Illicit Discharge Detection and Elimination (IDDE) Plan

Town of Lincoln, Massachusetts

Prepared June 30, 2019
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Prepared For:

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Illicit Discharge Detection and Elimination (IDDE) Plan Revision Log

Revision Date	Section(s) Revised	Revisions Made	Revisions Made by
June 30, 2019	All	Original IDDE Plan prepared.	Comprehensive Environmental Inc.
June 30, 2021	Appendix H	Dry weather outfall screening data.	Comprehensive Environmental Inc.
June 30, 2022	1.4 and appendices	Impaired waterbodies in Table 1-1, appendices associated with mapping, outfall screening, and training.	Comprehensive Environmental Inc.
June 30, 2025	1.4 and appendices	Impaired waterbodies in Table 1-1, appendices associated with mapping, outfall screening, and training.	Comprehensive Environmental Inc.

Table of Contents

Illicit Discharge Detection and Elimination Plan – Town of Lincoln

Tables

Appendices

1 Introduction

1.1 IDDE Regulatory Background

This Illicit Discharge Detection and Elimination (IDDE) Plan has been developed by the Town of Lincoln to address the requirements of the United States Environmental Protection Agency's (USEPA's) 2016 National Pollutant Discharge Elimination System (NPDES) General Permit for Stormwater Discharges from Small Municipal Separate Storm Sewer Systems (MS4) in Massachusetts, hereafter referred to as the "2016 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. After several years of litigation, the permit was updated in December 2020 with a revised effective date of January 6, 2021. Authorization to discharge was set to expire on July 1, 2022, however, was administratively continued by EPA. 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 municipal separate storm sewer 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, USEPA 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 entirely).

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 4 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 Lincoln's regulated area based on the Final 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]
Cambridge Reservoir	MA72014	5	Chloride	
Cambridge Reservoir, Upper Basin	MA72156	5	Aquatic Plants (Macrophytes)	
			Turbidity	
			Chloride	
Elm Brook	MA83-24	5	(Physical substrate habitat alterations*)	
			Fecal Coliform	2587
			Escherichia coli	2587
			Sedimentation/Siltation	
Farrar Pond	MA82036	5	Mercury in Fish Tissue	
Hobbs Brook	MA72-45	5	Chloride	

[1]At the time of preparation of this plan, the 2022 303d list is the most up to date finalized 303d List.
[2]"Approved TMDLs" are those that have been approved by EPA as of the date of issuance of the 2016 MS4 Permit.

Table 1-1 (continued). Impaired Waters (Based on 2016 Massachusetts Integrated List of Waters)

Waterbody Name	Segment ID and Category		Impairment(s)	Approved TMDL[3]
Shawsheen River	MA83-08	5	Fecal Coliform	2587
			Physical substrate habitat alterations	
			Dissolved Oxygen	
			Escherichia coli	2587
Stony Brook	MA72-26	5	Temperature	
Unnamed Tributary	MA72-47	5	Chloride	

Category 5 Waters – impaired waters that require a TMDL.
*TMDL not required (Non-pollutant)

Lincoln is also subject to the Charles River phosphorus TMDL, as the Town discharges to the Charles River (MA72-07) via Stony Brook (MA72-26). Lincoln is meeting the phosphorus sampling requirements as outlined further below.

1.5 IDDE Program Purpose, Goals and Framework

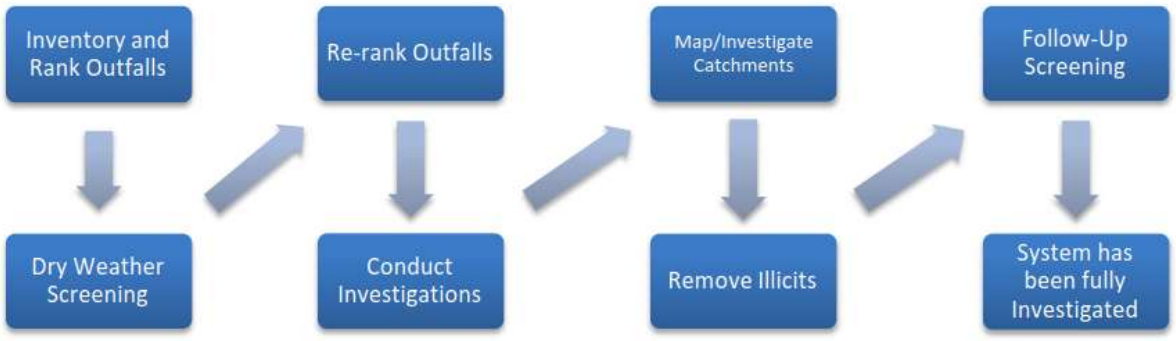
The purpose of this plan is to document the Town's IDDE program and to assist field staff and program staff with the proper identification, reporting, and resolution of pollution problems. A locus map with the regulated Urbanized Area shown is provided as **Figure 1-1** at the end of this section.

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

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

The general IDDE investigation procedure framework is shown below:

[3]"Approved TMDLs" are those that have been approved by EPA as of the date of issuance of the 2016 MS4 Permit.



1.6 How to Use this Plan

This plan is intended to be used by Town of Lincoln staff whose job involves frequent field or site visits, as well as staff responsible for administering the MS4 permit. This primarily consists of staff from the Department of Public Works, however may also involve staff from the Health Department. 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 is made available to all employees involved in the IDDE program.

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

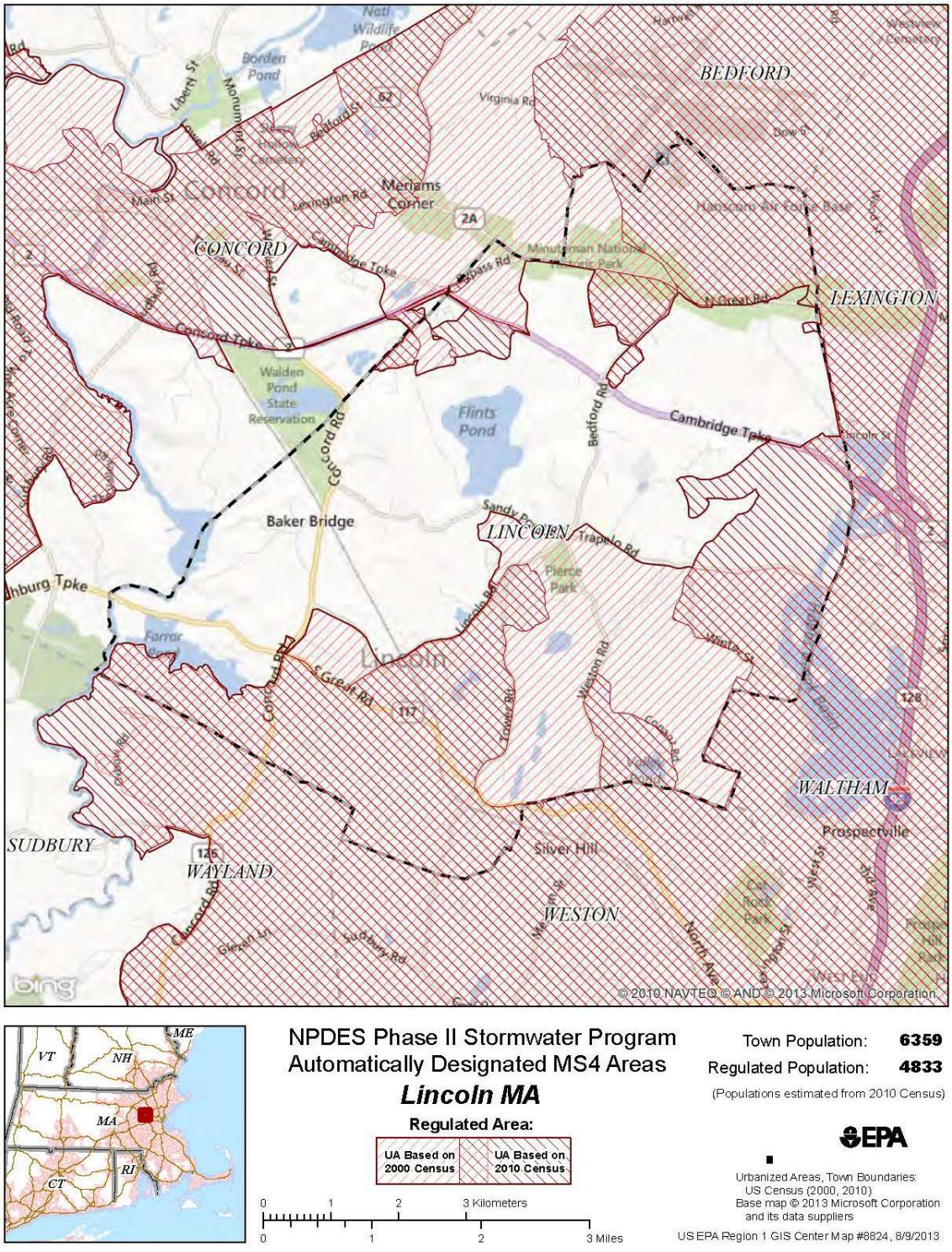


Figure 1-1. Urbanized Area

2 Authority and Statement of IDDE Responsibilities

2.1 Legal Authority

The Town of Lincoln has adopted an Illicit Discharge and Stormwater Management General Bylaw (Adopted May 15, 2021) that addresses illicit discharges into the MS4 as required under the 2016 MS4 Permit. A copy of the bylaw is provided in the Stormwater Management Program (SWMP) Plan. This bylaw provides the Town of Lincoln with adequate legal authority to:

- Prohibit illicit discharges and unauthorized discharges to the MS4;
- Investigate suspected illicit discharges;
- Require the removal of all such illicit connections;
- Eliminate illicit discharges, including discharges from properties not owned by or controlled by the MS4 that discharge into the MS4 system; and
- Implement appropriate enforcement procedures and actions.

2.2 Statement of Responsibilities

The Department of Public Works (DPW) and the Health Department (HD) are responsible for implementing the IDDE program. IDDE Program Responsibilities include:

- Drainage system mapping (DPW);
- Determining and inspecting key junction manholes (DPW & HD);
- Catchment delineation and prioritization for field screening (DPW & HD);
- Dry and wet weather outfall investigations where required (DPW & HD);
- Performing systematic catchment investigations (DPW & HD);
- Investigating and eliminating IDDE sources (DPW & HD);
- Enforcing IDDE ordinance requirements (DPW & HD);
- Tracking illicit discharge connections and removals for annual reporting (DPW & HD);
- Incorporating IDDE into public education efforts (DPW, HD, Planning Board); 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 Lincoln's stormwater infrastructure mapping is provided in **Appendix A** along with a copy of the map. The Town of Lincoln reports 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;
- Water bodies 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);
- Pipes;
- 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 Lincoln's population relies on septic systems for wastewater management, and thus sanitary system and combined sewer system mapping components do 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 Lincoln'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;
- 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 Lincoln'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 are 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.

Lincoln's entire population relies on septic systems for wastewater management, and thus SSO considerations do not apply to the Town's program.

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[4] and interconnections[5] 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 are 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 Town completed an initial outfall and interconnection inventory and priority ranking to assess illicit discharge potential based on existing information. The inventory is periodically updated to include data collected in connection with dry weather screening and other relevant inspections. 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
    - Ammonia ≥ 0.5 mg/L, surfactants ≥ 0.25 mg/L, and detectable levels of chlorine.

[4] **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.

[5] **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.

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 $\geq$ 0.5 mg/l; surfactants greater $\geq$ 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 B** 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 are 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 C**. Screening procedures should be implemented starting with High Priority outfalls, followed by Low Priority outfalls, based on the initial priority rankings provided in **Appendix D**. 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 use precipitation data sources that include the following:

1. Weather Underground station in Lincoln, MA
   https://www.wunderground.com/weather/us/ma/lincoln

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
Turbidity	Cloudy	Sanitary wastewater, concrete or stone operations, fertilizer facilities, automotive dealers
	Opaque	Food processors, lumber mills, metal operations, pigment plants

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

Parameter	Observations	Interpretation
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 is collected and analyzed for the required permit parameters[6] 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 Lincoln based on the 2016 Integrated List of Waters which must be sampled for select waterbodies. This list requires review and update each time a new list is finalized in Massachusetts. Updates are maintained in **Appendix C** 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 C**. All results are documented in **Appendix G**.

[6] 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).

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[7]: See Table 6-3	EPA certified laboratory procedure (40 CFR § 136) See Table 6-3	NA

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

Sample Parameter	Impairment	Impaired Water	Method
BOD5	• DO	• Shawsheen River	Laboratory Analysis: 300
Chloride	• Chloride	• Cambridge Reservoir • Cambridge Reservoir, Upper Basin • Hobbs Brook • Unnamed Tributary	Field Meter or Laboratory Analysis: 365.1; 365.2; 365.3

[7]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 (continued). Additional Sampling Parameters for Discharges to Impaired Waters

Sample Parameter	Impairment	Impaired Water	Method
Dissolved Oxygen	• DO	• Shawsheen River	Field Meter or Laboratory Analysis: 365.1; 365.2; 365.3
Fecal Coliform	• Fecal Coliform	• Elm Brook • Shawsheen River	Laboratory Analysis: 1680; 1681
Phosphorus	• Phosphorus	• Charles River Watershed	Laboratory Analysis: 365.1; 365.2; 365.3; SM 4500-P-E
TSS	• Turbidity	• Cambridge Reservoir, Upper Basin • Elm Brook	Field Meter or Laboratory Analysis: 160.2; 180.1
Turbidity	• Turbidity	• Cambridge Reservoir, Upper Basin • Elm Brook	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 C** 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

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

Equipment	Use/Notes
Water Quality Sonde	If needed, for sampling conductivity, temperature, pH
Water Quality Meter	Hand held meter, if available, for testing for various water quality parameters such as ammonia, surfactants and chlorine
Test Kits	Have extra kits on hand to sample more outfalls than are anticipated to be screened in a single day
Label Tape	For labeling sample containers
Sample Containers	Make sure all sample containers are clean. Keep extra sample containers on hand at all times. Make sure there are proper sample containers for what is being sampled for (i.e., bacteria 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 are documented in **Appendix G**.

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	>83oF

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

Parameter	Benchmark
Indicator Bacteria[8]: *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
Pollutants of Concern	>Applicable water quality criteria

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 Illicit Discharge Source Investigation SOP in **Appendix D**.

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 Lincoln periodically updates and re-prioritizes outfall and interconnection rankings based on information gathered during dry weather outfall screening as additional data becomes available. 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 are 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 are documented in **Appendix G**.

[8] 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 is 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/structures 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 or 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 are inventoried by 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, field crews systematically inspect key junction manholes for evidence of illicit discharges during dry weather. A stormwater key junction manhole screening standard operating procedure (SOP) and checklist is included in **Appendix E**. 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. All results are documented in **Appendix G**.

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 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 E**. All results are documented in **Appendix G**.

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).

Lincoln has never had a sanitary sewer system and has not had any wide-spread code-required septic system upgrades required at property transfers or history of multiple Board

of Health actions addressing widespread septic system failures. Based on this information, no SVFs were identified and wet weather sampling is not currently required. Should SVFs be identified in the future, wet weather sampling will be performed in accordance with the SOP included in **Appendix F**.

The SVF inventory (**Appendix B**) 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 F**, 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 Lincoln's MS4. All results will be documented in **Appendix G**.

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 G**.

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 notifies 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 D**). 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 promotes 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 Lincoln exercises its authority as necessary to require its removal. The Department of Public Works and Board of Health collects 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. Lincoln has established legal authority for enforcement of IDDE requirements as outlined in the Stormwater Management General Bylaw adopted on May 15, 2021 and provided in the SWMP Plan. 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 for each location, with overall actions recorded in the Illicit Discharge Log, both provided in **Appendix G**. The illicit discharge must 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 is made available to all employees involved in the IDDE program. This training at a minimum includes 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 are maintained in the IDDE Employee Training Record provided in **Appendix H**. The frequency and type of training are 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:

Activity	Timeline
Sanitary Sewer Overflow Inventory	Complete by June 30, 2019 (N/A – no sewer)
Initial Catchment Ranking	Complete by June 30, 2019
Mapping:	
• Outfalls and Interconnections	Complete by June 30, 2020
• Initial Catchment Delineation	Complete by June 30, 2020
• Remaining Mapping	Complete by June 30, 2028
Dry Weather Outfall Inspections	Complete by June 30, 2021
Catchment Investigations:	
• Problem Catchments	Begin by July 1, 2020 Complete by June 30, 2025
• All w/Potential Illicit Discharges	Complete by June 30, 2025
• 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 (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 is evaluated on an annual basis. The evaluation is documented in the annual report and includes 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 is measured by the IDDE activities completed within the required permit timeline.

Appendix A

Stormwater System Mapping

Status of Stormwater System Mapping

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
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	Complete (updates ongoing)
3. Manholes	Complete
4. Catch basins	Complete
5. Refined catchment delineations	Not started
6. Municipal sanitary system	Not applicable
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

Lincoln, MA

Legend

- Outfalls
- Private Outfalls
- Catch Basin
- Drain Manhole
- Inlet
- Building Drain
- Interconnection
- BMPs
- State Manhole
- State Catch Basin
- Town Drainage Pipe
- State Drainage Pipe
- Roads
- Lake, Pond, Reservoir
- Wetland, Marsh, Swamp
- Stream, Brook

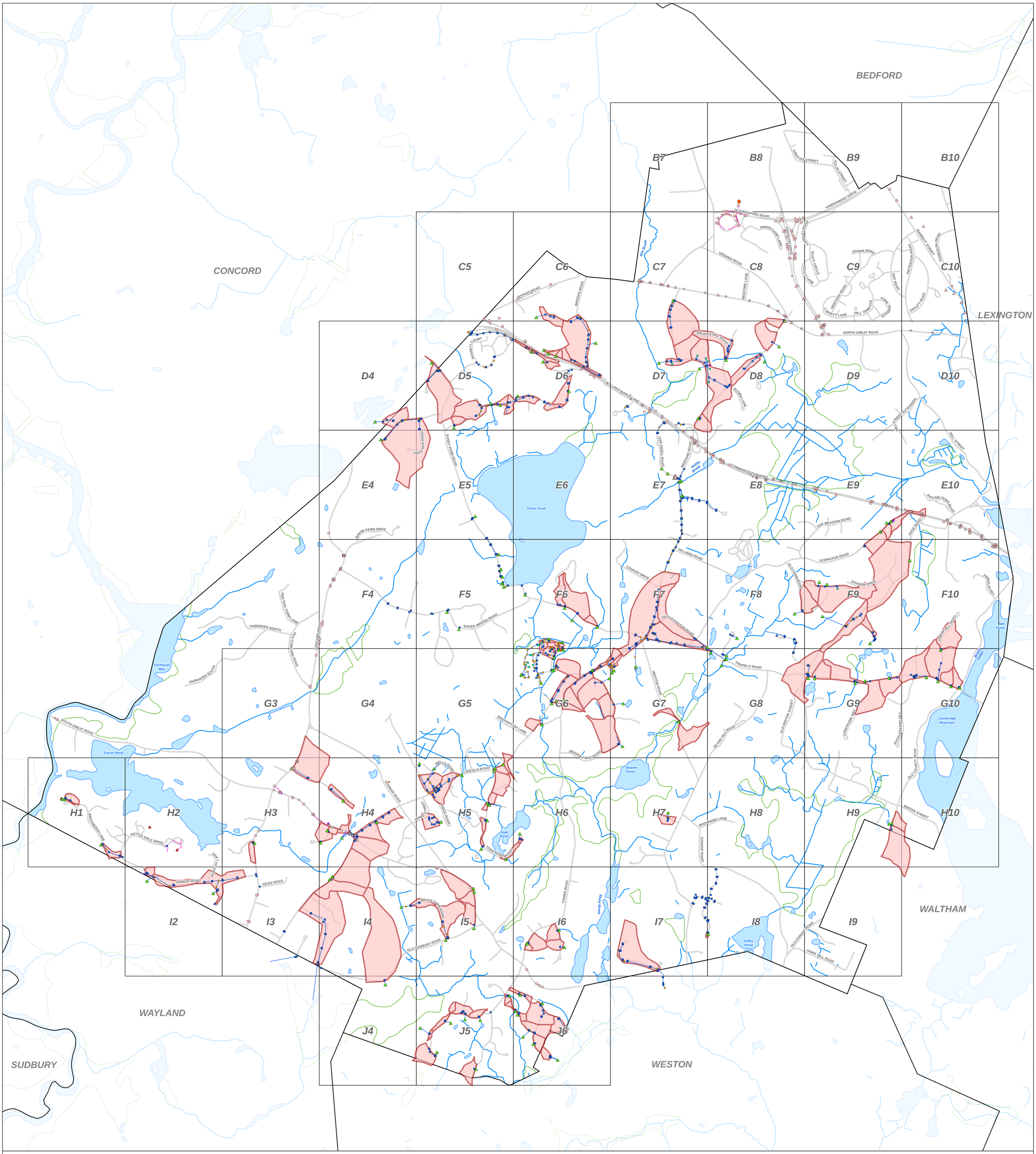
0 0.1 0.2 0.3 0.4

Miles

Comprehensive Environmental Incorporated

Data Sources: CEI, MassGIS, Town of Lincoln

5/9/2025



Legend

- Outfalls
- Private Outfalls
- Catch Basin
- Drain Manhole
- Inlet
- Building Drain
- Interconnection
- BMPs
- State Manhole
- State Catch Basin
- Town Drainage Pipe
- State Drainage Pipe
- Catchments
- Roads
- Lake, Pond, Reservoir
- Wetland, Marsh, Swamp
- Stream, Brook

0 0.1 0.2 0.3 0.4
Miles

Stormwater Master Tile Map
Lincoln, MA

Comprehensive Environmental Incorporated

Data Sources: CEI, MassGIS, Town of Lincoln

5/29/2025

N

BEDFORD

CONCORD

WALTHAM

WESTON

WAYLAND

B7 B8 B9 B10

C5 C6 C7 C8 C9 C10

D4 D5 D6 D7 D8 D9 D10

E4 E5 E6 E7 E8 E9 E10

F4 F5 F6 F7 F8 F9 F10

G3 G4 G5 G6 G7 G8 G9 G10

H1 H2 H3 H4 H5 H6 H7 H8 H9 H10

I2 I3 I4 I5 I6 I7 I8 I9

J4 J5 J6

VIRGINIA ROAD
OLD BEDFORD ROAD
HANSCOM DRIVE
ENT ROAD
NORTH GREAT ROAD
CAMBRIDGE TURNPIKE
MILL STREET
LEXINGTON ROAD
CONCORD ROAD
PAGE ROAD
SOUTH GREAT ROAD
CODMAN ROAD
WINTER STREET
FARRAR ROAD
WESTON ROAD
CONANT ROAD
OLD SUDBURY ROAD

0 0.25 0.5 0.75 1 Miles

Legend

Outfall Prioritization
- Top Priority
- 3
- 2
- 1
- Low Priority
- Excluded

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

Stormwater Map with Prioritized Outfalls and Areas

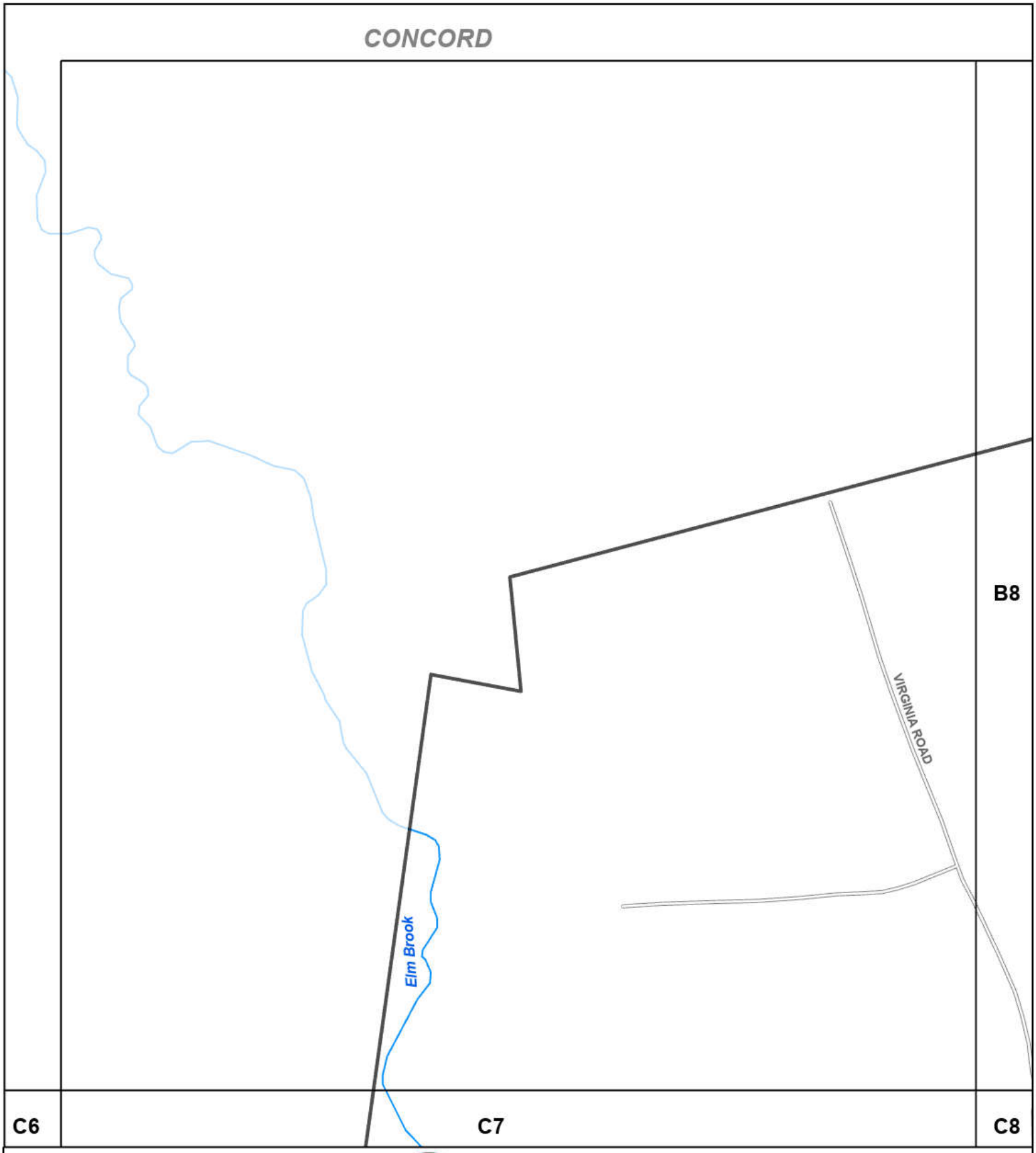
Lincoln, MA

Comprehensive Environmental Incorporated

Note: Higher priority outfalls are ranked 1-3 with 3 being the highest priority

Data Sources: MassGIS, Town of Lincoln, CEI

8/19/2025



- Outfalls
- Private Outfalls
- Catch Basin
- Channel
- DMH
- Interconnection
- Building Drain
- WQU
- State Outfall
- State Manhole
- State Catch Basin
- Town Drainage Pipe
- State Drainage Pipe
- Culvert
- BMP
- Lake, Pond, Reservoir
- Wetland, Marsh, Swamp
- Stream, Brook
- Catchment
- Non-Urban Area

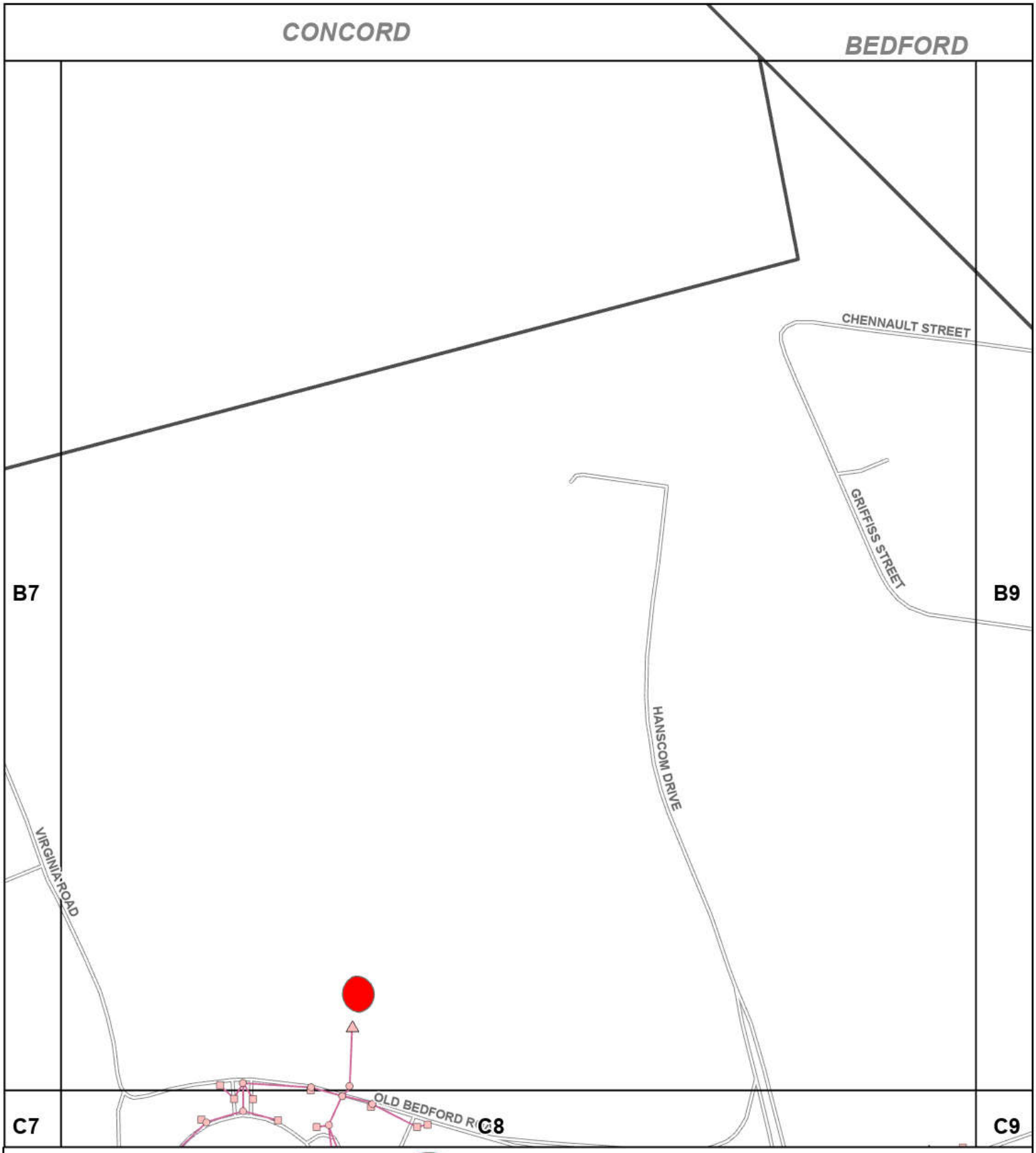
SHEET
B7

0 250 Feet

Stormwater Infrastructure Tile Map Lincoln, MA

Comprehensive Environmental Incorporated

5/29/2025



Outfalls
Private Outfalls
Catch Basin
Channel
DMH
Interconnection
Building Drain

WQU
State Outfall
State Manhole
State Catch Basin
Town Drainage Pipe
State Drainage Pipe
Culvert

BMP
Lake, Pond, Reservoir
Wetland, Marsh, Swamp
Stream, Brook
Catchment
Non-Urban Area

SHEET
B8

0 250
Feet

Stormwater Infrastructure Tile Map Lincoln, MA

Comprehensive Environmental Incorporated

5/29/2025

- Outfalls
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- Channel
- DMH
- Interconnection
- Building Drain
- WQU
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- State Catch Basin
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- State Drainage Pipe
- Culvert
- BMP
- Lake, Pond, Reservoir
- Wetland, Marsh, Swamp
- Stream, Brook
- Catchment
- Non-Urban Area

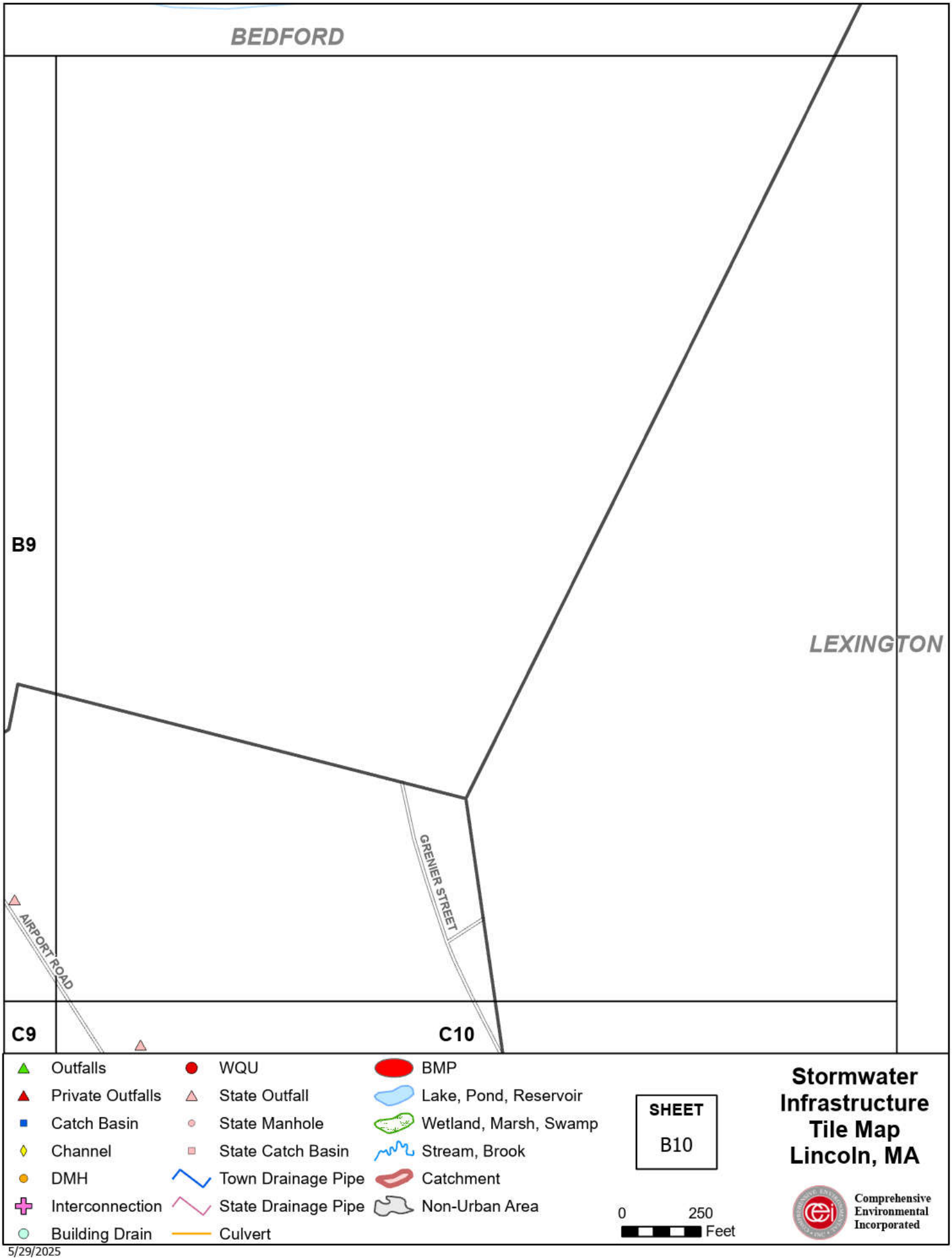
SHEET
B9

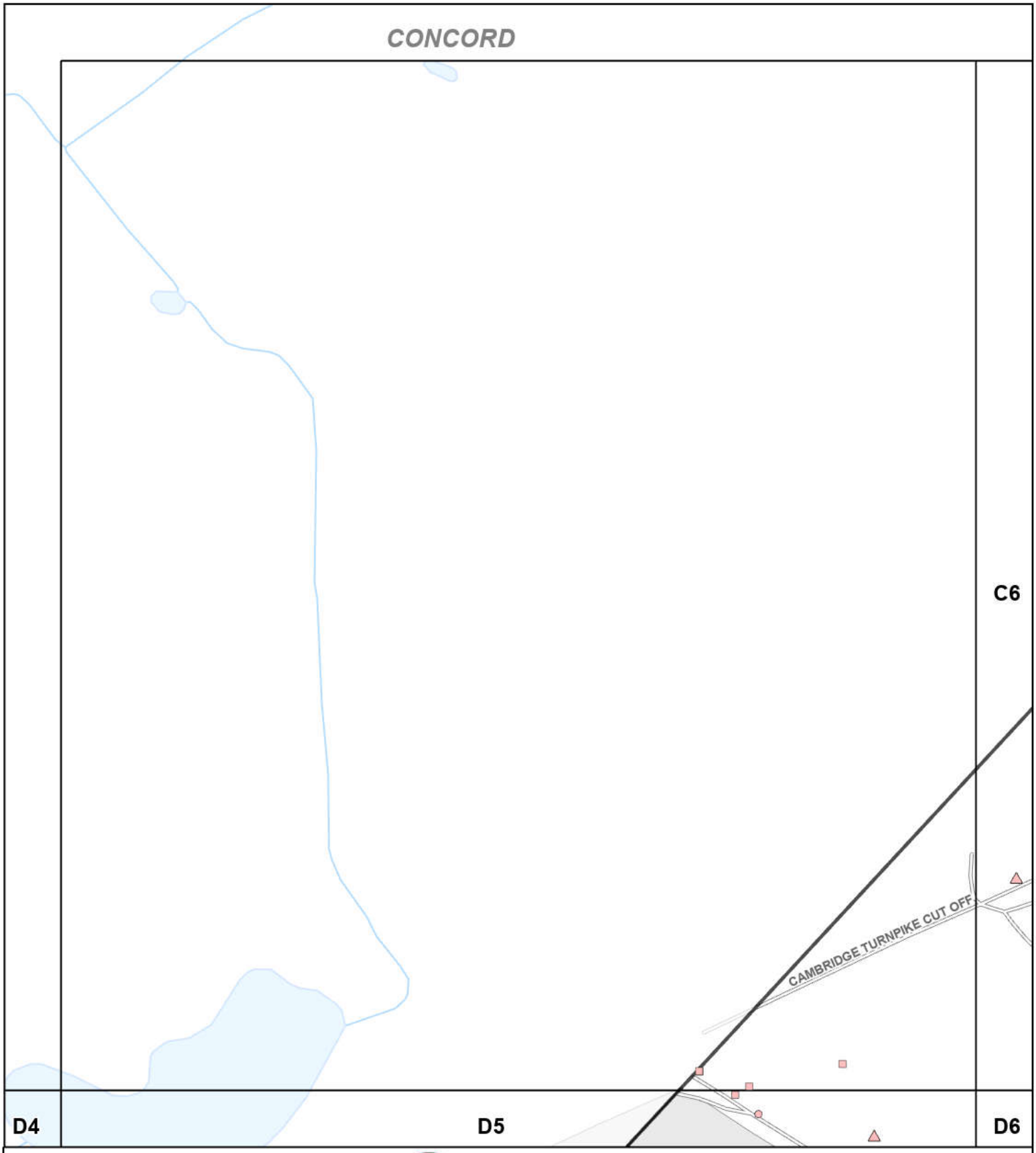
0 250 Feet

Stormwater Infrastructure Tile Map Lincoln, MA

Comprehensive Environmental Incorporated

5/29/2025


BEDFORD
B9
LEXINGTON
GRENIER STREET
AIRPORT ROAD
C9
C10
Outfalls
Private Outfalls
Catch Basin
Channel
DMH
Interconnection
Building Drain
WQU
State Outfall
State Manhole
State Catch Basin
Town Drainage Pipe
State Drainage Pipe
Culvert
BMP
Lake, Pond, Reservoir
Wetland, Marsh, Swamp
Stream, Brook
Catchment
Non-Urban Area
SHEET
B10
0
250
Feet
Stormwater Infrastructure Tile Map Lincoln, MA
Comprehensive Environmental Incorporated
5/29/2025



- Outfalls
- Private Outfalls
- Catch Basin
- Channel
- DMH
- Interconnection
- Building Drain
- WQU
- State Outfall
- State Manhole
- State Catch Basin
- Town Drainage Pipe
- State Drainage Pipe
- Culvert
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- Wetland, Marsh, Swamp
- Stream, Brook
- Catchment
- Non-Urban Area

