STORMWATER MANAGEMENT REPORT

Definitive Subdivision

At 20 Carleton Drive

GEORGETOWN, MASSACHUSETTS

January 6, 2022

SUBMITTED TO:

TOWN OF GEORGETOWN
PLANNING BOARD
1 LIBRARY STREET
GEORGETOWN, MA 01833

APPLICANT:

G. MELLO DISPOSAL CORP.
95 TENNEY STREET
GEORGETOWN, MA 01833

SUBMITTED BY:

THE MORIN-CAMERON GROUP, INC
66 ELM STREET
DANVERS, MA 01923

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PROJECT NARRATIVE

PROJECT NARRATIVE
Land Off 20 Carleton Drive

I. Executive Summary

G. Mello Disposal Corp., the applicant, proposes to develop two (2) lot commercial subdivision at 20 Carleton Drive in Georgetown, Massachusetts. This project will consist of the construction of a new 26-foot-wide roadway and cul-de-sac along the westerly lot boundary. The property is shown on the Town of Georgetown Assessor's Map 15, Lot 46 and is situated within the Business and Commercial (CC) Zoning District. This project requires Definitive Subdivision Plan Approval from the Georgetown Planning Board. The following narrative contains a description of existing and proposed site conditions and a stormwater management summary.

II. Existing Site Description

The site located along the north side of Carleton Drive and consists of approximately 14.57 acres with the Business and Commercial (CC) Zoning District. The site is also in the Medical Marijuana overlay district and partially within the water resource and flood plain overlay districts. The site has been subject to construction of a gravel access drive along the easterly lot line, land clearing activities and storage of earth materials in the middle portion of the property and is otherwise undeveloped. The property is bordered to the east by Interstate Highway 95, to the north by undeveloped CC zoned property and developed and undeveloped residential zoned property, to the west by developed industrial use property and to the south by Carleton Drive.

Soils on site are classified as Deerfield loamy find sand as defined in the Soil Resource Report for Essex County, Massachusetts. These soils are considered rapidly infiltrating and are in the NRCS Hydrologic Soil Group "A". Soil testing performed by Alexander Parker in October 2019 confirms this these classifications. Topographically, the property is generally flat with a high elevation of approximately 87 along the west side line to a low elevation of 83 along the east side line. The land generally slopes from west to east towards Interstate 95. The flat topography results in low areas which are wetland resource areas subject to jurisdiction under the Massachusetts Wetland Protection Act and its Regulations found in 310 CMR 10 and the Georgetown Wetlands Protection Bylaw and its Regulations. The site also contains two vernal pools within the Bordering Vegetated Wetlands (BVW) in the northern portion of the site, triggering a 100' Special Conditions Setback from the BVW limit as outlined in section 14 of the Georgetown Wetlands Protection Regulations.

The rear portion of the property is partially within the flood plain overlay district according to the Georgetown Zoning Map. However, the property does not contain any land within the 100-year floodplain (Zone A) according to the most recent Federal Emergency Management Agency (FEMA) Flood Insurance Rate Map Community Panel No. 25009C-0254-F effective July 3, 2012.

III. Proposed Site Description

The proposed project features a 26' wide paved roadway and cul-de-sac. Access will be provided from Carleton Drive.

The site will feature catch basins and hydrodynamic separators to collect and treat runoff from the proposed roadway. A surface infiltration pond is proposed at the south of the site near Carleton Drive and subsurface detention/infiltration system is proposed at the cul-de-sac to

provide groundwater recharge and attenuate peak discharge from the 2, 10, 50 and 100-year storm events.

The property will be served by the municipal water system which will be extended from the main on Carleton Drive for future development. Wastewater will be disposed of in a soil absorption system on site in accordance with 310 CMR 15 and Georgetown Health Regulations. The on-site septic disposal systems are to be designed and permitted after approval of the definitive subdivision. Gas, electric and communications services will also be extended from Carleton Drive for future development.

IV. Stormwater Management

The proposed stormwater management system for the project will consist of various Best Management Practice (BMP) techniques in both mitigating and renovating stormwater runoff. The entire stormwater system was designed in accordance with the Massachusetts Department of Environmental Protection Stormwater Management Handbook, the Stormwater Management Regulations, and the Town of Georgetown Erosion and Stormwater Control By-Law. A comprehensive Site Plan is included in the Definitive Subdivision Plan set. The existing watershed characteristics, flow paths and drainage patterns were generally matched in the proposed condition to ensure that there are no adverse impacts to adjacent properties. The following is a detailed narrative of the stormwater management system design.

A. Existing Watershed Characteristics

The analysis of stormwater and precipitation is referred to in the industry as hydrologic analysis or the study of hydrology. Hydrologic analysis takes into consideration various factors including time, intensity of precipitation, land area, ground cover and soil type in determining the peak rate of stormwater runoff for a given site. The first step in evaluating the impacts of a development project on hydrology is to evaluate the existing hydrologic conditions.

The property was divided into two (2) individual watersheds, also known as subcatchments, for analyzing the existing hydrology of the site. A third watershed is used to include off-site area flowing on to the property. The property Off Carleton Drive drains into three separate wetland systems. These wetland systems serve as the points where stormwater runoff leaves the watershed and shall herein be referred to as design points ("DP"). The undisturbed area within the wetland systems has not been included in the hydrologic analysis included in this report as it would return the same results in both pre- and post-development conditions. DP1 was identified at the wetland system along the eastern property line. DP2 was identified as the wetland system at the northern portion of the site, away from Carleton Drive. These design points and the tributary subcatchments are illustrated on Figure 5: Pre-Development Watershed Plan, included herein. The table below lists the total area associated with each subcatchment contributing to the design point.

Summary of Existing Watersheds

Existing Drainage Area (ES)	Total Area (SF)	% Impervious	Composite Curve Number
1a	162,297	5.2	45
1b	65,154	50.0	68
2	205,012	0	42
Total	**433,463 (9.95 acres)**	**9.46**	**47**

Description of Existing Watersheds

The watersheds analyzed in the existing condition can be described as follows:

- **Watershed ES1a:** Located the eastern side of the site and bound by the eastern property line and watershed ES2. This watershed is partially within the BVW 100' Buffer Zone and much of it has been altered in recent years. It is comprised of trees and vegetation as well as a gravel road and piles of gravel. ES1 flows east toward Interstate 95 and into the DP1 wetland system at the eastern property line. Part of the drainage plan as outlined in this report will remove the existing gravel road and restore the area to its historical drainage patterns.
- **Watershed ES1b:** Consists of area of the abutting parcel and Carleton Drive to the west of the property that flows onto the subject property. This area consists of mainly pavement and landscaped area with small pockets of wooded areas. This area flows overland into the DP1 wetland system at the eastern property line.
- **Watershed ES2:** Located in the center of the site and stretching north toward the DP2 wetland system. Most of ES2 has been altered within recent years, leaving behind large piles of gravel and fill throughout a large portion the watershed. The remaining portion consists of trees and vegetation. The DP2 wetland system contains an outstanding resource water in the form of a vernal pool, thus making it a critical area.

B. Proposed Watershed Characteristics

The same design points used to evaluate the existing condition of the site are used to evaluate the impact of the proposed project. To understand and analyze the proposed impacts, smaller watersheds were delineated to analyze stormwater impacts on a more detailed scale. These design points and the tributary subcatchments are illustrated on Figure 6: Post-Development Watershed Plan, included herein.

The table on the following page provides the total area of each watershed and the percentage that will be impervious in the proposed condition.

Summary of Proposed Watersheds

Proposed Drainage Area (PS)	Total Area (SF)	% Impervious Number	Composite Curve
1a	118,488	11.0	42
2b	10,789	64.1	77
3c	78,826	46.9	66
4d	26,805	61.8	75
2	198,555	0	37
Total	**433,463 (9.95 acres)**	**16.9**	**47**

Description of Proposed Watersheds

The watersheds analyzed in the proposed condition can be described as follows:

- **Watershed PS1a:** Located in the southern portion of the site along the Interstate 95 frontage and east of the proposed entry drive. This watershed is comprised of existing trees and vegetation as well as a portion of the wetland remediation area. Runoff flows to the DP1 wetland system.

- **Watershed PS1b:** Located to the west of the parcel between the access drive and abutting building. This watershed consists of paved and landscaped area. Runoff flows to a culvert the directs water under the road to the DP1 wetland system.
- **Watershed PS1c:** Consists of roadway near the intersection with Carleton Drive and landscaped area in the southwest corner of the site, as well as area of the abutting parcel and Carleton Drive to the west of the property that flows onto the subject property and into the proposed infiltration pond (pond 1P). This pond discharges through an outlet control structure to DP1.
- **Watershed PS1d:** Consists of roadway by the cul-de-sac and landscaped area in the southwest portion of the site, which flows to a catch basin that directs runoff to a subsurface infiltration system (Pond 2P). This system discharges through a culvert to DP1.
- **Watershed PS2:** Located in the portion of the site north of the proposed on-site development. This watershed is comprised of existing trees and vegetation. Runoff from this watershed flows north in the DP2 wetland system.

C. Hydrologic Analysis

The reason why hydrology is evaluated in the existing and proposed condition is to determine if the proposed development will adversely impact the land or surrounding land. The industry standard for stormwater management design in Massachusetts is the Stormwater Management Handbook published by the Mass Department of Environmental Protection, January 2008. The Regulations require development projects to comply with 10 standards. These standards address mitigation of peak rates of runoff, renovation or cleansing of stormwater runoff, construction phase stormwater management and erosion control and long term operation and maintenance of the stormwater system. A full discussion on the project compliance with the standards can be found at the end of this section. However, the following section will summarize the project's compliance with the mitigation standards 1 and 2 of the Handbook relating to reducing peak rates of runoff and creating no adverse downstream impacts.

To demonstrate that there will be no downstream impacts as a result of developing the site, a stormwater analysis was performed using the U.S. Soil Conservation Service (S.C.S) method of analysis contained in Technical Release #20 (TR-20) published by the U.S. Conservation Service. The software application HydroCAD was implemented to analyze the pre- and post-development watershed conditions. This application is widely used in the civil engineering industry and is an accepted means of performing a TR-20 analysis. It utilizes the latest techniques of the industry to accurately predict the consequences of various storm events. This analysis allows the engineer to verify that the designed drainage system is adequate for the area under consideration, and further allows the engineer to predict where flooding or erosion are most likely to occur so that it can be prevented.

The HydroCAD analysis was performed by examining the design points that are discussed above. The following is a summary of the peak rates of stormwater runoff for the pre- and post-development conditions. Four (4) storm intensities were evaluated, as is governed by the Stormwater Handbook and Georgetown Subdivision Regulations. These storm "events" included the 2, 10, 50 and 100-year rainfall events:

Comparison of Existing and Proposed Peak Rates of Runoff

Event (Frequency in yrs)	Existing Conditions (CFS)	Proposed Conditions (CFS)	Change in Peak (CFS)
DP1			
2	0.58	0.32	-0.26
10	1.95	0.69	-1.26
50	6.74	4.92	-1.82
100	10.29	10.28	-0.01
DP2			
2	0.01	0.00	-0.01
10	0.19	0.05	-0.14
50	3.30	1.34	-1.96
100	6.38	3.68	-2.70

The proposed development will reduce the peak flow rates at all design points for the 2, 10, 50 and 100-year design storm events.

D. Review of Stormwater Management Standards

The development of site will comply with all Stormwater Management Standards and will improve existing hydrologic conditions. The drainage system has been designed to attenuate peak rates of stormwater runoff leaving the site design points so that they are no greater than in the existing condition. Stormwater will be recharged to groundwater using subsurface infiltration systems. Measures will also be implemented to provide the required total suspended solids (TSS) removal to ensure the stormwater runoff is renovated prior to discharge. The following is an assessment of each Standard:

1. No stormwater conveyance system discharges untreated stormwater directly to or cause erosion in wetlands or waters of the Commonwealth. There are no proposed stormwater conveyance systems that discharge untreated stormwater directly to on-site wetlands or to the waters of the Commonwealth.

   The proposed development meets this standard.

2. The stormwater management system has been designed such that post-development peak rates of stormwater runoff do not exceed pre-development rates of stormwater runoff for all storm events.

   The proposed development meets this standard.

3. Loss of annual recharge to groundwater is being managed by proposed surface and subsurface infiltration systems. The recharge capacity in the proposed condition exceeds the recharge capacity of the site under existing conditions.

   The proposed development meets this standard.

4. The proposed stormwater management system has been designed to remove a minimum of 80% of the average annual post-construction load of Total Suspended Solids (TSS). The best management practices treatment train utilizes deep-sump hooded catch basins and

water quality units (hydrodynamic separators), which pretreat the runoff to at least 44% TSS removal prior to conveyance to the subsurface infiltration systems.

The proposed development meets the standard.

5. Land Uses with Higher Potential Pollutant Load.

   This standard does not apply.

6. Discharges to critical areas. The vernal pools and Water Resource District are both considered critical areas under the Handbook. Runoff from all impervious surfaces is treated by BMPs approved for these critical areas prior to discharging outside of the critical areas.

   The proposed development meets this standard.

7. Redevelopment Projects.

   This standard does not apply.

8. A Construction Phase Operation and Maintenance Plan: A Stormwater Pollution Prevention Plan following the EPA guidelines under the National Pollutant Discharge Elimination System is required since the disturbed land is greater than an acre. A NPDES submission will be made prior to initiation of construction.

   The proposed development meets this standard.

9. A Long-Term Operation and Maintenance Plan: A long-term O&M has been prepared to provide guidance for future owners to inspect and maintain the stormwater management systems in perpetuity. A copy of this O&M plan is included herein.

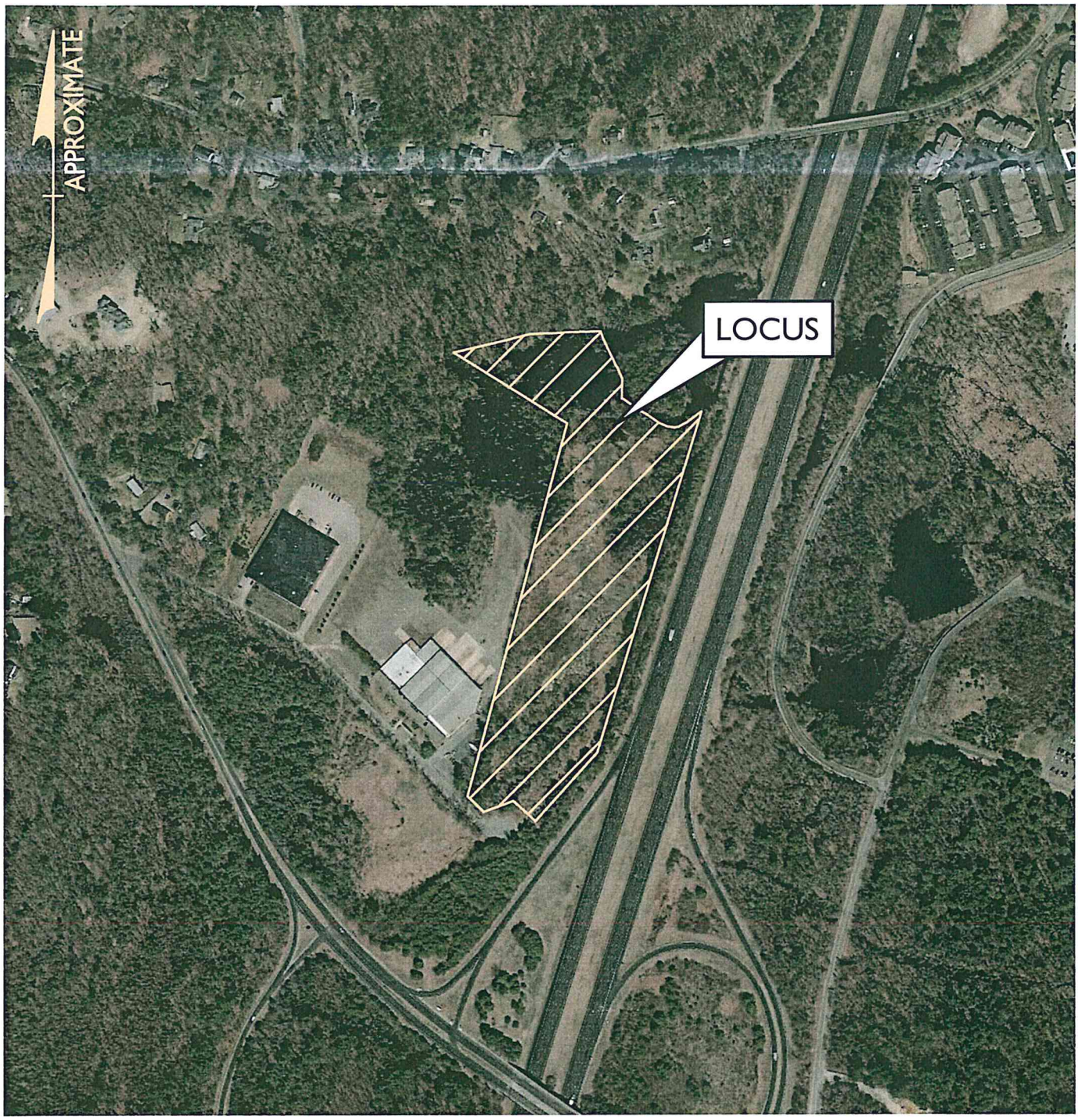
   The proposed development meets this standard.

10. Illicit discharges: To the best of our knowledge and belief there are no illicit discharges to the stormwater management system on this site. A certification is included herein.

    The proposed development meets this standard.

For questions regarding this report, please contact The Morin-Cameron Group, Inc. between the hours of 8:30am to 4:30pm at (978) 373-0310.

FIGURES



ORTHO IMAGERY OBTAINED FROM GOOGLE EARTH

0 250 500 1000

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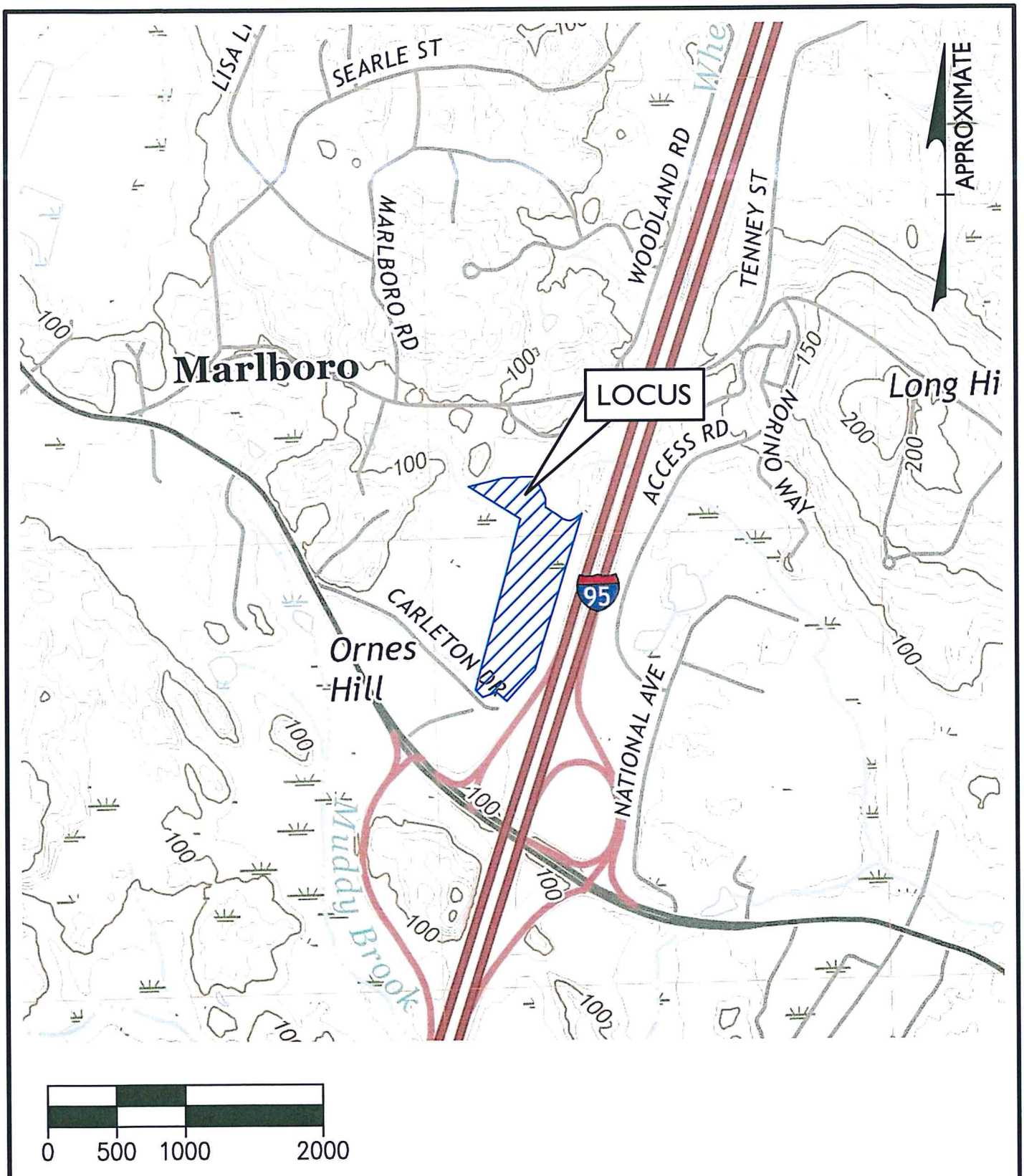
ORTHO MAP
LAND OFF CARLETON DRIVE
IN
GEORGETOWN, MA

DATE: JANUARY 6, 2022

Scale: 1" = 500'

