STORMWATER MANAGEMENT REPORT

YE'S TABLE ASIAN CUISINE
PARCEL ID: 1113-109W-19
125 MERRIMACK STREET
METHUEN, MASSACHUSETTS

GPI

44 Stiles Road, Suite One
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Prepared For:

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COMMONWEALTH OF MASSACHUSETTS
CORY N. MASON
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REGISTERED PROFESSIONAL ENGINEER
4/7/2021

April 7, 2021

(GPI Project No.: NEX-2020159)

Wan Yan, LLC
Ye's Table Asian Cuisine
Stormwater Management Report

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SECTION 1 EXECUTIVE SUMMARY

This report contains a stormwater management analysis for the proposed restaurant facility in Methuen, Massachusetts. The analysis includes both pre- and post-development calculations of stormwater runoff rates at specific locations on the project site. This analysis has been prepared in accordance with both City of Methuen requirements and the stormwater management standards of the Massachusetts Department of Environmental Protection (MassDEP) Massachusetts Stormwater Policy.

The project site consists of one parcel located in the Highway Business District (BH) identified as Parcel ID: 1113-109W-19 which totals approximately 2.891 acres. The site is bordered by commercial and retail developments to the north, Merrimack Street to the west, commercial and retail developments to the south, and a wooded area and a wetland to the east.

The applicant is proposing to renovate and expand the existing 2,475 square foot former bank building to create an approximately 5,000 square foot, two-story restaurant. Access to the proposed developed site will be provided from a 24-foot wide driveway which intersects Merrimack Street. The existing parking area will be expanded towards the east side of the lot and the proposed layout will result in an increase in impervious coverage on-site of approximately 25,500 square foot. The proposed building will utilize the existing public water, gas, and sewer services.

In order to mitigate increases in peak discharge rates of stormwater runoff as a result of the new impervious surfaces, the proposed stormwater management system will include a subsurface infiltration system consisting of ADS Stormtech MC-4500 chambers encased in crushed stone.

Based on site topography and discharge points, two analysis points are identified for the purposes of this analysis. Design Point #1 represents the area to the north-west of the property adjacent to Merrimack Street. Design Point #2 is the wetland area in the eastern portion of the property.

The table below summarizes the comparative pre- and post-development peak rates of stormwater runoff at each design point.

TABLE 1: PEAK RATE ANALYSIS SUMMARY

Design Storm	Pre-Development (cfs)	Post-Development (cfs)	Change (cfs)
DESIGN POINT #1			
2-year	0.1	0.0	-0.1
10-year	0.3	0.0	-0.3
25-year	0.5	0.1	-0.4
100-year	0.9	0.1	-0.8
DESIGN POINT #2			
2-year	0.0	0.0	-0.0
10-year	0.8	0.2	-0.6
25-year	2.2	1.0	-1.2
100-year	6.0	5.5	-0.5

(All values shown are peak rates in CFS)

As shown above, the proposed stormwater management system which includes provisions to collect, treat, and recharge stormwater runoff, will result in a decrease in post-development peak flow rates for all storms analyzed.

Implementing the maintenance procedures outlined in the Operation and Maintenance Plan (O&M) will ensure the long-term performance of the system.

SECTION 2 EXISTING CONDITIONS

The project site consists of one parcel located in the Highway Business District (BH) identified as Parcel ID: 1113-109W-19 which totals approximately 2.891 acres. The site is bordered by commercial and retail developments to the north, Merrimack Street to the west, commercial and retail developments to the south, and a wooded area and a wetland to the east.

Site topography is variable, with slopes ranging from moderate (2-6%) in the existing parking lot to severe (30% or greater) towards the east side of the property in the wooded area. Elevations range from approximately 100 in the southwest corner of the site adjacent to Merrimack Street to approximately 60 near the flagged wetland to the eastern property line.

Currently, there is no on-site drainage system. Stormwater runoff from a small area in the north-west portion of the property flows towards Merrimack Street at Design Point #1 and is eventually captured in an existing catch basin in Merrimack Street.

Stormwater runoff from the majority of the site flows over the existing paved driveway and parking area into the wooded area to the east and ultimately into the existing wetland in the eastern portion of the property.

The NRCS Web Soil Survey identifies on-site soils as Urban Land with no Hydrologic Soil Group (HSG) classification, Swansea Muck with an HSG-B classification, and Udorthents with an HSG-A classification. In the absence of a defined HSG classification for Urban Land, HSG-A has been conservatively used in the analysis. Refer to Appendix B for additional information.

Test pits were performed by Greenman-Pedersen, Inc. (GPI) on March 31, 2021. The three (3) test pits encountered loamy sand with depths to estimated seasonal high groundwater between 18 inches to 30 inches. Test pit logs are included in Appendix C.

An on-site wetland as shown on the Existing Conditions Plan was delineated by Norse Environmental Services on August 3, 2020. The wetland is located towards the eastern property line and its associated wetland setbacks are shown on the plan.

The project site is located within Zone X, which is an area of minimal flood hazard outside the 100-year flood zone, according to the Federal Emergency Management Agency (FEMA) FIRM panel 25009C0207F effective on 7/3/2012.

SECTION 3 PROPOSED CONDITIONS

The applicant is proposing to renovate and expand the existing 2,475 square foot former bank building to create an approximately 5,000 square foot two-story restaurant. Access to the proposed developed site will be provided from a 24-foot wide driveway which intersects Merrimack Street. The existing parking area will be expanded towards the east side of the lot and the proposed layout will result in an increase in impervious coverage on-site of approximately 25,500 square foot. The proposed building will utilize the existing public water, gas, and sewer services.

A new stormwater management system consisting of deep-sump, hooded catch basins and an underground infiltration system with an "isolator row", has been designed to collect, treat and recharge stormwater runoff from the proposed site. The proposed stormwater system was designed to comply with the MassDEP Stormwater Management Standards and will significantly improve stormwater quality and quantity to the design points.

In order to mitigate increases in peak discharge rates of stormwater runoff as a result of the new impervious surfaces, the proposed stormwater control measure will include a subsurface infiltration system consisting of ADS Stormtech MC-4500 chambers encased in crushed stone. Stormwater runoff from the proposed building and the paved parking areas will flow into the proposed underground infiltration system and then routed through an outlet control structure which discharges through a 12" CPP pipe towards the existing wetland.

Proposed site grading will direct the majority of stormwater runoff to the proposed stormwater management system and result in a reduction of peak flow rates at Design Point #1.

Runoff from the roof, paved driveways and parking area will be captured in deep sump catch basins with hooded outlets and directed to an underground infiltration system designed to store and exfiltrate the water quality volume before discharging through an outlet control structure eventually to Design Point #2.

An Operation and Maintenance (O&M) Plan will be implemented to safeguard against future intrusion of contaminants and TSS, and ensure proper functioning of drainage components.

To prevent erosion and discharge of sediment during construction, Best Management Practices including silt fence, a stabilized construction exit, mulch and seeding have been incorporated into the construction sequence.

The total area of disturbance related to the proposed roadway and stormwater management system construction is approximately 74,000 square feet, and therefore the project will require an EPA Construction General Permit under the NPDES program.

Stormwater Quality Controls:

1. **Street Sweeping** - to remove sediment prior to entering the drainage system. This would be done on a scheduled basis. TSS Removal Rate = 5%
2. **Catch Basins with Deep Sumps and Hooded Outlets** to capture, pretreat, and direct stormwater to the proposed treatment devices. TSS Removal Rate = 25%
3. **Underground Infiltration System** to provide stormwater treatment and groundwater recharge through infiltration into the underlying soils. TSS Removal Rate = 80%

Groundwater Recharge:
On-site groundwater recharge is provided by the underground infiltration system. Refer to standard #3.

Stormwater Quantity Controls:

The stormwater management system has been designed to control stormwater runoff from the site for the 25-year storm event. Peak flow rates of stormwater runoff are reduced by routing stormwater runoff through the proposed underground infiltration system. An outlet control structure at the underground infiltration system is designed to ensure the basin will perform during all storms analyzed.

Stormwater Management & Water Quality Calculations:

Standard #1: Untreated Stormwater

No new untreated stormwater discharges directly to wetlands or waters of the Commonwealth are proposed.

Standard #2: Post Development Peak Discharge Rates

By implementing the proposed underground infiltration system to detain and recharge stormwater runoff, will result in a decrease in post-development peak flow rates compared with pre-development rates for all storms analyzed.

Standard #3: Groundwater Recharge

On-site groundwater recharge is provided through the use of an underground infiltration system consisting of ADS Stormtech MC-4500 chambers encased in crushed stone.

In accordance with Massachusetts Stormwater Policy, the required groundwater recharge volume (Rv) is based on a target depth factor (F) over impervious areas. The target depth factors for HSG-A and HSG-B soils are 0.60 inches and 0.35 inches respectively. Conservatively, the recharge volume has been calculated as if the site was entirely HSG-A. The on-site impervious area = 45,913 sf.

Required Groundwater Recharge Volume:

$$R_v = F * A_{impervious}$$

$$R_v = 0.60\ inches\left(\frac{1\ in}{12\ ft}\right) * 45{,}913\ sf = \mathbf{2{,}296\ c.f.}$$

The recharge volume provided is the volume within the underground infiltration system below the lowest outlet elevation (measured statically). See summary table below.

Groundwater Recharge Volume Provided		
BMP	**Elevation**	**Volume**
UG INF (MC-4500)	82.25 – 85.50	**6,312 c.f.**

Total Recharge Volume Provided = 6,312 c.f.
(See following pages for HydroCAD Stage-Storage tables)

Standard #4: TSS Removal

Water Quality Volume Calculations:

The proposed underground infiltration system is designed to store and infiltrate the water quality volume (V_{WQ}) from proposed impervious surfaces. The water quality volume (V_{WQ}) is the volume of impervious surfaces times the water quality depth (D_{WQ}). Because the on-site soils have an infiltration rate greater than 2.4 inches/hour, the water quality depth is 1 inch.

$$V_{WQ} = D_{WQ} * A_{impervious}$$
$$V_{WQ} = 1\,in \left(\frac{1\,in}{12\,ft}\right) * 45{,}913\,sf = \mathbf{3{,}827\,c.f.}$$

The subsurface infiltration system consists of sixty-four MC-4500 chambers and crushed stone which provides a total of 11,572 cubic feet of storage and exceeds the 3,827 cubic feet required. Refer to the attached volume calculations.

TSS Removal Rates Summary:

BMP	TSS Removal Rate
Street Sweeping	5%
Deep Sump Catch Basin	25%
Underground Infiltration System	80%

Beginning Load: 1.00 x Street Sweeping removal rate (0.05) = 0.05
Load Remaining = 1.00 – 0.05 = **0.95**
Remaining Load: 0.95 x Catch Basin with deep sump removal rate (0.25) = 0.24
Load Remaining = 0.95 – 0.24 = **0.71**
Remaining Load: 0.71 x Infiltration System removal rate (0.80) = 0.57
Load Remaining = 0.71 – 0.57 = **0.14**

Total TSS Removal Rate = (1.00 – 0.14) **= 86%**

Standard #5: Land Uses with Higher Potential Pollutant Loads

The site does not contain uses identified as having higher potential pollutant loads.

Standard #6: Protection of Critical Areas

The site is not within a Zone II, wellhead protection area, or any other critical area.

Standard # 7: Redevelopment projects

The site results in an increase in on-site impervious area and is not considered a redevelopment.

Standard # 8: Erosion/sediment control

Erosion and sediment controls are incorporated into the project design to prevent erosion. An Erosion & Sediment Control Plan is included with the site plans.

Standard #9: Operation and Maintenance Plan

A long-term Operation and Maintenance Plan (O&M) meeting the requirements of this standard has been prepared and is included as a separate document.

Standard #10: Prohibition of Illicit Discharges

To the best of our knowledge, the site does not contain any illicit discharges. An illicit discharge statement is included below.

SECTION 4 STORMWATER MODELING METHODOLOGY

The drainage system for this project was modeled using HydroCAD, a stormwater modeling computer program that analyzes the hydrology, and hydraulics of stormwater runoff. HydroCAD is based largely on the hydrology techniques developed by the Soil Conservation Service (SCS/NRCS), combined with other hydrology and hydraulics calculations. For a given rainfall event, these techniques are used to generate hydrographs throughout a watershed. This provides verification that a given drainage system is adequate for the area under consideration, or to predict where flooding or erosion is likely to occur.

In HydroCAD, each watershed is modeled as a Subcatchment, streams and culverts as a Reach (or Pond, depending on available storage capacity), and large wetlands and other natural or artificial storage areas as a Pond. SCS hydrograph generation and routing procedures were used to model both Pre-development and Post-development runoff conditions.

The Pre-development and Post-development watershed limits and the subcatchment characteristics were determined using both USGS and on-the-ground topographic survey information and through visual, on-site inspection. Conservative estimates were used at all times in estimating the hydrologic characteristics of each watershed or subcatchment.

APPENDIX A

MassDEP Checklist for Stormwater Report

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

4/7/2021
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 (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): ______________________

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 (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 (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 (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 (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 (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.

April 7, 2021

City of Methuen Community Development Board
41 Pleasant Street
Methuen, MA 01844

Re: 125 Merrimack Street
Parcel ID: 1113-109W-19
Sub: Illicit Discharge Statement
Standard #10

Dear Board Members:

On behalf of our client, Wan Yan, LLC, we hereby state that to the best of our knowledge, no illicit discharges exist on the above referenced site and none are proposed with the site re-development plans. Implementing the pollution prevention plan measures outlined in the site redevelopment plans will prevent illicit discharges to the stormwater management system, including wastewater discharges and discharges of stormwater contaminated by contact with process wastes, raw materials, toxic pollutants, hazardous substances, oil, or grease. Refer to the Grading & Drainage Plan from the site plan set for additional information.

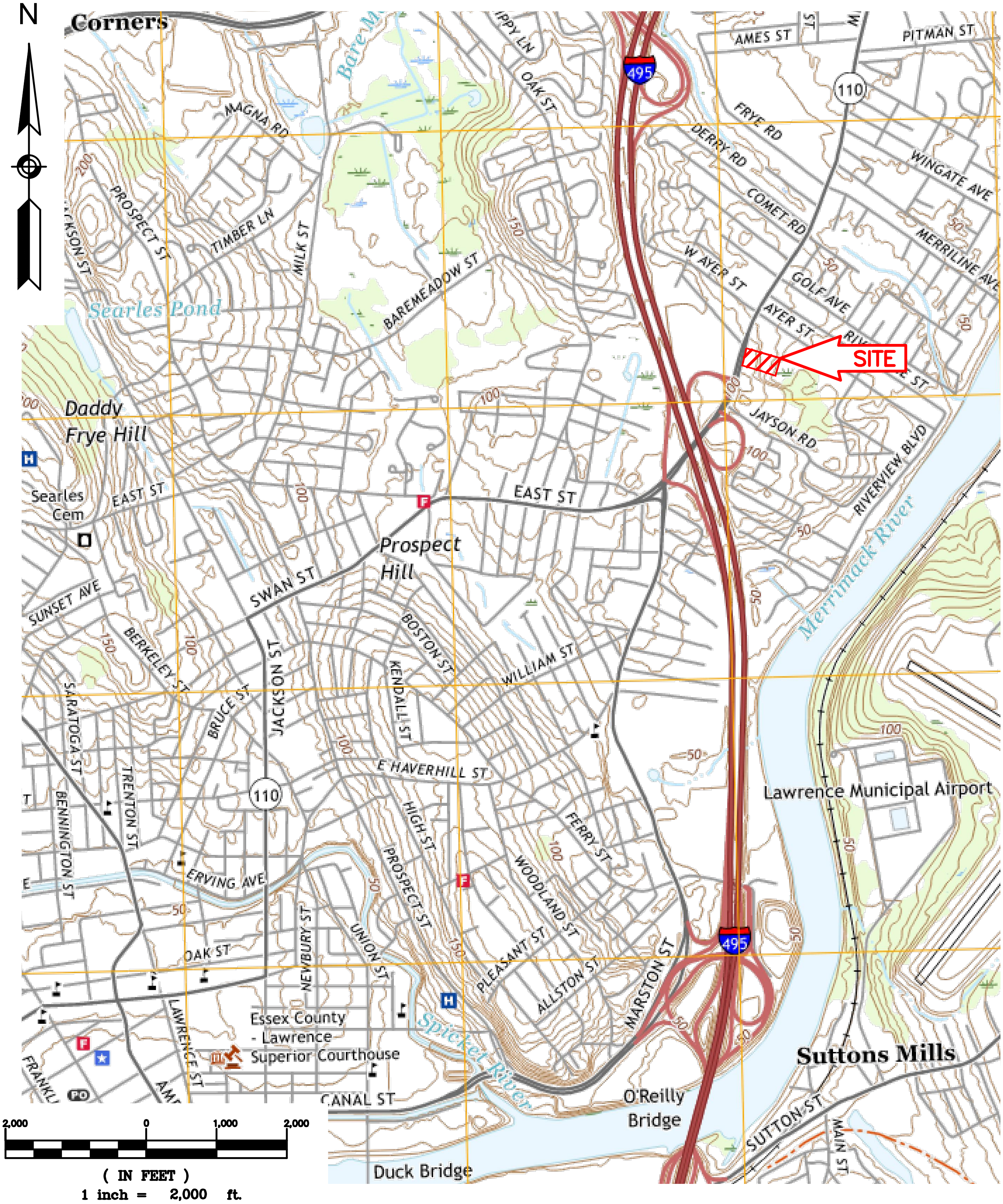
Sincerely,
Greenman-Pedersen, Inc.

Cory Mason

Cory Mason, P.E.
Project Engineer

APPENDIX B

USGS Map



USGS MAP

WAN YAN, LLC
125 MERRIMACK STREET
METHUEN, MA

GPI Engineering Design Planning Construction Management
603.893.0720 GPINET.COM
Greenman-Pedersen, Inc.
44 Stiles Road, Suite One
Salem, NH 03079

DRAWN BY:	CNM
PROJECT #:	NEX–2020159
DATE: 04/07/2021	FIGURE 1

APPENDIX C

NRCS Soils Information

United States Department of Agriculture

NRCS

Natural Resources Conservation Service

A product of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local participants

Custom Soil Resource Report for

Essex County, Massachusetts, Northern Part

March 2, 2021

Preface

Soil surveys contain information that affects land use planning in survey areas. They highlight soil limitations that affect various land uses and provide information about the properties of the soils in the survey areas. Soil surveys are designed for many different users, including farmers, ranchers, foresters, agronomists, urban planners, community officials, engineers, developers, builders, and home buyers. Also, conservationists, teachers, students, and specialists in recreation, waste disposal, and pollution control can use the surveys to help them understand, protect, or enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. Soil surveys identify soil properties that are used in making various land use or land treatment decisions. The information is intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Although soil survey information can be used for general farm, local, and wider area planning, onsite investigation is needed to supplement this information in some cases. Examples include soil quality assessments (http://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/health/) and certain conservation and engineering applications. For more detailed information, contact your local USDA Service Center (https://offices.sc.egov.usda.gov/locator/app?agency=nrcs) or your NRCS State Soil Scientist (http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/contactus/?cid=nrcs142p2_053951).

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

The National Cooperative Soil Survey is a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (NRCS) has leadership for the Federal part of the National Cooperative Soil Survey.

Information about soils is updated periodically. Updated information is available through the NRCS Web Soil Survey, the site for official soil survey information.

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Contents

How Soil Surveys Are Made

Soil surveys are made to provide information about the soils and miscellaneous areas in a specific area. They include a description of the soils and miscellaneous areas and their location on the landscape and tables that show soil properties and limitations affecting various uses. Soil scientists observed the steepness, length, and shape of the slopes; the general pattern of drainage; the kinds of crops and native plants; and the kinds of bedrock. They observed and described many soil profiles. A soil profile is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed or from the surface down to bedrock. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

Currently, soils are mapped according to the boundaries of major land resource areas (MLRAs). MLRAs are geographically associated land resource units that share common characteristics related to physiography, geology, climate, water resources, soils, biological resources, and land uses (USDA, 2006). Soil survey areas typically consist of parts of one or more MLRA.

The soils and miscellaneous areas in a survey area occur in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil and miscellaneous area is associated with a particular kind of landform or with a segment of the landform. By observing the soils and miscellaneous areas in the survey area and relating their position to specific segments of the landform, a soil scientist develops a concept, or model, of how they were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil or miscellaneous area at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-vegetation-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. Soil taxonomy, the system of taxonomic classification used in the United States, is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

The objective of soil mapping is not to delineate pure map unit components; the objective is to separate the landscape into landforms or landform segments that have similar use and management requirements. Each map unit is defined by a unique combination of soil components and/or miscellaneous areas in predictable proportions. Some components may be highly contrasting to the other components of the map unit. The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The delineation of such landforms and landform segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, onsite investigation is needed to define and locate the soils and miscellaneous areas.

Soil scientists make many field observations in the process of producing a soil map. The frequency of observation is dependent upon several factors, including scale of mapping, intensity of mapping, design of map units, complexity of the landscape, and experience of the soil scientist. Observations are made to test and refine the soil-landscape model and predictions and to verify the classification of the soils at specific locations. Once the soil-landscape model is refined, a significantly smaller number of measurements of individual soil properties are made and recorded. These measurements may include field measurements, such as those for color, depth to bedrock, and texture, and laboratory measurements, such as those for content of sand, silt, clay, salt, and other components. Properties of each soil typically vary from one point to another across the landscape.

Observations for map unit components are aggregated to develop ranges of characteristics for the components. The aggregated values are presented. Direct measurements do not exist for every property presented for every map unit component. Values for some properties are estimated from combinations of other properties.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses and under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot predict that a high water table will always be at a specific level in the soil on a specific date.

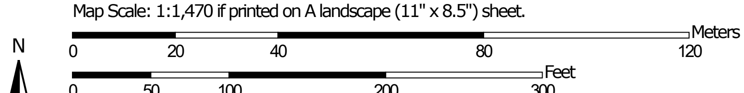
After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

Soil Map

The soil map section includes the soil map for the defined area of interest, a list of soil map units on the map and extent of each map unit, and cartographic symbols displayed on the map. Also presented are various metadata about data used to produce the map, and a description of each soil map unit.

Soil Map

Map Scale: 1:1,470 if printed on A landscape (11" x 8.5") sheet.



