ASE
Andrews Survey & Engineering, Inc.
Land Surveying - Civil Engineering - Site Planning

Stormwater Management Report

April 18, 2019
June 19, 2019

Project:
Cultivate Burncoat
22 Burncoat Street
Leicester, MA 01524

Assessors Map/Lot:
Map 18B, Parcels B11 & B12

Applicant:
Cultivate Holdings LLC
P.O. Box 245
Leicester, MA 01524

Owner:
Frank A. Germaine
67 Millbrook Street, Suite 100
Worcester, MA 01606

Representative:
Andrews Survey & Engineering, Inc.
104 Mendon Street
Uxbridge, MA 01569

ASE JN: 2019-049

Uxbridge
104 Mendon Street
Uxbridge, MA 01569
Tel. 508 278-3897 Fax. 508 278-2289

North Attleboro
500 East Washington Street
North Attleboro, MA 02760
Tel. 508 316-0452 Fax. 508 316-0963

www.andrews-engineering.com

U.S.G.S. LOCUS MAP

SCALE: 1"=1500'

CULTIVATE BURNCOAT
22 BURNCOAT STREET
LEICESTER, MASSACHUSETTS

Andrews Survey & Engineering, Inc.
Land Surveying - Civil Engineering - Site Planning

P.O. Box 312, 104 Mendon Street
Uxbridge, Massachusetts 01569-0312
P: 508-278-3897 F: 508-278-2289

N

FIGURE 1.0

STORMWATER MANAGEMENT REPORT

"Cultivate Burncoat"
22 Burncoat Street
Leicester, MA

April 18, 2019
June 19, 2019

Prepared for:

Cultivate Holdings LLC
P.O. Box 245
Leicester, MA 01524

Prepared by:

Andrews Survey & Engineering, Inc.
P.O. Box 312, 104 Mendon Street
Uxbridge, MA 01569

ASE Project #2019-049

Prepared by: _____
Travis R. Brown

Reviewed by: _____ 6/20/2019
Richard M. Mainville, P.E.

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PART 1 – SUMMARY

1.0 PROJECT DESCRIPTION

The proposed project consists of an approximately 132,325 s.f. building containing greenhouses and a processing center located at 22 Burncoat Street and is an allowed use in the Highway Business-Industrial District 1 (HB-1) zoning district and is defined as "Marijuana Establishment.". The site is located approximately 660 feet southerly of the intersection of Burncoat Street and Main Street (Route 9) and is bounded to the north by a currently vacant building, undeveloped parcels and a single-family home accessed from Main Street (Route 9), to the west by undeveloped properties, to the south by a residential subdivision on Pine Ridge Road and an undeveloped property, on the east by single-families residential properties and Burncoat Street.

The existing site consists an existing single-family house a garage and shed and approximately 39 acres of undeveloped wooded land. The topography of the existing project site consists of land sloping from the northeast to the southwest with a grade change of approximately 28 feet across the project area. The existing grade at Burncoat Street at the project entrance is approximately elevation 1037 and the elevation at the proposed building entrance is approximately 1030.

According to the USDA's Web Soil Survey, the subject parcels consist of hydrologic soil group classification C. The subject parcels do not have any known water protection districts or wellhead protection areas, areas of critical environmental concerns (ACEC's), NHESP Estimated or Priority Habitats, or Activity and Use Limitation areas (AUL). The subject site has three (3) wetland resource areas and associated buffer zones within the property limits. Two (2) of the wetland resource areas are located to the southwest of the project area and one (1) is located to the northwest of the project area.

This proposed establishment will consist of two (2) approximately 55,600 s.f of greenhouse space and one (1) approximately 21,100 s.f. processing area centered between the greenhouses. The proposed facility will contain 66 parking vehicular parking spaces and a loading lock providing access into the processing center. Water and sewer will be provided from Main Street (Route 9) down Burncoat Street to the site. Electric and communications will be provided from existing utility poles on Burncoat Street in the vicinity of the facility entrance. The project includes a stormwater management system designed in accordance with MassDEP Stormwater Management Handbook. As shown in the attached Stormwater Management Report, the project will incorporate Best Management Practices (BMP's), which include deep sump catch basins, a surface infiltration basin and a long-term pollution prevention operations and maintenance plan for the proposed facility.

2.0 BACKGROUND DATA

Soils explorations were performed on the property by Andrews Survey & Engineering, Inc. on April 11, 2019. The U.S. Natural Resources Conservation Service (NRCS), formerly SCS Soil Survey Maps indicate that soils with hydrologic soil group classification C are present on the site, see Part IV of this report.

Soils mapping indicates the following:

- 307B – Paxton fine sandy loam, 0 to 8 percent slopes, extremely stony (Hydrologic Soil Group Classification - C)
- 310B – Woodbridge fine sandy loam, 3 to 8 percent slopes (Hydrologic Soil Group Classification - C)
- 312B – Woodbridge fine sandy loam, 0 to 8 percent slopes, extremely stony (Hydrologic Soil Group Classification - C)

3.0 COMPLIANCE WITH STORMWATER STANDARDS

3.1 Untreated Stormwater (Standard 1)

The project is designed so that new stormwater conveyances (outfalls/ discharges) do not discharge untreated stormwater into, or cause erosion to, wetlands.

Standard #1 is met.

3.2 Post-Development Peak Rates (Standard 2)

Hydrologic calculations were performed to determine the rate of runoff for the 2, 10, 25 and 100-year storm events under pre-development (present) conditions. This value was established as the future (post-development) maximum allowable rate. Unmitigated post-development rates were then computed in a similar manner. It is the intent of the stormwater management system to minimize impacts to drainage patterns of downstream property and wetlands while simultaneously providing water quality treatment to runoff prior to its release from the site or discharge to wetlands.

The U.S.D.A. Soil Conservation Service (SCS) Technical Release 55 (TR-55), 1986, was used as the procedure for estimating runoff. A SCS TR-20-based computer program, "HydroCAD," was used for estimating peak discharges. TR-55 is a generally accepted model for use on small sites that begins with a rainfall amount uniformly imposed on the watershed over a specified time distribution. Mass rainfall is converted to mass runoff by using a runoff curve number (CN). CN is based on soils, ground cover, impervious areas, interception and surface storage. Runoff is then transformed into a hydrograph that depends on runoff travel time through segments of the watershed.

Development in a watershed changes its response to precipitation. The most common effects are reduced infiltration and decreased travel time, which result in significantly higher peak rates of runoff. The volume of runoff is determined primarily by the amount of precipitation and by infiltration characteristics related to soil type, antecedent rainfall, and type of vegetative cover, impervious surfaces, and surface retention. Travel time is determined primarily by slope, flow length, depth of flow surfaces. Peak rates of discharge are based on the relationship of the above parameters as well as the total drainage area of the watershed, the location of the development in relation to the total drainage area, and the effect of any flood control works or other manmade storage. Peak rates of discharge are also influenced by the distribution of rainfall within a given storm event.

Stormwater management computations for the project site were performed using SCS-based Hydrocad for existing and proposed conditions, curve numbers, time of concentration, and unit hydrograph computations. The following were considered as part of runoff calculations.

Since urban areas are seldom completely covered by impervious structure, soils and soil properties are an important factor in estimating the total volume of direct runoff. The infiltration and percolation rates of soils indicate their potential to absorb rainfall and thereby reduce the amount of direct runoff. Soils having a high infiltration rate (sands or gravels) have a low runoff potential, and soils having a low infiltration rate (clays) have a high runoff potential. Urbanization on soils with a high infiltration rate increases the volume of runoff and peak discharge more than urbanization on soils with a low infiltration rate.

The type of surface cover and its hydrologic condition affects runoff volume through its influence on the infiltration rate of the soil. Unused cultivated land yields more runoff than forested land for a given soil type. Covering areas with impervious material reduces surface storage and infiltration and increases the volume of runoff.

Some rainfall is retained on the ground surface and by vegetation before runoff begins. Interception is rainfall that is caught by foliage, twigs, branches, leaves, etc. This rainfall is lost to evaporation and thus never reaches the ground surface. Increasing the vegetative cover increases the amount of interception.

Surface depression storage begins when precipitation exceeds infiltration. Overland flow starts when the surface depressions are full. The water in depression storage is not available as direct runoff.

Initial abstraction is the sum of interception, depression, storage, and infiltration before runoff begins. It occurs on all types of cover, from lawn in good

condition to pavement. However, the amount of initial abstraction is less on pavement than on lawn.

Travel time (Tt) is the time it takes water to travel from one location to another in a watershed. Tt is a component of time of concentration (Tc) that is the time for runoff to travel from the hydraulically most distant point of the watershed to a point of interest within the watershed. Tc is computed by summing all the travel time for consecutive components of the drainage conveyance system.

Tc influences the shape and peak of the runoff hydrograph. Urbanization usually decreases Tc thereby increasing the peak discharge.
Development can change the effective slope of a watershed if flow paths are altered by channeling and by changing the surface grading for building lots, roads and ditches. The slopes of street gutters, roads and overland flow areas as well as stream channels are significant in determining travel times through urban watersheds.

Flow length may be reduced if natural meandering streams are changed to straight channels. It may be increased if overland flows are diverted through ditches, storm drains, or street gutters to larger collections systems.

Surface roughness is also a consideration. Flow velocity normally increases significantly when the flow path is changed from flow over rough surfaces of woodland, grassland and natural channels to sheet flow over smooth surfaces of parking lots, storm drains, gutters and lined channels.

3.2.1 Existing Conditions

Under the pre-development scenario, the watersheds have been identified as two (2) subcatchments (SC-1 & SC-2) areas outlining runoff to two (2) analysis points referenced above, as shown on the plan entitled "WATERSHED MAP – EXISTING CONDITIONS", included within the attached Maps.

3.2.2 Proposed Conditions

The proposed development will include the construction of greenhouses and processing center with associated parking, utilities, drainage, earthwork and paving. To accommodate stormwater runoff a number of Best Management Practices (BMP's) have been proposed, including deep sump catch basins, sediment forebay and an infiltration basin.

Under the post-development scenario, the site has been divided into five (5) drainage subcatchments, shown on the plan entitled "WATERSHED MAP – DEVELOPED CONDITIONS", included within Part II – Pre & Post Construction Computations. There is no increase in contributing watershed area due to the development and peak runoff rates and volumes are mitigated

through the construction of the proposed stormwater management system.

Post-development peak rates were determined and routed through infiltration basins with the resulting hydrographs added to the hydrographs for the overland areas. Based upon these analyses, the peak rates of runoff for the 2, 10, 25 and 100-year storm events are as follows:

Table 3.2.2.1 Stormwater Peak Rate Summary				
PEAK DISCHARGE RATE OF FLOW OFF-SITE				
Pre-Development (cfs)				
Analysis Point	2-YR	10-YR	25-YR	100-YR
AP 1	5.8	14.4	22.1	38.9
AP 2	3.6	9.1	13.9	24.5
AP TOT	9.4	23.5	36.0	63.4
Post-Development (cfs)				
Analysis Point	2-YR	10-YR	25-YR	100-YR
AP 1	4.8	14.4	21.5	38.5
AP 2	2.4	5.6	8.4	14.4
AP TOT	7.2	20.0	29.9	52.9
Pre-Development vs. Developed (cfs)				
Analysis Point	2-YR	10-YR	25-YR	100-YR
AP 1	-1.0	0.0	-0.6	-0.4
AP 2	-1.2	-3.5	-5.5	-10.1
AP TOT	-2.2	-3.5	-6.1	-10.5

Standard #2 is met.

3.3 Recharge to Groundwater (Standard 3)

Although runoff volumes will not increase after construction; recharge shall be provided. Therefore, stormwater runoff volume to be recharged to groundwater should be determined using the existing site (pre-development) soil conditions and the annual recharge from the post-development site should approximate the annual recharge from the pre-development or existing site, based on soil types.

Hydrologic Soil Group	Volume to Recharge (x Total Impervious Area)
A	0.60 inches of runoff
B	0.35 inches of runoff
C	0.25 inches of runoff
D	0.10 inches of runoff

Required Recharge Volume

0.60 inches runoff x total impervious area = Recharge Volume, "A" soil
0.35 inches runoff x total impervious area = Recharge Volume, "B" soil
0.25 inches runoff x total impervious area = Recharge Volume, "C" soil

0.10 inches runoff x total impervious area = Recharge Volume, "D" soil

Recharge Volume Required
0.60 inches x (1ft. /12in.) x (0) sq. ft. = 0 cubic feet
0.35 inches x (1ft. /12in.) x (0) sq. ft. = 0 cubic feet
0.25 inches x (1ft. /12in.) x (187,326) sq. ft. = 3,902 cubic feet
0.15 inches x (1ft. /12in.) x (0) sq. ft. = 0 cubic feet
Total Volume Required for Recharge = 3,902 cubic feet

Recharge Volume Provided
Infiltration Basin = 10,763 cu. ft. (volume below lowest outlet)
Total Recharge Volume Provided = 10,763 cu. ft.

Comparison of Required Recharge Volume to Provided Recharge
Provided Recharge - Required Recharge = Additional Recharge
10,763 cu. ft. – 3,902 cu. ft. = 6,861 cu. ft.

Drawdown Time

To determine whether an infiltration BMP will drain within 72 hours, the following formula must be used[1]:

$$Time_{drawdown} = \frac{Rv}{(K)(Bottom\ Area)}$$

Where:
Rv = Storage Volume
K = Saturated Hydraulic Conductivity For "Static" and "Simple Dynamic" Methods, use Rawls Rate (see Table 2.3.3). For "Dynamic Field" Method, use 50% of the in-situ saturated hydraulic conductivity.
Bottom Area = Bottom Area of Recharge Structure

Basin Storage Volume / ((Infiltration Rate / 12) x Basin Bottom Area))

Infiltration Basin:

10,763 c.f. / (0.27 in/hr)(1 ft/12 in)(9,777 s.f.) = 48.9 hours

Per the Massachusetts Stormwater Standards a mounding analysis is required when the vertical separation from the bottom of an exfiltration system to seasonal high groundwater is less than four (4) feet and the recharge system is proposed to attenuate the peak discharge from a 10-year or higher 24-hour storm.

Mounding analysis calculated using the Hantush (1967) method. Automated calculator available online from the Aquifer Test Forum sponsored by HydroSOLVE, Inc. The calculated mounds will not interfere with the draining of the infiltration basins, the results are as follows:

Infiltration Basin

	Infiltration Area	No.1
Hydraulic Conductivity	ft/day	39 Standard value for "Sandy Loam" material
Specific Yield		0.28 Standard value for "Sandy Loam" material
Initial Saturated Thickness	ft	15 Depth to bedrock
Design Recharge Rate	ft/day	0.54 infiltration rate
Time	days	3 Minimum 72 hr evaluation period
Bottom Infiltrating Area	sf	9,777
Length of Infiltration Area	ft	295
Width of Infiltration Area	ft	42
Time when Infiltration Stops	days	2.04 Calculated Drawdown Time (see Above)
Maximum Water table rise at 72 hours[1]	**ft** **in**	**1.91** **23**

- Resulting mound will not interfere with the full draining of the infiltration area in accordance with Mass Stormwater Standards -

Standard #3 is met.

3.4 Removal of 80% TSS (Standard 4)

The proposed stormwater management system design calls for 4' deep sump catch basins to collect runoff from the roadway. Stormwater runoff from pavement areas will then be conveyed by a closed pipe system to a sediment forebay followed by an infiltration basin. Calculations for removal rates for all paved runoff are below. These calculations are shown on the attached TSS Calculation Worksheets.

Deep Sump Catch Basins	25%
Infiltration Basin w/ Sediment Forebay	80%

Water Quality

$V_{wq} = (D_{wq} \div 12\text{inches/foot})\ (A_{imp})$

Where:

V_{wq} = Required Water Quality Volume (cubic feet)

Dwq = Water Quality Depth – 0.5 inches
Aimp = Impervious Area (s.f.)

Vwq Required
0.5 inch x (1ft. /12in.) x (187,326) sq. ft. = 7,805 cubic feet.

Water Quality Volume Provided
Outlets in the infiltration basin are set at an elevation above the required water quality volume.

Water Quality Volume Provided
Infiltration Basin = 10,763 cu. ft.

Total Water Quality Volume = 10,763 cu. ft.

Forebay Sizing
The forebay volume is based on 0.1-inch over the contributing impervious area, including pavers.

Infiltration Basin
Volume required = 0.1 inches x (1ft. /12in.) x (183,444) sq. ft. = 1,529 c.f.
Volume Provided Infiltration Basin = 2,132 c.f.

Standard #4 is met.

3.5 Land Uses with Higher Potential (Standard 5)

This project does not contain areas with higher potential for pollution.

