STORMWATER MANAGEMENT REPORT

DUNKIN DONUTS SITE REDEVELOPMENT
MAP 610 BLOCK 58 LOTS 4 & 5
477 & 479 BROADWAY
METHUEN, MASSACHUSETTS

GPI

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Prepared For:

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(GPI Project No.: NEX-2021347)

Dunkin Donuts Site Redevelopment
Cafua Management Company, LLC
Stormwater Management Report

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SECTION 1 EXECUTIVE SUMMARY

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

The project site consists of two parcels located in the Highway Business District (BH) identified as Map 610 Block 58 Lots 4 & 5 which total approximately 1.0 acre. The site is currently vacant and contains old foundations and driveways of two former residential dwellings which have been demolished and become overgrown with vegetation. The site is bordered by Broadway (Route 28) to the west, residential dwellings to the north and east, and a liquor store to the south.

The applicant is proposing to consolidate both lots and construct a 2,100 square foot Dunkin' with a drive-thru. An on-site parking lot will serve the proposed use and access will be provided by two 20-foot wide one-way driveways on Broadway with the "Entrance" driveway to the south and "Exit" driveway to the north. The new development will also include site grading, erosion control measures, new utility connections and construction of a new stormwater management system.

In order to mitigate increases in peak discharge rates of stormwater runoff as a result of the new impervious surfaces, a new stormwater management system consisting of deep-sump, hooded catch basins, a slotted drain, First Defense hydrodynamic separators, an underground detention system, and an underground infiltration system will be constructed. The underground infiltration system is designed to recharge a significant portion of stormwater runoff generated on-site. The BMP's included in the proposed stormwater system are designed in accordance with MassDEP Stormwater Management Standards to improve stormwater quality and quantity at the design point.

Based on site topography and discharge points, one analysis point is identified for the purposes of this analysis. Design Point #1 represents the existing municipal stormwater system in Broadway (Route 28).

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

TABLE 1: PEAK RATE ANALYSIS SUMMARY

Design Storm	Pre-Development (cfs)	Post-Development (cfs)	Change (cfs)
DESIGN POINT #1 – Broadway (Rte. 28)			
2-year	1.2	0.5	-0.7
10-year	2.2	1.1	-1.1
25-year	3.1	2.1	-1.0
100-year	6.3	5.7	-0.6

(All values shown are peak rates in CFS, cubic feet per second)

TABLE 2: VOLUME ANALYSIS SUMMARY

Design Storm	Pre-Development (cf)	Post-Development (cf)	Change (cf)
DESIGN POINT #1 – Broadway (Rte. 28)			
2-year	4,885	2,452	-2,433
10-year	9,328	5,567	-3,761
25-year	14,235	10,134	-4,101
100-year	28,226	23,344	-4,882

(All values shown are peak rates in CF, cubic feet)

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 and volumes 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 two parcels located in the Highway Business District (BH) identified as Map 610 Block 58 Lots 4 & 5 which total approximately 1.0 acre. The site is currently vacant and contains old foundations and driveways of two former residential dwellings which have been demolished and become overgrown with vegetation. The site is bordered by Broadway (Route 28) to the west, residential dwellings to the north and east, and a liquor store to the south.

Site topography is variable, with slopes generally ranging between 2% - 4% towards Broadway. Elevations range from 113 along Broadway to 119 in the southeast corner of the site.

Currently, there are no drainage structures on-site. Runoff from the site, including off-site contributing areas to the east, flows west through areas of woods and brush towards Broadway at Design Point #1.

The NRCS Web Soil Survey identifies on-site soils as Wareham loamy sand, Deerfield loamy fine sand, and Canton fine sandy loam with a Hydrologic Soils Group (HSG) classification of A/D, A, and B respectively. Refer to Appendix C for additional information.

Test pits were performed by Greenman-Pedersen, Inc (GPI) on June 6, 2022. The six (6) drainage test pits encountered medium-coarse sand overlain by loamy sand and urban fill. Estimated seasonal high groundwater table (ESHWT) was encountered at 60” below grade within each test pit. Test pit logs are included in Appendix D.

No wetlands or other resource areas are present on or immediately adjacent to the site.

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 25009C0202F effective on 7/3/2012.

SECTION 3 PROPOSED CONDITIONS

The applicant is proposing to consolidate both lots and construct a 2,100 square foot Dunkin' with a drive-thru. An on-site parking lot will serve the proposed use and access will be provided by two 20-foot wide one-way driveways on Broadway with the "Entrance" driveway to the south and "Exit" driveway to the north. The new development will also include site grading, erosion control measures, new utility connections and construction of a new stormwater management system.

The project results in an increase in impervious coverage of approximately 11,938 sf, therefore, this project is considered a mix of re-development and new development under the MassDEP Stormwater Policy Standards.

In order to mitigate increases in peak discharge rates of stormwater runoff as a result of the new impervious surfaces, a new stormwater management system consisting of deep-sump, hooded catch basins, a slotted drain, First Defense hydrodynamic separators, an underground detention system, and an underground infiltration system will be constructed. The underground infiltration system is designed to recharge a significant portion of stormwater runoff generated on-site. The BMP's included in the proposed stormwater system are designed in accordance with MassDEP Stormwater Management Standards to improve stormwater quality and quantity at the design point.

Stormwater runoff from paved parking areas northwest and southwest of the proposed building will be captured in First Defense hydrodynamic separator units with inlet grates to remove floatables and fine particles. Runoff will then enter the proposed underground detention system, consisting of 24" diameter HDPE pipes and to reduce peak runoff rates.

Runoff from paved parking areas north, northeast, and southeast of the proposed building will be captured in deep-sump catch basins and be routed directly to the isolator row of the underground infiltration system for additional pretreatment. The underground infiltration system consists of 32 Stormtech SC-740 chambers surrounded by crushed stone and includes an isolator row and manifold system for additional pretreatment of incoming flow. A 24" piped connection will equalize flows between the underground detention and infiltration systems.

Off-site areas are being routed around the development to be collected by a yard drain before discharging towards Design Point #1 via an existing 15" RCP connection.

Stormwater runoff from the proposed building roof will be discharged directly into the underground detention and infiltration systems via 6" diameter HDPE pipes.

The underground infiltration system will provide treatment through groundwater recharge and reduce peak flow rates of runoff leaving the site.

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

To prevent erosion and discharge of sediment during construction, Best Management Practices including erosion control mulch berms, catch basin inlet protection, a stabilized construction exit, mulch and seeding have been incorporated into the construction sequence.

The total area of disturbance related to the proposed site improvements and stormwater management system construction is approximately 36,500 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. **First Defense hydrodynamic particle separators with and without inlet grates** - to capture, treat, and direct stormwater to the proposed detention systems. TSS Removal Rate = 70%
4. **Isolator Row** – to provide pretreatment prior to infiltration by isolating incoming flow in a single chamber row with additional geotextile fabric and access for removal of captured sediment. TSS Removal Rate = 25%
5. **Underground Infiltration System** – to provide treatment through groundwater recharge. TSS Removal Rate = 80%

Groundwater Recharge:

On-site groundwater recharge of the Required Recharge Volume and the Water Quality Volume is achieved by the proposed underground infiltration system and above ground infiltration basin. Refer to the calculations in Standard #3.

Stormwater Quantity Controls:

The stormwater management system has been designed to control stormwater runoff from the site during all design storms. Peak flow rates of stormwater runoff are reduced by the underground detention system and underground infiltration system.

Stormwater Management Standards:

Standard #1: Untreated Stormwater

Full compliance:

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

Standard #2: Post Development Peak Discharge Rates

Full compliance:

- Implementing the stormwater management system will result in no change or a decrease in post-development peak flow rates compared with pre-development rates for all storms analyzed. Refer to Table 1 in Section 1.

Standard #3: Groundwater Recharge
Full Compliance

On-site groundwater recharge is provided through the use of an underground infiltration system.

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 soils is 0.60 inches. The proposed on-site impervious area = 21,447 sf.

Required Groundwater Recharge Volume:

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

$$R_v = 0.60\ inches\left(\frac{1\ in}{12\ ft}\right) * 21{,}447\ sf = \mathbf{1{,}072\ c.f.}$$

The recharge volume provided is the volume within the infiltration basin below the lowest outlet elevation (measured statically). **Total Annual Recharge Volume Provided = 2,024 c.f.** (See Appendix G for HydroCAD stage-storage tables).

Standard #4: TSS Removal
Full Compliance

Water Quality Volume Calculations:

The proposed infiltration practices are designed to store and infiltrate the water quality volume (V_{WQ}) from their contributing paved impervious surfaces. The water quality volume (V_{WQ}) is the volume of impervious surfaces times the water quality depth (D_{WQ}). A water quality depth of 1

inch is used due to the soils having an infiltration rate greater than 2.4 inches per hour and the high intensity parking lot classified as a land use with higher potential pollutant loads (LUHPPL).

Underground Infiltration System:

The contributing impervious area to the infiltration system is 21,000 sf.

$$V_{WQ} = D_{WQ} * A_{impervious}$$

$$V_{WQ} = 1\ in \left(\frac{1\ in}{12\ ft}\right) * 21{,}000\ sf = \mathbf{1{,}750\ c.f.}$$

The infiltration basin provides storage capacity for a treatment volume of **2,024 cf** of runoff and exceeds the required volume of 1,750 cf.

First Defense Units:

The proposed First Defense units are sized by the manufacturer to provide treatment of the water quality flow rate for each contributing area. The water quality flow rates at CB-2(FD) and CB-3(FD) during a 1-inch water quality storm are 0.14 cfs and 0.09 cfs respectively. The proposed First Defense FD-4HC unit is NJDEP certified to treat runoff up to 1.50 cfs. Refer to the product brochure included in Appendix G.

TSS Removal Rates Summary:

BMP	TSS Removal Rate
Street Sweeping	5%
Deep Sump Catch Basin	25%
Isolator Row	25%
First Defense Unit	70%
Underground Infiltration System	80%

Treatment Train 'A'
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 w/ deep sump removal rate (0.25) = 0.24
Load Remaining = 0.95 – 0.24 = **0.71**
Remaining Load: 0.71 x Isolator Row removal rate (0.25) = 0.18
Load Remaining = 0.71 – 0.18 = **0.53**
Remaining Load: 0.53 x Underground Infiltration System removal rate (0.80) = 0.42
Load Remaining = 0.53 – 0.42 = **0.11**
TSS Removal Rate = (1.00 – 0.11) **= 89%**

Treatment Train 'B'
Beginning Load: 1.00 x Street Sweeping removal rate (0.05) = 0.05
Load Remaining = 1.00 – 0.05 = **0.95**
Remaining Load: 0.71 x First Defense removal rate (0.70) = 0.50
Load Remaining = 0.71 – 0.50 = **0.21**
Remaining Load: 0.21 x Underground Infiltration System removal rate (0.80) = 0.17
Load Remaining = 0.21 – 0.17 = **0.04**
TSS Removal Rate = (1.00 – 0.04) **= 96%**

Standard #5: Land Uses with Higher Potential Pollutant Loads (LUHPPL)

Pollution Prevention:

- The site contains a land use with high potential pollutant loads (LUHPPL) as a high intensity parking lot with over 1,000 average daily vehicle trips as estimated by ITE.
- The long-term pollution plan includes good housekeeping practices, preventative maintenance procedures and regular inspections.

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 is considered a mix of redevelopment and new development. The redevelopment portions of the project are subject to Standard 2, Standard 3, and the pretreatment and structural best management practice requirements of Standards 4, 5, and 6 to the maximum extent practicable.

As shown in the standards above, the project fully complies with the Stormwater Management Standards.

Standard #8: Erosion and Sediment Control

Full compliance:

- Erosion and sediment controls are incorporated into the project design to prevent erosion. An Erosion & Sediment Control Plan is included in the site plan set.
-

Standard #9: Operation and Maintenance Plan

Full compliance:

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

Standard #10: Illicit Discharges

Full compliance:

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

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

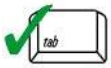
MassDEP Checklist for Stormwater Report & Illicit Discharge Statement

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

Checklist for Stormwater Report

A. Introduction

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



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

The Stormwater Report must include:

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

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

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

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

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

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

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

Checklist for Stormwater Report

B. Stormwater Checklist and Certification

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

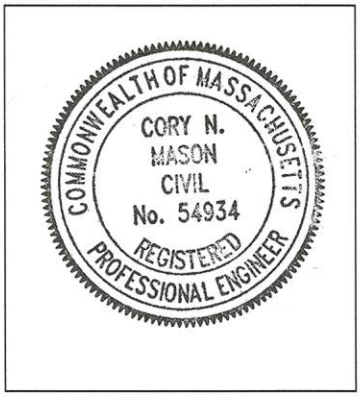
Note: Because stormwater requirements vary from project to project, it is possible that a complete Stormwater Report may not include information on some of the subjects specified in the Checklist. If it is determined that a specific item does not apply to the project under review, please note that the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

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

Registered Professional Engineer's Certification

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

Registered Professional Engineer Block and Signature



Cory Mason 3-6-24

Signature and Date

Checklist

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

☐ New development

☐ Redevelopment

☒ Mix of New Development and Redevelopment

Checklist for Stormwater Report

Checklist (continued)

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

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

Standard 1: No New Untreated Discharges

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

Checklist for Stormwater Report

Checklist (continued)

Standard 2: Peak Rate Attenuation

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

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

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

Standard 3: Recharge

☒ Soil Analysis provided.

☒ Required Recharge Volume calculation provided.

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

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

☒ Static ☐ Simple Dynamic ☐ Dynamic Field[1]

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

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

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

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

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

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

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

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

Checklist for Stormwater Report

Checklist (continued)

Standard 3: Recharge (continued)

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

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

Standard 4: Water Quality

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

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

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

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

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

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

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

Checklist for Stormwater Report

Checklist (continued)

Standard 4: Water Quality (continued)

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

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

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

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

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

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

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

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

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

☐ All exposure has been eliminated.

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

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

Standard 6: Critical Areas

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

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

Checklist for Stormwater Report

Checklist (continued)

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

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

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

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

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

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

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

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

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

Checklist for Stormwater Report

Checklist (continued)

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

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

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

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

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

Standard 9: Operation and Maintenance Plan

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

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

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

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

Standard 10: Prohibition of Illicit Discharges

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

☒ An Illicit Discharge Compliance Statement is attached;

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

March 6, 2024

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

Re: 477 & 479 Broadway
Assessors Map 610 Block 58 Lots 4 & 5
Sub: Illicit Discharge Statement
Standard #10

Dear Board Members:

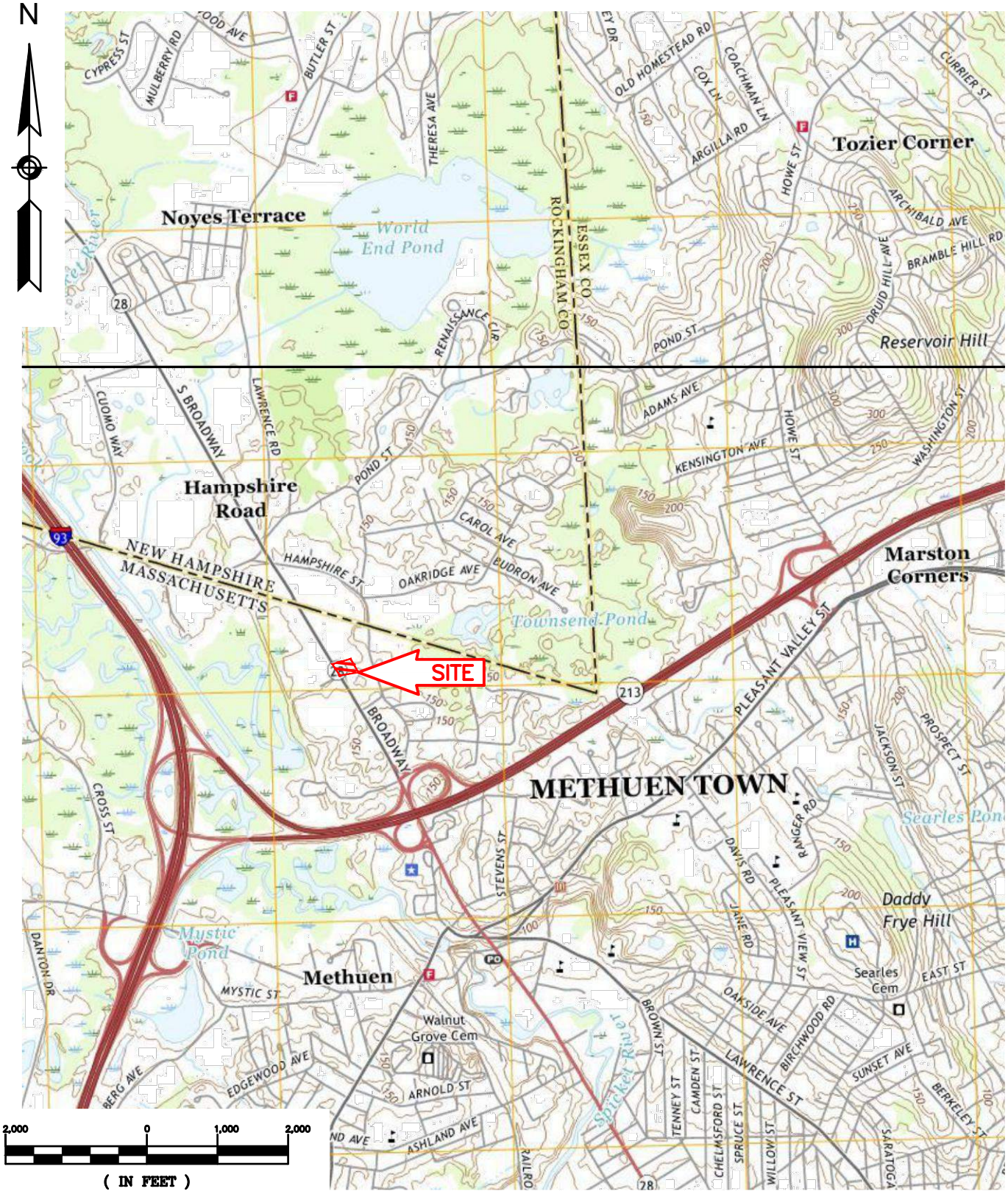
On behalf of our client, Cafua Management Company, LLC, we hereby state that to the best of our knowledge, no illicit discharges exist on the above referenced site and none are proposed with the site development plans. Implementing the pollution prevention plan measures outlined in the site development 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, P.E.
Project Engineer

APPENDIX B

USGS Map



F:\Projects\NEX-2021347 - Methuen, MA - Cafua Management (Old 351314)\Drainage\Stormwater Report\Appendix B - USGS Map\21347 - USGS Map.dwg USGS 9/06/22 11:30am sbonfanti

USGS MAP

CAFUA MANAGEMENT COMPANY, LLC.
477 & 479 BROADWAY
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: SJB
PROJECT #: NEX-2021347
DATE: 9/23/22
FIGURE 1

APPENDIX C

NRCS Soils Information

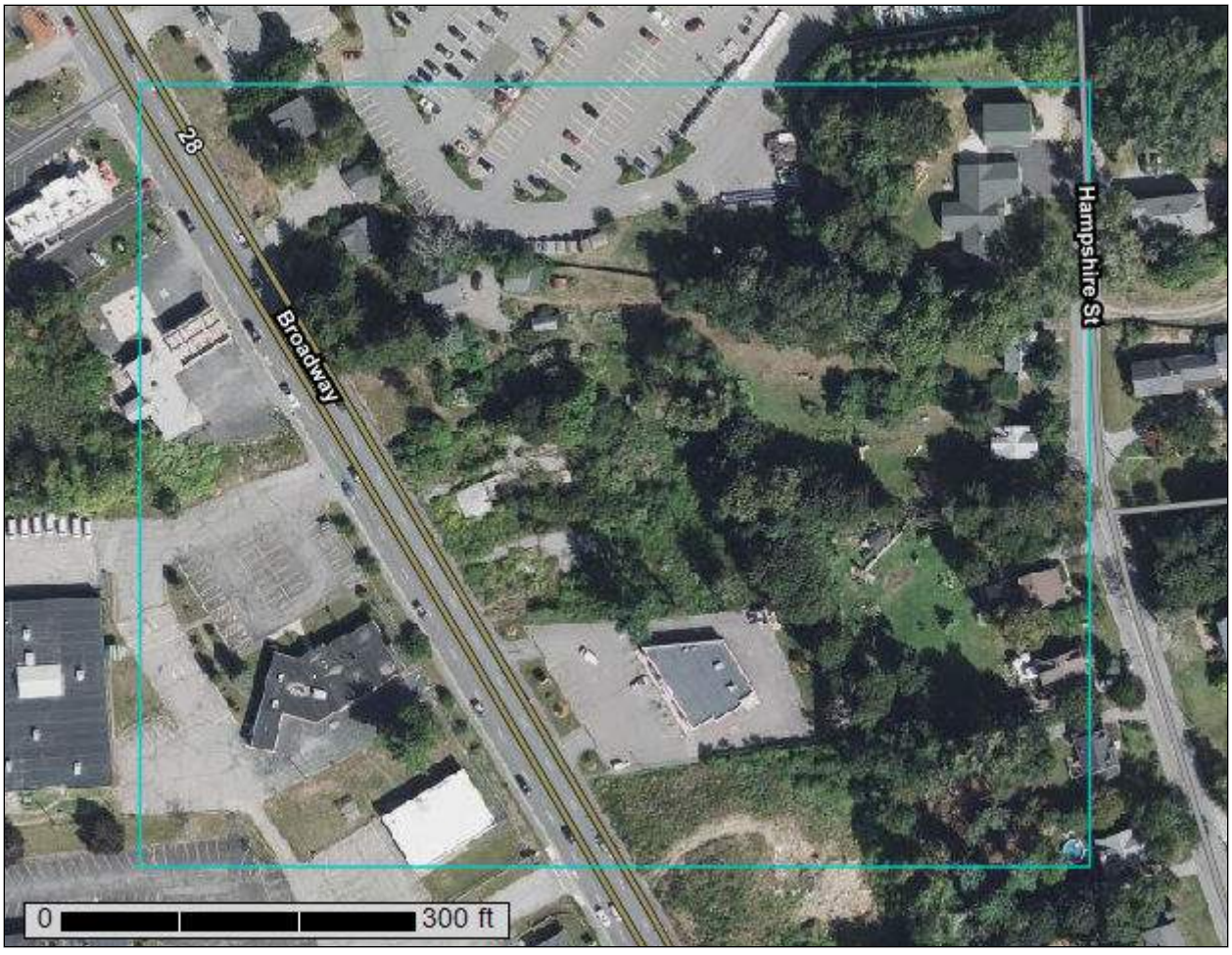
United States Department of Agriculture

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



May 25, 2022

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.

The U.S. Department of Agriculture (USDA) prohibits discrimination in all its programs and activities on the basis of race, color, national origin, age, disability, and where applicable, sex, marital status, familial status, parental status, religion, sexual orientation, genetic information, political beliefs, reprisal, or because all or a part of an individual's income is derived from any public assistance program. (Not all prohibited bases apply to all programs.) Persons with disabilities who require

alternative means for communication of program information (Braille, large print, audiotape, etc.) should contact USDA's TARGET Center at (202) 720-2600 (voice and TDD). To file a complaint of discrimination, write to USDA, Director, Office of Civil Rights, 1400 Independence Avenue, S.W., Washington, D.C. 20250-9410 or call (800) 795-3272 (voice) or (202) 720-6382 (TDD). USDA is an equal opportunity provider and employer.

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.

Custom Soil Resource Report
Soil Map

Map Scale: 1:1,700 if printed on A landscape (11" x 8.5") sheet.