FIGURE #1



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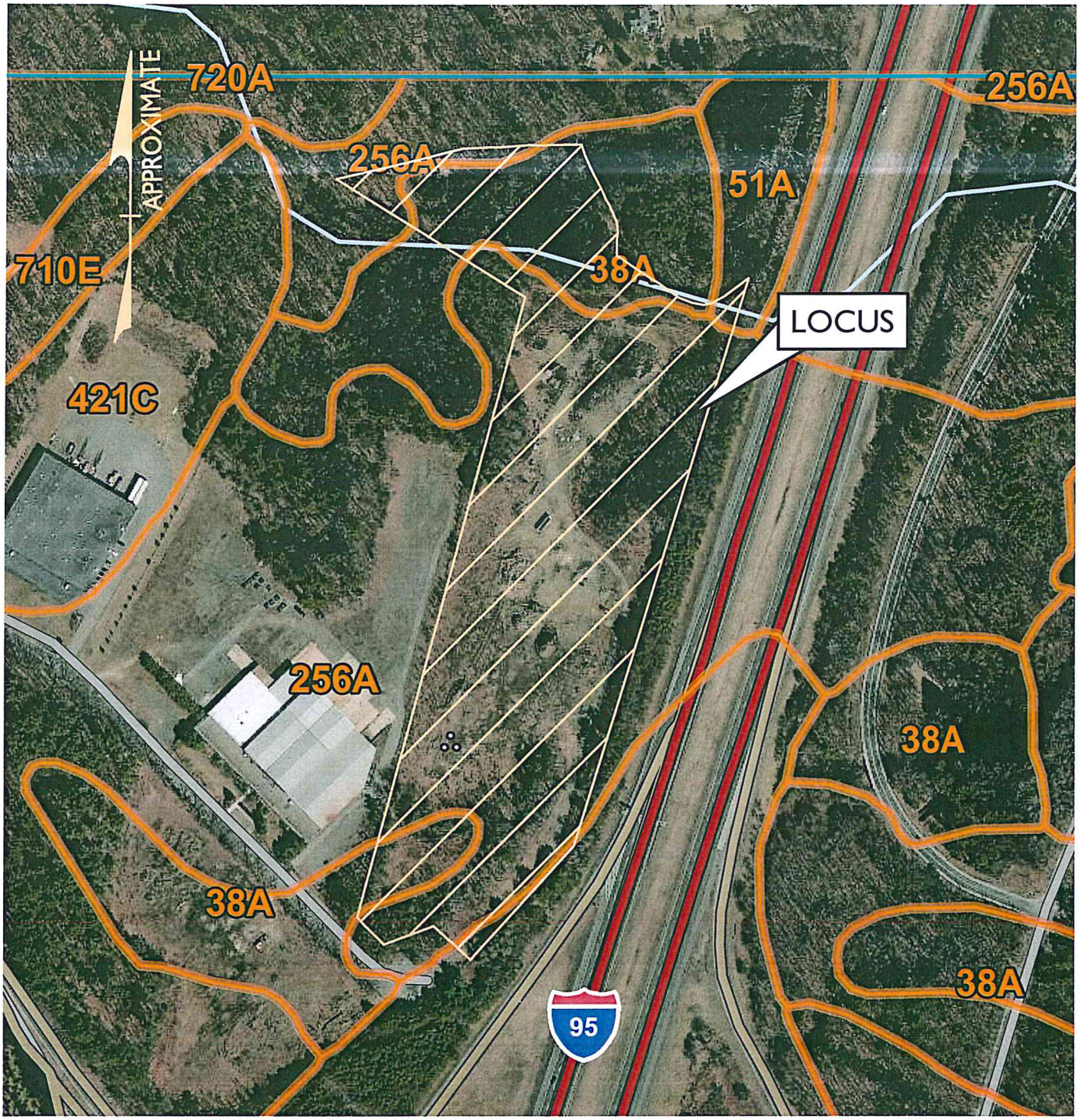
USGS MAP
LAND OFF CARLETON DRIVE
IN
GEORGETOWN, MA

DATE: JANUARY 6, 2022

Scale: 1" = 1000'

FIGURE #2



0 100 300 600

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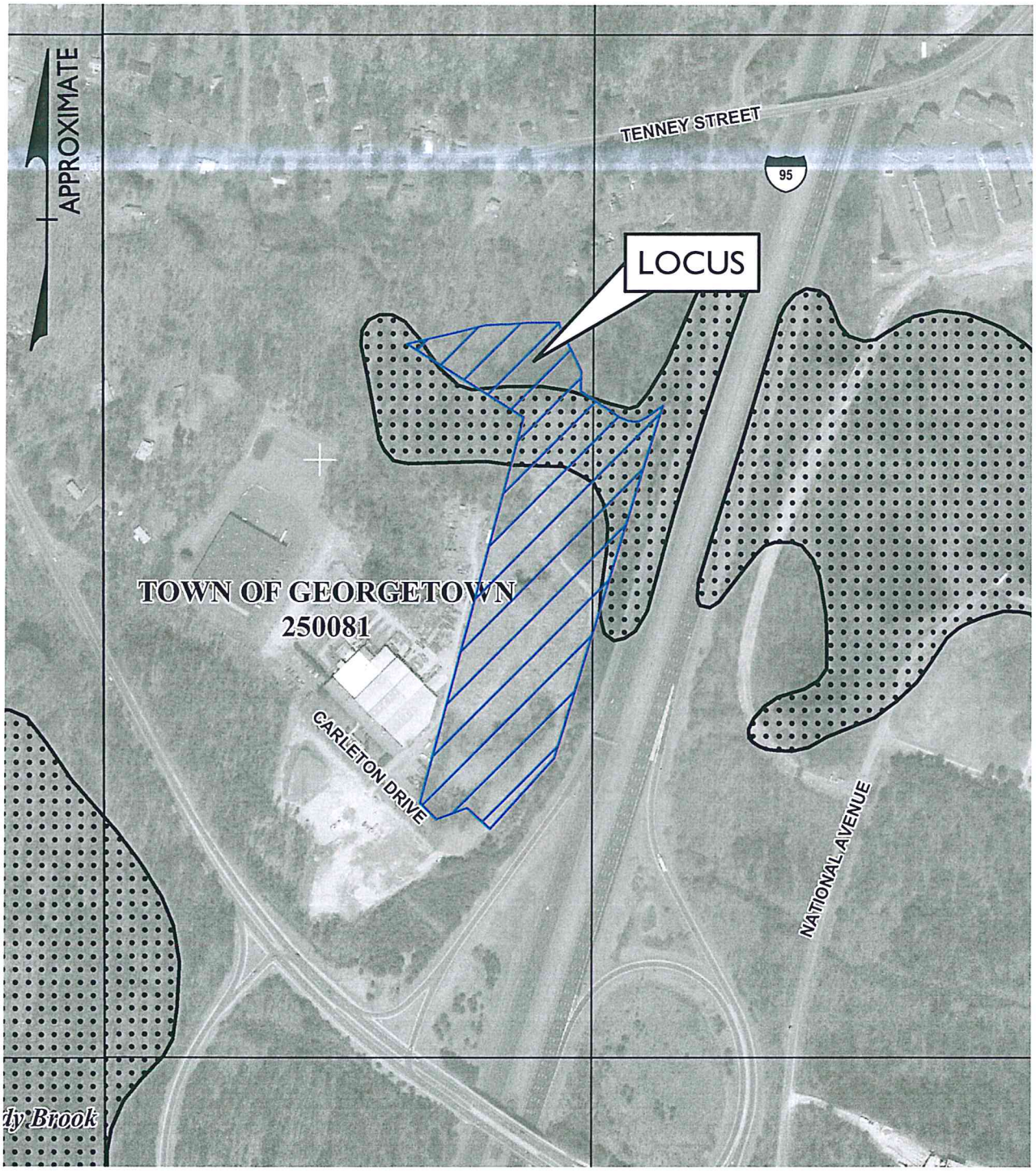
SCS SOIL MAP
LAND OFF CARLETON DRIVE
IN
GEORGETOWN, MA

DATE: JANUARY 6, 2022 | Scale: 1" = 300'

FIGURE #3



FEMA FLOOD MAP NO. 25009C0254F

0 250 500 1,000

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FEMA FLOOD MAP
LAND OFF CARLETON DRIVE
IN
GEORGETOWN, MA

DATE: JANUARY 6, 2022

Scale: 1" = 500'

FIGURE #4

FIGURE 5

EXISTING WATERSHED PLAN

CARLETON DRIVE
(PUBLIC - 60' WIDE)
(1931 COUNTY LAYOUT #2476)

ES1b

ES1a

ES2

DP1

DP2

TIME OF CONCENTRATION (TYP.)

TREELINE (TYP.)

SOIL PILE (TYP.)

GRAVEL MATERIAL PILE (TYP.)

CULVERT

LIMIT OF FEMA FLOOD ZONE "X"

APPROX. LOCATION OF INTERMITTENT STREAM CHANNEL

UNDISTURBED EXISTING WETLANDS EXCLUDED FROM ANALYSIS (TYP.)

LIMIT OF BORDERING VEGETATED WETLAND (BVW) (TYP.)

EDGE OF GRAVEL ROAD (TYP.)

100' BUFFER TO BORDERING VEGETATED WETLAND (TYP.)

100' VERNAL POOL BUFFER ZONE (TYP.)

LIMIT OF FEMA FLOOD ZONE "X"

LIMIT OF VERNAL POOL

INTERSTATE ROUTE 95
PUBLIC WAY
(1974 STATE LAYOUT No. 5995)
(1951 STATE LAYOUT No. 3904)

PLAN
SCALE: 1" = 80'
0 40 80 160

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SURVEY BY:
DRAFTED BY: JMB
CHECKED BY: SPC
APPROVED BY: SPC
SCALE: 1"=80'
DATE: JANUARY 6, 2022

REVISIONS		
NO.	DESCRIPTION	DATE

LAND OFF 20 CARLETON ROAD
GEORGETOWN, MASSACHUSETTS
PREPARED FOR:
G. MELLO DISPOSAL CORP.

CARLETON DRIVE
(PUBLIC - 60' WIDE)
(1931 COUNTY LAYOUT #2476)

PS1b
PS1c
PS1d
1P
2P
PS2
PS1a

LIMIT OF FEMA
FLOOD ZONE "X"

APPROX. LOCATION
OF INTERMITTENT
STREAM CHANNEL

CULVERT

DP1
DP2

LIMIT OF BORDERING
VEGETATED WETLAND
(BVW) (TYP.)

100' BUFFER TO
BORDERING VEGETATED
WETLAND (TYP.)

100' VERNAL POOL
BUFFER ZONE (TYP.)

LIMIT OF FEMA
FLOOD ZONE "X"

INTERSTATE ROUTE 95
PUBLIC WAY
(1974 STATE LAYOUT No. 5995)
(1951 STATE LAYOUT No. 3904)

PLAN
SCALE: 1" = 80'
0 40 80 160

FIGURE 6

PROPOSED WATERSHED PLAN

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SURVEY BY: MCG
DRAFTED BY: JMB
CHECKED BY: SPC
APPROVED BY: SPC
SCALE: 1"=80'
DATE: JANUARY 6, 2022

REVISIONS

NO.	DESCRIPTION	DATE

LAND OFF 20 CARLETON ROAD
GEORGETOWN, MASSACHUSETTS
PREPARED FOR:
G. MELLO DISPOSAL CORP.

APPENDIX A:

MASSDEP STORMWATER

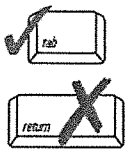
MANAGEMENT REPORT CHECKLIST

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

Checklist for Stormwater Report

A. Introduction

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



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

The Stormwater Report must include:

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

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

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

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.

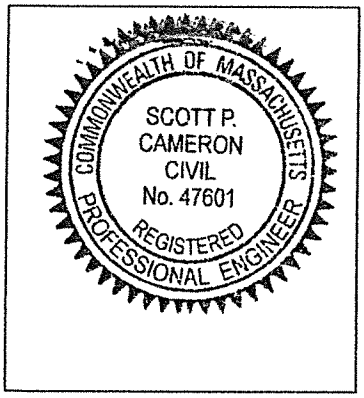
Note: Because stormwater requirements vary from project to project, it is possible that a complete Stormwater Report may not include information on some of the subjects specified in the Checklist. If it is determined that a specific item does not apply to the project under review, please note that the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



1-6-22

Signature and Date

Checklist

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

☒ New development

☐ Redevelopment

☐ Mix of New Development and Redevelopment

Checklist for Stormwater Report

Checklist (continued)

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

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

Standard 1: No New Untreated Discharges

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

Checklist for Stormwater Report

Checklist (continued)

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

- ☐ No disturbance to any Wetland Resource Areas
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- ☐ Reduced Impervious Area (Redevelopment Only)
- ☐ Minimizing disturbance to existing trees and shrubs
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  - ☐ Credit 1
  - ☐ Credit 2
  - ☐ Credit 3
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- ☐ Green Roof
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- ☒ Outlets have been designed so there is no erosion or scour to wetlands and waters of the Commonwealth
- ☒ Supporting calculations specified in Volume 3 of the Massachusetts Stormwater Handbook included.

Checklist for Stormwater Report

Checklist (continued)

Standard 3: Recharge (continued)

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

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

Standard 4: Water Quality

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

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

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

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

☐ is within the Zone II or Interim Wellhead Protection Area

☐ is near or to other critical areas

☒ is within soils with a rapid infiltration rate (greater than 2.4 inches per hour)

☐ involves runoff from land uses with higher potential pollutant loads.

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

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

Checklist for Stormwater Report

Checklist (continued)

Standard 4: Water Quality (continued)

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

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

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

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

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

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

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

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

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

☐ All exposure has been eliminated.

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

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

Standard 6: Critical Areas

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

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

Checklist for Stormwater Report

Checklist (continued)

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

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

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

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

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

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

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

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

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

Checklist for Stormwater Report

Checklist (continued)

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

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

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

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

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

Standard 9: Operation and Maintenance Plan

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

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

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

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

Standard 10: Prohibition of Illicit Discharges

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

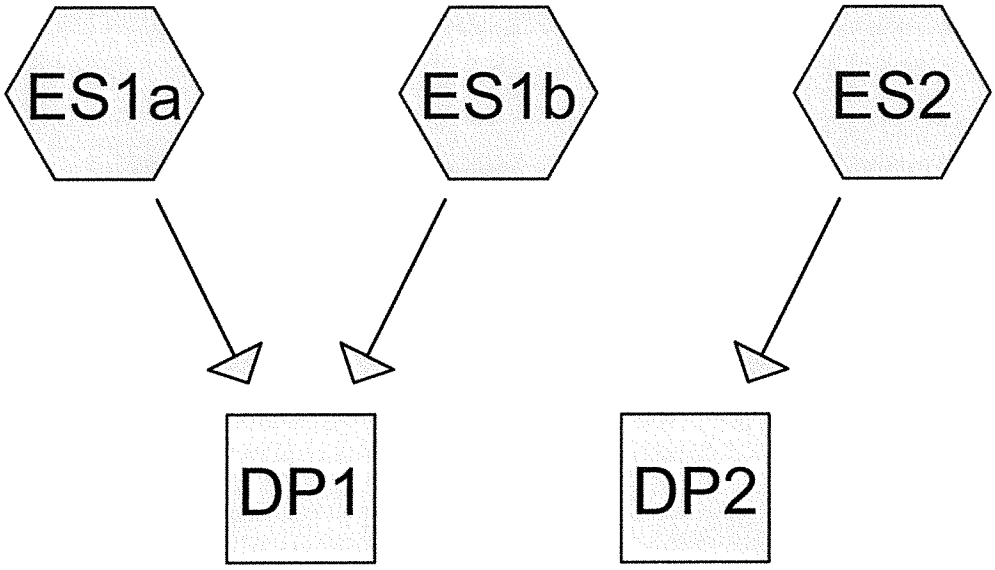
☒ An Illicit Discharge Compliance Statement is attached;

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

APPENDIX B:

EXISTING CONDITIONS

HYDROLOGIC ANALYSIS



Subcat Reach Pond Link

Routing Diagram for 3794 - Pre-Development
Prepared by The Morin-Cameron Group, Inc.

Area Listing (all nodes)

Area (sq-ft)	CN	Description (subcatchment-numbers)
191,027	39	>75% Grass cover, Good, HSG A (ES1a, ES1b, ES2)
39,632	96	Gravel surface, HSG A (ES1a, ES2)
32,558	98	Paved roads w/curbs & sewers, HSG A (ES1b)
8,435	98	Water Surface, HSG A (ES1a)
3,407	30	Woods, Good, HSG A (ES1b)
158,404	32	Woods/grass comb., Good, HSG A (ES1a, ES2)

Time span=0.00-36.00 hrs, dt=0.01 hrs, 3601 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment ES1a: Runoff Area=163,297 sf 5.17% Impervious Runoff Depth=0.04"
Flow Length=565' Tc=19.2 min CN=45 Runoff=0.02 cfs 524 cf

Subcatchment ES1b: Runoff Area=65,154 sf 49.97% Impervious Runoff Depth=0.71"
Flow Length=950' Tc=23.4 min CN=68 Runoff=0.58 cfs 3,831 cf

Subcatchment ES2: Runoff Area=205,012 sf 0.00% Impervious Runoff Depth=0.01"
Flow Length=609' Tc=13.6 min CN=42 Runoff=0.01 cfs 181 cf

Reach DP1: Inflow=0.58 cfs 4,355 cf
Outflow=0.58 cfs 4,355 cf

Reach DP2: Inflow=0.01 cfs 181 cf
Outflow=0.01 cfs 181 cf

Summary for Subcatchment ES1a:

Runoff = 0.02 cfs @ 22.72 hrs, Volume= 524 cf, Depth= 0.04"
Routed to Reach DP1 :

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
NRCC 24-hr D 2-Year Rainfall=3.15"

Area (sf)	CN	Description
103,680	32	Woods/grass comb., Good, HSG A
20,549	96	Gravel surface, HSG A
30,633	39	>75% Grass cover, Good, HSG A
8,435	98	Water Surface, HSG A
163,297	45	Weighted Average
154,862		94.83% Pervious Area
8,435		5.17% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.7	50	0.0200	0.15		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.10"
11.7	350	0.0100	0.50		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
1.8	165	0.0100	1.50		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
19.2	565	Total			

Summary for Subcatchment ES1b:

Runoff = 0.58 cfs @ 12.36 hrs, Volume= 3,831 cf, Depth= 0.71"
Routed to Reach DP1 :

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
NRCC 24-hr D 2-Year Rainfall=3.15"

Area (sf)	CN	Description
32,558	98	Paved roads w/curbs & sewers, HSG A
29,189	39	>75% Grass cover, Good, HSG A
3,407	30	Woods, Good, HSG A
65,154	68	Weighted Average
32,596		50.03% Pervious Area
32,558		49.97% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.7	50	0.0200	0.15		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.10"
1.8	143	0.0070	1.35		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
0.7	61	0.0050	1.44		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
1.7	75	0.0020	0.72		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
1.0	136	0.0125	2.27		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
10.7	320	0.0100	0.50		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
1.8	165	0.0100	1.50		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
23.4	950	Total			

Summary for Subcatchment ES2:

Runoff = 0.01 cfs @ 24.04 hrs, Volume= 181 cf, Depth= 0.01"
Routed to Reach DP2 :

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
NRCC 24-hr D 2-Year Rainfall=3.15"

Area (sf)	CN	Description
54,724	32	Woods/grass comb., Good, HSG A
19,083	96	Gravel surface, HSG A
131,205	39	>75% Grass cover, Good, HSG A
205,012	42	Weighted Average
205,012		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.7	50	0.0200	0.15		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.10"
2.9	195	0.0050	1.14		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
1.2	102	0.0050	1.44		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
3.8	262	0.0050	1.14		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
13.6	609	Total			

Summary for Reach DP1:

Inflow Area = 228,451 sf, 17.94% Impervious, Inflow Depth = 0.23" for 2-Year event
Inflow = 0.58 cfs @ 12.36 hrs, Volume= 4,355 cf
Outflow = 0.58 cfs @ 12.36 hrs, Volume= 4,355 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

Summary for Reach DP2:

Inflow Area = 205,012 sf, 0.00% Impervious, Inflow Depth = 0.01" for 2-Year event
Inflow = 0.01 cfs @ 24.04 hrs, Volume= 181 cf
Outflow = 0.01 cfs @ 24.04 hrs, Volume= 181 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

Time span=0.00-36.00 hrs, dt=0.01 hrs, 3601 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment ES1a: Runoff Area=163,297 sf 5.17% Impervious Runoff Depth=0.39"
Flow Length=565' Tc=19.2 min CN=45 Runoff=0.33 cfs 5,301 cf

Subcatchment ES1b: Runoff Area=65,154 sf 49.97% Impervious Runoff Depth=1.76"
Flow Length=950' Tc=23.4 min CN=68 Runoff=1.66 cfs 9,554 cf

Subcatchment ES2: Runoff Area=205,012 sf 0.00% Impervious Runoff Depth=0.27"
Flow Length=609' Tc=13.6 min CN=42 Runoff=0.19 cfs 4,602 cf

Reach DP1: Inflow=1.95 cfs 14,855 cf
Outflow=1.95 cfs 14,855 cf

Reach DP2: Inflow=0.19 cfs 4,602 cf
Outflow=0.19 cfs 4,602 cf

Summary for Subcatchment ES1a:

Runoff = 0.33 cfs @ 12.46 hrs, Volume= 5,301 cf, Depth= 0.39"
Routed to Reach DP1 :

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
NRCC 24-hr D 10-Year Rainfall=4.83"

Area (sf)	CN	Description
103,680	32	Woods/grass comb., Good, HSG A
20,549	96	Gravel surface, HSG A
30,633	39	>75% Grass cover, Good, HSG A
8,435	98	Water Surface, HSG A
163,297	45	Weighted Average
154,862		94.83% Pervious Area
8,435		5.17% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.7	50	0.0200	0.15		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.10"
11.7	350	0.0100	0.50		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
1.8	165	0.0100	1.50		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
19.2	565	Total			

Summary for Subcatchment ES1b:

Runoff = 1.66 cfs @ 12.35 hrs, Volume= 9,554 cf, Depth= 1.76"
Routed to Reach DP1 :

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
NRCC 24-hr D 10-Year Rainfall=4.83"

Area (sf)	CN	Description
32,558	98	Paved roads w/curbs & sewers, HSG A
29,189	39	>75% Grass cover, Good, HSG A
3,407	30	Woods, Good, HSG A
65,154	68	Weighted Average
32,596		50.03% Pervious Area
32,558		49.97% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.7	50	0.0200	0.15		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.10"
1.8	143	0.0070	1.35		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
0.7	61	0.0050	1.44		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
1.7	75	0.0020	0.72		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
1.0	136	0.0125	2.27		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
10.7	320	0.0100	0.50		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
1.8	165	0.0100	1.50		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
23.4	950	Total			

Summary for Subcatchment ES2:

Runoff = 0.19 cfs @ 12.65 hrs, Volume= 4,602 cf, Depth= 0.27"
Routed to Reach DP2 :

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
NRCC 24-hr D 10-Year Rainfall=4.83"

Area (sf)	CN	Description
54,724	32	Woods/grass comb., Good, HSG A
19,083	96	Gravel surface, HSG A
131,205	39	>75% Grass cover, Good, HSG A
205,012	42	Weighted Average
205,012		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.7	50	0.0200	0.15		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.10"
2.9	195	0.0050	1.14		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
1.2	102	0.0050	1.44		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
3.8	262	0.0050	1.14		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
13.6	609	Total			

Summary for Reach DP1:

Inflow Area = 228,451 sf, 17.94% Impervious, Inflow Depth = 0.78" for 10-Year event
Inflow = 1.95 cfs @ 12.36 hrs, Volume= 14,855 cf
Outflow = 1.95 cfs @ 12.36 hrs, Volume= 14,855 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

Summary for Reach DP2:

Inflow Area = 205,012 sf, 0.00% Impervious, Inflow Depth = 0.27" for 10-Year event
Inflow = 0.19 cfs @ 12.65 hrs, Volume= 4,602 cf
Outflow = 0.19 cfs @ 12.65 hrs, Volume= 4,602 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

