STORMWATER MANAGEMENT REPORT

FOR: OLD SILVER ESTUARY ON LITTLE RIVER, LLC

PROPOSED 6 LOT SUBDIVISION

100 FOREST ROAD

SALISBURY, MA

TAX MAP 26 LOT Nos. 5 & 7

PREPARED BY:

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AUGUST 2, 2022

REV. MAY 4, 2023
REV: JUNE 7, 2023

1.0 INTRODUCTION

1.1 Project Description

Old Silver Estuary On Little River, LLC proposes to construct a 6-lot residential subdivision. Associated infrastructure improvements will include a stormwater management system, utility connections, lighting and landscaping. Access to the site will continue to be provided via Forest Road.

1.2 Existing Site Characteristics

The subject parcels are described as Tax Map 26, Lot Nos. 5 & 7 on the Town of Salisbury, MA Assessor's Map and are bordered by Forest Road to the west. The property is located in the Low Density (R-1) and Medium Density (R-2) Zoning Districts. Elevations within the project site range from 28.00' within some of the ledge outcrops to 4.00' in the marsh at the rear of the site. These elevations are based upon 1988 NAVD.

Map 26 Lot 5 contains an old dwelling, barn and shed that will be removed. Access to the site is via a driveway that runs through 102 Forest Road. An old woods road runs through the parcel. The remainder of the parcel is undeveloped woodland.

Map 26 Lot 7 is a landlocked parcel that is undeveloped woodland. The old woods road runs through this parcel as well. This parcel contains a number of ledge outcrops as well as views of the marsh and Little River.

See the accompanying plan for a more detailed description of the existing site conditions and topography.

The lot consists of several soil groups: Swanton fine sandy loam, 40A (Hydrologic Soil Group C/D); Rock outcrop-Hollis complex, 105D (No Hydrologic Soil Group); Elmwood fine sandy loam, 240B (Hydrologic Soil Group B); Windsor loamy sand, 255B (Hydrologic Soil Group A); Ipswich and Westbrook mucky peats, 712A (Hydrologic Soil Group A/D); and Windsor-Rock outcrop complex, 721C (Hydrologic Soil Group A). See Appendix F for the NRCS soil map. In addition, soil evaluations were performed onsite to assist in the design of the septic systems. Nearly 100 test pits have been performed since July 2022 which indicated a mix of sandy soils and silty loam soils, as well as numerous areas of ledge.

1.3 Proposed Site Features

The proposal is to construct a 6-lot residential subdivision. 710 linear feet of 26' wide paved roadway connecting to Forest Road is proposed. The roadway profile throughout the development ranges from 1% to 2.44%.

The houses on Lots 1-4 will be accessed via a shared driveway. The shared driveway will run through Lot 3 and will have 2 small wetland crossings. Lots 5 and 6 will have their own driveway off of the proposed roadway.

The development will include the installation of public and private utilities to support the dwellings. The development will tie into the existing water distribution system. Each dwelling will have its own individual septic system. Electrical, telephone and cable service will be provided.

The storm water management system for the proposed development will consist of a typical pipe and catch basin/manhole drainage network within the proposed roadway. A Contech CDS unit will be provided to treat the runoff before it discharges into the resource area. Underground infiltration systems will be constructed for some dwellings to infiltrate the roof runoff. The subdivision plans show typical 3,000-5,000 s.f. building footprints on each lot. More detailed house designs and lot grading will occur on the septic and Notice of Intent plans.

2.0 WATERSHED ANALYSIS AND METHODOLOGY

The proposed site is located within or discharges to Land Subject to Coastal Storm Flowage; therefore, the site does not have to meet Stormwater Management Standard No.2 – Post-development peak discharge rates. However, all impervious areas will be directed to the roadway drainage system and a Contech CDS unit for treatment. The Contech CDS unit will remove the required 80% TSS from the runoff prior to leaving the site.

The stormwater runoff management system was analyzed using the storm events of the 2-year, 10-year and 100-year frequency. The analysis was performed using HydroCAD, version 10.00. Using USDA NRCS TR-20 and TR-55 methods of estimating runoff, the program uses the measured characteristics of the site and computes runoff produced by simulated rainfall events. The results are then used to design runoff control structures.

3.0 STORMWATER STANDARDS CALCULATIONS

The Stormwater Management Plan developed for this project incorporates water quantity and quality controls that will protect surface and groundwater resources and adjacent properties from potential impacts due to increased impervious areas on the site. The following provides a brief discussion on how the proposed project will meet the ten established performance standards of the DEP Stormwater Management Policy.

1. No new stormwater conveyances (e.g. outfalls) may discharge untreated stormwater directly to or cause erosion in wetlands or waters of the Commonwealth.

No proposed site stormwater conveyance systems will discharge untreated stormwater directly to wetlands or surrounding areas. Stormwater runoff from the proposed roadway will flow into the proposed treatment device before discharging into the resource area.

2. Stormwater management systems shall be designed so that post-development peak discharge rates do not exceed pre-development peak discharge rates. This Standard may be waived for discharges to land subject to coastal storm flowage as defined in 310 CMR 10.04.

The proposed site is located within Land Subject to Coastal Storm Flowage; therefore, the site does not have to meet Stormwater Management Standard No.2 – Post-development peak discharge rates.

3. Loss of annual recharge to groundwater shall be eliminated or minimized through the use of infiltration measures including environmentally sensitive site design, low impact development techniques, stormwater best management practices, and good operation and maintenance. At a minimum, the annual recharge from the post-development site shall approximate the annual recharge from pre-development conditions based on soil type. This Standard is met when the stormwater management system is designed to infiltrate the required recharge volume as determined in accordance with the Massachusetts Stormwater Handbook.

Required Recharge volume, Rv (A soil) = F * impervious area
= 0.60 in * 29,190 s.f.
= 1,460 c.f.

Required Recharge volume, Rv (B soil) = F * impervious area
= 0.35 in * 12,650 s.f.
= 369 c.f.

Required Recharge volume, Rv (C soil) = F * impervious area
= 0.25 in * 48,005 s.f.
= 1,000 c.f.

Total Recharge required = 2,829 c.f.
Total Recharge provided = 1,545 c.f. (Roof drywells Lots 1,4, and 6)

Standard No. 3 of the Massachusetts Stormwater Management Handbook requires post-development conditions to, at a minimum, approximate the annual recharge from pre-development conditions. The Handbook provides guidance for the design of best management practices (BMP's) used in new development and redevelopment projects. Due to the presence of ledge throughout the site, recharge is provided to the extent practicable.

4. Stormwater management systems shall be designed to remove 80% of the average annual post-construction load of Total Suspended Solids (TSS). This Standard is met when:

a. Suitable practices for source control and pollution prevention are identified in a long-term pollution prevention plan, and thereafter are implemented and maintained;

b. Structural stormwater best management practices are sized to capture the required water quality volume determined in accordance with the Massachusetts Stormwater Handbook; and
c. Pretreatment is provided in accordance with the Massachusetts Stormwater Handbook.

The Massachusetts DEP requires water quality calculations based on 0.5 inch of runoff for the total impervious area associated with the proposed development. The following calculation identifies the water quality volume required.

Total Impervious Area = 89,840 s.f.
89,840 s.f. x 0.5" / 12 (to convert to ft) = 3,743 c.f. of runoff to be treated for water quality.

The proposed development's drainage system must meet the MA Office of Coastal Zone management (CZM)/MA Department of Environmental Protection (DEP) Stormwater Management policy standard of removing 80% of the average annual load of Total Suspended Solids (TSS). The stormwater management system for this development will include the use of a Contech CDS unit for treatment prior to discharge into the drainage system. The following demonstrates that the proposed storm water management system for the development satisfies the requirement for treatment of 80% of total Suspended Solids:

Contech CDS2015-4	93%

5. For land uses with higher potential pollutant loads, source control and pollution prevention shall be implemented in accordance with the Massachusetts Stormwater Handbook to eliminate or reduce the discharge of stormwater runoff from such land uses to the maximum extent practicable. If through source control and/or pollution prevention all land uses with higher potential pollutant loads cannot be completely protected from exposure to rain, snow, snow melt, and stormwater runoff, the proponent shall use the specific structural stormwater BMPs determined by the Department to be suitable for such uses as provided in the Massachusetts Stormwater Handbook. Stormwater discharges from land uses with higher potential pollutant loads shall also comply with the requirements of the Massachusetts Clean Waters Act, M.G.L. c. 21, §§ 26-53 and the regulations promulgated there under at 314 CMR 3.00, 314 CMR 4.00 and 314 CMR 5.00.

This project does not qualify as a land use with higher potential pollutant loads.

6. Stormwater discharges within the Zone II or Interim Wellhead Protection Area of a public water supply, and stormwater discharges near or to any other critical area, require the use of the specific source control and pollution prevention measures and the specific structural stormwater best management practices determined by the Department to be suitable for managing discharges to such areas, as provided in the Massachusetts Stormwater Handbook. A discharge is near a critical area if there is a strong likelihood of a significant impact occurring to said area, taking into account site-specific factors.

Stormwater discharges to Outstanding Resource Waters and Special Resource Waters shall be removed and set back from the receiving water or wetland and receive the highest and best practical method of treatment. A "storm water discharge" as defined in 314 CMR 3.04(2)(a)1 or (b) to an Outstanding Resource Water or Special Resource Water shall comply with 314 CMR 3.00 and 314 CMR 4.00. Stormwater discharges to a Zone I or Zone A are prohibited unless essential to the operation of a public water supply.

This project does not fall within a critical area.

7. A redevelopment project is required to meet the following Stormwater Management Standards only to the maximum extent practicable: Standard 2, Standard 3, and the pretreatment and structural best management practice requirements of Standards 4, 5, and 6. Existing stormwater discharges shall comply with Standard 1 only to the maximum extent practicable. A redevelopment project shall also comply with all other requirements of the Stormwater Management Standards and improve existing conditions.

The proposed development is not considered a redevelopment project and does not meet the requirements of definition for this standard.

8. A plan to control construction-related impacts including erosion, sedimentation and other pollutant sources during construction and land disturbance activities (construction period erosion, sedimentation, and pollution prevention plan) shall be developed and implemented.

The proposed development design includes erosion and sediment controls to minimize the potential for sedimentation in down gradient resource areas. Reference is made to the project plans for additional information.

9. A long-term operation and maintenance plan shall be developed and implemented to ensure that stormwater management systems function as designed.

An O&M plan has been developed and is included in this report.

10. All illicit discharges to the stormwater management system are prohibited.

No illicit discharges exist on the site.

4.0 CONCLUSIONS

The results of this report indicate the proposed stormwater management system for the proposed development is capable of treating the runoff for the 2-year, 10-year and 100-year storm events. The proposed storm water management facilities shown on the Site Plan will produce no adverse storm water runoff impacts under the storms analyzed.

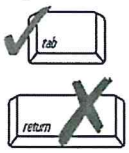
5.0 APPENDIX A – STORMWATER REPORT CHECKLIST

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

Checklist for Stormwater Report

A. Introduction

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



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

The Stormwater Report must include:

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

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

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

[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.

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

Checklist for Stormwater Report

conservation commissions and other reviewing authorities with a summary of the components necessary for a comprehensive Stormwater Report that addresses the ten Stormwater Standards.

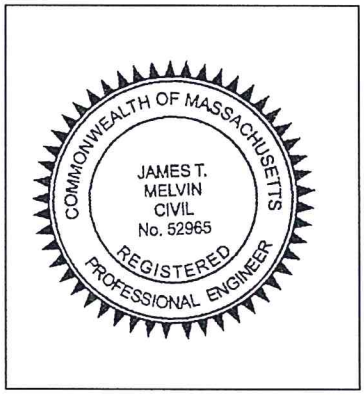
Note: Because stormwater requirements vary from project to project, it is possible that a complete Stormwater Report may not include information on some of the subjects specified in the Checklist. If it is determined that a specific item does not apply to the project under review, please note that the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



5-4-23

Signature and Date

Checklist

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

☒ New development

☐ Redevelopment

☐ Mix of New Development and Redevelopment

Checklist (continued)

Checklist for Stormwater Report

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

- ☐ 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): Underground Infiltration

Standard 1: No New Untreated Discharges

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

Checklist (continued)

Standard 2: Peak Rate Attenuation

Checklist for Stormwater Report

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

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

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

Standard 3: Recharge

☒ Soil Analysis provided.

☒ Required Recharge Volume calculation provided.

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

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

☒ Static ☐ Simple Dynamic ☐ Dynamic Field[1]

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

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

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

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

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

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

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

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

Checklist (continued)

Standard 3: Recharge (continued)

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

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

Standard 4: Water Quality

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

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

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

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

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

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

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

Checklist (continued)

Standard 4: Water Quality (continued)

Checklist for Stormwater Report

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

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

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

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

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

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

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

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

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

☐ All exposure has been eliminated.

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

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

Standard 6: Critical Areas

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

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

Checklist (continued)

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

Checklist for Stormwater Report

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

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

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

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

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

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

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

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

Checklist (continued)

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

Checklist for Stormwater Report

☐ 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.

6.0 APPENDIX B – LONG-TERM POLLUTION PREVENTION PLAN AND OPERATION & MAINTENANCE PLAN

LONG-TERM POLLUTION PREVENTION PLAN

AND

OPERATION & MAINTENANCE PLAN

For

OLD SILVER ESTUARY ON LITTLE RIVER, LLC
23 COLLINS STREET
NEWBURYPORT, MA 01950

PROPOSED 6-LOT SUBDIVISION AT 100 FOREST ROAD

PREPARED BY:

MILLENNIUM ENGINEERING, INC.
62 ELM STREET
SALISBURY, MA 01952
(978) 463–8980

AUGUST 2, 2022

This long-term Stormwater Management System Operations and Maintenance (O&M) Plan, filed with the Town of Salisbury, shall be implemented at 100 Forest Road to ensure that the stormwater management system functions as designed. The Owner holds the primary responsibility for overseeing and implementing the O&M Plan and assigning a Property Manager who will be responsible for the proper operation and maintenance of the stormwater structures. In case of transfer of property ownership, future property owners shall be notified of the presence of the stormwater management system and the requirements for proper implementation of the O&M Plan. Included in the manual is a Stormwater Management O&M Plan identifying the key components of the stormwater system and a log for tracking inspections and maintenance.

The stormwater management system protects and enhances the stormwater runoff water quality through the removal of sediment and pollutants, and source control significantly reduces the amount of pollutants entering the system. Preventive maintenance of the system will include a comprehensive source reduction program of regular vacuuming and litter removal, and prohibitions on the use of pesticides.

The purpose of the Stormwater Operations and Maintenance (O&M) plan is to ensure inspection of the system, removal of accumulated sediments, oils, and debris, and implementation of corrective action and record keeping activities.

The ongoing responsibility is the Owner, its successors and assigns. Adequate maintenance is defined in this document as good working condition.

Contact information is provided below:

Responsibility for Operations and Maintenance During Construction
Old Silver Estuary On Little River, LLC
23 Collins Street
Newburyport, MA 01950
(978) 518-0525

EROSION AND SEDIMENT CONTROL BMPs

Minimize Disturbed Area and Protect Natural Features and Soil

Topsoil

Topsoil stripped from the immediate construction area can be temporarily stockpiled on site providing that the perimeter of the stockpiles is properly staked with silt fence at the toe of slope. The stockpiles shall be in areas that will not interfere with construction and at least 15 feet away from areas of concentrated flows or pavement. The area shall be inspected weekly for erosion and immediately after storm events. Areas on or around the stockpile that have eroded shall be stabilized immediately with erosion controls.

Stabilize Soils

Temporary Stabilization

- All vegetated areas which do not exhibit a minimum of 85% vegetative growth by Oct. 15th, or which are disturbed after Oct. 15th, shall be stabilized by seeding and installing erosion control blankets on slopes greater than 3:1, and seeding and placing 3 to 4 tons of mulch per acre, secured with anchored netting, elsewhere. The placement of erosion control blankets or mulch and netting shall not occur over accumulated snow or on frozen ground and shall be completed in advance of thaw or spring melt events.
- All ditches or swales which do not exhibit a minimum of 85% vegetative growth by Oct. 15th, or which are disturbed after Oct. 15th, shall be stabilized with stone or erosion control blankets appropriate for the design flow conditions.
- After November 15th, incomplete road surfaces, where work has stopped for the winter season, shall be protected with a minimum of 3 inches of crushed gravel.

Protect Slopes

Geotextile erosion control blankets shall be used to provide stabilization for slopes exceeding 3:1. Prepare soil before installing erosion control blanket, including any necessary application of lime, fertilizer, and seed. Begin at the top of the slope by anchoring the blanket in a 6" deep x 6" wide trench with approximately 12" extended beyond the upslope portion of the trench. Anchor the blanket with a row of staples/stakes approximately 12" apart in the bottom of the trench. Backfill and compact the trench after stapling. Apply seed to compacted soil and fold remaining 12" portion of back over seed and compacted soil. Secure over compacted soil with a row of staples/stakes spaced approximately 12" apart across the width of the blanket. Roll erosion control blanket either down or horizontally across the slope. Blanket will unroll with appropriate side against the soil surface. All blankets must be securely fastened to soil surface by placing staples/stakes in appropriate locations as shown in the staple pattern guide. When using the dot system, staples/stakes should be placed through each of the colored dots corresponding to the appropriate staple pattern. The edges of parallel blankets must be stapled with approximately 2"-5" overlap. Consecutive blankets spliced down the slope must be placed end over end (shingle style) with an approximate 3" overlap. Staple through

overlapped area, approximately 12" apart across entire blanket's width. In loose soil conditions, the use of staple or stake lengths greater than 6" may be necessary to properly anchor the blanket.

Establish Perimeter Controls and Sediment Barriers

Silt fence shall be installed along the limit of work. The silt fence shall be installed before construction begins. Wooden posts shall be doubled and coupled at filter cloth seams. Filter cloth shall be fastened securely to support netting with ties spaced every 24" at top, midsection, and bottom. When two sections of filter cloth adjoin each other, they shall be overlapped by 6 inches, folded and stapled. Woodchips shall be installed at downslope side of silt fence and shall remain after silt fence is removed. Silt fence shall be removed upon completion of the project and stabilization of all soil.

Maintenance:
1. Silt fence shall be inspected immediately after each rainfall and at least daily during prolonged rainfall. Any repairs that are required shall be made immediately.
2. If the fabric on the silt fence shall decompose or become ineffective during the expected life of the fence, the fabric shall be replaced promptly.
3. Sediment deposits shall be inspected after every storm event. The deposits shall be removed when they reach approximately one-half the height of the barrier.
4. Sediment deposits that are removed or left in place after the fabric has been removed shall be graded to conform with the existing topography and vegetated.

Establish Stabilized Construction Entrance

A stabilized construction entrance shall be installed before construction begins on the site. The stone anti-tracking pad shall remain in place until the subgrade of pavement is installed.

1. Stone shall be 4-6" stone, reclaimed stone, or recycled concrete equivalent.
2. The length of the stabilized entrance shall not be less than 50'.
3. The thickness of the stone for the stabilized entrance shall not be less than 12".
4. Geotextile filter cloth shall be placed over the entire area prior to placing the stone.
5. All surface water that is flowing to or diverted toward the construction entrance shall be piped beneath the entrance. If piping is impractical, a berm with 5:1 slopes that can be crossed by vehicles may be substituted for the pipe.
6. The entrance shall be maintained in a condition that will prevent tracking or flowing of sediment onto public rights-of-way. This may require periodic top-dressing with additional stone as conditions demand and repair and/or cleanout of any measures used to trap sediment. All sediment spilled, washed, or tracked onto public rights-of-way must be removed promptly.
7. Wheels shall be cleaned to remove mud prior to entrance onto public rights-of way. When washing is required, it shall be done on an area stabilized with stone which drains into an approved sediment trapping device.

Catch Basin Inlet Protection

Inlet protection devices intercept and/or filter sediment before it can be transported from a site into the storm drain system and discharged into a lake, river, stream, wetland, or other waterbody. These devices also keep sediment from filling or clogging storm drain pipes, ditches, and downgradient sediment traps or ponds. A siltsack or approved equal shall be used for catch basin inlet protection. It should be inspected weekly. When the restraint cord is no longer visible, siltsack is full and shall be emptied.

POST-CONSTRUCTION BMPs

Snow and Snow Melt Management

Proper management of snow and snow melt, snow removal and storage, use of deicing compounds, and other practices can minimize major runoff and pollutant loading impacts. Snow will be stored in the areas shown on the site plan. Snow is not to be plowed or piled within the wetlands, wetland buffer, or constructed wetland. Use of alternative deicing compounds, such as calcium chloride and calcium magnesium acetate, will be investigated for use. Professional services will be used for snow management.

