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STORMWATER REPORT
FOR
15 LIBERTY WAY
FRANKLIN, MA

DATED: JANUARY 13, 2023
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LDG Project No.: 2081.00

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HYDROLOGIC SUMMARY

METHODOLOGY

The HydroCAD computer program (Hydro CAD) was used to model the existing and proposed hydrology of the site and design a stormwater management system. HydroCAD generates flood hydrographs dependent upon the type of land use, vegetation, soil types, land slope, watershed areas and rainfall data. HydroCAD also takes into account the antecedent moisture condition of the soil. The peak rate of runoff and volume of runoff are projected for the input storm frequency events (design storms).

Rainfall data was obtained from the Northeast Regional Climate Center and are based on Extreme Precipitation Events for the 2-, 10-, 25- and 100-year return periods for Franklin, Massachusetts. A 24-hour type III rainfall distribution was used in the HydroCAD analysis as prescribed for New England by the Northeast Regional Climate Center. A copy of the precipitation table is included herein.

PRE-DEVELOPMENT CONDITIONS

The existing site property is located at 15 Liberty Way between Constitution Boulevard and Rachael Circle. The existing property is developed and contains an approximately 95,000 square foot warehouse, paved driveway, and paved parking areas for cars and for trailer trucks. For the purposes of hydrological calculations, the proposed development consists of approximately 105,320 square feet located at the rear of the existing warehouse as shown on the site plans.

The existing topography of the site generally slopes from east to west and directs runoff to an existing stormwater basin located onsite. The southeastern corner of the site slopes south directing runoff to the existing paved driveway and parking area to the site east of the existing warehouse. The land cover is mostly wooded area and also includes pavement from the rear portion of the existing driveway and some grass areas.

Test pits were dug on-site in the areas of the proposed infiltration basin to verify the groundwater elevation. Groundwater depth in the area of the infiltration basin varies between approximately 2.5-feet to 3-feet below the surface. The soil logs of the test pits are attached.

The on-site soils as classified by the Soil Survey for Norfolk County Massachusetts are:

312B – Woodbridge fine sandy loam; 0 to 8 percent slopes; Hydrologic Soil Group (HSG) C/D

See the attached SCS soils documentation herein for additional soil details

POST-DEVELOPMENT CONDITIONS

The Applicant is proposing construct a new paved area to provide additional driveway and trailer parking area at the rear of the site. The project will also include the installation of a new stormwater management system and associated grading for this development.

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A new fully compliant stormwater management system has been designed to mitigate the impacts of the proposed site redevelopment. Runoff from the impervious areas will be directed to new catch basins and trench drains which will convey runoff to a subsurface infiltration basin. The subsurface infiltration basin will provide water quality treatment as well as attenuate peak rates of runoff and provide groundwater recharge.

A fully compliant stormwater management system for the entire site addressing compliance with the 10 MADEP Stormwater Standards will be part of the site redevelopment. Site improvements have been made to the maximum extent practicable in accordance with MADEP Stormwater Regulations.

STANDARD 1: Untreated Discharges

Stormwater Management Standard 1 requires that, "No new stormwater conveyances (e.g. outfalls) may discharge untreated stormwater directly to or cause erosion in wetlands or waters of the Commonwealth".

This standard is met by the proposed redevelopment not creating any new non-treated stormwater discharges and improving an existing residential site with no existing stormwater management system. All surface runoff from proposed impervious areas, with the exception of a redeveloped portion of the existing driveway, is collected in deep sump catch basins and trench drains and directed to a Stormceptor treatment unit prior to discharging to a subsurface infiltration basin. Overflow from the subsurface infiltration basin discharges from an outlet control structure to the existing detention basin through a 15" HPDE pipe. All discharges are designed to be placed in areas which mimic existing drainage flow patterns.

Redevelopment: The project has been designed to fully comply with Massachusetts Stormwater Regulations for Standard 1.

Full compliance with Standard 1 is required for new outfalls.

- What BMPs are proposed to ensure that all new discharges associated with the discharge are adequately treated? Proprietary Treatment Units, Subsurface infiltration basin
- What BMPs are proposed to ensure that no new discharges cause erosion in wetlands or waters of the Commonwealth? rip rap outlets are proposed in the existing stormwater basin designed to prevent erosion.
- Will the proposed discharge comply with all applicable requirements of the Massachusetts Clean Waters Act and the regulations promulgated thereunder at 314 CMR 3.00, 314 CMR 4.00 and 314 CMR 5.00? yes

Existing outfalls shall be brought into compliance with Standard 1 to the maximum extent practicable.

