Stormwater Management Report

July 2022

0 Bartzak Drive
Holliston, MA

Prepared for

Bartzak PV I, LLC
c/o Galehead Development
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Prepared by

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0. Executive Summary

On behalf of the applicant, Bartzak PV I, LLC (the "Applicant"), Beals Associates, Inc. ("BAI") is filing the enclosed Application for Grant of Site Plan Review and Special Permit with the Town of Holliston Planning Board for the development of a large-scale solar power generation system. The proposed development will be located at 0 Bartzak Drive in Holliston, MA on an ±2.9-acre parcel located to the east of the terminus of Bartzak Drive and to the west of the intersection of Praying Indian Way and Mohawk Path. The Town of Holliston Assessor's database lists the property as Parcel 14-04-21.4. Existing conditions of the site include a mostly forested site with about 0.25-acres cleared and covered in gravel.

Standard 1 – No Untreated Discharges or Erosion to Wetlands

This standard has been met by providing treatment to all points of discharge on the site. Calculations have been provided throughout the report to confirm this. **This standard has been met.**

Standard 2 – Peak Rate Attenuation

The proposed projects reduce or are equal to the post-development peak discharge rates for the 2-year, 10-year, 25-, 50- and 100 year 24 hour storms. **This standard has been met.**

Standard 3 – Stormwater Recharge

The project contains an addition of a small portion of concrete pads, and given this amount of area does not require stormwater recharge as it meets the definition of a de minimis stormwater discharge as set forth in volume 3 chapter 1 of the Massachusetts Stormwater Handbook. Recharge is not required. Regardless, stormwater recharge has been provided through infiltration trenches that exceed the requirement. Even though it can be said that this standard does not apply, **This standard has been met.**

Standard 4 – Water Quality

The project contains concrete pads which are a de minimis stormwater discharge as set forth in volume 3 chapter 1 of the Massachusetts Stormwater Handbook. With exception to this area, the project does not propose impervious surfaces, and water quality standards do not apply. **This standard does not apply.**

Standard 5 – Land Uses with Higher Potential Pollution Loads

This project is not considered to be a land use with a higher potential pollution load. **This standard does not apply.**

Standard 6 – Critical Areas

The project is not located within an ACEC. **This standard does not apply.**

Standard 7 – Redevelopment

This is not a redevelopment site. **This standard does not apply.**

Standard 8 – Construction Period Controls

A complete erosion control plan and narrative has been provided. In addition, there will be a SWPPP document in place in accordance with USEPA NPDES requirements, which will be provided to the Town at least 14 days prior to land disturbance. **This standard will be met.**

Standard 9 – Operation and Maintenance Plan

The project documentation includes a complete Stormwater Operation and Maintenance Manual for the site. This manual meets all MaDEP checklist requirements. **This standard has been met.**

Standard 10 – Illicit Discharges to Drainage System

The report includes a signed illicit discharge statement in the Appendix. **This standard has been met.**

Based on the documentation and calculations in this report, the project meets or exceeds Commonwealth of Massachusetts Stormwater Standards, as well as the Town of Holliston Stormwater Management and Land Disturbance Regulations.

1. Project Summary

The proposed development will be located at 0 Bartzak Drive in Holliston, MA on an ±2.9-acre parcel located to the east of the terminus of Bartzak Drive and to the west of the intersection of Praying Indian Way and Mohawk Path. The Town of Holliston Assessor's database lists the property as Parcel 14-04-21.4. Existing conditions of the site include a mostly forested site with about 0.25-acres cleared and covered in gravel.

The property is split-zoned with a majority of the property being located within the Industrial Zoning District ("I") and the remaining land to the east, within 100-feet of Jennings Road, being in the Agricultural-Residential District B ("AR-2"). According to the Town of Holliston Zoning By-Laws, dated May 10, 2021, large-scale solar power generation systems are permitted in the Industrial District by a Special Permit granted by the Planning Board. Although this use is not permitted within the AR-2 District, MGL Chapter 40A, Section 3 (commonly referred to as the 'Dover Amendment') provides exemption to the solar power generating use.

The proposed development is estimated to generate approximately 250 kilowatts of clean energy. The installation will be comprised of solar panels oriented appropriately in rows to maximize solar exposure. A transformer, two inverters, metering, disconnect, and recloser will be located on two concrete pads located in the northwestern corner of the area of development. The generated power will be transferred from the facility via overhead utility lines which will be interconnected to an existing underground circuit on Bartzak Drive.

All solar panels and associated equipment will be enclosed by a perimeter fence with a 20-foot-wide security gate containing a knox box providing access to the site from the existing driveway from Bartzak Drive to Praying Indian Way and Mohawk Path. Although the property contains legal frontage on Praying Indian Way, all access and utility connections will be from Bartzak Drive and the associated easement shown in the plan set included with this application. This is to limit disturbances to residential neighbors while also containing a majority of the technical elements of the development within the Industrial Zoning District.

2. Massachusetts Stormwater Standards

a. Standard 1 – No Untreated Discharges or Erosion to Wetlands

Stormwater Management Standard 1 requires that there be no new stormwater conveyances that would discharge untreated stormwater to or cause erosion to waters or wetlands of the Commonwealth. The project site has been designed to promote growth of a meadow area that will function in a manner similar to the existing conditions. Stormwater management has been provided through the addition of a stone trench along the gravel access road, and surrounding the concrete pads. These trenches have been designed to slow down stormwater as it enters the trenches prior to releasing stormwater to existing discharge locations at rates equal to or lesser than equal values.

b. Standard 2 – Peak Rate Attenuation

The Peak Rate Attenuation Standard requires that stormwater management systems be designed such that post development peak discharge rates do not exceed predevelopment discharge rates. The only time this standard may be waived is for discharges to land subject to coastal storm flowage. The project site does not fall into this category. Rain gardens, subsurface detention and infiltration systems have been designed at various locations across the project site to reduce these peak rates of runoff.

Methodology

The Town of Holliston requires that calculations of runoff volumes and peak rates be based on precipitation data provided in National Oceanic and Atmospheric Administration (NOAA) – National Weather Service "NOAA Atlas 14". The precipitation values provided in NOAA Atlas 14 are similar in rainfall amounts for the 2- year storm, however the 10-, 25-, 50-, and 100-year storm rainfall data is quite different amongst the two. The hydrologic analyses for the pre- and post-development conditions have been conducted based on NOAA Atlas 14.

RAINFALL		
STORM EVENT	SCS TP-40	NOAA Atlas 14
2-YEAR	3.1"	3.35"
10-YEAR	4.5"	5.25"
25-YEAR	5.3"	6.43"
50-YEAR	6.0"	7.30"
100-YEAR	6.6"	8.25"

The HydroCAD computer program was used in the analyses. This program determines the critical points of the overall drainage system and uses SCS TR-20 methodologies for evaluation of the anticipated conditions at these points. Travel times, storage capacity and the effects of hydraulic head are considered for analysis within the program. The model uses reservoirs and pipes to model actual conditions and can assess storage and kinematic effects.

The drainage system is represented by a system network consisting of four basic components in the model.

- Subcatchment: A relatively homogenous area of land that drains into a single reach or pond. Each subcatchment generates a hydrograph.
- Reach: A uniform stream, channel or pipe which conveys water from one point to another reach or pond. The outflow of each reach is determined by a hydrograph routing calculation.
- Pond: A pond, swamp, dam, catch basin, manhole or other impoundment which fill with water from one or more sources and empties in a manner determined by weir, culvert or other device(s) at tis outlet. A pond may empty into a reach or another pond. The outflow of the pond is also determined by a hydrograph routing calculation.
- Link: A multi-purpose mechanism for introducing a hydrograph from outside the diagram, either by manual entry, file import, or linkage to another diagram. A link also allows the diversion and/or scaling of a hydrograph. In this analysis, the links are simply used to compute the confluence of the various hydrographs at the points of analyses.

After identifying each of the components, the system may be represented by a routing diagram such as that shown in the computations in the appendices to this report.

Soils

A Natural Resources Conservation Service ("NRCS") soil resource report was obtained for the Bartzak Drive property. The NRCS report contains generalized soil information which can be used for a base level understanding of the soils on the site as well as the surrounding areas.

According to the NRCS Report the property primarily contains one (1) distinct soil classification group – Narragansett-Hollis-Rock outcrop complex. This soil group contains 3 to 15 percent slopes, is characterized in hydrologic soil group A, and is denoted as Map Unit 106C in the NRCS Map included with this application.

A small portion of the site is located within the Broadbrook very fine sandy loam soil group, contains 8 to 15 percent slopes, and is characterized in hydrologic soil group D. This soil group is denoted as Map Unit 341C in the NRCS Map.

Hydrologic Soils Groups have the following definitions:

Group A is sand, loamy sand or sandy loam types of soils. It has low runoff potential and high infiltration rates even when thoroughly wetted. They consist chiefly of deep, well to excessively drained sands or gravels and have a high rate of water transmission.

Group B is silt loam or loam. It has a moderate infiltration rate when thoroughly wetted and consists chiefly or moderately deep to deep, moderately well to well drained soils with moderately fine to moderately coarse textures.

Group C soils are sandy clay loam. They have low infiltration rates when thoroughly wetted and consist chiefly of soils with a layer that impedes downward movement of water and soils with moderately fine to fine structure.

Group D soils are clay loam, silty clay loam, sandy clay, silty clay or clay. This HSG has the highest runoff potential. They have very low infiltration rates when thoroughly wetted and consist chiefly of clay soils with a high swelling potential, soils with a permanent high-water table, soils with a claypan or clay layer at or near the surface and shallow soils over nearly impervious material.

Time of Concentration

Time of Concentration flow paths were developed using TR-55 methodologies. Sheet flow was limited to no more than 50 feet in length. The minimum time of concentration used for this analysis was 6.0 minutes.

Runoff Curve Numbers

The runoff curve numbers for the various soil types and land use covers were initially developed in accordance with TR-55 methodologies.

Points of Analyses

For this project, there were three points of analysis identified. The first point of analysis analyzes the flow that channelizes along the private drive that ultimately flows to a catch basin with Bartzak Drive. The second point of analysis analyzes the confluence of flow to the southwestern portion of the property line, which ultimately flows to the offsite wetland resource area. The third and final point of analysis analyzes the confluence of flow to the northwestern portion of the property line, which ultimately flows to the adjacent abutting property parking lot and detention pond. HydroCAD calculations for these points of analysis are included in the appendices.

Pre-development Subcatchments

Table 1 - Tributary to Point of Analysis #1		
Subcatchment ID	Total Area, acres	Runoff Curve Number
Catchment 1	0.71	54
P.O.A. Totals		
	0.71	54 (P.O.A. composite)

Table 2 - Tributary to Point of Analysis #2		
Subcatchment ID	Total Area, acres	Runoff Curve Number
Catchment 2	2.63	42
P.O.A. Totals		
	2.63	42 (P.O.A. composite)

Table 3 - Tributary to Point of Analysis #3		
Subcatchment ID	Total Area, acres	Runoff Curve Number
Catchment 3	0.24	30
P.O.A. Totals		
	0.24	30 (P.O.A. composite)

Post-development Subcatchments

Post-development subcatchments were determined by analyzing how the proposed development fit into the natural topography. The proposed development maintains existing drainage flow paths, and there will not be a change in area to each point of analyses.

Table 1 - Tributary to Point of Analysis #1		
Subcatchment ID	Total Area, acres	Runoff Curve Number
Catchment 1	0.71	54
P.O.A. Totals		
	0.71	42 (P.O.A. composite)

Table 2 - Tributary to Point of Analysis #2		
Subcatchment ID	Total Area, acres	Runoff Curve Number
Catchment 2	2.63	41
P.O.A. Totals		
	2.63	41 (P.O.A. composite)

Table 3 - Tributary to Point of Analysis #3		
Subcatchment ID	Total Area, acres	Runoff Curve Number
Catchment 3	0.24	30
P.O.A. Totals		
	0.24	30 (P.O.A. composite)

Stormwater Runoff Calculations

In order to compare the existing conditions to design flow rates and volumes, our office set up a simple model to compute the flow rates. By using this as a baseline, a comparison can be made to the design project that will check to ensure anticipated flow rates are not being exceeded to the points of analysis. The peak runoff rates were reduced from the pre-development condition through the reduction of gravel surfaces, maintaining existing drainage flow patterns, and by maintaining or lowering the runoff curve numbers (CNs). The following tables indicate the peak runoff rates to the Points of Analysis.

The results of the overall stormwater modeling indicate the following:

Peak Runoff Rates – Point of Analysis #1			
Storm	Rainfall	Pre-Development Rate, cfs	Post-Development Rate, cfs
2-Year	3.35”	0.07	0.00
10-Year	5.25”	0.51	0.09
25-Year	6.43”	0.92	0.27
50-Year	7.30”	1.26	0.47
100-Year	8.25”	1.66	0.75

Peak Runoff Rates – Point of Analysis #2			
Storm	Rainfall	Pre-Development Rate, cfs	Post-Development Rate, cfs
2-Year	3.35”	0.01	0.01
10-Year	5.25”	0.34	0.27
25-Year	6.43”	0.98	0.86
50-Year	7.30”	1.69	1.52
100-Year	8.25”	2.65	2.45

Peak Runoff Rates – Point of Analysis #3			
Storm	Rainfall	Pre-Development Rate, cfs	Post-Development Rate, cfs
2-Year	3.35”	0.00	0.00
10-Year	5.25”	0.00	0.00
25-Year	6.43”	0.00	0.00
50-Year	7.30”	0.01	0.00
100-Year	8.25”	0.04	0.04

Based on the results above and the discussion of the pre- and post- development methodology, the project meets the requirement for the peak runoff rate reduction for the 2- 10-, 25-, 50-, and 100-year storm events. **This Standard has been met.**

c. Standard 3 – Stormwater Recharge

Standard 3 of the Massachusetts Stormwater Handbook states that loss of annual recharge to groundwater shall be eliminated or minimized through the use of infiltration measures including environmentally sensitive site design, low impact development techniques, stormwater best management practices, and good operation and maintenance. At a minimum, the annual recharge from the post-development site shall approximate the annual recharge from pre-development conditions based on soil type. This Standard is met when the stormwater management system is designed to infiltrate the required recharge volume as determined in accordance with the Massachusetts Stormwater Handbook.

The first step in documenting compliance with this Standard is to compute the required recharge volume for the soil type that the site impacts. One component of this calculation is to determine the total area of new impervious surface over each soil type on the site.

The required volume of recharge is expressed as:

$$Rv = F \times \text{Impervious Area}$$

Where F is a factor dependent on Hydrologic Soil Groups. In this case, the onsite soils where impervious surfaces are located are Hydrologic Group A soils, therefore F is 0.60”. Applying this to the impervious site area yields:

$$Rv_1 = (0.60”) \times (1\ ft/12”) \times (552) = 28\ \text{Cubic-Feet}$$

Sufficient runoff must be directed to the infiltration BMPs to ensure infiltration of the Required Recharge Volume. In some cases only a portion of the site’s impervious area can be directed to the BMPs. As a result, the infiltration BMPs may not be able to capture sufficient rainfall on an average annual basis to meet the Required Recharge Volume. In this case, designers can either redesign the site so that runoff from more of the impervious areas located on the site are directed to the infiltration BMPs, or increase the storage capacity of the infiltration BMPs so that they may capture more of the runoff from the impervious surfaces in order to infiltrate the Required Recharge Volume. When less than 65% of impervious surfaces on a site are directed to infiltration BMPs, the system cannot capture sufficient runoff to inn the contributing area. In no case shall runoff from less than 65% of the site’s impervious cover be directed to the BMPs to infiltrate the Required Recharge Volume.

Since the recharge areas that will be used to satisfy this requirement captures 100% of the impervious site area, an adjustment factor is not required.

The project features stone infiltration trenches to infiltrate stormwater and provide recharge volume. The total available volume within each infiltration system, adjacent to the concrete pads, with the corresponding impervious area is shown in the table below.

Recharge Volume			
Name of System(s)	**Contributing Impervious Area (Square-Feet)**	**Static Volume Required (Cubic-Feet)**	**Static Volume Provided (Cubic-Feet)**
Inverter and Transformer Concrete Pad Trench	276	14	62
Metering and Disconnect Concrete Pad Trench	276	14	62
Total	552	28	124

As demonstrated in the table above, there is 124 cubic-feet of static volume provided within the infiltration systems, which is more than the 28 cubic-feet requirement.

Drawdown times have been analyzed for these systems as well. Per Massachusetts Stormwater Management Standards, the infiltration BMP (best management practice) must drain within 72 hours for the recharge volume. To determine whether an infiltration BMP will drain within 72 hours, the formula below has been used.

$$\text{Time}_{\text{drawdown}}=\frac{Rv}{(K)*(Bottom\ Area)}$$

Where:

Rv=Storage Volume

K = Saturated Hydraulic Conductivity for the Static Method utilizing Rawls Rates.

Bottom Area = Bottom area of the recharge structure.

Table 9 – Drawdown Time				
Name of System	**Storage Volume (R_v)**	**Saturated Hydraulic Conductivity (K)**	**Bottom Area of Recharge Structure**	**Drawdown Time (Hours)**
Inverter and Transformer Concrete Pad Trench	62 S.F.	2.41 (HSG A)	34 S.F.	9.1
Metering and Disconnect Concrete Pad Trench	62 S.F.	2.41 (HSG A)	34 S.F.	9.1

As documented above, the drawdown times are less than 72 hours. **This standard has been met.**

d. Standard 4 – Water Quality

Massachusetts Stormwater Standard 4 requires stormwater management systems shall be designed to remove 80% of the average annual post-construction load of Total Suspended Solids (TSS). In order to meet these criteria, BMPs must be designed into the overall site to provide treatment to impervious areas. Design criteria for many of these BMPs are based on a water quality volume of either ½" or 1", depending on several criteria for the project and site location. Since this project is not located in a Critical Area, water quality volumes may be based on a volume of 1/2" for each BMP when calculating effectiveness.

MaDEP's policy for solar facilities indicates that the panels are considered as "clean" generators of runoff and TSS removal is not required from the panels. In addition, the use of low impact development design features eliminates the need for specific TSS removal devices. Since the calculations demonstrating TSS removal and water quality characteristics are based on total impervious areas (pavement) and this project features virtually no impervious surface that generates TSS, t**his Standard has been met.**

e. Standard 5 – Land Uses with Higher Potential Pollution Loads

Land uses with Higher Potential Pollution Loads are required to implement source control measures as well as provide pretreatment to overall water quality systems. These land uses are defined as:

> Land uses with higher potential pollutant loads mean the following land uses: land uses identified in 310 CMR 22.20B(2), 310 CMR 22.20C(2)(a) - (k) and (m), 310 CMR22.21(2)(a) 1 -8, and 310 CMR 22.21(2)(b) 1 -6; areas within a site that are the location of activities that are subject to an individual National Pollutant Discharge Elimination System (NPDES) permit or the NPDES Multi-Sector General Permit; auto fueling facilities (gas stations); exterior fleet storage areas; exterior vehicle service and equipment cleaning areas; marinas and boatyards; parking lots with high intensity use; confined disposal facilities and disposal sites. Refer to Massachusetts Stormwater Management Standard 5 for higher potential pollutant loads, or the most current Massachusetts Stormwater Management Handbooks.

This project does not involve a use that is considered a Land Use with Higher Potential Pollution Loads. **This Standard does not apply**.

f. Standard 6 – Critical Areas

Standards 6 applies to Zone IIs, Interim Wellhead Protection Areas or near or to other Critical Areas: Shellfish Growing Areas, Bathing Beaches, Outstanding Resource Waters, Special Resource Waters, and Cold-Water Fisheries.

None of the discharge locations are defined as critical areas. **This Standard does not apply.**

g. Standard 7 – Redevelopment

The project is not a redevelopment. **This Standard is not applicable.**

h. Standard 8 – Construction Period Controls

Pollution prevention and erosion and sedimentation control measures will be implemented during all construction phases of the project. Control measures will address construction related impacts and land disturbance activities. Erosion Control Plans are included in the planset and incorporates the use of silt fences along the downstream slope of the property. Silt sacks will be installed in existing catch basins within the roadways to prevent sediment accumulation within them. An erosion control narrative is included with this report in Section 4.0 – Erosion Control Narrative. **This standard has been met.**

i. Standard 9 – Operation and Maintenance Plan

For this project, a Long-Term Operations and Maintenance manual has been developed under separate cover. This manual has been developed for the property owner and operator to maintain records of all required inspections and maintenance activities as the project site is operated in the future. The requirements listed in the Massachusetts Stormwater Checklist have been incorporated into the Manual. **This Standard has been met.**

j. Standard 10 – Illicit Discharges to Drainage System

This standard requires a signed statement regarding illicit discharges. A stamped and signed statement reading the following is included in the appendices.

> The stormwater management system is the system for conveying, treating, and infiltrating stormwater on-site, including stormwater best management practices and any pipes intended to transport stormwater to the groundwater, a surface water, or municipal separate storm sewer system. Illicit discharges to the stormwater management system are discharges that are not entirely comprised of stormwater. Notwithstanding the foregoing, an illicit discharge does not include discharges from the following activities or facilities: firefighting, water line flushing, landscape irrigation, uncontaminated groundwater, potable water sources, foundation drains, air conditioning condensation, footing drains, individual resident car washing, flows from riparian habitats and wetlands, dechlorinated water from swimming pools, water used for street washing and water used to clean residential buildings without detergents.
>
> It is our belief and understanding, to the best of our knowledge, that there are no known illicit discharges on the properties located at 0 Bartszak Drive in Holliston, Massachusetts.

Standard 10 also requires that, in addition to the Illicit Discharge Compliance Statement, a site map, drawn to scale, must identify the location of all systems conveying stormwater on the site and display that no connections between these systems and any waste management system exist. Engineering drawings accompanying this report display the location of all stormwater management components. These drawings serve as site maps and establish that no illicit discharges are proposed for this project.

This Standard has been met.

3. Holliston Land Disturbance Permit

The Town of Holliston has adopted their own Stormwater Management Performance Standards to further safeguard stormwater management. This section documents that these additional regulations have been met.

a. Section 11.10 Stormwater Management Performance Standards

"Standard 1" - Section 11.10.1.1 *– Low Impact Development (LID) site planning and design strategies must be implemented unless infeasible in order to reduce the discharge of stormwater from development sites. LID techniques mean innovative stormwater management systems that are modeled after natural hydrologic features. LID techniques manage rainfall at the source using uniformly distributed decentralized micro-scale controls. LID techniques use small cost-effective landscape features located at the lot level.*

The project features a low impact development by implementing a design that maintains existing drainage flow patterns, and promotes growth of a meadow that maintains the same drainage characteristics as a wooded site. To further enhance the stormwater management, stone infiltration trenches are proposed to be constructed adjacent to the concrete pads and the gravel roadway to provide recharge. **This "Standard" has been met.**

"Standard 2" - Section 11.10.1.2 *- BMPs shall be distributed throughout a site and not concentrated in any one location to better dilute the effects of any pollutants left untreated.*

As described in "Standard 1"*, BMPs for the concrete pads and adjacent to the gravel roadways, and are located at the source to dilute the effects of any pollutants left untreated.* **This "Standard" has been met.**

"Standard 3" - Section 11.10.1.3 *- All BMPs and their overflow areas shall be located on the site, in drainage easements or the road right-of-way. Separate drainage lots shall not be permitted without permission from the Board.*

All BMPs and their overflow areas are located on the site. **This "Standard" has been met.**

"Standard 4" - Section 11.10.1.4 *- Stormwater management systems design shall be consistent with these performance standards and the requirements of the 2008 Massachusetts Stormwater Handbook (as amended), whichever is more stringent.*

As documented in this report, the Stormwater Management System has been designed in accordance with the Town's performance Standards and the requirements of the Massachusetts Stormwater Handbook, as amended. **This "Standard" has been met.**

"Standard 5" - Section 11.10.1.5 *- Peak flows of run-off at the boundaries of the development in a two (2), ten (10), twenty-five (25), fifty (50) and one-hundred (100) year frequency storm, shall be no higher following development than prior to development.*

As documented in this report, the peak flows of run-off at the boundaries of the development during the 2-, 10-, 25-, 50-, and 100-year storm event are no higher following development than prior to development. **This "Standard" has been met.**

"Standard 6" - Section 11.10.1.6 *- Where the site is not proposed to be covered with gravel, hardscape or a building or structure, a planting plan to ensure permanent re-vegetation of the site shall be provided and approved;*

A landscaping plan has been provided in the planset documenting the practices that will be employed to ensure permanent re-vegetation of the site. **This "Standard" has been met.**

"Standard 7" - Section 11.10.1.7 *- Areas to be planted shall be loamed with not less than 6" compacted depth of good quality loam and seed with turf grass seed or other appropriate ground cover in accordance with good planting practice;*

A landscaping plan has been provided in the planset documenting the practices that will be employed to ensure permanent re-vegetation of the site. **This "Standard" has been met.**

"Standard 8" - Section 11.10.1.8 *- Stormwater management systems shall be designed to remove a percentage of the average annual load of Total Suspended Solids (TSS) and Total Phosphorus (TP) from the total post-construction impervious surface area on the site, as follows:*

a. Average annual pollutant removal requirements for TSS and TP are met through one of the following methods:

i. Installing BMPs that meet the pollutant removal percentages based on calculations developed consistent with EPA Region 1's BMP Accounting and Tracking Tool (2016) or other BMP performance evaluation tool provided by EPA Region 1, where available. If EPA Region 1 tools do not address the planned or installed BMP performance, then any federally or State-approved BMP design guidance or performance standards (e.g., State stormwater handbooks and design guidance manual(s)) may be used to calculate BMP performance; or

ii. Retaining the volume of runoff equivalent to, or greater than:

1. For new developments, one (1) inch multiplied by the total post-construction impervious surface area on the new development site; or

2. For redevelopments, 0.8 inch multiplied by the total post-construction impervious surface area on the redeveloped site; or

iii. Meeting a combination of retention and treatment that achieves the above standards, or

iv. Utilizing offsite mitigation that meets the above standards within the same USGS HUC12 as the new development site.

b. Redevelopment activities that are exclusively limited to maintenance and improvement of existing roadways (including widening less than a single lane, adding shoulders, correcting substandard intersections improving existing drainage systems and repaving projects), shall improve existing conditions unless infeasible and are exempt from Section 11.10.1.9.a.

As documented in this report, the sites impervious area, while de minimis in nature, drains to stone trenches that retain and recharge a volume of runoff greater than one inch multiplied by the tributary impervious area and meets the Town's requirement above. **This "Standard" has been met.**

"Standard 9" - Section 11.10.1.9*. - Discharges to water bodies subject to one or more approved Total Maximum Daily Loads (TMDLs) or impaired waterbodies and their tributaries, listed as Category 4b or 5 in the current Massachusetts Integrated List of Waters listed pursuant to the Federal Clean Water Act Sections 303(d) and 305(b), without an EPA approved TMDL impaired waters shall:*

a. For nitrogen and phosphorus impaired waters, stormwater management systems shall be designed using BMPs optimized for nitrogen and/or phosphorus removal, whichever applies.

b. For chloride impaired waters, the required Operation and Maintenance (O&M) Plan shall outline measures to minimize salt usage or use alternative deicing materials and practices. The Applicant shall consult with the Holliston Department of Public Works to develop these O&M provisions.

c. For waters impaired due to solids (turbidity), metals, or oil and grease (hydrocarbons), commercial or industrial land use development/redevelopments shall design stormwater management systems to allow shutdown and containment in the event of an emergency spill or other unexpected event. Systems designed to infiltrate shall provide the level of pollutant removal equal to or greater than the level of pollutant removal provided through the use of biofiltration of the same volume of runoff to be infiltrated, prior to infiltration.

The site does not discharge to a water body subject to a TMDL or impaired waterbody and their tributary listed as Category 4b or 5 in the current Massachusetts Integrated List of Waters. **This "Standard" does not apply.**

"Standard 10" - Section 11.11.1 - *The Applicant shall provide calculations supporting the design of the stormwater management system and its compliance with the performance standards established in these regulations.*

Calculations supporting the design of the stormwater management system and its compliance with the performance standards established in the Town of Holliston Stormwater Management and Land Disturbance Regulations have been documented above. **"This Standard" has been met.**

"Standard 11" - Section 11.11.2 - *All calculations shall comply with the standards, procedures, and methods described in the MassDEP's Massachusetts Stormwater Handbook, Volume 3, except as follows:*

a. The calculations of runoff volumes and peak rates required under Massachusetts Stormwater Management Standard 2 shall be based on precipitation data provided in National Oceanic and

Atmospheric Administration (NOAA) -National Weather Service "NOAA Atlas 14" unless otherwise authorized by the Board.

As documented in this report, all calculations to comply with the applicable standards, procedures, and methods described in the MassDEP's Massachusetts Stormwater Handbook, Volume 3 have been provided. Furthermore, calculations of runoff volumes and peak rates have been based on precipitation data provided by NOAA Atlas 14. **This "Standard" has been met.**

As documented above, all of the applicable Town of Holliston Stormwater Management Performance Standards have been met.

4. Erosion Control Narrative

b. Overview of Soil Erosion and Sedimentation Concerns

The susceptibility of soils to erosion is indicated on a relative "K" scale of values over a range of 0.02 to 0.69. The "K" value is frequently used with the universal soil loss equation. The higher values are indicative of the more erodible soils. The major factors affecting K values include particle sizes, organic matter, structure, permeability and even rock fragments. In very general terms, soil erodibility can also be a general effect of texture.

- Fine textured soils such as clays are resistant to detachment due to aggregation (K factors between 0.05 and 0.15)
- Course textures such as sands are easily detached, but have low runoff potential since dense particles are not easily transported. (K factors between 0.05 and 0.20)
- Medium textured soils (loams) are moderately detachable and feature high to moderate runoff. (K factors between 0.25 and 0.45)
- Silts are easily detachable and feature high runoff potential due to small, easily transported particles. (K factors between 0.45 and 0.65)

The K-factors of soils can be further divided into two categories; Kf and Kw. Kf represents erodibility factors of soil components that are free of rock fragments. Kw includes the rock fragments within the factor.

The NRCS soil mapping identifies the following soils and corresponding K factors on the site:

- 106C – Narragansett-Hollis-Rock K_W=0.24, K_F=0.32
- 341C – Broadbrook Very Fine Sandy Loam K_W=0.32, K_F=0.37
- 631C – Chalton-Urban Land-Hollis Complex K_W=0.20, K_F=0.32

The characterization of the site indicates that the majority of the soil that will be encountered will be till soils that are subject to moderate to high runoff. It is an important goal of the construction phase to minimize the amount and frequency of offsite transport of sediments through construction runoff, dust, or tracking. With this in mind, the primary emphasis of the erosion and sedimentation control plan to be implemented for this project will be:

- Plan the project to be constructed from areas of flatter grades and away from resources or the property boundaries to the extent practical.
- Develop a careful construction sequence.
- Rapid stabilization of denuded areas to minimize the period of soil exposure.
- Rapid stabilization of drainage paths to avoid rill and gully erosion.

- The use of onsite measures to capture sediment (straw bales, silt fence, etc.,)
- Protection of Natural Resource areas and drainage courses through buffering and the use of Best Management Practices.
- The implementation of long-term measures for erosion/sediment pollution treatment through the construction of permanent water quality measures.

c. Description and Location of Limits of Proposed Earthworks

Proposed earthwork will consist of what is necessary for the removal of trees, removal of gravel, construction of a gravel access road, installation of concrete pads, and the installation of solar panels.

d. Existing and Proposed Drainage Features

The existing site contains limited drainage features. Stormwater from the site generally flows to Bartzak Drive, an offsite detention pond, and an offsite wetland resource area. In the center of the site, there is a ridge point that directs runoff in the northern, western, eastern, and southern directions.

The proposed project will feature a Low Impact Development stormwater management system. The stormwater runoff from the gravel access road and the concrete pads will be conveyed into adjacent infiltration trenches that will recharge stormwater prior to releasing the stormwater to the existing drainage features.

This system is described and analyzed in the Stormwater Management Report for this project.

e. Natural Resource Areas

There are no wetland resource areas on-site, however there is a wetland resource area located to the south of the property. The wetlands were identified on the site during investigations on July 15, 2022. A portion of the respective 100-foot resource area buffer encroaches onto the property where development is proposed. As a result, a Notice of Intent will be filed with the Holliston Conservation Commission for approval of this work.

f. Erosion and Sediment Control Devices

Prior to and during the development of the construction activities, the site contractor shall implement the following erosion and sedimentation control measures.

Siltation Fence

Siltation fence shall be installed downstream of any disturbed areas to trap runoff borne sediments until the site has been stabilized. The silt fence shall be installed per the details on the construction plans and inspected immediately after each rainfall and at least daily during prolonged rainfall. Repairs shall be made immediately by the Contractor if there are any signs of erosion or sedimentation below the silt fence line. If such erosion is observed, the contractor shall take proactive action to identify the cause of the

erosion and take action to avoid its reoccurrence. Typically, this requires that stabilization measure be taken to the disturbed tributary area. Proper placement of stakes and keying the bottom of the fabric into the ground is critical for the filter's effectiveness. If there are signs of undercutting at the center or the edges, or impounding of large volumes of water behind the fence, the barrier shall be replaced with a stone check dam and measures taken to avoid the concentration of flows not intended to be directed to the silt fence.

