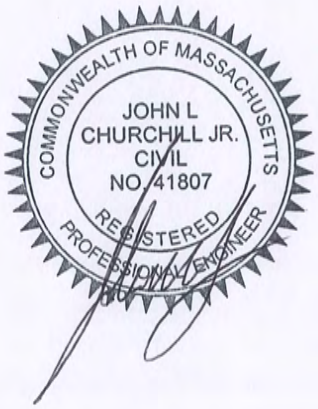
DRAINAGE CALCULATIONS
&
SUPPLEMENTAL INFORMATION

246 MARION ROAD
WAREHAM, MA

February 11, 2022



Prepared for:

246 Marion Road, LLC
7 Fieldstone Lane
Marion, MA 02738

Prepared by:

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2854 Cranberry Highway
East Wareham, Massachusetts 02538
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246 MARION ROAD

WAREHAM, MA

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1. Project Description

Narrative

This project involves the expansion of an existing paved parking lot to increase and formalize the number of parking spaces needed for the existing commercial use. The site has been developed to meet the Massachusetts Stormwater Standards and applicable Town of Wareham regulations pertaining to Stormwater Management.

Existing Conditions

The project site is known as 246 Marion Road and is shown as Lot 1010 on Wareham Assessors Map 56. The commercially used lot consists of 36,419 square feet of land and is partially developed with a 75-seat restaurant, a paved driveway, and gravel parking areas. The remainder of the property is undeveloped woodland except for some grassed lawn encroachment from the southeast abutter.

The property is abutted by residential properties to the southwest and southeast and is abutted by roadways to the northwest (Marion Road – Route 6) and northeast (Brown Street).

Proposed Conditions

The proposed project includes the expansion of a paved driveway to service the existing restaurant. The expanded parking lot will service multiple purposes. First, the informal gravel parking areas will be eliminated and replaced with a paved driveway and parking spaces that will provide for safer vehicular travel. Second, the existing parking spaces located adjacent to Marion Road will change to parallel parking spaces to eliminate the encroachment of vehicles into the State Highway Layout of Route 6. Currently, the front of the vehicles parked adjacent to Marion Road are obstructing the south facing views of vehicles exiting Brown Street. Changing to parallel parking adjacent to Marion Road will required the relocation of 9 existing parking spaces. Lastly, the expanded paved driveway will provide adequate paved access to all sides of the structure for emergency vehicles. The grading has been designed to minimize significant cuts & fills across the site and will follow existing drainage patterns. Due to the increase in stormwater runoff, the attached drainage analysis demonstrates the Stormwater Management System will capture, treat, and infiltrate runoff up to and including a 100-year storm event.

Soil Description

Existing soil classifications and hydrologic soil groups for the site were obtained from the USDA Soil Conservation Service, Soil Survey of Plymouth County, Massachusetts & The Web Soil Survey. The soil types found within the limits of the drainage analysis are classified as the following:

1.) Deerfield Loamy Fine Sand, 0 to 3 percent slopes (256A)

Deerfield Loamy Fine Sand is considered moderately well drained, exhibits a hydrological classification group “A”, and is the primary soil type over the project site.

2. Hydrologic Analysis & Stormwater Management

Methodology

Stormwater runoff was evaluated for the 2-year, 10-year, 25-year, and 100-year, Type III, 24-hour storm for both pre-development and post-development conditions. Pre-development and post-development conditions were modeled using HydroCAD software, which combines USDA Soil Conservation Service hydrology and hydraulic techniques (commonly known as SCS TR-55 and TR-20) to generate hydrographs (calculations are provided in the supplemental section of this report). The rainfall amounts used for calculating runoff for the 2-year, 10-year, 25-year and 100-year storm events were obtained from the NOAA Atlas 14 Volume 10 Frequency Estimates.

The drainage calculation provided at the end of this report identify on-site and off-site design points for both existing and proposed conditions. Under both existing and proposed conditions runoff is partially collected and infiltrated onsite, and directed offsite. **Table 1** compares the pre-development and post-development peak runoff rates and volumes for the 2-year, 10-year, 25-year, and 100-year storm events at two separate design points for the Type III, 24-hour storm events. The design points were evaluated to ensure post-development peak runoff rates and volumes do not exceed pre-development amounts.

Pre-Development Drainage Conditions

The site was modeled into two sub-catchment areas under existing conditions. Subcatchment Area 1S comprises the small northwestern portion of the site and contributes runoff to DP-1 which is a catch basin within Marion Road. Subcatchment Area 2S comprises the remainder of the site and contributes runoff to DP-2 which is located at the southerly corner of the property.

Refer to the Drainage Areas Plan prepared by this office at the end of this report.

Post-Development Drainage Conditions

Post-development drainage conditions and patterns were maintained to the maximum extent possible. Subcatchment Area 1S comprises the same small northwestern portion of the site and contributes runoff to DP-1which is a catch basin within Marion Road. No work is proposed that would impact the existing runoff patterns within existing Subcatchment Area 1S. Subcatchment Area 2S comprises the remaining outer perimeter of the site and contributes runoff to DP-2 which is located at the southerly corner of the property. Subcatchment Area 3S contributes to onsite stormwater management system and is directly recharged.

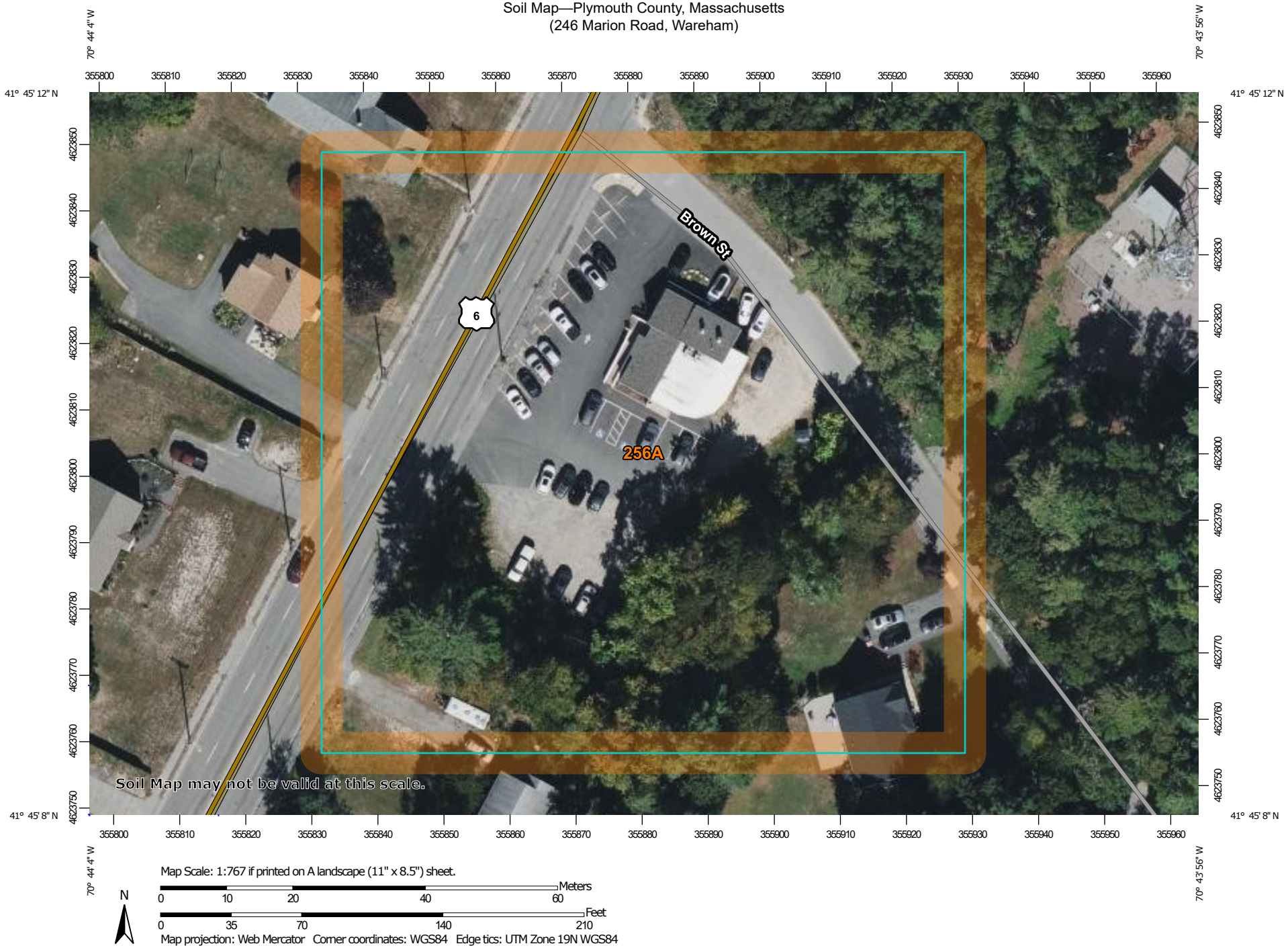
Refer to the Drainage Areas Plan prepared by this office at the end of this report.

Table 1 compares below the pre-development and post-development peak runoff rates and volumes for the 2-year, 10-year, 25-year, and 100-year storm events at the offsite design points.

	Ex. Flow (cfs)	**Prop. Flow (cfs)**	**Ex. Vol. (af)**	**Prop. Vol. (cf)**
DP-1				
2-Yr Event	0.28	0.28	0.023	0.023
10-Yr Event	0.41	0.41	0.034	0.034
25-Yr Event	0.49	0.49	0.041	0.041
100-Yr Event	0.62	0.62	0.052	0.052
DP-2				
2-Yr Event	0.38	0.18	0.037	0.017
10-Yr Event	1.18	0.54	0.092	0.042
25-Yr Event	1.77	0.80	0.133	0.060
100-Yr Event	2.78	1.24	0.203	0.090

Table 1 – Comparison of Off-site Stormwater Flows and Volumes

Soil Map—Plymouth County, Massachusetts
(246 Marion Road, Wareham)



Map Scale: 1:767 if printed on A landscape (11" x 8.5") sheet.

N

Meters
0 10 20 40 60

Feet
0 35 70 140 210

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

MAP LEGEND

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

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

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

Water Features
- Streams and Canals

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

Background
- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:12,000.