N

Meters: 0 25 50 100 150

Feet: 0 50 100 200 300

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 17, Sep 2, 2021

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

Date(s) aerial images were photographed: Aug 13, 2020—Sep 15, 2020

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
32A	Wareham loamy sand, 0 to 3 percent slopes	2.1	17.5%
256A	Deerfield loamy fine sand, 0 to 3 percent slopes	2.0	16.3%
420C	Canton fine sandy loam, 8 to 15 percent slopes	1.4	11.6%
421B	Canton fine sandy loam, 0 to 8 percent slopes, very stony	0.1	0.8%
421C	Canton fine sandy loam, 8 to 15 percent slopes, very stony	1.7	14.2%
602	Urban land	4.7	38.6%
713A	Limerick and Rumney soils, 0 to 3 percent slopes, frequently flooded	0.1	0.9%
Totals for Area of Interest		**12.2**	**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

32A—Wareham loamy sand, 0 to 3 percent slopes

Map Unit Setting

National map unit symbol: vjxp
Elevation: 100 to 1,000 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

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

Description of Wareham

Setting

Landform: Terraces
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Tread
Down-slope shape: Concave
Across-slope shape: Concave
Parent material: Loose sandy glaciofluvial deposits

Typical profile

H1 - 0 to 10 inches: loamy sand
H2 - 10 to 17 inches: loamy sand
H3 - 17 to 32 inches: sand
H4 - 32 to 60 inches: stratified sand to fine sand

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Poorly drained
Capacity of the most limiting layer to transmit water (Ksat): High to very high (6.00 to 20.00 in/hr)
Depth to water table: About 4 to 18 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Low (about 4.4 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4w
Hydrologic Soil Group: A/D
Ecological site: F144AY028MA - Wet Outwash
Hydric soil rating: Yes

Minor Components

Scarboro

Percent of map unit: 15 percent
Landform: Terraces

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 terraces, outwash deltas, outwash plains, kame terraces
Landform position (three-dimensional): Tread
Down-slope shape: Concave, convex, linear
Across-slope shape: Convex, linear, concave
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 supply, 0 to 60 inches: 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, kame terraces, outwash deltas, outwash plains
Landform position (three-dimensional): Tread
Down-slope shape: Concave, convex, linear
Across-slope shape: Convex, linear, concave
Hydric soil rating: No

Wareham

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

Sudbury

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

Ninigret

Percent of map unit: 1 percent
Landform: Kame terraces, outwash plains, outwash terraces
Landform position (three-dimensional): Tread
Down-slope shape: Convex, linear
Across-slope shape: Convex, concave
Hydric soil rating: No

420C—Canton fine sandy loam, 8 to 15 percent slopes

Map Unit Setting

National map unit symbol: 2w817
Elevation: 0 to 1,330 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

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

Description of Canton

Setting

Landform: Hills, moraines, ridges
Landform position (two-dimensional): Backslope, shoulder, summit
Landform position (three-dimensional): Side slope, crest, nose slope
Down-slope shape: Convex, linear
Across-slope shape: Convex
Parent material: Coarse-loamy over sandy melt-out till derived from gneiss, granite, and/or schist

Typical profile

Ap - 0 to 7 inches: fine sandy loam
Bw1 - 7 to 15 inches: fine sandy loam
Bw2 - 15 to 26 inches: gravelly fine sandy loam
2C - 26 to 65 inches: gravelly loamy sand

Properties and qualities

Slope: 8 to 15 percent
Depth to restrictive feature: 19 to 39 inches to strongly contrasting textural stratification
Drainage class: Well drained
Runoff class: Low
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: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Very low (about 2.7 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: B
Ecological site: F144AY034CT - Well Drained Till Uplands
Hydric soil rating: No

Minor Components

Montauk

Percent of map unit: 6 percent
Landform: Moraines, ground moraines, hills, drumlins
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex, linear
Across-slope shape: Convex
Hydric soil rating: No

Scituate

Percent of map unit: 6 percent
Landform: Hills, drumlins, ground moraines
Landform position (two-dimensional): Footslope, backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex, linear
Across-slope shape: Convex
Hydric soil rating: No

Charlton

Percent of map unit: 4 percent
Landform: Ridges, ground moraines, hills
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex, linear
Across-slope shape: Convex
Hydric soil rating: No

Newfields

Percent of map unit: 4 percent
Landform: Ground moraines, hills, moraines
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Base slope
Down-slope shape: Linear
Across-slope shape: Concave
Hydric soil rating: No

421B—Canton fine sandy loam, 0 to 8 percent slopes, very stony

Map Unit Setting

National map unit symbol: 2w81l
Elevation: 0 to 1,180 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

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

Description of Canton, Very Stony

Setting

Landform: Moraines, hills, ridges
Landform position (two-dimensional): Summit, shoulder, backslope
Landform position (three-dimensional): Side slope, crest, nose slope
Down-slope shape: Convex, linear
Across-slope shape: Convex
Parent material: Coarse-loamy over sandy melt-out till derived from gneiss, granite, and/or schist

Typical profile

Oi - 0 to 2 inches: slightly decomposed plant material
A - 2 to 5 inches: fine sandy loam
Bw1 - 5 to 16 inches: fine sandy loam
Bw2 - 16 to 22 inches: gravelly fine sandy loam
2C - 22 to 67 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: 19 to 39 inches to strongly contrasting textural stratification
Drainage class: Well drained
Runoff class: Low
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: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Maximum salinity: Nonsaline (0.0 to 1.9 mmhos/cm)
Available water supply, 0 to 60 inches: Low (about 3.4 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6s
Hydrologic Soil Group: B
Ecological site: F144AY034CT - Well Drained Till Uplands
Hydric soil rating: No

Minor Components

Scituate, very stony

Percent of map unit: 9 percent
Landform: Hills, drumlins, ground moraines
Landform position (two-dimensional): Footslope, backslope, summit
Landform position (three-dimensional): Side slope, crest
Down-slope shape: Convex, linear
Across-slope shape: Convex
Hydric soil rating: No

Montauk, very stony

Percent of map unit: 5 percent
Landform: Recessionial moraines, ground moraines, hills, drumlins
Landform position (two-dimensional): Backslope, shoulder, summit
Landform position (three-dimensional): Side slope, crest
Down-slope shape: Convex, linear
Across-slope shape: Convex
Hydric soil rating: No

Gloucester, very stony

Percent of map unit: 4 percent
Landform: Moraines, hills, ridges
Landform position (two-dimensional): Summit, backslope, shoulder
Landform position (three-dimensional): Crest, side slope
Down-slope shape: Convex, linear
Across-slope shape: Convex
Hydric soil rating: No

Swansea

Percent of map unit: 2 percent
Landform: Marshes, depressions, bogs, swamps, kettles
Down-slope shape: Concave
Across-slope shape: Concave

Hydric soil rating: Yes

421C—Canton fine sandy loam, 8 to 15 percent slopes, very stony

Map Unit Setting

National map unit symbol: 2w814
Elevation: 0 to 1,160 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

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

Description of Canton, Very Stony

Setting

Landform: Moraines, ridges, hills
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex, linear
Across-slope shape: Convex
Parent material: Coarse-loamy over sandy melt-out till derived from gneiss, granite, and/or schist

Typical profile

Oi - 0 to 2 inches: slightly decomposed plant material
A - 2 to 5 inches: fine sandy loam
Bw1 - 5 to 16 inches: fine sandy loam
Bw2 - 16 to 22 inches: gravelly fine sandy loam
2C - 22 to 67 inches: gravelly loamy sand

Properties and qualities

Slope: 8 to 15 percent
Surface area covered with cobbles, stones or boulders: 1.6 percent
Depth to restrictive feature: 19 to 39 inches to strongly contrasting textural stratification
Drainage class: Well drained
Runoff class: Low
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: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Maximum salinity: Nonsaline (0.0 to 1.9 mmhos/cm)
Available water supply, 0 to 60 inches: Low (about 3.4 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6s
Hydrologic Soil Group: B
Ecological site: F144AY034CT - Well Drained Till Uplands
Hydric soil rating: No

Minor Components

Montauk, very stony

Percent of map unit: 6 percent
Landform: Recessionial moraines, ground moraines, hills, drumlins
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex, linear
Across-slope shape: Convex
Hydric soil rating: No

Scituate, very stony

Percent of map unit: 5 percent
Landform: Ground moraines, hills, drumlins
Landform position (two-dimensional): Footslope, backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex, linear
Across-slope shape: Convex
Hydric soil rating: No

Chatfield, very stony

Percent of map unit: 3 percent
Landform: Hills, ridges
Landform position (two-dimensional): Shoulder, backslope, summit
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex
Hydric soil rating: No

Swansea

Percent of map unit: 1 percent
Landform: Marshes, depressions, bogs, swamps, kettles
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

Hinckley

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

Windsor

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

Charlton

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

Paxton

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

713A—Limerick and Rumney soils, 0 to 3 percent slopes, frequently flooded

Map Unit Setting

National map unit symbol: 2zvfc
Elevation: 10 to 2,000 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

Limerick and similar soils: 60 percent
Rumney and similar soils: 25 percent
Minor components: 15 percent

Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Limerick

Setting

Landform: Alluvial flats
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Dip
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Coarse-silty alluvium derived from mica schist over friable sandy alluvium derived from mica schist

Typical profile

H1 - 0 to 13 inches: silt loam
H2 - 13 to 25 inches: silt loam
H3 - 25 to 60 inches: very fine sandy loam

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Poorly drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 2.00 in/hr)
Depth to water table: About 6 to 10 inches
Frequency of flooding: Frequent
Frequency of ponding: None
Available water supply, 0 to 60 inches: Very high (about 13.4 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3w
Hydrologic Soil Group: B/D
Ecological site: F144AY015NY - Wet Silty Low Floodplain
Hydric soil rating: Yes

Description of Rumney

Setting

Landform: Alluvial flats
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Dip
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Coarse-loamy alluvium over sandy alluvium

Typical profile

O - 0 to 2 inches: muck
H2 - 2 to 7 inches: fine sandy loam
H3 - 7 to 31 inches: fine sandy loam
H4 - 31 to 60 inches: stratified gravelly sand to loamy sand to coarse sand

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Poorly drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 6.00 in/hr)

Depth to water table: About 0 to 18 inches
Frequency of flooding: NoneFrequent
Frequency of ponding: None
Available water supply, 0 to 60 inches: Moderate (about 7.7 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3w
Hydrologic Soil Group: A/D
Hydric soil rating: Yes

Minor Components

Winooski

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

Saco variant

Percent of map unit: 5 percent
Landform: Alluvial flats
Hydric soil rating: Yes

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 Scale: 1:1,700 if printed on A landscape (11" x 8.5") sheet.

N

Meters
0 25 50 100 150

Feet
0 50 100 200 300

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 17, Sep 2, 2021

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

Date(s) aerial images were photographed: Aug 13, 2020—Sep 15, 2020

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
32A	Wareham loamy sand, 0 to 3 percent slopes	A/D	2.1	17.5%
256A	Deerfield loamy fine sand, 0 to 3 percent slopes	A	2.0	16.3%
420C	Canton fine sandy loam, 8 to 15 percent slopes	B	1.4	11.6%
421B	Canton fine sandy loam, 0 to 8 percent slopes, very stony	B	0.1	0.8%
421C	Canton fine sandy loam, 8 to 15 percent slopes, very stony	B	1.7	14.2%
602	Urban land		4.7	38.6%
713A	Limerick and Rumney soils, 0 to 3 percent slopes, frequently flooded	B/D	0.1	0.9%
Totals for Area of Interest			**12.2**	**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: Cafua Management
Project Address: 477-479 Broadway
Town, State: Methuen, MA
Job Number: NEX-2021347
Date: June 6, 2022
Performed by: Diane Pantermoller

Test Pit No. **1** SCS Soil: Urban Land
ESHWT: 60” Standing Water: 108”
Refusal: >118” Roots: None

Depth	Horizon	Soil Texture	Color	Consistence	Mottles; Quantity/Contrast
0-40”	Fill	Urban Fill			
40-118”	C	Medium-Coarse Sand	2.5y 7/3	FR	@60” Distinct

Test Pit No. **2** SCS Soil: Urban Land
ESHWT: 60” Standing Water: 84”
Refusal: >116” Roots: 24”

Depth	Horizon	Soil Texture	Color	Consistence	Mottles; Quantity/Contrast
0-24”	A	Loamy Sand	10yr 3/2	FR	
24-36”	B	Loamy Sand	10yr 5/6	FR	
36-116”	C	Medium-Coarse Sand	2.5y 7/3	FR	@60” Distinct

Test Pit No. **3** SCS Soil: Wareham Loamy Sand
ESHWT: 60” Standing Water: 72”
Refusal: >119” Roots: 24”

Depth	Horizon	Soil Texture	Color	Consistence	Mottles; Quantity/Contrast
0-10”	A	Loamy Sand	10yr 3/2	FR	
10-21”	B	Loamy Sand	10yr 5/6	FR	
21-119”	C	Medium – Coarse Sand	2.5y 7/3		@ 60” Distinct

Test Pit No. **4** SCS Soil: Wareham Loamy Sand
ESHWT: 60” Standing Water: 84”
Refusal: >110” Roots: 24”

Depth	Horizon	Soil Texture	Color	Consistence	Mottles; Quantity/Contrast
0-32”	A	Loamy Sand	10yr 3/2	FR	
32-110”	C	Medium-Coarse Sand	2.5y 7/3	FR	@60” Distinct

Test Pit No.		**5**		SCS Soil:	Wareham Loamy Sand
ESHWT:		60”		Standing Water:	72”
Refusal:		>120”		Roots:	24”

Depth	Horizon	Soil Texture	Color	Consistence	Mottles; Quantity/Contrast
0-30”	Fill	Urban Fill			
30-120”	C	Medium – Coarse Sand	2.5y 7/3	FR	@60” Distinct

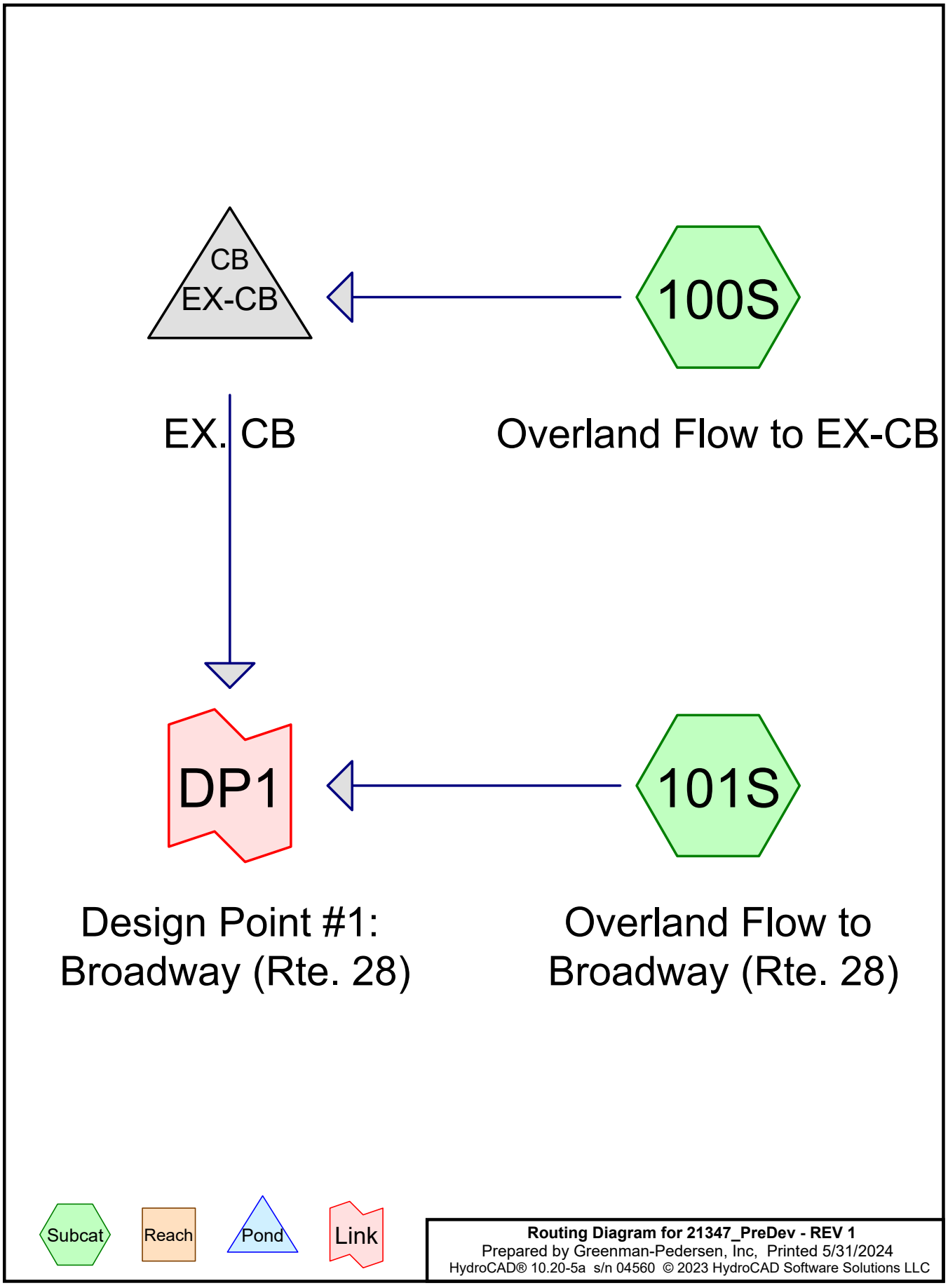
Test Pit No.		**6**		SCS Soil:	Deerfield Loamy Fine Sand
ESHWT:		60”		Standing Water:	108”
Refusal:		112”		Roots:	24”

Depth	Horizon	Soil Texture	Color	Consistence	Mottles; Quantity/Contrast
0-36”	Fill	Urban Fill			
36-112”	C	Medium-Coarse Sand	2.5y 7/3	FR	@60” Distinct

NOTES

APPENDIX E

Pre-Development HydroCAD Computations


CB
EX-CB
100S
EX. CB
Overland Flow to EX-CB
DP1
101S
Design Point #1:
Broadway (Rte. 28)
Overland Flow to
Broadway (Rte. 28)
Subcat
Reach
Pond
Link

Area Listing (all nodes)

Area (sq-ft)	CN	Description (subcatchment-numbers)
45,850	39	>75% Grass cover, Good, HSG A (100S)
16,207	61	>75% Grass cover, Good, HSG B (100S)
6,781	30	Brush, Good, HSG A (100S, 101S)
1,538	48	Brush, Good, HSG B (100S)
1,147	96	Gravel surface, HSG A (100S, 101S)
6,369	98	Paved parking, HSG A (100S, 101S)
5,583	98	Roofs, HSG A (100S, 101S)
4,648	98	Roofs, HSG B (100S)
49,952	30	Woods, Good, HSG A (100S, 101S)
7,114	55	Woods, Good, HSG B (100S)
145,188	**46**	**TOTAL AREA**

Soil Listing (all nodes)

Area (sq-ft)	Soil Group	Subcatchment Numbers
115,681	HSG A	100S, 101S
29,506	HSG B	100S
0	HSG C	
0	HSG D	
0	Other	
145,188		**TOTAL AREA**

Ground Covers (all nodes)

HSG-A (sq-ft)	HSG-B (sq-ft)	HSG-C (sq-ft)	HSG-D (sq-ft)	Other (sq-ft)	Total (sq-ft)	Ground Cover	Su Nu
45,850	16,207	0	0	0	62,056	>75% Grass cover, Good	
6,781	1,538	0	0	0	8,319	Brush, Good	
1,147	0	0	0	0	1,147	Gravel surface	
6,369	0	0	0	0	6,369	Paved parking	
5,583	4,648	0	0	0	10,231	Roofs	
49,952	7,114	0	0	0	57,066	Woods, Good	
115,681	**29,506**	**0**	**0**	**0**	**145,188**	**TOTAL AREA**	

Pipe Listing (all nodes)

Line#	Node Number	In-Invert (feet)	Out-Invert (feet)	Length (feet)	Slope (ft/ft)	n	Width (inches)	Diam/Height (inches)	Inside-Fill (inches)	Node Name
1	EX-CB	110.80	110.13	134.0	0.0050	0.013	0.0	15.0	0.0	

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

Subcatchment100S: Overland Flow to Runoff Area=140,299 sf 11.08% Impervious Runoff Depth=0.38"
Flow Length=530' Tc=9.6 min CN=WQ Runoff=1.06 cfs 4,494 cf

Subcatchment101S: Overland Flow to Runoff Area=4,889 sf 21.60% Impervious Runoff Depth=0.96"
Flow Length=40' Slope=0.0375 '/' Tc=5.0 min CN=WQ Runoff=0.12 cfs 391 cf

Pond EX-CB: EX. CB Peak Elev=111.36' Inflow=1.06 cfs 4,494 cf
15.0" Round Culvert n=0.013 L=134.0' S=0.0050 '/' Outflow=1.06 cfs 4,494 cf

Link DP1: Design Point #1: Broadway (Rte. 28) Inflow=1.15 cfs 4,885 cf
Primary=1.15 cfs 4,885 cf

Total Runoff Area = 145,188 sf Runoff Volume = 4,885 cf Average Runoff Depth = 0.40"
88.57% Pervious = 128,588 sf 11.43% Impervious = 16,600 sf

Summary for Subcatchment 100S: Overland Flow to EX-CB

Runoff = 1.06 cfs @ 12.13 hrs, Volume= 4,494 cf, Depth= 0.38"
Routed to Pond EX-CB : EX. CB

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-YR Rainfall=3.09"

Area (sf)	CN	Description
45,850	39	>75% Grass cover, Good, HSG A
16,207	61	>75% Grass cover, Good, HSG B
4,340	30	Brush, Good, HSG A
1,538	48	Brush, Good, HSG B
514	96	Gravel surface, HSG A
5,445	98	Paved parking, HSG A
5,451	98	Roofs, HSG A
4,648	98	Roofs, HSG B
49,192	30	Woods, Good, HSG A
7,114	55	Woods, Good, HSG B
140,299		Weighted Average
124,755		88.92% Pervious Area
15,544		11.08% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.5	25	0.0400	0.17		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.09"
0.7	65	0.0480	1.53		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
1.9	122	0.0470	1.08		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
1.5	135	0.0470	1.52		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
2.7	145	0.0320	0.89		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
0.3	38	0.0100	2.03		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
9.6	530	Total			

Summary for Subcatchment 101S: Overland Flow to Broadway (Rte. 28)

Runoff = 0.12 cfs @ 12.07 hrs, Volume= 391 cf, Depth= 0.96"
Routed to Link DP1 : Design Point #1: Broadway (Rte. 28)

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-YR Rainfall=3.09"

Area (sf)	CN	Description
2,441	30	Brush, Good, HSG A
633	96	Gravel surface, HSG A
924	98	Paved parking, HSG A
132	98	Roofs, HSG A
759	30	Woods, Good, HSG A
4,889		Weighted Average
3,833		78.40% Pervious Area
1,056		21.60% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.7	20	0.0375	0.07		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.09"
0.3	20	0.0375	0.97		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
5.0	40	Total			

Summary for Pond EX-CB: EX. CB

Inflow Area = 140,299 sf, 11.08% Impervious, Inflow Depth = 0.38" for 2-YR event
Inflow = 1.06 cfs @ 12.13 hrs, Volume= 4,494 cf
Outflow = 1.06 cfs @ 12.13 hrs, Volume= 4,494 cf, Atten= 0%, Lag= 0.0 min
Primary = 1.06 cfs @ 12.13 hrs, Volume= 4,494 cf
Routed to Link DP1 : Design Point #1: Broadway (Rte. 28)

Routing by Dyn-Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Peak Elev= 111.36' @ 12.13 hrs
Flood Elev= 113.70'

Device	Routing	Invert	Outlet Devices
#1	Primary	110.80'	**15.0" Round Culvert** L= 134.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 110.80' / 110.13' S= 0.0050 '/' Cc= 0.900 n= 0.013 Concrete pipe, bends & connections, Flow Area= 1.23 sf

Primary OutFlow Max=1.06 cfs @ 12.13 hrs HW=111.36' TW=0.00' (Dynamic Tailwater)
1=Culvert (Barrel Controls 1.06 cfs @ 2.92 fps)

Summary for Link DP1: Design Point #1: Broadway (Rte. 28)

Inflow Area = 145,188 sf, 11.43% Impervious, Inflow Depth = 0.40" for 2-YR event
Inflow = 1.15 cfs @ 12.13 hrs, Volume= 4,885 cf
Primary = 1.15 cfs @ 12.13 hrs, Volume= 4,885 cf, 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-Q
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment100S: Overland Flow to Runoff Area=140,299 sf 11.08% Impervious Runoff Depth=0.74"
Flow Length=530' Tc=9.6 min CN=WQ Runoff=2.02 cfs 8,710 cf

Subcatchment101S: Overland Flow to Runoff Area=4,889 sf 21.60% Impervious Runoff Depth=1.52"
Flow Length=40' Slope=0.0375 '/' Tc=5.0 min CN=WQ Runoff=0.18 cfs 617 cf

Pond EX-CB: EX. CB Peak Elev=111.60' Inflow=2.02 cfs 8,710 cf
15.0" Round Culvert n=0.013 L=134.0' S=0.0050 '/' Outflow=2.02 cfs 8,710 cf

Link DP1: Design Point #1: Broadway (Rte. 28) Inflow=2.16 cfs 9,328 cf
Primary=2.16 cfs 9,328 cf