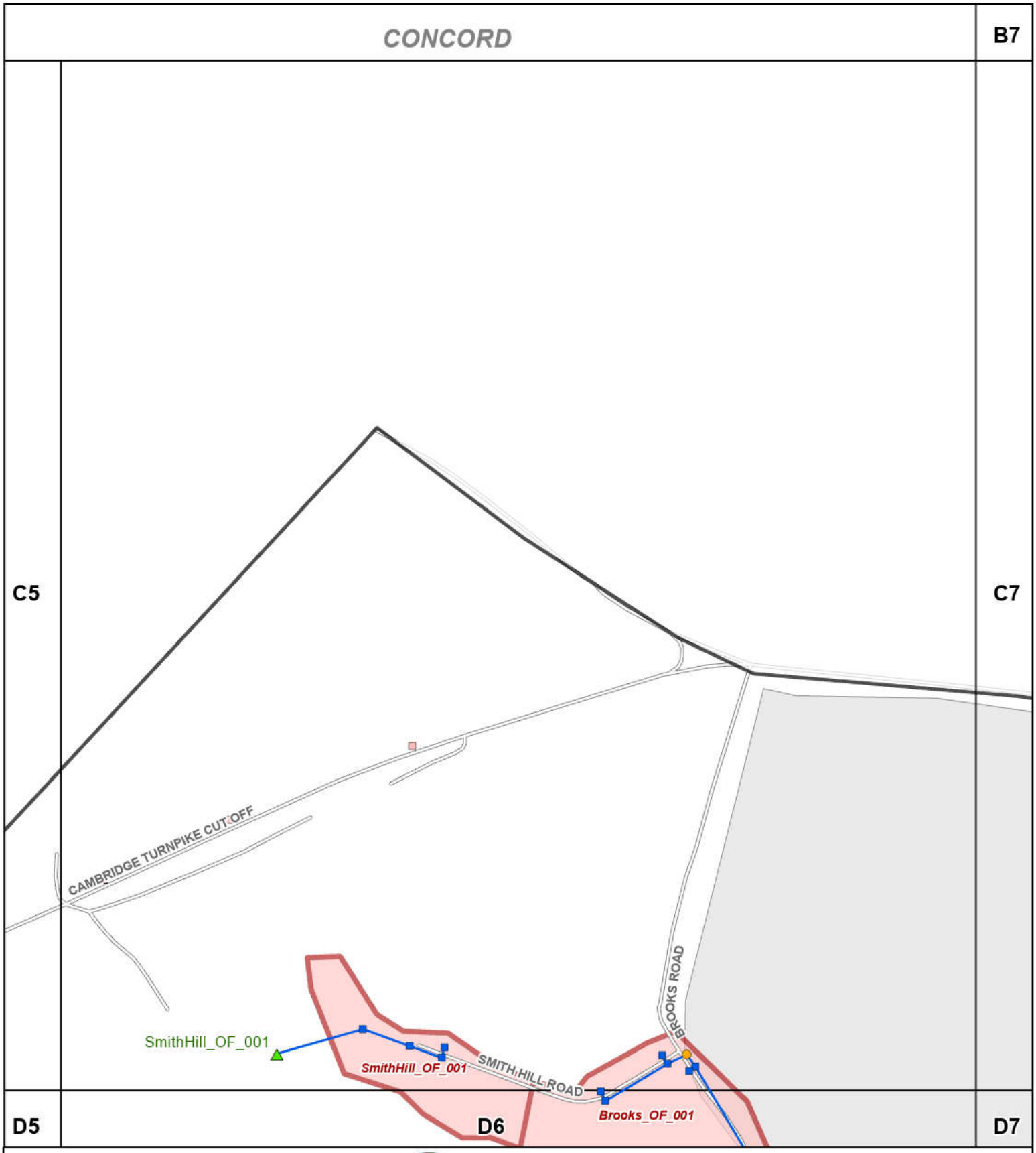
SHEET
C5

0 250 Feet

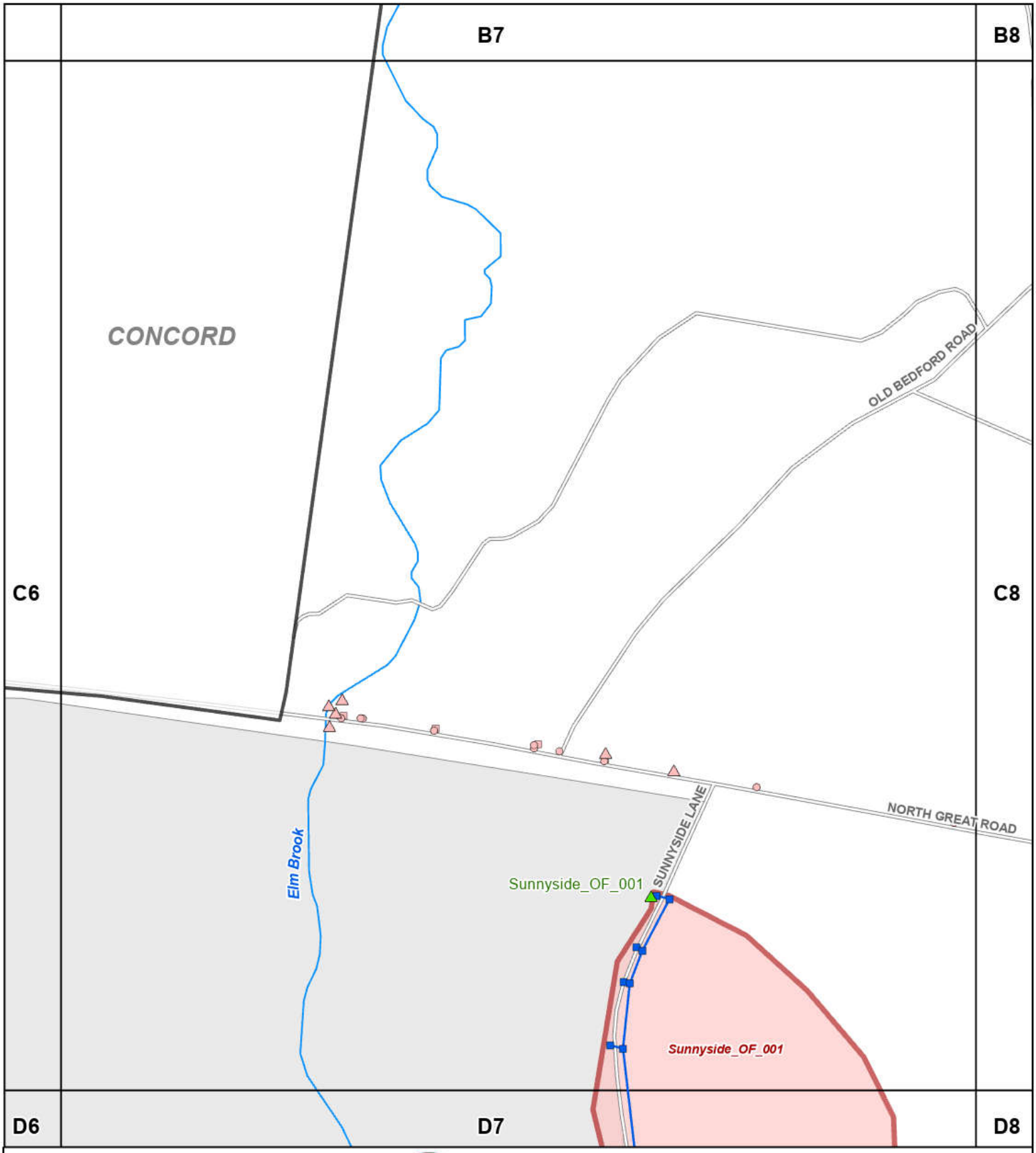
Stormwater Infrastructure Tile Map Lincoln, MA

Comprehensive Environmental Incorporated

5/29/2025


CONCORD
B7
C5
C7
D5
D6
D7
CAMBRIDGE TURNPIKE CUTOFF
SMITH HILL ROAD
BROOKS ROAD
SmithHill_OF_001
SmithHill_OF_001
Brooks_OF_001
Outfalls
Private Outfalls
Catch Basin
Channel
DMH
Interconnection
Building Drain
WQU
State Outfall
State Manhole
State Catch Basin
Town Drainage Pipe
State Drainage Pipe
Culvert
BMP
Lake, Pond, Reservoir
Wetland, Marsh, Swamp
Stream, Brook
Catchment
Non-Urban Area
SHEET
C6
0
250
Feet
Stormwater Infrastructure Tile Map Lincoln, MA
Comprehensive Environmental Incorporated

5/29/2025



Outfalls
Private Outfalls
Catch Basin
Channel
DMH
Interconnection
Building Drain
WQU
State Outfall
State Manhole
State Catch Basin
Town Drainage Pipe
State Drainage Pipe
Culvert
BMP
Lake, Pond, Reservoir
Wetland, Marsh, Swamp
Stream, Brook
Catchment
Non-Urban Area

SHEET
C7

0 250
Feet

Stormwater Infrastructure Tile Map Lincoln, MA

Comprehensive Environmental Incorporated

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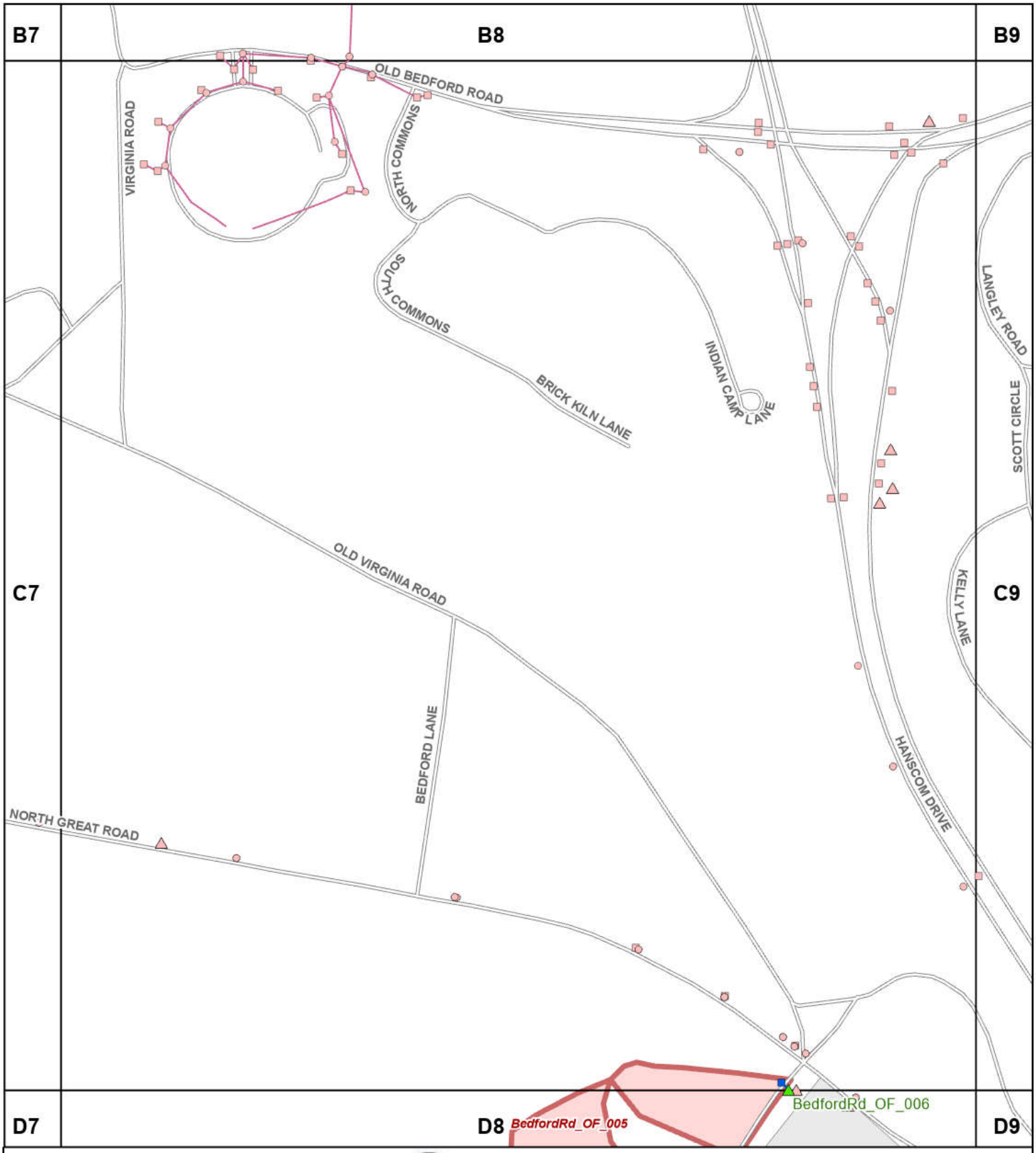

Outfalls
Private Outfalls
Catch Basin
Channel
DMH
Interconnection
Building Drain
WQU
State Outfall
State Manhole
State Catch Basin
Town Drainage Pipe
State Drainage Pipe
Culvert
BMP
Lake, Pond, Reservoir
Wetland, Marsh, Swamp
Stream, Brook
Catchment
Non-Urban Area

SHEET
C8

0 250
Feet

Stormwater Infrastructure Tile Map Lincoln, MA

Comprehensive Environmental Incorporated

5/29/2025

- Outfalls
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- Catch Basin
- Channel
- DMH
- Interconnection
- Building Drain
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- State Manhole
- State Catch Basin
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- State Drainage Pipe
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- Stream, Brook
- Catchment
- Non-Urban Area

SHEET
C9

0 250
Feet

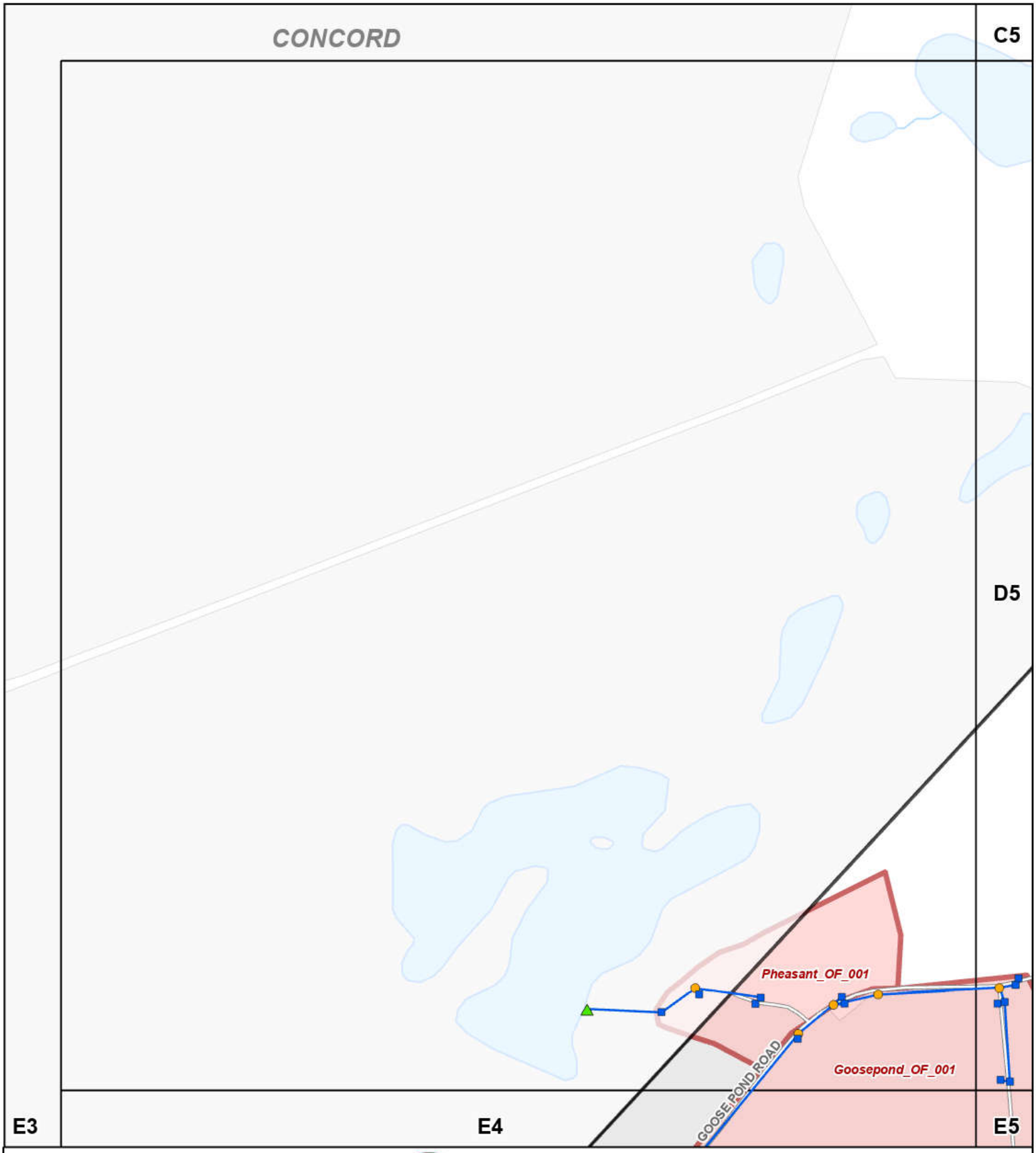
Stormwater Infrastructure Tile Map Lincoln, MA

Comprehensive Environmental Incorporated

5/29/2025


B9
B10
C9
D9
D10
ENT ROAD
AIRPORT ROAD
RANDOLPH ROAD
LEXINGTON
ANDREWS CIRCLE
PATTERSON ROAD
OFFUTT ROAD
Outfalls
Private Outfalls
Catch Basin
Channel
DMH
Interconnection
Building Drain
WQU
State Outfall
State Manhole
State Catch Basin
Town Drainage Pipe
State Drainage Pipe
Culvert
BMP
Lake, Pond, Reservoir
Wetland, Marsh, Swamp
Stream, Brook
Catchment
Non-Urban Area
SHEET
C10
0
250
Feet
Stormwater Infrastructure Tile Map Lincoln, MA
Comprehensive Environmental Incorporated

5/29/2025



- Outfalls
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- Catch Basin
- Channel
- DMH
- Interconnection
- Building Drain
- WQU
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- State Manhole
- State Catch Basin
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- State Drainage Pipe
- Culvert
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- Lake, Pond, Reservoir
- Wetland, Marsh, Swamp
- Stream, Brook
- Catchment
- Non-Urban Area

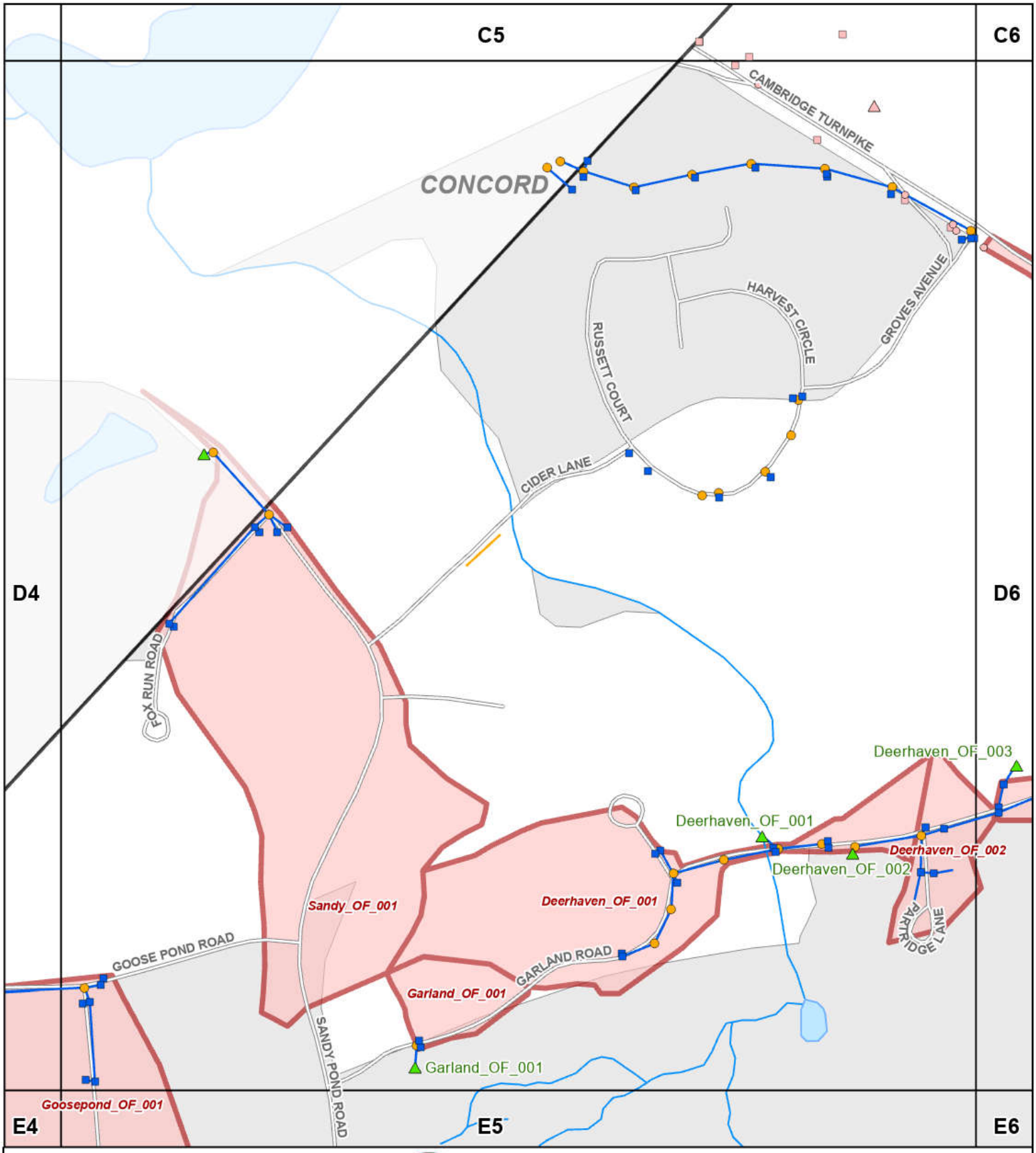
SHEET
D4

0 250
Feet

Stormwater Infrastructure Tile Map Lincoln, MA

Comprehensive Environmental Incorporated

5/29/2025



Outfalls
Private Outfalls
Catch Basin
Channel
DMH
Interconnection
Building Drain
WQU
State Outfall
State Manhole
State Catch Basin
Town Drainage Pipe
State Drainage Pipe
Culvert
BMP
Lake, Pond, Reservoir
Wetland, Marsh, Swamp
Stream, Brook
Catchment
Non-Urban Area

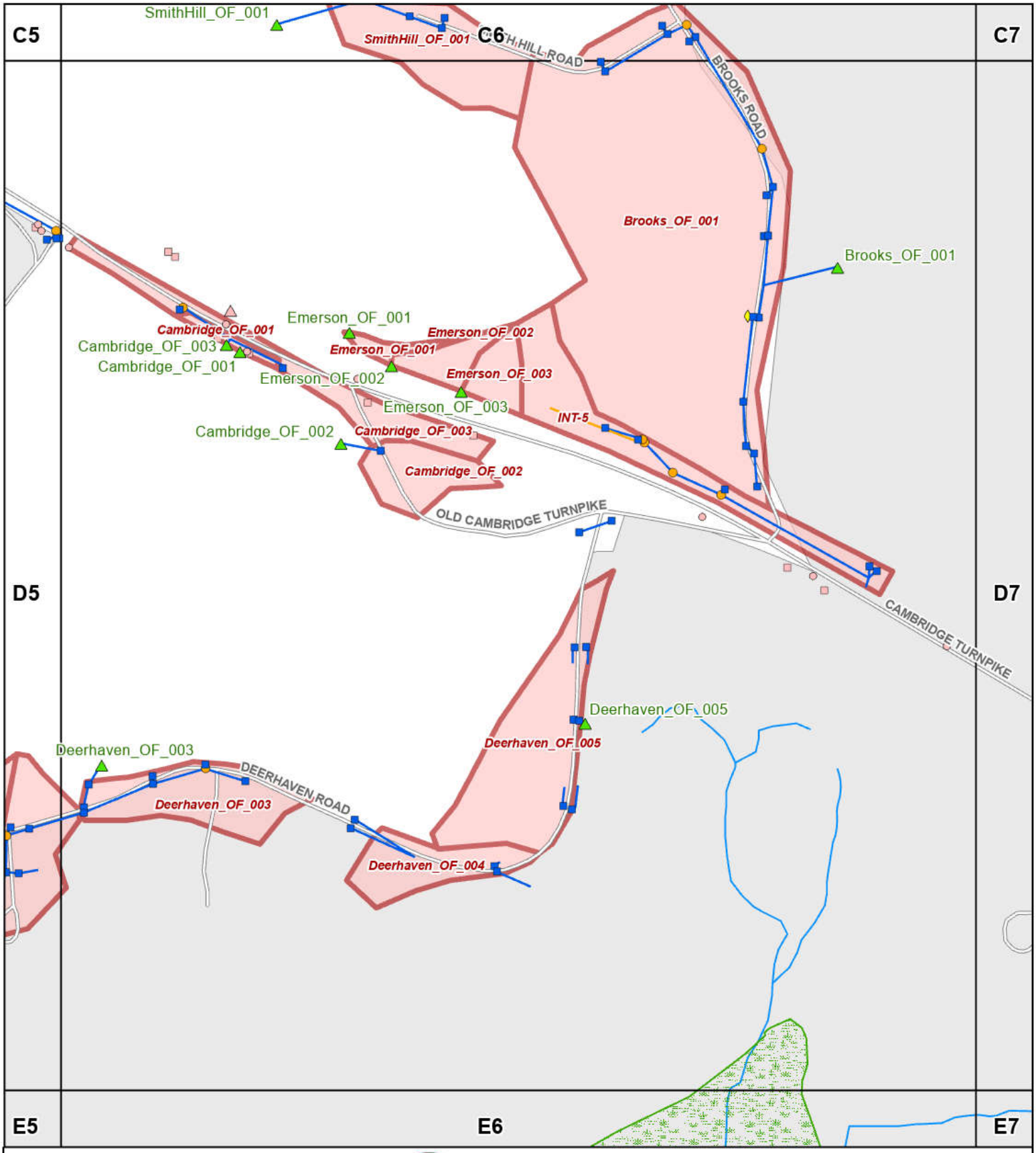
SHEET
D5

0 250
Feet

Stormwater Infrastructure Tile Map Lincoln, MA

Comprehensive Environmental Incorporated

5/29/2025



Outfalls
Private Outfalls
Catch Basin
Channel
DMH
Interconnection
Building Drain
WQU
State Outfall
State Manhole
State Catch Basin
Town Drainage Pipe
State Drainage Pipe
Culvert
BMP
Lake, Pond, Reservoir
Wetland, Marsh, Swamp
Stream, Brook
Catchment
Non-Urban Area

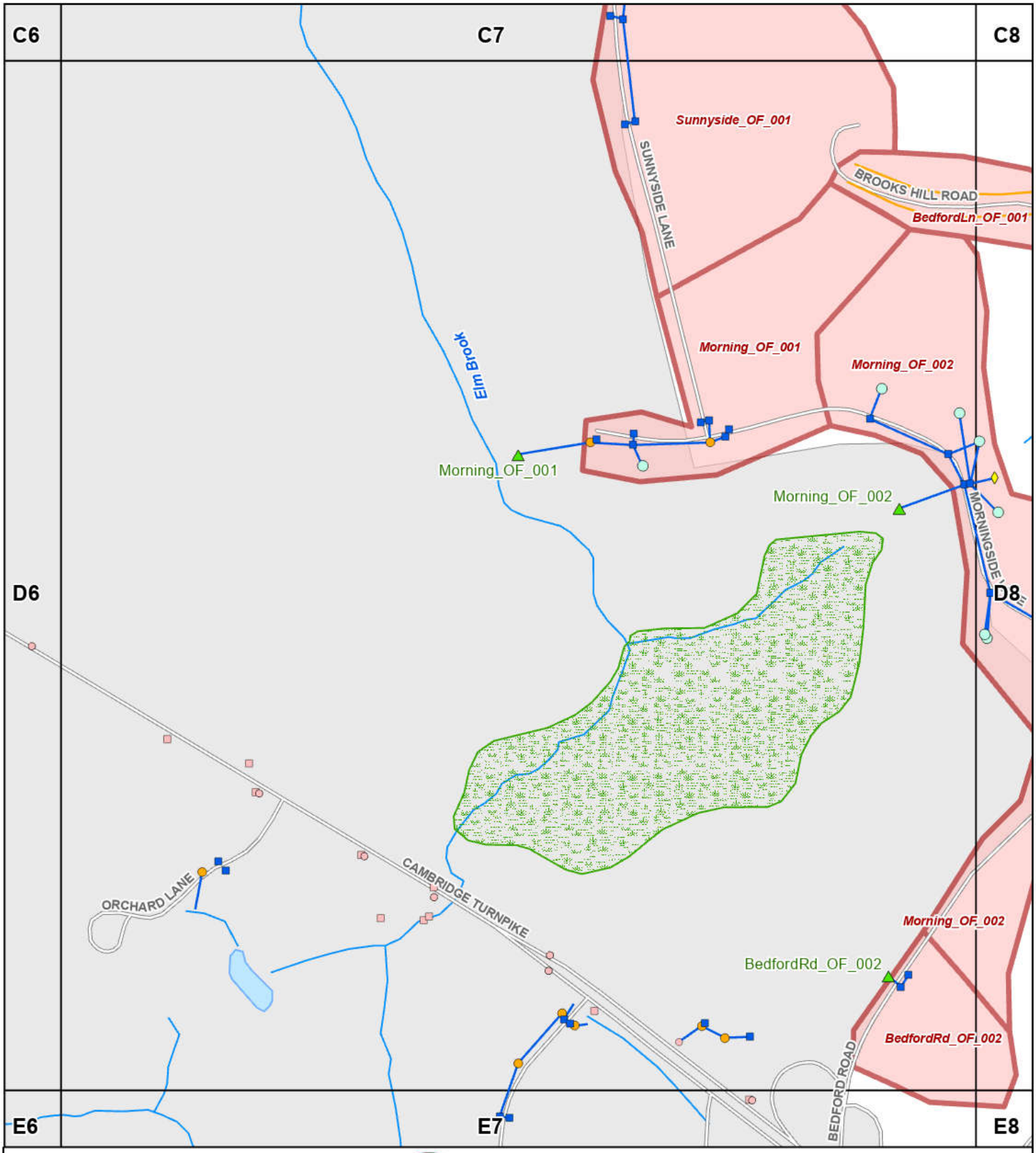
SHEET
D6

0 250
Feet

Stormwater Infrastructure Tile Map Lincoln, MA

Comprehensive Environmental Incorporated

5/29/2025



Outfalls
Private Outfalls
Catch Basin
Channel
DMH
Interconnection
Building Drain
WQU
State Outfall
State Manhole
State Catch Basin
Town Drainage Pipe
State Drainage Pipe
Culvert
BMP
Lake, Pond, Reservoir
Wetland, Marsh, Swamp
Stream, Brook
Catchment
Non-Urban Area

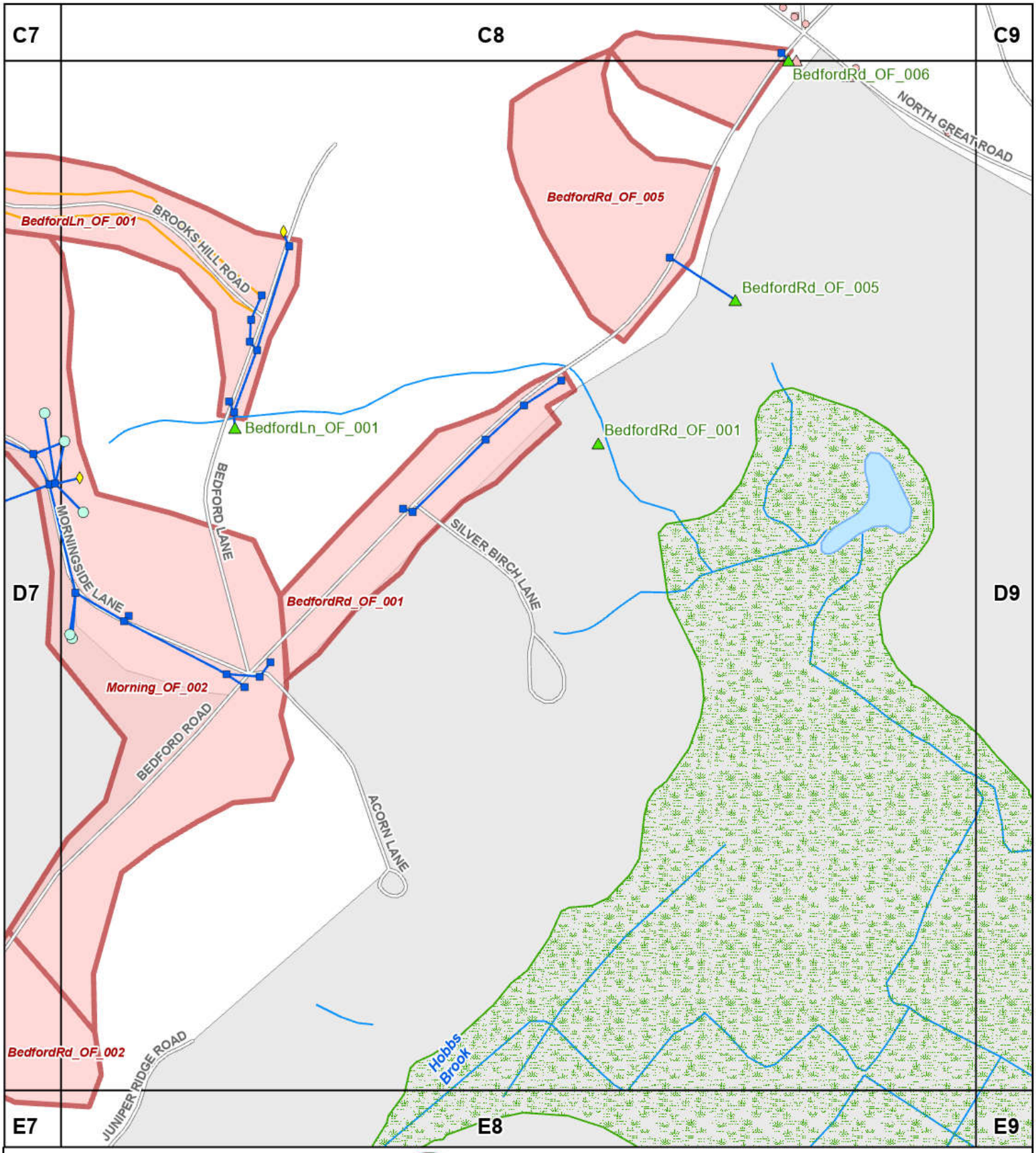
SHEET
D7

0 250
Feet

Stormwater Infrastructure Tile Map Lincoln, MA

Comprehensive Environmental Incorporated

5/29/2025



Outfalls
Private Outfalls
Catch Basin
Channel
DMH
Interconnection
Building Drain
WQU
State Outfall
State Manhole
State Catch Basin
Town Drainage Pipe
State Drainage Pipe
Culvert
BMP
Lake, Pond, Reservoir
Wetland, Marsh, Swamp
Stream, Brook
Catchment
Non-Urban Area

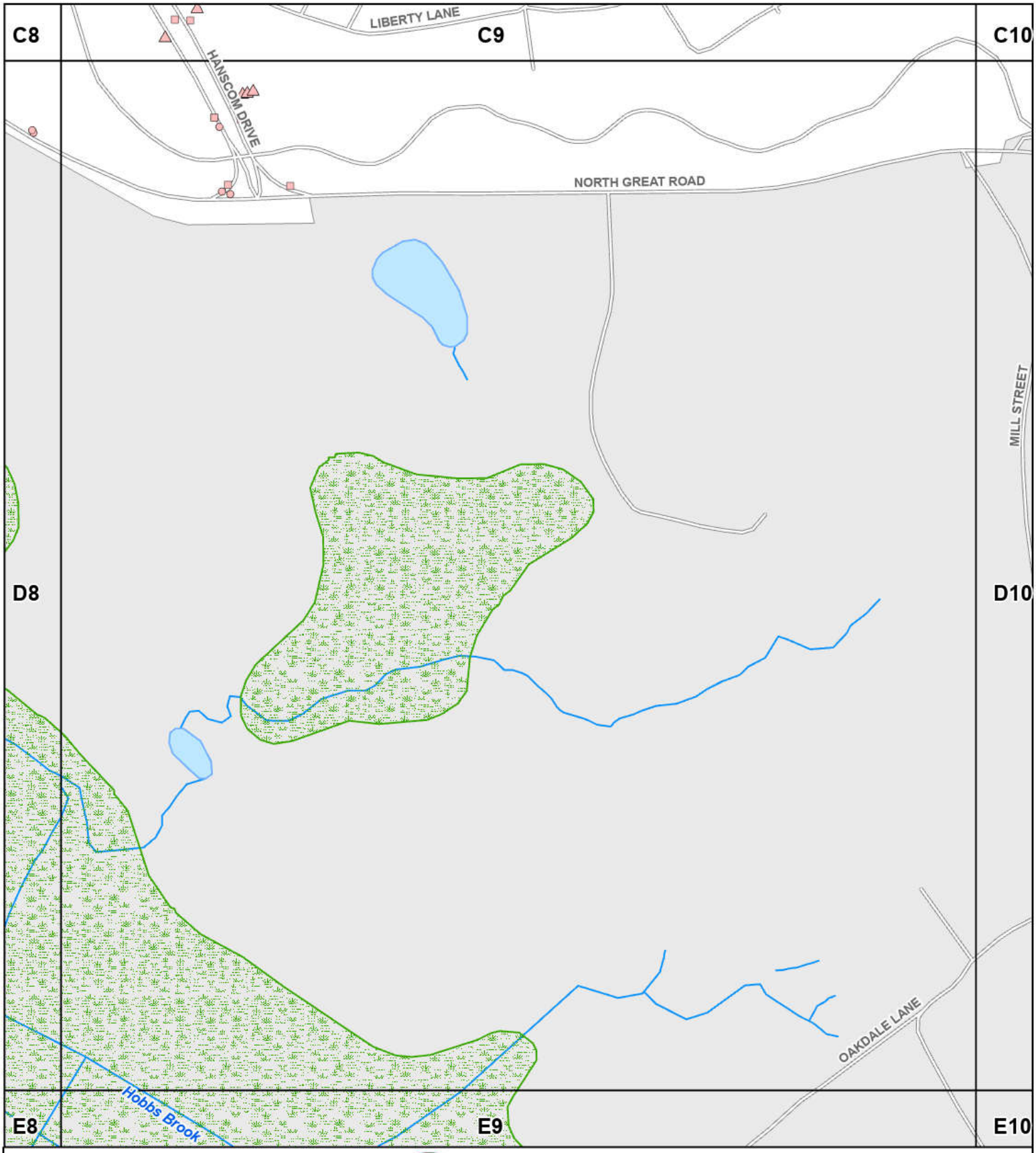
SHEET
D8

0 250
Feet

Stormwater Infrastructure Tile Map Lincoln, MA

Comprehensive Environmental Incorporated

5/29/2025



- Outfalls
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- Building Drain
- WQU
- State Outfall
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- State Catch Basin
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- State Drainage Pipe
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- Stream, Brook
- Catchment
- Non-Urban Area

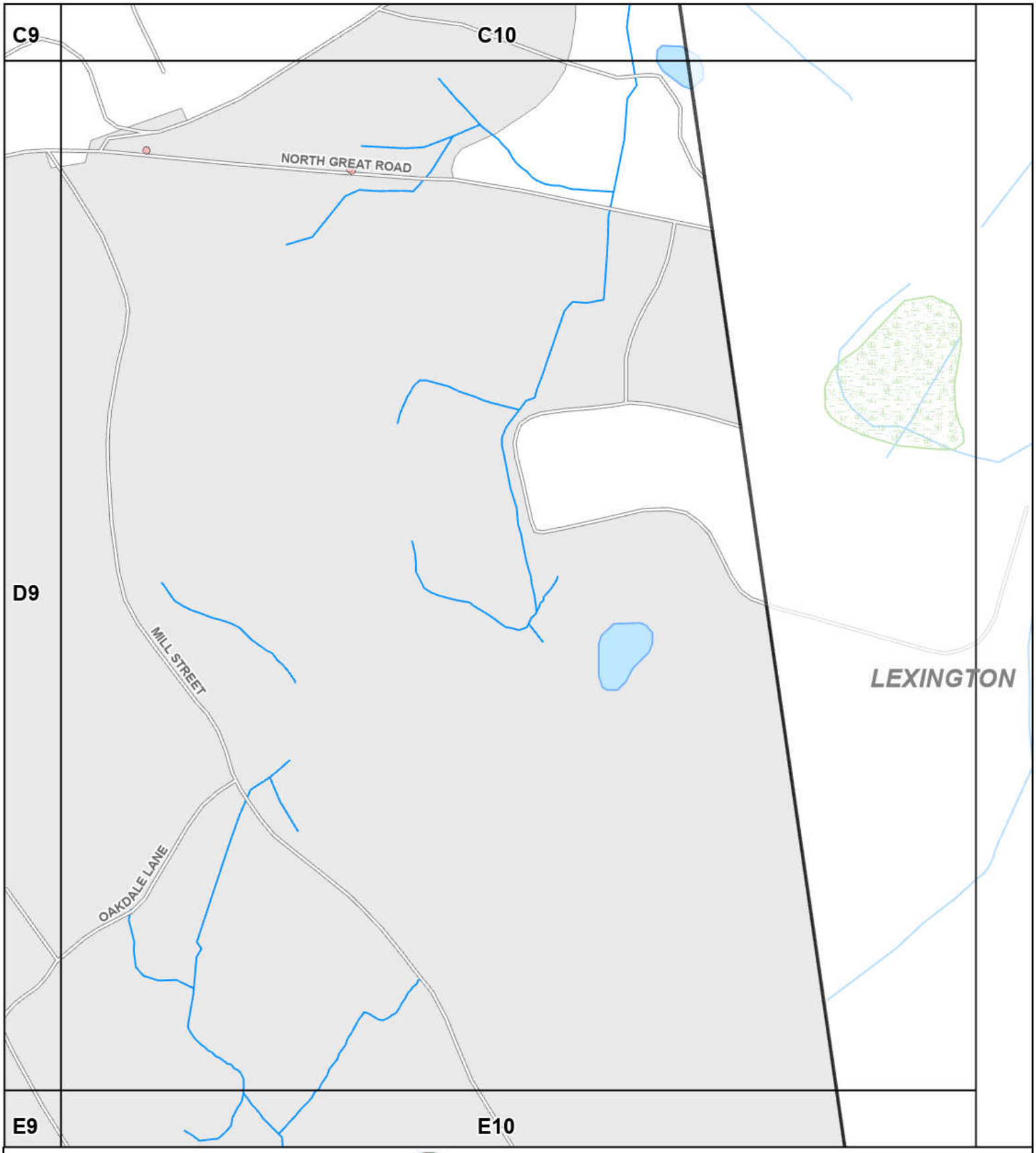
SHEET
D9

0 250
Feet

Stormwater Infrastructure Tile Map Lincoln, MA

Comprehensive Environmental Incorporated

5/29/2025



Outfalls
Private Outfalls
Catch Basin
Channel
DMH
Interconnection
Building Drain
WQU
State Outfall
State Manhole
State Catch Basin
Town Drainage Pipe
State Drainage Pipe
Culvert
BMP
Lake, Pond, Reservoir
Wetland, Marsh, Swamp
Stream, Brook
Catchment
Non-Urban Area