- Are there any existing discharges associated with the redevelopment project for which new treatment could be provided? No existing outfalls
- If so, the proponent shall specify the stormwater BMP retrofit measures that have been considered to ensure that the discharges are adequately treated and indicate the reasons for adopting or rejecting those measures. (See Section entitled "Retrofit of Existing BMPs".) N/A
- What BMPs have been considered to prevent erosion from existing stormwater discharges? N/A

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STANDARD 2: Peak Rate Control and Flood Prevention

Stormwater Management Standard 2 requires that, "Stormwater management systems must be designed so that post-development peak discharge rates do not exceed pre-development peak discharge rates. This Standard may be waived for land subject to coastal storm flowage."
This standard is met by the proposed development mitigating the post-development peak discharge rates at the designated control points for all design storm events. This is accomplished by directing stormwater flow to a subsurface infiltration basin. Below is a description of the design points used in the hydrologic analysis and a summary of pre- and post- development discharge rates. The proposed development will reduce the peak rate of runoff at all the design points and provide ample groundwater recharge.

Redevelopment: The project has been designed to fully comply with Massachusetts Stormwater Regulations for Standard 2.

Compliance to the Maximum Extent Practicable:

- Does the redevelopment design meet Standard 2, comparing post-development to pre-development conditions? Yes
- If not, the applicant shall document an analysis of alternative approaches for meeting the Standard. (See Menu of Strategies to Reduce Runoff and Peak Flows and/or Increase Recharge Menu included at the end of this chapter.) N/A

Improvement of existing conditions:

- Does the project reduce the volume and/or rate of runoff to less than current estimated conditions? Has the applicant considered all the alternatives for reducing the volume and/or rate of runoff from the site? (See Menu.) Yes
- Is the project located within a watershed subject to damage by flooding during the 2-year or 10-year 24-hour storm event? If so, does the project design provide for attenuation of the 2-year and 10-year 24-hour storm event to less than current estimated conditions? Have measures been implemented to reduce the volume of runoff from the site resulting from the 2 year or 10 year 24 hour storm event? (See Menu.) N/A
- Is the project located adjacent to a water body or watercourse subject to adverse impacts from flooding during the 100-year 24-hour storm event? If so, are portions of the site available to increase flood storage adjacent to existing Bordering Land Subject to Flooding (BLSF)? N/A
- Have measures been implemented to attenuate peak rates of discharge during the 100-year 24-hour storm event to less than the peak rates under current estimated conditions? Have measures been implemented to reduce the volume of runoff from the site resulting from the 100-year 24-hour storm event? (See Menu.) Yes

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SUMMARY OF PEAK STORMWATER RUNOFF (CFS)

Three design points were utilized to analyze the runoff characteristics of the site. Design Point 1 (DP-1) is the existing rip rap detention basin. The existing basin is the ultimate design point and no further analysis is included in the stormwater model, however it is assumed to provide infiltration and overflow to the wetlands on site. The existing basin currently collects runoff from surrounding areas on the site and discharges through an outlet without any issues. The proposed flow from the developed portion of the site is less than existing flow from the same area and therefore no adverse impacts are expected. As part of this project the owner is proposing to inspect and clean up any areas of the basin as needed. Design Point 2 (DP-2) is the existing paved driveway and parking area to the east of the existing warehouse. Design Point 3 (DP-3) is the northwestern corner of the property. The pre- and post- development peak discharge rates for all analyzed design storms is summarized in the following table:

Design Point – DP-1				
Year Storm	**Pre-Development**		**Post-Development**	
	Flow	Volume	Flow	Volume (Acre-Ft.)
2-yr	1.49 cfs	0.144	1.31 cfs	0.292
10-yr	4.53 cfs	0.399	4.15 cfs	0.636
25-yr	6.49 cfs	0.566	5.78 cfs	0.846
100-yr	9.57 cfs	0.833	8.73 cfs	1.169
Design Point – DP-2				
Year Storm	**Pre-Development**		**Post-Development**	
	Flow	Volume	Flow	Volume
2-yr	0.41 cfs	0.036	0.41 cfs	0.032
10-yr	0.94 cfs	0.081	0.70 cfs	0.062
25-yr	1.26 cfs	0.109	0.86 cfs	0.085
100-yr	1.73 cfs	0.151	1.11 cfs	0.121
Design Point – DP-3				
Year Storm	**Pre-Development**		**Post-Development**	
	Flow	Volume	Flow	Volume
2-yr	0.05 cfs	0.004	0.03 cfs	0.002
10-yr	0.13 cfs	0.010	0.08 cfs	0.006
25-yr	0.19 cfs	0.014	0.10 cfs	0.008
100-yr	0.27 cfs	0.020	0.14 cfs	0.011

