Lawrence Academy

Gray Building Expansion/ Renovation Project

Groton, Massachusetts

Stormwater Management Report

for

Lawrence Academy
26 Powderhouse Road
Groton, MA 01450

RFS 9686.002

September 20, 2024

Rist-Frost-Shumway Engineering, P.C.
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I. Executive Summary

This Stormwater Management Plan has been developed for proposed work to be conducted at Lawrence Academy, Powderhouse Road, Groton, Massachusetts (the site). This Plan has been prepared in accordance with the Massachusetts Stormwater Handbook and the Town of Groton Stormwater Ordinance. The Massachusetts Stormwater Checklist for the Project is included in **Appendix A**.

Existing Site & Project Description: The 28-acre (according to Town GIS) parcel on which the site is located contains a total of about 17 academic and residential buildings in a rural setting. This project is a renovation and expansion of the Gray Building, which is a student center where the dining hall is located. The roof footprint area being added to the building equal 4,540 square feet. The proposed work will also include landscape improvements, new pedestrian plazas and walkways, and reconfigured road & parking areas. The reconfigured roadway and parking results in a decrease in paved surfaces of 3,403 Square feet. The total resulting increase in impervious surfaces equals 1,137 SF.

Proposed Stormwater System: Stormwater improvements will include a water quality structure, subsurface detention system, and deep sump catch basins. This project has been designed so that the calculated peak rate of runoff for the 2-year, 10-year, 25-year, and 100-year storm events are nearly equal or less than what they are in existing conditions. Hydrocad® software, Version 10.00, was utilized to calculate runoff rates. A summary of these rates is shown below:

Table 1. Peak Runoff Rate (CFS)

2-Year		10-Year		25-Year		100-Year	
Existing	Proposed	Existing	Proposed	Existing	Proposed	Existing	Proposed
2.57	2.61	4.51	4.52	6.03	6.01	9.11	9.02

Note that no infiltration system was designed for the site due to the measured infiltration rate being less than the minimum rate of 0.17 inches per hour as stated in the Mass Stormwater Handbook.

II. Site Description

A. Existing Conditions:

Figures 1 & 2 show the location of the property.

Existing Stormwater System: The existing stormwater management system allows stormwater runoff to sheet flow away from the buildings and into grassed areas or onto the adjacent road. There is a catch basin system in the adjacent road which captures runoff from the road area and carries it downhill and away from the site. The project site is located on a hill, so that no off-site drainage flows onto the site.

Site Soils: The Natural Resources Conservation Service (NRCS), has identified the soils beneath the site as Bernardston very fine sandy loam belonging to type C hydrologic group. The NRCS hydrologic soil group report is included as Appendix B.

Geotechnical Investigation: To evaluate the site soils, a geotechnical investigation was conducted by S.W. Cole in August 2024, which report is included in Appendix C. Soils in the project vicinity generally consist of about 7 to 11 feet of fill material underlain by dense glacial till.

Infiltration Testing: A saturated hydraulic conductivity rate of 0.28 inches per hour was determined based on an actual field test using a Guelph Permeameter at a location adjacent to where the stormwater detention system is proposed. This is a very low rate which is not conducive to infiltrating stormwater runoff into the ground. For design purposes, Massachusetts requires that half of the measured infiltration rate be used, which in this case would be 0.14 in/hr. This is less than the minimum 0.17 in/hr required by the Massachusetts Stormwater Handbook. Infiltration into soils with less than 0.17 in/hr is not allowed due to the potential for system failure.

The existing site conditions are shown in the Project Site Plans, included in Appendix H.

B. Proposed Conditions:

The building is being expanded and the site upgraded to be more pedestrian friendly, with outdoor gathering spaces and walkways being added and upgraded. The main entrance to the dining hall will be located at the opposite side of the building from where it is now, transforming what is currently a nondescript rear delivery entrance to a campus focal point.

Proposed Stormwater Improvements: An underground chamber-type stormwater detention system is proposed to be located about 50 feet off the northeast corner of the new building addition and will receive runoff from all new impervious areas. During extreme storm events, the detention system will overflow to the nearby closed drainage system. Existing drainage patterns were maintained on the site to the greatest extent practicable. Note that no infiltration system was designed for the site due to the measured infiltration rate being

less than the minimum rate of 0.17 inches per hour as stated in the Massachusetts Stormwater Handbook.

Test Pits & Separation to Seasonal High Water Table: A test pit was dug adjacent to the location of the stormwater detention system for the purpose of performing a soil textural analysis and determining estimated seasonal high water table (ESHWT.) The ESHWT was determined to be greater than 8 feet below the ground surface, or deeper than elevation 359 based on a surface elevation at the test pit location of approximately 367. The bottom of the stone placed beneath the chambers will be at elevation 366.25, thereby achieving more than 4.0 feet of separation distance to the seasonal high water table. Because the separation distance to ESHWT exceeds 4.0 feet, a Hantush groundwater mounding analysis is not required. A Hantush mounding analysis is also not required due to the design not being based on infiltration. The R-Tank modules act only as a means of detaining the runoff, thereby causing no increase in the runoff rate from the site. The system will still drain (albeit slowly) and infiltrate into the ground between storms, but will not infiltrate to any significant extent during storms.

The proposed conditions and proposed stormwater system are shown in the Design Drawings, included in Appendix K.

III. Legal Framework

This Stormwater Management Report fulfills the requirements of the Massachusetts Stormwater Handbook, as required by the Town of Groton stormwater ordinance. This report has been structured in accordance with the ten performance standards outlined in the Handbook and the Checklist for Stormwater Report.

IV. Massachusetts Stormwater Handbook Standards

A. Standard 1: No New Untreated Discharges:

The proposed site will include no new untreated discharges. All stormwater from new impervious areas will be treated onsite to remove suspended solids by means of deep sump catch basins and a water quality inlet structure. Treated stormwater will be discharged onsite into the existing closed drainage system.

B. Standard 2: Peak Rate Attenuation:

Calculations were performed per the United States Department of Agriculture's (USDA) Urban

Hydrology for Small Watersheds (TR-55) using HydroCAD software[1]. The Hydrocad results are provided in **Appendix D** demonstrating that post-development peak discharge rates will not exceed pre-development peak discharge rates for the 2-year, 10-year, 25-year, and 100-year 24-hour storms.

Peak rate attenuation results are summarized in **Table 1**.

Table 1. Peak Runoff Rate (CFS)

2-Year		10-Year		25-Year		100-Year	
Existing	Proposed	Existing	Proposed	Existing	Proposed	Existing	Proposed
2.57	2.61	4.51	4.52	6.03	6.01	9.11	9.02

Time of Concentration:

Because the drainage areas analyzed are relatively small and include impervious surfaces that shed water quickly, the longest flow paths within the catchments under proposed conditions result in times of concentration that are less than 6 minutes in most cases. The minimum time of concentration that can be used with the TR-55 methodology is 6 minutes (TR-55 Chapter 3). Wherever the Hydrocad-calculated Tc was less than the minimum 6 minutes, the TR-55 minimum value of 6 minutes was used via the "direct entry" input method in Hydrocad.

Rainfall:

Rainfall was imported from HydroCAD's Atlas-14 Rain data lookup table for the study area, which includes Northeast Regional Climate Center data for the site.

C. *Standard 3: Recharge:*

Note that the Massachusetts Stormwater Handbook does not allow infiltration (or "recharge") where soils have a saturated hydraulic conductivity ("infiltration rate") of less than 0.17 inches per hour. Because the measured infiltration rate at this site is 0.28 in/hr, and Massachusetts requires only half of the measured rate be used for design purposes, the design rate of 0.14 in/hr is too low to design an infiltration system. Therefore, the system as designed only attenuates the rate of runoff and not the volume.

1 HydroCAD Software Solutions. 2012. HydroCAD Version 10.00.

D. Standard 4: Water Quality:

Per Volume 3, Chapter 1, page 32 of the Massachusetts Stormwater Handbook, the water quality volume is defined and calculated as follows:

WQV = (D_{WQ}/12 inches/foot) * (A_{IMP} * 43,560 square feet/acre)

Where:

WQV = Required Water Quality Volume (in cubic feet)

D_{WQ} = Water Quality Depth: one-inch for discharges within a Zone II or Interim Wellhead Protection Area, to or near another critical area, runoff from a land use with a higher potential pollutant load (LUHPPL,) or exfiltration to soils with an infiltration rate greater than 2.4 inches/hour (½-inch for discharges near or to other areas.)

A_{IMP} = Impervious Area (in acres) being directed toward the BMP

The Water Quality Depth is ½-inch (0.0417 ft) for this area.

The proposed impervious area being directed to the WQI= 25,423 SF

Total WQV required = (0.5 in/12 in/ft) * (25,423 SF) = 1059 CF =7921 gal

Treatment is provided in the Water Quality Inlet. The volume of the WQI is 7500 gallons, or 1003 cubic feet. Therefore 1003 CF is being treated, which is slightly smaller than required but within reason for a redevelopment project where the stormwater standards are to be applied to the greatest extent practicable.

The proposed series of runoff treatments ("treatment train") outlined in the Inspection & Maintenance Manual (**Appendix F**) are sufficient to remove 49% of Total Suspended Solids (TSS) in stormwater. Although the Massachusetts standard is to remove 80% of TSS, the most effective means of doing this is with infiltration, which is not feasible at this site. Therefore 49% is the best achievable removal rate for this redevelopment project, using a combination of street sweeping, deep sump hooded catch basins, and a Water Quality Inlet (AKA oil and grit separator). Calculations documenting that the treatment train achieves 49% TSS removal requirement are included in **Appendix E**.

E. Standard 5: Land Uses with Higher Potential Pollutant Loads (LUHPPLs):

The proposed development will not include Land Uses with Higher Potential Pollutant Loads. This standard does not apply.

F. Standard 6: Critical Areas:

There are no Zone II, Interim Wellhead Protection Areas, Shellfish Growing Areas, Bathing Beaches, Outstanding Resource Waters, Special Resource Waters, or Cold-Water Fisheries in the vicinity of the Site. Stormwater from the site will discharge onsite and will not affect Critical Areas.

G. 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 Redevelopment Project.

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

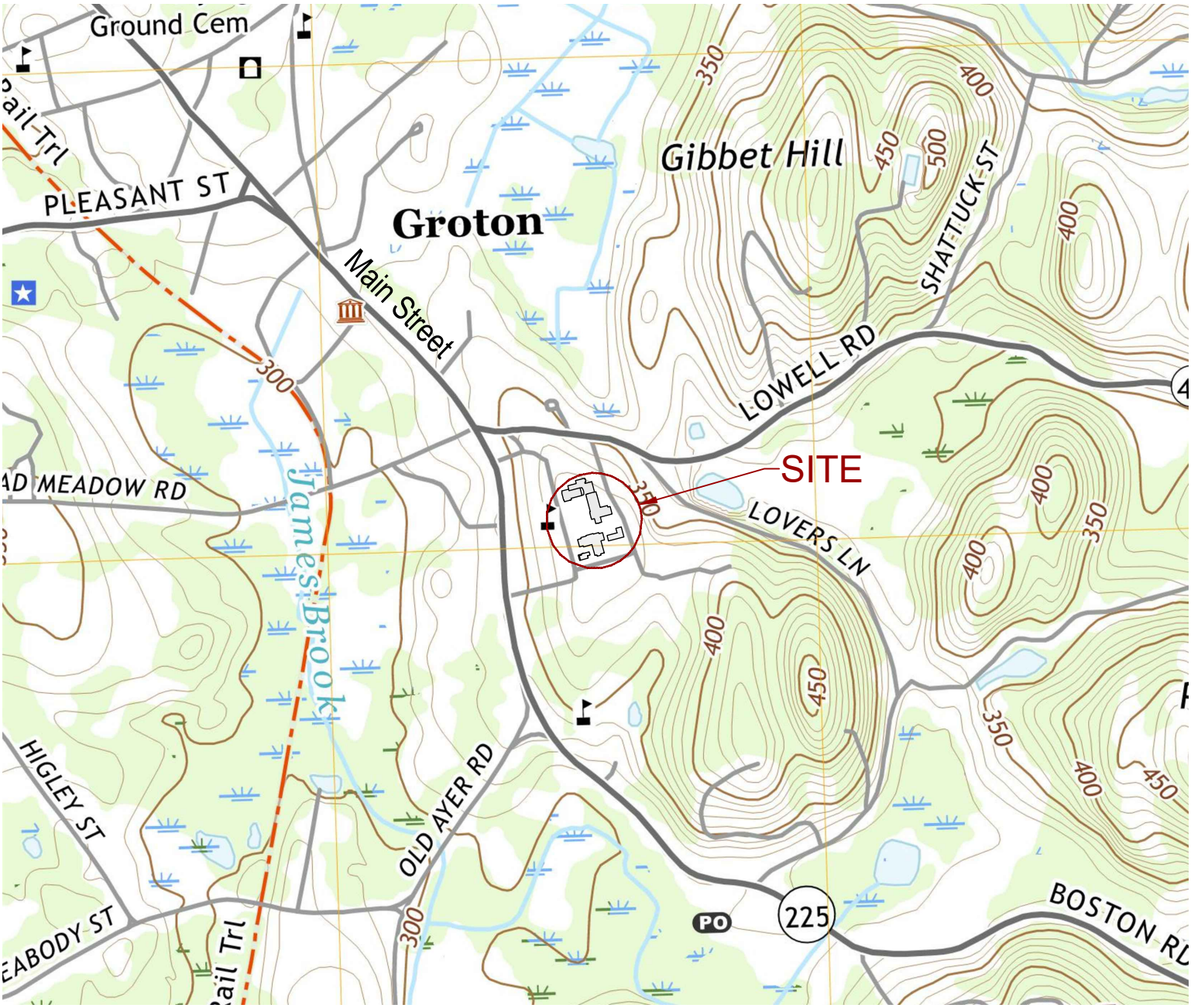
A Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan is included in the Project Site Plans (Appendix H).

I. Standard 9: Inspection and Maintenance Plan:

An Inspection and Maintenance Plan is included in Appendix F. This Inspection and Maintenance Plan will also function as a Long-Term Pollution Prevention Plan.

J. Standard 10: Prohibition of Illicit Discharges:

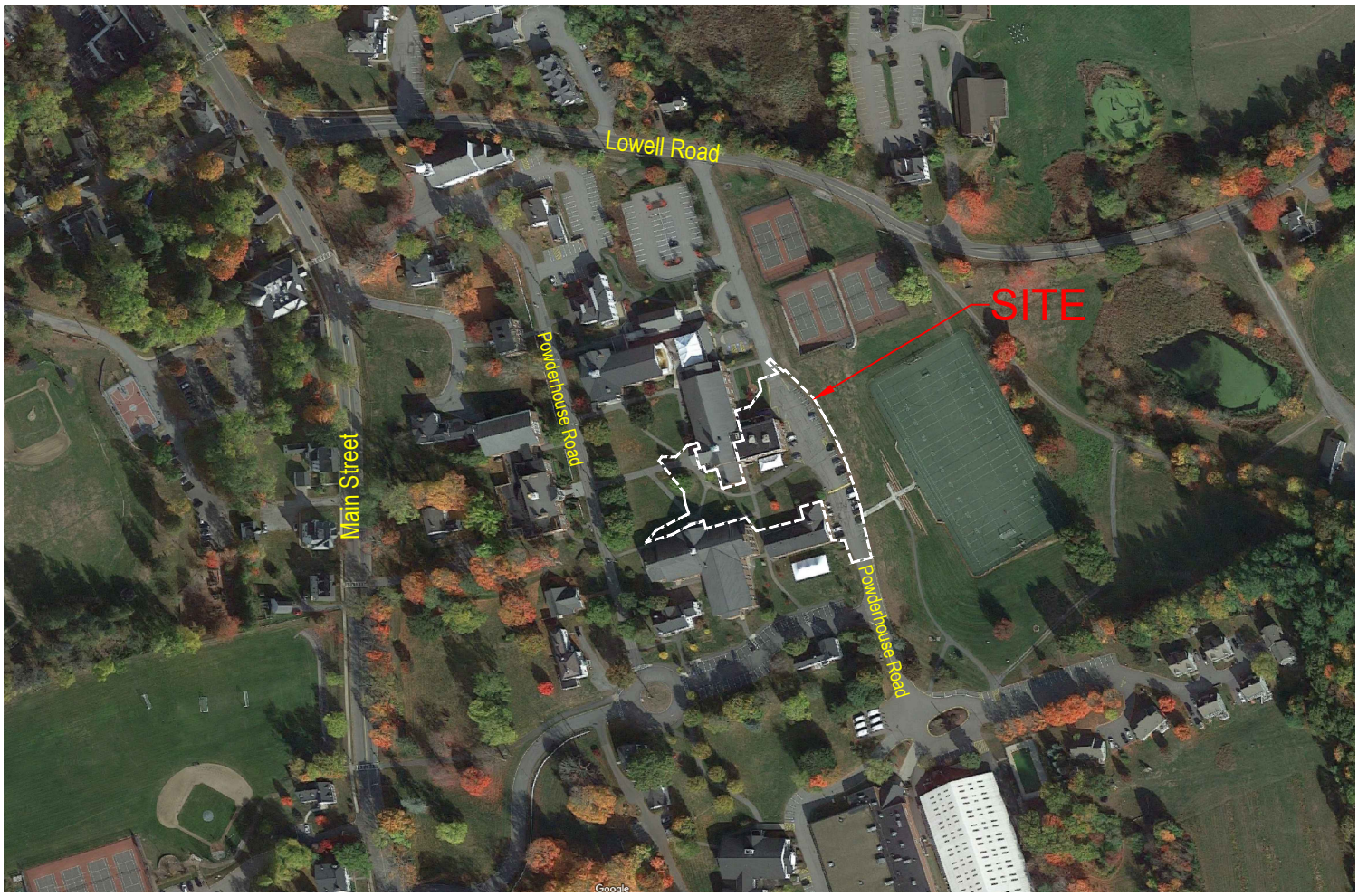
An Illicit Discharge Compliance Statement is attached in Appendix I.



USGS LOCATION MAP
SCALE: 1" = 1000'±

Lawrence Academy
Groton, MA
Gray Building Expansion
September 2022

Figure 1



PROJECT LOCUS
SCALE: 1" = 300'±

Lawrence Academy
Groton, MA
Gray Building Expansion
September 2024

Figure 2

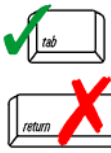
Appendix A – Massachusetts Stormwater Checklist for the Project

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

Checklist for Stormwater Report

A. Introduction

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



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

The Stormwater Report must include:

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

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

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

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

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

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

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

Checklist for Stormwater Report

B. Stormwater Checklist and Certification

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

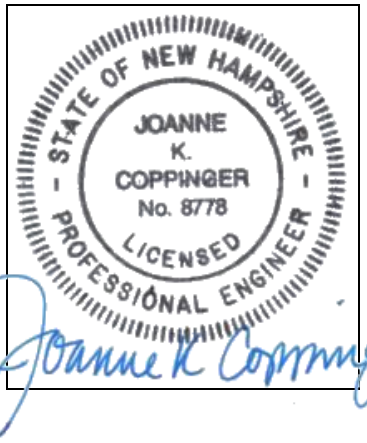
Note: Because stormwater requirements vary from project to project, it is possible that a complete Stormwater Report may not include information on some of the subjects specified in the Checklist. If it is determined that a specific item does not apply to the project under review, please note that the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

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

Registered Professional Engineer's Certification

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

Registered Professional Engineer Block and Signature



09/20/2024
Signature and Date

Checklist

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

☐ New development

X Redevelopment

☐ Mix of New Development and Redevelopment

Checklist for Stormwater Report

Checklist (continued)

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

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

Standard 1: No New Untreated Discharges

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

Checklist for Stormwater Report

Checklist (continued)

Standard 2: Peak Rate Attenuation

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

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

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

Standard 3: Recharge

☐ Soil Analysis provided.

☐ Required Recharge Volume calculation provided.

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

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

☐ Static ☐ Simple Dynamic ☐ Dynamic Field[1]

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

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

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

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

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

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

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

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

Checklist for Stormwater Report

Checklist (continued)

Standard 3: Recharge (continued)

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

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

Standard 4: Water Quality

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

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

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

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

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

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

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

Checklist for Stormwater Report

Checklist (continued)

Standard 4: Water Quality (continued)

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

- X 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.

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

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

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

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

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

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

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

☐ All exposure has been eliminated.

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

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

Standard 6: Critical Areas

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

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

Checklist for Stormwater Report

Checklist (continued)

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

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

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

X 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.

X 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.

X Will be provided by the Contractor

Checklist for Stormwater Report

Checklist (continued)

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

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

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

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

X 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

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

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

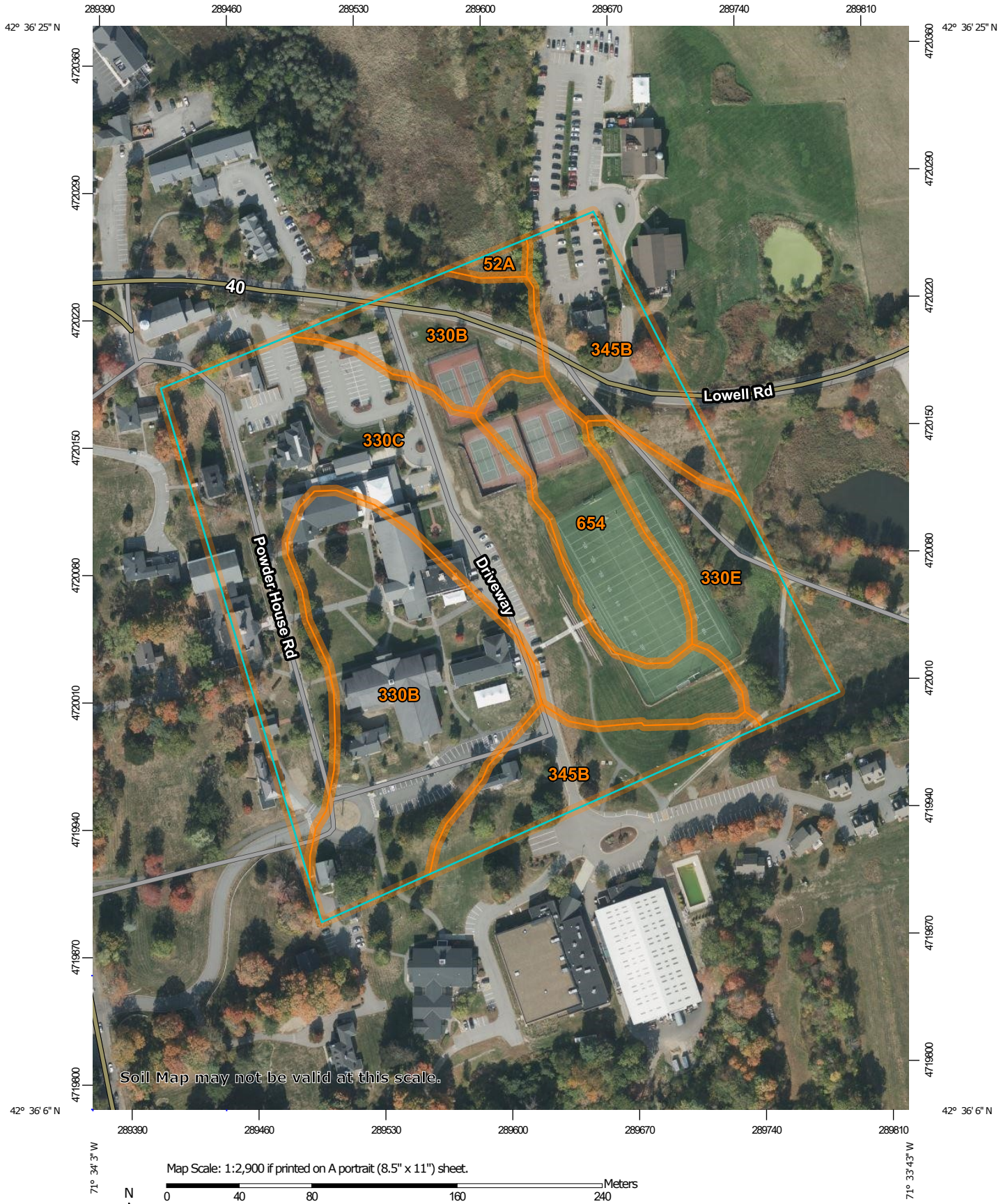
☐ The Long-Term Pollution Prevention Plan includes measures to prevent illicit discharges;

X An Illicit Discharge Compliance Statement is attached;

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

Appendix B

Natural Resources Conservation Service Hydrologic Soil Group Report



Map Scale: 1:2,900 if printed on A portrait (8.5" x 11") sheet.

N

Meters
0 40 80 160 240

Feet
0 100 200 400 600

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

MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils
- Soil Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

Special Point Features
- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

Water Features
- Streams and Canals

Transportation
- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background
- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:25,000.

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

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

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

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

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

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

Soil Survey Area: Middlesex County, Massachusetts
Survey Area Data: Version 21, Sep 2, 2021

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

Date(s) aerial images were photographed: Sep 9, 2020—Oct 15, 2020

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

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
52A	Freetown muck, 0 to 1 percent slopes	0.1	0.6%
330B	Bernardston very fine sandy loam, 3 to 8 percent slopes	6.2	29.3%
330C	Bernardston very fine sandy loam, 8 to 15 percent slopes	7.4	34.8%
330E	Bernardston very fine sandy loam, 25 to 35 percent slopes	2.1	9.9%
345B	Pittstown silt loam, 3 to 8 percent slopes	3.4	16.2%
654	Udorthents, loamy	1.9	9.2%
Totals for Area of Interest		**21.2**	**100.0%**

Appendix C – Geotechnical Report

REPORT

22-1132 S

September 3, 2024

Explorations and Geotechnical Engineering Services

Proposed Gray Building Addition
Lawrence Academy
26 Powderhouse Road
Groton, Massachusetts

Prepared For:
Lawrence Academy
Attention: Robert Kramer
26 Powderhouse Road
Groton, MA 01450

Prepared By:
S. W. Cole Engineering, Inc.
13 Delta Drive, Unit 8
Londonderry, NH 03053
T: 603-716-2111

S.W.COLE ENGINEERING, INC.

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22-1132 S

September 3, 2024

Lawrence Academy
Attention: Robert Kramer
26 Powderhouse Road
Groton, MA 01450

Subject: Explorations and Geotechnical Engineering Services
Proposed Gray Building Addition
Lawrence Academy
26 Powderhouse Road
Groton, Massachusetts

Dear Robert:

In accordance with our Proposal, dated July 20, 2022, we have performed subsurface explorations for the subject project. This report summarizes our findings and geotechnical recommendations and its contents are subject to the limitations set forth in Appendix A.

1.0 INTRODUCTION

1.1 Scope and Purpose

The purpose of our services was to obtain subsurface information at the site in order to develop geotechnical recommendations relative to foundations and earthwork associated with the proposed construction. Our scope of services included six test boring explorations, one test pit explorations, soils laboratory testing, a geotechnical analysis of the subsurface findings and preparation of this report.

1.2 Site and Proposed Construction

The site is located at the southeast area of the existing Gray Building at Lawrence Academy and is bordered by landscaped areas to the north and south, the existing building to the west, and Powderhouse Road to the east. The existing First Floor Elevation (FFE) of the south portion of the existing building is 377.2 feet and the north portion is 372.2 feet. The depth and configuration of existing perimeter and interior

footings are not known at this time. Exterior grade surrounding the building slope from south (385 feet) to north (375 feet).

We understand the project will consist of the partial demolition (6,000 SF) and construction of an addition (17,000 SF) to the existing building. The new addition will have an at-grade walkout basement level and a supported at-grade first floor. The height difference from basement slab to first floor slab is approximately 14 feet, and the basement will have a frost wall at the walkout slab further to the east and full height retaining walls opposite the walkout further to the west. The proposed Finished Floor Elevation (FFE) for the lower level/basement is 374.2 feet. Estimated wall loading will be 5.0 klf and column loading is approximately 200 kips. Underpinning of the existing foundations is anticipated to accommodate the lower elevation footings for the addition compared to the anticipated elevations of the existing footings. The existing foundation elements are believed to be spread footings.

Additional construction elements include an infiltration basin on the east side of Powderhouse Road and paved area east of the addition.

Proposed and existing site features are shown on the “Exploration Location Plan” attached in Appendix B.

2.0 EXPLORATION AND TESTING

2.1 Explorations

Six test borings (B-1 through B-6) were made at the site on August 25 and 26, 2022 by S. W. Cole Explorations, LLC working under subcontract to S. W. Cole Engineering, Inc. (S.W.COLE). The exploration locations were selected and established in the field by S.W.COLE using measurements from existing site features. The approximate exploration locations are shown on the “Exploration Location Plan” attached in Appendix B. Logs of the explorations and a key to the notes and symbols used on the logs are attached in Appendix C. The elevations shown on the logs were estimated based on topographic information shown on the “Exploration Location Plan”.

One test pit (TP-1) was performed at the site on August 23, 2024, by Seaboard Drilling, LLC, using a Komatsu PC40MR excavator. The exploration location was selected by

Rist-Frost-Shumway (RFS) Engineering, P.C. and established in the field by the S.W. COLE.

2.2 Field Testing

The test borings were drilled using a combination of hollow stem auger and cased wash-boring techniques. The soils were sampled at 2-to-5-foot intervals using a split spoon sampler and Standard Penetration Testing (SPT) methods. SPT blow counts are shown on the logs.

A Guelph Permeameter was used to measure a saturated infiltration rate of 0.28 inches/hour at Test Pit 1, performed at a depth of 3 feet below the existing ground surface, or at an approximate elevation of 364 feet. The soils at the infiltration elevation were visually described as gravelly sand and silt/clay. The infiltration rate is the direct value from the field testing and no safety factor has been applied. The proposed bottom elevation of the infiltration structure provided by RFS is 368 feet.

2.3 Laboratory Testing

Soil samples obtained from the explorations were returned to our laboratory for further classification and testing. Three gradation analyses and moisture content tests were performed on samples. The Lab IDs and moisture content results are noted on the logs and laboratory test results are attached in Appendix D.

3.0 SUBSURFACE CONDITIONS

3.1 Soil and Bedrock

Test borings B-1 through B-5 were made in the area of the proposed building addition, to the north and south of the existing building. They encountered a soils profile generally consisting of medium dense sandy silt or sand and silt (possible fill) or very loose to medium dense fill material to 7.0 to 10.9 feet underlain by dense to very dense native gravelly silt/clay and sand (glacial till) soils. In B-5 the fill was inferred to extend to 10.5 feet due to the placement of a ceramic drain pipe that was encountered during drilling. In general, the transition from fill to glacial till was difficult to discern due to the composition of the fill being similar to the native soils and was likely re-used from on-site or nearby sources. Identification of fill was made based on comparatively lower SPT values and

presence of foreign debris. Because of this, depth of fill may be slightly lesser or greater than presented on the boring logs.

Test boring B-6 was made in the parking lot to the east of the existing building. This test borings encountered a silty sand subbase to 2.5 feet and sandy silt/clay fill with some gravel to 7.0 feet (El. 370 feet) underlain by dense to very dense glacial till. The boring was terminated in glacial till at 17 feet.

Test pit TP-1 encountered gravelly sand and silt/clay soil that becomes increasingly more granular with depth. The test pit was performed to a depth of 8 feet.

Not all the strata were encountered at each exploration; refer to the attached logs for more detailed subsurface information.

3.2 Groundwater

Groundwater was not encountered in the six borings during drilling or the test pit, however the soils are considered to have slow permeability characteristics. Groundwater likely becomes perched on the relatively impervious glacial till encountered at the test borings. Long term groundwater information is not available. It should be anticipated that groundwater levels will fluctuate, particularly in response to periods of snowmelt and precipitation, as well as changes in site use.

4.0 EVALUATION AND RECOMMENDATIONS

4.1 General Findings

Based on the subsurface findings, the proposed construction appears feasible from a geotechnical standpoint. The principal geotechnical considerations include:

- Based on test boring findings, the site soils consist of medium dense sandy silt or sand and silt (possible fill) or very loose to medium dense fill material to depths of about 7.0 to 11.0 feet underlain by dense to very dense native glacial till.

- The fill material is not suitable for bearing support and should be completely removed from below the proposed building foundations.

- Based on the test boring findings, the fill extends to depths of 1 to 8 feet below the proposed floor slab elevation. The fill contains high percentages of silt and clay and is very loose in some zones which creates issues with poor slab support and potential settlement and slab movement. To eliminate the risk of settlement associated with the fill, the fill should be over-excavated and removed from below the proposed floor slab. We recognize there is a significant cost associated with fill removal and replacement. Presumably, the existing building and slab is supported on the fill and therefore, the owner may elect to eliminate fill removal below the slab, provided they understand and accept the risk of slab movement/settlement. Partial fill removal to a depth of about 3 feet below the top of slab would reduce, but not eliminate the risk, by removing a large portion of the very loose to loose fills.

- Careful observation of excavation work will be required to distinguish fill from native glacial till. S.W.COLE should be present to make recommendations regarding required over-excavation depths, observe subgrades and placement of compacted soils.

- Provided the unsuitable fill soils are removed and replaced with new controlled, compacted fill, spread footing foundations and slab-on-grade floors bearing on properly prepared subgrades appear suitable for the proposed building. Footings should bear on at least 6-inches of compacted Crushed Stone wrapped in geotextile fabric overlying undisturbed native non-organic soils. On-grade floor slabs should bear on at least 12-inches of properly compacted Structural Fill overlying properly prepared subgrades.

- Underpinning support of the existing building will be required at several locations where the proposed addition will adjoin the existing building. In addition to required underpinning depth to achieve bottom of new foundations, additional underpinning depth is likely necessary to remove unsuitable fill observed in boring B-5, near the intersection of gridlines ‘el’ and ‘5.4’ (S1.01: Foundation Plan). Underpinning using alternating hand-excavated underpinning pits filled with concrete are considered a practical method.

- The design frost depth for Groton, Massachusetts area is 4.0 feet. Footings exposed to freezing temperatures (i.e. perimeter footings) must have at least 4.0 feet of soil cover to provide frost protection.

- All topsoil, remnant structures, foundations and debris must be completely removed from beneath the proposed building and backfilled with properly compacted Structural Fill.

- Subgrades across the site will consist of fill and native material containing silt/clay soils with sand and gravel. Earthwork and grading activities should occur during drier, non-freezing weather of Spring, Summer and Fall. Rubber tired construction equipment should not operate directly on the native silt and clays when wet. Excavation of bearing surfaces should be completed with a smooth-edged bucket to lessen subgrade disturbance.

4.2 Site and Subgrade Preparation

We recommend that site preparation begin with the construction of an erosion control system to protect adjacent drainage ways and areas outside the construction limits. Surficial organics, roots and topsoil should be completely removed from areas of proposed fill and construction. As much vegetation as possible should remain outside the construction areas to lessen the potential for erosion and site disturbance.

Building Foundations: All uncontrolled fills, relic structures, foundations and debris must be completely removed from beneath the proposed building foundations. The extent of removal should extend 1 foot laterally outward from outside edge of perimeter footings for every 1-foot of excavation depth (1H:1V bearing splay). The over-excavated area should be backfilled with compacted Structural Fill.

We recommend that footings be excavated using a smooth-edged bucket and that footings be underlain by at least 6 inches of Crushed Stone wrapped in non-woven geotextile filter fabric, such as Mirafi 180N.

Floor Slab: As discussed in Section 4.1, Based on the test boring findings, the fill extends to depths of 1 to 8 feet below the proposed floor slab elevation. To eliminate the risk of settlement associated with the fill, the fill should be over-excavated and

removed from below the proposed floor slab. We recognize there is a significant cost associated with fill removal and replacement. Presumably, the existing building and slab is supported on the fill and therefore, the owner may elect to eliminate fill removal below the slab, provided they understand and accept the risk of slab movement/settlement. Partial fill removal to a depth of about 3 feet below the top of slab would reduce, but not eliminate the risk, by removing a large portion of the very loose to loose fills.

Pavement: A woven geotextile fabric, such as Mirafi 600X, should be placed over the subgrade soils followed by the pavement section.

4.3 Excavation and Dewatering

Excavation work will generally encounter fills consisting of native and fil materials consisting of silt/clay soils with sand and gravel. Care must be exercised during construction to limit disturbance of the bearing soils. Earthwork and grading activities should occur during drier, non-freezing weather of Spring, Summer and Fall. Rubber tired construction equipment should not operate directly on the subgrades, when wet. Final cuts to subgrade should be performed with a smooth-edged bucket to help reduce strength loss from soil disturbance.

Vibrations from construction should be controlled below threshold limits of 0.5 in/sec for structures, water supply wells and infrastructure within 500 feet of the project site. More restrictive vibration limits may be warranted in specific cases with sensitive equipment, historic structures or artifacts on-site or within close proximity.

