STORMWATER REPORT

SHARED RESIDENTIAL DRIVEWAY
STORMWATER MANAGEMENT PERMIT

FOR

THE PROPERTY LOCATED AT
64 BEAVER BROOK ROAD

IN

LITTLETON,
MASSACHUSETTS

PREPARED BY: DILLIS & ROY
CIVIL DESIGN GROUP, INC.
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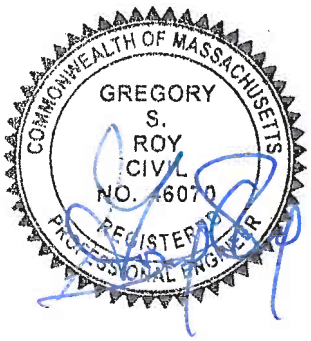

REVISED: JUNE 18TH, 2025
FEBRUARY 11TH, 2025
CDG PROJECT # 7462

DILLIS & ROY
CIVIL DESIGN GROUP
CIVIL ENGINEERS LAND SURVEYORS WETLAND CONSULTANTS

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1.0 Project Narrative

1.1 Project Type

The proposed project involves the construction of two single-family dwellings and a shared driveway. The shared driveway will require a wetland crossing and wetland replication area.

1.2 Purpose and Scope

This report has been prepared to comply with the requirements of the Stormwater Management Standards incorporated in the Massachusetts Wetlands Protection Act Regulations, 310 CMR 10.00. These standards are intended to promote increased groundwater recharge and prevent stormwater discharges from causing or contributing to the pollution of surface waters and ground waters of the Commonwealth. The standards aim to accomplish these goals by encouraging the greater use of low impact development techniques and improving the operation and maintenance of stormwater best management practices.

310 CMR 10.05(6)(1) states that the Stormwater Management Standards shall not apply to the development, as it is a development of four (4) or fewer units that does not discharge to critical areas. However, The Town of Littleton's Bylaw (Chapter 38-14) requires compliance with these standards for any land disturbing activity related to development that exceeds one acre. This report addresses compliance with the proposed development with each of the ten stormwater standards, it provides calculations to support the compliance information, and it provides a Long-Term Pollution Prevention Plan and an Operation and Maintenance Plan for the stormwater management system.

1.3 Proposed Development

The proposed project involves the construction of a 16-foot-wide shared driveway (±435 L.F.) to provide access to two residential lots (Lot 1 & Lot 3, as seen on Plan of Land in Littleton, Massachusetts, dated October 18th, 2024, prepared by Dillis and Roy Civil Design Group, Inc.). Both single-family dwellings and their associated private driveways will be located outside of the 100-foot buffer zone. Each dwelling will be serviced by a private septic system and private water supply well. Due to the wetland system which bisects the site, the proposed shared driveway will require a wetland crossing to provide access to the upland area at the rear of the property. The proposed scope of work also includes a wetland replication area to mitigate the direct BVW disturbance. Each dwelling will require separate utility connections and their appurtenances. Two sperate stormwater management areas are proposed to capture and mitigate stormwater runoff associated with the development.

Per the Massachusetts Stormwater Standards Handbook (Volume 1, Chapter1 Page 3), the stormwater standards do not apply to housing development projects comprised of detached single-family dwellings on four or fewer lots provided there is no discharge to critical areas. However, Section §38-14 of the Littleton Town Bylaw requires the filing of a stormwater management permit application for any disturbance over one acre. The disturbance associated with the proposed scope of work exceeds one acre.

The project has been designed to meet the Town of Littleton's local Stormwater Management requirements and the Massachusetts Stormwater Standards to the maximum extent practicable.

1.4 LID Measures

Care has been taken to lay out the proposed site in a manner that works with existing topography. BMPs will be used to manage stormwater runoff and control discharge to the analyzed design point. The proposed project will allow grassed swales equipped with a spillway to control the amount of runoff leaving the property.

1.5 Site Description

The subject property is located at 64 Beaver Brook Road and contains approximately ±10.12 acres of land. The property has been previously developed and includes an existing single-family dwelling, paved driveway, on-site private sewage disposal system & private water supply well. The parcel is located within the Residential Zoning District. Multiple Bordering Vegetated Wetland systems are found on-site behind the previous development as shown on the attached Site Plan. The largest BVW area bisects the rear of the lot from Beaver Brook Road. The USDA soil map indicated that the development area is underlain with soils belonging primarily to Hydrologic Soil Group (HSG) C. Group C soils have a slower infiltration rate when thoroughly wet. The site does not contain any stormwater infrastructure, or conveyance measures on-site. Generally, the stormwater runoff which accumulates on site sheet flows overland towards the wetland resource areas from south to north.

Site visits have been conducted to evaluate the above-mentioned site with regard to the presence of Wetland Resource Areas, as defined by the Massachusetts Wetlands Protection Act (M.G.L. c. 131 s. 40) and Regulations (310 CMR 10.00), and Littleton Wetlands Bylaw.

The existing topography of the site generally slopes from South to North towards the large Bordering Vegetated Wetland system which bisects the site.

Based on the most recently available Flood Insurance Rate map for the Town of Littleton, the project site does not have any areas subject to inundation during the

100-year frequency storm event. This information was obtained from the Federal Flood Insurance Rate (FIRM) Flood Plain Map 25017C0228E June 4, 2010.

In accordance with regulation 310 CMR 10.59, no project may be permitted which will have any adverse effect on specified habitat sites of rare vertebrate or invertebrate species. Specified habitat sites of rare species have been identified by the Massachusetts Natural Heritage and Endangered Species Program of the Division of Fisheries and Wildlife. The Massachusetts Natural Heritage Atlas 13th Edition indicates that the site does not contain areas identified as habitat sites of rare species and wildlife. There are no certified vernal pools on or near the project site.

The NRCS soil survey information indicates that all of the site is underlain by soils classified as belonging to Hydrologic Soil Groups C (Paxton fine sandy loam). Soils belonging to HSG C have a slower infiltration rate and have a high runoff potential.

1.6 Proposed Stormwater Management System

Runoff from the proposed development will be conveyed and treated through a combination of Best Management Practices (BMP's). The following is a brief discussion of each conveyance and treatment BMP proposed.

Infiltration Basin

The proposed infiltration basin was designed to reduce the post-construction runoff rates and increase groundwater recharge rates to the maximum extent practical. The basin will capture runoff associated with a large portion of the private driveway and overland flow from the undisturbed wooded area. The basin has been designed with an emergency overflow weir which will activate during more severe rain events to direct the overflow away from the development. An outlet control structure has been designed to provide the stormwater management area with a low-flow outlet during less sever rain events. Riprap will also be installed at the outlet of the emergency weir to control the overflow of stormwater and reduce the potential for scouring.

Grassed Swale

A grassed swale has been designed to capture runoff from portions of the shared driveway and to provide attenuation & treatment of stormwater. The grassed swale will consist of a small overflow berm to discharge stormwater towards the design point during larger storm events. The swale's entrance shall be reinforced with rip rap to decrease the velocity of flow and increase the settlement of heavy solids prior to entering the swale. Riprap will also be installed at the outlet of the weir to control the overflow of stormwater and reduce the potential for scouring.

1.7 Methods of Analysis

United States Department of Agriculture Natural Resources Conservation Service (NRCS) soil cover complex methods (TR-20) were employed to compute runoff quantities for the subject property. HydroCAD 10.0 computer software was employed in this hydrologic analysis. A comparison of pre- and post-development runoff quantities at various analysis points downstream around the site was performed in order to design a stormwater management system that will limit peak rates of runoff from the development to predevelopment levels for 24-hour rainfall events of 2-, 10-, 25-, 50- and 100-year return frequencies. Watershed boundaries for existing conditions are depicted on the attached Predevelopment Watershed Plan. Post-Developed watershed boundaries are indicated on the Post-Development Watershed Plan.

2.0 Stormwater Standards Compliance

2.1 Standard 1 – Untreated Discharges

The stormwater management system for the proposed development will not result in any new discharges of untreated stormwater to wetland resource areas. The stormwater management system has been designed such that there is no erosion or scour to wetland resource areas or waters of the Commonwealth.

2.2 Standard 2 – Peak Rate Attenuation

Hydrologic calculations for existing and proposed site conditions are included in Appendices D and E respectively. Calculations for 24-hour rainfall events of 2-, 10-, 25- and 100-year return frequencies are provided. The following table provides a summary of peak rates of runoff related to each of these storms for the design point through which all runoff from the subject property must flow. For all rainfall events considered, the proposed stormwater management system will control runoff from the development such that corresponding peak flows at the design point will be lower than pre-developed rates.

Table 1: Design Point - A Peak Runoff Rates

	Pre-Developed	**Post-Developed**	**Delta**
2-year	12.54 cfs	12.30 cfs	-0.24 cfs
10-year	31.16 cfs	29.53 cfs	-1.83 cfs
25-year	44.07 cfs	41.34 cfs	-2.73 cfs
50-year	53.89 cfs	50.57 cfs	-3.32 cfs
100-year	64.92 cfs	62.64 cfs	-2.28 cfs

2.1 Standard 3 – Recharge

As discussed in the Introduction, Natural Resource Conservation Service data indicates that the areas within the proposed development consist of soils from Hydrologic Group C. As the site consists of only C-rated soil and contains only two single-family dwellings, the recharge requirements have been met to the maximum extent practicable. Recharge and TSS calculations are provided in Appendix F.

2.2 Standard 4 – Water Quality

The BMP's have been designed to meet the 1" required water quality depth for the proposed development. Additionally, the proposed swale has been designed to meet water quality standards for the proposed development. Water Quality Volume calculations can be found in Appendix F.

2.3 Standard 5 – Land Uses with Higher Pollutant Loads

The current and proposed uses of the subject site do not constitute land use with higher potential pollutant load, thus Standard 5 does not apply to the proposed project.

2.4 Standard 6 – Critical Areas

The proposed project does not include any discharge to any Critical Areas as defined in 310 CMR 10.00.

2.5 Standard 7 – Redevelopment

The proposed project does not meet the standards to be considered a Redevelopment project.

2.6 Standard 8 – Construction Period Pollution Prevention and Erosion and Sediment Control

Because the project is subject to the filing of an Environmental Protection Agency Notice of Intent (EPA NOI), the Stormwater Pollution Prevention Plan (SWPPP) will be prepared prior to construction. This document will be prepared to satisfy the requirements of the EPA NOI and the Standard 8 Construction Period Pollution prevention and Erosion and Sedimentation Control Plan.

2.7 Standard 9 – Operation and Maintenance Plan

See Appendix G for the Stormwater Operation & Maintenance Manual documenting operations and maintenance activities for both during and post construction periods.

2.8 Standard 10 – Prohibition of Illicit Discharges

An illicit discharge statement will be prepared after approvals are received and prior to construction.

APPENDIX A

Locus Map

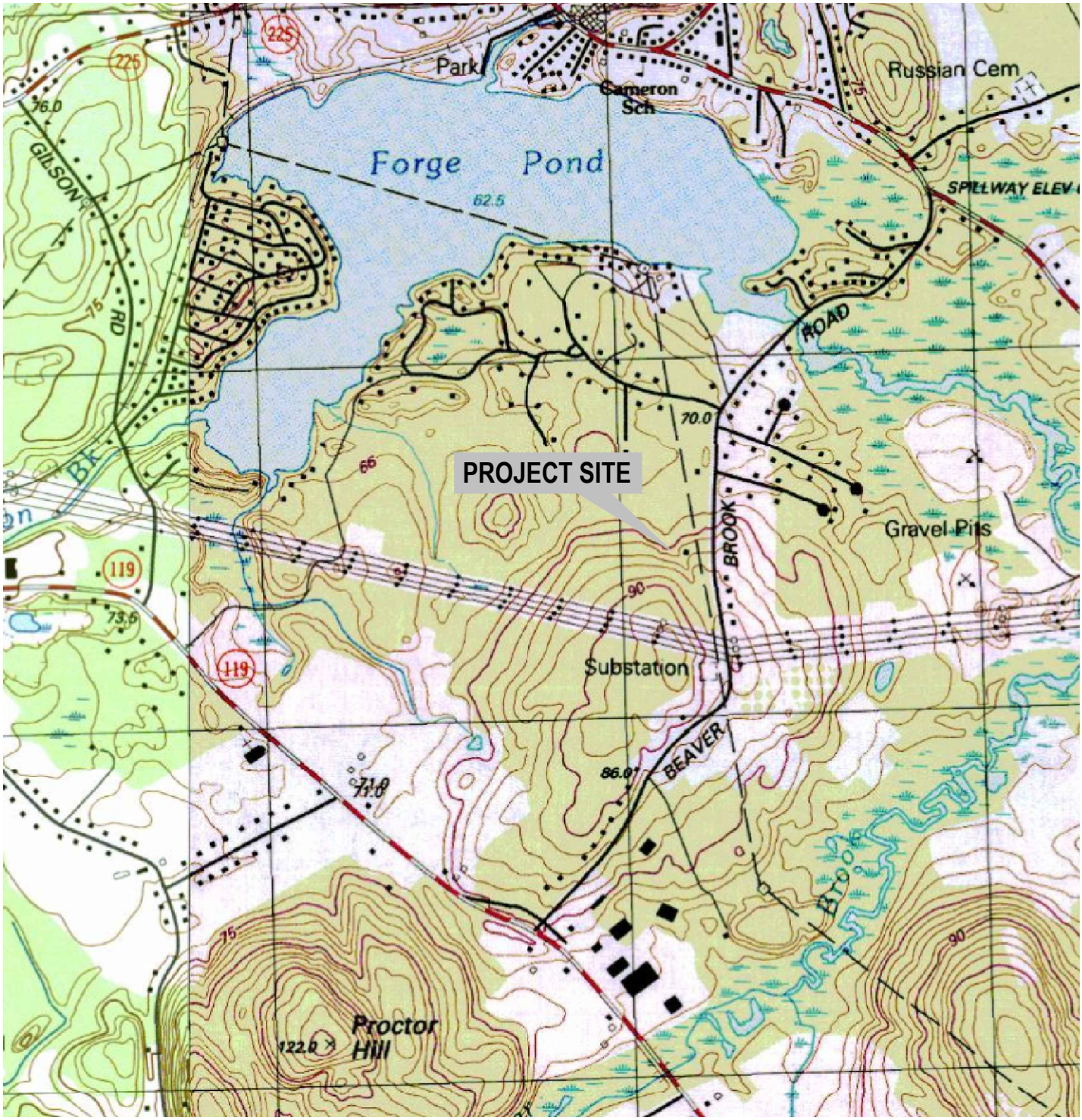

FIGURE 1 - LOCUS MAP

1"=1,000'