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: Plymouth County, Massachusetts
Survey Area Data: Version 14, Sep 2, 2021

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

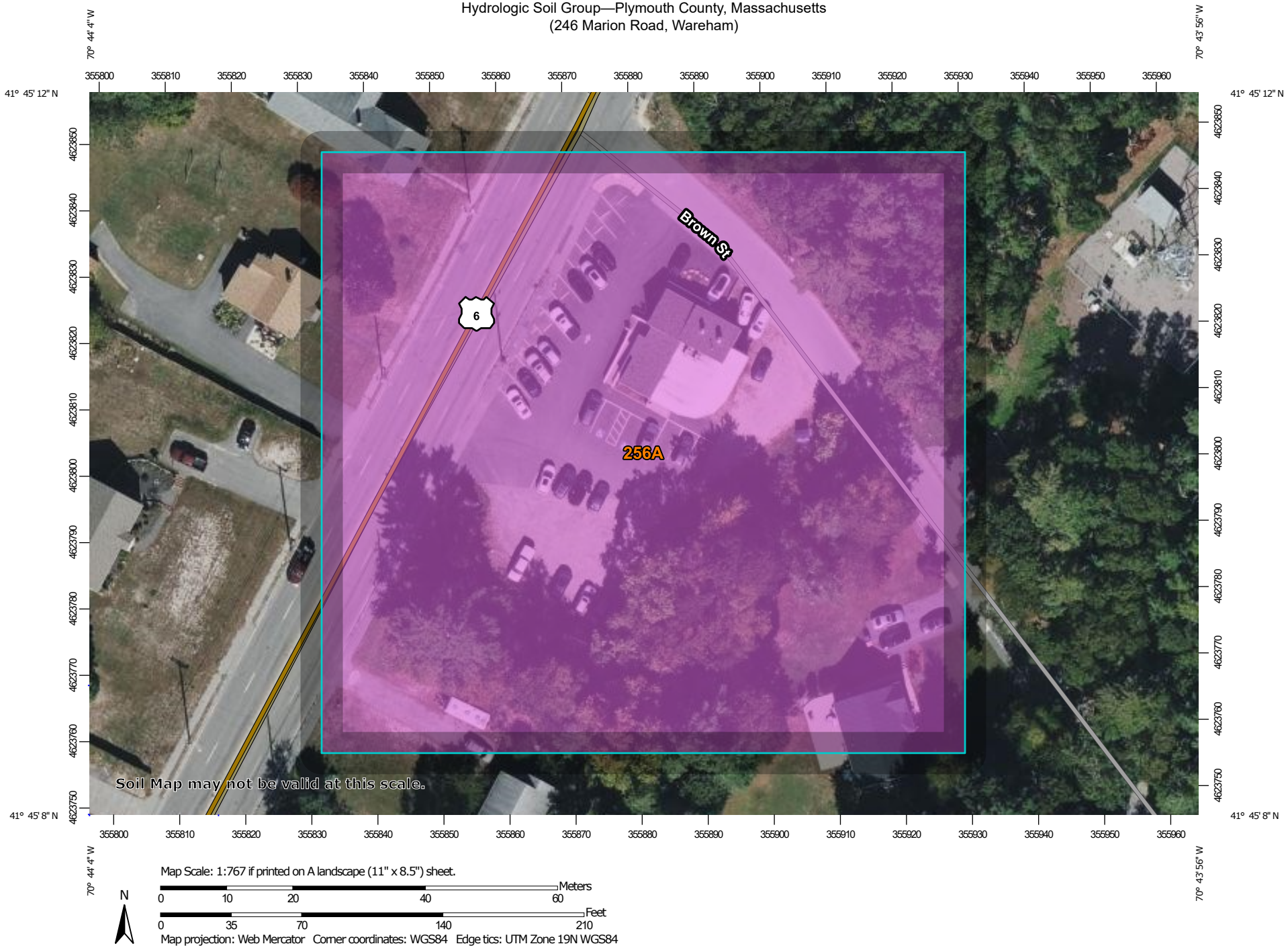
Date(s) aerial images were photographed: Sep 25, 2020—Oct 9, 2020

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

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
256A	Deerfield loamy fine sand, 0 to 3 percent slopes	2.2	100.0%
Totals for Area of Interest		**2.2**	**100.0%**

Hydrologic Soil Group—Plymouth County, Massachusetts
(246 Marion Road, Wareham)



Map Scale: 1:767 if printed on A landscape (11" x 8.5") sheet.

N

Meters
0 10 20 40 60

Feet
0 35 70 140 210

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

MAP LEGEND

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

Soils

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

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

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

Water Features
- Streams and Canals

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

Background
- Aerial Photography

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Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

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Survey Area Data: Version 14, Sep 2, 2021

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

Date(s) aerial images were photographed: Sep 25, 2020—Oct 9, 2020

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Hydrologic Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
256A	Deerfield loamy fine sand, 0 to 3 percent slopes	A	2.2	100.0%
Totals for Area of Interest			**2.2**	**100.0%**

Description

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

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

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

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

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

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

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

Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

NOAA Atlas 14, Volume 10, Version 3
Location name: Wareham, Massachusetts, USA*
Latitude: 41.7531°, Longitude: -70.7334°
Elevation: 16.81 ft**
* source: ESRI Maps
** source: USGS

POINT PRECIPITATION FREQUENCY ESTIMATES

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

NOAA, National Weather Service, Silver Spring, Maryland

PF_tabular | PF_graphical | Maps_&_aerials

PF tabular

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

Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	**0.294** (0.237-0.361)	**0.365** (0.293-0.448)	**0.480** (0.385-0.590)	**0.576** (0.460-0.711)	**0.707** (0.548-0.905)	**0.805** (0.612-1.05)	**0.909** (0.676-1.22)	**1.03** (0.723-1.39)	**1.22** (0.822-1.69)	**1.37** (0.908-1.93)
10-min	**0.417** (0.336-0.511)	**0.517** (0.415-0.634)	**0.680** (0.545-0.836)	**0.815** (0.650-1.01)	**1.00** (0.776-1.28)	**1.14** (0.867-1.48)	**1.29** (0.958-1.73)	**1.46** (1.02-1.98)	**1.73** (1.16-2.39)	**1.95** (1.29-2.73)
15-min	**0.491** (0.395-0.602)	**0.608** (0.489-0.746)	**0.800** (0.641-0.984)	**0.959** (0.764-1.18)	**1.18** (0.913-1.51)	**1.34** (1.02-1.75)	**1.52** (1.13-2.04)	**1.72** (1.21-2.33)	**2.03** (1.37-2.81)	**2.29** (1.51-3.21)
30-min	**0.705** (0.567-0.864)	**0.873** (0.702-1.07)	**1.15** (0.920-1.41)	**1.38** (1.10-1.70)	**1.69** (1.31-2.16)	**1.92** (1.47-2.51)	**2.17** (1.62-2.92)	**2.47** (1.73-3.33)	**2.91** (1.97-4.03)	**3.28** (2.17-4.61)
60-min	**0.919** (0.740-1.13)	**1.14** (0.915-1.40)	**1.50** (1.20-1.84)	**1.79** (1.43-2.21)	**2.20** (1.71-2.82)	**2.51** (1.91-3.26)	**2.83** (2.11-3.81)	**3.22** (2.25-4.34)	**3.79** (2.56-5.25)	**4.27** (2.82-6.00)
2-hr	**1.24** (1.00-1.51)	**1.54** (1.24-1.87)	**2.03** (1.64-2.48)	**2.44** (1.96-2.99)	**3.00** (2.35-3.82)	**3.42** (2.63-4.43)	**3.87** (2.91-5.18)	**4.41** (3.11-5.91)	**5.24** (3.57-7.19)	**5.95** (3.97-8.28)
3-hr	**1.46** (1.18-1.77)	**1.81** (1.47-2.19)	**2.38** (1.93-2.89)	**2.85** (2.30-3.49)	**3.51** (2.75-4.45)	**3.99** (3.08-5.15)	**4.51** (3.41-6.01)	**5.15** (3.65-6.86)	**6.12** (4.18-8.35)	**6.94** (4.65-9.61)
6-hr	**1.90** (1.55-2.29)	**2.32** (1.90-2.80)	**3.01** (2.45-3.64)	**3.58** (2.90-4.34)	**4.36** (3.44-5.49)	**4.95** (3.84-6.32)	**5.58** (4.23-7.34)	**6.32** (4.52-8.35)	**7.45** (5.14-10.1)	**8.40** (5.67-11.5)
12-hr	**2.41** (1.99-2.89)	**2.88** (2.37-3.46)	**3.66** (3.00-4.39)	**4.30** (3.51-5.18)	**5.18** (4.11-6.44)	**5.84** (4.55-7.37)	**6.54** (4.97-8.48)	**7.33** (5.29-9.59)	**8.49** (5.91-11.4)	**9.45** (6.44-12.8)
24-hr	**2.90** (2.41-3.45)	**3.44** (2.85-4.10)	**4.32** (3.57-5.15)	**5.05** (4.15-6.04)	**6.05** (4.83-7.45)	**6.81** (5.33-8.50)	**7.60** (5.79-9.73)	**8.47** (6.16-11.0)	**9.71** (6.81-12.9)	**10.7** (7.36-14.4)
2-day	**3.34** (2.79-3.95)	**3.97** (3.31-4.69)	**5.00** (4.16-5.93)	**5.86** (4.84-6.96)	**7.04** (5.65-8.60)	**7.92** (6.25-9.82)	**8.85** (6.80-11.2)	**9.88** (7.24-12.7)	**11.3** (8.02-14.9)	**12.5** (8.66-16.6)
3-day	**3.66** (3.07-4.31)	**4.33** (3.62-5.10)	**5.42** (4.52-6.39)	**6.32** (5.25-7.48)	**7.56** (6.10-9.20)	**8.50** (6.73-10.5)	**9.48** (7.31-12.0)	**10.6** (7.77-13.5)	**12.1** (8.57-15.7)	**13.3** (9.23-17.6)
4-day	**3.95** (3.32-4.64)	**4.63** (3.89-5.44)	**5.75** (4.81-6.76)	**6.67** (5.55-7.88)	**7.95** (6.42-9.63)	**8.91** (7.07-10.9)	**9.91** (7.65-12.4)	**11.0** (8.12-14.0)	**12.5** (8.91-16.2)	**13.7** (9.56-18.0)
7-day	**4.71** (3.98-5.50)	**5.42** (4.57-6.33)	**6.58** (5.53-7.70)	**7.54** (6.31-8.86)	**8.87** (7.20-10.7)	**9.88** (7.87-12.0)	**10.9** (8.45-13.5)	**12.0** (8.92-15.1)	**13.4** (9.66-17.3)	**14.6** (10.2-19.0)
10-day	**5.41** (4.59-6.30)	**6.15** (5.21-7.16)	**7.35** (6.20-8.57)	**8.35** (7.01-9.76)	**9.72** (7.92-11.6)	**10.8** (8.61-13.0)	**11.8** (9.17-14.6)	**12.9** (9.64-16.2)	**14.3** (10.3-18.3)	**15.4** (10.9-20.0)
20-day	**7.51** (6.41-8.68)	**8.32** (7.10-9.62)	**9.66** (8.21-11.2)	**10.8** (9.10-12.5)	**12.3** (10.1-14.5)	**13.5** (10.8-16.1)	**14.6** (11.4-17.7)	**15.7** (11.9-19.6)	**17.1** (12.5-21.7)	**18.1** (12.9-23.2)
30-day	**9.27** (7.94-10.7)	**10.2** (8.69-11.7)	**11.6** (9.90-13.4)	**12.8** (10.9-14.8)	**14.5** (11.9-17.0)	**15.8** (12.7-18.7)	**17.0** (13.3-20.5)	**18.2** (13.8-22.4)	**19.5** (14.3-24.7)	**20.5** (14.7-26.2)
45-day	**11.5** (9.87-13.1)	**12.5** (10.7-14.3)	**14.1** (12.0-16.1)	**15.4** (13.1-17.7)	**17.2** (14.2-20.1)	**18.7** (15.1-22.0)	**20.0** (15.7-23.9)	**21.2** (16.2-26.1)	**22.6** (16.7-28.4)	**23.5** (16.9-29.9)
60-day	**13.3** (11.5-15.2)	**14.4** (12.4-16.5)	**16.1** (13.9-18.5)	**17.6** (15.0-20.2)	**19.6** (16.2-22.8)	**21.1** (17.2-24.8)	**22.6** (17.7-26.9)	**23.8** (18.2-29.2)	**25.3** (18.7-31.6)	**26.1** (18.9-33.1)

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

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

Please refer to NOAA Atlas 14 document for more information.