Standard #5 is met.

3.6 Critical Areas (Standard 6 – Water Quality Treatments)

This site does not lie within a critical area.

Standard #6 is met.

3.7 Redevelopment (Standard 7)

Redevelopment projects are those that involve development, rehabilitation or expansion on previously developed sites provided the redevelopment results in no net increase in impervious area. Furthermore, components of redevelopment project, which include development of previously undeveloped sites, do not fall under Standard 7. In addition, redevelopment of previously developed sites must meet the Stormwater Management Standards to the maximum extent practicable. However, if it is not practicable to meet all the Standards, new

(retrofitted or expanded) stormwater management systems must be designed to improve existing conditions.

This site is not a redevelopment project.

Standard #7 is not applicable.

3.8 Erosion and Sedimentation Controls (Standard 8)

An Erosion and Sedimentation Control Plan is provided as part of the site plan application to the Planning Board.

Standard #8 is met.

3.9 Operation and Maintenance Plan (Standard 9)

An Operation and Maintenance Plan is provided as part of the site plan application to the Planning Board.

Standard #9 is met.

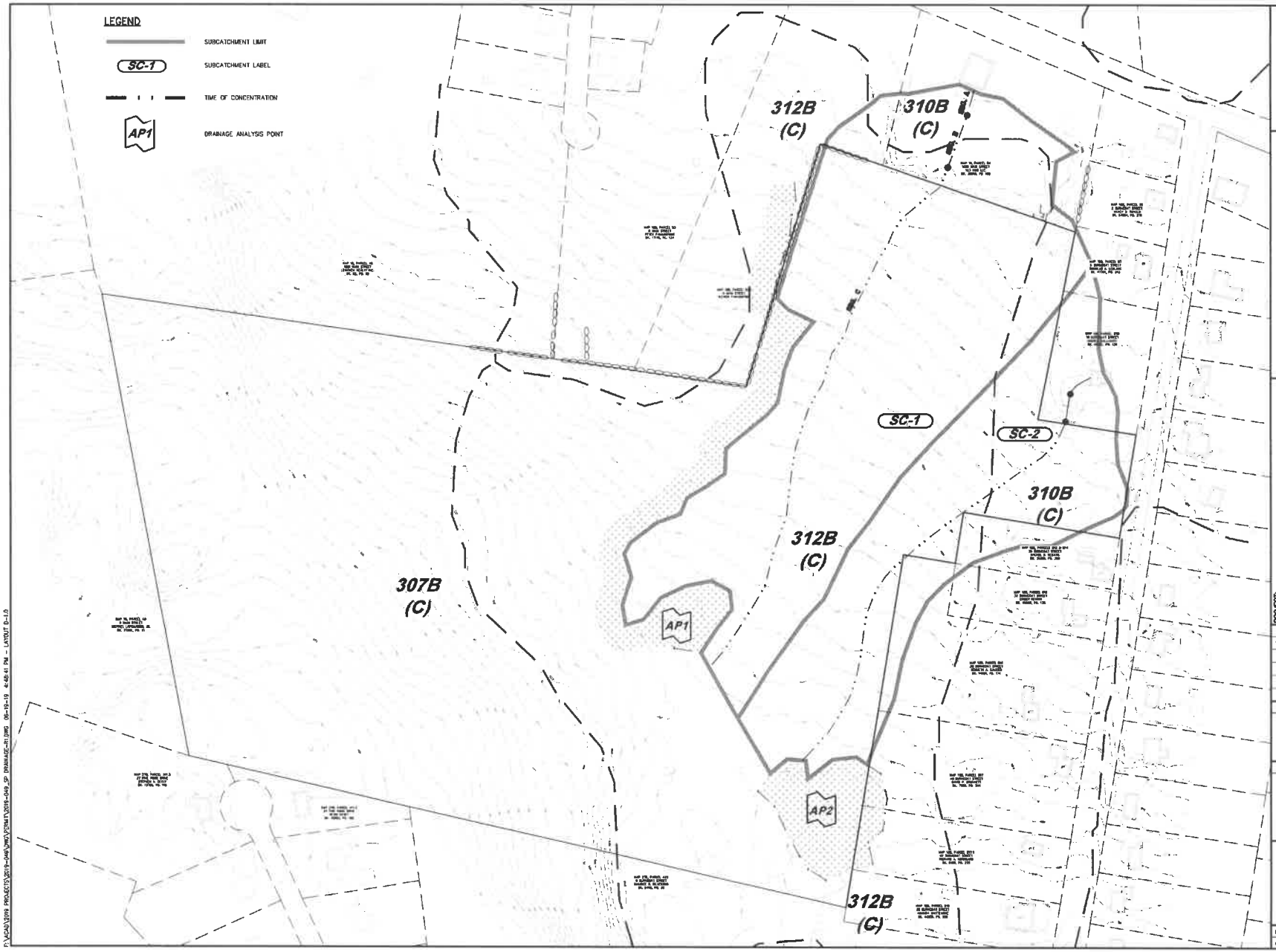
3.10 Illicit Discharges (Standard 10)

On April 11, 2019 a site inspection was performed by Andrews Survey & Engineering, Inc. and no illicit discharges were found.

A pollution prevention plan is incorporated into this report to prevent illicit discharges during and after construction.

Standard #10 is met.

PART II – PRE & POST-CONSTRUCTION COMPUTATIONS



ASE
Andrews Survey & Engineering, Inc.
Land Surveying - Civil Engineering - Site Planning
P.O. Box 332, 104 Meadow Street
Fitchburg, Massachusetts 01569
P: 508-278-3097 F: 508-278-2289
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REVISIONS

NO.	DATE	DESCRIPTION
1	6/19/19	REVISED DRAINAGE ANALYSIS

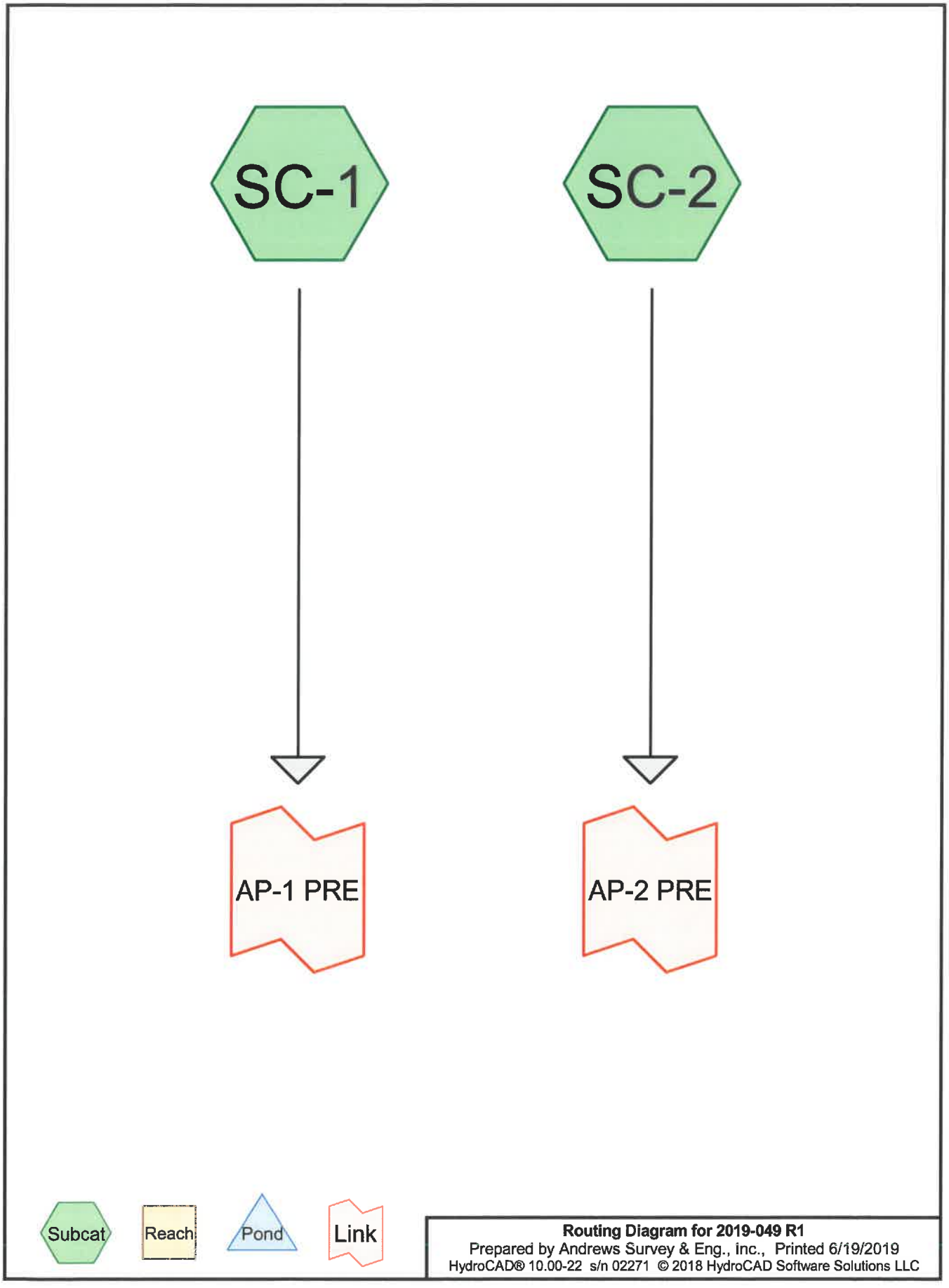
GRAPHIC SCALE
(IN FEET)
1 inch = 60 feet

SHEET TITLE

PRE-DEVELOPMENT WATERSHED MAP

DES BY: TRB | DATE: APRIL 11, 2019
CHK BY: RMH | PROJECT NO. 2019-049

D-1.0



Routing Diagram for 2019-049 R1
Prepared by Andrews Survey & Eng., inc., Printed 6/19/2019

Area Listing (selected nodes)

Area (sq-ft)	CN	Description (subcatchment-numbers)
53,052	74	>75% Grass cover, Good, HSG C (SC-1, SC-2)
2,660	98	Roofs, HSG C (SC-2)
669,186	70	Woods, Good, HSG C (SC-1, SC-2)
724,898	**70**	**TOTAL AREA**

Soil Listing (selected nodes)

Area (sq-ft)	Soil Group	Subcatchment Numbers
0	HSG A	
0	HSG B	
724,898	HSG C	SC-1, SC-2
0	HSG D	
0	Other	
724,898		**TOTAL AREA**

Ground Covers (selected nodes)

HSG-A (sq-ft)	HSG-B (sq-ft)	HSG-C (sq-ft)	HSG-D (sq-ft)	Other (sq-ft)	Total (sq-ft)	Ground Cover
0	0	53,052	0	0	53,052	>75% Grass cover, Good
0	0	2,660	0	0	2,660	Roofs
0	0	669,186	0	0	669,186	Woods, Good
0	**0**	**724,898**	**0**	**0**	**724,898**	**TOTAL AREA**

Time span=0.00-72.00 hrs, dt=0.01 hrs, 7201 points x 3
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment SC-1: Runoff Area=438,345 sf 0.00% Impervious Runoff Depth=0.79"
Flow Length=1,228' Tc=14.8 min CN=70 Runoff=5.76 cfs 28,772 cf

Subcatchment SC-2: Runoff Area=286,553 sf 0.93% Impervious Runoff Depth=0.79"
Flow Length=958' Tc=16.0 min CN=70 Runoff=3.61 cfs 18,809 cf

Link AP-1 PRE: Inflow=5.76 cfs 28,772 cf
Primary=5.76 cfs 28,772 cf

Link AP-2 PRE: Inflow=3.61 cfs 18,809 cf
Primary=3.61 cfs 18,809 cf

Total Runoff Area = 724,898 sf Runoff Volume = 47,581 cf Average Runoff Depth = 0.79"
99.63% Pervious = 722,238 sf 0.37% Impervious = 2,660 sf

Summary for Subcatchment SC-1:

Runoff = 5.76 cfs @ 12.25 hrs, Volume= 28,772 cf, Depth= 0.79"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NRCC 24-hr D 2-Year Rainfall=3.13"

Area (sf)	CN	Description
392,335	70	Woods, Good, HSG C
46,010	74	>75% Grass cover, Good, HSG C
438,345	70	Weighted Average
438,345		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.2	50	0.0200	0.10		**Sheet Flow, Segment A** Grass: Dense n= 0.240 P2= 3.20"
0.8	108	0.0200	2.28		**Shallow Concentrated Flow, Segment B** Unpaved Kv= 16.1 fps
5.8	1,070	0.0364	3.07		**Shallow Concentrated Flow, Segment C** Unpaved Kv= 16.1 fps
14.8	1,228	Total			

Summary for Subcatchment SC-2:

Runoff = 3.61 cfs @ 12.26 hrs, Volume= 18,809 cf, Depth= 0.79"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NRCC 24-hr D 2-Year Rainfall=3.13"

Area (sf)	CN	Description
2,660	98	Roofs, HSG C
276,851	70	Woods, Good, HSG C
7,042	74	>75% Grass cover, Good, HSG C
286,553	70	Weighted Average
283,893		99.07% Pervious Area
2,660		0.93% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.8	50	0.0100	0.08		**Sheet Flow, Segment A** Grass: Dense n= 0.240 P2= 3.20"
0.8	54	0.0050	1.14		**Shallow Concentrated Flow, Segment B** Unpaved Kv= 16.1 fps
4.4	854	0.0400	3.22		**Shallow Concentrated Flow, Segment C** Unpaved Kv= 16.1 fps
16.0	958	Total			

Summary for Link AP-1 PRE:

Inflow Area = 438,345 sf, 0.00% Impervious, Inflow Depth = 0.79" for 2-Year event
Inflow = 5.76 cfs @ 12.25 hrs, Volume= 28,772 cf
Primary = 5.76 cfs @ 12.25 hrs, Volume= 28,772 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Summary for Link AP-2 PRE:

Inflow Area = 286,553 sf, 0.93% Impervious, Inflow Depth = 0.79" for 2-Year event
Inflow = 3.61 cfs @ 12.26 hrs, Volume= 18,809 cf
Primary = 3.61 cfs @ 12.26 hrs, Volume= 18,809 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Time span=0.00-72.00 hrs, dt=0.01 hrs, 7201 points x 3
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment SC-1: Runoff Area=438,345 sf 0.00% Impervious Runoff Depth=1.80"
Flow Length=1,228' Tc=14.8 min CN=70 Runoff=14.42 cfs 65,836 cf

Subcatchment SC-2: Runoff Area=286,553 sf 0.93% Impervious Runoff Depth=1.80"
Flow Length=958' Tc=16.0 min CN=70 Runoff=9.08 cfs 43,038 cf

Link AP-1 PRE: Inflow=14.42 cfs 65,836 cf
Primary=14.42 cfs 65,836 cf

Link AP-2 PRE: Inflow=9.08 cfs 43,038 cf
Primary=9.08 cfs 43,038 cf

Total Runoff Area = 724,898 sf Runoff Volume = 108,875 cf Average Runoff Depth = 1.80"
99.63% Pervious = 722,238 sf 0.37% Impervious = 2,660 sf

Summary for Subcatchment SC-1:

Runoff = 14.42 cfs @ 12.23 hrs, Volume= 65,836 cf, Depth= 1.80"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NRCC 24-hr D 10-Year Rainfall=4.68"

Area (sf)	CN	Description
392,335	70	Woods, Good, HSG C
46,010	74	>75% Grass cover, Good, HSG C
438,345	70	Weighted Average
438,345		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.2	50	0.0200	0.10		**Sheet Flow, Segment A** Grass: Dense n= 0.240 P2= 3.20"
0.8	108	0.0200	2.28		**Shallow Concentrated Flow, Segment B** Unpaved Kv= 16.1 fps
5.8	1,070	0.0364	3.07		**Shallow Concentrated Flow, Segment C** Unpaved Kv= 16.1 fps
14.8	1,228	Total			

Summary for Subcatchment SC-2:

Runoff = 9.08 cfs @ 12.25 hrs, Volume= 43,038 cf, Depth= 1.80"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NRCC 24-hr D 10-Year Rainfall=4.68"

Area (sf)	CN	Description
2,660	98	Roofs, HSG C
276,851	70	Woods, Good, HSG C
7,042	74	>75% Grass cover, Good, HSG C
286,553	70	Weighted Average
283,893		99.07% Pervious Area
2,660		0.93% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.8	50	0.0100	0.08		**Sheet Flow, Segment A** Grass: Dense n= 0.240 P2= 3.20"
0.8	54	0.0050	1.14		**Shallow Concentrated Flow, Segment B** Unpaved Kv= 16.1 fps
4.4	854	0.0400	3.22		**Shallow Concentrated Flow, Segment C** Unpaved Kv= 16.1 fps
16.0	958	Total			