Straw Mulch

Straw mulch including hydro seeding is intended to provide cover for denuded or seeded areas until revegetation is established. Mulching should be occurring several times per week when the site construction activity is high and at sufficient intervals to reduce the period of exposure of bare soils to the time limits set forth in this plan. Mulch placed on slopes of less than 10 percent shall be anchored by applying water; mulch placed on slopes steeper than 10 percent shall be covered with fabric netting as immediately after mulching as practicable and anchored with staples in accordance with the manufacturer's recommendations. Proposed drainage channels, which are to be revegetated, shall receive Curlex blankets by American Excelsior or North American Green selected for the slope, velocity, and whether the measure is temporary or intended to be in place for a sustained period. Straw mulch shall be available on site at all times in order to provide immediate temporary stabilization when necessary.

Temporary Stormwater Settlement Basins

Temporary stormwater settlement basins may be constructed to provide sedimentation control for stormwater runoff from the individual site areas during construction. These basins may become necessary where other erosion control measures are not adequate to prevent offsite sedimentation. The basin should only be used where there is sufficient space and appropriate topography. The basin should be large enough to handle the maximum amount of expected site drainage. The basin may be constructed by excavation, construction of a compacted embankment or a combination of both. It may have one or more inflow points carrying polluted runoff. To improve trap efficiency, the basin should have the maximum surface area possible and sediment should enter the basin as far from the outlet as possible.

Stone Check Dams

A check dam is a small dam constructed across a drainage ditch, swale or channel to reduce the velocity of the surface runoff. Reduced runoff velocity reduces erosion and gullying in the channel and allows the sediment to settle out. Where temporary channels or permanent channels are not yet vegetated, channel lining is infeasible and velocity checks are required. This practice may be used as a temporary or emergency measure to limit erosion by reducing flow in small open channels.

Straw Bale Barriers

Straw bale barriers are used similarly to silt fence specifically where the area below the barrier is undisturbed and vegetated. Bale barriers require more maintenance than silt fence barriers and permeability through bale barriers is slower than silt fence. Bale barriers should be located where they will trap sediment. Bales located along the top of a ridge serve no useful purpose. Straw bale barriers

should be removed when they have served their usefulness, but not before the upslope areas have been permanently stabilized.

Construction Entrance

A construction entrance will be constructed at all access points onto the site to prevent tracking of soil onto adjacent local roads. Proposed construction entrances are shown on the Erosion Control plan. Construction entrances provide an area where mud can be removed from vehicle tires before they enter a public road. If the action of the vehicle travelling over the gravel pad is not sufficient to remove the majority of the mud, then tires must be washed before the vehicle enters a public road.

Inlet Protection

Storm drain catch basin inlet protection shall be provided through the use of stone sediment barriers or a premanufactured SiltSack as distributed by A.H. Harris. The barriers shall be inspected after each rainfall and repairs made as necessary. Sediment shall be removed and the barrier restored to its original dimensions when sediment has accumulated to 1/3 the design depth of the barrier. The barrier shall be removed when the tributary drainage area has been stabilized.

Filter Bags

Filter bags will be required to be onsite and available for construction dewatering. The use of filter bags will be required in the event that trench dewatering activities cannot be discharged through a natural buffer area at least 100 feet in length or at any signs of any turbid discharge from the site.

Slope Protection

Additional slope protection will be required in areas of steep slopes and where proposed grades meet existing grades at acute angles that could cause gully erosion. This protection will be mainly in the form of the installation of erosion control blankets in areas where slopes exceed 3:1, H:V, up to 2:1, H:V. Areas where slopes exceed 2:1, H:V, should be stabilized with rip rap slope stabilization at the toe of slope except where otherwise specified.

Loam and Seed

Loam and seed is intended to serve as the primary permanent revegetative measure for all denuded areas not provided with other erosion control measures, such as riprap or permanently covered with roadway gravel, pavement or building area.

f. Temporary Erosion and Sediment Control Measures

The following are planned as temporary erosion and sedimentation control measures during construction:

- A crushed stone-stabilized construction entrance shall be placed at any construction access points into the site. The locations of the construction entrances shown on the drawings should be considered illustrative and adjusted as appropriate and located at any area where tracking of mud and debris onto existing roads, previously paved areas within the project, or streets is a potential. Stone stabilized construction entrances will require the stone to be removed and replaced as it becomes covered or filled with mud and material tracked by vehicles exiting the site.

- Siltation fence or an equivalent sediment barrier shall be installed along the downgradient side of the proposed improvement areas. The siltation fence will remain in place and properly maintained until the site is acceptably revegetated. Siltation fence is to be used along the contour of significant fill slopes as illustrated on the erosion control plan site drawings. Siltation fence needs to be checked to insure the bottom is properly keyed in and inspected after significant rains. Wood chips from clearing are often used on the construction site in front of the silt fence to provide an extra margin of safety and security for the silt fence. This practice is encouraged, provided the chips are removed or dispersed into forested areas when the fence is removed.

- Filter bags shall be installed in accordance with the details in the plan set. The filter bag's function on the project is to receive any water pumped from excavations during construction. A filter bag shall be installed and prepared for operation prior to any trenching on site. When filter bags are observed to be at 50% capacity, they shall be cleaned or replaced. Stone under the filter bags shall be removed and replaced concurrently.

- Temporary stockpiles of common excavation will be protected as follows:

    - Temporary stockpiles shall not be located within 100 feet of critical areas and at least 50 feet upgradient of the perimeter silt fence.
    - Inactive stockpiles shall be stabilized within 5 days by either temporarily seeding the stockpile with a hydro seed method containing an emulsified mulch tackifier or by covering the stockpile with mulch. If necessary, mesh shall be installed to prevent wind from removing the mulch.

- Open areas of the site shall be limited to 5 acres. All denuded areas which have been rough graded shall receive mulch or erosion control mesh fabric within 7 days of initial disturbance of soil. Disturbed areas within 75' of critical areas must receive temporary erosion control measures within 48 hours.

- Between November 1 and April 1, open area shall be limited to three acres, and disturbed soil shall be covered with mulch within 5 days of disturbance, prior to any predicted storm event of the equivalent of ½" of equivalent rainfall in a 24-hour period, or prior to any work shutdown lasting more than 48 hours (including weekends and holidays). The mulch rate shall be double the normal rate.

- For work that is conducted between November 1 and April 15 of any calendar year, all denuded areas will be covered with hay mulch, applied at twice the normal application rate, and (in areas over 10% grade) anchored with a fabric netting. The time period for applying mulch shall be limited to 5 days for all areas or immediately in advance of a predicted rainfall event.

- The paved access roads shall be swept to control mud and dust as necessary. A street sweeper shall be available from the contractor on immediate notice or as requested by the Owner or regulatory agency.

- Stone check dams or hay bale barriers will be installed at any evident concentrated flow discharge points during construction and earthwork operations.

- Silt fencing with a maximum stake spacing of 8 feet should be used, unless the fence is supported by wire fence reinforcement of minimum 14 gauge and with a maximum mesh spacing of 6 inches, in which case stakes may be spaced a maximum of 10 feet apart. The bottom of the fence should be properly anchored a minimum of 6" per the plan detail and backfilled. Any silt fence identified by the Owner or reviewing agencies as not being properly installed during construction shall be immediately repaired in accordance with the installation details.

- Storm drain catch basin inlet protection shall be provided through the use of stone sediment barriers or a premanufactured SiltSack® as distributed by A.H. Harris Company, Portland, Maine. Stone sediment barrier installation details are provided in the plan set. The barriers or SiltSacks® shall be inspected after each rainfall and repairs made as necessary, including the removal of sediment. Sediment shall be removed and the barrier or SiltSack® restored to its original dimensions when the sediment has accumulated to ½ the design depth of the barrier. Inlet protection shall be removed when the tributary drainage area has been stabilized.

- All slopes over 3:1 shall receive erosion control mesh.

- All areas which feature narrow angles of slope interface between proposed surfaces and existing surfaces shall receive erosion control mesh to prevent scouring.

- Additional siltation fences or sediment barriers shall be installed as construction progresses.

- Areas of visible erosion shall be stabilized with crushed stone or equivalent measures.

g. Standards for Stabilizing Sites for Winter Conditions

The construction of the project will extend into the winter season. The contractor shall schedule work to avoid construction of stormwater basins during the winter months. For permitted winter construction,

the erosion control measures are substantially more stringent due to cold temperatures and lack of moisture which aids in drying the subgrade soils through evaporation.

The winter construction period is from November 15th through March 15th. If the construction site is not stabilized with pavement, aggregate subbase gravel, 90% mature vegetation cover or riprap prior to November 15th, then the site needs to be protected with over-winter stabilization. An area considered open is any area that is not stabilized with pavement, vegetation, mulching, erosion control mix, erosion control mats, riprap or subbase gravel.

During the winter construction period the Contractor shall install erosion control mix berms in lieu of silt fence.

During the winter construction period, a double row of sediment barriers shall be placed between any drainage path and the disturbed area.

In addition, during the winter construction period the amount of exposed area shall be limited to that which can be mulched within one day in the event of a predicted storm and shall not exceed a maximum open area of one acre.

Standard for the timely stabilization of ditches and channels: The contractor shall construct and stabilize all stone-lined ditches and channels on the site by November 15th. The contractor shall construct and stabilize all grass lined ditches and channels on the site by September 1st. If the contractor fails to stabilize a ditch or channel to be grass lined by September 1st, then the contractor shall take one of the following actions to stabilize the ditch for late fall and winter.

i. Install a sod lining in the ditch. The contractor shall line the ditch with properly installed sod by October 1st. Proper installation includes the applicant pinning the sod onto the soil with wire pins, rolling the sod to guarantee contact between the sod and underlying soil, watering the sod to promote root growth into the disturbed soil, and anchoring the sod with jute or plastic mesh to prevent the sod strips from sloughing during flow conditions.

ii. Install a stone lining in the ditch. The contractor shall line the ditch with stone riprap by November 1st. The contractor shall hire a registered professional engineer to determine the stone size and lining thickness needed to withstand the anticipated flow velocities and flow depths within the ditch. If necessary, the contractor shall regrade the ditch prior to placing the stone lining so as to prevent the stone lining from reducing the ditch's cross sectional area.

Standard for the timely stabilization of disturbed slopes: The contractor shall construct and stabilize stone covered slopes by November 15th. The contractor shall seed and mulch all slopes to be vegetated by September 1st. A slope is considered any area having a grade of greater than 15% (10H:1V). If the contractor fails to stabilize any slope to be vegetated by

September 15th, then the contractor shall take one of the following actions to stabilize the slope for late fall and winter:

i. Stabilize the soil with temporary vegetation and erosion control mesh. By October 1st the contractor shall seed the disturbed slope with winter rye at a seeding rate of 3 pounds per 1000 square feet and apply erosion control mats over the mulched slope. The contractor shall monitor growth of the rye over the next 45 days. If the rye fails to grow at least three inches or fails to cover at least 75% of the disturbed slope by November 15th, then the contractor shall cover the slope with a layer of wood waste compost as described in item iii of this standard or with stone rip rap as described in item iv of this standard.

ii. Stabilize the slope with sod. The contractor shall stabilize the disturbed slope with properly installed sod by October 1st. Proper installation includes the contractor pinning the sod onto the slope with wire pins, rolling the sod to guarantee contract between the sod and underlying soil, and watering the sod to promote root growth into the disturbed soil. The contractor shall not use late-season sod installation to stabilize slopes having a grade greater than 33% (3H: 1V) or having groundwater seeps on the slope face.

iii. Stabilize the slope with wood waste compost. The contractor shall place a six-inch layer of wood waste compost on the slope by November 15th. Prior to placing the wood waste compost, the contractor shall remove any snow accumulation on the disturbed slope. The contractor shall not use wood waste compost to stabilize slopes having grades greater than 50% (2H: 1V) or having groundwater seeps on the slope face.

iv. Stabilize the slope with stone riprap. The contractor shall place a layer of stone riprap on the slope by November 15th. The contractor shall hire a registered professional engineer to determine the stone size needed for stability and to design a filter layer for underneath the riprap.

Standard for the timely stabilization of disturbed soil: By September 15th, the contractor shall seed and mulch all disturbed soils on areas having a slope less than 15%. If the contractor fails to stabilize these soils by this date, then the contractor shall take one of the following actions to stabilize the soil for late fall and winter.

i. Stabilize the soil with temporary vegetation. By October 1st, the contractor shall seed the disturbed soil with winter rye at a seeding rate of 3 pounds per 1,000 square feet, lightly mulch the seeded soil with hay or straw at 75 pounds per 1,000 square feet, and anchor the mulch with plastic netting. The contractor shall monitor the growth of the rye over the next 45 days. If the rye fails to grow at least three inches or fails to cover at least 75% of the disturbed soil before November 1st, then the contractor shall mulch the area for over-winter protection as described in Item iii of this standard.

ii. Stabilize the soil with sod. The contractor shall stabilize the disturbed soil with properly installed sod by October 1st. Proper installation includes the contractor pinning the sod onto the soil with wire pins, rolling the sod to guarantee contact between the sod and underlying soil, and watering the sod to promote root growth into the disturbed soil.

iii. Stabilize the soil with mulch. By November 15th, the contractor shall mulch the disturbed soil by spreading hay or straw at a rate of at least 150 pounds per 1,000 square feet on the area so that no soil is visible through the mulch. Prior to applying the mulch, the contractor shall remove any snow accumulation on the disturbed area. Immediately after applying the mulch, the contractor shall anchor the mulch with plastic netting to prevent wind from moving the mulch off the disturbed soil.

Standard for timely stabilization of Soil Stockpiles: Stockpiles of soil or subsoil will be mulched for over winter protection with hay or straw at twice the normal application rate or with a four-inch thick layer of erosion control mix. This will be completed within 24-hours of stockpiling or re-established prior to any predicted rainfall or snowfall event. Any soil stockpile will not be placed (even covered with mulch) within 100 feet from a natural resource (i.e. wetland, etc.).

h. Special Measures for Summer Conditions

The summer period is generally optimum for construction for this site but it is also the period where intense short duration storms are most common making denuded areas very susceptible to erosion, where dust control needs to be the most stringent, and where the potential to establish vegetation is often restricted by moisture deficit. During these periods the contractor must:

- Implement a program to apply dust control measures on a daily basis except those days where the precipitation exceeds 0.25 inches;
- Spray the mulch after anchoring with water to dampen the soil and encourage early growth. Temporary seed may be required until the late summer seeding season.
- Mulch, cover, and moisten stockpiles of fine-grained materials that are susceptible to erosion.
- Take additional steps needed to control fugitive dust emissions to minimize reductions in visibility and the airborne disbursement of fine-grained soils. These measures may also be required in the spring and fall during the drier periods of these seasons.

i. Permanent Erosion Control Measures

The following permanent erosion control measures have been designed as part of the Erosion and Sedimentation Control Plan:

- The drainage conveyance systems have been designed to intercept and convey the 25-year storm. In the case of open channels or swales, this includes the design of measures to resist scour of the channel.

- All storm drain pipes shall have riprap aprons at their outlet to protect the outlet and receiving channel of the culverts from scour and deterioration. Installation details are provided in the plan set. The aprons shall be installed and stabilized prior to directing runoff to the tributary pipe or culvert.

- All areas disturbed during construction, but not subject to other restoration (paving, riprap, etc.) will be loamed, limed, fertilized, mulched, and seeded. Fabric netting, anchored with staples, shall be placed over the mulch in areas where the finish grade slope is greater than 10 percent. Native topsoil shall be stockpiled and temporarily stabilized with seed and mulch and reused for final restoration when it is of sufficient quality.

- Catch basins shall be provided with sediment sumps for all outlet pipes that are 12” in diameter or greater.

j. Timing and Sequence of the Erosion Control Measures

The following construction sequence shall be required to insure the effectiveness of the erosion and sedimentation control measures are optimized.

Note: For all grading activities, the contractor shall exercise extreme caution not to overexpose the site by limiting the disturbed area and shall stabilize any steep slopes within 24 hours if final slope grading and stabilization will not be completed within 7 days. Any final slopes shall have the specified erosion control measures installed within 7 days of final stabilization.

- Install crushed stone-stabilized construction entrances as shown on the Erosion and Sedimentation Control Plan.

- Mark the grading and clearing limits and initiate clearing that will permit the contractor to access the site and install silt fence.

- Install siltation fence where shown on the contract drawings. During periods of November 1st through April 15th, the Contractor shall install erosion control mix berms in lieu of silt fence.

- Any and all materials associated with the construction of the solar energy facility shall be stockpiled on the site.
- Scarify existing areas and over-sow cover crop of low-growing vegetation (I.E. alfalfa, red clover, white clover, crown vetch, hairy vetch, buckwheat, and birdsfoot trefoil).
- Install construction and maintenance drives as shown on the plans.
- Install 7 foot chain link fence or equal at limit of work.
- Establish and prepare filter bag areas.
- Construct diversion and drainage channels.
- Install stone and hay bale check dams at any concentrated flow discharge points.
- Install storm drain and other utility work. Install inlet and outlet protection immediately after the installation of any culverts. Pump any accumulated water within the trenches to a filter bag.
- Construct the disturbed areas to subgrade and restore the slopes.
- Place gravels in the paved and gravel roadway areas as soon as subgrade is prepared to minimize the period that the unprotected subgrade is exposed and vulnerable to erosion from runoff events.
- Remove all accumulated sediment from silt barriers.
- Review stability of the site. Removal of erosion control measures shall be performed within 30 days of establishing permanent stabilization. Permanent stabilization in meadow areas is established with 90% catch of meadow with no evidence of rilling or erosion.

This sequence is applicable to all phases of the project.

Soil will be considered disturbed if it does not have an established stand of vegetation covering at least 90% of the soil surface or has not been mulched with hay applied at a rate of 230 lb./1,000 sq. ft.

k. Provisions for Maintenance of the Erosion Control Measures

This project is subject to the requirements of a US EPA NPDES permit and an accompanying Stormwater Pollution Prevention Plan (SWPPP.) These documents require the Contractor to prepare a list and designate by name, address and telephone number all individuals who will be responsible for implementation, inspection and maintenance of all erosion control measures identified within this section

and as contained within the contract drawings. Specific responsibilities of the inspector(s) will include, but not be limited to:

- Execution of the Contractor/Subcontractor certification by any and all parties responsible for erosion control measures on the site as required by the SWPPP.

- Assuring and certifying the Owner's construction sequence is in conformance with the specified schedule of this section. A weekly certification stating compliance, any deviations, and corrective measures necessary to comply with the erosion control requirements of this section shall be prepared and signed by the inspector(s).

- In addition to the weekly certifications, the inspector(s) shall maintain written reports recording construction activities on site which include dates when major grading activities occur in a particular area; dates when major construction activities cease in a particular area, either temporary or permanent; dates when an area is stabilized.

- Inspection of the project work site at least once every seven (7) calendar days and before and after each significant rainfall event (0.25 inches or more in any 24-hour period) during construction until permanent erosion control measures have been properly installed and the site has been stabilized. Such inspections shall be submitted to the DPW on a monthly basis as per Section 20c of the Stormwater Management Rules and Regulations. Inspection of the project work site shall include:

  A. Identification of proper erosion control measure installation in accordance with the erosion control detail sheet or as specified in this section.

  B. Determine whether each erosion control measure is properly operating. If not, identify damage to the control device and determine remedial measures.

  C. Identify areas that appear vulnerable to erosion and determine additional erosion control measures that should be used to improve conditions.

  D. Inspect areas of recent seeding to determine percent catch of grass. A minimum catch of 90 percent is required prior to removal of erosion control measures.

  E. Record date of installation of sorbent bags in catch basins, dates of paving (if applicable), dates removed, and the disposal method and location.

- If inspection of the site indicates a change should be made to the erosion control plan, either to improve effectiveness or correct a site-specific deficiency, the inspector shall immediately implement the corrective measure and notify the owner of the change.

Once construction has been completed, long term maintenance of the facilities will be the responsibility of the applicant.

l. Preconstruction Conference

Prior to any construction at the site, representatives of the contractor, Town Officials, and the site Design Engineer shall arrange for and meet with the Owner to discuss the scheduling of the site construction, and the designation of the responsible parties for implementing the plan. This meeting shall be scheduled by the contractor with reasonable advance notice for all attendees. Prior to the meeting the contractor shall prepare a detailed schedule and a marked-up site plan indicating areas and components of the work and key dates showing date of disturbance and completion of the work. If bid through a general contractor, the general contractor's superintendent shall provide a written acknowledgement that the erosion control plan has definitive dates for implementation that may supersede the building schedule. The contractor shall conduct a meeting with employees and sub-contractors to review the erosion control plan, the construction techniques which will be employed to implement the plan, and provide a list of attendees and items discussed at the meeting to the Owner. Three copies of the schedule, the contractor's meeting minutes, and marked-up site plan shall be provided to the Owner at the preconstruction meeting.

5. Erosion Control Design Standards

Overview

The Town of Holliston has developed Erosion Control Design Standards (ECDS) to further enhance the requirements set forth by MassDEP and the NPDES Construction General Permit. This section below documents how each of the "Standards" relative to the Town's regulations have been met.

"ECDS Standard 1" - Section 11.10.2.1 *- Design of erosion and sediment control practices shall conform to the guidelines described in "Massachusetts Erosion and Sediment Control Guidelines for Urban and Suburban Areas" (1997 or amended) or alternative design guidance approved by the Board;*

Erosion and Sedimentation Control Plans have been developed utilizing guidelines described in the Massachusetts Erosion and Sediment Control Guidelines for Urban and Suburban Areas, printed March 1997. **This "Standard" has been met.**

"ECDS Standard 2" - Section 11.10.2.2 *- Prevent off-site transport of sediment using the following practices. There shall be no adverse impacts to abutting properties from any increase in volume of stormwater runoff including erosion, silting, flooding, sedimentation or impacts to wetlands, groundwater levels or wells;*

a. Minimize total area of disturbance and protect natural resources. Sequence activities to minimize simultaneous areas of disturbance;

b. Establish perimeter controls around areas that will be disturbed, including on and off-site material storage areas (overburden and stockpiles of dirt, borrow areas, or other areas used solely by the permitted project are considered part of the project);

c. Maximize infiltration and groundwater recharge;

d. Runoff flow shall not be routed through areas of protected vegetation or re-vegetated slopes and disturbed areas. Temporary runoff from erosion and sedimentation controls shall be directed to BMPs, such as vegetated swales;

e. Use stabilized construction site entrances and exits to prevent offsite tracking of sediments. During construction, any site access from a public way shall be improved with a gravel apron not more than 16' feet wide (residential) and 24' wide (commercial and industrial) and a minimum of 15 feet long to prevent unstable material from being transported onto the street by vehicle tires or by runoff;

f. Stabilize sites when projects are complete or operations have temporarily ceased. Interim and permanent stabilization measures shall be instituted on a disturbed area as soon as practicable but no more than fourteen (14) days after construction activity has temporarily or permanently ceased on that portion of the site. Until a disturbed area is permanently stabilized, sediment in runoff water shall be trapped by using a siltation barrier, siltation fences, and/or sedimentation traps;

g. Protect slopes on construction sites. Retaining walls may be required where side slopes are steeper than a ratio of 3:1;

h. Protect all storm drain inlets. The mouths of all catch basins shall be fitted with filter fabric during the entire construction process to minimize siltation or such basins shall be designed as temporary siltation basins with provisions made for final cleaning;

i. Armor or otherwise stabilize all newly constructed outlets;

j. Inspect stormwater controls at consistent intervals.

An erosion and sedimentation control plan has been developed, and is included in the planset demonstrating methods to prevent adverse impacts to abutting properties from runoff including erosion, silting, sedimentation or impacts to wetlands. The erosion control plans note to achieve stabilization as soon as practicable to reduce the potential for an increase in volume of stormwater runoff and flooding, which can occur when a site becomes denuded. **This "Standard" has been met.**

"ECDS Standard 3" - Section 11.10.2.3 - *Re-vegetation. Proper re-vegetation techniques shall be employed during construction using native plant species, proper seed bed preparation, fertilizer and mulching to protect germinating plants. Re-vegetation shall occur on cleared sites within seven (7) calendar days of final grading and shall occur during the planting season appropriate to the selected plant species.*

Notes for revegetating the site has been included on the Erosion and Sedimentation Control Plan, and in accordance with NPDES requirements, the site will be commence stabilization in the required timeframe. **This "Standard" has been met.**

"ECDS Standard 4" - Section 11.10.2.4 - *Install and maintain all erosion and sediment control measures in accordance with the manufacturer's specifications and good engineering practices.*

Details for installing and maintaining erosion and sediment control measures are included in the planset, and will be required to be maintained in accordance with NPDES requirements. **This "Standard" has been met.**

"ECDS Standard 5" - Section 11.10.2.5 - *Erosion control measures shall include the use of erosion control matting, mulches and/or temporary or permanent cover crops. Mulch areas damaged from heavy rainfalls, severe storms and construction activity shall be repaired immediately.*

Erosion control measures will include the use of erosion control matting, mulches, and/or temporary or permanent cover crops as necessary. Mulch will be added to areas damaged from heavy rainfalls, severe storms, and construction activity as necessary. **This "Standard" has been met.**

"ECDS Standard 6" - Section 11.10.2.6 - Erosion control matting or mulch shall be anchored where plantings are on areas subject to mulch removal by wind or water flows or where side slopes are steeper than 3:1 or exceed 10 feet in height. During the months of October through March when seeding and sodding may be impractical anchored mulch may be applied at the Board's discretion.

Plantings in areas where slopes are steeper than 3:1 are noted to receive erosion control matting. **This "Standard" has been met.**

"ECDS Standard 7" - Section 11.10.2.7 - Comply with applicable Federal, State and local laws and regulations including waste disposal, sanitary sewer or septic system regulations, and air quality requirements, including dust control;

All applicable Federal, State, and local laws and regulations including waste disposal, sanitary sewer or septic system regulations, and air quality requirements, including dust control, will be met if applicable. **This "Standard" will be met.**

"ECDS Standard 8" - Section 11.10.2.8 **- Dust control shall be used during all land disturbance project;**

Dust Control will be used as necessary in accordance with NPDES CGP requirements. **This "Standard" will be met.**

"ECDS Standard 9" - Section 11.10.2.9 - *Prevent significant alteration of habitats mapped by the Massachusetts Natural Heritage and Endangered Species Program as Endangered, Threatened or Of Special Concern, Estimated Habitats of Rare Wildlife and Certified Vernal Pools, and Priority Habitats from the proposed activities;*

There are no mapped habitats of Endagered, Threatened, or of Special Concern, Estimated Habitats of Rare Wildlife and Certified Vernal Pools, and Priority Habits within close proximity to the subject property. **This "Standard" is not applicable.**

"ECDS Standard 10" - Section 11.10.2.10 - *Ensure that any stormwater BMP (for post construction stormwater management) installed during construction will be protected from compaction, siltation, and erosion, or will be restored or replaced such that the BMP will be capable of functioning as designed in accordance with these stormwater regulations.*

Methods to protect stormwater BMPs from compaction, siltation, and erosion is included in the Erosion and Sedimentation Control Plan within the planset. **This "Standard" has been met.**

6. Appendices

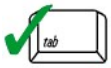
Appendix A – Massachusetts Stormwater Checklist

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

Checklist for Stormwater Report

A. Introduction

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



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

The Stormwater Report must include:

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

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

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

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

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

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

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

Checklist for Stormwater Report

B. Stormwater Checklist and Certification

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

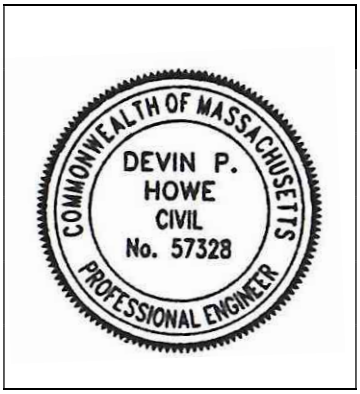
Note: Because stormwater requirements vary from project to project, it is possible that a complete Stormwater Report may not include information on some of the subjects specified in the Checklist. If it is determined that a specific item does not apply to the project under review, please note that the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

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

Registered Professional Engineer's Certification

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

Registered Professional Engineer Block and Signature



D Howe 7.27.22

Signature and Date

Checklist

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

☒ New development

☐ Redevelopment

☐ Mix of New Development and Redevelopment

Checklist for Stormwater Report

Checklist (continued)

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

☒ No disturbance to any Wetland Resource Areas

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

☐ Reduced Impervious Area (Redevelopment Only)

☐ Minimizing disturbance to existing trees and shrubs

☐ LID Site Design Credit Requested:

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

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

☐ Bioretention Cells (includes Rain Gardens)

☐ Constructed Stormwater Wetlands (includes Gravel Wetlands designs)

☐ Treebox Filter

☐ Water Quality Swale

☐ Grass Channel

☐ Green Roof

☒ Other (describe): Stone Infiltration Trench

Standard 1: No New Untreated Discharges

☒ No new untreated discharges

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

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

Checklist for Stormwater Report

Checklist (continued)

Standard 2: Peak Rate Attenuation

☐ Standard 2 waiver requested because the project is located in land subject to coastal storm flowage and stormwater discharge is to a wetland subject to coastal flooding.

☐ Evaluation provided to determine whether off-site flooding increases during the 100-year 24-hour storm.

☒ Calculations provided to show that post-development peak discharge rates do not exceed pre-development rates for the 2-year and 10-year 24-hour storms. If evaluation shows that off-site flooding increases during the 100-year 24-hour storm, calculations are also provided to show that post-development peak discharge rates do not exceed pre-development rates for the 100-year 24-hour storm.

Standard 3: Recharge

☒ Soil Analysis provided.

☒ Required Recharge Volume calculation provided.

☐ Required Recharge volume reduced through use of the LID site Design Credits.

☒ Sizing the infiltration, BMPs is based on the following method: Check the method used.

☒ Static ☐ Simple Dynamic ☐ Dynamic Field[1]

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

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

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

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

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

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

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

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

Checklist for Stormwater Report

Checklist (continued)

Standard 3: Recharge (continued)

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

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

Standard 4: Water Quality

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

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

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

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

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

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

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

Checklist for Stormwater Report

Checklist (continued)

Standard 4: Water Quality (continued)

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

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

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

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

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

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

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

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

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

☐ All exposure has been eliminated.

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

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

Standard 6: Critical Areas

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

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

Checklist for Stormwater Report

Checklist (continued)

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

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

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

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

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

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

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

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

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

Checklist for Stormwater Report

Checklist (continued)

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

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

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

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

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

Standard 9: Operation and Maintenance Plan

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

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

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

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

Standard 10: Prohibition of Illicit Discharges

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

☒ An Illicit Discharge Compliance Statement is attached;

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

Appendix B – Illicit Discharge Compliance Statement

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2 Park Plaza, Suite 200, Boston, MA 02116
Phone: 617-242-1120

ILLICIT DISCHARGE STATEMENT

The stormwater management system is the system for conveying, treating, and detaining stormwater on-site, including stormwater best management practices and any pipes intended to transport stormwater to the groundwater, a surface water, or municipal separate storm sewer system. Illicit discharges to the stormwater management system are discharges that are not entirely comprised of stormwater. Notwithstanding the foregoing, an illicit discharge does not include discharges from the following activities or facilities: firefighting, water line flushing, landscape irrigation, uncontaminated groundwater, potable water sources, foundation drains, air conditioning condensation, footing drains, individual resident car washing, flows from riparian habitats and wetlands, dechlorinated water from swimming pools, water used for street washing and water used to clean residential buildings without detergents.

It is our belief and understanding, to the best of our knowledge, that there are no known illicit discharges on the site known as Large-Scale Solar Power Generation System in Holliston, Massachusetts.

D Howe

Devin P. Howe, P.E.