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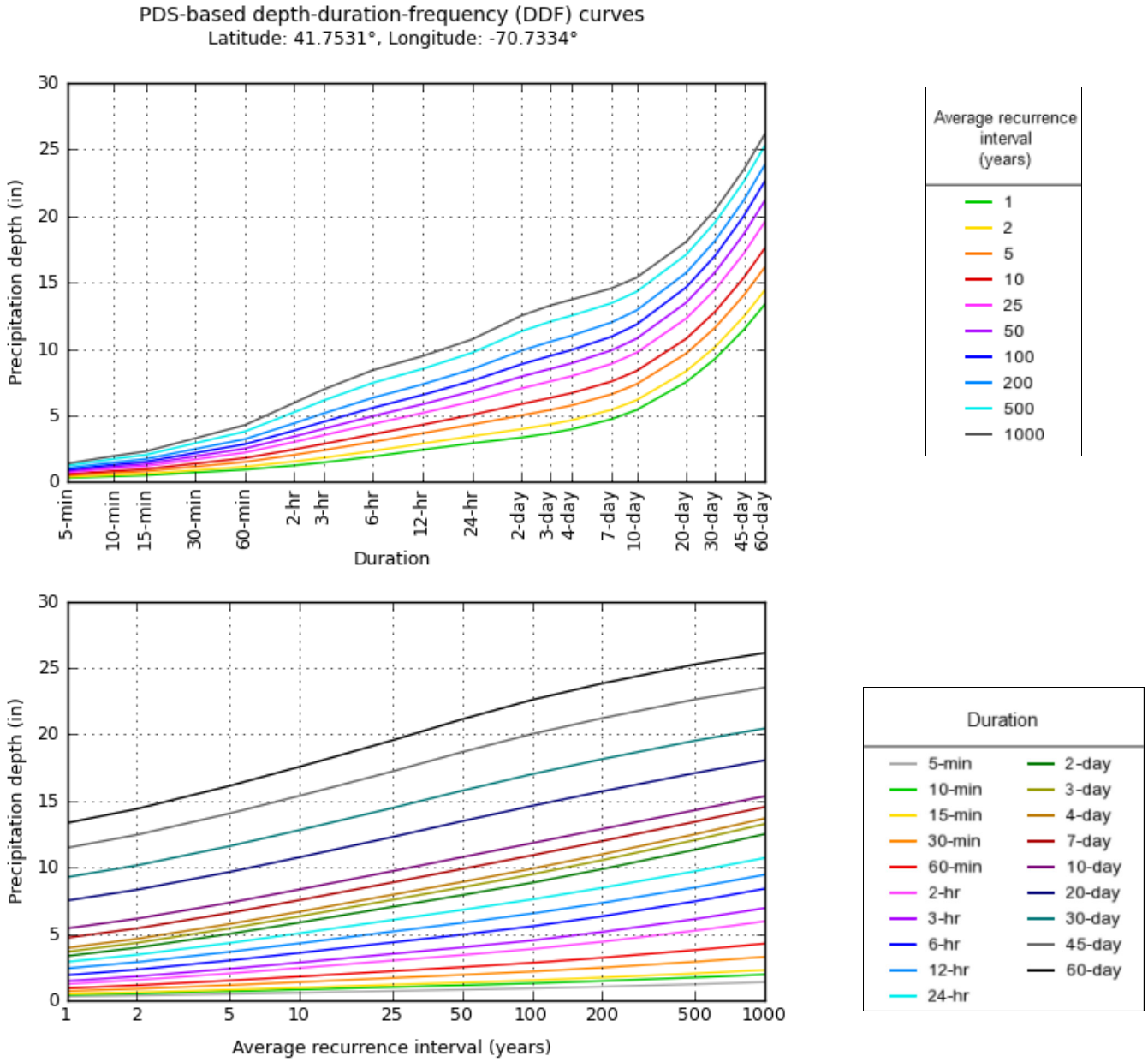
PF graphical



NOAA Atlas 14, Volume 10, Version 3 Created (GMT): Fri Dec 17 15:09:31 2021

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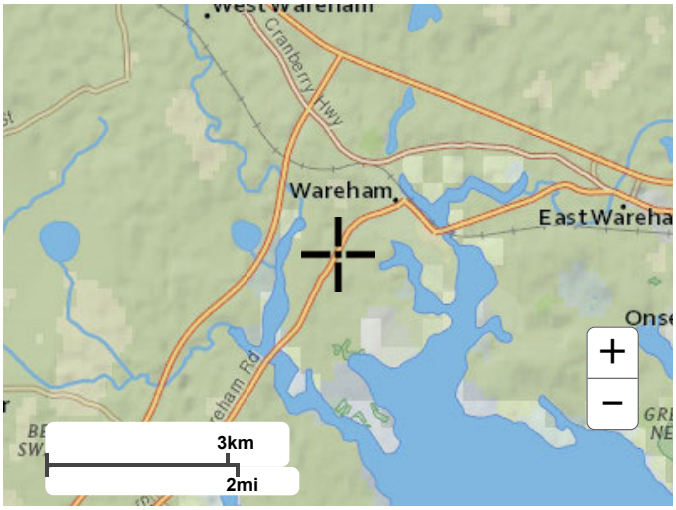
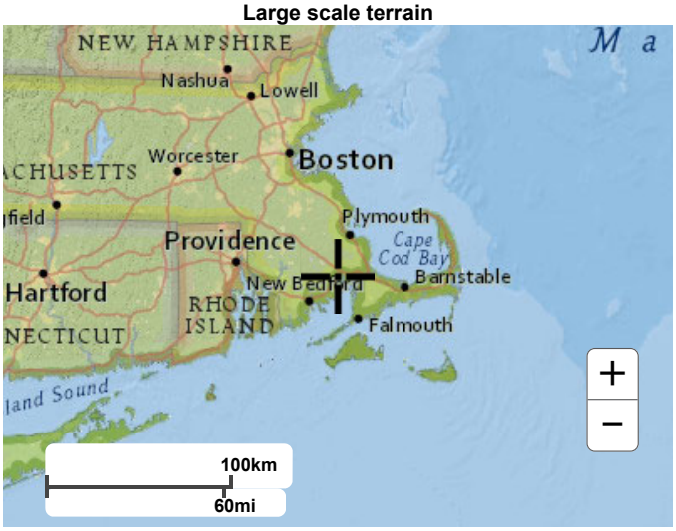
Maps & aerials

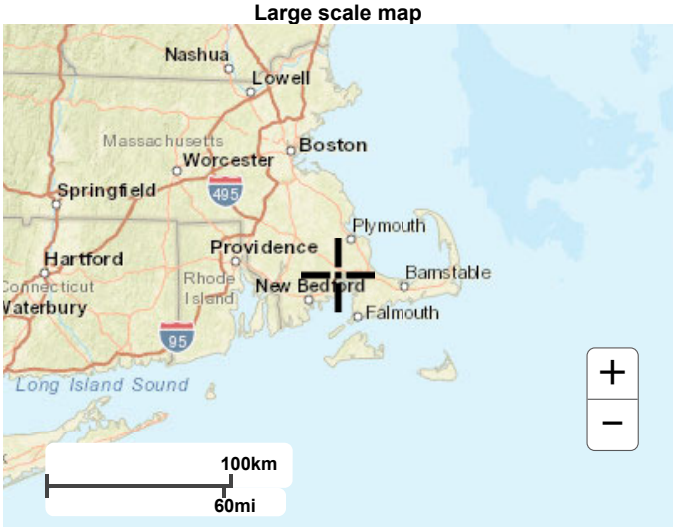
Small scale terrain



Large scale terrain



Large scale map



Large scale aerial

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

Disclaimer

GROUNDWATER RECHARGE VOLUME CALCULATIONS

246 MARION ROAD

WAREHAM, MASSACHUSETTS

Impervious Area

- Existing Impervious Area = 12,858s.f.
- New Impervious Area = 9,085 s.f.
- Total Impervious Area = 21,943 s.f.

Recharge Factor

Hydrologic Group A Soils = 0.60 inches of runoff

Groundwater Recharge Volume Required

21,943 s.f. x (0.60 inches x 1/12) = **1,097** c.f. required

Groundwater Recharge Volume Provided in Infiltration Basin

- The storage volume is **3,307** c.f. within the infiltration basin below elevation 16.5' (refer to HydroCAD output of "Pond 1P" in drainage report)

Conclusion: Total recharge volume of **3,307** c.f. provided is greater than the required recharge volume of **1,097** c.f.; therefore **OK**.

WATER QUALITY VOLUME CALCULATIONS

246 MARION ROAD

WAREHAM, MASSACHUSETTS

Impervious Area

- Impervious Area (I) = 21,943 s.f.

Water Quality Volume (WQV) Required to be Treated (1/2" of runoff)

- WQV = 1/2" x I (s.f.)
- WQV = 1/2"/(12 in/ft) x 21,943 s.f. = **914 c.f.** required

Water Quality Volume Provided

- The recharge volume is **3,307** c.f. within the leaching basin below elevation 16.5' (refer to HydroCAD output of "Pond 1P" in drainage report)

Conclusion: Proposed water quality volume of **3,307** c.f. provided is greater than **914** c.f. required; therefore OK.

SEDIMENT FOREBAY SIZING CALCULATIONS

246 MARION ROAD

WAREHAM, MASSACHUSETTS

Sediment Forebays:

Impervious Area

- Proposed Impervious Area (I) = 21,943 s.f.

Sediment Forebay Volume Required

- (0.10"/12) x I = **183** c.f.

Sediment Forebay Volume Provided

- The storage volume within forebays below spillway elevation 16.0':
  Base area at elevation 14.6 = 461 s.f.
  Base area at elevation 15.0 = 714 s.f.
  Base area at elevation 16.0 = 1,478 s.f.
  Volume between elevation 14.6' and 16.0' = **1,331 c.f.**

Conclusion: Proposed sediment forebay volume of **1,331** cubic feet provided is greater than **183** cubic feet required; therefore OK.