Sumping and pumping dewatering techniques should be adequate to control runoff water in excavations. Controlling the water levels to at least one foot below planned excavation depths will help stabilize subgrades during construction. Excavations must be properly shored or sloped in accordance with OSHA Regulations to prevent sloughing and caving of the sidewalls during construction. Care must be taken to preclude undermining adjacent structures, utilities and roadways.

Underpinning support of the existing building will be required at several locations where the proposed addition will adjoin the existing building. In addition to required underpinning depth to achieve bottom of new foundations, additional underpinning

depth is likely necessary to remove unsuitable fill observed in boring B-5, near the intersection of gridlines A and 5.4. The depth of existing footings is not known, however assuming the bottom of existing foundations are 2 to 3 feet below the FFE, underpinning may extend on the order of 5 to 6 feet below existing foundations.

Underpinning using alternating hand-excavated underpinning pits filled with concrete are considered a practical method. Underpinning should be a delegated design-build items provided by the contractor. The underpinning design should be performed and stamped by a registered Professional Engineer in the Commonwealth of Massachusetts and submitted to the Owner's engineer for review. Underpinning piers should be constructed within timber shored pits beneath the footing and from individual approach pits. General excavation on either side of the approach pits should not extend below an influence line of 1.5H to 1V from the bottom edge of the existing footing.

Underpinning piers should have a maximum length of 4 feet along the subject wall and should extend beneath the full width of the footing. Underpinning piers should have structural concrete which extends from approximately 6 inches below the bearing elevation of adjacent proposed footings to within 3 inches of the underside of the existing footing. The 3-inch gap should be dry-packed on the following day with a mixture of equal parts concrete sand and Type III Portland cement with minimum water for hydration. Simultaneously excavated underpinning pits should be no closer than 12 feet on center.

The design and planning of excavations, excavation support systems, underpinning, and dewatering is the responsibility of the contractor.

4.4 Foundations

We recommend the proposed building be supported on spread footings founded on at least 6-inches of Crushed Stone fully wrapped in non-woven geotextile fabric, such as Mirafi 180N, bearing on properly prepared subgrade or undisturbed glacial till or on new compacted Granular Borrow overlying undisturbed glacial till soils. For foundations bearing on properly prepared subgrades, we recommend the following geotechnical parameters for design consideration:

Geotechnical Parameters for Spread Footings and Foundation Walls	
Design Frost Depth (100 year AFI)	4.0 feet
Net Allowable Soil Bearing Pressure	4.0 ksf
Base Friction Factor	0.35
Total Unit Weight of Backfill	125 pcf
At-Rest Lateral Earth Pressure Coefficient	0.5
Internal Friction Angle of Backfill	30°
Seismic Soil Site Class (IBC 2015)	C
Estimated Total Settlement	1-inch
Differential Settlement	½-inch

4.5 Foundation Drainage

We recommend an underdrain system be installed on the outside edge of the geotextile fabric wrapped Crushed Stone layer recommended below perimeter footings. The underdrain pipe should consist of 4-inch diameter, perforated SDR-35 foundation drain pipe bedded in Crushed Stone and wrapped in non-woven geotextile fabric. The underdrain pipe must have a positive gravity outlet protected from freezing, clogging and backflow. Surface grades should be sloped away from the building for positive surface water drainage. General underdrain details are illustrated on the "Foundation Detail Sketch" attached in Appendix B.

4.6 Slab-On-Grade

On-grade floor slabs in heated areas may be designed using a subgrade reaction modulus of 100 pci (pounds per cubic inch) provided the slab is underlain by at least 12-inches of compacted Crushed Stone placed over properly prepared subgrades. The structural engineer or concrete consultant must design steel reinforcing and joint spacing appropriate to slab thickness and function, as well as prevention of slab cracking and curling.

We recommend a sub-slab vapor retarder particularly in areas of the building where the concrete slab will be covered with an impermeable surface treatment or floor covering that may be sensitive to moisture vapors. The vapor retarder must have a permeance that is less than the floor cover or surface treatment that is applied to the slab. The vapor retarder must have sufficient durability to withstand direct contact with the sub-slab base material and construction activity. The vapor retarder material should be placed according to the manufacturer's recommended method, including the taping and lapping of all joints and wall connections. The architect and/or flooring consultant

should select the vapor retarder products compatible with flooring and adhesive materials.

The floor slab should be appropriately cured using moisture retention methods after casting. Typical floor slab curing methods should be used for at least 7 days. The architect or flooring consultant should assign curing methods consistent with current applicable American Concrete Institute (ACI) procedures with consideration of curing method compatibility to proposed surface treatments, flooring and adhesive materials.

4.7 Entrance Slabs and Sidewalks

Entrance slabs and sidewalks adjacent to the building must be designed to reduce the effects of differential frost action between adjacent pavement, doorways, and entrances. We recommend that non-frost susceptible Structural Fill be provided to a depth of at least 4.0 feet below the top of entrance slabs. This thickness of Structural Fill should extend the full footprint of the entrance slab, thereafter transitioning up to the bottom of the adjacent sidewalk or pavement gravels at a 3H:1V or flatter slope. General details of this frost transition zone are shown on the “Foundation Detail Sketch” attached in Appendix B.

4.8 Internal Retaining Walls

We understand cast-in-place concrete retaining walls are proposed to construct the building. We recommend the retaining wall be founded on a minimum 12-inch-thick leveling course of compacted Crushed Stone wrapped in a non-woven geotextile fabric such as Mirafi 180N or equivalent overlying undisturbed native soils or compacted Structural Fill. For design of retaining walls, we recommend the following geotechnical parameters for design:

Geotechnical Parameters for Retaining Walls		
Wall Zone	**Unit Weight (pcf)**	**Friction Angle (deg)**
Crushed Stone	100	38
Retained Soil	125	30
Foundation Soil	125	30
Net Allowable Soil Bearing Pressure	4.0 ksf	

We recommend the retaining wall be backfilled with a vertical column of Crushed Stone directly behind the face of the wall for drainage. An underdrain should be installed behind the retaining wall to limit the buildup of hydrostatic pressures adjacent to the

retaining wall. Additionally, new soils placed adjacent to the Crushed Stone should consist of compacted Structural Fill.

We recommend an equivalent fluid pressure of 63 pcf for design of below-grade walls (at-rest pressures) and an equivalent fluid pressure of 38 pcf for design of site retaining walls (free to rotate, active pressures).

4.9 Fill, Backfill and Compaction

We recommend the following fill and backfill materials:

Granular Borrow: Fill to raise grades in building and paved areas, as well as to repair soft areas, should be sand or silty sand meeting the following gradation:

Granular Borrow	
Sieve Size	**Percent Finer by Weight**
6 inch	100
Portion Passing 3 inch Sieve	
No. 40	0 to 70
No. 200	0 to 20

In our opinion, MassDOT-SSHB, Division III, M1.03.0 Gravel Borrow, Type A meets the requirements of Granular Borrow.

Structural Fill: Backfill for foundations and material below exterior entrances slabs should be clean, non-frost susceptible sand and gravel meeting the gradation requirements for Structural Fill as given below:

Structural Fill	
Sieve Size	**Percent Finer by Weight**
4 inch	100
3 inch	90 to 100
¼ inch	25 to 90
#40	0 to 30
#200	0 to 6

In our opinion, MassDOT-SSHB, Division III, M1.03.0, Gravel Borrow Type B with less than 6 percent passing the #200 sieve meets requirements of Structural Fill.

Crushed Stone: Crushed Stone, used for slab base, beneath foundations, and for underdrain aggregate should be clean, washed crushed stone meeting the requirements of MassDOT-SSHB, Division III, M2.01.4, ¾-inch Crushed Stone.

Reuse of Site Soils: The on-site soils are unsuitable for reuse in building and pavement areas.

Placement and Compaction: Fill should be placed in horizontal lifts and compacted such that the desired density is achieved throughout the lift thickness with 3 to 5 passes of the compaction equipment. Loose lift thicknesses for grading, fill and backfill activities should not exceed 12 inches. We recommend that fill and backfill in building and paved areas be compacted to at least 95 percent of its maximum dry density as determined by ASTM D-1557. Crushed Stone should be compacted with 3 to 5 passes of a vibratory plate compactor having a static weight of at least 500 pounds.

4.10 Weather Considerations

Construction activity should be limited during wet and freezing weather and the site soils may require drying or thawing before construction activities may continue. The contractor should anticipate the need for water to temper fills in order to facilitate compaction during dry weather. If construction takes place during cold weather, subgrades, foundations and floor slabs must be protected during freezing conditions. Concrete and fill must not be placed on frozen soil; and once placed, the concrete and soil beneath the structure must be protected from freezing.

4.11 Paved Areas

We anticipate paved areas will be subjected primarily to passenger vehicle and light delivery truck traffic with occasional heavy delivery truck traffic. Considering the site soils, and proposed usage, we offer the following pavement section for consideration.

FLEXIBLE (HMA) PAVEMENT SECTION – MassDOT-SSHB	
Pavement Layer	**Material Thickness**
MassDOT, Section M3.11.03, Top Course	1 ½ inches
MassDOT, Section M3.11.03, Binder Course	2 ½ inches
MassDOT, Section M2.01.7, Dense-Graded Crushed Stone for Subbase	6 inches
MassDOT, Section M1.03.1, Processed Gravel for Subbase	12 inches

The base and subbase materials should be compacted to at least 95 percent of their maximum dry density as determined by ASTM D-1557. Hot mix asphalt pavement should be compacted to 92 to 97 percent of its theoretical maximum density as determined by ASTM D-2041. A tack coat should be used between successive lifts of bituminous pavement.

4.12 Additional Services

We recommend consideration of performing test pits on the exterior side of the existing foundations near the intersection of grid lines F and 6 and the intersection of grid lines A and 5.4. The purpose of these test pits would be to determine the depth and configuration of existing footings and to further assess/characterize the composition and depth of existing fill.

4.13 Design Review and Construction Testing

S.W.COLE should be retained to review the construction documents prior to bidding to determine that our earthwork, foundation and pavement recommendations have been properly interpreted and implemented.

A construction materials testing and quality assurance program should be implemented during construction to observe compliance with the design concepts, plans, and specifications. S.W.COLE is available to observe earthwork activities, the preparation of foundation bearing surfaces and pavement subgrades, as well as to provide testing and IBC Special Inspection services for soils, concrete, steel, spray-applied fireproofing, fire-stopping, structural masonry and asphalt construction materials.

5.0 CLOSURE

It has been a pleasure to be of assistance to you with this phase of your project. We look forward to working with you during the construction phase of the project.

Sincerely,

S. W. Cole Engineering, Inc.

Courtney W. Mattson

Digitally signed by Courtney W. Mattson
Date: 2024.09.03 21:58:30 -04'00'

Courtney W. Mattson, P.E.
Senior Geotechnical Engineer

CWM:cbm

APPENDIX A

Limitations

This report has been prepared for the exclusive use of the Lawrence Academy for specific application to the proposed Lawrence Academy Gray Building Addition at 26 Powderhouse Road in Groton, Massachusetts. S.W.Cole Engineering, Inc. (S.W.COLE) has endeavored to conduct our services in accordance with generally accepted soil and foundation engineering practices. No warranty, expressed or implied, is made.

The soil profiles described in the report are intended to convey general trends in subsurface conditions. The boundaries between strata are approximate and are based upon interpretation of exploration data and samples.

The analyses performed during this investigation and recommendations presented in this report are based in part upon the data obtained from subsurface explorations made at the site. Variations in subsurface conditions may occur between explorations and may not become evident until construction. If variations in subsurface conditions become evident after submission of this report, it will be necessary to evaluate their nature and to review the recommendations of this report.

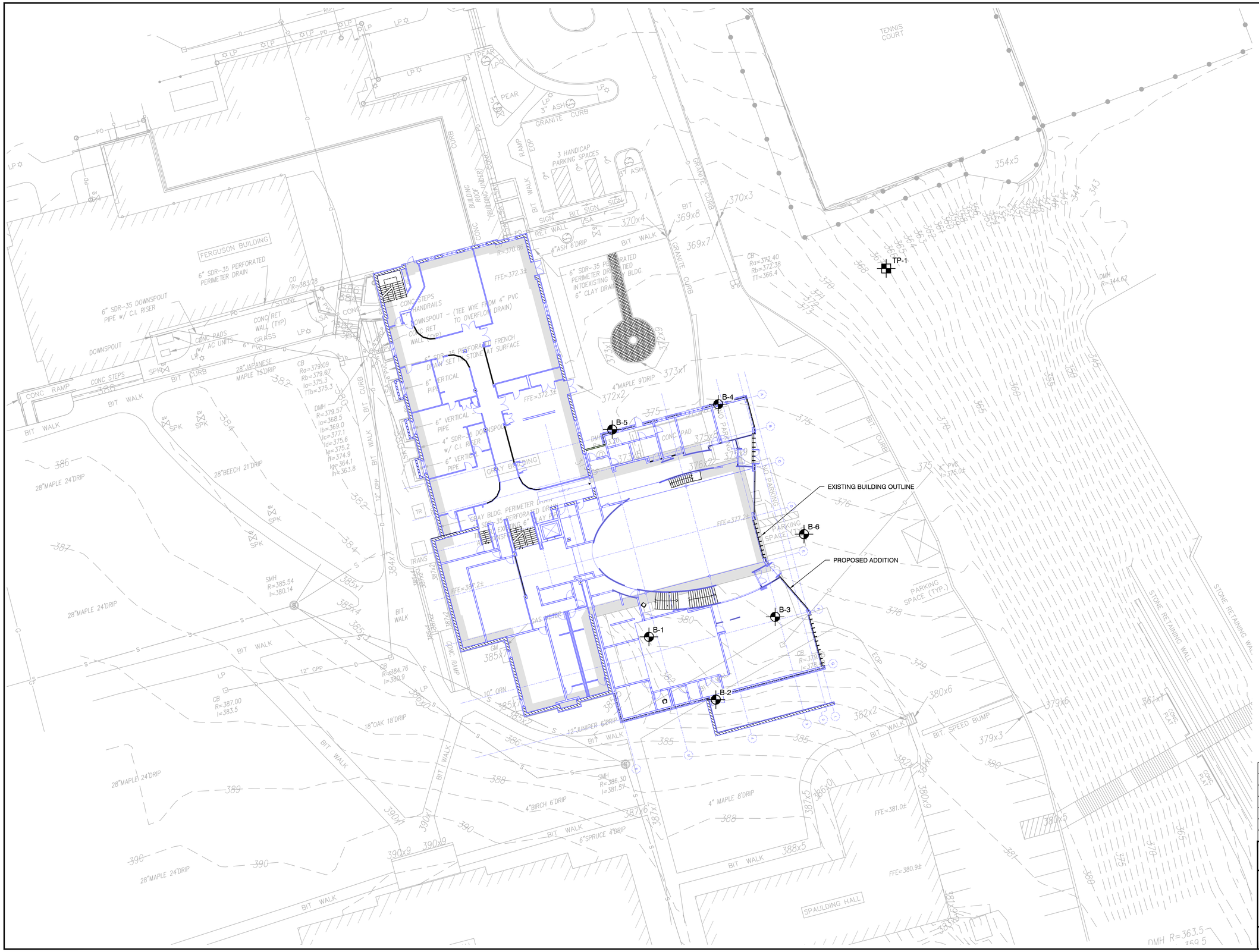
Observations have been made during exploration work to assess site groundwater levels. Fluctuations in water levels will occur due to variations in rainfall, temperature, and other factors.

S.W.COLE's scope of services has not included the investigation, detection, or prevention of any Biological Pollutants at the project site or in any existing or proposed structure at the site. The term "Biological Pollutants" includes, but is not limited to, molds, fungi, spores, bacteria, and viruses, and the byproducts of any such biological organisms.

Recommendations contained in this report are based substantially upon information provided by others regarding the proposed project. In the event that any changes are made in the design, nature, or location of the proposed project, S.W.COLE should review such changes as they relate to analyses associated with this report. Recommendations contained in this report shall not be considered valid unless the changes are reviewed by S.W.COLE.

APPENDIX B

Figures



NO.	DATE	DESCRIPTION	BY
1	08/29/2024	ADD TEST PIT TP-1	CEM
0	09/13/2022	REPORT SUBMISSION	CEM

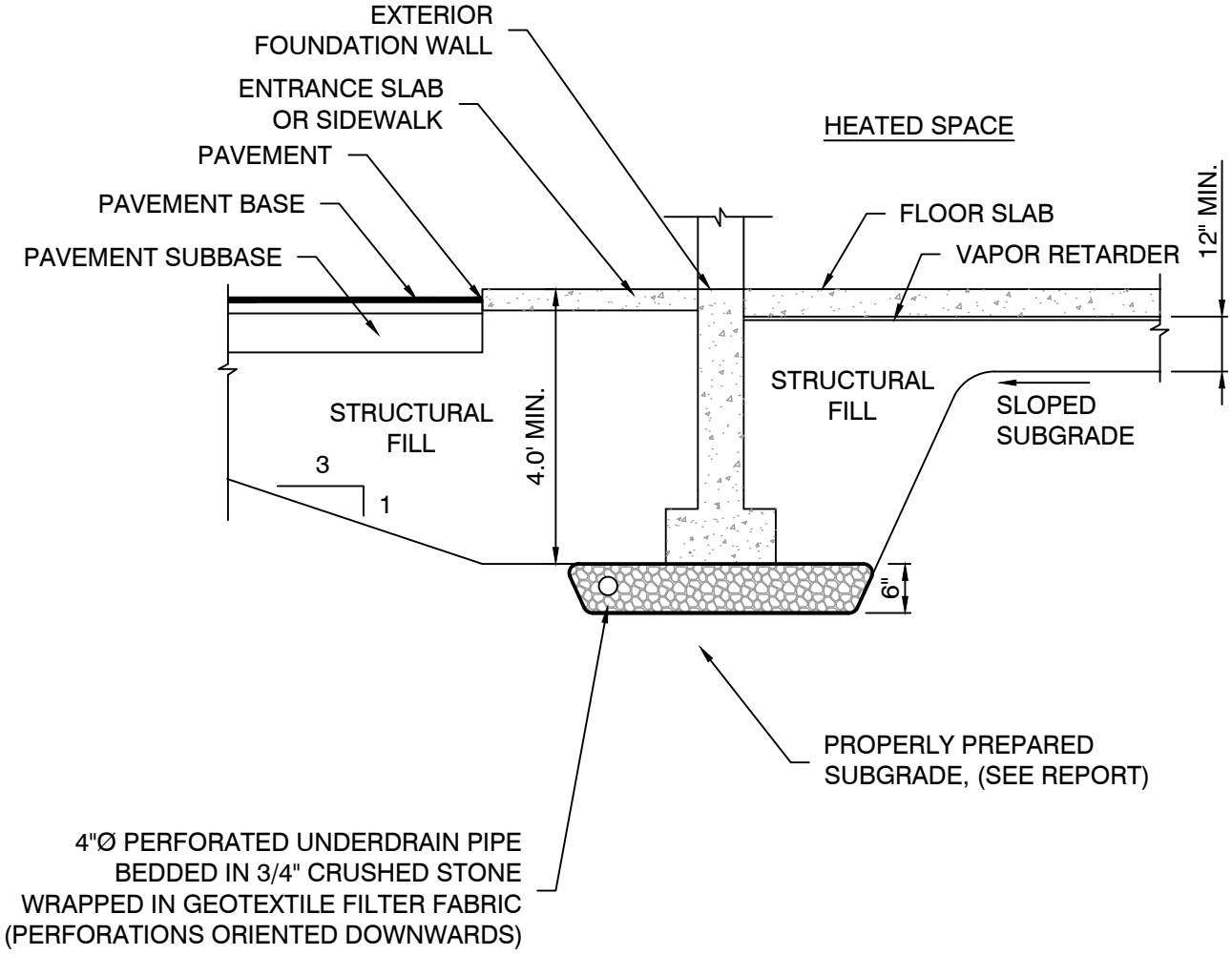
S.W.COLE ENGINEERING, INC.

LAWRENCE ACADEMY

EXPLORATION LOCATION PLAN

PROPOSED LAWRENCE ACADEMY GRAY BUILDING ADDITION
26 POWDERHOUSE ROAD
GROTON, MA

Job No.: 22-1132 Scale: 1" = 20'
Date : 09/13/2022 Sheet: 1



NOTE:

1. UNDERDRAIN INSTALLATION AND MATERIAL GRADATION RECOMMENDATIONS ARE CONTAINED WITHIN THIS REPORT.
2. DETAIL IS PROVIDED FOR ILLUSTRATIVE PURPOSES ONLY, NOT FOR CONSTRUCTION.

S.W.COLE
ENGINEERING, INC.

LAWRENCE ACADEMY

FOUNDATION DETAIL SKETCH

PROPOSED LAWRENCE ACADEMY GRAY BUILDING ADDITION
26 POWDERHOUSE ROAD
GROTON, MA

Job No.:	22-1132	Scale:	Not to Scale
Date :	09/13/2022	Sheet:	2

APPENDIX C

Exploration Logs and Key

DRILLER BORING LOG

BORING NO.:	**B-1**
SHEET:	1 of 1
PROJECT NO.	22-1132
DATE START:	8/26/2022
DATE FINISH:	8/26/2022

CLIENT: Lawrence Academy
PROJECT: Proposed Lawerence Academy Gray Building Addition
LOCATION: 26 Powderhouse Road, Groton, Masssachusetts

Drilling Information

LOCATION: See Exploration Location Plan **ELEVATION (FT):** 381' Estimated **TOTAL DEPTH (FT):** 22.5 **LOGGED BY:** Bryce Walker
DRILLING CO.: S. W. Cole Explorations, LLC **DRILLER:** Corey Culligan **DRILLING METHOD:** Hollow Stem Auger
RIG TYPE: Track Mounted Diedrich D-50 **AUGER ID/OD:** 2 1/4 in / 5 5/8 in **SAMPLER:** Standard Split-Spoon
HAMMER TYPE: Automatic **HAMMER WEIGHT (lbs):** 140 **CASING ID/OD:** N/A /N/A **CORE BARREL:** N/A
HAMMER CORRECTION FACTOR: 0.91 **HAMMER DROP (inch):** 30
WATER LEVEL DEPTHS (ft): No free-water observed.
GENERAL NOTES:

KEY TO NOTES AND SYMBOLS:
Water Level: ▽ At time of Drilling; ▼ At Completion of Drilling; ▼ After Drilling
D = Split Spoon Sample; U = Thin Walled Tube Sample; R = Rock Core Sample; V = Field Vane Shear
Pen. = Penetration Length; Rec. = Recovery Length; bpf = Blows per Foot; mpf = Minute per Foot
WOR = Weight of Rods; WOH = Weight of Hammer; RQD = Rock Quality Designation; PID = Photoionization Detector
S_v = Field Vane Shear Strength, kips/sq.ft.; q_u = Unconfined Compressive Strength, kips/sq.ft.; Ø = Friction Angle (Estimated); N/A = Not Applicable

Elev. (ft)	Depth (ft)	Casing Pen. (bpf)	SAMPLE INFORMATION: Sample No.	Type	Depth (ft)	Pen./ Rec. (in)	Blow Count or RQD	Field / Lab Test Data	Graphic Log	Sample Description & Classification	H_20 Depth	Remarks
380			1D	D	0-2	24/15	6-6-5-10			0.3 4" Grassed Topsoil Medium dense, brown, sandy SILT some gravel with shale fragments (Possible Fill)		
			2D	D	2-4	24/14	18-17-14-15					
	5		3D	D	5-7	24/22	8-8-10-14			4.5 Medium dense, brown to gray, sandy SILT/CLAY some gravel with rootlets and shale fragments (Possible Fill)		
375										7.0 Dense to very dense, blue to gray, silty sandy gravelly CLAY (Glacial Till)		
	10		4D	D	10-12	24/22	21-21-21-21					
370												
	15		5D	D	15-17	24/1	13-21-22-23					
365												
	20		6D	D	20-22	24/12	22-26-23-25					
360												

Auger Refusal at 22.5 feet
(Glacial Till)

Stratification lines represent approximate boundary between soil types, transitions may be gradual. Water level readings have been made at times and under conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.

BORING NO.: **B-1**

DRILLER BORING LOG

BORING NO.:	**B-2**
SHEET:	1 of 1
PROJECT NO.	22-1132
DATE START:	8/25/2022
DATE FINISH:	8/25/2022

CLIENT: Lawrence Academy
PROJECT: Proposed Lawerence Academy Gray Building Addition
LOCATION: 26 Powderhouse Road, Groton, Masssachusetts

Drilling Information

LOCATION: See Exploration Location Plan **ELEVATION (FT):** 382' Estimated **TOTAL DEPTH (FT):** 31.5 **LOGGED BY:** Bryce Walker
DRILLING CO.: S. W. Cole Explorations, LLC **DRILLER:** Corey Culligan **DRILLING METHOD:** Cased Boring
RIG TYPE: Track Mounted Diedrich D-50 **AUGER ID/OD:** N/A / N/A **SAMPLER:** Standard Split-Spoon
HAMMER TYPE: Automatic / Automatic **HAMMER WEIGHT (lbs):** 140 / 140 **CASING ID/OD:** 4 in / 4 1/2 in **CORE BARREL:** N/A
HAMMER CORRECTION FACTOR: 0.91 **HAMMER DROP (inch):** 30 / 30
WATER LEVEL DEPTHS (ft): Unstablized water level observed at 30.0'
GENERAL NOTES:

KEY TO NOTES AND SYMBOLS: Water Level: ▽ At time of Drilling; ▼ At Completion of Drilling; ▼ After Drilling
D = Split Spoon Sample; U = Thin Walled Tube Sample; R = Rock Core Sample; V = Field Vane Shear
Pen. = Penetration Length; Rec. = Recovery Length; bpf = Blows per Foot; mpf = Minute per Foot
WOR = Weight of Rods; WOH = Weight of Hammer; RQD = Rock Quality Designation; PID = Photoionization Detector
S_v = Field Vane Shear Strength, kips/sq.ft.; q_u = Unconfined Compressive Strength, kips/sq.ft.; Ø = Friction Angle (Estimated); N/A = Not Applicable

Elev. (ft)	Depth (ft)	Casing Pen. (bpf)	SAMPLE INFORMATION: Sample No.	Type	Depth (ft)	Pen./ Rec. (in)	Blow Count or RQD	Field / Lab Test Data	Graphic Log	Sample Description & Classification	H_20 Depth	Remarks
			1D		0-2	24/10	3-7-9-9			0.4 5" Grassed Topsoil Medium dense, brown, gravelly SAND and SILT with shale fragments (Possible Fill)		
380			2D		2-4	24/5	6-10-10-9	ID 6852M w =10.5 %				
	5		3D		5-7	24/6	10-16-19-18			4.5 Dense, brown to gray, CLAY some silt, sand and gravel with rootlets to 7' (Possible Fill)		
375										7.0 Dense to very dense, blue to gray, silty sandy gravelly CLAY (Glacial Till)		
	10		4D		10-12	24/24	17-17-20-21					
370												
	15		5D		15-17	24/12	13-15-18-17					
365												
	20		6D		20-22	24/15	16-22-22-21					
360												
	25		7D		25-27	24/10	8-19-20-33					
355												
	30		8D		30-31.5	18/12	45-56-47					

Stratification lines represent approximate boundary between soil types, transitions may be gradual. Water level readings have been made at times and under conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.

Bottom of Exploration at 31.5 feet

BORING NO.: **B-2**

BORING / WELL 10-12-2022 22-1132.GPJ SWCE TEMPLATE.GDT 9/3/24

DRILLER BORING LOG

BORING NO.:	**B-3**
SHEET:	1 of 1
PROJECT NO.	22-1132
DATE START:	8/25/2022
DATE FINISH:	8/25/2022

CLIENT: Lawrence Academy
PROJECT: Proposed Lawerence Academy Gray Building Addition
LOCATION: 26 Powderhouse Road, Groton, Masssachusetts

Drilling Information

LOCATION: See Exploration Location Plan **ELEVATION (FT):** 379' Estimated **TOTAL DEPTH (FT):** 17.8 **LOGGED BY:** Bryce Walker
DRILLING CO.: S. W. Cole Explorations, LLC **DRILLER:** Matt Bussey **DRILLING METHOD:** Hollow Stem Auger
RIG TYPE: Track Mounted Mobile Drill B-53 **AUGER ID/OD:** 2 1/4 in / 5 5/8 in **SAMPLER:** Standard Split-Spoon
HAMMER TYPE: Automatic **HAMMER WEIGHT (lbs):** 140 **CASING ID/OD:** N/A /N/A **CORE BARREL:** N/A
HAMMER CORRECTION FACTOR: 0.89 **HAMMER DROP (inch):** 30
WATER LEVEL DEPTHS (ft): No free-water observed.
GENERAL NOTES:

KEY TO NOTES AND SYMBOLS:
Water Level: ▽ At time of Drilling; ▼ At Completion of Drilling; ▼ After Drilling
D = Split Spoon Sample; U = Thin Walled Tube Sample; R = Rock Core Sample; V = Field Vane Shear
Pen. = Penetration Length; Rec. = Recovery Length; bpf = Blows per Foot; mpf = Minute per Foot
WOR = Weight of Rods; WOH = Weight of Hammer; RQD = Rock Quality Designation; PID = Photoionization Detector
S_v = Field Vane Shear Strength, kips/sq.ft.; q_u = Unconfined Compressive Strength, kips/sq.ft.; Ø = Friction Angle (Estimated); N/A = Not Applicable

Elev. (ft)	Depth (ft)	Casing Pen. (bpf)	SAMPLE INFORMATION: Sample No.	Type	Depth (ft)	Pen./ Rec. (in)	Blow Count or RQD	Field / Lab Test Data	Graphic Log	Sample Description & Classification	H_20 Depth	Remarks
			1D		0-2	24/15	3-8-11-11			0.4 5" Grassed Topsoil Loose to medium dense, brown to gray, sandy gravelly SILT with asphalt, shale fragments, and wood fibers (Fill)		
			2D		2-4	24/16	5-4-4-3					
375												
	5		3D		5-7	24/2	1-2-2-2			4.5 Very loose, brown to gray, sandy gravelly SILT/CLAY with rootlets (Fill)		
370												
	10		4D		10-12	24/21	1-6-16-21			10.9 Medium dense to dense, blue to gray, silty sandy gravelly CLAY (Glacial Till)		
365												
	15		5D		15-17	24/24	13-14-18-21					

Auger Refusal at 17.8 feet
(Glacial Till)

Stratification lines represent approximate boundary between soil types, transitions may be gradual. Water level readings have been made at times and under conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.

DRILLER BORING LOG

BORING NO.:	**B-4**
SHEET:	1 of 1
PROJECT NO.	22-1132
DATE START:	8/25/2022
DATE FINISH:	8/25/2022

CLIENT: Lawrence Academy
PROJECT: Proposed Lawerence Academy Gray Building Addition
LOCATION: 26 Powderhouse Road, Groton, Masssachusetts

Drilling Information

LOCATION: See Exploration Location Plan **ELEVATION (FT):** 375' Estimated **TOTAL DEPTH (FT):** 17.5 **LOGGED BY:** Bryce Walker
DRILLING CO.: S. W. Cole Explorations, LLC **DRILLER:** Corey Culligan **DRILLING METHOD:** Hollow Stem Auger
RIG TYPE: Track Mounted Diedrich D-50 **AUGER ID/OD:** 2 1/4 in / 5 5/8 in **SAMPLER:** Standard Split-Spoon
HAMMER TYPE: Automatic **HAMMER WEIGHT (lbs):** 140 **CASING ID/OD:** N/A /N/A **CORE BARREL:** N/A
HAMMER CORRECTION FACTOR: 0.91 **HAMMER DROP (inch):** 30
WATER LEVEL DEPTHS (ft): No free-water observed.
GENERAL NOTES:

KEY TO NOTES AND SYMBOLS:
Water Level: ▽ At time of Drilling; ▼ At Completion of Drilling; ▼ After Drilling
D = Split Spoon Sample; U = Thin Walled Tube Sample; R = Rock Core Sample; V = Field Vane Shear
Pen. = Penetration Length; Rec. = Recovery Length; bpf = Blows per Foot; mpf = Minute per Foot
WOR = Weight of Rods; WOH = Weight of Hammer; RQD = Rock Quality Designation; PID = Photoionization Detector
S_v = Field Vane Shear Strength, kips/sq.ft.; q_u = Unconfined Compressive Strength, kips/sq.ft.; Ø = Friction Angle (Estimated); N/A = Not Applicable

Elev. (ft)	Depth (ft)	Casing Pen. (bpf)	SAMPLE INFORMATION: Sample No.	Type	Depth (ft)	Pen./ Rec. (in)	Blow Count or RQD	Field / Lab Test Data	Graphic Log	Sample Description & Classification	H_20 Depth	Remarks
			1D		0.5-2.5	24/13	7-8-5-6			6" Asphalt (0.5) Medium dense to loose, brown to gray, gravelly SILT/CLAY and SAND with shale fragments (Fill)		
			2D		2.5-4.5	24/8	6-7-6-5					
370	5		3D		5-7	24/12	3-2-2-3	ID 6853M w =13.5 %				
										(7.0) Very dense, olive to gray, gravelly SILT/CLAY, some sand (Glacial Till)		
365	10		4D		10-12	24/22	54-25-25-21					
360	15		5D		15-17	24/24	15-50-41-41					

Auger Refusal at 17.5 feet
(Glacial Till)

Stratification lines represent approximate boundary between soil types, transitions may be gradual. Water level readings have been made at times and under conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.

DRILLER BORING LOG

BORING NO.:	**B-5**
SHEET:	1 of 1
PROJECT NO.	22-1132
DATE START:	8/25/2022
DATE FINISH:	8/25/2022

CLIENT: Lawrence Academy
PROJECT: Proposed Lawerence Academy Gray Building Addition
LOCATION: 26 Powderhouse Road, Groton, Masssachusetts

Drilling Information

LOCATION: See Exploration Location Plan **ELEVATION (FT):** 376' Estimated **TOTAL DEPTH (FT):** 14.5 **LOGGED BY:** Bryce Walker
DRILLING CO.: S. W. Cole Explorations, LLC **DRILLER:** Corey Culligan **DRILLING METHOD:** Hollow Stem Auger
RIG TYPE: Track Mounted Diedrich D-50 **AUGER ID/OD:** 2 1/4 in / 5 5/8 in **SAMPLER:** Standard Split-Spoon
HAMMER TYPE: Automatic **HAMMER WEIGHT (lbs):** 140 **CASING ID/OD:** N/A /N/A **CORE BARREL:** N/A
HAMMER CORRECTION FACTOR: 0.91 **HAMMER DROP (inch):** 30
WATER LEVEL DEPTHS (ft): No free-water observed.
GENERAL NOTES:

KEY TO NOTES AND SYMBOLS:
Water Level: ▽ At time of Drilling; ▼ At Completion of Drilling; ▼ After Drilling
D = Split Spoon Sample; U = Thin Walled Tube Sample; R = Rock Core Sample; V = Field Vane Shear
Pen. = Penetration Length; Rec. = Recovery Length; bpf = Blows per Foot; mpf = Minute per Foot
WOR = Weight of Rods; WOH = Weight of Hammer; RQD = Rock Quality Designation; PID = Photoionization Detector
S_v = Field Vane Shear Strength, kips/sq.ft.; q_u = Unconfined Compressive Strength, kips/sq.ft.; Ø = Friction Angle (Estimated); N/A = Not Applicable

Elev. (ft)	Depth (ft)	Casing Pen. (bpf)	SAMPLE INFORMATION: Sample No.	Type	Depth (ft)	Pen./ Rec. (in)	Blow Count or RQD	Field / Lab Test Data	Graphic Log	Sample Description & Classification	H_20 Depth	Remarks
375			1D		0-2	24/16	3-3-6-8			0.3 4" Grassed Topsoil Medium dense, brown to gray, SILT/CLAY some sand some gravel with shale fragments (Fill)		
			2D		2-4	24/15	7-5-4-4					
	5		3D		5-7	24/10	3-2-3-1					
370												
	10		4D		10-12	24/24	8-23-29-24			10.5 @ 10': Ceramic Pipe Dense, olive to gray, sandy gravelly SILT/CLAY (Glacial Till)		
365												

Auger Refusal at 14.5 feet
(Glacial Till)

Stratification lines represent approximate boundary between soil types, transitions may be gradual. Water level readings have been made at times and under conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.