Summary for Link AP-1 PRE:

Inflow Area = 438,345 sf, 0.00% Impervious, Inflow Depth = 1.80" for 10-Year event
Inflow = 14.42 cfs @ 12.23 hrs, Volume= 65,836 cf
Primary = 14.42 cfs @ 12.23 hrs, Volume= 65,836 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Summary for Link AP-2 PRE:

Inflow Area = 286,553 sf, 0.93% Impervious, Inflow Depth = 1.80" for 10-Year event
Inflow = 9.08 cfs @ 12.25 hrs, Volume= 43,038 cf
Primary = 9.08 cfs @ 12.25 hrs, Volume= 43,038 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Time span=0.00-72.00 hrs, dt=0.01 hrs, 7201 points x 3
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment SC-1: Runoff Area=438,345 sf 0.00% Impervious Runoff Depth=2.71"
Flow Length=1,228' Tc=14.8 min CN=70 Runoff=22.06 cfs 99,004 cf

Subcatchment SC-2: Runoff Area=286,553 sf 0.93% Impervious Runoff Depth=2.71"
Flow Length=958' Tc=16.0 min CN=70 Runoff=13.88 cfs 64,721 cf

Link AP-1 PRE: Inflow=22.06 cfs 99,004 cf
Primary=22.06 cfs 99,004 cf

Link AP-2 PRE: Inflow=13.88 cfs 64,721 cf
Primary=13.88 cfs 64,721 cf

Total Runoff Area = 724,898 sf Runoff Volume = 163,725 cf Average Runoff Depth = 2.71"
99.63% Pervious = 722,238 sf 0.37% Impervious = 2,660 sf

Summary for Subcatchment SC-1:

Runoff = 22.06 cfs @ 12.23 hrs, Volume= 99,004 cf, Depth= 2.71"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NRCC 24-hr D 25-Year Rainfall=5.88"

Area (sf)	CN	Description
392,335	70	Woods, Good, HSG C
46,010	74	>75% Grass cover, Good, HSG C
438,345	70	Weighted Average
438,345		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.2	50	0.0200	0.10		**Sheet Flow, Segment A** Grass: Dense n= 0.240 P2= 3.20"
0.8	108	0.0200	2.28		**Shallow Concentrated Flow, Segment B** Unpaved Kv= 16.1 fps
5.8	1,070	0.0364	3.07		**Shallow Concentrated Flow, Segment C** Unpaved Kv= 16.1 fps
14.8	1,228	Total			

Summary for Subcatchment SC-2:

Runoff = 13.88 cfs @ 12.25 hrs, Volume= 64,721 cf, Depth= 2.71"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NRCC 24-hr D 25-Year Rainfall=5.88"

Area (sf)	CN	Description
2,660	98	Roofs, HSG C
276,851	70	Woods, Good, HSG C
7,042	74	>75% Grass cover, Good, HSG C
286,553	70	Weighted Average
283,893		99.07% Pervious Area
2,660		0.93% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.8	50	0.0100	0.08		**Sheet Flow, Segment A** Grass: Dense n= 0.240 P2= 3.20"
0.8	54	0.0050	1.14		**Shallow Concentrated Flow, Segment B** Unpaved Kv= 16.1 fps
4.4	854	0.0400	3.22		**Shallow Concentrated Flow, Segment C** Unpaved Kv= 16.1 fps
16.0	958	Total			

Summary for Link AP-1 PRE:

Inflow Area = 438,345 sf, 0.00% Impervious, Inflow Depth = 2.71" for 25-Year event
Inflow = 22.06 cfs @ 12.23 hrs, Volume= 99,004 cf
Primary = 22.06 cfs @ 12.23 hrs, Volume= 99,004 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Summary for Link AP-2 PRE:

Inflow Area = 286,553 sf, 0.93% Impervious, Inflow Depth = 2.71" for 25-Year event
Inflow = 13.88 cfs @ 12.25 hrs, Volume= 64,721 cf
Primary = 13.88 cfs @ 12.25 hrs, Volume= 64,721 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Time span=0.00-72.00 hrs, dt=0.01 hrs, 7201 points x 3
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment SC-1: Runoff Area=438,345 sf 0.00% Impervious Runoff Depth=4.76"
Flow Length=1,228' Tc=14.8 min CN=70 Runoff=38.92 cfs 173,798 cf

Subcatchment SC-2: Runoff Area=286,553 sf 0.93% Impervious Runoff Depth=4.76"
Flow Length=958' Tc=16.0 min CN=70 Runoff=24.47 cfs 113,615 cf

Link AP-1 PRE: Inflow=38.92 cfs 173,798 cf
Primary=38.92 cfs 173,798 cf

Link AP-2 PRE: Inflow=24.47 cfs 113,615 cf
Primary=24.47 cfs 113,615 cf

Total Runoff Area = 724,898 sf Runoff Volume = 287,413 cf Average Runoff Depth = 4.76"
99.63% Pervious = 722,238 sf 0.37% Impervious = 2,660 sf

Summary for Subcatchment SC-1:

Runoff = 38.92 cfs @ 12.22 hrs, Volume= 173,798 cf, Depth= 4.76"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NRCC 24-hr D 100-Year Rainfall=8.34"

Area (sf)	CN	Description
392,335	70	Woods, Good, HSG C
46,010	74	>75% Grass cover, Good, HSG C
438,345	70	Weighted Average
438,345		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.2	50	0.0200	0.10		**Sheet Flow, Segment A** Grass: Dense n= 0.240 P2= 3.20"
0.8	108	0.0200	2.28		**Shallow Concentrated Flow, Segment B** Unpaved Kv= 16.1 fps
5.8	1,070	0.0364	3.07		**Shallow Concentrated Flow, Segment C** Unpaved Kv= 16.1 fps
14.8	1,228	Total			

Summary for Subcatchment SC-2:

Runoff = 24.47 cfs @ 12.25 hrs, Volume= 113,615 cf, Depth= 4.76"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NRCC 24-hr D 100-Year Rainfall=8.34"

Area (sf)	CN	Description
2,660	98	Roofs, HSG C
276,851	70	Woods, Good, HSG C
7,042	74	>75% Grass cover, Good, HSG C
286,553	70	Weighted Average
283,893		99.07% Pervious Area
2,660		0.93% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.8	50	0.0100	0.08		**Sheet Flow, Segment A** Grass: Dense n= 0.240 P2= 3.20"
0.8	54	0.0050	1.14		**Shallow Concentrated Flow, Segment B** Unpaved Kv= 16.1 fps
4.4	854	0.0400	3.22		**Shallow Concentrated Flow, Segment C** Unpaved Kv= 16.1 fps
16.0	958	Total			

Summary for Link AP-1 PRE:

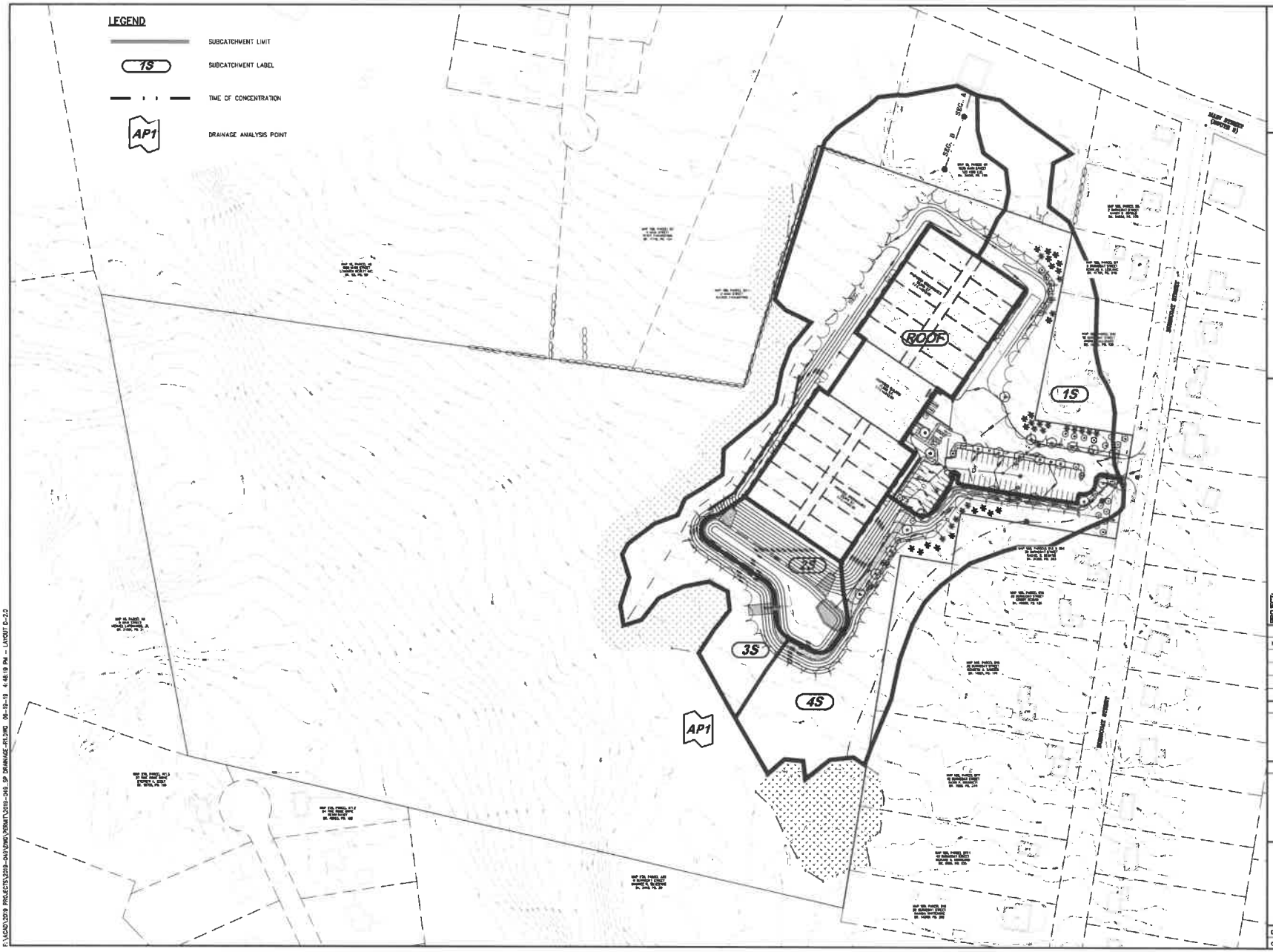
Inflow Area = 438,345 sf, 0.00% Impervious, Inflow Depth = 4.76" for 100-Year event
Inflow = 38.92 cfs @ 12.22 hrs, Volume= 173,798 cf
Primary = 38.92 cfs @ 12.22 hrs, Volume= 173,798 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Summary for Link AP-2 PRE:

Inflow Area = 286,553 sf, 0.93% Impervious, Inflow Depth = 4.76" for 100-Year event
Inflow = 24.47 cfs @ 12.25 hrs, Volume= 113,615 cf
Primary = 24.47 cfs @ 12.25 hrs, Volume= 113,615 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs



ASE
Andrews Survey & Engineering, Inc.
Land Surveying - Civil Engineering - Site Planning
P.O. Box 313, 104 Meeden Street
Uxbridge, Massachusetts 01569
P: 508-278-3077 F: 508-278-2289
508 East Washington Street
North Attleboro, Massachusetts 02760
P: 508-316-0452 F: 508-316-0963

PROJECT:
CULTIVATE BURNCOAT
22 BURNCOAT STREET
LEICESTER, MA 01524

APPLICANT:
CULTIVATE HOLDINGS LLC
P.O. BOX 245
LEICESTER, MA 01524

REVISIONS

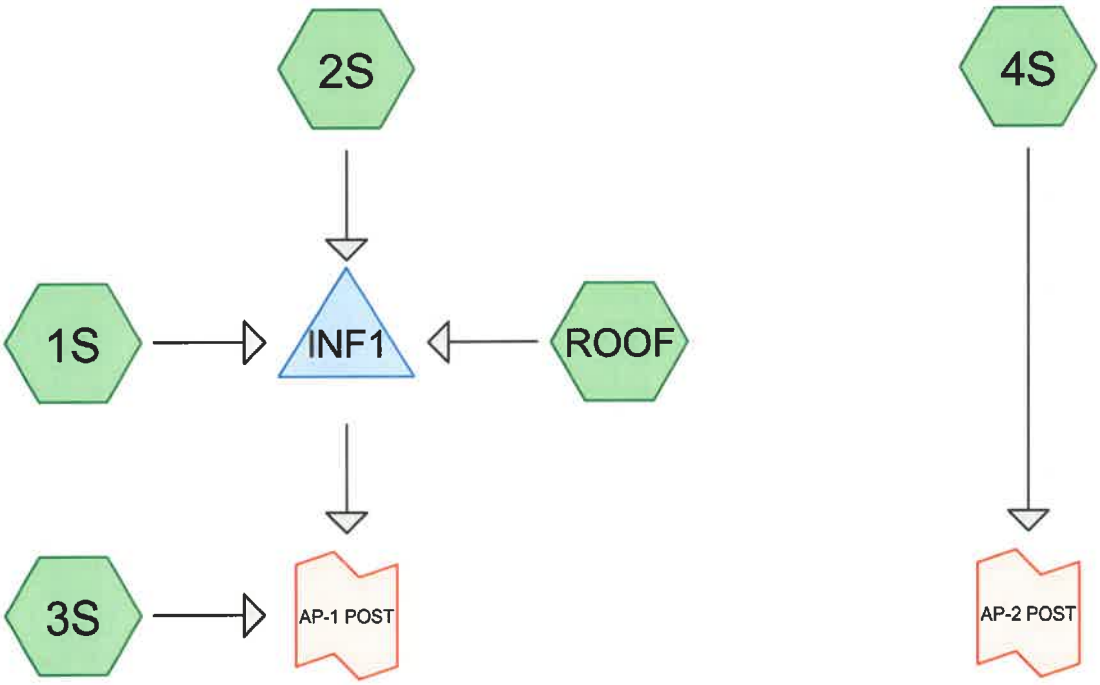
NO.	DATE	DESCRIPTION
1	6/19/19	REVISED DRAINAGE ANALYSIS

GRAPHIC SCALE
(IN FEET)
1 inch = 80 feet

SHEET TITLE
POST-DEVELOPMENT WATERSHED MAP

DES BY: TRB | DATE: APRIL 11, 2019
CHK BY: RWM | PROJECT NO. 2018-049
D-2.0

F:\ACAD\2018 PROJECTS\2018-049\DWG\PDMT\2018-049_SP DRAINAGE-REV.DWG 06-19-19 4:48:19 PM - LAYOUT D-2.0



Subcat Reach Pond Link

Routing Diagram for 2019-049 R1
Prepared by Andrews Survey & Eng., Inc., Printed 6/19/2019
HydroCAD® 10.00-22 s/n 02271 © 2018 HydroCAD Software Solutions LLC

Area Listing (selected nodes)

Area (sq-ft)	CN	Description (subcatchment-numbers)
181,920	74	>75% Grass cover, Good, HSG C (1S, 2S, 3S, 4S)
3,156	96	Gravel surface, HSG C (4S)
59,501	98	Paved parking, HSG C (1S)
132,325	98	Roofs, HSG C (ROOF)
301,986	70	Woods, Good, HSG C (1S, 3S, 4S)
678,888	**79**	**TOTAL AREA**

Soil Listing (selected nodes)

Area (sq-ft)	Soil Group	Subcatchment Numbers
0	HSG A	
0	HSG B	
678,888	HSG C	1S, 2S, 3S, 4S, ROOF
0	HSG D	
0	Other	
678,888		**TOTAL AREA**

Ground Covers (selected nodes)

HSG-A (sq-ft)	HSG-B (sq-ft)	HSG-C (sq-ft)	HSG-D (sq-ft)	Other (sq-ft)	Total (sq-ft)	Ground Cover
0	0	181,920	0	0	181,920	>75% Grass cover, Good
0	0	3,156	0	0	3,156	Gravel surface
0	0	59,501	0	0	59,501	Paved parking
0	0	132,325	0	0	132,325	Roofs
0	0	301,986	0	0	301,986	Woods, Good
0	**0**	**678,888**	**0**	**0**	**678,888**	**TOTAL AREA**

Time span=0.00-72.00 hrs, dt=0.01 hrs, 7201 points x 3
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 1S: Runoff Area=162,571 sf 36.60% Impervious Runoff Depth=1.41"
Tc=6.0 min CN=81 Runoff=5.89 cfs 19,159 cf