SHEET
D10

0 250
Feet

Stormwater Infrastructure Tile Map Lincoln, MA

Comprehensive Environmental Incorporated

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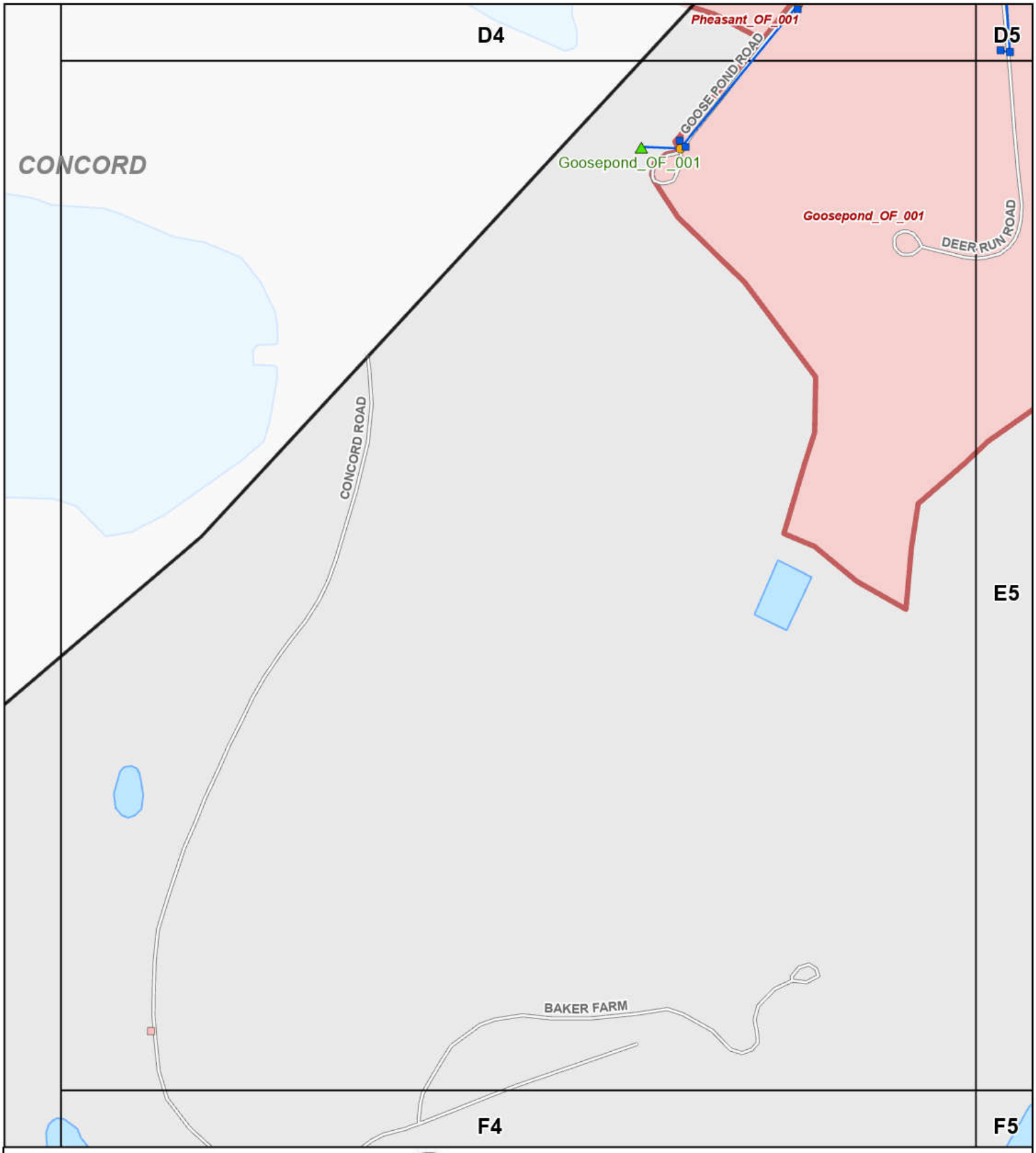


Outfalls
Private Outfalls
Catch Basin
Channel
DMH
Interconnection
Building Drain
WQU
State Outfall
State Manhole
State Catch Basin
Town Drainage Pipe
State Drainage Pipe
Culvert
BMP
Lake, Pond, Reservoir
Wetland, Marsh, Swamp
Stream, Brook
Catchment
Non-Urban Area

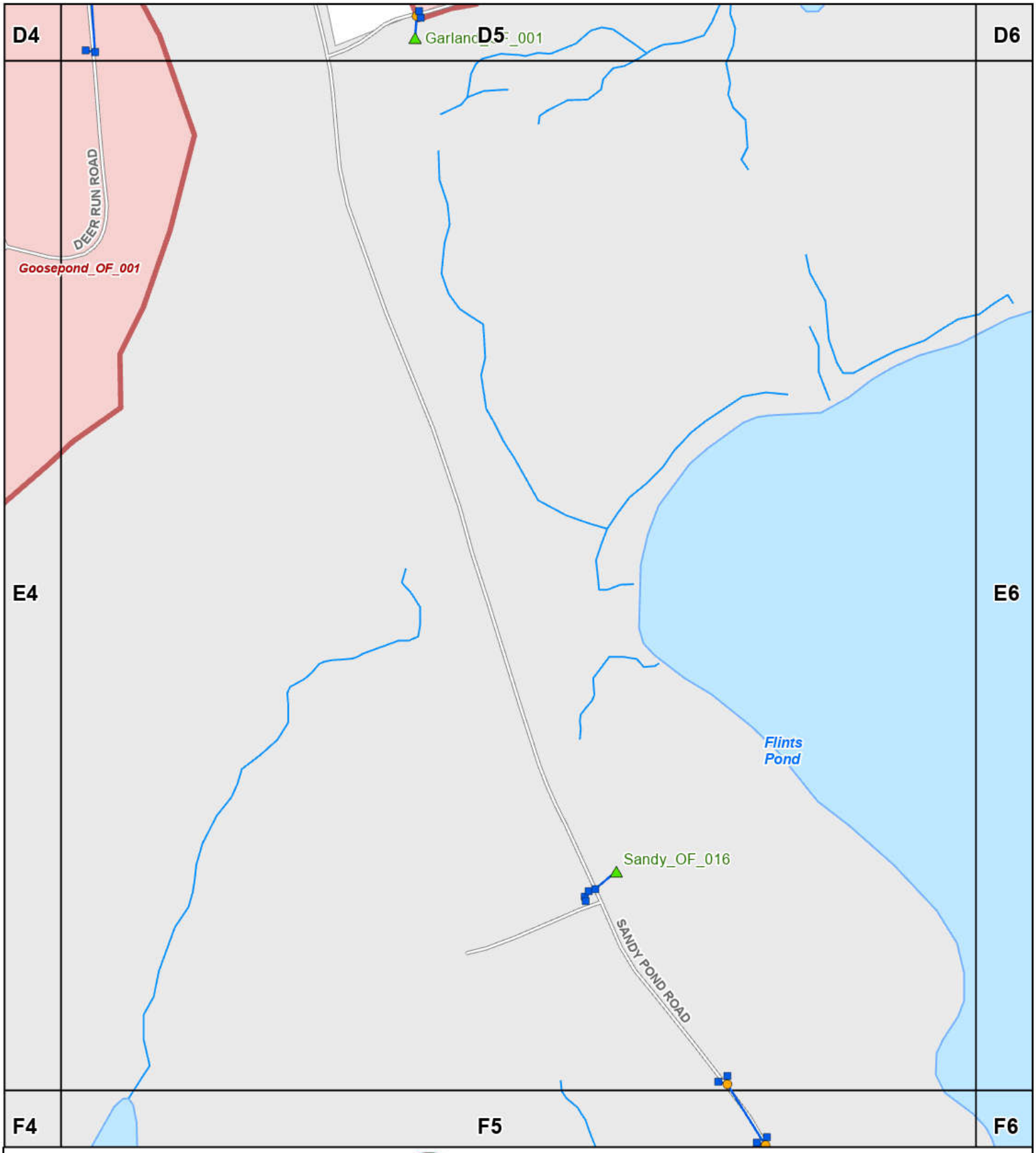
SHEET
E4

0 250
Feet

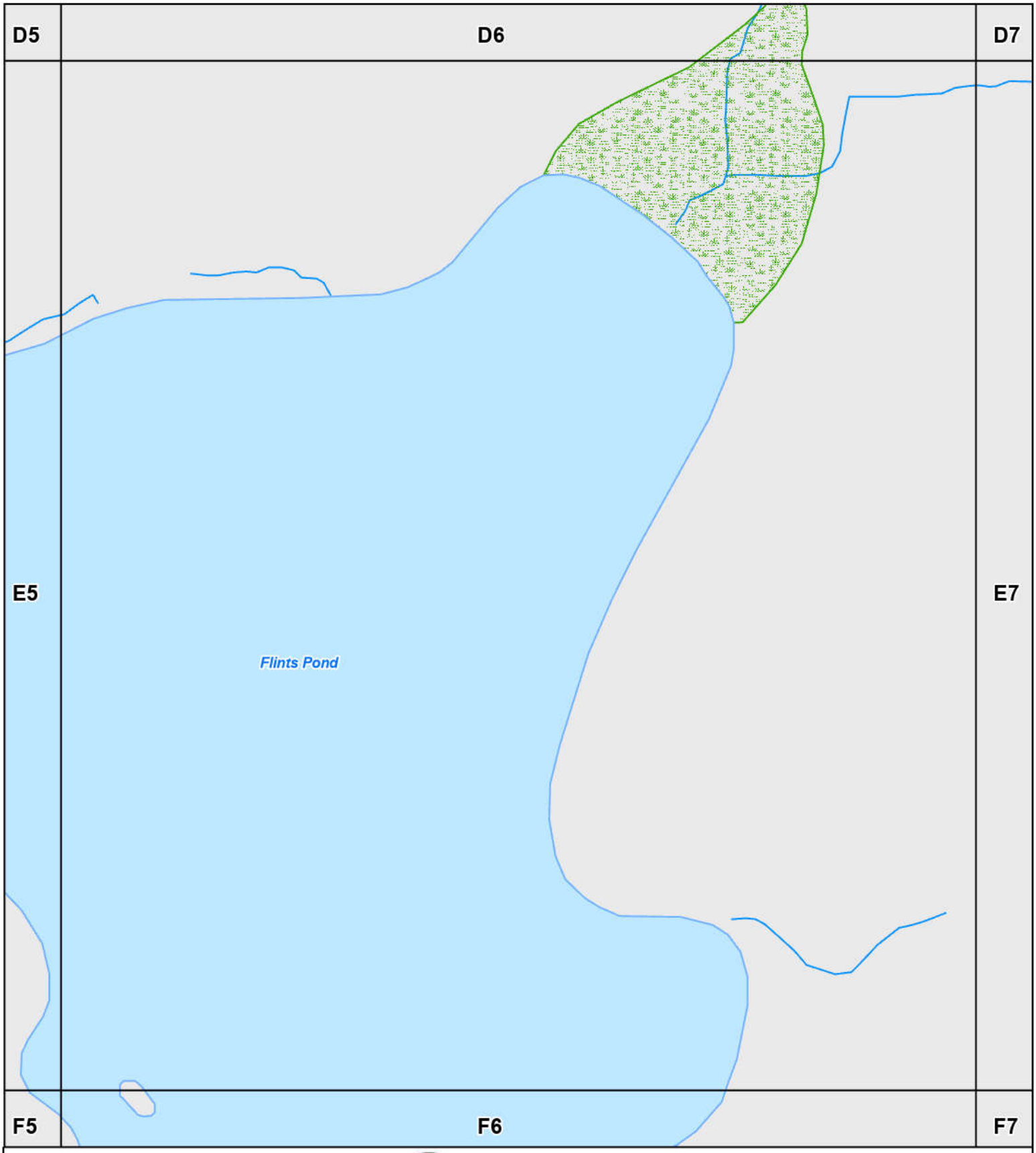
Stormwater Infrastructure Tile Map Lincoln, MA

Comprehensive Environmental Incorporated

5/29/2025


D4
D5
D6
E4
E6
F4
F5
F6
DEER RUN ROAD
Goosepond_OF_001
Garland
_001
Flints
Pond
Sandy_OF_016
SANDY POND ROAD
Outfalls
Private Outfalls
Catch Basin
Channel
DMH
Interconnection
Building Drain
WQU
State Outfall
State Manhole
State Catch Basin
Town Drainage Pipe
State Drainage Pipe
Culvert
BMP
Lake, Pond, Reservoir
Wetland, Marsh, Swamp
Stream, Brook
Catchment
Non-Urban Area
SHEET
E5
0
250
Feet
Stormwater Infrastructure Tile Map Lincoln, MA
Comprehensive Environmental Incorporated

5/29/2025



- Outfalls
- Private Outfalls
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- Channel
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- Building Drain
- WQU
- State Outfall
- State Manhole
- State Catch Basin
- Town Drainage Pipe
- State Drainage Pipe
- Culvert
- BMP
- Lake, Pond, Reservoir
- Wetland, Marsh, Swamp
- Stream, Brook
- Catchment
- Non-Urban Area

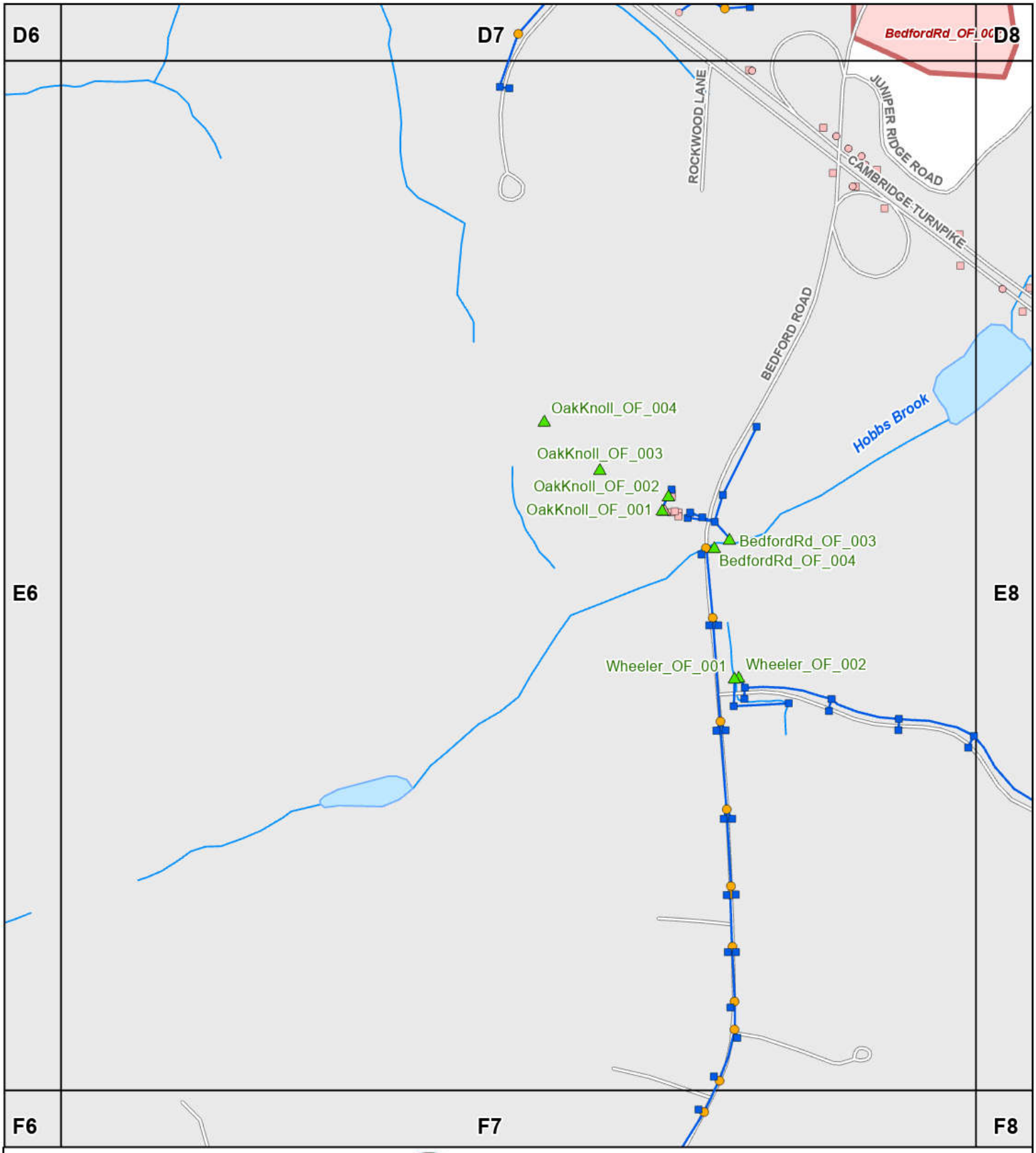
SHEET
E6

0 250
Feet

Stormwater Infrastructure Tile Map Lincoln, MA

Comprehensive Environmental Incorporated

5/29/2025



Outfalls
Private Outfalls
Catch Basin
Channel
DMH
Interconnection
Building Drain
WQU
State Outfall
State Manhole
State Catch Basin
Town Drainage Pipe
State Drainage Pipe
Culvert
BMP
Lake, Pond, Reservoir
Wetland, Marsh, Swamp
Stream, Brook
Catchment
Non-Urban Area

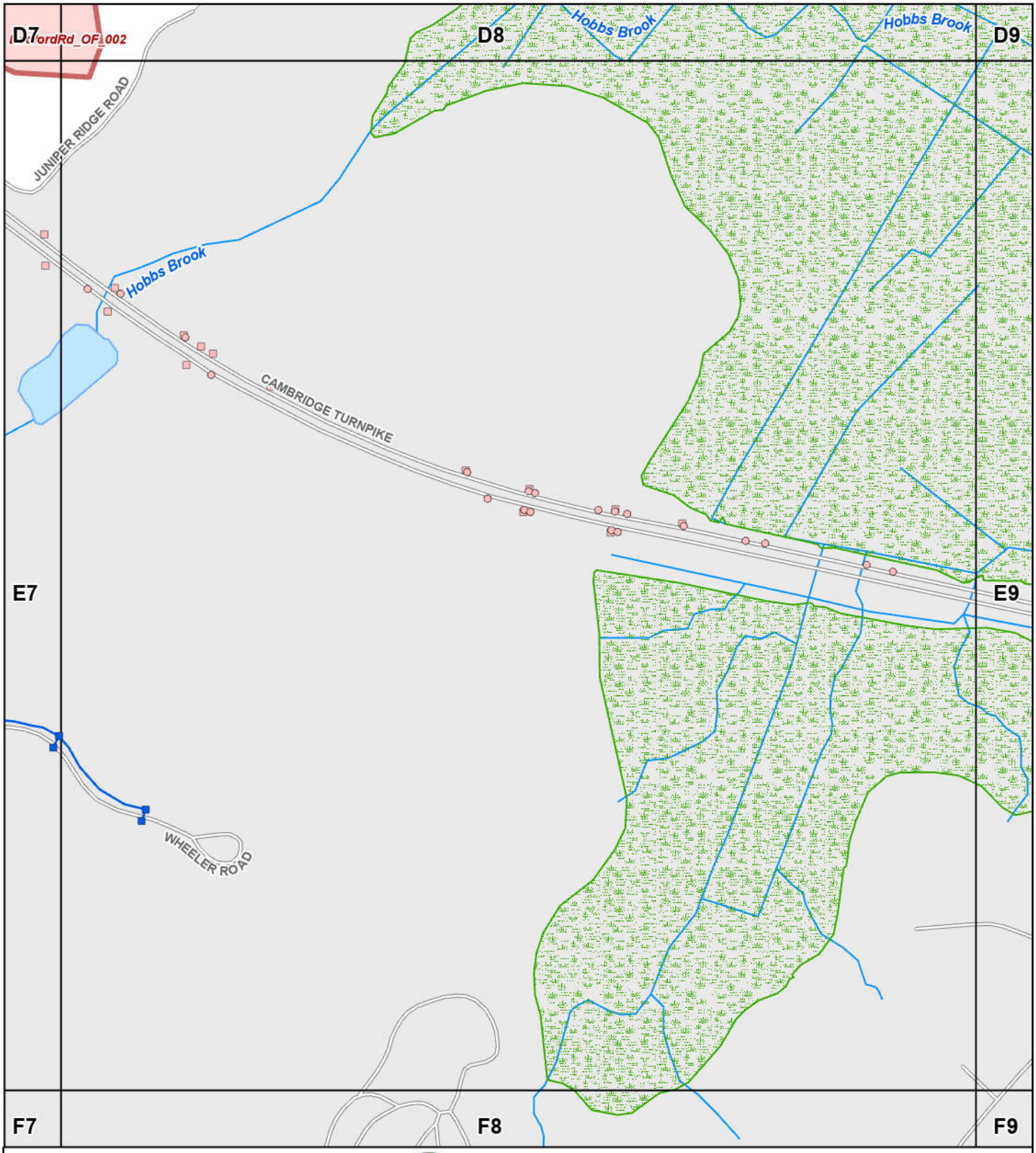
SHEET
E7

0 250
Feet

Stormwater Infrastructure Tile Map Lincoln, MA

Comprehensive Environmental Incorporated

5/29/2025


D7
D8
D9
E7
E9
F7
F8
F9
Hobbs Brook
Hobbs Brook
Hobbs Brook
JUNIPER RIDGE ROAD
CAMBRIDGE TURNPIKE
WHEELER ROAD
Outfalls
Private Outfalls
Catch Basin
Channel
DMH
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State Manhole
State Catch Basin
Town Drainage Pipe
State Drainage Pipe
Culvert
BMP
Lake, Pond, Reservoir
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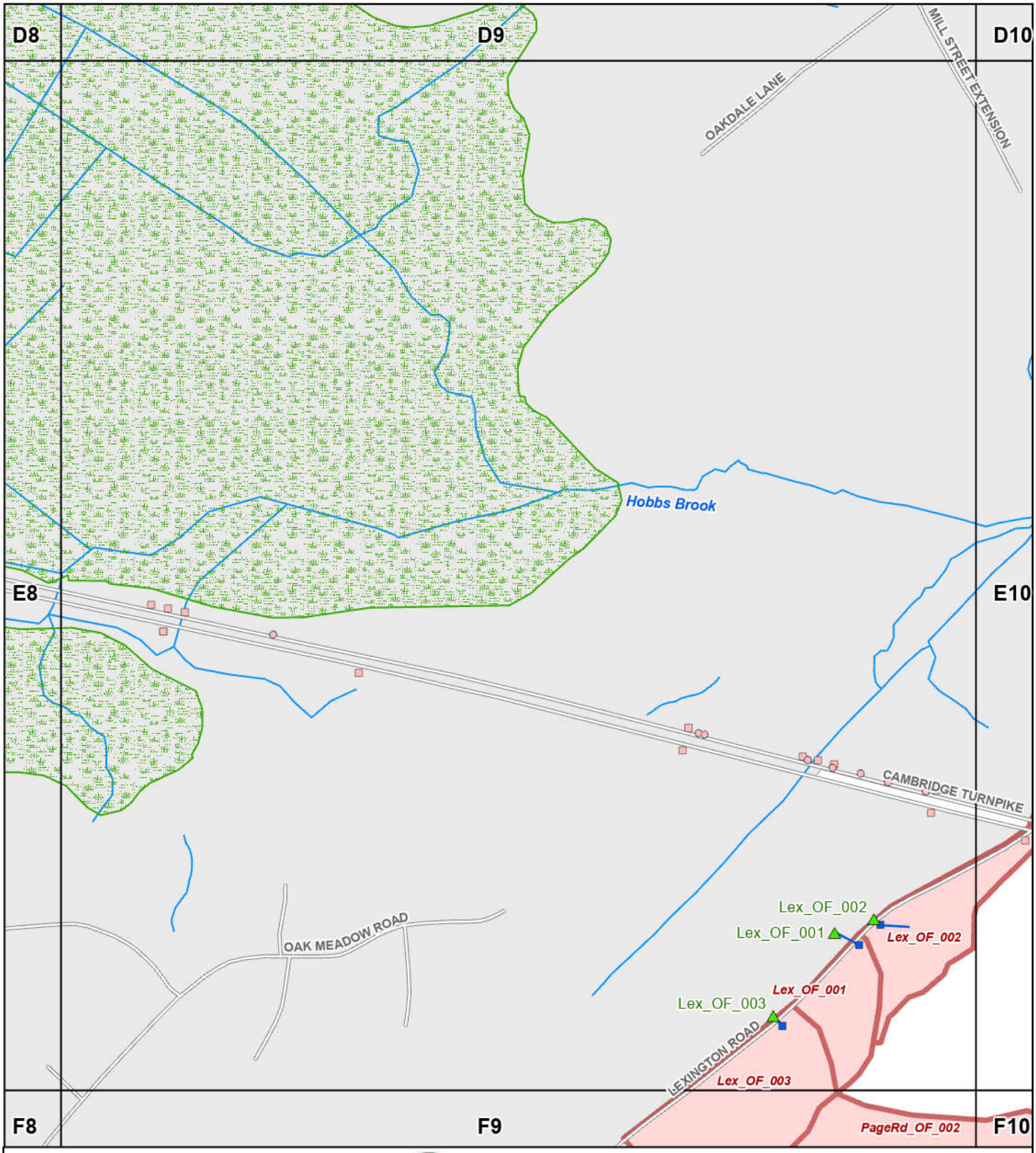
Catchment
Non-Urban Area
SHEET
E8
0
250
Feet
Stormwater Infrastructure Tile Map Lincoln, MA
Comprehensive Environmental Incorporated
5/29/2025



Outfalls
Private Outfalls
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State Catch Basin
Town Drainage Pipe
State Drainage Pipe
Culvert
BMP
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Stream, Brook
Catchment
Non-Urban Area

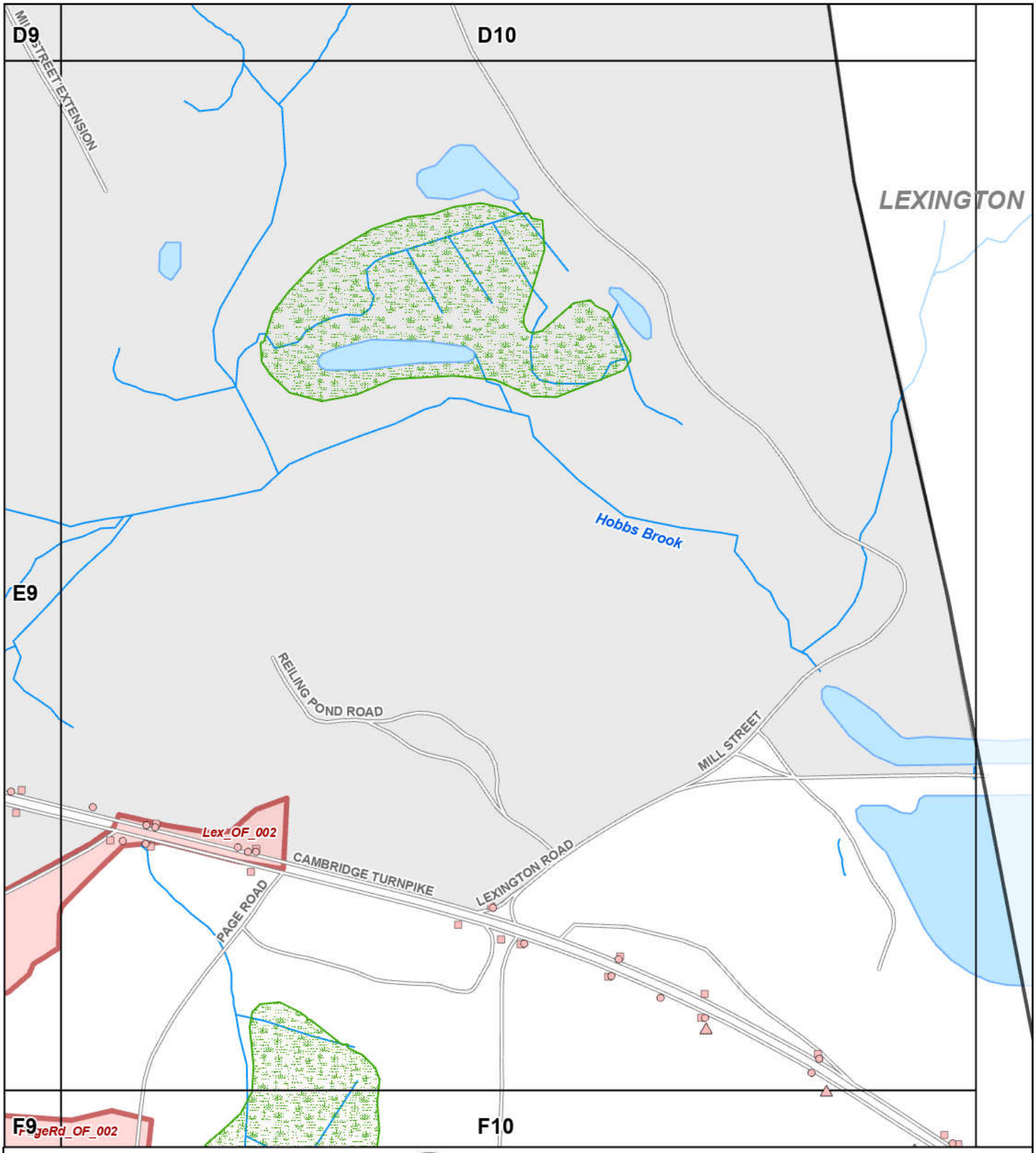
SHEET
E9

0 250
Feet

Stormwater Infrastructure Tile Map Lincoln, MA

Comprehensive Environmental Incorporated

5/29/2025



Outfalls
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Building Drain
WQU
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State Catch Basin
Town Drainage Pipe
State Drainage Pipe
Culvert
BMP
Lake, Pond, Reservoir
Wetland, Marsh, Swamp
Stream, Brook
Catchment
Non-Urban Area

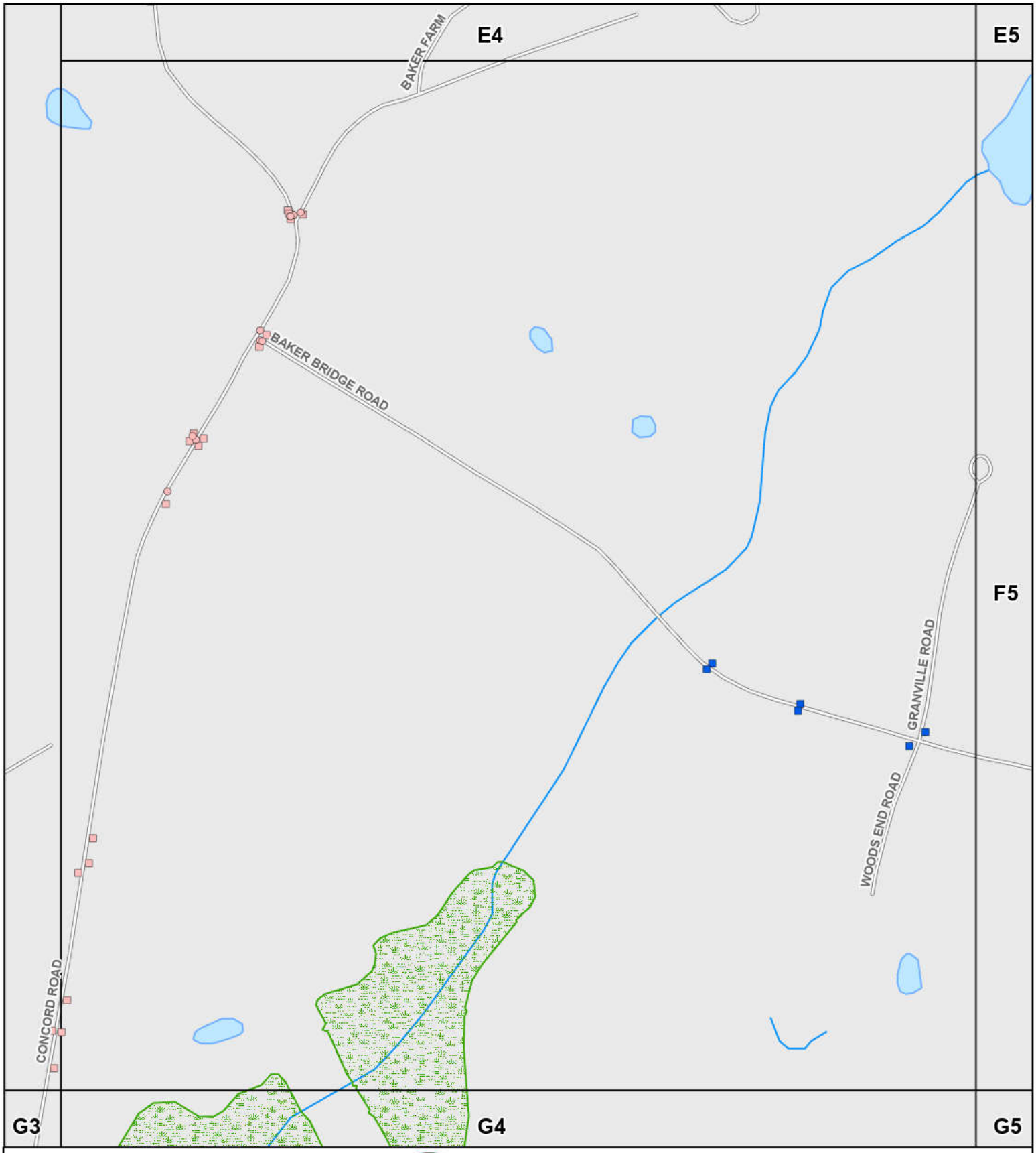
SHEET
E10

0 250
Feet

Stormwater Infrastructure Tile Map Lincoln, MA

Comprehensive Environmental Incorporated

5/29/2025



Outfalls
Private Outfalls
Catch Basin
Channel
DMH
Interconnection
Building Drain
WQU
State Outfall
State Manhole
State Catch Basin
Town Drainage Pipe
State Drainage Pipe
Culvert
BMP
Lake, Pond, Reservoir
Wetland, Marsh, Swamp
Stream, Brook
Catchment
Non-Urban Area

SHEET
F4

0 250
Feet

Stormwater Infrastructure Tile Map Lincoln, MA

Comprehensive Environmental Incorporated

5/29/2025

Outfalls
Private Outfalls
Catch Basin
Channel
DMH
Interconnection
Building Drain
WQU
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State Manhole
State Catch Basin
Town Drainage Pipe
State Drainage Pipe
Culvert
BMP
Lake, Pond, Reservoir
Wetland, Marsh, Swamp
Stream, Brook
Catchment
Non-Urban Area

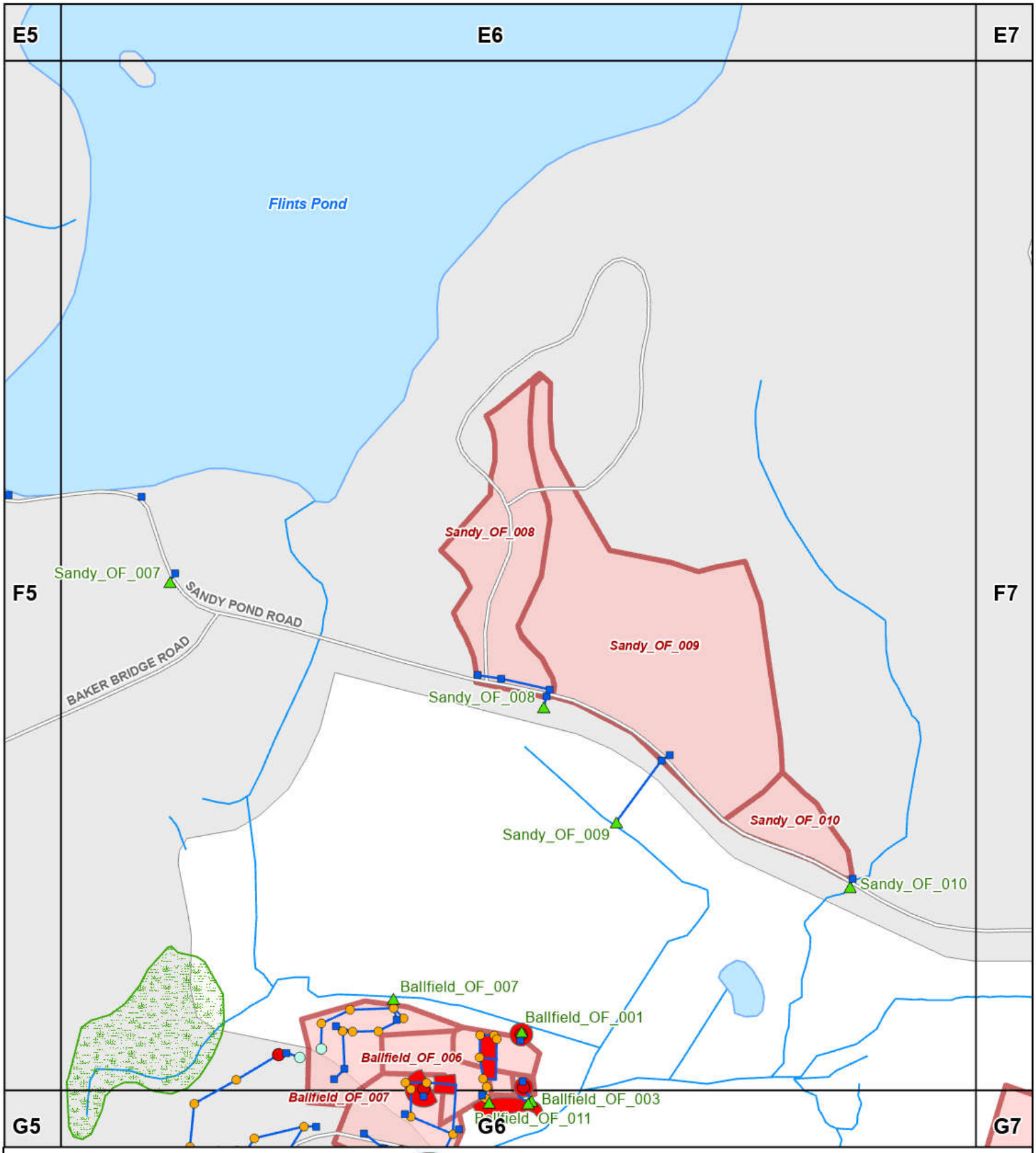
SHEET
F5

0 250
Feet

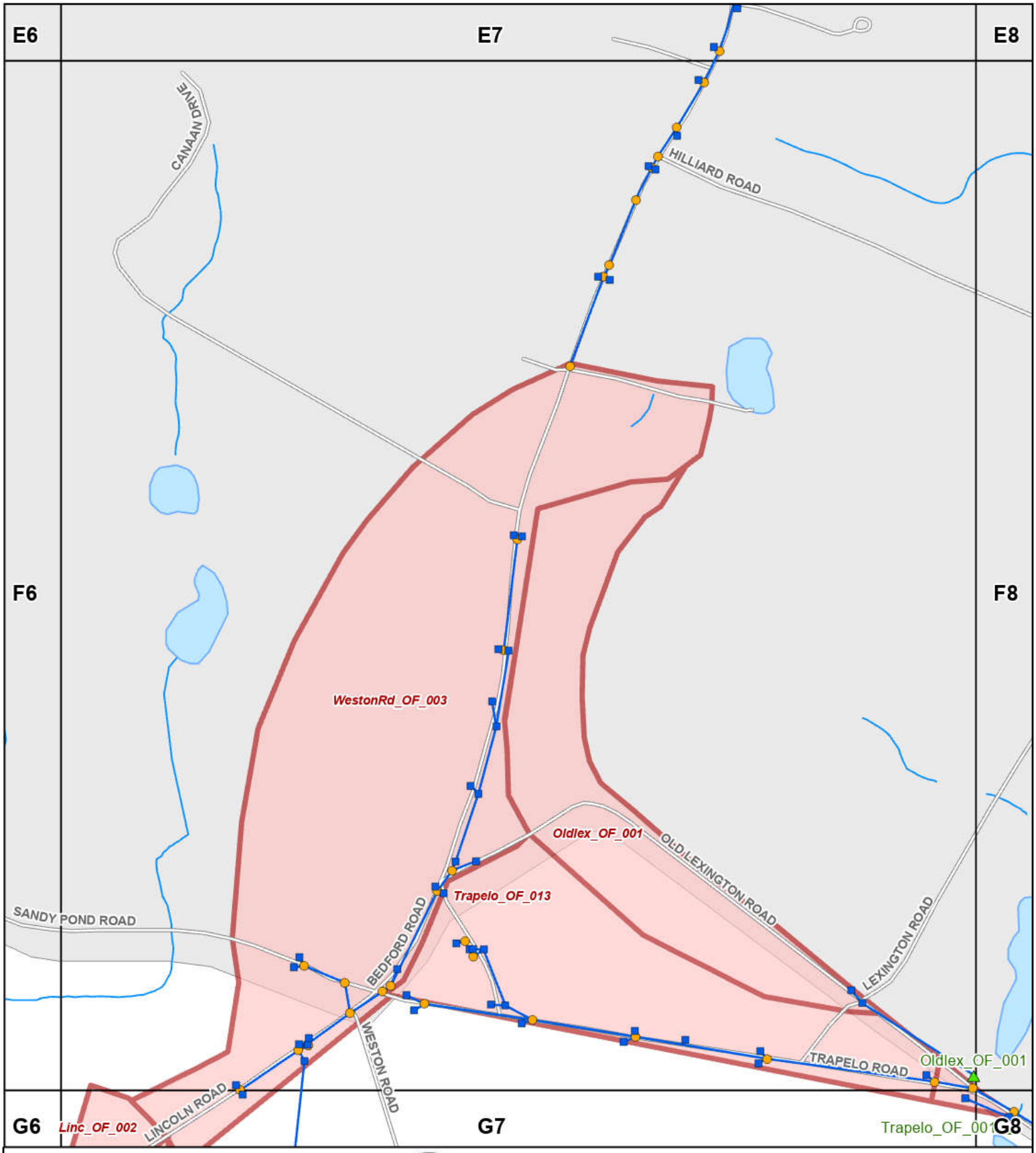
Stormwater Infrastructure Tile Map Lincoln, MA