The net peak discharge for DP-1 is controlled by the subsurface infiltration basin and does not increase flows off site for any of the evaluated design storms. There is a slight increase in volumes for the evaluated storms however based on the size of the total contributing area on abutting properties, the increase is negligible and there will be no adverse impacts to the wetlands. The net peak discharges for both DP-2 and DP-3 are un-controlled and flow off-site overland as occurs in existing conditions. Based on the proposed grading and the locations of new catch basins and trench drains, there is a reduction in total area contributing to both DP-2 and DP-3 and the proposed development does not increase flows or volumes to these design points for any of the evaluated design storms from existing conditions.

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STANDARD 3: Recharge to Groundwater

Stormwater Management Standard 3 requires 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, 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 the 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."

GROUND WATER RECHARGE

The proposed project will result in an increase in impervious area to a total of approximately 80,078 square feet. The on-site soils of the areas contributing to the proposed subsurface infiltration system as classified by the Soil Survey for Norfolk County Massachusetts are 312B – Woodbridge fine sandy loam 0 to 8 percent slopes with a hydrologic soil group classification of HSG C/D. On-site soil textures are sandy loam based on test pits performed by Level Design Group, LLC. Groundwater recharge will be provided by a proposed subsurface infiltration system. A curtain drain is proposed around the system to lower the groundwater in order to provide the minimum 2-feet of separation.

The on-site soils as classified by the Soil Survey for Plymouth County Massachusetts as Hydrologic Soil Group (HSG) C. The required infiltration for HSG C soil is 0.25 inches of runoff times the total impervious area.

The total post-development impervious area created is 80,078±sf. entirely located within soils with an HSA rating of C.

Water used to satisfy the recharge to groundwater standard is from proposed pavement area. The Simple Dynamic Method of Recharge Volume was utilized to calculate recharged groundwater.

Simple Dynamic Method Calculations for all proposed infiltration practices:

Required Recharge Volume:

Massachusetts Stormwater Handbook:
Rv = (F) x (New Impervious Area)

F = 0.25 (HSG C)
Impervious Area = 80,078 SF
Rv = (0.25) x (80,078 SF) x (1 ft./12 in.)
= 1,669 CF

Recharge Volume Provided:

SSI-1
Lowest Outlet Invert = 322.55 (6" orifice)
Volume at El. 322.55 = 1,801 CF → HydroCAD Report

1,801 CF > 1,669 CF

The recharge volume requirement 1,669 CF is exceeded with a total volume of 1,801 CF of storage provided below the lowest outlet of the infiltration systems.

Drawdown Calculations

$Time_{drawdown}$ = Rv / (K) x (Bottom Area)
Rv = Required recharge volume
K = Saturated Conductivity Rate
Bottom Area = Bottom area of recharge structure

SSI-1
Bottom Area = 7,434 SF
K = 0.27 in./hr.
$Time_{drawdown}$ = 1,801 CF / (0.27 in./hr.) x (7,434 SF) x (1 ft./12 in.)
= 10.77 hours

Redevelopment: The project has been designed comply with Massachusetts Stormwater Regulations for Standard 3 to the Maximum Extent Practicable.

Compliance to the Maximum Extent Practicable:

- Does the redevelopment design meet Standard 3, comparing post-development to pre-development conditions? No
- If not, the applicant shall document an analysis of alternative approaches for meeting the Standard? See Alternatives Analysis above.
- What soil types are present on the site? Is the site is comprised solely of C and D soils and bedrock at the land surface? Solely of C and D soils
- Does the project include sites where recharge is proposed at or adjacent to an area classified as contaminated, sites where contamination has been capped in place, sites that have an Activity and Use Limitation (AUL) that precludes inducing runoff to the groundwater, pursuant to MGL Chapter 21E and the Massachusetts Contingency Plan 310 CMR 40.0000; sites that are the location of a solid waste landfill as defined in 310 CMR 19.000; or sites where groundwater from the recharge location flows directly toward a solid waste landfill or 21E site?[1] N/A
- Is the stormwater runoff from a land use with a higher potential pollutant load? N/A
- Is the discharge to the ground located within the Zone II or Interim Wellhead Protection Area of a public water supply? No
- Does the site have an infiltration rate greater than 2.4 inches per hour? No

Improvements to Existing Conditions:

- Does the project increase the required recharge volume over existing (developed) conditions? If so, can the project be redesigned to reduce the required recharge volume by decreasing impervious surfaces (make building higher, put parking under the building, narrower roads, sidewalks on only one side of street, etc.) or using low impact development techniques such as porous pavement?