Prepared By: Dillis & Roy Civil Design Goup, Inc.
1 Main Street, Suite #1
Lunenburg, Massachusetts

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References: 1988 USGS Massachusetts Topographic Map

Prepared For: Michael & Hannah Gruar
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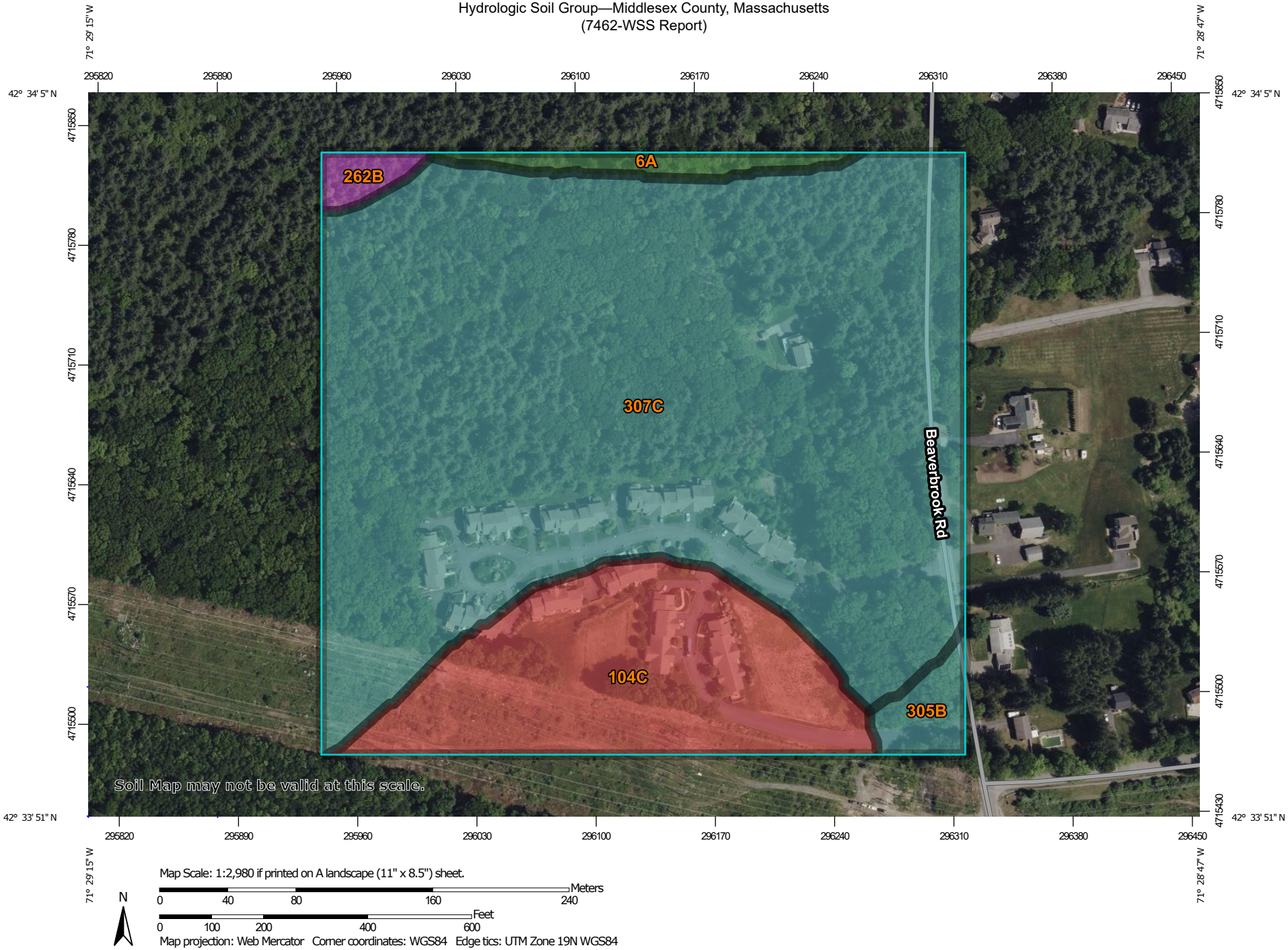
Littleton, Massachusetts 01460

APPENDIX B

NRCS Soils Data


71° 29' 15" W
71° 28' 47" W
42° 34' 5" N
42° 33' 51" N
295820
295890
295960
296030
296100
296170
296240
296310
296380
296450
4715850
4715780
4715710
4715640
4715570
4715500
4715430
262B
6A
307C
104C
305B
Beaverbrook Rd
Soil Map may not be valid at this scale.
Map Scale: 1:2,980 if printed on A landscape (11" x 8.5") sheet.
N
Meters
0 40 80 160 240
Feet
0 100 200 400 600
Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 19N WGS84

MAP LEGEND

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

Soils

Soil Rating Polygons
- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Lines
- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Points
- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Water Features
- Streams and Canals

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

Background
- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

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

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

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

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

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

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

Soil Survey Area: Middlesex County, Massachusetts
Survey Area Data: Version 24, Aug 27, 2024

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

Date(s) aerial images were photographed: May 22, 2022—Jun 5, 2022

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

Hydrologic Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
6A	Scarboro mucky fine sandy loam, 0 to 3 percent slopes	A/D	0.7	2.1%
104C	Hollis-Rock outcrop-Charlton complex, 0 to 15 percent slopes	D	6.0	18.3%
262B	Quonset sandy loam, 3 to 8 percent slopes	A	0.4	1.1%
305B	Paxton fine sandy loam, 3 to 8 percent slopes	C	0.6	1.9%
307C	Paxton fine sandy loam, 8 to 15 percent slopes, extremely stony	C	25.3	76.6%
Totals for Area of Interest			**33.0**	**100.0%**

Description

Hydrologic soil groups are based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms.

The soils in the United States are assigned to four groups (A, B, C, and D) and three dual classes (A/D, B/D, and C/D). The groups are defined as follows:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

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

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas. Only the soils that in their natural condition are in group D are assigned to dual classes.

Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

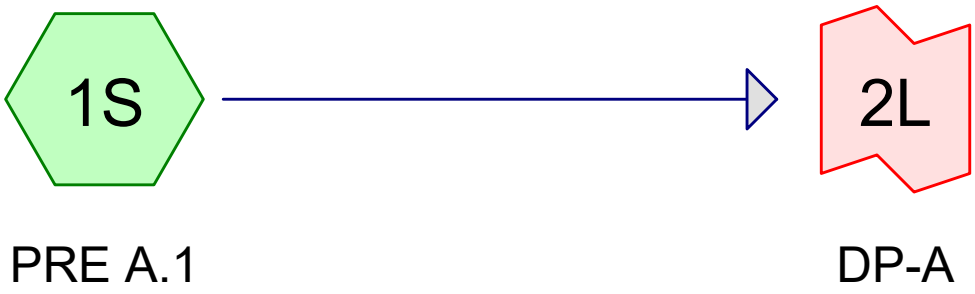
APPENDIX C

Stormwater Checklist

310 CMR 10.05(6)(1) states that the Stormwater Management Standards shall not apply to the development, as it is a development of four (4) or fewer units that does not discharge to critical areas. However, The Town of Littleton's Bylaw (Chapter 38-14) requires compliance with these standards for any land disturbing activity related to development that exceeds one acre. As such, the Stormwater Checklist has not been included within this Report.

APPENDIX D

Existing Conditions – Hydrologic Conditions



Subcat Reach Pond Link

Routing Diagram for 7462-PRE REV1
Prepared by Dillis & Roy Civil Design Group, Printed 6/17/2025
HydroCAD® 10.20-6a s/n 03590 © 2024 HydroCAD Software Solutions LLC

Time span=0.00-72.00 hrs, dt=0.05 hrs, 1441 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 1S: PRE A.1 Runoff Area=451,337 sf 1.37% Impervious Runoff Depth=0.86"
Flow Length=517' Tc=10.6 min CN=71 Runoff=12.54 cfs 0.743 af

Link 2L: DP-A Inflow=12.54 cfs 0.743 af
Primary=12.54 cfs 0.743 af

Total Runoff Area = 10.361 ac Runoff Volume = 0.743 af Average Runoff Depth = 0.86"
98.63% Pervious = 10.219 ac 1.37% Impervious = 0.142 ac

Summary for Subcatchment 1S: PRE A.1

Runoff = 12.54 cfs @ 12.04 hrs, Volume= 0.743 af, Depth= 0.86"
Routed to Link 2L : DP-A

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type II 24-hr 2-Year Rainfall=3.17"

Area (sf)	CN	Description
4,115	98	Paved parking, HSG C
2,079	98	Roofs, HSG C
18,879	74	>75% Grass cover, Good, HSG C
426,264	70	Woods, Good, HSG C
451,337	71	Weighted Average
445,143		98.63% Pervious Area
6,194		1.37% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.1	50	0.1800	0.16		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.17"
5.5	467	0.0800	1.41		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
10.6	517	Total			

Summary for Link 2L: DP-A

Inflow Area = 10.361 ac, 1.37% Impervious, Inflow Depth = 0.86" for 2-Year event
Inflow = 12.54 cfs @ 12.04 hrs, Volume= 0.743 af
Primary = 12.54 cfs @ 12.04 hrs, Volume= 0.743 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

Time span=0.00-72.00 hrs, dt=0.05 hrs, 1441 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 1S: PRE A.1 Runoff Area=451,337 sf 1.37% Impervious Runoff Depth=2.03"
Flow Length=517' Tc=10.6 min CN=71 Runoff=31.16 cfs 1.756 af

Link 2L: DP-A Inflow=31.16 cfs 1.756 af
Primary=31.16 cfs 1.756 af

Total Runoff Area = 10.361 ac Runoff Volume = 1.756 af Average Runoff Depth = 2.03"
98.63% Pervious = 10.219 ac 1.37% Impervious = 0.142 ac

Summary for Subcatchment 1S: PRE A.1

Runoff = 31.16 cfs @ 12.03 hrs, Volume= 1.756 af, Depth= 2.03"
Routed to Link 2L : DP-A

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type II 24-hr 10-Year Rainfall=4.89"

Area (sf)	CN	Description
4,115	98	Paved parking, HSG C
2,079	98	Roofs, HSG C
18,879	74	>75% Grass cover, Good, HSG C
426,264	70	Woods, Good, HSG C
451,337	71	Weighted Average
445,143		98.63% Pervious Area
6,194		1.37% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.1	50	0.1800	0.16		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.17"
5.5	467	0.0800	1.41		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
10.6	517	Total			

Summary for Link 2L: DP-A

Inflow Area = 10.361 ac, 1.37% Impervious, Inflow Depth = 2.03" for 10-Year event
Inflow = 31.16 cfs @ 12.03 hrs, Volume= 1.756 af
Primary = 31.16 cfs @ 12.03 hrs, Volume= 1.756 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

Time span=0.00-72.00 hrs, dt=0.05 hrs, 1441 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 1S: PRE A.1 Runoff Area=451,337 sf 1.37% Impervious Runoff Depth=2.87"
Flow Length=517' Tc=10.6 min CN=71 Runoff=44.07 cfs 2.475 af

Link 2L: DP-A Inflow=44.07 cfs 2.475 af
Primary=44.07 cfs 2.475 af

Total Runoff Area = 10.361 ac Runoff Volume = 2.475 af Average Runoff Depth = 2.87"
98.63% Pervious = 10.219 ac 1.37% Impervious = 0.142 ac

Summary for Subcatchment 1S: PRE A.1

Runoff = 44.07 cfs @ 12.03 hrs, Volume= 2.475 af, Depth= 2.87"
Routed to Link 2L : DP-A

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type II 24-hr 25-Year Rainfall=5.96"

Area (sf)	CN	Description
4,115	98	Paved parking, HSG C
2,079	98	Roofs, HSG C
18,879	74	>75% Grass cover, Good, HSG C
426,264	70	Woods, Good, HSG C
451,337	71	Weighted Average
445,143		98.63% Pervious Area
6,194		1.37% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.1	50	0.1800	0.16		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.17"
5.5	467	0.0800	1.41		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
10.6	517	Total			

Summary for Link 2L: DP-A

Inflow Area = 10.361 ac, 1.37% Impervious, Inflow Depth = 2.87" for 25-Year event
Inflow = 44.07 cfs @ 12.03 hrs, Volume= 2.475 af
Primary = 44.07 cfs @ 12.03 hrs, Volume= 2.475 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

Time span=0.00-72.00 hrs, dt=0.05 hrs, 1441 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 1S: PRE A.1 Runoff Area=451,337 sf 1.37% Impervious Runoff Depth=3.51"
Flow Length=517' Tc=10.6 min CN=71 Runoff=53.89 cfs 3.034 af

Link 2L: DP-A Inflow=53.89 cfs 3.034 af
Primary=53.89 cfs 3.034 af

Total Runoff Area = 10.361 ac Runoff Volume = 3.034 af Average Runoff Depth = 3.51"
98.63% Pervious = 10.219 ac 1.37% Impervious = 0.142 ac

Summary for Subcatchment 1S: PRE A.1

Runoff = 53.89 cfs @ 12.02 hrs, Volume= 3.034 af, Depth= 3.51"
Routed to Link 2L : DP-A

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type II 24-hr 50-Year Rainfall=6.75"

Area (sf)	CN	Description
4,115	98	Paved parking, HSG C
2,079	98	Roofs, HSG C
18,879	74	>75% Grass cover, Good, HSG C
426,264	70	Woods, Good, HSG C
451,337	71	Weighted Average
445,143		98.63% Pervious Area
6,194		1.37% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.1	50	0.1800	0.16		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.17"
5.5	467	0.0800	1.41		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
10.6	517	Total			

Summary for Link 2L: DP-A

Inflow Area = 10.361 ac, 1.37% Impervious, Inflow Depth = 3.51" for 50-Year event
Inflow = 53.89 cfs @ 12.02 hrs, Volume= 3.034 af
Primary = 53.89 cfs @ 12.02 hrs, Volume= 3.034 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

Time span=0.00-72.00 hrs, dt=0.05 hrs, 1441 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 1S: PRE A.1 Runoff Area=451,337 sf 1.37% Impervious Runoff Depth=4.24"
Flow Length=517' Tc=10.6 min CN=71 Runoff=64.92 cfs 3.663 af