Subcatchment 2S: Runoff Area=40,076 sf 0.00% Impervious Runoff Depth=0.99"
Tc=6.0 min CN=74 Runoff=0.99 cfs 3,312 cf

Subcatchment 3S: Runoff Area=209,503 sf 0.00% Impervious Runoff Depth=0.89"
Flow Length=1,228' Tc=14.8 min CN=72 Runoff=3.20 cfs 15,478 cf

Subcatchment 4S: Runoff Area=134,413 sf 0.00% Impervious Runoff Depth=0.89"
Flow Length=813' Tc=10.4 min CN=72 Runoff=2.40 cfs 9,930 cf

Subcatchment ROOF: Runoff Area=132,325 sf 100.00% Impervious Runoff Depth=2.90"
Tc=6.0 min CN=98 Runoff=8.55 cfs 31,954 cf

Pond INF1: Peak Elev=1,019.93' Storage=24,156 cf Inflow=15.42 cfs 54,425 cf
Discarded=0.09 cfs 13,240 cf Primary=1.82 cfs 41,185 cf Outflow=1.91 cfs 54,425 cf

Link AP-1 POST: Inflow=4.80 cfs 56,662 cf
Primary=4.80 cfs 56,662 cf

Link AP-2 POST: Inflow=2.40 cfs 9,930 cf
Primary=2.40 cfs 9,930 cf

Total Runoff Area = 678,888 sf Runoff Volume = 79,832 cf Average Runoff Depth = 1.41"
71.74% Pervious = 487,062 sf 28.26% Impervious = 191,826 sf

Summary for Subcatchment 1S:

Runoff = 5.89 cfs @ 12.13 hrs, Volume= 19,159 cf, Depth= 1.41"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NRCC 24-hr D 2-Year Rainfall=3.13"

Area (sf)	CN	Description
59,501	98	Paved parking, HSG C
80,017	70	Woods, Good, HSG C
23,053	74	>75% Grass cover, Good, HSG C
162,571	81	Weighted Average
103,070		63.40% Pervious Area
59,501		36.60% Impervious Area

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

Summary for Subcatchment 2S:

Runoff = 0.99 cfs @ 12.14 hrs, Volume= 3,312 cf, Depth= 0.99"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NRCC 24-hr D 2-Year Rainfall=3.13"

Area (sf)	CN	Description
40,076	74	>75% Grass cover, Good, HSG C
40,076		100.00% Pervious Area

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

Summary for Subcatchment 3S:

Runoff = 3.20 cfs @ 12.24 hrs, Volume= 15,478 cf, Depth= 0.89"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NRCC 24-hr D 2-Year Rainfall=3.13"

Area (sf)	CN	Description
126,884	70	Woods, Good, HSG C
82,619	74	>75% Grass cover, Good, HSG C
209,503	72	Weighted Average
209,503		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.2	50	0.0200	0.10		**Sheet Flow, Segment A** Grass: Dense n= 0.240 P2= 3.20"
0.8	108	0.0200	2.28		**Shallow Concentrated Flow, Segment B** Unpaved Kv= 16.1 fps
5.8	1,070	0.0364	3.07		**Shallow Concentrated Flow, Segment C** Unpaved Kv= 16.1 fps
14.8	1,228	Total			

Summary for Subcatchment 4S:

Runoff = 2.40 cfs @ 12.19 hrs, Volume= 9,930 cf, Depth= 0.89"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NRCC 24-hr D 2-Year Rainfall=3.13"

Area (sf)	CN	Description
95,085	70	Woods, Good, HSG C
36,172	74	>75% Grass cover, Good, HSG C
3,156	96	Gravel surface, HSG C
134,413	72	Weighted Average
134,413		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.2	50	0.0400	0.13		**Sheet Flow, Segment A** Grass: Dense n= 0.240 P2= 3.20"
1.1	156	0.0200	2.28		**Shallow Concentrated Flow, Segment B** Unpaved Kv= 16.1 fps
3.1	607	0.0400	3.22		**Shallow Concentrated Flow, Segment C** Unpaved Kv= 16.1 fps
10.4	813	Total			

Summary for Subcatchment ROOF:

Runoff = 8.55 cfs @ 12.13 hrs, Volume= 31,954 cf, Depth= 2.90"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NRCC 24-hr D 2-Year Rainfall=3.13"

Area (sf)	CN	Description
132,325	98	Roofs, HSG C
132,325		100.00% Impervious Area

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

Summary for Pond INF1:

Inflow Area = 334,972 sf, 57.27% Impervious, Inflow Depth = 1.95" for 2-Year event
Inflow = 15.42 cfs @ 12.13 hrs, Volume= 54,425 cf
Outflow = 1.91 cfs @ 12.85 hrs, Volume= 54,425 cf, Atten= 88%, Lag= 43.1 min
Discarded = 0.09 cfs @ 12.85 hrs, Volume= 13,240 cf
Primary = 1.82 cfs @ 12.85 hrs, Volume= 41,185 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs / 3
Peak Elev= 1,019.93' @ 12.85 hrs Surf.Area= 14,606 sf Storage= 24,156 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 403.1 min (1,209.9 - 806.9)

Volume	Invert	Avail.Storage	Storage Description
#1	1,018.00'	79,451 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
1,018.00	10,479	694.0	0	0	10,479
1,020.00	14,757	732.0	25,114	25,114	15,021
1,022.00	19,261	770.0	33,918	59,032	19,805
1,023.00	21,598	788.0	20,418	79,451	22,168

Device	Routing	Invert	Outlet Devices
#1	Primary	1,022.00'	**10.0' long x 10.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.49 2.56 2.70 2.69 2.68 2.69 2.67 2.64
#2	Discarded	1,018.00'	**0.270 in/hr Exfiltration over Surface area**
#3	Primary	1,017.50'	**24.0" Round Culvert** L= 32.8' CPP, end-section conforming to fill, Ke= 0.500 Inlet / Outlet Invert= 1,017.50' / 1,017.00' S= 0.0152 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 3.14 sf
#4	Device 3	1,018.00'	**2.0" Vert. Orifice/Grate** C= 0.600
#5	Device 3	1,019.00'	**5.0" Vert. Orifice/Grate X 3.00** C= 0.600
#6	Device 3	1,020.00'	**10.0" Vert. Orifice/Grate X 3.00** C= 0.600
#7	Device 3	1,021.25'	**1.5' long x 1.00' rise Sharp-Crested Rectangular Weir** 2 End Contraction(s)

Discarded OutFlow Max=0.09 cfs @ 12.85 hrs HW=1,019.93' (Free Discharge)
└─**2=Exfiltration** (Exfiltration Controls 0.09 cfs)

Primary OutFlow Max=1.82 cfs @ 12.85 hrs HW=1,019.93' TW=0.00' (Dynamic Tailwater)
├─**1=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)
└─**3=Culvert** (Passes 1.82 cfs of 18.12 cfs potential flow)
  ├─**4=Orifice/Grate** (Orifice Controls 0.14 cfs @ 6.55 fps)
  ├─**5=Orifice/Grate** (Orifice Controls 1.68 cfs @ 4.10 fps)
  ├─**6=Orifice/Grate** (Controls 0.00 cfs)
  └─**7=Sharp-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Link AP-1 POST:

Inflow Area = 544,475 sf, 35.23% Impervious, Inflow Depth = 1.25" for 2-Year event
Inflow = 4.80 cfs @ 12.25 hrs, Volume= 56,662 cf
Primary = 4.80 cfs @ 12.25 hrs, Volume= 56,662 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Summary for Link AP-2 POST:

Inflow Area = 134,413 sf, 0.00% Impervious, Inflow Depth = 0.89" for 2-Year event
Inflow = 2.40 cfs @ 12.19 hrs, Volume= 9,930 cf
Primary = 2.40 cfs @ 12.19 hrs, Volume= 9,930 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Time span=0.00-72.00 hrs, dt=0.01 hrs, 7201 points x 3
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 1S: Runoff Area=162,571 sf 36.60% Impervious Runoff Depth=2.70"
Tc=6.0 min CN=81 Runoff=11.21 cfs 36,638 cf

Subcatchment 2S: Runoff Area=40,076 sf 0.00% Impervious Runoff Depth=2.11"
Tc=6.0 min CN=74 Runoff=2.17 cfs 7,053 cf

Subcatchment 3S: Runoff Area=209,503 sf 0.00% Impervious Runoff Depth=1.95"
Flow Length=1,228' Tc=14.8 min CN=72 Runoff=7.54 cfs 34,122 cf

Subcatchment 4S: Runoff Area=134,413 sf 0.00% Impervious Runoff Depth=1.95"
Flow Length=813' Tc=10.4 min CN=72 Runoff=5.60 cfs 21,892 cf

Subcatchment ROOF: Runoff Area=132,325 sf 100.00% Impervious Runoff Depth=4.44"
Tc=6.0 min CN=98 Runoff=12.87 cfs 49,001 cf

Pond INF1: Peak Elev=1,020.75' Storage=36,722 cf Inflow=26.24 cfs 92,691 cf
Discarded=0.10 cfs 13,834 cf Primary=7.16 cfs 78,857 cf Outflow=7.26 cfs 92,692 cf

Link AP-1 POST: Inflow=14.36 cfs 112,979 cf
Primary=14.36 cfs 112,979 cf

Link AP-2 POST: Inflow=5.60 cfs 21,892 cf
Primary=5.60 cfs 21,892 cf

Total Runoff Area = 678,888 sf Runoff Volume = 148,705 cf Average Runoff Depth = 2.63"
71.74% Pervious = 487,062 sf 28.26% Impervious = 191,826 sf

Summary for Subcatchment 1S:

Runoff = 11.21 cfs @ 12.13 hrs, Volume= 36,638 cf, Depth= 2.70"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NRCC 24-hr D 10-Year Rainfall=4.68"

Area (sf)	CN	Description
59,501	98	Paved parking, HSG C
80,017	70	Woods, Good, HSG C
23,053	74	>75% Grass cover, Good, HSG C
162,571	81	Weighted Average
103,070		63.40% Pervious Area
59,501		36.60% Impervious Area

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

Summary for Subcatchment 2S:

Runoff = 2.17 cfs @ 12.13 hrs, Volume= 7,053 cf, Depth= 2.11"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NRCC 24-hr D 10-Year Rainfall=4.68"

Area (sf)	CN	Description
40,076	74	>75% Grass cover, Good, HSG C
40,076		100.00% Pervious Area

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

Summary for Subcatchment 3S:

Runoff = 7.54 cfs @ 12.23 hrs, Volume= 34,122 cf, Depth= 1.95"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NRCC 24-hr D 10-Year Rainfall=4.68"

Area (sf)	CN	Description
126,884	70	Woods, Good, HSG C
82,619	74	>75% Grass cover, Good, HSG C
209,503	72	Weighted Average
209,503		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.2	50	0.0200	0.10		**Sheet Flow, Segment A** Grass: Dense n= 0.240 P2= 3.20"
0.8	108	0.0200	2.28		**Shallow Concentrated Flow, Segment B** Unpaved Kv= 16.1 fps
5.8	1,070	0.0364	3.07		**Shallow Concentrated Flow, Segment C** Unpaved Kv= 16.1 fps
14.8	1,228	Total			

Summary for Subcatchment 4S:

Runoff = 5.60 cfs @ 12.18 hrs, Volume= 21,892 cf, Depth= 1.95"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NRCC 24-hr D 10-Year Rainfall=4.68"

Area (sf)	CN	Description
95,085	70	Woods, Good, HSG C
36,172	74	>75% Grass cover, Good, HSG C
3,156	96	Gravel surface, HSG C
134,413	72	Weighted Average
134,413		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.2	50	0.0400	0.13		**Sheet Flow, Segment A** Grass: Dense n= 0.240 P2= 3.20"
1.1	156	0.0200	2.28		**Shallow Concentrated Flow, Segment B** Unpaved Kv= 16.1 fps
3.1	607	0.0400	3.22		**Shallow Concentrated Flow, Segment C** Unpaved Kv= 16.1 fps
10.4	813	Total			

Summary for Subcatchment ROOF:

Runoff = 12.87 cfs @ 12.13 hrs, Volume= 49,001 cf, Depth= 4.44"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NRCC 24-hr D 10-Year Rainfall=4.68"

Area (sf)	CN	Description
132,325	98	Roofs, HSG C
132,325		100.00% Impervious Area

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

Summary for Pond INF1:

Inflow Area = 334,972 sf, 57.27% Impervious, Inflow Depth = 3.32" for 10-Year event
Inflow = 26.24 cfs @ 12.13 hrs, Volume= 92,691 cf
Outflow = 7.26 cfs @ 12.34 hrs, Volume= 92,692 cf, Atten= 72%, Lag= 12.7 min
Discarded = 0.10 cfs @ 12.34 hrs, Volume= 13,834 cf
Primary = 7.16 cfs @ 12.34 hrs, Volume= 78,857 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs / 3
Peak Elev= 1,020.75' @ 12.34 hrs Surf.Area= 16,367 sf Storage= 36,722 cf

Plug-Flow detention time= 286.9 min calculated for 92,679 cf (100% of inflow)
Center-of-Mass det. time= 287.1 min (1,084.1 - 797.0)

Volume	Invert	Avail.Storage	Storage Description
#1	1,018.00'	79,451 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
1,018.00	10,479	694.0	0	0	10,479
1,020.00	14,757	732.0	25,114	25,114	15,021
1,022.00	19,261	770.0	33,918	59,032	19,805
1,023.00	21,598	788.0	20,418	79,451	22,168

Device	Routing	Invert	Outlet Devices
#1	Primary	1,022.00'	**10.0' long x 10.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.49 2.56 2.70 2.69 2.68 2.69 2.67 2.64
#2	Discarded	1,018.00'	**0.270 in/hr Exfiltration over Surface area**
#3	Primary	1,017.50'	**24.0" Round Culvert** L= 32.8' CPP, end-section conforming to fill, Ke= 0.500 Inlet / Outlet Invert= 1,017.50' / 1,017.00' S= 0.0152 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 3.14 sf
#4	Device 3	1,018.00'	**2.0" Vert. Orifice/Grate** C= 0.600
#5	Device 3	1,019.00'	**5.0" Vert. Orifice/Grate X 3.00** C= 0.600
#6	Device 3	1,020.00'	**10.0" Vert. Orifice/Grate X 3.00** C= 0.600
#7	Device 3	1,021.25'	**1.5' long x 1.00' rise Sharp-Crested Rectangular Weir** 2 End Contraction(s)

Discarded OutFlow Max=0.10 cfs @ 12.34 hrs HW=1,020.75' (Free Discharge)
└─**2=Exfiltration** (Exfiltration Controls 0.10 cfs)

Primary OutFlow Max=7.16 cfs @ 12.34 hrs HW=1,020.75' TW=0.00' (Dynamic Tailwater)
├─**1=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)
└─**3=Culvert** (Passes 7.16 cfs of 22.67 cfs potential flow)
  ├─**4=Orifice/Grate** (Orifice Controls 0.17 cfs @ 7.86 fps)
  ├─**5=Orifice/Grate** (Orifice Controls 2.44 cfs @ 5.97 fps)
  ├─**6=Orifice/Grate** (Orifice Controls 4.54 cfs @ 2.94 fps)
  └─**7=Sharp-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Link AP-1 POST:

Inflow Area = 544,475 sf, 35.23% Impervious, Inflow Depth = 2.49" for 10-Year event
Inflow = 14.36 cfs @ 12.25 hrs, Volume= 112,979 cf
Primary = 14.36 cfs @ 12.25 hrs, Volume= 112,979 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Summary for Link AP-2 POST:

Inflow Area = 134,413 sf, 0.00% Impervious, Inflow Depth = 1.95" for 10-Year event
Inflow = 5.60 cfs @ 12.18 hrs, Volume= 21,892 cf
Primary = 5.60 cfs @ 12.18 hrs, Volume= 21,892 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Time span=0.00-72.00 hrs, dt=0.01 hrs, 7201 points x 3
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 1S: Runoff Area=162,571 sf 36.60% Impervious Runoff Depth=3.77"
Tc=6.0 min CN=81 Runoff=15.48 cfs 51,136 cf

Subcatchment 2S: Runoff Area=40,076 sf 0.00% Impervious Runoff Depth=3.08"
Tc=6.0 min CN=74 Runoff=3.17 cfs 10,300 cf

Subcatchment 3S: Runoff Area=209,503 sf 0.00% Impervious Runoff Depth=2.90"
Flow Length=1,228' Tc=14.8 min CN=72 Runoff=11.30 cfs 50,549 cf