[1] A mounding analysis is needed if a site falls within this category. See Volume 3.

The site increases the recharge volume requirement. Porous pavement was considered as an alternative to provide infiltration but is not practical based on it being primarily utilized by trailer trucks.

- Is the project located within a basin or sub-basin that has been categorized as under high or medium stress by the Massachusetts Water Resources Commission, or where there is other evidence that there are rivers and streams experiencing low flow problems? If so, have measures been considered to replace the natural recharge lost as a result of the prior development? (See Menu.) N/A
- Has the applicant evaluated measures for reducing site runoff? (See Menu.)
  Yes, See Alternatives Analysis above.

STANDARD 4: 80% TSS Removal

Stormwater Management Standard 4 requires that, "Stormwater management systems must be designed to remove 80% of the average annual post-construction of Total Suspended Solids (TSS). This standard is met when:

a. Suitable practices for source control and pollution prevention are identified in a long-term pollution prevention plan and thereafter are implemented and maintained;
b. Stormwater BMPs are sized to capture the required water quality volume determined in accordance with the Massachusetts Stormwater Handbook and;
c. Pretreatment is provided in accordance with the Massachusetts Stormwater Handbook"

To achieve the required 80% TSS removal, new stormwater BMP's will be installed. A subsurface infiltration basin is proposed which will collect runoff from all impervious areas within Drainage Area P-1a and provide the maximum level or stormwater treatment practicable. A proprietary stormwater treatment unit is proposed which provides treatment prior to discharge to the subsurface infiltration basin. MADEP TSS Removal Sheets are included herein which show 80% TSS removal by the proprietary stormwater treatment unit and the subsurface infiltration basin meeting the requirements for total treatment.

Water Quality Calculations:

CDS Stormwater Treatment Unit Sizing
Water quality treatment is provided by using CDS treatment units. The CDS Units are sized using the *Massachusetts Department of Environmental Protection Wetlands Program – Standard Method to Convert Required Water Quality Volume to a Discharge Rate for Sizing Flow Based Manufactured Proprietary Stormwater Treatment Practices.*

The water quality flow calculations are detailed below:

Flow to DHM-2/CDS

$Q_{1.0}$=(qu)(A)(WQV)
qu=774 csm/in for a Tc of 0.1 hours (taken from Figure 2 of the Massachusetts Department of Environmental Protection Wetlands program - Standard Method to Convert Required Water Quality Volume to a Discharge Rate
A=1.633 Acres

WQV=1.0 inches

$Q_{1.0}$ = (774 csm/in) (1.633 acres) (0.0015625 sq. mi / acre) (1.0 inch)

Q1.0 = 1.97 cfs < CDS Model 2020-5 Inlet Unit with a Treatment Capacity =2.20 cfs

Flow to CB-3/STC-450i

$Q_{1.0}$=(qu)(A)(WQV)
qu=774 csm/in for a Tc of 0.1 hours (taken from Figure 2 of the Massachusetts Department of Environmental Protection Wetlands program - Standard Method to Convert Required Water Quality Volume to a Discharge Rate
A=0.071 Acres
WQV=1.0 inches

$Q_{1.0}$ = (774 csm/in) (0.071 acres) (0.0015625 sq. mi / acre) (1.0 inch)

Q1.0 = 0.09 cfs < STC-450i with a Treatment Capacity =0.40 cfs

Redevelopment: The project has been designed to fully comply with Massachusetts Stormwater Regulations for Standard 4.

Full compliance for any component that is not a redevelopment
Full compliance with the long-term pollution plan requirement for new developments and redevelopments.