Comprehensive Environmental Incorporated

5/29/2025


E5
E6
E7
F5
F7
G5
G6
G7
Flints Pond
Sandy_OF_008
Sandy_OF_009
Sandy_OF_010
Sandy_OF_007
Sandy_OF_008
Sandy_OF_009
Sandy_OF_010
SANDY POND ROAD
BAKER BRIDGE ROAD
Ballfield_OF_007
Ballfield_OF_001
Ballfield_OF_006
Ballfield_OF_007
Ballfield_OF_003
Ballfield_OF_011
Outfalls
Private Outfalls
Catch Basin
Channel
DMH
Interconnection
Building Drain
WQU
State Outfall
State Manhole
State Catch Basin
Town Drainage Pipe
State Drainage Pipe
Culvert
BMP
Lake, Pond, Reservoir
Wetland, Marsh, Swamp
Stream, Brook
Catchment
Non-Urban Area
SHEET
F6
0
250
Feet
Stormwater Infrastructure Tile Map Lincoln, MA
Comprehensive Environmental Incorporated

5/29/2025



- Outfalls
- Private Outfalls
- Catch Basin
- Channel
- DMH
- Interconnection
- Building Drain
- WQU
- State Outfall
- State Manhole
- State Catch Basin
- Town Drainage Pipe
- State Drainage Pipe
- Culvert
- BMP
- Lake, Pond, Reservoir
- Wetland, Marsh, Swamp
- Stream, Brook
- Catchment
- Non-Urban Area

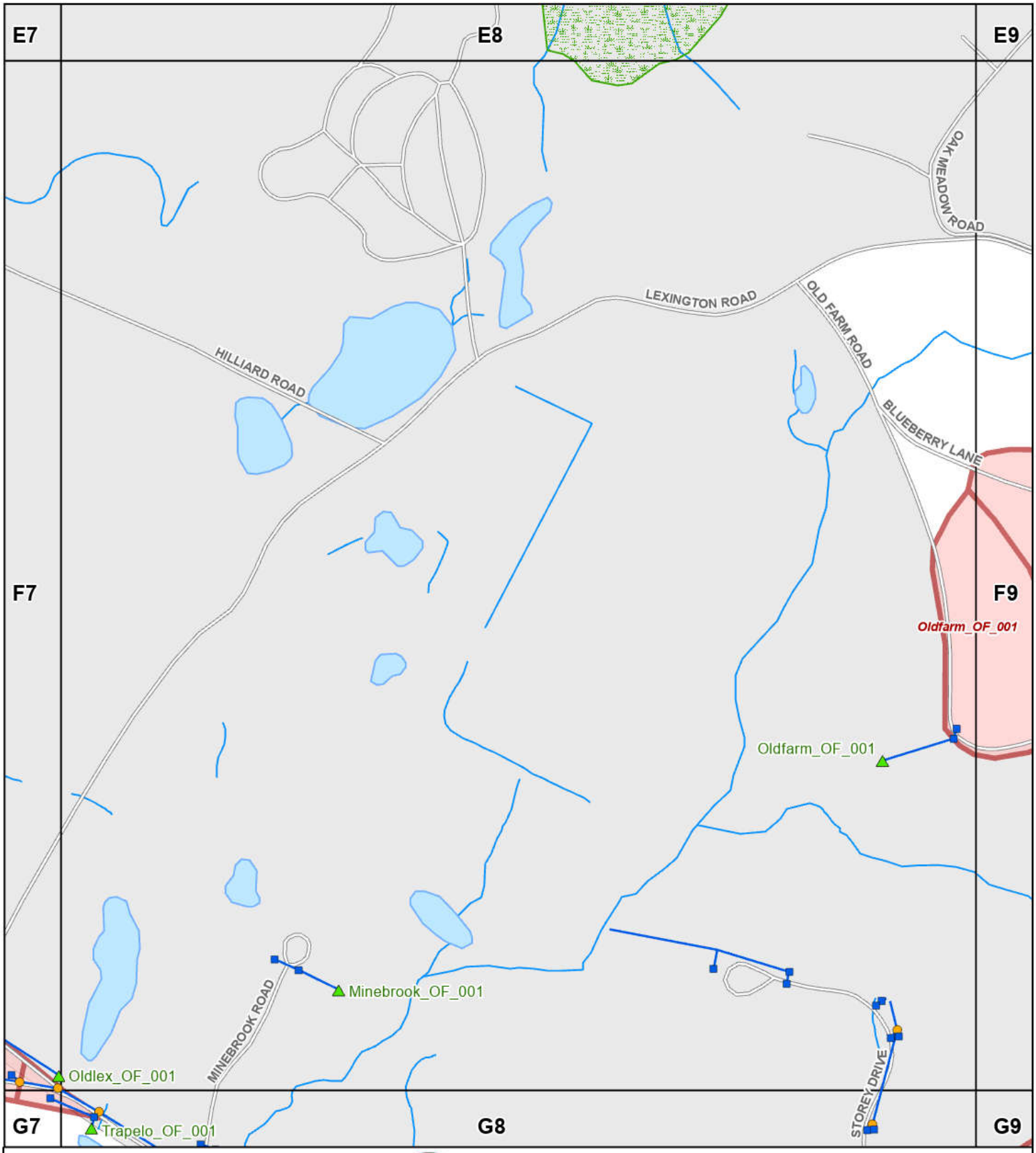
SHEET
F7

0 250
Feet

Stormwater Infrastructure Tile Map Lincoln, MA

Comprehensive Environmental Incorporated

5/29/2025



Outfalls
Private Outfalls
Catch Basin
Channel
DMH
Interconnection
Building Drain
WQU
State Outfall
State Manhole
State Catch Basin
Town Drainage Pipe
State Drainage Pipe
Culvert
BMP
Lake, Pond, Reservoir
Wetland, Marsh, Swamp
Stream, Brook
Catchment
Non-Urban Area

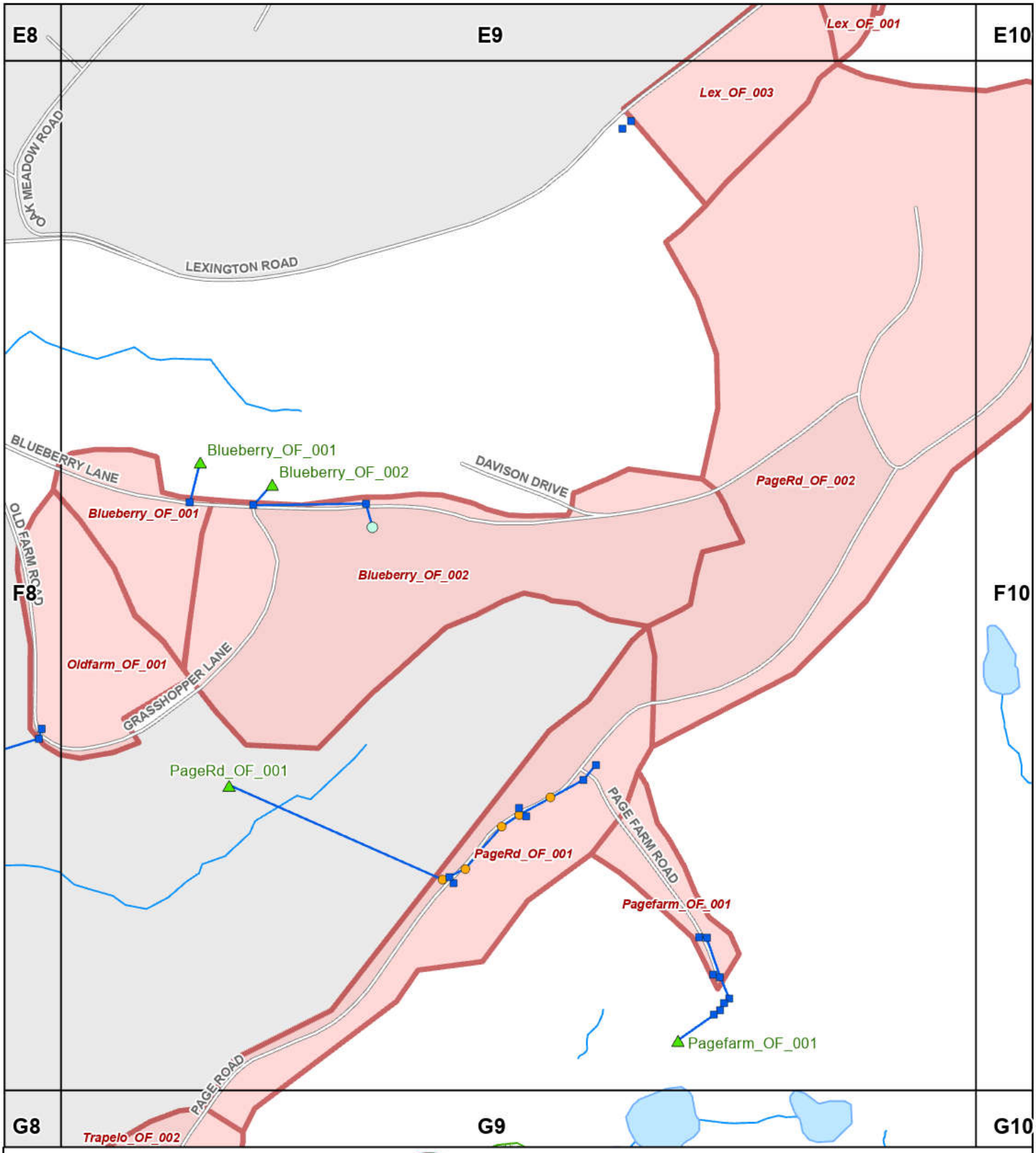
SHEET
F8

0 250
Feet

Stormwater Infrastructure Tile Map Lincoln, MA

Comprehensive Environmental Incorporated

5/29/2025



Outfalls
Private Outfalls
Catch Basin
Channel
DMH
Interconnection
Building Drain
WQU
State Outfall
State Manhole
State Catch Basin
Town Drainage Pipe
State Drainage Pipe
Culvert
BMP
Lake, Pond, Reservoir
Wetland, Marsh, Swamp
Stream, Brook
Catchment
Non-Urban Area

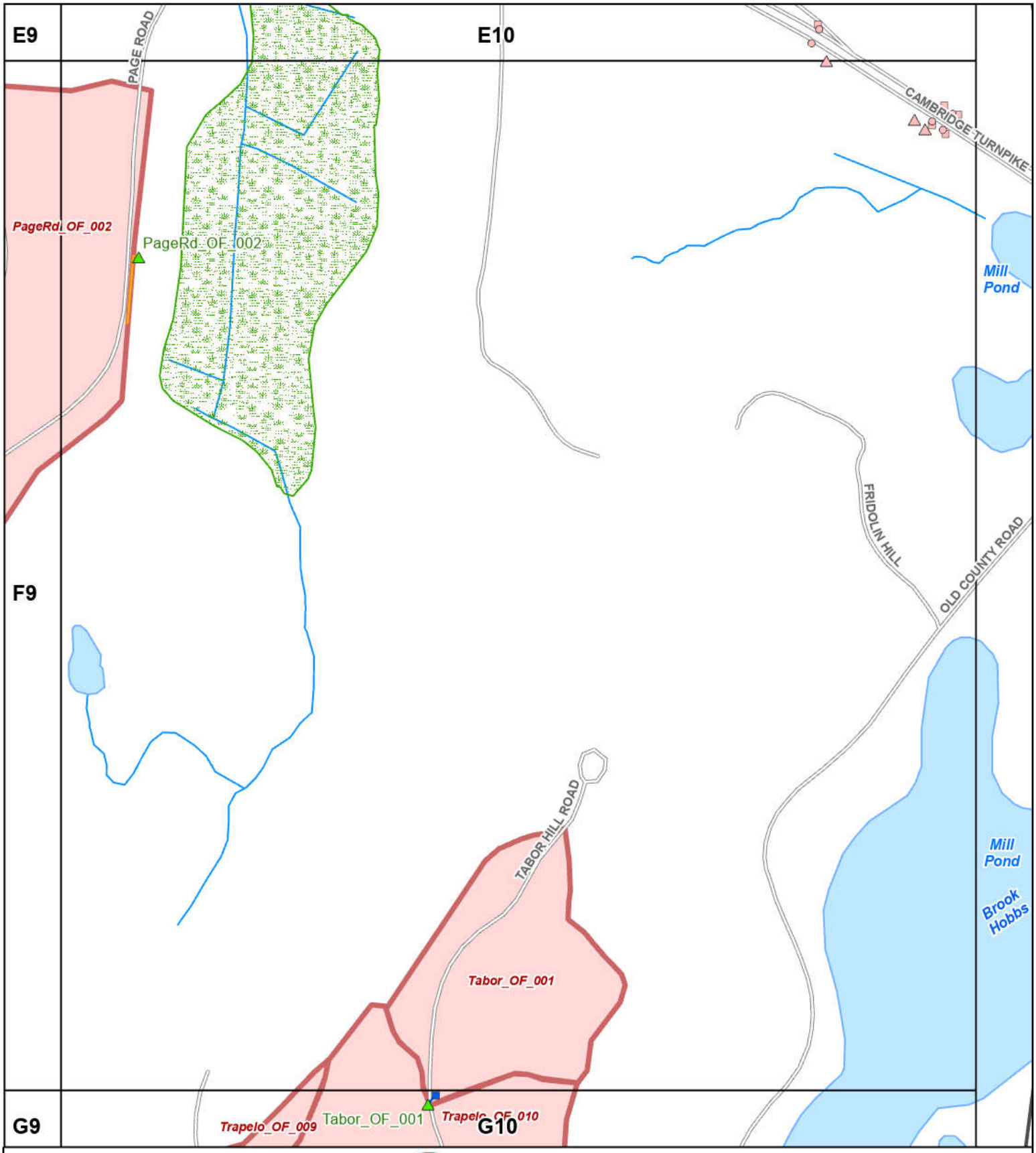
SHEET
F9

0 250
Feet

Stormwater Infrastructure Tile Map Lincoln, MA

Comprehensive Environmental Incorporated

5/29/2025



Outfalls
Private Outfalls
Catch Basin
Channel
DMH
Interconnection
Building Drain
WQU
State Outfall
State Manhole
State Catch Basin
Town Drainage Pipe
State Drainage Pipe
Culvert
BMP
Lake, Pond, Reservoir
Wetland, Marsh, Swamp
Stream, Brook
Catchment
Non-Urban Area

SHEET
F10

0 250
Feet

Stormwater Infrastructure Tile Map Lincoln, MA

Comprehensive Environmental Incorporated

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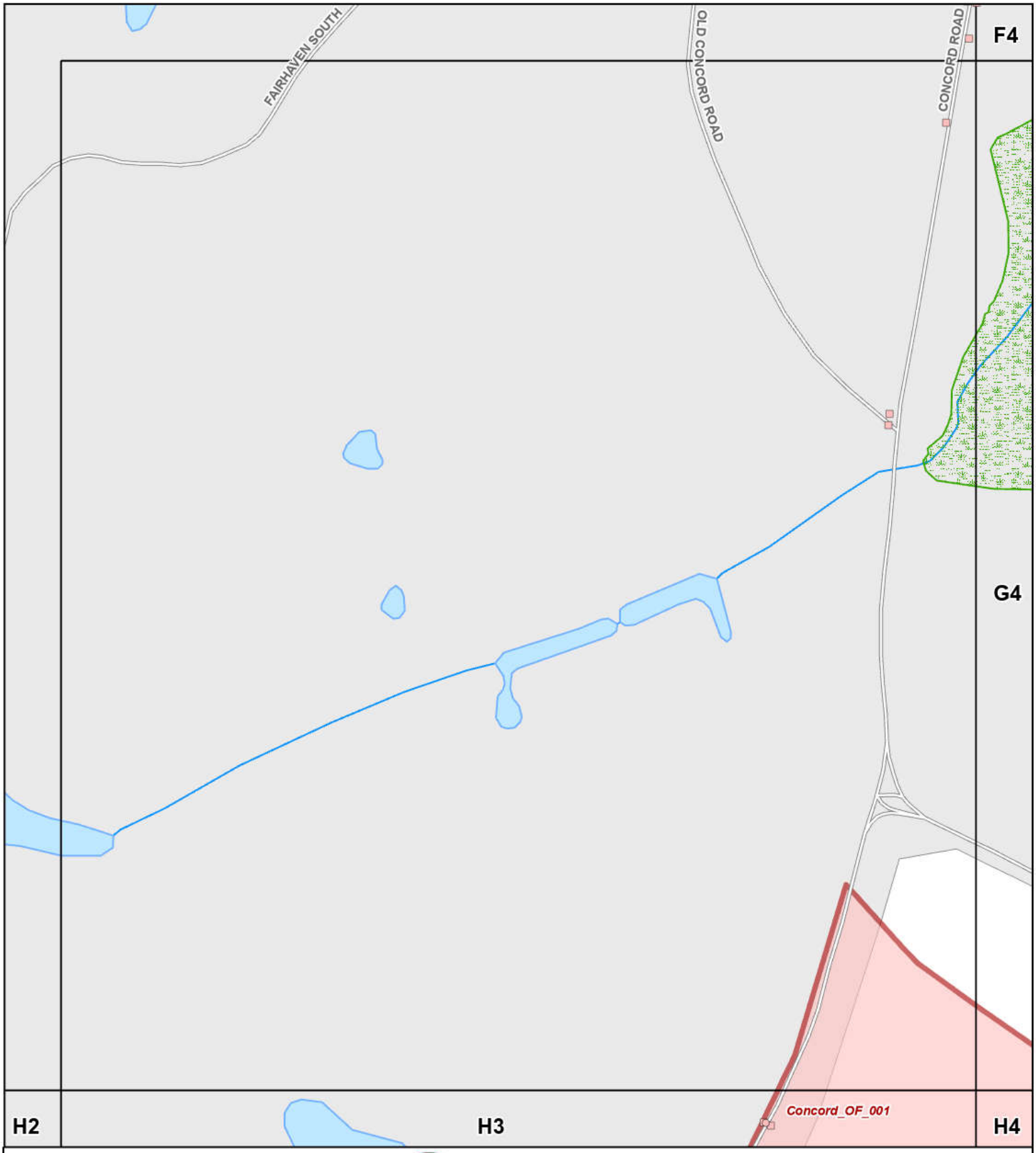

- Outfalls
- Private Outfalls
- Catch Basin
- Channel
- DMH
- Interconnection
- Building Drain
- WQU
- State Outfall
- State Manhole
- State Catch Basin
- Town Drainage Pipe
- State Drainage Pipe
- Culvert
- BMP
- Lake, Pond, Reservoir
- Wetland, Marsh, Swamp
- Stream, Brook
- Catchment
- Non-Urban Area

SHEET
G3

0 250
Feet

Stormwater Infrastructure Tile Map Lincoln, MA

Comprehensive Environmental Incorporated

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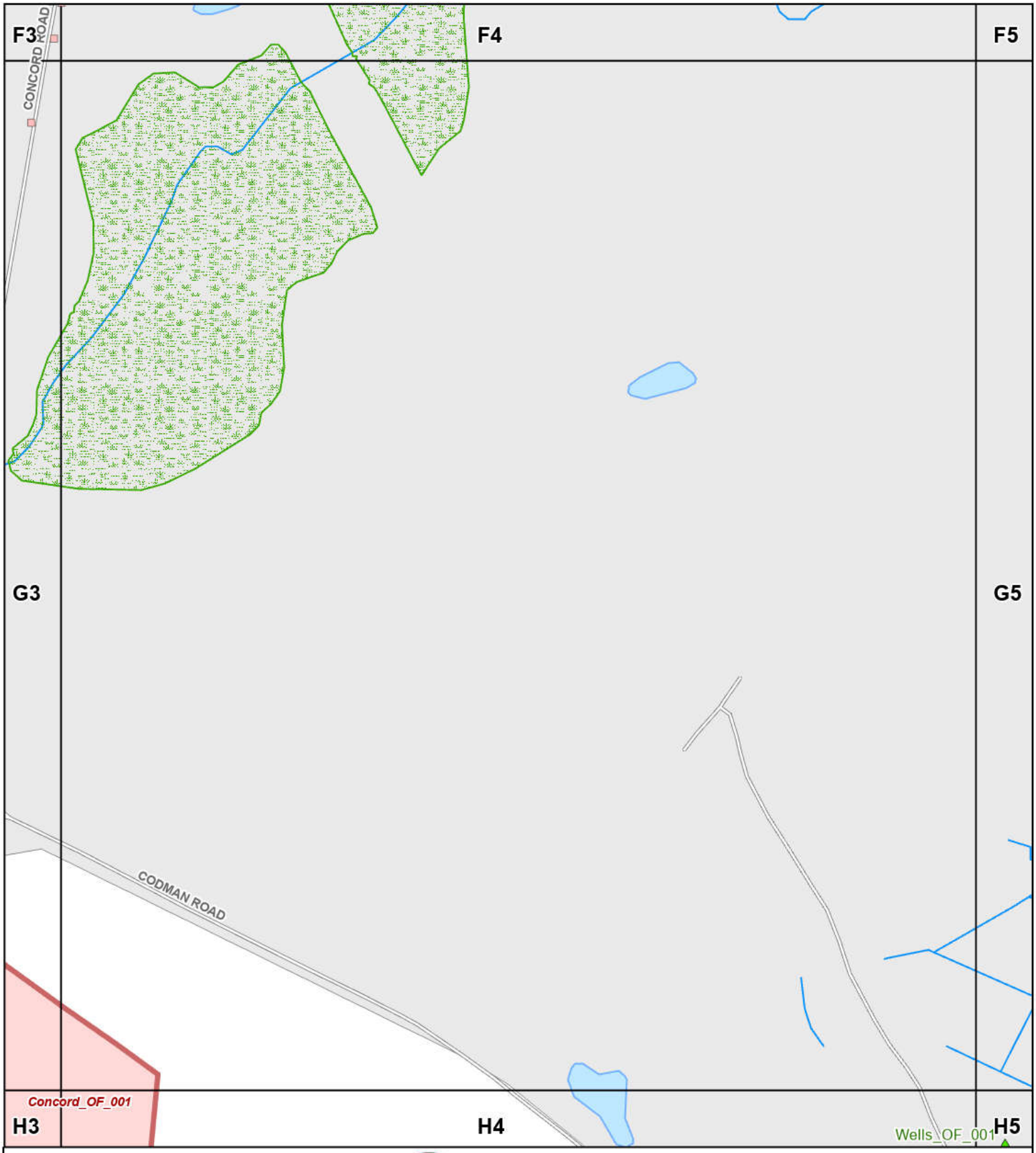


- Outfalls
- Private Outfalls
- Catch Basin
- Channel
- DMH
- Interconnection
- Building Drain
- WQU
- State Outfall
- State Manhole
- State Catch Basin
- Town Drainage Pipe
- State Drainage Pipe
- Culvert
- BMP
- Lake, Pond, Reservoir
- Wetland, Marsh, Swamp
- Stream, Brook
- Catchment
- Non-Urban Area

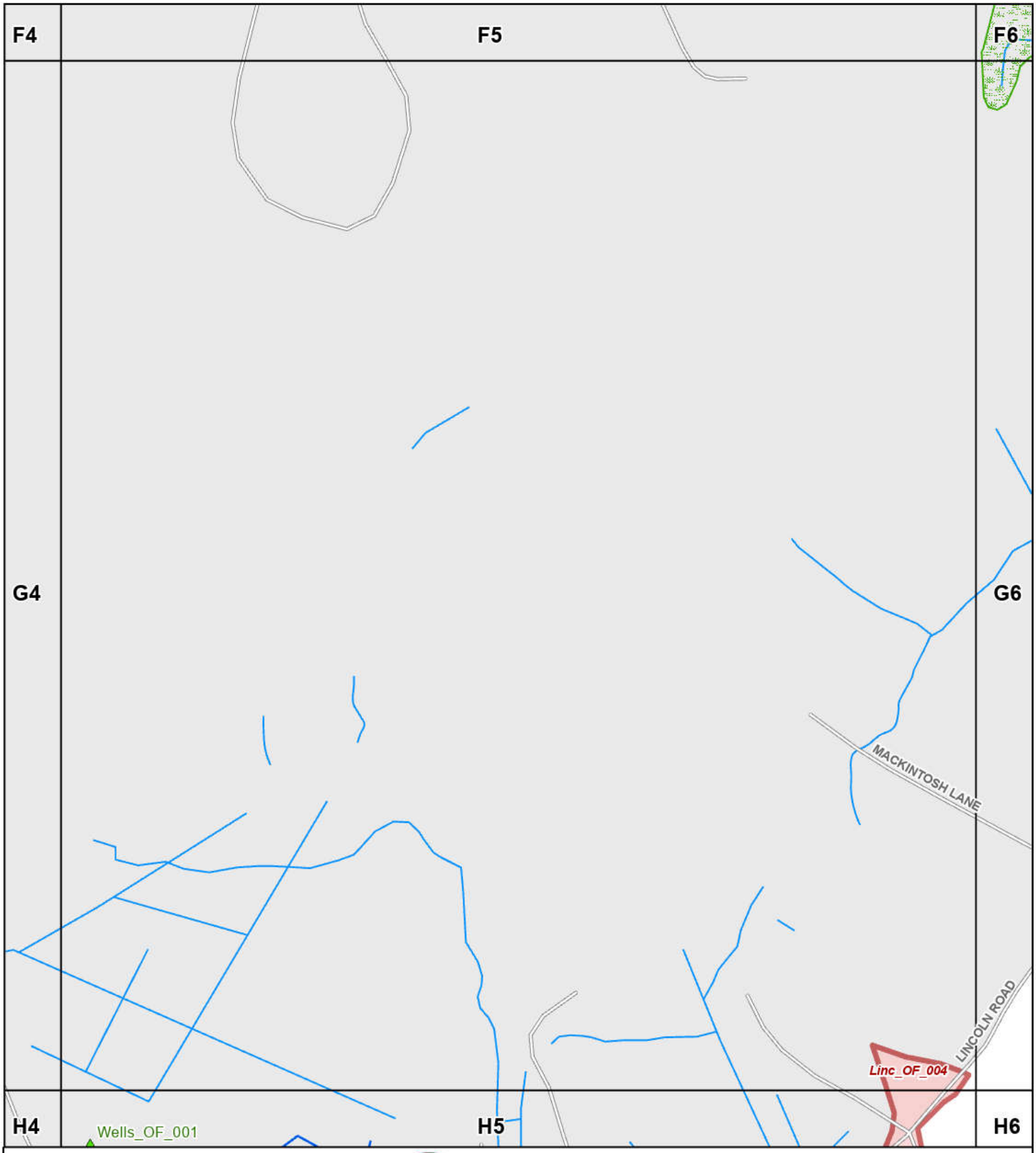
SHEET
G4

0 250 Feet

Stormwater Infrastructure Tile Map Lincoln, MA

Comprehensive Environmental Incorporated

5/29/2025



- Outfalls
- Private Outfalls
- Catch Basin
- Channel
- DMH
- Interconnection
- Building Drain
- WQU
- State Outfall
- State Manhole
- State Catch Basin
- Town Drainage Pipe
- State Drainage Pipe
- Culvert
- BMP
- Lake, Pond, Reservoir
- Wetland, Marsh, Swamp
- Stream, Brook
- Catchment
- Non-Urban Area

SHEET
G5

0 250 Feet

Stormwater Infrastructure Tile Map Lincoln, MA

Comprehensive Environmental Incorporated

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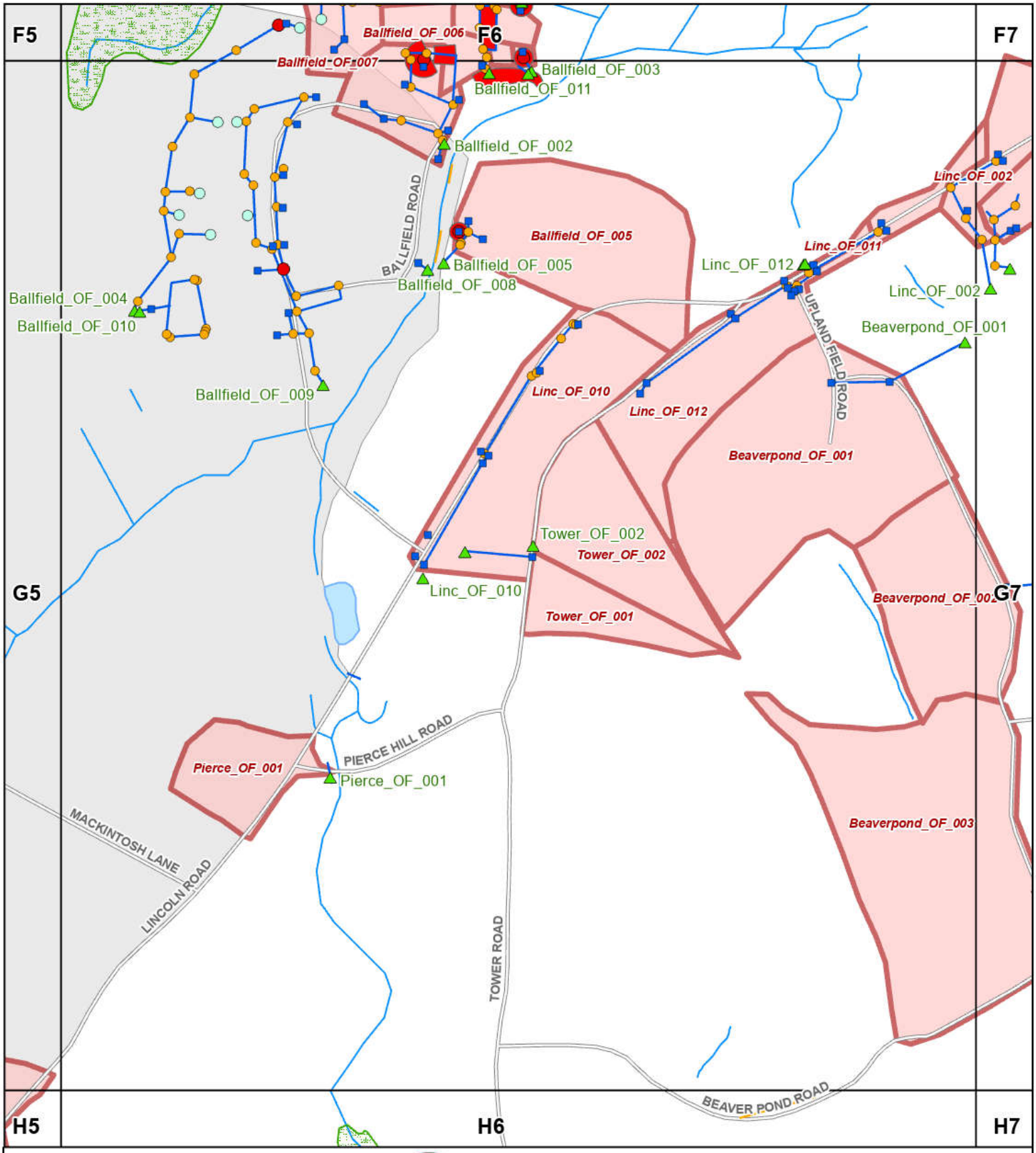
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F7
G5
G7
H5
H6
H7
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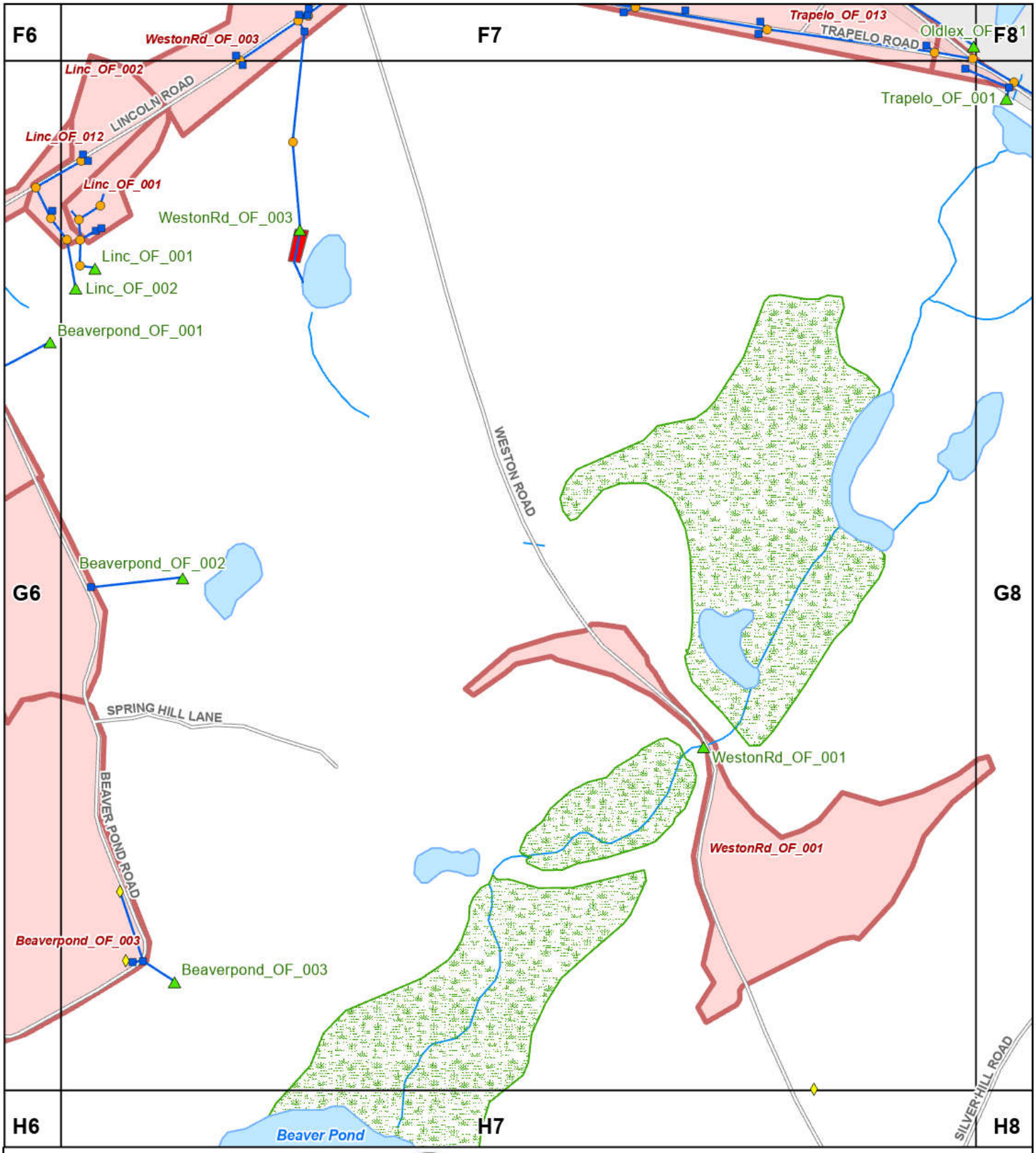
Ballfield_OF_007
Ballfield_OF_003
Ballfield_OF_011
Ballfield_OF_002
BALLFIELD ROAD
Ballfield_OF_005
Ballfield_OF_008
Ballfield_OF_004
Ballfield_OF_010
Ballfield_OF_009
Linc_OF_002
Linc_OF_011
Linc_OF_012
Linc_OF_002
Beaverpond_OF_001
UPLAND FIELD ROAD
Linc_OF_010
Linc_OF_012
Beaverpond_OF_001
Tower_OF_002
Tower_OF_002
Linc_OF_010
Beaverpond_OF_002
Tower_OF_001
PIERCE HILL ROAD
Pierce_OF_001
Pierce_OF_001
MACKINTOSH LANE
LINCOLN ROAD
Beaverpond_OF_003
TOWER ROAD
BEAVER POND ROAD
Outfalls
Private Outfalls
Catch Basin
Channel
DMH
Interconnection
Building Drain
WQU
State Outfall
State Manhole
State Catch Basin
Town Drainage Pipe
State Drainage Pipe
Culvert
BMP
Lake, Pond, Reservoir
Wetland, Marsh, Swamp
Stream, Brook
Catchment
Non-Urban Area
SHEET
G6
0
250
Feet
Stormwater Infrastructure Tile Map Lincoln, MA
Comprehensive Environmental Incorporated

5/29/2025


F6
F7
F8
G6
G8
H6
H7
H8
WestonRd_OF_003
Linc_OF_002
LINCOLN ROAD
Linc_OF_012
Linc_OF_001
WestonRd_OF_003
Linc_OF_001
Linc_OF_002
Beaverpond_OF_001
Trapelo_OF_013
TRAPELO ROAD
Oldlex_OF_001
Trapelo_OF_001
WESTON ROAD
Beaverpond_OF_002
SPRING HILL LANE
BEAVER POND ROAD
Beaverpond_OF_003
Beaverpond_OF_003
WestonRd_OF_001
WestonRd_OF_001
Beaver Pond
SILVER HILL ROAD
Outfalls
Private Outfalls
Catch Basin
Channel
DMH
Interconnection
Building Drain
WQU
State Outfall
State Manhole
State Catch Basin
Town Drainage Pipe
State Drainage Pipe
Culvert
BMP
Lake, Pond, Reservoir
Wetland, Marsh, Swamp
Stream, Brook
Catchment
Non-Urban Area
SHEET
G7
0
250
Feet
Stormwater Infrastructure Tile Map Lincoln, MA
Comprehensive Environmental Incorporated