Link 2L: DP-A Inflow=64.92 cfs 3.663 af
Primary=64.92 cfs 3.663 af

Total Runoff Area = 10.361 ac Runoff Volume = 3.663 af Average Runoff Depth = 4.24"
98.63% Pervious = 10.219 ac 1.37% Impervious = 0.142 ac

Summary for Subcatchment 1S: PRE A.1

Runoff = 64.92 cfs @ 12.02 hrs, Volume= 3.663 af, Depth= 4.24"
Routed to Link 2L : DP-A

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type II 24-hr 100-Year Rainfall=7.61"

Area (sf)	CN	Description
4,115	98	Paved parking, HSG C
2,079	98	Roofs, HSG C
18,879	74	>75% Grass cover, Good, HSG C
426,264	70	Woods, Good, HSG C
451,337	71	Weighted Average
445,143		98.63% Pervious Area
6,194		1.37% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.1	50	0.1800	0.16		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.17"
5.5	467	0.0800	1.41		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
10.6	517	Total			

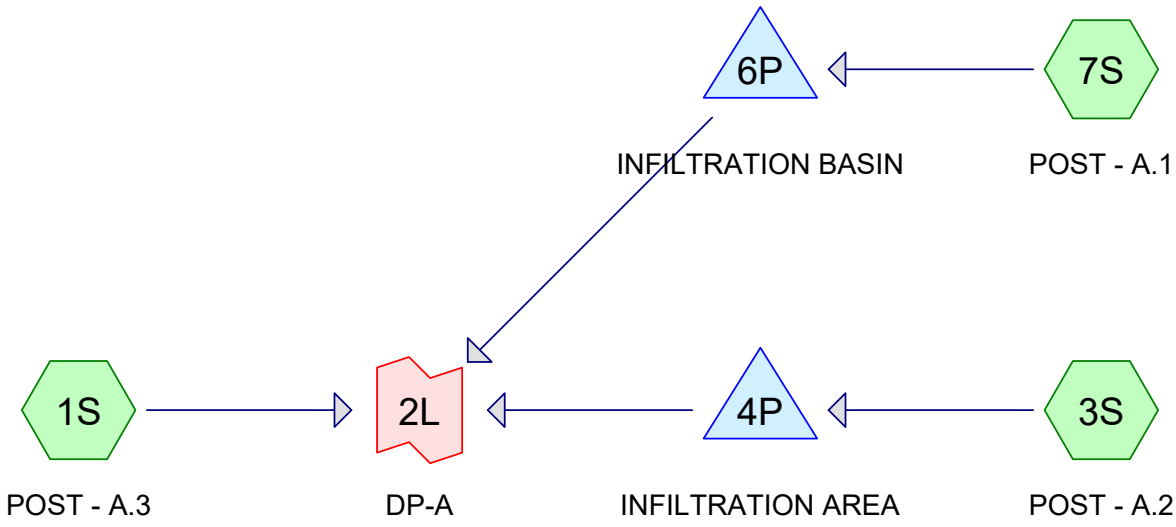
Summary for Link 2L: DP-A

Inflow Area = 10.361 ac, 1.37% Impervious, Inflow Depth = 4.24" for 100-Year event
Inflow = 64.92 cfs @ 12.02 hrs, Volume= 3.663 af
Primary = 64.92 cfs @ 12.02 hrs, Volume= 3.663 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

APPENDIX E

Proposed Conditions – Hydrologic Calculations



Subcat Reach Pond Link

Routing Diagram for 7462-POST REV1
Prepared by Dillis & Roy Civil Design Group, Printed 6/17/2025
HydroCAD® 10.20-6a s/n 03590 © 2024 HydroCAD Software Solutions LLC

Time span=0.00-72.00 hrs, dt=0.05 hrs, 1441 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 1S: POST - A.3 Runoff Area=379,043 sf 2.17% Impervious Runoff Depth=0.86"
Flow Length=517' Tc=10.6 min CN=71 Runoff=10.53 cfs 0.624 af

Subcatchment 3S: POST - A.2 Runoff Area=26,461 sf 27.20% Impervious Runoff Depth=1.25"
Tc=6.0 min CN=78 Runoff=1.32 cfs 0.063 af

Subcatchment 7S: POST - A.1 Runoff Area=45,836 sf 18.17% Impervious Runoff Depth=1.25"
Tc=6.0 min CN=78 Runoff=2.29 cfs 0.110 af

Pond 4P: INFILTRATION AREA Peak Elev=264.65' Storage=835 cf Inflow=1.32 cfs 0.063 af
Discarded=0.00 cfs 0.015 af Primary=1.08 cfs 0.043 af Outflow=1.09 cfs 0.058 af

Pond 6P: INFILTRATION BASIN Peak Elev=240.29' Storage=1,347 cf Inflow=2.29 cfs 0.110 af
Discarded=0.01 cfs 0.009 af Primary=0.81 cfs 0.100 af Outflow=0.82 cfs 0.110 af

Link 2L: DP-A Inflow=12.30 cfs 0.767 af
Primary=12.30 cfs 0.767 af

Total Runoff Area = 10.361 ac Runoff Volume = 0.797 af Average Runoff Depth = 0.92"
94.74% Pervious = 9.816 ac 5.26% Impervious = 0.545 ac

Summary for Subcatchment 1S: POST - A.3

Runoff = 10.53 cfs @ 12.04 hrs, Volume= 0.624 af, Depth= 0.86"
Routed to Link 2L : DP-A

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type II 24-hr 2-Year Rainfall=3.17"

Area (sf)	CN	Description
4,339	98	Paved parking, HSG C
3,879	98	Roofs, HSG C
58,463	74	>75% Grass cover, Good, HSG C
312,362	70	Woods, Good, HSG C
379,043	71	Weighted Average
370,825		97.83% Pervious Area
8,218		2.17% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.1	50	0.1800	0.16		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.17"
5.5	467	0.0800	1.41		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
10.6	517	Total			

Summary for Subcatchment 3S: POST - A.2

Runoff = 1.32 cfs @ 11.98 hrs, Volume= 0.063 af, Depth= 1.25"
Routed to Pond 4P : INFILTRATION AREA

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type II 24-hr 2-Year Rainfall=3.17"

Area (sf)	CN	Description
7,198	98	Paved parking, HSG C
15,512	70	Woods, Good, HSG C
3,751	74	>75% Grass cover, Good, HSG C
26,461	78	Weighted Average
19,263		72.80% Pervious Area
7,198		27.20% Impervious Area

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

Summary for Subcatchment 7S: POST - A.1

Runoff = 2.29 cfs @ 11.98 hrs, Volume= 0.110 af, Depth= 1.25"
Routed to Pond 6P : INFILTRATION BASIN

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type II 24-hr 2-Year Rainfall=3.17"

Area (sf)	CN	Description
6,529	98	Paved parking, HSG C
33,026	74	>75% Grass cover, Good, HSG C
4,481	70	Woods, Good, HSG C
1,800	98	Roofs, HSG A
45,836	78	Weighted Average
37,507		81.83% Pervious Area
8,329		18.17% Impervious Area

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

Summary for Pond 4P: INFILTRATION AREA

Inflow Area = 0.607 ac, 27.20% Impervious, Inflow Depth = 1.25" for 2-Year event
Inflow = 1.32 cfs @ 11.98 hrs, Volume= 0.063 af
Outflow = 1.09 cfs @ 12.02 hrs, Volume= 0.058 af, Atten= 18%, Lag= 2.8 min
Discarded = 0.00 cfs @ 12.02 hrs, Volume= 0.015 af
Primary = 1.08 cfs @ 12.02 hrs, Volume= 0.043 af
Routed to Link 2L : DP-A

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs / 3
Peak Elev= 264.65' @ 12.02 hrs Surf.Area= 646 sf Storage= 835 cf

Plug-Flow detention time= 448.1 min calculated for 0.058 af (92% of inflow)
Center-of-Mass det. time= 404.3 min (1,250.7 - 846.3)

Volume	Invert	Avail.Storage	Storage Description
#1	262.00'	1,081 cf	**Custom Stage Data (Irregular)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
262.00	69	35.0	0	0	69
263.00	227	62.0	140	140	283
264.00	460	86.0	337	477	575
265.00	760	108.0	604	1,081	928

Device	Routing	Invert	Outlet Devices
#1	Discarded	262.00'	**0.270 in/hr Exfiltration over Surface area**
#2	Primary	264.50'	**10.0' long x 12.0' breadth Broad-Crested Rectangular Weir**
			Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60
			Coef. (English) 2.57 2.62 2.70 2.67 2.66 2.67 2.66 2.64

Discarded OutFlow Max=0.00 cfs @ 12.02 hrs HW=264.61' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.00 cfs)

Primary OutFlow Max=0.96 cfs @ 12.02 hrs HW=264.61' (Free Discharge)
└**2=Broad-Crested Rectangular Weir** (Weir Controls 0.96 cfs @ 0.86 fps)

Summary for Pond 6P: INFILTRATION BASIN

Inflow Area = 1.052 ac, 18.17% Impervious, Inflow Depth = 1.25" for 2-Year event
Inflow = 2.29 cfs @ 11.98 hrs, Volume= 0.110 af
Outflow = 0.82 cfs @ 12.10 hrs, Volume= 0.110 af, Atten= 64%, Lag= 7.6 min
Discarded = 0.01 cfs @ 12.10 hrs, Volume= 0.009 af
Primary = 0.81 cfs @ 12.10 hrs, Volume= 0.100 af
Routed to Link 2L : DP-A

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 240.29' @ 12.10 hrs Surf.Area= 1,888 sf Storage= 1,347 cf

Plug-Flow detention time= 60.1 min calculated for 0.110 af (100% of inflow)
Center-of-Mass det. time= 60.7 min (907.1 - 846.3)

Volume	Invert	Avail.Storage	Storage Description
#1	239.00'	7,027 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
239.00	370	112.0	0	0	370
240.00	1,480	195.0	863	863	2,404
241.00	3,112	292.0	2,246	3,109	6,171
242.00	4,782	359.0	3,917	7,027	9,657

Device	Routing	Invert	Outlet Devices
#1	Discarded	239.00'	**0.270 in/hr Exfiltration over Surface area**
#2	Primary	241.50'	**10.0' long x 12.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.57 2.62 2.70 2.67 2.66 2.67 2.66 2.64
#3	Primary	239.00'	**12.0" Round Culvert** L= 30.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 239.00' / 238.00' S= 0.0333 '/' Cc= 0.900 n= 0.013, Flow Area= 0.79 sf
#4	Device 3	239.30'	**6.0" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Discarded OutFlow Max=0.01 cfs @ 12.10 hrs HW=240.29' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.01 cfs)

Primary OutFlow Max=0.81 cfs @ 12.10 hrs HW=240.29' (Free Discharge)
├**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)
└**3=Culvert** (Passes 0.81 cfs of 3.35 cfs potential flow)
└**4=Orifice/Grate** (Orifice Controls 0.81 cfs @ 4.13 fps)

Summary for Link 2L: DP-A

Inflow Area = 10.361 ac, 5.26% Impervious, Inflow Depth = 0.89" for 2-Year event
Inflow = 12.30 cfs @ 12.04 hrs, Volume= 0.767 af
Primary = 12.30 cfs @ 12.04 hrs, Volume= 0.767 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

Time span=0.00-72.00 hrs, dt=0.05 hrs, 1441 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 1S: POST - A.3 Runoff Area=379,043 sf 2.17% Impervious Runoff Depth=2.03"
Flow Length=517' Tc=10.6 min CN=71 Runoff=26.16 cfs 1.475 af

Subcatchment 3S: POST - A.2 Runoff Area=26,461 sf 27.20% Impervious Runoff Depth=2.62"
Tc=6.0 min CN=78 Runoff=2.73 cfs 0.133 af

Subcatchment 7S: POST - A.1 Runoff Area=45,836 sf 18.17% Impervious Runoff Depth=2.62"
Tc=6.0 min CN=78 Runoff=4.73 cfs 0.230 af

Pond 4P: INFILTRATION AREA Peak Elev=264.72' Storage=882 cf Inflow=2.73 cfs 0.133 af
Discarded=0.00 cfs 0.015 af Primary=2.68 cfs 0.111 af Outflow=2.68 cfs 0.127 af

Pond 6P: INFILTRATION BASIN Peak Elev=241.04' Storage=3,247 cf Inflow=4.73 cfs 0.230 af
Discarded=0.02 cfs 0.012 af Primary=1.16 cfs 0.218 af Outflow=1.18 cfs 0.230 af

Link 2L: DP-A Inflow=29.53 cfs 1.804 af
Primary=29.53 cfs 1.804 af

Total Runoff Area = 10.361 ac Runoff Volume = 1.837 af Average Runoff Depth = 2.13"
94.74% Pervious = 9.816 ac 5.26% Impervious = 0.545 ac

Summary for Subcatchment 1S: POST - A.3

Runoff = 26.16 cfs @ 12.03 hrs, Volume= 1.475 af, Depth= 2.03"
Routed to Link 2L : DP-A

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type II 24-hr 10-Year Rainfall=4.89"

Area (sf)	CN	Description
4,339	98	Paved parking, HSG C
3,879	98	Roofs, HSG C
58,463	74	>75% Grass cover, Good, HSG C
312,362	70	Woods, Good, HSG C
379,043	71	Weighted Average
370,825		97.83% Pervious Area
8,218		2.17% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.1	50	0.1800	0.16		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.17"
5.5	467	0.0800	1.41		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
10.6	517	Total			

Summary for Subcatchment 3S: POST - A.2

Runoff = 2.73 cfs @ 11.97 hrs, Volume= 0.133 af, Depth= 2.62"
Routed to Pond 4P : INFILTRATION AREA

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type II 24-hr 10-Year Rainfall=4.89"

Area (sf)	CN	Description
7,198	98	Paved parking, HSG C
15,512	70	Woods, Good, HSG C
3,751	74	>75% Grass cover, Good, HSG C
26,461	78	Weighted Average
19,263		72.80% Pervious Area
7,198		27.20% Impervious Area

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

Summary for Subcatchment 7S: POST - A.1

Runoff = 4.73 cfs @ 11.97 hrs, Volume= 0.230 af, Depth= 2.62"
Routed to Pond 6P : INFILTRATION BASIN

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type II 24-hr 10-Year Rainfall=4.89"

Area (sf)	CN	Description
6,529	98	Paved parking, HSG C
33,026	74	>75% Grass cover, Good, HSG C
4,481	70	Woods, Good, HSG C
1,800	98	Roofs, HSG A
45,836	78	Weighted Average
37,507		81.83% Pervious Area
8,329		18.17% Impervious Area

