HANCOCK
ASSOCIATES

LAND SURVEYING

CIVIL ENGINEERING

WETLAND SCIENCE

Stormwater Report

In Support Of

A Site Plan Review Application and Notice of Intent Filling

For

61 High Street
(Parcel ID #051 303)
Danvers, Ma

PREPARED BY:
Hancock Associates
#26733

PREPARED FOR:
a.point.design, Inc.
January 2025
Revised March 2025

COMMONWEALTH OF MASSACHUSETTS
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REGISTERED PROFESSIONAL ENGINEER

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Introduction

a.point.design, Inc. proposes to construct a new mixed-use building at 61 High Street, Danvers, MA. Associated improvements will include permeable paver vehicular areas, landscaped areas, a stormwater management system, and utility services. The project area is currently comprised of a developed, single-family, residential lot. The project area is accessed by High Street and consists of 0.35± acres. The property is bounded by residential properties to the north and west, a Verizon office to the south, and High Street to the east.

The project site is sloped from east to west with boarding vegetated wetlands located along the western property line. In the existing condition, stormwater runoff runs down the slope to the wetlands. The proposed stormwater system was designed to mimic the existing drainage pattern.

The proposed stormwater management system will consist of A subsurface chambers that will collect roof runoff, and permeable paver surfaces with underdrains. The chamber system is located at the rear of the proposed building and will reduce peak rates of runoff by promoting infiltration. Overflow from the chambers will drain to the wetlands via a rip-rap dissipation pad and a level spreader.

The proposed stormwater management system was designed to meet the Stormwater Management Standards described in the Massachusetts Stormwater Handbook. The following report describes the system's compliance with these standards.

Standard 1: No New Untreated Discharges

The Massachusetts Stormwater Handbook states that no new stormwater conveyances may discharge untreated stormwater directly to or cause erosions in wetlands or waters of the Commonwealth. Roof runoff will be collected via a network of pipes and conveyed to a subsurface chamber system. Overflow from the chamber system will flow to a new outfall featuring a rip-rap forebay with a level spreader. Per the Massachusetts Stormwater Handbook, roof runoff is considered clean. The level spreader has been designed to provide energy dissipation and will prevent erosion at the discharge point. Please see the forebay and level spreader sizing calculations below:

Per NCDEQ Stormwater BMP Manual Section C-9. Level Spreader-Filter Strip Page 8:
Required Surface Area of Rip-Rap Settling Basin = 0.2% of Contributing Impervious Area
Contributing Area = 0.14ac (6,195sf)
Required Surface Area of Forebay = 0.14ac (6,195sf) x 0.2% = 4.4sf
Provided Area of Forebay = 56 sf

Per Massachusetts Stormwater Handbook Structural BMPs – Volume 2 | Chapter 2 Page 129 (see below):
Required Minimum Spreader Length with Drainage Area of < 1ac = 10ft
Provided Spreader Length = 11ft

Drainage Area	Minimum spreader length
1 acre	10 feet
2 acres	10 feet
3 acres	15 feet
4 acres	18 feet
5 acres	20 feet

Massachusetts Stormwater Handbook BMPs – Volume 2 | Chapter 2 Page 128-129

Standard 2: Peak Rate Attenuation

The Massachusetts Stormwater Handbook states that stormwater management systems shall be designed so that post-development peak discharge rates do not exceed pre-development peak discharge rates. A summary of the existing and proposed discharge rates follows. The proposed condition discharge rates of runoff are at or below the existing rates to the same discharge points. Please see the attached "Existing Drainage Figure" and "Proposed Drainage Figure" figures (Appendix IV) and HydroCAD output (Appendix V) for more information.

For the purpose of these calculations the following assumptions were made:

- The project property lines were used to delineate watershed boundaries.
- The same total watershed area of the drainage areas is used to compare the existing and proposed.
- The Natural Resources Conservation Service (NRCS) Web Soil Survey of Essex County defines soils in the project area as:
    - 626B, Merrimac-Urban land complex, 0 to 8 percent slopes, Hydrologic Soil Group A
    - 602, Urban Land, no Hydrologic Soil Group listed
- On-site soil testing has determined that surficial soils are Sandy Loam, Hydrologic Soil Group B. Therefore, surficial soils have been modeled as Hydrologic Soil Group B.
  On-site soil testing has determined that there is a “Sand”, Hydrologic Soil Group A, horizon beneath the chamber system. Soils above this horizon will be removed and replaced with C-33 sand. For the purposes of these calculations, a Rawl’s rate of 8.27 in/hr was used to model exfiltration.

Two drainage areas have been modeled to represent the existing condition:

- Drainage Area EX1 consists of roof area, vehicular and pedestrian paved area, and landscaped areas. Stormwater runoff from EX drains via overland flow to the wetlands along the western property line (Discharge Point DP1).
- Drainage Area EX2 consists of vehicular and pedestrian paved area, and landscaped areas. Stormwater runoff from EX2 drains via overland flow to High Street (Discharge Point DP2).

In the proposed condition a stormwater management system will collect stormwater runoff from the proposed roof area. This system will consist of subsurface chambers and permeable pavers. Three drainage areas have been modeled to represent the proposed condition:

- Drainage Area PR1A will consist of roof area. Stormwater runoff from PR1A will be conveyed to the subsurface chamber system via a network of pipes. Overflow from the chamber system will outlet at Discharge Point DP1 via a flared end section, a rip rap dissipation pad, and a level spreader.
- Drainage Area PR1B will consist of permeable pavers and landscaped areas. Stormwater flow from PR1B will be conveyed to the Discharge Point DP1 via overland flow, mimicking existing drainage conditions.
- Drainage Area PR2 will consist of cement concrete walkways, permeable pavers and landscaped areas. Stormwater flow from PR2 will drain to Discharge Point DP2 via overland flow, mimicking existing drainage conditions.

The following tables compare the peak rates of runoff and peak volumes of runoff under the existing and proposed conditions using the latest Atlas-14 Precipitation Data:

Table 1: Peak Rates of Runoff

Discharge Point	Peak Rate (cfs)							
	2-Year Storm (3.26" Rainfall Depth)		**10-Year Storm** (5.14" Rainfall Depth)		**25-Year Storm** (6.31" Rainfall Depth)		**100-Year Storm** (8.12" Rainfall Depth)	
	Existing	Proposed	Existing	Proposed	Existing	Proposed	Existing	Proposed
DP1	0.29	0.28	0.77	0.49	1.11	0.93	1.65	1.58
DP2	0.14	0.02	0.25	0.07	0.32	0.11	0.42	0.18

cfs – Cubic Feet per Second

Table 2: Peak Volumes of Runoff

Discharge Point	Peak Volumes (af)							
	2-Year Storm (3.26" Rainfall Depth)		**10-Year Storm** (5.14" Rainfall Depth)		**25-Year Storm** (6.31" Rainfall Depth)		**100-Year Storm** (8.12" Rainfall Depth)	
	Existing	Proposed	Existing	Proposed	Existing	Proposed	Existing	Proposed
DP1	0.023	0.015	0.055	0..035	0.078	0.049	0.117	0.075
DP2	0.010	0.002	0.019	0.005	0.024	0.008	0.032	0.013

af – Acre-Foot

Standard 3: Recharge

The Massachusetts Stormwater Handbook states that loss of annual recharge to groundwater shall be eliminated or minimized. The annual recharge from the post-development site shall approximate the annual recharge from the pre-development conditions based on soil type. Recharge volume is provided for all of the proposed impervious areas. For the purpose of these calculations, all of the development areas are considered to be Hydrologic Soil Group B. The required recharge volume is 0.35" multiplied by the area of impervious surfaces. Please see the attached Hydrocad summaries for the recharge volumes provided within the infiltration basin (Appendix VI). The volume is as follows:
Required Recharge Volume, HSG B = Target Depth * Impervious Area = 0.35" * 6,236 SF = 182 CF

The recharge volume is provided below the top of the weir in the outlet structure. The volume provided is 266 cubic feet. Since the volume provided is greater than the required recharge volume, the standard is met.

The Massachusetts Stormwater Handbook states that the recharge volume must drain within 72 hours.

Observations in deep hole soil testing performed on-site indicate that the soil that the chamber system will be installed upon is sand. The following "drawdown" calculation assumes a Rawl's Rate of 8.27 inches per hour, corresponding to texture class "Sand".

Drawdown Time = Storage Volume / (Rawl's Rate * Bottom Area)
= 266 CF / (8.27 in/hr * 279 SF) = 1.4 Hour

Since the drawdown time of 1.4 hours is less than 72 hours, the requirement is met.

Standard 4: Water Quality

The Massachusetts Stormwater Handbook states that systems shall be designed to remove 80% of the average annual post-development construction load of Total Suspended Solids (TSS). The treatment BMP's have been sized to provide at least 80% TSS removal and measures will be taken for long-term pollution prevention.

According to the Massachusetts Stormwater Handbook, the stormwater runoff from roof area is considered "clean" and does not require TSS removal. Therefore, the subsurface chamber system has not been outfitted with any water quality treatment devices.

The Massachusetts Stormwater Handbook notes that permeable pavers can achieve 80% TSS removal if sized for 1" over the permeable paver area. The proposed permeable pavers feature a 12" crushed stone reservoir layer. The water quality volume calculation is as follows:

Required Water Quality Volume = 1" * Permeable Paver Area = 1" * 3,464 SF = 289 CF

Provided Water Quality Volume = Permeable Paver Area * 12" Depth * 40% Voids = 3,464 SF * 12" * 40%=1,386 CF

Because the provided water quality volume is greater than the required water quality volume, this standard is met.