7.27.22

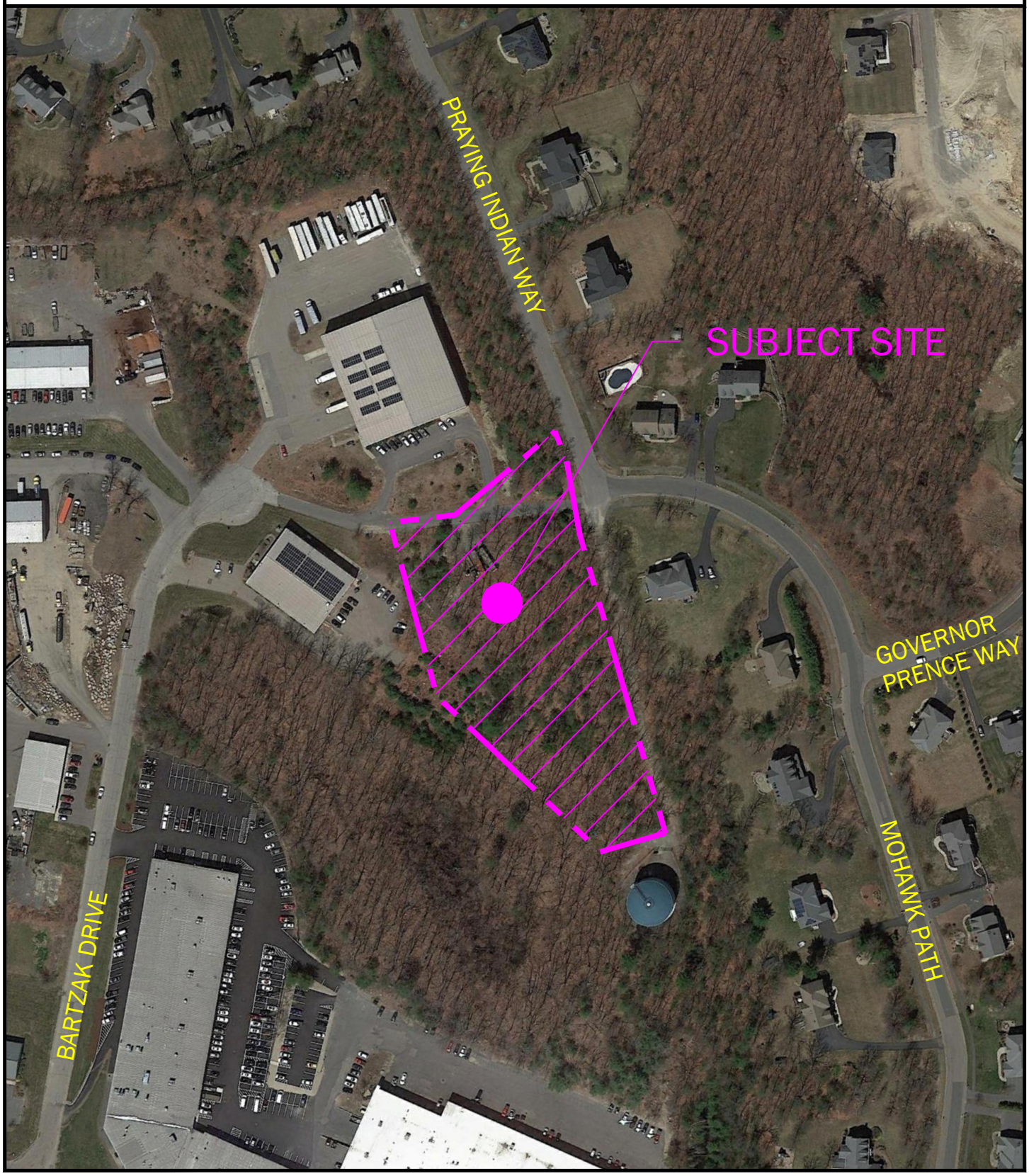
Date

Massachusetts 57328

Appendix C – Holliston Major Land Disturbance Permit Application

Appendix D – Location Maps and Figures

REFERENCES:
PROPERTY LINE INFORMATION OBTAINED FROM MASS GIS. AERIAL PHOTOGRAPHY OBTAINED FROM GOOGLE IMAGERY.



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2 PARK PLAZA SUITE 200 BOSTON, MA 02116
PHONE: 617-242-1120
•PLANNING •ENGINEERING •PERMITTING •MANAGEMENT

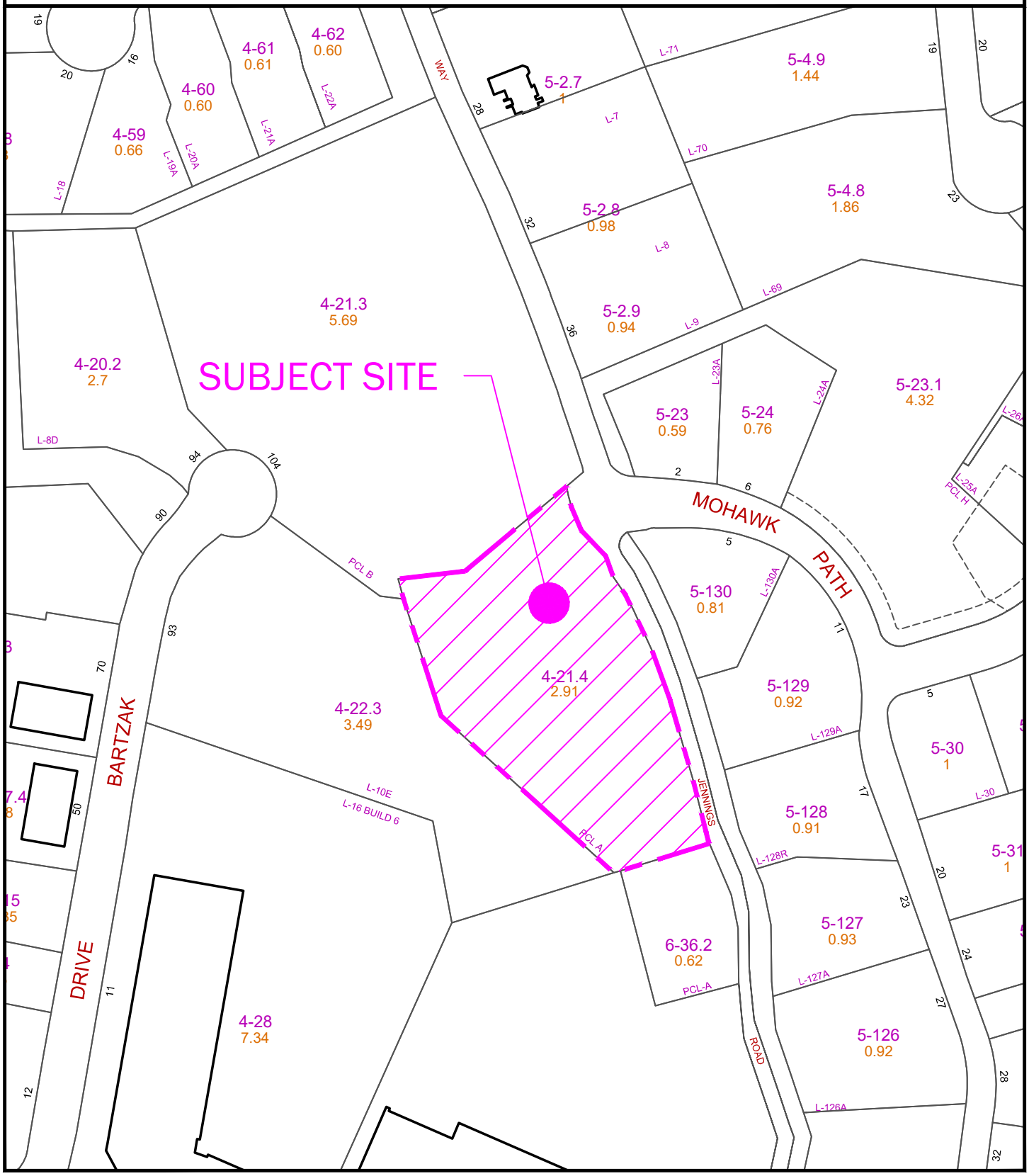
Aerial Image

Holliston
Massachusetts

Figure 1
Date:July 2022

SCALE: 1"=200'
0 100 200

REFERENCES:
PROPERTY LINE INFORMATION OBTAINED FROM MASS GIS. TAX MAP OBTAINED FROM TOWN OF HOLLISTON ASSESSOR'S DATABASE



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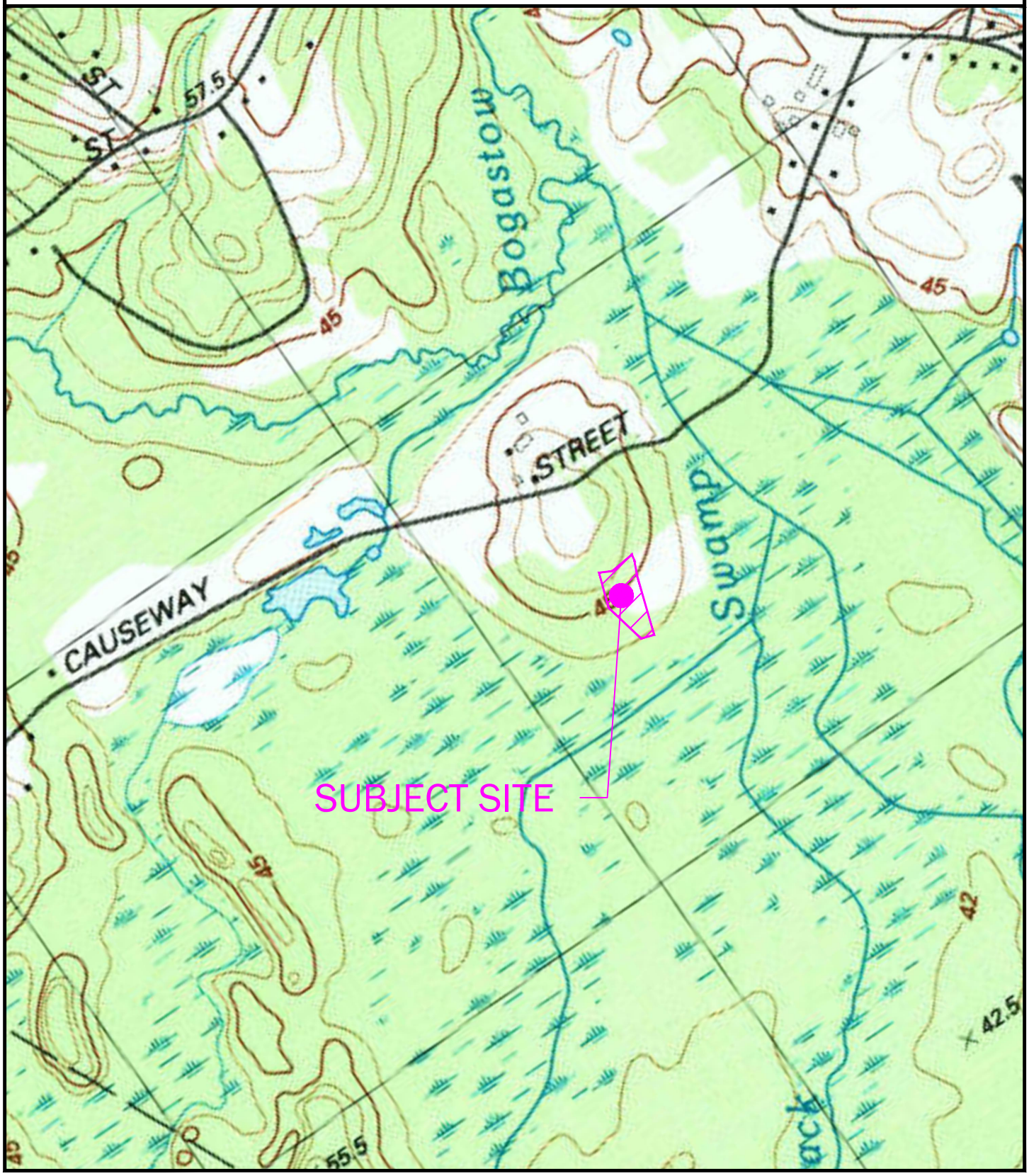
Tax Map

Holliston
Massachusetts

Figure 2
Date:July 2022

SCALE: 1"=200'
0 100 200

REFERENCES: PROPERTY LINE INFORMATION WAS OBTAINED FROM MASS GIS. USGS MAP WAS OBTAINED FROM USGS MEDFIELD MASSACHUSETTS TOPOGRAPHIC MAP DATED 1989.



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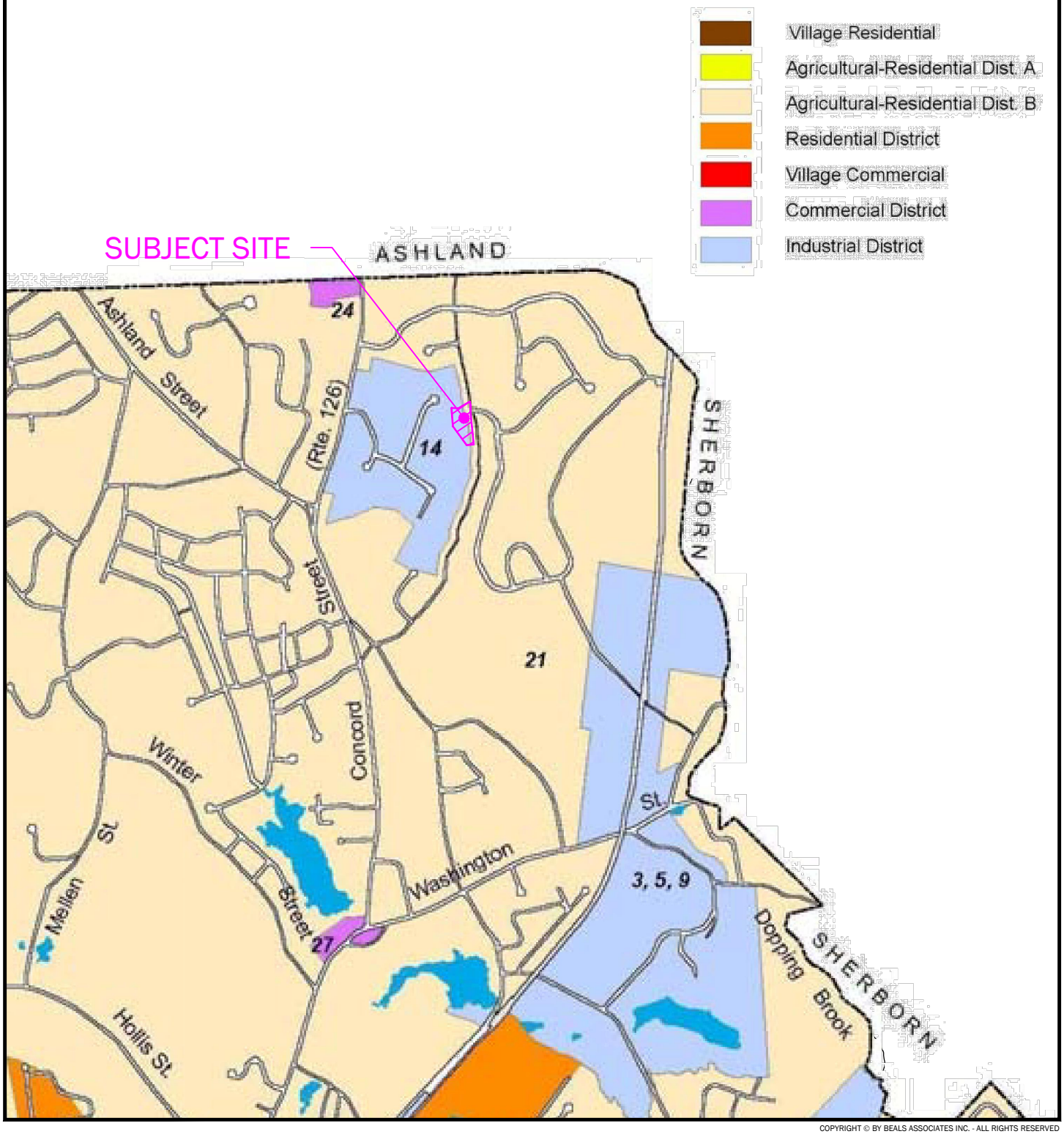
USGS Map

Holliston
Massachusetts

Figure 3
Date:July 2022

SCALE: 1"=1000'
0 500 1000

REFERENCES:
PROPERTY LINE INFORMATION OBTAINED FROM MASS GIS. ZONING MAP WAS OBTAINED FROM TOWN OF HOLLISTON MAPS ONLINE



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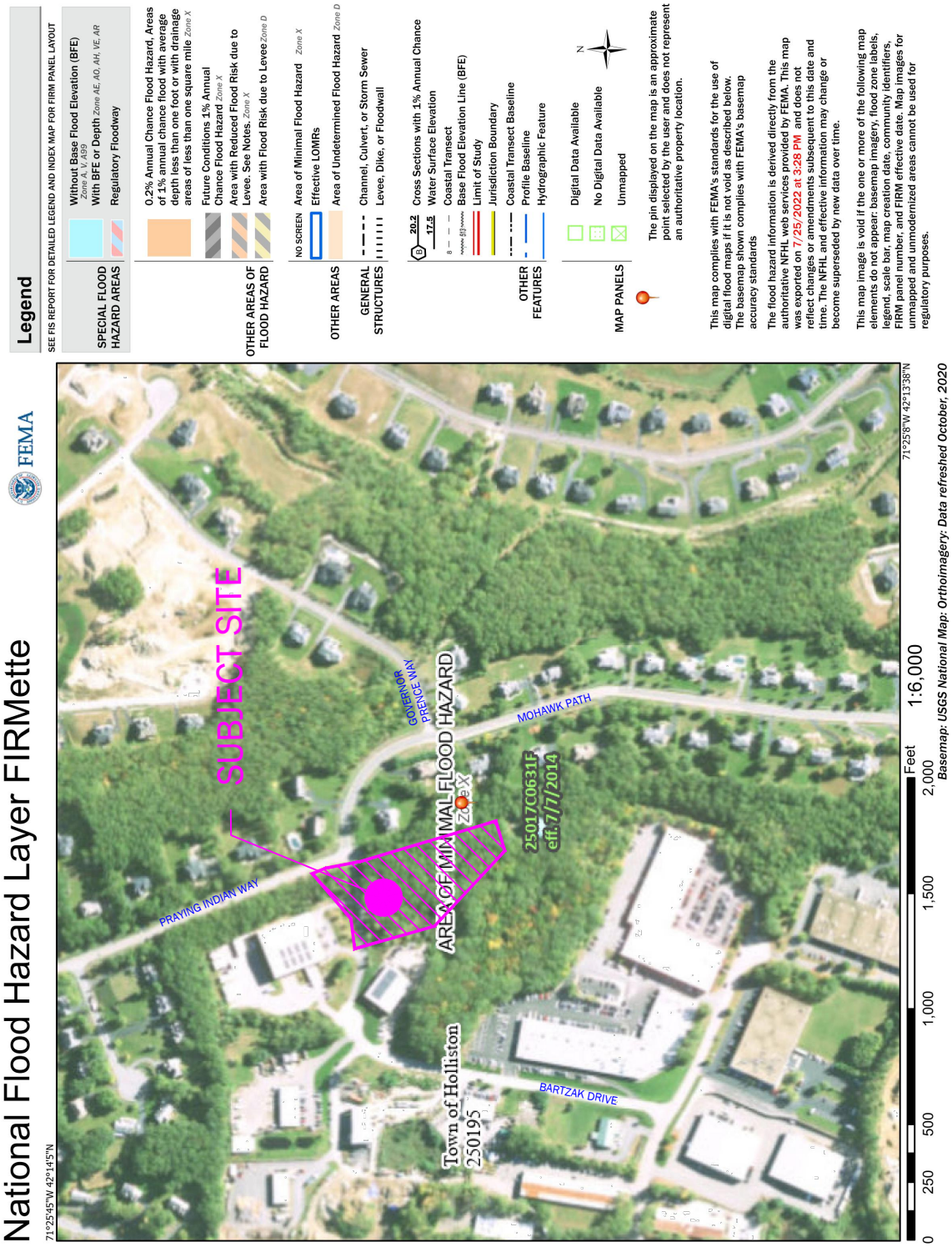
Zoning Map

Holliston
Massachusetts

Figure 4
Date:July 2022

SCALE: 1"=2000'
0 1000 2000

REFERENCES:
PROPERTY LINE INFORMATION OBTAINED FROM MASS GIS. FEMA WAS OBTAINED FROM FEMA FLOOD MAP SERVICE CENTER.



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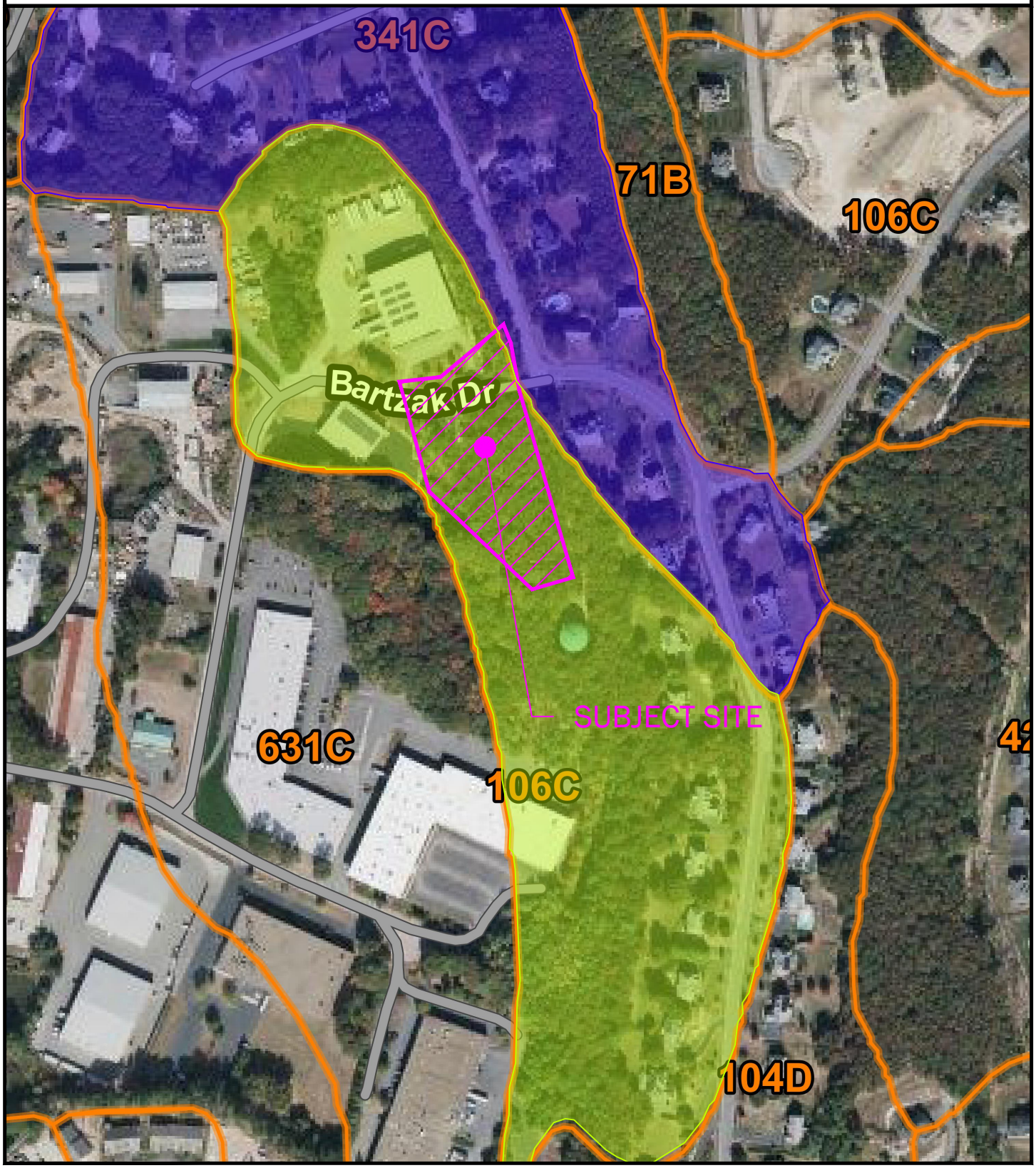
FEMA Map

Holliston
Massachusetts

Figure 5
Date:July 2022

N.T.S

REFERENCES:
INFORMATION OBTAINED FROM NRCS SOIL SURVEY.



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NRCS
Soil Report

Holliston
Massachusetts

Figure 6
Date:July 2022

N.T.S

REFERENCES:
INFORMATION OBTAINED FROM NRCS SOIL SURVEY.

MAP LEGEND		
MAP SYMBOL		MAP UNIT NAME
106 C		Narragansett–Hollis–Rock outcrop complex, 3 to 15% slope
341 C		Broadbrook very fine sandy loam, 8 to 15 % slope, very stony

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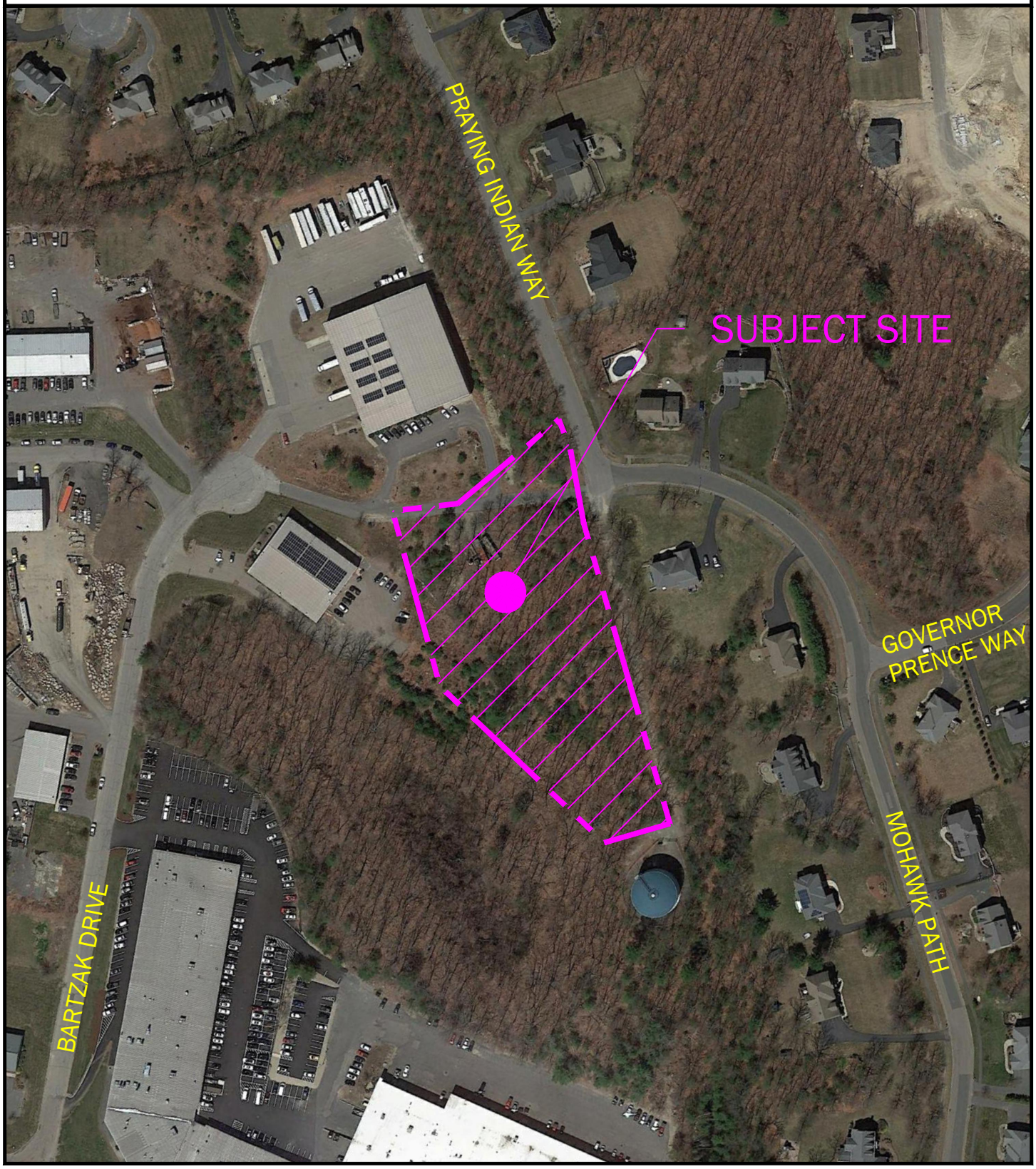
NRCS
Soil Report

Holliston
Massachusetts

Figure 6
Date:July 2022

N.T.S

REFERENCES:
PROPERTY LINE INFORMATION OBTAINED FROM MASS GIS. AERIAL PHOTOGRAPHY OBTAINED FROM GOOGLE IMAGERY. THERE ARE NO ESTIMATED OR PRIORITY HABITATS LOCATED WITH IN THE VICINITY.



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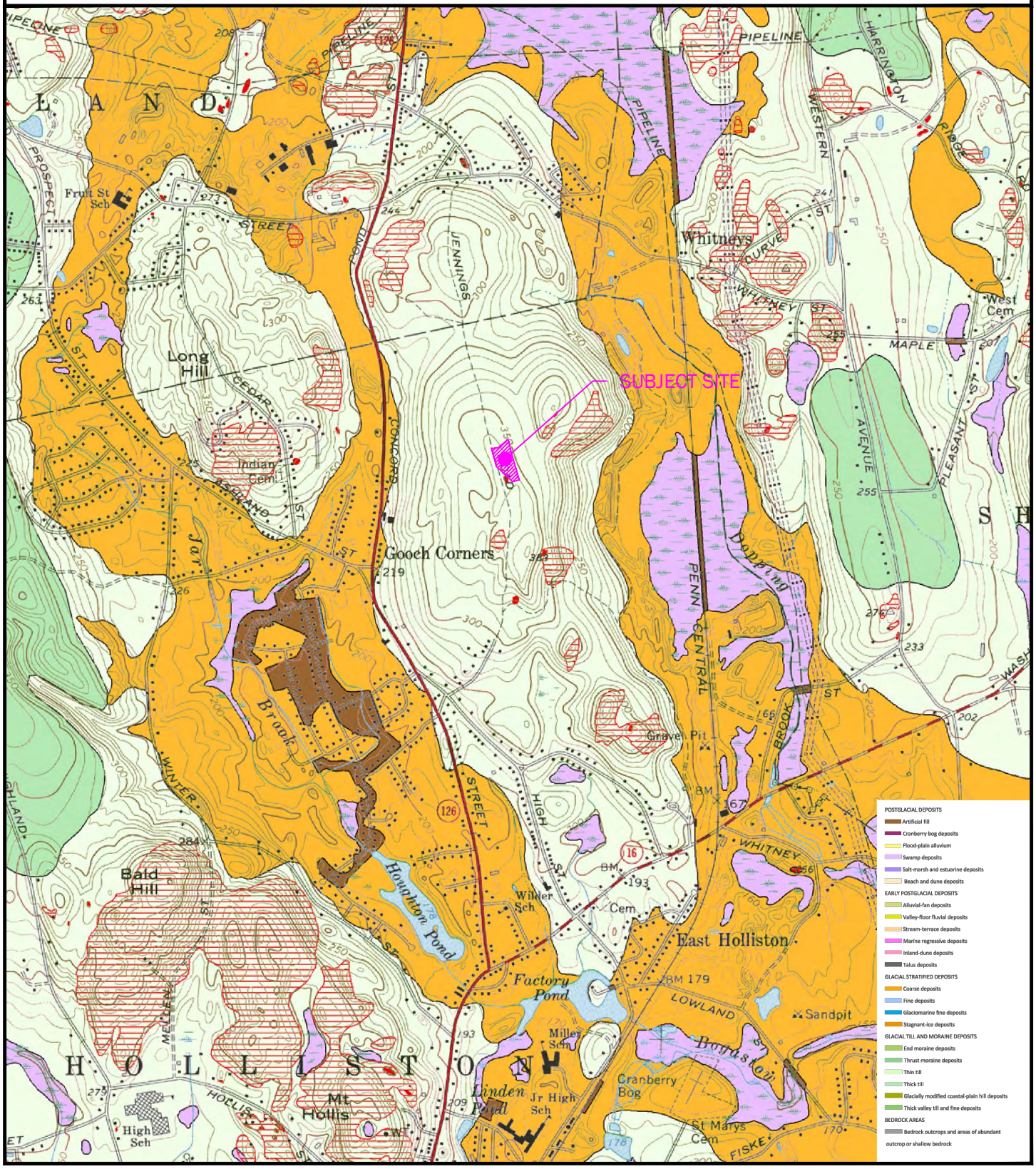
NHESP

Holliston
Massachusetts

Figure 7
Date:July 2022

SCALE: 1"=200'
0 100 200

REFERENCES:
INFORMATION OBTAINED FROM SURFICIAL MATERIALS MAP OF THE HOLLISTON QUADRANGLE, MASSACHUSETTS MAP PREPARED BY USGS IN COOPERATION WITH THE COMMONER WEALTH OF MASSACHUSETTS MASSACHUSETTS GEOLOGICAL SURVEY.



