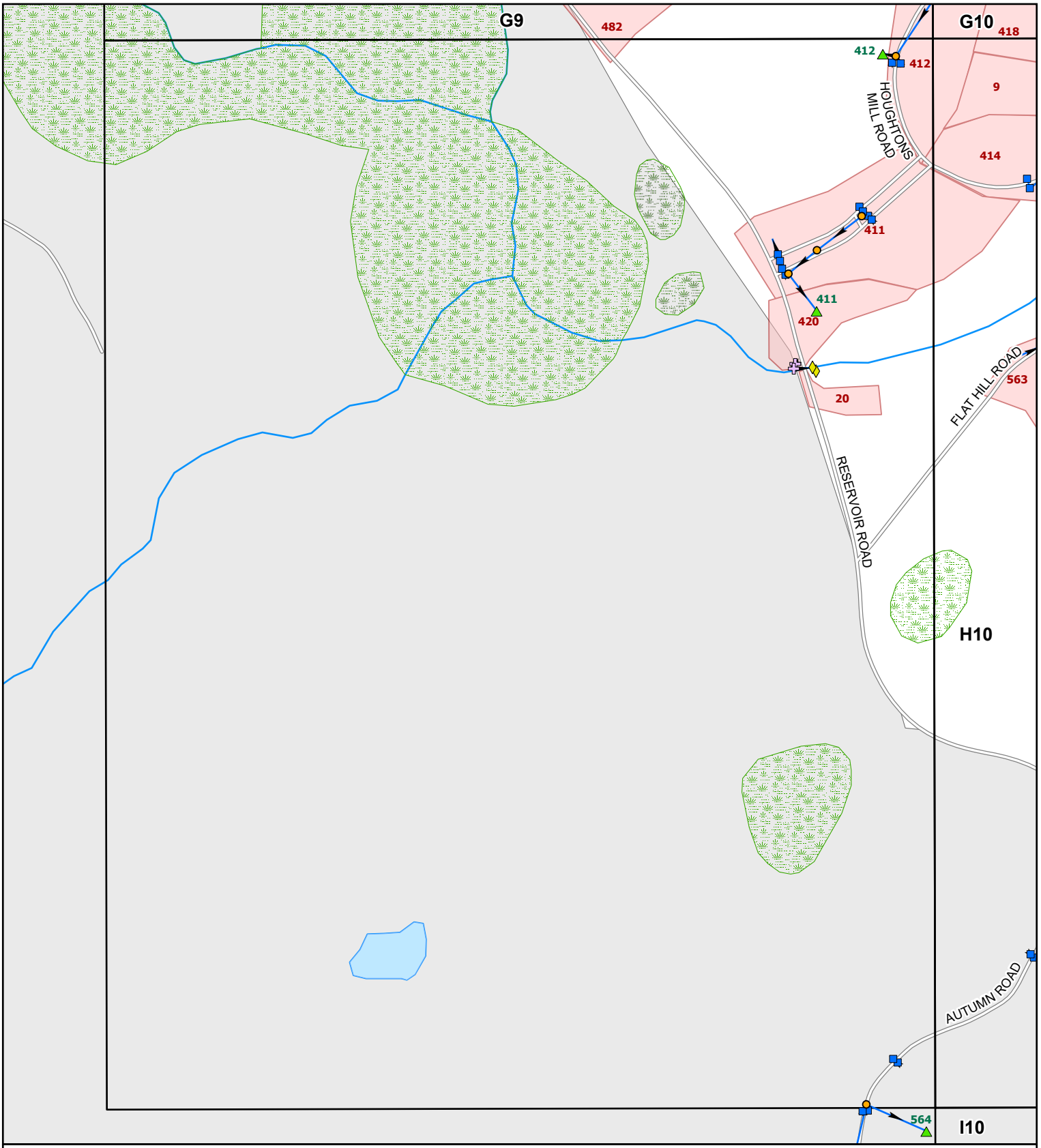
0 200 400 600
Feet

Data Sources: MassGIS, Town of Lunenburg

Map H5

Comprehensive Environmental Incorporated

2/1/2021



Outfalls
Key Junction
Manhole
Catch Basin
Detention/Infiltration Basin
Inlet
Dry Well
Culvert
Drainage Pipes
Pond, Reservoir
Wetland, Marsh
Stream, Brook
Catchments
Non-Urbanized Area

N

Stormwater Map

Lunenburg, MA

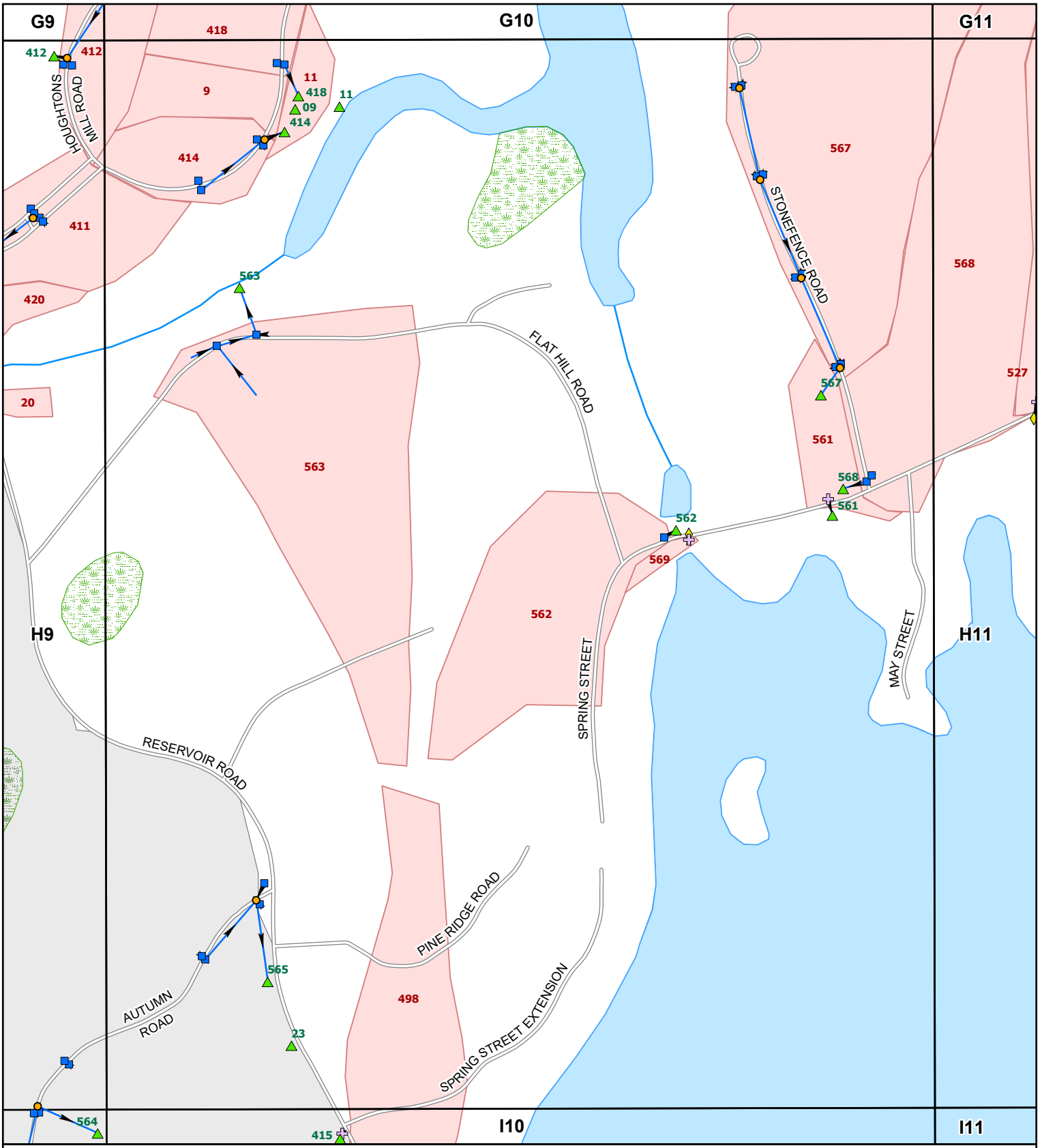
0 200 400 600
Feet

Data Sources: MassGIS, Town of Lunenburg

Map H9

Comprehensive Environmental Incorporated

2/1/2021



Outfalls
Key Junction
Manhole
Catch Basin
Detention/Infiltration Basin
Inlet
Dry Well
Culvert
Drainage Pipes
Pond, Reservoir
Wetland, Marsh
Stream, Brook
Catchments
Non-Urbanized Area

N

Stormwater Map

Lunenburg, MA

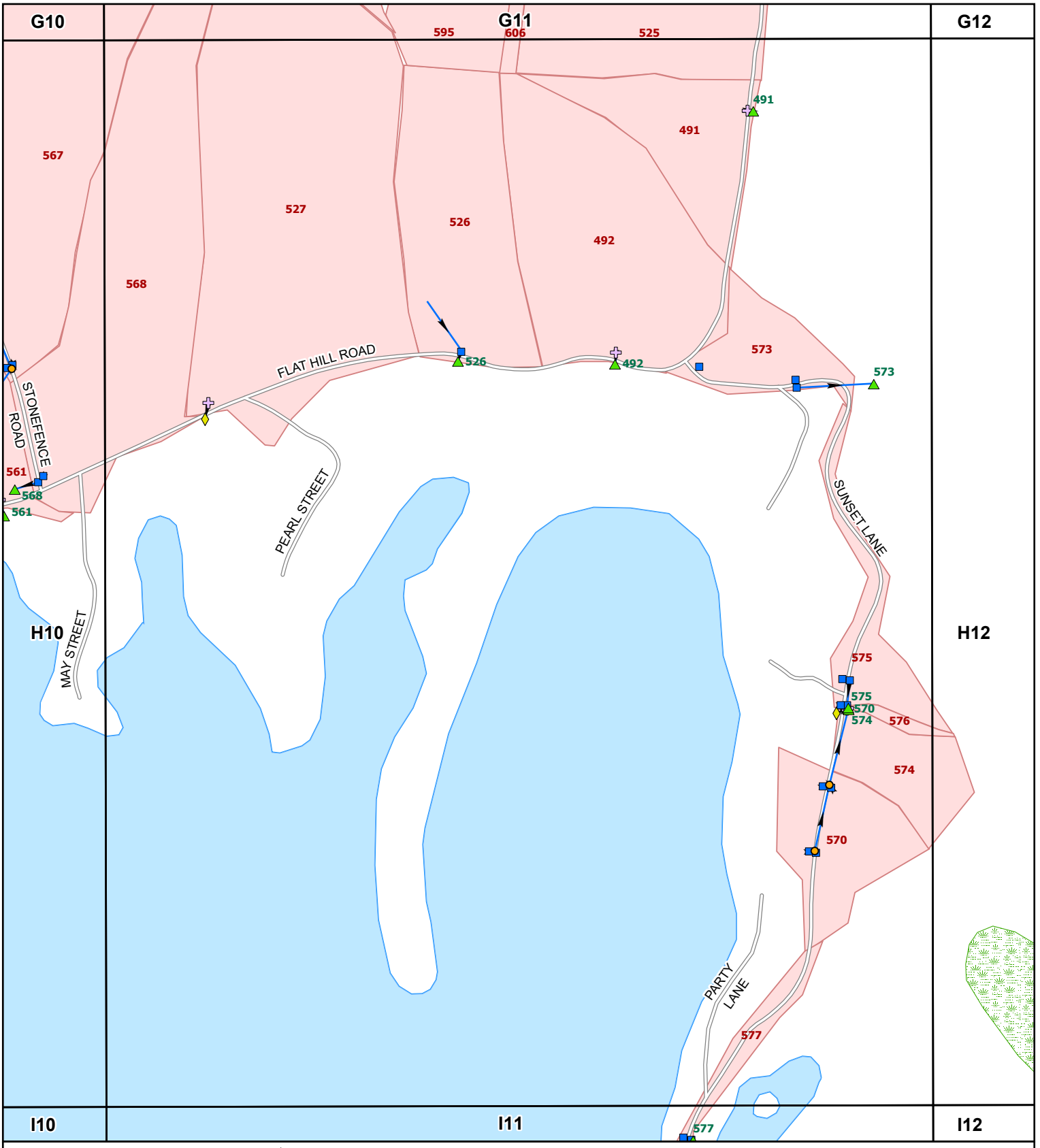
0 200 400 600
Feet

Data Sources: MassGIS, Town of Lunenburg

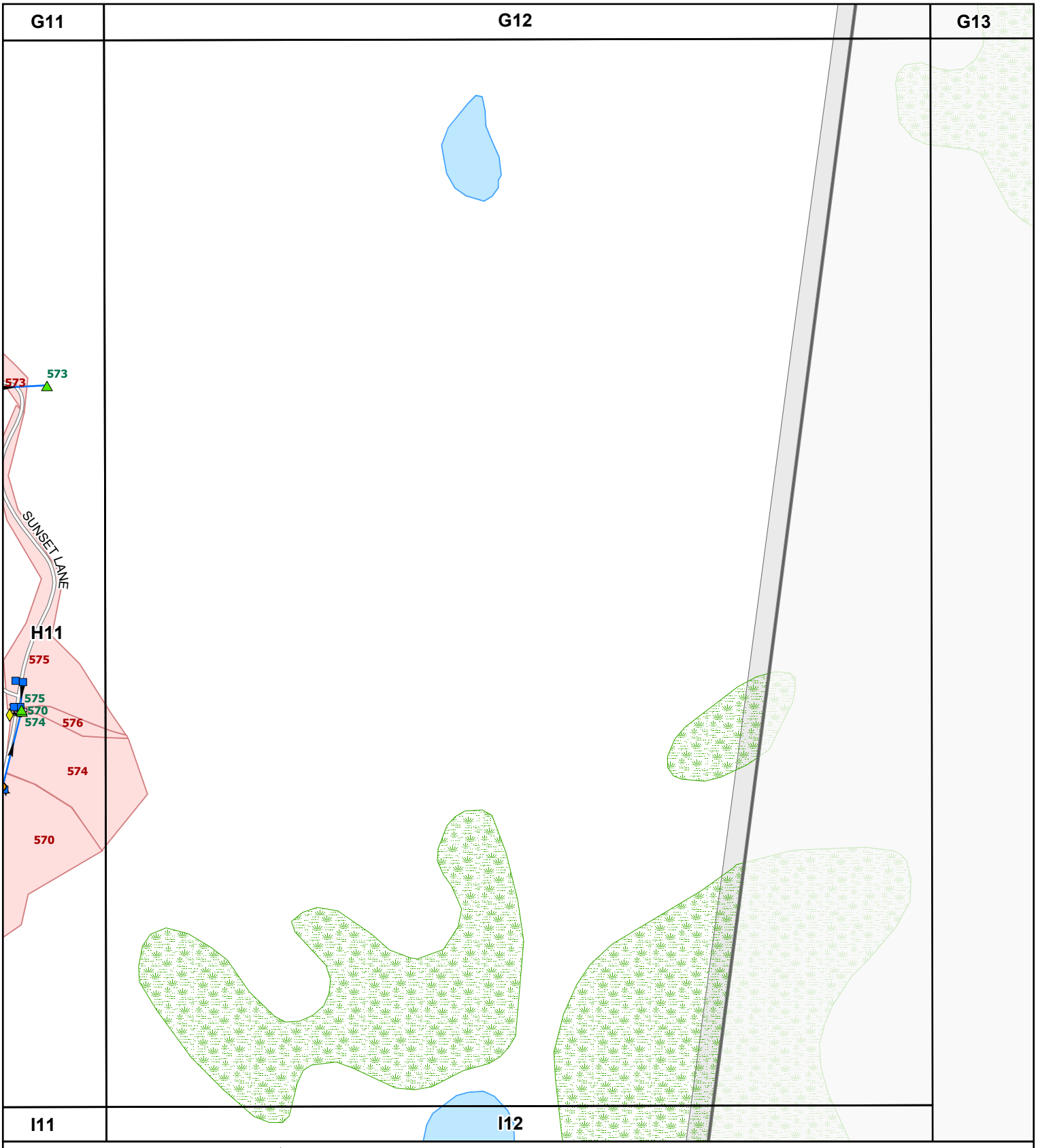
Map H10

Comprehensive Environmental Incorporated

2/1/2021


G10
G11
G12
H10
H12
I10
I11
I12
595
606
525
491
491
567
527
526
492
568
573
573
526
492
FLAT HILL ROAD
STONEFENCE ROAD
561
568
561
PEARL STREET
SUNSET LANE
MAY STREET
575
575
570
574
576
574
570
PARTY LANE
577
577
Outfalls
Key Junction
Manhole
Catch Basin
Detention/Infiltration Basin
Inlet
Dry Well
Culvert
Drainage Pipes
Pond, Reservoir
Wetland, Marsh
Stream, Brook
Catchments
Non-Urbanized Area
N
Stormwater Map
Lunenburg, MA
0
200
400
600
Feet
Data Sources: MassGIS, Town of Lunenburg
Map
H11
Comprehensive Environmental Incorporated

2/1/2021



- Outfalls
- Key Junction
- Manhole
- Catch Basin
- Detention/Infiltration Basin
- Inlet
- Dry Well
- Culvert
- Drainage Pipes
- Pond, Reservoir
- Wetland, Marsh
- Stream, Brook
- Catchments
- Non-Urbanized Area

N

Stormwater Map

Lunenburg, MA

0 200 400 600

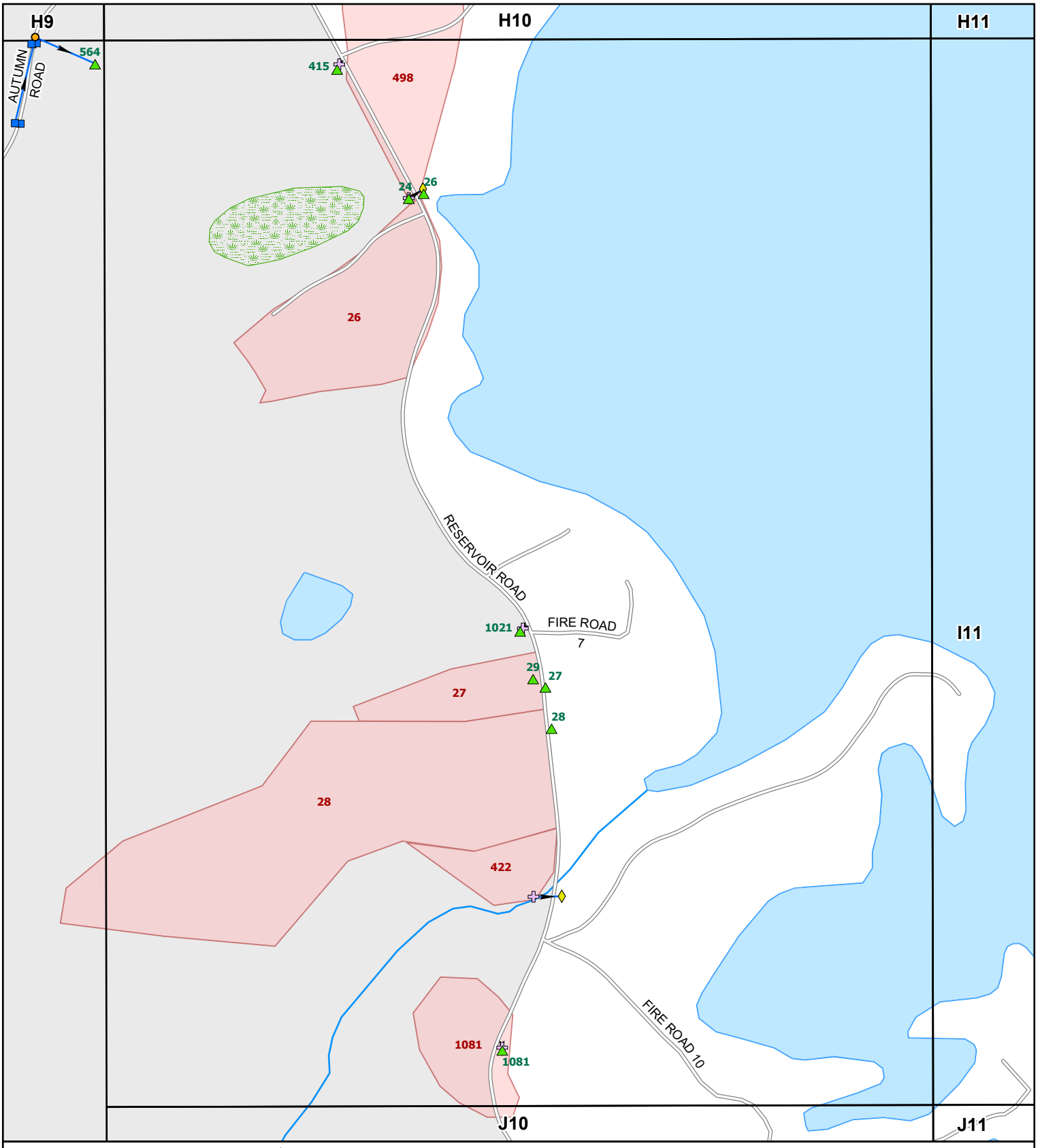
Feet

Data Sources: MassGIS, Town of Lunenburg

Map H12

Comprehensive Environmental Incorporated

2/1/2021



Outfalls
Key Junction
Manhole
Catch Basin
Detention/Infiltration Basin
Inlet
Dry Well
Culvert
Drainage Pipes
Pond, Reservoir
Wetland, Marsh
Stream, Brook
Catchments
Non-Urbanized Area

N

Stormwater Map

Lunenburg, MA

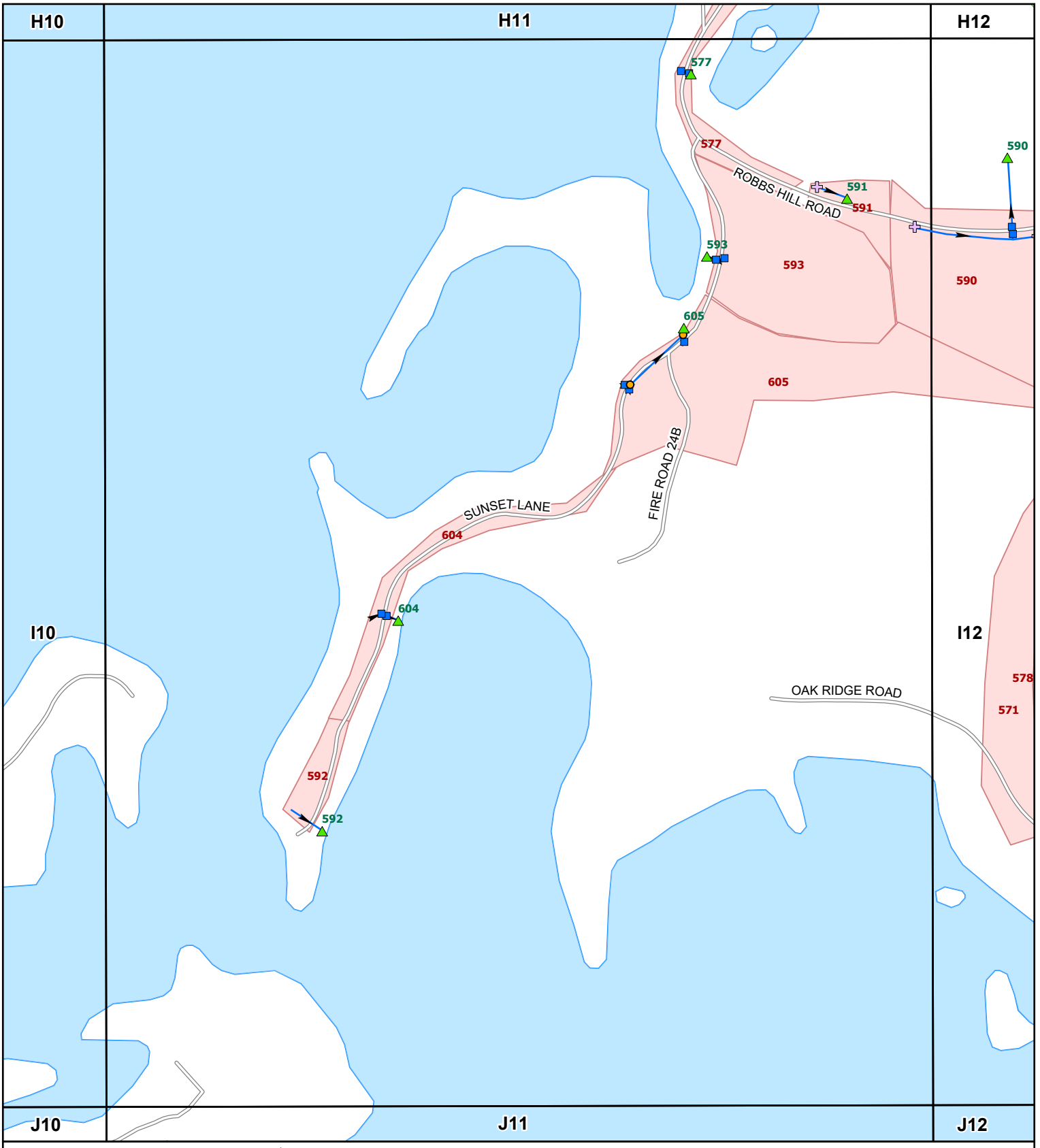
0 200 400 600
Feet

Data Sources: MassGIS, Town of Lunenburg

Map I10

Comprehensive Environmental Incorporated

2/1/2021



Outfalls
Key Junction
Manhole
Catch Basin
Detention/Infiltration Basin
Inlet
Dry Well
Culvert
Drainage Pipes
Pond, Reservoir
Wetland, Marsh
Stream, Brook
Catchments
Non-Urbanized Area

N

Stormwater Map

Lunenburg, MA

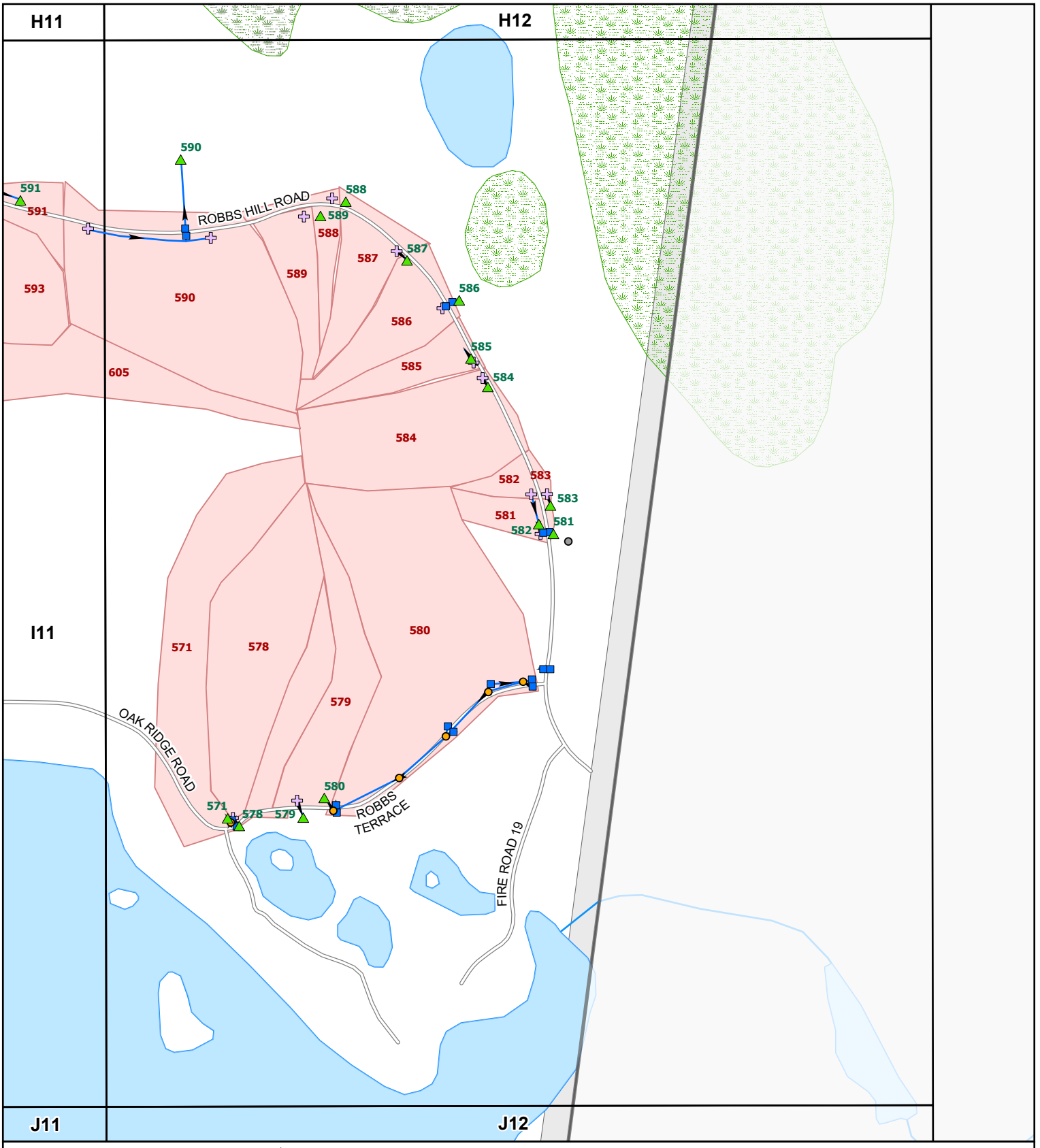
0 200 400 600
Feet

Data Sources: MassGIS, Town of Lunenburg

Map I11

Comprehensive Environmental Incorporated

2/1/2021



Outfalls
Key Junction
Manhole
Catch Basin
Detention/Infiltration Basin
Inlet
Dry Well
Culvert
Drainage Pipes
Pond, Reservoir
Wetland, Marsh
Stream, Brook
Catchments
Non-Urbanized Area