Standard 5: Land Uses with Higher Potential Pollutant Loads

The proposed project is not a Land Use with Higher Potential Pollutant Load (LUHPPL).

Standard 6: Critical Area

The proposed project is not in a critical area. Therefore, this standard is not applicable.

Standard 7: Redevelopment

The proposed project is not a redevelopment.

Standard 8: Construction Period Pollution Prevention and Erosion & Sedimentation Control

Best management practices (BMP) for erosion and sedimentation control are staked, silt fences, compost wood fiber sock, hydro seeding, and phased development. Many stormwater BMP technologies (e.g., infiltration technologies) are not designed to handle the high concentrations of sediments typically found in construction runoff and must be protected from construction-related sediment loadings. Construction BMP's **must** be maintained. In developing the proposed project certain measures will be implemented to minimize impacts erosion and sedimentation could have on surrounding areas. This section addresses items that involve proper construction techniques, close surveillance of workmanship, and immediate response to emergency situations.

The developer must be prepared to provide whatever reasonable measures are necessary to protect the environment during construction and to stabilize all disturbed areas as soon as construction ends. Construction period pollution prevention and erosion and sediment control shall meet the requirements for the 2022 EPA Construction General Permit for all projects requiring coverage under the CGP.

Pre-Construction

1. The contractor shall have a stockpile of materials required to control erosion on-site to be used to supplement or repair erosion control devices. These materials shall include, but are not limited to compost wood fiber sock, silt fence, compost wood fiber sock and crushed stone.
2. The contractor is responsible for erosion control on site and shall utilize erosion control measures where needed, regardless of whether the measures are specified on the plan or in the order of conditions.

Preliminary Site Work

1. Excavated materials should be stockpiled, separating the topsoil for future use on the site. Erosion control shall be utilized along the down slope side of the piles and side slopes shall not exceed 2:1.
2. If intense rainfall is anticipated, the installation of supplemental straw bale dikes, silt fences, or armored dikes shall be considered.
3. Unsuitable excavated material shall be removed from the site.
4. Construction entrance shall be installed.
5. Existing catch basins shall be protected with silt sacks.

Ongoing Site Work

1. Erosion control measures shall be regularly inspected and replaced as needed.
2. Dewatering shall be done in a manner so as not to transmit silt, sand or particulate matter to the receiving water or existing drainage system.

Landscaping

1. Landscaping shall occur as soon as possible to provide permanent stabilization of disturbed surfaces.
2. If the season or adverse weather conditions do not allow the establishment of vegetation, temporary mulching with straw, wood chips weighted with snow fence or branches, or other methods shall be provided.
3. A minimum of 4 inches of topsoil shall be placed and its surface smoothed to the specified grades.
4. The use of herbicides is strongly discouraged.
5. Hydro seeding is encouraged for steep slopes. Application rates on slopes greater than 3:1 shall have a minimum seeding rate of 5-lbs/1000 SF. A latex or fiber tackifier shall be used on these slopes at a minimum rate of 50 lbs. of tackifier per 500 gallons of water used.

61 High Street – Construction Phase Maintenance

Operations and Maintenance Log
Inspections for Year:_____

Structural Best Management Practice (Frequency)	Action	Date Completed	Completed By	Comments
Straw Wattle and Silt Fence Inspect weekly and after major storm event.	Inspect/ Clean			
	Inspect/ Clean			
	Inspect/ Clean			
	Inspect/ Clean			
Proposed Catch Basin Silt Sock Inspect weekly and after major storm event.	Inspect/ Clean			
	Inspect/ Clean			
	Inspect/ Clean			
	Inspect/ Clean			
Vegetated Areas Inspect weekly and after major storm event.	Inspect			
	Inspect			
Construction Entrance Inspect weekly and after major storm event.	Inspect/Clean			
	Inspect/Clean			
Soil Stock Pile Area Inspect weekly and after major storm event.	Inspect			
	Inspect			

Standard 9: Operations and Maintenance Plan

The information provided herein is intended to provide the base information for operation and maintenance of the site in perpetuity subject to updates and revisions as required at a future date. As such all future property owners must be notified in writing of this plan and be provided with a copy of this plan, a complete set of the design drawings and/or a completed as-built plan showing all the drainage features as they were constructed, which are considered part of this document. Please see the attached Operations and Maintenance Log (Appendix IX).

Stormwater management system owner: a.point.design, Inc.
The party responsible for operation and maintenance: a.point.design, Inc.

Preliminary Stormwater Operation and Maintenance Budget

Quarterly Inspection and Maintenance x $500 per visit = $2,000 annually

Illicit Discharge - Practices to Minimize Storm Water Contamination

- All waste materials will be collected and stored in a securely lidded metal dumpster.
- All trash and debris from the site will be deposited in the dumpster. The dumpster will be emptied on a regular schedule prior to being over full.
- All personnel will be instructed regarding the correct procedure for waste disposal.
- Good housekeeping and spill control practices will be followed to minimize storm water contamination from petroleum products, paints, and cleaning products.
- All site vehicles will be monitored for leaks and receive regular preventive maintenance to reduce the chance of leakage.
- Spill kits will be provided with any activity that could provide contamination.
- All paint containers and curing compounds will be tightly sealed and stored when not required for use. Excess paint will not be discharged to the storm sewers, but will be properly disposed according to the manufacturer's instructions.
- All spills will be cleaned up immediately upon discovery. Spills large enough to reach the storm sewers will be reported to the Massachusetts Department of Environmental Protection Northeast Regional Office at 1-888-304-1133.

Subsurface Chamber System

The subsurface chamber system shall be inspected after every major storm for the first few months to ensure it is stabilized and functioning properly. If necessary, corrective action shall be taken until the system functions properly. Inspectors should note how long water remains standing in the inspection port after a storm; standing water within the basin 48 to 72 hours after a storm indicates that the infiltration capacity may have been overestimated. If the ponding is due to clogging, immediately address the reasons for the clogging. Thereafter, inspect the infiltration BMP at least twice per year.

Roof Drain Leaders

Routine roof inspections shall be performed two times per year. The roof shall be kept clean and free of debris, and the roof drainage systems shall be kept clear. Gutters and downspouts shall be cleaned at least twice per year, or more frequently as necessary.

Permeable Pavers

The permeable pavers shall be inspected monthly to ensure they are clean of debris, clean of sediments, and to ensure proper drainage after storms. The permeable paver surface shall be cleaned via blowing, sweeping, or vacuuming as needed and inspected for deterioration or spalling annually. The permeable shall not be sanded or salted during the winter.

Vegetated Areas Maintenance

Although not a structural component of the drainage system, the maintenance of vegetated areas may affect the functioning of stormwater management practices. This includes the health/density of vegetative cover and activities such as the application and disposal of lawn and garden care products, disposal of leaves and yard trimmings.

Initial Post-Construction Inspection

During the initial period of vegetation establishment pruning and weeding are required twice in first year by contractor or owner. Any dead vegetation/plantings found after the first year will be replaced. Proper mulching is mandatory and regular watering may be required initially to ensure proper establishment of new vegetation.

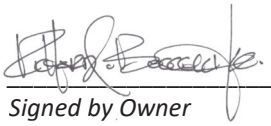
Long-Term Maintenance

The planted areas shall be inspected on a semi-annual basis and any litter removed. Weeds and invasive plant species shall be removed by hand. Maintain planted areas adjacent to pavement to prevent soil washout. Immediately clean any soil deposits on pavement. Leaf litter and other detritus shall be removed twice per year. If needed to maintain aesthetic appearance, perennial plantings may be trimmed at the end of the growing season.

Trees and shrubs shall be inspected twice per year to evaluate health and attended to as necessary. Seeded ground cover or grass areas shall not receive mulching. Re-seed bare areas; install appropriate erosion control measures when native soil is exposed or erosion channels are forming. Plant alternative mixtures of grass species in the event of unsuccessful establishment. The grass vegetation should not be cut to a height less than four inches.

Pesticide/Herbicide Usage

No pesticides are to be used unless a single spot treatment is required for a specific control application.



04/23/2025

Signed by Owner *Date*

61 High Street – Post Construction Maintenance

Operations and Maintenance Log
Inspections for Year:_____

Structural Best Management Practice (Frequency)	Action	Date Completed	Completed By	Comments
Subsurface Chambers – Inspect twice per year. Clean as required	Inspect			
	Inspect			
Roof Drain Leaders – Inspect/clean twice per year.	Inspect/Clean			
	Inspect/Clean			
Pervious Pavement – Inspect monthly. Clean as needed	Inspect			
	Inspect			
	Inspect			
	Inspect			
	Inspect			
	Inspect			
	Inspect			
	Inspect			
	Inspect			
	Inspect			
	Inspect			
	Inspect			
Vegetated Areas Maintenance – Inspect twice per year. Maintain as required.	Inspect			
	Inspect			

Standard 10: Prohibition of Illicit Discharges

No illicit discharges currently exist and no future illicit discharges will be allowed including wastewater discharges and discharges of stormwater contaminated by contact with process wastes, raw materials, toxic pollutants, hazardous substances, soil, or grease.