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Surficial Geology

Holliston
Massachusetts

Figure 8
Date:July 2022

SCALE: 1"=2000'
0 1000 2000

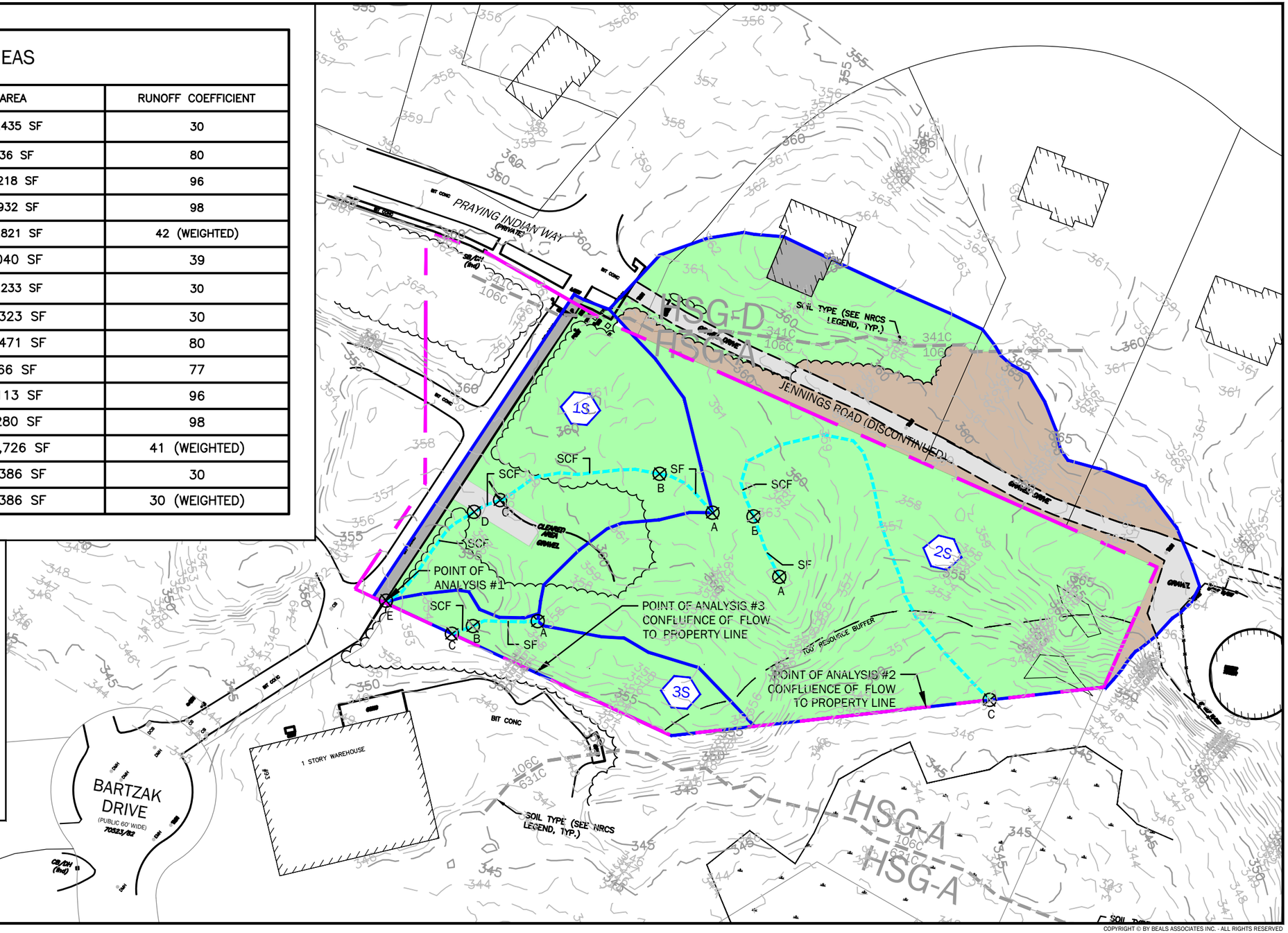
Appendix E – Watershed Maps

DRAINAGE AREAS

SUBCATCHMENT	DESCRIPTION	AREA	RUNOFF COEFFICIENT
1	MEADOW – NON–GRAZED, HSG A	25,435 SF	30
	GRASS – GOOD, HSG D	236 SF	80
	GRAVEL	1,218 SF	96
	IMPERVIOUS	3,932 SF	98
	TOTAL	30,821 SF	42 (WEIGHTED)
2	GRASS – GOOD, HSG A	3,040 SF	39
	MEADOW – NON–GRAZED, HSG A	72,233 SF	30
	WOODS – GOOD, HSG A	18,323 SF	30
	GRASS – GOOD, HSG D	12,471 SF	80
	WOODS – GOOD, HSG D	266 SF	77
	GRAVEL	7,113 SF	96
	IMPERVIOUS	1,280 SF	98
	TOTAL	114,726 SF	41 (WEIGHTED)
3	WOODS – GOOD, HSG A	10,386 SF	30
	TOTAL	10,386 SF	30 (WEIGHTED)

WATERSHED LEGEND

- PROJECT PROPERTY LINE
- TIME OF CONCENTRATION
- SUBCATCHMENT BOUNDARY
- OPEN SPACE – GOOD CONDITION
- GRAVEL – GOOD CONDITION
- WOODED – GOOD CONDITION
- IMPERVIOUS – PAVED
- (X) SUBCATCHMENT IDENTIFIER



PATH:H:\D-1278 Holliston\Autocad\Design Development\Figures Sketches Renderings\Watershed Map - Post Development.dwg

BEALS · ASSOCIATES INC.
2 PARK PLAZA SUITE 200 BOSTON, MA 02116
PHONE: 617-242-1120
•PLANNING •ENGINEERING •PERMITTING •MANAGEMENT

Galehead Development

Large-Scale Solar Power Generation System
0 Bartzak Drive
Holliston, MA

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

Sheet Title: Post-Development Watershed Map

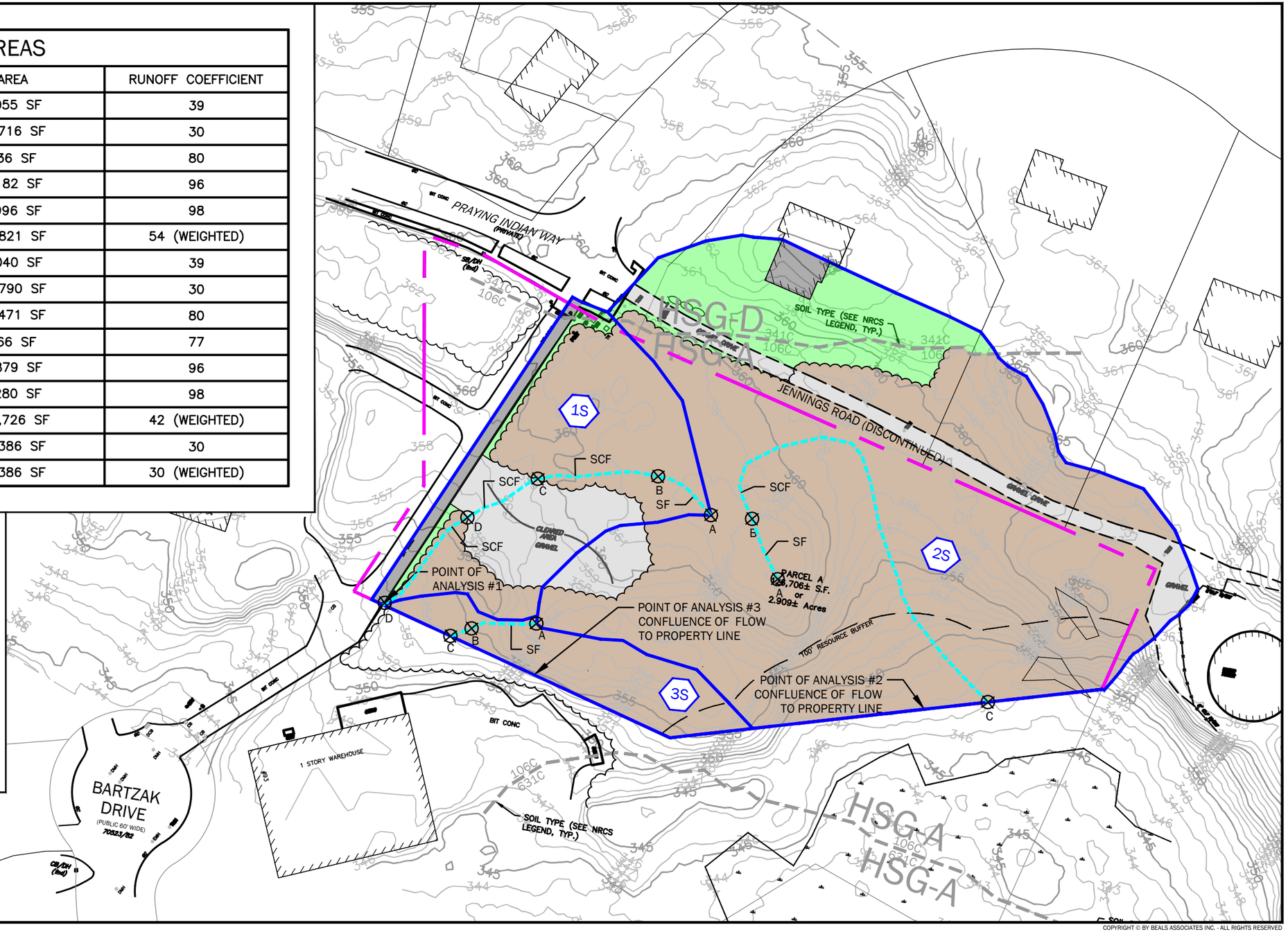
Sheet No: SK2
Date: July 27, 2022

DRAINAGE AREAS

SUBCATCHMENT	DESCRIPTION	AREA	RUNOFF COEFFICIENT
	GRASS – GOOD, HSG A	1,055 SF	39
	WOODS – GOOD, HSG A	18,716 SF	30
	GRASS – GOOD, HSG D	236 SF	80
	GRAVEL	8,182 SF	96
	IMPERVIOUS	1.996 SF	98
	TOTAL	30,821 SF	54 (WEIGHTED)
2	GRASS – GOOD, HSG A	3,040 SF	39
	WOODS – GOOD, HSG A	87,790 SF	30
	GRASS – GOOD, HSG D	12,471 SF	80
	WOODS – GOOD, HSG D	266 SF	77
	GRAVEL	9,879 SF	96
	IMPERVIOUS	1,280 SF	98
	TOTAL	114,726 SF	42 (WEIGHTED)
3	WOODS – GOOD, HSG A	10,386 SF	30
	TOTAL	10,386 SF	30 (WEIGHTED)

WATERSHED LEGEND

- PROJECT PROPERTY LINE
- TIME OF CONCENTRATION
- SUBCATCHMENT BOUNDARY
- OPEN SPACE – GOOD CONDITION
- GRAVEL – GOOD CONDITION
- WOODED – GOOD CONDITION
- IMPERVIOUS – PAVED
- X — SUBCATCHMENT IDENTIFIER



PATH:H:\D-1278 Holliston\Autocad\Design Development\Figures Sketches Renderings\Watershed Map - Pre Development.dwg

BEALS · ASSOCIATES INC.
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Galehead Development

Large-Scale Solar Power Generation System
0 Bartzak Drive
Holliston, MA

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

Sheet Title:
Pre-Development Watershed Map

Sheet No:
SK1
Date:
July 27, 2022

Appendix F – NRCS Soils Data

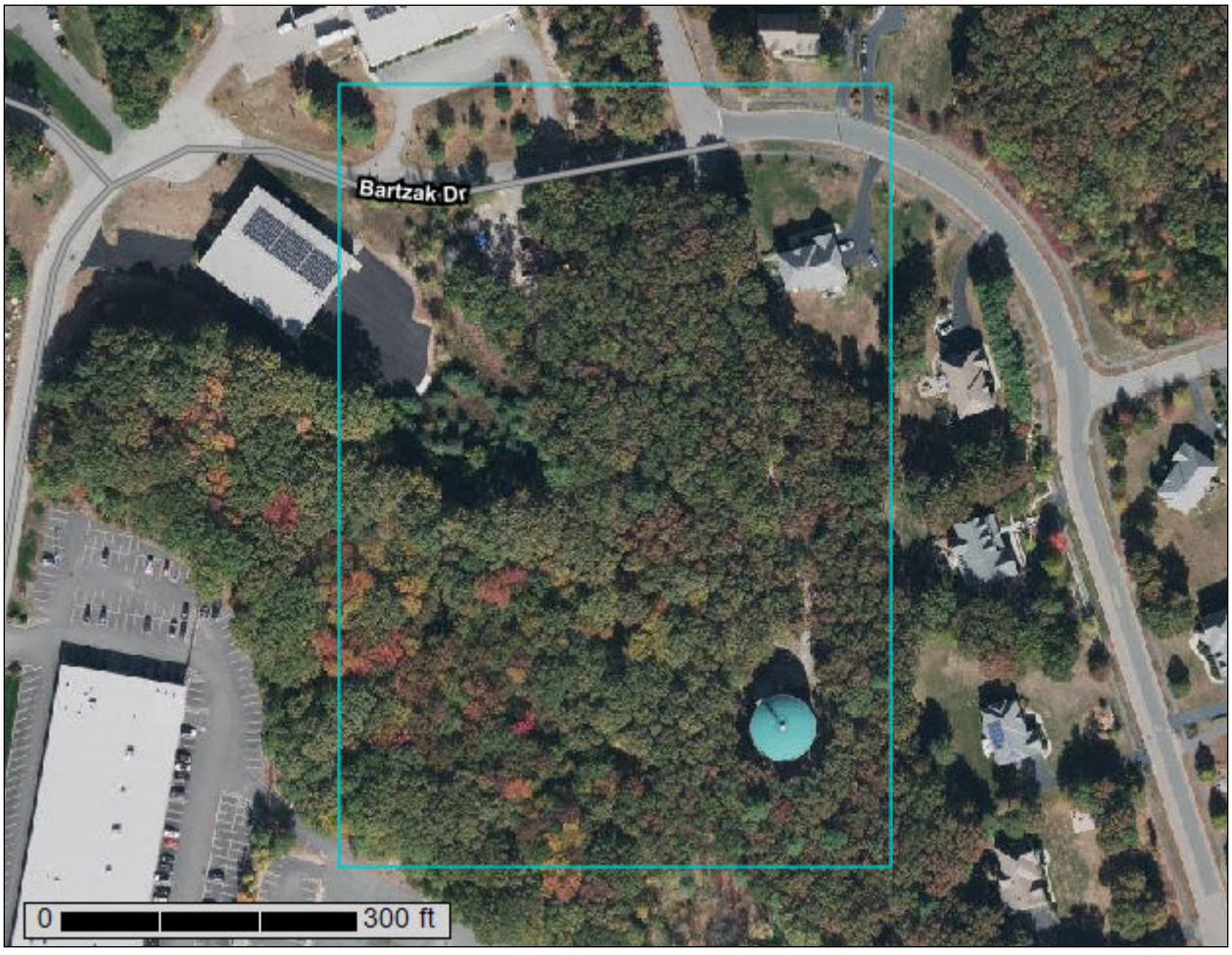
United States Department of Agriculture

NRCS

Natural Resources Conservation Service

A product of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local participants

Custom Soil Resource Report for Middlesex County, Massachusetts



June 20, 2022

Preface

Soil surveys contain information that affects land use planning in survey areas. They highlight soil limitations that affect various land uses and provide information about the properties of the soils in the survey areas. Soil surveys are designed for many different users, including farmers, ranchers, foresters, agronomists, urban planners, community officials, engineers, developers, builders, and home buyers. Also, conservationists, teachers, students, and specialists in recreation, waste disposal, and pollution control can use the surveys to help them understand, protect, or enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. Soil surveys identify soil properties that are used in making various land use or land treatment decisions. The information is intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Although soil survey information can be used for general farm, local, and wider area planning, onsite investigation is needed to supplement this information in some cases. Examples include soil quality assessments (http://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/health/) and certain conservation and engineering applications. For more detailed information, contact your local USDA Service Center (https://offices.sc.egov.usda.gov/locator/app?agency=nrcs) or your NRCS State Soil Scientist (http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/contactus/?cid=nrcs142p2_053951).

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

The National Cooperative Soil Survey is a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (NRCS) has leadership for the Federal part of the National Cooperative Soil Survey.

Information about soils is updated periodically. Updated information is available through the NRCS Web Soil Survey, the site for official soil survey information.

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Contents

How Soil Surveys Are Made

Soil surveys are made to provide information about the soils and miscellaneous areas in a specific area. They include a description of the soils and miscellaneous areas and their location on the landscape and tables that show soil properties and limitations affecting various uses. Soil scientists observed the steepness, length, and shape of the slopes; the general pattern of drainage; the kinds of crops and native plants; and the kinds of bedrock. They observed and described many soil profiles. A soil profile is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed or from the surface down to bedrock. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

Currently, soils are mapped according to the boundaries of major land resource areas (MLRAs). MLRAs are geographically associated land resource units that share common characteristics related to physiography, geology, climate, water resources, soils, biological resources, and land uses (USDA, 2006). Soil survey areas typically consist of parts of one or more MLRA.

The soils and miscellaneous areas in a survey area occur in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil and miscellaneous area is associated with a particular kind of landform or with a segment of the landform. By observing the soils and miscellaneous areas in the survey area and relating their position to specific segments of the landform, a soil scientist develops a concept, or model, of how they were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil or miscellaneous area at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-vegetation-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. Soil taxonomy, the system of taxonomic classification used in the United States, is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil

scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

The objective of soil mapping is not to delineate pure map unit components; the objective is to separate the landscape into landforms or landform segments that have similar use and management requirements. Each map unit is defined by a unique combination of soil components and/or miscellaneous areas in predictable proportions. Some components may be highly contrasting to the other components of the map unit. The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The delineation of such landforms and landform segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, onsite investigation is needed to define and locate the soils and miscellaneous areas.

Soil scientists make many field observations in the process of producing a soil map. The frequency of observation is dependent upon several factors, including scale of mapping, intensity of mapping, design of map units, complexity of the landscape, and experience of the soil scientist. Observations are made to test and refine the soil-landscape model and predictions and to verify the classification of the soils at specific locations. Once the soil-landscape model is refined, a significantly smaller number of measurements of individual soil properties are made and recorded. These measurements may include field measurements, such as those for color, depth to bedrock, and texture, and laboratory measurements, such as those for content of sand, silt, clay, salt, and other components. Properties of each soil typically vary from one point to another across the landscape.

Observations for map unit components are aggregated to develop ranges of characteristics for the components. The aggregated values are presented. Direct measurements do not exist for every property presented for every map unit component. Values for some properties are estimated from combinations of other properties.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses and under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot predict that a high water table will always be at a specific level in the soil on a specific date.

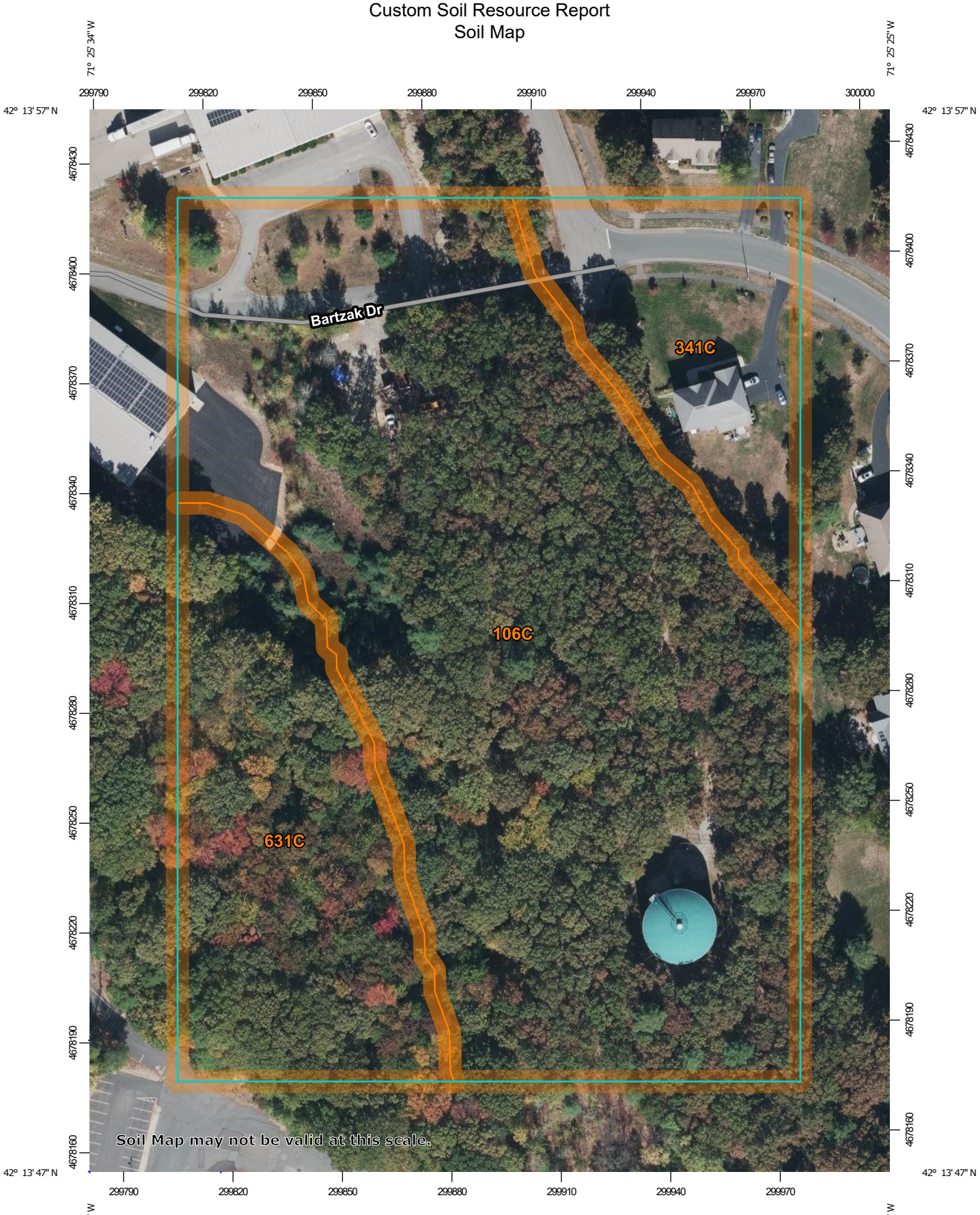
After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and

identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

Soil Map

The soil map section includes the soil map for the defined area of interest, a list of soil map units on the map and extent of each map unit, and cartographic symbols displayed on the map. Also presented are various metadata about data used to produce the map, and a description of each soil map unit.

Custom Soil Resource Report
Soil Map



Map Scale: 1:1,410 if printed on A portrait (8.5" x 11") sheet.

N

Meters: 0 20 40 80 120

Feet: 0 50 100 200 300

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

MAP LEGEND

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

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

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

Water Features
- Streams and Canals

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

Background
- Aerial Photography

MAP INFORMATION

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

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

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

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

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

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

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

Soil Survey Area: Middlesex County, Massachusetts
Survey Area Data: Version 21, Sep 2, 2021

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

Date(s) aerial images were photographed: Aug 31, 2020—Oct 22, 2020

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

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
106C	Narragansett-Hollis-Rock outcrop complex, 3 to 15 percent slopes	6.8	66.5%
341C	Broadbrook very fine sandy loam, 8 to 15 percent slopes, very stony	1.3	12.8%
631C	Charlton-Urban land-Hollis complex, 3 to 15 percent slopes, rocky	2.1	20.7%
Totals for Area of Interest		**10.2**	**100.0%**

Map Unit Descriptions

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

Middlesex County, Massachusetts

106C—Narragansett-Hollis-Rock outcrop complex, 3 to 15 percent slopes

Map Unit Setting

National map unit symbol: 98yk
Elevation: 0 to 1,000 feet
Mean annual precipitation: 45 to 54 inches
Mean annual air temperature: 43 to 54 degrees F
Frost-free period: 110 to 240 days
Farmland classification: Not prime farmland

Map Unit Composition

Narragansett and similar soils: 45 percent
Hollis and similar soils: 20 percent
Rock outcrop: 10 percent
Minor components: 25 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Narragansett

Setting

Landform: Hills, ridges
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Base slope
Down-slope shape: Linear
Across-slope shape: Convex
Parent material: Friable silty eolian deposits and/or friable loamy eolian deposits over loose sandy glaciofluvial deposits derived from metamorphic rock and/or friable sandy basal till derived from metamorphic rock

Typical profile

Oi - 0 to 2 inches: slightly decomposed plant material
A - 2 to 7 inches: silt loam
Bw - 7 to 35 inches: silt loam
2C1 - 35 to 60 inches: very gravelly loamy sand
2C2 - 60 to 65 inches: very gravelly loamy sand

Properties and qualities

Slope: 3 to 15 percent
Surface area covered with cobbles, stones or boulders: 1.6 percent
Depth to restrictive feature: 18 to 35 inches to strongly contrasting textural stratification
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 6.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Moderate (about 6.4 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6s

Hydrologic Soil Group: A
Ecological site: F144AY034CT - Well Drained Till Uplands
Hydric soil rating: No

Description of Hollis

Setting

Landform: Ridges, hills
Landform position (two-dimensional): Shoulder, summit
Landform position (three-dimensional): Head slope, crest
Down-slope shape: Linear
Across-slope shape: Convex
Parent material: Friable, shallow loamy basal till over granite and gneiss

Typical profile

H1 - 0 to 2 inches: fine sandy loam
H2 - 2 to 14 inches: fine sandy loam
H3 - 14 to 18 inches: unweathered bedrock

Properties and qualities

Slope: 3 to 15 percent
Surface area covered with cobbles, stones or boulders: 1.6 percent
Depth to restrictive feature: 8 to 20 inches to lithic bedrock
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.14 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Very low (about 2.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6s
Hydrologic Soil Group: D
Ecological site: F144AY033MA - Shallow Dry Till Uplands
Hydric soil rating: No

Description of Rock Outcrop

Setting

Landform: Ledges
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Head slope
Down-slope shape: Concave
Across-slope shape: Concave
Parent material: Granite and gneiss

Properties and qualities

Slope: 3 to 15 percent
Depth to restrictive feature: 0 inches to lithic bedrock

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 8s

Minor Components

Canton

Percent of map unit: 9 percent
Landform: Hills
Landform position (two-dimensional): Backslope, toeslope
Landform position (three-dimensional): Side slope, base slope
Down-slope shape: Linear
Across-slope shape: Convex
Hydric soil rating: No

Charlton

Percent of map unit: 6 percent
Landform: Hills, swales
Landform position (two-dimensional): Shoulder, summit
Landform position (three-dimensional): Side slope, base slope
Down-slope shape: Convex
Across-slope shape: Convex
Hydric soil rating: No

Scituate

Percent of map unit: 5 percent
Landform: Depressions, hillslopes
Landform position (two-dimensional): Toeslope, summit
Landform position (three-dimensional): Head slope, base slope
Down-slope shape: Linear
Across-slope shape: Concave
Hydric soil rating: No

Unnamed

Percent of map unit: 5 percent

341C—Broadbrook very fine sandy loam, 8 to 15 percent slopes, very stony

Map Unit Setting

National map unit symbol: 9937
Elevation: 110 to 560 feet
Mean annual precipitation: 45 to 54 inches
Mean annual air temperature: 43 to 54 degrees F
Frost-free period: 145 to 240 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Broadbrook and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Broadbrook

Setting

Landform: Hillslopes
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Convex
Parent material: Friable silty eolian deposits over dense loamy lodgment till derived from gneiss

Typical profile

H1 - 0 to 2 inches: moderately decomposed plant material
H2 - 2 to 10 inches: very fine sandy loam
H3 - 10 to 20 inches: gravelly very fine sandy loam
H4 - 20 to 65 inches: gravelly fine sandy loam

Properties and qualities

Slope: 8 to 15 percent
Surface area covered with cobbles, stones or boulders: 1.6 percent
Depth to restrictive feature: 18 to 39 inches to densic material
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Low to moderately high (0.01 to 0.20 in/hr)
Depth to water table: About 18 to 24 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Low (about 4.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6s
Hydrologic Soil Group: D
Ecological site: F144AY007CT - Well Drained Dense Till Uplands
Hydric soil rating: No

Minor Components

Paxton

Percent of map unit: 12 percent
Landform: Hillslopes
Landform position (two-dimensional): Backslope, summit
Landform position (three-dimensional): Head slope, side slope
Down-slope shape: Convex
Across-slope shape: Convex
Hydric soil rating: No

Rainbow

Percent of map unit: 3 percent
Landform: Hillslopes
Landform position (two-dimensional): Shoulder, toeslope
Landform position (three-dimensional): Nose slope, base slope
Down-slope shape: Linear
Across-slope shape: Concave
Hydric soil rating: No

631C—Charlton-Urban land-Hollis complex, 3 to 15 percent slopes, rocky

Map Unit Setting

National map unit symbol: vr1g
Elevation: 0 to 1,000 feet
Mean annual precipitation: 32 to 54 inches
Mean annual air temperature: 43 to 54 degrees F
Frost-free period: 110 to 240 days
Farmland classification: Not prime farmland

Map Unit Composition

Charlton and similar soils: 45 percent
Urban land: 35 percent
Hollis and similar soils: 10 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Charlton

Setting

Landform: Ground moraines, drumlins
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Convex
Parent material: Friable loamy eolian deposits over friable loamy basal till derived from granite and gneiss

Typical profile

H1 - 0 to 5 inches: fine sandy loam
H2 - 5 to 22 inches: sandy loam
H3 - 22 to 65 inches: gravelly sandy loam

Properties and qualities

Slope: 3 to 15 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 6.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Moderate (about 7.3 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: A
Ecological site: F144AY034CT - Well Drained Till Uplands

Hydric soil rating: No

Description of Urban Land

Setting

Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Base slope
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Excavated and filled land

Description of Hollis

Setting

Landform: Hillslopes, ridges
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Convex
Parent material: Friable, shallow loamy basal till over granite and gneiss

Typical profile

H1 - 0 to 2 inches: fine sandy loam
H2 - 2 to 14 inches: fine sandy loam
H3 - 14 to 18 inches: unweathered bedrock

Properties and qualities

Slope: 3 to 15 percent
Surface area covered with cobbles, stones or boulders: 9.0 percent
Depth to restrictive feature: 8 to 20 inches to lithic bedrock
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.14 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Very low (about 2.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6s
Hydrologic Soil Group: D
Ecological site: F144AY033MA - Shallow Dry Till Uplands
Hydric soil rating: No

Minor Components

Canton

Percent of map unit: 4 percent
Landform: Hills
Landform position (two-dimensional): Backslope, toeslope
Landform position (three-dimensional): Base slope, side slope
Down-slope shape: Linear
Across-slope shape: Convex
Hydric soil rating: No

Udorthents, loamy

Percent of map unit: 2 percent

Hydric soil rating: No

Rock outcrop

Percent of map unit: 2 percent
Landform: Ledges
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Head slope
Down-slope shape: Concave
Across-slope shape: Concave

Scituate

Percent of map unit: 1 percent
Landform: Hillslopes, depressions
Landform position (two-dimensional): Toeslope, summit
Landform position (three-dimensional): Base slope, head slope
Down-slope shape: Linear
Across-slope shape: Concave
Hydric soil rating: No

Montauk

Percent of map unit: 1 percent
Landform: Hillslopes
Landform position (two-dimensional): Shoulder, summit
Landform position (three-dimensional): Nose slope, head slope
Down-slope shape: Convex
Across-slope shape: Convex
Hydric soil rating: No

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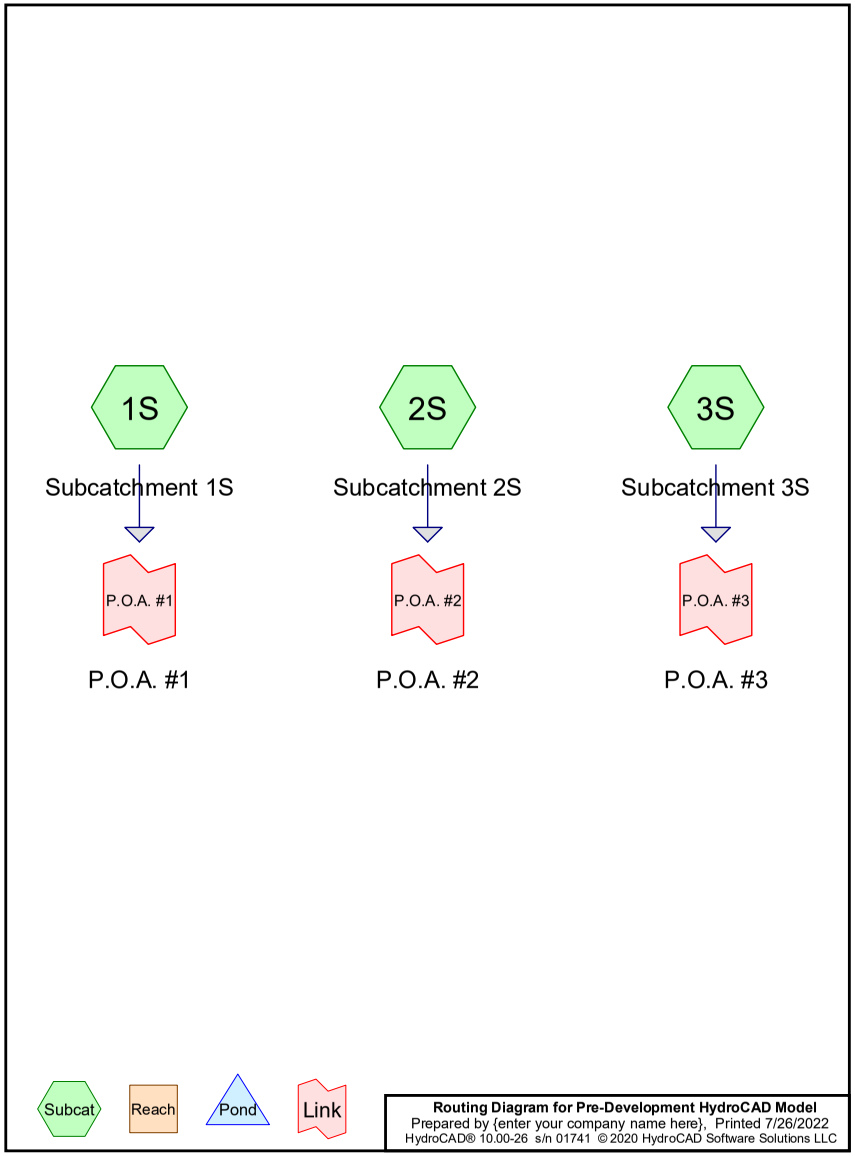
Appendix G – Calculations