Total Runoff Area = 145,188 sf Runoff Volume = 9,328 cf Average Runoff Depth = 0.77"
88.57% Pervious = 128,588 sf 11.43% Impervious = 16,600 sf

Summary for Subcatchment 100S: Overland Flow to EX-CB

Runoff = 2.02 cfs @ 12.13 hrs, Volume= 8,710 cf, Depth= 0.74"
Routed to Pond EX-CB : EX. CB

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-YR Rainfall=4.71"

Area (sf)	CN	Description
45,850	39	>75% Grass cover, Good, HSG A
16,207	61	>75% Grass cover, Good, HSG B
4,340	30	Brush, Good, HSG A
1,538	48	Brush, Good, HSG B
514	96	Gravel surface, HSG A
5,445	98	Paved parking, HSG A
5,451	98	Roofs, HSG A
4,648	98	Roofs, HSG B
49,192	30	Woods, Good, HSG A
7,114	55	Woods, Good, HSG B
140,299		Weighted Average
124,755		88.92% Pervious Area
15,544		11.08% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.5	25	0.0400	0.17		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.09"
0.7	65	0.0480	1.53		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
1.9	122	0.0470	1.08		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
1.5	135	0.0470	1.52		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
2.7	145	0.0320	0.89		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
0.3	38	0.0100	2.03		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
9.6	530	Total			

Summary for Subcatchment 101S: Overland Flow to Broadway (Rte. 28)

Runoff = 0.18 cfs @ 12.07 hrs, Volume= 617 cf, Depth= 1.52"
Routed to Link DP1 : Design Point #1: Broadway (Rte. 28)

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-YR Rainfall=4.71"

Area (sf)	CN	Description
2,441	30	Brush, Good, HSG A
633	96	Gravel surface, HSG A
924	98	Paved parking, HSG A
132	98	Roofs, HSG A
759	30	Woods, Good, HSG A
4,889		Weighted Average
3,833		78.40% Pervious Area
1,056		21.60% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.7	20	0.0375	0.07		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.09"
0.3	20	0.0375	0.97		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
5.0	40	Total			

Summary for Pond EX-CB: EX. CB

Inflow Area = 140,299 sf, 11.08% Impervious, Inflow Depth = 0.74" for 10-YR event
Inflow = 2.02 cfs @ 12.13 hrs, Volume= 8,710 cf
Outflow = 2.02 cfs @ 12.13 hrs, Volume= 8,710 cf, Atten= 0%, Lag= 0.0 min
Primary = 2.02 cfs @ 12.13 hrs, Volume= 8,710 cf
Routed to Link DP1 : Design Point #1: Broadway (Rte. 28)

Routing by Dyn-Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Peak Elev= 111.60' @ 12.13 hrs
Flood Elev= 113.70'

Device	Routing	Invert	Outlet Devices
#1	Primary	110.80'	**15.0" Round Culvert** L= 134.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 110.80' / 110.13' S= 0.0050 '/' Cc= 0.900 n= 0.013 Concrete pipe, bends & connections, Flow Area= 1.23 sf

Primary OutFlow Max=2.01 cfs @ 12.13 hrs HW=111.60' TW=0.00' (Dynamic Tailwater)
↑—**1=Culvert** (Barrel Controls 2.01 cfs @ 3.44 fps)

Summary for Link DP1: Design Point #1: Broadway (Rte. 28)

Inflow Area = 145,188 sf, 11.43% Impervious, Inflow Depth = 0.77" for 10-YR event
Inflow = 2.16 cfs @ 12.13 hrs, Volume= 9,328 cf
Primary = 2.16 cfs @ 12.13 hrs, Volume= 9,328 cf, 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-Q
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment100S: Overland Flow to Runoff Area=140,299 sf 11.08% Impervious Runoff Depth=1.15"
Flow Length=530' Tc=9.6 min CN=WQ Runoff=2.93 cfs 13,419 cf

Subcatchment101S: Overland Flow to Runoff Area=4,889 sf 21.60% Impervious Runoff Depth=2.00"
Flow Length=40' Slope=0.0375 '/' Tc=5.0 min CN=WQ Runoff=0.23 cfs 816 cf

Pond EX-CB: EX. CB Peak Elev=111.81' Inflow=2.93 cfs 13,419 cf
15.0" Round Culvert n=0.013 L=134.0' S=0.0050 '/' Outflow=2.93 cfs 13,419 cf

Link DP1: Design Point #1: Broadway (Rte. 28) Inflow=3.11 cfs 14,235 cf
Primary=3.11 cfs 14,235 cf

Total Runoff Area = 145,188 sf Runoff Volume = 14,235 cf Average Runoff Depth = 1.18"
88.57% Pervious = 128,588 sf 11.43% Impervious = 16,600 sf

Summary for Subcatchment 100S: Overland Flow to EX-CB

Runoff = 2.93 cfs @ 12.14 hrs, Volume= 13,419 cf, Depth= 1.15"
Routed to Pond EX-CB : EX. CB

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-YR Rainfall=5.99"

Area (sf)	CN	Description
45,850	39	>75% Grass cover, Good, HSG A
16,207	61	>75% Grass cover, Good, HSG B
4,340	30	Brush, Good, HSG A
1,538	48	Brush, Good, HSG B
514	96	Gravel surface, HSG A
5,445	98	Paved parking, HSG A
5,451	98	Roofs, HSG A
4,648	98	Roofs, HSG B
49,192	30	Woods, Good, HSG A
7,114	55	Woods, Good, HSG B
140,299		Weighted Average
124,755		88.92% Pervious Area
15,544		11.08% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.5	25	0.0400	0.17		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.09"
0.7	65	0.0480	1.53		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
1.9	122	0.0470	1.08		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
1.5	135	0.0470	1.52		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
2.7	145	0.0320	0.89		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
0.3	38	0.0100	2.03		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
9.6	530	Total			

Summary for Subcatchment 101S: Overland Flow to Broadway (Rte. 28)

Runoff = 0.23 cfs @ 12.07 hrs, Volume= 816 cf, Depth= 2.00"
Routed to Link DP1 : Design Point #1: Broadway (Rte. 28)

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-YR Rainfall=5.99"

Area (sf)	CN	Description
2,441	30	Brush, Good, HSG A
633	96	Gravel surface, HSG A
924	98	Paved parking, HSG A
132	98	Roofs, HSG A
759	30	Woods, Good, HSG A
4,889		Weighted Average
3,833		78.40% Pervious Area
1,056		21.60% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.7	20	0.0375	0.07		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.09"
0.3	20	0.0375	0.97		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
5.0	40	Total			

Summary for Pond EX-CB: EX. CB

Inflow Area = 140,299 sf, 11.08% Impervious, Inflow Depth = 1.15" for 25-YR event
Inflow = 2.93 cfs @ 12.14 hrs, Volume= 13,419 cf
Outflow = 2.93 cfs @ 12.14 hrs, Volume= 13,419 cf, Atten= 0%, Lag= 0.0 min
Primary = 2.93 cfs @ 12.14 hrs, Volume= 13,419 cf
Routed to Link DP1 : Design Point #1: Broadway (Rte. 28)

Routing by Dyn-Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Peak Elev= 111.81' @ 12.14 hrs
Flood Elev= 113.70'

Device	Routing	Invert	Outlet Devices
#1	Primary	110.80'	**15.0" Round Culvert** L= 134.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 110.80' / 110.13' S= 0.0050 '/' Cc= 0.900 n= 0.013 Concrete pipe, bends & connections, Flow Area= 1.23 sf

Primary OutFlow Max=2.93 cfs @ 12.14 hrs HW=111.81' TW=0.00' (Dynamic Tailwater)
1=Culvert (Barrel Controls 2.93 cfs @ 3.76 fps)

Summary for Link DP1: Design Point #1: Broadway (Rte. 28)

Inflow Area = 145,188 sf, 11.43% Impervious, Inflow Depth = 1.18" for 25-YR event
Inflow = 3.11 cfs @ 12.13 hrs, Volume= 14,235 cf
Primary = 3.11 cfs @ 12.13 hrs, Volume= 14,235 cf, 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-Q
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment100S: Overland Flow to Runoff Area=140,299 sf 11.08% Impervious Runoff Depth=2.30"
Flow Length=530' Tc=9.6 min CN=WQ Runoff=6.00 cfs 26,901 cf

Subcatchment101S: Overland Flow to Runoff Area=4,889 sf 21.60% Impervious Runoff Depth=3.25"
Flow Length=40' Slope=0.0375 '/' Tc=5.0 min CN=WQ Runoff=0.34 cfs 1,326 cf

Pond EX-CB: EX. CB Peak Elev=113.10' Inflow=6.00 cfs 26,901 cf
15.0" Round Culvert n=0.013 L=134.0' S=0.0050 '/' Outflow=6.00 cfs 26,901 cf

Link DP1: Design Point #1: Broadway (Rte. 28) Inflow=6.25 cfs 28,226 cf
Primary=6.25 cfs 28,226 cf

Total Runoff Area = 145,188 sf Runoff Volume = 28,226 cf Average Runoff Depth = 2.33"
88.57% Pervious = 128,588 sf 11.43% Impervious = 16,600 sf

Summary for Subcatchment 100S: Overland Flow to EX-CB

Runoff = 6.00 cfs @ 12.14 hrs, Volume= 26,901 cf, Depth= 2.30"
Routed to Pond EX-CB : EX. CB

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-YR Rainfall=8.65"

Area (sf)	CN	Description
45,850	39	>75% Grass cover, Good, HSG A
16,207	61	>75% Grass cover, Good, HSG B
4,340	30	Brush, Good, HSG A
1,538	48	Brush, Good, HSG B
514	96	Gravel surface, HSG A
5,445	98	Paved parking, HSG A
5,451	98	Roofs, HSG A
4,648	98	Roofs, HSG B
49,192	30	Woods, Good, HSG A
7,114	55	Woods, Good, HSG B
140,299		Weighted Average
124,755		88.92% Pervious Area
15,544		11.08% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.5	25	0.0400	0.17		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.09"
0.7	65	0.0480	1.53		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
1.9	122	0.0470	1.08		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
1.5	135	0.0470	1.52		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
2.7	145	0.0320	0.89		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
0.3	38	0.0100	2.03		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
9.6	530	Total			

Summary for Subcatchment 101S: Overland Flow to Broadway (Rte. 28)

Runoff = 0.34 cfs @ 12.07 hrs, Volume= 1,326 cf, Depth= 3.25"
Routed to Link DP1 : Design Point #1: Broadway (Rte. 28)

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-YR Rainfall=8.65"

Area (sf)	CN	Description
2,441	30	Brush, Good, HSG A
633	96	Gravel surface, HSG A
924	98	Paved parking, HSG A
132	98	Roofs, HSG A
759	30	Woods, Good, HSG A
4,889		Weighted Average
3,833		78.40% Pervious Area
1,056		21.60% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.7	20	0.0375	0.07		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.09"
0.3	20	0.0375	0.97		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
5.0	40	Total			

Summary for Pond EX-CB: EX. CB

Inflow Area = 140,299 sf, 11.08% Impervious, Inflow Depth = 2.30" for 100-YR event
Inflow = 6.00 cfs @ 12.14 hrs, Volume= 26,901 cf
Outflow = 6.00 cfs @ 12.14 hrs, Volume= 26,901 cf, Atten= 0%, Lag= 0.0 min
Primary = 6.00 cfs @ 12.14 hrs, Volume= 26,901 cf
Routed to Link DP1 : Design Point #1: Broadway (Rte. 28)

Routing by Dyn-Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Peak Elev= 113.10' @ 12.14 hrs
Flood Elev= 113.70'

Device	Routing	Invert	Outlet Devices
#1	Primary	110.80'	**15.0" Round Culvert** L= 134.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 110.80' / 110.13' S= 0.0050 '/' Cc= 0.900 n= 0.013 Concrete pipe, bends & connections, Flow Area= 1.23 sf

Primary OutFlow Max=5.99 cfs @ 12.14 hrs HW=113.09' TW=0.00' (Dynamic Tailwater)
↑—**1=Culvert** (Barrel Controls 5.99 cfs @ 4.89 fps)

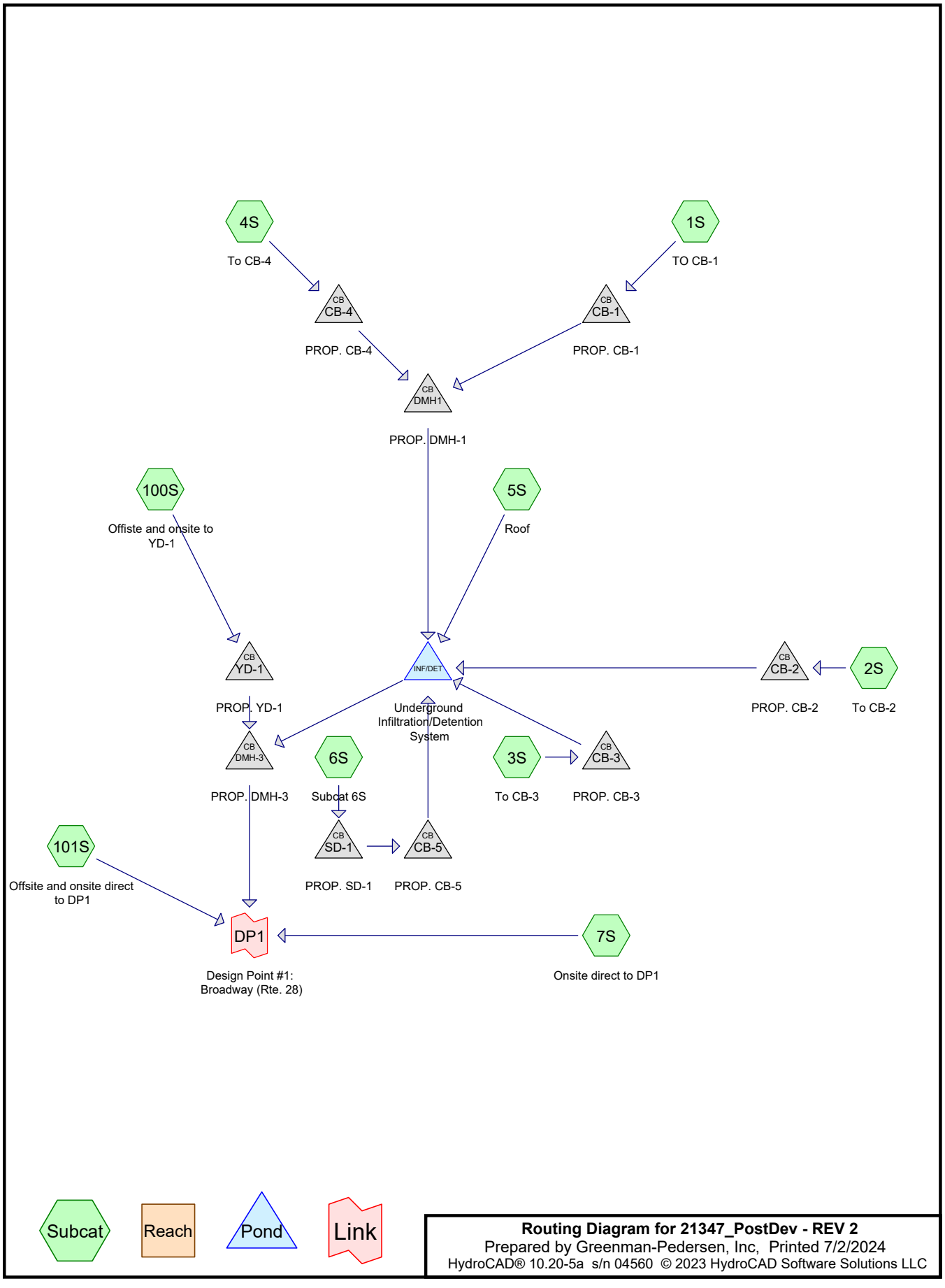
Summary for Link DP1: Design Point #1: Broadway (Rte. 28)

Inflow Area = 145,188 sf, 11.43% Impervious, Inflow Depth = 2.33" for 100-YR event
Inflow = 6.25 cfs @ 12.14 hrs, Volume= 28,226 cf
Primary = 6.25 cfs @ 12.14 hrs, Volume= 28,226 cf, Atten= 0%, Lag= 0.0 min

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

APPENDIX F

Post-Development HydroCAD Computations



Routing Diagram for 21347_PostDev - REV 2
Prepared by Greenman-Pedersen, Inc, Printed 7/2/2024

Area Listing (all nodes)

Area (sq-ft)	CN	Description (subcatchment-numbers)
59,673	39	>75% Grass cover, Good, HSG A (1S, 2S, 3S, 4S, 7S, 100S, 101S)
16,207	61	>75% Grass cover, Good, HSG B (100S)
3,499	30	Brush, Good, HSG A (1S, 2S, 7S)
2,229	48	Brush, Good, HSG B (1S)
19,268	98	Paved parking, HSG A (1S, 2S, 3S, 4S, 6S, 7S, 101S)
4,623	98	Roofs, HSG A (5S, 100S)
4,647	98	Roofs, HSG B (1S, 100S)
28,619	30	Woods, Good, HSG A (1S, 100S, 101S)
6,423	55	Woods, Good, HSG B (100S)
145,188	**52**	**TOTAL AREA**

Soil Listing (all nodes)

Area (sq-ft)	Soil Group	Subcatchment Numbers
115,682	HSG A	1S, 2S, 3S, 4S, 5S, 6S, 7S, 100S, 101S
29,506	HSG B	1S, 100S
0	HSG C	
0	HSG D	
0	Other	
145,188		**TOTAL AREA**

Ground Covers (all nodes)

HSG-A (sq-ft)	HSG-B (sq-ft)	HSG-C (sq-ft)	HSG-D (sq-ft)	Other (sq-ft)	Total (sq-ft)	Ground Cover	Su Nu
59,673	16,207	0	0	0	75,879	>75% Grass cover, Good	
3,499	2,229	0	0	0	5,728	Brush, Good	
19,268	0	0	0	0	19,268	Paved parking	
4,623	4,647	0	0	0	9,270	Roofs	
28,619	6,423	0	0	0	35,043	Woods, Good	
115,682	**29,506**	**0**	**0**	**0**	**145,188**	**TOTAL AREA**	

Pipe Listing (all nodes)

Line#	Node Number	In-Invert (feet)	Out-Invert (feet)	Length (feet)	Slope (ft/ft)	n	Width (inches)	Diam/Height (inches)	Inside-Fill (inches)	Node Name
1	CB-1	113.10	112.45	96.0	0.0068	0.012	0.0	12.0	0.0	
2	CB-2	112.20	112.00	34.0	0.0059	0.012	0.0	12.0	0.0	
3	CB-3	112.20	112.00	38.0	0.0053	0.012	0.0	12.0	0.0	
4	CB-4	113.00	112.60	12.0	0.0333	0.012	0.0	12.0	0.0	
5	CB-5	112.20	112.00	22.0	0.0091	0.012	0.0	12.0	0.0	
6	DMH-3	110.65	110.13	105.0	0.0050	0.013	0.0	15.0	0.0	
7	DMH1	112.35	112.10	14.0	0.0179	0.012	0.0	12.0	0.0	
8	INF/DET	113.10	112.10	17.0	0.0588	0.012	0.0	12.0	0.0	
9	SD-1	112.50	112.30	35.0	0.0057	0.012	0.0	8.0	0.0	
10	YD-1	110.85	110.75	14.0	0.0071	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-Q
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment1S: TO CB-1 Runoff Area=24,787 sf 21.88% Impervious Runoff Depth=0.63"
Flow Length=164' Tc=3.9 min CN=WQ Runoff=0.40 cfs 1,305 cf

Subcatchment2S: To CB-2 Runoff Area=10,744 sf 55.54% Impervious Runoff Depth=1.59"
Flow Length=80' Tc=2.6 min CN=WQ Runoff=0.46 cfs 1,421 cf

Subcatchment3S: To CB-3 Runoff Area=4,216 sf 95.42% Impervious Runoff Depth=2.73"
Flow Length=51' Tc=2.2 min CN=WQ Runoff=0.32 cfs 958 cf

Subcatchment4S: To CB-4 Runoff Area=3,101 sf 83.34% Impervious Runoff Depth=2.38"
Flow Length=74' Tc=4.0 min CN=WQ Runoff=0.19 cfs 615 cf

Subcatchment5S: Roof Runoff Area=2,284 sf 100.00% Impervious Runoff Depth=2.86"
Tc=0.0 min CN=98 Runoff=0.19 cfs 544 cf

Subcatchment6S: Subcat 6S Runoff Area=720 sf 100.00% Impervious Runoff Depth=2.86"
Tc=0.0 min CN=98 Runoff=0.06 cfs 172 cf

Subcatchment7S: Onsite direct to DP1 Runoff Area=1,725 sf 23.66% Impervious Runoff Depth=0.68"
Flow Length=19' Slope=0.0470 '/' Tc=1.9 min CN=WQ Runoff=0.03 cfs 97 cf

Subcatchment100S: Offiste and onsite to Runoff Area=96,074 sf 7.12% Impervious Runoff Depth=0.29"
Flow Length=625' Tc=12.2 min CN=WQ Runoff=0.46 cfs 2,287 cf

Subcatchment101S: Offsite and onsite Runoff Area=1,537 sf 18.56% Impervious Runoff Depth=0.53"
Flow Length=50' Slope=0.0100 '/' Tc=4.3 min CN=WQ Runoff=0.02 cfs 68 cf

Pond CB-1: PROP. CB-1 Peak Elev=113.44' Inflow=0.40 cfs 1,305 cf
12.0" Round Culvert n=0.012 L=96.0' S=0.0068 '/' Outflow=0.40 cfs 1,305 cf

Pond CB-2: PROP. CB-2 Peak Elev=112.62' Inflow=0.46 cfs 1,421 cf
12.0" Round Culvert n=0.012 L=34.0' S=0.0059 '/' Outflow=0.46 cfs 1,421 cf

Pond CB-3: PROP. CB-3 Peak Elev=112.61' Inflow=0.32 cfs 958 cf
12.0" Round Culvert n=0.012 L=38.0' S=0.0053 '/' Outflow=0.32 cfs 958 cf

Pond CB-4: PROP. CB-4 Peak Elev=113.21' Inflow=0.19 cfs 615 cf
12.0" Round Culvert n=0.012 L=12.0' S=0.0333 '/' Outflow=0.19 cfs 615 cf

Pond CB-5: PROP. CB-5 Peak Elev=112.61' Inflow=0.06 cfs 172 cf
12.0" Round Culvert n=0.012 L=22.0' S=0.0091 '/' Outflow=0.06 cfs 172 cf

Pond DMH-3: PROP. DMH-3 Peak Elev=111.01' Inflow=0.46 cfs 2,287 cf
15.0" Round Culvert n=0.013 L=105.0' S=0.0050 '/' Outflow=0.46 cfs 2,287 cf

Pond DMH1: PROP. DMH-1 Peak Elev=112.74' Inflow=0.59 cfs 1,920 cf
12.0" Round Culvert n=0.012 L=14.0' S=0.0179 '/' Outflow=0.59 cfs 1,920 cf

Pond INF/DET: Underground Peak Elev=112.61' Storage=1,140 cf Inflow=1.55 cfs 5,015 cf
Discarded=0.31 cfs 5,015 cf Primary=0.00 cfs 0 cf Outflow=0.31 cfs 5,015 cf

Pond SD-1: PROP. SD-1 Peak Elev=112.65' Inflow=0.06 cfs 172 cf
8.0" Round Culvert n=0.012 L=35.0' S=0.0057 '/' Outflow=0.06 cfs 172 cf

Pond YD-1: PROP. YD-1 Peak Elev=111.24' Inflow=0.46 cfs 2,287 cf
12.0" Round Culvert n=0.012 L=14.0' S=0.0071 '/' Outflow=0.46 cfs 2,287 cf

Link DP1: Design Point #1: Broadway (Rte. 28) Inflow=0.48 cfs 2,452 cf
Primary=0.48 cfs 2,452 cf

Total Runoff Area = 145,188 sf Runoff Volume = 7,468 cf Average Runoff Depth = 0.62"
80.34% Pervious = 116,650 sf 19.66% Impervious = 28,538 sf

Summary for Subcatchment 1S: TO CB-1

Runoff = 0.40 cfs @ 12.06 hrs, Volume= 1,305 cf, Depth= 0.63"
Routed to Pond CB-1 : PROP. CB-1

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-YR Rainfall=3.09"