DRILLER BORING LOG

BORING NO.:	**B-6**
SHEET:	1 of 1
PROJECT NO.	22-1132
DATE START:	8/25/2022
DATE FINISH:	8/25/2022

CLIENT: Lawrence Academy
PROJECT: Proposed Lawerence Academy Gray Building Addition
LOCATION: 26 Powderhouse Road, Groton, Masssachusetts

S.W.COLE

Drilling Information

LOCATION: See Exploration Location Plan **ELEVATION (FT):** 377' Estimated **TOTAL DEPTH (FT):** 17.0 **LOGGED BY:** Bryce Walker
DRILLING CO.: S. W. Cole Explorations, LLC **DRILLER:** Corey Culligan **DRILLING METHOD:** Hollow Stem Auger
RIG TYPE: Track Mounted Diedrich D-50 **AUGER ID/OD:** 2 1/4 in / 5 5/8 in **SAMPLER:** Standard Split-Spoon
HAMMER TYPE: Automatic **HAMMER WEIGHT (lbs):** 140 **CASING ID/OD:** N/A /N/A **CORE BARREL:** N/A
HAMMER CORRECTION FACTOR: 0.91 **HAMMER DROP (inch):** 30
WATER LEVEL DEPTHS (ft): No free-water observed.
GENERAL NOTES:

KEY TO NOTES AND SYMBOLS:
Water Level: ▽ At time of Drilling; ▼ At Completion of Drilling; ▼ After Drilling
D = Split Spoon Sample; U = Thin Walled Tube Sample; R = Rock Core Sample; V = Field Vane Shear
Pen. = Penetration Length; Rec. = Recovery Length; bpf = Blows per Foot; mpf = Minute per Foot
WOR = Weight of Rods; WOH = Weight of Hammer; RQD = Rock Quality Designation; PID = Photoionization Detector
S_v = Field Vane Shear Strength, kips/sq.ft.; q_u = Unconfined Compressive Strength, kips/sq.ft.; Ø = Friction Angle (Estimated); N/A = Not Applicable

Elev. (ft)	Depth (ft)	Casing Pen. (bpf)	SAMPLE INFORMATION: Sample No.	Type	Depth (ft)	Pen./ Rec. (in)	Blow Count or RQD	Field / Lab Test Data	Graphic Log	Sample Description & Classification	H_20 Depth	Remarks
			1D		0.5-2.5	24/15	9-11-9-10			6" Asphalt		
375										0.5 Medium dense, brown, silty SAND some gravel (Fill)		
			2D		2.5-4.5	24/16	12-10-11-15			2.5 Medium dense, brown to gray, sandy SILT/CLAY some gravel with shale fragments (Possible Fill)		
	5		3D		5-7	24/19	5-6-12-10					
370										7.0 Dense to very dense, olive to gray, gravelly SILT/CLAY and SAND (Glacial Till)		
	10		4D		10-12	24/24	15-20-24-22	ID 6854M w =10.4 %				
365												
	15		5D		15-17	24/2	17-24-30-35					
360										Auger Refusal at 17.0 feet (Glacial Till)		

Stratification lines represent approximate boundary between soil types, transitions may be gradual. Water level readings have been made at times and under conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.

TEST PIT LOGS

CLIENT:
PROJECT: Proposed Lawrence Academy Gray Building Addition
LOCATION: 26 Powderhouse Road, Groton, MA

PROJECT NO.: 22-1132
LOGGED BY: Courtney Mattson
CONTRACTOR: Seaboard Drilling
EQUIPMENT: Komatsu PC40MR

TEST PIT TP-1

DATE: 8/23/2024 **LOCATION:** See Exploration Location Plan **SURFACE ELEVATION (FT):** 367' Estimated **COMPLETION DEPTH (FT):** 8.0
WATER LEVEL DEPTHS (FT): No free flowing water observed. **REMARKS:** Proposed Infiltration Basin Area

Depth (feet)	Graphic Log	Stratum Description	H_20 Depth	Sample No.	Type	Sample Depth (ft)	Field / Lab Test Data
		0.2 2" Grassed Topsoil Damp to moist, brown, sandy gravelly SILT/CLAY with cobbles		1G		3-3.5	INF-1
5		6.5 Moist, brown, silty sandy CLAY and GRAVEL ocassional cobbes; more gravel and cobbles with depth					

Bottom of Exploration at 8.0 feet

Stratification lines represent approximate boundary between soil types, transitions may be gradual. Water level readings have been made at times and under conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.

KEY TO NOTES AND SYMBOLS:

Water Level
▽ At time of Digging
▼ At Completion of Digging
▼ After Digging

q_p = Pocket Penetrometer Strength, kips/sq.ft.

TEST PIT 22-1132_TP.GPJ SWCE TEMPLATE.GDT 8/23/24

KEY TO NOTES & SYMBOLS

Test Boring and Test Pit Explorations

Stratification lines represent the approximate boundary between soil types and the transition may be gradual.

Key to Symbols Used:

w	-	water content, percent (dry weight basis)
q_u	-	unconfined compressive strength, kips/sq. ft. - laboratory test
S_v	-	field vane shear strength, kips/sq. ft.
L_v	-	lab vane shear strength, kips/sq. ft.
q_p	-	unconfined compressive strength, kips/sq. ft. – pocket penetrometer test
O	-	organic content, percent (dry weight basis)
W_L	-	liquid limit - Atterberg test
W_P	-	plastic limit - Atterberg test
WOH	-	advance by weight of hammer
WOM	-	advance by weight of man
WOR	-	advance by weight of rods
HYD	-	advance by force of hydraulic piston on drill
RQD	-	Rock Quality Designator - an index of the quality of a rock mass.
γ_T	-	total soil weight
γ_B	-	buoyant soil weight

Description of Proportions:

Trace:	0 to 5%
Some:	5 to 12%
"Y"	12 to 35%
And	35+%
With	Undifferentiated

Description of Stratified Soils

Parting:	0 to 1/16" thickness
Seam:	1/16" to 1/2" thickness
Layer:	½" to 12" thickness
Varved:	Alternating seams or layers
Occasional:	one or less per foot of thickness
Frequent:	more than one per foot of thickness

REFUSAL: **Test Boring Explorations** - Refusal depth indicates that depth at which, in the drill foreman's opinion, sufficient resistance to the advance of the casing, auger, probe rod or sampler was encountered to render further advance impossible or impracticable by the procedures and equipment being used.

REFUSAL: **Test Pit Explorations** - Refusal depth indicates that depth at which sufficient resistance to the advance of the backhoe bucket was encountered to render further advance impossible or impracticable by the procedures and equipment being used.

Although refusal may indicate the encountering of the bedrock surface, it may indicate the striking of large cobbles, boulders, very dense or cemented soil, or other buried natural or man-made objects or it may indicate the encountering of a harder zone after penetrating a considerable depth through a weathered or disintegrated zone of the bedrock.

APPENDIX D

Laboratory Test Results

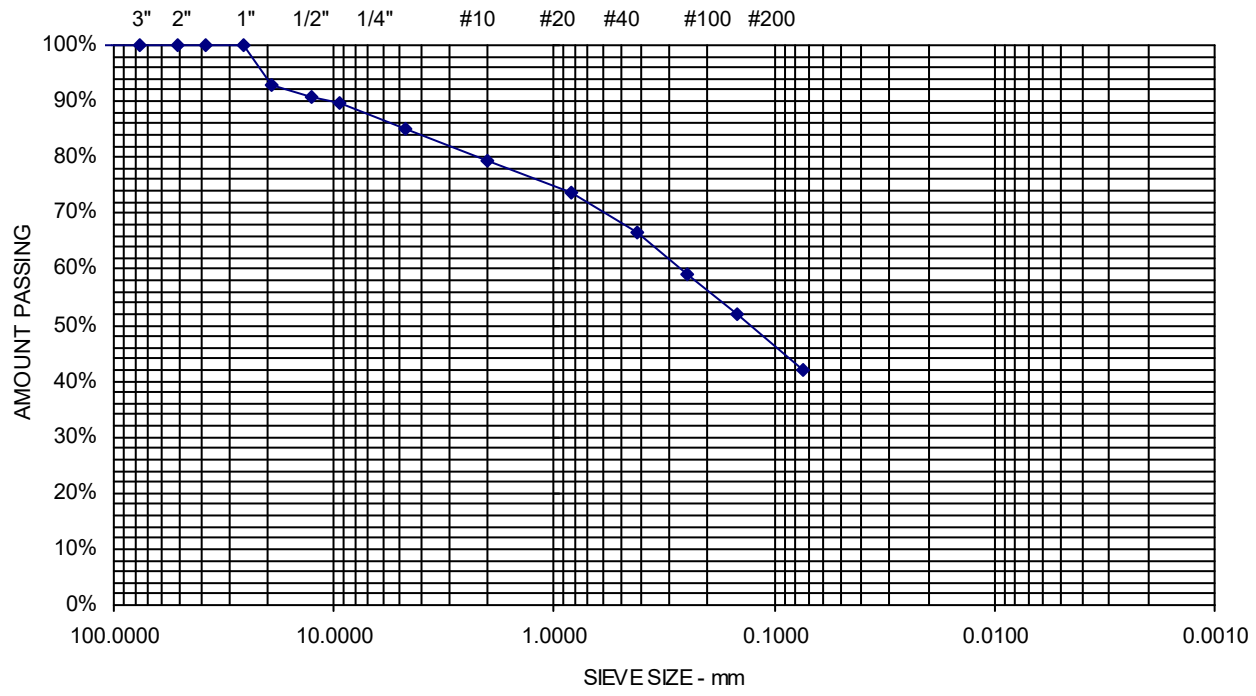
S.W.COLE ENGINEERING, INC.

Report of Gradation

ASTM C-117 & C-136

Project Name	GROTON MA - PROPOSED LAWRENCE ACADEMY GRAY BUILDING ADDITION - EXPLORATIONS AND GEOTECHNICAL ENGINEERING	Project Number	22-1132
Client	LAWRENCE ACADEMY	Lab ID	6852M
		Date Received	8/31/2022
		Date Completed	9/5/2022
Material Source	**B-2, 2D, 2-4'**	Tested By	DANIEL JACK

STANDARD DESIGNATION (mm/µm)	SIEVE SIZE	AMOUNT PASSING (%)	
150 mm	**6"**	**100**	
100 mm	**4"**	**100**	
75 mm	**3"**	**100**	
50 mm	**2"**	**100**	
38.1 mm	**1-1/2"**	**100**	
25.0 mm	**1"**	**100**	
19.0 mm	**3/4"**	**93**	
12.5 mm	**1/2"**	**91**	
9.5 mm	**3/8"**	**90**	
4.75 mm	**No. 4**	**85**	14.9% Gravel
2.00 mm	**No. 10**	**79**	
850 um	**No. 20**	**74**	
425 um	**No. 40**	**67**	43% Sand
250 um	**No. 60**	**59**	
150 um	**No. 100**	**52**	
75 um	**No. 200**	**42.1**	42.1% Fines



Comments: Moisture Content = 10.5%

Sheet

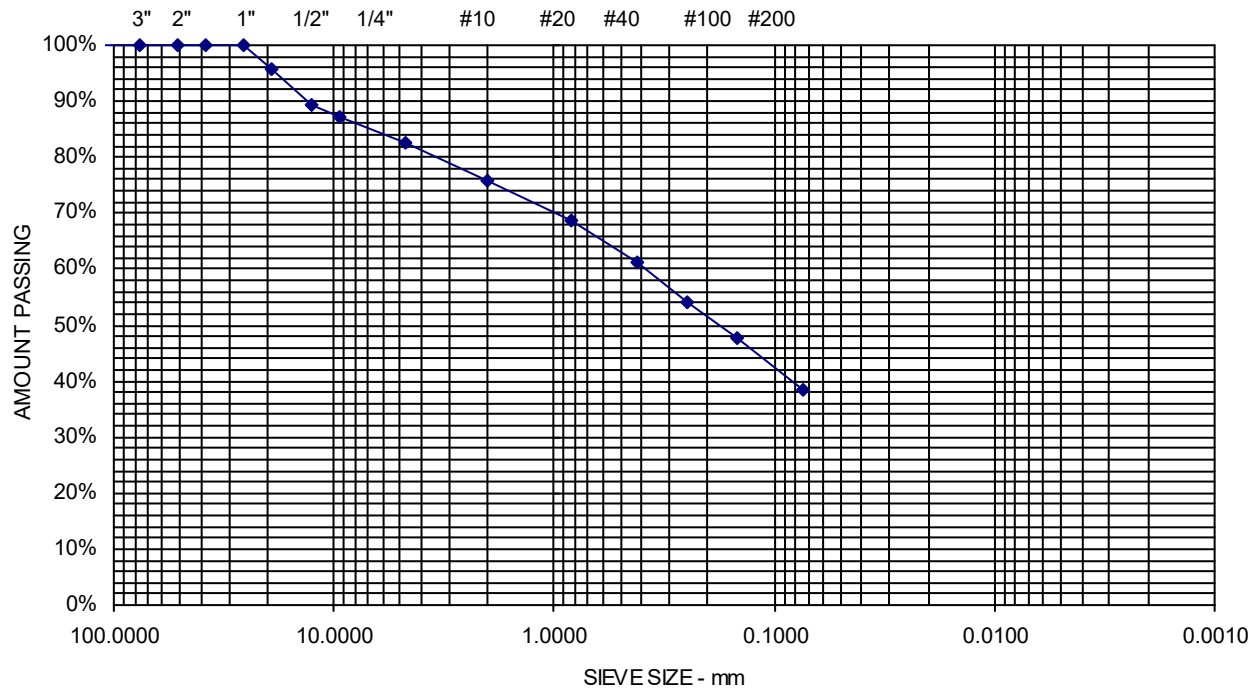
S.W.COLE ENGINEERING, INC.

Report of Gradation

ASTM C-117 & C-136

Project Name	GROTON MA - PROPOSED LAWRENCE ACADEMY GRAY BUILDING ADDITION - EXPLORATIONS AND GEOTECHNICAL ENGINEERING	Project Number	22-1132
Client	LAWRENCE ACADEMY	Lab ID	6853M
		Date Received	8/31/2022
		Date Completed	9/5/2022
Material Source	**B-4, 3D, 5-7'**	Tested By	DANIEL JACK

STANDARD DESIGNATION (mm/µm)	SIEVE SIZE	AMOUNT PASSING (%)	
150 mm	**6"**	**100**	
100 mm	**4"**	**100**	
75 mm	**3"**	**100**	
50 mm	**2"**	**100**	
38.1 mm	**1-1/2"**	**100**	
25.0 mm	**1"**	**100**	
19.0 mm	**3/4"**	**96**	
12.5 mm	**1/2"**	**89**	
9.5 mm	**3/8"**	**87**	
4.75 mm	**No. 4**	**83**	17.3% Gravel
2.00 mm	**No. 10**	**76**	
850 um	**No. 20**	**69**	
425 um	**No. 40**	**61**	44.1% Sand
250 um	**No. 60**	**54**	
150 um	**No. 100**	**48**	
75 um	**No. 200**	**38.6**	38.6% Fines



Comments: Moisture Content = 13.5%

Sheet

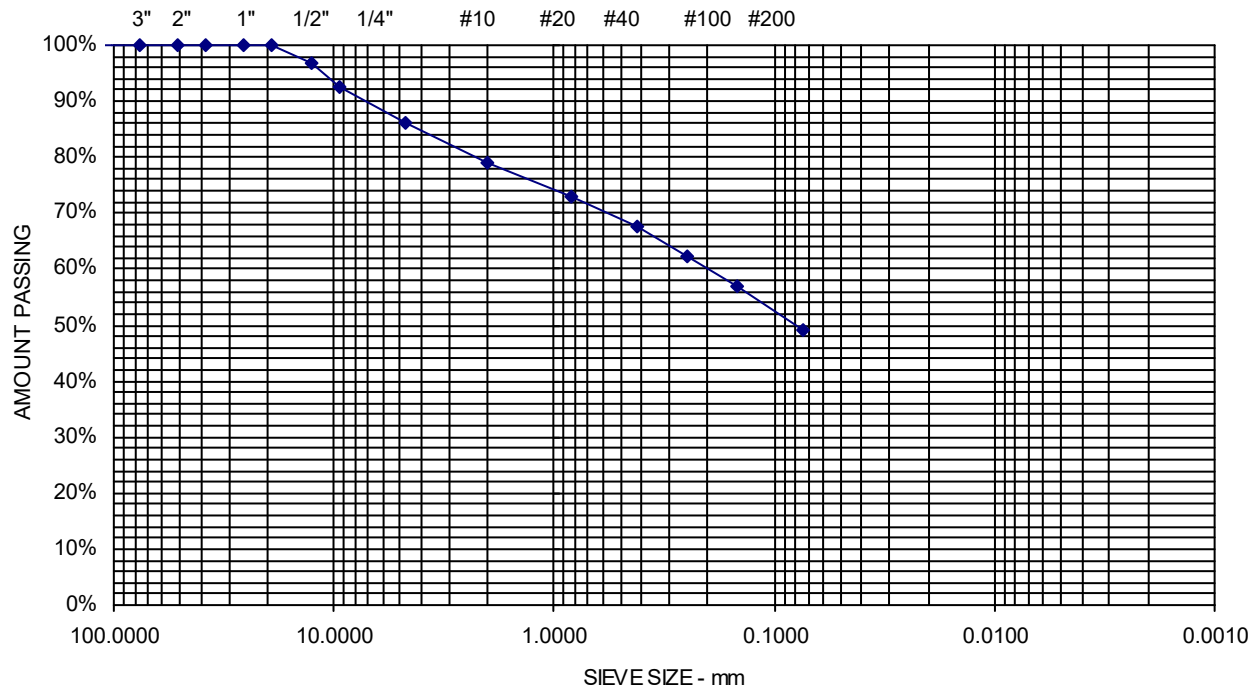
S.W.COLE ENGINEERING, INC.

Report of Gradation

ASTM C-117 & C-136

Project Name	GROTON MA - PROPOSED LAWRENCE ACADEMY GRAY BUILDING ADDITION - EXPLORATIONS AND GEOTECHNICAL ENGINEERING	Project Number	22-1132
Client	LAWRENCE ACADEMY	Lab ID	6854M
		Date Received	8/31/2022
		Date Completed	9/5/2022
Material Source	**B-6, 4D, 10-12'**	Tested By	DANIEL JACK

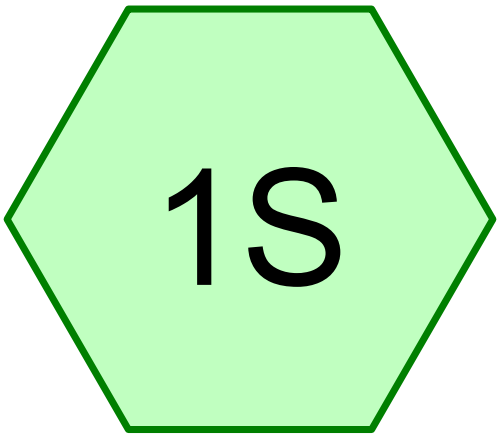
STANDARD DESIGNATION (mm/µm)	SIEVE SIZE	AMOUNT PASSING (%)	
150 mm	**6"**	**100**	
100 mm	**4"**	**100**	
75 mm	**3"**	**100**	
50 mm	**2"**	**100**	
38.1 mm	**1-1/2"**	**100**	
25.0 mm	**1"**	**100**	
19.0 mm	**3/4"**	**100**	
12.5 mm	**1/2"**	**97**	
9.5 mm	**3/8"**	**93**	
4.75 mm	**No. 4**	**86**	13.8% Gravel
2.00 mm	**No. 10**	**79**	
850 um	**No. 20**	**73**	
425 um	**No. 40**	**68**	37% Sand
250 um	**No. 60**	**62**	
150 um	**No. 100**	**57**	
75 um	**No. 200**	**49.2**	49.2% Fines



Comments: Moisture Content = 10.4%

Sheet

Appendix D – HydroCad Results



Pre-Development

Subcat Reach Pond Link

Routing Diagram for 9686 Lawrence Academy Pre-Development
Prepared by Rist-Frost-Shumway EngineeringPC, Printed 9/21/2024

Rainfall Events Listing (selected events)

Event#	Event Name	Storm Type	Curve	Mode	Duration (hours)	B/B	Depth (inches)	AMC
1	2-Year	NRCC 24-hr	C	Default	24.00	1	3.00	2
2	10-Year	NRCC 24-hr	C	Default	24.00	1	4.46	2
3	25-Year	NRCC 24-hr	C	Default	24.00	1	5.60	2
4	100-Year	NRCC 24-hr	C	Default	24.00	1	7.92	2

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
0.609	74	>75% Grass cover, Good, HSG C (1S)
0.552	98	Pavement, HSG C (1S)
0.106	98	existng building (1S)
1.267	**86**	**TOTAL AREA**

Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.000	HSG A	
0.000	HSG B	
1.161	HSG C	1S
0.000	HSG D	
0.106	Other	1S
1.267		**TOTAL AREA**

Ground Covers (all nodes)

HSG-A (acres)	HSG-B (acres)	HSG-C (acres)	HSG-D (acres)	Other (acres)	Total (acres)	Ground Cover	Subcatchment Numbers
0.000	0.000	0.609	0.000	0.000	0.609	>75% Grass cover, Good	1S
0.000	0.000	0.552	0.000	0.000	0.552	Pavement	1S
0.000	0.000	0.000	0.000	0.106	0.106	existng building	1S
0.000	**0.000**	**1.161**	**0.000**	**0.106**	**1.267**	**TOTAL AREA**	

Summary for Subcatchment 1S: Pre-Development

Runoff = 2.57 cfs @ 12.13 hrs, Volume= 0.175 af, Depth= 1.66"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.05 hrs
NRCC 24-hr C 2-Year Rainfall=3.00"

	Area (sf)	CN	Description
*	24,037	98	Pavement, HSG C
*	4,605	98	existng building
	26,534	74	>75% Grass cover, Good, HSG C
	55,176	86	Weighted Average
	26,534		48.09% Pervious Area
	28,642		51.91% Impervious Area

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

Hydrograph for Subcatchment 1S: Pre-Development

Time (hours)	Precip. (inches)	Excess (inches)	Runoff (cfs)
0.00	0.00	0.00	0.00
1.00	0.03	0.00	0.00
2.00	0.07	0.00	0.00
3.00	0.11	0.00	0.00
4.00	0.16	0.00	0.00
5.00	0.21	0.00	0.00
6.00	0.26	0.00	0.00
7.00	0.32	0.00	0.00
8.00	0.39	0.00	0.01
9.00	0.48	0.01	0.02
10.00	0.59	0.04	0.04
11.00	0.77	0.10	0.11
12.00	1.43	0.45	**1.25**
13.00	2.23	1.02	**0.29**
14.00	2.41	1.17	0.15
15.00	2.52	1.26	0.10
16.00	2.61	1.33	0.08
17.00	2.68	1.39	0.07
18.00	2.74	1.44	0.06
19.00	2.79	1.49	0.05
20.00	2.84	1.53	0.05
21.00	2.89	1.57	0.05
22.00	2.93	1.60	0.04
23.00	2.97	1.63	0.04
24.00	**3.00**	**1.66**	0.04
25.00	3.00	1.66	0.00
26.00	3.00	1.66	0.00
27.00	3.00	1.66	0.00
28.00	3.00	1.66	0.00
29.00	3.00	1.66	0.00
30.00	3.00	1.66	0.00
31.00	3.00	1.66	0.00
32.00	3.00	1.66	0.00
33.00	3.00	1.66	0.00
34.00	3.00	1.66	0.00
35.00	3.00	1.66	0.00
36.00	3.00	1.66	0.00
37.00	3.00	1.66	0.00
38.00	3.00	1.66	0.00
39.00	3.00	1.66	0.00
40.00	3.00	1.66	0.00
41.00	3.00	1.66	0.00
42.00	3.00	1.66	0.00
43.00	3.00	1.66	0.00
44.00	3.00	1.66	0.00
45.00	3.00	1.66	0.00
46.00	3.00	1.66	0.00
47.00	3.00	1.66	0.00
48.00	3.00	1.66	0.00
49.00	3.00	1.66	0.00
50.00	3.00	1.66	0.00
51.00	3.00	1.66	0.00
52.00	3.00	1.66	0.00
53.00	3.00	1.66	0.00
54.00	3.00	1.66	0.00
55.00	3.00	1.66	0.00
56.00	3.00	1.66	0.00
57.00	3.00	1.66	0.00
58.00	3.00	1.66	0.00
59.00	3.00	1.66	0.00
60.00	3.00	1.66	0.00

Summary for Subcatchment 1S: Pre-Development

Runoff = 4.51 cfs @ 12.13 hrs, Volume= 0.313 af, Depth= 2.97"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.05 hrs
NRCC 24-hr C 10-Year Rainfall=4.46"

	Area (sf)	CN	Description
*	24,037	98	Pavement, HSG C
*	4,605	98	existng building
	26,534	74	>75% Grass cover, Good, HSG C
	55,176	86	Weighted Average
	26,534		48.09% Pervious Area
	28,642		51.91% Impervious Area

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

Hydrograph for Subcatchment 1S: Pre-Development

Time (hours)	Precip. (inches)	Excess (inches)	Runoff (cfs)
0.00	0.00	0.00	0.00
1.00	0.05	0.00	0.00
2.00	0.11	0.00	0.00
3.00	0.17	0.00	0.00
4.00	0.24	0.00	0.00
5.00	0.31	0.00	0.00
6.00	0.38	0.00	0.01
7.00	0.47	0.01	0.02
8.00	0.58	0.03	0.04
9.00	0.71	0.07	0.06
10.00	0.88	0.14	0.11
11.00	1.15	0.28	0.25
12.00	2.12	0.94	**2.29**
13.00	3.31	1.93	**0.47**
14.00	3.58	2.17	0.24
15.00	3.75	2.32	0.17
16.00	3.88	2.44	0.14
17.00	3.99	2.54	0.12
18.00	4.08	2.62	0.09
19.00	4.15	2.69	0.09
20.00	4.22	2.75	0.08
21.00	4.29	2.81	0.07
22.00	4.35	2.87	0.07
23.00	4.41	2.92	0.06
24.00	**4.46**	**2.97**	0.06
25.00	4.46	2.97	0.00
26.00	4.46	2.97	0.00
27.00	4.46	2.97	0.00
28.00	4.46	2.97	0.00
29.00	4.46	2.97	0.00
30.00	4.46	2.97	0.00
31.00	4.46	2.97	0.00
32.00	4.46	2.97	0.00
33.00	4.46	2.97	0.00
34.00	4.46	2.97	0.00
35.00	4.46	2.97	0.00
36.00	4.46	2.97	0.00
37.00	4.46	2.97	0.00
38.00	4.46	2.97	0.00
39.00	4.46	2.97	0.00
40.00	4.46	2.97	0.00
41.00	4.46	2.97	0.00
42.00	4.46	2.97	0.00
43.00	4.46	2.97	0.00
44.00	4.46	2.97	0.00
45.00	4.46	2.97	0.00
46.00	4.46	2.97	0.00
47.00	4.46	2.97	0.00
48.00	4.46	2.97	0.00
49.00	4.46	2.97	0.00
50.00	4.46	2.97	0.00
51.00	4.46	2.97	0.00
52.00	4.46	2.97	0.00
53.00	4.46	2.97	0.00
54.00	4.46	2.97	0.00
55.00	4.46	2.97	0.00
56.00	4.46	2.97	0.00
57.00	4.46	2.97	0.00
58.00	4.46	2.97	0.00
59.00	4.46	2.97	0.00
60.00	4.46	2.97	0.00

Summary for Subcatchment 1S: Pre-Development

Runoff = 6.03 cfs @ 12.13 hrs, Volume= 0.425 af, Depth= 4.03"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.05 hrs
NRCC 24-hr C 25-Year Rainfall=5.60"

	Area (sf)	CN	Description
*	24,037	98	Pavement, HSG C
*	4,605	98	existng building
	26,534	74	>75% Grass cover, Good, HSG C
	55,176	86	Weighted Average
	26,534		48.09% Pervious Area
	28,642		51.91% Impervious Area

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

Hydrograph for Subcatchment 1S: Pre-Development

Time (hours)	Precip. (inches)	Excess (inches)	Runoff (cfs)
0.00	0.00	0.00	0.00
1.00	0.06	0.00	0.00
2.00	0.14	0.00	0.00
3.00	0.21	0.00	0.00
4.00	0.30	0.00	0.00
5.00	0.39	0.00	0.01
6.00	0.48	0.01	0.02
7.00	0.59	0.04	0.04
8.00	0.73	0.08	0.06
9.00	0.89	0.14	0.10
10.00	1.11	0.25	0.17
11.00	1.44	0.46	0.36
12.00	2.67	1.38	**3.13**
13.00	4.16	2.69	**0.62**
14.00	4.49	3.00	0.32
15.00	4.71	3.20	0.22
16.00	4.87	3.35	0.18
17.00	5.01	3.47	0.15
18.00	5.12	3.58	0.12
19.00	5.21	3.67	0.11
20.00	5.30	3.75	0.10
21.00	5.39	3.83	0.10
22.00	5.46	3.90	0.09
23.00	5.54	3.97	0.08
24.00	**5.60**	**4.03**	0.08
25.00	5.60	4.03	0.00
26.00	5.60	4.03	0.00
27.00	5.60	4.03	0.00
28.00	5.60	4.03	0.00
29.00	5.60	4.03	0.00
30.00	5.60	4.03	0.00
31.00	5.60	4.03	0.00
32.00	5.60	4.03	0.00
33.00	5.60	4.03	0.00
34.00	5.60	4.03	0.00
35.00	5.60	4.03	0.00
36.00	5.60	4.03	0.00
37.00	5.60	4.03	0.00
38.00	5.60	4.03	0.00
39.00	5.60	4.03	0.00
40.00	5.60	4.03	0.00
41.00	5.60	4.03	0.00
42.00	5.60	4.03	0.00
43.00	5.60	4.03	0.00
44.00	5.60	4.03	0.00
45.00	5.60	4.03	0.00
46.00	5.60	4.03	0.00
47.00	5.60	4.03	0.00
48.00	5.60	4.03	0.00
49.00	5.60	4.03	0.00
50.00	5.60	4.03	0.00
51.00	5.60	4.03	0.00
52.00	5.60	4.03	0.00
53.00	5.60	4.03	0.00
54.00	5.60	4.03	0.00
55.00	5.60	4.03	0.00
56.00	5.60	4.03	0.00
57.00	5.60	4.03	0.00
58.00	5.60	4.03	0.00
59.00	5.60	4.03	0.00
60.00	5.60	4.03	0.00

Summary for Subcatchment 1S: Pre-Development

Runoff = 9.11 cfs @ 12.13 hrs, Volume= 0.660 af, Depth= 6.25"

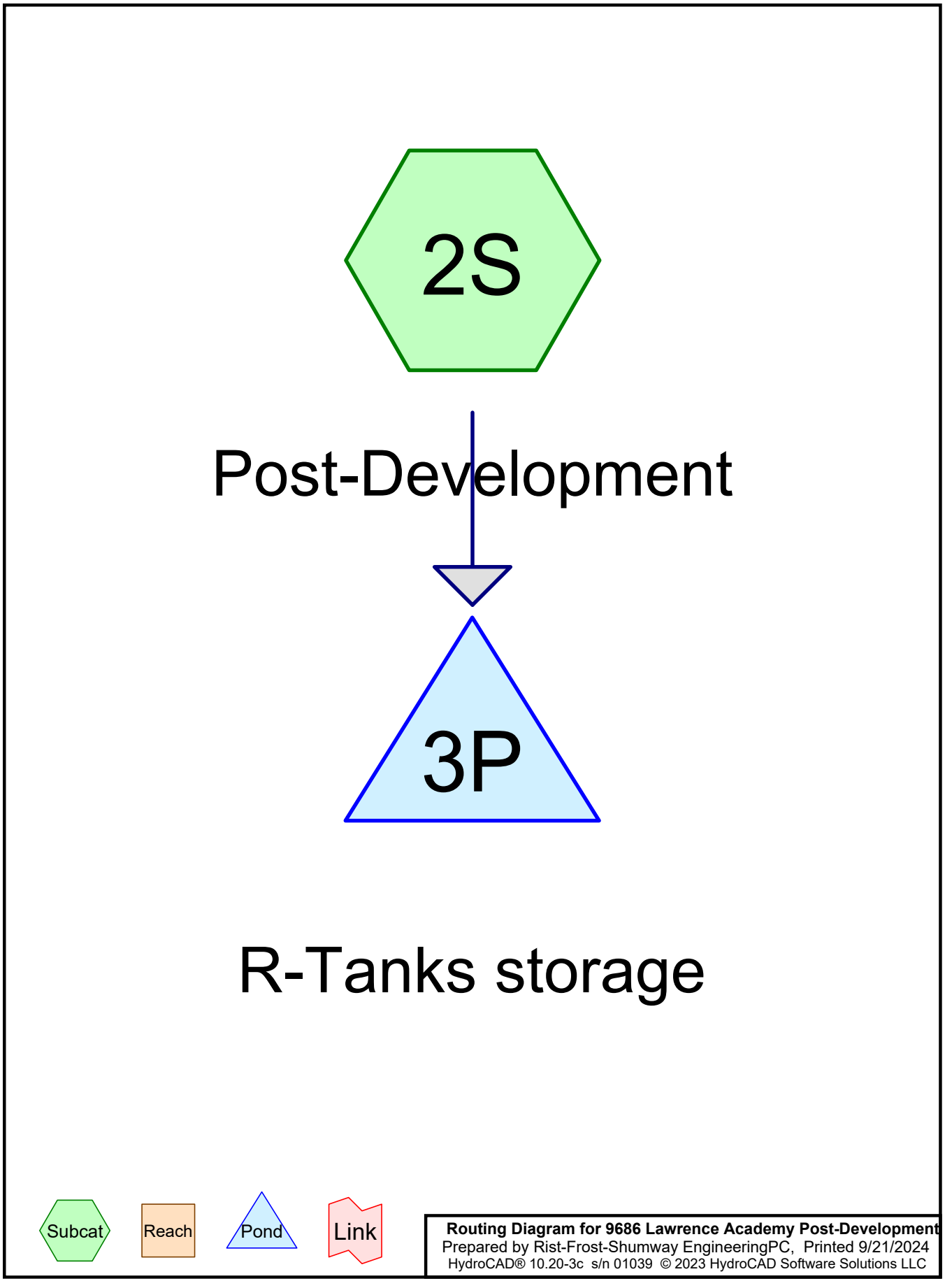
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.05 hrs
NRCC 24-hr C 100-Year Rainfall=7.92"

	Area (sf)	CN	Description
*	24,037	98	Pavement, HSG C
*	4,605	98	existng building
	26,534	74	>75% Grass cover, Good, HSG C
	55,176	86	Weighted Average
	26,534		48.09% Pervious Area
	28,642		51.91% Impervious Area

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

Hydrograph for Subcatchment 1S: Pre-Development

Time (hours)	Precip. (inches)	Excess (inches)	Runoff (cfs)
0.00	0.00	0.00	0.00
1.00	0.09	0.00	0.00
2.00	0.19	0.00	0.00
3.00	0.30	0.00	0.00
4.00	0.42	0.01	0.01
5.00	0.54	0.03	0.04
6.00	0.68	0.06	0.06
7.00	0.84	0.12	0.09
8.00	1.03	0.21	0.13
9.00	1.26	0.34	0.18
10.00	1.56	0.54	0.31
11.00	2.04	0.88	0.60
12.00	3.77	2.34	**4.83**
13.00	5.88	4.29	**0.91**
14.00	6.36	4.75	0.46
15.00	6.66	5.04	0.32
16.00	6.89	5.26	0.26
17.00	7.08	5.45	0.22
18.00	7.24	5.60	0.18
19.00	7.38	5.73	0.16
20.00	7.50	5.85	0.15
21.00	7.62	5.96	0.14
22.00	7.73	6.07	0.13
23.00	7.83	6.16	0.12
24.00	**7.92**	**6.25**	0.11
25.00	7.92	6.25	0.00
26.00	7.92	6.25	0.00
27.00	7.92	6.25	0.00
28.00	7.92	6.25	0.00
29.00	7.92	6.25	0.00
30.00	7.92	6.25	0.00
31.00	7.92	6.25	0.00
32.00	7.92	6.25	0.00
33.00	7.92	6.25	0.00
34.00	7.92	6.25	0.00
35.00	7.92	6.25	0.00
36.00	7.92	6.25	0.00
37.00	7.92	6.25	0.00
38.00	7.92	6.25	0.00
39.00	7.92	6.25	0.00
40.00	7.92	6.25	0.00
41.00	7.92	6.25	0.00
42.00	7.92	6.25	0.00
43.00	7.92	6.25	0.00
44.00	7.92	6.25	0.00
45.00	7.92	6.25	0.00
46.00	7.92	6.25	0.00
47.00	7.92	6.25	0.00
48.00	7.92	6.25	0.00
49.00	7.92	6.25	0.00
50.00	7.92	6.25	0.00
51.00	7.92	6.25	0.00
52.00	7.92	6.25	0.00
53.00	7.92	6.25	0.00
54.00	7.92	6.25	0.00
55.00	7.92	6.25	0.00
56.00	7.92	6.25	0.00
57.00	7.92	6.25	0.00
58.00	7.92	6.25	0.00
59.00	7.92	6.25	0.00
60.00	7.92	6.25	0.00