Catch Basins

Catch basins are incorporated in the proposed development's stormwater management plan. The sump provides for settlement of suspended solids and a hood is provided to remove floatables and trapped hydrocarbons. It is not anticipated that the proposed paved areas will become an area of high sediment loading. The sump should be inspected and cleaned at least four times per year; the more frequent the cleaning, the less likely sediment will be resuspended and subsequently discharged. Catch basin sediments and debris shall be disposed of at an approved DEP landfill. The Town shall be responsible for the catch basin cleaning operations.

CDS System

A CDS2015-4 is incorporated into the site design for treatment for the proposed Drainage system. At a minimum, the unit shall be inspected twice per year (spring and fall). The CDS unit should be vacuum cleaned when the level of sediment has reached 75% of capacity in the isolated sump. Sediments and debris shall be disposed of at an approved DEP landfill. The Town shall be responsible for the CDS cleaning operations.

Cultec Rechargers

Cultec rechargers are incorporated into the site design for rooftop infiltration. The Cultec recharge system shall be inspected after every major storm event in the first 4 months after construction to ensure proper function. Inspection ports shall be utilized for access and assessment. After the four-month period, the system shall be inspected a minimum of twice per year. Any grit or sediment found within the chambers impacting infiltration shall be

removed by manual or mechanical methods, such as a vacuum truck. The individual homeowners will be responsible for proper maintenance of the cultec system.

FINAL STABILIZATION

Permanent Seeding

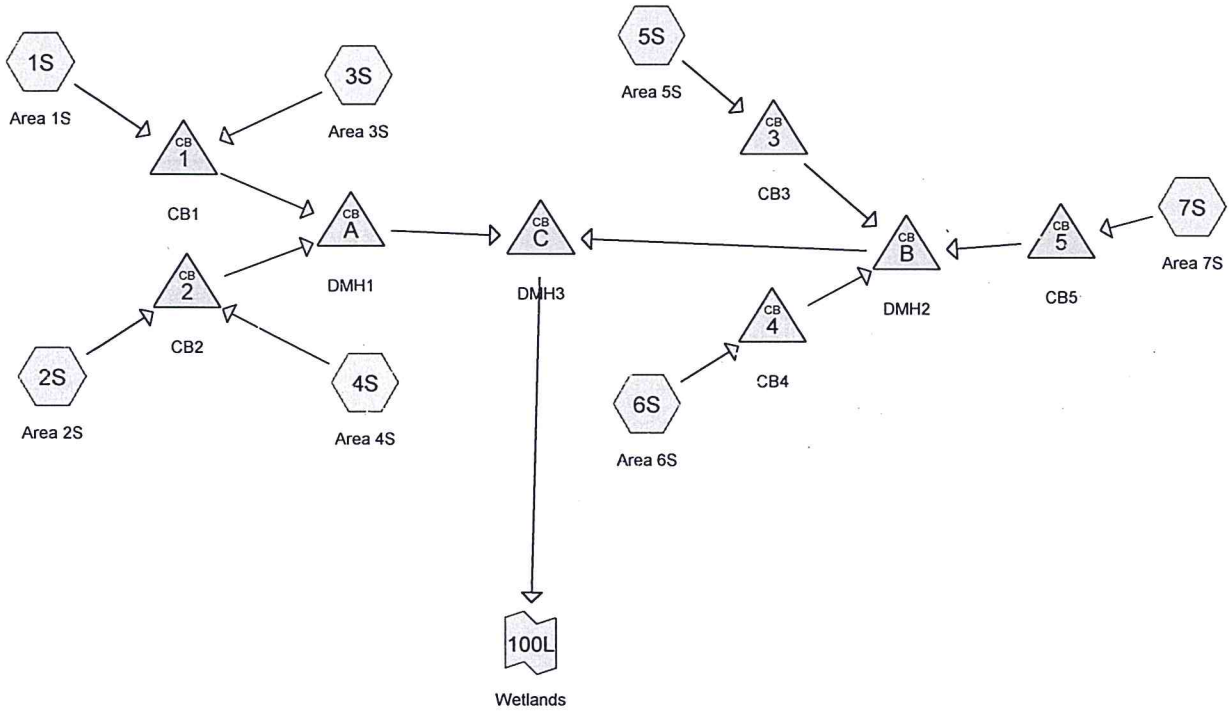
Loam and hydroseed any disturbed surfaces after the final design grades have been achieved. A minimum of 6" of loam shall be installed. Seed mix shall be MA State Slope Mixture (50% creeping red fescue, 30% Kentucky 31 tall fescue, 10% annual ryegrass, 5% red top, 5% ladino clover) and MA State Plot Mixture (50% creeping red fescue, 25% 85/80 Kentucky bluegrass, 10% annual ryegrass, 10% red top, 5% ladino clover).

Construction debris, trash and temporary BMPs (including silt fences, material storage areas, and inlet protection) will also be removed and any areas disturbed during removal will be seeded immediately.

INSPECTION & MAINTENANCE LOG

Activity	*Date*	*Inspected By*	*Findings*
Deep Sump Catch Basin (4x per year)			
CDS2015-4 Cleaning (2x per year)			
Rip-rap Outlet (2x per year)			
Cultec Recharger Inspection (2x per year min.)			
Roof Drain Cleanouts (2x per year)			
Vegetation and Landscaping (2x per year)			

7.0 APPENDIX C – POST-DEVELOPMENT DRAINAGE CALCULATIONS



Subcat Reach Pond Link

Routing Diagram for M213946-Proposed
Prepared by Millennium Engineering, Inc., Printed 8/2/2022

Summary for Subcatchment 1S: Area 1S

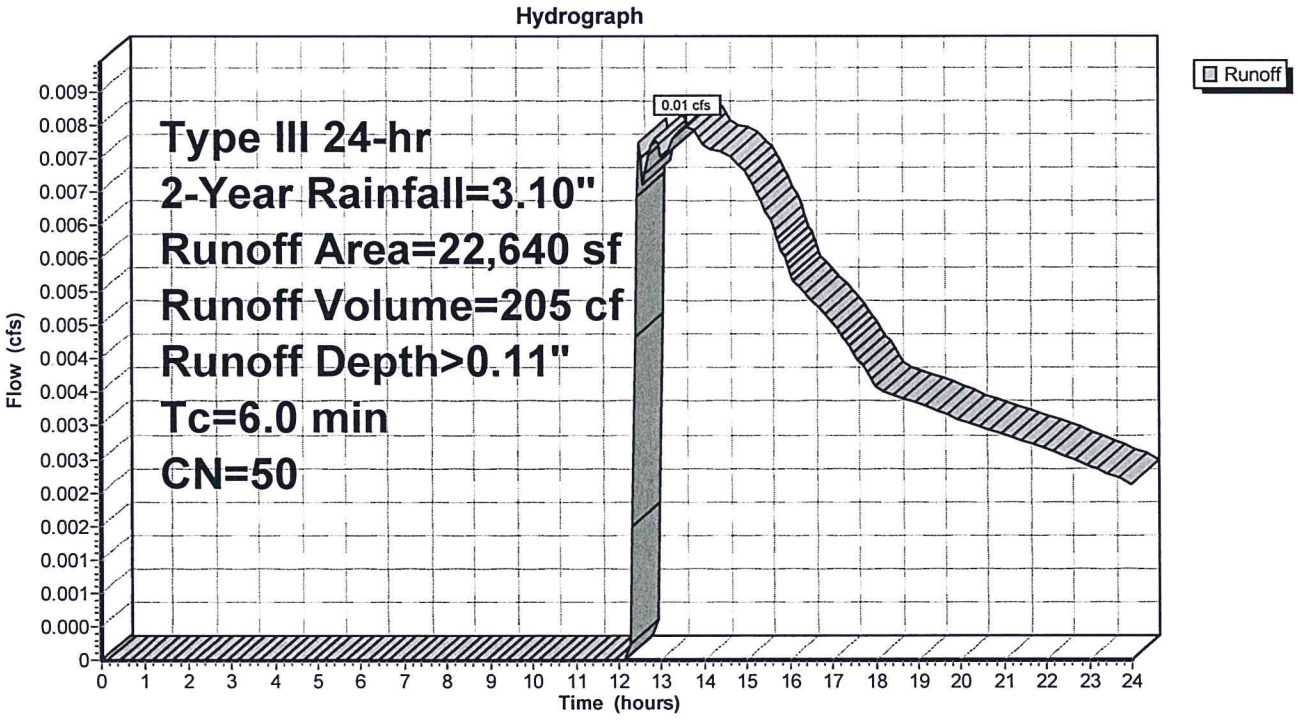
Runoff = 0.01 cfs @ 13.63 hrs, Volume= 205 cf, Depth> 0.11"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.10"

Area (sf)	CN	Description
2,020	98	Paved roads w/curbs & sewers, HSG A
1,050	98	Roofs, HSG A
2,300	96	Gravel surface, HSG A
10,170	39	>75% Grass cover, Good, HSG A
7,100	30	Woods, Good, HSG A
22,640	50	Weighted Average
19,570		86.44% Pervious Area
3,070		13.56% Impervious Area

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

Subcatchment 1S: Area 1S



Summary for Subcatchment 3S: Area 3S

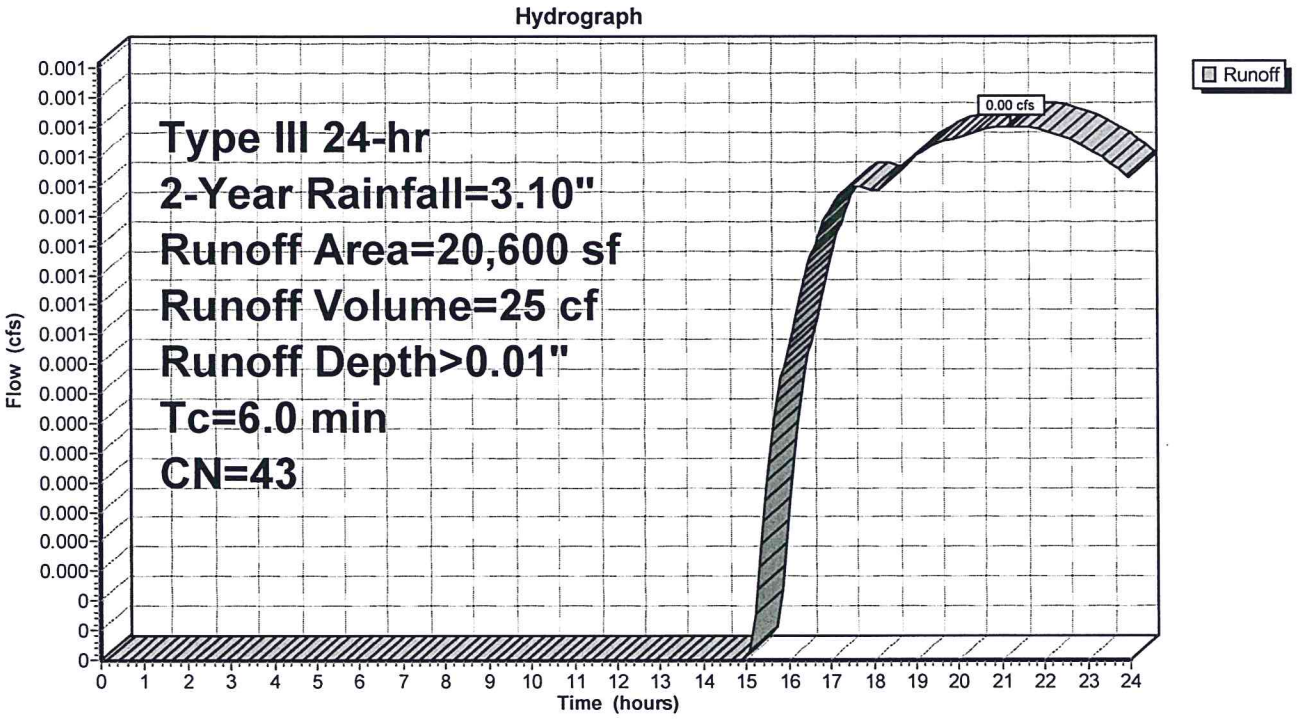
Runoff = 0.00 cfs @ 21.24 hrs, Volume= 25 cf, Depth> 0.01"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.10"

Area (sf)	CN	Description
2,900	98	Paved roads w/curbs & sewers, HSG A
8,200	39	>75% Grass cover, Good, HSG A
9,500	30	Woods, Good, HSG A
20,600	43	Weighted Average
17,700		85.92% Pervious Area
2,900		14.08% Impervious Area

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

Subcatchment 3S: Area 3S



Summary for Pond 1: CB1

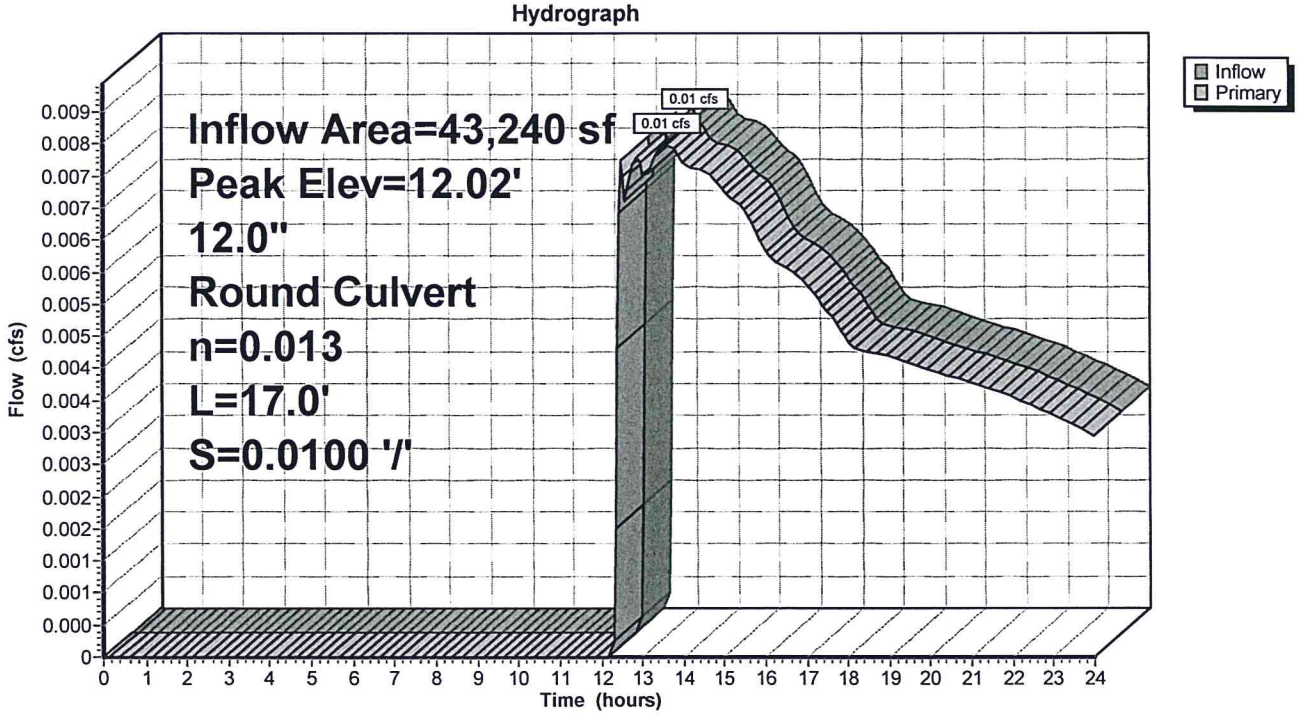
Inflow Area = 43,240 sf, 13.81% Impervious, Inflow Depth > 0.06" for 2-Year event
Inflow = 0.01 cfs @ 13.63 hrs, Volume= 230 cf
Outflow = 0.01 cfs @ 13.63 hrs, Volume= 230 cf, Atten= 0%, Lag= 0.0 min
Primary = 0.01 cfs @ 13.63 hrs, Volume= 230 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 12.02' @ 13.63 hrs
Flood Elev= 15.37'

Device	Routing	Invert	Outlet Devices
#1	Primary	11.97'	**12.0" Round Culvert** L= 17.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 11.97' / 11.80' S= 0.0100 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=0.01 cfs @ 13.63 hrs HW=12.02' TW=11.75' (Dynamic Tailwater)
↑—**1=Culvert** (Barrel Controls 0.01 cfs @ 0.91 fps)

Pond 1: CB1



Summary for Subcatchment 2S: Area 2S

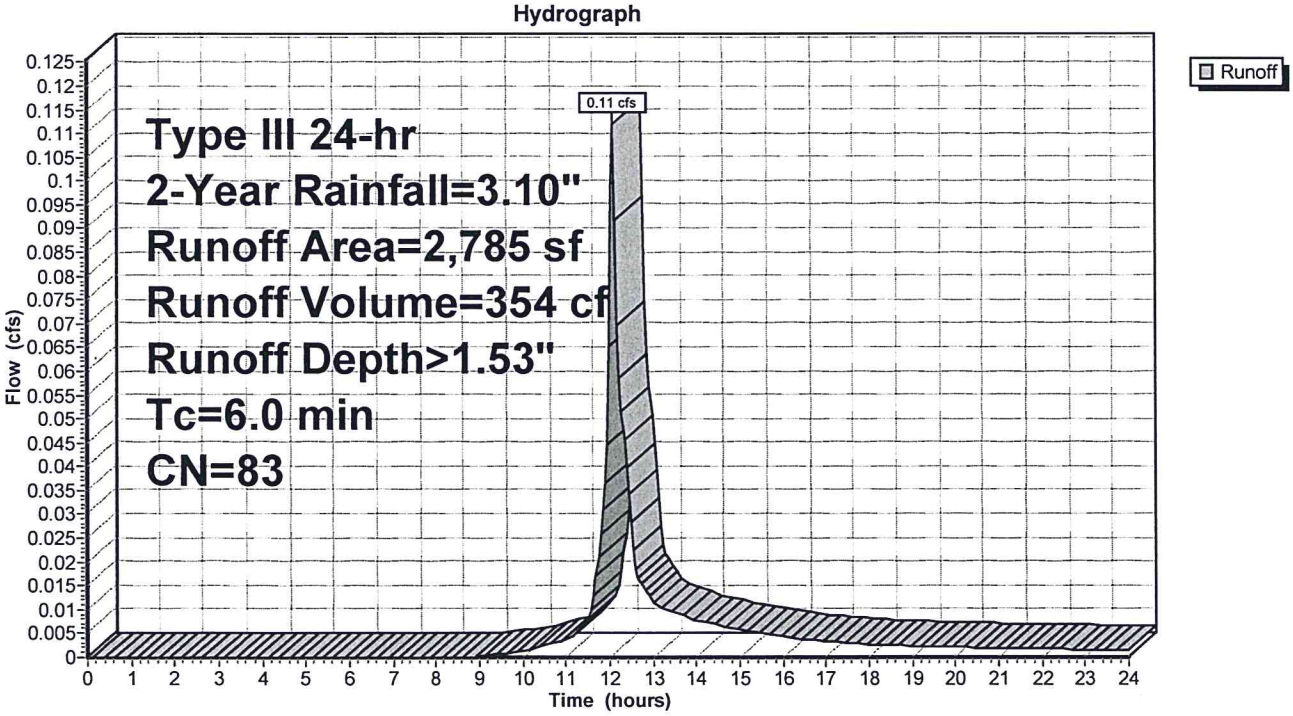
Runoff = 0.11 cfs @ 12.09 hrs, Volume= 354 cf, Depth> 1.53"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.10"

Area (sf)	CN	Description
2,095	98	Paved roads w/curbs & sewers, HSG A
690	39	>75% Grass cover, Good, HSG A
2,785	83	Weighted Average
690		24.78% Pervious Area
2,095		75.22% Impervious Area

