MASCONOMET REGIONAL SCHOOL DISTRICT FIELD RENOVATIONS STORMWATER REPORT



Stormwater Report

Masconomet Regional School District Field Renovations Boxford, Massachusetts 20 Endicott Road, Boxford MA

Submission Date: January 18th, 2024

Prepared for:

Michael M. Harvey Masconomet Regional School District 20 Endicott Road Boxford, MA 01921

Prepared by:

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EXECUTIVE SUMMARY

Masconomet Regional School District proposes to convert their existing two athletic fields into turf fields, along with redeveloping their baseball field. The proposed project includes seating and associated parking lots for both athletic fields. In addition, there is a proposed building along with walkways and landscaping. The western field will be a practice field and junior varsity field, and the eastern field will be used by the varsity team.

The project has site constraints which include resource areas such as bordering vegetated wetlands and the Ipswich River.

The project is considered to be a new development due to the proposed increase in impervious area within the site. The hydrologic analysis and associated stormwater management design has been completed for the project and meets all stormwater management standards. This stormwater report will establish design criteria for the proposed project and outline how the stormwater management standards are met.

Geotechnical investigations and soil evaluations have been performed to evaluate the soil conditions for the stormwater management design. Results from the geotechnical report indicate sandy soils that are consistent with the Natural Resources Conservation Service (NRCS) soil report.

STORMWATER MANAGEMENT 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 8²
- Operation and Maintenance Plan required by Standard 9

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

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

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

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

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



B. Stormwater Checklist and Certification

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

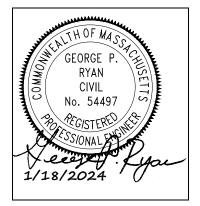
Note: Because stormwater requirements vary from project to project, it is possible that a complete Stormwater Report may not include information on some of the subjects specified in the Checklist. If it is determined that a specific item does not apply to the project under review, please note that the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

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

Registered Professional Engineer's Certification

I have reviewed the Stormwater Report, including the soil evaluation, computations, Long-term Pollution Prevention Plan, the Construction Period Erosion and Sedimentation Control Plan (if included), the Longterm 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

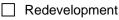


Signature and Date

Checklist

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

New development



Mix of New Development and Redevelopment



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

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



Standard 2: Peak Rate Attenuation

- Standard 2 waiver requested because the project is located in land subject to coastal storm flowage and stormwater discharge is to a wetland subject to coastal flooding.
- Evaluation provided to determine whether off-site flooding increases during the 100-year 24-hour storm.

✓ Calculations provided to show that post-development peak discharge rates do not exceed predevelopment 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 24hour storm.

Standard 3: Recharge

 \checkmark

\checkmark	Soil /	Analys	is prov	vided.
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- 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
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Dynamic Field¹

- 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.

\checkmark	Recharge BMPs ha	ave been sized to	infiltrate the	Required Rech	arge Volume.
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- 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.
- \checkmark 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.



Standard 3: Recharge (continued)

- The infiltration BMP is used to attenuate peak flows during storms greater than or equal to the 10year 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)
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Standard 4: Water Quality (continued)

- The BMP is sized (and calculations provided) based on:
 - ✓ The ½" or 1" Water Quality Volume or
 - The equivalent flow rate associated with the Water Quality Volume and documentation is provided showing that the BMP treats the required water quality volume.
- ☐ The applicant proposes to use proprietary BMPs, and documentation supporting use of proprietary BMP and proposed TSS removal rate is provided. This documentation may be in the form of the propriety BMP checklist found in Volume 2, Chapter 4 of the Massachusetts Stormwater Handbook and submitting copies of the TARP Report, STEP Report, and/or other third party studies verifying performance of the proprietary BMPs.
- A TMDL exists that indicates a need to reduce pollutants other than TSS and documentation showing that the BMPs selected are consistent with the TMDL is provided.

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

- The NPDES Multi-Sector General Permit covers the land use and the Stormwater Pollution Prevention Plan (SWPPP) has been included with the Stormwater Report.
- The NPDES Multi-Sector General Permit covers the land use and the SWPPP will be submitted **prior to** the discharge of stormwater to the post-construction stormwater BMPs.
- The NPDES Multi-Sector General Permit does *not* cover the land use.
- LUHPPLs are located at the site and industry specific source control and pollution prevention measures have been proposed to reduce or eliminate the exposure of LUHPPLs to rain, snow, snow melt and runoff, and been included in the long term Pollution Prevention Plan.
- All exposure has been eliminated.
- All exposure has *not* been eliminated and all BMPs selected are on MassDEP LUHPPL list.
- The LUHPPL has the potential to generate runoff with moderate to higher concentrations of oil and grease (e.g. all parking lots with >1000 vehicle trips per day) and the treatment train includes an oil grit separator, a filtering bioretention area, a sand filter or equivalent.

Standard 6: Critical Areas

- The discharge is near or to a critical area and the treatment train includes only BMPs that MassDEP has approved for stormwater discharges to or near that particular class of critical area.
- Critical areas and BMPs are identified in the Stormwater Report.



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

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

Limited Project	t
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- 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.



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

- ☐ The project is highly complex and information is included in the Stormwater Report that explains why it is not possible to submit the Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan with the application. A Construction Period Pollution Prevention and Erosion and Sedimentation Control has *not* been included in the Stormwater Report but will be submitted *before* land disturbance begins.
- The project is *not* covered by a NPDES Construction General Permit.
- The project is covered by a NPDES Construction General Permit and a copy of the SWPPP is in the Stormwater Report.
- The project is covered by a NPDES Construction General Permit but no SWPPP been submitted. The SWPPP will be submitted BEFORE land disturbance begins.

Standard 9: Operation and Maintenance Plan

- The Post Construction Operation and Maintenance Plan is included in the Stormwater Report and includes the following information:
 - Name of the stormwater management system owners;
 - Party responsible for operation and maintenance;
 - Schedule for implementation of routine and non-routine maintenance tasks;
 - Plan showing the location of all stormwater BMPs maintenance access areas;
 - Description and delineation of public safety features;
 - Estimated operation and maintenance budget; and
 - Operation and Maintenance Log Form.
- The responsible party is **not** the owner of the parcel where the BMP is located and the Stormwater Report includes the following submissions:
 - A copy of the legal instrument (deed, homeowner's association, utility trust or other legal entity) that establishes the terms of and legal responsibility for the operation and maintenance of the project site stormwater BMPs;
 - A plan and easement deed that allows site access for the legal entity to operate and maintain BMP functions.

Standard 10: Prohibition of Illicit Discharges

- The Long-Term Pollution Prevention Plan includes measures to prevent illicit discharges;
- An Illicit Discharge Compliance Statement is attached;
- NO Illicit Discharge Compliance Statement is attached but will be submitted *prior to* the discharge of any stormwater to post-construction BMPs.

1.0 EXISTING CONDITIONS

1.1 SITE LOCATION

The project site is in the Town of Boxford. The project site is bound by Route 95 to the West, the Ipswich River to the South and South-East, Fish Brook to the North-East, and Endicott Road to the North and North-West. For the stormwater analysis, the watershed boundary was established as 15.66-acre portion of the site. The watershed boundary includes two multi-use athletic fields, a baseball field, and proposed parking area.

1.2 SITE PEDOLOGY

Soil Types

The Natural Resources Conservation Service (NRCS) Soil Survey of Essex County, Massachusetts indicates that the soil onsite is composed predominately of Udorthents, smoothed, Map Unit 651. Other soil groups onsite are as follows:

- Merrimac fine sandy loam, 0 to 3 percent slopes, Map Unit 254A
- Saco variant silt loam, frequently ponded, 0 to 1 percent slopes, frequently flooded, Map Unit 718A

Hydrologic Soil Groups

The NRCS classification for Hydrologic Soil Groups (HSG) for the above listed soils varies between A, B and D. Much of the property is classified as either Udorthents or Merrimac fine sandy loam, both of which are assigned Hydrologic Soil Group C. A small portion of the site is classified as Saco variant silt loam, which is assigned both Hydrologic Soil Group B and D. The location and description of the Saco variant silt loam that is present on the site aligns closer with characteristics of Hydrologic Soil Group B, and therefor for purposed of the stormwater modeling HSG B was used in both the existing and proposed conditions. A summary of the NRCS Soil Survey Report can be found in Appendix A.

Subsurface Explorations

Between July 17th and July 24th of 2023, Haley & Aldrich (H&A) conducted a total of eight (8) test boring explorations and twenty (20) geoprobe explorations. The test boring explorations were designated as HA-1 through HA-8 and were drilled to depths of 27 to 32 feet below ground surface. The geoprobes were designated as GP-1 through GP-18, INFL-1 and INFL-2, and were drilled to depths 10 feet below ground surface.

The geotechnical report produced by Haley & Aldrich can be found in Appendix A.

1.3 GROUNDWATER ELEVATIONS

As part of the subsurface explorations performed by Haley & Aldrich, eight (8) test boring explorations and twenty (20) geoprobe explorations were conducted. A summary of the groundwater elevations observed in the boring explorations can be found in Table 1 – Groundwater Elevations. Refer to the geotechnical report in Appendix A for a figure showing the locations of the borings.

Test Boring	Groundwater Elevation
HA-1	46.6
HA-2	46.6
HA-3	45.5
HA-4	45.2
HA-5	44.5
HA-6	42.0
HA-7	41.6
HA-8	45.0

Table 1 – Groundwater Elevations

1.4 **DESIGN POINTS**

Design points serve as comparison points for the peak discharge rates of the pre- and post-development hydrologic conditions. Design points are often established at either the site's property line or at a hydrologic point of interest downstream from the project site. In total, three design points were established to compare the existing and proposed condition peak discharge rates for the Site. (Figure 1-1 – Existing Watershed Plan)

DP-1 – 21" Concrete Pipe

Stormwater runoff from a portion of the site's parking area along with surface runoff from the western athletic field and baseball field is collected into catch basins and routed through a drainage conveyance system that ultimately converges into a 21" concrete pipe. The 21" pipe is routed underneath the existing field to a flare-end-section where it discharges stormwater flow into the lpswich River.

To avoid disturbance to any wetland resource areas, the proposed stormwater conveyance design reuses the existing 21" concrete pipe that discharges into the Ipswich River. To ensure that the pipe maintained adequate capacity for stormwater conveyance, it was crucial to ensure that peak rates were not increased in the pipe, therefore making it worthy of being a design point.

DP-2 – 24" Reinforced Concrete Pipe

Stormwater runoff from a portion of the site's parking area is collected into catch basins and routed through a drainage conveyance system that ultimately converges into a 24" reinforced concrete drainage pipe. The 24" pipe is routed underneath the existing field to a flared-end-section where it discharges stormwater flow into the Ipswich River.

To avoid disturbance to any wetland resource areas, the proposed stormwater conveyance design reuses the existing 24" reinforced concrete pipe that discharges to the Ipswich River. To ensure that the pipe maintained adequate capacity for stormwater conveyance, it was crucial to ensure that peak rates were not increased in the pipe, therefore making it worthy of being a design point.

DP-3 – Ipswich River:

Stormwater runoff from eastern most athletic field is directly routed to the Ipswich River via surface flow. In addition, the stormwater routed through designs points one and two both discharge to the Ipswich River, making the river the ultimate destination for all stormwater runoff that results from the site.

1.5 EXISTING HYDROLOGIC CONDITIONS

For the existing conditions analysis, the Site was divided into three subcatchment areas (Figure 1-1 – Existing Watershed Plan). The following provides a general description of each subcatchment:

MASCONOMET REGIONAL SCHOOL DISTRICT FIELD RENOVATIONS STORMWATER REPORT 1/18/2024

Subcatchment EX-1 is comprised of a portion of the site's parking area. Stormwater runoff sheet flows into catch basins where it is routed through a stormwater conveyance system, through a 21-inch concrete pipe (DP-1) and ultimately discharges into the Ipswich River (DP-3).

Subcatchment EX-2 is comprised of pervious area, including the western athletic field and baseball fields. Stormwater runoff sheet flows into catch basins where it is routed through a stormwater conveyance system, through a 21-inch concrete pipe (DP-1) and ultimately discharges into the Ipswich River (DP-3).

Subcatchment EX-3 is comprised of a portion of the site's parking area. Stormwater runoff sheets flows into catch basins where it is routed through a stormwater conveyance system, through a 24-inch reinforced concrete pipe (DP-2) and ultimately discharges into the Ipswich River (DP-3).

Subcatchment EX-4 is comprised of pervious area, including the eastern athletic field and land along the Ipswich River. Stormwater runoff sheets flows directly into the Ipswich River (DP-3).

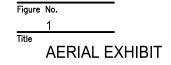
Subcatchment Area I.D.	Area (sf)	Time of Concentration, T _c (min. 6.0 minutes)	Curve Number, CN
EX-1	133,902	6.0	87
EX-2	290,906	15.9	39
EX-3	25,497	6.0	93
EX-4	231,675	12.5	43
Total	681,980		52

Table 2 – Existing Subcatchment Summary





Stantec Consulting Services, Inc. 40 Water Street, 3rd Floor Boston, MA 02109 U.S.A. Tel. 617.234.3100 Fax. 617.661.7118 www.stantec.com Client/Project JANUARY 2024 Masconomet Fields, Boxford







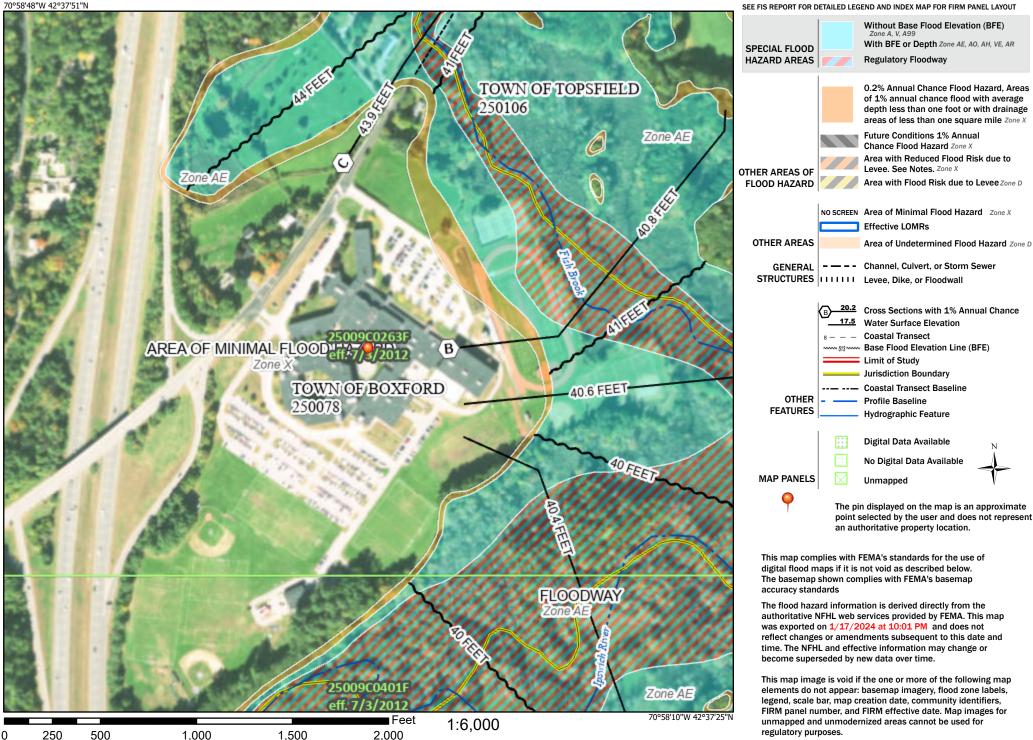
Stantec Consulting Services, Inc. 40 Water Street, 3rd Floor Boston, MA 02109 U.S.A. Tel. 617.234.3100 Fax. 617.661.7118 www.stantec.com Client/Project JANUARY 2024 MASCONOMET FIELD, BOXFORD SCALE: 1" = 750'



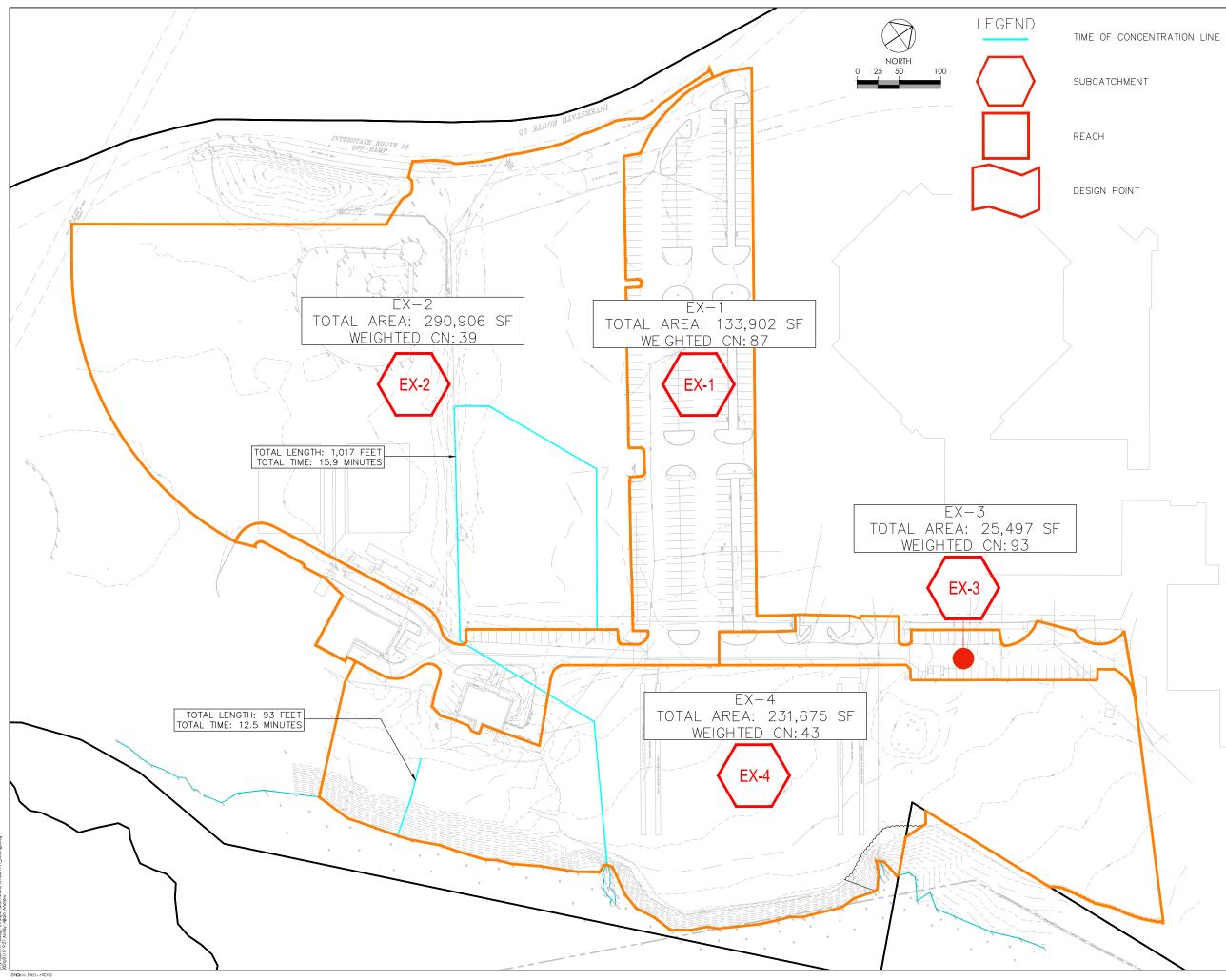
National Flood Hazard Layer FIRMette



Legend



Basemap Imagery Source: USGS National Map 2023



TIME	OF	CONCENTRATION	LINE
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Consultants

Legend

Notes

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Permit-Seal

Client/Project

MASCONOMET REGIONAL HIGH SCHOOL

20 ENDICOTT ROAD, BOXFORD MA

Title

EXISTING WATERSHED PLAN

Project No. 210801991 Sheet

Scale 1" = 50' Date 01/18/2024

Drawing No. EX-WS

2.0 PROPOSED CONDITIONS

2.1 PROJECT CLASSIFICATION

The proposed Project is considered a new development. Hydrologic analysis has been performed and stormwater management standards have been met based on the proposed development.

2.2 METHODOLOGY AND DESIGN CRITERIA

2.2.1 Methodology

Site drainage analysis was performed using the Soil Conservation Service (SCS) TR-55 and TR-20 methodologies facilitated by the computer program HydroCAD 10.00 (HydroCAD) by HydroCAD Software Solutions, LLC. Utilizing the HydroCAD software, a hydrologic model was developed to generate peak runoff rates for both the existing and proposed conditions. Design criteria for the hydrologic model includes subcatchments, design points, soil conditions, curve numbers, time of concentration, and design storms.

Curve numbers for each subcatchment are based on the different ground cover and underlying hydrologic soil group types. The curve numbers were based on the SCS TR-55 methodology and can be found in the attached HydroCAD reports.

2.2.1.1 Time of Concentration

The Time of Concentration (Tc) for each subcatchment was determined by finding the time necessary for runoff to travel from the most hydrologically distant point in the subcatchment to the Design Point. The travel path was drawn based on the topography of the Site and the time was calculated using TR-55 methodology. A minimum Tc value of 6.0 minutes was used for watersheds with calculated Tc values less than 6.0 minutes.

2.2.2 Design Rainfall Data

For both the existing and proposed conditions, the hydrologic model analyzed the Site's performance during the 2-, 10-, and 100-year storm events. The events were based on the Type-III, 24-hour duration storm. Rainfall depths used were taken from the National Oceanic and Atmospheric Administration (NOAA) Atlas 14 data. *Table 3 – Design Storm Events* contains a summary of the design storms that were used.

Storm Event	Rainfall Depth Modeled (in.)
2-year	3.24
10-year	5.12
100-year	8.10

Table 3 – Design Storm Events

2.2.3 Watershed Delineation

For the proposed hydrologic conditions analysis, the Site was divided into seven subcatchment areas (Figure 2-1 Proposed Watershed Plan). The peak discharge rates for the post-development conditions were analyzed at the three design points. The following provides a general description of each subcatchment:

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Subcatchment PR-1 is comprised of the site's roof area and a large portion of the site's parking area. The hydrology of this portion of the site remains unaltered from the existing site conditions. Stormwater runoff will be captured and routed through a series of catch basins and drain manholes before it is ultimately routed through an existing 21-inch concrete pipe (DP-1) that discharges to the Ipswich River (DP-3).

Subcatchment PR-2 is comprised of a parking lot, baseball field, walkways, seating, building, and grass areas associated with the western synthetic turf field and the baseball field. Stormwater runoff from this area will be captured and routed through catch basins and drain manholes into the perforated pipe infiltration system (PERF-1) below the western turf field. The system ultimately outlets through an existing 21-inch concrete pipe (DP-1) that discharges to the Ipswich River (DP-3).

Subcatchment PR-3 is the western synthetic turf field. Stormwater runoff from this area will be routed into the subsurface gravel (FIELD-1) which overflows into the perforated pipe infiltration system (PERF-1) below the field. The system then outlets through an existing 21-inch concrete pipe (DP-1) that discharges to the lpswich River (DP-3).

Subcatchment PR-4 is comprised of a small portion of the site's parking lot area. Stormwater runoff will be captured and routed through a series of catch basins and drain manholes before it is ultimately routed through an existing 24-inch reinforced concrete pipe (DP-2) that discharges to the Ipswich River (DP-3).

Subcatchment PR-5 is comprised of a portion of the site's parking lot area. Stormwater runoff from this area will be captured and routed through catch basins and drain manholes into the perforated pipe infiltration system (PERF-2) below the eastern turf field. The system ultimately outlets through an existing 24-inch reinforced concrete pipe (DP-2) that discharges to the Ipswich River (DP-3).

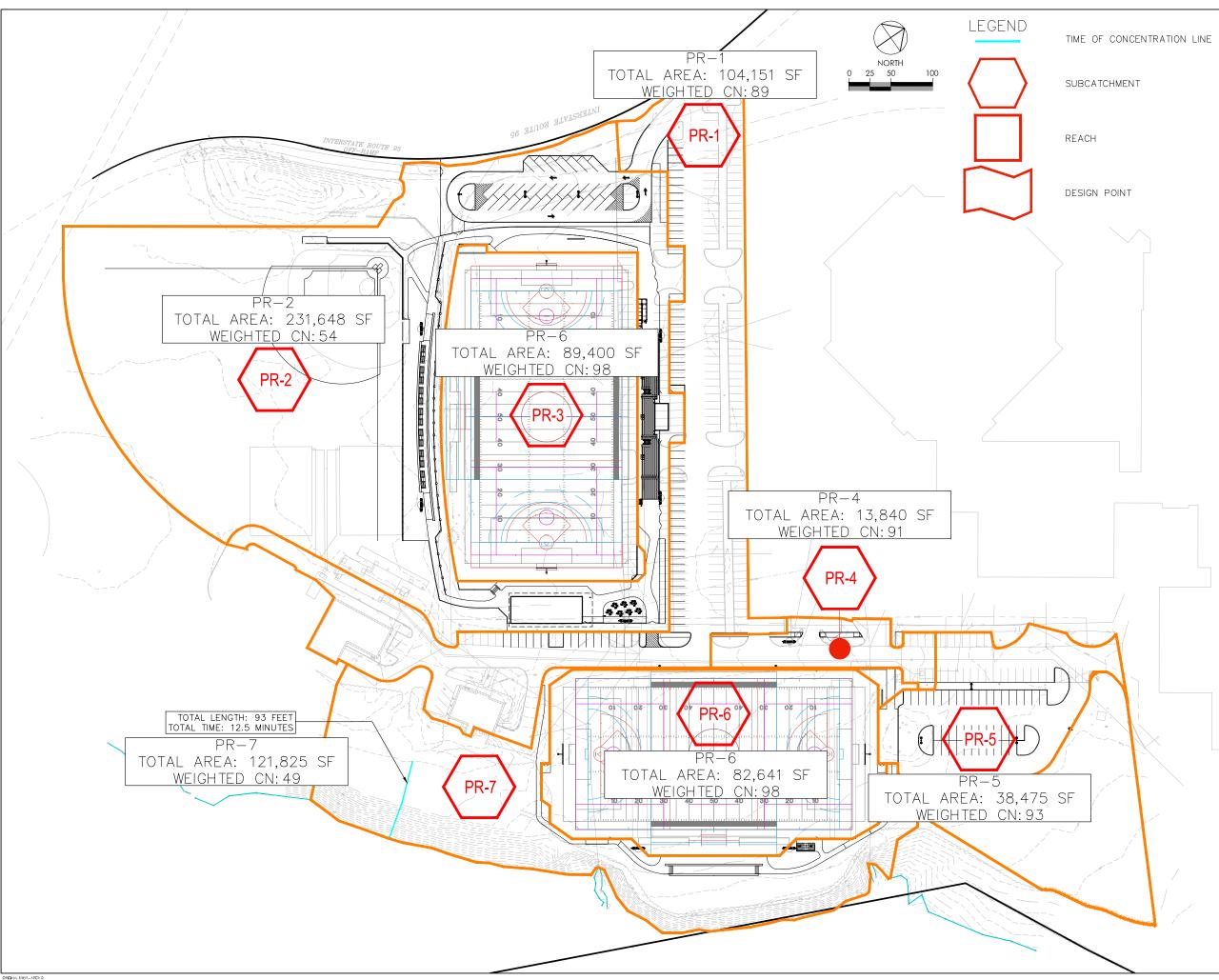
Subcatchment PR-6 is the eastern synthetic turf field. Stormwater runoff from this area will be routed into the subsurface gravel (FIELD-2) which overflows into the perforated pipe infiltration system (PERF-2) below the field. The system then outlets through an existing 24-inch reinforced concrete pipe (DP-2) that discharges to the Ipswich River (DP-3).

Subcatchment PR-7 is comprised of the portion of the site that discharges directly to the Ipswich River (DP-3). Stormwater runoff from this area flows over the surface, where it ultimately makes its way to the Ipswich River (DP-3).

Table 4 – Proposed Subcatchment Summary contains a summary of the proposed subcatchments and their corresponding area, time of concentration, and curve number.

Subcatchment Area I.D.	Area (sf)	Time of Concentration, Tc (min. 6.0 minutes)	Curve Number, CN
PR-1	104,151	6	89
PR-2	231,648	6	54
PR-3	89,400	6	98
PR-4	13,840	6	91
PR-5	38,475	6	93
PR-6	82,641	6	98
PR-7	121,825	12.5	49
Total	681,980		72

Table 4 – Proposed Subcatchment Summary





Stantec Planning and Landscape Architecture P.C. 226 Causeway St. Boston MA 02114 U.S.A. Tel. 617.523.8103 Fax. 617.523.4333 www.stantec.com Copyright Reserved py yight in tester ved The Contractors the verify and be responsible for al dimensions. DO NOT scale the drawing- any errors or omissions shall be reported to stantee without deby. The Copyrights to all designs and drawings are the property of Stantee. Reproduction or use for any purpose other than that authorates by Stantee's farbidicen.

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Permit-Seal

Client/Project MASCONOMET REGIONAL HIGH SCHOOL

20 ENDICOTT ROAD, BOXFORD MA

Title

PROPOSED WATERSHED PLAN

Proiect No. 210801991

Sheet

Scale 1" = 50' Date 01/18/2024

Drawing No. PR-WS

3.0 STORMWATER MANAGEMENT STANDARDS

The following section documents the Project's compliance with all ten standards for stormwater management as defined by the Massachusetts Department of Environmental Protection's (MassDEP) *Stormwater Management Standards*. The requirements for documenting compliance can be found within MassDEP's *Massachusetts Stormwater Handbook*.

3.1 STANDARD 1 – UNTREATED DISCHARGE

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

No new stormwater outfalls are proposed as part of the proposed development. To avoid disturbance to the wetland resource area, the stormwater runoff will be routed to the two existing outfalls; 21" concrete pipe and 24" reinforced concrete pipe. As described in more detail in later sections, the two existing outfalls have been chosen as design points and will therefore see a reduction in flow rates from the existing condition. Due to the reduction in flow rates, the proposed condition will mitigate erosion as compared to the existing condition.

Therefore, the Project complies with Standard 1.

3.2 STANDARD 2 – PEAK RATE ATTENUATION

Standard 2 states that "stormwater management systems shall be designed so that post-development peak discharge rates do not exceed pre-development peak discharge rates."

The proposed stormwater management systems are designed to attenuate all storms up to and including the 100-year, 24-hour event. In doing so, the post-development peak discharge rates do not exceed the pre-development peak discharges rates. The following sections outline the methodology and design criteria used in the development of a hydrologic model that represents the Site in the pre- and post-conditions. Table 5 – Peak Discharge Runoff Rate provides a summary of pre- and post-development peak flow rates, HydroCAD reports can be found in Appendices E & F.

3.2.1 Peak Discharge Runoff Rates Summary

The peak discharge runoff rates were calculated for the 2-, 10-, 100-year storm events for both proposed and existing conditions to demonstrate that proposed peak runoff rates do not exceed existing at all design points. *Table 5 – Peak Discharge Runoff Rate* contains a summary of the existing and proposed runoff rates.

	Design Point	2-Year Storm (3.24")	10-Year Storm (5.12")	100-Year Storm (8.10")
	Existing Rate (cfs)	7.02	13.01	23.68
DP-1	Proposed Rate (cfs)	5.90	10.57	21.51
	Existing Rate (cfs)	1.65	2.78	4.54
DP-2	Proposed Rate (cfs)	0.85	2.47	4.47
	Existing Rate (cfs)	8.67	15.80	32.05
DP-3	Proposed Rate (cfs)	6.75	13.30	30.11

Table 5 – Peak Discharge Runoff Rate

Proposed peak rates do not exceed existing rates, and therefore the Project complies with Standard 2.

3.3 STANDARD 3 – STORMWATER RECHARGE

Standard 3 states that the "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 the post-development site shall approximate the annual recharge from the 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."

3.3.1 Required Recharge Volume

As described in Section 2.4, the NRCS Soil Survey of Middlesex County, Massachusetts indicates that the soil on-site is composed of soil types that have been assigned an HSG ratings of "A", "B", "C" and "D". Per the Massachusetts Stormwater Handbook, sites with soils that have been assigned an HSG rating of "A" are required to recharge a volume equal to the product 0.60 inches per square foot (sf), "B" are required to recharge 0.35 inches per square foot (sf), "C" are required to recharge 0.25 inches per square foot (sf) and "D" are required to recharge 0.10 inches per square foot (sf).

The required recharge volume has been calculated accordingly, as depicted in Table 6 – Required Recharge Volume.

Hydrologic Soil Group	HSG A	HSG B	HSG C	HSG D	Σ
Δ Imp. Area within Soil Group (sf)	69,438	0	0	0	69,438
Required Recharge Depth (in/sf)	0.60	0.35	0.25	0.10	
Required Recharge Volume (cf)	3,472	0	0	0	3,472

Table 6 – Required Recharge Volume

3.3.2 Provided Recharge Volume

The Massachusetts Stormwater Handbook specifies three methods that may be used to determine what size infiltration system is required to provide the required recharge volume. The three methods include the Static method, the Simple Dynamic method, and the Dynamic Field method. The Static method was used to design the four subsurface infiltration systems. The "Static" method assumes that the required recharge volume is stored prior to any stormwater leaving the system. Table 7 – Provided Recharge Volume shows the provided recharge volume for each infiltration BMPs using the Static method.

Infiltration BMP	Provided Recharge Volume (cf)		
FIELD-1	6,751		
PERF-1	3,779		
FIELD-2	6,198		
PERF-2	1,365		
Total	18,093		

Table 7 – Provided Recharge Volume

The provided recharge volume exceeds the required recharge volume for each infiltration BMP. Supporting calculations can be found in Appendix B.

3.3.3 Drawdown Requirement

The Massachusetts Stormwater Handbook requires that all infiltration BMPs drawdown within 72 hours of a storm event. Drawdown time is calculated by dividing the required recharge volume by the product of the saturated hydraulic conductivity and the bottom surface area of the system, as noted below. When the Static method is used for sizing an infiltration BMP the Massachusetts Stormwater Handbook requires the use of the Rawls rate. The Rawls rate depends on the soil textural classification at the elevation of proposed infiltration. To calculate drawdown time for the proposed infiltration systems the most conservative HSG "A" Rawls rate of 2.41 inches per hour was used.

$T_{drawdown} =$	$\frac{Rv}{(K)(Area_{bottom})}$
Where:	$T_{drawdown}$ = Drawdown Time
	R_v = Required Recharge Volume
	K = Saturated Hydraulic Conductivity
	Area _{bottom} = Surface Area of System Bottom

The stormwater systems have been designed to drawdown within 72 hours of a storm event. A summary of the 72-hour drawdown times can be found in Table 8 – Drawdown Time Summary below which shows the infiltration rate, bottom surface area, and drawdown time of each proposed infiltration system.

Infiltration BMP	K (in/hour)	Bottom Area (sf)	Drawdown Time (hr)
FIELD-1	2.41	89,400	0.4
PERF-1	2.41	4,950	3.8
FIELD-2	2.41	82,641	0.4
PERF-2	2.41	3,400	2.0

Table 8 – Drawdown Time Summary

The proposed infiltration BMPs drawdown within 72 hours. Supporting calculations can be found in Appendix B.

3.3.4 Separation from Seasonal High Groundwater

The Massachusetts Stormwater Handbook requires two feet of vertical separation between the bottom of an infiltration system and the seasonal high groundwater table. Based off test pit and boring information

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estimated seasonal high groundwater varies at each proposed infiltration BMP. *Error! Reference source not found.* Below shows the bottom elevation of each proposed infiltration system and the estimated seasonal high groundwater elevation.

Infiltration BMP	Bottom System Elevation (ft)	ESHGW (ft)	Separation from ESHGW (ft)
FIELD-1	53.5	46.6	6.9
PERF-1	48.6	46.6	2.0
FIELD-2	51.0	42.0	9.0
PERF-2	44.0	42.0	2.0

Table 9 – Groundwater Separation Summary

The proposed infiltration BMPs provide adequate separation from seasonal high groundwater. Supporting geotechnical report can be found in Appendix A.

3.4 STANDARD 4 – WATER QUALITY

Standard 4 states that "Stormwater management systems shall be designed to remove 80% of the average annual post-construction load of Total Suspended Solids."

Standard 4 is met when a project complies with all the following criteria:

- 1. Suitable practices for source control and pollution prevention are identified in a long-term pollution prevention plan, and thereafter are implemented and maintained.
- 2. Structural stormwater best management practices are sized to capture the required water quality volume determined in accordance with the Massachusetts Stormwater Handbook; and
- 3. Pre-treatment is provided in accordance with the Massachusetts Stormwater Handbook.

3.4.1 Required & Provided Water Quality Volume

Table 10 – Required Water Quality Volume below contains a summary of the required water quality volume for the proposed project.

	Site Imp. Area (sf)	Water Quality Depth (inch)	Required Water Quality Volume (cf)	Provided Water Quality Volume (cf)
FIELD-1	0	0.5	0	6,751
PERF-1	54,805	0.5	2,284	3,779
FIELD-2	0	0.5	0	6,198
PERF-2	32,267	0.5	1,344	1,365

Table 10 – Required Water Quality Volume

Supporting calculations regarding required water quality volume can be found in Appendix C.

3.4.2 TSS Removal

The Massachusetts Stormwater Handbook requires that stormwater management systems remove 80% of the average annual post-construction load of Total Suspended Solids (TSS). This is accomplished by routing stormwater runoff through one or more "process" or "treatment" trains. Each treatment train consists of one or more stormwater BMPs that are designed to remove TSS from runoff. The

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Massachusetts Stormwater Handbook assigns TSS removal credits to various stormwater BMPs. A stormwater BMP is presumed to achieve the assigned TSS removal rate if the specific stormwater BMP is sized to meet the required water quality volume.

The proposed stormwater management system achieves greater than 80% TSS removal rate for each treatment train. Each treatment train is composed of a series of pre-treatment and treatment BMPs that reduce TSS loading prior to discharge. The proposed treatment trains are described in the following:

Treatment Train #1 – Parking Lots

Surface stormwater runoff from the new parking lot areas will be collected by deep sump catch basins, prior to being routed to either of the proposed perforated pipe infiltration systems.

Starting TSS Load (100%) * Deep Sump Catch Basin (25%) * Infiltration Basin (80%) = Remaining Load

Starting TSS Load (100%) * Deep Sump Catch Basin (25%) = 75% TSS Remaining

75% TSS Remaining * Infiltration Basin (80%) = 15% TSS Remaining

15% TSS Remaining = 85% TSS Removal

Treatment train #1 achieves 85% TSS removal.

Treatment Train #2 – Fields

Surface stormwater runoff from both of the synthetic turf fields will be routed through underdrains and into either of the proposed perforated pipe infiltration systems.

Starting TSS Load (100%) * Infiltration Basin (80%) = Remaining Load

Starting TSS Load (100%) * Infitration Basin (80%) = 20% TSS Remaining

20% TSS Remaining = 80% TSS Removal

Treatment train #2 achieves 80% TSS removal.

The proposed stormwater conveyance design provides TSS removal exceeding the stormwater management standards. Therefore, the Project complies with Standard 4.

3.4.3 Long-Term Pollution Prevention Plan

A long-term pollution prevention plan for the Project is included as part of the Operation and Maintenance Plan and can be found in Appendix D. The Operation and Maintenance Plan includes a site map delineating the specific stormwater BMPs present at the Site, a log for tracking maintenance of each stormwater BMP, and manufacturers' maintenance guidelines for proprietary technology.

Therefore, the Project complies with the Long-Term Pollution Prevention requirement of Standard 4.

3.5 STANDARD 5 – LAND USES WITH HIGHER POTENTIAL POLLUTANT LOADS (LUHPPL)

Standard 5 states that "for land uses with higher potential pollutant loads [LUHPPL], 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."

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The site is not considered a LUHPPL, as defined by the Massachusetts Department of Environmental Protection, therefore Standard 5 is not applicable.

3.6 STANDARD 6 – CRITICAL AREAS

Standard 6 states that "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."

Critical areas include any one of the following, as defined by the Massachusetts Department of Environmental Protection:

- Outstanding Resource Waters
- Special Resource Waters
- Zone I Recharge Areas
- Zone II Recharge Areas
- Interim Wellhead Protection Areas
- Zone A Recharge Areas
- Bathing Beaches
- Cold-water Fisheries
- Shellfish Growing Areas

The proposed stormwater management system does not discharge near or to any of the above listed critical areas.

Therefore, the Project complies with Standard 6.

3.7 STANDARD 7 – REDEVELOPMENT PROJECTS

Standard 7 states that "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."

A project may be classified as a redevelopment if it meets any one of the following criteria:

- 1. Maintenance and improvement of existing roadways, including widening less than a single lane, adding shoulders, correcting substandard intersections, improving existing drainage systems, and repaving.
- 2. Development, rehabilitation, expansion, and phased projects on previously developed sites, provided the redevelopment results in no net increase in impervious area.
- 3. Remedial projects specifically designed to provide improved stormwater management, such as projects related to separate storm drains and sanitary sewers and stormwater retrofit projects.

The project is considered a new development and thus complies fully with all the stormwater management standards.

Therefore, the Project complies with Standard 7.

3.8 STANDARD 8 – EROSION AND SEDIMENTATION CONTROL PLAN

Standard 8 states that "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."

Sedimentation and erosion controls will be installed and maintained throughout all phases of construction. Land disturbance will be evaluated on a parcel-by-parcel basis. A draft Stormwater Pollution Prevention Plan (SWPPP) has been prepared and is attached in Appendix G. The final SWPPP will be submitted prior to land disturbance.

Therefore, the Project complies with Standard 8.

3.9 STANDARD 9 – OPERATION AND MAINTENANCE PLAN

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

An Operation and Maintenance Plan, Maintenance Log and Operation and Maintenance Figure have been prepared for the site and are attached in Appendix D.

Therefore, the Project complies with Standard 9.

3.10 STANDARD 10 – ILLICIT DISCHARGES

Standard 10 states that "all illicit discharges to the stormwater management system are prohibited." As stated in the Massachusetts Stormwater Handbook, "The stormwater management system is the system for conveying, treating, and infiltrating stormwater onsite, including stormwater best management practices and any pipes intended to transport stormwater to the groundwater, a surface water, or municipal separate storm sewer system. Illicit discharges to the stormwater management system are discharges that are not entirely comprised of stormwater.

Proponents of projects within Wetlands jurisdiction must demonstrate compliance with this requirement by submitting to the issuing authority an Illicit Discharge Compliance Statement verifying that no illicit discharges exist on the project area and by including in the pollution prevention plan measures to prevent illicit discharges to the stormwater management system."

Standard 10 also states that "The Illicit Discharge Compliance Statement must be accompanied by a project area map that is drawn to scale and that identifies the location of any systems for conveying stormwater on the project area and shows that these systems do not allow the entry of any illicit discharges into the stormwater management system. The project area map shall identify the location of any systems for conveying wastewater and/or groundwater on the project area and show that there are no connections between the stormwater and wastewater management systems and the location of any measures taken to prevent the entry of illicit discharges into the stormwater to post-construction BMPs.

APPENDICES

Appendix A SOILS INFORMATION

NATURAL RESOURCES CONSERVATION SERVICE (NRCS) SOIL REPORT

HALEY & ALDRICH GEOTECHNICAL REPORT



United States Department of Agriculture

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



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.



	MAP LEGEND			MAP INFORMATION
Area of Int	terest (AOI)	33	Spoil Area	The soil surveys that comprise your AOI were mapped at
	Area of Interest (AOI)	۵	Stony Spot	1:15,800.
Soils	Sail Man Linit Dalvaana	0	Very Stony Spot	Warning: Soil Map may not be valid at this scale.
	Soil Map Unit Polygons	Ŷ	Wet Spot	
~	Soil Map Unit Lines	Δ	Other	Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil
	Soil Map Unit Points		Special Line Features	line placement. The maps do not show the small areas of
Special	Point Features Blowout	Water Fea	atures	contrasting soils that could have been shown at a more detailed scale.
×	Borrow Pit	\sim	Streams and Canals	
<u>م</u>	Clay Spot	Transport		Please rely on the bar scale on each map sheet for map
	Closed Depression	•••	Rails	measurements.
\diamond	Gravel Pit	~	Interstate Highways	Source of Map: Natural Resources Conservation Service
X	Gravelly Spot	~	US Routes	Web Soil Survey URL: Coordinate System: Web Mercator (EPSG:3857)
	Landfill	~	Major Roads	
0	Lava Flow	~	Local Roads	Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts
A.		Backgrou		distance and area. A projection that preserves area, such as the
عليه	Marsh or swamp	100	Aerial Photography	Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.
R	Mine or Quarry			
0	Miscellaneous Water			This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.
0	Perennial Water			
\vee	Rock Outcrop			Soil Survey Area: Essex County, Massachusetts, Northern Part Survey Area Data: Version 19, Sep 10, 2023
+	Saline Spot			Sulvey Alea Data. Version 19, Sep 10, 2025
° °	Sandy Spot			Soil map units are labeled (as space allows) for map scales
-	Severely Eroded Spot			1:50,000 or larger.
\diamond	Sinkhole			Date(s) aerial images were photographed: May 22, 2022—Jun
≫	Slide or Slip			5, 2022
ø	Sodic Spot			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 (Soil Map)

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
1	Water	0.5	0.2%
6A	Scarboro mucky fine sandy loam, 0 to 3 percent slopes	9.0	3.9%
31A	Walpole sandy loam, 0 to 3 percent slopes	11.3	4.9%
32B	Wareham loamy sand, 3 to 8 percent slopes	0.7	0.3%
51A	Swansea muck, 0 to 1 percent slopes	1.2	0.5%
73A	Whitman fine sandy loam, 0 to 3 percent slopes, extremely stony	1.9	0.8%
253B	Hinckley loamy sand, 3 to 8 percent slopes	2.4	1.0%
254A	Merrimac fine sandy loam, 0 to 3 percent slopes	6.9	3.0%
254C	Merrimac fine sandy loam, 8 to 15 percent slopes	1.7	0.7%
255A	Windsor loamy sand, 0 to 3 percent slopes	7.5	3.3%
255B	Windsor loamy sand, 3 to 8 percent slopes	3.3	1.4%
256A	Deerfield loamy fine sand, 0 to 3 percent slopes	12.7	5.5%
257E	Hinckley and Windsor soils, 25 to 35 percent slopes	1.1	0.5%
260B	Sudbury fine sandy loam, 3 to 8 percent slopes	0.2	0.1%
421B	Canton fine sandy loam, 0 to 8 percent slopes, very stony	5.5	2.4%
421C	Canton fine sandy loam, 8 to 15 percent slopes, very stony	1.1	0.5%
421D	Canton fine sandy loam, 15 to 25 percent slopes, very stony	6.0	2.6%
651	Udorthents, smoothed	61.4	26.8%
711C	Charlton-Rock outcrop-Hollis complex, 8 to 15 percent slopes	17.2	7.5%
713A	Limerick and Rumney soils, 0 to 3 percent slopes, frequently flooded	3.9	1.7%
717E	Rock outcrop-Charlton-Hollis complex, 15 to 35 percent slopes	4.8	2.1%

	-		
Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
718A	Saco variant silt loam, frequently ponded, 0 to 1 percent slopes, frequently flooded	68.7	30.1%
Totals for Area of Interest		228.6	100.0%

Map Unit Descriptions (Soil Map)

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 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.



HALEY & ALDRICH, INC. 465 Medford St. Suite 2200 Boston, MA 02129 617.886.7400

30 August 2023 File No. 0207135-000

Stantec 40 Water Street Boston, MA 02109

Attention: Josh Atkinson

Subject: Geotechnical Letter Masconomet Regional School District Field Renovations Boxford, MA

Ladies and Gentlemen:

This letter report provides a summary of the subsurface explorations conducted for the Masconomet Regional School District Phase 1 of the Synthetic Turf Feasibility Study located at 20 Endicott Road, Boxford, MA (refer to Figure 1). The purpose of the subsurface investigation program was to obtain information on the subsurface conditions and provide geotechnical design recommendations and construction considerations for the two (2) proposed synthetic turf fields to replace the existing natural grass athletic fields, design of new athletic lighting foundations, and design of athletic support structures. The work reported herein was undertaken by Haley & Aldrich, Inc. (Haley & Aldrich) in accordance with our agreement dated 20 December 2022 and your subsequent written authorization.