N

Stormwater Map

Lunenburg, MA

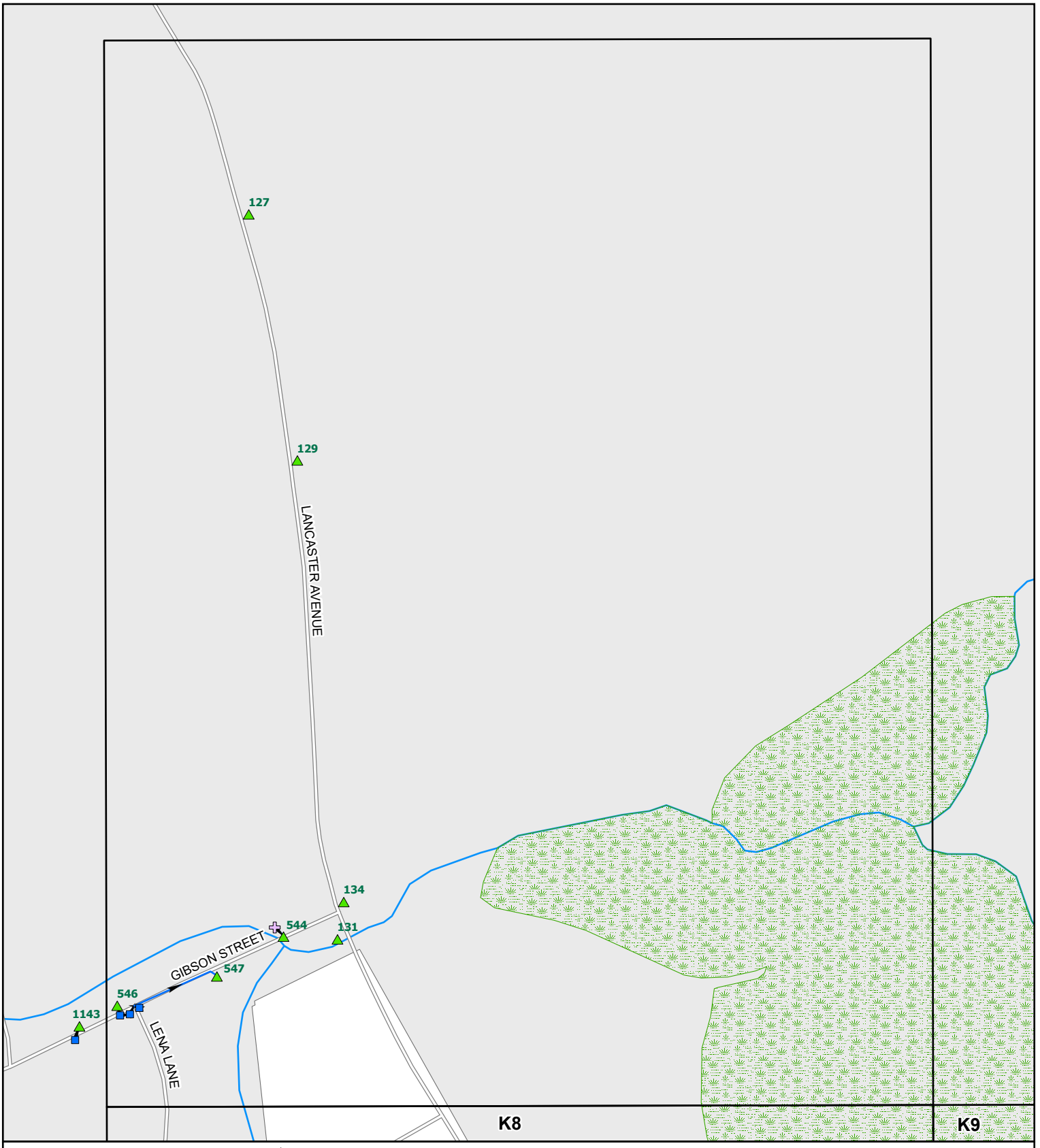
0 200 400 600
Feet

Data Sources: MassGIS, Town of Lunenburg

Map I12

Comprehensive Environmental Incorporated

2/1/2021



Outfalls
Key Junction
Manhole
Catch Basin
Detention/Infiltration Basin
Inlet
Dry Well
Culvert
Drainage Pipes
Pond, Reservoir
Wetland, Marsh
Stream, Brook
Catchments
Non-Urbanized Area

N

Stormwater Map

Lunenburg, MA

0 200 400 600

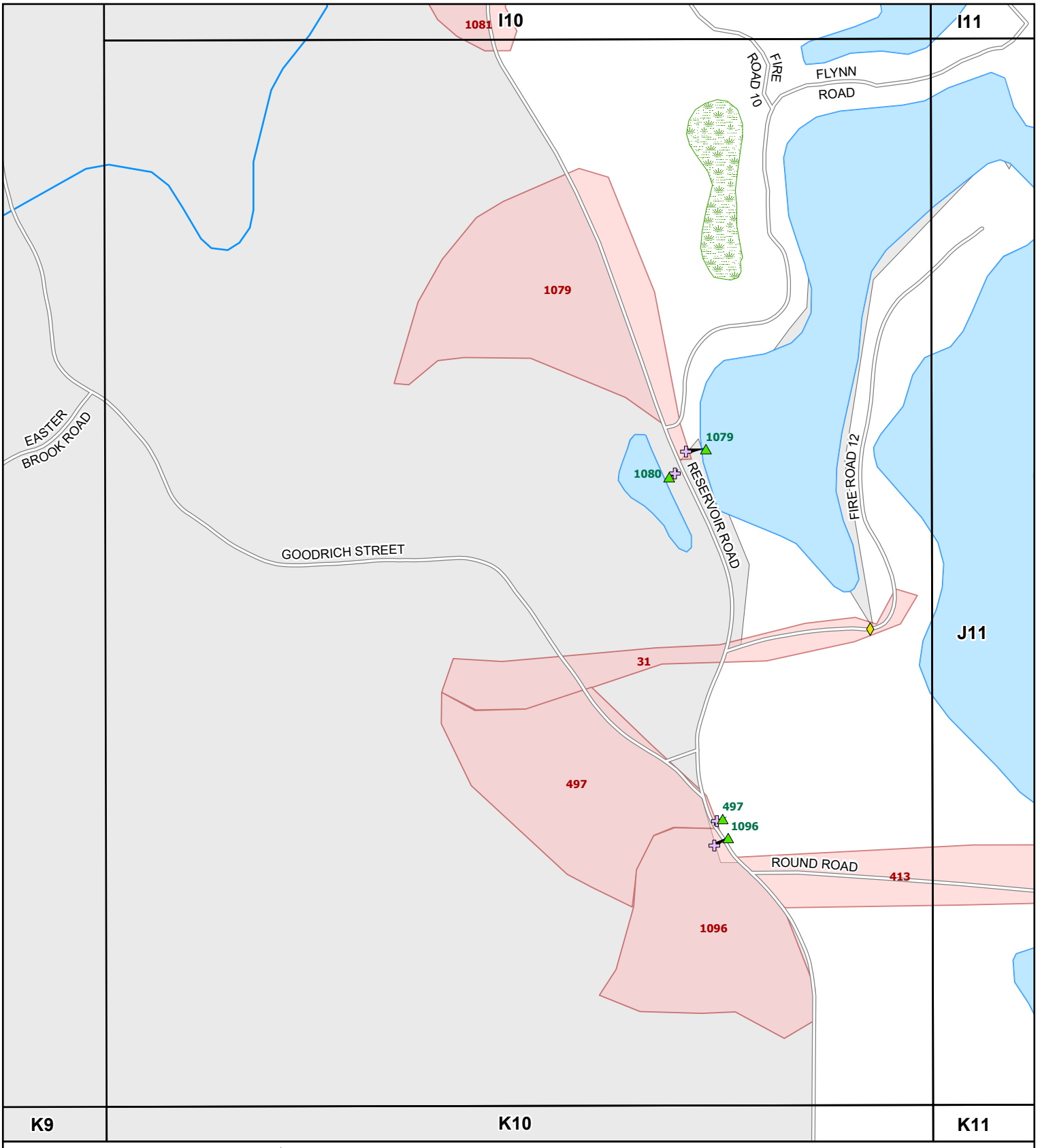
Feet

Data Sources: MassGIS, Town of Lunenburg

Map J8

Comprehensive Environmental Incorporated

2/1/2021



- Outfalls
- Key Junction
- Manhole
- Catch Basin
- Detention/Infiltration Basin
- Inlet
- Dry Well
- Culvert
- Drainage Pipes
- Pond, Reservoir
- Wetland, Marsh
- Stream, Brook
- Catchments
- Non-Urbanized Area

N

Stormwater Map

Lunenburg, MA

0 200 400 600

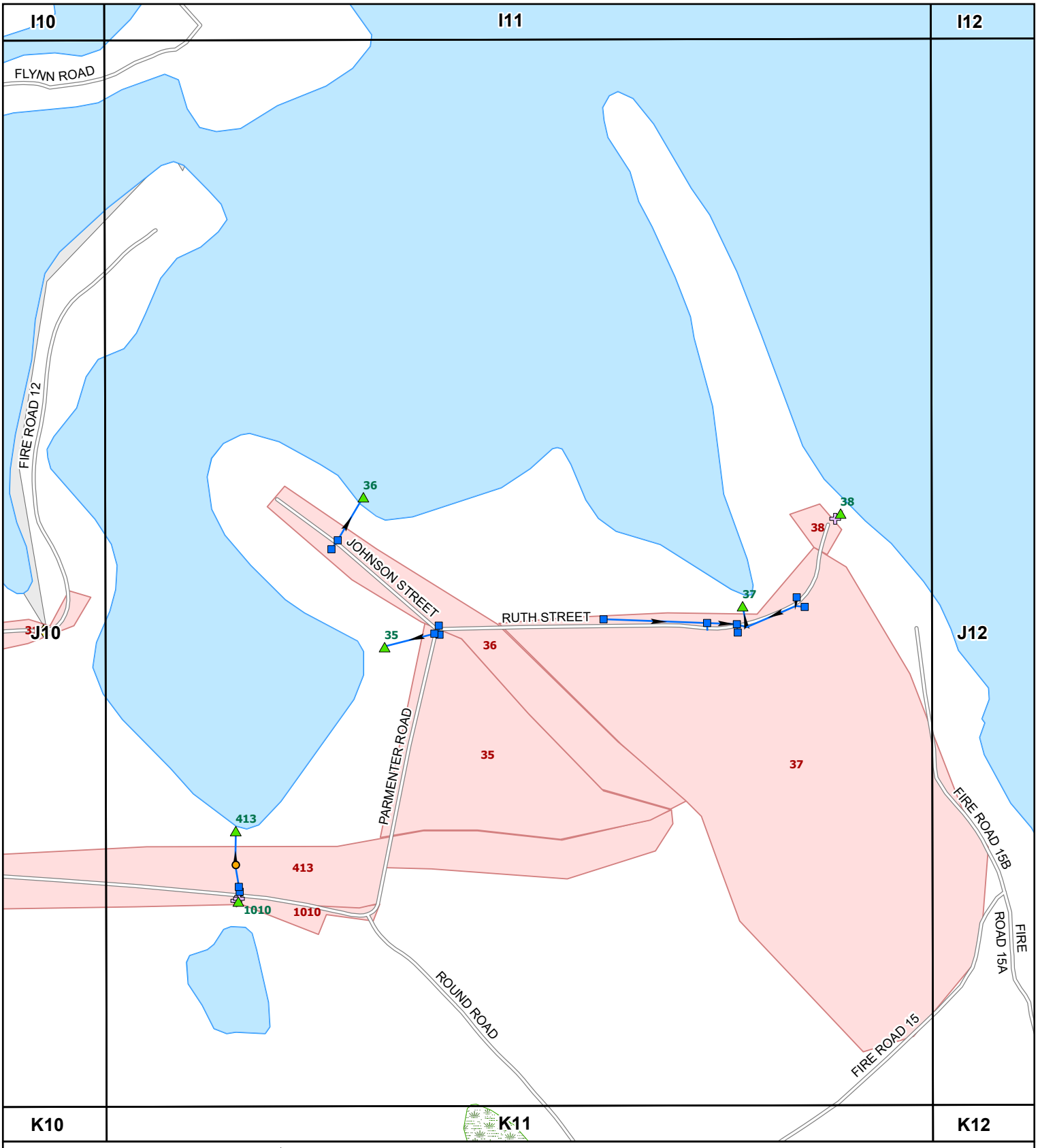
Feet

Data Sources: MassGIS, Town of Lunenburg

Map J10

Comprehensive Environmental Incorporated

2/1/2021



Outfalls
Key Junction
Manhole
Catch Basin
Detention/Infiltration Basin
Inlet
Dry Well
Culvert
Drainage Pipes
Pond, Reservoir
Wetland, Marsh
Stream, Brook
Catchments
Non-Urbanized Area

N

Stormwater Map

Lunenburg, MA

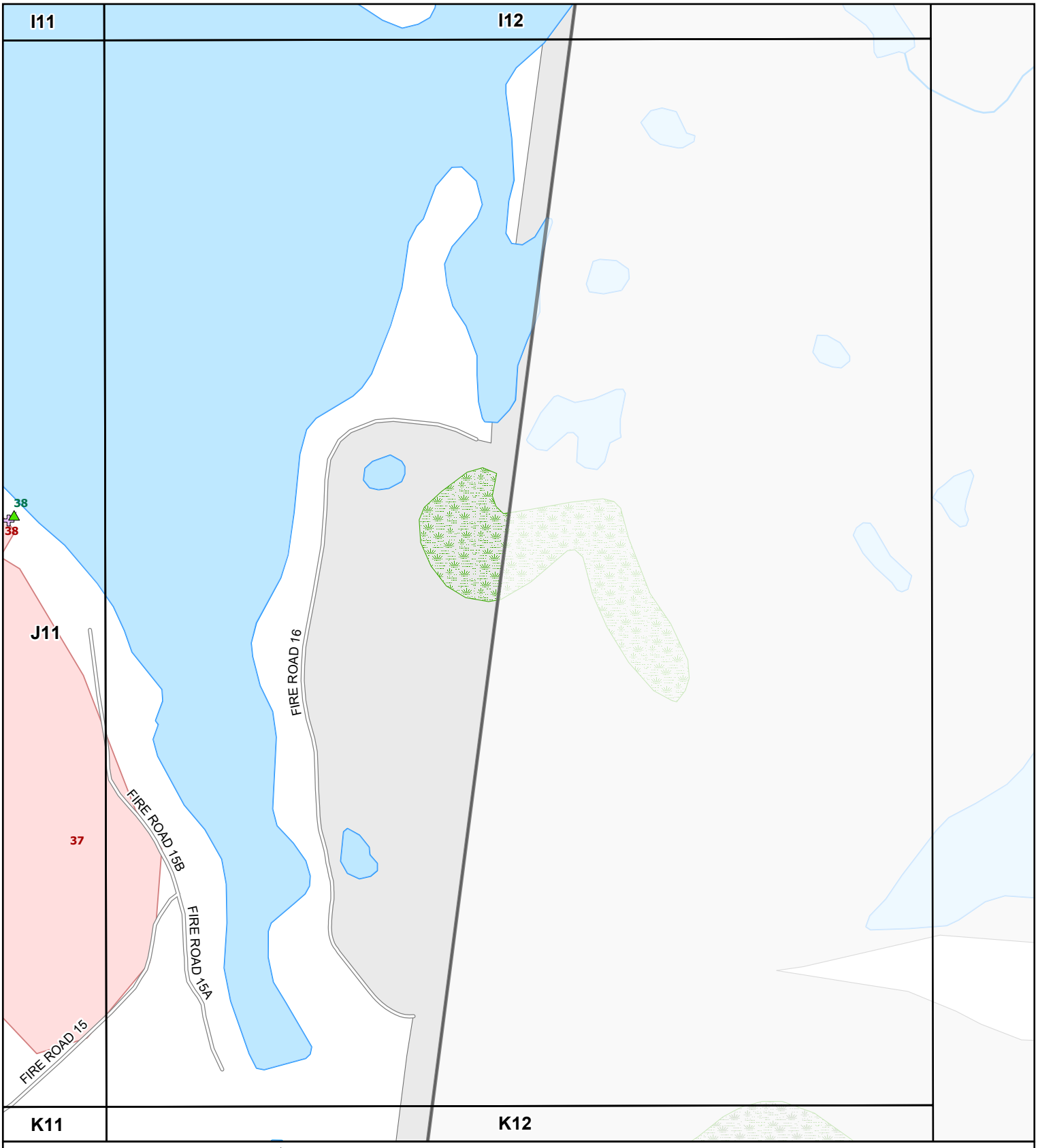
0 200 400 600
Feet

Data Sources: MassGIS, Town of Lunenburg

Map J11

Comprehensive Environmental Incorporated

2/1/2021



Outfalls
Key Junction
Manhole
Catch Basin
Detention/Infiltration Basin
Inlet
Dry Well
Culvert
Drainage Pipes
Pond, Reservoir
Wetland, Marsh
Stream, Brook
Catchments
Non-Urbanized Area

N

Stormwater Map

Lunenburg, MA

0 200 400 600

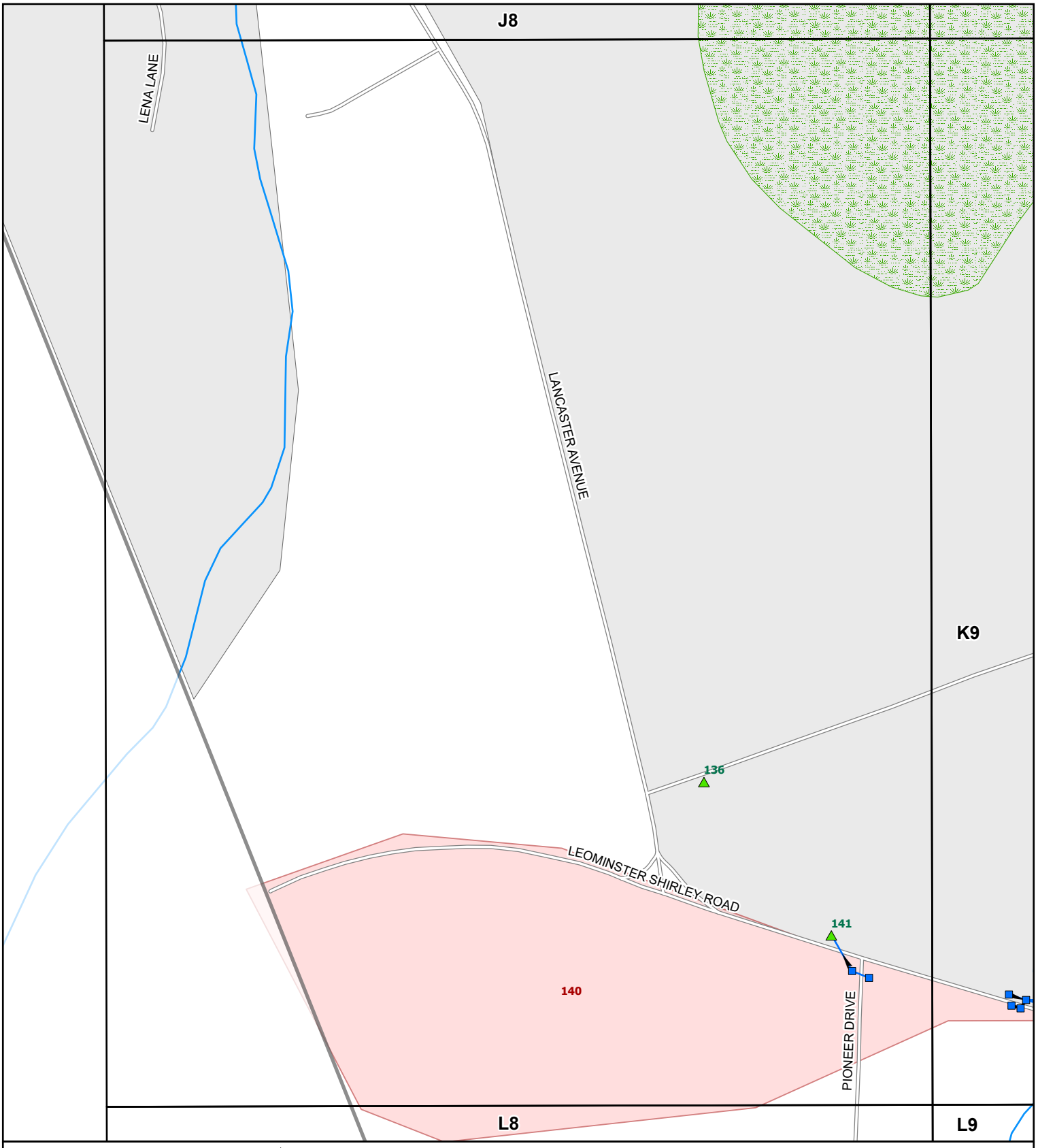
Feet

Data Sources: MassGIS, Town of Lunenburg

Map J12

Comprehensive Environmental Incorporated

2/1/2021



Outfalls
Key Junction
Manhole
Catch Basin
Detention/Infiltration Basin
Inlet
Dry Well
Culvert
Drainage Pipes
Pond, Reservoir
Wetland, Marsh
Stream, Brook
Catchments
Non-Urbanized Area

N

Stormwater Map

Lunenburg, MA

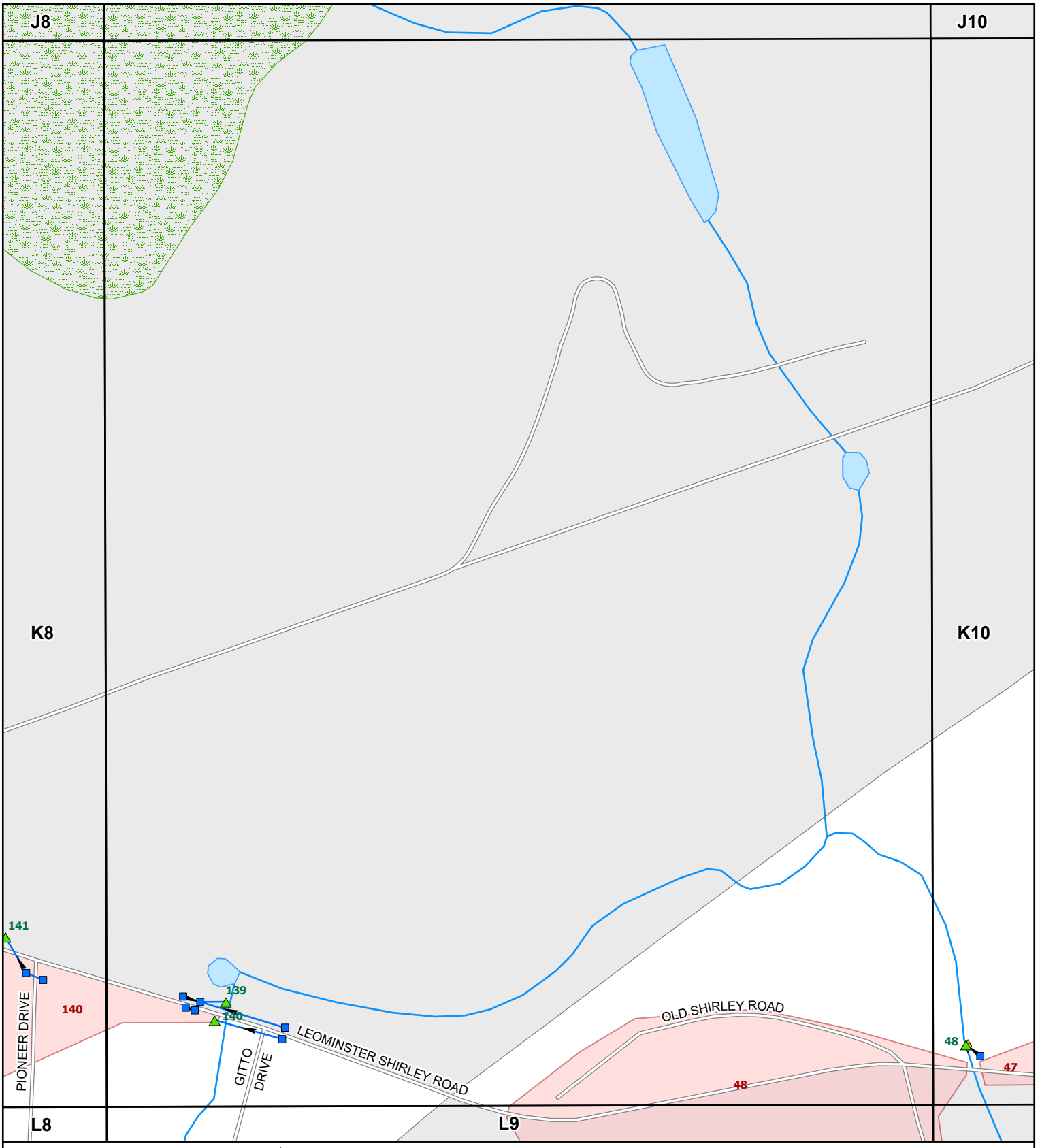
0 200 400 600
Feet

Data Sources: MassGIS, Town of Lunenburg

Map K8

Comprehensive Environmental Incorporated

2/1/2021



- Outfalls
- Key Junction
- Manhole
- Catch Basin
- Detention/Infiltration Basin
- Inlet
- Dry Well
- Culvert
- Drainage Pipes
- Pond, Reservoir
- Wetland, Marsh
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- Catchments
- Non-Urbanized Area

