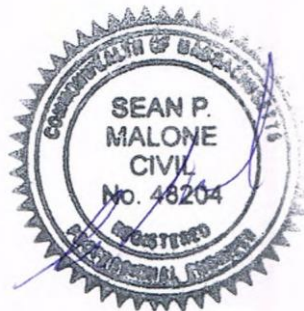


**STORMWATER MANAGEMENT STUDY  
FOR  
VILLAGE AT CLOCKTOWN**

**UNION STREET  
ASHLAND, MASSACHUSETTS**

Prepared for:

58 Exchange Ashland, LLC  
120 Quarry Drive  
Milford, Massachusetts 01757



Prepared by:

**Oak Consulting Group**  
P.O. Box 1123  
Newburyport, Massachusetts 01950  
(978) 312.3120

Project 17004  
April 2023

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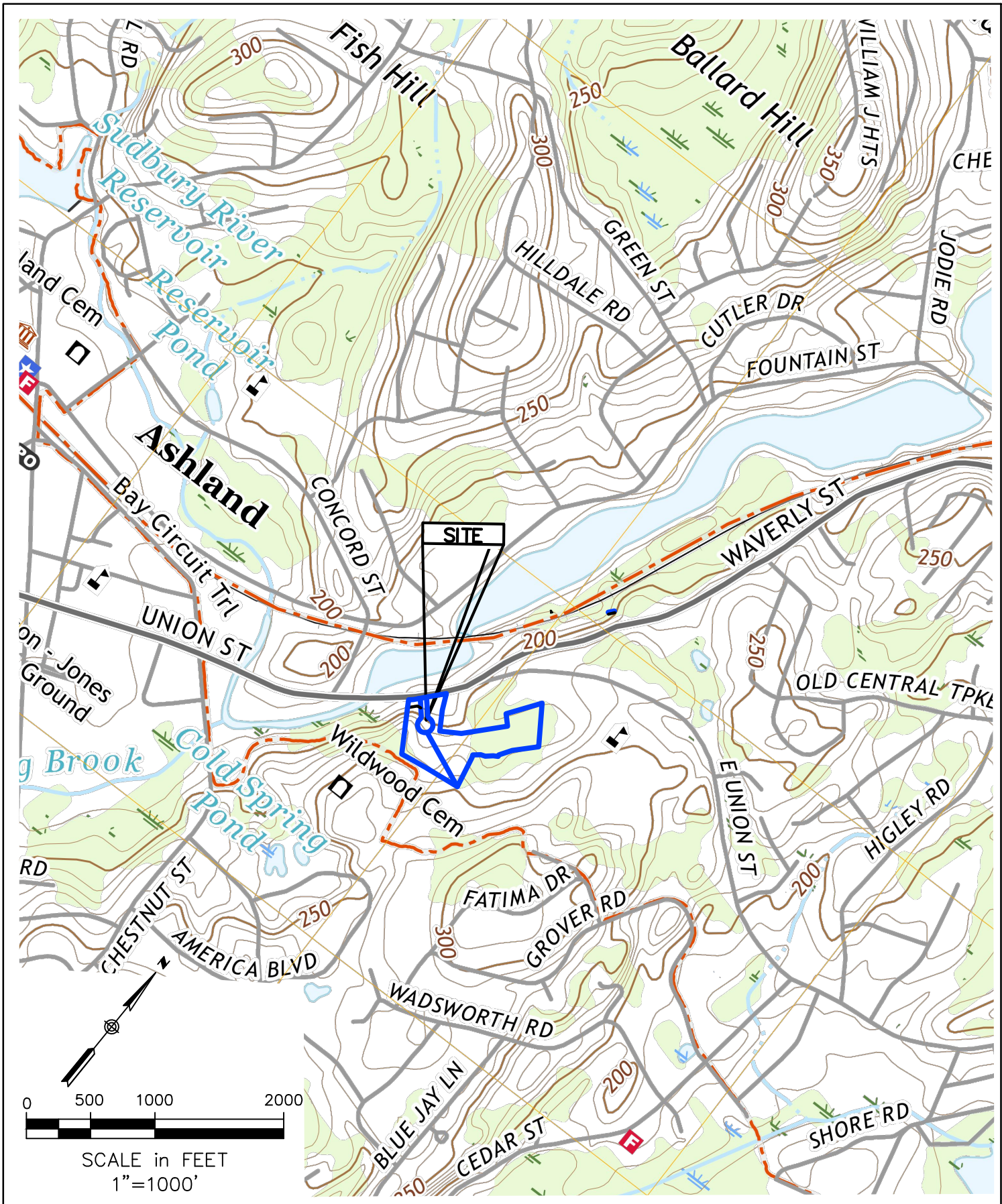
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**APPENDICES:**

- Appendix A: Pre-Development Watershed Plan and Drainage Calculations
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- Appendix E: Soils Information
- Appendix F: Rainfall Data



### Village at Clocktown

Union Street  
Ashland, Massachusetts

**OCG**

Oak Consulting Group  
P.O. Box 1123  
Newburyport, MA 01950  
Ph. 978.312.3120

### SITE LOCATION USGS PLAN

DRAWN BY:  
SPM  
SCALE:  
AS NOTED

CHECKED BY:  
SPM  
DATE:  
4/3/23

FIGURE NO.  
**1**

## 1.0 INTRODUCTION

Oak Consulting Group has prepared the following Stormwater Management Study for the proposed Village at Clocktown Definitive Subdivision. The objective of this study was to engineer a drainage design using Best Management Practices (BMPs) that meet the Stormwater Management Standards set forth in the Massachusetts Department of Environmental Protection's (MA DEP's) Stormwater Policy, Town of Ashland Standards, and standard engineering practice.

The Project Area is located on undeveloped land on Union Street in Ashland, Massachusetts. The site is bounded by Union Street to the north, a state facility to the west, a new public safety complex to the east, and athletic fields to the south. The project is a definitive subdivision consisting of 2 lots with associated road, utilities, landscape, and drainage improvements.

The total area of disturbance is approximately 1.2 acres. Portions of the proposed work area are within buffers to wetland resource areas, which are subject to protection under the Wetlands Protection Act and the Upton Wetlands Protection Bylaw. The project has been designed to minimize and mitigate disturbance in these buffers to help protect the abutting resource areas.

### 1.1 Existing Conditions

The site of the proposed project is a +/-8.54-acre undeveloped parcel located on the south side of Union Street. Wetlands have been identified in the east, northeast and southern portions of the site.

The site is in a vegetated/wooded state and shallow ledge has been identified in several locations. The site generally slopes from the south to the wetlands in the northeast portion of the site.

The site is characterized by a single watershed which flows to the wetland area in the northeast portion of the site. This wetland area is drained by a stone culvert which crosses Union Street and discharges to the Sudbury River. This watershed was divided into smaller subcatchments flowing to the wetland pockets on the site. The subcatchment areas are shown on the Pre-Development Subcatchment Plan, Sheet DR-001 found in Appendix A.

### 1.2 Site Geology and Hydrogeology

The NRCS has documented a majority of the site as having Loamy Sands with a Hydrologic Soil Group (HSG) "A" designation and muck and sandy loam in the southeast wetland area having a HSG "D" rating. As part of the site assessment 6 test pits were conducted in March 2023 and an additional 5 were conducted in March 2023 to characterize the site-specific soils in the areas of proposed stormwater management. Copies of the NRCS soils map and HSG map and test pit logs are enclosed in Appendix E.

The test pits indicated soils in the proposed stormwater management areas were primarily Loamy Sands and Sands and some shallow ledge. Based on the Rawl's Table and infiltration rate of 2.41 inches per hour was used to evaluate the proposed infiltration area.

### 1.3 Proposed Condition

The project proposes approximately 275 linear feet of road, along with new sidewalks, landscaping, utilities and drainage infrastructure to serve two lots. The drainage system has been designed to manage stormwater and mitigate the impacts of development to runoff from the site.

The proposed drainage design primarily uses a closed drainage system to capture, treat, retain and infiltrate stormwater from roadways prior to discharge. To mitigate increases in runoff, site drainage will be managed through on-site detention as well as infiltrated through subsurface infiltration chambers. The detention and retention of stormwater will effectively mimic the pre-development drainage condition by helping to control the rate of runoff generated by new impervious areas and recharging groundwater in accordance with the MADEP Stormwater Policy.

Stormwater treatment is provided primarily through the use treatment devices such as deep sump catch basins, proprietary treatment units (CDS or equal), and infiltration. These stormwater treatment areas are designed to remove at least 80% of the total annual load of Total Suspended Solids (TSS) of the site.

#### 1.4 Methodology

Drainage conditions of the project area were analyzed in both the pre-development and post-development condition using the computer program HydroCAD. This program utilized the SCS TR-20 drainage model to generate estimated peak rates of runoff for the Subcatchment areas modeled. Rainfall Data for the drainage model was obtained from the NOAA Atlas 14, volume 10, version 2. A copy of the rainfall table used can be found in Appendix F. The time of concentration was calculated using the TR-55 method using a minimum Tc of 6 minutes.

In the post-development analysis site was divided into smaller subcatchment areas to analyze the proposed BMP's for the project, while keeping the same points of discharge used in the Pre-development analysis. The Pre-Development Subcatchment Plans and Post-Development Subcatchment Plans depicting the sub-areas analyzed can be found in Appendices A and B, respectively.

## 2.0 STORMWATER MANAGEMENT STANDARDS

The plans included with this drainage study present the existing conditions and proposed storm drain systems and erosion control measures proposed for the project. The stormwater BMPs were designed to meet the performance standards described in the MADEP Stormwater Handbook. The measures taken to address each of the standards are presented below.

### 2.1 No New Untreated Discharges (Standard 1)

The proposed project will not result in new untreated discharges. Runoff from the proposed project area and new impervious areas will be captured, treated to remove total suspended solids (TSS). Treated runoff will be discharged at approximately the same location as the pre-development condition.

### 2.2 Peak Rate Attenuation (Standard 2)

The post-development rate of runoff from the site will be approximately equal to the pre-development Conditions. HydroCAD stormwater calculations for the 2-, 10-, 25-, 50- and 100-year design storms (NOAA Rainfall Numbers) are provided in Appendices A and B and are summarized in the table below. The existing and proposed drainage conditions were evaluated at the same points of discharge.

Table 2.2.1 - Rate of Discharge from Site

	<b>Peak Rate of Runoff for 2-Year Storm Event (3.33") Pre/Post</b>	<b>Peak Rate of Runoff for 10-Year Storm Event (5.14") Pre/Post</b>	<b>Peak Rate of Runoff for 25-Year Storm Event (6.27") Pre/Post</b>	<b>Peak Rate of Runoff for 50-Year Storm Event (6.27") Pre/Post</b>	<b>Peak Rate of Runoff for 100-Year Storm Event (8.01") Pre/Post</b>
Total Site	3.71/ <b>3.81</b> cfs	8.11/ <b>8.23</b> cfs	11.02/ <b>11.15</b> cfs	13.21/ <b>13.36</b> cfs	15.85/ <b>16.06</b> cfs
Total Site Change	<b>0.1 cfs (2.7%)</b>	<b>0.12 cfs (1.48%)</b>	<b>0.13 cfs 1.18%</b>	<b>0.15 cfs (1.14%)</b>	<b>0.21 cfs (1.32%)</b>

The site is 100% wooded and a majority of the site is HSG A soil, meaning very well-draining. This creates very little runoff in for the existing condition in the HydroCAD model. The subdivision uses approximately 1.2 acres of land. When this 1.2 acres is taken out the existing watershed area, the HydroCAD model shows the remaining undeveloped land still yields the same amount of runoff as the existing condition. This means to balance stormwater between the existing and proposed condition we the stormwater management system would need to capture and infiltrate 100% of the stormwater from the subdivision area.

The test pits show the site has relatively shallow ledge and existing grades slope steeply up from Union Street into the site. The test pit with the deepest ledge has refusal at approximately 181.0 The elevation of Union Street is approximately 183.0.

To infiltrate stormwater the regulations require at least 2' separation to groundwater, this would put the bottom of any infiltration structure at least at elevation 183.0 so there is no possible way to capture and infiltrate the bottom 3rd of the proposed road and therefore there will be some level of discharge which will exceed the predevelopment condition. The stormwater management system design minimizes the calculated change much as possible with only a 1-2% increase (0.1 to 0.21 cubic feet per second).

The area of development is in the northern portion of the site closest to Union Street and the site is at the bottom of a much larger watershed receiving stormwater from multiple off-site sources. The change shown in the HydroCAD is minimal and will have no affect when considering the larger watershed flowing to the design point and will be easily absorbed into the overall flow from the site.

### 2.3 Groundwater Recharge (Standard 3)

The performance standards require an approximate restoration of groundwater recharge in post-development conditions. Soil data was obtained from the NRC Web Soil Survey.

Below is a calculation of the required recharge volume for the new site impervious area in each of the soil groups found on the site.

Volume required in HSG A Soils  
 $12,453 \text{ sf} \times (0.6 \text{ in}) / (12 \text{ in/ft}) = \underline{622.65} \text{ cubic feet}$

Total recharge volume required = 622.65 cubic feet

The project will use subsurface infiltration chambers where 2 feet or greater separation from the estimated seasonal high groundwater and ledge can be achieved. These chambers are preceded by a surface detention basin which will provide additional storage for stormwater to be infiltrated. The total

static recharge volume for this system was calculated to be 4,129 cf. These basins will impound 2 feet of water or less and were calculated to have an expected drawdown of less than 72 hours.

#### 2.4 Water Quality (Standard 4)

Runoff generated by the site will be treated to remove at least 80 percent of the total annual load of Total Suspended Solids (TSS) as required by the Massachusetts DEP Stormwater Standards. BMPs used include, deep sump catchbasins, CDS Treatment Units by Contech, and stormwater infiltration. Treatment train calculations with MADEP TSS removal worksheets and treatment unit design worksheets are included in Appendix C.

#### 2.5 Land Use with Higher Potential Pollutant Loads (LUHPPLs) (Standard 5)

The proposed project involves the construction of a residential development. This use is not associated with higher potential pollutant loads.

#### 2.6 Critical Areas (Standard 6)

The site drains to the Sudbury Reservoir Watershed and is considered a critical area under Standard 6.

As such, stormwater draining to an infiltration BMP will receive at least 44% TSS removal using deep sump catchbasins (25% removal) and treatment units (80% removal) prior to reaching the infiltration area.

#### 2.7 Redevelopments and Other Projects Subject to the Standards Only to the Maximum Extent Practicable (Standard 7)

A “redevelopment” project is defined in the MA DEP Stormwater Policy as: “Development, rehabilitation, expansion, and phased projects on previously developed sites, provided the redevelopment results in no net increase in impervious area.” The proposed project does not meet this definition.

The project is a small residential project: 2-4 single family houses with a discharge to a critical area. As discussed in Section 2.2 of this report, due to existing constraints on the site the stormwater management system has been designed to meet the Stormwater Management Standards to the maximum extent practicable.

#### 2.8 Construction-Period Pollution Prevention and Erosion and Sedimentation Control (Standard 8)

Below is a summary of the erosion and sediment control procedures. Additional detail can be found on Sheet C-400, Erosion Control Notes, and details provided on the project plans.

Land-disturbing activities proposed under this project will include the items listed in, and be sequenced according to, the following preliminary construction schedule:

1. Installation of temporary erosion controls (construction entrances, sedimentation barriers, and catchbasin inlet protection).
2. Clearing and grubbing. Stockpile topsoil.

3. Excavation, grading, construction of temporary drainage basins, ditches, rough grading of site.
4. Construction of roadway, drainage and utilities.
5. Construction of landscaping, and final stabilization.
6. Removal of temporary erosion controls and any trapped sediment.

Erosion/sediment controls will be in place throughout the site during all phases of construction. All existing catchbasins in the project area will have a silt basket installed under the grate. The Contractor shall be responsible for checking all of the erosion/sediment control measures periodically and after every storm. The Contractor shall repair, replace, and maintain all erosion/sediment control measures throughout construction until all disturbed areas have been stabilized. Efforts will be made to establish vegetative cover over all disturbed areas as soon as possible after the work in that area is complete. All disturbed areas will be treated with a 4-inch depth of loam and seed.

The occurrence of an extended shutdown during the construction phase of this project is not anticipated and is unlikely. Should unexpected events dictate, measures will be taken to stabilize the disturbed areas of the site as a last construction activity before the start of an extended shutdown. These measures will include careful planning of the immediate construction schedule so that further land disturbance is kept to a minimum and the re-stabilization of existing disturbed areas is maximized prior to the extended shutdown. Other measures will include the reinforcement and repair of all erosion/sediment controls in place at the time of the extended shutdown.

#### 2.9 Operation and Maintenance Plan (Standard 9)

See Appendix D.

#### 2.10 Prohibition of Illicit Discharges

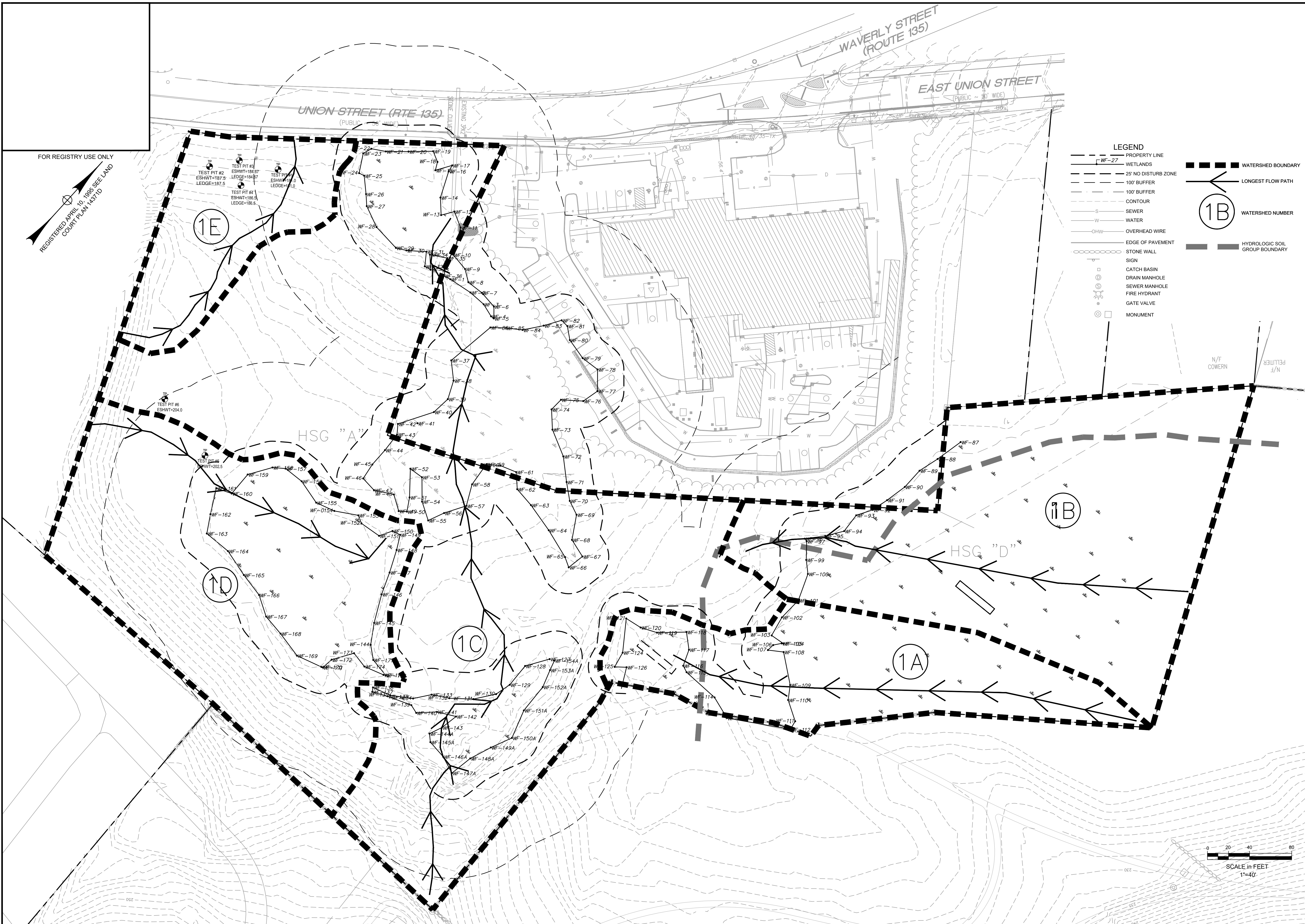
Illicit discharges are prohibited. An Illicit Discharge Statement will be provided prior to the start of construction.

**APPENDIX A**

Pre-Development Drainage Calculations

Village at Clocktown  
Union Street  
Ashland, Massachusetts





FOR REGISTRY USE ONLY  
 REGISTERED APRIL 10, 1985 SEE LAND  
 COURT PLAN 14377D

**LEGEND**

- PROPERTY LINE
- WF-27 WETLANDS
- 25' NO DISTURB ZONE
- 100' BUFFER
- 100' BUFFER
- CONTOUR
- S SEWER
- W WATER
- OHW OVERHEAD WIRE
- EDGE OF PAVEMENT
- STONE WALL
- SIGN
- CATCH BASIN
- DRAIN MANHOLE
- SEWER MANHOLE
- FIRE HYDRANT
- GATE VALVE
- MONUMENT

[Thick dashed line] WATERSHED BOUNDARY  
 [Arrow] LONGEST FLOW PATH  
 (1B) WATERSHED NUMBER  
 [Thick dashed line] HYDROLOGIC SOIL GROUP BOUNDARY

Site: **VILLAGE AT CLOCKTOWN**  
 UNION STREET  
 ASHLAND, MASSACHUSETTS  
 MAP 14, PARCELS 0076, 0077, AND 0078  
 ZONE: WILDWOOD MIXED USE SPECIAL DISTRICT  
 DEED REFERENCE: BOOK 66338, PAGE 298 AND  
 LAND COURT CERTIFICATE OF TITLE NO. 260840

Owner/Applicant:  
**58 EXCHANGE**  
**ASHLAND, LLC**  
 120 QUARRY DRIVE  
 MILFORD, MASSACHUSETTS 01757

THIS IS TO CERTIFY THAT NOTICE OF APPROVAL OF THIS PLAN BY THE ASHLAND PLANNING BOARD HAS BEEN RECEIVED AND RECORDED ON \_\_\_\_\_ AT \_\_\_\_\_ AND NO APPEAL WAS RECEIVED DURING THE 20 DAYS NEXT AFTER SUCH RECEIPT AND RECORDING OF SAID NOTICE.

TOWN CLERK \_\_\_\_\_ DATE \_\_\_\_\_  
 APPROVED SUBJECT TO COVENANT CONDITIONS SET FORTH IN A COVENANT EXECUTED BY \_\_\_\_\_ DATED \_\_\_\_\_ AND TO BE RECORDED HERewith, THIS PLAN CONFORMS WITH THE MASSACHUSETTS REGULATION 200 CMR 6:01  
 APPROVAL DATE: \_\_\_\_\_  
 ASHLAND PLANNING BOARD

SIGNATURE DATE: \_\_\_\_\_  
 BEING A MAJORITY



PROJECT ENGINEER  
**OCG**  
 Oak Consulting Group  
 P.O. Box 1123  
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 Ph. 978.312.3120

PROJECT SURVEYOR  
**GUERRIERE & HALNON, INC**  
 333 West Street  
 Milford, MA  
 Ph. 508.473.6630

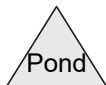
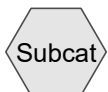
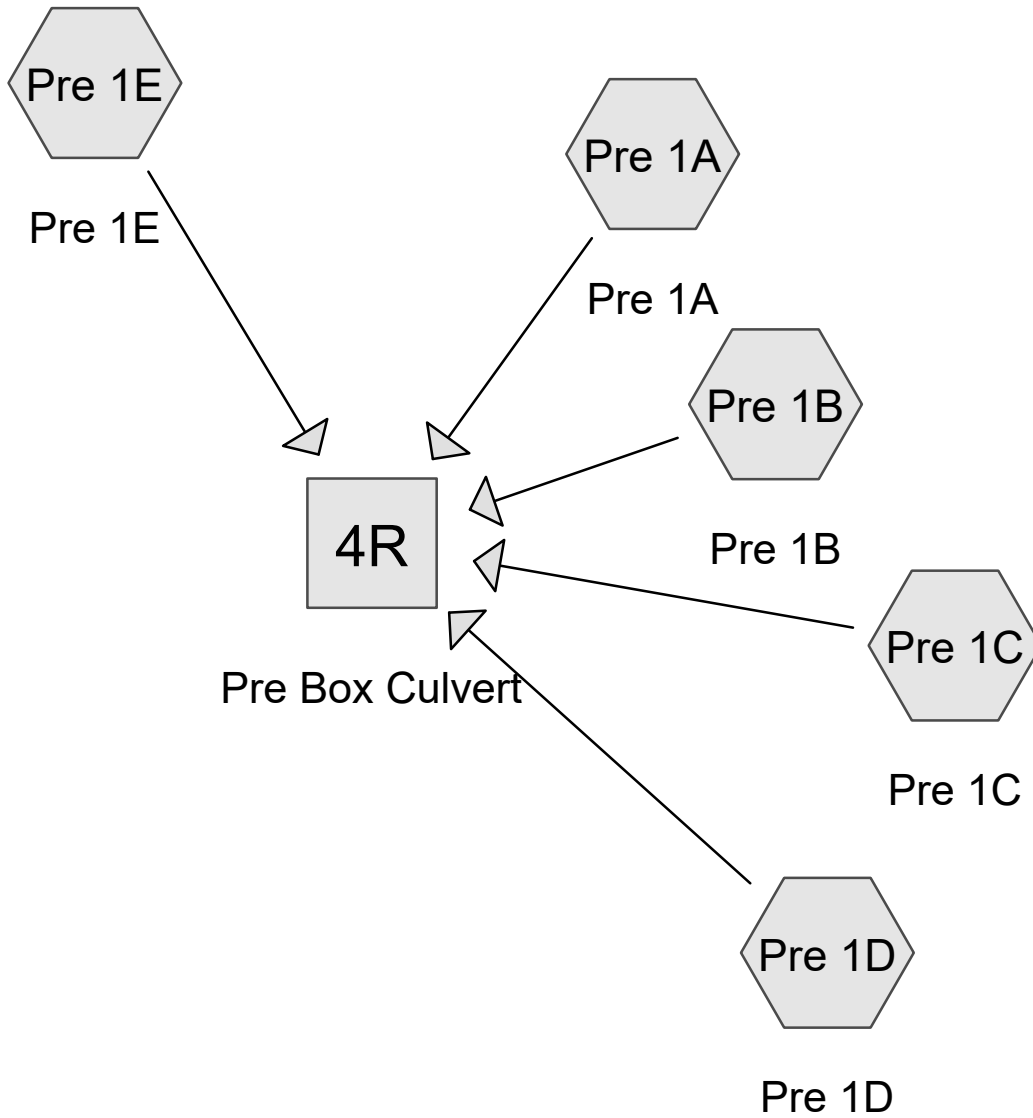
**PRE-DEVELOPMENT WATERSHED PLAN**

No.	Revision/Issue	Date

Design by: SPM	Checked by: PFA
Drawn by: SPM	Approved by: PFA
Project: 17004	Date: APRIL 3, 2023