INFILTRATION DRAIN-DOWN TIME CALCULATIONS

246 MARION ROAD

WAREHAM, MASSACHUSETTS

Pond 1P:

Maximum Drain Time = 72 hours

Provided Drain Time = Storage Volume / (K x Basin Bottom Area*)

Bottom Area = 1,103 s.f. (See Pond 1P) – 461 s.f. (See Forebay Sizing) = 642 s.f.

= 3,307 c.f. / [(2.4 in/hr) (1ft/12 inches) x 642 s.f.]

= **26.0 hours**, which is less than max. drain time of 72 hours, therefore OK.

Pond 2P:

Maximum Drain Time = 72 hours

Provided Drain Time = Storage Volume / (K x Basin Bottom Area*)

Bottom Area = 648 s.f. (See Pond 2P)

= 1,134 c.f. / [(8.27 in/hr) (1ft/12 inches) x 648 s.f.]

= **2.5 hours**, which is less than max. drain time of 72 hours, therefore OK.

TSS REMOVAL CALCULATIONS

INSTRUCTIONS:

Version 1, Automated: Mar. 4, 2008

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

Location: 246 Marion Road

TSS Removal Calculation Worksheet

B BMP[1]	C TSS Removal Rate[1]	D Starting TSS Load*	E Amount Removed (C*D)	F Remaining Load (D-E)
Infiltration Basin	**0.80**	**1.00**	**0.80**	**0.20**
	0.00	**0.20**	**0.00**	**0.20**
	0.00	**0.20**	**0.00**	**0.20**
	0.00	**0.20**	**0.00**	**0.20**
	0.00	**0.20**	**0.00**	**0.20**

Total TSS Removal = **80%**

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

Project:

Prepared By: **JC Engineering**

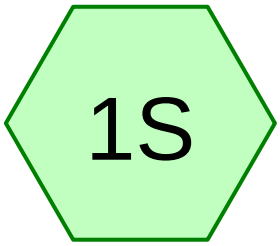
Date: **2/11/2022**

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

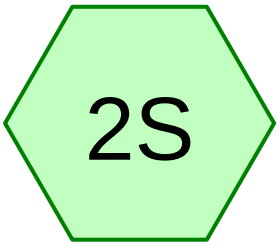
Non-automated TSS Calculation Sheet must be used if Proprietary BMP Proposed

1. From MassDEP Stormwater Handbook Vol. 1

EXISTING CONDITIONS DRAINAGE CALCULATIONS



To Route 6



Offsite to South

Subcat Reach Pond Link

Routing Diagram for Existing Conditions
Prepared by JC Engineering, Inc., Printed 2/9/2022

Summary for Subcatchment 1S: To Route 6

Runoff = 0.28 cfs @ 12.09 hrs, Volume= 0.023 af, Depth> 3.20"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-year Rainfall=3.44"

	Area (sf)	CN	Description
*	3,693	98	Roof and Paved Driveway, HSG A
	3,693		100.00% Impervious Area

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

Summary for Subcatchment 2S: Offsite to South

Runoff = 0.38 cfs @ 12.12 hrs, Volume= 0.037 af, Depth> 0.59"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-year Rainfall=3.44"

	Area (sf)	CN	Description
	12,335	30	Woods, Good, HSG A
	2,956	49	50-75% Grass cover, Fair, HSG A
*	8,269	76	Gravel driveway, HSG A
*	9,165	98	Roof and Paved Driveway, HSG A
	32,725	62	Weighted Average
	23,560		71.99% Pervious Area
	9,165		28.01% Impervious Area

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

Summary for Subcatchment 1S: To Route 6

Runoff = 0.41 cfs @ 12.09 hrs, Volume= 0.034 af, Depth> 4.81"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-year Rainfall=5.05"

	Area (sf)	CN	Description
*	3,693	98	Roof and Paved Driveway, HSG A
	3,693		100.00% Impervious Area

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

Summary for Subcatchment 2S: Offsite to South

Runoff = 1.18 cfs @ 12.10 hrs, Volume= 0.092 af, Depth> 1.47"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-year Rainfall=5.05"

	Area (sf)	CN	Description
	12,335	30	Woods, Good, HSG A
	2,956	49	50-75% Grass cover, Fair, HSG A
*	8,269	76	Gravel driveway, HSG A
*	9,165	98	Roof and Paved Driveway, HSG A
	32,725	62	Weighted Average
	23,560		71.99% Pervious Area
	9,165		28.01% Impervious Area

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

Summary for Subcatchment 1S: To Route 6

Runoff = 0.49 cfs @ 12.09 hrs, Volume= 0.041 af, Depth> 5.81"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-year Rainfall=6.05"

	Area (sf)	CN	Description
*	3,693	98	Roof and Paved Driveway, HSG A
	3,693		100.00% Impervious Area

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

Summary for Subcatchment 2S: Offsite to South

Runoff = 1.77 cfs @ 12.10 hrs, Volume= 0.133 af, Depth> 2.12"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-year Rainfall=6.05"

	Area (sf)	CN	Description
	12,335	30	Woods, Good, HSG A
	2,956	49	50-75% Grass cover, Fair, HSG A
*	8,269	76	Gravel driveway, HSG A
*	9,165	98	Roof and Paved Driveway, HSG A
	32,725	62	Weighted Average
	23,560		71.99% Pervious Area
	9,165		28.01% Impervious Area

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

Summary for Subcatchment 1S: To Route 6

Runoff = 0.62 cfs @ 12.09 hrs, Volume= 0.052 af, Depth> 7.35"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-year Rainfall=7.60"

	Area (sf)	CN	Description
*	3,693	98	Roof and Paved Driveway, HSG A
	3,693		100.00% Impervious Area

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

Summary for Subcatchment 2S: Offsite to South

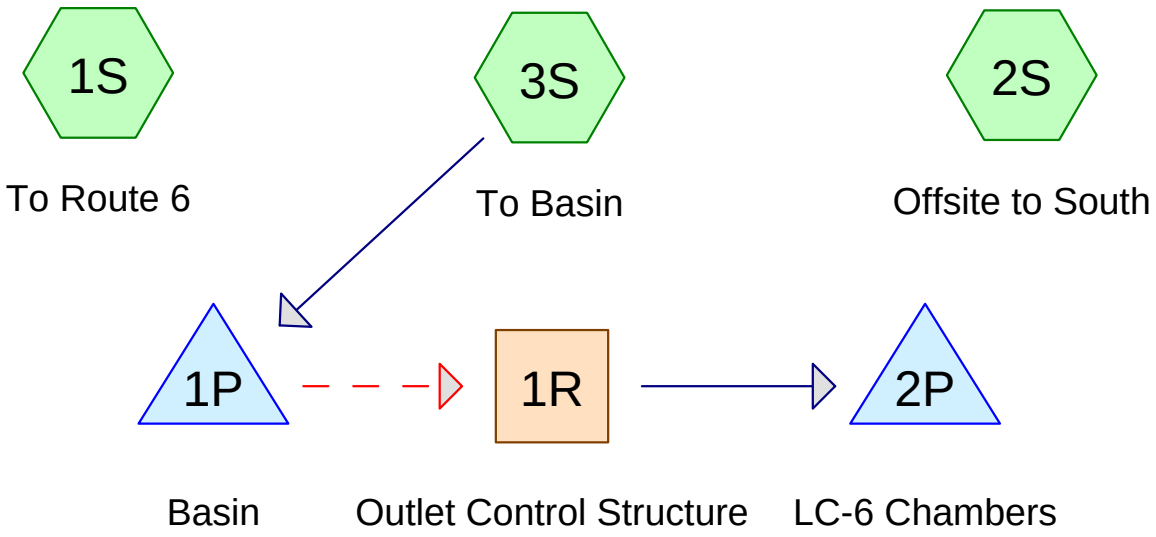
Runoff = 2.78 cfs @ 12.10 hrs, Volume= 0.203 af, Depth> 3.25"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-year Rainfall=7.60"

	Area (sf)	CN	Description
	12,335	30	Woods, Good, HSG A
	2,956	49	50-75% Grass cover, Fair, HSG A
*	8,269	76	Gravel driveway, HSG A
*	9,165	98	Roof and Paved Driveway, HSG A
	32,725	62	Weighted Average
	23,560		71.99% Pervious Area
	9,165		28.01% Impervious Area

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

PROPOSED CONDITIONS DRAINAGE CALCULATIONS



Subcat Reach Pond Link

Routing Diagram for Proposed Conditions
Prepared by JC Engineering, Inc., Printed 2/9/2022

Summary for Subcatchment 1S: To Route 6

Runoff = 0.28 cfs @ 12.09 hrs, Volume= 0.023 af, Depth> 3.20"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-year Rainfall=3.44"

	Area (sf)	CN	Description
*	3,693	98	Roof and Paved Driveway, HSG A
	3,693		100.00% Impervious Area

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

Summary for Subcatchment 2S: Offsite to South

Runoff = 0.18 cfs @ 12.11 hrs, Volume= 0.017 af, Depth> 0.63"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-year Rainfall=3.44"

	Area (sf)	CN	Description
	3,959	30	Woods, Good, HSG A
	3,927	49	50-75% Grass cover, Fair, HSG A
	1,256	76	Gravel roads, HSG A
*	4,958	98	Paved parking and Roof, HSG A
	14,100	63	Weighted Average
	9,142		64.84% Pervious Area
	4,958		35.16% Impervious Area

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

Summary for Subcatchment 3S: To Basin

Runoff = 1.26 cfs @ 12.09 hrs, Volume= 0.095 af, Depth> 2.68"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-year Rainfall=3.44"

	Area (sf)	CN	Description
*	13,292	98	Paved Driveway
	2,026	49	50-75% Grass cover, Fair, HSG A
*	3,307	98	Basin
	18,625	93	Weighted Average
	2,026		10.88% Pervious Area
	16,599		89.12% Impervious Area

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

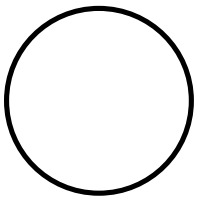
Summary for Reach 1R: Outlet Control Structure

Inflow = 0.00 cfs @ 1.00 hrs, Volume= 0.000 af
Outflow = 0.00 cfs @ 1.00 hrs, Volume= 0.000 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 1.00-24.00 hrs, dt= 0.05 hrs
Max. Velocity= 0.00 fps, Min. Travel Time= 0.0 min
Avg. Velocity = 0.00 fps, Avg. Travel Time= 0.0 min

Peak Storage= 0 cf @ 1.00 hrs
Average Depth at Peak Storage= 0.00'
Bank-Full Depth= 0.50' Flow Area= 0.2 sf, Capacity= 1.03 cfs

6.0" Round Pipe
n= 0.010 PVC, smooth interior
Length= 10.0' Slope= 0.0200 '/'
Inlet Invert= 15.55', Outlet Invert= 15.35'