N

Stormwater Map

Lunenburg, MA

0 200 400 600

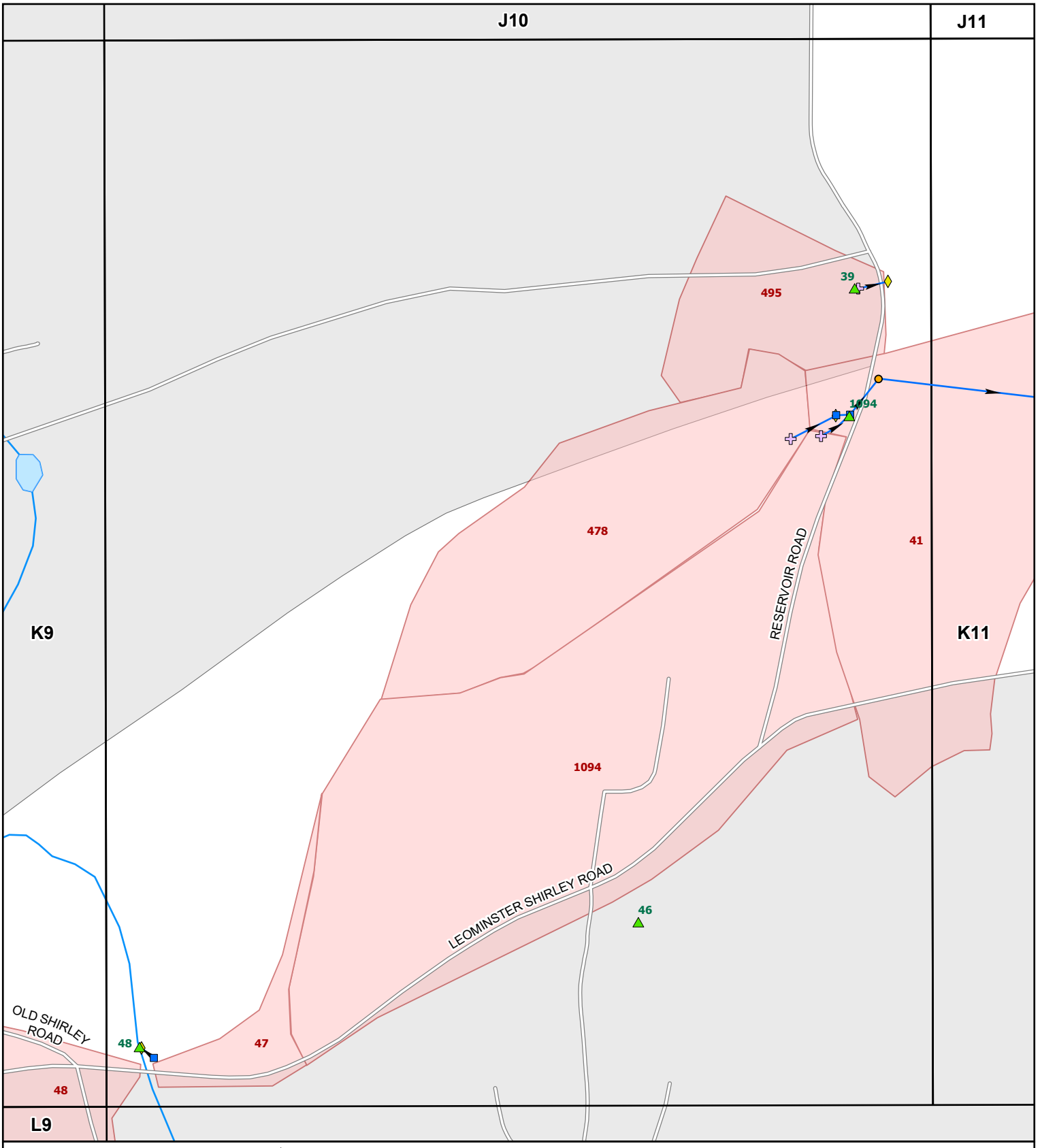
Feet

Data Sources: MassGIS, Town of Lunenburg

Map K9

Comprehensive Environmental Incorporated

2/1/2021



Outfalls
Key Junction
Manhole
Catch Basin
Detention/Infiltration Basin
Inlet
Dry Well
Culvert
Drainage Pipes
Pond, Reservoir
Wetland, Marsh
Stream, Brook
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Non-Urbanized Area

N

Stormwater Map

Lunenburg, MA

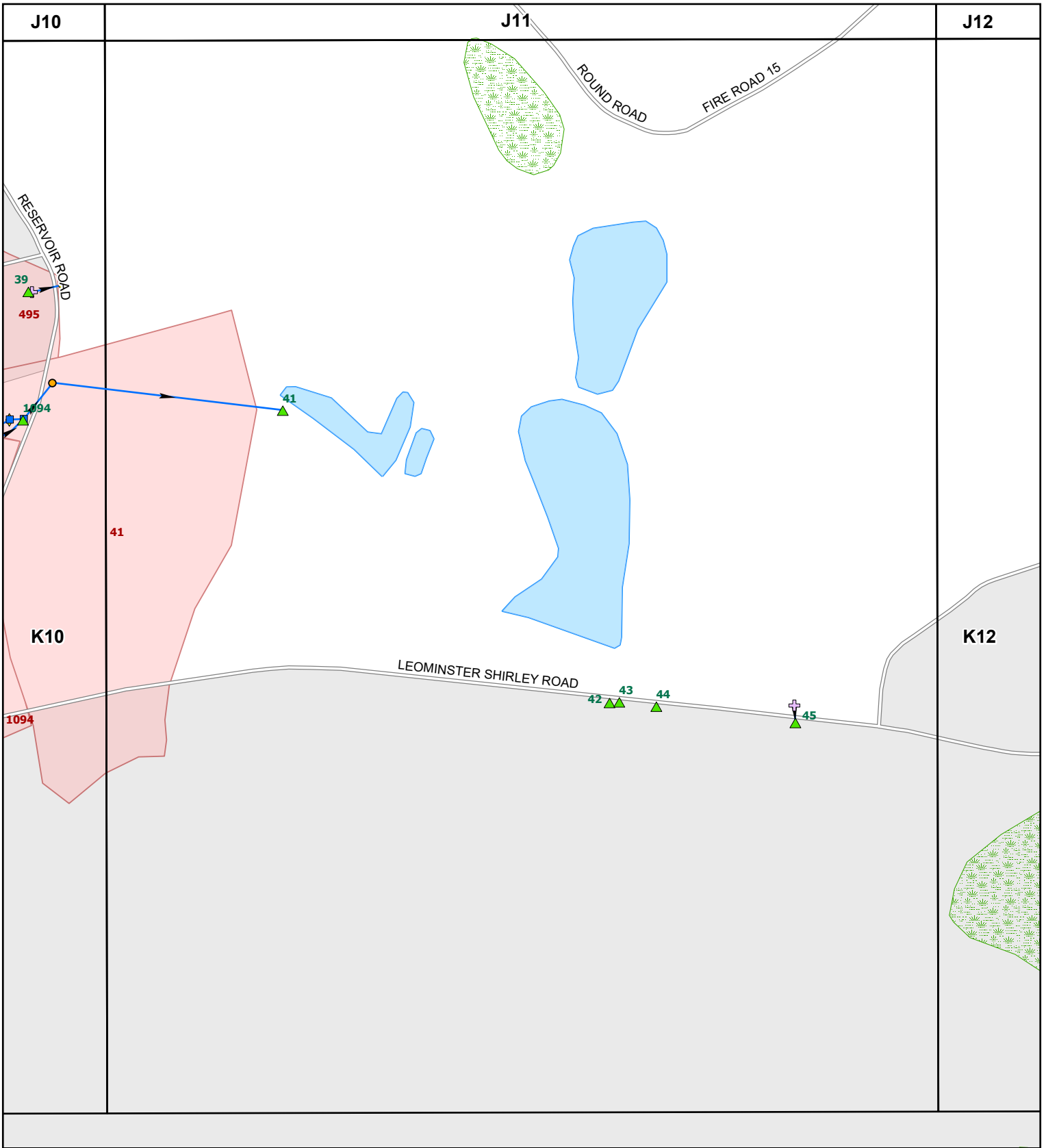
0 200 400 600
Feet

Data Sources: MassGIS, Town of Lunenburg

Map K10

Comprehensive Environmental Incorporated

2/1/2021



Outfalls
Key Junction
Manhole
Catch Basin
Detention/Infiltration Basin
Inlet
Dry Well
Culvert
Drainage Pipes
Pond, Reservoir
Wetland, Marsh
Stream, Brook
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Stormwater Map

Lunenburg, MA

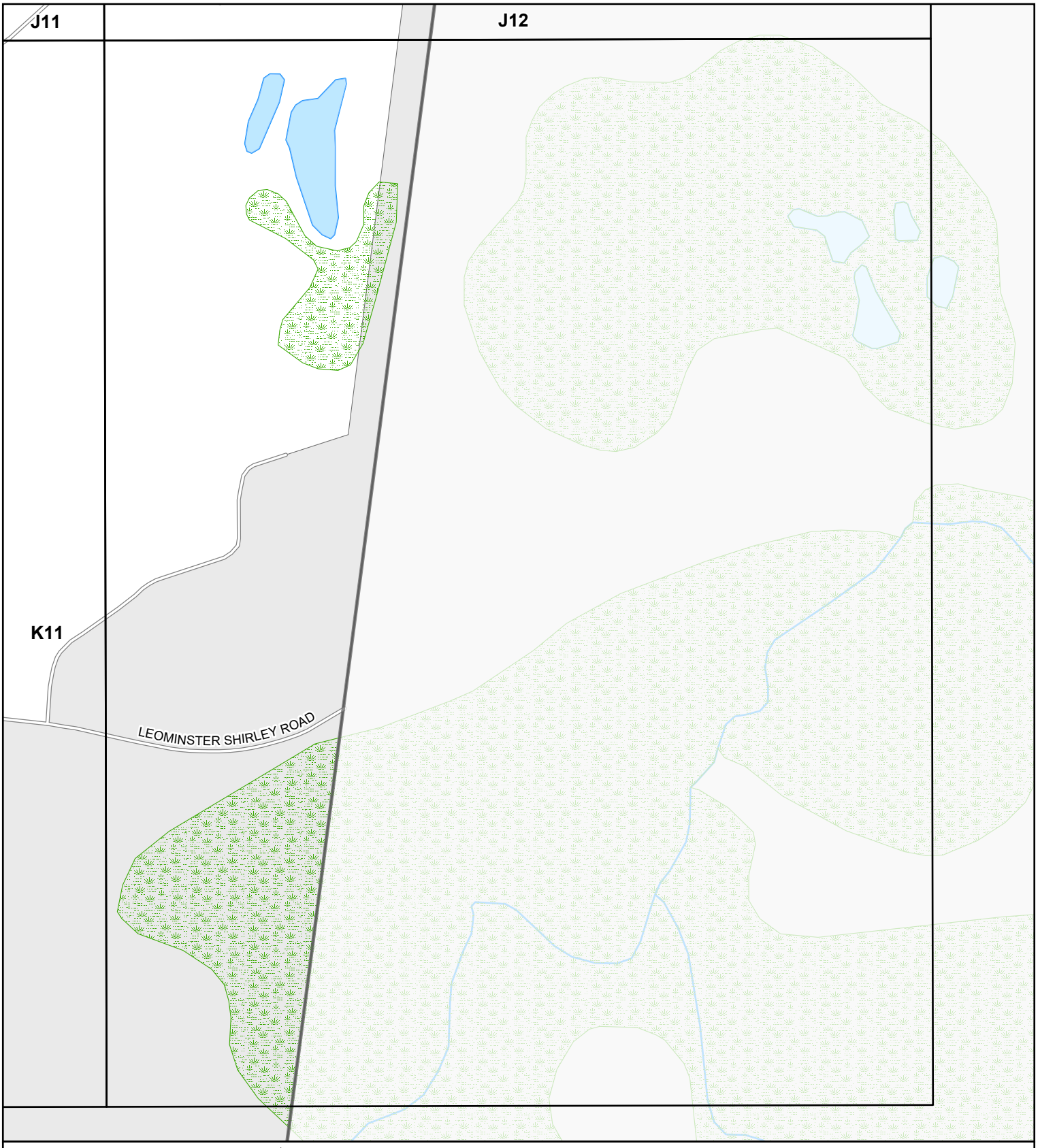
0 200 400 600
Feet

Data Sources: MassGIS, Town of Lunenburg

Map K11

Comprehensive Environmental Incorporated

2/1/2021



- Outfalls
- Key Junction
- Manhole
- Catch Basin
- Detention/Infiltration Basin
- Inlet
- Dry Well
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- Drainage Pipes
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- Stream, Brook
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N

Stormwater Map

Lunenburg, MA

0 200 400 600

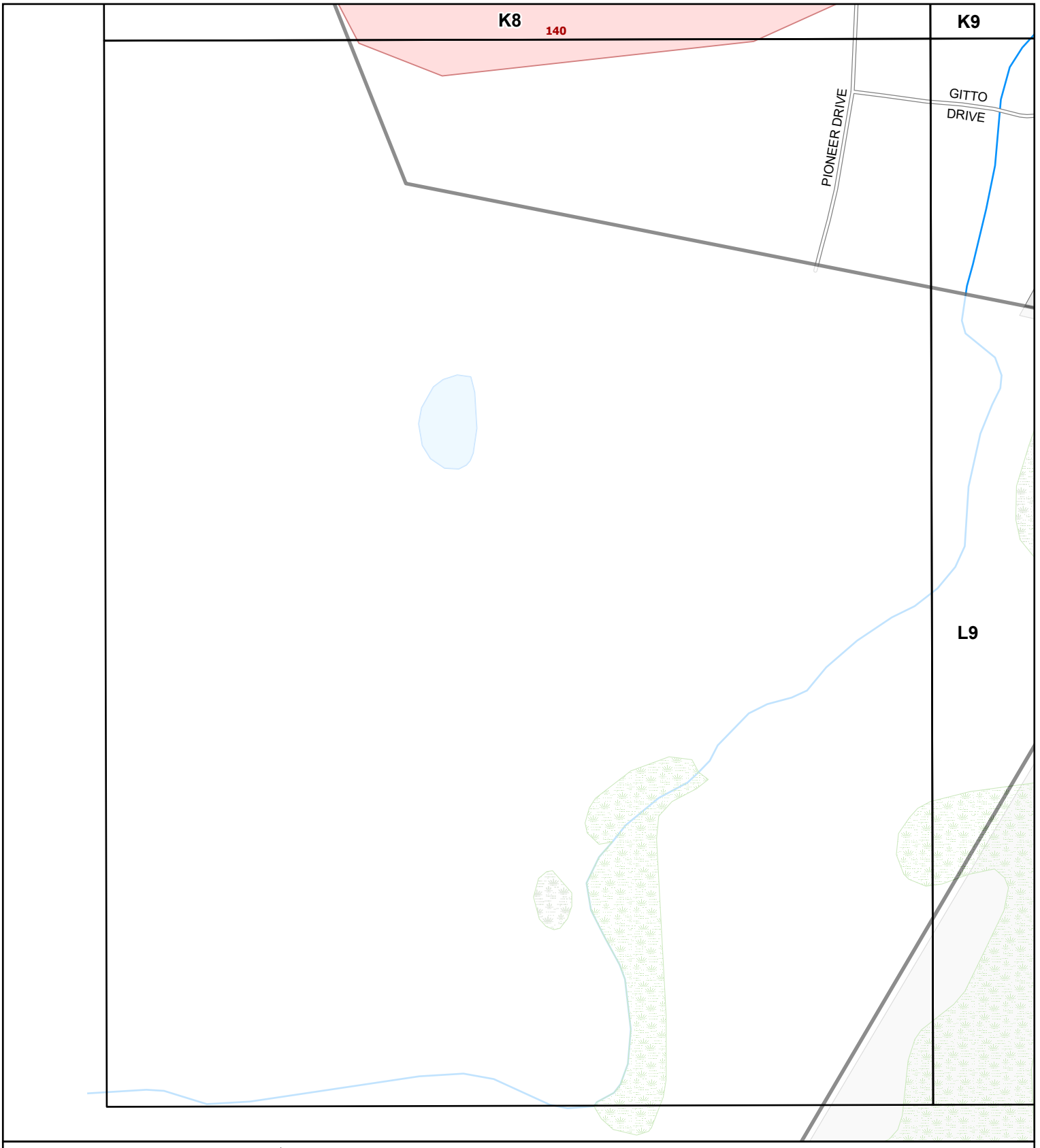
Feet

Data Sources: MassGIS, Town of Lunenburg

Map K12

Comprehensive Environmental Incorporated

2/1/2021



- Outfalls
- Key Junction
- Manhole
- Catch Basin
- Detention/Infiltration Basin
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- Dry Well
- Culvert
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Stormwater Map

Lunenburg, MA

0 200 400 600

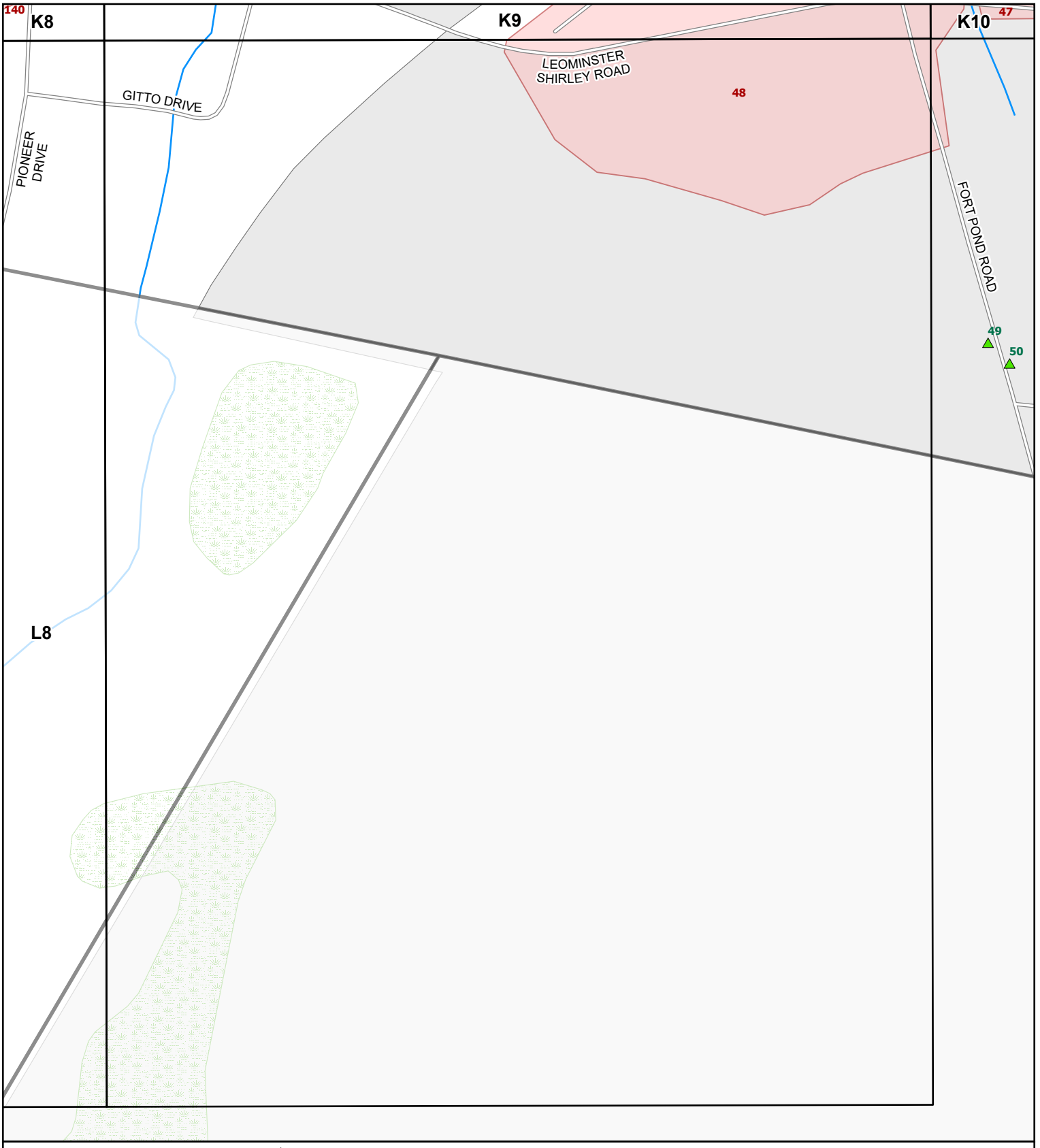
Feet

Data Sources: MassGIS, Town of Lunenburg

Map L8

Comprehensive Environmental Incorporated

2/1/2021



Outfalls
Key Junction
Manhole
Catch Basin
Detention/Infiltration Basin
Inlet
Dry Well
Culvert
Drainage Pipes
Pond, Reservoir
Wetland, Marsh
Stream, Brook
Catchments
Non-Urbanized Area

N

Stormwater Map

Lunenburg, MA

0 200 400 600
Feet

Data Sources: MassGIS, Town of Lunenburg

Map L9

Comprehensive Environmental Incorporated

2/1/2021

Appendix B

SSO Inventory

Sanitary Sewer Overflow Inventory

Prior 5-Year Period (July 1, 2016 - June 30, 2021)

SSO Location[1]	Receiving Waterbody	Discharge Statement[2]	Date & Time Start[3]	Date & Time End[3]	Date & Time Reported[3]	Estimated Volume[4]	Description of SSO, Expected Source and Cause[5]	Mitigation Completed[6]	Mitigation Planned[7]

[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 and time of each known SSO occurrence (i.e., beginning and end of any known discharge)

[4] Estimated volume or quantity of the occurrence

[5] Description of the occurrence indicating known or suspected cause(s)

[6] Mitigation and corrective measures taken to minimize volume and duration of bypass with dates implemented

[7] Mitigation and corrective measures planned with implementation schedules

Appendix C

IDDE Outfall Classification/Ranking & Vulnerability Assessment

Lunenburg, MA IDDE Outfall Classification and Ranking, By Outfall ID

			Problem Outfalls				High Priority Outfalls																				Excluded					
													Density of Generating Sites[2]						Age of development and infrastructure														
Outfall ID	Receiving Water	Receiving Water Impairment[1]	Known or suspected contributions of illicit discharges	Olfactory or visual evidence of sewage	Ammonia ≥ 0.5 mg/L, surfactants ≥ 0.25 mg/L, and bacteria > WQ criteria	Ammonia ≥ 0.5 mg/L, surfactants > 0.25 mg/L, and detectable levels of chlorine	Discharge to/near public beach	Discharge to/near recreational area	Discharge to/near drinking water supply	Discharge to/near shellfish beds	Past Discharge Complaints	Ammonia ≥ 0.5 mg/L; surfactants ≥ 0.25 mg/L; bacteria ≥ WQ criteria	Car dealers	Car washes	Gas stations	Garden centers	Industrial manufacturing	Other	Industrial areas >40 years old	Sewer areas >40 years old	Catchment areas serviced by septic systems converted to sewer[3]	Historic combined sewer system that has been separated	Density of septic systems ≥30 years old in residential land use[3]	Culverted stream lengths greater than a simple roadway crossing	Discharge to impaired water & potential to carry that pollutant	Presence of older industrial operations	Roadway drainage in undeveloped areas with no dwellings and no sanitary sewers	Outfall is drainage for athletic fields, parks or undeveloped green space & associated parking without services	Cross-country drainage alignments through undeveloped land	Overall Ranking (Problem, High, Low, Excluded)	Ranking Score (Number of Boxes Checked)	Notes
09	Catacoonamug Brook																														Low	0	
11	Catacoonamug Brook																														Low	0	
14	None																														Low	0	
20	Catacoonamug Brook																														Low	0	
26	Lake Shirley MA81122	T, Alg, Hg, Eurasian Water Milfoil, Plants, DO																				x		x							High	2	NE Regional Hg TMDL, CN 377.0
27	None																					x									High	1	
28	None							x																					x		High	2	Ben Normand Park
31	Lake Shirley MA81122	T, Alg, Hg, Eurasian Water Milfoil, Plants, DO																						x							High	1	NE Regional Hg TMDL, CN 377.0
35	Lake Shirley MA81122	T, Alg, Hg, Eurasian Water Milfoil, Plants, DO																				x		x							High	2	NE Regional Hg TMDL, CN 377.0
36	Lake Shirley MA81122	T, Alg, Hg, Eurasian Water Milfoil, Plants, DO																				x		x							High	2	NE Regional Hg TMDL, CN 377.0
37	Lake Shirley MA81122	T, Alg, Hg, Eurasian Water Milfoil, Plants, DO																				x		x							High	2	NE Regional Hg TMDL, CN 377.0
38	Lake Shirley MA81122	T, Alg, Hg, Eurasian Water Milfoil, Plants, DO																				x		x							High	2	NE Regional Hg TMDL, CN 377.0
41	Quarry pit at 1263 Reservoir Rd																x														High	1	Quarry on Reservoir Rd
47	Unnamed tributary to Easter Brook																														Low	0	
48	Unnamed tributary to Easter Brook																x						x								High	2	Quarry at corner or Fort Pond and Leominster Shirle
82	None																														Low	0	
86	Beaver Pond Brook																														Low	0	
89	None																														Low	0	
90	None																														Low	0	
92	None																														Low	0	
93	None																														Low	0	
94	None																														Low	0	
95	None																														Low	0	
109	Unnamed wetland, south side of Burrage St near Shaker Court														x		x														Low	0	
140	Unnamed tributary to Easter Brook																						x								High	3	Mobil; Ecological Fibers
187	None																				x		x								High	2	
190	None																				x										High	1	
198	Lake Whalom	Eurasian Water Milfoil, Plants																			x				x						High	2	
199	None																				x										High	1	
200	Lake Whalom	Eurasian Water Milfoil, Plants																			x		x		x						High	3	
202	Lake Whalom	Eurasian Water Milfoil, Plants																			x		x		x						High	3	
203	Lake Whalom	Eurasian Water Milfoil, Plants																			x		x		x						High	3	
204	Lake Whalom	Eurasian Water Milfoil, Plants																			x		x		x						High	3	
205	Lake Whalom	Eurasian Water Milfoil, Plants																			x		x		x						High	3	
206	Lake Whalom	Eurasian Water Milfoil, Plants																			x		x		x						High	3	
207	Lake Whalom	Eurasian Water Milfoil, Plants					x														x		x		x						High	4	Town Beach, Lake Whalom
210	Lake Whalom	Eurasian Water Milfoil, Plants																			x				x						High	2	
218	Unnamed tributary to Nashua River																				x										High	1	
219	None												x	x		x					x										High	4	346 Electric Ave; Whalom Wash; Lakeview Nurseri
223	None																						x								High	1	
227	None																				x										High	1	
229	None																				x										High	1	
230	None																				x										High	1	
231	None																				x										High	1	
232	None																				x		x								High	2	
241	None																						x								High	1	
249	None																				x										High	1	
250	None																														Low	0	
251	None																														Low	0	
258	Unnamed tributary to Nashua River																														Low	0	
273	None																														Low	0	
274	None																														Low	0	
275	Unnamed tributary to Nashua River																														Low	0	
276	Unnamed tributary to Nashua River																														Low	0	
277	Unnamed tributary to Nashua River																														Low	0	
278	Unnamed tributary to Nashua River																														Low	0	
295	None																														Low	0	
297	None																														Low	0	
298	None																														Low	0	

Lunenburg, MA IDDE Outfall Classification and Ranking, By Outfall ID

			Problem Outfalls				High Priority Outfalls																				Excluded						
													Density of Generating Sites[2]						Age of development and infrastructure															
Outfall ID	Receiving Water	Receiving Water Impairment[1]	Known or suspected contributions of illicit discharges	Olfactory or visual evidence of sewage	Ammonia ≥ 0.5 mg/L, surfactants ≥ 0.25 mg/L, and bacteria > WQ criteria	Ammonia ≥ 0.5 mg/L, surfactants > 0.25 mg/L, and detectable levels of chlorine	Discharge to/near public beach	Discharge to/near recreational area	Discharge to/near drinking water supply	Discharge to/near shellfish beds	Past Discharge Complaints	Ammonia ≥ 0.5 mg/L; surfactants ≥ 0.25 mg/L; bacteria ≥ WQ criteria	Car dealers	Car washes	Gas stations	Garden centers	Industrial manufacturing	Other	Industrial areas >40 years old	Sewer areas >40 years old	Catchment areas serviced by septic systems converted to sewer[3]	Historic combined sewer system that has been separated	Density of septic systems ≥30 years old in residential land use[3]	Culverted stream lengths greater than a simple roadway crossing	Discharge to impaired water & potential to carry that pollutant	Presence of older industrial operations	Roadway drainage in undeveloped areas with no dwellings and no sanitary sewers	Outfall is drainage for athletic fields, parks or undeveloped green space & associated parking without services	Cross-country drainage alignments through undeveloped land	Overall Ranking (Problem, High, Low, Excluded)	Ranking Score (Number of Boxes Checked)	Notes
372	None												x								x		x							High	3	Mass Ave Motors
374	None																				x		x							High	2	
376	None																				x		x							High	2	
377	None																				x		x							High	2	
378	None														x								x							High	2	Lunenburg Gulf
381	None																						x							High	1	
384	Unnamed tributary to Catacoonamug Brook																						x							High	1	
387	None												x								x		x							High	3	Tri-City Marine Sales, Inc.
397	Unnamed tributary to Mulpus Brook																						x							High	1	
399	Unnamed tributary to Mulpus Brook																				x		x							High	2	
401	None																				x		x							High	2	
403	None																				x									High	1	
404	None																				x									High	1	
405	None																						x							High	1	
406	None																						x							High	1	
407	None																						x							High	1	
408	None																						x							High	1	
411	Catacoonamug Brook																													Low	0	
412	None																													Low	0	
413	Lake Shirley MA81122	T, Alg, Hg, Eurasian Water Milfoil, Non-native plants, DO																					x			x				High	2	NE Regional Hg TMDL, CN 377.0
414	Houghtons Mill Pond																													Low	0	
416	None																													Low	0	
417	None																													Low	0	
418	Houghtons Mill Pond																													Low	0	
420	Catacoonamug Brook																													Low	0	
422	Easter Brook near Reservoir Rd							x																				x		High	2	Ben Normand Park
424	None																													Low	0	
425	None																				x									High	1	
426	None																				x									High	1	
428	None																				x									High	1	
429	None																				x		x							High	2	
430	None																				x		x							High	2	
431	None																													Low	0	
432	None																						x							High	1	
433	Unnamed tributary to Baker Brook																				x		x							High	2	
434	Unnamed tributary to Baker Brook																						x							High	1	
435	Unnamed tributary to Baker Brook																						x							High	1	
436	Unnamed tributary to Baker Brook																						x							High	1	
437	Unnamed tributary to Baker Brook																						x							High	1	
438	None																													Low	0	
439	None																						x							High	1	
440	None												x								x		x							High	3	Chapdelaine Truck Center Inc.
441	None																				x		x							High	2	
443	None																				x		x							High	2	
444	Unnamed wetland east of Chase Rd near Beal St																						x							High	1	
445	None																						x							High	1	
446	Unnamed tributary to Catacoonamug Brook																				x		x							High	2	
449	None																						x							High	1	
450	None																						x							High	1	
451	Unnamed tributary to Catacoonamug Brook																						x							High	1	
452	Unnamed tributary to Catacoonamug Brook																						x							High	1	
453	Catacoonamug Brook																						x							High	1	
454	Catacoonamug Brook																			x			x							High	2	According to DCI's table
455	None																						x							High	1	
456	None																				x		x							High	2	
457	None																				x		x							High	2	
458	None																													Low	0	
459	None																				x		x							High	2	
460	Lake Whalom MA81154	Plants, Eurasian water milfoil																			x					x				High	2	