Routing Diagram for 9686 Lawrence Academy Post-Development
Prepared by Rist-Frost-Shumway EngineeringPC, Printed 9/21/2024

Rainfall Events Listing (selected events)

Event#	Event Name	Storm Type	Curve	Mode	Duration (hours)	B/B	Depth (inches)	AMC
1	2-Year	NRCC 24-hr	C	Default	24.00	1	3.00	2
2	10-Year	NRCC 24-hr	C	Default	24.00	1	4.46	2
3	25-Year	NRCC 24-hr	C	Default	24.00	1	5.60	2
4	100-Year	NRCC 24-hr	C	Default	24.00	1	7.92	2

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
0.583	74	>75% Grass cover, Good, HSG C (2S)
0.474	98	Pavement, HSG C (2S)
0.210	98	prop. building (2S)
1.267	**87**	**TOTAL AREA**

Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.000	HSG A	
0.000	HSG B	
1.057	HSG C	2S
0.000	HSG D	
0.210	Other	2S
1.267		**TOTAL AREA**

Ground Covers (all nodes)

HSG-A (acres)	HSG-B (acres)	HSG-C (acres)	HSG-D (acres)	Other (acres)	Total (acres)	Ground Cover	Subcatchment Numbers
0.000	0.000	0.583	0.000	0.000	0.583	>75% Grass cover, Good	2S
0.000	0.000	0.474	0.000	0.000	0.474	Pavement	2S
0.000	0.000	0.000	0.000	0.210	0.210	prop. building	2S
0.000	**0.000**	**1.057**	**0.000**	**0.210**	**1.267**	**TOTAL AREA**	

Summary for Subcatchment 2S: Post-Development

Runoff = 2.68 cfs @ 12.13 hrs, Volume= 0.184 af, Depth= 1.74"
Routed to Pond 3P : R-Tanks storage

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.05 hrs
NRCC 24-hr C 2-Year Rainfall=3.00"

	Area (sf)	CN	Description
*	20,634	98	Pavement, HSG C
*	9,145	98	prop. building
	25,397	74	>75% Grass cover, Good, HSG C
	55,176	87	Weighted Average
	25,397		46.03% Pervious Area
	29,779		53.97% Impervious Area

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

Hydrograph for Subcatchment 2S: Post-Development

Time (hours)	Precip. (inches)	Excess (inches)	Runoff (cfs)
0.00	0.00	0.00	0.00
1.00	0.03	0.00	0.00
2.00	0.07	0.00	0.00
3.00	0.11	0.00	0.00
4.00	0.16	0.00	0.00
5.00	0.21	0.00	0.00
6.00	0.26	0.00	0.00
7.00	0.32	0.00	0.00
8.00	0.39	0.01	0.01
9.00	0.48	0.02	0.02
10.00	0.59	0.05	0.05
11.00	0.77	0.11	0.12
12.00	1.43	0.49	**1.32**
13.00	2.23	1.09	**0.29**
14.00	2.41	1.23	0.15
15.00	2.52	1.33	0.10
16.00	2.61	1.40	0.09
17.00	2.68	1.47	0.07
18.00	2.74	1.52	0.06
19.00	2.79	1.56	0.05
20.00	2.84	1.60	0.05
21.00	2.89	1.64	0.05
22.00	2.93	1.68	0.04
23.00	2.97	1.71	0.04
24.00	**3.00**	**1.74**	0.04
25.00	3.00	1.74	0.00
26.00	3.00	1.74	0.00
27.00	3.00	1.74	0.00
28.00	3.00	1.74	0.00
29.00	3.00	1.74	0.00
30.00	3.00	1.74	0.00
31.00	3.00	1.74	0.00
32.00	3.00	1.74	0.00
33.00	3.00	1.74	0.00
34.00	3.00	1.74	0.00
35.00	3.00	1.74	0.00
36.00	3.00	1.74	0.00
37.00	3.00	1.74	0.00
38.00	3.00	1.74	0.00
39.00	3.00	1.74	0.00
40.00	3.00	1.74	0.00
41.00	3.00	1.74	0.00
42.00	3.00	1.74	0.00
43.00	3.00	1.74	0.00
44.00	3.00	1.74	0.00
45.00	3.00	1.74	0.00
46.00	3.00	1.74	0.00
47.00	3.00	1.74	0.00
48.00	3.00	1.74	0.00
49.00	3.00	1.74	0.00
50.00	3.00	1.74	0.00
51.00	3.00	1.74	0.00
52.00	3.00	1.74	0.00
53.00	3.00	1.74	0.00
54.00	3.00	1.74	0.00
55.00	3.00	1.74	0.00
56.00	3.00	1.74	0.00
57.00	3.00	1.74	0.00
58.00	3.00	1.74	0.00
59.00	3.00	1.74	0.00
60.00	3.00	1.74	0.00

Summary for Pond 3P: R-Tanks storage

Inflow Area = 1.267 ac, 53.97% Impervious, Inflow Depth = 1.74" for 2-Year event
Inflow = 2.68 cfs @ 12.13 hrs, Volume= 0.184 af
Outflow = 2.61 cfs @ 12.14 hrs, Volume= 0.182 af, Atten= 3%, Lag= 0.5 min
Primary = 2.61 cfs @ 12.14 hrs, Volume= 0.182 af

Routing by Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.05 hrs / 2
Peak Elev= 367.67' @ 12.14 hrs Surf.Area= 364 sf Storage= 237 cf

Plug-Flow detention time= 12.6 min calculated for 0.182 af (99% of inflow)
Center-of-Mass det. time= 6.4 min (837.1 - 830.7)

Volume	Invert	Avail.Storage	Storage Description
#1	366.25'	331 cf	**Custom Stage Data (Irregular)** Listed below (Recalc) 826 cf Overall x 40.0% Voids
#2A	366.25'	243 cf	**6.62'W x 27.46'L x 4.54'H Field A** 826 cf Overall - 218 cf Embedded = 608 cf x 40.0% Voids
#3A	366.75'	207 cf	**Ferguson R-Tank HD 2.5** x 20 Inside #2 Inside= 15.7"W x 42.5"H => 4.42 sf x 2.35'L = 10.4 cf Outside= 15.7"W x 42.5"H => 4.65 sf x 2.35'L = 10.9 cf 20 Chambers in 2 Rows
		781 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
366.25	182	68.0	0	0	182
370.79	182	68.0	826	826	491

Device	Routing	Invert	Outlet Devices
#1	Primary	366.80'	**18.0" Round Culvert** L= 5.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 366.80' / 366.70' S= 0.0200 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.77 sf
#2	Primary	368.50'	**18.0" Round Culvert X 2.00** L= 5.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 368.50' / 368.40' S= 0.0200 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.77 sf

Primary OutFlow Max=2.54 cfs @ 12.14 hrs HW=367.65' (Free Discharge)
└**1=Culvert** (Barrel Controls 2.54 cfs @ 3.54 fps)
└**2=Culvert** (Controls 0.00 cfs)

Pond 3P: R-Tanks storage - Chamber Wizard Field A

Chamber Model = Ferguson R-Tank HD 2.5 (Ferguson R-Tank HD)
Inside= 15.7"W x 42.5"H => 4.42 sf x 2.35'L = 10.4 cf
Outside= 15.7"W x 42.5"H => 4.65 sf x 2.35'L = 10.9 cf

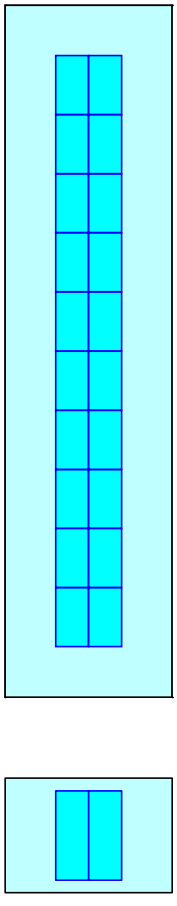
10 Chambers/Row x 2.35' Long = 23.46' Row Length +24.0" End Stone x 2 = 27.46' Base Length
2 Rows x 15.7" Wide + 24.0" Side Stone x 2 = 6.62' Base Width
6.0" Stone Base + 42.5" Chamber Height + 6.0" Stone Cover = 4.54' Field Height

20 Chambers x 10.4 cf = 207.3 cf Chamber Storage
20 Chambers x 10.9 cf = 218.2 cf Displacement

826.4 cf Field - 218.2 cf Chambers = 608.3 cf Stone x 40.0% Voids = 243.3 cf Stone Storage

Chamber Storage + Stone Storage = 450.6 cf = 0.010 af
Overall Storage Efficiency = 54.5%
Overall System Size = 27.46' x 6.62' x 4.54'

20 Chambers
30.6 cy Field
22.5 cy Stone



Hydrograph for Pond 3P: R-Tanks storage

Time (hours)	Inflow (cfs)	Storage (cubic-feet)	Elevation (feet)	Primary (cfs)
0.00	0.00	0	366.25	0.00
2.50	0.00	0	366.25	0.00
5.00	0.00	0	366.25	0.00
7.50	0.01	6	366.29	0.00
10.00	**0.05**	**99**	**366.89**	**0.05**
12.50	**0.54**	**145**	**367.15**	**0.55**
15.00	0.10	107	366.94	0.11
17.50	0.07	101	366.91	0.07
20.00	0.05	99	366.90	0.05
22.50	0.04	98	366.89	0.04
25.00	0.00	82	366.80	0.00
27.50	0.00	82	366.80	0.00
30.00	0.00	82	366.80	0.00
32.50	0.00	82	366.80	0.00
35.00	0.00	82	366.80	0.00
37.50	0.00	82	366.80	0.00
40.00	0.00	82	366.80	0.00
42.50	0.00	82	366.80	0.00
45.00	0.00	82	366.80	0.00
47.50	0.00	82	366.80	0.00
50.00	0.00	82	366.80	0.00
52.50	0.00	82	366.80	0.00
55.00	0.00	82	366.80	0.00
57.50	0.00	82	366.80	0.00
60.00	0.00	82	366.80	0.00

Stage-Area-Storage for Pond 3P: R-Tanks storage

Elevation (feet)	Storage (cubic-feet)	Elevation (feet)	Storage (cubic-feet)
366.25	0	368.85	450
366.30	7	368.90	459
366.35	15	368.95	468
366.40	22	369.00	476
366.45	29	369.05	485
366.50	36	369.10	494
366.55	44	369.15	503
366.60	51	369.20	512
366.65	58	369.25	521
366.70	66	369.30	530
366.75	73	369.35	539
366.80	82	369.40	548
366.85	91	369.45	557
366.90	100	369.50	566
366.95	109	369.55	575
367.00	118	369.60	584
367.05	127	369.65	593
367.10	136	369.70	602
367.15	145	369.75	611
367.20	154	369.80	620
367.25	162	369.85	629
367.30	171	369.90	638
367.35	180	369.95	647
367.40	189	370.00	656
367.45	198	370.05	665
367.50	207	370.10	674
367.55	216	370.15	683
367.60	225	370.20	692
367.65	234	370.25	701
367.70	243	370.30	710
367.75	252	370.35	717
367.80	261	370.40	724
367.85	270	370.45	731
367.90	279	370.50	739
367.95	288	370.55	746
368.00	297	370.60	753
368.05	306	370.65	760
368.10	315	370.70	768
368.15	324	370.75	**775**
368.20	333		
368.25	342		
368.30	351		
368.35	360		
368.40	369		
368.45	378		
368.50	387		
368.55	396		
368.60	405		
368.65	414		
368.70	423		
368.75	432		
368.80	441		

Summary for Subcatchment 2S: Post-Development

Runoff = 4.62 cfs @ 12.13 hrs, Volume= 0.323 af, Depth= 3.06"
Routed to Pond 3P : R-Tanks storage

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.05 hrs
NRCC 24-hr C 10-Year Rainfall=4.46"

	Area (sf)	CN	Description
*	20,634	98	Pavement, HSG C
*	9,145	98	prop. building
	25,397	74	>75% Grass cover, Good, HSG C
	55,176	87	Weighted Average
	25,397		46.03% Pervious Area
	29,779		53.97% Impervious Area

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

Hydrograph for Subcatchment 2S: Post-Development

Time (hours)	Precip. (inches)	Excess (inches)	Runoff (cfs)
0.00	0.00	0.00	0.00
1.00	0.05	0.00	0.00
2.00	0.11	0.00	0.00
3.00	0.17	0.00	0.00
4.00	0.24	0.00	0.00
5.00	0.31	0.00	0.00
6.00	0.38	0.00	0.01
7.00	0.47	0.02	0.02
8.00	0.58	0.04	0.04
9.00	0.71	0.09	0.06
10.00	0.88	0.16	0.12
11.00	1.15	0.31	0.26
12.00	2.12	1.00	**2.37**
13.00	3.31	2.01	**0.48**
14.00	3.58	2.25	0.25
15.00	3.75	2.41	0.17
16.00	3.88	2.53	0.14
17.00	3.99	2.63	0.12
18.00	4.08	2.71	0.09
19.00	4.15	2.78	0.09
20.00	4.22	2.84	0.08
21.00	4.29	2.90	0.08
22.00	4.35	2.96	0.07
23.00	4.41	3.01	0.06
24.00	**4.46**	**3.06**	0.06
25.00	4.46	3.06	0.00
26.00	4.46	3.06	0.00
27.00	4.46	3.06	0.00
28.00	4.46	3.06	0.00
29.00	4.46	3.06	0.00
30.00	4.46	3.06	0.00
31.00	4.46	3.06	0.00
32.00	4.46	3.06	0.00
33.00	4.46	3.06	0.00
34.00	4.46	3.06	0.00
35.00	4.46	3.06	0.00
36.00	4.46	3.06	0.00
37.00	4.46	3.06	0.00
38.00	4.46	3.06	0.00
39.00	4.46	3.06	0.00
40.00	4.46	3.06	0.00
41.00	4.46	3.06	0.00
42.00	4.46	3.06	0.00
43.00	4.46	3.06	0.00
44.00	4.46	3.06	0.00
45.00	4.46	3.06	0.00
46.00	4.46	3.06	0.00
47.00	4.46	3.06	0.00
48.00	4.46	3.06	0.00
49.00	4.46	3.06	0.00
50.00	4.46	3.06	0.00
51.00	4.46	3.06	0.00
52.00	4.46	3.06	0.00
53.00	4.46	3.06	0.00
54.00	4.46	3.06	0.00
55.00	4.46	3.06	0.00
56.00	4.46	3.06	0.00
57.00	4.46	3.06	0.00
58.00	4.46	3.06	0.00
59.00	4.46	3.06	0.00
60.00	4.46	3.06	0.00

Summary for Pond 3P: R-Tanks storage

Inflow Area = 1.267 ac, 53.97% Impervious, Inflow Depth = 3.06" for 10-Year event
Inflow = 4.62 cfs @ 12.13 hrs, Volume= 0.323 af
Outflow = 4.52 cfs @ 12.14 hrs, Volume= 0.321 af, Atten= 2%, Lag= 0.4 min
Primary = 4.52 cfs @ 12.14 hrs, Volume= 0.321 af

Routing by Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.05 hrs / 2
Peak Elev= 368.01' @ 12.14 hrs Surf.Area= 364 sf Storage= 299 cf

Plug-Flow detention time= 8.4 min calculated for 0.321 af (99% of inflow)
Center-of-Mass det. time= 4.9 min (817.7 - 812.8)

Volume	Invert	Avail.Storage	Storage Description
#1	366.25'	331 cf	**Custom Stage Data (Irregular)** Listed below (Recalc) 826 cf Overall x 40.0% Voids
#2A	366.25'	243 cf	**6.62'W x 27.46'L x 4.54'H Field A** 826 cf Overall - 218 cf Embedded = 608 cf x 40.0% Voids
#3A	366.75'	207 cf	**Ferguson R-Tank HD 2.5** x 20 Inside #2 Inside= 15.7"W x 42.5"H => 4.42 sf x 2.35'L = 10.4 cf Outside= 15.7"W x 42.5"H => 4.65 sf x 2.35'L = 10.9 cf 20 Chambers in 2 Rows
		781 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
366.25	182	68.0	0	0	182
370.79	182	68.0	826	826	491

Device	Routing	Invert	Outlet Devices
#1	Primary	366.80'	**18.0" Round Culvert** L= 5.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 366.80' / 366.70' S= 0.0200 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.77 sf
#2	Primary	368.50'	**18.0" Round Culvert X 2.00** L= 5.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 368.50' / 368.40' S= 0.0200 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.77 sf

Primary OutFlow Max=4.36 cfs @ 12.14 hrs HW=367.98' (Free Discharge)
└**1=Culvert** (Barrel Controls 4.36 cfs @ 4.01 fps)
└**2=Culvert** (Controls 0.00 cfs)

Pond 3P: R-Tanks storage - Chamber Wizard Field A

Chamber Model = Ferguson R-Tank HD 2.5 (Ferguson R-Tank HD)
Inside= 15.7"W x 42.5"H => 4.42 sf x 2.35'L = 10.4 cf
Outside= 15.7"W x 42.5"H => 4.65 sf x 2.35'L = 10.9 cf

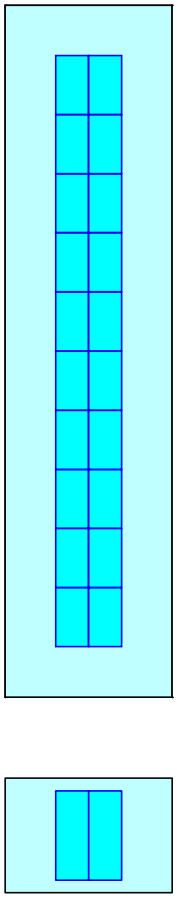
10 Chambers/Row x 2.35' Long = 23.46' Row Length +24.0" End Stone x 2 = 27.46' Base Length
2 Rows x 15.7" Wide + 24.0" Side Stone x 2 = 6.62' Base Width
6.0" Stone Base + 42.5" Chamber Height + 6.0" Stone Cover = 4.54' Field Height

20 Chambers x 10.4 cf = 207.3 cf Chamber Storage
20 Chambers x 10.9 cf = 218.2 cf Displacement

826.4 cf Field - 218.2 cf Chambers = 608.3 cf Stone x 40.0% Voids = 243.3 cf Stone Storage

Chamber Storage + Stone Storage = 450.6 cf = 0.010 af
Overall Storage Efficiency = 54.5%
Overall System Size = 27.46' x 6.62' x 4.54'

20 Chambers
30.6 cy Field
22.5 cy Stone



Hydrograph for Pond 3P: R-Tanks storage

Time (hours)	Inflow (cfs)	Storage (cubic-feet)	Elevation (feet)	Primary (cfs)
0.00	0.00	0	366.25	0.00
2.50	0.00	0	366.25	0.00
5.00	0.00	0	366.25	0.00
7.50	0.03	95	366.87	0.03
10.00	**0.12**	**109**	**366.95**	**0.12**
12.50	**0.89**	**166**	**367.27**	**0.91**
15.00	0.17	115	366.98	0.17
17.50	0.11	107	366.94	0.11
20.00	0.08	104	366.92	0.08
22.50	0.07	101	366.91	0.07
25.00	0.00	82	366.80	0.00
27.50	0.00	82	366.80	0.00
30.00	0.00	82	366.80	0.00
32.50	0.00	82	366.80	0.00
35.00	0.00	82	366.80	0.00
37.50	0.00	82	366.80	0.00
40.00	0.00	82	366.80	0.00
42.50	0.00	82	366.80	0.00
45.00	0.00	82	366.80	0.00
47.50	0.00	82	366.80	0.00
50.00	0.00	82	366.80	0.00
52.50	0.00	82	366.80	0.00
55.00	0.00	82	366.80	0.00
57.50	0.00	82	366.80	0.00
60.00	0.00	82	366.80	0.00

Stage-Area-Storage for Pond 3P: R-Tanks storage

Elevation (feet)	Storage (cubic-feet)	Elevation (feet)	Storage (cubic-feet)
366.25	0	368.85	450
366.30	7	368.90	459
366.35	15	368.95	468
366.40	22	369.00	476
366.45	29	369.05	485
366.50	36	369.10	494
366.55	44	369.15	503
366.60	51	369.20	512
366.65	58	369.25	521
366.70	66	369.30	530
366.75	73	369.35	539
366.80	82	369.40	548
366.85	91	369.45	557
366.90	100	369.50	566
366.95	109	369.55	575
367.00	118	369.60	584
367.05	127	369.65	593
367.10	136	369.70	602
367.15	145	369.75	611
367.20	154	369.80	620
367.25	162	369.85	629
367.30	171	369.90	638
367.35	180	369.95	647
367.40	189	370.00	656
367.45	198	370.05	665
367.50	207	370.10	674
367.55	216	370.15	683
367.60	225	370.20	692
367.65	234	370.25	701
367.70	243	370.30	710
367.75	252	370.35	717
367.80	261	370.40	724
367.85	270	370.45	731
367.90	279	370.50	739
367.95	288	370.55	746
368.00	297	370.60	753
368.05	306	370.65	760
368.10	315	370.70	768
368.15	324	370.75	**775**
368.20	333		
368.25	342		
368.30	351		
368.35	360		
368.40	369		
368.45	378		
368.50	387		
368.55	396		
368.60	405		
368.65	414		
368.70	423		
368.75	432		
368.80	441		

Summary for Subcatchment 2S: Post-Development

Runoff = 6.15 cfs @ 12.13 hrs, Volume= 0.437 af, Depth= 4.14"
Routed to Pond 3P : R-Tanks storage

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.05 hrs
NRCC 24-hr C 25-Year Rainfall=5.60"

	Area (sf)	CN	Description
*	20,634	98	Pavement, HSG C
*	9,145	98	prop. building
	25,397	74	>75% Grass cover, Good, HSG C
	55,176	87	Weighted Average
	25,397		46.03% Pervious Area
	29,779		53.97% Impervious Area

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

Hydrograph for Subcatchment 2S: Post-Development

Time (hours)	Precip. (inches)	Excess (inches)	Runoff (cfs)
0.00	0.00	0.00	0.00
1.00	0.06	0.00	0.00
2.00	0.14	0.00	0.00
3.00	0.21	0.00	0.00
4.00	0.30	0.00	0.00
5.00	0.39	0.00	0.01
6.00	0.48	0.02	0.02
7.00	0.59	0.05	0.05
8.00	0.73	0.10	0.07
9.00	0.89	0.17	0.10
10.00	1.11	0.28	0.18
11.00	1.44	0.50	0.38
12.00	2.67	1.45	**3.21**
13.00	4.16	2.78	**0.62**
14.00	4.49	3.09	0.32
15.00	4.71	3.30	0.22
16.00	4.87	3.45	0.18
17.00	5.01	3.57	0.15
18.00	5.12	3.68	0.12
19.00	5.21	3.77	0.11
20.00	5.30	3.85	0.10
21.00	5.39	3.93	0.10
22.00	5.46	4.01	0.09
23.00	5.54	4.07	0.08
24.00	**5.60**	**4.14**	0.08
25.00	5.60	4.14	0.00
26.00	5.60	4.14	0.00
27.00	5.60	4.14	0.00
28.00	5.60	4.14	0.00
29.00	5.60	4.14	0.00
30.00	5.60	4.14	0.00
31.00	5.60	4.14	0.00
32.00	5.60	4.14	0.00
33.00	5.60	4.14	0.00
34.00	5.60	4.14	0.00
35.00	5.60	4.14	0.00
36.00	5.60	4.14	0.00
37.00	5.60	4.14	0.00
38.00	5.60	4.14	0.00
39.00	5.60	4.14	0.00
40.00	5.60	4.14	0.00
41.00	5.60	4.14	0.00
42.00	5.60	4.14	0.00
43.00	5.60	4.14	0.00
44.00	5.60	4.14	0.00
45.00	5.60	4.14	0.00
46.00	5.60	4.14	0.00
47.00	5.60	4.14	0.00
48.00	5.60	4.14	0.00
49.00	5.60	4.14	0.00
50.00	5.60	4.14	0.00
51.00	5.60	4.14	0.00
52.00	5.60	4.14	0.00
53.00	5.60	4.14	0.00
54.00	5.60	4.14	0.00
55.00	5.60	4.14	0.00
56.00	5.60	4.14	0.00
57.00	5.60	4.14	0.00
58.00	5.60	4.14	0.00
59.00	5.60	4.14	0.00
60.00	5.60	4.14	0.00

Summary for Pond 3P: R-Tanks storage

Inflow Area = 1.267 ac, 53.97% Impervious, Inflow Depth = 4.14" for 25-Year event
Inflow = 6.15 cfs @ 12.13 hrs, Volume= 0.437 af
Outflow = 6.01 cfs @ 12.13 hrs, Volume= 0.435 af, Atten= 2%, Lag= 0.4 min
Primary = 6.01 cfs @ 12.13 hrs, Volume= 0.435 af

Routing by Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.05 hrs / 2
Peak Elev= 368.26' @ 12.13 hrs Surf.Area= 364 sf Storage= 343 cf

Plug-Flow detention time= 7.0 min calculated for 0.435 af (100% of inflow)
Center-of-Mass det. time= 4.2 min (807.7 - 803.5)

Volume	Invert	Avail.Storage	Storage Description
#1	366.25'	331 cf	**Custom Stage Data (Irregular)** Listed below (Recalc) 826 cf Overall x 40.0% Voids
#2A	366.25'	243 cf	**6.62'W x 27.46'L x 4.54'H Field A** 826 cf Overall - 218 cf Embedded = 608 cf x 40.0% Voids
#3A	366.75'	207 cf	**Ferguson R-Tank HD 2.5** x 20 Inside #2 Inside= 15.7"W x 42.5"H => 4.42 sf x 2.35'L = 10.4 cf Outside= 15.7"W x 42.5"H => 4.65 sf x 2.35'L = 10.9 cf 20 Chambers in 2 Rows
		781 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
366.25	182	68.0	0	0	182
370.79	182	68.0	826	826	491

Device	Routing	Invert	Outlet Devices
#1	Primary	366.80'	**18.0" Round Culvert** L= 5.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 366.80' / 366.70' S= 0.0200 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.77 sf
#2	Primary	368.50'	**18.0" Round Culvert X 2.00** L= 5.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 368.50' / 368.40' S= 0.0200 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.77 sf

Primary OutFlow Max=5.80 cfs @ 12.13 hrs HW=368.22' (Free Discharge)
└**1=Culvert** (Barrel Controls 5.80 cfs @ 4.32 fps)
└**2=Culvert** (Controls 0.00 cfs)

Pond 3P: R-Tanks storage - Chamber Wizard Field A

Chamber Model = Ferguson R-Tank HD 2.5 (Ferguson R-Tank HD)
Inside= 15.7"W x 42.5"H => 4.42 sf x 2.35'L = 10.4 cf
Outside= 15.7"W x 42.5"H => 4.65 sf x 2.35'L = 10.9 cf

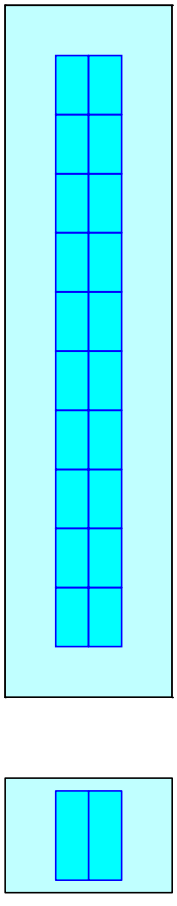
10 Chambers/Row x 2.35' Long = 23.46' Row Length +24.0" End Stone x 2 = 27.46' Base Length
2 Rows x 15.7" Wide + 24.0" Side Stone x 2 = 6.62' Base Width
6.0" Stone Base + 42.5" Chamber Height + 6.0" Stone Cover = 4.54' Field Height

20 Chambers x 10.4 cf = 207.3 cf Chamber Storage
20 Chambers x 10.9 cf = 218.2 cf Displacement

826.4 cf Field - 218.2 cf Chambers = 608.3 cf Stone x 40.0% Voids = 243.3 cf Stone Storage

Chamber Storage + Stone Storage = 450.6 cf = 0.010 af
Overall Storage Efficiency = 54.5%
Overall System Size = 27.46' x 6.62' x 4.54'

20 Chambers
30.6 cy Field
22.5 cy Stone



Hydrograph for Pond 3P: R-Tanks storage

Time (hours)	Inflow (cfs)	Storage (cubic-feet)	Elevation (feet)	Primary (cfs)
0.00	0.00	0	366.25	0.00
2.50	0.00	0	366.25	0.00
5.00	0.01	18	366.37	0.00
7.50	0.06	100	366.90	0.06
10.00	**0.18**	**116**	**366.99**	**0.18**
12.50	**1.17**	**180**	**367.35**	**1.19**
15.00	0.22	120	367.01	0.22
17.50	0.14	111	366.96	0.14
20.00	0.10	107	366.94	0.11
22.50	0.09	105	366.93	0.09
25.00	0.00	82	366.80	0.00
27.50	0.00	82	366.80	0.00
30.00	0.00	82	366.80	0.00
32.50	0.00	82	366.80	0.00
35.00	0.00	82	366.80	0.00
37.50	0.00	82	366.80	0.00
40.00	0.00	82	366.80	0.00
42.50	0.00	82	366.80	0.00
45.00	0.00	82	366.80	0.00
47.50	0.00	82	366.80	0.00
50.00	0.00	82	366.80	0.00
52.50	0.00	82	366.80	0.00
55.00	0.00	82	366.80	0.00
57.50	0.00	82	366.80	0.00
60.00	0.00	82	366.80	0.00

Stage-Area-Storage for Pond 3P: R-Tanks storage

Elevation (feet)	Storage (cubic-feet)	Elevation (feet)	Storage (cubic-feet)
366.25	0	368.85	450
366.30	7	368.90	459
366.35	15	368.95	468
366.40	22	369.00	476
366.45	29	369.05	485
366.50	36	369.10	494
366.55	44	369.15	503
366.60	51	369.20	512
366.65	58	369.25	521
366.70	66	369.30	530
366.75	73	369.35	539
366.80	82	369.40	548
366.85	91	369.45	557
366.90	100	369.50	566
366.95	109	369.55	575
367.00	118	369.60	584
367.05	127	369.65	593
367.10	136	369.70	602
367.15	145	369.75	611
367.20	154	369.80	620
367.25	162	369.85	629
367.30	171	369.90	638
367.35	180	369.95	647
367.40	189	370.00	656
367.45	198	370.05	665
367.50	207	370.10	674
367.55	216	370.15	683
367.60	225	370.20	692
367.65	234	370.25	701
367.70	243	370.30	710
367.75	252	370.35	717
367.80	261	370.40	724
367.85	270	370.45	731
367.90	279	370.50	739
367.95	288	370.55	746
368.00	297	370.60	753
368.05	306	370.65	760
368.10	315	370.70	768
368.15	324	370.75	**775**
368.20	333		
368.25	342		
368.30	351		
368.35	360		
368.40	369		
368.45	378		
368.50	387		
368.55	396		
368.60	405		
368.65	414		
368.70	423		
368.75	432		
368.80	441		

Summary for Subcatchment 2S: Post-Development

Runoff = 9.22 cfs @ 12.13 hrs, Volume= 0.673 af, Depth= 6.37"
Routed to Pond 3P : R-Tanks storage

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.05 hrs
NRCC 24-hr C 100-Year Rainfall=7.92"

	Area (sf)	CN	Description
*	20,634	98	Pavement, HSG C
*	9,145	98	prop. building
	25,397	74	>75% Grass cover, Good, HSG C
	55,176	87	Weighted Average
	25,397		46.03% Pervious Area
	29,779		53.97% Impervious Area

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

Hydrograph for Subcatchment 2S: Post-Development

Time (hours)	Precip. (inches)	Excess (inches)	Runoff (cfs)
0.00	0.00	0.00	0.00
1.00	0.09	0.00	0.00
2.00	0.19	0.00	0.00
3.00	0.30	0.00	0.00
4.00	0.42	0.01	0.02
5.00	0.54	0.03	0.04
6.00	0.68	0.08	0.06
7.00	0.84	0.14	0.10
8.00	1.03	0.24	0.14
9.00	1.26	0.37	0.19
10.00	1.56	0.58	0.32
11.00	2.04	0.94	0.62
12.00	3.77	2.43	**4.91**
13.00	5.88	4.40	**0.92**
14.00	6.36	4.86	0.47
15.00	6.66	5.16	0.32
16.00	6.89	5.37	0.26
17.00	7.08	5.56	0.22
18.00	7.24	5.71	0.18
19.00	7.38	5.84	0.16
20.00	7.50	5.97	0.15
21.00	7.62	6.08	0.14
22.00	7.73	6.18	0.13
23.00	7.83	6.28	0.12
24.00	**7.92**	**6.37**	0.11
25.00	7.92	6.37	0.00
26.00	7.92	6.37	0.00
27.00	7.92	6.37	0.00
28.00	7.92	6.37	0.00
29.00	7.92	6.37	0.00
30.00	7.92	6.37	0.00
31.00	7.92	6.37	0.00
32.00	7.92	6.37	0.00
33.00	7.92	6.37	0.00
34.00	7.92	6.37	0.00
35.00	7.92	6.37	0.00
36.00	7.92	6.37	0.00
37.00	7.92	6.37	0.00
38.00	7.92	6.37	0.00
39.00	7.92	6.37	0.00
40.00	7.92	6.37	0.00
41.00	7.92	6.37	0.00
42.00	7.92	6.37	0.00
43.00	7.92	6.37	0.00
44.00	7.92	6.37	0.00
45.00	7.92	6.37	0.00
46.00	7.92	6.37	0.00
47.00	7.92	6.37	0.00
48.00	7.92	6.37	0.00
49.00	7.92	6.37	0.00
50.00	7.92	6.37	0.00
51.00	7.92	6.37	0.00
52.00	7.92	6.37	0.00
53.00	7.92	6.37	0.00
54.00	7.92	6.37	0.00
55.00	7.92	6.37	0.00
56.00	7.92	6.37	0.00
57.00	7.92	6.37	0.00
58.00	7.92	6.37	0.00
59.00	7.92	6.37	0.00
60.00	7.92	6.37	0.00

Summary for Pond 3P: R-Tanks storage

Inflow Area = 1.267 ac, 53.97% Impervious, Inflow Depth = 6.37" for 100-Year event
Inflow = 9.22 cfs @ 12.13 hrs, Volume= 0.673 af
Outflow = 9.02 cfs @ 12.13 hrs, Volume= 0.671 af, Atten= 2%, Lag= 0.3 min
Primary = 9.02 cfs @ 12.13 hrs, Volume= 0.671 af

Routing by Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.05 hrs / 2
Peak Elev= 368.74' @ 12.13 hrs Surf.Area= 364 sf Storage= 429 cf

Plug-Flow detention time= 5.0 min calculated for 0.670 af (100% of inflow)
Center-of-Mass det. time= 3.3 min (793.7 - 790.3)

Volume	Invert	Avail.Storage	Storage Description
#1	366.25'	331 cf	**Custom Stage Data (Irregular)** Listed below (Recalc) 826 cf Overall x 40.0% Voids
#2A	366.25'	243 cf	**6.62'W x 27.46'L x 4.54'H Field A** 826 cf Overall - 218 cf Embedded = 608 cf x 40.0% Voids
#3A	366.75'	207 cf	**Ferguson R-Tank HD 2.5** x 20 Inside #2 Inside= 15.7"W x 42.5"H => 4.42 sf x 2.35'L = 10.4 cf Outside= 15.7"W x 42.5"H => 4.65 sf x 2.35'L = 10.9 cf 20 Chambers in 2 Rows
		781 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
366.25	182	68.0	0	0	182
370.79	182	68.0	826	826	491

Device	Routing	Invert	Outlet Devices
#1	Primary	366.80'	**18.0" Round Culvert** L= 5.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 366.80' / 366.70' S= 0.0200 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.77 sf
#2	Primary	368.50'	**18.0" Round Culvert X 2.00** L= 5.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 368.50' / 368.40' S= 0.0200 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.77 sf

Primary OutFlow Max=8.70 cfs @ 12.13 hrs HW=368.69' (Free Discharge)
└**1=Culvert** (Barrel Controls 8.35 cfs @ 4.83 fps)
└**2=Culvert** (Barrel Controls 0.35 cfs @ 2.11 fps)

Pond 3P: R-Tanks storage - Chamber Wizard Field A

Chamber Model = Ferguson R-Tank HD 2.5 (Ferguson R-Tank HD)
Inside= 15.7"W x 42.5"H => 4.42 sf x 2.35'L = 10.4 cf
Outside= 15.7"W x 42.5"H => 4.65 sf x 2.35'L = 10.9 cf

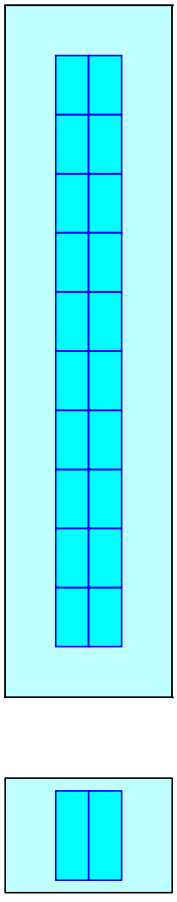
10 Chambers/Row x 2.35' Long = 23.46' Row Length +24.0" End Stone x 2 = 27.46' Base Length
2 Rows x 15.7" Wide + 24.0" Side Stone x 2 = 6.62' Base Width
6.0" Stone Base + 42.5" Chamber Height + 6.0" Stone Cover = 4.54' Field Height

20 Chambers x 10.4 cf = 207.3 cf Chamber Storage
20 Chambers x 10.9 cf = 218.2 cf Displacement

826.4 cf Field - 218.2 cf Chambers = 608.3 cf Stone x 40.0% Voids = 243.3 cf Stone Storage

Chamber Storage + Stone Storage = 450.6 cf = 0.010 af
Overall Storage Efficiency = 54.5%
Overall System Size = 27.46' x 6.62' x 4.54'

20 Chambers
30.6 cy Field
22.5 cy Stone



Hydrograph for Pond 3P: R-Tanks storage

Time (hours)	Inflow (cfs)	Storage (cubic-feet)	Elevation (feet)	Primary (cfs)
0.00	0.00	0	366.25	0.00
2.50	0.00	0	366.25	0.00
5.00	0.04	97	366.89	0.04
7.50	0.12	109	366.95	0.12
10.00	**0.32**	**128**	**367.06**	**0.32**
12.50	**1.72**	**204**	**367.48**	**1.74**
15.00	0.32	129	367.06	0.32
17.50	0.20	118	367.00	0.20
20.00	0.15	113	366.97	0.15
22.50	0.13	109	366.95	0.13
25.00	0.00	82	366.80	0.00
27.50	0.00	82	366.80	0.00
30.00	0.00	82	366.80	0.00
32.50	0.00	82	366.80	0.00
35.00	0.00	82	366.80	0.00
37.50	0.00	82	366.80	0.00
40.00	0.00	82	366.80	0.00
42.50	0.00	82	366.80	0.00
45.00	0.00	82	366.80	0.00
47.50	0.00	82	366.80	0.00
50.00	0.00	82	366.80	0.00
52.50	0.00	82	366.80	0.00
55.00	0.00	82	366.80	0.00
57.50	0.00	82	366.80	0.00
60.00	0.00	82	366.80	0.00

Stage-Area-Storage for Pond 3P: R-Tanks storage

Elevation (feet)	Storage (cubic-feet)	Elevation (feet)	Storage (cubic-feet)
366.25	0	368.85	450
366.30	7	368.90	459
366.35	15	368.95	468
366.40	22	369.00	476
366.45	29	369.05	485
366.50	36	369.10	494
366.55	44	369.15	503
366.60	51	369.20	512
366.65	58	369.25	521
366.70	66	369.30	530
366.75	73	369.35	539
366.80	82	369.40	548
366.85	91	369.45	557
366.90	100	369.50	566
366.95	109	369.55	575
367.00	118	369.60	584
367.05	127	369.65	593
367.10	136	369.70	602
367.15	145	369.75	611
367.20	154	369.80	620
367.25	162	369.85	629
367.30	171	369.90	638
367.35	180	369.95	647
367.40	189	370.00	656
367.45	198	370.05	665
367.50	207	370.10	674
367.55	216	370.15	683
367.60	225	370.20	692
367.65	234	370.25	701
367.70	243	370.30	710
367.75	252	370.35	717
367.80	261	370.40	724
367.85	270	370.45	731
367.90	279	370.50	739
367.95	288	370.55	746
368.00	297	370.60	753
368.05	306	370.65	760
368.10	315	370.70	768
368.15	324	370.75	**775**
368.20	333		
368.25	342		
368.30	351		
368.35	360		
368.40	369		
368.45	378		
368.50	387		
368.55	396		
368.60	405		
368.65	414		
368.70	423		
368.75	432		
368.80	441		

Appendix E – TSS Removal Calculations

INSTRUCTIONS:
1. In BMP Column, click on Blue Cell to Activate Drop Down Menu
2. Select BMP from Drop Down Menu
3. After BMP is selected, TSS Removal and other Columns are automatically completed.

