Phosphorus Source Identification Report

Nashua River

Town of Lunenburg, Massachusetts

June 30, 2022

Updated June 30, 2023

Prepared For:

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Phosphorus Source Identification Report – Town of Lunenburg

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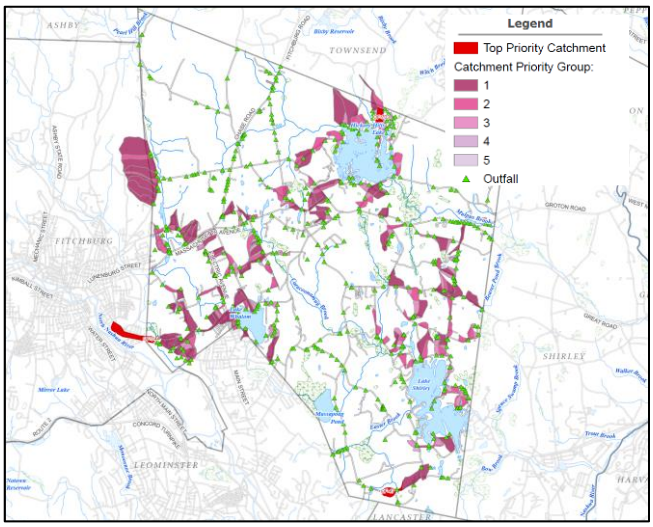
Executive Summary

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 that discharge to certain water quality limited waters are required to meet additional requirements as outlined in Appendix H of the MS4 Permit. The Town of Lunenburg must address the discharge of phosphorus from its MS4 to the Nashua River.



Priority catchment areas in the Nashua River watershed in Lunenburg

As part of these requirements, Lunenburg must develop a Phosphorus Source Identification Report within four years of effective date of the permit (*by June 30, 2022*). The overall goal of this plan is to determine specific areas of the MS4 that may be contributing higher concentrations of phosphorus to the impaired watershed.

Phosphorus Source Identification Report Requirements

This Phosphorus Source Identification Report includes the following elements as required under the MS4 Permit:

1. Calculation of the MS4 area draining to the water quality limited segment and its tributaries ("Phosphorus Source Area"). Drainage areas were delineated for each MS4 outfall.
2. All screening and monitoring results for outfalls in the Phosphorus Source Area.
3. Calculation of the impervious area and directly connected impervious area (DCIA) for each catchment in the Phosphorus Source Area.
4. Identification, delineation and prioritization of potential catchments with high phosphorus loading.
5. Identification of potential retrofit opportunities or opportunities for the installation of structural BMPs during redevelopment including the removal of impervious area. This focuses on municipally-owned parcels.

A summary of the assessment findings is provided in the table below.

Summary of Phosphorus Source Identification Report Findings for the Nashua River

Phosphorus Source Identification Report Requirement	Nashua River *Phosphorus Impairment*
Nashua River Watershed in Urbanized Area (UA)	7,791 acres
Total Number of Outfalls in Nashua River Watershed in UA	305 (#)
Catchment Area for 305 outfalls (Source Area) Impervious Area DCIA	2,112 acres 361 acres 46 acres
Priority Outfalls Identified in Source Area	Outfall OF-744 Outfall OF-47 Outfall OF-703
Total Phosphorus Load from Source Area	866 (lbs P/year)
Nutrient Reduction from Existing BMPs	4.91 (lbs P/year)
Reduction from Potential Retrofits	2.3 (lbs P/year)

Next Steps

The Town of Lunenburg will continue to evaluate phosphorus reduction opportunities in the Phosphorus Source Area and implement BMPs as funding sources and other resources become available. Specific next steps include:

- Install a demonstration BMP targeting a high nutrient load area in the Phosphorus Source Area by June 30, 2024.

1 MS4 Permit Impaired Waters Requirement

Under the EPA's 2016 NPDES MS4 Permit, regulated communities that discharge to certain water quality limited waters are required to meet additional requirements as outlined in Appendices F and H of the MS4 Permit. Water quality limited waters are any waterbodies that do not meet applicable water quality standards, including waterbodies listed in Categories 4a and 5 on the Massachusetts Integrated List of Waters, also known as the "303(d) List." These impaired waters fall into one of two categories as described in Section 2.2 of the 2016 MS4 Permit (as amended):

- Impaired waters with an approved Total Maximum Daily Load (TMDL) (subject to requirements in Appendix F of the MS4 Permit); or
- Impaired waters without an approved TMDL (subject to requirements in Appendix H of the MS4 Permit).

The Town of Lunenburg must address the discharge of phosphorus from its MS4 to the Nashua River. Though the Nashua River has a draft TMDL for Phosphorus (2007) requiring a 20% reduction in phosphorus, the TMDL was not finalized. As the Nashua River TMDL was not finalized, the most recent 303d List (2018/2020) considers the Nashua River a Category 5 impaired water.

As such, the Town of Lunenburg must comply with the requirements for phosphorus impaired waterbodies listed in Categories 4a and 5 on the 303d List, outlined in Appendix H, Section II of the 2016 MS4 Permit. for the contributing MS4 area to the Nashua River within four years of the effective date of the permit (*by June 30, 2022*). The Report must include:

1. Calculation of the MS4 area draining to the water quality limited segment and its tributaries ("Phosphorus Source Area").
2. All screening and monitoring results for outfalls in the Phosphorus Source Area.
3. Calculation of the impervious area and disconnected impervious area (DCIA) for each catchment in the Phosphorus Source Area.
4. Identification, delineation, and prioritization of catchments in the Phosphorus Source Area with high nutrient loading.
5. Identification of potential retrofit opportunities or opportunities for the installation of structural BMPs during redevelopment.

1.1 Reporting Requirements

Any structural BMPs installed in the Phosphorus Source Area shall be tracked, including BMP type, total area treated by the BMP, the design storage volume of the BMP, and the estimated nutrient load removed by the BMP, and reported in each Annual MS4 Report to EPA.

1.2 Phosphorus Source Identification Report

This Phosphorus Source Identification Report has been developed by the Town of Lunenburg to address the discharge of phosphorus to the Nashua River. Specific sections addressing permit requirements are provided in Table 1. This document will be updated as needed as new information becomes available.

Table 1: Location of the Source Identification Report Permit Requirements

MS4 Permit Requirement	Location in Report
Phosphorus Source Area	Section 2
Outfall Screening and Monitoring Results	Section 3
Calculation of Impervious Area	Section 3
High Nutrient Loading Catchment Evaluation	Section 3
Retrofit Opportunities	Section 4

2 Phosphorus Source Area

The Town of Lunenburg must define the area ("Phosphorus Source Area") in which to implement the Phosphorus Source Identification Report. This is defined as either the entire Nashua River watershed area within the municipal boundary, or only the MS4 regulated portion of the area under the jurisdiction of the town. Lunenburg has defined the Phosphorus Source Area as the MS4 drainage areas located within the Urbanized Area (UA) of Lunenburg and within the impaired watersheds. Outfalls and associated drainage areas outside of the Town's jurisdiction, including those belonging to MassDOT and private entities, were excluded from the Phosphorus Source Area. A summary of the Phosphorus Source Area is provided in Table 2.

2.1 Urbanized Area in Lunenburg, MA

Lunenburg's regulated MS4 area is defined as the MS4 located within the Tow's Urbanized Areas (UAs). UAs generally constitute the largest and most dense areas of settlement in the region. The Bureau of the Census determines UAs by applying a detailed set of published UA criteria to the latest decennial census data.

The UA in the Town of Lunenburg covers the approximately 44% of the Town's area, or 7,791 acres. This area includes the southeast corner of town near the border with Fitchburg and Leominster as well as the central portion of town north of Massachusetts Avenue surrounding Hickory Hills Lake. The eastern portion of town near Lake Shirley is also considered part of the UA (Figure 1).

2.2 Phosphorus Source Area in Lunenburg, MA

2.2.1 Nashua River Watershed

The Nashua River is a 37.5-mile river that forms at the confluence of the North Nashua River and South Nashua River downstream of the Wachusett Reservoir in Lunenburg, Massachusetts. From the Reservoir, the South Nashua River flows north and joins the North Nashua River in Lancaster, MA. From there, the Nashua River flows north/northeast to Nashua, NH where it joins with the Merrimack River to flow to the Atlantic Ocean.

The Nashua River watershed is approximately 340,801 acres in size and includes over thirty municipalities in Massachusetts and New Hampshire (Figure 2). Lunenburg is located near the center of the watershed to the west of the Nashua River and occupies approximately 17,793 acres, or 5% of the watershed.

Figure 1- Lunenburg, MA Urbanized Area

Comprehensive Environmental Incorporated

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- Roads
- Lake, Pond, Reservoir
- Wetland, Marsh, Swamp
- Stream, Brook
- Urbanized Area

Data Sources: MassGIS, Town of Lunenburg, CEI

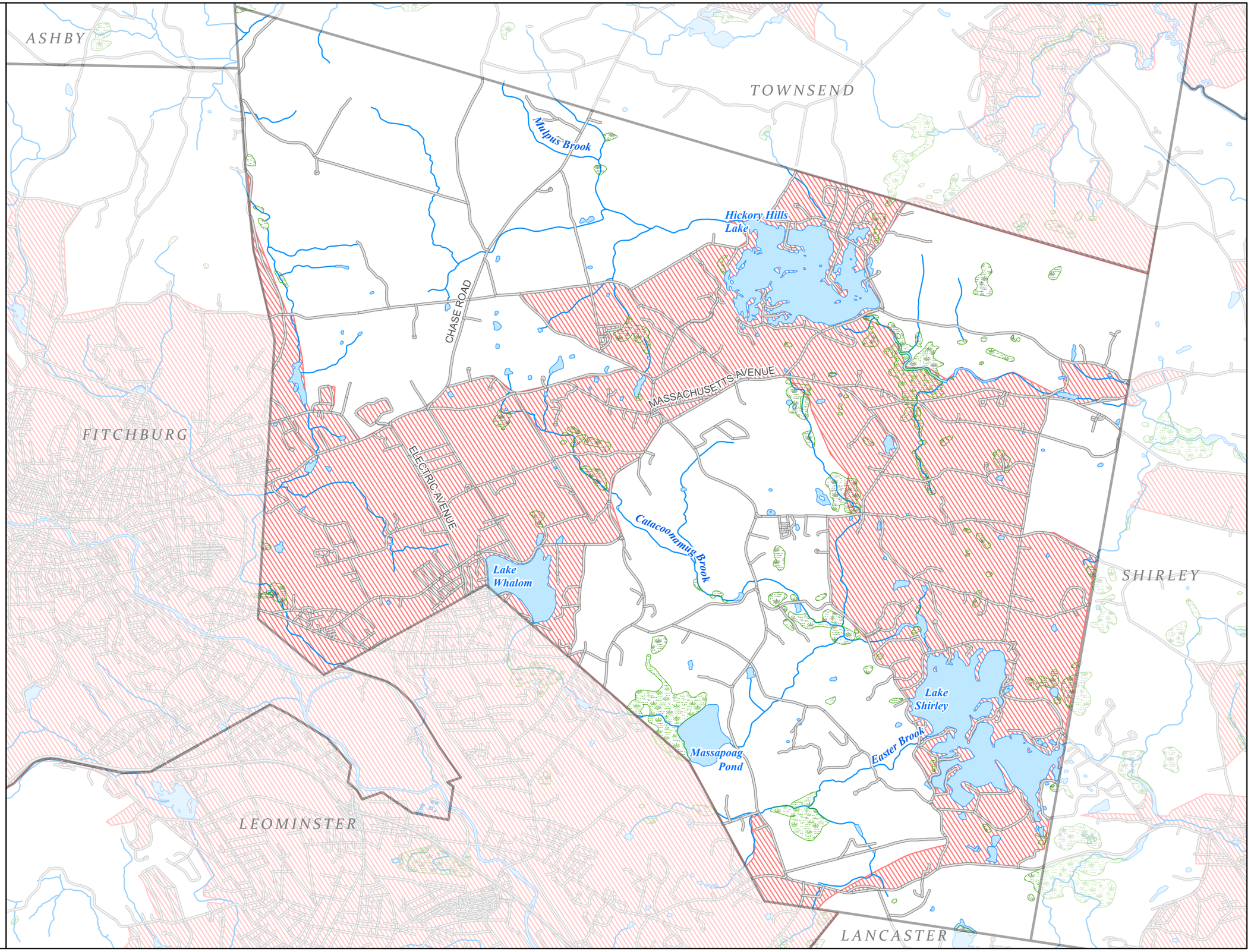

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Figure 2-
Nashua River Watershed

Comprehensive Environmental Incorporated

Data Sources: MassGIS, Town of Lunenburg, CEI

Legend

- Town Of Lunenburg
- Nashua River Impaired Section
- Nashua River
- Nashua River Watershed
- Pond, Reservoir
- Swamp, Marsh
- Stream, Brook

4/6/2022

2.2.2 Phosphorus Source Area

The Phosphorus Source Area is limited to the area of town discharging to the Nashua River watershed through its MS4. All 7,791 acres of the UA in Lunenburg are within the Nashua River watershed. Within the 7,791 acres, stormwater from approximately 2,112 acres is directed to catch basins that discharge through one of 305 MS4 outfalls. Runoff from the other 5,679 acres within this area does not drain to the Town's MS4 (Table 2, Figure 3). This water either flows as surface runoff or is directed to a non-municipal drainage network. As MS4 maps are updated, catchment areas will be updated and expanded if necessary.

The catchment areas for the 305 outfalls within the Phosphorus Source Area will be further investigated for sources of phosphorus as these areas directly discharge to the MS4 (Table 2, Figure 3).

Table 2: Phosphorus Source Area for Lunenburg, MA

Land Area used to Determine the Phosphorus Source Area	Acres
Nashua River Watershed	340,801
Lunenburg Urbanized Area (UA)	7.791
Nashua River Watershed in Lunenburg	17,793
Nashua River Watershed in Lunenburg's UA	7,791
Urbanized Area Outside of Catchment Area	5,679
Catchment Areas for 305 Outfalls in the Urbanized Area Only	2,112
Nashua River Phosphorus Source Area	**2,112**

Figure 3- Phosphorus Source Area in Lunenburg, MA

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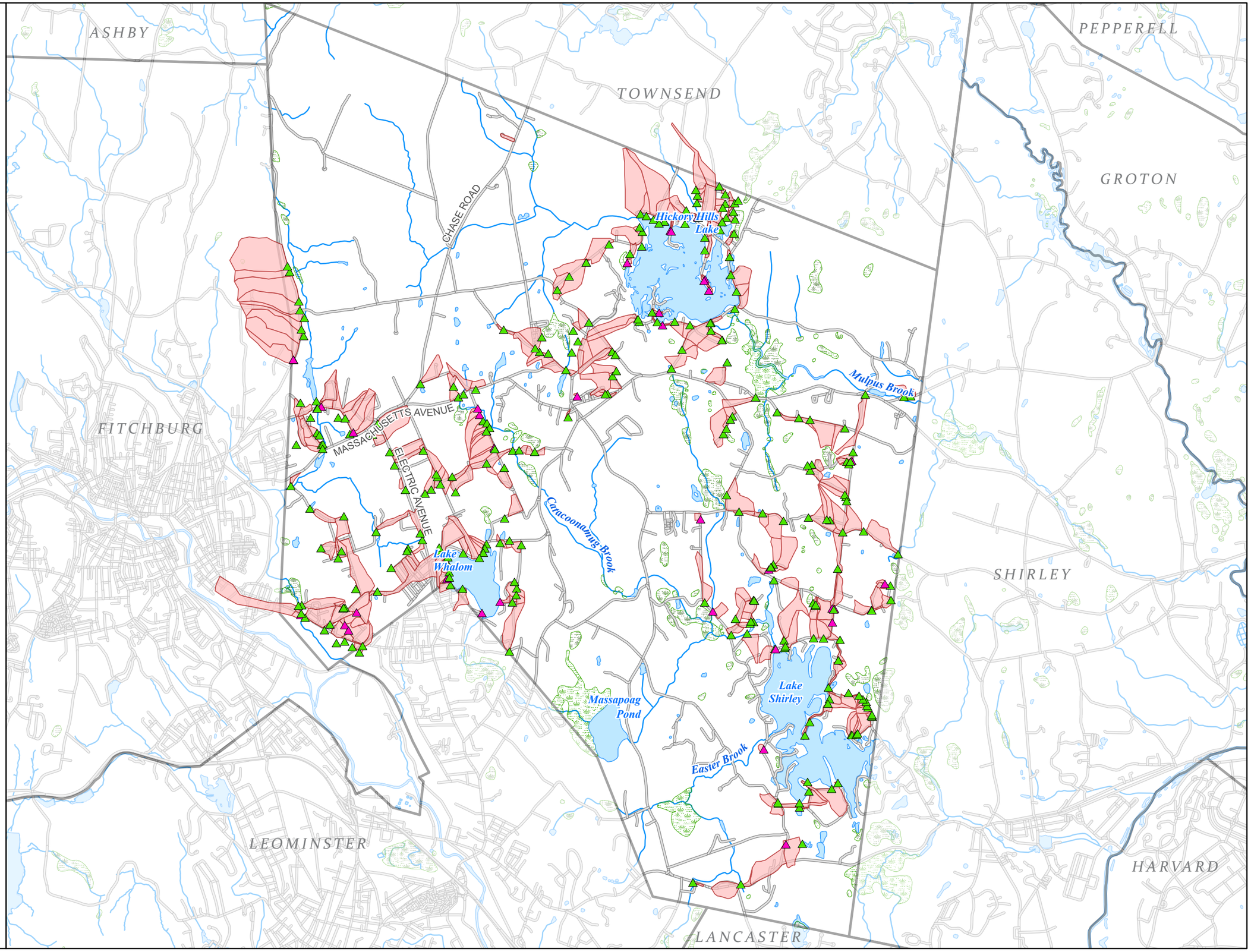
- Outfall
- Open Drainage Outfall
- P Source Area
- Roads
- Lake, Pond, Reservoir
- Wetland, Marsh, Swamp
- Stream, Brook

Data Sources: MassGIS, Town of Lunenburg, CEI



3 Phosphorus Source Area Evaluation

An evaluation of the Phosphorus Source Area was performed to determine the contribution of phosphorus from each outfall to the Nashua River and to prioritize outfalls and catchments with high phosphorus loading.

3.1 Catchment Analysis

Outfall catchment areas comprising the Phosphorus Source Area were evaluated for the following:

- Screening and monitoring results;
- Impervious area (IA);
- Directly connected impervious area (DCIA). DCIA is determined using the Small MS4 Permit Technical Support Document, Estimating Change in Impervious Area (IA) and Directly Connected Impervious Areas (DCIA) for Massachusetts Small MS4 Permit, April 2014;
- Receiving water impairments;
- Distance to receiving water; and
- Annual phosphorus load.

3.1.1 Illicit Discharge Screening

As part of the Town of Lunenburg's Illicit Discharge Detection and Elimination (IDDE) Program, the catchment areas to all outfalls in the town have been delineated and an outfall screening and monitoring program has been developed and implemented as described in part 2.3.4 of the 2016 MS4 Permit and in the Town of Lunenburg's IDDE Plan (June 30, 2022). Dry weather screening has been performed at all outfalls as described in Section 6 of the IDDE Plan.

The phosphorus results from the dry weather screening, where available, are shown in Appendix A.

3.1.2 Source Area Phosphorus Loads

Annual phosphorus loads for each of the 305 outfall catchment areas were calculated in accordance with Appendix F, Attachment 3 of the 2016 MS4 Permit Phosphorus loads are shown in Table 4. Impervious area, DCIA, and phosphorus loads calculated for each outfall are shown in Appendix A. Tables detailing the catchment area land use and calculations for phosphorus loads are provided in Appendix B.

3.1.3 Catchment Prioritization Criteria

Based on the outfall catchment analysis, a ranking system was developed to further prioritize catchments with high nutrient loading. Each catchment was ranked first by annual phosphorus load (highest to lowest). Catchments were then sorted into five prioritization groups based on percentile (20% increments) (Table 3). Each prioritization group was then sorted based on the distance from a waterbody.

Table 3: Catchment Area Prioritization Groups

Prioritization Group	TP range (lbs P/year)	No. of Catchment Areas
Group 1	> 4	68
Group 2	> 2 - 4	71
Group 3	> 1 - 2	61
Group 4	> 0.5 - 1	51
Group 5	0 - 0.5	54
	Total	**305**

The full catchment area analysis for the Phosphorus Source Area is shown in Appendix A. In addition to the above information, other information about the catchment areas is noted including the presence of any existing BMPs or municipally-owned properties. This information will be considered when selecting sites for potential municipal retrofits.

3.1.4 Nashua River Phosphorus Loads and Prioritization

The total phosphorus load from each of the 305 outfalls was calculated to be 866 lbs. P /year (Table 4). The 305 outfalls were grouped into one of five ranking groups as shown in Table 3. In addition to the five groups, the top three priority catchments are identified, considering the distance of discharge from a waterbody (Table 4). The full catchment area analysis for the Phosphorus Source Area is shown in Appendix A and Figure 4. Outfalls OF-744, OF-27, and OF-703 are the highest ranked outfall catchment areas. These outfalls all contribute over 65 lbs P/year to the watershed and are located within fifty feet of a waterbody. These outfalls should be prioritized for remediation (Table 4, Figure 4).

Table 4: Phosphorus Load and Prioritization for Nashua River Phosphorus Source Area

Nutrient Source Area	Number of Outfalls	Phosphorus Load (lbs P/year)	Top 3 Catchment Areas with phosphorus load (lbs P/year)
Nashua River	305	866 lbs P/year	Outfall OF-744 (45 lbs P/year) Outfall OF-47 (11 lbs P/year) Outfall OF-703 (9 lbs P/year)

Figure 4- Nashua River Phosphorus Source Area Catchment Prioritization Lunenburg, MA

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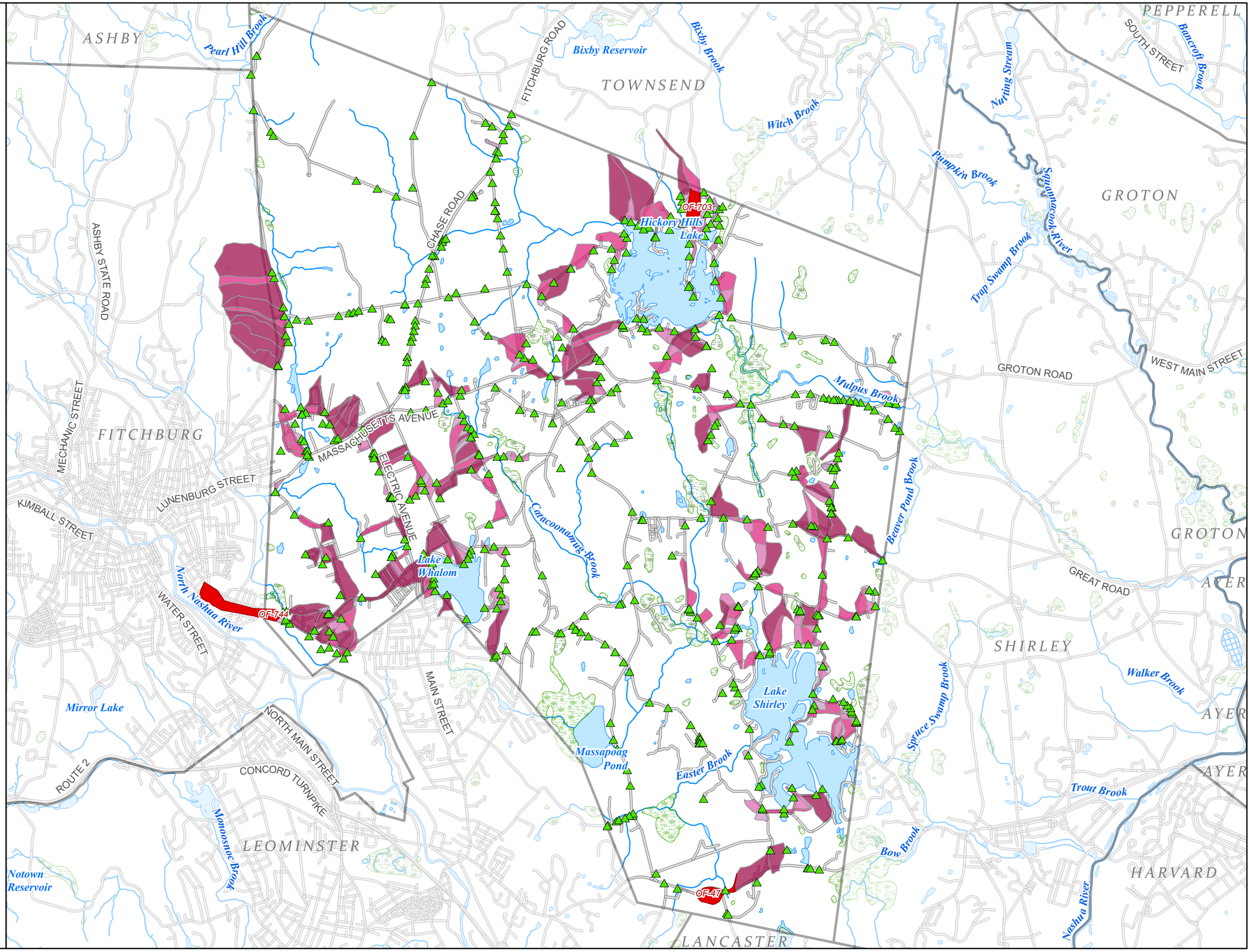
- Top Priority Catchment

Catchment Priority Group:

- 1
- 2
- 3
- 4
- 5
- Outfall
- Roads
- Lake, Pond, Reservoir
- Wetland, Marsh, Swamp
- Stream, Brook

Data Sources: MassGIS, Town of Lunenburg, CEI



4 Structural Nutrient Controls

As described in Appendix H of the 2016 MS4 Permit, the Town of Lunenburg must develop a list of planned structural BMPs that could be implemented to address nutrients in their Phosphorus Source Area within five years of the effective date of the permit (June 30, 2023). One structural BMP must be installed within six years (June 30, 2024) as a demonstration project within the drainage area.

To satisfy this requirement, the Town of Lunenburg assessed their existing town-owned BMPs and conducted an inventory of town-owned properties to identify existing and potential phosphorus reduction opportunities

4.1 Existing BMPs

The Town of Lunenburg recently assessed their existing stormwater BMPs to determine phosphorus removals within their impaired watersheds. Sixteen structural BMPs were identified within the Nashua River watershed. EPA's BMP Accounting and Tracking Tool (BATT) was used to compute pollutant removals in accordance with Attachment 3 of Appendix H of the MS4 Permit. A separate memo (BMP Pollutant Reduction Estimate Summary Memo) describes the calculation process in detail (Appendix C).

In summary, the total annual phosphorus removal from these BMPs in the Phosphorus Source Area is 5 lb P/year (Table 5). The Town of Lunenburg must maintain these BMPs to ensure they are functioning properly and receive credit for the pollutant removal. The locations of each BMP are shown in Figure 5.

Table 5: Existing BMPs in the Nashua River Phosphorus Source Area

BMP ID	Location	Stormwater BMP Type	Phosphorus Removal (lbs P/year)
BL-1	Butterfly Ln	Infiltration Basin	0.30
BL-2	Butterfly Ln	Infiltration Basin	0.50
CC-1	Cortland Circle	Detention Basin	0.20
FP-1	Fire/Police Station	Detention Basin	0.04
FP-2	Fire/Police Station	Detention Basin	0.03
LF-1	Landfill – south	Infiltration Basin	0.79
LF-2	Landfill – west	Infiltration Basin	0.56
LF-3	Landfill – east	Detention Basin	0.49
PL-1	Public Library	Detention Basin	0.35
RW-1	Richard's Way	Detention Basin	0.01
RW-2	Richard's Way	Detention Basin	0.26
RW-3	Richard's Way	Detention Basin	0.40
RH-5	Robbs Hill	Detention Basin	0.00
SC-1	Memorial Drive Senior Ctr.	Swale Conveyance	0.01
WC-1	Whitetail Crossing	Detention Basin	0.07
WC-2	Whitetail Crossing	Detention Basin	0.89
		Total	**4.91**

Figure 5- Lunenburg, MA Existing BMPs and Potential Retrofits in the Nashua River Phosphorus Source Area

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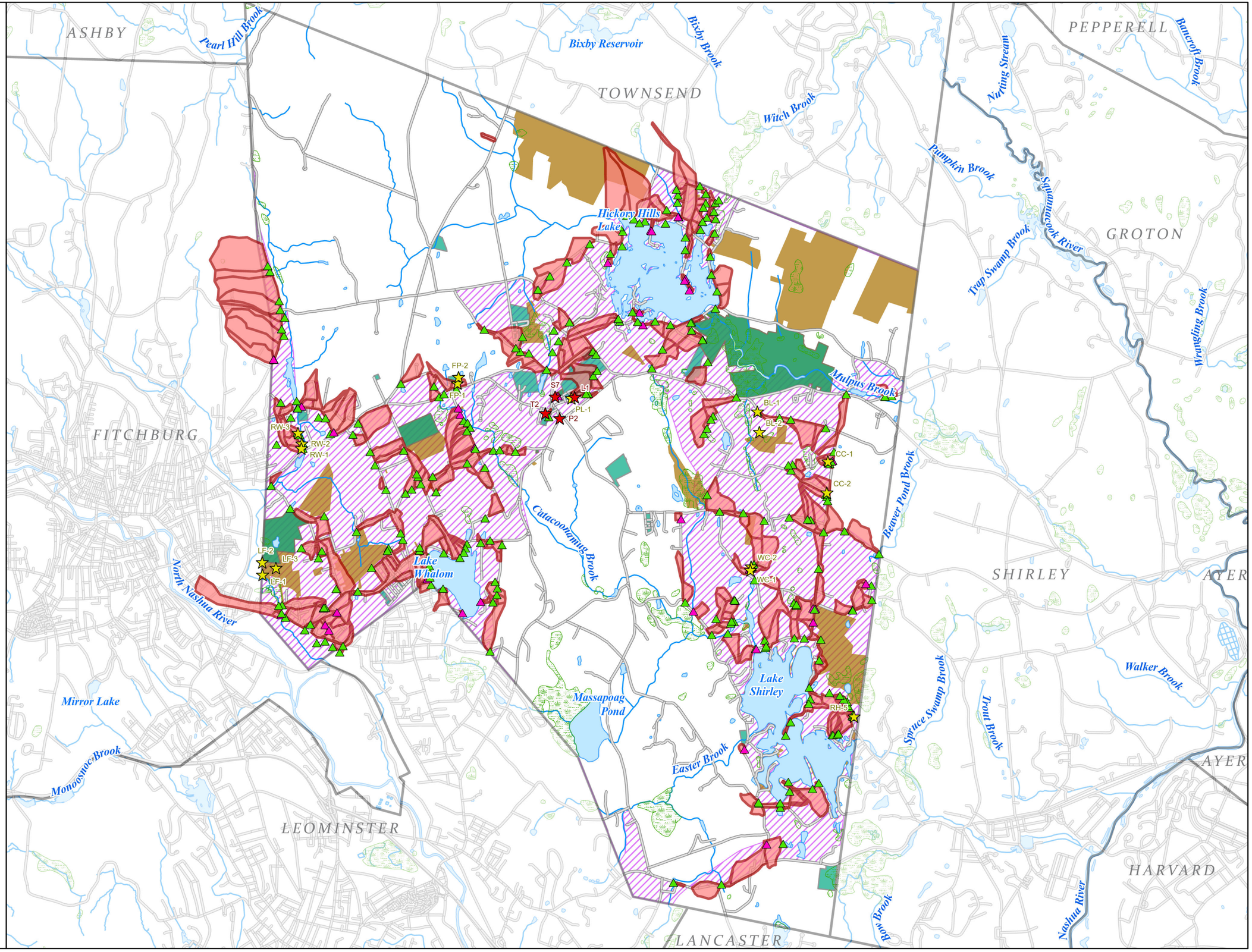
- Outfall
- Open Drainage Outfall
- Proposed BMP
- Existing BMP
- MS4 Catchment
- Municipal Property
- Municipal Vacant Parcel
- P Source Area
- Roads
- Lake, Pond, Reservoir
- Wetland, Marsh, Swamp
- Stream, Brook

Data Sources: MassGIS, Town of Lunenburg, CEI



4.2 Potential Retrofits

Under the MS4 permit, Lunenburg is required to complete an inventory and priority ranking of town-owned properties and existing stormwater infrastructure that could be retrofitted with stormwater BMPs designed to reduce the frequency, volume, and pollutant loads of stormwater discharges to the MS4. A separate memo (Municipal Property Retrofit Memo dated June 2023) describes the assessment and the priority ranking process in detail and is included in Appendix D.

In summary, 30 developed town-owned properties were assessed in the Fall of 2021. This assessment included a desktop analysis and a field assessment to determine potential for retrofits or the installation of new BMPs. In the Spring of 2023, an additional 42 undeveloped town-owned parcels were assessed through a desktop analysis. The results of these analyses are described in detail in the Municipal Property Retrofit Memo (Appendix D). The memo includes potential BMP options, estimated phosphorus load reductions, pre-conceptual designs and estimated costs for all properties, where applicable. A summary of the top sites is provided in Table 6 and shown in Figure 5.

In total, implementation of BMPs at the top locations has the potential to remove 2.0 lbs P/year. Implementation of all BMPs has the potential to remove 2.3 lbs P/year.

Table 6: BMP Retrofit Priority Locations

Location			Proposed BMP	Estimated Costs	TP Reduction
Site ID	*Facility Name*	*Address*	*Type*	*Construction & Engineering*	*lbs P / Year*
L1	Lunenburg Public Library	1023 Mass Avenue	Water Quality Swale/Detention Basin	Const: $213,500 Eng: $74,900	0.6
P2	Historical District Town Common	35 Lancaster Avenue	Infiltration Basin	Const: $91,200 Eng: $32,000	1.0
S7	Boys and Girls Club of Lunenburg	15 Memorial Drive	Rain Garden	Const: $12,200 Eng: $4,300	0.1
T2	Lunenburg Historical Society	10 School Street	Water Quality Swale/Infiltration Basin	Const: $18,200 Eng: $6,500	0.3
			Total	**$**452,800	**2.0**

5 Phosphorus Source Identification Report Implementation

The Town of Lunenburg recognizes the need to implement structural BMPs to reduce the amount of phosphorus within the Nashua River Source Area. The Town will implement one structural BMP, targeting a high nutrient load area, within six years of the permit effective date (by June 30, 2024) in the Nashua River Phosphorus Source Area. Additional BMPs will be implemented as funding sources and additional resources become available.

5.1 Funding Assessment

The design and implementation of stormwater BMPs will be dependent on available funding. Potential funding source may include a local stormwater utility and/or loans and grants offered at the state and federal level. A summary of potential state and federal funding sources is listed in Table 7. Additional resources can be found on the MassDEP Grant Program Directory webpage.

Table 7. Summary of Potential Funding Programs

Funding Program	Description
Planning and Implementation Programs	
MassDEP Stormwater MS4 Municipal Assistance Grant Program	The MassDEP Stormwater MS4 Municipal Assistance Grant program is available for Massachusetts municipalities, Regional Planning Agencies, stormwater coalitions, and non-profit organizations for innovative projects that will assist multiple communities in meeting the requirements of the MS4 permit. Eligible projects include assessment tools for prioritizing retrofit sites, tracking tools for regional stormwater retrofits, development of templates, formation of new regional stormwater coalitions, and other tasks that benefit multiple Massachusetts municipalities in seeking compliance with their MS4 permit.
MassDEP Clean Water State Revolving Fund	The SRF Clean Water program provides a low-cost financing method to help communities meet water quality standards. The program addresses issues such as watershed management priorities, stormwater management, and green infrastructure. SRF also supplies financial assistance to address communities with septic systems.

Funding Program	Description
MassDEP Watershed Assistance Grants	Water Quality Planning and 604(b) grants are available for water quality planning purposes. Other eligible projects include development of preliminary designs and implementation plans to address water quality impairments, and the development of green infrastructure projects. MassDEP also provides funding appropriated through the USEPA under Section 319 of the Clean Water Act to support local initiatives to restore impaired waters or protect high quality waters. 319-grant funds are targeted toward implementation of completed watershed-based plans. A minimum of 40% non-federal match is required for these grants. While 319 funds may not be used to fund work that is specifically required in the MS4 permit, work in the non-regulated area of town is eligible for these funds.
Climate Resiliency Programs	
Massachusetts Executive Office of Energy and Environmental Affairs (EEA) Municipal Vulnerability Preparedness (MVP) Grant Program	The MVP grant program provides support for cities and towns in Massachusetts to being the process of planning for climate change resiliency and implementing priority projects. The state awards communities with funding to complete vulnerability assessments and develop action-oriented resiliency plans. Communities who complete an MVP planning grant become certified as an MVP community and are eligible for MVP Action Grant funding and other opportunities.
Habitat Improvement Programs	
Massachusetts Division of Ecological Restoration (DER) Grant Programs	The Culvert Replacement Municipal Assistance Grant Program is for municipalities interested in replacing an undersized, perched, and/or degraded culvert located in an area of high ecological value. This funding is to encourage municipalities to replace aging culverts with better designed crossings that meet improved structural and environmental design standards and flood resiliency criteria. The Restoration and Revitalization Priority Projects Program selects projects that restore and protect Massachusetts rivers, wetlands, and watersheds for the benefit of people and the environment. The Priority Projects Program selects ecological and urban stream revitalization projects that present significant benefits to Massachusetts. Eligible applicants include restoration project site landowners, non-profit and/or non-governmental organizations, regional planning organizations, municipalities, and state and federal agencies. Current project focus is on cranberry bog wetland restoration, stream restoration, and urban stream and river revitalization.

Funding Program	Description
NOAA Community-Based Restoration Program Partnership	Grant funding provided for stream barrier removal projects that help restore riverine ecosystems, enhance public safety and community resilience, and have clear and identifiable benefits to diadromous fish populations.
National Fish and Wildlife Foundation (NFWF) Grant Programs	NFWF Five Star and Urban Waters Restoration Program provides funds to local partnerships for wetland, forest, riparian and coastal habitat restoration, with a focus on urban waters and watersheds. Funds approximately $1,500,000 annually, with average grants between $25,000 to $35,000 and 1:1 match requirement. NFWF New England Forests and Rivers Fund dedicated to restoring and sustaining healthy forests and rivers that provide habitat for diverse native bird and freshwater fish populations in New England. Annually awards grants ranging from $50,000 to $200,000 each.
Recreation and Trail Programs	
Fields Pond Foundation	Funds trail making and other enhancement of public access to conservation lands, land acquisitions for conservation, and establishing funds for stewardship. Funding levels: $25,000 maximum, $2,000 - $10,000 typical.
National Park Service – Rivers and Trails Program	Funds projects focused on protection of natural resources and enhancement of outdoor recreational opportunities.
Agricultural Programs	
Natural Resource Conservation Service (NRCS) Grant Programs	Environmental Quality Incentives Program (EQIP) provides financial and technical assistance to agricultural producers to address natural resources concerns and deliver environmental benefits such as improved water and air quality, conserved ground and surface water, reduced soil erosion, and improved wildlife habitat. Conservation Stewardship Program (CSP) is the largest conservation program in the United States with a goal of enhancing natural resources and improving agricultural operations. The program helps agricultural operations build on existing conservation efforts while strengthening their operations. The program focuses on improving grazing conditions, increasing crop yields, developing wildlife habitat, and increasing resilience to weather extremes.

6 Summary and Next Steps

Summary

A summary of the Phosphorus Source Identification Report components is provided in Table 8.