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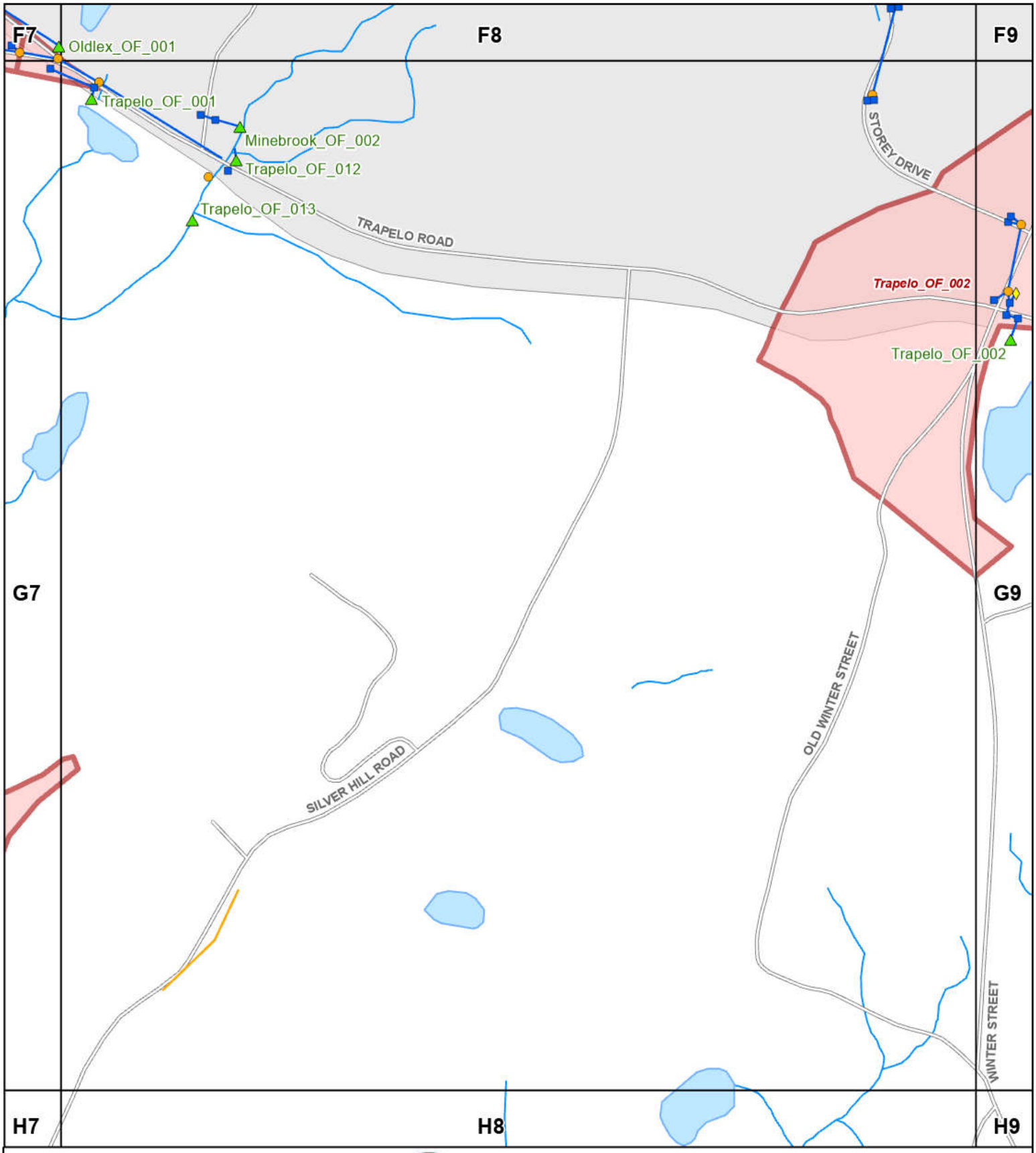

Outfalls
Private Outfalls
Catch Basin
Channel
DMH
Interconnection
Building Drain
WQU
State Outfall
State Manhole
State Catch Basin
Town Drainage Pipe
State Drainage Pipe
Culvert
BMP
Lake, Pond, Reservoir
Wetland, Marsh, Swamp
Stream, Brook
Catchment
Non-Urban Area

SHEET
G8

0 250
Feet

Stormwater Infrastructure Tile Map Lincoln, MA

Comprehensive Environmental Incorporated

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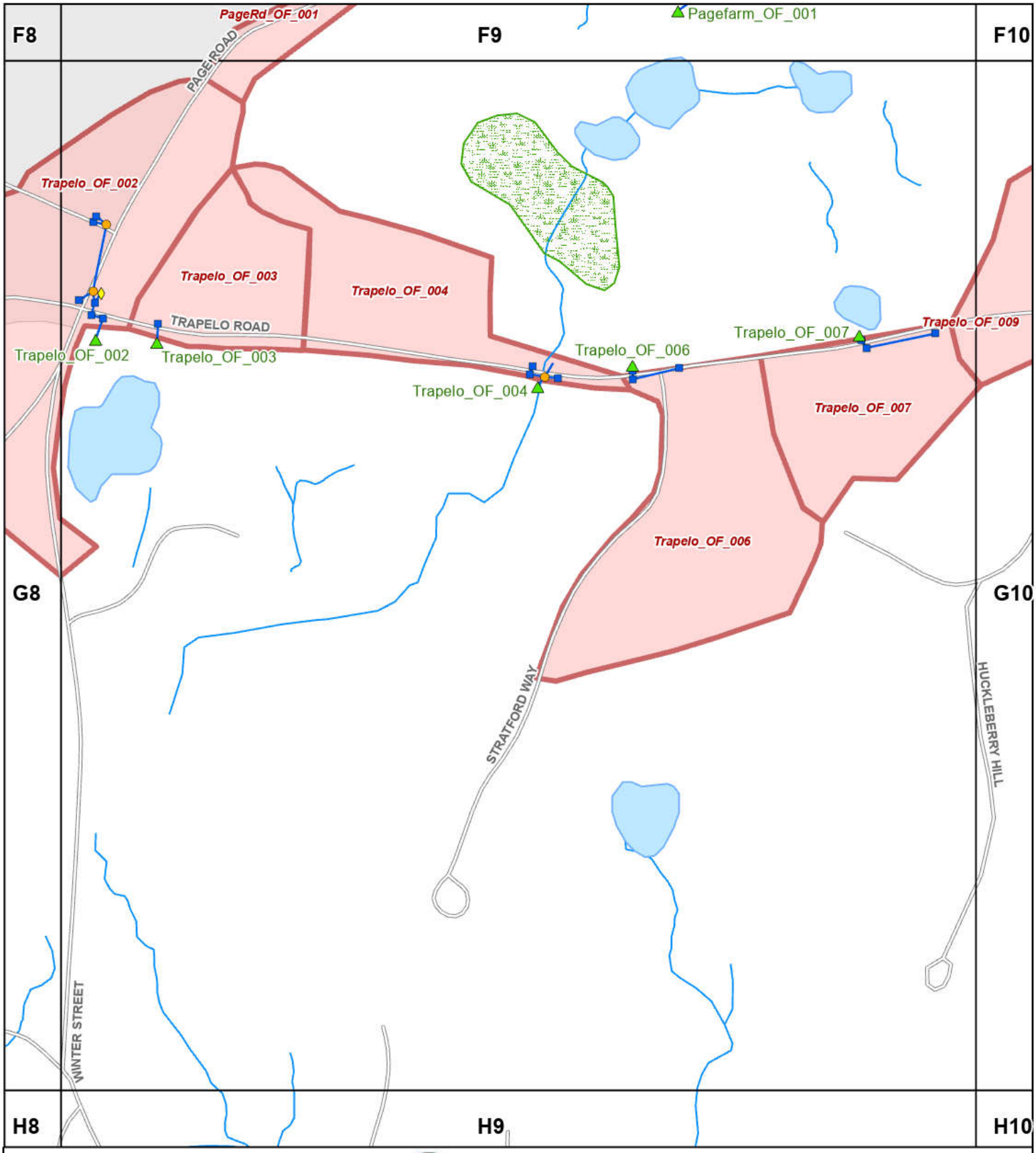
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F9
F10
G8
G10
H8
H9
H10
PageRd_OF_001
Pagefarm_OF_001
PAGE ROAD
Trapelo_OF_002
Trapelo_OF_003
Trapelo_OF_004
TRAPELO ROAD
Trapelo_OF_007
Trapelo_OF_009
Trapelo_OF_002
Trapelo_OF_003
Trapelo_OF_006
Trapelo_OF_004
Trapelo_OF_007
Trapelo_OF_006
STRATFORD WAY
HUCKLEBERRY HILL
WINTER STREET
Outfalls
Private Outfalls
Catch Basin
Channel
DMH
Interconnection
Building Drain
WQU
State Outfall
State Manhole
State Catch Basin
Town Drainage Pipe
State Drainage Pipe
Culvert
BMP
Lake, Pond, Reservoir
Wetland, Marsh, Swamp
Stream, Brook
Catchment
Non-Urban Area
SHEET
G9
0
250
Feet
Stormwater Infrastructure Tile Map Lincoln, MA
Comprehensive Environmental Incorporated

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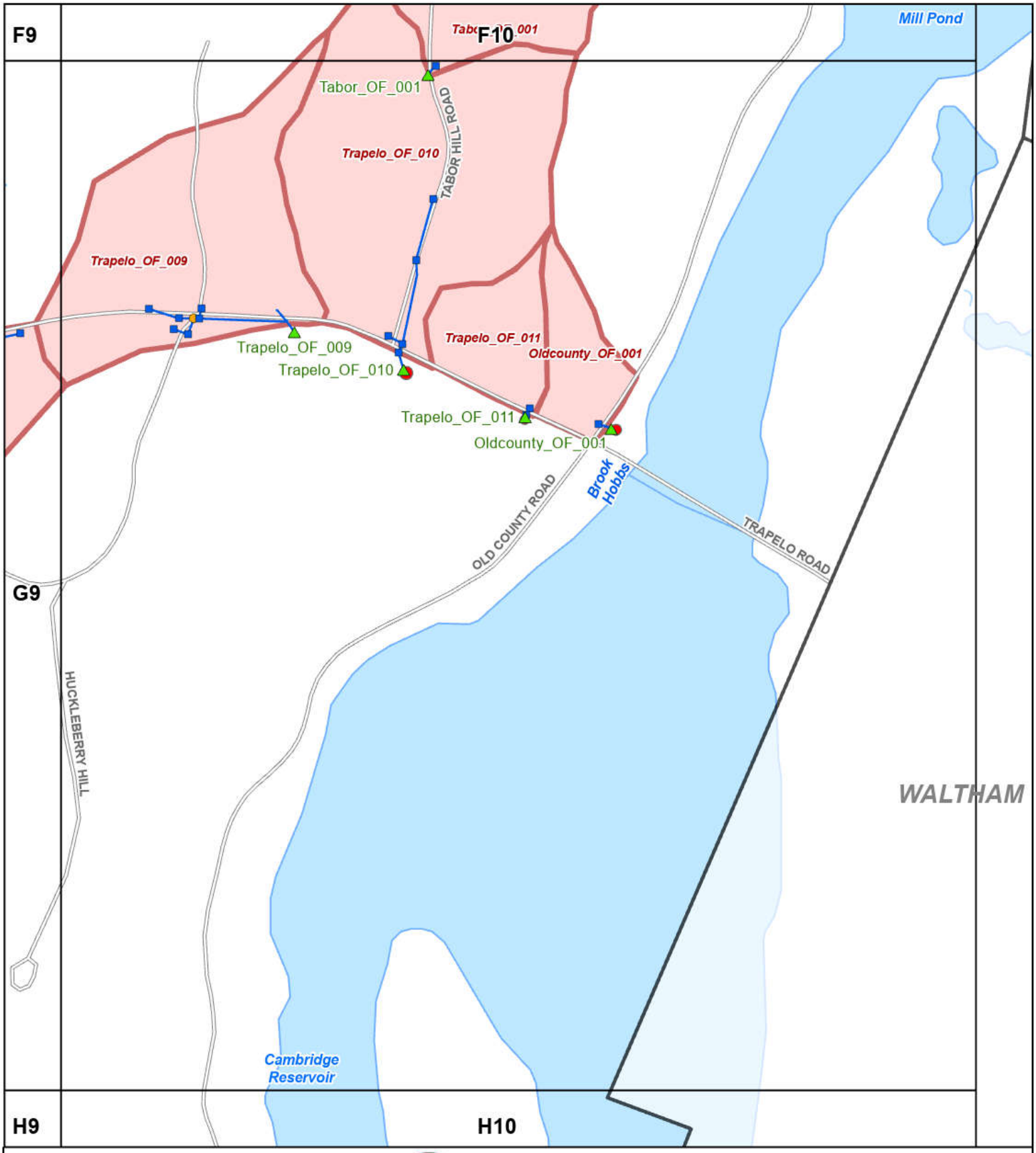

Outfalls
Private Outfalls
Catch Basin
Channel
DMH
Interconnection
Building Drain
WQU
State Outfall
State Manhole
State Catch Basin
Town Drainage Pipe
State Drainage Pipe
Culvert
BMP
Lake, Pond, Reservoir
Wetland, Marsh, Swamp
Stream, Brook
Catchment
Non-Urban Area

SHEET
G10

0 250
Feet

Stormwater Infrastructure Tile Map Lincoln, MA

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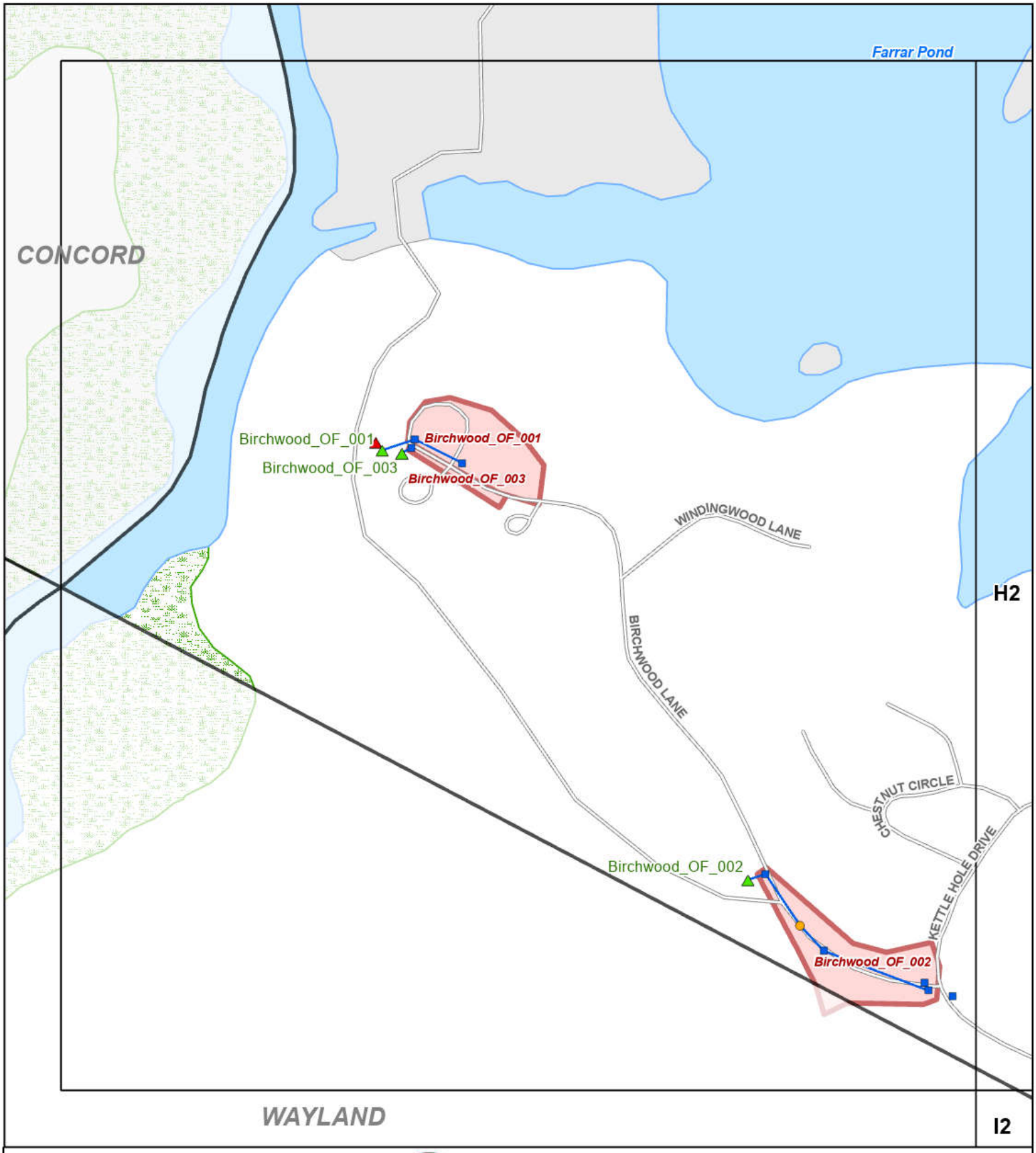


Outfalls
Private Outfalls
Catch Basin
Channel
DMH
Interconnection
Building Drain
WQU
State Outfall
State Manhole
State Catch Basin
Town Drainage Pipe
State Drainage Pipe
Culvert
BMP
Lake, Pond, Reservoir
Wetland, Marsh, Swamp
Stream, Brook
Catchment
Non-Urban Area

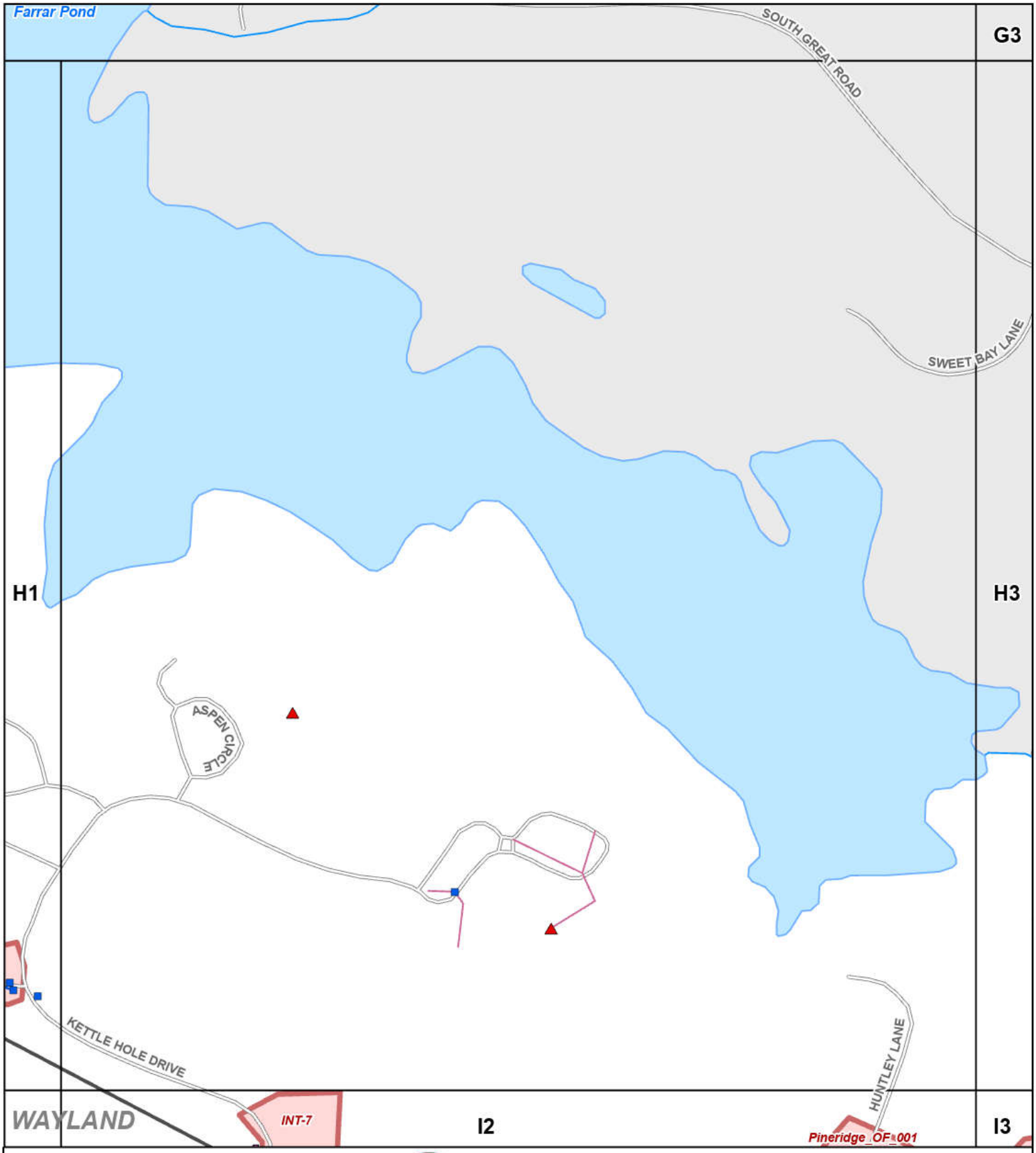
SHEET
H1

0 250
Feet

Stormwater Infrastructure Tile Map Lincoln, MA

Comprehensive Environmental Incorporated

5/29/2025



Outfalls
Private Outfalls
Catch Basin
Channel
DMH
Interconnection
Building Drain
WQU
State Outfall
State Manhole
State Catch Basin
Town Drainage Pipe
State Drainage Pipe
Culvert
BMP
Lake, Pond, Reservoir
Wetland, Marsh, Swamp
Stream, Brook
Catchment
Non-Urban Area

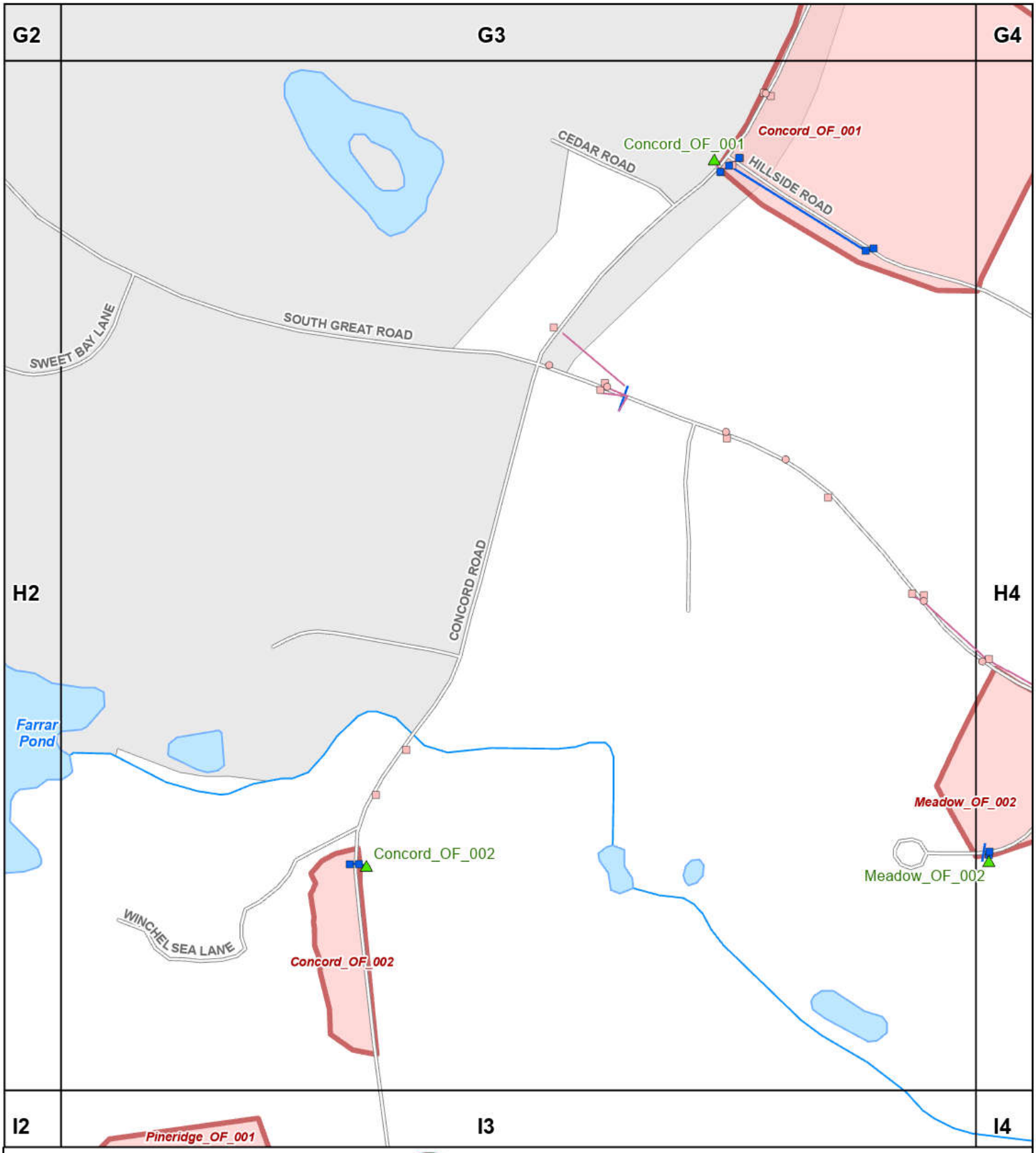
SHEET
H2

0 250
Feet

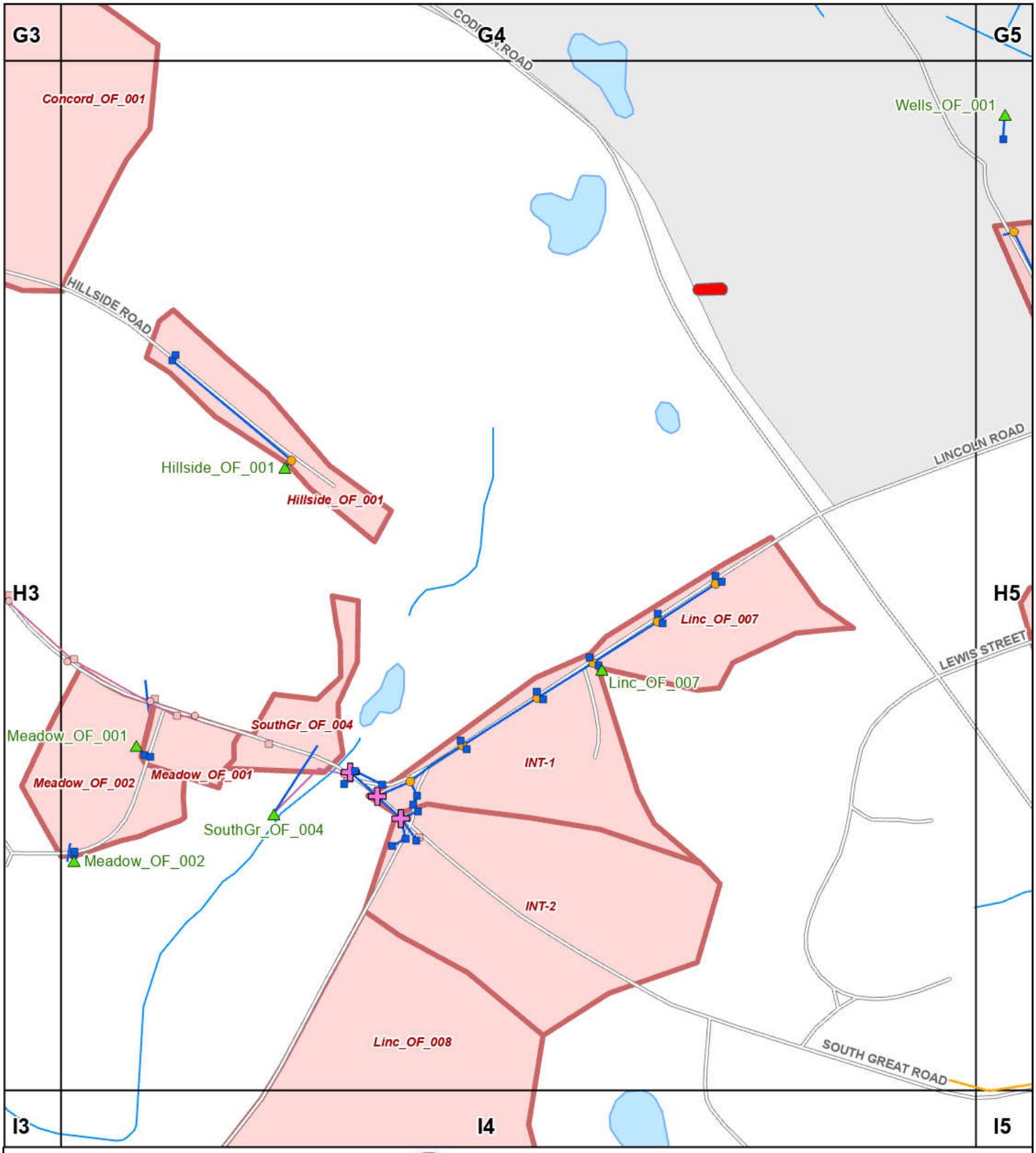
Stormwater Infrastructure Tile Map Lincoln, MA

Comprehensive Environmental Incorporated

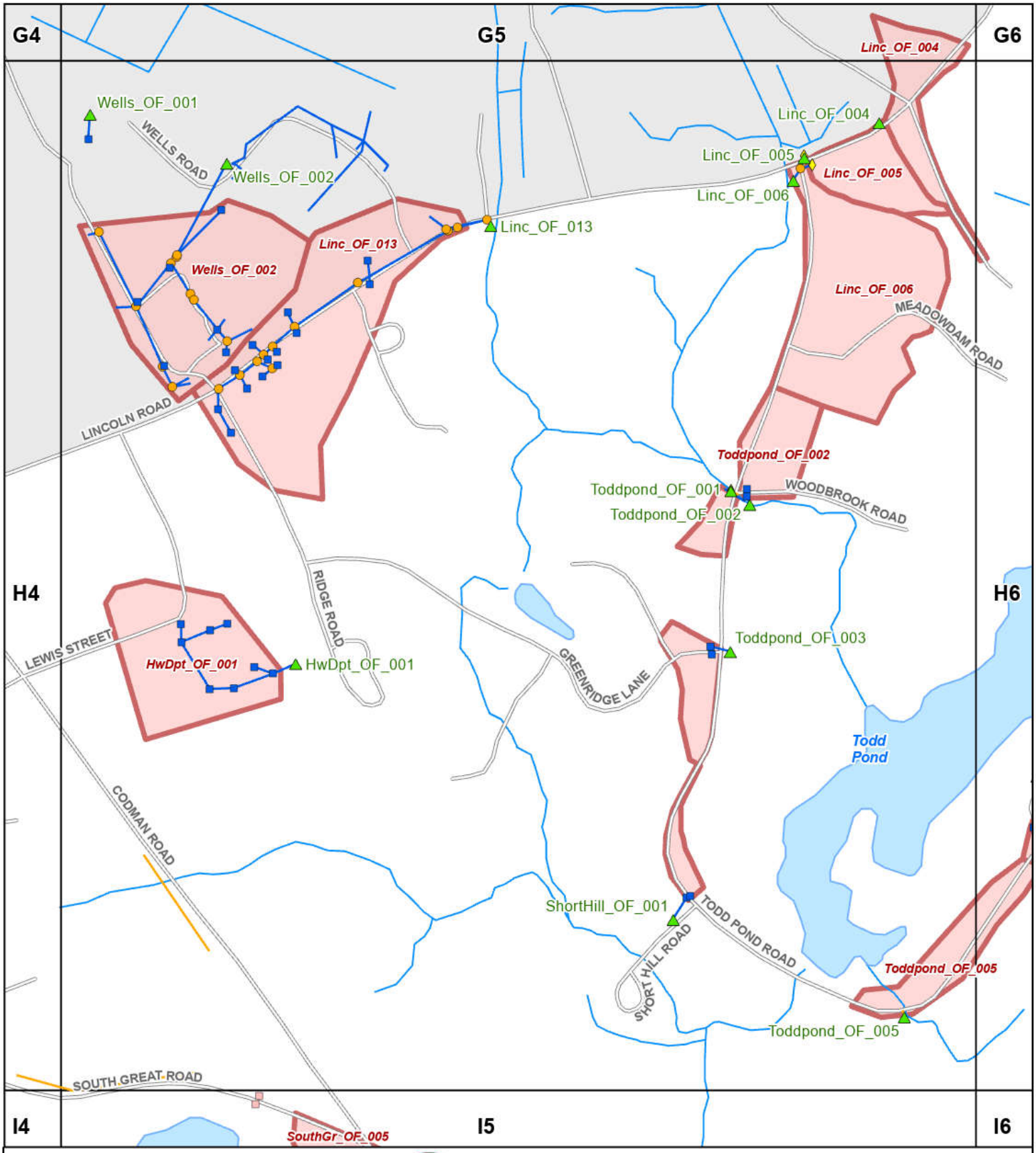
5/29/2025


G2
G3
G4
H2
H4
I2
I3
I4
CEDAR ROAD
HILLSIDE ROAD
SOUTH GREAT ROAD
SWEET BAY LANE
CONCORD ROAD
WINCHEL SEA LANE
Concord_OF_001
Concord_OF_001
Concord_OF_002
Concord_OF_002
Meadow_OF_002
Meadow_OF_002
Farrar Pond
Pineridge_OF_001
Outfalls
Private Outfalls
Catch Basin
Channel
DMH
Interconnection
Building Drain
WQU
State Outfall
State Manhole
State Catch Basin
Town Drainage Pipe
State Drainage Pipe
Culvert
BMP
Lake, Pond, Reservoir
Wetland, Marsh, Swamp
Stream, Brook
Catchment
Non-Urban Area
SHEET
H3
0
250
Feet
Stormwater Infrastructure Tile Map Lincoln, MA
Comprehensive Environmental Incorporated

5/29/2025


G3
G4
G5
H3
H5
I3
I4
I5
CODMAN ROAD
HILLSIDE ROAD
LINCOLN ROAD
LEWIS STREET
SOUTH GREAT ROAD
Concord_OF_001
Wells_OF_001
Hillside_OF_001
Hillside_OF_001
Linc_OF_007
Linc_OF_007
SouthGr_OF_004
Meadow_OF_001
Meadow_OF_002
Meadow_OF_001
SouthGr_OF_004
Meadow_OF_002
INT-1
INT-2
Linc_OF_008
Outfalls
Private Outfalls
Catch Basin
Channel
DMH
Interconnection
Building Drain
WQU
State Outfall
State Manhole
State Catch Basin
Town Drainage Pipe
State Drainage Pipe
Culvert
BMP
Lake, Pond, Reservoir
Wetland, Marsh, Swamp
Stream, Brook
Catchment
Non-Urban Area
SHEET
H4
0
250
Feet
Stormwater Infrastructure Tile Map Lincoln, MA
Comprehensive Environmental Incorporated

5/29/2025


G4
G5
G6
H4
H6
I4
I5
I6
Wells_OF_001
WELLS ROAD
Wells_OF_002
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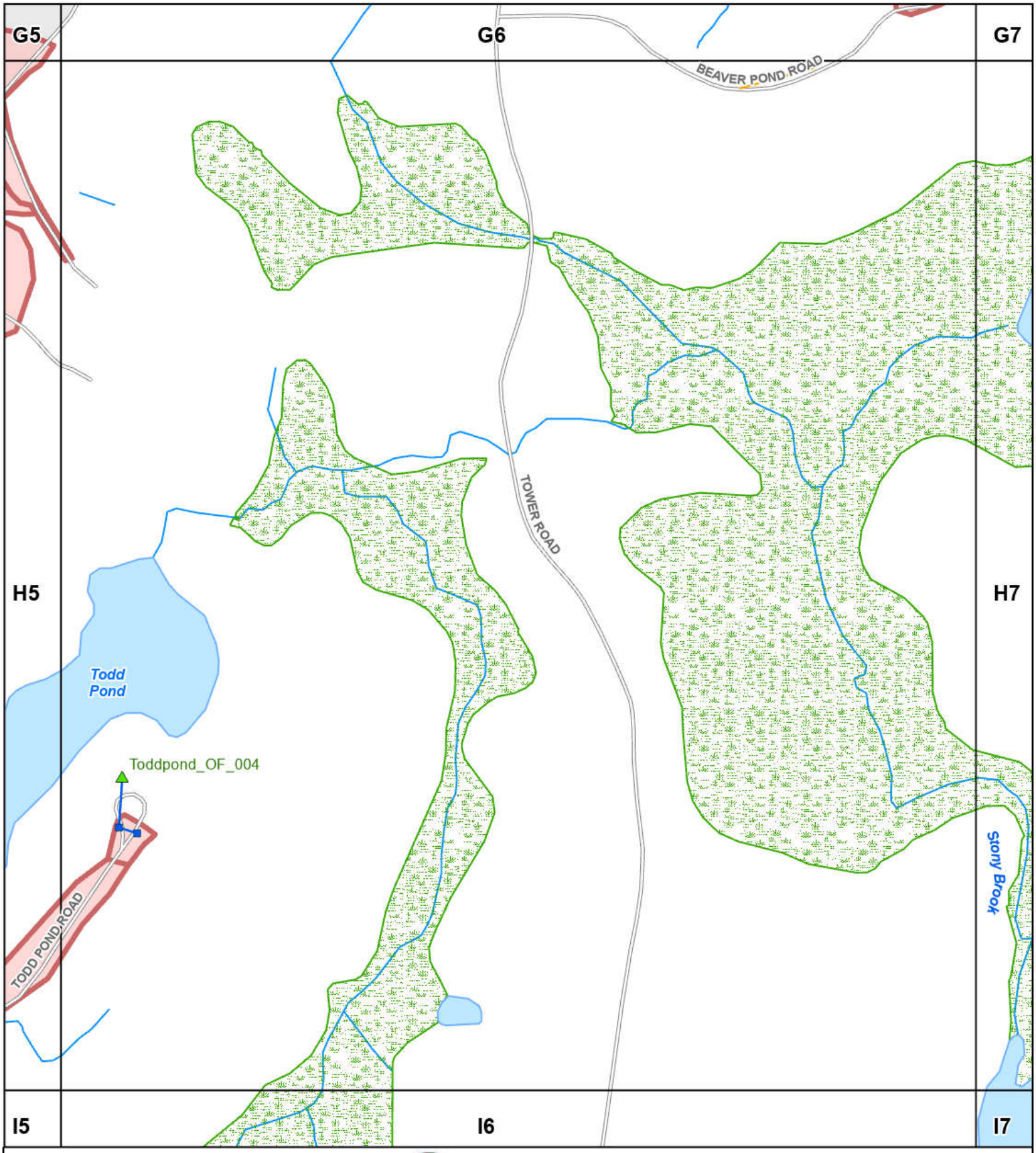
Linc_OF_005
Linc_OF_006
Linc_OF_013
Wells_OF_002
Linc_OF_013
Linc_OF_004
Linc_OF_005
Linc_OF_006
MEADOWDAM ROAD
LINCOLN ROAD
Toddpond_OF_002
Toddpond_OF_001
Toddpond_OF_002
WOODBROOK ROAD
RIDGE ROAD
LEWIS STREET
HwDpt_OF_001
HwDpt_OF_001
GREENRIDGE LANE
Toddpond_OF_003
Todd Pond
CODMAN ROAD
ShortHill_OF_001
TODD POND ROAD
SHORT HILL ROAD
Toddpond_OF_005
Toddpond_OF_005
SOUTH GREAT ROAD
SouthGr_OF_005
Outfalls
Private Outfalls
Catch Basin
Channel
DMH
Interconnection
Building Drain
WQU
State Outfall
State Manhole
State Catch Basin
Town Drainage Pipe
State Drainage Pipe
Culvert
BMP
Lake, Pond, Reservoir
Wetland, Marsh, Swamp
Stream, Brook
Catchment
Non-Urban Area
SHEET
H5
0
250
Feet
Stormwater Infrastructure Tile Map Lincoln, MA
Comprehensive Environmental Incorporated

5/29/2025



Outfalls
Private Outfalls
Catch Basin
Channel
DMH
Interconnection
Building Drain
WQU
State Outfall
State Manhole
State Catch Basin
Town Drainage Pipe
State Drainage Pipe
Culvert
BMP
Lake, Pond, Reservoir
Wetland, Marsh, Swamp
Stream, Brook
Catchment
Non-Urban Area

SHEET
H6

0 250
Feet

Stormwater Infrastructure Tile Map Lincoln, MA

Comprehensive Environmental Incorporated

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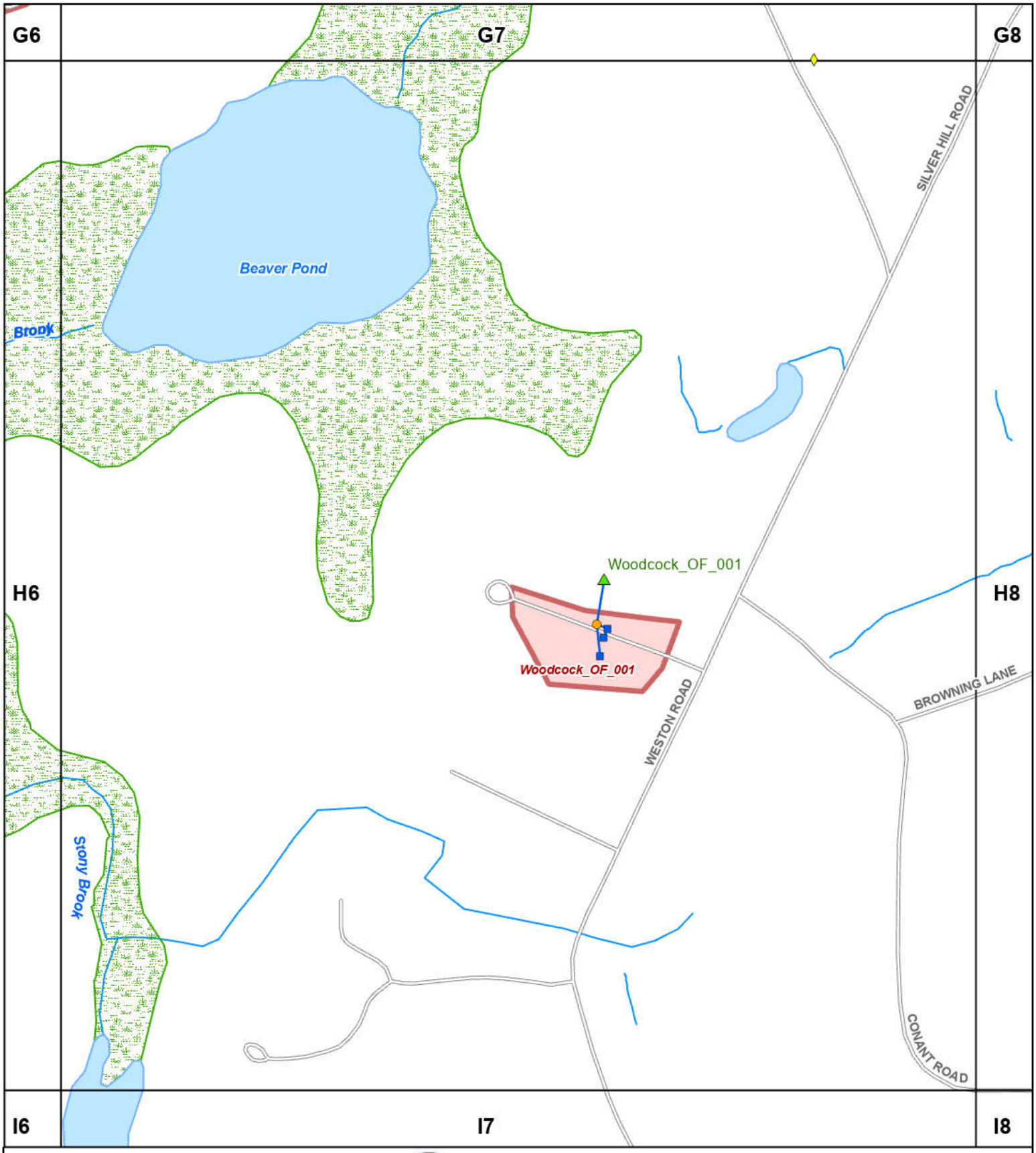