Subcatchment 4S: Runoff Area=134,413 sf 0.00% Impervious Runoff Depth=2.90"
Flow Length=813' Tc=10.4 min CN=72 Runoff=8.36 cfs 32,431 cf

Subcatchment ROOF: Runoff Area=132,325 sf 100.00% Impervious Runoff Depth=5.64"
Tc=6.0 min CN=98 Runoff=16.21 cfs 62,215 cf

Pond INF1: Peak Elev=1,021.29' Storage=45,986 cf Inflow=34.85 cfs 123,651 cf
Discarded=0.11 cfs 14,149 cf Primary=10.44 cfs 109,503 cf Outflow=10.55 cfs 123,652 cf

Link AP-1 POST: Inflow=21.50 cfs 160,052 cf
Primary=21.50 cfs 160,052 cf

Link AP-2 POST: Inflow=8.36 cfs 32,431 cf
Primary=8.36 cfs 32,431 cf

Total Runoff Area = 678,888 sf Runoff Volume = 206,632 cf Average Runoff Depth = 3.65"
71.74% Pervious = 487,062 sf 28.26% Impervious = 191,826 sf

Summary for Subcatchment 1S:

Runoff = 15.48 cfs @ 12.13 hrs, Volume= 51,136 cf, Depth= 3.77"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NRCC 24-hr D 25-Year Rainfall=5.88"

Area (sf)	CN	Description
59,501	98	Paved parking, HSG C
80,017	70	Woods, Good, HSG C
23,053	74	>75% Grass cover, Good, HSG C
162,571	81	Weighted Average
103,070		63.40% Pervious Area
59,501		36.60% Impervious Area

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

Summary for Subcatchment 2S:

Runoff = 3.17 cfs @ 12.13 hrs, Volume= 10,300 cf, Depth= 3.08"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NRCC 24-hr D 25-Year Rainfall=5.88"

Area (sf)	CN	Description
40,076	74	>75% Grass cover, Good, HSG C
40,076		100.00% Pervious Area

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

Summary for Subcatchment 3S:

Runoff = 11.30 cfs @ 12.23 hrs, Volume= 50,549 cf, Depth= 2.90"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NRCC 24-hr D 25-Year Rainfall=5.88"

Area (sf)	CN	Description
126,884	70	Woods, Good, HSG C
82,619	74	>75% Grass cover, Good, HSG C
209,503	72	Weighted Average
209,503		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.2	50	0.0200	0.10		**Sheet Flow, Segment A** Grass: Dense n= 0.240 P2= 3.20"
0.8	108	0.0200	2.28		**Shallow Concentrated Flow, Segment B** Unpaved Kv= 16.1 fps
5.8	1,070	0.0364	3.07		**Shallow Concentrated Flow, Segment C** Unpaved Kv= 16.1 fps
14.8	1,228	Total			

Summary for Subcatchment 4S:

Runoff = 8.36 cfs @ 12.18 hrs, Volume= 32,431 cf, Depth= 2.90"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NRCC 24-hr D 25-Year Rainfall=5.88"

Area (sf)	CN	Description
95,085	70	Woods, Good, HSG C
36,172	74	>75% Grass cover, Good, HSG C
3,156	96	Gravel surface, HSG C
134,413	72	Weighted Average
134,413		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.2	50	0.0400	0.13		**Sheet Flow, Segment A** Grass: Dense n= 0.240 P2= 3.20"
1.1	156	0.0200	2.28		**Shallow Concentrated Flow, Segment B** Unpaved Kv= 16.1 fps
3.1	607	0.0400	3.22		**Shallow Concentrated Flow, Segment C** Unpaved Kv= 16.1 fps
10.4	813	Total			

Summary for Subcatchment ROOF:

Runoff = 16.21 cfs @ 12.13 hrs, Volume= 62,215 cf, Depth= 5.64"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NRCC 24-hr D 25-Year Rainfall=5.88"

Area (sf)	CN	Description
132,325	98	Roofs, HSG C
132,325		100.00% Impervious Area

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

Summary for Pond INF1:

Inflow Area = 334,972 sf, 57.27% Impervious, Inflow Depth = 4.43" for 25-Year event
Inflow = 34.85 cfs @ 12.13 hrs, Volume= 123,651 cf
Outflow = 10.55 cfs @ 12.31 hrs, Volume= 123,652 cf, Atten= 70%, Lag= 10.9 min
Discarded = 0.11 cfs @ 12.31 hrs, Volume= 14,149 cf
Primary = 10.44 cfs @ 12.31 hrs, Volume= 109,503 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs / 3
Peak Elev= 1,021.29' @ 12.31 hrs Surf.Area= 17,598 sf Storage= 45,986 cf

Plug-Flow detention time= 239.9 min calculated for 123,635 cf (100% of inflow)
Center-of-Mass det. time= 240.1 min (1,031.1 - 791.1)

Volume	Invert	Avail.Storage	Storage Description
#1	1,018.00'	79,451 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
1,018.00	10,479	694.0	0	0	10,479
1,020.00	14,757	732.0	25,114	25,114	15,021
1,022.00	19,261	770.0	33,918	59,032	19,805
1,023.00	21,598	788.0	20,418	79,451	22,168

Device	Routing	Invert	Outlet Devices
#1	Primary	1,022.00'	**10.0' long x 10.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.49 2.56 2.70 2.69 2.68 2.69 2.67 2.64
#2	Discarded	1,018.00'	**0.270 in/hr Exfiltration over Surface area**
#3	Primary	1,017.50'	**24.0" Round Culvert** L= 32.8' CPP, end-section conforming to fill, Ke= 0.500 Inlet / Outlet Invert= 1,017.50' / 1,017.00' S= 0.0152 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 3.14 sf
#4	Device 3	1,018.00'	**2.0" Vert. Orifice/Grate** C= 0.600
#5	Device 3	1,019.00'	**5.0" Vert. Orifice/Grate X 3.00** C= 0.600
#6	Device 3	1,020.00'	**10.0" Vert. Orifice/Grate X 3.00** C= 0.600
#7	Device 3	1,021.25'	**1.5' long x 1.00' rise Sharp-Crested Rectangular Weir** 2 End Contraction(s)

Discarded OutFlow Max=0.11 cfs @ 12.31 hrs HW=1,021.29' (Free Discharge)
└─**2=Exfiltration** (Exfiltration Controls 0.11 cfs)

Primary OutFlow Max=10.44 cfs @ 12.31 hrs HW=1,021.29' TW=0.00' (Dynamic Tailwater)
├─**1=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)
└─**3=Culvert** (Passes 10.44 cfs of 25.27 cfs potential flow)
  ├─**4=Orifice/Grate** (Orifice Controls 0.19 cfs @ 8.62 fps)
  ├─**5=Orifice/Grate** (Orifice Controls 2.84 cfs @ 6.95 fps)
  ├─**6=Orifice/Grate** (Orifice Controls 7.37 cfs @ 4.50 fps)
  └─**7=Sharp-Crested Rectangular Weir** (Weir Controls 0.04 cfs @ 0.67 fps)

Summary for Link AP-1 POST:

Inflow Area = 544,475 sf, 35.23% Impervious, Inflow Depth = 3.53" for 25-Year event
Inflow = 21.50 cfs @ 12.24 hrs, Volume= 160,052 cf
Primary = 21.50 cfs @ 12.24 hrs, Volume= 160,052 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Summary for Link AP-2 POST:

Inflow Area = 134,413 sf, 0.00% Impervious, Inflow Depth = 2.90" for 25-Year event
Inflow = 8.36 cfs @ 12.18 hrs, Volume= 32,431 cf
Primary = 8.36 cfs @ 12.18 hrs, Volume= 32,431 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Time span=0.00-72.00 hrs, dt=0.01 hrs, 7201 points x 3
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 1S: Runoff Area=162,571 sf 36.60% Impervious Runoff Depth=6.06"
Tc=6.0 min CN=81 Runoff=24.32 cfs 82,149 cf

Subcatchment 2S: Runoff Area=40,076 sf 0.00% Impervious Runoff Depth=5.23"
Tc=6.0 min CN=74 Runoff=5.30 cfs 17,469 cf

Subcatchment 3S: Runoff Area=209,503 sf 0.00% Impervious Runoff Depth=4.99"
Flow Length=1,228' Tc=14.8 min CN=72 Runoff=19.49 cfs 87,189 cf

Subcatchment 4S: Runoff Area=134,413 sf 0.00% Impervious Runoff Depth=4.99"
Flow Length=813' Tc=10.4 min CN=72 Runoff=14.37 cfs 55,939 cf

Subcatchment ROOF: Runoff Area=132,325 sf 100.00% Impervious Runoff Depth=8.10"
Tc=6.0 min CN=98 Runoff=23.03 cfs 89,319 cf

Pond INF1: Peak Elev=1,022.16' Storage=62,207 cf Inflow=52.65 cfs 188,938 cf
Discarded=0.12 cfs 14,681 cf Primary=19.41 cfs 174,258 cf Outflow=19.53 cfs 188,939 cf

Link AP-1 POST: Inflow=38.51 cfs 261,447 cf
Primary=38.51 cfs 261,447 cf

Link AP-2 POST: Inflow=14.37 cfs 55,939 cf
Primary=14.37 cfs 55,939 cf

Total Runoff Area = 678,888 sf Runoff Volume = 332,065 cf Average Runoff Depth = 5.87"
71.74% Pervious = 487,062 sf 28.26% Impervious = 191,826 sf

Summary for Subcatchment 1S:

Runoff = 24.32 cfs @ 12.13 hrs, Volume= 82,149 cf, Depth= 6.06"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NRCC 24-hr D 100-Year Rainfall=8.34"

Area (sf)	CN	Description
59,501	98	Paved parking, HSG C
80,017	70	Woods, Good, HSG C
23,053	74	>75% Grass cover, Good, HSG C
162,571	81	Weighted Average
103,070		63.40% Pervious Area
59,501		36.60% Impervious Area

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

Summary for Subcatchment 2S:

Runoff = 5.30 cfs @ 12.13 hrs, Volume= 17,469 cf, Depth= 5.23"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NRCC 24-hr D 100-Year Rainfall=8.34"

Area (sf)	CN	Description
40,076	74	>75% Grass cover, Good, HSG C
40,076		100.00% Pervious Area

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

Summary for Subcatchment 3S:

Runoff = 19.49 cfs @ 12.22 hrs, Volume= 87,189 cf, Depth= 4.99"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NRCC 24-hr D 100-Year Rainfall=8.34"

Area (sf)	CN	Description
126,884	70	Woods, Good, HSG C
82,619	74	>75% Grass cover, Good, HSG C
209,503	72	Weighted Average
209,503		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.2	50	0.0200	0.10		**Sheet Flow, Segment A** Grass: Dense n= 0.240 P2= 3.20"
0.8	108	0.0200	2.28		**Shallow Concentrated Flow, Segment B** Unpaved Kv= 16.1 fps
5.8	1,070	0.0364	3.07		**Shallow Concentrated Flow, Segment C** Unpaved Kv= 16.1 fps
14.8	1,228	Total			

Summary for Subcatchment 4S:

Runoff = 14.37 cfs @ 12.18 hrs, Volume= 55,939 cf, Depth= 4.99"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NRCC 24-hr D 100-Year Rainfall=8.34"

Area (sf)	CN	Description
95,085	70	Woods, Good, HSG C
36,172	74	>75% Grass cover, Good, HSG C
3,156	96	Gravel surface, HSG C
134,413	72	Weighted Average
134,413		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.2	50	0.0400	0.13		**Sheet Flow, Segment A** Grass: Dense n= 0.240 P2= 3.20"
1.1	156	0.0200	2.28		**Shallow Concentrated Flow, Segment B** Unpaved Kv= 16.1 fps
3.1	607	0.0400	3.22		**Shallow Concentrated Flow, Segment C** Unpaved Kv= 16.1 fps
10.4	813	Total			

Summary for Subcatchment ROOF:

Runoff = 23.03 cfs @ 12.13 hrs, Volume= 89,319 cf, Depth= 8.10"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NRCC 24-hr D 100-Year Rainfall=8.34"

Area (sf)	CN	Description
132,325	98	Roofs, HSG C
132,325		100.00% Impervious Area

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

Summary for Pond INF1:

Inflow Area = 334,972 sf, 57.27% Impervious, Inflow Depth = 6.77" for 100-Year event
Inflow = 52.65 cfs @ 12.13 hrs, Volume= 188,938 cf
Outflow = 19.53 cfs @ 12.27 hrs, Volume= 188,939 cf, Atten= 63%, Lag= 8.5 min
Discarded = 0.12 cfs @ 12.27 hrs, Volume= 14,681 cf
Primary = 19.41 cfs @ 12.27 hrs, Volume= 174,258 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs / 3
Peak Elev= 1,022.16' @ 12.27 hrs Surf.Area= 19,633 sf Storage= 62,207 cf

Plug-Flow detention time= 188.2 min calculated for 188,913 cf (100% of inflow)
Center-of-Mass det. time= 188.4 min (970.3 - 781.9)

Volume	Invert	Avail.Storage	Storage Description
#1	1,018.00'	79,451 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
1,018.00	10,479	694.0	0	0	10,479
1,020.00	14,757	732.0	25,114	25,114	15,021
1,022.00	19,261	770.0	33,918	59,032	19,805
1,023.00	21,598	788.0	20,418	79,451	22,168

Device	Routing	Invert	Outlet Devices
#1	Primary	1,022.00'	**10.0' long x 10.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.49 2.56 2.70 2.69 2.68 2.69 2.67 2.64
#2	Discarded	1,018.00'	**0.270 in/hr Exfiltration over Surface area**
#3	Primary	1,017.50'	**24.0" Round Culvert** L= 32.8' CPP, end-section conforming to fill, Ke= 0.500 Inlet / Outlet Invert= 1,017.50' / 1,017.00' S= 0.0152 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 3.14 sf
#4	Device 3	1,018.00'	**2.0" Vert. Orifice/Grate** C= 0.600
#5	Device 3	1,019.00'	**5.0" Vert. Orifice/Grate X 3.00** C= 0.600
#6	Device 3	1,020.00'	**10.0" Vert. Orifice/Grate X 3.00** C= 0.600
#7	Device 3	1,021.25'	**1.5' long x 1.00' rise Sharp-Crested Rectangular Weir** 2 End Contraction(s)

Discarded OutFlow Max=0.12 cfs @ 12.27 hrs HW=1,022.16' (Free Discharge)
└**2=Exfiltration** (Exfiltration Controls 0.12 cfs)

Primary OutFlow Max=19.41 cfs @ 12.27 hrs HW=1,022.16' TW=0.00' (Dynamic Tailwater)
├**1=Broad-Crested Rectangular Weir** (Weir Controls 1.64 cfs @ 1.01 fps)
└**3=Culvert** (Passes 17.77 cfs of 28.95 cfs potential flow)
  ├**4=Orifice/Grate** (Orifice Controls 0.21 cfs @ 9.73 fps)
  ├**5=Orifice/Grate** (Orifice Controls 3.39 cfs @ 8.28 fps)
  ├**6=Orifice/Grate** (Orifice Controls 10.41 cfs @ 6.36 fps)
  └**7=Sharp-Crested Rectangular Weir** (Weir Controls 3.76 cfs @ 3.12 fps)

Summary for Link AP-1 POST:

Inflow Area = 544,475 sf, 35.23% Impervious, Inflow Depth = 5.76" for 100-Year event
Inflow = 38.51 cfs @ 12.24 hrs, Volume= 261,447 cf
Primary = 38.51 cfs @ 12.24 hrs, Volume= 261,447 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Summary for Link AP-2 POST:

Inflow Area = 134,413 sf, 0.00% Impervious, Inflow Depth = 4.99" for 100-Year event
Inflow = 14.37 cfs @ 12.18 hrs, Volume= 55,939 cf
Primary = 14.37 cfs @ 12.18 hrs, Volume= 55,939 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

PART III – PIPE SIZING CALCULATIONS

"Cultivate Burncoat"
Leicester, MA

From	To	Area (AC.) Incremental	Weighted Runoff Coefficient "C"	CxA	Cumulative CxA	Pipe Length (Feet)	Flow Time (min) To Inlet	Flow Time (min) In Channel	Design Storm (Year)	Intensity (IN/HR)	Q (CFS)	Size (IN)	Slope (FT/FT)	Mannings n	Full Capacity (cfs)	Full Velocity (fps)	Upper End Rim	Upper End Invert	Lower End Rim	Lower End Invert
DCB1	DMH1	2.98	0.36	1.06	1.06	22.60	10.0	0.05	25	5.40	5.72	12	0.0226	0.012	5.80	7.38	1035.86	1032.86	1035.95	1032.35
CB2	DMH1	0.23	0.83	0.19	0.19	16.20	5.0	0.03	25	6.60	1.29	12	0.0315	0.012	6.85	8.72	1035.86	1032.86	1035.95	1032.35
DMH1	DMH2	--	--	--	1.25	56.20	10.1	0.16	25	5.40	6.77	15	0.0107	0.012	7.23	5.89	1035.95	1032.10	1035.66	1031.50
DCB3	DMH2	0.54	0.86	0.46	0.46	28.40	5.0	0.09	25	6.60	3.04	12	0.0123	0.012	4.28	5.46	1035.10	1032.10	1035.66	1031.75
DMH2	DMH3	--	--	--	1.71	106.80	10.2	0.22	25	5.40	9.26	15	0.0201	0.012	9.93	8.09	1035.66	1031.40	1038.10	1029.25
ROOF	DMH3	0.22	0.90	0.20	0.20	89.10	5.0	0.35	25	6.60	1.33	15	0.0056	0.012	5.24	4.27		1029.75	1033.00	1029.25
DMH3	DMH5	--	--	--	2.49	104.00	10.4	0.22	25	5.40	13.45	18	0.0144	0.012	13.67	7.73	1038.10	1029.00	1033.00	1027.50
CB4	DMH5	0.22	0.82	0.18	0.18	14.00	5.0	0.03	25	6.60	1.18	12	0.0357	0.012	7.29	9.29	1032.75	1029.50	1033.00	1029.00
DMH5	DMH6	--	--	--	2.67	137.60	10.7	0.23	25	5.40	14.41	18	0.0236	0.012	17.49	9.90	1033.00	1026.75	1027.50	1023.50
DMH6	FES1	--	--	--	2.67	93.70	10.9	0.18	25	5.40	14.41	18	0.0176	0.012	15.10	8.55	1027.50	1023.40		1021.75
DMH4	DMH3	0.64	0.90	0.57	0.57	123.90	5.0	0.33	25	6.60	3.79	12	0.0161	0.012	4.90	6.24	1037.70	1034.70	1038.10	1032.70

Pipe Calculations

PART IV - SUPPLEMENTAL DOCUMENTATION

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.