Appendix G.1 – Pre-Development HydroCAD Report



Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
0.094	39	>75% Grass cover, Good, HSG A (1S, 2S)
0.292	80	>75% Grass cover, Good, HSG D (1S, 2S)
0.415	96	Gravel (1S, 2S)
0.090	98	Impervious (1S, 2S)
2.683	30	Woods, Good, HSG A (1S, 2S, 3S)
0.006	77	Woods, Good, HSG D (2S)
3.580	**44**	**TOTAL AREA**

Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
2.777	HSG A	1S, 2S, 3S
0.000	HSG B	
0.000	HSG C	
0.298	HSG D	1S, 2S
0.504	Other	1S, 2S
3.580		**TOTAL AREA**

Ground Covers (all nodes)

HSG-A (acres)	HSG-B (acres)	HSG-C (acres)	HSG-D (acres)	Other (acres)	Total (acres)	Ground Cover	Subcatchment Numbers
0.094	0.000	0.000	0.292	0.000	0.386	>75% Grass cover, Good	1S, 2S
0.000	0.000	0.000	0.000	0.415	0.415	Gravel	1S, 2S
0.000	0.000	0.000	0.000	0.090	0.090	Impervious	1S, 2S
2.683	0.000	0.000	0.006	0.000	2.690	Woods, Good	1S, 2S, 3S
2.777	**0.000**	**0.000**	**0.298**	**0.504**	**3.580**	**TOTAL AREA**	

Time span=0.00-80.00 hrs, dt=0.01 hrs, 8001 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment1S: Subcatchment1S Runoff Area=30,821 sf 8.54% Impervious Runoff Depth=0.27"
Flow Length=298' Tc=16.0 min CN=54 Runoff=0.07 cfs 0.016 af

Subcatchment2S: Subcatchment2S Runoff Area=114,726 sf 1.12% Impervious Runoff Depth=0.02"
Flow Length=408' Tc=17.9 min CN=42 Runoff=0.01 cfs 0.005 af

Subcatchment3S: Subcatchment3S Runoff Area=10,386 sf 0.00% Impervious Runoff Depth=0.00"
Flow Length=67' Tc=7.7 min CN=30 Runoff=0.00 cfs 0.000 af

Link P.O.A. #1: P.O.A. #1 Inflow=0.07 cfs 0.016 af
Primary=0.07 cfs 0.016 af

Link P.O.A. #2: P.O.A. #2 Inflow=0.01 cfs 0.005 af
Primary=0.01 cfs 0.005 af

Link P.O.A. #3: P.O.A. #3 Inflow=0.00 cfs 0.000 af
Primary=0.00 cfs 0.000 af

Total Runoff Area = 3.580 ac Runoff Volume = 0.021 af Average Runoff Depth = 0.07"
97.49% Pervious = 3.490 ac 2.51% Impervious = 0.090 ac

Summary for Subcatchment 1S: Subcatchment 1S

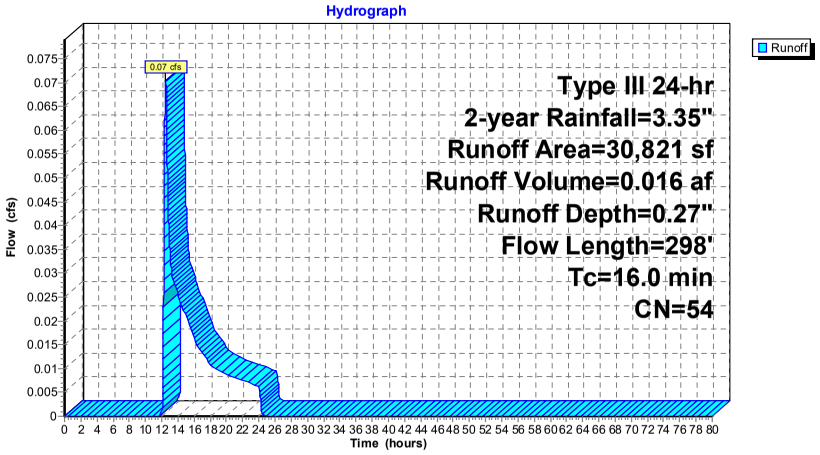
Runoff = 0.07 cfs @ 12.49 hrs, Volume= 0.016 af, Depth= 0.27"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-80.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-year Rainfall=3.35"

	Area (sf)	CN	Description
*	8,182	96	Gravel
*	2,632	98	Impervious
	236	80	>75% Grass cover, Good, HSG D
	1,055	39	>75% Grass cover, Good, HSG A
	18,716	30	Woods, Good, HSG A
	30,821	54	Weighted Average
	28,189		91.46% Pervious Area
	2,632		8.54% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.3	50	0.0200	0.07		**Sheet Flow, A-B** Woods: Light underbrush n= 0.400 P2= 3.20"
1.9	92	0.0270	0.82		**Shallow Concentrated Flow, B-C** Woodland Kv= 5.0 fps
0.3	62	0.0400	3.22		**Shallow Concentrated Flow, C-D** Unpaved Kv= 16.1 fps
1.5	94	0.0425	1.03		**Shallow Concentrated Flow, D-E** Woodland Kv= 5.0 fps
16.0	298	Total			

Subcatchment 1S: Subcatchment 1S



Summary for Subcatchment 2S: Subcatchment 2S

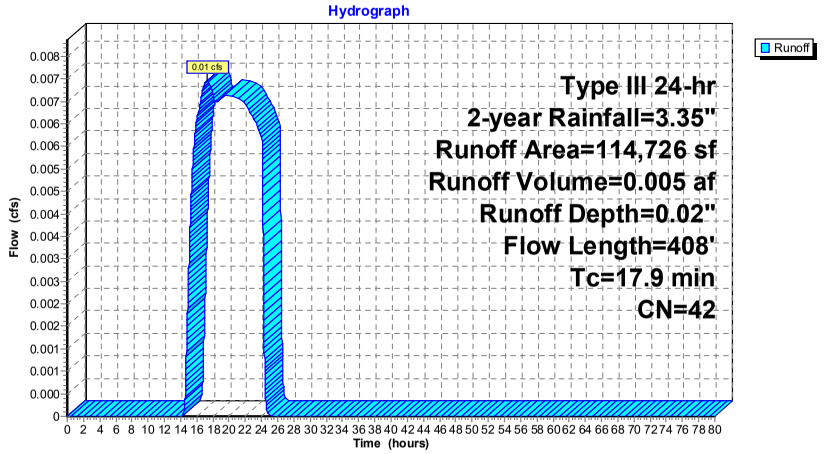
Runoff = 0.01 cfs @ 17.28 hrs, Volume= 0.005 af, Depth= 0.02"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-80.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-year Rainfall=3.35"

	Area (sf)	CN	Description
*	1,280	98	Impervious
*	9,879	96	Gravel
	12,471	80	>75% Grass cover, Good, HSG D
	3,040	39	>75% Grass cover, Good, HSG A
	266	77	Woods, Good, HSG D
	87,790	30	Woods, Good, HSG A
	114,726	42	Weighted Average
	113,446		98.88% Pervious Area
	1,280		1.12% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.3	50	0.0200	0.07		**Sheet Flow, A-B** Woods: Light underbrush n= 0.400 P2= 3.20"
5.6	358	0.0447	1.06		**Shallow Concentrated Flow, B-C** Woodland Kv= 5.0 fps
17.9	408	Total			

Subcatchment 2S: Subcatchment 2S



Summary for Subcatchment 3S: Subcatchment 3S

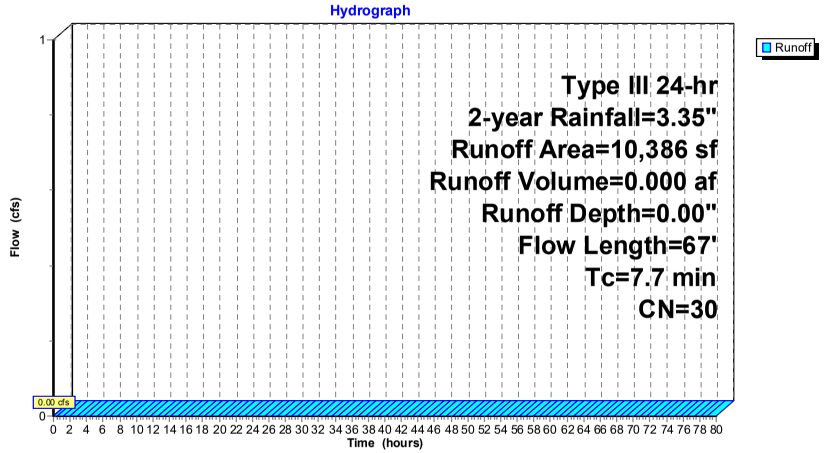
Runoff = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Depth= 0.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-80.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-year Rainfall=3.35"

Area (sf)	CN	Description
10,386	30	Woods, Good, HSG A
10,386		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.5	50	0.0700	0.11		**Sheet Flow, A-B** Woods: Light underbrush n= 0.400 P2= 3.20"
0.2	17	0.0588	1.21		**Shallow Concentrated Flow, B-C** Woodland Kv= 5.0 fps
7.7	67	Total			

Subcatchment 3S: Subcatchment 3S

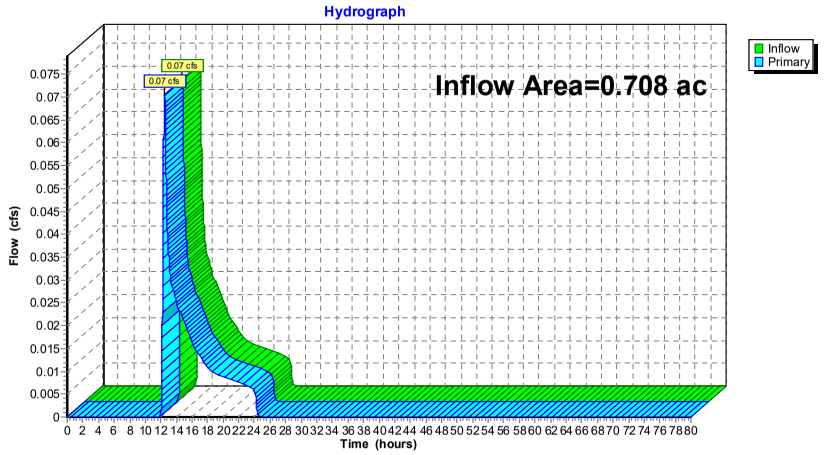


Summary for Link P.O.A. #1: P.O.A. #1

Inflow Area = 0.708 ac, 8.54% Impervious, Inflow Depth = 0.27" for 2-year event
Inflow = 0.07 cfs @ 12.49 hrs, Volume= 0.016 af
Primary = 0.07 cfs @ 12.49 hrs, Volume= 0.016 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-80.00 hrs, dt= 0.01 hrs

Link P.O.A. #1: P.O.A. #1

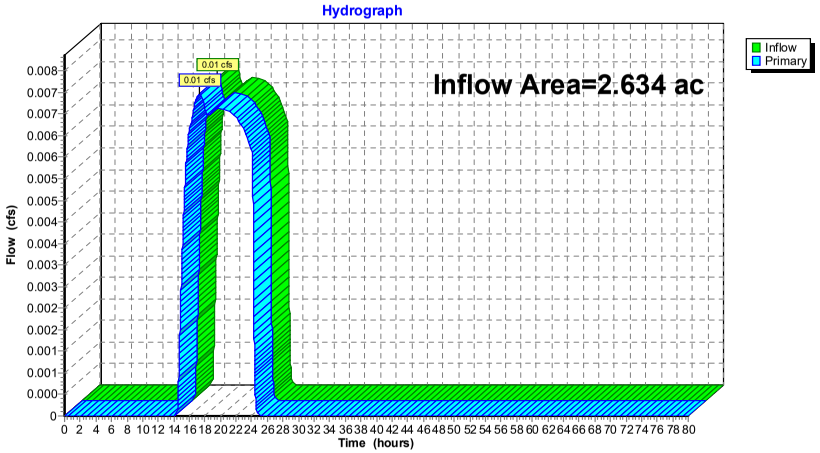


Summary for Link P.O.A. #2: P.O.A. #2

Inflow Area = 2.634 ac, 1.12% Impervious, Inflow Depth = 0.02" for 2-year event
Inflow = 0.01 cfs @ 17.28 hrs, Volume= 0.005 af
Primary = 0.01 cfs @ 17.28 hrs, Volume= 0.005 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-80.00 hrs, dt= 0.01 hrs

Link P.O.A. #2: P.O.A. #2

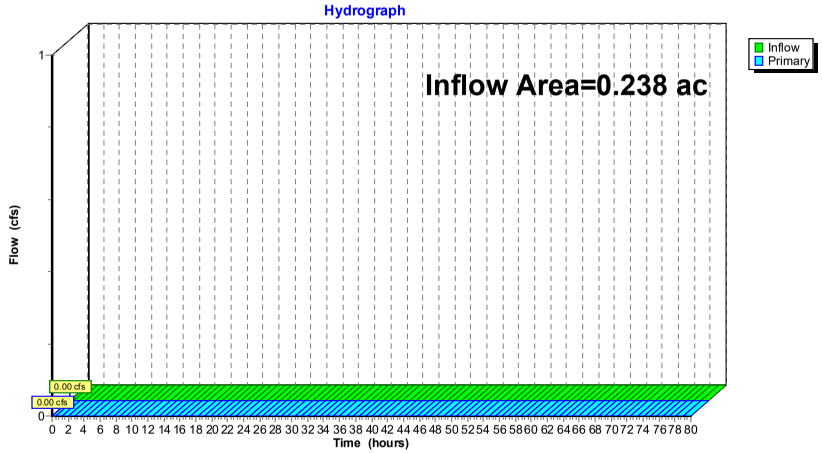


Summary for Link P.O.A. #3: P.O.A. #3

Inflow Area = 0.238 ac, 0.00% Impervious, Inflow Depth = 0.00" for 2-year event
Inflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-80.00 hrs, dt= 0.01 hrs

Link P.O.A. #3: P.O.A. #3



Time span=0.00-80.00 hrs, dt=0.01 hrs, 8001 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment1S: Subcatchment1S Runoff Area=30,821 sf 8.54% Impervious Runoff Depth=1.04"
Flow Length=298' Tc=16.0 min CN=54 Runoff=0.51 cfs 0.061 af

Subcatchment2S: Subcatchment2S Runoff Area=114,726 sf 1.12% Impervious Runoff Depth=0.38"
Flow Length=408' Tc=17.9 min CN=42 Runoff=0.34 cfs 0.083 af

Subcatchment3S: Subcatchment3S Runoff Area=10,386 sf 0.00% Impervious Runoff Depth=0.01"
Flow Length=67' Tc=7.7 min CN=30 Runoff=0.00 cfs 0.000 af

Link P.O.A. #1: P.O.A. #1 Inflow=0.51 cfs 0.061 af
Primary=0.51 cfs 0.061 af

Link P.O.A. #2: P.O.A. #2 Inflow=0.34 cfs 0.083 af
Primary=0.34 cfs 0.083 af

Link P.O.A. #3: P.O.A. #3 Inflow=0.00 cfs 0.000 af
Primary=0.00 cfs 0.000 af

Total Runoff Area = 3.580 ac Runoff Volume = 0.145 af Average Runoff Depth = 0.49"
97.49% Pervious = 3.490 ac 2.51% Impervious = 0.090 ac

Summary for Subcatchment 1S: Subcatchment 1S

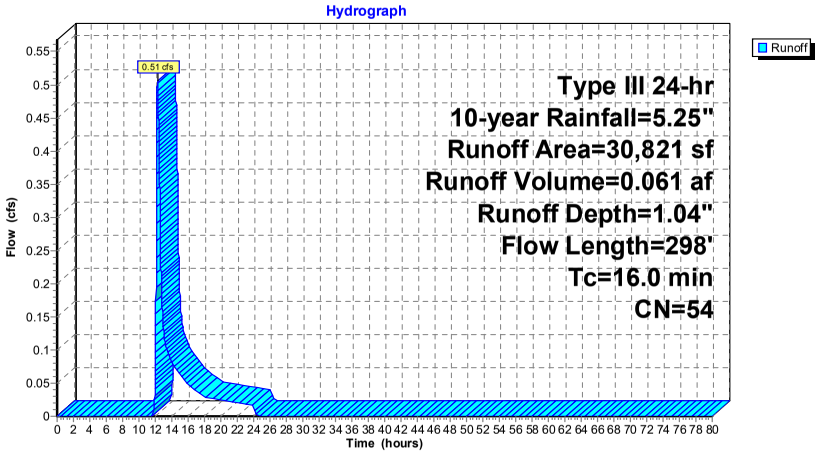
Runoff = 0.51 cfs @ 12.26 hrs, Volume= 0.061 af, Depth= 1.04"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-80.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-year Rainfall=5.25"

	Area (sf)	CN	Description
*	8,182	96	Gravel
*	2,632	98	Impervious
	236	80	>75% Grass cover, Good, HSG D
	1,055	39	>75% Grass cover, Good, HSG A
	18,716	30	Woods, Good, HSG A
	30,821	54	Weighted Average
	28,189		91.46% Pervious Area
	2,632		8.54% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.3	50	0.0200	0.07		**Sheet Flow, A-B** Woods: Light underbrush n= 0.400 P2= 3.20"
1.9	92	0.0270	0.82		**Shallow Concentrated Flow, B-C** Woodland Kv= 5.0 fps
0.3	62	0.0400	3.22		**Shallow Concentrated Flow, C-D** Unpaved Kv= 16.1 fps
1.5	94	0.0425	1.03		**Shallow Concentrated Flow, D-E** Woodland Kv= 5.0 fps
16.0	298	Total			

Subcatchment 1S: Subcatchment 1S



Summary for Subcatchment 2S: Subcatchment 2S

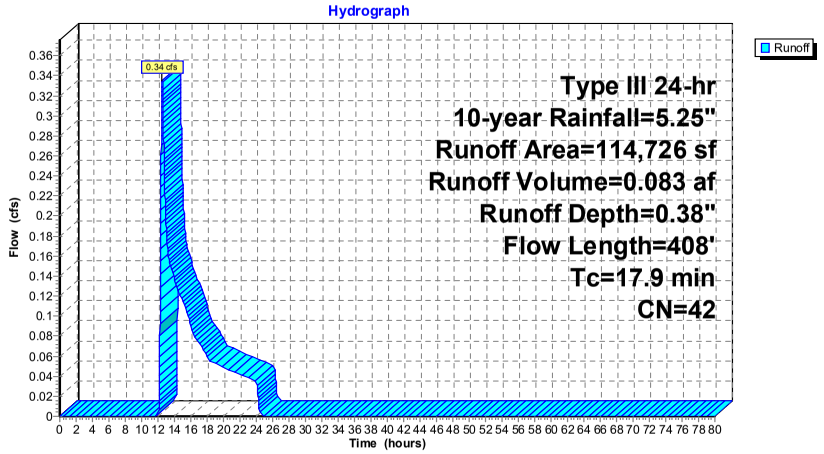
Runoff = 0.34 cfs @ 12.53 hrs, Volume= 0.083 af, Depth= 0.38"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-80.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-year Rainfall=5.25"

	Area (sf)	CN	Description
*	1,280	98	Impervious
*	9,879	96	Gravel
	12,471	80	>75% Grass cover, Good, HSG D
	3,040	39	>75% Grass cover, Good, HSG A
	266	77	Woods, Good, HSG D
	87,790	30	Woods, Good, HSG A
	114,726	42	Weighted Average
	113,446		98.88% Pervious Area
	1,280		1.12% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.3	50	0.0200	0.07		**Sheet Flow, A-B** Woods: Light underbrush n= 0.400 P2= 3.20"
5.6	358	0.0447	1.06		**Shallow Concentrated Flow, B-C** Woodland Kv= 5.0 fps
17.9	408	Total			

Subcatchment 2S: Subcatchment 2S



Summary for Subcatchment 3S: Subcatchment 3S

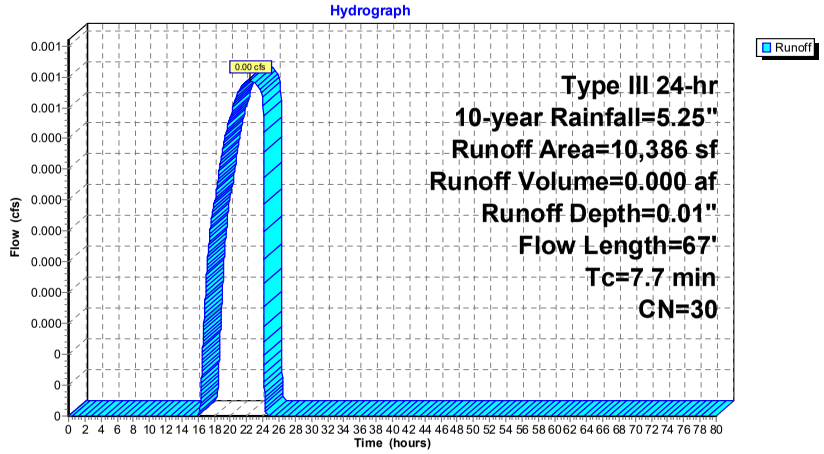
Runoff = 0.00 cfs @ 22.39 hrs, Volume= 0.000 af, Depth= 0.01"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-80.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-year Rainfall=5.25"

Area (sf)	CN	Description
10,386	30	Woods, Good, HSG A
10,386		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.5	50	0.0700	0.11		**Sheet Flow, A-B** Woods: Light underbrush n= 0.400 P2= 3.20"
0.2	17	0.0588	1.21		**Shallow Concentrated Flow, B-C** Woodland Kv= 5.0 fps
7.7	67	Total			

Subcatchment 3S: Subcatchment 3S

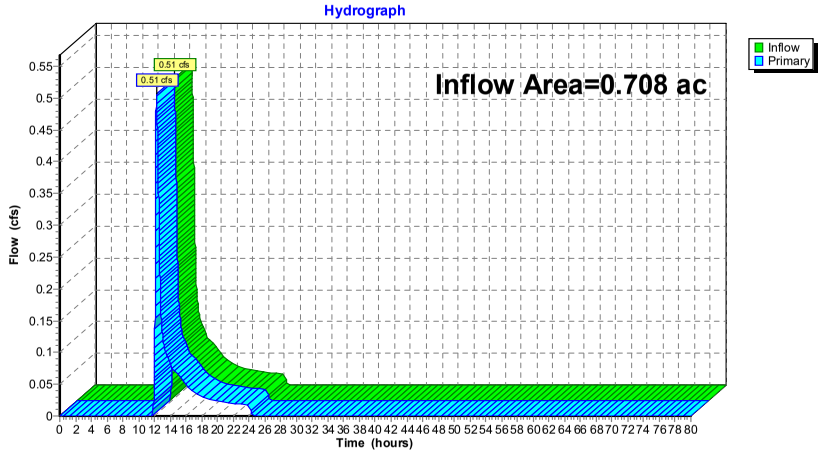


Summary for Link P.O.A. #1: P.O.A. #1

Inflow Area = 0.708 ac, 8.54% Impervious, Inflow Depth = 1.04" for 10-year event
Inflow = 0.51 cfs @ 12.26 hrs, Volume= 0.061 af
Primary = 0.51 cfs @ 12.26 hrs, Volume= 0.061 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-80.00 hrs, dt= 0.01 hrs

Link P.O.A. #1: P.O.A. #1

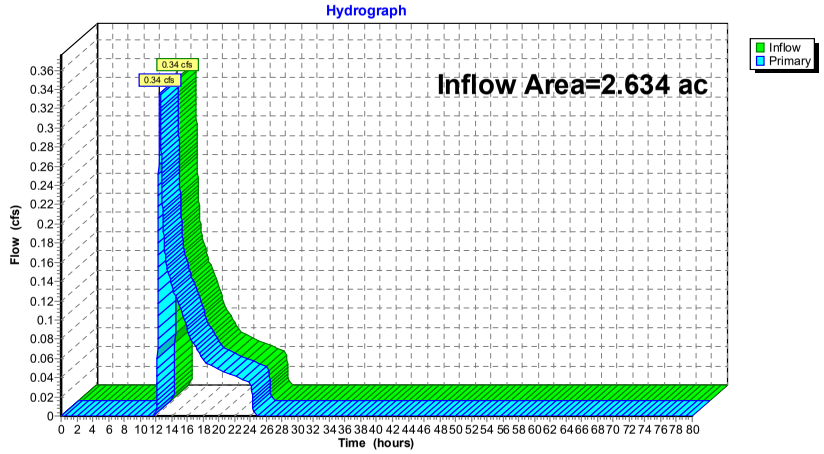


Summary for Link P.O.A. #2: P.O.A. #2

Inflow Area = 2.634 ac, 1.12% Impervious, Inflow Depth = 0.38" for 10-year event
Inflow = 0.34 cfs @ 12.53 hrs, Volume= 0.083 af
Primary = 0.34 cfs @ 12.53 hrs, Volume= 0.083 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-80.00 hrs, dt= 0.01 hrs

Link P.O.A. #2: P.O.A. #2

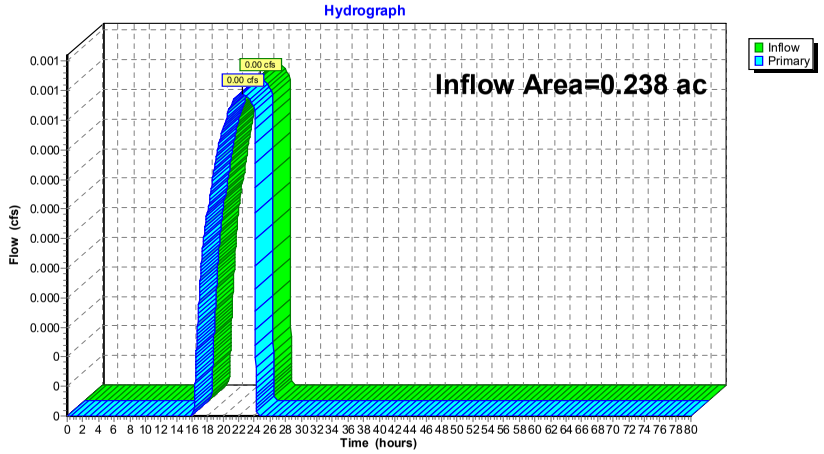


Summary for Link P.O.A. #3: P.O.A. #3

Inflow Area = 0.238 ac, 0.00% Impervious, Inflow Depth = 0.01" for 10-year event
Inflow = 0.00 cfs @ 22.39 hrs, Volume= 0.000 af
Primary = 0.00 cfs @ 22.39 hrs, Volume= 0.000 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-80.00 hrs, dt= 0.01 hrs

Link P.O.A. #3: P.O.A. #3



Time span=0.00-80.00 hrs, dt=0.01 hrs, 8001 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment1S: Subcatchment1S Runoff Area=30,821 sf 8.54% Impervious Runoff Depth=1.69"
Flow Length=298' Tc=16.0 min CN=54 Runoff=0.92 cfs 0.099 af

Subcatchment2S: Subcatchment2S Runoff Area=114,726 sf 1.12% Impervious Runoff Depth=0.77"
Flow Length=408' Tc=17.9 min CN=42 Runoff=0.98 cfs 0.169 af

Subcatchment3S: Subcatchment3S Runoff Area=10,386 sf 0.00% Impervious Runoff Depth=0.12"
Flow Length=67' Tc=7.7 min CN=30 Runoff=0.00 cfs 0.002 af

Link P.O.A. #1: P.O.A. #1 Inflow=0.92 cfs 0.099 af
Primary=0.92 cfs 0.099 af

Link P.O.A. #2: P.O.A. #2 Inflow=0.98 cfs 0.169 af
Primary=0.98 cfs 0.169 af

Link P.O.A. #3: P.O.A. #3 Inflow=0.00 cfs 0.002 af
Primary=0.00 cfs 0.002 af

Total Runoff Area = 3.580 ac Runoff Volume = 0.271 af Average Runoff Depth = 0.91"
97.49% Pervious = 3.490 ac 2.51% Impervious = 0.090 ac

Summary for Subcatchment 1S: Subcatchment 1S

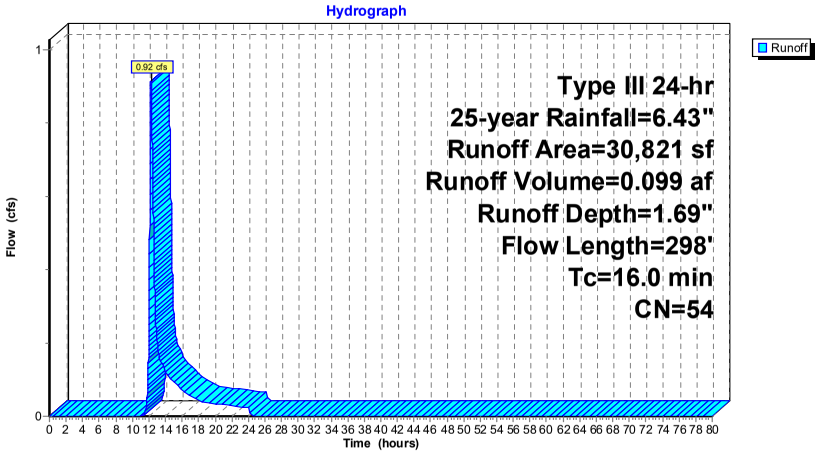
Runoff = 0.92 cfs @ 12.25 hrs, Volume= 0.099 af, Depth= 1.69"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-80.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-year Rainfall=6.43"

	Area (sf)	CN	Description
*	8,182	96	Gravel
*	2,632	98	Impervious
	236	80	>75% Grass cover, Good, HSG D
	1,055	39	>75% Grass cover, Good, HSG A
	18,716	30	Woods, Good, HSG A
	30,821	54	Weighted Average
	28,189		91.46% Pervious Area
	2,632		8.54% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.3	50	0.0200	0.07		**Sheet Flow, A-B** Woods: Light underbrush n= 0.400 P2= 3.20"
1.9	92	0.0270	0.82		**Shallow Concentrated Flow, B-C** Woodland Kv= 5.0 fps
0.3	62	0.0400	3.22		**Shallow Concentrated Flow, C-D** Unpaved Kv= 16.1 fps
1.5	94	0.0425	1.03		**Shallow Concentrated Flow, D-E** Woodland Kv= 5.0 fps
16.0	298	Total			

Subcatchment 1S: Subcatchment 1S



Summary for Subcatchment 2S: Subcatchment 2S

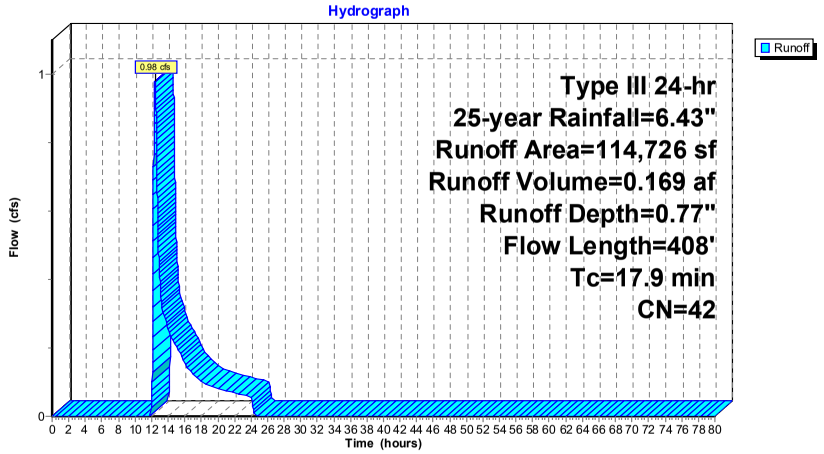
Runoff = 0.98 cfs @ 12.40 hrs, Volume= 0.169 af, Depth= 0.77"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-80.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-year Rainfall=6.43"

	Area (sf)	CN	Description
*	1,280	98	Impervious
*	9,879	96	Gravel
	12,471	80	>75% Grass cover, Good, HSG D
	3,040	39	>75% Grass cover, Good, HSG A
	266	77	Woods, Good, HSG D
	87,790	30	Woods, Good, HSG A
	114,726	42	Weighted Average
	113,446		98.88% Pervious Area
	1,280		1.12% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.3	50	0.0200	0.07		**Sheet Flow, A-B** Woods: Light underbrush n= 0.400 P2= 3.20"
5.6	358	0.0447	1.06		**Shallow Concentrated Flow, B-C** Woodland Kv= 5.0 fps
17.9	408	Total			

Subcatchment 2S: Subcatchment 2S



Summary for Subcatchment 3S: Subcatchment 3S

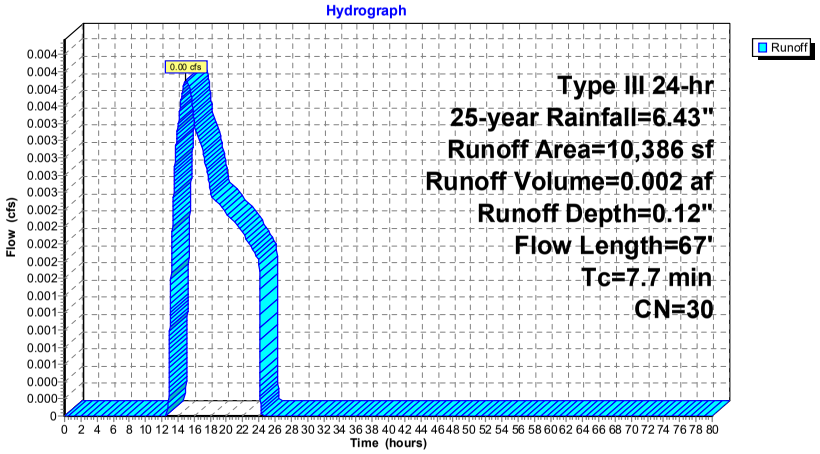
Runoff = 0.00 cfs @ 15.00 hrs, Volume= 0.002 af, Depth= 0.12"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-80.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-year Rainfall=6.43"