Area (sf)	CN	Description
3,127	39	>75% Grass cover, Good, HSG A
2,346	30	Brush, Good, HSG A
2,229	48	Brush, Good, HSG B
5,280	98	Paved parking, HSG A
143	98	Roofs, HSG B
11,662	30	Woods, Good, HSG A
24,787		Weighted Average
19,364		78.12% Pervious Area
5,423		21.88% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.7	20	0.0700	0.20		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.09"
1.5	100	0.0500	1.12		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
0.7	44	0.0200	0.99		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
3.9	164	Total			

Summary for Subcatchment 2S: To CB-2

Runoff = 0.46 cfs @ 12.04 hrs, Volume= 1,421 cf, Depth= 1.59"
Routed to Pond CB-2 : PROP. CB-2

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-YR Rainfall=3.09"

Area (sf)	CN	Description
3,624	39	>75% Grass cover, Good, HSG A
1,153	30	Brush, Good, HSG A
5,967	98	Paved parking, HSG A
10,744		Weighted Average
4,777		44.46% Pervious Area
5,967		55.54% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.1	10	0.0100	0.08		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.09"
0.5	70	0.0150	2.49		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
2.6	80	Total			

Summary for Subcatchment 3S: To CB-3

Runoff = 0.32 cfs @ 12.03 hrs, Volume= 958 cf, Depth= 2.73"
Routed to Pond CB-3 : PROP. CB-3

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-YR Rainfall=3.09"

Area (sf)	CN	Description
193	39	>75% Grass cover, Good, HSG A
4,023	98	Paved parking, HSG A
4,216		Weighted Average
193		4.58% Pervious Area
4,023		95.42% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.0	18	0.0350	0.15		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.09"
0.2	33	0.0200	2.87		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
2.2	51	Total			

Summary for Subcatchment 4S: To CB-4

Runoff = 0.19 cfs @ 12.06 hrs, Volume= 615 cf, Depth= 2.38"
Routed to Pond CB-4 : PROP. CB-4

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-YR Rainfall=3.09"

Area (sf)	CN	Description
517	39	>75% Grass cover, Good, HSG A
2,584	98	Paved parking, HSG A
3,101		Weighted Average
517		16.66% Pervious Area
2,584		83.34% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.6	20	0.0100	0.09		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.09"
0.4	54	0.0120	2.22		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
4.0	74	Total			

Summary for Subcatchment 5S: Roof

[46] Hint: Tc=0 (Instant runoff peak depends on dt)

Runoff = 0.19 cfs @ 12.00 hrs, Volume= 544 cf, Depth= 2.86"
Routed to Pond INF/DET : Underground Infiltration/Detention System

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-YR Rainfall=3.09"

Area (sf)	CN	Description
2,284	98	Roofs, HSG A
2,284		100.00% Impervious Area

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

Summary for Subcatchment 6S: Subcat 6S

[46] Hint: Tc=0 (Instant runoff peak depends on dt)

Runoff = 0.06 cfs @ 12.00 hrs, Volume= 172 cf, Depth= 2.86"
Routed to Pond SD-1 : PROP. SD-1

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-YR Rainfall=3.09"

Area (sf)	CN	Description
720	98	Paved parking, HSG A
720		100.00% Impervious Area

Summary for Subcatchment 7S: Onsite direct to DP1

Runoff = 0.03 cfs @ 12.03 hrs, Volume= 97 cf, Depth= 0.68"
Routed to Link DP1 : Design Point #1: Broadway (Rte. 28)

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-YR Rainfall=3.09"

Area (sf)	CN	Description
1,316	39	>75% Grass cover, Good, HSG A
1	30	Brush, Good, HSG A
408	98	Paved parking, HSG A
1,725		Weighted Average
1,317		76.34% Pervious Area
408		23.66% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.9	19	0.0470	0.17		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.09"

Summary for Subcatchment 100S: Offiste and onsite to YD-1

Runoff = 0.46 cfs @ 12.18 hrs, Volume= 2,287 cf, Depth= 0.29"
Routed to Pond YD-1 : PROP. YD-1

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-YR Rainfall=3.09"

Area (sf)	CN	Description
49,895	39	>75% Grass cover, Good, HSG A
16,207	61	>75% Grass cover, Good, HSG B
2,339	98	Roofs, HSG A
4,504	98	Roofs, HSG B
16,706	30	Woods, Good, HSG A
6,423	55	Woods, Good, HSG B
96,074		Weighted Average
89,231		92.88% Pervious Area
6,843		7.12% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.5	25	0.0400	0.17		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.09"
0.7	65	0.0480	1.53		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
1.9	122	0.0470	1.08		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
1.5	135	0.0470	1.52		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.6	38	0.0470	1.08		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
3.9	165	0.0100	0.70		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
1.1	75	0.0260	1.13		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
12.2	625	Total			

Summary for Subcatchment 101S: Offsite and onsite direct to DP1

Runoff = 0.02 cfs @ 12.06 hrs, Volume= 68 cf, Depth= 0.53"
Routed to Link DP1 : Design Point #1: Broadway (Rte. 28)

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-YR Rainfall=3.09"

Area (sf)	CN	Description
1,000	39	>75% Grass cover, Good, HSG A
285	98	Paved parking, HSG A
252	30	Woods, Good, HSG A
1,537		Weighted Average
1,252		81.44% Pervious Area
285		18.56% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.6	20	0.0100	0.09		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.09"
0.7	30	0.0100	0.70		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
4.3	50	Total			

Summary for Pond CB-1: PROP. CB-1

Inflow Area = 24,787 sf, 21.88% Impervious, Inflow Depth = 0.63" for 2-YR event
Inflow = 0.40 cfs @ 12.06 hrs, Volume= 1,305 cf
Outflow = 0.40 cfs @ 12.06 hrs, Volume= 1,305 cf, Atten= 0%, Lag= 0.0 min
Primary = 0.40 cfs @ 12.06 hrs, Volume= 1,305 cf
Routed to Pond DMH1 : PROP. DMH-1

Routing by Dyn-Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Peak Elev= 113.44' @ 12.06 hrs
Flood Elev= 116.10'

Device	Routing	Invert	Outlet Devices
#1	Primary	113.10'	**12.0" Round Culvert** L= 96.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 113.10' / 112.45' S= 0.0068 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=0.40 cfs @ 12.06 hrs HW=113.43' TW=112.74' (Dynamic Tailwater)
↑—**1=Culvert** (Outlet Controls 0.40 cfs @ 2.59 fps)

Summary for Pond CB-2: PROP. CB-2

First Defense unit

Inflow Area = 10,744 sf, 55.54% Impervious, Inflow Depth = 1.59" for 2-YR event
Inflow = 0.46 cfs @ 12.04 hrs, Volume= 1,421 cf
Outflow = 0.46 cfs @ 12.04 hrs, Volume= 1,421 cf, Atten= 0%, Lag= 0.0 min
Primary = 0.46 cfs @ 12.04 hrs, Volume= 1,421 cf
Routed to Pond INF/DET : Underground Infiltration/Detention System

Routing by Dyn-Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Peak Elev= 112.62' @ 12.43 hrs
Flood Elev= 115.15'

Device	Routing	Invert	Outlet Devices
#1	Primary	112.20'	**12.0" Round Culvert** L= 34.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 112.20' / 112.00' S= 0.0059 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=0.46 cfs @ 12.04 hrs HW=112.58' TW=112.25' (Dynamic Tailwater)
↑—**1=Culvert** (Barrel Controls 0.46 cfs @ 2.48 fps)

Summary for Pond CB-3: PROP. CB-3

First Defense unit

Inflow Area = 4,216 sf, 95.42% Impervious, Inflow Depth = 2.73" for 2-YR event
Inflow = 0.32 cfs @ 12.03 hrs, Volume= 958 cf
Outflow = 0.32 cfs @ 12.03 hrs, Volume= 958 cf, Atten= 0%, Lag= 0.0 min
Primary = 0.32 cfs @ 12.03 hrs, Volume= 958 cf
Routed to Pond INF/DET : Underground Infiltration/Detention System

Routing by Dyn-Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Peak Elev= 112.61' @ 12.44 hrs
Flood Elev= 115.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	112.20'	**12.0" Round Culvert** L= 38.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 112.20' / 112.00' S= 0.0053 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=0.32 cfs @ 12.03 hrs HW=112.52' TW=112.23' (Dynamic Tailwater)
↑—**1=Culvert** (Barrel Controls 0.32 cfs @ 2.21 fps)

Summary for Pond CB-4: PROP. CB-4

Inflow Area = 3,101 sf, 83.34% Impervious, Inflow Depth = 2.38" for 2-YR event
Inflow = 0.19 cfs @ 12.06 hrs, Volume= 615 cf
Outflow = 0.19 cfs @ 12.06 hrs, Volume= 615 cf, Atten= 0%, Lag= 0.0 min
Primary = 0.19 cfs @ 12.06 hrs, Volume= 615 cf
Routed to Pond DMH1 : PROP. DMH-1

Routing by Dyn-Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Peak Elev= 113.21' @ 12.06 hrs
Flood Elev= 116.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	113.00'	**12.0" Round Culvert** L= 12.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 113.00' / 112.60' S= 0.0333 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=0.19 cfs @ 12.06 hrs HW=113.21' TW=112.74' (Dynamic Tailwater)
1=Culvert (Inlet Controls 0.19 cfs @ 1.57 fps)

Summary for Pond CB-5: PROP. CB-5

Inflow Area = 720 sf,100.00% Impervious, Inflow Depth = 2.86" for 2-YR event
Inflow = 0.06 cfs @ 12.00 hrs, Volume= 172 cf
Outflow = 0.06 cfs @ 12.00 hrs, Volume= 172 cf, Atten= 0%, Lag= 0.0 min
Primary = 0.06 cfs @ 12.00 hrs, Volume= 172 cf
Routed to Pond INF/DET : Underground Infiltration/Detention System

Routing by Dyn-Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Peak Elev= 112.61' @ 12.45 hrs
Flood Elev= 116.40'

Device	Routing	Invert	Outlet Devices
#1	Primary	112.20'	**12.0" Round Culvert** L= 22.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 112.20' / 112.00' S= 0.0091 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=0.06 cfs @ 12.00 hrs HW=112.32' TW=112.12' (Dynamic Tailwater)
1=Culvert (Outlet Controls 0.06 cfs @ 1.53 fps)

Summary for Pond DMH-3: PROP. DMH-3

Inflow Area = 141,926 sf, 19.62% Impervious, Inflow Depth = 0.19" for 2-YR event
Inflow = 0.46 cfs @ 12.18 hrs, Volume= 2,287 cf
Outflow = 0.46 cfs @ 12.18 hrs, Volume= 2,287 cf, Atten= 0%, Lag= 0.0 min
Primary = 0.46 cfs @ 12.18 hrs, Volume= 2,287 cf
Routed to Link DP1 : Design Point #1: Broadway (Rte. 28)

Routing by Dyn-Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Peak Elev= 111.01' @ 12.18 hrs
Flood Elev= 116.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	110.65'	**15.0" Round Culvert** L= 105.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 110.65' / 110.13' S= 0.0050 '/' Cc= 0.900 n= 0.013 Concrete pipe, bends & connections, Flow Area= 1.23 sf

Primary OutFlow Max=0.46 cfs @ 12.18 hrs HW=111.01' TW=0.00' (Dynamic Tailwater)
1=Culvert (Barrel Controls 0.46 cfs @ 2.32 fps)

Summary for Pond DMH1: PROP. DMH-1

Inflow Area = 27,888 sf, 28.71% Impervious, Inflow Depth = 0.83" for 2-YR event
Inflow = 0.59 cfs @ 12.06 hrs, Volume= 1,920 cf
Outflow = 0.59 cfs @ 12.06 hrs, Volume= 1,920 cf, Atten= 0%, Lag= 0.0 min
Primary = 0.59 cfs @ 12.06 hrs, Volume= 1,920 cf
Routed to Pond INF/DET : Underground Infiltration/Detention System

Routing by Dyn-Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Peak Elev= 112.74' @ 12.06 hrs
Flood Elev= 116.45'

Device	Routing	Invert	Outlet Devices
#1	Primary	112.35'	**12.0" Round Culvert** L= 14.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 112.35' / 112.10' S= 0.0179 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=0.59 cfs @ 12.06 hrs HW=112.74' TW=112.31' (Dynamic Tailwater)
1=Culvert (Inlet Controls 0.59 cfs @ 2.11 fps)

Summary for Pond INF/DET: Underground Infiltration/Detention System

Test pits indicated medium-coarse sand. Therefore, an infiltration rate of 8.27 in/hf (based on Rawl's Rates) is utilized for this system. This system is modeled as a combination of infiltration (SC-740 chambers) and detention (solid pipe, infiltration not allowed) with a 24" flat pipe connecting the two systems so that the storage is shared between both fields.

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[80] Warning: Exceeded Pond CB-5 by 0.01' @ 12.10 hrs (0.04 cfs 64 cf)

Inflow Area = 45,852 sf, 45.80% Impervious, Inflow Depth = 1.31" for 2-YR event
Inflow = 1.55 cfs @ 12.04 hrs, Volume= 5,015 cf
Outflow = 0.31 cfs @ 12.44 hrs, Volume= 5,015 cf, Atten= 80%, Lag= 24.3 min
Discarded = 0.31 cfs @ 12.44 hrs, Volume= 5,015 cf
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf
Routed to Pond DMH-3 : PROP. DMH-3

Routing by Dyn-Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Peak Elev= 112.61' @ 12.44 hrs Surf.Area= 1,406 sf Storage= 1,140 cf
Flood Elev= 115.00' Surf.Area= 1,406 sf Storage= 4,153 cf

Plug-Flow detention time= 18.8 min calculated for 5,015 cf (100% of inflow)
Center-of-Mass det. time= 18.8 min (773.6 - 754.9)

Volume	Invert	Avail.Storage	Storage Description
#1A	111.50'	1,380 cf	**20.50'W x 68.58'L x 3.50'H Field A** 4,920 cf Overall - 1,470 cf Embedded = 3,450 cf x 40.0% Voids
#2A	112.00'	1,470 cf	**ADS_StormTech SC-740 +Cap** x 32 Inside #1 Effective Size= 44.6"W x 30.0"H => 6.45 sf x 7.12'L = 45.9 cf Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap 32 Chambers in 4 Rows
#3B	112.00'	0 cf	**23.03'W x 54.67'L x 2.33'H Field B** -Impervious 2,938 cf Overall - 1,552 cf Embedded = 1,386 cf x 0.0% Voids
#4B	112.00'	1,228 cf	**ADS N-12 24"** x 7 Inside #3 Inside= 23.8"W x 23.8"H => 3.10 sf x 20.00'L = 62.0 cf Outside= 28.0"W x 28.0"H => 3.92 sf x 20.00'L = 78.4 cf Row Length Adjustment= +30.00' x 3.10 sf x 7 rows 23.03' Header x 3.10 sf x 2 = 142.8 cf Inside
#5	112.00'	75 cf	**24.0" Round Pipe Storage** -Impervious L= 24.0'
		4,153 cf	Total Available Storage

Storage Group A created with Chamber Wizard
Storage Group B created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	113.10'	**12.0" Round Culvert** L= 17.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 113.10' / 112.10' S= 0.0588 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 0.79 sf
#2	Device 1	114.75'	**12.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Device 1	113.60'	**4.0" Vert. Orifice/Grate X 2.00** C= 0.600 Limited to weir flow at low heads
#4	Device 1	113.10'	**3.0" Vert. Orifice/Grate X 4.00** C= 0.600 Limited to weir flow at low heads
#5	Discarded	111.50'	**8.270 in/hr Exfiltration over Wetted area** Phase-In= 0.01'

Discarded OutFlow Max=0.31 cfs @ 12.44 hrs HW=112.61' (Free Discharge)
└**5=Exfiltration** (Exfiltration Controls 0.31 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=111.50' TW=110.65' (Dynamic Tailwater)
└**1=Culvert** (Controls 0.00 cfs)
  ├**2=Orifice/Grate** (Controls 0.00 cfs)
  ├**3=Orifice/Grate** (Controls 0.00 cfs)
  └**4=Orifice/Grate** (Controls 0.00 cfs)

Summary for Pond SD-1: PROP. SD-1

Inflow Area = 720 sf,100.00% Impervious, Inflow Depth = 2.86" for 2-YR event
Inflow = 0.06 cfs @ 12.00 hrs, Volume= 172 cf
Outflow = 0.06 cfs @ 12.00 hrs, Volume= 172 cf, Atten= 0%, Lag= 0.0 min
Primary = 0.06 cfs @ 12.00 hrs, Volume= 172 cf
Routed to Pond CB-5 : PROP. CB-5

Routing by Dyn-Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Peak Elev= 112.65' @ 12.00 hrs
Flood Elev= 114.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	112.50'	**8.0" Round Culvert** L= 35.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 112.50' / 112.30' S= 0.0057 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 0.35 sf

Primary OutFlow Max=0.06 cfs @ 12.00 hrs HW=112.65' TW=112.32' (Dynamic Tailwater)
1=Culvert (Barrel Controls 0.06 cfs @ 1.52 fps)

Summary for Pond YD-1: PROP. YD-1

Inflow Area = 96,074 sf, 7.12% Impervious, Inflow Depth = 0.29" for 2-YR event
Inflow = 0.46 cfs @ 12.18 hrs, Volume= 2,287 cf
Outflow = 0.46 cfs @ 12.18 hrs, Volume= 2,287 cf, Atten= 0%, Lag= 0.0 min
Primary = 0.46 cfs @ 12.18 hrs, Volume= 2,287 cf
Routed to Pond DMH-3 : PROP. DMH-3

Routing by Dyn-Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Peak Elev= 111.24' @ 12.18 hrs
Flood Elev= 113.35'

Device	Routing	Invert	Outlet Devices
#1	Primary	110.85'	**12.0" Round Culvert** L= 14.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 110.85' / 110.75' S= 0.0071 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=0.46 cfs @ 12.18 hrs HW=111.24' TW=111.01' (Dynamic Tailwater)
1=Culvert (Barrel Controls 0.46 cfs @ 2.43 fps)

Summary for Link DP1: Design Point #1: Broadway (Rte. 28)

Inflow Area = 145,188 sf, 19.66% Impervious, Inflow Depth = 0.20" for 2-YR event
Inflow = 0.48 cfs @ 12.17 hrs, Volume= 2,452 cf
Primary = 0.48 cfs @ 12.17 hrs, Volume= 2,452 cf, 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-Q
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment1S: TO CB-1 Runoff Area=24,787 sf 21.88% Impervious Runoff Depth=1.04"
Flow Length=164' Tc=3.9 min CN=WQ Runoff=0.63 cfs 2,149 cf

Subcatchment2S: To CB-2 Runoff Area=10,744 sf 55.54% Impervious Runoff Depth=2.53"
Flow Length=80' Tc=2.6 min CN=WQ Runoff=0.71 cfs 2,269 cf

Subcatchment3S: To CB-3 Runoff Area=4,216 sf 95.42% Impervious Runoff Depth=4.28"
Flow Length=51' Tc=2.2 min CN=WQ Runoff=0.49 cfs 1,502 cf

Subcatchment4S: To CB-4 Runoff Area=3,101 sf 83.34% Impervious Runoff Depth=3.75"
Flow Length=74' Tc=4.0 min CN=WQ Runoff=0.29 cfs 970 cf

Subcatchment5S: Roof Runoff Area=2,284 sf 100.00% Impervious Runoff Depth=4.47"
Tc=0.0 min CN=98 Runoff=0.29 cfs 851 cf

Subcatchment6S: Subcat 6S Runoff Area=720 sf 100.00% Impervious Runoff Depth=4.47"
Tc=0.0 min CN=98 Runoff=0.09 cfs 269 cf

Subcatchment7S: Onsite direct to DP1 Runoff Area=1,725 sf 23.66% Impervious Runoff Depth=1.17"
Flow Length=19' Slope=0.0470 '/' Tc=1.9 min CN=WQ Runoff=0.05 cfs 168 cf

Subcatchment100S: Offiste and onsite to Runoff Area=96,074 sf 7.12% Impervious Runoff Depth=0.65"
Flow Length=625' Tc=12.2 min CN=WQ Runoff=1.05 cfs 5,223 cf

Subcatchment101S: Offsite and onsite Runoff Area=1,537 sf 18.56% Impervious Runoff Depth=0.92"
Flow Length=50' Slope=0.0100 '/' Tc=4.3 min CN=WQ Runoff=0.03 cfs 118 cf

Pond CB-1: PROP. CB-1 Peak Elev=113.54' Inflow=0.63 cfs 2,149 cf
12.0" Round Culvert n=0.012 L=96.0' S=0.0068 '/' Outflow=0.63 cfs 2,149 cf

Pond CB-2: PROP. CB-2 Peak Elev=113.21' Inflow=0.71 cfs 2,269 cf
12.0" Round Culvert n=0.012 L=34.0' S=0.0059 '/' Outflow=0.71 cfs 2,269 cf

Pond CB-3: PROP. CB-3 Peak Elev=113.21' Inflow=0.49 cfs 1,502 cf
12.0" Round Culvert n=0.012 L=38.0' S=0.0053 '/' Outflow=0.49 cfs 1,502 cf

Pond CB-4: PROP. CB-4 Peak Elev=113.27' Inflow=0.29 cfs 970 cf
12.0" Round Culvert n=0.012 L=12.0' S=0.0333 '/' Outflow=0.29 cfs 970 cf

Pond CB-5: PROP. CB-5 Peak Elev=113.20' Inflow=0.09 cfs 269 cf
12.0" Round Culvert n=0.012 L=22.0' S=0.0091 '/' Outflow=0.09 cfs 268 cf

Pond DMH-3: PROP. DMH-3 Peak Elev=111.21' Inflow=1.05 cfs 5,281 cf
15.0" Round Culvert n=0.013 L=105.0' S=0.0050 '/' Outflow=1.05 cfs 5,281 cf

Pond DMH1: PROP. DMH-1 Peak Elev=113.21' Inflow=0.92 cfs 3,119 cf
12.0" Round Culvert n=0.012 L=14.0' S=0.0179 '/' Outflow=0.92 cfs 3,119 cf

Pond INF/DET: Underground Peak Elev=113.21' Storage=2,215 cf Inflow=2.38 cfs 8,010 cf
Discarded=0.33 cfs 7,952 cf Primary=0.05 cfs 57 cf Outflow=0.38 cfs 8,010 cf

Pond SD-1: PROP. SD-1 Peak Elev=113.20' Inflow=0.09 cfs 269 cf
8.0" Round Culvert n=0.012 L=35.0' S=0.0057 '/' Outflow=0.09 cfs 269 cf

Pond YD-1: PROP. YD-1 Peak Elev=111.47' Inflow=1.05 cfs 5,223 cf
12.0" Round Culvert n=0.012 L=14.0' S=0.0071 '/' Outflow=1.05 cfs 5,223 cf

Link DP1: Design Point #1: Broadway (Rte. 28) Inflow=1.09 cfs 5,567 cf
Primary=1.09 cfs 5,567 cf

Total Runoff Area = 145,188 sf Runoff Volume = 13,519 cf Average Runoff Depth = 1.12"
80.34% Pervious = 116,650 sf 19.66% Impervious = 28,538 sf

Summary for Subcatchment 1S: TO CB-1

Runoff = 0.63 cfs @ 12.06 hrs, Volume= 2,149 cf, Depth= 1.04"
Routed to Pond CB-1 : PROP. CB-1

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-YR Rainfall=4.71"

Area (sf)	CN	Description
3,127	39	>75% Grass cover, Good, HSG A
2,346	30	Brush, Good, HSG A
2,229	48	Brush, Good, HSG B
5,280	98	Paved parking, HSG A
143	98	Roofs, HSG B
11,662	30	Woods, Good, HSG A
24,787		Weighted Average
19,364		78.12% Pervious Area
5,423		21.88% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.7	20	0.0700	0.20		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.09"
1.5	100	0.0500	1.12		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
0.7	44	0.0200	0.99		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
3.9	164	Total			

Summary for Subcatchment 2S: To CB-2

Runoff = 0.71 cfs @ 12.04 hrs, Volume= 2,269 cf, Depth= 2.53"
Routed to Pond CB-2 : PROP. CB-2

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-YR Rainfall=4.71"

Area (sf)	CN	Description
3,624	39	>75% Grass cover, Good, HSG A
1,153	30	Brush, Good, HSG A
5,967	98	Paved parking, HSG A
10,744		Weighted Average
4,777		44.46% Pervious Area
5,967		55.54% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.1	10	0.0100	0.08		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.09"
0.5	70	0.0150	2.49		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
2.6	80	Total			

Summary for Subcatchment 3S: To CB-3

Runoff = 0.49 cfs @ 12.03 hrs, Volume= 1,502 cf, Depth= 4.28"
Routed to Pond CB-3 : PROP. CB-3