Table 8: Summary of Phosphorus Source Identification Report Findings for the Nashua River

Phosphorus Source Identification Report Requirement	Nashua River *Phosphorus Impairment*
Nashua River Watershed in Urbanized Area (UA)	7,791 acres
Total Number of Outfall in Nashua River Watershed in UA	305 (#)
Catchment Area for 305 outfalls (Source Area) Impervious Area DCIA	2,112 acres 361 acres 46 acres
Priority Outfalls Identified in the Source Area	Outfall OF-744 Outfall OF-47 Outfall OF-703
Total Phosphorus Load from Outfalls in Source Area	866 (lbs P/year)
Nutrient Reduction from Existing BMPs	4.91 (lbs P/year)
Reduction from Potential Retrofits	2.3 (lbs P/year)

Next Steps

The Town of Lunenburg will continue to evaluate phosphorus reduction opportunities in the Phosphorus Source Area and implement BMPs as funding sources and other resources become available. Specific next steps include:

- Install a demonstration BMP targeting a high nutrient load area in the Phosphorus Source Area by June 30, 2024.

Appendices

Appendix A: Catchment Prioritization

Appendix B: Catchment Area Land Use Calculations

Appendix C: BMP Pollutant Reduction Estimate Summary Memo

Appendix D: Municipal Property Retrofit Memo

Appendix A: Catchment Prioritization

Appendix A: Catchment Area Analysis for Outfalls in the Phosphorus Source Area

Catchment ID	TP Load (lbs P/year)	Receiving Water	Distance to Receiving Water (ft)	Catchment Area (Acres)	TP Load per acre (lbs/acre/yr)	Impervious Area in Catchment (acres)	DCIA in Catchment (acres)	Phosphorus (mg/L) if dry	Existing BMP in Catchment	Municipal Properties in Catchment	Prioritization Group
OF-744	45.36	Baker Brook	27.6	39.81	1.14	25.60	7.52				Top Priority Catchment
OF-47	10.78	Unnamed Stream	6.8	17.47	0.62	6.14	1.18				Top Priority Catchment
OF-703	9.33	Hickory Hills Lake	19.2	18.08	0.52	4.73	0.24				Top Priority Catchment
OF-678	7.22	Mulpus Brook	36.7	14.17	0.51	3.07	0.14			P5, 162/063.0-0007-0000.0	1
OF-749	6.83	Lake Whalom	31.9	7.93	0.86	3.96	0.28			PL1	1
OF-694	6.28	Hickory Hills Lake	20.3	38.98	0.16	0.94	0.01				1
OF-41	4.56	Quarry Pit	41.6	16.23	0.28	1.33	0.04				1
OF-446	4.34	Unnamed Stream	14.8	7.89	0.55	1.83	0.09			PD1	1
OF-37	4.17	Lake Shirley	41.6	21.42	0.19	1.17	0.03			162/126.0-0062-0000.0	1
OF-399	4.07	Unnamed Stream	22.8	7.80	0.52	2.24	0.12			P1	1
OF-454	9.17	Catacoonamug Brook	71.8	26.22	0.35	2.88	0.10				1
OF-206	7.24	Lake Whalom	56.8	11.14	0.65	3.73	0.22				1
OF-692	6.04	Hickory Hills Lake	142.4	45.55	0.13	0.42	0.00				1
OF-743	5.66	Baker Brook	53.0	13.79	0.41	2.57	0.11			162/115.0-0016-0000.0	1
OF-86	5.04	Beaver Pond Brook	114.4	18.35	0.27	1.99	0.07				1
OF-435	4.99	Unnamed Stream	67.0	12.33	0.40	2.37	0.10				1

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OF-689	4.29	Hickory Hills Lake	145.5	14.87	0.29	0.63	0.01				1
OF-466	4.13	Lake Whalom	71.2	6.92	0.60	2.12	0.12				1
OF-741	28.50	Unnamed Stream	292.1	32.56	0.88	16.52	1.18			P9, 162/098.0-0004-0000.0	1
OF-440	16.17	Unnamed Pond	306.0	17.01	0.95	8.23	8.23				1
OF-298	11.36	Unnamed Stream	352.8	72.22	0.16	0.85	0.01				1
OF-736	11.16	Baker Brook	199.2	18.02	0.62	5.88	0.34				1
OF-295	9.76	Unnamed Stream	441.1	46.29	0.21	1.43	0.03				1
OF-275	8.64	Unnamed Stream	407.9	30.99	0.28	1.26	0.03				1
OF-505	8.34	White Rabbit Swamp	169.7	23.04	0.36	2.21	0.07			162/089.0-0010-0000.0	1
OF-219	7.18	Unnamed Stream	412.1	7.80	0.92	4.15	0.30				1
OF-278	6.77	Unnamed Stream	352.2	32.32	0.21	1.02	0.02				1
OF-444	6.21	Unnamed Wetland	258.2	12.52	0.50	2.60	0.12				1
OF-509	6.06	Mulpus Brook	184.3	14.46	0.42	2.14	0.08	0.0			1
OF-276	5.46	Unnamed Stream	453.0	15.54	0.35	2.12	0.08				1
OF-506	4.99	Lane Pond	202.2	18.54	0.27	0.90	0.02				1
OF-680	4.23	Flurcum Swamp	271.0	11.09	0.38	1.21	0.04			P5	1
OF-725	4.05	Unnamed Stream	485.0	8.50	0.48	1.19	0.04				1
OF-1094	13.34	Quarry Pit	984.8	27.83	0.48	6.36	0.30				1
OF-441	11.95	Unnamed Pond	524.5	13.04	0.92	6.18	6.18				1

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OF-274	9.90	Unnamed Pond	785.0	35.80	0.28	0.96	0.02				1
OF-273	8.79	Unnamed Pond	755.7	20.86	0.42	2.49	0.09				1
OF-1161	8.45	Lake Whalom	722.1	17.98	0.47	3.02	0.35				1
OF-426	7.99	Unnamed Stream	932.6	20.57	0.39	2.84	0.11				1
OF-250	7.73	Baker Brook	951.0	16.07	0.48	3.15	0.14				1
OF-567	7.55	Houghtons Mill Pond	598.3	23.68	0.32	2.87	0.10				1
OF-1039	7.07	Unnamed Stream	837.9	8.05	0.88	3.41	3.41				1
OF-1086	6.04	Unnamed Wetland	752.5	12.97	0.47	1.01	0.03				1
OF-249	5.50	Baker Brook	817.6	7.79	0.71	2.52	0.46				1
OF-82	5.40	Unnamed Wetland	579.2	12.26	0.44	1.52	0.05				1
OF-1162	4.53	Unnamed Stream	642.8	8.04	0.56	2.26	0.12			162/094.0-0008-0000.0	1
OF-1038	4.53	Unnamed Stream	633.5	10.96	0.41	1.70	0.07				1
OF-603	4.45	Dead Pond	920.9	19.19	0.23	1.84	0.06	0.0			1
OF-412	4.03	Catacoonamug Brook	923.4	8.04	0.50	2.33	0.13				1
OF-714	4.02	Unnamed Stream	533.7	16.59	0.24	1.27	0.04				1
OF-1071	11.80	Baker Brook	1273.6	29.75	0.40	4.03	0.15			162/094.0-0008-0000.0	1
OF-1170	10.35	Unnamed Pond	2742.4	16.47	0.63	5.96	0.36			S1,S2,S6	1
OF-372	8.13	Unnamed Pond	2076.7	26.41	0.31	2.45	0.07				1
OF-553	8.05	Unnamed Stream	1964.1	28.59	0.28	1.96	0.05				1

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OF-1176	6.81	Unnamed Stream	2894.6	7.90	0.86	4.35	0.32			S1,S2,S6	1
OF-653	6.58	Unnamed Stream	1334.0	19.05	0.35	1.49	0.04				1
OF-1171	6.17	Unnamed Pond	2206.2	14.70	0.42	2.42	0.10			S1,S2,S6	1
OF-443	5.92	Unnamed Pond	2179.2	8.46	0.70	3.14	0.19			S1,S2,S6	1
OF-620	5.87	Unnamed Pond	1178.9	14.80	0.40	1.49	0.05				1
OF-631	5.79	Unnamed Stream	2855.7	13.34	0.43	2.51	0.11				1
OF-1074	5.45	Unnamed Wetland	1847.7	11.00	0.50	2.42	0.11			162/078.0-0037-0000.0	1
OF-572	5.28	Mulpus Brook	1115.2	11.21	0.47	2.37	0.11			S3	1
OF-732	5.16	Baker Brook	1891.7	9.36	0.55	2.22	0.11				1
OF-90	4.84	Unnamed Wetland	1406.3	8.64	0.56	1.71	0.22		x		1
OF-639	4.77	Unnamed Stream	1251.1	9.38	0.51	1.74	0.08			162/094.0-0026-0000.0	1
OF-463	4.35	Unnamed Pond	1348.9	7.10	0.61	2.19	0.12				1
OF-733	4.29	Baker Brook	1181.3	9.39	0.46	1.85	0.08				1
OF-525	4.28	Unnamed Wetland	1388.1	12.04	0.36	1.22	0.04			162/107.0-0021-0000.0	1
OF-1312	3.92	Unnamed Stream	16.4	15.21	0.26	1.06	0.03				2
OF-1072	3.52	Unnamed Stream	42.7	6.95	0.51	1.74	0.09			162/094.0-0008-0000.0	2
OF-696	3.27	Hickory Hills Lake	0.0	7.98	0.41	0.84	0.03				2
OF-563	3.13	Houghtons Mill Pond	18.7	11.18	0.28	0.89	0.03				2
OF-556	2.99	Hickory Hills Lake	18.0	14.48	0.21	1.19	0.03				2

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OF-413	2.82	Lake Shirley	17.2	6.62	0.43	1.60	0.08	0.0		162/126.0-0062-0000.0	2
OF-460	2.41	Lake Whalom	9.2	3.42	0.71	1.37	0.09				2
OF-482	2.35	Unnamed Stream	28.3	5.88	0.40	0.91	0.04				2
OF-433	2.30	Unnamed Stream	43.6	3.97	0.58	1.15	0.06				2
OF-699	2.20	Hickory Hills Lake	15.4	4.77	0.46	0.89	0.04				2
OF-629	2.07	Unnamed Stream	37.3	2.86	0.72	0.93	0.93		x		2
OF-437	2.04	Unnamed Stream	7.5	3.86	0.53	1.02	0.05			H1	2
OF-452	3.72	Unnamed Stream	145.0	12.61	0.29	0.42	0.01				2
OF-651	3.67	Flurcum Swamp	130.7	8.11	0.45	1.69	0.08				2
OF-218	3.49	Unnamed Stream	104.2	2.38	1.47	1.98	1.98				2
OF-468	3.45	Lake Whalom	53.8	3.45	1.00	2.11	0.17			PL1	2
OF-638	3.39	Unnamed Wetland	97.6	6.28	0.54	1.40	0.07			P6	2
OF-669	3.26	Hickory Hills Lake	71.2	13.29	0.25	1.38	0.04				2
OF-571	2.73	Unnamed Pond	128.5	5.29	0.52	1.42	0.07				2
OF-695	2.69	Hickory Hills Lake	115.4	6.40	0.42	1.07	0.04				2
OF-690	2.56	Hickory Hills Lake	147.3	9.60	0.27	0.37	0.01				2
OF-277	2.47	Unnamed Stream	88.8	9.21	0.27	0.87	0.03				2
OF-726	2.45	Unnamed Stream	140.8	4.10	0.60	1.12	0.06				2
OF-605	2.36	Lake Shirley	108.7	6.06	0.39	1.09	0.05				2
OF-207	2.18	Lake Whalom	127.2	3.91	0.56	1.09	0.06				2

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OF-562	2.11	Lake Shirley	54.2	6.45	0.33	0.72	0.02				2
OF-502	3.94	Unnamed Wetland	315.6	12.36	0.32	2.21	0.09				2
OF-297	3.11	Unnamed Stream	275.3	18.00	0.17	0.18	0.00				2
OF-580	3.04	Unnamed Pond	182.7	7.62	0.40	1.40	0.06				2
OF-623	2.84	Unnamed Stream	214.4	5.41	0.53	1.16	0.05				2
OF-676	2.84	Hickory Hills Lake	185.9	5.00	0.57	1.67	0.10				2
OF-1025	2.79	Unnamed Stream	204.4	13.66	0.20	1.15	0.03			C1, 162/051.0-0026-0000.0	2
OF-608	2.74	Unnamed Wetland	191.6	6.77	0.40	1.09	0.04				2
OF-411	2.39	Catacoonamug Brook	210.3	4.41	0.54	1.56	0.09				2
OF-1058	2.39	Unnamed Pond	284.7	7.59	0.31	0.74	0.02			WD3	2
OF-590	2.30	Lake Shirley	497.9	6.51	0.35	0.96	0.04				2
OF-625	2.23	Unnamed Stream	175.0	5.24	0.43	0.72	0.03				2
OF-568	2.12	Lake Shirley	268.9	10.90	0.19	1.07	0.03				2
OF-730	2.02	Unnamed Stream	209.5	3.22	0.63	1.09	0.06			162/098.0-0128-0000.0	2
OF-407	3.80	Unnamed Wetland	911.7	9.71	0.39	1.93	0.09				2
OF-522	3.44	Unnamed Wetland	981.3	9.42	0.37	1.52	0.06				2
OF-251	3.31	Baker Brook	966.4	2.75	1.20	1.97	0.63				2
OF-459	3.12	Unnamed Pond	836.6	7.95	0.39	1.02	0.04				2
OF-515	3.00	Unnamed Wetland	783.4	7.08	0.42	0.28	0.01				2
OF-92	2.97	Unnamed Pond	922.0	3.66	0.81	1.20	0.22				2

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OF-93	2.95	Unnamed Pond	784.3	3.43	0.86	1.36	0.29				2
OF-700	2.91	Hickory Hills Lake	555.3	7.12	0.41	1.22	0.14				2
OF-492	2.91	Lake Shirley	552.3	8.30	0.35	0.94	0.03				2
OF-520	2.45	Unnamed Pond	741.1	8.65	0.28	1.58	0.07				2
OF-416	2.43	Dead Pond	693.2	5.75	0.42	1.36	0.07				2
OF-521	2.25	Unnamed Pond	713.2	7.38	0.31	1.44	0.06				2
OF-387	2.16	Unnamed Stream	565.0	4.00	0.54	1.12	0.06		x	PD1	2
OF-597	2.14	Dead Pond	750.7	4.50	0.47	1.13	0.06				2
OF-432	2.08	Unnamed Pond	811.2	3.87	0.54	0.81	0.04				2
OF-457	2.07	Catacoonamug Brook	753.8	6.50	0.32	0.45	0.01				2
OF-405	2.00	Unnamed Wetland	823.5	7.12	0.28	0.87	0.03				2
OF-465	3.83	Unnamed Pond	2490.9	5.66	0.68	1.64	0.09				2
OF-715	3.78	Unnamed Wetland	1450.8	10.96	0.34	1.01	0.03				2
OF-626	3.52	Unnamed Pond	1380.5	5.53	0.64	1.58	0.08				2
OF-554	3.45	Unnamed Wetland	1031.6	17.72	0.19	1.92	0.06				2
OF-429	3.33	Baker Brook	1396.1	7.78	0.43	0.90	0.03				2
OF-439	2.95	Unnamed Stream	1226.8	6.69	0.44	0.96	0.04				2
OF-524	2.89	Unnamed Wetland	1428.3	8.62	0.34	1.28	0.05			162/107.0-0021-0000.0	2
OF-633	2.68	Unnamed Stream	2697.9	5.21	0.51	1.20	0.06				2
OF-619	2.57	Unnamed Wetland	1065.0	14.83	0.17	0.57	0.01				2
OF-643	2.47	Unnamed Stream	2829.2	7.44	0.33	0.82	0.03				2

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OF-635	2.45	Unnamed Pond	3254.0	7.81	0.31	1.16	0.04				2
OF-737	2.35	Baker Brook	1067.3	2.84	0.83	1.37	0.33				2
OF-745	2.23	Baker Brook	1383.7	3.98	0.56	1.14	0.06				2
OF-431	2.14	Unnamed Stream	1577.7	7.21	0.30	0.67	0.02				2
OF-223	2.11	Unnamed Wetland	2616.1	3.85	0.55	1.00	0.05				2
OF-36	1.53	Lake Shirley	0.0	3.46	0.44	0.88	0.04			162/126.0-0062-0000.0	3
OF-604	1.49	Lake Shirley	17.0	1.34	1.11	1.06	0.09			162/126.0-0062-0000.0	3
OF-722	1.37	Hickory Hills Lake	0.0	2.95	0.46	0.74	0.04				3
OF-205	1.25	Lake Whalom	40.0	3.48	0.36	0.38	0.01				3
OF-708	1.23	Hickory Hills Lake	17.0	3.20	0.39	0.79	0.04				3
OF-645	1.22	Catacoonamug Brook	32.3	2.01	0.61	0.67	0.04				3
OF-693	1.22	Hickory Hills Lake	27.6	5.20	0.23	0.56	0.02				3
OF-724	1.14	Unnamed Wetland	48.5	2.29	0.50	0.76	0.04				3
OF-677	1.09	Mulpus Brook	14.7	1.49	0.74	0.76	0.05			P5	3
OF-461	1.05	Lake Whalom	46.5	1.50	0.70	0.59	0.04			PL1	3
OF-469	1.95	Lake Whalom	50.1	2.70	0.72	1.10	0.07			PL1	3
OF-707	1.94	Hickory Hills Lake	63.9	2.70	0.72	1.15	0.08				3
OF-675	1.86	Hickory Hills Lake	57.8	5.10	0.37	0.94	0.04				3
OF-663	1.86	Unnamed Wetland	76.6	4.48	0.41	0.51	0.02				3
OF-578	1.74	Unnamed Pond	76.4	4.05	0.43	0.76	0.03				3

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OF-682	1.70	Hickory Hills Lake	79.9	5.62	0.30	0.78	0.03				3
OF-636	1.69	Unnamed Stream	131.0	1.67	1.01	1.01	0.28				3
OF-35	1.41	Lake Shirley	84.0	5.49	0.26	0.58	0.02			162/126.0-0062-0000.0, 162/136.0-0006-0000.0	3
OF-577	1.39	Lake Shirley	86.4	1.48	0.94	0.96	0.08				3
OF-659	1.39	Mulpus Brook	86.2	4.48	0.31	0.47	0.02				3
OF-618	1.96	Unnamed Wetland	157.2	5.75	0.34	0.80	0.03				3
OF-681	1.78	Hickory Hills Lake	331.4	4.25	0.42	0.65	0.03				3
OF-719	1.73	Hickory Hills Lake	201.4	4.52	0.38	1.03	0.05				3
OF-526	1.67	Lake Shirley	447.5	6.00	0.28	0.34	0.01				3
OF-731	1.60	Unnamed Stream	368.8	3.06	0.52	0.80	0.04			162/094.0-0008-0000.0, 162/098.0-0128-0000.0	3
OF-1173	1.58	Unnamed Stream	497.1	2.90	0.55	1.07	0.07				3
OF-646	1.57	Catacoonamug Brook	205.2	4.39	0.36	0.78	0.03				3
OF-595	1.54	Unnamed Wetland	273.4	3.53	0.44	0.66	0.03				3
OF-560	1.54	Hickory Hills Lake	177.3	3.63	0.42	1.02	0.05				3
OF-1089	1.54	Unnamed Wetland	475.8	4.01	0.38	1.02	0.05				3
OF-384	1.51	Unnamed Stream	184.6	3.90	0.39	0.52	0.05				3
OF-611	1.50	Unnamed Stream	395.8	2.44	0.62	0.84	0.05				3
OF-584	1.47	Unnamed Wetland	382.4	3.72	0.39	0.65	0.03				3

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OF-414	1.20	Houghtons Mill Pond	160.9	2.14	0.56	0.76	0.05				3
OF-418	1.19	Houghtons Mill Pond	181.8	2.78	0.43	0.57	0.03				3
OF-490	1.18	Unnamed Wetland	305.7	2.53	0.47	0.80	0.05				3
OF-570	1.14	Lake Shirley	416.1	2.94	0.39	0.73	0.04			162/107.0-0021-0000.0	3
OF-727	1.07	Unnamed Wetland	180.1	2.02	0.53	0.40	0.02				3
OF-575	1.05	Lake Shirley	416.1	1.92	0.55	0.70	0.04			162/107.0-0021-0000.0	3
OF-516	1.97	Unnamed Wetland	805.3	4.76	0.41	0.09	0.00				3
OF-417	1.81	Dead Pond	730.7	5.36	0.34	1.08	0.05				3
OF-445	1.71	Unnamed Stream	690.1	3.13	0.55	0.74	0.04				3
OF-691	1.51	Unnamed Wetland	593.0	3.94	0.38	0.42	0.01				3
OF-728	1.32	Lake Whalom	965.8	5.67	0.23	0.35	0.01				3
OF-573	1.26	Lake Shirley	897.6	2.01	0.63	0.69	0.04			162/107.0-0021-0000.0	3
OF-497	1.22	Lake Shirley	929.7	5.79	0.21	0.31	0.01				3
OF-602	1.20	Dead Pond	921.6	2.50	0.48	0.71	0.04				3
OF-89	1.97	Unnamed Wetland	1551.3	4.93	0.40	0.64	0.02				3
OF-227	1.82	Unnamed Stream	2480.5	1.46	1.24	1.35	0.13				3
OF-630	1.75	Unnamed Pond	1673.9	4.54	0.39	0.89	0.04				3
OF-642	1.70	Unnamed Wetland	2874.7	5.89	0.29	0.76	0.03				3
OF-430	1.65	Baker Brook	1882.1	4.62	0.36	0.21	0.00				3
INT-2	1.63			3.40	0.48	0.71	0.03			S1,S2,S6	3

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OF-458	1.61	Lane Pond	1111.4	3.94	0.41	0.65	0.03				3
OF-1031	1.58	Baker Brook	1770.7	4.19	0.38	0.35	0.01				3
OF-652	1.57	Unnamed Stream	1007.0	3.10	0.51	0.76	0.04			162/068.0-0010-0000.0	3
OF-600	1.45	Dead Pond	1105.8	9.32	0.16	0.59	0.01				3
OF-523	1.30	Unnamed Wetland	1281.0	2.35	0.55	0.78	0.04				3
OF-511	1.29	Unnamed Wetland	1778.9	5.98	0.22	0.17	0.00				3
OF-428	1.22	Unnamed Pond	1088.1	3.64	0.33	0.26	0.01				3
OF-491	1.21	Lake Shirley	1576.9	3.34	0.36	0.43	0.02			162/107.0-0021-0000.0	3
OF-593	0.96	Lake Shirley	32.3	4.19	0.23	0.26	0.01				4
OF-453	0.90	Catacoonamug Brook	5.4	2.36	0.38	0.23	0.01				4
OF-729	0.77	Lake Whalom	44.8	1.47	0.52	0.38	0.02			162/112.0-0040-0000.0	4
OF-204	0.65	Lake Whalom	30.1	2.07	0.32	0.11	0.00				4
OF-723	0.65	Hickory Hills Lake	45.3	0.89	0.73	0.44	0.03				4
OF-747	0.82	Baker Brook	55.8	0.64	1.28	0.56	0.05				4
OF-624	0.77	Unnamed Stream	119.5	2.45	0.32	0.16	0.00		x		4
OF-203	0.76	Lake Whalom	89.4	1.82	0.42	0.20	0.01				4
OF-579	0.59	Unnamed Pond	90.7	2.10	0.28	0.19	0.01				4
OF-735	0.57	Baker Brook	57.3	1.50	0.38	0.26	0.01				4
OF-673	0.53	Hickory Hills Lake	124.5	0.86	0.62	0.36	0.02				4
OF-449	0.92	Unnamed Stream	274.1	3.18	0.29	0.13	0.00				4

Catchment ID	TP Load (lbs P/year)	Receiving Water	Distance to Receiving Water (ft)	Catchment Area (Acres)	TP Load per acre (lbs/acre/yr)	Impervious Area in Catchment (acres)	DCIA in Catchment (acres)	Phosphorus (mg/L) if dry	Existing BMP in Catchment	Municipal Properties in Catchment	Prioritization Group
OF-566	0.91	Unnamed Stream	243.1	1.68	0.54	0.37	0.02				4
OF-713	0.90	Unnamed Stream	465.5	2.01	0.45	0.32	0.01				4
OF-1087	0.87	Unnamed Pond	400.9	2.46	0.35	0.28	0.01				4
OF-455	0.87	Catacoonamug Brook	336.4	3.52	0.25	0.10	0.00				4
OF-740	0.87	Unnamed Stream	290.1	0.85	1.02	0.50	0.04				4
OF-476	0.83	Mulpus Brook	360.4	1.27	0.65	0.48	0.03				4
OF-190	0.83	Unnamed Pond	321.0	1.73	0.48	0.28	0.01				4
OF-1169	0.82	Unnamed Wetland	333.9	1.23	0.67	0.51	0.03				4
OF-705	0.79	Unnamed Stream	225.4	1.85	0.43	0.26	0.01				4
OF-670	0.73	Flurcum Swamp	250.3	1.27	0.58	0.49	0.03				4
OF-587	0.63	Unnamed Wetland	232.0	1.41	0.45	0.34	0.02				4
OF-507	0.61	Lane Pond	339.8	1.46	0.42	0.26	0.01				4
OF-716	0.56	Unnamed Wetland	449.3	1.66	0.34	0.36	0.02				4
OF-684	0.54	Hickory Hills Lake	156.1	0.55	0.99	0.39	0.03				4
OF-649	0.52	Catacoonamug Brook	354.8	1.82	0.28	0.22	0.01				4
OF-450	0.51	Unnamed Stream	311.5	1.59	0.32	0.14	0.00				4
OF-408	0.96	Unnamed Stream	715.8	1.82	0.53	0.55	0.03				4
OF-1096	0.94	Lake Shirley	952.4	5.24	0.18	0.22	0.00				4
OF-656	0.94	Unnamed Pond	708.3	1.78	0.53	0.50	0.03				4
OF-438	0.91	Unnamed Stream	799.8	2.73	0.33	0.45	0.02				4
OF-720	0.90	Unnamed Wetland	704.9	2.45	0.37	0.32	0.01				4
OF-721	0.88	Unnamed Wetland	705.4	2.10	0.42	0.56	0.03				4

Catchment ID	TP Load (lbs P/year)	Receiving Water	Distance to Receiving Water (ft)	Catchment Area (Acres)	TP Load per acre (lbs/acre/yr)	Impervious Area in Catchment (acres)	DCIA in Catchment (acres)	Phosphorus (mg/L) if dry	Existing BMP in Catchment	Municipal Properties in Catchment	Prioritization Group
OF-406	0.82	Unnamed Wetland	683.2	3.67	0.22	0.30	0.01				4
OF-644	0.77	Unnamed Pond	724.1	2.16	0.36	0.20	0.01				4
OF-199	0.76	Lake Whalom	778.5	1.65	0.46	0.32	0.01				4
OF-1081	0.73	Easter Brook	521.5	1.92	0.38	0.42	0.02			P8	4
OF-746	0.61	Baker Brook	715.3	0.60	1.01	0.31	0.02				4
OF-504	0.53	White Rabbit Swamp	775.5	1.73	0.30	0.34	0.02				4
OF-581	0.51	Unnamed Wetland	717.2	0.62	0.83	0.33	0.02				4
OF-456	0.50	Catacoonamug Brook	721.3	2.13	0.24	0.05	0.00				4
OF-464	0.94	Unnamed Pond	2193.0	1.24	0.76	0.51	0.03				4
INT-7	0.93			2.03	0.46	0.54	0.03				4
OF-425	0.80	Lake Whalom	1018.9	2.77	0.29	0.20	0.01				4
OF-634	0.80	Unnamed Wetland	3265.0	3.07	0.26	0.31	0.01				4
OF-424	0.74	Lake Whalom	1052.1	2.16	0.34	0.23	0.01				4
OF-545	0.67	Unnamed Pond	1250.3	0.60	1.12	0.47	0.04			L2, T2, T3	4
OF-742	0.62	Baker Brook	1976.7	1.18	0.52	0.30	0.01				4
OF-94	0.60	Unnamed Pond	1037.8	1.78	0.34	0.15	0.01				4
INT-1	0.57			0.75	0.75	0.33	0.02				4
OF-701	0.41	Hickory Hills Lake	32.9	0.75	0.55	0.20	0.01				5
OF-592	0.40	Lake Shirley	22.3	0.59	0.68	0.25	0.02			162/126.0-0062-0000.0	5
OF-451	0.39	Unnamed Stream	6.9	0.92	0.42	0.10	0.00			162/072.0-0003-0000.0	5

Catchment ID	TP Load (lbs P/year)	Receiving Water	Distance to Receiving Water (ft)	Catchment Area (Acres)	TP Load per acre (lbs/acre/yr)	Impervious Area in Catchment (acres)	DCIA in Catchment (acres)	Phosphorus (mg/L) if dry	Existing BMP in Catchment	Municipal Properties in Catchment	Prioritization Group
OF-140	0.35	Unnamed Stream	43.9	0.53	0.66	0.25	0.02				5
OF-1168	0.24	Unnamed Wetland	22.9	0.44	0.53	0.16	0.01				5
OF-38	0.17	Lake Shirley	47.5	0.25	0.69	0.11	0.01				5
OF-688	0.15	Hickory Hills Lake	5.3	0.15	0.99	0.11	0.01				5
OF-11	0.07	Catacoonamug Brook	26.2	0.85	0.08	0.03	0.00				5
OF-462	0.04	Lake Whalom	26.7	0.10	0.46	0.02	0.00				5
OF-586	0.45	Unnamed Wetland	114.7	1.70	0.26	0.22	0.01				5
OF-718	0.43	Unnamed Wetland	92.1	1.25	0.34	0.26	0.01				5
OF-557	0.42	Hickory Hills Lake	109.6	0.90	0.47	0.28	0.02				5
OF-109	0.38	Unnamed Wetland	93.3	1.07	0.36	0.08	0.00				5
OF-1010	0.32	Unnamed Wetland	101.3	0.40	0.80	0.23	0.02				5
OF-683	0.31	Hickory Hills Lake	65.0	0.55	0.57	0.22	0.01				5
OF-698	0.28	Hickory Hills Lake	56.4	0.39	0.70	0.19	0.01				5
OF-709	0.25	Hickory Hills Lake	68.6	0.33	0.75	0.17	0.01				5
OF-697	0.23	Hickory Hills Lake	70.3	0.42	0.56	0.16	0.01				5
OF-686	0.22	Hickory Hills Lake	86.6	0.35	0.64	0.15	0.01				5
OF-710	0.16	Hickory Hills Lake	86.7	0.55	0.30	0.10	0.00				5
OF-569	0.15	Lake Shirley	72.4	0.20	0.74	0.10	0.01			162/126.0-0062-0000.0	5
OF-704	0.12	Hickory Hills Lake	70.9	0.17	0.70	0.07	0.00				5
OF-628	0.07	Unnamed Stream	109.1	0.25	0.28	0.00	0.00		x		5
OF-717	0.49	Unnamed Wetland	493.2	0.49	1.00	0.36	0.03				5

Catchment ID	TP Load (lbs P/year)	Receiving Water	Distance to Receiving Water (ft)	Catchment Area (Acres)	TP Load per acre (lbs/acre/yr)	Impervious Area in Catchment (acres)	DCIA in Catchment (acres)	Phosphorus (mg/L) if dry	Existing BMP in Catchment	Municipal Properties in Catchment	Prioritization Group
OF-574	0.49	Lake Shirley	417.3	1.94	0.25	0.26	0.01			162/107.0-0021-0000.0	5
OF-585	0.48	Unnamed Wetland	291.8	0.94	0.51	0.27	0.01				5
OF-467	0.47	Lake Whalom	205.7	0.85	0.56	0.23	0.01				5
OF-687	0.38	Hickory Hills Lake	179.6	0.35	1.07	0.27	0.02				5
OF-679	0.37	Mulpus Brook	307.5	0.89	0.42	0.24	0.01				5
OF-606	0.35	Unnamed Wetland	311.3	1.44	0.24	0.08	0.00				5
OF-627	0.34	Unnamed Stream	403.2	0.57	0.60	0.13	0.02				5
OF-559	0.29	Hickory Hills Lake	156.7	0.84	0.34	0.18	0.01				5
OF-558	0.28	Hickory Hills Lake	222.3	1.20	0.24	0.15	0.01				5
OF-588	0.28	Unnamed Pond	441.2	0.65	0.43	0.17	0.01				5
OF-607	0.28	Unnamed Wetland	272.4	0.41	0.70	0.18	0.01				5
OF-561	0.23	Lake Shirley	160.7	1.52	0.15	0.13	0.00				5
OF-436	0.16	Unnamed Stream	243.7	0.31	0.53	0.11	0.01				5
OF-510	0.43	Unnamed Wetland	877.2	1.07	0.40	0.24	0.01				5
OF-748	0.42	Lake Whalom	621.4	0.70	0.59	0.22	0.01			162/098.0-0008-0000.0	5
OF-582	0.34	Unnamed Wetland	736.2	0.35	0.98	0.22	0.02				5
OF-1172	0.31	Unnamed Pond	921.8	0.63	0.49	0.14	0.01		x		5
OF-519	0.31	Unnamed Wetland	609.4	0.94	0.32	0.19	0.01				5
OF-14	0.29	Dead Pond	772.6	0.48	0.60	0.20	0.01				5
OF-508	0.23	Lane Pond	891.0	0.54	0.42	0.09	0.00				5

Catchment ID	TP Load (lbs P/year)	Receiving Water	Distance to Receiving Water (ft)	Catchment Area (Acres)	TP Load per acre (lbs/acre/yr)	Impervious Area in Catchment (acres)	DCIA in Catchment (acres)	Phosphorus (mg/L) if dry	Existing BMP in Catchment	Municipal Properties in Catchment	Prioritization Group
OF-650	0.19	Unnamed Pond	810.1	0.29	0.65	0.09	0.01			S5	5
OF-657	0.16	Unnamed Pond	806.8	0.97	0.17	0.00	0.00				5
OF-583	0.09	Unnamed Wetland	655.8	0.11	0.82	0.07	0.01				5
OF-641	0.46	Unnamed Stream	3123.6	2.07	0.22	0.15	0.00				5
OF-632	0.44	Unnamed Stream	2623.2	1.02	0.43	0.25	0.01				5
OF-1175	0.42	Unnamed Pond	2491.7	1.44	0.30	0.01	0.00			S1,S2,S6	5
OF-734	0.30	Baker Brook	2023.9	0.87	0.35	0.10	0.00				5
OF-706	0.30	Unnamed Wetland	1148.8	0.77	0.39	0.14	0.01				5
OF-1174	0.20	Unnamed Pond	2630.6	0.84	0.24	0.00	0.00			S1,S2,S6	5
OF-552	0.13	Unnamed Stream	1961.6	0.28	0.49	0.09	0.01				5

Appendix B: Catchment Area Land Use Calculations

Phosphorus Load Calculations – Nashua River Phosphorus Source Area

Outfall ID	Catchment Area (acres)	Total Impervious Area (acres)	Land Use	Hydric Soil Group	Impervious Area (acres)	Pervious Area (acres)	BMP Load (lbs P/year)	Total Outfall BMP Load (lbs P/year)
INT-1	0.75	0.33	Forest	C/D		0.05	0.01	0.57
			Highway	C/D	0.26		0.35	
			LDR	C/D	0.07	0.33	0.20	
			Open	C/D		0.04	0.01	
INT-2	3.40	0.71	Forest	C		0.08	0.01	1.63
			Forest	C/D		0.36	0.05	
			Highway	C	0.40		0.53	
			LDR	C	0.27	0.97	0.61	
			LDR	C/D	0.05	1.05	0.38	
			Open	C		0.14	0.03	
			Open	C/D		0.09	0.03	
INT-7	2.03	0.54	Forest	B		0.37	0.05	0.93
			Forest	C/D		0.01	0.00	
			Highway	B	0.47		0.62	
			Highway	C/D	0.01		0.02	
			LDR	B	0.07	1.04	0.22	
			LDR	C/D	0.00	0.05	0.02	
			Open	B		0.03	0.00	
OF-1010	0.40	0.23	Forest	A		0.07	0.01	0.32
			Forest			0.00	0.00	
			Highway	A	0.18		0.24	
			LDR	A	0.04	0.09	0.07	
			Open	A		0.01	0.00	
OF-1025	13.66	1.15	Forest	A		1.06	0.14	2.79
			Forest	B		2.88	0.37	
			Forest	B/D		0.12	0.02	
			Highway	A	0.57		0.77	

Outfall ID	Catchment Area (acres)	Total Impervious Area (acres)	Land Use	Hydric Soil Group	Impervious Area (acres)	Pervious Area (acres)	BMP Load (lbs P/year)	Total Outfall BMP Load (lbs P/year)
			Highway	B	0.28		0.38	
			Highway	B/D	0.01		0.02	
			LDR	A	0.08	0.90	0.14	
			LDR	B	0.19	3.02	0.64	
			LDR	A/D		0.00	0.00	
			LDR	D	0.01	0.10	0.05	
			Open	A	0.00	3.15	0.10	
			Open	B		1.23	0.15	
			Open	B/D		0.05	0.01	
			HDR	C/D		0.08	0.02	
OF-1031	4.19	0.35	LDR	C	0.01	0.78	0.17	1.58
			LDR	C/D	0.34	2.98	1.39	
			Commercial	B		0.11	0.01	
			Commercial	C	0.04	1.36	0.36	
			Commercial	C/D		0.00	0.00	
			Commercial	D		0.20	0.08	
			Forest	B		0.27	0.04	
			Forest	C		1.78	0.23	
			Forest	C/D		0.09	0.01	
			Forest	D		0.60	0.08	
OF-1038	10.96	1.70	Highway	C	0.03		0.03	4.53
			Highway	C/D	0.75		1.00	
			LDR	C	0.27	0.76	0.57	
			LDR	C/D	0.61	3.85	2.04	
			LDR	D		0.02	0.01	
			Open	B		0.00	0.00	
			Open	C		0.02	0.00	
			Open	C/D		0.21	0.06	

Outfall ID	Catchment Area (acres)	Total Impervious Area (acres)	Land Use	Hydric Soil Group	Impervious Area (acres)	Pervious Area (acres)	BMP Load (lbs P/year)	Total Outfall BMP Load (lbs P/year)
OF-1039	8.05	3.41	Commercial	B		0.34	0.04	7.07
			Commercial	C	0.94	2.12	2.12	
			Commercial	C/D	0.01	0.38	0.12	
			Commercial	D	2.01	0.89	3.90	
			Forest	C/D		0.10	0.01	
			Highway	C/D	0.29		0.38	
			LDR	C/D	0.17	0.72	0.47	
			Open	C/D		0.09	0.03	
OF-1058	7.59	0.74	Forest	C		1.17	0.15	2.39
			Highway	C	0.46		0.62	
			LDR	C	0.28	5.21	1.52	
			Open	C	0.00	0.48	0.10	
OF-1071	29.75	4.03	Ag	C/D		0.98	0.44	11.80
			Forest	B		5.72	0.74	
			Forest	C/D		2.27	0.30	
			Forest	D		2.43	0.32	
			HDR	B		0.16	0.02	
			HDR	C/D	0.15	0.86	0.60	
			HDR	D	0.17	0.24	0.48	
			Highway	C/D	1.32		1.78	
			Highway	D	0.10		0.14	
			LDR	B		1.69	0.20	
			LDR	C/D	2.28	10.39	6.47	
			LDR	D	0.00	0.39	0.15	
			Open	B		0.04	0.00	
			Open	C/D	0.00	0.55	0.16	
			Open	D		0.00	0.00	
OF-1072	6.95	1.74	Forest	B		0.52	0.07	3.52