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 Map Unit Polygons

Soil Map Unit Lines

Soil Map Unit Points

Special Point Features

Blowout

Borrow Pit

Clay Spot

Closed Depression

Gravel Pit

Gravelly Spot

Landfill

Lava Flow

Marsh or swamp

Mine or Quarry

Miscellaneous Water

Perennial Water

Rock Outcrop

Saline Spot

Sandy Spot

Severely Eroded Spot

Sinkhole

Slide or Slip

Sodic Spot

Spoil Area

Stony Spot

Very Stony Spot

Wet Spot

Other

Special Line Features

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, Northern Part
Survey Area Data: Version 16, Jun 9, 2020

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

Date(s) aerial images were photographed: Aug 28, 2019—Sep 20, 2019

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.

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
51A	Swansea muck, 0 to 1 percent slopes	0.9	11.6%
256A	Deerfield loamy fine sand, 0 to 3 percent slopes	0.0	0.0%
301B	Montauk fine sandy loam, 0 to 8 percent slopes, very stony	0.6	7.2%
602	Urban land	4.3	54.8%
651	Udorthents, smoothed	2.1	26.3%
Totals for Area of Interest		**7.8**	**100.0%**

Map Unit Descriptions

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

Essex County, Massachusetts, Northern Part

51A—Swansea muck, 0 to 1 percent slopes

Map Unit Setting

National map unit symbol: 2trl2
Elevation: 0 to 1,140 feet
Mean annual precipitation: 36 to 71 inches
Mean annual air temperature: 39 to 55 degrees F
Frost-free period: 140 to 240 days
Farmland classification: Not prime farmland

Map Unit Composition

Swansea and similar soils: 80 percent
Minor components: 20 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Swansea

Setting

Landform: Bogs, swamps
Landform position (three-dimensional): Dip
Down-slope shape: Concave
Across-slope shape: Concave
Parent material: Highly decomposed organic material over loose sandy and gravelly glaciofluvial deposits

Typical profile

Oa1 - 0 to 24 inches: muck
Oa2 - 24 to 34 inches: muck
Cg - 34 to 79 inches: coarse sand

Properties and qualities

Slope: 0 to 1 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Very poorly drained
Runoff class: Negligible
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to high (0.14 to 14.17 in/hr)
Depth to water table: About 0 to 6 inches
Frequency of flooding: Rare
Frequency of ponding: Frequent
Available water capacity: Very high (about 16.5 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 8w
Hydrologic Soil Group: B/D
Ecological site: F144AY043MA - Acidic Organic Wetlands
Hydric soil rating: Yes

Minor Components

Freetown

Percent of map unit: 10 percent
Landform: Swamps, bogs

Landform position (three-dimensional): Dip
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

Whitman

Percent of map unit: 5 percent
Landform: Depressions, drainageways
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Base slope
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

Scarboro

Percent of map unit: 5 percent
Landform: Depressions, drainageways
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Base slope, tread, dip
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

256A—Deerfield loamy fine sand, 0 to 3 percent slopes

Map Unit Setting

National map unit symbol: 2xfg8
Elevation: 0 to 1,100 feet
Mean annual precipitation: 36 to 71 inches
Mean annual air temperature: 39 to 55 degrees F
Frost-free period: 145 to 240 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Deerfield and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Deerfield

Setting

Landform: Outwash plains, outwash deltas, outwash terraces, kame terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear, concave, convex
Across-slope shape: Concave, linear, convex
Parent material: Sandy outwash derived from granite, gneiss, and/or quartzite

Typical profile

Ap - 0 to 9 inches: loamy fine sand
Bw - 9 to 25 inches: loamy fine sand
BC - 25 to 33 inches: fine sand

Cg - 33 to 60 inches: sand

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Moderately well drained
Runoff class: Negligible
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to very high (1.42 to 99.90 in/hr)
Depth to water table: About 15 to 37 inches
Frequency of flooding: None
Frequency of ponding: None
Maximum salinity: Nonsaline (0.0 to 1.9 mmhos/cm)
Sodium adsorption ratio, maximum: 11.0
Available water capacity: Moderate (about 6.5 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2w
Hydrologic Soil Group: A
Ecological site: F144AY027MA - Moist Sandy Outwash
Hydric soil rating: No

Minor Components

Windsor

Percent of map unit: 7 percent
Landform: Outwash terraces, outwash plains, outwash deltas, kame terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear, convex, concave
Across-slope shape: Concave, linear, convex
Hydric soil rating: No

Wareham

Percent of map unit: 5 percent
Landform: Depressions, drainageways
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

Sudbury

Percent of map unit: 2 percent
Landform: Outwash terraces, outwash deltas, kame terraces, outwash plains
Landform position (three-dimensional): Tread
Down-slope shape: Convex, linear, concave
Across-slope shape: Concave, linear, convex
Hydric soil rating: No

Ninigret

Percent of map unit: 1 percent
Landform: Outwash terraces, outwash plains, kame terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear, convex
Across-slope shape: Concave, convex
Hydric soil rating: No

301B—Montauk fine sandy loam, 0 to 8 percent slopes, very stony

Map Unit Setting

National map unit symbol: 2w80v
Elevation: 0 to 1,070 feet
Mean annual precipitation: 36 to 71 inches
Mean annual air temperature: 39 to 55 degrees F
Frost-free period: 140 to 240 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Montauk, very stony, and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Montauk, Very Stony

Setting

Landform: Hills, ground moraines, recessionial moraines, drumlins
Landform position (two-dimensional): Backslope, shoulder, summit
Landform position (three-dimensional): Side slope, crest
Down-slope shape: Linear, convex
Across-slope shape: Convex
Parent material: Coarse-loamy over sandy lodgment till derived from gneiss, granite, and/or schist

Typical profile

Oe - 0 to 2 inches: moderately decomposed plant material
A - 2 to 6 inches: fine sandy loam
Bw1 - 6 to 28 inches: fine sandy loam
Bw2 - 28 to 36 inches: sandy loam
2Cd - 36 to 74 inches: gravelly loamy sand

Properties and qualities

Slope: 0 to 8 percent
Surface area covered with cobbles, stones or boulders: 1.6 percent
Depth to restrictive feature: 20 to 43 inches to densic material
Drainage class: Well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately high (0.00 to 1.42 in/hr)
Depth to water table: About 18 to 37 inches
Frequency of flooding: None
Frequency of ponding: None
Maximum salinity: Nonsaline (0.0 to 1.9 mmhos/cm)
Available water capacity: Low (about 5.6 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6s

Hydrologic Soil Group: C
Ecological site: F144AY007CT - Well Drained Dense Till Uplands
Hydric soil rating: No

Minor Components

Scituate, very stony

Percent of map unit: 6 percent
Landform: Hills, ground moraines, drumlins
Landform position (two-dimensional): Summit, footslope, backslope
Landform position (three-dimensional): Crest, side slope
Down-slope shape: Linear, convex
Across-slope shape: Convex
Hydric soil rating: No

Canton, very stony

Percent of map unit: 5 percent
Landform: Hills
Landform position (two-dimensional): Summit, shoulder, backslope
Landform position (three-dimensional): Side slope, crest
Down-slope shape: Convex, linear
Across-slope shape: Convex
Hydric soil rating: No

Ridgebury, very stony

Percent of map unit: 4 percent
Landform: Drainageways, hills, ground moraines, depressions
Landform position (two-dimensional): Footslope, toeslope
Landform position (three-dimensional): Base slope, head slope
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

602—Urban land

Map Unit Setting

National map unit symbol: vjx3
Frost-free period: 125 to 165 days
Farmland classification: Not prime farmland

Map Unit Composition

Urban land: 80 percent
Minor components: 20 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Urban Land

Setting

Parent material: Excavated and filled land

Minor Components

Udorthents

Percent of map unit: 10 percent
Hydric soil rating: No

Merrimac

Percent of map unit: 2 percent
Hydric soil rating: No

Windsor

Percent of map unit: 2 percent
Hydric soil rating: No

Paxton

Percent of map unit: 2 percent
Hydric soil rating: No

Charlton

Percent of map unit: 2 percent
Hydric soil rating: No

Hinckley

Percent of map unit: 2 percent
Hydric soil rating: No

651—Udorthents, smoothed

Map Unit Setting

National map unit symbol: vjwk
Elevation: 0 to 3,000 feet
Mean annual precipitation: 45 to 54 inches
Mean annual air temperature: 43 to 54 degrees F
Frost-free period: 145 to 240 days
Farmland classification: Not prime farmland

Map Unit Composition

Udorthents and similar soils: 80 percent
Minor components: 20 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Udorthents

Setting

Parent material: Excavated and filled land loamy and/or excavated and filled land sandy and gravelly

Typical profile

H1 - 0 to 6 inches: variable
H2 - 6 to 60 inches: variable

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to very high (0.06 to 20.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6s
Hydrologic Soil Group: A
Hydric soil rating: Unranked

Minor Components

Urban land

Percent of map unit: 10 percent
Hydric soil rating: Unranked

Beaches

Percent of map unit: 8 percent
Hydric soil rating: Unranked

Dumps

Percent of map unit: 2 percent
Hydric soil rating: Unranked

Soil Information for All Uses

Soil Properties and Qualities

The Soil Properties and Qualities section includes various soil properties and qualities displayed as thematic maps with a summary table for the soil map units in the selected area of interest. A single value or rating for each map unit is generated by aggregating the interpretive ratings of individual map unit components. This aggregation process is defined for each property or quality.

Soil Qualities and Features

Soil qualities are behavior and performance attributes that are not directly measured, but are inferred from observations of dynamic conditions and from soil properties. Example soil qualities include natural drainage, and frost action. Soil features are attributes that are not directly part of the soil. Example soil features include slope and depth to restrictive layer. These features can greatly impact the use and management of the soil.

Hydrologic Soil Group

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.

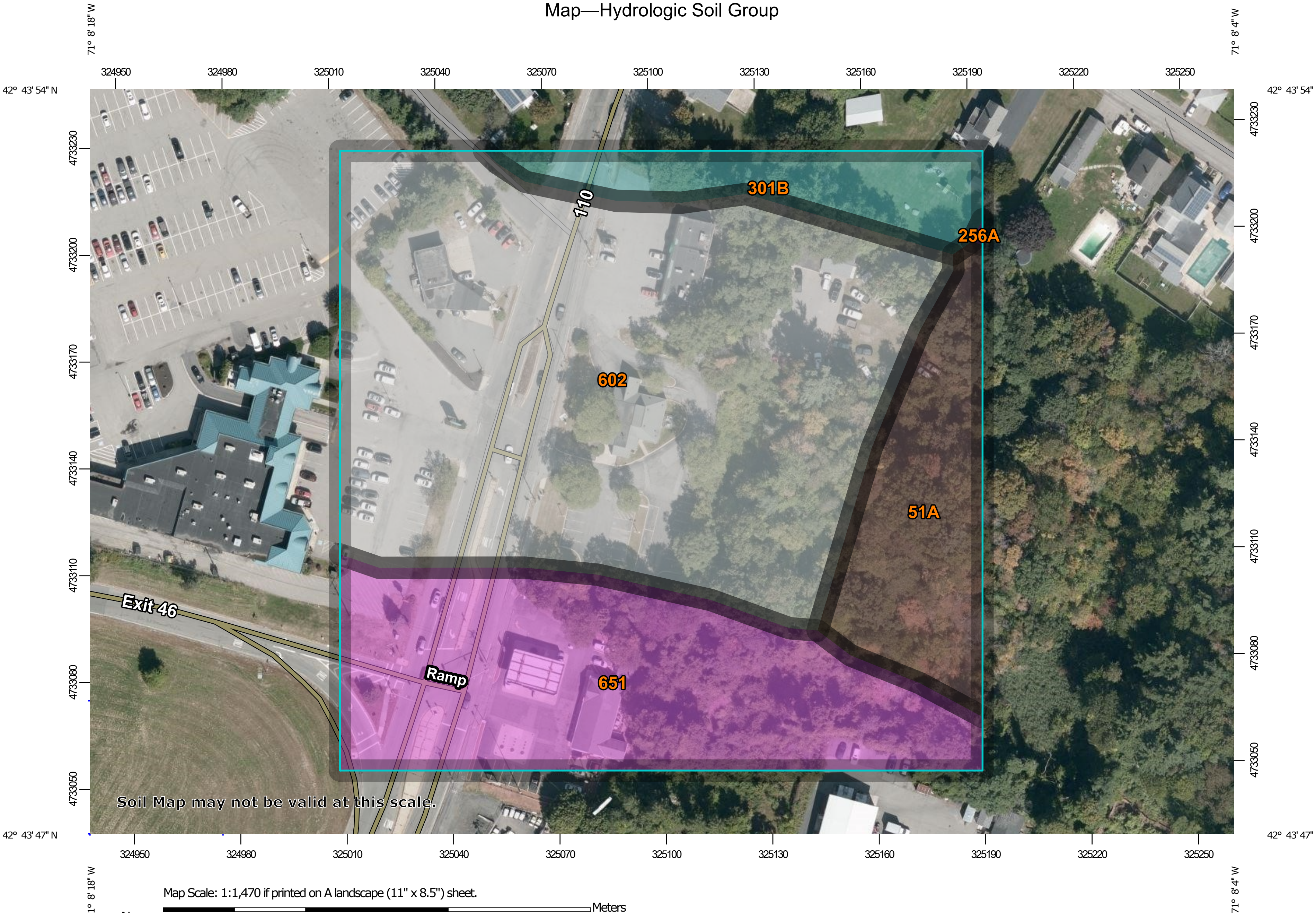
Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

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.

Map—Hydrologic Soil Group



Map Scale: 1:1,470 if printed on A landscape (11" x 8.5") sheet.

Meters: 0, 20, 40, 80, 120

Feet: 0, 50, 100, 200, 300

N

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, Northern Part
Survey Area Data: Version 16, Jun 9, 2020

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

Date(s) aerial images were photographed: Aug 28, 2019—Sep 20, 2019

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.

Table—Hydrologic Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
51A	Swansea muck, 0 to 1 percent slopes	B/D	0.9	11.6%
256A	Deerfield loamy fine sand, 0 to 3 percent slopes	A	0.0	0.0%
301B	Montauk fine sandy loam, 0 to 8 percent slopes, very stony	C	0.6	7.2%
602	Urban land		4.3	54.8%
651	Udorthents, smoothed	A	2.1	26.3%
Totals for Area of Interest			**7.8**	**100.0%**

Rating Options—Hydrologic Soil Group

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

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APPENDIX D

Test Pit Logs

TEST PIT DATA

Client: Wan Yan , LLC
Project Address: 125 Merrimack Street
Town, State: Methuen, MA
Job Number: NEX-2020159
Date: March 31, 2021
Performed by: Diane Pantermoller

Test Pit No. **1** SCS Soil: Urban Land
ESHWT: 18” Standing Water: 18”
Refusal: >132” Roots: 20”

Depth	Horizon	Soil Texture	Color	Consistence	Mottles; Quantity/Contrast
0-6”	A	Loamy Sand	10yr 3/2	FR	
6-22”	B	Loamy Sand	10yr 5/8	FR	
22-132”	C	Loamy Sand	2.5y 6/4	FR	@ 18” Distinct

Test Pit No. **2** SCS Soil: Urban Land
ESHWT: 24” Standing Water: 24”
Refusal: >120” Roots: 20”

Depth	Horizon	Soil Texture	Color	Consistence	Mottles; Quantity/Contrast
0-5”	A	Loamy Sand	10yr 3/2	FR	
5-20”	B	Loamy Sand	10yr 5/8	FR	
20-120”	C	Loamy Sand	2.5y 6/4	FR	@ 24” Distinct

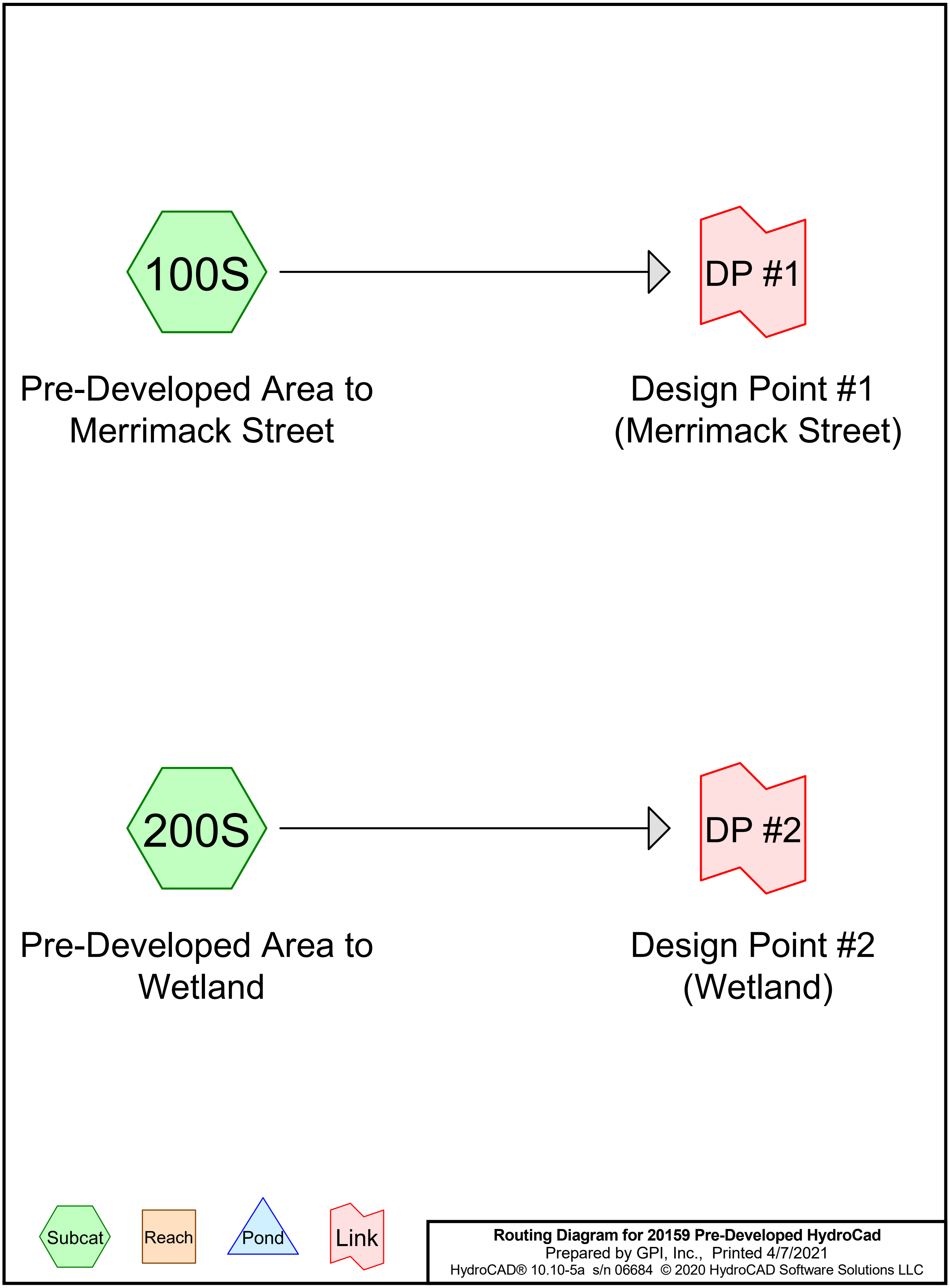
Test Pit No. **3** SCS Soil: Urban Land
ESHWT: 30” Standing Water: 72”
Refusal: >120” Roots: 24”

Depth	Horizon	Soil Texture	Color	Consistence	Mottles; Quantity/Contrast
0-20”	A	Loamy Sand	10yr 3/2	FR	
20-24”	B	Loamy Sand	10yr 5/8	FR	
24-120”	C	Loamy Sand	2.5y 6/4	FR	@ 30”

NOTES

APPENDIX E

Pre-Development HydroCAD Computations


100S
DP #1
Pre-Developed Area to Merrimack Street
Design Point #1 (Merrimack Street)
200S
DP #2
Pre-Developed Area to Wetland
Design Point #2 (Wetland)
Subcat
Reach
Pond
Link
Routing Diagram for 20159 Pre-Developed HydroCad
Prepared by GPI, Inc., Printed 4/7/2021
HydroCAD® 10.10-5a s/n 06684 © 2020 HydroCAD Software Solutions LLC

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
0.347	39	>75% Grass cover, Good, HSG A (100S, 200S)
0.468	98	Paved parking, HSG A (100S, 200S)
0.963	30	Woods, Good, HSG A (200S)
0.465	55	Woods, Good, HSG B (200S)
2.244	**51**	**TOTAL AREA**

Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
1.779	HSG A	100S, 200S
0.465	HSG B	200S
0.000	HSG C	
0.000	HSG D	
0.000	Other	
2.244		**TOTAL AREA**

Ground Covers (all nodes)

HSG-A (acres)	HSG-B (acres)	HSG-C (acres)	HSG-D (acres)	Other (acres)	Total (acres)	Ground Cover	Subcatchment Numbers
0.347	0.000	0.000	0.000	0.000	0.347	>75% Grass cover, Good	100S, 200S
0.468	0.000	0.000	0.000	0.000	0.468	Paved parking	100S, 200S
0.963	0.465	0.000	0.000	0.000	1.428	Woods, Good	200S
1.779	**0.465**	**0.000**	**0.000**	**0.000**	**2.244**	**TOTAL AREA**	

Time span=0.00-30.00 hrs, dt=0.01 hrs, 3001 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 100S: Pre-Developed Area to Runoff Area=6,824 sf 50.31% Impervious Runoff Depth=0.73"
Flow Length=130' Tc=6.3 min CN=69 Runoff=0.12 cfs 0.010 af

Subcatchment 200S: Pre-Developed Area Runoff Area=90,908 sf 18.66% Impervious Runoff Depth=0.09"
Flow Length=309' Tc=5.5 min CN=49 Runoff=0.02 cfs 0.016 af

Link DP #1: Design Point #1 (Merrimack Street) Inflow=0.12 cfs 0.010 af
Primary=0.12 cfs 0.010 af

Link DP #2: Design Point #2 (Wetland) Inflow=0.02 cfs 0.016 af
Primary=0.02 cfs 0.016 af