Time span=0.00-36.00 hrs, dt=0.01 hrs, 3601 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment ES1a: Runoff Area=163,297 sf 5.17% Impervious Runoff Depth=1.44"
Flow Length=565' Tc=19.2 min CN=45 Runoff=3.09 cfs 19,589 cf

Subcatchment ES1b: Runoff Area=65,154 sf 49.97% Impervious Runoff Depth=3.75"
Flow Length=950' Tc=23.4 min CN=68 Runoff=3.66 cfs 20,376 cf

Subcatchment ES2: Runoff Area=205,012 sf 0.00% Impervious Runoff Depth=1.17"
Flow Length=609' Tc=13.6 min CN=42 Runoff=3.30 cfs 20,073 cf

Reach DP1: Inflow=6.74 cfs 39,965 cf
Outflow=6.74 cfs 39,965 cf

Reach DP2: Inflow=3.30 cfs 20,073 cf
Outflow=3.30 cfs 20,073 cf

Summary for Subcatchment ES1a:

Runoff = 3.09 cfs @ 12.31 hrs, Volume= 19,589 cf, Depth= 1.44"
Routed to Reach DP1 :

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
NRCC 24-hr D 50-Year Rainfall=7.42"

Area (sf)	CN	Description
103,680	32	Woods/grass comb., Good, HSG A
20,549	96	Gravel surface, HSG A
30,633	39	>75% Grass cover, Good, HSG A
8,435	98	Water Surface, HSG A
163,297	45	Weighted Average
154,862		94.83% Pervious Area
8,435		5.17% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.7	50	0.0200	0.15		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.10"
11.7	350	0.0100	0.50		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
1.8	165	0.0100	1.50		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
19.2	565	Total			

Summary for Subcatchment ES1b:

Runoff = 3.66 cfs @ 12.35 hrs, Volume= 20,376 cf, Depth= 3.75"
Routed to Reach DP1 :

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
NRCC 24-hr D 50-Year Rainfall=7.42"

Area (sf)	CN	Description
32,558	98	Paved roads w/curbs & sewers, HSG A
29,189	39	>75% Grass cover, Good, HSG A
3,407	30	Woods, Good, HSG A
65,154	68	Weighted Average
32,596		50.03% Pervious Area
32,558		49.97% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.7	50	0.0200	0.15		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.10"
1.8	143	0.0070	1.35		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
0.7	61	0.0050	1.44		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
1.7	75	0.0020	0.72		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
1.0	136	0.0125	2.27		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
10.7	320	0.0100	0.50		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
1.8	165	0.0100	1.50		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
23.4	950	Total			

Summary for Subcatchment ES2:

Runoff = 3.30 cfs @ 12.25 hrs, Volume= 20,073 cf, Depth= 1.17"
Routed to Reach DP2 :

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
NRCC 24-hr D 50-Year Rainfall=7.42"

Area (sf)	CN	Description
54,724	32	Woods/grass comb., Good, HSG A
19,083	96	Gravel surface, HSG A
131,205	39	>75% Grass cover, Good, HSG A
205,012	42	Weighted Average
205,012		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.7	50	0.0200	0.15		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.10"
2.9	195	0.0050	1.14		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
1.2	102	0.0050	1.44		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
3.8	262	0.0050	1.14		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
13.6	609	Total			

Summary for Reach DP1:

Inflow Area = 228,451 sf, 17.94% Impervious, Inflow Depth = 2.10" for 50-Year event
Inflow = 6.74 cfs @ 12.33 hrs, Volume= 39,965 cf
Outflow = 6.74 cfs @ 12.33 hrs, Volume= 39,965 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

Summary for Reach DP2:

Inflow Area = 205,012 sf, 0.00% Impervious, Inflow Depth = 1.17" for 50-Year event
Inflow = 3.30 cfs @ 12.25 hrs, Volume= 20,073 cf
Outflow = 3.30 cfs @ 12.25 hrs, Volume= 20,073 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

Time span=0.00-36.00 hrs, dt=0.01 hrs, 3601 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment ES1a: Runoff Area=163,297 sf 5.17% Impervious Runoff Depth=2.25"
Flow Length=565' Tc=19.2 min CN=45 Runoff=5.41 cfs 30,674 cf

Subcatchment ES1b: Runoff Area=65,154 sf 49.97% Impervious Runoff Depth=5.04"
Flow Length=950' Tc=23.4 min CN=68 Runoff=4.92 cfs 27,343 cf

Subcatchment ES2: Runoff Area=205,012 sf 0.00% Impervious Runoff Depth=1.91"
Flow Length=609' Tc=13.6 min CN=42 Runoff=6.38 cfs 32,625 cf

Reach DP1: Inflow=10.29 cfs 58,017 cf
Outflow=10.29 cfs 58,017 cf

Reach DP2: Inflow=6.38 cfs 32,625 cf
Outflow=6.38 cfs 32,625 cf

Summary for Subcatchment ES1a:

Runoff = 5.41 cfs @ 12.31 hrs, Volume= 30,674 cf, Depth= 2.25"
Routed to Reach DP1 :

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
NRCC 24-hr D 100-Year Rainfall=8.94"

Area (sf)	CN	Description
103,680	32	Woods/grass comb., Good, HSG A
20,549	96	Gravel surface, HSG A
30,633	39	>75% Grass cover, Good, HSG A
8,435	98	Water Surface, HSG A
163,297	45	Weighted Average
154,862		94.83% Pervious Area
8,435		5.17% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.7	50	0.0200	0.15		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.10"
11.7	350	0.0100	0.50		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
1.8	165	0.0100	1.50		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
19.2	565	Total			

Summary for Subcatchment ES1b:

Runoff = 4.92 cfs @ 12.34 hrs, Volume= 27,343 cf, Depth= 5.04"
Routed to Reach DP1 :

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
NRCC 24-hr D 100-Year Rainfall=8.94"

Area (sf)	CN	Description
32,558	98	Paved roads w/curbs & sewers, HSG A
29,189	39	>75% Grass cover, Good, HSG A
3,407	30	Woods, Good, HSG A
65,154	68	Weighted Average
32,596		50.03% Pervious Area
32,558		49.97% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.7	50	0.0200	0.15		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.10"
1.8	143	0.0070	1.35		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
0.7	61	0.0050	1.44		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
1.7	75	0.0020	0.72		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
1.0	136	0.0125	2.27		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
10.7	320	0.0100	0.50		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
1.8	165	0.0100	1.50		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
23.4	950	Total			

Summary for Subcatchment ES2:

Runoff = 6.38 cfs @ 12.23 hrs, Volume= 32,625 cf, Depth= 1.91"
Routed to Reach DP2 :

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
NRCC 24-hr D 100-Year Rainfall=8.94"

Area (sf)	CN	Description
54,724	32	Woods/grass comb., Good, HSG A
19,083	96	Gravel surface, HSG A
131,205	39	>75% Grass cover, Good, HSG A
205,012	42	Weighted Average
205,012		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.7	50	0.0200	0.15		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.10"
2.9	195	0.0050	1.14		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
1.2	102	0.0050	1.44		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
3.8	262	0.0050	1.14		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
13.6	609	Total			

Summary for Reach DP1:

Inflow Area = 228,451 sf, 17.94% Impervious, Inflow Depth = 3.05" for 100-Year event
Inflow = 10.29 cfs @ 12.31 hrs, Volume= 58,017 cf
Outflow = 10.29 cfs @ 12.31 hrs, Volume= 58,017 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

Summary for Reach DP2:

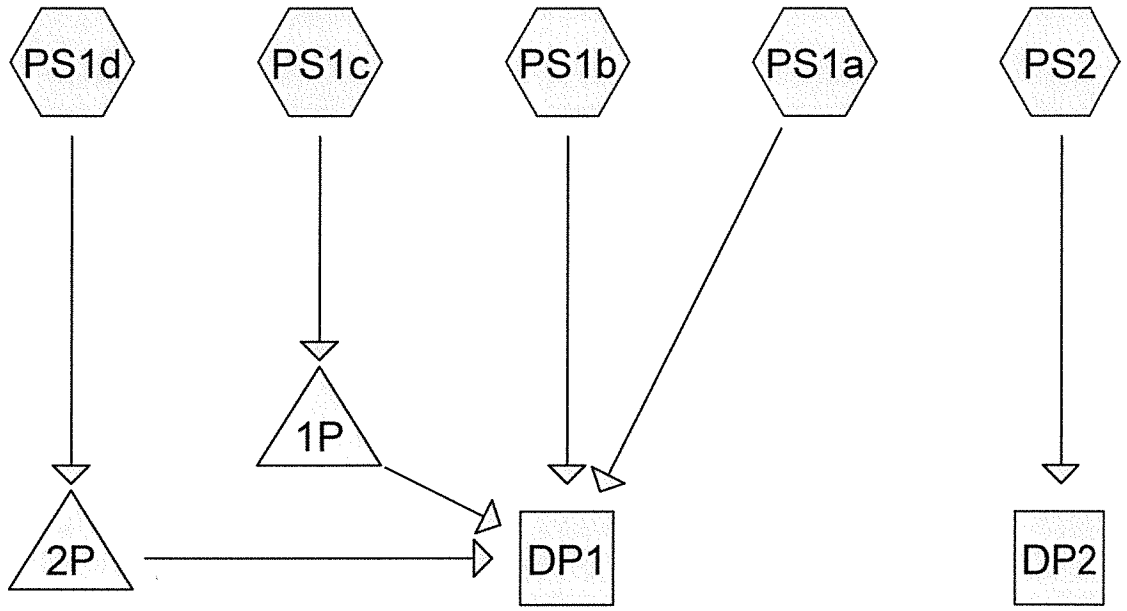
Inflow Area = 205,012 sf, 0.00% Impervious, Inflow Depth = 1.91" for 100-Year event
Inflow = 6.38 cfs @ 12.23 hrs, Volume= 32,625 cf
Outflow = 6.38 cfs @ 12.23 hrs, Volume= 32,625 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

APPENDIX C:

PROPOSED CONDITIONS

HYDROLOGIC ANALYSIS



Subcat Reach Pond Link

Routing Diagram for 3794 - Post Development
Prepared by The Morin-Cameron Group, Inc.

Area Listing (all nodes)

Area (sq-ft)	CN	Description (subcatchment-numbers)
249,135	39	>75% Grass cover, Good, HSG A (PS1a, PS1b, PS1c, PS1d, PS2)
6,913	98	Paved parking, HSG A (PS1b)
48,930	98	Paved roads w/curbs & sewers, HSG A (PS1c, PS1d)
4,565	98	Sidewalk (PS1c, PS1d)
13,020	98	Water Surface, HSG A (PS1a)
110,900	32	Woods/grass comb., Good, HSG A (PS1a, PS1c, PS2)

Time span=0.00-36.00 hrs, dt=0.01 hrs, 3601 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment PS1a: Runoff Area=118,488 sf 10.99% Impervious Runoff Depth=0.01"
Tc=6.0 min CN=42 Runoff=0.01 cfs 105 cf

Subcatchment PS1b: Runoff Area=10,789 sf 64.07% Impervious Runoff Depth=1.18"
Tc=6.0 min CN=77 Runoff=0.32 cfs 1,058 cf

Subcatchment PS1c: Runoff Area=78,826 sf 46.85% Impervious Runoff Depth=0.62"
Tc=6.0 min CN=66 Runoff=1.06 cfs 4,059 cf

Subcatchment PS1d: Runoff Area=26,805 sf 61.80% Impervious Runoff Depth=1.06"
Tc=6.0 min CN=75 Runoff=0.71 cfs 2,368 cf

Subcatchment PS2: Runoff Area=198,555 sf 0.00% Impervious Runoff Depth=0.00"
Flow Length=559' Tc=12.8 min CN=37 Runoff=0.00 cfs 0 cf

Reach DP1: Inflow=0.32 cfs 1,162 cf
Outflow=0.32 cfs 1,162 cf

Reach DP2: Inflow=0.00 cfs 0 cf
Outflow=0.00 cfs 0 cf

Pond 1P: Peak Elev=82.96' Storage=544 cf Inflow=1.06 cfs 4,059 cf
Discarded=0.42 cfs 4,059 cf Primary=0.00 cfs 0 cf Outflow=0.42 cfs 4,059 cf

Pond 2P: Peak Elev=82.90' Storage=229 cf Inflow=0.71 cfs 2,368 cf
Discarded=0.27 cfs 2,368 cf Primary=0.00 cfs 0 cf Outflow=0.27 cfs 2,368 cf

Summary for Subcatchment PS1a:

Runoff = 0.01 cfs @ 24.01 hrs, Volume= 105 cf, Depth= 0.01"
Routed to Reach DP1 :

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
NRCC 24-hr D 2-Year Rainfall=3.15"

Area (sf)	CN	Description
61,175	32	Woods/grass comb., Good, HSG A
44,293	39	>75% Grass cover, Good, HSG A
13,020	98	Water Surface, HSG A
118,488	42	Weighted Average
105,468		89.01% Pervious Area
13,020		10.99% Impervious Area

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

Summary for Subcatchment PS1b:

Runoff = 0.32 cfs @ 12.13 hrs, Volume= 1,058 cf, Depth= 1.18"
Routed to Reach DP1 :

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
NRCC 24-hr D 2-Year Rainfall=3.15"

Area (sf)	CN	Description
3,876	39	>75% Grass cover, Good, HSG A
6,913	98	Paved parking, HSG A
10,789	77	Weighted Average
3,876		35.93% Pervious Area
6,913		64.07% Impervious Area

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

Summary for Subcatchment PS1c:

Runoff = 1.06 cfs @ 12.14 hrs, Volume= 4,059 cf, Depth= 0.62"
Routed to Pond 1P :

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
NRCC 24-hr D 2-Year Rainfall=3.15"

	Area (sf)	CN	Description
	1,894	32	Woods/grass comb., Good, HSG A
	40,003	39	>75% Grass cover, Good, HSG A
	35,333	98	Paved roads w/curbs & sewers, HSG A
*	1,596	98	Sidewalk
	78,826	66	Weighted Average
	41,897		53.15% Pervious Area
	36,929		46.85% Impervious Area

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

Summary for Subcatchment PS1d:

Runoff = 0.71 cfs @ 12.14 hrs, Volume= 2,368 cf, Depth= 1.06"
Routed to Pond 2P :

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
NRCC 24-hr D 2-Year Rainfall=3.15"

	Area (sf)	CN	Description
	10,239	39	>75% Grass cover, Good, HSG A
	13,597	98	Paved roads w/curbs & sewers, HSG A
*	2,969	98	Sidewalk
	26,805	75	Weighted Average
	10,239		38.20% Pervious Area
	16,566		61.80% Impervious Area

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

Summary for Subcatchment PS2:

Runoff = 0.00 cfs @ 0.00 hrs, Volume= 0 cf, Depth= 0.00"
Routed to Reach DP2 :

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
NRCC 24-hr D 2-Year Rainfall=3.15"

Area (sf)	CN	Description
47,831	32	Woods/grass comb., Good, HSG A
150,724	39	>75% Grass cover, Good, HSG A
198,555	37	Weighted Average
198,555		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.7	50	0.0200	0.15		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.10"
2.1	145	0.0050	1.14		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
1.2	102	0.0050	1.44		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
3.8	262	0.0050	1.14		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
12.8	559	Total			

Summary for Reach DP1:

Inflow Area = 234,908 sf, 31.26% Impervious, Inflow Depth = 0.06" for 2-Year event
Inflow = 0.32 cfs @ 12.13 hrs, Volume= 1,162 cf
Outflow = 0.32 cfs @ 12.13 hrs, Volume= 1,162 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

Summary for Reach DP2:

Inflow Area = 198,555 sf, 0.00% Impervious, Inflow Depth = 0.00" for 2-Year event
Inflow = 0.00 cfs @ 0.00 hrs, Volume= 0 cf
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

Summary for Pond 1P:

Inflow Area = 78,826 sf, 46.85% Impervious, Inflow Depth = 0.62" for 2-Year event
Inflow = 1.06 cfs @ 12.14 hrs, Volume= 4,059 cf
Outflow = 0.42 cfs @ 12.31 hrs, Volume= 4,059 cf, Atten= 61%, Lag= 10.2 min
Discarded = 0.42 cfs @ 12.31 hrs, Volume= 4,059 cf
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf
Routed to Reach DP1 :

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Peak Elev= 82.96' @ 12.31 hrs Surf.Area= 2,175 sf Storage= 544 cf

Plug-Flow detention time= 21.8 min calculated for 4,059 cf (100% of inflow)
Center-of-Mass det. time= 21.8 min (954.2 - 932.5)

Volume	Invert	Avail.Storage	Storage Description
#1	82.50'	11,904 cf	**Custom Stage Data (Prismatic)** Listed below

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
82.50	0	0	0
83.00	2,342	586	586
84.00	3,255	2,799	3,384
85.00	4,266	3,761	7,145
86.00	5,253	4,760	11,904

Device	Routing	Invert	Outlet Devices
#1	Primary	84.00'	**18.0" Round Culvert** L= 63.0' RCP, sq.cut end projecting, Ke= 0.500 Inlet / Outlet Invert= 84.00' / 83.50' S= 0.0079 '/' Cc= 0.900 n= 0.011 Concrete pipe, straight & clean, Flow Area= 1.77 sf
#2	Discarded	82.50'	**8.270 in/hr Exfiltration over Surface area**
#3	Device 1	84.00'	**21.0" W x 3.0" H Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#4	Device 1	84.80'	**4.0' long x 0.5' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32

Discarded OutFlow Max=0.42 cfs @ 12.31 hrs HW=82.96' (Free Discharge)
└**2=Exfiltration** (Exfiltration Controls 0.42 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=82.50' (Free Discharge)
└**1=Culvert** (Controls 0.00 cfs)
  ├**3=Orifice/Grate** (Controls 0.00 cfs)
  └**4=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond 2P:

Inflow Area = 26,805 sf, 61.80% Impervious, Inflow Depth = 1.06" for 2-Year event
Inflow = 0.71 cfs @ 12.14 hrs, Volume= 2,368 cf
Outflow = 0.27 cfs @ 12.01 hrs, Volume= 2,368 cf, Atten= 62%, Lag= 0.0 min
Discarded = 0.27 cfs @ 12.01 hrs, Volume= 2,368 cf
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf
Routed to Reach DP1 :

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs / 3
Peak Elev= 82.90' @ 12.29 hrs Surf.Area= 1,428 sf Storage= 229 cf

Plug-Flow detention time= 3.5 min calculated for 2,367 cf (100% of inflow)
Center-of-Mass det. time= 3.5 min (895.5 - 892.0)

Volume	Invert	Avail.Storage	Storage Description
#1A	82.50'	443 cf	**34.00'W x 42.00'L x 3.17'H Field A** 4,522 cf Overall - 3,413 cf Embedded = 1,109 cf x 40.0% Voids
#2A	83.00'	2,172 cf	**retain_it retain_it 2.0'** x 20 Inside #1 Inside= 84.0"W x 24.0"H => 13.78 sf x 8.00'L = 110.3 cf Outside= 96.0"W x 32.0"H => 21.33 sf x 8.00'L = 170.7 cf 4 Rows adjusted for 34.0 cf perimeter wall
		2,615 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	82.50'	**8.270 in/hr Exfiltration over Surface area**
#2	Primary	84.00'	**12.0" Round Culvert** L= 50.0' RCP, sq.cut end projecting, Ke= 0.500 Inlet / Outlet Invert= 84.00' / 83.70' S= 0.0060 '/' Cc= 0.900 n= 0.011 Concrete pipe, straight & clean, Flow Area= 0.79 sf

Discarded OutFlow Max=0.27 cfs @ 12.01 hrs HW=82.53' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.27 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=82.50' (Free Discharge)
↑—**2=Culvert** (Controls 0.00 cfs)

Time span=0.00-36.00 hrs, dt=0.01 hrs, 3601 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment PS1a: Runoff Area=118,488 sf 10.99% Impervious Runoff Depth=0.27"
Tc=6.0 min CN=42 Runoff=0.11 cfs 2,660 cf

Subcatchment PS1b: Runoff Area=10,789 sf 64.07% Impervious Runoff Depth=2.48"
Tc=6.0 min CN=77 Runoff=0.69 cfs 2,231 cf

Subcatchment PS1c: Runoff Area=78,826 sf 46.85% Impervious Runoff Depth=1.61"
Tc=6.0 min CN=66 Runoff=3.18 cfs 10,595 cf

Subcatchment PS1d: Runoff Area=26,805 sf 61.80% Impervious Runoff Depth=2.31"
Tc=6.0 min CN=75 Runoff=1.59 cfs 5,165 cf

Subcatchment PS2: Runoff Area=198,555 sf 0.00% Impervious Runoff Depth=0.11"
Flow Length=559' Tc=12.8 min CN=37 Runoff=0.05 cfs 1,820 cf

Reach DP1: Inflow=0.69 cfs 4,891 cf
Outflow=0.69 cfs 4,891 cf

Reach DP2: Inflow=0.05 cfs 1,820 cf
Outflow=0.05 cfs 1,820 cf

Pond 1P: Peak Elev=83.70' Storage=2,540 cf Inflow=3.18 cfs 10,595 cf
Discarded=0.57 cfs 10,595 cf Primary=0.00 cfs 0 cf Outflow=0.57 cfs 10,595 cf

Pond 2P: Peak Elev=83.68' Storage=1,069 cf Inflow=1.59 cfs 5,165 cf
Discarded=0.27 cfs 5,165 cf Primary=0.00 cfs 0 cf Outflow=0.27 cfs 5,165 cf

Summary for Subcatchment PS1a:

Runoff = 0.11 cfs @ 12.54 hrs, Volume= 2,660 cf, Depth= 0.27"
Routed to Reach DP1 :

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
NRCC 24-hr D 10-Year Rainfall=4.83"

Area (sf)	CN	Description
61,175	32	Woods/grass comb., Good, HSG A
44,293	39	>75% Grass cover, Good, HSG A
13,020	98	Water Surface, HSG A
118,488	42	Weighted Average
105,468		89.01% Pervious Area
13,020		10.99% Impervious Area

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

Summary for Subcatchment PS1b:

Runoff = 0.69 cfs @ 12.13 hrs, Volume= 2,231 cf, Depth= 2.48"
Routed to Reach DP1 :

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
NRCC 24-hr D 10-Year Rainfall=4.83"

Area (sf)	CN	Description
3,876	39	>75% Grass cover, Good, HSG A
6,913	98	Paved parking, HSG A
10,789	77	Weighted Average
3,876		35.93% Pervious Area
6,913		64.07% Impervious Area

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

Summary for Subcatchment PS1c:

Runoff = 3.18 cfs @ 12.14 hrs, Volume= 10,595 cf, Depth= 1.61"
Routed to Pond 1P :

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
NRCC 24-hr D 10-Year Rainfall=4.83"

	Area (sf)	CN	Description
	1,894	32	Woods/grass comb., Good, HSG A
	40,003	39	>75% Grass cover, Good, HSG A
	35,333	98	Paved roads w/curbs & sewers, HSG A
*	1,596	98	Sidewalk
	78,826	66	Weighted Average
	41,897		53.15% Pervious Area
	36,929		46.85% Impervious Area