Appendix I Locus Map

USGS LOCUS MAP

61 HIGH STREET
DANVERS, MA

HANCOCK ASSOCIATES

185 CENTRE STREET, DANVERS, MA. 01923
VOICE (978) 777-3050, FAX (978) 774-7816

DATE:	1/27/25
SCALE:	1"=1,000'
DESIGN:	JJP
DRAWN:	JJP
LAYOUT:	*LOCUS*
JOB NO.:	26733

PATH: F:\Civil 3D Projects\26733-a.point.design-Danvers\Eng\DWG\ PLOT DATE: Jan 27, 2025 DWG: 26733ts.dwg

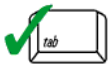
Appendix II Stormwater Checklist

Massachusetts Department of Environmental Protection
Bureau of Resource Protection - Wetlands Program

Checklist for Stormwater Report

A. Introduction

Important: When filling out forms on the computer, use only the tab key to move your cursor - do not use the return key.



A Stormwater Report must be submitted with the Notice of Intent permit application to document compliance with the Stormwater Management Standards. The following checklist is NOT a substitute for the Stormwater Report (which should provide more substantive and detailed information) but is offered here as a tool to help the applicant organize their Stormwater Management documentation for their Report and for the reviewer to assess this information in a consistent format. As noted in the Checklist, the Stormwater Report must contain the engineering computations and supporting information set forth in Volume 3 of the Massachusetts Stormwater Handbook. The Stormwater Report must be prepared and certified by a Registered Professional Engineer (RPE) licensed in the Commonwealth.

The Stormwater Report must include:

- The Stormwater Checklist completed and stamped by a Registered Professional Engineer (see page 2) that certifies that the Stormwater Report contains all required submittals.[1] This Checklist is to be used as the cover for the completed Stormwater Report.
- Applicant/Project Name
- Project Address
- Name of Firm and Registered Professional Engineer that prepared the Report
- Long-Term Pollution Prevention Plan required by Standards 4-6
- Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan required by Standard 8[2]
- Operation and Maintenance Plan required by Standard 9

In addition to all plans and supporting information, the Stormwater Report must include a brief narrative describing stormwater management practices, including environmentally sensitive site design and LID techniques, along with a diagram depicting runoff through the proposed BMP treatment train. Plans are required to show existing and proposed conditions, identify all wetland resource areas, NRCS soil types, critical areas, Land Uses with Higher Potential Pollutant Loads (LUHPPL), and any areas on the site where infiltration rate is greater than 2.4 inches per hour. The Plans shall identify the drainage areas for both existing and proposed conditions at a scale that enables verification of supporting calculations.

As noted in the Checklist, the Stormwater Management Report shall document compliance with each of the Stormwater Management Standards as provided in the Massachusetts Stormwater Handbook. The soils evaluation and calculations shall be done using the methodologies set forth in Volume 3 of the Massachusetts Stormwater Handbook.

To ensure that the Stormwater Report is complete, applicants are required to fill in the Stormwater Report Checklist by checking the box to indicate that the specified information has been included in the Stormwater Report. If any of the information specified in the checklist has not been submitted, the applicant must provide an explanation. The completed Stormwater Report Checklist and Certification must be submitted with the Stormwater Report.

[1] The Stormwater Report may also include the Illicit Discharge Compliance Statement required by Standard 10. If not included in the Stormwater Report, the Illicit Discharge Compliance Statement must be submitted prior to the discharge of stormwater runoff to the post-construction best management practices.

[2] For some complex projects, it may not be possible to include the Construction Period Erosion and Sedimentation Control Plan in the Stormwater Report. In that event, the issuing authority has the discretion to issue an Order of Conditions that approves the project and includes a condition requiring the proponent to submit the Construction Period Erosion and Sedimentation Control Plan before commencing any land disturbance activity on the site.

Massachusetts Department of Environmental Protection
Bureau of Resource Protection - Wetlands Program

Checklist for Stormwater Report

B. Stormwater Checklist and Certification

The following checklist is intended to serve as a guide for applicants as to the elements that ordinarily need to be addressed in a complete Stormwater Report. The checklist is also intended to provide conservation commissions and other reviewing authorities with a summary of the components necessary for a comprehensive Stormwater Report that addresses the ten Stormwater Standards.

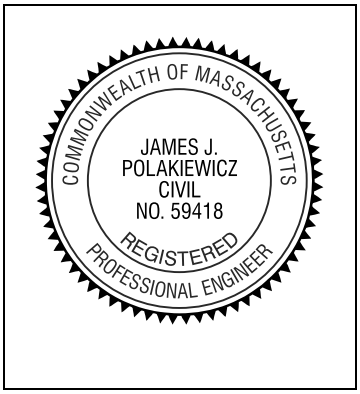
Note: Because stormwater requirements vary from project to project, it is possible that a complete Stormwater Report may not include information on some of the subjects specified in the Checklist. If it is determined that a specific item does not apply to the project under review, please note that the item is not applicable (N.A.) and provide the reasons for that determination.

A complete checklist must include the Certification set forth below signed by the Registered Professional Engineer who prepared the Stormwater Report.

Registered Professional Engineer's Certification

I have reviewed the Stormwater Report, including the soil evaluation, computations, Long-term Pollution Prevention Plan, the Construction Period Erosion and Sedimentation Control Plan (if included), the Long-term Post-Construction Operation and Maintenance Plan, the Illicit Discharge Compliance Statement (if included) and the plans showing the stormwater management system, and have determined that they have been prepared in accordance with the requirements of the Stormwater Management Standards as further elaborated by the Massachusetts Stormwater Handbook. I have also determined that the information presented in the Stormwater Checklist is accurate and that the information presented in the Stormwater Report accurately reflects conditions at the site as of the date of this permit application.

Registered Professional Engineer Block and Signature



3/31/25

Signature and Date

Checklist

Project Type: Is the application for new development, redevelopment, or a mix of new and redevelopment?

☒ New development

☐ Redevelopment

☐ Mix of New Development and Redevelopment

Checklist for Stormwater Report

Checklist (continued)

LID Measures: Stormwater Standards require LID measures to be considered. Document what environmentally sensitive design and LID Techniques were considered during the planning and design of the project:

- ☐ No disturbance to any Wetland Resource Areas
- ☐ Site Design Practices (e.g. clustered development, reduced frontage setbacks)
- ☐ Reduced Impervious Area (Redevelopment Only)
- ☐ Minimizing disturbance to existing trees and shrubs
- ☐ LID Site Design Credit Requested:
  - ☐ Credit 1
  - ☐ Credit 2
  - ☐ Credit 3
- ☐ Use of "country drainage" versus curb and gutter conveyance and pipe
- ☐ Bioretention Cells (includes Rain Gardens)
- ☐ Constructed Stormwater Wetlands (includes Gravel Wetlands designs)
- ☐ Treebox Filter
- ☐ Water Quality Swale
- ☐ Grass Channel
- ☐ Green Roof
- ☒ Other (describe): Permeable Pavers

Standard 1: No New Untreated Discharges

- ☐ No new untreated discharges
- ☒ Outlets have been designed so there is no erosion or scour to wetlands and waters of the Commonwealth
- ☐ Supporting calculations specified in Volume 3 of the Massachusetts Stormwater Handbook included.

Checklist for Stormwater Report

Checklist (continued)

Standard 2: Peak Rate Attenuation

☐ Standard 2 waiver requested because the project is located in land subject to coastal storm flowage and stormwater discharge is to a wetland subject to coastal flooding.

☐ Evaluation provided to determine whether off-site flooding increases during the 100-year 24-hour storm.

☒ Calculations provided to show that post-development peak discharge rates do not exceed pre-development rates for the 2-year and 10-year 24-hour storms. If evaluation shows that off-site flooding increases during the 100-year 24-hour storm, calculations are also provided to show that post-development peak discharge rates do not exceed pre-development rates for the 100-year 24-hour storm.

Standard 3: Recharge

☒ Soil Analysis provided.

☒ Required Recharge Volume calculation provided.

☐ Required Recharge volume reduced through use of the LID site Design Credits.

☒ Sizing the infiltration, BMPs is based on the following method: Check the method used.

☒ Static ☐ Simple Dynamic ☐ Dynamic Field[1]

☒ Runoff from all impervious areas at the site discharging to the infiltration BMP.

☐ Runoff from all impervious areas at the site is *not* discharging to the infiltration BMP and calculations are provided showing that the drainage area contributing runoff to the infiltration BMPs is sufficient to generate the required recharge volume.

☒ Recharge BMPs have been sized to infiltrate the Required Recharge Volume.

☐ Recharge BMPs have been sized to infiltrate the Required Recharge Volume *only* to the maximum extent practicable for the following reason:

- ☐ Site is comprised solely of C and D soils and/or bedrock at the land surface
- ☐ M.G.L. c. 21E sites pursuant to 310 CMR 40.0000
- ☐ Solid Waste Landfill pursuant to 310 CMR 19.000
- ☐ Project is otherwise subject to Stormwater Management Standards only to the maximum extent practicable.

☒ Calculations showing that the infiltration BMPs will drain in 72 hours are provided.

☐ Property includes a M.G.L. c. 21E site or a solid waste landfill and a mounding analysis is included.

[1] 80% TSS removal is required prior to discharge to infiltration BMP if Dynamic Field method is used.

Checklist for Stormwater Report

Checklist (continued)

Standard 3: Recharge (continued)

☐ The infiltration BMP is used to attenuate peak flows during storms greater than or equal to the 10-year 24-hour storm and separation to seasonal high groundwater is less than 4 feet and a mounding analysis is provided.

☐ Documentation is provided showing that infiltration BMPs do not adversely impact nearby wetland resource areas.