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-YR Rainfall=4.71"

Area (sf)	CN	Description
193	39	>75% Grass cover, Good, HSG A
4,023	98	Paved parking, HSG A
4,216		Weighted Average
193		4.58% Pervious Area
4,023		95.42% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.0	18	0.0350	0.15		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.09"
0.2	33	0.0200	2.87		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
2.2	51	Total			

Summary for Subcatchment 4S: To CB-4

Runoff = 0.29 cfs @ 12.06 hrs, Volume= 970 cf, Depth= 3.75"
Routed to Pond CB-4 : PROP. CB-4

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-YR Rainfall=4.71"

Area (sf)	CN	Description
517	39	>75% Grass cover, Good, HSG A
2,584	98	Paved parking, HSG A
3,101		Weighted Average
517		16.66% Pervious Area
2,584		83.34% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.6	20	0.0100	0.09		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.09"
0.4	54	0.0120	2.22		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
4.0	74	Total			

Summary for Subcatchment 5S: Roof

[46] Hint: Tc=0 (Instant runoff peak depends on dt)

Runoff = 0.29 cfs @ 12.00 hrs, Volume= 851 cf, Depth= 4.47"
Routed to Pond INF/DET : Underground Infiltration/Detention System

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-YR Rainfall=4.71"

Area (sf)	CN	Description
2,284	98	Roofs, HSG A
2,284		100.00% Impervious Area

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

Summary for Subcatchment 6S: Subcat 6S

[46] Hint: Tc=0 (Instant runoff peak depends on dt)

Runoff = 0.09 cfs @ 12.00 hrs, Volume= 269 cf, Depth= 4.47"
Routed to Pond SD-1 : PROP. SD-1

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-YR Rainfall=4.71"

Area (sf)	CN	Description
720	98	Paved parking, HSG A
720		100.00% Impervious Area

Summary for Subcatchment 7S: Onsite direct to DP1

Runoff = 0.05 cfs @ 12.03 hrs, Volume= 168 cf, Depth= 1.17"
Routed to Link DP1 : Design Point #1: Broadway (Rte. 28)

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-YR Rainfall=4.71"

Area (sf)	CN	Description
1,316	39	>75% Grass cover, Good, HSG A
1	30	Brush, Good, HSG A
408	98	Paved parking, HSG A
1,725		Weighted Average
1,317		76.34% Pervious Area
408		23.66% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.9	19	0.0470	0.17		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.09"

Summary for Subcatchment 100S: Offiste and onsite to YD-1

Runoff = 1.05 cfs @ 12.17 hrs, Volume= 5,223 cf, Depth= 0.65"
Routed to Pond YD-1 : PROP. YD-1

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-YR Rainfall=4.71"

Area (sf)	CN	Description
49,895	39	>75% Grass cover, Good, HSG A
16,207	61	>75% Grass cover, Good, HSG B
2,339	98	Roofs, HSG A
4,504	98	Roofs, HSG B
16,706	30	Woods, Good, HSG A
6,423	55	Woods, Good, HSG B
96,074		Weighted Average
89,231		92.88% Pervious Area
6,843		7.12% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.5	25	0.0400	0.17		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.09"
0.7	65	0.0480	1.53		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
1.9	122	0.0470	1.08		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
1.5	135	0.0470	1.52		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.6	38	0.0470	1.08		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
3.9	165	0.0100	0.70		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
1.1	75	0.0260	1.13		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
12.2	625	Total			

Summary for Subcatchment 101S: Offsite and onsite direct to DP1

Runoff = 0.03 cfs @ 12.06 hrs, Volume= 118 cf, Depth= 0.92"
Routed to Link DP1 : Design Point #1: Broadway (Rte. 28)

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-YR Rainfall=4.71"

Area (sf)	CN	Description
1,000	39	>75% Grass cover, Good, HSG A
285	98	Paved parking, HSG A
252	30	Woods, Good, HSG A
1,537		Weighted Average
1,252		81.44% Pervious Area
285		18.56% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.6	20	0.0100	0.09		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.09"
0.7	30	0.0100	0.70		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
4.3	50	Total			

Summary for Pond CB-1: PROP. CB-1

Inflow Area = 24,787 sf, 21.88% Impervious, Inflow Depth = 1.04" for 10-YR event
Inflow = 0.63 cfs @ 12.06 hrs, Volume= 2,149 cf
Outflow = 0.63 cfs @ 12.06 hrs, Volume= 2,149 cf, Atten= 0%, Lag= 0.0 min
Primary = 0.63 cfs @ 12.06 hrs, Volume= 2,149 cf
Routed to Pond DMH1 : PROP. DMH-1

Routing by Dyn-Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Peak Elev= 113.54' @ 12.06 hrs
Flood Elev= 116.10'

Device	Routing	Invert	Outlet Devices
#1	Primary	113.10'	**12.0" Round Culvert** L= 96.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 113.10' / 112.45' S= 0.0068 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=0.62 cfs @ 12.06 hrs HW=113.54' TW=112.90' (Dynamic Tailwater)
↑—**1=Culvert** (Outlet Controls 0.62 cfs @ 2.75 fps)

Summary for Pond CB-2: PROP. CB-2

First Defense unit

Inflow Area = 10,744 sf, 55.54% Impervious, Inflow Depth = 2.53" for 10-YR event
Inflow = 0.71 cfs @ 12.04 hrs, Volume= 2,269 cf
Outflow = 0.71 cfs @ 12.04 hrs, Volume= 2,269 cf, Atten= 0%, Lag= 0.0 min
Primary = 0.71 cfs @ 12.04 hrs, Volume= 2,269 cf
Routed to Pond INF/DET : Underground Infiltration/Detention System

Routing by Dyn-Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Peak Elev= 113.21' @ 12.50 hrs
Flood Elev= 115.15'

Device	Routing	Invert	Outlet Devices
#1	Primary	112.20'	**12.0" Round Culvert** L= 34.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 112.20' / 112.00' S= 0.0059 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=0.63 cfs @ 12.04 hrs HW=112.76' TW=112.59' (Dynamic Tailwater)
↑—**1=Culvert** (Outlet Controls 0.63 cfs @ 2.03 fps)

Summary for Pond CB-3: PROP. CB-3

First Defense unit

Inflow Area = 4,216 sf, 95.42% Impervious, Inflow Depth = 4.28" for 10-YR event
Inflow = 0.49 cfs @ 12.03 hrs, Volume= 1,502 cf
Outflow = 0.49 cfs @ 12.03 hrs, Volume= 1,502 cf, Atten= 0%, Lag= 0.0 min
Primary = 0.49 cfs @ 12.03 hrs, Volume= 1,502 cf
Routed to Pond INF/DET : Underground Infiltration/Detention System

Routing by Dyn-Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Peak Elev= 113.21' @ 12.50 hrs
Flood Elev= 115.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	112.20'	**12.0" Round Culvert** L= 38.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 112.20' / 112.00' S= 0.0053 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=0.42 cfs @ 12.03 hrs HW=112.69' TW=112.57' (Dynamic Tailwater)
↑—**1=Culvert** (Outlet Controls 0.42 cfs @ 1.61 fps)

Summary for Pond CB-4: PROP. CB-4

Inflow Area = 3,101 sf, 83.34% Impervious, Inflow Depth = 3.75" for 10-YR event
Inflow = 0.29 cfs @ 12.06 hrs, Volume= 970 cf
Outflow = 0.29 cfs @ 12.06 hrs, Volume= 970 cf, Atten= 0%, Lag= 0.0 min
Primary = 0.29 cfs @ 12.06 hrs, Volume= 970 cf
Routed to Pond DMH1 : PROP. DMH-1

Routing by Dyn-Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Peak Elev= 113.27' @ 12.06 hrs
Flood Elev= 116.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	113.00'	**12.0" Round Culvert** L= 12.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 113.00' / 112.60' S= 0.0333 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=0.29 cfs @ 12.06 hrs HW=113.27' TW=112.90' (Dynamic Tailwater)
↑—**1=Culvert** (Inlet Controls 0.29 cfs @ 1.75 fps)

Summary for Pond CB-5: PROP. CB-5

[87] Warning: Oscillations may require smaller dt or Finer Routing (severity=569)
[80] Warning: Exceeded Pond SD-1 by 0.02' @ 12.11 hrs (0.08 cfs 228 cf)

Inflow Area = 720 sf,100.00% Impervious, Inflow Depth = 4.47" for 10-YR event
Inflow = 0.09 cfs @ 12.00 hrs, Volume= 269 cf
Outflow = 0.09 cfs @ 12.00 hrs, Volume= 268 cf, Atten= 0%, Lag= 0.0 min
Primary = 0.09 cfs @ 12.00 hrs, Volume= 268 cf
Routed to Pond INF/DET : Underground Infiltration/Detention System

Routing by Dyn-Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Peak Elev= 113.20' @ 12.50 hrs
Flood Elev= 116.40'

Device	Routing	Invert	Outlet Devices
#1	Primary	112.20'	**12.0" Round Culvert** L= 22.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 112.20' / 112.00' S= 0.0091 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=0.03 cfs @ 12.00 hrs HW=112.44' TW=112.44' (Dynamic Tailwater)
↑—**1=Culvert** (Outlet Controls 0.03 cfs @ 0.35 fps)

Summary for Pond DMH-3: PROP. DMH-3

Inflow Area = 141,926 sf, 19.62% Impervious, Inflow Depth = 0.45" for 10-YR event
Inflow = 1.05 cfs @ 12.17 hrs, Volume= 5,281 cf
Outflow = 1.05 cfs @ 12.17 hrs, Volume= 5,281 cf, Atten= 0%, Lag= 0.0 min
Primary = 1.05 cfs @ 12.17 hrs, Volume= 5,281 cf
Routed to Link DP1 : Design Point #1: Broadway (Rte. 28)

Routing by Dyn-Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Peak Elev= 111.21' @ 12.17 hrs
Flood Elev= 116.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	110.65'	**15.0" Round Culvert** L= 105.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 110.65' / 110.13' S= 0.0050 '/' Cc= 0.900 n= 0.013 Concrete pipe, bends & connections, Flow Area= 1.23 sf

Primary OutFlow Max=1.05 cfs @ 12.17 hrs HW=111.21' TW=0.00' (Dynamic Tailwater)
1=Culvert (Barrel Controls 1.05 cfs @ 2.89 fps)

Summary for Pond DMH1: PROP. DMH-1

Inflow Area = 27,888 sf, 28.71% Impervious, Inflow Depth = 1.34" for 10-YR event
Inflow = 0.92 cfs @ 12.06 hrs, Volume= 3,119 cf
Outflow = 0.92 cfs @ 12.06 hrs, Volume= 3,119 cf, Atten= 0%, Lag= 0.0 min
Primary = 0.92 cfs @ 12.06 hrs, Volume= 3,119 cf
Routed to Pond INF/DET : Underground Infiltration/Detention System

Routing by Dyn-Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Peak Elev= 113.21' @ 12.50 hrs
Flood Elev= 116.45'

Device	Routing	Invert	Outlet Devices
#1	Primary	112.35'	**12.0" Round Culvert** L= 14.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 112.35' / 112.10' S= 0.0179 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=0.84 cfs @ 12.06 hrs HW=112.90' TW=112.68' (Dynamic Tailwater)
1=Culvert (Outlet Controls 0.84 cfs @ 2.74 fps)

Summary for Pond INF/DET: Underground Infiltration/Detention System

Test pits indicated medium-coarse sand. Therefore, an infiltration rate of 8.27 in/hf (based on Rawl's Rates) is utilized for this system. This system is modeled as a combination of infiltration (SC-740 chambers) and detention (solid pipe, infiltration not allowed) with a 24" flat pipe connecting the two systems so that the storage is shared between both fields.

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[80] Warning: Exceeded Pond CB-3 by 0.01' @ 12.14 hrs (0.22 cfs 288 cf)

[80] Warning: Exceeded Pond CB-5 by 0.32' @ 14.60 hrs (0.37 cfs 1,482 cf)

Inflow Area = 45,852 sf, 45.80% Impervious, Inflow Depth = 2.10" for 10-YR event
Inflow = 2.38 cfs @ 12.04 hrs, Volume= 8,010 cf
Outflow = 0.38 cfs @ 12.49 hrs, Volume= 8,010 cf, Atten= 84%, Lag= 27.3 min
Discarded = 0.33 cfs @ 12.49 hrs, Volume= 7,952 cf
Primary = 0.05 cfs @ 12.49 hrs, Volume= 57 cf
Routed to Pond DMH-3 : PROP. DMH-3

Routing by Dyn-Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Peak Elev= 113.21' @ 12.49 hrs Surf.Area= 1,406 sf Storage= 2,215 cf
Flood Elev= 115.00' Surf.Area= 1,406 sf Storage= 4,153 cf

Plug-Flow detention time= 39.3 min calculated for 8,007 cf (100% of inflow)
Center-of-Mass det. time= 39.3 min (790.5 - 751.3)

Volume	Invert	Avail.Storage	Storage Description
#1A	111.50'	1,380 cf	**20.50'W x 68.58'L x 3.50'H Field A** 4,920 cf Overall - 1,470 cf Embedded = 3,450 cf x 40.0% Voids
#2A	112.00'	1,470 cf	**ADS_StormTech SC-740 +Cap** x 32 Inside #1 Effective Size= 44.6"W x 30.0"H => 6.45 sf x 7.12'L = 45.9 cf Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap 32 Chambers in 4 Rows
#3B	112.00'	0 cf	**23.03'W x 54.67'L x 2.33'H Field B** Impervious 2,938 cf Overall - 1,552 cf Embedded = 1,386 cf x 0.0% Voids
#4B	112.00'	1,228 cf	**ADS N-12 24"** x 7 Inside #3 Inside= 23.8"W x 23.8"H => 3.10 sf x 20.00'L = 62.0 cf Outside= 28.0"W x 28.0"H => 3.92 sf x 20.00'L = 78.4 cf Row Length Adjustment= +30.00' x 3.10 sf x 7 rows 23.03' Header x 3.10 sf x 2 = 142.8 cf Inside
#5	112.00'	75 cf	**24.0" Round Pipe Storage** Impervious L= 24.0'
		4,153 cf	Total Available Storage

Storage Group A created with Chamber Wizard
Storage Group B created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	113.10'	**12.0" Round Culvert** L= 17.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 113.10' / 112.10' S= 0.0588 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 0.79 sf
#2	Device 1	114.75'	**12.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Device 1	113.60'	**4.0" Vert. Orifice/Grate X 2.00** C= 0.600 Limited to weir flow at low heads
#4	Device 1	113.10'	**3.0" Vert. Orifice/Grate X 4.00** C= 0.600 Limited to weir flow at low heads
#5	Discarded	111.50'	**8.270 in/hr Exfiltration over Wetted area** Phase-In= 0.01'

Discarded OutFlow Max=0.33 cfs @ 12.49 hrs HW=113.21' (Free Discharge)
└**5=Exfiltration** (Exfiltration Controls 0.33 cfs)

Primary OutFlow Max=0.05 cfs @ 12.49 hrs HW=113.21' TW=111.04' (Dynamic Tailwater)
└**1=Culvert** (Inlet Controls 0.05 cfs @ 1.11 fps)
  ├**2=Orifice/Grate** (Controls 0.00 cfs)
  ├**3=Orifice/Grate** (Controls 0.00 cfs)
  └**4=Orifice/Grate** (Passes 0.05 cfs of 0.09 cfs potential flow)

Summary for Pond SD-1: PROP. SD-1

Inflow Area = 720 sf,100.00% Impervious, Inflow Depth = 4.47" for 10-YR event
Inflow = 0.09 cfs @ 12.00 hrs, Volume= 269 cf
Outflow = 0.09 cfs @ 12.00 hrs, Volume= 269 cf, Atten= 0%, Lag= 0.0 min
Primary = 0.09 cfs @ 12.00 hrs, Volume= 269 cf
Routed to Pond CB-5 : PROP. CB-5

Routing by Dyn-Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Peak Elev= 113.20' @ 12.51 hrs
Flood Elev= 114.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	112.50'	**8.0" Round Culvert** L= 35.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 112.50' / 112.30' S= 0.0057 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 0.35 sf

Primary OutFlow Max=0.09 cfs @ 12.00 hrs HW=112.69' TW=112.44' (Dynamic Tailwater)
└**1=Culvert** (Outlet Controls 0.09 cfs @ 1.70 fps)

Summary for Pond YD-1: PROP. YD-1

Inflow Area = 96,074 sf, 7.12% Impervious, Inflow Depth = 0.65" for 10-YR event
Inflow = 1.05 cfs @ 12.17 hrs, Volume= 5,223 cf
Outflow = 1.05 cfs @ 12.17 hrs, Volume= 5,223 cf, Atten= 0%, Lag= 0.0 min
Primary = 1.05 cfs @ 12.17 hrs, Volume= 5,223 cf
Routed to Pond DMH-3 : PROP. DMH-3

Routing by Dyn-Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Peak Elev= 111.47' @ 12.17 hrs
Flood Elev= 113.35'

Device	Routing	Invert	Outlet Devices
#1	Primary	110.85'	**12.0" Round Culvert** L= 14.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 110.85' / 110.75' S= 0.0071 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=1.05 cfs @ 12.17 hrs HW=111.47' TW=111.21' (Dynamic Tailwater)
↑—**1=Culvert** (Barrel Controls 1.05 cfs @ 2.94 fps)

Summary for Link DP1: Design Point #1: Broadway (Rte. 28)

Inflow Area = 145,188 sf, 19.66% Impervious, Inflow Depth = 0.46" for 10-YR event
Inflow = 1.09 cfs @ 12.17 hrs, Volume= 5,567 cf
Primary = 1.09 cfs @ 12.17 hrs, Volume= 5,567 cf, 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-Q
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment1S: TO CB-1 Runoff Area=24,787 sf 21.88% Impervious Runoff Depth=1.44"
Flow Length=164' Tc=3.9 min CN=WQ Runoff=0.83 cfs 2,983 cf

Subcatchment2S: To CB-2 Runoff Area=10,744 sf 55.54% Impervious Runoff Depth=3.35"
Flow Length=80' Tc=2.6 min CN=WQ Runoff=0.91 cfs 3,001 cf

Subcatchment3S: To CB-3 Runoff Area=4,216 sf 95.42% Impervious Runoff Depth=5.51"
Flow Length=51' Tc=2.2 min CN=WQ Runoff=0.62 cfs 1,935 cf

Subcatchment4S: To CB-4 Runoff Area=3,101 sf 83.34% Impervious Runoff Depth=4.87"
Flow Length=74' Tc=4.0 min CN=WQ Runoff=0.37 cfs 1,258 cf

Subcatchment5S: Roof Runoff Area=2,284 sf 100.00% Impervious Runoff Depth=5.75"
Tc=0.0 min CN=98 Runoff=0.38 cfs 1,095 cf

Subcatchment6S: Subcat 6S Runoff Area=720 sf 100.00% Impervious Runoff Depth=5.75"
Tc=0.0 min CN=98 Runoff=0.12 cfs 345 cf

Subcatchment7S: Onsite direct to DP1 Runoff Area=1,725 sf 23.66% Impervious Runoff Depth=1.70"
Flow Length=19' Slope=0.0470 '/' Tc=1.9 min CN=WQ Runoff=0.06 cfs 244 cf

Subcatchment100S: Offiste and onsite to Runoff Area=96,074 sf 7.12% Impervious Runoff Depth=1.09"
Flow Length=625' Tc=12.2 min CN=WQ Runoff=1.66 cfs 8,728 cf

Subcatchment101S: Offsite and onsite Runoff Area=1,537 sf 18.56% Impervious Runoff Depth=1.37"
Flow Length=50' Slope=0.0100 '/' Tc=4.3 min CN=WQ Runoff=0.04 cfs 175 cf

Pond CB-1: PROP. CB-1 Peak Elev=113.64' Inflow=0.83 cfs 2,983 cf
12.0" Round Culvert n=0.012 L=96.0' S=0.0068 '/' Outflow=0.83 cfs 2,983 cf

Pond CB-2: PROP. CB-2 Peak Elev=113.49' Inflow=0.91 cfs 3,001 cf
12.0" Round Culvert n=0.012 L=34.0' S=0.0059 '/' Outflow=0.91 cfs 3,001 cf

Pond CB-3: PROP. CB-3 Peak Elev=113.49' Inflow=0.62 cfs 1,935 cf
12.0" Round Culvert n=0.012 L=38.0' S=0.0053 '/' Outflow=0.62 cfs 1,935 cf

Pond CB-4: PROP. CB-4 Peak Elev=113.50' Inflow=0.37 cfs 1,258 cf
12.0" Round Culvert n=0.012 L=12.0' S=0.0333 '/' Outflow=0.37 cfs 1,258 cf

Pond CB-5: PROP. CB-5 Peak Elev=113.49' Inflow=0.12 cfs 345 cf
12.0" Round Culvert n=0.012 L=22.0' S=0.0091 '/' Outflow=0.12 cfs 345 cf

Pond DMH-3: PROP. DMH-3 Peak Elev=111.46' Inflow=2.01 cfs 9,715 cf
15.0" Round Culvert n=0.013 L=105.0' S=0.0050 '/' Outflow=2.01 cfs 9,715 cf

Pond DMH1: PROP. DMH-1 Peak Elev=113.50' Inflow=1.21 cfs 4,240 cf
12.0" Round Culvert n=0.012 L=14.0' S=0.0179 '/' Outflow=1.21 cfs 4,240 cf

Pond INF/DET: Underground Peak Elev=113.49' Storage=2,717 cf Inflow=3.07 cfs 10,616 cf
Discarded=0.34 cfs 9,629 cf Primary=0.49 cfs 987 cf Outflow=0.82 cfs 10,616 cf

Pond SD-1: PROP. SD-1 Peak Elev=113.49' Inflow=0.12 cfs 345 cf
8.0" Round Culvert n=0.012 L=35.0' S=0.0057 '/' Outflow=0.12 cfs 345 cf

Pond YD-1: PROP. YD-1 Peak Elev=111.71' Inflow=1.66 cfs 8,728 cf
12.0" Round Culvert n=0.012 L=14.0' S=0.0071 '/' Outflow=1.66 cfs 8,728 cf

Link DP1: Design Point #1: Broadway (Rte. 28) Inflow=2.06 cfs 10,134 cf
Primary=2.06 cfs 10,134 cf

Total Runoff Area = 145,188 sf Runoff Volume = 19,764 cf Average Runoff Depth = 1.63"
80.34% Pervious = 116,650 sf 19.66% Impervious = 28,538 sf

Summary for Subcatchment 1S: TO CB-1

Runoff = 0.83 cfs @ 12.06 hrs, Volume= 2,983 cf, Depth= 1.44"
Routed to Pond CB-1 : PROP. CB-1

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-YR Rainfall=5.99"

Area (sf)	CN	Description
3,127	39	>75% Grass cover, Good, HSG A
2,346	30	Brush, Good, HSG A
2,229	48	Brush, Good, HSG B
5,280	98	Paved parking, HSG A
143	98	Roofs, HSG B
11,662	30	Woods, Good, HSG A
24,787		Weighted Average
19,364		78.12% Pervious Area
5,423		21.88% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.7	20	0.0700	0.20		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.09"
1.5	100	0.0500	1.12		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
0.7	44	0.0200	0.99		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
3.9	164	Total			

Summary for Subcatchment 2S: To CB-2

Runoff = 0.91 cfs @ 12.04 hrs, Volume= 3,001 cf, Depth= 3.35"
Routed to Pond CB-2 : PROP. CB-2

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-YR Rainfall=5.99"

Area (sf)	CN	Description
3,624	39	>75% Grass cover, Good, HSG A
1,153	30	Brush, Good, HSG A
5,967	98	Paved parking, HSG A
10,744		Weighted Average
4,777		44.46% Pervious Area
5,967		55.54% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.1	10	0.0100	0.08		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.09"
0.5	70	0.0150	2.49		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
2.6	80	Total			

Summary for Subcatchment 3S: To CB-3

Runoff = 0.62 cfs @ 12.03 hrs, Volume= 1,935 cf, Depth= 5.51"
Routed to Pond CB-3 : PROP. CB-3

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-YR Rainfall=5.99"

Area (sf)	CN	Description
193	39	>75% Grass cover, Good, HSG A
4,023	98	Paved parking, HSG A
4,216		Weighted Average
193		4.58% Pervious Area
4,023		95.42% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.0	18	0.0350	0.15		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.09"
0.2	33	0.0200	2.87		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
2.2	51	Total			

Summary for Subcatchment 4S: To CB-4

Runoff = 0.37 cfs @ 12.06 hrs, Volume= 1,258 cf, Depth= 4.87"
Routed to Pond CB-4 : PROP. CB-4