Total Runoff Area = 2.244 ac Runoff Volume = 0.026 af Average Runoff Depth = 0.14"
79.13% Pervious = 1.775 ac 20.87% Impervious = 0.468 ac

Time span=0.00-30.00 hrs, dt=0.01 hrs, 3001 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 100S: Pre-Developed Area to Runoff Area=6,824 sf 50.31% Impervious Runoff Depth=1.78"
Flow Length=130' Tc=6.3 min CN=69 Runoff=0.30 cfs 0.023 af

Subcatchment 200S: Pre-Developed Area Runoff Area=90,908 sf 18.66% Impervious Runoff Depth=0.55"
Flow Length=309' Tc=5.5 min CN=49 Runoff=0.75 cfs 0.095 af

Link DP #1: Design Point #1 (Merrimack Street) Inflow=0.30 cfs 0.023 af
Primary=0.30 cfs 0.023 af

Link DP #2: Design Point #2 (Wetland) Inflow=0.75 cfs 0.095 af
Primary=0.75 cfs 0.095 af

Total Runoff Area = 2.244 ac Runoff Volume = 0.119 af Average Runoff Depth = 0.63"
79.13% Pervious = 1.775 ac 20.87% Impervious = 0.468 ac

Time span=0.00-30.00 hrs, dt=0.01 hrs, 3001 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 100S: Pre-Developed Area to Runoff Area=6,824 sf 50.31% Impervious Runoff Depth=2.77"
Flow Length=130' Tc=6.3 min CN=69 Runoff=0.48 cfs 0.036 af

Subcatchment 200S: Pre-Developed Area Runoff Area=90,908 sf 18.66% Impervious Runoff Depth=1.10"
Flow Length=309' Tc=5.5 min CN=49 Runoff=2.19 cfs 0.192 af

Link DP #1: Design Point #1 (Merrimack Street) Inflow=0.48 cfs 0.036 af
Primary=0.48 cfs 0.036 af

Link DP #2: Design Point #2 (Wetland) Inflow=2.19 cfs 0.192 af
Primary=2.19 cfs 0.192 af

Total Runoff Area = 2.244 ac Runoff Volume = 0.228 af Average Runoff Depth = 1.22"
79.13% Pervious = 1.775 ac 20.87% Impervious = 0.468 ac

Summary for Subcatchment 100S: Pre-Developed Area to Merrimack Street

Runoff = 0.48 cfs @ 12.14 hrs, Volume= 0.036 af, Depth= 2.77"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
NRCC 24-hr D 25-year Rainfall=6.07"

Area (sf)	CN	Description
3,433	98	Paved parking, HSG A
3,391	39	>75% Grass cover, Good, HSG A
6,824	69	Weighted Average
3,391		49.69% Pervious Area
3,433		50.31% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.4	20	0.0060	0.08		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.12"
1.9	110	0.0186	0.95		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
6.3	130	Total			

Summary for Subcatchment 200S: Pre-Developed Area to Wetland

Runoff = 2.19 cfs @ 12.14 hrs, Volume= 0.192 af, Depth= 1.10"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
NRCC 24-hr D 25-year Rainfall=6.07"

Area (sf)	CN	Description
16,967	98	Paved parking, HSG A
11,739	39	>75% Grass cover, Good, HSG A
41,946	30	Woods, Good, HSG A
20,256	55	Woods, Good, HSG B
90,908	49	Weighted Average
73,941		81.34% Pervious Area
16,967		18.66% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.7	20	0.1420	0.12		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.12"
2.8	289	0.1170	1.71		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
5.5	309	Total			

Summary for Link DP #1: Design Point #1 (Merrimack Street)

Inflow Area = 0.157 ac, 50.31% Impervious, Inflow Depth = 2.77" for 25-year event
Inflow = 0.48 cfs @ 12.14 hrs, Volume= 0.036 af
Primary = 0.48 cfs @ 12.14 hrs, Volume= 0.036 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs

Summary for Link DP #2: Design Point #2 (Wetland)

Inflow Area = 2.087 ac, 18.66% Impervious, Inflow Depth = 1.10" for 25-year event
Inflow = 2.19 cfs @ 12.14 hrs, Volume= 0.192 af
Primary = 2.19 cfs @ 12.14 hrs, Volume= 0.192 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs

Time span=0.00-30.00 hrs, dt=0.01 hrs, 3001 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 100S: Pre-Developed Area to Runoff Area=6,824 sf 50.31% Impervious Runoff Depth=5.02"
Flow Length=130' Tc=6.3 min CN=69 Runoff=0.86 cfs 0.066 af

Subcatchment 200S: Pre-Developed Area Runoff Area=90,908 sf 18.66% Impervious Runoff Depth=2.62"
Flow Length=309' Tc=5.5 min CN=49 Runoff=6.02 cfs 0.456 af

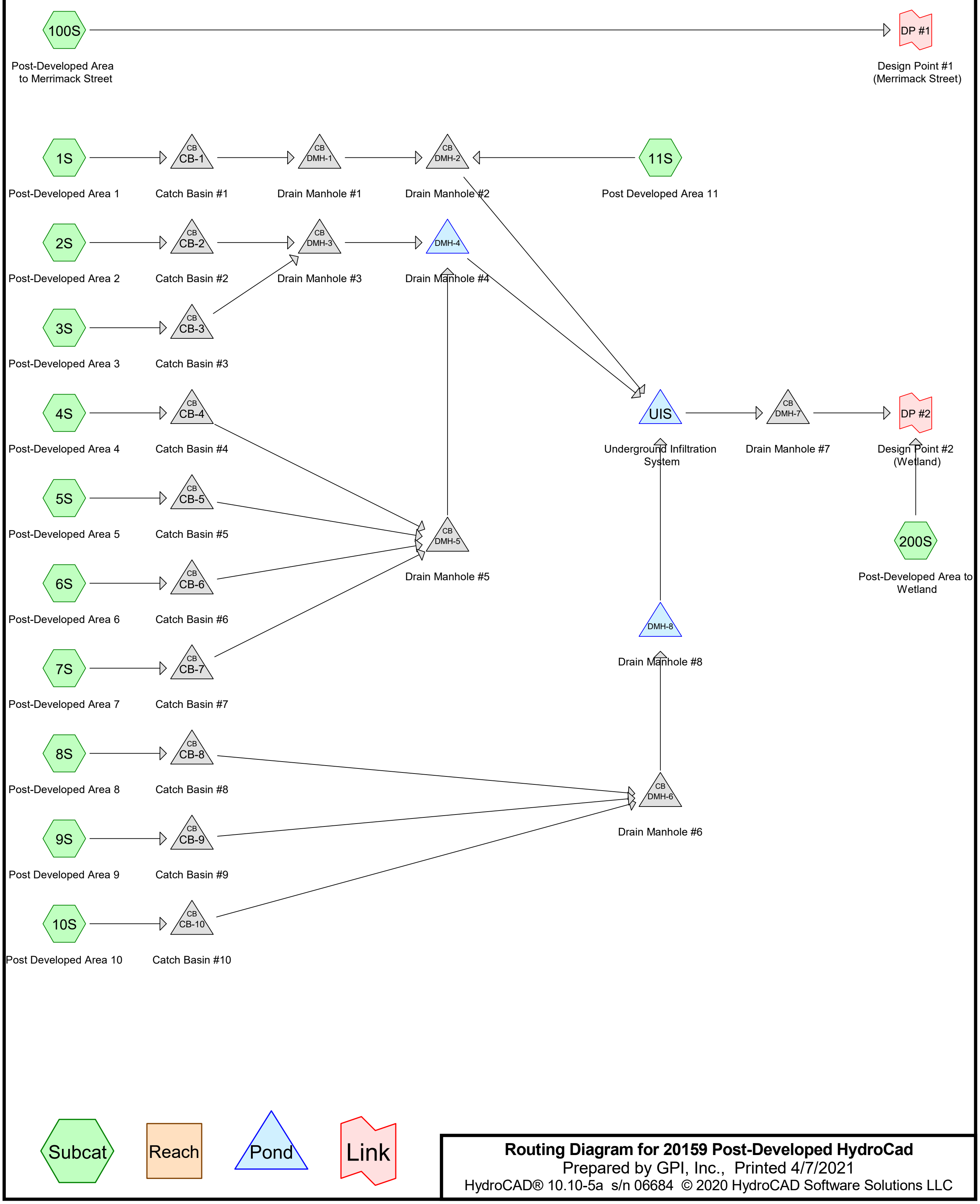
Link DP #1: Design Point #1 (Merrimack Street) Inflow=0.86 cfs 0.066 af
Primary=0.86 cfs 0.066 af

Link DP #2: Design Point #2 (Wetland) Inflow=6.02 cfs 0.456 af
Primary=6.02 cfs 0.456 af

Total Runoff Area = 2.244 ac Runoff Volume = 0.522 af Average Runoff Depth = 2.79"
79.13% Pervious = 1.775 ac 20.87% Impervious = 0.468 ac

APPENDIX F

Post-Development HydroCAD Computations



Routing Diagram for 20159 Post-Developed HydroCad
Prepared by GPI, Inc., Printed 4/7/2021
HydroCAD® 10.10-5a s/n 06684 © 2020 HydroCAD Software Solutions LLC

Area Listing (selected nodes)

Area (acres)	CN	Description (subcatchment-numbers)
0.503	39	>75% Grass cover, Good, HSG A (1S, 2S, 3S, 4S, 5S, 6S, 7S, 8S, 9S, 10S, 100S, 200S)
0.060	61	>75% Grass cover, Good, HSG B (200S)
0.949	98	Paved parking, HSG A (1S, 2S, 3S, 4S, 5S, 6S, 7S, 8S, 9S, 10S, 100S)
0.105	98	Roofs, HSG A (11S)
0.222	30	Woods, Good, HSG A (200S)
0.405	55	Woods, Good, HSG B (200S)
2.244	**69**	**TOTAL AREA**

Soil Listing (selected nodes)

Area (acres)	Soil Group	Subcatchment Numbers
1.779	HSG A	1S, 2S, 3S, 4S, 5S, 6S, 7S, 8S, 9S, 10S, 11S, 100S, 200S
0.465	HSG B	200S
0.000	HSG C	
0.000	HSG D	
0.000	Other	
2.244		**TOTAL AREA**

Ground Covers (selected nodes)

HSG-A (acres)	HSG-B (acres)	HSG-C (acres)	HSG-D (acres)	Other (acres)	Total (acres)	Ground Cover	Subcatchment Numbers
0.503	0.060	0.000	0.000	0.000	0.563	>75% Grass cover, Good	1S, 2S, 3S, 4S, 5S, 6S, 7S, 8S, 9S, 10S, 100S, 200S
0.949	0.000	0.000	0.000	0.000	0.949	Paved parking	1S, 2S, 3S, 4S, 5S, 6S, 7S, 8S, 9S, 10S, 100S
0.105	0.000	0.000	0.000	0.000	0.105	Roofs	11S
0.222	0.405	0.000	0.000	0.000	0.628	Woods, Good	200S
1.779	**0.465**	**0.000**	**0.000**	**0.000**	**2.244**	**TOTAL AREA**	

Pipe Listing (selected nodes)

Line#	Node Number	In-Invert (feet)	Out-Invert (feet)	Length (feet)	Slope (ft/ft)	n	Width (inches)	Diam/Height (inches)	Inside-Fill (inches)
1	CB-1	90.75	89.85	108.0	0.0083	0.012	0.0	12.0	0.0
2	CB-10	86.65	86.35	29.0	0.0103	0.012	0.0	12.0	0.0
3	CB-2	91.00	89.45	95.0	0.0163	0.012	0.0	12.0	0.0
4	CB-3	90.60	90.49	11.0	0.0100	0.012	0.0	12.0	0.0
5	CB-4	88.10	87.07	21.0	0.0490	0.012	0.0	12.0	0.0
6	CB-5	85.25	84.78	47.0	0.0100	0.012	0.0	12.0	0.0
7	CB-6	86.50	85.92	58.0	0.0100	0.012	0.0	12.0	0.0
8	CB-7	84.45	83.90	55.0	0.0100	0.012	0.0	12.0	0.0
9	CB-8	89.00	87.71	39.0	0.0331	0.012	0.0	12.0	0.0
10	CB-9	87.85	87.41	44.0	0.0100	0.012	0.0	12.0	0.0
11	DMH-1	89.75	89.15	67.5	0.0089	0.012	0.0	12.0	0.0
12	DMH-2	89.05	88.25	67.5	0.0119	0.012	0.0	12.0	0.0
13	DMH-3	89.45	87.49	59.0	0.0332	0.012	0.0	12.0	0.0
14	DMH-5	83.90	83.75	14.6	0.0103	0.012	0.0	15.0	0.0
15	DMH-6	86.35	86.28	8.5	0.0082	0.012	0.0	12.0	0.0
16	DMH-7	73.00	71.50	20.0	0.0750	0.012	0.0	12.0	0.0
17	UIS	82.25	79.00	44.5	0.0730	0.012	0.0	12.0	0.0

Time span=0.00-30.00 hrs, dt=0.01 hrs, 3001 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 1S: Post-Developed Area 1 Runoff Area=5,413 sf 31.96% Impervious Runoff Depth=0.31"
Flow Length=100' Tc=5.7 min CN=58 Runoff=0.02 cfs 0.003 af

Subcatchment 2S: Post-Developed Area 2 Runoff Area=6,128 sf 73.04% Impervious Runoff Depth=1.47"
Flow Length=63' Tc=1.3 min CN=82 Runoff=0.27 cfs 0.017 af

Subcatchment 3S: Post-Developed Area 3 Runoff Area=4,978 sf 80.39% Impervious Runoff Depth=1.77"
Flow Length=90' Tc=3.3 min CN=86 Runoff=0.25 cfs 0.017 af

Subcatchment 4S: Post-Developed Area 4 Runoff Area=2,982 sf 92.19% Impervious Runoff Depth=2.37"
Flow Length=90' Tc=1.8 min CN=93 Runoff=0.19 cfs 0.014 af

Subcatchment 5S: Post-Developed Area 5 Runoff Area=3,747 sf 96.53% Impervious Runoff Depth=2.67"
Flow Length=75' Tc=1.6 min CN=96 Runoff=0.26 cfs 0.019 af

Subcatchment 6S: Post-Developed Area 6 Runoff Area=7,437 sf 95.05% Impervious Runoff Depth=2.57"
Flow Length=133' Tc=1.8 min CN=95 Runoff=0.50 cfs 0.037 af

Subcatchment 7S: Post-Developed Area 7 Runoff Area=4,447 sf 94.31% Impervious Runoff Depth=2.57"
Flow Length=138' Tc=3.0 min CN=95 Runoff=0.30 cfs 0.022 af

Subcatchment 8S: Post-Developed Area 8 Runoff Area=5,125 sf 83.41% Impervious Runoff Depth=1.93"
Flow Length=78' Tc=1.8 min CN=88 Runoff=0.28 cfs 0.019 af

Subcatchment 9S: Post Developed Area 9 Runoff Area=5,006 sf 95.19% Impervious Runoff Depth=2.57"
Flow Length=126' Tc=4.7 min CN=95 Runoff=0.32 cfs 0.025 af

Subcatchment 10S: Post Developed Area 10 Runoff Area=4,359 sf 95.09% Impervious Runoff Depth=2.57"
Flow Length=65' Tc=2.4 min CN=95 Runoff=0.29 cfs 0.021 af

Subcatchment 11S: Post Developed Area Runoff Area=4,578 sf 100.00% Impervious Runoff Depth=2.89"
Tc=1.0 min CN=98 Runoff=0.33 cfs 0.025 af

Subcatchment 100S: Post-Developed Area to Runoff Area=369 sf 81.03% Impervious Runoff Depth=1.84"
Tc=1.0 min CN=87 Runoff=0.02 cfs 0.001 af

Subcatchment 200S: Post-Developed Area Runoff Area=43,173 sf 0.00% Impervious Runoff Depth=0.04"
Flow Length=309' Tc=5.0 min CN=45 Runoff=0.00 cfs 0.003 af

Pond CB-1: Catch Basin #1 Peak Elev=90.82' Inflow=0.02 cfs 0.003 af
12.0" Round Culvert n=0.012 L=108.0' S=0.0083 '/' Outflow=0.02 cfs 0.003 af

Pond CB-10: Catch Basin #10 Peak Elev=87.03' Inflow=0.29 cfs 0.021 af
12.0" Round Culvert n=0.012 L=29.0' S=0.0103 '/' Outflow=0.29 cfs 0.021 af

Pond CB-2: Catch Basin #2 Peak Elev=91.25' Inflow=0.27 cfs 0.017 af
12.0" Round Culvert n=0.012 L=95.0' S=0.0163 '/' Outflow=0.27 cfs 0.017 af

Pond CB-3: Catch Basin #3 Peak Elev=90.87' Inflow=0.25 cfs 0.017 af
12.0" Round Culvert n=0.012 L=11.0' S=0.0100 '/' Outflow=0.25 cfs 0.017 af

Pond CB-4: Catch Basin #4 Peak Elev=88.31' Inflow=0.19 cfs 0.014 af
12.0" Round Culvert n=0.012 L=21.0' S=0.0490 '/' Outflow=0.19 cfs 0.014 af

Pond CB-5: Catch Basin #5 Peak Elev=85.50' Inflow=0.26 cfs 0.019 af
12.0" Round Culvert n=0.012 L=47.0' S=0.0100 '/' Outflow=0.26 cfs 0.019 af

Pond CB-6: Catch Basin #6 Peak Elev=86.85' Inflow=0.50 cfs 0.037 af
12.0" Round Culvert n=0.012 L=58.0' S=0.0100 '/' Outflow=0.50 cfs 0.037 af

Pond CB-7: Catch Basin #7 Peak Elev=84.78' Inflow=0.30 cfs 0.022 af
12.0" Round Culvert n=0.012 L=55.0' S=0.0100 '/' Outflow=0.30 cfs 0.022 af

Pond CB-8: Catch Basin #8 Peak Elev=89.26' Inflow=0.28 cfs 0.019 af
12.0" Round Culvert n=0.012 L=39.0' S=0.0331 '/' Outflow=0.28 cfs 0.019 af

Pond CB-9: Catch Basin #9 Peak Elev=88.13' Inflow=0.32 cfs 0.025 af
12.0" Round Culvert n=0.012 L=44.0' S=0.0100 '/' Outflow=0.32 cfs 0.025 af

Pond DMH-1: Drain Manhole #1 Peak Elev=89.82' Inflow=0.02 cfs 0.003 af
12.0" Round Culvert n=0.012 L=67.5' S=0.0089 '/' Outflow=0.02 cfs 0.003 af

Pond DMH-2: Drain Manhole #2 Peak Elev=89.34' Inflow=0.34 cfs 0.029 af
12.0" Round Culvert n=0.012 L=67.5' S=0.0119 '/' Outflow=0.34 cfs 0.029 af

Pond DMH-3: Drain Manhole #3 Peak Elev=89.81' Inflow=0.51 cfs 0.034 af
12.0" Round Culvert n=0.012 L=59.0' S=0.0332 '/' Outflow=0.51 cfs 0.034 af

Pond DMH-4: Drain Manhole #4 Inflow=1.76 cfs 0.125 af
Primary=1.76 cfs 0.125 af

Pond DMH-5: Drain Manhole #5 Peak Elev=84.49' Inflow=1.25 cfs 0.091 af
15.0" Round Culvert n=0.012 L=14.6' S=0.0103 '/' Outflow=1.25 cfs 0.091 af

Pond DMH-6: Drain Manhole #6 Peak Elev=86.92' Inflow=0.89 cfs 0.065 af
12.0" Round Culvert n=0.012 L=8.5' S=0.0082 '/' Outflow=0.89 cfs 0.065 af

Pond DMH-7: Drain Manhole #7 Peak Elev=73.00' Inflow=0.00 cfs 0.000 af
12.0" Round Culvert n=0.012 L=20.0' S=0.0750 '/' Outflow=0.00 cfs 0.000 af

Pond DMH-8: Drain Manhole #8 Inflow=0.89 cfs 0.065 af
Primary=0.89 cfs 0.065 af

Pond UIS: Underground Infiltration System Peak Elev=84.32' Storage=3,786 cf Inflow=2.98 cfs 0.219 af
Discarded=0.15 cfs 0.219 af Primary=0.00 cfs 0.000 af Outflow=0.15 cfs 0.219 af

Link DP #1: Design Point #1 (Merrimack Street) Inflow=0.02 cfs 0.001 af
Primary=0.02 cfs 0.001 af

Link DP #2: Design Point #2 (Wetland)

Inflow=0.00 cfs 0.003 af
Primary=0.00 cfs 0.003 af

Total Runoff Area = 2.244 ac Runoff Volume = 0.223 af Average Runoff Depth = 1.19"
53.04% Pervious = 1.190 ac 46.96% Impervious = 1.054 ac

Time span=0.00-30.00 hrs, dt=0.01 hrs, 3001 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 1S: Post-Developed Area 1 Runoff Area=5,413 sf 31.96% Impervious Runoff Depth=1.04"
Flow Length=100' Tc=5.7 min CN=58 Runoff=0.13 cfs 0.011 af

Subcatchment 2S: Post-Developed Area 2 Runoff Area=6,128 sf 73.04% Impervious Runoff Depth=2.87"
Flow Length=63' Tc=1.3 min CN=82 Runoff=0.51 cfs 0.034 af

Subcatchment 3S: Post-Developed Area 3 Runoff Area=4,978 sf 80.39% Impervious Runoff Depth=3.24"
Flow Length=90' Tc=3.3 min CN=86 Runoff=0.44 cfs 0.031 af

Subcatchment 4S: Post-Developed Area 4 Runoff Area=2,982 sf 92.19% Impervious Runoff Depth=3.96"
Flow Length=90' Tc=1.8 min CN=93 Runoff=0.31 cfs 0.023 af

Subcatchment 5S: Post-Developed Area 5 Runoff Area=3,747 sf 96.53% Impervious Runoff Depth=4.29"
Flow Length=75' Tc=1.6 min CN=96 Runoff=0.40 cfs 0.031 af

Subcatchment 6S: Post-Developed Area 6 Runoff Area=7,437 sf 95.05% Impervious Runoff Depth=4.18"
Flow Length=133' Tc=1.8 min CN=95 Runoff=0.79 cfs 0.059 af