- Has the proponent developed a long-term pollution plan that fully meets the requirements of Standard 4? A Long Term Pollution Prevention Plan is provided
- Does the pollution prevention plan include the following source control measures?
    - Street sweeping - yes
    - Proper management of snow, salt, sand and other deicing chemicals – yes
    - Proper management of fertilizers, herbicides and pesticides - yes
    - Stabilization of existing eroding surfaces - yes

Compliance to the Maximum Extent Practicable for the other requirements:

- Does the redevelopment design provide for treatment of all runoff from existing (as well as new) impervious areas to achieve 80% TSS removal? If 80% TSS removal is not achieved, has the stormwater management system been designed to remove TSS to the maximum extent practicable? 80% TSS removal achieved
- Have the proposed stormwater BMPs been properly sized to capture the prescribed runoff volume? Yes
    - One inch rule applies for discharge
        - within a Zone II or Interim Wellhead Protection Area, - N/A
        - near or to another critical area, - N/A
        - from a land use with a higher potential pollutant load - N/A

        - to the ground where the infiltration rate is greater than 2.4 inches per hour - N/A
- Has adequate pretreatment been proposed?
    - 44% TSS Removal Pretreatment Requirement applies if:
        - Stormwater runoff is from a land use with a higher potential pollutant load
        - Stormwater is discharged - Yes, 44% TSS removal achieved (Zone II and rapid infiltration)
            - To the ground within the Zone II or Interim Wellhead Protection Area of a Public Water Supply - N/A
            - To the ground with an infiltration rate greater than 2.4 inches per hour - N/A
            - Near or to an Outstanding Resource Water, Special Resource Water, Cold-Water Fishery, Shellfish Growing Area, or Bathing Beach. - N/A

• If the stormwater BMPs do not meet all the requirements set forth above, the applicant shall document an analysis of alternative approaches for meeting the these requirements. (See Section on Retrofitting Existing BMPs (the "Retrofit Section"). N/A

Improvements to Existing Conditions:

- Have measures been provided to achieve at least partial compliance with the TSS removal standard? Fully complies
- Have any of the best management practices in the Retrofit Section been considered? N/A
- Have any of the following pollution prevention measures been considered?
  Operation & Maintenance and Long Term Pollution Prevention Plans have been prepared for the site in accordance with Massachusetts Stormwater regulations and are included in the Stormwater Report.
    - Reduction or elimination of winter sanding, where safe and prudent to do so
    - Tighter controls over the application of fertilizers, herbicides, and pesticides
    - Landscaping that reduces the need for fertilizer, herbicides and pesticides
    - High frequency sweeping of paved surfaces using vacuum sweepers
    - Improved catch basin cleaning
    - Waterfowl control programs

Are there any discharges (new or existing) to impaired waters? If so, see TMDL section. N/A

STANDARD 5: Higher Potential Pollutant Loads

Stormwater Management Standard 5 requires that, "For land uses with higher potential pollutant loads, source control and pollution prevention shall be implemented in accordance with the Massachusetts Stormwater Handbook to eliminate or reduce the discharge of stormwater runoff from such land uses to the maximum extent practicable. If through source control and/or pollution prevention, all land uses with higher potential pollutant loads cannot be completely protected from exposure to rain, snow, snow melt and stormwater runoff, the proponent shall use the specific stormwater BMPs determined by the Department to be suitable for such use as provided in the Massachusetts Stormwater Handbook. Stormwater discharges from land uses with higher potential pollutant loads shall also comply with the requirements of the Massachusetts Clean Waters Act, M.G.L. c. 2,§26-53, and the regulations promulgated thereunder at 314 CMF 3.00, 314 CMR 4.00 and 314 CMR 5.00."

The proposed use in not considered a use that would generate Higher Potential Pollutant Loads.

Redevelopment: The project use is not considered a use that would generate Higher Potential Pollutant Loads.

STANDARD 6: Critical Areas

Stormwater Management Standard 6 requires that Stormwater discharge to a Zone II Interim Wellhead Protection Area of a public water supply and stormwater discharges near any other critical area require the use of specific source control and pollution prevention measures and the specific stormwater best management practices determined by the Department to be suitable for managing discharges to such area, as provided in the Massachusetts Stormwater Handbook. A discharge near a critical area, if there is a strong likelihood of a significant impact occurring to said area, taking into account site-specific factors. Stormwater discharges to Outstanding Resource Waters or Special Resource Waters shall be set back from the receiving water and receive the highest and best practical method of treatment. A "stormwater discharge," as defined in 314 CMR 3.04(2)(a)1. or (b), to an Outstanding Resource Waters or Special Resource Waters shall comply with 314 CMF 3.00 and 314 CMR 4.00. Stormwater discharges to a Zone I or Zone A area prohibited unless essential to the operation of the public water supply."

The development site is not located within a Critical Area as defined by the Massachusetts Stormwater Handbook.

Redevelopment: The project is not located in a critical area as defined by the Massachusetts Stormwater Regulations for Standard 6.