Sheet:  
**DR-001**





**Routing Diagram for 17004 Pre-Post**  
 Prepared by {enter your company name here}, Printed 4/3/2023  
 HydroCAD® 10.00-26 s/n 01151 © 2020 HydroCAD Software Solutions LLC

**17004 Pre-Post**

Type III 24-hr 2-YR-NOAA Rainfall=3.36"

Prepared by {enter your company name here}

Printed 4/3/2023

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Page 2

Time span=0.00-48.00 hrs, dt=0.01 hrs, 4801 points x 2  
Runoff by SCS TR-20 method, UH=SCS, Weighted-Q  
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

**SubcatchmentPre 1A: Pre 1A**

Runoff Area=39,454 sf 0.00% Impervious Runoff Depth=1.24"  
Flow Length=438' Tc=20.0 min CN=WQ Runoff=0.87 cfs 0.094 af

**SubcatchmentPre 1B: Pre 1B**

Runoff Area=84,027 sf 0.00% Impervious Runoff Depth=1.26"  
Flow Length=426' Tc=19.9 min CN=WQ Runoff=1.88 cfs 0.203 af

**SubcatchmentPre 1C: Pre 1C**

Runoff Area=148,816 sf 0.00% Impervious Runoff Depth=0.21"  
Flow Length=748' Tc=15.9 min CN=WQ Runoff=0.61 cfs 0.060 af

**SubcatchmentPre 1D: Pre 1D**

Runoff Area=75,728 sf 0.00% Impervious Runoff Depth=0.36"  
Flow Length=328' Tc=7.3 min CN=WQ Runoff=0.69 cfs 0.052 af

**SubcatchmentPre 1E: Pre 1E**

Runoff Area=23,853 sf 0.00% Impervious Runoff Depth=0.00"  
Flow Length=274' Tc=6.0 min CN=WQ Runoff=0.00 cfs 0.000 af

**Reach 4R: Pre Box Culvert**

Inflow=3.71 cfs 0.409 af  
Outflow=3.71 cfs 0.409 af

**17004 Pre-Post**

Type III 24-hr 2-YR-NOAA Rainfall=3.36"

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Page 3

**Summary for Subcatchment Pre 1A: Pre 1A**

Runoff = 0.87 cfs @ 12.29 hrs, Volume= 0.094 af, Depth= 1.24"

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs  
Type III 24-hr 2-YR-NOAA Rainfall=3.36"

Area (sf)	CN	Description
* 4,187	77	Wetlands in A
* 25,787	77	Wetlands in D
2,589	30	Woods, Good, HSG A
0	39	>75% Grass cover, Good, HSG A
0	55	Woods, Good, HSG B
0	61	>75% Grass cover, Good, HSG B
0	70	Woods, Good, HSG C
0	74	>75% Grass cover, Good, HSG C
6,891	77	Woods, Good, HSG D
0	80	>75% Grass cover, Good, HSG D
39,454		Weighted Average
39,454	74	100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
14.9	100	0.0500	0.11		<b>Sheet Flow, sheet flow</b>
					Woods: Light underbrush n= 0.400 P2= 3.20"
5.1	338	0.0480	1.10		<b>Shallow Concentrated Flow, scf</b>
					Woodland Kv= 5.0 fps
20.0	438	Total			

**Summary for Subcatchment Pre 1B: Pre 1B**

Runoff = 1.88 cfs @ 12.29 hrs, Volume= 0.203 af, Depth= 1.26"

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs  
Type III 24-hr 2-YR-NOAA Rainfall=3.36"

Area (sf)	CN	Description
* 15,433	77	Wetlands in A
* 61,734	77	Wetlands in D
3,970	30	Woods, Good, HSG A
0	39	>75% Grass cover, Good, HSG A
0	55	Woods, Good, HSG B
0	61	>75% Grass cover, Good, HSG B
0	70	Woods, Good, HSG C
0	74	>75% Grass cover, Good, HSG C
2,890	77	Woods, Good, HSG D
0	80	>75% Grass cover, Good, HSG D
84,027		Weighted Average
84,027	75	100.00% Pervious Area

**17004 Pre-Post**

Type III 24-hr 2-YR-NOAA Rainfall=3.36"

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Page 4

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
14.9	100	0.0500	0.11		<b>Sheet Flow, sheet flow</b> Woods: Light underbrush n= 0.400 P2= 3.20"
5.0	326	0.0480	1.10		<b>Shallow Concentrated Flow, scf</b> Woodland Kv= 5.0 fps
19.9	426	Total			

**Summary for Subcatchment Pre 1C: Pre 1C**

Runoff = 0.61 cfs @ 12.23 hrs, Volume= 0.060 af, Depth= 0.21"

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs  
Type III 24-hr 2-YR-NOAA Rainfall=3.36"

Area (sf)	CN	Description
* 19,641	77	Wetlands in A
* 0	77	Wetlands in D
125,166	30	Woods, Good, HSG A
0	39	>75% Grass cover, Good, HSG A
0	55	Woods, Good, HSG B
0	61	>75% Grass cover, Good, HSG B
0	70	Woods, Good, HSG C
0	74	>75% Grass cover, Good, HSG C
4,009	77	Woods, Good, HSG D
0	80	>75% Grass cover, Good, HSG D
148,816		Weighted Average
148,816	37	100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.8	100	0.3500	0.24		<b>Sheet Flow, sheet flow</b> Woods: Light underbrush n= 0.400 P2= 3.20"
9.1	648	0.0560	1.18		<b>Shallow Concentrated Flow, scf</b> Woodland Kv= 5.0 fps
15.9	748	Total			

**Summary for Subcatchment Pre 1D: Pre 1D**

Runoff = 0.69 cfs @ 12.11 hrs, Volume= 0.052 af, Depth= 0.36"

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs  
Type III 24-hr 2-YR-NOAA Rainfall=3.36"

**17004 Pre-Post**

Type III 24-hr 2-YR-NOAA Rainfall=3.36"

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Page 5

Area (sf)	CN	Description
* 20,566	77	Wetlands in A
* 0	77	Wetlands in D
55,162	30	Woods, Good, HSG A
0	39	>75% Grass cover, Good, HSG A
0	55	Woods, Good, HSG B
0	61	>75% Grass cover, Good, HSG B
0	70	Woods, Good, HSG C
0	74	>75% Grass cover, Good, HSG C
0	77	Woods, Good, HSG D
0	80	>75% Grass cover, Good, HSG D
75,728		Weighted Average
75,728	43	100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.6	30	0.3500	0.19		<b>Sheet Flow, sheet flow</b> Woods: Light underbrush n= 0.400 P2= 3.20"
4.7	298	0.0450	1.06		<b>Shallow Concentrated Flow, scf</b> Woodland Kv= 5.0 fps
7.3	328	Total			

**Summary for Subcatchment Pre 1E: Pre 1E**

[45] Hint: Runoff=Zero

Runoff = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Depth= 0.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs  
Type III 24-hr 2-YR-NOAA Rainfall=3.36"

Area (sf)	CN	Description
23,853	30	Woods, Good, HSG A
0	39	>75% Grass cover, Good, HSG A
0	55	Woods, Good, HSG B
0	61	>75% Grass cover, Good, HSG B
0	70	Woods, Good, HSG C
0	74	>75% Grass cover, Good, HSG C
0	77	Woods, Good, HSG D
0	80	>75% Grass cover, Good, HSG D
23,853		Weighted Average
23,853	30	100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.1	25	0.4000	0.19		<b>Sheet Flow, sheet flow</b> Woods: Light underbrush n= 0.400 P2= 3.20"
2.6	249	0.1000	1.58		<b>Shallow Concentrated Flow, scf</b> Woodland Kv= 5.0 fps
4.7	274	Total, Increased to minimum Tc = 6.0 min			

**17004 Pre-Post**

Type III 24-hr 2-YR-NOAA Rainfall=3.36"

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**Summary for Reach 4R: Pre Box Culvert**

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 8.537 ac, 0.00% Impervious, Inflow Depth = 0.58" for 2-YR-NOAA event  
Inflow = 3.71 cfs @ 12.27 hrs, Volume= 0.409 af  
Outflow = 3.71 cfs @ 12.27 hrs, Volume= 0.409 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 2

**17004 Pre-Post**

Type III 24-hr 10-YR-NOAA Rainfall=5.25"

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Time span=0.00-48.00 hrs, dt=0.01 hrs, 4801 points x 2  
Runoff by SCS TR-20 method, UH=SCS, Weighted-Q  
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

**SubcatchmentPre 1A: Pre 1A**

Runoff Area=39,454 sf 0.00% Impervious Runoff Depth=2.65"  
Flow Length=438' Tc=20.0 min CN=WQ Runoff=1.89 cfs 0.200 af

**SubcatchmentPre 1B: Pre 1B**

Runoff Area=84,027 sf 0.00% Impervious Runoff Depth=2.70"  
Flow Length=426' Tc=19.9 min CN=WQ Runoff=4.13 cfs 0.434 af

**SubcatchmentPre 1C: Pre 1C**

Runoff Area=148,816 sf 0.00% Impervious Runoff Depth=0.46"  
Flow Length=748' Tc=15.9 min CN=WQ Runoff=1.33 cfs 0.132 af

**SubcatchmentPre 1D: Pre 1D**

Runoff Area=75,728 sf 0.00% Impervious Runoff Depth=0.78"  
Flow Length=328' Tc=7.3 min CN=WQ Runoff=1.50 cfs 0.113 af

**SubcatchmentPre 1E: Pre 1E**

Runoff Area=23,853 sf 0.00% Impervious Runoff Depth=0.01"  
Flow Length=274' Tc=6.0 min CN=WQ Runoff=0.00 cfs 0.001 af

**Reach 4R: Pre Box Culvert**

Inflow=8.11 cfs 0.879 af  
Outflow=8.11 cfs 0.879 af

**Summary for Subcatchment Pre 1A: Pre 1A**

Runoff = 1.89 cfs @ 12.28 hrs, Volume= 0.200 af, Depth= 2.65"

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs  
Type III 24-hr 10-YR-NOAA Rainfall=5.25"

Area (sf)	CN	Description
* 4,187	77	Wetlands in A
* 25,787	77	Wetlands in D
2,589	30	Woods, Good, HSG A
0	39	>75% Grass cover, Good, HSG A
0	55	Woods, Good, HSG B
0	61	>75% Grass cover, Good, HSG B
0	70	Woods, Good, HSG C
0	74	>75% Grass cover, Good, HSG C
6,891	77	Woods, Good, HSG D
0	80	>75% Grass cover, Good, HSG D
39,454		Weighted Average
39,454	74	100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
14.9	100	0.0500	0.11		<b>Sheet Flow, sheet flow</b>
					Woods: Light underbrush n= 0.400 P2= 3.20"
5.1	338	0.0480	1.10		<b>Shallow Concentrated Flow, scf</b>
					Woodland Kv= 5.0 fps
20.0	438	Total			

**Summary for Subcatchment Pre 1B: Pre 1B**

Runoff = 4.13 cfs @ 12.27 hrs, Volume= 0.434 af, Depth= 2.70"

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs  
Type III 24-hr 10-YR-NOAA Rainfall=5.25"

Area (sf)	CN	Description
* 15,433	77	Wetlands in A
* 61,734	77	Wetlands in D
3,970	30	Woods, Good, HSG A
0	39	>75% Grass cover, Good, HSG A
0	55	Woods, Good, HSG B
0	61	>75% Grass cover, Good, HSG B
0	70	Woods, Good, HSG C
0	74	>75% Grass cover, Good, HSG C
2,890	77	Woods, Good, HSG D
0	80	>75% Grass cover, Good, HSG D
84,027		Weighted Average
84,027	75	100.00% Pervious Area

**17004 Pre-Post**

Type III 24-hr 10-YR-NOAA Rainfall=5.25"

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Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
14.9	100	0.0500	0.11		<b>Sheet Flow, sheet flow</b> Woods: Light underbrush n= 0.400 P2= 3.20"
5.0	326	0.0480	1.10		<b>Shallow Concentrated Flow, scf</b> Woodland Kv= 5.0 fps
19.9	426	Total			

**Summary for Subcatchment Pre 1C: Pre 1C**

Runoff = 1.33 cfs @ 12.21 hrs, Volume= 0.132 af, Depth= 0.46"

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs  
Type III 24-hr 10-YR-NOAA Rainfall=5.25"

Area (sf)	CN	Description
* 19,641	77	Wetlands in A
* 0	77	Wetlands in D
125,166	30	Woods, Good, HSG A
0	39	>75% Grass cover, Good, HSG A
0	55	Woods, Good, HSG B
0	61	>75% Grass cover, Good, HSG B
0	70	Woods, Good, HSG C
0	74	>75% Grass cover, Good, HSG C
4,009	77	Woods, Good, HSG D
0	80	>75% Grass cover, Good, HSG D
148,816		Weighted Average
148,816	37	100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.8	100	0.3500	0.24		<b>Sheet Flow, sheet flow</b> Woods: Light underbrush n= 0.400 P2= 3.20"
9.1	648	0.0560	1.18		<b>Shallow Concentrated Flow, scf</b> Woodland Kv= 5.0 fps
15.9	748	Total			

**Summary for Subcatchment Pre 1D: Pre 1D**

Runoff = 1.50 cfs @ 12.11 hrs, Volume= 0.113 af, Depth= 0.78"

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs  
Type III 24-hr 10-YR-NOAA Rainfall=5.25"

**17004 Pre-Post**

Type III 24-hr 10-YR-NOAA Rainfall=5.25"

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Area (sf)	CN	Description
* 20,566	77	Wetlands in A
* 0	77	Wetlands in D
55,162	30	Woods, Good, HSG A
0	39	>75% Grass cover, Good, HSG A
0	55	Woods, Good, HSG B
0	61	>75% Grass cover, Good, HSG B
0	70	Woods, Good, HSG C
0	74	>75% Grass cover, Good, HSG C
0	77	Woods, Good, HSG D
0	80	>75% Grass cover, Good, HSG D
75,728		Weighted Average
75,728	43	100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.6	30	0.3500	0.19		<b>Sheet Flow, sheet flow</b> Woods: Light underbrush n= 0.400 P2= 3.20"
4.7	298	0.0450	1.06		<b>Shallow Concentrated Flow, scf</b> Woodland Kv= 5.0 fps
7.3	328	Total			

**Summary for Subcatchment Pre 1E: Pre 1E**

Runoff = 0.00 cfs @ 22.34 hrs, Volume= 0.001 af, Depth= 0.01"

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs  
Type III 24-hr 10-YR-NOAA Rainfall=5.25"

Area (sf)	CN	Description
23,853	30	Woods, Good, HSG A
0	39	>75% Grass cover, Good, HSG A
0	55	Woods, Good, HSG B
0	61	>75% Grass cover, Good, HSG B
0	70	Woods, Good, HSG C
0	74	>75% Grass cover, Good, HSG C
0	77	Woods, Good, HSG D
0	80	>75% Grass cover, Good, HSG D
23,853		Weighted Average
23,853	30	100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.1	25	0.4000	0.19		<b>Sheet Flow, sheet flow</b> Woods: Light underbrush n= 0.400 P2= 3.20"
2.6	249	0.1000	1.58		<b>Shallow Concentrated Flow, scf</b> Woodland Kv= 5.0 fps
4.7	274	Total, Increased to minimum Tc = 6.0 min			

**17004 Pre-Post**

Type III 24-hr 10-YR-NOAA Rainfall=5.25"

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**Summary for Reach 4R: Pre Box Culvert**

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 8.537 ac, 0.00% Impervious, Inflow Depth = 1.24" for 10-YR-NOAA event  
Inflow = 8.11 cfs @ 12.25 hrs, Volume= 0.879 af  
Outflow = 8.11 cfs @ 12.25 hrs, Volume= 0.879 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 2

**17004 Pre-Post**

Type III 24-hr 25-YR-NOAA Rainfall=6.42"

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Time span=0.00-48.00 hrs, dt=0.01 hrs, 4801 points x 2  
Runoff by SCS TR-20 method, UH=SCS, Weighted-Q  
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

**SubcatchmentPre 1A: Pre 1A**

Runoff Area=39,454 sf 0.00% Impervious Runoff Depth=3.60"  
Flow Length=438' Tc=20.0 min CN=WQ Runoff=2.57 cfs 0.272 af

**SubcatchmentPre 1B: Pre 1B**

Runoff Area=84,027 sf 0.00% Impervious Runoff Depth=3.67"  
Flow Length=426' Tc=19.9 min CN=WQ Runoff=5.61 cfs 0.590 af

**SubcatchmentPre 1C: Pre 1C**

Runoff Area=148,816 sf 0.00% Impervious Runoff Depth=0.71"  
Flow Length=748' Tc=15.9 min CN=WQ Runoff=1.81 cfs 0.203 af

**SubcatchmentPre 1D: Pre 1D**

Runoff Area=75,728 sf 0.00% Impervious Runoff Depth=1.13"  
Flow Length=328' Tc=7.3 min CN=WQ Runoff=2.03 cfs 0.164 af

**SubcatchmentPre 1E: Pre 1E**

Runoff Area=23,853 sf 0.00% Impervious Runoff Depth=0.12"  
Flow Length=274' Tc=6.0 min CN=WQ Runoff=0.01 cfs 0.006 af

**Reach 4R: Pre Box Culvert**

Inflow=11.02 cfs 1.236 af  
Outflow=11.02 cfs 1.236 af

**17004 Pre-Post**

Type III 24-hr 25-YR-NOAA Rainfall=6.42"

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**Summary for Subcatchment Pre 1A: Pre 1A**

Runoff = 2.57 cfs @ 12.27 hrs, Volume= 0.272 af, Depth= 3.60"

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs  
Type III 24-hr 25-YR-NOAA Rainfall=6.42"

Area (sf)	CN	Description
* 4,187	77	Wetlands in A
* 25,787	77	Wetlands in D
2,589	30	Woods, Good, HSG A
0	39	>75% Grass cover, Good, HSG A
0	55	Woods, Good, HSG B
0	61	>75% Grass cover, Good, HSG B
0	70	Woods, Good, HSG C
0	74	>75% Grass cover, Good, HSG C
6,891	77	Woods, Good, HSG D
0	80	>75% Grass cover, Good, HSG D
39,454		Weighted Average
39,454	74	100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
14.9	100	0.0500	0.11		<b>Sheet Flow, sheet flow</b>
					Woods: Light underbrush n= 0.400 P2= 3.20"
5.1	338	0.0480	1.10		<b>Shallow Concentrated Flow, scf</b>
					Woodland Kv= 5.0 fps
20.0	438	Total			

**Summary for Subcatchment Pre 1B: Pre 1B**

Runoff = 5.61 cfs @ 12.27 hrs, Volume= 0.590 af, Depth= 3.67"

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs  
Type III 24-hr 25-YR-NOAA Rainfall=6.42"

Area (sf)	CN	Description
* 15,433	77	Wetlands in A
* 61,734	77	Wetlands in D
3,970	30	Woods, Good, HSG A
0	39	>75% Grass cover, Good, HSG A
0	55	Woods, Good, HSG B
0	61	>75% Grass cover, Good, HSG B
0	70	Woods, Good, HSG C
0	74	>75% Grass cover, Good, HSG C
2,890	77	Woods, Good, HSG D
0	80	>75% Grass cover, Good, HSG D
84,027		Weighted Average
84,027	75	100.00% Pervious Area

**17004 Pre-Post**

Type III 24-hr 25-YR-NOAA Rainfall=6.42"

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Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
14.9	100	0.0500	0.11		<b>Sheet Flow, sheet flow</b> Woods: Light underbrush n= 0.400 P2= 3.20"
5.0	326	0.0480	1.10		<b>Shallow Concentrated Flow, scf</b> Woodland Kv= 5.0 fps
19.9	426	Total			

**Summary for Subcatchment Pre 1C: Pre 1C**

Runoff = 1.81 cfs @ 12.21 hrs, Volume= 0.203 af, Depth= 0.71"

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs  
Type III 24-hr 25-YR-NOAA Rainfall=6.42"

Area (sf)	CN	Description
* 19,641	77	Wetlands in A
* 0	77	Wetlands in D
125,166	30	Woods, Good, HSG A
0	39	>75% Grass cover, Good, HSG A
0	55	Woods, Good, HSG B
0	61	>75% Grass cover, Good, HSG B
0	70	Woods, Good, HSG C
0	74	>75% Grass cover, Good, HSG C
4,009	77	Woods, Good, HSG D
0	80	>75% Grass cover, Good, HSG D
148,816		Weighted Average
148,816	37	100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.8	100	0.3500	0.24		<b>Sheet Flow, sheet flow</b> Woods: Light underbrush n= 0.400 P2= 3.20"
9.1	648	0.0560	1.18		<b>Shallow Concentrated Flow, scf</b> Woodland Kv= 5.0 fps
15.9	748	Total			

**Summary for Subcatchment Pre 1D: Pre 1D**

Runoff = 2.03 cfs @ 12.11 hrs, Volume= 0.164 af, Depth= 1.13"

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs  
Type III 24-hr 25-YR-NOAA Rainfall=6.42"

**17004 Pre-Post**

Type III 24-hr 25-YR-NOAA Rainfall=6.42"

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Area (sf)	CN	Description
* 20,566	77	Wetlands in A
* 0	77	Wetlands in D
55,162	30	Woods, Good, HSG A
0	39	>75% Grass cover, Good, HSG A
0	55	Woods, Good, HSG B
0	61	>75% Grass cover, Good, HSG B
0	70	Woods, Good, HSG C
0	74	>75% Grass cover, Good, HSG C
0	77	Woods, Good, HSG D
0	80	>75% Grass cover, Good, HSG D
75,728		Weighted Average
75,728	43	100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.6	30	0.3500	0.19		<b>Sheet Flow, sheet flow</b> Woods: Light underbrush n= 0.400 P2= 3.20"
4.7	298	0.0450	1.06		<b>Shallow Concentrated Flow, scf</b> Woodland Kv= 5.0 fps
7.3	328	Total			

**Summary for Subcatchment Pre 1E: Pre 1E**

Runoff = 0.01 cfs @ 14.98 hrs, Volume= 0.006 af, Depth= 0.12"

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs  
Type III 24-hr 25-YR-NOAA Rainfall=6.42"

Area (sf)	CN	Description
23,853	30	Woods, Good, HSG A
0	39	>75% Grass cover, Good, HSG A
0	55	Woods, Good, HSG B
0	61	>75% Grass cover, Good, HSG B
0	70	Woods, Good, HSG C
0	74	>75% Grass cover, Good, HSG C
0	77	Woods, Good, HSG D
0	80	>75% Grass cover, Good, HSG D
23,853		Weighted Average
23,853	30	100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.1	25	0.4000	0.19		<b>Sheet Flow, sheet flow</b> Woods: Light underbrush n= 0.400 P2= 3.20"
2.6	249	0.1000	1.58		<b>Shallow Concentrated Flow, scf</b> Woodland Kv= 5.0 fps
4.7	274	Total, Increased to minimum Tc = 6.0 min			

**17004 Pre-Post**

Type III 24-hr 25-YR-NOAA Rainfall=6.42"

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**Summary for Reach 4R: Pre Box Culvert**

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 8.537 ac, 0.00% Impervious, Inflow Depth = 1.74" for 25-YR-NOAA event  
Inflow = 11.02 cfs @ 12.25 hrs, Volume= 1.236 af  
Outflow = 11.02 cfs @ 12.25 hrs, Volume= 1.236 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 2

**17004 Pre-Post**

Type III 24-hr 50-YR-NOAA Rainfall=7.29"

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Time span=0.00-48.00 hrs, dt=0.01 hrs, 4801 points x 2  
Runoff by SCS TR-20 method, UH=SCS, Weighted-Q  
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

**SubcatchmentPre 1A: Pre 1A**

Runoff Area=39,454 sf 0.00% Impervious Runoff Depth=4.34"  
Flow Length=438' Tc=20.0 min CN=WQ Runoff=3.09 cfs 0.328 af

**SubcatchmentPre 1B: Pre 1B**

Runoff Area=84,027 sf 0.00% Impervious Runoff Depth=4.42"  
Flow Length=426' Tc=19.9 min CN=WQ Runoff=6.73 cfs 0.711 af

**SubcatchmentPre 1C: Pre 1C**

Runoff Area=148,816 sf 0.00% Impervious Runoff Depth=0.96"  
Flow Length=748' Tc=15.9 min CN=WQ Runoff=2.18 cfs 0.273 af

**SubcatchmentPre 1D: Pre 1D**

Runoff Area=75,728 sf 0.00% Impervious Runoff Depth=1.45"  
Flow Length=328' Tc=7.3 min CN=WQ Runoff=2.44 cfs 0.210 af

**SubcatchmentPre 1E: Pre 1E**

Runoff Area=23,853 sf 0.00% Impervious Runoff Depth=0.27"  
Flow Length=274' Tc=6.0 min CN=WQ Runoff=0.02 cfs 0.012 af

**Reach 4R: Pre Box Culvert**

Inflow=13.21 cfs 1.533 af  
Outflow=13.21 cfs 1.533 af

**17004 Pre-Post**

Type III 24-hr 50-YR-NOAA Rainfall=7.29"

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**Summary for Subcatchment Pre 1A: Pre 1A**

Runoff = 3.09 cfs @ 12.27 hrs, Volume= 0.328 af, Depth= 4.34"

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs  
Type III 24-hr 50-YR-NOAA Rainfall=7.29"

Area (sf)	CN	Description
* 4,187	77	Wetlands in A
* 25,787	77	Wetlands in D
2,589	30	Woods, Good, HSG A
0	39	>75% Grass cover, Good, HSG A
0	55	Woods, Good, HSG B
0	61	>75% Grass cover, Good, HSG B
0	70	Woods, Good, HSG C
0	74	>75% Grass cover, Good, HSG C
6,891	77	Woods, Good, HSG D
0	80	>75% Grass cover, Good, HSG D
39,454		Weighted Average
39,454	74	100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
14.9	100	0.0500	0.11		<b>Sheet Flow, sheet flow</b>
					Woods: Light underbrush n= 0.400 P2= 3.20"
5.1	338	0.0480	1.10		<b>Shallow Concentrated Flow, scf</b>
					Woodland Kv= 5.0 fps
20.0	438	Total			

**Summary for Subcatchment Pre 1B: Pre 1B**

Runoff = 6.73 cfs @ 12.27 hrs, Volume= 0.711 af, Depth= 4.42"

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs  
Type III 24-hr 50-YR-NOAA Rainfall=7.29"

Area (sf)	CN	Description
* 15,433	77	Wetlands in A
* 61,734	77	Wetlands in D
3,970	30	Woods, Good, HSG A
0	39	>75% Grass cover, Good, HSG A
0	55	Woods, Good, HSG B
0	61	>75% Grass cover, Good, HSG B
0	70	Woods, Good, HSG C
0	74	>75% Grass cover, Good, HSG C
2,890	77	Woods, Good, HSG D
0	80	>75% Grass cover, Good, HSG D
84,027		Weighted Average
84,027	75	100.00% Pervious Area

**17004 Pre-Post**

Type III 24-hr 50-YR-NOAA Rainfall=7.29"

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Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
14.9	100	0.0500	0.11		<b>Sheet Flow, sheet flow</b> Woods: Light underbrush n= 0.400 P2= 3.20"
5.0	326	0.0480	1.10		<b>Shallow Concentrated Flow, scf</b> Woodland Kv= 5.0 fps
19.9	426	Total			

**Summary for Subcatchment Pre 1C: Pre 1C**

Runoff = 2.18 cfs @ 12.21 hrs, Volume= 0.273 af, Depth= 0.96"