Subcatchment 7S: Post-Developed Area 7 Runoff Area=4,447 sf 94.31% Impervious Runoff Depth=4.18"
Flow Length=138' Tc=3.0 min CN=95 Runoff=0.47 cfs 0.036 af

Subcatchment 8S: Post-Developed Area 8 Runoff Area=5,125 sf 83.41% Impervious Runoff Depth=3.44"
Flow Length=78' Tc=1.8 min CN=88 Runoff=0.49 cfs 0.034 af

Subcatchment 9S: Post Developed Area 9 Runoff Area=5,006 sf 95.19% Impervious Runoff Depth=4.18"
Flow Length=126' Tc=4.7 min CN=95 Runoff=0.50 cfs 0.040 af

Subcatchment 10S: Post Developed Area 10 Runoff Area=4,359 sf 95.09% Impervious Runoff Depth=4.18"
Flow Length=65' Tc=2.4 min CN=95 Runoff=0.46 cfs 0.035 af

Subcatchment 11S: Post Developed Area Runoff Area=4,578 sf 100.00% Impervious Runoff Depth=4.52"
Tc=1.0 min CN=98 Runoff=0.50 cfs 0.040 af

Subcatchment 100S: Post-Developed Area to Runoff Area=369 sf 81.03% Impervious Runoff Depth=3.34"
Tc=1.0 min CN=87 Runoff=0.03 cfs 0.002 af

Subcatchment 200S: Post-Developed Area Runoff Area=43,173 sf 0.00% Impervious Runoff Depth=0.37"
Flow Length=309' Tc=5.0 min CN=45 Runoff=0.11 cfs 0.030 af

Pond CB-1: Catch Basin #1 Peak Elev=90.93' Inflow=0.13 cfs 0.011 af
12.0" Round Culvert n=0.012 L=108.0' S=0.0083 '/' Outflow=0.13 cfs 0.011 af

Pond CB-10: Catch Basin #10 Peak Elev=87.19' Inflow=0.46 cfs 0.035 af
12.0" Round Culvert n=0.012 L=29.0' S=0.0103 '/' Outflow=0.46 cfs 0.035 af

Pond CB-2: Catch Basin #2 Peak Elev=91.35' Inflow=0.51 cfs 0.034 af
12.0" Round Culvert n=0.012 L=95.0' S=0.0163 '/' Outflow=0.51 cfs 0.034 af

Pond CB-3: Catch Basin #3 Peak Elev=90.97' Inflow=0.44 cfs 0.031 af
12.0" Round Culvert n=0.012 L=11.0' S=0.0100 '/' Outflow=0.44 cfs 0.031 af

Pond CB-4: Catch Basin #4 Peak Elev=88.37' Inflow=0.31 cfs 0.023 af
12.0" Round Culvert n=0.012 L=21.0' S=0.0490 '/' Outflow=0.31 cfs 0.023 af

Pond CB-5: Catch Basin #5 Peak Elev=85.56' Inflow=0.40 cfs 0.031 af
12.0" Round Culvert n=0.012 L=47.0' S=0.0100 '/' Outflow=0.40 cfs 0.031 af

Pond CB-6: Catch Basin #6 Peak Elev=86.95' Inflow=0.79 cfs 0.059 af
12.0" Round Culvert n=0.012 L=58.0' S=0.0100 '/' Outflow=0.79 cfs 0.059 af

Pond CB-7: Catch Basin #7 Peak Elev=84.90' Inflow=0.47 cfs 0.036 af
12.0" Round Culvert n=0.012 L=55.0' S=0.0100 '/' Outflow=0.47 cfs 0.036 af

Pond CB-8: Catch Basin #8 Peak Elev=89.35' Inflow=0.49 cfs 0.034 af
12.0" Round Culvert n=0.012 L=39.0' S=0.0331 '/' Outflow=0.49 cfs 0.034 af

Pond CB-9: Catch Basin #9 Peak Elev=88.20' Inflow=0.50 cfs 0.040 af
12.0" Round Culvert n=0.012 L=44.0' S=0.0100 '/' Outflow=0.50 cfs 0.040 af

Pond DMH-1: Drain Manhole #1 Peak Elev=89.93' Inflow=0.13 cfs 0.011 af
12.0" Round Culvert n=0.012 L=67.5' S=0.0089 '/' Outflow=0.13 cfs 0.011 af

Pond DMH-2: Drain Manhole #2 Peak Elev=89.44' Inflow=0.62 cfs 0.050 af
12.0" Round Culvert n=0.012 L=67.5' S=0.0119 '/' Outflow=0.62 cfs 0.050 af

Pond DMH-3: Drain Manhole #3 Peak Elev=89.95' Inflow=0.95 cfs 0.064 af
12.0" Round Culvert n=0.012 L=59.0' S=0.0332 '/' Outflow=0.95 cfs 0.064 af

Pond DMH-4: Drain Manhole #4 Inflow=2.92 cfs 0.213 af
Primary=2.92 cfs 0.213 af

Pond DMH-5: Drain Manhole #5 Peak Elev=84.68' Inflow=1.97 cfs 0.148 af
15.0" Round Culvert n=0.012 L=14.6' S=0.0103 '/' Outflow=1.97 cfs 0.148 af

Pond DMH-6: Drain Manhole #6 Peak Elev=87.11' Inflow=1.44 cfs 0.109 af
12.0" Round Culvert n=0.012 L=8.5' S=0.0082 '/' Outflow=1.44 cfs 0.109 af

Pond DMH-7: Drain Manhole #7 Peak Elev=73.21' Inflow=0.18 cfs 0.036 af
12.0" Round Culvert n=0.012 L=20.0' S=0.0750 '/' Outflow=0.18 cfs 0.036 af

Pond DMH-8: Drain Manhole #8 Inflow=1.44 cfs 0.109 af
Primary=1.44 cfs 0.109 af

Pond UIS: Underground Infiltration System Peak Elev=85.85' Storage=7,026 cf Inflow=4.97 cfs 0.372 af
Discarded=0.15 cfs 0.292 af Primary=0.18 cfs 0.036 af Outflow=0.33 cfs 0.329 af

Link DP #1: Design Point #1 (Merrimack Street) Inflow=0.03 cfs 0.002 af
Primary=0.03 cfs 0.002 af

Link DP #2: Design Point #2 (Wetland) Inflow=0.23 cfs 0.067 af
Primary=0.23 cfs 0.067 af

Total Runoff Area = 2.244 ac Runoff Volume = 0.405 af Average Runoff Depth = 2.16"
53.04% Pervious = 1.190 ac 46.96% Impervious = 1.054 ac

Time span=0.00-30.00 hrs, dt=0.01 hrs, 3001 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 1S: Post-Developed Area 1 Runoff Area=5,413 sf 31.96% Impervious Runoff Depth=1.80"
Flow Length=100' Tc=5.7 min CN=58 Runoff=0.24 cfs 0.019 af

Subcatchment 2S: Post-Developed Area 2 Runoff Area=6,128 sf 73.04% Impervious Runoff Depth=4.05"
Flow Length=63' Tc=1.3 min CN=82 Runoff=0.70 cfs 0.047 af

Subcatchment 3S: Post-Developed Area 3 Runoff Area=4,978 sf 80.39% Impervious Runoff Depth=4.48"
Flow Length=90' Tc=3.3 min CN=86 Runoff=0.60 cfs 0.043 af

Subcatchment 4S: Post-Developed Area 4 Runoff Area=2,982 sf 92.19% Impervious Runoff Depth=5.25"
Flow Length=90' Tc=1.8 min CN=93 Runoff=0.40 cfs 0.030 af

Subcatchment 5S: Post-Developed Area 5 Runoff Area=3,747 sf 96.53% Impervious Runoff Depth=5.60"
Flow Length=75' Tc=1.6 min CN=96 Runoff=0.52 cfs 0.040 af

Subcatchment 6S: Post-Developed Area 6 Runoff Area=7,437 sf 95.05% Impervious Runoff Depth=5.48"
Flow Length=133' Tc=1.8 min CN=95 Runoff=1.02 cfs 0.078 af

Subcatchment 7S: Post-Developed Area 7 Runoff Area=4,447 sf 94.31% Impervious Runoff Depth=5.48"
Flow Length=138' Tc=3.0 min CN=95 Runoff=0.60 cfs 0.047 af

Subcatchment 8S: Post-Developed Area 8 Runoff Area=5,125 sf 83.41% Impervious Runoff Depth=4.69"
Flow Length=78' Tc=1.8 min CN=88 Runoff=0.65 cfs 0.046 af

Subcatchment 9S: Post Developed Area 9 Runoff Area=5,006 sf 95.19% Impervious Runoff Depth=5.48"
Flow Length=126' Tc=4.7 min CN=95 Runoff=0.65 cfs 0.052 af

Subcatchment 10S: Post Developed Area 10 Runoff Area=4,359 sf 95.09% Impervious Runoff Depth=5.48"
Flow Length=65' Tc=2.4 min CN=95 Runoff=0.60 cfs 0.046 af

Subcatchment 11S: Post Developed Area Runoff Area=4,578 sf 100.00% Impervious Runoff Depth=5.83"
Tc=1.0 min CN=98 Runoff=0.64 cfs 0.051 af

Subcatchment 100S: Post-Developed Area to Runoff Area=369 sf 81.03% Impervious Runoff Depth=4.58"
Tc=1.0 min CN=87 Runoff=0.05 cfs 0.003 af

Subcatchment 200S: Post-Developed Area Runoff Area=43,173 sf 0.00% Impervious Runoff Depth=0.83"
Flow Length=309' Tc=5.0 min CN=45 Runoff=0.67 cfs 0.069 af

Pond CB-1: Catch Basin #1 Peak Elev=90.99' Inflow=0.24 cfs 0.019 af
12.0" Round Culvert n=0.012 L=108.0' S=0.0083 '/' Outflow=0.24 cfs 0.019 af

Pond CB-10: Catch Basin #10 Peak Elev=87.32' Inflow=0.60 cfs 0.046 af
12.0" Round Culvert n=0.012 L=29.0' S=0.0103 '/' Outflow=0.60 cfs 0.046 af

Pond CB-2: Catch Basin #2 Peak Elev=91.42' Inflow=0.70 cfs 0.047 af
12.0" Round Culvert n=0.012 L=95.0' S=0.0163 '/' Outflow=0.70 cfs 0.047 af

Pond CB-3: Catch Basin #3 Peak Elev=91.03' Inflow=0.60 cfs 0.043 af
12.0" Round Culvert n=0.012 L=11.0' S=0.0100 '/' Outflow=0.60 cfs 0.043 af

Pond CB-4: Catch Basin #4 Peak Elev=88.41' Inflow=0.40 cfs 0.030 af
12.0" Round Culvert n=0.012 L=21.0' S=0.0490 '/' Outflow=0.40 cfs 0.030 af

Pond CB-5: Catch Basin #5 Peak Elev=85.61' Inflow=0.52 cfs 0.040 af
12.0" Round Culvert n=0.012 L=47.0' S=0.0100 '/' Outflow=0.52 cfs 0.040 af

Pond CB-6: Catch Basin #6 Peak Elev=87.02' Inflow=1.02 cfs 0.078 af
12.0" Round Culvert n=0.012 L=58.0' S=0.0100 '/' Outflow=1.02 cfs 0.078 af

Pond CB-7: Catch Basin #7 Peak Elev=85.00' Inflow=0.60 cfs 0.047 af
12.0" Round Culvert n=0.012 L=55.0' S=0.0100 '/' Outflow=0.60 cfs 0.047 af

Pond CB-8: Catch Basin #8 Peak Elev=89.41' Inflow=0.65 cfs 0.046 af
12.0" Round Culvert n=0.012 L=39.0' S=0.0331 '/' Outflow=0.65 cfs 0.046 af

Pond CB-9: Catch Basin #9 Peak Elev=88.26' Inflow=0.65 cfs 0.052 af
12.0" Round Culvert n=0.012 L=44.0' S=0.0100 '/' Outflow=0.65 cfs 0.052 af

Pond DMH-1: Drain Manhole #1 Peak Elev=90.01' Inflow=0.24 cfs 0.019 af
12.0" Round Culvert n=0.012 L=67.5' S=0.0089 '/' Outflow=0.24 cfs 0.019 af

Pond DMH-2: Drain Manhole #2 Peak Elev=89.52' Inflow=0.86 cfs 0.070 af
12.0" Round Culvert n=0.012 L=67.5' S=0.0119 '/' Outflow=0.86 cfs 0.070 af

Pond DMH-3: Drain Manhole #3 Peak Elev=90.05' Inflow=1.30 cfs 0.090 af
12.0" Round Culvert n=0.012 L=59.0' S=0.0332 '/' Outflow=1.30 cfs 0.090 af

Pond DMH-4: Drain Manhole #4 Inflow=3.84 cfs 0.285 af
Primary=3.84 cfs 0.285 af

Pond DMH-5: Drain Manhole #5 Peak Elev=84.81' Inflow=2.54 cfs 0.195 af
15.0" Round Culvert n=0.012 L=14.6' S=0.0103 '/' Outflow=2.54 cfs 0.195 af

Pond DMH-6: Drain Manhole #6 Peak Elev=87.24' Inflow=1.88 cfs 0.144 af
12.0" Round Culvert n=0.012 L=8.5' S=0.0082 '/' Outflow=1.88 cfs 0.144 af

Pond DMH-7: Drain Manhole #7 Peak Elev=73.45' Inflow=0.77 cfs 0.130 af
12.0" Round Culvert n=0.012 L=20.0' S=0.0750 '/' Outflow=0.77 cfs 0.130 af

Pond DMH-8: Drain Manhole #8 Inflow=1.88 cfs 0.144 af
Primary=1.88 cfs 0.144 af

Pond UIS: Underground Infiltration System Peak Elev=86.60' Storage=8,437 cf Inflow=6.57 cfs 0.499 af
Discarded=0.15 cfs 0.309 af Primary=0.77 cfs 0.130 af Outflow=0.92 cfs 0.439 af

Link DP #1: Design Point #1 (Merrimack Street) Inflow=0.05 cfs 0.003 af
Primary=0.05 cfs 0.003 af

Link DP #2: Design Point #2 (Wetland)

Inflow=0.97 cfs 0.199 af
Primary=0.97 cfs 0.199 af

Total Runoff Area = 2.244 ac Runoff Volume = 0.570 af Average Runoff Depth = 3.05"
53.04% Pervious = 1.190 ac 46.96% Impervious = 1.054 ac

Summary for Subcatchment 1S: Post-Developed Area 1

Runoff = 0.24 cfs @ 12.13 hrs, Volume= 0.019 af, Depth= 1.80"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
NRCC 24-hr D 25-year Rainfall=6.07"

Area (sf)	CN	Description
1,730	98	Paved parking, HSG A
3,683	39	>75% Grass cover, Good, HSG A
5,413	58	Weighted Average
3,683		68.04% Pervious Area
1,730		31.96% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.4	20	0.0060	0.08		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.12"
1.3	80	0.0232	1.07		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
5.7	100	Total			

Summary for Subcatchment 2S: Post-Developed Area 2

Runoff = 0.70 cfs @ 12.10 hrs, Volume= 0.047 af, Depth= 4.05"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
NRCC 24-hr D 25-year Rainfall=6.07"

Area (sf)	CN	Description
4,476	98	Paved parking, HSG A
1,652	39	>75% Grass cover, Good, HSG A
6,128	82	Weighted Average
1,652		26.96% Pervious Area
4,476		73.04% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.0	15	0.1400	0.25		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.12"
0.3	48	0.0220	3.01		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
1.3	63	Total			

Summary for Subcatchment 3S: Post-Developed Area 3

Runoff = 0.60 cfs @ 12.11 hrs, Volume= 0.043 af, Depth= 4.48"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
NRCC 24-hr D 25-year Rainfall=6.07"

Area (sf)	CN	Description
4,002	98	Paved parking, HSG A
976	39	>75% Grass cover, Good, HSG A
4,978	86	Weighted Average
976		19.61% Pervious Area
4,002		80.39% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.9	20	0.0180	0.12		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.12"
0.4	70	0.0220	3.01		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
3.3	90	Total			

Summary for Subcatchment 4S: Post-Developed Area 4

Runoff = 0.40 cfs @ 12.10 hrs, Volume= 0.030 af, Depth= 5.25"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
NRCC 24-hr D 25-year Rainfall=6.07"

Area (sf)	CN	Description
2,749	98	Paved parking, HSG A
233	39	>75% Grass cover, Good, HSG A
2,982	93	Weighted Average
233		7.81% Pervious Area
2,749		92.19% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.5	8	0.0150	0.09		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.12"
0.3	82	0.0420	4.16		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
1.8	90	Total			

Summary for Subcatchment 5S: Post-Developed Area 5

Runoff = 0.52 cfs @ 12.10 hrs, Volume= 0.040 af, Depth= 5.60"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
NRCC 24-hr D 25-year Rainfall=6.07"

Area (sf)	CN	Description
3,617	98	Paved parking, HSG A
130	39	>75% Grass cover, Good, HSG A
3,747	96	Weighted Average
130		3.47% Pervious Area
3,617		96.53% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.3	4	0.0050	0.05		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.12"
0.3	71	0.0483	4.46		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
1.6	75	Total			

Summary for Subcatchment 6S: Post-Developed Area 6

Runoff = 1.02 cfs @ 12.10 hrs, Volume= 0.078 af, Depth= 5.48"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
NRCC 24-hr D 25-year Rainfall=6.07"

Area (sf)	CN	Description
7,069	98	Paved parking, HSG A
368	39	>75% Grass cover, Good, HSG A
7,437	95	Weighted Average
368		4.95% Pervious Area
7,069		95.05% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.3	4	0.0050	0.05		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.12"
0.5	129	0.0418	4.15		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
1.8	133	Total			

Summary for Subcatchment 7S: Post-Developed Area 7

Runoff = 0.60 cfs @ 12.11 hrs, Volume= 0.047 af, Depth= 5.48"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
NRCC 24-hr D 25-year Rainfall=6.07"

Area (sf)	CN	Description
4,194	98	Paved parking, HSG A
253	39	>75% Grass cover, Good, HSG A
4,447	95	Weighted Average
253		5.69% Pervious Area
4,194		94.31% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.5	9	0.0050	0.06		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.12"
0.5	129	0.0440	4.26		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
3.0	138	Total			

Summary for Subcatchment 8S: Post-Developed Area 8

Runoff = 0.65 cfs @ 12.10 hrs, Volume= 0.046 af, Depth= 4.69"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
NRCC 24-hr D 25-year Rainfall=6.07"

Area (sf)	CN	Description
4,275	98	Paved parking, HSG A
850	39	>75% Grass cover, Good, HSG A
5,125	88	Weighted Average
850		16.59% Pervious Area
4,275		83.41% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.6	13	0.0346	0.14		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.12"
0.0	5	0.0200	2.87		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
0.2	60	0.0408	4.10		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
1.8	78	Total			

Summary for Subcatchment 9S: Post Developed Area 9

Runoff = 0.65 cfs @ 12.12 hrs, Volume= 0.052 af, Depth= 5.48"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
NRCC 24-hr D 25-year Rainfall=6.07"

Area (sf)	CN	Description
4,765	98	Paved parking, HSG A
241	39	>75% Grass cover, Good, HSG A
5,006	95	Weighted Average
241		4.81% Pervious Area
4,765		95.19% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.2	17	0.0050	0.07		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.12"
0.5	109	0.0328	3.68		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
4.7	126	Total			

Summary for Subcatchment 10S: Post Developed Area 10

Runoff = 0.60 cfs @ 12.10 hrs, Volume= 0.046 af, Depth= 5.48"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
NRCC 24-hr D 25-year Rainfall=6.07"

Area (sf)	CN	Description
4,145	98	Paved parking, HSG A
214	39	>75% Grass cover, Good, HSG A
4,359	95	Weighted Average
214		4.91% Pervious Area
4,145		95.09% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.1	7	0.0050	0.06		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.12"
0.3	58	0.0362	3.86		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
2.4	65	Total			

Summary for Subcatchment 11S: Post Developed Area 11

[49] Hint: Tc<2dt may require smaller dt

Runoff = 0.64 cfs @ 12.09 hrs, Volume= 0.051 af, Depth= 5.83"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
NRCC 24-hr D 25-year Rainfall=6.07"

Area (sf)	CN	Description
4,578	98	Roofs, HSG A
4,578		100.00% Impervious Area

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

Summary for Subcatchment 100S: Post-Developed Area to Merrimack Street

[49] Hint: Tc<2dt may require smaller dt

Runoff = 0.05 cfs @ 12.10 hrs, Volume= 0.003 af, Depth= 4.58"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
NRCC 24-hr D 25-year Rainfall=6.07"

Area (sf)	CN	Description
299	98	Paved parking, HSG A
70	39	>75% Grass cover, Good, HSG A
369	87	Weighted Average
70		18.97% Pervious Area
299		81.03% Impervious Area

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

Summary for Subcatchment 200S: Post-Developed Area to Wetland

Runoff = 0.67 cfs @ 12.14 hrs, Volume= 0.069 af, Depth= 0.83"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
NRCC 24-hr D 25-year Rainfall=6.07"

Area (sf)	CN	Description
17,654	55	Woods, Good, HSG B
9,683	30	Woods, Good, HSG A
2,603	61	>75% Grass cover, Good, HSG B
13,233	39	>75% Grass cover, Good, HSG A
43,173	45	Weighted Average
43,173		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.7	20	0.1420	0.12		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.12"
2.3	289	0.1771	2.10		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
5.0	309	Total			

Summary for Pond CB-1: Catch Basin #1

Inflow Area = 0.124 ac, 31.96% Impervious, Inflow Depth = 1.80" for 25-year event
Inflow = 0.24 cfs @ 12.13 hrs, Volume= 0.019 af
Outflow = 0.24 cfs @ 12.13 hrs, Volume= 0.019 af, Atten= 0%, Lag= 0.0 min
Primary = 0.24 cfs @ 12.13 hrs, Volume= 0.019 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Peak Elev= 90.99' @ 12.13 hrs
Flood Elev= 94.20'

Device	Routing	Invert	Outlet Devices
#1	Primary	90.75'	**12.0" Round Culvert** L= 108.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 90.75' / 89.85' S= 0.0083 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=0.24 cfs @ 12.13 hrs HW=90.99' TW=90.00' (Dynamic Tailwater)
↑—**1=Culvert** (Barrel Controls 0.24 cfs @ 2.48 fps)