Site Conditions

EXISTING CONDITIONS

The project site consists of two (2) natural grass athletic fields that were constructed between 2002 and 2003 according to historic aerial images. Prior to construction, the area of the existing soccer field (shown on the left in Image 1) was a school building and the area of the lacrosse field (on the right in Image 1) was undeveloped. Existing site grades are approximately Elevation (El.) 54 (NAVD88)¹ at the soccer field and El. 51 at the lacrosse field. At the time of this report, documents for demolition of the school building



Image 1 Image taken from Google Maps. Approximate limits of Phase 1 work shown in "blue"

or construction documents for the new fields were not available for our review.

¹ Elevations in this report are in feet and reference the North American Vertical Datum of 1988 (NAVD88).

PROPOSED RENOVATION

We understand that the Phase 1 renovations are proposed to replace the existing grass fields with artificial turf fields and install sports lighting, bleachers, and an athletic support building containing restrooms, team rooms, concessions, and storage space.

Subsurface Investigation Program

TEST BORING AND GEOPROBE EXPLORATIONS

The designation and approximate location of subsurface explorations are indicated on the attached Figure 1. The locations of the recent subsurface explorations were measured in the field by Haley & Aldrich personnel from existing site features and therefore are considered approximate.

Between 17 July and 24 July 2023, Northern Drill Service, Inc. of Northborough, Massachusetts conducted a total of eight (8) test boring explorations designated as HA-1 through HA-8 and twenty (20) geoprobe explorations designated as GP-1 through GP-18, INFL-1, and INFL-2. The test boring explorations were drilling to depths ranging from 27 to 32 feet (ft) below ground surface (bgs) using a truck-mounted drill rig. The geoprobes were each drilled to 10 ft bgs using a track-mounted geoprobe rig. Refer to the test boring and geoprobe logs included in Appendix A for additional information.

SUBSURFACE CONDITIONS

Subsurface soil conditions encountered in the recent explorations consisted of the following generalized sequence of subsurface units, listed in descending order of occurrence below ground surface.

Generalized Subsurface Stratum	Depth Top of Stratum (ft)	Stratum Thickness (ft)		
Topsoil	0.0	0.5 to 2.0		
Fill	0.5 to 2.0	0.8 to 10.0		
Glacial Deposits	1.0 to 11.2	Not Determined		

A detailed description of the units encountered is provided below.

<u>Topsoil</u> – Topsoil was encountered in each of the subsurface explorations at ground surface up to 2.0 ft bgs. The topsoil generally consisted of brown silty SAND with varying amounts of gravel, grass roots, plant matter.

<u>Fill</u> – The Fill encountered generally consisted of medium dense dark brown SAND with varying amounts of silt, gravel, asphalt, brick, and grass roots. Where encountered, the Fill layer generally ranged from 0.8 to 10.0 ft in thickness. Fill encountered in HA-7 and HA-8 also included either pockets or 1 to 3 inch (in.) thick layers of organic soil. Fill was not encountered in explorations HA-3, GP-11, GP-15, or INFL-2.



<u>Glacial Deposits</u> – Glacial Deposits were encountered below the fill or topsoil in each exploration between 1.0 to 11.2 ft bgs. The Glacial Deposits (Glaciolacustrine Deposits) generally consisted of loose to medium dense gray to light brown poorly-graded SAND with varying amounts of silt and gravel.

GROUNDWATER MEASUREMENTS

Groundwater was encountered at depths between 6.0 and 10.1 ft bgs during drilling the test boring explorations.

Groundwater observation wells were not installed as part of the recently completed subsurface exploration program. Groundwater levels recorded during drilling of the test boring explorations are not anticipated to have stabilized and may not represent actual groundwater conditions at the site. Additionally, groundwater levels are also influenced by precipitation, the presence of below grade structures and utilities in the area, leakage into or out of utility pipes, the infiltration of surface water runoff, building underdrain systems, localized water recharging and other factors. Groundwater conditions encountered during subsequent site visits and/or during construction may differ from those reported herein.

Soil Laboratory Testing

Grain size distribution testing was performed on two (2) samples, one sample collected from each of the geoprobes INFL-1 and INFL-2 to support preliminary efforts for the proposed infiltration design. The soil samples (collected from 5 to 10 ft below ground surface) were submitted to the Haley & Aldrich Geotechnical Laboratory for soil grain size analysis. Soil grain size analyses indicate the soils at depths between 5 and 10 ft below ground surface were characterized as poorly graded SAND with varying amounts of silt. The soil sample at the INFL-1 location had 12% fines, whereas the soil sample at the INFL-2 location had 35% fines. The results of the grain size analyses are included in Appendix B.

Based on preliminary review of soil grain size distribution test results and our calculated estimates for infiltration rates within the Glaciolacustrine Deposits, Haley & Aldrich recommends an estimated infiltration value of 5.0 in/hr and 0.1 in/hr be utilized for evaluating infiltration system locations at the INFL-1 and INFL-2 locations, respectively. As the infiltration design is progressed further, additional testing will be required to meet stormwater design regulations.

Geotechnical Design Considerations

Site Development

Construction will require management of existing on-site materials. In order to minimize the cost of transporting and disposing of material off-site, every effort should be made by the designers and contractor to process and reuse excavated material on-site, whether in landscaped areas around the site, or for material meeting specific geotechnical criteria as backfill.



Existing utilities to be abandoned will require cut-and-capping beyond the plan limits of the work and/or complete removal. Existing, active utilities to remain and new utilities to be installed will require coordination with new work to avoid potential design conflicts, and construction activities will need to be coordinated to not impact operation of active utilities to remain or new utilities to be constructed. Additionally, construction activities will need to be coordinated to not interrupt/impact underground utilities.

Synthetic Turf Field

- We understand that the new field is planned to be constructed such that the playing surface will be generally at the same grade as the current natural grass field. As such, preparation of the subgrade immediately below the synthetic turf system will require excavation/stripping and removal of all Topsoil. Depending on final design subgrade preparation, this may also include excavation of Fill and natural soils within the limits of the field.
- In some areas where the anticipated topsoil thickness extends below the design subgrade elevation, we recommend that the excavation extend to a depth to completely remove the topsoil materials, followed by controlled placement and compaction of an approved backfill material up to design subgrade elevation. Backfill materials may include previously excavated fill soils encountered during the stripping/removal of the near surface soils or may require importing granular fill. At a minimum, imported backfill shall consist of well graded granular materials containing less than 20% fines. Backfill placed to raise grades to the design subgrade elevation shall be compacted to 95% of the material's maximum dry unit weight (determined in accordance with ASTM D1557) using appropriate compactive efforts. As a minimum, each layer of fill should receive four complete coverages with suitable compaction equipment.
- Re-use of any excavated soils will be dependent upon visual characterization of the materials and results of grain size analyses and laboratory compaction tests. Accordingly, we recommend to the extent possible, that an on-site location be established for segregating and stockpiling excavated soils.
- Following completion of excavation to strip/remove the near surface soils down to design subgrade elevation for the turf system, static roll the surface using a large compaction roller to prepare a firm, dry and stable subgrade. If, during static rolling of the subgrades pumping or weaving conditions are observed, alternate compaction techniques may be required and/or additional subgrade preparation may be recommended (e.g., removal and replacement of soft, compressible soils).
- At all times prior to placement of the turf system, we recommend maintaining a dry and undisturbed design subgrade to promote a stable working surface to receive the turf system. Temporary re-grading outside the limits of the new field may be considered to divert possible surface water runoff away from the work areas. Construction dewatering is not anticipated to be required; however, if it becomes necessary, the contractor shall make efforts to discharge dewatering effluent on-site at distances away from the work areas so as not to disturb subgrade preparation and to allow for construction in-the-dry.



- The turf system subgrade soils are anticipated to consist primarily of Fill or Glacial Deposits. In the event the work is conducted during winter conditions, be advised that these types of soils could be susceptible to disturbance due to freezing and thawing temperatures and the contractor would have to sequence their operations, including protection of exposed and excavated (i.e., stockpiled) soils from moisture, to allow for successful completion of the work.
- For the permanent condition, the maintenance, protection and long-term performance of the synthetic turf field will require an effective stormwater runoff collection and management system. At a minimum, the sub-turf drainage systems must be designed such that the system is entirely and at all times above groundwater level. Pending further discussions with Stantec regarding final surface grading and estimated runoff volume calculations, we recommend a sub-turf drainage system design comprised of a layer of double-washed, 3/4-in. crushed stone (Stantec to determine minimum thickness required) with perforated HDPE pipes (sized by Stantec) embedded within the crushed stone to effectively collect and transport by gravity any accumulated runoff water that filters from the turf layer above to an appropriately sized on-site collection/groundwater recharge/infiltration system (or direct discharge into a permitted storm drain). Prior to placing the crushed stone and perforated piping, a nonwoven geotextile fabric (Mirafi 160N or similar) should be placed on top of the prepared and approved subgrade.

Sport Lighting and Bleacher System

As a general recommendation, foundation design and construction should be performed in accordance with applicable provisions of the 9th Edition of the Massachusetts State Building Code. If construction permits are obtained after the new 10th Edition of the Building Code is promulgated or the grace period, if one is granted, then Haley & Aldrich will need to review the recommendations provided herein to ensure that they address any changes to the Building Code.

Typically, the lighting system includes a pre-cast concrete "base" encased in concrete and designed to bear on natural inorganic soils. The diameter and design depth of the foundation element into the Glacial Deposits will depend on the anticipated combined foundation loadings (vertical, lateral and moment loads) calculated by the designer of the foundations based on the criteria in the below table.

	Fill	Glacial Deposits
Total Unit Weight (lb/ft ³)	120	125
Buoyant Unit Weight (lb/ft ³)	57.6	62.6
Effective Friction Angle (deg)	25	30
Undrained Shear Strength (psf)	NA	NA
Active Earth Pressure Coefficient (Ka)	0.4	0.33
Passive Earth Pressure Coefficient (K _p)	1.6 (1)	2.0 (1)

Sport Lighting Foundation Design Criteria

Note:

1. Passive Earth Pressure Coefficient (K_p) includes a factor of safety of 1.5.



Footing foundations for the Bleacher System should be designed based on an allowable bearing pressure of 3.0 kips per square foot (ksf) in the glacial deposits. The footing should bear at least 4 ft below the lowest ground surface exposed to freezing. Footings should be designed to provide resistance to sliding, overturning, and uplift. We recommend a minimum factor of safety of 1.5 for sliding, and 2.0 for overturning.

Athletics Support Building (restroom, team rooms, concessions, and storage)

The following recommendations pertain to the permanent design of the at grade proposed structure, intended primarily for members of the project team responsible for design. As we currently understand, below grade space is not anticipated as part of the design for the proposed structure.

- The building site can be classified as Seismic Site Class D.
- Excavations to Glacial Deposits will be required to achieve footing foundation subgrades. Accordingly, construction of the building may be supported on conventional footing foundations. Foundation bearing conditions are anticipated to consist of naturally deposited Glacial Deposits or compacted Granular Fill bearing on glacial soil subgrades.
- Footing foundations should be designed to bear on naturally deposited inorganic Glacial Deposits or on compacted Granular Fill after removal of unsuitable materials at an allowable bearing pressure of 3 ksf.
- Footings founded on soils should bear a minimum of 4 ft below the lowest adjacent ground surface exposed to freezing.
- For footings with least lateral dimension less than 3 ft, the allowable bearing pressure in tons per square foot should be 1/3 of the recommended allowable bearing pressure multiplied by the least lateral dimension in feet. In no instance should footings be less than 18 in. wide.
- Footings shall bear below a line drawn upward and outward on a 2 horizontal to 1 vertical slope from the bottom outside edge of any utility trenches, or other localized excavation, located below-grade or below slab.
- It is recommended that the ground floor slab be designed as a slab-on-grade, bearing directly on a minimum thickness of 12 in. of compacted Granular Fill placed on a prepared soil subgrade.
- Lateral loads acting on the structure can be resisted by passive earth pressures acting against below grade portions of the structure such as footings or grade beams and frictional resistance between the bottom of concrete foundations and the underlying soil. Passive forces to resist lateral loads may be calculated based on an equivalent fluid unit weight of soil equal to 300 pounds per cubic foot (pcf). This value assumes that granular backfill is placed and systematically compacted in lifts. If the backfill is not systematically compacted, an equivalent fluid weight of 100 pcf should be used.



• In computing frictional resistance forces between soil and concrete on the underside of footings, a coefficient of friction equal to 0.5 is recommended for design. Note: This would not apply to soil supported slabs having vapor protection beneath.

Construction Considerations

The primary purpose of this section of the report is to comment on items related to excavation, earthwork, and related geotechnical engineering aspects of the proposed construction.

Subgrade Preparation

The Fill and Glacial soils on-site generally contain large quantities of fine-grained materials (fine sand with varying amounts of silt) and will be susceptible to weaving during compaction during rain events which may require changes in compaction techniques. As such, management of soils during subgrade preparation for the synthetic turf field will require surface water and erosion control.

As mentioned previously in this report, the existing natural grass soccer field is located within the limits of a former school building. Demolition documents were not available at the time of this report, but as noted in the geoprobe logs asphalt and bricks were noted within the Fill. If building demolition debris greater than 12-in. diameter is observed at subgrade elevation, the demolition debris should be removed, disposed off-site, and the excavation backfilled with granular onsite soils or compacted Granular Fill.

Following completion of excavation to strip/remove the near-surface soils down to design subgrade elevation for the turf system, static roll the subgrade using a large compaction roller to prepare a firm, dry, and stable subgrade. If, during static rolling of the subgrades pumping or weaving conditions are observed, alternate compaction techniques may be required and/or additional subgrade preparation may be recommended (e.g., removal and replacement of soft, compressible soils). Tree stumps and roots should be removed to the degree possible and when encountered.

At all times prior to placement of the turf system, we recommend maintaining a dry and undisturbed design subgrade to ensure a stable working surface to receive the turf system. Temporary re-grading outside the limits of the new field will be required to divert surface runoff away from the work areas. Construction dewatering is not anticipated; however, if it becomes necessary, efforts should be taken by the contractor to discharge dewatering effluent on-site at distances away from the work areas so as not to disturb subgrade preparation.



Filling and Backfilling

Compacted Granular Fill beneath the fields should consist of suitable bank-run sand and gravel, free of clay, organic material, snow, ice, or other unsuitable materials and should be well-graded within the following limits:

Sieve Size	Percent Finer by Weight
3 in.	100
No. 4	30 - 90
No. 40	10 - 50
No. 200	0 - 8

Compacted Granular Fill should be placed in loose lift thicknesses not exceeding 9 in. and should be compacted to a dry density of at least 95% of the maximum dry density as determined in accordance with ASTM Test Designation D1557. As a minimum, each layer of fill should receive four complete coverages with suitable compaction equipment.

Control of Surface Water Runoff

Control of surface water runoff into excavations will be necessary in order to retain the integrity of the subgrade soils. The contractor should control the flow of surface water into excavations at all times. Careful water control will be necessary to retain the integrity of the subgrade soils. Dewatering of excavations during construction can likely be performed using collection trenches and shallow sump wells. Every effort should be made to collect and recharge collected water on-site. If off-site discharge of collected water is required, dewatering will need to be performed with all applicable Federal, State and Local Regulations.

Handling and Disposal of Excavated Soil

In order to minimize the cost of transporting and disposing of material off-site, every effort should be made by the designers and contractor to reuse excavated material on-site, whether in landscaped areas around the site, or for material meeting specific geotechnical criteria as backfill.

The excavation work will most likely generate quantities of excavated soils, a portion of which will require special handling during off-site disposal. The management of these excavated soils must be performed in compliance with all applicable Federal, State, and Local Regulations.



Limitations

This report was prepared in accordance with our authorized Agreement with Stantec and our proposal dated 20 December 2022. This report has been prepared for the specific application to the Masconomet Regional School District Phase 1 of the Synthetic Turf Feasibility Study.

The nature and extent of variations in the subsurface conditions between explorations may not become evident until construction, and the project design may change from our current understanding. Any additional information pertaining to the project that becomes available should be provided to Haley & Aldrich, so that our conclusions and recommendations can be reviewed and modified, as necessary.

We appreciate the opportunity to provide engineering services on this project. Please do not hesitate to call if you have any questions or comments.

Sincerely yours, HALEY & ALDRICH, INC.

megan Hamilton

Megan Hamilton, PE (NY) Assistant Project Manager

R. Scott Goldkamp, PE (MA/NH) Principal

Attachments:

Figure 1 – Site and Subsurface Exploration Location Plan Appendix A – Test Boring and Geoprobe Exploration Logs Appendix B – Geotechnical Laboratory Test Results

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NOTES

1. BASE PLAN TAKEN FROM "CONCEPTUAL MASTER PLAN" DRAWING IN THE MASCONOMET REGIONAL SCHOOL DISTRICT SYNTHETIC TURF FEASIBILTY STUDY DATED OCTOBER 2022 AND PROVIDED BY STANTEC.

LEGEND



DESIGNATION AND APPROXIMATE LOCATION OF TEST BORING DRILLED BETWEEN 17 AND 20 JULY 2023 BY NEW ENGLAND BORING CONTRACTORS AND OBSERVED BY HALEY & ALDRICH, INC.



DESIGNATION AND APPROXIMATE LOCATION OF GEOPROBE DRILLED BETWEEN 21 AND 24 JULY 2023 BY NEW ENGLAND BORING CONTRACTORS AND OBSERVED BY HALEY & ALDRICH, INC.

MASCONOMET FIELD RENOVATIONS BOXFORD, MASSACHUSETTS



FIGURE 1

SITE AND SUBSURFACE **EXPLORATION LOCATION PLAN**

SCALE: AS SHOWN AUGUST 2023

APPENDIX A
Test Boring and Geoprobe Exploration Logs

IDENTIFICATION AND DESCRIPTION OF SUBSURFACE MATERIALS

SOIL

Soil description on logs of subsurface explorations are based on Standard Penetration Test results, visual-manual examination of exposed soil and soil samples, and the results of laboratory tests on selected samples. The criteria, descriptive terms and definitions are as follows:

DENSITY OR CONSISTENCY

Density of Cohesionless Soils	Penetration Resistance (Blows per ft.)	Consistency of Cohesive Soils	Penetration Resistance (Blows per ft.)
Very Loose	0-4	Very Soft	0-2
Loose	5-10	Soft	3-4
Medium	11-30	Medium	5-8
Dense	31-50	Stiff	9-15
Very Dense	over 50	Very Stiff	16-30
-		Hard	over 30

PENETRATION RESISTANCE

Standard Penetration Test (ASTM D-1586) - Number of blows required to drive a standard 2 in. O.D. split spoon sampler 1 ft. with a 140 lb. weight falling freely through 30 in.

Silts and Clays

Liquid limit 50% or less

Silts and Clays

Liquid limit greater than 50%

Highly organic soils

1. Logs of subsurface explorations depict soil, rock and groundwater

conditions only at the locations specified on the dates indicated.

Subsurface conditions may vary at other locations and at other times.

COLOR: Basic colors and combinations: black, brown, gray, yellow-brown, etc.

SUPPLEMENTAL SOIL TERMINOLOGY:

Laminae Parting Seam	- 0 to 1/16 in. thick (cohesive) - 0 to 1/16 in. thick (granular) - 1/16 to 1/2 in. thick				
Layer	- 1/2 to 12 in. thick				
Stratum	- > 12 in. thick				
Pocket	- Small, erratic deposit less than 12 in. size				
Lens	 Lenticular deposit larger than a pocket 				
Occasional	- One or less per 12 in. of thickness				
Frequent	- More than one per 12 in. of thickness				
Interbedded	- Alternating soil layers of differing composition				
Varved	 Alternating thin seams of silt and clay 				
Mottled	- Variation of color				
GEOLOGIC INTERPRETATION					
Deposit type - GLACIAL TILL, ALLUVIUM, FILL					

The natural soils are identified by criteria of Unified Soil Classification System (USCS), with appropriate group symbol in parenthesis for each soil description. Fill materials may not be classified by USCS criteria.

Inorganic clays of low to medium plasticity, gravelly clays, sandy

Inorganic silty, micaceous or diatomaceous fine sandy or silty soils,

Organic clays and organic silty clays of low plasticity

Organic clays of medium to high plasticity, organic silts

Inorganic clays of high plasticity, fat clays

Peat and other highly organic soils

2. Water levels noted on the logs were measured at the times and under the

conditions indicated. During test borings, these water levels could have been

affected by the introduction of water into the borehole, extraction of tools on other procedures and thus may not reflect actual groundwater level at the test boring location. Groundwater level fluctuations may also occur as a result of variations in precipitation, temperature, season, tides, adjacent construction activities and pumping of water supply wells and construction dewatering systems.

clays, silty clays, lean clays

elastic silts

yenow	-brown, etc.									
			dard Series Seive						•	eve Openings
1	2" 3		3/4"	4		10	4	.0	20	00
Boulders	Cobbles	Gravel					Sand			Silts and Clays
Douideis	Cobbles	Coarse	Coarse Fine		Coarse		Medium	Medium Fine		Sills and Clays
305	5 mm 76 r	nm 19	9 mm 4.	75 mm	:	2.00 n	nm 0.43	mm	0.074	mm
		UNIFIED	SOIL CLASS	IFICA		SYS	ТЕМ			
MAJO	R DIVISIONS					Graph Symb				
	Gravels		Gravels with little or no fines		Gw		Well graded gravels, gravel-sand mixtures			
	More than ha	alf			GP		Poorly graded gravels, gravel-sand mixtures			
Coarse grained soils:	fraction is lan than numbe		Gravels with over 12% fines		GM		Silty gravels, poorly graded gravel-sand-silt mixtures			and-silt mixtures
more than half	sieve				GC		Clayey gravels, poorly graded gravel-sand-clay mixtures			
is larger than number	Sands		Sands with little or no fines		sw		Well graded san	ds, grave	lly sands	
200 sieve	More than ha	alf			SP		Poorly graded sands, gravelly sands			
	fraction is smaller tha	n	Sands with over 12% fines		SM		Silty sands, poorly graded sand-silt mixtures			nixtures
	number 4 sie				sc		Clayey sands, poorly graded sand-clay mixtures			
	Silts and Clavs			ML		Inorganic silts an sands or clayey			ock flour, silty or clayey fine city	

CL

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OH

PΤ

Rock descriptions noted on logs of subsurface explorations are based on visual-manual examination of exposed rock outcrops and core samples. The criteria, descriptive terms and definitions used are as follows:

ROCK

	measure of resistance to scratching.				
Very Hard	Cannot be scratched with a knife point or sharp pick.				
Hard	Can be scratched with a knife point or sharp pick, only with difficulty.				
Moderately Hard	Can be readily scratched with a knife point or pick.				
Medium Hard	Can be grooved or gouged 1/16 in. deep with firm pressure on a knife point or sharp pick.				
Soft	Can be grooved or gouged easily with a knife point or pick.				
Very Soft	Can be carved with a knife and excavated with a pick point.				
and	action of organic and inorganic and chemical physical processes resulting in alteration of r, texture and composition.				
Fresh-FR	No visible sign of alteration, except perhaps slight discoloration on major discontinuity surfaces.				
Slight-SL	Discoloration of rock material and discontinuity surfaces. All rock may be discolored and/or somewhat weaker than in its fresh condition.				
Moderate-MOD	Less than half the rock material is decomposed and/or disintegrated to a soil. Some fresh or discolored rock is present as either a continuous framework or as corestones.				
High-HIGH	More than half the rock material is decomposed and/or disintegrated to a soil. Fresh or discolored rock is present as either a discontinuous framework or as corestones.				
Complete-COMP	All rock material is decomposed and/or disintegrated to soil. The original mass structure is largely intact.				
Residual Soil	All rock material is converted to soil. The mass structure and material fabric are destroyed. There has been a large change of volume, but the material has not been significantly transported.				
COLOR: Basic color red-brown	ors and combinations: gray, light gray, brown, ı.				
TEXTURE: Size, sha	pe and arrangements of constituents.				
 Term	Size				
	Igneous Sedimentary				
Coarse-grained	> 5 mm > 2 mm				
Medium-grained	1 - 5 mm 0.625 - 2 mm				
Fine-grained	< 1 mm < 0.625 mm				
Aphanitic	Individual grains invisible to the unaided eye.				
LITHOLOGY: Rock classification and modifiers; accepted formation names.					

J:\GRAPHICS\TEMP\MCELENEY-T\FIELD SERVICES\SUBSURFACE EXPLORATION LOG KEY\SUBSURFACE EXPLORATION KEY20

Fined-grained

soils:

more than half

smaller than

number 200

sieve

GENERAL NOTES

DISCONTINUITIES:

Туре	Definition			
Joint	A natural fracture along which no displacement has occurred. May occur in parallel groups called sets.			
Shear	A natural fracture along which displacement has occurred. Surface may be slickensided or striated.			
Fault	A natural fracture along which displacement has occurred. Usually lined with gouge and slickensides.			
Shear or Fault Zone	Zone of fractured rock and gouge bordering the displacement plane.			

ORIENTATION/ATTITUDE:

Angle (degrees)
0-5
6-35
36-55
56-85
86-100

SPACING:

Discontinuity Term	Bedding Term	Inches
Extremely Close	Extremely Thin	< 3/4
Very Close	Very Thin	3/4 - 2.5
Close	Thin	2.5 - 8
Moderate	Medium	8 - 24
Wide	Thick	24 - 80
Very Wide	Very Thick	80 - 240
Extremely Wide	Extremely Thick	> 240

PERSISTENCE/CONTINUITY:

- Term Very Low Low Medium High Very High
- Feet 0-3 3-10 10-35 35-65 > 65

APERTURE/GAP:

- Term Very Tight Tight Partly Open Open Moderately Wide Wide Very Wide Extremely Wide Cavernous
- Distance < 0.1mm 0.1mm-0.25mm 0.25mm-0.5mm 0.5mm-2.5mm 2.5mm-1cm > 1cm 1cm-10cm 10cm-1m > 1m

POROSITY:

<u>Type</u> Primary: Pre-depositional and depositional inter- and intra- granular, particle, or crystalline pores.

Secondary: Solution features including pits, vugs, caverns, molds, and channels. Fracture features including joints, shears, faults, shrinkage and breccia fabrics.

Term	<u>Size</u>
Micro	< 0.0625 mm
Meso	0.0625-4.0 mm
Mega	4.0-256 mm



SUBSURFACE EXPLORATION KEY

	Â	-EY	RIC	Н		T	EST	BORING REPOR	RT			Bo	rin	g١	ю.		H	4-1		
Proj Clie	ect nt	MA ST.	SCO ANTE	NOME				NS, BOXFORD, MA			Sh			. 1	0713 of 18 Ji	2	00	3		-
Cor	itracto	r ne				NG CO			t and Due as done a		Fir	nish			18 Ji	uly	2023			
				Casing	Sam		Barrel	3 1 1	t and Procedures			iller &A F			Shav					
Туре				HW	S	6		Rig Make & Model: Mobil Bit Type: Roller Bit				evat	· ·				ney est.	<u>, </u>		
		neter (i	í	4.0	1.			Drill Mud: None Casing: HW driven to 25	ft		Da	atun	n		NA	VD	88	,		
		Veight (140	14		-	Hoist/Hammer: Winch			Lo	cati	on	S	ee F	Plan	I			
пап		all (in.))	30	3		-	PID Make & Model: No	tused		0									-
(Ħ	Blows in.	(in.)	ele (#)	oquu	т Д		VISU	JAL-MANUAL IDENTIFICATIO	N AND DESCRIPTION		-	avel		Sano				eld T ຮູ		T
Depth (ft)	Sampler I per 6 i	Sample No. & Rec. (in.)	Sample Depth (ft)	USCS Symbol	Stratum Change Elev/Depth (ft)		(De	nsity/consistency, color, GROI structure, odor, moisture, opt GEOLOGIC INTERPR	onal descriptions		% Coarse	% Fine	% Coarse	% Medium	% Fine	% Fines	Dilatancy	I oughness	Plasticity	
0 -	<i>м</i>	GB1	0.0	SM	53.5		rown silty	y SAND (SM), no structure, slig	ght organic odor, moist, 10	% to	0.	5	5			25		-	1	
			2.0	SM	0.5			s and plant matter -TOPSOIL-	- *	/		5	5		50		\top	\uparrow		
					52.0			orange silty SAND (SM), no str		moist,										
	4	S2	2.0	SP	52.0 2.0	glass b	oottle, tra	sh, 10% grass roots and surfa -FILL-	ce organics	/			5	10	85		+	\uparrow		ļ
	6 6	22	4.0				n dense	tan to orange poorly-graded SA	AND (SP), no structure, no	odor,										
	6					dry		, , , ,					_							
	6 9	S3 22	4.0 6.0	SP		Mediur	n dense	tan to poorly-graded SAND (SI	ר), no structure, no odor, d	ry			5	10	85					
5 -	11 8							-GLACIOLACUSTRINE	DEPOSITS-											
	10 10	S4 17	6.0 8.0	SP		Mediur	n dense	tan to poorly-graded SAND (SI), no structure, no odor, d	ry			5	15	80					
	10 11 7		0.0																	
	6 7 7 8	S5 23	8.0 10.0	SP				tan poorly-graded SAND (SP), layers of orange alteration	frequently bedded, no odd	ır,					100					
10 -	5 6 7	S6 10	10.0 12.0	SP				tan poorly-graded SAND (SP), of orange alteration	frequently bedded, no odd	r, wet,				5	95					
15 -	7 5 6 9 8	S7 13	15.0 17.0	SP				tan poorly-graded SAND (SP), of orange alteration	frequently bedded, no odc	r, wet,				5	95					
20		Wa	ater Le	evel Da	ta			Sample ID	Well Diagram		L	<u>ب</u>	L Surr	l nma	∟⊥ rv					1
D	ate	Time	Elap	osed	Dept	h (ft) to	:	O - Open End Rod	Riser Pipe	Overt	ouro					7.0				
			Time (hr.) Bottom Bottom Water T - Thin Wall Tube Screen Filter Sand R						Rock	Co	red	• •			-					
	8/23	09:12			25.0	27.0	9.1	U - Undisturbed Sample S - Split Spoon Sample	<u>िलं.</u> Cuttings Grout	Samp	les			S	9					
07/1	8/23	09:38			0.0	27.0	7.4		Concrete Bentonite Seal	Bori	ng	No).			H	A-1			
	l Tests	•	1	Dilata	ncy:R- iness:L	Rapid S	- Slow N		city: N - Nonplastic L - Lo	w M-M							ligh			

	Н	Ņ	-E)	RIC			TEST BORING REPORT			i ng No.	Nc		405	HA	\-1		
								S	shee	et N	0.	2	135- of	2			_
	(#)	Blow: in	e No.	ple n (ft)	ymbo	um nge pth (ft	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION		avel		Sano E					Test	-
	Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	USCS Symbol	Stratum Change Elev/Depth (ft)	(Density/consistency, color, GROUP NAME & SYMBOL, structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)	% Coarse	% Fine	% Coarse	% Medium	% Fine	% Fines	Dilatancy	Toughness	Plasticity Strength	'
	20 -	5 4	S8 21	20.0 22.0	SP		Medium dense tan poorly-graded SAND (SP), frequently bedded, no odor, wet, frequent layers of orange alteration				5	95					
-		2 4		22.0			-GLACIOLACUSTRINE DEPOSITS-										
	25	9 16 19 19	S9	25.0 27.0	SP	07.0	Medium dense tan poorly-graded SAND (SP), frequently bedded, no odor, wet, frequent layers of orange alteration				5	95					
57 BNY 67						27.0 27.0	BOTTOM OF EXPLORATION 27.0 FT									+	-
י-ובטו מר		NOTT		lene''C	4			P		na	No			HA	- 1		╡
δĽ		NUTE	Soil ic	ientifica	tion ba	ised on vi	sual-manual methods of the USCS as practiced by Haley & Aldrich, Inc.			iy	110	•					

29 Aug 23 H&A-TEST BORING-09 REV PLOG-HALLB09-BOS STANDARD ONLY - COPYIGLB GREAT PYRAMID H&A.GPJ WHALEYALDRICH.COMISHAREICFIPROJECTS10207135/000-TB-GP.GPJ

ST	ASCC TANTI EW EI (in.) (lb) n.) (lb) n.) 0.0 2.0 2.0	NOME EC NGLAN Casing HW 4.0 140 30	D BORI	NG CONTRAC oler Barrel 4 0 -) - VISU	Drilling Equipment Rig Make & Model: Mobile Bit Type: Roller Bit Drill Mud: None Casing: HW driven to 25 f Hoist/Hammer: Winch / PID Make & Model: Not	e Drill B53 t. Automatic hammer used	S F H E L G	hee inis rille &A l&A	et No h r Rep atior m tion	5. 5 5.	54 NA See F	2 luly w Tiel	202 202 rney (est	23	
ameter (i Weight Fall (in. ON eld Weight ON eld Weight GB1 GB1 S2 23	(in.) (lb) n.) Sample 0.0 2.0 2.0	Casing HW 4.0 140 30	Sam S 1.4 14 30	oler Barrel 4 0 -) - VISU	Drilling Equipment Rig Make & Model: Mobile Bit Type: Roller Bit Drill Mud: None Casing: HW driven to 25 f Hoist/Hammer: Winch / PID Make & Model: Not	e Drill B53 t. Automatic hammer used	F D H D L	inis orille &A l&A leva oca	h r Rep atior m tion	S. 9 5. 1	17 J Shav F. 54 N/ See F	Uly W Tie .0 (202 rney (est 088	23	
Weight Fall (in. GB1 (iu.) GB1 S2 23	(lb) (lb)	HW 4.0 140 30	S 1.4 14 30	4 0 -) - VISU	Rig Make & Model: Mobile Bit Type: Roller Bit Drill Mud: None Casing: HW driven to 25 f Hoist/Hammer: Winch / PID Make & Model: Not	e Drill B53 t. Automatic hammer used		erille &A leva eatu oca	r Rep atior m tion	S. 8 5. 1 S	Shav F. 54 N/ See F	w Tie .0 (AVE	rney (est 088	/	
Weight Fall (in. GB1 (iu.) GB1 S2 23	(lb) (lb)	4.0 140 30	1.4 14 30	4 0 - 0 - VISU	Bit Type: Roller Bit Drill Mud: None Casing: HW driven to 25 f Hoist/Hammer: Winch / PID Make & Model: Not	t. Automatic hammer used	E D L G	ileva vatu oca	atior m tion	ı S	54 NA See F	.0 (AVE	(est 088		
Weight Fall (in. GB1 (iu.) GB1 S2 23	(lb) (lb)	140 30	14 30	0 -) - VISU	Drill Mud: None Casing: HW driven to 25 f Hoist/Hammer: Winch / PID Make & Model: Not	Automatic hammer used	D L G	oca	m tion	S	N/ See F	٩VE	<u>)</u> 88	.)	
Fall (in. (iu) (iu) (iu) (iu) (iu) (iu) (iu) (iu)	1.) Sample Sample 2.0 2.0	30 INSCS Symbol	30	visu	Casing: HW driven to 25 f Hoist/Hammer: Winch / PID Make & Model: Not JAL-MANUAL IDENTIFICATION	Automatic hammer used	G	oca	tion		iee F				
Bandle No. Sample No. Carlos Sample No. S2 S3 S2 S3 S2 S3 S3 S3 S3 S3 S3 S3 S3 S3 S3	Complete Com	USCS Symbol		visu	PID Make & Model: Not	used	G						•		
GB1 S2 23	0.0 2.0 2.0		Stratum Change Elev/Depth (ft)		JAL-MANUAL IDENTIFICATION			rave	1	0		_			
GB1 S2 23	0.0 2.0 2.0		Stratum Change Elev/Depth						-	San			F	ield	Tes
GB1 S2 23	0.0 2.0 2.0		Stra Cha Elev/D	(De			a s		rse	Medium		ŝ	5	Toughness	Plasticity
GB1 S2 23	0.0 2.0 2.0		Ĕ	(Density/consistency, color, GROUP NAME & SYMBOL, structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)		onal descriptions	Coarse	Fine	Coarse	Med	% Fine	% Fines	Dilatancy	nghr	Plasticity
S2 23	2.0	SM				,	%	2 %	2 %	%	%		ā	ř	
23	2.0				y SAND with gravel (SM), no str n. asphalt fragments	ucture, slight organic odor,	5	5	10	15	35	30			
23		1			-TOPSOIL-										
23		SM	52.0 2.0	Medium denso	- I OPSOIL- dark brown silty SAND with gra	vel (SM) no structure slight	5	5	10	15	35	30	\vdash	\dashv	
	4.0		51.2 2.8		noist, trace 2-in. asphalt fragme					15		50		\square	
		SP	2.8	Light brown to c	-FILL- prange poorly-graded SAND (SF	P) frequently varved no odor	_/				100				
S3	4.0	SP		moist						5	95				
23	6.0			Medium dense	tan poorly-graded SAND (SP), i -GLACIOLACUSTRINE [dry								
S4	6.0	SP			tan poorly-graded SAND (SP), t	frequently bedded, no odor,					100				
23	8.0			moist, frequent	layers of orange alteration										
S5	8.0 SP			light brown poorly-graded SANI	D (SP), frequently bedded, no					100					
24	10.0			odor, wet, frequ	ent layers of orange alteration										
S6											100				
	12.0				, e, wet, noquent layer										
	15 () SP		Medium dense	gray-brown and light brown poo	orly-graded SAND (SP),					100				
15															
W	Vater L	evel Da	ata	l	Sample ID	Well Diagram			Sur	nma	⊥⊥_ iry				
	Ela	Elapsed Depth (ft) to: O - Open End Rod Riser Pipe Ov					Overbu					27.0)		
	Tim				T - Thin Wall Tube	Filter Sand			•	·		-			
12:22			15.0	27.0 7.4	U - Undisturbed Sample S - Split Spoon Sample	<u>ির:</u> Cuttings ব Grout	Sample	s		S	7				
13:22	2	0.0	0.0	27.0 9.4		Concrete	Boring	j N	о.			H	A-2	!	
1						ity: N - Nonplastic L - Low	M - Medi	um	H - I	ligh					
	S7 15 V Time 12:2	S7 15.0 15 15.0 15 17.0 Water L Ela Time Ela 12:22 13:22	S7 15.0 SP 15 17.0 SP Water Level Da Time Elapsed Time Elapsed Fine (hr.) 12:22 0.0 13:22 0.0 S: Dilata	S7 15.0 SP 15 17.0 SP 15 17.0 SP Water Level Data Time Elapsed Depti Time (hr.) of Casing 12:22 0.0 15.0 13:22 0.0 0.0 Bilatancy: R - f	Trequently bedd 12.0 frequently bedd 12.0 Medium dense frequently bedd S7 15.0 15 17.0 SP Medium dense frequently bedd Water Level Data Medium dense frequently bedd Time Elapsed Depth (ft) to: Time (hr.) Bottom of Hole Water 12:22 0.0 15.0 27.0 7.4 13:22 0.0 0.0 27.0 9.4 Dilatancy: R - Rapid S - Slow I	S7 15.0 SP Medium dense gray-brown and light brown poor frequently bedded, no odor, wet, frequent layer S7 15.0 SP Medium dense gray-brown and light brown poor frequently bedded, no odor, wet, frequent layer 15 17.0 SP Medium dense gray-brown and light brown poor frequently bedded, no odor, wet, frequent layer Water Level Data Sample ID Time Elapsed Depth (ft) to: Time (hr.) Bottom of Casing of Hole Water 12:22 0.0 15.0 27.0 13:22 0.0 0.0 27.0 9.4 Si Dilatancy: R - Rapid S - Slow N - None Plastic	12.0 12.0 frequently bedded, no odor, wet, frequent layers of orange alteration S7 15.0 SP Medium dense gray-brown and light brown poorly-graded SAND (SP), frequently bedded, no odor, wet, frequent layers of orange alteration Water Level Data Medium dense gray-brown and light brown poorly-graded SAND (SP), frequently bedded, no odor, wet, frequent layers of orange alteration Water Level Data Depth (ft) to: O - Open End Rod Time Bottom Bottom 12:22 0.0 15.0 27.0 13:22 0.0 15.0 27.0 7.4 13:22 0.0 15.0 27.0 7.4 St Dilatancy: R - Rapid S - Slow N - None Plasticity: N - Nonplastic L - Low	12.0 12.0 frequently bedded, no odor, wet, frequent layers of orange alteration 12.0 12.0 Image: state of the stat	12.0 12.0 frequently bedded, no odor, wet, frequent layers of orange alteration S7 15.0 SP Medium dense gray-brown and light brown poorly-graded SAND (SP), frequently bedded, no odor, wet, frequent layers of orange alteration 15 17.0 SP Medium dense gray-brown and light brown poorly-graded SAND (SP), frequently bedded, no odor, wet, frequent layers of orange alteration Water Level Data Sample ID Well Diagram Time Elapsed Depth (ft) to: Time (hr.) 0 - Open End Rod T - Thin Wall Tube Riser Pipe Screen Overburder 12:22 0.0 15.0 27.0 7.4 S- Split Spoon Sample Cuttings Grout Overburder 12:22 0.0 0.0 27.0 9.4 Sector Screen Samples Bentonite Seal St Dilatancy: R - Rapid S - Slow N - None Plasticity: N - Nonplastic L - Low M - Medium	12.0 12.0 frequently bedded, no odor, wet, frequent layers of orange alteration S7 15.0 SP Medium dense gray-brown and light brown poorly-graded SAND (SP), frequently bedded, no odor, wet, frequent layers of orange alteration 15 17.0 SP Medium dense gray-brown and light brown poorly-graded SAND (SP), frequently bedded, no odor, wet, frequent layers of orange alteration Water Level Data Sample ID Well Diagram Sur Time Elapsed Depth (ft) to: 0 - Open End Rod Riser Pipe Overburden (ft Time (hr., bottom bottom of Casing of Hole Water 0 - Open End Rod Filter Sand Overburden (ft 12:22 0.0 15.0 27.0 7.4 Split Spoon Sample Cuttings Grout Overburden (ft 13:22 0.0 0.0 27.0 9.4 Septit Spoon Sample Setticty: N - Nonplastic L - Low M - Medium H - I s: Dilatancy: R - Rapid S - Slow N - None Plasticity: N - Nonplastic L - Low M - Medium H - I	12.0 12.0 frequently bedded, no odor, wet, frequent layers of orange alteration 57 15.0 SP Medium dense gray-brown and light brown poorly-graded SAND (SP), frequently bedded, no odor, wet, frequent layers of orange alteration 15 17.0 SP Medium dense gray-brown and light brown poorly-graded SAND (SP), frequently bedded, no odor, wet, frequent layers of orange alteration Water Level Data Sample ID Well Diagram Summa Time Elapsed Depth (ft) to: 0 - Open End Rod Riser Pipe Screen Overburden (ft) Rock Cored (ft) 12:22 0.0 15.0 27.0 7.4 0 - Open End Rod Sample S - Split Spoon Sample Overburden (ft) Samples S Samples S 3:22 0.0 0.0 27.0 9.4 Section Sample Section Sample S Bortion Nonplastic L - Low M - Medium H - High	12.0 12.0 frequently bedded, no odor, wet, frequent layers of orange alteration 57 15.0 SP Medium dense gray-brown and light brown poorly-graded SAND (SP), frequently bedded, no odor, wet, frequent layers of orange alteration 100 57 15.0 17.0 SP Medium dense gray-brown and light brown poorly-graded SAND (SP), frequently bedded, no odor, wet, frequent layers of orange alteration 100 Water Level Data Sample ID Well Diagram Summary Time Elapsed Depth (ft) to: 0 - Open End Rod Siser Pipe Overburden (ft) Riser Pipe 12:22 0.0 15.0 27.0 7.4 0 - Open End Rod Siser Pipe Overburden (ft) Rock Cored (ft) 12:22 0.0 15.0 27.0 7.4 Sittored Sample Sittored Countings Countings Overburden (ft) Samples S7 13:22 0.0 0.0 27.0 9.4 Sittored Sample Sittored Sample Bentonite Seal Boring No. s: Dilatancy: R - Rapid S - Slow N - None Plasticity: N - Nonplastic L - Low M - Medium H - High Site Plasticity: N - Nonplastic L - Low M - Medium H - High	S7 15.0 15 17.0 S7 15.0 15 17.0 SP Medium dense gray-brown and light brown poorly-graded SAND (SP), frequently bedded, no odor, wet, frequent layers of orange alteration Medium dense gray-brown and light brown poorly-graded SAND (SP), frequently bedded, no odor, wet, frequent layers of orange alteration Medium dense gray-brown and light brown poorly-graded SAND (SP), frequently bedded, no odor, wet, frequent layers of orange alteration Medium dense gray-brown and light brown poorly-graded SAND (SP), frequently bedded, no odor, wet, frequent layers of orange alteration Medium dense gray-brown and light brown poorly-graded SAND (SP), frequently bedded, no odor, wet, frequent layers of orange alteration Medium dense gray-brown and light brown poorly-graded SAND (SP), frequently bedded, no odor, wet, frequent layers of orange alteration Medium dense gray-brown and light brown poorly-graded SAND (SP), frequently bedded, no odor, wet, frequent layers of orange alteration Medium dense gray-brown and light brown poorly-graded SAND (SP), frequently bedded, no odor, wet, frequent layers of orange alteration Medium dense gray-brown and light brown poorly-graded SAND (SP), frequently bedded, no odor, wet, frequent layers of orange alteration Medium (hr, bedded from bottom	S7 15.0 SP Medium dense gray-brown and light brown poorly-graded SAND (SP), frequently bedded, no odor, wet, frequent layers of orange alteration 100 S7 15.0 17.0 SP Medium dense gray-brown and light brown poorly-graded SAND (SP), frequently bedded, no odor, wet, frequent layers of orange alteration 100 Water Level Data Corponent (ft) to: 0 - Open End Rod Riser Pipe Screen Time Elapsed Depth (ft) to: 0 - Open End Rod Riser Pipe Overburden (ft) 27.0 12.22 0.0 15.0 27.0 7.4 S - Split Spoon Sample Screen Cuttings Grout Samples S7 13.22 0.0 0.0 27.0 9.4 S - Split Spoon Sample String No. HA-2 Bentomite Seal Dilatancy: R - Rapid S - Slow N - None Plasticity: N - Nonplastic L - Low M - Medium H - High	S7 15.0 SP Medium dense gray-brown and light brown poorly-graded SAND (SP), frequently bedded, no odor, wet, frequent layers of orange alteration 100 S7 15.0 SP Medium dense gray-brown and light brown poorly-graded SAND (SP), frequently bedded, no odor, wet, frequent layers of orange alteration 100 Water Level Data Sample ID Well Diagram Summary Time Elapsed Dotom Bottom of Hole Vater 12.22 0.0 15.0 27.0 7.4 13.22 0.0 0.0 27.0 9.4 St Dilatancy: R - Rapid S - Slow N - None Plasticity: N - Nonestand Plasticity: N - Nonestand

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			_DF	RIC	H		TEST BORING REPORT	S	ile N Shee	et N	0 0.	207 [.] 2	135- of	000 2		
	(#)	Blows in.	, No.	ole (ft)	/mbol	um ge th (ft)	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION		avel		Sano E		-	Fi	ield ss	Test
	Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	USCS Symbol	Stratum Change Elev/Depth (ft)	(Density/consistency, color, GROUP NAME & SYMBOL, structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)	% Coarse	% Fine	% Coarse	-		% Fines	Dilatancy	Toughness	Plasticity Strength
	. 20 -	6 6	S8 20	20.0 22.0	SP		Medium dense gray-brown and light brown poorly-graded SAND (SP), frequently bedded, no odor, wet, frequent layers of orange alteration					100				
-	 -	6 6					-GLACIOLACUSTRINE DEPOSITS-									
-	- 25	4 4 5 6	S9 18	25.0 27.0	SP		Loose gray-brown and light brown poorly-graded SAND (SP), frequently bedded, no odor, wet, frequent layers of orange alteration					100				
G-09 REV PLOG-HA-LIB09-BOS STANDARD ONLY - COPY.GLB GREAT PYRAMID H&A.GPJ WHALE YALDRICH. COM SHARE (CFIPROJECTS/0207135/GINT/0207135-000-TB-GP/GPJ 29 Aug 23						27.0	BOTTOM OF EXPLORATION 27.0 FT									
H&A-TEST BORING-09 REV		NOTE:	Soil id	lentifica	tion ba	sed on vi	sual-manual methods of the USCS as practiced by Haley & Aldrich, Inc.	В	oriı	ng	No			HA	۹-2	