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs  
Type III 24-hr 50-YR-NOAA Rainfall=7.29"

Area (sf)	CN	Description
* 19,641	77	Wetlands in A
* 0	77	Wetlands in D
125,166	30	Woods, Good, HSG A
0	39	>75% Grass cover, Good, HSG A
0	55	Woods, Good, HSG B
0	61	>75% Grass cover, Good, HSG B
0	70	Woods, Good, HSG C
0	74	>75% Grass cover, Good, HSG C
4,009	77	Woods, Good, HSG D
0	80	>75% Grass cover, Good, HSG D
148,816		Weighted Average
148,816	37	100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.8	100	0.3500	0.24		<b>Sheet Flow, sheet flow</b> Woods: Light underbrush n= 0.400 P2= 3.20"
9.1	648	0.0560	1.18		<b>Shallow Concentrated Flow, scf</b> Woodland Kv= 5.0 fps
15.9	748	Total			

**Summary for Subcatchment Pre 1D: Pre 1D**

Runoff = 2.44 cfs @ 12.10 hrs, Volume= 0.210 af, Depth= 1.45"

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs  
Type III 24-hr 50-YR-NOAA Rainfall=7.29"

**17004 Pre-Post**

Type III 24-hr 50-YR-NOAA Rainfall=7.29"

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Area (sf)	CN	Description
* 20,566	77	Wetlands in A
* 0	77	Wetlands in D
55,162	30	Woods, Good, HSG A
0	39	>75% Grass cover, Good, HSG A
0	55	Woods, Good, HSG B
0	61	>75% Grass cover, Good, HSG B
0	70	Woods, Good, HSG C
0	74	>75% Grass cover, Good, HSG C
0	77	Woods, Good, HSG D
0	80	>75% Grass cover, Good, HSG D
75,728		Weighted Average
75,728	43	100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.6	30	0.3500	0.19		<b>Sheet Flow, sheet flow</b> Woods: Light underbrush n= 0.400 P2= 3.20"
4.7	298	0.0450	1.06		<b>Shallow Concentrated Flow, scf</b> Woodland Kv= 5.0 fps
7.3	328	Total			

**Summary for Subcatchment Pre 1E: Pre 1E**

Runoff = 0.02 cfs @ 12.50 hrs, Volume= 0.012 af, Depth= 0.27"

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs  
Type III 24-hr 50-YR-NOAA Rainfall=7.29"

Area (sf)	CN	Description
23,853	30	Woods, Good, HSG A
0	39	>75% Grass cover, Good, HSG A
0	55	Woods, Good, HSG B
0	61	>75% Grass cover, Good, HSG B
0	70	Woods, Good, HSG C
0	74	>75% Grass cover, Good, HSG C
0	77	Woods, Good, HSG D
0	80	>75% Grass cover, Good, HSG D
23,853		Weighted Average
23,853	30	100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.1	25	0.4000	0.19		<b>Sheet Flow, sheet flow</b> Woods: Light underbrush n= 0.400 P2= 3.20"
2.6	249	0.1000	1.58		<b>Shallow Concentrated Flow, scf</b> Woodland Kv= 5.0 fps
4.7	274	Total, Increased to minimum Tc = 6.0 min			

**17004 Pre-Post**

Type III 24-hr 50-YR-NOAA Rainfall=7.29"

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**Summary for Reach 4R: Pre Box Culvert**

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 8.537 ac, 0.00% Impervious, Inflow Depth = 2.16" for 50-YR-NOAA event  
Inflow = 13.21 cfs @ 12.25 hrs, Volume= 1.533 af  
Outflow = 13.21 cfs @ 12.25 hrs, Volume= 1.533 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 2

**17004 Pre-Post**

Type III 24-hr 100-YR-NOAA Rainfall=8.24"

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Time span=0.00-48.00 hrs, dt=0.01 hrs, 4801 points x 2  
Runoff by SCS TR-20 method, UH=SCS, Weighted-Q  
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

**SubcatchmentPre 1A: Pre 1A**

Runoff Area=39,454 sf 0.00% Impervious Runoff Depth=5.17"  
Flow Length=438' Tc=20.0 min CN=WQ Runoff=3.65 cfs 0.390 af

**SubcatchmentPre 1B: Pre 1B**

Runoff Area=84,027 sf 0.00% Impervious Runoff Depth=5.26"  
Flow Length=426' Tc=19.9 min CN=WQ Runoff=7.97 cfs 0.845 af

**SubcatchmentPre 1C: Pre 1C**

Runoff Area=148,816 sf 0.00% Impervious Runoff Depth=1.27"  
Flow Length=748' Tc=15.9 min CN=WQ Runoff=2.60 cfs 0.362 af

**SubcatchmentPre 1D: Pre 1D**

Runoff Area=75,728 sf 0.00% Impervious Runoff Depth=1.84"  
Flow Length=328' Tc=7.3 min CN=WQ Runoff=2.88 cfs 0.266 af

**SubcatchmentPre 1E: Pre 1E**

Runoff Area=23,853 sf 0.00% Impervious Runoff Depth=0.47"  
Flow Length=274' Tc=6.0 min CN=WQ Runoff=0.08 cfs 0.022 af

**Reach 4R: Pre Box Culvert**

Inflow=15.85 cfs 1.885 af  
Outflow=15.85 cfs 1.885 af

**17004 Pre-Post**

Type III 24-hr 100-YR-NOAA Rainfall=8.24"

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**Summary for Subcatchment Pre 1A: Pre 1A**

Runoff = 3.65 cfs @ 12.27 hrs, Volume= 0.390 af, Depth= 5.17"

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs  
Type III 24-hr 100-YR-NOAA Rainfall=8.24"

Area (sf)	CN	Description
* 4,187	77	Wetlands in A
* 25,787	77	Wetlands in D
2,589	30	Woods, Good, HSG A
0	39	>75% Grass cover, Good, HSG A
0	55	Woods, Good, HSG B
0	61	>75% Grass cover, Good, HSG B
0	70	Woods, Good, HSG C
0	74	>75% Grass cover, Good, HSG C
6,891	77	Woods, Good, HSG D
0	80	>75% Grass cover, Good, HSG D
39,454		Weighted Average
39,454	74	100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
14.9	100	0.0500	0.11		<b>Sheet Flow, sheet flow</b>
					Woods: Light underbrush n= 0.400 P2= 3.20"
5.1	338	0.0480	1.10		<b>Shallow Concentrated Flow, scf</b>
					Woodland Kv= 5.0 fps
20.0	438	Total			

**Summary for Subcatchment Pre 1B: Pre 1B**

Runoff = 7.97 cfs @ 12.27 hrs, Volume= 0.845 af, Depth= 5.26"

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs  
Type III 24-hr 100-YR-NOAA Rainfall=8.24"

Area (sf)	CN	Description
* 15,433	77	Wetlands in A
* 61,734	77	Wetlands in D
3,970	30	Woods, Good, HSG A
0	39	>75% Grass cover, Good, HSG A
0	55	Woods, Good, HSG B
0	61	>75% Grass cover, Good, HSG B
0	70	Woods, Good, HSG C
0	74	>75% Grass cover, Good, HSG C
2,890	77	Woods, Good, HSG D
0	80	>75% Grass cover, Good, HSG D
84,027		Weighted Average
84,027	75	100.00% Pervious Area

**17004 Pre-Post**

Type III 24-hr 100-YR-NOAA Rainfall=8.24"

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Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
14.9	100	0.0500	0.11		<b>Sheet Flow, sheet flow</b> Woods: Light underbrush n= 0.400 P2= 3.20"
5.0	326	0.0480	1.10		<b>Shallow Concentrated Flow, scf</b> Woodland Kv= 5.0 fps
19.9	426	Total			

**Summary for Subcatchment Pre 1C: Pre 1C**

Runoff = 2.60 cfs @ 12.22 hrs, Volume= 0.362 af, Depth= 1.27"

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs  
Type III 24-hr 100-YR-NOAA Rainfall=8.24"

Area (sf)	CN	Description
* 19,641	77	Wetlands in A
* 0	77	Wetlands in D
125,166	30	Woods, Good, HSG A
0	39	>75% Grass cover, Good, HSG A
0	55	Woods, Good, HSG B
0	61	>75% Grass cover, Good, HSG B
0	70	Woods, Good, HSG C
0	74	>75% Grass cover, Good, HSG C
4,009	77	Woods, Good, HSG D
0	80	>75% Grass cover, Good, HSG D
148,816		Weighted Average
148,816	37	100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.8	100	0.3500	0.24		<b>Sheet Flow, sheet flow</b> Woods: Light underbrush n= 0.400 P2= 3.20"
9.1	648	0.0560	1.18		<b>Shallow Concentrated Flow, scf</b> Woodland Kv= 5.0 fps
15.9	748	Total			

**Summary for Subcatchment Pre 1D: Pre 1D**

Runoff = 2.88 cfs @ 12.10 hrs, Volume= 0.266 af, Depth= 1.84"

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs  
Type III 24-hr 100-YR-NOAA Rainfall=8.24"

**17004 Pre-Post**

Type III 24-hr 100-YR-NOAA Rainfall=8.24"

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Area (sf)	CN	Description
* 20,566	77	Wetlands in A
* 0	77	Wetlands in D
55,162	30	Woods, Good, HSG A
0	39	>75% Grass cover, Good, HSG A
0	55	Woods, Good, HSG B
0	61	>75% Grass cover, Good, HSG B
0	70	Woods, Good, HSG C
0	74	>75% Grass cover, Good, HSG C
0	77	Woods, Good, HSG D
0	80	>75% Grass cover, Good, HSG D
75,728		Weighted Average
75,728	43	100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.6	30	0.3500	0.19		<b>Sheet Flow, sheet flow</b> Woods: Light underbrush n= 0.400 P2= 3.20"
4.7	298	0.0450	1.06		<b>Shallow Concentrated Flow, scf</b> Woodland Kv= 5.0 fps
7.3	328	Total			

**Summary for Subcatchment Pre 1E: Pre 1E**

Runoff = 0.08 cfs @ 12.40 hrs, Volume= 0.022 af, Depth= 0.47"

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs  
Type III 24-hr 100-YR-NOAA Rainfall=8.24"

Area (sf)	CN	Description
23,853	30	Woods, Good, HSG A
0	39	>75% Grass cover, Good, HSG A
0	55	Woods, Good, HSG B
0	61	>75% Grass cover, Good, HSG B
0	70	Woods, Good, HSG C
0	74	>75% Grass cover, Good, HSG C
0	77	Woods, Good, HSG D
0	80	>75% Grass cover, Good, HSG D
23,853		Weighted Average
23,853	30	100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.1	25	0.4000	0.19		<b>Sheet Flow, sheet flow</b> Woods: Light underbrush n= 0.400 P2= 3.20"
2.6	249	0.1000	1.58		<b>Shallow Concentrated Flow, scf</b> Woodland Kv= 5.0 fps
4.7	274	Total, Increased to minimum Tc = 6.0 min			

**17004 Pre-Post**

Type III 24-hr 100-YR-NOAA Rainfall=8.24"

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**Summary for Reach 4R: Pre Box Culvert**

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 8.537 ac, 0.00% Impervious, Inflow Depth = 2.65" for 100-YR-NOAA event  
Inflow = 15.85 cfs @ 12.25 hrs, Volume= 1.885 af  
Outflow = 15.85 cfs @ 12.25 hrs, Volume= 1.885 af, Atten= 0%, Lag= 0.0 min

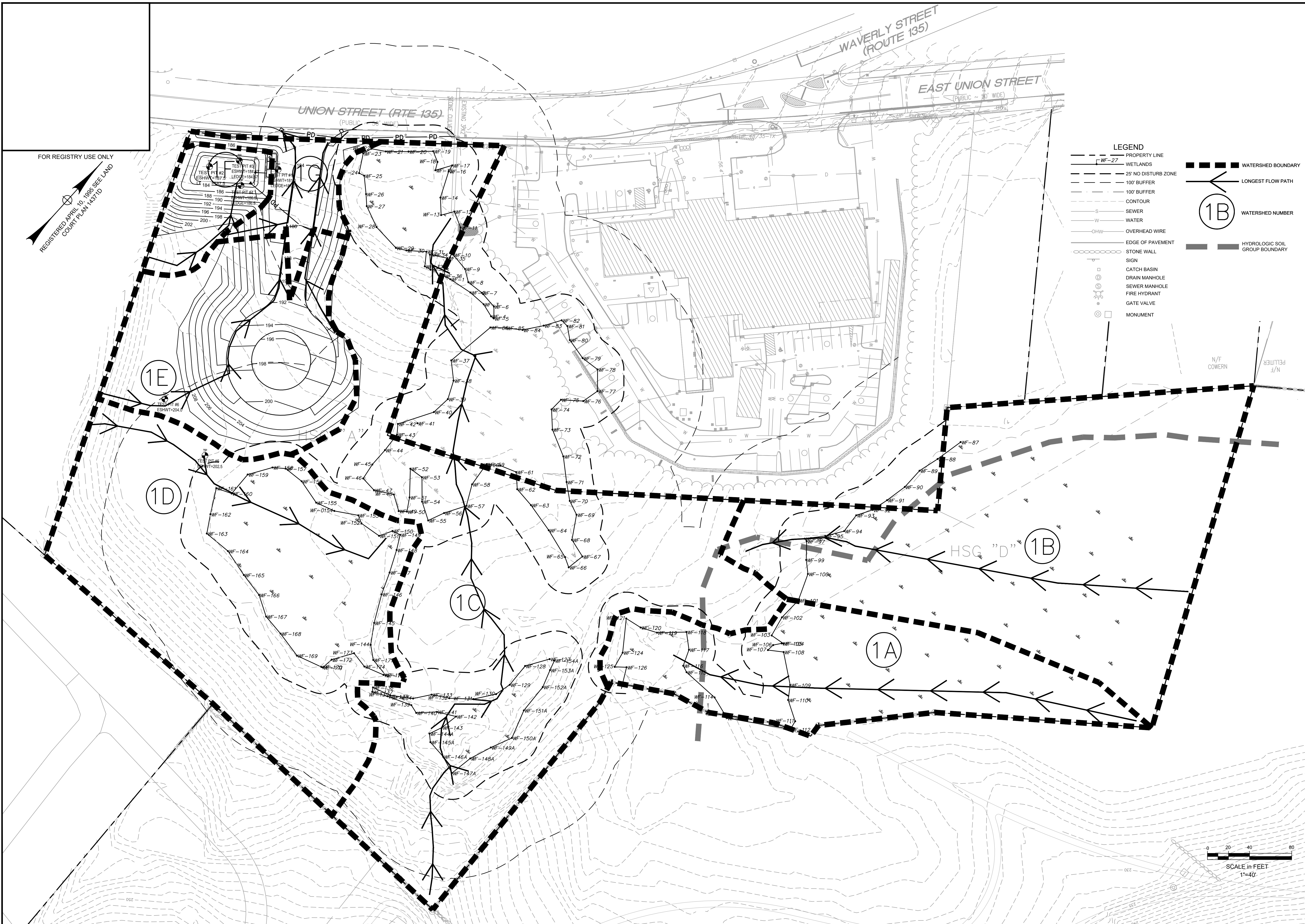
Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 2

**APPENDIX B**

Post-Development Drainage Calculations

Village at Clocktown  
Union Street  
Ashland, Massachusetts





FOR REGISTRY USE ONLY  
 REGISTERED APRIL 10, 1985 SEE LAND COURT PLAN 14377D

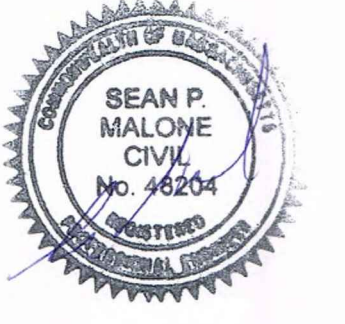
Site: **VILLAGE AT CLOCKTOWN**  
 UNION STREET  
 ASHLAND, MASSACHUSETTS  
 MAP 14, PARCELS 0076, 0077, AND 0078  
 ZONE: WILDWOOD MIXED USE SPECIAL DISTRICT  
 DEED REFERENCE: BOOK 66338, PAGE 298 AND  
 LAND COURT CERTIFICATE OF TITLE NO. 260840

Owner/Applicant:  
**58 EXCHANGE**  
**ASHLAND, LLC**  
 120 QUARRY DRIVE  
 MILFORD, MASSACHUSETTS 01757

THIS IS TO CERTIFY THAT NOTICE OF APPROVAL OF THIS PLAN BY THE ASHLAND PLANNING BOARD HAS BEEN RECEIVED AND RECORDED ON \_\_\_\_\_ AT \_\_\_\_\_ AND NO APPEAL WAS RECEIVED DURING THE 20 DAYS NEXT AFTER SUCH RECEIPT AND RECORDING OF SAID NOTICE.

TOWN CLERK \_\_\_\_\_ DATE \_\_\_\_\_  
 APPROVED SUBJECT TO COVENANT CONDITIONS SET FORTH IN A COVENANT EXECUTED BY \_\_\_\_\_ DATED \_\_\_\_\_ AND TO BE RECORDED HERewith, THIS PLAN CONFORMS WITH THE MASSACHUSETTS REGULATION 200 CMR 6:01  
 APPROVAL DATE: \_\_\_\_\_  
 ASHLAND PLANNING BOARD

SIGNATURE DATE: \_\_\_\_\_  
 BEING A MAJORITY



PROJECT ENGINEER  
**OCG**  
 Oak Consulting Group  
 P.O. Box 1123  
 Newburyport, MA 01950  
 Ph. 978.312.3120

PROJECT SURVEYOR  
**GUERRIERE & HALNON, INC**  
 333 West Street  
 Millford, MA  
 Ph. 508.473.6630

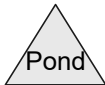
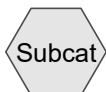
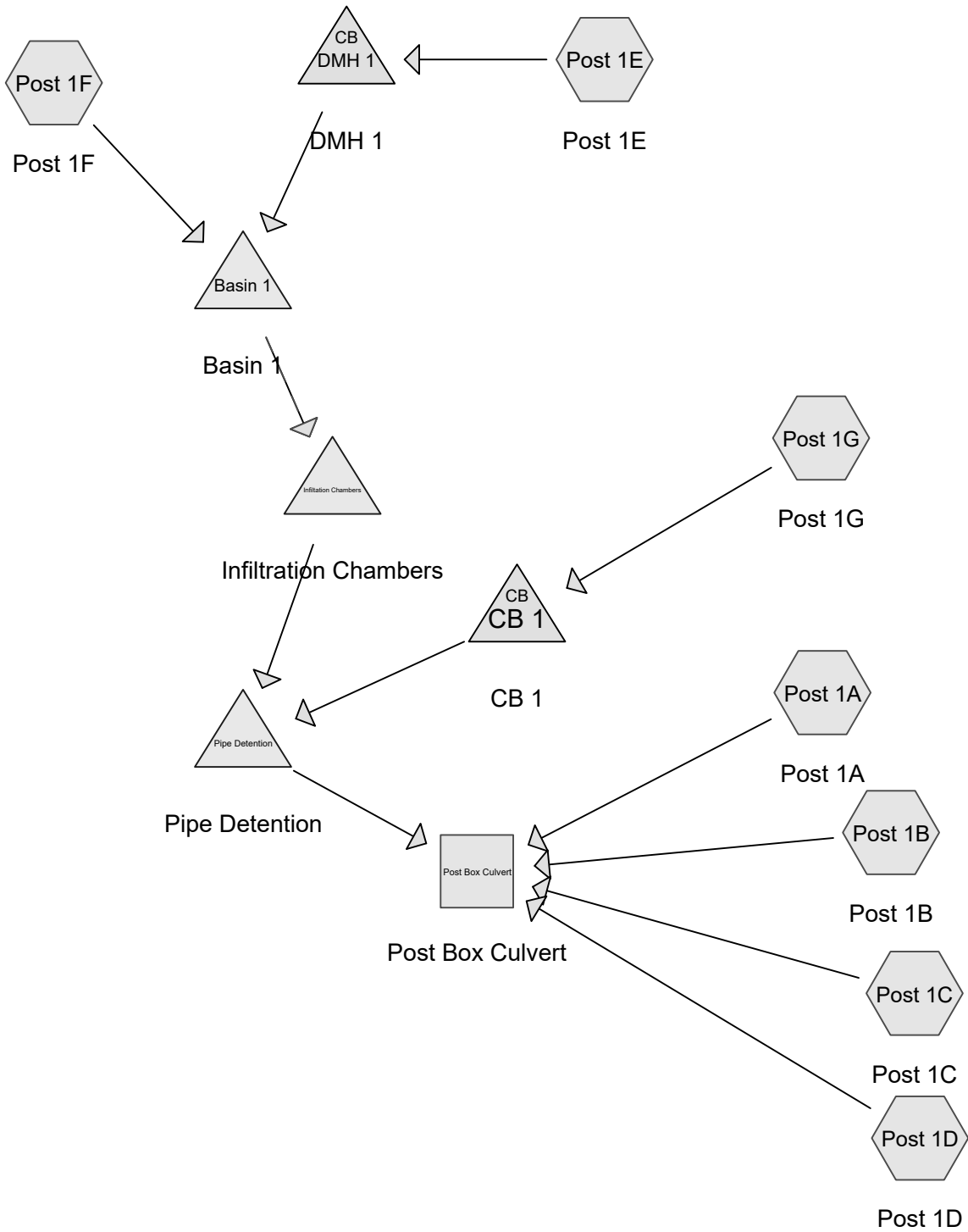
**POST-DEVELOPMENT WATERSHED PLAN**

No.	Revision/Issue	Date

Design by: SPM	Checked by: PFA
Drawn by: SPM	Approved by: PFA
Project: 17004	Date: APRIL 3, 2023

Sheet:  
**DR-002**





**Routing Diagram for 17004 Pre-Post**  
 Prepared by {enter your company name here}, Printed 4/3/2023  
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**17004 Pre-Post**

Type III 24-hr 2-YR-NOAA Rainfall=3.36"

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Time span=0.00-48.00 hrs, dt=0.01 hrs, 4801 points x 2  
 Runoff by SCS TR-20 method, UH=SCS, Weighted-Q  
 Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

<b>SubcatchmentPost 1A: Post 1A</b>	Runoff Area=39,454 sf 0.00% Impervious Runoff Depth=1.24" Flow Length=438' Tc=20.0 min CN=WQ Runoff=0.87 cfs 0.094 af
<b>SubcatchmentPost 1B: Post 1B</b>	Runoff Area=84,027 sf 0.00% Impervious Runoff Depth=1.26" Flow Length=426' Tc=19.9 min CN=WQ Runoff=1.88 cfs 0.203 af
<b>SubcatchmentPost 1C: Post 1C</b>	Runoff Area=117,424 sf 0.00% Impervious Runoff Depth=0.27" Flow Length=748' Tc=15.9 min CN=WQ Runoff=0.61 cfs 0.060 af
<b>SubcatchmentPost 1D: Post 1D</b>	Runoff Area=75,728 sf 0.00% Impervious Runoff Depth=0.36" Flow Length=328' Tc=7.3 min CN=WQ Runoff=0.69 cfs 0.052 af
<b>SubcatchmentPost 1E: Post 1E</b>	Runoff Area=36,938 sf 23.70% Impervious Runoff Depth=0.74" Flow Length=430' Tc=7.4 min CN=WQ Runoff=0.63 cfs 0.052 af
<b>SubcatchmentPost 1F: Post 1F</b>	Runoff Area=9,288 sf 0.00% Impervious Runoff Depth=0.00" Flow Length=129' Tc=6.0 min CN=WQ Runoff=0.00 cfs 0.000 af
<b>SubcatchmentPost 1G: Post 1G</b>	Runoff Area=9,018 sf 41.01% Impervious Runoff Depth=1.28" Flow Length=153' Tc=6.0 min CN=WQ Runoff=0.28 cfs 0.022 af
<b>Reach Post Box Culvert: Post Box Culvert</b>	Inflow=3.81 cfs 0.431 af Outflow=3.81 cfs 0.431 af
<b>Pond Basin 1: Basin 1</b>	Peak Elev=183.98' Storage=731 cf Inflow=0.63 cfs 0.053 af Outflow=0.10 cfs 0.053 af
<b>Pond CB 1: CB 1</b>	Peak Elev=181.29' Inflow=0.28 cfs 0.022 af 12.0" Round Culvert n=0.013 L=54.0' S=0.0050 '/ Outflow=0.28 cfs 0.022 af
<b>Pond DMH 1: DMH 1</b>	Peak Elev=184.27' Inflow=0.63 cfs 0.052 af 12.0" Round Culvert n=0.013 L=58.0' S=0.0052 '/ Outflow=0.63 cfs 0.052 af
<b>Pond Infiltration Chambers: Infiltration</b>	Peak Elev=183.93' Storage=121 cf Inflow=0.10 cfs 0.053 af Discarded=0.05 cfs 0.053 af Primary=0.00 cfs 0.000 af Outflow=0.05 cfs 0.053 af
<b>Pond Pipe Detention: Pipe Detention</b>	Peak Elev=181.29' Storage=196 cf Inflow=0.28 cfs 0.022 af Outflow=0.09 cfs 0.022 af

**17004 Pre-Post**

Type III 24-hr 2-YR-NOAA Rainfall=3.36"

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**Summary for Subcatchment Post 1A: Post 1A**

Runoff = 0.87 cfs @ 12.29 hrs, Volume= 0.094 af, Depth= 1.24"

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs  
Type III 24-hr 2-YR-NOAA Rainfall=3.36"

Area (sf)	CN	Description
* 4,187	77	Wetlands in A
* 25,787	77	Wetlands in D
2,589	30	Woods, Good, HSG A
0	39	>75% Grass cover, Good, HSG A
0	55	Woods, Good, HSG B
0	61	>75% Grass cover, Good, HSG B
0	70	Woods, Good, HSG C
0	74	>75% Grass cover, Good, HSG C
6,891	77	Woods, Good, HSG D
0	80	>75% Grass cover, Good, HSG D
39,454		Weighted Average
39,454	74	100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
14.9	100	0.0500	0.11		<b>Sheet Flow, sheet flow</b>
					Woods: Light underbrush n= 0.400 P2= 3.20"
5.1	338	0.0480	1.10		<b>Shallow Concentrated Flow, scf</b>
					Woodland Kv= 5.0 fps
20.0	438	Total			

**Summary for Subcatchment Post 1B: Post 1B**

Runoff = 1.88 cfs @ 12.29 hrs, Volume= 0.203 af, Depth= 1.26"

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs  
Type III 24-hr 2-YR-NOAA Rainfall=3.36"

Area (sf)	CN	Description
* 15,433	77	Wetlands in A
* 61,734	77	Wetlands in D
3,970	30	Woods, Good, HSG A
0	39	>75% Grass cover, Good, HSG A
0	55	Woods, Good, HSG B
0	61	>75% Grass cover, Good, HSG B
0	70	Woods, Good, HSG C
0	74	>75% Grass cover, Good, HSG C
2,890	77	Woods, Good, HSG D
0	80	>75% Grass cover, Good, HSG D
84,027		Weighted Average
84,027	75	100.00% Pervious Area

**17004 Pre-Post**

Type III 24-hr 2-YR-NOAA Rainfall=3.36"