Summary for Pond CB-10: Catch Basin #10

Inflow Area = 0.100 ac, 95.09% Impervious, Inflow Depth = 5.48" for 25-year event
Inflow = 0.60 cfs @ 12.10 hrs, Volume= 0.046 af
Outflow = 0.60 cfs @ 12.10 hrs, Volume= 0.046 af, Atten= 0%, Lag= 0.0 min
Primary = 0.60 cfs @ 12.10 hrs, Volume= 0.046 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Peak Elev= 87.32' @ 12.11 hrs
Flood Elev= 90.65'

Device	Routing	Invert	Outlet Devices
#1	Primary	86.65'	**12.0" Round Culvert**

L= 29.0' CPP, square edge headwall, Ke= 0.500
Inlet / Outlet Invert= 86.65' / 86.35' S= 0.0103 '/' Cc= 0.900
n= 0.012 Corrugated PP, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=0.56 cfs @ 12.10 hrs HW=87.32' TW=87.24' (Dynamic Tailwater)
↑—**1=Culvert** (Outlet Controls 0.56 cfs @ 1.44 fps)

Summary for Pond CB-2: Catch Basin #2

Inflow Area = 0.141 ac, 73.04% Impervious, Inflow Depth = 4.05" for 25-year event
Inflow = 0.70 cfs @ 12.10 hrs, Volume= 0.047 af
Outflow = 0.70 cfs @ 12.10 hrs, Volume= 0.047 af, Atten= 0%, Lag= 0.0 min
Primary = 0.70 cfs @ 12.10 hrs, Volume= 0.047 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Peak Elev= 91.42' @ 12.10 hrs
Flood Elev= 95.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	91.00'	**12.0" Round Culvert** L= 95.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 91.00' / 89.45' S= 0.0163 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=0.70 cfs @ 12.10 hrs HW=91.42' TW=90.05' (Dynamic Tailwater)
↑—**1=Culvert** (Inlet Controls 0.70 cfs @ 2.21 fps)

Summary for Pond CB-3: Catch Basin #3

Inflow Area = 0.114 ac, 80.39% Impervious, Inflow Depth = 4.48" for 25-year event
Inflow = 0.60 cfs @ 12.11 hrs, Volume= 0.043 af
Outflow = 0.60 cfs @ 12.11 hrs, Volume= 0.043 af, Atten= 0%, Lag= 0.0 min
Primary = 0.60 cfs @ 12.11 hrs, Volume= 0.043 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Peak Elev= 91.03' @ 12.11 hrs
Flood Elev= 94.60'

Device	Routing	Invert	Outlet Devices
#1	Primary	90.60'	**12.0" Round Culvert** L= 11.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 90.60' / 90.49' S= 0.0100 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=0.60 cfs @ 12.11 hrs HW=91.03' TW=90.04' (Dynamic Tailwater)
↑—**1=Culvert** (Barrel Controls 0.60 cfs @ 2.69 fps)

Summary for Pond CB-4: Catch Basin #4

Inflow Area = 0.068 ac, 92.19% Impervious, Inflow Depth = 5.25" for 25-year event
Inflow = 0.40 cfs @ 12.10 hrs, Volume= 0.030 af
Outflow = 0.40 cfs @ 12.10 hrs, Volume= 0.030 af, Atten= 0%, Lag= 0.0 min
Primary = 0.40 cfs @ 12.10 hrs, Volume= 0.030 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Peak Elev= 88.41' @ 12.10 hrs
Flood Elev= 92.10'

Device	Routing	Invert	Outlet Devices
#1	Primary	88.10'	**12.0" Round Culvert** L= 21.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 88.10' / 87.07' S= 0.0490 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=0.40 cfs @ 12.10 hrs HW=88.41' TW=84.81' (Dynamic Tailwater)
↑—**1=Culvert** (Inlet Controls 0.40 cfs @ 1.91 fps)

Summary for Pond CB-5: Catch Basin #5

Inflow Area = 0.086 ac, 96.53% Impervious, Inflow Depth = 5.60" for 25-year event
Inflow = 0.52 cfs @ 12.10 hrs, Volume= 0.040 af
Outflow = 0.52 cfs @ 12.10 hrs, Volume= 0.040 af, Atten= 0%, Lag= 0.0 min
Primary = 0.52 cfs @ 12.10 hrs, Volume= 0.040 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Peak Elev= 85.61' @ 12.10 hrs
Flood Elev= 89.25'

Device	Routing	Invert	Outlet Devices
#1	Primary	85.25'	**12.0" Round Culvert** L= 47.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 85.25' / 84.78' S= 0.0100 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=0.52 cfs @ 12.10 hrs HW=85.61' TW=84.81' (Dynamic Tailwater)
↑—**1=Culvert** (Inlet Controls 0.52 cfs @ 2.04 fps)

Summary for Pond CB-6: Catch Basin #6

Inflow Area = 0.171 ac, 95.05% Impervious, Inflow Depth = 5.48" for 25-year event
Inflow = 1.02 cfs @ 12.10 hrs, Volume= 0.078 af
Outflow = 1.02 cfs @ 12.10 hrs, Volume= 0.078 af, Atten= 0%, Lag= 0.0 min
Primary = 1.02 cfs @ 12.10 hrs, Volume= 0.078 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs

Peak Elev= 87.02' @ 12.10 hrs
Flood Elev= 90.50'

Device	Routing	Invert	Outlet Devices
#1	Primary	86.50'	**12.0" Round Culvert** L= 58.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 86.50' / 85.92' S= 0.0100 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=1.02 cfs @ 12.10 hrs HW=87.02' TW=84.81' (Dynamic Tailwater)
↑—**1=Culvert** (Inlet Controls 1.02 cfs @ 2.46 fps)

Summary for Pond CB-7: Catch Basin #7

Inflow Area = 0.102 ac, 94.31% Impervious, Inflow Depth = 5.48" for 25-year event
Inflow = 0.60 cfs @ 12.11 hrs, Volume= 0.047 af
Outflow = 0.60 cfs @ 12.11 hrs, Volume= 0.047 af, Atten= 0%, Lag= 0.0 min
Primary = 0.60 cfs @ 12.11 hrs, Volume= 0.047 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Peak Elev= 85.00' @ 12.11 hrs
Flood Elev= 88.45'

Device	Routing	Invert	Outlet Devices
#1	Primary	84.45'	**12.0" Round Culvert** L= 55.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 84.45' / 83.90' S= 0.0100 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=0.61 cfs @ 12.11 hrs HW=85.00' TW=84.80' (Dynamic Tailwater)
↑—**1=Culvert** (Outlet Controls 0.61 cfs @ 1.99 fps)

Summary for Pond CB-8: Catch Basin #8

Inflow Area = 0.118 ac, 83.41% Impervious, Inflow Depth = 4.69" for 25-year event
Inflow = 0.65 cfs @ 12.10 hrs, Volume= 0.046 af
Outflow = 0.65 cfs @ 12.10 hrs, Volume= 0.046 af, Atten= 0%, Lag= 0.0 min
Primary = 0.65 cfs @ 12.10 hrs, Volume= 0.046 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Peak Elev= 89.41' @ 12.10 hrs
Flood Elev= 93.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	89.00'	**12.0" Round Culvert** L= 39.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 89.00' / 87.71' S= 0.0331 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=0.65 cfs @ 12.10 hrs HW=89.41' TW=87.24' (Dynamic Tailwater)
↑—**1=Culvert** (Inlet Controls 0.65 cfs @ 2.17 fps)

Summary for Pond CB-9: Catch Basin #9

Inflow Area = 0.115 ac, 95.19% Impervious, Inflow Depth = 5.48" for 25-year event
Inflow = 0.65 cfs @ 12.12 hrs, Volume= 0.052 af
Outflow = 0.65 cfs @ 12.12 hrs, Volume= 0.052 af, Atten= 0%, Lag= 0.0 min
Primary = 0.65 cfs @ 12.12 hrs, Volume= 0.052 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Peak Elev= 88.26' @ 12.12 hrs
Flood Elev= 91.85'

Device	Routing	Invert	Outlet Devices
#1	Primary	87.85'	**12.0" Round Culvert** L= 44.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 87.85' / 87.41' S= 0.0100 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=0.65 cfs @ 12.12 hrs HW=88.26' TW=87.21' (Dynamic Tailwater)
↑—**1=Culvert** (Barrel Controls 0.65 cfs @ 3.19 fps)

Summary for Pond DMH-1: Drain Manhole #1

Inflow Area = 0.124 ac, 31.96% Impervious, Inflow Depth = 1.80" for 25-year event
Inflow = 0.24 cfs @ 12.13 hrs, Volume= 0.019 af
Outflow = 0.24 cfs @ 12.13 hrs, Volume= 0.019 af, Atten= 0%, Lag= 0.0 min
Primary = 0.24 cfs @ 12.13 hrs, Volume= 0.019 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Peak Elev= 90.01' @ 12.12 hrs
Flood Elev= 95.55'

Device	Routing	Invert	Outlet Devices
#1	Primary	89.75'	**12.0" Round Culvert** L= 67.5' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 89.75' / 89.15' S= 0.0089 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=0.25 cfs @ 12.13 hrs HW=90.00' TW=89.39' (Dynamic Tailwater)
↑—**1=Culvert** (Outlet Controls 0.25 cfs @ 2.43 fps)

Summary for Pond DMH-2: Drain Manhole #2

Inflow Area = 0.229 ac, 63.14% Impervious, Inflow Depth = 3.65" for 25-year event
Inflow = 0.86 cfs @ 12.10 hrs, Volume= 0.070 af
Outflow = 0.86 cfs @ 12.10 hrs, Volume= 0.070 af, Atten= 0%, Lag= 0.0 min
Primary = 0.86 cfs @ 12.10 hrs, Volume= 0.070 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Peak Elev= 89.52' @ 12.10 hrs
Flood Elev= 95.50'

Device	Routing	Invert	Outlet Devices
#1	Primary	89.05'	**12.0" Round Culvert** L= 67.5' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 89.05' / 88.25' S= 0.0119 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=0.85 cfs @ 12.10 hrs HW=89.52' TW=85.53' (Dynamic Tailwater)
↑—**1=Culvert** (Inlet Controls 0.85 cfs @ 2.33 fps)

Summary for Pond DMH-3: Drain Manhole #3

Inflow Area = 0.255 ac, 76.34% Impervious, Inflow Depth = 4.24" for 25-year event
Inflow = 1.30 cfs @ 12.10 hrs, Volume= 0.090 af
Outflow = 1.30 cfs @ 12.10 hrs, Volume= 0.090 af, Atten= 0%, Lag= 0.0 min
Primary = 1.30 cfs @ 12.10 hrs, Volume= 0.090 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Peak Elev= 90.05' @ 12.10 hrs
Flood Elev= 93.45'

Device	Routing	Invert	Outlet Devices
#1	Primary	89.45'	**12.0" Round Culvert** L= 59.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 89.45' / 87.49' S= 0.0332 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=1.29 cfs @ 12.10 hrs HW=90.05' TW=0.00' (Dynamic Tailwater)
↑—**1=Culvert** (Inlet Controls 1.29 cfs @ 2.63 fps)

Summary for Pond DMH-4: Drain Manhole #4

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 0.682 ac, 87.85% Impervious, Inflow Depth = 5.01" for 25-year event
Inflow = 3.84 cfs @ 12.10 hrs, Volume= 0.285 af
Primary = 3.84 cfs @ 12.10 hrs, Volume= 0.285 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs

Summary for Pond DMH-5: Drain Manhole #5

Inflow Area = 0.427 ac, 94.71% Impervious, Inflow Depth = 5.47" for 25-year event
Inflow = 2.54 cfs @ 12.10 hrs, Volume= 0.195 af
Outflow = 2.54 cfs @ 12.10 hrs, Volume= 0.195 af, Atten= 0%, Lag= 0.0 min
Primary = 2.54 cfs @ 12.10 hrs, Volume= 0.195 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Peak Elev= 84.81' @ 12.10 hrs
Flood Elev= 91.07'

Device	Routing	Invert	Outlet Devices
#1	Primary	83.90'	**15.0" Round Culvert** L= 14.6' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 83.90' / 83.75' S= 0.0103 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 1.23 sf

Primary OutFlow Max=2.54 cfs @ 12.10 hrs HW=84.81' TW=0.00' (Dynamic Tailwater)
└─**1=Culvert** (Barrel Controls 2.54 cfs @ 3.71 fps)

Summary for Pond DMH-6: Drain Manhole #6

Inflow Area = 0.333 ac, 90.99% Impervious, Inflow Depth = 5.20" for 25-year event
Inflow = 1.88 cfs @ 12.10 hrs, Volume= 0.144 af
Outflow = 1.88 cfs @ 12.10 hrs, Volume= 0.144 af, Atten= 0%, Lag= 0.0 min
Primary = 1.88 cfs @ 12.10 hrs, Volume= 0.144 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Peak Elev= 87.24' @ 12.10 hrs
Flood Elev= 91.71'

Device	Routing	Invert	Outlet Devices
#1	Primary	86.35'	**12.0" Round Culvert** L= 8.5' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 86.35' / 86.28' S= 0.0082 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=1.87 cfs @ 12.10 hrs HW=87.24' TW=0.00' (Dynamic Tailwater)
└─**1=Culvert** (Barrel Controls 1.87 cfs @ 3.35 fps)

Summary for Pond DMH-7: Drain Manhole #7

Inflow Area = 1.244 ac, 84.13% Impervious, Inflow Depth = 1.26" for 25-year event
Inflow = 0.77 cfs @ 12.53 hrs, Volume= 0.130 af
Outflow = 0.77 cfs @ 12.53 hrs, Volume= 0.130 af, Atten= 0%, Lag= 0.0 min
Primary = 0.77 cfs @ 12.53 hrs, Volume= 0.130 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs

Peak Elev= 73.45' @ 12.53 hrs
Flood Elev= 82.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	73.00'	**12.0" Round Culvert** L= 20.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 73.00' / 71.50' S= 0.0750 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=0.77 cfs @ 12.53 hrs HW=73.45' TW=0.00' (Dynamic Tailwater)
↑—**1=Culvert** (Inlet Controls 0.77 cfs @ 2.28 fps)

Summary for Pond DMH-8: Drain Manhole #8

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 0.333 ac, 90.99% Impervious, Inflow Depth = 5.20" for 25-year event
Inflow = 1.88 cfs @ 12.10 hrs, Volume= 0.144 af
Primary = 1.88 cfs @ 12.10 hrs, Volume= 0.144 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs

Summary for Pond UIS: Underground Infiltration System

[92] Warning: Device #5 is above defined storage

Inflow Area = 1.244 ac, 84.13% Impervious, Inflow Depth = 4.81" for 25-year event
Inflow = 6.57 cfs @ 12.10 hrs, Volume= 0.499 af
Outflow = 0.92 cfs @ 12.53 hrs, Volume= 0.439 af, Atten= 86%, Lag= 26.1 min
Discarded = 0.15 cfs @ 9.11 hrs, Volume= 0.309 af
Primary = 0.77 cfs @ 12.53 hrs, Volume= 0.130 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Peak Elev= 86.60' @ 12.53 hrs Surf.Area= 2,701 sf Storage= 8,437 cf
Flood Elev= 89.00' Surf.Area= 2,701 sf Storage= 11,572 cf

Plug-Flow detention time= 271.0 min calculated for 0.439 af (88% of inflow)
Center-of-Mass det. time= 206.4 min (987.2 - 780.8)

Volume	Invert	Avail.Storage	Storage Description
#1A	82.25'	4,440 cf	**37.58'W x 71.87'L x 6.75'H Field A** 18,232 cf Overall - 7,131 cf Embedded = 11,100 cf x 40.0% Voids
#2A	83.00'	7,131 cf	**ADS_StormTech MC-4500 b +Cap** x 64 Inside #1 Effective Size= 90.4"W x 60.0"H => 26.46 sf x 4.03'L = 106.5 cf Overall Size= 100.0"W x 60.0"H x 4.33'L with 0.31' Overlap 64 Chambers in 4 Rows Cap Storage= +39.5 cf x 2 x 4 rows = 316.0 cf
		11,572 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	82.25'	**12.0" Round Culvert** L= 44.5' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 82.25' / 79.00' S= 0.0730 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 0.79 sf
#2	Discarded	82.25'	**2.410 in/hr Exfiltration over Surface area** Phase-In= 0.10'
#3	Device 1	85.50'	**4.0" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#4	Device 1	86.25'	**8.0" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#5	Device 1	89.00'	**12.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Discarded OutFlow Max=0.15 cfs @ 9.11 hrs HW=82.39' (Free Discharge)
└─**2=Exfiltration** (Exfiltration Controls 0.15 cfs)

Primary OutFlow Max=0.77 cfs @ 12.53 hrs HW=86.60' TW=73.45' (Dynamic Tailwater)
└─**1=Culvert** (Passes 0.77 cfs of 7.42 cfs potential flow)
  ├─**3=Orifice/Grate** (Orifice Controls 0.41 cfs @ 4.64 fps)
  ├─**4=Orifice/Grate** (Orifice Controls 0.37 cfs @ 2.01 fps)
  └─**5=Orifice/Grate** (Controls 0.00 cfs)

Summary for Link DP #1: Design Point #1 (Merrimack Street)

Inflow Area = 0.008 ac, 81.03% Impervious, Inflow Depth = 4.58" for 25-year event
Inflow = 0.05 cfs @ 12.10 hrs, Volume= 0.003 af
Primary = 0.05 cfs @ 12.10 hrs, Volume= 0.003 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs

Summary for Link DP #2: Design Point #2 (Wetland)

Inflow Area = 2.235 ac, 46.83% Impervious, Inflow Depth = 1.07" for 25-year event
Inflow = 0.97 cfs @ 12.53 hrs, Volume= 0.199 af
Primary = 0.97 cfs @ 12.53 hrs, Volume= 0.199 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs

Time span=0.00-30.00 hrs, dt=0.01 hrs, 3001 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 1S: Post-Developed Area 1 Runoff Area=5,413 sf 31.96% Impervious Runoff Depth=3.69"
Flow Length=100' Tc=5.7 min CN=58 Runoff=0.52 cfs 0.038 af

Subcatchment 2S: Post-Developed Area 2 Runoff Area=6,128 sf 73.04% Impervious Runoff Depth=6.60"
Flow Length=63' Tc=1.3 min CN=82 Runoff=1.10 cfs 0.077 af

Subcatchment 3S: Post-Developed Area 3 Runoff Area=4,978 sf 80.39% Impervious Runoff Depth=7.09"
Flow Length=90' Tc=3.3 min CN=86 Runoff=0.92 cfs 0.068 af

Subcatchment 4S: Post-Developed Area 4 Runoff Area=2,982 sf 92.19% Impervious Runoff Depth=7.94"
Flow Length=90' Tc=1.8 min CN=93 Runoff=0.59 cfs 0.045 af

Subcatchment 5S: Post-Developed Area 5 Runoff Area=3,747 sf 96.53% Impervious Runoff Depth=8.30"
Flow Length=75' Tc=1.6 min CN=96 Runoff=0.75 cfs 0.059 af

Subcatchment 6S: Post-Developed Area 6 Runoff Area=7,437 sf 95.05% Impervious Runoff Depth=8.18"
Flow Length=133' Tc=1.8 min CN=95 Runoff=1.49 cfs 0.116 af

Subcatchment 7S: Post-Developed Area 7 Runoff Area=4,447 sf 94.31% Impervious Runoff Depth=8.18"
Flow Length=138' Tc=3.0 min CN=95 Runoff=0.88 cfs 0.070 af

Subcatchment 8S: Post-Developed Area 8 Runoff Area=5,125 sf 83.41% Impervious Runoff Depth=7.33"
Flow Length=78' Tc=1.8 min CN=88 Runoff=0.98 cfs 0.072 af

Subcatchment 9S: Post Developed Area 9 Runoff Area=5,006 sf 95.19% Impervious Runoff Depth=8.18"
Flow Length=126' Tc=4.7 min CN=95 Runoff=0.95 cfs 0.078 af

Subcatchment 10S: Post Developed Area 10 Runoff Area=4,359 sf 95.09% Impervious Runoff Depth=8.18"
Flow Length=65' Tc=2.4 min CN=95 Runoff=0.87 cfs 0.068 af

Subcatchment 11S: Post Developed Area Runoff Area=4,578 sf 100.00% Impervious Runoff Depth=8.54"
Tc=1.0 min CN=98 Runoff=0.92 cfs 0.075 af

Subcatchment 100S: Post-Developed Area to Runoff Area=369 sf 81.03% Impervious Runoff Depth=7.21"
Tc=1.0 min CN=87 Runoff=0.07 cfs 0.005 af

Subcatchment 200S: Post-Developed Area Runoff Area=43,173 sf 0.00% Impervious Runoff Depth=2.16"
Flow Length=309' Tc=5.0 min CN=45 Runoff=2.32 cfs 0.179 af

Pond CB-1: Catch Basin #1 Peak Elev=91.11' Inflow=0.52 cfs 0.038 af
12.0" Round Culvert n=0.012 L=108.0' S=0.0083 '/' Outflow=0.52 cfs 0.038 af

Pond CB-10: Catch Basin #10 Peak Elev=87.61' Inflow=0.87 cfs 0.068 af
12.0" Round Culvert n=0.012 L=29.0' S=0.0103 '/' Outflow=0.87 cfs 0.068 af

Pond CB-2: Catch Basin #2 Peak Elev=91.55' Inflow=1.10 cfs 0.077 af
12.0" Round Culvert n=0.012 L=95.0' S=0.0163 '/' Outflow=1.10 cfs 0.077 af

Pond CB-3: Catch Basin #3 Peak Elev=91.16' Inflow=0.92 cfs 0.068 af
12.0" Round Culvert n=0.012 L=11.0' S=0.0100 '/' Outflow=0.92 cfs 0.068 af

Pond CB-4: Catch Basin #4 Peak Elev=88.49' Inflow=0.59 cfs 0.045 af
12.0" Round Culvert n=0.012 L=21.0' S=0.0490 '/' Outflow=0.59 cfs 0.045 af

Pond CB-5: Catch Basin #5 Peak Elev=85.69' Inflow=0.75 cfs 0.059 af
12.0" Round Culvert n=0.012 L=47.0' S=0.0100 '/' Outflow=0.75 cfs 0.059 af