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

Subcatchment 2S: Area 2S



Summary for Subcatchment 4S: Area 4S

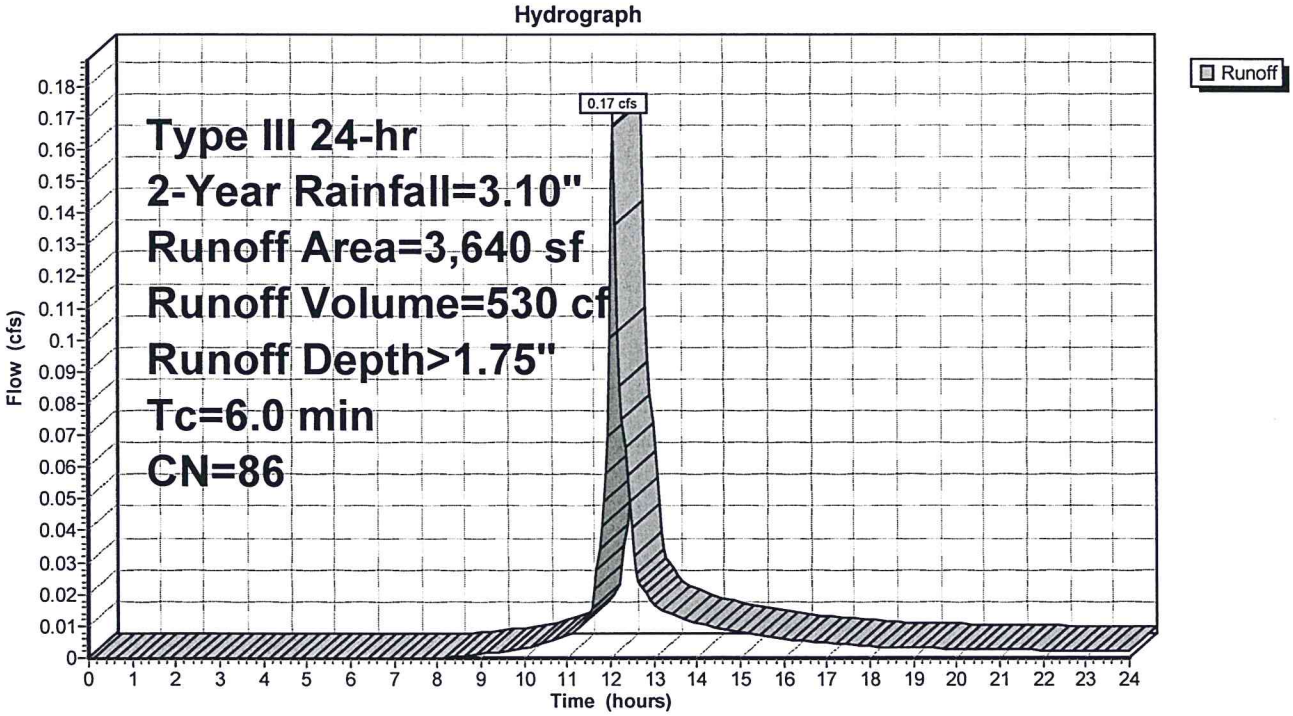
Runoff = 0.17 cfs @ 12.09 hrs, Volume= 530 cf, Depth> 1.75"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.10"

Area (sf)	CN	Description
2,910	98	Paved roads w/curbs & sewers, HSG A
730	39	>75% Grass cover, Good, HSG A
3,640	86	Weighted Average
730		20.05% Pervious Area
2,910		79.95% Impervious Area

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

Subcatchment 4S: Area 4S



Summary for Pond 2: CB2

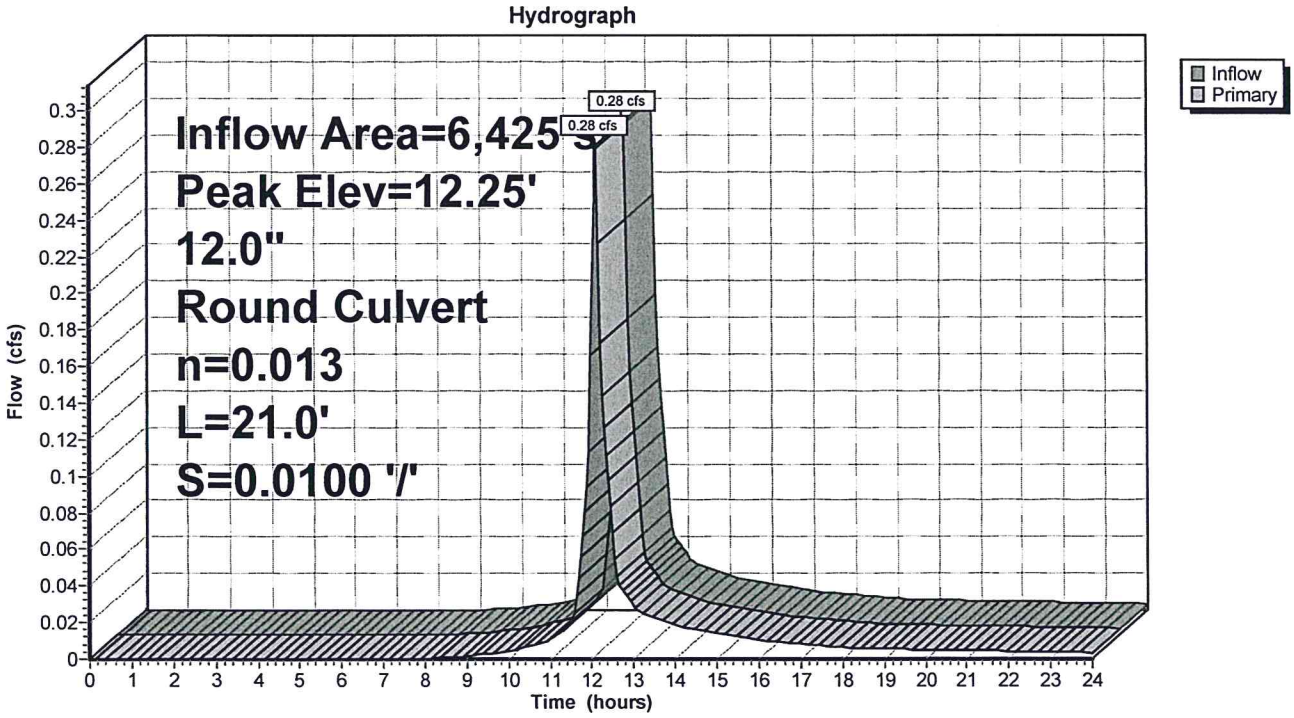
Inflow Area = 6,425 sf, 77.90% Impervious, Inflow Depth > 1.65" for 2-Year event
Inflow = 0.28 cfs @ 12.09 hrs, Volume= 884 cf
Outflow = 0.28 cfs @ 12.09 hrs, Volume= 884 cf, Atten= 0%, Lag= 0.0 min
Primary = 0.28 cfs @ 12.09 hrs, Volume= 884 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 12.25' @ 12.09 hrs
Flood Elev= 15.36'

Device	Routing	Invert	Outlet Devices
#1	Primary	11.97'	**12.0" Round Culvert** L= 21.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 11.97' / 11.76' S= 0.0100 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=0.28 cfs @ 12.09 hrs HW=12.24' TW=11.92' (Dynamic Tailwater)
↑—**1=Culvert** (Barrel Controls 0.28 cfs @ 2.37 fps)

Pond 2: CB2



Summary for Pond A: DMH1

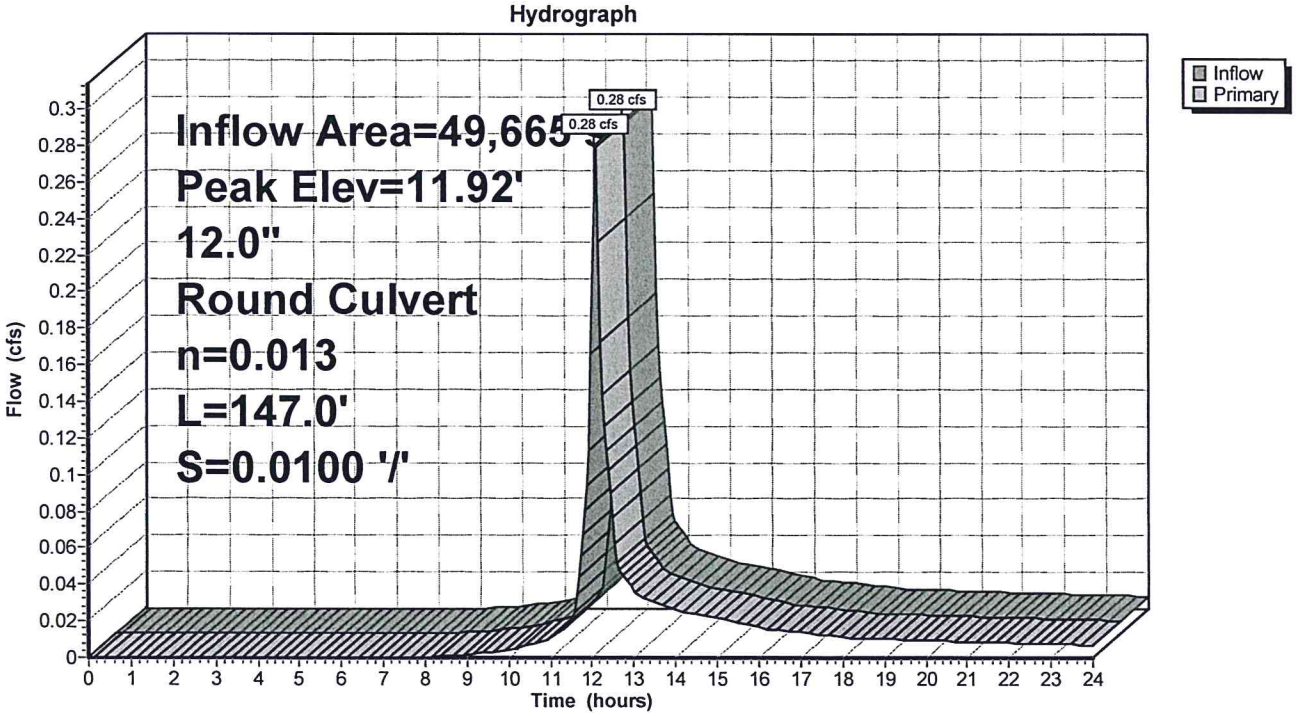
Inflow Area = 49,665 sf, 22.10% Impervious, Inflow Depth > 0.27" for 2-Year event
Inflow = 0.28 cfs @ 12.09 hrs, Volume= 1,114 cf
Outflow = 0.28 cfs @ 12.09 hrs, Volume= 1,114 cf, Atten= 0%, Lag= 0.0 min
Primary = 0.28 cfs @ 12.09 hrs, Volume= 1,114 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 11.92' @ 12.09 hrs
Flood Elev= 15.51'

Device	Routing	Invert	Outlet Devices
#1	Primary	11.66'	**12.0" Round Culvert** L= 147.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 11.66' / 10.19' S= 0.0100 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=0.27 cfs @ 12.09 hrs HW=11.92' TW=10.44' (Dynamic Tailwater)
↑—**1=Culvert** (Outlet Controls 0.27 cfs @ 2.58 fps)

Pond A: DMH1



Summary for Subcatchment 5S: Area 5S

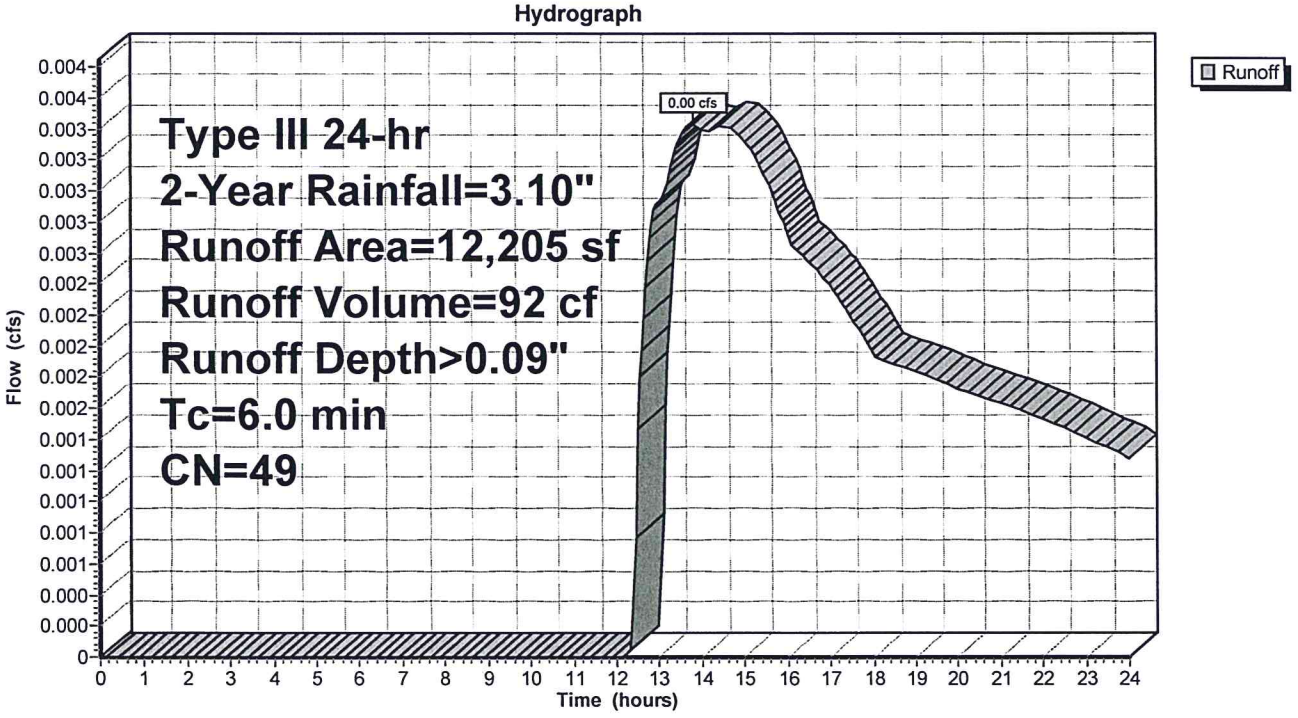
Runoff = 0.00 cfs @ 13.80 hrs, Volume= 92 cf, Depth> 0.09"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.10"

Area (sf)	CN	Description
2,850	98	Paved roads w/curbs & sewers, HSG A
4,355	39	>75% Grass cover, Good, HSG A
5,000	30	Woods, Good, HSG A
12,205	49	Weighted Average
9,355		76.65% Pervious Area
2,850		23.35% Impervious Area

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

Subcatchment 5S: Area 5S



Summary for Pond 3: CB3

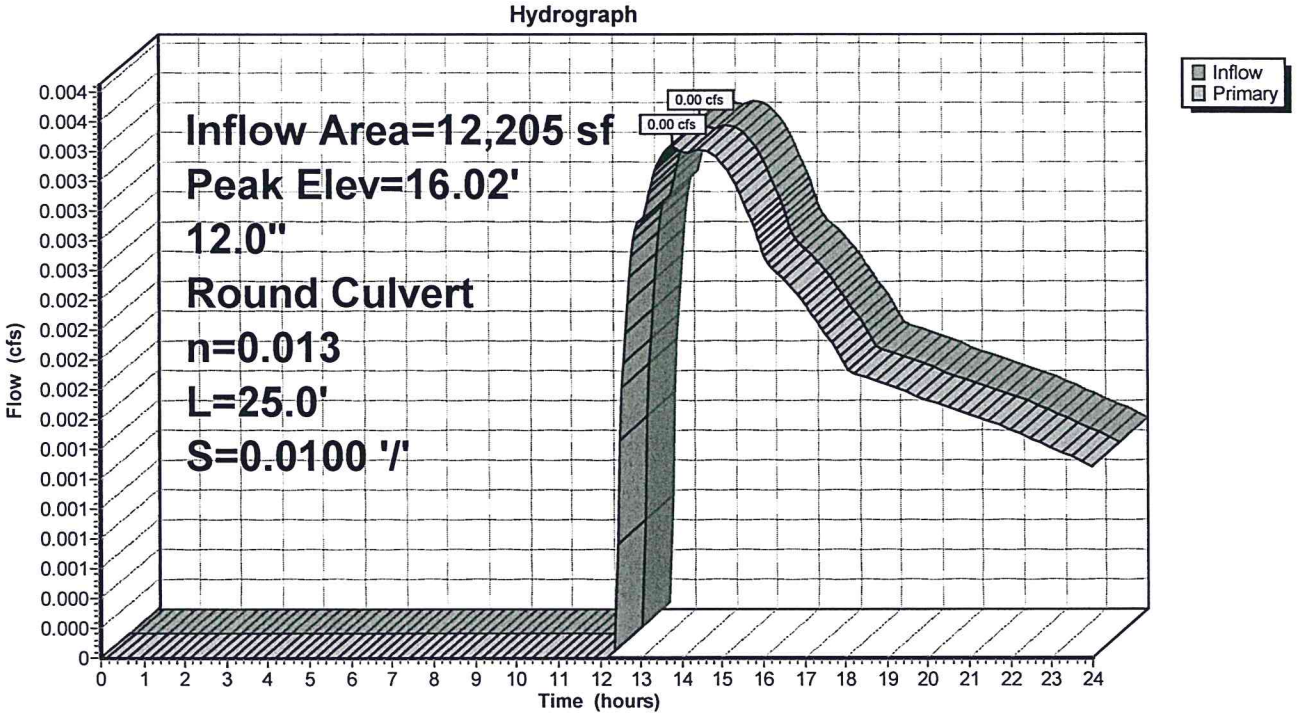
Inflow Area = 12,205 sf, 23.35% Impervious, Inflow Depth > 0.09" for 2-Year event
Inflow = 0.00 cfs @ 13.80 hrs, Volume= 92 cf
Outflow = 0.00 cfs @ 13.80 hrs, Volume= 92 cf, Atten= 0%, Lag= 0.0 min
Primary = 0.00 cfs @ 13.80 hrs, Volume= 92 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 16.02' @ 13.80 hrs
Flood Elev= 19.39'

Device	Routing	Invert	Outlet Devices
#1	Primary	15.99'	**12.0" Round Culvert** L= 25.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 15.99' / 15.74' S= 0.0100 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=0.00 cfs @ 13.80 hrs HW=16.02' TW=14.71' (Dynamic Tailwater)
↑—**1=Culvert** (Barrel Controls 0.00 cfs @ 0.71 fps)

Pond 3: CB3



Summary for Subcatchment 6S: Area 6S

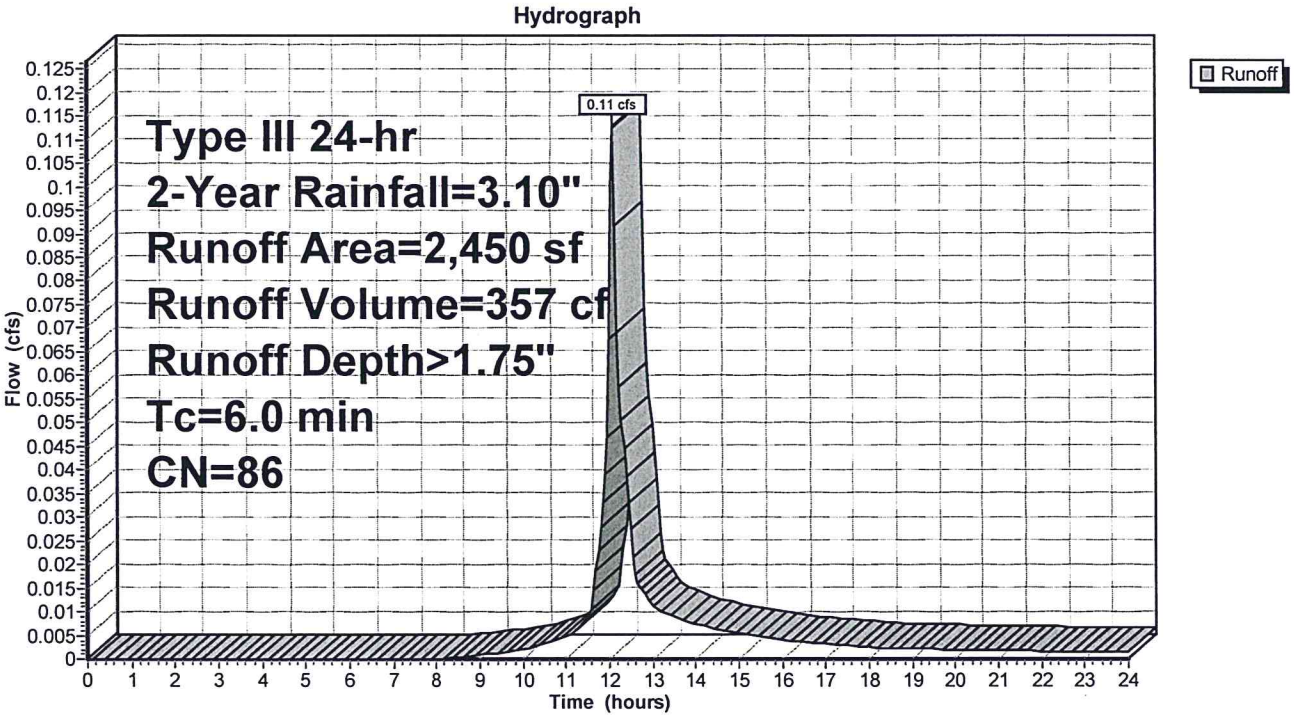
Runoff = 0.11 cfs @ 12.09 hrs, Volume= 357 cf, Depth> 1.75"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.10"