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Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
14.9	100	0.0500	0.11		<b>Sheet Flow, sheet flow</b> Woods: Light underbrush n= 0.400 P2= 3.20"
5.0	326	0.0480	1.10		<b>Shallow Concentrated Flow, scf</b> Woodland Kv= 5.0 fps
19.9	426	Total			

**Summary for Subcatchment Post 1C: Post 1C**

Runoff = 0.61 cfs @ 12.23 hrs, Volume= 0.060 af, Depth= 0.27"

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs  
Type III 24-hr 2-YR-NOAA Rainfall=3.36"

Area (sf)	CN	Description
* 19,641	77	Wetlands in A
* 0	77	Wetlands in D
93,774	30	Woods, Good, HSG A
0	39	>75% Grass cover, Good, HSG A
0	55	Woods, Good, HSG B
0	61	>75% Grass cover, Good, HSG B
0	70	Woods, Good, HSG C
0	74	>75% Grass cover, Good, HSG C
4,009	77	Woods, Good, HSG D
0	80	>75% Grass cover, Good, HSG D
117,424		Weighted Average
117,424	39	100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.8	100	0.3500	0.24		<b>Sheet Flow, sheet flow</b> Woods: Light underbrush n= 0.400 P2= 3.20"
9.1	648	0.0560	1.18		<b>Shallow Concentrated Flow, scf</b> Woodland Kv= 5.0 fps
15.9	748	Total			

**Summary for Subcatchment Post 1D: Post 1D**

Runoff = 0.69 cfs @ 12.11 hrs, Volume= 0.052 af, Depth= 0.36"

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs  
Type III 24-hr 2-YR-NOAA Rainfall=3.36"

**17004 Pre-Post**

Type III 24-hr 2-YR-NOAA Rainfall=3.36"

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Area (sf)	CN	Description
* 20,566	77	Wetlands in A
* 0	77	Wetlands in D
55,162	30	Woods, Good, HSG A
0	39	>75% Grass cover, Good, HSG A
0	55	Woods, Good, HSG B
0	61	>75% Grass cover, Good, HSG B
0	70	Woods, Good, HSG C
0	74	>75% Grass cover, Good, HSG C
0	77	Woods, Good, HSG D
0	80	>75% Grass cover, Good, HSG D
75,728		Weighted Average
75,728	43	100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.6	30	0.3500	0.19		<b>Sheet Flow, sheet flow</b> Woods: Light underbrush n= 0.400 P2= 3.20"
4.7	298	0.0450	1.06		<b>Shallow Concentrated Flow, scf</b> Woodland Kv= 5.0 fps
7.3	328	Total			

**Summary for Subcatchment Post 1E: Post 1E**

Runoff = 0.63 cfs @ 12.10 hrs, Volume= 0.052 af, Depth= 0.74"

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs  
Type III 24-hr 2-YR-NOAA Rainfall=3.36"

Area (sf)	CN	Description
8,755	98	Paved parking, HSG A
10,798	30	Woods, Good, HSG A
17,385	39	>75% Grass cover, Good, HSG A
0	55	Woods, Good, HSG B
0	61	>75% Grass cover, Good, HSG B
0	70	Woods, Good, HSG C
0	74	>75% Grass cover, Good, HSG C
0	77	Woods, Good, HSG D
0	80	>75% Grass cover, Good, HSG D
36,938		Weighted Average
28,183	36	76.30% Pervious Area
8,755	98	23.70% Impervious Area

**17004 Pre-Post**

Type III 24-hr 2-YR-NOAA Rainfall=3.36"

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Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.3	55	0.3300	0.21		<b>Sheet Flow, sheet flow</b> Woods: Light underbrush n= 0.400 P2= 3.20"
2.4	125	0.0300	0.87		<b>Shallow Concentrated Flow, scf</b> Woodland Kv= 5.0 fps
0.1	30	0.3000	3.83		<b>Shallow Concentrated Flow, scf</b> Short Grass Pasture Kv= 7.0 fps
0.6	220	0.1000	6.42		<b>Shallow Concentrated Flow, scf</b> Paved Kv= 20.3 fps
7.4	430	Total			

**Summary for Subcatchment Post 1F: Post 1F**

Runoff = 0.00 cfs @ 23.86 hrs, Volume= 0.000 af, Depth= 0.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs  
Type III 24-hr 2-YR-NOAA Rainfall=3.36"

Area (sf)	CN	Description
0	98	Paved parking, HSG A
2,409	30	Woods, Good, HSG A
6,879	39	>75% Grass cover, Good, HSG A
0	55	Woods, Good, HSG B
0	61	>75% Grass cover, Good, HSG B
0	70	Woods, Good, HSG C
0	74	>75% Grass cover, Good, HSG C
0	77	Woods, Good, HSG D
0	80	>75% Grass cover, Good, HSG D
9,288		Weighted Average
9,288	37	100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.2	89	0.2000	0.29		<b>Sheet Flow, sheet low</b> Grass: Dense n= 0.240 P2= 3.20"
0.2	40	0.2500	3.50		<b>Shallow Concentrated Flow, scf</b> Short Grass Pasture Kv= 7.0 fps
5.4	129	Total, Increased to minimum Tc = 6.0 min			

**Summary for Subcatchment Post 1G: Post 1G**

Runoff = 0.28 cfs @ 12.08 hrs, Volume= 0.022 af, Depth= 1.28"

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs  
Type III 24-hr 2-YR-NOAA Rainfall=3.36"

**17004 Pre-Post**

Type III 24-hr 2-YR-NOAA Rainfall=3.36"

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Area (sf)	CN	Description
3,698	98	Paved parking, HSG A
0	30	Woods, Good, HSG A
5,320	39	>75% Grass cover, Good, HSG A
0	55	Woods, Good, HSG B
0	61	>75% Grass cover, Good, HSG B
0	70	Woods, Good, HSG C
0	74	>75% Grass cover, Good, HSG C
0	77	Woods, Good, HSG D
0	80	>75% Grass cover, Good, HSG D
9,018		Weighted Average
5,320	39	58.99% Pervious Area
3,698	98	41.01% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.8	50	0.3000	0.30		<b>Sheet Flow, sheet flow</b> Grass: Dense n= 0.240 P2= 3.20"
0.3	103	0.0700	5.37		<b>Shallow Concentrated Flow, scf</b> Paved Kv= 20.3 fps
3.1	153	Total, Increased to minimum Tc = 6.0 min			

**Summary for Reach Post Box Culvert: Post Box Culvert**

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 8.537 ac, 3.35% Impervious, Inflow Depth = 0.61" for 2-YR-NOAA event  
 Inflow = 3.81 cfs @ 12.27 hrs, Volume= 0.431 af  
 Outflow = 3.81 cfs @ 12.27 hrs, Volume= 0.431 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 2

**Summary for Pond Basin 1: Basin 1**

[44] Hint: Outlet device #1 is below defined storage

[87] Warning: Oscillations may require smaller dt or Finer Routing (severity=181)

Inflow Area = 1.061 ac, 18.94% Impervious, Inflow Depth = 0.59" for 2-YR-NOAA event  
 Inflow = 0.63 cfs @ 12.10 hrs, Volume= 0.053 af  
 Outflow = 0.10 cfs @ 11.65 hrs, Volume= 0.053 af, Atten= 84%, Lag= 0.0 min  
 Primary = 0.10 cfs @ 11.65 hrs, Volume= 0.053 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 2

Peak Elev= 183.98' @ 13.14 hrs Surf.Area= 1,784 sf Storage= 731 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)

Center-of-Mass det. time= 104.3 min ( 862.7 - 758.3 )

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Volume	Invert	Avail.Storage	Storage Description
#1	183.50'	5,648 cf	<b>Custom Stage Data (Prismatic)</b> Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
183.50	1,295	0	0
184.00	1,810	776	776
186.00	3,062	4,872	5,648

Device	Routing	Invert	Outlet Devices
#1	Primary	183.00'	<b>3.0" Vert. Orifice/Grate</b> C= 0.600
#2	Primary	185.50'	<b>12.0" Vert. Orifice/Grate</b> C= 0.600

**Primary OutFlow** Max=0.10 cfs @ 11.65 hrs HW=183.50' TW=183.31' (Dynamic Tailwater)

↑1=Orifice/Grate (Orifice Controls 0.10 cfs @ 2.10 fps)

└2=Orifice/Grate ( Controls 0.00 cfs)

**Summary for Pond CB 1: CB 1**

[57] Hint: Peaked at 181.29' (Flood elevation advised)

Inflow Area = 0.207 ac, 41.01% Impervious, Inflow Depth = 1.28" for 2-YR-NOAA event  
 Inflow = 0.28 cfs @ 12.08 hrs, Volume= 0.022 af  
 Outflow = 0.28 cfs @ 12.08 hrs, Volume= 0.022 af, Atten= 0%, Lag= 0.0 min  
 Primary = 0.28 cfs @ 12.08 hrs, Volume= 0.022 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 2

Peak Elev= 181.29' @ 12.34 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	180.76'	<b>12.0" Round Culvert</b> L= 54.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 180.76' / 180.49' S= 0.0050 '/' Cc= 0.900 n= 0.013, Flow Area= 0.79 sf

**Primary OutFlow** Max=0.28 cfs @ 12.08 hrs HW=181.17' TW=181.05' (Dynamic Tailwater)

↑1=Culvert (Outlet Controls 0.28 cfs @ 1.36 fps)

**Summary for Pond DMH 1: DMH 1**

[57] Hint: Peaked at 184.27' (Flood elevation advised)

Inflow Area = 0.848 ac, 23.70% Impervious, Inflow Depth = 0.74" for 2-YR-NOAA event  
 Inflow = 0.63 cfs @ 12.10 hrs, Volume= 0.052 af  
 Outflow = 0.63 cfs @ 12.10 hrs, Volume= 0.052 af, Atten= 0%, Lag= 0.0 min  
 Primary = 0.63 cfs @ 12.10 hrs, Volume= 0.052 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 2

Peak Elev= 184.27' @ 12.10 hrs

**17004 Pre-Post**

Type III 24-hr 2-YR-NOAA Rainfall=3.36"

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Device	Routing	Invert	Outlet Devices
#1	Primary	183.80'	<b>12.0" Round Culvert</b> L= 58.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 183.80' / 183.50' S= 0.0052 '/' Cc= 0.900 n= 0.013, Flow Area= 0.79 sf

**Primary OutFlow** Max=0.63 cfs @ 12.10 hrs HW=184.27' TW=183.74' (Dynamic Tailwater)  
 ↳1=Culvert (Barrel Controls 0.63 cfs @ 2.57 fps)

**Summary for Pond Infiltration Chambers: Infiltration Chambers**

[92] Warning: Device #2 is above defined storage

Inflow Area = 1.061 ac, 18.94% Impervious, Inflow Depth = 0.59" for 2-YR-NOAA event  
 Inflow = 0.10 cfs @ 11.65 hrs, Volume= 0.053 af  
 Outflow = 0.05 cfs @ 11.31 hrs, Volume= 0.053 af, Atten= 51%, Lag= 0.0 min  
 Discarded = 0.05 cfs @ 11.31 hrs, Volume= 0.053 af  
 Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 2

Peak Elev= 183.93' @ 13.25 hrs Surf.Area= 257 sf Storage= 121 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)

Center-of-Mass det. time= 22.2 min ( 884.8 - 862.7 )

Volume	Invert	Avail.Storage	Storage Description
#1	183.50'	88 cf	<b>ADS_StormTech SC-310 +Cap</b> x 6 Inside #2 Effective Size= 28.9"W x 16.0"H => 2.07 sf x 7.12'L = 14.7 cf Overall Size= 34.0"W x 16.0"H x 7.56'L with 0.44' Overlap 6 Chambers in 2 Rows
#2	183.00'	204 cf	<b>Custom Stage Data (Prismatic)</b> Listed below (Recalc) 599 cf Overall - 88 cf Embedded = 510 cf x 40.0% Voids
		293 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
183.00	257	0	0
185.33	257	599	599

Device	Routing	Invert	Outlet Devices
#1	Discarded	183.00'	<b>8.270 in/hr Exfiltration over Surface area</b>
#2	Primary	186.00'	<b>12.0" Horiz. Orifice/Grate</b> C= 0.600 Limited to weir flow at low heads

**Discarded OutFlow** Max=0.05 cfs @ 11.31 hrs HW=183.03' (Free Discharge)

↳1=Exfiltration (Exfiltration Controls 0.05 cfs)

**Primary OutFlow** Max=0.00 cfs @ 0.00 hrs HW=183.00' TW=180.39' (Dynamic Tailwater)

↳2=Orifice/Grate ( Controls 0.00 cfs)

**Summary for Pond Pipe Detention: Pipe Detention**

Inflow Area = 1.268 ac, 22.54% Impervious, Inflow Depth = 0.21" for 2-YR-NOAA event  
 Inflow = 0.28 cfs @ 12.08 hrs, Volume= 0.022 af  
 Outflow = 0.09 cfs @ 12.35 hrs, Volume= 0.022 af, Atten= 66%, Lag= 16.1 min  
 Primary = 0.09 cfs @ 12.35 hrs, Volume= 0.022 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 2  
 Peak Elev= 181.29' @ 12.35 hrs Surf.Area= 302 sf Storage= 196 cf

Plug-Flow detention time= 17.5 min calculated for 0.022 af (100% of inflow)  
 Center-of-Mass det. time= 17.5 min ( 773.8 - 756.2 )

Volume	Invert	Avail.Storage	Storage Description
#1	180.39'	778 cf	<b>36.0" Round Pipe Storage</b> L= 110.0'

Device	Routing	Invert	Outlet Devices
#1	Primary	180.39'	<b>2.0" Vert. Orifice/Grate</b> C= 0.600
#2	Primary	182.39'	<b>3.0" Vert. Orifice/Grate</b> C= 0.600

**Primary OutFlow** Max=0.09 cfs @ 12.35 hrs HW=181.29' TW=0.00' (Dynamic Tailwater)

1=Orifice/Grate (Orifice Controls 0.09 cfs @ 4.35 fps)  
 2=Orifice/Grate ( Controls 0.00 cfs)

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Type III 24-hr 10-YR-NOAA Rainfall=5.25"

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Time span=0.00-48.00 hrs, dt=0.01 hrs, 4801 points x 2  
 Runoff by SCS TR-20 method, UH=SCS, Weighted-Q  
 Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

<b>SubcatchmentPost 1A: Post 1A</b>	Runoff Area=39,454 sf 0.00% Impervious Runoff Depth=2.65" Flow Length=438' Tc=20.0 min CN=WQ Runoff=1.89 cfs 0.200 af
<b>SubcatchmentPost 1B: Post 1B</b>	Runoff Area=84,027 sf 0.00% Impervious Runoff Depth=2.70" Flow Length=426' Tc=19.9 min CN=WQ Runoff=4.13 cfs 0.434 af
<b>SubcatchmentPost 1C: Post 1C</b>	Runoff Area=117,424 sf 0.00% Impervious Runoff Depth=0.58" Flow Length=748' Tc=15.9 min CN=WQ Runoff=1.33 cfs 0.131 af
<b>SubcatchmentPost 1D: Post 1D</b>	Runoff Area=75,728 sf 0.00% Impervious Runoff Depth=0.78" Flow Length=328' Tc=7.3 min CN=WQ Runoff=1.50 cfs 0.113 af
<b>SubcatchmentPost 1E: Post 1E</b>	Runoff Area=36,938 sf 23.70% Impervious Runoff Depth=1.31" Flow Length=430' Tc=7.4 min CN=WQ Runoff=0.99 cfs 0.093 af
<b>SubcatchmentPost 1F: Post 1F</b>	Runoff Area=9,288 sf 0.00% Impervious Runoff Depth=0.19" Flow Length=129' Tc=6.0 min CN=WQ Runoff=0.01 cfs 0.003 af
<b>SubcatchmentPost 1G: Post 1G</b>	Runoff Area=9,018 sf 41.01% Impervious Runoff Depth=2.21" Flow Length=153' Tc=6.0 min CN=WQ Runoff=0.44 cfs 0.038 af
<b>Reach Post Box Culvert: Post Box Culvert</b>	Inflow=8.23 cfs 0.916 af Outflow=8.23 cfs 0.916 af
<b>Pond Basin 1: Basin 1</b>	Peak Elev=184.46' Storage=1,676 cf Inflow=0.99 cfs 0.096 af Outflow=0.11 cfs 0.096 af
<b>Pond CB 1: CB 1</b>	Peak Elev=181.83' Inflow=0.44 cfs 0.038 af 12.0" Round Culvert n=0.013 L=54.0' S=0.0050 '/' Outflow=0.44 cfs 0.038 af
<b>Pond DMH 1: DMH 1</b>	Peak Elev=184.46' Inflow=0.99 cfs 0.093 af 12.0" Round Culvert n=0.013 L=58.0' S=0.0052 '/' Outflow=0.99 cfs 0.093 af
<b>Pond Infiltration Chambers: Infiltration</b>	Peak Elev=184.42' Storage=193 cf Inflow=0.11 cfs 0.096 af Discarded=0.05 cfs 0.096 af Primary=0.00 cfs 0.000 af Outflow=0.05 cfs 0.096 af
<b>Pond Pipe Detention: Pipe Detention</b>	Peak Elev=181.83' Storage=370 cf Inflow=0.44 cfs 0.038 af Outflow=0.12 cfs 0.038 af

**17004 Pre-Post**

Type III 24-hr 10-YR-NOAA Rainfall=5.25"

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**Summary for Subcatchment Post 1A: Post 1A**

Runoff = 1.89 cfs @ 12.28 hrs, Volume= 0.200 af, Depth= 2.65"

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs  
Type III 24-hr 10-YR-NOAA Rainfall=5.25"

Area (sf)	CN	Description
* 4,187	77	Wetlands in A
* 25,787	77	Wetlands in D
2,589	30	Woods, Good, HSG A
0	39	>75% Grass cover, Good, HSG A
0	55	Woods, Good, HSG B
0	61	>75% Grass cover, Good, HSG B
0	70	Woods, Good, HSG C
0	74	>75% Grass cover, Good, HSG C
6,891	77	Woods, Good, HSG D
0	80	>75% Grass cover, Good, HSG D
39,454		Weighted Average
39,454	74	100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
14.9	100	0.0500	0.11		<b>Sheet Flow, sheet flow</b>
					Woods: Light underbrush n= 0.400 P2= 3.20"
5.1	338	0.0480	1.10		<b>Shallow Concentrated Flow, scf</b>
					Woodland Kv= 5.0 fps
20.0	438	Total			

**Summary for Subcatchment Post 1B: Post 1B**

Runoff = 4.13 cfs @ 12.27 hrs, Volume= 0.434 af, Depth= 2.70"

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs  
Type III 24-hr 10-YR-NOAA Rainfall=5.25"

Area (sf)	CN	Description
* 15,433	77	Wetlands in A
* 61,734	77	Wetlands in D
3,970	30	Woods, Good, HSG A
0	39	>75% Grass cover, Good, HSG A
0	55	Woods, Good, HSG B
0	61	>75% Grass cover, Good, HSG B
0	70	Woods, Good, HSG C
0	74	>75% Grass cover, Good, HSG C
2,890	77	Woods, Good, HSG D
0	80	>75% Grass cover, Good, HSG D
84,027		Weighted Average
84,027	75	100.00% Pervious Area

**17004 Pre-Post**

Type III 24-hr 10-YR-NOAA Rainfall=5.25"

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Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
14.9	100	0.0500	0.11		<b>Sheet Flow, sheet flow</b> Woods: Light underbrush n= 0.400 P2= 3.20"
5.0	326	0.0480	1.10		<b>Shallow Concentrated Flow, scf</b> Woodland Kv= 5.0 fps
19.9	426	Total			

**Summary for Subcatchment Post 1C: Post 1C**

Runoff = 1.33 cfs @ 12.21 hrs, Volume= 0.131 af, Depth= 0.58"

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs  
Type III 24-hr 10-YR-NOAA Rainfall=5.25"

Area (sf)	CN	Description
* 19,641	77	Wetlands in A
* 0	77	Wetlands in D
93,774	30	Woods, Good, HSG A
0	39	>75% Grass cover, Good, HSG A
0	55	Woods, Good, HSG B
0	61	>75% Grass cover, Good, HSG B
0	70	Woods, Good, HSG C
0	74	>75% Grass cover, Good, HSG C
4,009	77	Woods, Good, HSG D
0	80	>75% Grass cover, Good, HSG D
117,424		Weighted Average
117,424	39	100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.8	100	0.3500	0.24		<b>Sheet Flow, sheet flow</b> Woods: Light underbrush n= 0.400 P2= 3.20"
9.1	648	0.0560	1.18		<b>Shallow Concentrated Flow, scf</b> Woodland Kv= 5.0 fps
15.9	748	Total			

**Summary for Subcatchment Post 1D: Post 1D**

Runoff = 1.50 cfs @ 12.11 hrs, Volume= 0.113 af, Depth= 0.78"

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs  
Type III 24-hr 10-YR-NOAA Rainfall=5.25"

**17004 Pre-Post**

Type III 24-hr 10-YR-NOAA Rainfall=5.25"

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Area (sf)	CN	Description
* 20,566	77	Wetlands in A
* 0	77	Wetlands in D
55,162	30	Woods, Good, HSG A
0	39	>75% Grass cover, Good, HSG A
0	55	Woods, Good, HSG B
0	61	>75% Grass cover, Good, HSG B
0	70	Woods, Good, HSG C
0	74	>75% Grass cover, Good, HSG C
0	77	Woods, Good, HSG D
0	80	>75% Grass cover, Good, HSG D
75,728		Weighted Average
75,728	43	100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.6	30	0.3500	0.19		<b>Sheet Flow, sheet flow</b> Woods: Light underbrush n= 0.400 P2= 3.20"
4.7	298	0.0450	1.06		<b>Shallow Concentrated Flow, scf</b> Woodland Kv= 5.0 fps
7.3	328	Total			

**Summary for Subcatchment Post 1E: Post 1E**

Runoff = 0.99 cfs @ 12.10 hrs, Volume= 0.093 af, Depth= 1.31"

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs  
Type III 24-hr 10-YR-NOAA Rainfall=5.25"

Area (sf)	CN	Description
8,755	98	Paved parking, HSG A
10,798	30	Woods, Good, HSG A
17,385	39	>75% Grass cover, Good, HSG A
0	55	Woods, Good, HSG B
0	61	>75% Grass cover, Good, HSG B
0	70	Woods, Good, HSG C
0	74	>75% Grass cover, Good, HSG C
0	77	Woods, Good, HSG D
0	80	>75% Grass cover, Good, HSG D
36,938		Weighted Average
28,183	36	76.30% Pervious Area
8,755	98	23.70% Impervious Area

**17004 Pre-Post**

Type III 24-hr 10-YR-NOAA Rainfall=5.25"

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Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.3	55	0.3300	0.21		<b>Sheet Flow, sheet flow</b> Woods: Light underbrush n= 0.400 P2= 3.20"
2.4	125	0.0300	0.87		<b>Shallow Concentrated Flow, scf</b> Woodland Kv= 5.0 fps
0.1	30	0.3000	3.83		<b>Shallow Concentrated Flow, scf</b> Short Grass Pasture Kv= 7.0 fps
0.6	220	0.1000	6.42		<b>Shallow Concentrated Flow, scf</b> Paved Kv= 20.3 fps
7.4	430	Total			

**Summary for Subcatchment Post 1F: Post 1F**

Runoff = 0.01 cfs @ 12.43 hrs, Volume= 0.003 af, Depth= 0.19"

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs  
Type III 24-hr 10-YR-NOAA Rainfall=5.25"

Area (sf)	CN	Description
0	98	Paved parking, HSG A
2,409	30	Woods, Good, HSG A
6,879	39	>75% Grass cover, Good, HSG A
0	55	Woods, Good, HSG B
0	61	>75% Grass cover, Good, HSG B
0	70	Woods, Good, HSG C
0	74	>75% Grass cover, Good, HSG C
0	77	Woods, Good, HSG D
0	80	>75% Grass cover, Good, HSG D
9,288		Weighted Average
9,288	37	100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.2	89	0.2000	0.29		<b>Sheet Flow, sheet low</b> Grass: Dense n= 0.240 P2= 3.20"
0.2	40	0.2500	3.50		<b>Shallow Concentrated Flow, scf</b> Short Grass Pasture Kv= 7.0 fps
5.4	129	Total, Increased to minimum Tc = 6.0 min			

**Summary for Subcatchment Post 1G: Post 1G**

Runoff = 0.44 cfs @ 12.08 hrs, Volume= 0.038 af, Depth= 2.21"

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs  
Type III 24-hr 10-YR-NOAA Rainfall=5.25"

**17004 Pre-Post**

Type III 24-hr 10-YR-NOAA Rainfall=5.25"

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Area (sf)	CN	Description
3,698	98	Paved parking, HSG A
0	30	Woods, Good, HSG A
5,320	39	>75% Grass cover, Good, HSG A
0	55	Woods, Good, HSG B
0	61	>75% Grass cover, Good, HSG B
0	70	Woods, Good, HSG C
0	74	>75% Grass cover, Good, HSG C
0	77	Woods, Good, HSG D
0	80	>75% Grass cover, Good, HSG D
9,018		Weighted Average
5,320	39	58.99% Pervious Area
3,698	98	41.01% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.8	50	0.3000	0.30		<b>Sheet Flow, sheet flow</b> Grass: Dense n= 0.240 P2= 3.20"
0.3	103	0.0700	5.37		<b>Shallow Concentrated Flow, scf</b> Paved Kv= 20.3 fps
3.1	153	Total, Increased to minimum Tc = 6.0 min			

**Summary for Reach Post Box Culvert: Post Box Culvert**

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 8.537 ac, 3.35% Impervious, Inflow Depth = 1.29" for 10-YR-NOAA event  
 Inflow = 8.23 cfs @ 12.25 hrs, Volume= 0.916 af  
 Outflow = 8.23 cfs @ 12.25 hrs, Volume= 0.916 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 2

**Summary for Pond Basin 1: Basin 1**

[44] Hint: Outlet device #1 is below defined storage

[80] Warning: Exceeded Pond DMH 1 by 0.29' @ 24.39 hrs (0.23 cfs 0.005 af)

Inflow Area = 1.061 ac, 18.94% Impervious, Inflow Depth = 1.09" for 10-YR-NOAA event  
 Inflow = 0.99 cfs @ 12.10 hrs, Volume= 0.096 af  
 Outflow = 0.11 cfs @ 12.17 hrs, Volume= 0.096 af, Atten= 89%, Lag= 4.0 min  
 Primary = 0.11 cfs @ 12.17 hrs, Volume= 0.096 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 2

Peak Elev= 184.46' @ 15.59 hrs Surf.Area= 2,098 sf Storage= 1,676 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)

Center-of-Mass det. time= 292.6 min ( 1,073.2 - 780.6 )

**17004 Pre-Post**

Type III 24-hr 10-YR-NOAA Rainfall=5.25"

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Volume	Invert	Avail.Storage	Storage Description
#1	183.50'	5,648 cf	<b>Custom Stage Data (Prismatic)</b> Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
183.50	1,295	0	0
184.00	1,810	776	776
186.00	3,062	4,872	5,648

Device	Routing	Invert	Outlet Devices
#1	Primary	183.00'	<b>3.0" Vert. Orifice/Grate</b> C= 0.600
#2	Primary	185.50'	<b>12.0" Vert. Orifice/Grate</b> C= 0.600

**Primary OutFlow** Max=0.11 cfs @ 12.17 hrs HW=184.06' TW=183.85' (Dynamic Tailwater)

↑1=**Orifice/Grate** (Orifice Controls 0.11 cfs @ 2.19 fps)