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.

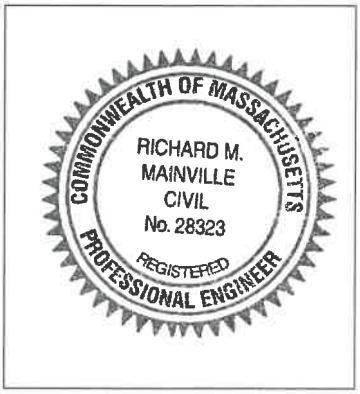
Note: Because stormwater requirements vary from project to project, it is possible that a complete Stormwater Report may not include information on some of the subjects specified in the Checklist. If it is determined that a specific item does not apply to the project under review, please note that the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



4/23/19
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 (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 (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

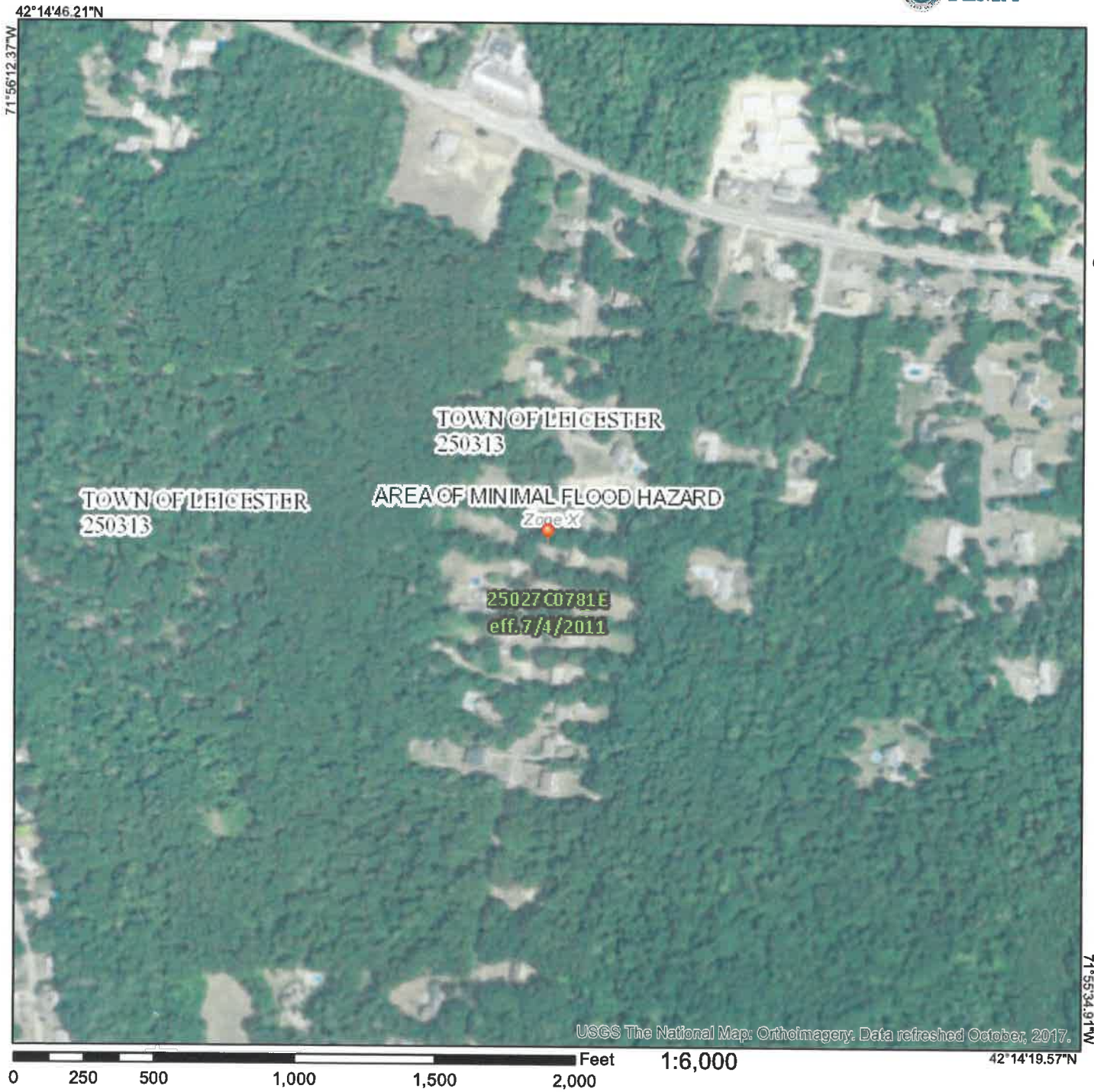
☒ The Long-Term Pollution Prevention Plan includes measures to prevent illicit discharges;

☒ 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.

National Flood Hazard Layer FIRMette

FEMA



Legend

SEE FIS REPORT FOR DETAILED LEGEND AND INDEX MAP FOR FIRM PANEL LAYOUT

SPECIAL FLOOD HAZARD AREAS
- Without Base Flood Elevation (BFE) *Zone A, V, A99*
- With BFE or Depth *Zone AE, AO, AH, VE, AR*
- Regulatory Floodway

OTHER AREAS OF FLOOD HAZARD
- 0.2% Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile *Zone X*
- Future Conditions 1% Annual Chance Flood Hazard *Zone X*
- Area with Reduced Flood Risk due to Levee. See Notes. *Zone X*
- Area with Flood Risk due to Levee *Zone D*

OTHER AREAS
- NO SCREEN Area of Minimal Flood Hazard *Zone X*
- Effective LOMRs
- Area of Undetermined Flood Hazard *Zone D*

GENERAL STRUCTURES
- Channel, Culvert, or Storm Sewer
- Levee, Dike, or Floodwall

OTHER FEATURES
- 20.2 / 17.5 Cross Sections with 1% Annual Chance Water Surface Elevation
- Coastal Transect
- 513 Base Flood Elevation Line (BFE)
- Limit of Study
- Jurisdiction Boundary
- Coastal Transect Baseline
- Profile Baseline
- Hydrographic Feature

MAP PANELS
- Digital Data Available
- No Digital Data Available
- Unmapped

N

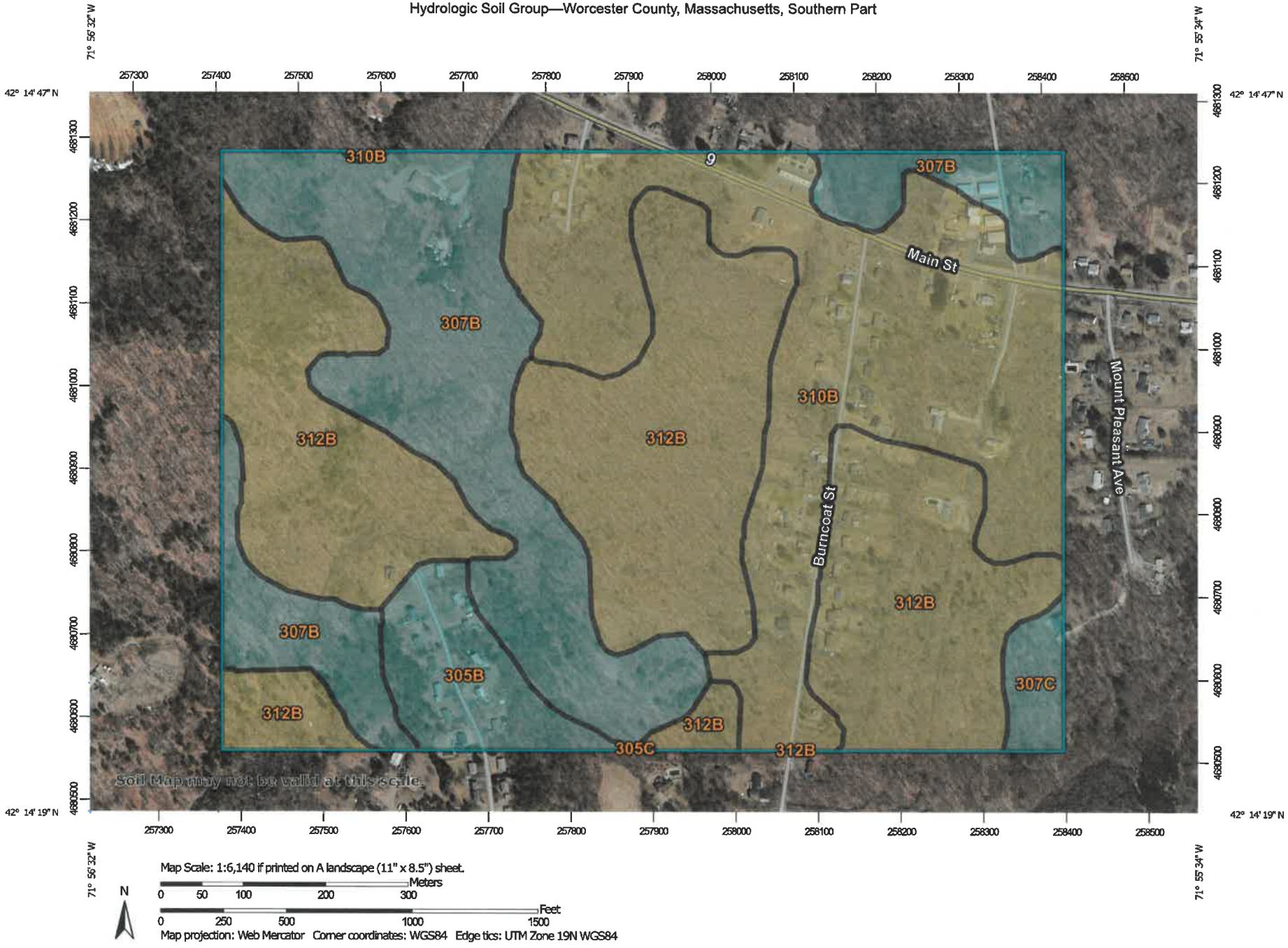
The pin displayed on the map is an approximate point selected by the user and does not represent an authoritative property location.

This map complies with FEMA's standards for the use of digital flood maps if it is not void as described below. The basemap shown complies with FEMA's basemap accuracy standards

The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on 4/18/2019 at 8:38:23 AM and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time.

This map image is void if the one or more of the following map elements do not appear: basemap imagery, flood zone labels, legend, scale bar, map creation date, community identifiers, FIRM panel number, and FIRM effective date. Map images for unmapped and unmodernized areas cannot be used for regulatory purposes.

Hydrologic Soil Group—Worcester County, Massachusetts, Southern Part



Map Scale: 1:6,140 if printed on A landscape (11" x 8.5") sheet.

N

Meters
0 50 100 200 300

Feet
0 250 500 1000 1500

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

MAP LEGEND

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

Soils

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

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

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

Water Features
- Streams and Canals

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

Background
- Aerial Photography

MAP INFORMATION

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

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: Worcester County, Massachusetts, Southern Part
Survey Area Data: Version 11, Sep 11, 2018

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

Date(s) aerial images were photographed: Apr 8, 2011—Apr 9, 2011

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
305B	Paxton fine sandy loam, 3 to 8 percent slopes	C	8.7	4.8%
305C	Paxton fine sandy loam, 8 to 15 percent slopes	C	0.0	0.0%
307B	Paxton fine sandy loam, 0 to 8 percent slopes, extremely stony	C	46.4	25.3%
307C	Paxton fine sandy loam, 8 to 15 percent slopes, extremely stony	C	2.9	1.6%
310B	Woodbridge fine sandy loam, 3 to 8 percent slopes	C/D	50.0	27.3%
312B	Woodbridge fine sandy loam, 0 to 8 percent slopes, extremely stony	C/D	75.3	41.1%
Totals for Area of Interest			**183.4**	**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

Cultivate Burncoat - Leicester, MA

ASE# 2019-049

FES1

Do=	1.5	ft
Q=	14.1	cfs (25-yr Storm)
Tw=	0.75	ft

$La=1.7Q/(Do^{3/2})+8Do$

La=	25.05	ft

$W=3Do+0.4La$

W=	14.52	ft

$d50=(0.02/Tw)*((Q/Do)^{4/3})$

d50=	0.53	ft
	6.35	in

FES2

Do=	1.25	ft
Q=	4.9	cfs (100-yr Storm)
Tw=	0.625	ft

$La=1.7Q/(Do^{3/2})+8Do$

La=	15.96	ft

$W=3Do+0.4La$

W=	10.13	ft

$d50=(0.02/Tw)*((Q/Do)^{4/3})$

d50=	0.20	ft
	2.37	in

FES3

Do=	1.25	ft
Q=	11.5	cfs (100-yr Storm)
Tw=	0.625	ft

$La=1.7Q/(Do^{3/2})+8Do$

La=	23.99	ft

$W=3Do+0.4La$

W=	13.35	ft

$d50=(0.02/Tw)*((Q/Do)^{4/3})$

d50=	0.62	ft
	7.40	in

FES4

Do=	2	ft
Q=	22.2	cfs (100-yr Storm)
Tw=	1	ft

$La=1.7Q/(Do^{3/2})+8Do$

La=	29.34	ft

$W=3Do+0.4La$

W=	17.74	ft

$d50=(0.02/Tw)*((Q/Do)^{4/3})$

d50=	0.50	ft
	5.94	in

TSS REMOVAL WORKSHEET PRIOR TO INFILTRATION

A	B	C	D	E
BMP	**TSS Removal Rate**	**Starting TSS Load***	**Amount Removed (B x C)**	**Remaining Load (C - D)**
Deep sump CB's w/ hoods	25.0%	100.0%	25.0%	75.0%
Sediment forebay	25.0%	75.0%	18.8%	56.3%
		Total TSS Removal =	44.0%	

* Equals remaining load from previous BMP (E)

TSS REMOVAL WORKSHEET PRIOR TO DISCHARGE

A	B	C	D	E
BMP	**TSS Removal Rate**	**Starting TSS Load***	**Amount Removed (B x C)**	**Remaining Load (C - D)**
Deep sump CB's w/ hoods	25.0%	100.0%	25.0%	75.0%
Infiltration Basin w/ sediment forebay	80.0%	75.0%	60.0%	15.0%
		Total TSS Removal =	85.0%	

* Equals remaining load from previous BMP (E)