Summary for Pond 1P: Basin

Inflow Area = 0.428 ac, 89.12% Impervious, Inflow Depth > 2.68" for 2-year event
Inflow = 1.26 cfs @ 12.09 hrs, Volume= 0.095 af
Outflow = 0.12 cfs @ 12.92 hrs, Volume= 0.095 af, Atten= 90%, Lag= 50.0 min
Discarded = 0.12 cfs @ 12.92 hrs, Volume= 0.095 af
Secondary = 0.00 cfs @ 1.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 1.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 15.65' @ 12.92 hrs Surf.Area= 2,222 sf Storage= 1,707 cf

Plug-Flow detention time= 131.6 min calculated for 0.095 af (100% of inflow)
Center-of-Mass det. time= 130.5 min (920.2 - 789.7)

Volume	Invert	Avail.Storage	Storage Description
#1	14.60'	6,713 cf	**Custom Stage Data (Conic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
14.60	1,103	0	0	1,103
15.00	1,472	513	513	1,475
16.00	2,689	2,050	2,563	2,703
16.50	3,307	1,496	4,060	3,328
17.00	7,599	2,653	6,713	7,622

Device	Routing	Invert	Outlet Devices
#1	Discarded	14.60'	**2.410 in/hr Exfiltration over Surface area from 14.59' - 16.50'** Excluded Surface area = 0 sf
#2	Secondary	16.50'	**4.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s) 0.5' Crest Height

Discarded OutFlow Max=0.12 cfs @ 12.92 hrs HW=15.65' (Free Discharge)
↑**1=Exfiltration** (Exfiltration Controls 0.12 cfs)

Secondary OutFlow Max=0.00 cfs @ 1.00 hrs HW=14.60' (Free Discharge)
↑**2=Sharp-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond 2P: LC-6 Chambers

Inflow	=	0.00 cfs @	1.00 hrs, Volume=	0.000 af
Outflow	=	0.00 cfs @	1.00 hrs, Volume=	0.000 af, Atten= 0%, Lag= 0.0 min
Discarded	=	0.00 cfs @	1.00 hrs, Volume=	0.000 af

Routing by Stor-Ind method, Time Span= 1.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 14.60' @ 1.00 hrs Surf.Area= 648 sf Storage= 0 cf

Plug-Flow detention time= (not calculated: initial storage exceeds outflow)
Center-of-Mass det. time= (not calculated: no inflow)

Volume	Invert	Avail.Storage	Storage Description
#1	14.60'	323 cf	**Custom Stage Data (Conic)**Listed below (Recalc) 1,348 cf Overall - 540 cf Embedded = 808 cf x 40.0% Voids
#2	14.85'	413 cf	**2.50'W x 5.50'L x 1.50'H Prismatoid** x 20 Inside #1 540 cf Overall - 3.0" Wall Thickness = 413 cf
		736 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
14.60	648	0	0	648
14.85	648	162	162	671
16.35	648	972	1,134	806
16.68	648	214	1,348	836

Device	Routing	Invert	Outlet Devices
#1	Discarded	14.60'	**8.270 in/hr Exfiltration over Wetted area**

Discarded OutFlow Max=0.00 cfs @ 1.00 hrs HW=14.60' (Free Discharge)
↑**1=Exfiltration** (Passes 0.00 cfs of 0.12 cfs potential flow)

Summary for Subcatchment 1S: To Route 6

Runoff = 0.41 cfs @ 12.09 hrs, Volume= 0.034 af, Depth> 4.81"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-year Rainfall=5.05"

	Area (sf)	CN	Description
*	3,693	98	Roof and Paved Driveway, HSG A
	3,693		100.00% Impervious Area

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

Summary for Subcatchment 2S: Offsite to South

Runoff = 0.54 cfs @ 12.10 hrs, Volume= 0.042 af, Depth> 1.54"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-year Rainfall=5.05"

	Area (sf)	CN	Description
	3,959	30	Woods, Good, HSG A
	3,927	49	50-75% Grass cover, Fair, HSG A
	1,256	76	Gravel roads, HSG A
*	4,958	98	Paved parking and Roof, HSG A
	14,100	63	Weighted Average
	9,142		64.84% Pervious Area
	4,958		35.16% Impervious Area

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

Summary for Subcatchment 3S: To Basin

Runoff = 1.95 cfs @ 12.09 hrs, Volume= 0.151 af, Depth> 4.24"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-year Rainfall=5.05"

	Area (sf)	CN	Description
*	13,292	98	Paved Driveway
	2,026	49	50-75% Grass cover, Fair, HSG A
*	3,307	98	Basin
	18,625	93	Weighted Average
	2,026		10.88% Pervious Area
	16,599		89.12% Impervious Area

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

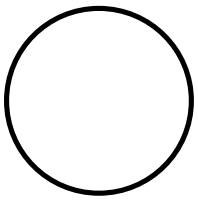
Summary for Reach 1R: Outlet Control Structure

Inflow = 0.00 cfs @ 1.00 hrs, Volume= 0.000 af
Outflow = 0.00 cfs @ 1.00 hrs, Volume= 0.000 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 1.00-24.00 hrs, dt= 0.05 hrs
Max. Velocity= 0.00 fps, Min. Travel Time= 0.0 min
Avg. Velocity = 0.00 fps, Avg. Travel Time= 0.0 min

Peak Storage= 0 cf @ 1.00 hrs
Average Depth at Peak Storage= 0.00'
Bank-Full Depth= 0.50' Flow Area= 0.2 sf, Capacity= 1.03 cfs

6.0" Round Pipe
n= 0.010 PVC, smooth interior
Length= 10.0' Slope= 0.0200 '/'
Inlet Invert= 15.55', Outlet Invert= 15.35'



Summary for Pond 1P: Basin

Inflow Area = 0.428 ac, 89.12% Impervious, Inflow Depth > 4.24" for 10-year event
Inflow = 1.95 cfs @ 12.09 hrs, Volume= 0.151 af
Outflow = 0.16 cfs @ 13.07 hrs, Volume= 0.146 af, Atten= 92%, Lag= 59.0 min
Discarded = 0.16 cfs @ 13.07 hrs, Volume= 0.146 af
Secondary = 0.00 cfs @ 1.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 1.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 16.15' @ 13.07 hrs Surf.Area= 2,872 sf Storage= 2,991 cf

Plug-Flow detention time= 196.1 min calculated for 0.146 af (97% of inflow)
Center-of-Mass det. time= 176.4 min (954.0 - 777.5)

Volume	Invert	Avail.Storage	Storage Description
#1	14.60'	6,713 cf	**Custom Stage Data (Conic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
14.60	1,103	0	0	1,103
15.00	1,472	513	513	1,475
16.00	2,689	2,050	2,563	2,703
16.50	3,307	1,496	4,060	3,328
17.00	7,599	2,653	6,713	7,622

Device	Routing	Invert	Outlet Devices
#1	Discarded	14.60'	**2.410 in/hr Exfiltration over Surface area from 14.59' - 16.50'** Excluded Surface area = 0 sf
#2	Secondary	16.50'	**4.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s) 0.5' Crest Height

Discarded OutFlow Max=0.16 cfs @ 13.07 hrs HW=16.15' (Free Discharge)
1=Exfiltration (Exfiltration Controls 0.16 cfs)

Secondary OutFlow Max=0.00 cfs @ 1.00 hrs HW=14.60' (Free Discharge)
2=Sharp-Crested Rectangular Weir (Controls 0.00 cfs)

Summary for Pond 2P: LC-6 Chambers

Inflow	=	0.00 cfs @	1.00 hrs, Volume=	0.000 af
Outflow	=	0.00 cfs @	1.00 hrs, Volume=	0.000 af, Atten= 0%, Lag= 0.0 min
Discarded	=	0.00 cfs @	1.00 hrs, Volume=	0.000 af

Routing by Stor-Ind method, Time Span= 1.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 14.60' @ 1.00 hrs Surf.Area= 648 sf Storage= 0 cf

Plug-Flow detention time= (not calculated: initial storage exceeds outflow)
Center-of-Mass det. time= (not calculated: no inflow)

Volume	Invert	Avail.Storage	Storage Description
#1	14.60'	323 cf	**Custom Stage Data (Conic)** Listed below (Recalc) 1,348 cf Overall - 540 cf Embedded = 808 cf x 40.0% Voids
#2	14.85'	413 cf	**2.50'W x 5.50'L x 1.50'H Prismatoid** x 20 Inside #1 540 cf Overall - 3.0" Wall Thickness = 413 cf
		736 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
14.60	648	0	0	648
14.85	648	162	162	671
16.35	648	972	1,134	806
16.68	648	214	1,348	836

Device	Routing	Invert	Outlet Devices
#1	Discarded	14.60'	**8.270 in/hr Exfiltration over Wetted area**

Discarded OutFlow Max=0.00 cfs @ 1.00 hrs HW=14.60' (Free Discharge)
1=Exfiltration (Passes 0.00 cfs of 0.12 cfs potential flow)

Summary for Subcatchment 1S: To Route 6

Runoff = 0.49 cfs @ 12.09 hrs, Volume= 0.041 af, Depth> 5.81"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-year Rainfall=6.05"

	Area (sf)	CN	Description
*	3,693	98	Roof and Paved Driveway, HSG A
	3,693		100.00% Impervious Area

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

Summary for Subcatchment 2S: Offsite to South

Runoff = 0.80 cfs @ 12.10 hrs, Volume= 0.060 af, Depth> 2.21"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-year Rainfall=6.05"

	Area (sf)	CN	Description
	3,959	30	Woods, Good, HSG A
	3,927	49	50-75% Grass cover, Fair, HSG A
	1,256	76	Gravel roads, HSG A
*	4,958	98	Paved parking and Roof, HSG A
	14,100	63	Weighted Average
	9,142		64.84% Pervious Area
	4,958		35.16% Impervious Area

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

Summary for Subcatchment 3S: To Basin

Runoff = 2.38 cfs @ 12.09 hrs, Volume= 0.186 af, Depth> 5.23"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-year Rainfall=6.05"

	Area (sf)	CN	Description
*	13,292	98	Paved Driveway
	2,026	49	50-75% Grass cover, Fair, HSG A
*	3,307	98	Basin
	18,625	93	Weighted Average
	2,026		10.88% Pervious Area
	16,599		89.12% Impervious Area

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

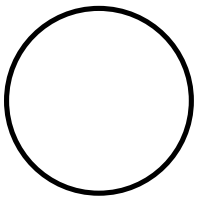
Summary for Reach 1R: Outlet Control Structure

Inflow = 0.00 cfs @ 1.00 hrs, Volume= 0.000 af
Outflow = 0.00 cfs @ 1.00 hrs, Volume= 0.000 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 1.00-24.00 hrs, dt= 0.05 hrs
Max. Velocity= 0.00 fps, Min. Travel Time= 0.0 min
Avg. Velocity = 0.00 fps, Avg. Travel Time= 0.0 min