└2=**Orifice/Grate** ( Controls 0.00 cfs)

**Summary for Pond CB 1: CB 1**

[57] Hint: Peaked at 181.83' (Flood elevation advised)

Inflow Area = 0.207 ac, 41.01% Impervious, Inflow Depth = 2.21" for 10-YR-NOAA event  
 Inflow = 0.44 cfs @ 12.08 hrs, Volume= 0.038 af  
 Outflow = 0.44 cfs @ 12.08 hrs, Volume= 0.038 af, Atten= 0%, Lag= 0.0 min  
 Primary = 0.44 cfs @ 12.08 hrs, Volume= 0.038 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 2

Peak Elev= 181.83' @ 12.44 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	180.76'	<b>12.0" Round Culvert</b> L= 54.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 180.76' / 180.49' S= 0.0050 '/' Cc= 0.900 n= 0.013, Flow Area= 0.79 sf

**Primary OutFlow** Max=0.44 cfs @ 12.08 hrs HW=181.44' TW=181.39' (Dynamic Tailwater)

↑1=**Culvert** (Outlet Controls 0.44 cfs @ 1.08 fps)

**Summary for Pond DMH 1: DMH 1**

[57] Hint: Peaked at 184.46' (Flood elevation advised)

Inflow Area = 0.848 ac, 23.70% Impervious, Inflow Depth = 1.31" for 10-YR-NOAA event  
 Inflow = 0.99 cfs @ 12.10 hrs, Volume= 0.093 af  
 Outflow = 0.99 cfs @ 12.10 hrs, Volume= 0.093 af, Atten= 0%, Lag= 0.0 min  
 Primary = 0.99 cfs @ 12.10 hrs, Volume= 0.093 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 2

Peak Elev= 184.46' @ 15.58 hrs

**17004 Pre-Post**

Type III 24-hr 10-YR-NOAA Rainfall=5.25"

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Device	Routing	Invert	Outlet Devices
#1	Primary	183.80'	<b>12.0" Round Culvert</b> L= 58.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 183.80' / 183.50' S= 0.0052 '/' Cc= 0.900 n= 0.013, Flow Area= 0.79 sf

**Primary OutFlow** Max=0.98 cfs @ 12.10 hrs HW=184.40' TW=183.95' (Dynamic Tailwater)  
 ↳1=Culvert (Outlet Controls 0.98 cfs @ 2.87 fps)

**Summary for Pond Infiltration Chambers: Infiltration Chambers**

[92] Warning: Device #2 is above defined storage

Inflow Area = 1.061 ac, 18.94% Impervious, Inflow Depth = 1.09" for 10-YR-NOAA event  
 Inflow = 0.11 cfs @ 12.17 hrs, Volume= 0.096 af  
 Outflow = 0.05 cfs @ 10.31 hrs, Volume= 0.096 af, Atten= 54%, Lag= 0.0 min  
 Discarded = 0.05 cfs @ 10.31 hrs, Volume= 0.096 af  
 Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 2

Peak Elev= 184.42' @ 15.66 hrs Surf.Area= 257 sf Storage= 193 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)

Center-of-Mass det. time= 40.0 min ( 1,113.2 - 1,073.2 )

Volume	Invert	Avail.Storage	Storage Description
#1	183.50'	88 cf	<b>ADS_StormTech SC-310 +Cap</b> x 6 Inside #2 Effective Size= 28.9"W x 16.0"H => 2.07 sf x 7.12'L = 14.7 cf Overall Size= 34.0"W x 16.0"H x 7.56'L with 0.44' Overlap 6 Chambers in 2 Rows
#2	183.00'	204 cf	<b>Custom Stage Data (Prismatic)</b> Listed below (Recalc) 599 cf Overall - 88 cf Embedded = 510 cf x 40.0% Voids
		293 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
183.00	257	0	0
185.33	257	599	599

Device	Routing	Invert	Outlet Devices
#1	Discarded	183.00'	<b>8.270 in/hr Exfiltration over Surface area</b>
#2	Primary	186.00'	<b>12.0" Horiz. Orifice/Grate</b> C= 0.600 Limited to weir flow at low heads

**Discarded OutFlow** Max=0.05 cfs @ 10.31 hrs HW=183.03' (Free Discharge)  
 ↳1=Exfiltration (Exfiltration Controls 0.05 cfs)

**Primary OutFlow** Max=0.00 cfs @ 0.00 hrs HW=183.00' TW=180.39' (Dynamic Tailwater)  
 ↳2=Orifice/Grate ( Controls 0.00 cfs)

**Summary for Pond Pipe Detention: Pipe Detention**

Inflow Area = 1.268 ac, 22.54% Impervious, Inflow Depth = 0.36" for 10-YR-NOAA event  
 Inflow = 0.44 cfs @ 12.08 hrs, Volume= 0.038 af  
 Outflow = 0.12 cfs @ 12.44 hrs, Volume= 0.038 af, Atten= 72%, Lag= 21.2 min  
 Primary = 0.12 cfs @ 12.44 hrs, Volume= 0.038 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 2  
 Peak Elev= 181.83' @ 12.44 hrs Surf.Area= 330 sf Storage= 370 cf

Plug-Flow detention time= 23.4 min calculated for 0.038 af (100% of inflow)  
 Center-of-Mass det. time= 23.4 min ( 787.3 - 764.0 )

Volume	Invert	Avail.Storage	Storage Description
#1	180.39'	778 cf	<b>36.0" Round Pipe Storage</b> L= 110.0'

Device	Routing	Invert	Outlet Devices
#1	Primary	180.39'	<b>2.0" Vert. Orifice/Grate</b> C= 0.600
#2	Primary	182.39'	<b>3.0" Vert. Orifice/Grate</b> C= 0.600

**Primary OutFlow** Max=0.12 cfs @ 12.44 hrs HW=181.83' TW=0.00' (Dynamic Tailwater)

1=Orifice/Grate (Orifice Controls 0.12 cfs @ 5.62 fps)  
 2=Orifice/Grate ( Controls 0.00 cfs)

**17004 Pre-Post**

Type III 24-hr 25-YR-NOAA Rainfall=6.42"

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Time span=0.00-48.00 hrs, dt=0.01 hrs, 4801 points x 2  
 Runoff by SCS TR-20 method, UH=SCS, Weighted-Q  
 Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

<b>SubcatchmentPost 1A: Post 1A</b>	Runoff Area=39,454 sf 0.00% Impervious Runoff Depth=3.60" Flow Length=438' Tc=20.0 min CN=WQ Runoff=2.57 cfs 0.272 af
<b>SubcatchmentPost 1B: Post 1B</b>	Runoff Area=84,027 sf 0.00% Impervious Runoff Depth=3.67" Flow Length=426' Tc=19.9 min CN=WQ Runoff=5.61 cfs 0.590 af
<b>SubcatchmentPost 1C: Post 1C</b>	Runoff Area=117,424 sf 0.00% Impervious Runoff Depth=0.87" Flow Length=748' Tc=15.9 min CN=WQ Runoff=1.81 cfs 0.196 af
<b>SubcatchmentPost 1D: Post 1D</b>	Runoff Area=75,728 sf 0.00% Impervious Runoff Depth=1.13" Flow Length=328' Tc=7.3 min CN=WQ Runoff=2.03 cfs 0.164 af
<b>SubcatchmentPost 1E: Post 1E</b>	Runoff Area=36,938 sf 23.70% Impervious Runoff Depth=1.77" Flow Length=430' Tc=7.4 min CN=WQ Runoff=1.25 cfs 0.125 af
<b>SubcatchmentPost 1F: Post 1F</b>	Runoff Area=9,288 sf 0.00% Impervious Runoff Depth=0.46" Flow Length=129' Tc=6.0 min CN=WQ Runoff=0.04 cfs 0.008 af
<b>SubcatchmentPost 1G: Post 1G</b>	Runoff Area=9,018 sf 41.01% Impervious Runoff Depth=2.87" Flow Length=153' Tc=6.0 min CN=WQ Runoff=0.55 cfs 0.050 af
<b>Reach Post Box Culvert: Post Box Culvert</b>	Inflow=11.15 cfs 1.272 af Outflow=11.15 cfs 1.272 af
<b>Pond Basin 1: Basin 1</b>	Peak Elev=184.94' Storage=2,763 cf Inflow=1.28 cfs 0.133 af Outflow=0.12 cfs 0.133 af
<b>Pond CB 1: CB 1</b>	Peak Elev=182.29' Inflow=0.55 cfs 0.050 af 12.0" Round Culvert n=0.013 L=54.0' S=0.0050 '/ Outflow=0.55 cfs 0.050 af
<b>Pond DMH 1: DMH 1</b>	Peak Elev=184.94' Inflow=1.25 cfs 0.125 af 12.0" Round Culvert n=0.013 L=58.0' S=0.0052 '/ Outflow=1.25 cfs 0.125 af
<b>Pond Infiltration Chambers: Infiltration</b>	Peak Elev=184.90' Storage=248 cf Inflow=0.12 cfs 0.133 af Discarded=0.05 cfs 0.133 af Primary=0.00 cfs 0.000 af Outflow=0.05 cfs 0.133 af
<b>Pond Pipe Detention: Pipe Detention</b>	Peak Elev=182.28' Storage=517 cf Inflow=0.55 cfs 0.050 af Outflow=0.14 cfs 0.050 af

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**Summary for Subcatchment Post 1A: Post 1A**

Runoff = 2.57 cfs @ 12.27 hrs, Volume= 0.272 af, Depth= 3.60"

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs  
Type III 24-hr 25-YR-NOAA Rainfall=6.42"

Area (sf)	CN	Description
* 4,187	77	Wetlands in A
* 25,787	77	Wetlands in D
2,589	30	Woods, Good, HSG A
0	39	>75% Grass cover, Good, HSG A
0	55	Woods, Good, HSG B
0	61	>75% Grass cover, Good, HSG B
0	70	Woods, Good, HSG C
0	74	>75% Grass cover, Good, HSG C
6,891	77	Woods, Good, HSG D
0	80	>75% Grass cover, Good, HSG D
39,454		Weighted Average
39,454	74	100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
14.9	100	0.0500	0.11		<b>Sheet Flow, sheet flow</b>
					Woods: Light underbrush n= 0.400 P2= 3.20"
5.1	338	0.0480	1.10		<b>Shallow Concentrated Flow, scf</b>
					Woodland Kv= 5.0 fps
20.0	438	Total			

**Summary for Subcatchment Post 1B: Post 1B**

Runoff = 5.61 cfs @ 12.27 hrs, Volume= 0.590 af, Depth= 3.67"

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs  
Type III 24-hr 25-YR-NOAA Rainfall=6.42"

Area (sf)	CN	Description
* 15,433	77	Wetlands in A
* 61,734	77	Wetlands in D
3,970	30	Woods, Good, HSG A
0	39	>75% Grass cover, Good, HSG A
0	55	Woods, Good, HSG B
0	61	>75% Grass cover, Good, HSG B
0	70	Woods, Good, HSG C
0	74	>75% Grass cover, Good, HSG C
2,890	77	Woods, Good, HSG D
0	80	>75% Grass cover, Good, HSG D
84,027		Weighted Average
84,027	75	100.00% Pervious Area

**17004 Pre-Post**

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Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
14.9	100	0.0500	0.11		<b>Sheet Flow, sheet flow</b> Woods: Light underbrush n= 0.400 P2= 3.20"
5.0	326	0.0480	1.10		<b>Shallow Concentrated Flow, scf</b> Woodland Kv= 5.0 fps
19.9	426	Total			

**Summary for Subcatchment Post 1C: Post 1C**

Runoff = 1.81 cfs @ 12.21 hrs, Volume= 0.196 af, Depth= 0.87"

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs  
Type III 24-hr 25-YR-NOAA Rainfall=6.42"

Area (sf)	CN	Description
* 19,641	77	Wetlands in A
* 0	77	Wetlands in D
93,774	30	Woods, Good, HSG A
0	39	>75% Grass cover, Good, HSG A
0	55	Woods, Good, HSG B
0	61	>75% Grass cover, Good, HSG B
0	70	Woods, Good, HSG C
0	74	>75% Grass cover, Good, HSG C
4,009	77	Woods, Good, HSG D
0	80	>75% Grass cover, Good, HSG D
117,424		Weighted Average
117,424	39	100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.8	100	0.3500	0.24		<b>Sheet Flow, sheet flow</b> Woods: Light underbrush n= 0.400 P2= 3.20"
9.1	648	0.0560	1.18		<b>Shallow Concentrated Flow, scf</b> Woodland Kv= 5.0 fps
15.9	748	Total			

**Summary for Subcatchment Post 1D: Post 1D**

Runoff = 2.03 cfs @ 12.11 hrs, Volume= 0.164 af, Depth= 1.13"

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs  
Type III 24-hr 25-YR-NOAA Rainfall=6.42"

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Area (sf)	CN	Description
* 20,566	77	Wetlands in A
* 0	77	Wetlands in D
55,162	30	Woods, Good, HSG A
0	39	>75% Grass cover, Good, HSG A
0	55	Woods, Good, HSG B
0	61	>75% Grass cover, Good, HSG B
0	70	Woods, Good, HSG C
0	74	>75% Grass cover, Good, HSG C
0	77	Woods, Good, HSG D
0	80	>75% Grass cover, Good, HSG D
75,728		Weighted Average
75,728	43	100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.6	30	0.3500	0.19		<b>Sheet Flow, sheet flow</b> Woods: Light underbrush n= 0.400 P2= 3.20"
4.7	298	0.0450	1.06		<b>Shallow Concentrated Flow, scf</b> Woodland Kv= 5.0 fps
7.3	328	Total			

**Summary for Subcatchment Post 1E: Post 1E**

Runoff = 1.25 cfs @ 12.11 hrs, Volume= 0.125 af, Depth= 1.77"

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs  
Type III 24-hr 25-YR-NOAA Rainfall=6.42"

Area (sf)	CN	Description
8,755	98	Paved parking, HSG A
10,798	30	Woods, Good, HSG A
17,385	39	>75% Grass cover, Good, HSG A
0	55	Woods, Good, HSG B
0	61	>75% Grass cover, Good, HSG B
0	70	Woods, Good, HSG C
0	74	>75% Grass cover, Good, HSG C
0	77	Woods, Good, HSG D
0	80	>75% Grass cover, Good, HSG D
36,938		Weighted Average
28,183	36	76.30% Pervious Area
8,755	98	23.70% Impervious Area

**17004 Pre-Post**

Type III 24-hr 25-YR-NOAA Rainfall=6.42"

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Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.3	55	0.3300	0.21		<b>Sheet Flow, sheet flow</b> Woods: Light underbrush n= 0.400 P2= 3.20"
2.4	125	0.0300	0.87		<b>Shallow Concentrated Flow, scf</b> Woodland Kv= 5.0 fps
0.1	30	0.3000	3.83		<b>Shallow Concentrated Flow, scf</b> Short Grass Pasture Kv= 7.0 fps
0.6	220	0.1000	6.42		<b>Shallow Concentrated Flow, scf</b> Paved Kv= 20.3 fps
7.4	430	Total			

**Summary for Subcatchment Post 1F: Post 1F**

Runoff = 0.04 cfs @ 12.30 hrs, Volume= 0.008 af, Depth= 0.46"

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs  
Type III 24-hr 25-YR-NOAA Rainfall=6.42"

Area (sf)	CN	Description
0	98	Paved parking, HSG A
2,409	30	Woods, Good, HSG A
6,879	39	>75% Grass cover, Good, HSG A
0	55	Woods, Good, HSG B
0	61	>75% Grass cover, Good, HSG B
0	70	Woods, Good, HSG C
0	74	>75% Grass cover, Good, HSG C
0	77	Woods, Good, HSG D
0	80	>75% Grass cover, Good, HSG D
9,288		Weighted Average
9,288	37	100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.2	89	0.2000	0.29		<b>Sheet Flow, sheet low</b> Grass: Dense n= 0.240 P2= 3.20"
0.2	40	0.2500	3.50		<b>Shallow Concentrated Flow, scf</b> Short Grass Pasture Kv= 7.0 fps
5.4	129	Total, Increased to minimum Tc = 6.0 min			

**Summary for Subcatchment Post 1G: Post 1G**

Runoff = 0.55 cfs @ 12.09 hrs, Volume= 0.050 af, Depth= 2.87"

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs  
Type III 24-hr 25-YR-NOAA Rainfall=6.42"

**17004 Pre-Post**

Type III 24-hr 25-YR-NOAA Rainfall=6.42"

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Area (sf)	CN	Description
3,698	98	Paved parking, HSG A
0	30	Woods, Good, HSG A
5,320	39	>75% Grass cover, Good, HSG A
0	55	Woods, Good, HSG B
0	61	>75% Grass cover, Good, HSG B
0	70	Woods, Good, HSG C
0	74	>75% Grass cover, Good, HSG C
0	77	Woods, Good, HSG D
0	80	>75% Grass cover, Good, HSG D
9,018		Weighted Average
5,320	39	58.99% Pervious Area
3,698	98	41.01% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.8	50	0.3000	0.30		<b>Sheet Flow, sheet flow</b> Grass: Dense n= 0.240 P2= 3.20"
0.3	103	0.0700	5.37		<b>Shallow Concentrated Flow, scf</b> Paved Kv= 20.3 fps
3.1	153	Total, Increased to minimum Tc = 6.0 min			

**Summary for Reach Post Box Culvert: Post Box Culvert**

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 8.537 ac, 3.35% Impervious, Inflow Depth = 1.79" for 25-YR-NOAA event  
 Inflow = 11.15 cfs @ 12.25 hrs, Volume= 1.272 af  
 Outflow = 11.15 cfs @ 12.25 hrs, Volume= 1.272 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 2

**Summary for Pond Basin 1: Basin 1**

[44] Hint: Outlet device #1 is below defined storage

[80] Warning: Exceeded Pond DMH 1 by 0.97' @ 24.31 hrs (2.10 cfs 0.147 af)

Inflow Area = 1.061 ac, 18.94% Impervious, Inflow Depth = 1.51" for 25-YR-NOAA event  
 Inflow = 1.28 cfs @ 12.11 hrs, Volume= 0.133 af  
 Outflow = 0.12 cfs @ 12.18 hrs, Volume= 0.133 af, Atten= 91%, Lag= 4.4 min  
 Primary = 0.12 cfs @ 12.18 hrs, Volume= 0.133 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 2

Peak Elev= 184.94' @ 17.35 hrs Surf.Area= 2,401 sf Storage= 2,763 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)

Center-of-Mass det. time= 496.1 min ( 1,289.4 - 793.3 )

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Volume	Invert	Avail.Storage	Storage Description
#1	183.50'	5,648 cf	<b>Custom Stage Data (Prismatic)</b> Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
183.50	1,295	0	0
184.00	1,810	776	776
186.00	3,062	4,872	5,648

Device	Routing	Invert	Outlet Devices
#1	Primary	183.00'	<b>3.0" Vert. Orifice/Grate</b> C= 0.600
#2	Primary	185.50'	<b>12.0" Vert. Orifice/Grate</b> C= 0.600

**Primary OutFlow** Max=0.12 cfs @ 12.18 hrs HW=184.26' TW=184.01' (Dynamic Tailwater)

↑1=**Orifice/Grate** (Orifice Controls 0.12 cfs @ 2.41 fps)

└2=**Orifice/Grate** ( Controls 0.00 cfs)

**Summary for Pond CB 1: CB 1**

[57] Hint: Peaked at 182.29' (Flood elevation advised)

Inflow Area = 0.207 ac, 41.01% Impervious, Inflow Depth = 2.87" for 25-YR-NOAA event  
 Inflow = 0.55 cfs @ 12.09 hrs, Volume= 0.050 af  
 Outflow = 0.55 cfs @ 12.09 hrs, Volume= 0.050 af, Atten= 0%, Lag= 0.0 min  
 Primary = 0.55 cfs @ 12.09 hrs, Volume= 0.050 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 2

Peak Elev= 182.29' @ 12.48 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	180.76'	<b>12.0" Round Culvert</b> L= 54.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 180.76' / 180.49' S= 0.0050 '/' Cc= 0.900 n= 0.013, Flow Area= 0.79 sf

**Primary OutFlow** Max=0.55 cfs @ 12.09 hrs HW=181.66' TW=181.62' (Dynamic Tailwater)

↑1=**Culvert** (Outlet Controls 0.55 cfs @ 0.97 fps)

**Summary for Pond DMH 1: DMH 1**

[57] Hint: Peaked at 184.94' (Flood elevation advised)

Inflow Area = 0.848 ac, 23.70% Impervious, Inflow Depth = 1.77" for 25-YR-NOAA event  
 Inflow = 1.25 cfs @ 12.11 hrs, Volume= 0.125 af  
 Outflow = 1.25 cfs @ 12.11 hrs, Volume= 0.125 af, Atten= 0%, Lag= 0.0 min  
 Primary = 1.25 cfs @ 12.11 hrs, Volume= 0.125 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 2

Peak Elev= 184.94' @ 17.34 hrs

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Device	Routing	Invert	Outlet Devices
#1	Primary	183.80'	<b>12.0" Round Culvert</b> L= 58.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 183.80' / 183.50' S= 0.0052 '/' Cc= 0.900 n= 0.013, Flow Area= 0.79 sf

**Primary OutFlow** Max=1.25 cfs @ 12.11 hrs HW=184.52' TW=184.11' (Dynamic Tailwater)  
 ↳1=Culvert (Outlet Controls 1.25 cfs @ 2.87 fps)

**Summary for Pond Infiltration Chambers: Infiltration Chambers**

[92] Warning: Device #2 is above defined storage

Inflow Area = 1.061 ac, 18.94% Impervious, Inflow Depth = 1.51" for 25-YR-NOAA event  
 Inflow = 0.12 cfs @ 12.18 hrs, Volume= 0.133 af  
 Outflow = 0.05 cfs @ 9.59 hrs, Volume= 0.133 af, Atten= 58%, Lag= 0.0 min  
 Discarded = 0.05 cfs @ 9.59 hrs, Volume= 0.133 af  
 Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 2  
 Peak Elev= 184.90' @ 17.40 hrs Surf.Area= 257 sf Storage= 248 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)  
 Center-of-Mass det. time= 53.6 min ( 1,343.1 - 1,289.4 )

Volume	Invert	Avail.Storage	Storage Description
#1	183.50'	88 cf	<b>ADS_StormTech SC-310 +Cap</b> x 6 Inside #2 Effective Size= 28.9"W x 16.0"H => 2.07 sf x 7.12'L = 14.7 cf Overall Size= 34.0"W x 16.0"H x 7.56'L with 0.44' Overlap 6 Chambers in 2 Rows
#2	183.00'	204 cf	<b>Custom Stage Data (Prismatic)</b> Listed below (Recalc) 599 cf Overall - 88 cf Embedded = 510 cf x 40.0% Voids
		293 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
183.00	257	0	0
185.33	257	599	599

Device	Routing	Invert	Outlet Devices
#1	Discarded	183.00'	<b>8.270 in/hr Exfiltration over Surface area</b>
#2	Primary	186.00'	<b>12.0" Horiz. Orifice/Grate</b> C= 0.600 Limited to weir flow at low heads

**Discarded OutFlow** Max=0.05 cfs @ 9.59 hrs HW=183.03' (Free Discharge)  
 ↳1=Exfiltration (Exfiltration Controls 0.05 cfs)

**Primary OutFlow** Max=0.00 cfs @ 0.00 hrs HW=183.00' TW=180.39' (Dynamic Tailwater)  
 ↳2=Orifice/Grate ( Controls 0.00 cfs)

**Summary for Pond Pipe Detention: Pipe Detention**

Inflow Area = 1.268 ac, 22.54% Impervious, Inflow Depth = 0.47" for 25-YR-NOAA event  
 Inflow = 0.55 cfs @ 12.09 hrs, Volume= 0.050 af  
 Outflow = 0.14 cfs @ 12.48 hrs, Volume= 0.050 af, Atten= 74%, Lag= 23.8 min  
 Primary = 0.14 cfs @ 12.48 hrs, Volume= 0.050 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 2  
 Peak Elev= 182.28' @ 12.48 hrs Surf.Area= 318 sf Storage= 517 cf

Plug-Flow detention time= 28.4 min calculated for 0.050 af (100% of inflow)  
 Center-of-Mass det. time= 28.4 min ( 796.3 - 767.9 )

Volume	Invert	Avail.Storage	Storage Description
#1	180.39'	778 cf	<b>36.0" Round Pipe Storage</b> L= 110.0'

Device	Routing	Invert	Outlet Devices
#1	Primary	180.39'	<b>2.0" Vert. Orifice/Grate</b> C= 0.600
#2	Primary	182.39'	<b>3.0" Vert. Orifice/Grate</b> C= 0.600

**Primary OutFlow** Max=0.14 cfs @ 12.48 hrs HW=182.28' TW=0.00' (Dynamic Tailwater)  
 1=Orifice/Grate (Orifice Controls 0.14 cfs @ 6.48 fps)  
 2=Orifice/Grate ( Controls 0.00 cfs)

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Time span=0.00-48.00 hrs, dt=0.01 hrs, 4801 points x 2  
 Runoff by SCS TR-20 method, UH=SCS, Weighted-Q  
 Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

<b>SubcatchmentPost 1A: Post 1A</b>	Runoff Area=39,454 sf 0.00% Impervious Runoff Depth=4.34" Flow Length=438' Tc=20.0 min CN=WQ Runoff=3.09 cfs 0.328 af
<b>SubcatchmentPost 1B: Post 1B</b>	Runoff Area=84,027 sf 0.00% Impervious Runoff Depth=4.42" Flow Length=426' Tc=19.9 min CN=WQ Runoff=6.73 cfs 0.711 af
<b>SubcatchmentPost 1C: Post 1C</b>	Runoff Area=117,424 sf 0.00% Impervious Runoff Depth=1.14" Flow Length=748' Tc=15.9 min CN=WQ Runoff=2.18 cfs 0.257 af
<b>SubcatchmentPost 1D: Post 1D</b>	Runoff Area=75,728 sf 0.00% Impervious Runoff Depth=1.45" Flow Length=328' Tc=7.3 min CN=WQ Runoff=2.44 cfs 0.210 af
<b>SubcatchmentPost 1E: Post 1E</b>	Runoff Area=36,938 sf 23.70% Impervious Runoff Depth=2.16" Flow Length=430' Tc=7.4 min CN=WQ Runoff=1.54 cfs 0.153 af
<b>SubcatchmentPost 1F: Post 1F</b>	Runoff Area=9,288 sf 0.00% Impervious Runoff Depth=0.72" Flow Length=129' Tc=6.0 min CN=WQ Runoff=0.09 cfs 0.013 af
<b>SubcatchmentPost 1G: Post 1G</b>	Runoff Area=9,018 sf 41.01% Impervious Runoff Depth=3.41" Flow Length=153' Tc=6.0 min CN=WQ Runoff=0.66 cfs 0.059 af
<b>Reach Post Box Culvert: Post Box Culvert</b>	Inflow=13.36 cfs 1.564 af Outflow=13.36 cfs 1.564 af
<b>Pond Basin 1: Basin 1</b>	Peak Elev=185.37' Storage=3,837 cf Inflow=1.62 cfs 0.165 af Outflow=0.13 cfs 0.165 af
<b>Pond CB 1: CB 1</b>	Peak Elev=182.60' Inflow=0.66 cfs 0.059 af 12.0" Round Culvert n=0.013 L=54.0' S=0.0050 '/ Outflow=0.66 cfs 0.059 af
<b>Pond DMH 1: DMH 1</b>	Peak Elev=185.37' Inflow=1.54 cfs 0.153 af 12.0" Round Culvert n=0.013 L=58.0' S=0.0052 '/ Outflow=1.54 cfs 0.153 af
<b>Pond Infiltration Chambers: Infiltration</b>	Peak Elev=185.32' Storage=292 cf Inflow=0.13 cfs 0.165 af Discarded=0.05 cfs 0.165 af Primary=0.00 cfs 0.000 af Outflow=0.05 cfs 0.165 af
<b>Pond Pipe Detention: Pipe Detention</b>	Peak Elev=182.59' Storage=612 cf Inflow=0.66 cfs 0.059 af Outflow=0.22 cfs 0.059 af