Outfall ID	Catchment Area (acres)	Total Impervious Area (acres)	Land Use	Hydric Soil Group	Impervious Area (acres)	Pervious Area (acres)	BMP Load (lbs P/year)	Total Outfall BMP Load (lbs P/year)
			Forest	D		0.15	0.02	
			HDR	B	0.04	0.11	0.11	
			HDR	D	0.03	0.19	0.14	
			Highway	B	0.63		0.84	
			Highway	D	0.25		0.33	
			Industrial	B	0.02	0.13	0.04	
			LDR	B	0.55	2.84	1.18	
			LDR	D	0.19	1.13	0.70	
			Open	B	0.04	0.09	0.07	
			Open	D	0.00	0.05	0.03	
OF-1074	11.00	2.42	Forest	B		0.69	0.09	5.45
			Forest	C		0.16	0.02	
			Forest	C/D		0.21	0.03	
			Highway	B	0.43		0.57	
			Highway	C	0.46		0.62	
			Highway	C/D	0.47		0.63	
			LDR	B	0.00	0.51	0.07	
			LDR	C	0.48	2.20	1.19	
			LDR	C/D	0.58	4.29	2.13	
			Open	B	0.00	0.10	0.01	
			Open	C		0.24	0.05	
			Open	C/D	0.00	0.17	0.05	
OF-1081	1.92	0.42	Forest	A		0.46	0.06	0.73
			Forest	A/D		0.35	0.05	
			Highway	A	0.18		0.24	
			Highway	A/D	0.00		0.00	
			LDR	A	0.24	0.67	0.38	
			Open	A		0.02	0.00	

Outfall ID	Catchment Area (acres)	Total Impervious Area (acres)	Land Use	Hydric Soil Group	Impervious Area (acres)	Pervious Area (acres)	BMP Load (lbs P/year)	Total Outfall BMP Load (lbs P/year)
OF-1086	12.97	1.01	Ag	C/D		7.89	3.55	6.04
			Forest	C/D		0.64	0.08	
			HDR	C/D	0.00	0.72	0.21	
			Highway	C/D	0.71		0.95	
			LDR	C/D	0.31	2.62	1.23	
			Open	C/D		0.09	0.03	
OF-1087	2.46	0.28	Ag	C/D		0.00	0.00	0.87
			Forest	C/D		1.09	0.14	
			Highway	C/D	0.10		0.14	
			LDR	C/D	0.18	1.03	0.57	
			Open	C/D		0.06	0.02	
OF-1089	4.01	1.02	Forest	A		0.05	0.01	1.54
			Highway	A	0.58		0.78	
			LDR	A	0.44	2.84	0.75	
			Open	A		0.10	0.00	
OF-109	1.07	0.08	Forest	C		0.00	0.00	0.38
			Highway	C	0.00		0.00	
			LDR	C	0.07	0.60	0.24	
			LDR	D		0.38	0.14	
			Open	C		0.02	0.00	
			Open	D		0.00	0.00	
OF-1094	27.83	6.36	Forest			4.76	0.62	13.34
			Forest	D		4.74	0.62	
			Highway		3.74		5.01	
			Highway	D	0.22		0.29	
			Industrial		2.41	2.31	4.78	
			Open			9.65	2.03	
OF-1096	5.24	0.22	Forest	A		3.27	0.43	0.94

Outfall ID	Catchment Area (acres)	Total Impervious Area (acres)	Land Use	Hydric Soil Group	Impervious Area (acres)	Pervious Area (acres)	BMP Load (lbs P/year)	Total Outfall BMP Load (lbs P/year)
			Forest			1.75	0.23	
			Highway	A	0.11		0.15	
			Highway		0.11		0.14	
OF-11	0.85	0.03	Forest	A		0.00	0.00	0.07
			Highway	A	0.01		0.01	
			LDR	A	0.02	0.80	0.06	
			Open	A		0.01	0.00	
OF-1161	17.98	3.02	Commercial	C	0.13	0.42	0.32	8.45
			Commercial	C/D	0.16	7.86	2.56	
			Forest	C		0.22	0.03	
			Forest	C/D		0.43	0.06	
			HDR	C	0.02	0.17	0.08	
			Highway	C	0.94		1.26	
			Highway	C/D	0.88		1.17	
			LDR	C	0.17	0.82	0.44	
			LDR	C/D	0.68	4.20	2.26	
			Open	C	0.02	0.28	0.08	
			Open	C/D	0.02	0.57	0.20	
OF-1162	8.04	2.26	Forest	C		0.23	0.03	4.53
			Forest	C/D		0.14	0.02	
			Highway	C	0.85		1.13	
			Highway	C/D	0.19		0.25	
			LDR	C	0.95	3.73	2.23	
			LDR	C/D	0.27	1.04	0.72	
			Open	C		0.44	0.09	
			Open	C/D		0.19	0.06	
OF-1168	0.44	0.16	Forest	A		0.07	0.01	0.24
			Highway	A	0.12		0.16	

Outfall ID	Catchment Area (acres)	Total Impervious Area (acres)	Land Use	Hydric Soil Group	Impervious Area (acres)	Pervious Area (acres)	BMP Load (lbs P/year)	Total Outfall BMP Load (lbs P/year)
			LDR	A	0.04	0.21	0.06	
			Open	A		0.00	0.00	
OF-1169	1.23	0.51	Forest	A		0.08	0.01	0.82
			Forest	D		0.02	0.00	
			HDR	A	0.01	0.02	0.02	
			Highway	A	0.28		0.38	
			Highway	D	0.06		0.08	
			LDR	A	0.04	0.35	0.08	
			LDR	D	0.11	0.17	0.24	
			Open	A		0.04	0.00	
			Open	D		0.03	0.01	
OF-1170	16.47	5.96	Forest	C		0.54	0.07	10.35
			Forest	C/D		0.95	0.12	
			HDR	C/D		0.01	0.00	
			Highway	C	2.57		3.44	
			Highway	C/D	3.29		4.41	
			LDR	C		0.13	0.03	
			LDR	C/D	0.10	1.18	0.49	
			Open	C		5.56	1.17	
			Open	C/D		2.15	0.62	
OF-1171	14.70	2.42	Forest	C/D		1.72	0.22	6.17
			Forest	D		3.30	0.43	
			HDR	C/D		0.30	0.09	
			Highway	C/D	1.80		2.41	
			Highway	D	0.00		0.00	
			LDR	C/D	0.62	5.02	2.40	
			LDR	D		0.39	0.14	
			Open	C/D	0.00	1.22	0.36	

Outfall ID	Catchment Area (acres)	Total Impervious Area (acres)	Land Use	Hydric Soil Group	Impervious Area (acres)	Pervious Area (acres)	BMP Load (lbs P/year)	Total Outfall BMP Load (lbs P/year)
			Open	D		0.33	0.12	
OF-1172	0.63	0.14	Forest	C/D		0.35	0.04	0.31
			HDR	C/D	0.04	0.15	0.13	
			Highway	C/D	0.10		0.13	
			Open	C/D		0.00	0.00	
OF-1173	2.90	1.07	Forest	A		0.19	0.02	1.58
			Forest	C		0.03	0.00	
			Highway	A	0.73		0.98	
			Highway	C	0.01		0.01	
			LDR	A	0.34	1.46	0.55	
			LDR	C		0.05	0.01	
			Open	A		0.10	0.00	
OF-1174	0.84	0.00	Forest	C		0.01	0.00	0.20
			Highway	C/D	0.00		0.00	
			Open	C		0.54	0.11	
			Open	C/D		0.28	0.08	
OF-1175	1.44	0.01	Highway	C/D	0.01		0.01	0.42
			Open	C		0.04	0.01	
			Open	C/D		1.38	0.40	
OF-1176	7.90	4.35	Forest	C		0.00	0.00	6.81
			Forest	C/D		0.02	0.00	
			Highway	C/D	4.34		5.82	
			LDR	C/D		0.78	0.23	
			LDR	D	0.00	0.17	0.07	
			Open	C		0.64	0.13	
			Open	C/D		1.94	0.56	
OF-1312	15.21	1.06	Forest	A		1.96	0.26	3.92
			Forest	C		0.30	0.04	

Outfall ID	Catchment Area (acres)	Total Impervious Area (acres)	Land Use	Hydric Soil Group	Impervious Area (acres)	Pervious Area (acres)	BMP Load (lbs P/year)	Total Outfall BMP Load (lbs P/year)
			Forest	C/D		0.00	0.00	
			Highway	A	0.65		0.86	
			Highway	C/D	0.00		0.01	
			LDR	A	0.17	4.44	0.39	
			LDR	C	0.09	3.21	0.81	
			LDR	C/D	0.15	2.99	1.09	
			LDR	D		1.24	0.46	
			Open	A	0.00	0.01	0.01	
OF-14	0.48	0.20	Forest	A		0.03	0.00	0.29
			Highway	A	0.18		0.24	
			LDR	A	0.02	0.24	0.04	
			Open	A		0.01	0.00	
OF-140	0.53	0.25	Forest	A		0.02	0.00	0.35
			Highway	A	0.25		0.34	
			Industrial	A	0.00	0.05	0.00	
			Open	A		0.21	0.01	
OF-190	1.73	0.28	Ag	C/D		0.00	0.00	0.83
			Forest	C/D		0.00	0.00	
			Highway	C/D	0.12		0.16	
			LDR	C/D	0.16	1.44	0.67	
OF-199	1.65	0.32	Forest	C		0.06	0.01	0.76
			HDR	C	0.04	0.52	0.19	
			Highway	C	0.16		0.21	
			LDR	C	0.12	0.73	0.34	
			Open	C		0.02	0.00	
OF-203	1.82	0.20	Forest	C/D		0.01	0.00	0.76
			Highway	C/D	0.07		0.10	
			LDR	C/D	0.13	1.59	0.65	

Outfall ID	Catchment Area (acres)	Total Impervious Area (acres)	Land Use	Hydric Soil Group	Impervious Area (acres)	Pervious Area (acres)	BMP Load (lbs P/year)	Total Outfall BMP Load (lbs P/year)
			Open	C/D		0.02	0.01	
OF-204	2.07	0.11	Forest	C/D		0.41	0.05	0.65
			Highway	C/D	0.09		0.12	
			LDR	C/D	0.02	1.27	0.41	
			Open	C/D		0.27	0.08	
OF-205	3.48	0.38	Forest	C/D		1.14	0.15	1.25
			Highway	C/D	0.26		0.34	
			LDR	C/D	0.12	1.46	0.61	
			Open	C/D	0.00	0.51	0.15	
OF-206	11.14	3.73	Ag	C/D		0.01	0.00	7.24
			Forest	C		0.00	0.00	
			Forest	C/D		1.43	0.19	
			Highway	C	0.03		0.04	
			Highway	C/D	1.90		2.55	
			LDR	C	0.08	0.02	0.13	
			LDR	C/D	1.71	5.82	4.29	
			Open	C/D	0.00	0.12	0.04	
OF-207	3.91	1.09	Forest	C		0.18	0.02	2.18
			Highway	C	0.46		0.62	
			Highway	C/D	0.00		0.01	
			LDR	C	0.41	2.14	1.07	
			LDR	C/D	0.21	0.44	0.45	
			Open	C		0.06	0.01	
			Open	C/D		0.00	0.00	
OF-218	2.38	1.98	Commercial		0.55	0.00	0.99	3.49
			Commercial	C	0.50	0.19	0.94	
			Commercial	D	0.59		1.04	
			Forest	C		0.01	0.00	

Outfall ID	Catchment Area (acres)	Total Impervious Area (acres)	Land Use	Hydric Soil Group	Impervious Area (acres)	Pervious Area (acres)	BMP Load (lbs P/year)	Total Outfall BMP Load (lbs P/year)
			Highway	D	0.18		0.25	
			LDR	C	0.15	0.19	0.27	
			Open	D	0.00		0.01	
OF-219	7.80	4.15	Commercial	B		0.00	0.00	7.18
			Commercial		0.94	0.31	1.73	
			Forest	B		0.16	0.02	
			Forest			0.58	0.07	
			Forest	D		0.04	0.01	
			HDR	B	0.17	0.27	0.44	
			HDR	D	0.02	0.10	0.08	
			Highway	B	0.71		0.95	
			Highway		0.86		1.15	
			Highway	D	0.02		0.03	
			Industrial	B	0.29	0.04	0.51	
			LDR	B	0.10	0.32	0.20	
			LDR		0.02	0.25	0.08	
			LDR	D	0.03	0.56	0.25	
			Open	B	0.84	0.71	1.36	
			Open		0.15	0.29	0.28	
			Open	D		0.01	0.00	
OF-223	3.85	1.00	Forest	B		0.02	0.00	2.11
			Forest	C		0.12	0.02	
			Forest	C/D		0.28	0.04	
			Highway	B	0.16		0.22	
			Highway	C	0.06		0.08	
			Highway	C/D	0.23		0.31	
			LDR	B	0.01	0.07	0.02	
			LDR	C	0.13	0.77	0.36	

Outfall ID	Catchment Area (acres)	Total Impervious Area (acres)	Land Use	Hydric Soil Group	Impervious Area (acres)	Pervious Area (acres)	BMP Load (lbs P/year)	Total Outfall BMP Load (lbs P/year)
			LDR	C/D	0.41	1.46	1.04	
			Open	B		0.04	0.01	
			Open	C		0.00	0.00	
			Open	C/D		0.08	0.02	
OF-227	1.46	1.35	Forest	B		0.00	0.00	1.82
			Highway	B	1.35		1.81	
			Open	B		0.11	0.01	
OF-249	7.79	2.52	Commercial		0.01	0.00	0.01	5.50
			Forest			0.00	0.00	
			Forest	C		0.03	0.00	
			HDR		0.39	0.51	1.02	
			HDR	C	0.48	3.46	1.84	
			Highway		0.92		1.23	
			Industrial		0.12	0.21	0.26	
			LDR		0.08	0.10	0.15	
			LDR	C	0.16	0.83	0.42	
			Open		0.26	0.12	0.42	
			Open	C	0.09	0.01	0.15	
OF-250	16.07	3.15	Forest			0.04	0.01	7.73
			Forest	C		0.70	0.09	
			Forest	C/D		1.23	0.16	
			HDR		0.07	0.19	0.19	
			HDR	C	0.30	0.92	0.88	
			HDR	C/D	0.08	0.26	0.26	
			Highway		0.36		0.48	
			Highway	C	0.79		1.06	
			Highway	C/D	0.13		0.17	
			LDR		0.05	0.27	0.14	

Outfall ID	Catchment Area (acres)	Total Impervious Area (acres)	Land Use	Hydric Soil Group	Impervious Area (acres)	Pervious Area (acres)	BMP Load (lbs P/year)	Total Outfall BMP Load (lbs P/year)
			LDR	C	0.92	6.06	2.67	
			LDR	C/D	0.47	2.87	1.54	
			Open			0.05	0.01	
			Open	C		0.22	0.05	
			Open	C/D		0.11	0.03	
OF-251	2.75	1.97	Commercial	A	0.02	0.03	0.04	3.31
			Commercial		0.41	0.08	0.75	
			Commercial	C	0.00		0.01	
			Commercial	C/D	0.19		0.34	
			Forest	A		0.00	0.00	
			Forest			0.02	0.00	
			Forest	C		0.08	0.01	
			Forest	C/D		0.19	0.03	
			Highway	A	0.00		0.00	
			Highway		0.01		0.02	
			Highway	C	0.00		0.00	
			Highway	C/D	0.01		0.01	
			LDR	C/D	0.02	0.21	0.09	
			Open	A	0.01	0.00	0.02	
			Open		0.23	0.16	0.39	
			Open	C	0.61	0.00	0.93	
			Open	C/D	0.45		0.68	
OF-273	20.86	2.49	Ag	C		5.88	2.65	8.79
			Ag	D		0.39	0.18	
			Forest	A		0.28	0.04	
			Forest	B		0.48	0.06	
			Forest	C		0.39	0.05	
			Forest	C/D		0.64	0.08	

Outfall ID	Catchment Area (acres)	Total Impervious Area (acres)	Land Use	Hydric Soil Group	Impervious Area (acres)	Pervious Area (acres)	BMP Load (lbs P/year)	Total Outfall BMP Load (lbs P/year)
			Forest	D		0.27	0.03	
			Highway	A	0.10		0.14	
			Highway	C	0.50		0.68	
			Highway	C/D	0.22		0.30	
			LDR	A	0.13	0.93	0.23	
			LDR	B	0.13	0.99	0.31	
			LDR	C	0.81	4.32	2.14	
			LDR	C/D	0.57	2.66	1.64	
			Open	A		0.01	0.00	
			Open	B	0.02	0.10	0.04	
			Open	C		0.93	0.20	
			Open	C/D		0.09	0.03	
OF-274	35.80	0.96	Ag	C		2.66	1.20	9.90
			Ag	C/D		0.13	0.06	
			Ag	D		2.50	1.13	
			Forest	A		0.42	0.05	
			Forest	B		0.11	0.01	
			Forest	C		1.13	0.15	
			Forest	C/D		2.97	0.39	
			Forest	D		1.22	0.16	
			Highway	A	0.24		0.32	
			Highway	C	0.02		0.03	
			LDR	A	0.16	1.40	0.29	
			LDR	B	0.03	1.67	0.24	
			LDR	C	0.50	13.10	3.50	
			LDR	C/D	0.02	5.02	1.48	
			LDR	D		2.32	0.86	
			Open	A		0.03	0.00	

Outfall ID	Catchment Area (acres)	Total Impervious Area (acres)	Land Use	Hydric Soil Group	Impervious Area (acres)	Pervious Area (acres)	BMP Load (lbs P/year)	Total Outfall BMP Load (lbs P/year)
			Open	B		0.00	0.00	
			Open	C		0.09	0.02	
			Open	C/D		0.08	0.02	
OF-275	30.99	1.26	Forest	A		0.28	0.04	8.64
			Forest	C		0.48	0.06	
			Forest	D		0.01	0.00	
			Highway	A	0.26		0.35	
			LDR	A	0.11	0.90	0.20	
			LDR	B	0.28	1.81	0.65	
			LDR	C	0.61	19.77	5.08	
			LDR	C/D		1.16	0.34	
			LDR	D		5.21	1.93	
			Open	A		0.09	0.00	
			Water	C		0.02	0.00	
OF-276	15.54	2.12	Forest	A		0.26	0.03	5.46
			Forest	C		0.78	0.10	
			HDR	B	0.01	0.08	0.02	
			Highway	A	0.19		0.26	
			Highway	C	0.64		0.86	
			Highway	D	0.00		0.00	
			LDR	A	0.02	0.89	0.05	
			LDR	B	0.19	2.99	0.65	
			LDR	C	0.92	7.50	2.97	
			LDR	D	0.15	0.61	0.45	
			Open	A		0.05	0.00	
			Open	C		0.25	0.05	
			Open	D		0.00	0.00	
OF-277	9.21	0.87	Forest	A		0.18	0.02	2.47

Outfall ID	Catchment Area (acres)	Total Impervious Area (acres)	Land Use	Hydric Soil Group	Impervious Area (acres)	Pervious Area (acres)	BMP Load (lbs P/year)	Total Outfall BMP Load (lbs P/year)
			Forest	B		0.04	0.00	
			Forest	C		1.48	0.19	
			Forest	D		0.02	0.00	
			HDR	B		0.07	0.01	
			Highway	A	0.18		0.24	
			Highway	B	0.03		0.05	
			Highway	C	0.15		0.20	
			Highway	D	0.03		0.05	
			LDR	A	0.13	1.32	0.24	
			LDR	B	0.05	1.66	0.27	
			LDR	C	0.29	3.24	1.12	
			LDR	D	0.00	0.01	0.01	
			Open	A		0.06	0.00	
			Open	B		0.00	0.00	
			Open	C	0.00	0.25	0.06	
			Open	D		0.01	0.00	
OF-278	32.32	1.02	Ag	C		1.30	0.58	6.77
			Forest	A		0.41	0.05	
			Forest	B		2.35	0.31	
			Forest	C		8.36	1.09	
			Forest	D		0.44	0.06	
			HDR	B	0.00	0.01	0.01	
			Highway	A	0.28		0.37	
			Highway	B	0.12		0.16	
			Highway	C	0.16		0.22	
			LDR	A	0.09	0.79	0.16	
			LDR	B	0.21	5.51	0.98	
			LDR	C	0.11	10.71	2.42	

Outfall ID	Catchment Area (acres)	Total Impervious Area (acres)	Land Use	Hydric Soil Group	Impervious Area (acres)	Pervious Area (acres)	BMP Load (lbs P/year)	Total Outfall BMP Load (lbs P/year)
			LDR	D		0.04	0.02	
			Open	A		0.06	0.00	
			Open	B		0.03	0.00	
			Open	C	0.04	1.29	0.34	
OF-295	46.29	1.43	Ag	C		1.87	0.84	9.76
			Forest	B		6.81	0.89	
			Forest	C		15.65	2.03	
			Forest	D		1.74	0.23	
			Highway	B	0.39		0.52	
			Highway	D	0.25		0.33	
			LDR	A		0.00	0.00	
			LDR	B	0.18	7.58	1.18	
			LDR	C	0.38	7.80	2.22	
			LDR	D	0.24	2.91	1.44	
			Open	B		0.08	0.01	
			Open	C		0.32	0.07	
			Open	D		0.02	0.01	
			Water	C		0.07	0.00	
OF-297	18.00	0.18	Forest	B		2.11	0.27	3.11
			Forest	C		10.34	1.34	
			Forest	D		0.18	0.02	
			Highway	D	0.18		0.24	
			LDR	B		0.81	0.10	
			LDR	C		3.10	0.65	
			LDR	D	0.00	1.27	0.48	
			Open	D		0.01	0.01	
OF-298	72.22	0.85	Forest	B		2.53	0.33	11.36
			Forest	C		37.19	4.83	

Outfall ID	Catchment Area (acres)	Total Impervious Area (acres)	Land Use	Hydric Soil Group	Impervious Area (acres)	Pervious Area (acres)	BMP Load (lbs P/year)	Total Outfall BMP Load (lbs P/year)
			Forest	C/D		2.45	0.32	
			Forest	D		19.53	2.54	
			Highway	B	0.11		0.15	
			Highway	C	0.11		0.14	
			Highway	D	0.28		0.38	
			LDR	B	0.00	0.70	0.09	
			LDR	C	0.32	7.36	2.04	
			LDR	D	0.02	1.01	0.41	
			Open	B		0.02	0.00	
			Open	C		0.53	0.11	
			Open	D	0.00	0.05	0.02	
OF-35	5.49	0.58	Forest	A		0.18	0.02	1.41
			Forest	C		4.65	0.60	
			HDR	A	0.01	0.03	0.01	
			Highway	A	0.50		0.67	
			Highway	C	0.05		0.07	
			LDR	A	0.02	0.05	0.03	
			Open	A	0.00	0.00	0.01	
OF-36	3.46	0.88	Forest	A		0.29	0.04	1.53
			Forest	C		1.84	0.24	
			HDR	A	0.02	0.03	0.04	
			Highway	A	0.54		0.73	
			Highway	C	0.04		0.06	
			LDR	A	0.23	0.36	0.36	
			Open	A	0.04	0.06	0.07	
OF-37	21.42	1.17	Forest	A		6.36	0.83	4.17
			Forest	C		12.32	1.60	
			Highway	A	0.31		0.41	

Outfall ID	Catchment Area (acres)	Total Impervious Area (acres)	Land Use	Hydric Soil Group	Impervious Area (acres)	Pervious Area (acres)	BMP Load (lbs P/year)	Total Outfall BMP Load (lbs P/year)
			Highway	C	0.19		0.26	
			LDR	A	0.35	1.40	0.58	
			Open	A	0.32	0.17	0.50	
			Open	C		0.01	0.00	
OF-372	26.41	2.45	Commercial	B	0.71	0.91	1.37	8.13
			Commercial		0.20	0.10	0.37	
			Commercial	D	0.06	0.04	0.11	
			Forest	B		4.81	0.63	
			Forest			0.02	0.00	
			Forest	D		4.49	0.58	
			HDR	B	0.06	0.29	0.17	
			HDR	D		0.00	0.00	
			Highway	B	0.08		0.10	
			Highway		0.10		0.13	
			Highway	D	0.14		0.19	
			LDR	B	0.95	8.42	2.45	
			LDR		0.04	0.11	0.08	
			LDR	D	0.13	4.60	1.89	
			Open	B		0.09	0.01	
			Open			0.01	0.00	
			Open	D		0.07	0.02	
OF-38	0.25	0.11	LDR	A	0.10	0.13	0.15	0.17
			Open	A	0.01	0.01	0.02	
OF-384	3.90	0.52	Commercial	C	0.11	1.74	0.57	1.51
			Forest	C		0.23	0.03	
			HDR	C	0.06	0.77	0.30	
			Highway	C	0.30		0.41	
			LDR	C	0.04	0.51	0.18	

Outfall ID	Catchment Area (acres)	Total Impervious Area (acres)	Land Use	Hydric Soil Group	Impervious Area (acres)	Pervious Area (acres)	BMP Load (lbs P/year)	Total Outfall BMP Load (lbs P/year)
			LDR	C/D		0.08	0.02	
			Open	C		0.05	0.01	
OF-387	4.00	1.12	Commercial		0.39	0.57	0.81	2.16
			Commercial	D		0.00	0.00	
			Forest	B		0.02	0.00	
			Forest			0.18	0.02	
			Highway	B	0.01		0.01	
			Highway		0.56		0.75	
			Highway	C/D	0.05		0.06	
			LDR	B	0.12	1.42	0.35	
			LDR			0.32	0.07	
			Open	B		0.00	0.00	
			Open			0.37	0.08	
			Open	C/D		0.00	0.00	
			Open	D		0.00	0.00	
OF-399	7.80	2.24	Forest	B		0.34	0.04	4.07
			Forest			0.00	0.00	
			Forest	A/D		0.05	0.01	
			Forest	C/D		0.06	0.01	
			HDR	C/D	0.07	0.18	0.23	
			Highway	B	0.89		1.19	
			Highway	A/D	0.18		0.25	
			Highway	C/D	0.20		0.27	
			LDR	B	0.75	3.82	1.60	
			LDR	A/D	0.01	0.04	0.02	
			LDR	C/D	0.14	0.63	0.39	
			Open	B		0.34	0.04	
			Open	A/D		0.02	0.01	

Outfall ID	Catchment Area (acres)	Total Impervious Area (acres)	Land Use	Hydric Soil Group	Impervious Area (acres)	Pervious Area (acres)	BMP Load (lbs P/year)	Total Outfall BMP Load (lbs P/year)
			Open	C/D		0.06	0.02	
OF-405	7.12	0.87	Forest	B		0.97	0.13	2.00
			Highway	B	0.46		0.61	
			LDR	B	0.41	4.97	1.22	
			Open	B	0.00	0.31	0.04	
OF-406	3.67	0.30	Forest	B		0.02	0.00	0.82
			Highway	A	0.05		0.06	
			Highway	B	0.14		0.19	
			LDR	A	0.05	0.06	0.08	
			LDR	B	0.06	3.21	0.47	
			Open	A		0.02	0.00	
			Open	B		0.07	0.01	
OF-407	9.71	1.93	Forest	A		0.18	0.02	3.80
			Forest	B		0.11	0.01	
			HDR	B	0.00	0.20	0.02	
			Highway	A	0.38		0.50	
			Highway	B	0.47		0.63	
			LDR	A	0.32	1.26	0.52	
			LDR	B	0.52	4.83	1.36	
			LDR	D	0.25	0.87	0.69	
			Open	A		0.13	0.00	
			Open	B		0.21	0.03	
OF-408	1.82	0.55	Forest	B		0.15	0.02	0.96
			Forest	D		0.11	0.01	
			Highway	B	0.34		0.45	
			Highway	D	0.07		0.10	
			LDR	B	0.13	0.79	0.29	
			LDR	D	0.01	0.20	0.09	

Outfall ID	Catchment Area (acres)	Total Impervious Area (acres)	Land Use	Hydric Soil Group	Impervious Area (acres)	Pervious Area (acres)	BMP Load (lbs P/year)	Total Outfall BMP Load (lbs P/year)
			Open	B		0.04	0.00	
			Open	D		0.00	0.00	
OF-41	16.23	1.33	Forest	A		0.31	0.04	4.56
			Forest			1.05	0.14	
			Forest	C		0.09	0.01	
			Highway	A	0.10		0.14	
			Highway		1.23		1.65	
			Open	A		1.33	0.04	
			Open			12.12	2.55	
OF-411	4.41	1.56	Forest	A		0.19	0.02	2.39
			Forest			0.04	0.01	
			Highway	A	0.70		0.94	
			Highway		0.28		0.38	
			LDR	A	0.55	2.01	0.89	
			LDR		0.02	0.49	0.14	
			Open	A		0.11	0.00	
			Open			0.01	0.00	
OF-412	8.04	2.33	Forest	A		0.00	0.00	4.03
			Forest			0.08	0.01	
			Highway	A	0.26		0.34	
			Highway		0.88		1.18	
			LDR	A	0.56	2.72	0.94	
			LDR		0.62	2.79	1.53	
			Open	A		0.01	0.00	
			Open			0.10	0.02	
OF-413	6.62	1.60	Forest	A		0.35	0.04	2.82
			Forest			0.06	0.01	
			Forest	C		1.86	0.24	

Outfall ID	Catchment Area (acres)	Total Impervious Area (acres)	Land Use	Hydric Soil Group	Impervious Area (acres)	Pervious Area (acres)	BMP Load (lbs P/year)	Total Outfall BMP Load (lbs P/year)
			HDR	A	0.17	0.35	0.40	
			Highway	A	0.75		1.01	
			Highway		0.06		0.08	
			LDR	A	0.55	2.15	0.91	
			LDR		0.07	0.10	0.13	
			Open	A		0.14	0.00	
			Open			0.01	0.00	
			Water	A		0.00	0.00	
OF-414	2.14	0.76	Forest	A		0.01	0.00	1.20
			Highway	A	0.45		0.60	
			Highway		0.09		0.12	
			LDR	A	0.08	0.75	0.14	
			LDR		0.13	0.58	0.33	
			Open	A		0.04	0.00	
			Open			0.01	0.00	
OF-416	5.75	1.36	Forest	A		0.01	0.00	2.43
			Highway	A	0.64		0.86	
			LDR	A	0.44	2.38	0.74	
			LDR		0.28	1.95	0.83	
			Open	A		0.05	0.00	
OF-417	5.36	1.08	Forest	A		0.86	0.11	1.81
			Highway	A	0.25		0.34	
			LDR	A	0.83	3.39	1.36	
			Open	A		0.03	0.00	
OF-418	2.78	0.57	Forest	A		0.02	0.00	1.19
			Highway	A	0.27		0.36	
			LDR	A	0.03	0.47	0.06	
			LDR		0.27	1.67	0.76	

Outfall ID	Catchment Area (acres)	Total Impervious Area (acres)	Land Use	Hydric Soil Group	Impervious Area (acres)	Pervious Area (acres)	BMP Load (lbs P/year)	Total Outfall BMP Load (lbs P/year)
			Open	A		0.05	0.00	
OF-424	2.16	0.23	Forest	C		0.10	0.01	0.74
			Highway	C	0.08		0.11	
			LDR	C	0.15	1.83	0.61	
OF-425	2.77	0.20	Forest	C		0.16	0.02	0.80
			Highway	C	0.16		0.21	
			LDR	C	0.04	2.39	0.56	
			Open	C		0.02	0.00	
OF-426	20.57	2.84	Forest	C		0.27	0.04	7.99
			Forest	C/D		0.15	0.02	
			Highway	B	0.05		0.07	
			Highway	C	0.70		0.94	
			Highway	C/D	0.56		0.75	
			LDR	B	0.00	0.00	0.00	
			LDR	C	1.26	14.30	4.91	
			LDR	C/D	0.26	2.68	1.18	
			Open	B		0.00	0.00	
			Open	C		0.18	0.04	
			Open	C/D		0.15	0.04	
OF-428	3.64	0.26	Ag	C		0.08	0.04	1.22
			Ag	C/D		0.00	0.00	
			Forest	C		0.09	0.01	
			Forest	C/D		0.08	0.01	
			Highway	C	0.14		0.19	
			Highway	C/D	0.03		0.04	
			LDR	C		1.37	0.29	
			LDR	C/D	0.09	1.68	0.62	
			Open	C		0.06	0.01	

Outfall ID	Catchment Area (acres)	Total Impervious Area (acres)	Land Use	Hydric Soil Group	Impervious Area (acres)	Pervious Area (acres)	BMP Load (lbs P/year)	Total Outfall BMP Load (lbs P/year)
			Open	C/D		0.03	0.01	
OF-429	7.78	0.90	Forest	C/D		0.18	0.02	3.33
			HDR	C/D	0.09	0.73	0.42	
			Highway	C/D	0.40		0.54	
			LDR	C/D	0.40	5.85	2.31	
			Open	C/D		0.13	0.04	
OF-430	4.62	0.21	Forest	C/D		0.08	0.01	1.65
			HDR	C	0.03	0.30	0.13	
			HDR	C/D	0.11	1.06	0.57	
			LDR	C		0.27	0.06	
			LDR	C/D	0.07	2.70	0.89	
			Open	C		0.00	0.00	
			Open	C/D		0.00	0.00	
OF-431	7.21	0.67	Commercial	B	0.01	0.11	0.02	2.14
			Commercial	C/D	0.06	0.97	0.38	
			Forest	B		1.22	0.16	
			Forest	C/D		0.24	0.03	
			Highway	B	0.24		0.32	
			Highway	C/D	0.24		0.32	
			LDR	B	0.09	2.69	0.47	
			LDR	C/D	0.01	1.28	0.39	
			Open	B	0.02	0.02	0.04	
			Open	C/D		0.01	0.00	
OF-432	3.87	0.81	Forest	C/D		0.09	0.01	2.08
			HDR	C/D	0.08	0.63	0.37	
			Highway	C/D	0.44		0.60	
			LDR	C/D	0.28	2.10	1.04	
			Open	C/D		0.24	0.07	

Outfall ID	Catchment Area (acres)	Total Impervious Area (acres)	Land Use	Hydric Soil Group	Impervious Area (acres)	Pervious Area (acres)	BMP Load (lbs P/year)	Total Outfall BMP Load (lbs P/year)
OF-433	3.97	1.15	Forest	B		0.07	0.01	2.30
			Forest	C/D		0.14	0.02	
			HDR	C/D	0.06	0.23	0.21	
			Highway	B	0.12		0.16	
			Highway	C/D	0.52		0.70	
			LDR	B	0.07	0.90	0.22	
			LDR	C/D	0.38	1.21	0.92	
			Open	B		0.10	0.01	
			Open	C/D		0.17	0.05	
OF-435	12.33	2.37	Forest	A		0.10	0.01	4.99
			Forest	C		4.80	0.62	
			Highway	A	0.09		0.12	
			Highway	C	1.55		2.08	
			Highway	C/D	0.00		0.00	
			LDR	A	0.00	0.12	0.00	
			LDR	C	0.73	4.24	2.00	
			LDR	C/D	0.00	0.09	0.03	
			Open	A		0.01	0.00	
			Open	C	0.00	0.59	0.13	
			Open	C/D		0.00	0.00	
OF-436	0.31	0.11	Forest	A		0.00	0.00	0.16
			Highway	A	0.08		0.11	
			LDR	A	0.03	0.17	0.05	
			LDR	C		0.01	0.00	
			Open	A		0.01	0.00	
OF-437	3.86	1.02	Forest	A		0.04	0.00	2.04
			Forest	C		0.00	0.00	
			Forest	C/D		0.01	0.00	

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			HDR	C/D	0.00	0.02	0.02	
			Highway	A	0.21		0.28	
			Highway	C	0.01		0.01	
			Highway	C/D	0.19		0.25	
			LDR	A	0.12	0.55	0.19	
			LDR	C	0.20	1.23	0.56	
			LDR	C/D	0.30	0.82	0.69	
			Open	A		0.09	0.00	
			Open	C		0.01	0.00	
			Open	C/D		0.08	0.02	
OF-438	2.73	0.45	Forest	B		0.39	0.05	0.91
			Highway	B	0.25		0.34	
			LDR	B	0.19	1.69	0.50	
			Open	B		0.20	0.02	
OF-439	6.69	0.96	Forest	C/D		0.52	0.07	2.95
			HDR	C/D	0.00	0.07	0.02	
			Highway	C/D	0.55		0.74	
			LDR	C/D	0.41	4.79	2.01	
			LDR	D		0.15	0.05	
			Open	C/D		0.20	0.06	
OF-440	17.01	8.23	Commercial	B	5.48	2.20	10.02	16.17
			Commercial	C	0.65	5.81	2.39	
			Commercial	C/D		0.43	0.13	
			Commercial	D	1.72	0.04	3.08	
			Forest	B		0.02	0.00	
			Forest	C		0.01	0.00	
			Forest	C/D		0.12	0.02	
			Highway	C	0.01		0.01	

Outfall ID	Catchment Area (acres)	Total Impervious Area (acres)	Land Use	Hydric Soil Group	Impervious Area (acres)	Pervious Area (acres)	BMP Load (lbs P/year)	Total Outfall BMP Load (lbs P/year)
			Highway	C/D	0.36		0.48	
			LDR	C/D	0.00	0.02	0.01	
			Open	B		0.02	0.00	
			Open	C/D		0.12	0.03	
OF-441	13.04	6.18	Commercial	B	6.02	4.91	11.30	11.95
			Commercial	C	0.01	1.70	0.37	
			Commercial	D		0.17	0.06	
			Forest	B		0.01	0.00	
			Forest	C		0.01	0.00	
			Highway	C	0.13		0.17	
			Highway	C/D	0.01		0.01	
			LDR	C	0.01	0.00	0.01	
			LDR	C/D	0.00	0.01	0.00	
			Open	B		0.02	0.00	
			Open	C		0.02	0.00	
			Open	C/D		0.01	0.00	
OF-443	8.46	3.14	Forest	C/D		0.67	0.09	5.92
			Forest	D		0.11	0.01	
			HDR	C/D	0.16	0.63	0.55	
			Highway	C/D	2.23		2.98	
			Highway	D	0.24		0.33	
			LDR	C/D	0.41	2.03	1.22	
			LDR	D	0.10	0.35	0.28	
			Open	C/D		1.38	0.40	
			Open	D		0.16	0.06	
OF-444	12.52	2.60	Ag	C/D		0.53	0.24	6.21
			Forest			0.82	0.11	
			Forest	C		0.15	0.02	

Outfall ID	Catchment Area (acres)	Total Impervious Area (acres)	Land Use	Hydric Soil Group	Impervious Area (acres)	Pervious Area (acres)	BMP Load (lbs P/year)	Total Outfall BMP Load (lbs P/year)
			Forest	C/D		0.45	0.06	
			Forest	D		0.12	0.02	
			Highway		0.93		1.25	
			Highway	C	0.29		0.39	
			Highway	C/D	0.34		0.46	
			Highway	D	0.12		0.16	
			LDR			0.22	0.05	
			LDR	C	0.26	1.47	0.70	
			LDR	C/D	0.60	4.86	2.32	
			LDR	D	0.06	0.42	0.24	
			Open		0.01	0.63	0.14	
			Open	C	0.00	0.12	0.03	
			Open	C/D		0.12	0.03	
			Open	D		0.02	0.01	
OF-445	3.13	0.74	Forest	C/D		0.17	0.02	1.71
			Highway	C/D	0.40		0.53	
			LDR	C	0.04	0.08	0.07	
			LDR	C/D	0.30	2.00	1.04	
			Open	C/D		0.15	0.04	
OF-446	7.89	1.83	Commercial		0.15	0.79	0.43	4.34
			Commercial	C	0.00	0.13	0.03	
			Commercial	D		0.50	0.18	
			Forest			0.03	0.00	
			Forest	C		0.06	0.01	
			Forest	C/D		0.16	0.02	
			Forest	D		0.11	0.01	
			HDR	C/D	0.18	0.84	0.66	
			Highway		0.34		0.46	