Commonwealth of Massachusetts
City/Town of LEICESTER

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

A. Facility Information

Campanelli
Owner Name

22 Burncoat Street
Street Address

18B B11
Map/Lot #

LeicesterMA
City

MA
State

01524
Zip Code

B. Site Information

1. (Check one) ☒ New Construction ☐ Upgrade ☐ Repair

2. Soil Survey Available? ☒ Yes ☐ No If yes: Oliver MA GIS (Source) 312 B (Soil Map Unit)

Woodbridge FSL,3-8% slopes, extremely stony
Soil Name

None
Soil Limitations

Glacial Till
Soil Parent material

Ground Morraine
Landform

3. Surficial Geological Report Available? ☐ Yes ☒ No If yes: (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)

7. Current Water Resource Conditions (USGS): 4/19 (Month/Day/ Year) Range: ☒ Above Normal ☐ Normal ☐ Below Normal

8. Other references reviewed:

Commonwealth of Massachusetts
City/Town of LEICESTER

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: 4-11-1 (Hole #) | 4-11-19 (Date) | 9 AM (Time) | Sun 50 (Weather) | 42.243474 (Latitude) | -71.931438 (Longitude:)

1. Land Use: Woodland (e.g., woodland, agricultural field, vacant lot, etc.) | Trees / Shrubs (Vegetation) | Common (Surface Stones (e.g., cobbles, stones, boulders, etc.)) | 0-3 (Slope (%))

Description of Location:

2. Soil Parent Material: Glacial Till | Ground Morraine (Landform) | On Slope (Position on Landscape (SU, SH, BS, FS, TS))

3. Distances from: Open Water Body >200 feet | Drainage Way >100 feet | Wetlands >100 feet | Property Line >50 feet | Drinking Water Well > 100 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: 25" Depth Weeping from Pit | 30" Depth 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			
0-6	A	FSL	10 YR 3/2						Granular	Friable	
6-16	B	FSL	10 YR 5/6						Granular	Friable	
16-72	C	SL	2.5 Y 3/4	24"	10 YR 4/6	30	10	10	SAB	Firm	Redox Abundant / Distinct

Additional Notes:

Commonwealth of Massachusetts
City/Town of LEICESTER

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: 4-11-2 (Hole #) | 4-11-19 (Date) | 9 AM (Time) | Sun 50 (Weather) | 42.243474 (Latitude) | -71.931438 (Longitude:)

1. Land Use: Woodland (e.g., woodland, agricultural field, vacant lot, etc.) | Trees / Shrubs (Vegetation) | Common (Surface Stones (e.g., cobbles, stones, boulders, etc.)) | 0-3 (Slope (%))

Description of Location:

2. Soil Parent Material: Glacial Till | Ground Morraine (Landform) | On Slope (Position on Landscape (SU, SH, BS, FS, TS))

3. Distances from: Open Water Body > 100 feet | Drainage Way > 50 feet | Wetlands > 100 feet | Property Line > 50 feet | Drinking Water Well > 100 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: 25" Depth Weeping from Pit | 30" Depth 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			
0-6	A	FSL	10 YR 3/2						Granular	Friable	
6-16	B	FSL	10 YR 5/6						Granular	Friable	
16-72	C	SL	2.5 Y 3/4	24"	10 YR 4/5		10	10	SAB	Firm	Redox Abundant / Distinct

Additional Notes:

Commonwealth of Massachusetts
City/Town of LEICESTER

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

D. Determination of High Groundwater Elevation

1. Method Used:

	Obs. Hole #4-11-1	Obs. Hole #4-11-2
☐ Depth observed standing water in observation hole	_____ inches	_____ inches
☐ Depth weeping from side of observation hole	_____ inches	_____ inches
☒ Depth to soil redoximorphic features (mottles)	24 inches	24 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 _____

2. Estimated Depth to High Groundwater: _____ inches

E. Depth of Pervious Material

1. Depth of Naturally Occurring Pervious Material

a. Does at least four feet of naturally occurring pervious material exist in all areas observed throughout the area proposed for the soil absorption system?

☒ Yes ☐ No

b. If yes, at what depth was it observed (exclude A and O Horizons)? Upper boundary: 16 inches Lower boundary: 72 inches

c. If no, at what depth was impervious material observed? Upper boundary: _____ inches Lower boundary: _____ inches

Commonwealth of Massachusetts
City/Town of LEICESTER

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

F. 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	4-22-19 Date
John M. Madeiros / SE # 2849 Typed or Printed Name of Soil Evaluator / License #	6-30-2019 Expiration Date of License
Name of Approving Authority Witness	Town of Leicester 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.

Field Diagrams: Use this area for field diagrams:

Commonwealth of Massachusetts
City/Town of LEICESTER

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

A. Facility Information

Campanelli
Owner Name

22 Burncoat Street
Street Address

18B B11
Map/Lot #

LeicesterMA
City

MA
State

01524
Zip Code

B. Site Information

1. (Check one) ☒ New Construction ☐ Upgrade ☐ Repair

2. Soil Survey Available? ☒ Yes ☐ No If yes: Oliver MA GIS (Source) 312 B (Soil Map Unit)

Woodbridge FSL,3-8% slopes, extremely stony
Soil Name

None
Soil Limitations

Glacial Till
Soil Parent material

Ground Morraine
Landform

3. Surficial Geological Report Available? ☐ Yes ☒ No If yes: (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)

7. Current Water Resource Conditions (USGS): 4/19 (Month/Day/ Year) Range: ☒ Above Normal ☐ Normal ☐ Below Normal

8. Other references reviewed:

Commonwealth of Massachusetts
City/Town of LEICESTER

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: 4-11-3 (Hole #) | 4-11-19 (Date) | 9 AM (Time) | Sun 50 (Weather) | 42.243474 (Latitude) | -71.931438 (Longitude:)

1. Land Use: Woodland (e.g., woodland, agricultural field, vacant lot, etc.) | Trees / Shrubs (Vegetation) | Common (Surface Stones (e.g., cobbles, stones, boulders, etc.)) | 0-3 (Slope (%))

Description of Location:

2. Soil Parent Material: Glacial Till | Ground Morraine (Landform) | On Slope (Position on Landscape (SU, SH, BS, FS, TS))

3. Distances from: Open Water Body >200 feet | Drainage Way >100 feet | Wetlands >100 feet | Property Line >50 feet | Drinking Water Well > 100 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: 25" Depth Weeping from Pit | 30" Depth 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			
0-10	A	FSL	10 YR 3/2						Granular	Friable	
10-16	B	FSL	10 YR 5/6						Granular	Friable	
16-72	C	SL	2.5 Y 3/4	24"	10 YR 4/6	30	10	10	SAB	Firm	Redox Abundant / Distinct

Additional Notes:

Commonwealth of Massachusetts
City/Town of LEICESTER

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: 4-11-4 (Hole #) | 4-11-19 (Date) | 9 AM (Time) | Sun 50 (Weather) | 42.243474 (Latitude) | -71.931438 (Longitude:)

1. Land Use: Woodland (e.g., woodland, agricultural field, vacant lot, etc.) | Trees / Shrubs (Vegetation) | Common (Surface Stones (e.g., cobbles, stones, boulders, etc.)) | 0-3 (Slope (%))

Description of Location:

2. Soil Parent Material: Glacial Till | Ground Morraine (Landform) | On Slope (Position on Landscape (SU, SH, BS, FS, TS))

3. Distances from: Open Water Body > 100 feet | Drainage Way > 50 feet | Wetlands > 100 feet | Property Line > 50 feet | Drinking Water Well > 100 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: 33" Depth Weeping from Pit | 35" Depth 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			
0-10	A	FSL	10 YR 3/2						Granular	Friable	
10-16	B	FSL	10 YR 5/6						Granular	Friable	
16-72	C	SL	2.5 Y 3/4	30"	10 YR 4/5		10	10	SAB	Firm	Redox Abundant / Distinct

Additional Notes:

Commonwealth of Massachusetts
City/Town of LEICESTER

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

D. Determination of High Groundwater Elevation

1. Method Used:

	Obs. Hole #4-11-3	Obs. Hole #4-11-4
☐ Depth observed standing water in observation hole	_____ inches	_____ inches
☐ Depth weeping from side of observation hole	_____ inches	_____ inches
☒ Depth to soil redoximorphic features (mottles)	24 inches	30 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 _____

2. Estimated Depth to High Groundwater: _____ inches

E. Depth of Pervious Material

1. Depth of Naturally Occurring Pervious Material

a. Does at least four feet of naturally occurring pervious material exist in all areas observed throughout the area proposed for the soil absorption system?

☒ Yes ☐ No

b. If yes, at what depth was it observed (exclude A and O Horizons)? Upper boundary: 16 inches Lower boundary: 72 inches

c. If no, at what depth was impervious material observed? Upper boundary: _____ inches Lower boundary: _____ inches

Commonwealth of Massachusetts
City/Town of LEICESTER

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

F. 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	4-22-19 Date
John M. Madeiros / SE # 2849 Typed or Printed Name of Soil Evaluator / License #	6-30-2019 Expiration Date of License
Name of Approving Authority Witness	Town of Leicester 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.

Field Diagrams: Use this area for field diagrams:

Commonwealth of Massachusetts
City/Town of LEICESTER

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

A. Facility Information

Campanelli
Owner Name

22 Burncoat Street
Street Address

18B B11
Map/Lot #

LeicesterMA
City

MA
State

01524
Zip Code

B. Site Information

1. (Check one) ☒ New Construction ☐ Upgrade ☐ Repair

2. Soil Survey Available? ☒ Yes ☐ No If yes: Oliver MA GIS (Source) 312 B (Soil Map Unit)

Woodbridge FSL,3-8% slopes, extremely stony
Soil Name

None
Soil Limitations

Glacial Till
Soil Parent material

Ground Morraine
Landform

3. Surficial Geological Report Available? ☐ Yes ☒ No If yes: (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)

7. Current Water Resource Conditions (USGS): 4/19 (Month/Day/ Year) Range: ☒ Above Normal ☐ Normal ☐ Below Normal

8. Other references reviewed:

Commonwealth of Massachusetts
City/Town of LEICESTER

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: 4-11-5 (Hole #) | 4-11-19 (Date) | 10 AM (Time) | Sun 50 (Weather) | 42.243474 (Latitude) | -71.931438 (Longitude:)

1. Land Use: Woodland (e.g., woodland, agricultural field, vacant lot, etc.) | Trees / Shrubs (Vegetation) | Common (Surface Stones (e.g., cobbles, stones, boulders, etc.)) | 0-3 (Slope (%))

Description of Location:

2. Soil Parent Material: Glacial Till | Ground Morraine (Landform) | On Slope (Position on Landscape (SU, SH, BS, FS, TS))

3. Distances from: Open Water Body >200 feet | Drainage Way >100 feet | Wetlands >100 feet | Property Line >50 feet | Drinking Water Well > 100 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: 38" Depth Weeping from Pit 42" Depth 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			
0-10	A	FSL	10 YR 3/2						Granular	Friable	
10-18	B	FSL	10 YR 5/6						Granular	Friable	
18-72	C	SL	2.5 Y 3/4	30"	10 YR 4/6	30	10	20	SAB	Firm	Redox Abundant / Distinct

Additional Notes:

Commonwealth of Massachusetts
City/Town of LEICESTER

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: 4-11-6 (Hole #) | 4-11-19 (Date) | 9 AM (Time) | Sun 50 (Weather) | 42.243474 (Latitude) | -71.931438 (Longitude:)

1. Land Use: Woodland (e.g., woodland, agricultural field, vacant lot, etc.) | Trees / Shrubs (Vegetation) | Common (Surface Stones (e.g., cobbles, stones, boulders, etc.)) | 0-3 (Slope (%))

Description of Location:

2. Soil Parent Material: Glacial Till | Ground Morraine (Landform) | On Slope (Position on Landscape (SU, SH, BS, FS, TS))

3. Distances from: Open Water Body > 100 feet | Drainage Way > 50 feet | Wetlands > 100 feet | Property Line > 50 feet | Drinking Water Well > 100 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: 38" Depth Weeping from Pit | 42" Depth 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			
0-10	A	FSL	10 YR 3/2						Granular	Friable	
10-17	B	FSL	10 YR 5/6						Granular	Friable	
17-72	C	SL	2.5 Y 3/4	30"	10 YR 4/5		10	20	SAB	Firm	Redox Abundant / Distinct

Additional Notes:

Commonwealth of Massachusetts
City/Town of LEICESTER

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

D. Determination of High Groundwater Elevation

1. Method Used:

	Obs. Hole #4-11-5	Obs. Hole #4-11-6
☐ Depth observed standing water in observation hole	_____ inches	_____ inches
☐ Depth weeping from side of observation hole	_____ inches	_____ inches
☒ Depth to soil redoximorphic features (mottles)	30 inches	30 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 _____

2. Estimated Depth to High Groundwater: _____ inches

E. Depth of Pervious Material

1. Depth of Naturally Occurring Pervious Material

a. Does at least four feet of naturally occurring pervious material exist in all areas observed throughout the area proposed for the soil absorption system?

☒ Yes ☐ No

b. If yes, at what depth was it observed (exclude A and O Horizons)?	Upper boundary:	18 inches	Lower boundary:	72 inches
c. If no, at what depth was impervious material observed?	Upper boundary:	_____ inches	Lower boundary:	_____ inches

Commonwealth of Massachusetts
City/Town of LEICESTER

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

F. 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	4-22-19 Date
John M. Madeiros / SE # 2849 Typed or Printed Name of Soil Evaluator / License #	6-30-2019 Expiration Date of License
Name of Approving Authority Witness	Town of Leicester 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.

Field Diagrams: Use this area for field diagrams:

Commonwealth of Massachusetts
City/Town of LEICESTER

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

A. Facility Information

Campanelli
Owner Name

22 Burncoat Street
Street Address

18B B11
Map/Lot #

LeicesterMA
City

MA
State

01524
Zip Code

B. Site Information

1. (Check one) ☒ New Construction ☐ Upgrade ☐ Repair

2. Soil Survey Available? ☒ Yes ☐ No If yes: Oliver MA GIS (Source) 312 B (Soil Map Unit)

Woodbridge FSL,3-8% slopes, extremely stony
Soil Name

None
Soil Limitations

Glacial Till
Soil Parent material

Ground Morraine
Landform

3. Surficial Geological Report Available? ☐ Yes ☒ No If yes: _____ (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)

7. Current Water Resource Conditions (USGS): 4/19 (Month/Day/ Year) Range: ☒ Above Normal ☐ Normal ☐ Below Normal

8. Other references reviewed:

Commonwealth of Massachusetts
City/Town of LEICESTER

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: 4-11-7 (Hole #) | 4-11-19 (Date) | 11 AM (Time) | Sun 50 (Weather) | 42.243474 (Latitude) | -71.931438 (Longitude:)

1. Land Use: Woodland (e.g., woodland, agricultural field, vacant lot, etc.) | Trees / Shrubs (Vegetation) | Common (Surface Stones (e.g., cobbles, stones, boulders, etc.)) | 0-3 (Slope (%))

Description of Location:

2. Soil Parent Material: Glacial Till | Ground Morraine (Landform) | On Slope (Position on Landscape (SU, SH, BS, FS, TS))

3. Distances from: Open Water Body >200 feet | Drainage Way >100 feet | Wetlands >100 feet | Property Line >50 feet | Drinking Water Well > 100 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: 50" Depth Weeping from Pit | 60" Depth 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			
0-10	A	FSL	10 YR 3/2						Granular	Friable	
10-19	B	FSL	10 YR 5/6						Granular	Friable	
19-72	C	SL	2.5 Y 3/4	42"	10 YR 4/6	30	10	20	SAB	Firm	Redox Abundant / Distinct

Additional Notes:

Commonwealth of Massachusetts
City/Town of LEICESTER

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: 4-11-8 (Hole #) | 4-11-19 (Date) | 11 AM (Time) | Sun 50 (Weather) | 42.243474 (Latitude) | -71.931438 (Longitude:)

1. Land Use: Woodland (e.g., woodland, agricultural field, vacant lot, etc.) | Trees / Shrubs (Vegetation) | Common (Surface Stones (e.g., cobbles, stones, boulders, etc.)) | 0-3 (Slope (%))

Description of Location:

2. Soil Parent Material: Glacial Till | Ground Morraine (Landform) | Top Slope (Position on Landscape (SU, SH, BS, FS, TS))

3. Distances from: Open Water Body > 100 feet | Drainage Way > 50 feet | Wetlands > 100 feet | Property Line > 50 feet | Drinking Water Well > 100 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: N/A Depth Weeping from Pit | N/A Depth 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			
0-8	A	FSL	10 YR 3/2						Granular	Friable	
8-20	B	FSL	10 YR 5/6						Granular	Friable	
20-72	C	SL	2.5 Y 3/4	38"	10 YR 4/5		10	20	SAB	Firm	Redox Abundant / Distinct

Additional Notes:

Commonwealth of Massachusetts
City/Town of LEICESTER

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

D. Determination of High Groundwater Elevation

1. Method Used:

	Obs. Hole #4-11-7	Obs. Hole #4-11-8
☐ Depth observed standing water in observation hole	_____ inches	_____ inches
☐ Depth weeping from side of observation hole	_____ inches	_____ inches
☒ Depth to soil redoximorphic features (mottles)	42 inches	38 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 _____

2. Estimated Depth to High Groundwater: _____ inches

E. Depth of Pervious Material

1. Depth of Naturally Occurring Pervious Material

a. Does at least four feet of naturally occurring pervious material exist **in all** areas observed throughout the area proposed for the soil absorption system?