Standard 4: Water Quality

The Long-Term Pollution Prevention Plan typically includes the following:

- Good housekeeping practices;
- Provisions for storing materials and waste products inside or under cover;
- Vehicle washing controls;
- Requirements for routine inspections and maintenance of stormwater BMPs;
- Spill prevention and response plans;
- Provisions for maintenance of lawns, gardens, and other landscaped areas;
- Requirements for storage and use of fertilizers, herbicides, and pesticides;
- Pet waste management provisions;
- Provisions for operation and management of septic systems;
- Provisions for solid waste management;
- Snow disposal and plowing plans relative to Wetland Resource Areas;
- Winter Road Salt and/or Sand Use and Storage restrictions;
- Street sweeping schedules;
- Provisions for prevention of illicit discharges to the stormwater management system;
- Documentation that Stormwater BMPs are designed to provide for shutdown and containment in the event of a spill or discharges to or near critical areas or from LUHPPL;
- Training for staff or personnel involved with implementing Long-Term Pollution Prevention Plan;
- List of Emergency contacts for implementing Long-Term Pollution Prevention Plan.

☒ A Long-Term Pollution Prevention Plan is attached to Stormwater Report and is included as an attachment to the Wetlands Notice of Intent.

☐ Treatment BMPs subject to the 44% TSS removal pretreatment requirement and the one inch rule for calculating the water quality volume are included, and discharge:

- ☐ is within the Zone II or Interim Wellhead Protection Area
- ☐ is near or to other critical areas
- ☐ is within soils with a rapid infiltration rate (greater than 2.4 inches per hour)
- ☐ involves runoff from land uses with higher potential pollutant loads.

☐ The Required Water Quality Volume is reduced through use of the LID site Design Credits.

☒ Calculations documenting that the treatment train meets the 80% TSS removal requirement and, if applicable, the 44% TSS removal pretreatment requirement, are provided.

Checklist for Stormwater Report

Checklist (continued)

Standard 4: Water Quality (continued)

☒ The BMP is sized (and calculations provided) based on:

- ☒ The ½" or 1" Water Quality Volume or
- ☐ The equivalent flow rate associated with the Water Quality Volume and documentation is provided showing that the BMP treats the required water quality volume.

☐ The applicant proposes to use proprietary BMPs, and documentation supporting use of proprietary BMP and proposed TSS removal rate is provided. This documentation may be in the form of the propriety BMP checklist found in Volume 2, Chapter 4 of the Massachusetts Stormwater Handbook and submitting copies of the TARP Report, STEP Report, and/or other third party studies verifying performance of the proprietary BMPs.

☐ A TMDL exists that indicates a need to reduce pollutants other than TSS and documentation showing that the BMPs selected are consistent with the TMDL is provided.

Standard 5: Land Uses With Higher Potential Pollutant Loads (LUHPPLs)

☐ The NPDES Multi-Sector General Permit covers the land use and the Stormwater Pollution Prevention Plan (SWPPP) has been included with the Stormwater Report.

☐ The NPDES Multi-Sector General Permit covers the land use and the SWPPP will be submitted ***prior to*** the discharge of stormwater to the post-construction stormwater BMPs.

☐ The NPDES Multi-Sector General Permit does ***not*** cover the land use.

☐ LUHPPLs are located at the site and industry specific source control and pollution prevention measures have been proposed to reduce or eliminate the exposure of LUHPPLs to rain, snow, snow melt and runoff, and been included in the long term Pollution Prevention Plan.

☐ All exposure has been eliminated.

☐ All exposure has ***not*** been eliminated and all BMPs selected are on MassDEP LUHPPL list.

☐ The LUHPPL has the potential to generate runoff with moderate to higher concentrations of oil and grease (e.g. all parking lots with >1000 vehicle trips per day) and the treatment train includes an oil grit separator, a filtering bioretention area, a sand filter or equivalent.

Standard 6: Critical Areas

☐ The discharge is near or to a critical area and the treatment train includes only BMPs that MassDEP has approved for stormwater discharges to or near that particular class of critical area.

☐ Critical areas and BMPs are identified in the Stormwater Report.

Checklist for Stormwater Report

Checklist (continued)

Standard 7: Redevelopments and Other Projects Subject to the Standards only to the maximum extent practicable

☐ The project is subject to the Stormwater Management Standards only to the maximum Extent Practicable as a:

- ☐ Limited Project
- ☐ Small Residential Projects: 5-9 single family houses or 5-9 units in a multi-family development provided there is no discharge that may potentially affect a critical area.
- ☐ Small Residential Projects: 2-4 single family houses or 2-4 units in a multi-family development with a discharge to a critical area
- ☐ Marina and/or boatyard provided the hull painting, service and maintenance areas are protected from exposure to rain, snow, snow melt and runoff
- ☐ Bike Path and/or Foot Path
- ☐ Redevelopment Project
- ☐ Redevelopment portion of mix of new and redevelopment.

☐ Certain standards are not fully met (Standard No. 1, 8, 9, and 10 must always be fully met) and an explanation of why these standards are not met is contained in the Stormwater Report.

☐ The project involves redevelopment and a description of all measures that have been taken to improve existing conditions is provided in the Stormwater Report. The redevelopment checklist found in Volume 2 Chapter 3 of the Massachusetts Stormwater Handbook may be used to document that the proposed stormwater management system (a) complies with Standards 2, 3 and the pretreatment and structural BMP requirements of Standards 4-6 to the maximum extent practicable and (b) improves existing conditions.

Standard 8: Construction Period Pollution Prevention and Erosion and Sedimentation Control

A Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan must include the following information:

- Narrative;
- Construction Period Operation and Maintenance Plan;
- Names of Persons or Entity Responsible for Plan Compliance;
- Construction Period Pollution Prevention Measures;
- Erosion and Sedimentation Control Plan Drawings;
- Detail drawings and specifications for erosion control BMPs, including sizing calculations;
- Vegetation Planning;
- Site Development Plan;
- Construction Sequencing Plan;
- Sequencing of Erosion and Sedimentation Controls;
- Operation and Maintenance of Erosion and Sedimentation Controls;
- Inspection Schedule;
- Maintenance Schedule;
- Inspection and Maintenance Log Form.

☒ A Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan containing the information set forth above has been included in the Stormwater Report.

Checklist for Stormwater Report

Checklist (continued)

Standard 8: Construction Period Pollution Prevention and Erosion and Sedimentation Control (continued)

☐ The project is highly complex and information is included in the Stormwater Report that explains why it is not possible to submit the Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan with the application. A Construction Period Pollution Prevention and Erosion and Sedimentation Control has ***not*** been included in the Stormwater Report but will be submitted ***before*** land disturbance begins.

☒ The project is ***not*** covered by a NPDES Construction General Permit.

☐ The project is covered by a NPDES Construction General Permit and a copy of the SWPPP is in the Stormwater Report.

☐ The project is covered by a NPDES Construction General Permit but no SWPPP been submitted. The SWPPP will be submitted BEFORE land disturbance begins.

Standard 9: Operation and Maintenance Plan

☒ The Post Construction Operation and Maintenance Plan is included in the Stormwater Report and includes the following information:

- ☒ Name of the stormwater management system owners;
- ☒ Party responsible for operation and maintenance;
- ☒ Schedule for implementation of routine and non-routine maintenance tasks;
- ☒ Plan showing the location of all stormwater BMPs maintenance access areas;
- ☐ Description and delineation of public safety features;
- ☒ Estimated operation and maintenance budget; and
- ☒ Operation and Maintenance Log Form.

☐ The responsible party is ***not*** the owner of the parcel where the BMP is located and the Stormwater Report includes the following submissions:

- ☐ A copy of the legal instrument (deed, homeowner's association, utility trust or other legal entity) that establishes the terms of and legal responsibility for the operation and maintenance of the project site stormwater BMPs;
- ☐ A plan and easement deed that allows site access for the legal entity to operate and maintain BMP functions.

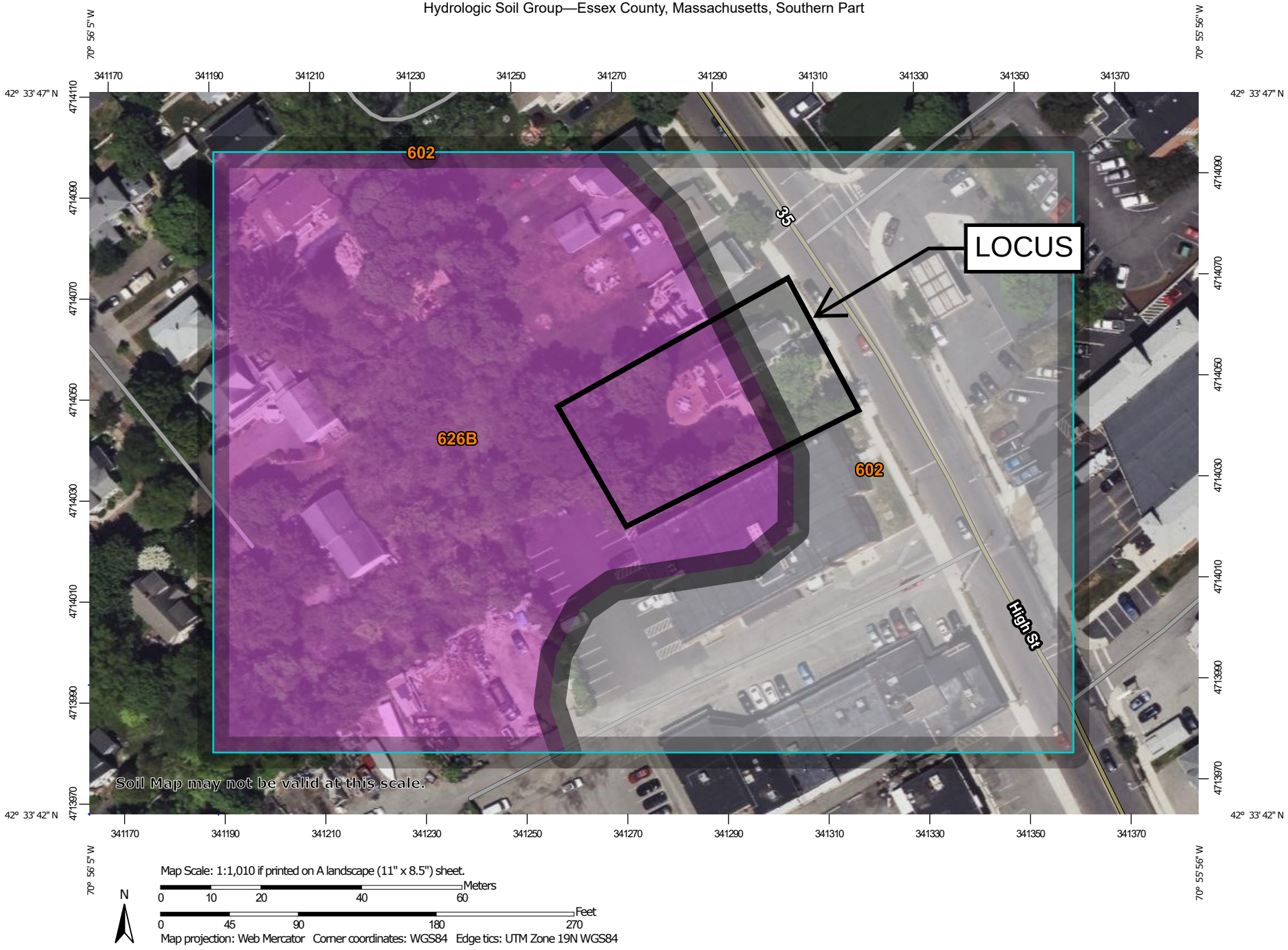
Standard 10: Prohibition of Illicit Discharges