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-YR Rainfall=5.99"

Area (sf)	CN	Description
517	39	>75% Grass cover, Good, HSG A
2,584	98	Paved parking, HSG A
3,101		Weighted Average
517		16.66% Pervious Area
2,584		83.34% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.6	20	0.0100	0.09		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.09"
0.4	54	0.0120	2.22		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
4.0	74	Total			

Summary for Subcatchment 5S: Roof

[46] Hint: Tc=0 (Instant runoff peak depends on dt)

Runoff = 0.38 cfs @ 12.00 hrs, Volume= 1,095 cf, Depth= 5.75"
Routed to Pond INF/DET : Underground Infiltration/Detention System

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-YR Rainfall=5.99"

Area (sf)	CN	Description
2,284	98	Roofs, HSG A
2,284		100.00% Impervious Area

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

Summary for Subcatchment 6S: Subcat 6S

[46] Hint: Tc=0 (Instant runoff peak depends on dt)

Runoff = 0.12 cfs @ 12.00 hrs, Volume= 345 cf, Depth= 5.75"
Routed to Pond SD-1 : PROP. SD-1

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-YR Rainfall=5.99"

Area (sf)	CN	Description
720	98	Paved parking, HSG A
720		100.00% Impervious Area

Summary for Subcatchment 7S: Onsite direct to DP1

Runoff = 0.06 cfs @ 12.03 hrs, Volume= 244 cf, Depth= 1.70"
Routed to Link DP1 : Design Point #1: Broadway (Rte. 28)

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-YR Rainfall=5.99"

Area (sf)	CN	Description
1,316	39	>75% Grass cover, Good, HSG A
1	30	Brush, Good, HSG A
408	98	Paved parking, HSG A
1,725		Weighted Average
1,317		76.34% Pervious Area
408		23.66% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.9	19	0.0470	0.17		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.09"

Summary for Subcatchment 100S: Offiste and onsite to YD-1

Runoff = 1.66 cfs @ 12.18 hrs, Volume= 8,728 cf, Depth= 1.09"
Routed to Pond YD-1 : PROP. YD-1

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-YR Rainfall=5.99"

Area (sf)	CN	Description
49,895	39	>75% Grass cover, Good, HSG A
16,207	61	>75% Grass cover, Good, HSG B
2,339	98	Roofs, HSG A
4,504	98	Roofs, HSG B
16,706	30	Woods, Good, HSG A
6,423	55	Woods, Good, HSG B
96,074		Weighted Average
89,231		92.88% Pervious Area
6,843		7.12% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.5	25	0.0400	0.17		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.09"
0.7	65	0.0480	1.53		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
1.9	122	0.0470	1.08		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
1.5	135	0.0470	1.52		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.6	38	0.0470	1.08		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
3.9	165	0.0100	0.70		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
1.1	75	0.0260	1.13		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
12.2	625	Total			

Summary for Subcatchment 101S: Offsite and onsite direct to DP1

Runoff = 0.04 cfs @ 12.06 hrs, Volume= 175 cf, Depth= 1.37"
Routed to Link DP1 : Design Point #1: Broadway (Rte. 28)

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-YR Rainfall=5.99"

Area (sf)	CN	Description
1,000	39	>75% Grass cover, Good, HSG A
285	98	Paved parking, HSG A
252	30	Woods, Good, HSG A
1,537		Weighted Average
1,252		81.44% Pervious Area
285		18.56% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.6	20	0.0100	0.09		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.09"
0.7	30	0.0100	0.70		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
4.3	50	Total			

Summary for Pond CB-1: PROP. CB-1

Inflow Area = 24,787 sf, 21.88% Impervious, Inflow Depth = 1.44" for 25-YR event
Inflow = 0.83 cfs @ 12.06 hrs, Volume= 2,983 cf
Outflow = 0.83 cfs @ 12.06 hrs, Volume= 2,983 cf, Atten= 0%, Lag= 0.0 min
Primary = 0.83 cfs @ 12.06 hrs, Volume= 2,983 cf
Routed to Pond DMH1 : PROP. DMH-1

Routing by Dyn-Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Peak Elev= 113.64' @ 12.07 hrs
Flood Elev= 116.10'

Device	Routing	Invert	Outlet Devices
#1	Primary	113.10'	**12.0" Round Culvert** L= 96.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 113.10' / 112.45' S= 0.0068 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=0.80 cfs @ 12.06 hrs HW=113.64' TW=113.11' (Dynamic Tailwater)
↑—**1=Culvert** (Outlet Controls 0.80 cfs @ 2.71 fps)

Summary for Pond CB-2: PROP. CB-2

First Defense unit

Inflow Area = 10,744 sf, 55.54% Impervious, Inflow Depth = 3.35" for 25-YR event
Inflow = 0.91 cfs @ 12.04 hrs, Volume= 3,001 cf
Outflow = 0.91 cfs @ 12.04 hrs, Volume= 3,001 cf, Atten= 0%, Lag= 0.0 min
Primary = 0.91 cfs @ 12.04 hrs, Volume= 3,001 cf
Routed to Pond INF/DET : Underground Infiltration/Detention System

Routing by Dyn-Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Peak Elev= 113.49' @ 12.38 hrs
Flood Elev= 115.15'

Device	Routing	Invert	Outlet Devices
#1	Primary	112.20'	**12.0" Round Culvert** L= 34.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 112.20' / 112.00' S= 0.0059 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=0.71 cfs @ 12.04 hrs HW=112.95' TW=112.87' (Dynamic Tailwater)
↑—**1=Culvert** (Outlet Controls 0.71 cfs @ 1.55 fps)

Summary for Pond CB-3: PROP. CB-3

First Defense unit

Inflow Area = 4,216 sf, 95.42% Impervious, Inflow Depth = 5.51" for 25-YR event
Inflow = 0.62 cfs @ 12.03 hrs, Volume= 1,935 cf
Outflow = 0.62 cfs @ 12.03 hrs, Volume= 1,935 cf, Atten= 0%, Lag= 0.0 min
Primary = 0.62 cfs @ 12.03 hrs, Volume= 1,935 cf
Routed to Pond INF/DET : Underground Infiltration/Detention System

Routing by Dyn-Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Peak Elev= 113.49' @ 12.38 hrs
Flood Elev= 115.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	112.20'	**12.0" Round Culvert** L= 38.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 112.20' / 112.00' S= 0.0053 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=0.41 cfs @ 12.03 hrs HW=112.88' TW=112.83' (Dynamic Tailwater)
↑—**1=Culvert** (Outlet Controls 0.41 cfs @ 1.02 fps)

Summary for Pond CB-4: PROP. CB-4

Inflow Area = 3,101 sf, 83.34% Impervious, Inflow Depth = 4.87" for 25-YR event
Inflow = 0.37 cfs @ 12.06 hrs, Volume= 1,258 cf
Outflow = 0.37 cfs @ 12.06 hrs, Volume= 1,258 cf, Atten= 0%, Lag= 0.0 min
Primary = 0.37 cfs @ 12.06 hrs, Volume= 1,258 cf
Routed to Pond DMH1 : PROP. DMH-1

Routing by Dyn-Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Peak Elev= 113.50' @ 12.38 hrs
Flood Elev= 116.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	113.00'	**12.0" Round Culvert** L= 12.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 113.00' / 112.60' S= 0.0333 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=0.35 cfs @ 12.06 hrs HW=113.31' TW=113.11' (Dynamic Tailwater)
1=Culvert (Outlet Controls 0.35 cfs @ 2.44 fps)

Summary for Pond CB-5: PROP. CB-5

[87] Warning: Oscillations may require smaller dt or Finer Routing (severity=557)
[80] Warning: Exceeded Pond SD-1 by 0.71' @ 12.88 hrs (0.97 cfs 925 cf)

Inflow Area = 720 sf,100.00% Impervious, Inflow Depth = 5.75" for 25-YR event
Inflow = 0.12 cfs @ 12.00 hrs, Volume= 345 cf
Outflow = 0.12 cfs @ 12.00 hrs, Volume= 345 cf, Atten= 0%, Lag= 0.0 min
Primary = 0.12 cfs @ 12.00 hrs, Volume= 345 cf
Routed to Pond INF/DET : Underground Infiltration/Detention System

Routing by Dyn-Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Peak Elev= 113.49' @ 12.38 hrs
Flood Elev= 116.40'

Device	Routing	Invert	Outlet Devices
#1	Primary	112.20'	**12.0" Round Culvert** L= 22.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 112.20' / 112.00' S= 0.0091 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=0.00 cfs @ 12.00 hrs HW=112.64' TW=112.67' (Dynamic Tailwater)
1=Culvert (Controls 0.00 cfs)

Summary for Pond DMH-3: PROP. DMH-3

Inflow Area = 141,926 sf, 19.62% Impervious, Inflow Depth = 0.82" for 25-YR event
Inflow = 2.01 cfs @ 12.21 hrs, Volume= 9,715 cf
Outflow = 2.01 cfs @ 12.21 hrs, Volume= 9,715 cf, Atten= 0%, Lag= 0.0 min
Primary = 2.01 cfs @ 12.21 hrs, Volume= 9,715 cf
Routed to Link DP1 : Design Point #1: Broadway (Rte. 28)

Routing by Dyn-Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Peak Elev= 111.46' @ 12.21 hrs
Flood Elev= 116.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	110.65'	**15.0" Round Culvert** L= 105.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 110.65' / 110.13' S= 0.0050 '/' Cc= 0.900 n= 0.013 Concrete pipe, bends & connections, Flow Area= 1.23 sf

Primary OutFlow Max=2.01 cfs @ 12.21 hrs HW=111.46' TW=0.00' (Dynamic Tailwater)
1=Culvert (Barrel Controls 2.01 cfs @ 3.40 fps)

Summary for Pond DMH1: PROP. DMH-1

Inflow Area = 27,888 sf, 28.71% Impervious, Inflow Depth = 1.82" for 25-YR event
Inflow = 1.21 cfs @ 12.06 hrs, Volume= 4,240 cf
Outflow = 1.21 cfs @ 12.06 hrs, Volume= 4,240 cf, Atten= 0%, Lag= 0.0 min
Primary = 1.21 cfs @ 12.06 hrs, Volume= 4,240 cf
Routed to Pond INF/DET : Underground Infiltration/Detention System

Routing by Dyn-Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Peak Elev= 113.50' @ 12.38 hrs
Flood Elev= 116.45'

Device	Routing	Invert	Outlet Devices
#1	Primary	112.35'	**12.0" Round Culvert** L= 14.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 112.35' / 112.10' S= 0.0179 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=1.02 cfs @ 12.06 hrs HW=113.11' TW=112.97' (Dynamic Tailwater)
1=Culvert (Outlet Controls 1.02 cfs @ 2.21 fps)

Summary for Pond INF/DET: Underground Infiltration/Detention System

Test pits indicated medium-coarse sand. Therefore, an infiltration rate of 8.27 in/hf (based on Rawl's Rates) is utilized for this system. This system is modeled as a combination of infiltration (SC-740 chambers) and detention (solid pipe, infiltration not allowed) with a 24" flat pipe connecting the two systems so that the storage is shared between both fields.

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[80] Warning: Exceeded Pond CB-2 by 0.01' @ 12.13 hrs (0.38 cfs 155 cf)

[80] Warning: Exceeded Pond CB-3 by 0.02' @ 12.11 hrs (0.53 cfs 345 cf)
[80] Warning: Exceeded Pond CB-5 by 1.06' @ 12.87 hrs (2.63 cfs 3,106 cf)

Inflow Area = 45,852 sf, 45.80% Impervious, Inflow Depth = 2.78" for 25-YR event
Inflow = 3.07 cfs @ 12.04 hrs, Volume= 10,616 cf
Outflow = 0.82 cfs @ 12.37 hrs, Volume= 10,616 cf, Atten= 73%, Lag= 20.1 min
Discarded = 0.34 cfs @ 12.37 hrs, Volume= 9,629 cf
Primary = 0.49 cfs @ 12.37 hrs, Volume= 987 cf
Routed to Pond DMH-3 : PROP. DMH-3

Routing by Dyn-Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Peak Elev= 113.49' @ 12.37 hrs Surf.Area= 1,406 sf Storage= 2,717 cf
Flood Elev= 115.00' Surf.Area= 1,406 sf Storage= 4,153 cf

Plug-Flow detention time= 40.0 min calculated for 10,612 cf (100% of inflow)
Center-of-Mass det. time= 39.9 min (793.6 - 753.6)

Volume	Invert	Avail.Storage	Storage Description
#1A	111.50'	1,380 cf	**20.50'W x 68.58'L x 3.50'H Field A** 4,920 cf Overall - 1,470 cf Embedded = 3,450 cf x 40.0% Voids
#2A	112.00'	1,470 cf	**ADS_StormTech SC-740 +Cap** x 32 Inside #1 Effective Size= 44.6"W x 30.0"H => 6.45 sf x 7.12'L = 45.9 cf Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap 32 Chambers in 4 Rows
#3B	112.00'	0 cf	**23.03'W x 54.67'L x 2.33'H Field B** Impervious 2,938 cf Overall - 1,552 cf Embedded = 1,386 cf x 0.0% Voids
#4B	112.00'	1,228 cf	**ADS N-12 24"** x 7 Inside #3 Inside= 23.8"W x 23.8"H => 3.10 sf x 20.00'L = 62.0 cf Outside= 28.0"W x 28.0"H => 3.92 sf x 20.00'L = 78.4 cf Row Length Adjustment= +30.00' x 3.10 sf x 7 rows 23.03' Header x 3.10 sf x 2 = 142.8 cf Inside
#5	112.00'	75 cf	**24.0" Round Pipe Storage** Impervious L= 24.0'
		4,153 cf	Total Available Storage

Storage Group A created with Chamber Wizard
Storage Group B created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	113.10'	**12.0" Round Culvert** L= 17.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 113.10' / 112.10' S= 0.0588 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 0.79 sf
#2	Device 1	114.75'	**12.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Device 1	113.60'	**4.0" Vert. Orifice/Grate X 2.00** C= 0.600 Limited to weir flow at low heads
#4	Device 1	113.10'	**3.0" Vert. Orifice/Grate X 4.00** C= 0.600 Limited to weir flow at low heads
#5	Discarded	111.50'	**8.270 in/hr Exfiltration over Wetted area** Phase-In= 0.01'

Discarded OutFlow Max=0.34 cfs @ 12.37 hrs HW=113.49' (Free Discharge)
└**5=Exfiltration** (Exfiltration Controls 0.34 cfs)

Primary OutFlow Max=0.49 cfs @ 12.37 hrs HW=113.49' TW=111.37' (Dynamic Tailwater)
└**1=Culvert** (Passes 0.49 cfs of 0.60 cfs potential flow)
  ├**2=Orifice/Grate** (Controls 0.00 cfs)
  ├**3=Orifice/Grate** (Controls 0.00 cfs)
  └**4=Orifice/Grate** (Orifice Controls 0.49 cfs @ 2.48 fps)

Summary for Pond SD-1: PROP. SD-1

Inflow Area = 720 sf,100.00% Impervious, Inflow Depth = 5.75" for 25-YR event
Inflow = 0.12 cfs @ 12.00 hrs, Volume= 345 cf
Outflow = 0.12 cfs @ 12.00 hrs, Volume= 345 cf, Atten= 0%, Lag= 0.0 min
Primary = 0.12 cfs @ 12.00 hrs, Volume= 345 cf
Routed to Pond CB-5 : PROP. CB-5

Routing by Dyn-Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Peak Elev= 113.49' @ 12.39 hrs
Flood Elev= 114.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	112.50'	**8.0" Round Culvert** L= 35.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 112.50' / 112.30' S= 0.0057 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 0.35 sf

Primary OutFlow Max=0.10 cfs @ 12.00 hrs HW=112.75' TW=112.64' (Dynamic Tailwater)
└**1=Culvert** (Outlet Controls 0.10 cfs @ 1.28 fps)

Summary for Pond YD-1: PROP. YD-1

Inflow Area = 96,074 sf, 7.12% Impervious, Inflow Depth = 1.09" for 25-YR event
Inflow = 1.66 cfs @ 12.18 hrs, Volume= 8,728 cf
Outflow = 1.66 cfs @ 12.18 hrs, Volume= 8,728 cf, Atten= 0%, Lag= 0.0 min
Primary = 1.66 cfs @ 12.18 hrs, Volume= 8,728 cf
Routed to Pond DMH-3 : PROP. DMH-3

Routing by Dyn-Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Peak Elev= 111.71' @ 12.20 hrs
Flood Elev= 113.35'

Device	Routing	Invert	Outlet Devices
#1	Primary	110.85'	**12.0" Round Culvert** L= 14.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 110.85' / 110.75' S= 0.0071 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=1.64 cfs @ 12.18 hrs HW=111.71' TW=111.45' (Dynamic Tailwater)
↑—**1=Culvert** (Outlet Controls 1.64 cfs @ 3.05 fps)

Summary for Link DP1: Design Point #1: Broadway (Rte. 28)

Inflow Area = 145,188 sf, 19.66% Impervious, Inflow Depth = 0.84" for 25-YR event
Inflow = 2.06 cfs @ 12.21 hrs, Volume= 10,134 cf
Primary = 2.06 cfs @ 12.21 hrs, Volume= 10,134 cf, 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-Q
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment1S: TO CB-1 Runoff Area=24,787 sf 21.88% Impervious Runoff Depth=2.57"
Flow Length=164' Tc=3.9 min CN=WQ Runoff=1.37 cfs 5,305 cf

Subcatchment2S: To CB-2 Runoff Area=10,744 sf 55.54% Impervious Runoff Depth=5.22"
Flow Length=80' Tc=2.6 min CN=WQ Runoff=1.42 cfs 4,673 cf

Subcatchment3S: To CB-3 Runoff Area=4,216 sf 95.42% Impervious Runoff Depth=8.09"
Flow Length=51' Tc=2.2 min CN=WQ Runoff=0.90 cfs 2,843 cf

Subcatchment4S: To CB-4 Runoff Area=3,101 sf 83.34% Impervious Runoff Depth=7.25"
Flow Length=74' Tc=4.0 min CN=WQ Runoff=0.56 cfs 1,873 cf

Subcatchment5S: Roof Runoff Area=2,284 sf 100.00% Impervious Runoff Depth=8.41"
Tc=0.0 min CN=98 Runoff=0.54 cfs 1,601 cf

Subcatchment6S: Subcat 6S Runoff Area=720 sf 100.00% Impervious Runoff Depth=8.41"
Tc=0.0 min CN=98 Runoff=0.17 cfs 505 cf

Subcatchment7S: Onsite direct to DP1 Runoff Area=1,725 sf 23.66% Impervious Runoff Depth=3.09"
Flow Length=19' Slope=0.0470 '/' Tc=1.9 min CN=WQ Runoff=0.13 cfs 444 cf

Subcatchment100S: Offiste and onsite to Runoff Area=96,074 sf 7.12% Impervious Runoff Depth=2.33"
Flow Length=625' Tc=12.2 min CN=WQ Runoff=4.02 cfs 18,659 cf

Subcatchment101S: Offsite and onsite Runoff Area=1,537 sf 18.56% Impervious Runoff Depth=2.59"
Flow Length=50' Slope=0.0100 '/' Tc=4.3 min CN=WQ Runoff=0.09 cfs 332 cf

Pond CB-1: PROP. CB-1 Peak Elev=114.39' Inflow=1.37 cfs 5,305 cf
12.0" Round Culvert n=0.012 L=96.0' S=0.0068 '/' Outflow=1.37 cfs 5,305 cf

Pond CB-2: PROP. CB-2 Peak Elev=114.32' Inflow=1.42 cfs 4,673 cf
12.0" Round Culvert n=0.012 L=34.0' S=0.0059 '/' Outflow=1.42 cfs 4,673 cf

Pond CB-3: PROP. CB-3 Peak Elev=114.30' Inflow=0.90 cfs 2,843 cf
12.0" Round Culvert n=0.012 L=38.0' S=0.0053 '/' Outflow=0.90 cfs 2,843 cf

Pond CB-4: PROP. CB-4 Peak Elev=114.35' Inflow=0.56 cfs 1,873 cf
12.0" Round Culvert n=0.012 L=12.0' S=0.0333 '/' Outflow=0.56 cfs 1,873 cf

Pond CB-5: PROP. CB-5 Peak Elev=114.30' Inflow=0.17 cfs 505 cf
12.0" Round Culvert n=0.012 L=22.0' S=0.0091 '/' Outflow=0.17 cfs 504 cf

Pond DMH-3: PROP. DMH-3 Peak Elev=112.65' Inflow=5.59 cfs 22,568 cf
15.0" Round Culvert n=0.013 L=105.0' S=0.0050 '/' Outflow=5.59 cfs 22,568 cf

Pond DMH1: PROP. DMH-1 Peak Elev=114.35' Inflow=1.93 cfs 7,178 cf
12.0" Round Culvert n=0.012 L=14.0' S=0.0179 '/' Outflow=1.93 cfs 7,178 cf

Pond INF/DET: Underground Peak Elev=114.30' Storage=3,751 cf Inflow=4.72 cfs 16,798 cf
Discarded=0.36 cfs 12,889 cf Primary=1.59 cfs 3,909 cf Outflow=1.95 cfs 16,798 cf

Pond SD-1: PROP. SD-1 Peak Elev=114.30' Inflow=0.17 cfs 505 cf
8.0" Round Culvert n=0.012 L=35.0' S=0.0057 '/' Outflow=0.17 cfs 505 cf

Pond YD-1: PROP. YD-1 Peak Elev=113.78' Inflow=4.02 cfs 18,659 cf
12.0" Round Culvert n=0.012 L=14.0' S=0.0071 '/' Outflow=4.02 cfs 18,659 cf

Link DP1: Design Point #1: Broadway (Rte. 28) Inflow=5.70 cfs 23,344 cf
Primary=5.70 cfs 23,344 cf

Total Runoff Area = 145,188 sf Runoff Volume = 36,234 cf Average Runoff Depth = 2.99"
80.34% Pervious = 116,650 sf 19.66% Impervious = 28,538 sf

Summary for Subcatchment 1S: TO CB-1

Runoff = 1.37 cfs @ 12.06 hrs, Volume= 5,305 cf, Depth= 2.57"
Routed to Pond CB-1 : PROP. CB-1

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-YR Rainfall=8.65"

Area (sf)	CN	Description
3,127	39	>75% Grass cover, Good, HSG A
2,346	30	Brush, Good, HSG A
2,229	48	Brush, Good, HSG B
5,280	98	Paved parking, HSG A
143	98	Roofs, HSG B
11,662	30	Woods, Good, HSG A
24,787		Weighted Average
19,364		78.12% Pervious Area
5,423		21.88% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.7	20	0.0700	0.20		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.09"
1.5	100	0.0500	1.12		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
0.7	44	0.0200	0.99		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
3.9	164	Total			

Summary for Subcatchment 2S: To CB-2

Runoff = 1.42 cfs @ 12.04 hrs, Volume= 4,673 cf, Depth= 5.22"
Routed to Pond CB-2 : PROP. CB-2

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-YR Rainfall=8.65"

Area (sf)	CN	Description
3,624	39	>75% Grass cover, Good, HSG A
1,153	30	Brush, Good, HSG A
5,967	98	Paved parking, HSG A
10,744		Weighted Average
4,777		44.46% Pervious Area
5,967		55.54% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.1	10	0.0100	0.08		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.09"
0.5	70	0.0150	2.49		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
2.6	80	Total			

Summary for Subcatchment 3S: To CB-3

Runoff = 0.90 cfs @ 12.03 hrs, Volume= 2,843 cf, Depth= 8.09"
Routed to Pond CB-3 : PROP. CB-3

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-YR Rainfall=8.65"

Area (sf)	CN	Description
193	39	>75% Grass cover, Good, HSG A
4,023	98	Paved parking, HSG A
4,216		Weighted Average
193		4.58% Pervious Area
4,023		95.42% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.0	18	0.0350	0.15		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.09"
0.2	33	0.0200	2.87		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
2.2	51	Total			

Summary for Subcatchment 4S: To CB-4

Runoff = 0.56 cfs @ 12.06 hrs, Volume= 1,873 cf, Depth= 7.25"
Routed to Pond CB-4 : PROP. CB-4

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-YR Rainfall=8.65"

Area (sf)	CN	Description
517	39	>75% Grass cover, Good, HSG A
2,584	98	Paved parking, HSG A
3,101		Weighted Average
517		16.66% Pervious Area
2,584		83.34% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.6	20	0.0100	0.09		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.09"
0.4	54	0.0120	2.22		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
4.0	74	Total			