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

Summary for Subcatchment PS1d:

Runoff = 1.59 cfs @ 12.13 hrs, Volume= 5,165 cf, Depth= 2.31"
Routed to Pond 2P :

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
NRCC 24-hr D 10-Year Rainfall=4.83"

	Area (sf)	CN	Description
	10,239	39	>75% Grass cover, Good, HSG A
	13,597	98	Paved roads w/curbs & sewers, HSG A
*	2,969	98	Sidewalk
	26,805	75	Weighted Average
	10,239		38.20% Pervious Area
	16,566		61.80% Impervious Area

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

Summary for Subcatchment PS2:

Runoff = 0.05 cfs @ 16.60 hrs, Volume= 1,820 cf, Depth= 0.11"
Routed to Reach DP2 :

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
NRCC 24-hr D 10-Year Rainfall=4.83"

Area (sf)	CN	Description
47,831	32	Woods/grass comb., Good, HSG A
150,724	39	>75% Grass cover, Good, HSG A
198,555	37	Weighted Average
198,555		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.7	50	0.0200	0.15		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.10"
2.1	145	0.0050	1.14		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
1.2	102	0.0050	1.44		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
3.8	262	0.0050	1.14		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
12.8	559	Total			

Summary for Reach DP1:

Inflow Area = 234,908 sf, 31.26% Impervious, Inflow Depth = 0.25" for 10-Year event
Inflow = 0.69 cfs @ 12.13 hrs, Volume= 4,891 cf
Outflow = 0.69 cfs @ 12.13 hrs, Volume= 4,891 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

Summary for Reach DP2:

Inflow Area = 198,555 sf, 0.00% Impervious, Inflow Depth = 0.11" for 10-Year event
Inflow = 0.05 cfs @ 16.60 hrs, Volume= 1,820 cf
Outflow = 0.05 cfs @ 16.60 hrs, Volume= 1,820 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

Summary for Pond 1P:

Inflow Area = 78,826 sf, 46.85% Impervious, Inflow Depth = 1.61" for 10-Year event
Inflow = 3.18 cfs @ 12.14 hrs, Volume= 10,595 cf
Outflow = 0.57 cfs @ 12.61 hrs, Volume= 10,595 cf, Atten= 82%, Lag= 28.5 min
Discarded = 0.57 cfs @ 12.61 hrs, Volume= 10,595 cf
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf
Routed to Reach DP1 :

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Peak Elev= 83.70' @ 12.61 hrs Surf.Area= 2,980 sf Storage= 2,540 cf

Plug-Flow detention time= 40.5 min calculated for 10,595 cf (100% of inflow)
Center-of-Mass det. time= 40.4 min (933.1 - 892.6)

Volume	Invert	Avail.Storage	Storage Description
#1	82.50'	11,904 cf	**Custom Stage Data (Prismatic)** Listed below

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
82.50	0	0	0
83.00	2,342	586	586
84.00	3,255	2,799	3,384
85.00	4,266	3,761	7,145
86.00	5,253	4,760	11,904

Device	Routing	Invert	Outlet Devices
#1	Primary	84.00'	**18.0" Round Culvert** L= 63.0' RCP, sq.cut end projecting, Ke= 0.500 Inlet / Outlet Invert= 84.00' / 83.50' S= 0.0079 '/' Cc= 0.900 n= 0.011 Concrete pipe, straight & clean, Flow Area= 1.77 sf
#2	Discarded	82.50'	**8.270 in/hr Exfiltration over Surface area**
#3	Device 1	84.00'	**21.0" W x 3.0" H Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#4	Device 1	84.80'	**4.0' long x 0.5' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32

Discarded OutFlow Max=0.57 cfs @ 12.61 hrs HW=83.70' (Free Discharge)
└**2=Exfiltration** (Exfiltration Controls 0.57 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=82.50' (Free Discharge)
└**1=Culvert** (Controls 0.00 cfs)
  ├**3=Orifice/Grate** (Controls 0.00 cfs)
  └**4=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond 2P:

Inflow Area = 26,805 sf, 61.80% Impervious, Inflow Depth = 2.31" for 10-Year event
Inflow = 1.59 cfs @ 12.13 hrs, Volume= 5,165 cf
Outflow = 0.27 cfs @ 11.83 hrs, Volume= 5,165 cf, Atten= 83%, Lag= 0.0 min
Discarded = 0.27 cfs @ 11.83 hrs, Volume= 5,165 cf
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf
Routed to Reach DP1 :

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs / 3
Peak Elev= 83.68' @ 12.59 hrs Surf.Area= 1,428 sf Storage= 1,069 cf

Plug-Flow detention time= 22.3 min calculated for 5,163 cf (100% of inflow)
Center-of-Mass det. time= 22.3 min (884.9 - 862.6)

Volume	Invert	Avail.Storage	Storage Description
#1A	82.50'	443 cf	**34.00'W x 42.00'L x 3.17'H Field A** 4,522 cf Overall - 3,413 cf Embedded = 1,109 cf x 40.0% Voids
#2A	83.00'	2,172 cf	**retain_it retain_it 2.0'** x 20 Inside #1 Inside= 84.0"W x 24.0"H => 13.78 sf x 8.00'L = 110.3 cf Outside= 96.0"W x 32.0"H => 21.33 sf x 8.00'L = 170.7 cf 4 Rows adjusted for 34.0 cf perimeter wall
		2,615 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	82.50'	**8.270 in/hr Exfiltration over Surface area**
#2	Primary	84.00'	**12.0" Round Culvert** L= 50.0' RCP, sq.cut end projecting, Ke= 0.500 Inlet / Outlet Invert= 84.00' / 83.70' S= 0.0060 '/' Cc= 0.900 n= 0.011 Concrete pipe, straight & clean, Flow Area= 0.79 sf

Discarded OutFlow Max=0.27 cfs @ 11.83 hrs HW=82.53' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.27 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=82.50' (Free Discharge)
↑—**2=Culvert** (Controls 0.00 cfs)

Time span=0.00-36.00 hrs, dt=0.01 hrs, 3601 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment PS1a: Runoff Area=118,488 sf 10.99% Impervious Runoff Depth=1.17"
Tc=6.0 min CN=42 Runoff=2.71 cfs 11,601 cf

Subcatchment PS1b: Runoff Area=10,789 sf 64.07% Impervious Runoff Depth=4.75"
Tc=6.0 min CN=77 Runoff=1.29 cfs 4,266 cf

Subcatchment PS1c: Runoff Area=78,826 sf 46.85% Impervious Runoff Depth=3.54"
Tc=6.0 min CN=66 Runoff=7.15 cfs 23,238 cf

Subcatchment PS1d: Runoff Area=26,805 sf 61.80% Impervious Runoff Depth=4.52"
Tc=6.0 min CN=75 Runoff=3.08 cfs 10,100 cf

Subcatchment PS2: Runoff Area=198,555 sf 0.00% Impervious Runoff Depth=0.77"
Flow Length=559' Tc=12.8 min CN=37 Runoff=1.34 cfs 12,674 cf

Reach DP1: Inflow=4.92 cfs 21,462 cf
Outflow=4.92 cfs 21,462 cf

Reach DP2: Inflow=1.34 cfs 12,674 cf
Outflow=1.34 cfs 12,674 cf

Pond 1P: Peak Elev=84.61' Storage=5,688 cf Inflow=7.15 cfs 23,238 cf
Discarded=0.74 cfs 19,285 cf Primary=1.47 cfs 3,953 cf Outflow=2.21 cfs 23,238 cf

Pond 2P: Peak Elev=84.57' Storage=2,084 cf Inflow=3.08 cfs 10,100 cf
Discarded=0.27 cfs 8,459 cf Primary=1.03 cfs 1,641 cf Outflow=1.30 cfs 10,100 cf

Summary for Subcatchment PS1a:

Runoff = 2.71 cfs @ 12.14 hrs, Volume= 11,601 cf, Depth= 1.17"
Routed to Reach DP1 :

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
NRCC 24-hr D 50-Year Rainfall=7.42"

Area (sf)	CN	Description
61,175	32	Woods/grass comb., Good, HSG A
44,293	39	>75% Grass cover, Good, HSG A
13,020	98	Water Surface, HSG A
118,488	42	Weighted Average
105,468		89.01% Pervious Area
13,020		10.99% Impervious Area

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

Summary for Subcatchment PS1b:

Runoff = 1.29 cfs @ 12.13 hrs, Volume= 4,266 cf, Depth= 4.75"
Routed to Reach DP1 :

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
NRCC 24-hr D 50-Year Rainfall=7.42"

Area (sf)	CN	Description
3,876	39	>75% Grass cover, Good, HSG A
6,913	98	Paved parking, HSG A
10,789	77	Weighted Average
3,876		35.93% Pervious Area
6,913		64.07% Impervious Area

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

Summary for Subcatchment PS1c:

Runoff = 7.15 cfs @ 12.13 hrs, Volume= 23,238 cf, Depth= 3.54"
Routed to Pond 1P :

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
NRCC 24-hr D 50-Year Rainfall=7.42"

	Area (sf)	CN	Description
	1,894	32	Woods/grass comb., Good, HSG A
	40,003	39	>75% Grass cover, Good, HSG A
	35,333	98	Paved roads w/curbs & sewers, HSG A
*	1,596	98	Sidewalk
	78,826	66	Weighted Average
	41,897		53.15% Pervious Area
	36,929		46.85% Impervious Area

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

Summary for Subcatchment PS1d:

Runoff = 3.08 cfs @ 12.13 hrs, Volume= 10,100 cf, Depth= 4.52"
Routed to Pond 2P :

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
NRCC 24-hr D 50-Year Rainfall=7.42"

	Area (sf)	CN	Description
	10,239	39	>75% Grass cover, Good, HSG A
	13,597	98	Paved roads w/curbs & sewers, HSG A
*	2,969	98	Sidewalk
	26,805	75	Weighted Average
	10,239		38.20% Pervious Area
	16,566		61.80% Impervious Area

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

Summary for Subcatchment PS2:

Runoff = 1.34 cfs @ 12.27 hrs, Volume= 12,674 cf, Depth= 0.77"
Routed to Reach DP2 :

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
NRCC 24-hr D 50-Year Rainfall=7.42"

Area (sf)	CN	Description
47,831	32	Woods/grass comb., Good, HSG A
150,724	39	>75% Grass cover, Good, HSG A
198,555	37	Weighted Average
198,555		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.7	50	0.0200	0.15		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.10"
2.1	145	0.0050	1.14		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
1.2	102	0.0050	1.44		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
3.8	262	0.0050	1.14		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
12.8	559	Total			

Summary for Reach DP1:

Inflow Area = 234,908 sf, 31.26% Impervious, Inflow Depth = 1.10" for 50-Year event
Inflow = 4.92 cfs @ 12.18 hrs, Volume= 21,462 cf
Outflow = 4.92 cfs @ 12.18 hrs, Volume= 21,462 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

Summary for Reach DP2:

Inflow Area = 198,555 sf, 0.00% Impervious, Inflow Depth = 0.77" for 50-Year event
Inflow = 1.34 cfs @ 12.27 hrs, Volume= 12,674 cf
Outflow = 1.34 cfs @ 12.27 hrs, Volume= 12,674 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

Summary for Pond 1P:

Inflow Area = 78,826 sf, 46.85% Impervious, Inflow Depth = 3.54" for 50-Year event
Inflow = 7.15 cfs @ 12.13 hrs, Volume= 23,238 cf
Outflow = 2.21 cfs @ 12.33 hrs, Volume= 23,238 cf, Atten= 69%, Lag= 11.6 min
Discarded = 0.74 cfs @ 12.33 hrs, Volume= 19,285 cf
Primary = 1.47 cfs @ 12.33 hrs, Volume= 3,953 cf
Routed to Reach DP1 :

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Peak Elev= 84.61' @ 12.33 hrs Surf.Area= 3,874 sf Storage= 5,688 cf

Plug-Flow detention time= 50.8 min calculated for 23,231 cf (100% of inflow)
Center-of-Mass det. time= 50.8 min (913.8 - 863.0)

Volume	Invert	Avail.Storage	Storage Description
#1	82.50'	11,904 cf	**Custom Stage Data (Prismatic)** Listed below

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
82.50	0	0	0
83.00	2,342	586	586
84.00	3,255	2,799	3,384
85.00	4,266	3,761	7,145
86.00	5,253	4,760	11,904

Device	Routing	Invert	Outlet Devices
#1	Primary	84.00'	**18.0" Round Culvert** L= 63.0' RCP, sq.cut end projecting, Ke= 0.500 Inlet / Outlet Invert= 84.00' / 83.50' S= 0.0079 '/' Cc= 0.900 n= 0.011 Concrete pipe, straight & clean, Flow Area= 1.77 sf
#2	Discarded	82.50'	**8.270 in/hr Exfiltration over Surface area**
#3	Device 1	84.00'	**21.0" W x 3.0" H Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#4	Device 1	84.80'	**4.0' long x 0.5' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32

Discarded OutFlow Max=0.74 cfs @ 12.33 hrs HW=84.61' (Free Discharge)
└**2=Exfiltration** (Exfiltration Controls 0.74 cfs)

Primary OutFlow Max=1.47 cfs @ 12.33 hrs HW=84.61' (Free Discharge)
└**1=Culvert** (Passes 1.47 cfs of 1.77 cfs potential flow)
  ├**3=Orifice/Grate** (Orifice Controls 1.47 cfs @ 3.35 fps)
  └**4=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond 2P:

Inflow Area = 26,805 sf, 61.80% Impervious, Inflow Depth = 4.52" for 50-Year event
Inflow = 3.08 cfs @ 12.13 hrs, Volume= 10,100 cf
Outflow = 1.30 cfs @ 12.25 hrs, Volume= 10,100 cf, Atten= 58%, Lag= 7.4 min
Discarded = 0.27 cfs @ 11.43 hrs, Volume= 8,459 cf
Primary = 1.03 cfs @ 12.25 hrs, Volume= 1,641 cf
Routed to Reach DP1 :

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs / 3
Peak Elev= 84.57' @ 12.25 hrs Surf.Area= 1,428 sf Storage= 2,084 cf

Plug-Flow detention time= 33.0 min calculated for 10,097 cf (100% of inflow)
Center-of-Mass det. time= 33.0 min (870.6 - 837.7)

Volume	Invert	Avail.Storage	Storage Description
#1A	82.50'	443 cf	**34.00'W x 42.00'L x 3.17'H Field A** 4,522 cf Overall - 3,413 cf Embedded = 1,109 cf x 40.0% Voids
#2A	83.00'	2,172 cf	**retain_it retain_it 2.0'** x 20 Inside #1 Inside= 84.0"W x 24.0"H => 13.78 sf x 8.00'L = 110.3 cf Outside= 96.0"W x 32.0"H => 21.33 sf x 8.00'L = 170.7 cf 4 Rows adjusted for 34.0 cf perimeter wall
		2,615 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	82.50'	**8.270 in/hr Exfiltration over Surface area**
#2	Primary	84.00'	**12.0" Round Culvert** L= 50.0' RCP, sq.cut end projecting, Ke= 0.500 Inlet / Outlet Invert= 84.00' / 83.70' S= 0.0060 '/' Cc= 0.900 n= 0.011 Concrete pipe, straight & clean, Flow Area= 0.79 sf

Discarded OutFlow Max=0.27 cfs @ 11.43 hrs HW=82.53' (Free Discharge)
↑**1=Exfiltration** (Exfiltration Controls 0.27 cfs)

Primary OutFlow Max=1.02 cfs @ 12.25 hrs HW=84.57' (Free Discharge)
↑**2=Culvert** (Barrel Controls 1.02 cfs @ 3.19 fps)

Time span=0.00-36.00 hrs, dt=0.01 hrs, 3601 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment PS1a: Runoff Area=118,488 sf 10.99% Impervious Runoff Depth=1.91"
Tc=6.0 min CN=42 Runoff=5.10 cfs 18,856 cf

Subcatchment PS1b: Runoff Area=10,789 sf 64.07% Impervious Runoff Depth=6.14"
Tc=6.0 min CN=77 Runoff=1.65 cfs 5,523 cf

Subcatchment PS1c: Runoff Area=78,826 sf 46.85% Impervious Runoff Depth=4.79"
Tc=6.0 min CN=66 Runoff=9.67 cfs 31,465 cf

Subcatchment PS1d: Runoff Area=26,805 sf 61.80% Impervious Runoff Depth=5.90"
Tc=6.0 min CN=75 Runoff=3.97 cfs 13,173 cf

Subcatchment PS2: Runoff Area=198,555 sf 0.00% Impervious Runoff Depth=1.36"
Flow Length=559' Tc=12.8 min CN=37 Runoff=3.68 cfs 22,465 cf

Reach DP1: Inflow=10.28 cfs 35,822 cf
Outflow=10.28 cfs 35,822 cf

Reach DP2: Inflow=3.68 cfs 22,465 cf
Outflow=3.68 cfs 22,465 cf

Pond 1P: Peak Elev=85.05' Storage=7,383 cf Inflow=9.67 cfs 31,465 cf
Discarded=0.83 cfs 23,240 cf Primary=3.44 cfs 8,224 cf Outflow=4.27 cfs 31,465 cf

Pond 2P: Peak Elev=84.92' Storage=2,487 cf Inflow=3.97 cfs 13,173 cf
Discarded=0.27 cfs 9,954 cf Primary=2.19 cfs 3,219 cf Outflow=2.46 cfs 13,173 cf

Summary for Subcatchment PS1a:

Runoff = 5.10 cfs @ 12.14 hrs, Volume= 18,856 cf, Depth= 1.91"
Routed to Reach DP1 :

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
NRCC 24-hr D 100-Year Rainfall=8.94"

Area (sf)	CN	Description
61,175	32	Woods/grass comb., Good, HSG A
44,293	39	>75% Grass cover, Good, HSG A
13,020	98	Water Surface, HSG A
118,488	42	Weighted Average
105,468		89.01% Pervious Area
13,020		10.99% Impervious Area

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

Summary for Subcatchment PS1b:

Runoff = 1.65 cfs @ 12.13 hrs, Volume= 5,523 cf, Depth= 6.14"
Routed to Reach DP1 :

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
NRCC 24-hr D 100-Year Rainfall=8.94"

Area (sf)	CN	Description
3,876	39	>75% Grass cover, Good, HSG A
6,913	98	Paved parking, HSG A
10,789	77	Weighted Average
3,876		35.93% Pervious Area
6,913		64.07% Impervious Area

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

Summary for Subcatchment PS1c:

Runoff = 9.67 cfs @ 12.13 hrs, Volume= 31,465 cf, Depth= 4.79"
Routed to Pond 1P :

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
NRCC 24-hr D 100-Year Rainfall=8.94"

	Area (sf)	CN	Description
	1,894	32	Woods/grass comb., Good, HSG A
	40,003	39	>75% Grass cover, Good, HSG A
	35,333	98	Paved roads w/curbs & sewers, HSG A
*	1,596	98	Sidewalk
	78,826	66	Weighted Average
	41,897		53.15% Pervious Area
	36,929		46.85% Impervious Area

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

Summary for Subcatchment PS1d:

Runoff = 3.97 cfs @ 12.13 hrs, Volume= 13,173 cf, Depth= 5.90"
Routed to Pond 2P :

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
NRCC 24-hr D 100-Year Rainfall=8.94"

	Area (sf)	CN	Description
	10,239	39	>75% Grass cover, Good, HSG A
	13,597	98	Paved roads w/curbs & sewers, HSG A
*	2,969	98	Sidewalk
	26,805	75	Weighted Average
	10,239		38.20% Pervious Area
	16,566		61.80% Impervious Area

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

Summary for Subcatchment PS2:

Runoff = 3.68 cfs @ 12.24 hrs, Volume= 22,465 cf, Depth= 1.36"
Routed to Reach DP2 :

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
NRCC 24-hr D 100-Year Rainfall=8.94"

Area (sf)	CN	Description
47,831	32	Woods/grass comb., Good, HSG A
150,724	39	>75% Grass cover, Good, HSG A
198,555	37	Weighted Average
198,555		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.7	50	0.0200	0.15		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.10"
2.1	145	0.0050	1.14		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
1.2	102	0.0050	1.44		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
3.8	262	0.0050	1.14		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
12.8	559	Total			

Summary for Reach DP1:

Inflow Area = 234,908 sf, 31.26% Impervious, Inflow Depth = 1.83" for 100-Year event
Inflow = 10.28 cfs @ 12.17 hrs, Volume= 35,822 cf
Outflow = 10.28 cfs @ 12.17 hrs, Volume= 35,822 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

Summary for Reach DP2:

Inflow Area = 198,555 sf, 0.00% Impervious, Inflow Depth = 1.36" for 100-Year event
Inflow = 3.68 cfs @ 12.24 hrs, Volume= 22,465 cf
Outflow = 3.68 cfs @ 12.24 hrs, Volume= 22,465 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

Summary for Pond 1P:

Inflow Area = 78,826 sf, 46.85% Impervious, Inflow Depth = 4.79" for 100-Year event
Inflow = 9.67 cfs @ 12.13 hrs, Volume= 31,465 cf
Outflow = 4.27 cfs @ 12.25 hrs, Volume= 31,465 cf, Atten= 56%, Lag= 7.1 min
Discarded = 0.83 cfs @ 12.25 hrs, Volume= 23,240 cf
Primary = 3.44 cfs @ 12.25 hrs, Volume= 8,224 cf
Routed to Reach DP1 :

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Peak Elev= 85.05' @ 12.25 hrs Surf.Area= 4,315 sf Storage= 7,383 cf

Plug-Flow detention time= 48.9 min calculated for 31,456 cf (100% of inflow)
Center-of-Mass det. time= 48.9 min (900.6 - 851.7)

Volume	Invert	Avail.Storage	Storage Description
#1	82.50'	11,904 cf	**Custom Stage Data (Prismatic)** Listed below

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
82.50	0	0	0
83.00	2,342	586	586
84.00	3,255	2,799	3,384
85.00	4,266	3,761	7,145
86.00	5,253	4,760	11,904

Device	Routing	Invert	Outlet Devices
#1	Primary	84.00'	**18.0" Round Culvert** L= 63.0' RCP, sq.cut end projecting, Ke= 0.500 Inlet / Outlet Invert= 84.00' / 83.50' S= 0.0079 '/' Cc= 0.900 n= 0.011 Concrete pipe, straight & clean, Flow Area= 1.77 sf
#2	Discarded	82.50'	**8.270 in/hr Exfiltration over Surface area**
#3	Device 1	84.00'	**21.0" W x 3.0" H Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#4	Device 1	84.80'	**4.0' long x 0.5' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32

Discarded OutFlow Max=0.83 cfs @ 12.25 hrs HW=85.05' (Free Discharge)
└**2=Exfiltration** (Exfiltration Controls 0.83 cfs)