Lunenburg, MA IDDE Outfall Classification and Ranking, By Outfall ID

			Problem Outfalls				High Priority Outfalls																			Excluded					
													Density of Generating Sites[2]						Age of development and infrastructure													
Outfall ID	Receiving Water	Receiving Water Impairment[1]	Known or suspected contributions of illicit discharges	Olfactory or visual evidence of sewage	Ammonia ≥ 0.5 mg/L, surfactants ≥ 0.25 mg/L, and bacteria > WQ criteria	Ammonia ≥ 0.5 mg/L, surfactants > 0.25 mg/L, and detectable levels of chlorine	Discharge to/near public beach	Discharge to/near recreational area	Discharge to/near drinking water supply	Discharge to/near shellfish beds	Past Discharge Complaints	Ammonia ≥ 0.5 mg/L; surfactants ≥ 0.25 mg/L; bacteria ≥ WQ criteria	Car dealers	Car washes	Gas stations	Garden centers	Industrial manufacturing	Other	Industrial areas >40 years old	Sewer areas >40 years old	Catchment areas serviced by septic systems converted to sewer[3]	Historic combined sewer system that has been separated	Density of septic systems ≥30 years old in residential land use[3]	Culverted stream lengths greater than a simple roadway crossing	Discharge to impaired water & potential to carry that pollutant	Presence of older industrial operations	Roadway drainage in undeveloped areas with no dwellings and no sanitary sewers	Outfall is drainage for athletic fields, parks or undeveloped green space & associated parking without services	Cross-country drainage alignments through undeveloped land	Overall Ranking (Problem, High, Low, Excluded)	Ranking Score (Number of Boxes Checked)	Notes
461	Lake Whalom MA81154	Plants, Eurasian water milfoil																			x				x						
462	Lake Whalom MA81154	Plants, Eurasian water milfoil																			x				x						
463	None																						x								
464	None																						x								
465	None																				x		x								
466	Lake Whalom MA81154	Plants, Eurasian water milfoil																			x				x						
467	Lake Whalom MA81154	Plants, Eurasian water milfoil																			x				x						
468	Lake Whalom MA81154	Plants, Eurasian water milfoil																			x				x						
469	Lake Whalom MA81154	Plants, Eurasian water milfoil																			x				x						
470	Lake Whalom MA81154	Plants, Eurasian water milfoil																			x				x						
473	Unnamed tributary to Baker Brook																														
476	None																														
478	None																x														
479	Perrins Pond																														
480	Mulpus Brook	Lack of a coldwater assemblage																													
481	Mulpus Brook	Lack of a coldwater assemblage																													
482	Unnamed tributary to Catacoonamug Brook																														
483	Mulpus Brook	Lack of a coldwater assemblage																													
484	None																														
485	None																														
486	None																														
487	None																				x										
489	Flurcum Swamp																				x										
490	Unnamed wetland on Beaver Pond Brook between Longwood, Holden, and Whitney Rds																														
491	None																						x								
492	None																						x								
494	None																				x										
495	None																														
496	Unnamed tributary to Catacoonamug Brook																				x		x								
497	None																														
498	Lake Shirley MA81122	T, Alg, Hg, Eurasian Water Milfoil, Non-native plants, DO																					x		x						
502	None																														
504	White Rabbit Swamp																														
505	White Rabbit Swamp																														
506	Unnamed wetland between Lane Pond and Canterbury Drive																														
507	None																														
508	None																														
509	Mulpus Brook MA81-37	Lack of a coldwater assemblage																													
510	None																														
511	None																														
514	None																														
515	None																														
516	None																														
517	None																														
518	None																														
519	Unnamed wetland on Beaver Pond Brook between Longwood, Holden, and Whitney Rds																														
520	None																														
521	None																														
522	None																														
523	None																														
524	None																														
525	None																														
526	None																						x								
527	None																						x								
545	None																				x										
552	None																														
553	None																														
554	None																														
556	Hickory Hills Lake MA81031	Hg																					x		x						

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													Density of Generating Sites[2]						Age of development and infrastructure														
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557	Hickory Hills Lake MA81031	Hg																				x		x							High	2	NE Regional Hg TMDL, CN 377.0
558	Hickory Hills Lake MA81031	Hg																				x		x							High	2	NE Regional Hg TMDL, CN 377.0
559	Hickory Hills Lake MA81031	Hg																				x		x							High	2	NE Regional Hg TMDL, CN 377.0
560	Hickory Hills Lake MA81031																					x									High	1	
561	Lake Shirley MA81122	T, Alg, Hg, Eurasian Water Milfoil, Non-native plants, DO																				x		x							High	2	NE Regional Hg TMDL, CN 377.0
562	Lake Shirley MA81122	T, Alg, Hg, Eurasian Water Milfoil, Non-native plants, DO																				x		x							High	2	NE Regional Hg TMDL, CN 377.0
563	Houghtons Mill Pond																					x									High	1	
566	Unnamed tributary to Mulpus Brook																					x									High	1	
567	None																					x									High	1	
568	Lake Shirley MA81122	T, Alg, Hg, Eurasian Water Milfoil, Non-native plants, DO																				x		x							High	2	NE Regional Hg TMDL, CN 377.0
569	Lake Shirley MA81122	T, Alg, Hg, Eurasian Water Milfoil, Non-native plants, DO																				x		x							High	2	NE Regional Hg TMDL, CN 377.0
570	None																					x									High	1	
571	Unnamed pond near intersection of Robbs Terrace and Oak Ridge Rd																					x									High	1	
572	None																				x										High	1	
573	None																					x									High	1	
574	None																														Low	0	
575	None																														Low	0	
576	None																														Low	0	
577	Lake Shirley MA81122	T, Alg, Hg, Eurasian Water Milfoil, Non-native plants, DO																				x		x							High	2	NE Regional Hg TMDL, CN 377.0
578	Unnamed pond near intersection of Robbs Terrace and Oak Ridge Rd																														Low	0	
579	Unnamed pond near intersection of Robbs Terrace and Oak Ridge Rd																														Low	0	
580	Unnamed pond near intersection of Robbs Terrace and Oak Ridge Rd																														Low	0	
581	None																														Low	0	
582	None																														Low	0	
583	None																														Low	0	
584	None																														Low	0	
585	None																														Low	0	
586	Unnamed wetland at 103 Robbs Hill Rd																														Low	0	
587	Unnamed wetland at 103 Robbs Hill Rd																														Low	0	
588	None																														Low	0	
589	None																														Low	0	
590	None																														Low	0	
591	None																					x									High	1	
592	Lake Shirley MA81122	T, Alg, Hg, Eurasian Water Milfoil, Non-native plants, DO																				x		x							High	2	NE Regional Hg TMDL, CN 377.0
593	Lake Shirley MA81122	T, Alg, Hg, Eurasian Water Milfoil, Non-native plants, DO																				x		x							High	2	NE Regional Hg TMDL, CN 377.0
594	None																														Low	0	
595	None																														Low	0	
596	Unnamed wetland, south side of Burrage St near Shaker Court																					x									High	1	
597	None																														Low	0	
598	None																														Low	0	
599	None																														Low	0	
600	None																														Low	0	
601	None																														Low	0	
602	None																														Low	0	
603	None																														Low	0	
604	Lake Shirley MA81122	T, Alg, Hg, Eurasian Water Milfoil, Non-native plants, DO																				x		x							High	2	NE Regional Hg TMDL, CN 377.0
605	Lake Shirley MA81122	T, Alg, Hg, Eurasian Water Milfoil, Non-native plants, DO																				x		x							High	2	NE Regional Hg TMDL, CN 377.0
606	None																														Low	0	
607	None																														Low	0	
608	Unnamed wetland near intersection of Burrage St and Stone Fence Rd																														Low	0	
609	None																														Low	0	
610	Unnamed wetland on 110 Burrage St near the road																														Low	0	
611	None																														Low	0	
612	White Rabbit Swamp																														Low	0	
616	White Rabbit Swamp																														Low	0	
618	Unnamed wetland at 337 Page St, near the road																														Low	0	
619	None																														Low	0	
620	None																														Low	0	
621	None																														Low	0	

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			Problem Outfalls				High Priority Outfalls																			Excluded					
													Density of Generating Sites[2]						Age of development and infrastructure												
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623	Unnamed tributary to Baker Brook																				x		x								
624	Unnamed tributary to Baker Brook																				x										
625	Unnamed tributary to Baker Brook																				x										
626	None																				x		x								
627	None																				x		x								
628	Unnamed tributary to Baker Brook																				x										
629	Unnamed tributary to Baker Brook														x						x										
630	None																				x										
631	None																				x		x								
632	None																						x								
633	None																				x		x								
634	None																														
635	None																						x								
636	Unnamed tributary to Baker Brook																				x		x								
637	Unnamed tributary to Baker Brook																				x										
638	Unnamed wetland at 101 Pleasant St, near the road																						x								
639	None																						x								
640	None																				x										
641	None																														
642	None																						x								
643	None																														
644	None																						x								
645	Catacoonamug Brook																				x		x								
646	Catacoonamug Brook																				x										
648	Catacoonamug Brook																				x		x								
649	None																				x										
650	None																				x										
651	Flurcum Swamp																														
652	None																														
653	None																														
654	Unnamed wetland at 218 Elmwood Rd, near the road																														
655	Unnamed wetland at 218 Elmwood Rd, near the road																														
656	None																														
657	None																														
659	Mulpus Brook MA81-37	Lack of a coldwater assemblage																													
660	None																														
661	Unnamed wetland near intersection of Mulpus and Hunting Hill Rds																														
662	Unnamed tributary to Mulpus Brook																														
663	Unnamed wetland at 218 Elmwood Rd, near the road																														
668	Unnamed wetland on Townsend line west of Townsend Harbor Rd																						x								
669	Hickory Hills Lake MA81031	Hg																					x		x						
670	Flurcum Swamp																						x								
673	Hickory Hills Lake MA81031	Hg																					x		x						
674	Hickory Hills Lake MA81031	Hg																					x		x						
675	Hickory Hills Lake MA81031	Hg																					x		x						
676	Hickory Hills Lake MA81031	Hg																					x		x						
677	Mulpus Brook MA81-37	Lack of a coldwater assemblage																					x								
678	Mulpus Brook MA81-37	Lack of a coldwater assemblage																					x								
679	None																						x								
680	Flurcum Swamp																				x		x								
681	None																						x								
682	Hickory Hills Lake MA81031	Hg																					x		x						
683	Hickory Hills Lake MA81031	Hg																					x		x						
684	Hickory Hills Lake MA81031	Hg																					x		x						
685	Hickory Hills Lake MA81031	Hg																					x		x						
686	Hickory Hills Lake MA81031	Hg																					x		x						
687	Hickory Hills Lake MA81031	Hg																					x		x						
688	Hickory Hills Lake MA81031	Hg																							x						
689	Hickory Hills Lake MA81031	Hg																					x		x						

Lunenburg, MA IDDE Outfall Classification and Ranking, By Outfall ID

			Problem Outfalls				High Priority Outfalls																			Excluded					
Outfall ID	Receiving Water	Receiving Water Impairment[1]	Known or suspected contributions of illicit discharges	Olfactory or visual evidence of sewage	Ammonia ≥ 0.5 mg/L, surfactants ≥ 0.25 mg/L, and bacteria > WQ criteria	Ammonia ≥ 0.5 mg/L, surfactants > 0.25 mg/L, and detectable levels of chlorine	Discharge to/near public beach	Discharge to/near recreational area	Discharge to/near drinking water supply	Discharge to/near shellfish beds	Past Discharge Complaints	Ammonia ≥ 0.5 mg/L; surfactants ≥ 0.25 mg/L; bacteria ≥ WQ criteria	Density of Generating Sites[2]						Age of development and infrastructure		Catchment areas serviced by septic systems converted to sewer[3]	Historic combined sewer system that has been separated	Density of septic systems ≥30 years old in residential land use[3]	Culverted stream lengths greater than a simple roadway crossing	Discharge to impaired water & potential to carry that pollutant	Presence of older industrial operations	Roadway drainage in undeveloped areas with no dwellings and no sanitary sewers	Outfall is drainage for athletic fields, parks or undeveloped green space & associated parking without services	Cross-country drainage alignments through undeveloped land	Overall Ranking (Problem, High, Low, Excluded)	Ranking Score (Number of Boxes Checked)	Notes
													Car dealers	Car washes	Gas stations	Garden centers	Industrial manufacturing	Other	Industrial areas >40 years old	Sewer areas >40 years old											
690	Hickory Hills Lake MA81031	Hg																					x		x					High	2	NE Regional Hg TMDL, CN 377.0
691	None																						x							High	1	
692	Hickory Hills Lake MA81031	Hg																					x		x					High	2	NE Regional Hg TMDL, CN 377.0
693	Hickory Hills Lake MA81031	Hg																					x		x					High	2	NE Regional Hg TMDL, CN 377.0
694	Hickory Hills Lake MA81031	Hg																					x		x					High	2	NE Regional Hg TMDL, CN 377.0
695	Hickory Hills Lake MA81031	Hg																					x		x					High	2	NE Regional Hg TMDL, CN 377.0
696	Hickory Hills Lake MA81031	Hg																					x		x					High	2	NE Regional Hg TMDL, CN 377.0
697	Hickory Hills Lake MA81031	Hg																					x		x					High	2	NE Regional Hg TMDL, CN 377.0
698	Hickory Hills Lake MA81031	Hg																					x		x					High	2	NE Regional Hg TMDL, CN 377.0
699	Hickory Hills Lake MA81031	Hg																					x		x					High	2	NE Regional Hg TMDL, CN 377.0
700	None																						x							High	1	
701	Hickory Hills Lake MA81031	Hg																					x		x					High	2	NE Regional Hg TMDL, CN 377.0
702	Hickory Hills Lake MA81031	Hg																							x					High	1	NE Regional Hg TMDL, CN 377.0
703	Hickory Hills Lake MA81031	Hg																					x		x					High	2	NE Regional Hg TMDL, CN 377.0
704	Hickory Hills Lake MA81031	Hg																					x		x					High	2	NE Regional Hg TMDL, CN 377.0
705	Unnamed tributary to Hickory Hills Lake near Wildwood Rd																						x							High	1	
706	None																						x							High	1	
707	Hickory Hills Lake MA81031	Hg																					x		x					High	2	NE Regional Hg TMDL, CN 377.0
708	Hickory Hills Lake MA81031	Hg																					x		x					High	2	NE Regional Hg TMDL, CN 377.0
709	Hickory Hills Lake MA81031	Hg																					x		x					High	2	NE Regional Hg TMDL, CN 377.0
710	Hickory Hills Lake MA81031	Hg																					x		x					High	2	NE Regional Hg TMDL, CN 377.0
711	Hickory Hills Lake MA81031	Hg																					x		x					High	2	NE Regional Hg TMDL, CN 377.0
713	None																						x							High	1	
714	None																						x							High	1	
715	None																						x							High	1	
716	Unnamed wetland on Townsend line west of Townsend Harbor Rd																						x							High	1	
717	None																						x							High	1	
718	Unnamed wetland on Townsend line west of Townsend Harbor Rd																						x							High	1	
719	Hickory Hills Lake MA81031																						x							High	1	
720	None																						x							High	1	
721	None																						x							High	1	
722	Hickory Hills Lake MA81031																						x							High	1	
723	Hickory Hills Lake MA81031	Hg																					x		x					High	2	NE Regional Hg TMDL, CN 377.0
724	Unnamed wetland on Townsend line west of Townsend Harbor Rd																						x							High	1	
725	None																				x		x							High	2	
726	Unnamed tributary to Mulpus Brook																				x		x							High	2	
727	Unnamed wetland on Prospect St across from Laurel Ln																				x									High	1	
728	None																				x									High	1	
729	Lake Whalom MA81154	Plants, Eurasian water milfoil																			x				x					High	2	
730	Unnamed tributary to Baker Brook																				x									High	1	
731	None																				x									High	1	
732	None												x								x		x							High	3	Whalom Sales and Service
733	None																				x		x							High	2	
734	None																				x		x							High	2	
735	Baker Brook MA81-62	No uses assessed											x								x									High	2	Summer Street Autos, LLC
736	Baker Brook MA81-62	No uses assessed													x						x		x							High	3	Whalom Gas
737	None																				x									High	1	
740	Unnamed tributary to Baker Brook																				x		x							High	2	
741	Unnamed tributary to Baker Brook												x								x		x							High	3	R C Motors
742	None																						x							High	1	
743	Baker Brook MA81-62	No uses assessed																			x		x							High	2	
744	Baker Brook MA81-62	No uses assessed											x								x									High	2	Daewoo North
745	None																				x		x							High	2	
746	None																				x		x							High	2	
747	Baker Brook MA81-62	No uses assessed																			x									High	1	
748	None																				x									High	1	
749	Lake Whalom MA81154	Plants, Eurasian water milfoil																			x				x					High	2	
1010	Unnamed wetland near Round Rd across from Lake Shirley																						x							High	1	
1025	Unnamed tributary to Mulpus Brook																													Low	0	

Lunenburg, MA IDDE Outfall Classification and Ranking, By Outfall ID

			Problem Outfalls				High Priority Outfalls																				Excluded					
Outfall ID	Receiving Water	Receiving Water Impairment[1]	Known or suspected contributions of illicit discharges	Olfactory or visual evidence of sewage	Ammonia ≥ 0.5 mg/L, surfactants ≥ 0.25 mg/L, and bacteria > WQ criteria	Ammonia ≥ 0.5 mg/L, surfactants > 0.25 mg/L, and detectable levels of chlorine	Discharge to/near public beach	Discharge to/near recreational area	Discharge to/near drinking water supply	Discharge to/near shellfish beds	Past Discharge Complaints	Ammonia ≥ 0.5 mg/L; surfactants ≥ 0.25 mg/L; bacteria ≥ WQ criteria	Density of Generating Sites[2]						Age of development and infrastructure		Catchment areas serviced by septic systems converted to sewer[3]	Historic combined sewer system that has been separated	Density of septic systems ≥30 years old in residential land use[3]	Culverted stream lengths greater than a simple roadway crossing	Discharge to impaired water & potential to carry that pollutant	Presence of older industrial operations	Roadway drainage in undeveloped areas with no dwellings and no sanitary sewers	Outfall is drainage for athletic fields, parks or undeveloped green space & associated parking without services	Cross-country drainage alignments through undeveloped land	Overall Ranking (Problem, High, Low, Excluded)	Ranking Score (Number of Boxes Checked)	Notes
													Car dealers	Car washes	Gas stations	Garden centers	Industrial manufacturing	Other	Industrial areas >40 years old	Sewer areas >40 years old												
1031	None																				x		x								High	2	
1038	None												x								x		x								High	3	Chapdelaine Truck Center Inc.
1039	None												x								x		x								High	3	Chapdelaine Truck Center Inc.
1058	None																				x		x								High	2	
1071	None																				x		x								High	2	
1072	Unnamed tributary to Baker Brook																				x										High	1	
1074	None																						x								High	1	
1081	None																						x								High	1	
1086	None																														Low	0	
1087	None																														Low	0	
1089	Unnamed wetland on Beaver Pond Brook between Longwood, Holden, and Whitney Rds																														Low	0	
1094	None																x														High	1	Quarry on Reservoir Rd
1096	None																														Low	0	
1312	Unnamed tributary to Catacoonamug Brook																				x		x								High	2	

Notes:

1. DO = Dissolved oxygen, Alg = Excess algal growth, Plants = Non-native aquatic plants, T = Turbidity, Hg = Mercury in Fish Tissue

2. Locations of gas stations, car dealerships, car washes and garden centers obtained from Google in October 2019.

3. Determination based on Sewered and Unsewered Service Areas shapefile supplied by Town.

Appendix D

SOP for Dry Weather Outfall Investigation/Sampling

Dry Weather Outfall Inspection/Sampling SOP

Purpose of SOP

1. The inspection of stormwater drainage outfalls and interconnections to assess the **condition of the structure;**
2. The inspection of stormwater drainage outfalls and interconnections to assess the **possibility of illicit discharges**; and
3. The **collection of samples** during dry weather conditions.

Prior to the Leaving the Facility

1. **Check the weather**: 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.
2. **Gather** all required equipment and materials:
    - Necessary Forms:
        - Form 1: Outfall Description and Condition Inventory and Inspection
        - Form 2: Illicit Discharge Detection Inspection
        - Form 3: Dry Weather Water Quality Sampling Form
    - Multi-meters for chlorine, conductivity, salinity, and temperature
    - Sample kits ammonia and surfactants
    - Sampling bottles for *E. coli* analysis
    - Multi meters for dissolved oxygen (*for discharges to impaired and TMDL waters only*)
    - Sampling bottles for total phosphorus, TSS, turbidity, and BOD5, (*for discharges to impaired and TMDL waters only*)
    - Dipper with extension rod
    - Tape measure
    - Pen
    - Cooler with ice or ice packs to transport samples
3. **Calibrate** meters following methods in the instruction manuals.

In Field

1. **Observe** each outfall under dry weather conditions. If an outfall/interconnection is inaccessible or submerged, proceed to the first accessible upstream manhole or structure for the observation and sampling.
2. **Record observations** about the condition of the outfall and interconnection on **Form 1**: **Outfall Description and Condition Inventory and Inspection**. Take photos and document on form.
3. **Record observations** about the possibility of an illicit discharge on **Form 2**: **Illicit Discharge Detection Inspectio**n. Take photos and document on form.
4. If flow is present, **collect samples** for analysis following procedures in **Table 1**. Follow hold times and instructions in **Table 2.** Record information in **Form 3.**
5. **Report** any signs of illicit discharges to your supervisor.

Dry Weather Outfall Inspection/Sampling SOP

Form 1: Outfall Description and Condition Inventory and Inspection

Inspection Information					
Outfall ID					
Outfall Location					
Inspector's Name					
Date of Inspection					
Rainfall (in)	Last 24 hours:		Last 48 hours:		
Outfall Description					
Type of Outfall (circle)	**Material**	**Shape**	**Dimensions**	**Submerged**	
Closed Pipe	☐ RCP ☐ CMP ☐ HDPE ☐ Aluminum Other:_____	☐ Circular ☐ Elliptical ☐ Box Other:_____	Diameter/ Dimensions:	<u>In water</u>: ☐ No ☐ Partially ☐ Fully	<u>With sediment</u>: ☐ No ☐ Partially ☐ Fully
Open Drainage	☐ Paved ☐ Grass ☐ Rip-rap Other:_____	☐ Trapezoid ☐ Parabolic Other:_____	Depth:_____ Top Width: _____ Bottom Width:_____		

Condition Assessment	
Outfall Damage: No Yes	Damage Type: Spalling Cracking/Chipping Corrosion Other:
Deposits: No Yes	None Grease/Oil Trash Foam Sediment Other:
Sediment: No Yes, Depth:	None Minor Moderate High Other:
Vegetation Distress: No Yes	Little or No Moderate High N/A Other:
Erosion Damage: No Yes	Little or No Moderate High N/A Other:
Comments or any other non-illicit discharge concerns (e.g. trash or needed infrastructure repairs?):	

Dry Weather Outfall Inspection/Sampling SOP

Form 2: Illicit Discharge Detection Inspection

Outfall ID:	**Date:**
Outfall Location:	**Inspector's Name:**

Indicators (*all outfalls with indicators*)

Indicator	**Description (circle all that apply)**
☐ Deposits and Stains	Oily Flow Line Paint Other:
☐ Poor Pool Quality (circle)	Odors Colors Oil Sheen Suds Algae Floatables Other:
☐ Pipe Benthic Growth (circle)	Brown Orange Green Other:

Flow Description

Flow Present: Yes No	Notes:
Flow Description: Trickle Moderate Substantial	Flow Depth:

Physical Indicators (*flowing outfalls*)

Indicator	**Description**	**Severity Indicators**	**Notes**
Odor	☐ Sewage ☐ Petroleum/Gas ☐ Sulfide ☐ Rancid/Sour ☐ Other:_____	☐ 1 – Faint (unclear source) ☐ 2 – Easily detected ☐ 3 – Noticeable from a distance	*Confirm the odor is coming from the discharge location and water and not the surrounding area. Avoid deeply inhaling odors as they may potentially be harmful vapors.*
Color	☐ Clear ☐ Brown ☐ Gray ☐ Yellow ☐ Green ☐ Orange ☐ Red ☐ Other: _____	☐ 1 – Faint colors in sample bottle ☐ 2 – Clearly visible in sample bottle ☐ 3 – Clearly visible in the flow	*Color is defined by the tint or intensity of color observed.*
Turbidity/ Cloudiness		☐ 1 – Slight ☐ 2 – Cloudy ☐ 3 – Opaque	*Turbidity or cloudiness is a measure of how easily light can penetrate through the sample.*
Floatables *(other than trash)*	☐ Sewage (toilet paper, etc.) ☐ Suds ☐ Petroleum/oil sheen ☐ Other:_____	☐ 1 – Few/slight; origin not obvious ☐ 2 – Some; indications of origin ☐ 3 – Some; origin clear	*- In some cases, surface sheens may be created by in-stream processes. A thick or swirling sheen with a gas-like odor may indicate an oil discharge.* *- Suds that break up quickly may simply indicate water turbulence. Suds with a strong organic/sewage odor may indicate sewage. Suds with a fragrant odor may indicate laundry water.*

Possibility of Illicit Discharge			**Sum of Severity Indicators: _____**
☐ Unlikely	☐ Potential *(two or more indicators)*	☐ Suspect *(one or more indicators at severity 3)*	☐ Obvious

Comments/Possible Sources:

Dry Weather Outfall Inspection/Sampling SOP

Table 1: Sampling Protocol

General Sampling Protocols

1) Do not eat, drink or smoke during sample collection and processing.
2) Do not collect or process samples near a running vehicle.
3) Do not park vehicles in the immediate sample collection area, including both running and non-running vehicles.

Sample Collection Protocols

1) Bring all materials and equipment including all forms, the cooler containing the sample bottles, and multi-meters to the site where the sample is going to be taken.
2) For any sample to be collected with a **multi-meter**, follow this protocol:
    a. Turn on multi-meters and place the probe in the flow being careful not to let it rest on the bottom or become encased in sediment.
    b. Once the numbers on the probe have stopped changing, record data from the multi-meters onto **Form 3: Dry Weather Water Quality Sampling Form**.
3) For any sample that must be collected by **bottle**, follow this protocol:
    a. Put on clean, powder-free nitrile gloves and be careful not to touch anything other than the dippers or the sampling containers.
    b. The second sampler should be prepared to open bottles and hand them to the first sampler when needed. The bottle caps should be left in the bags and not placed on the ground or other surface.
    c. Keep hands away from the bottle opening to prevent contamination.
    d. Collect the sample by placing the bottle in the main stream of flow, being careful not to allow the water to flow over your hands or the outside of the bottle first.
    e. Do not overfill the bottle (only fill to about ½ inch from the top of the bottle) and do not dump any liquid from them as some of the bottles supplied by the lab have preservatives.
    f. Once the sample bottle is filled, immediately hand the bottle to the second sampler to place and tighten the cap on the bottle.
    g. Label sample bottle with location, date, and time.
    h. Place the bottle in the plastic bag and immediately store it in the cooler before taking the next sample.
    i. If the flow cannot be reached by the sampler, remove the dipper and extension rod from the sealed bag. Fill and rinse the dipper in the flow three times being careful not to disturb the sediment. Collect the sample in the dipper and carefully pour into the bottle following the protocol listed above.
4) Complete **Form 3: Dry Weather Water Quality Sampling Form** if analytical samples were collected, specify parameters, and note the sample time on the form. This creates a reference point for samples.
5) Complete the Chain of Custody for any samples delivered to a laboratory for analytical analysis.
6) Clean and maintain all equipment according to user manual.