Area (sf)	CN	Description
1,955	98	Paved roads w/curbs & sewers, HSG A
495	39	>75% Grass cover, Good, HSG A
2,450	86	Weighted Average
495		20.20% Pervious Area
1,955		79.80% Impervious Area

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

Subcatchment 6S: Area 6S



Summary for Pond 4: CB4

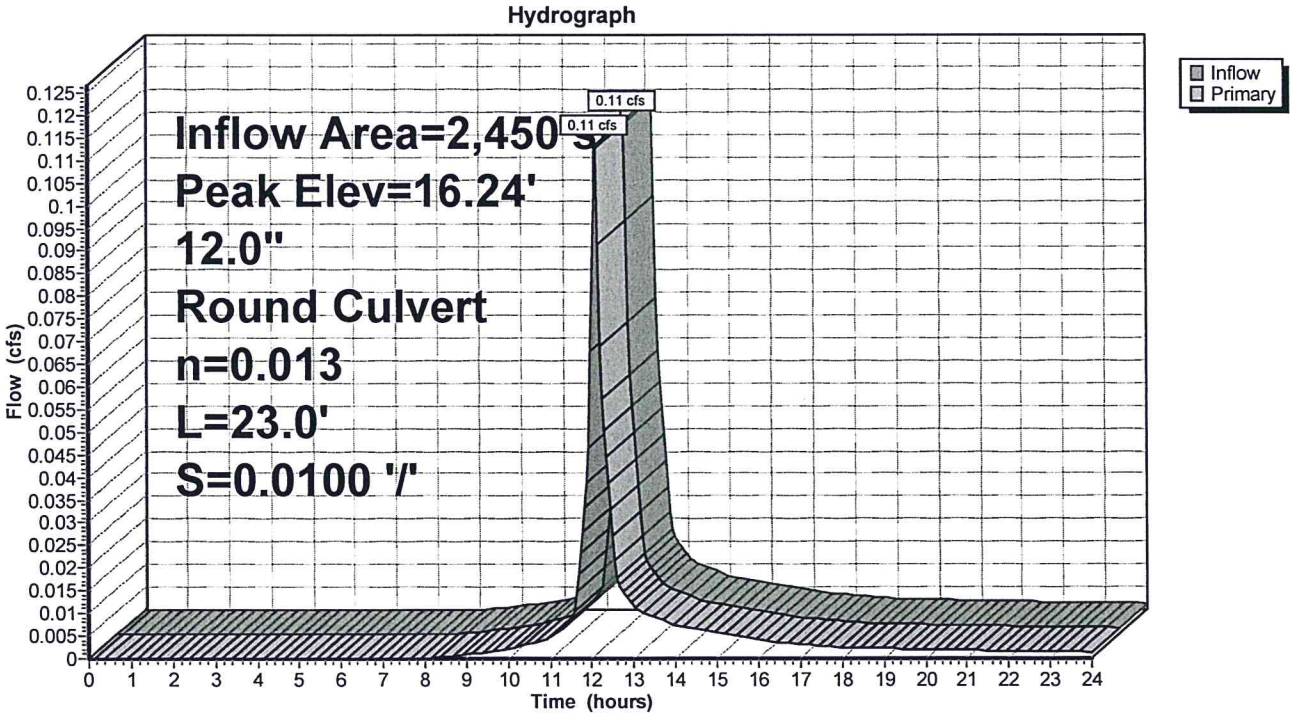
Inflow Area = 2,450 sf, 79.80% Impervious, Inflow Depth > 1.75" for 2-Year event
Inflow = 0.11 cfs @ 12.09 hrs, Volume= 357 cf
Outflow = 0.11 cfs @ 12.09 hrs, Volume= 357 cf, Atten= 0%, Lag= 0.0 min
Primary = 0.11 cfs @ 12.09 hrs, Volume= 357 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 16.24' @ 12.09 hrs
Flood Elev= 19.47'

Device	Routing	Invert	Outlet Devices
#1	Primary	16.07'	**12.0" Round Culvert** L= 23.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 16.07' / 15.84' S= 0.0100 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=0.11 cfs @ 12.09 hrs HW=16.24' TW=14.85' (Dynamic Tailwater)
1=Culvert (Barrel Controls 0.11 cfs @ 1.91 fps)

Pond 4: CB4



Summary for Subcatchment 7S: Area 7S

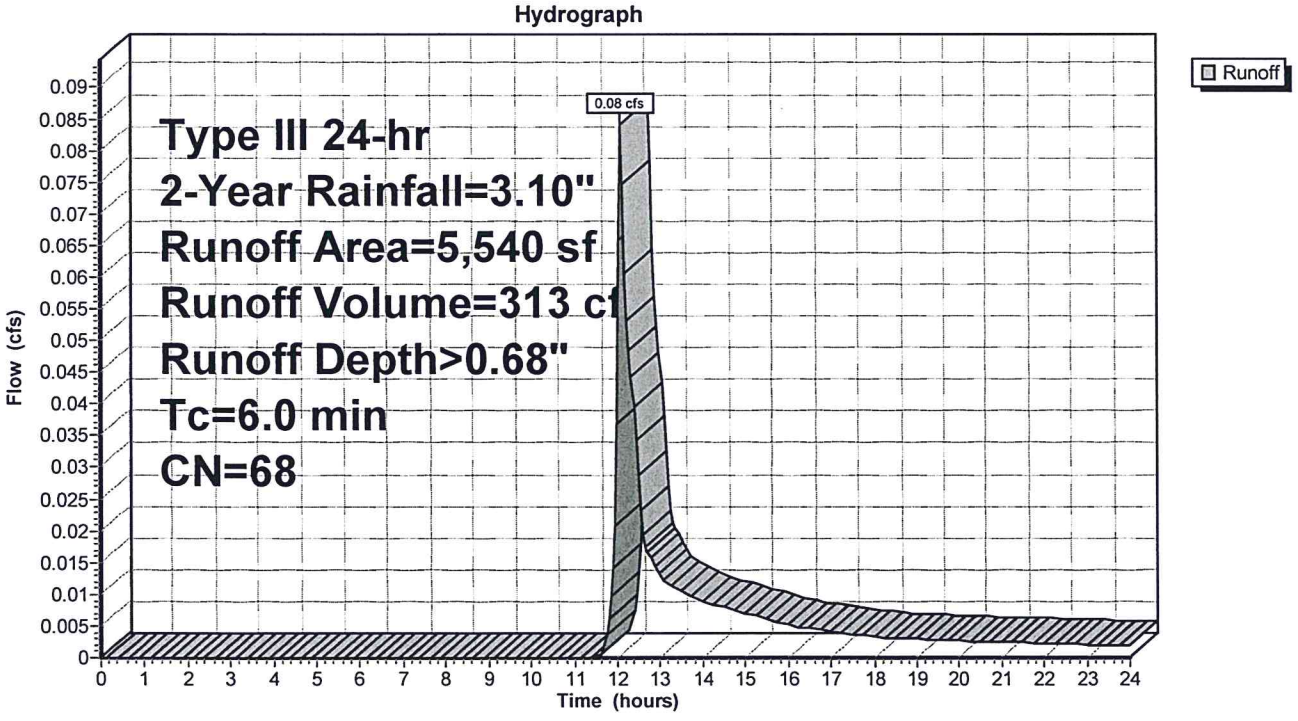
Runoff = 0.08 cfs @ 12.11 hrs, Volume= 313 cf, Depth> 0.68"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.10"

Area (sf)	CN	Description
2,715	98	Paved roads w/curbs & sewers, HSG A
2,825	39	>75% Grass cover, Good, HSG A
5,540	68	Weighted Average
2,825		50.99% Pervious Area
2,715		49.01% Impervious Area

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

Subcatchment 7S: Area 7S



Summary for Pond 5: CB5

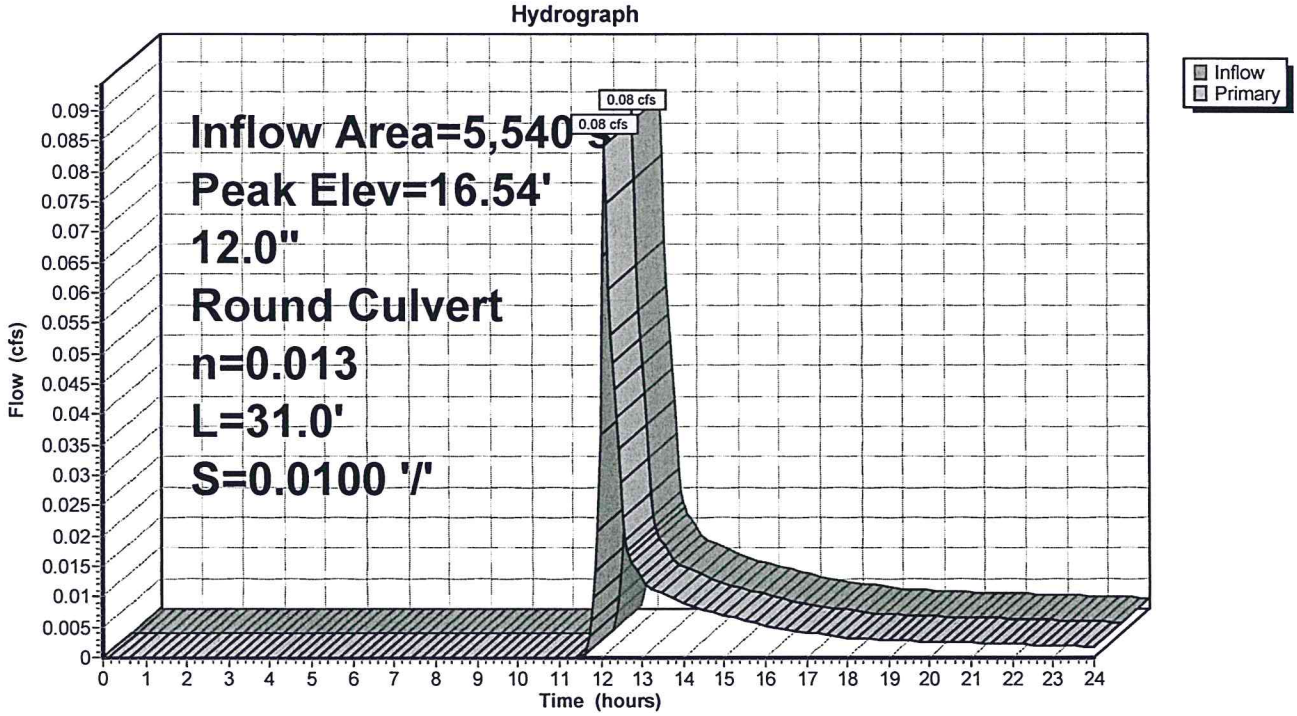
Inflow Area = 5,540 sf, 49.01% Impervious, Inflow Depth > 0.68" for 2-Year event
Inflow = 0.08 cfs @ 12.11 hrs, Volume= 313 cf
Outflow = 0.08 cfs @ 12.11 hrs, Volume= 313 cf, Atten= 0%, Lag= 0.0 min
Primary = 0.08 cfs @ 12.11 hrs, Volume= 313 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 16.54' @ 12.11 hrs
Flood Elev= 19.79'

Device	Routing	Invert	Outlet Devices
#1	Primary	16.39'	**12.0" Round Culvert** L= 31.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 16.39' / 16.08' S= 0.0100 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=0.08 cfs @ 12.11 hrs HW=16.53' TW=14.85' (Dynamic Tailwater)
↑—**1=Culvert** (Barrel Controls 0.08 cfs @ 1.79 fps)

Pond 5: CB5



Summary for Pond B: DMH2

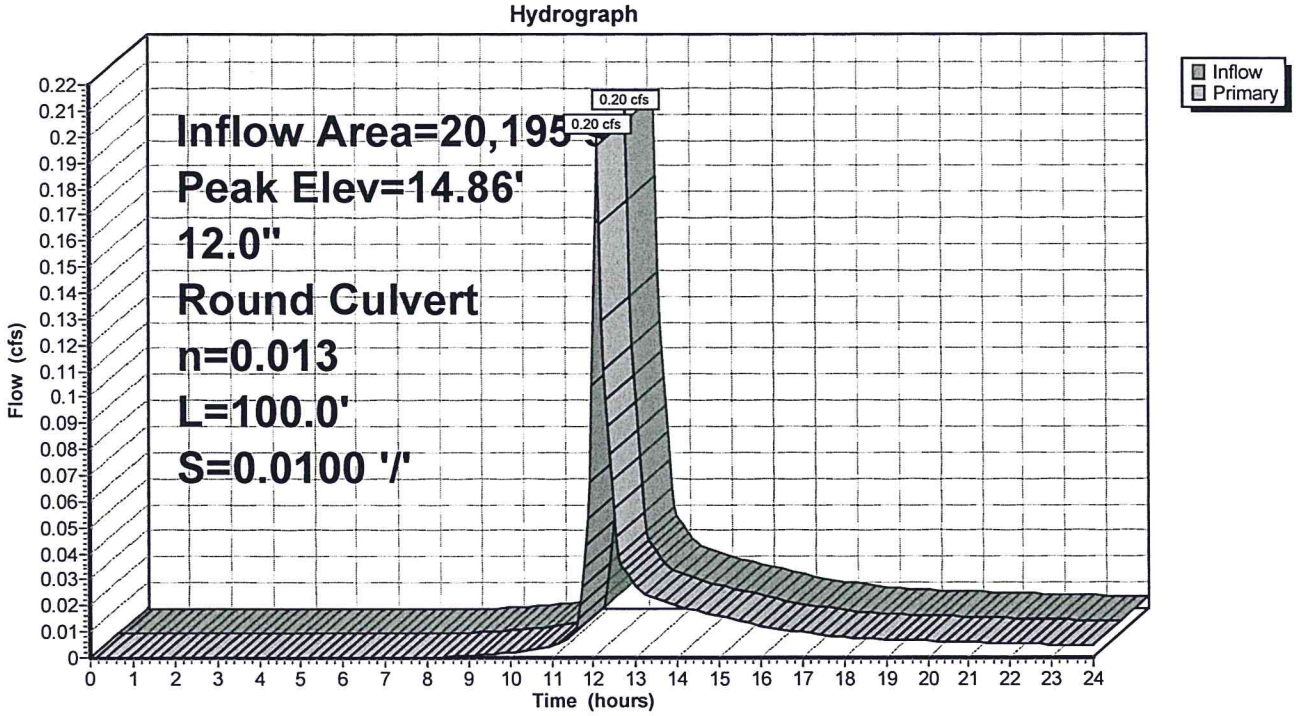
Inflow Area = 20,195 sf, 37.24% Impervious, Inflow Depth > 0.45" for 2-Year event
Inflow = 0.20 cfs @ 12.10 hrs, Volume= 762 cf
Outflow = 0.20 cfs @ 12.10 hrs, Volume= 762 cf, Atten= 0%, Lag= 0.0 min
Primary = 0.20 cfs @ 12.10 hrs, Volume= 762 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 14.86' @ 12.10 hrs
Flood Elev= 20.04'

Device	Routing	Invert	Outlet Devices
#1	Primary	14.64'	**12.0" Round Culvert** L= 100.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 14.64' / 13.64' S= 0.0100 '/' Cc= 0.900 n= 0.013 Concrete pipe, bends & connections, Flow Area= 0.79 sf

Primary OutFlow Max=0.20 cfs @ 12.10 hrs HW=14.86' TW=10.44' (Dynamic Tailwater)
↑—**1=Culvert** (Barrel Controls 0.20 cfs @ 2.36 fps)

Pond B: DMH2



Summary for Pond C: DMH3

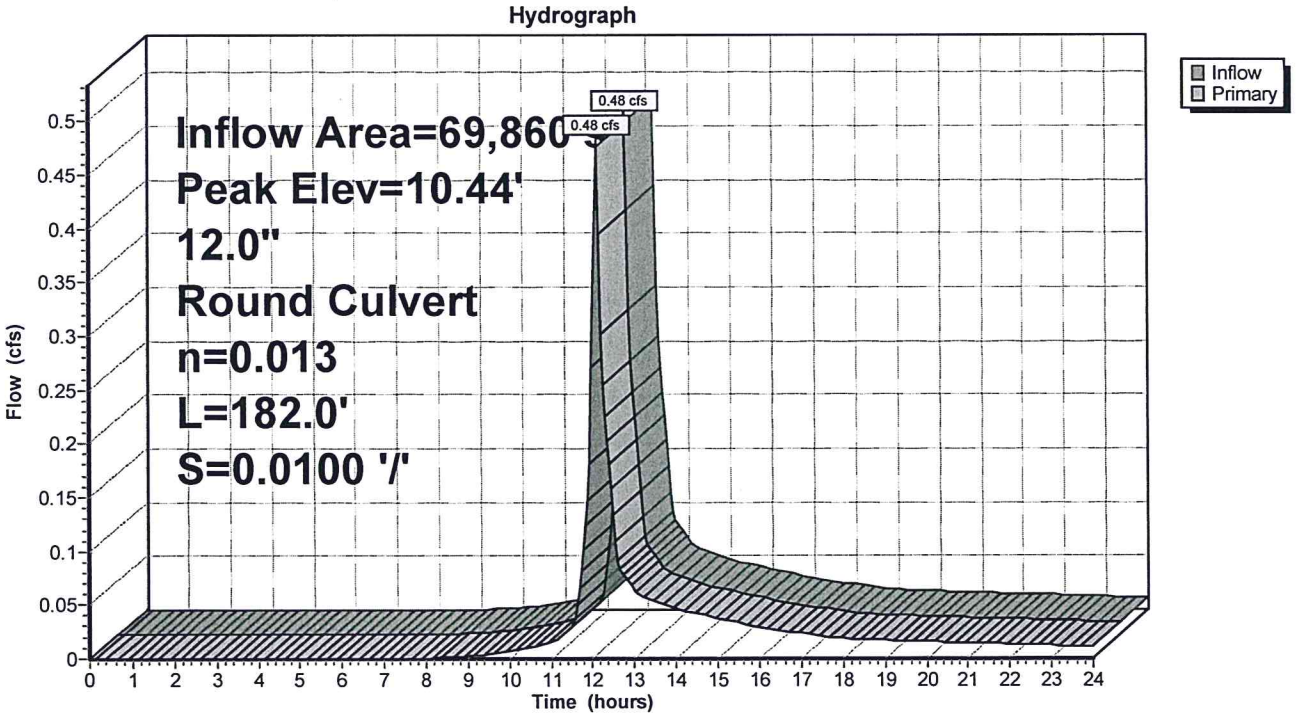
Inflow Area = 69,860 sf, 26.47% Impervious, Inflow Depth > 0.32" for 2-Year event
Inflow = 0.48 cfs @ 12.10 hrs, Volume= 1,876 cf
Outflow = 0.48 cfs @ 12.10 hrs, Volume= 1,876 cf, Atten= 0%, Lag= 0.0 min
Primary = 0.48 cfs @ 12.10 hrs, Volume= 1,876 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 10.44' @ 12.10 hrs
Flood Elev= 17.67'

Device	Routing	Invert	Outlet Devices
#1	Primary	10.10'	**12.0" Round Culvert** L= 182.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 10.10' / 8.28' S= 0.0100 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=0.47 cfs @ 12.10 hrs HW=10.44' TW=0.00' (Dynamic Tailwater)
1=Culvert (Inlet Controls 0.47 cfs @ 1.99 fps)