STANDARD 7: Redevelopment and Other Projects Subject to the Standards only to the Maximum Extent Practicable

The definition of a Redevelopment Project under the definition provided in the MADEP Stormwater Handbook for Standard 7 is listed below:

> "Development rehabilitation, expansion and phased projected on previously developed sites, provided that redevelopment results in no next increase in impervious area."

The proposed development is not considered a Redevelopment Project and fully complies with the requirements of the MADEP Stormwater Management Standards.

STANDARD 8: Erosion and Sediment Control

Stormwater Management Standard 8 requires that, "A plan to control construction-related impacts, including erosion sedimentation and other pollutant sources during construction and land disturbance activities (construction period erosion, sedimentation, and pollution prevention plan), must be developed and implemented."

This standard is met through the type and style of construction. The existing driveway will, to the extent possible, remain intact until the proposed driveway is to be graded and paved. This will provide a pad for wheel cleaning prior to the vehicle exit on Washington Street. The site is self-contained with abutting properties draining overland to the rear of the subject property. Thereby there will be no additional erosion from this property to abutting properties. With careful construction the project will limit erosion potential through the development itself and no additional structural measures, passive or active, are proposed. A Construction Period Pollution and Erosion & Sedimentation Control Plan has also been prepared and is included as part of the Stormwater Report.

Redevelopment: The project has been designed to fully comply with Massachusetts Stormwater Regulations for Standard 8.

All redevelopment projects shall fully comply with Standard 8.

- Has the proponent submitted a construction period erosion, sedimentation and pollution prevention plan that meets the requirements of Standard 8?
  A draft Stormwater Pollution Prevention Plan is included with the stormwater report and will be finalized prior to the start of construction.

STANDARD 9: Operation and Maintenance

Stormwater Management Standard 9 requires that, "A long-term operation and maintenance plan must be developed and implemented to ensure that stormwater management systems function as designed".

This standard is fully met with development and implementation of an Operation and Maintenance Plan is included in Stormwater Management Report.

Redevelopment: The project has been designed to fully comply with Massachusetts Stormwater Regulations for Standard 9.

All redevelopment projects shall fully comply with Standard 9.

- Has the proponent submitted a long-term Operation and Maintenance plan that meets the requirements of Standard 9?
  O&M included in Stormwater Report

STANDARD 10: Illicit Discharges

Stormwater Management Standard 10 requires that, "All illicit discharges to the stormwater management system are prohibited".

This standard is fully met with development and implementation of a Long-Term Pollution Prevention which is included in the Stormwater Management Report. An Illicit Discharge statement has been prepared and is included herein.

Redevelopment: The project has been designed to fully comply with Massachusetts Stormwater Regulations for Standard 10.

All redevelopment projects shall fully comply with Standard 10.

- Are there any known or suspected illicit discharges to the stormwater management system at the redevelopment project site? No
- Has an illicit connection detection program been implemented using visual screening, dye or smoke testing? No
- Have an Illicit Discharge Compliance Statement and associated site map been submitted verifying that there are no illicit discharges to the stormwater management system at the site? Yes

Improvements to Existing Conditions:

- Once all illicit discharges are removed, has the proponent implemented any measures to prevent additional illicit discharges? N/A

CONCLUSION

The proposed redevelopment of this parcel will be a significant improvement to the area and to the resource area on and adjacent to the site. The proposed 2081 redevelopment meets or exceeds the current MADEP Stormwater Management Standards and Guidelines and provides a stormwater management system that will maintain water quality while attenuating peak rates of runoff at the control points. This was achieved by using pretreatment BMPs and directing the stormwater runoff to a subsurface infiltration basin which attenuates peak flows, provides groundwater recharge, and provides a high level of TSS removal. An Operation and Maintenance Plan for post-construction maintenance of the Stormwater Management System has been developed and is included with this report.

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MADEP Stormwater Report Checklist

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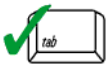
Massachusetts Department of Environmental Protection
Bureau of Resource Protection - Wetlands Program

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.