Table 2: Analytical Methods, Detection Limits, Hold Times, and Preservatives

Analyte or Parameter	Analytical Method[1]	Detection Limit	Max. Hold Time	Preservative/Cooling
Ammonia	**EPA**: 350.2 **SM**: 4500-NH3C	0.05 mg/L	28 days	Cool ≤6°C, H_2SO_4 to pH <2, none if analyzed immediately
BOD5	**EPA:** 405.1 **SM:** 5210	**EPA:** 0.1mg/L **SM:** 0.1 mg/L	24 hours	Cool ≤6°C
Chlorine	**SM**: 4500-Cl G	0.02 mg/L	15 minutes	None
Conductivity	**EPA**: 120.1 **SM**: 2510B	0.2 µs/cm	28 days	Cool ≤6°C
Copper	**EPA**: 200.7	0.0033 mg/L	14 days	HNO_3 to pH <2
Indicator Bacteria: *E.coli*	**EPA**: 1603 **SM**: 9221B, 9221F, 9223 B **Other**: Colilert, Colilert-18	**EPA**: 1 cfu/100mL **SM**: 2 MPN/100mL **Other**: 1 MPN/100mL	6 hours	Cool ≤10°C, 0.0008% $Na_2S_2O_3$
Indicator Bacteria: Enterococcus	**EPA**: 1600 **SM**: 9230 C **Other**: Enterolert	**EPA**: 1 cfu/100mL **SM**: 1 MPN/100mL **Other**: 1 MPN/100mL	6 hours	Cool ≤10°C, 0.0008% $Na_2S_2O_3$
Indicator Bacteria: Fecal coliform	**SM:** 9221E, 9222D	**SM**: 1.8 org/100mL	6 hours	Cool 4°C, 0.0008% $Na_2S_2O_3$
Lead	**EPA**: 200.7	0.0033 mg/L	14 days	HNO_3 to pH <2
Salinity	**SM**: 2520		28 days	Cool ≤6°C
Surfactants	**SM**: 5540-C	0.01 mg/L	48 hours	Cool ≤6°C
Temperature	**SM**: 2550B	Not applicable	Immediate	None
Total Nitrogen (TN) (methods are for TN and TKN, NO_3/NO_2 which comprise TN)	**TN SM**: 4500 NC **TKN EPA**: 353-3 **TKN SM:** 4500 NH_3-H **NO_3/NO_2 EPA:** 353.2 **NO_3/NO_2 SM:** 4500NO_3-F	**TN**: 0.055 mg/L **TKN EPA**: 0.05 mg/L **NO_3/NO_2:** 0.005 mg/L	28 days	Cool ≤6°C, H_2SO_4 to pH <2
Total Phosphorus	**EPA**: Manual-365.3, Automated Ascorbic acid digestion-365.1 Rev. 2, ICP/AES4 200.7 Rev. 4.4 **SM**: 4500-P E-F	**EPA**: 0.01 mg/L **SM** : 0.01 mg/L	28 days	Cool ≤6°C, H_2SO_4 to pH <2
TSS	**EPA:** 160.2 (residue, non-filterable) **SM:** 2540D	**EPA:** 0.5 mg/L **SM:** 0.5 mg/L	7 days	Cool ≤6°C

Notes:
Select meters/test kits that can read below the detection limit provided in the table.
Follow the instrumentation/test kit instructions for sampling.
[1]SM = Standard Methods

Form 3: Dry Weather Water Quality Sampling Form

Outfall ID:		**Date:**	
Outfall Location:		**Inspector's Name:**	
FOR ALL OUTFALLS			
Sample Parameter	**Field Meter/Test Kit Name**		**Field Screening Result**
Uses a Field Meter			
Temperature			
Salinity			
Specific Conductance			
Chlorine			
Uses a Test Kit			
Surfactant as MBAS			
Ammonia (NH_3)			
Uses bottles to be sent to lab (*see Table 2 for method, transport, and hold times)*			
Sample Parameter	**Time/Date**	**Laboratory**	**Result**
E.coli			
FOR DISCHARGES TO IMPAIRED WATERS ONLY			
Sample Parameter	**Field Meter/Test Kit Name**		**Field Screening Result**
Uses a Field Meter			
Dissolved Oxygen (*discharges to oxygen impaired waters)*			
Uses bottles to be sent to lab *(see Table 2 for method, transport, and hold times)*			
Sample Parameter	**Time/Date**	**Laboratory**	**Result**
BOD5 (*discharges to oxygen impaired waters)*			
Total Phosphorus (*discharges to phosphorus and DO impaired waters)*			
Turbidity (*discharges to turbidity impaired waters)*			
Total Suspended Solids (*discharges to turbidity impaired waters)*			

Appendix E

SOP for Illicit Discharge Source Investigation

Illicit Discharge Source Investigation SOP

Purpose of SOP

1. Once a potential illicit discharge has been identified during routine dry weather sampling or inspection, an investigation to **identify the source** of the illicit discharge must be conducted.
2. **Observations of flow** during dry weather conditions will assist with identifying the source of an illicit discharge.

Prior to the Leaving the Facility

1. **Check the weather**: The illicit discharge source investigation 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.
2. **Gather** all required equipment and materials:
    - Necessary Forms:
        - Form 1: Illicit Discharge Source Investigation (at outfall)
        - Form 2: Illicit Discharge Source Investigation (for each structure upstream from outfall)
    - Detailed map of stormwater drainage infrastructure
    - Pen

Illicit Discharge Source Investigation

1. Once a potential illicit discharge has been identified during routine dry weather sampling or inspection**, observe the outfall** under dry weather conditions.
2. **Record observations** about the possibility of an illicit discharge on **Form 1**: **Illicit Discharge Source Investigation (at outfall)**. Take photos and document on form.
3. If flow is present, **proceed to the first accessible upstream manhole or structure** to continue the investigation to the source of the flow.
4. At each structure, **record observations about all flow** from inlet pipes on **Form 2: Illicit Discharge Source Investigation** (for each structure upstream from outfall). Take photos and document on form. Note flow on stormwater map.
5. If an illicit discharge is identified and sampling and flow observations do not identify the source**, use alternative investigation techniques** (additional sampling, dye or smoke testing, television inspection, etc.) as needed to identify the source.
6. Once the source is identified, **notify the responsible entity** of the illicit discharge and encourage voluntary removal.
7. **Use existing regulations** to enforce the removal of the illicit discharge. Impose a compliance schedule and fees (if allowed).

Form 1: Illicit Discharge Source Investigation (at outfall)

Outfall ID:	**Date:**
Inspector's Name:	
Flow Present: Yes No	
Flow Description (circle): Trickle Moderate Substantial	
Notes (color, odor, trash, etc.):	
Possibility of Illicit Discharge? Yes No	Possible Sources:

Form 2: Illicit Discharge Source Investigation

(for each structure upstream from outfall or key junction structure)

Structure ID:		**Date:**	
Inspector's Name:			
Flow in Inlet Pipes? Yes No		Notes:	
List all inlet pipes with flow (if more space is required, use back of form)			
Pipe ID		Flow Description (circle): Trickle Moderate Substantial	
		Notes (color, odor, trash, etc.):	
		Possibility of Illicit Discharge? Yes No	Possible Sources:
Pipe ID		Flow Description (circle): Trickle Moderate Substantial	
		Notes (color, odor, trash, etc.):	
		Possibility of Illicit Discharge? Yes No	Possible Sources:
Pipe ID		Flow Description (circle): Trickle Moderate Substantial	
		Notes (color, odor, trash, etc.):	
		Possibility of Illicit Discharge? Yes No	Possible Sources:
Pipe ID		Flow Description (circle): Trickle Moderate Substantial	
		Notes (color, odor, trash, etc.):	
		Possibility of Illicit Discharge? Yes No	Possible Sources:

Appendix F

SOP for Dry Weather Key Junction Investigation/Sampling

Dry Weather Key Junction Screening SOP

Purpose of SOP

1. The inspection of key junction structures to assess the **condition of the structure;**
2. The inspection of key junction structures to assess the **possibility of illicit discharges**; and
3. The **collection of samples** during dry weather conditions.

Prior to the Leaving the Facility

1. **Check the weather**: 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.
2. **Gather** all required equipment and materials:
   - Necessary Forms:
     - Form 1: Key Junction Structure Description and Condition Inventory
     - Form 2: Illicit Discharge Detection Inspection
     - Form 3: Dry Weather Water Quality Sampling Form
   - Multi-meter for chlorine
   - Sample kits for ammonia and surfactants
   - Dipper with extension rod
   - Tape measure
   - Pen
   - Cooler with ice or ice packs to transport samples
3. **Calibrate** meters following methods in the instruction manuals.

In Field

1. **Observe** each key junction structure under dry weather conditions.
2. **Record observations** about the condition of the key junction structure on **Form 1**: **Key Junction Structure Description and Condition Inventory and Inspection**. Take photos and document on form.
3. **Record observations** about the possibility of an illicit discharge on **Form 2**: **Illicit Discharge Detection Inspectio**n. Take photos and document on form.
4. If flow is present, assign an ID to the flowing pipes on the site map. **collect samples** for analysis following procedures in **Table 1**. Follow hold times and instructions in **Table 2.** Record information in **Form 3.**
5. **Report** any signs of illicit discharges to your supervisor.

Table 2: Analytical Methods, Detection Limits, Hold Times, and Preservatives

Analyte or Parameter	Analytical Method[1]	Detection Limit	Max. Hold Time	Preservative/Cooling
Ammonia	**EPA**: 350.2 **SM**: 4500-NH3C	0.05 mg/L	28 days	Cool ≤6°C, H_2SO_4 to pH <2
Chlorine	**SM**: 4500-Cl G	0.02 mg/L	15 minutes	None
Surfactants	**SM**: 5540-C	0.01 mg/L	48 hours	Cool ≤6°C

Dry Weather Key Junction Screening SOP

Form 1: Key Junction Structure Description and Condition Inventory

Inspection Information					
Junction ID					
Associated Outfall ID					
Inspector's Name					
Date of Inspection					
Rainfall (in)	Last 24 hours:		Last 48 hours:		
Description of Key Junction Structure					
Type of Structure	Manhole	Catch Basin	Other: _____		
Condition of Structure	**Good**	**Fair**	**Poor**	**Comments**	**Construction Material**
Cover					
Frame					
Corbel					
Walls					
Floor					
Key Junction Damage (circle)	Spalling Cracking/Chipping Corrosion Other: _____				
Comments or any other non-illicit discharge concerns (e.g., trash or needed infrastructure repairs?):					

Dry Weather Key Junction Screening SOP

Form 2: Illicit Discharge Detection Inspection

Junction ID:			**Date:**	
Associated Outfall ID:			**Inspector's Name:**	
Flow Description				
Flow in Inlet Pipes? Yes No		Notes:		
List all inlet pipes with flow (if more space is required, use back of form)				
Pipe ID		Flow Description (circle): Trickle Moderate Substantial		
		Depth in Center of Flow (in.)	Width (in.)	
Pipe ID		Flow Description (circle): Trickle Moderate Substantial		
		Depth in Center of Flow (in.)	Width (in.)	

Physical Indicators (*all key structures*)				
Indicator	**Description**			
☐ Deposits and Stains (circle)	Oily	Flow Line	Paint	Other:
☐ Pipe Benthic Growth (circle)	Brown	Orange	Green	Other:

Physical Indicators (*flowing structures/pipes only*)			
Indicator	**Description**	**Severity**	**Notes**
Odor	☐ Sewage ☐ Petroleum/Gas ☐ Sulfide ☐ Rancid/Sour Other:_____	☐ 1 – Faint ☐ 2 – Easily detected ☐ 3 – Noticeable from a distance	*Confirm the odor is coming from the discharge location and water and not the surrounding area. Avoid deeply inhaling odors as they may potentially be harmful vapors.*
Color	☐ Clear ☐ Brown ☐ Gray ☐ Yellow ☐ Green ☐ Orange ☐ Red ☐ Other: _____	☐ 1 – Faint colors in sample bottle ☐ 2 – Clearly visible in sample bottle ☐ 3 – Clearly visible in the flow	*Color is defined by the tint or intensity of color observed*
Turbidity/ Cloudiness		☐ 1 – Slight ☐ 2 – Cloudy ☐ 3 – Opaque	*Turbidity or cloudiness is a measure of how easily light can penetrate through the sample.*
Floatables (*other than trash)*	☐ Sewage (toilet paper, etc.) ☐ Suds ☐ Petroleum/oil sheen Other:_____	☐ 1 – Few/slight; origin not obvious ☐ 2 – Some; indications of origin ☐ 3 – Some; origin clear	*- In some cases, surface sheens may be created by in-stream processes. A thick or swirling sheen with a gas-like odor may indicate an oil discharge.* *- Suds that break up quickly may simply indicate water turbulence. Suds with a strong organic/sewage odor may indicate sewage. Suds with a fragrant odor may indicate laundry water.*

Possibility of Illicit Discharge		**Sum of Severity Indicators: _____**	
☐ Unlikely	☐ Potential *(two or more indicators)*	☐ Suspect *(one or more indicators with severity 3)*	☐ Obvious
Comments/Possible Sources:			

Dry Weather Key Junction Screening SOP

Table 1: Sampling Protocol

General Sampling Protocols

1) Do not eat, drink or smoke during sample collection and processing.
2) Do not collect or process samples near a running vehicle.
3) Do not park vehicles in the immediate sample collection area, including both running and non-running vehicles.

Sample Collection Protocols

1) Bring all materials and equipment including all forms, the cooler containing the sample bottles, and multi-meters to the site where the sample is going to be taken.
2) For any sample to be collected with a **multi-meter**, follow this protocol:
    a. Turn on multi-meters and place the probe in the flow being careful not to let it rest on the bottom or become encased in sediment.
    b. Once the numbers on the probe have stopped changing, record data from the multi-meters onto **Form 3: Dry Weather Water Quality Sampling Form**.
3) For any sample that must be collected by **bottle**, follow this protocol:
    a. Put on clean, powder-free nitrile gloves and be careful not to touch anything other than the dippers or the sampling containers.
    b. The second sampler should be prepared to open bottles and hand them to the first sampler when needed. The bottle caps should be left in the bags and not placed on the ground or other surface.
    c. Keep hands away from the bottle opening to prevent contamination.
    d. Collect the sample by placing the bottle in the main stream of flow, being careful not to allow the water to flow over your hands or the outside of the bottle first.
    e. Do not overfill the bottle (only fill to about ½ inch from the top of the bottle) and do not dump any liquid from them as some of the bottles supplied by the lab have preservatives.
    f. Once the sample bottle is filled, immediately hand the bottle to the second sampler to place and tighten the cap on the bottle.
    g. Label sample bottle with location, date, and time.
    h. Place the bottle in the plastic bag and immediately store it in the cooler before taking the next sample.
    i. If the flow cannot be reached by the sampler, remove the dipper and extension rod from the sealed bag. Fill and rinse the dipper in the flow three times being careful not to disturb the sediment. Collect the sample in the dipper and carefully pour into the bottle following the protocol listed above.
4) Complete **Form 3: Dry Weather Water Quality Sampling Form** if analytical samples were collected, specify parameters, and note the sample time on the form. This creates a reference point for samples.
5) Complete the Chain of Custody for any samples delivered to a laboratory for analytical analysis.
6) Clean and maintain all equipment according to the user manual.

Dry Weather Key Junction Screening SOP

Form 3: Dry Weather Water Quality Sampling Form

Junction ID:	**Date and Time:**			
Associated Outfall ID:		**Inspector's Name:**		
Sample Parameter	**Field Meter/Test Kit Name**	**Field Screening Result**		
		Pipe ID	**Pipe ID**	**Pipe**
	Units:			
Uses a Field Meter				
Chlorine				
Uses a Test Kit				
Surfactant as MBAS				
Ammonia (NH_3)				

Junction ID:	**Date and Time:**			
Associated Outfall ID:		**Inspector's Name:**		
Sample Parameter	**Field Meter/Test Kit Name**	**Field Screening Result**		
		Pipe ID	**Pipe ID**	**Pipe**
	Units:			
Uses a Field Meter				
Chlorine				
Uses a Test Kit				
Surfactant as MBAS				
Ammonia (NH_3)				

Appendix G

SOP for Wet Weather Outfall Sampling

Wet Weather Outfall Sampling SOP

Purpose of SOP

- A **wet weather investigation** will be conducted for outfalls that have been identified by the Town of Abington as having a higher potential for illicit connections; and
- The investigation will include an **inspection** of stormwater drainage outfalls and the **collection of samples** during wet-weather induced flows to determine the presence of illicit discharges to the MS4.

Prior to the Leaving the Facility

1. **Check the weather**:
    - The storm event should be large enough to produce stormwater discharge.
    - Wet weather screening and sampling shall proceed when more than 0.1 inches of rainfall has occurred in the previous 24-hour period.
    - Sampling is recommended in the spring when groundwater levels are high.
2. **Gather** all required equipment and materials:
    - Necessary Forms:
        - Form 1: Wet Weather Illicit Discharge Detection Inspection
        - Form 2: Wet Weather Water Quality Sampling Form
    - Multi-meters for chlorine, conductivity, salinity, and temperature
    - Sample kits for ammonia and surfactants
    - Sampling bottles for *E. coli* analysis
    - Multi meters for dissolved oxygen (*for discharges to impaired and TMDL waters only*)
    - Sampling bottles for total phosphorus, TSS, turbidity, and BOD5, (*for discharges to impaired and TMDL waters only*)
    - Dipper with extension rod
    - Tape measure
    - Pen
    - Cooler with ice or ice packs to transport samples
3. **Calibrate** meters following methods in the instruction manuals.

In Field

1. **Observe** each outfall under wet weather conditions. If an outfall is inaccessible or submerged, proceed to the first accessible upstream manhole or structure.
2. **Record observations** about the general condition of the structure and the possibility of an illicit discharge on **Form 1**: **Wet Weather Illicit Discharge Detection Inspectio**n. Take photos and document on form.
3. **Collect samples** for analysis following procedures in **Table 1**. Follow hold times and instructions in **Table 2.** Record information in **Form 2: Wet Weather Water Quality Sampling Form.**
4. **Report** any signs of illicit discharges to your supervisor.

Form 1: Illicit Discharge Detection Inspection

Outfall ID:	**Date:**
Outfall Location:	**Inspector's Name:**

Indicators (*all outfalls with indicators*)	
Indicator	**Description (circle all that apply)**
☐ Deposits and Stains	Oily Flow Line Paint Other:
☐ Poor Pool Quality (circle)	Odors Colors Oil Sheen Suds Algae Floatables Other:
☐ Pipe Benthic Growth (circle)	Brown Orange Green Other:

Flow Description	
Flow Present: Yes No	Notes:
Flow Description: Trickle Moderate Substantial	Flow Depth:

Physical Indicators (*flowing outfalls*)			
Indicator	**Description**	**Severity Indicators**	**Notes**
Odor	☐ Sewage ☐ Petroleum/Gas ☐ Sulfide ☐ Rancid/Sour ☐ Other:_____	☐ 1 – Faint (unclear source) ☐ 2 – Easily detected ☐ 3 – Noticeable from a distance	*Confirm the odor is coming from the discharge location and water and not the surrounding area. Avoid deeply inhaling odors as they may potentially be harmful vapors.*
Color	☐ Clear ☐ Brown ☐ Gray ☐ Yellow ☐ Green ☐ Orange ☐ Red ☐ Other: _____	☐ 1 – Faint colors in sample bottle ☐ 2 – Clearly visible in sample bottle ☐ 3 – Clearly visible in the flow	*Color is defined by the tint or intensity of color observed.*
Turbidity/ Cloudiness		☐ 1 – Slight ☐ 2 – Cloudy ☐ 3 – Opaque	*Turbidity or cloudiness is a measure of how easily light can penetrate through the sample.*
Floatables *(other than trash)*	☐ Sewage (toilet paper, etc.) ☐ Suds ☐ Petroleum/oil sheen ☐ Other:_____	☐ 1 – Few/slight; origin not obvious ☐ 2 – Some; indications of origin ☐ 3 – Some; origin clear	*- In some cases, surface sheens may be created by in-stream processes. A thick or swirling sheen with a gas-like odor may indicate an oil discharge.* *- Suds that break up quickly may simply indicate water turbulence. Suds with a strong organic/sewage odor may indicate sewage. Suds with a fragrant odor may indicate laundry water.*

Possibility of Illicit Discharge			**Sum of Severity Indicators: _____**
☐ Unlikely	☐ Potential *(two or more indicators)*	☐ Suspect *(one or more indicators at severity 3)*	☐ Obvious
Comments/Possible Sources:			

Table 1: Sampling Protocol

General Sampling Protocols

1) Do not eat, drink or smoke during sample collection and processing.
2) Do not collect or process samples near a running vehicle.
3) Do not park vehicles in the immediate sample collection area, including both running and non-running vehicles.

Sample Collection Protocols

1) Bring all materials and equipment including all forms, the cooler containing the sample bottles, and multi-meters to the site where the sample is going to be taken.
2) For any sample to be collected with a **multi-meter**, follow this protocol:
    a. Turn on multi-meters and place the probe in the flow being careful not to let it rest on the bottom or become encased in sediment.
    b. Once the numbers on the probe have stopped changing, record data from the multi-meters onto **Form 2: Wet Weather Water Quality Sampling Form**.
3) For any sample that must be collected by **bottle**, follow this protocol:
    a. Put on clean, powder-free nitrile gloves and be careful not to touch anything other than the dippers or the sampling containers.
    b. The second sampler should be prepared to open bottles and hand them to the first sampler when needed. The bottle caps should be left in the bags and not placed on the ground or other surface.
    c. Keep hands away from the bottle opening to prevent contamination.
    d. Collect the sample by placing the bottle in the main stream of flow, being careful not to allow the water to flow over your hands or the outside of the bottle first.
    e. Do not overfill the bottle (only fill to about ½ inch from the top of the bottle) and do not dump any liquid from them as some of the bottles supplied by the lab have preservatives.
    f. Once the sample bottle is filled, immediately hand the bottle to the second sampler to place and tighten the cap on the bottle.
    g. Label sample bottle with location, date, and time.
    h. Place the bottle in the plastic bag and immediately store it in the cooler before taking the next sample.
    i. If the flow cannot be reached by the sampler, remove the dipper and extension rod from the sealed bag. Fill and rinse the dipper in the flow three times being careful not to disturb the sediment. Collect the sample in the dipper and carefully pour into the bottle following the protocol listed above.
4) Complete **Form 2: Wet Weather Water Quality Sampling Form** if analytical samples were collected, specify parameters, and note the sample time on the form. This creates a reference point for samples.
5) Complete the Chain of Custody for any samples delivered to a laboratory for analytical analysis.
6) Clean and maintain all equipment according to user manual.

Table 2: Analytical Methods, Detection Limits, Hold Times, and Preservatives

Analyte or Parameter	Analytical Method[1]	Detection Limit	Max. Hold Time	Preservative/Cooling
Ammonia	**EPA**: 350.2 **SM**: 4500-NH3C	0.05 mg/L	28 days	Cool ≤6°C, H_2SO_4 to pH <2, none if analyzed immediately
BOD5	**EPA:** 405.1 **SM:** 5210	**EPA:** 0.1mg/L **SM:** 0.1 mg/L	24 hours	Cool ≤6°C
Chlorine	**SM**: 4500-Cl G	0.02 mg/L	15 minutes	None
Conductivity	**EPA**: 120.1 **SM**: 2510B	0.2 µs/cm	28 days	Cool ≤6°C
Copper	**EPA**: 200.7	0.0033 mg/L	14 days	HNO_3 to pH <2
Indicator Bacteria: *E.coli*	**EPA**: 1603 **SM**: 9221B, 9221F, 9223 B **Other**: Colilert, Colilert-18	**EPA**: 1 cfu/100mL **SM**: 2 MPN/100mL **Other**: 1 MPN/100mL	6 hours	Cool ≤10°C, 0.0008% $Na_2S_2O_3$
Indicator Bacteria: Enterococcus	**EPA**: 1600 **SM**: 9230 C **Other**: Enterolert	**EPA**: 1 cfu/100mL **SM**: 1 MPN/100mL **Other**: 1 MPN/100mL	6 hours	Cool ≤10°C, 0.0008% $Na_2S_2O_3$
Indicator Bacteria: Fecal coliform	**SM:** 9221E, 9222D	**SM**: 1.8 org/100mL	6 hours	Cool 4°C, 0.0008% $Na_2S_2O_3$
Lead	**EPA**: 200.7	0.0033 mg/L	14 days	HNO_3 to pH <2
Salinity	**SM**: 2520		28 days	Cool ≤6°C
Surfactants	**SM**: 5540-C	0.01 mg/L	48 hours	Cool ≤6°C
Temperature	**SM**: 2550B	Not applicable	Immediate	None
Total Nitrogen (TN) (methods are for TN and TKN, NO_3/NO_2 which comprise TN)	**TN SM**: 4500 NC **TKN EPA**: 353-3 **TKN SM:** 4500 NH_3-H **NO_3/NO_2 EPA:** 353.2 **NO_3/NO_2 SM:** 4500NO_3-F	**TN**: 0.055 mg/L **TKN EPA**: 0.05 mg/L **NO_3/NO_2:** 0.005 mg/L	28 days	Cool ≤6°C, H_2SO_4 to pH <2
Total Phosphorus	**EPA**: Manual-365.3, Automated Ascorbic acid digestion-365.1 Rev. 2, ICP/AES4 200.7 Rev. 4.4 **SM**: 4500-P E-F	**EPA**: 0.01 mg/L **SM** : 0.01 mg/L	28 days	Cool ≤6°C, H_2SO_4 to pH <2
TSS	**EPA:** 160.2 (residue, non-filterable) **SM:** 2540D	**EPA:** 0.5 mg/L **SM:** 0.5 mg/L	7 days	Cool ≤6°C

Notes:
Select meters/test kits that can read below the detection limit provided in the table.
Follow the instrumentation/test kit instructions for sampling.
[1]SM = Standard Methods

Form 2: Wet Weather Water Quality Sampling Form

Outfall ID:		**Date:**	
Outfall Location:		**Inspector's Name:**	
FOR ALL OUTFALLS			
Sample Parameter	**Field Meter/Test Kit Name**		**Field Screening Result**
Uses a Field Meter			
Temperature			
Salinity			
Specific Conductance			
Chlorine			
Uses a Test Kit			
Surfactant as MBAS			
Ammonia (NH_3)			
Uses bottles to be sent to lab (*see Table 2 for method, transport, and hold times)*			
Sample Parameter	**Time/Date**	**Laboratory**	**Result**
E.coli			
FOR DISCHARGES TO IMPAIRED WATERS ONLY			
Sample Parameter	**Field Meter/Test Kit Name**		**Field Screening Result**
Uses a Field Meter			
Dissolved Oxygen (*discharges to oxygen impaired waters)*			
Uses bottles to be sent to lab *(see Table 2 for method, transport, and hold times)*			
Sample Parameter	**Time/Date**	**Laboratory**	**Result**
BOD5 (*discharges to oxygen impaired waters)*			
Total Phosphorus (*discharges to phosphorus and DO impaired waters)*			
Turbidity (*discharges to turbidity impaired waters)*			
Total Suspended Solids (*discharges to turbidity impaired waters)*			

Appendix H

Field Evaluation Records

DRY WEATHER OUTFALL INSPECTION REPORT

To: Ms. Heather Lemieux, Town Manager

From: Nick Cristofori, P.E., Comprehensive Environmental Inc.