H&A-TEST BORING-09 REV PLOG-HALIB09-BOS STANDARD ONLY - COPY/GLB GREAT PYRAMID H&A, GPJ WHALEYALDRICH. COMISHARE/GFPROJECTSI0207135/000-TB-GP GPJ 29 Aug 23

		-EY	RIC	Ж		1	TEST	BORING REPOR	RT			Bo	rin	g٨	lo.		H	4-3	i	
Proj Clie		ST	ANTE	EC				NS, BOXFORD, MA			Sh			. 1	713 of 17 Ju	2		3		
COI	Illacio			_	-				t and Dragaduras		Fir	nish		1	7 Ju	ıly 2				
			_	Casing	Sam		Barrel	Drilling Equipmen				iller			Shaw					
Туре				HW	S	\$		Rig Make & Model: Mobil Bit Type: Roller Bit	e Drill B53			&A F evat					ney est.`			
		neter (i		4.0	1.			Drill Mud: None	F 4			atum			NA					
		Veight (· 1	140	14	-	-	Casing: HW driven to 25 Hoist/Hammer: Winch /			Lo	cati	on	S	ee P	lan				
Ham		all (in.))	30	30		-	PID Make & Model: Not	used		-									•
(H	Blows in.	(in.) No.	ele (ff)	loqu	тур Ц		VISU	IAL-MANUAL IDENTIFICATIO	N AND DESCRIPTION		-	avel		Sanc E		+		sld ⁻ s		I
Depth (ft)	Sampler E per 6 i	Sample No. & Rec. (in.)	Sample Depth (ft)	USCS Symbol	Stratum Change Elev/Depth (ft)		(De	nsity/consistency, color, GROL structure, odor, moisture, opti GEOLOGIC INTERPRI	onal descriptions		% Coarse	% Fine	% Coarse	% Medium	% Fine	% Fines	Dilatancy	Iougnness	Plasticity	
0 -	S	GB1	0.0	SM	ш		k brown and	brown silty SAND with gravel	(SM), no structure, slight o	rganic	5	5	°` 10	°` 15		°` 30		+	-	
		_	2.0		53.0	odo	r, moist	red piece of fragmented iron pi		-			_							
	9 9	S2 20	1.0 3.0	SP	1.0			-TOPSOIL-		/			5	10	85					
	11	-	0.0			Med	lium dense	light brown poorly-graded SAN	D (SP), no structure, no oc	or, dry										
	13 13	S3 23	3.0 5.0	SP		Med	lium dense	tan poorly-graded SAND (SP),	infrequently mottled, no od	or, dry				5	95					
	12 12		0.0					-GLACIOLACUSTRINE	DEPOSITS-											
5 -	11 9 9	S4 24	5.0 7.0	SP		Med	lium dense	tan poorly-graded SAND (SP),	infrequently mottled, no od	or, dry				5	95					
	8	S5	7.0	SP		Med	lium dense	tan and light brown poorly-grac	led SAND (SP), no odor, m	oist				5	95					
	7 6 6	21	9.0																	
10 -	5 7 7 8	S6 11	9.0 11.0				lium dense cture, no oc	gray-brown and light brown poo lor, moist	orly-graded SAND (SP), no						95	5				
15 -	5 9 9 8	S7 15	15.0 17.0					light brown poorly-graded SAN ent layers of orange alteration	D (SP), frequently bedded,	no					100					
07/1	ate 17/23 17/23	Wa Time 10:17 11:16	Ela Tim		Dept ottom	h (ft) Bottor of Hol 27.0 27.0	water 8.5	Sample ID O - Open End Rod T - Thin Wall Tube U - Undisturbed Sample S - Split Spoon Sample	Well Diagram Riser Pipe Screen Filter Sand Cuttings Grout Concrete	Overt Rock Samp Bori	Co les	den ored	(ft) (ft)		2 [.] 9	7.0 - H/	4-3			
Eis!-	Tact			Dilatar	ICV: P	Rapid	S - Slow 1	 N - None Diactic	Bentonite Seal		-			liah						•
Field	Tests	5:					S - Slow I <u>M - Mediur</u>		rength: N - Nonplastic L - Low	M - Med	ium	н г Н-	· Hig	ngn h V	' - Ver	уH	igh			

Н		-E)		н		TEST BORING REPORT	F	ile	No.	Nc 0 0.	207	135- of	000	A-3		_
Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	USCS Symbol	Stratum Change Elev/Depth (ft)	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (Density/consistency, color, GROUP NAME & SYMBOL, structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)	-	% Fine	e e	Sano			F	ŝ	Plasticity sa I	t
- 20	<u>ທ</u> 4 5 5	S8 15	20.0 22.0	SP		Medium dense tan poorly-graded SAND (SP), frequently bedded, no odor, wet, frequent layers of orange alteration Note: Mica and coarse sand in wash.	»	%	%	-	» 100	%	D	-		
- - 25 -	10 12 12 10	S9 13	25.0 27.0	SP	27.0	-GLACIOLACUSTRINE DEPOSITS- Tan poorly-graded SAND (SP), frequently bedded, no odor, wet, frequent layers fine sand					100					
					27.0	BOTTOM OF EXPLORATION 27.0 FT										
	NOTE	: Soil id	lentifica	tion ba	ised on vi	sual-manual methods of the USCS as practiced by Haley & Aldrich, Inc.	В	ori	ng	No	•		H	A-3		-

		DF	RIC	H		Т	EST	BORING REPOI	RT			Bo	rin	g١	lo.		H	۹-4	
Proj Clie	nt STANTEC tractor NEW ENG	С				NS, BOXFORD, MA			s		t No	. 1)713 of 20 J	2		3			
Cor	ntracto	r NE		IGLAN	-			-				nisł			20 J	,			
				Casing	Sam	pler	Barrel	Drilling Equipmer		es		riller			Shav				
Туре				HW	S			Rig Make & Model: Mobi Bit Type: Roller Bit	e Drill B53			&A leva				Tier			
				4.0	1.4			Drill Mud: None Casing: HW driven to 25	£4			atur			NA	VD	88 ์		
		0 (´		14		-	Hoist/Hammer: Winch		mer		ocat	ion	S	ee F	Plan			
nan		. ,			30		-	PID Make & Model: No	tused					0					
(#)	Blow in .	: No.	ele (#	/mbo	њ а		VISU	JAL-MANUAL IDENTIFICATIO	N AND DESCRIP	TION	_	avel	-	Sano E		F		ald T	
Depth (ft)	Sampler per 6	Sample & Rec.	Samp Depth	uscs sy	Stratum Change Elev/Depth (ft)		(De	nsity/consistency, color, GRO structure, odor, moisture, opt GEOLOGIC INTERPR	onal descriptions		% Coarse	% Fine	% Coarse	% Medium	% Fine	% Fines	Dilatancy	I ougnness	Plasticity
0 -				SM		Dark b		y SAND (SM), no structure, sli s and plant matter	ght organic odor, ı	noist, 10% to		5	5	25		25			
					52.0			-TOPSOIL-											
	14 9	$ \begin{array}{cccccccccccccccccccccccccccccccccccc$	SM	2.0	Mediu to moi		dark brown and gray silty SAN -FILL-	D (SM), no structi	ure, no odor, c	ry	5	5	20	40	30				
	de Diameter (in.) 4.0 nmer Weight (lb) 140 mer Fall (in.) 30 Immer Fall (in.) Immer Fall (in.) Immer Fall (in.) Immer Fall (in.)	SM ,	49.7	Mediu	m dense	brown silty SAND (SM), no str	ucture, no odor, d	ry			5	20	60	15					
5 -		\sim	4.3			tan poorly-graded SAND (SP),		,				10	90						
					-GLACIOLACUSTRINE	DEPOSITS-													
		SP		Loose dry	to mediu	Im dense tan poorly-graded SA	ND (SP), no struc	cture, no odor,				10	90						
				bedde	d, no odo light brov	light brown and orange poorly r, moist wn and orange poorly-graded \$			סו				100 100						
10 -	4 4			SP				wn and orange poorly-graded a lent layers of orange and brow		ently bedded,	o				100				
15 -	4 18 10.0 S 3 S6 10.0 S 4 13 12.0 S 4 13 12.0 S 4 S7 15.0 S 4 S7 15.0 S 4 S7 17.0 S 4 S7 Elapsed S		SP				wn and orange poorly-graded a lent layers of orange and brow		ently bedded,	no				100					
20	ate		Elap	osed _	Dept	h (ft) to		Sample ID O - Open End Rod	Well Diac	Pipe O	verbur					27.0			
		T T	Time			Bottom of Hole	Water	T - Thin Wall Tube U - Undisturbed Sample	Scree	n Sand R	ock C	ored	• • •)		-			
		-			15.0 0.0	27.0 27.0	9.2 8.8	S - Split Spoon Sample	ितः ते Cuttin Grout		ample: oring		0.	S	9	HA	۹-4		
Field	d Tests	:					- Slow		city: N - Nonplast rength: N - None	ic L-Low M									

ŀ			RIC	Н		TEST BORING REPORT	F	ile	No.	NC 0.	207	135- of	-000	A-4	
Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	USCS Symbol	Stratum Change Elev/Depth (ft)	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (Density/consistency, color, GROUP NAME & SYMBOL, structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)	-	% Fine	se	San			F	ŝŝ	Plasticity
- 20 - - -	5 7 8 10	S8 15	20.0 22.0	SP		Medium dense gray-brown and orange poorly-graded SAND (SP), frequently bedded, no odor, wet, frequent layers of brown alteration -GLACIOLACUSTRINE DEPOSITS-					100				
- - 25 - -	8 10 11 13	S9 17	25.0 27.0	SP	. 27.0 27.0	Medium dense gray-brown and orange poorly-graded SAND (SP), frequently bedded, no odor, wet, frequent layers of brown alteration					95	5			
	NOTE	: Soil id	lentifica	tion ba	nsed on vi	isual-manual methods of the USCS as practiced by Haley & Aldrich, Inc.	В	ori	ng	No	•		H	A-4	

	ect MASCONOMET FIELD RENOVATIONS, BO nt STANTEC tractor NEW ENGLAND BORING CONTRACTORS Casing Sampler Barrel P HW S Barrel P HW S Barrel P HW S Barrel P Barre			H		TEST	BORING REPOR	RT			Bo	rın	gг	10.		Н	 A -{	5	
Proje Client	Antractor STANTEC Intractor NEW END Intractor Intractor Intractor Intractor Intractor Intractor Intractor Intractor Intractor Intractor Intractor Intractor Intractor <t< th=""><th></th><th>T FIELD</th><th>RENOVATIO</th><th>ONS, BOXFORD, MA</th><th></th><th></th><th>Sh</th><th>leet</th><th></th><th>. 1</th><th>)713 of</th><th>2</th><th></th><th>20</th><th></th><th>-</th></t<>				T FIELD	RENOVATIO	ONS, BOXFORD, MA			Sh	leet		. 1)713 of	2		20		-
Contr	racto	r NE	WEN	IGLAN	D BORI	NG CONTRA	CTORS				art nish			20 J 20 J	-				
				Casing	Sam	pler Barrel	Drilling Equipmer	t and Procedures			iller			Shav	•				
Туре				HW	s	;	Rig Make & Model: Mobi	e Drill B53		Hð	ka f	Rep).	F.	Tie	rne	y		
Inside	e Diar	neter (i	n.)	4.0	1.	4					eva atun				.0 AVE	(est			
Hamm	ner V	Veight (lb)	140	14	0 -	Casing: HW driven to 25				cati		S	ee F					-
Hamn	ner F	all (in.))	30	30	- o	PID Make & Model: No	' Automatic hammer t used											
t)	SWC	of c	- -	lod	(ŧ	VIS				Gra	avel		San	b		F	ield	Te	s
Depth (ft)	er Blo 6 in.	ole N c. (i	th (f	Sym	atum ange epth	([Densitv/consistency.color.GRO	JP NAME & SYMBOL.		Coarse	0	Coarse	Medium	a a	se	JCY	Toughness	ity	
Dep	per	amp Re	Sal Dep	SCS	ev/D		structure, odor, moisture, opt	onal descriptions		õ	Fine	ő	Me	% Fine	Fines	Dilatancy	lguo	Plasticity	
0	GB1 0. 8 S2 2. 9 20 4. 14 20 4. 14 20 4. 14 20 6. 17 20 6. 12 7 S4 6. 11 4 8. 9 10 S5 8. 7 22 10 7 22 10 7 22 10 7 22 10 4 S6 10 5 12 12 4 S7 15 4 18 17 5 9 10 5 9 10 5 12 12 18 17 15 4 18 17 5 9 10 9 9 9 10 10 10 10 10 11 18 17 5			Ξ			,	to	%	% 5	% 5	% 25		% 25		Ĕ	۵.	-	
	ide Diameter (in.) mmer Weight (lb) mmer Fall (in.) in i		SIVI	53.0		ots and plant matter	ght organic odor, moist, 107	0 10		5	5	25	40	25					
	ide Diameter (in.) immer Weight (lb) immer Fall (in.) $\begin{bmatrix} 0 & & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0$		SM		Medium dens		ND (SM) no structure slight			5	5	25	50	15					
- -	GB1 0.0 8 S2 2.0 9 20 4.0 14 - - 4 S3 4.0 17 20 6.0 -14 - - 7 S4 6.0 9 12 - 10 S5 8.0 7 22 10.0 7 7 - 4 S6 10.1 5 12 12.0	20	-	F4 F		moist, 10% grass roots and surf													
	side Diameter (in.) ammer Weight (lb) ammer Fall (in.) $\begin{array}{c} & & & & \\ & & & & \\ & & & & \\ & & & & $		SP	51.5 2.5	Medium dens		d SAND (SP), infreauently				\square	10	90						
								, ,, ······· · ,											
			4.0	SP			. , ,		l, no				5	95					
5 -	14	20	6.0			odor, dry, infr	equent layers of orange alteratio	n											
	12						-GLACIOLACUSTRINE	DEPOSITS-											
		Weight (b) 140 140 - - Classing: HW driven to 25 ft. Fall (in.) 30 30 - Hoist/Hammer: Winch / Automatic ham PID Make & Model: Not used ViSUAL-MANUAL IDENTIFICATION AND DESCRIF (0 esting of est), no structure, no odor, dry	to			5	5	70	20									
	9	Weight (b) 140 140 - Casing: HW driven to 25 ft. Hoist/Hammer: Winch / Automatic h PID Make & Model: Not used Visual-Manual IDENTIFICATION AND DESC Generation of the second of second of the second of the second of second of the second of the second of the second of second of the second of the second of the second of second of the second of the second of the second of the second of the second of the																	
				SP			a , .	ly-graded SAND (SP),		5			5	90					
	7	Z = 5 BE 2 B = 0 B = 0																	
10 +		Pain (III.) 30 30 - PID Make & Model: Not used 9 <td>ntlv</td> <td></td> <td></td> <td></td> <td> </td> <td>100</td> <td></td> <td></td> <td></td> <td></td> <td></td>	ntlv					100											
	5							Sidded on the (OF), include						100					
- -																			
-																			
15				SP			rown to light brown poorly-grade	d SAND (SP), frequently be	dded,					100					
	2	18	17.0			wei													
	C			-															
,																			
20		 W:	ater L	evel Da	Ita		Sample ID	Well Diagram			<u> </u>	Sun	hma						-
Dət	e Time Elapsed Depth (ft) to: O - Open End Rod Time (hr) Bottom Bottom Water T - Thip Weither		Riser Pipe	Overb	ouro					27.0)								
		- inte	Time					Filter Sand	Rock			• •		-	-				
07/20)/23	11:54			15.0	27.0 9.5			Samp	les			S	9					_
								Concrete	Boriı	١g	No) .			H,	A-5	5		
		I	1	Dilata	ncv:R-	Rapid S - Slow	N - None Plastic		M - Me	diu	m ł	H - F	liah						-

ſ	Н		E							ing).		H	A-5		
			_DF	RIC	Н		TEST BORING REPORT	F S	ile l Shee	No. et N	0 0.	207 2	135- of	000 2			
Ī	ft)	lows I.	No. in.)	e ft)	lodn	n e f(f)	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION	-	avel		Sano	k I				Test	_
	Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	USCS Symbol	Stratum Change Elev/Depth (ft)	(Density/consistency, color, GROUP NAME & SYMBOL, structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)	% Coarse	% Fine	% Coarse	% Medium	% Fine	% Fines	Dilatancy	Toughness	Plasticity Strength	
F	20 -	2 3	S8 23	20.0	SP		Loose gray-brown poorly-graded SAND (SP), frequently bedded, no odor, wet					95	5				
-		6 3		22.0			-GLACIOLACUSTRINE DEPOSITS-										
23	25	6 5 4 5	S9 16	25.0 27.0	SP	27.0	Loose gray-brown poorly-graded SAND (SP), frequently bedded, no odor, wet					95	5				
29 Aug 23						27.0 27.0	BOTTOM OF EXPLORATION 27.0 FT									+	-
H&A-TEST BORING-09 REV PLOG-HA-LIB09-BOS STANDARD ONLY - COPY.GLB GREAT PYRAMID H&A.GPJ WHALEYALDRICH.COMSHARE/CFIPROJECTS/0207135/0GINT/0207135-000-TB-GP.GPJ																	
kA-TEST	_	NOTE	Soil in	lentifica	tion ba	ised on vi	sual-manual methods of the USCS as practiced by Haley & Aldrich, Inc.	В	ori	ng	No			H	A-5		-
Ϋ́										-							

H&A-TEST BORING-09 REV PLOG-HALIB09-BOS STANDARD ONLY - COPY/GLB GREAT PYRAMID H&A, GPJ WHALEYALDRICH. COMISHARE/GFPROJECTSI0207135/000-TB-GP GPJ 29 Aug 23

ŀ		-E)	RIC	ЭН			TEST	BORING REPOR	۲۲				Bo	rin	g١	۱o.		Н	A-6	5	
Pro Clie	ject	M/ ST	ASCO ANT	DNOME EC				NS, BOXFORD, MA				Sh			. 1)713 of 19 J	2		23		
COI	Illacio			_						aaduraa		Fir	nish			19 J	uly				
-				Casin	-		Barrel	Drilling Equipment					iller &A F			Sha\ ⊑		rne	,		
Тур								Bit Type: Roller Bit		55			evat			51		mey			
							_		t.				atum								
		Fall (in.	ΎΙ	30			-	Hoist/Hammer: Winch /	Automa	tic hammer		LO	ocati	ION	5	iee F	lar	1			
	Blows in.	e ĉ	ail (in.) 30 30 - PID Make & Model: Not used OZ OZ </td <td>ESCRIPTION</td> <td></td> <td>Gr</td> <td>avel</td> <td></td> <td>San</td> <td>d</td> <td></td> <td></td> <td>ield</td> <td>Tes</td> <td>t</td>				ESCRIPTION		Gr	avel		San	d			ield	Tes	t			
Depth (ft)	er Blo	ole N c. (ir	hple 14	Sym	atum ange epth							Coarse	0	Coarse	dium	0	ŝS	ЪС	ness	ïty	ŧ
Dep	Sampler I per 6	Samp & Re	Sar	lscs	Stra Cha		(20	structure, odor, moisture, optic	onal desc	criptions		% Coa	% Fine	% Coa	% Medium	% Fine	% Fines	Dilatancy	Toughness	Plasticity	Strendth
0 -	S S	GB1		SM	ш	Da			nt organi	ic odor, moist, 10	1% to	<u> </u>	5	5	25		25		╞	<u>ш</u>	-
		49.5 -TOPSOIL- SP 1.5 Light brown to tan poorly-graded SAND (SP), no structure, no odor, o -FILL-						_	10	75	10										
			S2 3.0 21 5.0			are, no odor, dry				5	10	75	10								
	10	52																			
	12 10		B1 0.0 SM Last Dark brown silty SAND (SM), no structure, slight organic odor, 20% grass roots and plant matter -TOPSOIL- 2 3.0 1.5 1.5 Light brown to tan poorly-graded SAND (SP), no structure, no or -FILL- 2 3.0 5.0 SP 47.0 3 5.0 SP 47.0 44 7.0 SP 460 44 7.0 SP Medium dense tan poorly-graded SAND (SP), frequently bedde to moist 5 9.0 SP Medium dense tan to gray-brown poorly-graded SAND (SP), in frequently bedded, no odor, moist								100										
F	10			SP	4.0	IVIE	aium dense	tan poorly-graded SAND (SP),	beaded,	no odor, dry to m	IOIST					100					
5 -	9 12		3.0 5.0 47.0 5.0 SP 4.0 5.0 SP 7.0 SP				y bedded, no odd	or, dry					100								
	11 10		1.0					-GLACIOLACUSTRINE	EPOSIT	rs-											
	10	S4	7.0	SP		Me	dium dense	tan to gray-brown poorly-graded	SAND	(SP), infrequently	/					100					
	8 6 7	24	HW S Rig Make & Model: Mobile Drill BS: Bit Type: Roller Bit Drill Mud: None (in.) 4.0 1.4 Drill Mud: None 150 140 - Casing: HW driven to 25 ft. Hoist/Hammer: Winch / Automati PID Make & Model: Not used 0.0 30 30 - PID Make & Model: Not used 0.0 SM Eggs for 50 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0																		
	5	S5	9.0	SP		Me	dium dense	tan to orange poorly-graded SA	ND (SP)	, infrequently be	dded,					100					
· 10 –	6 7 7	-				no	odor, wet		()		,										
	7	56	11 (n SP		Me	dium dense	arav-brown to orange poorly-ar	aded SA	ND (SP). infreau	entlv					100					
	8 7 7			· .						<i>, </i>	,										
				_																	
15 -	-																				
	_					NA-	dium dares	arov brown poorly and a OAN	י יספ) ר	nfroquently bear	od na					100					
	7 5 7							gray-brown poony-graded SAN	J (3F), I		eu, no					100					
	11																				
20 -		\ \//	ater I	evel D	ata			Sample ID		ell Diagram		_		Sum	 1m2						_
П	ate	Time Elapsed Time (hr.) Depth (ft) to: Bottom O - Open End Rod Water Image: Comparison of Com		Riser Pipe	Overt	bur					28.0)									
			lim		f Casing		le vvater			Filter Sand	Rock	Co	ored	• •)		-				
	19/23 19/23	11:20			15.0 0.0	28.0 28.0		S - Split Spoon Sample		Cuttings Grout	Samp				S	9	μ	A 6			
										Bentonite Sea		-						H-0			
Field	d Tests	6:					S - Slow M M - Mediun			Nonplastic L - Lo N - None L - Low						/ - Ve	ery ⊢	ligh			
07/ ⁻	19/23	12:20		Toug	0.0 ancy: R-F hness: L-	28.0 Rapid - Low) 10.1 S - Slow M M - Mediun	N - None Plastic	ength: N	Grout Concrete Bentonite Sea Nonplastic L - Low N - None L - Low	Bori w M - Me	ng ediu ium	Nc т н	H - ⊢ - Hig	ligh h	/ - Ve		A-6			

29 Aug 23 H&A-TEST BORING-09 REV PLOG-HA-LIB09-BOS STANDARD ONLY - COPYIGLB GREAT PYRAMID H&A.GPJ WHALEYALDRICH.COMISHARE/GFPROJECTSI0207135/0017135/000-TB-GP.GPJ

			RIC	Η		TEST BORING REPORT	F	ile l	No.	0.). 207 ⁷ 2	135- of	-000	4-6		
Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	USCS Symbol	Stratum Change Elev/Depth (ft)	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (Density/consistency, color, GROUP NAME & SYMBOL, structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)	% Coarse	% Fine	se	% Medium		% Fines		ŝ	Plasticity set	Strength 1
	11 15 17 20	S8 20	21.0 23.0	SP		Dense gray-brown and orange poorly-graded SAND (SP), frequently bedded, no odor, wet -GLACIOLACUSTRINE DEPOSITS-					100					
- 25 -	11 11 15 12	S9 17	26.0 28.0	SP	23.0 28.0	Medium dense gray-brown and orange poorly-graded SAND (SP), frequently bedded, no odor, wet					100					
					28.0	BOTTOM OF EXPLORATION 28.0 FT										
	NOTE	: Soil id	dentifica	tion ba	ased on v	isual-manual methods of the USCS as practiced by Haley & Aldrich, Inc.	В	ori	ng	No			H/	A-6		

5		-EY	RIC	H		Т	EST	BORING REPO	RT				Bo	rin	g١	lo.		Н	A- 7	7	
Proj Clie	nt	ST	ANTE	С	T FIELD			NS, BOXFORD, MA				Sł). 1)713 of 18 J	2		23		-
CO	ntracto							Drilling Equipme		raaduraa		Fi	nish			18 J		202	3		
T				Casing			Barrel	Rig Make & Model: Mob					iller &A F			Sha\ F	<i>N</i> Tier	no	,		
Туре				HW	S			Bit Type: Roller Bit		00			eva				.0 (-
		neter (i Veight (í I	4.0 140	1.4			Drill Mud: None Casing: HW driven to 25	ft			-	atun			NA	VD	88	,		_
		0 (´				_	Hoist/Hammer: Winch	/ Automa	atic hammer			ocati	Ion	S	ee F	lan	l			
		. ,										Gr	avel		San	d		Fi	ield	Ter	_
(ft)	Blov in	e No	ple (ff)	ymb	um pth (1							-	1						ŝ		
Depth (ft)	Sampler per 6	Sample & Rec.	Sam Depth	nscs s	Strat Char Elev/De		(De	structure, odor, moisture, op	ional des	criptions		% Coarse	% Fine	% Coarse	% Medium	% Fine	% Fines	Dilatancy	Toughness	Plasticity	
0 -		GB1	0.0	SM		Dark b			ght organ	ic odor, moist, 10	% to		5	5	25	40	25				
			2.0	SP	50.0 1.0			-TOPSOIL			/	┝	-	5	10	75	10		\rightarrow		-
						-	-			-							4				
	4 3 4 3	S2 20	2.0 4.0	SM		Loose	brown ar	nd tan silty SAND (SM), no stri -FILL-	icture, no	odor, dry					10	75	15				
5 -	2 3 4	S3 8	4.0 6.0	SM		Loose	brown sil	lty SAND (SM), no structure, r	o odor, m	oist				5	10	65	20				
	Immer Pair (III.) 30 30 30 - PID Make & Model: No Image: Inclusion of the second secon	vn silty SAND (SM), no structu	re, no ode	or, moist, appears	5				5	75	20										
	2	2.0 SP 50.0 1.0 20% grass roots and plant matter	ooil				5	75 70													
10 -		S6	10.0	- 5101		pocket Black \$	s, trace r 50% woo	ootlets from 9 to 9.7 ft d, 0.2-in. to 1-in. wood chips,	50% fine	sand and organic	soil					10	30				
	3	14	12.0	SP		S6 Mediur	n dense	tan to gray-brown poorly-grad	ed SAND						5	95					-
				-		no odc	or, wet, fre			۲S-											
15 -				SP						(SP), frequently b	edded,				5	95					
	10			-																	
20 -								1													_
						h (ft) to	:				<u> </u>				<u>nma</u>						-
D	ate	e ime		(hr)	Bottom	Bottom		1 · · ·		Screen	Overl Rock			• •		3	32.0				
07/1	18/23	11:31						U - Undisturbed Sample		Cuttings	Samp			(IL) S [,]	10	-				
	18/23			-				S - Split Spoon Sample		Grout	Bori) .		-	H	A- 7	,		
Field	d Tests	:			ncy: R - I					Nonplastic L - Lo N - None L - Low						1.10	ny L	liah			

Н	Å	-E)	RIC			TEST BORING REPORT			ing			405		4-7	
			AIC				l s	Shee	No. et N	0.)207 2	135- of	2		
(t)	lows 1.	No. U	ff.	lodn) (#)	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION		avel		San	_			ield ဖ	Tes
Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	USCS Symbol	Stratum Change Elev/Depth (ft)	(Density/consistency, color, GROUP NAME & SYMBOL, structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)	% Coarse	% Fine	% Coarse	% Medium	% Fine	% Fines	Dilatancy	Toughness	Plasticity
20 -	5 5 8	S8	20.0 22.0	SP		Medium dense tan to gray-brown poorly-graded SAND (SP), frequently bedded, no odor, wet, frequent layers of orange alteration				5	95				
	9			-		-GLACIOLACUSTRINE DEPOSITS-									
25	8 13 14 16	S9 19	25.0 27.0	SP		Medium dense gray-brown and orange poorly-graded SAND (SP), frequently bedded, no odor, wet, frequent layers of orange alteration, orange iron staining at 26.5 ft				5	95				
30 -	5 11 12 12	S10 18	30.0 32.0	SP	10.0	Medium dense gray-brown and orange poorly-graded SAND (SP), frequently bedded, no odor, wet, frequent layers of orange alteration, orange iron staining at 31.5 ft				5	95				
					19.0 32.0	BOTTOM OF EXPLORATION 32.0 FT									
			Intifica	tion b		isual-manual methods of the USCS as practiced by Haley & Aldrich, Inc.	B	ori	ng	No			H	4-7	_

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		neter (i	í I	4.0	1.4			Drill Mud: None Casing: HW driven to 25	f+		Da	atun	۱		NA	٧D	88	.,		
		Veight(all (in.)	· /	140 30	14	-	-	Hoist/Hammer: Winch	Automatic hammer		Lo	cati	on	S	ee F	Plan	I			
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(Ħ	Blows in.	Sample No. & Rec. (in.)	Sample Depth (ft)	USCS Symbol	Stratum Change Elev/Depth (ft)		VISU	JAL-MANUAL IDENTIFICATIO	N AND DESCRIPTION		-	-				ŀ		ŝ		
Depth (ft)	Sampler I per 6	mple Rec.	samp	S S	Stratu Chan		(De	nsity/consistency, color, GROU structure, odor, moisture, opti	JP NAME & SYMBOL, onal descriptions		Coarse	% Fine	Coarse	Medium	Fine	Fines	Dilatancy	Toughness	Plasticity	
	Sam	Sal & F	۵ ۵	nso	Elev			GEOLOGIC INTERPR			0 %	₩ 8	%	N %	₩ 8	4 %	Dila	Tou	Plas	
0 -		GB1_/	0.0	SM				y SAND (SM), no structure, sliç s and plant matter	ht organic odor, moist, 10	% to		5	5	25	40	25				
			0.2		49.6			-TOPSOIL-												
				SP	1.4 49.0	U .		orly-graded SAND (SP), no stru	· · · ·			L.	5	L _	75					
	3 2 3 3	S2 21	2.0 4.0	ŚM	2.0	Loos	e light brov	wn and tan silty SAND (SM), no -FILL-	o structure, no odor, dry					10	75	15				
5 -	8 8 8	S3 19	4.0 5.5	SP- SM		1		light brown and tan poorly-grad lor, dry, infrequent 1-in. to 3-in.	,					10	80	10				
-	12 14 13 8	S4 22	6.0 8.0	SP		1	dry to mo	light brown and tan poorly-grad ist, infrequent 1-in. to 3-in. laye					5	10	85					
	7 6 6 6	S5 24	8.0 10.0			no o		light brown and orange poorly- to wet, infrequent 1-in. to 3-in. bed					5	10	80	5				
10 -	2 4 7	S6 15	10.0 12.0		39.8			light brown and orange poorly- to wet, appears disturbed	graded SAND (SP), no str	ucture,			5	10	80	5				
	8			SP	11.2			gray-brown poorly-graded SAN of brown and orange alteratior		wet,					100					
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15 -	2 5 7 8	S7 17	15.0 17.0					gray-brown poorly-graded SAN of brown and orange alteratior		wet,					100					
	ate 19/23	Wi Time 09:52	Ela	e (hr.) _{of}	Deptl Bottom	h (ft) t Bottom of Hole 32.0	Water	Sample ID O - Open End Rod T - Thin Wall Tube U - Undisturbed Sample	Well Diagram Riser Pipe Screen Filter Sand	Overb Rock Samp	Co	den red	(ft)		3	32.0)			-
								S - Split Spoon Sample	Grout Grout Concrete Bentonite Seal	Boriı	ng	No				H	A-8	}		-
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Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	USCS Symbol	Stratum Change Elev/Depth (ft)	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (Density/consistency, color, GROUP NAME & SYMBOL, structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)	% Coarse	% Fine	é	-	-	% Fines		ŝ		
20 -	5 7	S8 21	20.0 22.0	⊃ SP	ш	Medium dense gray-brown and orange poorly-graded SAND (SP), layered, no odor, wet, frequent layers of brown and orange alteration	~	%	~	~	× 100	%		-	Р	-
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						isual-manual methods of the USCS as practiced by Haley & Aldrich, Inc.			ng	Na			H	4-8		

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Project MASCONOMET FIELD RENOVATIONS, BOXFORD, MA File No. 002071354 Client STANTEC Start 21 July 20 Start 21 July 20 Contractor NORTHERN DRILL SERVICE, INC. Start 21 July 20 Drilling Equipment and Procedures File No. 002071354 Type Casing Sampler Barrel Drilling Equipment and Procedures File No. 02071354 Type Inside Diameter (In.) AUTO - Rig Make & Model: Gesprote 6712DT BARE P, F. Temper 100 Miles & Model: Not used Elevation SAL 00 (etc.) Hammer Weigh (In) AUTO - Cessing: None Holdel: Not used Cessing: None Holdel: Not used Cessing: None Holdel: Not used Cesting: None Model: Not used </td <td></td> <td></td> <td></td> <td></td>																				
	Stantics Stantics Sheet No. 1 of 1 Casing Service, NO. Stantics Sheet No. 1 of 1 Casing Service, NO. Finish Sheet No. 1 of 1 ype G Bit Media Drilling Equipment and Procedures Processor ype G Bit Type: Cuting Head Drilling Equipment and Procedures H8A Rep. F. There mammer Weight (lb) AUTO - Casing Nores Head Harmmer: Winch Automatic harmer Elevation Sk0 (b Bit Street Street Street Street Street Street Street Street Street Street Bit Street Street Street Street Street Street Street Street Street Street Bit Street Street Street Street Street Street Street Street Street Street Bit Street Street Street Street Street Street Street Street Street Street Bit Street Street Street Street Street Street Street Street Street Street Street Street Bit Street Street Street Street Street Street Street Street Street Street																			
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			G1 0.0 SM Dark brown silty SAND (SM), no structure, slight organic odor, m 20% grass roots and plant matter 51 52.8 5.0 SP -TOPSOL- 51.6 5.4 SP -GLACIOLACUSTRINE DEPOSITS- 51.6 5.4 SP Light brown and tan poorly-graded SAND (SP), no structure, no odor, o -GLACIOLACUSTRINE DEPOSITS- 62 5.0 5.0 SP Light brown and tan poorly-graded SAND (SP), frequently bedde 62 5.0 5.0 SP Light brown and tan poorly-graded SAND (SP), no structure, no odor, o -GLACIOLACUSTRINE DEPOSITS- 62 5.0 5.0 SP Light brown and tan poorly-graded SAND (SP), frequently bedde 62 5.0 10.0 BOTTOM OF EXPLORATION 10.0 FT SP 7 10.0 10.0 BOTTOM OF EXPLORATION 10.0 FT SP 7 10.0 SP Sample ID Well Diagr 7 SP Depth (ft) to: or Casing of Hole 0 - Open End Rod Rise F 7 SP Bottom Bottom Streen Streen 8 SP Setting Streen Streen Streen 7 SP Setting Streen Streen Streen																	
Date Time Elapsed Depth (ft) to: O - Open End Rod Time (hr) Bottom Bottom (hr) Screen Overburden (ft)						-					_									
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				- or C	asing	<u>or Ho</u>	e	U - Undisturbed Sample	<u>਼ੈ ਜ</u> . Cuttings				(II)			- G2				
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Type Casing Sampler Barrel Drilling Equipment and Procedures Driller S. Shaw Type Inside Diameter (in.) A G Rig Make & Model: Geoprobe \$712DT H&A Rep. F. Tierney Hammer Weight (lb) 1.5 Drill Mut: None Drill Mut: None Datum NAVD88 Hammer Fall (in.) AUTO - Casing: None Casing: None Casing: None Hoist/Hammer: PID Make & Model: Not used G G G G Visual-MANUAL IDENTIFICATION AND DESCRIPTION Gravel Sand G G Visual-MANUAL IDENTIFICATION NUCCOGIC INTERPRETATION G G G G Visual-MANUAL IDENTIFICATION AND DESCRIPTION G G G G G Visual-MANUAL G G G G G G G Visual-MANUAL G G G G G G G <t< td=""><td>3</td><td></td><td></td></t<>			3																
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Olient STANTEC LLD FLOOM INFO. DOW ONE, NM Sheet No. Contractor NORTHERN DRILL SERVICE, INC. Start 21 July 2023 Type Casing Sampler Barrel Drilling Equipment and Procedures Processor Type G Barrel Processor Sampler Barrel Drilling Equipment and Procedures Processor Type G Barrel Processor Costing: None Elevation 54.0 (est.) Datum NAUTO - Casing: None Location: See Plan Hammer Fail (n.) AUTO - Costing: None Casing: None Costing: None																			
Carbon Children GEOPROBE REPORT Project MASCONOMET FIELD RENOVATIONS, BOXFORD, MA File No. 0.207135-000 Client STANTEC Sheet No. 1 of 1 Contractor NORTHEEN DRILL SERVICE, INC. Site 21 July 2023 Type G Rig Make & Model: Geoprobe 6712DT Finish 21 July 2023 Inside Diameter (in.) 1.5 Drill Mud: None Elevation 54.0 (est.) Harmer Weight (b) AUTO - Casing: None Elevation 54.0 (est.) Harmer Fall (n.) AUTO - Casing: None Location See Plan Harmer Veight (b) AUTO - Casing: None Location See Plan Harmer Fall (n.) AUTO - Casing: None Location See Plan Visual-Manual IDENTIFICATION AND DESCRIPTION Gravel Sand Field Te Q P G G SM Dark brown sity SAND (SM), no structure, slight organic color, moist, 10% to Visual-Manual Dentrification not brown (SM), no structure, no odor, dry to moist, 15% cobbles 5 10 10 10 10 45 20 - Visual-Manual Dentrification poorty-graded SAND (SP), rins structure, no odor, dry to moist, 15% cobbles																			
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0 -						Dark brown		,	% to	%							F	۵.	
	Ŭ			0.4			oots and plant matter	gamo odor, moist, 10		5									t
						Dark brown		dry to moist, 15% cobb	les										
	P G2 5.0 U 60 10.0 S H H 47.3 6.7 SP Orange to tan poorly-graded SAND (SP), no structure, no of -GLACIOLACUSTRINE DEPOSITS-46.0 8.0 SP Tan to light brown poorly-graded SAND (SP), frequently be																		
Orient Drink Tool Start 21 at 21 a																			
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					aaniy		S - Splitspoon Sample	์				(11)			- G2	2			
								Concrete Bentonite Seal	Borir	ng	No).			G	P- 4	1		
	d Tests		1	Dilatanc		Rapid S - Slov	N Nono Plasticity	N - Nonplastic L - Lov	N M Mc	diu	m F	I - H	iah						_

Н		PRIC	Η			GEO	PROBE REPOR	Т		B	orir	ng I	No.		G	iP-	5	
Proj Clie Cor		ST	ANT	EC		RENOVATIO	NS, BOXFORD, MA			File She Star	et N	o. 1	207 of 1 Ju	1				-
				Casing	Sam		Drilling Equipme	nt and Procedures		Finis Drille		2	21 Ju 6. SI	uly 2	2023			
Туре	е				G		Rig Make & Model: Ge Bit Type: Geoprobe Sp		-	H&A								_
Ham	nmer V	meter (Veight ⁻ all (in.	(lb)		1.5 AUT	-	Drill Mud: None Casing: None Hoist/Hammer: Winch PID Make & Model: No	Automatic hammer		Elev Datu Loca	m	Ν	4.0 IAV See	D86	3			-
ft)	lows	, Č	e 🗄	i (ii)	Symbol	vis	UAL-MANUAL IDENTIFICATIO		H	Grav	-	San			F	ield ၈	Tes	s T
Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample	Stratum Change Elev/Depth (ft)	USCS Syr	(D	ensity/consistency, color, GRC structure, odor, moisture, op GEOLOGIC INTERPF	tional descriptions		% Coarse	% Coarse	% Medium	% Fine	% Fines	Dilatancy	Toughness	Plasticity	
0 -	P U S	G1 43	0.0 5.0) 53.5	SM SM	20% grass roc	ty SAND (SM), no structure, sli ts and plant matter -TOPSOIL			5 5			40 45	30 15				
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				44.0														
10				10.0			BOTTOM OF EXPLORA	TION 10.0 FT										
		W	ater l	Level Data	ца		Sample ID	Well Diagram			Su	mma	ary_					
Da	ate	Time	Ela	apsed	Deptl ottom	n (ft) to: ^{Bottom} of Hole	O - Open End Rod T - Thin Wall Tube U - Undisturbed Sample	□□ Riser Pipe □□ Screen □□ Filter Sand Image: Street S	Overb Rock	Core	n (f	t)		0.0 - G2				
							S - Splitspoon Sample G - Geoprobe	Grout Grout Concrete	Sampl Borir		lo.			-	<u>^</u> P-5	5		
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Pro Clie	-	ST	ANT	EC			ONS, BOXFORD, MA		:	She		No. '	1 of	1	5-00			
Cor	ntracto	or NC	DRTH	IERN DR	ILL SEF	RVICE, INC.	Drilling Equipme	nt and Procedures		Sta Fini Dril	ish	2	21 J	•	202 202			
Тур	е		_	Casing	G		Rig Make & Model: Ge	oprobe 6712DT				ep. I						
Insic	de Diar	meter (in.)		1.5		Bit Type: Geoprobe Sp Drill Mud: None	oon			vati um	on () (es /D88				
	nmer F	Veight Fall (in.			AUT	0 -	Casing: None Hoist/Hammer: Winch PID Make & Model: No	Automatic hammer t used		Loc	catio	on (See	Pla	n			
(Ħ)	Blows in.	: No. (in.)	ole (#)	tige a line	Symbol	VIS	SUAL-MANUAL IDENTIFICATIO	ON AND DESCRIPTION	-	Gra v	-	Sar v E	_	-		ield S		T
Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample	Stratum Change Elev/Depth (ft)	USCS S	(D	Density/consistency, color, GRO structure, odor, moisture, op GEOLOGIC INTERPF	ional descriptions	:	% Coarse	% Fine	% Coarse % Medium	% Fine	% Fines	Dilatancy	Toughness	Plasticity	
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	S H		5.0	53.0 1.0	SM		-TOPSOIL- nd tan silty SAND with gravel (S			5	5	5 25	5 45	15				ł
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			FI	Level Data		(ft) to:	Sample ID O - Open End Rod	Well Diagram	Overbu	urde		umm (ft)		0.0				-
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							S - Splitspoon Sample G - Geoprobe	ितं. Cuttings Grout	Sample					G				_
								Concrete Bentonite Seal	Borin	-				G	iP-6	3		-
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CO	Illacio						Drilling Equipme	nt and Procedures	F	inis rille	h	2		uly 2	2023			
Туре	е			<u> </u>								р. F						
Insid	le Diar	neter (i	n.)		1.5	5	Drill Mud: None	boon		ilev atu		n 5 N	64.0 JAV					
	nmer F	0	` ´			FO - -	Hoist/Hammer: Winch	Automatic hammer ot used	L	002	ition	S	See	Plar	ו			
(ft)	Blows in.	No. (ii)	ele (#)	the filler (iii)	/mbol	VISU	JAL-MANUAL IDENTIFICATI	ON AND DESCRIPTION		rave		San	-			ield S		
Depth	Project MASCONOMET FIELD RENOVATIONS, BOXFORD, MA Clent STANTEC Contractor NORTHERN DRILL SERVICE, INC. Type G Barrel Dnilling Equipment and Procedures Type G Rig Make & Model: Geoprobe 6712DT Bt Type: Geoprobe 5000 Hammer Fall (In.) AUTO - Casing: None Hammer Fall (In.) AUTO - Casing: None 1 Strate Strate Strate 0 Strate Strate Strate 10 Strate Strate Strate	% Coarse	% Eine	% Coarse	% Medium	% Fine	% Fines	Dilatancy	Toughness	Plasticity								
- 0 -	P U)			ts and plant matter		6 to	5	5 5	20	40	30				
						Gray to black fi												
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- 5 -		- 00					-GLACIOLACUSTRINE	E DEPOSITS-										
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10				44 0		moist												
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D	ate	Time		hr) Bo	ottom	Bottom Water	T - Thin Wall Tube	Screen	Rock C		•	·	1(0.0 -				
							S - Splitspoon Sample	Grout	Sample	s				G2				-
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Field	d Tests	s:					N - None Plast	icity: N - Nonplastic L - Lov	/ M - Medi	um _.	Н-	High						