Summary for Subcatchment 5S: Roof

[46] Hint: Tc=0 (Instant runoff peak depends on dt)

Runoff = 0.54 cfs @ 12.00 hrs, Volume= 1,601 cf, Depth= 8.41"
Routed to Pond INF/DET : Underground Infiltration/Detention System

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-YR Rainfall=8.65"

Area (sf)	CN	Description
2,284	98	Roofs, HSG A
2,284		100.00% Impervious Area

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

Summary for Subcatchment 6S: Subcat 6S

[46] Hint: Tc=0 (Instant runoff peak depends on dt)

Runoff = 0.17 cfs @ 12.00 hrs, Volume= 505 cf, Depth= 8.41"
Routed to Pond SD-1 : PROP. SD-1

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-YR Rainfall=8.65"

Area (sf)	CN	Description
720	98	Paved parking, HSG A
720		100.00% Impervious Area

Summary for Subcatchment 7S: Onsite direct to DP1

Runoff = 0.13 cfs @ 12.03 hrs, Volume= 444 cf, Depth= 3.09"
Routed to Link DP1 : Design Point #1: Broadway (Rte. 28)

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-YR Rainfall=8.65"

Area (sf)	CN	Description
1,316	39	>75% Grass cover, Good, HSG A
1	30	Brush, Good, HSG A
408	98	Paved parking, HSG A
1,725		Weighted Average
1,317		76.34% Pervious Area
408		23.66% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.9	19	0.0470	0.17		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.09"

Summary for Subcatchment 100S: Offiste and onsite to YD-1

Runoff = 4.02 cfs @ 12.18 hrs, Volume= 18,659 cf, Depth= 2.33"
Routed to Pond YD-1 : PROP. YD-1

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-YR Rainfall=8.65"

Area (sf)	CN	Description
49,895	39	>75% Grass cover, Good, HSG A
16,207	61	>75% Grass cover, Good, HSG B
2,339	98	Roofs, HSG A
4,504	98	Roofs, HSG B
16,706	30	Woods, Good, HSG A
6,423	55	Woods, Good, HSG B
96,074		Weighted Average
89,231		92.88% Pervious Area
6,843		7.12% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.5	25	0.0400	0.17		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.09"
0.7	65	0.0480	1.53		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
1.9	122	0.0470	1.08		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
1.5	135	0.0470	1.52		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.6	38	0.0470	1.08		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
3.9	165	0.0100	0.70		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
1.1	75	0.0260	1.13		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
12.2	625	Total			

Summary for Subcatchment 101S: Offsite and onsite direct to DP1

Runoff = 0.09 cfs @ 12.07 hrs, Volume= 332 cf, Depth= 2.59"
Routed to Link DP1 : Design Point #1: Broadway (Rte. 28)

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-YR Rainfall=8.65"

Area (sf)	CN	Description
1,000	39	>75% Grass cover, Good, HSG A
285	98	Paved parking, HSG A
252	30	Woods, Good, HSG A
1,537		Weighted Average
1,252		81.44% Pervious Area
285		18.56% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.6	20	0.0100	0.09		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.09"
0.7	30	0.0100	0.70		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
4.3	50	Total			

Summary for Pond CB-1: PROP. CB-1

Inflow Area = 24,787 sf, 21.88% Impervious, Inflow Depth = 2.57" for 100-YR event
Inflow = 1.37 cfs @ 12.06 hrs, Volume= 5,305 cf
Outflow = 1.37 cfs @ 12.06 hrs, Volume= 5,305 cf, Atten= 0%, Lag= 0.0 min
Primary = 1.37 cfs @ 12.06 hrs, Volume= 5,305 cf
Routed to Pond DMH1 : PROP. DMH-1

Routing by Dyn-Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Peak Elev= 114.39' @ 12.23 hrs
Flood Elev= 116.10'

Device	Routing	Invert	Outlet Devices
#1	Primary	113.10'	**12.0" Round Culvert** L= 96.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 113.10' / 112.45' S= 0.0068 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=1.14 cfs @ 12.06 hrs HW=114.06' TW=113.87' (Dynamic Tailwater)
↑—**1=Culvert** (Outlet Controls 1.14 cfs @ 1.87 fps)

Summary for Pond CB-2: PROP. CB-2

First Defense unit

Inflow Area = 10,744 sf, 55.54% Impervious, Inflow Depth = 5.22" for 100-YR event
Inflow = 1.42 cfs @ 12.04 hrs, Volume= 4,673 cf
Outflow = 1.42 cfs @ 12.04 hrs, Volume= 4,673 cf, Atten= 0%, Lag= 0.0 min
Primary = 1.42 cfs @ 12.04 hrs, Volume= 4,673 cf
Routed to Pond INF/DET : Underground Infiltration/Detention System

Routing by Dyn-Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Peak Elev= 114.32' @ 12.23 hrs
Flood Elev= 115.15'

Device	Routing	Invert	Outlet Devices
#1	Primary	112.20'	**12.0" Round Culvert** L= 34.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 112.20' / 112.00' S= 0.0059 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=0.92 cfs @ 12.04 hrs HW=113.59' TW=113.53' (Dynamic Tailwater)
↑—**1=Culvert** (Inlet Controls 0.92 cfs @ 1.18 fps)

Summary for Pond CB-3: PROP. CB-3

First Defense unit

Inflow Area = 4,216 sf, 95.42% Impervious, Inflow Depth = 8.09" for 100-YR event
Inflow = 0.90 cfs @ 12.03 hrs, Volume= 2,843 cf
Outflow = 0.90 cfs @ 12.03 hrs, Volume= 2,843 cf, Atten= 0%, Lag= 0.0 min
Primary = 0.90 cfs @ 12.03 hrs, Volume= 2,843 cf
Routed to Pond INF/DET : Underground Infiltration/Detention System

Routing by Dyn-Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Peak Elev= 114.30' @ 12.23 hrs
Flood Elev= 115.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	112.20'	**12.0" Round Culvert** L= 38.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 112.20' / 112.00' S= 0.0053 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=0.00 cfs @ 12.03 hrs HW=113.45' TW=113.47' (Dynamic Tailwater)
↑—**1=Culvert** (Controls 0.00 cfs)

Summary for Pond CB-4: PROP. CB-4

Inflow Area = 3,101 sf, 83.34% Impervious, Inflow Depth = 7.25" for 100-YR event
Inflow = 0.56 cfs @ 12.06 hrs, Volume= 1,873 cf
Outflow = 0.56 cfs @ 12.06 hrs, Volume= 1,873 cf, Atten= 0%, Lag= 0.0 min
Primary = 0.56 cfs @ 12.06 hrs, Volume= 1,873 cf
Routed to Pond DMH1 : PROP. DMH-1

Routing by Dyn-Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Peak Elev= 114.35' @ 12.24 hrs
Flood Elev= 116.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	113.00'	**12.0" Round Culvert** L= 12.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 113.00' / 112.60' S= 0.0333 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=0.00 cfs @ 12.06 hrs HW=113.81' TW=113.86' (Dynamic Tailwater)
1=Culvert (Controls 0.00 cfs)

Summary for Pond CB-5: PROP. CB-5

[87] Warning: Oscillations may require smaller dt or Finer Routing (severity=569)
[80] Warning: Exceeded Pond SD-1 by 0.91' @ 12.92 hrs (1.13 cfs 1,323 cf)

Inflow Area = 720 sf,100.00% Impervious, Inflow Depth = 8.41" for 100-YR event
Inflow = 0.17 cfs @ 12.00 hrs, Volume= 505 cf
Outflow = 0.17 cfs @ 12.00 hrs, Volume= 504 cf, Atten= 0%, Lag= 0.0 min
Primary = 0.17 cfs @ 12.00 hrs, Volume= 504 cf
Routed to Pond INF/DET : Underground Infiltration/Detention System

Routing by Dyn-Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Peak Elev= 114.30' @ 12.24 hrs
Flood Elev= 116.40'

Device	Routing	Invert	Outlet Devices
#1	Primary	112.20'	**12.0" Round Culvert** L= 22.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 112.20' / 112.00' S= 0.0091 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=0.00 cfs @ 12.00 hrs HW=113.16' TW=113.23' (Dynamic Tailwater)
1=Culvert (Controls 0.00 cfs)

Summary for Pond DMH-3: PROP. DMH-3

Inflow Area = 141,926 sf, 19.62% Impervious, Inflow Depth = 1.91" for 100-YR event
Inflow = 5.59 cfs @ 12.19 hrs, Volume= 22,568 cf
Outflow = 5.59 cfs @ 12.19 hrs, Volume= 22,568 cf, Atten= 0%, Lag= 0.0 min
Primary = 5.59 cfs @ 12.19 hrs, Volume= 22,568 cf
Routed to Link DP1 : Design Point #1: Broadway (Rte. 28)

Routing by Dyn-Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Peak Elev= 112.65' @ 12.19 hrs
Flood Elev= 116.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	110.65'	**15.0" Round Culvert** L= 105.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 110.65' / 110.13' S= 0.0050 '/' Cc= 0.900 n= 0.013 Concrete pipe, bends & connections, Flow Area= 1.23 sf

Primary OutFlow Max=5.59 cfs @ 12.19 hrs HW=112.65' TW=0.00' (Dynamic Tailwater)
1=Culvert (Barrel Controls 5.59 cfs @ 4.55 fps)

Summary for Pond DMH1: PROP. DMH-1

[80] Warning: Exceeded Pond CB-4 by 0.05' @ 12.05 hrs (0.69 cfs 361 cf)

Inflow Area = 27,888 sf, 28.71% Impervious, Inflow Depth = 3.09" for 100-YR event
Inflow = 1.93 cfs @ 12.06 hrs, Volume= 7,178 cf
Outflow = 1.93 cfs @ 12.06 hrs, Volume= 7,178 cf, Atten= 0%, Lag= 0.0 min
Primary = 1.93 cfs @ 12.06 hrs, Volume= 7,178 cf
Routed to Pond INF/DET : Underground Infiltration/Detention System

Routing by Dyn-Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Peak Elev= 114.35' @ 12.23 hrs
Flood Elev= 116.45'

Device	Routing	Invert	Outlet Devices
#1	Primary	112.35'	**12.0" Round Culvert** L= 14.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 112.35' / 112.10' S= 0.0179 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=1.59 cfs @ 12.06 hrs HW=113.87' TW=113.69' (Dynamic Tailwater)
1=Culvert (Inlet Controls 1.59 cfs @ 2.03 fps)

Summary for Pond INF/DET: Underground Infiltration/Detention System

Test pits indicated medium-coarse sand. Therefore, an infiltration rate of 8.27 in/hf (based on Rawl's Rates) is utilized for this system. This system is modeled as a combination of infiltration (SC-740 chambers) and detention (solid pipe, infiltration not allowed) with a 24" flat pipe connecting the two systems so that the storage is shared between both fields.

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[80] Warning: Exceeded Pond CB-2 by 0.01' @ 12.15 hrs (0.27 cfs 25 cf)
[80] Warning: Exceeded Pond CB-3 by 0.04' @ 12.08 hrs (0.74 cfs 457 cf)
[80] Warning: Exceeded Pond CB-5 by 1.28' @ 12.91 hrs (3.16 cfs 4,488 cf)

Inflow Area = 45,852 sf, 45.80% Impervious, Inflow Depth = 4.40" for 100-YR event
Inflow = 4.72 cfs @ 12.04 hrs, Volume= 16,798 cf
Outflow = 1.95 cfs @ 12.23 hrs, Volume= 16,798 cf, Atten= 59%, Lag= 11.1 min
Discarded = 0.36 cfs @ 12.23 hrs, Volume= 12,889 cf
Primary = 1.59 cfs @ 12.23 hrs, Volume= 3,909 cf
Routed to Pond DMH-3 : PROP. DMH-3

Routing by Dyn-Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Peak Elev= 114.30' @ 12.23 hrs Surf.Area= 1,406 sf Storage= 3,751 cf
Flood Elev= 115.00' Surf.Area= 1,406 sf Storage= 4,153 cf

Plug-Flow detention time= 40.0 min calculated for 16,798 cf (100% of inflow)
Center-of-Mass det. time= 40.0 min (799.3 - 759.4)

Volume	Invert	Avail.Storage	Storage Description
#1A	111.50'	1,380 cf	**20.50'W x 68.58'L x 3.50'H Field A** 4,920 cf Overall - 1,470 cf Embedded = 3,450 cf x 40.0% Voids
#2A	112.00'	1,470 cf	**ADS_StormTech SC-740 +Cap** x 32 Inside #1 Effective Size= 44.6"W x 30.0"H => 6.45 sf x 7.12'L = 45.9 cf Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap 32 Chambers in 4 Rows
#3B	112.00'	0 cf	**23.03'W x 54.67'L x 2.33'H Field B** -Impervious 2,938 cf Overall - 1,552 cf Embedded = 1,386 cf x 0.0% Voids
#4B	112.00'	1,228 cf	**ADS N-12 24"** x 7 Inside #3 Inside= 23.8"W x 23.8"H => 3.10 sf x 20.00'L = 62.0 cf Outside= 28.0"W x 28.0"H => 3.92 sf x 20.00'L = 78.4 cf Row Length Adjustment= +30.00' x 3.10 sf x 7 rows 23.03' Header x 3.10 sf x 2 = 142.8 cf Inside
#5	112.00'	75 cf	**24.0" Round Pipe Storage** -Impervious L= 24.0'
		4,153 cf	Total Available Storage

Storage Group A created with Chamber Wizard
Storage Group B created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	113.10'	**12.0" Round Culvert** L= 17.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 113.10' / 112.10' S= 0.0588 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 0.79 sf
#2	Device 1	114.75'	**12.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Device 1	113.60'	**4.0" Vert. Orifice/Grate X 2.00** C= 0.600 Limited to weir flow at low heads
#4	Device 1	113.10'	**3.0" Vert. Orifice/Grate X 4.00** C= 0.600 Limited to weir flow at low heads
#5	Discarded	111.50'	**8.270 in/hr Exfiltration over Wetted area** Phase-In= 0.01'

Discarded OutFlow Max=0.36 cfs @ 12.23 hrs HW=114.30' (Free Discharge)
└**5=Exfiltration** (Exfiltration Controls 0.36 cfs)

Primary OutFlow Max=1.59 cfs @ 12.23 hrs HW=114.30' TW=112.57' (Dynamic Tailwater)
└**1=Culvert** (Passes 1.59 cfs of 3.15 cfs potential flow)
  ├**2=Orifice/Grate** (Controls 0.00 cfs)
  ├**3=Orifice/Grate** (Orifice Controls 0.61 cfs @ 3.50 fps)
  └**4=Orifice/Grate** (Orifice Controls 0.98 cfs @ 4.98 fps)

Summary for Pond SD-1: PROP. SD-1

[58] Hint: Peaked 0.30' above defined flood level

Inflow Area = 720 sf,100.00% Impervious, Inflow Depth = 8.41" for 100-YR event
Inflow = 0.17 cfs @ 12.00 hrs, Volume= 505 cf
Outflow = 0.17 cfs @ 12.00 hrs, Volume= 505 cf, Atten= 0%, Lag= 0.0 min
Primary = 0.17 cfs @ 12.00 hrs, Volume= 505 cf
Routed to Pond CB-5 : PROP. CB-5

Routing by Dyn-Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Peak Elev= 114.30' @ 12.25 hrs
Flood Elev= 114.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	112.50'	**8.0" Round Culvert** L= 35.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 112.50' / 112.30' S= 0.0057 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 0.35 sf

Primary OutFlow Max=0.00 cfs @ 12.00 hrs HW=113.12' TW=113.16' (Dynamic Tailwater)
└**1=Culvert** (Controls 0.00 cfs)

Summary for Pond YD-1: PROP. YD-1

[58] Hint: Peaked 0.43' above defined flood level

Inflow Area = 96,074 sf, 7.12% Impervious, Inflow Depth = 2.33" for 100-YR event
Inflow = 4.02 cfs @ 12.18 hrs, Volume= 18,659 cf
Outflow = 4.02 cfs @ 12.18 hrs, Volume= 18,659 cf, Atten= 0%, Lag= 0.0 min
Primary = 4.02 cfs @ 12.18 hrs, Volume= 18,659 cf
Routed to Pond DMH-3 : PROP. DMH-3

Routing by Dyn-Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Peak Elev= 113.78' @ 12.19 hrs
Flood Elev= 113.35'

Device	Routing	Invert	Outlet Devices
#1	Primary	110.85'	**12.0" Round Culvert** L= 14.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 110.85' / 110.75' S= 0.0071 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=4.00 cfs @ 12.18 hrs HW=113.77' TW=112.65' (Dynamic Tailwater)
1=Culvert (Inlet Controls 4.00 cfs @ 5.09 fps)

Summary for Link DP1: Design Point #1: Broadway (Rte. 28)

Inflow Area = 145,188 sf, 19.66% Impervious, Inflow Depth = 1.93" for 100-YR event
Inflow = 5.70 cfs @ 12.19 hrs, Volume= 23,344 cf
Primary = 5.70 cfs @ 12.19 hrs, Volume= 23,344 cf, Atten= 0%, Lag= 0.0 min

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

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	71.196 degrees West
Latitude	42.739 degrees North
Elevation	0 feet
Date/Time	Wed, 25 May 2022 13:03:17 -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	2.01	2.57	2.78	**1yr**	2.27	2.67	3.12	3.79	4.42	**1yr**
2yr	0.33	0.51	0.64	0.84	1.06	1.33	**2yr**	0.91	1.22	1.54	1.94	2.45	3.09	3.41	**2yr**	2.73	3.28	3.80	4.51	5.14	**2yr**
5yr	0.39	0.61	0.77	1.03	1.32	1.68	**5yr**	1.14	1.53	1.95	2.47	3.11	3.92	4.36	**5yr**	3.47	4.20	4.82	5.72	6.47	**5yr**
10yr	0.44	0.69	0.88	1.19	1.55	2.00	**10yr**	1.34	1.81	2.34	2.96	3.74	4.71	5.26	**10yr**	4.17	5.06	5.78	6.84	7.71	**10yr**
25yr	0.52	0.83	1.06	1.46	1.94	2.52	**25yr**	1.67	2.27	2.96	3.77	4.77	5.99	6.74	**25yr**	5.30	6.48	7.34	8.68	9.72	**25yr**
50yr	0.59	0.94	1.21	1.70	2.29	3.02	**50yr**	1.98	2.69	3.56	4.54	5.74	7.20	8.13	**50yr**	6.37	7.82	8.80	10.39	11.58	**50yr**
100yr	0.67	1.09	1.41	1.99	2.71	3.59	**100yr**	2.34	3.20	4.25	5.44	6.89	8.65	9.81	**100yr**	7.65	9.43	10.56	12.45	13.81	**100yr**
200yr	0.77	1.25	1.62	2.33	3.22	4.29	**200yr**	2.78	3.80	5.09	6.54	8.28	10.39	11.85	**200yr**	9.19	11.39	12.67	14.93	16.48	**200yr**
500yr	0.92	1.51	1.98	2.87	4.03	5.43	**500yr**	3.48	4.77	6.46	8.32	10.56	13.26	15.21	**500yr**	11.73	14.62	16.12	18.98	20.82	**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	0.60	0.74	0.88	**1yr**	0.64	0.86	1.11	1.37	1.66	2.36	2.57	**1yr**	2.09	2.47	2.80	3.37	4.03	**1yr**
2yr	0.32	0.49	0.61	0.82	1.01	1.21	**2yr**	0.87	1.18	1.38	1.82	2.32	2.99	3.31	**2yr**	2.64	3.18	3.69	4.38	5.00	**2yr**
5yr	0.37	0.57	0.71	0.97	1.23	1.45	**5yr**	1.06	1.41	1.63	2.12	2.70	3.68	4.03	**5yr**	3.26	3.88	4.50	5.31	6.04	**5yr**
10yr	0.41	0.63	0.78	1.09	1.41	1.65	**10yr**	1.21	1.61	1.86	2.39	3.03	4.27	4.64	**10yr**	3.78	4.46	5.20	6.14	6.95	**10yr**
25yr	0.47	0.72	0.89	1.27	1.68	1.95	**25yr**	1.45	1.90	2.20	2.79	3.53	5.21	5.59	**25yr**	4.61	5.37	6.33	7.45	8.31	**25yr**
50yr	0.52	0.79	0.99	1.42	1.91	2.22	**50yr**	1.65	2.17	2.49	3.14	3.97	6.04	6.43	**50yr**	5.34	6.18	7.35	8.62	9.49	**50yr**
100yr	0.59	0.89	1.11	1.60	2.20	2.52	**100yr**	1.90	2.46	2.82	3.54	4.46	6.63	7.40	**100yr**	5.87	7.11	8.56	9.99	10.85	**100yr**
200yr	0.65	0.99	1.25	1.81	2.52	2.86	**200yr**	2.18	2.79	3.19	3.98	5.03	7.62	8.53	**200yr**	6.74	8.20	9.96	11.55	12.37	**200yr**
500yr	0.77	1.14	1.47	2.13	3.03	3.38	**500yr**	2.61	3.31	3.76	4.66	5.89	9.10	10.29	**500yr**	8.05	9.90	12.20	14.01	14.71	**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	0.57	0.76	0.94	1.10	**1yr**	0.81	1.07	1.25	1.66	2.12	2.77	2.95	**1yr**	2.45	2.84	3.37	4.06	4.79	**1yr**
2yr	0.34	0.53	0.65	0.89	1.09	1.30	**2yr**	0.94	1.27	1.49	1.95	2.49	3.20	3.56	**2yr**	2.83	3.42	3.93	4.66	5.33	**2yr**
5yr	0.43	0.66	0.82	1.12	1.42	1.68	**5yr**	1.23	1.64	1.93	2.49	3.16	4.18	4.70	**5yr**	3.70	4.52	5.16	6.13	6.91	**5yr**
10yr	0.52	0.79	0.98	1.37	1.77	2.05	**10yr**	1.53	2.00	2.35	3.01	3.80	5.15	5.83	**10yr**	4.56	5.61	6.34	7.53	8.46	**10yr**
25yr	0.66	1.01	1.26	1.79	2.36	2.68	**25yr**	2.04	2.62	3.08	3.86	4.83	6.81	7.77	**25yr**	6.02	7.47	8.34	9.93	11.11	**25yr**
50yr	0.80	1.21	1.51	2.17	2.92	3.28	**50yr**	2.52	3.21	3.77	4.68	5.80	8.41	9.68	**50yr**	7.44	9.31	10.25	12.24	13.65	**50yr**
100yr	0.97	1.47	1.84	2.65	3.64	4.02	**100yr**	3.14	3.93	4.63	5.66	6.98	10.87	12.06	**100yr**	9.62	11.60	12.61	15.10	16.80	**100yr**
200yr	1.17	1.77	2.24	3.24	4.52	4.94	**200yr**	3.90	4.83	5.68	6.86	8.38	13.54	15.03	**200yr**	11.98	14.45	15.50	18.60	20.70	**200yr**
500yr	1.52	2.26	2.91	4.23	6.01	6.48	**500yr**	5.19	6.34	7.47	8.83	10.70	18.13	20.14	**500yr**	16.04	19.36	20.36	24.54	27.31	**500yr**

Powered by ACIS Northeast Regional Climate Center

Hydro International

First Defense® High Capacity

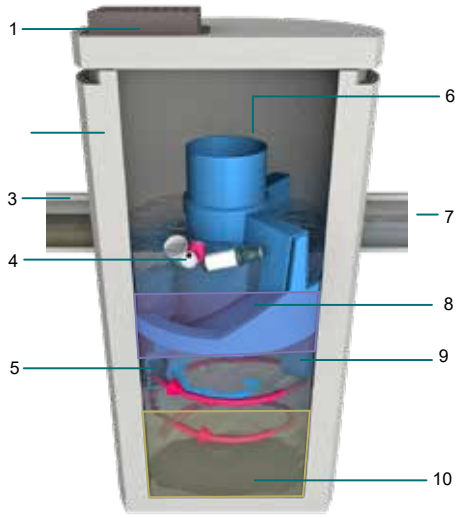
Advanced Hydrodynamic Separator

Product Summary

A Simple Solution for your Trickiest Sites

First Defense® High Capacity is a versatile stormwater separator with some of the highest approved flow rates in the United States, enabling engineers and contractors to save site space and projects costs by using the smallest possible footprint. It also works with single and multiple inlet pipes and inlet grates has an internal bypass to convey infrequent peak flows directly to the outlet.