Pond C: DMH3

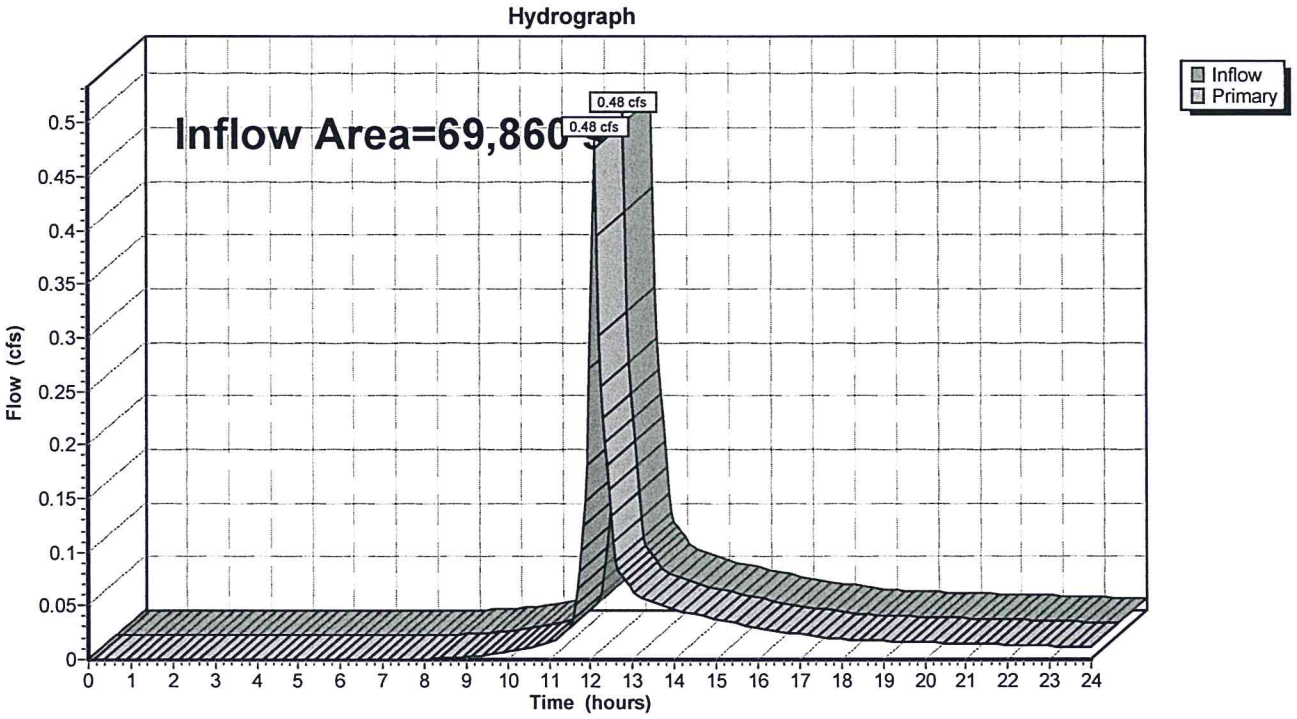


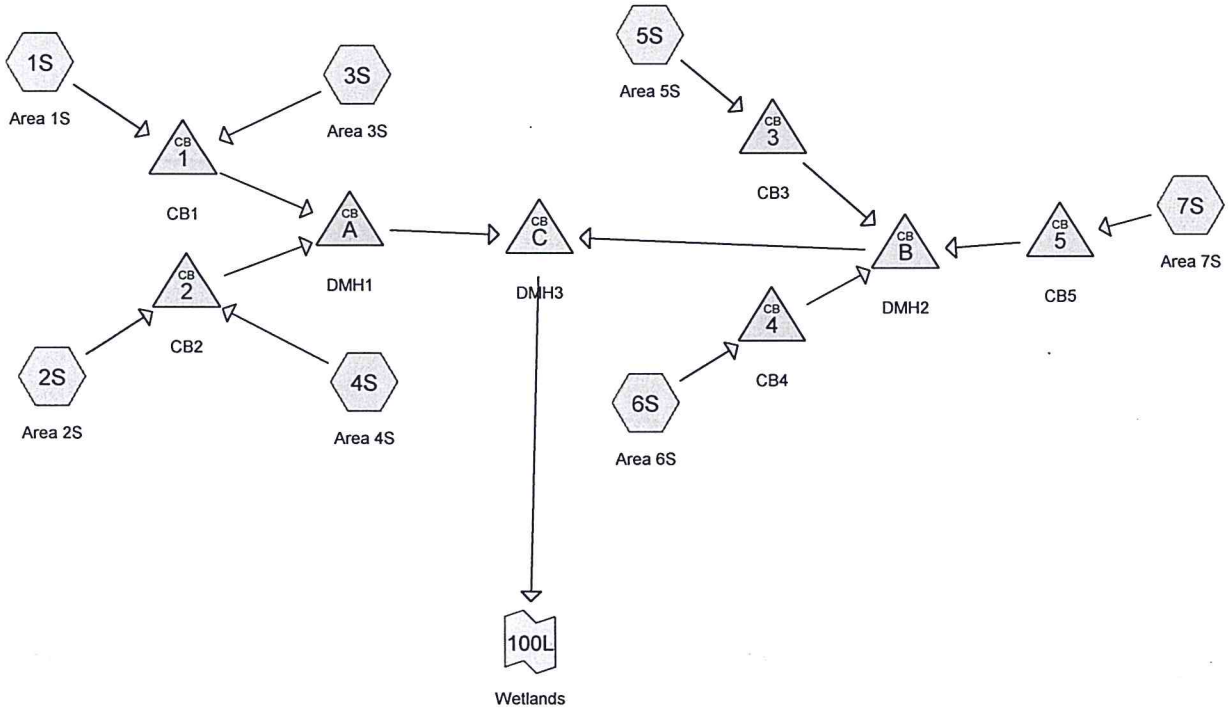
Summary for Link 100L: Wetlands

Inflow Area = 69,860 sf, 26.47% Impervious, Inflow Depth > 0.32" for 2-Year event
Inflow = 0.48 cfs @ 12.10 hrs, Volume= 1,876 cf
Primary = 0.48 cfs @ 12.10 hrs, Volume= 1,876 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

Link 100L: Wetlands





Subcat Reach Pond Link

Routing Diagram for M213946-Proposed
Prepared by Millennium Engineering, Inc., Printed 8/2/2022

Summary for Subcatchment 1S: Area 1S

Runoff = 0.15 cfs @ 12.16 hrs, Volume= 942 cf, Depth> 0.50"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.50"

Area (sf)	CN	Description
2,020	98	Paved roads w/curbs & sewers, HSG A
1,050	98	Roofs, HSG A
2,300	96	Gravel surface, HSG A
10,170	39	>75% Grass cover, Good, HSG A
7,100	30	Woods, Good, HSG A
22,640	50	Weighted Average
19,570		86.44% Pervious Area
3,070		13.56% Impervious Area

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

Summary for Subcatchment 2S: Area 2S

Runoff = 0.20 cfs @ 12.09 hrs, Volume= 632 cf, Depth> 2.72"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.50"

Area (sf)	CN	Description
2,095	98	Paved roads w/curbs & sewers, HSG A
690	39	>75% Grass cover, Good, HSG A
2,785	83	Weighted Average
690		24.78% Pervious Area
2,095		75.22% Impervious Area

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

Summary for Subcatchment 3S: Area 3S

Runoff = 0.03 cfs @ 12.43 hrs, Volume= 387 cf, Depth> 0.23"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.50"

Area (sf)	CN	Description
2,900	98	Paved roads w/curbs & sewers, HSG A
8,200	39	>75% Grass cover, Good, HSG A
9,500	30	Woods, Good, HSG A
20,600	43	Weighted Average
17,700		85.92% Pervious Area
2,900		14.08% Impervious Area

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

Summary for Subcatchment 4S: Area 4S

Runoff = 0.29 cfs @ 12.09 hrs, Volume= 910 cf, Depth> 3.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.50"

Area (sf)	CN	Description
2,910	98	Paved roads w/curbs & sewers, HSG A
730	39	>75% Grass cover, Good, HSG A
3,640	86	Weighted Average
730		20.05% Pervious Area
2,910		79.95% Impervious Area

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

Summary for Subcatchment 5S: Area 5S

Runoff = 0.06 cfs @ 12.15 hrs, Volume= 463 cf, Depth> 0.46"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.50"

Area (sf)	CN	Description
2,850	98	Paved roads w/curbs & sewers, HSG A
4,355	39	>75% Grass cover, Good, HSG A
5,000	30	Woods, Good, HSG A
12,205	49	Weighted Average
9,355		76.65% Pervious Area
2,850		23.35% Impervious Area

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

Summary for Subcatchment 6S: Area 6S

Runoff = 0.19 cfs @ 12.09 hrs, Volume= 613 cf, Depth> 3.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.50"

Area (sf)	CN	Description
1,955	98	Paved roads w/curbs & sewers, HSG A
495	39	>75% Grass cover, Good, HSG A
2,450	86	Weighted Average
495		20.20% Pervious Area
1,955		79.80% Impervious Area

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

Summary for Subcatchment 7S: Area 7S

Runoff = 0.22 cfs @ 12.10 hrs, Volume= 707 cf, Depth> 1.53"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.50"

Area (sf)	CN	Description
2,715	98	Paved roads w/curbs & sewers, HSG A
2,825	39	>75% Grass cover, Good, HSG A
5,540	68	Weighted Average
2,825		50.99% Pervious Area
2,715		49.01% Impervious Area

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

Summary for Pond 1: CB1

Inflow Area = 43,240 sf, 13.81% Impervious, Inflow Depth > 0.37" for 10-Year event
Inflow = 0.15 cfs @ 12.32 hrs, Volume= 1,329 cf
Outflow = 0.15 cfs @ 12.32 hrs, Volume= 1,329 cf, Atten= 0%, Lag= 0.0 min
Primary = 0.15 cfs @ 12.32 hrs, Volume= 1,329 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 12.19' @ 12.16 hrs
Flood Elev= 15.37'

Device	Routing	Invert	Outlet Devices
#1	Primary	11.97'	**12.0" Round Culvert** L= 17.0' CPP, square edge headwall, Ke= 0.500

Inlet / Outlet Invert= 11.97' / 11.80' S= 0.0100 '/' Cc= 0.900
n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=0.15 cfs @ 12.32 hrs HW=12.17' TW=11.95' (Dynamic Tailwater)
↑—**1=Culvert** (Barrel Controls 0.15 cfs @ 2.03 fps)

Summary for Pond 2: CB2

Inflow Area = 6,425 sf, 77.90% Impervious, Inflow Depth > 2.88" for 10-Year event
Inflow = 0.49 cfs @ 12.09 hrs, Volume= 1,542 cf
Outflow = 0.49 cfs @ 12.09 hrs, Volume= 1,542 cf, Atten= 0%, Lag= 0.0 min
Primary = 0.49 cfs @ 12.09 hrs, Volume= 1,542 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 12.34' @ 12.09 hrs
Flood Elev= 15.36'

Device	Routing	Invert	Outlet Devices
#1	Primary	11.97'	**12.0" Round Culvert** L= 21.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 11.97' / 11.76' S= 0.0100 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=0.47 cfs @ 12.09 hrs HW=12.34' TW=12.04' (Dynamic Tailwater)
↑—**1=Culvert** (Outlet Controls 0.47 cfs @ 2.65 fps)

Summary for Pond 3: CB3

Inflow Area = 12,205 sf, 23.35% Impervious, Inflow Depth > 0.46" for 10-Year event
Inflow = 0.06 cfs @ 12.15 hrs, Volume= 463 cf
Outflow = 0.06 cfs @ 12.15 hrs, Volume= 463 cf, Atten= 0%, Lag= 0.0 min
Primary = 0.06 cfs @ 12.15 hrs, Volume= 463 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 16.12' @ 12.15 hrs
Flood Elev= 19.39'

Device	Routing	Invert	Outlet Devices
#1	Primary	15.99'	**12.0" Round Culvert** L= 25.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 15.99' / 15.74' S= 0.0100 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=0.06 cfs @ 12.15 hrs HW=16.12' TW=14.95' (Dynamic Tailwater)
↑—**1=Culvert** (Barrel Controls 0.06 cfs @ 1.65 fps)

Summary for Pond 4: CB4

Inflow Area = 2,450 sf, 79.80% Impervious, Inflow Depth > 3.00" for 10-Year event
Inflow = 0.19 cfs @ 12.09 hrs, Volume= 613 cf
Outflow = 0.19 cfs @ 12.09 hrs, Volume= 613 cf, Atten= 0%, Lag= 0.0 min
Primary = 0.19 cfs @ 12.09 hrs, Volume= 613 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 16.30' @ 12.09 hrs
Flood Elev= 19.47'

Device	Routing	Invert	Outlet Devices
#1	Primary	16.07'	**12.0" Round Culvert** L= 23.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 16.07' / 15.84' S= 0.0100 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=0.19 cfs @ 12.09 hrs HW=16.29' TW=14.97' (Dynamic Tailwater)
1=Culvert (Barrel Controls 0.19 cfs @ 2.18 fps)

Summary for Pond 5: CB5

Inflow Area = 5,540 sf, 49.01% Impervious, Inflow Depth > 1.53" for 10-Year event
Inflow = 0.22 cfs @ 12.10 hrs, Volume= 707 cf
Outflow = 0.22 cfs @ 12.10 hrs, Volume= 707 cf, Atten= 0%, Lag= 0.0 min
Primary = 0.22 cfs @ 12.10 hrs, Volume= 707 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 16.63' @ 12.10 hrs
Flood Elev= 19.79'

Device	Routing	Invert	Outlet Devices
#1	Primary	16.39'	**12.0" Round Culvert** L= 31.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 16.39' / 16.08' S= 0.0100 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=0.21 cfs @ 12.10 hrs HW=16.63' TW=14.97' (Dynamic Tailwater)
1=Culvert (Barrel Controls 0.21 cfs @ 2.30 fps)

Summary for Pond A: DMH1

Inflow Area = 49,665 sf, 22.10% Impervious, Inflow Depth > 0.69" for 10-Year event
Inflow = 0.61 cfs @ 12.11 hrs, Volume= 2,871 cf
Outflow = 0.61 cfs @ 12.11 hrs, Volume= 2,871 cf, Atten= 0%, Lag= 0.0 min
Primary = 0.61 cfs @ 12.11 hrs, Volume= 2,871 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 12.05' @ 12.11 hrs
Flood Elev= 15.51'

Device	Routing	Invert	Outlet Devices
#1	Primary	11.66'	**12.0" Round Culvert** L= 147.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 11.66' / 10.19' S= 0.0100 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=0.60 cfs @ 12.11 hrs HW=12.05' TW=10.63' (Dynamic Tailwater)
↑—**1=Culvert** (Outlet Controls 0.60 cfs @ 3.12 fps)

Summary for Pond B: DMH2

Inflow Area = 20,195 sf, 37.24% Impervious, Inflow Depth > 1.06" for 10-Year event
Inflow = 0.46 cfs @ 12.10 hrs, Volume= 1,782 cf
Outflow = 0.46 cfs @ 12.10 hrs, Volume= 1,782 cf, Atten= 0%, Lag= 0.0 min
Primary = 0.46 cfs @ 12.10 hrs, Volume= 1,782 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 14.98' @ 12.10 hrs
Flood Elev= 20.04'

Device	Routing	Invert	Outlet Devices
#1	Primary	14.64'	**12.0" Round Culvert** L= 100.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 14.64' / 13.64' S= 0.0100 '/' Cc= 0.900 n= 0.013 Concrete pipe, bends & connections, Flow Area= 0.79 sf

Primary OutFlow Max=0.45 cfs @ 12.10 hrs HW=14.97' TW=10.63' (Dynamic Tailwater)
↑—**1=Culvert** (Inlet Controls 0.45 cfs @ 1.97 fps)

Summary for Pond C: DMH3

Inflow Area = 69,860 sf, 26.47% Impervious, Inflow Depth > 0.80" for 10-Year event
Inflow = 1.07 cfs @ 12.10 hrs, Volume= 4,653 cf
Outflow = 1.07 cfs @ 12.10 hrs, Volume= 4,653 cf, Atten= 0%, Lag= 0.0 min
Primary = 1.07 cfs @ 12.10 hrs, Volume= 4,653 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 10.64' @ 12.11 hrs
Flood Elev= 17.67'

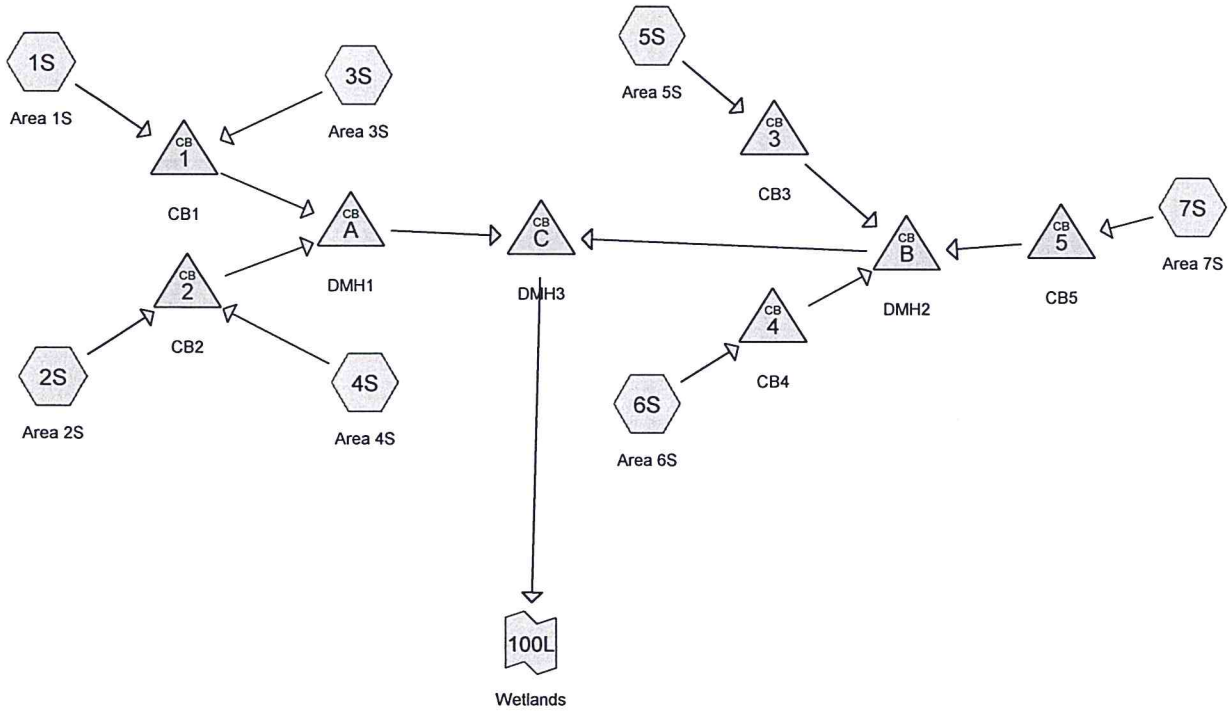
Device	Routing	Invert	Outlet Devices
#1	Primary	10.10'	**12.0" Round Culvert** L= 182.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 10.10' / 8.28' S= 0.0100 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=1.05 cfs @ 12.10 hrs HW=10.63' TW=0.00' (Dynamic Tailwater)
↑—**1=Culvert** (Inlet Controls 1.05 cfs @ 2.48 fps)

Summary for Link 100L: Wetlands

Inflow Area = 69,860 sf, 26.47% Impervious, Inflow Depth > 0.80" for 10-Year event
Inflow = 1.07 cfs @ 12.10 hrs, Volume= 4,653 cf
Primary = 1.07 cfs @ 12.10 hrs, Volume= 4,653 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs



Subcat Reach Pond Link

Routing Diagram for M213946-Proposed
Prepared by Millennium Engineering, Inc., Printed 8/2/2022

Time span=0.00-24.00 hrs, dt=0.05 hrs, 481 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 1S: Area 1S Runoff Area=22,640 sf 13.56% Impervious Runoff Depth>1.39"
Tc=6.0 min CN=50 Runoff=0.70 cfs 2,631 cf

Subcatchment 2S: Area 2S Runoff Area=2,785 sf 75.22% Impervious Runoff Depth>4.55"
Tc=6.0 min CN=83 Runoff=0.33 cfs 1,057 cf

Subcatchment 3S: Area 3S Runoff Area=20,600 sf 14.08% Impervious Runoff Depth>0.86"
Tc=6.0 min CN=43 Runoff=0.28 cfs 1,484 cf

Subcatchment 4S: Area 4S Runoff Area=3,640 sf 79.95% Impervious Runoff Depth>4.88"
Tc=6.0 min CN=86 Runoff=0.45 cfs 1,481 cf