Outfall ID	Catchment Area (acres)	Total Impervious Area (acres)	Land Use	Hydric Soil Group	Impervious Area (acres)	Pervious Area (acres)	BMP Load (lbs P/year)	Total Outfall BMP Load (lbs P/year)
			Highway	C	0.26		0.34	
			Highway	C/D	0.43		0.58	
			Highway	D	0.02		0.02	
			LDR		0.01	0.06	0.02	
			LDR	C	0.36	1.54	0.86	
			LDR	C/D	0.09	1.11	0.46	
			LDR	D		0.39	0.14	
			Open			0.06	0.01	
			Open	C		0.12	0.03	
			Open	C/D		0.06	0.02	
			Open	D		0.10	0.04	
OF-449	3.18	0.13	Forest	C/D		0.17	0.02	0.92
			Forest	D		0.88	0.11	
			Highway	C/D	0.09		0.12	
			LDR	C/D	0.04	1.56	0.52	
			LDR	D		0.10	0.04	
			Open	C/D		0.20	0.06	
			Open	D		0.14	0.05	
OF-450	1.59	0.14	LDR	C	0.14	1.46	0.51	0.51
OF-451	0.92	0.10	Forest	C/D		0.01	0.00	0.39
			Forest	D		0.11	0.01	
			Highway	C/D	0.02		0.02	
			Highway	D	0.05		0.07	
			LDR	C/D	0.03	0.33	0.15	
			LDR	D	0.00	0.22	0.08	
			Open	C/D		0.07	0.02	
			Open	D		0.07	0.03	
OF-452	12.61	0.42	Forest	A/D		0.01	0.00	3.72

Outfall ID	Catchment Area (acres)	Total Impervious Area (acres)	Land Use	Hydric Soil Group	Impervious Area (acres)	Pervious Area (acres)	BMP Load (lbs P/year)	Total Outfall BMP Load (lbs P/year)
			Forest	C/D		0.29	0.04	
			Forest	D		0.66	0.09	
			Highway	A/D	0.02		0.03	
			Highway	C/D	0.16		0.21	
			LDR	C	0.13	4.86	1.23	
			LDR	C/D	0.11	4.78	1.55	
			LDR	D		1.31	0.49	
			Open	A/D	0.00	0.02	0.01	
			Open	C/D		0.08	0.02	
			Open	D		0.19	0.07	
OF-453	2.36	0.23	Forest	A/D		0.02	0.00	0.90
			Forest	C/D		0.02	0.00	
			Forest	D		0.15	0.02	
			Highway	A/D	0.06		0.08	
			Highway	C/D	0.06		0.09	
			LDR	A/D	0.00	0.08	0.02	
			LDR	C	0.00	0.87	0.18	
			LDR	C/D	0.01	0.10	0.04	
			LDR	D	0.09	0.85	0.46	
			Open	A/D		0.02	0.01	
			Open	C/D		0.02	0.01	
OF-454	26.22	2.88	Forest	C		1.45	0.19	9.17
			Forest	C/D		0.11	0.01	
			HDR	C		0.02	0.00	
			HDR	C/D	0.11	0.27	0.34	
			Highway	C	1.03		1.38	
			Highway	C/D	0.31		0.41	
			LDR	C	1.20	19.14	5.84	

Outfall ID	Catchment Area (acres)	Total Impervious Area (acres)	Land Use	Hydric Soil Group	Impervious Area (acres)	Pervious Area (acres)	BMP Load (lbs P/year)	Total Outfall BMP Load (lbs P/year)
			LDR	C/D	0.14	1.65	0.70	
			Open	C	0.09	0.48	0.24	
			Open	C/D		0.22	0.06	
OF-455	3.52	0.10	LDR	C	0.10	3.42	0.87	0.87
OF-456	2.13	0.05	Forest	C		0.23	0.03	0.50
			LDR	C	0.05	1.72	0.44	
			Open	C		0.13	0.03	
OF-457	6.50	0.45	Forest	C		0.24	0.03	2.07
			Forest	C/D		0.11	0.01	
			HDR	C		0.06	0.01	
			HDR	C/D	0.01	0.15	0.07	
			LDR	C	0.40	3.46	1.34	
			LDR	C/D	0.04	1.26	0.42	
			Open	C		0.50	0.10	
			Open	C/D		0.28	0.08	
OF-458	3.94	0.65	Forest	C		0.04	0.01	1.61
			Highway	C	0.38		0.51	
			LDR	C	0.27	3.06	1.05	
			Open	C		0.18	0.04	
OF-459	7.95	1.02	Ag	C/D		0.58	0.26	3.12
			Forest	B		0.10	0.01	
			Forest	C		0.11	0.01	
			Forest	C/D		0.24	0.03	
			Highway	B	0.16		0.22	
			Highway	C	0.25		0.33	
			Highway	C/D	0.35		0.46	
			LDR	B	0.01	0.52	0.08	
			LDR	C	0.24	2.74	0.94	

Outfall ID	Catchment Area (acres)	Total Impervious Area (acres)	Land Use	Hydric Soil Group	Impervious Area (acres)	Pervious Area (acres)	BMP Load (lbs P/year)	Total Outfall BMP Load (lbs P/year)
			LDR	C/D	0.01	2.50	0.74	
			Open	B		0.06	0.01	
			Open	C		0.08	0.02	
			Open	C/D	0.00	0.01	0.00	
OF-460	3.42	1.37	Forest	C		0.10	0.01	2.41
			Highway	C	0.50		0.67	
			LDR	C	0.87	1.89	1.72	
			Open	C	0.00	0.06	0.01	
OF-461	1.50	0.59	Highway	C	0.20		0.27	1.05
			LDR	C	0.34	0.83	0.70	
			Open	C	0.04	0.09	0.08	
OF-462	0.10	0.02	Forest	C		0.01	0.00	0.04
			Highway	C	0.02		0.03	
			LDR	C		0.04	0.01	
			Open	C	0.00	0.02	0.01	
			Water	C		0.00	0.00	
OF-463	7.10	2.19	Forest	C		0.24	0.03	4.35
			Forest	C/D		0.13	0.02	
			Highway	C	0.46		0.61	
			Highway	C/D	0.57		0.77	
			LDR	C	0.49	1.81	1.12	
			LDR	C/D	0.67	2.32	1.69	
			Open	C		0.15	0.03	
			Open	C/D		0.26	0.08	
OF-464	1.24	0.51	Forest	C/D		0.05	0.01	0.94
			Highway	C/D	0.21		0.28	
			LDR	C/D	0.31	0.63	0.65	
			Open	C/D		0.05	0.01	

Outfall ID	Catchment Area (acres)	Total Impervious Area (acres)	Land Use	Hydric Soil Group	Impervious Area (acres)	Pervious Area (acres)	BMP Load (lbs P/year)	Total Outfall BMP Load (lbs P/year)
OF-465	5.66	1.64	Ag	C/D		0.00	0.00	3.83
			Forest	C/D		0.02	0.00	
			Forest	D		0.02	0.00	
			HDR	C/D	0.31	1.55	1.16	
			HDR	D	0.01	0.09	0.05	
			Highway	C/D	0.33		0.44	
			Highway	D	0.15		0.20	
			LDR	C/D	0.79	2.08	1.80	
			LDR	D	0.06	0.13	0.14	
			Open	C/D		0.08	0.02	
			Open	D		0.02	0.01	
OF-466	6.92	2.12	Forest	C		0.52	0.07	4.13
			HDR	C	0.13	1.48	0.61	
			Highway	C	0.86		1.16	
			LDR	C	1.11	2.56	2.22	
			Open	C	0.01	0.24	0.07	
OF-467	0.85	0.23	Commercial	C	0.01	0.01	0.02	0.47
			Forest	C		0.06	0.01	
			Highway	C	0.00		0.00	
			LDR	C	0.11	0.49	0.27	
			Open	C	0.11	0.06	0.18	
OF-468	3.45	2.11	Commercial	C	0.16	0.05	0.30	3.45
			Forest	C		0.01	0.00	
			Highway	C	0.48		0.64	
			LDR	C	1.28	1.21	2.21	
			Open	C	0.19	0.07	0.30	
			Water	C		0.00	0.00	
OF-469	2.70	1.10	Highway	C	0.33		0.44	1.95

Outfall ID	Catchment Area (acres)	Total Impervious Area (acres)	Land Use	Hydric Soil Group	Impervious Area (acres)	Pervious Area (acres)	BMP Load (lbs P/year)	Total Outfall BMP Load (lbs P/year)
			LDR	C	0.65	1.46	1.29	
			Open	C	0.12	0.14	0.22	
OF-47	17.47	6.14	Commercial	A	1.10	0.14	1.95	10.78
			Commercial	D	0.31	0.20	0.63	
			Forest	A		2.14	0.28	
			Forest	A/D		0.30	0.04	
			Forest	C		0.26	0.03	
			Forest	D		0.51	0.07	
			Highway	A	3.03		4.06	
			Highway	A/D	0.11		0.14	
			Highway	D	0.39		0.53	
			Industrial	A	0.16	1.90	0.34	
			Industrial	C		2.24	0.47	
			LDR	A	0.20		0.30	
			Open	A	0.84	0.68	1.30	
			Open	A/D		0.05	0.01	
			Open	C		2.85	0.60	
			Open	D		0.05	0.02	
			Water	A		0.00	0.00	
OF-476	1.27	0.48	Forest	A		0.07	0.01	0.83
			Forest	B		0.03	0.00	
			Highway	A	0.05		0.07	
			Highway	B	0.12		0.16	
			LDR	A	0.04	0.11	0.06	
			LDR	B	0.11	0.13	0.19	
			LDR	C	0.16	0.43	0.33	
			Open	B		0.01	0.00	
OF-482	5.88	0.91	Forest			0.08	0.01	2.35

Outfall ID	Catchment Area (acres)	Total Impervious Area (acres)	Land Use	Hydric Soil Group	Impervious Area (acres)	Pervious Area (acres)	BMP Load (lbs P/year)	Total Outfall BMP Load (lbs P/year)
			Forest	B/D		0.14	0.02	
			Forest	C		0.07	0.01	
			Highway		0.27		0.36	
			LDR		0.09	0.71	0.28	
			LDR	B/D		0.09	0.02	
			LDR	C	0.55	3.78	1.63	
			Open			0.10	0.02	
OF-490	2.53	0.80	Forest	A		0.02	0.00	1.18
			Highway	A	0.51		0.69	
			LDR	A	0.29	1.50	0.49	
			Open	A		0.21	0.01	
OF-491	3.34	0.43	Forest	C		0.06	0.01	1.21
			Forest	C/D		0.04	0.01	
			Highway	C	0.22		0.30	
			Highway	C/D	0.05		0.06	
			LDR	C	0.14	2.72	0.78	
			LDR	C/D	0.02	0.08	0.05	
			Open	C		0.00	0.00	
			Open	C/D		0.02	0.00	
OF-492	8.30	0.94	Forest	C		0.15	0.02	2.91
			Highway	C	0.29		0.39	
			LDR	C	0.65	7.20	2.50	
			Open	C		0.01	0.00	
OF-497	5.79	0.31	Forest	A		3.94	0.51	1.22
			Forest	C		0.26	0.03	
			Highway	A	0.29		0.39	
			LDR	A		0.06	0.00	
			LDR	C	0.02	1.21	0.28	

Outfall ID	Catchment Area (acres)	Total Impervious Area (acres)	Land Use	Hydric Soil Group	Impervious Area (acres)	Pervious Area (acres)	BMP Load (lbs P/year)	Total Outfall BMP Load (lbs P/year)
			Open	A		0.00	0.00	
OF-502	12.36	2.21	Forest	A		1.03	0.13	3.94
			Forest	B/D		0.00	0.00	
			Highway	A	1.35		1.81	
			Highway	B/D	0.02		0.03	
			LDR	A	0.49	6.39	0.93	
			LDR	B/D	0.36	2.32	1.03	
			Open	A	0.00	0.41	0.01	
			Open	B/D		0.00	0.00	
OF-504	1.73	0.34	Forest	A		0.03	0.00	0.53
			Highway	A	0.22		0.30	
			LDR	A	0.12	1.27	0.22	
			Open	A		0.09	0.00	
OF-505	23.04	2.21	Forest	A		0.43	0.06	8.34
			Forest	B		0.15	0.02	
			Forest	B/D		0.15	0.02	
			Forest	C/D		0.59	0.08	
			Highway	A	0.30		0.41	
			Highway	B	0.16		0.21	
			Highway	B/D	0.24		0.32	
			Highway	C/D	0.47		0.64	
			LDR	A	0.00	1.20	0.04	
			LDR	B	0.16	1.03	0.37	
			LDR	B/D		0.03	0.01	
			LDR	C	0.10	1.78	0.52	
			LDR	C/D	0.77	15.42	5.65	
			Open	B		0.05	0.01	
			Open	C/D		0.00	0.00	

Outfall ID	Catchment Area (acres)	Total Impervious Area (acres)	Land Use	Hydric Soil Group	Impervious Area (acres)	Pervious Area (acres)	BMP Load (lbs P/year)	Total Outfall BMP Load (lbs P/year)
OF-506	18.54	0.90	Forest	C		1.56	0.20	4.99
			Forest	C/D		0.14	0.02	
			Highway	C	0.18		0.24	
			Highway	C/D	0.10		0.14	
			LDR	C	0.60	14.52	3.96	
			LDR	C/D	0.01	1.29	0.40	
			Open	C		0.11	0.02	
			Open	C/D		0.02	0.01	
OF-507	1.46	0.26	Forest	C		0.11	0.01	0.61
			Highway	C	0.19		0.26	
			LDR	C	0.07	0.98	0.31	
			Open	C		0.11	0.02	
OF-508	0.54	0.09	Forest	C		0.03	0.00	0.23
			Highway	C	0.03		0.04	
			LDR	C	0.06	0.39	0.17	
			Open	C		0.04	0.01	
OF-509	14.46	2.14	Ag	B		0.07	0.03	6.06
			Ag	C/D		0.03	0.02	
			Forest	B		0.19	0.02	
			Forest	C		0.05	0.01	
			Forest	C/D		0.28	0.04	
			Forest	D		0.38	0.05	
			Highway	B	0.57		0.77	
			Highway	C	0.17		0.23	
			Highway	C/D	0.54		0.72	
			Highway	D	0.03		0.04	
			LDR	B	0.19	2.60	0.60	
			LDR	C	0.07	0.74	0.26	

Outfall ID	Catchment Area (acres)	Total Impervious Area (acres)	Land Use	Hydric Soil Group	Impervious Area (acres)	Pervious Area (acres)	BMP Load (lbs P/year)	Total Outfall BMP Load (lbs P/year)
			LDR	C/D	0.57	6.46	2.74	
			LDR	D		1.35	0.50	
			Open	B		0.07	0.01	
			Open	C		0.00	0.00	
			Open	C/D		0.10	0.03	
			Open	D		0.00	0.00	
OF-510	1.07	0.24	Forest	C/D		0.50	0.06	0.43
			Forest	D		0.32	0.04	
			Highway	C/D	0.12		0.16	
			Highway	D	0.12		0.16	
			Open	C/D		0.01	0.00	
OF-511	5.98	0.17	Forest	C		0.03	0.00	1.29
			Forest	C/D		4.18	0.54	
			HDR	C	0.01	0.20	0.07	
			HDR	C/D	0.06	0.80	0.37	
			Highway	C	0.00		0.01	
			Highway	C/D	0.09		0.12	
			LDR	C/D		0.10	0.03	
			Open	C		0.00	0.00	
			Open	C/D		0.51	0.15	
OF-515	7.08	0.28	Ag	C		0.64	0.29	3.00
			Ag	C/D		3.85	1.73	
			Forest	C		0.14	0.02	
			Forest	C/D		0.02	0.00	
			HDR	C	0.06	0.09	0.16	
			Highway	C/D	0.14		0.19	
			LDR	C		1.35	0.28	
			LDR	C/D	0.08	0.69	0.32	

Outfall ID	Catchment Area (acres)	Total Impervious Area (acres)	Land Use	Hydric Soil Group	Impervious Area (acres)	Pervious Area (acres)	BMP Load (lbs P/year)	Total Outfall BMP Load (lbs P/year)
			Open	C/D		0.02	0.01	
OF-516	4.76	0.09	Ag	C		1.67	0.75	1.97
			Ag	C/D		1.81	0.81	
			Forest	C		0.00	0.00	
			Forest	C/D		0.02	0.00	
			HDR	C	0.01	0.11	0.05	
			Highway	C/D	0.06		0.08	
			LDR	C		0.81	0.17	
			LDR	C/D	0.02	0.25	0.10	
			Open	C/D		0.01	0.00	
OF-519	0.94	0.19	LDR	A	0.19	0.76	0.31	0.31
OF-520	8.65	1.58	Forest	A		0.04	0.01	2.45
			Highway	A	0.90		1.20	
			LDR	A	0.68	6.75	1.23	
			Open	A		0.28	0.01	
OF-521	7.38	1.44	Forest	A		0.20	0.03	2.25
			Highway	A	0.74		0.99	
			LDR	A	0.70	5.71	1.24	
			Open	A		0.03	0.00	
OF-522	9.42	1.52	Forest	B		0.34	0.04	3.44
			Forest	C/D		0.04	0.01	
			Highway	B	0.90		1.21	
			Highway	C/D	0.13		0.17	
			LDR	B	0.40	5.30	1.24	
			LDR	C/D	0.10	2.07	0.76	
			Open	B		0.13	0.02	
			Open	C/D		0.02	0.01	
OF-523	2.35	0.78	Forest	B		0.15	0.02	1.30

Outfall ID	Catchment Area (acres)	Total Impervious Area (acres)	Land Use	Hydric Soil Group	Impervious Area (acres)	Pervious Area (acres)	BMP Load (lbs P/year)	Total Outfall BMP Load (lbs P/year)
			Forest	C/D		0.00	0.00	
			Highway	B	0.56		0.75	
			Highway	C/D	0.01		0.01	
			LDR	B	0.16	1.23	0.39	
			LDR	C/D	0.05	0.18	0.13	
			Open	B		0.01	0.00	
OF-524	8.62	1.28	Forest	B		2.27	0.30	2.89
			Forest	C/D		0.01	0.00	
			HDR	B	0.15	1.06	0.48	
			Highway	B	0.49		0.65	
			Highway	C/D	0.00		0.00	
			LDR	B	0.57	4.00	1.35	
			Open	B	0.07		0.11	
OF-525	12.04	1.22	Forest	B		0.00	0.00	4.28
			Forest	C		0.47	0.06	
			Forest	C/D		0.27	0.03	
			Highway	B	0.00		0.00	
			Highway	C	0.08		0.11	
			Highway	C/D	0.31		0.41	
			LDR	B		0.04	0.00	
			LDR	C	0.35	6.44	1.88	
			LDR	C/D	0.48	3.55	1.76	
			Open	C	0.00	0.04	0.01	
			Open	C/D	0.00	0.01	0.00	
OF-526	6.00	0.34	Forest	C		0.07	0.01	1.67
			Highway	C	0.15		0.19	
			LDR	C	0.19	5.56	1.46	
			Open	C		0.03	0.01	

Outfall ID	Catchment Area (acres)	Total Impervious Area (acres)	Land Use	Hydric Soil Group	Impervious Area (acres)	Pervious Area (acres)	BMP Load (lbs P/year)	Total Outfall BMP Load (lbs P/year)
OF-545	0.60	0.47	Forest	C		0.01	0.00	0.67
			Highway	C	0.45		0.60	
			Industrial	C	0.02		0.03	
			LDR	C	0.01	0.01	0.01	
			Open	C	0.00	0.11	0.02	
OF-552	0.28	0.09	Forest	A		0.01	0.00	0.13
			Highway	A	0.07		0.09	
			LDR	A	0.03	0.16	0.04	
			Open	A		0.02	0.00	
OF-553	28.59	1.96	Commercial	C/D	0.13	4.96	1.67	8.05
			Forest	A		0.02	0.00	
			Forest	B		1.92	0.25	
			Highway	A	0.05		0.06	
			Highway	B	0.37		0.50	
			LDR	A	0.01	0.34	0.02	
			LDR	B	0.90	12.91	2.92	
			LDR	B/D		0.04	0.01	
			LDR	C		0.01	0.00	
			LDR	C/D	0.50	6.36	2.61	
			Open	A		0.02	0.00	
			Open	B		0.05	0.01	
OF-554	17.72	1.92	Forest	A		2.25	0.29	3.45
			HDR	A	0.00	0.56	0.02	
			Highway	A	0.90		1.21	
			LDR	A	1.01	12.90	1.93	
			Open	A		0.08	0.00	
OF-556	14.48	1.19	Forest	A		2.84	0.37	2.99
			Forest	A/D		0.37	0.05	

Outfall ID	Catchment Area (acres)	Total Impervious Area (acres)	Land Use	Hydric Soil Group	Impervious Area (acres)	Pervious Area (acres)	BMP Load (lbs P/year)	Total Outfall BMP Load (lbs P/year)
			Highway	A	0.35		0.47	
			LDR	A	0.83	7.17	1.48	
			LDR	A/D	0.01	2.90	0.62	
			Open	A	0.00	0.01	0.00	
OF-557	0.90	0.28	Forest	A		0.05	0.01	0.42
			Highway	A	0.17		0.23	
			LDR	A	0.11	0.51	0.18	
			Open	A		0.05	0.00	
OF-558	1.20	0.15	Forest	A		0.51	0.07	0.28
			Highway	A	0.12		0.16	
			LDR	A	0.03	0.51	0.06	
			Open	A		0.03	0.00	
OF-559	0.84	0.18	Forest	A		0.18	0.02	0.29
			Highway	A	0.15		0.21	
			LDR	A	0.03	0.47	0.06	
			Open	A		0.01	0.00	
OF-560	3.63	1.02	Forest	A		0.36	0.05	1.54
			Highway	A	0.68		0.92	
			LDR	A	0.34	2.23	0.58	
			Open	A		0.02	0.00	
OF-561	1.52	0.13	Forest	A		0.03	0.00	0.23
			Highway	A	0.07		0.10	
			LDR	A	0.05	1.36	0.12	
			Open	A	0.00	0.00	0.00	
OF-562	6.45	0.72	Forest	A		0.06	0.01	2.11
			Forest	C		0.65	0.08	
			Highway	A	0.11		0.14	
			Highway	C	0.23		0.31	

Outfall ID	Catchment Area (acres)	Total Impervious Area (acres)	Land Use	Hydric Soil Group	Impervious Area (acres)	Pervious Area (acres)	BMP Load (lbs P/year)	Total Outfall BMP Load (lbs P/year)
			LDR	A	0.13	0.27	0.20	
			LDR	C	0.25	4.60	1.35	
			Open	A		0.09	0.00	
			Open	C		0.05	0.01	
OF-563	11.18	0.89	Forest	A		0.32	0.04	3.13
			Forest	C		0.15	0.02	
			Highway	A	0.28		0.37	
			Highway	C	0.20		0.27	
			LDR	A	0.00	1.43	0.05	
			LDR	C	0.41	8.37	2.38	
			Open	A		0.00	0.00	
			Open	C		0.01	0.00	
OF-566	1.68	0.37	Forest	C/D		0.03	0.00	0.91
			Forest	D		0.04	0.01	
			Highway	C/D	0.09		0.12	
			Highway	D	0.16		0.21	
			LDR	C/D	0.10	0.88	0.41	
			LDR	D	0.02	0.21	0.11	
			Open	C/D		0.04	0.01	
			Open	D		0.10	0.04	
OF-567	23.68	2.87	Forest	A		0.24	0.03	7.55
			Forest	C		0.02	0.00	
			Forest	C/D		0.69	0.09	
			Forest	D		0.22	0.03	
			Highway	A	0.93		1.24	
			LDR	A	0.87	8.87	1.59	
			LDR	C	0.61	2.37	1.42	
			LDR	C/D	0.47	7.85	2.99	

Outfall ID	Catchment Area (acres)	Total Impervious Area (acres)	Land Use	Hydric Soil Group	Impervious Area (acres)	Pervious Area (acres)	BMP Load (lbs P/year)	Total Outfall BMP Load (lbs P/year)
			LDR	D		0.41	0.15	
			Open	A		0.14	0.00	
			Open	C/D		0.00	0.00	
OF-568	10.90	1.07	Forest	A		1.34	0.17	2.12
			Forest	C		0.01	0.00	
			Forest	C/D		1.11	0.14	
			Highway	A	0.42		0.57	
			LDR	A	0.64	7.26	1.20	
			LDR	C		0.00	0.00	
			LDR	C/D		0.10	0.03	
			Open	A		0.02	0.00	
OF-569	0.20	0.10	Forest	A		0.00	0.00	0.15
			Highway	A	0.04		0.05	
			Highway		0.00		0.00	
			LDR	A	0.06	0.09	0.10	
			Open	A		0.01	0.00	
			Open			0.00	0.00	
			Water	A		0.00	0.00	
			Water			0.00	0.00	
OF-570	2.94	0.73	Forest	A		0.07	0.01	1.14
			HDR	A	0.03	0.14	0.07	
			Highway	A	0.31		0.42	
			LDR	A	0.38	1.93	0.64	
			Open	A		0.08	0.00	
OF-571	5.29	1.42	Forest	A		0.14	0.02	2.73
			Highway	A	0.12		0.16	
			LDR	A	0.88	1.06	1.36	
			LDR	C	0.39	2.62	1.14	

Outfall ID	Catchment Area (acres)	Total Impervious Area (acres)	Land Use	Hydric Soil Group	Impervious Area (acres)	Pervious Area (acres)	BMP Load (lbs P/year)	Total Outfall BMP Load (lbs P/year)
			Open	A	0.03	0.06	0.05	
OF-572	11.21	2.37	Forest	C		1.56	0.20	5.28
			Forest	C/D		1.22	0.16	
			HDR	C	0.04	0.10	0.10	
			HDR	C/D		0.02	0.01	
			Highway	C	0.68		0.91	
			Highway	C/D	1.03		1.38	
			LDR	C	0.42	1.68	1.00	
			LDR	C/D	0.20	1.56	0.76	
			Open	C		0.32	0.07	
			Open	C/D		2.37	0.69	
OF-573	2.01	0.69	Forest	A		0.15	0.02	1.26
			Forest	C		0.10	0.01	
			Highway	A	0.10		0.13	
			Highway	C	0.15		0.20	
			LDR	C	0.44	1.04	0.89	
			Open	A	0.00	0.01	0.00	
			Open	C		0.02	0.00	
OF-574	1.94	0.26	Forest	A		0.60	0.08	0.49
			Highway	A	0.08		0.10	
			LDR	A	0.18	1.06	0.31	
			Open	A		0.03	0.00	
OF-575	1.92	0.70	Forest	A		0.35	0.05	1.05
			HDR	A	0.03	0.11	0.06	
			Highway	A	0.60		0.80	
			LDR	A	0.05	0.70	0.09	
			Open	A	0.03	0.06	0.04	
OF-577	1.48	0.96	Forest	A		0.29	0.04	1.39

Outfall ID	Catchment Area (acres)	Total Impervious Area (acres)	Land Use	Hydric Soil Group	Impervious Area (acres)	Pervious Area (acres)	BMP Load (lbs P/year)	Total Outfall BMP Load (lbs P/year)
			HDR	A	0.03	0.02	0.07	
			Highway	A	0.81		1.09	
			LDR	A	0.12	0.14	0.18	
			Open	A	0.00	0.07	0.01	
			Water	A		0.00	0.00	
OF-578	4.05	0.76	Highway	A	0.00		0.00	1.74
			LDR	A	0.28	0.63	0.44	
			LDR	C	0.48	2.65	1.29	
			Open	A		0.01	0.00	
OF-579	2.10	0.19	Highway	A	0.04		0.06	0.59
			LDR	A	0.08	0.53	0.13	
			LDR	C	0.07	1.36	0.39	
			Open	A		0.01	0.00	
OF-580	7.62	1.40	Forest	A		0.00	0.00	3.04
			Highway	A	0.54		0.73	
			LDR	A	0.28	1.60	0.47	
			LDR	C	0.58	4.55	1.84	
			Open	A		0.06	0.00	
OF-581	0.62	0.33	Forest	A		0.00	0.00	0.51
			Highway	A	0.08		0.11	
			LDR	A	0.05	0.16	0.08	
			LDR	C	0.20	0.12	0.32	
			Open	A		0.01	0.00	
OF-582	0.35	0.22	Forest	A		0.01	0.00	0.34
			Highway	A	0.03		0.04	
			LDR	A	0.03	0.09	0.04	
			LDR	C	0.16	0.03	0.25	
			Open	A		0.00	0.00	

Outfall ID	Catchment Area (acres)	Total Impervious Area (acres)	Land Use	Hydric Soil Group	Impervious Area (acres)	Pervious Area (acres)	BMP Load (lbs P/year)	Total Outfall BMP Load (lbs P/year)
OF-583	0.11	0.07	Forest	A		0.00	0.00	0.09
			Highway	A	0.06		0.09	
			LDR	A	0.00	0.02	0.01	
			Open	A		0.03	0.00	
OF-584	3.72	0.65	Forest	A		0.00	0.00	1.47
			Forest	C		0.00	0.00	
			Highway	A	0.14		0.18	
			Highway	C	0.00		0.00	
			LDR	A	0.10	0.73	0.17	
			LDR	C	0.42	2.31	1.12	
			Open	A		0.02	0.00	
			Open	C		0.00	0.00	
OF-585	0.94	0.27	Forest	A		0.00	0.00	0.48
			Highway	A	0.06		0.08	
			LDR	A	0.21	0.38	0.33	
			LDR	C	0.00	0.28	0.06	
			Open	A		0.00	0.00	
OF-586	1.70	0.22	Highway	A	0.17		0.23	0.45
			LDR	A	0.05	0.92	0.11	
			LDR	C		0.53	0.11	
			Open	A		0.03	0.00	
OF-587	1.41	0.34	Highway	A	0.18		0.24	0.63
			LDR	A	0.10	0.39	0.17	
			LDR	C	0.06	0.63	0.23	
			Open	A		0.05	0.00	
OF-588	0.65	0.17	Forest	A		0.00	0.00	0.28
			Highway	A	0.13		0.17	
			LDR	A	0.04	0.24	0.06	

Outfall ID	Catchment Area (acres)	Total Impervious Area (acres)	Land Use	Hydric Soil Group	Impervious Area (acres)	Pervious Area (acres)	BMP Load (lbs P/year)	Total Outfall BMP Load (lbs P/year)
			LDR	C		0.21	0.05	
			Open	A		0.03	0.00	
OF-590	6.51	0.96	Forest	A		0.01	0.00	2.30
			Highway	A	0.41		0.55	
			LDR	A	0.41	1.33	0.67	
			LDR	C	0.14	4.13	1.08	
			Open	A		0.08	0.00	
OF-592	0.59	0.25	Forest	A		0.12	0.02	0.40
			HDR	A	0.02	0.10	0.06	
			Highway	A	0.13		0.17	
			LDR	A	0.10	0.10	0.15	
			Open	A		0.02	0.00	
OF-593	4.19	0.26	Forest	A		1.85	0.24	0.96
			Forest	C		0.11	0.01	
			Highway	A	0.20		0.26	
			LDR	A	0.02	0.36	0.04	
			LDR	C	0.04	1.58	0.39	
			Open	A	0.01	0.02	0.01	
OF-595	3.53	0.66	Forest	C		0.01	0.00	1.54
			Highway	C	0.37		0.50	
			Highway	D	0.00		0.00	
			LDR	C	0.29	2.76	1.02	
			LDR	D		0.01	0.00	
			Open	C		0.09	0.02	
			Open	D		0.00	0.00	
OF-597	4.50	1.13	Forest	A		0.18	0.02	2.14
			Forest	C		0.01	0.00	
			HDR	A	0.03	0.02	0.07	

Outfall ID	Catchment Area (acres)	Total Impervious Area (acres)	Land Use	Hydric Soil Group	Impervious Area (acres)	Pervious Area (acres)	BMP Load (lbs P/year)	Total Outfall BMP Load (lbs P/year)
			Highway	A	0.59		0.79	
			Highway	C	0.01		0.01	
			LDR	A	0.14	0.98	0.24	
			LDR	C	0.37	2.11	1.00	
			Open	A		0.07	0.00	
			Open	C		0.00	0.00	
OF-600	9.32	0.59	Forest	A		1.73	0.22	1.45
			Forest	B		0.72	0.09	
			Highway	A	0.01		0.02	
			LDR	A	0.58	5.73	1.05	
			LDR	B		0.55	0.07	
			Open	A		0.00	0.00	
OF-602	2.50	0.71	Forest	C/D		0.01	0.00	1.20
			Highway	A	0.10		0.13	
			Highway	C/D	0.04		0.05	
			LDR	A	0.52	1.40	0.83	
			LDR	C/D	0.06	0.27	0.17	
			Open	A		0.03	0.00	
			Open	C/D		0.08	0.02	
OF-603	19.19	1.84	Forest	C/D		0.00	0.00	4.45
			Highway	A	0.36		0.48	
			Highway	C/D	0.25		0.33	
			LDR	A	0.81	13.33	1.62	
			LDR	C/D	0.23	0.56	0.51	
			LDR	D	0.20	2.88	1.37	
			Open	A		0.13	0.00	
			Open	C/D	0.00	0.45	0.13	
OF-604	1.34	1.06	Forest	A		0.07	0.01	1.49

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			HDR	A	0.00	0.00	0.00	
			Highway	A	0.74		0.99	
			LDR	A	0.30	0.16	0.46	
			Open	A	0.02	0.05	0.03	
OF-605	6.06	1.09	Forest	A		1.82	0.24	2.36
			Forest	C		0.05	0.01	
			Highway	A	0.37		0.49	
			LDR	A	0.15	0.66	0.25	
			LDR	C	0.54	2.42	1.33	
			Open	A	0.03	0.02	0.04	
			Water	A		0.00	0.00	
OF-606	1.44	0.08	Forest	C		0.57	0.07	0.35
			Highway	C	0.07		0.09	
			LDR	C	0.01	0.78	0.18	
			Open	C	0.00	0.00	0.00	
OF-607	0.41	0.18	Forest	C		0.08	0.01	0.28
			Highway	C	0.17		0.23	
			LDR	C	0.01	0.11	0.03	
			Open	C		0.03	0.01	
OF-608	6.77	1.09	Forest	C		0.27	0.04	2.74
			Highway	C	0.45		0.61	
			LDR	C	0.63	5.24	2.07	
			Open	C		0.17	0.04	
OF-611	2.44	0.84	Forest	B		0.06	0.01	1.50
			Forest	C		0.08	0.01	
			Forest	C/D		0.11	0.01	
			Highway	B	0.22		0.29	
			Highway	C	0.09		0.12	

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			Highway	C/D	0.30		0.41	
			LDR	B	0.12	0.38	0.23	
			LDR	C	0.07	0.39	0.19	
			LDR	C/D	0.04	0.56	0.23	
			Open	B		0.00	0.00	
			Open	C/D		0.02	0.01	
OF-618	5.75	0.80	Forest	B		0.45	0.06	1.96
			Forest	C		0.07	0.01	
			Forest	C/D		0.07	0.01	
			Highway	B	0.27		0.36	
			Highway	C	0.12		0.16	
			Highway	C/D	0.06		0.08	
			LDR	B	0.17	3.01	0.63	
			LDR	C	0.02	0.64	0.16	
			LDR	C/D	0.15	0.18	0.28	
			LDR	D		0.54	0.20	
			Open	C		0.00	0.00	
OF-619	14.83	0.57	Forest	A		3.33	0.43	2.57
			Forest	B		7.63	0.99	
			Highway	A	0.07		0.09	
			Highway	B	0.40		0.54	
			LDR	A		0.36	0.01	
			LDR	B	0.05	2.81	0.41	
			LDR	D		0.00	0.00	
			Open	B	0.05	0.13	0.09	
OF-620	14.80	1.49	Ag	C/D		0.02	0.01	5.87
			Forest	C		0.11	0.01	
			Forest	C/D		0.24	0.03	

Outfall ID	Catchment Area (acres)	Total Impervious Area (acres)	Land Use	Hydric Soil Group	Impervious Area (acres)	Pervious Area (acres)	BMP Load (lbs P/year)	Total Outfall BMP Load (lbs P/year)
			HDR	C/D	0.18	0.44	0.55	
			Highway	C	0.21		0.28	
			Highway	C/D	0.61		0.82	
			LDR	C	0.04	2.55	0.60	
			LDR	C/D	0.45	9.83	3.53	
			Open	C/D		0.11	0.03	
OF-623	5.41	1.16	Forest	B		0.08	0.01	2.84
			Forest	C/D		0.30	0.04	
			HDR	B	0.26	0.43	0.66	
			HDR	C/D	0.10	0.41	0.36	
			Highway	B	0.07		0.10	
			Highway	C/D	0.60		0.81	
			LDR	B		0.82	0.10	
			LDR	C/D	0.12	1.04	0.48	
			Open	B	0.00	0.31	0.04	
			Open	C/D	0.01	0.86	0.26	
OF-624	2.45	0.16	Forest	C/D		0.81	0.11	0.77
			HDR	C/D	0.00	0.28	0.08	
			Highway	C/D	0.03		0.05	
			LDR	C/D	0.12	1.08	0.50	
			Open	C/D	0.01	0.12	0.04	
OF-625	5.24	0.72	Commercial	A		0.02	0.00	2.23
			Commercial	C/D	0.01	0.24	0.09	
			Forest	A		0.02	0.00	
			Forest	B		0.00	0.00	
			Forest	C/D		0.07	0.01	
			HDR	A		0.00	0.00	
			HDR	D		0.00	0.00	

Outfall ID	Catchment Area (acres)	Total Impervious Area (acres)	Land Use	Hydric Soil Group	Impervious Area (acres)	Pervious Area (acres)	BMP Load (lbs P/year)	Total Outfall BMP Load (lbs P/year)
			Highway	A	0.09		0.12	
			Highway	B	0.01		0.01	
			Highway	C/D	0.23		0.31	
			Highway	D	0.08		0.10	
			LDR	B	0.12	0.45	0.23	
			LDR	C/D	0.18	3.48	1.29	
			LDR	D		0.00	0.00	
			Open	A		0.03	0.00	
			Open	B		0.01	0.00	
			Open	C/D		0.15	0.04	
			Open	D		0.05	0.02	
OF-626	5.53	1.58	Forest	B		0.07	0.01	3.52
			Forest	C/D		0.00	0.00	
			HDR	B		0.00	0.00	
			HDR	C/D	0.64	1.15	1.82	
			Highway	B	0.44		0.60	
			Highway	C/D	0.13		0.18	
			LDR	B	0.35	2.04	0.78	
			LDR	C/D	0.01	0.14	0.05	
			Open	B		0.43	0.05	
			Open	C/D		0.12	0.04	
OF-627	0.57	0.13	Forest	C/D		0.01	0.00	0.34
			HDR	B		0.01	0.00	
			HDR	C/D	0.05	0.36	0.22	
			Highway	C/D	0.08		0.10	
			Open	C/D		0.05	0.02	
OF-628	0.25	0.00	Forest	A		0.00	0.00	0.07
			Forest	D		0.00	0.00	