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

Summary for Pond 4P: INFILTRATION AREA

Inflow Area = 0.607 ac, 27.20% Impervious, Inflow Depth = 2.62" for 10-Year event
Inflow = 2.73 cfs @ 11.97 hrs, Volume= 0.133 af
Outflow = 2.68 cfs @ 11.98 hrs, Volume= 0.127 af, Atten= 2%, Lag= 0.6 min
Discarded = 0.00 cfs @ 11.98 hrs, Volume= 0.015 af
Primary = 2.68 cfs @ 11.98 hrs, Volume= 0.111 af
Routed to Link 2L : DP-A

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs / 3
Peak Elev= 264.72' @ 11.98 hrs Surf.Area= 669 sf Storage= 882 cf

Plug-Flow detention time= 213.6 min calculated for 0.127 af (96% of inflow)
Center-of-Mass det. time= 190.4 min (1,015.3 - 825.0)

Volume	Invert	Avail.Storage	Storage Description
#1	262.00'	1,081 cf	**Custom Stage Data (Irregular)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
262.00	69	35.0	0	0	69
263.00	227	62.0	140	140	283
264.00	460	86.0	337	477	575
265.00	760	108.0	604	1,081	928

Device	Routing	Invert	Outlet Devices
#1	Discarded	262.00'	**0.270 in/hr Exfiltration over Surface area**
#2	Primary	264.50'	**10.0' long x 12.0' breadth Broad-Crested Rectangular Weir**
			Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60
			Coef. (English) 2.57 2.62 2.70 2.67 2.66 2.67 2.66 2.64

Discarded OutFlow Max=0.00 cfs @ 11.98 hrs HW=264.72' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.00 cfs)

Primary OutFlow Max=2.57 cfs @ 11.98 hrs HW=264.72' (Free Discharge)
└**2=Broad-Crested Rectangular Weir** (Weir Controls 2.57 cfs @ 1.19 fps)

Summary for Pond 6P: INFILTRATION BASIN

Inflow Area = 1.052 ac, 18.17% Impervious, Inflow Depth = 2.62" for 10-Year event
Inflow = 4.73 cfs @ 11.97 hrs, Volume= 0.230 af
Outflow = 1.18 cfs @ 12.13 hrs, Volume= 0.230 af, Atten= 75%, Lag= 9.5 min
Discarded = 0.02 cfs @ 12.13 hrs, Volume= 0.012 af
Primary = 1.16 cfs @ 12.13 hrs, Volume= 0.218 af
Routed to Link 2L : DP-A

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 241.04' @ 12.13 hrs Surf.Area= 3,178 sf Storage= 3,247 cf

Plug-Flow detention time= 46.6 min calculated for 0.229 af (100% of inflow)
Center-of-Mass det. time= 47.3 min (872.3 - 825.0)

Volume	Invert	Avail.Storage	Storage Description
#1	239.00'	7,027 cf	**Custom Stage Data (Irregular)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
239.00	370	112.0	0	0	370
240.00	1,480	195.0	863	863	2,404
241.00	3,112	292.0	2,246	3,109	6,171
242.00	4,782	359.0	3,917	7,027	9,657

Device	Routing	Invert	Outlet Devices
#1	Discarded	239.00'	**0.270 in/hr Exfiltration over Surface area**
#2	Primary	241.50'	**10.0' long x 12.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.57 2.62 2.70 2.67 2.66 2.67 2.66 2.64
#3	Primary	239.00'	**12.0" Round Culvert** L= 30.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 239.00' / 238.00' S= 0.0333 '/' Cc= 0.900 n= 0.013, Flow Area= 0.79 sf
#4	Device 3	239.30'	**6.0" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Discarded OutFlow Max=0.02 cfs @ 12.13 hrs HW=241.04' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.02 cfs)

Primary OutFlow Max=1.15 cfs @ 12.13 hrs HW=241.04' (Free Discharge)
├**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)
└**3=Culvert** (Passes 1.15 cfs of 4.70 cfs potential flow)
└**4=Orifice/Grate** (Orifice Controls 1.15 cfs @ 5.88 fps)

Summary for Link 2L: DP-A

Inflow Area = 10.361 ac, 5.26% Impervious, Inflow Depth = 2.09" for 10-Year event
Inflow = 29.53 cfs @ 12.02 hrs, Volume= 1.804 af
Primary = 29.53 cfs @ 12.02 hrs, Volume= 1.804 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

Time span=0.00-72.00 hrs, dt=0.05 hrs, 1441 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 1S: POST - A.3 Runoff Area=379,043 sf 2.17% Impervious Runoff Depth=2.87"
Flow Length=517' Tc=10.6 min CN=71 Runoff=37.01 cfs 2.079 af

Subcatchment 3S: POST - A.2 Runoff Area=26,461 sf 27.20% Impervious Runoff Depth=3.54"
Tc=6.0 min CN=78 Runoff=3.66 cfs 0.179 af

Subcatchment 7S: POST - A.1 Runoff Area=45,836 sf 18.17% Impervious Runoff Depth=3.54"
Tc=6.0 min CN=78 Runoff=6.34 cfs 0.311 af

Pond 4P: INFILTRATION AREA Peak Elev=264.77' Storage=914 cf Inflow=3.66 cfs 0.179 af
Discarded=0.00 cfs 0.016 af Primary=3.60 cfs 0.158 af Outflow=3.60 cfs 0.174 af

Pond 6P: INFILTRATION BASIN Peak Elev=241.44' Storage=4,643 cf Inflow=6.34 cfs 0.311 af
Discarded=0.02 cfs 0.013 af Primary=1.30 cfs 0.298 af Outflow=1.32 cfs 0.311 af

Link 2L: DP-A Inflow=41.34 cfs 2.534 af
Primary=41.34 cfs 2.534 af

Total Runoff Area = 10.361 ac Runoff Volume = 2.569 af Average Runoff Depth = 2.98"
94.74% Pervious = 9.816 ac 5.26% Impervious = 0.545 ac

Summary for Subcatchment 1S: POST - A.3

Runoff = 37.01 cfs @ 12.03 hrs, Volume= 2.079 af, Depth= 2.87"
Routed to Link 2L : DP-A

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type II 24-hr 25-Year Rainfall=5.96"

Area (sf)	CN	Description
4,339	98	Paved parking, HSG C
3,879	98	Roofs, HSG C
58,463	74	>75% Grass cover, Good, HSG C
312,362	70	Woods, Good, HSG C
379,043	71	Weighted Average
370,825		97.83% Pervious Area
8,218		2.17% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.1	50	0.1800	0.16		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.17"
5.5	467	0.0800	1.41		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
10.6	517	Total			

Summary for Subcatchment 3S: POST - A.2

Runoff = 3.66 cfs @ 11.97 hrs, Volume= 0.179 af, Depth= 3.54"
Routed to Pond 4P : INFILTRATION AREA

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type II 24-hr 25-Year Rainfall=5.96"

Area (sf)	CN	Description
7,198	98	Paved parking, HSG C
15,512	70	Woods, Good, HSG C
3,751	74	>75% Grass cover, Good, HSG C
26,461	78	Weighted Average
19,263		72.80% Pervious Area
7,198		27.20% Impervious Area

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

Summary for Subcatchment 7S: POST - A.1

Runoff = 6.34 cfs @ 11.97 hrs, Volume= 0.311 af, Depth= 3.54"
Routed to Pond 6P : INFILTRATION BASIN

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type II 24-hr 25-Year Rainfall=5.96"

Area (sf)	CN	Description
6,529	98	Paved parking, HSG C
33,026	74	>75% Grass cover, Good, HSG C
4,481	70	Woods, Good, HSG C
1,800	98	Roofs, HSG A
45,836	78	Weighted Average
37,507		81.83% Pervious Area
8,329		18.17% Impervious Area

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

Summary for Pond 4P: INFILTRATION AREA

Inflow Area = 0.607 ac, 27.20% Impervious, Inflow Depth = 3.54" for 25-Year event
Inflow = 3.66 cfs @ 11.97 hrs, Volume= 0.179 af
Outflow = 3.60 cfs @ 11.98 hrs, Volume= 0.174 af, Atten= 2%, Lag= 0.5 min
Discarded = 0.00 cfs @ 11.98 hrs, Volume= 0.016 af
Primary = 3.60 cfs @ 11.98 hrs, Volume= 0.158 af
Routed to Link 2L : DP-A

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs / 3
Peak Elev= 264.77' @ 11.98 hrs Surf.Area= 684 sf Storage= 914 cf

Plug-Flow detention time= 159.2 min calculated for 0.174 af (97% of inflow)
Center-of-Mass det. time= 142.2 min (958.5 - 816.4)

Volume	Invert	Avail.Storage	Storage Description
#1	262.00'	1,081 cf	**Custom Stage Data (Irregular)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
262.00	69	35.0	0	0	69
263.00	227	62.0	140	140	283
264.00	460	86.0	337	477	575
265.00	760	108.0	604	1,081	928

Device	Routing	Invert	Outlet Devices
#1	Discarded	262.00'	**0.270 in/hr Exfiltration over Surface area**
#2	Primary	264.50'	**10.0' long x 12.0' breadth Broad-Crested Rectangular Weir**
			Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60
			Coef. (English) 2.57 2.62 2.70 2.67 2.66 2.67 2.66 2.64

Discarded OutFlow Max=0.00 cfs @ 11.98 hrs HW=264.76' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.00 cfs)

Primary OutFlow Max=3.46 cfs @ 11.98 hrs HW=264.76' (Free Discharge)
└**2=Broad-Crested Rectangular Weir** (Weir Controls 3.46 cfs @ 1.32 fps)

Summary for Pond 6P: INFILTRATION BASIN

Inflow Area = 1.052 ac, 18.17% Impervious, Inflow Depth = 3.54" for 25-Year event
Inflow = 6.34 cfs @ 11.97 hrs, Volume= 0.311 af
Outflow = 1.32 cfs @ 12.15 hrs, Volume= 0.311 af, Atten= 79%, Lag= 11.0 min
Discarded = 0.02 cfs @ 12.15 hrs, Volume= 0.013 af
Primary = 1.30 cfs @ 12.15 hrs, Volume= 0.298 af
Routed to Link 2L : DP-A

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 241.44' @ 12.15 hrs Surf.Area= 3,809 sf Storage= 4,643 cf

Plug-Flow detention time= 46.9 min calculated for 0.311 af (100% of inflow)
Center-of-Mass det. time= 47.5 min (863.9 - 816.4)

Volume	Invert	Avail.Storage	Storage Description
#1	239.00'	7,027 cf	**Custom Stage Data (Irregular)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
239.00	370	112.0	0	0	370
240.00	1,480	195.0	863	863	2,404
241.00	3,112	292.0	2,246	3,109	6,171
242.00	4,782	359.0	3,917	7,027	9,657

Device	Routing	Invert	Outlet Devices
#1	Discarded	239.00'	**0.270 in/hr Exfiltration over Surface area**
#2	Primary	241.50'	**10.0' long x 12.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.57 2.62 2.70 2.67 2.66 2.67 2.66 2.64
#3	Primary	239.00'	**12.0" Round Culvert** L= 30.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 239.00' / 238.00' S= 0.0333 '/' Cc= 0.900 n= 0.013, Flow Area= 0.79 sf
#4	Device 3	239.30'	**6.0" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Discarded OutFlow Max=0.02 cfs @ 12.15 hrs HW=241.44' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.02 cfs)

Primary OutFlow Max=1.30 cfs @ 12.15 hrs HW=241.44' (Free Discharge)
├**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)
└**3=Culvert** (Passes 1.30 cfs of 5.27 cfs potential flow)
└**4=Orifice/Grate** (Orifice Controls 1.30 cfs @ 6.63 fps)

Summary for Link 2L: DP-A

Inflow Area = 10.361 ac, 5.26% Impervious, Inflow Depth = 2.94" for 25-Year event
Inflow = 41.34 cfs @ 12.02 hrs, Volume= 2.534 af
Primary = 41.34 cfs @ 12.02 hrs, Volume= 2.534 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

Time span=0.00-72.00 hrs, dt=0.05 hrs, 1441 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 1S: POST - A.3 Runoff Area=379,043 sf 2.17% Impervious Runoff Depth=3.51"
Flow Length=517' Tc=10.6 min CN=71 Runoff=45.26 cfs 2.548 af

Subcatchment 3S: POST - A.2 Runoff Area=26,461 sf 27.20% Impervious Runoff Depth=4.25"
Tc=6.0 min CN=78 Runoff=4.36 cfs 0.215 af

Subcatchment 7S: POST - A.1 Runoff Area=45,836 sf 18.17% Impervious Runoff Depth=4.25"
Tc=6.0 min CN=78 Runoff=7.55 cfs 0.373 af

Pond 4P: INFILTRATION AREA Peak Elev=264.80' Storage=936 cf Inflow=4.36 cfs 0.215 af
Discarded=0.00 cfs 0.016 af Primary=4.29 cfs 0.194 af Outflow=4.29 cfs 0.209 af

Pond 6P: INFILTRATION BASIN Peak Elev=241.64' Storage=5,412 cf Inflow=7.55 cfs 0.373 af
Discarded=0.03 cfs 0.014 af Primary=2.68 cfs 0.359 af Outflow=2.70 cfs 0.373 af

Link 2L: DP-A Inflow=50.57 cfs 3.100 af
Primary=50.57 cfs 3.100 af

Total Runoff Area = 10.361 ac Runoff Volume = 3.136 af Average Runoff Depth = 3.63"
94.74% Pervious = 9.816 ac 5.26% Impervious = 0.545 ac

Summary for Subcatchment 1S: POST - A.3

Runoff = 45.26 cfs @ 12.02 hrs, Volume= 2.548 af, Depth= 3.51"
Routed to Link 2L : DP-A

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type II 24-hr 50-Year Rainfall=6.75"

Area (sf)	CN	Description
4,339	98	Paved parking, HSG C
3,879	98	Roofs, HSG C
58,463	74	>75% Grass cover, Good, HSG C
312,362	70	Woods, Good, HSG C
379,043	71	Weighted Average
370,825		97.83% Pervious Area
8,218		2.17% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.1	50	0.1800	0.16		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.17"
5.5	467	0.0800	1.41		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
10.6	517	Total			

Summary for Subcatchment 3S: POST - A.2

Runoff = 4.36 cfs @ 11.97 hrs, Volume= 0.215 af, Depth= 4.25"
Routed to Pond 4P : INFILTRATION AREA