Fig.1 The First Defense® High Capacity has internal components designed to efficiently capture pollutants and prevent washout at



Product Profile

1. Inlet Grate (optional)
2. Precast chamber
3. Inlet Pipe (optional)
4. Floatables Draw Off Slot (not pictured)
5. Inlet Chute
6. Internal Bypass
7. Outlet pipe
8. Oil and Floatables Storage
9. Outlet chute
10. Sediment Storage Sump

Applications

- Areas requiring a minimum of 50% TSS removal
- Stormwater treatment at the point of entry into the drainage line
- Sites constrained by space, topography or drainage profiles with limited slope and depth of cover
- Highways, car parks, industrial areas and urban developments
- Pre-treatment to ponds, storage systems, green infrastructure

How it Works

Highest Flow through the Smallest Footprint

Contaminated stormwater runoff enters the inlet chute from a surface grate and/or inlet pipe. The inlet chute introduces flow into the chamber tangentially to create a low energy vortex flow regime (magenta arrow) that directs sediment into the sump while oils, floating trash and debris rise to the surface.

Treated stormwater exits through a submerged outlet chute located opposite to the direction of the rotating flow (blue arrow). Enhanced vortex separation is provided by forcing the rotating flow within the vessel to follow the longest path possible rather than directly from inlet to outlet.

Higher flows bypass the treatment chamber to prevent turbulence and washout of captured pollutants. An internal bypass conveys infrequent peak flows directly to the outlet eliminating the need for, and expense of, external bypass control structures. A floatables draw off slot functions to convey floatables into the treatment chamber prior to bypass.

Benefits

Small & Simple

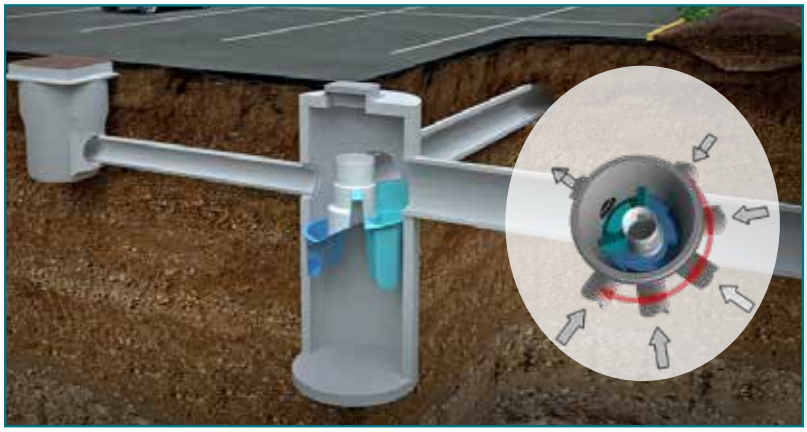
- Cut footprint size, cut costs: First Defense® provides space-saving, easy-to-install surface water treatment in standard sized chambers/ manholes.
- Adapt to site limitations: Variable configuratoins will help you effectively slip First Defense® into a tight spot. It also works well with large pipes, multiple inlet pipes and inlet grates.
- Save installation time: Every First Defense® unit is delivered to site pre-assembled and ready for installation – so installation is as easy as fitting any chamber/manhole.

Stormwater Solutions

→ hydro-int.com/firstdefense

Sizing & Design

This adaptable online treatment system works easily with large pipes, multiple inlet pipes, inlet grates and now, contains a high capacity bypass for the conveyance of large peak flows. Designed with site flexibility in mind, the First Defense® High Capacity allows engineers to maximize available site space without compromising treatment level.



Free Sizing Tool

This simple online tool will recommend the best separator, model size and online/offline arrangement based on site-specific data entered by the user.

Go to hydro-int.com/sizing to access the tool.

First Defense® High Capacity Model Number	Diameter	Typical TSS Treatment Flow Rates		Peak Online Flow Rate	Maximum Pipe Diameter[1]	Oil Storage Capacity	Typical Sediment Storage Capacity[2]	Minimum Distance from Outlet Invert to Top of Rim[3]	Standard Distance from Outlet Invert to Sump Floor
		NJDEP Certified	110µm						
	(ft / m)	(cfs / L/s)	(cfs / L/s)	(cfs / L/s)	(in / mm)	(gal / L)	(yd^3 / m^3)	(ft / m)	(ft / m)
FD-3HC	3 / 0.9	0.84 / 23.7	1.06 / 30.0	15 / 424	18 / 450	125 / 473	0.4 / 0.3	2.0 - 3.5 / 0.6 - 1.0	3.71 / 1.13
FD-4HC	4 / 1.2	1.50 / 42.4	1.88 / 53.2	18 / 510	24 / 600	191 / 723	0.7 / 0.5	2.3 - 3.9 / 0.7 - 1.2	4.97 / 1.5
FD-5HC	5 / 1.5	2.35 / 66.2	2.94 / 83.2	20 / 566	24 / 600	300 / 1135	1.1 / .84	2.5 - 4.5 / 0.7 - 1.3	5.19 / 1.5
FD-6HC	6 / 1.8	3.38 / 95.7	4.23 / 119.8	32 / 906	30 / 750	496 / 1,878	1.6 / 1.2	3.0 - 5.1 / 0.9 - 1.6	5.97 / 1.8
FD-8HC	8 / 2.4	6.00 / 169.9	7.52 / 212.9	50 / 1415	48 / 1200	1120 / 4239	2.8 / 2.1	3.0 - 6.0 / 0.9 -1.8	7.40 / 2.2
FD-10HC	10 / 3.0	9.38 / 265.6	11.75 / 332.7	50 / 1415	48 / 1200	1742 / 6594	4.4 / 3.3	6.5 -8.0 / 2.0 - 2.4	10.25 / 3.12

[1]Contact Hydro International when larger pipe sizes are required.
[2]Contact Hydro International when custom sediment storage capacity is required.
[3]Minimum distance for models depends on pipe diameter.

Maintenance

Easy vactor hose access through the center shaft of the system makes for quick, simple sump cleanout while trash and floatables can be fished out from the surface with a net.

Nobody maintains our systems better than we do. To ensure optimal, ongoing device performance, be sure to recommend Hydro International as a preferred service and maintenance provider to your clients.

Hydro International

Hydro International, 94 Hutchins Drive, Portland, ME 04102
Tel: (207) 756-6200
Email: stormwaterinquiry@hydro-int.com
Web: www.hydro-int.com/firstdefense

FD_SS_B_2105

Download Drawings!

→ hydro-int.com/fddrawings

Access the Operation & Maintenance Manual

→ hydro-int.com/fd-om

Stage-Area-Storage for Pond INF/DET: Underground Infiltration/Detention System

Elevation (feet)	Wetted (sq-ft)	Storage (cubic-feet)	Elevation (feet)	Wetted (sq-ft)	Storage (cubic-feet)
111.50	1,406	0	112.01	1,497	292
111.51	1,408	6	112.02	1,498	303
111.52	1,409	11	112.03	1,500	314
111.53	1,411	17	112.04	1,502	324
111.54	1,413	22	112.05	1,504	335
111.55	1,415	28	112.06	1,506	346
111.56	1,417	34	112.07	1,507	357
111.57	1,418	39	112.08	1,509	368
111.58	1,420	45	112.09	1,511	379
111.59	1,422	51	112.10	1,513	390
111.60	1,424	56	112.11	1,514	401
111.61	1,425	62	112.12	1,516	411
111.62	1,427	67	112.13	1,518	422
111.63	1,429	73	112.14	1,520	433
111.64	1,431	79	112.15	1,522	444
111.65	1,433	84	112.16	1,523	455
111.66	1,434	90	112.17	1,525	466
111.67	1,436	96	112.18	1,527	478
111.68	1,438	101	112.19	1,529	490
111.69	1,440	107	112.20	1,531	502
111.70	1,441	112	112.21	1,532	515
111.71	1,443	118	112.22	1,534	528
111.72	1,445	124	112.23	1,536	542
111.73	1,447	129	112.24	1,538	555
111.74	1,449	135	112.25	1,539	569
111.75	1,450	141	112.26	1,541	583
111.76	1,452	146	112.27	1,543	597
111.77	1,454	152	112.28	1,545	612
111.78	1,456	157	112.29	1,547	626
111.79	1,457	163	112.30	1,548	641
111.80	1,459	169	112.31	1,550	656
111.81	1,461	174	112.32	1,552	671
111.82	1,463	180	112.33	1,554	686
111.83	1,465	186	112.34	1,555	701
111.84	1,466	191	112.35	1,557	717
111.85	1,468	197	112.36	1,559	732
111.86	1,470	202	112.37	1,561	748
111.87	1,472	208	112.38	1,563	763
111.88	1,474	214	112.39	1,564	779
111.89	1,475	219	112.40	1,566	795
111.90	1,477	225	112.41	1,568	811
111.91	1,479	231	112.42	1,570	827
111.92	1,481	236	112.43	1,572	843
111.93	1,482	242	112.44	1,573	859
111.94	1,484	247	112.45	1,575	875
111.95	1,486	253	112.46	1,577	892
111.96	1,488	259	112.47	1,579	908
111.97	1,490	264	112.48	1,580	925
111.98	1,491	270	112.49	1,582	941
111.99	1,493	276	112.50	1,584	958
112.00	1,495	281	112.51	1,586	975

Stage-Area-Storage for Pond INF/DET: Underground Infiltration/Detention System (continued)

Elevation (feet)	Wetted (sq-ft)	Storage (cubic-feet)
112.52	1,588	992
112.53	1,589	1,008
112.54	1,591	1,025
112.55	1,593	1,042
112.56	1,595	1,059
112.57	1,596	1,076
112.58	1,598	1,093
112.59	1,600	1,111
112.60	1,602	1,128
112.61	1,604	1,145
112.62	1,605	1,162
112.63	1,607	1,180
112.64	1,609	1,197
112.65	1,611	1,215
112.66	1,612	1,232
112.67	1,614	1,250
112.68	1,616	1,267
112.69	1,618	1,285
112.70	1,620	1,303
112.71	1,621	1,320
112.72	1,623	1,338
112.73	1,625	1,356
112.74	1,627	1,373
112.75	1,629	1,391
112.76	1,630	1,409
112.77	1,632	1,427
112.78	1,634	1,445
112.79	1,636	1,463
112.80	1,637	1,481
112.81	1,639	1,499
112.82	1,641	1,517
112.83	1,643	1,535
112.84	1,645	1,553
112.85	1,646	1,571
112.86	1,648	1,589
112.87	1,650	1,607
112.88	1,652	1,625
112.89	1,653	1,643
112.90	1,655	1,661
112.91	1,657	1,679
112.92	1,659	1,697
112.93	1,661	1,715
112.94	1,662	1,734
112.95	1,664	1,752
112.96	1,666	1,770
112.97	1,668	1,788
112.98	1,669	1,806
112.99	1,671	1,824
113.00	1,673	1,843
113.01	1,675	1,861
113.02	1,677	1,879
113.03	1,678	1,897
113.04	1,680	1,915
113.05	1,682	1,933
113.06	1,684	1,952
113.07	1,686	1,970
113.08	1,687	1,988
113.09	1,689	2,006
113.10	1,691	2,024
113.11	1,693	2,042
113.12	1,694	2,061
113.13	1,696	2,079
113.14	1,698	2,097
113.15	1,700	2,115
113.16	1,702	2,133
113.17	1,703	2,151
113.18	1,705	2,169
113.19	1,707	2,187
113.20	1,709	2,205
113.21	1,710	2,223
113.22	1,712	2,241
113.23	1,714	2,259
113.24	1,716	2,277
113.25	1,718	2,295
113.26	1,719	2,313
113.27	1,721	2,331
113.28	1,723	2,348
113.29	1,725	2,366
113.30	1,726	2,384
113.31	1,728	2,402
113.32	1,730	2,420
113.33	1,732	2,437
113.34	1,734	2,455
113.35	1,735	2,473
113.36	1,737	2,490
113.37	1,739	2,508
113.38	1,741	2,525
113.39	1,743	2,543
113.40	1,744	2,560
113.41	1,746	2,578
113.42	1,748	2,595
113.43	1,750	2,613
113.44	1,751	2,630
113.45	1,753	2,647
113.46	1,755	2,664
113.47	1,757	2,682
113.48	1,759	2,699
113.49	1,760	2,716
113.50	1,762	2,733
113.51	1,764	2,750
113.52	1,766	2,767
113.53	1,767	2,784

Required groundwater recharge elevation

Require water quality volume elevation

Storage provided below lowest outlet

Stage-Area-Storage for Pond INF/DET: Underground Infiltration/Detention System (continued)

Elevation (feet)	Wetted (sq-ft)	Storage (cubic-feet)	Elevation (feet)	Wetted (sq-ft)	Storage (cubic-feet)
113.54	1,769	2,801	114.05	1,860	3,549
113.55	1,771	2,817	114.06	1,862	3,560
113.56	1,773	2,834	114.07	1,864	3,571
113.57	1,775	2,851	114.08	1,865	3,582
113.58	1,776	2,867	114.09	1,867	3,592
113.59	1,778	2,884	114.10	1,869	3,603
113.60	1,780	2,901	114.11	1,871	3,613
113.61	1,782	2,917	114.12	1,873	3,623
113.62	1,784	2,933	114.13	1,874	3,632
113.63	1,785	2,950	114.14	1,876	3,641
113.64	1,787	2,966	114.15	1,878	3,650
113.65	1,789	2,982	114.16	1,880	3,658
113.66	1,791	2,998	114.17	1,881	3,666
113.67	1,792	3,014	114.18	1,883	3,673
113.68	1,794	3,030	114.19	1,885	3,680
113.69	1,796	3,046	114.20	1,887	3,687
113.70	1,798	3,062	114.21	1,889	3,694
113.71	1,800	3,078	114.22	1,890	3,701
113.72	1,801	3,093	114.23	1,892	3,707
113.73	1,803	3,109	114.24	1,894	3,714
113.74	1,805	3,124	114.25	1,896	3,721
113.75	1,807	3,140	114.26	1,898	3,728
113.76	1,808	3,155	114.27	1,899	3,734
113.77	1,810	3,170	114.28	1,901	3,741
113.78	1,812	3,185	114.29	1,903	3,747
113.79	1,814	3,200	114.30	1,905	3,753
113.80	1,816	3,215	114.31	1,906	3,760
113.81	1,817	3,230	114.32	1,908	3,766
113.82	1,819	3,245	114.33	1,910	3,772
113.83	1,821	3,259	114.34	1,912	3,778
113.84	1,823	3,274	114.35	1,914	3,784
113.85	1,824	3,288	114.36	1,915	3,790
113.86	1,826	3,302	114.37	1,917	3,797
113.87	1,828	3,317	114.38	1,919	3,803
113.88	1,830	3,331	114.39	1,921	3,809
113.89	1,832	3,345	114.40	1,922	3,814
113.90	1,833	3,359	114.41	1,924	3,820
113.91	1,835	3,372	114.42	1,926	3,826
113.92	1,837	3,386	114.43	1,928	3,832
113.93	1,839	3,399	114.44	1,930	3,838
113.94	1,841	3,413	114.45	1,931	3,844
113.95	1,842	3,426	114.46	1,933	3,849
113.96	1,844	3,439	114.47	1,935	3,855
113.97	1,846	3,452	114.48	1,937	3,861
113.98	1,848	3,465	114.49	1,939	3,867
113.99	1,849	3,477	114.50	1,940	3,872
114.00	1,851	3,489	114.51	1,942	3,878
114.01	1,853	3,502	114.52	1,944	3,883
114.02	1,855	3,514	114.53	1,946	3,889
114.03	1,857	3,525	114.54	1,947	3,895
114.04	1,858	3,537	114.55	1,949	3,900

Stage-Area-Storage for Pond INF/DET: Underground Infiltration/Detention System (continued)

Elevation (feet)	Wetted (sq-ft)	Storage (cubic-feet)
114.56	1,951	3,906
114.57	1,953	3,912
114.58	1,955	3,917
114.59	1,956	3,923
114.60	1,958	3,928
114.61	1,960	3,934
114.62	1,962	3,940
114.63	1,963	3,945
114.64	1,965	3,951
114.65	1,967	3,957
114.66	1,969	3,962
114.67	1,971	3,968
114.68	1,972	3,973
114.69	1,974	3,979
114.70	1,976	3,985
114.71	1,978	3,990
114.72	1,979	3,996
114.73	1,981	4,002
114.74	1,983	4,007
114.75	1,985	4,013
114.76	1,987	4,018
114.77	1,988	4,024
114.78	1,990	4,030
114.79	1,992	4,035
114.80	1,994	4,041
114.81	1,996	4,047
114.82	1,997	4,052
114.83	1,999	4,058
114.84	2,001	4,063
114.85	2,003	4,069
114.86	2,004	4,075
114.87	2,006	4,080
114.88	2,008	4,086
114.89	2,010	4,092
114.90	2,012	4,097
114.91	2,013	4,103
114.92	2,015	4,108
114.93	2,017	4,114
114.94	2,019	4,120
114.95	2,020	4,125
114.96	2,022	4,131
114.97	2,024	4,137
114.98	2,026	4,142
114.99	2,028	4,148
115.00	**2,029**	**4,153**

GPI Project No.	21347	**Sheet**	1 of 1
Project Description	477 & 479 Broadway - Methuen, MA		
Task	Drawdown Calculations		
Calculated By	CNM	**Date**	03/06/24
Checked By		**Date**	

Greenman-Pedersen, Inc.

Drawdown within 72 hours Analysis for Static Method

Underground Infiltration System

Infiltration Rate: 8.27 inches/hour (From table 2.3.3: Rawls, Brakensiek, Saxton, 1982)

Design Infiltration Rate: 8.27 inches/hour

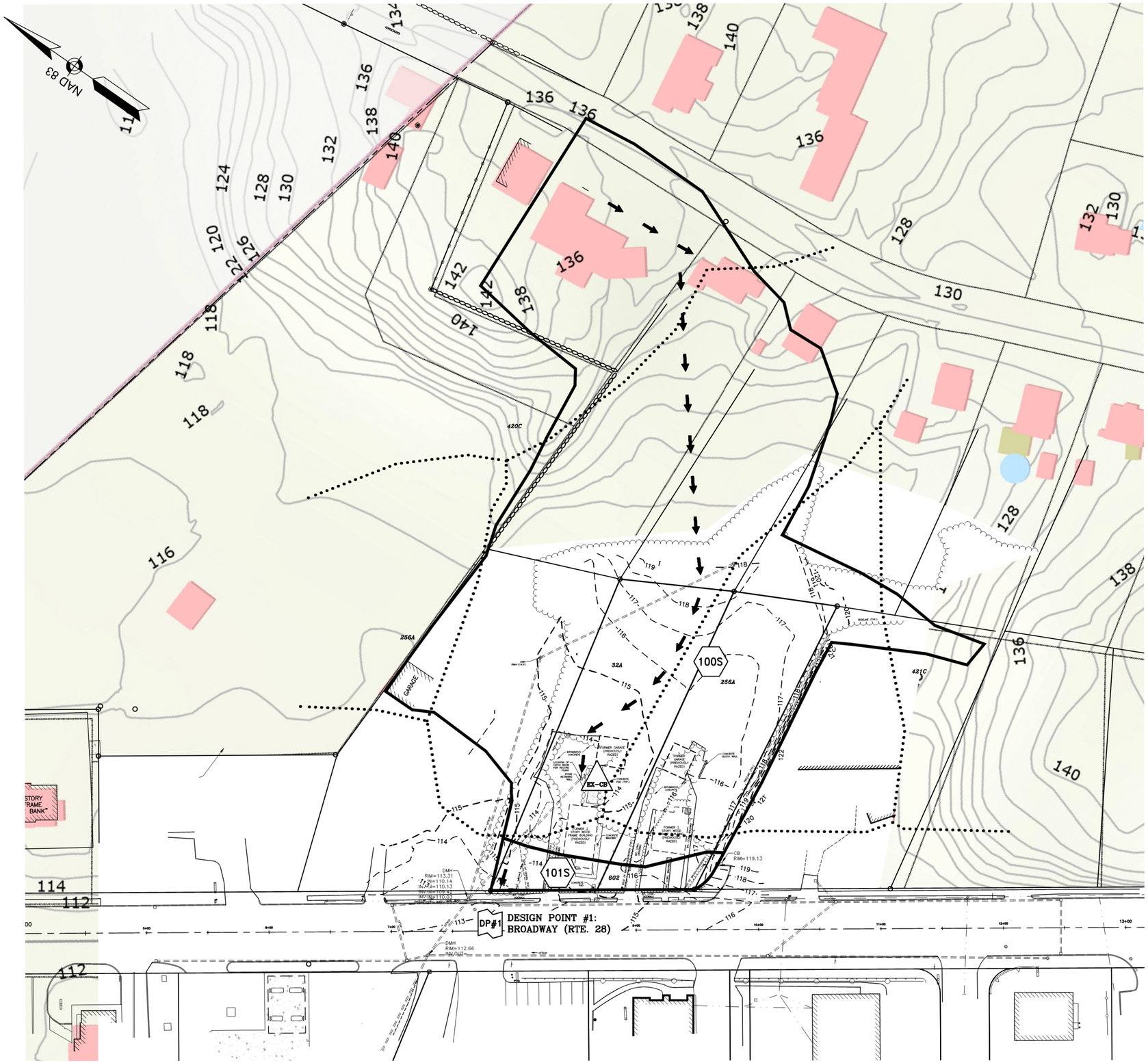
Total Volume: 2,024 cf (volume below lowest outlet orifice)

System bottom area: 1,406 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)

$Time_{drawdown}$ = (2,024 cf) (1 / 8.27 in/hr) (1ft/12 in.) (1 / 1,406 sf)

= 2.09 hours



WATERSHED LEGEND

SUB — SUBCATCHMENT: A relatively homogeneous area of land that drains into a single reach or pond. Each subcatchment generates a runoff hydrograph. (A subcatchment may also be used to account for the rain falling directly on the surface of a pond.)

REACH — REACH: A uniform stream, channel, or pipe that conveys water from one point to another reach or pond. The outflow of each reach is determined by a hydrograph routing calculation.

POND — POND: A pond, swamp, dam, or other impoundment that fills with water from one or more sources and empties in a manner determined by a weir, culvert, or other device(s) at its outlet. The outflow(s) of each pond is determined by a hydrograph routing calculation. The primary and/or secondary outflow may drain into a reach or into another pond.

DP#1 — DESIGN POINT

Time of Concentration Path (Tc)

Watershed Divide Line

SOIL LEGEND

256A — SOIL TYPE DESIGNATION

SOIL BOUNDARY

0 40 100 160

SCALE: 1" = 40'

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

PREPARED FOR
CAFUA MANAGEMENT COMPANY, LLC
280 MERRIMACK STREET
METHUEN, MA 01844

ASSESSORS MAP 610 BLOCK 58 LOTS 4 & 5
477 & 479 BROADWAY
METHUEN, MASSACHUSETTS

REVISIONS		
1	MISC. REVISIONS	5/30/24
NO.	REVISION	DATE

MARCH 6, 2024

DRAWN/DESIGN BY	CHECKED BY
SJB/CMT	CMT

PRE - DEVELOPMENT DRAINAGE AREA PLAN

SCALE: 1"=40'

PROJECT NO. NEX-2021347

WATERSHED LEGEND

SUB — SUBCATCHMENT: A relatively homogeneous area of land that drains into a single reach or pond. Each subcatchment generates a runoff hydrograph. (A subcatchment may also be used to account for the rain falling directly on the surface of a pond.)

REACH — REACH: A uniform stream, channel, or pipe that conveys water from one point to another reach or pond. The outflow of each reach is determined by a hydrograph routing calculation.

POND — POND: A pond, swamp, dam, or other impoundment that fills with water from one or more sources and empties in a manner determined by a weir, culvert, or other device(s) at its outlet. The outflow(s) of each pond is determined by a hydrograph routing calculation. The primary and/or secondary outflow may drain into a reach or into another pond.

DP#1 — DESIGN POINT

Time of Concentration Path (Tc)

Watershed Divide Line

SOIL LEGEND

256B — SOIL TYPE DESIGNATION

SOIL BOUNDARY

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

PREPARED FOR
CAFUA MANAGEMENT
COMPANY, LLC
280 MERRIMACK STREET
METHUEN, MA 01844

ASSESSORS MAP 610 BLOCK 58 LOTS 4 & 5
477 & 479 BROADWAY
METHUEN, MASSACHUSETTS

REVISIONS		
2	MISC. REVISIONS	7/2/24
1	MISC. REVISIONS	5/30/24
NO.	REVISION	DATE

MARCH 6, 2024

DRAWN/DESIGN BY	CHECKED BY
SJB/CMT	CMT

POST - DEVELOPMENT DRAINAGE AREA PLAN

SCALE: 1"=40'

PROJECT NO. NEX-2021347

2 OF 2