Subcatchment 5S: Area 5S Runoff Area=12,205 sf 23.35% Impervious Runoff Depth>1.31"
Tc=6.0 min CN=49 Runoff=0.35 cfs 1,337 cf

Subcatchment 6S: Area 6S Runoff Area=2,450 sf 79.80% Impervious Runoff Depth>4.88"
Tc=6.0 min CN=86 Runoff=0.31 cfs 997 cf

Subcatchment 7S: Area 7S Runoff Area=5,540 sf 49.01% Impervious Runoff Depth>3.01"
Tc=6.0 min CN=68 Runoff=0.44 cfs 1,388 cf

Pond 1: CB1 Peak Elev=12.59' Inflow=0.98 cfs 4,115 cf
12.0" Round Culvert n=0.013 L=17.0' S=0.0100 '/' Outflow=0.98 cfs 4,115 cf

Pond 2: CB2 Peak Elev=12.54' Inflow=0.78 cfs 2,538 cf
12.0" Round Culvert n=0.013 L=21.0' S=0.0100 '/' Outflow=0.78 cfs 2,538 cf

Pond 3: CB3 Peak Elev=16.30' Inflow=0.35 cfs 1,337 cf
12.0" Round Culvert n=0.013 L=25.0' S=0.0100 '/' Outflow=0.35 cfs 1,337 cf

Pond 4: CB4 Peak Elev=16.36' Inflow=0.31 cfs 997 cf
12.0" Round Culvert n=0.013 L=23.0' S=0.0100 '/' Outflow=0.31 cfs 997 cf

Pond 5: CB5 Peak Elev=16.73' Inflow=0.44 cfs 1,388 cf
12.0" Round Culvert n=0.013 L=31.0' S=0.0100 '/' Outflow=0.44 cfs 1,388 cf

Pond A: DMH1 Peak Elev=12.40' Inflow=1.75 cfs 6,653 cf
12.0" Round Culvert n=0.013 L=147.0' S=0.0100 '/' Outflow=1.75 cfs 6,653 cf

Pond B: DMH2 Peak Elev=15.18' Inflow=1.09 cfs 3,723 cf
12.0" Round Culvert n=0.013 L=100.0' S=0.0100 '/' Outflow=1.09 cfs 3,723 cf

Pond C: DMH3 Peak Elev=11.16' Inflow=2.83 cfs 10,376 cf
12.0" Round Culvert n=0.013 L=182.0' S=0.0100 '/' Outflow=2.83 cfs 10,376 cf

Link 100L: Wetlands Inflow=2.83 cfs 10,376 cf
Primary=2.83 cfs 10,376 cf

Total Runoff Area = 69,860 sf Runoff Volume = 10,376 cf Average Runoff Depth = 1.78"
73.53% Pervious = 51,365 sf 26.47% Impervious = 18,495 sf

8.0 APPENDIX D – PROPRIETARY BMP DOCUMENTATION

Project:	**100 Forest Road**
Location:	**Salisbury, MA**
Prepared For:	**Millennium Engineering**

CONTECH ENGINEERED SOLUTIONS

Purpose: To calculate the water quality flow rate (WQF) over a given site area. In this situation the WQF is derived from the first 1/2" of runoff from the contributing impervious surface.

Reference: Massachusetts Dept. of Environmental Protection Wetlands Program / United States Department of Agriculture Natural Resources Conservation Service TR-55 Manual

Procedure: Determine unit peak discharge using Figure 1 or 2. Figure 2 is in tabular form so is preferred. Using the tc, read the unit peak discharge (qu) from Figure 1 or Table in Figure 2. qu is expressed in the following units: cfs/mi^2/watershed inches (csm/in).

Compute Q Rate using the following equation:

$$Q = (qu)\ (A)\ (WQV)$$

where:

Q = flow rate associated with first 1/2" of runoff
qu = the unit peak discharge, in csm/in.
A = impervious surface drainage area (in square miles)
WQV = water quality volume in watershed inches (1/2" in this case)

Structure Name	Impv. (acres)	A (miles^2)	t_c (min)	t_c (hr)	WQV (in)	qu (csm/in.)	Q (cfs)
DMH 3	0.40	0.0006266	6.0	0.100	0.50	752.00	0.24

CONTECH ENGINEERED SOLUTIONS

CDS TECHNOLOGIES

CDS ESTIMATED NET ANNUAL SOLIDS LOAD REDUCTION BASED ON THE RATIONAL RAINFALL METHOD

100 FOREST ROAD
SALISBURY, MA

Area	0.40 ac	Unit Site Designation	DMH 3
Weighted C	0.9	Rainfall Station #	67
t_c	6 min		
CDS Model	2015-4	CDS Treatment Capacity	**1.4 cfs**

Rainfall Intensity[1] (in/hr)	Percent Rainfall Volume[1]	Cumulative Rainfall Volume	Total Flowrate (cfs)	Treated Flowrate (cfs)	Incremental Removal (%)
0.08	41.0%	41.0%	0.03	0.03	39.3
0.16	23.9%	64.9%	0.06	0.06	22.5
0.24	11.5%	76.5%	0.09	0.09	10.7
0.32	7.4%	83.9%	0.12	0.12	6.8
0.40	4.4%	88.3%	0.14	0.14	4.0
0.48	2.9%	91.2%	0.17	0.17	2.6
0.56	1.8%	93.0%	0.20	0.20	1.6
0.64	1.2%	94.2%	0.23	0.23	1.0
0.72	1.6%	95.8%	0.26	0.26	1.3
0.80	0.8%	96.6%	0.29	0.29	0.7
1.00	0.6%	97.1%	0.36	0.36	0.5
1.40	1.4%	98.6%	0.51	0.51	1.0
1.80	0.9%	99.5%	0.65	0.65	0.6
2.20	0.5%	100.0%	0.79	0.79	0.3
0.00	0.0%	100.0%	0.00	0.00	0.0
0.00	0.0%	100.0%	0.00	0.00	0.0
0.00	0.0%	100.0%	0.00	0.00	0.0
0.00	0.0%	100.0%	0.00	0.00	0.0
0.00	0.0%	100.0%	0.00	0.00	0.0
0.00	0.0%	100.0%	0.00	0.00	0.0
0.00	0.0%	100.0%	0.00	0.00	0.0
					92.9
				Removal Efficiency Adjustment[2] =	0.0%
				Predicted % Annual Rainfall Treated =	100.0%
				Predicted Net Annual Load Removal Efficiency =	**92.9%**

1 - Based on 7 years of data from NCDC station #3276, Groveland, Essex County, MA
2 - Reduction due to use of 60-minute data for a site that has a time of concentration less than 30-minutes.

9.0 APPENDIX E – NRCS SOIL DATA

SOIL SUITABILITY ASSESSMENT REPORT

COMMONWEALTH OF MASSACHUSETTS

SALISBURY, MASSACHUSETTS

SOIL EVALUATION FOR NEW CONSTRUCTION OF ON-SITE SUBSURFACE SEWAGE DISPOSAL SYSTEMS

SITE INFORMATION

Street Address: 100 Forest Road Town: Salisbury State: Massachusetts Zip Code: 01952 County: Essex

Land Use: Undeveloped; Forested Latitude: ~42° 51' 23.47" N Longitude: ~71° 50' 35.51" W

Elevation: 11' to 25' AMSL

PUBLISHED SOIL DATA AND MAP UNIT DESCRIPTION

Physiographic Division: Appalachian Highlands Physio. Province: New England Physio. Section: Seaboard lowland section

Soil survey area: Essex County, Massachusetts, Northern Part

Series name: 105D – Rock outcrop-Hollis complex Order: Inceptisol Suborder: Ochrepts Family: Loamy, mixed, mesic Lithic Dystrochrepts

Series name: 240B – Elmwood FSL Order: Inceptisol Suborder: Ochrepts Family: Coarse-loamy over clayey, Aquic Dystric Eutrochrepts

Series name: 255B – Windsor LS Order: Inceptisol Suborder: Ochrepts Family: Mixed, mesic Typic Udipsamments

Soil hydric or upland: Upland Average depth to water table: Variable Depth to restrictive feature: Variable among site

Frequency of flooding: None Frequency of ponding: None

Drainage Class: Somewhat excessively drained Hydrologic Soil Group: D Ksat: Very low

Drainage Class: Moderately well drained Hydrologic Soil Group: B Ksat: Very low to moderately high

Drainage Class: Excessively drained Hydrologic Soil Group: A Ksat: Moderately high to high

Ecological site: Shallow Dry Till Uplands, Moist lake Plain, Dry outwash

WETLAND AREA

National Wetland Inventory Map: NA Wetlands Conservancy Program: NA Bordering vegetative wetland: 100'+

SURFICIAL GEOLOGY:

Geologic parent material: Shallow deposits over Granite and Gneiss Geomorphic component: Ridges, hills
Geologic parent material: Glaciofluvial deposits over clayey deposits Geomorphic component: Relict lakebed
Geologic parent material: Loose sandy glaciofluvial deposits Geomorphic component: Outwash Terrace

Slope aspect: Southerly Landform position (2D): Summit/ shoulder Landform position (3D): Crest/ side slope

Slope gradient: ~00 - 08 % Down slope shape: Convex/ concave Across slope shape: Convex/ concave

Slope complexity: Variable Bedrock outcropping in vicinity: Abundant among site Glacial erratics in vicinity: Common

Bedrock Type: Newburyport complex: Gray, medium-grained Tonalite and Granodiorite

TPD-1 DEEP OBSERVATION HOL

100 Forest Road, Salisbury, Massachusetts

LOT 6

Date: January 03, 2023 Weather: Clear, calm, damp, 35º- 40º F.

Landscape: Upland Landform: Ground moraine Position on landscape: Summit/ Crest

Slope aspect: Southerly Slope (%): 00 – 02 % Slope complexity: Simple Land Cover: Forested

Property line: 10^+ feet Drainage way: 50^+ feet Drinking water well: 100^+ feet Abutting septic system: 50^+ feet

Wetlands: 50^+ feet Public water supply reservoir: 400^+ feet Tributary to reservoir: 200^+ feet

SOIL PROFILE ► TPD-1

Depth below land surface (inches)	Soil Horizon/ Layer	Soil Texture (USDA/ NRCS)	Soil Color (Munsell)	Redoxomorphic Features/ ESHGWT	Consistence, grade, size, structure, grain size, soil moisture state, roots, horizon boundary, clasts, stratification, artifacts, restrictive features, etc.
00" → 15"	A	Sandy Loam	10YR 3/2 very dark grayish brown	none observed	Very friable; moderate-grade; fine-to-medium granular structure; somewhat cohesive; fine grained mineral content; damp matrix; non-sticky; non-plastic; many fine and few medium roots; free of clasts; clear smooth boundary.
15" → 24"	B_W	Sandy Loam	10YR 4/4 dark yellowish brown	none observed	Loose; structureless; non-cohesive; mixed medium to mostly fine-grained mineral content; non-cohesive; damp matrix; non-sticky; non-plastic; few fine tree roots; free of clasts; gradual wavy boundary.
24" → 100"	$2C_d$	Silt Loam	2.5Y 5/1 gray	46" (m,1-3,p) Gley I 7/N 5YR 5/8	Firm; massive structure; very fine-grained mineral content; damp matrix; somewhat sticky; non-plastic; well stratified; well graded; free of clasts; dense and tight matrix; very silty; redoximorphic features observed at 46"; apparent water observed at 48"; no bedrock refusal at test hole depth.

Depth to bedrock: 100" Seasonal High Groundwater Table: 46" Apparent water: 48"

TPD-1 DEEP OBSERVATION HOLE

100 Forest Road, Salisbury, Massachusetts

DEPTH TO PHREATIC GROUNDWATER TABLE:

Apparent water seeping from pit face: 48" (below land surface) Depth to stabilized apparent water: ___ (below land surface)

Soil moisture state: Damp to wet

ESTIMATED SEASONAL HIGH GROUNDWATER TABLE:

Depth of Estimated Seasonal High Groundwater Table: 46" (below land surface)

Kind: Iron concentrations and reduction; iron coatings on silt grains surrounded by redoximorphic halos.

Location: In $2C_d$ matrix Shape: Irregular/ linear

Hardness: Soft Boundary: Clear Abundance: Many Size: Medium to coarse Contrast: Prominent

Concentration color: 5YR 5/8 yellowish red Reduction color: Gley1 7/N light gray Moisture state: Damp to wet

DETERMINATION OF HIGH GROUNDWATER ELEVATION

Observed depth to redoximorphic features: 46" inches below grade

Observed water weeping from side of deep hole: 48" inches below grade

Observed depth to stabilized phreatic water: ___ inches below grade

DEPTH OF NATURALLY OCCURRING PERVIOUS MATERIAL: ► 7.08'

Depth of naturally occurring pervious material in TPD-1 Upper boundary: 15"
Lower boundary: 100"

Certification

I certify that I am currently approved by the Department of Environmental Protection pursuant to 310 CMR 15.017 to conduct evaluations and that the above analysis has been performed by me consistent with the required training, expertise and experience described in 310 CMR 15.017. I further certify that the results of my soil evaluation, as indicated in the attached Soil Evaluation Form, are accurate and in accordance with 310 CMR 15.017.

#1848 October 1998

Alexander F. Parker Date of License issuance

Massachusetts Soil Evaluator License number

Unofficial testing for drainage 01/03/23

Salisbury Town Witness Date of soil testing

TPD-2 DEEP OBSERVATION HOL

100 Forest Road, Salisbury, Massachusetts

LOT 6

Date: January 03, 2023 Weather: Clear, calm, damp, 35º- 40º F.

Landscape: Upland Landform: Ground moraine Position on landscape: Summit/ Crest

Slope aspect: Southerly Slope (%): 00 – 02 % Slope complexity: Simple Land Cover: Forested

Property line: 10^+ feet Drainage way: 50^+ feet Drinking water well: 100^+ feet Abutting septic system: 50^+ feet

Wetlands: 50^+ feet Public water supply reservoir: 400^+ feet Tributary to reservoir: 200^+ feet

SOIL PROFILE ► TPD-2

Depth below land surface (inches)	Soil Horizon/ Layer	Soil Texture (USDA/ NRCS)	Soil Color (Munsell)	Redoxomorphic Features/ ESHGWT	Consistence, grade, size, structure, grain size, soil moisture state, roots, horizon boundary, clasts, stratification, artifacts, restrictive features, etc.
00" → 13"	A	Sandy Loam	10YR 3/2 very dark grayish brown	none observed	Very friable; moderate-grade; fine-to-medium granular structure; somewhat cohesive; fine grained mineral content; damp matrix; non-sticky; non-plastic; many fine and few medium roots; free of clasts; clear smooth boundary.
13" → 22"	B_W	Sandy Loam	10YR 4/4 dark yellowish brown	none observed	Loose; structureless; non-cohesive; mixed medium to mostly fine-grained mineral content; non-cohesive; damp matrix; non-sticky; non-plastic; few fine tree roots; free of clasts; gradual wavy boundary.
22" → 46" Bedrock refusal at 46"	$2C_d$	Silt Loam	2.5Y 5/1 gray	44" (m,1-3,p) Gley I 7/N 5YR 5/8	Firm; massive structure; very fine-grained mineral content; damp matrix; somewhat sticky; non-plastic; well stratified; well graded; free of clasts; dense and tight matrix; very silty; redoximorphic features observed at 44"; no apparent water observed; bedrock refusal at test hole depth of 46".

Depth to bedrock: 46" Seasonal High Groundwater Table: 44" Apparent water: ___

TPD-2 DEEP OBSERVATION HOLE

100 Forest Road, Salisbury, Massachusetts

DEPTH TO PHREATIC GROUNDWATER TABLE:

Apparent water seeping from pit face: ___ (below land surface) Depth to stabilized apparent water: ___ (below land surface)

Soil moisture state: Damp

ESTIMATED SEASONAL HIGH GROUNDWATER TABLE:

Depth of Estimated Seasonal High Groundwater Table: 44" (below land surface)

Kind: Iron concentrations and reduction; iron coatings on silt grains surrounded by redoximorphic halos.

Location: In $2C_d$ matrix Shape: Irregular/ linear

Hardness: Soft Boundary: Clear Abundance: Many Size: Medium to coarse Contrast: Prominent

Concentration color: 5YR 5/8 yellowish red Reduction color: Gley1 7/N light gray Moisture state: Damp to wet

DETERMINATION OF HIGH GROUNDWATER ELEVATION

Observed depth to redoximorphic features: 46" inches below grade

Observed water weeping from side of deep hole: ___ inches below grade

Observed depth to stabilized phreatic water: ___ inches below grade

DEPTH OF NATURALLY OCCURRING PERVIOUS MATERIAL: ► 2.75'

Depth of naturally occurring pervious material in TPD-2 Upper boundary: 13"
Lower boundary: 46"

Certification

I certify that I am currently approved by the Department of Environmental Protection pursuant to 310 CMR 15.017 to conduct evaluations and that the above analysis has been performed by me consistent with the required training, expertise and experience described in 310 CMR 15.017. I further certify that the results of my soil evaluation, as indicated in the attached Soil Evaluation Form, are accurate and in accordance with 310 CMR 15.017.

#1848 October 1998

Alexander F. Parker Date of License issuance

Massachusetts Soil Evaluator License number

Unofficial testing for drainage 01/03/23

Salisbury Town Witness Date of soil testing

TPD-3 DEEP OBSERVATION HOL

100 Forest Road, Salisbury, Massachusetts

LOT 6

Date: January 03, 2023 Weather: Clear, calm, damp, 35º- 40º F.

Landscape: Upland Landform: Ground moraine Position on landscape: Summit/ Crest

Slope aspect: Southerly Slope (%): 00 – 02 % Slope complexity: Simple Land Cover: Forested

Property line: 10^+ feet Drainage way: 50^+ feet Drinking water well: 100^+ feet Abutting septic system: 50^+ feet

Wetlands: 50^+ feet Public water supply reservoir: 400^+ feet Tributary to reservoir: 200^+ feet

SOIL PROFILE ► TPD-3

Depth below land surface (inches)	Soil Horizon/ Layer	Soil Texture (USDA/ NRCS)	Soil Color (Munsell)	Redoxomorphic Features/ ESHGWT	Consistence, grade, size, structure, grain size, soil moisture state, roots, horizon boundary, clasts, stratification, artifacts, restrictive features, etc.
00" → 10"	A	Sandy Loam	10YR 3/2 very dark grayish brown	none observed	Very friable; moderate-grade; fine-to-medium granular structure; somewhat cohesive; fine grained mineral content; damp matrix; non-sticky; non-plastic; many fine and few medium roots; free of clasts; clear smooth boundary.
10" → 28"	B_W	Sandy Loam	10YR 4/4 dark yellowish brown	none observed	Loose; structureless; non-cohesive; mixed medium to mostly fine-grained mineral content; non-cohesive; damp matrix; non-sticky; non-plastic; few fine tree roots; free of clasts; gradual wavy boundary.
28" → 91"	$2C_d$	Silt Loam	2.5Y 5/1 gray	33" (m,1-3,p) Gley I 7/N 5YR 5/8	Firm; massive structure; very fine-grained mineral content; damp matrix; somewhat sticky; non-plastic; well stratified; well graded; free of clasts; dense and tight matrix; very silty; redoximorphic features observed at 33"; no apparent water observed; no bedrock refusal at test hole depth.

Depth to bedrock: > 91" Seasonal High Groundwater Table: 33" Apparent water: ___

TPD-3 DEEP OBSERVATION HOLE

100 Forest Road, Salisbury, Massachusetts

DEPTH TO PHREATIC GROUNDWATER TABLE:

Apparent water seeping from pit face: ____ (below land surface) Depth to stabilized apparent water: ____ (below land surface)

Soil moisture state: Damp

ESTIMATED SEASONAL HIGH GROUNDWATER TABLE:

Depth of Estimated Seasonal High Groundwater Table: 33" (below land surface)

Kind: Iron concentrations and reduction; iron coatings on silt grains surrounded by redoximorphic halos.

Location: In $2C_d$ matrix Shape: Irregular/ linear

Hardness: Soft Boundary: Clear Abundance: Many Size: Medium to coarse Contrast: Prominent

Concentration color: 5YR 5/8 yellowish red Reduction color: Gley1 7/N light gray Moisture state: Damp to wet

DETERMINATION OF HIGH GROUNDWATER ELEVATION

Observed depth to redoximorphic features: 33" inches below grade

Observed water weeping from side of deep hole: ____ inches below grade

Observed depth to stabilized phreatic water: ____ inches below grade

DEPTH OF NATURALLY OCCURRING PERVIOUS MATERIAL: ► 6.75'

Depth of naturally occurring pervious material in TPD-3 Upper boundary: 10"
Lower boundary: 91"

Certification

I certify that I am currently approved by the Department of Environmental Protection pursuant to 310 CMR 15.017 to conduct evaluations and that the above analysis has been performed by me consistent with the required training, expertise and experience described in 310 CMR 15.017. I further certify that the results of my soil evaluation, as indicated in the attached Soil Evaluation Form, are accurate and in accordance with 310 CMR 15.017.