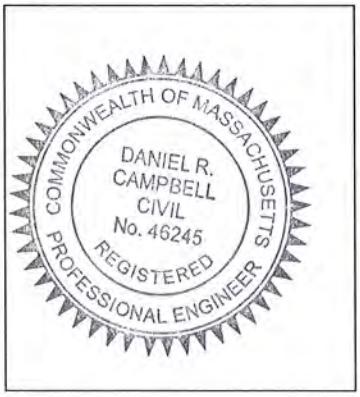
Note: Because stormwater requirements vary from project to project, it is possible that a complete Stormwater Report may not include information on some of the subjects specified in the Checklist. If it is determined that a specific item does not apply to the project under review, please note that the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



10/16/23
Signature and Date

Checklist

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

☐ New development

☐ Redevelopment

☒ Mix of New Development and Redevelopment

Checklist for Stormwater Report

Checklist (continued)

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

- ☒ No disturbance to any Wetland Resource Areas
- ☐ Site Design Practices (e.g. clustered development, reduced frontage setbacks)
- ☐ Reduced Impervious Area (Redevelopment Only)
- ☐ Minimizing disturbance to existing trees and shrubs
- ☐ LID Site Design Credit Requested:
  - ☐ Credit 1
  - ☐ Credit 2
  - ☐ Credit 3
- ☐ Use of “country drainage” versus curb and gutter conveyance and pipe
- ☐ Bioretention Cells (includes Rain Gardens)
- ☐ Constructed Stormwater Wetlands (includes Gravel Wetlands designs)
- ☐ Treebox Filter
- ☐ Water Quality Swale
- ☐ Grass Channel
- ☐ Green Roof
- ☐ Other (describe): _____

Standard 1: No New Untreated Discharges

- ☒ No new untreated discharges
- ☐ Outlets have been designed so there is no erosion or scour to wetlands and waters of the Commonwealth
- ☐ Supporting calculations specified in Volume 3 of the Massachusetts Stormwater Handbook included.

Checklist for Stormwater Report

Checklist (continued)

Standard 2: Peak Rate Attenuation

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

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

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

Standard 3: Recharge

☒ Soil Analysis provided.

☐ Required Recharge Volume calculation provided.

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

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

☐ Static ☐ Simple Dynamic ☐ Dynamic Field[1]

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

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

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

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

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

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

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

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

Checklist for Stormwater Report

Checklist (continued)

Standard 3: Recharge (continued)

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

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

Standard 4: Water Quality

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

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

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

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

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

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

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

Checklist for Stormwater Report

Checklist (continued)

Standard 4: Water Quality (continued)

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

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

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

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

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

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

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

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

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

☐ All exposure has been eliminated.

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

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

Standard 6: Critical Areas

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

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

Checklist for Stormwater Report

Checklist (continued)

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

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

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

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

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

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

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

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

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

Checklist for Stormwater Report

Checklist (continued)

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

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

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

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

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

Standard 9: Operation and Maintenance Plan

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

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

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

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

Standard 10: Prohibition of Illicit Discharges

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

☒ An Illicit Discharge Compliance Statement is attached;

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

LEVEL
DESIGN GROUP

Aerial Photograph (MAGIS)

249 SOUTH STREET UNIT 1 PLAINVILLE MA 02762
TEL508 695 2221 FAX508 695 2219 CONTACT@LEVELDG.COM LEVELDG.COM

15 Liberty Way

Franklin, MA

1 inch = 300 Feet

0 300 600 900

January 17, 2023

www.cai-tech.com

This information is believed to be correct but is subject to change and is not warrantied.

LEVEL
DESIGN GROUP

USGS Topographic Map (MAGIS)