☒ Yes ☐ No

b. If yes, at what depth was it observed (exclude A and O Horizons)? Upper boundary: 20 inches Lower boundary: 72 inches

c. If no, at what depth was impervious material observed? Upper boundary: _____ inches Lower boundary: _____ inches

Commonwealth of Massachusetts
City/Town of LEICESTER

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

F. Certification

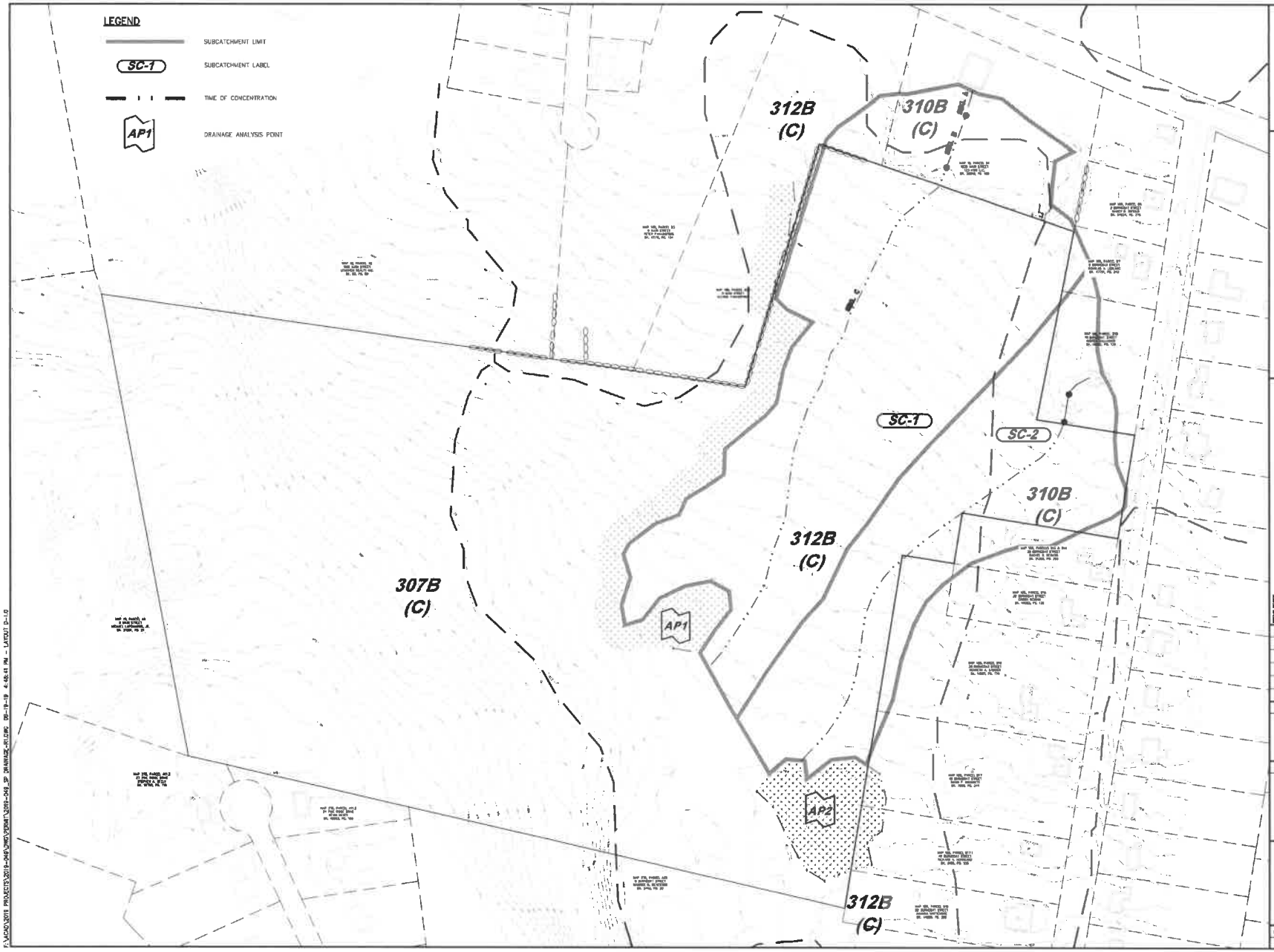
I certify that I am currently approved by the Department of Environmental Protection pursuant to 310 CMR 15.017 to conduct soil evaluations and that the above analysis has been performed by me consistent with the required training, expertise and experience described in 310 CMR 15.017. I further certify 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	4-22-19 Date
John M. Madeiros / SE # 2849 Typed or Printed Name of Soil Evaluator / License #	6-30-2019 Expiration Date of License
Name of Approving Authority Witness	Town of Leicester 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.

Field Diagrams: Use this area for field diagrams:

PART V – MAPS



ASE
Andrews Survey & Engineering, Inc.
Land Surveying - Civil Engineering - Site Planning
P.O. Box 312, 194 Mendon Street
Uxbridge, Massachusetts 01569
P: 508-278-3897 F: 508-278-2289
500 East Washington Street
North Attleboro, Massachusetts 02760
P: 508-316-8452 F: 508-316-8963

PROJECT: CULTIVATE BURNCOAT
22 BURNCOAT STREET
LEICESTER, MA 01524

APPLICANT: CULTIVATE HOLDINGS LLC
P.O. BOX 245
LEICESTER, MA 01524

REVISIONS

NO.	DATE	DESCRIPTION
1	6/19/19	REVISED DRAINAGE ANALYSIS

GRAPHIC SCALE
(IN FEET)
1 inch = 80 feet

SHEET TITLE
PRE-DEVELOPMENT WATERSHED MAP

DES BY: TRB | DATE: APRIL 11, 2019
CHK BY: RWA | PROJECT NO. 2019-049

D-1.0

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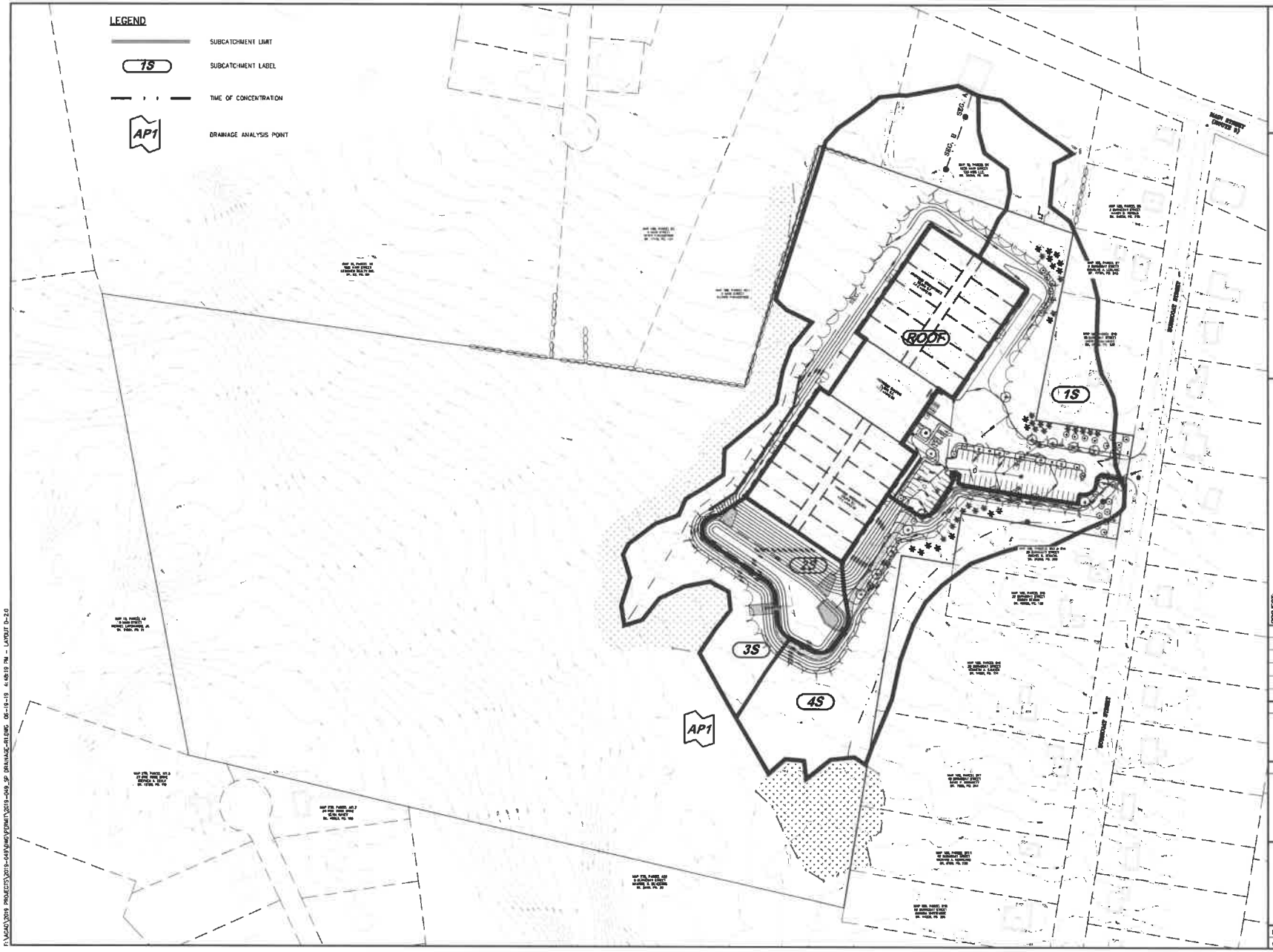

ASE
Andrews Survey & Engineering, Inc.
Land Surveying - Civil Engineering - Site Planning
P.O. Box 313, 184 Mendon Street
Uxbridge, Massachusetts 01569
P: 508-278-3897 F: 508-278-2289
590 East Washington Street
North Attleboro, Massachusetts 02760
P: 508-316-0851 F: 508-316-0963

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22 BURNCOAT STREET
LEICESTER, MA 01524

APPLICANT:
CULTIVATE HOLDINGS LLC
P.O. BOX 245
LEICESTER, MA 01524

REVISIONS

NO.	DATE	DESCRIPTION
1	6/19/19	REVISED DRAINAGE ANALYSIS

GRAPHIC SCALE
(IN FEET)
1 inch = 60 feet

SHEET TITLE
POST-DEVELOPMENT WATERSHED MAP

DES BY: TRB | DATE: APRIL 11, 2019
CHK BY: RMH | PROJECT NO. 2018-049
D-2.0

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Andrews Survey & Engineering, Inc.
Land Surveying - Civil Engineering - Site Planning
P.O. Box 112, 104 Mendon Street
Uxbridge, Massachusetts 01569
P: 508-278-3897 F: 508-278-2289
500 East Washington Street
North Attleboro, Massachusetts 02760
P: 508-316-0452 F: 508-316-0963

PROJECT:
CULTIVATE BURNCOAT
22 BURNCOAT STREET
LEICESTER, MA 01524

APPLICANT:
CULTIVATE HOLDINGS LLC
P.O. BOX 245
LEICESTER, MA 01524

REVISIONS

NO.	DATE	DESCRIPTION

GRAPHIC SCALE
(IN FEET)
1 inch = 80 feet

SHEET TITLE
CATCH BASIN AREAS
WATERSHED MAP

DES BY: TRB | DATE: APRIL 11, 2019
CHK BY: RMM | PROJECT NO. 2019-049

D-3.0

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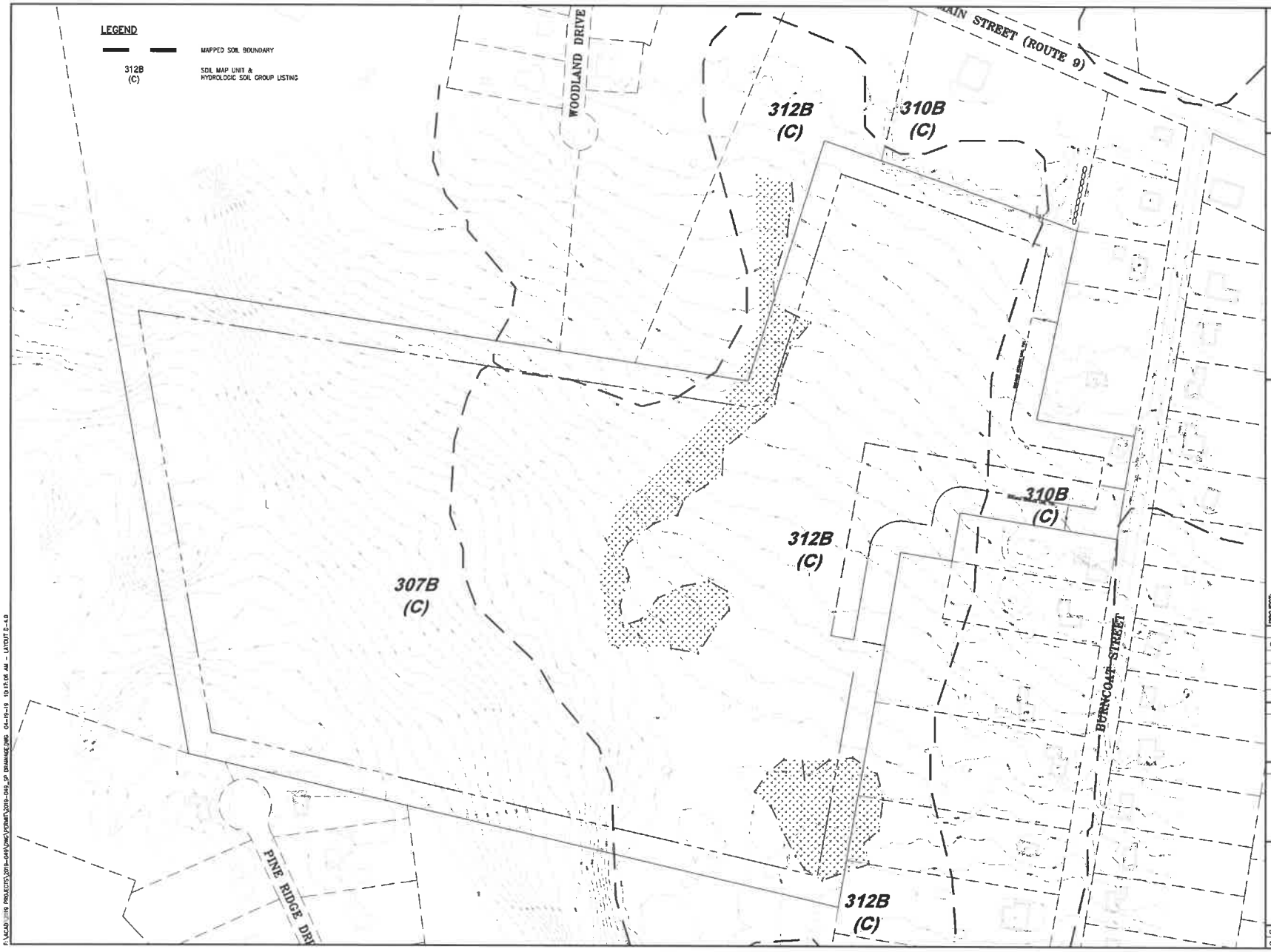

ASE
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Land Surveying - Civil Engineering - Site Planning
P.O. Box 332, 194 Meadow Street
Oakbridge, Massachusetts 01569
P: 508-278-3097 F: 508-278-2289
509 East Washington Street
North Attleboro, Massachusetts 02760
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LEICESTER, MA 01524

APPLICANT: CULTIVATE HOLDINGS LLC
P.O. BOX 245
LEICESTER, MA 01524

REVISIONS

NO.	DATE	DESCRIPTION

GRAPHIC SCALE
(IN FEET)
1 inch = 80 feet.

SHEET TITLE
SOILS MAP

DES BY: TRB | DATE: APRIL 11, 2019
CHK BY: RMM | PROJECT NO. 2018-049
D-4.0