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			HDR	A	0.00	0.08	0.00	
			HDR	D		0.12	0.05	
			Highway	A	0.00		0.00	
			LDR	D		0.04	0.02	
			Open	A		0.00	0.00	
			Open	D		0.00	0.00	
OF-629	2.86	0.93	Commercial	A	0.29	0.19	0.52	2.07
			Commercial	C/D	0.43	0.64	0.95	
			Forest	A		0.00	0.00	
			Forest	B		0.01	0.00	
			Forest	C/D		0.01	0.00	
			Highway	A	0.08		0.10	
			Highway	B	0.00		0.00	
			LDR	B		0.00	0.00	
			LDR	C/D	0.13	0.99	0.49	
			Open	A		0.09	0.00	
OF-630	4.54	0.89	Forest	B		0.52	0.07	1.75
			Forest	D		0.45	0.06	
			HDR	D	0.02	0.03	0.05	
			Highway	B	0.40		0.53	
			Highway	D	0.06		0.08	
			LDR	B	0.36	2.40	0.83	
			LDR	D		0.01	0.00	
			Open	B	0.01	0.24	0.05	
			Open	D	0.05	0.00	0.08	
OF-631	13.34	2.51	Forest	B		0.43	0.06	5.79
			Forest	D		0.39	0.05	
			Highway	B	1.22		1.64	

Outfall ID	Catchment Area (acres)	Total Impervious Area (acres)	Land Use	Hydric Soil Group	Impervious Area (acres)	Pervious Area (acres)	BMP Load (lbs P/year)	Total Outfall BMP Load (lbs P/year)
			Highway	D	0.42		0.56	
			LDR	B	0.64	5.89	1.68	
			LDR	D	0.22	3.68	1.70	
			Open	B	0.01	0.30	0.05	
			Open	D	0.01	0.14	0.06	
OF-632	1.02	0.25	Forest	B		0.01	0.00	0.44
			Highway	B	0.15		0.20	
			LDR	B	0.10	0.62	0.22	
			Open	B		0.15	0.02	
OF-633	5.21	1.20	Forest	B		0.04	0.01	2.68
			Forest	D		0.15	0.02	
			Highway	B	0.48		0.65	
			Highway	D	0.30		0.40	
			LDR	B	0.24	1.51	0.54	
			LDR	D	0.18	1.94	1.00	
			Open	B		0.27	0.03	
			Open	D		0.09	0.03	
OF-634	3.07	0.31	Forest	B		0.03	0.00	0.80
			Forest	D		0.03	0.00	
			Highway	B	0.09		0.12	
			Highway	D	0.06		0.08	
			LDR	B	0.16	2.60	0.56	
			LDR	D		0.09	0.03	
OF-635	7.81	1.16	Forest	B		0.76	0.10	2.45
			HDR	B		0.01	0.00	
			Highway	B	0.61		0.82	
			LDR	B	0.55	5.81	1.53	
			Open	B	0.00	0.06	0.01	

Outfall ID	Catchment Area (acres)	Total Impervious Area (acres)	Land Use	Hydric Soil Group	Impervious Area (acres)	Pervious Area (acres)	BMP Load (lbs P/year)	Total Outfall BMP Load (lbs P/year)
OF-636	1.67	1.01	Commercial	A	0.10	0.06	0.19	1.69
			Commercial		0.32	0.07	0.58	
			Forest	A		0.02	0.00	
			HDR	A	0.05	0.08	0.12	
			Highway	A	0.20		0.27	
			Highway		0.04		0.05	
			LDR	A	0.23	0.33	0.35	
			LDR		0.08	0.08	0.14	
			Open	A		0.02	0.00	
OF-638	6.28	1.40	Ag	C		0.03	0.01	3.39
			Ag	C/D		1.22	0.55	
			Forest	A		0.00	0.00	
			Forest	C		0.14	0.02	
			Forest	C/D		1.10	0.14	
			HDR	C/D	0.02	0.12	0.09	
			Highway	C	0.09		0.12	
			Highway	C/D	0.54		0.72	
			LDR	C	0.13	0.64	0.33	
			LDR	C/D	0.62	1.55	1.39	
			Open	C		0.00	0.00	
			Open	C/D		0.07	0.02	
OF-639	9.38	1.74	Ag	C/D		0.03	0.02	4.77
			Forest	C/D		0.11	0.01	
			HDR	C/D	0.07	0.18	0.22	
			Highway	C/D	0.79		1.05	
			LDR	C/D	0.87	7.15	3.39	
			Open	C/D	0.01	0.17	0.07	
OF-641	2.07	0.15	Forest	B		0.89	0.12	0.46

Outfall ID	Catchment Area (acres)	Total Impervious Area (acres)	Land Use	Hydric Soil Group	Impervious Area (acres)	Pervious Area (acres)	BMP Load (lbs P/year)	Total Outfall BMP Load (lbs P/year)
			Highway	B	0.10		0.13	
			LDR	B	0.01	1.02	0.14	
			Open	B	0.05		0.07	
OF-642	5.89	0.76	Forest	B		0.63	0.08	1.70
			Forest	D		0.02	0.00	
			Highway	B	0.44		0.59	
			Highway	D	0.01		0.01	
			LDR	B	0.31	4.47	1.01	
			Open	B		0.00	0.00	
OF-643	7.44	0.82	Forest	B		1.60	0.21	2.47
			Forest	D		0.06	0.01	
			Highway	B	0.32		0.43	
			Highway	D	0.01		0.01	
			LDR	B	0.27	2.90	0.76	
			LDR	D	0.17	1.90	0.96	
			Open	B	0.05	0.16	0.09	
OF-644	2.16	0.20	LDR	C	0.13	1.26	0.47	0.77
			LDR	C/D	0.06	0.70	0.30	
OF-645	2.01	0.67	Forest	C		0.09	0.01	1.22
			Forest	C/D		0.00	0.00	
			Highway	C	0.39		0.52	
			LDR	C	0.28	1.07	0.65	
			LDR	C/D		0.03	0.01	
			Open	C		0.16	0.03	
OF-646	4.39	0.78	Forest	B		0.19	0.02	1.57
			Forest	B/D		0.07	0.01	
			HDR	B		0.01	0.00	
			Highway	B	0.27		0.37	

Outfall ID	Catchment Area (acres)	Total Impervious Area (acres)	Land Use	Hydric Soil Group	Impervious Area (acres)	Pervious Area (acres)	BMP Load (lbs P/year)	Total Outfall BMP Load (lbs P/year)
			Highway	B/D	0.00		0.01	
			LDR	B	0.50	3.31	1.16	
			Open	B		0.03	0.00	
OF-649	1.82	0.22	Forest	B		0.36	0.05	0.52
			Forest	A/D		0.00	0.00	
			HDR	B		0.35	0.04	
			Highway	B	0.07		0.09	
			LDR	B	0.13	0.85	0.30	
			Open	B	0.02	0.04	0.04	
OF-650	0.29	0.09	Forest	C/D		0.05	0.01	0.19
			LDR	C/D	0.08	0.05	0.14	
			Open	C/D	0.01	0.09	0.05	
OF-651	8.11	1.69	Forest	A		0.05	0.01	3.67
			Forest	C		0.27	0.03	
			Forest	C/D		0.15	0.02	
			Highway	A	0.18		0.24	
			Highway	C	0.53		0.71	
			Highway	C/D	0.11		0.14	
			LDR	A	0.08	0.79	0.15	
			LDR	C	0.45	3.99	1.52	
			LDR	C/D	0.34	1.04	0.82	
			Open	A		0.01	0.00	
			Open	C		0.10	0.02	
			Open	C/D		0.02	0.01	
OF-652	3.10	0.76	Forest	C		0.37	0.05	1.57
			Forest	C/D		0.00	0.00	
			Highway	C	0.37		0.50	
			LDR	C	0.35	1.70	0.89	

Outfall ID	Catchment Area (acres)	Total Impervious Area (acres)	Land Use	Hydric Soil Group	Impervious Area (acres)	Pervious Area (acres)	BMP Load (lbs P/year)	Total Outfall BMP Load (lbs P/year)
			LDR	C/D	0.04	0.22	0.12	
			Open	C	0.00	0.04	0.01	
OF-653	19.05	1.49	Ag	C/D		0.08	0.04	6.58
			Forest	C		0.00	0.00	
			Forest	C/D		1.01	0.13	
			Highway	C	0.01		0.01	
			Highway	C/D	0.84		1.12	
			LDR	C	0.24	5.91	1.61	
			LDR	C/D	0.40	10.40	3.62	
			Open	C/D		0.17	0.05	
OF-656	1.78	0.50	Forest	C/D		0.87	0.11	0.94
			HDR	C/D	0.03	0.35	0.18	
			Highway	C/D	0.47		0.63	
			Open	C/D		0.05	0.02	
OF-657	0.97	0.00	Forest	C/D		0.73	0.10	0.16
			HDR	C/D		0.24	0.07	
OF-659	4.48	0.47	Forest	A/D		0.00	0.00	1.39
			Forest	C		0.24	0.03	
			Highway	A/D	0.08		0.11	
			LDR	B	0.10	1.48	0.33	
			LDR	A/D	0.29	1.02	0.65	
			LDR	C		1.09	0.23	
			Open	A/D		0.00	0.00	
			Open	C		0.17	0.04	
OF-663	4.48	0.51	Forest	C/D		0.20	0.03	1.86
			HDR	C/D		0.01	0.00	
			HDR	D	0.00	0.09	0.03	
			Highway	C/D	0.26		0.35	

Outfall ID	Catchment Area (acres)	Total Impervious Area (acres)	Land Use	Hydric Soil Group	Impervious Area (acres)	Pervious Area (acres)	BMP Load (lbs P/year)	Total Outfall BMP Load (lbs P/year)
			LDR	C/D	0.25	3.65	1.44	
			Open	C/D		0.01	0.00	
OF-669	13.29	1.38	Forest	A	0.03	1.15	0.19	3.26
			Forest	B	0.01	3.28	0.43	
			Forest			0.03	0.00	
			Highway	A	0.70		0.94	
			Highway	B	0.00		0.00	
			LDR	A	0.61	2.00	0.98	
			LDR	B	0.03	5.42	0.69	
			Open	A	0.00	0.03	0.00	
			Open	B	0.01		0.02	
OF-670	1.27	0.49	Forest	A		0.20	0.03	0.73
			Highway	A	0.29		0.39	
			LDR	A	0.20	0.56	0.31	
			Open	A		0.02	0.00	
OF-673	0.86	0.36	Forest	A		0.20	0.03	0.53
			Highway	A	0.28		0.38	
			LDR	A	0.08	0.27	0.13	
			Open	A		0.02	0.00	
OF-675	5.10	0.94	Forest	A		0.02	0.00	1.86
			Forest	B		1.00	0.13	
			Highway	A	0.10		0.13	
			Highway	B	0.30		0.40	
			LDR	A	0.04	0.03	0.06	
			LDR	B	0.49	3.07	1.11	
			Open	A	0.00	0.01	0.00	
			Open	B	0.01	0.03	0.02	
OF-676	5.00	1.67	Forest	A		0.26	0.03	2.84

Outfall ID	Catchment Area (acres)	Total Impervious Area (acres)	Land Use	Hydric Soil Group	Impervious Area (acres)	Pervious Area (acres)	BMP Load (lbs P/year)	Total Outfall BMP Load (lbs P/year)
			Forest	B		0.06	0.01	
			HDR	A	0.11	0.37	0.28	
			HDR	B		0.00	0.00	
			Highway	A	0.60		0.81	
			Highway	B	0.17		0.23	
			LDR	A	0.31	0.19	0.48	
			LDR	B	0.44	2.43	0.95	
			Open	A	0.03	0.00	0.05	
			Open	B	0.00	0.00	0.00	
			Water	A		0.01	0.00	
			Water	B		0.00	0.00	
OF-677	1.49	0.76	Forest	A		0.10	0.01	1.09
			Highway	A	0.52		0.69	
			LDR	A	0.24	0.42	0.38	
			Open	A	0.01	0.21	0.02	
			Water	A		0.00	0.00	
OF-678	14.17	3.07	Forest	A		0.09	0.01	7.22
			Forest	C		0.10	0.01	
			Forest	C/D		0.70	0.09	
			Highway	A	0.44		0.59	
			Highway		0.00		0.00	
			Highway	C	0.14		0.19	
			Highway	C/D	1.18		1.58	
			LDR	A	0.10	0.46	0.17	
			LDR	C	0.06	0.91	0.28	
			LDR	C/D	1.12	8.62	4.21	
			Open	A	0.03	0.05	0.04	
			Open	C		0.00	0.00	

Outfall ID	Catchment Area (acres)	Total Impervious Area (acres)	Land Use	Hydric Soil Group	Impervious Area (acres)	Pervious Area (acres)	BMP Load (lbs P/year)	Total Outfall BMP Load (lbs P/year)
			Open	C/D		0.16	0.05	
OF-679	0.89	0.24	Forest	A		0.15	0.02	0.37
			Highway	A	0.17		0.23	
			LDR	A	0.07	0.46	0.12	
			LDR	C/D	0.00	0.00	0.00	
			Open	A		0.03	0.00	
OF-680	11.09	1.21	Forest	A		0.11	0.01	4.23
			Forest	C/D		0.88	0.11	
			Highway	A	0.11		0.14	
			Highway	C/D	0.34		0.45	
			LDR	A	0.09	0.81	0.16	
			LDR	C	0.03	0.37	0.12	
			LDR	C/D	0.65	7.64	3.20	
			Open	A	0.00		0.00	
			Open	C/D	0.00	0.06	0.02	
OF-681	4.25	0.65	Forest	C		0.32	0.04	1.78
			Forest	C/D		0.13	0.02	
			Highway	C	0.05		0.07	
			Highway	C/D	0.24		0.32	
			LDR	C	0.13	1.59	0.53	
			LDR	C/D	0.23	1.46	0.77	
			Open	C		0.01	0.00	
			Open	C/D		0.08	0.02	
OF-682	5.62	0.78	Forest	A		0.92	0.12	1.70
			Forest	C		1.95	0.25	
			Highway	A	0.30		0.40	
			Highway	C	0.23		0.30	
			LDR	A	0.21	0.92	0.35	

Outfall ID	Catchment Area (acres)	Total Impervious Area (acres)	Land Use	Hydric Soil Group	Impervious Area (acres)	Pervious Area (acres)	BMP Load (lbs P/year)	Total Outfall BMP Load (lbs P/year)
			LDR	C	0.04	0.96	0.27	
			Open	A		0.04	0.00	
			Open	C		0.04	0.01	
			Water	A		0.01	0.00	
OF-683	0.55	0.22	Forest	A		0.02	0.00	0.31
			Highway	A	0.17		0.22	
			LDR	A	0.05	0.30	0.09	
			Open	A		0.01	0.00	
OF-684	0.55	0.39	Forest	A		0.13	0.02	0.54
			Highway	A	0.38		0.51	
			LDR	A	0.01	0.02	0.01	
			Open	A		0.02	0.00	
OF-686	0.35	0.15	Forest	A		0.15	0.02	0.22
			Highway	A	0.15		0.20	
			LDR	A		0.04	0.00	
OF-687	0.35	0.27	Forest	A		0.06	0.01	0.38
			Highway	A	0.26		0.35	
			LDR	A	0.01	0.02	0.02	
			Open	A		0.00	0.00	
OF-688	0.15	0.11	Forest	A		0.03	0.00	0.15
			Highway	A	0.11		0.15	
			LDR	A		0.00	0.00	
			Open	A		0.01	0.00	
OF-689	14.87	0.63	Forest	A		0.34	0.04	4.29
			Forest	C/D		0.56	0.07	
			Forest	D		0.09	0.01	
			HDR	C/D	0.03	0.65	0.25	
			Highway	A	0.15		0.20	

Outfall ID	Catchment Area (acres)	Total Impervious Area (acres)	Land Use	Hydric Soil Group	Impervious Area (acres)	Pervious Area (acres)	BMP Load (lbs P/year)	Total Outfall BMP Load (lbs P/year)
			Highway	C/D	0.20		0.26	
			LDR	A		0.28	0.01	
			LDR	B		3.33	0.40	
			LDR	C/D	0.24	8.38	2.79	
			LDR	D	0.02	0.49	0.22	
			Open	A		0.01	0.00	
			Open	C/D		0.11	0.03	
			Open	D		0.00	0.00	
OF-690	9.60	0.37	Forest	A		0.03	0.00	2.56
			Forest	C/D		0.93	0.12	
			Forest	D		1.75	0.23	
			Highway	A	0.03		0.04	
			Highway	C/D	0.16		0.22	
			LDR	A	0.06	0.50	0.11	
			LDR	B		0.47	0.06	
			LDR	C/D	0.11	5.50	1.76	
			LDR	D		0.02	0.01	
			Open	C/D		0.03	0.01	
OF-691	3.94	0.42	Ag	C		0.02	0.01	1.51
			Ag	C/D		0.00	0.00	
			Forest	A		0.00	0.00	
			Forest	C		0.04	0.01	
			Forest	C/D		0.05	0.01	
			Highway	A	0.00		0.00	
			Highway	C	0.13		0.17	
			Highway	C/D	0.22		0.30	
			LDR	C	0.01	0.92	0.20	
			LDR	C/D	0.06	2.47	0.80	

Outfall ID	Catchment Area (acres)	Total Impervious Area (acres)	Land Use	Hydric Soil Group	Impervious Area (acres)	Pervious Area (acres)	BMP Load (lbs P/year)	Total Outfall BMP Load (lbs P/year)
			Open	C		0.02	0.00	
OF-692	45.55	0.42	Forest	A		18.41	2.39	6.04
			Forest	B		12.86	1.67	
			Forest	D		9.58	1.25	
			Highway	A	0.26		0.35	
			LDR	A	0.15	4.03	0.35	
			LDR	B	0.00	0.22	0.03	
			Open	A		0.04	0.00	
OF-693	5.20	0.56	Forest	A		2.55	0.33	1.22
			Forest	B		0.18	0.02	
			Highway	A	0.28		0.38	
			LDR	A	0.27	1.87	0.47	
			Open	A	0.01	0.03	0.02	
OF-694	38.98	0.94	Forest	A		1.37	0.18	6.28
			Forest	B		25.06	3.26	
			Forest	D		6.10	0.79	
			HDR	B	0.10	0.45	0.29	
			HDR	D	0.02	0.30	0.15	
			Highway	A	0.12		0.17	
			LDR	A	0.16	2.11	0.30	
			LDR	B	0.29	2.62	0.75	
			LDR	D	0.00	0.01	0.01	
			Open	A	0.00	0.03	0.00	
			Open	B	0.19		0.29	
			Open	D	0.05		0.08	
OF-695	6.40	1.07	Forest	A		0.31	0.04	2.69
			Forest	D		0.00	0.00	
			Highway	A	0.41		0.55	

Outfall ID	Catchment Area (acres)	Total Impervious Area (acres)	Land Use	Hydric Soil Group	Impervious Area (acres)	Pervious Area (acres)	BMP Load (lbs P/year)	Total Outfall BMP Load (lbs P/year)
			Highway	D	0.06		0.08	
			LDR	A	0.26	1.44	0.43	
			LDR	B	0.21	0.99	0.44	
			LDR	D	0.13	2.54	1.13	
			Open	A		0.04	0.00	
			Open	D		0.00	0.00	
OF-696	7.98	0.84	Forest	A		0.03	0.00	3.27
			Forest	B		0.09	0.01	
			Forest	D		0.10	0.01	
			HDR	B	0.00	0.05	0.01	
			HDR	D	0.00	0.06	0.02	
			Highway	A	0.05		0.07	
			Highway	D	0.04		0.06	
			LDR	A	0.19	1.05	0.32	
			LDR	B	0.10	0.82	0.25	
			LDR	D	0.40	4.95	2.44	
			Open	A		0.00	0.00	
			Open	B	0.00		0.01	
			Open	D	0.04		0.06	
OF-697	0.42	0.16	Forest	A		0.03	0.00	0.23
			Forest			0.05	0.01	
			Highway	A	0.09		0.12	
			Highway		0.05		0.06	
			LDR	A	0.02	0.17	0.04	
			LDR			0.00	0.00	
			Open	A		0.01	0.00	
			Water			0.00	0.00	
OF-698	0.39	0.19	Forest	A		0.07	0.01	0.28

Outfall ID	Catchment Area (acres)	Total Impervious Area (acres)	Land Use	Hydric Soil Group	Impervious Area (acres)	Pervious Area (acres)	BMP Load (lbs P/year)	Total Outfall BMP Load (lbs P/year)
			Forest			0.00	0.00	
			Highway	A	0.11		0.15	
			Highway		0.05		0.07	
			LDR	A	0.03	0.13	0.05	
OF-699	4.77	0.89	Forest	A		0.15	0.02	2.20
			Forest	C/D		0.05	0.01	
			Highway	A	0.22		0.30	
			Highway	C/D	0.20		0.27	
			LDR	A	0.05	0.31	0.09	
			LDR	B	0.06	1.14	0.23	
			LDR	C/D	0.19	0.87	0.53	
			LDR	D	0.17	1.30	0.74	
			Open	A		0.01	0.00	
			Open	C/D		0.04	0.01	
OF-700	7.12	1.22	Forest	B		0.01	0.00	2.91
			Forest	C/D		0.13	0.02	
			HDR	B	0.13	1.42	0.47	
			HDR	C/D	0.05	0.87	0.36	
			Highway	B	0.12		0.16	
			Highway	C/D	0.74		0.99	
			LDR	B	0.06	2.20	0.36	
			LDR	C/D	0.13	1.02	0.49	
			LDR	D		0.00	0.00	
			Open	B		0.02	0.00	
			Open	C/D		0.22	0.06	
OF-701	0.75	0.20	Forest	C/D		0.13	0.02	0.41
			Highway	C/D	0.19		0.25	
			LDR	C/D	0.01	0.39	0.13	

Outfall ID	Catchment Area (acres)	Total Impervious Area (acres)	Land Use	Hydric Soil Group	Impervious Area (acres)	Pervious Area (acres)	BMP Load (lbs P/year)	Total Outfall BMP Load (lbs P/year)
			Open	C/D		0.03	0.01	
OF-703	18.08	4.73	Forest	A		1.03	0.13	9.33
			Forest	C/D		1.83	0.24	
			Highway	A	0.64		0.85	
			Highway	C/D	1.81		2.42	
			LDR	A	0.46	3.09	0.80	
			LDR	C/D	1.80	6.83	4.72	
			Open	A	0.00	0.12	0.00	
			Open	C/D	0.02	0.44	0.16	
OF-704	0.17	0.07	Forest	C/D		0.04	0.01	0.12
			Highway	C/D	0.07		0.10	
			LDR	C/D		0.06	0.02	
OF-705	1.85	0.26	Forest	C/D		0.21	0.03	0.79
			Highway	C/D	0.16		0.22	
			LDR	C/D	0.10	1.37	0.54	
			Open	C/D		0.01	0.00	
OF-706	0.77	0.14	Forest	C/D		0.34	0.04	0.30
			Forest	D		0.12	0.02	
			Highway	C/D	0.07		0.10	
			Highway	D	0.04		0.05	
			LDR	C/D	0.03	0.14	0.08	
			LDR	D		0.00	0.00	
			Open	C/D		0.01	0.00	
			Open	D		0.02	0.01	
OF-707	2.70	1.15	Forest	A		0.12	0.02	1.94
			Forest	C/D		0.18	0.02	
			Highway	A	0.13		0.18	
			Highway	C/D	0.60		0.80	

Outfall ID	Catchment Area (acres)	Total Impervious Area (acres)	Land Use	Hydric Soil Group	Impervious Area (acres)	Pervious Area (acres)	BMP Load (lbs P/year)	Total Outfall BMP Load (lbs P/year)
			LDR	A	0.11	0.31	0.18	
			LDR	C/D	0.31	0.89	0.74	
			Open	A		0.00	0.00	
			Open	C/D		0.05	0.01	
OF-708	3.20	0.79	Forest	A		0.68	0.09	1.23
			Highway	A	0.60		0.80	
			LDR	A	0.19	1.60	0.34	
			Open	A		0.13	0.00	
OF-709	0.33	0.17	Forest	A		0.03	0.00	0.25
			Highway	A	0.08		0.11	
			LDR	A	0.09	0.12	0.14	
			Open	A		0.02	0.00	
OF-710	0.55	0.10	Forest	A		0.15	0.02	0.16
			Highway	A	0.10		0.13	
			LDR	A	0.00	0.29	0.01	
			Open	A		0.00	0.00	
OF-713	2.01	0.32	Forest	C/D		0.24	0.03	0.90
			Highway	C/D	0.19		0.25	
			LDR	C/D	0.13	1.45	0.62	
			Open	C/D		0.00	0.00	
OF-714	16.59	1.27	Forest	A		0.07	0.01	4.02
			Forest	B		2.24	0.29	
			Forest	C		0.02	0.00	
			Forest	C/D		0.23	0.03	
			Highway	A	0.08		0.11	
			Highway	C	0.00		0.00	
			Highway	C/D	0.27		0.36	
			LDR	A	0.18	1.25	0.32	

Outfall ID	Catchment Area (acres)	Total Impervious Area (acres)	Land Use	Hydric Soil Group	Impervious Area (acres)	Pervious Area (acres)	BMP Load (lbs P/year)	Total Outfall BMP Load (lbs P/year)
			LDR	B	0.40	8.48	1.63	
			LDR	C	0.05	1.47	0.38	
			LDR	C/D	0.29	1.50	0.87	
			LDR	D	0.00	0.02	0.01	
			Open	C/D		0.05	0.02	
OF-715	10.96	1.01	Forest	B		0.00	0.00	3.78
			Forest	C/D		0.60	0.08	
			Forest	D		0.25	0.03	
			Highway	C/D	0.31		0.41	
			Highway	D	0.15		0.20	
			LDR	B	0.10	3.84	0.61	
			LDR	C/D	0.14	2.45	0.92	
			LDR	D	0.32	2.79	1.52	
			Open	C/D		0.02	0.01	
OF-716	1.66	0.36	Forest	A		0.12	0.02	0.56
			Highway	A	0.26		0.35	
			LDR	A	0.10	1.15	0.19	
			Open	A		0.02	0.00	
OF-717	0.49	0.36	Forest	A		0.07	0.01	0.49
			Highway	A	0.33		0.44	
			LDR	A	0.02	0.03	0.04	
			Open	A		0.03	0.00	
OF-718	1.25	0.26	Forest	A		0.24	0.03	0.43
			Highway	A	0.12		0.16	
			LDR	A	0.14	0.75	0.24	
OF-719	4.52	1.03	Forest	A		0.54	0.07	1.73
			Forest	C/D		0.05	0.01	
			Highway	A	0.32		0.43	

Outfall ID	Catchment Area (acres)	Total Impervious Area (acres)	Land Use	Hydric Soil Group	Impervious Area (acres)	Pervious Area (acres)	BMP Load (lbs P/year)	Total Outfall BMP Load (lbs P/year)
			Highway	C/D	0.05		0.07	
			LDR	A	0.60	2.62	0.99	
			LDR	C/D	0.05	0.26	0.15	
			Open	A	0.00	0.01	0.01	
			Open	C/D		0.00	0.00	
OF-720	2.45	0.32	Forest	A		0.00	0.00	0.90
			Forest	C/D		0.01	0.00	
			Forest	D		0.03	0.00	
			Highway	A	0.01		0.01	
			Highway	C/D	0.01		0.01	
			Highway	D	0.09		0.12	
			LDR	A	0.11	0.72	0.19	
			LDR	C/D	0.09	1.21	0.49	
			LDR	D		0.16	0.06	
OF-721	2.10	0.56	Forest	A		0.24	0.03	0.88
			Highway	A	0.27		0.36	
			Highway	D	0.00		0.00	
			LDR	A	0.29	1.27	0.48	
			Open	A		0.03	0.00	
OF-722	2.95	0.74	Forest	A		0.19	0.02	1.37
			Forest	C/D		0.38	0.05	
			Highway	A	0.02		0.02	
			Highway	C/D	0.35		0.47	
			LDR	A	0.18	0.91	0.30	
			LDR	C/D	0.18	0.72	0.49	
			Open	A		0.01	0.00	
			Open	C/D	0.00	0.02	0.01	
OF-723	0.89	0.44	Forest	A		0.12	0.02	0.65

Outfall ID	Catchment Area (acres)	Total Impervious Area (acres)	Land Use	Hydric Soil Group	Impervious Area (acres)	Pervious Area (acres)	BMP Load (lbs P/year)	Total Outfall BMP Load (lbs P/year)
			Forest			0.02	0.00	
			Highway	A	0.24		0.32	
			LDR	A	0.14	0.22	0.22	
			LDR			0.01	0.00	
			Open	A	0.06	0.08	0.09	
			Open		0.00		0.00	
OF-724	2.29	0.76	Forest	A		0.28	0.04	1.14
			Highway	A	0.51		0.68	
			LDR	A	0.25	1.25	0.41	
			Open	A	0.00	0.00	0.00	
OF-725	8.50	1.19	Forest	C/D		0.44	0.06	4.05
			Forest	D		0.17	0.02	
			Highway	C/D	0.19		0.26	
			Highway	D	0.16		0.22	
			LDR	C/D	0.34	3.10	1.42	
			LDR	D	0.49	3.39	2.01	
			Open	C/D	0.00	0.13	0.04	
			Open	D		0.09	0.03	
OF-726	4.10	1.12	Forest	C/D		0.17	0.02	2.45
			Highway	C/D	0.51		0.69	
			LDR	C/D	0.58	2.47	1.61	
			LDR	D	0.02	0.05	0.05	
			Open	C/D	0.00	0.28	0.08	
OF-727	2.02	0.40	Ag	C/D		0.00	0.00	1.07
			Forest	C/D		0.09	0.01	
			HDR	C/D	0.06	0.44	0.27	
			Highway	C/D	0.22		0.29	
			LDR	C/D	0.12	1.04	0.49	

Outfall ID	Catchment Area (acres)	Total Impervious Area (acres)	Land Use	Hydric Soil Group	Impervious Area (acres)	Pervious Area (acres)	BMP Load (lbs P/year)	Total Outfall BMP Load (lbs P/year)
			Open	C/D		0.05	0.02	
OF-728	5.67	0.35	Forest	C		3.47	0.45	1.32
			HDR	C		0.14	0.03	
			Highway	C	0.27		0.37	
			LDR	C	0.06	1.68	0.44	
			Open	C	0.02	0.02	0.03	
OF-729	1.47	0.38	Forest	C		0.07	0.01	0.77
			Forest	C/D		0.42	0.06	
			HDR	C	0.06	0.20	0.17	
			Highway	C	0.25		0.33	
			Highway	C/D	0.01		0.02	
			LDR	C	0.05	0.32	0.15	
			LDR	C/D	0.00	0.06	0.03	
			Open	C		0.02	0.00	
			Open	C/D		0.00	0.00	
OF-730	3.22	1.09	Forest	C		0.15	0.02	2.02
			HDR	C	0.01	0.05	0.02	
			Highway	C	0.41		0.55	
			LDR	C	0.67	1.60	1.36	
			Open	C		0.33	0.07	
OF-731	3.06	0.80	Forest	C		0.21	0.03	1.60
			Highway	C	0.43		0.58	
			LDR	C	0.37	1.87	0.96	
			Open	C		0.18	0.04	
OF-732	9.36	2.22	Forest	C/D		0.29	0.04	5.16
			Highway	C/D	1.31		1.76	
			LDR	C/D	0.91	6.71	3.33	
			Open	C/D		0.14	0.04	

Outfall ID	Catchment Area (acres)	Total Impervious Area (acres)	Land Use	Hydric Soil Group	Impervious Area (acres)	Pervious Area (acres)	BMP Load (lbs P/year)	Total Outfall BMP Load (lbs P/year)
OF-733	9.39	1.85	Forest	C		0.12	0.01	4.29
			Forest	C/D		0.38	0.05	
			HDR	C	0.01	0.15	0.05	
			Highway	C	0.78		1.04	
			Highway	C/D	0.24		0.32	
			LDR	C	0.57	5.26	1.97	
			LDR	C/D	0.24	1.46	0.79	
			Open	C		0.16	0.03	
			Open	C/D	0.01	0.02	0.02	
OF-734	0.87	0.10	Forest	C		0.06	0.01	0.30
			Forest	D		0.00	0.00	
			Highway	C	0.08		0.11	
			LDR	C	0.01	0.61	0.15	
			LDR	C/D	0.00	0.00	0.00	
			LDR	D		0.09	0.03	
OF-735	1.50	0.26	Commercial		0.05	0.29	0.15	0.57
			Forest			0.70	0.09	
			Highway		0.21		0.28	
			Open			0.25	0.05	
OF-736	18.02	5.88	Commercial	A	0.05	0.09	0.09	11.16
			Commercial		0.27	0.02	0.49	
			Forest	A		0.41	0.05	
			Forest			0.01	0.00	
			Forest	C		0.49	0.06	
			HDR	A	0.23	0.51	0.56	
			HDR		0.18	0.30	0.49	
			HDR	C	0.31	0.71	0.86	
			Highway	A	0.67		0.89	

Outfall ID	Catchment Area (acres)	Total Impervious Area (acres)	Land Use	Hydric Soil Group	Impervious Area (acres)	Pervious Area (acres)	BMP Load (lbs P/year)	Total Outfall BMP Load (lbs P/year)
			Highway		1.64		2.20	
			Highway	C	0.03		0.05	
			Industrial		0.44	0.60	0.91	
			LDR	A	1.07	2.65	1.70	
			LDR		0.14	1.02	0.42	
			LDR	C	0.62	4.76	1.95	
			Open	A	0.12	0.13	0.19	
			Open		0.11	0.23	0.21	
			Open	C		0.20	0.04	
OF-737	2.84	1.37	Forest			0.02	0.00	2.35
			HDR		0.13	0.24	0.35	
			HDR	C	0.03	0.58	0.20	
			Highway		0.94		1.25	
			Highway	C/D	0.02		0.03	
			LDR		0.12	0.20	0.23	
			LDR	C	0.12	0.34	0.25	
			Open			0.09	0.02	
OF-740	0.85	0.50	Forest	C		0.00	0.00	0.87
			Forest	C/D		0.02	0.00	
			Forest	D		0.01	0.00	
			HDR	C/D	0.07	0.05	0.18	
			Highway	C	0.01		0.01	
			Highway	C/D	0.17		0.23	
			Highway	D	0.12		0.16	
			LDR	C		0.00	0.00	
			LDR	C/D	0.11	0.24	0.24	
			LDR	D	0.03	0.00	0.04	
			Open	C		0.00	0.00	

Outfall ID	Catchment Area (acres)	Total Impervious Area (acres)	Land Use	Hydric Soil Group	Impervious Area (acres)	Pervious Area (acres)	BMP Load (lbs P/year)	Total Outfall BMP Load (lbs P/year)
			Open	C/D		0.02	0.01	
			Open	D		0.01	0.00	
OF-741	32.56	16.52	Commercial		1.74	0.29	3.15	28.50
			Commercial	C	1.52	0.42	2.79	
			Forest			0.10	0.01	
			Forest	C		1.06	0.14	
			Forest	C/D		0.43	0.06	
			HDR	C	0.44	0.72	1.16	
			HDR	C/D	0.04	0.07	0.12	
			Highway		1.91		2.56	
			Highway	C	3.83		5.13	
			Highway	C/D	0.85		1.14	
			Highway	D	0.00		0.00	
			LDR		2.10	1.46	3.49	
			LDR	C	3.79	8.71	7.59	
			LDR	C/D	0.27	0.95	0.69	
			LDR	D	0.00	0.00	0.00	
			Open			0.29	0.06	
			Open	C	0.04	1.25	0.33	
			Open	C/D	0.00	0.27	0.08	
OF-742	1.18	0.30	Forest	C		0.06	0.01	0.62
			Highway	C	0.09		0.11	
			LDR	C	0.21	0.82	0.49	
			Open	C		0.00	0.00	
OF-743	13.79	2.57	Forest	A		0.30	0.04	5.66
			Forest			0.04	0.01	
			Forest	C		0.35	0.05	
			HDR	A	0.06	0.40	0.16	

Outfall ID	Catchment Area (acres)	Total Impervious Area (acres)	Land Use	Hydric Soil Group	Impervious Area (acres)	Pervious Area (acres)	BMP Load (lbs P/year)	Total Outfall BMP Load (lbs P/year)
			HDR		0.09	0.80	0.37	
			Highway	A	0.72		0.96	
			Highway		0.16		0.22	
			Highway	C	0.34		0.45	
			LDR	A	0.75	1.85	1.19	
			LDR		0.22	0.35	0.41	
			LDR	C	0.23	6.83	1.78	
			Open	A	0.00	0.20	0.01	
			Open		0.00	0.08	0.02	
			Open	C	0.01	0.02	0.01	
OF-744	39.81	25.60	Commercial	A	0.52	0.27	0.93	45.36
			Commercial		14.47	3.76	26.55	
			Forest	A		0.10	0.01	
			Forest			2.15	0.28	
			HDR		1.19	1.17	3.01	
			Highway		6.48		8.69	
			Industrial		0.47	0.18	0.87	
			LDR		1.64	2.27	2.98	
			Open	A		0.58	0.02	
			Open		0.82	3.73	2.03	
OF-745	3.98	1.14	Forest	C		0.28	0.04	2.23
			Forest	C/D		0.98	0.13	
			HDR	C	0.01	0.03	0.04	
			HDR	C/D	0.04	0.00	0.09	
			Highway		0.01		0.01	
			Highway	C	0.18		0.24	
			Highway	C/D	0.44		0.60	
			LDR	C	0.04	0.58	0.18	

Outfall ID	Catchment Area (acres)	Total Impervious Area (acres)	Land Use	Hydric Soil Group	Impervious Area (acres)	Pervious Area (acres)	BMP Load (lbs P/year)	Total Outfall BMP Load (lbs P/year)
			LDR	C/D	0.34	0.84	0.77	
			Open	C	0.03	0.03	0.05	
			Open	C/D	0.04	0.10	0.09	
OF-746	0.60	0.31	Commercial		0.00		0.00	0.61
			HDR		0.11	0.04	0.26	
			HDR	C	0.01	0.01	0.03	
			Highway		0.03		0.05	
			Highway	C	0.06		0.08	
			LDR		0.00	0.01	0.00	
			LDR	C	0.09	0.23	0.19	
			Open	C		0.01	0.00	
OF-747	0.64	0.56	Forest			0.04	0.01	0.82
			Highway		0.26		0.35	
			Open		0.30	0.04	0.46	
OF-748	0.70	0.22	Forest	C		0.01	0.00	0.42
			Highway	C	0.13		0.17	
			LDR	C	0.09	0.39	0.22	
			Open	C		0.09	0.02	
OF-749	7.93	3.96	Forest	C		0.01	0.00	6.83
			Forest	C/D		0.01	0.00	
			Highway	C	0.24		0.32	
			LDR		0.03	0.05	0.06	
			LDR	C	3.50	3.54	6.07	
			LDR	C/D	0.18	0.27	0.35	
			Open	C	0.01	0.09	0.03	
			Open	C/D		0.00	0.00	
OF-82	12.26	1.52	Ag	C		0.96	0.43	5.40
			Ag	C/D		1.15	0.52	

Outfall ID	Catchment Area (acres)	Total Impervious Area (acres)	Land Use	Hydric Soil Group	Impervious Area (acres)	Pervious Area (acres)	BMP Load (lbs P/year)	Total Outfall BMP Load (lbs P/year)
			Forest	C		0.27	0.04	
			Forest	C/D		0.49	0.06	
			HDR	C/D	0.05	2.19	0.76	
			Highway	C	0.38		0.51	
			Highway	C/D	0.46		0.62	
			LDR	C	0.22	1.77	0.71	
			LDR	C/D	0.36	3.74	1.64	
			LDR	D	0.03	0.12	0.09	
			Open	C		0.02	0.00	
			Open	C/D	0.01	0.04	0.03	
OF-86	18.35	1.99	Forest	A		0.07	0.01	5.04
			Forest	B		3.19	0.41	
			Forest	C/D		0.03	0.00	
			HDR	B	0.22	2.02	0.76	
			HDR	C/D		0.23	0.07	
			Highway	A	0.20		0.27	
			Highway	B	0.51		0.68	
			Highway	C/D	0.04		0.05	
			LDR	A	0.10	0.91	0.18	
			LDR	B	0.91	9.69	2.55	
			LDR	B/D		0.00	0.00	
			LDR	C/D		0.16	0.05	
			Open	A		0.00	0.00	
			Open	B		0.06	0.01	
			Open	C/D		0.01	0.00	
OF-89	4.93	0.64	Ag	C/D		0.02	0.01	1.97
			Forest	C/D		1.12	0.15	
			HDR	C/D	0.00	0.96	0.29	

Outfall ID	Catchment Area (acres)	Total Impervious Area (acres)	Land Use	Hydric Soil Group	Impervious Area (acres)	Pervious Area (acres)	BMP Load (lbs P/year)	Total Outfall BMP Load (lbs P/year)
			Highway	C/D	0.43		0.57	
			LDR	C/D	0.21	1.72	0.82	
			Open	C/D		0.48	0.14	
OF-90	8.64	1.71	Forest	C		0.05	0.01	4.84
			Forest	C/D		1.69	0.22	
			HDR	C		0.00	0.00	
			HDR	C/D	0.84	4.45	3.25	
			Highway	C	0.05		0.07	
			Highway	C/D	0.81		1.09	
			LDR	C/D		0.10	0.03	
			Open	C		0.01	0.00	
			Open	C/D		0.62	0.18	
OF-92	3.66	1.20	Forest	C		0.07	0.01	2.97
			Forest	C/D		0.12	0.02	
			Forest	D		0.03	0.00	
			HDR	C	0.78	1.73	2.17	
			HDR	C/D	0.00	0.13	0.04	
			HDR	D	0.05	0.25	0.20	
			Highway	C	0.38		0.50	
			Open	C		0.13	0.03	
OF-93	3.43	1.36	Forest	C		0.09	0.01	2.95
			HDR	C	0.71	1.78	2.02	
			Highway	C	0.65		0.88	
			Open	C		0.21	0.04	
OF-94	1.78	0.15	Forest	C		0.34	0.04	0.60
			HDR	C	0.09	0.70	0.35	
			Highway	C	0.06		0.08	
			Open	C		0.59	0.12	

Outfall ID	Catchment Area (acres)	Total Impervious Area (acres)	Land Use	Hydric Soil Group	Impervious Area (acres)	Pervious Area (acres)	BMP Load (lbs P/year)	Total Outfall BMP Load (lbs P/year)
Total	**2112**	**3601**						**866**

Appendix C: BMP Pollutant Reduction Estimate Summary Memo

BMP POLLUTANT REDUCTION CREDITS

To: Mr. Rob Oliva, Town of Lunenburg DPW

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

Date: April 5, 2021

Subject: BMP Pollutant Reduction Estimate Summary

Under the Environmental Protection Agency's (EPA's) 2016 National Pollutant Discharge and Elimination System (NPDES) Municipal Separate Storm Sewer System (MS4) Permit, regulated communities such as Lunenburg are required to estimate pollutant load reductions provided by stormwater Best Management Practices (BMPs) within the regulated Urbanized Area (UA) that discharge to the following waterbodies:

- Those with an out-of-state nitrogen or phosphorus Total Maximum Daily Load (TMDL) (Appendix F, Part B.I or B.II of the 2016 MS4 Permit, respectively); or
- Those impaired for nitrogen and phosphorous (Appendix H, Part I or II of the 2016 MS4 Permit, respectively)

Per discussions with the Town of Lunenburg after completing the most recent round of stormwater BMP inspections in mid-2020, the Lunenburg DPW has identified sixteen different locations or sites with existing structural stormwater BMPs which are listed in **Table 1** below and shown in the attached **Attachment 1: Stormwater BMPs Map**.