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Clie	ent	MASCONOMET FIELD RENOVATIONS, BOXFORD, MA STANTEC NORTHERN DRILL SERVICE, INC. Casing Sampler Barrel Drilling Equipment and Procedures Casing Sampler Barrel Drilling Equipment and Procedures Diameter (in.) Casing Sampler Barrel Drilling Equipment and Procedures Diameter (in.) G 1.5 Rig Make & Model: Geoprobe Spoon Drill Mud: None ar Weight (lb) G 1.5 AUTO - Geographic field Geographic field Optimic field Optimic field Geographic field Geographic field Geographic field Optimic field Geographic field Geographic field Geographic field Optimic field Geographic field Geographic field Geographic field Geographic field Geographic field Geographic field						Sh Sta	eet art	No	. 1 2'	of 1 Ju	1 ly 2	2023	3						
			MASCONOMET FIELD RENOVATIONS, BOXFORD, MA STANTEC NORTHERN DRILL SERVICE, INC. Casing Sampler Barrel Drilling Equipment and Procedure Bit Type: Geoprobe 6712DT Bit Type: Geoprobe Spoon Drill Mud: None Casing: None Hoist/Hammer: Winch Automatic hamn PID Make & Model: Not used (in.) Image: Color of the transmer: tra		rocedures								2023	3							
Tvn	e	GEOPROBE REPORT Interview of the standard			Rep				y												
VELORICET MASCONOMET FIELD RENOVATIONS, BOXFORD, MA File No. 0.007135-000 Contract STANTEC Start 21 July 2023 Start 21 July 2023 Type Casting Sample Barrel Diffing Equipment and Proceedures Priler S. Show Type Casting Simulation Casting Simulation Priler S. Show Type G Bit Type: Geode/Spoon Casting None Elevation 54.0 (est.) Hammer Yeall (in) 1.5 Diff Med. Note: Casting: None Elevation 54.0 (est.) Bit Type: Geode/Spoon Casting: None Casting: None Elevation 54.0 (est.) Elevation 54.0 (est.) Hammer Yeall (in) Auro - Casting: None Elevation 54.0 (est.) Elevation 54.0 (est.) Bit Start (in) Auro - Casting: None Start (in) Elevation 54.0 (in) Elevation 54.0 (in) Bit Start (in) Auro - Casting: None Start (in) Elevation 54.0 (in) Elevation 54.0 (in) Bit Start (in) Start (in) S																					
Check GEOPROBE REPORT Contractor Contractor Contractor Contractor MascConcomer Field Renovations, BOXFORD, Ma Contractor NORTHERN ORILL SERVICE, INC. Flie No. 101 / 1 Start 21 July 2023 Type Casing Sampler Barrel Diffing Equipment and Procedures Finish 21 July 2023 Type Casing Sampler Diffing Equipment and Procedures Finish 21 July 2023 Type G Rig Make & Model: Gaptable 61/2017 Barrel Particle Provide Store Particle Provide Provide Store Particle Provide																					
	nmer F	all (in.	` ´				-	Hoist/Hammer: Winch	Automat used	tic hammer					_		lan				_
(Ħ	Blow: n.	No.) (in.)	ele (ff	ња –	oqu		VISU	UAL-MANUAL IDENTIFICATIO	N AND D	ESCRIPTION			avel				-		ŝ		
Depth	Sampler I per 6	Sample & Rec.	Samp Depth	Stratu Chanç Elev/Dep	JSCS S		(De	structure, odor, moisture, opti	onal des	criptions		% Coars	% Fine	% Coars	% Mediu	% Fine	% Fines	Dilatancy	Toughne	Plasticity	
0 -	P U	G1			SM			ts and plant matter	ht organi	ic odor, moist, 10			5	5	20	40	30			_	=
								brown silty SAND (SM), no struc	cture, slig	ght organic odor, i	/ noist,										
			50.8 5% to 10% asphalt fragments, trace brick 50.8 -FILL- 3.2 SP Tan poorly-graded SAND (SP), occasional layer, no odor, drg -G2 5.0 60 10.0 46.7																		
		G1 0.0 53.5 SM Dark brown silty SAND (SM), no structure, slight organic odor, moist 20% grass roots and plant matter 50 5.0 5.0 SM SM 20% grass roots and plant matter -TOPSOIL- Brown to light brown silty SAND (SM), no structure, slight organic od 5% to 10% asphalt fragments, trace brick 50.8 3.2 SP Tan poorly-graded SAND (SP), occasional layer, no odor, dry G2 5.0 60 10.0 46.7 -GLACIOLACUSTRINE DEPOSITS- G2 5.0 SP Tan to light brown poorly-graded SAND (SP), frequently bedded, no of moist G2 5.0 SP Tan to light brown poorly-graded SAND (SP), frequently bedded, no of moist G2 5.0 SP Tan to light brown poorly-graded SAND (SP), frequently bedded, no of moist	or, dry					10	85	5											
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GEOPROBE REPORT File No. 0207135-000 Sheet No. 1 of 1 Sheet No. 1 Sheet No. 1 of 1 Sheet No. 1 Sheet No. 1 of 1 Sheet No. 1 Shet No. 1 Sheet No. 1 Sheet No. 1 Sheet No. 1 Shet No. 1																			
GEOPROBE REPORT Project MASCONOMET FIELD RENOVATIONS, BOXFORD, MA Client STANTEC Contractor NORTHERN DRILL SERVICE, INC. Type G Inside Diameter (in.) Barrel Drilling Equipment and Procedures Frish Drillometer (in.) AUTO - Casing Marrer G Bit Type: G Casing: None Hammer Veight (lb) AUTO - Casing: None Casing: Hammer Fall (in.) - Visual-MANUAL DENTIFICATION AND DESCRIPTION Gravel Set Stat Stat Visual-MANUAL DENTIFICATION AND DESCRIPTION Gravel Set Stat Stat U Stat Stat Stat Visual-MANUAL DENTIFICATION AND DESCRIPTION Stat Set Stat Stat O P G1 0.0 Stat Stat Stat Stat Stat Stat Stat Stat O P G1 0.0 Stat Stat Stat Stat Stat																			
Product GEOPROBE REPORT Product Project MASCONONET FIELD RENOVATIONS, BOXFORD, MA File No. 0007135-000 Clerent STATTEC Contractor NORTHERN DRILL SERVICE, INC. Type Casing Sampler Barrel Drilling Equipment and Procedures Inside Dameter (in) 1.5 File No. Output None Hammer Veight (ib) AUTO - Casing Sampler Elevation Hammer Veight (ib) AUTO - Casing None Casing Sampler Elevation None Hammer Veight (ib) AUTO - Casing None Elevation None Casing Sampler Elevation None Elevation None Casing Sampler Elevation None Casing Sampler Elevation Sa																			
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0 -			0.0						ht organic odor, n	oist, 10% to	-	-	-	_			+	+	
		U 51 5.0 S 50 H 51 51 5.0 S 52.1 1.9 52.1 SM Medium dense dark brown to orange silty SAND (SM), no structure organic odor, moist, 10% grass roots and surface organics -FILL- 50.0 4.0 SP Orange to tan poorly-graded SAND (SP), no structure, no odor, dr -GLACIOLACUSTRINE DEPOSITS- 60 10.0 47.4 6.6 SP Tan to light-brown poorly-graded SAND (SP), infrequently bedded to moist -GLACIOLACUSTRINE DEPOSITS-																	
	н			52.1	SM	Mor	tium donco		D (SM) po struct	uro clight	5	5	5	25	45	15			
		And Wolghit (Ib) Image: Pick Formula Image: Pick Formula <td></td> <td>ire, siigni</td> <td>5</td> <td>5</td> <td></td> <td>20</td> <td>45</td> <td>15</td> <td></td> <td></td> <td></td>			ire, siigni	5	5		20	45	15								
Client STANTEC Contractor NORTHERN DRLL SERVICE, INC. Type Client Casing Sampler Barrel Drilling Equipment and Procedures Type Client Casing Sampler Barrel Drilling Equipment and Procedures Type Garder (in.) AUTO Client																			
	ructure, no odor,	dry			5	10	80	5		+	+								
5 -	je Diameter (in.) 1.5 mmer Weight (ib) AUTO - mmer Fall (in.) - ge je	DEPOSITS-																	
Casing Sampler Barrel Drilling Equipment and Procedures Type Inside Diameter (in.) Hammer Veight (ib) AUTO - Casing: None Casing: None Hammer Veight (ib) AUTO - - Casing: None Hammer Fall (n.) AUTO - - House & Model: Not used Image:																			
Collision Textminute Status Collection Status Colspan="2">Type Index Diameter (in.) G 1.5 Bit Type: Geoprobe Spoon Eleven Hammer Fall (in.) AUTO - Casing: None Date Date (i) G S Bit Type: Geoprobe Spoon Diffuence: Winch Automatic hammer Diffuence: Winch Automatic hammer Hammer Fall (in.) AUTO - Casing: None Casing: None Casing: None (i) G G G S S G G G (i) G G G G G G G G (i) G G G G G G G G (i) G G G G G G G G (i) G G G G G G G G (i) G G G G G G G G (i) G G G G G G G G (i) G G G G G G G G (i) G G G <td>+-</td> <td></td> <td></td> <td>100</td> <td>-+</td> <td>-+</td> <td>-+-</td> <td>+</td>	+-			100	-+	-+	-+-	+											
	Pint Part (III.) Pint Make & Model: Not use 0																		
		C1 0.0 51 0.0 5.0 SM Dark brown silty SAND (SM), no structure, slight organic c 20% grass roots and plant matter 1 5.0 52.1 50.0 52.1 SM Medium dense dark brown to orange silty SAND (SM), no organic odor, moist, 10% grass roots and surface organic 50.0 50.0 50.0 60 10.0 40 SP Orange to tan poorly-graded SAND (SP), no structure, no 51.0 60 10.0 47.4 6.6 SP Tan to light-brown poorly-graded SAND (SP), infrequently to moist 44.0 10.0 BOTTOM OF EXPLORATION 10.0 F 44.0 10.0 BOTTOM OF EXPLORATION 10.0 F	DEPOSITS-																
10 -		P G1 0.0 51 5.0 SM Dark brown silty SAND (SM), no structure, sil 20% grass roots and plant matter SH 51 5.0 52.1 -TOPSOIL -TOPSOIL SM SM Medium dense dark brown to orange silty SA organic odor, moist, 10% grass roots and su -FILL- SN SP Orange to tan poorly-graded SAND (SP), no -FILL- SN 47.4 SP Orange to tan poorly-graded SAND (SP), no SH 47.4 SP Tan to light-brown poorly-graded SAND (SP) to moist G0 10.0 47.4 SP Tan to light-brown poorly-graded SAND (SP) to moist G1 G0 10.0 BOTTOM OF EXPLORA -GLACIOLACUSTRINE G1 G0 10.0 BOTTOM OF EXPLORA -GLACIOLACUSTRINE G1 G0 BOTTOM OF EXPLORA Sample ID -GLACIOLACUSTRINE G1 G1 G1 G1 G1 -GLACIOLACUSTRINE G1 G1 G1 G1 G1 G1 G1 G2 G1 G1 G1 G1 G1 G1 G1 G2 G1 <td>TION 10.0 FT</td> <td></td>		TION 10.0 FT															
		Value G Rig Make & Model: Geoprobe 5/12DT Diameter (in.) I.5 AUTO - Bit Type: Geoprobe Spoon Diameter (in.) I.5 AUTO - Casing: None Hoist/Hammer: Winch Automatic hammer Pill Muke & Model: Not used MUTO - Casing: None Hoist/Hammer: Winch Automatic hammer Pill Git																	
		44.0 10.0 BOTTOM OF EXPLORATION 1																	
Water Level Data			Sample ID	Well Diag	am		۱ ٤	⊥ Sum	nma	ry	-			-					
D	ate	Time		(hr) BO	ttom	Bottor	n			. 0			• • •		10	0			
			1 11116	• (III.) of C	asing	of Hol	e vvater	U - Undisturbed Sample	Filter S	Sand Ro			(ft))		- 62			
									Grout		•		<u>ר</u>			-	0_9		
Field	d Tooto			Dilatano	w: R -	Rapid	S - Slow	N - None Plastic	Bentor	ite Seal				liah					
	. 10515														/ - Ve	ry Hi	gh		

н		RIC	ASCONOMET FIELD RENOVATIONS, BOXFORD, MA TANTEC ORTHERN DRILL SERVICE, INC. Casing Sampler Barrel Drilling Equipment and Procedures (in.) G Rig Make & Model: Geoprobe 6712DT (in.) G 1.5 Drill Mud: None (in.) AUTO - Casing: None (ib) AUTO - Casing: None 1.) Egge of the second seco					Во	rin	g N	lo.		GF	P-1	0					
Clie	nt	ST.	ASCONOMET FIELD RENOVATIONS, BOXFORD, MA TANTEC ORTHERN DRILL SERVICE, INC. Casing Sampler Barrel Drilling Equipment and Proced (in.) (ib) AUTO - Rig Make & Model: Geoprobe 6712D Bit Type: Geoprobe Spoon Drill Mud: None Casing: None Hoist/Hammer: Winch Automatic har PID Make & Model: Not used VISUAL-MANUAL IDENTIFICATION AND DESCF (Density/consistency, color, GROUP NAME & SY structure, odor, moisture, optional description GEOLOGIC INTERPRETATION) 0.0 5.0 0.4 48.4 2.6 47.0 4.0 5.0 0.0 0						Sł St	neet art	No	. 1 24	of 4 Ju	1 ly 2	023	3				
			SCONOMET FIELD RENOVATIONS, BOXFORD, MA ANTEC RTHERN DRILL SERVICE, INC. Casing Sampler Barrel Drilling Equipment and Proce n.) G Rig Make & Model: Geoprobe 67121 bit Type: Geoprobe Spoon Drill Mud: None 1.5 Drill Mud: None AUTO - Casing: None Hoist/Hammer: Winch Automatic h - PID Make & Model: Not used - PID Make & Model: Not used - VISUAL-MANUAL IDENTIFICATION AND DESC - Octor Clensity/consistency, color, GROUP NAME & S - SP Orark brown silty SAND (SM), no structure, slight organic oc - SP Dark brown silty SAND (SM), no structure, slight organic oc - - COSOIC - SP Orange to tan poorly-graded SAND (SP), infrequently layer - SP Orange to tan poorly-graded SAND (SP), frequently be - - - - SP Light-brown to tan poorly-graded SAND (SP), frequently be - - - - - <td>nt and Procedure</td> <td>3</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td>023</td> <td>3</td> <td></td> <td></td>					nt and Procedure	3							023	3			
Τγρε	е		MASCONOMET FIELD RENOVATIONS, BOXFORD, MA STANTEC NORTHERN DRILL SERVICE, INC. Casing Sampler Barrel Drilling Equipment and Procedures r (in.) I.5 Rig Make & Model: Geoprobe 5712DT Bit Type: Geoprobe Spoon Drill Mud: None Casing: None Int (ib) Bit Type: Geoprobe Spoon Drill Mud: None Casing: None PID Make & Model: Not used is is is is is is is is is is is is is is is is is is is is is is is is is is is is					_						у						
	ALLPHOLT File No. C207/135-000 right MSCONOMET FIELD RENOVATIONS, BOXFORD, MA STANTEC File No. C207/135-000 ontractor NORTHERN DRILL SERVICE, INC. Service Service Service rpp Casing Sampler Barre Drilling Equipment and Procedures Hish 24 July 2023 rpp G Intermeter Intermeter Service Bit Type: Casing: Intermeter HisA Rep. F. Tierney side Diameter (Int) AUTO - Casing: Intermeter Casing: Intermeter Bit Type: Casing: Intermeter Intermeter Casing: Intermeter Interme																			
		0	MASCONOMET FIELD RENOVATIONS, BOXFORD, MA STANTEC JORTHERN DRILL SERVICE, INC. Image: Casing Sampler Barrel G Barrel Drilling Equipment and Proc Grin, J. 5 Image: Casing G G G G Gring Sampler Barrel G Bit Type: Geoprobe Spoon In, J. 5 Image: G G G G Gring Sampler Barrel Drill Mud: None Casing: None HoisUHammer: Winch Automatic PD DMake & Model: Not used Image: G G G G G G G G G G G G G G G G G G G					Automatic hamm	er											
Ham			MASCONOMET FIELD RENOVATIONS, BOXFORD, MA STANTEC NORTHERN DRILL SERVICE, INC. casing Sampler Barrel Drilling Equipment and Procedu ar (in.) G Rig Make & Model: Geoprobe 6712DT bit Type: Geoprobe 5000 Drill Mud: None (in.) AUTO - Hoist/Hammer: Winch Automatic har (in.) - PID Make & Model: Not used VISUAL-MANUAL IDENTIFICATION AND DESCR (in.) - - VISUAL-MANUAL IDENTIFICATION AND DESCR (in.) - - VISUAL-MANUAL IDENTIFICATION AND DESCR (in.) - - VISUAL-MANUAL IDENTIFICATION AND DESCR (Density/consistency, color, GROUP NAME & SY SP Comparison of the color of the						t used		Gr	avel		Sand	4		Fi	ald	Tec	
(Ħ	Blow	e No . (in.)	III (III.) - PID Make & Model: Not used O (: :) • • • • • • • • • • • • • • • • • • •									-				1	ŝ		Γ	
Depth	ampler per 6	G1 0.0 50.6 SM Dark brown silty SAND (SM), no structure, slight organic odor 48 5.0 0.4 SP 20% grass roots and plant matter 20% grass roots and plant matter -TOPSOIL- Light brown poorly-graded SAND with gravel (SP), no structure trace asphalt, trace grass roots, trace brick -FILL- 48.4 2.6 SP Orange to tan poorly-graded SAND (SP), infrequently layered, -GLACIOLACUSTRINE DEPOSITS-				ional descriptions	DL,	% Coar	% Fine	% Coar	% Medi	% Fine	% Fines	Dilatano	Toughness	Plasticity	i			
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			eight (lb) all (in.) AUTO - Casing: None Hoist/Hammer: Winch Automatic ham PID Make & Model: Not used \vec{O} (i) \vec{O} (i) \vec{O} (i) \vec{O} (i) \vec{O} (ii) \vec{O} (iii) \vec{O} (iiii) \vec{O} (iiiii) \vec{O} (iiiiii) \vec{O} (iiiiiii) \vec{O} (iiiiiii) \vec{O} (iiiiiii) \vec{O} (iiiiiii) \vec{O} (iiiiiii) \vec{O} (iiiiiii) \vec{O} (iiiiiii) \vec{O} (iiiiii) \vec{O} (iiiiiii) \vec{O} (iiiiiii) \vec{O} (iiiiiii) \vec{O} (iiiiiiii) \vec{O} (iiiiiii) \vec{O} (iiiiiii) \vec{O} (iiiiii) \vec{O} (iiiiii) \vec{O} (iiiiiii) \vec{O} (iiiiiii) \vec{O} (iiiiii) \vec{O} (iiiiii) \vec{O} (iiiiiii) \vec{O} (iiiiii) \vec{O} (iiiiiii) \vec{O} (iiiiii) \vec{O} (iiiiii) \vec{O} (iiiiii) \vec{O} (iiiiiii) \vec{O} (iiiiiii) \vec{O} (iiiiii) \vec{O} (iiiiii) \vec{O} (iiiii) \vec{O} (iiiiii) \vec{O} (iiiii) \vec{O} (iiiiii) \vec{O} (iiiii) \vec{O} (iiii) \vec{O} (iiii) \vec{O} (iiiii) \vec{O} (iiii) \vec{O} (iiiii) \vec{O} (iiii) \vec{O} (iiii) \vec{O} (iiii) \vec{O} (i			DEPOSITS-	-													
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	ect MASCONOMET FIELD RENOVATIONS, BOXFORD, MA File No. 02071 nt STANTEC Start 24 Jul tractor NORTHERN DRILL SERVICE, INC. Start 24 Jul Casing Sampler Barrel Drilling Equipment and Procedures e Casing Sampler Barrel Drilling Equipment and Procedures e G Rig Make & Model: Geoprobe 6712DT bit Type: Geoprobe Spoon Drill Mud: None H&A Rep. F. Tie Elevation 51.0 Drill Mud: None Datum NAVE Marce Fall (in.) AUTO - Casing: None Hoist/Hammer: Winch Automatic hammer vig uad output of the structure, odor, moisture, optional descriptions Gravel Sand mer Weight (lb) Image brief of the structure, odor, moisture, optional descriptions Gravel Sand mer Fall (in.) Image brief of the structure, odor, moisture, optional descriptions Gravel Sand Image brief of the structure, odor, moisture, optional descriptions Gravel Sand Image brief of the structure, odor, moisture, optional descriptions Gravel Sand Image brief of the structure, odor, moisture, optional descriptions Gravel Sand Image brief of the structure Gravel Sand Gravel Gr				023	3														
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Clie	GEOPROBE REPORT Image: Contractor MASCONOMET FIELD RENOVATIONS, BOXFORD, MA Start STANTEC Start 24 July 2023 Contractor NORTHERN DRLL SERVICE, INC. Image: Casing Sampler Barrel Dilling Equipment and Procedures Side Diameter (in.) G Bit Type: Geoprobe 5000 Finish 24 July 2023 Dilli Mud: None Dilli Mud: None Elevation 51.0 (est.) Dammer Fall (in.) AUTO - Geoprobe Spoon Dilli Mud: None Casing: None Hoist/Hammer: Winch Automatic hammer PID Make & Model: Not used Carting: None Geoprobe Group Group Group Geoprobe Group Group Group Geoprobe Group Group Group Geoprobe Group Group Geoprobe Group Group Dill Mud: None Casing: None Hoist/Hammer: Winch Automatic hammer Elevation Store PID Make & Model: Not used GeoLoGOC INTERPRETATION Operating Group Group Geologic Group Geologic Group SM Darkbrown alth SAND (SM) no structure, optional descriptions Geologic Group SM Darkbrown alth SAND (SM) no structure, no odor, dry, trace asphalt, trace grass rods, trace brick																				
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Date Time Elapsed Depth (ft) to: O - Open End Rod Image: Constraint of Using Section Overburden (ft) 10.0 Time Image: Constraint of Using Section Bottom Water T - Thin Wall Tube Image: Constraint of Using Section Overburden (ft) 10.0																					
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Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample	Stratum Change Elev/Depth (ft)	USCS Syr		(Dei	nsity/consistency, color, GRO structure, odor, moisture, opt GEOLOGIC INTERPR	ional descriptions		% Coarse	% Fine	% Coarse	% Medium	% Fine % Einos	Dilatancv	Toughness	Plasticity	
- 0 -	P U S	G1 40	0.0 5.0) 50.5	SM SP			/ SAND (SM), no structure, slig s and plant matter -TOPSOIL-	ght organic odor, moist, 10			5	5	20	40 3 75 1	0			-
	Н			48.6		Light bro trace gra	•	orly-graded SAND (SP), no struss	ucture, no odor, dry, trace a	asphalt,									
				2.4	SP	Orange	to tan p	-FILL- oorly-graded SAND (SP), no s	tructure, no odor, dry				5	10	80 5	5			
								-GLACIOLACUSTRINE	DEPOSITS-										
- 5 -	P U S H	G2 54	5.0 10.0																
-				43.5 7.5	- -	Gray-bro	own to t	an poorly-graded SAND (SP),	frequently bedded, no odo	, moist				5	95	+			
								-GLACIOLACUSTRINE		-									
· 10 –				41.0				BOTTOM OF EXPLORA	TION 10.0 FT					_					
			-4																
	ota		F	Level Data	Dept	n (ft) to:		Sample ID O - Open End Rod	Well Diagram	Overb	our		<u>Sum</u> (ft)	mar	y 10.0)			
D	ate	Time		hr Bo		Bottom of Hole	Vater	T - Thin Wall Tube U - Undisturbed Sample	Screen Filter Sand	Rock	Co	red	• •		10.0				
								S - Splitspoon Sample G - Geoprobe	<u>क्षि</u> Cuttings Grout	Samp						32			
Field	d Ta-+-			Dilatary		Rapid S -	Slow N		د کے گی Concrete Bentonite Seal city: N - Nonplastic L - Lo	Borii				ah	G	βP-′	13		_
rielo	d Tests	5:		Toughn	ess: L	Low M-	Medium		rength: N - None L - Low						- Very	/ Higl	1		_

HAL	EY DRIC	H				GEO	PROBE REPOR	г			Boi	rin	g N	lo.		GF	- 1	4
Project Client Contrac	S	TANTE					NS, BOXFORD, MA			Sł	e No leet art		. 1	207 [,] of 4 Ju	1		-	
Contract			Casing	Sam		Barrel	Drilling Equipmen	t and Procedures			nish iller			4 Ju . Sh		023	3	
Hammer Hamme	-	(lb)		G 1.: AU ⁻	5	-	Rig Make & Model: Geo Bit Type: Geoprobe Spo Drill Mud: None Casing: None Hoist/Hammer: Winch PID Make & Model: Not	oon Automatic hammer		El Da		ion 1	5 ⁻ N	. Tie 1.0 AV[ee F	(es)88	t.)		
Depth (ft) Sampler Blows	Sample No. & Rec. (in.)	Sample Depth (ft)	Stratum Change Elev/Depth (ft)	USCS Symbol			JAL-MANUAL IDENTIFICATIO ensity/consistency, color, GROL structure, odor, moisture, opti GEOLOGIC INTERPRI	JP NAME & SYMBOL, onal descriptions		% Coarse	% Fine	% Coarse	% Medium 8	Fine	% Fines		ŝ	Plasticity
0 P U S	G1 58	0.0 5.0		SM			y SAND (SM), no structure, slig s and plant matter -TOPSOIL-	ht organic odor, moist,	10% to		5	5	20	40				
				SP			d brown poorly-graded SAND (race grass roots, trace brick -FILL-	SP), no structure, no ode	or, dry,			5	10	75	10			
			2.8	SP	Orar	ige to tan p	- ILL- poorly-graded SAND (SP), infre -GLACIOLACUSTRINE I		, dry			5	10	80	5			
S	P G2 5.0 U 60 10.0 S H 44.0		Light	brown to t	tan poorly-graded SAND (SP), f		lor, moist				5	95						
. 10	E P G1 0.0 5.0 SM Dark brown si H 58 5.0 49.3 SP Light brown at trace asphalt, H 58 5.0 49.3 SP Orange to tan P G2 5.0 49.3 SP Orange to tan P G2 5.0 10.0 SP Orange to tan H I I I SP Orange to tan P G2 5.0 10.0 SP Light brown to H I I I SP Orange to tan I I I I I I I I I I I I I I I I </td <td></td> <td>BOTTOM OF EXPLORAT</td> <td>TION 10.0 FT</td> <td></td>		BOTTOM OF EXPLORAT	TION 10.0 FT														
Date	e Time Elapsed Depth (ft) to: O - Open End Rod Elapsed Screen	Overi Rock Sam	Co bles	den red	(ft) (ft)	ıma	10	- G2	14	1								
Field Te	sts:					S - Slow M - Mediur		Bentonite Se ity: N - Nonplastic L - rength: N - None L - Lo	al∣ Low M-M	ediu	m ŀ	1 - H					•	

Н		RIC	н				GEO	PROBE REPORT	Г			I	301	rinș	g N	lo.		GP	-15	;
Proj Clie Cor		ST	ANTE	С			NOVATIO	NS, BOXFORD, MA				Sh Sta	art	No.	. 1 24	2071 of 4 Jul	1 y 2(023		
			(Casing	Sam	pler	Barrel	Drilling Equipmen	t and Pr	ocedures			iish Iler			4 Jul . Sha		023		
Тур	е				G	;		Rig Make & Model: Geo		712DT				Rep		. Tie		/		
		neter (i	n.)		1.	5		Bit Type: Geoprobe Spo Drill Mud: None	on				evat itum			1.0 (AVE		.)		
		/eight(all (in.)	· /		AU	го	-	Casing: None Hoist/Hammer: Winch , PID Make & Model: Not	Automat	ic hammer			cati			ee P				
t)	SWC	oʻr		(£	lod		VISI	JAL-MANUAL IDENTIFICATIO		ESCRIPTION		Gra	avel	ç	Sand	ł			ld T	est
Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	Stratum Change Elev/Depth (ft)	USCS Symbol			ensity/consistency, color, GROL structure, odor, moisture, opti GEOLOGIC INTERPRI	IP NAME	& SYMBOL, criptions		% Coarse	% Fine	% Coarse	% Medium	% Fine	% Fines	Dilatancy +	l ougnness	Strongth
0 -	P U	G1 43	0.0 5.0		SM			y SAND (SM), no structure, slig s and plant matter -TOPSOIL-	ht organi	c odor, moist, 10	% to		5	5		40 ;	_			
	H			49.6 1.4	SP	Ligh	nt brown to	tan poorly-graded SAND (SP), f	requently	/ bedded, no odor	, moist				5	95	+		-	+
		P G1 0.0 J 43 5.0 S 1.4 P G2 5.0 J 45 10.0				-GLACIOLACUSTRINE I	DEPOSIT	ГS-												
5 -																				
10 -																				
		U 45 10.0 S H H H																		
		Time Elapsed Depth (ft) to: O - Open End Rod Time Screen											\perp							
D	ate		Elapsed Time Depth (ft) to: O - Open End Rod IIII Riser Pipe Time (hr.) Bottom of Casing Bottom of Hole Water O - Open End Rod IIII Riser Pipe U - Undisturbed Sample S - Splitspoon Sample Cuttings	Overt Rock		len	(ft)		r <u>y</u> 10.	0										
								S - Splitspoon Sample	9. gi ø .i .i .	Cuttings	Samp			. /			G2			
Fiol	d Tests			Dilatano	v : R-	Rapid	S - Slow	G - Geoprobe	ity: N-	Concrete Bentonite Seal Nonplastic L - Lo	Bori				ligh	(GΡ	-15		
reic	I I USTS							m H - High Dry Sti		Nonplastic L-Low						' - Vei	у Ні	gh		

Н		RIC	н				GEO	PROBE REPOR	г			I	Boi	ring	g N	lo.		GF	- -1	6	
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				Casing	Sam		Barrel	Drilling Equipmen	t and P	rocedures			nish iller			4 Jul . Sha		023	3		
Tun				Jasing			Darrei	Rig Make & Model: Geo						Rep		. Sna . Tie		v			
Тур					G			Bit Type: Geoprobe Spo					evat					<u>,</u>			
		neter (i Veight (<i>'</i>		1.5 AUT	-		Drill Mud: None Casing: None					tum			AVE					
	nmer F	all (in.)	· /		_		-	Hoist/Hammer: Winch PID Make & Model: Not	Automa used	tic hammer		LO	cati	on	S	ee P	lan				
(ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	(Ħ)	Stratum Change Elev/Depth (ft)	Symbol		VISU	JAL-MANUAL IDENTIFICATIO	n and i	DESCRIPTION		-	avel		Sanc E	ł			eld ୪		Γ
Depth (ft)	oler E er 6 i	aldr ec. (Sample Depth (ft)	hang Dept	s sy		(De	ensity/consistency, color, GROU structure, odor, moisture, opti		E & SYMBOL,		Coarse	Fine	Coarse	% Medium	Fine	Fines	Dilatancy	Toughness	Plasticity	
De	Samp	San & R	ω θ	Elevo	nscs			GEOLOGIC INTERPR	ETATIO	N)		Ŭ %	% Fi	Ŭ %	% M	% Fi	% Fi	Dilat	Toug	Plas	1
0 -	P U	G1 60	0.0 5.0		SM			y SAND (SM), no structure, slig ts and plant matter	ht orgar	nic odor, moist, 10	% to		5	5		40 3	_				
	S H			49.7 1.3	SP	Light	brown an	-TOPSOIL- d brown poorly-graded SAND (SP), no s	structure, no odor,	dry,			5	10	75	10	_	_		╞
				47.9		trace	e asphalt, t	race grass roots, trace brick -FILL-	,-												
				3.1	SP	Oran	ige to tan p	poorly-graded SAND (SP), layer	, no odc	or, dry				5	10	80	5				
	P G2 5.0 U 52 10.0 S H						-GLACIOLACUSTRINE	DEPOSI	TS-												
5 -	U 52 10.0 S		-																		
	U 52 10.0 S	5.0 10.0																			
	U 52 10 S		44.8 6.2	-SP-	Light	brown to	tan poorly-graded SAND (SP), t	requent	ly bedded, no odor	, moist				5	95	- +	-+	-+		-	
	U 52 10.0 S																				
	S S			SP	Gray	-brown to	tan poorly-graded SAND (SP), t	frequent	ly bedded, no odoi	r, moist					100						
	S I I I I I I I I I I I I I I I I I I I					-GLACIOLACUSTRINE	DEPOSI	TS-													
10 -				41.0 10.0				BOTTOM OF EXPLORAT	TION 10.	.0 FT						_	_				_
		B 3.1 SP Orange to tan poorly-graded SAND (S P G2 5.0 -GLACIOLACUS S 10.0 44.8 - 6.2 SP Light brown to tan poorly-graded SANI SP Gray-brown to tan poorly-graded SANI -GLACIOLACUS																			
		Time (hr.) bluent bluent Vater T - Thin Wall Tube of Casing of Hole U - Undisturbed Sar S - Splitspoon Samp			/ell Diagram Riser Pipe					nma	· ·					_					
D	ate	e Time Elapsed Depth (ft) to: O - Open End Rod Time (hr.) Bottom Bottom of Hole Water U - Thin Wall Tube		Screen	Overt			• •		10.	0										
				· ′ot C	asing	ot Hole		U - Undisturbed Sample	•••••• •••••	Filter Sand Cuttings	Rock Samp			(IT)			- G2				
								G - Geoprobe	<u>≜.</u> ≜	Grout Concrete Bentonite Seal	Bori	ng	No				-	P-16	ô		_
	d Tests		e Exceed to a stress of		odiu	- L	1 1	liab		-											

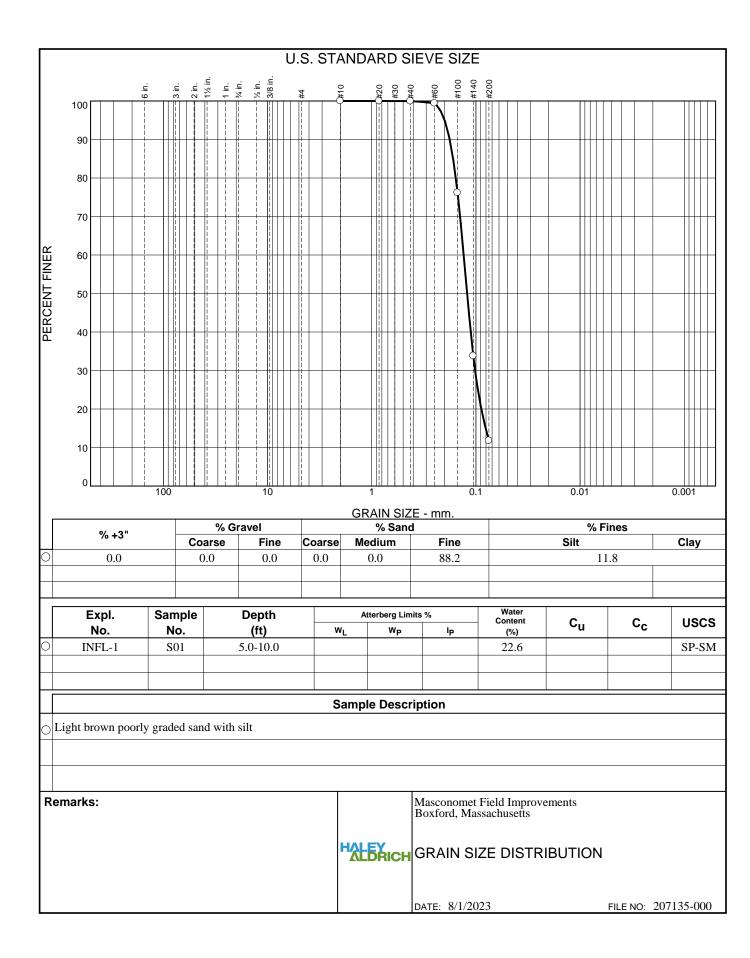
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				Casing	Sam	pler E	Barrel	Drilling Equipment	and Procedures			nish iller			4 Ju . Sh			3		
Туре	Э				G			Rig Make & Model: Geo	probe 6712DT		ļ				. Tie					
		neter (i	n)		1.5			Bit Type: Geoprobe Spo							1.0					
		Veight	<i>`</i>			-	-	Drill Mud: None Casing: None				atum cati			AVE ee F					
	nmer F	all (in.	` '				-	Hoist/Hammer: Winch / PID Make & Model: Not	Automatic hammer used								1			
(Ħ	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	ele (ff	Stratum Change Elev/Depth (ft)	Symbol		VISU	JAL-MANUAL IDENTIFICATIO	N AND DESCRIPTION			avel		Sano	1	-	1	ield ഗ്ഗ		Γ
Depth (ft)	oler E er 6 i	nple.	Sample Depth (ft)	Tratu Depi	s sy		(De	nsity/consistency, color, GROU structure, odor, moisture, optic	IP NAME & SYMBOL,		Coarse	Fine	Coarse	% Medium	Fine	% Fines	Dilatancy	Toughness	Plasticity	
Ճ	Sam	Sar & R	တမ္ရ	E C S	nscs			GEOLOGIC INTERPRE	ETATION)		% C	% F	0 %	% N	% F	% F	Dilat	Toug	Plas	ā
0 -	Р	G1	0.0	-	SM			y SAND (SM), no structure, slig	ht organic odor, moist, 1	0% to		5	5	20	40	30				-
	U S	55	5.0		SP	20% gra	ass root	s and plant matter\ -TOPSOIL-		/	1		5	10	75	10				
	H			49.4 1.6	SP	N 0		orly-graded SAND (SP), no stru	cture, no odor, dry, trace	asphalt,		-	5	5	90		-	+		╞
						trace gr	rass roo	-FILL-		/										
		U 57 5.0 0.5 SP 20% grass roots and plant matte SF 5.0 0.5 SP Light brown poorly-graded SANE trace grass roots H 1.6 SP Gray-brown to tan poorly-graded -GLACIOL P G2 5.0 10.0	an poorly-graded SAND (SP), f	requently bedded, no od	or, moist															
						-GLACIOLACUSTRINE	DEPOSITS-													
5 -	Р			-																
	U S	60	10.0																	
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10 -				41.0	SM	4	own to b odor, m	prown poorly-graded SAND (SM noist	I), frequently bedded, slig	ght /	_		5	5	70	20		_		┢
								BOTTOM OF EXPLORAT	ION 10.0 FT											
		1.47	atc!							1		Ļ								1
			Time (hr.) bottom bottom Water T - Thin Wall Tube Filter Sand of Casing of Hole U - Undisturbed Sample S - Splitspoon Sample Crowt	0	ou •==			nma						_						
Da	ate	Time	Time Elapsed Time (hr.) Depth (ft) to: Bottom of Casing O - Open End Rod T - Thin Wall Tube Riser Pipe Screen U - Undisturbed Sample S - Splitspoon Sample G - Geoprobe Image: Construction of the c	Overl Rock			• •		10	.0										
				- pr C	asing				1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	Samp			(11)			- G2	2			
									Grout	Bori			<u> </u>			-	2-17	7		
						Denil C	0		Bentonite Sea	al				liat		5	- 1 /	•		
	l Tests			Dilatano	:y :R-I	Rapid S ·	- Slow 1	N - None Plastic	ity: N - Nonplastic L - L	ow M-M	ediu	m ŀ	Η-Η Hig	ligh						

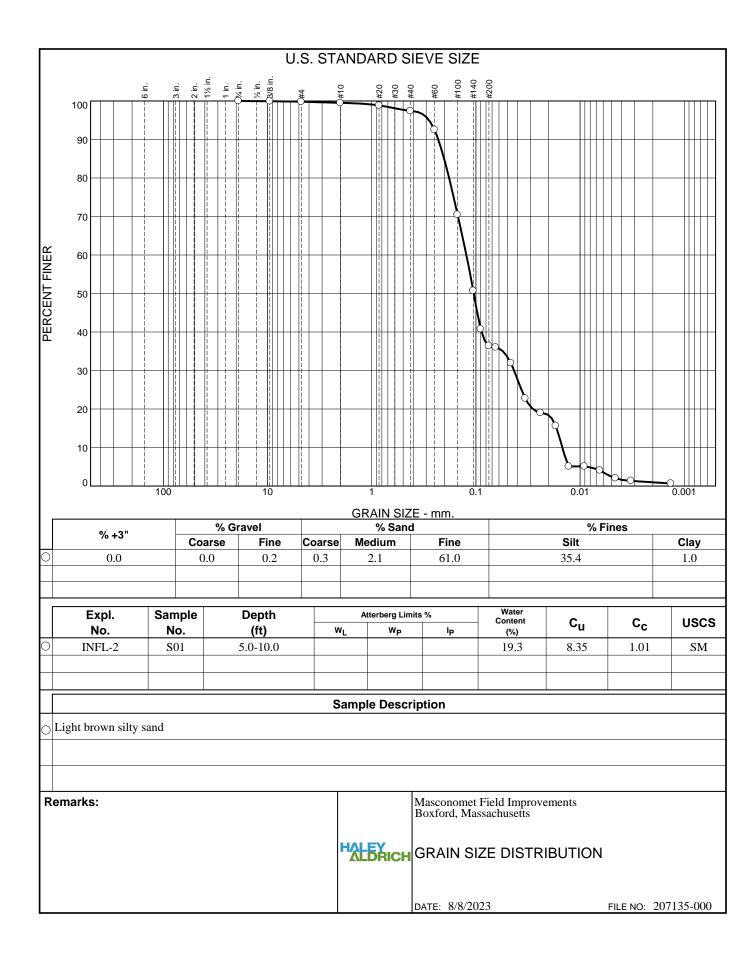
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Туре					G			Bit Type: Geoprobe Spo							1.0		<u> </u>			
		neter (Voight	Ý I		1. ALT	-	_	Drill Mud: None Casing: None			Da	atum	1	Ν	AV	<u>)</u> 88				
lam	mer F	all (in					-	Hoist/Hammer: Winch	Automatic hammer used			ocati			ee F	rian				
Ē	Blogs	(in.)	le (ft)	tigenal, tigenal,	mbo		VIS	JAL-MANUAL IDENTIFICATIO	N AND DESCRIPTION			avel		Sano E		-		eld S		
Uepth (tt)	pler I er 6 i	nple Rec.	amp	tratu hang /Dep	is sy		(De	ensity/consistency, color, GROL	JP NAME & SYMBOL,		Coarse	Fine	Coarse	% Medium	Fine	Fines	Dilatancy	Toughness	Plasticity	
ă	Sam	& F	۳ م	Elevos	nsc			GEOLOGIC INTERPRI	ETATION)		% C	% F	% C	% M	% F	% F	Dilat	Tou	Plas	i
0 -	P U	G1 52	0.0 5.0		SM			ts and plant matter	ht organic odor, moist, 1	0% to		5	5	20	40					_
	S H	Per Weight (lb) her Fall (in.) AUTO - Casing: None Hoist/Hammer: Winch Aut PID Make & Model: Not use PID Make & Model: Not use PID Make & Model: Not use (Density/consistency, color, GROUP N structure, odor, moisture, optiona GEOLOGIC INTERPRETA 90 00 00 00 00 00 00 00 00 00 00 00 00 0	turo no oder drute a	iot trans				15	60	15				_						
		G1 0.0 SM Dark brown s 52 5.0 49.5 20% grass rd 49.5 1.5 SM Light brown s 48.0 3.0 SP Light brown s 62 5.0 3.0 SP Light brown s 62 5.0 46 10.0 SP Light brown s		y fines, trace asphalt	cture, no odor, dry to mo	isi, (race		5	5	15	60	15								
		G1 0.0 SM 52 5.0 49.5 49.5 1.5 SM 48.0 3.0 SP G2 5.0 48.0 46 10.0	1.71	t brows t			on mai-1			-	-						ŀ			
		P G2 5.0		SP	Lign	it drown to			or, moist			5	5	90						
		P G2 5.0 U 46 10.0						-GLACIOLACUSTRINE I	DEPOSITS-											
5 +	P	U 46 10.0																		
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			46 10.0																	
10+				41.0				BOTTOM OF EXPLORAT	ION 10.0 FT											_
			48.0 3.0 SP Light brown to tan poorly-graded SAND (SP), frequently bedded, no odo -GLACIOLACUSTRINE DEPOSITS-																	
		41.0 10.0 BOTTOM OF EXPLORATION 10.0 FT																		
		Water Level Data Sample ID Well Diagram Elenced Depth (ft) to: 0.0 5.40 IIII Riser Pipe 0.00											L							
		W	Elapsed Depth (ft) to: O - Open End Rod Riser Pipe Time Bottom of Casing Bottom of Hole Water O - Open End Rod IIII Riser Pipe U - Undisturbed Sample Bottom U - Undisturbed Sample Filter Sand	_				nma	-			_		_						
Da	ate	Time Elapsed Time (hr.) Depth (ft) to: Bottom of Casing O - Open End Rod T - Thin Wall Tube Riser Pipe Screen O - Open End Rod Filter Sand U - Undisturbed Sample S - Splitspoon Sample S - Splitspoon Sample G - Geoprobe O - Open End Rod T - Thin Wall Tube Image: Comparison of the pipe Screen O - Open End Rod Filter Sand Image: Comparison of the pipe Screen O - Open End Rod Filter Sand Image: Comparison of the pipe Screen Image: Comparison of the pipe Screen O - Open End Rod Filter Sand Image: Comparison of the pipe Screen Image: Compariso	Over			• • •		10	.0											
				<u>`</u> f C	asing	of Hol	e	U - Undisturbed Sample					(Tt))		- G2				
									Grout Grout Concrete	Bori).			-		3		_
ield	Tests	:					S - Slow		ity: N - Nonplastic L - I	ow M-M					, .,		1			_
ield	Tests			Dilatano Toughn	cy: R-	of Hol Rapid - Low	s - Slow M - Mediu	U - Undisturbed Sample S - Splitspoon Sample G - Geoprobe N - None Plastic	Cuttings Grout Concrete Bentonite Se ity: N - Nonplastic L - L rength: N - None L - Lo	al∣ ∟ow M-M w M-Meo	oles ng ediu	Nc т н). H - Hig	ligh ∣h V	/ - Ve	GF	F	P-18	P-18	P-18

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Туре	e			3	G			Rig Make & Model: Geo	probe 6	712DT						. Tie		у			
		neter (i	in.)		1.			Bit Type: Geoprobe Spo Drill Mud: None	on							4.0					
Ham	nmer V	Veight	(lb)		AU	то	-	Casing: None					iturr cati			AVE ee P					
Han		all (in.)				-	Hoist/Hammer: Winch PID Make & Model: Not	Automa used	tic hammer											
ft)	lows 1.	No. in.)	e ff	Stratum Change Elev/Depth (ft)	Symbol		VISU	JAL-MANUAL IDENTIFICATIO	N AND I	DESCRIPTION			avel		Sand	ł			ield ທູ	Tes	st
Depth (ft)	oler B er 6 ir	nple ec. (ampl pth (ratun Jang	s Syr		(De	ensity/consistency, color, GRO				Coarse	Fine	Coarse	ediun	Fine	Jes	ancy	Toughness	icity	Ctranoth
De	Samp	San & R	S De	Ele (nscs			structure, odor, moisture, opti GEOLOGIC INTERPR				ö %	% Fir	00 %	% Medium	% Fir	% Fines	Dilatancy	Toug	Plasticity	040
0 -	Р	G1	0.0		SM				ht organ	ic odor, moist, 10	% to		5	5	20	40					F
	U S	50	5.0	53.1 0.9	SM	20%	⊚ grass roo	ts and plant matter -TOPSOIL-			/	5	5	5	25	45	15		+		┢
	Η	P G1 0.0 U 50 5.0 S -			trac	e grass roc	,														
		P G2 5.0 U 55 10.0 S						-FILL-													
		U 55 10.0 S		49.8 4.2	SP	Tar	n to light bro	wn poorly-graded SAND (SP),	nfreque	ntly bedded, no od	or,					90	10		-		╞
5 -	P G2 5.0 U 55 10.0			-		moi	ist			•											
	Ŭ	P G2 5.0 U 55 10.0 S						-GLACIOLACUSTRINE	DEPOSI	TS-											
		P G2 5.0 U 55 10.0 S U ST DLO																			
		49.8 49.8 4.2 SP Tan to light brown poorly-graded SAND (SP), infrequently bedded, no moist																			
		moist G2 5.0 J 55 10.0 -GLACIOLACUSTRINE DEPOSITS-																			
		P G2 5.0 U 55 10.0 S -GLACIOLACUSTRINE																			
10 -		55 10.0																			
				10.0				BOTTOM OF EXPLORAT	ION 10.	0 FT.											
		G1 0.0 53.1 Dark brown silty SAND (SM), no structure, slight organic odor, moi 20% grass roots and plant matter 50 50 53.1 SM																			
		G2 5.0 55 10.0 44.0																			
		G1 0.0 53.1 0.9 SM Dark brown silty SAND (SM), no structure, slight organic odor, moist, 10% t 50 5.0 5.0 53.1 0.9 -TOPSOIL- Brown and tan silty SAND with gravel (SM), no structure, no odor, dry to mo trace grass roots and surface organics, trace brick, trace asphalt fragments and gravel -FILL- 49.8 4.2 SP Tan to light brown poorly-graded SAND (SP), infrequently bedded, no odor, moist G2 5.0 10.0 44.0 44.0																			
		G2 5.0 55 10.0 44.0 49.8 49.8 49.8 49.8 49.8 55 55 49.8 49.8 49.8 49.8 49.8 49.8 49.8 49.8 49.8 49.8 49.8 49.8 49.8 55 10.0 44.0 44.0 44.0																			
		44.0 BOTTOM OF EXPLORATION 10.0 FT.																			
		Water Level Data Sample ID Well Diagram																			
		Time Elapsed Depth (ft) to: O - Open End Rod																			
		H G2 5.0 H S5 10.0 H S5 S5 S5 <td>to:</td> <td>·</td> <td></td> <td><u> </u></td> <td>Over</td> <td></td> <td></td> <td></td> <td>ima</td> <td>-</td> <td></td> <td></td> <td></td> <td></td> <td></td>	to:	·		<u> </u>	Over				ima	-									
D	S H G2 5.0 U S 55 10.0 S H S S H S S 10.0 S H S S H S S 10.0 S H S S S H S S H S S S S H S S S H S S S H S S S H S S S H S S S H S S S H S S S S S S S S S S S S S S S S S S S S S S S S S S <td></td> <td>(hr) BO</td> <td>ttom</td> <td>Botto</td> <td>m</td> <td>T - Thin Wall Tube</td> <td></td> <td>Screen</td> <td>Overt Rock</td> <td></td> <td></td> <td>• •</td> <td></td> <td>10</td> <td>.0</td> <td></td> <td></td> <td></td> <td></td>		(hr) BO	ttom	Botto	m	T - Thin Wall Tube		Screen	Overt Rock			• •		10	.0					
					Joing	0110		U - Undisturbed Sample S - Splitspoon Sample	\$. <i></i>	Cuttings	Samp			()			- G2				
								G - Geoprobe		Concrete Bentonite Seal	Bori					I	NF	۲ L -	1		
-				Elapsed Depth (ft) to: O - Open End Rod Riser Pipe Time (hr.) Bottom Bottom Water O - Open End Rod Filter U - Undisturbed Sample S - Splitspoon Sample G - Geoprobe Filter Sand Dilatancy: R - Rapid S - Slow N - None Plasticity: N - Nonplastic				M M - M	diu	m k	1 - H	liah						-			

Н	ÂLE	Y RIC	н				GEO	PROBE REPORT			I	Bo	rin	g١	lo.		IN	FL	-2	
Proj Clie Cor		ST.	ANTE					NS, BOXFORD, MA			Sh	e N neet art		. 1 2	207 of 4 Ju	1 Ily 2	2023	3		
				Casing	Sam	pler	Barrel	Drilling Equipment an	d Procedures			nish iller			4 Ju Sh			3		
Туре	е			3	G	•		Rig Make & Model: Geoprob	be 6712DT						. Tie					
		neter (i	n.)		1.5			Bit Type: Geoprobe Spoon Drill Mud: None							1.0					
Ham	nmer V	/eight ((lb)		AUT	го	-	Casing: None				atun cati			IAVI ee F					
Ham		all (in.)				-	Hoist/Hammer: Winch Auto PID Make & Model: Not use	omatic hammer ed											
ft)	Sampler Blows per 6 in.	No. in.)	ft) e	Stratum Change Elev/Depth (ft)	Symbol		VISU	JAL-MANUAL IDENTIFICATION AN	ND DESCRIPTION			avel		Sano	b		F	ield ഗ	Te	st
Depth (ft)	oler B er 6 ir	ec. (Sample Depth (ft)	hang Deptl	s syr		(De	ensity/consistency, color, GROUP N	AME & SYMBOL,		Coarse	Ъе	% Coarse	% Medium	Fine	nes	Dilatancy	Toughness	licity	:
e De	Samp	Sample No. & Rec. (in.)	n Si	Elevo	nscs			structure, odor, moisture, optional GEOLOGIC INTERPRETA	TION)		Ŭ%	% Fine	Ŭ %	% W	% Fii	% Fines	Dilat	Toug	Plasticity	
0 -	Р	G1	0.0		SM			y SAND (SM), no structure, slight or	rganic odor, moist, 10 ^r	% to		5	5	20	40			_		F
	U S	60	5.0	50.0 1.0	SP		0	s and plant matter -TOPSOIL-		/	_		-	5	95			_		╞
	Н					Ligh	nt brown to	an poorly-graded SAND (SP), frequ	ently bedded, no odor	, moist										
	S H 2.0 Н 9 G2 5.0					-GLACIOLACUSTRINE DEP	OSITS-													
5 -	P G2 5.0 U 60 10.0 S H		SP	Ligh	nt brown to t	an poorly-graded SAND (SP), frequ	iently bedded, no odor	, moist				5	60	35						
10 -		S S S				BOTTOM OF EXPLORATION	140.0 FT													
	ate	W. Time	Ela		Depti ttom	Bottor	m	T - Thin Wall Tube	Screen Filter Sand Cuttings Grout Concrete	Overl Rock Samp Bori	Co oles	den red	(ft))	10	0.0 - G2		2		
Field	d Tests	:							N - Nonplastic L - Lov	w M-M	ediu	m ł	H - H		, ,,		lice!-			
Field	d Tests		Elapsed Depth (ft) to: O - Open End Rod Riser Pipe Time (hr.) Bottom of Casing Bottom of Hole Water O - Open End Rod Image: Comparison of Hole Image:						w M-M M-Meo	ediu lium	m H H·	H - H - Hig	ŀĽ∖		ery H	ligh				

APPENDIX B Geotechnical Laboratory Test Results





Appendix B SUPPORTING STORMWATER CALCULATIONS

RECHARGE VOLUME CALCULATIONS

DRAWDOWN CALCULATIONS

STAGE-STORAGE TABLES



Stantec Planning and Landscape Architecture P.C. 40 Water Street, 3rd Floor Boston, MA 02109

Recharge Volume Calculations						
Project:	Masconomet Field	Project #:	210801991			
Location:	Boxford, MA	Date:	12/14/2023			
Calculated by:	AA	Revised:				
Checked by:	GR					

Recharge Volume Calculations

Objective:

To size a groundwater recharge systems that will approximate the annual recharge of pre-development conditions.