Date: September 29, 2020

Town: Lunenburg, MA

Subject: Dry Weather Outfall Inspection and Screening

Under the Environmental Protection Agency's (EPA's) 2016 National Pollutant Discharge and Elimination System (NPDES) Municipal Separate Storm Sewer System (MS4) Permit, regulated communities such as Lunenburg are required to inspect all known outfalls and interconnections for the presence of dry weather flow (no more than 0.1-inches of rainfall has occurred during the previous 24-hour period and no significant snow melt is occurring) within three years of the permit effective date, or by June 30, 2021. CEI performed field work related to dry weather screening over the course of sixteen field days on:

- October 1, 15, 16, 22, and 24, 2019;
- June 15, 16, 17, 18, 22, and 23, 2020;
- August 12, 13, and 26, 2020; and
- September 1 and 9, 2020.

The following relevant outfall conditions were observed:

Table 1 – Dry Weather Flow Screening Results

Parameter	Number
Known Outfalls within the Urbanized Area	369
Outfalls that were Attempted to Visit	369
Outfalls that Could Not be Located	57
Outfalls that Could Not be Accessed	8
Structures Identified as an Outfall Found that were not an Outfall	48
Culverts Found	41
Swales Found	7
Actual Outfalls Found	256
Outfalls Found	256
Outfalls Found Not Flowing	247
Outfalls Found with Evidence of Flow	9
Found with Illicit Discharge Potential	3
Total Not Yet Attempted to Visit	0

The nine flowing outfalls were sampled for the following parameters as required by the permit: ammonia, chlorine, conductivity, salinity, e.coli, surfactants, and temperature. Five of these outfalls were also sampled for total phosphorus as they discharged to a waterbody within the Nashua River

watershed. One outfall was also sampled for both total suspended solids (TSS) and turbidity, as it discharges to Lake Shirley. Results are as follows:

Table 2 – Dry Weather Flow Screening Results

Outfall ID	Ammonia (mg/L)	Chlorine (mg/L)	Surfactants mg/L)	Conductivity (uS/cm)	Salinity (ppt)	Temperature (C)	E. Coli (MPN/100 mL)	Total Phosphorus (mg/L)	TSS (mg/L)	Turbidity (NTU)
93	0	0	**0.25***	230	0.11	17.7	26			
258	0	**0.12***	**0.25***	1528	0.9	16.4	**320***	0.14		
372	0	0	**0.75***	302.1	0.14	18.5	8			
413	0	0	0	489	43.6	12.2	**1,800***	0.10	5	1.4
454	0	0	**0.25***	200.1	0.09	19.7	NS[1]	NS[1]		
509	0	0	**0.50***	471.6	0.23	15.4	8	0		
603	0	**0.20***	NS[2]	214.6	0.1	14.8	0	0		
677	**0.5***	0	**1.00***	160.1	11.6	15.8	1			
678	0	0	**0.25***	197.2	14.7	15.3	33			

Notes:

* Numbers in bold exceeds illicit discharge or water quality benchmarks

1. Outfall 454 was not sampled for e.coli or total phosphorus and will be resampled during field efforts to be conducted during Year 3.
2. Outfall 603 was not sampled for surfactants due to inadequate field kits. However, other sampling parameters indicate the potential for illicit discharges is very low (i.e. 0 mg/L ammonia, minimal chlorine amounts, and no bacteria).

Per the 2016 MS4 Permit, the following criteria indicate likely sewer input and should be considered highly likely to contain illicit discharges from sanitary sources:

1. Olfactory or visual evidence of sewage;
2. Ammonia ≥ 0.5 mg/L, surfactants ≥ 0.25 mg/L, and bacteria levels greater than the water quality criteria applicable to the receiving water (235 colonies per 100 mL); and/or
3. Ammonia ≥ 0.5 mg/L, surfactants ≥ 0.25 mg/L, and detectable levels of chlorine.

Recommendations and Next Steps

The following items are recommended as follow-up actions:

- While none of the sampling data collected from flowing outfalls met the Permit criteria as being highly likely to contain illicit discharges from sanitary sources, several outfalls exhibited one or more water quality indicators that could be indicative of an intermittent illicit discharge due to the amount that benchmarks were exceeded:
    - Outfall 258 exhibited chlorine and surfactant readings that were above benchmarks, as well as elevated bacteria readings. Although this outfall did not exhibit detectable

levels of ammonia, it is recommended that this location be revisited and resampled during Year 3 to better assess potential water quality impacts.
    - Outfall 413 exhibited bacteria levels greater than 1,000 which greatly exceeds water quality standards. Although this outfall did not exhibit detectable levels of ammonia, chlorine, or surfactants, it is recommended that this location be revisited and resampled during Year 3 to better assess potential water quality impacts.
- Outfalls 454 and 603 should be revisited and resampled during Year 3 to evaluate water quality parameters that were not sampled during Year 2.
- Outfall 258 exhibited some discoloration and a sewage smell; however, dry weather screening did not indicate the likelihood of an illicit discharge.
- Outfall 452 and 686 exhibited minor evidence of an illicit discharge including an oil sheen, minor floatables, and a sulfur smell, however, illicit discharges appear unlikely as no other evidence was observed in these areas.
- Outfalls 11, 14, 36, 205, 219, 227, 276, 374, 401, 408, 412, 431, 438, 445, 452, 466, 468, 474, 483, 494, 496, 507, 521, 522, 557, 558, 618, 632, 634, 635, 643, 646, 652, 653, 675, 679, 680, 713, 715, 717, 725, 731, 748, and 1074 were observed to be at least half buried in sediment and should be cleaned out to preserve flow capacity.
- Outfalls 27, 89, 140, 229, 258, 404, 408, 430, 445, 496, 522, 552, 618, 631, 642, 643, 652, 679, 685, 686, 695, 725, and 1074 are showing evidence of deterioration and should be monitored during future years and/or repaired as soon as practical.
- Outfalls 227, 229, 230, 231, 232, 494, 643, 680, 681, 691, and 711 exhibited headwall deterioration which should be monitored during future years and/or repaired as soon as practical.
- Outfalls 404, 413, 509, 521, 552, 554, 676, 678, 681, 690, and 744 exhibit evidence of downstream erosion which should be monitored during future years and/or repaired as soon as practical.
- A total of 65 outfalls could not be located or accessed. These outfalls should be field-located so that dry weather inspections and screening can occur, or determined not to exist and removed from mapping. Outfalls that have not yet been visited or located should be inspected for dry weather flows by the end of Year 3 (June 30, 2021).

If you have any further questions or would like additional information, please feel free to contact me at 800.725.2550 x303 or ncristofori@ceiengineers.com. Thank you.

Nick Cristofori, P.E.
Principal, Project Manager

Attachments:
- Dry Weather Outfall Sampling Results map
- Table of Results
- Stormwater Infrastructure Map

ASHBY

TOWNSEND

FITCHBURG

LEOMINSTER

SHIRLEY

LANCASTER

HOWARD STREET

WEST TOWNSEND ROAD

STAGECOACH ROAD

HOLMAN STREET

NORTHFIELD ROAD

CHASE ROAD

MULPUS ROAD

Mulpus Brook

Hickory Hills Lake

BEAL STREET

HOLLIS ROAD

OAK AVENUE

MASSACHUSETTS AVENUE

ARBOR STREET

Flurcum Swamp

Lane Pond

ELMWOOD ROAD

White Rabbit Swamp

Turkey Hill Pond

PAGE STREET

LEOMINSTER ROAD

Catacoonamug Brook

RESERVOIR ROAD

WHALOM ROAD

Lake Whalom

CROSS ROAD

KILBURN STREET

GOODRICH STREET

Massapoag Pond

LANCASTER AVENUE

Easter Brook

FIRE ROAD 16

LEOMINSTER SHIRLEY ROAD

Tophet Swamp

Legend

- Flowing Outfall
- Not Flowing Outfall
- Not Found Outfall
- Could Not Access
- Culvert with Drainage Connection
- Not Visited
- Culvert
- Lake, Pond, Reservoir
- Wetland, Marsh, Swamp
- Stream, Brook
- Non-Urban Area

N W E S

0 1

Miles

Dry Weather Outfall Screening Results Lunenburg, MA

Comprehensive Environmental Incorporated

Data Sources: MassGIS, Town of Lunenburg, CEI

10/8/2020

Lunenburg Massachusetts Dry Weather Outfall Screening

Outfall Characteristics														Pipe Ends and Headwall Conditions			Erosion and Sedimentation		
Outfall ID	Lat.	Lon.	Date of Inspection	Outfall Located?	Receiving Waterbody (if any)	Number of Outfall Pipes	Outfall Type	Outfall Shape	Outfall Diameter (inches)	Outfall Height (inches)	Pipe Material	Outfall Condition	Outfall Condition Comment	Headwall Material	Headwall Condition	Headwall and Downstream Condition Comment	Downstream Erosion	Sedimentation Level	Downstream Erosion Comment
9	42.5689	-71.6952	10/16/2019	Found		1	Outfall	Round	16		RCP	Good		N/A			Moderate	<25%	Scour adjacent to outfall, riprap slope displaced and scattered
11	42.5689	-71.6947	10/16/2019	Found	Catacoonamug Brook	1	Outfall	Round	12		RCP	Fair	Almost buried	N/A	N/A		No	50%-75%	
14	42.5716	-71.6947	10/16/2019	Found		1	Outfall	Round	12		RCP	Good		N/A	N/A		No	>75%	
20	42.5669	-71.6986	10/16/2019	Found, not an Outfall	Catacoonamug Brook		Culvert												
26	42.5600	-71.6939	9/1/2020	Found		1	Outfall	Round	16		CMP	Good		N/A	N/A		No	25%-50%	
27	42.5562	-71.6926	9/1/2020	Found		1	Outfall	Round	12		CMP	Poor	Top of pipe torn off	N/A	N/A		Moderate	25%-50%	Bank erosion starting to fill in around pipe
28	42.5559	-71.6925	9/1/2020	Found		1	Outfall	Round	12		CMP	Good		N/A	N/A		No	None	
31	42.5484	-71.6891	9/1/2020	Found, not an Outfall			Culvert												
35	42.5483	-71.6856	10/24/2019	Found	Lake Shirley	1	Outfall	Round	18		RCP	Good		N/A	N/A		No	None	
36	42.5494	-71.6859	10/24/2019	Found	Lake Shirley	1	Outfall	Round	12		RCP	Fair	Outfall too buried to evaluate thoroughly	Stone	Good		No	>75%	
37	42.5489	-71.6815	10/24/2019	Found	Lake Shirley	1	Outfall	Round	18		RCP	Good		N/A	N/A		No	<25%	
38	42.5493	-71.6805	10/24/2019	Found	Lake Shirley	1	Outfall	Round	12		RCP	Fair	Chipped flared end section	Stone	Fair	Stones displaced	No	None	
41	42.5419	-71.6866	9/1/2020	Could not Access		0													
47	42.5369	-71.6968	9/1/2020	Found, not an Outfall			Culvert												
48	42.5369	-71.6968	9/1/2020	Found		1	Outfall	Round				Fair	Outfall submerged, unable to structurally assess	N/A	N/A		No	None	
82	42.5816	-71.6857	9/9/2020	Found		1	Outfall	Round	12		CMP	Good	Invert rusting but in good condition otherwise	Stone	Good		No	None	
86	42.5772	-71.6709	6/22/2020	Found		1	Outfall	Round	12		CMP	Good		N/A	N/A		No	<25%	
89	42.5842	-71.6796	9/1/2020	Found		1	Outfall	Round	24		CMP	Poor	Corroded	Stone	Fair	Some displaced stones	No	<25%	
90	42.5844	-71.6798	9/1/2020	Found		1	Outfall	Round	24		HDPE	Good		Stone	Fair	Some displaced stones	No	None	
92	42.5874	-71.6855	6/18/2020	Found		1	Outfall	Round	6		HDPE	Good		N/A	N/A		No	None	
93	42.5881	-71.6852	9/1/2020	Found		1	Outfall	Round	18		HDPE	Good		Stone	Good		Moderate	<25%	Channelization in bank beneath outfall
94	42.5880	-71.6858	6/18/2020	Found		1	Outfall	Round	24		CMP	Good		Stone	Good		No	None	
95	42.5885	-71.6795	6/18/2020	Not Found															
109	42.5712	-71.6849	6/22/2020	Could not Access															
140	42.5371	-71.7046	9/1/2020	Found		1	Outfall	Round	12		PVC	Poor	Pipe half filled with sediment and top of pipe buried in bank	N/A	N/A		No	None	
187	42.5816	-71.7359	8/12/2020	Found, not an Outfall		0	Culvert												
190	42.5788	-71.7350	8/12/2020	Found		1	Outfall	Round	8		CMP	Good		Stone	Good	Loose stone	No	None	
198	42.5712	-71.7360	8/12/2020	Not Found															
199	42.5712	-71.7345	8/12/2020	Found		1	Outfall	Round	12		CMP	Good		N/A	N/A		No	25%-50%	
200	42.5785	-71.7388	8/26/2020	Found, not an Outfall			Culvert												
202	42.5784	-71.7387	8/12/2020	Found, not an Outfall			Culvert												
203	42.5783	-71.7388	8/12/2020	Found	Lake Whalom	1	Outfall	Round	12		CMP	Good		N/A	N/A		No	None	
204	42.5778	-71.7391	8/12/2020	Found	Lake Whalom	1	Outfall	Round	12		CMP	Fair	Invert has completely deteriorated away	N/A	N/A		No	None	
205	42.5773	-71.7394	8/12/2020	Found	Lake Whalom	1	Outfall	Round	12		CMP	Fair	Half filled with sediment	N/A	N/A		No	50%-75%	
206	42.5766	-71.7400	8/12/2020	Could not Access															
207	42.5772	-71.7427	8/12/2020	Found	Lake Whalom	1	Outfall	Round	12		CMP	Good		N/A	N/A		Moderate	None	Plunge pool
210	42.5764	-71.7451	10/15/2019	Not Found															
218	42.5788	-71.7494	8/26/2020	Found		0	Outfall	Round	24		RCP	Good	Flared pipe end	N/A	N/A		Moderate	<25%	Some erosion in stream bed
219	42.5796	-71.7498	8/26/2020	Found		0	Outfall	Round					Unable to fully structurally assess because pipe is covered in debris	N/A	N/A		No	>75%	
223	42.5865	-71.7445	10/15/2019	Found		1	Outfall	Round	12		CMP	Good		N/A			Moderate	None	Channelization
227	42.5849	-71.7522	10/15/2019	Found		1	Outfall	Round			RCP	Fair	Outfall buried within earthen slope. Condition cannot be assessed.	Stone	Poor	Headwall stones displaced along slope	Moderate	>75%	Some channelization / exposed roots
229	42.5847	-71.7521	10/15/2019	Found		1	Outfall	Round	12		RCP	Poor	Completely displaced and blocked	Stone	Poor	Displaced	Moderate	25%-50%	
230	42.5846	-71.7521	10/15/2019	Found		1	Outfall	Round	12		RCP	Good		Stone	Poor	Displaced	Moderate	None	
231	42.5848	-71.7519	10/15/2019	Found		1	Outfall	Round	12		RCP	Good		Stone	Poor	Collapsed down slope	Moderate	<25%	Channelization
232	42.5847	-71.7519	10/15/2019	Found		1	Outfall	Round	12		RCP	Good		Stone	Poor	Displaced	Moderate	None	Channelization
241	42.5697	-71.7606	10/1/2019	Not Found															
249	42.5662	-71.7635	8/26/2020	Not Found															
250	42.5657	-71.7609	8/26/2020	Could not Access															
251	42.5651	-71.7597	8/26/2020	Found		1	Outfall	Round	12		HDPE	Fair	Pipe end is being crushed by falling rock	N/A	N/A		No	25%-50%	
258	42.5897	-71.7656	10/1/2019	Found		1	Outfall	Round	36		RCP	Poor	Flow discharging at joint 5' before pipe opening	Reinforced Concrete	Fair	Cracks and chipping	Moderate	None	Depression formed within stream beneath outfall
273	42.6007	-71.7707	6/16/2020	Found		1	Outfall	Round	24		HDPE	Good		Stone	Good		No	None	
274	42.6007	-71.7707	6/16/2020	Found		1	Outfall	Round	24		HDPE	Good		Stone	Good		No	None	
275	42.6036	-71.7691	6/16/2020	Found		1	Outfall	Round	24		CMP	Good		N/A	N/A		Moderate	None	Conveyance scoured
276	42.6044	-71.7695	6/16/2020	Found, not an Outfall		1	Culvert	Round	18		RCP	Good		Stone	Good		No	50%-75%	
277	42.6059	-71.7689	6/16/2020	Found		1	Outfall	Round	18		CMP	Good		N/A	N/A		No	None	
278	42.6068	-71.7697	6/16/2020	Found, not an Outfall		1	Culvert	Round	24		CMP	Good		Stone	Good		No	None	
295	42.6081	-71.7700	6/16/2020	Found, not an Outfall		1	Culvert	Round	12		CMP	Fair	End of pipe deformed and concave	N/A	N/A		No	25%-50%	
297	42.6114	-71.7715	6/16/2020	Found		1	Outfall	Round	15		CMP	Good	End of pipe deformed and concave	N/A	N/A		No	<25%	
298	42.6121	-71.7718	6/16/2020	Found		1	Outfall	Round	12		CMP	Fair	Invert deterioration	N/A	N/A		Moderate	None	Bank erosion undercutting large tree next to pipe. Tree should fall away from roads and power lines if it does fall
372	42.5930	-71.7568	8/26/2020	Found		1	Outfall	Round	30		CMP	Good		Stone	Good		No	None	
374	42.5898	-71.7549	10/15/2019	Found		1	Outfall	Round	12		RCP	Fair		Stone	Fair	Displaced	Moderate	50%-75%	
376	42.5901	-71.7551	10/15/2019	Not Found															
377	42.5901	-71.7549	10/15/2019	Found		1	Outfall	Round	12		RCP	Good		N/A			Moderate	None	
378	42.5951	-71.7488	6/23/2020	Found		1	Outfall	Round	12		CMP	Good		Reinforced Concrete	Good		No	<25%	
381	42.5954	-71.7463	6/23/2020	Found		1	Outfall	Round	12		RCP	Good	Flared end section	Stone	Good		No	None	
384	42.5956	-71.7457	6/23/2020	Could not Access															
387	42.5971	-71.7407	8/26/2020	Found		1	Outfall	Rectangula	12		RCP	Good		Reinforced Concrete	Good		Moderate	<25%	Bank erosion
397	42.5995	-71.7257	6/23/2020	Found, not an Outfall			Culvert												
399	42.5996	-71.7258	6/23/2020	Found		1	Outfall	Round	15		CMP	Good		Reinforced Concrete	Good		No	None	
401	42.5981	-71.7349	8/26/2020	Found		1	Outfall	Rectangula	24		RCP	Good		Reinforced Concrete	Good		No	>75%	
403	42.5954	-71.7309	9/1/2020	Found		0	Outfall	Round	36		CMP	Fair	Rusting on invert and flared end	N/A	N/A		No	None	
404	42.5950	-71.7285	9/1/2020	Found		0	Outfall	Round	18		RCP	Poor	Bottom half of pipe completely gone	Stone	Fair	Leaning forward	Severe	<25%	Large plunge pit and channelization
405	42.6016	-71.7287	8/12/2020	Found		1	Outfall	Round	12		CMP	Good	Pipe exposed for 6'	N/A	N/A		No	None	
406	42.6018	-71.7302	8/12/2020	Found		1	Outfall	Round				Fair	Pipe covered in debris, couldn't fully assess	N/A	N/A		No	None	
407	42.6022	-71.7309	8/12/2020	Found		1	Outfall	Round	12		CMP	Good		Stone	Fair	Some displaced stones	No	None	
408	42.6045	-71.7361	9/1/2020	Found		1	Outfall					Poor	Totally buried, unable to assess pipe	N/A	N/A		No	>75%	

Outfall Characteristics														Pipe Ends and Headwall Conditions			Erosion and Sedimentation		
Outfall ID	Lat.	Lon.	Date of Inspection	Outfall Located?	Receiving Waterbody (if any)	Number of Outfall Pipes	Outfall Type	Outfall Shape	Outfall Diameter (inches)	Outfall Height (inches)	Pipe Material	Outfall Condition	Outfall Condition Comment	Headwall Material	Headwall Condition	Headwall and Downstream Condition Comment	Downstream Erosion	Sedimentation Level	Downstream Erosion Comment
411	42.5673	-71.6984	10/16/2019	Found		1	Outfall	Round	18		RCP	Good		N/A			No	None	
412	42.5693	-71.6978	10/16/2019	Found		1	Outfall	Round	24		RCP	Good		N/A	N/A		Moderate	>75%	Deep channelization
413	42.5468	-71.6871	10/24/2019	Found	Lake Shirley	1	Outfall	Round	18		CMP	Good		Reinforced Concrete	Fair	Signs of potential collapse	Severe	None	Adjacent wooden retaining wall collapsing due to apparent erosion from flowing outfall
414	42.5687	-71.6953	10/16/2019	Found		1	Outfall	Round	12		RCP	Good		N/A	N/A		No	None	
416	42.5715	-71.6946	10/16/2019	Found		1	Outfall	Round	12		RCP	Good		N/A	N/A		Moderate	None	Starting to perch, scour, depression forming below outfall
417	42.5716	-71.6947	10/16/2019	Found		1	Outfall	Round	24		RCP	Good	Exposed rebar	N/A	N/A		No	<25%	
418	42.5689	-71.6951	10/16/2019	Found		1	Outfall	Round	12		RCP	Good		N/A	N/A		No	None	
420	42.5668	-71.6985	10/16/2019	Found, not an Outfall	Catacoonamug Brook		Culvert												
422	42.5546	-71.6924	9/1/2020	Found, not an Outfall			Culvert												
424	42.5729	-71.7338	8/12/2020	Found		1	Outfall	Round	12		CMP	Good	Beginning to perch	N/A	N/A		No	25%-50%	
425	42.5721	-71.7339	8/12/2020	Found		1	Outfall	Round	12		CMP	Good	Beginning to perch	N/A	N/A		No	None	Minor plunge pool
426	42.5652	-71.7350	8/12/2020	Found		1	Outfall	Round	12		CMP	Good		Stone	Good		Moderate	None	Several plunge pools along conveyance, outfall perched
428	42.5782	-71.7331	8/12/2020	Not Found															
429	42.5700	-71.7602	10/1/2019	Not Found															
430	42.5684	-71.7622	8/26/2020	Found, not an Outfall		0	Swale	Irregular				Poor	Collapsing at end of swale where it meets catch basin, ditch leading into catch basin	N/A	N/A		No	None	
431	42.6110	-71.7253	8/12/2020	Found		1	Outfall	Rectangular			Stone	Fair	Completely filled with sediment. Unable to measure dimensions	N/A	N/A		No	>75%	
432	42.5955	-71.7696	8/26/2020	Not Found															
433	42.5948	-71.7669	8/26/2020	Found		1	Outfall	Round	18		RCP	Good		Stone	Good		No	None	
434	42.5949	-71.7669	8/26/2020	Found, not an Outfall			Culvert												
435	42.5957	-71.7670	8/26/2020	Found		1	Outfall	Round	24		RCP	Good		N/A	N/A		Moderate	None	Small plunge pool
436	42.5950	-71.7662	8/26/2020	Found		0	Outfall	Irregular				Good	Open drainage outfall, small pieces broken off end	N/A	N/A		Moderate	None	Plunge pool at end of open drainage
437	42.5948	-71.7668	8/26/2020	Found		1	Outfall	Round	18		RCP	Good	Perched	Stone	Good		No	None	
438	42.6093	-71.7273	8/12/2020	Found		1	Outfall	Round	8		CMP	Fair	Partially buried	N/A	N/A		Moderate	>75%	Bank erosion
439	42.6054	-71.7221	8/13/2020	Found		1	Outfall	Round	12		CMP	Good		N/A	N/A		Moderate	<25%	Bank erosion
440	42.5917	-71.7614	8/26/2020	Found		0	Outfall	Round	24		RCP	Good	Flared end treatment	N/A	N/A		Moderate	None	
441	42.5919	-71.7608	8/26/2020	Found		0	Outfall	Irregular				Good	Paved open drainage outfall	N/A	N/A		No	None	
443	42.6018	-71.7182	8/13/2020	Found		1	Outfall	Round	24		RCP	Good		N/A	N/A		No	None	
444	42.5978	-71.7499	10/15/2019	Found		1	Outfall	Round	12		RCP	Good		Reinforced Concrete	Good		Moderate	<25%	Some scour and sedimentation
445	42.5976	-71.7444	10/15/2019	Found		1	Outfall	Round			CMP	Poor	Completely collapsed	N/A			Moderate	>75%	
446	42.5957	-71.7457	6/23/2020	Could not Access															
449	42.5941	-71.7400	6/23/2020	Found		0	Outfall	Irregular	12			Good	Unpaved open drain	N/A	N/A		No	None	
450	42.5921	-71.7388	6/23/2020	Found		0	Outfall	Irregular	12			Good	Unpaved open drainage outfall	N/A	N/A		No	None	
451	42.5949	-71.7404	6/23/2020	Found		0	Outfall	Irregular	18			Good	Unpaved open drain	N/A	N/A		No	None	
452	42.5933	-71.7394	6/23/2020	Found		1	Outfall	Round	12		RCP	Fair	Almost buried.	Stone	Good		No	>75%	
453	42.5931	-71.7388	6/23/2020	Found		1	Outfall	Round	18		HDPE	Good		N/A	N/A		No	<25%	
454	42.5925	-71.7384	6/23/2020	Found		1	Outfall	Round	18		CMP	Good	Projecting	N/A			No	None	
455	42.5921	-71.7389	6/23/2020	Found		2	Outfall	Round	8		PVC	Good		N/A	N/A		No	None	
456	42.5901	-71.7376	6/23/2020	Found		0	Outfall	Irregular	32	8	RCP	Good	Paved open drainage outfall	N/A	N/A		No	None	
457	42.5899	-71.7375	6/23/2020	Found		1	Outfall	Round	12		CMP	Fair	Rusty and partly crushed.	N/A	N/A		No	<25%	
458	42.5940	-71.6983	6/22/2020	Found		1	Outfall	Round	12		CMP	Good		Stone	Good		No	<25%	
459	42.5815	-71.7359	8/12/2020	Found		1	Outfall	Round	36		RCP	Good		Stone	Good		No	<25%	
460	42.5733	-71.7448	10/15/2019	Found	Lake Whalom		Outfall		12		CMP	Good	Outfall is submerged, no flow in upstream catch basin	Reinforced Concrete	Good		No	25%-50%	
461	42.5749	-71.7450	10/15/2019	Found	Lake Whalom	1	Outfall	Round	12		CI	Good	Outfall is submerged, no flow in upstream catch basin	Reinforced Concrete	Good		No	<25%	
462	42.5699	-71.7396	8/26/2020	Found	Whalom Lake	0	Outfall	Irregular				Good	Stone open drainage outfall	N/A	N/A		No	None	
463	42.5777	-71.7661	10/1/2019	Not Found															
464	42.5771	-71.7626	10/1/2019	Found		1	Outfall	Round	12		CMP	Good		Stone	Good		No	None	
465	42.5766	-71.7634	10/1/2019	Found		1	Outfall	Round	12		CMP	Good		N/A	N/A		Moderate	None	Bank erosion, under mining outfall
466	42.5729	-71.7428	8/26/2020	Found	Whalom Lake	1	Outfall	Round	12		CMP	Good	Pipe in good condition but high sedimentation	N/A	N/A		No	50%-75%	
467	42.5741	-71.7453	10/15/2019	Not Found															
468	42.5742	-71.7449	10/15/2019	Found	Lake Whalom	1	Outfall	Round	12		CI	Good	Outfall is submerged, no flow in upstream catch basin	Reinforced Concrete	Good		No	50%-75%	
469	42.5757	-71.7451	10/15/2019	Found	Lake Whalom	1	Outfall	Round	12		CI	Good	Outfall is submerged, no evidence of dry weather flow	Reinforced Concrete	Good		No	<25%	
470	42.5691	-71.7399	8/26/2020	Found, not an Outfall			Culvert												
473	42.5798	-71.7572	8/12/2020	Found, not an Outfall			Culvert												
476	42.5965	-71.6689	6/18/2020	Found		1	Outfall	Round	18		CMP	Good	Projecting	N/A	N/A		No	None	
478	42.5418	-71.6895	9/1/2020	Not Found															
479	42.5959	-71.6735	6/18/2020	Found		1	Outfall	Round	16		CI	Good		Reinforced Concrete	Good		No	None	
480	42.5964	-71.6747	6/18/2020	Found		1	Outfall	Round	12		CI	Good		Reinforced Concrete	Fair	Invert crumbling	No	None	
481	42.5965	-71.6754	6/18/2020	Found		1	Outfall	Round	16		CI	Good		Reinforced Concrete	Good		No	None	
482	42.5702	-71.7015	6/22/2020	Found			Outfall	Irregular	24			Good	Paved open drainage outfall	N/A	N/A		No	None	
483	42.5968	-71.6775	6/18/2020	Found		1	Outfall	Round	12		CMP	Fair	Mostly buried	N/A	N/A		No	>75%	
484	42.5968	-71.6783	6/18/2020	Found		1	Outfall	Round	18		CI	Good		Reinforced Concrete	Good		No	None	
485	42.5968	-71.6787	6/18/2020	Found		1	Outfall	Round	16		CI	Good		Reinforced Concrete	Good		No	None	
486	42.5968	-71.6798	6/18/2020	Found		1	Outfall	Round	16		CI	Good		Reinforced Concrete	Good		No	None	
487	42.5970	-71.6807	6/18/2020	Found		1	Outfall	Rectangula	24	22	RCP	Good		Reinforced Concrete	Good		No	None	
489	42.5974	-71.6854	8/13/2020	Not Found															
490	42.5734	-71.6723	6/22/2020	Found		1	Outfall	Round	12		RCP	Good	Flared end section and grate over opening	N/A	N/A		No	<25%	
491	42.5689	-71.6818	6/22/2020	Found		0	Outfall	Irregular				Good	Unpaved open drainage outfall	N/A	N/A		No	None	
492	42.5669	-71.6833	10/16/2019	Found		1	Outfall	Round	12		CMP	Good		Stone	Good		No	25%-50%	
494	42.5981	-71.7016	8/13/2020	Found		1	Outfall	Round	18		CI	Fair	Partially buried	Stone	Poor	Severe corrosion	No	>75%	
495	42.5429	-71.6889	9/1/2020	Found, not an Outfall			Culvert												
496	42.5991	-71.7083	8/13/2020	Found		1	Outfall					Poor	End collapsed and/or buried, filled with sediment	Stone	Good		No	>75%	
497	42.5470	-71.6907	10/24/2019	Found, not an Outfall			Swale												
498	42.5600	-71.6939	9/9/2020	Found, not an Outfall			Culvert												
502	42.5712	-71.7029	6/22/2020	Found		1	Outfall	Round	12		HDPE	Good		Stone	Good		No	None	