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**Summary for Subcatchment Post 1A: Post 1A**

Runoff = 3.09 cfs @ 12.27 hrs, Volume= 0.328 af, Depth= 4.34"

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs  
Type III 24-hr 50-YR-NOAA Rainfall=7.29"

Area (sf)	CN	Description
* 4,187	77	Wetlands in A
* 25,787	77	Wetlands in D
2,589	30	Woods, Good, HSG A
0	39	>75% Grass cover, Good, HSG A
0	55	Woods, Good, HSG B
0	61	>75% Grass cover, Good, HSG B
0	70	Woods, Good, HSG C
0	74	>75% Grass cover, Good, HSG C
6,891	77	Woods, Good, HSG D
0	80	>75% Grass cover, Good, HSG D
39,454		Weighted Average
39,454	74	100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
14.9	100	0.0500	0.11		<b>Sheet Flow, sheet flow</b>
					Woods: Light underbrush n= 0.400 P2= 3.20"
5.1	338	0.0480	1.10		<b>Shallow Concentrated Flow, scf</b>
					Woodland Kv= 5.0 fps
20.0	438	Total			

**Summary for Subcatchment Post 1B: Post 1B**

Runoff = 6.73 cfs @ 12.27 hrs, Volume= 0.711 af, Depth= 4.42"

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs  
Type III 24-hr 50-YR-NOAA Rainfall=7.29"

Area (sf)	CN	Description
* 15,433	77	Wetlands in A
* 61,734	77	Wetlands in D
3,970	30	Woods, Good, HSG A
0	39	>75% Grass cover, Good, HSG A
0	55	Woods, Good, HSG B
0	61	>75% Grass cover, Good, HSG B
0	70	Woods, Good, HSG C
0	74	>75% Grass cover, Good, HSG C
2,890	77	Woods, Good, HSG D
0	80	>75% Grass cover, Good, HSG D
84,027		Weighted Average
84,027	75	100.00% Pervious Area

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Type III 24-hr 50-YR-NOAA Rainfall=7.29"

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Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
14.9	100	0.0500	0.11		<b>Sheet Flow, sheet flow</b> Woods: Light underbrush n= 0.400 P2= 3.20"
5.0	326	0.0480	1.10		<b>Shallow Concentrated Flow, scf</b> Woodland Kv= 5.0 fps
19.9	426	Total			

**Summary for Subcatchment Post 1C: Post 1C**

Runoff = 2.18 cfs @ 12.21 hrs, Volume= 0.257 af, Depth= 1.14"

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs  
Type III 24-hr 50-YR-NOAA Rainfall=7.29"

Area (sf)	CN	Description
* 19,641	77	Wetlands in A
* 0	77	Wetlands in D
93,774	30	Woods, Good, HSG A
0	39	>75% Grass cover, Good, HSG A
0	55	Woods, Good, HSG B
0	61	>75% Grass cover, Good, HSG B
0	70	Woods, Good, HSG C
0	74	>75% Grass cover, Good, HSG C
4,009	77	Woods, Good, HSG D
0	80	>75% Grass cover, Good, HSG D
117,424		Weighted Average
117,424	39	100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.8	100	0.3500	0.24		<b>Sheet Flow, sheet flow</b> Woods: Light underbrush n= 0.400 P2= 3.20"
9.1	648	0.0560	1.18		<b>Shallow Concentrated Flow, scf</b> Woodland Kv= 5.0 fps
15.9	748	Total			

**Summary for Subcatchment Post 1D: Post 1D**

Runoff = 2.44 cfs @ 12.10 hrs, Volume= 0.210 af, Depth= 1.45"

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs  
Type III 24-hr 50-YR-NOAA Rainfall=7.29"

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Area (sf)	CN	Description
* 20,566	77	Wetlands in A
* 0	77	Wetlands in D
55,162	30	Woods, Good, HSG A
0	39	>75% Grass cover, Good, HSG A
0	55	Woods, Good, HSG B
0	61	>75% Grass cover, Good, HSG B
0	70	Woods, Good, HSG C
0	74	>75% Grass cover, Good, HSG C
0	77	Woods, Good, HSG D
0	80	>75% Grass cover, Good, HSG D
75,728		Weighted Average
75,728	43	100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.6	30	0.3500	0.19		<b>Sheet Flow, sheet flow</b> Woods: Light underbrush n= 0.400 P2= 3.20"
4.7	298	0.0450	1.06		<b>Shallow Concentrated Flow, scf</b> Woodland Kv= 5.0 fps
7.3	328	Total			

**Summary for Subcatchment Post 1E: Post 1E**

Runoff = 1.54 cfs @ 12.11 hrs, Volume= 0.153 af, Depth= 2.16"

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs  
Type III 24-hr 50-YR-NOAA Rainfall=7.29"

Area (sf)	CN	Description
8,755	98	Paved parking, HSG A
10,798	30	Woods, Good, HSG A
17,385	39	>75% Grass cover, Good, HSG A
0	55	Woods, Good, HSG B
0	61	>75% Grass cover, Good, HSG B
0	70	Woods, Good, HSG C
0	74	>75% Grass cover, Good, HSG C
0	77	Woods, Good, HSG D
0	80	>75% Grass cover, Good, HSG D
36,938		Weighted Average
28,183	36	76.30% Pervious Area
8,755	98	23.70% Impervious Area

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Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.3	55	0.3300	0.21		<b>Sheet Flow, sheet flow</b> Woods: Light underbrush n= 0.400 P2= 3.20"
2.4	125	0.0300	0.87		<b>Shallow Concentrated Flow, scf</b> Woodland Kv= 5.0 fps
0.1	30	0.3000	3.83		<b>Shallow Concentrated Flow, scf</b> Short Grass Pasture Kv= 7.0 fps
0.6	220	0.1000	6.42		<b>Shallow Concentrated Flow, scf</b> Paved Kv= 20.3 fps
7.4	430	Total			

**Summary for Subcatchment Post 1F: Post 1F**

Runoff = 0.09 cfs @ 12.13 hrs, Volume= 0.013 af, Depth= 0.72"

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs  
Type III 24-hr 50-YR-NOAA Rainfall=7.29"

Area (sf)	CN	Description
0	98	Paved parking, HSG A
2,409	30	Woods, Good, HSG A
6,879	39	>75% Grass cover, Good, HSG A
0	55	Woods, Good, HSG B
0	61	>75% Grass cover, Good, HSG B
0	70	Woods, Good, HSG C
0	74	>75% Grass cover, Good, HSG C
0	77	Woods, Good, HSG D
0	80	>75% Grass cover, Good, HSG D
9,288		Weighted Average
9,288	37	100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.2	89	0.2000	0.29		<b>Sheet Flow, sheet low</b> Grass: Dense n= 0.240 P2= 3.20"
0.2	40	0.2500	3.50		<b>Shallow Concentrated Flow, scf</b> Short Grass Pasture Kv= 7.0 fps
5.4	129	Total, Increased to minimum Tc = 6.0 min			

**Summary for Subcatchment Post 1G: Post 1G**

Runoff = 0.66 cfs @ 12.09 hrs, Volume= 0.059 af, Depth= 3.41"

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs  
Type III 24-hr 50-YR-NOAA Rainfall=7.29"

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Type III 24-hr 50-YR-NOAA Rainfall=7.29"

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Area (sf)	CN	Description
3,698	98	Paved parking, HSG A
0	30	Woods, Good, HSG A
5,320	39	>75% Grass cover, Good, HSG A
0	55	Woods, Good, HSG B
0	61	>75% Grass cover, Good, HSG B
0	70	Woods, Good, HSG C
0	74	>75% Grass cover, Good, HSG C
0	77	Woods, Good, HSG D
0	80	>75% Grass cover, Good, HSG D
9,018		Weighted Average
5,320	39	58.99% Pervious Area
3,698	98	41.01% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.8	50	0.3000	0.30		<b>Sheet Flow, sheet flow</b> Grass: Dense n= 0.240 P2= 3.20"
0.3	103	0.0700	5.37		<b>Shallow Concentrated Flow, scf</b> Paved Kv= 20.3 fps
3.1	153	Total, Increased to minimum Tc = 6.0 min			

**Summary for Reach Post Box Culvert: Post Box Culvert**

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 8.537 ac, 3.35% Impervious, Inflow Depth = 2.20" for 50-YR-NOAA event  
 Inflow = 13.36 cfs @ 12.25 hrs, Volume= 1.564 af  
 Outflow = 13.36 cfs @ 12.25 hrs, Volume= 1.564 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 2

**Summary for Pond Basin 1: Basin 1**

[44] Hint: Outlet device #1 is below defined storage

[80] Warning: Exceeded Pond DMH 1 by 1.47' @ 24.44 hrs (3.04 cfs 0.353 af)

Inflow Area = 1.061 ac, 18.94% Impervious, Inflow Depth = 1.87" for 50-YR-NOAA event  
 Inflow = 1.62 cfs @ 12.11 hrs, Volume= 0.165 af  
 Outflow = 0.13 cfs @ 12.19 hrs, Volume= 0.165 af, Atten= 92%, Lag= 4.6 min  
 Primary = 0.13 cfs @ 12.19 hrs, Volume= 0.165 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 2

Peak Elev= 185.37' @ 18.70 hrs Surf.Area= 2,666 sf Storage= 3,837 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)

Center-of-Mass det. time= 689.0 min ( 1,488.5 - 799.5 )

**17004 Pre-Post**

Type III 24-hr 50-YR-NOAA Rainfall=7.29"

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Volume	Invert	Avail.Storage	Storage Description
#1	183.50'	5,648 cf	<b>Custom Stage Data (Prismatic)</b> Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
183.50	1,295	0	0
184.00	1,810	776	776
186.00	3,062	4,872	5,648

Device	Routing	Invert	Outlet Devices
#1	Primary	183.00'	<b>3.0" Vert. Orifice/Grate</b> C= 0.600
#2	Primary	185.50'	<b>12.0" Vert. Orifice/Grate</b> C= 0.600

**Primary OutFlow** Max=0.13 cfs @ 12.19 hrs HW=184.44' TW=184.14' (Dynamic Tailwater)

↑1=Orifice/Grate (Orifice Controls 0.13 cfs @ 2.64 fps)

└2=Orifice/Grate ( Controls 0.00 cfs)

**Summary for Pond CB 1: CB 1**

[57] Hint: Peaked at 182.60' (Flood elevation advised)

Inflow Area = 0.207 ac, 41.01% Impervious, Inflow Depth = 3.41" for 50-YR-NOAA event  
 Inflow = 0.66 cfs @ 12.09 hrs, Volume= 0.059 af  
 Outflow = 0.66 cfs @ 12.09 hrs, Volume= 0.059 af, Atten= 0%, Lag= 0.0 min  
 Primary = 0.66 cfs @ 12.09 hrs, Volume= 0.059 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 2

Peak Elev= 182.60' @ 12.41 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	180.76'	<b>12.0" Round Culvert</b> L= 54.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 180.76' / 180.49' S= 0.0050 '/' Cc= 0.900 n= 0.013, Flow Area= 0.79 sf

**Primary OutFlow** Max=0.66 cfs @ 12.09 hrs HW=181.85' TW=181.81' (Dynamic Tailwater)

↑1=Culvert (Outlet Controls 0.66 cfs @ 0.96 fps)

**Summary for Pond DMH 1: DMH 1**

[57] Hint: Peaked at 185.37' (Flood elevation advised)

Inflow Area = 0.848 ac, 23.70% Impervious, Inflow Depth = 2.16" for 50-YR-NOAA event  
 Inflow = 1.54 cfs @ 12.11 hrs, Volume= 0.153 af  
 Outflow = 1.54 cfs @ 12.11 hrs, Volume= 0.153 af, Atten= 0%, Lag= 0.0 min  
 Primary = 1.54 cfs @ 12.11 hrs, Volume= 0.153 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 2

Peak Elev= 185.37' @ 18.70 hrs

**17004 Pre-Post**

Type III 24-hr 50-YR-NOAA Rainfall=7.29"

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Device	Routing	Invert	Outlet Devices
#1	Primary	183.80'	<b>12.0" Round Culvert</b> L= 58.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 183.80' / 183.50' S= 0.0052 '/ Cc= 0.900 n= 0.013, Flow Area= 0.79 sf

**Primary OutFlow** Max=1.54 cfs @ 12.11 hrs HW=184.65' TW=184.25' (Dynamic Tailwater)  
 ↳1=Culvert (Outlet Controls 1.54 cfs @ 2.92 fps)

### Summary for Pond Infiltration Chambers: Infiltration Chambers

[92] Warning: Device #2 is above defined storage

Inflow Area = 1.061 ac, 18.94% Impervious, Inflow Depth = 1.87" for 50-YR-NOAA event  
 Inflow = 0.13 cfs @ 12.19 hrs, Volume= 0.165 af  
 Outflow = 0.05 cfs @ 9.16 hrs, Volume= 0.165 af, Atten= 62%, Lag= 0.0 min  
 Discarded = 0.05 cfs @ 9.16 hrs, Volume= 0.165 af  
 Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 2

Peak Elev= 185.32' @ 18.76 hrs Surf.Area= 257 sf Storage= 292 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)

Center-of-Mass det. time= 63.7 min ( 1,552.2 - 1,488.5 )

Volume	Invert	Avail.Storage	Storage Description
#1	183.50'	88 cf	<b>ADS_StormTech SC-310 +Cap</b> x 6 Inside #2 Effective Size= 28.9"W x 16.0"H => 2.07 sf x 7.12'L = 14.7 cf Overall Size= 34.0"W x 16.0"H x 7.56'L with 0.44' Overlap 6 Chambers in 2 Rows
#2	183.00'	204 cf	<b>Custom Stage Data (Prismatic)</b> Listed below (Recalc) 599 cf Overall - 88 cf Embedded = 510 cf x 40.0% Voids
		293 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
183.00	257	0	0
185.33	257	599	599

Device	Routing	Invert	Outlet Devices
#1	Discarded	183.00'	<b>8.270 in/hr Exfiltration over Surface area</b>
#2	Primary	186.00'	<b>12.0" Horiz. Orifice/Grate</b> C= 0.600 Limited to weir flow at low heads

**Discarded OutFlow** Max=0.05 cfs @ 9.16 hrs HW=183.03' (Free Discharge)

↳1=Exfiltration (Exfiltration Controls 0.05 cfs)

**Primary OutFlow** Max=0.00 cfs @ 0.00 hrs HW=183.00' TW=180.39' (Dynamic Tailwater)

↳2=Orifice/Grate ( Controls 0.00 cfs)

**Summary for Pond Pipe Detention: Pipe Detention**

Inflow Area = 1.268 ac, 22.54% Impervious, Inflow Depth = 0.56" for 50-YR-NOAA event  
 Inflow = 0.66 cfs @ 12.09 hrs, Volume= 0.059 af  
 Outflow = 0.22 cfs @ 12.42 hrs, Volume= 0.059 af, Atten= 67%, Lag= 19.6 min  
 Primary = 0.22 cfs @ 12.42 hrs, Volume= 0.059 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 2  
 Peak Elev= 182.59' @ 12.42 hrs Surf.Area= 292 sf Storage= 612 cf

Plug-Flow detention time= 30.4 min calculated for 0.059 af (100% of inflow)  
 Center-of-Mass det. time= 30.4 min ( 800.4 - 770.0 )

Volume	Invert	Avail.Storage	Storage Description
#1	180.39'	778 cf	<b>36.0" Round Pipe Storage</b> L= 110.0'

Device	Routing	Invert	Outlet Devices
#1	Primary	180.39'	<b>2.0" Vert. Orifice/Grate</b> C= 0.600
#2	Primary	182.39'	<b>3.0" Vert. Orifice/Grate</b> C= 0.600

**Primary OutFlow** Max=0.22 cfs @ 12.42 hrs HW=182.59' TW=0.00' (Dynamic Tailwater)

- 1=Orifice/Grate (Orifice Controls 0.15 cfs @ 7.01 fps)
- 2=Orifice/Grate (Orifice Controls 0.06 cfs @ 1.53 fps)

**17004 Pre-Post**

Type III 24-hr 100-YR-NOAA Rainfall=8.24"

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Time span=0.00-48.00 hrs, dt=0.01 hrs, 4801 points x 2  
 Runoff by SCS TR-20 method, UH=SCS, Weighted-Q  
 Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

<b>SubcatchmentPost 1A: Post 1A</b>	Runoff Area=39,454 sf 0.00% Impervious Runoff Depth=5.17" Flow Length=438' Tc=20.0 min CN=WQ Runoff=3.65 cfs 0.390 af
<b>SubcatchmentPost 1B: Post 1B</b>	Runoff Area=84,027 sf 0.00% Impervious Runoff Depth=5.26" Flow Length=426' Tc=19.9 min CN=WQ Runoff=7.97 cfs 0.845 af
<b>SubcatchmentPost 1C: Post 1C</b>	Runoff Area=117,424 sf 0.00% Impervious Runoff Depth=1.49" Flow Length=748' Tc=15.9 min CN=WQ Runoff=2.59 cfs 0.334 af
<b>SubcatchmentPost 1D: Post 1D</b>	Runoff Area=75,728 sf 0.00% Impervious Runoff Depth=1.84" Flow Length=328' Tc=7.3 min CN=WQ Runoff=2.88 cfs 0.266 af
<b>SubcatchmentPost 1E: Post 1E</b>	Runoff Area=36,938 sf 23.70% Impervious Runoff Depth=2.63" Flow Length=430' Tc=7.4 min CN=WQ Runoff=1.90 cfs 0.186 af
<b>SubcatchmentPost 1F: Post 1F</b>	Runoff Area=9,288 sf 0.00% Impervious Runoff Depth=1.06" Flow Length=129' Tc=6.0 min CN=WQ Runoff=0.16 cfs 0.019 af
<b>SubcatchmentPost 1G: Post 1G</b>	Runoff Area=9,018 sf 41.01% Impervious Runoff Depth=4.02" Flow Length=153' Tc=6.0 min CN=WQ Runoff=0.80 cfs 0.069 af
<b>Reach Post Box Culvert: Post Box Culvert</b>	Inflow=16.06 cfs 1.938 af Outflow=16.06 cfs 1.938 af
<b>Pond Basin 1: Basin 1</b>	Peak Elev=185.56' Storage=4,368 cf Inflow=2.06 cfs 0.204 af Outflow=0.14 cfs 0.204 af
<b>Pond CB 1: CB 1</b>	Peak Elev=182.87' Inflow=0.80 cfs 0.069 af 12.0" Round Culvert n=0.013 L=54.0' S=0.0050 '/' Outflow=0.80 cfs 0.069 af
<b>Pond DMH 1: DMH 1</b>	Peak Elev=185.56' Inflow=1.90 cfs 0.186 af 12.0" Round Culvert n=0.013 L=58.0' S=0.0052 '/' Outflow=1.90 cfs 0.186 af
<b>Pond Infiltration Chambers: Infiltration</b>	Peak Elev=186.04' Storage=293 cf Inflow=0.14 cfs 0.204 af Discarded=0.05 cfs 0.171 af Primary=0.09 cfs 0.033 af Outflow=0.14 cfs 0.205 af
<b>Pond Pipe Detention: Pipe Detention</b>	Peak Elev=182.87' Storage=686 cf Inflow=0.80 cfs 0.103 af Outflow=0.30 cfs 0.103 af

**17004 Pre-Post**

Type III 24-hr 100-YR-NOAA Rainfall=8.24"

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**Summary for Subcatchment Post 1A: Post 1A**

Runoff = 3.65 cfs @ 12.27 hrs, Volume= 0.390 af, Depth= 5.17"

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs  
Type III 24-hr 100-YR-NOAA Rainfall=8.24"

Area (sf)	CN	Description
* 4,187	77	Wetlands in A
* 25,787	77	Wetlands in D
2,589	30	Woods, Good, HSG A
0	39	>75% Grass cover, Good, HSG A
0	55	Woods, Good, HSG B
0	61	>75% Grass cover, Good, HSG B
0	70	Woods, Good, HSG C
0	74	>75% Grass cover, Good, HSG C
6,891	77	Woods, Good, HSG D
0	80	>75% Grass cover, Good, HSG D
39,454		Weighted Average
39,454	74	100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
14.9	100	0.0500	0.11		<b>Sheet Flow, sheet flow</b>
					Woods: Light underbrush n= 0.400 P2= 3.20"
5.1	338	0.0480	1.10		<b>Shallow Concentrated Flow, scf</b>
					Woodland Kv= 5.0 fps
20.0	438	Total			

**Summary for Subcatchment Post 1B: Post 1B**

Runoff = 7.97 cfs @ 12.27 hrs, Volume= 0.845 af, Depth= 5.26"

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs  
Type III 24-hr 100-YR-NOAA Rainfall=8.24"

Area (sf)	CN	Description
* 15,433	77	Wetlands in A
* 61,734	77	Wetlands in D
3,970	30	Woods, Good, HSG A
0	39	>75% Grass cover, Good, HSG A
0	55	Woods, Good, HSG B
0	61	>75% Grass cover, Good, HSG B
0	70	Woods, Good, HSG C
0	74	>75% Grass cover, Good, HSG C
2,890	77	Woods, Good, HSG D
0	80	>75% Grass cover, Good, HSG D
84,027		Weighted Average
84,027	75	100.00% Pervious Area

**17004 Pre-Post**

Type III 24-hr 100-YR-NOAA Rainfall=8.24"

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Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
14.9	100	0.0500	0.11		<b>Sheet Flow, sheet flow</b> Woods: Light underbrush n= 0.400 P2= 3.20"
5.0	326	0.0480	1.10		<b>Shallow Concentrated Flow, scf</b> Woodland Kv= 5.0 fps
19.9	426	Total			

**Summary for Subcatchment Post 1C: Post 1C**

Runoff = 2.59 cfs @ 12.21 hrs, Volume= 0.334 af, Depth= 1.49"

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs  
Type III 24-hr 100-YR-NOAA Rainfall=8.24"

Area (sf)	CN	Description
* 19,641	77	Wetlands in A
* 0	77	Wetlands in D
93,774	30	Woods, Good, HSG A
0	39	>75% Grass cover, Good, HSG A
0	55	Woods, Good, HSG B
0	61	>75% Grass cover, Good, HSG B
0	70	Woods, Good, HSG C
0	74	>75% Grass cover, Good, HSG C
4,009	77	Woods, Good, HSG D
0	80	>75% Grass cover, Good, HSG D
117,424		Weighted Average
117,424	39	100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.8	100	0.3500	0.24		<b>Sheet Flow, sheet flow</b> Woods: Light underbrush n= 0.400 P2= 3.20"
9.1	648	0.0560	1.18		<b>Shallow Concentrated Flow, scf</b> Woodland Kv= 5.0 fps
15.9	748	Total			

**Summary for Subcatchment Post 1D: Post 1D**

Runoff = 2.88 cfs @ 12.10 hrs, Volume= 0.266 af, Depth= 1.84"

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs  
Type III 24-hr 100-YR-NOAA Rainfall=8.24"

**17004 Pre-Post**

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Area (sf)	CN	Description
* 20,566	77	Wetlands in A
* 0	77	Wetlands in D
55,162	30	Woods, Good, HSG A
0	39	>75% Grass cover, Good, HSG A
0	55	Woods, Good, HSG B
0	61	>75% Grass cover, Good, HSG B
0	70	Woods, Good, HSG C
0	74	>75% Grass cover, Good, HSG C
0	77	Woods, Good, HSG D
0	80	>75% Grass cover, Good, HSG D
75,728		Weighted Average
75,728	43	100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.6	30	0.3500	0.19		<b>Sheet Flow, sheet flow</b> Woods: Light underbrush n= 0.400 P2= 3.20"
4.7	298	0.0450	1.06		<b>Shallow Concentrated Flow, scf</b> Woodland Kv= 5.0 fps
7.3	328	Total			

**Summary for Subcatchment Post 1E: Post 1E**

Runoff = 1.90 cfs @ 12.11 hrs, Volume= 0.186 af, Depth= 2.63"

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs  
Type III 24-hr 100-YR-NOAA Rainfall=8.24"

Area (sf)	CN	Description
8,755	98	Paved parking, HSG A
10,798	30	Woods, Good, HSG A
17,385	39	>75% Grass cover, Good, HSG A
0	55	Woods, Good, HSG B
0	61	>75% Grass cover, Good, HSG B
0	70	Woods, Good, HSG C
0	74	>75% Grass cover, Good, HSG C
0	77	Woods, Good, HSG D
0	80	>75% Grass cover, Good, HSG D
36,938		Weighted Average
28,183	36	76.30% Pervious Area
8,755	98	23.70% Impervious Area

**17004 Pre-Post**

Type III 24-hr 100-YR-NOAA Rainfall=8.24"

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Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.3	55	0.3300	0.21		<b>Sheet Flow, sheet flow</b> Woods: Light underbrush n= 0.400 P2= 3.20"
2.4	125	0.0300	0.87		<b>Shallow Concentrated Flow, scf</b> Woodland Kv= 5.0 fps
0.1	30	0.3000	3.83		<b>Shallow Concentrated Flow, scf</b> Short Grass Pasture Kv= 7.0 fps
0.6	220	0.1000	6.42		<b>Shallow Concentrated Flow, scf</b> Paved Kv= 20.3 fps
7.4	430	Total			

**Summary for Subcatchment Post 1F: Post 1F**

Runoff = 0.16 cfs @ 12.12 hrs, Volume= 0.019 af, Depth= 1.06"

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs  
Type III 24-hr 100-YR-NOAA Rainfall=8.24"

Area (sf)	CN	Description
0	98	Paved parking, HSG A
2,409	30	Woods, Good, HSG A
6,879	39	>75% Grass cover, Good, HSG A
0	55	Woods, Good, HSG B
0	61	>75% Grass cover, Good, HSG B
0	70	Woods, Good, HSG C
0	74	>75% Grass cover, Good, HSG C
0	77	Woods, Good, HSG D
0	80	>75% Grass cover, Good, HSG D
9,288		Weighted Average
9,288	37	100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.2	89	0.2000	0.29		<b>Sheet Flow, sheet low</b> Grass: Dense n= 0.240 P2= 3.20"
0.2	40	0.2500	3.50		<b>Shallow Concentrated Flow, scf</b> Short Grass Pasture Kv= 7.0 fps
5.4	129	Total, Increased to minimum Tc = 6.0 min			

**Summary for Subcatchment Post 1G: Post 1G**

Runoff = 0.80 cfs @ 12.09 hrs, Volume= 0.069 af, Depth= 4.02"

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs  
Type III 24-hr 100-YR-NOAA Rainfall=8.24"

**17004 Pre-Post**

Type III 24-hr 100-YR-NOAA Rainfall=8.24"