☒ The Long-Term Pollution Prevention Plan includes measures to prevent illicit discharges;

☒ An Illicit Discharge Compliance Statement is attached;

☐ NO Illicit Discharge Compliance Statement is attached but will be submitted ***prior to*** the discharge of any stormwater to post-construction BMPs.

Appendix III NRCS Soils Map



Map Scale: 1:1,010 if printed on A landscape (11" x 8.5") sheet.

N

Meters
0 10 20 40 60

Feet
0 45 90 180 270

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 19N WGS84

MAP LEGEND

Area of Interest (AOI)

Area of Interest (AOI)

Soils

Soil Rating Polygons

A
A/D
B
B/D
C
C/D
D
Not rated or not available

Soil Rating Lines

A
A/D
B
B/D
C
C/D
D
Not rated or not available

Soil Rating Points

A
A/D
B
B/D
C
C/D
D
Not rated or not available

Water Features

Streams and Canals

Transportation

Rails
Interstate Highways
US Routes
Major Roads
Local Roads

Background

Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:15,800.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Essex County, Massachusetts, Southern Part
Survey Area Data: Version 21, Aug 27, 2024

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: May 22, 2022—Jun 5, 2022

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Hydrologic Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
602	Urban land		2.3	45.1%
626B	Merrimac-Urban land complex, 0 to 8 percent slopes	A	2.8	54.9%
Totals for Area of Interest			**5.0**	**100.0%**

Description

Hydrologic soil groups are based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms.

The soils in the United States are assigned to four groups (A, B, C, and D) and three dual classes (A/D, B/D, and C/D). The groups are defined as follows:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas. Only the soils that in their natural condition are in group D are assigned to dual classes.

Rating Options

Aggregation Method: Dominant Condition

Appendix IV Soil Testing Logs

Soil Evaluation for Drainage
January 23, 2024
Evaluation by: James Polakiewicz

61 High Street
Danvers, MA

HANCOCK ASSOCIATES

See Site Plan for Locations

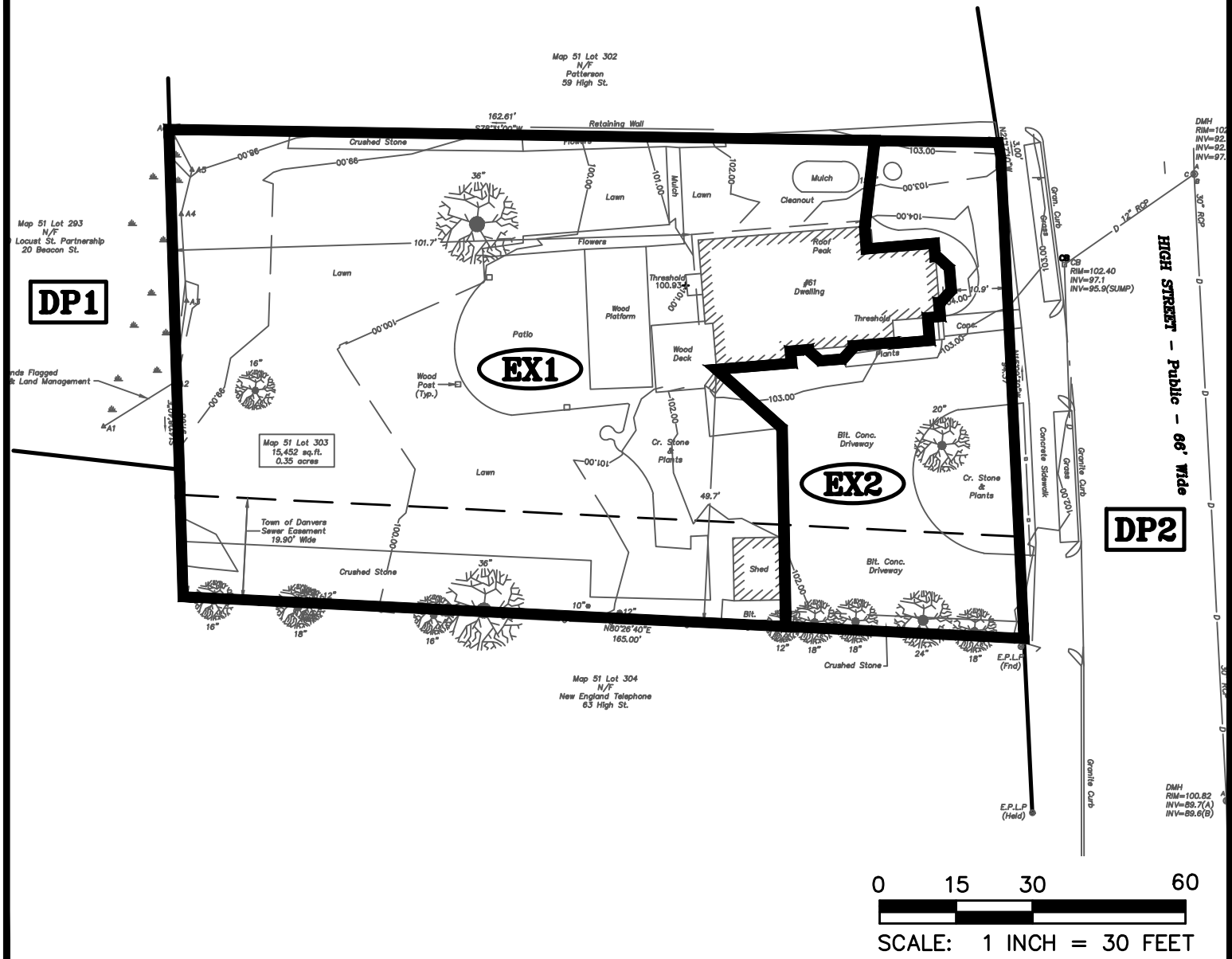
TP1

Depth (in)	Soil Horizon/ Layer	Matrix: Color-Moist (Munsell)	Redoximorphic Features (mottles)			Soil Texture (USDA)	Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	
			Depth	Color	Percent		Gravel	Cobbles & Stones			
0-4	Fill					Sandy Loam					Top Soil
5-30	Fill					Sandy Loam					
30-48	Fill		45"			Coarse Sand					
48-70	Ab					Loam					
70-77	C1					Sand					
77-97+	C2					Silty Clay Loam					
No Weeping, No Standing, No Refusal											

TP2

Depth (in)	Soil Horizon/ Layer	Soil Matrix: Color-Moist	Redoximorphic Features (mottles)			Soil Texture (USDA)	Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	
			Depth	Color	Percent		Gravel	Cobbles & Stones			
0-21	Fill					Sandy Loam					Top Soil
21-55	Fill					Loamy Sand					
55-80	Ab		60"			Loam					
80-107+	C					Silty Clay Loam					
Weeping @ 92", Standing @ 105", No Refusal											

Appendix V Existing and Proposed Drainage Figures



F:\Civil 3D Projects\26733-a.point.design-Danvers\Eng\DWG\26733 EX Drainage Figure.dwg Jan 27, 2025

Prepared for:

61
HIGH STREET

DANVERS, MA

HANCOCK ASSOCIATES

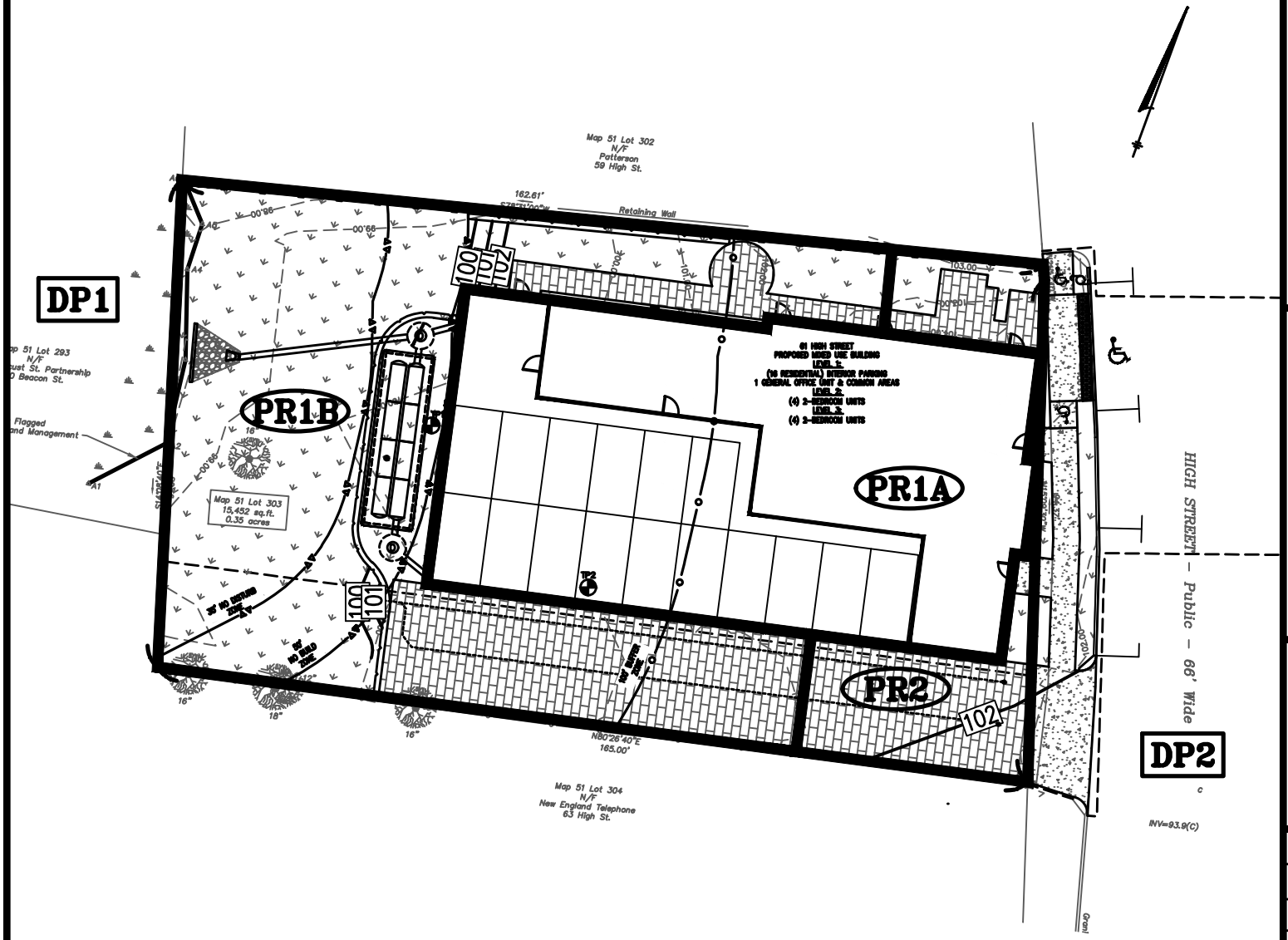
Civil Engineers
Land Surveyors
Wetland Scientists

185 CENTRE STREET
DANVERS, MA. 01923
VOICE (978) 777-3050
FAX (978) 774-7816

EXISTING DRAINAGE FIGURE

DATE:	01/27/25
DWG:	26733 EX Drainage Figure.dwg
SCALE:	1"=30'
DESIGN:	JJP
LAYOUT: EX	
DRAWN:	JJP
SHEET:	1 OF 2
JOB NO.:	26733

EX



F:\Civil 3D Projects\26733-a.point.design-Danvers\Eng\DWG\26733gu.dwg Mar 31, 2025

Prepared for:

61
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DANVERS, MA

HANCOCK ASSOCIATES

Civil Engineers
Land Surveyors
Wetland Scientists

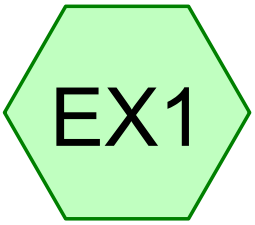
185 CENTRE STREET
DANVERS, MA. 01923
VOICE (978) 777-3050
FAX (978) 774-7816

PROPOSED DRAINAGE FIGURE

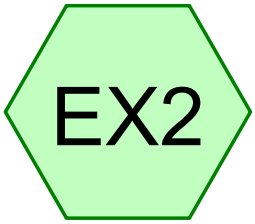
DATE:	03/31/25
DWG:	26733gu.dwg
SCALE:	1"=30'
DESIGN:	JJP
LAYOUT:	PR
DRAWN:	JJP
SHEET:	2 OF 2
JOB NO.:	26733

PR

Appendix VI Hydrocad Output



Existing to Wetlands



Existing to Street

Subcat Reach Pond Link

Routing Diagram for 26733 HydroCAD
Prepared by Hancock Associates, Printed 3/31/2025

Summary for Subcatchment EX1: Existing to Wetlands

Runoff = 0.29 cfs @ 12.09 hrs, Volume= 0.023 af, Depth> 0.91"
Routed to nonexistent node EX DP1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.06 hrs
Type III 24-hr 2-year Rainfall=3.26"

	Area (sf)	CN	Description
	9,519	61	>75% Grass cover, Good, HSG B
*	2,323	98	Impervious Area, HSG B
	1,187	98	Roofs, HSG B
	13,029	71	Weighted Average
	9,519		73.06% Pervious Area
	3,510		26.94% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Summary for Subcatchment EX2: Existing to Street

Runoff = 0.14 cfs @ 12.07 hrs, Volume= 0.010 af, Depth> 2.22"
Routed to nonexistent node EX DP1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.06 hrs
Type III 24-hr 2-year Rainfall=3.26"

	Area (sf)	CN	Description
	527	61	>75% Grass cover, Good, HSG B
*	1,896	98	Impervious Area, HSG B
	2,423	90	Weighted Average
	527		21.75% Pervious Area
	1,896		78.25% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Summary for Subcatchment EX1: Existing to Wetlands

Runoff = 0.77 cfs @ 12.08 hrs, Volume= 0.055 af, Depth> 2.22"
Routed to nonexistent node EX DP1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.06 hrs
Type III 24-hr 10-year Rainfall=5.14"

	Area (sf)	CN	Description
	9,519	61	>75% Grass cover, Good, HSG B
*	2,323	98	Impervious Area, HSG B
	1,187	98	Roofs, HSG B
	13,029	71	Weighted Average
	9,519		73.06% Pervious Area
	3,510		26.94% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Summary for Subcatchment EX2: Existing to Street

Runoff = 0.25 cfs @ 12.07 hrs, Volume= 0.019 af, Depth> 4.01"
Routed to nonexistent node EX DP1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.06 hrs
Type III 24-hr 10-year Rainfall=5.14"

	Area (sf)	CN	Description
	527	61	>75% Grass cover, Good, HSG B
*	1,896	98	Impervious Area, HSG B
	2,423	90	Weighted Average
	527		21.75% Pervious Area
	1,896		78.25% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Summary for Subcatchment EX1: Existing to Wetlands

Runoff = 1.11 cfs @ 12.08 hrs, Volume= 0.078 af, Depth> 3.15"
Routed to nonexistent node EX DP1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.06 hrs
Type III 24-hr 25-year Rainfall=6.31"

	Area (sf)	CN	Description
	9,519	61	>75% Grass cover, Good, HSG B
*	2,323	98	Impervious Area, HSG B
	1,187	98	Roofs, HSG B
	13,029	71	Weighted Average
	9,519		73.06% Pervious Area
	3,510		26.94% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Summary for Subcatchment EX2: Existing to Street

Runoff = 0.32 cfs @ 12.07 hrs, Volume= 0.024 af, Depth> 5.15"
Routed to nonexistent node EX DP1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.06 hrs
Type III 24-hr 25-year Rainfall=6.31"

	Area (sf)	CN	Description
	527	61	>75% Grass cover, Good, HSG B
*	1,896	98	Impervious Area, HSG B
	2,423	90	Weighted Average
	527		21.75% Pervious Area
	1,896		78.25% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Summary for Subcatchment EX1: Existing to Wetlands

Runoff = 1.65 cfs @ 12.08 hrs, Volume= 0.117 af, Depth> 4.68"
Routed to nonexistent node EX DP1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.06 hrs
Type III 24-hr 100-year Rainfall=8.12"

	Area (sf)	CN	Description
	9,519	61	>75% Grass cover, Good, HSG B
*	2,323	98	Impervious Area, HSG B
	1,187	98	Roofs, HSG B
	13,029	71	Weighted Average
	9,519		73.06% Pervious Area
	3,510		26.94% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