Peak Storage= 0 cf @ 1.00 hrs
Average Depth at Peak Storage= 0.00'
Bank-Full Depth= 0.50' Flow Area= 0.2 sf, Capacity= 1.03 cfs

6.0" Round Pipe
n= 0.010 PVC, smooth interior
Length= 10.0' Slope= 0.0200 '/'
Inlet Invert= 15.55', Outlet Invert= 15.35'



Summary for Pond 1P: Basin

Inflow Area = 0.428 ac, 89.12% Impervious, Inflow Depth > 5.23" for 25-year event
Inflow = 2.38 cfs @ 12.09 hrs, Volume= 0.186 af
Outflow = 0.18 cfs @ 13.20 hrs, Volume= 0.171 af, Atten= 92%, Lag= 67.1 min
Discarded = 0.18 cfs @ 13.20 hrs, Volume= 0.171 af
Secondary = 0.00 cfs @ 1.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 1.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 16.43' @ 13.20 hrs Surf.Area= 3,223 sf Storage= 3,847 cf

Plug-Flow detention time= 224.6 min calculated for 0.171 af (92% of inflow)
Center-of-Mass det. time= 183.1 min (955.4 - 772.3)

Volume	Invert	Avail.Storage	Storage Description
#1	14.60'	6,713 cf	**Custom Stage Data (Conic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
14.60	1,103	0	0	1,103
15.00	1,472	513	513	1,475
16.00	2,689	2,050	2,563	2,703
16.50	3,307	1,496	4,060	3,328
17.00	7,599	2,653	6,713	7,622

Device	Routing	Invert	Outlet Devices
#1	Discarded	14.60'	**2.410 in/hr Exfiltration over Surface area from 14.59' - 16.50'** Excluded Surface area = 0 sf
#2	Secondary	16.50'	**4.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s) 0.5' Crest Height

Discarded OutFlow Max=0.18 cfs @ 13.20 hrs HW=16.43' (Free Discharge)
↑**1=Exfiltration** (Exfiltration Controls 0.18 cfs)

Secondary OutFlow Max=0.00 cfs @ 1.00 hrs HW=14.60' (Free Discharge)
↑**2=Sharp-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond 2P: LC-6 Chambers

Inflow	=	0.00 cfs @	1.00 hrs, Volume=	0.000 af
Outflow	=	0.00 cfs @	1.00 hrs, Volume=	0.000 af, Atten= 0%, Lag= 0.0 min
Discarded	=	0.00 cfs @	1.00 hrs, Volume=	0.000 af

Routing by Stor-Ind method, Time Span= 1.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 14.60' @ 1.00 hrs Surf.Area= 648 sf Storage= 0 cf

Plug-Flow detention time= (not calculated: initial storage exceeds outflow)
Center-of-Mass det. time= (not calculated: no inflow)

Volume	Invert	Avail.Storage	Storage Description
#1	14.60'	323 cf	**Custom Stage Data (Conic)**Listed below (Recalc) 1,348 cf Overall - 540 cf Embedded = 808 cf x 40.0% Voids
#2	14.85'	413 cf	**2.50'W x 5.50'L x 1.50'H Prismatoid** x 20 Inside #1 540 cf Overall - 3.0" Wall Thickness = 413 cf
		736 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
14.60	648	0	0	648
14.85	648	162	162	671
16.35	648	972	1,134	806
16.68	648	214	1,348	836

Device	Routing	Invert	Outlet Devices
#1	Discarded	14.60'	**8.270 in/hr Exfiltration over Wetted area**

Discarded OutFlow Max=0.00 cfs @ 1.00 hrs HW=14.60' (Free Discharge)
↑**1=Exfiltration** (Passes 0.00 cfs of 0.12 cfs potential flow)

Summary for Subcatchment 1S: To Route 6

Runoff = 0.62 cfs @ 12.09 hrs, Volume= 0.052 af, Depth> 7.35"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-year Rainfall=7.60"

	Area (sf)	CN	Description
*	3,693	98	Roof and Paved Driveway, HSG A
	3,693		100.00% Impervious Area

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

Summary for Subcatchment 2S: Offsite to South

Runoff = 1.24 cfs @ 12.10 hrs, Volume= 0.090 af, Depth> 3.35"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-year Rainfall=7.60"

	Area (sf)	CN	Description
	3,959	30	Woods, Good, HSG A
	3,927	49	50-75% Grass cover, Fair, HSG A
	1,256	76	Gravel roads, HSG A
*	4,958	98	Paved parking and Roof, HSG A
	14,100	63	Weighted Average
	9,142		64.84% Pervious Area
	4,958		35.16% Impervious Area

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

Summary for Subcatchment 3S: To Basin

Runoff = 3.03 cfs @ 12.09 hrs, Volume= 0.241 af, Depth> 6.76"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-year Rainfall=7.60"

	Area (sf)	CN	Description
*	13,292	98	Paved Driveway
	2,026	49	50-75% Grass cover, Fair, HSG A
*	3,307	98	Basin
	18,625	93	Weighted Average
	2,026		10.88% Pervious Area
	16,599		89.12% Impervious Area

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

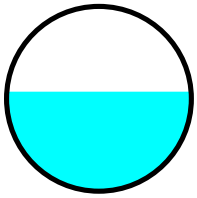
Summary for Reach 1R: Outlet Control Structure

Inflow = 0.58 cfs @ 12.46 hrs, Volume= 0.028 af
Outflow = 0.58 cfs @ 12.46 hrs, Volume= 0.028 af, Atten= 0%, Lag= 0.1 min

Routing by Stor-Ind+Trans method, Time Span= 1.00-24.00 hrs, dt= 0.05 hrs
Max. Velocity= 5.41 fps, Min. Travel Time= 0.0 min
Avg. Velocity = 3.31 fps, Avg. Travel Time= 0.1 min

Peak Storage= 1 cf @ 12.46 hrs
Average Depth at Peak Storage= 0.27'
Bank-Full Depth= 0.50' Flow Area= 0.2 sf, Capacity= 1.03 cfs

6.0" Round Pipe
n= 0.010 PVC, smooth interior
Length= 10.0' Slope= 0.0200 '/'
Inlet Invert= 15.55', Outlet Invert= 15.35'



Summary for Pond 1P: Basin

Inflow Area = 0.428 ac, 89.12% Impervious, Inflow Depth > 6.76" for 100-year event
Inflow = 3.03 cfs @ 12.09 hrs, Volume= 0.241 af
Outflow = 0.77 cfs @ 12.46 hrs, Volume= 0.218 af, Atten= 75%, Lag= 22.5 min
Discarded = 0.18 cfs @ 12.25 hrs, Volume= 0.190 af
Secondary = 0.58 cfs @ 12.46 hrs, Volume= 0.028 af

Routing by Stor-Ind method, Time Span= 1.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 16.62' @ 12.46 hrs Surf.Area= 4,202 sf Storage= 4,522 cf

Plug-Flow detention time= 203.7 min calculated for 0.218 af (90% of inflow)
Center-of-Mass det. time= 156.3 min (922.5 - 766.2)

Volume	Invert	Avail.Storage	Storage Description
#1	14.60'	6,713 cf	**Custom Stage Data (Conic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
14.60	1,103	0	0	1,103
15.00	1,472	513	513	1,475
16.00	2,689	2,050	2,563	2,703
16.50	3,307	1,496	4,060	3,328
17.00	7,599	2,653	6,713	7,622

Device	Routing	Invert	Outlet Devices
#1	Discarded	14.60'	**2.410 in/hr Exfiltration over Surface area from 14.59' - 16.50'** Excluded Surface area = 0 sf
#2	Secondary	16.50'	**4.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s) 0.5' Crest Height

Discarded OutFlow Max=0.18 cfs @ 12.25 hrs HW=16.53' (Free Discharge)
↑**1=Exfiltration** (Exfiltration Controls 0.18 cfs)

Secondary OutFlow Max=0.58 cfs @ 12.46 hrs HW=16.62' (Free Discharge)
↑**2=Sharp-Crested Rectangular Weir** (Weir Controls 0.58 cfs @ 1.18 fps)

Summary for Pond 2P: LC-6 Chambers

Inflow	=	0.58 cfs @	12.46 hrs, Volume=	0.028 af
Outflow	=	0.15 cfs @	13.04 hrs, Volume=	0.028 af, Atten= 74%, Lag= 34.5 min
Discarded	=	0.15 cfs @	13.04 hrs, Volume=	0.028 af

Routing by Stor-Ind method, Time Span= 1.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 16.26' @ 13.04 hrs Surf.Area= 648 sf Storage= 613 cf

Plug-Flow detention time= 43.3 min calculated for 0.028 af (100% of inflow)
Center-of-Mass det. time= 43.3 min (807.0 - 763.7)

Volume	Invert	Avail.Storage	Storage Description
#1	14.60'	323 cf	**Custom Stage Data (Conic)** Listed below (Recalc) 1,348 cf Overall - 540 cf Embedded = 808 cf x 40.0% Voids
#2	14.85'	413 cf	**2.50'W x 5.50'L x 1.50'H Prismatoid** x 20 Inside #1 540 cf Overall - 3.0" Wall Thickness = 413 cf
		736 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
14.60	648	0	0	648
14.85	648	162	162	671
16.35	648	972	1,134	806
16.68	648	214	1,348	836

Device	Routing	Invert	Outlet Devices
#1	Discarded	14.60'	**8.270 in/hr Exfiltration over Wetted area**

Discarded OutFlow Max=0.15 cfs @ 13.04 hrs HW=16.25' (Free Discharge)
↑**1=Exfiltration** (Exfiltration Controls 0.15 cfs)

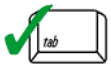
DEP STORMWATER MANAGEMENT FORMS

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

Checklist for Stormwater Report

A. Introduction

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



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

The Stormwater Report must include:

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

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

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

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

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

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

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

Checklist for Stormwater Report

B. Stormwater Checklist and Certification

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

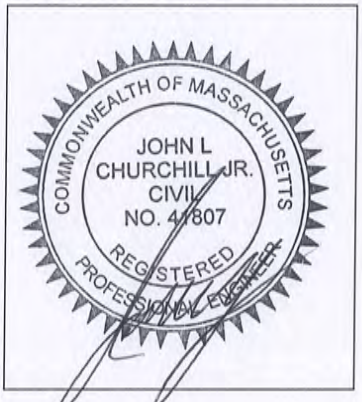
Note: Because stormwater requirements vary from project to project, it is possible that a complete Stormwater Report may not include information on some of the subjects specified in the Checklist. If it is determined that a specific item does not apply to the project under review, please note that the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

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

Registered Professional Engineer's Certification

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

Registered Professional Engineer Block and Signature



2/11/22

Signature and Date

Checklist

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

☐ New development

☐ Redevelopment

☒ Mix of New Development and Redevelopment

Checklist for Stormwater Report

Checklist (continued)

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

☒ No disturbance to any Wetland Resource Areas

☐ Site Design Practices (e.g. clustered development, reduced frontage setbacks)

☐ Reduced Impervious Area (Redevelopment Only)

☐ Minimizing disturbance to existing trees and shrubs

☐ LID Site Design Credit Requested:

- ☐ Credit 1
- ☐ Credit 2
- ☐ Credit 3

☐ Use of "country drainage" versus curb and gutter conveyance and pipe

☐ Bioretention Cells (includes Rain Gardens)

☐ Constructed Stormwater Wetlands (includes Gravel Wetlands designs)

☐ Treebox Filter

☐ Water Quality Swale

☐ Grass Channel

☐ Green Roof

☐ Other (describe): _____

Standard 1: No New Untreated Discharges

☒ No new untreated discharges

☒ Outlets have been designed so there is no erosion or scour to wetlands and waters of the Commonwealth

☒ Supporting calculations specified in Volume 3 of the Massachusetts Stormwater Handbook included.