- Outfalls
- Private Outfalls
- Catch Basin
- Channel
- DMH
- Interconnection
- Building Drain
- WQU
- State Outfall
- State Manhole
- State Catch Basin
- Town Drainage Pipe
- State Drainage Pipe
- Culvert
- BMP
- Lake, Pond, Reservoir
- Wetland, Marsh, Swamp
- Stream, Brook
- Catchment
- Non-Urban Area

SHEET
H7

0 250
Feet

Stormwater Infrastructure Tile Map Lincoln, MA

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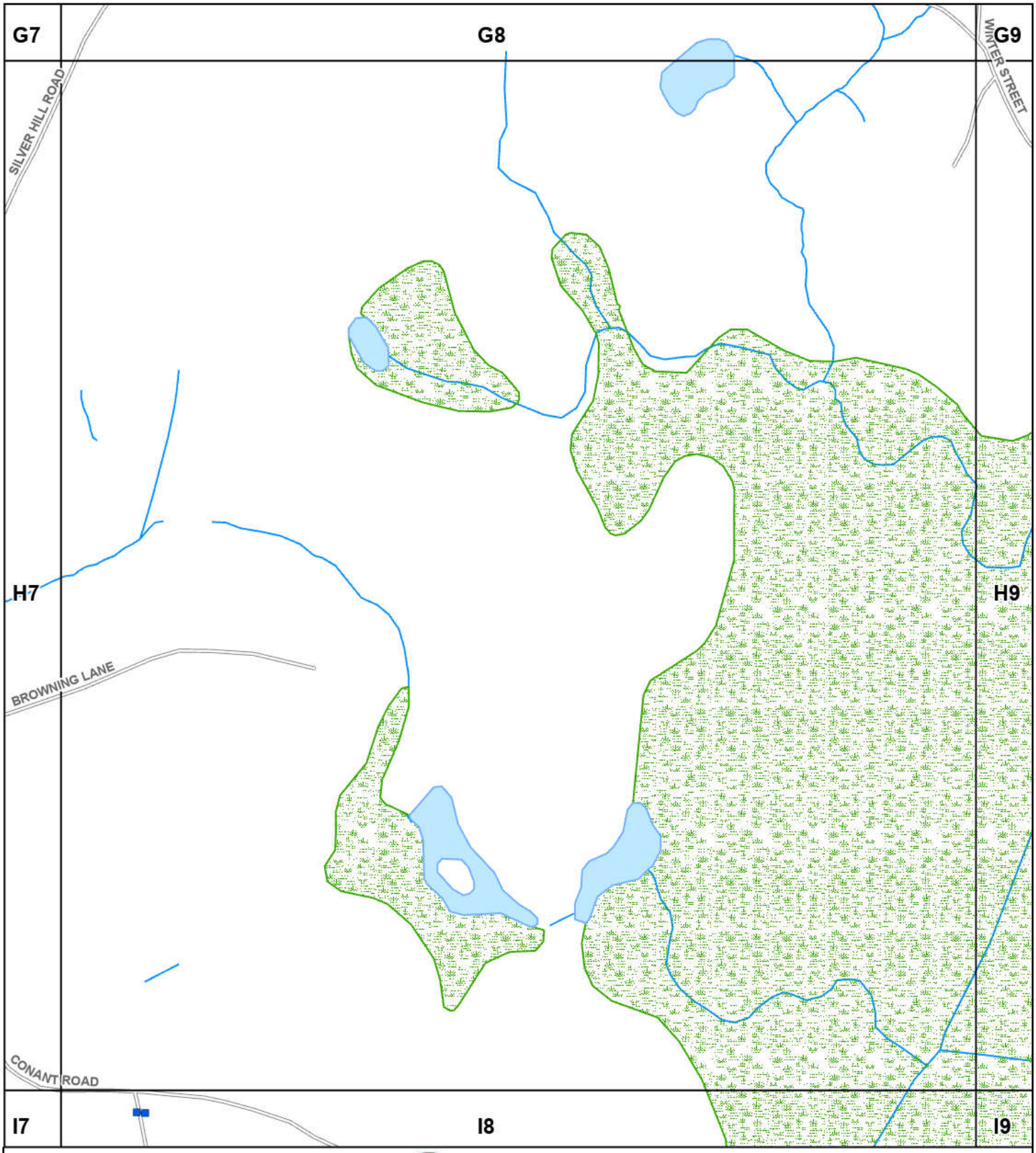

- Outfalls
- Private Outfalls
- Catch Basin
- Channel
- DMH
- Interconnection
- Building Drain
- WQU
- State Outfall
- State Manhole
- State Catch Basin
- Town Drainage Pipe
- State Drainage Pipe
- Culvert
- BMP
- Lake, Pond, Reservoir
- Wetland, Marsh, Swamp
- Stream, Brook
- Catchment
- Non-Urban Area

SHEET
H8

0 250
Feet

Stormwater Infrastructure Tile Map Lincoln, MA

Comprehensive Environmental Incorporated

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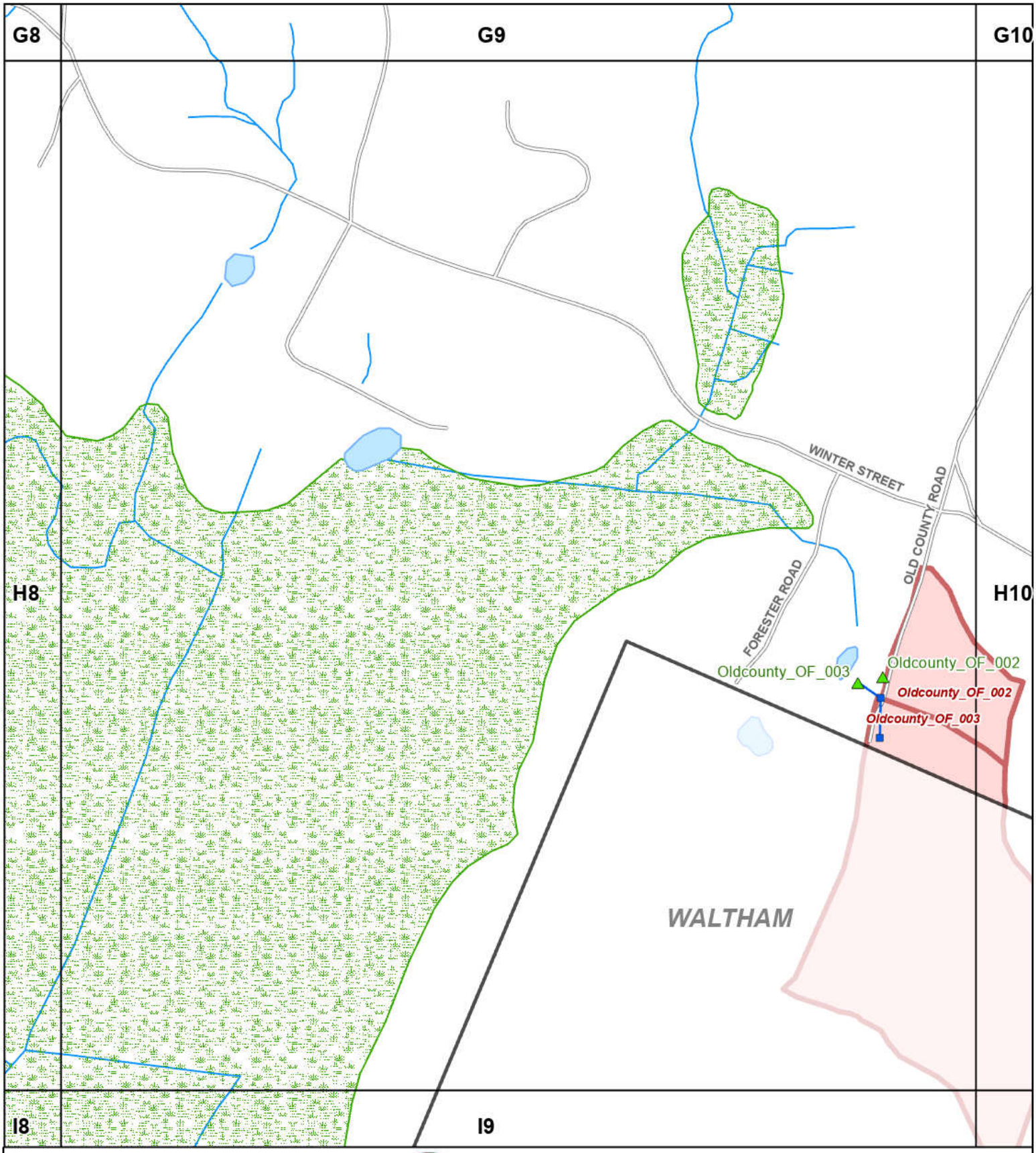

Outfalls
Private Outfalls
Catch Basin
Channel
DMH
Interconnection
Building Drain
WQU
State Outfall
State Manhole
State Catch Basin
Town Drainage Pipe
State Drainage Pipe
Culvert
BMP
Lake, Pond, Reservoir
Wetland, Marsh, Swamp
Stream, Brook
Catchment
Non-Urban Area

SHEET
H9

0 250
Feet

Stormwater Infrastructure Tile Map Lincoln, MA

Comprehensive Environmental Incorporated

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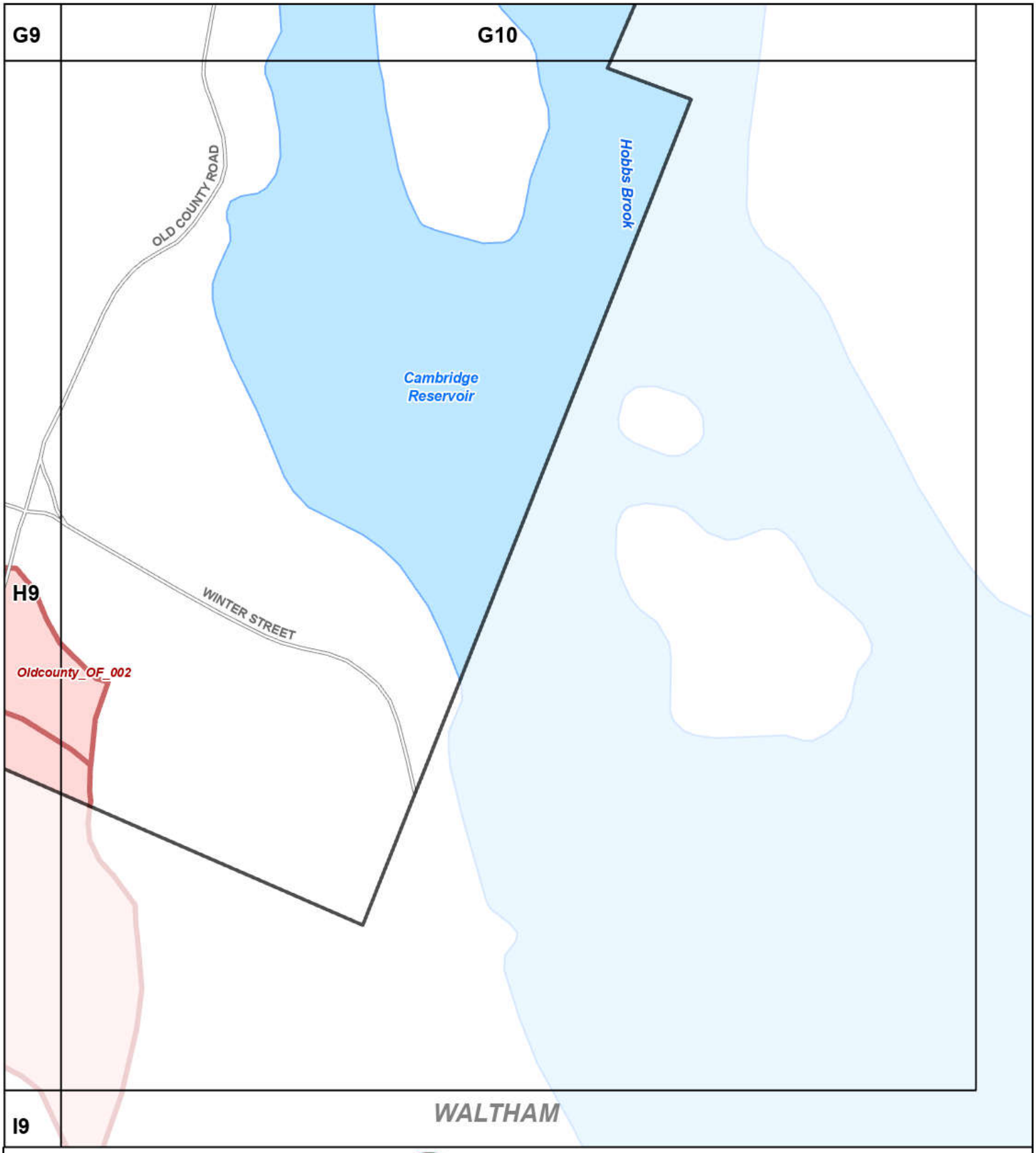

- Outfalls
- Private Outfalls
- Catch Basin
- Channel
- DMH
- Interconnection
- Building Drain
- WQU
- State Outfall
- State Manhole
- State Catch Basin
- Town Drainage Pipe
- State Drainage Pipe
- Culvert
- BMP
- Lake, Pond, Reservoir
- Wetland, Marsh, Swamp
- Stream, Brook
- Catchment
- Non-Urban Area

SHEET H10

0 250 Feet

Stormwater Infrastructure Tile Map Lincoln, MA

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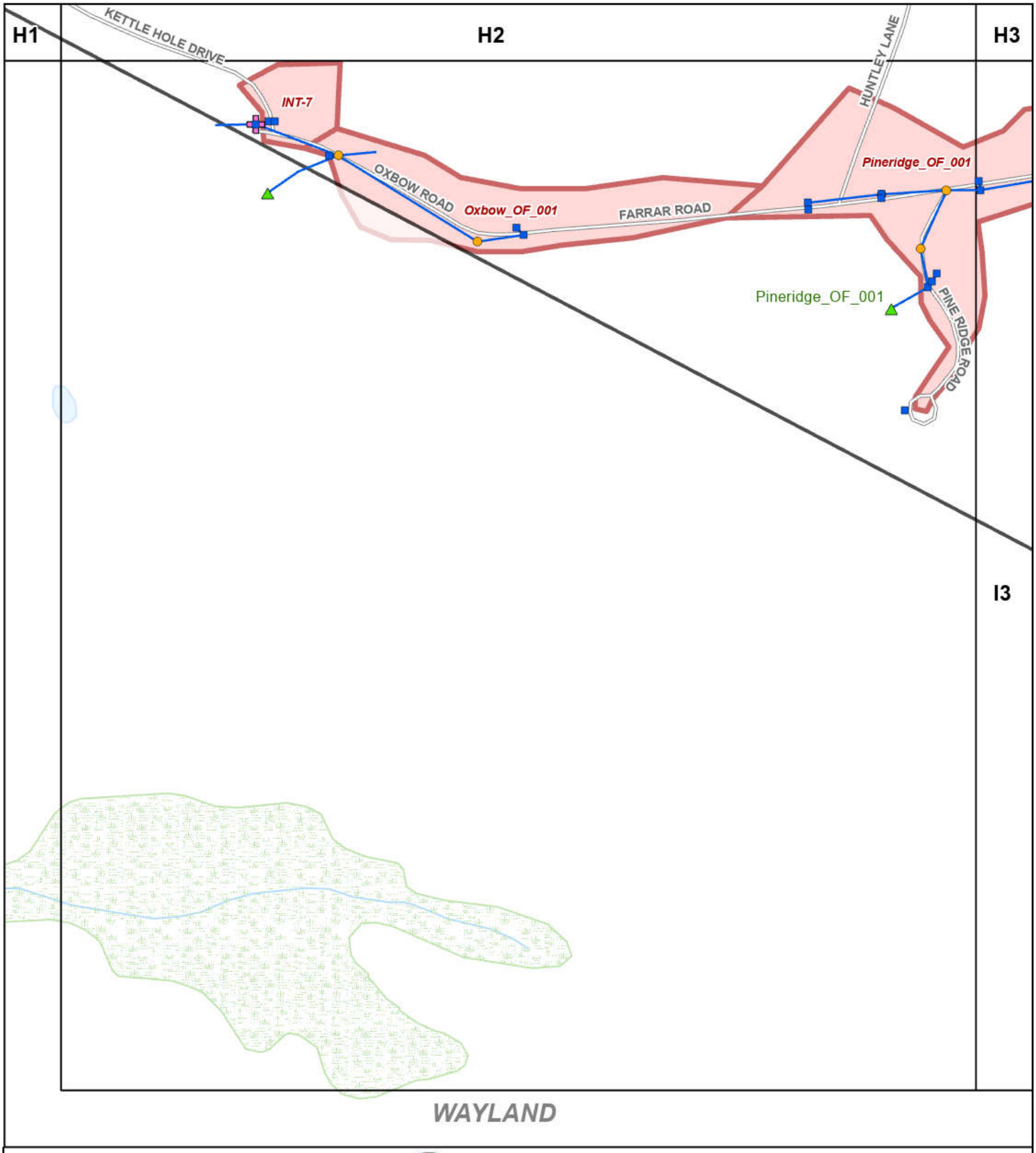

- Outfalls
- Private Outfalls
- Catch Basin
- Channel
- DMH
- Interconnection
- Building Drain
- WQU
- State Outfall
- State Manhole
- State Catch Basin
- Town Drainage Pipe
- State Drainage Pipe
- Culvert
- BMP
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- Stream, Brook
- Catchment
- Non-Urban Area

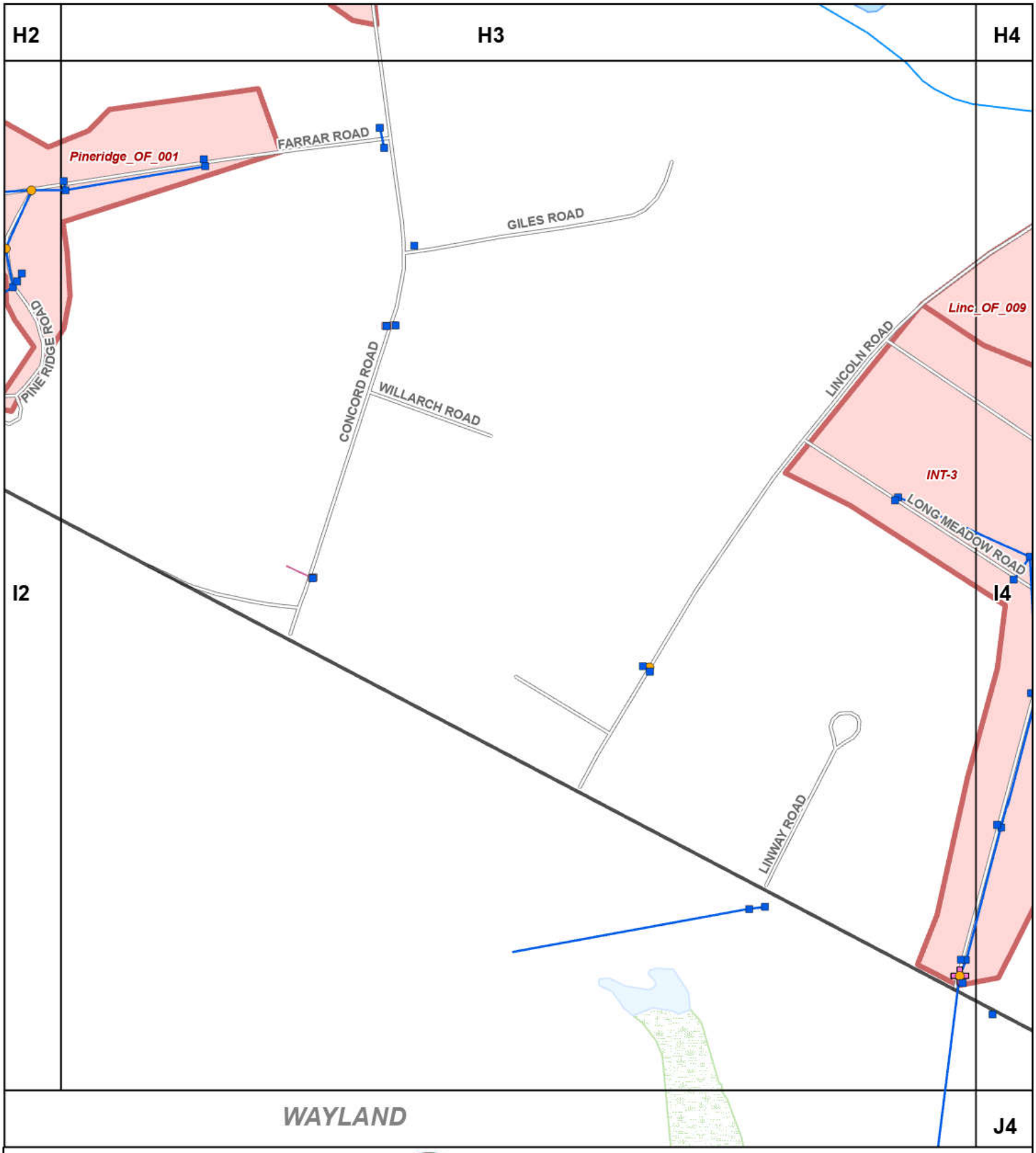
SHEET
I2

0 250 Feet

Stormwater Infrastructure Tile Map Lincoln, MA

Comprehensive Environmental Incorporated

5/29/2025



Outfalls
Private Outfalls
Catch Basin
Channel
DMH
Interconnection
Building Drain
WQU
State Outfall
State Manhole
State Catch Basin
Town Drainage Pipe
State Drainage Pipe
Culvert
BMP
Lake, Pond, Reservoir
Wetland, Marsh, Swamp
Stream, Brook
Catchment
Non-Urban Area

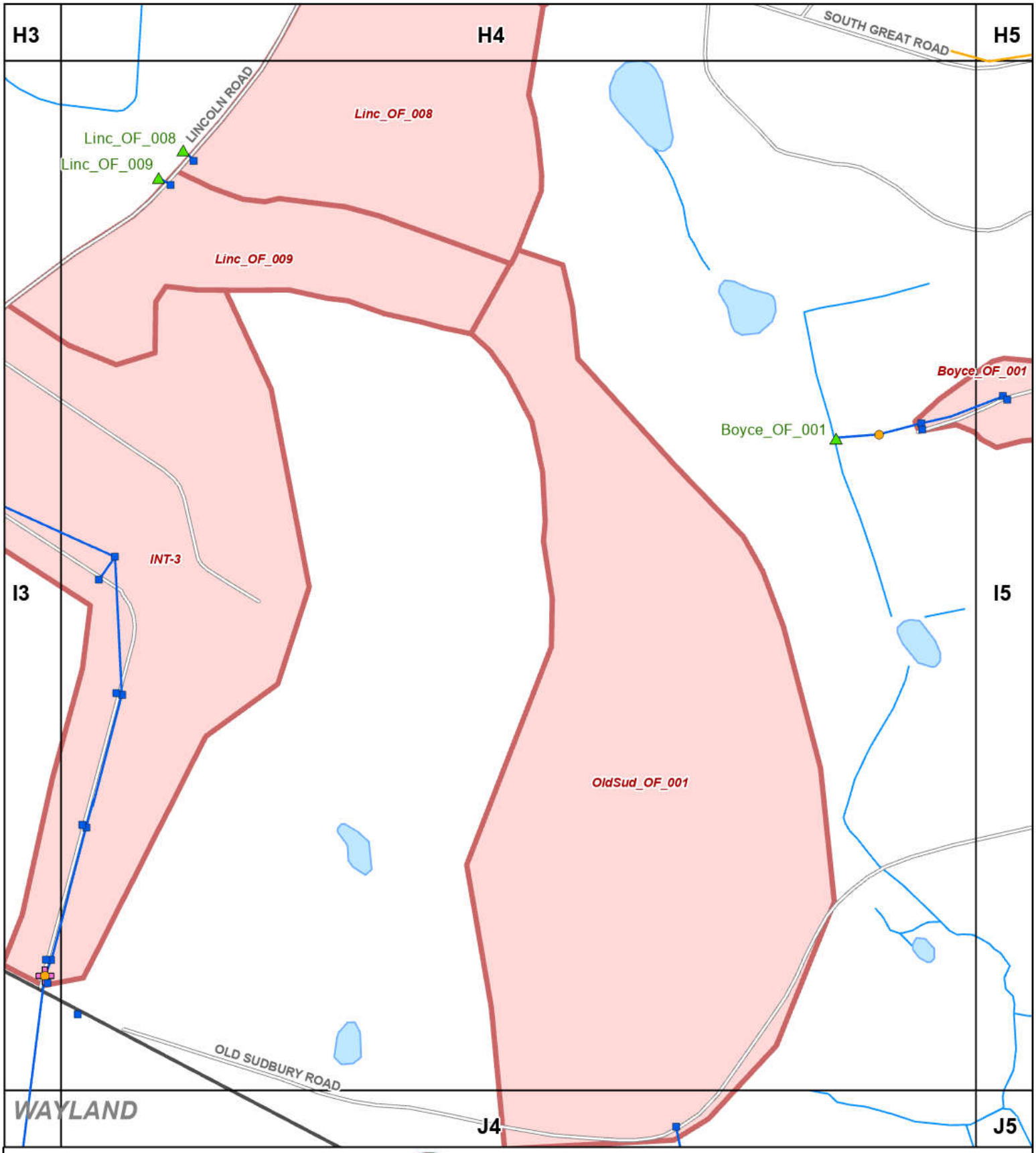
SHEET
I3

0 250 Feet

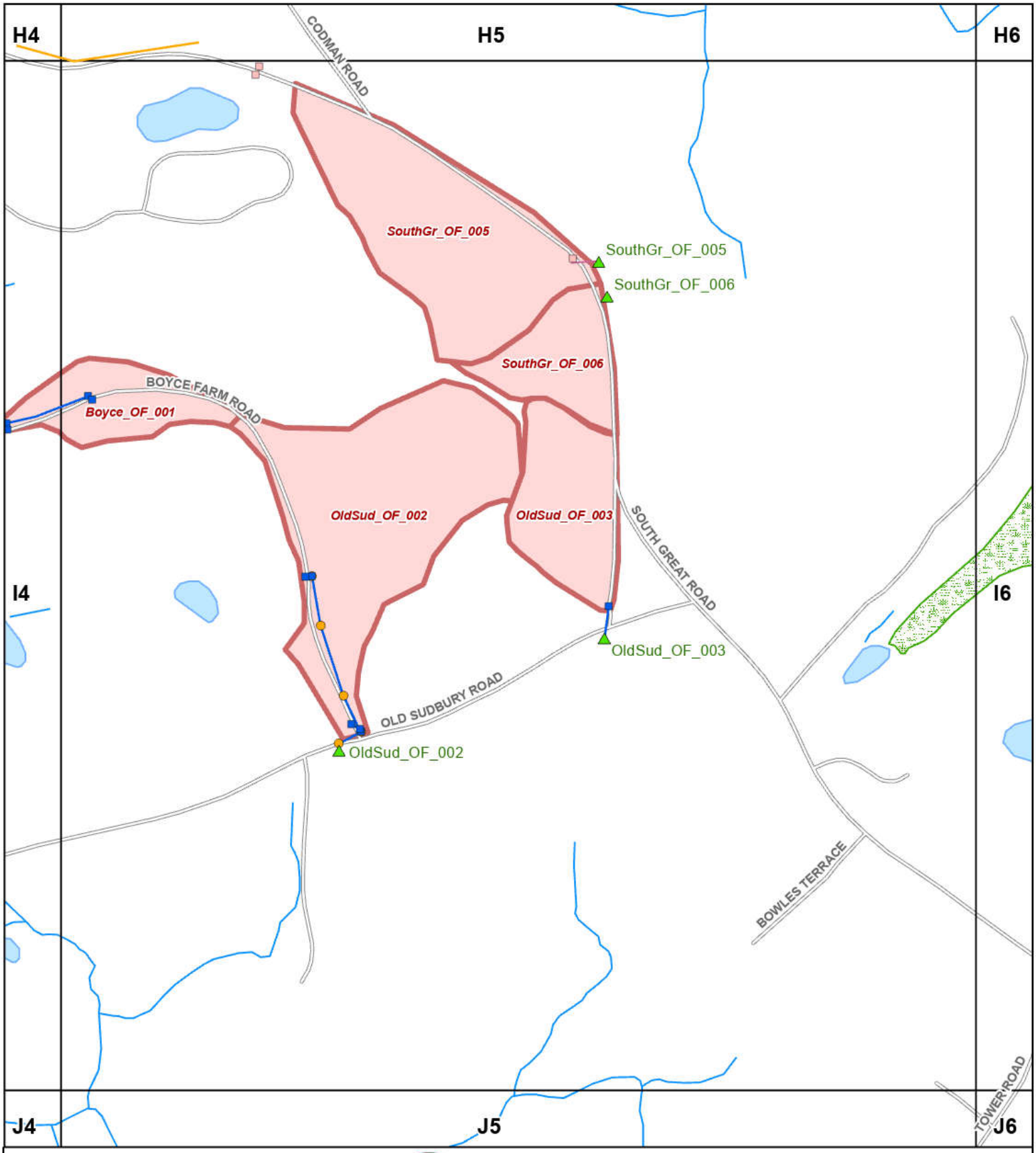
Stormwater Infrastructure Tile Map Lincoln, MA

Comprehensive Environmental Incorporated

5/29/2025


H3
H4
H5
I3
I5
J4
J5
SOUTH GREAT ROAD
LINCOLN ROAD
Linc_OF_008
Linc_OF_009
Linc_OF_008
Linc_OF_009
Boyce_OF_001
Boyce_OF_001
INT-3
OldSud_OF_001
OLD SUDBURY ROAD
WAYLAND
Outfalls
Private Outfalls
Catch Basin
Channel
DMH
Interconnection
Building Drain
WQU
State Outfall
State Manhole
State Catch Basin
Town Drainage Pipe
State Drainage Pipe
Culvert
BMP
Lake, Pond, Reservoir
Wetland, Marsh, Swamp
Stream, Brook
Catchment
Non-Urban Area
SHEET
I4
0
250
Feet
Stormwater Infrastructure Tile Map Lincoln, MA
Comprehensive Environmental Incorporated

5/29/2025



Outfalls
Private Outfalls
Catch Basin
Channel
DMH
Interconnection
Building Drain
WQU
State Outfall
State Manhole
State Catch Basin
Town Drainage Pipe
State Drainage Pipe
Culvert
BMP
Lake, Pond, Reservoir
Wetland, Marsh, Swamp
Stream, Brook
Catchment
Non-Urban Area

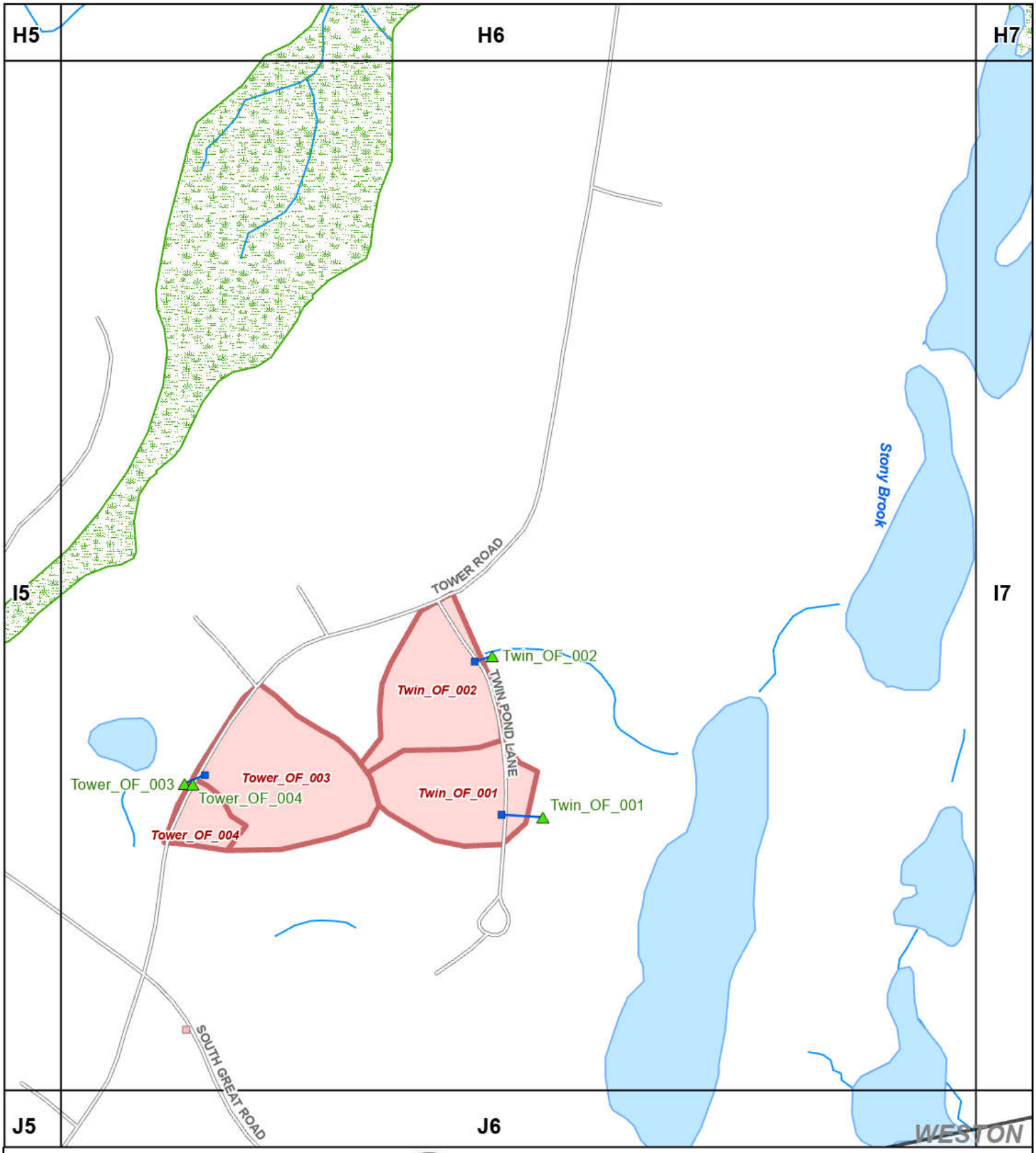
SHEET
I5

0 250
Feet

Stormwater Infrastructure Tile Map Lincoln, MA

Comprehensive Environmental Incorporated

5/29/2025



Outfalls
Private Outfalls
Catch Basin
Channel
DMH
Interconnection
Building Drain
WQU
State Outfall
State Manhole
State Catch Basin
Town Drainage Pipe
State Drainage Pipe
Culvert
BMP
Lake, Pond, Reservoir
Wetland, Marsh, Swamp
Stream, Brook
Catchment
Non-Urban Area

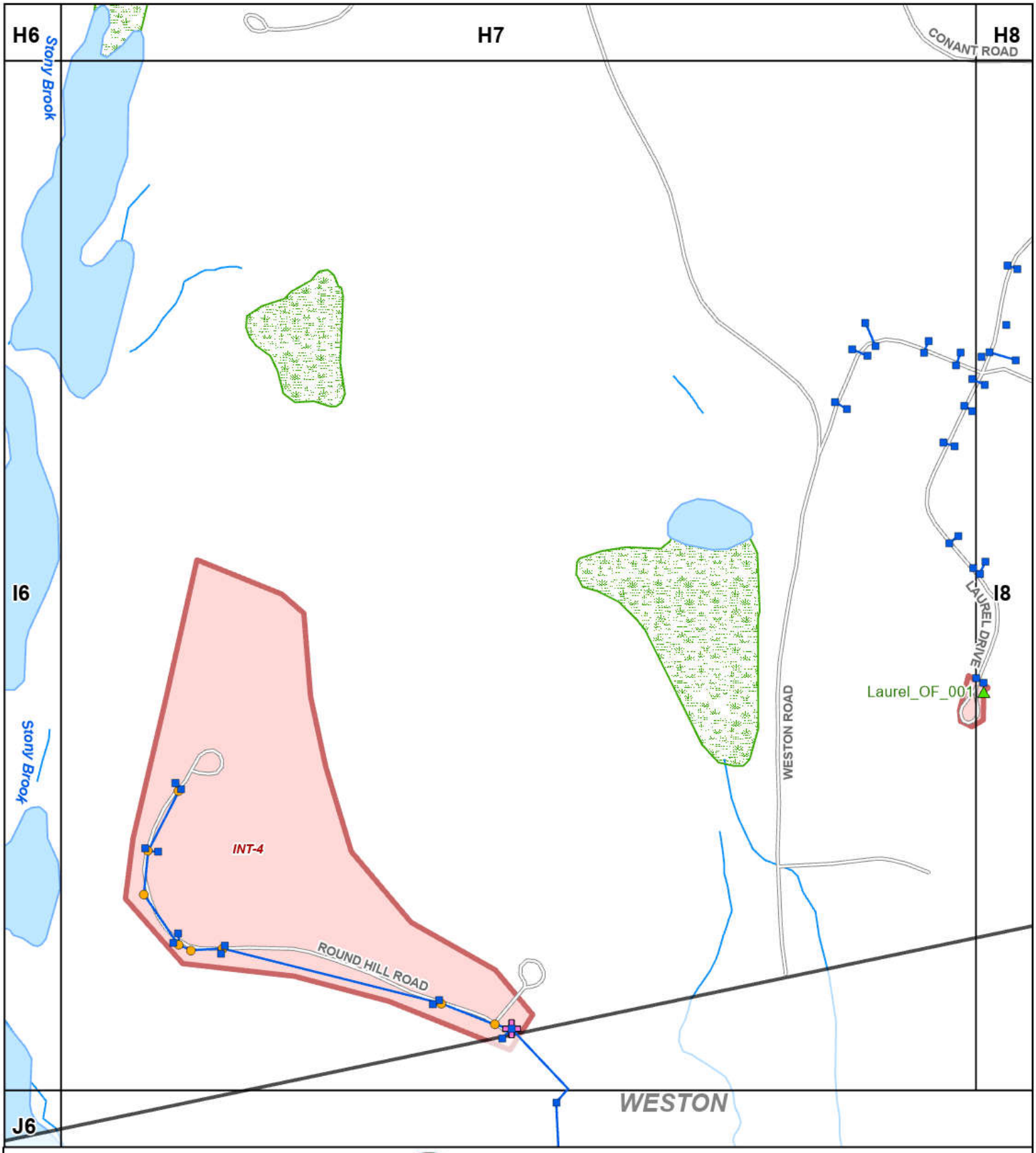
SHEET
I6

0 250
Feet

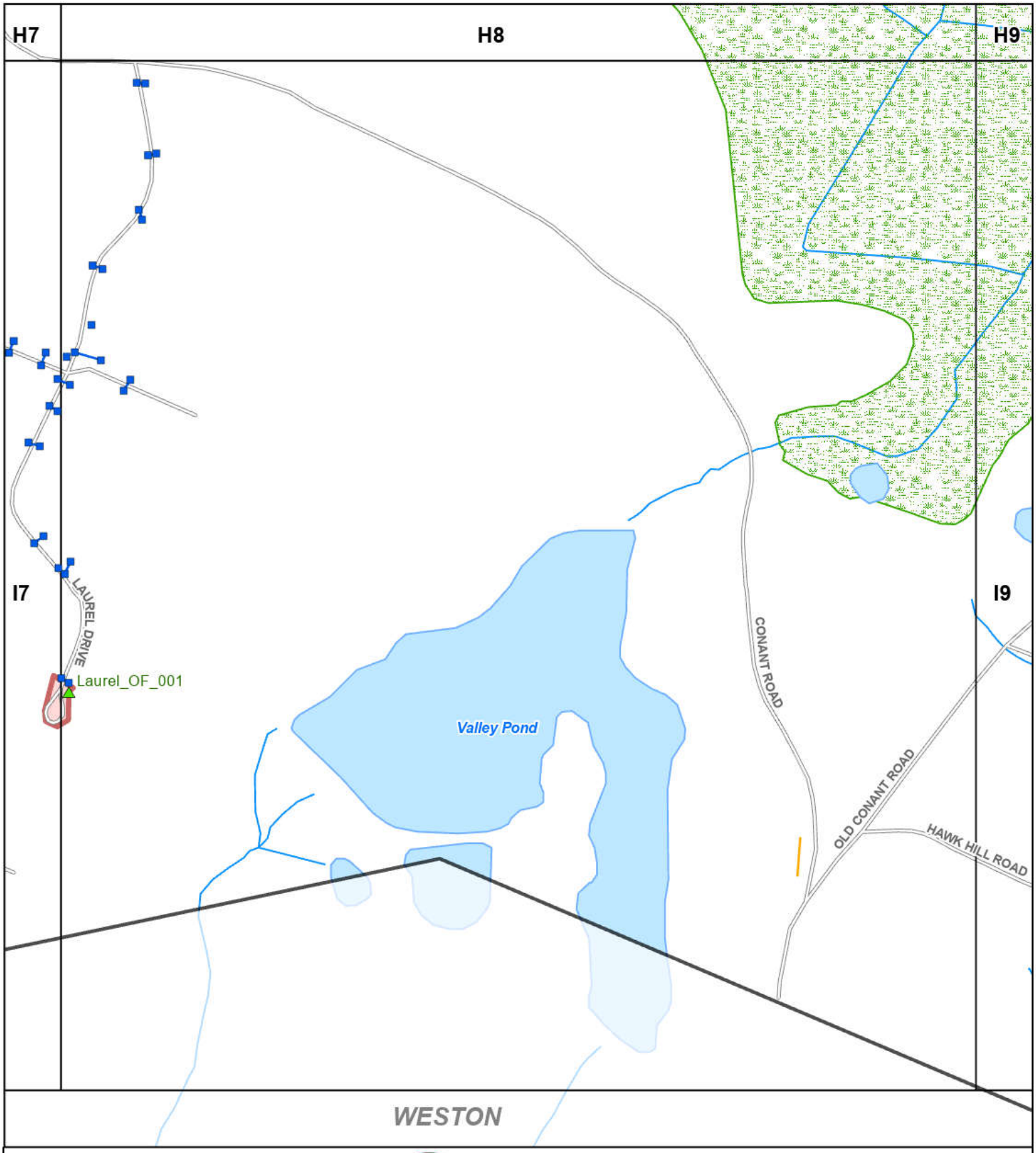
Stormwater Infrastructure Tile Map Lincoln, MA