Area (sf)	CN	Description
10,386	30	Woods, Good, HSG A
10,386		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.5	50	0.0700	0.11		**Sheet Flow, A-B** Woods: Light underbrush n= 0.400 P2= 3.20"
0.2	17	0.0588	1.21		**Shallow Concentrated Flow, B-C** Woodland Kv= 5.0 fps
7.7	67	Total			

Subcatchment 3S: Subcatchment 3S

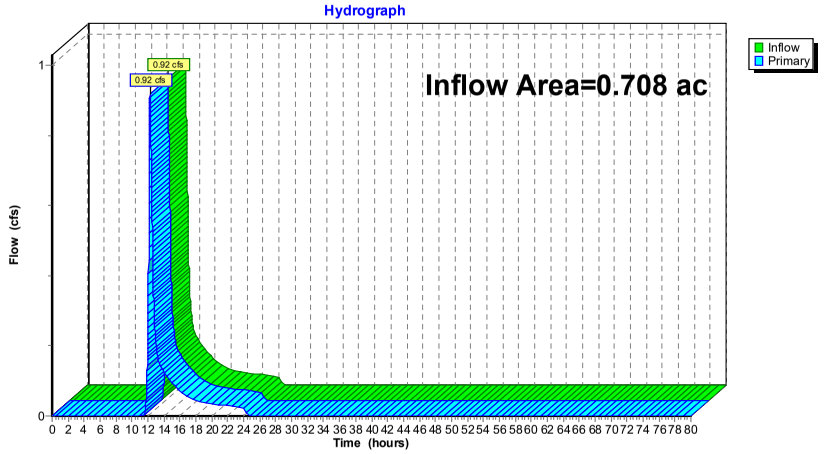


Summary for Link P.O.A. #1: P.O.A. #1

Inflow Area = 0.708 ac, 8.54% Impervious, Inflow Depth = 1.69" for 25-year event
Inflow = 0.92 cfs @ 12.25 hrs, Volume= 0.099 af
Primary = 0.92 cfs @ 12.25 hrs, Volume= 0.099 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-80.00 hrs, dt= 0.01 hrs

Link P.O.A. #1: P.O.A. #1

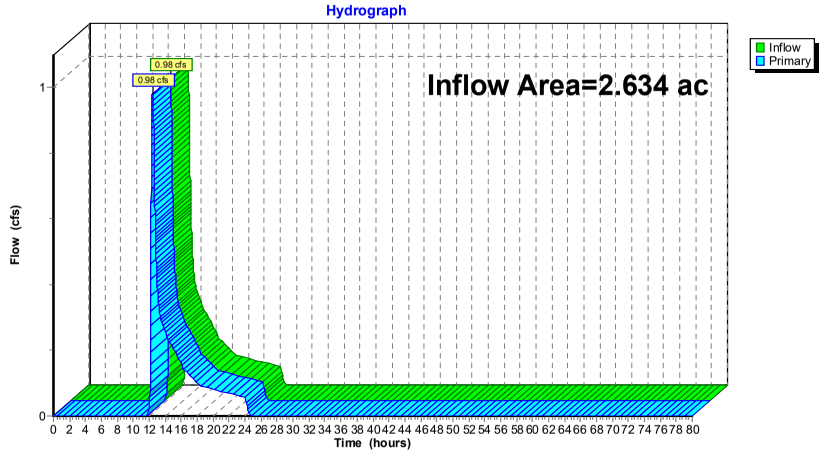


Summary for Link P.O.A. #2: P.O.A. #2

Inflow Area = 2.634 ac, 1.12% Impervious, Inflow Depth = 0.77" for 25-year event
Inflow = 0.98 cfs @ 12.40 hrs, Volume= 0.169 af
Primary = 0.98 cfs @ 12.40 hrs, Volume= 0.169 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-80.00 hrs, dt= 0.01 hrs

Link P.O.A. #2: P.O.A. #2

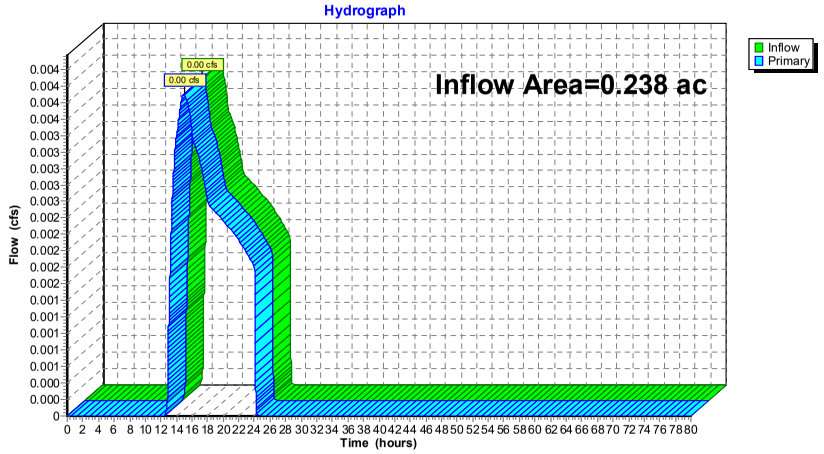


Summary for Link P.O.A. #3: P.O.A. #3

Inflow Area = 0.238 ac, 0.00% Impervious, Inflow Depth = 0.12" for 25-year event
Inflow = 0.00 cfs @ 15.00 hrs, Volume= 0.002 af
Primary = 0.00 cfs @ 15.00 hrs, Volume= 0.002 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-80.00 hrs, dt= 0.01 hrs

Link P.O.A. #3: P.O.A. #3



Time span=0.00-80.00 hrs, dt=0.01 hrs, 8001 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment1S: Subcatchment1S Runoff Area=30,821 sf 8.54% Impervious Runoff Depth=2.22"
Flow Length=298' Tc=16.0 min CN=54 Runoff=1.26 cfs 0.131 af

Subcatchment2S: Subcatchment2S Runoff Area=114,726 sf 1.12% Impervious Runoff Depth=1.12"
Flow Length=408' Tc=17.9 min CN=42 Runoff=1.69 cfs 0.246 af

Subcatchment3S: Subcatchment3S Runoff Area=10,386 sf 0.00% Impervious Runoff Depth=0.27"
Flow Length=67' Tc=7.7 min CN=30 Runoff=0.01 cfs 0.005 af

Link P.O.A. #1: P.O.A. #1 Inflow=1.26 cfs 0.131 af
Primary=1.26 cfs 0.131 af

Link P.O.A. #2: P.O.A. #2 Inflow=1.69 cfs 0.246 af
Primary=1.69 cfs 0.246 af

Link P.O.A. #3: P.O.A. #3 Inflow=0.01 cfs 0.005 af
Primary=0.01 cfs 0.005 af

Total Runoff Area = 3.580 ac Runoff Volume = 0.382 af Average Runoff Depth = 1.28"
97.49% Pervious = 3.490 ac 2.51% Impervious = 0.090 ac

Summary for Subcatchment 1S: Subcatchment 1S

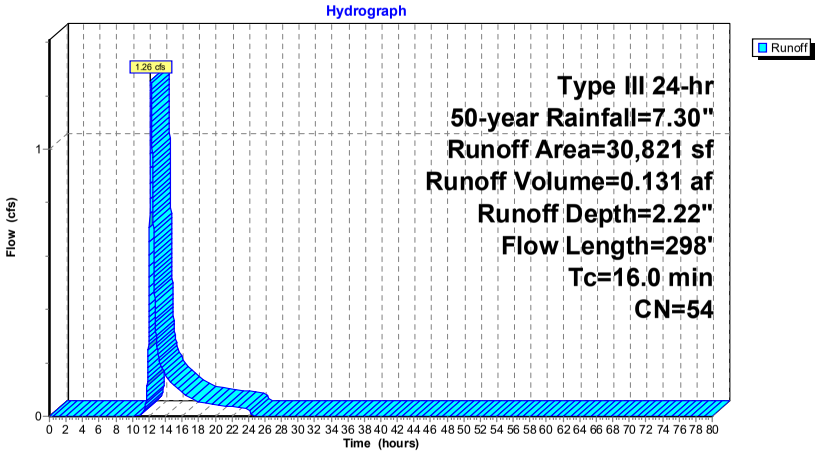
Runoff = 1.26 cfs @ 12.24 hrs, Volume= 0.131 af, Depth= 2.22"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-80.00 hrs, dt= 0.01 hrs
Type III 24-hr 50-year Rainfall=7.30"

	Area (sf)	CN	Description
*	8,182	96	Gravel
*	2,632	98	Impervious
	236	80	>75% Grass cover, Good, HSG D
	1,055	39	>75% Grass cover, Good, HSG A
	18,716	30	Woods, Good, HSG A
	30,821	54	Weighted Average
	28,189		91.46% Pervious Area
	2,632		8.54% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.3	50	0.0200	0.07		**Sheet Flow, A-B** Woods: Light underbrush n= 0.400 P2= 3.20"
1.9	92	0.0270	0.82		**Shallow Concentrated Flow, B-C** Woodland Kv= 5.0 fps
0.3	62	0.0400	3.22		**Shallow Concentrated Flow, C-D** Unpaved Kv= 16.1 fps
1.5	94	0.0425	1.03		**Shallow Concentrated Flow, D-E** Woodland Kv= 5.0 fps
16.0	298	Total			

Subcatchment 1S: Subcatchment 1S



Summary for Subcatchment 2S: Subcatchment 2S

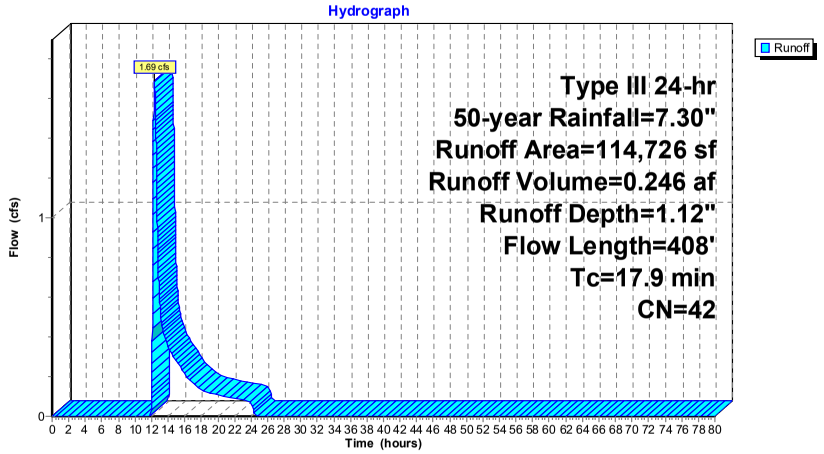
Runoff = 1.69 cfs @ 12.33 hrs, Volume= 0.246 af, Depth= 1.12"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-80.00 hrs, dt= 0.01 hrs
Type III 24-hr 50-year Rainfall=7.30"

	Area (sf)	CN	Description
*	1,280	98	Impervious
*	9,879	96	Gravel
	12,471	80	>75% Grass cover, Good, HSG D
	3,040	39	>75% Grass cover, Good, HSG A
	266	77	Woods, Good, HSG D
	87,790	30	Woods, Good, HSG A
	114,726	42	Weighted Average
	113,446		98.88% Pervious Area
	1,280		1.12% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.3	50	0.0200	0.07		**Sheet Flow, A-B** Woods: Light underbrush n= 0.400 P2= 3.20"
5.6	358	0.0447	1.06		**Shallow Concentrated Flow, B-C** Woodland Kv= 5.0 fps
17.9	408	Total			

Subcatchment 2S: Subcatchment 2S



Summary for Subcatchment 3S: Subcatchment 3S

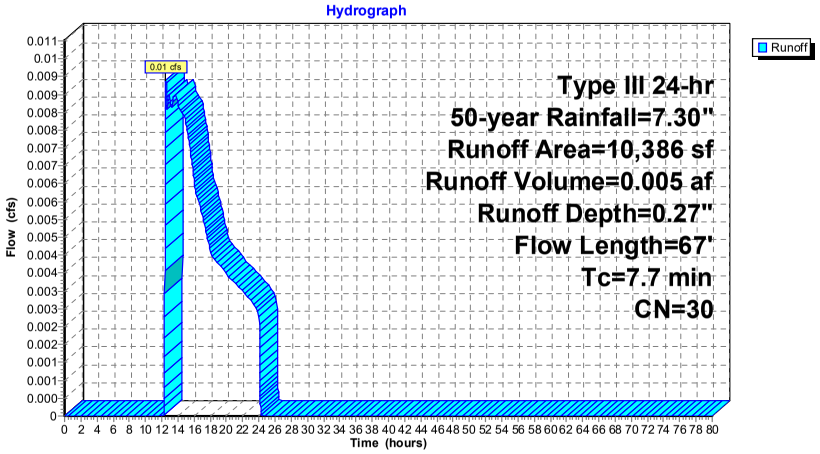
Runoff = 0.01 cfs @ 12.52 hrs, Volume= 0.005 af, Depth= 0.27"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-80.00 hrs, dt= 0.01 hrs
Type III 24-hr 50-year Rainfall=7.30"

Area (sf)	CN	Description
10,386	30	Woods, Good, HSG A
10,386		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.5	50	0.0700	0.11		**Sheet Flow, A-B** Woods: Light underbrush n= 0.400 P2= 3.20"
0.2	17	0.0588	1.21		**Shallow Concentrated Flow, B-C** Woodland Kv= 5.0 fps
7.7	67	Total			

Subcatchment 3S: Subcatchment 3S

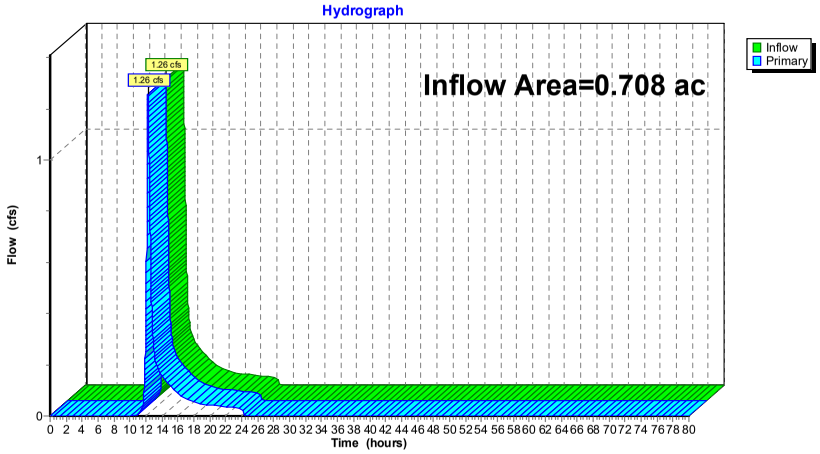


Summary for Link P.O.A. #1: P.O.A. #1

Inflow Area = 0.708 ac, 8.54% Impervious, Inflow Depth = 2.22" for 50-year event
Inflow = 1.26 cfs @ 12.24 hrs, Volume= 0.131 af
Primary = 1.26 cfs @ 12.24 hrs, Volume= 0.131 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-80.00 hrs, dt= 0.01 hrs

Link P.O.A. #1: P.O.A. #1

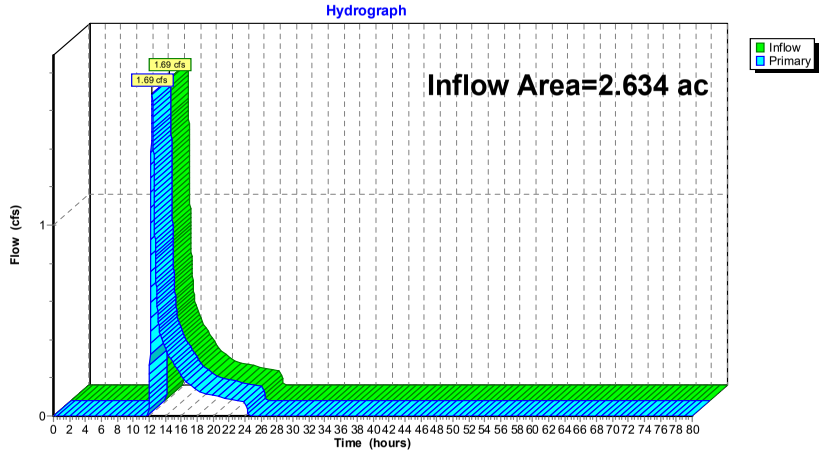


Summary for Link P.O.A. #2: P.O.A. #2

Inflow Area = 2.634 ac, 1.12% Impervious, Inflow Depth = 1.12" for 50-year event
Inflow = 1.69 cfs @ 12.33 hrs, Volume= 0.246 af
Primary = 1.69 cfs @ 12.33 hrs, Volume= 0.246 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-80.00 hrs, dt= 0.01 hrs

Link P.O.A. #2: P.O.A. #2

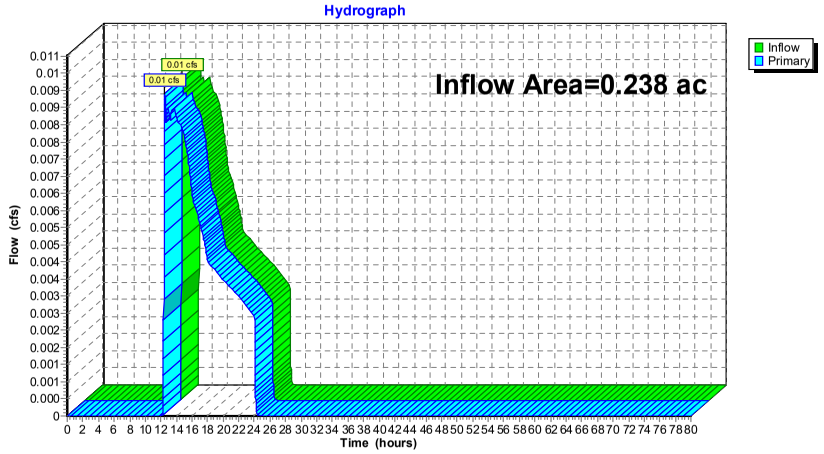


Summary for Link P.O.A. #3: P.O.A. #3

Inflow Area = 0.238 ac, 0.00% Impervious, Inflow Depth = 0.27" for 50-year event
Inflow = 0.01 cfs @ 12.52 hrs, Volume= 0.005 af
Primary = 0.01 cfs @ 12.52 hrs, Volume= 0.005 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-80.00 hrs, dt= 0.01 hrs

Link P.O.A. #3: P.O.A. #3



Time span=0.00-80.00 hrs, dt=0.01 hrs, 8001 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment1S: Subcatchment1S Runoff Area=30,821 sf 8.54% Impervious Runoff Depth=2.84"
Flow Length=298' Tc=16.0 min CN=54 Runoff=1.66 cfs 0.168 af

Subcatchment2S: Subcatchment2S Runoff Area=114,726 sf 1.12% Impervious Runoff Depth=1.56"
Flow Length=408' Tc=17.9 min CN=42 Runoff=2.65 cfs 0.343 af

Subcatchment3S: Subcatchment3S Runoff Area=10,386 sf 0.00% Impervious Runoff Depth=0.48"
Flow Length=67' Tc=7.7 min CN=30 Runoff=0.04 cfs 0.009 af

Link P.O.A. #1: P.O.A. #1 Inflow=1.66 cfs 0.168 af
Primary=1.66 cfs 0.168 af

Link P.O.A. #2: P.O.A. #2 Inflow=2.65 cfs 0.343 af
Primary=2.65 cfs 0.343 af

Link P.O.A. #3: P.O.A. #3 Inflow=0.04 cfs 0.009 af
Primary=0.04 cfs 0.009 af

Total Runoff Area = 3.580 ac Runoff Volume = 0.520 af Average Runoff Depth = 1.74"
97.49% Pervious = 3.490 ac 2.51% Impervious = 0.090 ac

Summary for Subcatchment 1S: Subcatchment 1S

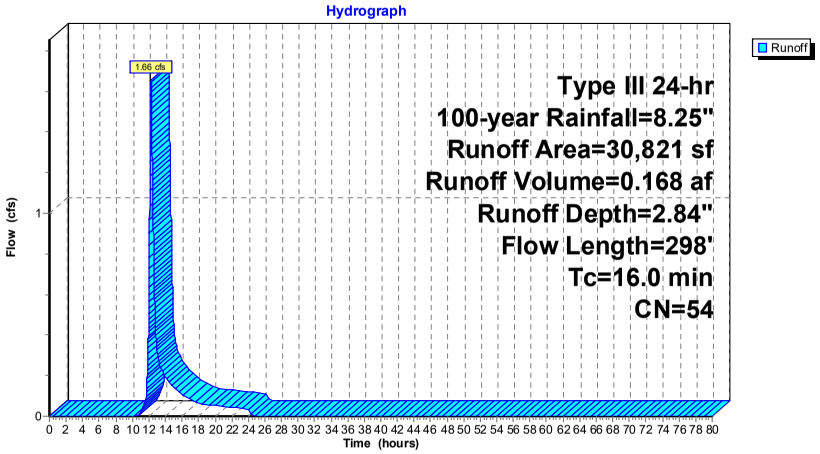
Runoff = 1.66 cfs @ 12.23 hrs, Volume= 0.168 af, Depth= 2.84"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-80.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-year Rainfall=8.25"

	Area (sf)	CN	Description
*	8,182	96	Gravel
*	2,632	98	Impervious
	236	80	>75% Grass cover, Good, HSG D
	1,055	39	>75% Grass cover, Good, HSG A
	18,716	30	Woods, Good, HSG A
	30,821	54	Weighted Average
	28,189		91.46% Pervious Area
	2,632		8.54% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.3	50	0.0200	0.07		**Sheet Flow, A-B** Woods: Light underbrush n= 0.400 P2= 3.20"
1.9	92	0.0270	0.82		**Shallow Concentrated Flow, B-C** Woodland Kv= 5.0 fps
0.3	62	0.0400	3.22		**Shallow Concentrated Flow, C-D** Unpaved Kv= 16.1 fps
1.5	94	0.0425	1.03		**Shallow Concentrated Flow, D-E** Woodland Kv= 5.0 fps
16.0	298	Total			

Subcatchment 1S: Subcatchment 1S



Summary for Subcatchment 2S: Subcatchment 2S

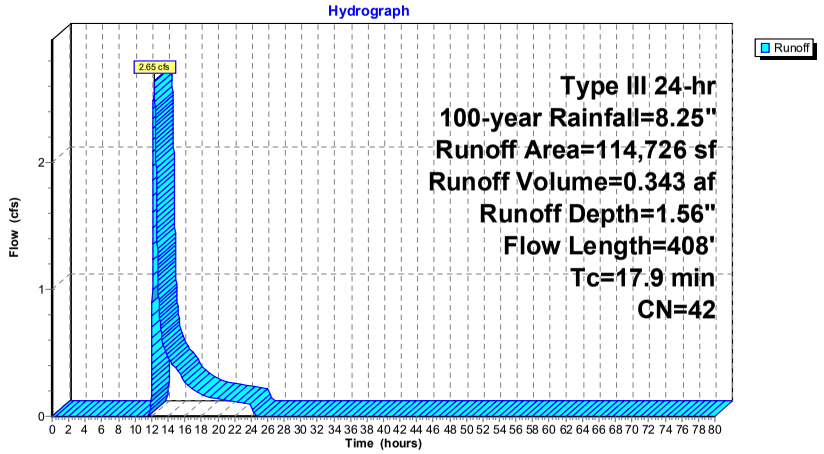
Runoff = 2.65 cfs @ 12.31 hrs, Volume= 0.343 af, Depth= 1.56"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-80.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-year Rainfall=8.25"

	Area (sf)	CN	Description
*	1,280	98	Impervious
*	9,879	96	Gravel
	12,471	80	>75% Grass cover, Good, HSG D
	3,040	39	>75% Grass cover, Good, HSG A
	266	77	Woods, Good, HSG D
	87,790	30	Woods, Good, HSG A
	114,726	42	Weighted Average
	113,446		98.88% Pervious Area
	1,280		1.12% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.3	50	0.0200	0.07		**Sheet Flow, A-B** Woods: Light underbrush n= 0.400 P2= 3.20"
5.6	358	0.0447	1.06		**Shallow Concentrated Flow, B-C** Woodland Kv= 5.0 fps
17.9	408	Total			

Subcatchment 2S: Subcatchment 2S



Summary for Subcatchment 3S: Subcatchment 3S

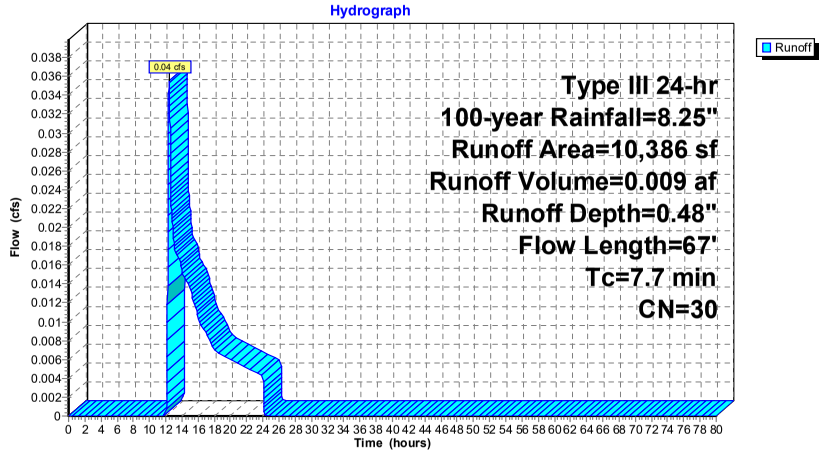
Runoff = 0.04 cfs @ 12.42 hrs, Volume= 0.009 af, Depth= 0.48"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-80.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-year Rainfall=8.25"

Area (sf)	CN	Description
10,386	30	Woods, Good, HSG A
10,386		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.5	50	0.0700	0.11		**Sheet Flow, A-B** Woods: Light underbrush n= 0.400 P2= 3.20"
0.2	17	0.0588	1.21		**Shallow Concentrated Flow, B-C** Woodland Kv= 5.0 fps
7.7	67	Total			

Subcatchment 3S: Subcatchment 3S

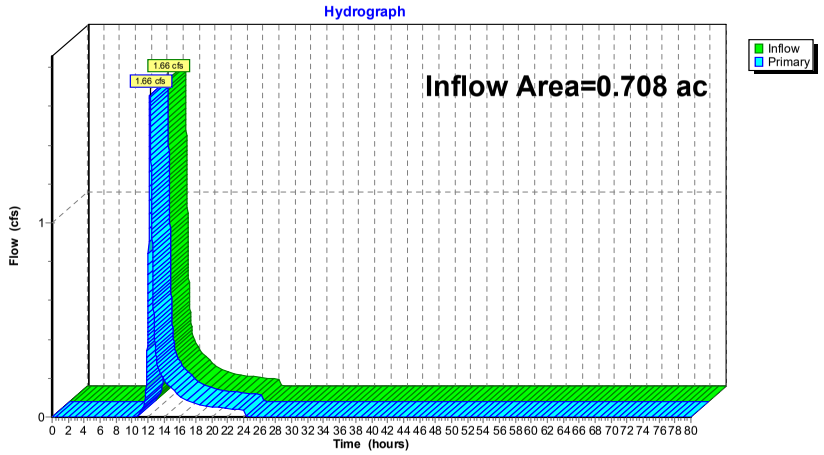


Summary for Link P.O.A. #1: P.O.A. #1

Inflow Area = 0.708 ac, 8.54% Impervious, Inflow Depth = 2.84" for 100-year event
Inflow = 1.66 cfs @ 12.23 hrs, Volume= 0.168 af
Primary = 1.66 cfs @ 12.23 hrs, Volume= 0.168 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-80.00 hrs, dt= 0.01 hrs

Link P.O.A. #1: P.O.A. #1

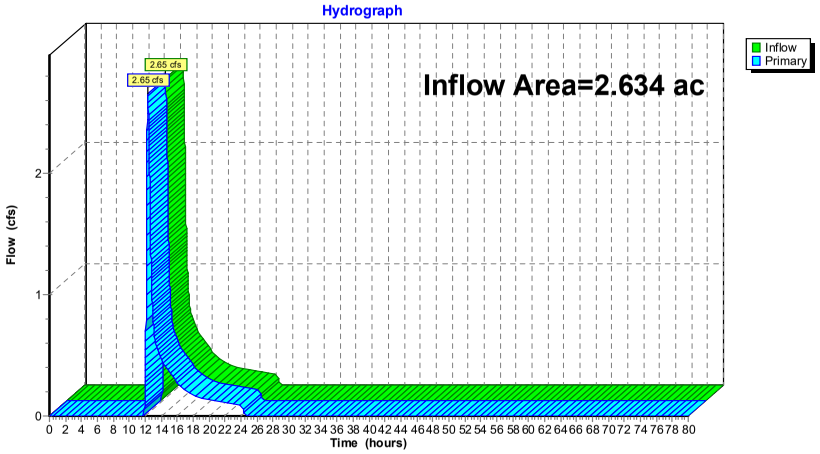


Summary for Link P.O.A. #2: P.O.A. #2

Inflow Area = 2.634 ac, 1.12% Impervious, Inflow Depth = 1.56" for 100-year event
Inflow = 2.65 cfs @ 12.31 hrs, Volume= 0.343 af
Primary = 2.65 cfs @ 12.31 hrs, Volume= 0.343 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-80.00 hrs, dt= 0.01 hrs

Link P.O.A. #2: P.O.A. #2

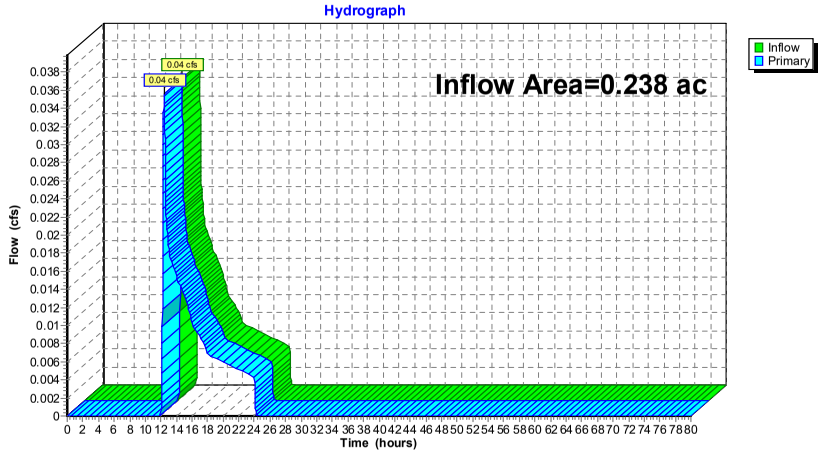


Summary for Link P.O.A. #3: P.O.A. #3

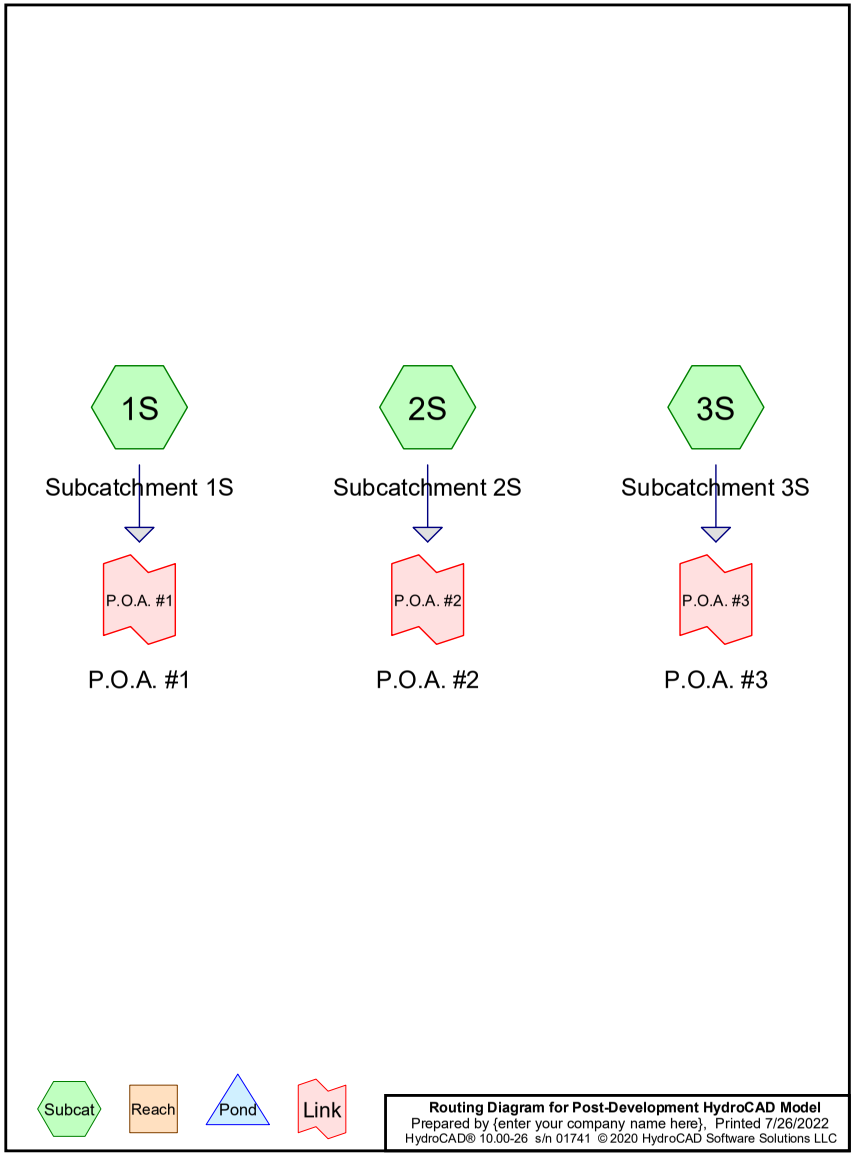
Inflow Area = 0.238 ac, 0.00% Impervious, Inflow Depth = 0.48" for 100-year event
Inflow = 0.04 cfs @ 12.42 hrs, Volume= 0.009 af
Primary = 0.04 cfs @ 12.42 hrs, Volume= 0.009 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-80.00 hrs, dt= 0.01 hrs