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Area (sf)	CN	Description
3,698	98	Paved parking, HSG A
0	30	Woods, Good, HSG A
5,320	39	>75% Grass cover, Good, HSG A
0	55	Woods, Good, HSG B
0	61	>75% Grass cover, Good, HSG B
0	70	Woods, Good, HSG C
0	74	>75% Grass cover, Good, HSG C
0	77	Woods, Good, HSG D
0	80	>75% Grass cover, Good, HSG D
9,018		Weighted Average
5,320	39	58.99% Pervious Area
3,698	98	41.01% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.8	50	0.3000	0.30		<b>Sheet Flow, sheet flow</b> Grass: Dense n= 0.240 P2= 3.20"
0.3	103	0.0700	5.37		<b>Shallow Concentrated Flow, scf</b> Paved Kv= 20.3 fps
3.1	153	Total, Increased to minimum Tc = 6.0 min			

**Summary for Reach Post Box Culvert: Post Box Culvert**

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 8.537 ac, 3.35% Impervious, Inflow Depth = 2.72" for 100-YR-NOAA event  
 Inflow = 16.06 cfs @ 12.25 hrs, Volume= 1.938 af  
 Outflow = 16.06 cfs @ 12.25 hrs, Volume= 1.938 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 2

**Summary for Pond Basin 1: Basin 1**

[44] Hint: Outlet device #1 is below defined storage

[87] Warning: Oscillations may require smaller dt or Finer Routing (severity=2)

[80] Warning: Exceeded Pond DMH 1 by 1.53' @ 24.43 hrs (3.15 cfs 0.380 af)

Inflow Area = 1.061 ac, 18.94% Impervious, Inflow Depth = 2.31" for 100-YR-NOAA event  
 Inflow = 2.06 cfs @ 12.11 hrs, Volume= 0.204 af  
 Outflow = 0.14 cfs @ 12.19 hrs, Volume= 0.204 af, Atten= 93%, Lag= 4.7 min  
 Primary = 0.14 cfs @ 12.19 hrs, Volume= 0.204 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 2  
 Peak Elev= 185.56' @ 15.33 hrs Surf.Area= 2,788 sf Storage= 4,368 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)  
 Center-of-Mass det. time= 615.4 min ( 1,419.3 - 803.9 )

**17004 Pre-Post**

Type III 24-hr 100-YR-NOAA Rainfall=8.24"

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Volume	Invert	Avail.Storage	Storage Description
#1	183.50'	5,648 cf	<b>Custom Stage Data (Prismatic)</b> Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
183.50	1,295	0	0
184.00	1,810	776	776
186.00	3,062	4,872	5,648

Device	Routing	Invert	Outlet Devices
#1	Primary	183.00'	<b>3.0" Vert. Orifice/Grate</b> C= 0.600
#2	Primary	185.50'	<b>12.0" Vert. Orifice/Grate</b> C= 0.600

**Primary OutFlow** Max=0.14 cfs @ 12.19 hrs HW=184.64' TW=184.28' (Dynamic Tailwater)

↑1=Orifice/Grate (Orifice Controls 0.14 cfs @ 2.90 fps)

└2=Orifice/Grate ( Controls 0.00 cfs)

**Summary for Pond CB 1: CB 1**

[57] Hint: Peaked at 182.87' (Flood elevation advised)

Inflow Area = 0.207 ac, 41.01% Impervious, Inflow Depth = 4.02" for 100-YR-NOAA event  
 Inflow = 0.80 cfs @ 12.09 hrs, Volume= 0.069 af  
 Outflow = 0.80 cfs @ 12.09 hrs, Volume= 0.069 af, Atten= 0%, Lag= 0.0 min  
 Primary = 0.80 cfs @ 12.09 hrs, Volume= 0.069 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 2

Peak Elev= 182.87' @ 12.36 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	180.76'	<b>12.0" Round Culvert</b> L= 54.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 180.76' / 180.49' S= 0.0050 ' / S= 0.0050 ' / Cc= 0.900 n= 0.013, Flow Area= 0.79 sf

**Primary OutFlow** Max=0.80 cfs @ 12.09 hrs HW=182.10' TW=182.05' (Dynamic Tailwater)

↑1=Culvert (Outlet Controls 0.80 cfs @ 1.01 fps)

**Summary for Pond DMH 1: DMH 1**

[57] Hint: Peaked at 185.56' (Flood elevation advised)

Inflow Area = 0.848 ac, 23.70% Impervious, Inflow Depth = 2.63" for 100-YR-NOAA event  
 Inflow = 1.90 cfs @ 12.11 hrs, Volume= 0.186 af  
 Outflow = 1.90 cfs @ 12.11 hrs, Volume= 0.186 af, Atten= 0%, Lag= 0.0 min  
 Primary = 1.90 cfs @ 12.11 hrs, Volume= 0.186 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 2

Peak Elev= 185.56' @ 15.31 hrs

**17004 Pre-Post**

Type III 24-hr 100-YR-NOAA Rainfall=8.24"

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Device	Routing	Invert	Outlet Devices
#1	Primary	183.80'	<b>12.0" Round Culvert</b> L= 58.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 183.80' / 183.50' S= 0.0052 '/' Cc= 0.900 n= 0.013, Flow Area= 0.79 sf

**Primary OutFlow** Max=1.90 cfs @ 12.11 hrs HW=184.81' TW=184.41' (Dynamic Tailwater)  
 ↳ **1=Culvert** (Outlet Controls 1.90 cfs @ 2.97 fps)

**Summary for Pond Infiltration Chambers: Infiltration Chambers**

- [92] Warning: Device #2 is above defined storage
- [93] Warning: Storage range exceeded by 0.71'
- [87] Warning: Oscillations may require smaller dt or Finer Routing (severity=471)
- [80] Warning: Exceeded Pond Basin 1 by 0.64' @ 22.90 hrs (1.15 cfs 0.953 af)

Inflow Area = 1.061 ac, 18.94% Impervious, Inflow Depth = 2.31" for 100-YR-NOAA event  
 Inflow = 0.14 cfs @ 12.19 hrs, Volume= 0.204 af  
 Outflow = 0.14 cfs @ 15.32 hrs, Volume= 0.205 af, Atten= 5%, Lag= 187.9 min  
 Discarded = 0.05 cfs @ 8.79 hrs, Volume= 0.171 af  
 Primary = 0.09 cfs @ 15.32 hrs, Volume= 0.033 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 2  
 Peak Elev= 186.04' @ 15.32 hrs Surf.Area= 257 sf Storage= 293 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)  
 Center-of-Mass det. time= 54.3 min ( 1,473.4 - 1,419.2 )

Volume	Invert	Avail.Storage	Storage Description
#1	183.50'	88 cf	<b>ADS_StormTech SC-310 +Cap</b> x 6 Inside #2 Effective Size= 28.9"W x 16.0"H => 2.07 sf x 7.12'L = 14.7 cf Overall Size= 34.0"W x 16.0"H x 7.56'L with 0.44' Overlap 6 Chambers in 2 Rows
#2	183.00'	204 cf	<b>Custom Stage Data (Prismatic)</b> Listed below (Recalc) 599 cf Overall - 88 cf Embedded = 510 cf x 40.0% Voids
		293 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
183.00	257	0	0
185.33	257	599	599

Device	Routing	Invert	Outlet Devices
#1	Discarded	183.00'	<b>8.270 in/hr Exfiltration over Surface area</b>
#2	Primary	186.00'	<b>12.0" Horiz. Orifice/Grate</b> C= 0.600 Limited to weir flow at low heads

**17004 Pre-Post**

Type III 24-hr 100-YR-NOAA Rainfall=8.24"

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**Discarded OutFlow** Max=0.05 cfs @ 8.79 hrs HW=183.03' (Free Discharge)

↑1=Exfiltration (Exfiltration Controls 0.05 cfs)

**Primary OutFlow** Max=0.09 cfs @ 15.32 hrs HW=186.04' TW=181.79' (Dynamic Tailwater)

↑2=Orifice/Grate (Weir Controls 0.09 cfs @ 0.66 fps)

**Summary for Pond Pipe Detention: Pipe Detention**

Inflow Area = 1.268 ac, 22.54% Impervious, Inflow Depth = 0.97" for 100-YR-NOAA event  
 Inflow = 0.80 cfs @ 12.09 hrs, Volume= 0.103 af  
 Outflow = 0.30 cfs @ 12.36 hrs, Volume= 0.103 af, Atten= 62%, Lag= 16.5 min  
 Primary = 0.30 cfs @ 12.36 hrs, Volume= 0.103 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 2  
 Peak Elev= 182.87' @ 12.36 hrs Surf.Area= 251 sf Storage= 686 cf

Plug-Flow detention time= 36.1 min calculated for 0.103 af (100% of inflow)  
 Center-of-Mass det. time= 36.1 min ( 884.5 - 848.4 )

Volume	Invert	Avail.Storage	Storage Description
#1	180.39'	778 cf	<b>36.0" Round Pipe Storage</b> L= 110.0'

Device	Routing	Invert	Outlet Devices
#1	Primary	180.39'	<b>2.0" Vert. Orifice/Grate</b> C= 0.600
#2	Primary	182.39'	<b>3.0" Vert. Orifice/Grate</b> C= 0.600

**Primary OutFlow** Max=0.30 cfs @ 12.36 hrs HW=182.87' TW=0.00' (Dynamic Tailwater)

↑1=Orifice/Grate (Orifice Controls 0.16 cfs @ 7.45 fps)

↑2=Orifice/Grate (Orifice Controls 0.14 cfs @ 2.85 fps)

## **APPENDIX C**

Stormwater Checklist and Sizing Calculations

Village at Clocktown  
Union Street  
Ashland, Massachusetts

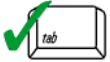




# Checklist for Stormwater Report

## 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.<sup>1</sup> 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<sup>2</sup>
- 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.

<sup>1</sup> 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.

<sup>2</sup> 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.



# 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.

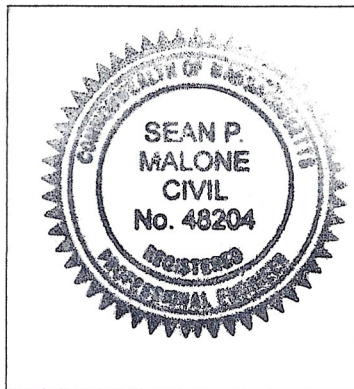
*Note:* Because stormwater requirements vary from project to project, it is possible that a complete Stormwater Report may not include information on some of the subjects specified in the Checklist. If it is determined that a specific item does not apply to the project under review, please note that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



3/28/2023

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): Infiltration Basins

### 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

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## Checklist (continued)

### Standard 2: Peak Rate Attenuation

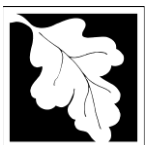
- Standard 2 waiver requested because the project is located in land subject to coastal storm flowage and stormwater discharge is to a wetland subject to coastal flooding.
- Evaluation provided to determine whether off-site flooding increases during the 100-year 24-hour storm.
- Calculations provided to show that post-development peak discharge rates do not exceed pre-development rates for the 2-year and 10-year 24-hour storms. If evaluation shows that off-site flooding increases during the 100-year 24-hour storm, calculations are also provided to show that post-development peak discharge rates do not exceed pre-development rates for the 100-year 24-hour storm.

### Standard 3: Recharge

- Soil Analysis provided.
- Required Recharge Volume calculation provided.
- Required Recharge volume reduced through use of the LID site Design Credits.
- Sizing the infiltration, BMPs is based on the following method: Check the method used.
  - Static
  - Simple Dynamic
  - Dynamic Field<sup>1</sup>
- Runoff from all impervious areas at the site discharging to the infiltration BMP.
- Runoff from all impervious areas at the site is *not* discharging to the infiltration BMP and calculations are provided showing that the drainage area contributing runoff to the infiltration BMPs is sufficient to generate the required recharge volume.
- Recharge BMPs have been sized to infiltrate the Required Recharge Volume.
- Recharge BMPs have been sized to infiltrate the Required Recharge Volume *only* to the maximum extent practicable for the following reason:
  - Site is comprised solely of C and D soils and/or bedrock at the land surface
  - M.G.L. c. 21E sites pursuant to 310 CMR 40.0000
  - Solid Waste Landfill pursuant to 310 CMR 19.000
  - Project is otherwise subject to Stormwater Management Standards only to the maximum extent practicable.
- Calculations showing that the infiltration BMPs will drain in 72 hours are provided.
- Property includes a M.G.L. c. 21E site or a solid waste landfill and a mounding analysis is included.

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<sup>1</sup> 80% TSS removal is required prior to discharge to infiltration BMP if Dynamic Field method is used.



# Checklist for Stormwater Report

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## 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

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## 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

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## Checklist (continued)

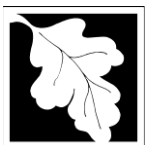
### Standard 7: Redevelopments and Other Projects Subject to the Standards only to the maximum extent practicable

- 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.

**INSTRUCTIONS:**

Non-automated: Mar. 4, 2008

1. Sheet is nonautomated. Print sheet and complete using hand calculations. Column A and B: See MassDEP Structural BMP Table
2. The calculations must be completed using the Column Headings specified in Chart and Not the Excel Column Headings
3. To complete Chart Column D, multiple Column B value within Row x Column C value within Row
4. To complete Chart Column E value, subtract Column D value within Row from Column C value within Row
5. Total TSS Removal = Sum All Values in Column D

Location:

A	B	C	D	E
BMP <sup>1</sup>	TSS Removal Rate <sup>1</sup>	Starting TSS Load*	Amount Removed (B*C)	Remaining Load (C-D)
Deep Sump CB	25%	1.00	0.25	0.75
Treatment Unit	80%	0.75	0.60	0.15
Infiltration Basin	80%	0.15	0.12	0.03

**Total TSS Removal =**

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

Project:   
 Prepared By:   
 Date:

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

**INSTRUCTIONS:**

Non-automated: Mar. 4, 2008

1. Sheet is nonautomated. Print sheet and complete using hand calculations. Column A and B: See MassDEP Structural BMP Table
2. The calculations must be completed using the Column Headings specified in Chart and Not the Excel Column Headings
3. To complete Chart Column D, multiple Column B value within Row x Column C value within Row
4. To complete Chart Column E value, subtract Column D value within Row from Column C value within Row
5. Total TSS Removal = Sum All Values in Column D

Location:

A	B	C	D	E
BMP <sup>1</sup>	TSS Removal Rate <sup>1</sup>	Starting TSS Load*	Amount Removed (B*C)	Remaining Load (C-D)
Deep Sump CB	25%	1.00	0.25	0.75
Treatment Unit	80%	0.75	0.60	0.15

**Total TSS Removal =**

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

Project:   
 Prepared By:   
 Date:

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

**APPENDIX D**

Pollution Prevention and Stormwater Operation and Maintenance Plan

Village at Clocktown  
Union Street  
Ashland, Massachusetts



# **Pollution Prevention, Stormwater Operation and Maintenance Plan**

For

Village at Clocktown

Union Street  
Ashland, Massachusetts

**April 2023**

Prepared by:



P.O. Box 1123  
Newburyport, Massachusetts  
(978) 312-3120

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**APPENDICES:**

- Appendix A: Stormwater System O&M Inspection Plan
- Appendix B: Water Quality Unit Operations and Maintenance

## **1.0 INTRODUCTION**

This Pollution Prevention and Operation and Maintenance (O&M) Plan has been prepared to implement procedures for the Village at Clocktown definitive subdivision which will minimize the potential for stormwater pollution and adverse impacts to resource areas subject to protection under the Massachusetts Wetlands Protections Act and Town of Ashland requirements.

A plan showing the configuration of the Project stormwater systems and wetlands resource areas is provided on Sheets C-300. Inspection forms for Stormwater BMPs are enclosed in Appendix A.

### **1.1 Roles and Responsibilities**

#### Owner

Village at Clocktown (The Association)

#### Implementation

This plan shall be maintained by the Association and distributed to all residents, homeowners and outside contractors on an annual basis.

## **2.0 POLLUTION PREVENTION**

The following section presents methods and procedures implemented by the Project as part of daily operations to minimize potential stormwater pollution. The procedures presented below have been developed to be practical to implement and sufficiently protective of nearby resource areas and the environment in general.

### **2.1 Equipment and Material Storage**

Seasonal equipment is not to be permanently stored on-site. This equipment is generally limited to snow plows, lawn mowers and other miscellaneous equipment used by the personnel or companies conducting routine maintenance at the Project. Equipment used at the Project shall be generally clean and free of oil leaks and/or hazardous material which could potentially impact storm water quality.

Supplies such as sand, grass seed, fertilizers, and other materials which may be affected by weather or become airborne shall not be stored on site unless they are stored indoors.

### **2.2 Fuel Storage**

There is no proposed fuel storage at the Project.

### **2.3 Trash and Recyclables Collection**

Trash and recyclables will be picked up from the Project on a routine basis by an outside, licensed hauler. Trash and recyclable containers shall be kept under cover until they are brought by the homeowner to the curb side for pickup. Trash and recyclable containers may not be brought to the curbside more than 24 hours prior to the scheduled pickup.

### **2.4 General Housekeeping**

Cleanup to remove accumulated trash and debris shall be performed on both an as-needed and scheduled basis. Routine cleanup activities include the following:

#### **2.4.1 Trash and Debris Pickup**

Trash and debris pickup shall be performed continuously as needed. Landscape and maintenance contractors shall be responsible for removing litter from the grounds. Residents and guests are prohibited from littering and are encouraged to pickup miscellaneous debris which they may encounter.

#### **2.4.2 Sweeping**

Sweeping of roadways and parking areas shall be performed on a semi-annual basis during the early spring to remove salt and sand applied to these surfaces during the winter months and late fall. Sweeping will be performed by an outside contractor using suitable equipment. Recovered sweepings shall be disposed with other yard waste off-site in accordance with all applicable state, local and federal laws.

### 2.4.3 Spring and Fall Cleanup

Spring and fall cleanups shall be performed once per year following snow melt and tree defoliation, respectively. The majority of the spring and fall cleanup efforts shall focus on landscaped and lawn areas throughout the Project. Yard waste, including leaves, grass cuttings, nuisance vegetation, branches, stumps, rocks, etc., shall be disposed of off-site in accordance with all applicable state, local and federal laws.

## 2.5 Snow Plowing/Deicing

Snow and ice removal operations shall be performed on an as-needed basis. Snow from driveways, parking areas and walkways shall be plowed to the sides of the paved surfaces in accordance with customary snow plowing procedures. Snow shall be plowed away from wetlands resource areas. Snow stockpiles shall be located beyond wetlands buffer zones to the greatest extent practicable. Snow banks or piles may be removed from parking areas or other critical areas as needed. Snow which may be removed in this manner shall be disposed of off-site in accordance with applicable state, local and federal laws. Snow shall not be dumped or pushed into resource areas.

Deicing operations consist of applying sand or salt to walkways and other paved surfaces as needed for vehicle and pedestrian safety. Salt shall be applied at the minimal acceptable rates to provide safe vehicle and pedestrian safety.

Estimated budget = \$5,500.00 per year.

## 2.6 Landscape Maintenance

Lawn and landscape areas shall be regularly maintained by a qualified landscape contractor. The landscape contractor shall be responsible for the maintenance and upkeep of the stormwater Basins including by not limited to replacement of dead or dying vegetation, removal of sediment and replacement of mulch.

## 3.0 OPERATION AND MAINTENANCE

An outside contractor shall inspect the stormwater management systems on a routine basis. Refer to the Grading, Drainage & Erosion Control Plans (Plans) for drainage structure locations. Inspection and maintenance shall be performed as follows:

Estimated Budget:

Inspections: \$1,000.00 per year

Maintenance: \$2,500.00 per year

## 3.1 Catch Basins and Manholes

Catch basins and manholes shall be inspected for accumulation of silt, sediment, or debris on a semi-annual basis. Cleaning will be performed at least once per year or more frequently if the sediment level rises 2 feet above the bottom of the sump. Removed sediment will be disposed off site by a qualified waste disposal contractor in accordance with local, state and federal regulations.

### 3.2 Stormwater Basins

Stormwater basins consist of a detention basin. The basins will be inspected for sediment and debris accumulation on regular basis. Vegetation will also be inspected and mowed or replaced as needed. The maintenance schedule for stormwater basins is as follows:

Activity	Time of Year	Frequency
Inspect and Remove Trash	Year round	Biannually
Mulch	Spring	Biannually
Mow	Fall	Annually
Replace Dead Vegetation	Spring	Annually
Prune	Spring	Annually
Repair areas of erosion and revegetate	Spring	As necessary, but not less than once a year.
Remove sediment from grass swale	Spring	Annually
Inspect basin to ensure it is operating as designed	Summer	First few months after construction and semi-annually thereafter
Remove sediment from basin	Spring	As necessary

### 3.3 Stormwater Treatment Units

Stormwater Treatment Units shall be visually inspected annually and be cleaned out per the manufacturer's recommendations. Removed sediment will be disposed of off-site by a qualified waste disposal contractor in accordance with state and federal regulations.

### 3.4 Drain Outfalls

Drain outfalls shall be inspected annually. Any signs of erosion shall be promptly repaired. Accumulated sediment and/or debris shall be removed and disposed off-site. Any observed erosion shall be repaired with the placement of new rip-rap as needed.

### 3.5 Record Keeping

The Association shall complete the Stormwater System Inspection Report (Appendix A) as part of routine inspections. Copies of completed reports shall be kept for at least 5 years. Receipts of catch basin cleaning and other O&M activities which require contracted services shall also kept on file for a minimum of 5 years.

### 3.6 Pet Waste

Owners and guests will be responsible for clean up and disposal of pet waste on the site

**APPENDIX A**

Stormwater System O&M Inspection Report

Paradise Valley Club

## **STORMWATER MANAGEMENT OPERATIONS AND MAINTENANCE PLAN**

Village at Clocktown  
Union Street  
Ashland, Massachusetts

The following Stormwater Management Operation and Maintenance (O&M) Plan has been prepared to operate and maintain the stormwater management system for the Village at Clocktown Definitive Subdivision. The association shall be responsible for maintenance of all BMP's and drainage structures on-site.

**Owner/Operator:** The Village at Clocktown

### **Inspection and Maintenance Schedule**

Facility personnel will inspect the stormwater management system on a routine basis not less than once per month for the first 6 months of operation and annually thereafter. Refer to Sheet C-300 for drainage structure locations. Stormwater inspection and maintenance is estimated to be \$3,500.00 per year.

Inspection and maintenance shall be performed as follows:

1. Catchbasins and Manholes shall be inspected for accumulation of silt, sediment, or debris on a semi-annual basis. Cleaning will be performed whenever the sediment level rises to within 1 foot of the invert elevation of the outlet pipe. Removed sediment will be disposed off-site by a qualified waste disposal contractor in accordance with state and federal regulations.
2. Stormwater Treatment Units shall be visually inspected annually and be cleaned out per the manufacturer's recommendations. Removed sediment will be disposed of off-site by a qualified waste disposal contractor in accordance with state and federal regulations. See enclosed Manufactures O&M procedures
3. Grassed Swales and Lawn/Landscaped Areas shall be inspected and maintained on a regular basis. Swales shall be inspected at least twice per year and any sediment or debris shall be removed. Areas of erosion will be stabilized and reseeded immediately. These operations will be performed as part of ongoing routine grounds maintenance operations.
4. Detention basins shall be visually inspected monthly for the first three months of use and at least twice a year there after. Promptly repair any settlement or erosion to grass, remove any trash or accumulated sediment. Sediment removal shall be when basin bottom is dry Basins shall be mowed two times a year and grass clippings shall be removed. If grass is disturbed by sediment removal, deep till remaining soils and revegetate as soon as possible
5. Subsurface Infiltration Systems shall be inspected annually via the overflow basin grate/inspection port. If accumulated sediment is observed greater than 3 inches deep, the accumulated sediment shall be vacuumed out.

## Stormwater System Inspection Report

General Information			
<b>Location:</b> Village at Clocktown			
<b>Date of Inspection</b>		<b>Start/End Time</b>	
<b>Inspector's Name(s)</b>			
<b>Inspector's Title(s)</b>			
<b>Inspector's Contact Information</b>			
<b>Purpose of Inspection</b>			
Weather Information			
<b>Has it rained since the last inspection?</b> <input type="checkbox"/> Yes <input type="checkbox"/> No			
<b>Weather at time of this inspection?</b>			

### Site-Specific Stormwater Devices

	Description	Installed and Operating Properly?	Corrective Action Needed	Date for Corrective Action/Responsible Person
1		<input type="checkbox"/> Yes <input type="checkbox"/> No		
2		<input type="checkbox"/> Yes <input type="checkbox"/> No		
3		<input type="checkbox"/> Yes <input type="checkbox"/> No		
4		<input type="checkbox"/> Yes <input type="checkbox"/> No		
5		<input type="checkbox"/> Yes <input type="checkbox"/> No		
6		<input type="checkbox"/> Yes <input type="checkbox"/> No		
7		<input type="checkbox"/> Yes <input type="checkbox"/> No		
8		<input type="checkbox"/> Yes <input type="checkbox"/> No		
9		<input type="checkbox"/> Yes <input type="checkbox"/> No		
10		<input type="checkbox"/> Yes <input type="checkbox"/> No		
11		<input type="checkbox"/> Yes <input type="checkbox"/> No		

	Description	Installed and Operating Properly?	Corrective Action Needed	Date for Corrective Action/Responsible Person
12		<input type="checkbox"/> Yes <input type="checkbox"/> No		
13		<input type="checkbox"/> Yes <input type="checkbox"/> No		
14		<input type="checkbox"/> Yes <input type="checkbox"/> No		
15		<input type="checkbox"/> Yes <input type="checkbox"/> No		

**Overall Site Issues**

	Description		Corrective Action	Date for Corrective Action/Responsible Person
1	Are all slopes properly stabilized?	<input type="checkbox"/> Yes <input type="checkbox"/> No		
2	Are natural resource areas (e.g., streams, wetlands, etc.) being subjected to erosion?	<input type="checkbox"/> Yes <input type="checkbox"/> No		
3	Are discharge points free of sediment deposits?	<input type="checkbox"/> Yes <input type="checkbox"/> No		

**Certification Statement:**

“I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gathered and evaluated the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.”

Print name: \_\_\_\_\_

Signature: \_\_\_\_\_ Date: \_\_\_\_\_

**APPENDIX B**

Stormceptor Operations and Maintenance

Village at Clocktown

## CDS<sup>®</sup> Inspection and Maintenance Guide

---



## 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 allow 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 whether 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 system 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 <sup>3</sup>	m <sup>3</sup>
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](http://www.contechstormwater.com).
- Site-specific design support is available from our engineers.

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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.