Methodology:

MassDEP Stormwater Handbook (Volume Three, Chapter 1). Utilize the Static Method for the sizing of the infiltration BMPs.

Design Criteria/Recharge Requirements:

Hydrologic Soil Group	Volume to Recharge		
A	0.60	inches times Total Imp. Area	
В	0.35	inches times Total Imp. Area	
С	0.25	inches times Total Imp. Area	
D	0.10	inches times Total Imp. Area	

In accordance with the above Recharge Requirements table, 0.25 inches times the total impervious area of HSG "C" type soils. Poor soil conditions and high bedrock make infiltration in the portions of the site with HSG "D" soils infeasible.

Required Recharge Volume:

Area Summary	Total Proposed Impervious Area = Existing Impervious Area = Impervious Area to be Recharged = Impervious Area Draining to Infiltration BMPs=	132,252 69,438	sf sf sf sf				
	Hydrologic Soil Group =	HSG A	HSG B	HSG C	HSG D	Σ	٦
Required Recharge	Δ Impervious Area within Soil Group =	69,438	0	0	0	69,438	sf
Required Recharge	Required Recharge Depth =	0.60	0.35	0.25	0.10		in/sf impervious
	Required Recharge Volume =	3,472	0	0	0	3,472	cf

Provided Recharge Volume:

<u>Subsurface Infiltration System "FIELD-1"</u> System Outlet Elevation = System Storage Capacity at Outlet Elevation =	53.75 ft 6,751 cf		
<u>Subsurface Infiltration System "PERF-1"</u> System Outlet Elevation = System Storage Capacity at Outlet Elevation =	50.05 ft 3,779 cf		
<u>Subsurface Infiltration System "FIELD-2"</u> System Outlet Elevation = System Storage Capacity at Outlet Elevation =	51.25 ft 6,198 cf		
<u>Subsurface Infiltration System "PERF-2"</u> System Outlet Elevation = System Storage Capacity at Outlet Elevation =	44.95 ft 1,365 cf		

ovided Recharge Volume Sur	nmary:	Area (sf)	Hydrologic Soil Group	Provided Recharge per System (cf)
	Impervious Area Contributing to Pond "FIELD-1" =	0	A	6,751
Commercial Systems	Impervious Area Contributing to Pond "PERF-1" =	57,680	А	3,779
Commercial Systems	Impervious Area Contributing to Pond "FIELD-2" =	0	А	6,198
	Impervious Area Contributing to Pond "PERF-2" =	35,267	А	1,365
	Impervious Area Draining to Infiltration BMP =	92,947		18,093

Summary:

Cumulative Storage (cf) =



3,472

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Stantec Planning and Landscape Architecture P.C. 40 Water Street, 3rd Floor Boston, MA 02109

	Blawaowi	n Calculation	3
Project:	Masconomet Field	Project #:	210801991
Location:	Boxford, MA	Date:	12/14/2023
Calculated by:	AA	Revised:	
Checked by:	GR		

			Drawd	own Calcula	tions			
Objective:	Demonstrate that all infiltr	Demonstrate that all infiltration BMPs drawdown within 72 hours of a rain event.						
Methodology:	MassDEP Stormwater Ha	MassDEP Stormwater Handbook (Volume Three, Chapter 1).						
Design Criteria:	For infiltration systems size	ed using the Sta	atic Method, the drawdown o	calculation shall u	tilize the Rawls Rate for exfiltration.			
	Drawdown Time	=	Rv (K x Bottom Area)	Where:	Rv = Required Recharge Volume K = Permeability Rate			

Drawdown Time:

72-Hour Drawdown Summary (Recharge Volume)

Infiltration BMP	K (in/hr)	Bottom Area (sf)	Rv (cf)	Rv Drawdown Time (hr)
Subsurface Infiltration System "FIELD-1"	2.41	89,400	6,751	0.4
Subsurface Infiltration System "PERF-1"	2.41	4,950	3,779	3.8
Subsurface Infiltration System "FIELD-2"	2.41	82,641	6,198	0.4
Subsurface Infiltration System "PERF-2"	2.41	3.400	1.365	2.0

The infiltration BMPs draw down within 72 hours. Therefore, the Project complies with 72-hour drawdown requirement of Standard 3.

Stage-Area-Storage for Pond FIELD-1: Subsurface Stone

Elevation	Surface	Storage	Elevation	Surface	Storage
(feet)	(sq-ft)	(cubic-feet)	(feet)	(sq-ft)	(cubic-feet)
53.50	90,007	0	54.54	90,007	27,002
53.52	90,007	540	54.56	90,007	27,002
53.54	90,007	1,080	54.58	90,007	27,002
53.56	90,007	1,620	54.60	90,007	27,002
53.58	90,007	2,160	54.62	90,007	27,002
53.60	90,007	2,700	54.64	90,007	27,002
53.62	90,007	3,240	54.66	90,007	27,002
53.64	90,007	3,780	54.68	90,007	27,002
53.66	90,007	4,320	54.70	90,007	27,002
53.68	90,007	4,860	54.72	90,007	27,002
53.70	90,007	5,400	54.74	90,007	27,002
53.72	90,007	5,940	54.74	50,007	21,002
53.74	90,007	6,481			
53.76	90,007	7,021			
53.78	90,007	7,561			
53.80	90,007	8,101			
	90,007	8,641			
53.82		,			
53.84	90,007	9,181			
53.86	90,007	9,721			
53.88	90,007	10,261			
53.90	90,007	10,801			
53.92	90,007	11,341			
53.94	90,007	11,881			
53.96	90,007	12,421			
53.98	90,007	12,961			
54.00	90,007	13,501			
54.02	90,007	14,041			
54.04	90,007	14,581			
54.06	90,007	15,121			
54.08	90,007	15,661			
54.10	90,007	16,201			
54.12	90,007	16,741			
54.14	90,007	17,281			
54.16	90,007	17,821			
54.18	90,007	18,361			
54.20	90,007	18,901			
54.22	90,007	19,442			
54.24	90,007	19,982			
54.26	90,007	20,522			
54.28	90,007	21,062			
54.30	90,007	21,602			
54.32	90,007	22,142			
54.34	90,007	22,682			
54.36	90,007	23,222			
54.38	90,007	23,762			
54.40	90,007	24,302			
54.42	90,007	24,842			
54.44	90,007	25,382			
54.46	90,007	25,922			
54.48	90,007	26,462			
54.50	90,007	27,002			
54.52	90,007	27,002			

Stage-Area-Storage for Pond FIELD-2: Subsurface Stone

Elevation	Surface	Storage	Elevation	Surface	Storage
(feet)	(sq-ft)	(cubic-feet)	(feet)	(sq-ft)	(cubic-feet)
51.00	82,641	0	52.04	82,641	24,792
51.02	82,641	496	52.06	82,641	24,792
51.04	82,641	992	52.08	82,641	24,792
51.06	82,641	1,488	52.10	82,641	24,792
51.08	82,641	1,983	52.12	82,641	24,792
51.10	82,641	2,479	52.14	82,641	24,792
51.12	82,641	2,975	52.16	82,641	24,792
51.14	82,641	3,471	52.18	82,641	24,792
51.16	82,641	3,967	52.20	82,641	24,792
51.18	82,641	4,463	52.22	82,641	24,792
51.20	82,641	4,958	52.24	82,641	24,792
51.22	82,641	5,454		,	
51.24	82,641	5,950			
51.26	82,641	6,446			
51.28	82,641	6,942			
51.30	82,641	7,438			
51.32	82,641	7,934			
51.34	82,641	8,429			
51.36	82,641	8,925			
51.38	82,641	9,421			
51.40	82,641	9,917			
51.42	82,641	10,413			
51.44	82,641	10,909			
51.46	82,641	11,404			
51.48	82,641	11,900			
51.50	82,641	12,396			
51.52	82,641	12,892			
51.54	82,641	13,388			
51.56	82,641	13,884			
51.58	82,641	14,380			
51.60	82,641	14,875			
51.62	82,641	15,371			
51.64	82,641	15,867			
51.66	82,641	16,363			
51.68	82,641	16,859			
51.70	82,641	17,355			
51.72	82,641	17,850			
51.74	82,641	18,346			
51.76	82,641	18,842			
51.78	82,641	19,338			
51.80	82,641	19,834			
51.82	82,641	20,330			
51.84	82,641	20,826			
51.86	82,641	21,321			
51.88	82,641	21,817			
51.90	82,641	22,313			
51.92	82,641	22,809			
51.94	82,641	23,305			
51.96	82,641	23,801			
51.98	82,641	24,296			
52.00	82,641	24,792			
52.02	82,641	24,792			

Stage-Area-Storage for Pond PERF-1: 42" Perforated Pipe

Elevation	Surface	Storage	Elevation	Surface	Storage
(feet)	(sq-ft)	(cubic-feet)	(feet)	(sq-ft)	(cubic-feet)
47.25	4,950	0	49.85	4,950	8,502
47.30	4,950	74	49.90	4,950	8,708
47.35	4,950	149	49.95	4,950	8,913
47.40	4,950	223	50.00	4,950	9,117
47.45	4,950	297	50.05	4,950	9,320
47.50	4,950	371	50.10	4,950	9,521
47.55	4,950	445	50.15	4,950	9,721
47.60	4,950	520	50.20	4,950	9,920
47.65	4,950	594	50.25	4,950	
47.70					10,117
	4,950	668	50.30	4,950	10,312
47.75	4,950	743	50.35	4,950	10,505
47.80	4,950	838	50.40	4,950	10,696
47.85	4,950	951	50.45	4,950	10,884
47.90	4,950	1,075	50.50	4,950	11,071
47.95	4,950	1,208	50.55	4,950	11,254
48.00	4,950	1,349	50.60	4,950	11,435
48.05	4,950	1,495	50.65	4,950	11,612
48.10	4,950	1,648	50.70	4,950	11,786
48.15	4,950	1,805	50.75	4,950	11,957
48.20	4,950	1,968	50.80	4,950	12,123
48.25	4,950	2,134	50.85	4,950	12,285
48.30	4,950	2,305	50.90	4,950	12,443
48.35	4,950	2,479	50.95	4,950	12,595
48.40	4,950	2,656	51.00	4,950	12,742
48.45	4,950	2,837	51.05	4,950	12,882
48.50	4,950	3,020	51.10	4,950	13,015
48.55	4,950	3,206	51.15	4,950	13,140
48.60	4,950	3,395	51.20	4,950	13,253
48.65	4,950	3,586	51.25	4,950	13,348
48.70	4,950	3,779	51.30	4,950	13,423
48.75	4,950	3,974	51.35	4,950	13,497
48.80	4,950	4,171	51.40	4,950	13,571
48.85	4,950	4,370	51.45	4,950	13,645
48.90	4,950	4,570	51.50	4,950	13,720
48.95	4,950	4,771	51.55	4,950	13,794
49.00	4,950	4,974	51.60	4,950	13,868
49.05	4,950	5,178	51.65	4,950	13,942
49.10	4,950	5,383	51.70	4,950	14,017
49.15	4,950	5,589	51.75	4,950	14,091
49.20	4,950	5,795		,	,
49.25	4,950	6,003			
49.30	4,950	6,211			
49.35	4,950	6,419			
49.40	4,950	6,628			
49.45	4,950	6,836			
49.50	4,950	7,045			
49.55	4,950	7,254			
49.60	4,950	7,463			
49.65	4,950	7,672			
49.70	4,950	7,880			
49.75	4,950	8,088			
49.80	4,950	8,295			
	.,	0,200			

Stage-Area-Storage for Pond PERF-2: 36" Perforated Pipe

Elevation	Surface	Storage	Elevation	Surface	Storage
(feet)	(sq-ft)	(cubic-feet)	(feet)	(sq-ft)	(cubic-feet)
44.00	3,400	0	46.60	3,400	5,797
44.05	3,400	51	46.65	3,400	5,929
44.10	3,400	102	46.70	3,400	6,059
44.15	3,400	153	46.75	3,400	6,189
44.20	3,400	204	46.80	3,400	6,316
44.25	3,400	255	46.85	3,400	6,442
44.30	3,400	306	46.90	3,400	6,565
44.35	3,400	357			
44.35		408	46.95 47.00	3,400	6,686
	3,400			3,400	6,805
44.45	3,400	459	47.05	3,400	6,921
44.50	3,400	510	47.10	3,400	7,034
44.55	3,400	576	47.15	3,400	7,144
44.60	3,400	655	47.20	3,400	7,251
44.65	3,400	742	47.25	3,400	7,353
44.70	3,400	834	47.30	3,400	7,451
44.75	3,400	932	47.35	3,400	7,544
44.80	3,400	1,035	47.40	3,400	7,631
44.85	3,400	1,141	47.45	3,400	7,710
44.90	3,400	1,251	47.50	3,400	7,776
44.95	3,400	1,365	47.55	3,400	7,827
45.00	3,400	1,481	47.60	3,400	7,878
45.05	3,400	1,600	47.65	3,400	7,929
45.10	3,400	1,721	47.70	3,400	7,980
45.15	3,400	1,844	47.75	3,400	8,031
45.20	3,400	1,970	47.80	3,400	8,082
45.25	3,400	2,097	47.85	3,400	8,133
45.30	3,400	2,226	47.90	3,400	8,184
45.35	3,400	2,357	47.95	3,400	8,235
45.40	3,400	2,489	48.00	3,400	8,286
45.45	3,400	2,623		-,	-,
45.50	3,400	2,757			
45.55	3,400	2,893			
45.60	3,400	3,029			
45.65	3,400	3,167			
45.70	3,400	3,305			
45.75	3,400	3,444			
45.80	3,400	3,583			
45.85	3,400	3,723			
45.90	3,400	3,863			
45.95	3,400	4,003			
46.00	3,400	4,003			
46.05	3,400	4,143			
46.10	3,400	4,423			
46.15	3,400	4,563			
46.20	3,400	4,703			
46.25	3,400	4,842			
46.30	3,400	4,981			
46.35	3,400	5,119			
46.40	3,400	5,256			
46.45	3,400	5,393			
46.50	3,400	5,529			
46.55	3,400	5,663			

Appendix C WATER QUALITY CALCULATIONS

WATER QUALITY VOLUME CALCULATIONS

TSS REMOVAL WORKSHEET

Stantec Planning and Landscape Architecture P.C. 40 Water Street, 3rd Floor Boston, MA 02109

Water Quality Volume Calculations				
Project:	Masconomet Field	Project #:	210801991	
Location:	Boxford, MA Date: 12/14/2023			
Calculated by:	AA Revised:			
Checked by:	GR			

	Water Quality Volume	Calculations			
Objective:	To treat the water quality volume as required by Standard 4 of the MassDEP Stormwater Management Standards				
Methodology:	MassDEP Stormwater Handbook (Volume Three, Chapter 1).				
Design Criteria:	Treat a volume of stormwater equal to the product of the contributing onsite impervious area and the required water quality volume factor.				
Required Water Quality	Volume:				
	Total Impervious Area =	201,690	sf		
Site Summary	Roof Impervious Area =	9,675	sf		
-	Site Impervious Area =	192,015	sf		
Required Water Quality	Volume per infiltration BMP:	Site Imp. Area (sf)	Water Quality Depth (inch)	Required Water Quality Volume (cf)	Provided Water Quality Volume (cf)
	Site Impervious Area Draining to Pond "FIELD-1" =	0	0.5	0	6,751
	Site Impervious Area Draining to Pond "PERF-1" =	54,805	0.5	2,284	3,779
		04,000	0.0	2,207	
	Site Impervious Area Draining to Pond "FIELD-2" =	0	0.5	0	6,198
	Site Impervious Area Draining to Pond "FIELD-2" = Site Impervious Area Draining to Pond "PERF-2" =				
		0	0.5	0	6,198
·	Site Impervious Area Draining to Pond "PERF-2" = Impervious Area Draining to Infiltration BMP = ibuting to Infiltration BMPs ONLY includes site impervious area and does N	0 32,267 87,072	0.5 0.5 	0 1,344 3,628	6,198 1,365
	Site Impervious Area Draining to Pond "PERF-2" = Impervious Area Draining to Infiltration BMP = ibuting to Infiltration BMPs ONLY includes site impervious area and does N	0 32,267 87,072	0.5 0.5 	0 1,344 3,628	6,198 1,365
1. Impervious Area Contr	Site Impervious Area Draining to Pond "PERF-2" = Impervious Area Draining to Infiltration BMP = ibuting to Infiltration BMPs ONLY includes site impervious area and does N Volume: Subsurface Infiltration System "FIELD-1"	0 32,267 87,072 IOT include roof area, as it is alread	0.5 0.5 	0 1,344 3,628	6,198 1,365
1. Impervious Area Contr	Site Impervious Area Draining to Pond "PERF-2" = Impervious Area Draining to Infiltration BMP = ibuting to Infiltration BMPs ONLY includes site impervious area and does N Volume: Subsurface Infiltration System "FIELD-1" System Outlet Elevation =	0 32,267 87,072 IOT include roof area, as it is alread	0.5 0.5 ly considered clear	0 1,344 3,628	6,198 1,365
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Note: Impervious Area Contributing to Infiltration BMPs ONLY includes site impervious area and does NOT include roof area, as it is already considered clean.

Stantec	Stantec Planning and Landscape Architecture P.C.	Total Sus	Total Suspended Soilds (TSS) Removal Worksheet			
Juliec	40 Water Street, 3rd Floor	Project:	Masconomet Field	Project #:	210801991	
	Boston, MA 02109	Location:	Boxford, MA	Date:	12/14/2023	
		Calculated by: Checked by:	AA GR	Revised:		
Objective:	To provide TSS removal as required by Standard 4 of the MassDEP Stormwater Management Standards					
Methodology:	MassDEP Stormwater Handbook (Volume Three, Chapter 1).					
Design Criteria:	Treat a volume of stormwater equal to the product of the contributing onsite impervious area and the required water quality volulme factor.					

Treatment Train #1

	TSS Removal	Starting TSS	Amount	Remaining	TSS Removal
BMP	Rate	Load	Removed (BxC)	Load (C-D)	Rate
Deep Sump and Hooded Catch Basin	0.25	1.00	0.25	0.75	25%
Infiltration Basin	0.80	0.75	0.60	0.15	85%
	Total TS	SS Removal =	85%		

Treatment Train #2

	TSS Removal	Starting TSS	Amount	Remaining	TSS Removal
BMP	Rate	Load	Removed (BxC)	Load (C-D)	Rate
Infiltration Basin	0.80	1.00	0.80	0.20	80%

Total TSS Removal =	80%	
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Appendix D OPERATIONS AND MAINTENANCE PLAN

OPERATIONS AND MAINTENANCE PLAN OPERATIONS AND MAINTENANCE LOG OPERATIONS AND MAINTENANCE FIGURE



Operation and Maintenance Plan

Masconomet Regional School District 20 Endicott Road Boxford, MA 01921

Issued: 1/18/2024

Prepared for:

Michael M. Harvey Masconomet Regional School District 20 Endicott Road Boxford, MA 01921

Prepared by:

Stantec Consulting Services, Inc 40 Water Street Boston, MA 02109

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Executive Summary

The Operation and Maintenance Plan for Masconomet Regional School District Field Renovations, located at 20 Endicott Road, Boxford MA provides current and future operators of the property with site-specific guidance on the Best Management Practices (BMPs) for stormwater controls installed at the property. The stormwater management system constructed at the property includes several stormwater BMPs that require continuous maintenance to ensure that all components function as designed. Insufficient maintenance may result in the deterioration of pollutant controls, a reduction in groundwater recharge, the discharge of pollutants to off-site infrastructure, and property flooding. Pollution prevention measures are grouped into three general categories: non-structural pollutant controls, structural pollutant controls has been developed in according with Volume 2 Chapter 2 of the Massachusetts Department of Environmental Protection's *Massachusetts Stormwater Handbook*. A figure depicting the location of each structural pollutant control is included in Appendix A. An operation and maintenance log for each structural pollutant control is included in Appendix B. The manufacturers' maintenance guidelines for each proprietary structural BMP are included in Appendix C.

1.0 OWNERSHIP/RESPONSIBLE PARTY

1.1 OWNER OF THE SYSTEM

Michael M. Han 20 Endicott Roa Boxford, MA 01	ad
Name:	
Company:	
Title:	
Signature:	
Date:	

1.2 **RESPONSIBILITY FOR OPERATION AND MAINTENANCE**

The land owner of record is the responsible party for the operation and maintenance of the stormwater system. The land owner shall retain a Qualified Inspector who shall submit, on an annual basis by January 1st of each year, a written certification to the Stormwater Agency documenting that work has been done to properly operate and maintain the stormwater management facilities consistent with the approved O&M plan. The [land owner of record] responsible for the operation and maintenance of a stormwater management system shall prepare records of all maintenance and repairs." A copy of the Operation and Maintenance Log form is included in Appendix B.

The Town of Boxford Rules and Regulations for Stormwater Management and Erosion Control (Regulations) designates the Department of Public Works as the administrative agency responsible for implementing and enforcing the rules and regulations. A "Qualified Inspector" defined as "[a] person knowledgeable in the principles and practice of erosion and sediment controls and pollution prevention, who possesses the skills to assess conditions at the construction Site that could impact stormwater quality, and the skills to assess the effectiveness of any stormwater management facilities selected and installed to meet the requirements of this permit. The inspector must have a practical knowledge of stormwater hydrology and stormwater management techniques, including the maintenance requirements



for stormwater management facilities; and the inspector must have the ability to determine if stormwater BMPS and facilities are performing as intended."

1.3 RESPONSIBILITY FOR FINANCING MAINTENANCE AND EMERGENCY REPAIRS

The land owner of record is the responsible party for financing maintenance and emergency repairs for the stormwater system.

1.4 INSPECTION AND MAINTENANCE LOG

An operation and maintenance log can be found under Appendix B. The operation and maintenance log must be updated by the land owner (or their designee), as required, per the Operation and Maintenance Plan. A copy of the operation and maintenance log should be maintained on-site at all times.

2.0 NON-STRUCTURAL POLLUTANT CONTROLS

Non-structural pollutant controls involve prevention procedures that aim to minimize the quantity of sediment, debris, and pollutants that enter the stormwater management system. Non-structural stormwater controls at the property include bituminous asphalt pavement maintenance, the regulation of deicing chemicals, and the use of specialty fertilizers.

2.1 BITUMINOUS ASPHALT PAVEMENT MAINTENANCE

Parking areas on the property generate several stormwater pollutants, such as sediment, salt, heavy metals, and oils/lubricants. Sidewalks generate similar pollutants when pedestrians track pollutants. To prevent pollutants from washing into catch basins during rain events and snow melt, a pavement maintenance program should be instituted. Parking areas should be swept and/or vacuumed quarterly by industrial equipment (e.g. street sweeper). At a minimum, street sweeping should be performed in late fall (October/November), following leaf abscission, and early spring (April/May), following the conclusion of winter surface treatment practices.

2.2 DEICING CHEMICALS

The use of road salt (sodium chloride) should be minimized during winter months to prevent salt from entering the stormwater management system. When permitted, salt substitutes, such as calcium magnesium acetate (CMA) should be used in place of traditional road salt. Furthermore, deicing chemicals should be limited to areas with pedestrian traffic, such as the parking areas and sidewalks connecting the parking areas to the building.



2.3 FERTILIZER USAGE

The use of slow-release, organic fertilizers should be limited within landscaped areas to minimize the amount of nutrients migrating downstream the drainage network. Additionally, fertilizer usage should be reduced once all proposed landscaping areas are established.

3.0 STRUCTURAL POLLUTANT CONTROLS

The proposed stormwater management system is designed to protect runoff water quality through the removal of sediment and pollutants. Minimum operation and maintenance requirements for the structural pollutant controls used to separate and capture stormwater pollutants are described below.

3.1 CATCH BASINS AND AREA DRAINS

All catch basins include a four-foot deep sump and a hooded outlet pipe to trap debris, sediments, and floating contaminants. Area drains located within landscaped areas will include two-foot sumps. This design practice, in coordination with the minimal usage of sand and regular street sweeping, provides a multi-level source control approach that prevents sand, sediment, and litter from discharging to the stormwater detention and infiltration basin. Regular maintenance and cleaning of catch basins and area drains will ensure adequate performance of these structures.

The proper removal of pollutants associated with trash and sediments only occurs when catch basins and area drains are cleaned out regularly. Frequent cleaning will reduce the likelihood that trash and sediments will be re-suspended and discharged from the drain inlet. In addition, frequent cleaning will result in greater available volume for future deposition of trash and sediment. More frequent sweeping of paved surfaces should result in reduced sediment accumulation in catch basins, reduced the cleaning effort required for each downstream stormwater BMP, and reduced disposal costs.

Inspections and Cleaning

- All catch basins shall be inspected at least two times per year at the end of the foliage and snowremoval seasons.
- Sediment and/or floatable pollutants must also be removed two times per year or whenever the depth of deposits is greater than or equal to one half the depth from the bottom of the invert of the lowest pipe in the basin. All sediment/pollutants shall be disposed of at an approved offsite facility in accordance with all applicable regulations.
- Any structural damage or other indication of malfunction should be repaired.
- During colder periods, the catch basin grates must be kept free of snow and ice.

• During warmer periods, the catch basin grates must be kept free of leaves, litter, sand, and debris.

3.2 DRAINAGE MANHOLES AND OUTLET CONTROL STRUCTURES

Drainage manholes and outlet control structures shall be inspected to remove any sediment build up and to remove any obstructions to the runoff flow. Special care shall be taken to inspect the orifices and above the weir for any potential obstructions.

Inspections and Cleaning

- All drainage manhole structures and outlet control structures shall be inspected at least two times at the end of the foliage and snow-removal seasons.
- Sediment must also be removed two times per year. All sediment/pollutants shall be disposed of at an approved offsite facility in accordance with all applicable regulations.
- Any structural damage or other indication of malfunction should be repaired.

3.3 SUBSURFACE INFILTRATION SYSTEM

The manufacturer's recommended maintenance instructions are included in Appendix C. In addition to the manufacturer's recommendations, the subsurface infiltration systems should undergo the following minor and major inspection and cleaning schedule (next page):



Inspections and Cleaning (Minor)

Component	Frequency	Action
Inlets and	Monthly in first year	Check inlets and outlets for clogging; remove any debris as required
Outlets	Spring and fall of each year	Check inlets and outlets for clogging; remove any debris as required
	One year after commissioning <i>and</i> every third year	Check inlets and outlets for clogging; remove any debris as required
All System Components	After any storm event greater than 3 inches over 24 hours	Inspect for operation integrity, and remove any debris as required

Inspections and Cleaning (Major)

Component	Frequency	Actions
Inlets and Outlets	Yearly	• Obtain documentation that the inlets, outlets, and vents have been cleaned and function as intended.
	Spring and Fall of each year	Check inlets and outlets for clogging and remove any debris as required.
Stormwater Chambers	Yearly	 Inspect the interior of the stormwater management chambers through inspection port for deficiencies using CCTV or comparable technique. Obtain documentation that stormwater management chambers and feed connectors will function as anticipated.
	9 years after commissioning, and every 9 years following	 Clean stormwater management chambers and feed connectors of any debris. Inspect the interior of the stormwater management structures for deficiencies using CCTV or comparable technique. Obtain documentation that stormwater management chambers and feed connectors have been cleaned and will function as intended.
	45 years after commissioning	 Clean stormwater management chambers and feed connectors of any debris. Determine the remaining life expectancy of the stormwater management chambers and recommend schedule and actions to rehabilitate the stormwater management chambers as required. Inspect the interior of the stormwater management structures for deficiencies using CCTV or comparable technique.
	45 to 50 years after commissioning	 Replace or restore the stormwater management chambers in accordance with the schedule determined at the 45-year inspection Attain the appropriate approvals as required. Establish a new operation and maintenance schedule.
Surrounding Site	Monthly in first year	Check for depressions in areas over and surrounding the stormwater management system.
	Spring and fall of each year	Check for depressions in areas over and surrounding the stormwater management system.
	Yearly	Confirm that no authorized modifications have been performed to the site.



3.4 VEGETATED AREAS

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

- Inspect planted areas on a semi-annual basis and remove any litter.
- Maintain planted areas adjacent to pavement to prevent soil washout.
- Immediately clean any soil deposited on pavement.
- Re-seed bare areas; install appropriate erosion control measures when native soil is exposed or erosion channels are forming.
- Plant alternative mixture of grass species in the event of unsuccessful establishment.

Initial Post-Construction Inspection

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

Long-Term Maintenance

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

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

Fertilizer usage should be avoided. If deemed necessary, slow release fertilizer should be used. Fertilizer should be used to begin the establishment of vegetation in bare or damaged areas, but should not be applied on a regular basis unless necessary. Inspect planted areas on a semi-annual basis and remove any litter.

- Maintain planted areas adjacent to pavement to prevent soil washout.
- Immediately clean any soil deposited on pavement.



- Re-seed bare areas; install appropriate erosion control measures when native soil is exposed or erosion channels are forming.
- Plant alternative mixture of grass species in the event of unsuccessful establishment.

Pesticide/Herbicide Usage

The Project will require that landscaping maintenance contractors implement a program to test soils at the site every five years and to limit the amount of fertilizer, pesticides, and herbicides to only what is needed to maintain healthy plant materials and landscaped areas.

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

After establishment, fertilizer usage should be avoided. If deemed necessary, slow release fertilizer should be used, and applied only in the minimum amounts recommended by the manufacturer. Once applied, the fertilizer should be worked into the soil to limit exposure to stormwater. Storage should be in a covered area; and the contents of any partially used bags should be transferred to a sealable, plastic bin to avoid spills.

Fertilizer should be used to begin the establishment of vegetation in bare or damaged areas but should not be applied on a regular basis unless necessary.

Records of soil management, application dates, planting dates, preventive measures, treatments, and other appropriate information should be kept. This information should be used as a reference when fertilizer/pesticide/herbicide management decisions in the future.

4.0 SPILL PREVENTION AND GOOD HOUSEKEEPING

4.1 SPILL PREVENTION AND CONTROL

The owner or the property management designee should implement a spill prevention program, which should include stormwater contamination assessment, flow diversion, record keeping, internal reporting, employee training, and preventive maintenance. The Owner or the property management designee should be responsible for training of people in the proper handling and cleanup of spilled materials. No spilled hazardous materials or hazardous wastes should be allowed to come in contact with stormwater discharges. If such contact occurs, the stormwater discharge should be contained on-site until appropriate measures in compliance with state and federal regulations are taken to dispose of such contaminated stormwater.

In order to minimize the potential for a spill of hazardous materials to come into contact with stormwater, the following steps should be implemented:

1. All materials with hazardous properties (such as pesticides, petroleum products, fertilizers, detergents, construction chemicals, acids, paints, paint solvents, cleaning solvents, additives for



soil stabilization, concrete curing compounds and additives, etc.) should be stored in a secure location, with their lids on, preferably under cover, when not in use.

- 2. The minimum practical quantity of all such materials should be kept on the site.
- 3. A spill control and containment kit (containing, for example, absorbent materials, acid neutralizing powder, brooms, dust pans, mops, rags, gloves, goggles, plastic, and metal trash containers, etc.) should be provided at the maintenance area of the site.
- The manufacturers' recommended methods for spill cleanup should be clearly posted and site personnel should be trained regarding these procedures and the location of the information and cleanup supplies.

In the event of a spill, the following procedures should be followed:

- 1. The owner or its property management designee should be notified immediately.
- 2. All spills should be cleaned up immediately after discovery.
- 3. The spill area should be kept well ventilated and personnel should wear appropriate personal protective equipment (PPE) to prevent injury from contact with the hazardous substances.
- 4. Materials and equipment necessary for spill cleanup should be kept in the material storage area on-site. Equipment and materials may include, as appropriate, shovels, wheel barrows, brooms, dust pans, mops, rags, gloves, goggles, kitty litter or Speedi-Dry, sand, sawdust, and plastic and metal trash containers specifically designated for this purpose.
- Spills of toxic or hazardous material in excess of reportable quantities, as established in the Massachusetts Contingency Plan (MCP), should be reported to the Massachusetts Department of Environmental Protection Division of Hazardous Waste (888)304-1133. Additionally, the local fire department should be called immediately at 911.

The owner or its property management designee should be the spill prevention and response coordinator. The owner or its property management designee should designate individuals who should receive spill prevention and response training. These individuals should become responsible for a particular phase of prevention and response. The names of these personnel should be posted in the material storage area and other applicable areas onsite.

4.2 SNOW STORAGE/DISPOSAL

Snow storage/disposal should be allowed in landscaped islands and underutilized parking spaces. Snow should not be stored in the sediment forebays, pea gravel diaphragm, or extended dry detention basin. Storing snow within the sediment forebay or extended dry detention basin may consolidate soil within the BMP (reducing natural infiltration capabilities) or damage vegetation. Snow should not be stored directly on any catch basins as this will impeded snow melt from being capture and result in ponding at other areas of the site.



4.3 MATERIALS MANAGEMENT AND HOUSEKEEPING PRACTICES

The following product-specific practices should be followed on-site. Recommendations are provided for petroleum products, fertilizers, solvents, paints, and other hazardous substances.

4.3.1 Petroleum Products

No vehicle maintenance or handling of petroleum products should occur on site. Aside from necessary diesel fuel for the emergency generator, no petroleum products or asphalt substances should be stored on-site.

4.3.2 Solvents, Paints, and other Hazardous Substances

All containers should be tightly sealed and stored indoors when not required for use. Excess materials should not be discharged to the storm sewer system, but should be properly disposed according to manufacturer's instructions or state and local regulations. Outside storage on the property should be prohibited.

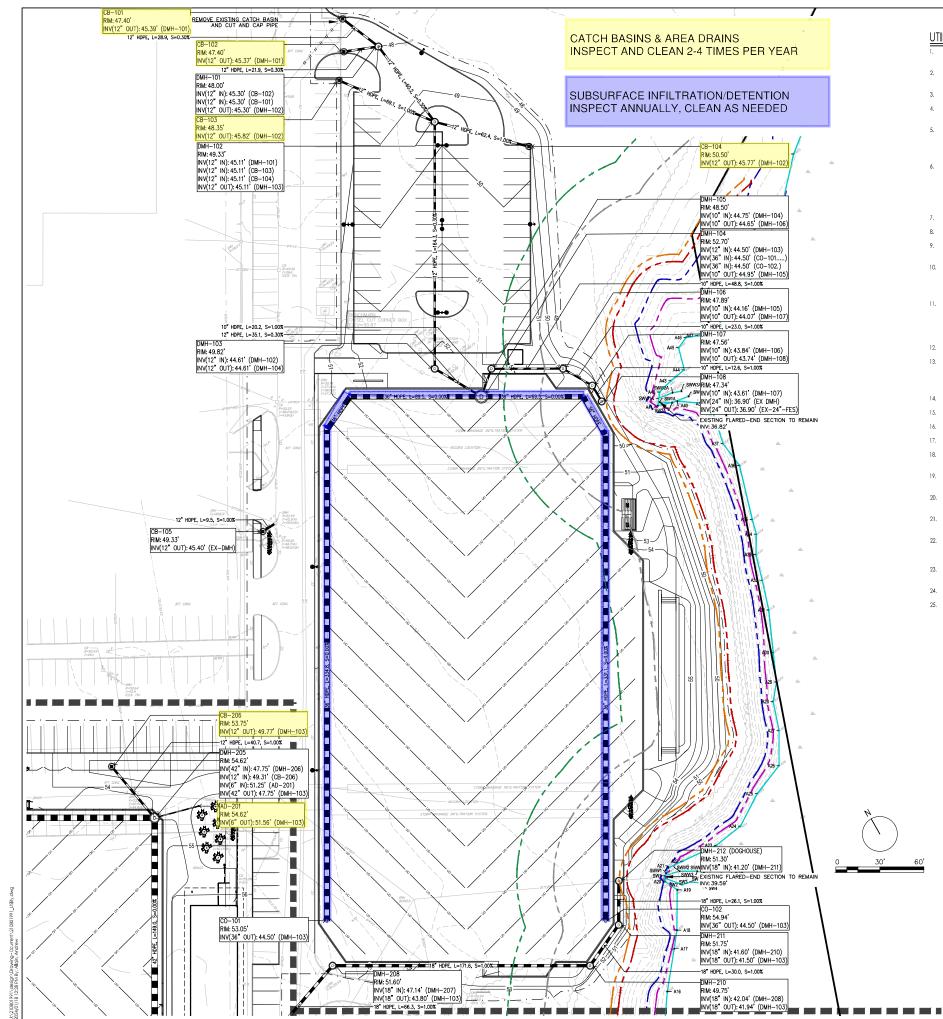


APPENDICES



Appendix A OPERATION AND MAINTENANCE SITE MAP





UTILITY NOTES

- EXISTING CONDITIONS INFORMATION IS REPRODUCED FROM THE SURVEY PREPARED BY PRECISION LAND SURVERYING, INC. OF SOUTHBOROUGH, MA, DATED AUGUST 7, 2023.
- WITH A DIGSAFE NUMBER INDICATING THAT ALL EXISTING UTILITIES HAVE BEEN LOCATED AND MARKED.
- 3. ALL CONSTRUCTION TO BE DONE IN ACCORDANCE WITH THE TOWN OF BOXFORD PUBLIC WORKS DEPARTMENT SPECIFICATIONS.
- HIT VB DEFIRSY VIT/REDUCESTED IN EVAN DAK VINO YAW STANKORSYA AK AN INWORS SAR ASTILITU CHUORSPEDIAL DATIEXES TO & NOTIFACI ST DAK XBOW ONDREMMOD SHORESTERISTER SARANGAL SARANGAL SARANGAL SARANGAL SARANGAL SARANGAL SARANGAL SARANGAL SARANG DAK XBOW ONDREMMOD SHORESTERISTERIATE ON OTFACIOLITICAXES HIT SHIMPHETIC SHALL SATANGAL SARANGAL SARANGAL SARANG DAK XBOW ONDREMMOD SHORESTERISTERIATE ON OTFACIOLITICAXES HIT SHIMPHETIC SHALL SARANGAL SARANGAL SARANGAL SARANG DAK XBOW ONDREMMOD SHORESTERISTERIATE ON OTFACIOLITICAXES HIT SHIMPHETIC SHALL SARANGAL SARANGAL SARANGAL SARANG DAK XBOW ONDREMMOD SHALL SARANGAL SARANGAL SARANGAL SARANGAL SARANGAL SARANGAL SARANGAL SARANGAL SARANGAL SARANG DAK XBOW ONDREMMOD SHALL SARANGAL SARANGAL SARANGAL SARANGAL SARANGAL SARANGAL SARANGAL SARANGAL SARANGAL SARANG DAK XBOW ONDREMMOD SARANGAL SA PARANGAL SARANGAL SAR PARANGAL SARANGAL SAR
- 6. THE CONTRACTOR SHALL MAINTAIN OR ADJUST TO NEW FINISH GRADE, AS NECESSARY, ALL UTILITY AND SITE STRUCTURES SUCH AS LIGHT POLES, SIGN POLES, MANHOLES CATCH BASINS, HAND HOLES, WATER AND GAS CATES, HYDRANTS, ETC., FROM MAINTAINED UTILITY AND SITE SYSTEMS, UNLESS OTHERWISE HOTED OR DIRECTED BY OWNERS REPRESIDATIVE. THE CONTRACTOR SHALL ALTER THE MASONRY OF THE TOP SECTION OF ALL LESISTIC DRAIN AND SEWER STRUCTURES, AS NECESSARY, FOR CHANGES IN GRADE, CONTRACTOR SHALL RESET UTILITY FRAMES, GRATES, AND COVERS MEANT TO BE FLUSH WITH GRADE (CLEANOUTS, UTILITY MANHOLES, CATCH BASINS, INLETS, ETC.) THAT ARE AFFECTED BY SITE WORK OR GRADE CHANGES, WHETHER SPECIFICALLY NOTED ON PLANS OR NOT.
- 7. ALL SEWER PIPES SHALL BE PVC PER ASTM D3034. SDR-35 AND ASTM D1784 WITH RUBBER GASKET JOINTS, UNLESS OTHERWISE NOTED.
- 8. SITE LIGHTING IS SHOWN ON THIS PLAN FOR COORDINATION PURPOSES ONLY, REFER TO ELECTRICAL PLANS FOR EXACT TYPE AND LOCATION.
 - 9. AREAS OUTSIDE THE LIMITS OF PROPOSED WORK DISTURBED BY THE CONTRACTOR'S OPERATIONS SHALL BE RESTORED BY THE CONTRACTOR'S EXPENSE.
 - 10. THE LOCATION, SIZE, DEPTH, AND SPECIFICATIONS FOR CONSTRUCTION OF PRIVATE UTILITY SERVICES SHALL BE PROVIDED BY, AND APPROVED BY, THE RESPECTIVE UTILITY COMPANY (GAS/TELEPHONE/ELECTRICAL) AND INSTALLED ACCORDING TO THOSE REQUIREMENTS. THE CONTRACTOR SHALL COORDINATE THE INSTALLATION, ALTERATION, OR ADJUSTMENT OF THE UTILITY CONNECTIONS WITH THE RESPECTIVE COMPANIES PRIOR TO ANY UTILITY CONSTRUCTION
 - 11. ALL CEMENT LINED DUCTILE IRON JOINTS AT HITINGS (CLASS 52.) VALVES, AND HYDRANT LATERALS SHALL BE MECHANICAL WITH NEOPRENE GASKETS. JOINTS AT OTHER LOCATIONS SHALL BE PUSHON TYPE WITH NEOPRENE OR SYNTHETIC RUBBER GASKETS. ALL WATER GATES SHALL OPEN AS PER MUNICIPAL REQUIREMENTS. ALL WATER LINES SHALL HAVE A MINIMUM OF FIVE FEET OF GROUND COVER AND A MINIMUM SEPARATION OF TEN FEET FROM THE SEWER SYSTEM. AT WATER AND SEWER CROSSINGS, THE WATER LINE SHALL BE ENCASED IN SIX INCHES OF CONCRETE FOR A DISTANCE OF TEN FEET ON EITHER SIDE OF THE CROSSING
 - 12. PROTECT AND MAINTAIN EXISTING ON-SITE DRAINAGE STRUCTURES AND PIPES UNLESS OTHERWISE NOTED.
 - 13 THIS PROJECT DISTURBS MORE THAN ONE ACRE OF LAND AND REQUIRES A PERMIT FOR STORMWATER DISCHARGES FROM CONSTRUCTION ACTIVITIES AT IND FOUCEL USUBBS WORKE THAN ONE ACCE OF END AND REQUIRES A FERMIL FOR SOCIATION TRE USERNAVED FOR OWNER UNDER LEST 14 DAYS PROJECT ON HESTARD OF CONSTRUCTION THE CONTRACTOR SHALL FILE AN ELECTRONC FORCE OF INTENT (MON) WITH THE UNITED STATES ENVIRONMENTAL PROTECTION AGENCY (U.S. EPA) FOR CONSTRUCTION DISCHARGES ASSOCIATED WITH THIS PROJECT AND MAINTAIN A STORMWATER POLLITION PREVENTION PLAN (SWPPP) IN ACCORDANCE WITH NATIONAL POLLITANT DISCHARGE ELIMINATION SYSTEM (NPDES) REGULATIONS.
 - 14. CONTRACTOR SHALL MAINTAIN POSITIVE DRAINAGE AWAY FROM ALL BUILDING FOUNDATIONS, STRUCTURES AND PLANTING BEDS.
 - 15. ENSURE ALL EXISTING (TO REMAIN) AND PROPOSED MANHOLE COVERS PROPERLY IDENTIFY UTILITIES SERVICED
 - 16. BITUMINOUS CONCRETE ELEVATIONS SHALL BE 1/4 INCH ABOVE THE RIM ELEVATION SHOWN FOR EACH CATCH BASIN.
 - 17. ALL PROPOSED STORM DRAIN LINES SHALL BE 12" NON-PERFORATED HDPE UNLESS OTHERWISE NOTED ON PLANS.
 - REFER TO ARCHTECTURAL/PLUMBING PLANS FOR PROPOSED LOCATION OF UTUTY SERVICE STUBS AT BUILDING, FINAL DESIGN AND LOCATIONS OF UTILITY SERVICE STUBS. WILL BE PROVIDED BY THE ARCHTECT.
 - 19. ALL EROSION AND SEDIMENTATION CONTROLS SHALL BE INSTALLED PRIOR TO COMMENCEMENT OF ANY EARTH MOVING ACTIVITIES. REFER TO SITE PREPARATION PLAN FOR COMPLETE EROSION AND SEDIMENTATION CONTROLS.