Link P.O.A. #3: P.O.A. #3



Appendix G.2 – Post-Development HydroCAD Report



Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
0.070	39	>75% Grass cover, Good, HSG A (2S)
0.292	80	>75% Grass cover, Good, HSG D (1S, 2S)
0.191	96	Gravel (1S, 2S)
0.120	98	Impervious (1S, 2S)
2.481	30	Meadow, non-grazed, HSG A (1S, 2S, 3S)
0.421	30	Woods, Good, HSG A (2S)
0.006	77	Woods, Good, HSG D (2S)
3.580	**40**	**TOTAL AREA**

Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
2.971	HSG A	1S, 2S, 3S
0.000	HSG B	
0.000	HSG C	
0.298	HSG D	1S, 2S
0.311	Other	1S, 2S
3.580		**TOTAL AREA**

Ground Covers (all nodes)

HSG-A (acres)	HSG-B (acres)	HSG-C (acres)	HSG-D (acres)	Other (acres)	Total (acres)	Ground Cover	Subcatchment Numbers
0.070	0.000	0.000	0.292	0.000	0.362	>75% Grass cover, Good	1S, 2S
0.000	0.000	0.000	0.000	0.191	0.191	Gravel	1S, 2S
0.000	0.000	0.000	0.000	0.120	0.120	Impervious	1S, 2S
2.481	0.000	0.000	0.000	0.000	2.481	Meadow, non-grazed	1S, 2S, 3S
0.421	0.000	0.000	0.006	0.000	0.427	Woods, Good	2S
2.971	**0.000**	**0.000**	**0.298**	**0.311**	**3.580**	**TOTAL AREA**	

Time span=0.00-80.00 hrs, dt=0.01 hrs, 8001 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment1S: Subcatchment1S Runoff Area=30,821 sf 12.76% Impervious Runoff Depth=0.02"
Flow Length=297' Tc=15.6 min CN=42 Runoff=0.00 cfs 0.001 af

Subcatchment2S: Subcatchment2S Runoff Area=114,726 sf 1.12% Impervious Runoff Depth=0.01"
Flow Length=408' Tc=16.6 min CN=41 Runoff=0.01 cfs 0.003 af

Subcatchment3S: Subcatchment3S Runoff Area=10,386 sf 0.00% Impervious Runoff Depth=0.00"
Flow Length=67' Tc=7.8 min CN=30 Runoff=0.00 cfs 0.000 af

Link P.O.A. #1: P.O.A. #1 Inflow=0.00 cfs 0.001 af
Primary=0.00 cfs 0.001 af

Link P.O.A. #2: P.O.A. #2 Inflow=0.01 cfs 0.003 af
Primary=0.01 cfs 0.003 af

Link P.O.A. #3: P.O.A. #3 Inflow=0.00 cfs 0.000 af
Primary=0.00 cfs 0.000 af

Total Runoff Area = 3.580 ac Runoff Volume = 0.005 af Average Runoff Depth = 0.02"
96.66% Pervious = 3.460 ac 3.34% Impervious = 0.120 ac

Summary for Subcatchment 1S: Subcatchment 1S

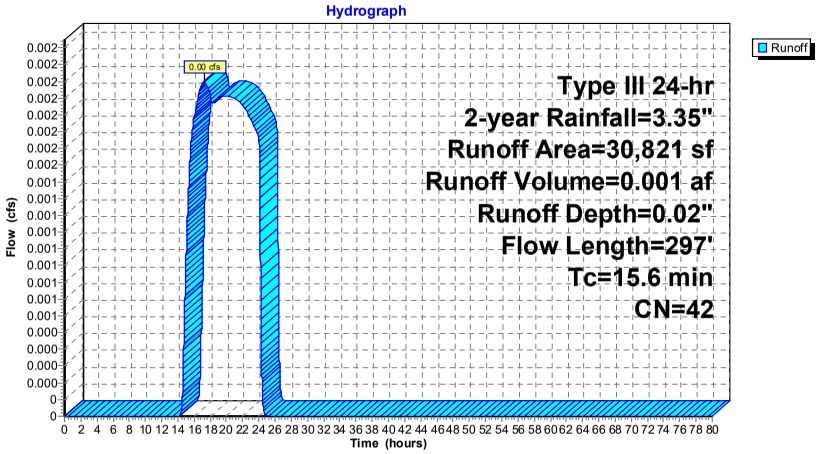
Runoff = 0.00 cfs @ 17.28 hrs, Volume= 0.001 af, Depth= 0.02"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-80.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-year Rainfall=3.35"

	Area (sf)	CN	Description
*	3,932	98	Impervious
*	1,218	96	Gravel
	236	80	>75% Grass cover, Good, HSG D
	25,435	30	Meadow, non-grazed, HSG A
	30,821	42	Weighted Average
	26,889		87.24% Pervious Area
	3,932		12.76% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.6	50	0.0200	0.07		**Sheet Flow, A-B** Grass: Bermuda n= 0.410 P2= 3.20"
1.8	127	0.0275	1.16		**Shallow Concentrated Flow, B-C** Short Grass Pasture Kv= 7.0 fps
0.1	22	0.0300	2.79		**Shallow Concentrated Flow, C-D** Unpaved Kv= 16.1 fps
1.1	98	0.0464	1.51		**Shallow Concentrated Flow, D-E** Short Grass Pasture Kv= 7.0 fps
15.6	297	Total			

Subcatchment 1S: Subcatchment 1S



Summary for Subcatchment 2S: Subcatchment 2S

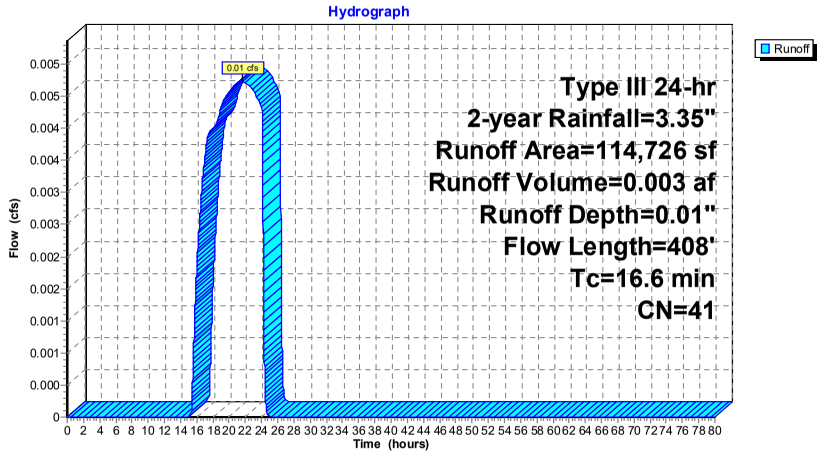
Runoff = 0.01 cfs @ 21.56 hrs, Volume= 0.003 af, Depth= 0.01"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-80.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-year Rainfall=3.35"

	Area (sf)	CN	Description
*	1,280	98	Impervious
*	7,113	96	Gravel
	12,471	80	>75% Grass cover, Good, HSG D
	3,040	39	>75% Grass cover, Good, HSG A
	266	77	Woods, Good, HSG D
	18,323	30	Woods, Good, HSG A
	72,233	30	Meadow, non-grazed, HSG A
	114,726	41	Weighted Average
	113,446		98.88% Pervious Area
	1,280		1.12% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.6	50	0.0200	0.07		**Sheet Flow, A-B** Grass: Bermuda n= 0.410 P2= 3.20"
4.0	358	0.0447	1.48		**Shallow Concentrated Flow, B-C** Short Grass Pasture Kv= 7.0 fps
16.6	408	Total			

Subcatchment 2S: Subcatchment 2S



Summary for Subcatchment 3S: Subcatchment 3S

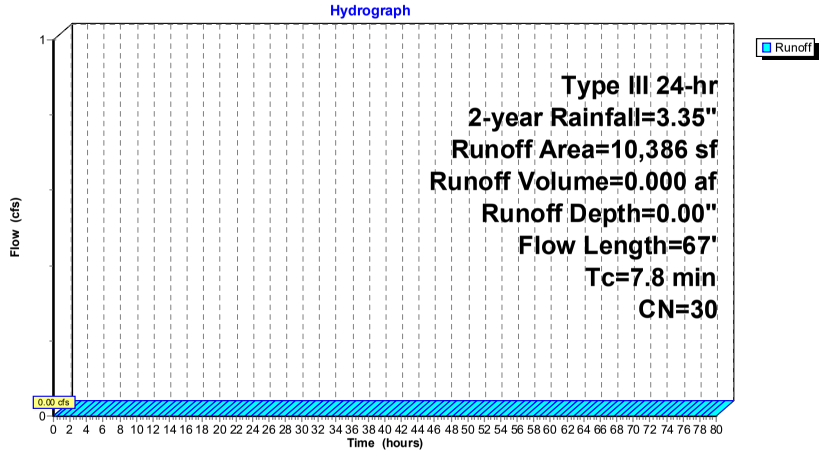
Runoff = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Depth= 0.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-80.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-year Rainfall=3.35"

Area (sf)	CN	Description
10,386	30	Meadow, non-grazed, HSG A
10,386		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.6	50	0.0700	0.11		**Sheet Flow, A-B** Grass: Bermuda n= 0.410 P2= 3.20"
0.2	17	0.0588	1.70		**Shallow Concentrated Flow, B-C** Short Grass Pasture Kv= 7.0 fps
7.8	67	Total			

Subcatchment 3S: Subcatchment 3S

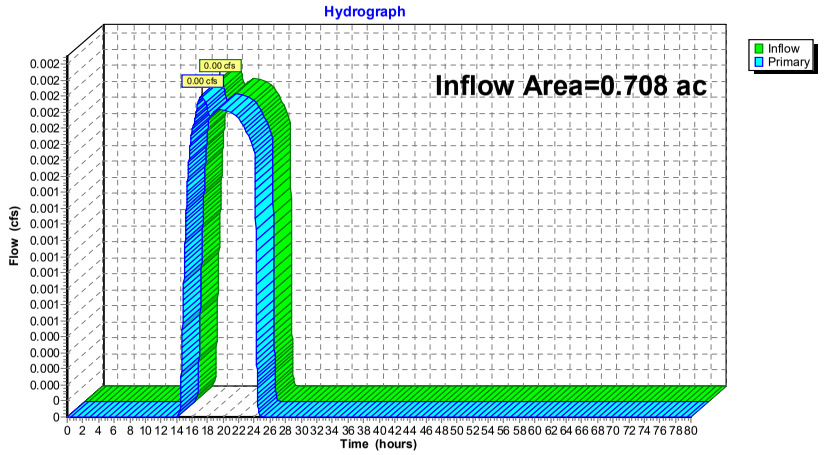


Summary for Link P.O.A. #1: P.O.A. #1

Inflow Area = 0.708 ac, 12.76% Impervious, Inflow Depth = 0.02" for 2-year event
Inflow = 0.00 cfs @ 17.28 hrs, Volume= 0.001 af
Primary = 0.00 cfs @ 17.28 hrs, Volume= 0.001 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-80.00 hrs, dt= 0.01 hrs

Link P.O.A. #1: P.O.A. #1

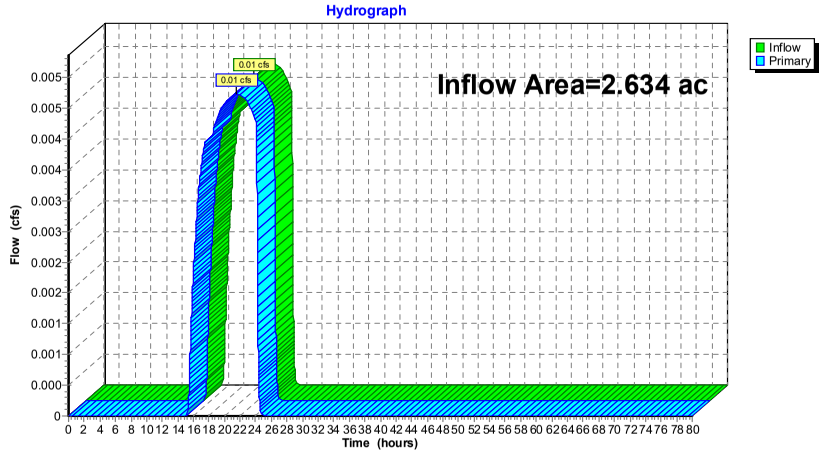


Summary for Link P.O.A. #2: P.O.A. #2

Inflow Area = 2.634 ac, 1.12% Impervious, Inflow Depth = 0.01" for 2-year event
Inflow = 0.01 cfs @ 21.56 hrs, Volume= 0.003 af
Primary = 0.01 cfs @ 21.56 hrs, Volume= 0.003 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-80.00 hrs, dt= 0.01 hrs

Link P.O.A. #2: P.O.A. #2

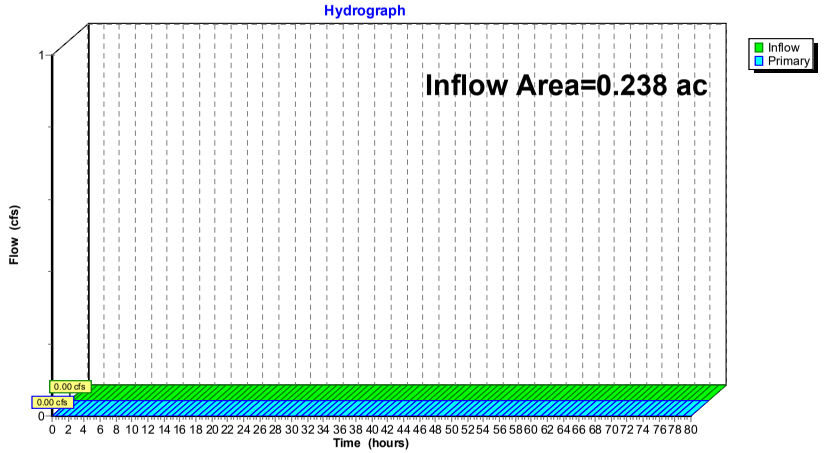


Summary for Link P.O.A. #3: P.O.A. #3

Inflow Area = 0.238 ac, 0.00% Impervious, Inflow Depth = 0.00" for 2-year event
Inflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-80.00 hrs, dt= 0.01 hrs

Link P.O.A. #3: P.O.A. #3



Time span=0.00-80.00 hrs, dt=0.01 hrs, 8001 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment1S: Subcatchment1S Runoff Area=30,821 sf 12.76% Impervious Runoff Depth=0.38"
Flow Length=297' Tc=15.6 min CN=42 Runoff=0.09 cfs 0.022 af

Subcatchment2S: Subcatchment2S Runoff Area=114,726 sf 1.12% Impervious Runoff Depth=0.34"
Flow Length=408' Tc=16.6 min CN=41 Runoff=0.27 cfs 0.074 af

Subcatchment3S: Subcatchment3S Runoff Area=10,386 sf 0.00% Impervious Runoff Depth=0.01"
Flow Length=67' Tc=7.8 min CN=30 Runoff=0.00 cfs 0.000 af

Link P.O.A. #1: P.O.A. #1 Inflow=0.09 cfs 0.022 af
Primary=0.09 cfs 0.022 af

Link P.O.A. #2: P.O.A. #2 Inflow=0.27 cfs 0.074 af
Primary=0.27 cfs 0.074 af

Link P.O.A. #3: P.O.A. #3 Inflow=0.00 cfs 0.000 af
Primary=0.00 cfs 0.000 af

Total Runoff Area = 3.580 ac Runoff Volume = 0.096 af Average Runoff Depth = 0.32"
96.66% Pervious = 3.460 ac 3.34% Impervious = 0.120 ac

Summary for Subcatchment 1S: Subcatchment 1S

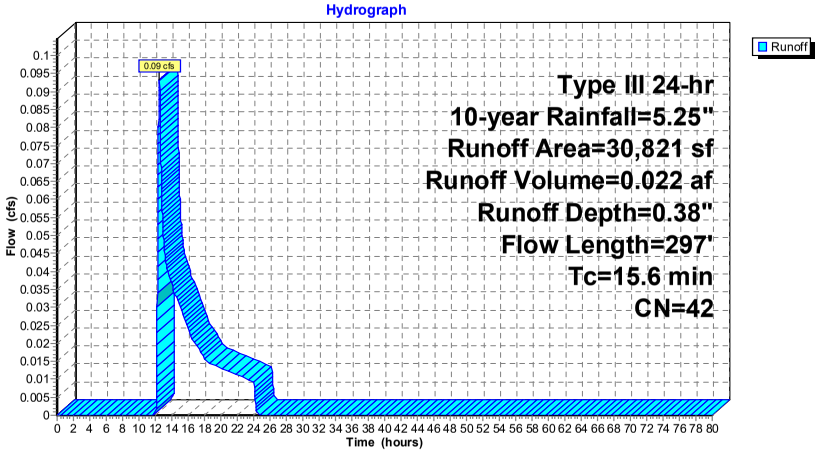
Runoff = 0.09 cfs @ 12.50 hrs, Volume= 0.022 af, Depth= 0.38"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-80.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-year Rainfall=5.25"

	Area (sf)	CN	Description
*	3,932	98	Impervious
*	1,218	96	Gravel
	236	80	>75% Grass cover, Good, HSG D
	25,435	30	Meadow, non-grazed, HSG A
	30,821	42	Weighted Average
	26,889		87.24% Pervious Area
	3,932		12.76% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.6	50	0.0200	0.07		**Sheet Flow, A-B** Grass: Bermuda n= 0.410 P2= 3.20"
1.8	127	0.0275	1.16		**Shallow Concentrated Flow, B-C** Short Grass Pasture Kv= 7.0 fps
0.1	22	0.0300	2.79		**Shallow Concentrated Flow, C-D** Unpaved Kv= 16.1 fps
1.1	98	0.0464	1.51		**Shallow Concentrated Flow, D-E** Short Grass Pasture Kv= 7.0 fps
15.6	297	Total			

Subcatchment 1S: Subcatchment 1S



Summary for Subcatchment 2S: Subcatchment 2S

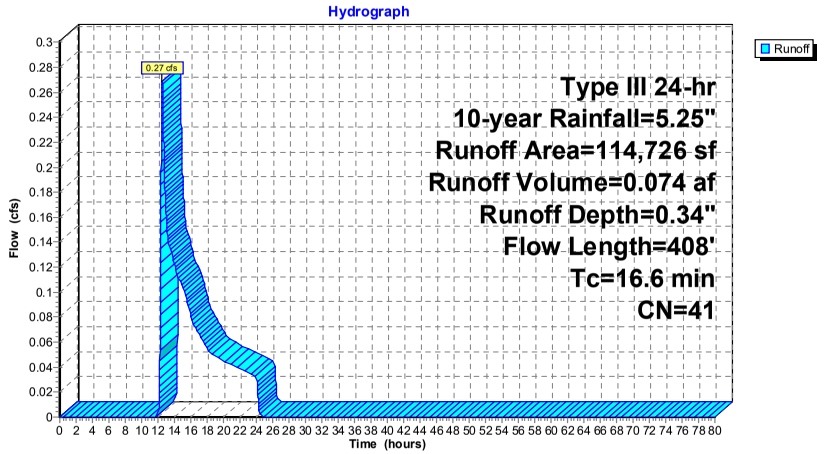
Runoff = 0.27 cfs @ 12.53 hrs, Volume= 0.074 af, Depth= 0.34"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-80.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-year Rainfall=5.25"

	Area (sf)	CN	Description
*	1,280	98	Impervious
*	7,113	96	Gravel
	12,471	80	>75% Grass cover, Good, HSG D
	3,040	39	>75% Grass cover, Good, HSG A
	266	77	Woods, Good, HSG D
	18,323	30	Woods, Good, HSG A
	72,233	30	Meadow, non-grazed, HSG A
	114,726	41	Weighted Average
	113,446		98.88% Pervious Area
	1,280		1.12% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.6	50	0.0200	0.07		**Sheet Flow, A-B** Grass: Bermuda n= 0.410 P2= 3.20"
4.0	358	0.0447	1.48		**Shallow Concentrated Flow, B-C** Short Grass Pasture Kv= 7.0 fps
16.6	408	Total			

Subcatchment 2S: Subcatchment 2S



Summary for Subcatchment 3S: Subcatchment 3S

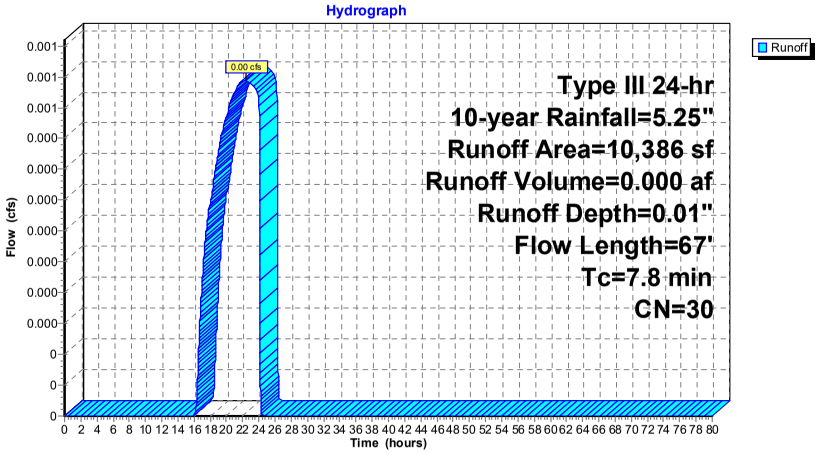
Runoff = 0.00 cfs @ 22.37 hrs, Volume= 0.000 af, Depth= 0.01"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-80.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-year Rainfall=5.25"

Area (sf)	CN	Description
10,386	30	Meadow, non-grazed, HSG A
10,386		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.6	50	0.0700	0.11		**Sheet Flow, A-B** Grass: Bermuda n= 0.410 P2= 3.20"
0.2	17	0.0588	1.70		**Shallow Concentrated Flow, B-C** Short Grass Pasture Kv= 7.0 fps
7.8	67	Total			

Subcatchment 3S: Subcatchment 3S

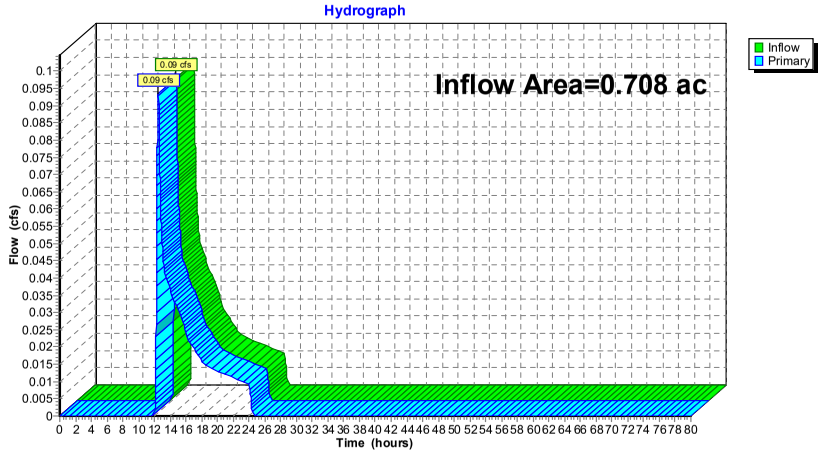


Summary for Link P.O.A. #1: P.O.A. #1

Inflow Area = 0.708 ac, 12.76% Impervious, Inflow Depth = 0.38" for 10-year event
Inflow = 0.09 cfs @ 12.50 hrs, Volume= 0.022 af
Primary = 0.09 cfs @ 12.50 hrs, Volume= 0.022 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-80.00 hrs, dt= 0.01 hrs

Link P.O.A. #1: P.O.A. #1

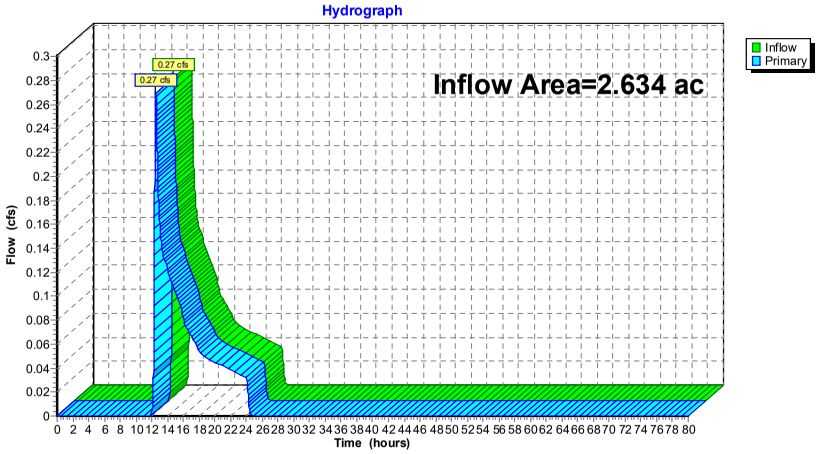


Summary for Link P.O.A. #2: P.O.A. #2

Inflow Area = 2.634 ac, 1.12% Impervious, Inflow Depth = 0.34" for 10-year event
Inflow = 0.27 cfs @ 12.53 hrs, Volume= 0.074 af
Primary = 0.27 cfs @ 12.53 hrs, Volume= 0.074 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-80.00 hrs, dt= 0.01 hrs

Link P.O.A. #2: P.O.A. #2

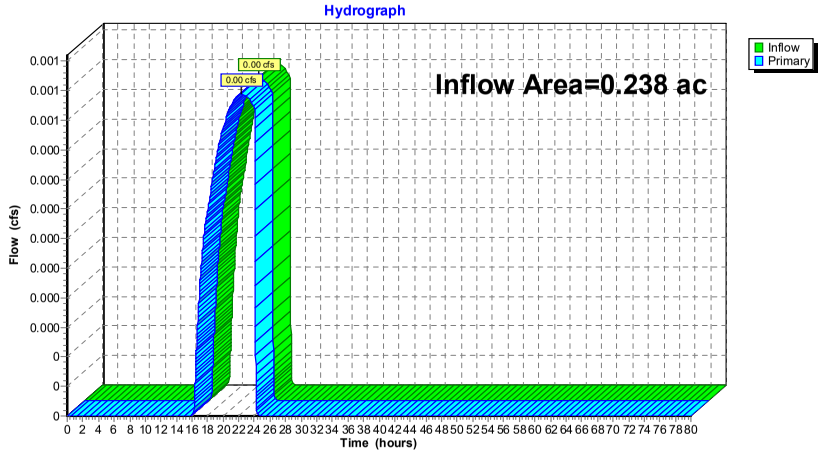


Summary for Link P.O.A. #3: P.O.A. #3

Inflow Area = 0.238 ac, 0.00% Impervious, Inflow Depth = 0.01" for 10-year event
Inflow = 0.00 cfs @ 22.37 hrs, Volume= 0.000 af
Primary = 0.00 cfs @ 22.37 hrs, Volume= 0.000 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-80.00 hrs, dt= 0.01 hrs

Link P.O.A. #3: P.O.A. #3



Time span=0.00-80.00 hrs, dt=0.01 hrs, 8001 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment1S: Subcatchment1S Runoff Area=30,821 sf 12.76% Impervious Runoff Depth=0.77"
Flow Length=297' Tc=15.6 min CN=42 Runoff=0.27 cfs 0.045 af

Subcatchment2S: Subcatchment2S Runoff Area=114,726 sf 1.12% Impervious Runoff Depth=0.70"
Flow Length=408' Tc=16.6 min CN=41 Runoff=0.86 cfs 0.154 af

Subcatchment3S: Subcatchment3S Runoff Area=10,386 sf 0.00% Impervious Runoff Depth=0.12"
Flow Length=67' Tc=7.8 min CN=30 Runoff=0.00 cfs 0.002 af

Link P.O.A. #1: P.O.A. #1 Inflow=0.27 cfs 0.045 af
Primary=0.27 cfs 0.045 af

Link P.O.A. #2: P.O.A. #2 Inflow=0.86 cfs 0.154 af
Primary=0.86 cfs 0.154 af

Link P.O.A. #3: P.O.A. #3 Inflow=0.00 cfs 0.002 af
Primary=0.00 cfs 0.002 af

Total Runoff Area = 3.580 ac Runoff Volume = 0.202 af Average Runoff Depth = 0.68"
96.66% Pervious = 3.460 ac 3.34% Impervious = 0.120 ac

Summary for Subcatchment 1S: Subcatchment 1S

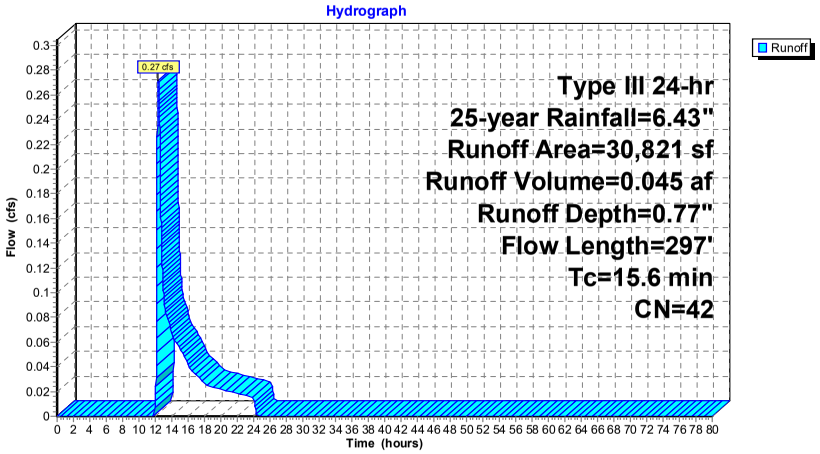
Runoff = 0.27 cfs @ 12.36 hrs, Volume= 0.045 af, Depth= 0.77"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-80.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-year Rainfall=6.43"

	Area (sf)	CN	Description
*	3,932	98	Impervious
*	1,218	96	Gravel
	236	80	>75% Grass cover, Good, HSG D
	25,435	30	Meadow, non-grazed, HSG A
	30,821	42	Weighted Average
	26,889		87.24% Pervious Area
	3,932		12.76% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.6	50	0.0200	0.07		**Sheet Flow, A-B** Grass: Bermuda n= 0.410 P2= 3.20"
1.8	127	0.0275	1.16		**Shallow Concentrated Flow, B-C** Short Grass Pasture Kv= 7.0 fps
0.1	22	0.0300	2.79		**Shallow Concentrated Flow, C-D** Unpaved Kv= 16.1 fps
1.1	98	0.0464	1.51		**Shallow Concentrated Flow, D-E** Short Grass Pasture Kv= 7.0 fps
15.6	297	Total			

Subcatchment 1S: Subcatchment 1S



Summary for Subcatchment 2S: Subcatchment 2S

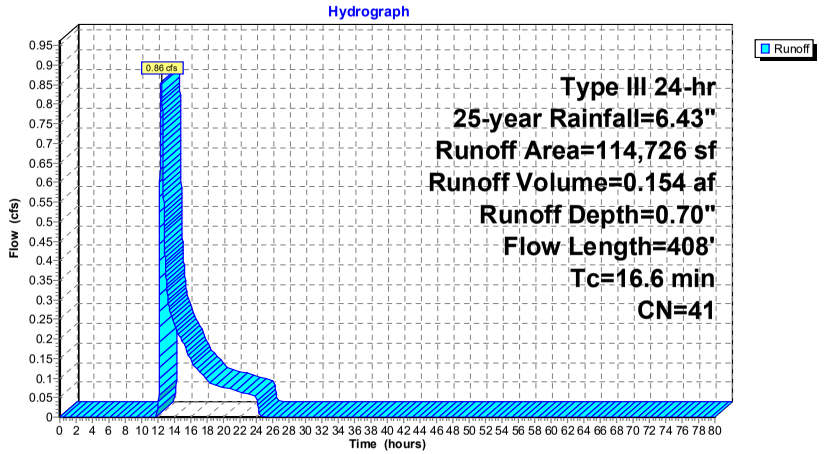
Runoff = 0.86 cfs @ 12.41 hrs, Volume= 0.154 af, Depth= 0.70"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-80.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-year Rainfall=6.43"