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type II 24-hr 50-Year Rainfall=6.75"

Area (sf)	CN	Description
7,198	98	Paved parking, HSG C
15,512	70	Woods, Good, HSG C
3,751	74	>75% Grass cover, Good, HSG C
26,461	78	Weighted Average
19,263		72.80% Pervious Area
7,198		27.20% Impervious Area

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

Summary for Subcatchment 7S: POST - A.1

Runoff = 7.55 cfs @ 11.97 hrs, Volume= 0.373 af, Depth= 4.25"
Routed to Pond 6P : INFILTRATION BASIN

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type II 24-hr 50-Year Rainfall=6.75"

Area (sf)	CN	Description
6,529	98	Paved parking, HSG C
33,026	74	>75% Grass cover, Good, HSG C
4,481	70	Woods, Good, HSG C
1,800	98	Roofs, HSG A
45,836	78	Weighted Average
37,507		81.83% Pervious Area
8,329		18.17% Impervious Area

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

Summary for Pond 4P: INFILTRATION AREA

Inflow Area = 0.607 ac, 27.20% Impervious, Inflow Depth = 4.25" for 50-Year event
Inflow = 4.36 cfs @ 11.97 hrs, Volume= 0.215 af
Outflow = 4.29 cfs @ 11.98 hrs, Volume= 0.209 af, Atten= 2%, Lag= 0.5 min
Discarded = 0.00 cfs @ 11.98 hrs, Volume= 0.016 af
Primary = 4.29 cfs @ 11.98 hrs, Volume= 0.194 af
Routed to Link 2L : DP-A

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs / 3
Peak Elev= 264.80' @ 11.98 hrs Surf.Area= 694 sf Storage= 936 cf

Plug-Flow detention time= 136.3 min calculated for 0.209 af (97% of inflow)
Center-of-Mass det. time= 120.2 min (931.4 - 811.2)

Volume	Invert	Avail.Storage	Storage Description
#1	262.00'	1,081 cf	**Custom Stage Data (Irregular)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
262.00	69	35.0	0	0	69
263.00	227	62.0	140	140	283
264.00	460	86.0	337	477	575
265.00	760	108.0	604	1,081	928

Device	Routing	Invert	Outlet Devices
#1	Discarded	262.00'	**0.270 in/hr Exfiltration over Surface area**
#2	Primary	264.50'	**10.0' long x 12.0' breadth Broad-Crested Rectangular Weir**
			Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60
			Coef. (English) 2.57 2.62 2.70 2.67 2.66 2.67 2.66 2.64

Discarded OutFlow Max=0.00 cfs @ 11.98 hrs HW=264.79' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.00 cfs)

Primary OutFlow Max=4.12 cfs @ 11.98 hrs HW=264.79' (Free Discharge)
└**2=Broad-Crested Rectangular Weir** (Weir Controls 4.12 cfs @ 1.40 fps)

Summary for Pond 6P: INFILTRATION BASIN

Inflow Area = 1.052 ac, 18.17% Impervious, Inflow Depth = 4.25" for 50-Year event
Inflow = 7.55 cfs @ 11.97 hrs, Volume= 0.373 af
Outflow = 2.70 cfs @ 12.10 hrs, Volume= 0.373 af, Atten= 64%, Lag= 8.2 min
Discarded = 0.03 cfs @ 12.11 hrs, Volume= 0.014 af
Primary = 2.68 cfs @ 12.10 hrs, Volume= 0.359 af
Routed to Link 2L : DP-A

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 241.64' @ 12.11 hrs Surf.Area= 4,135 sf Storage= 5,412 cf

Plug-Flow detention time= 46.1 min calculated for 0.373 af (100% of inflow)
Center-of-Mass det. time= 45.5 min (856.7 - 811.2)

Volume	Invert	Avail.Storage	Storage Description
#1	239.00'	7,027 cf	**Custom Stage Data (Irregular)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
239.00	370	112.0	0	0	370
240.00	1,480	195.0	863	863	2,404
241.00	3,112	292.0	2,246	3,109	6,171
242.00	4,782	359.0	3,917	7,027	9,657

Device	Routing	Invert	Outlet Devices
#1	Discarded	239.00'	**0.270 in/hr Exfiltration over Surface area**
#2	Primary	241.50'	**10.0' long x 12.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.57 2.62 2.70 2.67 2.66 2.67 2.66 2.64
#3	Primary	239.00'	**12.0" Round Culvert** L= 30.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 239.00' / 238.00' S= 0.0333 '/' Cc= 0.900 n= 0.013, Flow Area= 0.79 sf
#4	Device 3	239.30'	**6.0" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Discarded OutFlow Max=0.03 cfs @ 12.11 hrs HW=241.63' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.03 cfs)

Primary OutFlow Max=2.63 cfs @ 12.10 hrs HW=241.63' (Free Discharge)
├**2=Broad-Crested Rectangular Weir** (Weir Controls 1.27 cfs @ 0.94 fps)
└**3=Culvert** (Passes 1.36 cfs of 5.52 cfs potential flow)
└**4=Orifice/Grate** (Orifice Controls 1.36 cfs @ 6.95 fps)

Summary for Link 2L: DP-A

Inflow Area = 10.361 ac, 5.26% Impervious, Inflow Depth = 3.59" for 50-Year event
Inflow = 50.57 cfs @ 12.02 hrs, Volume= 3.100 af
Primary = 50.57 cfs @ 12.02 hrs, Volume= 3.100 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

Time span=0.00-72.00 hrs, dt=0.05 hrs, 1441 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 1S: POST - A.3 Runoff Area=379,043 sf 2.17% Impervious Runoff Depth=4.24"
Flow Length=517' Tc=10.6 min CN=71 Runoff=54.52 cfs 3.076 af

Subcatchment 3S: POST - A.2 Runoff Area=26,461 sf 27.20% Impervious Runoff Depth=5.03"
Tc=6.0 min CN=78 Runoff=5.12 cfs 0.255 af

Subcatchment 7S: POST - A.1 Runoff Area=45,836 sf 18.17% Impervious Runoff Depth=5.03"
Tc=6.0 min CN=78 Runoff=8.88 cfs 0.441 af

Pond 4P: INFILTRATION AREA Peak Elev=264.84' Storage=960 cf Inflow=5.12 cfs 0.255 af
Discarded=0.00 cfs 0.016 af Primary=5.04 cfs 0.233 af Outflow=5.05 cfs 0.249 af

Pond 6P: INFILTRATION BASIN Peak Elev=241.77' Storage=5,959 cf Inflow=8.88 cfs 0.441 af
Discarded=0.03 cfs 0.014 af Primary=4.92 cfs 0.427 af Outflow=4.94 cfs 0.441 af

Link 2L: DP-A Inflow=62.64 cfs 3.736 af
Primary=62.64 cfs 3.736 af

Total Runoff Area = 10.361 ac Runoff Volume = 3.772 af Average Runoff Depth = 4.37"
94.74% Pervious = 9.816 ac 5.26% Impervious = 0.545 ac

Summary for Subcatchment 1S: POST - A.3

Runoff = 54.52 cfs @ 12.02 hrs, Volume= 3.076 af, Depth= 4.24"
Routed to Link 2L : DP-A

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type II 24-hr 100-Year Rainfall=7.61"

Area (sf)	CN	Description
4,339	98	Paved parking, HSG C
3,879	98	Roofs, HSG C
58,463	74	>75% Grass cover, Good, HSG C
312,362	70	Woods, Good, HSG C
379,043	71	Weighted Average
370,825		97.83% Pervious Area
8,218		2.17% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.1	50	0.1800	0.16		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.17"
5.5	467	0.0800	1.41		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
10.6	517	Total			

Summary for Subcatchment 3S: POST - A.2

Runoff = 5.12 cfs @ 11.97 hrs, Volume= 0.255 af, Depth= 5.03"
Routed to Pond 4P : INFILTRATION AREA

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type II 24-hr 100-Year Rainfall=7.61"

Area (sf)	CN	Description
7,198	98	Paved parking, HSG C
15,512	70	Woods, Good, HSG C
3,751	74	>75% Grass cover, Good, HSG C
26,461	78	Weighted Average
19,263		72.80% Pervious Area
7,198		27.20% Impervious Area

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

Summary for Subcatchment 7S: POST - A.1

Runoff = 8.88 cfs @ 11.97 hrs, Volume= 0.441 af, Depth= 5.03"
Routed to Pond 6P : INFILTRATION BASIN

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type II 24-hr 100-Year Rainfall=7.61"

Area (sf)	CN	Description
6,529	98	Paved parking, HSG C
33,026	74	>75% Grass cover, Good, HSG C
4,481	70	Woods, Good, HSG C
1,800	98	Roofs, HSG A
45,836	78	Weighted Average
37,507		81.83% Pervious Area
8,329		18.17% Impervious Area

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

Summary for Pond 4P: INFILTRATION AREA

Inflow Area = 0.607 ac, 27.20% Impervious, Inflow Depth = 5.03" for 100-Year event
Inflow = 5.12 cfs @ 11.97 hrs, Volume= 0.255 af
Outflow = 5.05 cfs @ 11.98 hrs, Volume= 0.249 af, Atten= 2%, Lag= 0.5 min
Discarded = 0.00 cfs @ 11.98 hrs, Volume= 0.016 af
Primary = 5.04 cfs @ 11.98 hrs, Volume= 0.233 af
Routed to Link 2L : DP-A

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs / 3
Peak Elev= 264.84' @ 11.98 hrs Surf.Area= 705 sf Storage= 960 cf

Plug-Flow detention time= 115.0 min calculated for 0.249 af (98% of inflow)
Center-of-Mass det. time= 103.2 min (909.6 - 806.4)

Volume	Invert	Avail.Storage	Storage Description
#1	262.00'	1,081 cf	**Custom Stage Data (Irregular)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
262.00	69	35.0	0	0	69
263.00	227	62.0	140	140	283
264.00	460	86.0	337	477	575
265.00	760	108.0	604	1,081	928

Device	Routing	Invert	Outlet Devices
#1	Discarded	262.00'	**0.270 in/hr Exfiltration over Surface area**
#2	Primary	264.50'	**10.0' long x 12.0' breadth Broad-Crested Rectangular Weir**
			Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60
			Coef. (English) 2.57 2.62 2.70 2.67 2.66 2.67 2.66 2.64

Discarded OutFlow Max=0.00 cfs @ 11.98 hrs HW=264.83' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.00 cfs)

Primary OutFlow Max=4.85 cfs @ 11.98 hrs HW=264.83' (Free Discharge)
└**2=Broad-Crested Rectangular Weir** (Weir Controls 4.85 cfs @ 1.49 fps)

Summary for Pond 6P: INFILTRATION BASIN

Inflow Area = 1.052 ac, 18.17% Impervious, Inflow Depth = 5.03" for 100-Year event
Inflow = 8.88 cfs @ 11.97 hrs, Volume= 0.441 af
Outflow = 4.94 cfs @ 12.07 hrs, Volume= 0.441 af, Atten= 44%, Lag= 6.0 min
Discarded = 0.03 cfs @ 12.07 hrs, Volume= 0.014 af
Primary = 4.92 cfs @ 12.07 hrs, Volume= 0.427 af
Routed to Link 2L : DP-A

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 241.77' @ 12.07 hrs Surf.Area= 4,360 sf Storage= 5,959 cf

Plug-Flow detention time= 41.2 min calculated for 0.441 af (100% of inflow)
Center-of-Mass det. time= 41.8 min (848.2 - 806.4)

Volume	Invert	Avail.Storage	Storage Description
#1	239.00'	7,027 cf	**Custom Stage Data (Irregular)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
239.00	370	112.0	0	0	370
240.00	1,480	195.0	863	863	2,404
241.00	3,112	292.0	2,246	3,109	6,171
242.00	4,782	359.0	3,917	7,027	9,657

Device	Routing	Invert	Outlet Devices
#1	Discarded	239.00'	**0.270 in/hr Exfiltration over Surface area**
#2	Primary	241.50'	**10.0' long x 12.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.57 2.62 2.70 2.67 2.66 2.67 2.66 2.64
#3	Primary	239.00'	**12.0" Round Culvert** L= 30.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 239.00' / 238.00' S= 0.0333 '/' Cc= 0.900 n= 0.013, Flow Area= 0.79 sf
#4	Device 3	239.30'	**6.0" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Discarded OutFlow Max=0.03 cfs @ 12.07 hrs HW=241.75' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.03 cfs)

Primary OutFlow Max=4.60 cfs @ 12.07 hrs HW=241.75' (Free Discharge)
├**2=Broad-Crested Rectangular Weir** (Weir Controls 3.20 cfs @ 1.29 fps)
└**3=Culvert** (Passes 1.40 cfs of 5.67 cfs potential flow)
└**4=Orifice/Grate** (Orifice Controls 1.40 cfs @ 7.14 fps)

Summary for Link 2L: DP-A

Inflow Area = 10.361 ac, 5.26% Impervious, Inflow Depth = 4.33" for 100-Year event
Inflow = 62.64 cfs @ 12.03 hrs, Volume= 3.736 af
Primary = 62.64 cfs @ 12.03 hrs, Volume= 3.736 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

APPENDIX F

Recharge/WQV / TSS Calculations

NOAA Atlas 14, Volume 10, Version 3
Location name: Littleton, Massachusetts, USA*
Latitude: 42.5669°, Longitude: -71.4826°
Elevation: 253 ft**
* source: ESRI Maps
** source: USGS

POINT PRECIPITATION FREQUENCY ESTIMATES

Sanja Perica, Sandra Pavlovic, Michael St. Laurent, Carl Trypaluk, Dale Unruh, Orlan Wilhite

NOAA, National Weather Service, Silver Spring, Maryland

PF_tabular | PF_graphical | Maps_&_aerials

PF tabular

PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches)[1]

Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	**0.322** (0.255-0.404)	**0.383** (0.303-0.481)	**0.482** (0.379-0.607)	**0.564** (0.441-0.713)	**0.677** (0.512-0.892)	**0.761** (0.564-1.02)	**0.851** (0.611-1.18)	**0.955** (0.645-1.35)	**1.11** (0.718-1.61)	**1.23** (0.781-1.83)
10-min	**0.457** (0.361-0.573)	**0.542** (0.429-0.681)	**0.682** (0.536-0.858)	**0.799** (0.625-1.01)	**0.959** (0.726-1.26)	**1.08** (0.799-1.45)	**1.20** (0.866-1.68)	**1.35** (0.915-1.91)	**1.57** (1.02-2.29)	**1.75** (1.11-2.60)
15-min	**0.537** (0.425-0.674)	**0.638** (0.504-0.801)	**0.803** (0.632-1.01)	**0.940** (0.735-1.19)	**1.13** (0.854-1.49)	**1.27** (0.940-1.70)	**1.42** (1.02-1.97)	**1.59** (1.08-2.25)	**1.84** (1.20-2.69)	**2.06** (1.30-3.05)
30-min	**0.732** (0.579-0.918)	**0.870** (0.688-1.09)	**1.10** (0.863-1.38)	**1.28** (1.00-1.62)	**1.54** (1.17-2.03)	**1.74** (1.28-2.33)	**1.94** (1.39-2.70)	**2.18** (1.47-3.08)	**2.53** (1.64-3.68)	**2.82** (1.78-4.18)
60-min	**0.927** (0.734-1.16)	**1.10** (0.871-1.38)	**1.39** (1.09-1.75)	**1.63** (1.27-2.06)	**1.96** (1.48-2.58)	**2.20** (1.63-2.96)	**2.46** (1.77-3.43)	**2.76** (1.87-3.90)	**3.21** (2.08-4.67)	**3.58** (2.26-5.31)
2-hr	**1.17** (0.933-1.46)	**1.41** (1.12-1.76)	**1.81** (1.44-2.26)	**2.14** (1.69-2.69)	**2.59** (1.98-3.40)	**2.93** (2.19-3.92)	**3.29** (2.39-4.58)	**3.73** (2.53-5.24)	**4.40** (2.86-6.37)	**4.98** (3.16-7.33)
3-hr	**1.34** (1.08-1.66)	**1.63** (1.30-2.02)	**2.10** (1.68-2.62)	**2.50** (1.98-3.12)	**3.03** (2.33-3.97)	**3.43** (2.58-4.58)	**3.86** (2.82-5.37)	**4.40** (2.99-6.14)	**5.22** (3.40-7.52)	**5.93** (3.77-8.69)
6-hr	**1.71** (1.38-2.10)	**2.08** (1.68-2.56)	**2.70** (2.17-3.33)	**3.21** (2.56-3.98)	**3.91** (3.02-5.07)	**4.42** (3.34-5.87)	**4.99** (3.67-6.89)	**5.69** (3.88-7.88)	**6.77** (4.43-9.67)	**7.70** (4.91-11.2)
12-hr	**2.16** (1.76-2.64)	**2.63** (2.14-3.21)	**3.40** (2.75-4.16)	**4.04** (3.24-4.96)	**4.91** (3.82-6.32)	**5.56** (4.23-7.31)	**6.26** (4.62-8.56)	**7.13** (4.89-9.80)	**8.45** (5.55-12.0)	**9.60** (6.14-13.8)
24-hr	**2.59** (2.12-3.13)	**3.17** (2.59-3.83)	**4.11** (3.35-4.99)	**4.89** (3.96-5.96)	**5.96** (4.66-7.61)	**6.75** (5.16-8.80)	**7.61** (5.65-10.3)	**8.67** (5.97-11.8)	**10.3** (6.78-14.5)	**11.7** (7.50-16.7)
2-day	**2.95** (2.44-3.54)	**3.63** (3.00-4.36)	**4.75** (3.90-5.72)	**5.68** (4.64-6.87)	**6.96** (5.48-8.82)	**7.90** (6.08-10.2)	**8.92** (6.67-12.0)	**10.2** (7.05-13.8)	**12.2** (8.04-17.0)	**13.9** (8.92-19.7)
3-day	**3.22** (2.68-3.85)	**3.96** (3.28-4.73)	**5.15** (4.26-6.18)	**6.15** (5.04-7.41)	**7.51** (5.94-9.47)	**8.52** (6.59-11.0)	**9.62** (7.21-12.9)	**11.0** (7.62-14.8)	**13.1** (8.66-18.1)	**14.9** (9.60-21.0)
4-day	**3.48** (2.90-4.14)	**4.24** (3.53-5.05)	**5.48** (4.54-6.55)	**6.51** (5.35-7.82)	**7.92** (6.28-9.95)	**8.97** (6.95-11.5)	**10.1** (7.58-13.5)	**11.5** (7.99-15.4)	**13.6** (9.05-18.8)	**15.5** (10.0-21.8)
7-day	**4.20** (3.52-4.97)	**5.00** (4.18-5.91)	**6.30** (5.25-7.48)	**7.38** (6.11-8.80)	**8.86** (7.06-11.0)	**9.97** (7.75-12.7)	**11.2** (8.38-14.7)	**12.6** (8.78-16.7)	**14.7** (9.80-20.2)	**16.5** (10.7-23.1)
10-day	**4.88** (4.10-5.74)	**5.70** (4.79-6.71)	**7.04** (5.89-8.32)	**8.15** (6.77-9.68)	**9.68** (7.73-12.0)	**10.8** (8.42-13.6)	**12.0** (9.03-15.7)	**13.4** (9.42-17.8)	**15.5** (10.4-21.2)	**17.3** (11.2-24.0)
20-day	**6.87** (5.83-8.02)	**7.75** (6.57-9.06)	**9.20** (7.76-10.8)	**10.4** (8.71-12.2)	**12.0** (9.67-14.7)	**13.3** (10.4-16.5)	**14.6** (10.9-18.6)	**16.0** (11.3-20.9)	**17.8** (12.0-24.1)	**19.3** (12.5-26.6)
30-day	**8.52** (7.27-9.90)	**9.46** (8.05-11.0)	**11.0** (9.32-12.8)	**12.3** (10.3-14.4)	**14.0** (11.3-16.9)	**15.4** (12.0-18.9)	**16.7** (12.5-21.1)	**18.0** (12.8-23.5)	**19.7** (13.3-26.6)	**21.0** (13.7-28.8)
45-day	**10.6** (9.07-12.2)	**11.6** (9.92-13.4)	**13.2** (11.3-15.4)	**14.6** (12.3-17.0)	**16.5** (13.3-19.8)	**17.9** (14.1-21.9)	**19.4** (14.4-24.2)	**20.7** (14.7-26.8)	**22.3** (15.1-29.8)	**23.4** (15.3-31.9)
60-day	**12.3** (10.6-14.2)	**13.4** (11.5-15.4)	**15.1** (12.9-17.5)	**16.6** (14.0-19.2)	**18.5** (15.0-22.1)	**20.1** (15.8-24.4)	**21.6** (16.1-26.8)	**22.9** (16.3-29.5)	**24.5** (16.6-32.6)	**25.5** (16.7-34.6)

[1] Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS).

Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values.

Please refer to NOAA Atlas 14 document for more information.

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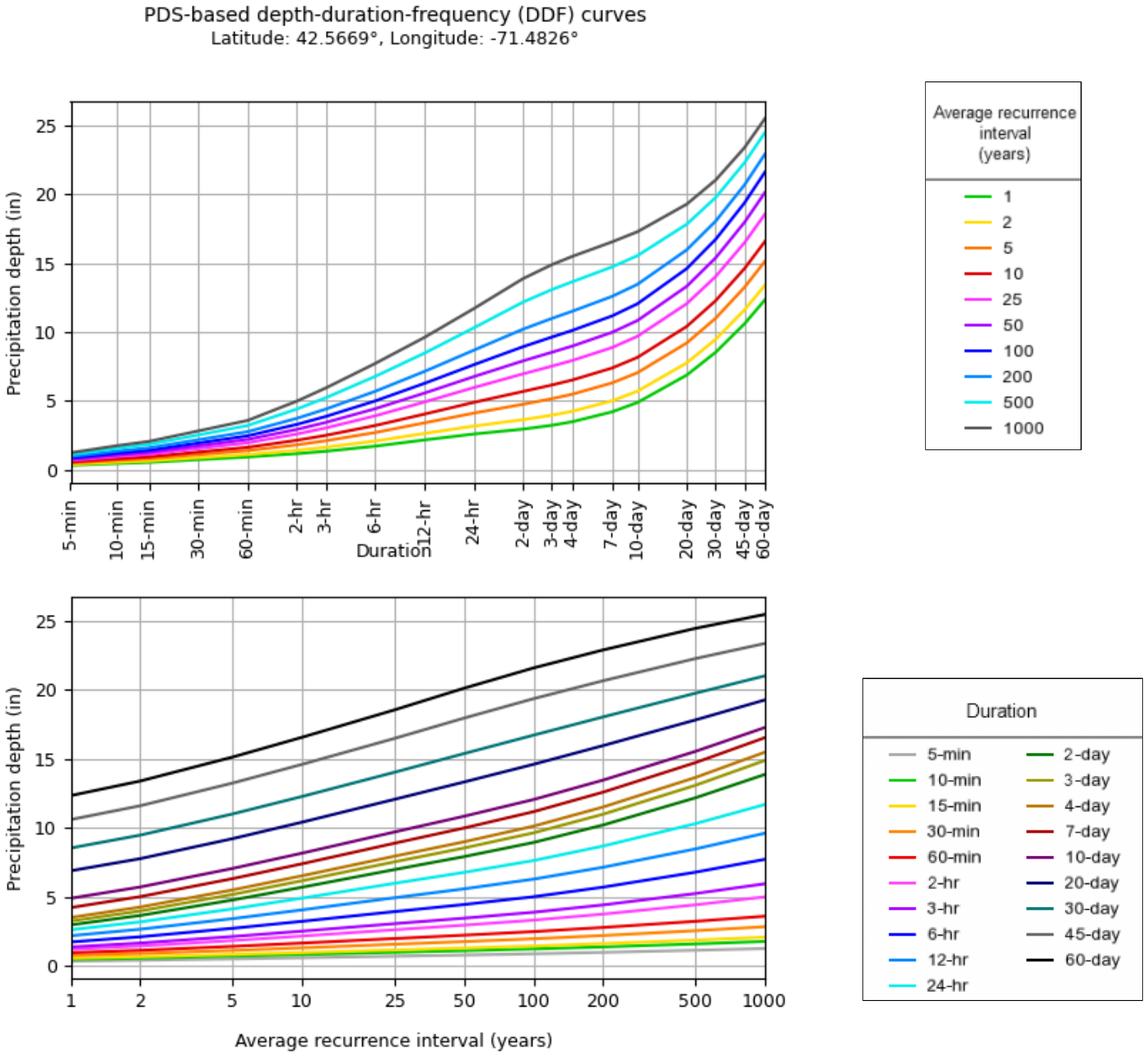
PF graphical



NOAA Atlas 14, Volume 10, Version 3 Created (GMT): Mon Jun 9 16:19:23 2025

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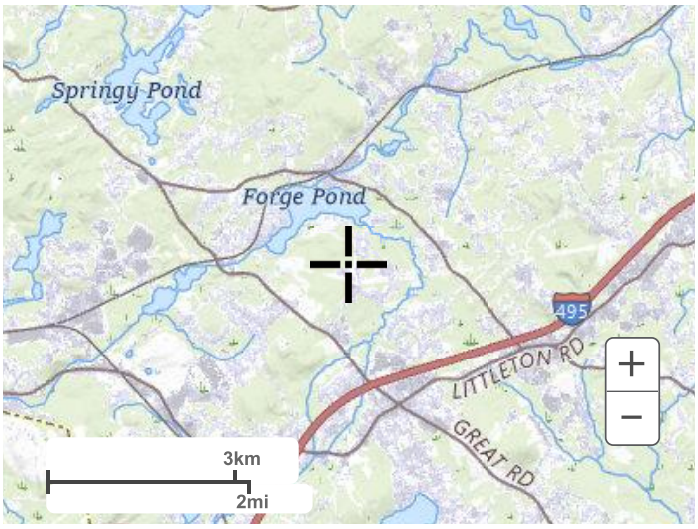
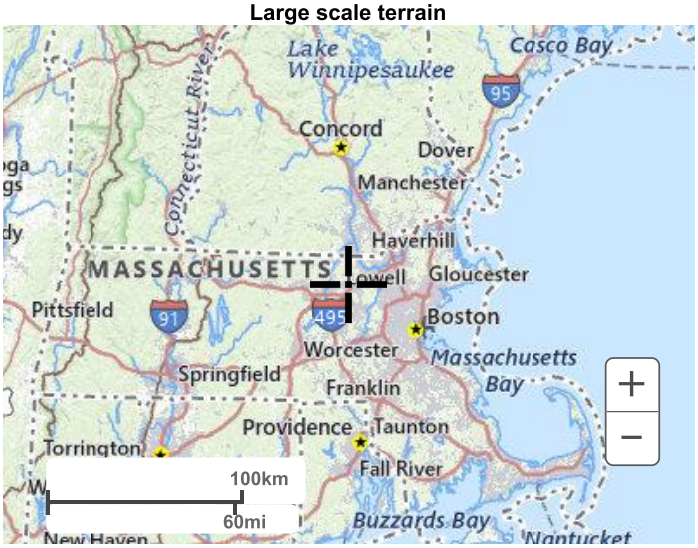
Maps & aerials

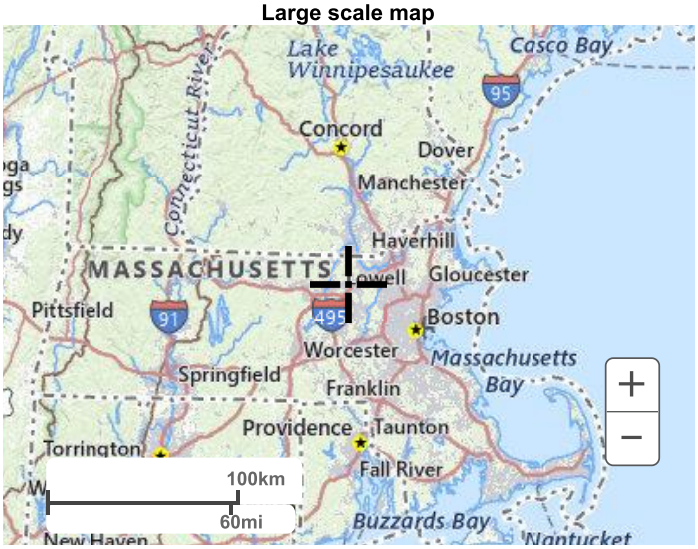
Small scale terrain



Large scale terrain



Large scale map



Large scale aerial

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US Department of Commerce
National Oceanic and Atmospheric Administration
National Weather Service
National Water Center
1325 East West Highway
Silver Spring, MD 20910
Questions?: HDSC.Questions@noaa.gov

Disclaimer

INSTRUCTIONS:

Version 1, Automated: Mar. 4, 2008

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

Location: Swale to Infiltration Basin

TSS Removal Calculation Worksheet

B BMP[1]	C TSS Removal Rate[1]	D Starting TSS Load*	E Amount Removed (C*D)	F Remaining Load (D-E)
Grass Channel	0.25	1.00	0.25	0.75
Infiltration Basin	0.80	0.75	0.60	0.15
	0.00	0.15	0.00	0.15
	0.00	0.15	0.00	0.15
	0.00	0.15	0.00	0.15

Total TSS Removal = 85%

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

Project: 7462

Prepared By: RPV

Date: 17-Jun-25

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

INSTRUCTIONS:

Version 1, Automated: Mar. 4, 2008

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

Location: Sediment Forebay to Infiltration Area

TSS Removal Calculation Worksheet

B BMP[1]	C TSS Removal Rate[1]	D Starting TSS Load*	E Amount Removed (C*D)	F Remaining Load (D-E)
Sediment Forebay	0.25	1.00	0.25	0.75
Infiltration Basin	0.80	0.75	0.60	0.15
	0.00	0.15	0.00	0.15
	0.00	0.15	0.00	0.15
	0.00	0.15	0.00	0.15

Total TSS Removal = 85%

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

Project: 7462

Prepared By: RPV

Date: 17-Jun-25

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

64 Beaver Brook Road
Littleton, MA

June 17, 2025
7462

Infiltration Basin

Stormwater Recharge Calculations

CALCULATIONS

Recharge Volume, Rv:

$R_v = A_C x F$

Hydrologic Soil Group	Impervious Area (Ac) [1]	Target Depth (F)	Recharge Volume (Rv) Ac-feet
C	0.150	0.25	0.003
Total	**0.150**		**0.003**

Total Recharge Volume Required = 0.003 Ac-ft
Total Recharge Volume Required (Rv) = 136 C.ft
Recharge Vol. Provided (from SW Area) = 148.0 C.ft

REFERENCES

Table 2.3.2: Recharge Target Depth by Hydrologic Soil Group

NRCS Hydrologic Soil Group	Approx. Soil Texture	Target Depth Factor (F)
A	sand	0.6 inch
B	loam	0.35 inch
C	silty loam	0.25 inch
D	clay	0.1 inch

CALCULATIONS

Proposed Infiltration Area Calculations:

$$Drawdown = \frac{R_V}{(Rawls\ Rate)(Bottom\ Area)}$$

Drawdown Calculations:

Soil Texture: 5 Silt Loam

Surface Area (A): 370 SF
Rawls Rate: **0.09 in/hr**
olume Provided = **148 C.ft**
Drawdown: **53.33 hr**
Drawdown is less than 72 Hours as Required

NOTES:
Input Values

Outlet designed at 239.3-feet

REFERENCES

Table 2.3.3: 1982 Rawls Rates

Texture Class	NRCS Hydrologic Soil Group	Infiltration Rate
1 Sand	A	8.27 in/hr
2 Loamy Sand	A	2.41 in/hr
3 Sandy Loam	B	1.02 in/hr
4 Loam	B	0.52 in/hr
5 Silt Loam	C	0.27 in/hr
6 Sandy Clay Loam	C	0.17 in/hr
7 Clay Loam	D	0.09 in/hr
8 Silty Clay Loam	D	0.06 in/hr
9 Sandy Clay	D	0.05 in/hr
10 Silty Clay	D	0.04 in/hr
11 Clay	D	0.02 in/hr

[1] = Refer to Proposed Conditions HydroCAD modeling report
[2] = Bottom Surface Area (A) for drawdown calculations was computed by dividing the storage volume below the invert of the outlet by the change in depth to the bottom of the pond.

Stage-Area-Storage for Pond 6P: INFILTRATION BASIN

Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)
239.00	370	0
239.05	408	19
239.10	448	41
239.15	489	64
239.20	533	90
239.25	578	118
239.30	625	148
239.35	674	180
239.40	725	215
239.45	778	253
239.50	833	293
239.55	889	336
239.60	947	382
239.65	1,007	431
239.70	1,069	483
239.75	1,133	538
239.80	1,199	596
239.85	1,266	658
239.90	1,336	723
239.95	1,407	791
240.00	1,480	863
240.05	1,547	939
240.10	1,616	1,018
240.15	1,687	1,101
240.20	1,758	1,187
240.25	1,832	1,277
240.30	1,907	1,370
240.35	1,983	1,467
240.40	2,061	1,568
240.45	2,140	1,673
240.50	2,221	1,782
240.55	2,303	1,895
240.60	2,387	2,013
240.65	2,473	2,134
240.70	2,559	2,260
240.75	2,648	2,390
240.80	2,738	2,525
240.85	2,829	2,664
240.90	2,922	2,808
240.95	3,016	2,956
241.00	3,112	3,109
241.05	3,187	3,267
241.10	3,263	3,428
241.15	3,340	3,593
241.20	3,417	3,762
241.25	3,496	3,935
241.30	3,575	4,112
241.35	3,656	4,292
241.40	3,737	4,477
241.45	3,819	4,666
241.50	3,902	4,859
241.55	3,986	5,056
241.60	4,071	5,258

Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)
241.65	4,157	5,464
241.70	4,243	5,674
241.75	4,331	5,888
241.80	4,419	6,107
241.85	4,509	6,330
241.90	4,599	6,558
241.95	4,690	6,790
242.00	**4,782**	**7,027**

148 cubic feet of recharge volume below the lowest outlet elevation

64 Beaver Brook Road
Littleton, MA

January 15, 2025
7462

Infiltration Area

Stormwater Recharge Calculations

CALCULATIONS

Recharge Volume, Rv:

$R_v = A_C x F$

Hydrologic Soil Group	Impervious Area (Ac) [1]	Target Depth (F)	Recharge Volume (Rv) Ac-feet
C	0.165	0.25	0.003
Total	**0.165**		**0.003**

Total Recharge Volume Required = 0.003 Ac-ft
Total Recharge Volume Required (Rv) = 150 C.ft
Recharge Vol. Provided (from SW Area) = 741.0 **C.ft**

REFERENCES

Table 2.3.2: Recharge Target Depth by Hydrologic Soil Group

NRCS Hydrologic Soil Group	Approx. Soil Texture	Target Depth Factor (F)
A	sand	0.6 inch
B	loam	0.35 inch
C	silty loam	0.25 inch
D	clay	0.1 inch

Stage-Area-Storage for Pond 4P: INFILTRATION AREA

Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)
262.00	69	0
262.05	75	4
262.10	81	7
262.15	87	12
262.20	93	16
262.25	100	21
262.30	107	26
262.35	114	32
262.40	121	38
262.45	129	44
262.50	137	50
262.55	145	57
262.60	153	65
262.65	161	73
262.70	170	81
262.75	179	90
262.80	188	99
262.85	197	109
262.90	207	119
262.95	217	129
263.00	227	140
263.05	237	152
263.10	247	164
263.15	257	177
263.20	267	190
263.25	278	203
263.30	288	218
263.35	299	232
263.40	310	247
263.45	322	263
263.50	333	280
263.55	345	297
263.60	357	314
263.65	369	332
263.70	382	351
263.75	394	370
263.80	407	390
263.85	420	411
263.90	433	432
263.95	446	454
264.00	460	477
264.05	473	500
264.10	487	524
264.15	500	549
264.20	514	574
264.25	528	600
264.30	542	627
264.35	556	655
264.40	571	683
264.45	586	712
264.50	601	741
264.55	616	772
264.60	631	803
264.65	646	835
264.70	662	868
264.75	678	901
264.80	694	936
264.85	710	971
264.90	727	1,007
264.95	743	1,043
265.00	**760**	**1,081**

741 cubic feet of recharge volume below the lowest outlet elevation

64 Beaver Brook Road
Littleton, MA

January 15, 2025
7462

Adjusted Recharge/WQV Calcs

Stormwater Recharge Calculations

Capture Area Adjustment, Rvadj:

$$R_v adj = \frac{A_t}{A_p} x R_v$$

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

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

[1] Imp. area captured by ponds, Ap =	0.36	Ac	
[1] Total impervious area on site, AT =	0.407	Ac	Proposed impervious area
Recharge volume required, Rv =	886	C.ft	(omits existing dwelling and driveway
Capture Rate=	**88%**	OK	
Capture Area Adjustment Factor=	**1.13**		
Adjusted Recharge Volume Required Rvadj =	**1,002**	**C.ft**	
Total Recharge Volume Provided =	889.0	**C.ft**	

NOTES:

Input Values

Water Quality Calculations

CALCULATIONS

Water Quality Calculation:

$$V_{WQ} = D_{WQ}(ft) x\ A_T(ft^2)$$

Water Quality Depth =	1	in
Water Quality Depth , DwQ =	**0.08**	**ft.**
Total impervious area on site, AT =	0.407	Ac.
AT =	**17,729**	**ft²**
Required Water Quality Volume, VwQ =	**1,477**	**C.ft.**

REFERENCES

1 inch depth
Zone II discharges
IWPA discharges
Critical Area
Runoff from LUHPPL
Infiltration rate >2.4 inches/hour
1/2 inch depth
Discharge to other ares
8 inch
9 inch
10 inch
11 inch

APPENDIX G

Stormwater Operation & Maintenance Manual

STORMWATER OPERATION & MAINTENANCE MANUAL

FOR

THE PROPERTY LOCATED AT
64 BEAVER BROOK ROAD

IN

LITTLETON,
MASSACHUSETTS

PREPARED BY: DILLIS & ROY
CIVIL DESIGN GROUP, INC.
1 Main Street, Suite #1
Lunenburg, MA 01462

PREPARED FOR: MICHAEL & HANNAH GRUAR
64 BEAVER BROOK ROAD
LITTLETON, MA 01460

JANUARY 15TH, 2025
CDG PROJECT # 7462

DILLIS & ROY CIVIL DESIGN GROUP
CIVIL ENGINEERS LAND SURVEYORS WETLAND CONSULTANTS

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1.0 Project Narrative

1.1 Overview of Drainage System
1.2 Construction Period Operations & Maintenance Tasks
1.3 Spill Plan
1.4 O&M Schedule

2.0 Appendices

Appendix A – Stormwater Management System Owners/Operators

1.0 Project Narrative

1.1 Proposed Stormwater Management System

The proposed stormwater management system was designed to reduce the peak rate of stormwater leaving the site, promote groundwater recharge, and increase the water quality. The following are the controls used in the stormwater management system and the roles they play within the system.

Infiltration Basin

The proposed infiltration basin was designed to reduce the post-construction runoff rates and increase groundwater recharge rates to the maximum extent practical. The basin will capture runoff associated with a large portion of the private driveway and overland flow from the undisturbed wooded area. The basin has been designed with an emergency overflow weir which will activate during more severe rain events to direct the overflow away from the development. An outlet control structure has been designed to provide the stormwater management area with a low-flow outlet during less sever rain events. Riprap will also be installed at the outlet of the emergency weir to control the overflow of stormwater and reduce the potential for scouring.

Grassed Swale

A grassed swale has been designed to capture runoff from portions of the shared driveway and to provide attenuation & treatment of stormwater. The grassed swale will consist of a small overflow berm to discharge stormwater towards the design point during larger storm events. The swale's entrance shall be reinforced with rip rap to decrease the velocity of flow and increase the settlement of heavy solids prior to entering the swale. Riprap will also be installed at the outlet of the weir to control the overflow of stormwater and reduce the potential for scouring.

1.2 Construction Period Operation & Maintenance Tasks

The following activities shall be performed routinely during the period of active construction to allow for proper functioning of the Soil Erosion and Sediment Control system. The following are guidelines referring to each major component.

Siltation Barriers

Siltation Barriers shall be inspected on a weekly basis and after every storm event in excess of 0.25 inches. Any damaged siltation barrier shall be repaired or replaced promptly. Sediment shall be removed and properly disposed of once it reaches a height of 18-inches.

Maintain siltation barriers as depicted on the site plan for the duration of the construction period.

Straw Wattles

Straw Wattles shall be inspected on a weekly basis and after every storm event in excess of 0.25 inches. Any damaged erosion control barrier shall be repaired or replaced promptly. Sediment shall be removed and properly disposed of once it reaches a height of 3-inches.

Straw Wattles are to be temporary in nature and are to be used only as needed to temporarily stabilize areas of active construction.

Storm Drain Lines

Storm drainage inlets and outlets should be inspected incidentally with all structure inspections. Evidence of debris intrusion or excessive siltation or sedimentation could result in the need to clean a storm drain line. Flushing or jetting should be performed as required. All flushing and jetting should be performed in the direction away from any outlet devices. A vacuum truck should be used at the opposite end of the flushing or jetting to remove any silt or sediment that is cleaned from the storm drain.

Infiltration Basins

Infiltration basins are stormwater runoff impoundments that are constructed over permeable soils and require pretreatment from sediment forebays. Runoff from the design storm is stored until it exfiltrates through the soil of the basin floor. The basins were located to capture most of the runoff from the impervious areas of the site.

Infiltration basins are prone to clogging and failure if proper maintenance is not scheduled. The basin should be inspected at least twice per year or after a major storm event to ensure that the basin is operating as intended. The outlet structures should be inspected for clogging or overflow release velocities that are causing scouring or erosion. The upper stage, side slopes, embankments and emergency spillway should be mowed twice a year.

Sediment forebay

A sediment forebay is required as a pretreatment device prior to discharging stormwater to the swale. It will provide pretreatment by slowing stormwater runoff and increasing settlement of the sediment. The sediment forebay should be inspected monthly and cleaned of accumulated sediment on a quarterly basis. After sediment removal,

repair any damaged vegetation by reseeding or resodding. Maintain grass at a height of 4-6 inches.

Stone Rip Rap

The proposed swales have been designed with angular stone riprap. The stone riprap will be placed approximately 1-foot deep over Tencate Mirafi filter fabric.

Rip Rap should be inspected periodically for signs of failure. Such signs would include, undermining, high velocity wear (displacement of stones downstream), sliding, settlement, siltation, etc. Riprap should be repaired immediately upon the observation of such conditions mentioned.

Periodically, rip rap should be cleaned of silt. Siltation will be most prevalent in low velocity areas (such as directly up-stream of outlet control structures). Silt and sediment should be removed from these areas by hand.

Grass Swales

Swales should be checked for scouring, sloughing, erosion and/or accumulation of silt. The vegetation helps reduce velocity of runoff, which helps to maintain the swale, and encourages the sedimentation filtrations prior to exfiltration. Grass should be mowed and kept below 6 inches. Debris and trash should be removed as encountered.