Checklist for Stormwater Report

Checklist (continued)

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[1]

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

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

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

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

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

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

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

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

Checklist for Stormwater Report

Checklist (continued)

Standard 3: Recharge (continued)

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

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

Standard 4: Water Quality

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

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

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

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

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

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

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

Checklist for Stormwater Report

Checklist (continued)

Standard 4: Water Quality (continued)

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

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

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

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

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

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

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

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

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

☐ All exposure has been eliminated.

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

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

Standard 6: Critical Areas

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

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

Checklist for Stormwater Report

Checklist (continued)

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

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

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

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

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

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

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

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

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

Checklist for Stormwater Report

Checklist (continued)

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

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

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

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

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

Standard 9: Operation and Maintenance Plan

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

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

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

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

Standard 10: Prohibition of Illicit Discharges

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

☒ An Illicit Discharge Compliance Statement is attached;

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

STORMWATER OPERATIONS AND MAINTENANCE PLAN

Stormwater Operations and Maintenance Plan

DATE: February 11, 2022

Responsible Party:
246 Marion Road, LLC
7 Fieldstone Lane
Marion, MA 02738

Project Address:
246 Marion Road
Wareham, MA 02571

Engineering By:
JC Engineering, Inc.
2854 Cranberry Highway
East Wareham, MA 02538

The project site will be owned and maintained by the owner of the property. The owner will be responsible for the required inspections and maintenance of the drainage system.

Illicit Discharges
All Illicit discharges to the stormwater management system are prohibited.

Pre-Construction Requirements

Prior to the start of any construction on the site the following procedures are to be implemented.

- Hay bale dikes and silt fence are to be installed down gradient of all earthwork proposed in that particular phase of work. Hay bales and silt fence are to be installed at the limit of work and/or adjacent to the wetland resource areas and/or natural areas to be protected as shown on the plans.

- All major trees designated to be saved are to be flagged in the field and fenced off as necessary to prevent damage during construction.

- A temporary settling pool is to be constructed on the up gradient side of silt fences and hay bale dikes at the limit of work such that stormwater runoff is channeled to the temporary settling pool and filtered through the hay bales prior to leaving the site.

- Safety barriers, warnings and fences to be installed along Marion Road and Cross Street as necessary to protect the general public prior to the start of the work adjacent to the roadway.

- A temporary construction entrance is to be constructed at the access point to the site. The entrance is to be stabilized in such a manner as to prevent the tracking of soil onto the public way.

- A dust monitoring plan will be established prior to the start of construction.

- Weekly training sessions will be conducted for all site contractors at the job.

- A person responsible for daily inspection of all erosion control methodologies and action plan for corrections/repairs when needed will be established.

Construction Period Pollution Prevention

- The contractor must install erosion control measures as shown on the plans and details prior to starting any other work on the site construction. Erosion control must be installed at every inlet structure and inlet swale and maintained for the duration of the project. Silt fence and/or haybales as shown on plans shall be inspected, repaired and/or maintained by the contractor weekly and within 12 hours of each storm event.

- Water and/or covers to minimize dust and erosion from newly graded areas and stock piles of earth will be implemented during construction as needed or when conditions are anticipated to be greater than 20 m.p.h. Application rate of water shall be sufficient to moisten soil so as to not create runoff and/or ponding. No surfactants shall be used.

- A regular street sweeping schedule of hard surfaces will be established prior to construction and will be continued until the completion of the full site development.

- A person will be assigned to monitor the perimeter erosion control methodologies on a daily basis.

- Owner or its representative shall perform weekly review/training sessions.

- Construction of a temporary settling area is to be utilized as a method of controlling concentrated flows from areas that are under construction.

- Temporary settling areas are to be constructed on an as needed basis and located throughout the construction phase as required by earthwork activities.

- At the beginning of earthwork operations on the site a mechanical on-site sweeper is to be maintained such that the public way can be kept clean during the construction phase.

- As elements of the drainage system are installed, silt fences and “silt sacs” are to be installed around all catch basins and under grates until the tributary area to that basin is completely stabilized.

- As general earthwork is completed the exterior perimeters of the areas that have been completed are to be stabilized using erosion control grass.

- Stabilize slopes steeper than 3:1 (horizontal to vertical) with seed, secured geotextile fabric, or rock rip-rap as required to prevent erosion during construction.

- Sediment shall be contained within the construction site and shall be removed when they reach a depth of 6 inches.

- Clean out catch basins, drain manholes and storm drain pipes after completion of construction.

- No stormwater shall be allowed to enter the structures until all catchbasins, drain manholes and stormdrain pipes have been cleaned, the binder course is installed and all disturbed areas are stabilized.

- If the binder course is in place for more than 3 months without a wearing course, the contractor shall set the rim elevation of the drainage structures level with the binder course. The rim elevations shall be reset just prior to placing the wearing course.

- The contractor is responsible for all stormwater best management practices being in place to contain stormwater in the event that drainage structures are not at pavement grade during a storm event, and all cleanup in the event that such measures fail during said storm event.

- Temporary surfaces should be stabilized with as soon as active grading is suspended. Temporary measures include seeding with grass, jute netting, or straw mulch. Permanent stabilization should be established early in the fall to allow good cover before cold weather comes.

- A construction entrance in accordance with construction details shall be installed at the site entrance to prevent sediments from being tracked offsite.

- It is the responsibility of the contractor to maintain and supplement the specified sedimentation controls as necessary to prevent sedimentation of off-site areas and/or any regulated resource areas. Failure by the contractor to

control erosion, pollution and/or siltation shall be cause for the owner to employ outside assistance or to use his own forces to provide the necessary corrective measures, the cost of such assistance plus project engineering costs will be the contractor's responsibility. If the owner shall fail their responsibility of this Plan, the Town has the right to enter upon property after 15 days notice to take corrective actions and bill the Owner for their Services.

- Haybales and Silt Fence shall be installed at the following locations: Toe of slope of embankment construction, Toe of temporary earthwork stockpiles. All locations as indicated on the Plans.

- A log of regular inspections and maintenance is to be maintained by the construction superintendent.

- When all areas tributary to any catch basin on the site are stabilized with permanent plantings and paving, that catch basin is to be cleaned of all sediment and debris that has accumulated during construction and the "silt sacs" removed.

- During construction of the project, the Owner and/or its representative, is to be the responsible party for enforcing the installation and maintenance of all erosion control devices. A permanent file is to be established for recording daily inspections, problems and maintenance of the erosion control devices. A 24 hour emergency hotline is to be established with the number posted on a sign at the construction entrance to the project and on the construction trailer indicating who can be contacted in case of an emergency on the site.

Long-Term Operation and Maintenance Program

- At the end of construction on the project, Owner shall be provided with a certified as built plan of all utilities constructed on the site.

- **Subsurface Infiltration Structures**

  Once the system is operational, inspections of the leaching structures should occur after every major storm event for the first few months. After the system is in operation, inspections should be every six months. Special attention should be directed towards the depth of sediment in the leaching structures. There should be no accumulation of sediment within the leaching structures. Silt and debris are to be removed using vacuum pumping techniques as required.

- **Sediment Forebay & Infiltration Basin**

  The infiltration basin and sediment forebay should be inspected after every major storm for the first few months after stabilization. After that, the

sediment forebay should be inspected monthly and removed of accumulated sediment four times per year. The infiltration basin should be inspected at least twice per year. At a minimum the responsible party should check for signs of differential settlement, cracking, erosion, leakage in the embankments, tree growth, the condition of rip raps, sediment accumulation, and the health of the turf.

At least twice per year, the access area, side slopes and basin bottom should be mowed. Grass clippings should not be left in the basin. Sediment should be removed from the basin as needed.

- All Catch basins, if present, shall be inspected by the owner/operator on a quarterly basis or after a major storm event. Catch basins sumps will be cleaned annually during the early spring or when the sediment rises to within half the available sump height of the catch basin, whichever comes first.

- Once the system is operational, inspections of the Infiltration Structures should occur after every major storm event for the first few months. After the system is in operation, inspections should be every six months. Special attention should be directed towards the depth of sediment in the leaching structures. Sediment removal from the leaching structures accomplished as needed by means of a labor crew. Sediment shall be removed off-site and disposed of in a legal manner. Inspections should also include checking for potential problems that include, but are not limited to, any forms of erosion, tree growth in the leaching area, and sediment accumulation, etc. Trash and debris accumulated within any portion of the Infiltration Structures should be removed at this time. Silt and debris is to be removed using vacuum pumping techniques as required.

- The Owner, is to be responsible for the maintenance of the project after construction has been completed. The owner is to provide the Planning Department, Conservation Commission and Building Department with a contact name and telephone number for purposes of communication between the owner and the Town Boards and Commissions. At each time that the contact person changes, the above Boards and Commission are to be notified of the new contact information.

- The Owner shall hire a Stormwater Professional to inspect the system quarterly as required.

- This Operations and Maintenance plan is to be incorporated into all necessary documents with the stormwater operations and maintenance plan to ensure that a long-term maintenance program is adhered to by the developer and all future property owners.

- Waste shall be properly stored in sealed containers if stored outside. The preferred method is to store waste either indoors or in a structure with a locking cover to prevent entrance from animals. The containers shall be covered to prevent rainfall from leaching through the household waste.

- Vehicle washing shall be performed with non-detergent cleaners. The preferred method is to clean a vehicle is at a vehicle washing facility.

- Yard maintenance equipment, including lawn mowers and chainsaws shall be stored in a covered area. Periodic maintenance shall be performed on all equipment to ensure that no gas or oil leak into the ground.

- Yard waste shall be disposed in an approved off-site disposal facility or stored on-site in a composting pile.

- If applicable, septic systems shall be properly maintained and inspected in accordance with the State Environmental Code, Title 5. A failing septic systems shall be repaired immediately to prevent effluent from discharging into the storm drains. Never discharge gasoline, oils or chemicals into septic systems.

- Gasoline and oils shall be stored in sealed containers and in a covered, secure, and level area to prevent accidental spills. All gasoline, oil, and chemical spills shall be reported to the Wareham Fire Department and Regional DEP office.