 - 21. ALL PIPING WITHIN 10 FEET OF BUILDING IS COVERED UNDER THE COMMONWEALTH OF MASSACHUSETTS UNIFORM STATE PLUMBING CODE AND IS SHOWN FOR COORDINATION ONLY, REFER TO PLUMBING PLANS AND SPECIFICATIONS FOR UTILITY WORK WITHIN 10 FEET OF BUILDING.
 - 22. THE ENGINEER-OF-RECORD SHALL WITNESS INSTALLATION OF ALL SUBSURFACE INFILTRATION SYSTEMS. IF THE SUBSURFACE SOIL CONDITIONS DIFFER FROM HAT SHOWN ON THE PLAN. THE DESIGN SHALL BE MODIFIED AND RESUBMITED TO THE CITY/TOWN OF BOXFORD FOR APPROVAL PRIOR TO CONTINUING INSTALLATION.
 - 23. THE USE OF FIRE HYDRANTS FOR CONSTRUCTION IS NOT PERMITTED WITHOUT PRIOR APPROVAL FROM THE CITY/TOWN OF BOXFORD WATER AND SEWER DEPARTMENT AND FIRE DEPARTMENT.
 - 24. CONTRACTOR SHALL COORDINATE ANY WATER SHUT DOWNS THE CITY/TOWN OF BOXFORD WATER AND SEWER DEPARTMENT AND FIRE DEPARTMENT
 - 25. ALL TRENCH EXCAVATION CONTRACTORS SHALL COMPLY WITH MASSACHUSETTS GENERAL LAWS CHAPTER 82A. TRENCH EXCAVATION SAFETY REQUIREMENTS, ID PROTECT THE GENERAL PUBLIC FROM UNAUTHORIZED ACCESS TO UNATTENDED TRENCHES. TRENCH EXCAVATION PERMITS ARE REQUIRED. THIS APPLIES TO ALL TRENCHES ON UNDUCIAND PROVERVS.



60

PRIOR TO THE START OF ANY EXCAVATION FOR THE PROJECT. BOTH ON AND OFF THE SITE. THE CONTRACTOR SHALL NOTIFY DIGSAFE AND BE PROVIDED

ALL WORK TO BE DONE WITHIN PUBLIC RIGHT-OF-WAYS SHALL CONFORM TO THE REQUREMENTS AND SPECIFICATIONS OF THE TOWN OF BOXFORD PUBLIC WORKS DEPARTMENT AND/OR THE MASSACHUSETIS DEPARTMENT OF TRANSPORTATION.

20. WHERE AN EXISTING UTILITY IS FOUND TO BE IN CONFLICT WITH THE PROPOSED WORK. THE CONTRACTOR SHALL ACCURATELY DETERMINE THE LOCATION, ELEVATION, AND SIZE OF THE UTILITY AND TRANSMIT THIS INFORMATION TO THE ENGINEER WITHOUT DELAY.



tantec Planning and andscape Architecture P.C. 40 Water Street, 3rd Floo Boston, MA 02109 U.S.A. Tel. 617.234.3100 Fax. 617.661.7118 www.stantec.con

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Consultants

Notes



SDL JA 01.18.2024 File Name: 210801991_Utility.dwg 01.18.2024 Dsgn.

Permit/Sea

Client/Project MASCONOMET REGIONAL SCHOOL DISTRICT

SYNTHETIC TURF FIELDS NOTICE OF INTENT BOXFORD, MA

Project No.: 210801991 Scale: AS NOTED Title

Drawing No.

DRAINAGE AND GRADING PLAN

Appendix B OPERATION AND MAINTENANCE LOG



Masconomet Regional School District

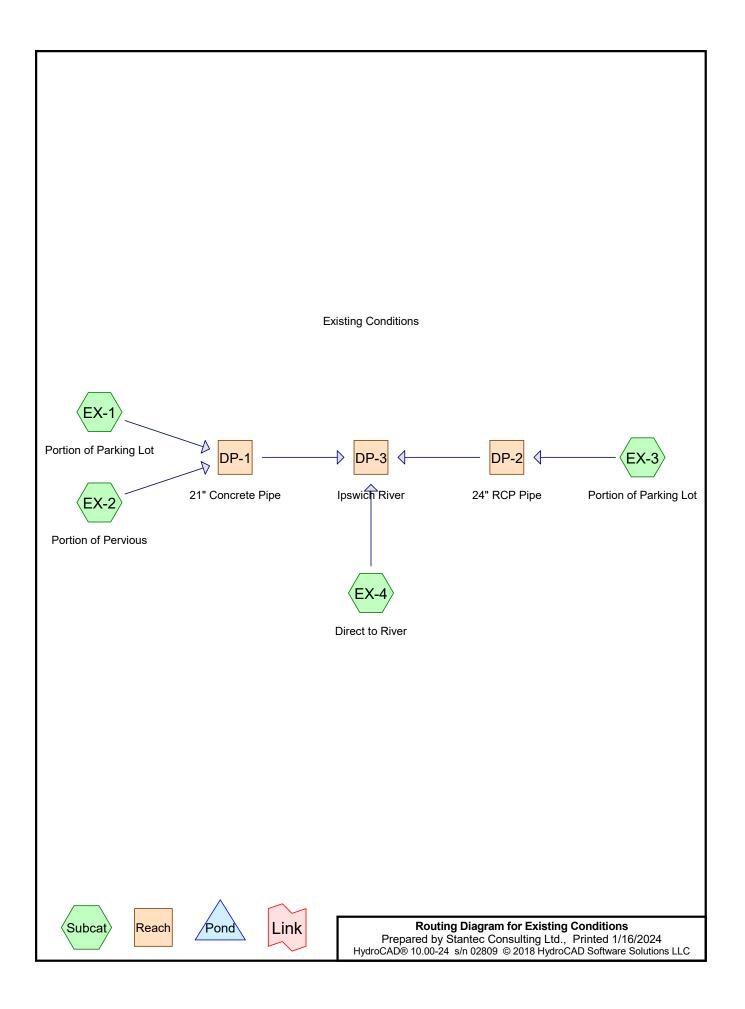
Boxford, MA

Operation and Maintenance Log Inspection Year:_____

Structural Best Management Practice	Action	Date Completed	Completed By	Condition	Additional Actions	Date Completed	Completed By	Comments
Catch Basins/Area Drains – Inspect two to four times per year. Clean two times per year.	Inspect							
Subsurface Infiltration System – Inspect annually. Clean as required.	Inspect							
Stormwater Outfalls - Inspect annaully. Maintain vegetation and repair riprap as required.	Inspect							
Vegetated Areas Maintenance - Inspect twice annually in the spring and the fall.	Inspect							
Overall Site Inspection - Twice annually.	Inspect							

Appendix E EXISTING HYDROLOGIC CONDITIONS

EXISTING CONDITIONS HYDROCAD REPORT



Area Listing (all nodes)

Area	CN	Description
(sq-ft)		(subcatchment-numbers)
17,062	39	>75% Grass cover, Good, HSG A (Map Unit 254A) (EX-1, EX-2, EX-4)
454,878	39	>75% Grass cover, Good, HSG A (Map Unit 651) (EX-1, EX-2, EX-3, EX-4)
25,219	61	>75% Grass cover, Good, HSG B (Map Unit 718A) (EX-4)
5,898	98	Paved parking, HSG A (Map Unit 254A) (EX-1)
119,554	98	Paved parking, HSG A (Map Unit 651) (EX-1, EX-3)
4,331	98	Roofs, HSG A (Map Unit 254A) (EX-1)
2,469	98	Roofs, HSG A (Map Unit 651) (EX-1)
15,368	30	Woods, Good, HSG A (Map Unit 651) (EX-4)
37,201	55	Woods, Good, HSG B (Map Unit 718A) (EX-4)
681,980	52	TOTAL AREA

Soil Listing (all nodes)

Area (sq-ft)	Soil Group	Subcatchment Numbers
619,560	HSG A	EX-1, EX-2, EX-3, EX-4
62,420	HSG B	EX-4
0	HSG C	
0	HSG D	
0	Other	
681,980		TOTAL AREA

Existing Conditions	
Prepared by Stantec Consulting Ltd.	Printed 1/16/2024
HydroCAD® 10.00-24 s/n 02809 © 2018 HydroCAD Software Solutions LLC	Page 4
	-

Pipe	Listing	(all	nodes)
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Line#	Node	In-Invert	Out-Invert	Length	Slope	n	Diam/Width	Height	Inside-Fill
	Number	(feet)	(feet)	(feet)	(ft/ft)		(inches)	(inches)	(inches)
 1	EX-2	0.00	0.00	637.0	0.0090	0.012	21.0	0.0	0.0

Existing Conditions Prepared by Stantec Consulting Ltd. <u>HydroCAD® 10.00-24 s/n 02809 © 2018 Hyd</u>	Type III 24-hr 2-year Rainfall=3.24"Printed 1/16/2024roCAD Software Solutions LLCPage 5						
Time span=0.00-30.00 hrs, dt=0.01 hrs, 3001 points Runoff by SCS TR-20 method, UH=SCS, Weighted-CN Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method							
Subcatchment EX-1: Portion of Parking	Runoff Area=133,902 sf 81.21% Impervious Runoff Depth=1.95" Tc=6.0 min CN=87 Runoff=7.02 cfs 21,762 cf						
Subcatchment EX-2: Portion of Pervious	Runoff Area=290,906 sf 0.00% Impervious Runoff Depth=0.00" Flow Length=1,017' Tc=15.9 min CN=39 Runoff=0.00 cfs 19 cf						
Subcatchment EX-3: Portion of Parking L	otRunoff Area=25,497 sf 92.23% Impervious Runoff Depth=2.48" Tc=6.0 min CN=93 Runoff=1.65 cfs 5,278 cf						
Subcatchment EX-4: Direct to River	Runoff Area=231,675 sf 0.00% Impervious Runoff Depth=0.03" Flow Length=93' Tc=12.5 min CN=43 Runoff=0.02 cfs 484 cf						
Reach DP-1: 21" Concrete Pipe	Inflow=7.02 cfs 21,782 cf Outflow=7.02 cfs 21,782 cf						
Reach DP-2: 24" RCP Pipe	Inflow=1.65 cfs 5,278 cf Outflow=1.65 cfs 5,278 cf						
Reach DP-3: Ipswich River	Inflow=8.67 cfs 27,544 cf Outflow=8.67 cfs 27,544 cf						
Total Runoff Area = 681,980	sf Runoff Volume = 27,544 cf Average Runoff Depth = 0.48"						

Total Runoff Area = 681,980 sf Runoff Volume = 27,544 cf Average Runoff Depth = 0.48" 80.61% Pervious = 549,728 sf 19.39% Impervious = 132,252 sf

Summary for Subcatchment EX-1: Portion of Parking Lot

Runoff = 7.02 cfs @ 12.09 hrs, Volume= 21,762 cf, Depth= 1.95"

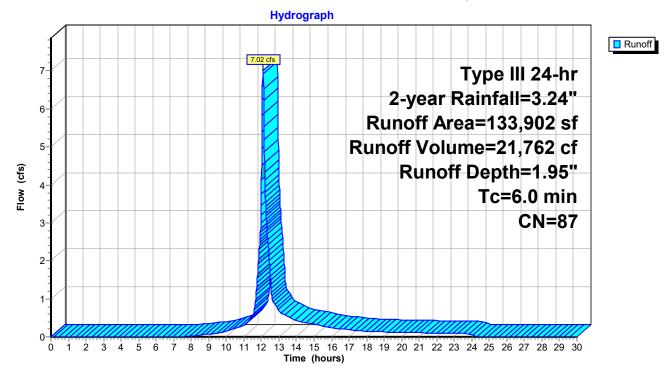
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs Type III 24-hr 2-year Rainfall=3.24"

	Area (sf)	CN	Description				
*	2,469	98	Roofs, HSG A (Map Unit 651)				
*	4,331	98	Roofs, HSG A (Map Unit 254A)				
*	9,746	39	>75% Grass cover, Good, HSG A (Map Unit 254A)				
*	5,898	98	Paved parking, HSG A (Map Unit 254A)				
*	15,420	39	>75% Grass cover, Good, HSG A (Map Unit 651)				
*	96,038	98	Paved parking, HSG A (Map Unit 651)				
133,902 87 Weighted Average			Weighted Average				
	25,166		18.79% Pervious Area				
108,736 81.21% Impervious Area							
	Tc Length	Slo	pe Velocity Capacity Description				
	(min) (feet)		/ft) (ft/sec) (cfs)				
_	0.0		Dise of France				



Direct Entry,

Subcatchment EX-1: Portion of Parking Lot



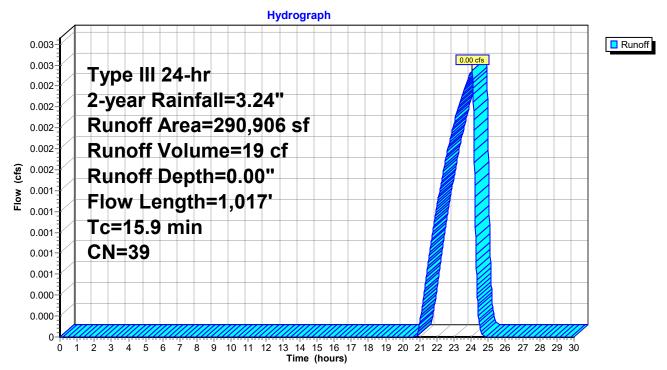
Summary for Subcatchment EX-2: Portion of Pervious

Runoff = 0.00 cfs @ 24.04 hrs, Volume= 19 cf, Depth= 0.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs Type III 24-hr 2-year Rainfall=3.24"

_	A	rea (sf)	CN I	Description						
*		6,806	39 >	>75% Grass cover, Good, HSG A (Map Unit 254A)						
*	2	84,100	39 >	>75% Gras	75% Grass cover, Good, HSG A (Map Unit 651)					
	290,90639Weighted Average290,906100.00% Pervious Area					a				
	Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description				
	6.9	50	0.0120	0.12		Sheet Flow,				
						Grass: Short n= 0.150 P2= 3.24"				
	7.4	330	0.0112	0.74		Shallow Concentrated Flow,				
						Short Grass Pasture Kv= 7.0 fps				
	1.6	637	0.0090	6.77	16.28	Pipe Channel,				
						21.0" Round Area= 2.4 sf Perim= 5.5' r= 0.44'				
						n= 0.012 Concrete pipe, finished				
	15.9	1,017	Total							

Subcatchment EX-2: Portion of Pervious



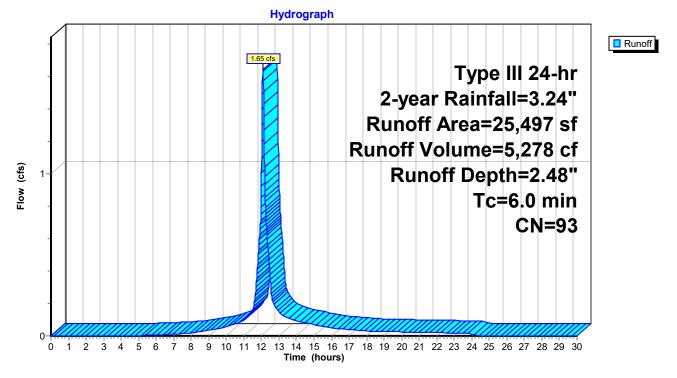
Summary for Subcatchment EX-3: Portion of Parking Lot

Runoff = 1.65 cfs @ 12.09 hrs, Volume= 5,278 cf, Depth= 2.48"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs Type III 24-hr 2-year Rainfall=3.24"

_	A	rea (sf)	CN	Description					
*		23,516	98	Paved park	ing, HSG A	(Map Unit 651)			
*		1,981	39	>75% Gras	>75% Grass cover, Good, HSG A (Map Unit 651)				
		25,497 1,981 23,516	93	Weighted A 7.77% Perv 92.23% Imp	vious Area	ea			
	Tc (min)	Length (feet)	Slop (ft/ft		Capacity (cfs)	Description			
_	6.0					Direct Entry,			

Subcatchment EX-3: Portion of Parking Lot



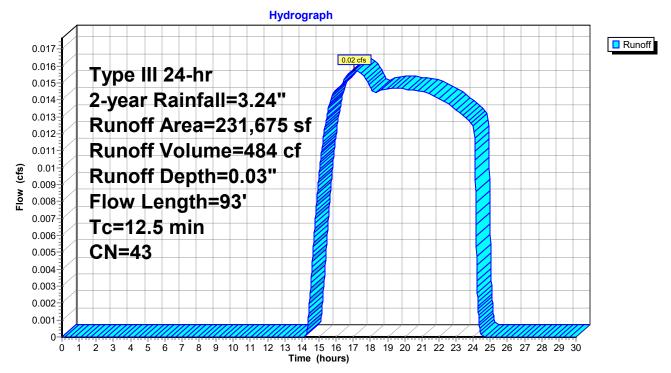
Summary for Subcatchment EX-4: Direct to River

Runoff = 0.02 cfs @ 17.07 hrs, Volume= 484 cf, Depth= 0.03"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs Type III 24-hr 2-year Rainfall=3.24"

	A	rea (sf)	CN I	Description		
*	1	53,377	39 :	>75% Gras	s cover, Go	bod, HSG A (Map Unit 651)
*		510				bod, HSG A (Map Unit 254A)
*		25,219				bod, HSG B (Map Unit 718A)
*		15,368				(Map Unit 651)
*		37,201				(Map Unit 718Á)
_	2	31,675	43	Neighted A	verage	
	231,675 100.00% Pervious Area					a
	-					-
	Тс	Length	Slope	Velocity	Capacity	Description
	(min)	(feet)	(ft/ft)		(cfs)	
	12.3	50	0.0200			Sheet Flow,
	12.0	00	0.0200	0.07		Woods: Light underbrush n= 0.400 P2= 3.24"
	0.2	43	0.3950	3.14		Shallow Concentrated Flow,
	0.2 40 0.0000 0.14			0.14		Woodland Kv= 5.0 fps
_	12.5	93	Total			
	12.0	93	rolar			

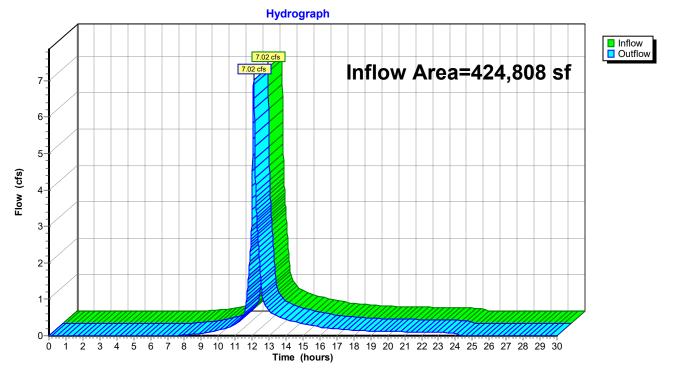
Subcatchment EX-4: Direct to River



Summary for Reach DP-1: 21" Concrete Pipe

Inflow Area =	424,808 sf, 25.60% Impervious,	Inflow Depth = 0.62"	for 2-year event
Inflow =	7.02 cfs @ 12.09 hrs, Volume=	21,782 cf	
Outflow =	7.02 cfs @ 12.09 hrs, Volume=	21,782 cf, Atter	n= 0%, Lag= 0.0 min

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

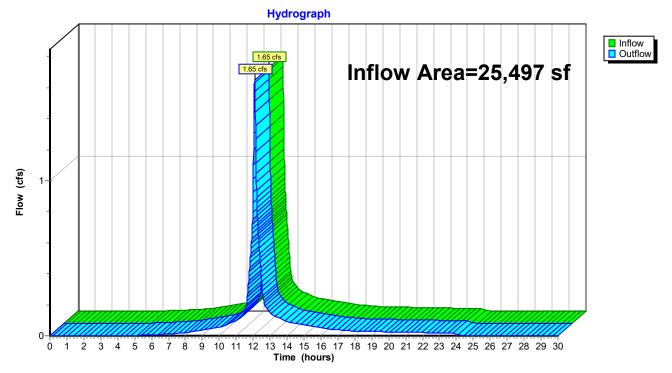


Reach DP-1: 21" Concrete Pipe

Summary for Reach DP-2: 24" RCP Pipe

Inflow Are	a =	25,497 sf, 92.23% Impervious, I	Inflow Depth = 2.48" for 2-year event
Inflow	=	1.65 cfs @ 12.09 hrs, Volume=	5,278 cf
Outflow	=	1.65 cfs @ 12.09 hrs, Volume=	5,278 cf, Atten= 0%, Lag= 0.0 min

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

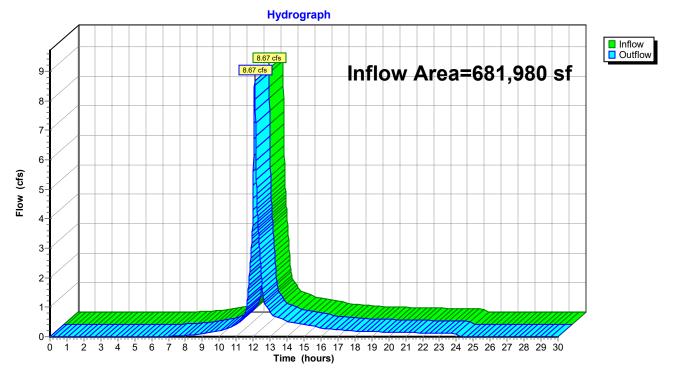


Reach DP-2: 24" RCP Pipe

Summary for Reach DP-3: Ipswich River

Inflow Are	a =	681,980 sf, 19.39% Impervious, Inflow Depth = 0.48" for 2-	year event
Inflow	=	8.67 cfs @ 12.09 hrs, Volume= 27,544 cf	
Outflow	=	8.67 cfs @ 12.09 hrs, Volume= 27,544 cf, Atten= 0%,	Lag= 0.0 min

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



Reach DP-3: Ipswich River

Existing Conditions	Type III 24-hr 10-year Rainfall=5.12"			
Prepared by Stantec Consulting Ltd.	Printed 1/16/2024			
HydroCAD® 10.00-24 s/n 02809 © 2018 Hyd	droCAD Software Solutions LLC Page 13			
Time span=0.00-30.00 hrs, dt=0.01 hrs, 3001 points Runoff by SCS TR-20 method, UH=SCS, Weighted-CN Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method				
Subcatchment EX-1: Portion of Parking	Runoff Area=133,902 sf 81.21% Impervious Runoff Depth=3.68" Tc=6.0 min CN=87 Runoff=13.01 cfs 41,068 cf			
Subcatchment EX-2: Portion of Pervious	Runoff Area=290,906 sf 0.00% Impervious Runoff Depth=0.22" low Length=1,017' Tc=15.9 min CN=39 Runoff=0.28 cfs 5,454 cf			
Subcatchment EX-3: Portion of Parking L	otRunoff Area=25,497 sf 92.23% Impervious Runoff Depth=4.32" Tc=6.0 min CN=93 Runoff=2.78 cfs 9,170 cf			
Subcatchment EX-4: Direct to River	Runoff Area=231,675 sf 0.00% Impervious Runoff Depth=0.39" Flow Length=93' Tc=12.5 min CN=43 Runoff=0.78 cfs 7,483 cf			
Reach DP-1: 21" Concrete Pipe	Inflow=13.01 cfs 46,523 cf Outflow=13.01 cfs 46,523 cf			
Reach DP-2: 24" RCP Pipe	Inflow=2.78 cfs 9,170 cf Outflow=2.78 cfs 9,170 cf			
Reach DP-3: Ipswich River	Inflow=15.80 cfs 63,176 cf Outflow=15.80 cfs 63,176 cf			
Total Runoff Area = 681,980	sf Runoff Volume = 63,176 cf Average Runoff Depth = 1.11"			

Total Runoff Area = 681,980 sf Runoff Volume = 63,176 cf Average Runoff Depth = 1.11" 80.61% Pervious = 549,728 sf 19.39% Impervious = 132,252 sf

Summary for Subcatchment EX-1: Portion of Parking Lot

Runoff = 13.01 cfs @ 12.09 hrs, Volume= 41,068 cf, Depth= 3.68"

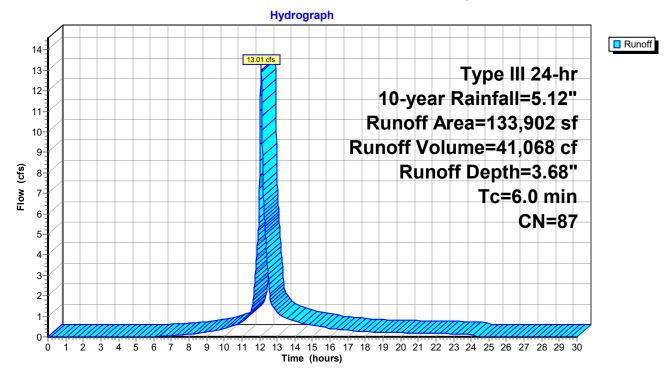
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs Type III 24-hr 10-year Rainfall=5.12"

	Area (sf)	CN	Description				
*	2,469	98	Roofs, HSG A (Map Unit 651)				
*	4,331	98	Roofs, HSG A (Map Unit 254A)				
*	9,746	39	>75% Grass cover, Good, HSG A (Map Unit 254A)				
*	5,898	98	Paved parking, HSG A (Map Unit 254A)				
*	15,420	39	>75% Ġrass cover, Good, HSG A (Map Unit 651)				
*	* 96,038 98 Paved parking, HSG A (Map Unit 651)						
	133,902	87	Weighted Average				
	25,166		18.79% Pervious Area				
	108,736		81.21% Impervious Area				
	Tc Length (min) (feet)	Slor (ft/					



Direct Entry,

Subcatchment EX-1: Portion of Parking Lot



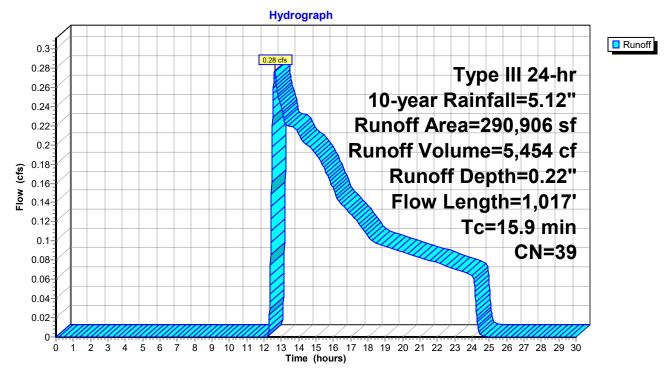
Summary for Subcatchment EX-2: Portion of Pervious

Runoff = 0.28 cfs @ 12.61 hrs, Volume= 5,454 cf, Depth= 0.22"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs Type III 24-hr 10-year Rainfall=5.12"

	A	rea (sf)	CN E	Description				
*		6,806	39 >	39 >75% Grass cover, Good, HSG A (Map Unit 254A)				
*								
		90,906		Weighted Average				
	2	90,906	1	00.00% Pe	ervious Are	a		
	Тс	Length	Slope	Velocity	Capacity	Description		
	(min)	(feet)	(ft/ft)	(ft/sec)	(cfs)			
	6.9	50	0.0120	0.12		Sheet Flow,		
						Grass: Short n= 0.150 P2= 3.24"		
	7.4	330	0.0112	0.74		Shallow Concentrated Flow,		
						Short Grass Pasture Kv= 7.0 fps		
	1.6	637	0.0090	6.77	16.28	Pipe Channel,		
						21.0" Round Area= 2.4 sf Perim= 5.5' r= 0.44'		
						n= 0.012 Concrete pipe, finished		
	15.9	1,017	Total					

Subcatchment EX-2: Portion of Pervious



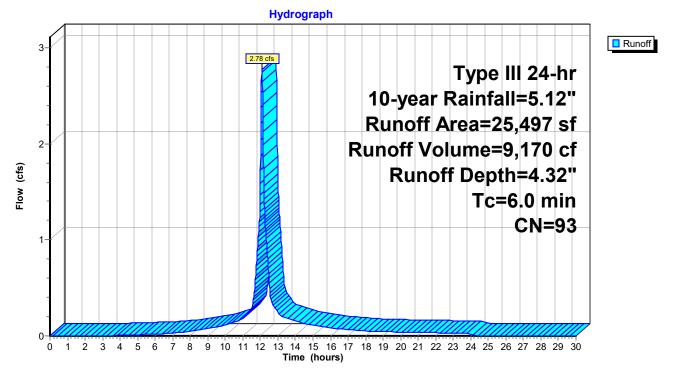
Summary for Subcatchment EX-3: Portion of Parking Lot

Runoff = 2.78 cfs @ 12.08 hrs, Volume= 9,170 cf, Depth= 4.32"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs Type III 24-hr 10-year Rainfall=5.12"

_	A	rea (sf)	CN	Description			
*		23,516	98	Paved park	Paved parking, HSG A (Map Unit 651)		
*		1,981	39	>75% Gras	>75% Grass cover, Good, HSG A (Map Unit 651)		
		25,497 1,981 23,516	93	Weighted A 7.77% Perv 92.23% Imp	vious Area	ea	
	Tc (min)	Length (feet)	Slop (ft/f		Capacity (cfs)	Description	
	6.0					Direct Entry,	

Subcatchment EX-3: Portion of Parking Lot



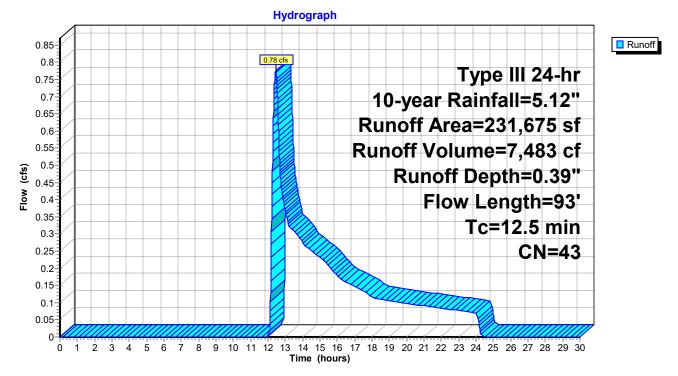
Summary for Subcatchment EX-4: Direct to River

Runoff = 0.78 cfs @ 12.44 hrs, Volume= 7,483 cf, Depth= 0.39"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs Type III 24-hr 10-year Rainfall=5.12"

_	A	rea (sf)	CN [Description				
*	1	53,377	39 >	39 >75% Grass cover, Good, HSG A (Map Unit 651)				
*		510	39 >	39 >75% Grass cover, Good, HSG A (Map Unit 254A)				
*		25,219	61 >	>75% Grass cover, Good, HSG B (Map Unit 718A)				
*		15,368	30 N					
*		37,201	55 N	Voods, Go	od, HSG B	(Map Unit 718A)		
		31,675 31,675		Veighted A 00.00% Pe	verage ervious Are	а		
	Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description		
_	12.3	50	0.0200	0.07		Sheet Flow,		
	0.2	43	0.3950	3.14		Woods: Light underbrush n= 0.400 P2= 3.24" Shallow Concentrated Flow, Woodland Kv= 5.0 fps		
	12.5	93	Total					

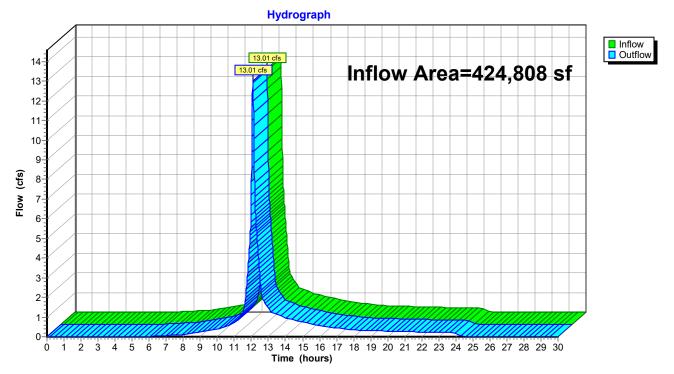
Subcatchment EX-4: Direct to River



Summary for Reach DP-1: 21" Concrete Pipe

Inflow Area	a =	424,808 sf,	25.60% Impervious,	Inflow Depth = 1.31"	for 10-year event
Inflow	=	13.01 cfs @	12.09 hrs, Volume=	46,523 cf	
Outflow	=	13.01 cfs @	12.09 hrs, Volume=	46,523 cf, Atte	en= 0%, Lag= 0.0 min

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

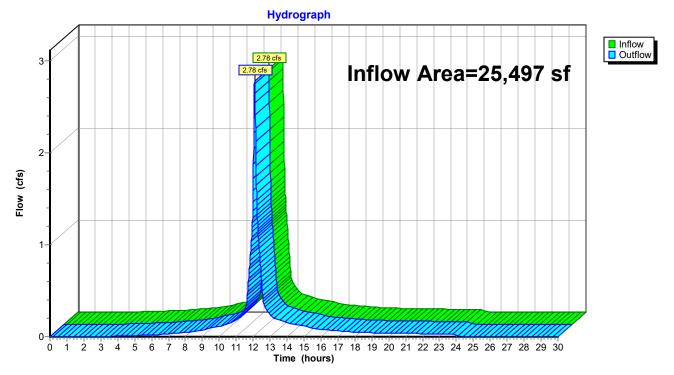


Reach DP-1: 21" Concrete Pipe

Summary for Reach DP-2: 24" RCP Pipe

Inflow Area	. =	25,497 sf,	92.23% Impervious,	Inflow Depth = 4.32 "	for 10-year event
Inflow	=	2.78 cfs @	12.08 hrs, Volume=	9,170 cf	
Outflow	=	2.78 cfs @	12.08 hrs, Volume=	9,170 cf, Atte	n= 0%, Lag= 0.0 min

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

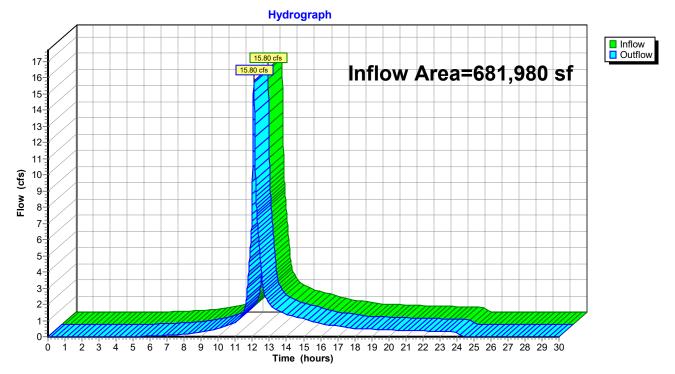


Reach DP-2: 24" RCP Pipe

Summary for Reach DP-3: Ipswich River

Inflow Area	a =	681,980 sf,	19.39% Impervious,	Inflow Depth = 1.11"	for 10-year event
Inflow	=	15.80 cfs @	12.09 hrs, Volume=	63,176 cf	
Outflow	=	15.80 cfs @	12.09 hrs, Volume=	63,176 cf, Atte	n= 0%, Lag= 0.0 min

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



Reach DP-3: Ipswich River

Existing Conditions	Type III 24-hr 100-year Rainfall=8.10"
Prepared by Stantec Consulting Ltd.	Printed 1/16/2024
HydroCAD® 10.00-24 s/n 02809 © 2018 Hy	droCAD Software Solutions LLC Page 21
	0-30.00 hrs, dt=0.01 hrs, 3001 points
	R-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+	Trans method - Pond routing by Stor-Ind method
Subcatchment EX-1: Portion of Parking	Runoff Area=133,902 sf 81.21% Impervious Runoff Depth=6.55"
	Tc=6.0 min CN=87 Runoff=22.48 cfs 73,056 cf
Subcatchment EX-2: Portion of Pervious	Runoff Area=290,906 sf 0.00% Impervious Runoff Depth=1.20"
	$r_{1,20}$ = $r_{1,20}$ = $r_{2,30}$, r_{30} = $r_{2,30}$, r_{30} = $r_{2,30}$
Subcatchment EX-3: Portion of Parking	Lot Runoff Area=25,497 sf 92.23% Impervious Runoff Depth=7.26"
j·	Tc=6.0 min CN=93 Runoff=4.54 cfs 15,430 cf
Subcatchment EX-4: Direct to River	Runoff Area=231,675 sf 0.00% Impervious Runoff Depth=1.59"
	Flow Length=93' Tc=12.5 min CN=43 Runoff=6.31 cfs 30,645 cf
Reach DP-1: 21" Concrete Pipe	Inflow=23.68 cfs 102,127 cf
	Outflow=23.68 cfs 102,127 cf
Reach DP-2: 24" RCP Pipe	Inflow=4.54 cfs 15,430 cf
Reach DF-2. 24 RCF Fipe	Outflow=4.54 cfs 15,430 cf
Reach DP-3: Ipswich River	Inflow=32.05 cfs 148,201 cf
·	Outflow=32.05 cfs 148,201 cf
	sf Runoff Volume = 148,201 cf Average Runoff Depth = 2.61"

al Runoff Area = 681,980 sf Runoff Volume = 148,201 ct Average אנאסת שפתח = 2.01 80.61% Pervious = 549,728 sf 19.39% Impervious = 132,252 sf

Summary for Subcatchment EX-1: Portion of Parking Lot

Runoff = 22.48 cfs @ 12.08 hrs, Volume= 73,056 cf, Depth= 6.55"

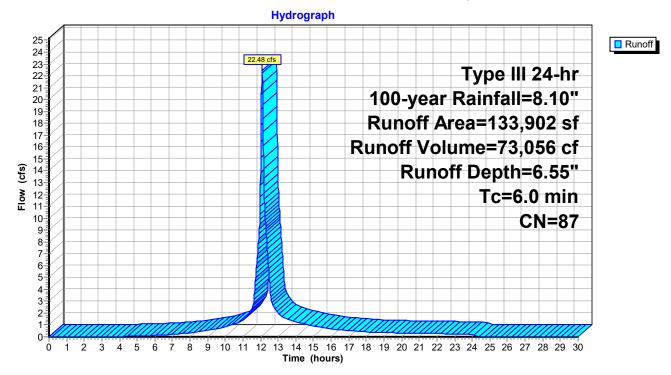
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs Type III 24-hr 100-year Rainfall=8.10"

	Area (sf)	CN	Description			
*	2,469	98	Roofs, HSG A (Map Unit 651)			
*	4,331	98	Roofs, HSG A (Map Unit 254A)			
*	9,746	39	>75% Grass cover, Good, HSG A (Map Unit 254A)			
*	5,898	98	Paved parking, HSG A (Map Unit 254A)			
*	15,420	39	>75% Ġrass cover, Good, HSG A (Map Unit 651)			
*	96,038	,038 98 Paved parking, HSG A (Map Unit 651)				
	133,902	87	Weighted Average			
	25,166		18.79% Pervious Area			
	108,736		81.21% Impervious Area			
	Tc Length (min) (feet)	Slop (ft/				



Direct Entry,

Subcatchment EX-1: Portion of Parking Lot



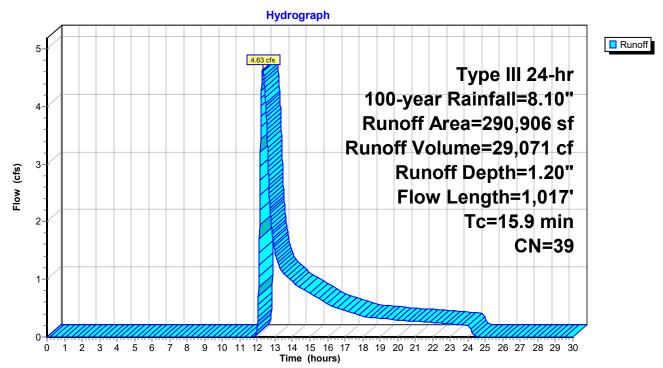
Summary for Subcatchment EX-2: Portion of Pervious

Runoff = 4.63 cfs @ 12.31 hrs, Volume= 29,071 cf, Depth= 1.20"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs Type III 24-hr 100-year Rainfall=8.10"

_	A	rea (sf)	CN E	Description		
*		6,806	39 >	75% Gras	s cover, Go	ood, HSG A (Map Unit 254A)
*	2	84,100	39 >	75% Gras	s cover, Go	bod, HSG A (Map Unit 651)
		90,906 90,906		Veighted A 00.00% Pe	verage ervious Are	а
	Тс	Length	Slope	Velocity	Capacity	Description
	(min)	(feet)	(ft/ft)	(ft/sec)	(cfs)	
	6.9	50	0.0120	0.12		Sheet Flow,
						Grass: Short n= 0.150 P2= 3.24"
	7.4	330	0.0112	0.74		Shallow Concentrated Flow,
						Short Grass Pasture Kv= 7.0 fps
	1.6	637	0.0090	6.77	16.28	Pipe Channel,
						21.0" Round Area= 2.4 sf Perim= 5.5' r= 0.44'
_						n= 0.012 Concrete pipe, finished
	15.9	1,017	Total			

Subcatchment EX-2: Portion of Pervious



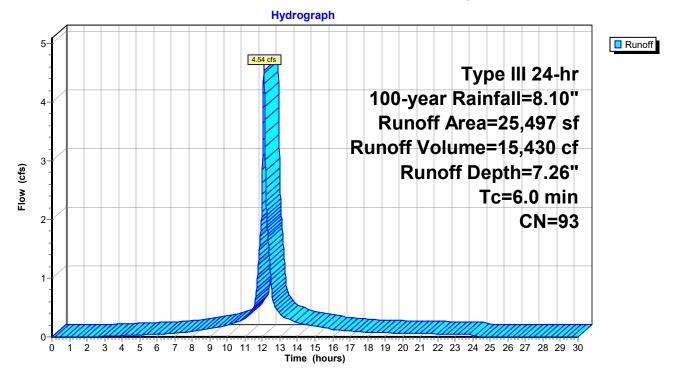
Summary for Subcatchment EX-3: Portion of Parking Lot

Runoff = 4.54 cfs @ 12.08 hrs, Volume= 15,430 cf, Depth= 7.26"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs Type III 24-hr 100-year Rainfall=8.10"

_	A	rea (sf)	CN	Description		
*		23,516	98	Paved park	ing, HSG A	(Map Unit 651)
*		1,981	39	>75% Gras	s cover, Go	bod, HSG A (Map Unit 651)
		25,497 1,981 23,516	93	Weighted A 7.77% Perv 92.23% Imp	vious Area	ea
	Tc (min)	Length (feet)	Slope (ft/ft	,	Capacity (cfs)	Description
	6.0					Direct Entry,

Subcatchment EX-3: Portion of Parking Lot



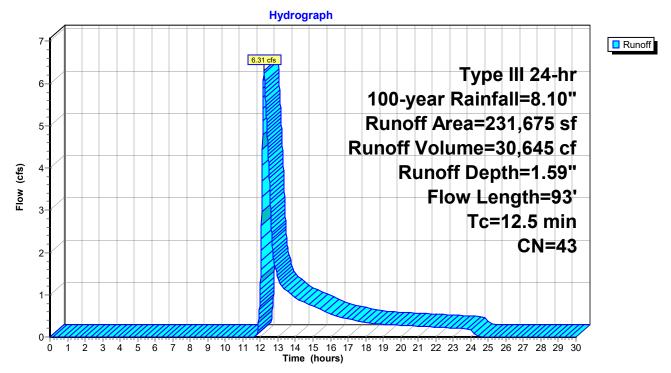
Summary for Subcatchment EX-4: Direct to River

Runoff = 6.31 cfs @ 12.21 hrs, Volume= 30,645 cf, Depth= 1.59"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs Type III 24-hr 100-year Rainfall=8.10"

	Δ	rea (sf)	CN [Description		
*		53,377		I		bod, HSG A (Map Unit 651)
*	1	,			,	
		510				ood, HSG A (Map Unit 254A)
*		25,219	61 >	⊳75% Gras	s cover, Go	bod, HSG B (Map Unit 718A)
*		15,368	30 \	Voods, Go	od, HSG A	(Map Unit 651)
*		37,201	55 \	Voods, Go	od, HSG B	(Map Unit 718A)
_	2	31,675	43 \	Veighted A	verage	
	231,675				ervious Are	2
	2	51,075		00.00701		a
	Та	Longth	Slope	Valaaity	Conocity	Description
	Tc	Length	Slope		Capacity	Description
_	(min)	(feet)	(ft/ft)	(ft/sec)	(cfs)	
	12.3	50	0.0200	0.07		Sheet Flow,
						Woods: Light underbrush n= 0.400 P2= 3.24"
	0.2	43	0.3950	3.14		Shallow Concentrated Flow,
	0.2	43	0.3950	5.14		•
_						Woodland Kv= 5.0 fps
	12.5	93	Total			

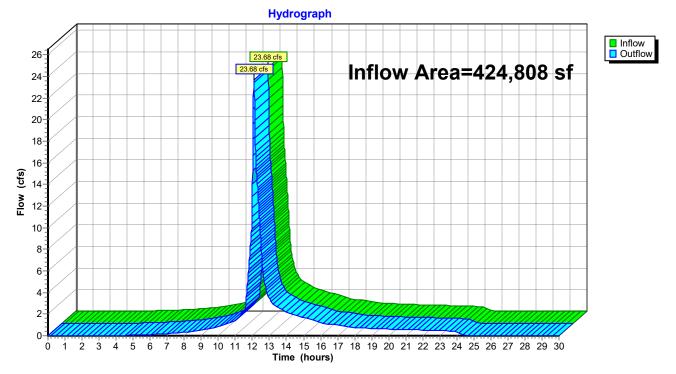
Subcatchment EX-4: Direct to River



Summary for Reach DP-1: 21" Concrete Pipe

Inflow Area =		424,808 sf, 25.60% Impervious, Inflow Depth = 2.88" for 100-year	r event
Inflow	=	23.68 cfs @ 12.09 hrs, Volume= 102,127 cf	
Outflow	=	23.68 cfs @ 12.09 hrs, Volume= 102,127 cf, Atten= 0%, Lag=	0.0 min

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

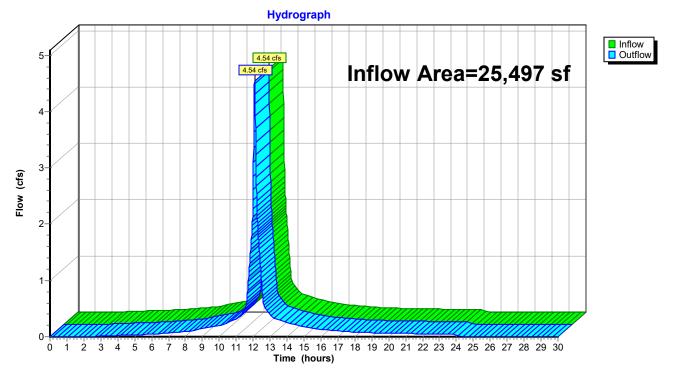


Reach DP-1: 21" Concrete Pipe

Summary for Reach DP-2: 24" RCP Pipe

Inflow Area =		25,497 sf, 92.23% Impervious, Inflow Depth = 7.26" for	or 100-year event
Inflow	=	4.54 cfs @ 12.08 hrs, Volume= 15,430 cf	
Outflow	=	4.54 cfs @ 12.08 hrs, Volume= 15,430 cf, Atten=	0%, Lag= 0.0 min

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

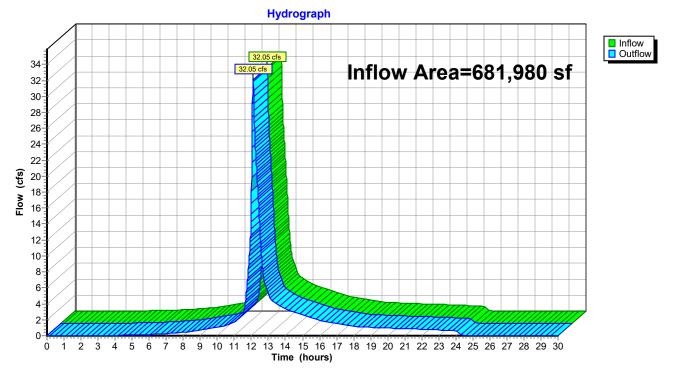


Reach DP-2: 24" RCP Pipe

Summary for Reach DP-3: Ipswich River

Inflow Area =		681,980 sf, 19.39% Impervious, Inflow Depth = 2.61" for 100-year ev	/ent
Inflow	=	32.05 cfs @ 12.10 hrs, Volume= 148,201 cf	
Outflow	=	32.05 cfs @ 12.10 hrs, Volume= 148,201 cf, Atten= 0%, Lag= 0.0	min