	Area (sf)	CN	Description
*	1,280	98	Impervious
*	7,113	96	Gravel
	12,471	80	>75% Grass cover, Good, HSG D
	3,040	39	>75% Grass cover, Good, HSG A
	266	77	Woods, Good, HSG D
	18,323	30	Woods, Good, HSG A
	72,233	30	Meadow, non-grazed, HSG A
	114,726	41	Weighted Average
	113,446		98.88% Pervious Area
	1,280		1.12% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.6	50	0.0200	0.07		**Sheet Flow, A-B** Grass: Bermuda n= 0.410 P2= 3.20"
4.0	358	0.0447	1.48		**Shallow Concentrated Flow, B-C** Short Grass Pasture Kv= 7.0 fps
16.6	408	Total			

Subcatchment 2S: Subcatchment 2S



Summary for Subcatchment 3S: Subcatchment 3S

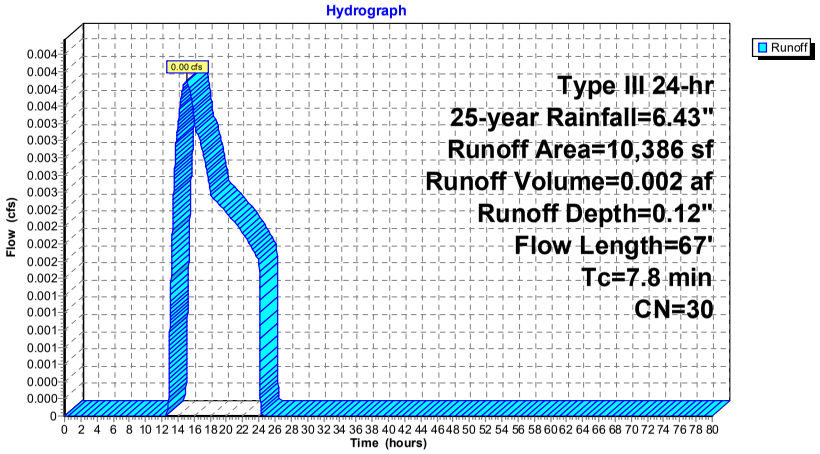
Runoff = 0.00 cfs @ 15.02 hrs, Volume= 0.002 af, Depth= 0.12"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-80.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-year Rainfall=6.43"

Area (sf)	CN	Description
10,386	30	Meadow, non-grazed, HSG A
10,386		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.6	50	0.0700	0.11		**Sheet Flow, A-B** Grass: Bermuda n= 0.410 P2= 3.20"
0.2	17	0.0588	1.70		**Shallow Concentrated Flow, B-C** Short Grass Pasture Kv= 7.0 fps
7.8	67	Total			

Subcatchment 3S: Subcatchment 3S

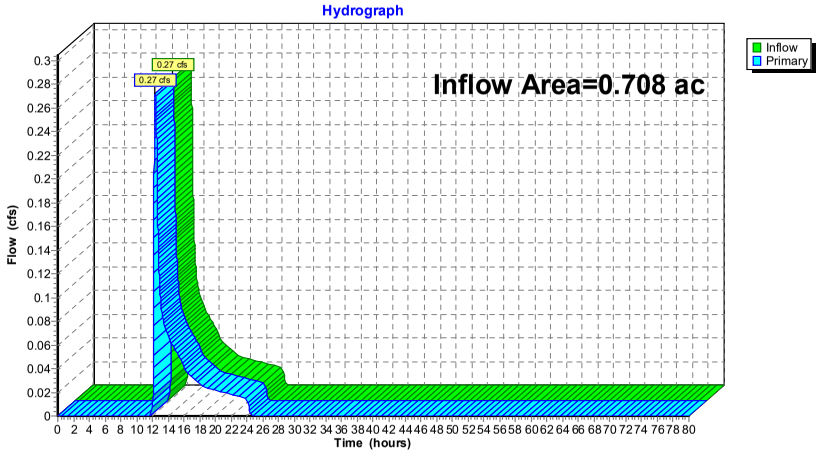


Summary for Link P.O.A. #1: P.O.A. #1

Inflow Area = 0.708 ac, 12.76% Impervious, Inflow Depth = 0.77" for 25-year event
Inflow = 0.27 cfs @ 12.36 hrs, Volume= 0.045 af
Primary = 0.27 cfs @ 12.36 hrs, Volume= 0.045 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-80.00 hrs, dt= 0.01 hrs

Link P.O.A. #1: P.O.A. #1

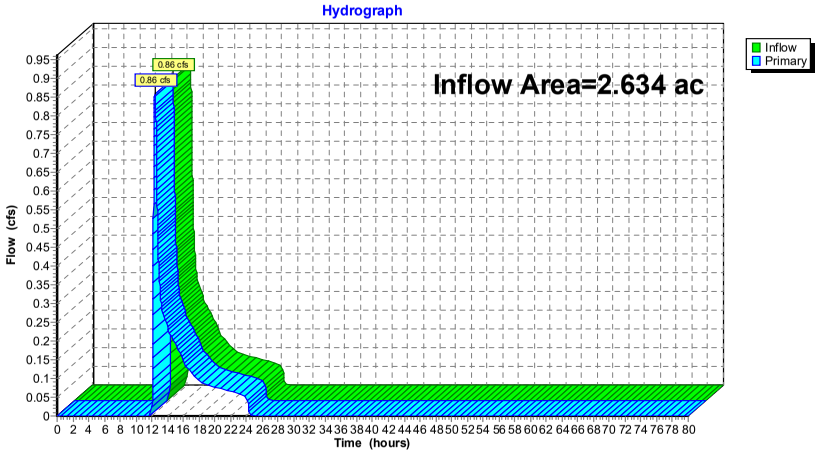


Summary for Link P.O.A. #2: P.O.A. #2

Inflow Area = 2.634 ac, 1.12% Impervious, Inflow Depth = 0.70" for 25-year event
Inflow = 0.86 cfs @ 12.41 hrs, Volume= 0.154 af
Primary = 0.86 cfs @ 12.41 hrs, Volume= 0.154 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-80.00 hrs, dt= 0.01 hrs

Link P.O.A. #2: P.O.A. #2

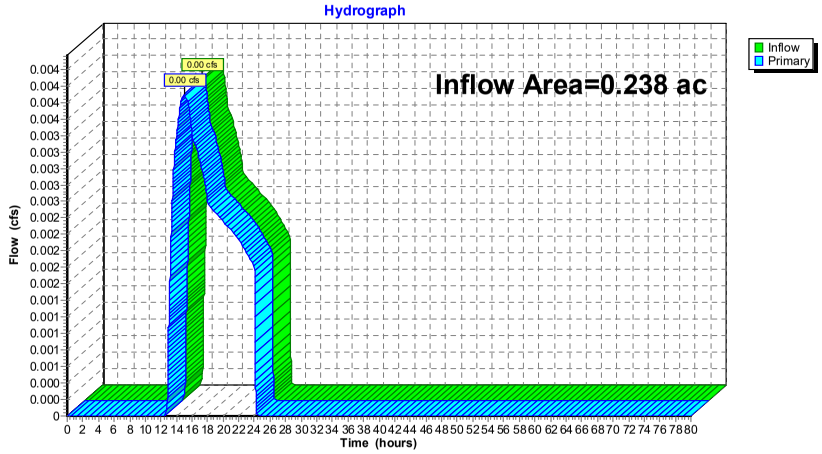


Summary for Link P.O.A. #3: P.O.A. #3

Inflow Area = 0.238 ac, 0.00% Impervious, Inflow Depth = 0.12" for 25-year event
Inflow = 0.00 cfs @ 15.02 hrs, Volume= 0.002 af
Primary = 0.00 cfs @ 15.02 hrs, Volume= 0.002 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-80.00 hrs, dt= 0.01 hrs

Link P.O.A. #3: P.O.A. #3



Time span=0.00-80.00 hrs, dt=0.01 hrs, 8001 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment1S: Subcatchment1S Runoff Area=30,821 sf 12.76% Impervious Runoff Depth=1.12"
Flow Length=297' Tc=15.6 min CN=42 Runoff=0.47 cfs 0.066 af

Subcatchment2S: Subcatchment2S Runoff Area=114,726 sf 1.12% Impervious Runoff Depth=1.04"
Flow Length=408' Tc=16.6 min CN=41 Runoff=1.52 cfs 0.228 af

Subcatchment3S: Subcatchment3S Runoff Area=10,386 sf 0.00% Impervious Runoff Depth=0.27"
Flow Length=67' Tc=7.8 min CN=30 Runoff=0.01 cfs 0.005 af

Link P.O.A. #1: P.O.A. #1 Inflow=0.47 cfs 0.066 af
Primary=0.47 cfs 0.066 af

Link P.O.A. #2: P.O.A. #2 Inflow=1.52 cfs 0.228 af
Primary=1.52 cfs 0.228 af

Link P.O.A. #3: P.O.A. #3 Inflow=0.01 cfs 0.005 af
Primary=0.01 cfs 0.005 af

Total Runoff Area = 3.580 ac Runoff Volume = 0.300 af Average Runoff Depth = 1.00"
96.66% Pervious = 3.460 ac 3.34% Impervious = 0.120 ac

Summary for Subcatchment 1S: Subcatchment 1S

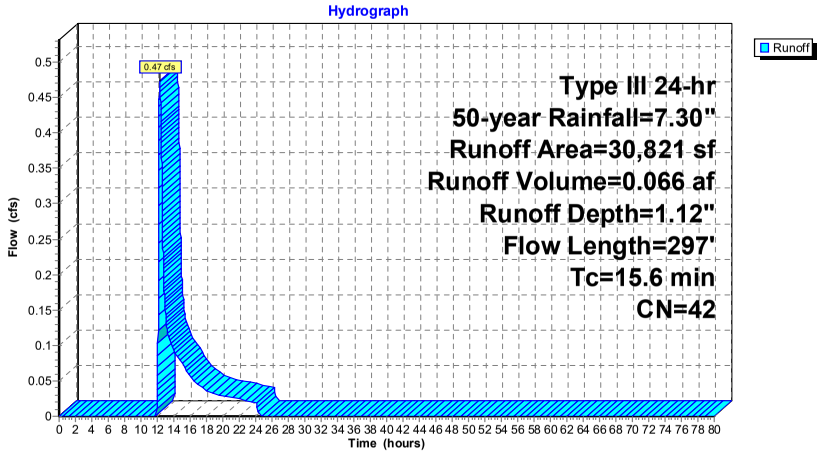
Runoff = 0.47 cfs @ 12.29 hrs, Volume= 0.066 af, Depth= 1.12"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-80.00 hrs, dt= 0.01 hrs
Type III 24-hr 50-year Rainfall=7.30"

	Area (sf)	CN	Description
*	3,932	98	Impervious
*	1,218	96	Gravel
	236	80	>75% Grass cover, Good, HSG D
	25,435	30	Meadow, non-grazed, HSG A
	30,821	42	Weighted Average
	26,889		87.24% Pervious Area
	3,932		12.76% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.6	50	0.0200	0.07		**Sheet Flow, A-B** Grass: Bermuda n= 0.410 P2= 3.20"
1.8	127	0.0275	1.16		**Shallow Concentrated Flow, B-C** Short Grass Pasture Kv= 7.0 fps
0.1	22	0.0300	2.79		**Shallow Concentrated Flow, C-D** Unpaved Kv= 16.1 fps
1.1	98	0.0464	1.51		**Shallow Concentrated Flow, D-E** Short Grass Pasture Kv= 7.0 fps
15.6	297	Total			

Subcatchment 1S: Subcatchment 1S



Summary for Subcatchment 2S: Subcatchment 2S

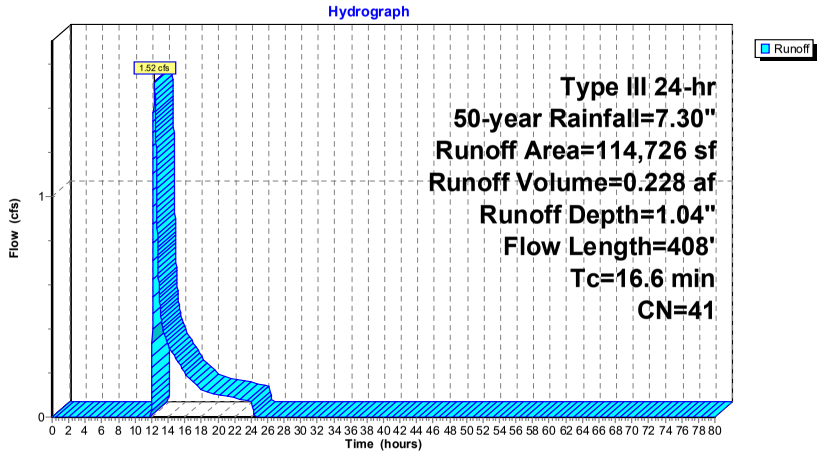
Runoff = 1.52 cfs @ 12.33 hrs, Volume= 0.228 af, Depth= 1.04"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-80.00 hrs, dt= 0.01 hrs
Type III 24-hr 50-year Rainfall=7.30"

	Area (sf)	CN	Description
*	1,280	98	Impervious
*	7,113	96	Gravel
	12,471	80	>75% Grass cover, Good, HSG D
	3,040	39	>75% Grass cover, Good, HSG A
	266	77	Woods, Good, HSG D
	18,323	30	Woods, Good, HSG A
	72,233	30	Meadow, non-grazed, HSG A
	114,726	41	Weighted Average
	113,446		98.88% Pervious Area
	1,280		1.12% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.6	50	0.0200	0.07		**Sheet Flow, A-B** Grass: Bermuda n= 0.410 P2= 3.20"
4.0	358	0.0447	1.48		**Shallow Concentrated Flow, B-C** Short Grass Pasture Kv= 7.0 fps
16.6	408	Total			

Subcatchment 2S: Subcatchment 2S



Summary for Subcatchment 3S: Subcatchment 3S

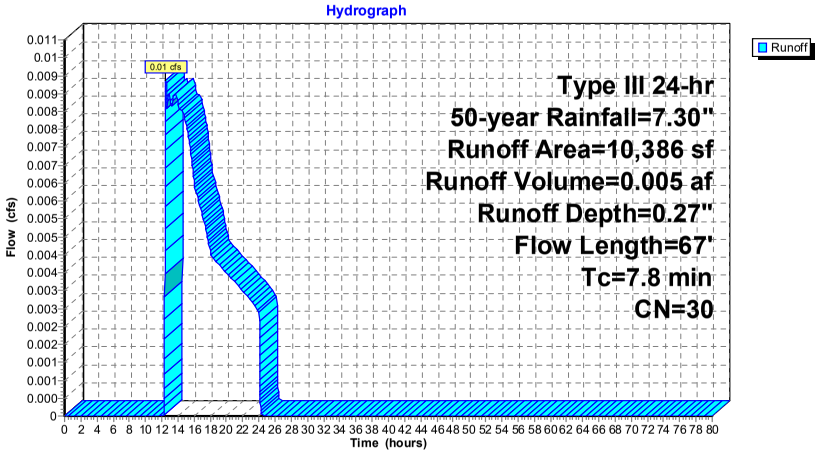
Runoff = 0.01 cfs @ 12.53 hrs, Volume= 0.005 af, Depth= 0.27"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-80.00 hrs, dt= 0.01 hrs
Type III 24-hr 50-year Rainfall=7.30"

Area (sf)	CN	Description
10,386	30	Meadow, non-grazed, HSG A
10,386		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.6	50	0.0700	0.11		**Sheet Flow, A-B** Grass: Bermuda n= 0.410 P2= 3.20"
0.2	17	0.0588	1.70		**Shallow Concentrated Flow, B-C** Short Grass Pasture Kv= 7.0 fps
7.8	67	Total			

Subcatchment 3S: Subcatchment 3S

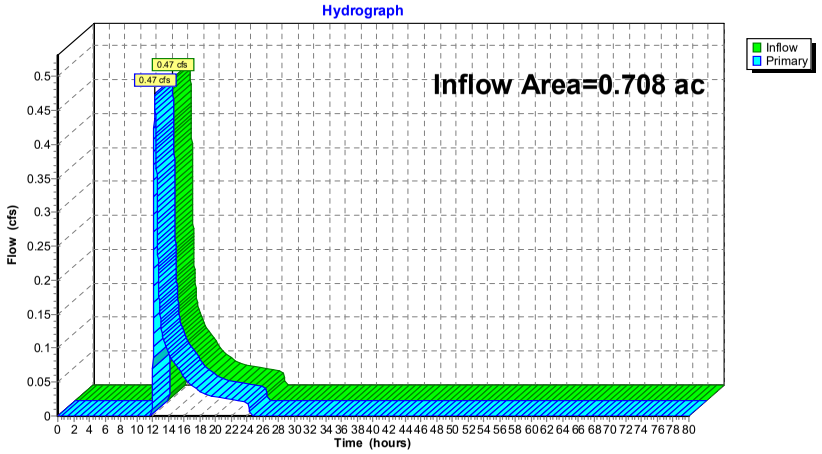


Summary for Link P.O.A. #1: P.O.A. #1

Inflow Area = 0.708 ac, 12.76% Impervious, Inflow Depth = 1.12" for 50-year event
Inflow = 0.47 cfs @ 12.29 hrs, Volume= 0.066 af
Primary = 0.47 cfs @ 12.29 hrs, Volume= 0.066 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-80.00 hrs, dt= 0.01 hrs

Link P.O.A. #1: P.O.A. #1

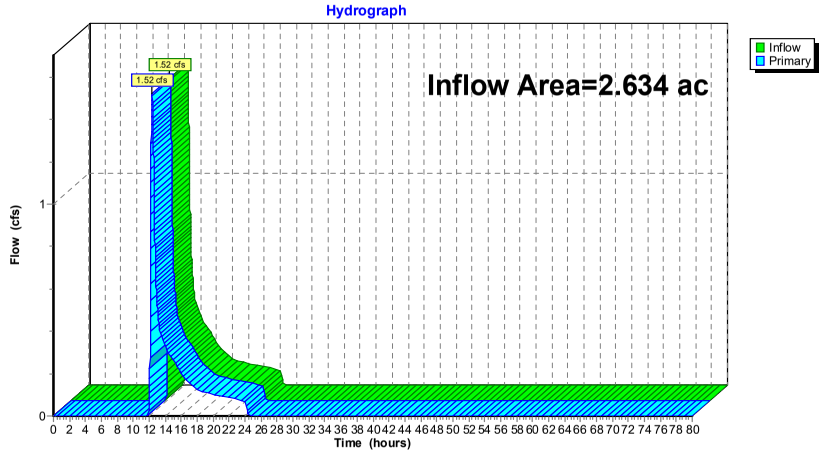


Summary for Link P.O.A. #2: P.O.A. #2

Inflow Area = 2.634 ac, 1.12% Impervious, Inflow Depth = 1.04" for 50-year event
Inflow = 1.52 cfs @ 12.33 hrs, Volume= 0.228 af
Primary = 1.52 cfs @ 12.33 hrs, Volume= 0.228 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-80.00 hrs, dt= 0.01 hrs

Link P.O.A. #2: P.O.A. #2

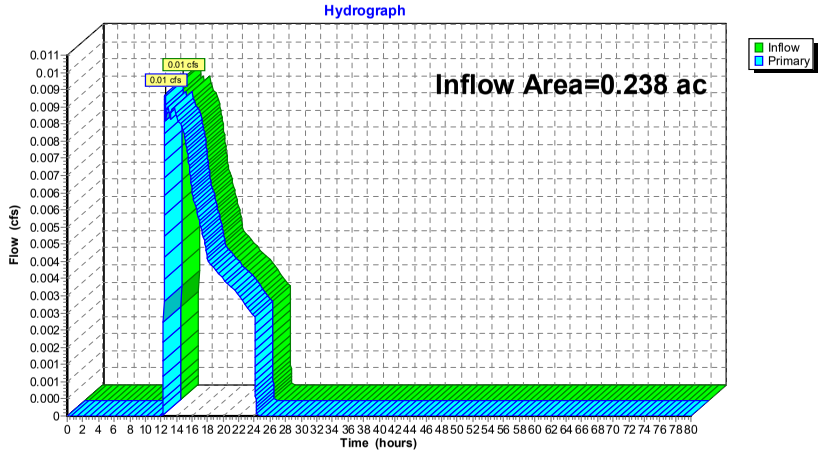


Summary for Link P.O.A. #3: P.O.A. #3

Inflow Area = 0.238 ac, 0.00% Impervious, Inflow Depth = 0.27" for 50-year event
Inflow = 0.01 cfs @ 12.53 hrs, Volume= 0.005 af
Primary = 0.01 cfs @ 12.53 hrs, Volume= 0.005 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-80.00 hrs, dt= 0.01 hrs

Link P.O.A. #3: P.O.A. #3



Time span=0.00-80.00 hrs, dt=0.01 hrs, 8001 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment1S: Subcatchment1S Runoff Area=30,821 sf 12.76% Impervious Runoff Depth=1.56"
Flow Length=297' Tc=15.6 min CN=42 Runoff=0.75 cfs 0.092 af

Subcatchment2S: Subcatchment2S Runoff Area=114,726 sf 1.12% Impervious Runoff Depth=1.46"
Flow Length=408' Tc=16.6 min CN=41 Runoff=2.45 cfs 0.320 af

Subcatchment3S: Subcatchment3S Runoff Area=10,386 sf 0.00% Impervious Runoff Depth=0.48"
Flow Length=67' Tc=7.8 min CN=30 Runoff=0.04 cfs 0.009 af

Link P.O.A. #1: P.O.A. #1 Inflow=0.75 cfs 0.092 af
Primary=0.75 cfs 0.092 af

Link P.O.A. #2: P.O.A. #2 Inflow=2.45 cfs 0.320 af
Primary=2.45 cfs 0.320 af

Link P.O.A. #3: P.O.A. #3 Inflow=0.04 cfs 0.009 af
Primary=0.04 cfs 0.009 af

Total Runoff Area = 3.580 ac Runoff Volume = 0.422 af Average Runoff Depth = 1.41"
96.66% Pervious = 3.460 ac 3.34% Impervious = 0.120 ac

Summary for Subcatchment 1S: Subcatchment 1S

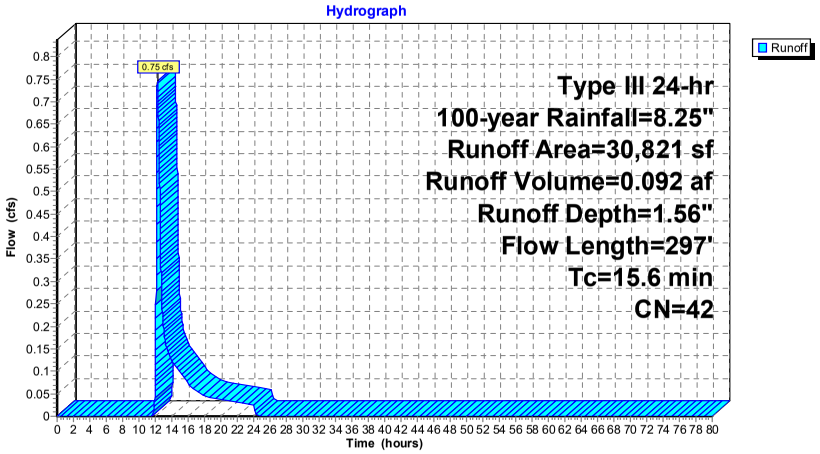
Runoff = 0.75 cfs @ 12.26 hrs, Volume= 0.092 af, Depth= 1.56"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-80.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-year Rainfall=8.25"

	Area (sf)	CN	Description
*	3,932	98	Impervious
*	1,218	96	Gravel
	236	80	>75% Grass cover, Good, HSG D
	25,435	30	Meadow, non-grazed, HSG A
	30,821	42	Weighted Average
	26,889		87.24% Pervious Area
	3,932		12.76% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.6	50	0.0200	0.07		**Sheet Flow, A-B** Grass: Bermuda n= 0.410 P2= 3.20"
1.8	127	0.0275	1.16		**Shallow Concentrated Flow, B-C** Short Grass Pasture Kv= 7.0 fps
0.1	22	0.0300	2.79		**Shallow Concentrated Flow, C-D** Unpaved Kv= 16.1 fps
1.1	98	0.0464	1.51		**Shallow Concentrated Flow, D-E** Short Grass Pasture Kv= 7.0 fps
15.6	297	Total			

Subcatchment 1S: Subcatchment 1S



Summary for Subcatchment 2S: Subcatchment 2S

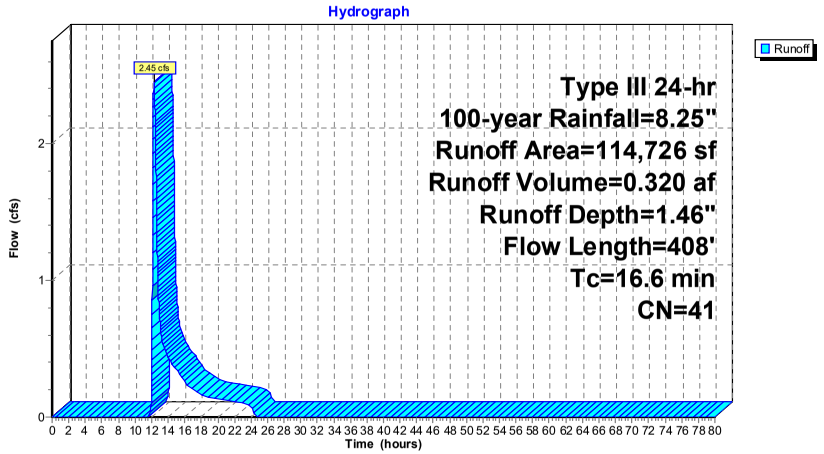
Runoff = 2.45 cfs @ 12.29 hrs, Volume= 0.320 af, Depth= 1.46"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-80.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-year Rainfall=8.25"

	Area (sf)	CN	Description
*	1,280	98	Impervious
*	7,113	96	Gravel
	12,471	80	>75% Grass cover, Good, HSG D
	3,040	39	>75% Grass cover, Good, HSG A
	266	77	Woods, Good, HSG D
	18,323	30	Woods, Good, HSG A
	72,233	30	Meadow, non-grazed, HSG A
	114,726	41	Weighted Average
	113,446		98.88% Pervious Area
	1,280		1.12% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.6	50	0.0200	0.07		**Sheet Flow, A-B** Grass: Bermuda n= 0.410 P2= 3.20"
4.0	358	0.0447	1.48		**Shallow Concentrated Flow, B-C** Short Grass Pasture Kv= 7.0 fps
16.6	408	Total			

Subcatchment 2S: Subcatchment 2S



Summary for Subcatchment 3S: Subcatchment 3S

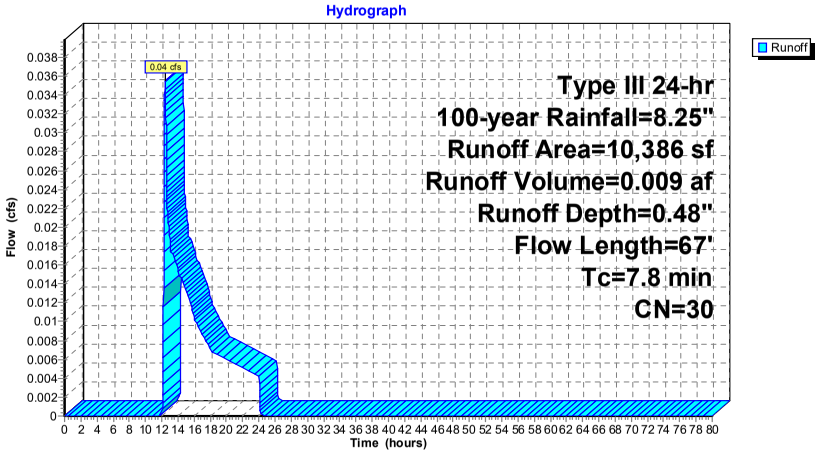
Runoff = 0.04 cfs @ 12.42 hrs, Volume= 0.009 af, Depth= 0.48"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-80.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-year Rainfall=8.25"

Area (sf)	CN	Description
10,386	30	Meadow, non-grazed, HSG A
10,386		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.6	50	0.0700	0.11		**Sheet Flow, A-B** Grass: Bermuda n= 0.410 P2= 3.20"
0.2	17	0.0588	1.70		**Shallow Concentrated Flow, B-C** Short Grass Pasture Kv= 7.0 fps
7.8	67	Total			

Subcatchment 3S: Subcatchment 3S

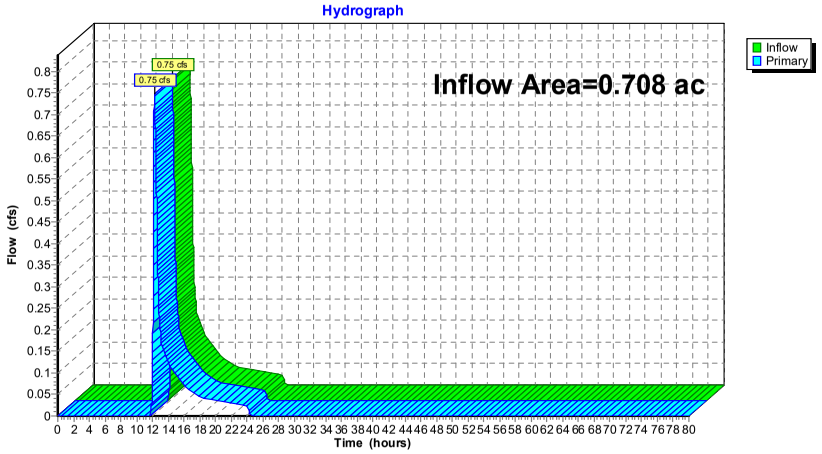


Summary for Link P.O.A. #1: P.O.A. #1

Inflow Area = 0.708 ac, 12.76% Impervious, Inflow Depth = 1.56" for 100-year event
Inflow = 0.75 cfs @ 12.26 hrs, Volume= 0.092 af
Primary = 0.75 cfs @ 12.26 hrs, Volume= 0.092 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-80.00 hrs, dt= 0.01 hrs

Link P.O.A. #1: P.O.A. #1

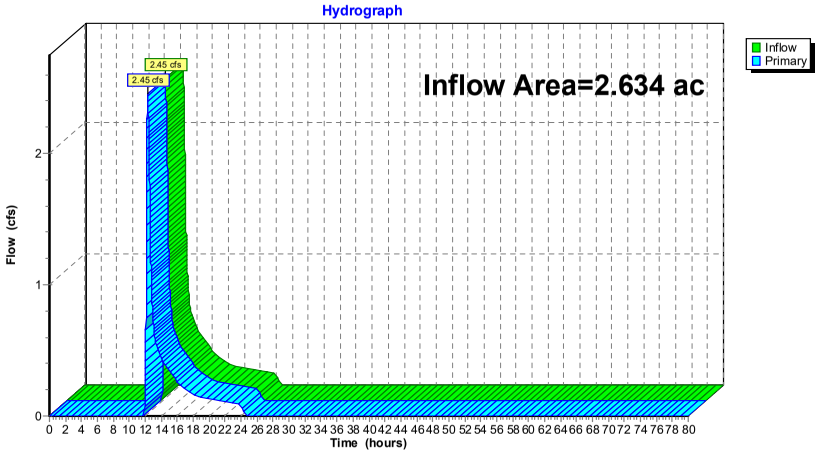


Summary for Link P.O.A. #2: P.O.A. #2

Inflow Area = 2.634 ac, 1.12% Impervious, Inflow Depth = 1.46" for 100-year event
Inflow = 2.45 cfs @ 12.29 hrs, Volume= 0.320 af
Primary = 2.45 cfs @ 12.29 hrs, Volume= 0.320 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-80.00 hrs, dt= 0.01 hrs

Link P.O.A. #2: P.O.A. #2

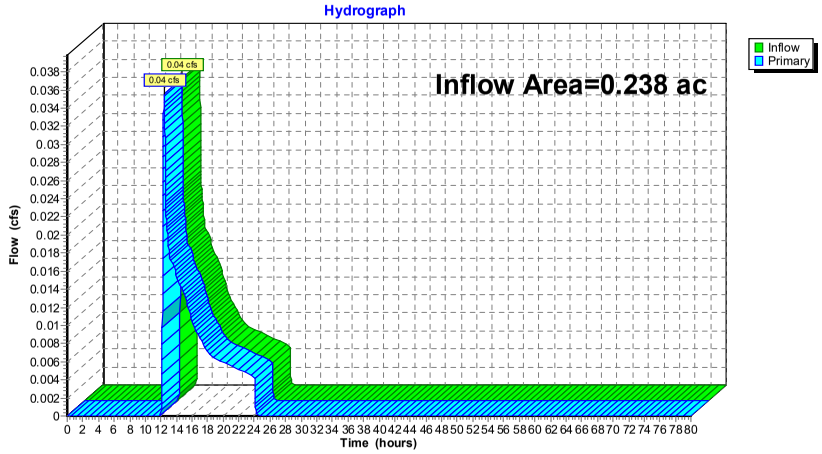


Summary for Link P.O.A. #3: P.O.A. #3

Inflow Area = 0.238 ac, 0.00% Impervious, Inflow Depth = 0.48" for 100-year event
Inflow = 0.04 cfs @ 12.42 hrs, Volume= 0.009 af
Primary = 0.04 cfs @ 12.42 hrs, Volume= 0.009 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-80.00 hrs, dt= 0.01 hrs

Link P.O.A. #3: P.O.A. #3



Appendix I – Operation and Maintenance Control Plan

Available under separate cover