Table 1 – Stormwater BMPs

BMP ID	Location	Stormwater BMP Type
BL-1	Butterfly Ln	Infiltration Basin
BL-2	Butterfly Ln	Infiltration Basin
CC-1	Cortland Circle	Detention Basin
FP-1	Fire/Police Station	Detention Basin
FP-2	Fire/Police Station	Detention Basin
LF-1	Landfill – south	Infiltration Basin
LF-2	Landfill – west	Infiltration Basin
LF-3	Landfill – east	Detention Basin
PL-1	Public Library	Detention Basin
RW-1	Richard's Way	Detention Basin
RW-2	Richard's Way	Detention Basin
RW-3	Richard's Way	Detention Basin
RH-5	Robbs Hill	Detention Basin
SC-1	Memorial Drive Senior Ctr.	Swale Conveyance
WC-1	Whitetail Crossing	Detention Basin
WC-2	Whitetail Crossing	Detention Basin

To determine the waterbodies within Lunenburg that may require calculation of nutrient removals provided by stormwater BMPs, CEI reviewed the final Massachusetts Year 2016 Integrated List of Waters (2016 303d List). Although none of Lunenburg's waterbodies have specific impairments for nitrogen or phosphorus, the entire town is located within the Nashua River watershed, a waterbody impaired for phosphorus. Thus, pollutant removals must be computed for all stormwater BMPs

within Lunenburg's regulated Urbanized Area using Attachment 1 of Appendix H of the 2016 MS4 Permit.

Due to a lack of available as-built plan information for the Town's BMPs, additional field investigations were performed to determine the size and storage volume of each BMP in order to estimate pollutant load reductions. CEI then calculated phosphorus, nitrogen and total suspended solids removal efficiencies for each BMP using EPA's BMP Accounting and Tracking Tool (BATT), a tool developed for EPA to compute pollutant removals in accordance with Attachment 3 of Appendix H of the permit. The BATT calculator requires two different categories of information in order to determine removal efficiencies:

1. Subcatchment information (e.g., subcatchment area, land use, pervious/impervious area, hydrologic soil group etc.); and,
2. BMP-specific information (e.g., BMP type, storage volume, infiltration rate, location, operation & maintenance, etc.)

Under the subcatchment information category, CEI used GIS data including topography and drainage infrastructure mapping to delineate subcatchment areas of all applicable BMPs. Land uses, impervious/pervious areas, and hydrologic soil groups (HSG) within each subcatchment area was obtained by layering GIS data and distinguishing all unique land use types within the subcatchment (i.e., Low Density Residential, Pervious, HSG B; or Highway, Impervious). Note that impervious areas are not assigned an HSG. Under the BMP-specific information category, BMP types were assigned to each BMP per the most recent field observations. CEI used geotifs (geo-referenced aerial imagery), field measurements, AutoCAD, and Excel to approximate the storage volume of all applicable BMPs. Where applicable, BMP infiltration rates were approximated based on saturated hydraulic conductivity for hydrologic soil groups (USDA, 2010). All information was entered into the BATT calculator to estimate the pollutant removal efficiency of the BMP. All other BMP-specific information, including location and operation & maintenance, was obtained from the most recent inspection report and readily available tax parcel information online.

A detailed breakdown of subcatchment information, including land use types, impervious/pervious area, and hydrologic soil group, for each BMP is provided as **Attachment 2: BATT Input Data – Subcatchment Information**. A summary of BMP-specific information and subcatchment information for each BMP is provided as **Attachment 3: BATT Input Data Summary**. After processing all of the inputted data, the BATT calculator outputs annual reduction credits for phosphorus, nitrogen, and sediment from the inputted BMPs. A summary of total pollutant removal from all applicable BMPs is shown in **Table 2** and a summary of individual pollutant removal from each BMP, along with pollutant loading to each BMP and pollutant removal efficiency of each BMP, is provided as **Attachment 4: BATT Output Data Summary**.

Table 2 – Summary of Pollutant Load Reductions for All Town-owned Structural BMPs

	Removed Phosphorus Load (lb/yr)	Removed Nitrogen Load (lb/yr)	Removed Sediment Load (lb/yr)
Structural	4.91	53.08	3,725.82
Non-Structural	0	0	0
Land Use Conversion	0	0	0
Total	4.91	53.08	3,725.82

BMP POLLUTANT REDUCTION CREDITS

Note that these pollutant removal estimates are based on the available stormwater infrastructure information that has been obtained as of the date of this memo. As infrastructure mapping is updated or changed (i.e., additions of catch basins, piping networks, and outfalls), subcatchment contributing areas to the BMPs may increase or decrease which will affect estimated pollutant removals. Per MS4 permit requirements, these estimates should be updated if any changes are made to existing BMPs, or as new Town-owned stormwater BMPs are located or constructed. In the event that any of these occur, the Town should notify CEI and we will update all required calculations.

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.

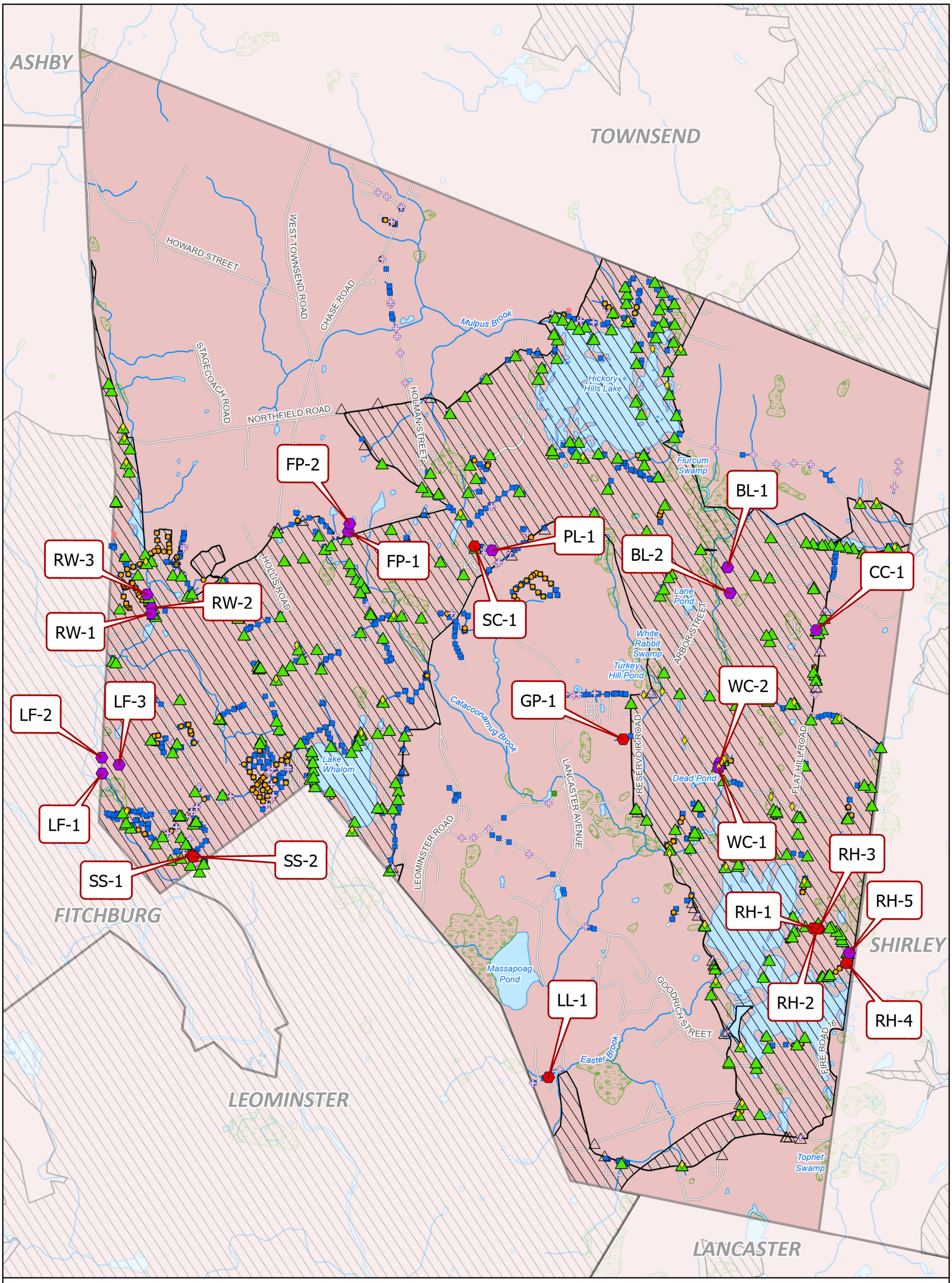
Nick Cristofori, P.E., Principal, Project Manager

Attachments:

- Attachment 1: Stormwater BMP Map
- Attachment 2: BATT Input Data – Subcatchment Information
- Attachment 3: BATT Input Data Summary
- Attachment 4: BATT Output Data Summary

ATTACHMENT 1

BMPS WITHIN IMPAIRED WATERSHEDS



BMPs in Nashua River Watershed Lunenburg, MA

Comprehensive Environmental Incorporated

Data Sources: MassGIS, Town of Lunenburg, CEI

9/17/2020

ATTACHMENT 2

BATT INPUT DATA – SUBCATCHMENT INFORMATION

Attachment 2: BATT Input Data - Subcatchment Information				
BMP Type	**Land Use Type**	**Hydrologic Soil Group**	**Impervious Area (acres)**	**Pervious Area (acres)**
BL-1	Forest	A	0.1252908	0.2656178
BL-1	Low Density Residential	A	0.1627197	0.2674733
BL-2	Forest	A	0.2485389	0.9191018
BL-2	Low Density Residential	A	0.0106499	0.1490086
CC-1	Forest	C/D	0.4906919	1.4489219
CC-1	Low Density Residential	C/D	0.1285952	0.8210448
CC-1	Water	C/D		0.1849864
FP-1	Commercial	B	0.0000937	
FP-1	Commercial		0.1491557	0.009277
FP-1	Forest		0.0083052	0.1185117
FP-2	Commercial	B	0.0639936	0.155738
FP-2	Forest	B	0.0041457	0.6514446
FP-2	Low Density Residential	B		0.0036853
LF-1	Forest	A		0.1243109
LF-1	Forest	B/D		0.0100091
LF-1	Forest			0.142601
LF-1	Open Land	A	0.0250503	0.5349504
LF-1	Open Land	B/D		0.001285
LF-1	Open Land		0.2504396	1.0789846
LF-2	Forest	A	0.0049139	0.409744
LF-2	Forest			0.0010663
LF-2	Open Land	A	0.1239162	0.5635007
LF-2	Open Land		0.1919692	1.0793707
LF-3	Forest	A	0.0024575	0.3431864
LF-3	Open Land	A	1.2836194	1.0662976
LF-3	Open Land		0.9292002	1.2224851
PL-1	Commercial	C	0.0398562	
PL-1	Commercial	C/D	1.3646655	0.1291694
RH-5	Forest	A	0.0182134	0.1525853
RH-5	Low Density Residential	A	0.3035845	0.646063
RH-5	Low Density Residential	C	0.1756635	0.7912217
RW-1	Commercial	A	0.4701565	0.3126764
RW-1	Commercial	C/D	0.3804821	0.4800454
RW-1	Forest	C/D		0.4597402
RW-1	Industrial	A	0.000469	
RW-1	Industrial	C/D	0.0059868	
RW-1	Medium Density Residential	C/D	0.0587003	0.089387
RW-2	Commercial	A	0.02479	0.0288895
RW-2	Commercial	C/D	0.1531191	0.1816686
RW-2	Forest	A	0.0378216	0.076401
RW-2	Forest	B	0.0003895	0.0274782
RW-2	Forest	C/D	0.2077827	3.1546755
RW-2	Forest	D	0.053091	0.1793072

Attachment 2: BATT Input Data - Subcatchment Information				
BMP Type	**Land Use Type**	**Hydrologic Soil Group**	**Impervious Area (acres)**	**Pervious Area (acres)**
RW-2	High Density Residential	C/D	0.0666096	0.0078712
RW-2	Medium Density Residential	B	0.1558166	1.2878239
RW-2	Medium Density Residential	C/D	0.296431	1.5044926
RW-3	Agriculture	B	0.026122	0.7001844
RW-3	Agriculture	C/D	0.20388	0.6658337
RW-3	Forest	C/D	0.0195749	0.9232784
RW-3	High Density Residential	B	0.0102864	0.4938315
RW-3	High Density Residential	C/D	0.5654829	1.3273687
RW-3	Medium Density Residential	B		0.1603855
RW-3	Medium Density Residential	C/D	0.1983309	0.5149273
RW-3	Open Land	C/D		0.390498
SC-1	Commercial	C	0.2016069	0.3982305
SC-1	Commercial	C/D	0.6451417	0.8559065
SC-1	High Density Residential	C/D	0.30121	0.5575903
SC-1	Low Density Residential	C	0.0219124	0.1545933
SC-1	Low Density Residential	C/D	0.2105821	0.2876529
WC-1	Forest	A	0.0014495	0.4631507
WC-1	Industrial	A	0.2321076	0.1336623
WC-2	Forest	A		2.454715
WC-2	Forest	B		1.812664
WC-2	Forest	C		0.537423
WC-2	Forest	C/D		0.057141
WC-2	Forest	D		0.06274
WC-2	Low Density Residential	A	2.888938	7.511814
WC-2	Low Density Residential	B	0.357785	1.540912
WC-2	Low Density Residential	C	0.226338	0.71381

ATTACHMENT 3

BATT INPUT DATA SUMMARY

Attachment 3: BATT Input Data Summary									
BMP ID	**BMP Type**	**BMP Storage Capacity (ft^3)**	**Infiltration Rate (in/hr)**	**Total Subcatchment Area (acres)**	**Impervious Area (acres)**	**Impervious Area (%)**	**Pervious Area (acres)**	**Pervious Area (%)**	**Hydrologic Soil Groups**
BL-1	INFILTRATION BASIN	1,900	2.41	0.29	0.53	1.85	0.82	2.85	A
BL-2	INFILTRATION BASIN	10,000	0.52	1.33	0.26	0.20	1.07	0.80	A
CC-1	EXTENDED DRY DETENTION POND	32,400	N/A	3.07	0.62	0.20	2.45	0.80	C/D
FP-1	EXTENDED DRY DETENTION POND	20,000	N/A	0.16	0.13	0.81	0.29	1.81	B
FP-2	EXTENDED DRY DETENTION POND	10,000	N/A	0.07	0.81	11.90	0.88	12.90	B
LF-1	INFILTRATION BASIN	13,000	0.27	2.17	0.28	0.13	1.89	0.87	A & B & D
LF-2	INFILTRATION BASIN	5,900	0.52	0.32	2.05	6.40	2.37	7.40	A
LF-3	EXTENDED DRY DETENTION POND	31,600	N/A	4.85	2.22	0.46	2.63	0.54	A
PL-1	EXTENDED DRY DETENTION POND	10,000	N/A	1.53	1.40	0.92	0.13	0.08	C & C/D
RH-5	EXTENDED DRY DETENTION POND	23,000	N/A	2.09	0.50	0.24	1.59	0.76	A & C
RW-1	EXTENDED DRY DETENTION POND	3,800	N/A	2.26	0.92	0.41	1.34	0.59	A & C/D
RW-2	EXTENDED DRY DETENTION POND	22,300	N/A	7.44	1.00	0.13	6.45	0.87	A & B & C/D
RW-3	EXTENDED DRY DETENTION POND	106,000	N/A	6.20	1.02	0.17	5.18	0.83	B & C/D
SC-1	GRASS SWALE (CONVEYANCE)	100	N/A	3.63	1.38	0.38	2.25	0.62	C & C/D
WC-1	EXTENDED DRY DETENTION POND	41,700	N/A	0.83	0.23	0.28	0.60	0.72	A
WC-2	EXTENDED DRY DETENTION POND	22,000	N/A	18.16	3.47	0.19	14.69	0.81	A & B & C & C/D & D

ATTACHMENT 4

BATT OUTPUT DATA SUMMARY

Attachment 4: BATT Output Data Summary									
BMP ID	**Total Phosphorus Loading (lb/yr)**	**Total Nitrogen Loading (lb/yr)**	**Total Sediment Loading (lb/yr)**	**Phosphorus Removal Efficiency (%)**	**Nitrogen Removal Efficiency (%)**	**Total Sediment Removal Efficiency (%)**	**Phosphorus Load Reduction (lb/yr)**	**Nitrogen Load Reduction (lb/yr)**	**Total Sediment Load Reduction (lb/yr)**
BL-1	0.299	3.075	136.855	14.00	23.13	49.00	0.20	2.59	242.00
BL-2	0.504	3.513	194.676	14.00	23.13	49.00	0.04	0.56	32.61
CC-1	0.197	2.591	0.564	14.00	23.13	49.00	0.03	0.36	24.81
FP-1	0.041	0.041	0.564	62.60	78.23	84.23	0.30	3.07	136.85
FP-2	0.030	0.358	24.807	94.20	98.00	100.00	0.56	4.26	234.80
LF-1	0.793	7.213	285.920	14.00	23.13	49.00	0.49	5.99	717.90
LF-2	0.558	4.257	234.799	14.00	23.13	49.00	0.35	4.97	263.68
LF-3	0.487	5.991	717.902	0.83	0.39	4.96	0.01	0.04	13.78
PL-1	0.354	4.974	263.683	14.00	23.13	49.00	0.26	3.65	199.86
RH-5	0.080	0.035	13.781	14.00	23.13	49.00	0.40	5.05	370.55
RW-1	0.262	3.654	199.858	0.05	0.02	0.30	0.00	0.01	2.29
RW-2	0.402	5.055	370.548	14.00	23.13	49.00	0.07	0.88	50.37
RW-3	0.002	0.006	2.289	98.80	100.00	100.00	0.50	3.51	194.68
SC-1	0.013	0.075	41.411	91.50	98.00	99.00	0.79	7.21	285.92
WC-1	0.066	0.878	50.368	0.40	0.28	5.78	0.01	0.07	41.41
WC-2	0.901	11.400	917.198	12.75	17.23	46.75	0.89	10.85	914.32
						TOTAL	4.91	53.08	3725.82

Appendix D: Municipal Property Retrofit Memo

MUNICIPAL PROPERTY BMP RETROFITS

To: Heather Lemieux, Town Manager, Town of Lunenburg

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

Date: June 30, 2023

Subject: Municipal Property BMP Retrofits

Permit Requirements and Project Background

Under the Environmental Protection Agency's (EPA's) 2016 National Pollutant Discharge and Elimination System (NPDES) Municipal Separate Storm Sewer System (MS4) Permit, as amended (Permit), the Town of Lunenburg is required to complete an inventory and priority ranking of Town-owned properties (minimum of five properties) and existing stormwater infrastructure that could be retrofitted with stormwater Best Management Practices (BMPs) designed to reduce the frequency, volume and pollutant loads of stormwater discharges to its MS4 through the mitigation of impervious area. At a minimum, Lunenburg must consider municipal property with significant impervious area that could be mitigated, existing street right-of-ways, and open space and undeveloped land available to mitigate stormwater runoff from nearby areas (e.g. from a trunk line in the street).

The potential for retrofitting particular properties must consider, on a screening level and subject to availability, factors such as maintenance access; subsurface geology; depth to water table; site slope and elevation; and proximity to aquifers and subsurface infrastructure including sanitary sewers and septic systems. Sites must be priority ranked based on factors such as schedules for planned capital improvements to storm and sanitary sewer infrastructure and paving projects as available; current storm sewer level of service (if known); control of discharges to impaired or critical receiving waters; the complexity and cost of implementation; and opportunities for public use and education.

Additionally, the Town has waterbodies listed under the final Massachusetts Year 2018/2020 List of Impaired Waters (2018/2020 303d List[1]) as being subject to Total Maximum Daily Loads (TMDLs) and impaired waters requirements. Specifically, the Town is subject to phosphorus impaired waters requirements for discharges to the Nashua River. For this waterbody, the town must evaluate Town-owned properties within the watershed for opportunities to construct or retrofit BMPs. The evaluation must address the engineering and regulatory feasibility of the retrofit, estimated costs for BMP implementation, and the schedule for any planned infrastructure, resurfacing or redevelopment activity. Lunenburg must then design and construct a stormwater BMP as a public demonstration project targeting a catchment with high phosphorus load by the end of June 2024 (Permit Year 6).

Beginning with the fifth year MS4 annual report and in each subsequent annual report, Lunenburg must report on those permittee-owned properties and infrastructure inventoried that have been

[1] As of the date of this memorandum, the finalized 2016 303d List is the most recent List of Impaired Waters available.

retrofitted with BMPs to mitigate impervious area and associated water quality impacts. A minimum of five sites must be maintained in the retrofit inventory.

This memorandum outlines activities completed by Comprehensive Environmental Inc. (CEI) to assist the Town of Lunenburg with meeting the above Permit requirements, with a focus on potential retrofit opportunities on developed municipal parcels. Additionally, desktop analysis of open space and undeveloped land available to mitigate stormwater runoff was conducted.

Municipal Parcel Retrofits

Desktop and Field Analysis

The Town identified 30 Town-owned facilities located within the MS4 regulated area with impervious cover such as parking lots and rooftops as required by the permit which were advanced for additional desktop and field analysis. CEI first developed a series of parcel maps for each facility to be used for recording existing conditions and field notes. Parcel maps typically showed an aerial view of each facility, along with property lines, topography data, available drainage information, and other relevant information. Noah Parent and Nicole Haggerty of CEI conducted field assessments of all 30 facilities in fall 2021. The goal was to evaluate opportunities to reduce pollutant loads discharging to the MS4 or surface water bodies from the site through reduction or treatment of stormwater runoff from impervious surfaces. An additional 42 undeveloped municipally owned parcels within the MS4 regulated area were selected for desktop analysis.

One parcel associated with the Lunenburg Middle High School was identified as a good candidate for retrofit opportunities. Discussion with onsite facilities personnel indicated that existing onsite BMPs treat some stormwater runoff generated, however, locations and designs are unknown. CEI attempted to obtain as-built plans for the site and drainage infrastructure, however, were unsuccessful. This site should be further evaluated to determine additional BMP retrofit opportunities due to the extensive impervious cover onsite.

A map of the 30 facilities visited is provided as **Figure 1** at the end of this memorandum. A summary of the existing conditions for each site is included as **Table 1**, with proposed retrofit conditions provided as **Table 2** the end of this memorandum. An existing condition summary for each vacant site is included in **Table 3**.

Proposed BMP Selection

Proposed conceptual BMPs have been selected based largely on available space, soil types within the area, and proximity to wetland areas. For planning, pollutant removal, and cost estimating purposes, locations with larger areas available for implementation were assigned BMPs with larger footprints such as infiltration basins, extended detention basins, or constructed wetlands, whereas smaller areas were assigned to rain gardens, trenches, or swales. Implementation areas with soils classified primarily as HSG C or D were assigned non-infiltrating BMP types such as extended detention basins. Areas located in close proximity to wetlands are assumed to have relatively high groundwater, and thus were assigned BMP types such as constructed wetlands.

For the purposes of this initial screening effort, BMP selection focused on surface BMPs that could be installed in existing available spaces with little disturbance to existing paved surfaces, as a typical surface BMP is less expensive on a pounds of pollutant removed than a subsurface system installed below a parking lot or ball field. More expensive underground infiltration BMPs (e.g., subsurface infiltration) will be considered for proposed redevelopment projects where demolition, reconstruction and/or repaving are proposed to minimize the costs of installation. The use of subsurface infiltration BMPs would significantly increase treatment costs, as they can cost up to 4-10 times more than surface BMPs. Other BMPs that disturb pavement, including leaching catch basins and porous pavement, can likely be implemented at a wide variety of site, however, were not comprehensively assessed as part of this project will also be evaluated during redevelopment projects. Actual BMP types and sizes are expected to be refined as part of future designs.

BMP Unit Costs

Costs for BMP design and construction were estimated based on a memorandum from EPA titled "Methodology for developing cost estimates for Opti-Tool" (**Attachment A**). This memorandum built on multiple previous studies dating as far back as 2010 to estimate total implementation costs for multiple types of stormwater BMPs on a dollars per cubic foot of constructed volume in 2016 dollars, which also assumed that 35% of the construction cost would go towards engineering design and other contingencies. For the purposes of this memorandum, 2016 dollars were then converted to 2022 dollars by adding 18% to the total cost in order to account for inflation over the preceding six years.

Additionally, the Opti-Tool memorandum notes that cost adjustment factors may be incorporated to more accurately account for BMP site constraints associated with installation in a urban environments as follows:

- Undeveloped areas: 1.0;
- Partially developed areas: 1.5;
- Developed areas: 2.0; and
- Highly urban setting: 3.0.

Based on current development conditions, a cost adjustment factor of 1.5 was applied to all potential BMPs. Actual engineering costs depend on many factors, and engineering for larger projects generally consist of a lower total percent of the construction cost, with the inverse being true for smaller projects (e.g., a $250,000 construction project may have a $50,000 engineering cost or 20% of construction, whereas a $50,000 construction project may have a $25,000 engineering cost or 50% of construction). Costs outlined in this memorandum are for guidance and comparison purposes only, and future design phases will further refine costs associated with all BMPs. A summary of costing data is provided in **Table 4** at the end of this memorandum.

Pollutant Removal and Cost Summary

Based on calculations from the BATT calculator, implementation of the top five stormwater BMPs outlined in Table 2 will remove a total of 2.0 pounds of phosphorus per year for a total engineering and construction cost of approximately $452,800 at an average cost of $226,400 per pound of

phosphorus removed. Pre-conceptual designs for the top five sites have been prepared and are included as **Attachment B**. Implementation of all recommended BMPs will remove a total of 2.3 pounds of phosphorus for a total cost of approximately $546,700.

Roadway Improvement Projects

Roadway improvement projects such as pavement resurfacing, reclamation, and/or roadway widening serve as an opportunity for the Town to coordinate drainage improvements with roadway improvements. It also provides an opportunity to incorporate water quality BMPs, however, such opportunities are often restricted to areas located within, or immediately adjacent to, the roadway. Example roadway intersection improvements for Town to consideration are provided in **Attachment C**. Implementation of such BMPs requires evaluation on a case-by-case basis in consideration of the size of the ROW, soil type, surrounding drainage infrastructure and location of other utilities.

Recommendations and Next Steps

It is recommended that the Town move forward with design and construction of a public demonstration project targeting a catchment with high phosphorus load within the Nashua River watershed by the end of June 2024. **Table 1** below outlines the top recommended locations, all of which are located within the watershed. These locations were identified to be of high priority as they have good opportunities for retrofit, discharge to waterbodies with a nitrogen TMDL or impairment, and have good public education opportunities. Pre-conceptual designs for the sites have been prepared and are included as **Attachment B**.

Additionally, is recommended that the Town review as-built plans for the High School to determine additional locations and opportunities for BMP retrofits at this location due to the large amounts of impervious area. It is further recommended that the Town repair and stabilize the eroded areas downstream of the High School outfall, located just southeast of the football field and track, to reduce the amount of sediment entering natural waterbodies.

The Town should also consider investigating, and implementing where feasible, water quality treatment BMPs as part of drainage improvements during roadway improvement projects. The cost and amount of phosphorus removed from these systems will vary based on the size of the BMP and contributing drainage area.

Table 1 – Top Priority BMP Locations

Location		Proposed BMP(s)			TP Reduction	
Facility Name	**Address**	**Type**	**Estimated Size**	**Construction & Engineering**	**Lbs / Year**	**Dollars / Pound**
Lunenburg Public Library	1023 Mass. Avenue	Water Quality Swale	270' x 15' x 2' Deep	$288,400	0.6	$465,200
		Detention Basin	110' x 50' x 3' Deep			
Historical District Town Common	35 Lancaster Avenue	Infiltration Basin	70' x 30' x 4' Deep	$123,200	1.0	$124,500
		Catch Basin	4 Units			
Boys and Girls Club of Lunenburg	15 Memorial Drive	Rain Garden	20' x 15' x 2' Deep	$16,500	0.1	$235,800
Lunenburg Historical Society	10 School Streets.	Water Quality Swale	80' x 4' x 1' Deep	$24,700	0.3	$82,400
		Infiltration Basin	35' x 15' x 3' Deep			
Lunenburg Middle High School[2]	1079 Mass. Avenue	TBD	TBD	TBD	TBD	TBD

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.
Project Manager

Attachments:

- Table 1: Summary of Existing Conditions
- Table 2: Proposed Improvements
- Table 3: Summary of Undeveloped Site Existing Conditions
- Table 4: BMP Costing Information
- Figure 1: Municipal Properties Visited
- Attachment A: Memorandum report on Methodology for developing cost estimates for Opti-Tool; February 20, 2016
- Attachment B: Pre-Conceptual Designs for Top Locations

Attachment C: Example Roadway and Intersection BMP Improvements

[2] Onsite facilities personnel indicated that existing BMPs treat some stormwater runoff, however, locations and designs are unknown. This site should be further evaluated to determine additional BMP retrofit opportunities.

Table 1: Summary of Existing Conditions

Description	Address	CEI Map ID	Total Parcel Area (acres)	Impervious Area (acres)	Existing Conditions Description	Watershed	Direct or Near-Direct Discharge	BMPs Present?	Soil Type	Hydric Soil Group	Soil Area (acres)
Lunenburg Public Library	1023 Mass Ave	L1	1.49	0.30	The Lunenburg Public Library is a large multi-storey building with a large parking area. A single catch basin exists in the parking lot, directing water to an existing BMP. A rough drainage swale exists north of the building, flowing west to east. Water enters a low lying grassed area with overflow structure near the main Middle-High School entrance.	Mulpus Brook-Nashua River	No	Yes (Detention Basin)	Paxton-Urban land complex	C	0.15
									Woodbridge fine sandy loam	C/D	1.63
Historical District Town Common	35 Lancaster Ave	P2	0.50	0.01	Small grassed common between Lancaster Avenue, Whiting Street and Leominster Road. A small garden area exists on the northern portion of the common and a small gazebo exists in the center. Multiple large trees exist throughout the common.	Mulpus Brook-Nashua River	No	No	Paxton fine sandy loam	C	0.51
Boys and Girls Club of Lunenburg	15 Memorial Dr	S7	0.34	0.50	A Boys and Girls Club building with two medium sized parking areas. Basketball court present west of the building. Two catch basins present in southern parking area.	Mulpus Brook-Nashua River	No	No	Paxton fine sandy loam	C	0.26
									Woodbridge fine sandy loam	C/D	0.58
Lunenburg Historical Society	10 School St	T2	0.44	0.11	The Lunenburg Historical Society building with oversized parking area (located on Map ID T2), off of school street. A small grassed island exists in between the parking area and School Street.	Mulpus Brook-Nashua River	No	No	Paxton fine sandy loam	C	0.55
Lunenburg Middle High School	1079 Mass Ave	S1, S2, S6	35.22	16.67	Recommend installing rain gardens throughout grass areas to treat runoff prior to entering drainage system. Recommend repairing areas of erosion downstream of school outfall.	Mulpus Brook-Nashua River	No	No	Chatfield-Hollis-Rock outcrop complex	B	0.95
									Paxton fine sandy loam	C	1.85
									Paxton-Urban land complex	C	15.03
									Woodbridge fine sandy loam	C/D	29.44
									Ridgebury fine sandy loam	D	4.63
Low-Income Housing Complex	131 White St	H1	4.48	1.48	Housing development community with multiple units and paved parking areas. Multiple catch basins exist throughout.	Sand Brook-North Nashua River	No	No	Hinckley loamy sand	A	4.23
									Ridgebury fine sandy loam, extremely stony	D	1.73
Brian McNally Park	10 Lesure Ave	P3	2.26	0.10	Park with baseball field, small paved/gravel parking area, picnic area and medium sized wooded area.	Sand Brook-North Nashua River		No	Paxton-Urban land complex	C	0.70
									Woodbridge fine sandy loam	C/D	1.57
									Ridgebury fine sandy loam	D	0.10
Lunenburg Police Department	655 Mass Ave	PD1	2.69	2.01	Police station with multiple existing BMPs.	N/A	N/A	Yes (Detention Basins)	Udorthents, smoothed	N/A	1.17
									Chatfield-Hollis-Rock outcrop complex	B	2.35
									Woodbridge fine sandy loam, very stony	C/D	0.96
									Whitman fine sandy loam, extremely stony	D	0.23
Lunenburg Primary School	1401 Mass Ave	S3	12.04	4.29	Primary School with multiple existing BMPS.	N/A	N/A	Yes (Dentention Basins)	Paxton fine sandy loam	C	1.38
									Woodbridge fine sandy loam, very stony	C/D	1.32
									Woodbridge fine sandy loam	C/D	13.52
									Ridgebury fine sandy loam	D	0.11
Town Beach	265 Prospect St	B1	0.03	0.16	Thin beach area between Prospect Street and Lake Whalom. Multiple catch basins observed on Prospect Street.	N/A	N/A	No	Paxton fine sandy loam	C	0.18
									Woodbridge fine sandy loam	C/D	0.01
North Cemeterie	50 Holman St	C1	20.69	1.66	Town cemetery.	N/A	N/A	No	Hinckley loamy sand	A	0.60
									Windsor loamy sand	A	9.86
									Scarboro mucky fine sandy loam	A/D	1.90
									Chatfield-Hollis-Rock outcrop complex	B	9.55
									Swansea muck	B/D	0.45
Cemetery	60 Page St	C2	4.55	1.48	Town cemetery.	N/A	N/A	No	Quonset loamy sand	A	6.03
Highway Department	520 Chase Rd	D1	3.09	3.57	Large maintenance building, parking area and areas for equipment and material storage. Wooded area abuts Chase Road. Mulpus Brook flows south to north through the western portion of the parcel.	N/A	N/A	No	Urban land	N/A	3.05
									Hinckley loamy sand	A	0.35
									Scarboro mucky fine sandy loam	A/D	1.31
									Woodbridge fine sandy loam, very stony	C/D	1.78
									Woodbridge fine sandy loam	C/D	0.03
									Ridgebury fine sandy loam	D	0.13
Pump Station	500 Leominster-Shirley Rd	D2	17.49	0.00	Large wooded parcel with wetland area. Pump station and associated gravel area exist near Leominster Shirley Road.	N/A	N/A	No	Pits, gravel	N/A	4.92
									Scarboro mucky fine sandy loam	A/D	5.46
									Freetown muck	B/D	7.12
Ritter Memorial Library	960 Mass Ave	L2	0.47	0.61	Library and business building between School Street, Mass Avenue and Lancaster Avenue. Parking areas east and west of building with connecting paved road south of the building. Grassed area north of the building.	N/A	N/A	No	Paxton fine sandy loam	C	1.09
									Water	N/A	3.11