#1848 October 1998

Alexander F. Parker Date of License issuance

Massachusetts Soil Evaluator License number

Unofficial testing for drainage 01/03/23

Salisbury Town Witness Date of soil testing

TPD-4 DEEP OBSERVATION HOL

100 Forest Road, Salisbury, Massachusetts

LOT 4

Date: January 03, 2023 Weather: Clear, calm, damp, 35°- 40° F.

Landscape: Upland Landform: Ground moraine Position on landscape: Summit/ Crest

Slope aspect: Southerly Slope (%): 00 – 02 % Slope complexity: Simple Land Cover: Forested

Property line: 10^+ feet Drainage way: 50^+ feet Drinking water well: 100^+ feet Abutting septic system: 50^+ feet

Wetlands: 50^+ feet Public water supply reservoir: 400^+ feet Tributary to reservoir: 200^+ feet

SOIL PROFILE ► TPD-4

Depth below land surface (inches)	Soil Horizon/ Layer	Soil Texture (USDA/ NRCS)	Soil Color (Munsell)	Redoxomorphic Features/ ESHGWT	Consistence, grade, size, structure, grain size, soil moisture state, roots, horizon boundary, clasts, stratification, artifacts, restrictive features, etc.
00” → 10”	A	Sandy Loam	10YR 3/2 very dark grayish brown	none observed	Very friable; moderate-grade; fine-to-medium granular structure; somewhat cohesive; fine grained mineral content; damp matrix; non-sticky; non-plastic; many fine and few medium roots; free of clasts; clear smooth boundary.
10” → 16”	B_W	Sandy Loam	10YR 4/4 dark yellowish brown	none observed	Loose; structureless; non-cohesive; mixed medium to mostly fine-grained mineral content; non-cohesive; damp matrix; non-sticky; non-plastic; few fine tree roots; free of clasts; gradual wavy boundary.
16” → 31”	$2C_{1d}$	Silt Loam	2.5Y 5/1 gray	none observed	Firm; massive structure; very fine-grained mineral content; damp matrix; somewhat sticky; non-plastic; well stratified; well graded; free of clasts; dense and tight matrix; very silty; abrupt smooth boundary.
31” → 81”	$2C_2$	Loamy Sand	2.5Y 5/3 light olive brown	39” (m,1-3,p) Gley I 7/N 5YR 5/8	Loose; structureless; non-cohesive; mixed medium to fine-grained mineral content; crudely stratified; damp matrix; non-sticky; non-plastic; free of clasts; redoximorphic features observed at 39”; apparent water observed at 38”; no bedrock refusal at test hole depth.

Depth to bedrock: > 81” Seasonal High Groundwater Table: 39” Apparent water: 38”

TPD-4 DEEP OBSERVATION HOLE

100 Forest Road, Salisbury, Massachusetts

DEPTH TO PHREATIC GROUNDWATER TABLE:

Apparent water seeping from pit face: 38" (below land surface) Depth to stabilized apparent water: ___ (below land surface)

Soil moisture state: Damp to wet

ESTIMATED SEASONAL HIGH GROUNDWATER TABLE:

Depth of Estimated Seasonal High Groundwater Table: 39" (below land surface)

Kind: Iron concentrations and reduction; iron coatings on silt grains surrounded by redoximorphic halos.

Location: In $2C_2$ matrix Shape: Irregular/ linear

Hardness: Soft Boundary: Clear Abundance: Many Size: Medium to coarse Contrast: Prominent

Concentration color: 5YR 5/8 yellowish red Reduction color: Gley1 7/N light gray Moisture state: Damp to wet

DETERMINATION OF HIGH GROUNDWATER ELEVATION

Observed depth to redoximorphic features: 39" inches below grade

Observed water weeping from side of deep hole: 38" inches below grade

Observed depth to stabilized phreatic water: ___ inches below grade

DEPTH OF NATURALLY OCCURRING PERVIOUS MATERIAL: ► 5.92'

Depth of naturally occurring pervious material in TPD-4 Upper boundary: 10"
Lower boundary: 81"

Certification

I certify that I am currently approved by the Department of Environmental Protection pursuant to 310 CMR 15.017 to conduct evaluations and that the above analysis has been performed by me consistent with the required training, expertise and experience described in 310 CMR 15.017. I further certify that the results of my soil evaluation, as indicated in the attached Soil Evaluation Form, are accurate and in accordance with 310 CMR 15.017.

#1848 October 1998

Alexander F. Parker Date of License issuance

Massachusetts Soil Evaluator License number

Unofficial testing for drainage 01/03/23

Salisbury Town Witness Date of soil testing

TPD-5 DEEP OBSERVATION HOL

100 Forest Road, Salisbury, Massachusetts

LOT 4

Date: January 03, 2023 Weather: Clear, calm, damp, 35º- 40º F.

Landscape: Upland Landform: Ground moraine Position on landscape: Summit/ Crest

Slope aspect: Southerly Slope (%): 00 – 02 % Slope complexity: Simple Land Cover: Forested

Property line: 10^{+} feet Drainage way: 50^{+} feet Drinking water well: 100^{+} feet Abutting septic system: 50^{+} feet

Wetlands: 50^{+} feet Public water supply reservoir: 400^{+} feet Tributary to reservoir: 200^{+} feet

SOIL PROFILE ► TPD-5

Depth below land surface (inches)	Soil Horizon/ Layer	Soil Texture (USDA/ NRCS)	Soil Color (Munsell)	Redoxomorphic Features/ ESHGWT	Consistence, grade, size, structure, grain size, soil moisture state, roots, horizon boundary, clasts, stratification, artifacts, restrictive features, etc.
00” → 12”	A	Sandy Loam	10YR 3/2 very dark grayish brown	none observed	Very friable; moderate-grade; fine-to-medium granular structure; somewhat cohesive; fine grained mineral content; damp matrix; non-sticky; non-plastic; many fine and few medium roots; free of clasts; clear smooth boundary.
12” → 14”	B_W	Sandy Loam	10YR 4/4 dark yellowish brown	none observed	Loose; structureless; non-cohesive; mixed medium to mostly fine-grained mineral content; non-cohesive; damp matrix; non-sticky; non-plastic; few fine tree roots; free of clasts; gradual wavy boundary.
14” → 77”	$2C_{1d}$	Silt Loam	2.5Y 5/1 gray	none observed	Firm; massive structure; very fine-grained mineral content; damp matrix; somewhat sticky; non-plastic; well stratified; well graded; free of clasts; dense and tight matrix; very silty; abrupt smooth boundary.
77” → 90”	$2C_2$	Loamy Sand	2.5Y 5/3 light olive brown	35” (m,1-3,p) Gley I 7/N 5YR 5/8	Loose; structureless; non-cohesive; mixed medium to fine-grained mineral content; crudely stratified; damp matrix; non-sticky; non-plastic; free of clasts; redoximorphic features observed at 35”; apparent water observed at 37”; no bedrock refusal at test hole depth.

Depth to bedrock: > 90” Seasonal High Groundwater Table: 35” Apparent water: 37”

TPD-5 DEEP OBSERVATION HOLE

100 Forest Road, Salisbury, Massachusetts

DEPTH TO PHREATIC GROUNDWATER TABLE:

Apparent water seeping from pit face: 37" (below land surface) Depth to stabilized apparent water: ___ (below land surface)

Soil moisture state: Damp to wet

ESTIMATED SEASONAL HIGH GROUNDWATER TABLE:

Depth of Estimated Seasonal High Groundwater Table: 35" (below land surface)

Kind: Iron concentrations and reduction; iron coatings on silt grains surrounded by redoximorphic halos.

Location: In $2C_2$ matrix Shape: Irregular/ linear

Hardness: Soft Boundary: Clear Abundance: Many Size: Medium to coarse Contrast: Prominent

Concentration color: 5YR 5/8 yellowish red Reduction color: Gley1 7/N light gray Moisture state: Damp to wet

DETERMINATION OF HIGH GROUNDWATER ELEVATION

Observed depth to redoximorphic features: 35" inches below grade

Observed water weeping from side of deep hole: 37" inches below grade

Observed depth to stabilized phreatic water: ___ inches below grade

DEPTH OF NATURALLY OCCURRING PERVIOUS MATERIAL: ► 6.50'

Depth of naturally occurring pervious material in TPD-5 Upper boundary: 12"
Lower boundary: 90"

Certification

I certify that I am currently approved by the Department of Environmental Protection pursuant to 310 CMR 15.017 to conduct evaluations and that the above analysis has been performed by me consistent with the required training, expertise and experience described in 310 CMR 15.017. I further certify that the results of my soil evaluation, as indicated in the attached Soil Evaluation Form, are accurate and in accordance with 310 CMR 15.017.

#1848 October 1998

Alexander F. Parker Date of License issuance

Massachusetts Soil Evaluator License number

Unofficial testing for drainage 01/03/23

Salisbury Town Witness Date of soil testing

TPD-6 DEEP OBSERVATION HOL

100 Forest Road, Salisbury, Massachusetts

LOT 4

Date: January 03, 2023 Weather: Clear, calm, damp, 35°- 40° F.

Landscape: Upland Landform: Ground moraine Position on landscape: Summit/ Crest

Slope aspect: Southerly Slope (%): 00 – 02 % Slope complexity: Simple Land Cover: Forested

Property line: 10^{+} feet Drainage way: 50^{+} feet Drinking water well: 100^{+} feet Abutting septic system: 50^{+} feet

Wetlands: 50^{+} feet Public water supply reservoir: 400^{+} feet Tributary to reservoir: 200^{+} feet

SOIL PROFILE ► TPD-6

Depth below land surface (inches)	Soil Horizon/ Layer	Soil Texture (USDA/ NRCS)	Soil Color (Munsell)	Redoxomorphic Features/ ESHGWT	Consistence, grade, size, structure, grain size, soil moisture state, roots, horizon boundary, clasts, stratification, artifacts, restrictive features, etc.
00” → 08”	A	Sandy Loam	10YR 3/2 very dark grayish brown	none observed	Very friable; moderate-grade; fine-to-medium granular structure; somewhat cohesive; fine grained mineral content; damp matrix; non-sticky; non-plastic; many fine and few medium roots; free of clasts; clear smooth boundary.
08” → 12”	B_W	Sandy Loam	10YR 4/4 dark yellowish brown	none observed	Loose; structureless; non-cohesive; mixed medium to mostly fine-grained mineral content; non-cohesive; damp matrix; non-sticky; non-plastic; few fine tree roots; free of clasts; gradual wavy boundary.
12” → 90”	$2C_d$	Silt Loam	2.5Y 5/1 gray	36” (m,1-3,p) Gley I 7/N 5YR 5/8	Firm; massive structure; very fine-grained mineral content; damp matrix; somewhat sticky; non-plastic; well stratified; well graded; free of clasts; dense and tight matrix; very silty; redoximorphic features observed at 36”; apparent water observed at 41”; no bedrock refusal at test hole depth.

Depth to bedrock: > 90” Seasonal High Groundwater Table: 36” Apparent water: 41”

TPD-6 DEEP OBSERVATION HOLE

100 Forest Road, Salisbury, Massachusetts

DEPTH TO PHREATIC GROUNDWATER TABLE:

Apparent water seeping from pit face: 41" (below land surface) Depth to stabilized apparent water: ___ (below land surface)

Soil moisture state: Damp to wet

ESTIMATED SEASONAL HIGH GROUNDWATER TABLE:

Depth of Estimated Seasonal High Groundwater Table: 36" (below land surface)

Kind: Iron concentrations and reduction; iron coatings on silt grains surrounded by redoximorphic halos.

Location: In $2C_d$ matrix Shape: Irregular/ linear

Hardness: Soft Boundary: Clear Abundance: Many Size: Medium to coarse Contrast: Prominent

Concentration color: 5YR 5/8 yellowish red Reduction color: Gley1 7/N light gray Moisture state: Damp to wet

DETERMINATION OF HIGH GROUNDWATER ELEVATION

Observed depth to redoximorphic features: 36" inches below grade

Observed water weeping from side of deep hole: 41" inches below grade

Observed depth to stabilized phreatic water: ___ inches below grade

DEPTH OF NATURALLY OCCURRING PERVIOUS MATERIAL: ► 6.83'

Depth of naturally occurring pervious material in TPD-6 Upper boundary: 08"
Lower boundary: 90"

Certification

I certify that I am currently approved by the Department of Environmental Protection pursuant to 310 CMR 15.017 to conduct evaluations and that the above analysis has been performed by me consistent with the required training, expertise and experience described in 310 CMR 15.017. I further certify that the results of my soil evaluation, as indicated in the attached Soil Evaluation Form, are accurate and in accordance with 310 CMR 15.017.

#1848 October 1998

Alexander F. Parker Date of License issuance

Massachusetts Soil Evaluator License number

Unofficial testing for drainage 01/03/23

Salisbury Town Witness Date of soil testing

TPD-7 DEEP OBSERVATION HOL

100 Forest Road, Salisbury, Massachusetts

LOT 1

Date: January 03, 2023 Weather: Clear, calm, damp, 35°- 40° F.

Landscape: Upland Landform: Ground moraine Position on landscape: Summit/ Crest

Slope aspect: Southerly Slope (%): 00 – 02 % Slope complexity: Simple Land Cover: Forested

Property line: 10^{+} feet Drainage way: 50^{+} feet Drinking water well: 100^{+} feet Abutting septic system: 50^{+} feet

Wetlands: 50^{+} feet Public water supply reservoir: 400^{+} feet Tributary to reservoir: 200^{+} feet

SOIL PROFILE ► TPD-7

Depth below land surface (inches)	Soil Horizon/ Layer	Soil Texture (USDA/ NRCS)	Soil Color (Munsell)	Redoxomorphic Features/ ESHGWT	Consistence, grade, size, structure, grain size, soil moisture state, roots, horizon boundary, clasts, stratification, artifacts, restrictive features, etc.
00" → 18"	A	Sandy Loam	10YR 3/2 very dark grayish brown	none observed	Very friable; moderate-grade; fine-to-medium granular structure; somewhat cohesive; fine grained mineral content; damp matrix; non-sticky; non-plastic; many fine and few medium roots; free of clasts; clear smooth boundary.
18" → 21"	B_W	Sandy Loam	10YR 4/4 dark yellowish brown	none observed	Loose; structureless; non-cohesive; mixed medium to mostly fine-grained mineral content; non-cohesive; damp matrix; non-sticky; non-plastic; few fine tree roots; free of clasts; gradual wavy boundary.
21" → 92"	$_2C$	Loamy Sand	2.5Y 5/3 light olive brown	34" (m,1-3,p) Gley I 7/N 5YR 5/8	Loose; structureless; non-cohesive; mixed medium to fine-grained mineral content; crudely stratified; damp matrix; non-sticky; non-plastic; free of clasts; redoximorphic features observed at 34"; apparent water observed at 37"; no bedrock refusal at test hole depth.

Depth to bedrock: > 92" Seasonal High Groundwater Table: 34" Apparent water: 37"

TPD-7 DEEP OBSERVATION HOLE

100 Forest Road, Salisbury, Massachusetts

DEPTH TO PHREATIC GROUNDWATER TABLE:

Apparent water seeping from pit face: 37" (below land surface) Depth to stabilized apparent water: ___ (below land surface)

Soil moisture state: Damp to wet

ESTIMATED SEASONAL HIGH GROUNDWATER TABLE:

Depth of Estimated Seasonal High Groundwater Table: 34" (below land surface)

Kind: Iron concentrations and reduction; iron coatings on silt grains surrounded by redoximorphic halos.

Location: In 2C matrix Shape: Irregular/ linear

Hardness: Soft Boundary: Clear Abundance: Many Size: Medium to coarse Contrast: Prominent

Concentration color: 5YR 5/8 yellowish red Reduction color: Gley1 7/N light gray Moisture state: Damp to wet

DETERMINATION OF HIGH GROUNDWATER ELEVATION

Observed depth to redoximorphic features: 34" inches below grade

Observed water weeping from side of deep hole: 37" inches below grade

Observed depth to stabilized phreatic water: ___ inches below grade

DEPTH OF NATURALLY OCCURRING PERVIOUS MATERIAL: ► 6.16'

Depth of naturally occurring pervious material in TPD-7 Upper boundary: 18"
Lower boundary: 92"

Certification

I certify that I am currently approved by the Department of Environmental Protection pursuant to 310 CMR 15.017 to conduct evaluations and that the above analysis has been performed by me consistent with the required training, expertise and experience described in 310 CMR 15.017. I further certify that the results of my soil evaluation, as indicated in the attached Soil Evaluation Form, are accurate and in accordance with 310 CMR 15.017.

#1848 October 1998

Alexander F. Parker Date of License issuance

Massachusetts Soil Evaluator License number

Unofficial testing for drainage 01/03/23

Salisbury Town Witness Date of soil testing

TPD-8 DEEP OBSERVATION HOL

100 Forest Road, Salisbury, Massachusetts

LOT 1

Date: January 03, 2023 Weather: Clear, calm, damp, 35°- 40° F.

Landscape: Upland Landform: Ground moraine Position on landscape: Summit/ Crest

Slope aspect: Southerly Slope (%): 00 – 02 % Slope complexity: Simple Land Cover: Forested

Property line: 10^+ feet Drainage way: 50^+ feet Drinking water well: 100^+ feet Abutting septic system: 50^+ feet

Wetlands: 50^+ feet Public water supply reservoir: 400^+ feet Tributary to reservoir: 200^+ feet

SOIL PROFILE ► TPD-8

Depth below land surface (inches)	Soil Horizon/ Layer	Soil Texture (USDA/ NRCS)	Soil Color (Munsell)	Redoxomorphic Features/ ESHGWT	Consistence, grade, size, structure, grain size, soil moisture state, roots, horizon boundary, clasts, stratification, artifacts, restrictive features, etc.
00" → 13"	A	Sandy Loam	10YR 3/2 very dark grayish brown	none observed	Very friable; moderate-grade; fine-to-medium granular structure; somewhat cohesive; fine grained mineral content; damp matrix; non-sticky; non-plastic; many fine and few medium roots; free of clasts; clear smooth boundary.
13" → 21"	B_W	Sandy Loam	10YR 4/4 dark yellowish brown	none observed	Loose; structureless; non-cohesive; mixed medium to mostly fine-grained mineral content; non-cohesive; damp matrix; non-sticky; non-plastic; few fine tree roots; free of clasts; gradual wavy boundary.
21" → 90"	$_2C$	Loamy Sand	2.5Y 5/3 light olive brown	33" (m,1-3,p) Gley I 7/N 5YR 5/8	Loose; structureless; non-cohesive; mixed medium to fine-grained mineral content; crudely stratified; damp matrix; non-sticky; non-plastic; free of clasts; redoximorphic features observed at 33"; apparent water observed at 37"; no bedrock refusal at test hole depth.

Depth to bedrock: > 90" Seasonal High Groundwater Table: 33" Apparent water: 37"

TPD-8 DEEP OBSERVATION HOLE

100 Forest Road, Salisbury, Massachusetts

DEPTH TO PHREATIC GROUNDWATER TABLE:

Apparent water seeping from pit face: 37" (below land surface) Depth to stabilized apparent water: ___ (below land surface)

Soil moisture state: Damp to wet

ESTIMATED SEASONAL HIGH GROUNDWATER TABLE:

Depth of Estimated Seasonal High Groundwater Table: 33" (below land surface)

Kind: Iron concentrations and reduction; iron coatings on silt grains surrounded by redoximorphic halos.

Location: In 2C matrix Shape: Irregular/ linear

Hardness: Soft Boundary: Clear Abundance: Many Size: Medium to coarse Contrast: Prominent

Concentration color: 5YR 5/8 yellowish red Reduction color: Gley1 7/N light gray Moisture state: Damp to wet

DETERMINATION OF HIGH GROUNDWATER ELEVATION

Observed depth to redoximorphic features: 33" inches below grade

Observed water weeping from side of deep hole: 37" inches below grade

Observed depth to stabilized phreatic water: ___ inches below grade

DEPTH OF NATURALLY OCCURRING PERVIOUS MATERIAL: ► 6.42'

Depth of naturally occurring pervious material in TPD-8 Upper boundary: 13"
Lower boundary: 90"

Certification

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Salisbury Town Witness Date of soil testing

TPD-9 DEEP OBSERVATION HOL

100 Forest Road, Salisbury, Massachusetts

LOT 1

Date: January 03, 2023 Weather: Clear, calm, damp, 35º- 40º F.