Version 1, Automated: Mar. 4, 2008

Location: Water Quality Inlet

TSS Removal Calculation Worksheet

B BMP[1]	C TSS Removal Rate[1]	D Starting TSS Load*	E Amount Removed (C*D)	F Remaining Load (D-E)
Street Sweeping - 9%	**0.09**	**1.00**	**0.09**	**0.91**
Deep Sump and Hooded Catch Basin	**0.25**	**0.91**	**0.23**	**0.68**
Oil Grit Separator	**0.25**	**0.68**	**0.17**	**0.51**
	0.00	**0.51**	**0.00**	**0.51**
	0.00	**0.51**	**0.00**	**0.51**

Total TSS Removal = **49%**

Separate Form Needs to be Completed for Each Outlet or BMP Train

Project: Lawrence Academy
Prepared By: Joanne Coppinger
Date: 9/20/2024

*Equals remaining load from previous BMP (E) which enters the BMP

Non-automated TSS Calculation Sheet must be used if Proprietary BMP Proposed

1. From MassDEP Stormwater Handbook Vol. 1

Appendix F – Inspection and Maintenance Plan

Lawrence Academy Gray Building Expansion Project
26 Powder House Road, Groton, MA
Stormwater Management System
Inspection & Maintenance Manual
September 2024

Purpose of this Manual:

Proper maintenance of stormwater Management Best Management Practices (BMPs) is critical to continued proper functioning of stormwater management systems. Left unchecked, stormwater BMPs fill up with sediment and generally suffer degradation from uncontrolled growth of vegetation and the ravages of time and the elements. When this occurs, BMPs are not effective in treating stormwater and preventing flooding, erosion, and pollution. The following goals will be achieved through diligent stormwater BMP maintenance over the long term:

- Maintain the volume of storm water treated over the long term;
- Sustain the pollutant removal efficiency of the BMP;
- Reduce the risk of re-suspending sediment and other pollutants captured by the BMP;
- Prevent structural deterioration of the BMP and minimize the need for expensive repairs;
- Decrease the potential for failure of the BMP.

This manual was developed to comply with the Town of Groton Stormwater Ordinance, which requires development of a plan for the long-term maintenance and repair of the stormwater management system.

Prepared by:

Rist-Frost-Shumway Engineering, P.C.
71 Water Street
Laconia, NH 03246
www.rfsengineering.com
603.524.4647
RFS Project #: 9686.002

Lawrence Academy Gray Building Expansion Project
26 Powder House Road, Groton, MA
Stormwater Management System
Inspection & Maintenance Manual
September 2024

Responsible Party:

The responsible party listed below shall be responsible for ensuring the long-term effectiveness of the stormwater management system for this project.

The responsible party for maintaining these facilities is:

Lawrence Academy Facilities Operation & Management (FO&M)
Carl Anderson, Director of FO&M
26 Powder House Road, Groton, MA 01450
978.302.6013

Periodic inspections of the stormwater BMPs listed below are necessary to prevent flooding, erosion, and pollution, and to ensure the continued effectiveness of these devices.

1. **ACF R-Tanks Underground Detention & Infiltration System:**
   Designed to both treat and detain stormwater from the site. See pages 4 through 8 for detailed information from the manufacturer and inspection forms.

2. **Stormwater Quality Inlet:**
   Designed to promote sedimentation of course materials and separation of debris and free oil from stormwater. See pages 9 through 11 for more information and inspection forms.

3. **Drain pipes, drain basins, areaway drains, trench drains, slot drains, drain cleanouts, and drain manholes:**
   Drainage conveyance and maintenance structures need to be inspected regularly to ensure unimpeded flow and continuing flood control. See pages 12 & 13 for more information and inspection forms.

4. **De-icing activities:**
   See page 14 for a de-icing log.

Forms for documenting compliance with the protocols detailed herein are provided on the following pages. Only one copy of each form is provided; additional copies will need to made for continuing inspections and record-keeping as needed. Inspectors may also create their own forms in lieu of the ones provided.

Lawrence Academy Gray Building Expansion Project
26 Powder House Road, Groton, MA
Stormwater Management System
Inspection & Maintenance Manual
September 2024

General Notes Applying to this Manual:

- Every effort has been made to provide a comprehensive stormwater inspection and maintenance plan for this project. All guidelines presented in this plan are the minimum required to achieve the intent of the plan, which is to prevent soil erosion, control flooding, and minimize downstream impacts from stormwater runoff.
- Should any omissions or inconsistencies arise in the plan, the owner, and government officials are expected to use reasonable and experienced judgement in the field relative to evaluation and implementing measures based on the intent of this plan.
- This manual does not preclude the implementation of additional inspections, increase in the frequency of inspections, or any other measures deemed necessary by the owner to ensure the continued proper functioning of the stormwater management system.
- Lawrence Academy FO&M will be responsible for implementing the required inspection and maintenance activities identified in this Inspection and Maintenance (I&M) manual.
- Lawrence Academy FO&M shall maintain all record keeping required by the I&M manual. Any transfer of responsibility for I&M activities or transfer in ownership shall be documented to the town in writing.
- Inspection and maintenance reports shall be completed after each inspection. Copies of the report forms to be completed by the inspector are attached at the end of this manual, including:

  * BMP-specific forms for the R-Tanks system, stormwater quality inlet, drain basins and other drain inlets, invasive species control, and de-icing of pavements.

- An overview plan showing the locations of all the stormwater collection & conveyance structures, treatment practices, and detention/ infiltration practices is on page 15 of this manual. Also see the approved set of design plans for more details.

ACF R-Tanks Underground Detention System:

See the R-Tanks inspection and maintenance information and inspection logs from the manufacturer that follow this page. This project has one section of R-Tanks located as shown on the site plan on page 15.

R-TANK OPERATI ON, INSPECTION & MAINTENANCE

Operation

Your ACF R-Tank System has been designed to function in conjunction with the engineered drainage system on your site, the existing municipal infrastructure, and/or the existing soils and geography of the receiving watershed. Unless your site includes certain unique and rare features, the operation of your R-Tank System will be driven by naturally occurring systems and will function autonomously. However, upholding a proper schedule of Inspection & Maintenance is critical to ensuring continued functionality and optimum performance of the system.

Inspection

Both the R-Tank and all stormwater pre-treatment features incorporated into your site must be inspected regularly. Inspection frequency for your system must be determined based on the contributing drainage area, but should never exceed one year between inspections (six months during the first year of operation).

Inspections may be required more frequently for pre-treatment systems. You should refer to the manufacturer requirements for the proper inspection schedule.

With the right equipment your inspection and measurements can be accomplished from the surface without physically entering any confined spaces. If your inspection does require confined space entry, you MUST follow all local/regional requirements as well as OSHA standards.

R-Tank Systems may incorporate Inspection Ports, Maintenance Ports, and/or adjoining manholes. Each of these features are easily accessed by removing the lid at the surface. With the cover removed, a visual inspection can be performed to identify sediment deposits within the structure. Using a flashlight, ALL access points should be examined to complete a thorough inspection.

Inspection Ports

Usually located centrally in the R-Tank System, these perforated columns are designed to give the user a base-line sediment depth across the system floor.

Maintenance Ports

Usually located near the inlet and outlet connections, you'll likely find deeper deposits of heavier sediments when compared to the Inspection Ports.

Manholes

Most systems will include at least two manholes - one at the inlet and another at the outlet. There may be more than one location where stormwater enters the system, which would result in additional manholes to inspect.

Bear in mind that these manholes often include a sump below the invert of the pipe connecting to the R-Tank. These sumps are designed to capture sediment before it reaches the R-Tank, and they should be kept clean to ensure they function properly. However, existence of sediment in the sump does NOT necessarily mean sediment has accumulated in the R-Tank.

After inspecting the bottom of the structure, use a mirror on a pole (or some other device) to check for sediment or debris in the pipe connecting to the R-Tank.

If sediment or debris is observed in any of these structures, you should determine the depth of the material. This is typically accomplished with a stadia rod, but you should determine the best way to obtain the measurement.

All observations and measurements should be recorded on an Inspection Log kept on file. We've included a form you can use at the end of this guideline.

Maintenance

The R-Tank System should be back-flushed once sediment accumulation has reached 6" or 15% of the total system height. Use the chart below as a guideline to determine the point at which maintenance is required on your system.

R-Tank Unit	Height	Max Sediment Dept
Mini	9.5"	1.5"
Single	17"	3"
Double	34"	5"
Triple	50"	6"
Quad	67"	6"
Pent	84"	6"

Before any maintenance is performed on your system, be sure to plug the outlet pipe to prevent contamination of the adjacent systems.

To back-flush the R-Tank, water is pumped into the system through the Maintenance Ports as rapidly as possible. Water should be pumped into ALL Maintenance Ports. The turbulent action of the water moving through the R-Tank will suspend sediments which may then be pumped out.

If your system includes an Outlet Structure, this will be the ideal location to pump contaminated water out of the system. However, removal of back-flush water may be accomplished through the Maintenance Ports, as well.

For systems with large footprints that would require extensive volumes of water to properly flush the system, you should consider performing your maintenance within 24 hours of a rain event. Stormwater entering the system will aid in the suspension of sediments and reduce the volume of water required to properly flush the system.

Once removed, sediment-laden water may be captured for disposal or pumped through a Dirtbag™ (if permitted by the locality).

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Step-By-Step Inspection & Maintenance Routine

1) Inspection

a. Inspection Port
   i. Remove Cap
   ii. Use flashlight to detect sediment deposits
   iii. If present, measure sediment depth with stadia rod
   iv. Record results on Maintenance Log
   v. Replace Cap

b. Maintenance Port/s
   i. Remove Cap
   ii. Use flashlight to detect sediment deposits
   iii. If present, measure sediment depth with stadia rod
   iv. Record results on Maintenance Log
   v. Replace Cap
   vi. Repeat for ALL Maintenance Ports

c. Adjacent Manholes
   i. Remove Cover
   ii. Use flashlight to detect sediment deposits
   iii. If present, measure sediment depth with stadia rod, accounting for depth of sump
   iv. Inspect pipes connecting to R-Tank
   v. Record results on Maintenance Log
   vi. Replace Cover
   vii. Repeat for ALL Manholes that connect to the R-Tank

2) Maintenance

a. Plug system outlet to prevent discharge of back-flush water
b. Determine best location to pump out back-flush water
c. Remove Cap from Maintenance Port
d. Pump water as rapidly as possible (without over-topping port) into system until at least 1”
e. of water covers system bottom
f. Replace Cap
g. Repeat at ALL Maintenance Ports
h. Pump out back-flush water to complete back-flushing
i. Vacuum all adjacent structures and any other structures or stormwater pre-treatment systems that require attention
j. Sediment-laden water may be captured for disposal or pumped through a DirtbagTM.
k. Replace any remaining Caps or Covers
l. Record the back-flushing event in your Maintenance Log with any relevant specifics

R-Tank Maintenance Log

Site Name:______________________________

Location:______________________________

System Owner:___________________________

Company Responsible
for Maintenance:___________________________________

Contact:____

Phone Number:____

Date	Location	Depth to Bottom	Depth to Sediment	Sediment Depth	Observations/Notes	Initials

Stormwater Quality Inlet:

Description:

The water quality inlet (WQI) consists of one or more chambers that promote sedimentation of course materials and separation of debris and free oil from stormwater. WQIs are subject to sediment and debris accumulation and clogging, and the following protocols apply for keeping them functioning properly:

Inspection:

1. Inspect the bypass structure for blockage. Inspect the diversion structure and weir for damage and sediment buildup. Any damage should be repaired, and sediment should be removed as required.

2. Locate and remove the lid of each riser (see page 10 for diagram). It is recommended that this be done one at a time, so an open riser is not left exposed during inspection or maintenance of the other risers.

3. In the riser over the sediment chamber, inspect the amount of floatable debris. Then measure the sediment buildup with a measuring device such as a Sludge Judge®. Inspect that the inlet pipe does not have any blockage. Blockage inspection is better suited after the unit is vacuumed. Any confined space entry would be done through this riser and OSHA requirements must be followed.

4. In the riser over the oil chamber, measure/inspect the oil depth.

5. Inspect structure and components for any damage.

6. Replace all riser lids.

Sediment Measurement Procedure:

7. Lower measuring device into sediment riser of unit.

8. Read measurements at ground surface.

9. Subtract the current measurement reading from the distance between the ground surface to the invert of the WQU (obtained when unit is first installed or clean).

10. If measurement is 20% or more of total chamber depth, maintenance shall be performed.

Maintenance:

1. Inspect WQI when system is installed to provide owner with invert measurement prior to sediment accumulation. Inspect quarterly and after major storm events thereon.

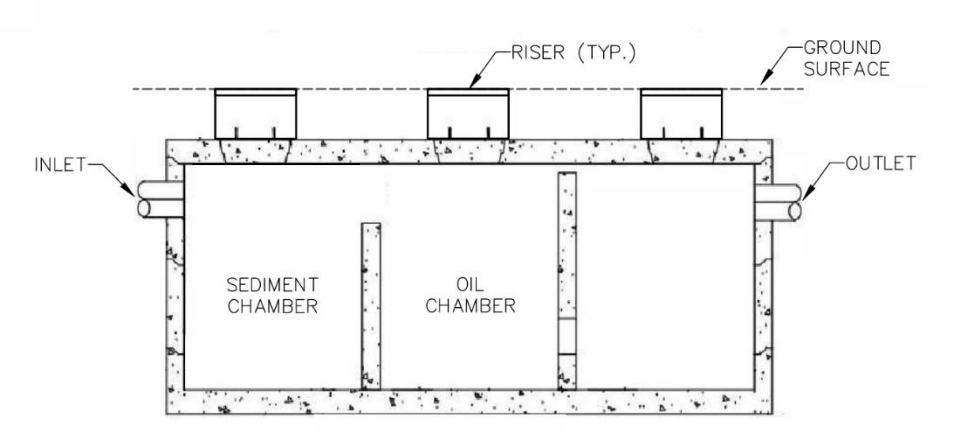
2. Clean when sediment volume has reduced storage area by 20%, or annually.

Site or surrounding conditions may require more inspections and maintenance.

Cleaning Procedure:

1. Insert vacuum hose into bypass Structure and pump out. Inspect bypass Structure for any damage.
2. Insert vacuum hose into riser and pump out the sediment chamber. Pressure wash chamber if needed. Inspect for any damage.
3. Insert vacuum hose into other riser to pump out oil chamber. Pressure wash chamber if needed.
4. Refill WQI with water. Inspect the inlet pipe for any blockage, the weir plate for damage, and for any structural damage.
5. Replace all riser lids.

The owner or operator is responsible for meeting all federal, state, and local laws and regulations during the maintenance and clean out operations



Water Quality Inlet Diagram

Stormwater Quality Inlet:

Practice Location: 26 Powder House Road, Groton, MA

Date:_____

Performed by:_____ Signature:_____

Inspection Checklist

Presence of accumulated sediment	❑ Yes	❑ No
Presence of trash or debris	❑ Yes	❑ No

Maintenance Performed

Drain pipes, drain basins, areaway drains, trench drains, slot drains, drain cleanouts, and drain manholes:

Description:

Drain pipes, drain basins, and other drain inlets make up the closed drainage system, the primary purpose of which is to collect and convey stormwater. Closed drainage systems are subject to debris accumulation and clogging, and the following protocols apply for keeping them functioning properly:

Maintenance:

1. Inspect closed drainage system elements periodically for sediment accumulation and detritus accumulation. Look for signs of erosion at inlet and outlet locations. Minimum recommended frequency of inspections is quarterly to start; subject to modification based on observed maintenance requirements.

2. Hire a catch basin cleaning company to clean all drain basins at least once every two years, or more frequently if conditions warrant, based on inspections.

3. Clear leaves and detritus from drain basin grates and pipes as needed.

Drain pipes, drain basins, areaway drains, trench drains, slot drains, drain cleanouts and drain manholes:

Practice Location: 26 Powder House Road, Groton, MA

Date:_____

Performed by:_____ Signature:_____

Inspection Checklist

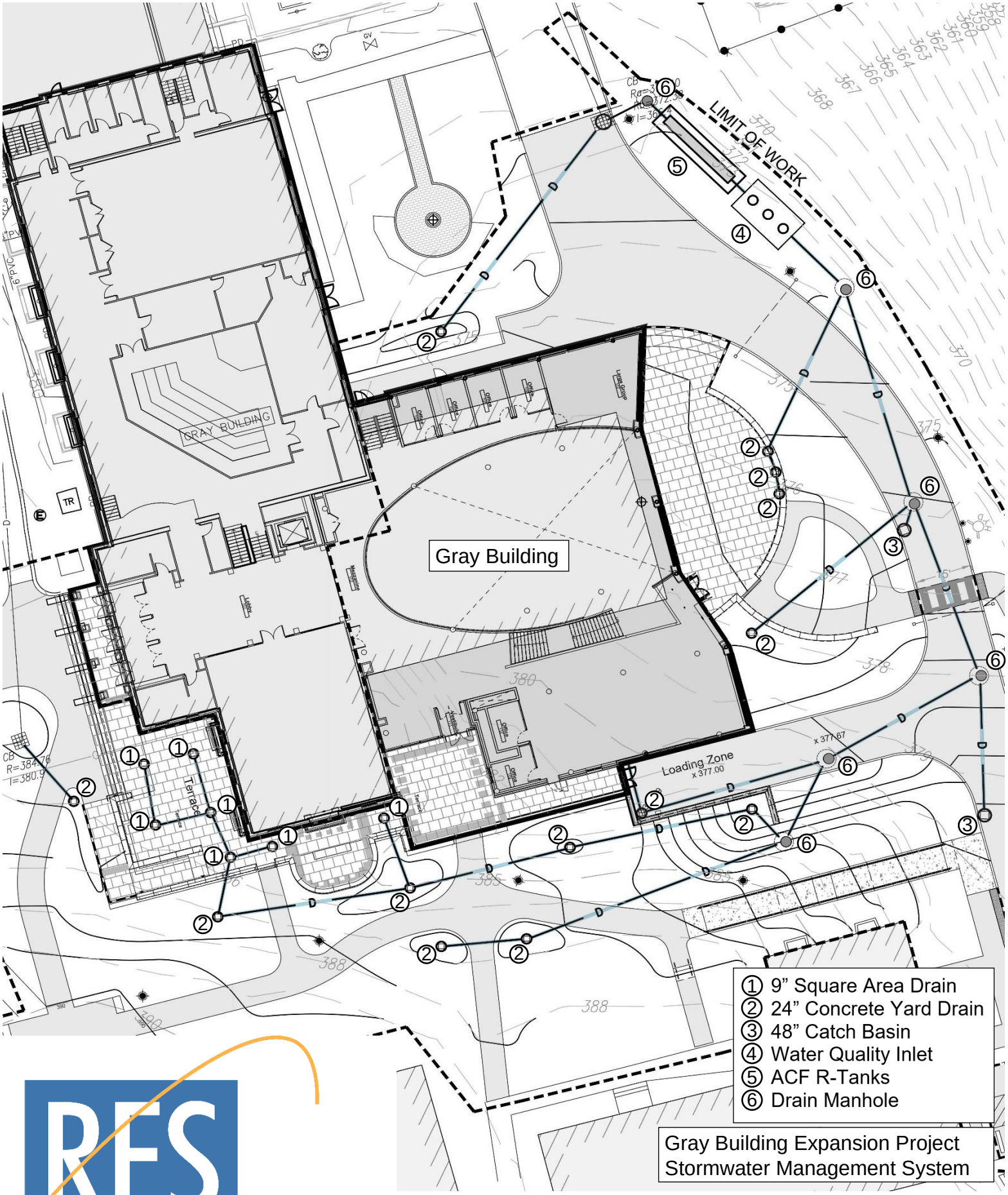
Presence of accumulated sediment	❑ Yes	❑ No
Presence of trash or debris	❑ Yes	❑ No

Maintenance Performed

Deicing Log, Walkways & other pavements:

* Do not apply deicing chemicals of any kind to areas with snow melt systems

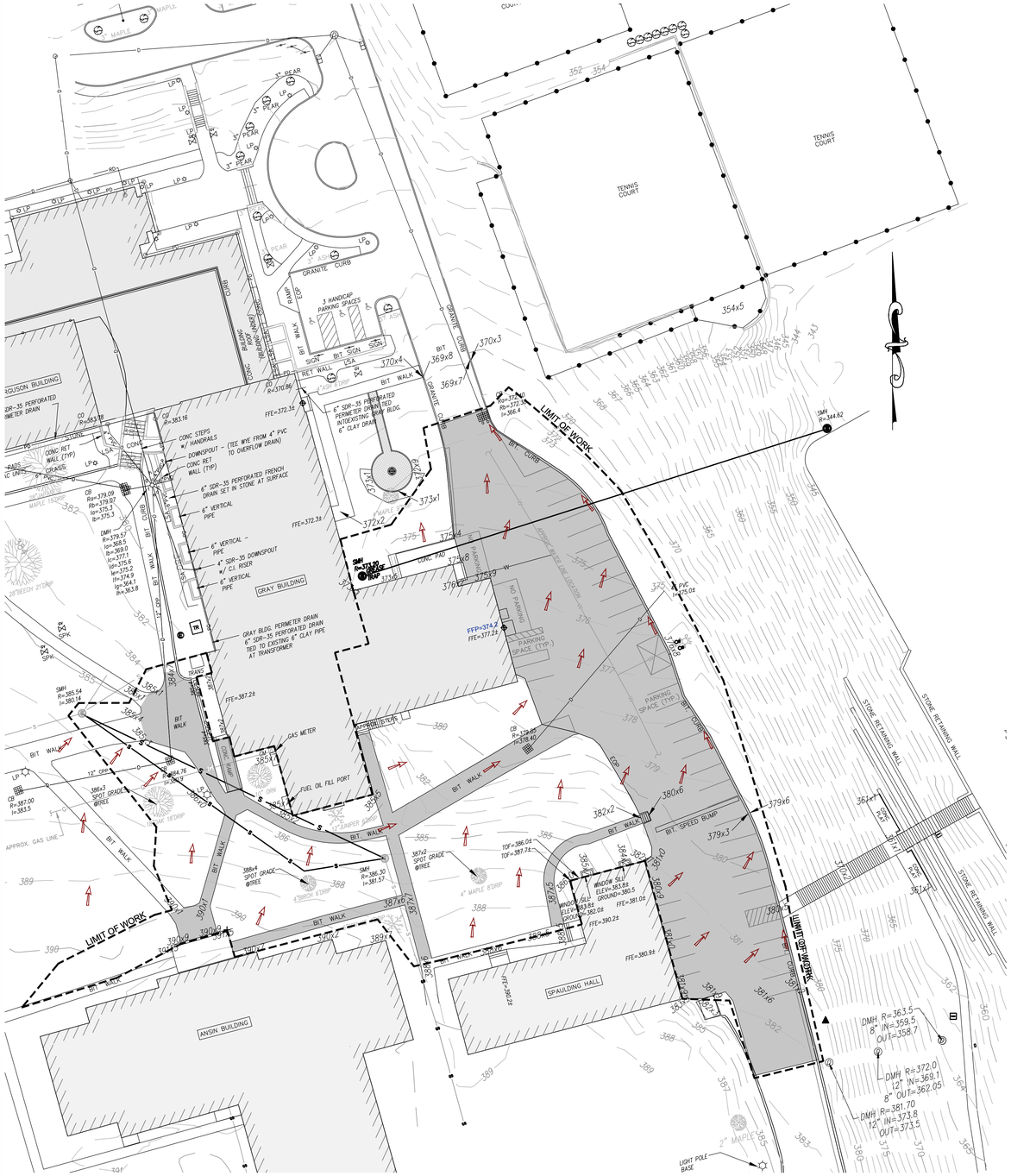
Deicing Material Used	Amount of Deicing Material Applied	Date	Logged By



Gray Building Expansion Project
Stormwater Management System

RFS engineering

Appendix G – Pre- and Post-Development Drainage Area Plans



GRAPHIC SCALE

0 30 60 90 150

(IN FEET)

1 INCH = 30 FT.

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DRAINAGE AREA WITH FLOW ARROWS

Construction Documents
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JKC	2101
Reviewed By	Scale
Plot Date 09/17/24	Issue Date 09/17/24

Sheet No.

C3.00

Appendix H – Project Site Plans

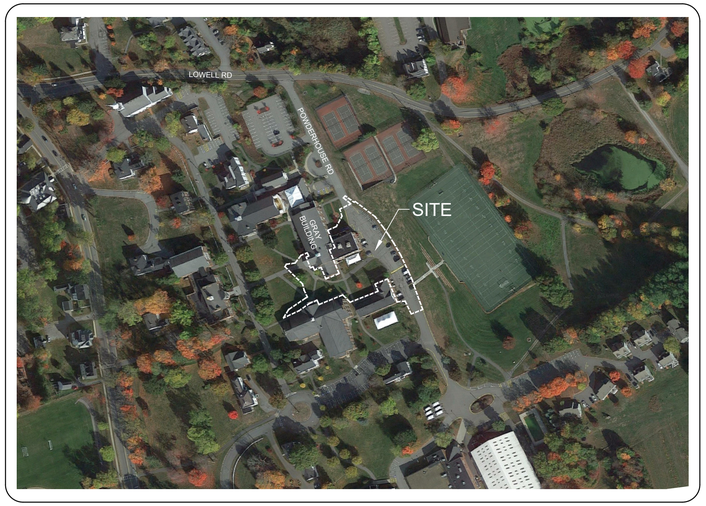
CIVIL SYMBOLS

ASPHALT
CATCH BASIN
COMMUNICATION VAULT / HANDHOLE
COMMUNICATION PULLBOX
CONCRETE
CONTOUR INTERVAL
DRAIN MANHOLE / CLEANOUT
DRAINAGE LINE
EDGE OF VEGETATION
ELECTRICAL VAULT / HANDHOLE
ELECTRICAL PULLBOX
FIRE HYDRANT
FIRE SERVICE
GAS METER
GAS MAIN
GATE VALVE
GUARD RAIL
LOAM AND SEED
LOAM, SEED, AND IRRIGATION
SEWER MANHOLE
SEWER LINE
SILT FENCE
SPOT GRADE
STEEL FENCING
TREE LINE
TRANSFORMER
UNDERGROUND COMMUNICATIONS LINES
UNDERGROUND ELECTRIC
WATER MAIN
WOOD FENCING
YARD DRAIN
WETLAND BOUNDARY
TWO-WAY TRAFFIC
ONE-WAY TRAFFIC

UNDERGROUND ELECTRIC LINE
WATER LINE
SANITARY SEWER LINE
STORM DRAIN
STORM DRAIN (LOCATION UNCLEAR)
UNDERGROUND DATA CONDUIT
SEWER MANHOLE
DRAIN MANHOLE
CATCH BASIN
CATCH BASIN
IRRIGATION CONTROL VALVE
SITE LIGHTING
SITE LIGHTING W/ CONCRETE BASE
TEST BORING
DECIDUOUS TREE
CONIFEROUS TREE
TREE WITH DRIP LINE
SHRUB
ROCK RETAINING WALL
EXISTING CONTOUR
SPOT ELEVATION
BUILDING
PAVED SURFACE
CONCRETE SURFACE
PLANTING BED

CIVIL ABBREVIATIONS

BM	BENCHMARK
BIT.	BITUMINOUS
BC	BOTTOM OF CURB
BND	BOUND
TV	CABLE TELEVISION
CI	CAST IRON
CB	CATCH BASIN
CLDI	CEMENT-LINED DUCTILE IRON
COMM.	COMMUNICATIONS
CMH	COMMUNICATIONS MANHOLE
CONC.	CONCRETE
C.C.S.	CONCRETE CURB STOP
CMP	CORRUGATED METAL PIPE
CPP	CORRUGATED PLASTIC PIPE
D	DIAMETER OR DRAIN
DMH	DRAIN MANHOLE
DS	DOOR SILL
DH	DRILL HOLE
DI	DUCTILE IRON
E	ELECTRIC
EMH	ELECTRIC MANHOLE
ELEV	ELEVATION
EXIST.	EXISTING
FT.	FEET
FF ELEV	FINISH FLOOR ELEVATION
H.C.	HANDICAPPED
HDPE	HIGH DENSITY POLYETHYLENE PIPE
INV	INVERT
LT.	LEFT
LF	LINEAR FEET
L.P.	LIQUID PETROLEUM
MH	MANHOLE
PE	POLYETHYLENE
PVI	POINT OF VERTICAL INTERSECTION
PVC	POLYVINYL CHLORIDE
R	RADIUS
RCP	REINFORCED CONCRETE PIPE
RT.	RIGHT
SMH	SEWER MANHOLE
S	SLOPE
SF	SQUARE FEET
STA	STATION
STMH	STEAM MANHOLE
TEL	TELEPHONE
TC	TOP OF CURB
TW	TOP OF WALL
TRANS.	TRANSFORMER
TYP.	TYPICAL
U. POLE	UTILITY POLE
WV	WATER VALVE
W/	WITH
VC	VERTICAL CURVE
V.G.C.	VERTICAL GRANITE CURB
WF	WETLAND FLAG



AERIAL VIEW
SCALE: 1" = 200'±

CIVIL TRADE NOTES

C-1 GENERAL NOTES APPLY TO ALL DRAWINGS FOR THE TOTAL PROJECT. DRAWING NOTES APPLY ONLY TO THOSE DRAWINGS ON WHICH THEY APPEAR.

C-2 THE CONTRACTOR SHALL COORDINATE THE CONSTRUCTION SCHEDULE WITH THE VARIOUS AFFECTED UTILITIES IN ORDER TO PREVENT UNNECESSARY DELAY OF WORK OR INTERRUPTION OF SERVICES.

C-3 EXISTING UTILITIES AND UNDERGROUND STRUCTURES SHOWN ON THE DRAWINGS ARE APPROXIMATE ONLY. THE CONTRACTOR SHALL BE RESPONSIBLE FOR MARKING OF ALL UNDERGROUND UTILITIES THROUGH THE DIG-SAFE PROGRAM AND/OR A PRIVATE UTILITY MARKING COMPANY SUCH THAT ALL UTILITIES ARE LOCATED AND MARKED IN THE FIELD PRIOR TO THE START OF CONSTRUCTION. NEITHER THE ENGINEER NOR THE OWNER WARRANTS OR GUARANTEES THE CONDITIONS SHOWN ON THE DRAWINGS.

C-4 THE CONTRACTOR SHALL MAINTAIN TRAFFIC IN A SAFE MANNER AT ALL TIMES DURING CONSTRUCTION.

C-5 THE CONTRACTOR SHALL BE RESPONSIBLE FOR ANY DAMAGE TO EXISTING PAVEMENT AND ROADWAYS, AND SHALL REPAIR SUCH DAMAGE AT NO ADDITIONAL COST TO THE OWNER.

C-6 ANY AREAS BEYOND THE "PROJECT LIMITS" AS SHOWN ON THESE PLANS WHICH ARE DISTURBED BY THE CONTRACTOR SHALL BE RESTORED TO THEIR ORIGINAL CONDITION.

C-7 THE CONTRACTOR SHALL DIG TEST PITS AS REQUIRED TO LOCATE / VERIFY EXISTING UTILITIES AND OTHER UNDERGROUND ITEMS. FAILURE TO PERFORM TEST PITS MAY RESULT IN UNNECESSARY DELAYS AND CONFLICTS FOR WHICH THE CONTRACTOR MAY BE HELD RESPONSIBLE. TEST PITS ARE TO BE COORDINATED WITH THE ENGINEER AND SHALL INCLUDE INFORMATION AS TO THE SIZE AND CONFIGURATION OF THE PIPES FOUND, AS WELL AS INVERT ELEVATIONS.

C-8 THE CONTRACTOR SHALL PROVIDE EROSION AND SEDIMENTATION CONTROLS AS REQUIRED IN SPECIFICATION SECTION 312500, AS SHOWN ON THE PLANS, AND AS REQUIRED BY LOCAL AND STATE REGULATIONS THROUGHOUT THE DURATION OF ALL CONSTRUCTION OPERATIONS.