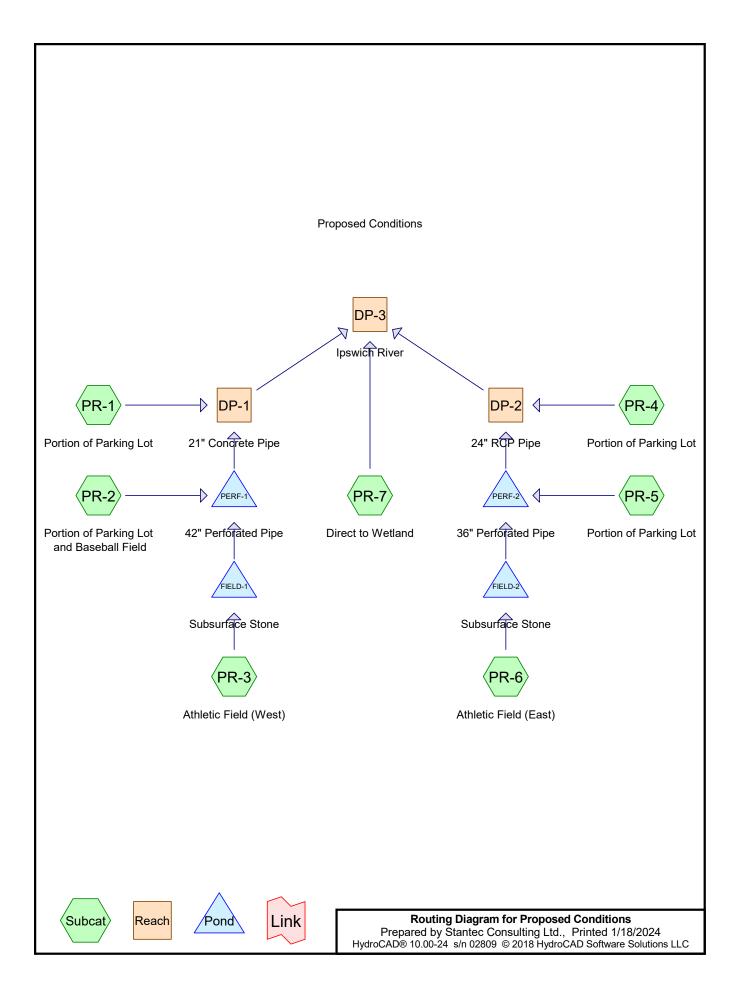
Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs



Reach DP-3: Ipswich River

Appendix F PROPOSED HYDROLOGIC CONDITIONS

PROPOSED CONDITIONS HYDROCAD REPORT



Proposed Conditions Prepared by Stantec Consulting Ltd. HydroCAD® 10.00-24 s/n 02809 © 2018 HydroCAD Software Solutions LLC

Area Listing (all nodes)

Area	CN	Description	
(sq-ft)		(subcatchment-numbers)	
9,138	39	>75% Grass cover, Good, HSG A (Map Unit 254A) (PR-1, PR-2, PR-7)	
237,655	39	>75% Grass cover, Good, HSG A (Map Unit 651) (PR-1, PR-2, PR-4, PR-5,	
11,092	61	>75% Grass cover, Good, HSG B (Map Unit 718A) (PR-7)	
9,738	98	Paved parking, HSG A (Map Unit 254A) (PR-1)	
177,673	98	Paved parking, HSG A (Map Unit 651) (PR-1, PR-2, PR-4, PR-5, PR-7)	
4,604	98	Paved parking, HSG B (Map Unit 718A) (PR-7)	
4,331	98	Roofs, HSG A (Map Unit 254A) (PR-1)	
5,344	98	Roofs, HSG A (Map Unit 651) (PR-1, PR-2)	
160,992	98	Synthetic Turf Field (Map Unit 651) (PR-3, PR-6)	
11,049	98	Synthetic Turf Field (Map Unit 718A) (PR-6)	
14,690	30	Woods, Good, HSG A (Map Unit 651) (PR-7)	
35,674	55	Woods, Good, HSG B (Map Unit 718A) (PR-7)	
681,980	72	TOTAL AREA	

Soil Listing (all nodes)

Area	Soil	Subcatchment
(sq-ft)	Group	Numbers
458,569	HSG A	PR-1, PR-2, PR-4, PR-5, PR-7
51,370	HSG B	PR-7
0	HSG C	
0	HSG D	
172,041	Other	PR-3, PR-6
681,980		TOTAL AREA

Proposed Conditions	
Prepared by Stantec Consulting Ltd.	Printed 1/18/2024
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Li	ne#	Node	In-Invert	Out-Invert	Length	Slope	n	Diam/Width	Height	Inside-Fill
		Number	(feet)	(feet)	(feet)	(ft/ft)		(inches)	(inches)	(inches)
	1	PERF-1	48.70	48.60	10.0	0.0100	0.013	18.0	0.0	0.0
	2	PERF-2	44.95	44.85	10.0	0.0100	0.013	10.0	0.0	0.0

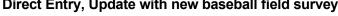
Proposed ConditionsType III 24-hr2-year Rainfall=3.24"Prepared by Stantec Consulting Ltd.Printed 1/18/2024HydroCAD® 10.00-24 s/n 02809 © 2018 HydroCAD Software Solutions LLCPage 5
Time span=0.00-30.00 hrs, dt=0.01 hrs, 3001 points Runoff by SCS TR-20 method, UH=SCS, Weighted-CN Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method
Subcatchment PR-1: Portion of Parking Runoff Area=104,151 sf 84.10% Impervious Runoff Depth=2.12" Tc=6.0 min CN=89 Runoff=5.90 cfs 18,383 cf
Subcatchment PR-2: Portion of Parking Runoff Area=231,648 sf 24.90% Impervious Runoff Depth=0.23" Tc=6.0 min CN=54 Runoff=0.49 cfs 4,531 cf
Subcatchment PR-3: Athletic Field (West) Runoff Area=89,400 sf 100.00% Impervious Runoff Depth=3.01" Tc=6.0 min CN=98 Runoff=6.46 cfs 22,405 cf
Subcatchment PR-4: Portion of Parking Lot Runoff Area=13,840 sf 88.83% Impervious Runoff Depth=2.30" Tc=6.0 min CN=91 Runoff=0.84 cfs 2,648 cf
Subcatchment PR-5: Portion of Parking Lot Runoff Area=38,475 sf 91.66% Impervious Runoff Depth=2.48" Tc=6.0 min CN=93 Runoff=2.49 cfs 7,965 cf
Subcatchment PR-6: Athletic Field (East) Runoff Area=82,641 sf 100.00% Impervious Runoff Depth=3.01" Tc=6.0 min CN=98 Runoff=5.97 cfs 20,711 cf
Subcatchment PR-7: Direct to Wetland Flow Length=93' Tc=12.5 min CN=49 Runoff=0.05 cfs 1,178 cf
Reach DP-1: 21" Concrete Pipe Inflow=5.90 cfs 18,383 cf Outflow=5.90 cfs 18,383 cf
Reach DP-2: 24" RCP Pipe Inflow=0.85 cfs 4,197 cf Outflow=0.85 cfs 4,197 cf
Reach DP-3: Ipswich RiverInflow=6.75 cfs23,759 cfOutflow=6.75 cfs23,759 cfOutflow=6.75 cfs23,759 cf
Pond FIELD-1: Subsurface StonePeak Elev=53.53' Storage=709 cfInflow=6.46 cfs22,405 cfDiscarded=5.02 cfs22,405 cfPrimary=0.00 cfs0 cfOutflow=5.02 cfs22,405 cf
Pond FIELD-2: Subsurface StonePeak Elev=51.03' Storage=667 cf Inflow=5.97 cfs 20,711 cfDiscarded=4.61 cfs 20,711 cfPrimary=0.00 cfs 0 cf Outflow=4.61 cfs 20,711 cf
Pond PERF-1: 42" Perforated PipePeak Elev=47.42' Storage=259 cfInflow=0.49 cfs4,531 cfDiscarded=0.28 cfs4,531 cfPrimary=0.00 cfs0 cfOutflow=0.28 cfs4,531 cf
Pond PERF-2: 36" Perforated Pipe Peak Elev=45.39' Storage=2,472 cf Inflow=2.49 cfs 7,965 cf Discarded=0.19 cfs 6,415 cf Primary=0.48 cfs 1,550 cf Outflow=0.67 cfs 7,965 cf
Total Runoff Area = 681,980 sf Runoff Volume = 77,821 cf Average Runoff Depth = 1.37" 45.20% Pervious = 308,249 sf 54.80% Impervious = 373,731 sf

Summary for Subcatchment PR-1: Portion of Parking Lot

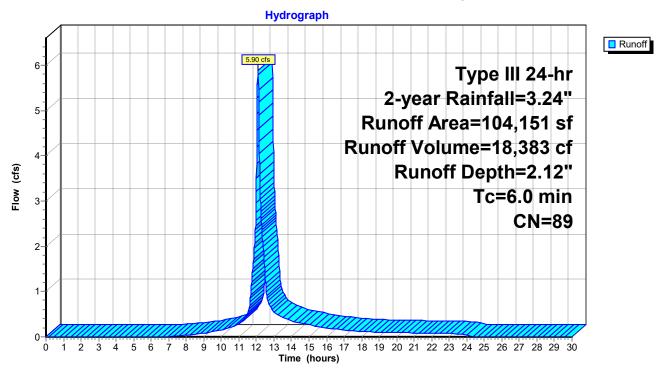
5.90 cfs @ 12.09 hrs, Volume= 18,383 cf, Depth= 2.12" Runoff =

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs Type III 24-hr 2-year Rainfall=3.24"

	Area (sf) CN	Description					
*	2,469	9 98	Roofs, HSC	G A (Map U	nit 651)			
*	4,33	1 98	Roofs, HSC	G A (Map U	nit 254Å)			
*	71,056	6 98	Paved park	ing, HSG A	(Map Unit 651)			
*	9,738	3 98	Paved park	ing, HSG A	(Map Unit 254A)			
*	1,820) 39	>75% Gras	s cover, Go	bod, HSG A (Map Unit 254A)			
*	14,737	7 39	>75% Gras	>75% Grass cover, Good, HSG A (Map Unit 651)				
	104,15 [,]	1 89	Weighted A	verage				
	16,557	7	15.90% Pe	rvious Area				
	87,594	4	84.10% Im	pervious Ar	ea			
	Tc Leng	th Slo	pe Velocity	Capacity	Description			
	(min) (fee	et) (ft/	(ft/sec)	(cfs)				
	6.0				Direct Entry, Update with new baseball field survey			



Subcatchment PR-1: Portion of Parking Lot



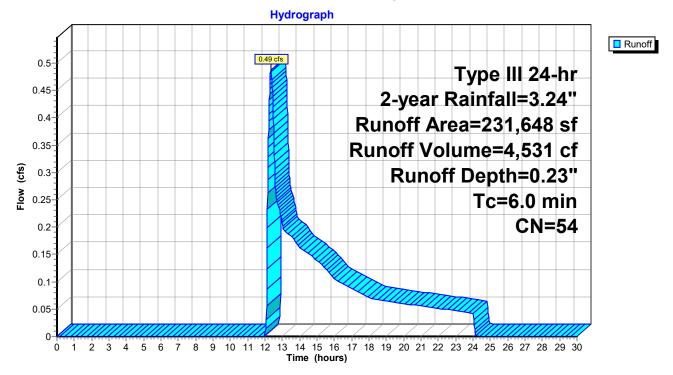
Summary for Subcatchment PR-2: Portion of Parking Lot and Baseball Field

Runoff = 0.49 cfs @ 12.35 hrs, Volume= 4,531 cf, Depth= 0.23"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs Type III 24-hr 2-year Rainfall=3.24"

_	A	rea (sf)	CN	Description		
*		2,875	98	Roofs, HSG	A (Map U	nit 651)
*		54,805	98	Paved park	ing, HSG A	(Map Unit 651)
*		6,808	39	>75% Gras	s cover, Go	bod, HSG A (Map Unit 254A)
*	1	67,160	39	>75% Gras	s cover, Go	bod, HSG A (Map Unit 651)
	2	31,648	54	Weighted A	verage	
	1	73,968		75.10% Pei	vious Area	
		57,680		24.90% Imp	pervious Are	ea
	Тс	Length	Slop		Capacity	Description
_	(min)	(feet)	(ft/ft	:) (ft/sec)	(cfs)	
	6.0					Direct Entry, Update with new baseball field survey





Summary for Subcatchment PR-3: Athletic Field (West)

Runoff = 6.46 cfs @ 12.08 hrs, Volume= 22,405 cf, Depth= 3.01"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs Type III 24-hr 2-year Rainfall=3.24"

	rea (sf) 89,400		escription vnthetic Tu	urf Field (M	lap Unit 651)
	89,400			pervious A	
Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					Direct Entry,
			Subcate	chment P	PR-3: Athletic Field (West)
				Hydro	ograph
7- 6- 5-				6.46 cfs	Type III 24-hr 2-year Rainfall=3.24" Runoff Area=89,400 sf Runoff Volume=22,405 cf
Flow (cfs)					Runoff Depth=3.01"
Elow					Tc=6.0 min CN=98
2- 1-					
- - - 0 -	1 2 3	4 5 6	7 8 9 10		4 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 e (hours)

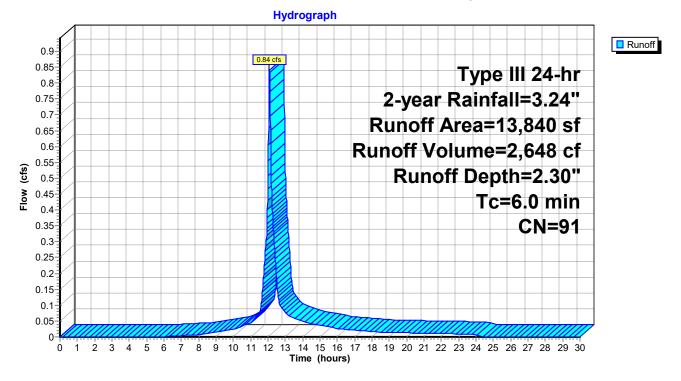
Summary for Subcatchment PR-4: Portion of Parking Lot

Runoff = 0.84 cfs @ 12.09 hrs, Volume= 2,648 cf, Depth= 2.30"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs Type III 24-hr 2-year Rainfall=3.24"

_	A	rea (sf)	CN	Description				
*		12,294	98	Paved park	ing, HSG A	(Map Unit 651)		
*		1,546	39	>75% Ġras	s cover, Go	bod, HSG A (Map Unit 651)		
		13,840 1,546 12,294		91 Weighted Average 11.17% Pervious Area 88.83% Impervious Area				
	Tc (min)	Length (feet)	Slope (ft/ft	,	Capacity (cfs)	Description		
	6.0					Direct Entry,		

Subcatchment PR-4: Portion of Parking Lot



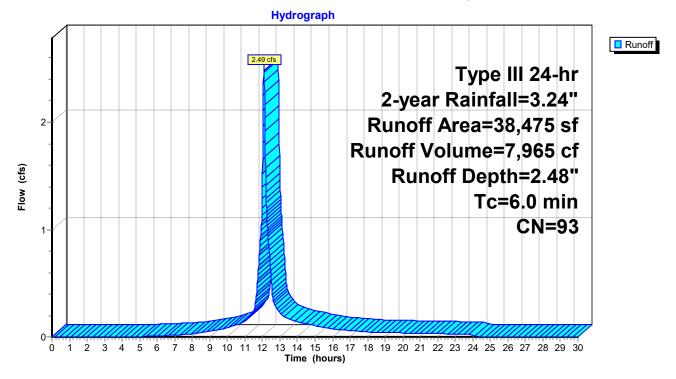
Summary for Subcatchment PR-5: Portion of Parking Lot

Runoff = 2.49 cfs @ 12.09 hrs, Volume= 7,965 cf, Depth= 2.48"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs Type III 24-hr 2-year Rainfall=3.24"

_	A	rea (sf)	CN	Description				
*		35,267	98	Paved park	ing, HSG A	(Map Unit 651)		
*		3,208	39	>75% Ġras	s cover, Go	pod, HSG A (Map Unit 651)		
		38,475 3,208 35,267	93	Weighted Average 8.34% Pervious Area 91.66% Impervious Area				
	Tc (min)	Length (feet)	Slope (ft/ft		Capacity (cfs)	Description		
	6.0					Direct Entry,		

Subcatchment PR-5: Portion of Parking Lot



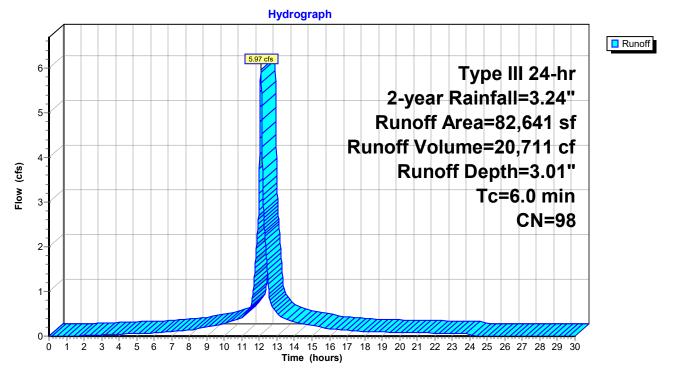
Summary for Subcatchment PR-6: Athletic Field (East)

Runoff = 5.97 cfs @ 12.08 hrs, Volume= 20,711 cf, Depth= 3.01"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs Type III 24-hr 2-year Rainfall=3.24"

	A	rea (sf)	CN	Description		
*		71,592	98	Synthetic T	urf Field (M	Map Unit 651)
*		11,049	98	Synthetic T	urf Field (M	Map Unit 718A)
		82,641	98	Weighted A	verage	
		82,641		100.00% Im	npervious A	Area
	То	Longth	Slop		Capacity	
	Tc (min)	Length (feet)	Slope	,	Capacity (cfs)	1
	(min)	(leet)	(ft/ft) (11/Sec)	(CIS)	
	6.0					Direct Entry,

Subcatchment PR-6: Athletic Field (East)



Summary for Subcatchment PR-7: Direct to Wetland

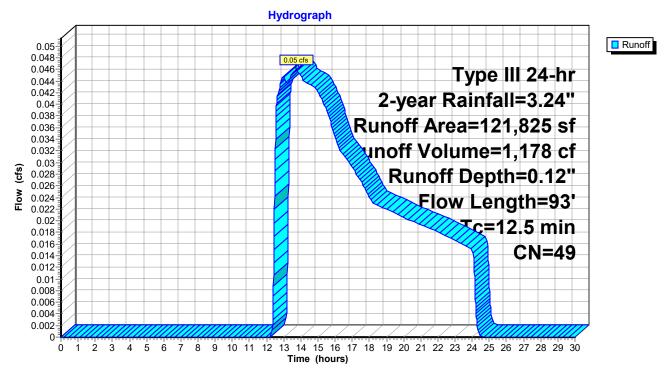
1,178 cf, Depth= 0.12" Runoff 0.05 cfs @ 13.71 hrs, Volume= =

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs Type III 24-hr 2-year Rainfall=3.24"

	A	rea (sf)	CN [Description			
*		510	39 >	>75% Grass cover, Good, HSG A (Map Unit 254A)			
*		51,004	39 >	>75% Gras	s cover, Go	bod, HSG A (Map Unit 651)	
*		11,092	61 >	>75% Gras	s cover, Go	bod, HSG B (Map Unit 718A)	
*		35,674	55 \	Noods, Go	od, HSG B	(Map Unit 718A)	
*		14,690	30 \	Noods, Go	od, HSG A	(Map Unit 651)	
*		4,251	98 F	Paved park	ing, HSG A	(Map Unit 651)	
*		4,604	98 F	Paved park	ing, HSG B	B (Map Unit 718A)	
	121,825 49 Weighted Average						
	1	12,970	ç	92.73% Pei	rvious Area		
		8,855	7	7.27% Impe	ervious Are	a	
				-			
	Tc	Length	Slope	Velocity	Capacity	Description	
	(min)	(feet)	(ft/ft)	(ft/sec)	(cfs)		
	12.3	50	0.0200	0.07		Sheet Flow,	
						Woods: Light underbrush n= 0.400 P2= 3.24"	
	0.2	43	0.3950	3.14		Shallow Concentrated Flow,	
						Woodland Kv= 5.0 fps	
_	12.5	93	Total				

93 Total

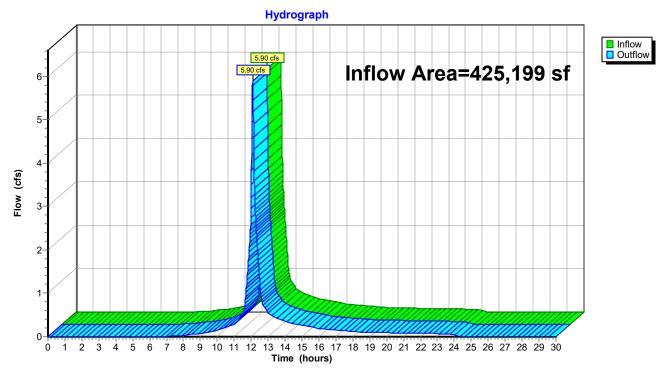
Subcatchment PR-7: Direct to Wetland



Summary for Reach DP-1: 21" Concrete Pipe

Inflow Are	a =	425,199 sf, 55.19% Impervious, Inflow Depth = 0.52" for 2-year event
Inflow	=	5.90 cfs @ 12.09 hrs, Volume= 18,383 cf
Outflow	=	5.90 cfs @ 12.09 hrs, Volume= 18,383 cf, Atten= 0%, Lag= 0.0 min

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

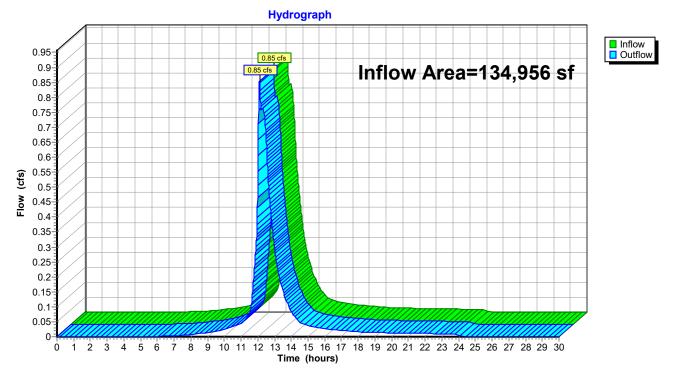


Reach DP-1: 21" Concrete Pipe

Summary for Reach DP-2: 24" RCP Pipe

Inflow Area =	134,956 sf, 96.48% Impervious,	Inflow Depth = 0.37"	for 2-year event
Inflow =	0.85 cfs @ 12.10 hrs, Volume=	4,197 cf	
Outflow =	0.85 cfs @ 12.10 hrs, Volume=	4,197 cf, Atter	n= 0%, Lag= 0.0 min

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

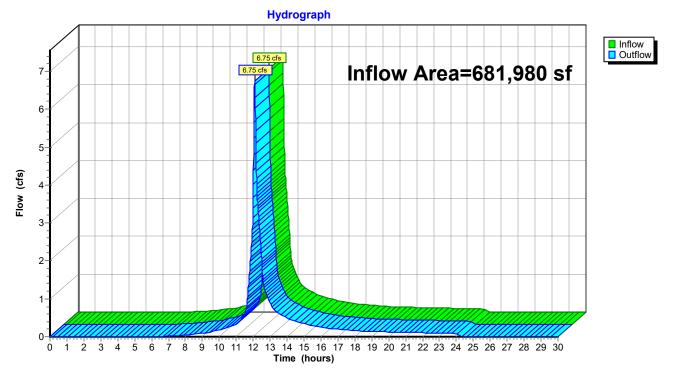


Reach DP-2: 24" RCP Pipe

Summary for Reach DP-3: Ipswich River

Inflow Are	a =	681,980 sf, 54.80% Impervious, Inflow Depth = 0.42" for 2-year event	i
Inflow	=	6.75 cfs @ 12.09 hrs, Volume= 23,759 cf	
Outflow	=	6.75 cfs @ 12.09 hrs, Volume= 23,759 cf, Atten= 0%, Lag= 0.0 r	min

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

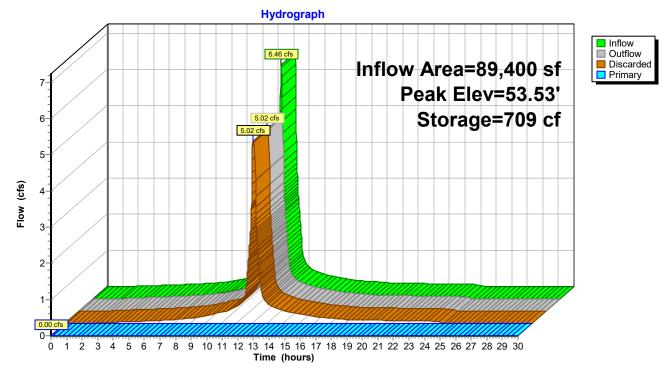


Reach DP-3: Ipswich River

Summary for Pond FIELD-1: Subsurface Stone

Inflow Ar Inflow Outflow Discarde Primary	= 6.4 = 5.0 ed = 5.0	16 cfs @ 12 02 cfs @ 12 02 cfs @ 12	00.00% Impervious 2.08 hrs, Volume= 2.05 hrs, Volume= 2.05 hrs, Volume= 0.00 hrs, Volume=	22,405 c 22,405 c 22,405 c	, Atten= 22%, Lag= 0.0 min		
	Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs Peak Elev= 53.53' @ 12.15 hrs Surf.Area= 90,007 sf Storage= 709 cf						
Plug-Flow detention time= 1.2 min calculated for 22,397 cf (100% of inflow) Center-of-Mass det. time= 1.2 min(757.4 - 756.1)							
Volume	Invert	Avail.Sto	rage Storage De	scription			
#1 53.50' 27,002 cf Custom Stage Data (Prismatic) Listed below (R 90,007 cf Overall x 30.0% Voids							
Elevatio	n Sur	f.Area	Inc.Store	Cum.Store			
(fee	t)	(sq-ft)	(cubic-feet)	(cubic-feet)			
53.5		0,007	0	0			
54.5	0 9	0,007	90,007	90,007			
Device	Routing	Invert	Outlet Devices				
#1	Discarded	53.50'	2.410 in/hr Exfilt	ration over Surfa	ce area		
#2	Primary	53.75'	0.500 cfs Consta	ant Flow/Skimmer	X 34.00		
	Discarded OutFlow Max=5.02 cfs @ 12.05 hrs HW=53.51' (Free Discharge) 1=Exfiltration (Exfiltration Controls 5.02 cfs)						

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=53.50' (Free Discharge)

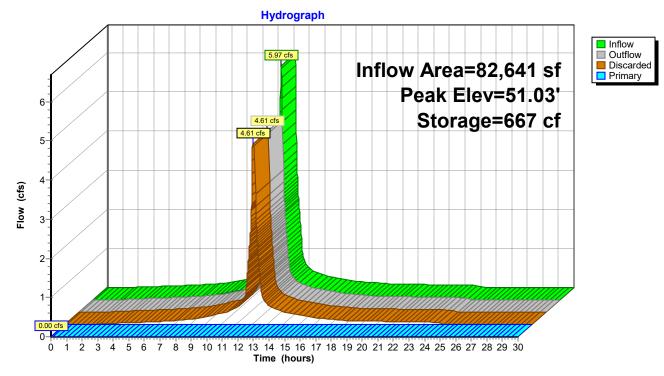


Pond FIELD-1: Subsurface Stone

Summary for Pond FIELD-2: Subsurface Stone

Inflow Area = Inflow = Outflow = Discarded = Primary =	5.97 cfs @ 1 4.61 cfs @ 1 4.61 cfs @ 1	00.00% Impervious, 2.08 hrs, Volume= 2.05 hrs, Volume= 2.05 hrs, Volume= 0.00 hrs, Volume=	20,711 cf, Atten= 23%, Lag= 0.0 min 20,711 cf				
Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs Peak Elev= 51.03' @ 12.15 hrs Surf.Area= 82,641 sf Storage= 667 cf							
Center-of-Mass of	Plug-Flow detention time= 1.2 min calculated for 20,704 cf (100% of inflow) Center-of-Mass det. time= 1.2 min(757.4 - 756.1)						
-	/ert Avail.Sto	U	•				
#1 51.	.00' 24,79		age Data (Prismatic) Listed below (Recalc) verall x 30.0% Voids				
Elevation	Surf.Area	Inc.Store	Cum.Store				
(feet)	(sq-ft)		(cubic-feet)				
51.00	82,641	0					
	,	v	00.044				
52.00	82,641	82,641	82,641				
Device Routing	Invert	Outlet Devices					
#1 Discard	ed 51.00'	2.410 in/hr Exfiltr	ration over Surface area				
#2 Primary	51.25'	0.500 cfs Consta	nt Flow/Skimmer X 32.00				
Discarded OutFlow Max=4.61 cfs @ 12.05 hrs HW=51.01' (Free Discharge) 1=Exfiltration (Exfiltration Controls 4.61 cfs)							

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=51.00' (Free Discharge) ←2=Constant Flow/Skimmer (Controls 0.00 cfs)

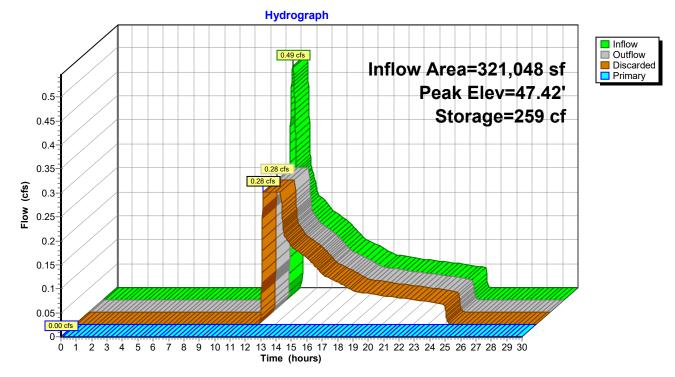


Pond FIELD-2: Subsurface Stone

Summary for Pond PERF-1: 42" Perforated Pipe

Inflow A Inflow Outflow Discarde Primary	= 0. = 0. ed = 0.	49 cfs @ 12.35	hrs, Volume= 4,531 cf, Atten= 43%, Lag= 0.0 min hrs, Volume= 4,531 cf					
	Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs Peak Elev= 47.42' @ 12.59 hrs Surf.Area= 4,950 sf Storage= 259 cf							
Plug-Flow detention time= 5.9 min calculated for 4,531 cf (100% of inflow) Center-of-Mass det. time= 5.9 min (967.4 - 961.4)								
Volume	Invert	Avail.Storage	Storage Description					
#1	47.75'	10,583 cf	42.0" Round Pipe Storage x 2 Inside #2 L= 550.0'					
#2	47.25'	3,508 cf	4.50'W x 550.00'L x 4.50'H Prismatoid x 2 22,275 cf Overall - 10,583 cf Embedded = 11,692 cf x 30.0% Voids					
		14,091 cf	Total Available Storage					
Device	Routing	Invert Ou	itlet Devices					
#1	Discarded	47.25' 2.4	10 in/hr Exfiltration over Surface area					
#2	Primary	48.70' 18 .	.0" Round Culvert					
		L=	10.0' CMP, projecting, no headwall, Ke= 0.900					
		Inle	et / Outlet Invert= 48.70' / 48.60' S= 0.0100 '/' Cc= 0.900					
		n=	0.013 Cast iron, coated, Flow Area= 1.77 sf					
		Max=0.28 cfs @ filtration Controls	12.23 hrs HW=47.30' (Free Discharge) s 0.28 cfs)					

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=47.25' (Free Discharge) ←2=Culvert (Controls 0.00 cfs)



Pond PERF-1: 42" Perforated Pipe

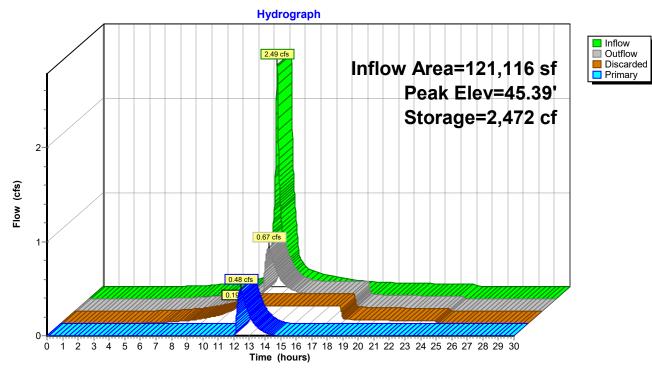
Summary for Pond PERF-2: 36" Perforated Pipe

Inflow Area =	· · · · · ·	, Inflow Depth = 0.79" for 2-year event				
Inflow =	2.49 cfs @ 12.09 hrs, Volume=	= 7,965 cf				
Outflow =	0.67 cfs @ 12.44 hrs, Volume=	7,965 cf, Atten= 73%, Lag= 21.4 min				
Discarded =	0.19 cfs @ 11.34 hrs, Volume=	= 6,415 cf				
Primary =	0.48 cfs @ 12.44 hrs, Volume=	= 1,550 cf				
Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs Peak Elev= 45.39' @ 12.44 hrs Surf.Area= 3,400 sf Storage= 2,472 cf						
Plug-Flow detention time= 59.4 min calculated for 7,962 cf (100% of inflow) Center-of-Mass det. time= 59.4 min (851.6 - 792.2)						
Volume Inve	ert Avail.Storage Storage Des	scription				

#1	44.50'	6,008 cf	36.0" Round Pipe Storage x 2 Inside #2		
#2 44.00' 2,278 cf		2,278 cf	4.00'W x 425.00'L x 4.00'H Prismatoid x 2 13,600 cf Overall - 6,008 cf Embedded = 7,592 cf x 30.0% Voids		
		8,286 cf	Total Available Storage		
Device	Routing	Invert Out	let Devices		
#1 #2	Discarded Primary	44.95' 10.0 L= Inle	10 in/hr Exfiltration over Surface area D" Round Culvert 10.0' CMP, projecting, no headwall, Ke= 0.900 t / Outlet Invert= 44.95' / 44.85' S= 0.0100 '/' Cc= 0.900 0.013 Cast iron, coated, Flow Area= 0.55 sf		
Discarded OutFlow Max=0 19 cfs @ 11 34 brs HW=44 04' (Free Discharge)					

Discarded OutFlow Max=0.19 cfs @ 11.34 hrs HW=44.04' (Free Discharge) **1=Exfiltration** (Exfiltration Controls 0.19 cfs)

Primary OutFlow Max=0.48 cfs @ 12.44 hrs HW=45.39' (Free Discharge) ←2=Culvert (Barrel Controls 0.48 cfs @ 2.38 fps)



Pond PERF-2: 36" Perforated Pipe

Proposed ConditionsType IIPrepared by Stantec Consulting Ltd.HydroCAD® 10.00-24 s/n 02809 © 2018 HydroCAD Software Solutions LLC	<i>I 24-hr 10-year Rainfall=5.12"</i> Printed 1/18/2024 Page 24
Time span=0.00-30.00 hrs, dt=0.01 hrs, 3001 p Runoff by SCS TR-20 method, UH=SCS, Weight Reach routing by Stor-Ind+Trans method - Pond routing by	ed-CN
	% Impervious Runoff Depth=3.89" N=89 Runoff=10.57 cfs 33,736 cf
	% Impervious Runoff Depth=0.98" CN=54 Runoff=4.81 cfs 18,877 cf
Subcatchment PR-3: Athletic Field (West) Runoff Area=89,400 sf 100.009 Tc=6.0 min Cl	% Impervious Runoff Depth=4.88" N=98 Runoff=10.28 cfs 36,378 cf
Subcatchment PR-4: Portion of Parking LotRunoff Area=13,840 sf 88.839 Tc=6.0 min	% Impervious Runoff Depth=4.10" CN=91 Runoff=1.46 cfs 4,727 cf
Subcatchment PR-5: Portion of Parking LotRunoff Area=38,475 sf 91.669 Tc=6.0 min 0	% Impervious Runoff Depth=4.32" CN=93 Runoff=4.19 cfs 13,837 cf
Subcatchment PR-6: Athletic Field (East) Runoff Area=82,641 sf 100.009 Tc=6.0 min 0	% Impervious Runoff Depth=4.88" CN=98 Runoff=9.51 cfs 33,628 cf
	% Impervious Runoff Depth=0.69" CN=49 Runoff=1.10 cfs 6,970 cf
Reach DP-1: 21" Concrete Pipe	Inflow=10.57 cfs 39,100 cf Outflow=10.57 cfs 39,100 cf
Reach DP-2: 24" RCP Pipe	Inflow=2.47 cfs 9,929 cf Outflow=2.47 cfs 9,929 cf
Reach DP-3: Ipswich River	Inflow=13.30 cfs 56,000 cf Outflow=13.30 cfs 56,000 cf
Pond FIELD-1: Subsurface StonePeak Elev=53.61' Storage=2,Discarded=5.02 cfs36,378 cfPrimary=0.00 cfs	893 cf Inflow=10.28 cfs 36,378 cf 0 cf Outflow=5.02 cfs 36,378 cf
Pond FIELD-2: Subsurface Stone Peak Elev=51.11' Storage=2 Discarded=4.61 cfs 33,628 cf Primary=0.00 cfs	2,703 cf Inflow=9.51 cfs 33,628 cf 6 0 cf Outflow=4.61 cfs 33,628 cf
Pond PERF-1: 42" Perforated PipePeak Elev=49.14' Storage=5Discarded=0.28 cfs13,513 cfPrimary=0.69 cfs5,33	5,540 cf Inflow=4.81 cfs 18,877 cf 65 cf Outflow=0.97 cfs 18,877 cf
Pond PERF-2: 36" Perforated PipePeak Elev=45.89' Storage=3Discarded=0.19 cfs8,635 cfPrimary=1.50 cfs5,2	8,843 cf Inflow=4.19 cfs 13,837 cf 202 cf Outflow=1.69 cfs 13,837 cf
Total Runoff Area = 681,980 sf Runoff Volume = 148,154 cf 45.20% Pervious = 308,249 sf	

Summary for Subcatchment PR-1: Portion of Parking Lot

Runoff 10.57 cfs @ 12.09 hrs, Volume= 33,736 cf, Depth= 3.89" =

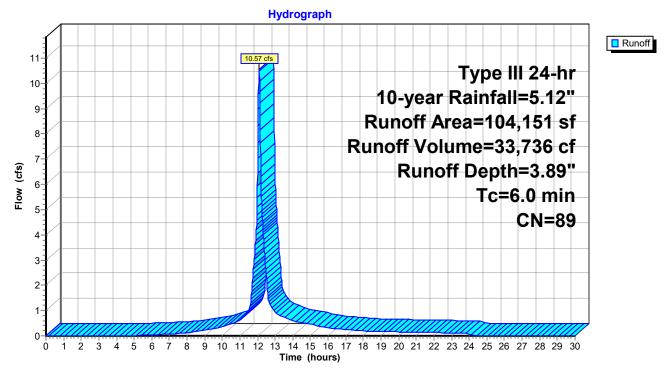
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs Type III 24-hr 10-year Rainfall=5.12"

	Area (sf) CN	Description					
*	2,469	9 98	Roofs, HSC	G A (Map U	nit 651)			
*	4,33	1 98	Roofs, HSC	G A (Map U	nit 254Å)			
*	71,056	6 98	Paved park	ing, HSG A	(Map Unit 651)			
*	9,738	3 98	Paved park	ing, HSG A	(Map Unit 254A)			
*	1,820) 39	>75% Gras	s cover, Go	bod, HSG A (Map Unit 254A)			
*	14,737	7 39	>75% Gras	>75% Grass cover, Good, HSG A (Map Unit 651)				
	104,15 [,]	1 89	Weighted A	verage				
	16,557	7	15.90% Pe	rvious Area				
	87,594	4	84.10% Im	pervious Ar	ea			
	Tc Leng	th Slo	pe Velocity	Capacity	Description			
	(min) (fee	et) (ft/	(ft/sec)	(cfs)				
	6.0				Direct Entry, Update with new baseball field survey			



Direct Entry, Update with new baseball field survey

Subcatchment PR-1: Portion of Parking Lot



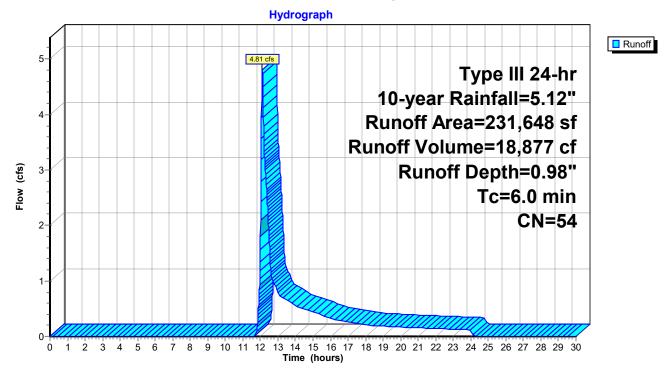
Summary for Subcatchment PR-2: Portion of Parking Lot and Baseball Field

Runoff = 4.81 cfs @ 12.11 hrs, Volume= 18,877 cf, Depth= 0.98"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs Type III 24-hr 10-year Rainfall=5.12"

	Area (sf) C	N D	escription				
*	2,8	375 S	98 R	oofs, HSG	a (Map Ur	nit 651)		
*	54,8	805 S	98 P	aved park	ing, HSG A	(Map Unit 651)		
*	6,8	808 3	39 >	75% Ġras	s cover, Go	ood, HSG A (Map Unit 254A)		
*	167,1	60 3	39 >	75% Gras	s cover, Go	ood, HSG A (Map Unit 651)		
	231,6	648 5	54 W	/eighted A	verage			
	173,9	173,968 75.10% Pervious Area						
	57,6	680	2	24.90% Impervious Area				
	Tc Ler	ngth S	Slope	Velocity	Capacity	Description		
_	(min) (f	eet)	(ft/ft)	(ft/sec)	(cfs)			
	6.0					Direct Entry, Update with new baseball field survey		

Subcatchment PR-2: Portion of Parking Lot and Baseball Field



Summary for Subcatchment PR-3: Athletic Field (West)

Runoff 10.28 cfs @ 12.08 hrs, Volume= 36,378 cf, Depth= 4.88" =

Flow (cfs) 6

5-

4-3-2 1-0-

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs Type III 24-hr 10-year Rainfall=5.12"

Area (sf)	CN Description		
* 89,400	98 Synthetic Turf Field (N	vlap Unit 651)	
89,400	100.00% Impervious	Area	
Tc Length (min) (feet)		•	
6.0		Direct Entry,	
		PR-3: Athletic Field (West)	
	Hydr	ograph	
11			ff
10	10.28 cfs	Type III 24-hr	
9-		10-year Rainfall=5.12"	
8		Runoff Area=89,400 sf	
7		Runoff Volume=36,378 cf	
(cts)		Runoff Depth=4.88"	

0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 Time (hours)

Tc=6.0 min

CN=98

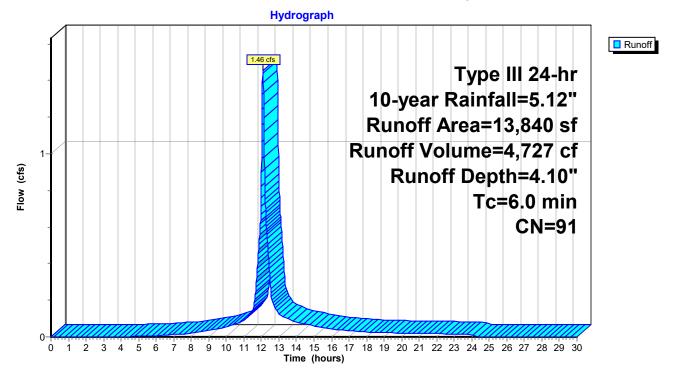
Summary for Subcatchment PR-4: Portion of Parking Lot

Runoff = 1.46 cfs @ 12.08 hrs, Volume= 4,727 cf, Depth= 4.10"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs Type III 24-hr 10-year Rainfall=5.12"

_	A	rea (sf)	CN	Description				
*		12,294	98	Paved parking, HSG A (Map Unit 651)				
*		1,546	39	>75% Gras	>75% Grass cover, Good, HSG A (Map Unit 651)			
		13,840 1,546 12,294	91	Weighted A 11.17% Pei 88.83% Imp	rvious Area			
	Tc (min)	Length (feet)	Slope (ft/ft	,	Capacity (cfs)	Description		
	6.0					Direct Entry,		

Subcatchment PR-4: Portion of Parking Lot



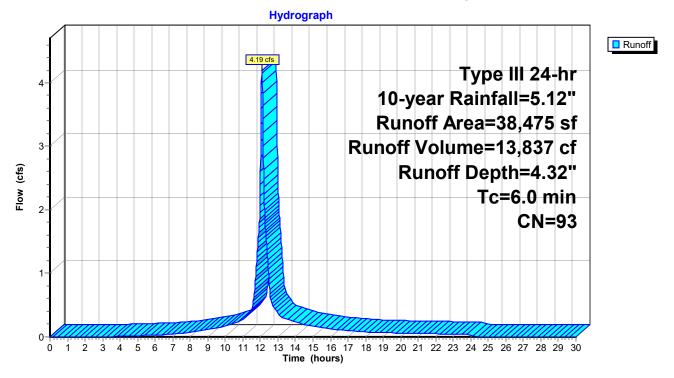
Summary for Subcatchment PR-5: Portion of Parking Lot

Runoff = 4.19 cfs @ 12.08 hrs, Volume= 13,837 cf, Depth= 4.32"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs Type III 24-hr 10-year Rainfall=5.12"

_	A	rea (sf)	CN	Description					
*		35,267	98	Paved park	aved parking, HSG A (Map Unit 651)				
*		3,208	39	>75% Gras	75% Grass cover, Good, HSG A (Map Unit 651)				
		38,475 3,208 35,267	93	Weighted A 8.34% Perv 91.66% Imp	vious Area	ea			
	Tc (min)	Length (feet)	Slope (ft/ft	,	Capacity (cfs)	Description			
	6.0					Direct Entry,			

Subcatchment PR-5: Portion of Parking Lot

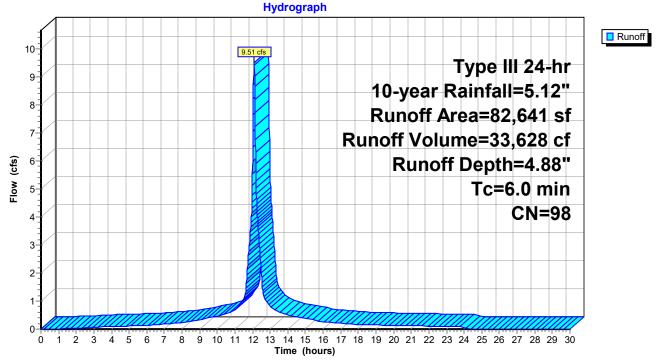


Summary for Subcatchment PR-6: Athletic Field (East)

Runoff 9.51 cfs @ 12.08 hrs, Volume= 33,628 cf, Depth= 4.88" =

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs Type III 24-hr 10-year Rainfall=5.12"

	A	rea (sf)	CN	Description				
*		71,592	98	Synthetic Turf Field (Map Unit 651)				
*		11,049				/lap Unit 718A)		
		82,641 82,641	0 0					
	Tc (min)	Length (feet)	Slope (ft/ft	,	Capacity (cfs)	Description		
	6.0					Direct Entry,		
	Subcatchment PR-6: Athletic Field (East)							