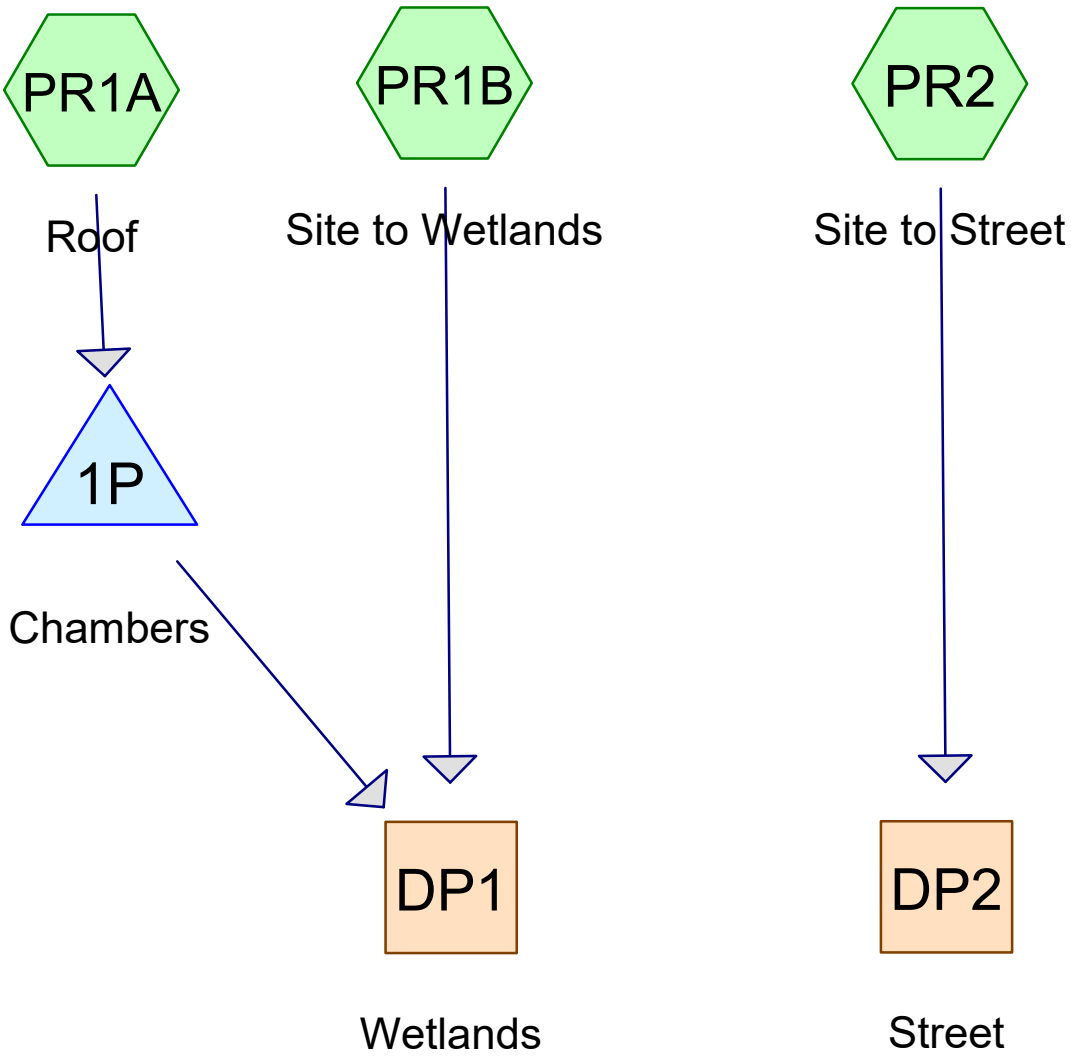
Summary for Subcatchment EX2: Existing to Street

Runoff = 0.42 cfs @ 12.07 hrs, Volume= 0.032 af, Depth> 6.92"
Routed to nonexistent node EX DP1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.06 hrs
Type III 24-hr 100-year Rainfall=8.12"

	Area (sf)	CN	Description
	527	61	>75% Grass cover, Good, HSG B
*	1,896	98	Impervious Area, HSG B
	2,423	90	Weighted Average
	527		21.75% Pervious Area
	1,896		78.25% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**



Subcat Reach Pond Link

Routing Diagram for 26733 HydroCAD
Prepared by Hancock Associates, Printed 3/31/2025

Summary for Subcatchment PR1A: Roof

Runoff = 0.45 cfs @ 12.07 hrs, Volume= 0.036 af, Depth> 3.03"
Routed to Pond 1P : Chambers

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.06 hrs
Type III 24-hr 2-year Rainfall=3.26"

Area (sf)	CN	Description
6,195	98	Roofs, HSG B
6,195		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Summary for Subcatchment PR1B: Site to Wetlands

Runoff = 0.04 cfs @ 12.12 hrs, Volume= 0.004 af, Depth> 0.47"
Routed to Reach DP1 : Wetlands

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.06 hrs
Type III 24-hr 2-year Rainfall=3.26"

	Area (sf)	CN	Description
	2,453	61	>75% Grass cover, Good, HSG B
*	2,183	61	Permeable Pavers, HSG B
	4,636	61	Weighted Average
	4,636		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Summary for Subcatchment PR2: Site to Street

Runoff = 0.02 cfs @ 12.12 hrs, Volume= 0.002 af, Depth> 0.51"
Routed to Reach DP2 : Street

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.06 hrs
Type III 24-hr 2-year Rainfall=3.26"

	Area (sf)	CN	Description
	301	61	>75% Grass cover, Good, HSG B
	41	98	Paved parking, HSG B
*	1,518	61	Permeable Pavers, HSG B
	1,860	62	Weighted Average
	1,819		97.80% Pervious Area
	41		2.20% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Summary for Reach DP1: Wetlands

Inflow Area = 0.249 ac, 57.20% Impervious, Inflow Depth > 0.75" for 2-year event
Inflow = 0.28 cfs @ 12.15 hrs, Volume= 0.015 af
Outflow = 0.28 cfs @ 12.15 hrs, Volume= 0.015 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.06 hrs

Summary for Reach DP2: Street

Inflow Area = 0.043 ac, 2.20% Impervious, Inflow Depth > 0.51" for 2-year event
Inflow = 0.02 cfs @ 12.12 hrs, Volume= 0.002 af
Outflow = 0.02 cfs @ 12.12 hrs, Volume= 0.002 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.06 hrs

Summary for Pond 1P: Chambers

Inflow Area = 0.142 ac,100.00% Impervious, Inflow Depth > 3.03" for 2-year event
Inflow = 0.45 cfs @ 12.07 hrs, Volume= 0.036 af
Outflow = 0.29 cfs @ 12.17 hrs, Volume= 0.036 af, Atten= 35%, Lag= 6.0 min
Discarded = 0.05 cfs @ 11.58 hrs, Volume= 0.025 af
Primary = 0.24 cfs @ 12.17 hrs, Volume= 0.011 af
Routed to Reach DP1 : Wetlands

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.06 hrs / 3
Peak Elev= 100.09' @ 12.17 hrs Surf.Area= 279 sf Storage= 120 cf
Flood Elev= 2.25' Storage= 0 cf

Plug-Flow detention time= 2.7 min calculated for 0.036 af (100% of inflow)
Center-of-Mass det. time= 2.4 min (757.2 - 754.8)

Volume	Invert	Avail.Storage	Storage Description
#1A	99.25'	213 cf	**8.67'W x 32.18'L x 2.33'H Field A** 651 cf Overall - 118 cf Embedded = 533 cf x 40.0% Voids
#2A	99.75'	118 cf	**ADS_StormTech SC-310 +Cap** x 8 Inside #1 Effective Size= 28.9"W x 16.0"H => 2.07 sf x 7.12'L = 14.7 cf Overall Size= 34.0"W x 16.0"H x 7.56'L with 0.44' Overlap 8 Chambers in 2 Rows
		331 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	101.00'	**4.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)
#2	Primary	99.25'	**3.3" Vert. Orifice** C= 0.600 Limited to weir flow at low heads
#3	Discarded	99.25'	**8.270 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=0.05 cfs @ 11.58 hrs HW=99.28' (Free Discharge)
└**3=Exfiltration** (Exfiltration Controls 0.05 cfs)

Primary OutFlow Max=0.24 cfs @ 12.17 hrs HW=100.08' (Free Discharge)
├**1=Sharp-Crested Rectangular Weir** (Controls 0.00 cfs)
└**2=Orifice** (Orifice Controls 0.24 cfs @ 4.01 fps)

Time span=0.00-24.00 hrs, dt=0.06 hrs, 401 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment PR1A: Roof Runoff Area=6,195 sf 100.00% Impervious Runoff Depth>4.90"
Tc=5.0 min CN=98 Runoff=0.72 cfs 0.058 af

Subcatchment PR1B: Site to Wetlands Runoff Area=4,636 sf 0.00% Impervious Runoff Depth>1.45"
Tc=5.0 min CN=61 Runoff=0.17 cfs 0.013 af

Subcatchment PR2: Site to Street Runoff Area=1,860 sf 2.20% Impervious Runoff Depth>1.52"
Tc=5.0 min CN=62 Runoff=0.07 cfs 0.005 af

Reach DP1: Wetlands Inflow=0.49 cfs 0.035 af
Outflow=0.49 cfs 0.035 af

Reach DP2: Street Inflow=0.07 cfs 0.005 af
Outflow=0.07 cfs 0.005 af

Summary for Pond 1P: Chambers

Inflow Area = 0.142 ac,100.00% Impervious, Inflow Depth > 4.90" for 10-year event
Inflow = 0.72 cfs @ 12.07 hrs, Volume= 0.058 af
Outflow = 0.41 cfs @ 12.19 hrs, Volume= 0.058 af, Atten= 43%, Lag= 7.3 min
Discarded = 0.05 cfs @ 11.16 hrs, Volume= 0.036 af
Primary = 0.36 cfs @ 12.19 hrs, Volume= 0.022 af
Routed to Reach DP1 : Wetlands