Landscape: Upland Landform: Ground moraine Position on landscape: Summit/ Crest

Slope aspect: Southerly Slope (%): 00 – 02 % Slope complexity: Simple Land Cover: Forested

Property line: 10^+ feet Drainage way: 50^+ feet Drinking water well: 100^+ feet Abutting septic system: 50^+ feet

Wetlands: 50^+ feet Public water supply reservoir: 400^+ feet Tributary to reservoir: 200^+ feet

SOIL PROFILE ► TPD-9

Depth below land surface (inches)	Soil Horizon/ Layer	Soil Texture (USDA/ NRCS)	Soil Color (Munsell)	Redoxomorphic Features/ ESHGWT	Consistence, grade, size, structure, grain size, soil moisture state, roots, horizon boundary, clasts, stratification, artifacts, restrictive features, etc.
00" → 12"	A	Sandy Loam	10YR 3/2 very dark grayish brown	none observed	Very friable; moderate-grade; fine-to-medium granular structure; somewhat cohesive; fine grained mineral content; damp matrix; non-sticky; non-plastic; many fine and few medium roots; free of clasts; clear smooth boundary.
12" → 22"	B_W	Sandy Loam	10YR 4/4 dark yellowish brown	none observed	Loose; structureless; non-cohesive; mixed medium to mostly fine-grained mineral content; non-cohesive; damp matrix; non-sticky; non-plastic; few fine tree roots; free of clasts; gradual wavy boundary.
22" → 89"	$_2C$	Loamy Sand	2.5Y 5/3 light olive brown	36" (m,1-3,p) Gley I 7/N 5YR 5/8	Loose; structureless; non-cohesive; mixed medium to fine-grained mineral content; crudely stratified; damp matrix; non-sticky; non-plastic; free of clasts; redoximorphic features observed at 36"; apparent water observed at 44"; no bedrock refusal at test hole depth.

Depth to bedrock: > 89" Seasonal High Groundwater Table: 36" Apparent water: 44"

TPD-9 DEEP OBSERVATION HOLE

100 Forest Road, Salisbury, Massachusetts

DEPTH TO PHREATIC GROUNDWATER TABLE:

Apparent water seeping from pit face: 44" (below land surface) Depth to stabilized apparent water: ___ (below land surface)

Soil moisture state: Damp to wet

ESTIMATED SEASONAL HIGH GROUNDWATER TABLE:

Depth of Estimated Seasonal High Groundwater Table: 36" (below land surface)

Kind: Iron concentrations and reduction; iron coatings on silt grains surrounded by redoximorphic halos.

Location: In 2C matrix Shape: Irregular/ linear

Hardness: Soft Boundary: Clear Abundance: Many Size: Medium to coarse Contrast: Prominent

Concentration color: 5YR 5/8 yellowish red Reduction color: Gley1 7/N light gray Moisture state: Damp to wet

DETERMINATION OF HIGH GROUNDWATER ELEVATION

Observed depth to redoximorphic features: 36" inches below grade

Observed water weeping from side of deep hole: 44" inches below grade

Observed depth to stabilized phreatic water: ___ inches below grade

DEPTH OF NATURALLY OCCURRING PERVIOUS MATERIAL: ► 6.42'

Depth of naturally occurring pervious material in TPD-9 Upper boundary: 12"
Lower boundary: 89"

Certification

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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

100 Forest Road

July 5, 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.

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Contents

How Soil Surveys Are Made

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

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

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

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

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

scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

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

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

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

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

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

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and

identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

Soil Map

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

Custom Soil Resource Report
Soil Map

Map Scale: 1:4,970 if printed on A portrait (8.5" x 11") sheet.

N

Meters: 0 50 100 200 300

Feet: 0 200 400 800 1200

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: May 22, 2020—Sep 25, 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
40A	Swanton fine sandy loam, 0 to 3 percent slopes	1.2	2.0%
105D	Rock outcrop-Hollis complex, 3 to 25 percent slopes	21.5	35.5%
240B	Elmwood fine sandy loam, 3 to 8 percent slopes	4.7	7.8%
255B	Windsor loamy sand, 3 to 8 percent slopes	4.6	7.6%
607	Water, saline	1.0	1.6%
712A	Ipswich and Westbrook mucky peats, 0 to 2 percent slopes, very frequently flooded	21.2	35.1%
721C	Windsor-Rock outcrop complex, 3 to 15 percent slopes	6.3	10.4%
Totals for Area of Interest		**60.6**	**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

40A—Swanton fine sandy loam, 0 to 3 percent slopes

Map Unit Setting

National map unit symbol: vjvz
Elevation: 10 to 900 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

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

Description of Swanton

Setting

Landform: Depressions, depressions, depressions
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Dip
Down-slope shape: Concave
Across-slope shape: Concave
Parent material: Loose coarse-loamy glaciofluvial deposits over hard clayey glaciolacustrine deposits and/or firm clayey glaciomarine deposits

Typical profile

O - 0 to 1 inches: muck
H2 - 1 to 9 inches: fine sandy loam
H3 - 9 to 29 inches: fine sandy loam
H4 - 29 to 60 inches: silty clay

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: 18 to 40 inches to strongly contrasting textural stratification
Drainage class: Poorly drained
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately high (0.00 to 0.20 in/hr)
Depth to water table: About 0 to 18 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Low (about 4.6 inches)

Interpretive groups

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

Minor Components

Whately variant

Percent of map unit: 10 percent

Landform: Depressions
Hydric soil rating: Yes

Melrose
Percent of map unit: 5 percent
Hydric soil rating: No

105D—Rock outcrop-Hollis complex, 3 to 25 percent slopes

Map Unit Setting
National map unit symbol: vjrd
Elevation: 0 to 130 feet
Mean annual precipitation: 45 to 54 inches
Mean annual air temperature: 43 to 54 degrees F
Frost-free period: 125 to 240 days
Farmland classification: Not prime farmland

Map Unit Composition
Rock outcrop: 65 percent
Hollis and similar soils: 20 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Rock Outcrop

Setting
Parent material: Granite and gneiss

Properties and qualities
Slope: 25 to 35 percent
Depth to restrictive feature: 0 inches to lithic bedrock

Interpretive groups
Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 8s
Hydric soil rating: Unranked

Description of Hollis

Setting
Landform: Ridges, hills
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Convex
Parent material: Shallow, friable loamy eolian deposits over granite and gneiss

Typical profile
O - 0 to 1 inches: muck
H2 - 1 to 6 inches: fine sandy loam
H3 - 6 to 17 inches: gravelly fine sandy loam
H4 - 17 to 20 inches: unweathered bedrock

Properties and qualities

Slope: 25 to 35 percent
Depth to restrictive feature: 10 to 60 inches to lithic bedrock
Drainage class: Somewhat excessively drained
Capacity of the most limiting layer to transmit water (Ksat): Very low (0.00 to 0.00 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 2.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7e
Hydrologic Soil Group: D
Ecological site: F144AY033MA - Shallow Dry Till Uplands
Hydric soil rating: No

Minor Components

Chatfield

Percent of map unit: 15 percent
Hydric soil rating: No

240B—Elmwood fine sandy loam, 3 to 8 percent slopes

Map Unit Setting

National map unit symbol: vj7q
Elevation: 10 to 900 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: All areas are prime farmland

Map Unit Composition

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

Description of Elmwood

Setting

Landform: Lakebeds (relict), lakebeds (relict)
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Dip
Down-slope shape: Linear
Across-slope shape: Concave
Parent material: Friable coarse-loamy glaciofluvial deposits over hard clayey glaciolacustrine deposits derived from schist

Typical profile

O - 0 to 2 inches: muck
H2 - 2 to 7 inches: fine sandy loam
H3 - 7 to 37 inches: fine sandy loam
H4 - 37 to 60 inches: silty clay

Properties and qualities

Slope: 3 to 8 percent
Depth to restrictive feature: 18 to 40 inches to strongly contrasting textural stratification
Drainage class: Moderately well drained
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately high (0.00 to 0.20 in/hr)
Depth to water table: About 12 to 36 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Moderate (about 6.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2w
Hydrologic Soil Group: B
Ecological site: F144AY018NY - Moist Lake Plain
Hydric soil rating: No

Minor Components

Melrose

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

Swanton

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

255B—Windsor loamy sand, 3 to 8 percent slopes

Map Unit Setting

National map unit symbol: 2svkf
Elevation: 0 to 1,210 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

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

Description of Windsor, Loamy Sand

Setting

Landform: Dunes, outwash plains, deltas, outwash terraces
Landform position (three-dimensional): Tread, riser
Down-slope shape: Convex, linear
Across-slope shape: Convex, linear
Parent material: Loose sandy glaciofluvial deposits derived from granite and/or loose sandy glaciofluvial deposits derived from schist and/or loose sandy glaciofluvial deposits derived from gneiss

Typical profile

O - 0 to 1 inches: moderately decomposed plant material
A - 1 to 3 inches: loamy sand
Bw - 3 to 25 inches: loamy sand
C - 25 to 65 inches: sand

Properties and qualities

Slope: 3 to 8 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Excessively drained
Runoff class: Low
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: 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 4.5 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2s
Hydrologic Soil Group: A
Ecological site: F144AY022MA - Dry Outwash
Hydric soil rating: No

Minor Components

Hinckley, loamy sand

Percent of map unit: 10 percent
Landform: Deltas, kames, eskers, outwash plains
Landform position (two-dimensional): Summit, shoulder, backslope
Landform position (three-dimensional): Crest, head slope, nose slope, side slope, rise
Down-slope shape: Convex
Across-slope shape: Convex, linear
Hydric soil rating: No

Deerfield, loamy sand

Percent of map unit: 5 percent
Landform: Deltas, terraces, outwash plains
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Tread, talf
Down-slope shape: Linear
Across-slope shape: Linear

Hydric soil rating: No

607—Water, saline

Map Unit Setting

National map unit symbol: vk29
Frost-free period: 120 to 200 days
Farmland classification: Not prime farmland

Map Unit Composition

Water, saline: 95 percent
Minor components: 5 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Minor Components

Westbrook

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

712A—Ipswich and Westbrook mucky peats, 0 to 2 percent slopes, very frequently flooded

Map Unit Setting

National map unit symbol: 2tyqn
Elevation: 0 to 10 feet
Mean annual precipitation: 36 to 71 inches
Mean annual air temperature: 39 to 55 degrees F
Frost-free period: 140 to 250 days
Farmland classification: Not prime farmland

Map Unit Composition

Ipswich and similar soils: 55 percent
Westbrook and similar soils: 30 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Ipswich

Setting

Landform: Tidal marshes
Landform position (three-dimensional): Dip
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Partially- decomposed herbaceous organic material

Typical profile

Oe - 0 to 42 inches: mucky peat
Oa - 42 to 59 inches: muck

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Very poorly drained
Runoff class: Negligible
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to very high (0.14 to 99.90 in/hr)
Depth to water table: About 0 inches
Frequency of flooding: Very frequent
Frequency of ponding: None
Calcium carbonate, maximum content: 5 percent
Maximum salinity: Nonsaline to strongly saline (0.7 to 111.6 mmhos/cm)
Sodium adsorption ratio, maximum: 20.0
Available water supply, 0 to 60 inches: Very high (about 26.6 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 8w
Hydrologic Soil Group: A/D
Ecological site: R144AY001CT - Tidal Salt Low Marsh mesic very frequently flooded, R144AY002CT - Tidal Salt High Marsh mesic very frequently flooded
Hydric soil rating: Yes

Description of Westbrook

Setting

Landform: Tidal marshes
Landform position (three-dimensional): Dip
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Partly-decomposed herbaceous organic material over loamy mineral material

Typical profile

Oe - 0 to 19 inches: mucky peat
Cg - 19 to 59 inches: silt loam

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Very poorly drained
Runoff class: Negligible
Capacity of the most limiting layer to transmit water (Ksat): Very low to high (0.00 to 14.17 in/hr)
Depth to water table: About 0 inches
Frequency of flooding: Very frequent
Frequency of ponding: None
Calcium carbonate, maximum content: 5 percent
Maximum salinity: Nonsaline to strongly saline (0.7 to 111.6 mmhos/cm)
Sodium adsorption ratio, maximum: 33.0
Available water supply, 0 to 60 inches: High (about 9.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 8w
Hydrologic Soil Group: B/D
Ecological site: R144AY001CT - Tidal Salt Low Marsh mesic very frequently flooded, R144AY002CT - Tidal Salt High Marsh mesic very frequently flooded
Hydric soil rating: Yes

Minor Components

Pawcatuck

Percent of map unit: 15 percent
Landform: Tidal marshes
Landform position (three-dimensional): Dip
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: R144AY001CT - Tidal Salt Low Marsh mesic very frequently flooded, R144AY002CT - Tidal Salt High Marsh mesic very frequently flooded
Hydric soil rating: Yes

721C—Windsor-Rock outcrop complex, 3 to 15 percent slopes

Map Unit Setting

National map unit symbol: 2w2x8
Elevation: 0 to 130 feet
Mean annual precipitation: 36 to 71 inches
Mean annual air temperature: 39 to 55 degrees F
Frost-free period: 140 to 240 days
Farmland classification: Not prime farmland

Map Unit Composition

Windsor and similar soils: 60 percent
Rock outcrop: 25 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Windsor

Setting

Landform: Kame terraces, outwash terraces, eskers, kames, outwash deltas, outwash plains
Landform position (two-dimensional): Toeslope, backslope, summit, footslope, shoulder
Landform position (three-dimensional): Head slope, nose slope, side slope, crest, riser, tread
Down-slope shape: Concave, convex, linear
Across-slope shape: Convex, linear, concave

Parent material: Loose sandy glaciofluvial deposits derived from granite and/or loose sandy glaciofluvial deposits derived from schist and/or loose sandy glaciofluvial deposits derived from gneiss

Typical profile

A - 0 to 3 inches: loamy sand
Bw - 3 to 25 inches: loamy sand
C - 25 to 65 inches: sand

Properties and qualities

Slope: 3 to 15 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Excessively drained
Runoff class: Very low
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: 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 5.2 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: A
Ecological site: F144AY022MA - Dry Outwash
Hydric soil rating: No

Description of Rock Outcrop

Setting

Landform: Hills
Landform position (two-dimensional): Summit, shoulder, backslope
Landform position (three-dimensional): Crest, side slope
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Igneous and metamorphic rock

Typical profile

R - 0 to 10 inches: bedrock

Properties and qualities

Slope: 3 to 15 percent
Depth to restrictive feature: 0 inches to lithic bedrock
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Very low (0.00 to 0.00 in/hr)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 8
Hydrologic Soil Group: D
Hydric soil rating: Unranked

Minor Components

Scarboro

Percent of map unit: 5 percent
Landform: Depressions, outwash deltas, drainageways, outwash terraces
Landform position (three-dimensional): Tread
Down-slope shape: Concave
Across-slope shape: Concave, linear
Hydric soil rating: Yes

Wareham

Percent of map unit: 5 percent
Landform: Depressions
Down-slope shape: Concave
Across-slope shape: Linear
Hydric soil rating: No

Mashpee

Percent of map unit: 5 percent
Landform: Terraces, drainageways, depressions
Landform position (three-dimensional): Tread
Down-slope shape: Concave
Across-slope shape: Concave
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.

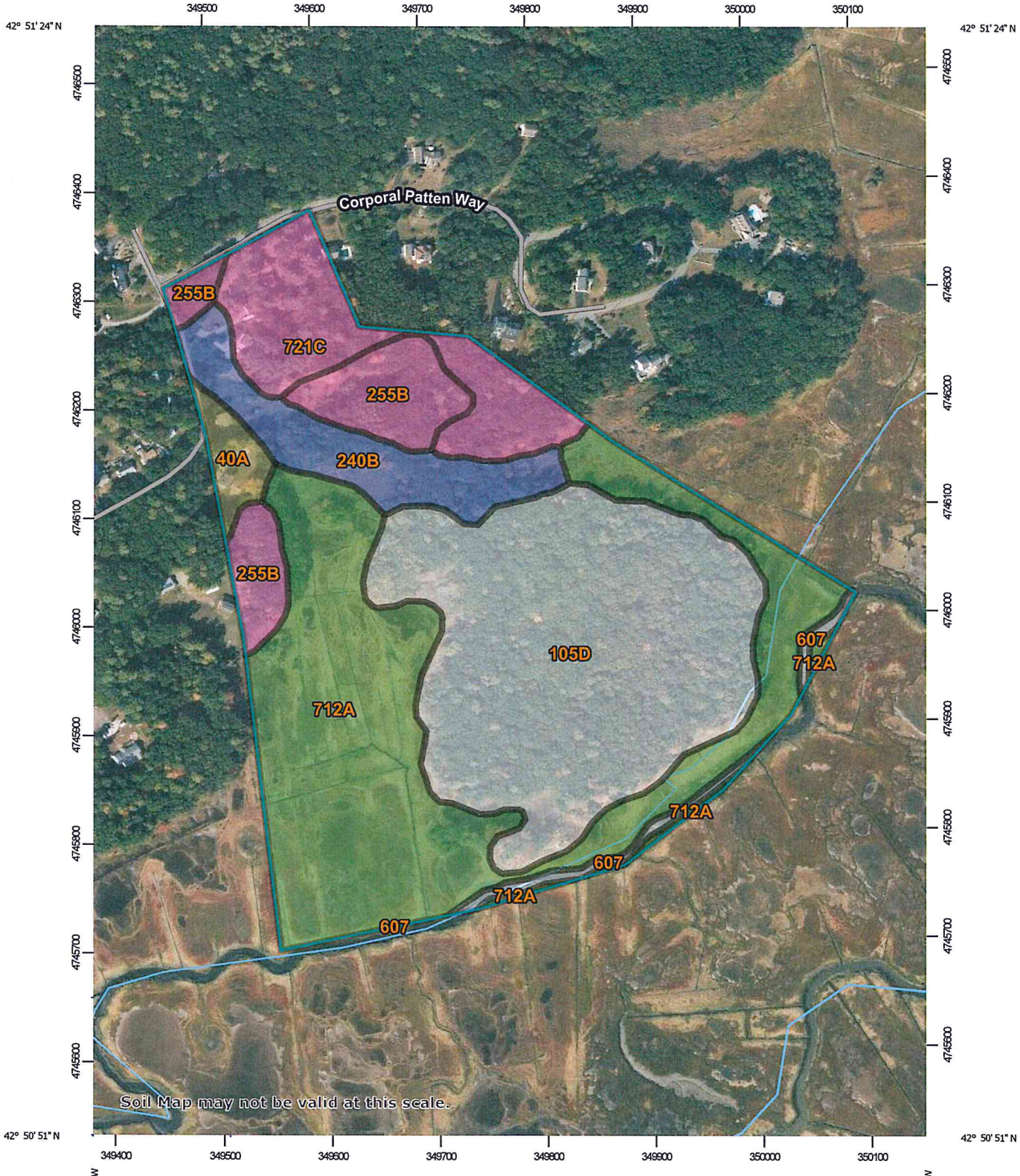
Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

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.

Custom Soil Resource Report
Map—Hydrologic Soil Group



Map Scale: 1:4,970 if printed on A portrait (8.5" x 11") sheet.

N

Meters: 0 50 100 200 300

Feet: 0 200 400 800 1200

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: May 22, 2020—Sep 25, 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
40A	Swanton fine sandy loam, 0 to 3 percent slopes	C/D	1.2	2.0%
105D	Rock outcrop-Hollis complex, 3 to 25 percent slopes		21.5	35.5%
240B	Elmwood fine sandy loam, 3 to 8 percent slopes	B	4.7	7.8%
255B	Windsor loamy sand, 3 to 8 percent slopes	A	4.6	7.6%
607	Water, saline		1.0	1.6%
712A	Ipswich and Westbrook mucky peats, 0 to 2 percent slopes, very frequently flooded	A/D	21.2	35.1%
721C	Windsor-Rock outcrop complex, 3 to 15 percent slopes	A	6.3	10.4%
Totals for Area of Interest			**60.6**	**100.0%**

Rating Options—Hydrologic Soil Group

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

10.0 APPENDIX F – WATERSHED PLANS