- Lawn fertilizers and pesticides shall be in sealed containers within a covered area and remain dry. Slow release lawn fertilizers shall be used to limit the amount of fertilizer entering the groundwater. Limit the application of fertilizers to lawn area only. Sweep up any spills on impervious material to prevent runoff into the storm drains.

- Pet waste shall be properly disposed of to prevent bacteria from washing into storm drains. Small amounts of waste can be buried or sealed in a plastic bag and thrown into the trash. The preferred method is to flush the waste down the toilet.

- Snow de-icing chemicals shall be stored in a sealed container and a covered area.

- Snow shall be removed from all parking surfaces and fire truck clearance areas to provide adequate access for all safety vehicles. Snow shall be removed from all catch basin grates to avoid flooding during snow melt.

- All sand and loam piles stored on-site shall be properly stabilized or covered to prevent sediment from entering the storm drains. All piles shall be contained in a level, upland area and surrounded by a silt fence and/or haybales.

- All structural and non-structural stormwater management facilities shall be maintained to ensure proper working condition during construction and shall be fully maintained in accordance with this plan. The owner shall be responsible for maintaining the site's storm water management system in compliance with Federal, state, and local requirements and in accordance with best management practices. In the event that the Town determines that the owner has materially failed in its obligation to maintain the drainage system in accordance with best management practices and the Stormwater Operation and Maintenance Plan, the Town shall have the right, upon written notice to the Owner, and Owner's failure to remedy the maintenance issue within fifteen (15) days' notice thereof, to enter upon the site to perform the required maintenance. All costs incurred by the Town in connection with its performance of such required maintenance on the site shall be reimbursed by the Owner to the Town within thirty (30) days of the Owner's receipt of the Town's invoice for such costs.

REFERENCES

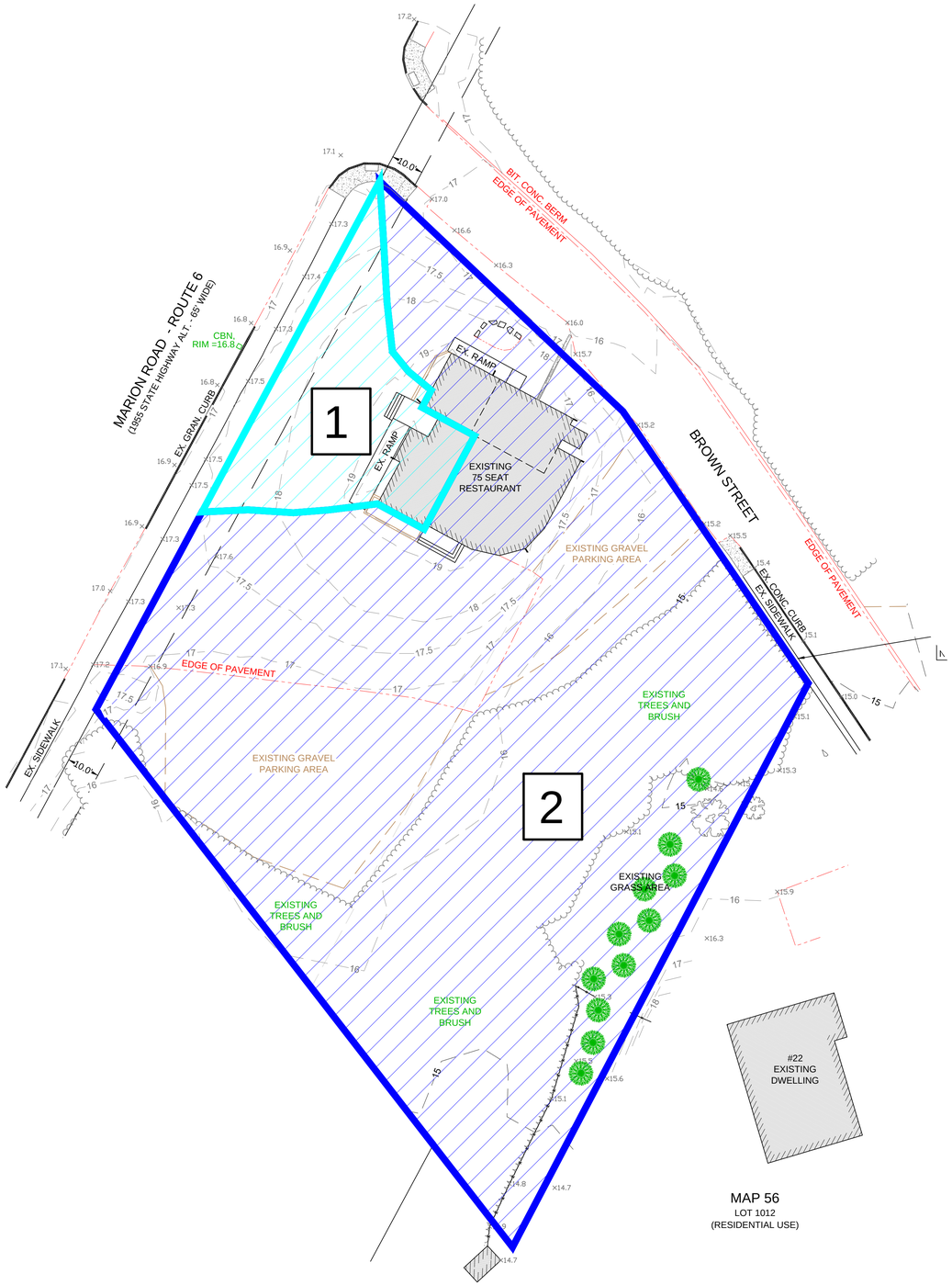
HydroCAD. Stormwater Analysis Software, Heastead Methods, Inc. 1998.

Massachusetts Department of Environmental Protection & Massachusetts Office of Coastal Zone Management. March 1997. *Stormwater Management Handboo*k. Volume 1 & 2.

U.S. Soil Conservation Service 1969. *Soil Survey of Plymouth County, Massachusetts.*

U.S. Soil Conservation Service. June 1986. *Urban Hydrology for Small Watersheds (Technical Release 55)*

DRAINAGE AREA PLANS



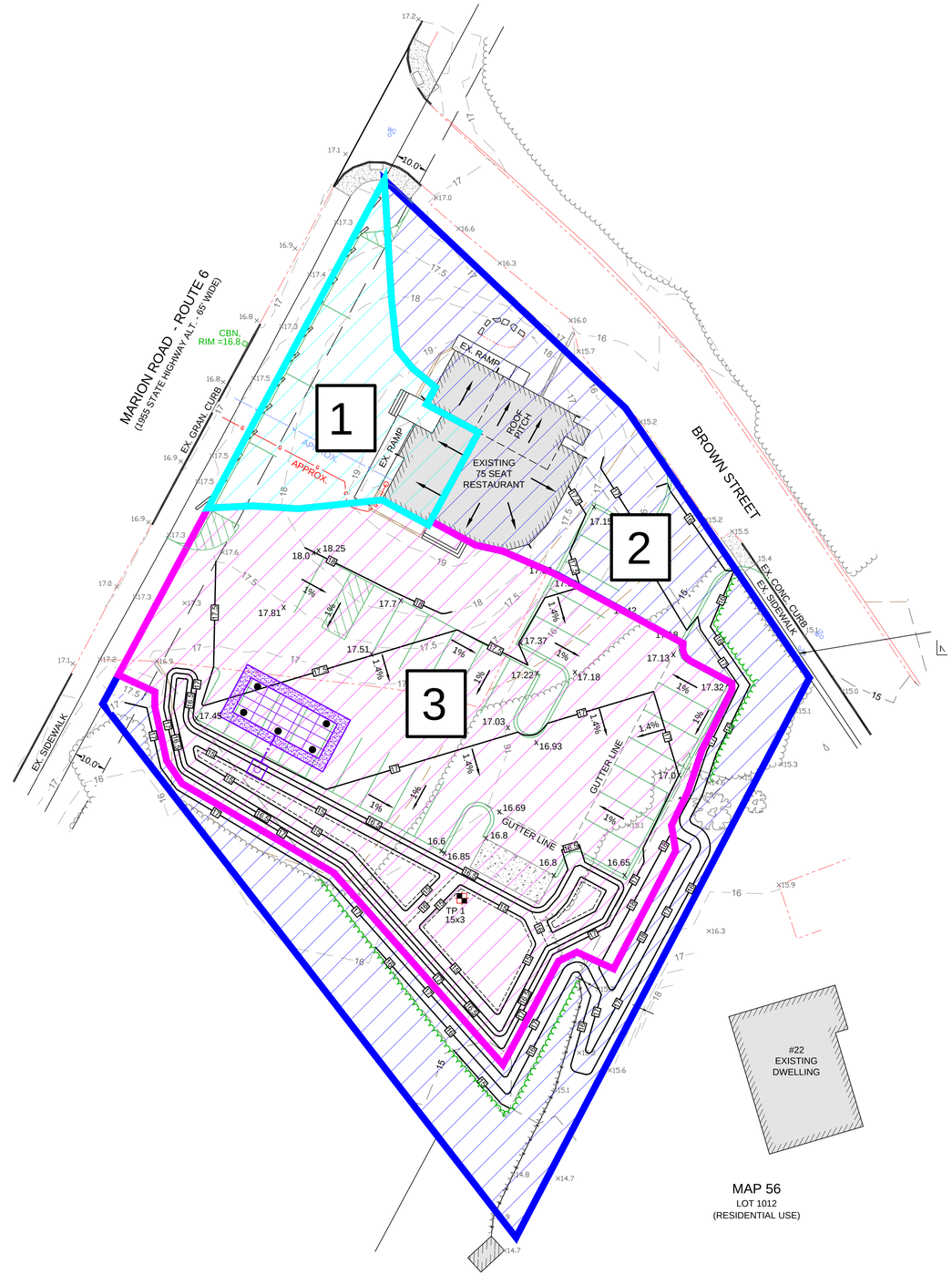
EXISTING DRAINAGE AREAS

SCALE: 1" = 20'

GRAPHIC SCALE

20 0 10 20 40 80

(IN FEET)
1 inch = 20 ft.



PROPOSED DRAINAGE AREAS

SCALE: 1" = 20'

LOCUS MAP
SCALE 1" = 2000'

PROPOSED SITE PLAN

AT

246 MARION ROAD

IN

WAREHAM
MASSACHUSETTS
(PLYMOUTH COUNTY)

DRAINAGE AREAS

REVISIONS:

No.	DATE	DESC.

PREPARED FOR:

246 MARION ROAD LLC
7 FIELDSTONE LANE
MARION, MA 02738

ENGINEERING BY:

JC ENGINEERING, INC.
2854 CRANBERRY HIGHWAY
EAST WAREHAM, MA 02538
508-273-0377

DATE: FEBRUARY 11, 2021
FIELD: JM/BS
CALC./DESIGN: BMB
DRAWN: BMB
CHECK: JLC
JOB NO: 5799

SHEET 1 OF 1