Primary OutFlow Max=3.44 cfs @ 12.25 hrs HW=85.05' (Free Discharge)
└**1=Culvert** (Passes 3.44 cfs of 4.35 cfs potential flow)
  ├**3=Orifice/Grate** (Orifice Controls 2.02 cfs @ 4.63 fps)
  └**4=Broad-Crested Rectangular Weir** (Weir Controls 1.42 cfs @ 1.42 fps)

Summary for Pond 2P:

Inflow Area = 26,805 sf, 61.80% Impervious, Inflow Depth = 5.90" for 100-Year event
Inflow = 3.97 cfs @ 12.13 hrs, Volume= 13,173 cf
Outflow = 2.46 cfs @ 12.20 hrs, Volume= 13,173 cf, Atten= 38%, Lag= 4.2 min
Discarded = 0.27 cfs @ 11.13 hrs, Volume= 9,954 cf
Primary = 2.19 cfs @ 12.20 hrs, Volume= 3,219 cf
Routed to Reach DP1 :

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs / 3
Peak Elev= 84.92' @ 12.20 hrs Surf.Area= 1,428 sf Storage= 2,487 cf

Plug-Flow detention time= 31.7 min calculated for 13,173 cf (100% of inflow)
Center-of-Mass det. time= 31.7 min (859.6 - 827.9)

Volume	Invert	Avail.Storage	Storage Description
#1A	82.50'	443 cf	**34.00'W x 42.00'L x 3.17'H Field A** 4,522 cf Overall - 3,413 cf Embedded = 1,109 cf x 40.0% Voids
#2A	83.00'	2,172 cf	**retain_it retain_it 2.0'** x 20 Inside #1 Inside= 84.0"W x 24.0"H => 13.78 sf x 8.00'L = 110.3 cf Outside= 96.0"W x 32.0"H => 21.33 sf x 8.00'L = 170.7 cf 4 Rows adjusted for 34.0 cf perimeter wall
		2,615 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	82.50'	**8.270 in/hr Exfiltration over Surface area**
#2	Primary	84.00'	**12.0" Round Culvert** L= 50.0' RCP, sq.cut end projecting, Ke= 0.500 Inlet / Outlet Invert= 84.00' / 83.70' S= 0.0060 '/' Cc= 0.900 n= 0.011 Concrete pipe, straight & clean, Flow Area= 0.79 sf

Discarded OutFlow Max=0.27 cfs @ 11.13 hrs HW=82.53' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.27 cfs)

Primary OutFlow Max=2.19 cfs @ 12.20 hrs HW=84.92' (Free Discharge)
↑—**2=Culvert** (Barrel Controls 2.19 cfs @ 3.77 fps)

APPENDIX D:

SUPPLEMENTAL STORMWATER MANAGEMENT CALCULATIONS

January 6, 2022

Stormwater Management Calculations

STANDARD 3: Recharge to Groundwater: Static Method
(On site only)

- Calculate Post-Construction in Impervious Area
  (From HydroCAD Model – includes off-site area)

  Existing Impervious Area HSG A Soil = 32,558 SF
  Proposed Impervious Area HSG A Soil = 60,408 SF

  Increase in Impervious = 60,408 SF – 32,558 SF = 27,850 SF

- Determine Rainfall Depth to be Recharged
  (MassDEP Stormwater Management Handbook: Table 2.3.2)

Hydrologic Soil Group	Recharge Rainfall Depth
A	0.60"

- Calculate Recharge Volume
  'Rv' = [0.60" x 27,850 SF] = 167,100 SF-In
  'Rv' = [167,100 SF-In] / 12 SF-In = 1,393 CF
  'Rv' **= 0 CF**

- Calculate Recharge Volume (Georgetown Stormwater Regulations)
  'Rv' = [2" x 27,850 SF] = 55,700 SF-In
  'Rv' = [55,700 SF-In] / 12 SF-In = 4,642 CF
  'Rv' **= 4,642 CF**

  ***USE LARGER 'Rv' (4,642 cf)**

- Calculate Provided Recharge
  Schedule of Proposed Recharge System Volumes

HCAD System ID	Bottom of System	Lowest System Outlet	Total Recharge Volume Provided	Description
1P	82.50	84.00	3,384 cf	Infiltration Basin
2P	82.50	84.00	1,431 cf	Concrete Galleys
		Total Volume: 4,815 CF		

Recharge volume provided measured to lowest system outlet.

Required Recharge Volume Summary of Results

Total Volume Provided Below Outlet = 4,815 CF
Total Volume Required = 4,642 CF

Verify Drawdown, Maximum 72-Hours: Static Method

HCAD System ID	Recharge Volume (CF)	Bottom Surface Area (SF)	Rawls Rate Inches/Hour	Drawdown Time Rv / (K x A) - Hours	Description
1P	3,384	2,342	8.27	2.1	Infiltration Basin
2P	1,431	1,428	8.27	1.5	Concrete Galleys

Design Complies with Recharge Volume Standard*

STANDARD 4: Water Quality Volume

HCAD System ID	Tributary Impervious Area		Treatment Volume	Minimum Volume (CF)	Provided Volume (CF)
1P	36,929	sf	1"	3,077	3384
2P	16,293	sf	1"	1,358	1431
Total Site:	53,222	sf	1"	4,435	**4,815**

The Morin-Cameron GROUP, INC.
CIVIL ENGINEERS | ENVIRONMENTAL CONSULTANTS
LAND SURVEYORS | LAND USE PLANNERS
66 Elm Street, Danvers, MA 01923
P: 978-777-8586
www.morincameron.com

PROJECT ADDRESS 20 CARLETON DRIVE - GEORGETOWN
SHEET NO. 1 OF 1
CALCULATED BY DJP DATE 1-5-2022
CHECKED BY _____ DATE _____
JOB NO. 3794 CLIENT G. MELLO DISPOSAL CORP

PHOSPHORUS REMOVAL LOAD CALCULATIONS

* REFERENCE USED
- MA MS4 GENERAL PERMIT

- 1P

ID	LAND USE	COVER	AREA (AC)	PLER (lb/ac/yr)
1	COMMERCIAL	IMPERVIOUS	0.833	1.78
2	LANDSCAPED (A)	PERVIOUS	0.962	0.03

BMP LOAD$_P$ = (0.833)(1.78) + (0.962)(0.03) = 1.51

- 3P

ID	LAND USE	COVER	AREA (AC)	PLER (lb/ac/yr)
1	COMMERCIAL	IMPERVIOUS	0.380	1.78
2	LANDSCAPED (A)	PERVIOUS	0.235	0.03

BMP LOAD$_P$ = (0.380)(1.78) + (0.235)(0.03) = 0.68

- 1P

IA = 0.833 ac
IR = 8.27 "/hr
P$_{TARGET}$ = 60%
DEPTH = 0.1"

BMP-VOLUME$_{EX-FT^3}$ = 0.833 (0.1) (3630) = 302 cf
DSV = 3,384 cf
BMP LOAD = 1.51
BMP REDUCTION = 1.51 (60/100) = 0.91 lb/yr

- 3P

IA = 0.380
IR = 8.27 "/hr
P$_{TARGET}$ = 60% DEPTH = 0.1"

BMP-VOLUME$_{EX-FT^3}$ = 0.38 (0.1) (3630) = 138 cf
DSV = 1,431 cf
BMP LOAD = 0.68
BMP REDUCTION = 0.68 (60/100) = 0.41 lb/yr

VERIFY PIPE CAPACITY-50 YEAR STORM

Pipe Sizing Calculation Spreadsheet:

THE MORIN-CAMERON GROUP, INC.
66 Elm Street
Danvers, MA 01923
P: (978) 777-8586
W: www.morincameron.com

Name: Land off 20 Carleton Drive
Location: Land off 20 Carleton Drive
Georgetown, MA
County: Essex County
Owner: G. Mello Disposal Corp.

Proj. No.: 3794
Date: 1/6/2022
Revised:
Computed by: Daniel J. Powers. P.E.
Checked by: Scott P, Cameron, P.E.

Design Parameters:
IDF Curve
50 Year Storm Boston, MA
k_e= 0.2

DESCRIPTION	LOCATION		AREA (AC.)	C	C x A	SUM C x A	FLOW TIME (MIN)		i*	DESIGN					CAPACITY		PIPE PROFILE				
	FROM	TO					PIPE	CONC. TIME		Q cfs	V fps	n	PIPE SIZE	SLOPE	Q full ft^3/s	V full ft/s	LENGTH ft	FALL ft	RIM	INV UPPER	INV LOWER
CB-1	CB-1	DMH-1	1.02	0.59	0.60	0.60	0.08	6.0	6.3	3.8	5.1	0.012	12	0.010	3.9	4.9	23	0.23	86.11	83.01	82.78
CB-2	CB-2	DMH-1	0.16	0.75	0.12	0.12	0.23	6.0	6.3	0.8	3.1	0.012	12	0.010	3.9	4.9	43	0.43	96.11	83.21	82.78
DMH-1	DMH-1	IB	-	-	-	0.72	0.03	6.2	6.2	4.5	6.9	0.012	12	0.020	5.5	6.9	14	0.28	86.44	82.78	82.50
OCS-1	OCS-1	Outfall	-	-	-	-	-	6.0	6.3	1.5	3.3	0.012	18	0.008	10.0	5.6	65	0.50	85.80	84.00	83.50
HW-2	HW-2	Outfall	0.25	0.70	0.17	0.17	0.22	6.0	6.3	1.1	4.9	0.012	12	0.025	6.1	7.7	65	1.60	-	84.50	82.90
CB-3	CB-3	SIS	0.62	0.69	0.42	0.42	0.08	6.0	6.3	2.7	4.6	0.012	12	0.010	4.0	5.0	21	0.22	85.72	83.22	83.00
SIS	SIS	HW-3	-	-	-	-	-	6.0	6.3	1.0	2.7	0.012	12	0.005	2.7	3.5	60	0.30	-	84.00	83.70

APPENDIX E:

CONSTRUCTION PHASE

BEST MANAGEMENT PRACTICES PLAN

Construction Phase Best Management Practices (BMP's)

Erosion and Sedimentation will be controlled at the site by utilizing Structural Practices, Stabilization Practices, and Dust Control. These practices correspond with plans entitled "Definitive Plan of Land 20 Carleton Drive in Georgetown, Massachusetts", prepared by The Morin-Cameron Group, Inc. dated January 6, 2022 as revised and approved by the Georgetown Planning Board, hereinafter referred to as the Site Plans.

Responsible Party Contact Information:

Stormwater Management System Owner:	G. Mello Waste Disposal Corp. 95 Tenney Street Georgetown, MA 01833 P: (978) 352-8581
Georgetown Public Works Department:	1 Library Street Georgetown, MA 01833 P: (978) 352-5710
Georgetown Planning Board:	1 Library Street Georgetown, MA 01833 P: (978) 352-5710
Site Design Engineer Information:	The Morin-Cameron Group, Inc. 66 Elm Street Danvers, MA 01923 Phone: (978) 777-8586

Structural Practices:

1) **Mulch Sock** – A mulch sock sediment barrier will be constructed around the limit of work as indicated on the Site Plan to prevent the spreading of fine sediments from the site. This control will be installed prior to major soil disturbance on the site.

Mulch Sock Requirements *

a) Locate the mulch sock upland where identified on the plans.
b) The mulch sock should be nearly level through most of its length to impound a broad, temporary pool. The last 10 to 20 feet at each end of the mulch sock should be swung slightly uphill (approximately 0.5 feet in elevation) to provide storage capacity.
c) Stake the mulch sock in accordance with the construction details.
d) The mulch sock should be removed when it has served its useful purpose, but not before the upslope area has been permanently stabilized through one growing season and only following approval by the Conservation Commission or their representative. Retained sediment must be removed and properly disposed of, or mulched and seeded.

Mulch Sock Inspection/Maintenance *

a) Mulch socks should be inspected immediately after each rainfall event of 1-inch or greater, and at least daily during prolonged rainfall. Inspect the depth of sediment, tears, if the mulch sock is securely attached to the stakes, and to see that the stakes are firmly in the ground. Repair or replace as necessary.
b) Remove sediment deposits promptly after storm events to provide adequate storage volume for the next rain and to reduce pressure on the mulch sock. Sediment will be removed from behind the mulch sock when it becomes about 4" deep at the mulch sock. Take care to avoid undermining the mulch sock during cleanout.
c) If the mulch sock tears, decomposes, or in any way becomes ineffective, replace it immediately.
d) Remove all mulch sock materials after the contributing drainage area has been properly stabilized. The mulch can remain at the discretion of the owner as this will decompose over time. However, any fabric or stakes should be removed. Sediment deposits remaining after the mulch sock has been removed should be graded to conform to the existing topography and vegetation.

2) **Sediment Track-Out:** Stabilized Construction Exit: Prior to the commencement of site work, crushed stone anti-tracking pads will be installed at the entrance to the site. This will prevent trucks from tracking material onto the road from the construction site. If, at any point during the project, the tracking pad becomes ineffective due to accumulation of soil, the crushed stone shall be replaced. Details for construction of the stabilized entrance can be found in the Detail Sheets that are a part of the comprehensive permit plan set associated with the project. The site supervisor will inspect the tracking pads weekly to ensure that they are properly limiting the tracking of soil onto the road. If tracking onto the roadway is noted, it shall be removed immediately via a mechanical street sweeper.

Stabilization Practices:

Stabilization measures shall be implemented as soon as practicable in portions of the site where construction activities have temporarily or permanently ceased, but in no case more than 14 days after the construction activity in that portion of the site has temporarily or permanently ceased, with the following exceptions.

- Where the initiation of stabilization measures by the 14th day after construction activity temporary or permanently cease is precluded by snow cover, stabilization measures shall be initiated as soon as practicable.

- Where construction activity will resume on a portion of the site within 21 days from when activities ceased, (e.g. the total time period that construction activity is temporarily ceased is less than 21 days) then stabilization measures do not have to be initiated on that portion of the site by the 14th day after construction activity temporarily ceased.

1) **Temporary Seeding** – Temporary seeding will allow a short-term vegetative cover on disturbed site areas that may be in danger of erosion. Temporary seeding will be done at stock piles and disturbed portions of the site where construction activity will temporarily cease for at least 21 days. The temporary seeding will stabilize cleared and unvegetated areas that will not be brought into final grade for several weeks or months.

   Temporary Seeding Planting Procedures *

   a) Planting should preferably be done between April 1st and June 30th, and September 1st through September 31st. If planting is done in the months of July and August, irrigation may be required. If planting is done between October 1st and March 31st, mulching should be applied immediately after planting. If seeding is done during the summer months, irrigation of some sort will probably be necessary.

   b) Before seeding, install structural practice controls. Utilize Amoco supergro or equivalent.

   c) Select the appropriate seed species for temporary cover from the following table.

Species	Seeding Rate (lbs./1,000 sq.)	Seeding Rate (lbs./acre)	Recommended Seeding Dates	Seed Cover required
Annual Ryegrass	1	40	April 1st to June 1st August 15th to Sept. 15th	¼ inch
Foxtail Millet	0.7	30	May 1st to June 30th	½ to ¾ inch
Oats	2	80	April 1st to July 1st August 15th to Sept. 15th	1 to 1-½ inch
Winter Rye	3	120	August 15th to Oct. 15th	1 to 1-½ inch

Apply the seed uniformly by hydroseeding, broadcasting, or by hand.

d) Use effective mulch, such as clean grain straw; tacked and/or tied with netting to protect seedbed and encourage plant growth.

Temporary Seeding Inspection/Maintenance *

a) Inspect within 6 weeks of planting to see if stands are adequate. Check for damage within 24 hours of the end to a heavy rainfall, defined as a 2-year storm event (i.e., 3.2 inches of rainfall within a twenty-four-hour period). Stands should be uniform and dense. Reseed and mulch damaged and sparse areas immediately. Tack or tie down mulch as necessary.

b) Seeds should be supplied with adequate moisture. Furnish water as needed, especially in abnormally hot or dry weather. Water application rates should be controlled to prevent runoff.

2) **Geotextiles** - Geotextiles such as jute netting will be used in combination with other practices such as mulching to stabilize slopes. The following geotextile materials or equivalent are to be utilized for structural and nonstructural controls as shown in the following table.

Practice	Manufacturer	Product	Remarks
Sediment Fence	Amoco	Woven polypropylene 1198 or equivalent	0.425 mm opening
Construction Entrance	Amoco	Woven polypropylene 2002 or equivalent	0.300 mm opening
Outlet Protection	Amoco	Nonwoven polypropylene 4551 or equivalent	0.150 mm opening
Erosion Control (slope stability)	Amoco	Supergro or equivalent	Erosion control revegetation mix, open polypropylene fiber on degradable polypropylene net scrim

Amoco may be reached at (800) 445-7732

Geotextile Installation

a) Netting and matting require firm, continuous contact between the materials and the soil. If there is no contact, the material will not hold the soil and erosion will occur underneath the material.

Geotextile Inspection/Maintenance *

a) In the field, regular inspections should be made to check for cracks, tears, or breaches in the fabric. The appropriate repairs should be made.

3) **Mulching and Netting** – Mulching will provide immediate protection to exposed soils during the period of short construction delays, or over winter months through the application of plant residues, or other suitable materials, to exposed soil areas. In areas, which have been seeded either for temporary or permanent cover, mulching should immediately follow seeding. On steep slopes, mulch must be supplemented with netting. The preferred mulching material is straw.

Mulch (Hay or Straw) Materials and Installation

a) Straw has been found to be one of the most effective organic mulch materials. The specifications for straw are described below, but other material may be appropriate. The straw should be air-dried; free of undesirable seeds & coarse materials. The application rate per 1,000 sq. is 90-100 lbs. (2-3 bales) and the application rate per acre is 2 tons (100-120 bales). The application should cover about 90% of the surface. The use of straw mulch is appropriate where mulch is maintained for more than three months. Straw mulch is subject to wind blowing unless anchored, is the most commonly used mulching material, and has the best microenvironment for germinating seeds.

Mulch Maintenance *

a) Inspect after rainstorms to check for movement of mulch or erosion. If washout, breakage, or erosion occurs, repair surface, reseed, remulch, and install new netting.

b) Straw or grass mulches that blow or wash away should be repaired promptly.

c) If plastic netting is used to anchor mulch, care should be taken during initial mowing to keep the mower height high. Otherwise, the netting can wrap up on the mower blade shafts. After a period of time, the netting degrades and becomes less of a problem.

d) Continue inspections until vegetation is well established.

4) **Land Grading** – Grading on fill slopes, cut slopes, and stockpile areas will be done with full siltation controls in place.

Land Grading Design/Installation Requirements

a) Areas to be graded should be cleared and grubbed of all timber, logs, brush, rubbish, and vegetated matter that will interfere with the grading operation. Topsoil should be stripped and stockpiled for use on critical disturbed areas for establishment of vegetation. Cut slopes to be topsoiled should be thoroughly scarified to a minimum depth of 3-inches prior to placement of topsoil.

b) Fill materials should be generally free of brush, rubbish, rocks, and stumps. Frozen materials or soft and easily compressible materials should not be used in fills intended to support buildings, parking lots, roads, conduits, or other structures.

c) Earth fill intended to support structural measures should be compacted to a minimum of 90 percent of Standard Proctor Test density with proper moisture control, or as otherwise specified by the engineer responsible for the design. Compaction of other fills should be to the density required to control sloughing, erosion or excessive moisture content. Maximum thickness of fill layers prior to compaction should not exceed 9 inches.

d) The uppermost one foot of fill slopes should be compacted to at least 85 percent of the maximum unit weight (based on the modified AASHTO compaction test). This is usually accomplished by running heavy equipment over the fill.

e) Fill should consist of material from borrow areas and excess cut will be stockpiled in areas shown on the Site Plans. All disturbed areas should be free draining, left with a neat and finished appearance, and should be protected from erosion.

Land Grading Stabilization Inspection/Maintenance *

a) All slopes should be checked periodically to see that vegetation is in good condition. Any rills or damage from erosion and animal burrowing should be repaired immediately to avoid further damage.

b) If seeps develop on the slopes, the area should be evaluated to determine if the seep will cause an unstable condition. Subsurface drains or a gravel mulch may be required to solve seep problems. However, no seeps are anticipated.

c) Areas requiring revegetation should be repaired immediately. Control undesirable vegetation such as weeds and woody growth to avoid bank stability problems in the future.

5) **Topsoiling *** – Topsoiling will help establish vegetation on all disturbed areas throughout the site during the seeding process. The soil texture of the topsoil to be used will be a sandy loam to a silt loam texture with 15% to 20% organic content.

Topsoiling Placement

a) Topsoil should not be placed while in a frozen or muddy condition, when the subgrade is excessively wet, or when conditions exist that may otherwise be detrimental to proper grading or proposed seeding.

b) Do not place topsoil on slopes steeper than 2.5:1, as it will tend to erode.

c) If topsoil and subsoil are not properly bonded, water will not infiltrate the soil profile evenly and it will be difficult to establish vegetation. The best method is to actually work the topsoil into the layer below for a depth of at least 6 inches.

6) **Permanent Seeding** – Permanent Seeding should be done immediately after the final design grades are achieved. Native species of plants should be used to establish perennial vegetative cover on disturbed areas. The revegetation should be done early enough in the fall so that a good cover is established before cold weather comes and growth stops until the spring. A good cover is defined as vegetation covering 75 percent or more of the ground surface.

Permanent Seeding Seedbed Preparation

a) In infertile or coarse-textured subsoil, it is best to stockpile topsoil and re-spread it over the finished slope at a minimum 2 to 6-inch depth and roll it to provide a firm seedbed. The topsoil must have a sandy loam to silt loam texture with 15% to 20% organic content. If construction fill operations have left soil exposed with a loose, rough, or irregular surface, smooth with blade and roll.

b) Loosen the soil to a depth of 3-5 inches with suitable agricultural or construction equipment.

c) Areas not to receive topsoil shall be treated to firm the seedbed after incorporation of the lime and fertilizer so that it is depressed no more than ½ - 1 inch when stepped on with a shoe. Areas to receive topsoil shall not be firmed until after topsoiling and lime and fertilizer is applied and incorporated, at which time it shall be treated to firm the seedbed as described above.

Permanent Seeding Grass Selection/Application

a) Select an appropriate cool or warm season grass based on site conditions and seeding date. Apply the seed uniformly by hydro-seeding, broadcasting, or by hand. Uniform seed distribution is essential. On steep slopes, hydroseeding may be the most effective seeding method. Surface roughening is particularly important when preparing slopes for hydroseeding.

b) Lime and fertilize. Organic fertilizer shall be utilized in areas within the 100-foot buffer zone to a wetland resource area.

c) Mulch the seedings with straw applied at the rate of ½ tons per acre. Anchor the mulch with erosion control netting or fabric on sloping areas. Amoco supergro or equivalent should be utilized.