GENERAL NOTES

THE FOLLOWING GENERAL NOTES APPLY TO ALL RIST-FROST-SHUMWAY ENGINEERING, P.C., DRAWINGS AND TRADES ASSOCIATED WITH THOSE DRAWINGS INVOLVED ON THIS PROJECT:

G-1 RIST-FROST-SHUMWAY ENGINEERING, P.C., WAIVES ANY AND ALL RESPONSIBILITY AND LIABILITY FOR PROBLEMS WHICH ARISE FROM FAILURE TO FOLLOW THESE PLANS, SPECIFICATIONS, AND/OR THE DESIGN INTENT THEY CONVEY, OR FOR PROBLEMS WHICH ARISE FROM OTHERS' FAILURE TO OBTAIN AND/OR FOLLOW THE GUIDANCE OF RIST-FROST-SHUMWAY ENGINEERING, P.C., WITH RESPECT TO ANY ERRORS, OMISSIONS, INCONSISTENCIES, AMBIGUITIES OR CONFLICTS WHICH ARE DISCOVERED OR ALLEGED.

G-2 ALL WORK SHALL CONFORM TO ALL FEDERAL, STATE, AND LOCAL CODES AND STANDARDS INCLUDING, BUT NOT LIMITED TO: NFPA, BOCA, UL, SMACNA, OSHA, AND NEC.

G-3 THE CONTRACTOR AND ALL SUBCONTRACTORS SHALL PROTECT THE WORK SITE, SURROUNDING AREAS AND OCCUPANTS FROM DAMAGE AND INJURY.

G-4 ALL DRAWINGS ARE INTENDED TO SHOW THE GENERAL ARRANGEMENT, DESIGN INTENT, AND EXTENT OF THE WORK. AS SUCH, THEY SHALL BE CONSIDERED PARTLY DIAGRAMMATIC. THEY ARE NOT INTENDED TO BE SCALED FOR ROUGHING-IN MEASUREMENTS OR TO SERVE AS SHOP DRAWINGS.

G-5 DETAILS SHOWN ON ANY DRAWING ARE TO BE CONSIDERED TYPICAL FOR ALL SIMILAR CONDITIONS, UNLESS OTHERWISE INDICATED.

G-6 INFORMATION ON THESE DRAWINGS PERTAINING TO AS-BUILT CONSTRUCTION AND OTHER EXISTING CONDITIONS HAS BEEN OBTAINED FROM ENGINEERING DRAWINGS OR BY FIELD INVESTIGATION. THIS INFORMATION IS PROVIDED FOR THE CONTRACTOR'S BENEFIT IN PERFORMANCE OF THE WORK.

G-7 IN THE EVENT THE CONTRACTOR ENCOUNTERS MATERIAL REASONABLY BELIEVED TO BE HAZARDOUS WHICH HAS NOT BEEN RENDERED HARMLESS, THE CONTRACTOR SHALL IMMEDIATELY STOP WORK IN THE AREA AFFECTED AND REPORT THE CONDITION TO THE OWNER AND ARCHITECT/ENGINEER IN WRITING. THE WORK IN THE AFFECTED AREA SHALL NOT BE RESUMED UNTIL WRITTEN VERIFICATION BY THE OWNER IS RECEIVED THAT THE MATERIAL HAS BEEN REMOVED OR OTHERWISE BEEN RENDERED HARMLESS.

PLAN NOTES

1. THIS PROJECT IS A RENOVATION AND ADDITION TO THE GRAY BUILDING ON THE LAWRENCE ACADEMY CAMPUS.
2. THIS PLAN DEPICTS EXISTING CONDITIONS AT THE SITE AS OF JULY 2022, AS PROVIDED ON A PLAN BY DILLIS & ROY CIVIL DESIGN GROUP DATED 1-31-2022 WITH A REVISION DATE OF 7-14-2022, TITLED "EXISTING CONDITIONS, POWDERHOUSE ROAD, GROTON, MA."

Lawrence Academy
Community Commons Addition & Gray Building Renovation
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Sheet Title
CIVIL NOTES, LEGENDS, & ABBREVIATIONS

Construction Documents
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Drawn By: JKC	Project ID: 2101
Reviewed By:	Scale:
Plot Date: 09/17/24	Issue Date: 09/17/24

Sheet No.
C0.00

SITE DEMOLITION NOTES

1. APPROXIMATE SAWCUT AND PAVEMENT REMOVAL LIMITS (GRAY SHADED AREA). VERIFY LIMITS IN THE FIELD.
2. REMOVE PORTION OF BUILDING TO ACCOMMODATE NEW WORK AND DISPOSE OF IN ACCORDANCE WITH APPLICABLE REGULATIONS.
3. REMOVE & DISPOSE OF CONCRETE PAD AND FENCE.
4. REMOVE & DISPOSE OF CONCRETE RAMP/ STEPS/ PADS.
5. REMOVE TREES AND OTHER VEGETATION WITHIN THE LIMITS OF WORK IN ACCORDANCE WITH THE LANDSCAPE PLANS.
6. PROTECT EXISTING TREES MARKED TO REMAIN (SEE LANDSCAPE PLANS.) PROVIDE AND MAINTAIN TREE PROTECTION THROUGHOUT PROJECT.
7. REMOVE SEWER AND DRAINAGE STRUCTURES AND PIPE RUNS AS SHOWN. COORDINATE LIMITS WITH NEW SYSTEMS. SEE PLUMBING DRAWINGS.
8. UTILITIES SERVING THE EXISTING BUILDING: CUT & CAP UTILITIES BEING INTERRUPTED OR PROTECT UTILITIES TO REMAIN TO ACCOMMODATE THE WORK. REMOVE AFFECTED UTILITIES WITHIN THE LIMITS OF WORK. COORDINATE WITH THE VARIOUS AFFECTED UTILITIES.
9. PROTECT HARDSCAPE & SHRUBBERY.
10. REMOVE AND SALVAGE GRANITE CURB.
11. REMOVE LIGHT POLE AND SALVAGE.
12. REMOVE & DISPOSE OF BOLLARD TO ENABLE THE WORK.

GRAPHIC SCALE

0 20 40 60 100

(IN FEET)

1 INCH = 20 FT.

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Sheet Title
EXISTING CONDITIONS & DEMOLITION PLAN

Construction Documents
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Drawn By: JKC	Project ID: 2101
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Plot Date: 09/17/24	Issue Date: 09/17/24

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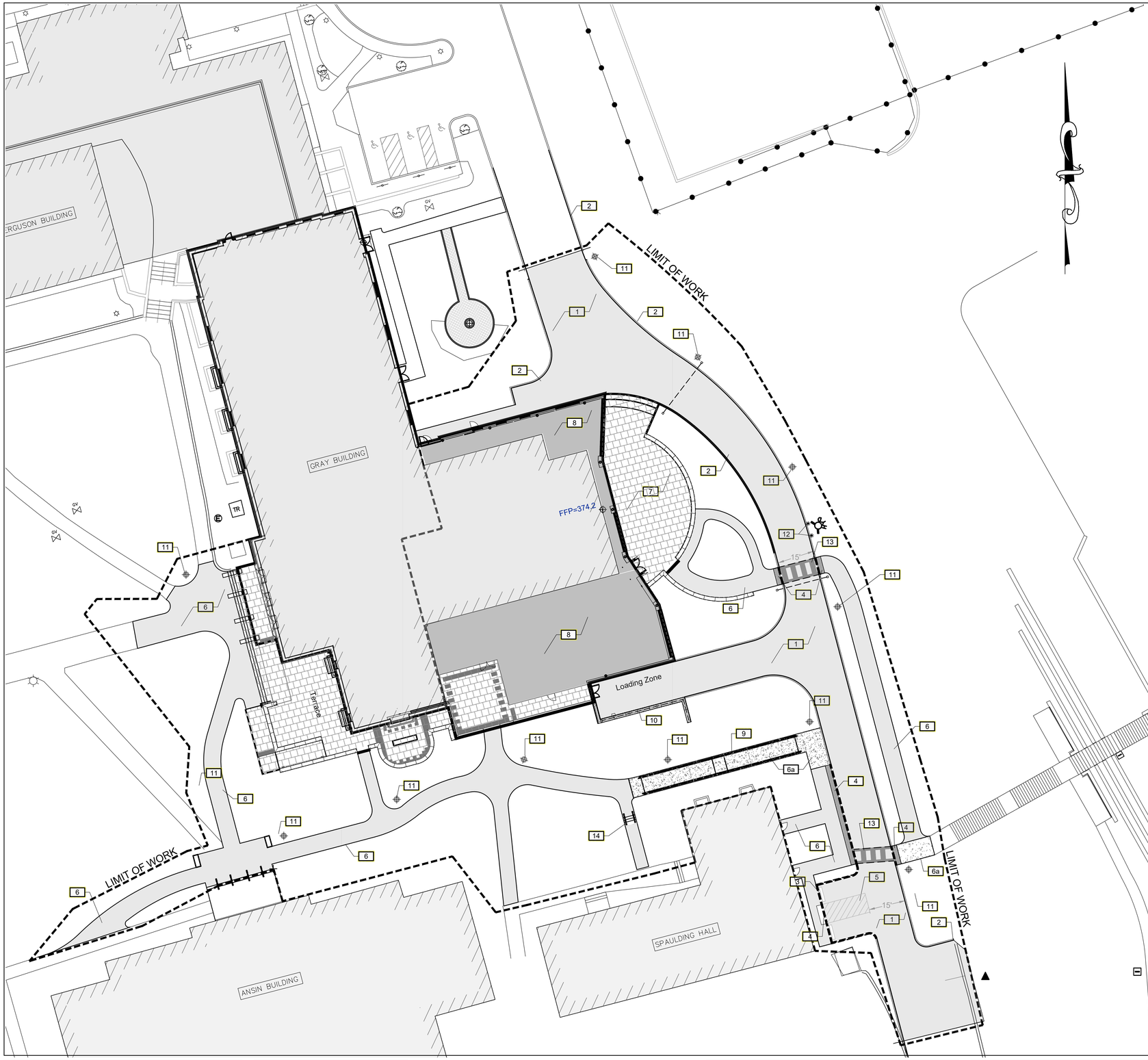
C1.00



SITE MATERIALS NOTES

1. CONSTRUCT NEW ASPHALT DRIVE AS SHOWN. SEE SHEET C6.00 FOR DETAIL.
2. INSTALL VERTICAL GRANITE CURBING. SEE SHEET C6.00 FOR DETAIL.
3. INSTALL FLUSH GRANITE CURBING. SEE SHEET C6.00 FOR DETAIL.
4. INSTALL CONCRETE SLAB AND TIP DOWN. SEE SHEET C6.00 FOR DETAIL.
5. INSTALL PAVEMENT MARKINGS AS SHOWN. SEE SHEET C6.00 FOR DETAIL.
6. CONSTRUCT ASPHALT WALKWAY. SEE SEE SHEET C6.00 FOR DETAIL.
6a. CONSTRUCT CONCRETE WALKWAY. SEE SEE SHEET C6.00 FOR DETAIL.
7. CONSTRUCT PEDESTRIAN PLAZA AS DETAILED ON THE LANDSCAPE DRAWINGS.
8. COORDINATE EXCAVATION & BACKFILL FOR NEW BUILDING CONSTRUCTION WITH STRUCTURAL & ARCHITECTURAL DRAWINGS AND GEOTECHNICAL REPORT.
9. ADA RAMP WITH HANDRAILS. SEE LANDSCAPE DRAWINGS.
10. CONSTRUCT NEW RETAINING WALL AS SHOWN. SEE STRUCTURAL DRAWINGS.
11. NEW SITE LIGHT. SEE LANDSCAPE DRAWINGS.
12. INSTALL NEW BOLLARDS FOR HYDRANT PROTECTION. SEE SHEET C6.00 FOR DETAIL.
13. PAINT CROSSWALK AS SHOWN. SEE DETAIL ON SHEET C6.03.
14. SEE LANDSCAPE DRAWINGS FOR STAIR DETAILS.

GRAPHIC SCALE

0 20 40 60 100

(IN FEET)

1 INCH = 20 FT.

Lawrence Academy

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Sheet Title
SITE LAYOUT & MATERIALS PLAN

Construction Documents
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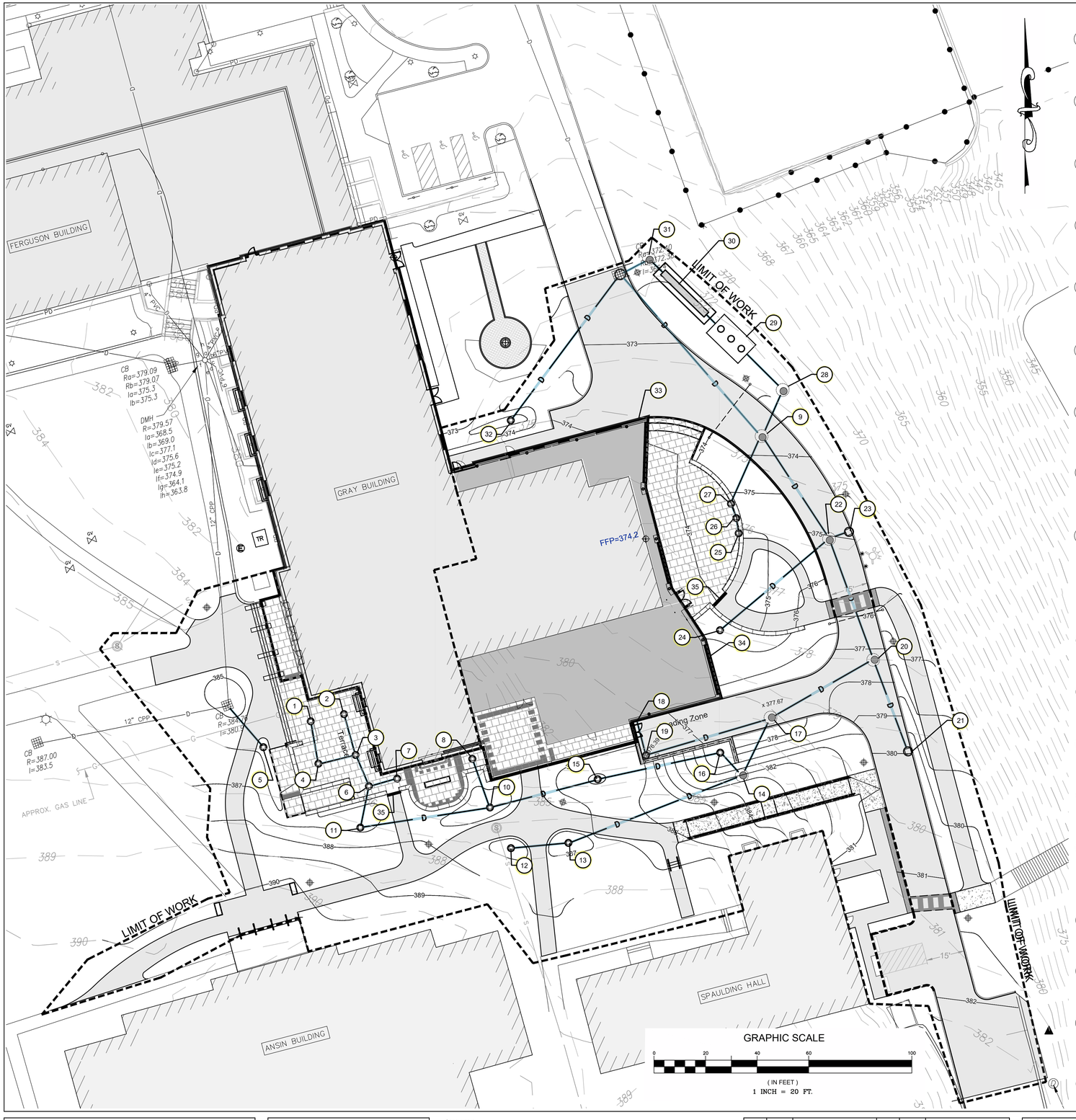
Drawn By: JKC	Project ID: 2101
Reviewed By:	Scale:
Plot Date: 09/17/24	Issue Date: 09/17/24
Sheet No.	**C2.00**



SITE GRADING AND DRAINAGE NOTES

1. INSTALL 9" SQUARE AREA DRAIN WITH PVC BASIN (NYLOPLAST OR EQUAL). SEE LANDSCAPE DRAWINGS & DETAIL ON C6.02.
RIM = 387.02
INV = 385.02
19 LF 6" HDPE @ S = 0.0X00'/' (TO NOTE 4)

2. INSTALL 9" SQUARE AREA DRAIN WITH PVC BASIN (NYLOPLAST OR EQUAL). SEE LANDSCAPE DRAWINGS & DETAIL ON C6.02.
RIM = 387.02
INV = 38XXX
14 LF 6" HDPE @ S = 0.0X00'/' (TO NOTE 3)

3. INSTALL 9" SQUARE AREA DRAIN WITH PVC BASIN (NYLOPLAST OR EQUAL). SEE LANDSCAPE DRAWINGS & DETAIL ON C6.02.
RIM = 387.02
INV = 38XXX
12 LF 6" HDPE @ S = 0.0X00'/' (TO NOTE 6)

4. INSTALL 9" SQUARE AREA DRAIN WITH PVC BASIN (NYLOPLAST OR EQUAL). SEE LANDSCAPE DRAWINGS & DETAIL ON C6.02.
RIM = 387.02
INV = 38XXX
14 LF 6" HDPE @ S = 0.0X00'/' (TO NOTE 3)

5. INSTALL 24" CONCRETE YARD DRAIN WITH 2' SUMP AND 12" FRAME & GRATE. SEE SHEET C6.01 FOR DETAIL.
RIM = 385.0
8" INV = 382.00
19 LF 8" HDPE @ S = 0.0579'/' (TO EXISTING)

6. INSTALL 9" SQUARE AREA DRAIN WITH PVC BASIN (NYLOPLAST OR EQUAL). SEE LANDSCAPE DRAWINGS & DETAIL ON C6.02.
RIM = 387.11
INV = 38XXX
11 LF 6" HDPE @ S = 0.0XX'/' (TO NOTE 11)

7. INSTALL 9" SQUARE AREA DRAIN WITH PVC BASIN (NYLOPLAST OR EQUAL). SEE LANDSCAPE DRAWINGS & DETAIL ON C6.02.
RIM = 387.11
INV = 3XXX
9 LF 6" HDPE @ S = 0.0X00'/' (TO NOTE 6)

8. INSTALL 9" SQUARE AREA DRAIN WITH PVC BASIN (NYLOPLAST OR EQUAL). SEE LANDSCAPE DRAWINGS & DETAIL ON C6.02.
RIM = 387.11
INV = 384.19
18 LF 6" HDPE @ S = 0.0500'/' (TO NOTE 10)

9. INSTALL 48" DIA. CONCRETE DRAIN MANHOLE WITH 30" DIA. CI FRAME AND COVER. SEE SHEET C6.01 FOR DETAIL.
RIM = 373.8AST IRON
12" INV IN (FROM 22) = 369.24
12" INV IN (FROM 27) = 370.00
12" INV OUT (TO EXISTING) = 370.14
12" INV OUT (TO 28) = 369.14
15 LF 12" HDPE @ S = 0.0100'/' (TO NOTE 28)
79 LF 12" HDPE @ S = 0.0144'/' (TO EXISTING)

10. INSTALL 24" CONCRETE YARD DRAIN WITH 2' SUMP AND 12" FRAME & GRATE.
RIM = 386.5
12" INV = 383.29
41 LF 8" HDPE @ S = 0.0756'/' (TO NOTE 15)

11. INSTALL 24" CONCRETE YARD DRAIN WITH 2' SUMP AND 12" FRAME & GRATE.
RIM = 386.5
8" INV = 38XXX
XX LF 8" HDPE @ S = 0.00XXX0'/' (TO NOTE 10)

12. INSTALL 24" CONCRETE YARD DRAIN WITH 2' SUMP AND 12" FRAME & GRATE.
RIM = 386.5
12" INV = 383.70
20 LF 12" HDPE @ S = 0.0100'/' (TO NOTE 13)

13. INSTALL 24" CONCRETE YARD DRAIN WITH 2' SUMP AND 12" FRAME & GRATE.
RIM = 386.5
12" INV = 383.50
69 LF 8" HDPE @ S = 0.0580'/' (TO NOTE 14)

14. INSTALL 48" DIA. CONCRETE DRAIN MANHOLE WITH 30" DIA. CI FRAME AND COVER.
RIM = 382.0
12" INV IN (FROM 16) = 377.0
12" INV IN (FROM 13) = 379.15
12" INV OUT = 375.50
21 LF 12" HDPE @ S = 0.0750'/' (TO NOTE 17)

15. INSTALL 24" CONCRETE YARD DRAIN WITH 2' SUMP AND 12" FRAME & GRATE.
RIM = 385.75
12" INV = 380.75
45 LF 12" HDPE @ S = 0.0650'/' (TO NOTE 16)

16. INSTALL 24" CONCRETE YARD DRAIN WITH 2' SUMP AND 12" FRAME & GRATE.
RIM = 379.5
12" INV = 377.80
9 LF 12" HDPE @ S = 0.08890'/' (TO NOTE 14)

17. INSTALL 48" DIA. CONCRETE DRAIN MANHOLE WITH 30" DIA. CI FRAME AND COVER.
RIM = 377.6
12" INV IN (FROM 19) = 370.86
12" INV IN (FROM 14) = 373.92
12" INV OUT = 370.76
42 LF 12" HDPE @ S = 0.0100'/' (TO NOTE 20)

18. ROOF DRAIN EXIT.
6" INV AT BUILDING = 371.46
13 LF 6" HDPE @ S = 0.0100'/' (TO NOTE 19)

19. INSTALL 24" YARD DRAIN WITH 2' SUMP AND 12" FRAME & GRATE.
RIM = 376.39
8" INV IN = 371.33
12" INV OUT= 371.33
47 LF 12" HDPE @ S = 0.0100'/' (TO NOTE 17)

20. INSTALL 48" DIA. CONCRETE DRAIN MANHOLE WITH 30" DIA. CAST IRON FRAME AND COVER.
RIM = 377.2
12" INV IN (FROM 21) = 373.40
12" INV IN (FROM 17) = 370.34
12" INV OUT = 370.24
46 LF 12" HDPE @ S = 0.0100'/' (TO NOTE 22)

21. INSTALL 48" CATCH BASIN WITH 24" SQUARE CAST IRON FRAME & GRATE. SEE SHEET C6.01 FOR DETAIL.
RIM = 380.0
12" INV = 373.74
34 LF 12" HDPE @ S = 0.0100'/' (TO NOTE 20)

22. INSTALL 48" DIA. CONCRETE DRAIN MANHOLE WITH 30" DIA. CAST IRON FRAME AND COVER.
RIM = 375.0
12" INV IN (FROM 24) = 370.00
12" INV IN (FROM 23) = 371.50
12" INV IN (FROM 20) = 369.78
12" INV OUT (TO 9)= 369.68
44 LF 12" HDPE @ S = 0.0120'/' (TO NOTE 9)

23. INSTALL 48" CATCH BASIN WITH 24" SQUARE CAST IRON FRAME & GRATE. SEE SHEET C6.00 FOR DETAIL.
RIM = 374.9
12" INV = 372.73
4 LF 8" HDPE @ S = 0.0100'/' (TO NOTE 22)

24. INSTALL 24" CONCRETE YARD DRAIN WITH 2' SUMP AND 12" FRAME & GRATE.
RIM = 375.47
12" INV = 372.50
52 LF 12" HDPE @ S = 0.0481'/' (TO 22)

25. INSTALL 9" SQUARE AREA DRAIN WITH PVC BASIN (NYLOPLAST OR EQUAL). SEE LANDSCAPE DRAWINGS & DETAIL ON C6.02.
RIM = 373.71
INV = 371.36
4 LF 8" HDPE @ S = 0.0500'/' (TO 26)

26. INSTALL 9" SQUARE AREA DRAIN WITH PVC BASIN (NYLOPLAST OR EQUAL). SEE LANDSCAPE DRAWINGS & DETAIL ON C6.02.
RIM = 373.31
INV = 371.16
4 LF 8" HDPE @ S = 0.0500'/' (TO 27)

27. INSTALL 9" SQUARE AREA DRAIN WITH PVC BASIN (NYLOPLAST OR EQUAL). SEE LANDSCAPE DRAWINGS & DETAIL ON C6.02.
RIM = 373.31
INV = 370.96
25 LF 12" HDPE @ S = 0.0384'/' (TO 9)

28. INSTALL 48" DIA. CONCRETE DRAIN MANHOLE WITH 30" DIA. CI FRAME AND COVER.
RIM = 373.3
12" IN IN (FROM 27) = 370.00
12" INV IN (FROM 22) = 369.00
12" INV OUT = 368.90
3 LF 12" HDPE @ S = 0.0330'/' (TO NOTE 29)

29. INSTALL 7500-GALLON CONCRETE WATER QUALITY INLET BY SHEA CONCRETE OR EQUAL. SEE SHEET C6.01 FOR DETAIL.
12" INV IN = 368.85
12" INV OUT = 368.77
13 LF 12" HDPE @ S = 0.0100'/' (TO NOTE 30)

30. INSTALL 20 ACF R-TANK HD MODULES (DOUBLE + MINI) IN TWO ROWS OF 10 UNITS EACH, SURROUNDED BY STONE AND WRAPPED IN NON-WOVEN FILTER FABRIC. SEE SHEET C6.02 FOR DETAIL.
TOP OF R-TANKS = 370.29
BOTTOM OF R-TANKS = 366.75
12" INV IN = 368.572
18" INV OUT (HIGH) = 368.50 (TO NOTE 31)
18" INV OUT (LOW) = 366.80 (TO NOTE 31)
BOTTOM OF STONE = 366.25
UNIT HEIGHT = 42.5"

31. INSTALL 48" DIA. CONCRETE DRAIN MANHOLE WITH 30" DIA. CAST IRON FRAME AND COVER & CONNECT NEW 18" PIPES FROM NOTE 30. VERIFY EXISTING PIPE INVERT AT CONNECTION IN FIELD.
RIM = 371.2
18" INVS IN = 366.70 & 368.40
12" INV OUT = 366.60

32. INSTALL 24" CONCRETE YARD DRAIN WITH 2' SUMP AND 12" FRAME & GRATE.
RIM = 372.80
8" INV = 369.70
66 LF 8" HDPE @ S = 0.0500'/' (TO EXISTING)

33. RECONNECT ROOF DRAIN LEADERS FROM BUILDING AS NEEDED (LOCATIONS TO BE DETERMINED). COORDINATE INSTALLATION WITH PLUMBING CONTRACTOR.

34. INSTALL 4" PERFORATED PVC, STONE, AND FABRIC PERIMETER FOUNDATION DRAIN WITH CLEANOUTS. (VERIFY ELEVATION WITH FOOTING). INSTALL 4" SOLID PVC PIPE FROM BUILDING / WALL TO DAYLIGHT (LOCATIONS TO BE DETERMINED). SEE SHEET C6.01 FOR DETAIL.

35. INSTALL TRENCH DRAIN & TIE INTO NEAREST DRAINAGE STRUCTURE.

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	09/20/24	Planning Board Submission			

REVISIONS ISSUE

Key Plan

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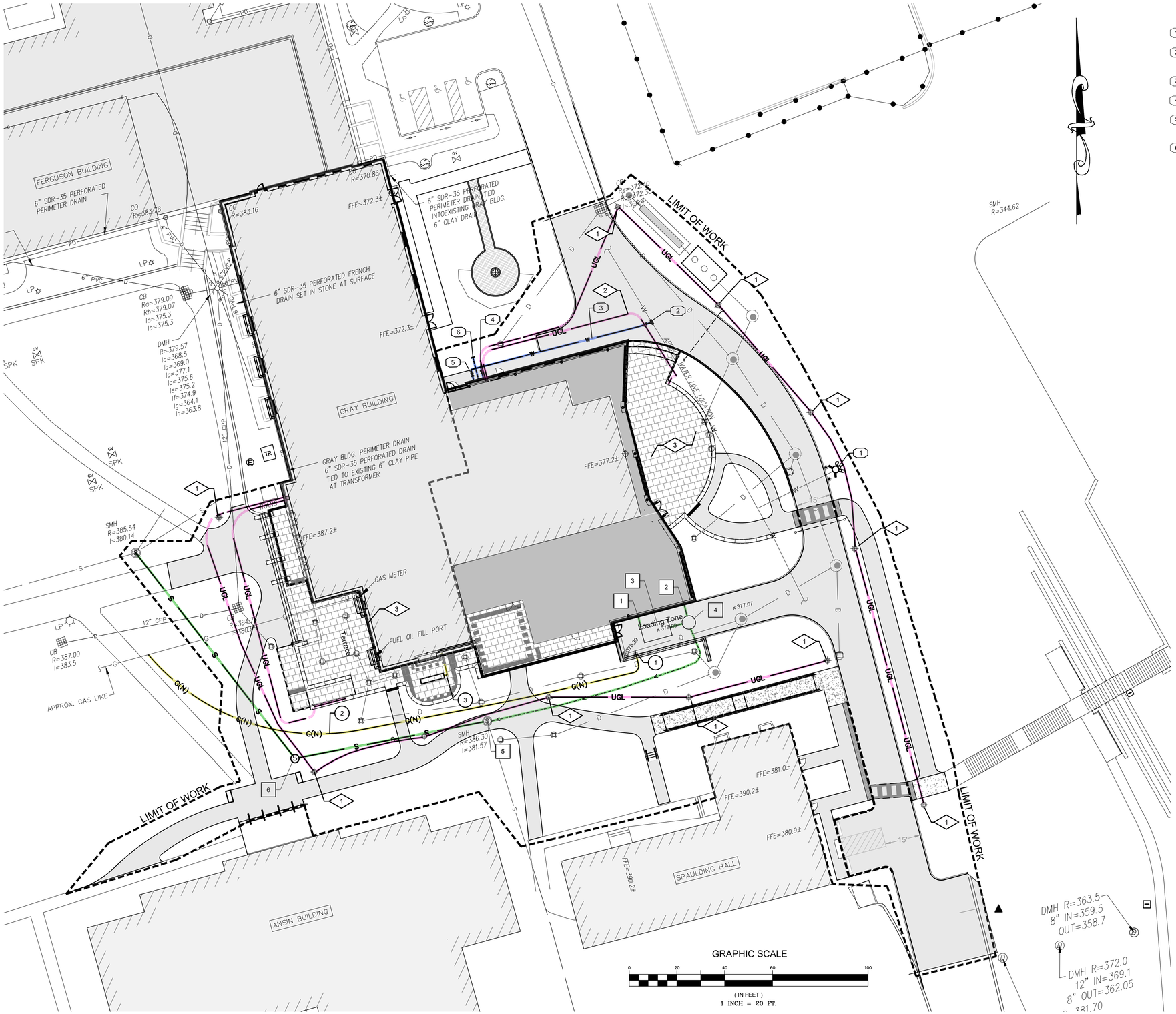
Sheet Title
SITE GRADING & DRAINAGE PLAN

Construction Documents
100% PRICING SET

Drawn By	Project ID
JKC	2101
Reviewed By	Scale
Plot Date	Issue Date
09/17/24	09/17/24

Sheet No.
C3.00



WATER SYSTEM NOTES

1. RESET EXISTING HYDRANT TO ACCOMMODATE NEW GRADES AS NEEDED.
2. INSTALL TAPPING SLEEVE & 6" VALVE. SIZE OF EXISTING WATER MAIN UNKNOWN. SEE SHEET C6.03 FOR WATER VALVE BOX DETAIL.
3. INSTALL 6" DI WATER SERVICE TO BUILDING. SEE SHEET C6.00 FOR TRENCHING DETAIL.
4. INSTALL 6"X4" TEE, 4" GATE VALVE, AND 4" DI DOMESTIC SERVICE TO BUILDING. SEE PLUMBING PLANS.
5. INSTALL 6" 90° ELBOW, 6" GATE VALVE, AND 6" DI FIRE SERVICE TO BUILDING. SEE PLUMBING DRAWINGS. SEE SHEET C6.03 FOR WATER ENTRANCE DETAIL.
6. COORDINATE WITH IRRIGATION CONTRACTOR FOR IRRIGATION FEED TO BUILDING FROM EXISTING SYSTEM.

SEWER SYSTEM NOTES

1. INSTALL 4" DI KITCHEN WASTE LINE TO GREASE INTERCEPTOR. SEE SHEET C6.00 FOR TRENCHING DETAIL.
   4" INV AT BUILDING = 370.82
   5 LF @ S = 0.0200\' (TO NOTE 3)
2. INSTALL 4" DI SEWER LINE TO SEWAGE PUMP STATION.
   4" INV AT BUILDING = 367.25
   5 LF @ S = 0.0200\' (TO NOTE 4)
3. COORDINATE INSTALLATION OF GREASE INTERCEPTOR WITH PLUMBING CONTRACTOR. SEE PLUMBING DRAWINGS FOR DETAILS.
   INV IN = 370.72
   INV OUT = 370.47
   6 LF 4" DI @ S = 0.0200\' (TO NOTE 4)
4. SEWAGE PUMP STATION
   FURNISH AND INSTALL SEWAGE PUMP STATION IN LOCATION AS SHOWN ON THE PLANS. STATION SHALL INCLUDE BUT NOT BE LIMITED TO A CONCRETE WET WELL, LEVEL CONTROL, STAINLESS STEEL GUIDE RAILS, STAINLESS STEEL LIFT CHAIN, SOLIDS HANDLING SEWAGE PUMP, WIRING, WET WELL PIPING, A CONCRETE TOP AND ACCESS HATCH DESIGNED TO ACCOMMODATE AN H-20 WHEEL LOAD, AND DUPLEX CONTROL PANEL FOR AUTOMATIC OPERATION OF PUMPS. EACH PUMP TO HAVE A CAPACITY OF 75 GALLONS PER MINUTE AGAINST A TDH OF 20 FEET.

   WET WELL
   PUMP CHAMBER TO BE A 6-FOOT DIAMETER PRECAST CONCRETE TANK. ACCESS COVER SHALL BE A 48" X 30" HATCH. WET WELL AND COVER SHALL BE DESIGNED TO ACCOMMODATE AN H-20 WHEEL LOADING. WET WELL SHALL BE SEALED AND GROUTED.

   PIPING
   THE DISCHARGE PIPE SHALL BE THREE INCH IN DIAMETER. PIPING WITHIN WET WELL TO BE SCHEDULE 80, OR EQUIVALENT. FORCE MAIN PIPING TO BE SDR-21, OR EQUIVALENT. VALVING TO BE PLACED IN SEPARATE CHAMBER.

   LEVEL CONTROL
   THE LEVEL CONTROL SHALL BE SUBMERSIBLE TRANSDUCER/MERCURY FREE MECHANICAL FLOAT SWITCHES SET TO HEIGHTS AS INDICATED ON PLAN PAGE.

   DUPLEX CONTROL PANEL
   DUPLEX CONTROL PANEL SHALL BE MOUNTED INDOORS, WITH MEANS OF SERVICE POWER DISCONNECT ON BUILDING EXTERIOR IN LINE OF SIGHT FROM PUMP STATION TO ENSURE MAINTENANCE OPERATOR SAFETY DURING SERVICE. CONTROL PANEL TO CONSIST OF THREE CIRCUIT BREAKERS WITH THROUGH-DOOR OPERATING HANDLES (ONE FOR CONTROL POWER AND INDIVIDUAL BREAKERS FOR EACH PUMP), TWO FULL VOLTAGE NON-REVERSING MAGNETIC STARTERS WITH DOOR MOUNTED RESETTABLE OVERLOADS, PUMP RUN INDICATION LIGHTS, LIGHTENING ARRESTOR, PUMP FAULT ALARMS, ALTERNATING RELAY, CYCLE COUNTERS AND ELAPSED TIME METERS, HAND-OFF-AUTO SELECTOR SWITCHES FOR EACH PANEL, ALARM SILENCE BUTTON, ALARM LIGHT WITH CONTACTS TO ALLOW FOR REMOTE MOUNTING OF SECONDARY ALARM LIGHT IN OBVIOUS LOCATION. ALARM LIGHT TO HAVE AMBER COLORED GLOBE. CONTROL TO AUTOMATICALLY PERFORM DUPLEXING AND ALTERNATION.

   CONTROL PANEL TO BE EQUIPPED WITH AUTOMATIC ALARM DIALER FOR NOTIFICATION OF MAINTENANCE PERSONNEL IN EVENT OF AN ALARM OUTSIDE NORMAL OPERATING HOURS.