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.06 hrs / 3
Peak Elev= 100.94' @ 12.19 hrs Surf.Area= 279 sf Storage= 258 cf
Flood Elev= 2.25' Storage= 0 cf

Plug-Flow detention time= 3.8 min calculated for 0.058 af (100% of inflow)
Center-of-Mass det. time= 3.7 min (750.0 - 746.3)

Volume	Invert	Avail.Storage	Storage Description
#1A	99.25'	213 cf	**8.67'W x 32.18'L x 2.33'H Field A** 651 cf Overall - 118 cf Embedded = 533 cf x 40.0% Voids
#2A	99.75'	118 cf	**ADS_StormTech SC-310 +Cap** x 8 Inside #1 Effective Size= 28.9"W x 16.0"H => 2.07 sf x 7.12'L = 14.7 cf Overall Size= 34.0"W x 16.0"H x 7.56'L with 0.44' Overlap 8 Chambers in 2 Rows
		331 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	101.00'	**4.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)
#2	Primary	99.25'	**3.3" Vert. Orifice** C= 0.600 Limited to weir flow at low heads
#3	Discarded	99.25'	**8.270 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=0.05 cfs @ 11.16 hrs HW=99.28' (Free Discharge)
└**3=Exfiltration** (Exfiltration Controls 0.05 cfs)

Primary OutFlow Max=0.35 cfs @ 12.19 hrs HW=100.92' (Free Discharge)
├**1=Sharp-Crested Rectangular Weir** (Controls 0.00 cfs)
└**2=Orifice** (Orifice Controls 0.35 cfs @ 5.96 fps)

Time span=0.00-24.00 hrs, dt=0.06 hrs, 401 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment PR1A: Roof Runoff Area=6,195 sf 100.00% Impervious Runoff Depth>6.07"
Tc=5.0 min CN=98 Runoff=0.89 cfs 0.072 af

Subcatchment PR1B: Site to Wetlands Runoff Area=4,636 sf 0.00% Impervious Runoff Depth>2.21"
Tc=5.0 min CN=61 Runoff=0.27 cfs 0.020 af

Subcatchment PR2: Site to Street Runoff Area=1,860 sf 2.20% Impervious Runoff Depth>2.30"
Tc=5.0 min CN=62 Runoff=0.11 cfs 0.008 af

Reach DP1: Wetlands Inflow=0.93 cfs 0.049 af
Outflow=0.93 cfs 0.049 af

Reach DP2: Street Inflow=0.11 cfs 0.008 af
Outflow=0.11 cfs 0.008 af

Summary for Pond 1P: Chambers

Inflow Area = 0.142 ac,100.00% Impervious, Inflow Depth > 6.07" for 25-year event
Inflow = 0.89 cfs @ 12.07 hrs, Volume= 0.072 af
Outflow = 0.74 cfs @ 12.13 hrs, Volume= 0.072 af, Atten= 16%, Lag= 3.5 min
Discarded = 0.05 cfs @ 10.62 hrs, Volume= 0.042 af
Primary = 0.69 cfs @ 12.13 hrs, Volume= 0.029 af
Routed to Reach DP1 : Wetlands

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.06 hrs / 3
Peak Elev= 101.11' @ 12.14 hrs Surf.Area= 279 sf Storage= 278 cf
Flood Elev= 2.25' Storage= 0 cf

Plug-Flow detention time= 7.0 min calculated for 0.071 af (99% of inflow)
Center-of-Mass det. time= 3.9 min (747.0 - 743.2)

Volume	Invert	Avail.Storage	Storage Description
#1A	99.25'	213 cf	**8.67'W x 32.18'L x 2.33'H Field A** 651 cf Overall - 118 cf Embedded = 533 cf x 40.0% Voids
#2A	99.75'	118 cf	**ADS_StormTech SC-310 +Cap** x 8 Inside #1 Effective Size= 28.9"W x 16.0"H => 2.07 sf x 7.12'L = 14.7 cf Overall Size= 34.0"W x 16.0"H x 7.56'L with 0.44' Overlap 8 Chambers in 2 Rows
		331 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	101.00'	**4.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)
#2	Primary	99.25'	**3.3" Vert. Orifice** C= 0.600 Limited to weir flow at low heads
#3	Discarded	99.25'	**8.270 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=0.05 cfs @ 10.62 hrs HW=99.27' (Free Discharge)
└**3=Exfiltration** (Exfiltration Controls 0.05 cfs)

Primary OutFlow Max=0.65 cfs @ 12.13 hrs HW=101.08' (Free Discharge)
├**1=Sharp-Crested Rectangular Weir** (Weir Controls 0.28 cfs @ 0.91 fps)
└**2=Orifice** (Orifice Controls 0.37 cfs @ 6.26 fps)

Time span=0.00-24.00 hrs, dt=0.06 hrs, 401 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment PR1A: Roof Runoff Area=6,195 sf 100.00% Impervious Runoff Depth>7.88"
Tc=5.0 min CN=98 Runoff=1.14 cfs 0.093 af

Subcatchment PR1B: Site to Wetlands Runoff Area=4,636 sf 0.00% Impervious Runoff Depth>3.53"
Tc=5.0 min CN=61 Runoff=0.44 cfs 0.031 af

Subcatchment PR2: Site to Street Runoff Area=1,860 sf 2.20% Impervious Runoff Depth>3.65"
Tc=5.0 min CN=62 Runoff=0.18 cfs 0.013 af

Reach DP1: Wetlands Inflow=1.58 cfs 0.075 af
Outflow=1.58 cfs 0.075 af

Reach DP2: Street Inflow=0.18 cfs 0.013 af
Outflow=0.18 cfs 0.013 af

Summary for Pond 1P: Chambers

Inflow Area = 0.142 ac,100.00% Impervious, Inflow Depth > 7.88" for 100-year event
Inflow = 1.14 cfs @ 12.07 hrs, Volume= 0.093 af
Outflow = 1.19 cfs @ 12.08 hrs, Volume= 0.094 af, Atten= 0%, Lag= 0.6 min
Discarded = 0.05 cfs @ 10.02 hrs, Volume= 0.051 af
Primary = 1.14 cfs @ 12.08 hrs, Volume= 0.043 af
Routed to Reach DP1 : Wetlands

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.06 hrs / 3
Peak Elev= 101.19' @ 12.09 hrs Surf.Area= 279 sf Storage= 288 cf
Flood Elev= 2.25' Storage= 0 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 3.7 min (743.5 - 739.8)

Volume	Invert	Avail.Storage	Storage Description
#1A	99.25'	213 cf	**8.67'W x 32.18'L x 2.33'H Field A** 651 cf Overall - 118 cf Embedded = 533 cf x 40.0% Voids
#2A	99.75'	118 cf	**ADS_StormTech SC-310 +Cap** x 8 Inside #1 Effective Size= 28.9"W x 16.0"H => 2.07 sf x 7.12'L = 14.7 cf Overall Size= 34.0"W x 16.0"H x 7.56'L with 0.44' Overlap 8 Chambers in 2 Rows
		331 cf	Total Available Storage

Storage Group A created with Chamber Wizard

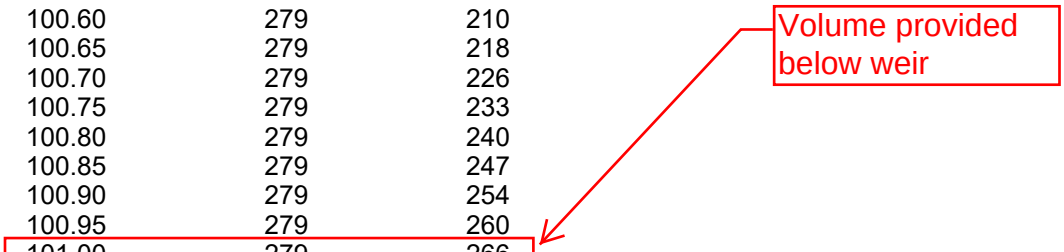
Device	Routing	Invert	Outlet Devices
#1	Primary	101.00'	**4.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)
#2	Primary	99.25'	**3.3" Vert. Orifice** C= 0.600 Limited to weir flow at low heads
#3	Discarded	99.25'	**8.270 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=0.05 cfs @ 10.02 hrs HW=99.27' (Free Discharge)
└**3=Exfiltration** (Exfiltration Controls 0.05 cfs)

Primary OutFlow Max=1.03 cfs @ 12.08 hrs HW=101.14' (Free Discharge)
├**1=Sharp-Crested Rectangular Weir** (Weir Controls 0.66 cfs @ 1.21 fps)
└**2=Orifice** (Orifice Controls 0.38 cfs @ 6.37 fps)

Stage-Area-Storage for Pond 1P: Chambers

Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)
99.25	**279**	0
99.30	279	6
99.35	279	11
99.40	279	17
99.45	279	22
99.50	279	28
99.55	279	33
99.60	279	39
99.65	279	45
99.70	279	50
99.75	279	56
99.80	279	65
99.85	279	75
99.90	279	85
99.95	279	94
100.00	279	104
100.05	279	113
100.10	279	123
100.15	279	132
100.20	279	141
100.25	279	150
100.30	279	159
100.35	279	168
100.40	279	176
100.45	279	185
100.50	279	194
100.55	279	202
100.60	279	210
100.65	279	218
100.70	279	226
100.75	279	233
100.80	279	240
100.85	279	247
100.90	279	254
100.95	279	260
101.00	279	266
101.05	279	272
101.10	279	277
101.15	279	283
101.20	279	288
101.25	279	294
101.30	279	299
101.35	279	305
101.40	279	311
101.45	279	316
101.50	279	322
101.55	279	**327**



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