Permanent Seeding Inspection/Maintenance *

a) Frequently inspect seeded areas for failure and make necessary repairs and reseed immediately. Conduct or follow-up survey after one year and replace failed plants where necessary.

b) If vegetative cover is inadequate to prevent rill erosion, overseed and fertilize in accordance with soil test results.

c) If a stand has less than 40% cover, reevaluate choice of plant materials and quantities of lime and fertilizer. Re-establish the stand following seedbed preparation and seeding recommendations, omitting lime and fertilizer in the absence of soil test results. If the season prevents resowing, mulch or jute netting is an effective temporary cover.

d) Seeded areas should be fertilized during the second growing season. Lime and fertilize thereafter at periodic intervals, as needed. Organic fertilizer shall be utilized in areas within the 100-foot buffer zone to a wetland resource area.

Dust Control:

Dust control will be utilized throughout the entire construction process of the site. For example, keeping disturbed surfaces moist during windy periods will be an effective control measure, especially for construction access roads. The use of dust control will prevent the movement of soil to offsite areas. However, care must be taken to not create runoff from excessive use of water to control dust. The following are methods of Dust Control that may be used on-site:

- Vegetative Cover – The most practical method for disturbed areas not subject to traffic.
- Calcium Chloride – Calcium chloride may be applied by mechanical spreader as loose, dry granules or flakes at a rate that keeps the surface moist but not so high as to cause water pollution or plant damage.
- Sprinkling – The site may be sprinkled until the surface is wet. Sprinkling will be effective for dust control on haul roads and other traffic routes.
- Stone – Stone will be used to stabilize construction roads; will also be effective for dust control.

The general contractor shall employ an on-site water vehicle for the control of dust as necessary.

Non-Stormwater Discharges:

The construction de-watering and all non-stormwater discharges will be directed into a sediment dirt bag (or equivalent inlet protection) or a sediment basin. Sediment material removed shall be disposed of in accordance with all applicable local, state, and federal regulations.

The developer and site general contractor will comply with the E.P.A.'s Final General Permit for Construction De-watering Discharges, (N.P.D.E.S., Section 402 and 40 C.F.R. 122.26(b) (14) (x).

Inspection/Maintenance:

Operator personnel must inspect the construction site at least once every 7 calendar days and within 24 hours of a storm event of ½-inch or greater. The applicant shall be responsible to secure the services of a design professional or similar professional (inspector) on an on-going basis throughout all phases of the project. Refer to the Inspection/Maintenance Requirements presented earlier in the "Structural and Stabilization Practices." The inspector should review the erosion and sediment controls with respect to the following:

- Whether or not the measure was installed/performed correctly.
- Whether or not there has been damage to the measure since it was installed or performed.
- What should be done to correct any problems with the measure.

The inspector should complete a Stormwater Management Construction Phase BMP Inspection Schedule and Evaluation Checklist for documenting the findings and should request the required maintenance or repair for the pollution prevention measures when the inspector finds that it is necessary for the measure to be effective. The inspector should notify the appropriate person to make the changes and submit copies of the form to the Georgetown DPW and Planning Board.

It is essential that the inspector document the inspection of the pollution prevention measures. These records will be used to request maintenance and repair and to prove that the inspection and maintenance were performed. The forms list each of the measures to be inspected on the site, the inspector's name, the date of the inspection, the condition of the measure/area inspected, maintenance or repair performed and any changes which should be made to the Operation and Maintenance Plan to control or eliminate unforeseen pollution of storm water.

APPENDIX F:

LONG TERM BEST MANAGEMENT PRACTICES O&M PLAN

Long Term Stormwater Best Management Practices
Operation and Maintenance Plan
for
20 Carleton Drive
Georgetown, Massachusetts
Issued: January 6, 2022

The following operation and maintenance plan has been provided to satisfy the requirements of Standard 9 of the Mass DEP Stormwater Management Handbook associated with development of the site and associated infrastructure. The success of the Stormwater Management Plan depends on the proper implementation, operation and maintenance of several management components. The following procedures shall be implemented to ensure success of the Stormwater Management Plan:

1. The contractor shall comply with the details of construction of the site as shown on the approved plans.
2. The catch basins, water quality units, infiltration basin, and subsurface infiltration units shall be inspected and maintained as indicated below.
3. Effective erosion control measurers during and after construction shall be maintained until a stable turf is established on all altered areas.
4. A Stormwater Management Maintenance Log is included at the end of this Appendix.

Basic Information

Stormwater Management System Owner:	G. Mello Waste Disposal Corp. 95 Tenney Street Georgetown, MA 01833 P: (978) 352-8581
Georgetown Public Works Department:	1 Library Street Georgetown, MA 01833 P: (978) 352-5704
Georgetown Planning Board:	1 Library Street Georgetown, MA 01833 P: (978) 352-5710

Erosion and Sedimentation Controls during Construction:

The site and drainage construction contractor shall be responsible for maintaining the stormwater system during construction. Routine maintenance of all items shall be performed to ensure adequate runoff and pollution control during construction.

A proposed erosion control barrier will be placed as shown on the Grading & Utility Plan prior to the commencement of any clearing, grubbing, and earth removal or construction activity. The integrity of the erosion control barrier will be maintained by periodic inspection and replacement as necessary. The erosion control barrier will remain in place until the first course of pavement has been placed and all side slopes have been loamed and seeded and vegetation has been established. Silt sacks will also be placed in all new catch basins once constructed.

Operations and maintenance plans for the Stormwater Management construction phase and long term operation of the system have been attached to this report.

General Conditions

1. The developer shall be responsible for scheduling regular inspections and maintenance of the stormwater BMP's until such time as the project is completed and approved at which time the owner shall become the responsible party. The BMP maintenance shall be conducted as detailed in the following long-term pollution prevention plan and illustrated on the approved design plans:
   "Definitive Plan of Land 20 Carleton Drive in Georgetown, Massachusetts," prepared by The Morin-Cameron Group, Inc. dated January 6, 2022 as revised and approved by the Georgetown Planning Board.
2. All Stormwater BMP's shall be operated and maintained in accordance with the design plans and the following Long-Term Pollution Prevention Plan.
3. The owner shall:
   a. Maintain an Operation and Maintenance Log for the last three years. The Log shall include all BMP inspections, repairs, replacement activities and disposal activities (disposal material and disposal location shall be included in the Log);
   b. Make the log available to the Georgetown Public Works Department and Planning Board upon request;
   c. Allow members and agents of the Georgetown Public Works Department and Planning Board to enter the premises and ensure that the Owner has complied with the Operation and Maintenance Plan requirements for each BMP.
4. A recommended inspection and maintenance schedule is outlined below based on statewide averages. This inspection and maintenance schedule shall be adhered to at a minimum for the first year of service of all BMP's referenced in this document. At the commencement of the first year of service, a more accurate inspection/maintenance schedule shall be determined based on the level of service for this site.

Long-Term Pollution Prevention Plan (LTPPP)

Vegetated Areas:

Immediately after construction, monitoring of the erosion control systems shall occur until establishment of natural vegetation. Afterwards, vegetated areas shall be maintained as such. Vegetation shall be replaced as necessary to ensure proper stabilization of the site.

Cost: Included with annual landscaping budget. Consult with local landscape contractors.

Paved Areas:

Sweepers shall sweep paved areas periodically during dry weather to remove excess sediments and to reduce the amount of sediments that the drainage system shall have to remove from the runoff. The sweeping shall be conducted primarily between March 15th and November 15th. Special attention should be made to sweeping paved surfaces in March and April before spring rains wash residual sand into the drainage system. Sweeping shall occur at a minimum of twice per year (Spring and Fall).

Cost: $100-$300 per sweeping

Salt used for de-icing on the roadway during winter months shall be limited as much as possible as this will reduce the need for removal and treatment. Sand containing the minimum amount of calcium chloride (or approved equivalent) needed for handling may be applied as part of the routine winter maintenance activities.

Deep Sump Hooded Catch Basins:

The catch basin grates shall be checked quarterly and following heavy rainfalls to verify that the inlet openings are not clogged by debris. Debris shall be removed from the grates and disposed of properly. Deep sump catch basins shall be inspected four times per year and cleaned as needed when accumulated sediments exceeds 2' from the bottom of the sump (approximately 1/2 of the sump capacity). The catch basins shall also be inspected to check oil build-up and outlet obstructions. Material shall be removed from catch basins and disposed of in accordance with all applicable regulations

Cost: Estimated $50 - $100 per cleaning per catch basin as needed. The Owner shall consult local vacuum cleaning contractors for detailed cost estimates.

Public Safety Concerns: Catch basins shall not be left open and unattended at any time during inspection, cleaning or otherwise. Broken or missing grates or frames shall be replaced immediately. At no time shall any person enter the basin structure unless measures have been taken to ensure safe access in accordance with OSHA enclosed space regulations.

CDS Water Quality Units:

The CDS Water Quality Units shall be inspected after every major storm event for the first 3 months after construction; a major storm event is 3.9 inches of rainfall in a 24-hour period (5 year storm). Thereafter, the system shall be inspected twice per year in April and October. The units shall be cleaned per manufacturer's instructions included herein.

Cost: $50 - $100 per cleaning per unit as needed. The owner shall consult local vacuum cleaning contractors for detailed cost estimates.

Public Safety Concerns: The manhole covers shall not be left open and unattended at any time during inspection, cleaning or otherwise. Broken covers or frames shall be replaced immediately.

Infiltration Basin:

The infiltration basins and overflow spillways shall be inspected twice per year. Additional inspections should be scheduled during the first few months to make sure that the vegetation becomes adequately established in the detention basin and that the facility is functioning as intended. Trash, leaves, branches, etc. shall be removed from facility. Silt, sand and sediment, if significant accumulation occurs, shall be removed by rubber tired excavator annually. Material removed from the basins shall be disposed of in accordance with all applicable local, state, and federal regulations. Reseeding, weed control, and invasive species removal may need to be performed periodically to maintain healthy vegetation and maintain the pollutant removal efficiency of the facilities.

The embankment shall be inspected for structural integrity. The basin embankment should be inspected for signs of differential settlement, cracking, erosion, general health of turf and leakage. The low flow channel should be inspected for condition of the rip-rap.

The basin outlet control structure should be inspected for condition, structural integrity and debris accumulation. If accumulated debris is present it should be removed and disposed of legally. The basin bottom and side slopes should be mowed at least twice per year. All clippings and other organic matter should be removed and disposed of legally. Periodic inspections of the infiltration basin should be performed during or immediately after substantial rainfall events to confirm storm drainage and infiltration basins are properly functioning. The inspections shall be conducted by qualified personnel.

In the case that water remains in the infiltration facilities for greater than three (3) days after a storm event, an inspection is warranted and necessary maintenance or repairs to the bottom of the basin may be necessary. Any slope erosion within the basins shall be stabilized and repaired as soon as practical.

Cost: $500-$1000 per cleaning if excavator is necessary to remove sediment. The owner should consult local landscape contractors for a detailed cost estimate.

Subsurface Infiltration Concrete Galley System:

The subsurface infiltration concrete galley systems are equipped with inspection ports at the outlet chambers. Additional inspections should be scheduled during the first few months to make sure that the systems are functioning as intended. Silt, sand and sediment, if significant accumulation occurs, shall be removed annually. Material removed from the systems shall be disposed of in accordance with all applicable local, state, and federal regulations. In the case that water remains in the infiltration facilities for greater than three (3) days after a storm event, an inspection is warranted and maintenance or repairs should be addressed as necessary.

Cost: $500-$2,500 per cleaning depending on the volume of material/liquids that need to be removed.

Public Safety Concerns: The manhole covers shall not be left open and unattended at any time during inspection, cleaning or otherwise. Broken covers or frames shall be replaced immediately. At no time shall any person enter the subsurface structure unless measures have been taken to ensure safe access in accordance with OSHA enclosed space regulations.

Culvert & Pipe Inlets and Outlets:
The culvert and pipe inlets and outlets require biannual inspections to check for debris or blockages which could impede the flow of stormwater runoff through the pipe. Trash, leaves, branches, etc. shall be removed from the inlets or outlets by hand. Material removed from the pipes shall be disposed of in accordance with all applicable local, state, and federal regulations. The rip-rap protection should be inspected for condition and signs of erosion. If evidence of erosion is presence it should be repaired and reinforced with additional rip-rap protection.

Cost: $300-$500 per cleaning. Add for backhoe if necessary.

Overall Site Grading:
After construction, and during the initial vegetation establishment period, the site should be inspected after every rainfall. Mowing, litter removal, and spot vegetation repair should be performed on a regular basis.

Debris & Litter:
All debris and litter shall be removed from the driveway/parking area as necessary to prevent migration into the drainage system.

Pesticides, Herbicides, and Fertilizers:
Pesticides and herbicides shall be used sparingly. Fertilizers shall be restricted to the use of organic fertilizers only. All fertilizers, herbicides, pesticides, sand and salt for deicing and the like shall be stored in dry area that is protected from weather.

Cost: Included in the routine landscaping maintenance schedule. The Owner shall consult local landscaping contractors for details.

Public Safety Concerns: Chemicals shall be stored in a secure area to prevent children from obtaining access to them. Any major spills shall be reported to municipal officials.

Prevention of Illicit Discharges:
Illicit discharges to the stormwater management system are not allowed. Illicit discharges are discharges that are not comprised entirely of stormwater. Pursuant to Mass DEP Stormwater Standards the following activities or facilities are not considered illicit discharges: firefighting, water line flushing, landscape irrigation, uncontaminated groundwater, potable water sources, foundation drains, air conditioning condensation, footing drains, individual resident car washing, flows from riparian habitats and wetlands, Dechlorinated water from swimming pools, water used for street washing and water used to clean residential building without detergents.

To prevent illicit discharges to the stormwater management system the following policies should be implemented:

1. Good Housekeeping Practices
   - The site shall be kept clean of litter and debris and continuously maintained in accordance with the Long-Term Pollution Prevention Plan as noted above. All chemicals shall be covered and stored in secured location. Any land disturbances that change drainage characteristics shall be remedied to pre-disturbance characteristics (i.e. shoulder rutting from vehicles, land disturbance from plowing, etc.) as soon as possible to ensure proper treatment of all stormwater runoff.
2. Provisions for Storing Materials and Waste Products Inside or Under Cover
   - All chemicals and chemical waste products shall be stored inside or in a secured covered location to prevent potential discharge. Any major spills shall be reported to municipal officials and a remediation plan shall be implemented immediately.

3. Vehicle Maintenance
    - Any vehicle maintenance shall be done with care to prevent discharge of illicit fluids. If fluids are accidentally spilled, immediate action shall be implemented to clean and remove the fluid to prevent discharge into the stormwater management system and/or infiltrating into the groundwater.
4. Pet Waste Management Provisions
    - Pet waste shall be picked up and disposed of in an appropriate individual waste refuse area or a refuse area.
5. Spill Prevention and Response Plans
    - If a major spill of an illicit substance occurs, town officials (including but not limited to the Georgetown Fire Department and Georgetown Police Department) shall be notified immediately. A response plan shall then be implemented immediately to prevent any illicit discharges from entering the stormwater management system and ultimately surface waters of the Commonwealth.
6. Awareness and responsible parties
    - All owners shall be informed and provided a copy of the Long-Term Pollution Prevention Plan. A member/members shall be designaed to be responsible for overseeing and implementing the Long-Term Pollution Prevention Plan and insuring all stormwater management systems are upkept on a regular basis.
7. Solid waste
    - All domestic solid waste shall be disposed of in accordance with all applicable local, state and federal regulations. Waste shall be placed into covered dumpsters and/or covered waste bins to prevent water intrusion and potentially contaminated runoff. No household chemicals, hazardous materials, construction debris or non-household generated refuse shall be disposed of in the on-site waste disposal containers. The owners shall be responsible for the waste refuse disposal and collection.

Stormwater System Maintenance Log

Land off 20 Carleton Drive, Georgetown, MA

The Following structures shall be inspected and maintained by the owner.

BMP STRUCTURE	INSPECTION DATE	WORK PERFORMED	DATE WORK PERFORMED	COMMENTS
Stormwater Management Infrastructure				
Catch Basin - CB-1				
Catch Basin - CB-2				
Drain Manhole DMH-1 (CDS)				
Surface Infiltration Basin				
Outlet Control Structure OCS-1				
Catch Basin - CB-3 (CDS)				
Subsurface Infiltration Galleys				
Headwall 1 - HW-1				
Headwall 2 - HW-2				
Headwall 3 - HW-3				
Roadway Culvert 1				
Roadway Culvert 2				

NOTE: All structures to be inspected at least two times per year. Refer to O&M plan dated 01/06/22.

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CDS® Inspection and Maintenance Guide

CDS TECHNOLOGIES

Maintenance

The CDS system should be inspected at regular intervals and maintained when necessary to ensure optimum performance. The rate at which the system collects pollutants will depend more heavily on site activities than the size of the unit. For example, unstable soils or heavy winter sanding will cause the grit chamber to fill more quickly but regular sweeping of paved surfaces will slow accumulation.

Inspection

Inspection is the key to effective maintenance and is easily performed. Pollutant transport and deposition may vary from year to year and regular inspections will help ensure that the system is cleaned out at the appropriate time. At a minimum, inspections should be performed twice per year (e.g. spring and fall) however more frequent inspections may be necessary in climates where winter sanding operations may lead to rapid accumulations, or in equipment washdown areas. Installations should also be inspected more frequently where excessive amounts of trash are expected.

The visual inspection should ascertain that the system components are in working order and that there are no blockages or obstructions in the inlet and separation screen. The inspection should also quantify the accumulation of hydrocarbons, trash, and sediment in the system. Measuring pollutant accumulation can be done with a calibrated dipstick, tape measure or other measuring instrument. If absorbent material is used for enhanced removal of hydrocarbons, the level of discoloration of the sorbent material should also be identified during inspection. It is useful and often required as part of an operating permit to keep a record of each inspection. A simple form for doing so is provided.

Access to the CDS unit is typically achieved through two manhole access covers. One opening allows for inspection and cleanout of the separation chamber (cylinder and screen) and isolated sump. The other allows for inspection and cleanout of sediment captured and retained outside the screen. For deep units, a single manhole access point would allows both sump cleanout and access outside the screen.

The CDS system should be cleaned when the level of sediment has reached 75% of capacity in the isolated sump or when an appreciable level of hydrocarbons and trash has accumulated. If absorbent material is used, it should be replaced when significant discoloration has occurred. Performance will not be impacted until 100% of the sump capacity is exceeded however it is recommended that the system be cleaned prior to that for easier removal of sediment. The level of sediment is easily determined by measuring from finished grade down to the top of the sediment pile. To avoid underestimating the level of sediment in the chamber, the measuring device must be lowered to the top of the sediment pile carefully. Particles at the top of the pile typically offer less resistance to the end of the rod than consolidated particles toward the bottom of the pile. Once this measurement is recorded, it should be compared to the as-built drawing for the unit to determine weather the height of the sediment pile off the bottom of the sump floor exceeds 75% of the total height of isolated sump.

Cleaning

Cleaning of a CDS systems should be done during dry weather conditions when no flow is entering the system. The use of a vacuum truck is generally the most effective and convenient method of removing pollutants from the system. Simply remove the manhole covers and insert the vacuum hose into the sump. The system should be completely drained down and the sump fully evacuated of sediment. The area outside the screen should also be cleaned out if pollutant build-up exists in this area.

In installations where the risk of petroleum spills is small, liquid contaminants may not accumulate as quickly as sediment. However, the system should be cleaned out immediately in the event of an oil or gasoline spill should be cleaned out immediately. Motor oil and other hydrocarbons that accumulate on a more routine basis should be removed when an appreciable layer has been captured. To remove these pollutants, it may be preferable to use absorbent pads since they are usually less expensive to dispose than the oil/water emulsion that may be created by vacuuming the oily layer. Trash and debris can be netted out to separate it from the other pollutants. The screen should be power washed to ensure it is free of trash and debris.

Manhole covers should be securely seated following cleaning activities to prevent leakage of runoff into the system from above and also to ensure that proper safety precautions have been followed. Confined space entry procedures need to be followed if physical access is required. Disposal of all material removed from the CDS system should be done in accordance with local regulations. In many jurisdictions, disposal of the sediments may be handled in the same manner as the disposal of sediments removed from catch basins or deep sump manholes.

CDS Model	Diameter		Distance from Water Surface to Top of Sediment Pile		Sediment Storage Capacity	
	ft	m	ft	m	y^3	m^3
CDS1515	3	0.9	3.0	0.9	0.5	0.4
CDS2015	4	1.2	3.0	0.9	0.9	0.7
CDS2015	5	1.3	3.0	0.9	1.3	1.0
CDS2020	5	1.3	3.5	1.1	1.3	1.0
CDS2025	5	1.3	4.0	1.2	1.3	1.0
CDS3020	6	1.8	4.0	1.2	2.1	1.6
CDS3025	6	1.8	4.0	1.2	2.1	1.6
CDS3030	6	1.8	4.6	1.4	2.1	1.6
CDS3035	6	1.8	5.0	1.5	2.1	1.6
CDS4030	8	2.4	4.6	1.4	5.6	4.3
CDS4040	8	2.4	5.7	1.7	5.6	4.3
CDS4045	8	2.4	6.2	1.9	5.6	4.3
CDS5640	10	3.0	6.3	1.9	8.7	6.7
CDS5653	10	3.0	7.7	2.3	8.7	6.7
CDS5668	10	3.0	9.3	2.8	8.7	6.7
CDS5678	10	3.0	10.3	3.1	8.7	6.7

Table 1: CDS Maintenance Indicators and Sediment Storage Capacities

Support

- Drawings and specifications are available at www.contechstormwater.com.
- Site-specific design support is available from our engineers.

Contech Engineered Solutions LLC provides site solutions for the civil engineering industry. Contech's portfolio includes bridges, drainage, sanitary sewer, stormwater, earth stabilization and wastewater treament products. For information, visit www.ContechES.com or call 800.338.1122

The product(s) described may be protected by one or more of the following US patents: 5,322,629; 5,624,576; 5,707,527; 5,759,415; 5,788,848; 5,985,157; 6,027,639; 6,350,374; 6,406,218; 6,641,720; 6,511,595; 6,649,048; 6,991,114; 6,998,038; 7,186,058; 7,296,692; 7,297,266; 7,517,450 related foreign patents or other patents pending.

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CDS Inspection & Maintenance Log

CDS Model: _____ Location: _____

Date	Water depth to sediment[1]	Floatable Layer Thickness[2]	Describe Maintenance Performed	Maintenance Personnel	Comments

1. The water depth to sediment is determined by taking two measurements with a stadia rod: one measurement from the manhole opening to the top of the sediment pile and the other from the manhole opening to the water surface. If the difference between these measurements is less than the values listed in table 1 the system should be cleaned out. **Note: to avoid underestimating the volume of sediment in the chamber, the measuring device must be carefully lowered to the top of the sediment pile.**

2. For optimum performance, the system should be cleaned out when the floating hydrocarbon layer accumulates to an appreciable thickness. In the event of an oil spill, the system should be cleaned immediately.