Outfall Characteristics														Pipe Ends and Headwall Conditions			Erosion and Sedimentation		
Outfall ID	Lat.	Lon.	Date of Inspection	Outfall Located?	Receiving Waterbody (if any)	Number of Outfall Pipes	Outfall Type	Outfall Shape	Outfall Diameter (inches)	Outfall Height (inches)	Pipe Material	Outfall Condition	Outfall Condition Comment	Headwall Material	Headwall Condition	Headwall and Downstream Condition Comment	Downstream Erosion	Sedimentation Level	Downstream Erosion Comment
504	42.5814	-71.7035	6/22/2020	Found, not an Outfall			Swale												
505	42.5844	-71.6993	6/22/2020	Found		1	Outfall	Round	12		CMP	Good	Projecting.	Stone	Good		No	None	
506	42.5918	-71.6999	6/22/2020	Found		1	Outfall	Round	24		RCP	Good		N/A	N/A		No	<25%	
507	42.5925	-71.6994	6/22/2020	Found		1	Outfall	Rectangula	16	12	RCP	Fair	Buried but in good shape.	Stone	Good		No	>75%	
508	42.5936	-71.6986	6/22/2020	Found		1	Outfall	Rectangula	12	10	RCP	Good		Stone	Good		No	<25%	
509	42.5966	-71.6765	6/18/2020	Found		1	Outfall	Round	16		CI	Good		Reinforced Concrete	Fair	Invert of pipe and parts of headwall base undermined	Severe	None	Heavy downstream channeling
510	42.5885	-71.6786	6/18/2020	Not Found															
511	42.5644	-71.6860	6/18/2020	Found		1	Outfall	Round	16		CMP	Fair	Heavily rusted and corroded	Stone	Good		No	<25%	
514	42.5814	-71.6822	6/22/2020	Found, not an Outfall			Swale												
515	42.5813	-71.6822	6/22/2020	Found		1	Outfall	Round	12		CMP	Fair	Invert deterioration and perched	Stone	Good		No	None	
516	42.5814	-71.6827	6/22/2020	Found		1	Outfall	Round	12		CMP	Good		N/A	N/A		No	None	
517	42.5817	-71.6856	6/22/2020	Found, not an Outfall			Swale												
518	42.5818	-71.6861	6/22/2020	Not Found															
519	42.5736	-71.6732	6/22/2020	Found		0	Outfall	Irregular				Good	Rip rap open drainage outfall	N/A	N/A		No	None	
520	42.5704	-71.6753	6/15/2020	Found		0	Outfall	Irregular	12			Good	Paved open drainage outfall	N/A	N/A		No	<25%	
521	42.5704	-71.6753	6/22/2020	Found		1	Outfall	Round	12		RCP	Good		Stone	Fair		Severe	50%-75%	Sever sedimentation and channeling
522	42.5754	-71.6808	6/22/2020	Found		1	Outfall	Round	12		CMP	Poor	Completely buried	Stone	Good		No	>75%	
523	42.5706	-71.6817	6/22/2020	Found		0	Outfall	Irregular				Fair	Unpaved open drainage outfall	N/A	N/A		No	25%-50%	
524	42.5705	-71.6816	6/22/2020	Found		0	Outfall	Irregular				Good	Unpaved open drainage outfall	N/A	N/A		No	None	
525	42.5704	-71.6816	6/22/2020	Found		1	Outfall	Round	12		CMP	Good		Stone	Good		No	<25%	
526	42.5670	-71.6848	10/16/2019	Found		1	Outfall	Round	12		CMP	Good		N/A	N/A		Moderate	None	Channelization, outfall beginning to be perched
527	42.5665	-71.6875	10/16/2019	Found, not an Outfall		1	Culvert	Round	24		CMP	Good		Stone	Good		Moderate	<25%	Scouring
545	42.5938	-71.7254	8/13/2020	Not Found															
552	42.6127	-71.7225	8/12/2020	Found		0	Outfall	Irregular	12			Poor	Paved open drainage outfall. End of outfall has been undercut and crumbled off	N/A	N/A		Severe	None	Outfall and roadway being undercut
553	42.6127	-71.7225	8/12/2020	Found		1	Outfall	Round	12		CMP	Fair	Very rusted and deteriorated. Top of pipe has completely eroded away	N/A	N/A		Severe	<25%	Erosion above outfall beginning to undercut roadway
554	42.6149	-71.7187	8/12/2020	Found		1	Outfall	Round	12		RCP	Good		N/A	N/A		No	<25%	
556	42.6146	-71.7133	9/1/2020	Found		1	Outfall	Round	24		RCP	Fair	Non reinforced concrete. Broken and 25% filled with sediment	N/A	N/A		No	<25%	
557	42.6164	-71.7133	8/12/2020	Found	Dickinson Reservoir	1	Outfall	Round	18		RCP	Fair	Almost buried, set below ground surface	N/A	N/A		No	>75%	
558	42.6170	-71.7137	8/12/2020	Found	Dickinson Reservoir	1	Outfall	Round	18		RCP	Fair	Almost filled with sediment	N/A	N/A		No	>75%	
559	42.6126	-71.7157	8/12/2020	Found		0	Outfall	Irregular	36			Good	Unpaved open drainage outfall	N/A	N/A		Moderate	<25%	Bank erosion
560	42.6137	-71.7153	8/12/2020	Found		1	Outfall	Round	8		CI	Good	Beginning to perch	N/A	N/A		No	None	
561	42.5658	-71.6898	10/16/2019	Found		1	Outfall	Round	18		CMP	Good		Stone	Good		No	<25%	
562	42.5656	-71.6912	10/16/2019	Found		1	Outfall	Round	12		CMP	Good		N/A	N/A		No	None	
563	42.5675	-71.6958	10/16/2019	Found	Catacoonamug Brook	1	Outfall	Round	12		CMP	Good		N/A			No	None	
566	42.6044	-71.7246	9/1/2020	Found		1	Outfall	Round	12		HDPE	Good		N/A	N/A	Projecting end treatment	No	None	
567	42.5667	-71.6898	10/16/2019	Found		1	Outfall	Round	12		RCP	Fair	Exposed rebar	N/A	N/A		No	None	
568	42.5659	-71.6895	10/16/2019	Found		1	Outfall	Round	12		RCP	Good	Outfall becoming backed up with sediment	N/A	N/A		No	25%-50%	
569	42.5656	-71.6911	8/12/2020	Found		0	Outfall	Irregular	18			Good	Paved open drainage outfall	N/A	N/A		No	<25%	
570	42.5642	-71.6808	10/16/2019	Found		1	Outfall	Round	12		RCP	Fair	Pipe deterioration	Reinforced Concrete	Fair	Chipping	No	<25%	
571	42.5552	-71.6785	10/16/2019	Found		1	Outfall	Round	12		RCP	Good		Stone	Fair	Riprap slope is displaced	No	<25%	
572	42.6006	-71.6992	8/13/2020	Found		1	Outfall	Round	18		RCP	Good		N/A	N/A		Moderate	None	Channelization
573	42.5667	-71.6805	10/16/2019	Found		1	Outfall	Round	12		HDPE	Good		Stone	Good		Moderate	None	Channelization
574	42.5642	-71.6808	10/16/2019	Not Found															
575	42.5643	-71.6808	10/16/2019	Found		1	Outfall	Round	12		RCP	Fair	Chipping	Reinforced Concrete	Fair	Chipping	No	None	
576	42.5643	-71.6809	10/16/2019	Found, not an Outfall	Lake Shirley	1	Culvert	Round	32		HDPE	Good		Reinforced Concrete	Good		No	None	Erosion controls left in channel
577	42.5609	-71.6824	10/16/2019	Found		1	Outfall	Round			RCP	Fair	Corrosion and chipping	N/A	N/A		No	None	
578	42.5551	-71.6784	10/16/2019	Found		1	Outfall	Round	18		RCP	Fair	Half full of sediment	N/A	N/A		No	25%-50%	
579	42.5552	-71.6778	10/16/2019	Found		1	Outfall	Round			HDPE	Good		N/A	N/A		No	<25%	
580	42.5553	-71.6776	10/16/2019	Found		1	Outfall	Round	12		HDPE	Good		N/A	N/A		No	25%-50%	
581	42.5574	-71.6750	10/16/2019	Found		1	Outfall	Round	18		HDPE	Good		N/A	N/A		No	<25%	
582	42.5574	-71.6753	10/16/2019	Found		1	Outfall	Round	15		HDPE	Good		Stone	Good		No	<25%	
583	42.5575	-71.6752	10/16/2019	Found		1	Outfall	Round	18		HDPE	Good		N/A	N/A		No	<25%	
584	42.5587	-71.6759	10/16/2019	Not Found															
585	42.5587	-71.6760	10/16/2019	Not Found															
586	42.5591	-71.6762	10/16/2019	Found		1	Outfall	Round		22	HDPE	Good		N/A	N/A		No	25%-50%	
587	42.5595	-71.6768	10/16/2019	Found		1	Outfall	Round	8		HDPE	Good	Wire screen over outfall is ripped	N/A	N/A		No	<25%	
588	42.5599	-71.6773	10/16/2019	Found		1	Outfall	Round	18		HDPE	Good	Leaves built up around screen but otherwise in good condition	Stone	Good		No	None	
589	42.5598	-71.6776	10/16/2019	Found		1	Outfall	Round	18		HDPE	Good		Stone	Good		No	<25%	
590	42.5598	-71.6789	10/16/2019	Not Found															
591	42.5600	-71.6808	10/16/2019	Found		1	Outfall	Round	18		HDPE	Good		Stone	Good		No	<25%	
592	42.5550	-71.6863	10/16/2019	Found	Lake shirley	1	Outfall	Round	4		HDPE	Good		N/A	N/A		No	None	
593	42.5595	-71.6823	10/16/2019	Found	Lake Shirley	1	Outfall	Round	12		RCP	Good		N/A	N/A		Moderate	25%-50%	Channelization and scouring
594	42.5715	-71.6826	6/22/2020	Found, not an Outfall			Culvert												
595	42.5710	-71.6846	6/22/2020	Found		1	Outfall	Round	24		RCP	Good		N/A	N/A		No	<25%	
596	42.5724	-71.6852	6/22/2020	Found, not an Outfall			Culvert												
597	42.5754	-71.6923	6/22/2020	Found		0	Outfall	Irregular	18	12	RCP	Good		N/A	N/A		No	None	
598	42.5760	-71.6914	6/22/2020	Found, not an Outfall			Culvert												
599	42.5760	-71.6914	6/22/2020	Found, not an Outfall			Culvert												
600	42.5760	-71.6914	6/22/2020	Found		1	Outfall	Round	16		HDPE	Good		Stone	Good		No	<25%	
601	42.5757	-71.6917	6/22/2020	Found, not an Outfall			Culvert												
602	42.5756	-71.6919	6/22/2020	Found		1	Outfall	Round	24		HDPE	Good		Stone	Good		No	None	
603	42.5756	-71.6919	6/22/2020	Found		1	Outfall	Round	12		HDPE	Good		Stone	Good		No	None	
604	42.5568	-71.6854	10/16/2019	Found	Lake Shirley	1	Outfall	Round	12		RCP	Good		N/A	N/A		Moderate	<25%	Outfall perched
605	42.5589	-71.6824	10/16/2019	Found	Lake Shirley	1	Outfall	Round	12		RCP	Good		Stone	Good		No	25%-50%	
606	42.5710	-71.6845	6/22/2020	Found		1	Outfall	Round	24		RCP	Good		N/A	N/A		No	None	
607	42.5711	-71.6846	6/22/2020	Found		1	Outfall	Round	15		RCP	Good		N/A	N/A		No	None	
608	42.5740	-71.6915	6/22/2020	Found		1	Outfall	Round	12		CMP	Good		Stone	Fair		Moderate	<25%	Small plunge pool
609	42.5753	-71.6921	6/15/2020	Found, not an Outfall			Culvert												
610	42.5778	-71.6966	6/22/2020	Found, not an Outfall			Culvert												
611	42.5824	-71.6972	6/22/2020	Found		1	Outfall	Round	12		CMP	Good		N/A	N/A		No	<25%	
612	42.5825	-71.6994	6/22/2020	Found, not an Outfall			Culvert												
616	42.5822	-71.7019	6/22/2020	Found, not an Outfall			Culvert												

Outfall Characteristics														Pipe Ends and Headwall Conditions			Erosion and Sedimentation		
Outfall ID	Lat.	Lon.	Date of Inspection	Outfall Located?	Receiving Waterbody (if any)	Number of Outfall Pipes	Outfall Type	Outfall Shape	Outfall Diameter (inches)	Outfall Height (inches)	Pipe Material	Outfall Condition	Outfall Condition Comment	Headwall Material	Headwall Condition	Headwall and Downstream Condition Comment	Downstream Erosion	Sedimentation Level	Downstream Erosion Comment
618	42.5821	-71.6933	6/22/2020	Found		1	Outfall	Round	24		HDPE	Poor	Pipe almost completely buried	Stone	Good		No	>75%	
619	42.5812	-71.6900	6/22/2020	Found		1	Outfall	Round	18		CMP	Good		Stone	Good		No	<25%	
620	42.5800	-71.6766	6/22/2020	Found		1	Outfall	Round	12		CMP	Good		N/A	N/A		No	None	
621	42.5799	-71.6764	6/22/2020	Found, not an Outfall			Culvert												
623	42.5917	-71.7669	10/1/2019	Not Found															
624	42.5915	-71.7665	10/1/2019	Found		1	Outfall	Irregular	34	26	RCP	Good		N/A	N/A		No	None	
625	42.5904	-71.7662	10/1/2019	Found		1	Outfall	Irregular	22	14	RCP	Good		N/A	N/A		No	<25%	
626	42.5904	-71.7703	8/26/2020	Found		1	Outfall	Round	18		RCP	Good	Flared end treatment	N/A	N/A		No	None	
627	42.5937	-71.7679	8/26/2020	Not Found															
628	42.5904	-71.7659	10/1/2019	Found		1	Outfall	Irregular	28	26	RCP	Good		N/A	N/A		No	None	
629	42.5899	-71.7658	10/1/2019	Found		1	Outfall	Irregular	34	20	RCP	Good		N/A	N/A		No	<25%	
630	42.5916	-71.7577	8/26/2020	Not Found															
631	42.5895	-71.7548	10/15/2019	Found		1	Outfall	Round	18		RCP	Poor	Pipe chipped, standing water due to earthen blockage caused by erosion/sedimentation	Stone	Fair	Earthen slope beginning to overtake headwall, some stones displaced	Moderate	<25%	Channelization, erosion leading to downstream sedimentation and blockages
632	42.5897	-71.7493	8/12/2020	Found		1	Outfall	Round	12		VC	Fair	Mostly buried	N/A	N/A		No	>75%	
633	42.5879	-71.7541	10/15/2019	Not Found															
634	42.5866	-71.7469	10/15/2019	Found		1	Outfall	Round	18		CMP	Fair	Pipe is rusted and slightly bent/deformed	Stone	Good		No	50%-75%	
635	42.5868	-71.7472	8/12/2020	Found		1	Outfall	Round	12		CMP	Fair	Mostly buried	Stone	Good		No	>75%	
636	42.5853	-71.7711	10/1/2019	Found		1	Outfall	Round	12		CMP	Good		Stone	Good		No	<25%	
637	42.5852	-71.7707	10/1/2019	Not Found															
638	42.5825	-71.7677	10/1/2019	Found, not an Outfall			Swale												
639	42.5817	-71.7624	10/1/2019	Found		1	Outfall	Round	16		CMP	Fair		N/A	N/A		No	25%-50%	
640	42.5836	-71.7498	8/12/2020	Found, not an Outfall			Culvert				CMP	Good		Stone	Good		No	None	
641	42.5851	-71.7478	10/15/2019	Found		1	Outfall	Round	12		CMP	Good		Stone	Good		Moderate	25%-50%	Slight channelization
642	42.5856	-71.7464	10/15/2019	Found		1	Outfall		12		CMP	Poor	Crumbling pitted ends	Stone	Good		Moderate	None	
643	42.5845	-71.7490	10/15/2019	Found		1	Outfall	Round			CMP	Poor	Pipe fully submerged	Stone	Poor	One stone covering pipe	Moderate	>75%	
644	42.5882	-71.7388	8/26/2020	Not Found															
645	42.5897	-71.7346	8/12/2020	Found	Catacoonamug Brook	1	Outfall	Round	24		CMP	Good		Stone	Good	Shares headwall with culvert	No	None	
646	42.5896	-71.7309	8/12/2020	Found	Unnamed wetland	1	Outfall	Round	18		RCP	Good		Stone	Good		No	>75%	
648	42.5897	-71.7345	8/12/2020	Found, not an Outfall			Culvert												
649	42.5898	-71.7335	8/12/2020	Found		1	Outfall	Round	12		CMP	Good	Pipe looks fairly new	N/A	N/A		No	<25%	
650	42.5964	-71.7239	9/1/2020	Found		0	Outfall	Irregular	24			Good	Stone open drainage outfall	N/A	N/A		No	None	
651	42.5963	-71.6945	8/13/2020	Not Found															
652	42.5937	-71.6874	6/18/2020	Found		1	Outfall	Round	16		CMP	Poor	Almost fully buried	N/A	N/A		No	>75%	
653	42.5935	-71.6855	6/18/2020	Found		1	Outfall						Due to sediment accumulation pipe cannot be fully assessed	Stone	Good		No	50%-75%	
654	42.5925	-71.6797	6/18/2020	Found		1	Outfall	Round	12		CMP	Good		N/A	N/A		No	<25%	
655	42.5927	-71.6797	6/18/2020	Found		1	Outfall	Round	18		CMP	Fair	Invert deteriorated away and pipe is perched	Stone	Good		No	None	
656	42.5885	-71.6795	6/18/2020	Found		1	Outfall	Round	16		HDPE	Fair	Half buried. Top of pie exposed and has large holes in it	N/A	N/A		No	25%-50%	
657	42.5881	-71.6792	6/18/2020	Found		1	Outfall	Round	24		CMP	Fair	Corrosion, missing metal	Stone	Fair	Missing several rocks	No	None	
659	42.5964	-71.6700	6/18/2020	Found	Mulpus Brook	1	Outfall	Round	18		CMP	Good	Projecting	N/A	N/A		No	None	
660	42.5964	-71.6691	6/18/2020	Found, not an Outfall			Culvert												
660	42.5965	-71.6692	8/13/2020	Found, not an Outfall			Culvert												
661	42.6008	-71.6716	8/13/2020	Found, not an Outfall			Culvert												
662	42.6008	-71.6737	8/13/2020	Found, not an Outfall			Culvert												
668	42.6155	-71.6972	8/13/2020	Found, not an Outfall			Culvert												
669	42.6113	-71.6986	10/22/2019	Not Found															
670	42.6034	-71.7002	10/22/2019	Not Found															
673	42.6133	-71.6989	10/22/2019	Not Found															
674	42.6120	-71.6988	10/22/2019	Found, not an Outfall	Dickinson Reservoir	1	Culvert	Round	18		RCP	Fair	Metal slightly deformed	N/A	N/A		No	None	
675	42.6091	-71.6977	10/22/2019	Found		1	Outfall	Round	12		CMP	Fair	Sediment buildup	Stone	Good		Moderate	50%-75%	
676	42.6070	-71.6980	10/22/2019	Found	Unnamed wetland	1	Outfall	Round	18		CMP	Fair	Outfall is dented into half circle shape.	N/A	N/A		Severe	<25%	Distinct channelization, plunge pools and exposed roots
677	42.6055	-71.7019	10/24/2019	Found		1	Outfall	Round	12		CMP	Fair	Corroded, invert deterioration	Stone	Good		No	None	
678	42.6054	-71.7020	10/24/2019	Found		1	Outfall	Round	18		CMP	Fair	Outfall is partially buried in slope	N/A	N/A		Severe	None	Plunge pool present immediately downstream of outfall
679	42.6043	-71.7019	10/22/2019	Found	Apparent vernal pool		Outfall	Round			CMP	Poor	Outfall almost entirely buried	N/A	N/A		Moderate	>75%	Slight channelization
680	42.6032	-71.7001	10/22/2019	Found	Unnamed wetland	1	Outfall	Round	12		RCP	Fair	Outfall is set back into slope and barely visible	Stone	Poor	Headwall collapsed causing partial burying of outfall	Moderate	50%-75%	Channelization and signs of step pools
681	42.6052	-71.7053	10/22/2019	Found		1	Outfall	Round	12			Fair	Slightly	Stone	Poor	Collapsing	Severe	<25%	
682	42.6058	-71.7081	10/22/2019	Found	Dickinson Reservoir	1	Outfall	Round	12		CMP	Good		N/A	N/A		Moderate	<25%	Channelization and exposed roots
683	42.6065	-71.7104	10/22/2019	Not Found															
684	42.6051	-71.7099	10/22/2019	Not Found															
685	42.6050	-71.7099	10/15/2019	Found, not an Outfall		1	Culvert	Round	12		RCP	Poor	Bottomed out culvert	N/A			No	25%-50%	
686	42.6050	-71.7108	10/22/2019	Found		1	Outfall	Irregular				Poor	Pipe completely corroded. Appears to be a conveyance not an outfall	N/A			No	25%-50%	
687	42.6066	-71.7116	10/22/2019	Not Found															
688	42.6055	-71.7137	10/22/2019	Found		1	Outfall	Round	12		RCP	Good		N/A	N/A		Moderate	25%-50%	Channelization, exposed roots
689	42.6058	-71.7140	10/22/2019	Not Found															
690	42.6058	-71.7139	10/22/2019	Found	Dickinson Reservoir	1	Outfall	Round	12		CMP	Good		N/A	N/A	Surrounding earthen slope shows signs of collapse around outfall, scattered stones may have served as riprap	Severe	None	Clear channelization
691	42.6021	-71.7067	6/23/2020	Found		1	Outfall	Round	18		CMP	Fair		Stone	Poor	Top of headwall is leaning back and separating away from outfall pipe	Moderate	<25%	
692	42.6187	-71.7135	10/22/2019	Found	Dickinson Reservoir	1	Outfall	Round	18		RCP	Fair	Outfall looks weathered with vegetation growth on concrete	N/A	N/A		Moderate	None	Distinct channelization, exposed roots and undercut soil
693	42.6184	-71.7127	10/22/2019	Found	Dickinson Reservoir	1	Outfall		18		RCP	Good		Stone	Good		Moderate	<25%	Signs of scour
694	42.6180	-71.7114	10/22/2019	Not Found															
695	42.6177	-71.7096	10/22/2019	Found		1	Outfall	Round	12		HDPE	Poor	Completely exposed, not fully buried	N/A			Moderate	<25%	
696	42.6175	-71.7104	10/22/2019	Not Found															
697	42.6165	-71.7086	10/22/2019	Not Found															