Comprehensive Environmental Incorporated

5/29/2025


H6
H7
H8
I6
I8
J6
Stony Brook
Stony Brook
CONANT ROAD
LAUREL DRIVE
WESTON ROAD
ROUND HILL ROAD
INT-4
Laurel_OF_001
WESTON
Outfalls
Private Outfalls
Catch Basin
Channel
DMH
Interconnection
Building Drain
WQU
State Outfall
State Manhole
State Catch Basin
Town Drainage Pipe
State Drainage Pipe
Culvert
BMP
Lake, Pond, Reservoir
Wetland, Marsh, Swamp
Stream, Brook
Catchment
Non-Urban Area
SHEET
I7
0
250
Feet
Stormwater Infrastructure Tile Map Lincoln, MA
Comprehensive Environmental Incorporated

5/29/2025



Outfalls
Private Outfalls
Catch Basin
Channel
DMH
Interconnection
Building Drain
WQU
State Outfall
State Manhole
State Catch Basin
Town Drainage Pipe
State Drainage Pipe
Culvert
BMP
Lake, Pond, Reservoir
Wetland, Marsh, Swamp
Stream, Brook
Catchment
Non-Urban Area

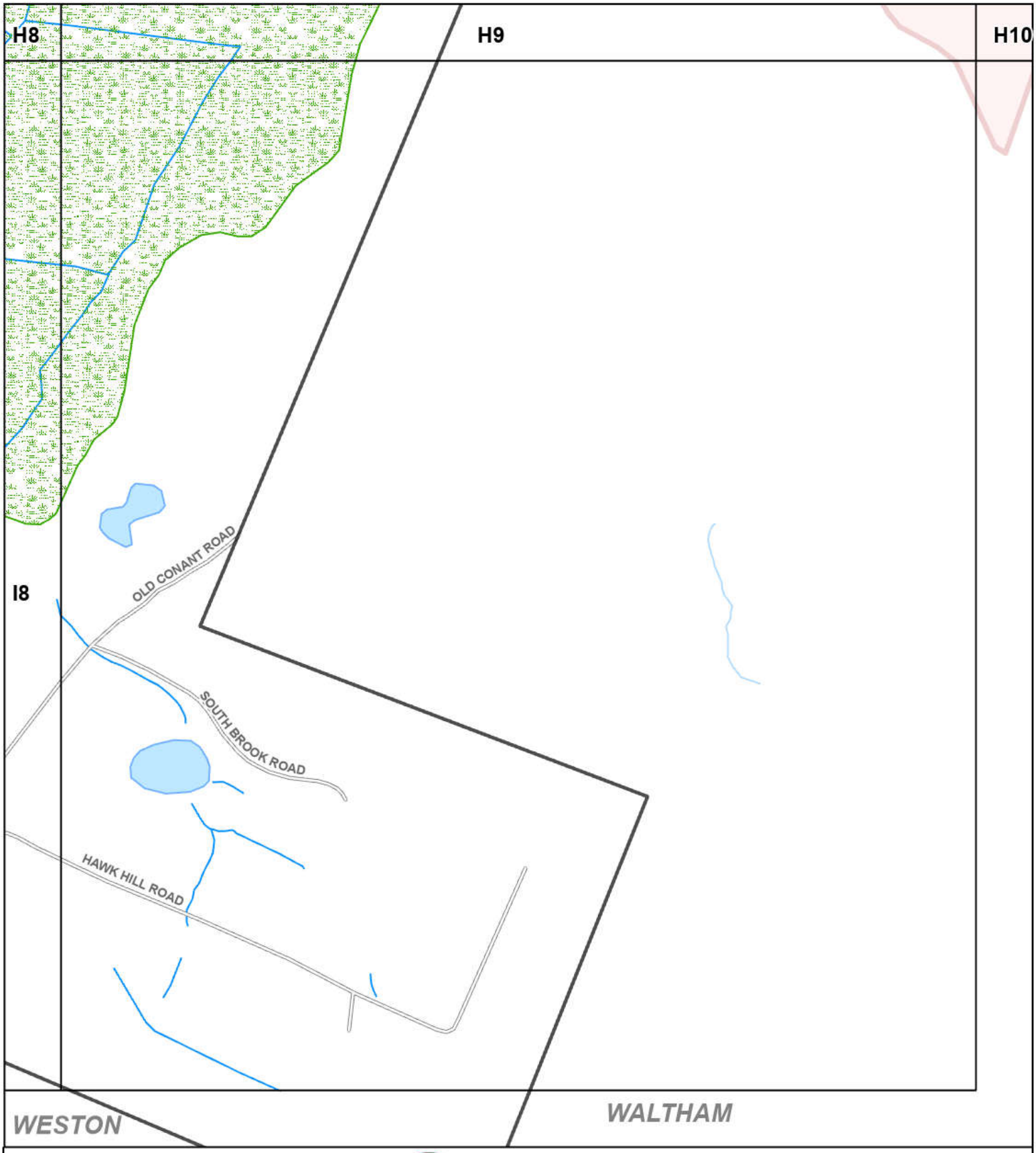
SHEET
I8

0 250
Feet

Stormwater Infrastructure Tile Map Lincoln, MA

Comprehensive Environmental Incorporated

5/29/2025



- Outfalls
- Private Outfalls
- Catch Basin
- Channel
- DMH
- Interconnection
- Building Drain
- WQU
- State Outfall
- State Manhole
- State Catch Basin
- Town Drainage Pipe
- State Drainage Pipe
- Culvert
- BMP
- Lake, Pond, Reservoir
- Wetland, Marsh, Swamp
- Stream, Brook
- Catchment
- Non-Urban Area

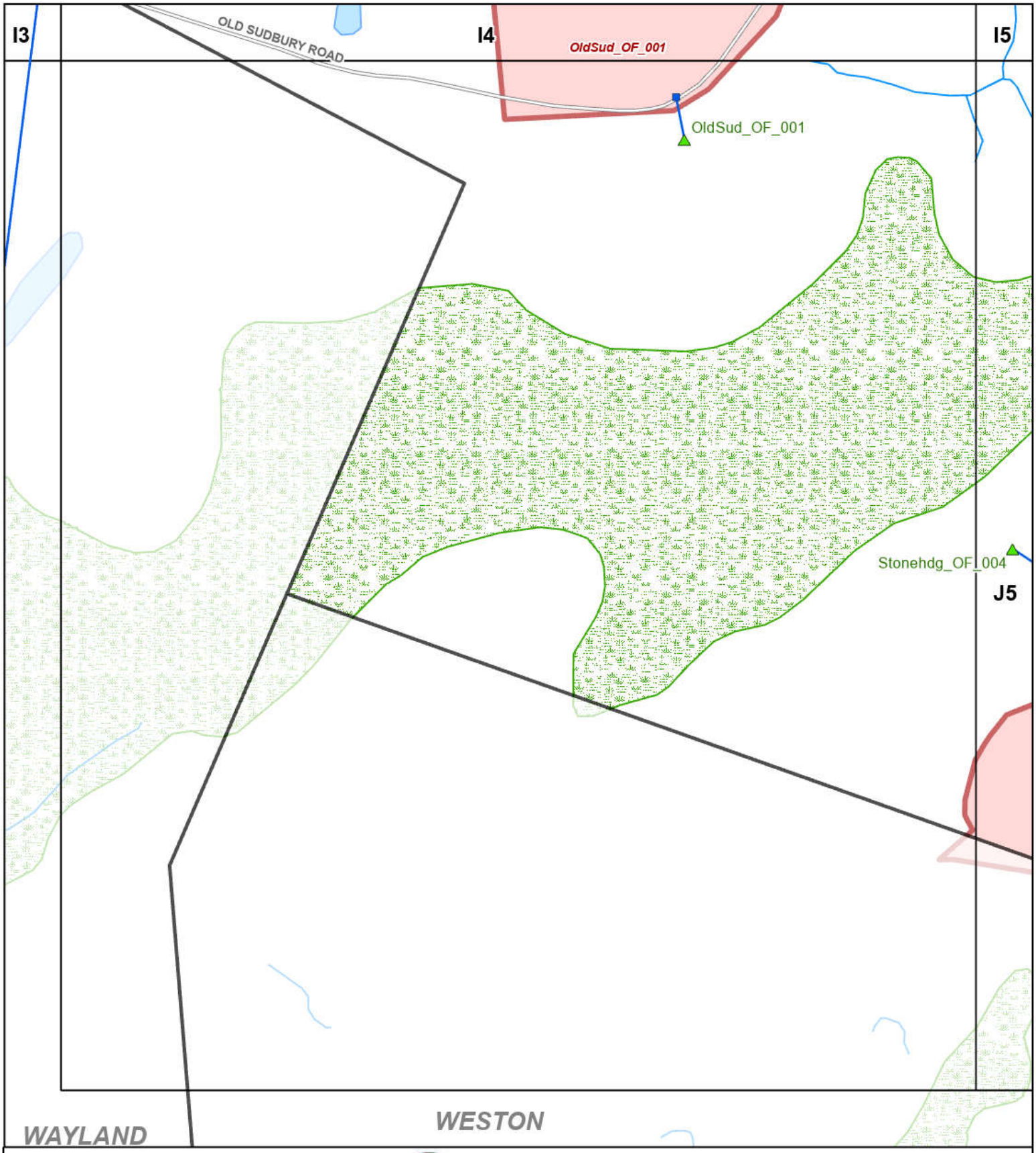
SHEET
I9

0 250 Feet

Stormwater Infrastructure Tile Map Lincoln, MA

Comprehensive Environmental Incorporated

5/29/2025



Outfalls
Private Outfalls
Catch Basin
Channel
DMH
Interconnection
Building Drain
WQU
State Outfall
State Manhole
State Catch Basin
Town Drainage Pipe
State Drainage Pipe
Culvert
BMP
Lake, Pond, Reservoir
Wetland, Marsh, Swamp
Stream, Brook
Catchment
Non-Urban Area

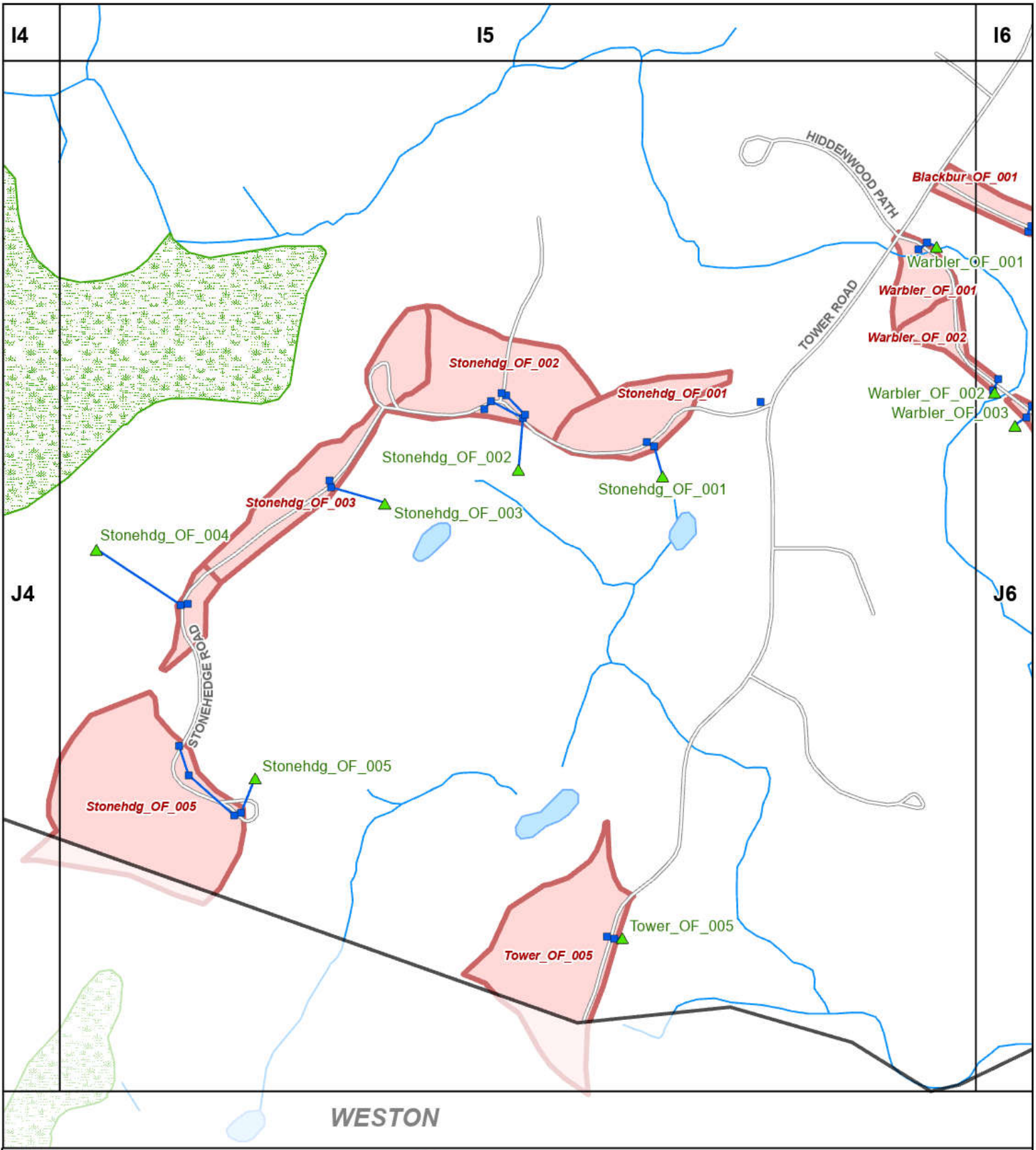
SHEET
J4

0 250
Feet

Stormwater Infrastructure Tile Map Lincoln, MA

Comprehensive Environmental Incorporated

5/29/2025



Outfalls
Private Outfalls
Catch Basin
Channel
DMH
Interconnection
Building Drain
WQU
State Outfall
State Manhole
State Catch Basin
Town Drainage Pipe
State Drainage Pipe
Culvert
BMP
Lake, Pond, Reservoir
Wetland, Marsh, Swamp
Stream, Brook
Catchment
Non-Urban Area

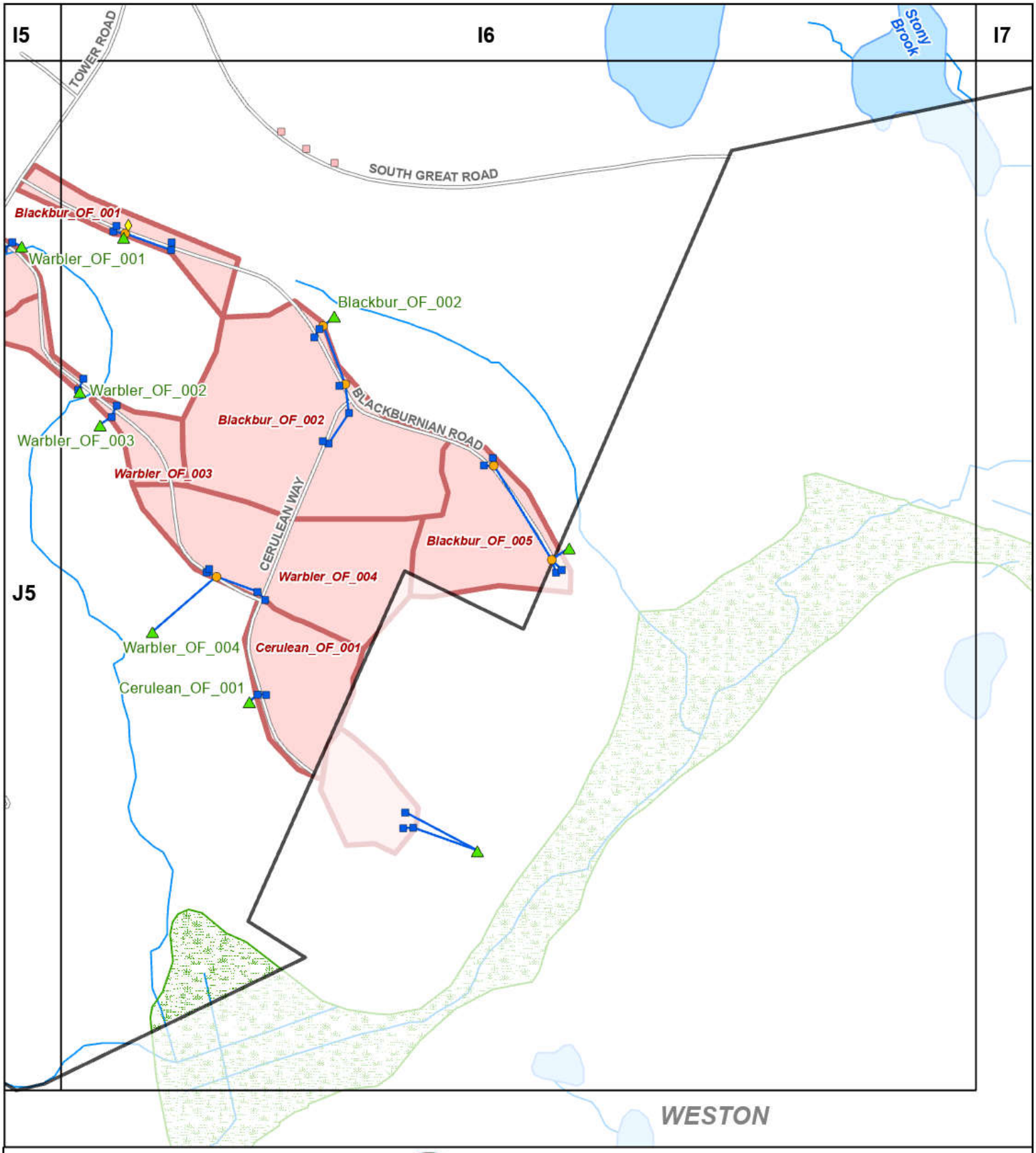
SHEET
J5

0 250
Feet

Stormwater Infrastructure Tile Map Lincoln, MA

Comprehensive Environmental Incorporated

5/29/2025



Outfalls
Private Outfalls
Catch Basin
Channel
DMH
Interconnection
Building Drain
WQU
State Outfall
State Manhole
State Catch Basin
Town Drainage Pipe
State Drainage Pipe
Culvert
BMP
Lake, Pond, Reservoir
Wetland, Marsh, Swamp
Stream, Brook
Catchment
Non-Urban Area

SHEET
J6

0 250
Feet

Stormwater Infrastructure Tile Map Lincoln, MA

Comprehensive Environmental Incorporated

5/29/2025

Appendix B

IDDE Outfall Classification/Ranking & Vulnerability Assessment

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

Outfall Data			Sampling Data							Problem Outfalls		High Priority Outfalls																				Excluded			Ranking		Notes
																Density of Generating Sites[2]						Age of development																	
Outfall ID	Receiving Water	Receiving Water Impairment	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	Ammonia > 0.5 mg/L	Surfactants > 0.25 mg/L	Chlorine > 0 mg/L	Bacteria > WQ criteria	Sewer odor detected during inspection	Known or suspected contributions of illicit discharges	Olfactory or visual evidence of sewage	Discharge to/near public beach	Discharge to/near recreational area	Discharge to/near drinking water supply	Discharge to/near shellfish beds	Past Discharge Complaints	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	Historic combined sewer system that has been separated	Density of septic systems ≥30 years old in residential land use	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
Ballfield_OF_001	Stony Brook main stem to Sandy Pond													x																					Zone II, Tower Rd. GP Well
Ballfield_OF_002	Stony Brook west fork												x	x																				High	2	Lincoln Elementary School, Zone II
Ballfield_OF_003	Stony Brook west fork												x	x																				High	2	Lincoln Elementary School, Zone II
Ballfield_OF_005	Stony Brook west fork												x	x																				High	2	Lincoln Elementary School, Zone II
Ballfield_OF_006													x	x																				High	2	Lincoln Elementary School, Zone II
Ballfield_OF_007	Stony Brook west fork												x	x																				High	2	Lincoln Elementary School, Zone II
Ballfield_OF_010																																		Low	0	
Ballfield_OF_011	Stony Brook west fork												x	x																				High	2	Lincoln Elementary School, Zone II
Beaverpond_OF_001													x																					High	1	Pierce Park
Beaverpond_OF_002	Unnamed pond in Pierce Park near Beaver Pond Rd												x																					High	1	Pierce Park
Beaverpond_OF_003																																		Low	0	
BedfordLn_OF_001	Unnamed Tributary to Hobbs Brook																																	Low	0	
BedfordRd_OF_001	Unnamed Tributary to Hobbs Brook																																	Low	0	
BedfordRd_OF_002																																		Low	0	
BedfordRd_OF_005	Unnamed Tributary to Stony Brook																																	Low	0	
BedfordRd_OF_006																																		Low	0	
Birchwood_OF_001																																		Low	0	
Birchwood_OF_002																																		Low	0	
Birchwood_OF_003																																		Low	0	
Blackbur_OF_001																																		Low	0	
Blackbur_OF_002																																		Low	0	
Blackbur_OF_004																																		Low	0	
Blackbur_OF_005																																		Low	0	
Blueberry_OF_001																																		Low	0	
Blueberry_OF_002																																		Low	0	
Boyce_OF_001																																		Low	0	
Brooks_OF_001																																		Low	0	
Cambridge_OF_001																																		Low	0	
Cambridge_OF_002																																		Low	0	
Cambridge_OF_003																																		Low	0	
Cerulean_OF_001	Mill Brook																																	Low	0	
Concord_OF_001																																		Low	0	
Concord_OF_002																																		Low	0	
Deerhaven_OF_001	Mill Brook																																	Low	0	
Deerhaven_OF_002						x	x																											2nd Priority	2	
Deerhaven_OF_003																																		Low	0	
Deerhaven_OF_005																																		Low	0	
Emerson_OF_001																																		Low	0	
Emerson_OF_002																																		Low	0	
Emerson_OF_003																																		Low	0	
Garland_OF_001																																		Low	0	
Goosepond_OF_001																																		Low	0	
Hillside_OF_001																																		Low	0	
HwDpt_OF_001														x						x		x												High	3	Zone II, Lincoln DPW, SavATree Lawn Care
INT-1																																		Low	0	
INT-2																																		Low	0	
INT-3																																		Low		
INT-4																																		Low		
INT-5																																		Low	0	
INT-7																																		Low	0	
Laurel_OF_001																																		Low	0	
Lex_OF_001																																		Low	0	
Lex_OF_002																																		Low	0	
Lex_OF_003																																		Low	0	

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

Outfall Data			Sampling Data							Problem Outfalls		High Priority Outfalls																			Excluded			Ranking		Notes
																Density of Generating Sites[2]						Age of development															
Outfall ID	Receiving Water	Receiving Water Impairment	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	Ammonia > 0.5 mg/L	Surfactants > 0.25 mg/L	Chlorine > 0 mg/L	Bacteria > WQ criteria	Sewer odor detected during inspection	Known or suspected contributions of illicit discharges	Olfactory or visual evidence of sewage	Discharge to/near public beach	Discharge to/near recreational area	Discharge to/near drinking water supply	Discharge to/near shellfish beds	Past Discharge Complaints	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	Historic combined sewer system that has been separated	Density of septic systems ≥30 years old in residential land use	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
Linc_OF_001													x																					High	1	Pierce Park
Linc_OF_002													x																					High	1	Pierce Park
Linc_OF_004																																		Low	0	
Linc_OF_005																																		Low	0	
Linc_OF_006																																		Low	0	
Linc_OF_007																																		Low	0	
Linc_OF_008	Unnamed tributary to Farrar Pond																																	Low	0	
Linc_OF_009	Unnamed tributary to Farrar Pond																															x			Excluded	1	
Linc_OF_010														x																					High	1	Zone II
Linc_OF_011																																		Low	0	
Linc_OF_012																																		Low	0	
Linc_OF_013	Unnamed tributary to Todd Pond													x					x																High	2	Zone II, Mobil
Meadow_OF_001																			x																High	1	Lincoln Service Ctr, South Great Rd.
Meadow_OF_002																																		Low	0	
Minebrook_OF_001																																		Low	0	
Minebrook_OF_002																																		Low	0	
Morning_OF_001	Elm Brook					x																												2nd Priority	1	
Morning_OF_002	Elm Brook																																	Low	0	
Oldcounty_OF_001	Cambridge Reservoir	Chloride																												x				High	1	
Oldcounty_OF_002	Unnamed pond between Old County and Forester Rds																																	Low	0	
Oldcounty_OF_003	Unnamed pond between Old County and Forester Rds																																	Low	0	
Oldfarm_OF_001																																		Low	0	
Oldlex_OF_001																																		Low	0	
OldSud_OF_001	Unnamed wetland S of Old Sudbury Rd																																	Low	0	
OldSud_OF_002																																		Low	0	
OldSud_OF_003																																		Low	0	
Oxbow_OF_001														x																					High	1	Zone II
Pagefarm_OF_001	Unnamed wetland at end of Page Farm Rd																																	Low	0	
PageRd_OF_001																																		Low	0	
PageRd_OF_002	Unnamed wetland near corner of Page Rd and Rte 2																																	Low	0	
Pheasant_OF_001																																		Low	0	
Pierce_OF_001	Stony Brook main stem to Sandy Pond													x																					High	1	Zone II, Tower Rd. GP Well
Pineridge_OF_001														x																					High	1	Zone II, Campbel Rd GP Well 1 (Wayland)
Sandy_OF_001	Unnamed pond S of Sandy Pond Rd, just inside Concord																																	Low	0	
Sandy_OF_008																																		Low	0	
Sandy_OF_009																																		Low	0	
Sandy_OF_010																																		Low	0	
ShortHill_OF_001														x																					High	1	Zone II, Tower Rd. GP Well
SmithHill_OF_001																																		Low	0	
SouthGr_OF_001																																		Low	0	
SouthGr_OF_002																																		Low	0	
SouthGr_OF_003																			x																High	1	Lincoln Service Ctr, South Great Rd.
SouthGr_OF_004	Unnamed tributary to Farrar Pond																																	Low	0	
SouthGr_OF_005														x																					High	1	Zone II, Tower Rd. GP Well
SouthGr_OF_006														x																					High	1	Zone II, Tower Rd. GP Well

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

Outfall Data			Sampling Data							Problem Outfalls		High Priority Outfalls																				Excluded			Ranking		Notes
																Density of Generating Sites[2]							Age of development																
Outfall ID	Receiving Water	Receiving Water Impairment	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	Ammonia > 0.5 mg/L	Surfactants > 0.25 mg/L	Chlorine > 0 mg/L	Bacteria > WQ criteria	Sewer odor detected during inspection	Known or suspected contributions of illicit discharges	Olfactory or visual evidence of sewage	Discharge to/near public beach	Discharge to/near recreational area	Discharge to/near drinking water supply	Discharge to/near shellfish beds	Past Discharge Complaints	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	Historic combined sewer system that has been separated	Density of septic systems ≥30 years old in residential land use	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
Stonehdg_OF_001	Unnamed pond S of Stonehedge Rd																																	Low	0	
Stonehdg_OF_002																																		Low	0	
Stonehdg_OF_003	Unnamed pond S of Stonehedge Rd																																	Low	0	
Stonehdg_OF_004	Unnamed pond S of Sandy Pond Rd, just inside Concord																																	Low	0	
Stonehdg_OF_005																																		Low	0	
Sunnyside_OF_001																																		Low	0	
Tabor_OF_001																																		Low	0	
Toddpond_OF_001														x																				High	1	Zone II, Tower Rd. GP Well
Toddpond_OF_003														x																				High	1	Zone II, Tower Rd. GP Well
Toddpond_OF_004	Todd Pond	No uses assessed												x																				High	1	Zone II, Tower Rd. GP Well
Toddpond_OF_005	Unnamed tributary to Todd Pond													x																				High	1	Zone II, Tower Rd. GP Well
Tower_OF_001																																		Low	0	
Tower_OF_002																																		Low	0	
Tower_OF_003	Unnamed pond between Tower Rd and S Great Rd																																	Low	0	
Tower_OF_004																																		Low	0	
Tower_OF_005																																		Low	0	
Trapelo_OF_001	Iron Mine Brook																																	Low	0	
Trapelo_OF_002	Denormandie Land wetland at Trapelo Rd/Winter St																																	Low	0	
Trapelo_OF_003	Denormandie Land wetland at Trapelo Rd/Winter St																																	Low	0	
Trapelo_OF_004																																		Low	0	
Trapelo_OF_006																																		Low	0	
Trapelo_OF_007	Unnamed pond between #134 and #144 Trapelo Rd																																	Low	0	
Trapelo_OF_009																																		Low	0	
Trapelo_OF_010																																		Low	0	
Trapelo_OF_011																																		Low	0	
Trapelo_OF_012																																		Low	0	
Trapelo_OF_013	Iron Mine Brook					x																												2nd Priority	1	
Twin_OF_001	Unnamed Tributary to Twin Pond																																	Low	0	
Twin_OF_002																																		Low	0	
Warbler_OF_001	Stony Brook west fork																																	Low	0	
Warbler_OF_002	Stony Brook west fork																																	Low	0	
Warbler_OF_003	Stony Brook west fork																																	Low	0	
Warbler_OF_004	Stony Brook west fork																																	Low	0	
WestonRd_OF_001																																		Low	0	
WestonRd_OF_003	Pierce Pond												x																					High	1	Pierce Park
Woodcock_OF_001																																		Low	0	

Notes:
1. Locations of gas stations, car dealerships, car washes and garden centers obtained from Google in August 2025.

Lincoln, MA Vulnerability Assessment

	Required SVFs								Recommended SVFs				
Outfall ID	History of SSOs	Common or twin-inert manholes serving storm & sanitary sewer alignments	Common trench construction serving storm & sanitary sewer alignments	Crossings of storm & sanitary sewer alignments where the sanitary system is shallower than the storm drain system	Sanitary sewer alignments known or suspected to have been constructed with an underdrain system	Inadequate sanitary sewer level of service (LOS) resulting in regular surcharging, customer back-ups, or frequent customer complaints	Areas formerly served by combined sewers systems	Sanitary sewer infrastructure defects (e.g., 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 I/I, etc.)	Sewer pump/lift stations, siphons, sewer restrictions where power/equipment failures or blockages could result in SSOs	Sanitary sewer & storm drain infrastructure >40 years old	Widespread code-required septic system upgrades required at property transfers due to inadequate soils, water table separation or other physical constraints rather than poor owner maintenance	History of multiple BOH actions addressing widespread septic system failures due to inadequate soils, water table separation, or other physical constraints, rather than poor owner maintenance	Wet Weather Sampling Required? (Y or N)
Ballfield_OF_001													No
Ballfield_OF_002													No
Ballfield_OF_003													No
Ballfield_OF_005													No
Ballfield_OF_006													No
Ballfield_OF_007													No
Ballfield_OF_010													No
Ballfield_OF_011													No
Beaverpond_OF_001													No
Beaverpond_OF_002													No
Beaverpond_OF_003													No
BedfordLn_OF_001													No
BedfordRd_OF_001													No
BedfordRd_OF_002													No
BedfordRd_OF_005													No
BedfordRd_OF_006													No
Birchwood_OF_001													No
Birchwood_OF_002													No
Birchwood_OF_003													No
Blackbur_OF_001													No
Blackbur_OF_002													No
Blackbur_OF_004													No
Blackbur_OF_005													No
Blueberry_OF_001													No
Blueberry_OF_002													No
Boyce_OF_001													No
Brooks_OF_001													No
Cambridge_OF_001													No
Cambridge_OF_002													No
Cambridge_OF_003													No
Cerulean_OF_001													No
Concord_OF_001													No
Concord_OF_002													No
Deerhaven_OF_001													No
Deerhaven_OF_002													No
Deerhaven_OF_003													No
Deerhaven_OF_005													No
Emerson_OF_001													No
Emerson_OF_002													No
Emerson_OF_003													No
Garland_OF_001													No
Goosepond_OF_001													No
Hillside_OF_001													No

Lincoln, MA Vulnerability Assessment

	Required SVFs								Recommended SVFs				
Outfall ID	History of SSOs	Common or twin-inert manholes serving storm & sanitary sewer alignments	Common trench construction serving storm & sanitary sewer alignments	Crossings of storm & sanitary sewer alignments where the sanitary system is shallower than the storm drain system	Sanitary sewer alignments known or suspected to have been constructed with an underdrain system	Inadequate sanitary sewer level of service (LOS) resulting in regular surcharging, customer back-ups, or frequent customer complaints	Areas formerly served by combined sewers systems	Sanitary sewer infrastructure defects (e.g., 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 I/I, etc.)	Sewer pump/lift stations, siphons, sewer restrictions where power/equipment failures or blockages could result in SSOs	Sanitary sewer & storm drain infrastructure >40 years old	Widespread code-required septic system upgrades required at property transfers due to inadequate soils, water table separation or other physical constraints rather than poor owner maintenance	History of multiple BOH actions addressing widespread septic system failures due to inadequate soils, water table separation, or other physical constraints, rather than poor owner maintenance	Wet Weather Sampling Required? (Y or N)
HwDpt_OF_001													No
INT-1													No
INT-2													No
INT-3													No
INT-4													No
INT-5													No
INT-7													No
Laurel_OF_001													No
Lex_OF_001													No
Lex_OF_002													No
Lex_OF_003													No
Linc_OF_001													No
Linc_OF_002													No
Linc_OF_004													No
Linc_OF_005													No
Linc_OF_006													No
Linc_OF_007													No
Linc_OF_008													No
Linc_OF_009													No
Linc_OF_010													No
Linc_OF_011													No
Linc_OF_012													No
Linc_OF_013													No
Meadow_OF_001													No
Meadow_OF_002													No
Minebrook_OF_001													No
Minebrook_OF_002													No
Morning_OF_001													No
Morning_OF_002													No
Oldcounty_OF_001													No
Oldcounty_OF_002													No
Oldcounty_OF_003													No
Oldfarm_OF_001													No
Oldlex_OF_001													No
OldSud_OF_001													No
OldSud_OF_002													No
OldSud_OF_003													No
Oxbow_OF_001													No
Pagefarm_OF_001													No
PageRd_OF_001													No
PageRd_OF_002													No
Pheasant_OF_001													No
Pierce_OF_001													No

Lincoln, MA Vulnerability Assessment

	Required SVFs								Recommended SVFs				
Outfall ID	**History of SSOs**	**Common or twin-inert manholes serving storm & sanitary sewer alignments**	**Common trench construction serving storm & sanitary sewer alignments**	**Crossings of storm & sanitary sewer alignments where the sanitary system is shallower than the storm drain system**	**Sanitary sewer alignments known or suspected to have been constructed with an underdrain system**	**Inadequate sanitary sewer level of service (LOS) resulting in regular surcharging, customer back-ups, or frequent customer complaints**	**Areas formerly served by combined sewers systems**	**Sanitary sewer infrastructure defects (e.g., 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 I/I, etc.)**	**Sewer pump/lift stations, siphons, sewer restrictions where power/equipment failures or blockages could result in SSOs**	**Sanitary sewer & storm drain infrastructure >40 years old**	**Widespread code-required septic system upgrades required at property transfers due to inadequate soils, water table separation or other physical constraints rather than poor owner maintenance**	**History of multiple BOH actions addressing widespread septic system failures due to inadequate soils, water table separation, or other physical constraints, rather than poor owner maintenance**	**Wet Weather Sampling Required? (Y or N)**
Pineridge_OF_001													No
Sandy_OF_001													No
Sandy_OF_008													No
Sandy_OF_009													No
Sandy_OF_010													No
ShortHill_OF_001													No
SmithHill_OF_001													No
SouthGr_OF_001													No
SouthGr_OF_002													No
SouthGr_OF_003													No
SouthGr_OF_004													No
SouthGr_OF_005													No
SouthGr_OF_006													No
Stonehdg_OF_001													No
Stonehdg_OF_002													No
Stonehdg_OF_003													No
Stonehdg_OF_004													No
Stonehdg_OF_005													No
Sunnyside_OF_001													No
Tabor_OF_001													No
Toddpond_OF_001													No
Toddpond_OF_003													No
Toddpond_OF_004													No
Toddpond_OF_005													No
Tower_OF_001													No
Tower_OF_002													No
Tower_OF_003													No
Tower_OF_004													No
Tower_OF_005													No
Trapelo_OF_001													No
Trapelo_OF_002													No
Trapelo_OF_003													No
Trapelo_OF_004													No
Trapelo_OF_006													No
Trapelo_OF_007													No
Trapelo_OF_009													No
Trapelo_OF_010													No
Trapelo_OF_011													No
Trapelo_OF_012													No
Trapelo_OF_013													No
Twin_OF_001													No
Twin_OF_002													No
Warbler_OF_001													No

Lincoln, MA Vulnerability Assessment

	Required SVFs								Recommended SVFs				
Outfall ID	History of SSOs	Common or twin-inert manholes serving storm & sanitary sewer alignments	Common trench construction serving storm & sanitary sewer alignments	Crossings of storm & sanitary sewer alignments where the sanitary system is shallower than the storm drain system	Sanitary sewer alignments known or suspected to have been constructed with an underdrain system	Inadequate sanitary sewer level of service (LOS) resulting in regular surcharging, customer back-ups, or frequent customer complaints	Areas formerly served by combined sewers systems	Sanitary sewer infrastructure defects (e.g., 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 I/I, etc.)	Sewer pump/lift stations, siphons, sewer restrictions where power/equipment failures or blockages could result in SSOs	Sanitary sewer & storm drain infrastructure >40 years old	Widespread code-required septic system upgrades required at property transfers due to inadequate soils, water table separation or other physical constraints rather than poor owner maintenance	History of multiple BOH actions addressing widespread septic system failures due to inadequate soils, water table separation, or other physical constraints, rather than poor owner maintenance	Wet Weather Sampling Required? (Y or N)
Warbler_OF_002													No
Warbler_OF_003													No
Warbler_OF_004													No
WestonRd_OF_001													No
WestonRd_OF_003													No
Woodcock_OF_001													No

Note: as of August 2025, the town has no applicable SVFs under the 2016 MS4 Permit.