Description	Address	CEI Map ID	Total Parcel Area (acres)	Impervious Area (acres)	Existing Conditions Description	Watershed	Direct or Near-Direct Discharge	BMPs Present?	Soil Type	Hydric Soil Group	Soil Area (acres)
Marshall Park and Pond	100 Chestnut St	P1	25.16	2.64	Large park with two baseball fields, a softball field, parking areas, wooded areas and pond.	N/A	N/A	No	Scarboro mucky fine sandy loam	A/D	0.40
									Chatfield-Hollis-Rock outcrop complex	B	17.97
									Paxton fine sandy loam	C	1.04
									Woodbridge fine sandy loam	C/D	0.54
									Ridgebury fine sandy loam	D	3.28
									Whitman fine sandy loam, extremely stony	D	1.45
Veterans Memmorial Park	999 Mass Ave	P4	0.29	0.01	Thin parcel between Memorial Drive and Mass Avenue. Multiple veteran memorials.	N/A	N/A	No	Woodbridge fine sandy loam	C/D	0.30
Cowdrey Conservation Area	1625 Mass Ave	P5	312.72	0.37	Very Large conservation area with large amounts of wetlands. Mulpus Brook flows through parcel.	N/A	N/A	No	Pits, gravel	N/A	8.84
									Water	N/A	4.91
									Deerfield loamy fine sand	A	30.96
									Quonset loamy sand	A	111.38
									Chatfield-Hollis-Rock outcrop complex	B	2.94
									Freetown muck	B/D	79.34
									Paxton fine sandy loam	C	38.86
									Woodbridge fine sandy loam	C/D	14.47
									Whitman fine sandy loam	D	21.39
Laurel Bank Conservation Area	120 Pleasant St	P6	66.92	0.91	Conservation land made up of mostly wooded areas, wetlands and ponds. Elevation varies throughout.	N/A	N/A	No	Udorthents, smoothed	N/A	0.25
									Water	N/A	1.51
									Hinckley loamy sand	A	51.78
									Freetown muck	B/D	2.05
									Swansea muck	B/D	1.80
									Paxton fine sandy loam, extremely stony	C	4.74
									Paxton fine sandy loam	C	0.09
									Woodbridge fine sandy loam	C/D	5.61
Clarks Hill	301 Lancaster Ave	P7	17.43	0.00	Large wooded parcel with very steep slope off of Lancaster Avenue.	N/A	N/A	No	Paxton fine sandy loam	C	3.22
									Woodbridge fine sandy loam	C/D	14.21
Ben Normand Park	702 Reservoir Rd	P8	4.05	0.07	Roadside park with a softball and baseball field. Very little impervious area exists. Adjacent Reservoir Road is fairly flat with no drainage structures.	N/A	N/A	No	Quonset loamy sand	A	2.70
									Scarboro mucky fine sandy loam	A/D	1.42
Wallis Park	10 Wallis Park	P9	1.45	0.67	Park with two basketball courts, playground and large wooded area. Parcel is relatively flat with little to no room for a BMP.	N/A	N/A	No	Paxton-Urban land complex	C	2.12
Lake Access Area	75 Lakefront Ave	PL1	0.11	0.58	A long thin strip of land between Lake Front Avenue and Lake Whalom. Area is mostly paved with rock wall abutting lake. Small grassed islands exist throughout.	N/A	N/A	No	Water	N/A	0.04
									Paxton-Urban land complex	C	0.65
Eagle House Senior Center	25 Memorial Dr	S5	1.21	0.59	Senior center building and associated parking area. Multiple catch basins exist on and around the parcel. A game area and playground for the neighboring school exists on the parcel.	N/A	N/A	No	Woodbridge fine sandy loam	C/D	1.79
Town Hall	17 Main St	T1	0.03	0.11	Town Hall building takes up the vast majority of space on the parcel. Very limited pervious area.	N/A	N/A	No	Paxton fine sandy loam	C	0.15
Old School Building	30 School St	T3	1.61	0.82	Old Primary School building and associated parking areas located at the end of School Street.	N/A	N/A	No	Paxton fine sandy loam	C	2.44
Lunenburg Community Pollinator Habitat	123 Hollis Rd	T4	34.11	0.07	Nature and wildlife area with single family residence. Mostly wooded with a noticeable decrease in elevation from west to east.	N/A	N/A	No	Chatfield-Hollis-Rock outcrop complex	B	17.33
									Woodbridge fine sandy loam, very stony	C/D	13.05
									Ridgebury fine sandy loam, extremely stony	D	3.80
Lunenburg Water Department	50 Leasure Ave	WD1	0.62	0.24	Small Water Department building and paved parking area. Pavement in poor condition. Multiple drainage structures on Water Street.	N/A	N/A	No	Paxton-Urban land complex	C	0.09
									Ridgebury fine sandy loam	D	0.78
Water Tower	9 Chase Rd	WD2	0.73	0.26	Water tower on wooded parcel, surrounded by wooded areas. Could not locate access road to investigate further.	N/A	N/A	No	Chatfield-Hollis-Rock outcrop complex	B	0.99
Water Tower	314 Sunny Hill Rd	WD3	0.55	0.16	Water tower off of Sunnyhill Road. Paved access road and small parking area. Multiple catch basins observed east of the water tower.	N/A	N/A	No	Paxton fine sandy loam	C	0.71

1. All soils data obtained from GIS sources.

Table 2: Proposed Improvements

Description	Address	CEI Map ID	Recommendations and Conclusions	Area For Treatment		Pollutant Loading[1]			Proposed BMP(s)		Pollutant Reduction Estimates[2]			BMP Implementation Costs[3]				Dollars per Pound of Removal		
				Total (acres)	Impervious (acres)	Impervious Area TP Load (lbs/yr)	Impervious Area TN Load (lbs/yr)	Impervious Area TSS Load (lbs/yr)	Proposed BMP(s)	Estimated Size	TP Reduction (lbs/yr)	TN Reduction (lbs/yr)	TSS Reduction (lbs/yr)	Unit Construction Cost per SF, CF or LF	Estimated Construction Cost	Estimated Engineering Cost	Total BMP Cost (Design & Construction)	TP Reduction ($$/lb)	TN Reduction ($$/lb)	TSS Reduction ($$/lb)
Lunenburg Public Library	1023 Mass Ave	L1	Recommend the enhancement of the drainage swale north of the library, creating a more defined and armored swale. Asphalt curbing with curb cuts should be added along the south side of the Elementary School driveway. Riprap swales will transport water from the roadway to the main swale. Grassed basin should be dug out to allow for additional storage.	1.68	1.16	1.55	11.80	1716.95	Water Quality Swale	270' x 15' x 2' Deep	0.6	3.6	1,717	$8.18	$66,300	$23,300	$288,400	$465,200	$80,800	$170
									Detention Basin	110' x 50' x 3' Deep				$8.92	$147,200	$51,600				
Historical District Town Common	35 Lancaster Ave	P2	Recommend the installation of a rain garden or infiltration basin on the south western corner of the common. Catch basin(s) installed along the eastern edge of Leominster Road will transport runoff to the rain garden. An overflow structure will allow water to flow into an existing catch basin on Leominster Road during high flow events.	1.17	0.75	1.01	7.63	1110.10	Infiltration Basin	70' x 30' x 4' Deep	1.0	7.6	1,110	$8.18	$68,800	$24,100	$123,200	$124,500	$16,200	$120
									Catch Basin	4 Units				$5,600	$22,400	$7,900				
Boys and Girls Club of Lunenburg	15 Memorial Dr	S7	Recommend the replacement of the catch basin located in the northeastern corner of the southern parking area with a manhole. Install curb cut and riprap swale to small rain garden in the grassed area west of the building. Rain garden overflow structure will connect to new manhole and follow existing drainage to the street.	0.09	0.08	0.11	0.81	118.41	Rain Garden	20' x 15' x 2' Deep	0.1	0.3	118	$20.27	$12,200	$4,300	$16,500	$235,800	$48,600	$200
Lunenburg Historical Society	10 School St	T2	Recommend the pave and regrade of the parking area to promote positive drainage to the proposed infiltration basin, north of the building. The installation of a catch basin will allow water to enter the basin. A swale northwest of the building will transport any runoff from the paved driveway and building to the BMP.	0.27	0.24	0.32	2.44	355.23	Water Quality Swale	80' x 4' x 1' Deep	0.3	2.3	332	$16.38	$5,300	$1,900	$24,700	$82,400	$10,900	$100
									Infiltration Basin	35' x 15' x 3' Deep				$8.18	$12,900	$4,600				
Lunenburg Middle High School	1079 Mass Ave	S1, S2, S6	Recommend the installation of rain gardens throughout grassed areas where feasible in order to treat runoff prior to entering drainage system. Recommend repairing erosion downstream of school outfall.	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Low-Income Housing Complex	131 White Street	H1	Recommend the addition of a swale along the western edge of the western most parking area to capture and treat sheet flow.	0.21	0.21	0.28	2.14	310.83	Water Quality Swale	100' x 10' x 1' Deep	0.1	0.4	262	$16.38	$16,400	$5,800	$22,200	$317,200	$63,500	$100.00
Brian McNally Park	10 Lesure Ave	P3	Recommend a repave of existing parking lot, possible use porous pavement for additional infiltration.	0.27	0.25	0.34	2.54	370.03	Porous Pavement	7600 SF	0.2	1.9	340	$6.98	$53,100	$18,600	$71,700	$341,500	$37,200	$300.00
Lunenburg Police Department	655 Mass Ave	PD1	Recommend keeping up with BMP maintenance.	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Lunenburg Primary School	1401 Mass Ave	S3	Recommend keeping up with BMP maintenance.	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Town Beach	265 Prospect St	B1	No Recommendations	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
North Cemeterie	50 Holman St	C1	No Recommendations	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Cemetery	60 Page St	C2	No Recommendations	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Highway Department	520 Chase Rd	D1	No Recommendations	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Pump Station	500 Leominster-Shirley Rd	D2	No Recommendations	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Ritter Memorial Library	960 Mass Ave	L2	No Recommendations	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Marshall Park and Pond	100 Chestnut St	P1	No Recommendations	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Veterans Memmorial Park	999 Mass Ave	P4	No Recommendations	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Cowdrey Conservation Area	1625 Mass Ave	P5	No Recommendations	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Laurel Bank Conservation Area	120 Pleasant St	P6	No Recommendations	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Clarks Hill	301 Lancaster Ave	P7	No Recommendations	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Ben Normand Park	702 Reservoir Rd	P8	No Recommendations	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Wallis Park	10 Wallis Park	P9	No Recommendations	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Lake Access Area	75 Lakefront Ave	PL1	No Recommendations	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Eagle House Senior Center	25 Memorial Dr	S5	No Recommendations	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Town Hall	17 Main St	T1	No Recommendations	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Old School Building	30 School St	T3	No Recommendations	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Lunenburg Community Pollinator Habitat	123 Hollis Rd	T4	No Recommendations	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Lunenburg Water Department	50 Leasure Ave	WD1	No Recommendations	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Water Tower	9 Chase Rd	WD2	No Recommendations	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Water Tower	314 Sunny Hill Rd	WD3	No Recommendations	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
										Total	**2.3**	**16.1**	**3,880**	-	**$404,600**	**$142,100**	**$546,700**	**$179,100**	**$8,900**	**$200**

1. Pollutant loading calculated for impervious areas only using the land use loading rates provided in the BATT calculator for "Highway". Rates are as follows, in pounds per acre per year: 1.34 pounds of Total Phosphorus; 10.17 pounds of Total Nitrogen; 1,480.13 pounds of Total Suspended Solids
2. Pollutant reduction estimates calculated through EPA's BATT calculator
3. Information on BMP costing is attached as Attachment A.

Table 3: Summary of Undeveloped Site Existing Conditions

Parcel ID	Address	Total Parcel Size (acres)	Total Impervious Area (acres)	Existing Conditions Description	Drainage Network	Catchment Area (Acres)	Impervious Area in Catchment (acres)	DCIA in Catchment (acres)	Distance from Drainage Network (ft)	Drainage Network Intersect Type	Municipal Properties in Catchment	Existing BMPs in Catchment	Impaired Watershed	Distance to Receiving Water (ft)	Within 50' of Water?	Slope Class	Can a BMP Be Built Here?*
162/013.0-0002-0000.0	842 REAR CHASE RD	280.4	0.2	Parcel is within 50' of a waterbody and generally flat, with no nearby drainage networks. Parcel is mostly pervious, with 0.2 acres of impervious area.						None			Nashua River		Yes	0-12.5%	No
162/024.0-0143-0000.0	204 SOUTH ROW RD	0.3	0.0	Parcel is generally flat with no nearby drainage networks. Parcel is mostly pervious.						None			Nashua River		No	0-12.5%	No
162/028.0-0009-0000.0	510 TOWNSEND HARBOR RD	43.0	0.0	Parcel is within 50' of a waterbody and generally flat, with no nearby drainage networks. Parcel is mostly pervious.						None			Nashua River		Yes	0-12.5%	No
162/029.0-0067-0000.0	11 SANDY COVE RD	0.3	0.0	Parcel is generally flat with no nearby drainage networks. Parcel is mostly pervious.						None			Nashua River		No	0-12.5%	No
162/029.0-0092-0000.0	485 TOWNSEND HARBOR RD	0.3	0.0	Parcel is generally flat with no nearby drainage networks. Parcel is mostly pervious.						None			Nashua River		No	0-12.5%	No
162/044.0-0001-0000.0	255 MULPUS RD	252.5	0.0	Parcel is within 50' of a waterbody and generally flat, with no nearby drainage networks. Parcel is mostly pervious.						Outfall			Nashua River		Yes	0-12.5%	No
162/045.0-0001-0000.0	415 REAR MULPUS RD	65.7	0	Parcel is generally flat with no nearby drainage networks. Parcel is mostly pervious.						None			Nashua River		No	0-12.5%	No
162/045.0-0002-0000.0	103 PAR B HUNTING HILL RD	47.3	0.0	Parcel is generally flat with no nearby drainage networks. Parcel is mostly pervious.						None			Nashua River		No	0-12.5%	No
162/050.0-0010-0000.0	1249 REAR MASS AVE	6.1	0	Parcel is generally flat with no nearby drainage networks. Parcel is mostly pervious.						None			Nashua River		No	0-12.5%	No
162/051.0-0026-0000.0	52 HOLMAN ST	23.1	0	Parcel is within 50' of a waterbody and is generally flat, with the OF-1025 drainage network located 15' away. Additionally, a municipal property is located within the drainage catchment. Parcel is mostly pervious.	OF-1025	13.7	1.1	0.0	15	Outfall	x		Nashua River	204	Yes	0-12.5%	No
162/063.0-0007-0000.0	1625 MASS AVE	313.1	0	Parcel is within 50' of a waterbody and is generally flat, with the OF-678 drainage network located 15' away. Additionally, a municipal property is located within the drainage catchment. Parcel is mostly pervious.	OF-678	14.2	3.1	0.1	15	Outfall	x		Nashua River	37	Yes	0-12.5%	No
162/068.0-0010-0000.0	110 ELMWOOD RD	24.1	0	Parcel is within 50' of a waterbody and is generally flat, with a possible intersection with the OF-652 drainage network located 15' away. Parcel is mostly pervious.	OF-652	3.1	0.8	0.0	15	Network Intersect			Nashua River	1007	Yes	0-12.5%	No
162/072.0-0003-0000.0	63 SUNNY HILL RD	0.5	0	Parcel is within 50' of a water body, is generally flat, with a possible intersection with the OF-451 drainage network located 50' away. Parcel is mostly pervious.	OF-451	0.9	0.1	0.0	50	Network Intersect			Nashua River	7	Yes	0-12.5%	No
162/073.0-0016-0000.0	145 HOLLIS RD	12.5	0.0	Pacel is generally flat with no nearby drainage networks. Parcel is mostly pervious.						None			Nashua River		No	0-12.5%	No
162/078.0-0004-0000.0	171 REAR HOLLIS RD	14.4	0	Pacel is generally flat with no nearby drainage networks. Parcel is mostly pervious.						None			Nashua River		No	0-12.5%	No
162/078.0-0037-0000.0	8 RANGELEY RD	0.5	0	Parcel is generally flat, with a possible intersection with the OF-1074 drainage network located 15' away. Parcel is mostly pervious.	OF-1074	11.0	2.4	0.1	15	Network Intersect			Nashua River	1848	No	0-12.5%	Yes
162/078.0-0040-0000.0	14 CLIFTON RD	0.9	0	Pacel is generally flat with no nearby drainage networks. Parcel is mostly pervious.						None			Nashua River		No	0-12.5%	No
162/078.0-0064-0000.0	159 ELECTRIC AVE	0.4	0	Pacel is generally flat with no nearby drainage networks. Parcel is mostly pervious.						None			Nashua River		No	0-12.5%	No
162/080.0-0034-0000.0	177 LEOMINSTER RD	0.4	0.0	Pacel is generally flat with no nearby drainage networks. Parcel is mostly pervious.						None			Nashua River		No	0-12.5%	No
162/080.0-0044-0000.0	257 LEOMINSTER RD	0.2	0.0	Parcel is within 50' of a waterbody and generally flat, with no nearby drainage networks. Parcel is mostly pervious.						None			Nashua River		Yes	0-12.5%	No
162/088.0-0031-0000.0	374 PAGE ST	8.1	0.0	Pacel is generally flat with no nearby drainage networks. Parcel is mostly pervious.						None			Nashua River		No	0-12.5%	No
162/089.0-0008-0000.0	195 PAGE ST	29.3	0	Parcel is within 50' of a waterbody and generally flat, with no nearby drainage networks. Parcel is mostly pervious.						None			Nashua River		Yes	0-12.5%	No

Parcel ID	Address	Total Parcel Size (acres)	Total Impervious Area (acres)	Existing Conditions Description	Drainage Network	Catchment Area (Acres)	Impervious Area in Catchment (acres)	DCIA in Catchment (acres)	Distance from Drainage Network (ft)	Drainage Network Intersect Type	Municipal Properties in Catchment	Existing BMPs in Catchment	Impaired Watershed	Distance to Receiving Water (ft)	Within 50' of Water?	Slope Class	Can a BMP Be Built Here?*
162/089.0-0010-0000.0	380 ARBOR ST	11.4	0	Parcel is within 50' of a waterbody and is generally flat, with a possible intersection with the OF-505 drainage network located 15' away. Parcel is mostly pervious.	OF-505	23.0	2.2	0.1	15	Network Intersect			Nashua River	170	Yes	0-12.5%	No
162/094.0-0008-0000.0	671 WEST ST	66.6	0	Parcel is within 50' of a waterbody and is generally flat, with the OF-1071 drainage network located 15' away. Parcel is mostly pervious.	OF-1071	29.7	4.0	0.1	15	Outfall			Nashua River	1274	Yes	0-12.5%	No
162/094.0-0008-0000.0	671 WEST ST	66.6	0	Parcel is within 50' of a waterbody and is generally flat, with the OF-1162 drainage network located 15' away. Parcel is mostly pervious.	OF-1162	8.0	2.3	0.1	15	Outfall			Nashua River	643	Yes	0-12.5%	No
162/094.0-0008-0000.0	671 WEST ST	66.6	0	Parcel is within 50' of a waterbody and is generally flat, with the OF-1072 drainage network located 15' away. Parcel is mostly pervious.	OF-1072	6.9	1.7	0.1	15	Outfall			Nashua River	43	Yes	0-12.5%	No
162/094.0-0008-0000.0	671 WEST ST	66.6	0	Parcel is within 50' of a waterbody and is generally flat, with the OF-731 drainage network located 15' away. Parcel is mostly pervious.	OF-731	3.1	0.8	0.0	15	Outfall			Nashua River	369	Yes	0-12.5%	No
162/094.0-0026-0000.0	225 PLEASANT ST	41.0	0	Parcel is within 50' of a waterbody and is generally flat, with the OF-639 drainage network located 15' away. Parcel is mostly pervious.	OF-639	9.4	1.7	0.1	15	Outfall			Nashua River	1251	Yes	0-12.5%	No
162/097.0-0028-0000.0	30 RENNIE ST	2.0	0.0	Pacel is generally flat with no nearby drainage networks. Parcel is mostly pervious.						None			Nashua River		No	0-12.5%	No
162/098.0-0004-0000.0	415 WHALOM RD	0.2	0	Parcel is generally flat, with a possible intersection with the OF-741 drainage network located 50' away. Additionally, a municipal property is located within the drainage catchment. Parcel is mostly pervious.	OF-741	32.6	16.5	1.2	50	Network Intersect	x		Nashua River	292	No	0-12.5%	Yes
162/098.0-0008-0000.0	431 WHALOM RD	0.4	0	Parcel is generally flat, with the OF-748 drainage network located 15' away. Parcel is mostly pervious.	OF-748	0.7	0.2	0.0	15	Outfall			Nashua River	621	No	0-12.5%	Yes
162/098.0-0128-0000.0	54 NATICK ST	0.2	0	Parcel is generally flat, with a possible intersection with the OF-730 drainage network located 15' away. Parcel is mostly pervious.	OF-730	3.2	1.1	0.1	15	Network Intersect			Nashua River	210	No	0-12.5%	Yes
162/098.0-0128-0000.0	54 NATICK ST	0.2	0	Parcel is generally flat, with a possible intersection with the OF-731 drainage network located 15' away. Parcel is mostly pervious.	OF-731	3.1	0.8	0.0	15	Network Intersect			Nashua River	369	No	0-12.5%	Yes
162/107.0-0021-0000.0	470 BURRAGE ST	67.5	0	Parcel is within 50' of a waterbody and is generally flat, with the OF-525 drainage network located 15' away. Parcel is mostly pervious.	OF-525	12.0	1.2	0.0	15	Outfall			Nashua River	1388	Yes	0-12.5%	No
162/107.0-0021-0000.0	470 BURRAGE ST	67.5	0	Parcel is within 50' of a waterbody and is generally flat, with the OF-524 drainage network located 15' away. Parcel is mostly pervious.	OF-524	8.6	1.3	0.0	15	Outfall			Nashua River	1428	Yes	0-12.5%	No
162/107.0-0021-0000.0	470 BURRAGE ST	67.5	0	Parcel is within 50' of a waterbody and is generally flat, with the OF-491 drainage network located 15' away. Parcel is mostly pervious.	OF-491	3.3	0.4	0.0	15	Outfall			Nashua River	1577	Yes	0-12.5%	No
162/107.0-0021-0000.0	470 BURRAGE ST	67.5	0	Parcel is within 50' of a waterbody and is generally flat, with the OF-570 drainage network located 15' away. Parcel is mostly pervious.	OF-570	2.9	0.7	0.0	15	Outfall			Nashua River	416	Yes	0-12.5%	No
162/107.0-0021-0000.0	470 BURRAGE ST	67.5	0	Parcel is within 50' of a waterbody and is generally flat, with the OF-573 drainage network located 15' away. Parcel is mostly pervious.	OF-573	2.0	0.7	0.0	15	Outfall			Nashua River	898	Yes	0-12.5%	No
162/107.0-0021-0000.0	470 BURRAGE ST	67.5	0	Parcel is within 50' of a waterbody and is generally flat, with the OF-574 drainage network located 15' away. Parcel is mostly pervious.	OF-574	1.9	0.3	0.0	15	Outfall			Nashua River	417	Yes	0-12.5%	No
162/107.0-0021-0000.0	470 BURRAGE ST	67.5	0	Parcel is within 50' of a waterbody and is generally flat, with the OF-575 drainage network located 15' away. Parcel is mostly pervious.	OF-575	1.9	0.7	0.0	15	Outfall			Nashua River	416	Yes	0-12.5%	No
162/108.0-0041-0000.0	1000 REAR FLAT HILL RD	1.3	0	Parcel is within 50' of a waterbody and generally flat, with no nearby drainage networks. Parcel is mostly pervious.						None			Nashua River		Yes	0-12.5%	No
162/109.0-0018-0000.0	339 RESERVOIR RD	0.4	0.1	Pacel is generally flat with no nearby drainage networks. Parcel is mostly pervious, with 0.1 acres of impervious area.						None			Nashua River		No	0-12.5%	No

Parcel ID	Address	Total Parcel Size (acres)	Total Impervious Area (acres)	Existing Conditions Description	Drainage Network	Catchment Area (Acres)	Impervious Area in Catchment (acres)	DCIA in Catchment (acres)	Distance from Drainage Network (ft)	Drainage Network Intersect Type	Municipal Properties in Catchment	Existing BMPs in Catchment	Impaired Watershed	Distance to Receiving Water (ft)	Within 50' of Water?	Slope Class	Can a BMP Be Built Here?*
162/112.0-0040-0000.0	40 LAKEVIEW AVE	0.3	0	Parcel is within 50' of a waterbody and has steep slopes, with a possible intersection with the OF-729 drainage network located 15' away. Parcel is mostly pervious.	OF-729	1.5	0.4	0.0	15	Network Intersect			Nashua River	45	Yes	12.5-25%	No
162/115.0-0016-0000.0	27 YOUNGS RD	41.8	0	Parcel is within 50' of a waterbody and is generally flat, with the OF-743 drainage network located 15' away. Parcel is mostly pervious.	OF-743	13.8	2.6	0.1	15	Outfall			Nashua River	53	Yes	0-12.5%	No
162/123.0-0008-0000.0	103 ROBBS HILL RD	61.8	0.0	Parcel is within 50' of a waterbody and generally flat, with no nearby drainage networks. Parcel is mostly pervious.						None			Nashua River		Yes	0-12.5%	No
162/126.0-0062-0000.0	0 LAKE SHIRLEY RESERVOIR	358.6	0	Parcel is within 50' of a waterbody and is generally flat, with the OF-37 drainage network located 30' away. Parcel is mostly pervious.	OF-37	21.4	1.2	0.0	30	Outfall			Nashua River	42	Yes	0-12.5%	No
162/126.0-0062-0000.0	0 LAKE SHIRLEY RESERVOIR	358.6	0	Parcel is within 50' of a waterbody and is generally flat, with the OF-413 drainage network located 15' away. Parcel is mostly pervious.	OF-413	6.6	1.6	0.1	15	Outfall			Nashua River	17	Yes	0-12.5%	No
162/126.0-0062-0000.0	0 LAKE SHIRLEY RESERVOIR	358.6	0	Parcel is within 50' of a waterbody and is generally flat, with the OF-35 drainage network located 30' away. Parcel is mostly pervious.	OF-35	5.5	0.6	0.0	30	Outfall			Nashua River	84	Yes	0-12.5%	No
162/126.0-0062-0000.0	0 LAKE SHIRLEY RESERVOIR	358.6	0	Parcel is within 50' of a waterbody and is generally flat, with the OF-36 drainage network located 15' away. Parcel is mostly pervious.	OF-36	3.5	0.9	0.0	15	Outfall			Nashua River	0	Yes	0-12.5%	No
162/126.0-0062-0000.0	0 LAKE SHIRLEY RESERVOIR	358.6	0	Parcel is within 50' of a waterbody and is generally flat, with the OF-604 drainage network located 15' away. Parcel is mostly pervious.	OF-604	1.3	1.1	0.1	15	Outfall			Nashua River	17	Yes	0-12.5%	No
162/126.0-0062-0000.0	0 LAKE SHIRLEY RESERVOIR	358.6	0	Parcel is within 50' of a waterbody and is generally flat, with the OF-592 drainage network located 15' away. Parcel is mostly pervious.	OF-592	0.6	0.2	0.0	15	Outfall			Nashua River	22	Yes	0-12.5%	No
162/126.0-0062-0000.0	0 LAKE SHIRLEY RESERVOIR	358.6	0	Parcel is within 50' of a waterbody and is generally flat, with the OF-569 drainage network located 15' away. Parcel is mostly pervious.	OF-569	0.2	0.1	0.0	15	Outfall			Nashua River	72	Yes	0-12.5%	No
162/134.0-0016-0000.0	0 FLYNN RD	0.0	0.0	Parcel is within 50' of a waterbody and generally flat, with no nearby drainage networks. Parcel is mostly pervious.						None			Nashua River		Yes	0-12.5%	No
162/134.0-0018-0000.0	0 LAKE SHIRLEY RESERVOIR	0.3	0.1	Parcel is within 50' of a waterbody and generally flat, with no nearby drainage networks. Parcel is mostly pervious, with 0.1 acre of impervious area.						None			Nashua River		Yes	0-12.5%	No
162/134.0-0024-0000.0	0 FLYNN RD	0.5	0.0	Pacel is generally flat with no nearby drainage networks. Parcel is mostly pervious.						None			Nashua River		No	0-12.5%	No
162/135.0-0019-0000.0	25 FIRE RD 19	1.0	0.0	Parcel is within 50' of a waterbody and generally flat, with no nearby drainage networks. Parcel is mostly pervious.						None			Nashua River		Yes	0-12.5%	No
162/136.0-0006-0000.0	51 PARMENTER RD	0.3	0	Parcel is within 50' of a waterbody and has steep slopes, with the OF-35 drainage network located 15' away. Parcel is mostly pervious.	OF-35	5.5	0.6	0.0	15	Outfall			Nashua River	84	Yes	12.5-25%	No
162/137.0-0012-0000.0	0 LAKE SHIRLEY RESERVOIR	3.3	0.4	Parcel is within 50' of a waterbody and generally flat, with no nearby drainage networks. Parcel is mostly pervious, with 0.4 acres of impervious area.						None			Nashua River		Yes	0-12.5%	No

Table 4 - BMP Costing Information

Stormwater BMP Type	Unit	OptiTool BMP Estimates, 2016[1,2]	OptiTool BMP Estimates, 2022[3]	Adjusted BMP Estimate, 2022[4]	Adjusted Construction Estimate[4]	Adjusted Engineering/ Contingency Estimate[5]
Biorentention / Rain Garden	per CF	$15.46	$18.24	$27.36	$20.27	$7.09
Constructed Wetlands	per CF	$6.80	$8.02	$12.04	$8.92	$3.12
Dry Detention Basin	per CF	$6.80	$8.02	$12.04	$8.92	$3.12
Gravel Wetland	per CF	$8.78	$10.36	$15.54	$11.51	$4.03
Infiltration Basin	per CF	$6.24	$7.36	$11.04	$8.18	$2.86
Infiltration Trench	per CF	$12.49	$14.74	$22.11	$16.38	$5.73
Porous Pavement	per CF	$5.32	$6.28	$9.42	$6.98	$2.44
Sand Filter	per CF	$17.94	$21.17	$31.75	$23.52	$8.23
Wet Detention Basin	per CF	$6.80	$8.02	$12.04	$8.92	$3.12
Subsurface Infiltration/Detention System (aka Infiltration Chamber)	per CF	$67.85	$80.06	$160.13	$118.61	$41.51

1. Memorandum on Methodology for developing cost estimates for Opti-Tool is provided as Attachment A.
2. Total includes cost of construction, engineering, and contingencies.
3. 2022 Estimate assumes a 18% markup from 2016 Estimate due to inflation.
4. Adjustment factor of 1.5 is applied to account for construction in developed areas.
5. Engineering/Contingency Estimate is 35% of the Construction Estimate.

ASHBY
TOWNSEND
FITCHBURG
LEOMINSTER
SHIRLEY
LANCASTER
HOWARD STREET
WEST TOWNSEND ROAD
NEW WEST TOWNSEND ROAD
STAGECOACH ROAD
ASPLUND DRIVE
CHASE ROAD
HOLMAN STREET
NORTHFIELD ROAD
GILCHREST STREET
VALLEY ROAD
ISLAND ROAD
SOUTH ROW ROAD
COVE ROAD
WOODWOOD ROAD
PENINSULA DRIVE
TOWNSEND HARBOR ROAD
HEMLOCK DRIVE
MULPUS ROAD
CROSS STREET
HIGHLAND STREET
BEAL STREET
CHESTNUT STREET
RILEY ROAD
MASSACHUSETTS AVENUE
WHITE STREET
RICHARDS WAY
ROLLING ACRES ROAD
THE LANE
ELMWOOD ROAD
ARBOR STREET
COURT AND CIRCLE
SUNNYHILL ROAD
FAIRVIEW ROAD
WEST STREET
ELECTRIC AVENUE
PLEASANT STREET
BROWN AVENUE
PRATT STREET
HOLLIS ROAD
ELM STREET
PROSPECT STREET
LEOMINSTER ROAD
LAUREL LANE
CAROUSEL LANE
CROSS ROAD
WHALOM ROAD
YOUNGS ROAD
SUMMER STREET
ASH STREET
KILBURN STREET
LANCASTER AVENUE
PAGE STREET
WATT STREET
RESERVOIR ROAD
BURRAGE STREET
FLAT HILL ROAD
LONGWOOD DRIVE
HOUGHTONS MILL ROAD
SUNSET LANE
ROBBS HILL ROAD
OAK RIDGE ROAD
GOODRICH STREET
FLYNN ROAD
FIRE ROAD 12
FIRE ROAD 16
FIRE ROAD 15
RUTH STREET
ROUND ROAD
LEOMINSTER SHIRLEY ROAD
H1
WD2
PD1
T4
T2
T1
S7
P1
S1,S2,S6
S3
P5
L1
P4
S5
T3
L2
P2
P7
C2
WD3
P6
P9
PL1
P3
B1
WD1
P8
D1
C1
D2

Figure 1
Municipal Properties Visited

Lunenburg, MA

Comprehensive Environmental Incorporated

N

0 0.5 1
Miles

Data source: MassGIS, CEI, Town of Lunenburg

6/30/2022

Legend

- Outfall
- Open Drainage Outfall
- Culvert
- DNE
- Catch Basin
- Drop Inlet
- Leaching Catch Basin
- Inlet
- Swale Inlet
- Manhole
- Dry Well
- Interconnections
- Detention Basin
- Infiltration Basin
- Swale
- Drainage_Pipes
- Non-Urban Area
- Lake, Pond, Reservoir
- Wetland, Marsh, Swamp
- Stream, Brook

MunicipaProperties:

- Cemeteries
- Low-Income Housing
- Municipal Buildings
- Open Spaces
- Parking
- Schools and Community Buildings
- Town Beach

MUNICIPAL PROPERTY BMP RETROFITS

Attachment A:

BMP costing table and memorandum report on Methodology for developing cost estimates for Opti-Tool; February 20, 2016

MEMORANDUM

DATE: February 20, 2016

TO: Opti-Tool TAC

FROM: Karen Mateleska, EPA Region- I

SUBJECT: **Methodology for developing cost estimates for Opti-Tool**

Introduction

EPA – Region I offered to provide TetraTech with BMP cost information for the New England Stormwater Management Optimization Tool (Opti-Tool). The goal was to include the latest available information that would accurately reflect capital costs for select BMPs installed in the New England region. This document describes the approach used to determine these values.

The unit cost estimates originally developed as part of a 2010 study were used as the basis/starting-point for the cost estimates for the Opti-Tool. This study, entitled *Stormwater Management Plan for Spruce Pond Brook Subwatershed,* was produced by the Charles River Watershed Association (CRWA). The full report can be viewed at: http://www.crwa.org/hs-fs/hub/311892/file-636820515-pdf/Our_Work_/Blue_Cities_Initiative/Scientific_and_Technical/CRWA_Franklin_Plan.pdf. This subwatershed in the Town of Franklin (in eastern Massachusetts) was selected, in part, because it represented one of the many communities in the watershed that would be required to reduce nutrient (phosphorus) loads in stormwater runoff as part of EPA's Phase II MS4 General Stormwater Permit and a TMDL for Nutrients in the Upper/Middle Charles River. The cost estimates developed in the study can predominantly be attributed to CRWA and both Rich Claytor and Nigel Pickering of Horsley Witten Group (CRWA *et al.* 2010). The development of these costs was based on a literature review of BMP cost information and Claytor's extensive experience working in this field with Massachusetts communities. These values were originally reported in Appendix B of the aforementioned CRWA document. Those cost estimates have also been used in additional stormwater studies supported by EPA – Region I, including the *Sustainable Stormwater Funding Evaluation for the Upper Charles River Communities of Bellingham, Franklin, and Milford, MA (*2011). (That report can be viewed at: http://www.epa.gov/region1/npdes/charlesriver/pdfs/20110930-SWUtilityReport.pdf)

Before simply relying on the CRWA cost estimates, additional research was conducted of publicly available (online) resources to determine if more recent BMP cost information for the New England region was available. These resources included:

- EPA's LID webpage: http://water.epa.gov/polwaste/green/
- EPA's 2013 Article: *Case Studies Analyzing the Economic Benefits of Low Impact Development and Green Infrastructure Programs: http://water.epa.gov/polwaste/green/upload/lid-gi-programs_report_8-6-13_combined.pdf*

- New England Environmental Finance Center: http://efc.muskie.usm.maine.edu/
- UNC Environmental Finance Center's *Catalog of Finance Publications on Green Infrastructure Approaches to Stormwater Management* (This spreadsheet provides a catalog of 46 publications related on green infrastructure for stormwater management that have finance relevance; Several of the sources from the catalog were reviewed for this document) : http://www.efc.sog.unc.edu/reslib/item/catalog-green-infrastructure-and-stormwater-finance-publications
- Houle, *et al. Comparison of Maintenance Cost, Labor Demands, and System Performance for LID and Conventional Stormwater Management*: http://www.unh.edu/unhsc/sites/unh.edu.unhsc/files/Houle_JEE_July-2013.pdf
- University of New Hampshire Stormwater Center's *Forging the Link: Linking the Economic Benefits of LID and Community Decisions: http://www.unh.edu/unhsc/forging-link-topics*
- Center for Neighborhood Technology's *Green Values Stormwater Tool Box: http://greenvalues.cnt.org/* which included the Green Values Calculator: http://greenvalues.cnt.org/national/calculator.php
- Water Environment Research Foundation (WERF): User's Guide to the BMP and LID Whole Life Cost Models, Version 2.0: www.werf.org/bmpcost
- Low Impact Development Center: http://www.lowimpactdevelopment.org/
- ECONorthwest's *The Economics of Low-Impact Development: A Literature Review:* http://www.econw.com/our-work/publications/the-economics-of-low-impact-development-a-literature-review/
- Drexel University's Low Impact Development Rapid Assessment (LIDRA Model) http://www.lidratool.org/home/publications.aspx

A review of these resources did highlight the multitude of variables that can impact the cost of installing LID BMPs and the variety of cost analysis methods that can be used when assessing the cost effectiveness of various LID storm water controls. For example, many of the resources emphasized that costs tend to be site specific. Costs often differ significantly among different geographical locations, depending upon labor and material expenses and the constraints of a particular site. Unfortunately, most of the aforementioned resources highlighted projects outside of the New England region (with the exception of the articles by Houle of the UNHSC and New England Environmental Finance Center.)

EPA's recent (2013) report entitled *Case Studies Analyzing the Economic Benefits of Low Impact Development and Green Infrastructure Programs* listed the 7 different types of economic analyses that were represented by the 13 case studies highlighted in the report. These ranged from the simplest form of economic analysis (i.e., the capital cost assessment) to more robust forms, including the life cycle cost assessment. Whole life-cycle costs would provide a more accurate estimate of the cost of installing, operating, maintaining, and replacing a project (i.e., BMP) throughout its expected lifetime. However this type of analysis requires solid estimates for capital, land purchase, O&M, and other related costs.

Ideally, the goal was to include a more advanced economic analysis (i.e. – life cycle costs) in the Opti-Tool while still maintaining some level of simplicity for the end user. However, such a robust economic analysis does not currently appear possible because the literary search for more recent BMP cost estimates, reflective of New England states, was largely unsuccessful. However, the search was not

entirely fruitless. Jamie Houle of the UNHSC did provide extremely valuable information on capital and maintenance costs for various BMPs that have been tested at the UNHSC. Cost estimates for a particular BMP available from *both* the CRWA study and UNHSC were discussed among Mark Voorhees of EPA, Jamie Houle of UNHSC, and Karen Mateleska of EPA, and a best professional judgment decision was made.

The recommendation at this time is to use a combination of the CRWA cost estimates **and** UNHSC costs estimates as the basis for the Opti-Tool BMP cost estimates, and to use a modified capital cost assessment (which includes a fixed percentage for Design and Contingency Costs) as well as a separate field for maintenance hours (from the UNHSC). The details supporting this approach are described below.

Overview of Scope and Approach

According to a draft memo, dated 6/20/14 from Tetra Tech to EPA Region I, the current SUSTAIN BMP Cost function has seven major individual components, using a formula that would likely be useful in a more detailed design mode. For purposes of simplicity, EPA Region I is proposing the following cost function formula for the tool's "planning" mode:

General Cost Function Formula = Storage Volume of BMP* (ft^3) X Cost Estimate for BMP ($/$ft^3$)

X Adjustment Factor

* Storage Volume of BMP is more accurately defined as (Design) Physical Storage Capacity of BMP; See Section A below for more details

Initially, the intention was to include the preliminary Operations and Maintenance (O&M) costs in the general formula (page 3) by simply multiplying the formula results by our Preliminary O & M costs. However, such an approach would only include **one year's worth** of operations and maintenance, which could have been misleading because it would not have reflected the true life cycle cost of the BMP (i.e., assume life cycle of 20 years). However, simply including the 20 year life cycle cost (O&M cost *20) in the above formula would have greatly increased the cost value and perhaps have created misconceptions about BMP use and affordability.