Outfall Characteristics													Pipe Ends and Headwall Conditions			Erosion and Sedimentation		
Outfall ID	Lat.	Lon.	Date of Inspection	Outfall Located?	Receiving Waterbody (if any)	Number of Outfall Pipes	Outfall Type	Outfall Shape	Outfall Diameter (inches)	Outfall Height (inches)	Pipe Material	Outfall Condition	Outfall Condition Comment	Headwall Material	Headwall Condition	Headwall and Downstream Condition Comment	Downstream Erosion	Sedimentation Level	Downstream Erosion Comment
698	42.6165	-71.7086	10/22/2019	Not Found															
699	42.6174	-71.7062	8/13/2020	Found	Dickinson Reservoir	1	Outfall	Round	12		CMP	Good		N/A	N/A		No	<25%	
700	42.6191	-71.7060	8/13/2020	Found		1	Outfall	Round	36		RCP	Good		N/A	N/A		No	None	
701	42.6181	-71.7040	10/22/2019	Found		1	Outfall	Round	12		HDPE	Good		Stone	Fair		Moderate	<25%	
702	42.6182	-71.7041	10/22/2019	Found, not an Outfall		1	Culvert	Round	36		HDPE	Good	A culvert for a stream	Stone	Fair		Moderate	<25%	Scour
703	42.6181	-71.7043	10/22/2019	Found		1	Outfall	Round	12		CMP	Good		Stone	Fair	Collapsing	No	25%-50%	
704	42.6182	-71.7039	10/22/2019	Not Found															
705	42.6200	-71.7043	8/13/2020	Found		1	Outfall	Round	12		CMP	Good		N/A	N/A		Moderate	<25%	Channelization
706	42.6210	-71.6996	8/13/2020	Found		1	Outfall	Round	12		CMP	Good		Stone	Good		No	<25%	
707	42.6158	-71.7030	10/22/2019	Not Found									Owner parked boat on top. Severe erosion identified						
708	42.6142	-71.7029	10/22/2019	Not Found									Appears to be buried under headwall/property boundary rock pile						
709	42.6106	-71.7030	10/22/2019	Not Found															
710	42.6105	-71.7031	10/22/2019	Not Found															
711	42.6155	-71.7008	10/22/2019	Found, not an Outfall		2	Culvert	Round	24		CMP	Good	Sediment screen	Stone	Poor	Collapsed	No	25%-50%	
713	42.6209	-71.7042	8/13/2020	Not Found														>75%	
714	42.6216	-71.7045	8/13/2020	Found		1	Outfall	Round	12		CMP	Good	Rocks stacked in front of opening blocking outfall	Stone	Good		No	None	
715	42.6220	-71.7006	8/13/2020	Found		1	Outfall	Round	8		HDPE	Good	Mostly buried by yard waste pile	N/A	N/A		No	50%-75%	
716	42.6199	-71.6980	8/13/2020	Found		1	Outfall	Round	16		RCP	Good		N/A	N/A		No	None	
717	42.6182	-71.6994	8/13/2020	Not Found									Completely buried	N/A	N/A		No	>75%	
718	42.6180	-71.6980	8/13/2020	Found		1	Outfall	Round	12		PVC	Good	Perched	N/A	N/A		No	None	
719	42.6176	-71.7001	8/13/2020	Found		1	Outfall	Round			CMP	Fair	Corroding	N/A	N/A		No	<25%	
720	42.6199	-71.6996	8/13/2020	Could not Access										Stone					
721	42.6194	-71.7000	8/13/2020	Not Found															
722	42.6167	-71.7004	8/20/2020	Could not Access															
723	42.6094	-71.7020	10/22/2019	Not Found															
724	42.6162	-71.6981	8/13/2020	Found		1	Outfall	Round	10		CMP	Good		N/A	N/A		No	<25%	
725	42.6031	-71.7238	9/1/2020	Found		1	Outfall					Poor	Fully buried, unable to assess pipe	N/A	N/A		No	>75%	
726	42.6017	-71.7249	9/1/2020	Found		1	Outfall	Round	12		CMP	Good		Stone	Fair	Displaced stone caused by flow undercutting structure	Moderate	<25%,None	Undercutting the headwall
727	42.5785	-71.7366	8/12/2020	Found		1	Outfall	Round	36		HDPE	Good		Stone	Good		No	<25%	
728	42.5737	-71.7342	8/12/2020	Found		1	Outfall	Round	12		CMP	Good		Stone	Good		No	None	Minor plunge pool and outfall perched
729	42.5713	-71.7366	8/12/2020	Not Found															
730	42.5778	-71.7518	8/12/2020	Found		1	Outfall	Round	12		CMP	Fair	Invert completely deteriorated for 10'	N/A	N/A		No	None	
731	42.5775	-71.7519	8/12/2020	Found		1	Outfall	Round	12		RCP	Fair	Outfall submerged and partially buried	Stone	Good		No	50%-75%	
732	42.5705	-71.7622	10/1/2019	Not Found															
733	42.5686	-71.7646	10/1/2019	Found		1	Outfall	Round	30		RCP	Good	Slight channelization	Reinforced Concrete	Good		Moderate	None	Channelization
734	42.5704	-71.7625	10/1/2019	Found		1	Outfall	Round	24		CMP	Good		Stone	Good		No	<25%	
735	42.5696	-71.7694	8/26/2020	Found	Baker Brook	0	Outfall	Irregular				Good	Slight collapse on right side near headwall of culvert	N/A	N/A		No	None	
736	42.5693	-71.7687	8/26/2020	Found		1	Outfall	Round	24		CMP	Good		Stone	Good		No	None	
737	42.5664	-71.7622	8/26/2020	Not Found															
740	42.5725	-71.7568	8/12/2020	Found		1	Outfall	Round	12		CMP	Good	Perched	Stone	Good	Shares headwall with culvert	Moderate	None	Small plunge pool
741	42.5725	-71.7568	8/12/2020	Found		1	Outfall	Round	24		RCP	Good		Stone	Good	Shares headwall with culvert	Moderate	None	Small plunge pool
742	42.5705	-71.7623	10/1/2019	Found, not an Outfall		1	Culvert	Round	12		CMP	Good		Stone	Good		No	<25%	
743	42.5708	-71.7693	8/26/2020	Not Found															
744	42.5707	-71.7699	10/1/2019	Found		1	Outfall	Round	16		CMP	Fair	Erosion below outfall, outfall perched above ground	N/A	N/A		Severe	None	Outfall perched, eroded away bowl below outfall
745	42.5658	-71.7592	8/26/2020	Not Found															
746	42.5678	-71.7655	8/26/2020	Found		1	Outfall	Round	20		RCP	Good		Reinforced Concrete	Good		Moderate	None	Channelization and bank erosion
747	42.5698	-71.7693	8/26/2020	Not Found															
748	42.5775	-71.7467	8/12/2020	Found		2	Outfall	Round	18		VC	Good		N/A	N/A		No	50%-75%	
749	42.5767	-71.7452	10/15/2019	Found	Lake Whalom	1	Outfall	Round	18		RCP	Good		Stone	Good		No	25%-50%	
1010	42.5463	-71.6871	10/24/2019	Found	Unnamed wetland	1	Outfall	Round	18		RCP	Good		N/A	N/A		Moderate	None	Some undercutting and exposed roots
1025	42.6036	-71.7298	8/12/2020	Found		1	Outfall	Round	8		PVC	Fair	End slightly crushed and deformed	Stone	Good		No	<25%	
1031	42.5677	-71.7615	8/26/2020	Found		0	Outfall	Irregular				Good	Unpaved open drainage outfall	N/A	N/A		No	None	
1038	42.5937	-71.7634	8/26/2020	Found		1	Outfall	Round	30		CMP	Good		N/A	N/A		No	25%-50%	
1039	42.5936	-71.7622	8/26/2020	Not Found															
1058	42.5876	-71.7359	6/23/2020	Found		1	Outfall	Round	12		CMP	Good	Perched	N/A	N/A		No	None	
1071	42.5728	-71.7604	10/1/2019	Found		1	Outfall	Round	16		RCP	Good		N/A	N/A		No	<25%	
1072	42.5798	-71.7570	8/12/2020	Found		1	Outfall	Round	12		CMP	Good		N/A	N/A		No	None	
1074	42.5846	-71.7440	10/15/2019	Found		1	Outfall	Round	12		RCP	Poor	Crumbling and partially submerged	N/A			No	50%-75%	
1081	42.5534	-71.6930	10/24/2019	Found, not an Outfall			Swale												
1086	42.5799	-71.6801	6/22/2020	Found		2	Outfall	Rectangula	24	12	Stone	Good		Stone	Good		No	<25%	
1087	42.5896	-71.6784	6/18/2020	Found		1	Outfall	Round	12		CMP	Good		N/A	N/A		No	25%-50%	
1089	42.5715	-71.6721	6/22/2020	Not Found															
1094	42.5418	-71.6893	9/1/2020	Found		0	Outfall	Irregular				Good	Riprap open drain	N/A	N/A		No	None	
1096	42.5468	-71.6906	10/24/2019	Found			Outfall												
1312	42.5998	-71.7084	6/23/2020	Not Found															
New Mass	42.5967	-71.6792	6/18/2020	Not Found															

Notes

1. Outfall Material: RCP = Reinforced Concrete Pipe; CMP = Corrugated Metal Pipe; HDPE = High Density Polyethylene; CI = Cast Iron; PVC = Polyvinyl Chloride

	Illicit Discharge Potential				Flow Characteristics				Sampling Parameters														Overall Comments
Outfall ID	Any Illicit D	Illicit Discharge Indicators	Illicit Discharge Potential	Illicit Discharge Indicator Comments	Is Dry Weather Flow Present?	Flow Description	Flow Depth (inches)	Revisit Required?	Is a Sample Required?	Is Outfall Submerged?	Unique ID	Pollutant(s) of Concern	Ammonia Result (mg/L)	Chlorine Result (mg/L)	Surfactants Result (mg/L)	Conductivity Result (uS/cm)	Salinity Result (ppt)	Temperature Result (C)	E. Coli Result (CFU/100 mL)	Total Phosphorus Result - Lab (mg/L)	Total Suspended Solids Result - Lab (mg/L)	Turbidity Result - Lab (NTU)	Overall Comments
9	No				No			No	No														
11	No				No			No	No														
14	No				No			No	No														
20																							One of three culverts for Catacoonamug Brook
26	No				No			No	No														
27	No				No			No	No														Second 4" PVC pipe above outfall, could be roof leader.
28	No				No			No	No														
31																							HDPE culvert with under private roadway
35					No			No	No														
36	No				No			No	No														Outfall buried behind sediment, only top 25% of outfall visible
37	No				No			No	No														
38	No				No			No	No														
41																							Could not access. Outfall located on other side of large gravel industrial yard.
47																							Culvert for wetland
48	No				No			No	No														Outfall submerged but not flowing.
82	No				No			No	No														Discharges to small conjunction basin where flow joins culvert flow and exits out 12' HDPE pipe.
86	No				No			No	No														
89	No				No			No	No														Outfall from BMP overflow structure
90	No				No			No	No														
92	No				No			No	No														
93	No				Yes	Trickle	0	No	Yes	No	93		0	0	0.25	230	0.11	17.7	26				DO 10.5, PH 8.7
94	No				No			No	No														Part of outlet control structure
95																							Could not locate in BMP
109																							Not accessible due to overgrown vegetation. Likely an overflow culvert from adjacent BMP.
140	No				No			No	No														Mostly buried
187																							Inlet for culvert with drainage connection. Any drainage would flow through outlet (outfall 459)
190	No				No			No	No														
198																							Not found - possibly buried
199	No				No			No	No														Area surrounding structure is overgrown with invasive Japanese knotweed
200																							Double barrel PVC culvert with no apparent drainage connection
202																							Double barrel PVC culvert with no apparent drainage connection
203	No				No			No	No														
204	No				No			No	No														
205	No				No			No	No														
206																							Could not access due to fencing and locked gate
207	No				No			No	No														
210																							
218	No				No			No	No														Standing water in pipe but no flow
219	No				No			No	No														Buried under leaf and tree debris. Clear stream channel but no flow. Unknown pipe characteristics.
223	No				No			No	No														
227	No				No			No	No														
229	No				No			No	No														
230	No				No			No	No														
231	No				No			No	No														
232	No				No			No	No														
241																							May be buried under brush pile
249																							Mapped near rail yard. Searched overgrown ditch filled with brush and debris near tracks. Could not locate outfall but found a manhole structure
250																							Could not access. Warehouse storage on one side of building, debris on other side of building and could not access from top of hill
251	No				No			No	No														
258	Yes	Sewage Odor, Cloudy	Yes	Green cloudy discoloration in water beneath outfall. Sewage smell, possibly from pipes running under bridge.	Yes	Trickle	0.5	No	Yes	No	258	TP	0	0.12	0.25	1528	0.932	16.4	320	0.14			Salinity calculated using specific conductivity
273	No				No			No	No														
274	No				No			No	No														
275	No				No			No	No														
276	No				No			No	No														Drainage culvert. Sediment build up is not present in upstream end of culvert
277	No				No			No	No														
278	No				No			No	No														Drainage culvert
295	No				No			No	No														Drainage culvert
297	No				No			No	No														
298	No				No			No	No														
372	No				Yes	Substantial	0.5	No	Yes	No	372		0	0	0.75	302.1	0.14	18.5	8				pH 9.6, DO 14.36
374	No				No			No	No														
376																							
377	No				No			No	No														
378	No				No			No	No														
381	No				No			No	No														Area surrounding outfall overgrown with vegetation
384																							Could not access, overgrown and heavy traffic.
387	No				No			No	No														
397																							Culvert overflow for pond.
399	No				No			No	No														Overflow for pond
401	No				No			No	No														Full with sediment so unsure of height, paved open drainage next to structure
403	No				No			No	No														
404	No				No			No	No														
405	No				No			No	No														
406	No				No			No	No														Debris and tree roots covering outfall- couldn't fully assess
407	No				No			No	No														
408	No				No			No	No														Totally buried

	Illicit Discharge Potential				Flow Characteristics				Sampling Parameters														Overall Comments
Outfall ID	Any Illicit D	Illicit Discharge Indicators	Illicit Discharge Potential	Illicit Discharge Indicator Comments	Is Dry Weather Flow Present?	Flow Description	Flow Depth (inches)	Revisit Required?	Is a Sample Required?	Is Outfall Submerged?	Unique ID	Pollutant(s) of Concern	Ammonia Result (mg/L)	Chlorine Result (mg/L)	Surfactants Result (mg/L)	Conductivity Result (uS/cm)	Salinity Result (ppt)	Temperature Result (C)	E. Coli Result (CFU/100 mL)	Total Phosphorus Result - Lab (mg/L)	Total Suspended Solids Result - Lab (mg/L)	Turbidity Result - Lab (NTU)	Overall Comments
411	No				No			No	No														
412	No				No			No	No														
413	No				Yes	Substantial	5	No	Yes	No	413	TP, Turbidity, T	0	0	0	489	43.573	12.2	1800	0	0	1.4	Flow possibly culvert flow from wetland on other side of Round Rd but could not find inlet to confirm. Salinity calculated using conductivity and temperature readings. Total P and TSS result were non detects.
414	No				No			No	No														
416	No				No			No	No														
417	No				No			No	No														
418	No				No			No	No														
420																							One of three culverts for Catacoonamug Brook
422																							Culvert for Easter Brook
424	No				No			No	No														
425	No				No			No	No														
426	No				No			No	No														Outfall perched, conveyance contains several plunge pools in succession
428																							Not found, potentially obscured by overgrown vegetation
429																							
430	No				No			No	No														Swale outlet draining to catch basin
431	No				No			No	No														
432																							Assumed buried under lawn
433	No				No			No	No														
434																							Double barrel culvert to Unnamed tributary to Baker Brook
435	No				No			No	No														
436	No				No			No	No														Open drainage, some collapse at end of pavement and downstream plunge pool. Drains to swale conveyance structure
437	No				No			No	No														
438	No				No			No	No														Conveyance filled with sediment
439	No				No			No	No														
440	No				No			No	No														
441	No				No			No	No														Appears to be paved open drainage from wooded area directing flow to catch basin on roadway
443	No				No			No	No														Open drainage outfall also present above outfall
444	No				No			No	No														
445	No				No			No	No														
446																							Could not access. Potentially hidden by overgrown vegetation
449	No				No			No	No														Unpaved open drainage outfall into block basin
450	No				No			No	No														Unpaved open drainage outfall
451	No				No			No	No														Unpaved open drainage outfall directing flow into unnamed stream
452	Yes	Floatables, Oil Sheen	Unlikely		No			No	No														
453	No				No			No	No														
454	No				Yes	Moderate	0.25	No	Yes	No	454	TP	0	0	0.25	200.1	0.09	19.7					
455	No				No			No	No														
456	No				No			No	No														Paved open drainage outfall directing flow to a block basin
457	No				No			No	No														
458	No				No			No	No														
459	No				No			No	No														Culvert with drainage connection
460	No				No			No	No														
461	No				No			No	No														
462	No				No			No	No														Open drainage outfall at bottom of hill directing flow to Whalom Lake
463																							May be under brush pile
464	No				No			No	No														2" pvc pipe coming from adjacent house
465	No				No			No	No														
466	No				No			No	No														
467																							
468	No				No			No	No														
469	No				No			No	No														Excessive algal growth in outfalls direct vicinity
470																							36 in culvert with flow from Whalom Lake to swale on other side of the street. No apparent pipe connection to the catch basins in the road
473																							Culvert with no apparent drainage connection
476	No				No			No	No														
478																							Appears to be a detention basin, could not locate an outfall pipe. Pressurized metal pipe runs thru BMP to catch basin
479	No				No			No	No														
480	No				No			No	No														Headwall below invert has some crumbling. 3 ft drop from outlet to conveyance
481	No				No			No	No														
482	No				No			No	No														Open drainage outfall above culvert
483	No				No			No	No														
484	No				No			No	No														
485	No				No			No	No														
486	No				No			No	No														Log inside of outfall.
487	No				No			No	No														Rectangular pipe, some erosion. Hiking bridge built 50' downstream. Outlet grate has some debris built up
489																							Could not find, possibly buried. Catch basins not located either
490	No				No			No	No														
491	No				No			No	No														Open drainage outfall
492	No				No			No	No														
494	No				No			No	No														
495																							Culvert with no apparent drainage connection
496	No				No			No	No														
497																							No outfall pipe, apparent drainage swale
498																							Culvert with no apparent drainage connection. Paved open drain next to culvert
502	No				No			No	No														

	Illicit Discharge Potential				Flow Characteristics				Sampling Parameters													Overall Comments
Outfall ID	Any Illicit D	Illicit Discharge Indicators	Illicit Discharge Potential	Illicit Discharge Indicator Comments	Is Dry Weather Flow Present?	Flow Description	Flow Depth (inches)	Revisit Required?	Is a Sample Required?	Is Outfall Submerged?	Unique ID	Pollutant(s) of Concern	Ammonia Result (mg/L)	Chlorine Result (mg/L)	Surfactants Result (mg/L)	Conductivity Result (uS/cm)	Salinity Result (ppt)	Temperature Result (C)	E. Coli Result (CFU/100 mL)	Total Phosphorus Result - Lab (mg/L)	Total Suspended Solids Result - Lab (mg/L)	Turbidity Result - Lab (NTU)	Overall Comments
504																							Swale in location but no outfall found
505	No				No			No	No														
506	No				No			No	No														
507	No				No			No	No														Mostly buried so height measurement is an estimate
508	No				No			No	No														Overgrown poison ivy surrounding outfall, was not able to get a closer picture
509	No				Yes	Trickle	0.25	No	Yes	No	509		0	0	0.5	471.6	0.23	15.4	8	0			Heavy downstream erosion. Headwall has moderate crumbling below pipe invert and is moderately undermined below base. Surfactant exceeded benchmark
510																							Found catch basin but outfall not visible. Possibly buried in adjacent rip rap.
511	No				No			No	No														Found at 511 location, gps put the point way off.
514																							Swale with no outfall pipe or visible open drainage outlet
515	No				No			No	No														
516	No				No			No	No														
517																							Basin between culvert and outfall pipe.
518																							Potentially a leaching catch basin
519	No				No			No	No														Open drainage outfall
520	No				No			No	No														Open drainage outfall
521	No				No			No	No														Outfall pipe clogged 50% with sediment and leaves
522	No				No			No	No														Outfall buried and will obstruct flow
523	No				No			No	No														Open drainage outfall, appears to be filled with sediment
524	No				No			No	No														Open drainage outfall
525	No				No			No	No														
526	No				No			No	No														
527	No				No			No	No														Appears to be a culvert
545																							Could not locate outfall. Upstream catch basin dry
552	No				No			No	No														Paved open drainage outfall above outfall pipe 553. Road is being undercut from erosion at end of outlet
553	No				No			No	No														Erosion above outfall has caused top of pipe to deteriorate away. Roadway is beginning to be undercut
554	No				No			No	No														
556	No				No			No	No														Standing water in pipe from lake
557	No				No			No	No														Outfall in a pit below ground surface that would flood during a storm event
558	No				No			No	No														
559	No				No			No	No														Unpaved open drainage outfall 3' wide
560	No				No			No	No														
561	No				No			No	No														
562	No				No			No	No														
563	No				No			No	No														
566	No				No			No	No														
567	No				No			No	No														
568	No				No			No	No														
569	No				No			No	No														Paved open drainage outfall next to headwall of culvert.
570	No				No			No	No														Sheen on water near outfall
571	No				No			No	No														
572	No				No			No	No														Flared end
573	No				No			No	No														
574																							
575	No				No			No	No														
576	No				No			No	No														Appears to be a culvert, receiving water from intermittent stream, no catch basins or stormwater features tied in
577	No				No			No	No														
578	No				No			No	No														
579	No				No			No	No														
580	No				No			No	No														
581	No				No			No	No														
582	No				No			No	No														
583	No				No			No	No														Discharges to BMP
584																							
585																							
586	No				No			No	No														
587	No				No			No	No														
588	No				No			No	No														
589	No				No			No	No														Leaf build up in outfall but otherwise Good
590																							
591	No				No			No	No														Appears to be an inlet not an outfall. Located at top of hill and pipe pitched downwards
592	No				No			No	No														No storm water features to be found, might not be stormwater outfall
593	No				No			No	No														
594																							Culvert
595	No				No			No	No														
596																							Road culvert
597	No				No			No	No														
598																							Culvert
599																							Culvert
600	No				No			No	No														Outlet for a culvert drainage system
601																							Culvert
602	No				No			No	No														End of drainage culvert system.
603	No				Yes	Moderate	0.5	Yes	Yes	No	603	TP	0	0.2		214.6	0.1	14.8	0	0			Chlorine exceeded benchmark. E. coli lab result was a non detect. Revisit required to collect surfactants sample
604	No				No			No	No														Outfall submerged, no flow in upstream catch basins
605	No				No			No	No														
606	No				No			No	No														
607	No				No			No	No														
608	No				No			No	No														
609																							Culverts connecting two BMPs
610																							Road culvert
611	No				No			No	No														
612																							Culvert
616																							Culvert with no drainage connection

	Illicit Discharge Potential				Flow Characteristics				Sampling Parameters														Overall Comments
Outfall ID	Any Illicit D	Illicit Discharge Indicators	Illicit Discharge Potential	Illicit Discharge Indicator Comments	Is Dry Weather Flow Present?	Flow Description	Flow Depth (inches)	Revisit Required?	Is a Sample Required?	Is Outfall Submerged?	Unique ID	Pollutant(s) of Concern	Ammonia Result (mg/L)	Chlorine Result (mg/L)	Surfactants Result (mg/L)	Conductivity Result (uS/cm)	Salinity Result (ppt)	Temperature Result (C)	E. Coli Result (CFU/100 mL)	Total Phosphorus Result - Lab (mg/L)	Total Suspended Solids Result - Lab (mg/L)	Turbidity Result - Lab (NTU)	Overall Comments
618	No				No			No	No														Buried
619	No				No			No	No														Switch to other end of pipe, the map marks the inlet.
620	No				No			No	No														
621																							Structure is a culvert
623																							Could not locate in overgrown detention basin
624	No				No			No	No														
625	No				No			No	No														Discharges to detention basin
626	No				No			No	No														
627																							Mapped in wooded area, adjacent to BMP and newer condo complex. Could be buried in wooded area or in the BMP but no clear channel present. No flow in catch basin
628	No				No			No	No														Discharges from detention basin
629	No				No			No	No														
630																							Manhole surrounded by riprap located at top of hill. Outfall not found
631	No				No			No	No														Mystery pipe directly adjacent to outfall. Possibly to redirect flow from outfall
632	No				No			No	No														
633																							
634	No				No			No	No														
635	No				No			No	No														Sediment build up in conveyance and pipe will limit discharge during flow event
636	No				No			No	No														
637																							
638																							No outfall pipe, apparent drainage swale
639	No				No			No	No														
640	No				No			No	No														Culvert with no apparent drainage connection
641	No				No			No	No														
642	No				No			No	No														
643	No				No			No	No														
644																							Leaching catch basin with no outlet pipe found in mapped location. Potentially buried on opposite side of street
645	No				No			No	No														
646	No				No			No	No														
648																							Culvert
649	No				No			No	No														
650	No				No			No	No														Open drainage outfall directing flow to catch basin
651																							Could not locate outfall within overgrown vegetation.
652	No				No			No	No														
653	No				No			No	No														Rock head wall, heavy sediment deposits can't view pipe
654	No				No			No	No														Outlet pipe from livestock pond. Discharges into swale the outlets across road in another culvert
655	No				No			No	No														
656	No				No			No	No														
657	No				No			No	No														Outfall from BMP overflow structure
659	No				No			No	No														
660																							Culvert
660																							Culvert
661																							Culverted stream
662																							Culverted stream
668																							Double barrel culvert with red tint to pipe and conveyance. Tires and debris on other side of road, which has similar red tint but no sign of pipes
669																							
670																							
673																							
674	No				No			No	No														Outfall is a culvert connecting pond/wetland to Reservoir
675	No				No			No	No														Passes under private dock
676	No				No			No	No														Groundwater flow present immediately beneath outfall, seems to be contributing to most of the erosion present and undercutting the outfall.
677	No				Yes	Trickle	2	No	Yes	No	677		0.5	0	1	160.1	11.588	15.8	1				Salinity calculated using conductivity and temperature readings. E. coli lab result was <1
678	No				Yes	Trickle	0.25	No	Yes	No	678		0	0	0.25	197.2	14.721	15.3	33				Salinity calculated using conductivity and temperature readings
679	No				No			No	No														Outfall completely buried by apparent residential yard waste dumping.
680	No				No			No	No														
681	No				No			No	No														Signs of residential yard waste dumping
682	No				No			No	No														Outfall located on private property, resident seems to be blocking channel with wood and brush to prevent erosion.
683																							Old wooden plank inside apparent stone headwall indicates a possible outfall but no sign of actual pipe or discharge point.
684																							
685	No				No			No	No														
686	Yes	Oil Sheen, Sulfur Smell	Unlikely	Not a catch basin, would be hard to dump. Oil sheen could be from boats	No			No	No														
687																							Outfall likely buried beneath extensive residential yard waste dump.
688	No				No			No	No														Signs of residential yard waste dumping directly above outfall and within channel.
689																							
690	No				No			No	No														
691	No				No			No	No														Top of headwall separating from pipe and base
692	No				No			No	No														
693	No				No			No	No														
694																							
695	No				No			No	No														
696																							
697																							

	Illicit Discharge Potential				Flow Characteristics				Sampling Parameters														Overall Comments
Outfall ID	Any Illicit D	Illicit Discharge Indicators	Illicit Discharge Potential	Illicit Discharge Indicator Comments	Is Dry Weather Flow Present?	Flow Description	Flow Depth (inches)	Revisit Required?	Is a Sample Required?	Is Outfall Submerged?	Unique ID	Pollutant(s) of Concern	Ammonia Result (mg/L)	Chlorine Result (mg/L)	Surfactants Result (mg/L)	Conductivity Result (uS/cm)	Salinity Result (ppt)	Temperature Result (C)	E. Coli Result (CFU/100 mL)	Total Phosphorus Result - Lab (mg/L)	Total Suspended Solids Result - Lab (mg/L)	Turbidity Result - Lab (NTU)	Overall Comments
698																							
699	No				No			No	No														
700	No				No			No	No														Flared end, riprap conveyance
701	No				No			No	No														
702	No				No			No	No														
703	No				No			No	No														
704																							
705	No				No			No	No														
706	No				No			No	No														
707																							
708																							
709																							
710																							
711	No				No			No	No														
713																							Channel in mapped location indicates outfall is present but is completely buried.
714	No				No			No	No														Flow blocked by rocks placed in front
715	No				No			No	No														
716	No				No			No	No														Projecting pipe end treatment
717	No				No			No	No														Channel in mapped location indicates outfall is present but is completely buried.
718	No				No			No	No														Outfall perched
719	No				No			No	No														Culvert with drainage connection. Inlet to catch basins on opposite side of street
720																							Could not access outfall due to excessive overgrown vegetation. Stone headwall visible through vegetation
721																							
722																							Could not access, fenced off yards. No flow in catch basins
723																							
724	No				No			No	No														
725	No				No			No	No														
726	No				No			No	No														
727	No				No			No	No														
728	No				No			No	No														
729																							Not found - potentially submerged
730	No				No			No	No														Invert and side of pipe have deteriorated away for about 10'
731	No				No			No	No														Standing water in pipe, but no flow.
732																							Channel runs through riprap mound with driveway on top, no outfall pipe found
733	No				No			No	No														
734	No				No			No	No														Channel filled with trash
735	No				No			No	No														Open drainage outfall conveying flow to Baker Brook and double barrel culvert
736	No				No			No	No														
737																							Not found, likely buried. Previous inspection noted on a steep slope with excessive erosion and dumped yard and construction debris
740	No				No			No	No														
741	No				No			No	No														
742	No				No			No	No														Discharges next to culvert into intermittent wide channel
743																							Highly vegetated. No evidence of outfall anywhere near mapped location. No channel observed.
744	No				No			No	No														
745																							Not found, appears to be a channel but filled with debris
746	No				No			No	No														
747																							Highly vegetated, doesn't appear to be any open drainage as seen on the other side of the road
748	No				No			No	No														Sediment buildup in conveyance will obstruct flow
749	No				No			No	No														
1010	No				No			No	No														
1025	No				No			No	No														
1031	No				No			No	No														Swale outlet draining to catch basin on street
1038	No				No			No	No														
1039																							Not visible, probably buried but signs of a channel
1058	No				No			No	No														
1071	No				No			No	No														
1072	No				No			No	No														Discharges to channel 10' upstream of culvert
1074	No				No			No	No														
1081																							No outfall, apparent drainage swale
1086	No				No			No	No														
1087	No				No			No	No														Top of pipe exposed for 5' to bank. Moderate levels of sand buildup
1089																							Outfall not found. Associated catch basin is dry
1094	No				No			No	No														Riprap open drainage outfall directing flow to catch basin
1096																							Inlet pipe can be seen on other side of Reservoir Rd, brick piled up in outlet and channel is present. Outfall plugged?
1312																							Found indications of outfalls location but no pipe visible. Metal sediment containment structure near outfall area.
New Mass																							Evidence of new outfall but buried

Stormwater Infrastructure Map
Lunenburg, MA

Comprehensive Environmental Incorporated

N

0 0.5 1
Miles

Data source: MassGIS, Town of Lunenburg

Legend

- Outfall
- Culvert
- Catch Basin
- Leaching Catch Basin
- Drainage Manhole
- Detention or Infiltration Basin
- Inlet
- Dry Well
- Drainage Pipes
- Sewer Pipes
- Lake, Pond, Reservoir
- Wetland, Marsh, Swamp
- Stream, Brook
- Urbanized Area

9/11/2019

Appendix I

IDDE Employee Training Records

Training Topics:		
Date:	**Hours:**	
Employee Name	**Department / Position**	**Contact Info**