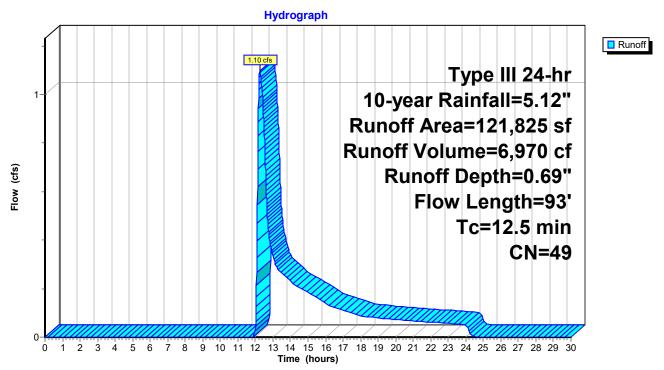
Summary for Subcatchment PR-7: Direct to Wetland

1.10 cfs @ 12.24 hrs, Volume= 6,970 cf, Depth= 0.69" Runoff =

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs Type III 24-hr 10-year Rainfall=5.12"

	А	rea (sf)	CN	Description						
*		510	39	>75% Gras	>75% Grass cover, Good, HSG A (Map Unit 254A)					
*		51,004	39		75% Grass cover, Good, HSG A (Map Unit 651)					
*		11,092	61		75% Grass cover, Good, HSG B (Map Unit 718A)					
*		35,674	55		,	(Map Unit 718A)				
*		14,690	30			(Map Unit 651)				
*		4,251	98	Paved park	ing, HSG A	(Map Unit 651)				
*		4,604	98	Paved park	ing, HSG B	B (Map Unit 718A)				
	1	21,825	49	Weighted A	verage					
	1	112,970 92.73% Pervious A		rvious Area	l					
		8,855	7.27% Impervious Area		ervious Are	а				
	Тс	Length	Slop			Description				
_	(min)	(feet)	(ft/f	t) (ft/sec)	(cfs)					
	12.3	50	0.020	0 0.07		Sheet Flow,				
						Woods: Light underbrush n= 0.400 P2= 3.24"				
	0.2	43	0.395	0 3.14		Shallow Concentrated Flow,				
_						Woodland Kv= 5.0 fps				
	12.5	93	Total							

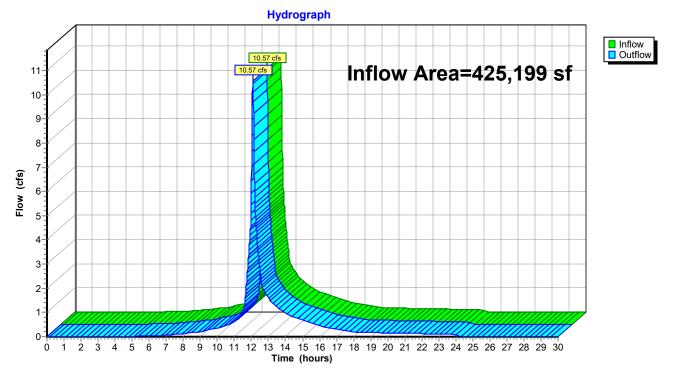
Subcatchment PR-7: Direct to Wetland



Summary for Reach DP-1: 21" Concrete Pipe

Inflow Are	a =	425,199 sf, 55.19% Impervious, Infl	low Depth = 1.10" for 10-year event
Inflow	=	10.57 cfs @ 12.09 hrs, Volume=	39,100 cf
Outflow	=	10.57 cfs @ 12.09 hrs, Volume=	39,100 cf, Atten= 0%, Lag= 0.0 min

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

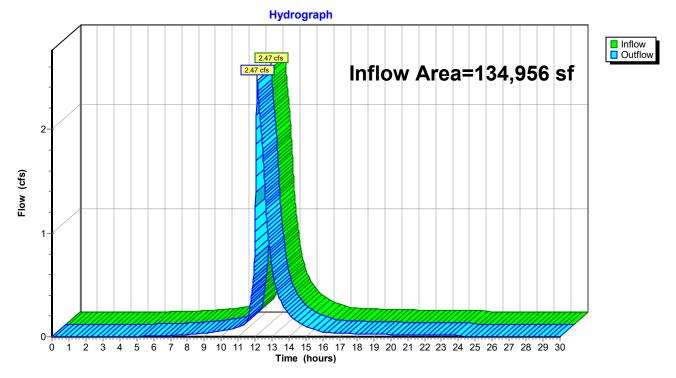


Reach DP-1: 21" Concrete Pipe

Summary for Reach DP-2: 24" RCP Pipe

Inflow Area	a =	134,956 sf, 96.48% Impervious, Inflow Depth = 0).88" for 10-year event
Inflow	=	2.47 cfs @ 12.13 hrs, Volume= 9,929 cf	
Outflow	=	2.47 cfs @ 12.13 hrs, Volume= 9,929 cf,	Atten= 0%, Lag= 0.0 min

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

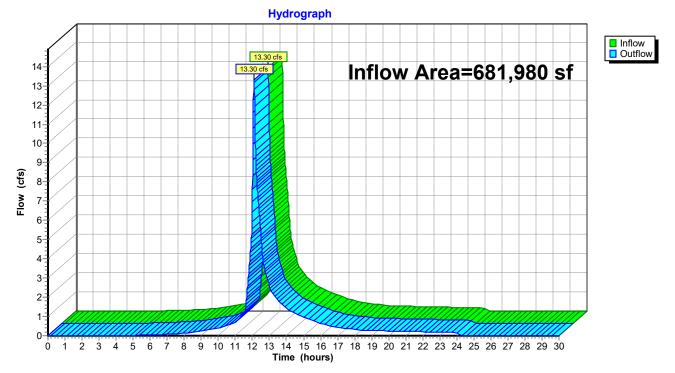


Reach DP-2: 24" RCP Pipe

Summary for Reach DP-3: Ipswich River

Inflow Area	=	681,980 sf, 5	54.80% Impervious,	Inflow Depth = 0.99" for 10-year event	
Inflow	=	13.30 cfs @ 12	2.09 hrs, Volume=	56,000 cf	
Outflow :	=	13.30 cfs @ 12	2.09 hrs, Volume=	56,000 cf, Atten= 0%, Lag= 0.0 min	

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

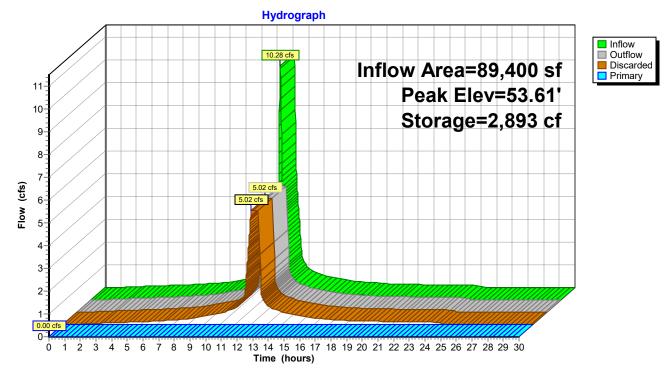


Reach DP-3: Ipswich River

Summary for Pond FIELD-1: Subsurface Stone

Inflow Are Inflow Outflow Discardeo Primary	= 10.28 c = 5.02 c d = 5.02 c	ofs @ 12. ofs @ 11. ofs @ 11.	0.00% Impervious 08 hrs, Volume= 99 hrs, Volume= 99 hrs, Volume= 00 hrs, Volume=	= 36 = 36 = 36	,378 cf	for 10-year event = 51%, Lag= 0.0 min		
Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs Peak Elev= 53.61' @ 12.23 hrs Surf.Area= 90,007 sf Storage= 2,893 cf								
	Plug-Flow detention time= 2.7 min calculated for 36,366 cf (100% of inflow) Center-of-Mass det. time= 2.7 min (750.3 - 747.6)							
Volume	Invert A	Avail.Stora	age Storage De	scription				
#1								
Elevatior	n Surf.Ar	ea	Inc.Store	Cum.Store				
(feet) (sq·	-ft) (cubic-feet)	(cubic-feet)				
53.50) 90,0	07	0	0				
54.50	90,0	07	90,007	90,007				
Device	Routing	Invert	Outlet Devices					
	Discarded	53.50'	2.410 in/hr Exfilt	ration over	Surface area			
#2	Primary	53.75'	0.500 cfs Consta	ant Flow/Sk	immer X 34.0	0		
Discarded OutFlow Max=5.02 cfs @ 11.99 hrs HW=53.51' (Free Discharge) 1=Exfiltration (Exfiltration Controls 5.02 cfs)								

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=53.50' (Free Discharge)

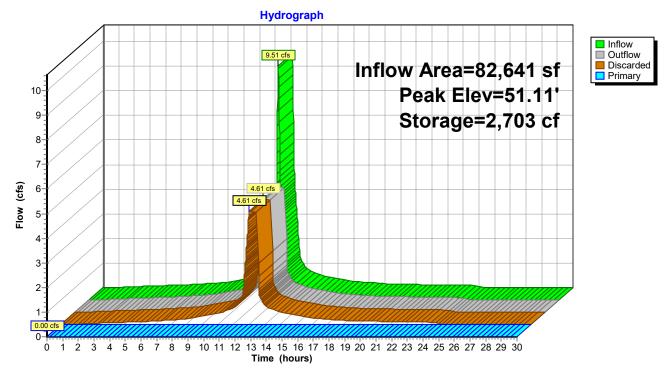


Pond FIELD-1: Subsurface Stone

Summary for Pond FIELD-2: Subsurface Stone

Inflow Area = Inflow = Outflow = Discarded = Primary =	9.51 cfs @ 1 4.61 cfs @ 1 4.61 cfs @ 1	00.00% Impervious, 2.08 hrs, Volume= 1.98 hrs, Volume= 1.98 hrs, Volume= 0.00 hrs, Volume=	33,628 cf, Atter 33,628 cf	for 10-year event n= 51%, Lag= 0.0 min				
Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs Peak Elev= 51.11' @ 12.23 hrs Surf.Area= 82,641 sf Storage= 2,703 cf								
Center-of-Mass	Plug-Flow detention time= 2.7 min calculated for 33,617 cf (100% of inflow) Center-of-Mass det. time= 2.7 min (750.3 - 747.6)							
Volume Ir	ivert Avail.Sto	orage Storage Des	scription					
#1 5 [^]	1.00' 24,7		ge Data (Prismatic) List /erall x 30.0% Voids	ed below (Recalc)				
Elevation	Surf.Area	Inc.Store	Cum.Store					
(feet)	(sq-ft)		cubic-feet)					
		0	0					
51.00	82,641	•	v					
52.00	82,641	82,641	82,641					
Device Routin	g Invert	Outlet Devices						
#1 Discar	ded 51.00'	2.410 in/hr Exfiltr	ation over Surface area	1				
#2 Primar	v 51.25'	0.500 cfs Consta	nt Flow/Skimmer X 32.0	0				
Discarded OutFlow Max=4.61 cfs @ 11.98 hrs HW=51.01' (Free Discharge)								

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=51.00' (Free Discharge) ←2=Constant Flow/Skimmer (Controls 0.00 cfs)



Pond FIELD-2: Subsurface Stone

Summary for Pond PERF-1: 42" Perforated Pipe

Inflow Area =	321,048 sf, 45.81% Impervious,	Inflow Depth = 0.71" for 10-year event
Inflow =	4.81 cfs @ 12.11 hrs, Volume=	18,877 cf
Outflow =	0.97 cfs @ 12.77 hrs, Volume=	18,877 cf, Atten= 80%, Lag= 39.9 min
Discarded =	0.28 cfs @ 11.90 hrs, Volume=	13,513 cf
Primary =	0.69 cfs @ 12.77 hrs, Volume=	5,365 cf

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs Peak Elev= 49.14' @ 12.77 hrs Surf.Area= 4,950 sf Storage= 5,540 cf

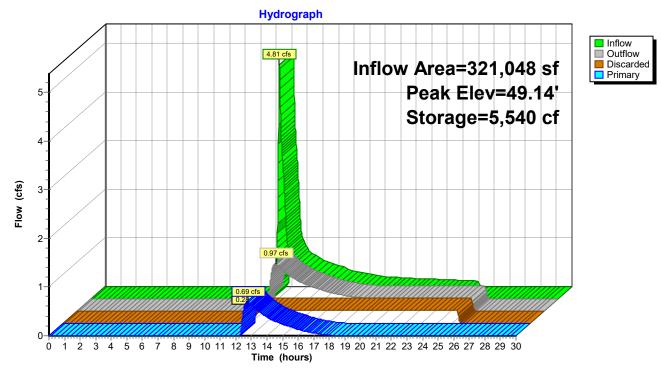
Plug-Flow detention time= 144.6 min calculated for 18,871 cf (100% of inflow) Center-of-Mass det. time= 144.6 min (1,038.9 - 894.3)

Volume	Invert	Avail.Storag	e Storage Description
#1	47.75'	10,583	
#2	47.25'	3.508	L= 550.0' cf 4.50'W x 550.00'L x 4.50'H Prismatoid x 2
#2	47.25	3,500	22,275 cf Overall - 10,583 cf Embedded = 11,692 cf x 30.0% Voids
		14,091	cf Total Available Storage
Device	Routing	Invert C	Dutlet Devices
#1	Discarded	47.25' 2	.410 in/hr Exfiltration over Surface area
#2	Primary	48.70' 1	8.0" Round Culvert

40.10	
	L= 10.0' CMP, projecting, no headwall, Ke= 0.900
	Inlet / Outlet Invert= 48.70' / 48.60' S= 0.0100 '/' Cc= 0.900
	n= 0.013 Cast iron, coated, Flow Area= 1.77 sf

Discarded OutFlow Max=0.28 cfs @ 11.90 hrs HW=47.30' (Free Discharge) **1=Exfiltration** (Exfiltration Controls 0.28 cfs)

Primary OutFlow Max=0.69 cfs @ 12.77 hrs HW=49.14' (Free Discharge) ←2=Culvert (Barrel Controls 0.69 cfs @ 2.40 fps)

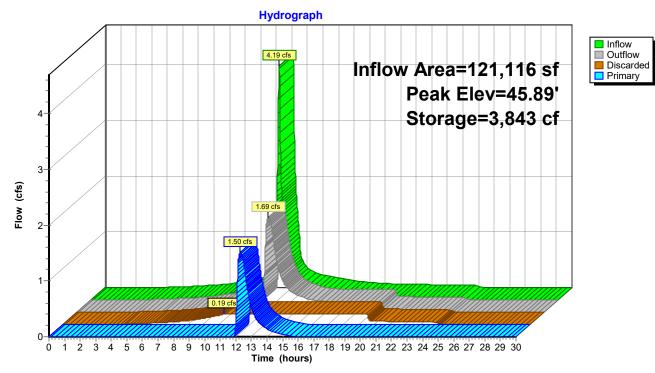


Pond PERF-1: 42" Perforated Pipe

Summary for Pond PERF-2: 36" Perforated Pipe

Inflow A Inflow Outflow Discarde Primary	= 4 = 1 ed = 0	121,116 sf, 97.3 .19 cfs @ 12.08 .69 cfs @ 12.30 .19 cfs @ 10.33 .50 cfs @ 12.30	hrs, Volume= 13,837 cf, Atten= 60%, Lag= 12.7 min 8,635 cf						
Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs Peak Elev= 45.89' @ 12.30 hrs Surf.Area= 3,400 sf Storage= 3,843 cf									
Center-o	Plug-Flow detention time= 53.1 min calculated for 13,837 cf (100% of inflow) Center-of-Mass det. time= 53.1 min (830.7 - 777.6)								
Volume	Invert	Avail.Storage	e Storage Description						
#1	44.50'	6,008 ct	f 36.0" Round Pipe Storage x 2 Inside #2 L= 425.0'						
#2	44.00'	2,278 ct	f 4.00'W x 425.00'L x 4.00'H Prismatoid x 2 13,600 cf Overall - 6,008 cf Embedded = 7,592 cf x 30.0% Voids						
		8,286 ct	f Total Available Storage						
Device	Routing	Invert Ou	utlet Devices						
#1 #2	Discarded Primary	44.00' 2.4 44.95' 10 L= Inle	410 in/hr Exfiltration over Surface area .0" Round Culvert 10.0' CMP, projecting, no headwall, Ke= 0.900 et / Outlet Invert= 44.95' / 44.85' S= 0.0100 '/' Cc= 0.900 0.013 Cast iron, coated, Flow Area= 0.55 sf						
	Discarded OutFlow Max=0.19 cfs @ 10.33 hrs HW=44.04' (Free Discharge) ☐ 1=Exfiltration (Exfiltration Controls 0.19 cfs)								
- .									

Primary OutFlow Max=1.50 cfs @ 12.30 hrs HW=45.89' (Free Discharge) ←2=Culvert (Inlet Controls 1.50 cfs @ 2.76 fps)



Pond PERF-2: 36" Perforated Pipe

Proposed ConditionsType III 24-hr100-year Rainfall=8.10"Prepared by Stantec Consulting Ltd.Printed1/18/2024HydroCAD® 10.00-24s/n 02809 © 2018 HydroCAD Software Solutions LLCPage 43
Time span=0.00-30.00 hrs, dt=0.01 hrs, 3001 points Runoff by SCS TR-20 method, UH=SCS, Weighted-CN Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method
Subcatchment PR-1: Portion of Parking Runoff Area=104,151 sf 84.10% Impervious Runoff Depth=6.78" Tc=6.0 min CN=89 Runoff=17.89 cfs 58,888 cf
Subcatchment PR-2: Portion of Parking Runoff Area=231,648 sf 24.90% Impervious Runoff Depth=2.74" Tc=6.0 min CN=54 Runoff=16.35 cfs 52,953 cf
Subcatchment PR-3: Athletic Field (West) Runoff Area=89,400 sf 100.00% Impervious Runoff Depth=7.86" Tc=6.0 min CN=98 Runoff=16.32 cfs 58,558 cf
Subcatchment PR-4: Portion of Parking Lot Runoff Area=13,840 sf 88.83% Impervious Runoff Depth=7.02" Tc=6.0 min CN=91 Runoff=2.43 cfs 8,100 cf
Subcatchment PR-5: Portion of Parking Lot Runoff Area=38,475 sf 91.66% Impervious Runoff Depth=7.26" Tc=6.0 min CN=93 Runoff=6.85 cfs 23,283 cf
Subcatchment PR-6: Athletic Field (East) Runoff Area=82,641 sf 100.00% Impervious Runoff Depth=7.86" Tc=6.0 min CN=98 Runoff=15.09 cfs 54,131 cf
Subcatchment PR-7: Direct to Wetland Flow Length=93' Tc=12.5 min CN=49 Runoff=5.26 cfs 22,385 cf
Reach DP-1: 21" Concrete Pipe Inflow=21.51 cfs 96,716 cf Outflow=21.51 cfs 96,716 cf
Reach DP-2: 24" RCP Pipe Inflow=4.47 cfs 22,178 cf Outflow=4.47 cfs 22,178 cf
Reach DP-3: Ipswich River Inflow=30.11 cfs 141,280 cf Outflow=30.11 cfs 141,280 cf
Pond FIELD-1: Subsurface Stone Peak Elev=53.75' Storage=6,874 cf Inflow=16.32 cfs 58,558 cf Discarded=5.02 cfs 56,598 cf Primary=6.24 cfs 1,961 cf Outflow=11.26 cfs 58,558 cf
Pond FIELD-2: Subsurface Stone Peak Elev=51.25' Storage=6,308 cf Inflow=15.09 cfs 54,131 cf Discarded=4.61 cfs 52,212 cf Primary=5.70 cfs 1,919 cf Outflow=10.31 cfs 54,131 cf
Pond PERF-1: 42" Perforated Pipe Peak Elev=51.16' Storage=13,169 cf Inflow=18.21 cfs 54,913 cf Discarded=0.28 cfs 17,085 cf Primary=8.79 cfs 37,828 cf Outflow=9.07 cfs 54,913 cf
Pond PERF-2: 36" Perforated Pipe Peak Elev=47.65' Storage=7,933 cf Inflow=10.25 cfs 25,203 cf Discarded=0.19 cfs 11,125 cf Primary=3.14 cfs 14,078 cf Outflow=3.33 cfs 25,203 cf
Total Runoff Area = 681,980 sf Runoff Volume = 278,298 cf Average Runoff Depth = 4.90" 45.20% Pervious = 308,249 sf 54.80% Impervious = 373,731 sf

Summary for Subcatchment PR-1: Portion of Parking Lot

Runoff = 17.89 cfs @ 12.08 hrs, Volume= 58,888 cf, Depth= 6.78"

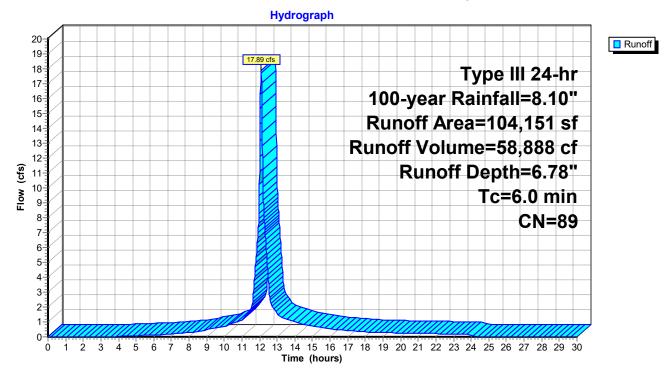
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs Type III 24-hr 100-year Rainfall=8.10"

	Area (sf)	CN	Description				
*	2,469	98	Roofs, HSG A (Map Unit 651)				
*	4,331	98	Roofs, HSG A (Map Unit 254A)				
*	71,056	98	Paved parking, HSG A (Map Unit 651)				
*	9,738	98	Paved parking, HSG A (Map Unit 254A)				
*	1,820	39	>75% Grass cover, Good, HSG A (Map Unit 254A)				
*	14,737	39	>75% Grass cover, Good, HSG A (Map Unit 651)				
	104,151	89	Weighted Average				
	16,557		15.90% Pervious Area				
	87,594		84.10% Impervious Area				
	Tc Length	Slop	be Velocity Capacity Description				
	(min) (feet)	(ft/	ft) (ft/sec) (cfs)				



Direct Entry, Update with new baseball field survey

Subcatchment PR-1: Portion of Parking Lot



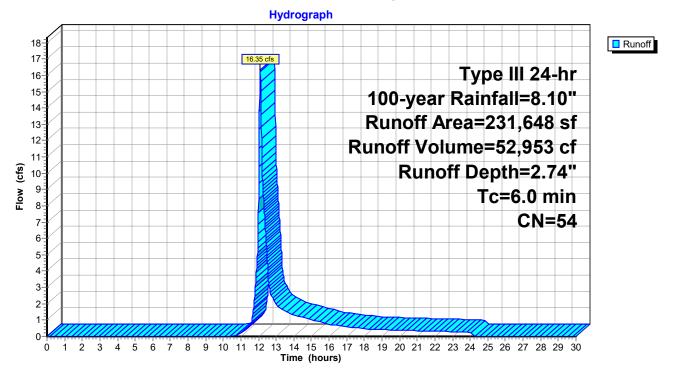
Summary for Subcatchment PR-2: Portion of Parking Lot and Baseball Field

Runoff = 16.35 cfs @ 12.10 hrs, Volume= 52,953 cf, Depth= 2.74"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs Type III 24-hr 100-year Rainfall=8.10"

_	Area	(sf) CN	l D	escription						
*	2,8	875 98	R	Roofs, HSG A (Map Unit 651)						
*	54,8	305 98	B Pa	aved parki	ing, HSG A	(Map Unit 651)				
*	6,8	308 39) >7	75% Ġras	s cover, Go	ood, HSG A (Map Unit 254A)				
*	167, ²	60 39) >7	>75% Grass cover, Good, HSG A (Map Unit 651)						
-	231,6	648 54	. W							
	173,9	968	75.10% Pervious Area							
	57,6	680	24.90% Impervious Area							
	Tc Le	ngth Sl	ope	Velocity	Capacity	Description				
_	(min) (1	eet) (f	ft/ft)	(ft/sec)	(cfs)					
	6.0					Direct Entry, Update with new baseball field survey				

Subcatchment PR-2: Portion of Parking Lot and Baseball Field



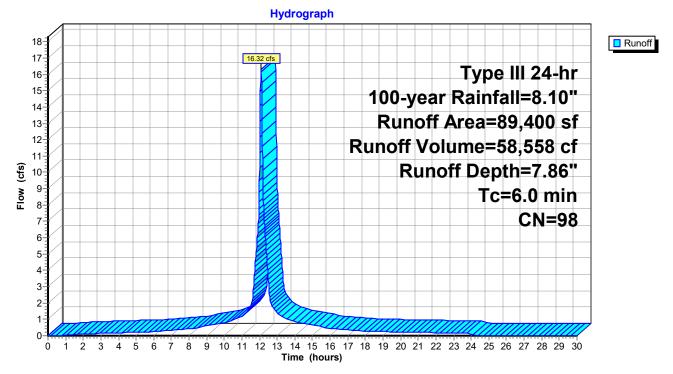
Summary for Subcatchment PR-3: Athletic Field (West)

Runoff = 16.32 cfs @ 12.08 hrs, Volume= 58,558 cf, Depth= 7.86"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs Type III 24-hr 100-year Rainfall=8.10"

	A	rea (sf)	CN I	N Description						
*		89,400	98	8 Synthetic Turf Field (Map Unit 651)						
		89,400	100.00% Impervious Area							
(Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description				
	6.0					Direct Entry,				
				_						

Subcatchment PR-3: Athletic Field (West)



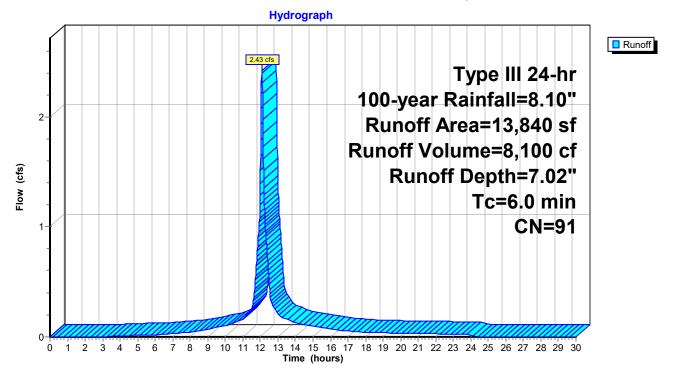
Summary for Subcatchment PR-4: Portion of Parking Lot

Runoff = 2.43 cfs @ 12.08 hrs, Volume= 8,100 cf, Depth= 7.02"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs Type III 24-hr 100-year Rainfall=8.10"

A	rea (sf)	CN	Description				
	12,294	98	Paved park	ing, HSG A	(Map Unit 651)		
	1,546	39	>75% Gras	s cover, Go	bod, HSG A (Map Unit 651)		
	13,840	91	Weighted Average				
	1,546		11.17% Per	vious Area			
	12,294	88.83% Impervious Area			ea		
Tc (min)	Length (feet)		,	Capacity (cfs)	Description		
6.0					Direct Entry,		
	Tc (min)	1,546 13,840 1,546 12,294 Tc Length (min) (feet)	12,294 98 1,546 39 13,840 91 1,546 12,294 Tc Length Slope (min) (feet) (ft/ft	12,294 98 Paved park 1,546 39 >75% Gras 13,840 91 Weighted A 1,546 11.17% Per 12,294 88.83% Imp Tc Length Slope Velocity (min) (feet) (ft/ft) (ft/sec)	12,29498Paved parking, HSG A1,54639>75% Grass cover, Go13,84091Weighted Average1,54611.17% Pervious Area12,29488.83% Impervious ArTcLengthSlopeVelocity(min)(feet)(ft/ft)(ft/sec)(cfs)		

Subcatchment PR-4: Portion of Parking Lot



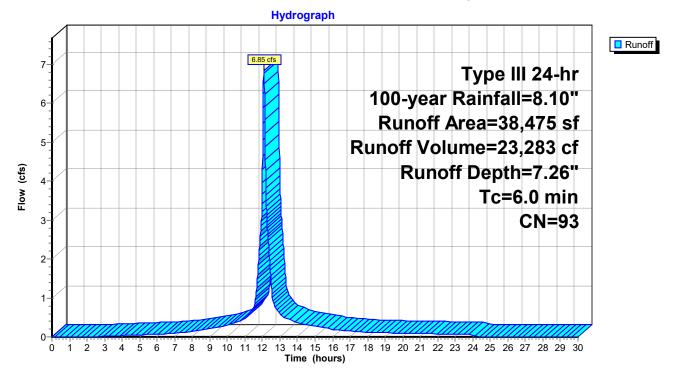
Summary for Subcatchment PR-5: Portion of Parking Lot

Runoff = 6.85 cfs @ 12.08 hrs, Volume= 23,283 cf, Depth= 7.26"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs Type III 24-hr 100-year Rainfall=8.10"

_	A	rea (sf)	CN	Description				
*		35,267	98	Paved park	ing, HSG A	(Map Unit 651)		
*		3,208	39	>75% Grass cover, Good, HSG A (Map Unit 651)				
		38,475		Weighted A				
		3,208		8.34% Perv				
		35,267		91.66% Imp	pervious Ar	ea		
	Tc (min)	Length (feet)	Slope (ft/ft		Capacity (cfs)	Description		
	6.0					Direct Entry,		

Subcatchment PR-5: Portion of Parking Lot



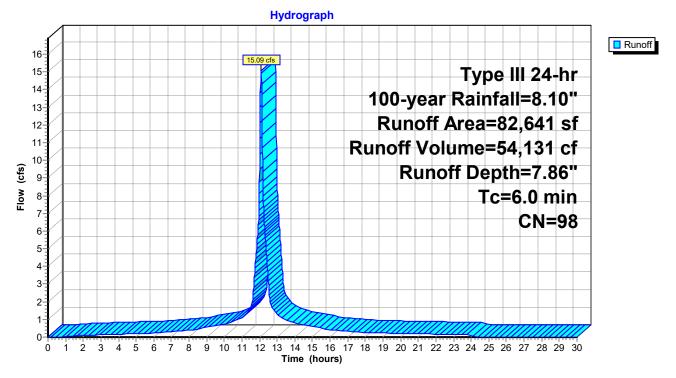
Summary for Subcatchment PR-6: Athletic Field (East)

Runoff = 15.09 cfs @ 12.08 hrs, Volume= 54,131 cf, Depth= 7.86"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs Type III 24-hr 100-year Rainfall=8.10"

	А	rea (sf)	CN	Description		
*		71,592	98	Synthetic T	urf Field (N	Map Unit 651)
*		11,049	98	Synthetic T	urf Field (N	Map Unit 718A)
		82,641 82,641	98	Weighted A 100.00% Im	0	Area
	Tc (min)	Length (feet)	Slop (ft/f	,	Capacity (cfs)	
	6.0					Direct Entry,

Subcatchment PR-6: Athletic Field (East)



Summary for Subcatchment PR-7: Direct to Wetland

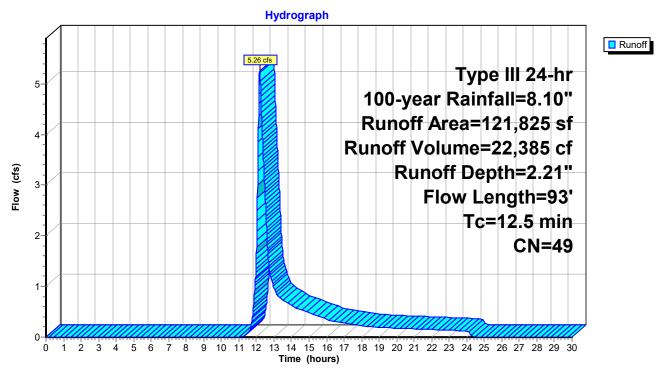
5.26 cfs @ 12.19 hrs, Volume= 22,385 cf, Depth= 2.21" Runoff =

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs Type III 24-hr 100-year Rainfall=8.10"

	А	rea (sf)	CN	Description		
*		510	39			ood, HSG A (Map Unit 254A)
*		51,004	39			bod, HSG A (Map Unit 651)
*		,				
		11,092	61		,	ood, HSG B (Map Unit 718A)
*		35,674	55			(Map Unit 718A)
*		14,690	30	Woods, Go	od, HSG A	(Map Unit 651)
*		4,251	98	Paved park	ing, HSG A	(Map Unit 651)
*		4,604	98			(Map Unit 718Á)
_	1	21,825	49	Weighted A	verage	
	1	12,970		92.73% Pe	rvious Area	
		8,855		7.27% Impe	ervious Are	а
		0,000				-
	Тс	Length	Slope	e Velocity	Capacity	Description
	(min)	(feet)	(ft/ft	•	(cfs)	
_	12.3	50	0.0200	/ /	()	Sheet Flow,
	12.0	00	0.0200	5 0.07		Woods: Light underbrush n= 0.400 P2= 3.24"
	0.0	40	0.005	0 0 4 4		•
	0.2	43	0.3950	3.14		Shallow Concentrated Flow,
_						Woodland Kv= 5.0 fps
	12.5	93	Total			

93 Total

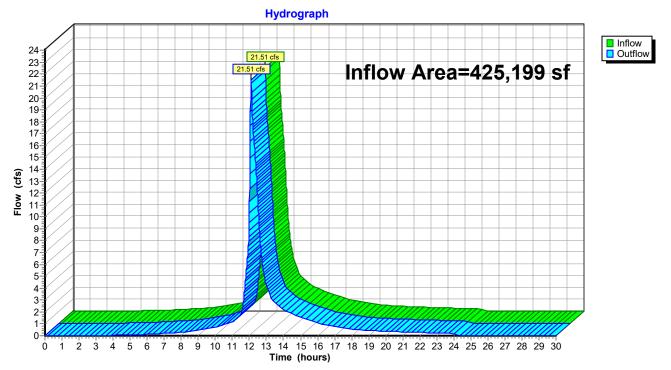
Subcatchment PR-7: Direct to Wetland



Summary for Reach DP-1: 21" Concrete Pipe

Inflow Area	a =	425,199 sf, 55.19% Impervious, Inflow Depth = 2.73" for 100-year event
Inflow	=	21.51 cfs @ 12.11 hrs, Volume= 96,716 cf
Outflow	=	21.51 cfs @ 12.11 hrs, Volume= 96,716 cf, Atten= 0%, Lag= 0.0 min

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

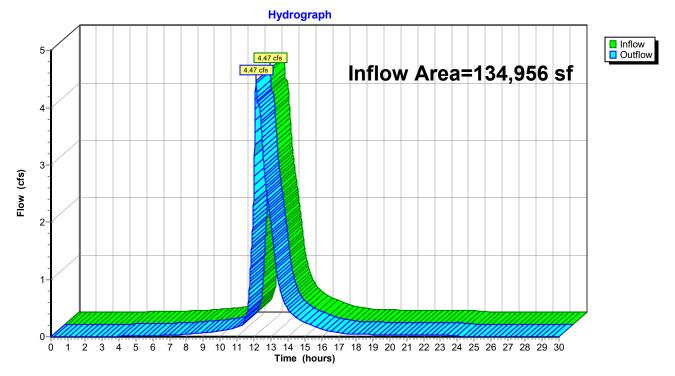


Reach DP-1: 21" Concrete Pipe

Summary for Reach DP-2: 24" RCP Pipe

Inflow Area	a =	134,956 sf,	96.48% Impervious,	Inflow Depth = 1	.97" for 100-year event
Inflow	=	4.47 cfs @	12.10 hrs, Volume=	22,178 cf	
Outflow	=	4.47 cfs @	12.10 hrs, Volume=	22,178 cf,	Atten= 0%, Lag= 0.0 min

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

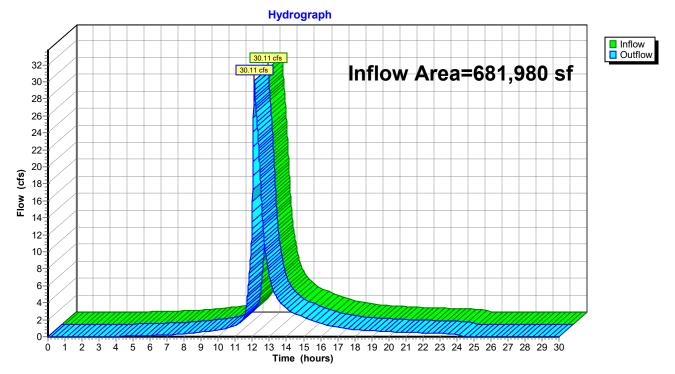


Reach DP-2: 24" RCP Pipe

Summary for Reach DP-3: Ipswich River

Inflow Are	a =	681,980 sf, 54.80% Impervious, Inflow Depth = 2.49" for 100-year event
Inflow	=	30.11 cfs @ 12.12 hrs, Volume= 141,280 cf
Outflow	=	30.11 cfs @ 12.12 hrs, Volume= 141,280 cf, Atten= 0%, Lag= 0.0 min

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



Reach DP-3: Ipswich River

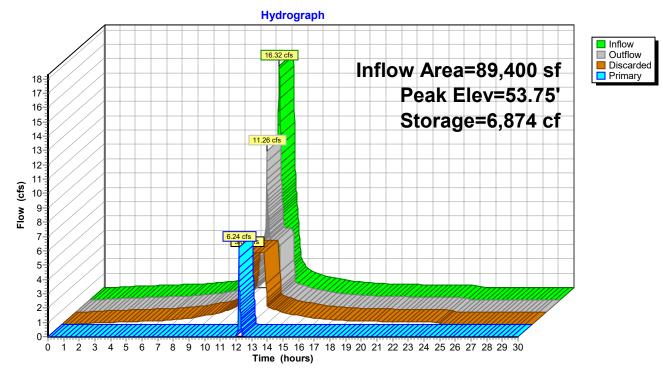
Summary for Pond FIELD-1: Subsurface Stone

Inflow Area = Inflow = Outflow = Discarded = Primary =	16.32 cfs @ 11.26 cfs @ 5.02 cfs @	,100.00% Impervious, 12.08 hrs, Volume= 12.17 hrs, Volume= 11.82 hrs, Volume= 12.17 hrs, Volume=	Inflow Depth = 7.86" 58,558 cf 58,558 cf, Atter 56,598 cf 1,961 cf	for 100-year event n= 31%, Lag= 5.4 min	
Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs Peak Elev= 53.75' @ 12.17 hrs Surf.Area= 90,007 sf Storage= 6,874 cf					

Plug-Flow detention time= 5.8 min calculated for 58,558 cf (100% of inflow) Center-of-Mass det. time= 5.8 min (746.9 - 741.1)

Volume	Invert	Avail.Sto	rage Ste	Storage Description		
#1	53.50'	53.50' 27,002 cf		Custom Stage Data (Prismatic) Listed below (Recalc)		
			90	90,007 cf Overall x 30.0% Voids		
Elevatio	on Si	urf.Area	Inc.Sto	Store Cum.Store		
(fee	et)	(sq-ft)	(cubic-fe	feet) (cubic-feet)		
53.5	50	90,007		0 0		
54.5	50	90,007	90,0	,007 90,007		
Device	Routing	Invert	Outlet D	Devices		
#1	Discarded	53.50'	2.410 in	in/hr Exfiltration over Surface area		
#2	Primary	53.75'	0.500 cf	cfs Constant Flow/Skimmer X 34.00		
Discarded OutFlow Max=5.02 cfs @ 11.82 hrs HW=53.51' (Free Discharge) ☐ 1=Exfiltration (Exfiltration Controls 5.02 cfs)						

Primary OutFlow Max=17.00 cfs @ 12.17 hrs HW=53.75' (Free Discharge) **2=Constant Flow/Skimmer** (Constant Controls 17.00 cfs)



Pond FIELD-1: Subsurface Stone

Summary for Pond FIELD-2: Subsurface Stone

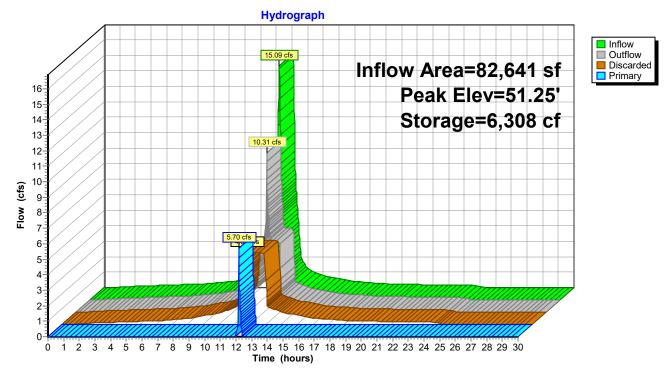
Inflow Area =	82,641 sf,100.00% Impervious,	Inflow Depth = 7.86" for 100-year event
Inflow =	15.09 cfs @ 12.08 hrs, Volume=	54,131 cf
Outflow =	10.31 cfs @ 12.17 hrs, Volume=	54,131 cf, Atten= 32%, Lag= 5.3 min
Discarded =	4.61 cfs @ 11.82 hrs, Volume=	52,212 cf
Primary =	5.70 cfs @ 12.17 hrs, Volume=	1,919 cf

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs Peak Elev= 51.25' @ 12.17 hrs Surf.Area= 82,641 sf Storage= 6,308 cf

Plug-Flow detention time= 5.8 min calculated for 54,113 cf (100% of inflow) Center-of-Mass det. time= 5.8 min (746.9 - 741.1)

Volume	Inver	t Avail.Sto	rage Sto	rage Description		
#1	51.00	51.00' 24,79		stom Stage Data (Prismatic) Listed below (Recalc)		
			82,6	641 cf Overall x 30.0% Voids		
Elevatio	on S	urf.Area	Inc.Stor	re Cum.Store		
(fee	et)	(sq-ft)	(cubic-fee	et) (cubic-feet)		
51.0	00	82,641		0 0		
52.0	00	82,641	82,64	41 82,641		
Davias	Douting	Invert				
Device	Routing	Invert	Outlet De			
#1	Discarded	51.00'	2.410 in/	hr Exfiltration over Surface area		
#2	Primary	51.25'	0.500 cfs	s Constant Flow/Skimmer X 32.00		
	Discarded OutFlow Max=4.61 cfs @ 11.82 hrs HW=51.01' (Free Discharge) 1=Exfiltration (Exfiltration Controls 4.61 cfs)					

Primary OutFlow Max=16.00 cfs @ 12.17 hrs HW=51.25' (Free Discharge) ←2=Constant Flow/Skimmer (Constant Controls 16.00 cfs)



Pond FIELD-2: Subsurface Stone

Summary for Pond PERF-1: 42" Perforated Pipe

Inflow Area =	321,048 sf, 45.81% Impervious,	Inflow Depth = 2.05" for 100-year event
Inflow =	18.21 cfs @ 12.17 hrs, Volume=	54,913 cf
Outflow =	9.07 cfs @ 12.31 hrs, Volume=	54,913 cf, Atten= 50%, Lag= 8.5 min
Discarded =	0.28 cfs @ 11.22 hrs, Volume=	17,085 cf
Primary =	8.79 cfs @ 12.31 hrs, Volume=	37,828 cf

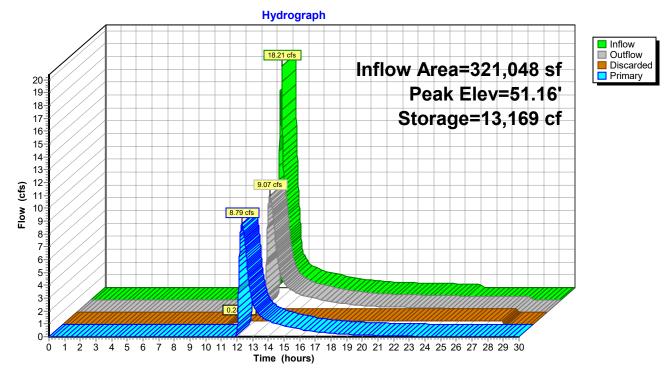
Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs Peak Elev= 51.16' @ 12.31 hrs Surf.Area= 4,950 sf Storage= 13,169 cf

Plug-Flow detention time= 80.9 min calculated for 54,895 cf (100% of inflow) Center-of-Mass det. time= 81.0 min (935.9 - 854.9)

Volume	Invert	Avail.Storage	Storage Description		
#1	47.75'	10,583 cf	42.0" Round Pipe Storage x 2 Inside #2		
#2	47.25'	3,508 cf	L= 550.0' 4.50'W x 550.00'L x 4.50'H Prismatoid x 2 22,275 cf Overall - 10,583 cf Embedded = 11,692 cf x 30.0% Voids		
		14,091 cf	Total Available Storage		
Device	Routing	Invert Out	let Devices		
#1	Discarded	47.25' 2.4	10 in/hr Exfiltration over Surface area		
#2	Primary		0" Round Culvert		
			10.0' CMP, projecting, no headwall, Ke= 0.900		
			et / Outlet Invert= 48.70' / 48.60' S= 0.0100 '/' Cc= 0.900		
		n=	0.013 Cast iron, coated, Flow Area= 1.77 sf		

Discarded OutFlow Max=0.28 cfs @ 11.22 hrs HW=47.30' (Free Discharge) **1=Exfiltration** (Exfiltration Controls 0.28 cfs)

Primary OutFlow Max=8.79 cfs @ 12.31 hrs HW=51.16' (Free Discharge) ←2=Culvert (Inlet Controls 8.79 cfs @ 4.97 fps)



Pond PERF-1: 42" Perforated Pipe

Summary for Pond PERF-2: 36" Perforated Pipe

Inflow Area =	121,116 sf, 97.35% Impervious,	Inflow Depth = 2.50" for 100-year event
Inflow =	10.25 cfs @ 12.17 hrs, Volume=	25,203 cf
Outflow =	3.33 cfs @ 12.34 hrs, Volume=	25,203 cf, Atten= 68%, Lag= 10.0 min
Discarded =	0.19 cfs @ 8.76 hrs, Volume=	11,125 cf
Primary =	3.14 cfs @ 12.34 hrs, Volume=	14,078 cf

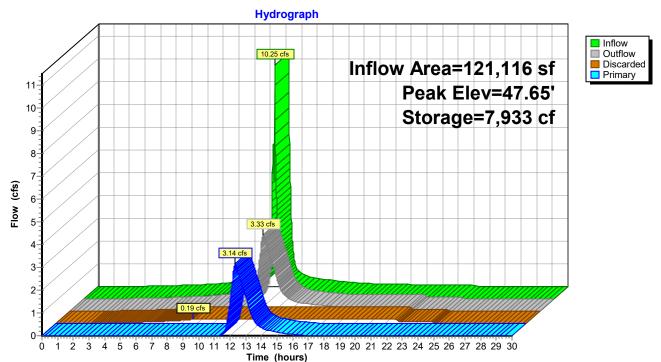
Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs Peak Elev= 47.65' @ 12.34 hrs Surf.Area= 3,400 sf Storage= 7,933 cf

Plug-Flow detention time= 51.1 min calculated for 25,194 cf (100% of inflow) Center-of-Mass det. time= 51.1 min (813.8 - 762.6)

Volume	Invert	Avail.Storage	Storage Description
#1	44.50'	6,008 cf	36.0" Round Pipe Storage x 2 Inside #2
#2	44.00'	2,278 cf	L= 425.0' 4.00'W x 425.00'L x 4.00'H Prismatoid x 2 13,600 cf Overall - 6,008 cf Embedded = 7,592 cf x 30.0% Voids
		8,286 cf	Total Available Storage
Device #1 #2	Routing Discarded Primary	InvertOutlet Devices44.00'2.410 in/hr Exfiltration over Surface area44.95'10.0" Round CulvertL= 10.0'CMP, projecting, no headwall, Ke= 0.900Inlet / Outlet Invert= 44.95' / 44.85'S= 0.0100 '/' Cc= 0.900n= 0.013Cast iron, coated, Flow Area= 0.55 sf	

Discarded OutFlow Max=0.19 cfs @ 8.76 hrs HW=44.04' (Free Discharge) **1=Exfiltration** (Exfiltration Controls 0.19 cfs)

Primary OutFlow Max=3.14 cfs @ 12.34 hrs HW=47.65' (Free Discharge) ←2=Culvert (Inlet Controls 3.14 cfs @ 5.75 fps)



Pond PERF-2: 36" Perforated Pipe

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