Pond CB-6: Catch Basin #6 Peak Elev=87.15' Inflow=1.49 cfs 0.116 af
12.0" Round Culvert n=0.012 L=58.0' S=0.0100 '/' Outflow=1.49 cfs 0.116 af

Pond CB-7: Catch Basin #7 Peak Elev=85.22' Inflow=0.88 cfs 0.070 af
12.0" Round Culvert n=0.012 L=55.0' S=0.0100 '/' Outflow=0.88 cfs 0.070 af

Pond CB-8: Catch Basin #8 Peak Elev=89.51' Inflow=0.98 cfs 0.072 af
12.0" Round Culvert n=0.012 L=39.0' S=0.0331 '/' Outflow=0.98 cfs 0.072 af

Pond CB-9: Catch Basin #9 Peak Elev=88.36' Inflow=0.95 cfs 0.078 af
12.0" Round Culvert n=0.012 L=44.0' S=0.0100 '/' Outflow=0.95 cfs 0.078 af

Pond DMH-1: Drain Manhole #1 Peak Elev=90.14' Inflow=0.52 cfs 0.038 af
12.0" Round Culvert n=0.012 L=67.5' S=0.0089 '/' Outflow=0.52 cfs 0.038 af

Pond DMH-2: Drain Manhole #2 Peak Elev=89.68' Inflow=1.40 cfs 0.113 af
12.0" Round Culvert n=0.012 L=67.5' S=0.0119 '/' Outflow=1.40 cfs 0.113 af

Pond DMH-3: Drain Manhole #3 Peak Elev=90.24' Inflow=2.02 cfs 0.145 af
12.0" Round Culvert n=0.012 L=59.0' S=0.0332 '/' Outflow=2.02 cfs 0.145 af

Pond DMH-4: Drain Manhole #4 Inflow=5.74 cfs 0.436 af
Primary=5.74 cfs 0.436 af

Pond DMH-5: Drain Manhole #5 Peak Elev=85.07' Inflow=3.71 cfs 0.291 af
15.0" Round Culvert n=0.012 L=14.6' S=0.0103 '/' Outflow=3.71 cfs 0.291 af

Pond DMH-6: Drain Manhole #6 Peak Elev=87.54' Inflow=2.78 cfs 0.218 af
12.0" Round Culvert n=0.012 L=8.5' S=0.0082 '/' Outflow=2.78 cfs 0.218 af

Pond DMH-7: Drain Manhole #7 Peak Elev=74.29' Inflow=3.36 cfs 0.361 af
12.0" Round Culvert n=0.012 L=20.0' S=0.0750 '/' Outflow=3.36 cfs 0.361 af

Pond DMH-8: Drain Manhole #8 Inflow=2.78 cfs 0.218 af
Primary=2.78 cfs 0.218 af

Pond UIS: Underground Infiltration System Peak Elev=88.96' Storage=11,532 cf Inflow=9.92 cfs 0.767 af
Discarded=0.15 cfs 0.332 af Primary=3.36 cfs 0.361 af Outflow=3.51 cfs 0.693 af

Link DP #1: Design Point #1 (Merrimack Street) Inflow=0.07 cfs 0.005 af
Primary=0.07 cfs 0.005 af

Link DP #2: Design Point #2 (Wetland)

Inflow=5.53 cfs 0.540 af
Primary=5.53 cfs 0.540 af

Total Runoff Area = 2.244 ac Runoff Volume = 0.951 af Average Runoff Depth = 5.08"
53.04% Pervious = 1.190 ac 46.96% Impervious = 1.054 ac

APPENDIX G

Supplemental Calculations and Backup Data

Extreme Precipitation Tables

Northeast Regional Climate Center

Data represents point estimates calculated from partial duration series. All precipitation amounts are displayed in inches.

Smoothing	Yes
State	Massachusetts
Location	
Longitude	71.137 degrees West
Latitude	42.731 degrees North
Elevation	0 feet
Date/Time	Wed, 07 Apr 2021 10:03:15 -0400

Extreme Precipitation Estimates

	5min	10min	15min	30min	60min	120min		1hr	2hr	3hr	6hr	12hr	24hr	48hr		1day	2day	4day	7day	10day	
1yr	0.27	0.42	0.52	0.68	0.85	1.07	**1yr**	0.73	1.01	1.24	1.58	2.02	2.59	2.82	**1yr**	2.30	2.71	3.15	3.82	4.46	**1yr**
2yr	0.33	0.51	0.64	0.84	1.06	1.34	**2yr**	0.91	1.22	1.55	1.95	2.47	3.12	3.45	**2yr**	2.76	3.31	3.83	4.54	5.19	**2yr**
5yr	0.39	0.61	0.77	1.03	1.32	1.68	**5yr**	1.14	1.53	1.96	2.48	3.14	3.97	4.41	**5yr**	3.51	4.24	4.87	5.78	6.54	**5yr**
10yr	0.44	0.69	0.88	1.19	1.55	2.00	**10yr**	1.34	1.81	2.34	2.98	3.77	4.76	5.32	**10yr**	4.22	5.12	5.85	6.93	7.80	**10yr**
25yr	0.52	0.83	1.06	1.46	1.93	2.52	**25yr**	1.67	2.27	2.96	3.79	4.81	6.07	6.83	**25yr**	5.37	6.57	7.44	8.82	9.84	**25yr**
50yr	0.58	0.94	1.21	1.69	2.29	3.02	**50yr**	1.98	2.70	3.56	4.57	5.80	7.30	8.25	**50yr**	6.46	7.93	8.94	10.59	11.75	**50yr**
100yr	0.67	1.09	1.40	1.99	2.71	3.59	**100yr**	2.34	3.21	4.25	5.47	6.95	8.78	9.96	**100yr**	7.77	9.58	10.74	12.72	14.03	**100yr**
200yr	0.76	1.25	1.62	2.32	3.21	4.29	**200yr**	2.77	3.81	5.10	6.58	8.37	10.56	12.04	**200yr**	9.35	11.58	12.90	15.29	16.76	**200yr**
500yr	0.92	1.51	1.97	2.86	4.02	5.42	**500yr**	3.47	4.79	6.47	8.37	10.68	13.49	15.47	**500yr**	11.94	14.88	16.44	19.51	21.21	**500yr**

Lower Confidence Limits

	5min	10min	15min	30min	60min	120min		1hr	2hr	3hr	6hr	12hr	24hr	48hr		1day	2day	4day	7day	10day	
1yr	0.24	0.37	0.45	0.61	0.75	0.88	**1yr**	0.65	0.86	1.09	1.35	1.64	2.42	2.61	**1yr**	2.14	2.51	2.88	3.49	4.08	**1yr**
2yr	0.32	0.49	0.61	0.82	1.02	1.21	**2yr**	0.88	1.19	1.39	1.83	2.34	3.03	3.36	**2yr**	2.68	3.23	3.74	4.43	5.07	**2yr**
5yr	0.37	0.57	0.71	0.97	1.24	1.45	**5yr**	1.07	1.42	1.64	2.13	2.72	3.72	4.13	**5yr**	3.29	3.97	4.59	5.41	6.15	**5yr**
10yr	0.41	0.63	0.78	1.09	1.41	1.66	**10yr**	1.22	1.63	1.87	2.40	3.05	4.32	4.80	**10yr**	3.83	4.61	5.35	6.28	7.10	**10yr**
25yr	0.47	0.72	0.90	1.28	1.69	1.97	**25yr**	1.46	1.93	2.20	2.79	3.55	5.27	5.84	**25yr**	4.66	5.62	6.55	7.66	8.57	**25yr**
50yr	0.53	0.80	1.00	1.43	1.93	2.26	**50yr**	1.67	2.21	2.49	3.14	3.99	6.11	6.78	**50yr**	5.41	6.52	7.64	8.91	9.86	**50yr**
100yr	0.59	0.89	1.12	1.62	2.22	2.57	**100yr**	1.92	2.52	2.81	3.54	4.48	7.02	7.86	**100yr**	6.21	7.56	8.93	10.36	11.34	**100yr**
200yr	0.66	1.00	1.27	1.83	2.55	2.93	**200yr**	2.20	2.87	3.18	3.97	5.03	8.13	9.14	**200yr**	7.19	8.79	10.42	12.03	13.02	**200yr**
500yr	0.78	1.16	1.49	2.16	3.07	3.50	**500yr**	2.65	3.42	3.74	4.64	5.89	9.83	11.15	**500yr**	8.70	10.72	12.81	14.65	15.62	**500yr**

Upper Confidence Limits

	5min	10min	15min	30min	60min	120min		1hr	2hr	3hr	6hr	12hr	24hr	48hr		1day	2day	4day	7day	10day	
1yr	0.30	0.46	0.56	0.76	0.93	1.10	**1yr**	0.80	1.07	1.27	1.67	2.13	2.77	3.00	**1yr**	2.45	2.88	3.37	4.05	4.77	**1yr**
2yr	0.34	0.53	0.65	0.89	1.09	1.30	**2yr**	0.94	1.27	1.49	1.96	2.50	3.21	3.56	**2yr**	2.84	3.42	3.94	4.67	5.34	**2yr**
5yr	0.43	0.66	0.81	1.12	1.42	1.68	**5yr**	1.23	1.64	1.94	2.51	3.18	4.22	4.70	**5yr**	3.74	4.52	5.18	6.15	6.93	**5yr**
10yr	0.51	0.79	0.98	1.37	1.77	2.06	**10yr**	1.53	2.01	2.36	3.03	3.82	5.21	5.82	**10yr**	4.61	5.60	6.36	7.57	8.48	**10yr**
25yr	0.66	1.01	1.25	1.79	2.35	2.69	**25yr**	2.03	2.63	3.09	3.90	4.87	6.90	7.73	**25yr**	6.10	7.44	8.37	9.99	11.10	**25yr**
50yr	0.79	1.21	1.50	2.16	2.90	3.30	**50yr**	2.51	3.23	3.78	4.73	5.86	8.53	9.60	**50yr**	7.55	9.24	10.29	12.34	13.61	**50yr**
100yr	0.96	1.45	1.82	2.63	3.61	4.05	**100yr**	3.11	3.96	4.65	5.74	7.05	10.66	11.93	**100yr**	9.44	11.47	12.67	15.24	16.71	**100yr**
200yr	1.16	1.75	2.21	3.20	4.47	4.97	**200yr**	3.86	4.86	5.71	6.96	8.48	13.22	14.83	**200yr**	11.70	14.26	15.59	18.82	20.54	**200yr**
500yr	1.50	2.23	2.87	4.17	5.92	6.52	**500yr**	5.11	6.38	7.51	9.00	10.86	17.57	19.79	**500yr**	15.55	19.03	20.51	24.88	27.04	**500yr**

OUTLET APRON DESIGN

Project: 125 Merrimack Street   Job # 2020159
Date: 7-Apr-21

Engineering
Design
Planning
Construction Management
603.893.0720 GPINET.COM

Greenman-Pedersen, Inc.
44 Stiles Road
Suite One
Salem, NH 03079

FES-1 (from HydroCAD POND DMH-7)

Q25 = 0.75 cfs
D_o = 12 inches
Tw = 0.21 feet

Design Criteria

Apron Dimensions

The dimensions of the apron at the outlet of the pipe shall be determined as follows:

1.) The width of the apron at the outlet of the pipe or channel shall be 3 times the diameter of the pipe, or the width of the channel.

USE THIS W= **3** feet

2.) The length of the apron shall be determined from the following formula when the tailwater depth at the outlet of the pipe or channel is less than one-half the diameter of the pipe or one-half the width of the channel:

USE THIS La=1.8*Q/ Do^3/2+ 7Do
La= **8.35** feet

Where:

La is the length of the apron
Q is the discharge from the pipe or channel
D_o is the diameter of pipe of width of channel

3.) When the depth of the tailwater at the outlet of the pipe or channel is equal to or greater than one-half the diameter of the pipe or the width of the channel. Then the following formula applies:

La=3.0*Qo/ Do^1.5 +7D_o
La= **9.25** feet

4.) Where there is no well defined channel downstream of the outlet, the width of the downstream end of the apron shall be determined as follows:

a. For minimum tailwater conditions where the tailwater depth is less than the elevation of the center of the pipe:

USE THIS W=3*Do+La
W= **11.35** feet

b. For maximum tailwater conditions where the tailwater depth is greater than the elevation of the center of the pipe:

W=3*Do+0.4*La
W= **6.70** feet

5.) Where there is a stable well-defined channel downstream of the apron, the bottom of the apron shall be equal to the width of the channel.

6.) The side of the apron in a well-defined channel shall be 2:1 (horizontal to vertical) or flatter. The height of the structural lining along the channel sides shall begin at the elevation equal to the top of conduit and taper down to the channel bottom through the length of the apron.

7.) The bottom grade of the apron shall be level (0% grade). No overfall is allowable at the end of the apron.

8.) The apron shall be located so that there are no bends in the horizontal alignment of the apron.

Rock Riprap

The following criteria shall be used to determine the dimensions of the rock riprap used for the apron:

1.) The median stone diameter shall be determined using the formula:

d_{50}=0.02*Q^4/3/(Tw*D_o)

d_{50}=	**0.78**	inches	**USE**	**3** inches

d_{50} minimum 3 inches

Where:
d_{50} is the median stone diameter in feet
Tw is the tailwater depth above the invert of the pipe channel in feet
Q is the discharge from the pipe or channel in cubic feet per second
D_o is the diameter of the pipe or width of the channel in feet

2.) Fifty percent by weight of the riprap mixture shall be smaller the than median size stone designated as d_{50}. The largest stone size in the mixture shall be 1.5 times the d_{50} size.

3.) The quality and gradation of the rock, the thickness of the riprap lining, filter material and the quality of the stone shall meet the requirements in the Rock Riprap BMP. The minimum depth shall be 6 inches or 1.5 times the largest stone size in the mixture whichever is larger (d).

Thickness of the riprap
d = 1.5*(d100 avg.(largest stone size))

d=	**8**	inches*

* must use a minimum of 6"

Rock Rip Rap Gradation

% of weight smaller than the given size	size of stone in inches		
100	**4.5**	to	**6.0**
85	**3.9**	to	**5.4**
50	**3.0**	to	**4.5**
15	**0.9**	to	**1.5**

Greenman-Pedersen, Inc.

GPI Project No.	2020159	**Sheet**	1 of 1
Project Description	125 Merrimack Street - Methuen, MA		
Task	Drawdown Calculations		
Calculated By	DSP	**Date**	04/07/21
Checked By		**Date**	

Drawdown within 72 hours Analysis for Static Method

Proposed Underground Infiltration System

Infiltration Rate: 2.41 inches/hour (From table 2.3.3: Rawls, Brakensiek, Saxton, 1982)

Design Infiltration Rate: 2.41 inches/hour

Volume Provided for Recharge: 6,312 cf

Basin bottom area: 2,996 sf

$Time_{drawdown}$ = (Required Recharge Volume in cubic feet as determined by the Static Method)(1/Design Infiltration Rate in inches per hour)(conversion for inches to feet)(1/bottom area in feet)

$Time_{drawdown}$ = (6,312 cf) (1 / 2.41 in/hr) (1ft/12 in.) (1 / 2,996 sf)

= 10.49 hours

Stage-Area-Storage for Pond UIS: Underground Infiltration System

Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)	Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)
82.25	**2,701**	0	82.77	2,701	562
82.26	2,701	11	82.78	2,701	573
82.27	2,701	22	82.79	2,701	583
82.28	2,701	32	82.80	2,701	594
82.29	2,701	43	82.81	2,701	605
82.30	2,701	54	82.82	2,701	616
82.31	2,701	65	82.83	2,701	627
82.32	2,701	76	82.84	2,701	637
82.33	2,701	86	82.85	2,701	648
82.34	2,701	97	82.86	2,701	659
82.35	2,701	108	82.87	2,701	670
82.36	2,701	119	82.88	2,701	681
82.37	2,701	130	82.89	2,701	691
82.38	2,701	140	82.90	2,701	702
82.39	2,701	151	82.91	2,701	713
82.40	2,701	162	82.92	2,701	724
82.41	2,701	173	82.93	2,701	735
82.42	2,701	184	82.94	2,701	745
82.43	2,701	194	82.95	2,701	756
82.44	2,701	205	82.96	2,701	767
82.45	2,701	216	82.97	2,701	778
82.46	2,701	227	82.98	2,701	789
82.47	2,701	238	82.99	2,701	799
82.48	2,701	248	83.00	2,701	810
82.49	2,701	259	83.01	2,701	833
82.50	2,701	270	83.02	2,701	856
82.51	2,701	281	83.03	2,701	879
82.52	2,701	292	83.04	2,701	902
82.53	2,701	303	83.05	2,701	925
82.54	2,701	313	83.06	2,701	948
82.55	2,701	324	83.07	2,701	971
82.56	2,701	335	83.08	2,701	994
82.57	2,701	346	83.09	2,701	1,017
82.58	2,701	357	83.10	2,701	1,040
82.59	2,701	367	83.11	2,701	1,063
82.60	2,701	378	83.12	2,701	1,086
82.61	2,701	389	83.13	2,701	1,109
82.62	2,701	400	83.14	2,701	1,132
82.63	2,701	411	83.15	2,701	1,155
82.64	2,701	421	83.16	2,701	1,178
82.65	2,701	432	83.17	2,701	1,201
82.66	2,701	443	83.18	2,701	1,223
82.67	2,701	454	83.19	2,701	1,246
82.68	2,701	465	83.20	2,701	1,269
82.69	2,701	475	83.21	2,701	1,292
82.70	2,701	486	83.22	2,701	1,315
82.71	2,701	497	83.23	2,701	1,338
82.72	2,701	508	83.24	2,701	1,361
82.73	2,701	519	83.25	2,701	1,384
82.74	2,701	529	83.26	2,701	1,407
82.75	2,701	540	83.27	2,701	1,429
82.76	2,701	551	83.28	2,701	1,452

Stage-Area-Storage for Pond UIS: Underground Infiltration System (continued)

Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)
83.29	2,701	1,475
83.30	2,701	1,498
83.31	2,701	1,521
83.32	2,701	1,544
83.33	2,701	1,567
83.34	2,701	1,589
83.35	2,701	1,612
83.36	2,701	1,635
83.37	2,701	1,658
83.38	2,701	1,681
83.39	2,701	1,703
83.40	2,701	1,726
83.41	2,701	1,749
83.42	2,701	1,772
83.43	2,701	1,795
83.44	2,701	1,817
83.45	2,701	1,840
83.46	2,701	1,863
83.47	2,701	1,886
83.48	2,701	1,908
83.49	2,701	1,931
83.50	2,701	1,954
83.51	2,701	1,977
83.52	2,701	1,999
83.53	2,701	2,022
83.54	2,701	2,045
83.55	2,701	2,067
83.56	2,701	2,090
83.57	2,701	2,113
83.58	2,701	2,135
83.59	2,701	2,158
83.60	2,701	2,181
83.61	2,701	2,203
83.62	2,701	2,226
83.63	2,701	2,249
83.64	2,701	2,271
83.65	2,701	2,294
83.66	2,701	2,317
83.67	2,701	2,339
83.68	2,701	2,362
83.69	2,701	2,384
83.70	2,701	2,407
83.71	2,701	2,430
83.72	2,701	2,452
83.73	2,701	2,475
83.74	2,701	2,497
83.75	2,701	2,520
83.76	2,701	2,542
83.77	2,701	2,565
83.78	2,701	2,587
83.79	2,701	2,610
83.80	2,701	2,633
83.81	2,701	2,655
83.82	2,701	2,678
83.83	2,701	2,700
83.84	2,701	2,723
83.85	2,701	2,745
83.86	2,701	2,768
83.87	2,701	2,790
83.88	2,701	2,812
83.89	2,701	2,835
83.90	2,701	2,857
83.91	2,701	2,880
83.92	2,701	2,902
83.93	2,701	2,925
83.94	2,701	2,947
83.95	2,701	2,970
83.96	2,701	2,992
83.97	2,701	3,014
83.98	2,701	3,037
83.99	2,701	3,059
84.00	2,701	3,081
84.01	2,701	3,104
84.02	2,701	3,126
84.03	2,701	3,149
84.04	2,701	3,171
84.05	2,701	3,193
84.06	2,701	3,216
84.07	2,701	3,238
84.08	2,701	3,260
84.09	2,701	3,282
84.10	2,701	3,305
84.11	2,701	3,327
84.12	2,701	3,349
84.13	2,701	3,372
84.14	2,701	3,394
84.15	2,701	3,416
84.16	2,701	3,438
84.17	2,701	3,460
84.18	2,701	3,483
84.19	2,701	3,505
84.20	2,701	3,527
84.21	2,701	3,549
84.22	2,701	3,571
84.23	2,701	3,594
84.24	2,701	3,616
84.25	2,701	3,638
84.26	2,701	3,660
84.27	2,701	3,682
84.28	2,701	3,704
84.29	2,701	3,726
84.30	2,701	3,748
84.31	2,701	3,770
84.32	2,701	3,793

Stage-Area-Storage for Pond UIS: Underground Infiltration System (continued)

Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)	Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)
84.33	2,701	3,815	84.85	2,701	4,947
84.34	2,701	3,837	84.86	2,701	4,969
84.35	2,701	3,859	84.87	2,701	4,990
84.36	2,701	3,881	84.88	2,701	5,012
84.37	2,701	3,903	84.89	2,701	5,033
84.38	2,701	3,925	84.90	2,701	5,054
84.39	2,701	3,947	84.91	2,701	5,076
84.40	2,701	3,969	84.92	2,701	5,097
84.41	2,701	3,991	84.93	2,701	5,118
84.42	2,701	4,013	84.94	2,701	5,140
84.43	2,701	4,035	84.95	2,701	5,161
84.44	2,701	4,057	84.96	2,701	5,183
84.45	2,701	4,079	84.97	2,701	5,204
84.46	2,701	4,101	84.98	2,701	5,225
84.47	2,701	4,123	84.99	2,701	5,246
84.48	2,701	4,144	85.00	2,701	5,268
84.49	2,701	4,166	85.01	2,701	5,289
84.50	2,701	4,188	85.02	2,701	5,310
84.51	2,701	4,210	85.03	2,701	5,331
84.52	2,701	4,232	85.04	2,701	5,353
84.53	2,701	4,254	85.05	2,701	5,374
84.54	2,701	4,276	85.06	2,701	5,395
84.55	2,701	4,298	85.07	2,701	5,416
84.56	2,701	4,319	85.08	2,701	5,437
84.57	2,701	4,341	85.09	2,701	5,458
84.58	2,701	4,363	85.10	2,701	5,480
84.59	2,701	4,385	85.11	2,701	5,501
84.60	2,701	4,407	85.12	2,701	5,522
84.61	2,701	4,428	85.13	2,701	5,543
84.62	2,701	4,450	85.14	2,701	5,564
84.63	2,701	4,472	85.15	2,701	5,585
84.64	2,701	4,494	85.16	2,701	5,606
84.65	2,701	4,515	85.17	2,701	5,627
84.66	2,701	4,537	85.18	2,701	5,648
84.67	2,701	4,559	85.19	2,701	5,669
84.68	2,701	4,580	85.20	2,701	5,690
84.69	2,701	4,602	85.21	2,701	5,711
84.70	2,701	4,624	85.22	2,701	5,732
84.71	2,701	4,645	85.23	2,701	5,753
84.72	2,701	4,667	85.24	2,701	5,774
84.73	2,701	4,689	85.25	2,701	5,795
84.74	2,701	4,710	85.26	2,701	5,816
84.75	2,701	4,732	85.27	2,701	5,837
84.76	2,701	4,753	85.28	2,701	5,858
84.77	2,701	4,775	85.29	2,701	5,878
84.78	2,701	4,797	85.30	2,701	5,899
84.79	2,701	4,818	85.31	2,701	5,920
84.80	2,701	4,840	85.32	2,701	5,941
84.81	2,701	4,861	85.33	2,701	5,962
84.82	2,701	4,883	85.34	2,701	5,982
84.83	2,701	4,904	85.35	2,701	6,003
84.84	2,701	4,926	85.36	2,701	6,024

Stage-Area-Storage for Pond UIS: Underground Infiltration System (continued)

Storage at lowest orifice elevation

Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)	Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)
85.37	2,701	6,045	85.89	2,701	7,098
85.38	2,701	6,065	85.90	2,701	7,118
85.39	2,701	6,086	85.91	2,701	7,137
85.40	2,701	6,107	85.92	2,701	7,157
85.41	2,701	6,127	85.93	2,701	7,177
85.42	2,701	6,148	85.94	2,701	7,196
85.43	2,701	6,169	85.95	2,701	7,216
85.44	2,701	6,189	85.96	2,701	7,236
85.45	2,701	6,210	85.97	2,701	7,255
85.46	2,701	6,230	85.98	2,701	7,275
85.47	2,701	6,251	85.99	2,701	7,294
85.48	2,701	6,271	86.00	2,701	7,314
85.49	2,701	6,292	86.01	2,701	7,333
85.50	2,701	6,312	86.02	2,701	7,353
85.51	2,701	6,333	86.03	2,701	7,372
85.52	2,701	6,353	86.04	2,701	7,392
85.53	2,701	6,374	86.05	2,701	7,411
85.54	2,701	6,394	86.06	2,701	7,431
85.55	2,701	6,415	86.07	2,701	7,450
85.56	2,701	6,435	86.08	2,701	7,469
85.57	2,701	6,455	86.09	2,701	7,489
85.58	2,701	6,476	86.10	2,701	7,508
85.59	2,701	6,496	86.11	2,701	7,527
85.60	2,701	6,517	86.12	2,701	7,547
85.61	2,701	6,537	86.13	2,701	7,566
85.62	2,701	6,557	86.14	2,701	7,585
85.63	2,701	6,577	86.15	2,701	7,604
85.64	2,701	6,598	86.16	2,701	7,624
85.65	2,701	6,618	86.17	2,701	7,643
85.66	2,701	6,638	86.18	2,701	7,662
85.67	2,701	6,658	86.19	2,701	7,681
85.68	2,701	6,679	86.20	2,701	7,700
85.69	2,701	6,699	86.21	2,701	7,719
85.70	2,701	6,719	86.22	2,701	7,738
85.71	2,701	6,739	86.23	2,701	7,757
85.72	2,701	6,759	86.24	2,701	7,776
85.73	2,701	6,779	86.25	2,701	7,795
85.74	2,701	6,799	86.26	2,701	7,814
85.75	2,701	6,819	86.27	2,701	7,833
85.76	2,701	6,839	86.28	2,701	7,852
85.77	2,701	6,859	86.29	2,701	7,871
85.78	2,701	6,879	86.30	2,701	7,889
85.79	2,701	6,899	86.31	2,701	7,908
85.80	2,701	6,919	86.32	2,701	7,927
85.81	2,701	6,939	86.33	2,701	7,946
85.82	2,701	6,959	86.34	2,701	7,964
85.83	2,701	6,979	86.35	2,701	7,983
85.84	2,701	6,999	86.36	2,701	8,002
85.85	2,701	7,019	86.37	2,701	8,021
85.86	2,701	7,039	86.38	2,701	8,039
85.87	2,701	7,058	86.39	2,701	8,058
85.88	2,701	7,078	86.40	2,701	8,076

Stage-Area-Storage for Pond UIS: Underground Infiltration System (continued)

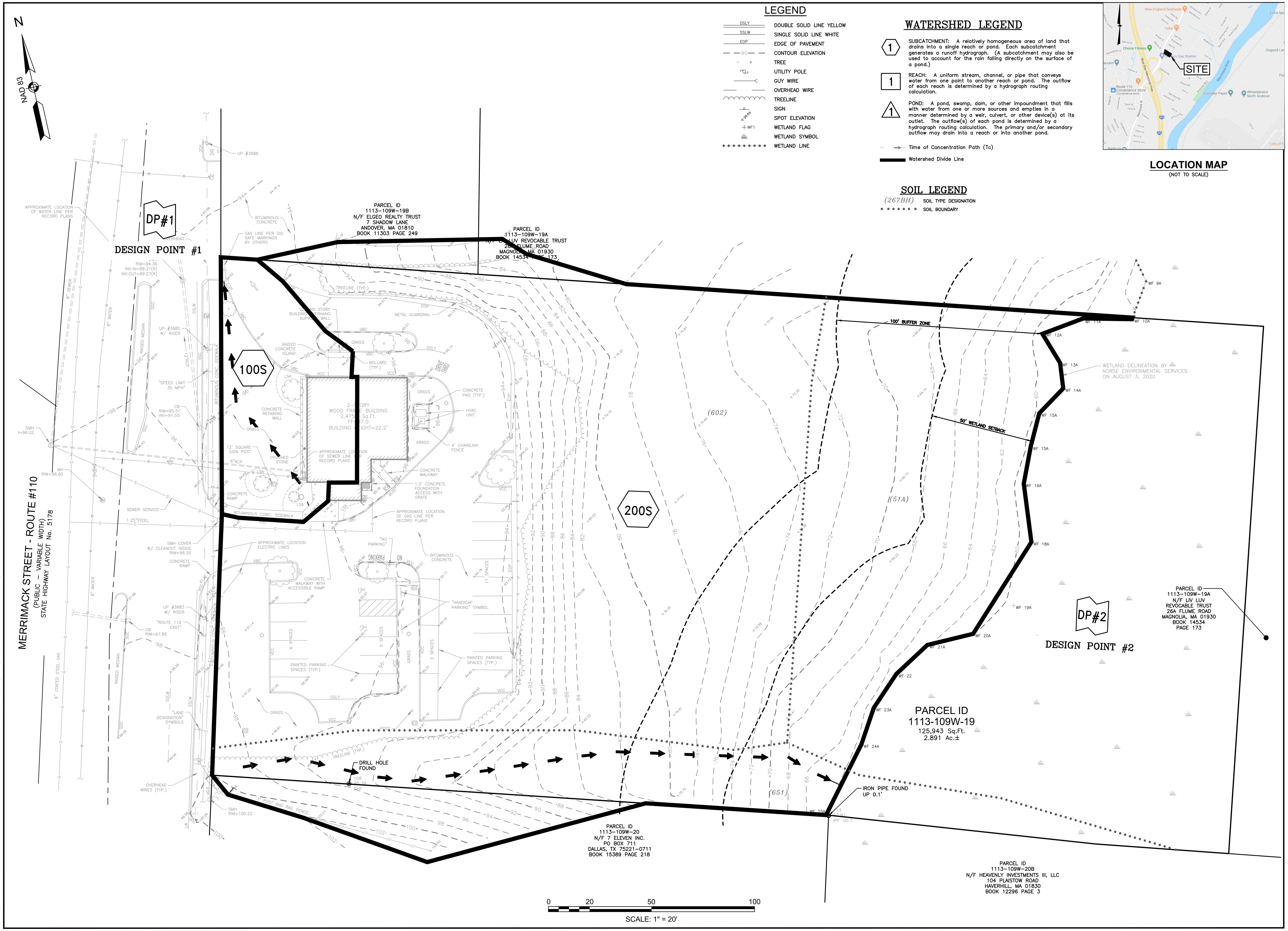
Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)	Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)
86.41	2,701	8,095	86.93	2,701	9,017
86.42	2,701	8,113	86.94	2,701	9,034
86.43	2,701	8,132	86.95	2,701	9,051
86.44	2,701	8,150	86.96	2,701	9,068
86.45	2,701	8,169	86.97	2,701	9,084
86.46	2,701	8,187	86.98	2,701	9,101
86.47	2,701	8,205	86.99	2,701	9,118
86.48	2,701	8,224	87.00	2,701	9,134
86.49	2,701	8,242	87.01	2,701	9,151
86.50	2,701	8,260	87.02	2,701	9,167
86.51	2,701	8,279	87.03	2,701	9,184
86.52	2,701	8,297	87.04	2,701	9,200
86.53	2,701	8,315	87.05	2,701	9,217
86.54	2,701	8,333	87.06	2,701	9,233
86.55	2,701	8,351	87.07	2,701	9,249
86.56	2,701	8,370	87.08	2,701	9,266
86.57	2,701	8,388	87.09	2,701	9,282
86.58	2,701	8,406	87.10	2,701	9,298
86.59	2,701	8,424	87.11	2,701	9,314
86.60	2,701	8,442	87.12	2,701	9,330
86.61	2,701	8,460	87.13	2,701	9,346
86.62	2,701	8,478	87.14	2,701	9,362
86.63	2,701	8,496	87.15	2,701	9,378
86.64	2,701	8,513	87.16	2,701	9,394
86.65	2,701	8,531	87.17	2,701	9,410
86.66	2,701	8,549	87.18	2,701	9,426
86.67	2,701	8,567	87.19	2,701	9,442
86.68	2,701	8,585	87.20	2,701	9,457
86.69	2,701	8,602	87.21	2,701	9,473
86.70	2,701	8,620	87.22	2,701	9,488
86.71	2,701	8,638	87.23	2,701	9,504
86.72	2,701	8,655	87.24	2,701	9,519
86.73	2,701	8,673	87.25	2,701	9,535
86.74	2,701	8,690	87.26	2,701	9,550
86.75	2,701	8,708	87.27	2,701	9,566
86.76	2,701	8,725	87.28	2,701	9,581
86.77	2,701	8,743	87.29	2,701	9,596
86.78	2,701	8,760	87.30	2,701	9,611
86.79	2,701	8,778	87.31	2,701	9,626
86.80	2,701	8,795	87.32	2,701	9,641
86.81	2,701	8,812	87.33	2,701	9,656
86.82	2,701	8,830	87.34	2,701	9,671
86.83	2,701	8,847	87.35	2,701	9,686
86.84	2,701	8,864	87.36	2,701	9,701
86.85	2,701	8,881	87.37	2,701	9,716
86.86	2,701	8,898	87.38	2,701	9,730
86.87	2,701	8,915	87.39	2,701	9,745
86.88	2,701	8,932	87.40	2,701	9,759
86.89	2,701	8,950	87.41	2,701	9,774
86.90	2,701	8,967	87.42	2,701	9,788
86.91	2,701	8,983	87.43	2,701	9,802
86.92	2,701	9,000	87.44	2,701	9,816

Stage-Area-Storage for Pond UIS: Underground Infiltration System (continued)

Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)	Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)
87.45	2,701	9,831	87.97	2,701	10,458
87.46	2,701	9,844	87.98	2,701	10,469
87.47	2,701	9,858	87.99	2,701	10,480
87.48	2,701	9,872	88.00	2,701	10,491
87.49	2,701	9,886	88.01	2,701	10,502
87.50	2,701	9,899	88.02	2,701	10,513
87.51	2,701	9,913	88.03	2,701	10,524
87.52	2,701	9,926	88.04	2,701	10,534
87.53	2,701	9,939	88.05	2,701	10,545
87.54	2,701	9,952	88.06	2,701	10,556
87.55	2,701	9,965	88.07	2,701	10,567
87.56	2,701	9,978	88.08	2,701	10,578
87.57	2,701	9,991	88.09	2,701	10,588
87.58	2,701	10,004	88.10	2,701	10,599
87.59	2,701	10,016	88.11	2,701	10,610
87.60	2,701	10,029	88.12	2,701	10,621
87.61	2,701	10,041	88.13	2,701	10,632
87.62	2,701	10,053	88.14	2,701	10,642
87.63	2,701	10,065	88.15	2,701	10,653
87.64	2,701	10,078	88.16	2,701	10,664
87.65	2,701	10,090	88.17	2,701	10,675
87.66	2,701	10,102	88.18	2,701	10,686
87.67	2,701	10,114	88.19	2,701	10,696
87.68	2,701	10,126	88.20	2,701	10,707
87.69	2,701	10,138	88.21	2,701	10,718
87.70	2,701	10,149	88.22	2,701	10,729
87.71	2,701	10,161	88.23	2,701	10,740
87.72	2,701	10,173	88.24	2,701	10,750
87.73	2,701	10,185	88.25	2,701	10,761
87.74	2,701	10,197	88.26	2,701	10,772
87.75	2,701	10,208	88.27	2,701	10,783
87.76	2,701	10,220	88.28	2,701	10,794
87.77	2,701	10,232	88.29	2,701	10,804
87.78	2,701	10,243	88.30	2,701	10,815
87.79	2,701	10,255	88.31	2,701	10,826
87.80	2,701	10,267	88.32	2,701	10,837
87.81	2,701	10,278	88.33	2,701	10,848
87.82	2,701	10,290	88.34	2,701	10,858
87.83	2,701	10,301	88.35	2,701	10,869
87.84	2,701	10,313	88.36	2,701	10,880
87.85	2,701	10,324	88.37	2,701	10,891
87.86	2,701	10,336	88.38	2,701	10,902
87.87	2,701	10,347	88.39	2,701	10,912
87.88	2,701	10,358	88.40	2,701	10,923
87.89	2,701	10,370	88.41	2,701	10,934
87.90	2,701	10,381	88.42	2,701	10,945
87.91	2,701	10,392	88.43	2,701	10,956
87.92	2,701	10,403	88.44	2,701	10,966
87.93	2,701	10,414	88.45	2,701	10,977
87.94	2,701	10,425	88.46	2,701	10,988
87.95	2,701	10,436	88.47	2,701	10,999
87.96	2,701	10,447	88.48	2,701	11,010

Stage-Area-Storage for Pond UIS: Underground Infiltration System (continued)

Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)
88.49	2,701	11,021
88.50	2,701	11,031
88.51	2,701	11,042
88.52	2,701	11,053
88.53	2,701	11,064
88.54	2,701	11,075
88.55	2,701	11,085
88.56	2,701	11,096
88.57	2,701	11,107
88.58	2,701	11,118
88.59	2,701	11,129
88.60	2,701	11,139
88.61	2,701	11,150
88.62	2,701	11,161
88.63	2,701	11,172
88.64	2,701	11,183
88.65	2,701	11,193
88.66	2,701	11,204
88.67	2,701	11,215
88.68	2,701	11,226
88.69	2,701	11,237
88.70	2,701	11,247
88.71	2,701	11,258
88.72	2,701	11,269
88.73	2,701	11,280
88.74	2,701	11,291
88.75	2,701	11,301
88.76	2,701	11,312
88.77	2,701	11,323
88.78	2,701	11,334
88.79	2,701	11,345
88.80	2,701	11,355
88.81	2,701	11,366
88.82	2,701	11,377
88.83	2,701	11,388
88.84	2,701	11,399
88.85	2,701	11,409
88.86	2,701	11,420
88.87	2,701	11,431
88.88	2,701	11,442
88.89	2,701	11,453
88.90	2,701	11,463
88.91	2,701	11,474
88.92	2,701	11,485
88.93	2,701	11,496
88.94	2,701	11,507
88.95	2,701	11,517
88.96	2,701	11,528
88.97	2,701	11,539
88.98	2,701	11,550
88.99	2,701	11,561
89.00	2,701	**11,572**



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44 Stiles Road, Suite One
Salem, NH 03079

PREPARED FOR
WAN YAN, LLC
53 MAYFLOWER DRIVE
NORTH ANDOVER, MA 01845

FUSION HOUSE RESTAURANT
PARCEL ID: 1113-109W-19
125 MERRIMACK STREET
METHUEN, MA 01844

REVISIONS

NO.	REVISION	DATE

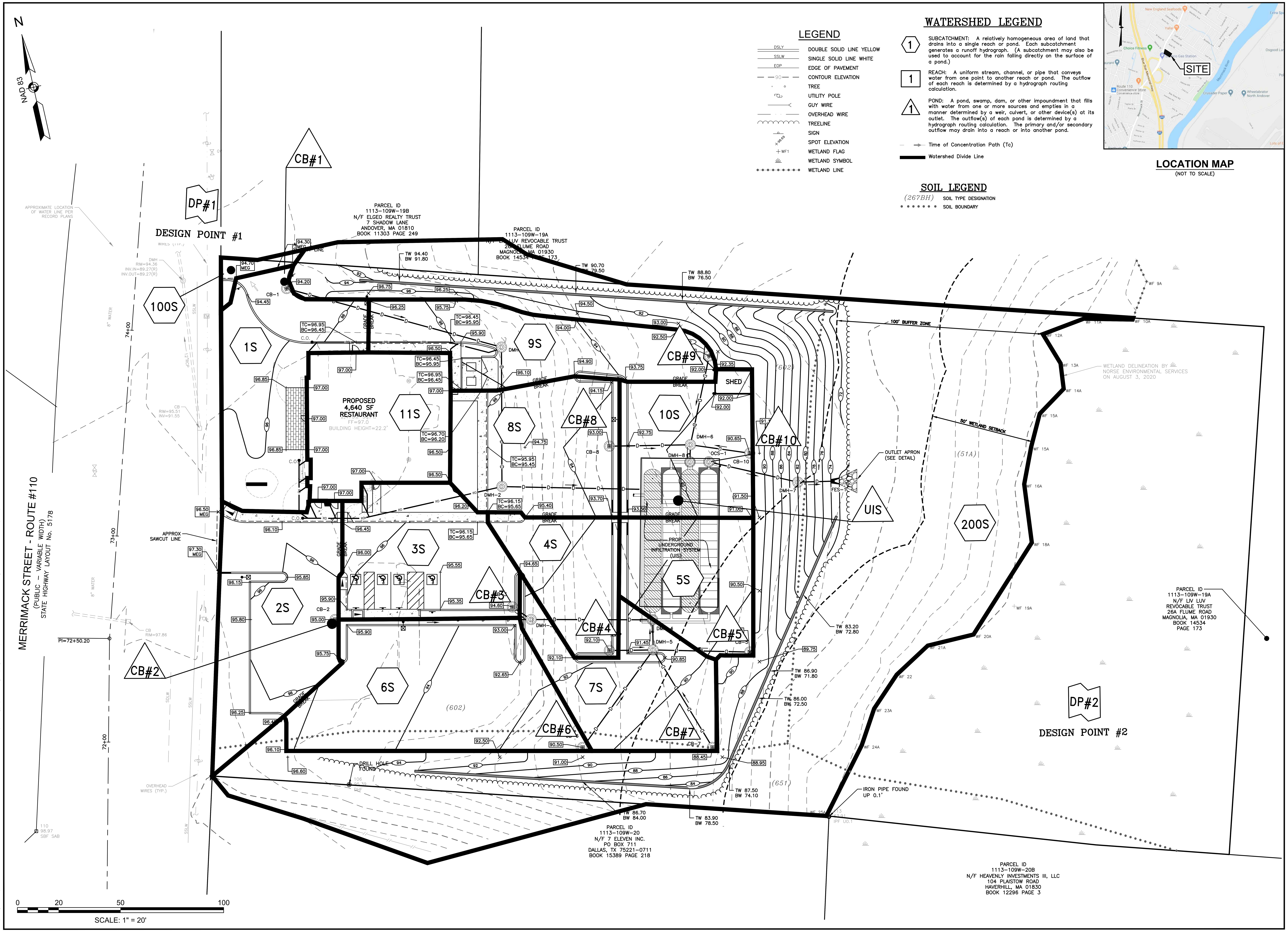
APRIL 07, 2021

DRAWN/DESIGN BY	CHECKED BY
CCC/DRJ	DRJ

PRE-DEVELOPMENT DRAINAGE PLAN

SCALE: 1"=20'

PROJECT NO. NEX-2020159



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125 MERRIMACK STREET METHUEN, MA 01844

REVISIONS

NO.	REVISION	DATE

APRIL 07, 2021

DRAWN/DESIGN BY	CHECKED BY
CCC/DRJ	DRJ

POST-DEVELOPMENT DRAINAGE PLAN

SCALE: 1"=20'

PROJECT NO. NEX-2020159

OPERATION AND MAINTENANCE PLAN

YE'S TABLE ASIAN CUISINE
PARCEL ID: 1113-109W-19
125 MERRIMACK STREET
METHUEN, MASSACHUSETTS

GPI

44 Stiles Road, Suite One
Salem, NH 03079
(603) 893-0720

Prepared For:

Wan Yan, LLC
53 Mayflower Drive
North Andover, MA 01845

April 7, 2021

(GPI Project No.: NEX-2020159)

Wan Yan, LLC
Ye's Table Asian Cuisine
Operation and Maintenance Plan

TABLE OF CONTENTS

<u>SECTION 1 O&M DOCUMENTATION REQUIREMENTS</u>

The property owner shall be responsible for the operation and maintenance of all stormwater management systems after construction in accordance with the below criteria. Logs of inspections and cleanings shall be maintained by the owner and annual BMP inspection forms shall be made available to the City of Methuen upon request.