APPENDIX G:

ILLICIT DISCHARGE

COMPLIANCE STATEMENT

Illicit Discharge Compliance Statement

I, Scott P. Cameron, P.E., hereby notify the Georgetown Planning Board that I have not witnessed, nor am aware of any existing illicit discharges at the site known as Land Off 20 Carleton Drive in Georgetown, Massachusetts. I also hereby certify that the development of said property as illustrated on the final plans entitled "Definitive Plan of Land 20 Carleton Drive in Georgetown, Massachusetts," prepared by The Morin-Cameron Group, Inc. dated January 6, 2022 and as revised and approved by the Georgetown Planning Board and maintenance thereof in accordance with the "Construction Period Pollution Prevention Plan" and "Long-Term Pollution Prevention Plan" prepared by The Morin-Cameron Group, Inc dated January 6, 2022 and as revised and approved by the Georgetown Planning Board will not create any new illicit discharges. There is no warranty implied regarding future illicit discharges that may occur as a result of improper construction or maintenance of the stormwater management system or unforeseen accidents.

Name: Scott P. Cameron, P.E.

Company: The Morin-Cameron Group, Inc.

Title: Owner's Representative

Signature:

Date: 1-6-22

APPENDIX H:

TSS REMOVAL

CALCULATIONS

THE MORIN-CAMERON GROUP, INC.
66 Elm Street,
Danvers, MA 01923
p | 978.777.8586

Standard 4: Total Suspended Solids Calculation for Subsurface Infiltration Structure - 1P Pretreatment Standard for Rapidly Draining Soil

Name: Site Development Plans
Location: Off Carleton Drive
Georgetown, MA
County: Essex
Applicant: G. Mello Disposal Corp

Proj. No.: 3794
Date: 1/6/2022
Revised:
Computed by: Jarret Bastys, E.I.T.
Checked by: Scott P, Cameron, P.E.

TSS Removal Calculation

B BMP	C TSS Removal Rate	D Starting TSS Load	E Amount Removed (C*D)	F Remaining Load (D-E)
Deep Sump and Hooded Catch Basin	**0.25**	**1.00**	**0.25**	**0.75**
Proprietary Treatment Practice*	**0.88**	**0.75**	**0.66**	**0.09**
	0.00	**0.09**	**0.00**	**0.09**
	0.00	**0.09**	**0.00**	**0.09**
	0.00	**0.09**	**0.00**	**0.09**

Total TSS Removal = **91%**

*Refer to sheet found in this report titled: *CDS ESTIMATED NET ANNUAL SOLIDS LOAD REDUCTION BASED ON THE RATIONAL RAINFALL METHOD*
for Subcatchment PS1c prepared by Contech

Non-automated TSS Calculation Sheet
must be used if Proprietary BMP Proposed
1. From MassDEP Stormwater Handbook Vol. 1

THE MORIN-CAMERON GROUP, INC.
66 Elm Street,
Danvers, MA 01923
p | 978.777.8586

Standard 4: Total Suspended Solids Calculation for Surface Infiltration System - 1P With Pretreatment

Name: Definitive Subidvision
Location: Off Carleton Drive
Georgetown, MA
County: Essex
Applicant: G. Mello Disposal Corp

Proj. No.: 3794
Date: 1/6/2022
Revised:
Computed by: Jarret Bastys, E.I.T.
Checked by: Scott P, Cameron, P.E.

TSS Removal Calculation

B BMP	C TSS Removal Rate	D Starting TSS Load	E Amount Removed (C*D)	F Remaining Load (D-E)
Deep Sump and Hooded Catch Basin	0.25	1.00	0.25	0.75
Proprietary Treatment Practice	0.87	0.75	0.65	0.10
Infiltration Basin	0.80	0.10	0.08	0.02
	0.00	0.02	0.00	0.02
	0.00	0.02	0.00	0.02

Total TSS Removal = 98%

Non-automated TSS Calculation Sheet
must be used if Proprietary BMP Proposed
1. From MassDEP Stormwater Handbook Vol. 1

THE MORIN-CAMERON GROUP, INC.
66 Elm Street,
Danvers, MA 01923
p | 978.777.8586

Standard 4: Total Suspended Solids Calculation for Subsurface Infiltration Structure - 2P Pretreatment Standard for Rapidly Draining Soil

Name: Site Development Plans
Location: Off Carleton Drive
Georgetown, MA
County: Essex
Applicant: G. Mello Disposal Corp

Proj. No.: 3794
Date: 1/6/2022
Revised:
Computed by: Jarret Bastys, E.I.T.
Checked by: Scott P, Cameron, P.E.

TSS Removal Calculation

B BMP	C TSS Removal Rate	D Starting TSS Load	E Amount Removed (C*D)	F Remaining Load (D-E)
Proprietary Treatment Practice*	0.86	1.00	0.86	0.14
	0.00	0.14	0.00	0.14
	0.00	0.14	0.00	0.14
	0.00	0.14	0.00	0.14
	0.00	0.14	0.00	0.14

Total TSS Removal = 86%

*Refer to sheet found in this report titled: *CDS ESTIMATED NET ANNUAL SOLIDS LOAD REDUCTION BASED ON THE RATIONAL RAINFALL METHOD*
for Subcatchment PS1d prepared by Contech

Non-automated TSS Calculation Sheet
must be used if Proprietary BMP Proposed
1. From MassDEP Stormwater Handbook Vol. 1

THE MORIN-CAMERON GROUP, INC.
66 Elm Street,
Danvers, MA 01923
p | 978.777.8586

Standard 4: Total Suspended Solids Calculation for Subsurface Infiltration System - 2P With Pretreatment

Name: Definitive Subidvision
Location: Off Carleton Drive
Georgetown, MA
County: Essex
Applicant: G. Mello Disposal Corp

Proj. No.: 3794
Date: 1/6/2022
Revised:
Computed by: Jarret Bastys, E.I.T.
Checked by: Scott P, Cameron, P.E.

TSS Removal Calculation

B BMP	C TSS Removal Rate	D Starting TSS Load	E Amount Removed (C*D)	F Remaining Load (D-E)
Proprietary Treatment Practice	0.86	1.00	0.86	0.14
Subsurface Infiltration Structure	0.80	0.14	0.11	0.03
	0.00	0.03	0.00	0.03
	0.00	0.03	0.00	0.03
	0.00	0.03	0.00	0.03

Total TSS Removal = 97%

Non-automated TSS Calculation Sheet
must be used if Proprietary BMP Proposed
1. From MassDEP Stormwater Handbook Vol. 1

CONTECH ENGINEERED SOLUTIONS

CDS TECHNOLOGIES

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

LAND OFF CARLETON DRIVE GEORGETOWN, MA

Area	0.26 ac	Unit Site Designation	PS1c
Weighted C	0.9	Rainfall Station #	69
t_c	6 min		
CDS Model	1515-3	CDS Treatment Capacity	**1.0 cfs**

Rainfall Intensity[1] (in/hr)	Percent Rainfall Volume[1]	Cumulative Rainfall Volume	Total Flowrate (cfs)	Treated Flowrate (cfs)	Incremental Removal (%)
0.02	10.2%	10.2%	0.00	0.00	9.9
0.04	9.6%	19.8%	0.01	0.01	9.3
0.06	9.4%	29.3%	0.01	0.01	9.1
0.08	7.7%	37.0%	0.02	0.02	7.4
0.10	8.6%	45.6%	0.02	0.02	8.2
0.12	6.3%	51.9%	0.03	0.03	6.0
0.14	4.7%	56.5%	0.03	0.03	4.4
0.16	4.6%	61.2%	0.04	0.04	4.4
0.18	3.5%	64.7%	0.04	0.04	3.3
0.20	4.3%	69.1%	0.05	0.05	4.1
0.25	8.0%	77.1%	0.06	0.06	7.5
0.30	5.6%	82.7%	0.07	0.07	5.2
0.35	4.4%	87.0%	0.08	0.08	4.0
0.40	2.5%	89.5%	0.09	0.09	2.3
0.45	2.5%	92.1%	0.10	0.10	2.3
0.50	1.4%	93.5%	0.11	0.11	1.2
0.75	5.0%	98.5%	0.17	0.17	4.3
1.00	1.0%	99.5%	0.23	0.23	0.8
1.50	0.0%	99.5%	0.34	0.34	0.0
2.00	0.0%	99.5%	0.46	0.46	0.0
3.00	0.5%	100.0%	0.69	0.69	0.2
					94.0
				Removal Efficiency Adjustment[2] =	6.5%
				Predicted % Annual Rainfall Treated =	93.5%
				Predicted Net Annual Load Removal Efficiency =	**87.5%**

1 - Based on 10 years of hourly precipitation data from NCDC Station 770, Boston WSFO AP, Suffolk County, MA
2 - Reduction due to use of 60-minute data for a site that has a time of concentration less than 30-minutes.

CONTECH ENGINEERED SOLUTIONS

CDS TECHNOLOGIES

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

LAND OFF CARLETON DRIVE
GEORGETOWN, MA

Area	0.38 ac	Unit Site Designation	PS1d
Weighted C	0.9	Rainfall Station #	69
t_c	6 min		
CDS Model	1515-3	CDS Treatment Capacity	1.0 cfs

Rainfall Intensity[1] (in/hr)	Percent Rainfall Volume[1]	Cumulative Rainfall Volume	Total Flowrate (cfs)	Treated Flowrate (cfs)	Incremental Removal (%)
0.02	10.2%	10.2%	0.01	0.01	9.8
0.04	9.6%	19.8%	0.01	0.01	9.3
0.06	9.4%	29.3%	0.02	0.02	9.1
0.08	7.7%	37.0%	0.03	0.03	7.4
0.10	8.6%	45.6%	0.03	0.03	8.1
0.12	6.3%	51.9%	0.04	0.04	5.9
0.14	4.7%	56.5%	0.05	0.05	4.4
0.16	4.6%	61.2%	0.05	0.05	4.3
0.18	3.5%	64.7%	0.06	0.06	3.3
0.20	4.3%	69.1%	0.07	0.07	4.0
0.25	8.0%	77.1%	0.09	0.09	7.3
0.30	5.6%	82.7%	0.10	0.10	5.0
0.35	4.4%	87.0%	0.12	0.12	3.9
0.40	2.5%	89.5%	0.14	0.14	2.2
0.45	2.5%	92.1%	0.15	0.15	2.2
0.50	1.4%	93.5%	0.17	0.17	1.2
0.75	5.0%	98.5%	0.26	0.26	4.0
1.00	1.0%	99.5%	0.34	0.34	0.7
1.50	0.0%	99.5%	0.51	0.51	0.0
2.00	0.0%	99.5%	0.68	0.68	0.0
3.00	0.5%	100.0%	1.03	1.00	0.1
					92.4
				Removal Efficiency Adjustment[2] =	6.5%
				Predicted % Annual Rainfall Treated =	93.5%
				Predicted Net Annual Load Removal Efficiency =	**86.0%**

1 - Based on 10 years of hourly precipitation data from NCDC Station 770, Boston WSFO AP, Suffolk County, MA
2 - Reduction due to use of 60-minute data for a site that has a time of concentration less than 30-minutes.

APPENDIX I:

SOIL SUITABILITY

ASSESSMENT REPORT

SOIL SUITABILITY ASSESSMENT REPORT

COMMONWEALTH OF MASSACHUSETTS

GEORGETOWN, MASSACHUSETTS

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

SITE INFORMATION

Street Address: Carlton Drive Town: Georgetown State: Massachusetts Zip Code: 01833 County: Essex

Land Use: Undeveloped/ commercial Latitude: ~42° 42' 46.2" N Longitude: ~70° 57' 49.1" W Elevation: 80' to 85' AMSL

PUBLISHED SOIL DATA AND MAP UNIT DESCRIPTION

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

Soil survey area: Essex County, Massachusetts, Northern Part Series name: 256A– Deerfield LFS, 00-03% slopes

Order: Entisol Suborder: Psamments Family: Mixed, mesic Aquic Udipsamments

Soil moisture regime: Udic Soil temperature regime: Mesic Runoff class: Negligible

Soil hydric or upland: Upland Average depth to water table: > 80" Depth to restrictive feature: > 80"

Frequency of flooding: None Frequency of ponding: None Available water capacity: Moderate (~6.5")

Drainage Class: Moderately well drained Hydrologic Soil Group: A Ksat: High to very high (1.42 – 99.00 in/hr)

WETLAND AREA & USGS WELL MEASUREMENTS

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

Current Water Resource Condition (USGS): Well Site # 424520070562401- MA-NIW 27 Newbury, MA

Well depth: 19.8 feet Land altitude: 55.00 feet above NGVD29 Latitude: ~42°45'19.3"N Longitude: ~70°56'22.1"

Most recent data value: 10.30' on 10/15/19 (depth to water level in feet below land surface) Range: Normal

SURFICIAL GEOLOGY:

Surficial geology map: Qcs: Collapsed stratified drift deposits - Yellow-brown to gray-brown poorly-sorted, crudely stratified, sandy cobble gravel. Occurs as imperfectly formed kame terraces and irregular hills.

Geologic parent material: Sandy proglacial outwash Geomorphic component: Outwash plain

Slope aspect: Northerly Landform position (2D): Plain Landform position (3D): Tread

Slope gradient: ~01 - 03 % Down slope shape: Convex Across slope shape: Convex Slope complexity: Simple

Bedrock outcropping in vicinity: None observed Glacial erratics in vicinity: None observed

Bedrock Type: Nashoba Formation – Boxford Member: Thin bedded to massive amphibolite & minor biotite gneiss

TP19-1 DEEP OBSERVATION HOLE

Land off Carlton Drive, Georgetown, Massachusetts

Date: October 15, 2019 Time: 09:00 Weather: Clear and sunny, ~60-65°F, calm.

Landscape: Upland Landform: Outwash Plain Position on landscape: Tread Slope aspect: Northerly

Slope (%): 0 – 1 % Slope complexity: Simple Land Cover: Shrubs, sapling trees, stripped land

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

Wetlands: 100^+ feet Public water supply reservoir: 400^+ feet Tributary to reservoir: 200^+ feet

SOIL PROFILE ▶ TP19-1

Depth below land surface (inches)	Soil Horizon/ Layer	Soil Texture (USDA/ NRCS)	Soil Color (Munsell)	Redoxomorphic Features/ ESHGWT	Consistence, grade, size, structure, grain size, soil moisture state, roots, horizon boundary, clasts, stratification, artifacts, restrictive features, etc.
00" → 30"	$2C_1$	Sand	2.5Y 6/4 light yellowish brown	none observed	Loose, structurless; mixed fine-to-medium grained mineral content; crudely stratified; damp matrix; free of aggregate; non-sticky; non-plastic; abrupt wavy boundary.
30" → 120"	$2C_2$	Sand gravelly	2.5Y 5/3 light olive brown	68" (c,2,d) 5YR 5/8 10YR 7/1	Loose, structurless; mixed fine-to-coarse grained mineral content; stratified; damp matrix; ~15 - 20% sub-angular to sub-rounded gravel content and ~10 - 15% sub-angular to sub-rounded cobble content of mixed lithology; non-sticky; non-plastic; redoximorphic high and low chroma colors dispersed within matrix below 68"; apparent water observed at 72"; no bedrock refusal at test hole depth.

Depth to bedrock: 120" Seasonal High Groundwater Table: 68" Apparent water: 72"

TP19-1 DEEP OBSERVATION HOLE

Land off Carlton Drive, Georgetown, Massachusetts

DEPTH TO PHREATIC GROUNDWATER TABLE:

Apparent water seeping from pit face: 72" (below land surface) Depth to stabilized apparent water: 72" (below land surface)

Soil moisture state: Damp

ESTIMATED SEASONAL HIGH GROUNDWATER TABLE:

Depth of Estimated Seasonal High Groundwater Table: 68" (below land surface)

Kind: Iron concentrations; noncemented iron masses - coatings on sand grains

Location: In $2C_2$ matrix surrounding redox depletions Shape: Irregular/ spherical

Hardness: Soft Boundary: Clear Abundance: Common Size: Medium Contrast: Distinct

Concentration color: 5YR 5/8 red Reduction color: 10YR 7/1 light gray Moisture state: Damp

DETERMINATION OF HIGH GROUNDWATER ELEVATION

Observed depth to redoximorphic features: 68" inches below grade

Observed depth to stabilized phreatic water: 72" inches below grade

Observed water weeping from side of deep hole: 72" inches below grade

DEPTH OF NATURALLY OCCURRING PERVIOUS MATERIAL: ▶ 10.00 feet

Depth of naturally occurring pervious material in TP19-1 Upper boundary: 00"
Lower boundary: 120"

Certification

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

Alexander F. Parker *License #1848* June 1998

Evaluator & license number Certification Date of Certification

Mrs. Deborah Rogers, Georgetown Board of Health Director 10/15/19

Georgetown Town Witness Date of soil testing

TP19-2 DEEP OBSERVATION HOLE

Land off Carlton Drive, Georgetown, Massachusetts

Date: October 15, 2019 Time: 09:44 Weather: Clear and sunny, ~60-65°F, calm.

Landscape: Upland Landform: Outwash Plain Position on landscape: Tread Slope aspect: Northerly

Slope (%): 0 – 1 % Slope complexity: Simple Land Cover: Shrubs, sapling trees, stripped land

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

Wetlands: 100+ feet Public water supply reservoir: 400+ feet Tributary to reservoir: 200+ feet

SOIL PROFILE ▶ TP19-2

Depth below land surface (inches)	Soil Horizon/ Layer	Soil Texture (USDA/ NRCS)	Soil Color (Munsell)	Redoxomorphic Features/ ESHGWT	Consistence, grade, size, structure, grain size, soil moisture state, roots, horizon boundary, clasts, stratification, artifacts, restrictive features, etc.
00" → 25"	$2C_1$	Sand	2.5Y 6/4 light yellowish brown	none observed	Loose, structurless; mixed fine-to-medium grained mineral content; crudely stratified; damp matrix; free of aggregate; non-sticky; non-plastic; abrupt wavy boundary.
25" → 121"	$2C_2$	Sand gravelly	2.5Y 5/3 light olive brown	68" (c,2,d) 5YR 5/8 10YR 7/1	Loose, structurless; mixed fine-to-coarse grained mineral content; stratified; damp matrix; ~15 - 20% sub-angular to sub-rounded gravel content and ~10 - 15% sub-angular to sub-rounded cobble content of mixed lithology; non-sticky; non-plastic; redoximorphic high and low chroma colors dispersed within matrix below 68"; apparent water observed at 73"; no bedrock refusal at test hole depth.

Depth to bedrock: 121" Seasonal High Groundwater Table: 68" Apparent water: 73"

TP19-2 DEEP OBSERVATION HOLE

Land off Carlton Drive, Georgetown, Massachusetts

DEPTH TO PHREATIC GROUNDWATER TABLE:

Apparent water seeping from pit face: 73" (below land surface) Depth to stabilized apparent water: 73" (below land surface)

Soil moisture state: Damp

ESTIMATED SEASONAL HIGH GROUNDWATER TABLE:

Depth of Estimated Seasonal High Groundwater Table: 68" (below land surface)

Kind: Iron concentrations; noncemented iron masses - coatings on sand grains

Location: In $2C_2$ matrix surrounding redox depletions Shape: Irregular/ spherical

Hardness: Soft Boundary: Clear Abundance: Common Size: Medium Contrast: Distinct

Concentration color: 5YR 5/8 red Reduction color: 10YR 7/1 light gray Moisture state: Damp

DETERMINATION OF HIGH GROUNDWATER ELEVATION

Observed depth to redoximorphic features: 68" inches below grade

Observed depth to stabilized phreatic water: 73" inches below grade

Observed water weeping from side of deep hole: 73" inches below grade

DEPTH OF NATURALLY OCCURRING PERVIOUS MATERIAL: ▶ 10.08 feet

Depth of naturally occurring pervious material in TP19-2 Upper boundary: 00"
Lower boundary: 121"

Certification

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

Alexander F. Parker *License #1848* June 1998

Evaluator & license number Certification Date of Certification

Mrs. Deborah Rogers, Georgetown Board of Health Director 10/15/19

Georgetown Town Witness Date of soil testing

TP19-3 DEEP OBSERVATION HOLE

Land off Carlton Drive, Georgetown, Massachusetts

Date: October 15, 2019 Time: 10:18 Weather: Clear and sunny, ~60-65°F, calm.

Landscape: Upland Landform: Outwash Plain Position on landscape: Tread Slope aspect: Northerly

Slope (%): 0 – 1 % Slope complexity: Simple Land Cover: Shrubs, sapling trees, stripped land

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

Wetlands: 100^{+} feet Public water supply reservoir: 400^{+} feet Tributary to reservoir: 200^{+} feet

SOIL PROFILE ▸ TP19-3

Depth below land surface (inches)	Soil Horizon/ Layer	Soil Texture (USDA/ NRCS)	Soil Color (Munsell)	Redoxomorphic Features/ ESHGWT	Consistence, grade, size, structure, grain size, soil moisture state, roots, horizon boundary, clasts, stratification, artifacts, restrictive features, etc.
00" → 31"	$2C_1$	Sand	2.5Y 6/4 light yellowish brown	none observed	Loose, structurless; mixed fine-to-medium grained mineral content; crudely stratified; damp matrix; free of aggregate; non-sticky; non-plastic; abrupt wavy boundary.
31" → 122"	$2C_2$	Sand gravelly	2.5Y 5/3 light olive brown	69" (c,2,d) 5YR 5/8 10YR 7/1	Loose, structurless; mixed fine-to-coarse grained mineral content; stratified; damp matrix; ~15 - 20% sub-angular to sub-rounded gravel content and ~10 - 15% sub-angular to sub-rounded cobble content of mixed lithology; non-sticky; non-plastic; redoximorphic high and low chroma colors dispersed within matrix below 69"; apparent water observed at 73"; no bedrock refusal at test hole depth.

Depth to bedrock: 122" Seasonal High Groundwater Table: 69" Apparent water: 73"

TP19-3 DEEP OBSERVATION HOLE

Land off Carlton Drive, Georgetown, Massachusetts

DEPTH TO PHREATIC GROUNDWATER TABLE:

Apparent water seeping from pit face: 73" (below land surface) Depth to stabilized apparent water: 73" (below land surface)

Soil moisture state: Damp

ESTIMATED SEASONAL HIGH GROUNDWATER TABLE:

Depth of Estimated Seasonal High Groundwater Table: 69" (below land surface)

Kind: Iron concentrations; noncemented iron masses - coatings on sand grains

Location: In $2C_2$ matrix surrounding redox depletions Shape: Irregular/ spherical

Hardness: Soft Boundary: Clear Abundance: Common Size: Medium Contrast: Distinct

Concentration color: 5YR 5/8 red Reduction color: 10YR 7/1 light gray Moisture state: Damp

DETERMINATION OF HIGH GROUNDWATER ELEVATION

Observed depth to redoximorphic features: 69" inches below grade

Observed depth to stabilized phreatic water: 73" inches below grade

Observed water weeping from side of deep hole: 73" inches below grade

DEPTH OF NATURALLY OCCURRING PERVIOUS MATERIAL: ▶ 10.16 feet

Depth of naturally occurring pervious material in TP19-3 Upper boundary: 00"
Lower boundary: 122"

Certification

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

Alexander F. Parker *License #1848* June 1998

Evaluator & license number Certification Date of Certification

Mrs. Deborah Rogers, Georgetown Board of Health Director 10/15/19

Georgetown Town Witness Date of soil testing

TP19-4 DEEP OBSERVATION HOLE

Land off Carlton Drive, Georgetown, Massachusetts

Date: October 15, 2019 Time: 10:48 Weather: Clear and sunny, ~60-65°F, calm.