   PUMP STATION RIM= 377.3
   INV IN (FROM BUILDING) = 367.15
   INV IN (FROM GREASE INTERCEPTOR) = 370.35
   BOTTOM OF BASIN= 364.5±
   105 LF 3" PVC PUMP LINE TO NOTE 5
5. CORE EXISTING SEWER MANHOLE AND CONNECT NEW 2" PUMP LINE.
   RIM= 387.06 (ADJUSTED FROM EXISTING)
   INV IN = 381.67 (MATCH EXISTING)
   INV OUT = 381.57
   78 LF 6" PVC @ S = 0.0075\'/' (TO NOTE 6)
6. INSTALL 4' DIA. SEWER MANHOLE. SEE SHEET C6.03 FOR DETAIL.
   RIM= 389.5
   INV = 380.98
   105 LF 6" PVC @ S = 0.0080\'/' (TO EXISTING)

ELECTRICAL SYSTEM NOTES

1. INSTALL NEW SITE LIGHT POLE TO MATCH CAMPUS STANDARD. SEE ELECTRICAL DRAWINGS FOR FIXTURE INFORMATION.
2. INSTALL SITE LIGHTING CIRCUIT. SEE ELECTRICAL DRAWINGS FOR CONDUIT & CIRCUIT SIZING. SEE SHEET C6.00 FOR TRENCHING DETAIL.
3. INSTALL NEW ELECTRICAL OUTLETS AT TERRACE.

GAS NOTES

1. NEW GAS ENTRANCE. SEE PLUMBING DRAWINGS.
2. COORDINATE WITH GAS COMPANY TO INSTALL NEW GAS SERVICE. SEE PLUMBING DRAWINGS AND SHEET C6.00 FOR TRENCHING DETAIL.
3. NEW 1" GAS LINE FOR OUTDOOR FIREPLACE. COORDINATE WITH GAS COMPANY AND SEE PLUMBING DRAWINGS.

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NO.	DATE	NOTE	NO.	DATE	NOTE
		09/20/24 Planning Board Submission			
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Key Plan

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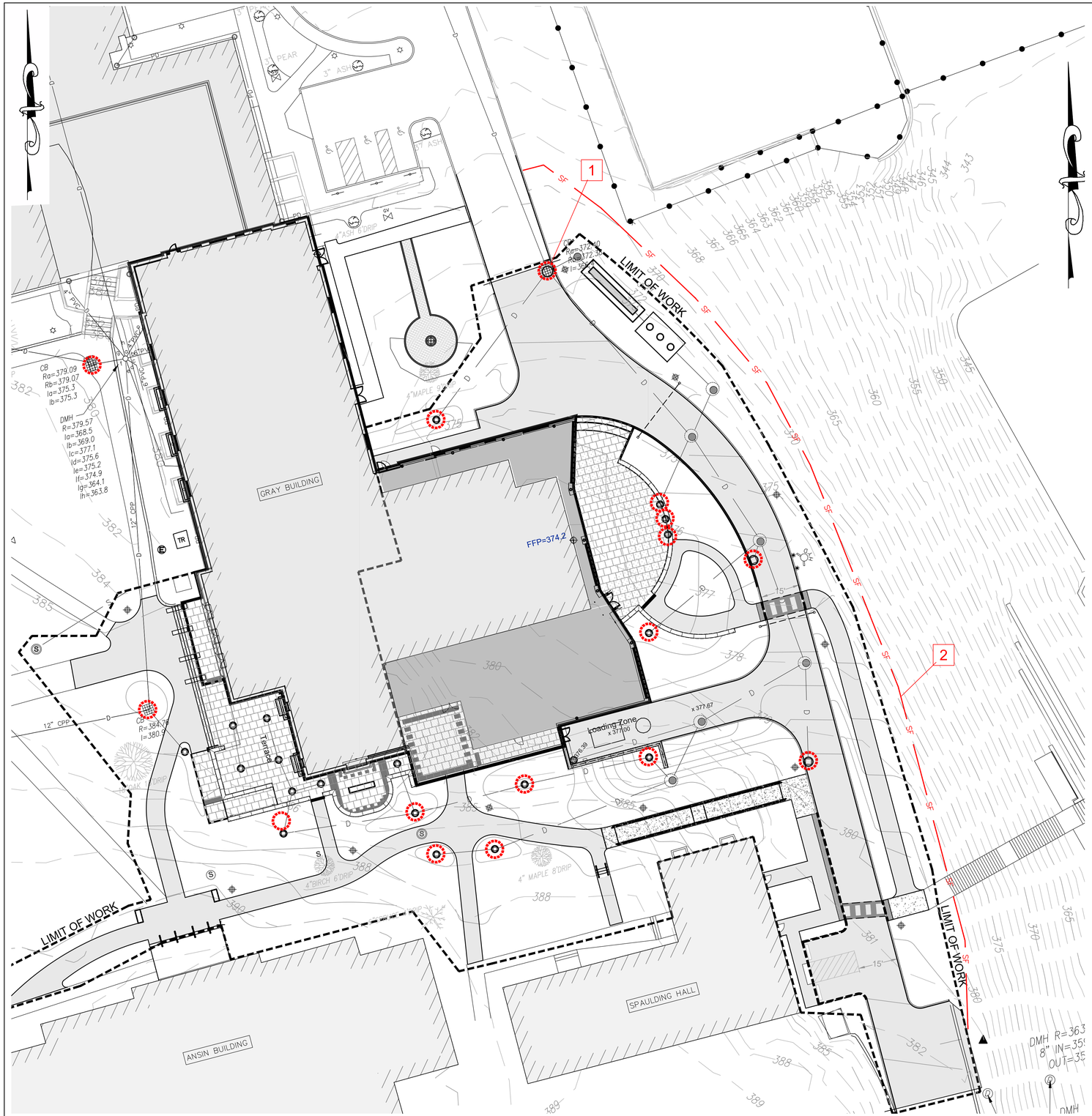
Sheet Title
SITE UTILITIES PLAN

Construction Documents
100% PRICING SET

Drawn By: JKC	Project ID: 2101
Reviewed By:	Scale:
Plot Date: 09/17/24	Issue Date: 09/17/24
Sheet No.	**C4.00**



GRAPHIC SCALE

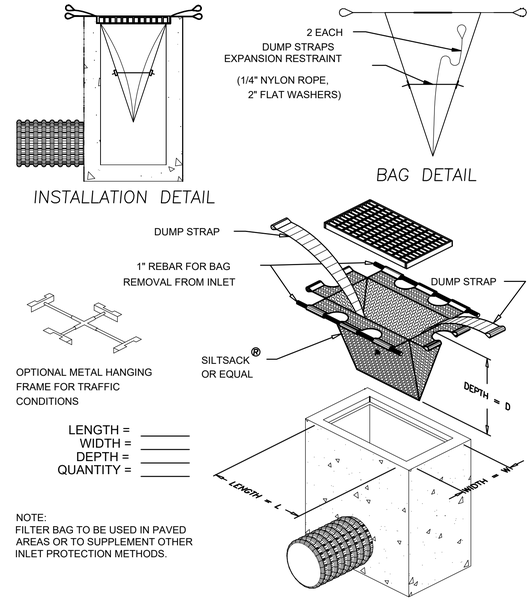
0 20 40 60 100

(IN FEET)
1 INCH = 20 FT.

PLAN NOTES

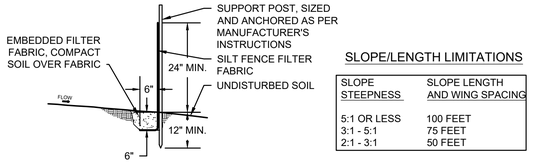
1. INSTALL INLET/ OUTLET PROTECTION AT ALL EXISTING AND PROPOSED CATCH BASINS AND DRAINAGE INLETS/ OUTLETS (TYPICAL.)
2. INSTALL SILT FENCE (TYPICAL) - SUGGESTED LOCATION. CONTRACTOR TO DETERMINE EXACT LOCATIONS AS DICTATED BY FIELD CONDITIONS. SEE DETAIL.

NOTE: EROSION AND SEDIMENTATION CONTROLS SHOWN ARE TO BE CONSIDERED A MINIMUM. THE CONTRACTOR SHALL BE RESPONSIBLE FOR DEVELOPING A STORMWATER POLLUTION PREVENTION PLAN AND MAINTAINING INSPECTION REPORTS THROUGHOUT THE PROJECT AS REQUIRED BY US EPA STORMWATER NPDES PERMIT.



NOTE:
FILTER BAG TO BE USED IN PAVED AREAS OR TO SUPPLEMENT OTHER INLET PROTECTION METHODS.

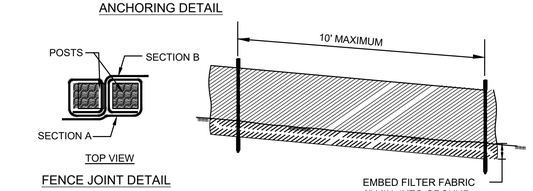
INLET PROTECTION DETAIL
(FILTER BAG METHOD)
NOT TO SCALE



SLOPE/LENGTH LIMITATIONS

SLOPE STEEPNESS	SLOPE LENGTH AND WING SPACING
5:1 OR LESS	100 FEET
3:1 - 5:1	75 FEET
2:1 - 3:1	50 FEET

ANCHORING DETAIL



FENCE JOINT DETAIL

PERSPECTIVE DETAIL

CONSTRUCTION NOTES

1. SECURELY FASTEN FILTER FABRIC TO FENCE POSTS WITH WIRE TIES OR STAPLES, UNLESS PRE-ASSEMBLED.
2. WHEN TWO SECTIONS OF FILTER FABRIC ADJOIN EACH OTHER, OVERLAP SECTIONS BY 6 INCHES, FOLD, AND STAPLE AT A POST.
3. PLACE SILT FENCE 6 FEET MINIMUM DOWNGRADIENT FROM THE TOE OF SLOPE. SILT FENCE SHALL BE PLACED ALONG THE CONTOUR. IF THE FENCE CANNOT BE PLACED ALONG THE CONTOUR THE FENCE SHALL BE INSTALLED WITH PERPENDICULAR WINGS TO BREAK VELOCITY OF WATER FLOWING ALONG THE FENCE. PERPENDICULAR WINGS SHALL ALSO BE PLACED AT THE END OF THE SILT FENCE RUNS.
4. PROVIDE CLOSER FENCE POST SPACING IN AREAS WHERE HIGH RUNOFF VOLUMES ARE ANTICIPATED, OR IN LOW SPOTS WHERE SEDIMENT WILL BE COLLECTED.
5. MAINTAIN SILT FENCE UNTIL ALL UPSLOPE SOILS ARE STABILIZED.
6. SEDIMENT DEPOSITION SHALL BE REMOVED, AT A MINIMUM WHEN IT HAS ACCUMULATED TO ONE-THIRD OF THE FENCE HEIGHT.

SILT FENCE DETAIL
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Key Plan

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Sheet Title
EROSION CONTROL PLAN

Construction Documents
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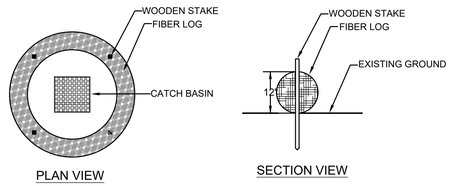
Drawn By: JKC	Project ID: 2101
Reviewed By:	Scale:
Plot Date: 09/17/24	Issue Date: 09/17/24

Sheet No.
C5.00

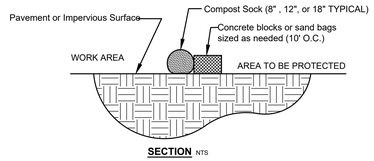


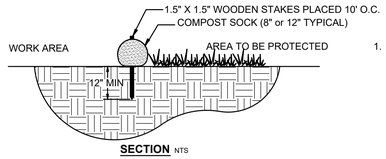
NOTES:

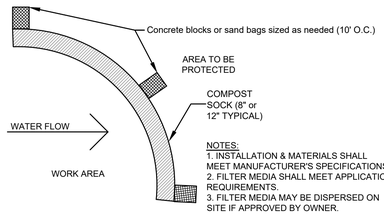
1. INSTALL FIBER LOG AROUND THE CATCH BASIN WITH ENDS TIGHTLY ADJOINED.
2. EACH FIBER LOG SHALL BE ANCHORED IN PLACE USING MINIMUM OF 4 WOODEN STAKES. WHEN USED ON PAVEMENT CONCRETE BLOCKS SHALL BE USED BEHIND THE FIBER LOG.
3. EACH FIBER LOG SHALL BE INSPECTED REGULARLY AND AFTER EVERY RAINFALL. REPAIR OR REPLACE AS NECESSARY.

INLET PROTECTION DETAIL (FIBER LOG LOG METHOD)

NOT TO SCALE

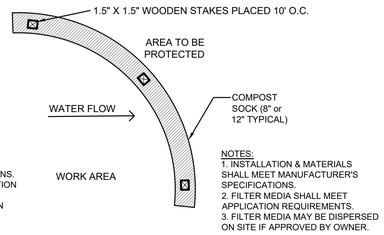






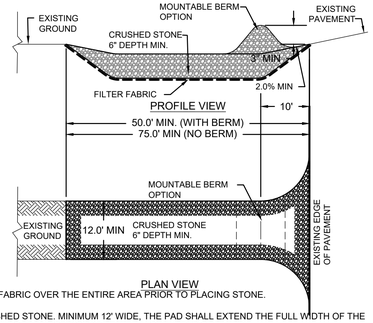
COMPOST SOCK FOR SEDIMENT CONTROL ON PAVEMENT

NOT TO SCALE



COMPOST SOCK FOR SEDIMENT CONTROL

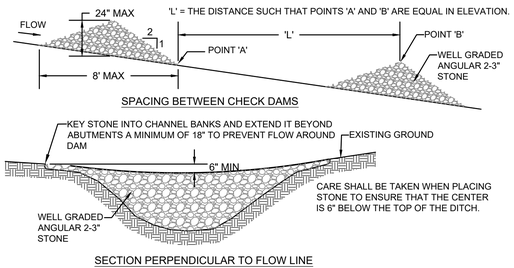
NOT TO SCALE



1. PLACE FILTER FABRIC OVER THE ENTIRE AREA PRIOR TO PLACING STONE.
2. PLACE 3" CRUSHED STONE. MINIMUM 12' WIDE, THE PAD SHALL EXTEND THE FULL WIDTH OF THE CONSTRUCTION ACCESS ROAD OR 12 FEET, WHICHEVER IS GREATER.
3. THE ENTRANCE SHALL BE MAINTAINED IN A CONDITION WHICH WILL PREVENT TRACKING OR FLOWING OF SEDIMENT ONTO PUBLIC RIGHTS-OF-WAY. ALL SEDIMENT SPILLED, DROPPED, WASHED, OR TRACKED ONTO PUBLIC RIGHTS-OF-WAY MUST BE REMOVED IMMEDIATELY. REPLENISH OR REPLACE STONE AS REQUIRED TO MAINTAIN ABILITY TO RETAIN SOIL PARTICLES.

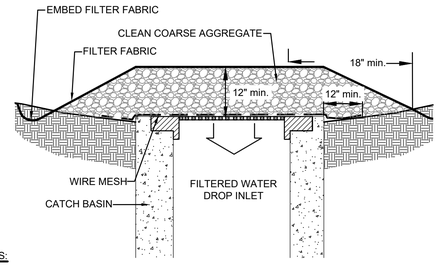
TEMPORARY CONSTRUCTION EXIT DETAIL

NOT TO SCALE



STONE CHECK DAM DETAIL

NOT TO SCALE

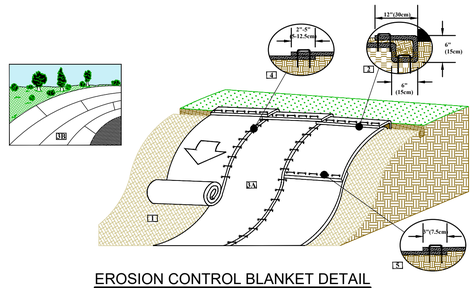


NOTES:

1. PLACE WIRE MESH OVER THE DROP INLET OR CURB OPENING SO THAT THE ENTIRE OPENING AND A MINIMUM OF 12 INCHES AROUND THE OPENING ARE COVERED BY THE WIRE MESH. THE MESH MAY BE ORDINARY HARDWARE CLOTH OR WIRE MESH WITH OPENINGS UP TO 1/2 INCH.
2. THE WIRE MESH SHOULD BE COVERED WITH CLEAN COARSE AGGREGATE SUCH AS SEWER STONE TO A MINIMUM DEPTH OF 12 INCHES AND EXTEND A MINIMUM OF 18" BEYOND THE DRAIN OPENING.
3. PLACE FILTER FABRIC OVER THE TOP OF THE STONE AND EMBED 6" DEEP AROUND STONE.
4. INSPECT FILTER FABRIC AND STONE REGULARLY. CLEAN AND REPLACE FABRIC AND STONE AS NECESSARY.
5. REMOVE SEDIMENT BUILD-UP AROUND STONE WHEN IT REACHES A DEPTH OF 6 INCHES.

INLET PROTECTION DETAIL (GRAVEL & WIRE MESH FILTER METHOD)

NOT TO SCALE



EROSION CONTROL BLANKET DETAIL

NOT TO SCALE

1. Prepare soil before installing rolled erosion control products (RECPs), including any necessary application of lime, fertilizer, and seed.
2. Begin at the top of the slope by anchoring the RECPs in a 6" deep X 6" wide trench with approximately 12" of RECPs extended beyond the up-slope portion of the trench. Anchor the RECPs with a row of staples/stakes approximately 12" apart in the bottom of the trench. Backfill and compact the trench after stapling. Apply seed to the compacted soil and fold the remaining 12" portion of RECPs back over the seed and compacted soil. Secure RECPs over compacted soil with a row of staples/stakes spaced approximately 12" apart across the width of the RECPs.
3. Roll the RECPs (A) down or (B) horizontally across the slope. RECPs will unroll with appropriate side against the soil surface. All RECPs must be securely fastened to soil surface by placing staples/stakes in appropriate locations as shown in the staple pattern guide.
4. The edges of parallel RECPs must be stapled with approximately 2" - 5" overlap depending on the RECPs type.
5. Consecutive RECPs spliced down the slope must be end over end (Shingle style) with an approximate 3" overlap. Staple through overlapped area, approximately 12" apart across entire RECPs width.

*NOTE:
In loose soil conditions, the use of staple or stake lengths greater than 6" may be necessary to properly secure the RECPs.

EROSION CONTROL METHODS

1. TEMPORARY AND PERMANENT MULCHING:
   a. HAY AND STRAW MULCHES SHALL BE ANCHORED WITH MULCH NETTING, TACKIFIER, SO THAT THEY ARE NOT BLOWN AWAY BY WIND OR WASHED AWAY BY FLOWING WATER.
   b. MULCH MATERIALS SHALL BE SELECTED BASED UPON SOILS, SLOPE, FLOW CONDITIONS, AND TIME OF YEAR; ALL MULCH MATERIALS SHALL BE APPROVED BY ENGINEER.
   c. HAY OR STRAW MULCH SHALL BE APPLIED AT A RATE OF 1.5 TO 2 TONS PER ACRE OR 70 TO 90 LBS PER 1000 SQUARE FEET.
   d. WOOD CHIPS OR GROUND BARK SHALL BE APPLIED AT 2 TO 6 INCHES DEEP AT A RATE OF 10 TO 20 TONS PER ACRES OR 460 TO 920 LBS PER 1000 SQUARE FEET.
   e. JUTE AND FIBROUS MATS AND WOOD EXCELSIOR SHALL BE INSTALLED ACCORDING TO MANUFACTURER'S RECOMMENDATIONS.
   f. EROSION CONTROL MIX SHALL BE PLACED AT A MINIMUM THICKNESS OF 2 INCHES.
2. VEGETATION:
   a. STONES AND TRASH SHALL BE REMOVED SO AS NOT TO INTERFERE WITH SEEDING AREA.
   b. ON SLOPES 4:1 OR STEEPER THE FINAL PREPARATION SHALL INCLUDE TRACKING TO CREATE HORIZONTAL GROOVES PERPENDICULAR TO THE SLOPE TO CATCH SEED AND REDUCE RUNOFF EROSION POTENTIAL.
   c. FERTILIZER AND ORGANIC SOIL AMENDMENTS SHALL BE APPLIED DURING THE GROWING SEASON AS PER SPECIFICATIONS.
   d. RUNOFF SHALL BE DIVERTED FROM THE SEEDED AREA.
   e. SEEDING SHALL OCCUR PRIOR SEPTEMBER 15TH.
   f. AREAS SEEDED BETWEEN MAY 15TH TO AUGUST 15TH SHALL BE COVERED WITH HAY OR STRAW MULCH AS INDICATED ABOVE.
   g. VEGETATED GROWTH COVERING AT LEAST 85% OF THE DISTURBED AREA SHALL BE ACHIEVED PRIOR TO OCTOBER 15TH.
3. TEMPORARY EROSION CONTROL BLANKETS:
   a. BLANKETS SHALL BE INSTALLED PER THE MANUFACTURER'S SPECIFICATIONS.
   b. BLANKETS SHALL BE PLACED WITHIN 24 HOURS AFTER SOWING SEED IN THAT AREA.
   c. BLANKETS SHALL BE ANCHORED AT THE TOP OF THE SLOPE IN A TRENCH PER MANUFACTURER'S INSTRUCTIONS.
   d. BLANKETS SHALL BE UNROLLED IN THE DIRECTION OF THE WATER FLOW, OVERLAPPING EDGES AND STAPLING PER MANUFACTURER'S INSTRUCTIONS.
   e. BLANKETS SHALL BE LAID LOOSELY OVER THE SOILS, MAINTAINING CONTACT WITH THE SOIL, AND NOT STRETCHED.

SEDIMENT CONTROL METHODS

1. SILT FENCES:
   a. FENCES SHALL BE USED IN AREAS WHERE EROSION WILL OCCUR ONLY IN THE FORM OF SHEET EROSION AND THERE IS NO CONCENTRATION OF WATER IN A CHANNEL OR DRAINAGE WAY ABOVE THE FENCE.
   b. THE MAXIMUM CONTRIBUTING DRAINAGE AREA ABOVE THE FENCE SHALL BE LESS THAN 1/4 ACRE PER 100 LINEAR FEET OF FENCE.
   c. THE MAXIMUM LENGTH OF SLOPE ABOVE THE FENCE SHALL BE 100 FEET.
   d. THE MAXIMUM SLOPE ABOVE THE FENCE SHALL BE 2:1.
   e. FENCES SHALL BE INSTALLED IN ACCORDANCE WITH THE DETAIL.
   f. FENCES SHALL BE INSPECTED AND MAINTAINED IN ACCORDANCE WITH THE DETAIL.
2. EROSION CONTROL BERM MIX:
   a. BERMS SHALL BE USED IN AREAS WHERE EROSION WILL ONLY OCCUR IN THE FORM OF SHEET EROSION AND THERE IS NO CONCENTRATION OF WATER IN A CHANNEL OR DRAINAGE WAY ABOVE THE BERM.
   b. THE BERM SHALL BE INSTALLED FOLLOWING THE CONTOUR OF THE LAND AS CLOSE AS POSSIBLE.
   c. THE BERMS SHALL NO BE USED UNLESS THE AREA UPSLOPE OF THE BERM HAS A SLOPE OF LESS THAN 5%.
   d. THE MIX SHALL HAVE AN ORGANIC PORTION BETWEEN 25% AND 65%, DRY WEIGHT BASIS, AND BE FIBROUS AND ELONGATED SUCH AS FROM SHREDDED BARK, STUMP GRINDINGS, COMPOSTED BARK, OR EQUIVALENT MANUFACTURED PRODUCTS.
   e. WOOD AND BARK CHIPS, GROUND CONSTRUCTION DEBRIS, OR REPROCESSED WOOD PRODUCTS SHALL NOT BE USED AS ORGANIC MATERIAL.
   f. THE MIX SHALL NOT CONTAIN SILTS, CLAYS, OR FINE SANDS.
   g. THE MIX HALL HAVE A PARTICLE SIZE BY WEIGHT OF

SIEVE SIZE	% PASSING
3" SCREEN	100%
1" SCREEN	90-100%
3/4" SCREEN	70-100%
1/4" SCREEN	30-75%

   h. THE MIX SHALL HAVE A PH BETWEEN 5.0 AND 8.0.
   i. THE BERM SHALL BE AT LEAST 12" HIGH AND 24" WIDE.
3. STRAW OR HAY BALE BARRIERS:
   a. THE BARRIERS SHALL BE USED IN AREAS WHERE EROSION WILL OCCUR ONLY IN THE FORM OF SHEET EROSION AND THERE IS NO CONCENTRATION OF WATER IN A CHANNEL OR DRAINAGE WAY ABOVE THE BARRIER.
   b. THE MAXIMUM LENGTH OF SLOPE ABOVE THE FENCE SHALL BE 100 FEET.
   c. THE MAXIMUM SLOPE ABOVE THE FENCE SHALL BE 2:1.
   d. THE BARRIERS SHALL BE INSTALLED IN ACCORDANCE WITH THE DETAIL.
   f. THE BARRIERS SHALL BE INSPECTED AND MAINTAINED IN ACCORDANCE WITH THE DETAIL.
4. TEMPORARY STONE CHECK DAMS:
   a. THE MAXIMUM CONTRIBUTING DRAINAGE AREA ABOVE THE CHECK DAM SHALL BE LESS THAN 1ACRE.
   b. THE CHECK DAMS SHALL BE INSTALLED IN ACCORDANCE WITH THE DETAIL ON THIS SHEET.
   c. THE CHECK DAMS SHALL NOT BE USED IN FLOWING STREAMS.
   d. THE BARRIERS SHALL BE INSPECTED AND MAINTAINED IN ACCORDANCE WITH THE DETAIL.
5. TEMPORARY CATCH BASIN INLET PROTECTION:
   a. THE MAXIMUM CONTRIBUTING DRAINAGE AREA TO THE CATCH BASIN SHALL BE LESS THAN 1ACRE.
   b. ACCEPTABLE METHODS OF INLET PROTECTION ARE GRAVEL AND WIRE MESH FILTER, FILTER BAG, OR FIBER LOG.
   c. THE INLET PROTECTION METHOD SHALL BE INSTALLED IN ACCORDANCE WITH THE DETAILS ON THIS SHEET.
   d. THE INLET PROTECTION METHOD SHALL BE INSPECTED AND MAINTAINED IN ACCORDANCE WITH THE DETAIL.

SEDIMENT CONTROL METHODS (continued)

6. TEMPORARY CONSTRUCTION EXIT:
   a. THE TEMPORARY CONSTRUCTION EXIT(S) SHALL BE INSTALLED IN ALL AREAS WHERE TRACKING OF SEDIMENT OFF THE CONSTRUCTION SITE IS POSSIBLE.
   b. THE TEMPORARY CONSTRUCTION EXIT SHALL BE INSTALLED IN ACCORDANCE WITH THE DETAILS ON THIS SHEET.
   c. THE TEMPORARY CONSTRUCTION EXIT SHALL BE INSPECTED AND MAINTAINED IN ACCORDANCE WITH THE DETAIL ON THIS SHEET.
7. TEMPORARY SEDIMENT TRAP:
   a. THE TRAP SHALL BE INSTALLED AS CLOSE TO THE DISTURBED AREA OR SOURCE OF SEDIMENT AS POSSIBLE.
   b. THE MAXIMUM CONTRIBUTING DRAINAGE AREA TO THE CATCH BASIN SHALL BE LESS THAN 5 ACRES.
   c. THE TEMPORARY SEDIMENT TRAP SHALL BE INSTALLED IN ACCORDANCE WITH THE DETAILS.
   d. THE TEMPORARY SEDIMENT TRAP SHALL BE INSPECTED AND MAINTAINED IN ACCORDANCE WITH THE DETAIL.

CONSTRUCTION SEQUENCE

1. INSTALL SEDIMENTATION CONTROL (DEVICES) IN LOCATIONS SHOWN ON PLANS AND ANY OTHER LOCATION DEEMED NECESSARY PRIOR TO ANY EARTH MOVING OR BLASTING OPERATION.
2. REMOVE TOPSOIL AND STOCKPILE AWAY FROM ANY WETLAND. STABILIZE STOCKPILE IMMEDIATELY BY SEEDING OR COVERING. STOCKPILE SHALL BE ENCLOSED WITH SILT FENCE OR OTHER SUITABLE EROSION CONTROL DEVICE.
3. REMOVE EXISTING STRUCTURES AND IMPROVEMENTS NECESSARY TO PERMIT CONSTRUCTION AND SITE WORK AS SHOWN ON THE PLANS.
4. ROUGH GRADE THE SITE. ALL CUT AND FILL SLOPES SHALL BE STABILIZED UPON COMPLETION OF ROUGH GRADING PER THE EROSION CONTROL NOTES.
5. INSTALL DRAINAGE PIPES AND STRUCTURES. STABILIZE IMMEDIATELY PER THE EROSION CONTROL NOTES. RUNOFF SHALL NOT BE DIRECTED TOWARDS PERMANENT EROSION CONTROL STRUCTURES UNTIL THEY HAVE BEEN STABILIZED.
6. INSTALL SEDIMENTATION CONTROL AT NEW CATCH BASINS ACCORDING TO DETAIL HEREON. INSPECT AND MAINTAIN EROSION CONTROL MEASURES ON A DAILY BASIS AND AFTER ANY STORMS.
7. DAILY, OR AS REQUIRED, CONSTRUCT TEMPORARY BERMS, CULVERT, DITCHES, SILT FENCES, SEDIMENT TRAPS, ETC. MULCH AND SEED AS REQUIRED.
8. CONSTRUCT SITE IMPROVEMENTS.
9. FINISH GRADE THE SITE TO PREPARE FOR PAVING AND LOAMING. ALL DISTURBED AREAS SHALL BE STABILIZED WITHIN 72 HOURS AFTER FINAL GRADING.
10. PERFORM FINISH PAVING. PERMANENT SEEDING SHALL BE PERFORMED UPON COMPLETION OF PAVING PER EROSION CONTROL NOTES.
11. TEMPORARY EROSION CONTROL MEASURES SHALL BE REMOVED ONCE ALL DISTURBED AREAS HAVE BEEN STABILIZED.

EROSION & SEDIMENTATION CONTROL NOTES

1. EROSION AND SEDIMENTATION CONTROL DEVICES SHALL BE INSTALLED AS SHOWN ON THE CONSTRUCTION DOCUMENTS OR AS MODIFIED BY THE STORMWATER POLLUTION PREVENTION PLAN.
2. EROSION AND SEDIMENTATION CONTROL METHODS EMPLOYED SHALL BE IN ACCORDANCE WITH ALL FEDERAL, STATE, AND LOCAL REQUIREMENTS.
3. EROSION AND SEDIMENTATION CONTROL METHODS SHALL BE INSPECTED WEEKLY OR WITHIN 24 HOURS OF ANY 0.5" OR GREATER RAINFALL EVENT.
4. WEEKLY INSPECTION LOGS SHALL BE MAINTAINED ON SITE AND SHALL BE MADE AVAILABLE TO FEDERAL, STATE, OR LOCAL OFFICIALS.
5. THE SMALLEST PRACTICAL AREA OF LAND SHALL BE EXPOSED AT ANY ONE TIME. ALL NON-ACTIVE DISTURBED AREAS (CLEARED FOR CONSTRUCTION BUT NOT CURRENTLY UNDERGOING CONSTRUCTION) SHALL BE STABILIZED WITHIN 14 DAYS OF DISTURBANCE. MAXIMUM EXPOSED AREA AT ANY TIME SHALL BE LIMITED TO 5 ACRES OR LESS.
6. DISTURBED SLOPES SHALL BE PROTECTED WITH JUTE MATTING UNTIL STABILIZED.
7. THE CONTRACTOR SHALL LIMIT THE AREAS OF EXPOSURE TO 45 DAYS MAXIMUM WITHOUT FINAL STABILIZATION.
8. AN AREA SHALL BE CONSIDERED STABLE IF ONE OF THE FOLLOWING HAS OCCURED:
   A. BASE COURSE GRAVELS HAVE BEEN INSTALLED IN AREAS TO BE PAVED.
   B. A MINIMUM OF 85 % VEGETATED GROWTH HAS BEEN ESTABLISHED.
   C. A MINIMUM OF 3 INCHES OF NON-EROSION MATERIAL SUCH AS STONE OR RIP-RAP HAS BEEN INSTALLED.
   D. EROSION CONTROL BLANKETS HAVE BEEN PROPERLY INSTALLED.
9. PERMANENT SEEDING AND LOAMING SHALL CONFORM TO THE PROJECT SPECIFICATIONS MANUAL.
10. ALL EROSION CONTROL DEVICES SHOWN ON THESE PLANS ARE THE MINIMUM RECOMMENDED. THE CONTRACTOR IS RESPONSIBLE FOR INSTALLING ADDITIONAL EROSION CONTROL DEVICES AS DEEMED NECESSARY.

COLD WEATHER STABILIZATION MEASURES

1. COLD WEATHER STABILIZATION TECHNIQUES APPLY FROM NOVEMBER 30 THROUGH MAY 1.
2. THE AREA OF EXPOSED, UNSTABILIZED SOIL SHALL BE LIMITED TO ONE ACRE AND SHALL BE PROTECTED AGAINST EROSION BY METHODS INDICATED ON THE PLANS PRIOR TO TO ANY THAW OR SPRING MELT EVENT.
3. ALL PROPOSED VEGETATED AREAS HAVING A SLOPE OF LESS THAN 15% WHICH DO NOT EXHIBIT A MINIMUM OF 85% VEGETATIVE GROWTH BY NOVEMBER 30, OR WHICH ARE DISTURBED AFTER NOVEMBER 30, SHALL BE SEEDED AND COVERED WITH 3 TO 4 TONS OF HAY OR STRAW MULCH PER ACRE SECURED WITH ANCHORED NETTING OR TACKIFIER, OR WITH A MINIMUM OF 2 INCHES OF EROSION CONTROL MIX.
4. ALL PROPOSED VEGETATED AREAS HAVING A SLOPE GREATER THAN 15% WHICH DO NOT EXHIBIT A MINIMUM OF 85% VEGETATIVE GROWTH BY NOVEMBER 30, OR WHICH ARE DISTURBED AFTER NOVEMBER 30, SHALL BE SEEDED AND COVERED WITH A PROPERLY INSTALLED AND ANCHORED EROSION CONTROL BLANKET OR WITH A MINIMUM OF 4 INCHES OF EROSION CONTROL MIX.
5. INSTALLATION OF ANCHORED HAY MULCH OR EROSION CONTROL MIX SHALL NOT OCCUR OVER SNOW OF GREATER THAN ONE INCH IN DEPTH.
6. INSTALLATION OF EROSION CONTROL BLANKETS SHALL NOT OCCUR OVER SNOW OF GREATER THAN ONE INCH IN DEPTH OR ON FROZEN GROUND.
7. ALL PROPOSED STABILIZATION IN ACCORDANCE WITH 3 AND 4 ABOVE, SHALL BE COMPLETED WITHIN A DAY OF ESTABLISHING THE GRADE THAT IS FINAL OR THE OTHERWISE WILL EXIST FOR MORE THAN 5 DAYS.
8. ALL DITCHES AND SWALES WHICH DO NOT EXHIBIT A MINIMUM OF 85% VEGETATIVE GROWTH BY NOVEMBER 30, OR WHICH ARE DISTURBED AFTER NOVEMBER 30, SHALL BE STABILIZED TEMPORARILY WITH STONE OR EROSION CONTROL BLANKETS APPROPRIATE FOR THE DESIGN FLOW CONDITIONS, AS DETERMINED BY THE DESIGN ENGINEER.
9. AFTER NOVEMBER 30, INCOMPLETE ROAD OR PARKING AREAS WHERE ACTIVE CONSTRUCTION HAS STOPPED FOR THE WINTER SEASON SHALL BE PROTECTED WITH A MINIMUM 3 INCH LAYER OF BASE COURSE GRAVELS MEETING NHDOT ITEM NO. 304.1 OR 304.2.