As required by the MassDEP Stormwater Management Handbook, which serves as guidance on the Massachusetts Stormwater Policy, and in accordance with Stormwater Standard #9, the following post construction operation and maintenance plan has been prepared.

<u>Stormwater Management System Owner:</u> Property owner

<u>Party or Parties Responsible for Operation and Maintenance:</u> Property owner

<u>Documentation:</u> A maintenance log shall be kept summarizing inspections, maintenance and any corrective actions taken. The log shall include the date on which each inspection or maintenance task was performed, a description of the inspection findings or maintenance completed, and the name of the inspector or maintenance personnel performing the task. If a maintenance task requires the clean out of any sediments or debris, the location where the sediment and debris was disposed after removal will be indicated. Disposal of the accumulated sediment and hydrocarbons must be in accordance with applicable local, state, and federal guidelines and regulations. The logs shall be made accessible to the City of Methuen upon request.

All stormwater facilities associated with this redevelopment are identified on Figure 1 contained within Section 4 of this manual and listed individually on the log form included herein and shall be inspected and maintained in accordance with the procedures outlined in Section 2.

SECTION 2 BMP SPECIFIC O & M PROCEDURES

Driveway/Parking Lot Sweeping

Sweeping shall be done once in the early fall and then immediately following spring snowmelt to remove sand and other debris and when visual buildup of debris is apparent. Pavement surfaces shall be swept at other times such as in the fall after leaves have dropped to remove accumulated debris. Since contaminants typically accumulate within 12 inches of the curbline, street cleaning operations should concentrate in cleaning curb and gutter lines for maximum pollutant removal efficiency. Other areas shall also be swept periodically when visual buildup of debris is apparent. Once removed from paved surfaces, the sweeping must be handled and disposed of properly. Disposal of the accumulated sediment and hydrocarbons must be in accordance with applicable local, state, and federal guidelines and regulations.

Deep Sump Hooded Catch Basins

Inspect catch basins at least 4 times per year and at the end of the foliage and snow removal seasons (preferably in spring and fall) to ensure that the catch basins are working in their intended fashion and that they are free of debris. Sediment must also be removed 4 times per year of whenever the depth of deposits is greater than or equal to one half the depth form the bottom of the invert of the lowest pipe in the basin. If the basin outlet is designed with a hood to trap floatable materials check to ensure watertight seal is working. At a minimum, remove floating debris and hydrocarbons at the time of the inspection. Sediment and debris can be removed by a clamshell bucket however, a vacuum truck is preferred. A vacuum truck must be used at a minimum of once per year for sediment removal. Disposal of the accumulated sediment and hydrocarbons must be in accordance with applicable local, state, and federal guidelines and regulations.

Riprap Aprons/Weirs

Inspect at least once annually for damage and deterioration. Repair damages immediately.

Stormtech Underground Infiltration System

Inspect and measure the level of sediment in the isolator row via the inspection port and the sumps of the drainage manholes. If sediment is at, or above 3", jetvac the isolator row with a fixed culvert cleaning nozzle with rear facing spread of 45". Apply multiple passes of the jetvac until backflush water is clean. Vacuum connecting drain manhole structures. In the first year, inspect the System every 6 months. After the first year, the inspection schedule should be adjusted based on previous observations of sediment accumulation and high water elevations; however, inspections should be performed once a year at a minimum.

Vegetated Areas

Inspect slopes and embankments early in the growing season to identify active or potential erosion problems. Replant bare areas or areas with sparse growth. Where rill erosion is evident, armor the area with an appropriate lining or divert the erosive flows to on-site areas able to withstand the concentrated flows. During the summer months, all landscape features are to be maintained with the minimum possible amount of fertilizers, pesticides or herbicides.

Winter Maintenance

Proposed snow storage is located along the edge of the roadways. Any excess snow is to be trucked offsite. During the winter months all snow is to be stored such that snowmelt is controlled. Avoid disposing of snow on top of storm drain catch basins or in stormwater drainage swales or ditches. The minimum amount of deicing chemicals needed is to be used.

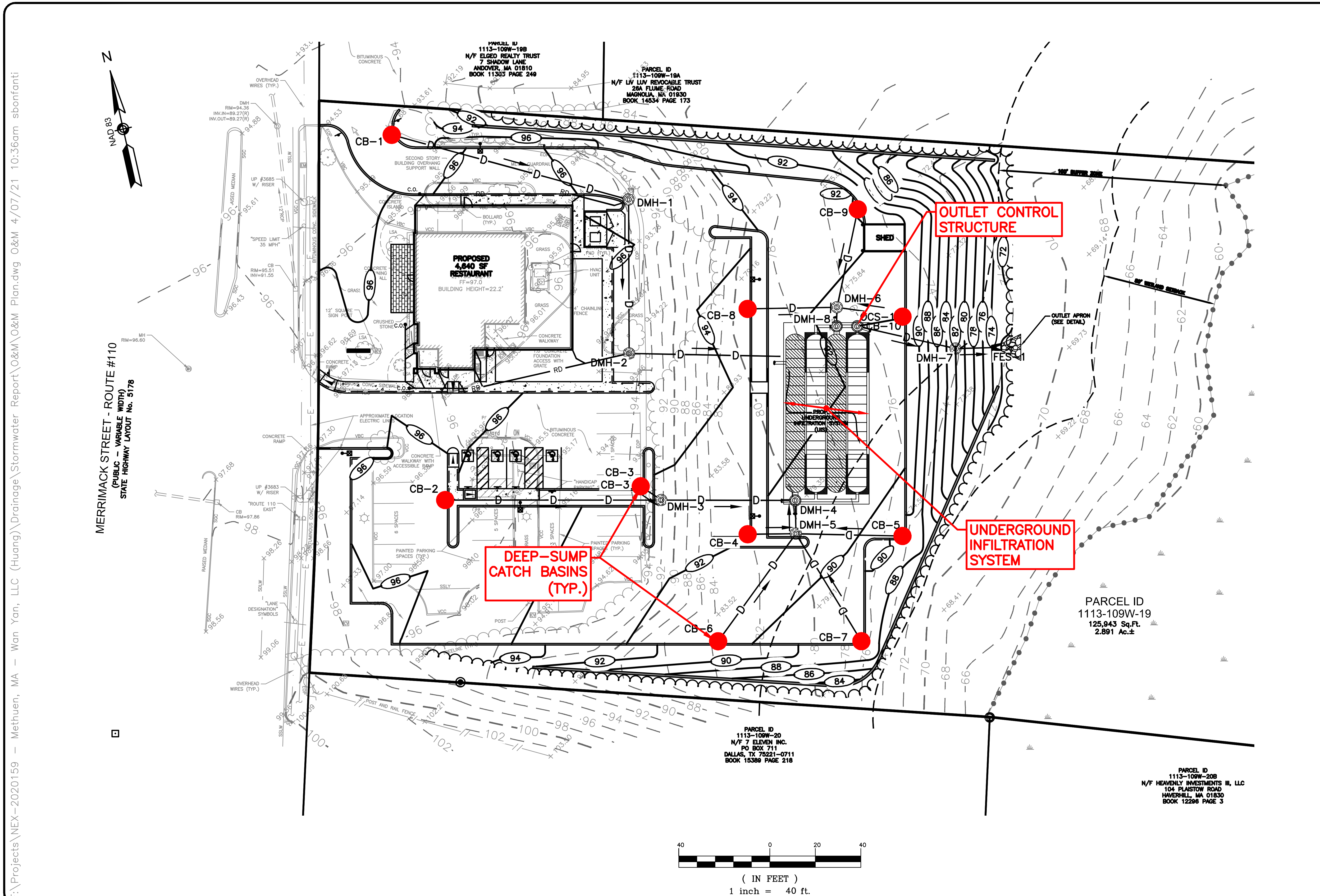
For questions and additional information regarding snow storage or disposal, please contact the Mass DEP's Northeast Regional Office in Wilmington, 978-694-3200.

SECTION 3 LONG-TERM MAINTENANCE PLAN

The primary focus of the Long-Term Pollution Prevention Plan (LTPPP) is to establish procedures and controls for limiting the potential sources of pollutants, including nutrients that may contribute to excessive contaminant levels in the site's stormwater runoff. To this end the following source controls and procedures will be in place at the site:

- **Good House Keeping** – It shall be the responsibility of the property owner to keep the site clean at all times. Refuse disposal and pickup shall occur on a regular basis and all material shall be disposed of in the specified dumpster location area on the Site Development Plans.
- **Storing Material and waste products inside or under cover** – No material storage is to take place outside the proposed facility on either paved or lawn areas. All material stored on site will conform with all storage requirements of local, state and federal agencies.
- **Routine inspections and maintenance of stormwater BMP's** – Refer to the Operation and Maintenance procedures for each BMP as described in the O&M Plan as described herein.
- **Maintenance of lawns, gardens and other landscaped areas** – All landscaping and maintenance to be performed by an authorized company chosen by the property owner.
- **Storage and use of fertilizers, herbicides and pesticides** – All landscape maintenance will be conducted by an authorized company chosen by the property owner. Any application of herbicides or pesticides will be applied by a licensed applicator.
- **Proper management of deicing chemicals and snow** – Deicing chemicals and snow removal shall primarily be the responsibility of the property owner additional information can be found in the O&M Plan as described herein.
- **Nutrient management plan** - The goal of the nutrient management plan is to minimize the potential sources of excess nutrients on the site and the release of nutrients in the stormwater from the site. This minimization relates both to infiltrated water and runoff. In general, the nature of the site use will tend to reduce the nutrients in the stormwater. Further, procedures indicated above or in the O&M Plan related to deicing procedures, BMP maintenance procedures, and street sweeping will act to reduce the levels of nutrients in the stormwater, and the nutrients entering the adjacent wetland and the groundwater.

SECTION 4 LONG-TERM MAINTENANCE PLAN EXHIBIT



LONG TERM MAINTENANCE PLAN EXHIBIT

125 MERRIMACK STREET
METHUEN, MASSACHUSETTS

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603.893.0720
Greenman-Pedersen, Inc.
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Salem, NH 03079

DRAWN BY: SJB
PROJECT #: NEX–2020159
DATE: 4/7/21
REV.: –

FIGURE
1

SECTION 5 STORMWATER OPERATION & MAINTENANCE LOG

STORMWATER INSPECTION MAINTENANCE LOG

125 Merrimack Street - Methuen, MA

General Information			
Project Name	Ye's Table Asian Cuisine	**Location**	Methuen, MA
Date of Inspection		**Start/ End Time**	
Inspector's Name(s)			
Inspector's Title(s)			
Inspector's Contact Information			

	Site Specific BMP's	Maintenance Interval
1	Street Sweeping	1 year
2	Deep Sump Catch Basins	6 months
3	Stone Lined Outlet Protection Area	1 Year
4	Stormtech Underground Infiltration System	6 months

STORMWATER INSPECTION MAINTENANCE LOG

125 Merrimack Street - Methuen, MA

BMP Description	Corrective Action Required?		Notes
Street Sweeping			
Evidence of debris accumulation	YES	NO	
Evidence of oil grease	YES	NO	
Other (specify)	YES	NO	
Deep Sump Catch Basins			
Grates clear of debris	YES	NO	
Inlet and outlet clear of debris	YES	NO	
Evidence of oil grease	YES	NO	
Observance of accumulated sediment	YES	NO	Sediment Depth =
Evidence of structural deterioration	YES	NO	
Evidence of flow bypassing facility	YES	NO	
Other (specify)	YES	NO	
Stone Lined Outlet Protection Areas			
Inlet/ inflow pipe clear of debris	YES	NO	
Overflow spillway clear of debris	YES	NO	
Evidence of rilling or gullying	YES	NO	
Tree growth	YES	NO	
Other (specify)	YES	NO	
Stormtech Underground Infiltration System			
Inlet and outlet clear of debris	YES	NO	
Bottom surface clear of debris	YES	NO	
Evidence of rilling or gullying	YES	NO	
Observance of accumulated sediment	YES	NO	
Bottom dewaters within 72 hrs. of a storm event	YES	NO	
Standing water or wet spots	YES	NO	
Other (specify)	YES	NO	

NOTE: Photos shall be provided with each inspection log and shall be sufficiently labeled to identify photo location.

Deicing Log

Date Applied	Type of Deicing Material	Amount Applied

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Isolator® Row O&M Manual

THE MOST **ADVANCED** NAME IN WATER MANAGEMENT SOLUTIONS™

THE ISOLATOR® ROW

INTRODUCTION
An important component of any Stormwater Pollution Prevention Plan is inspection and maintenance. The StormTech Isolator Row is a technique to inexpensively enhance Total Suspended Solids (TSS) removal and provide easy access for inspection and maintenance.

THE ISOLATOR ROW
The Isolator Row is a row of StormTech chambers, either SC-160LP, SC-310, SC-310-3, SC-740, DC-780, MC-3500 or MC-4500 models, that is surrounded with filter fabric and connected to a closely located manhole for easy access. The fabric-wrapped chambers provide for settling and filtration of sediment as storm water rises in the Isolator Row and ultimately passes through the filter fabric. The open bottom chambers and perforated sidewalls (SC-310, SC- 310-3 and SC-740 models) allow storm water to flow both vertically and horizontally out of the chambers. Sediments are captured in the Isolator Row protecting the storage areas of the adjacent stone and chambers from sediment accumulation.

Two different fabrics are used for the Isolator Row. A woven geotextile fabric is placed between the stone and the Isolator Row chambers. The tough geotextile provides a media for storm water filtration and provides a durable surface for maintenance operations. It is also designed to prevent scour of the underlying stone and remain intact during high pressure jetting. A non-woven fabric is placed over the chambers to provide a filter media for flows passing through the perforations in the sidewall of the chamber. The non-woven fabric is not required over the SC-160LP, DC-780, MC-3500 or MC-4500 models as these chambers do not have perforated side walls.

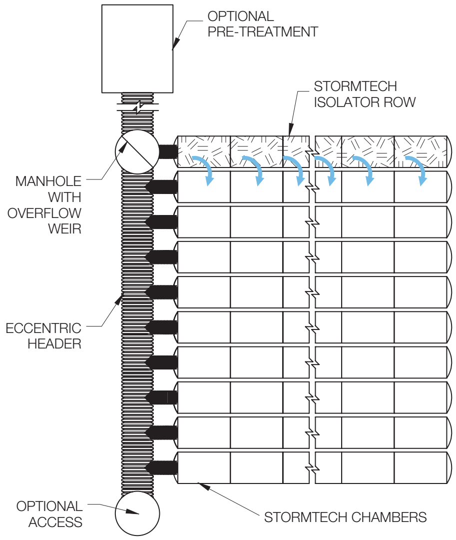
The Isolator Row is typically designed to capture the "first flush" and offers the versatility to be sized on a volume basis or flow rate basis. An upstream manhole not only provides access to the Isolator Row but typically includes a high flow weir such that storm water flowrates or volumes that exceed the capacity of the Isolator Row overtop the over flow weir and discharge through a manifold to the other chambers.

The Isolator Row may also be part of a treatment train. By treating storm water prior to entry into the chamber system, the service life can be extended and pollutants such as hydrocarbons can be captured. Pre-treatment best management practices can be as simple as deep sump catch basins, oil-water separators or can be innovative storm water treatment devices. The design of the treatment train and selection of pretreatment devices by the design engineer is often driven by regulatory requirements. Whether pretreatment is used or not, the Isolator Row is recommended by StormTech as an effective means to minimize maintenance requirements and maintenance costs.

Note: See the StormTech Design Manual for detailed information on designing inlets for a StormTech system, including the Isolator Row.

Looking down the Isolator Row from the manhole opening, woven geotextile is shown between the chamber and stone base.

StormTech Isolator Row with Overflow Spillway (not to scale)



ISOLATOR ROW INSPECTION/MAINTENANCE

INSPECTION

The frequency of inspection and maintenance varies by location. A routine inspection schedule needs to be established for each individual location based upon site specific variables. The type of land use (i.e. industrial, commercial, residential), anticipated pollutant load, percent imperviousness, climate, etc. all play a critical role in determining the actual frequency of inspection and maintenance practices.

At a minimum, StormTech recommends annual inspections. Initially, the Isolator Row should be inspected every 6 months for the first year of operation. For subsequent years, the inspection should be adjusted based upon previous observation of sediment deposition.

The Isolator Row incorporates a combination of standard manhole(s) and strategically located inspection ports (as needed). The inspection ports allow for easy access to the system from the surface, eliminating the need to perform a confined space entry for inspection purposes.

If upon visual inspection it is found that sediment has accumulated, a stadia rod should be inserted to determine the depth of sediment. When the average depth of sediment exceeds 3 inches throughout the length of the Isolator Row, clean-out should be performed.

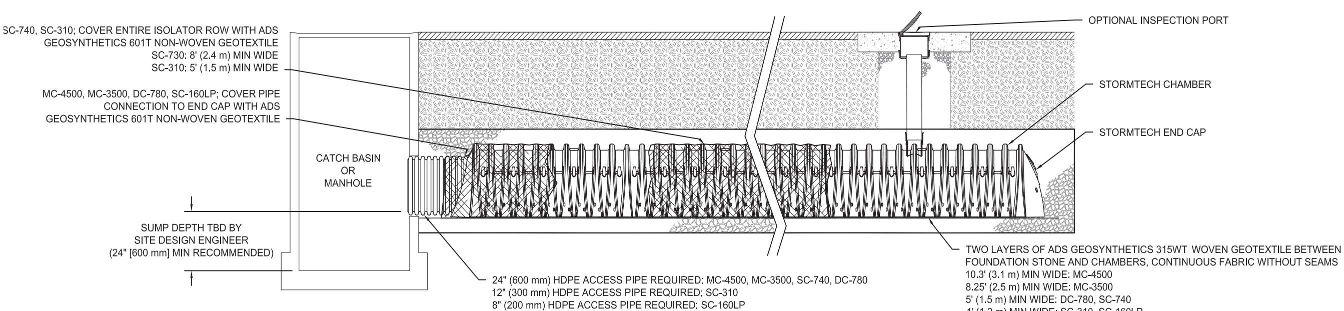
MAINTENANCE

The Isolator Row was designed to reduce the cost of periodic maintenance. By “isolating” sediments to just one row, costs are dramatically reduced by eliminating the need to clean out each row of the entire storage bed. If inspection indicates the potential need for maintenance, access is provided via a manhole(s) located on the end(s) of the row for cleanout. If entry into the manhole is required, please follow local and OSHA rules for a confined space entries.

Maintenance is accomplished with the JetVac process. The JetVac process utilizes a high pressure water nozzle to propel itself down the Isolator Row while scouring and suspending sediments. As the nozzle is retrieved, the captured pollutants are flushed back into the manhole for vacuuming. Most sewer and pipe maintenance companies have vacuum/JetVac combination vehicles. Selection of an appropriate JetVac nozzle will improve maintenance efficiency. Fixed nozzles designed for culverts or large diameter pipe cleaning are preferable. Rear facing jets with an effective spread of at least 45” are best. Most JetVac reels have 400 feet of hose allowing maintenance of an Isolator Row up to 50 chambers long. **The JetVac process shall only be performed on StormTech Isolator Rows that have AASHTO class 1 woven geotextile (as specified by StormTech) over their angular base stone.**

StormTech Isolator Row (not to scale)

Note: Non-woven fabric is only required over the inlet pipe connection into the end cap for SC-160LP, DC-780, MC-3500 and MC-4500 chamber models and is not required over the entire Isolator Row.



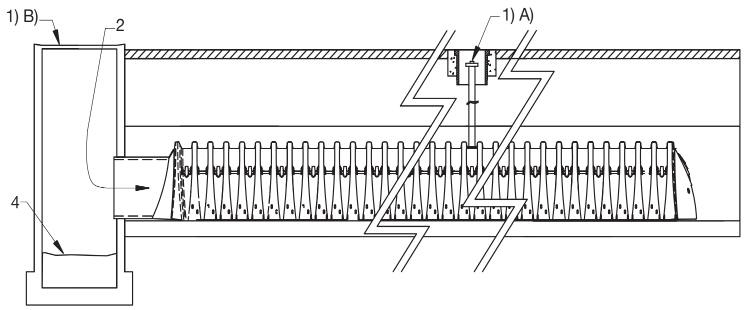
ISOLATOR ROW STEP BY STEP MAINTENANCE PROCEDURES

STEP 1
Inspect Isolator Row for sediment.
A) Inspection ports (if present)
  i. Remove lid from floor box frame
  ii. Remove cap from inspection riser
  iii. Using a flashlight and stadia rod,measure depth of sediment and record results on maintenance log.
  iv. If sediment is at or above 3 inch depth, proceed to Step 2. If not, proceed to Step 3.
B) All Isolator Rows
  i. Remove cover from manhole at upstream end of Isolator Row
  ii. Using a flashlight, inspect down Isolator Row through outlet pipe
    1. Mirrors on poles or cameras may be used to avoid a confined space entry
    2. Follow OSHA regulations for confined space entry if entering manhole
  iii. If sediment is at or above the lower row of sidewall holes (approximately 3 inches), proceed to Step 2. If not, proceed to Step 3.

STEP 2
Clean out Isolator Row using the JetVac process.
A) A fixed floor cleaning nozzle with rear facing nozzle spread of 45 inches or more is preferable
B) Apply multiple passes of JetVac until backflush water is clean
C) Vacuum manhole sump as required

STEP 3
Replace all caps, lids and covers, record observations and actions.

STEP 4
Inspect & clean catch basins and manholes upstream of the StormTech system.



SAMPLE MAINTENANCE LOG

Date	Stadia Rod Readings		Sediment Depth (1)–(2)	Observations/Actions	Inspector
	Fixed point to chamber bottom (1)	Fixed point to top of sediment (2)			
3/15/11	6.3 ft	none		New installation. Fixed point is CI frame at grade	DJM
9/24/11		6.2	0.1 ft	Some grit felt	SM
6/20/13		5.8	0.5 ft	Mucky feel, debris visible in manhole and in Isolator Row, maintenance due	NV
7/7/13	6.3 ft		0	System jetted and vacuumed	DJM

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StormTech Maintenance Log

Project Name:
Location:

StormTech
www.stormtech.com

	Stadia Rod Readings				
Date	**Fixed point to chamber bottom (1)**	**Fixed point to top of sediment (2)**	**Sediment Depth (1) - (2)**	**Observations / Actions**	**Inspector**