1.3 Spill Prevention and Control Plan

A spill contingency plan will be implemented during construction, including the following provisions:

- Equipment necessary to quickly attend to inadvertent spills will be stored on-site in a secure but accessible location. Such equipment will include:
  - Safety goggles
  - Chemically resistant gloves and overshoe boots
  - Water and chemical fire extinguishers
  - Sand and shovels
  - Suitable absorbent materials (speed dry, absorbent pads)
  - Storage containers
  - First aid equipment
- Spills or leaks will be treated properly in accordance with material type, volume of spillage, and location of the spill. Mitigation will include
  - Prevention of further spillage
  - Containment of the spilled material in the smallest practical area
  - Removal of spilled material immediately in a safe and environmentally sound manner
  - Mitigation of any damage to the environment
- Contractor shall notify the Engineer and Owner immediately upon knowledge of any spill of any quantity/volume.
- For spills less than the reportable quantity (RQ), as established in the Massachusetts Contingency Plan (MCP), the Contractor shall proceed with source control, containment, and clean up with absorbent materials or other applicable means, unless an imminent hazard or if other circumstances dictate the spill shall be treated by a professional response contractor.
- Spills of toxic or hazardous materials greater than the reportable quantity shall be reported to the appropriate Federal, State, and/or Local government agency.

1.4 O&M Schedule

	O&M Task	Monthly	Quarterly	Spring	Fall	2-years	As-required
1.	**Infiltration Basin**						
	Inspection			**x**	**x**		**x**
	Mowing	**3-4 times during the growing season**					
	Remove Debris			**x**	**x**		**x**
	Remove Sediment						**x**
	Re-seed						**x**
2.	**Sediment Forebay**						
	Inspection	**x**		**x**	**x**		**x**
	Mowing	**3-4 times during the growing season**					
	Remove Debris		**x**				**x**
	Remove Sediment		**x**				**x**
	Re-seed						**x**
3.	**Stone Rip Rap**						
	Inspection			**x**			
	Remove Debris			**x**			**x**
	Remove Silt/Sediment					**x**	**x**
	Repair						**x**
4.	**Storm drain Lines**						
	Inspection			**x**			**x**
	Clean						**x**
6.	**Grass Swales**						
	Inspection			**x**			**x**
	Clean			**x**			**x**

APPENDIX A

Stormwater Management System Owners/Operators

Stormwater Management System Owners/Operators

1.	Stormwater Management System Owners:	TBD
2.	Current and future operators:	TBD
3.	Emergency contact information:	TBD
4.	Change of trustee:	TBD
5.	Financial Responsible Party:	TBD
6.	Routine Maintenance:	TBD
7.	O&M activities:	TBD
8.	Record keeping	TBD

NOTE: STORMWATER MANAGEMENT SYSTEM OWNERSHIP AND OPERATION RESPONSIBILITIES SHALL TRANSFER WITH SALE OF PROPERTY TO FUTURE PROPERTY OWNERS.

APPENDIX H

Long Term Pollution Prevention Plan

LONG-TERM POLLUTION PREVENTION PLAN

FOR

THE PROPERTY LOCATED AT
64 BEAVER BROOK ROAD

IN

LITTLETON,
MASSACHUSETTS

PREPARED BY: DILLIS & ROY
CIVIL DESIGN GROUP, INC.
1 Main Street, Suite #1
Lunenburg, MA 01462

PREPARED FOR: MICHAEL & HANNAH GRUAR
64 BEAVER BROOK ROAD
LITTLETON, MA 01460

JANUARY 15TH, 2025
CDG PROJECT # 7462

DILLIS & ROY CIVIL DESIGN GROUP
CIVIL ENGINEERS LAND SURVEYORS WETLAND CONSULTANTS

1.0 Summary

This Long-Term Pollution Prevention Plan (LTPPP) has been prepared by Dillis & Roy Civil Design Group, Inc. pursuant to the Massachusetts Stormwater Regulations. The proposed project involves the construction of a 16-foot-wide shared driveway (±435 L.F.) to provide access to two residential lots. Each dwelling will be serviced by a private septic system and private water supply well. Due to the wetland system which bisects the site, the proposed shared driveway will require a wetland crossing to provide access to the upland area at the rear of the property. Each dwelling will require separate utility connections and their appurtenances. Two sperate stormwater management areas are proposed to capture and mitigate stormwater runoff associated with the development.

2.0 Spill Prevention Plan

No hazardous materials other than normal cleaning items are expected to be stored on site after the construction period has ended.

It is expected that normal DEP notification procedures would be triggered for major spills such as heating oil or propane and natural gas leaks.

3.0 Stormwater System O&M

A Stormwater Operation & Maintenance plan has been prepared for the proposed stormwater management system. Refer to this document for details pertaining to the required inspections, routine maintenance and operation details.

4.0 Fertilizers, herbicides, and pesticides

Application of fertilizer, herbicides and pesticides shall be performed in a manner consistent with the industry standards for the application.

No application of chemicals is to be performed within the stormwater management areas on the site.

5.0 Snow/Salt Management

5.1 Snow Plowing

It is expected that the driveway will be plowed or snow blown by the owner or a private contractor.

5.2 Salt/Sand Usage

It is expected that sanding and salting will be performed on an infrequent basis during times when unusually icy conditions persist for periods of time.

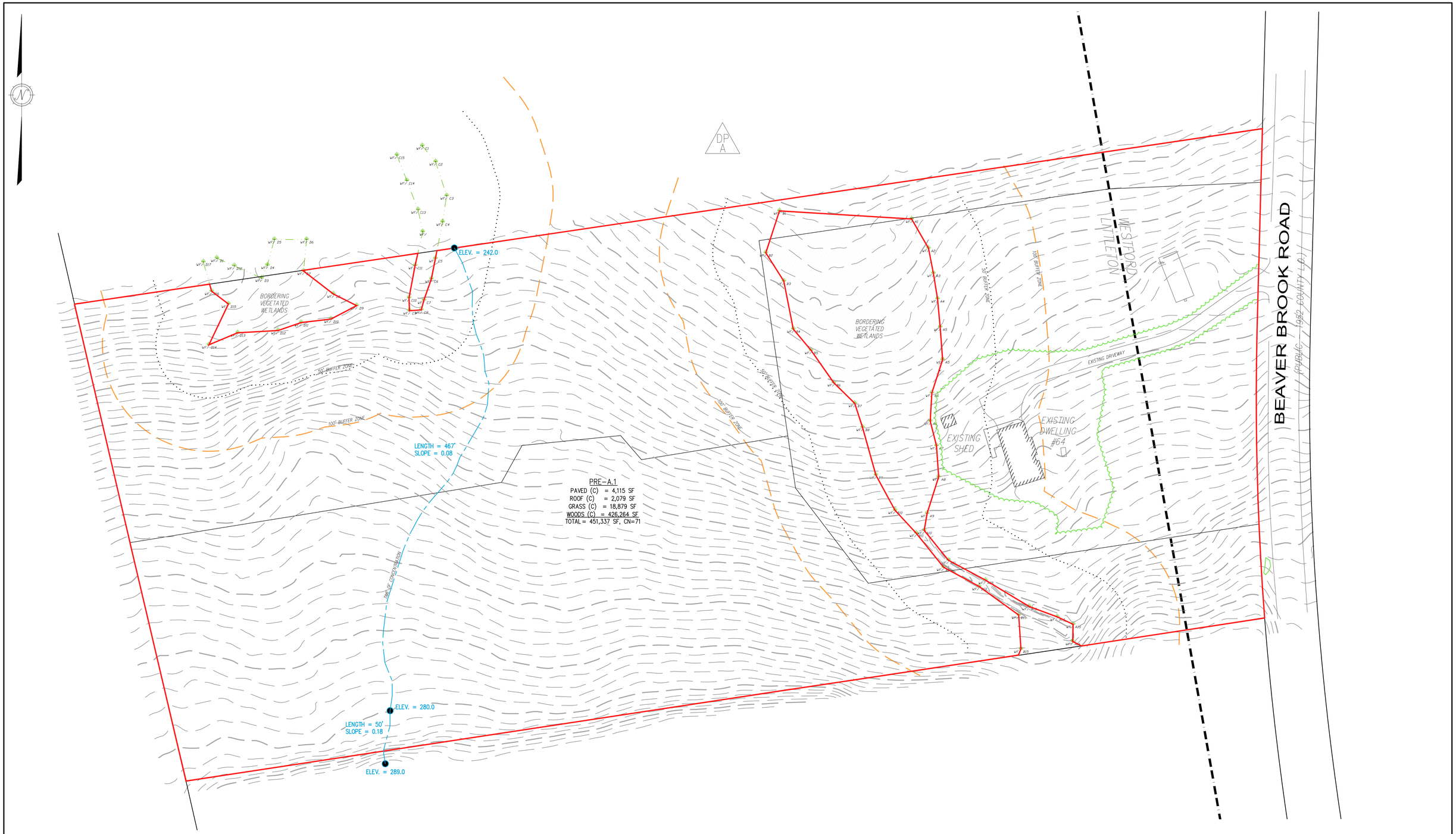
6.0 Waste Management

6.1 Solid Waste

A dumpster will be located on the site during construction. This area will be the primary area for the on-site storage of solid waste prior to pick-up by a waste management company.

4.0 Plans

Pre-development Watershed Plan



PREPARED BY:

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CIVIL DESIGN GROUP

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64 BEAVER BROOK ROAD
LITTLETON, MASSACHUSETTS 01460

APPLICANT:
MICHAEL & HANNAH GRUAR
64 BEAVER BROOK ROAD
LITTLETON, MASSACHUSETTS 01460

SCALE:
40 0 20 40 80 160
1 in. = 40 ft.

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DIG SAFE 1-888-344-7233

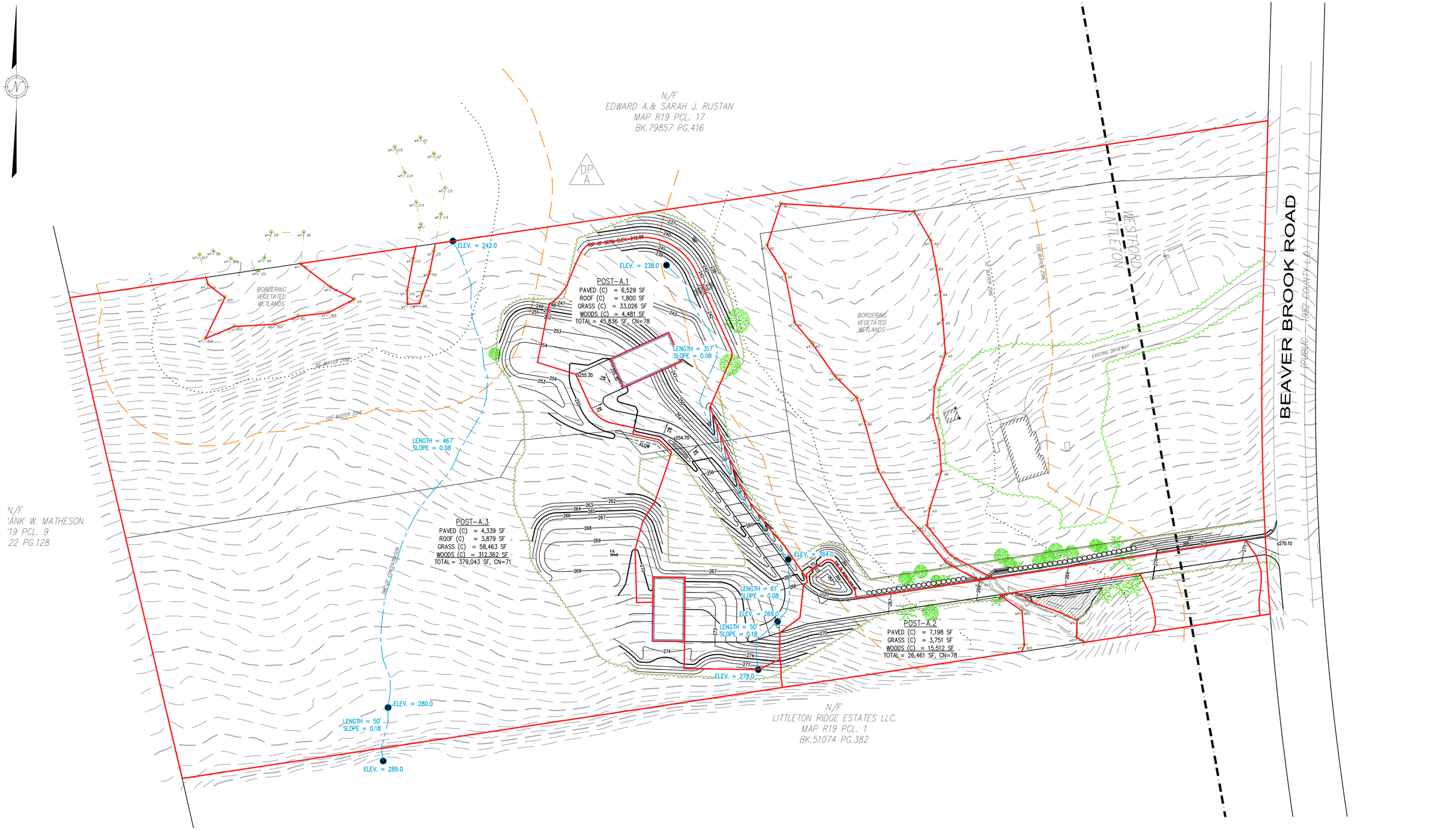
DATE: 02/11/25
DESIGN BY: RPV
DRAWN BY: RPV
CHECKED BY: GSR

PRE-DEVELOPED WATERSHED MAP
BEAVER BROOK RD. (M:R19 P:18)
LITTLETON, MASSACHUSETTS 01460

NO.	DATE	DESCRIPTION	BY
1.	6/18/25	REVISED PER CONSERVATION COMMISSION & DEP	RPV

JOB NO. 7462
DRAWING NO. 7462-PRE
SHEET NO. DRN

Post-development Watershed Plan



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POST-DEVELOPED WATERSHED MAP

BEAVER BROOK RD. (M:R19 P:18)
LITTLETON, MASSACHUSETTS 01460

NO.	DATE	DESCRIPTION	BY
1.	6/18/25	REVISED PER CONSERVATION COMMISSION & DEP	RPV

JOB NO. 7462
DRAWING NO. 7462-POST
SHEET NO. DRN