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NO.	DATE	NOTE	NO.	DATE	NOTE
	09/20/24	Planning Board Submission			
REVISIONS			ISSUE		

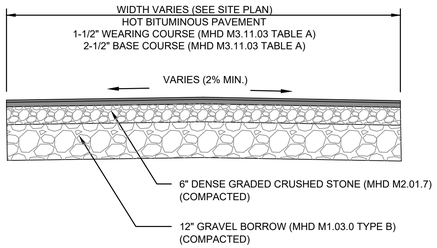
Key Plan

Stamp

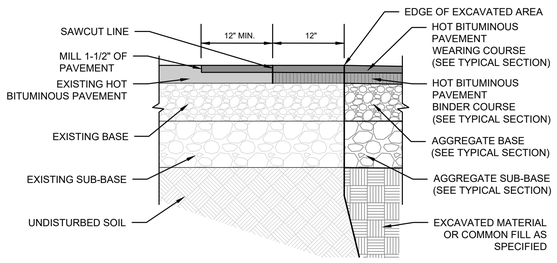
Sheet Title
EROSION CONTROL PLAN

Construction Documents
100% PRICING SET

Drawn By: JKC	Project ID: 2101
Reviewed By	Scale
Plot Date: 09/17/24	Issue Date: 09/17/24
Sheet No.	**C5.01**



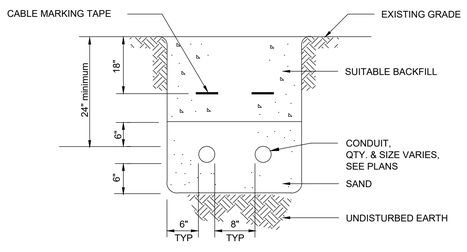
TYPICAL PAVEMENT SECTION
NOT TO SCALE



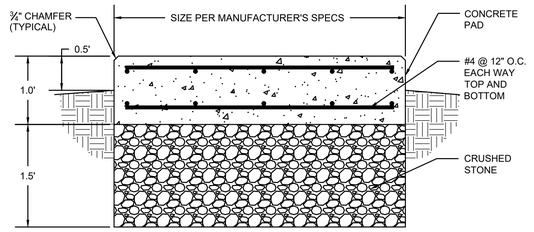
EXISTING PAVEMENT INTERFACE DETAIL
NOT TO SCALE

NOTE
1. CONTRACTOR SHALL PROVIDE EXCAVATION AND SAND BACKFILL.
2. LPG COMPANY TO PROVIDE AND INSTALL LP GAS PIPE AND MARKING TAPE.
3. CONTRACTOR SHALL COORDINATE WITH THE LP GAS COMPANY.

LP GAS LINE TRENCH DETAIL
NOT TO SCALE

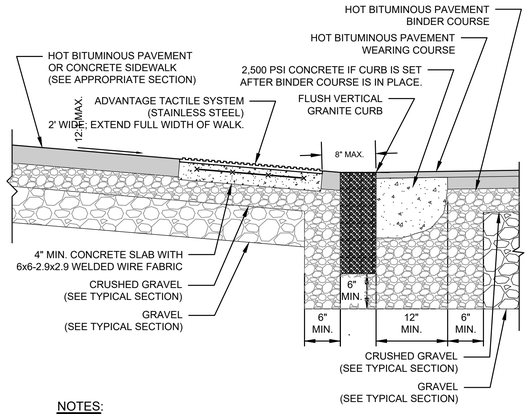


SEE ELECTRICAL SITE SHEETS FOR ADDITIONAL INFORMATION.
TYPICAL POWER / TELECOM TRENCH DETAIL
NOT TO SCALE



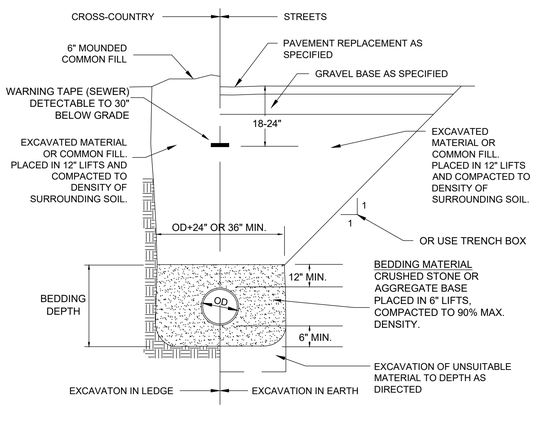
EXTERIOR EQUIPMENT PAD
NOT TO SCALE

NOTE:
ANCHOR EQUIPMENT PER MANUFACTURER'S SPECIFICATIONS

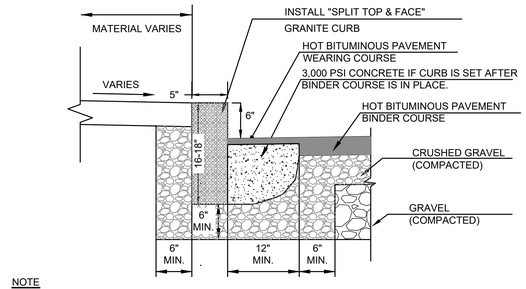


NOTES:
1. SEE ROAD AND WALK SECTIONS FOR MATERIAL THICKNESSES.

ACCESSIBLE TIP DOWN WITH STAINLESS STEEL DETECTABLE WARNING SURFACE DETAIL
NOT TO SCALE

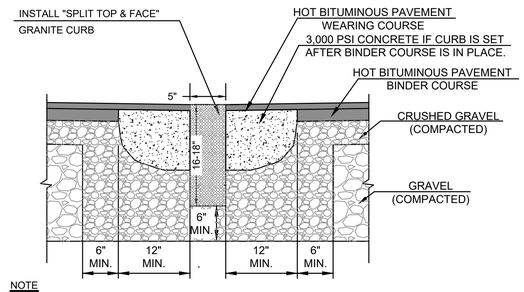


OD= MAXIMUM OUTSIDE PIPE DIAMETER
TYPICAL SEWER TRENCH DETAIL
NOT TO SCALE



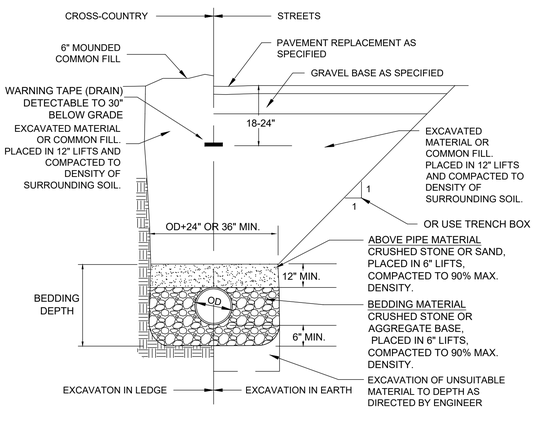
NOTE
1. SEE ROAD SECTION FOR MATERIAL THICKNESSES.

VERTICAL GRANITE CURB DETAIL
NOT TO SCALE

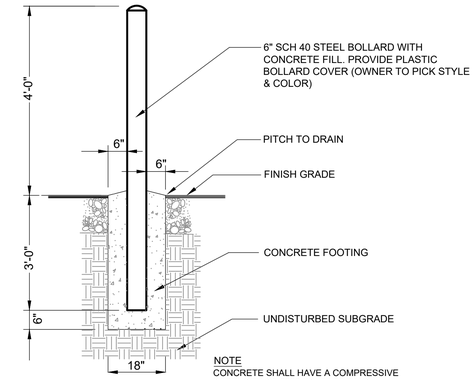


NOTE
1. SEE ROAD SECTION FOR MATERIAL THICKNESSES.

FLUSH VERTICAL GRANITE CURB DETAIL
NOT TO SCALE

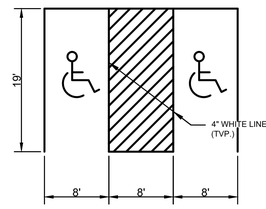


OD= MAXIMUM OUTSIDE PIPE DIAMETER
TYPICAL DRAINAGE TRENCH DETAIL
NOT TO SCALE

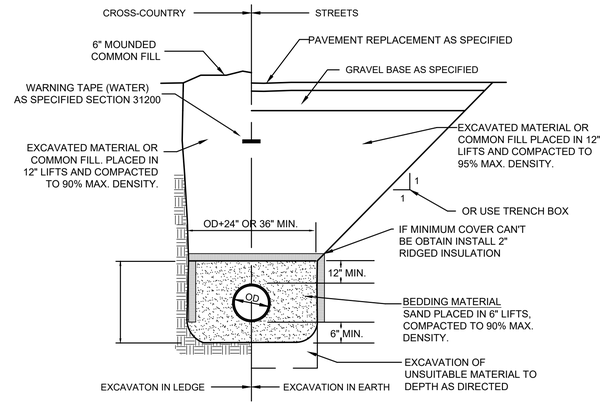


NOTE
CONCRETE SHALL HAVE A COMPRESSIVE STRENGTH OF 3000 PSI AT 28 DAYS.

BOLLARD DETAIL
NOT TO SCALE



90° ACCESSIBLE VAN LAYOUT DETAIL
NOT TO SCALE



NOTE: OD= MAXIMUM OUTSIDE PIPE DIAMETER

TYPICAL WATER TRENCH DETAIL
NOT TO SCALE

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Boston, MA 02135

NO.	DATE	NOTE	NO.	DATE	NOTE
		09/20/24 Planning Board Submission			
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Sheet Title
CIVIL DETAILS

Construction Documents
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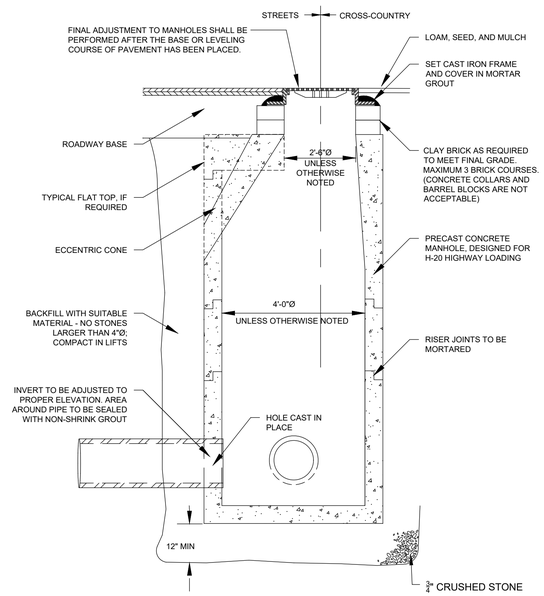
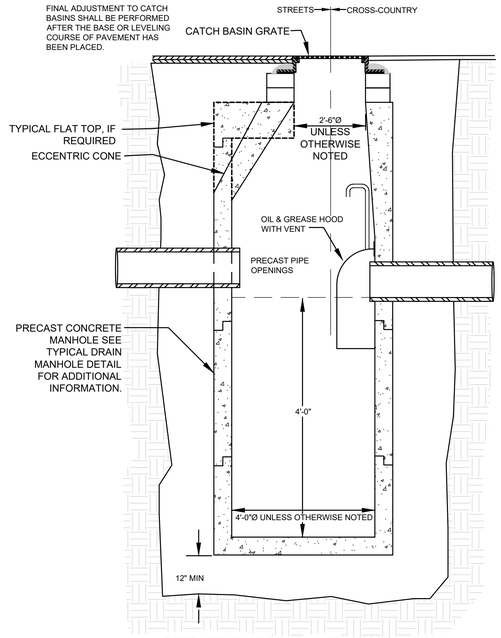
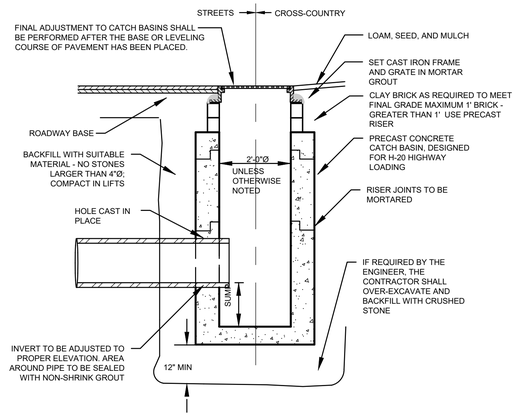
Drawn By: JKC	Project ID: 2101
Reviewed By	Scale
Plot Date: 09/17/24	Issue Date: 09/17/24
Sheet No.	**C6.00**



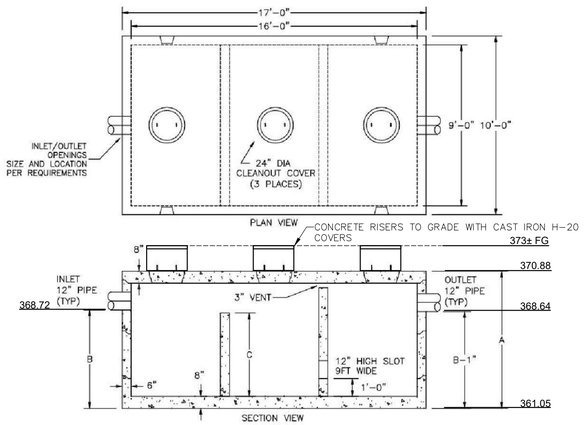
TYPICAL DRAIN MANHOLE DETAIL
NOT TO SCALE



DEEP SUMP HOODED CATCH BASIN DETAIL
NOT TO SCALE



TYPICAL CONCRETE YARD DRAIN DETAIL
NOT TO SCALE



5000-GALLON WQI SHALL BE BY SHEA CONCRETE OR EQUAL.

SHEA CONCRETE PRODUCTS — New England's Premier Precaster
800-696-7432 (SHEA) www.sheaconcrete.com
BILLING ADDRESS: 87 HAVERHILL RD, AMESBURY MA 01913

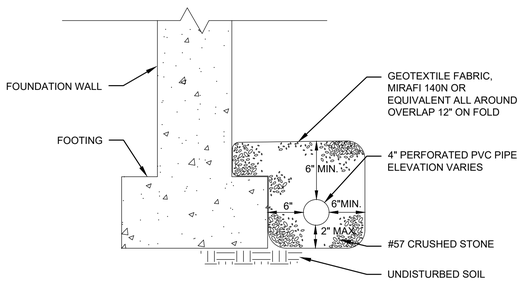
NOTES:

1. CONCRETE: 5,000 PSI MINIMUM AFTER 28 DAYS.
2. DESIGNED FOR AASHTO HS-20 LOADING, COVER 1 TO 5 FEET.
3. TONGUE AND GROOVE JOINT SEALED WITH BUTYL RESIN. INLET HEIGHT MAY INCREASE SLIGHTLY DUE TO THE BUTYL RESIN USED.

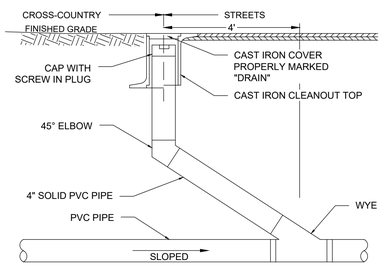
GALLONS	A (HEIGHT)	B (INLET)	C (BAFFLE)	WEIGHT (LBS)
5,000	92"	66"	56"	58,180
7,500	118"	92"	82"	66,510
10,000	146"	120"	110"	75,500

*OTHER SIZES AVAILABLE

WATER QUALITY INLET DETAIL
NOT TO SCALE



FOUNDATION DRAIN DETAIL
NOT TO SCALE



TYPICAL STORM DRAIN CLEANOUT DETAIL
NOT TO SCALE

Lawrence Academy
Community Commons Addition & Gray Building Renovation
26 POWDER HOUSE ROAD
GROTON, MA 01450

FLANSBURGH
77 NORTH WASHINGTON STREET
BOSTON, MA 02114-1910
FLANSBURGH.COM

Consultants

Rist-Frost- Shumway Eng. P. C.:
NH: 71 Water St | Laconia, NH 03246
P: 603.524.4647
MA: 24 Federal St, 3rd Floor | Boston, MA 02110
P: 617.494.1464
ME: 82 Hanover St, Suite 2 | Portland, ME 04101
P: 207.761.4647
www.rfsengineering.com
RFS Project #: 9686.002

Brown Sardina, Inc.:
Landscape Architect
24 Roland Street
Boston, MA 02129

Crabtree McGrath:
Food Service
161 West Main Street
Georgetown, MA 01833

Le Messurier:
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Sheet Title: **CIVIL DETAILS**

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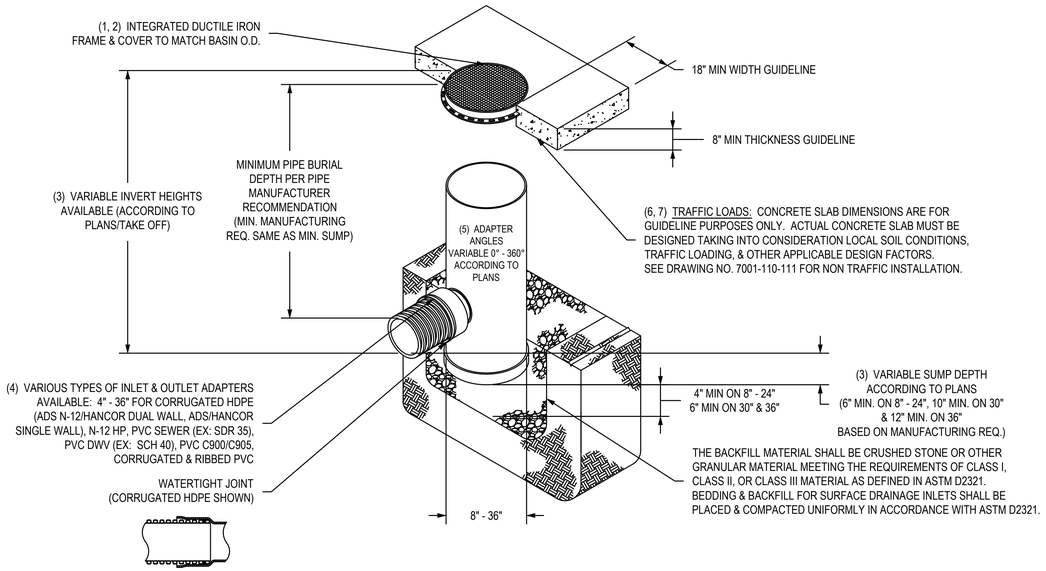
Drawn By	Project ID
JKC	2101
Reviewed By	Scale
Plot Date: 09/17/24	Issue Date: 09/17/24

Sheet No.
C6.01

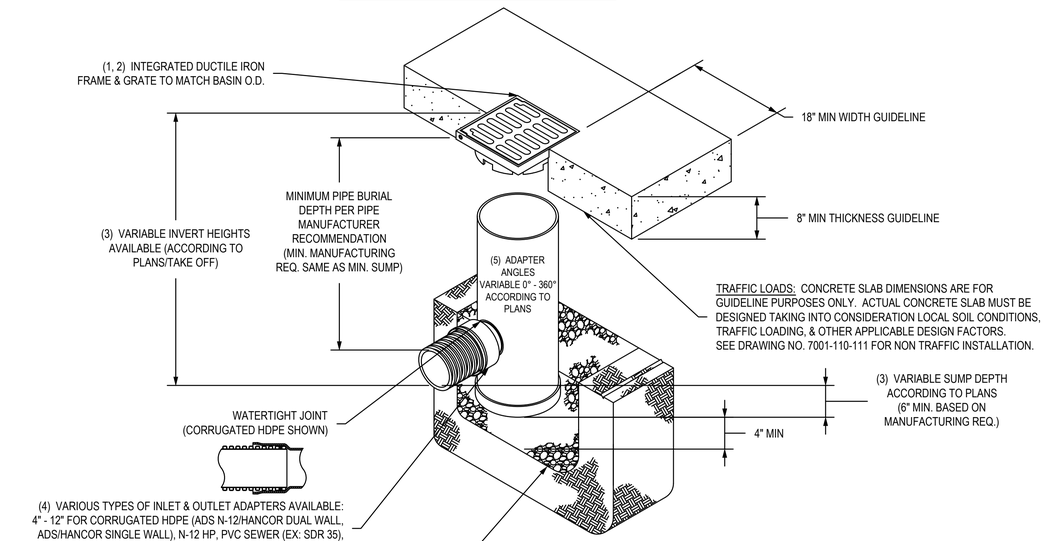
NYLOPLAST DRAIN BASIN WITH SOLID COVER



1 - 8" - 30" SOLID COVERS SHALL BE DUCTILE IRON PER ASTM A536 GRADE 70-50-05.
2 - 12" - 30" FRAMES SHALL BE DUCTILE IRON PER ASTM A536 GRADE 70-50-05. 8" & 10" SOLID COVERS FIT DIRECTLY ONTO DRAIN BASINS WITH THE USE OF A PVC BODY TOP. SEE DRAWING NO. 7001-110-045.
3 - DRAIN BASIN TO BE CUSTOM MANUFACTURED ACCORDING TO PLAN DETAILS. RISERS ARE NEEDED FOR BASINS OVER 84" DUE TO SHIPPING RESTRICTIONS. SEE DRAWING NO. 7001-110-065.
4 - DRAINAGE CONNECTION STUB JOINT TIGHTNESS SHALL CONFORM TO ASTM D3212 FOR CORRUGATED HDPE (ADS N-12/HANCOR DUAL WALL), N-12 HP, & PVC SEWER (4" - 36").
5 - ADAPTERS CAN BE MOUNTED ON ANY ANGLE 0° TO 360°. TO DETERMINE MINIMUM ANGLE BETWEEN ADAPTERS SEE DRAWING NO. 7001-110-012.
6 - 12" - 30" SOLID COVERS SHALL MEET H-20 LOAD RATING.
7 - 8" & 10" SOLID COVERS ARE RATED FOR LIGHT DUTY APPLICATIONS ONLY; NO CONCRETE COLLAR NEEDED FOR LIGHT DUTY RATING.

DRAWN BY EBC	MATERIAL	ADS Nyloplast	3130 VERONA AVE BUFORD, GA 30518 PHN (770) 932-2443 FAX (770) 932-2490 www.nyloplast-us.com
DATE 09-14-07			
REVISED BY NMH	PROJECT NO./NAME	TITLE	DRAIN BASIN WITH SOLID COVER QUICK SPEC INSTALLATION DETAIL
DATE 06-12-18			
DWG SIZE A	SCALE 1:40 SHEET 1 OF 1	DWG NO. 7001-110-298	REV E

NYLOPLAST 12" DRAIN BASIN: 2812AG _ _ X



GRATE OPTIONS	LOAD RATING	PART #	DRAWING #
PEDESTRIAN	MEETS H-10	1299CGP	7001-110-202
STANDARD	MEETS H-20	1299CGS	7001-110-203
SOLID COVER	MEETS H-20	1299CGC	7001-110-204
PEDESTRIAN BRONZE	N/A	1299CGPB	7001-110-205
DOME	N/A	1299CGD	7001-110-206
DROP IN GRATE	LIGHT DUTY	1201DI	7001-110-021

1 - GRATES/SOLID COVER SHALL BE DUCTILE IRON PER ASTM A536 GRADE 70-50-05, WITH THE EXCEPTION OF THE BRONZE GRATE.
2 - FRAMES SHALL BE DUCTILE IRON PER ASTM A536 GRADE 70-50-05
3 - DRAIN BASIN TO BE CUSTOM MANUFACTURED ACCORDING TO PLAN DETAILS. RISERS ARE NEEDED FOR BASINS OVER 84" DUE TO SHIPPING RESTRICTIONS. SEE DRAWING NO. 7001-110-065
4 - DRAINAGE CONNECTION STUB JOINT TIGHTNESS SHALL CONFORM TO ASTM D3212 FOR CORRUGATED HDPE (ADS N-12/HANCOR DUAL WALL), N-12 HP, & PVC SEWER.
5 - ADAPTERS CAN BE MOUNTED ON ANY ANGLE 0° TO 360°. TO DETERMINE MINIMUM ANGLE BETWEEN ADAPTERS SEE DRAWING NO. 7001-110-012.

DRAWN BY EBC	MATERIAL	ADS Nyloplast	3130 VERONA AVE BUFORD, GA 30518 PHN (770) 932-2443 FAX (770) 932-2490 www.nyloplast-us.com
DATE 03-29-06			
REVISED BY NMH	PROJECT NO./NAME	TITLE	12 IN DRAIN BASIN QUICK SPEC INSTALLATION DETAIL
DATE 03-11-16			
DWG SIZE A	SCALE 1:20 SHEET 1 OF 1	DWG NO. 7001-110-189	REV E

NYLOPLAST BASIN DETAIL

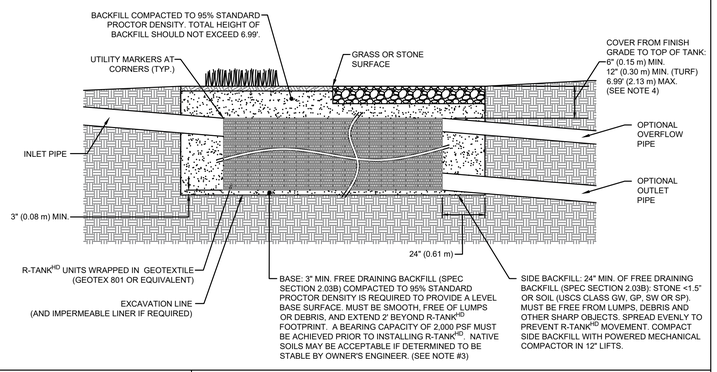
NOT TO SCALE

NYLOPLAST BASIN DETAIL

NOT TO SCALE

NOTES:

1. FOR COMPLETE MODULE DATA, SEE APPROPRIATE R-TANK^{HD} SHEET (MINI MODULE, SINGLE MODULE, DOUBLE MODULE, TRIPLE MODULE, QUAD MODULE, OR PENTA MODULE).
2. PRE-TREATMENT STRUCTURES NOT SHOWN.
3. FOR INFILTRATION APPLICATIONS, GEOTEXTILE ENVELOPING R-TANK SHALL BE ACF M200 (PER SPEC SECTION 2.02A) AND BASE SHALL BE 4" MIN. UNCOMPACTED FREE DRAINING BACKFILL (SPEC SECTION 2.03A) TO PROVIDE A LEVEL BASE. SURFACE MUST BE SMOOTH, FREE OF LUMPS OR DEBRIS, AND EXTEND 2' BEYOND R-TANK^{HD} FOOTPRINT.
4. MINIMUM COVER IN A NON-TRAFFIC/GREEN SPACE AREA FROM FINISH GRADE TO TOP OF R-TANK^{HD} MUST NOT BE LESS THAN 6". FOR TURF AREAS, THE RECOMMENDED MINIMUM COVER IS 12" TO ESTABLISH VEGETATION. COVER FROM FINISH GRADE TO TOP OF R-TANK^{HD} MUST NOT EXCEED 6.99' AT ANY LOCATION WITHIN THE TANK AREA.



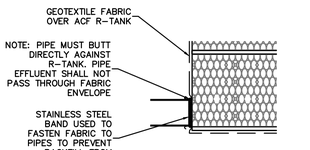
ACF ENVIRONMENTAL — LET'S GET IT DONE

08/01/2018

R-TANK^{HD} IN GREEN SPACE - SECTION VIEW

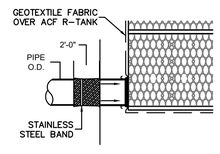
NOT TO SCALE

FOR ADDITIONAL INFORMATION PLEASE CONTACT: ACF ENVIRONMENTAL, 1-800-448-3636, www.acfenvironmental.com



SIDE VIEW OF PIPE/FABRIC CONNECTION

AFTER TANK WRAP IS SECURED TO PIPE, SLIDE BOOT AGAINST R-TANK AND SECURE WITH SECOND STAINLESS STEEL BAND, THEN ATTACH BOOT FLAP TO TANK ENVELOPE FABRIC WITH DUCT TAPE OR OTHER ADHESIVE.



SIDE VIEW OF GEOTEXTILE BOOT

R-TANK TYPICAL INLET/OUTLET W/ GEOTEXTILE BOOT

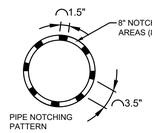
NOT TO SCALE

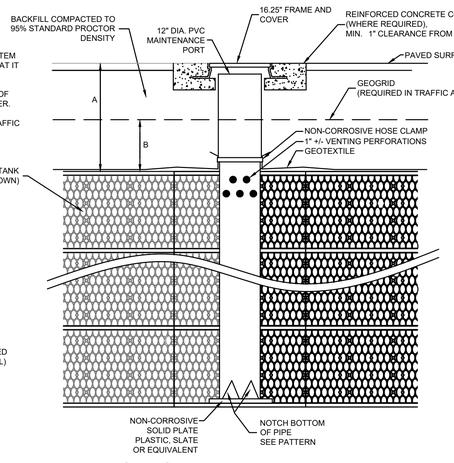
NOTES

- THIS PORT IS USED TO PUMP WATER INTO THE SYSTEM AND RE-SUSPEND ACCUMULATED SEDIMENT SO THAT IT MAY BE PUMPED OUT.
- MINIMUM REQUIRED MAINTENANCE INCLUDES A QUARTERLY INSPECTION DURING THE FIRST YEAR OF OPERATION AND A YEARLY INSPECTION THEREAFTER. FLUSH AS NEEDED.
- ONLY R-TANK^{HD} AND R-TANK^{HD} MAY BE USED IN TRAFFIC APPLICATIONS.

DEPTH SUMMARY

TYPE	A	B
R-TANK^{LD}	12" MIN - 36" MAX	AS SHOWN ON PLANS
R-TANK^{HD}	20" MIN - 6.99' MAX	12"
R-TANK^{SD}	18" MIN - 9.99' MAX	12"

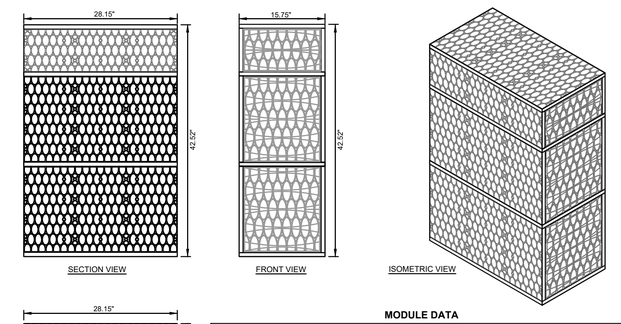




MAINTENANCE PORT

FOR R-TANK^{LD}, R-TANK^{HD}, AND R-TANK^{SD}

NOT TO SCALE



MODULE DATA

GEOMETRY: LENGTH = 28.15 IN. (715 MM)
WIDTH = 15.75 IN. (400 MM)
HEIGHT = 42.52 IN. (1080 MM)
TANK VOLUME = 10.91 CF
STORAGE VOLUME = 10.36 CF
VOID INTERNAL VOLUME: 95%
VOID SURFACE AREA: 90%

LOAD RATING: 33.4 PSI, (MODULE ONLY) HS25, (WITH ACF COVER SYSTEM)

MATERIAL: 100% RECYCLED POLYPROPYLENE

SMALL PLATES PER SEGMENT/TOTAL: 5/15

R-TANK^{HD} - DOUBLE + MINI MODULES

NOT TO SCALE

Lawrence Academy

Community Commons Addition & Gray Building Renovation

26 POWDER HOUSE ROAD
GROTON, MA 01450

FLANSBURGH

77 NORTH WASHINGTON STREET
BOSTON, MA 02114-1910

FLANSBURGH.COM

Consultants

Rist-Frost- Shumway Eng. P. C.:
NH: 71 Water St | Laconia, NH 03246
P: 603.524.4647
MA: 24 Federal St, 3rd Floor | Boston, MA 02110
P: 617.494.1464
ME: 82 Hanover St, Suite 2 | Portland, ME 04101
P: 207.761.4647
www.rfsengineering.com
RFS Project #: 9686.002

Brown Sardina, Inc.:
Landscape Architect
24 Roland Street
Boston, MA 02129

Crabtree McGrath:
Food Service
161 West Main Street
Georgetown, MA 01833

Le Messurier:
Envelop Consultant
1380 Soldiers Field Rd
Boston, MA 02135

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Sheet Title: **CIVIL DETAILS**

Construction Documents
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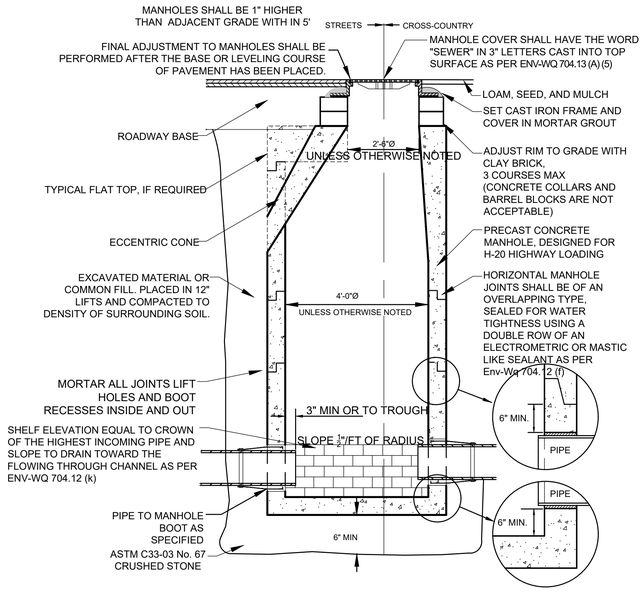
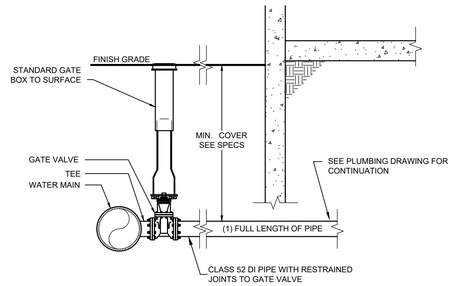
Drawn By JKC	Project ID 2101
Reviewed By	Scale
Plot Date 09/17/24	Issue Date 09/17/24
Sheet No. **C6.02**	



NOTE: MANHOLE STEPS IF REQUIRED BY MUNICIPALITY SHALL BE STAINLESS STEEL OR PLASTIC COATED STEEL; MEETING THE REQUIREMENTS OF ASTM C478-06; BE APPROX. 10"X14"; HAVE DROP SECTION OR RAISED ABUTMENTS TO PREVENT SLIPPAGE; HAVE NON SKID SAFETY SERRATION AND SHALL MEET THE REQUIREMENTS OF Env-Wq 704.14

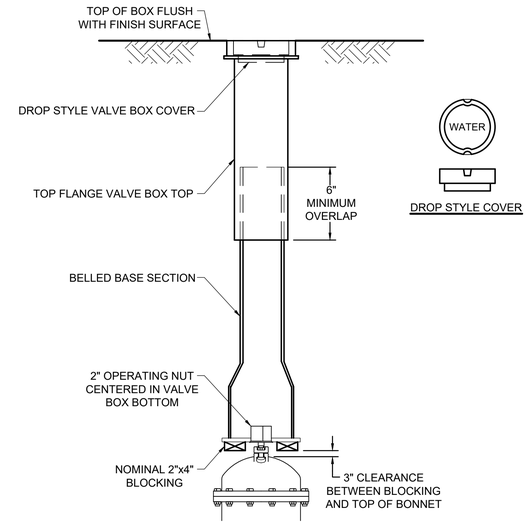
TYPICAL SANITARY SEWER MANHOLE DETAIL

NOT TO SCALE



TVPICAL WATER ENTRANCE DETAIL

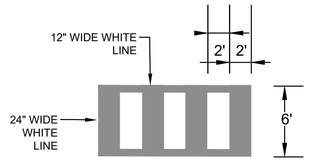
NOT TO SCALE



NOTES:
1. ALL MATERIALS AND INSTALLATION PROCEDURES WILL CONFORM TO LOCAL WATER DEPARTMENT TECHNICAL SPECIFICATIONS.
2. COVER MUST BE MARKED "WATER".

WATER VALVE BOX DETAIL

NOT TO SCALE



CROSS WALK LAYOUT DETAIL

NOT TO SCALE

Lawrence Academy

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FLANSBURGH

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Drawn By	Project ID
JKC	2101
Reviewed By	Scale
Plot Date: 09/17/24	Issue Date: 09/17/24

Sheet No.: **C6.03**

Appendix I – Illicit Discharge Compliance Statement

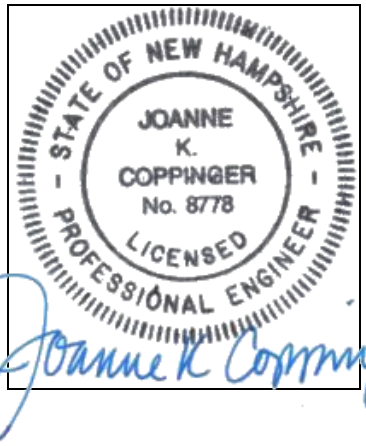
Illicit Discharge Statement

Per Standard 10 of the Stormwater Massachusetts Handbook, the following is an Illicit Discharge Compliance Statement:

The design plans submitted for the Notice of Intent have been designed in full compliance with current standards.

The Long-Term Pollution Prevention Plan is part of the Inspection and Maintenance Plan and includes measures to prevent illicit discharges. There are no known combined sewer outfalls and to the best of our knowledge all closed stormwater systems discharge per MA DEP requirements. The existing site is developed, but based on observations during site visits in 2024, the site does not contain any known existing illicit discharges.

Registered Professional Engineer Block and Signature



09/20/2024
Signature and Date