Therefore, the subcommittee decided to include the anticipated operation and maintenance **hours** required for each BMP per year instead. This parameter was included as a completely separate field in the Opti-Tool. The rationale was that Opti-Tool users need to understand that operation and maintenance impact the overall cost-effectiveness of BMPs and should be considered when selecting a BMP. Including O&M hours (instead of costs) as a separate field, would still highlight this important consideration for stormwater managers.

A. Storage Volume and Proposed Cost Estimate Values

As highlighted above, the general cost function formula used in the Opti-Tool consists of 3 factors: the BMP storage volume, the proposed BMP storage volume cost estimate, and the adjustment factor. The first two factors will be covered together in this memo because they are so closely linked. Table 1 below summarizes the proposed BMP cost estimates for the Opti-Tool.

Table 1: Proposed BMP Cost Estimates for Opti-Tool

BMP (From Opti-Tool)	Cost ($/ft^3) [1]	Cost ($/ft^3) – 2016 dollars[6]
Bioretention (Includes rain garden)	13.37 [2,4]	15.46
Dry Pond or detention basin	5.88 [2,4]	6.80
Enhanced Bioretention (aka-Bio-filtration Practice)	13.5 [2,3]	15.61
Infiltration Basin (or other Surface Infiltration Practice)	5.4 [2,3]	6.24
Infiltration Trench	10.8 [2,3]	12.49
Porous Pavement - Porous Asphalt Pavement	4.60 [2,4]	5.32
Porous Pavement - Pervious Concrete	15.63 [2,4]	18.07
Sand Filter	15.51 [2,4]	17.94
Gravel Wetland System (aka-subsurface gravel wetland)	7.59 [2,4]	8.78
Wet Pond or wet detention basin	5.88 [2,4]	6.80
Subsurface Infiltration/Detention System (aka-Infiltration Chamber)	54.54[5]	67.85

[1] Footnote: Includes 35% add on for design engineering and contingencies

[2] Costs in 2010 dollars

[3] From CRWA Cost Estimates

[4] From UNHSC Cost Estimates; Most of original costs were from 2004 and converted to 2010 dollars using U.S. Department of Labor (USDOL). (2012). Bureau of Labor Statistics consumer price index inflation calculator. http://www.bls.gov/data/inflation_calculator.htm

[5] From Cost Estimate of MA TT Rizzo Project (2008 Dollars)

[6] 2010 costs were converted to 2016 values to adjust for inflation. The ENR Cost Index Method was used for this conversion.

Table 1 includes all of the BMPs that are included in the Opti-Tool. The unit costs represent the dollar amount ($) per cubic foot of storage volume (ft^3), where the storage volume reflects the (design) physical static storage capacity that the relevant BMP can hold. This volume includes the volume of ponding water *and* the volume of water retained in the porous media or subbase materials if applicable. (This storage volume does *not* represent the *treated* volume of stormwater, which may be significantly higher than the physical storage volume of a BMP particularly for systems that are sized dynamically or

by a water quality flow rate as opposed to a water quality volume.) This unit cost per storage volume captured by a BMP differs from other (perhaps more traditional) methods that can be used. By choosing to use the unit cost per storage volume instead of volume of water treated, we are trying to eliminate confusion over what the actual dimensions of the BMP will be for the costs being estimated. Additionally, this use of the unit cost per storage volume is consistent with the approach used in developing the BMP performance curves (used in the Opti-Tool) where the x-axis is the actual **physical storage capacity** to hold water. Lastly, expressing the unit costs in this manner will benefit users who are simply interested in using the unit costs (outside of the Opti-Tool) by eliminating the step of modeling hydrology and routing the water through the BMP, which can yield widely varying results depending on modeling approach and supporting assumptions. Attachment A describes the method used in calculating the design storage volume for each of the selected BMPs.

Also, each unit cost per storage value represents the capital cost of construction/installation of the BMP and includes a 35% design/engineering/contingency (D & E) cost. This 35% fixed percentage of the total construction cost follows a general "rule of thumb," often used by consulting firms. Based upon a conversation between Mark Voorhees and Jamie Houle (two members of the Opti-Tool cost subcommittee), a decision was made to include this D&E cost. The values in Table 1 do *not* include the cost of purchasing any land, nor does it include any O&M costs (which is discussed in more detail in a subsequent section). Therefore, each unit cost in Table 1 that was based on the CRWA's 2010 values was calculated by multiplying the relevant BMP cost by 1.35.

Since the CRWA study did not include cost estimates for porous pavement or sand filters, which are BMPs included in the Opti-Tool, relevant data was obtained from Jamie Houle of the University of New Hampshire Stormwater Center (UNHSC). He also provided additional cost estimates (as denoted by Footnote 4 in Table 1) for some of the other BMPs included in the tool. UNHSC can provide valuable data because they have been directly involved with the engineering, design and construction of numerous LID controls, as well as evaluating multiple stormwater treatment systems over multiple years at their primary field research facility in Durham, N.H. Since they could provide cost information for both porous asphalt pavement and pervious concrete, separately, the general category of porous pavement was divided into the aforementioned two sub-categories.

It should be noted that the costs used for the Opti-tool *assume linearity*, which will both allow for *and* incentivize the scaling to smaller-sized systems. For example, EPA has estimated that *smaller* capacity designs for BMPs, rather than large-sized BMPs, can increase both the technical and economic feasibility of installing controls, particularly for retrofits. The assumption of linearity was made for the following reasons: 1) Limited data currently exists on the cost of small capacity systems. Until a larger pool of cost data becomes available which will allow for the development of a non-linear cost curve, the current method is the best available alternative; 2) As the installation of smaller systems becomes more wide-spread, it is likely that economies of scale will develop and cost savings will occur. For example, if one entity is contracted to install multiple small systems at once, materials can be bought in bulk and the installation process can become more efficient and less expensive; 3) An undersized system built to treat a large area can be a very cost effective approach. As an example, there should not be a significant cost difference between a 1-inch system treating 1 acre and a 1/10-inch-system that treats 10 acres, since the absolute capacity of the system is the same in both cases. This topic of linearity will be revisited in the future when more data is available.

Since UNHSC typically calculates the capital costs per cubic foot (ft^3) *treated*, using WQv, Jamie Houle converted the costs to represent the capital costs per BMP storage volume (ft^3). This was necessary so the capital cost data would be consistent with the method used in the Opti-Tool. Also, all of the costs were converted to 2010, and ultimately 2015, dollars. As with the CRWA costs, the UNHSC capital costs were already adjusted to include the 35% design/engineering/contingency (D & E) cost. Details of all of these calculations, and any other assumptions made, are presented in Attachment B.

When developing cost estimates, another topic for consideration was whether or not to address the issue of inflation. CRWA's BMP cost estimates were based on capital costs from 2010. As previously stated, UNHSW's cost estimates have also already been converted to constant 2010 dollars using consumer price index inflation rates [U.S. Department of Labor (USDOL) 2014].[1] Therefore, there was the option of converting all of these 2010 costs to 2016 costs, using the U.S. Department of Labor's consumer price index inflation calculator. However, another suggestion was made to use the ENR Cost Index method to adjust for inflation instead because it more closely tracks construction work. At least one New England state (i.e., Vermont) also uses the ENR Cost Index method, so this could provide some consistency, as well. Therefore, the decision was made to ultimately convert all of the costs to 2016 values using the ENR Cost Index method. These values are reflected in Table 1.

To use the index, one calculates the quotient of the current index number (based on the month and year of *current* date) divided by the index number from a given date (e.g., June of 2010). Since the month was not known for the 2010 costs, the month of June was used as an estimate. This assumption was used because it falls mid-way between the construction season and would likely provide a reasonable estimate. Once the quotient was calculated, it was multiplied by the construction cost (found in the middle column in Table 1, above) to provide the 2016 construction cost value

B. Cost Adjustment Factor

Since the cost of installing a BMP will vary depending on the specific site location, the TAC subcommittee believed it was important for the Opti-Tool to include a scalable cost adjustment factor. The proposed cost estimates for the Opti-Tool (in Table 1) are all based on a Cost Adjustment Factor of 1. However, each Opti-Tool user has the option to choose and enter into the tool a cost adjustment factor that is appropriate for their site. This will adjust the storage volume cost function in the Opti-Tool.

For example, the CRWA report included the cost factors summarized in Table 2.

[1] Reference: U.S. Department of Labor (USDOL). (2014). Bureau of Labor Statistics consumer price index inflation calculator." ⟨http://www.bls.gov/data/inflation_calculator.htm⟩(Sep. 12, 2014)

Table 2: Example of Cost Adjustment Factors

BMP Type	**EXAMPLE** Cost Adjustment Factor
New BMP in undeveloped area	1
New BMP in partially developed area	1.5
New BMP in developed area	2
Difficult installation in highly urban settings	3

(Source: Table 4 of Appendix B of CRWA's Spruce Pond Brook Subwatershed Project for Town of Franklin)

The assumption made was that it would cost more to install a new BMP in a developed area (with more site constraints) than it would cost to install the same BMP in a previously undeveloped area. So in the above example, the cost adjustment factor would be 2 for installing a BMP in a previously developed area versus a cost adjustment factor of 1 for installing a BMP in an undeveloped area.

It should be noted that Table 2 (above) provides just *one example* of adjustment factors. The factor should be flexible enough so that another location (or Opti-Tool user) can adjust it, as needed. For example, the Charles River Watershed (in eastern Massachusetts) used an adjustment factor of 2 for installing a BMP in a developed area, while the State of Vermont uses an adjustment factor of 1.4 to estimate the cost of installing a BMP for existing development.

C. Maintenance (O&M) Costs

Originally, one goal was to include Operation and Maintenance (O&M) costs as part of the cost estimates for the Opti-Tool. These O&M costs would help to provide a more realistic reflection of the long-term expenses of structural storm water controls, which is obviously critical in the practical, real-world implementation of BMPs. However, it is difficult to obtain accurate maintenance costs and they will be highly variable depending on the size, location and equipment needed to perform long-term O&M.

This point was highlighted by a key finding in EPA's recent (2013) publication, *Case Studies Analyzing the Economic Benefits of Low Impact Development and Green Infrastructure Programs.* The report indicated that only a small percentage of the entities that implement LID and GI approach for stormwater management conduct economic analyses due to the "uncertainties surrounding costs, operation and maintenance (O&M) requirements, budgetary constraints, and difficulties associated with quantifying the benefits provided by LID/GI" and the need "to obtain better estimates of the O&M costs associated with different types of LID/GI projects" was a key finding of the report.

As previously mentioned, one article entitled, *Comparison of Maintenance Cost, Labor Demands, and System Performance for LID and Conventional Stormwater Management* (Houle *et al. 2013)*, did contain relevant information for BMP costs in the New England region. During initial discussions between EPA Region I (Mark Voorhees) and UNHSC (Jamie Houle), there was concern that not enough data existed on O&M costs to propose accurate values for each of the BMPs included in the Opti-Tool. There was also

the concern that the O&M costs were not scaleable. For example, initial O&M costs for each BMP were based on the cost of operation and maintenance per year per acre of IC treated. Scaled differences such as the annual O&M costs for treating 0.5 acres of IC or 2 acres of IC have **not** been evaluated and may or may **not** result in a simple linear relationship. Yet the Opti-Tool costs subcommittee also realized the importance of including some maintenance parameter in order to *initiate* the conversation on the importance of accounting for O&M to maintain the functionality of the BMPs. Therefore Table 3, below, presents these annual maintenance costs (in $) for select BMPs, as well as the annual maintenance hours. Although the O&M costs have been presented in this memo, only the O&M **hours** will be included (as a separate field) in the Opti-Tool.

Table 3: Maintenance Costs ($) and Hours per year for select BMPs – From UNHSC

BMP	Maintenance Cost ($) per year	Annual Maintenance Hours
Bioretention	$1,890.00	20.7
Chamber System	Not Assessed	Not Assessed
Detention Pond	$2,380.00	24.0
Gravel Wetland	$2,138.33	21.7
Porous Asphalt	$1,080.00	6.0
Pervious Concrete	$1,080.00	6.0
Retention Pond	$3,060.00	28.0
Sand Filter	$2,807.50	28.5

*Note: initial costs based on cost of maintenance per year per acre of IC treated

Annual maintenance strategies were evaluated by directly quantifying hours spent categorizing maintenance activities, and assessing difficulty of those activities. To better illustrate costs and anticipate maintenance burdens, activities were characterized into distinct categories and a standard cost structure was applied. This unit conversion can easily be adapted according to local conditions, current economic climate, and regional cost variations which is why we decided to go with maintenance **hours** as those were directly measured and should remain constant. These maintenance activity categories allow more accurate cost predictions and provide insight into the appropriate assignment of maintenance responsibilities.

Annual maintenance costs were normalized to 2012 dollars and calculated for all SCMs by both dollars and personnel hours per acre of IC treated per system per year. It is important to note that inflation was not considered in life cycle maintenance cost projections.

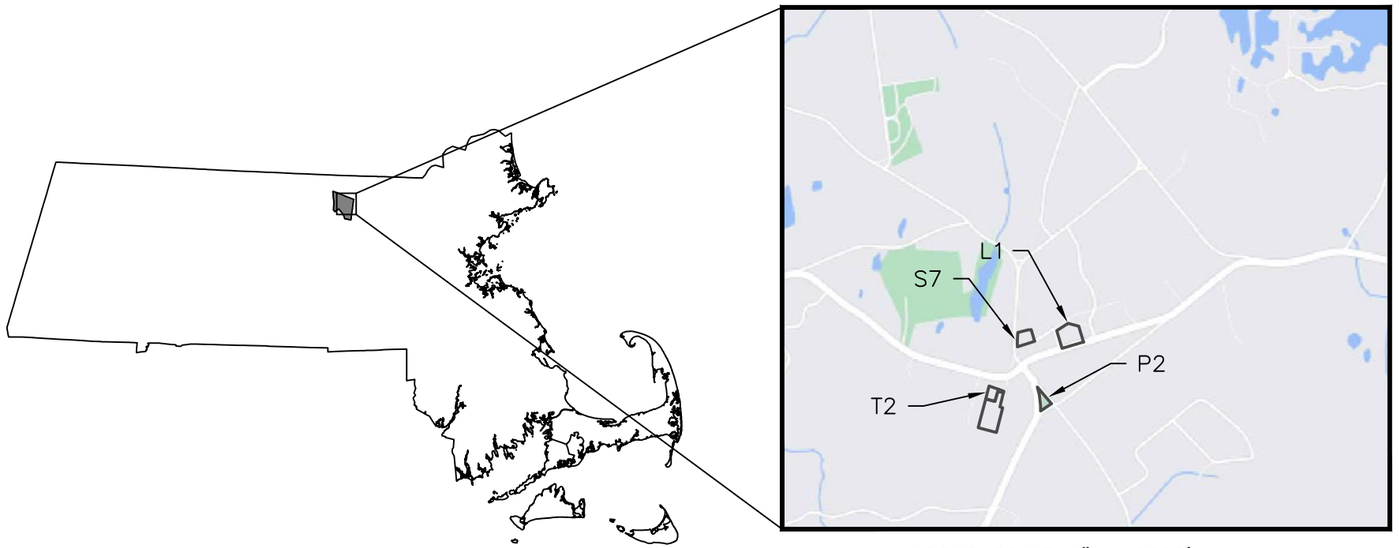
MUNICIPAL PROPERTY BMP RETROFITS

Attachment B:
Pre-Conceptual Designs for Top Locations

TOWN OF LUNENBURG

MUNICIPAL PROPERTY BMP RETROFITS
LUNENBURG, MA

JUNE 2022



LOCUS SCALE 1" = 2000'

SHEET	TITLE
C-1	BOYS AND GIRLS CLUB OF LUNENBURG
C-2	LUNENBURG PUBLIC LIBRARY
C-3	LUNENBURG HISTORICAL SOCIETY
C-4	HISTORICAL DISTRICT TOWN COMMON

COMPREHENSIVE ENVIRONMENTAL INCORPORATED • BOLTON, MASSACHUSETTS

GENERAL NOTES

LEGEND

- PROJECT PARCEL
- PROPERTY LINE
- EXISTING DRAIN PIPE
- EXISTING CATCH BASIN
- EXISTING DRAIN MANHOLE
- EXISTING BUILDING
- EDGE OF PAVEMENT
- FLOW DIRECTION ARROW
- PROPOSED DRAIN PIPE

COMPREHENSIVE ENVIRONMENTAL INCORPORATED

41 MAIN STREET
BOLTON, MA 01740

PROPOSED CONDITIONS
BOYS AND GIRLS CLUB OF LUNENBURG
PLAN VIEW

TOWN OF LUNENBURG, MA

Project No.: 356-04 Date: 12/9/2021	Sheet
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Checked By: NC	
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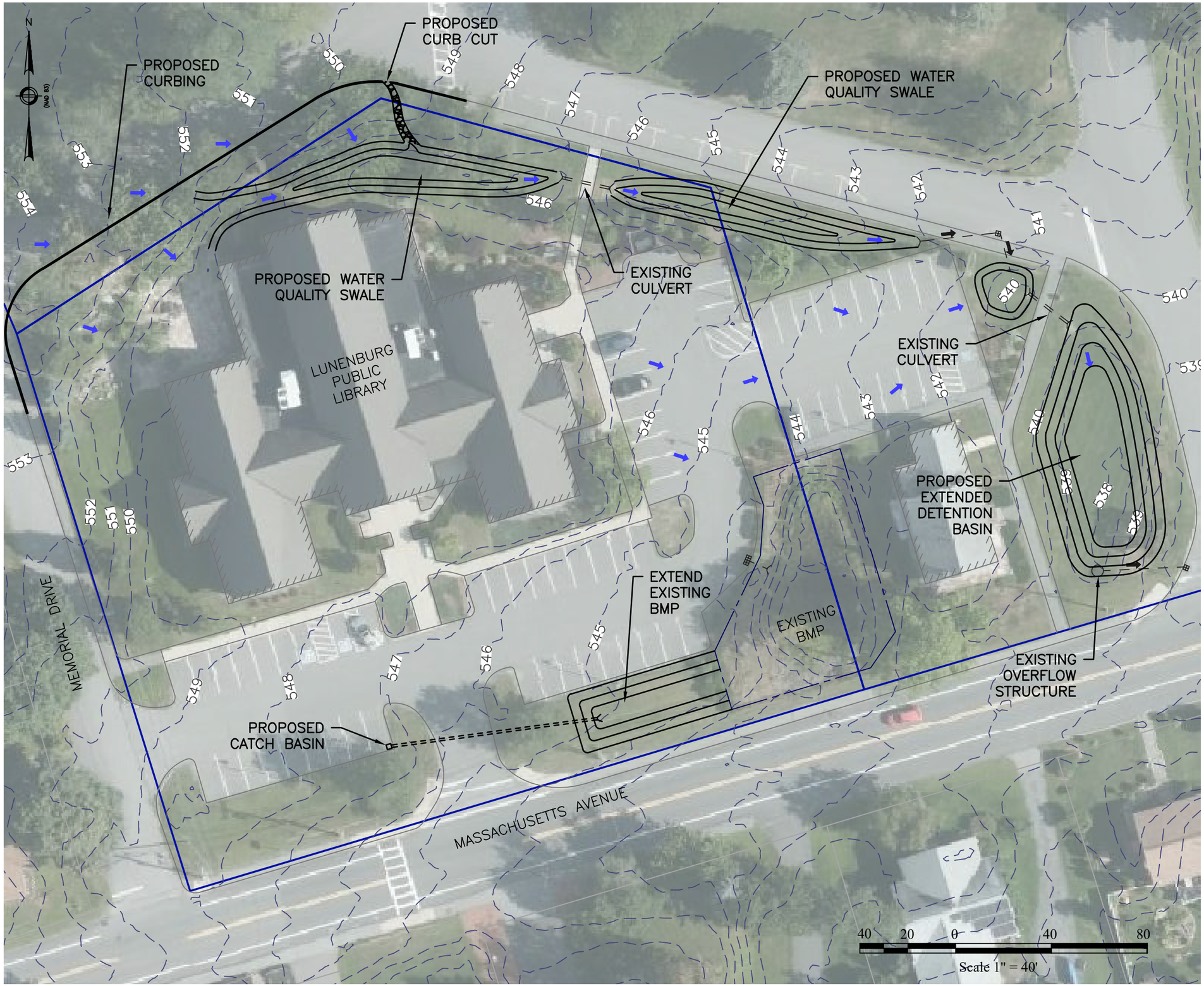

GENERAL NOTES

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COMPREHENSIVE ENVIRONMENTAL INCORPORATED

41 MAIN STREET
BOLTON, MA 01740

PROPOSED CONDITIONS LUNENBURG PUBLIC LIBRARY PLAN VIEW

TOWN OF LUNENBURG, MA

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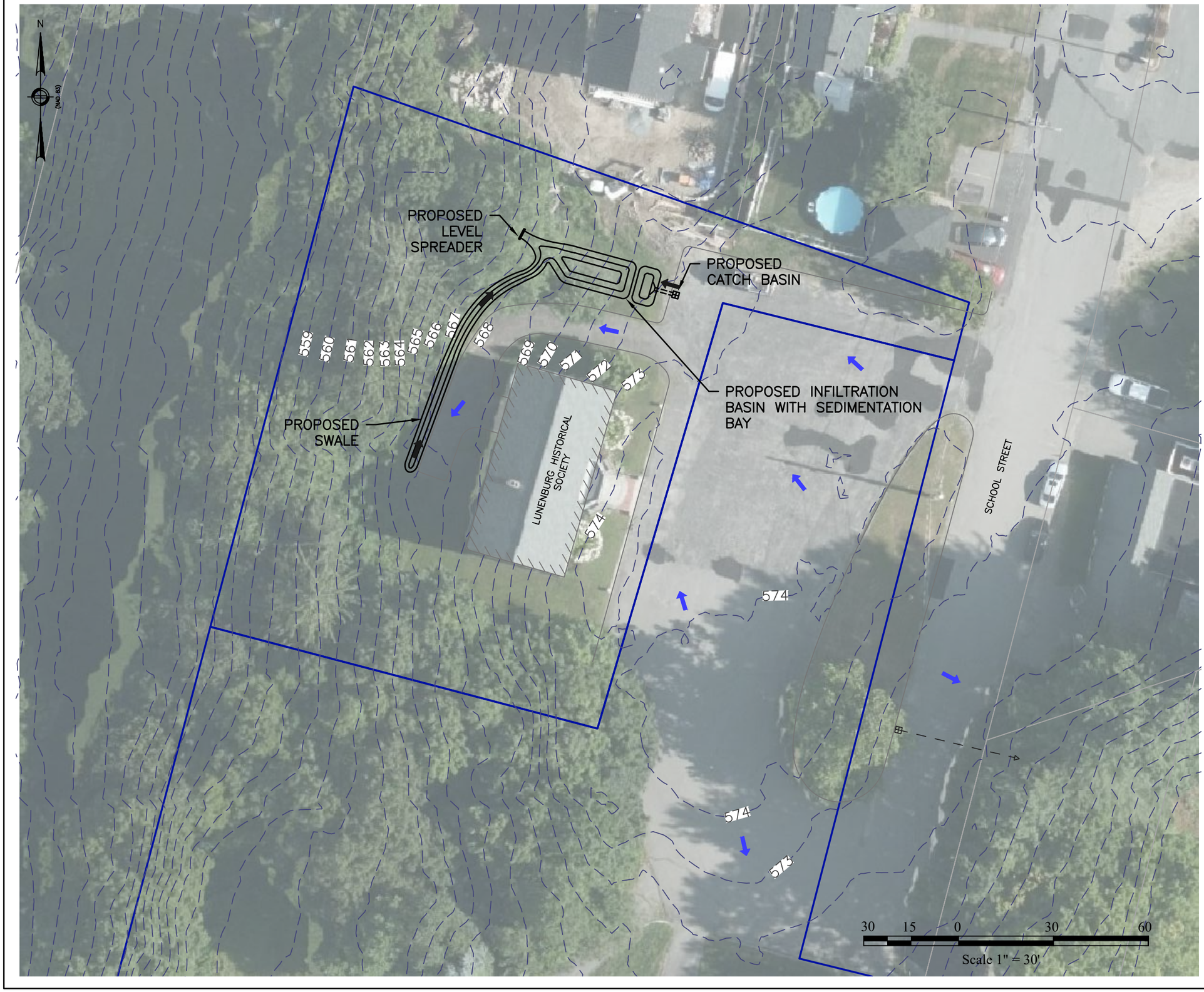

GENERAL NOTES

LEGEND

- PROJECT PARCEL
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41 MAIN STREET
BOLTON, MA 01740

PROPOSED CONDITIONS LUNENBURG HISTORICAL SOCIETY PLAN VIEW

TOWN OF LUNENBURG, MA

Project No.: 356-04 Date: 12/9/2021	Sheet
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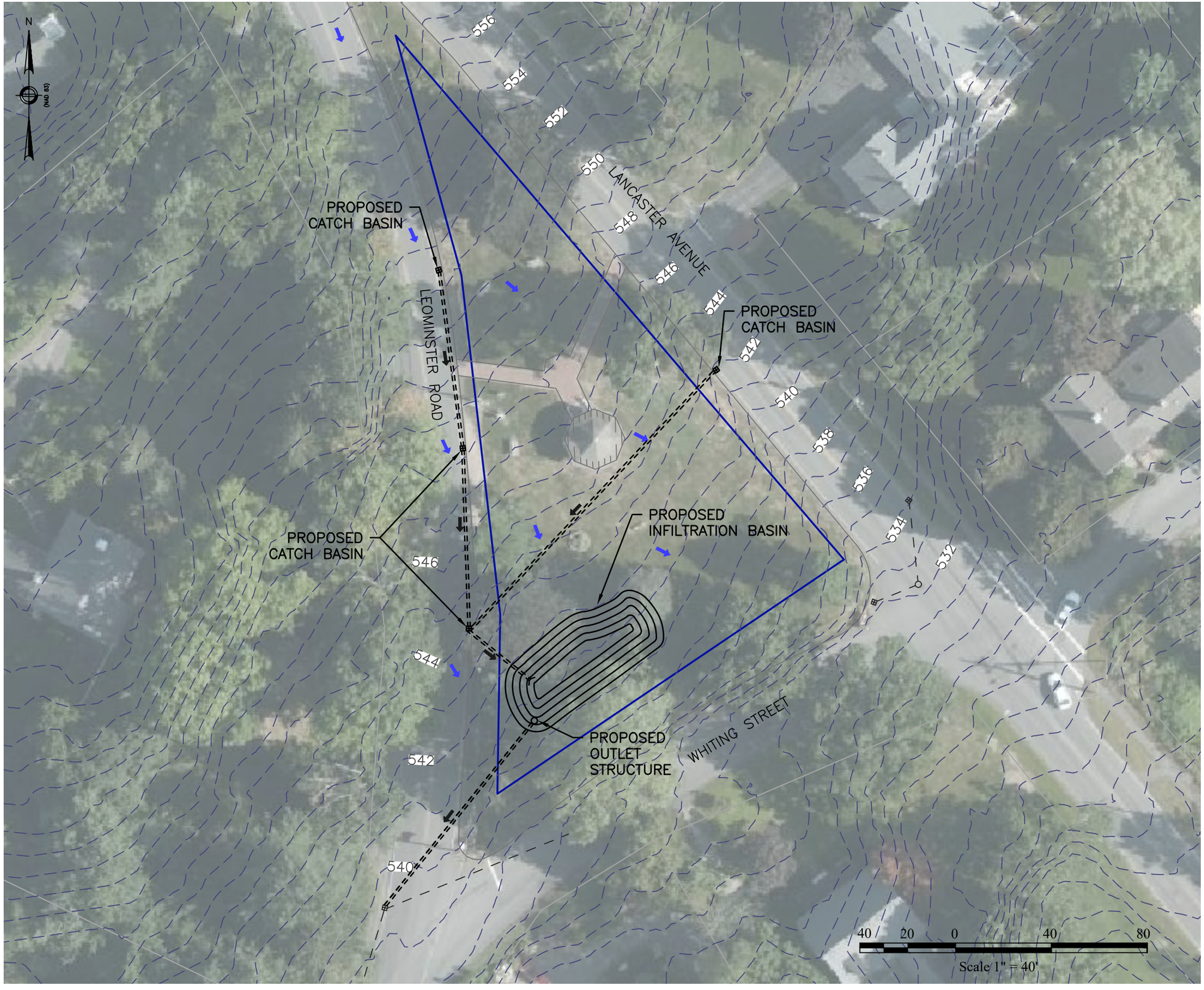

GENERAL NOTES

LEGEND

- PROJECT PARCEL
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- EXISTING DRAIN MANHOLE
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- PROPOSED DRAIN PIPE

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41 MAIN STREET
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PROPOSED CONDITIONS HISTORICAL DISTRICT TOWN COMMON PLAN VIEW

TOWN OF LUNENBURG, MA

Project No.: 356-04 Date: 12/9/2021	Sheet C-4
Drawn By: NP	
Checked By: NC	
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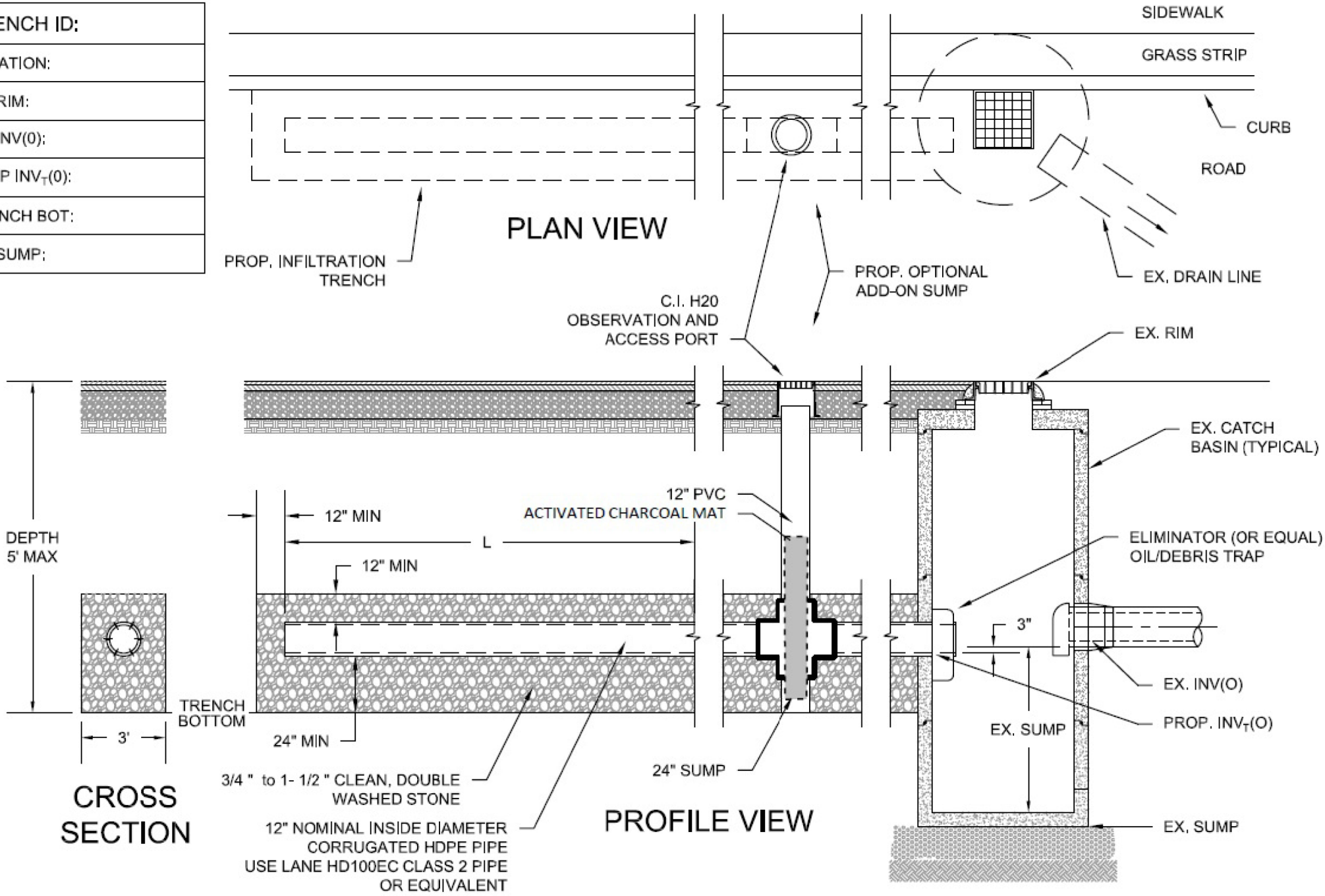
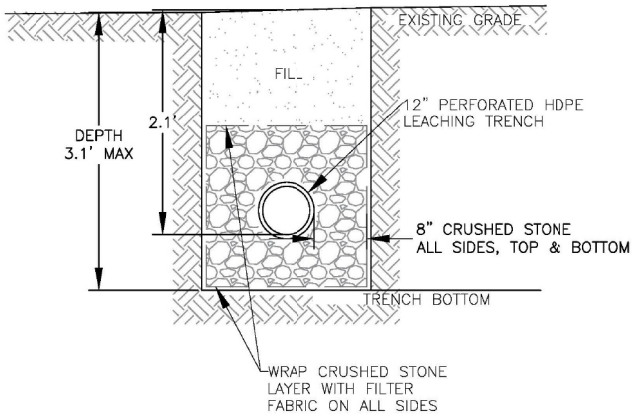
MUNICIPAL PROPERTY BMP RETROFITS

Attachment C:

Example Roadway and Intersection BMP Improvements

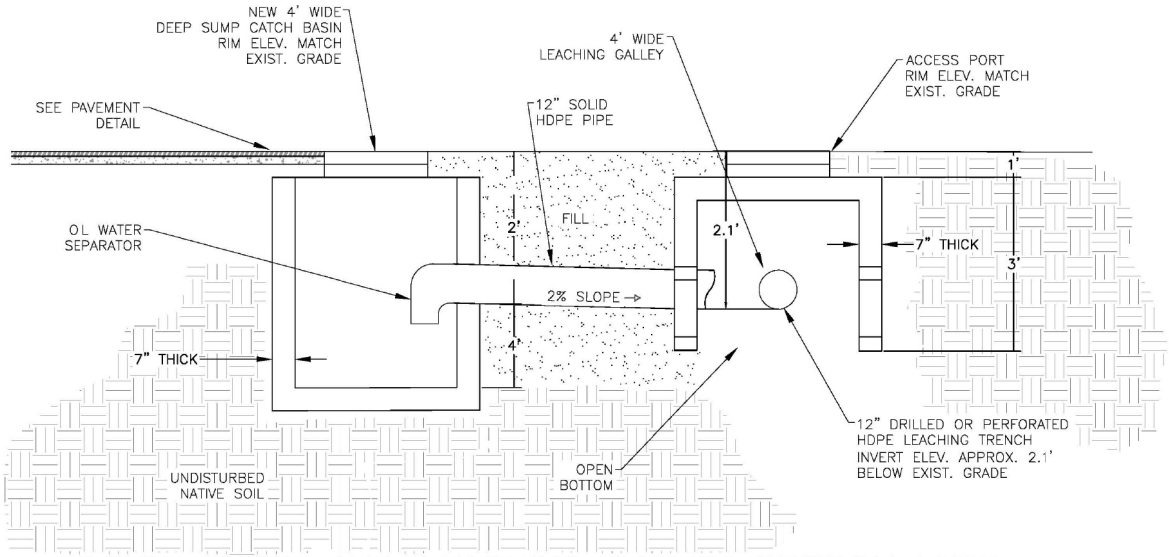
TRENCH ID:
LOCATION:
EX. RIM:
EX. INV(0):
PROP INV_T(0):
TRENCH BOT:
EX. SUMP:





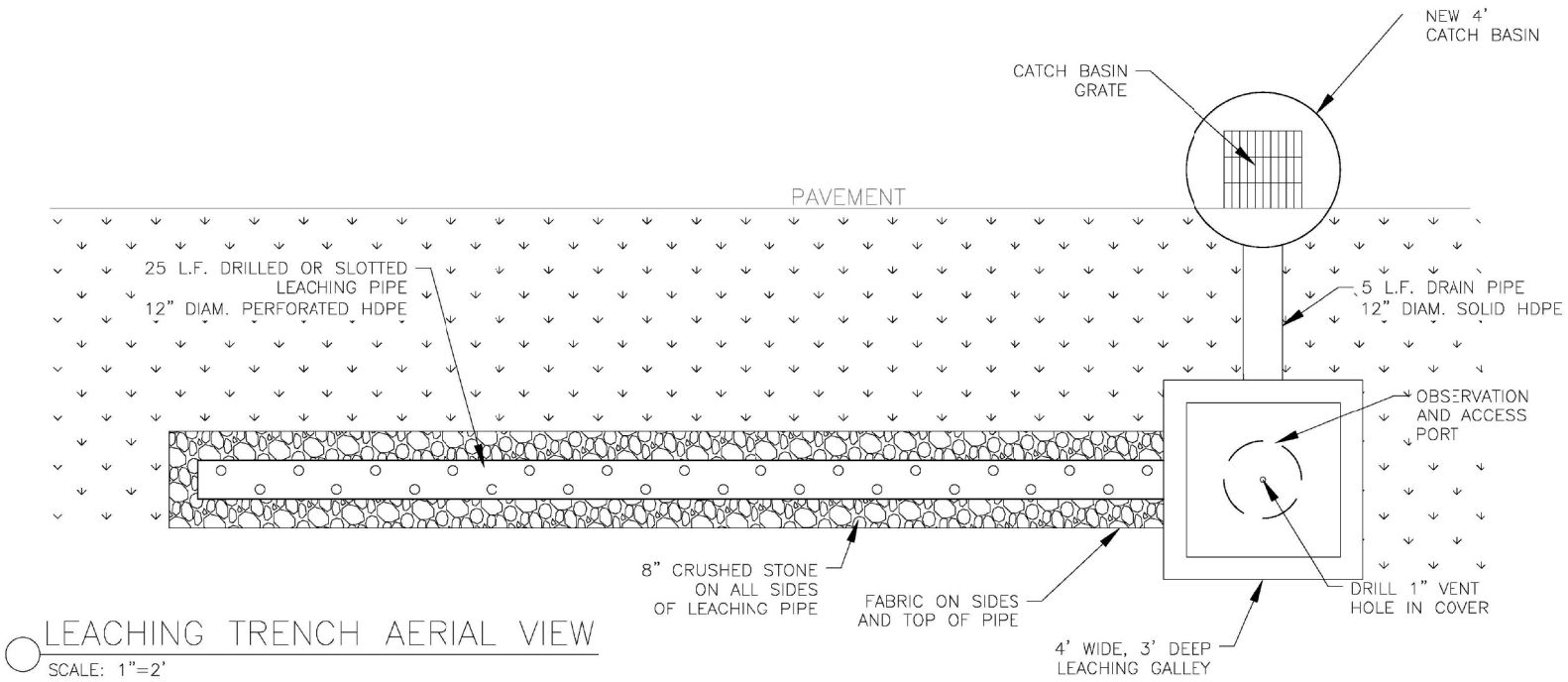
LEACHING TRENCH SECTION VIEW

SCALE N.T.S.



CATCH BASIN AND LEACHING GALLEY SECTION VIEW

SCALE: 1"=3'



LEACHING TRENCH AERIAL VIEW

SCALE: 1"=2'