**APPENDIX E**

Soils Information

Village at Clocktown  
Union Street  
Ashland, Massachusetts





**Commonwealth of Massachusetts  
City/Town of Ashland**

**Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal**

**A. Facility Information**

58 Exchange Ashland, LLC  
 Owner Name \_\_\_\_\_  
 Union Street \_\_\_\_\_ 0150-0076  
 Street Address \_\_\_\_\_ Map/Lot # \_\_\_\_\_  
 Ashland \_\_\_\_\_ MA \_\_\_\_\_ 01721  
 City \_\_\_\_\_ State \_\_\_\_\_ Zip Code \_\_\_\_\_

**B. Site Information**

1. (Check one)  New Construction  Upgrade
2. Soil Survey \_\_\_\_\_ Source \_\_\_\_\_ Soil Map Unit \_\_\_\_\_ Soil Series \_\_\_\_\_  
 Landform \_\_\_\_\_ Soil Limitations \_\_\_\_\_
3. Surficial Geological Report \_\_\_\_\_ Year Published/Source \_\_\_\_\_ Map Unit \_\_\_\_\_  
 Description of Geologic Map Unit: \_\_\_\_\_
4. Flood Rate Insurance Map \_\_\_\_\_ Within a regulatory floodway?  Yes  No
5. Within a velocity zone?  Yes  No
6. Within a Mapped Wetland Area?  Yes  No  
 If yes, MassGIS Wetland Data Layer: \_\_\_\_\_  
 Wetland Type  Normal  Below Normal
7. Current Water Resource Conditions (USGS): \_\_\_\_\_ Range:  Above Normal  Normal  Below Normal  
 Month/Day/ Year \_\_\_\_\_
8. Other references reviewed: \_\_\_\_\_  
 (Zone II, IWPA, Zone A, EEA Data Portal, etc.) \_\_\_\_\_



**Commonwealth of Massachusetts  
City/Town of Ashland**

**Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal**

**C. On-Site Review** *(minimum of two holes required at every proposed primary and reserve disposal area)*

**Deep Observation Hole Number:** 1 Hole # 3/1/23 Date 9:30 am Time Clear Weather >15 Longitude  
>15 Slope (%)

1. Land Use Single Family Lot Woodland Some stones Latitude  
 (e.g., woodland, agricultural field, vacant lot, etc.) Surface Stones (e.g., cobbles, stones, boulders, etc.) Longitude  
 Description of Location: Woodland near edge of treeline

2. Soil Parent Material: SH Landform SH Position on Landscape (SU, SH, BS, FS, TS, Plain)  
Position on Landscape (SU, SH, BS, FS, TS, Plain)

3. Distances from: Open Water Body >50 feet Drainage Way >50 feet Wetlands >65 feet  
Property Line >35 feet Drinking Water Well >75 feet Other \_\_\_\_\_ feet

4. Unsuitable Materials Present:  Yes  No If Yes:  Disturbed Soil/Fill Material  Weathered/Fractured Rock  Bedrock

5. Groundwater Observed:  Yes  No If yes: \_\_\_\_\_ Depth to Weeping in Hole \_\_\_\_\_ Depth to Standing Water in Hole

**Soil Log**

Depth (in)	Soil Horizon /Layer	Soil Texture (USDA)	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features			Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
				Depth	Color	Percent	Gravel	Cobbles & Stones			
8	A	LS		Cnc : Dpl:							
52	B	LS	10 YR 4/3	Cnc : Dpl:				>10			
42	C	SAND	10 YR 6/3	Cnc : Dpl:			>5	>5			Pockets of LS, Refusal @ 102"
				Cnc : Dpl:							
				Cnc : Dpl:							
				Cnc : Dpl:							

Additional Notes:

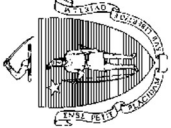












**Commonwealth of Massachusetts  
City/Town of Ashland**

**Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal**

**D. Determination of High Groundwater Elevation**

1. Method Used (Choose one):

Depth to soil redoximorphic features

Obs. Hole #1      Obs. Hole #2  
\_\_\_\_\_ inches      \_\_\_\_\_ inches

Depth to observed standing water in observation hole

\_\_\_\_\_ inches      \_\_\_\_\_ inches

Depth to adjusted seasonal high groundwater ( $S_h$ )  
(USGS methodology)

\_\_\_\_\_ inches      \_\_\_\_\_ inches

\_\_\_\_\_ Index Well Number      \_\_\_\_\_ Reading Date

$$S_h = S_c - [S_r \times (OW_c - OW_{max}) / OW_r]$$

Obs. Hole/Well# \_\_\_\_\_  $S_c$  \_\_\_\_\_  $S_r$  \_\_\_\_\_  $OW_c$  \_\_\_\_\_  $OW_{max}$  \_\_\_\_\_  $OW_r$  \_\_\_\_\_  $S_h$  \_\_\_\_\_

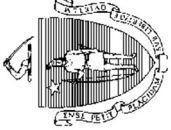
**E. Certification**

I certify that I am currently approved by the Department of Environmental Protection pursuant to 310 CMR 15.017 to conduct soil 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 15.100 through 15.107.

Signature of Soil Evaluator \_\_\_\_\_ Date \_\_\_\_\_  
John Federico SE#14303      6/30/2025  
Typed or Printed Name of Soil Evaluator / License # \_\_\_\_\_ Expiration Date of License \_\_\_\_\_

Name of Approving Authority Witness \_\_\_\_\_ Approving Authority \_\_\_\_\_

**Note:** In accordance with 310 CMR 15.018(2) this form must be submitted to the approving authority within 60 days of the date of field testing, and to the designer and the property owner with [Percolation Test Form 12](#).



## Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

### D. Determination of High Groundwater Elevation

1. Method Used (Choose one):

Depth to soil redoximorphic features

Obs. Hole # 3  
\_\_\_\_\_ inches

Obs. Hole # 4  
\_\_\_\_\_ inches

Depth to observed standing water in observation hole

\_\_\_\_\_ inches

\_\_\_\_\_ inches

Depth to adjusted seasonal high groundwater ( $S_h$ )  
(USGS methodology)

\_\_\_\_\_ inches

\_\_\_\_\_ inches

\_\_\_\_\_ Index Well Number \_\_\_\_\_ Reading Date

$$S_h = S_c - [S_r \times (OW_c - OW_{max}) / OW_r]$$

Obs. Hole/Well# \_\_\_\_\_  $S_c$  \_\_\_\_\_  $S_r$  \_\_\_\_\_  $OW_c$  \_\_\_\_\_  $OW_{max}$  \_\_\_\_\_  $OW_r$  \_\_\_\_\_  $S_h$  \_\_\_\_\_

### E. Certification

I certify that I am currently approved by the Department of Environmental Protection pursuant to 310 CMR 15.017 to conduct soil 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 15.100 through 15.107.

\_\_\_\_\_  
Signature of Soil Evaluator

John Federico SE#14303  
Typed or Printed Name of Soil Evaluator / License #

\_\_\_\_\_  
Date

6/30/2025  
Expiration Date of License

\_\_\_\_\_  
Date

\_\_\_\_\_  
Name of Approving Authority Witness

\_\_\_\_\_  
Approving Authority

**Note:** In accordance with 310 CMR 15.018(2) this form must be submitted to the approving authority within 60 days of the date of field testing, and to the designer and the property owner with [Percolation Test Form 12](#).



**Commonwealth of Massachusetts  
City/Town of Ashland**

**Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal**

**D. Determination of High Groundwater Elevation**

1. Method Used (Choose one):

Depth to soil redoximorphic features

Obs. Hole # 5 inches  
Obs. Hole # 6 inches

Depth to observed standing water in observation hole

66 inches  
60 inches

Depth to adjusted seasonal high groundwater ( $S_h$ ) (USGS methodology)

\_\_\_\_\_ inches  
\_\_\_\_\_ inches

Index Well Number \_\_\_\_\_ Reading Date \_\_\_\_\_

$$S_h = S_c - [S_r \times (OW_c - OW_{max}) / OW_r]$$

Obs. Hole/Well# \_\_\_\_\_  $S_c$  \_\_\_\_\_  $S_r$  \_\_\_\_\_  $OW_c$  \_\_\_\_\_  $OW_{max}$  \_\_\_\_\_  $OW_r$  \_\_\_\_\_  $S_h$  \_\_\_\_\_

**E. Certification**

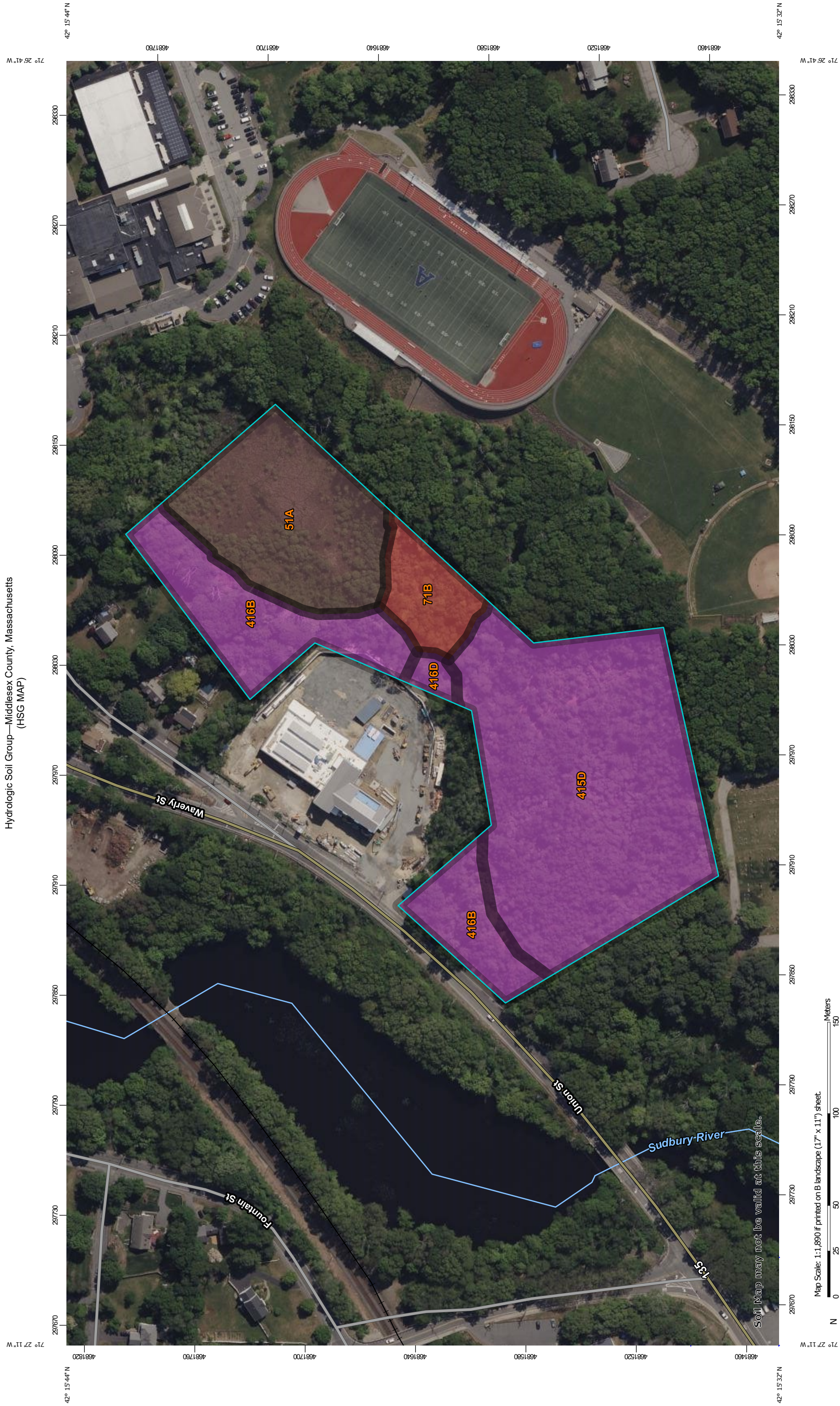
I certify that I am currently approved by the Department of Environmental Protection pursuant to 310 CMR 15.017 to conduct soil evaluations and that the above analysis has been performed by me consistent with the required training, expertise and experience described in 310 CMR 15.017. I further certify that the results of my soil evaluation, as indicated in the attached Soil Evaluation Form, are accurate and in accordance with 310 CMR 15.100 through 15.107.

Signature of Soil Evaluator \_\_\_\_\_ Date \_\_\_\_\_  
 John Federico SE#14303 6/30/2025  
 Typed or Printed Name of Soil Evaluator / License # \_\_\_\_\_ Expiration Date of License \_\_\_\_\_

Name of Approving Authority Witness \_\_\_\_\_ Approving Authority \_\_\_\_\_

**Note:** In accordance with 310 CMR 15.018(2) this form must be submitted to the approving authority within 60 days of the date of field testing, and to the designer and the property owner with [Percolation Test Form 12](#).

Hydrologic Soil Group—Middlesex County, Massachusetts  
(HSG MAP)



Soil Map may not be valid at this scale.

Map Scale: 1:1,890 if printed on B landscape (17" x 11") sheet.

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

0 25 50 100 150 Meters

0 50 100 200 300 Feet



Natural Resources  
Conservation Service









Web Soil Survey  
National Cooperative Soil Survey

## 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

## MAP INFORMATION

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

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

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

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

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

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

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

Soil Survey Area: Middlesex County, Massachusetts  
 Survey Area Data: Version 22, Sep 9, 2022

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
51A	Swansea muck, 0 to 1 percent slopes	B/D	2.1	21.6%
71B	Ridgebury fine sandy loam, 3 to 8 percent slopes, extremely stony	D	0.6	6.5%
415D	Narragansett silt loam, 15 to 25 percent slopes	A	4.9	49.4%
416B	Narragansett silt loam, 3 to 8 percent slopes, very stony	A	2.1	21.2%
416D	Narragansett silt loam, 15 to 25 percent slopes, very stony	A	0.1	1.3%
<b>Totals for Area of Interest</b>			<b>9.9</b>	<b>100.0%</b>

## 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 F**

Rainfall Data

Village at Clocktown  
Union Street  
Ashland, Massachusetts





**NOAA Atlas 14, Volume 10, Version 3**  
**Location name: Ashland, Massachusetts, USA\***  
**Latitude: 42.262°, Longitude: -71.4665°**  
**Elevation: m/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 & aeriels](#)

**PF tabular**

<b>PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches)<sup>1</sup></b>										
Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
<b>5-min</b>	<b>0.333</b> (0.259-0.425)	<b>0.401</b> (0.311-0.512)	<b>0.511</b> (0.396-0.655)	<b>0.602</b> (0.464-0.778)	<b>0.728</b> (0.543-0.981)	<b>0.823</b> (0.601-1.13)	<b>0.922</b> (0.655-1.32)	<b>1.03</b> (0.696-1.51)	<b>1.19</b> (0.774-1.81)	<b>1.33</b> (0.839-2.05)
<b>10-min</b>	<b>0.472</b> (0.367-0.603)	<b>0.568</b> (0.441-0.725)	<b>0.724</b> (0.561-0.929)	<b>0.854</b> (0.658-1.10)	<b>1.03</b> (0.770-1.39)	<b>1.17</b> (0.853-1.61)	<b>1.31</b> (0.928-1.87)	<b>1.46</b> (0.986-2.14)	<b>1.69</b> (1.10-2.56)	<b>1.88</b> (1.19-2.90)
<b>15-min</b>	<b>0.555</b> (0.432-0.709)	<b>0.668</b> (0.519-0.853)	<b>0.852</b> (0.661-1.09)	<b>1.00</b> (0.773-1.30)	<b>1.21</b> (0.906-1.64)	<b>1.37</b> (1.00-1.89)	<b>1.54</b> (1.09-2.20)	<b>1.72</b> (1.16-2.52)	<b>1.99</b> (1.29-3.01)	<b>2.21</b> (1.40-3.41)
<b>30-min</b>	<b>0.761</b> (0.592-0.972)	<b>0.915</b> (0.711-1.17)	<b>1.17</b> (0.904-1.50)	<b>1.38</b> (1.06-1.77)	<b>1.66</b> (1.24-2.24)	<b>1.88</b> (1.37-2.59)	<b>2.11</b> (1.50-3.01)	<b>2.36</b> (1.59-3.45)	<b>2.72</b> (1.76-4.12)	<b>3.02</b> (1.91-4.66)
<b>60-min</b>	<b>0.967</b> (0.753-1.24)	<b>1.16</b> (0.904-1.49)	<b>1.48</b> (1.15-1.90)	<b>1.75</b> (1.35-2.25)	<b>2.11</b> (1.58-2.84)	<b>2.39</b> (1.74-3.28)	<b>2.67</b> (1.90-3.82)	<b>3.00</b> (2.02-4.38)	<b>3.45</b> (2.24-5.23)	<b>3.83</b> (2.42-5.91)
<b>2-hr</b>	<b>1.23</b> (0.963-1.56)	<b>1.49</b> (1.16-1.89)	<b>1.90</b> (1.48-2.42)	<b>2.25</b> (1.75-2.88)	<b>2.73</b> (2.05-3.67)	<b>3.08</b> (2.28-4.24)	<b>3.47</b> (2.49-4.96)	<b>3.92</b> (2.65-5.70)	<b>4.61</b> (3.00-6.93)	<b>5.20</b> (3.30-7.97)
<b>3-hr</b>	<b>1.42</b> (1.11-1.79)	<b>1.72</b> (1.35-2.17)	<b>2.21</b> (1.73-2.80)	<b>2.61</b> (2.03-3.33)	<b>3.17</b> (2.40-4.25)	<b>3.58</b> (2.66-4.92)	<b>4.03</b> (2.92-5.78)	<b>4.58</b> (3.10-6.63)	<b>5.43</b> (3.53-8.13)	<b>6.16</b> (3.92-9.40)
<b>6-hr</b>	<b>1.81</b> (1.44-2.27)	<b>2.20</b> (1.74-2.77)	<b>2.84</b> (2.24-3.58)	<b>3.37</b> (2.64-4.27)	<b>4.10</b> (3.12-5.46)	<b>4.63</b> (3.46-6.32)	<b>5.22</b> (3.80-7.44)	<b>5.94</b> (4.04-8.54)	<b>7.08</b> (4.62-10.5)	<b>8.06</b> (5.14-12.2)
<b>12-hr</b>	<b>2.30</b> (1.83-2.86)	<b>2.80</b> (2.23-3.49)	<b>3.62</b> (2.87-4.53)	<b>4.30</b> (3.39-5.41)	<b>5.24</b> (4.01-6.93)	<b>5.93</b> (4.45-8.03)	<b>6.68</b> (4.89-9.45)	<b>7.61</b> (5.19-10.9)	<b>9.04</b> (5.93-13.4)	<b>10.3</b> (6.58-15.5)
<b>24-hr</b>	<b>2.73</b> (2.19-3.38)	<b>3.36</b> (2.69-4.16)	<b>4.39</b> (3.51-5.46)	<b>5.25</b> (4.17-6.56)	<b>6.42</b> (4.95-8.45)	<b>7.29</b> (5.51-9.82)	<b>8.24</b> (6.07-11.6)	<b>9.42</b> (6.45-13.4)	<b>11.3</b> (7.40-16.5)	<b>12.9</b> (8.25-19.2)
<b>2-day</b>	<b>3.03</b> (2.45-3.73)	<b>3.79</b> (3.06-4.66)	<b>5.03</b> (4.05-6.21)	<b>6.06</b> (4.84-7.52)	<b>7.47</b> (5.80-9.79)	<b>8.51</b> (6.48-11.4)	<b>9.65</b> (7.18-13.6)	<b>11.1</b> (7.64-15.7)	<b>13.5</b> (8.88-19.6)	<b>15.5</b> (9.99-23.0)
<b>3-day</b>	<b>3.28</b> (2.66-4.01)	<b>4.09</b> (3.31-5.01)	<b>5.41</b> (4.37-6.65)	<b>6.51</b> (5.22-8.04)	<b>8.02</b> (6.25-10.5)	<b>9.12</b> (6.97-12.2)	<b>10.3</b> (7.72-14.5)	<b>11.9</b> (8.21-16.7)	<b>14.4</b> (9.53-20.9)	<b>16.6</b> (10.7-24.6)
<b>4-day</b>	<b>3.52</b> (2.86-4.29)	<b>4.35</b> (3.54-5.32)	<b>5.72</b> (4.64-7.01)	<b>6.86</b> (5.52-8.45)	<b>8.42</b> (6.57-10.9)	<b>9.56</b> (7.32-12.7)	<b>10.8</b> (8.09-15.1)	<b>12.4</b> (8.59-17.4)	<b>15.0</b> (9.93-21.7)	<b>17.3</b> (11.1-25.4)
<b>7-day</b>	<b>4.21</b> (3.45-5.10)	<b>5.09</b> (4.17-6.18)	<b>6.54</b> (5.33-7.97)	<b>7.74</b> (6.26-9.48)	<b>9.39</b> (7.35-12.1)	<b>10.6</b> (8.14-14.0)	<b>11.9</b> (8.90-16.4)	<b>13.6</b> (9.41-18.9)	<b>16.1</b> (10.7-23.2)	<b>18.4</b> (11.9-26.9)
<b>10-day</b>	<b>4.88</b> (4.01-5.89)	<b>5.79</b> (4.76-7.01)	<b>7.29</b> (5.96-8.85)	<b>8.53</b> (6.93-10.4)	<b>10.2</b> (8.03-13.1)	<b>11.5</b> (8.83-15.1)	<b>12.9</b> (9.59-17.6)	<b>14.5</b> (10.1-20.1)	<b>17.0</b> (11.3-24.3)	<b>19.2</b> (12.4-27.9)
<b>20-day</b>	<b>6.88</b> (5.69-8.25)	<b>7.86</b> (6.50-9.44)	<b>9.46</b> (7.79-11.4)	<b>10.8</b> (8.83-13.1)	<b>12.6</b> (9.95-15.9)	<b>14.0</b> (10.8-18.1)	<b>15.4</b> (11.5-20.6)	<b>17.1</b> (11.9-23.4)	<b>19.3</b> (12.9-27.4)	<b>21.2</b> (13.8-30.7)
<b>30-day</b>	<b>8.51</b> (7.08-10.2)	<b>9.54</b> (7.92-11.4)	<b>11.2</b> (9.27-13.5)	<b>12.6</b> (10.3-15.2)	<b>14.5</b> (11.5-18.2)	<b>16.0</b> (12.3-20.4)	<b>17.5</b> (12.9-23.0)	<b>19.0</b> (13.3-25.9)	<b>21.1</b> (14.2-29.8)	<b>22.7</b> (14.8-32.7)
<b>45-day</b>	<b>10.5</b> (8.78-12.5)	<b>11.6</b> (9.66-13.8)	<b>13.3</b> (11.1-15.9)	<b>14.8</b> (12.2-17.7)	<b>16.8</b> (13.3-20.8)	<b>18.3</b> (14.1-23.2)	<b>19.8</b> (14.6-25.8)	<b>21.3</b> (15.0-28.8)	<b>23.1</b> (15.6-32.5)	<b>24.5</b> (16.0-35.1)
<b>60-day</b>	<b>12.2</b> (10.2-14.4)	<b>13.3</b> (11.1-15.8)	<b>15.1</b> (12.5-17.9)	<b>16.5</b> (13.7-19.8)	<b>18.6</b> (14.7-23.0)	<b>20.2</b> (15.6-25.4)	<b>21.7</b> (16.0-28.1)	<b>23.1</b> (16.3-31.2)	<b>24.7</b> (16.7-34.6)	<b>25.8</b> (16.9-37.0)

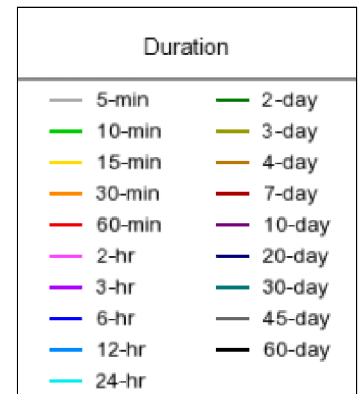
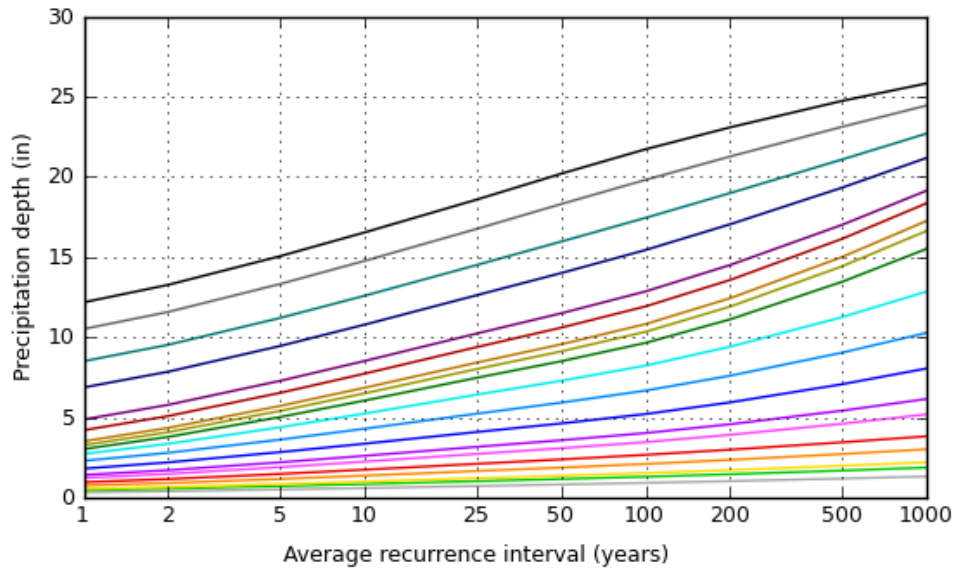
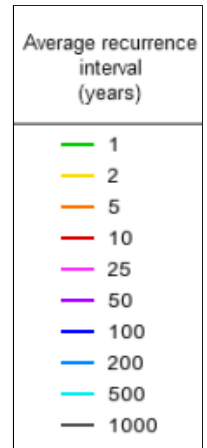
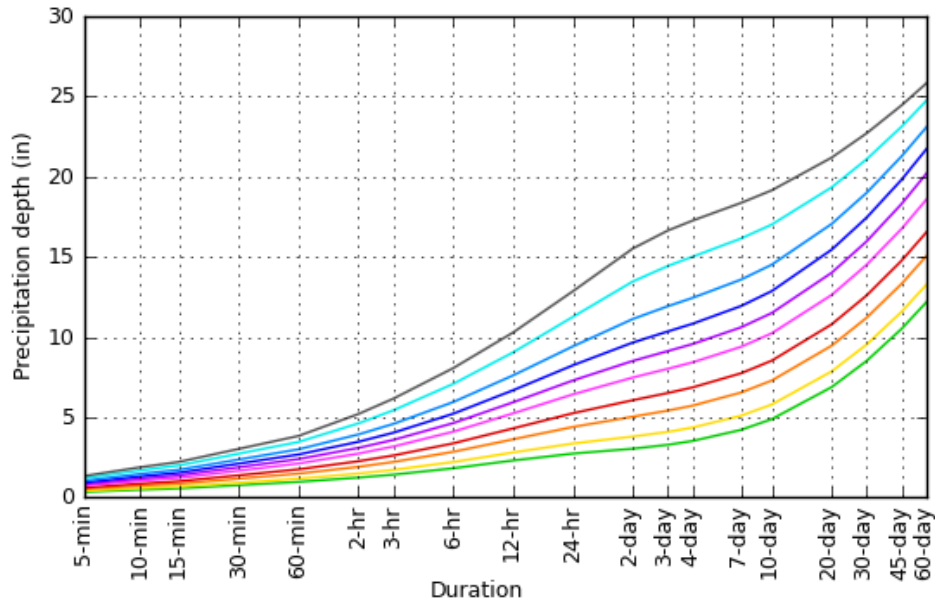
<sup>1</sup> Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS). Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration 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**

### PDS-based depth-duration-frequency (DDF) curves

Latitude: 42.2620°, Longitude: -71.4665°



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## Maps & aerials

Small scale terrain