Appendix C

SOP for Dry Weather Outfall Inspection/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 turbidity and TSS (*for discharges to impaired and TMDL waters only*)
    - Sampling bottles for fecal coliform and phosphorus (*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
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
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: Fecal coliform	**SM:** 9221E, 9222D	**SM**: 1.8 org/100mL	6 hours	Cool 4°C, 0.0008% $Na_2S_2O_3$
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 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			
Turbidity (*discharges to turbidity impaired waters only)*			
TSS (*discharges to turbidity impaired waters only)*			
Uses bottles to be sent to lab *(see Table 2 for method, transport, and hold times)*			
Sample Parameter	**Time/Date**	**Laboratory**	**Result**
Fecal Coliform (*discharges fecal coliform impaired waters)*			
Total Phosphorus (*discharges phosphorus impaired waters)*			

Appendix D

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 E

SOP for Dry Weather Key Junction Inspection/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

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:			

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 F

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 Lincoln 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 turbidity and TSS (*for discharges to impaired and TMDL waters only*)
    - Sampling bottles for fecal coliform and phosphorus (*for discharges to impaired*
    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
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
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: Fecal coliform	**SM:** 9221E, 9222D	**SM**: 1.8 org/100mL	6 hours	Cool 4°C, 0.0008% $Na_2S_2O_3$
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 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			
Turbidity (*discharges to turbidity impaired waters only)*			
TSS (*discharges to turbidity impaired waters only)*			
Uses bottles to be sent to lab *(see Table 2 for method, transport, and hold times)*			
Sample Parameter	**Time/Date**	**Laboratory**	**Result**
Fecal Coliform (*discharges fecal coliform impaired waters)*			
Total Phosphorus (*discharges phosphorus impaired waters)*			

Appendix G

Field Evaluation Records

DRY WEATHER OUTFALL INSPECTION REPORT

To: Mr. Chris Bibbo, DPW Director

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

Date: May 19, 2021

Town: Lincoln, 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 Lincoln 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 five field days on November 13 and 14, 2019, September 4 and 9, 2020, and April 15, 2021. The following relevant outfall conditions were observed:

Table 1 – Dry Weather Flow Screening Results

Parameter	Number
Known Outfalls within the Urbanized Area	89
Outfalls that were Attempted to Visit	89
Outfalls that Could Not be Located	7
Outfalls that Could Not be Accessed	1
Structures Identified as an Outfall Found that were not an Outfall (i.e. culvert)	6
Actual Outfalls Found	75
Outfalls Found	75
Outfalls Found Not Flowing	74
Outfalls Found with Evidence of Flow	1
Found with Illicit Discharge Potential	0
Total Not Yet Attempted to Visit	0

The one flowing outfall was sampled for the following parameters as required by the permit: ammonia, chlorine, conductivity, salinity, e.coli, surfactants, and temperature. This location did not require sampling for any pollutants of concern. 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)
Deerhaven_OF_002	0	**0.50***	**0.25***	365.7	0.17	8.9	<10

*Exceeds illicit discharge or water quality benchmarks

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:

- None of the sampling data collected from the flowing outfall met the Permit criteria as being highly likely to contain illicit discharges from sanitary sources.
- Outfall Deerhaven_OF_001 exhibited some potential for illicit discharge based on an orange color observed in standing water downstream of the outfall, however, had only a single indicator likely associated with natural iron deposits and is unlikely to have illicit discharges.
- Two outfalls (Blueberry_OF_001 and Tabor_OF_001,) were observed to be at least 75% buried in sediment and should be cleaned out to preserve flow capacity. An additional six outfalls (Linc_OF_008, Meadow_OF_001, OldSud_OF_003, SouthGr_OF_003, Stonehdg_OF_004, and Tower_OF_002) were observed to be at least 50% buried in sediment and should be monitored for potential blockages and/or cleaned.
- Outfalls Deerhaven_OF_005, Meadow_OF_001, Stonehdg_OF_002, SouthGr_OF_004, Tabor_OF_001, Tower_OF_002, and Tower_OF_005 and are showing evidence of deterioration and should be monitored during future years and/or repaired as soon as practical.
- Outfall Meadow_OF_001 exhibited headwall deterioration and should be monitored during future years and/or repaired as soon as practical.
- Outfalls Blueberry_OF_001 exhibited evidence of severe downstream erosion which should be repaired as soon as practical.
- Outfalls Blueberry_OF_001, Stonehdg_OF_002, and Trapelo_OF_009 exhibited evidence of downstream erosion which should be monitored during future years and/or repaired as soon as practical.

- One outfall could not be accessed as shown in blue on the attached map. Where practical, this area should be made accessible for inspection . Where access cannot be obtained, the next upgradient structure should be located and inspected for the presence of dry weather flow.
- A total of seven outfalls could not be located as shown in purple on the attached map. These outfalls should be field-located and evaluated so that dry weather inspections and screening can occur, or determined not to exist and removed from mapping.
- Outfalls that have not yet been located or accessed should be inspected for dry weather flows by the end of Year 3 (June 30, 2021).

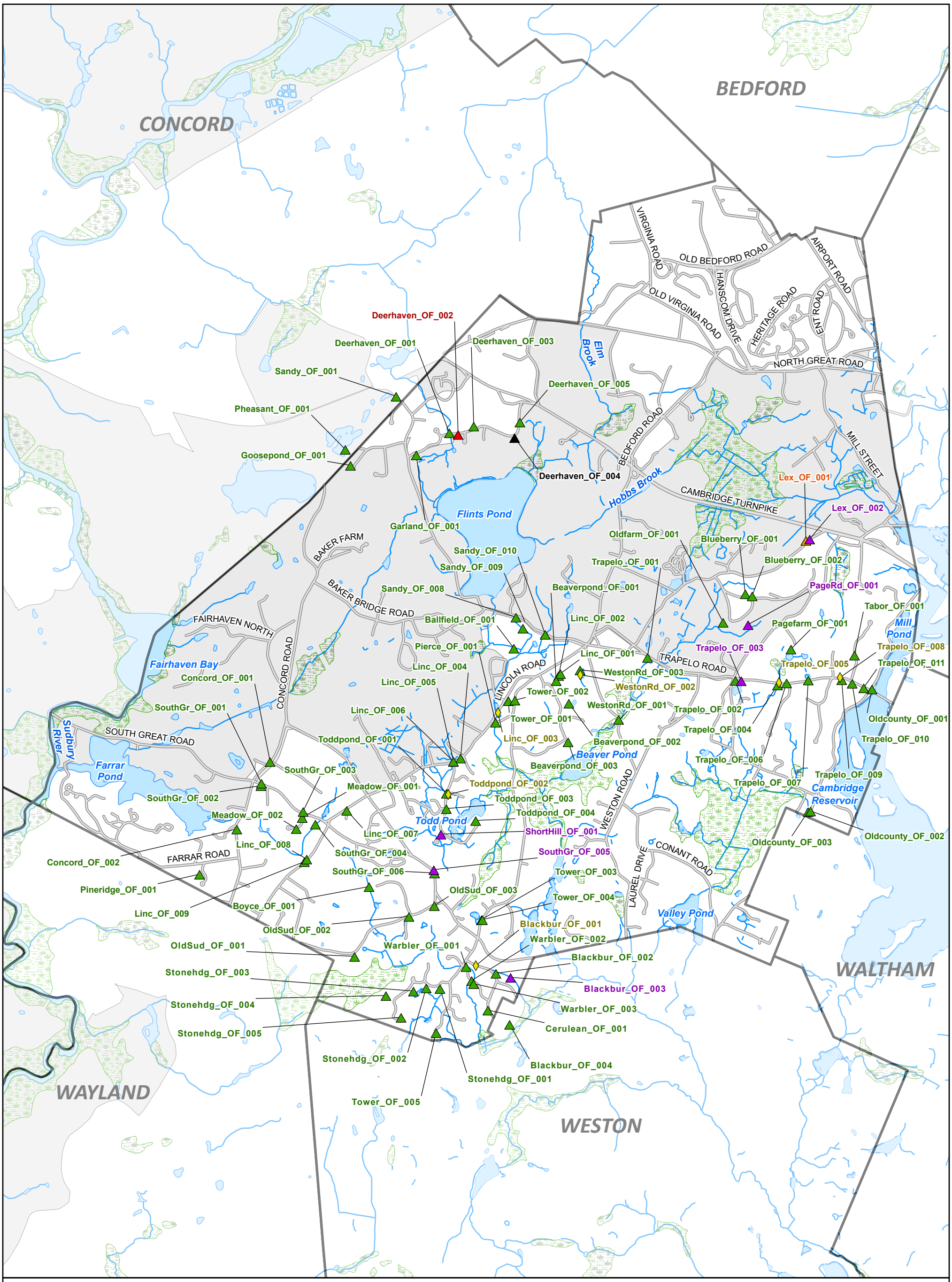
For more information on maintenance recommendations, please see the attached Summary of Maintenance Recommendations and Next Steps.

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



Legend

Outfall Result:

- Flowing
- Not Flowing
- Not Found
- Could Not Access
- Culvert
- May Not Exist
- Roads
- Lake, Pond, Reservoir
- Wetland, Marsh, Swamp
- Stream, Brook
- Non-Urban Area

N W E S

0 0.25 0.5 0.75 1

Miles

Dry Weather Outfall Screening Results Lincoln, MA

Comprehensive Environmental Incorporated

Data Sources: MassGIS, Town of Lincoln, CEI

6/14/2021

Lincoln Massachusetts Dry Weather Outfall Screening

Outfall Characteristics												Headwall and Downstream Condition					
Outfall ID	Lat.	Lon.	Date / Time of Inspection	Outfall Located?	Receiving Waterbody (if any)	Number of Outfall Pipes	Outfall Type	Outfall Shape	Outfall Diameter (inches)	Outfall Material	Outfall Condition	Outfall Condition Comment	Headwall Material	Headwall Condition	Headwall Condition Comment	Downstream Erosion	Downstream Erosion Comment	Sedimentation Level
Ballfield_OF_001	42.42557	-71.31209	4/15/2021 14:38	Found	Stony Brook	1	Outfall	Round	24	RCP	Good	Outfall is in great condition	N/A	N/A		None		None
Beaverpond_OF_001	42.42281	-71.30743	9/4/2020 15:33	Found		1	Outfall	Round	12	CMP	Good	Some minor undermining of outfall pipe	N/A	N/A		Moderate	Some minor undermining of the outfall and some minor bank erosion.	None
Beaverpond_OF_002	42.42090	-71.30594	9/9/2020 13:20	Found		1	Outfall	Round	12	RCP	Fair	End pipe segment disjointed	N/A	N/A		None		None
Beaverpond_OF_003	42.41766	-71.30607	9/9/2020 13:32	Found		1	Outfall	Round	12	RCP	Good	Minor corrosion in bottom right of pipe	N/A	N/A		None		None
Blackbur_OF_001	42.39899	-71.31655	11/13/2019 18:04	Found, not an Outfall			Culvert											
Blackbur_OF_002	42.39822	-71.31431	11/13/2019 17:34	Found		1	Outfall			RCP	Good		RC	Good		None		None
Blackbur_OF_003	42.39823	-71.31431	4/15/2021 15:25	Not Found														
Blackbur_OF_004	42.39428	-71.31287	9/9/2020 14:05	Found		1	Outfall	Round	12	RCP	Good		Stone	Good		None		None
Blueberry_OF_001	42.43017	-71.28593	4/15/2021 13:15	Found		1	Oufall	Round	12	CMP	Good	Outfall was buried beneath leaf pile	N/A	N/A		Severe	Bank erosion and deep channelization	Minimal, <25%
Blueberry_OF_002	42.42997	-71.28531	11/14/2019 14:49	Found		1	Outfall	Round	12	CMP	Good		N/A	N/A		None		None
Boyce_OF_001	42.40563	-71.32860	11/13/2019 18:46	Found		1	Outfall	Round	12	RCP	Good		RC	Fair	Old	None		None
Cerulean_OF_001	42.39524	-71.31518	11/13/2019 17:14	Found		1	Outfall	Round	18	RCP	Good		RC	Fair	Covered	None		Minimal, <25%
Concord_OF_001	42.41593	-71.33980	11/14/2019 18:58	Found		1	Outfall	Round	12	HDPE	Good		N/A	N/A		None		Moderate, 25%-50%
Concord_OF_002	42.41050	-71.34352	9/4/2020 12:48	Found		1	Outfall	Round	12	CMP	Good		N/A	N/A		None		None
Deerhaven_OF_001	42.44361	-71.31939	11/14/2019 16:56	Found		1	Outfall	Irregular	36	RCP	Good	Flared end pipe	N/A	N/A		None		None
Deerhaven_OF_002	42.44352	-71.31853	11/14/2019 17:58	Found	Tanner brook	1	Outfall	Round	12	RCP	Good		N/A	N/A		None		None
Deerhaven_OF_003	42.44417	-71.31670	11/14/2019 17:12	Found		1	Outfall	Round	8	HDPE	Good	Obscured with grate	Stone	Good		None		None
Deerhaven_OF_004	42.44335	-71.31189	4/15/2021 12:56	Not Found														
Deerhaven_OF_005	42.44443	-71.31146	11/14/2019 17:23	Found		1	Outfall	Round	24	VC	Poor	Tree partially blocking outlet and growing into pipe. Chipping and cracking	N/A	N/A		None		Minimal, <25%
Garland_OF_001	42.44179	-71.32315	11/14/2019 16:51	Found		1	Outfall	Round	12	RCP	Good		N/A	N/A		None		Minimal, <25%
Goosepond_OF_001	42.44082	-71.33090	11/14/2019 17:38	Found		1	Outfall	Round	12	RCP	Good		Stone	Fair	Cracked mortar	Moderate	Bank erosion and channelization	None
Lex_OF_001	42.43446	-71.27901	4/15/2021 13:08	Could Not Access														
Lex_OF_002	42.43459	-71.27859	4/15/2021 13:14	Not Found														
Linc_OF_001	42.42338	-71.30691	9/4/2020 15:39	Found		1	Outfall	Round	12	HDPE	Good	HDPE flared end treatment	N/A	N/A		Moderate	Channelization, rubber mat appears to be solution to erosion	None
Linc_OF_002	42.42322	-71.30712	9/4/2020 15:44	Found		1	Outfall	Round	12	RCP	Good		N/A	N/A	Boulders surrounding pipe, but do not	None		None
Linc_OF_003	42.42010	-71.31403	9/4/2020 15:15	Found, not an Outfall			Culvert											
Linc_OF_004	42.41637	-71.31812	9/4/2020 14:40	Found			Outfall	Irregular	24		Good	Paved open drainage outfall	N/A	N/A		None		None
Linc_OF_005	42.41609	-71.31907	9/4/2020 14:32	Found			Outfall	Irregular	60		Good	Paved open drainage outfall	N/A	N/A		None		None
Linc_OF_006	42.41615	-71.31902	9/4/2020 14:33	Found		1	Outfall	Round	24	CMP	Good	Some rusting on the interior of the pipe but no major issues	Stone	Good		None		Minimal, <25%
Linc_OF_007	42.41196	-71.33113	9/4/2020 14:01	Found		1	Outfall	Round	12	RCP	Good	Outfall has a flared end. Structure in good condition	N/A	N/A		None		Minimal, <25%
Linc_OF_008	42.40786	-71.33564	9/4/2020 13:53	Found	Unnamed Tributary to Farrar Pond	1	Outfall	Round	12	CMP	Fair	Pipe buried underneath dense vegetation. Half of pipe filled with sediment	N/A	N/A		None		High 50%-75%
Linc_OF_009	42.40772	-71.33590	9/4/2020 13:56	Found		1	Outfall	Round	12	CMP	Good		N/A	N/A		None		None
Meadow_OF_001	42.41141	-71.33613	11/13/2019 14:55	Found		1	Outfall				Poor	Standing water, no flow	RC	Poor	Collapsed	Moderate		High, 50%-75%
Meadow_OF_002	42.41050	-71.33680	11/13/2019 14:49	Found		1	Outfall	Round	12	RCP	Good		RC	Good	Minor cracking			Moderate, 25%-50%
Oldcounty_OF_001	42.42201	-71.27188	11/14/2019 16:19	Found		1	Outfall	Round	12	CMP	Fair	Pipe deterioration	RC	Fair		None		None
Oldcounty_OF_002	42.41191	-71.27864	11/14/2019 16:35	Found		1	Outfall	Round	8	HDPE	Good		N/A	N/A		None		None
Oldcounty_OF_003	42.41174	-71.27878	11/14/2019 16:32	Found		1	Outfall	Round	12	HDPE	Good		Stone	Fair	Granite blocks falling out of place	None		None
Oldfarm_OF_001	42.42774	-71.28855	11/14/2019 14:21	Found		1	Outfall	Round	12	HDPE	Good		Other - Wood	Good		None		None
OldSud_OF_001	42.39976	-71.33023	11/13/2019 19:00	Found		1	Outfall	Round	12	RCP	Good		N/A	N/A		None		Minimal, <25%
OldSud_OF_002	42.40311	-71.32414	11/13/2019 18:52	Found		1	Outfall	Round	12	RCP	Fair	Chipping	RC	Good		Moderate		None
OldSud_OF_003	42.40403	-71.32161	9/4/2020 13:19	Found		1	Outfall	Round	12	RCP	Good		N/A	N/A		Moderate	Scour pool present downstream	None
Pagefarm_OF_001	42.42539	-71.28087	11/14/2019 15:03	Found		1	Outfall	Round	18	RCP	Good		Stone	Good		None		Moderate, 25%-50%
PageRd_OF_001	42.42741	-71.28549	4/15/2021 13:56	Not Found														
Pheasant_OF_001	42.44218	-71.33117	11/14/2019 17:45	Found		1	Outfall	Round	18	RCP	Good		Stone	Fair	Cracked and disassembling	Moderate		Moderate, 25%-50%
Pierce_OF_001	42.41929	-71.31425	9/4/2020 14:50	Found			Outfall	Irregular			Good	Paved open drainage outfall	N/A	N/A		None		None
Pineridge_OF_001	42.40668	-71.34767	11/13/2019 19:18	Found		1	Outfall	Round	18	HDPE	Good	Covered with logs	N/A	N/A		Moderate		None
Sandy_OF_001	42.44673	-71.32543	11/14/2019 17:31	Found		1	Outfall	Round	18	RCP	Good		Stone	Good		None		Minimal, <25%
Sandy_OF_008	42.42820	-71.31193	9/9/2020 13:05	Found		1	Outfall	Round	12	CMP	Good		N/A	N/A		None		Moderate, 25%-50%
Sandy_OF_009	42.42723	-71.31114	4/15/2021 14:29	Found	Unnamed Wetland	1	Outfall	Round	12	CMP	Good		N/A	N/A		None		None
Sandy_OF_010	42.42669	-71.30867	9/9/2020 12:55	Found		1	Outfall	Round	24	CMP	Fair	Pipe is rusted and collapsing. Pieces of metal are starting to break off.	Stone	Good		None		None
ShortHill_OF_001	42.41000	-71.32052	4/15/2021 14:57	Not Found														
SouthGr_OF_001	42.41420	-71.34081	9/4/2020 13:05	Found		1	Outfall	Round	8	CMP	Good		N/A	N/A		None		Minimal, <25%
SouthGr_OF_002	42.41405	-71.34065	11/14/2019 18:51	Found		1	Outfall	Round	12	RCP	Good		RC	Good		Moderate	Scour	None
SouthGr_OF_003	42.41198	-71.33599	11/13/2019 15:02	Found		1	Outfall	Round		RCP	Fair	Crack exposing rebar Standing water	N/A	N/A		None		High, 50%-75%
SouthGr_OF_004	42.41095	-71.33459	9/9/2020 14:17	Found		1	Outfall	Round	36	CMP	Poor	Bottom half of pipe has deteriorated away and is completely missing. Pipe is rusted and metal is chipping off	N/A	N/A		None		None
SouthGr_OF_005	42.40695	-71.32125	4/15/2021 15:39	Not Found														
SouthGr_OF_006	42.40672	-71.32115	9/9/2020 14:24	Found			Outfall	Irregular			Fair	Paved open drainage outfall. Pavement broken up and deteriorating	N/A	N/A		None		None
Stonehdg_OF_001	42.39697	-71.32054	11/13/2019 16:54	Found		1	Outfall	Round	12	RCP	Fair		Stone	Fair	Displaced	None		Moderate, 25%-50%
Stonehdg_OF_002	42.39708	-71.32211	11/13/2019 16:44	Found		1	Outfall	Round		Other - Unknown	Poor		N/A	N/A		Severe	Hole created	Minimal, <25%
Stonehdg_OF_003	42.39695	-71.32357	11/13/2019 16:34	Found		1	Outfall	Round	18	RCP	Fair	Erosion	Stone	Fair	Displaced	Moderate		Moderate, 25%-50%

Lincoln Massachusetts Dry Weather Outfall Screening

Outfall Characteristics													Headwall and Downstream Condition					
Outfall ID	Lat.	Lon.	Date / Time of Inspection	Outfall Located?	Receiving Waterbody (if any)	Number of Outfall Pipes	Outfall Type	Outfall Shape	Outfall Diameter (inches)	Outfall Material	Outfall Condition	Outfall Condition Comment	Headwall Material	Headwall Condition	Headwall Condition Comment	Downstream Erosion	Downstream Erosion Comment	Sedimentation Level
Stonehdg_OF_004	42.39644	-71.32626	11/13/2019 16:28	Found		1	Outfall	Round	12	RCP	Good		N/A	N/A		None		High, 50%-75%
Stonehdg_OF_005	42.39458	-71.32501	11/13/2019 16:22	Found		1	Outfall	Round	18	CMP	Good		Stone	Fair	Missing rocks	Moderate		Minimal, <25%
Tabor_OF_001	42.42504	-71.27369	11/14/2019 15:52	Found		1	Outfall	Round		RCP	Poor	Exposed rebar, buried in sediment	Stone	Fair		None		Full, >75%
Toddpond_OF_001	42.41347	-71.31982	11/13/2019 15:33	Found			Outfall	Other - Apron				Apron from road, no pipe	N/A	N/A		None		Minimal, <25%
Toddpond_OF_002	42.41342	-71.31975	9/4/2020 14:11	Found, not an Outfall			Culvert											
Toddpond_OF_003	42.41218	-71.31985	11/13/2019 15:26	Found		1	Outfall	Round	12	CMP	Good	Standing water, no flow	Stone	Fair		Moderate	Riprap slightly filled with sediment	Minimal, <25%
Toddpond_OF_004	42.41119	-71.31659	11/13/2019 15:14	Found		1	Outfall	Round	18	CMP	Good		Stone	Fair	Minor erosion	Moderate		Minimal, <25%
Tower_OF_001	42.42095	-71.31327	9/4/2020 15:11	Found		1	Outfall	Round	12	CMP	Good		Stone	Good		None		Minimal, <25%
Tower_OF_002	42.42114	-71.31211	9/4/2020 14:56	Found		1	Outfall	Round	12	CMP	Poor	Pipe is almost collapsed and half full of sediment.	N/A	N/A		None		High 50%-75%
Tower_OF_003	42.40272	-71.31584	4/15/2021 15:12	Found		1	Outfall	Irregular	60		Good	Riprap open drainage outfall	N/A	N/A		None		Minimal, <25%
Tower_OF_004	42.40279	-71.31580	9/4/2020 17:48	Found			Outfall	Irregular			Good	Riprap open drainage outfall	N/A	N/A		None		None
Tower_OF_005	42.39333	-71.32106	11/13/2019 17:05	Found		1	Outfall	Round	8	RCP	Poor	Pipe cracked and separated	N/A	N/A		Moderate	Large vertical drop	None
Trapelo_OF_001	42.42475	-71.29725	9/4/2020 16:56	Found	Iron Mine Brook	1	Outfall	Round	12	RCP	Fair	Dimensions are approximate, outfall was submerged at time of inspection.	Stone	Good		None		None
Trapelo_OF_002	42.42291	-71.28718	4/15/2021 13:43	Found	Unnamed Wetland	1	Outfall	Round	12	RCP	Good	Submerged	N/A	N/A		None		Moderate, 25%-50%
Trapelo_OF_003	42.42289	-71.28662	4/15/2021 13:40	Not Found														
Trapelo_OF_004	42.42241	-71.28237	11/14/2019 15:30	Found		1	Outfall	Round	24	CMP	Good		Stone	Good		Moderate	Bank erosion	Minimal, <25%
Trapelo_OF_005	42.42254	-71.28202	11/14/2019 15:33	Found, not an Outfall			Culvert											
Trapelo_OF_006	42.42261	-71.28133	11/14/2019 15:37	Found		1	Outfall	Round	12	CMP	Fair		Other - Asphalt	Fair	Breaking apart	None		Moderate, 25%-50%
Trapelo_OF_007	42.42291	-71.27887	11/14/2019 15:43	Found		1	Outfall	Round	8	RCP	Good		RC	Good		Moderate		Moderate, 25%-50%
Trapelo_OF_008	42.42301	-71.27532	11/14/2019 16:07	Found, not an Outfall			Culvert											
Trapelo_OF_009	42.42288	-71.27505	11/14/2019 16:02	Found		1	Outfall	Round	12	Other - Plastic	Good		Other - Plastic	Good		Severe	Large scour pit	None
Trapelo_OF_010	42.42260	-71.27390	11/14/2019 16:09	Found		1	Outfall	Round	12	HDPE	Good		N/A	N/A		None		Minimal, <25%
Trapelo_OF_011	42.42217	-71.27258	11/14/2019 16:13	Found		1	Outfall	Round	12	RCP	Good		Stone	Good		None		Minimal, <25%
Warbler_OF_001	42.39891	-71.31759	11/13/2019 18:12	Found		1	Outfall	Round	12	RCP	Good		RC	Good		Moderate		Minimal, <25%
Warbler_OF_002	42.39772	-71.31704	11/13/2019 18:17	Found		1	Outfall	Round	12	RCP	Good		RC	Good		None		None
Warbler_OF_003	42.39748	-71.31674	11/13/2019 18:20	Found		1	Outfall	Round	12	RCP	Good		RC	Good		None		Moderate, 25%-50%
WestonRd_OF_001	42.41948	-71.30037	4/15/2021 14:18	Found	Unnamed Wetland	1	Outfall	Irregular	12	RCP	Good	Paved open drainage outfall	N/A	N/A		None		None
WestonRd_OF_002	42.42327	-71.30474	9/4/2020 16:38	Found, not an Outfall			Culvert											
WestonRd_OF_003	42.42371	-71.30470	9/4/2020 16:41	Found		1	Outfall	Round	24	RCP	Good	Some minor spalling around rim of pipe, but overall good condition	Stone	Good		None		None

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				Sampling Parameters																Overall Comments
Outfall ID	Any Illicit Discharge Indicators?	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 of Sampled Structure	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 - Lab (MPN/100 mL)	Overall Comments
Ballfield_OF_001	No		Unlikely		No			No	No											Outfall looks recently installed and is in good condition. Outlet currently discharging into hale bales due to school construction.
Beaverpond_OF_001	No		Unlikely		No			No	No											
Beaverpond_OF_002	No		Unlikely		No			No	No											End segment of pipe disjointed but otherwise in good condition
Beaverpond_OF_003	No		Unlikely		No			No	No											4" PVC pipe from driveway drain located 20' downstream of outfall
Blackbur_OF_001																				Culvert
Blackbur_OF_002	No		Unlikely		No			No	No											Excessive yard waste dumping; outfall and headwall partially buried in leaves
Blackbur_OF_003																				Outfall not found, potentially buried or covered by fallen trees. No flow in upgradient catch basin
Blackbur_OF_004	No		Unlikely		No			No	No											
Blueberry_OF_001	No		Unlikely		No			No	No											Pipe not found beneath leaf pile but deep channel present. Erosion at bottom of hill
Blueberry_OF_002	No		Unlikely		No			No	No											
Boyce_OF_001	No		Unlikely		No			No	No											
Cerulean_OF_001	No		Unlikely		No			No	No											Dumped yard waste on top of outfall
Concord_OF_001	No		Unlikely		No			No	No											
Concord_OF_002	No		Unlikely		No			No	No											
Deerhaven_OF_001	Yes	Orange color	Unlikely	Orange color	No			No	No											Standing water is buildup from stream flow. Confirmed no flow in upstream catch basin
Deerhaven_OF_002	No		Unlikely		Yes	Trickle	0.25	No	Yes	No	L121.3		0	0.5	0.25	365.7	0.17	8.9	<10	
Deerhaven_OF_003	No		Unlikely		No			No	No											
Deerhaven_OF_004																				Mapped location is in the middle of a residential lawn. Searched woods behind houses but outfall could not be located. Upgradient catch basins have no outlet pipe and suggest outfall may not exist
Deerhaven_OF_005	No		Unlikely		No			No	No											
Garland_OF_001	No		Unlikely		No			No	No											
Goosepond_OF_001	No		Unlikely		No			No	No											
Lex_OF_001																				Could not access, area fenced off and marked no trespassing
Lex_OF_002																				Outfall mapped in patch of grass between roadway and fence. Pipe could not be located, potentially buried or on other side of fence. No flow in upgradient catch basin
Linc_OF_001	No		Unlikely		No			No	No											
Linc_OF_002	No		Unlikely		No			No	No											
Linc_OF_003																				Culvert with no apparent drainage connection. No other pipes observed
Linc_OF_004	No		Unlikely		No			No	No											Open drainage outfall
Linc_OF_005	No		Unlikely		No			No	No											Paved open drainage outfall
Linc_OF_006	No		Unlikely		No			No	No											Manhole with drain pipe and culvert connection
Linc_OF_007	No		Unlikely		No			No	No											
Linc_OF_008	No		Unlikely		No			No	No											Pipe covered in vegetation and partially filled with sediment
Linc_OF_009	No		Unlikely		No			No	No											
Meadow_OF_001	No		Unlikely		No			No	No											
Meadow_OF_002	No		Unlikely		No			No	No											
Oldcounty_OF_001	No		Unlikely		No			No	No											
Oldcounty_OF_002	No		Unlikely		No			No	No											
Oldcounty_OF_003	No		Unlikely		No			No	No											
Oldfarm_OF_001	No		Unlikely		No			No	No											
OldSud_OF_001	No		Unlikely		No			No	No											
OldSud_OF_002	No		Unlikely		No			No	No											
OldSud_OF_003	No		Unlikely		No			No	No											
Pagefarm_OF_001	No		Unlikely		No			No	No											Half filled sediment
PageRd_OF_001																				Searched mapped location but outfall couldn't be located. Pipe orientation in upgradient catch basin suggests outfall may be located in large basin southwest of mapped location but pipe may be buried under fallen trees and debris. No flow in upgradient catch basin
Pheasant_OF_001	No		Unlikely		No			No	No											
Pierce_OF_001	No		Unlikely		No			No	No											Paved open drainage above culverted stream
Pineridge_OF_001	No		Unlikely		No			No	No											Dumping behind house
Sandy_OF_001	No		Unlikely		No			No	No											
Sandy_OF_008	No		Unlikely		No			No	No											
Sandy_OF_009	No		Unlikely		No			No	No											Location updated by moving outfall 250' south of mapped location. Discharges to small wetland next to culvert
Sandy_OF_010	No		Unlikely		No			No	No											
ShortHill_OF_001																				Outfall not found, potentially buried. No flow in upgradient catch basin
SouthGr_OF_001	No		Unlikely		No			No	No											
SouthGr_OF_002	No		Unlikely		No			No	No											
SouthGr_OF_003	No		Unlikely		No			No	No											Standing water. No flow confirmed in upstream catch basin
SouthGr_OF_004	No		Unlikely		No			No	No											
SouthGr_OF_005																				Signs of a drainage channel but could not locate pipe. Checked bank across from railroad but no pipe could be found
SouthGr_OF_006	No		Unlikely		No			No	No											Paved open drainage outfall directing flow from sidewalk to train tracks
Stonehdg_OF_001	No		Unlikely		No			No	No											
Stonehdg_OF_002	No		Unlikely		No			No	No											Standing water. No flow confirmed in upstream catch basin
Stonehdg_OF_003	No		Unlikely		No			No	No											

	Illicit Discharge Potential				Sampling Parameters																Overall Comments
Outfall ID	Any Illicit Discharge Indicators?	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 of Sampled Structure	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 - Lab (MPN/100 mL)	Overall Comments
Stonehdg_OF_004	No		Unlikely		No			No	No											Heavy sediment
Stonehdg_OF_005	No		Unlikely		No			No	No											
Tabor_OF_001	No		Unlikely		No			No	No											Outfall buried. Appears to have become more of an inlet
Toddpond_OF_001	No		Unlikely		No			No	No											
Toddpond_OF_002																				Culvert with no apparent drainage connection
Toddpond_OF_003	No		Unlikely		No			No	No											
Toddpond_OF_004	No		Unlikely		No			No	No											
Tower_OF_001	No		Unlikely		No			No	No											
Tower_OF_002	No		Unlikely		No			No	No											Pipe almost collapsed and half full of sediment
Tower_OF_003	No		Unlikely		No			No	No											Rip rap open drainage outfall
Tower_OF_004	No		Unlikely		No			No	No											Rip rap open drainage from roadway to wooded area
Tower_OF_005	No		Unlikely		No			No	No											
Trapelo_OF_001	No		Unlikely		No			No	No											Outfall may be a culvert with a drainage connection. There is an open end of pipe in the same location across the road.
Trapelo_OF_002	Yes	Floating green algal growth	Unlikely		No			No	No											Outfall is completely submerged in small pit. No flow in upgradient catch basin
Trapelo_OF_003																				Outfall not found potentially buried. No flow in upgradient catch basin
Trapelo_OF_004	No		Unlikely		No			No	No											No flow confirmed in upstream catch basin
Trapelo_OF_005																				Culvert inlet
Trapelo_OF_006	No		Unlikely		No			No	No											Half full of sediment
Trapelo_OF_007	No		Unlikely		No			No	No											
Trapelo_OF_008																				Culvert inlet
Trapelo_OF_009	No		Unlikely		No			No	No											
Trapelo_OF_010	No		Unlikely		No			No	No											
Trapelo_OF_011	No		Unlikely		No			No	No											
Warbler_OF_001	No		Unlikely		No			No	No											
Warbler_OF_002	No		Unlikely		No			No	No											
Warbler_OF_003	No		Unlikely		No			No	No											
WestonRd_OF_001	No		Unlikely		No			No	No											Paved open drainage outfall in good condition. Outfall location moved 1,000' north up road.
WestonRd_OF_002																				Structure appears to be a culvert with no drainage connection
WestonRd_OF_003	No		Unlikely		No			No	No											

BEDFORD
LEXINGTON
CONCORD
SUDBURY
SUDBURY
SUDBURY
WALTHAM
WAYLAND

Concord River
Assabet River
Sudbury River
Sudbury River Swamp
Shawsheen River
Mill Brook
Crosby Pond
Elm Brook
Goose Pond
Walden Pond
Flints Pond
Fairhaven Bay
Farrar Pond
Beaver Pond
Todd Pond
Valley Pond
Mill Pond
Cambridge Reservoir
Hobbs Brook
Bridge Brook Swamp

GRIFFISS STREET
EGLIN STREET
LANGLEY ROAD
OLD BEDFORD ROAD
VIRGINIA ROAD
INDIAN CAMP LANE
SOUTH COMMONS
SCOTT CIRCLE
KELLY LANE
HARESCOM DRIVE
ADAMS ROAD
HERITAGE ROAD
HICKMAN LANE
PATTERSON ROAD
OFFUTT ROAD
BATT ROAD
ARMORY ROAD
RANDOLPH ROAD
LIBERTY LANE
POPE TERRACE
HILL TERRACE
OLD BEDFORD ROAD
OLD VIRGINIA ROAD
BEDFORD LANE
NORTH GREAT ROAD
BROOKS HILL ROAD
BEDFORD LANE
SUNNYSIDE LANE
MORNINGSIDE LANE
BEDFORD ROAD
ACORN LANE
BROOKS ROAD
CAMBRIDGE TURNPIKE CUT OFF
SMITH HILL ROAD
HARVEST CIRCLE
GROVES AVENUE
OLD CAMBRIDGE TURNPIKE
CIDER LANE
DEERHAVEN ROAD
GARLAND ROAD
GOOSE POND ROAD
DEER RUN ROAD
ORCHARD LANE
ROCKWOOD LANE
JUNIPER RIDGE ROAD
OAKDALE LANE
MILL STREET
WHEELER ROAD
CAMBRIDGE TURNPIKE
OAK MEADOW ROAD
HILLIARD ROAD
LEXINGTON ROAD
CANAAN DRIVE
OLD FARM ROAD
BLUEBERRY LANE
DAVISON DRIVE
GRASSHOPPER LANE
PAGE ROAD
PAGE FARM ROAD
FRIDOLIN HILL
TABOR HILL ROAD
HUCKLEBERRY HILL
OLD COUNTY ROAD
STRATFORD WAY
OLD WINTER STREET
WINTER STREET
SILVER HILL ROAD
BAKER FARM
SANDY POND ROAD
GRANVILLE ROAD
BAKER BRIDGE ROAD
REDRAT FARM LANE
OLD CONCORD ROAD
FAIRHAVEN NORTH
FAIRHAVEN SOUTH
CONCORD ROAD
BALLFIELD ROAD
UPLAND FIELD ROAD
BEAVER POND ROAD
SPRING HILL LANE
MACKINTOSH LANE
COOMAN ROAD
CEDAR ROAD
HILLSIDE ROAD
SWEET BAY LANE
SOUTH GREAT ROAD
WINDING WOOD LANE
IRONWOOD LANE
CHESTNUT CIRCLE
ASPEN CIRCLE
KETTLE HOLE DRIVE
OSBORN ROAD
HUNTLEY LANE
FARRAR ROAD
GILES ROAD
WILLARCH ROAD
UNDERWOOD CIRCLE
LANIKAY ROAD
LONG MEADOW ROAD
WELLS ROAD
MEADOWBROOK ROAD
LINCOLN ROAD
LEWIS STREET
RIDGE ROAD
GREENRIDGE LANE
MEADOWDAM ROAD
WOODBROOK ROAD
TODD POND ROAD
TOWER ROAD
WESTON ROAD
BROWNING LANE
CONANT ROAD
MOCCASIN HILL DRIVE
CHAMISE DRIVE
TWIN POND LANE
ROUND HILL ROAD
OLD CONANT ROAD
SOUTH BROOK ROAD
HAWK HILL ROAD
FORESTER ROAD
BOYCE FARM ROAD
OLD SUDBURY ROAD
BOWLES TERRACE
STONEHEDGE ROAD
WARBLER RUN RIDGE ROAD
BLACKBURNIAN ROAD
OLD LEXINGTON ROAD
TRAPELO ROAD
MINEBROOK ROAD
STOREY DRIVE

Legend

- Breakout Point, Riprap Area, Eroded Channel- Outfall
- Paved Channel Outfall
- Pipe Outfall
- Stone Channel Outfall
- Catch Basin
- Channel
- Drainage Manhole
- Interconnection
- Drainage Pipe
- Lake, Pond, Reservoir
- Wetland, Marsh, Swamp
- Stream, Brook
- Roads
- Non-Urban Area

N
W E
S

0 0.25 0.5 1
Miles

Stormwater Infrastructure Map
Lincoln, MA

Comprehensive Environmental Incorporated

Data Sources: CEI, MassGIS, Town of Lincoln

06.25.2019

Illicit Discharge Log

Date	Outfall ID	Outfall Location	Description of Discharge	Description of Discovery	Source of Discharge	Date of Mitigation	Planned Corrective Actions	Estimated volume of Flow Removed

Illicit Discharge Tracking Form

Outfall ID:	
Outfall Location:	
Description of Discharge:	
Description of Discovery (Methods used):	
Source of Discharge:	
Date of Discovery:	**Date of Mitigation (if corrected):**
Planned Corrective Actions (with schedule):	
Estimated Volume of Flow Removed:	

Appendix H

IDDE Employee Training Record

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

Training Topics: IDDE & SWPPP - Lincoln		
Date: 6/18/2020	Hours:	
Employee Name	**Department / Position**	**Contact Info**
Brent Boudrot	Highway	339 203 8246
Steve McDonald	Highway	781 858 0025
Jim Durkin	Highway	978 490-7816
Ian Sears	Highway	978-407-7239
Daniel Scirocco	Highway	781-831-3564
Steve Fellas	Highway	978-514-0554
Brian Kerrigan	Highway	978-263-3370
JOHN P. HERI	HIGHWAY CREW MEMBER	781-258-7432
Chris Bibbo	Super.	bibboc@lincolntown.org

Training Topics: MS4 Training Lincoln		
Date: 6/7/2021	Hours: 10 - 11	
Employee Name	**Department / Position**	**Contact Info**
Danny Scirocco	crew	
Steve Frias	crew	
Steven McDonald	Foreman	
JOHN P. NERI	CREW MEMBER	
Ian Sears	crew	
Brian Kerrigan	Mechanic	
Chris Bibbo	DPW	

Training: Lincoln MS4 - IDDE & SWPPP			
Date: 5/24/2022		Hours: 2-3	
Employee Name	**Department**	**Position**	**Contact Info**
Ian Sears	Highway	Laborer/operator	
Brent Boudrot	Highway	Treeworker/Laborer	
Jake Robinshaw	Highway	Laborer/operator	
Steve McDonald	Highway	Foreman	
Danny Sairaco	Highway	Laborer/operator	
Brian Kerrigan	Highway	Mechanic	
Chris Bibbo	Highway	Super.	bibboc@lincolntown.org

Training Topics: Lincoln MS4 (IDDE & SWPPP)		
Date: 4/6/2023	Hours: 1:30 - 2:30	
Employee Name	**Department / Position**	**Contact Info**
Ian Sears	Operater / Laborer	
Steve FRCAS	Crew member	
Jake Robinshaw	crew member	
Brent Boudrot	Crew member	
Brian Kerrigan	Mechanic	
Jim Durlin	Crew chief	
[signature]	crew member	

Training: IDDE & SWPPP		
Date: 4/9/2024		Hours: 2PM-3PM
Trainer: Stefany Campbell		
Employee Name	**Department**	**Position**
Brian Kernigan	Highway	Mechanic
Danny Siracusa	Highway	Crewman
[signature]	Highway	Foreman
Jake Robinshaw	Highway	Crewman
Ian Sears	Highway	Crewman
Jim Durkin	Highway	Crew Chief

Training: Lincoln IDDE & SWPPP		
Date: June 26, 2025		Hours: 1:00 – 2:00
Trainer: Stefany Campbell (CEI)		
Employee Name	**Department**	**Position**
CAMERON ARGENTA	DPW	
Steve McDonald	DPW	
Jake Robinshaw	DPW Foreman	
Daniel Scirocco	DPW	
Dimitri Lubay	DPW	
Stephen Olsen	DPW	
Jim Durkin	DPW	
Brent Boudreau	DPW	
Ryan Kerrigan	DPW	