Landscape: Upland Landform: Outwash Plain Position on landscape: Tread Slope aspect: Northerly

Slope (%): 0 – 1 % Slope complexity: Simple Land Cover: Shrubs, sapling trees, stripped land

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

Wetlands: 100^+ feet Public water supply reservoir: 400^+ feet Tributary to reservoir: 200^+ feet

SOIL PROFILE ▶ TP19-4

Depth below land surface (inches)	Soil Horizon/ Layer	Soil Texture (USDA/ NRCS)	Soil Color (Munsell)	Redoxomorphic Features/ ESHGWT	Consistence, grade, size, structure, grain size, soil moisture state, roots, horizon boundary, clasts, stratification, artifacts, restrictive features, etc.
00" → 25"	$2C_1$	Sand	2.5Y 6/4 light yellowish brown	none observed	Loose, structurless; mixed fine-to-medium grained mineral content; crudely stratified; damp matrix; free of aggregate; non-sticky; non-plastic; abrupt wavy boundary.
25" → 121"	$2C_2$	Sand gravelly	2.5Y 5/3 light olive brown	68" (c,2,d) 5YR 5/8 10YR 7/1	Loose, structurless; mixed fine-to-coarse grained mineral content; stratified; damp matrix; ~15 - 20% sub-angular to sub-rounded gravel content and ~10 - 15% sub-angular to sub-rounded cobble content of mixed lithology; non-sticky; non-plastic; redoximorphic high and low chroma colors dispersed within matrix below 68"; apparent water observed at 74"; no bedrock refusal at test hole depth.

Depth to bedrock: 121" Seasonal High Groundwater Table: 68" Apparent water: 74"

TP19-4 DEEP OBSERVATION HOLE

Land off Carlton Drive, Georgetown, Massachusetts

DEPTH TO PHREATIC GROUNDWATER TABLE:

Apparent water seeping from pit face: 74" (below land surface) Depth to stabilized apparent water: 74" (below land surface)

Soil moisture state: Damp

ESTIMATED SEASONAL HIGH GROUNDWATER TABLE:

Depth of Estimated Seasonal High Groundwater Table: 68" (below land surface)

Kind: Iron concentrations; noncemented iron masses - coatings on sand grains

Location: In $2C_2$ matrix surrounding redox depletions Shape: Irregular/ spherical

Hardness: Soft Boundary: Clear Abundance: Common Size: Medium Contrast: Distinct

Concentration color: 5YR 5/8 red Reduction color: 10YR 7/1 light gray Moisture state: Damp

DETERMINATION OF HIGH GROUNDWATER ELEVATION

Observed depth to redoximorphic features: 68" inches below grade

Observed depth to stabilized phreatic water: 74" inches below grade

Observed water weeping from side of deep hole: 74" inches below grade

DEPTH OF NATURALLY OCCURRING PERVIOUS MATERIAL: ▶ 10.08 feet

Depth of naturally occurring pervious material in TP19-4 Upper boundary: 00"
Lower boundary: 121"

Certification

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

Alexander F. Parker *License #1848* June 1998

Evaluator & license number Certification Date of Certification

Mrs. Deborah Rogers, Georgetown Board of Health Director 10/15/19

Georgetown Town Witness Date of soil testing

TP19-5 DEEP OBSERVATION HOLE

Land off Carlton Drive, Georgetown, Massachusetts

Date: October 15, 2019 Time: 11:11 Weather: Clear and sunny, ~60-65°F, calm.

Landscape: Upland Landform: Outwash Plain Position on landscape: Tread Slope aspect: Northerly

Slope (%): 0 – 1 % Slope complexity: Simple Land Cover: Shrubs, sapling trees, stripped land

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

Wetlands: 100+ feet Public water supply reservoir: 400+ feet Tributary to reservoir: 200+ feet

SOIL PROFILE ▶ TP19-5

Depth below land surface (inches)	Soil Horizon/ Layer	Soil Texture (USDA/ NRCS)	Soil Color (Munsell)	Redoxomorphic Features/ ESHGWT	Consistence, grade, size, structure, grain size, soil moisture state, roots, horizon boundary, clasts, stratification, artifacts, restrictive features, etc.
00" → 37"	C^	Sandy Loam Mixture	2.5Y 3/1 very dark gray	none observed	Fill material. Loose, structurless; mixed fine-to-medium grained mineral content; non-deleterious material; brick, concrete, organics and stone mixed within matrix; abrupt wavy boundary
37" → 120"	2C	Sand gravelly	2.5Y 5/3 light olive brown	65" (c,2,d) 5YR 5/8 10YR 7/1	Loose, structurless; mixed fine-to-coarse grained mineral content; stratified; damp matrix; ~15 - 20% sub-angular to sub-rounded gravel content and ~10 - 15% sub-angular to sub-rounded cobble content of mixed lithology; non-sticky; non-plastic; redoximorphic high and low chroma colors dispersed within matrix below 65"; apparent water observed at 74"; no bedrock refusal at test hole depth.

Depth to bedrock: 120" Seasonal High Groundwater Table: 65" Apparent water: 74"

TP19-5 DEEP OBSERVATION HOLE

Land off Carlton Drive, Georgetown, Massachusetts

DEPTH TO PHREATIC GROUNDWATER TABLE:

Apparent water seeping from pit face: 74" (below land surface) Depth to stabilized apparent water: 74" (below land surface)

Soil moisture state: Damp

ESTIMATED SEASONAL HIGH GROUNDWATER TABLE:

Depth of Estimated Seasonal High Groundwater Table: 65" (below land surface)

Kind: Iron concentrations; noncemented iron masses - coatings on sand grains

Location: In $2C_2$ matrix surrounding redox depletions Shape: Irregular/ spherical

Hardness: Soft Boundary: Clear Abundance: Common Size: Medium Contrast: Distinct

Concentration color: 5YR 5/8 red Reduction color: 10YR 7/1 light gray Moisture state: Damp

DETERMINATION OF HIGH GROUNDWATER ELEVATION

Observed depth to redoximorphic features: 68" inches below grade

Observed depth to stabilized phreatic water: 74" inches below grade

Observed water weeping from side of deep hole: 74" inches below grade

DEPTH OF NATURALLY OCCURRING PERVIOUS MATERIAL: ▶ 6.92 feet

Depth of naturally occurring pervious material in TP19-5 Upper boundary: 37"
Lower boundary: 120"

Certification

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

Alexander F. Parker *License #1848* June 1998

Evaluator & license number Certification Date of Certification

Mrs. Deborah Rogers, Georgetown Board of Health Director 10/15/19

Georgetown Town Witness Date of soil testing

TP19-6 DEEP OBSERVATION HOLE

Land off Carlton Drive, Georgetown, Massachusetts

Date: October 15, 2019 Time: 11:48 Weather: Clear and sunny, ~60-65°F, calm.

Landscape: Upland Landform: Outwash Plain Position on landscape: Tread Slope aspect: Northerly

Slope (%): 0 – 1 % Slope complexity: Simple Land Cover: Shrubs, sapling trees, stripped land

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

Wetlands: 100^+ feet Public water supply reservoir: 400^+ feet Tributary to reservoir: 200^+ feet

SOIL PROFILE ▶ TP19-6

Depth below land surface (inches)	Soil Horizon/ Layer	Soil Texture (USDA/ NRCS)	Soil Color (Munsell)	Redoxomorphic Features/ ESHGWT	Consistence, grade, size, structure, grain size, soil moisture state, roots, horizon boundary, clasts, stratification, artifacts, restrictive features, etc.
00" → 02"	A_p	Sandy Loam Fine grained	10YR 3/2 very dark grayish brown	none observed	Very friable; moderate-grade fine-to-medium granular structure; slightly cohesive; fine grained mineral content; dry matrix; non-sticky; non-plastic; common fine roots; free of clasts; clear smooth boundary.
02" → 40"	$2C_1$	Sand	2.5Y 6/4 light yellowish brown	none observed	Loose, structurless; mixed fine-to-medium grained mineral content; crudely stratified; damp matrix; free of aggregate; non-sticky; non-plastic; abrupt wavy boundary.
40" → 120"	$2C_2$	Sand gravelly	2.5Y 5/3 light olive brown	64" (c,2,d) 5YR 5/8 10YR 7/1	Loose, structurless; mixed fine-to-coarse grained mineral content; stratified; damp matrix; ~15 - 20% sub-angular to sub-rounded gravel content and ~10 - 15% sub-angular to sub-rounded cobble content of mixed lithology; non-sticky; non-plastic; redoximorphic high and low chroma colors dispersed within matrix below 64"; apparent water observed at 75"; no bedrock refusal at test hole depth.

Depth to bedrock: 120" Seasonal High Groundwater Table: 64" Apparent water: 75"

TP19-6 DEEP OBSERVATION HOLE

Land off Carlton Drive, Georgetown, Massachusetts

DEPTH TO PHREATIC GROUNDWATER TABLE:

Apparent water seeping from pit face: 75" (below land surface) Depth to stabilized apparent water: 75" (below land surface)

Soil moisture state: Damp

ESTIMATED SEASONAL HIGH GROUNDWATER TABLE:

Depth of Estimated Seasonal High Groundwater Table: 64" (below land surface)

Kind: Iron concentrations; noncemented iron masses - coatings on sand grains

Location: In $2C_2$ matrix surrounding redox depletions Shape: Irregular/ spherical

Hardness: Soft Boundary: Clear Abundance: Common Size: Medium Contrast: Distinct

Concentration color: 5YR 5/8 red Reduction color: 10YR 7/1 light gray Moisture state: Damp

DETERMINATION OF HIGH GROUNDWATER ELEVATION

Observed depth to redoximorphic features: 64" inches below grade

Observed depth to stabilized phreatic water: 75" inches below grade

Observed water weeping from side of deep hole: 75" inches below grade

DEPTH OF NATURALLY OCCURRING PERVIOUS MATERIAL: ▶ 9.83 feet

Depth of naturally occurring pervious material in TP19-6 Upper boundary: 02"
Lower boundary: 120"

Certification

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

Alexander F. Parker *License #1848* June 1998

Evaluator & license number Certification Date of Certification

Mrs. Deborah Rogers, Georgetown Board of Health Director 10/15/19

Georgetown Town Witness Date of soil testing

TP19-7 DEEP OBSERVATION HOLE

Land off Carlton Drive, Georgetown, Massachusetts

Date: October 15, 2019 Time: 12:21 Weather: Clear and sunny, ~60-65°F, calm.

Landscape: Upland Landform: Outwash Plain Position on landscape: Tread Slope aspect: Northerly

Slope (%): 0 – 1 % Slope complexity: Simple Land Cover: Shrubs, sapling trees, stripped land

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

Wetlands: 100^{+} feet Public water supply reservoir: 400^{+} feet Tributary to reservoir: 200^{+} feet

SOIL PROFILE ▶ TP19-7

Depth below land surface (inches)	Soil Horizon/ Layer	Soil Texture (USDA/ NRCS)	Soil Color (Munsell)	Redoxomorphic Features/ ESHGWT	Consistence, grade, size, structure, grain size, soil moisture state, roots, horizon boundary, clasts, stratification, artifacts, restrictive features, etc.
00" → 04"	A_p	Sandy Loam Fine grained	10YR 3/2 very dark grayish brown	none observed	Very friable; moderate-grade fine-to-medium granular structure; slightly cohesive; fine grained mineral content; dry matrix; non-sticky; non-plastic; common fine roots; free of clasts; clear smooth boundary.
04" → 29"	$2C_1$	Sand	2.5Y 6/4 light yellowish brown	none observed	Loose, structurless; mixed fine-to-medium grained mineral content; crudely stratified; damp matrix; free of aggregate; non-sticky; non-plastic; abrupt wavy boundary.
29" → 120"	$2C_2$	Sand gravelly	2.5Y 5/3 light olive brown	65" (c,2,d) 5YR 5/8 10YR 7/1	Loose, structurless; mixed fine-to-coarse grained mineral content; stratified; damp matrix; ~15 - 20% sub-angular to sub-rounded gravel content and ~10 - 15% sub-angular to sub-rounded cobble content of mixed lithology; non-sticky; non-plastic; redoximorphic high and low chroma colors dispersed within matrix below 65"; apparent water observed at 75"; no bedrock refusal at test hole depth.

Depth to bedrock: 120" Seasonal High Groundwater Table: 65" Apparent water: 75"

TP19-7 DEEP OBSERVATION HOLE

Land off Carlton Drive, Georgetown, Massachusetts

DEPTH TO PHREATIC GROUNDWATER TABLE:

Apparent water seeping from pit face: 75" (below land surface) Depth to stabilized apparent water: 75" (below land surface)

Soil moisture state: Damp

ESTIMATED SEASONAL HIGH GROUNDWATER TABLE:

Depth of Estimated Seasonal High Groundwater Table: 65" (below land surface)

Kind: Iron concentrations; noncemented iron masses - coatings on sand grains

Location: In $2C_2$ matrix surrounding redox depletions Shape: Irregular/ spherical

Hardness: Soft Boundary: Clear Abundance: Common Size: Medium Contrast: Distinct

Concentration color: 5YR 5/8 red Reduction color: 10YR 7/1 light gray Moisture state: Damp

DETERMINATION OF HIGH GROUNDWATER ELEVATION

Observed depth to redoximorphic features: 65" inches below grade

Observed depth to stabilized phreatic water: 75" inches below grade

Observed water weeping from side of deep hole: 75" inches below grade

DEPTH OF NATURALLY OCCURRING PERVIOUS MATERIAL: ▶ 9.66 feet

Depth of naturally occurring pervious material in TP19-7 Upper boundary: 04"
Lower boundary: 120"

Certification

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

Alexander F. Parker *License #1848* June 1998

Evaluator & license number Certification Date of Certification

Mrs. Deborah Rogers, Georgetown Board of Health Director 10/15/19

Georgetown Town Witness Date of soil testing

TP19-8 DEEP OBSERVATION HOLE

Land off Carlton Drive, Georgetown, Massachusetts

Date: October 15, 2019 Time: 12:51 Weather: Clear and sunny, ~60-65°F, calm.

Landscape: Upland Landform: Outwash Plain Position on landscape: Tread Slope aspect: Northerly

Slope (%): 0 – 1 % Slope complexity: Simple Land Cover: Shrubs, sapling trees, stripped land

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

Wetlands: 100^+ feet Public water supply reservoir: 400^+ feet Tributary to reservoir: 200^+ feet

SOIL PROFILE ▶ TP19-8

Depth below land surface (inches)	Soil Horizon/ Layer	Soil Texture (USDA/ NRCS)	Soil Color (Munsell)	Redoxomorphic Features/ ESHGWT	Consistence, grade, size, structure, grain size, soil moisture state, roots, horizon boundary, clasts, stratification, artifacts, restrictive features, etc.
00" → 07"	A_p	Sandy Loam Fine grained	10YR 3/2 very dark grayish brown	none observed	Very friable; moderate-grade fine-to-medium granular structure; slightly cohesive; fine grained mineral content; dry matrix; non-sticky; non-plastic; common fine roots; free of clasts; clear smooth boundary.
07" → 36"	$2C_1$	Sand	2.5Y 6/4 light yellowish brown	none observed	Loose, structurless; mixed fine-to-medium grained mineral content; crudely stratified; damp matrix; free of aggregate; non-sticky; non-plastic; abrupt wavy boundary.
36" → 120"	$2C_2$	Sand gravelly	2.5Y 5/3 light olive brown	66" (c,2,d) 5YR 5/8 10YR 7/1	Loose, structurless; mixed fine-to-coarse grained mineral content; stratified; damp matrix; ~15 - 20% sub-angular to sub-rounded gravel content and ~10 - 15% sub-angular to sub-rounded cobble content of mixed lithology; non-sticky; non-plastic; redoximorphic high and low chroma colors dispersed within matrix below 66"; apparent water observed at 72"; no bedrock refusal at test hole depth.

Depth to bedrock: 120" Seasonal High Groundwater Table: 66" Apparent water: 72"

TP19-8 DEEP OBSERVATION HOLE

Land off Carlton Drive, Georgetown, Massachusetts

DEPTH TO PHREATIC GROUNDWATER TABLE:

Apparent water seeping from pit face: 72" (below land surface) Depth to stabilized apparent water: 72" (below land surface)

Soil moisture state: Damp

ESTIMATED SEASONAL HIGH GROUNDWATER TABLE:

Depth of Estimated Seasonal High Groundwater Table: 66" (below land surface)

Kind: Iron concentrations; noncemented iron masses - coatings on sand grains

Location: In $2C_2$ matrix surrounding redox depletions Shape: Irregular/ spherical

Hardness: Soft Boundary: Clear Abundance: Common Size: Medium Contrast: Distinct

Concentration color: 5YR 5/8 red Reduction color: 10YR 7/1 light gray Moisture state: Damp

DETERMINATION OF HIGH GROUNDWATER ELEVATION

Observed depth to redoximorphic features: 66" inches below grade

Observed depth to stabilized phreatic water: 72" inches below grade

Observed water weeping from side of deep hole: 72" inches below grade

DEPTH OF NATURALLY OCCURRING PERVIOUS MATERIAL: ▶ 9.42 feet

Depth of naturally occurring pervious material in TP19-8 Upper boundary: 07"
Lower boundary: 120"

Certification

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Alexander F. Parker *License #1848* June 1998

Evaluator & license number Certification Date of Certification

Mrs. Deborah Rogers, Georgetown Board of Health Director 10/15/19

Georgetown Town Witness Date of soil testing

TP19-9 DEEP OBSERVATION HOLE

Land off Carlton Drive, Georgetown, Massachusetts

Date: October 15, 2019 Time: 12:51 Weather: Clear and sunny, ~60-65°F, calm.

Landscape: Upland Landform: Outwash Plain Position on landscape: Tread Slope aspect: Northerly

Slope (%): 0 – 1 % Slope complexity: Simple Land Cover: Shrubs, sapling trees, stripped land

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

Wetlands: 100^{+} feet Public water supply reservoir: 400^{+} feet Tributary to reservoir: 200^{+} feet

SOIL PROFILE ▶ TP19-9

Depth below land surface (inches)	Soil Horizon/ Layer	Soil Texture (USDA/ NRCS)	Soil Color (Munsell)	Redoxomorphic Features/ ESHGWT	Consistence, grade, size, structure, grain size, soil moisture state, roots, horizon boundary, clasts, stratification, artifacts, restrictive features, etc.
00" → 14"	C^	Sandy Loam Mixture	2.5Y 3/1 very dark gray	none observed	Fill material. Loose, structurless; mixed fine-to-medium grained mineral content; non-deleterious material; brick, concrete, organics and stone mixed within matrix; abrupt wavy boundary
14" → 22"	A_b	Sandy Loam Fine grained	10YR 3/2 very dark grayish brown	none observed	Very friable; moderate-grade fine-to-medium granular structure; slightly cohesive; fine grained mineral content; dry matrix; non-sticky; non-plastic; common fine roots; free of clasts; clear smooth boundary.
22" → 34"	BC	Loamy Sand Fine to medium grained	10YR 5/4 yellowish brown	none observed	Very friable; weak-grade, fine, sub-angular blocky structure; somewhat cohesive; mixed medium to mostly fine-grained mineral content; dry matrix; non-sticky; non-plastic; few fine roots and few medium to coarse roots; approximately 05% sub-angular to sub-rounded gravel content of mixed lithology; diffuse wavy boundary.
34" → 122"	$2C_2$	Sand gravelly	2.5Y 5/3 light olive brown	69" (c,2,d) 5YR 5/8 10YR 7/1	Loose, structurless; mixed fine-to-coarse grained mineral content; stratified; damp matrix; ~15 - 20% sub-angular to sub-rounded gravel content and ~10 - 15% sub-angular to sub-rounded cobble content of mixed lithology; non-sticky; non-plastic; redoximorphic high and low chroma colors dispersed within matrix below 69"; apparent water observed at 78"; no bedrock refusal at test hole depth.

Depth to bedrock: 122" Seasonal High Groundwater Table: 69" Apparent water: 78"

TP19-9 DEEP OBSERVATION HOLE

Land off Carlton Drive, Georgetown, Massachusetts

DEPTH TO PHREATIC GROUNDWATER TABLE:

Apparent water seeping from pit face: 78" (below land surface) Depth to stabilized apparent water: 78" (below land surface)

Soil moisture state: Damp

ESTIMATED SEASONAL HIGH GROUNDWATER TABLE:

Depth of Estimated Seasonal High Groundwater Table: 69" (below land surface)

Kind: Iron concentrations; noncemented iron masses - coatings on sand grains

Location: In $2C_2$ matrix surrounding redox depletions Shape: Irregular/ spherical

Hardness: Soft Boundary: Clear Abundance: Common Size: Medium Contrast: Distinct

Concentration color: 5YR 5/8 red Reduction color: 10YR 7/1 light gray Moisture state: Damp

DETERMINATION OF HIGH GROUNDWATER ELEVATION

Observed depth to redoximorphic features: 68" inches below grade

Observed depth to stabilized phreatic water: 78" inches below grade

Observed water weeping from side of deep hole: 78" inches below grade

DEPTH OF NATURALLY OCCURRING PERVIOUS MATERIAL: ▶ 8.33 feet

Depth of naturally occurring pervious material in TP19-9 Upper boundary: 22"
Lower boundary: 122"

Certification

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Alexander F. Parker *License #1848* June 1998

Evaluator & license number Certification Date of Certification

Mrs. Deborah Rogers, Georgetown Board of Health Director 10/15/19

Georgetown Town Witness Date of soil testing

SOIL SUITABILITY PERCOLATION TEST

COMMONWEALTH OF MASSACHUSETTS

GEORGETOWN, MASSACHUSETTS

Land off Carlton Drive, Georgetown, Massachusetts

Percolation Test	Percolation Test-1 TP19-1	Percolation Test-2 TP19-4
Depth of test:	Depth to shelf: 04" 22" Depth of hole: 18"	Depth to shelf: 05" 23" Depth of hole: 18"
Start presoak:	09:17	09:50
End presoak:	09:41	10:05
Time at 12"→	09:41	10:05
Time at 9"→	09:35	10:08
Time at 6"→	09:41	10:11
Total time 9" to 6"→	6 minutes	3 minutes
Rate (minutes per inch)	2.0 MPI CLASS I SOIL LTAR 0.74	1.0 MPI CLASS I SOIL LTAR 0.74

Alexander F. Parker *#1848*

Massachusetts Soil Evaluator & Certification number

Mrs. Deborah Rogers, Georgetown Board of Health Director — 10/15/19

Georgetown Town Witness — Date of soil testing

MCG# 3794