249 SOUTH STREET UNIT 1 PLAINVILLE MA 02762
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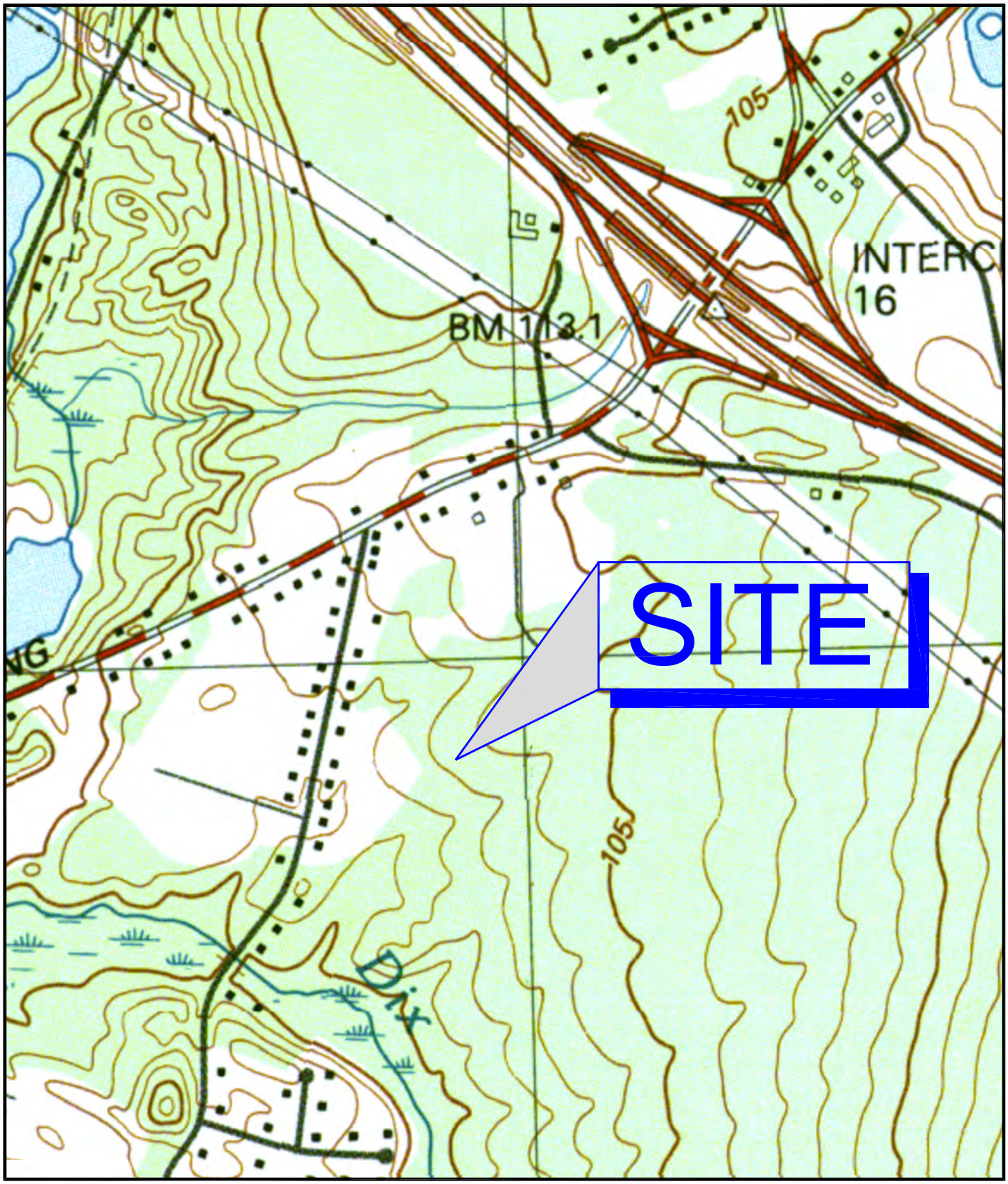


USGS LOCUS MAP

LEVEL DESIGN GROUP
Civil Engineers & Land Surveyors

CIVIL ENGINEERS AND LAND SURVEYORS
249 SOUTH STREET, UNIT 1
PLAINVILLE, MA 02762
508.695.2221 (F) 508.695.2219
WWW.LEVELDG.COM

15 LIBERTY WAY
FRANKLIN, MA

PROJ NO.: 2081.00
SCALE: 1" = 1,000'

LEVEL
DESIGN GROUP

On-Site Soils Documentation

249 SOUTH STREET UNIT 1 PLAINVILLE MA 02762
TEL508 695 2221 FAX508 695 2219 CONTACT@LEVELDG.COM LEVELDG.COM

Project No: 2081.00 **Soil Evaluator** Adam Hunt E.I.T. SE# 12794

Project: 15 Liberty Way Franklin **Temp** 48F Rain

Date of Testing 11/16/22

Test Hole No.: TH-1 Ground Elevation at Hole = 334.70

Time: 10:15 AM Groundwater Elevation = 331.78

Depth (inches)	Horizon	Color	Texture	Redox Depth	Redox Color	Comments
0-10	A	10YR 2/2	SL			
10-24	B	10YR 5/6	SL			
24-108	C1	2.5Y 6/3	SL	35"		Very Compact

Weeping Observed	none
Standing Water Observed	none
Redox Observed	35"

Test Hole No.: TH-2 Ground Elevation at Hole = 331.05

Time: 11:00 AM Groundwater Elevation = 328.38

Depth (inches)	Horizon	Color	Texture	Redox Depth	Redox Color	Comments
0-12	A	10YR 2/2	SL			
12-24	B	10YR 5/6	SL			
24-120	C1	2.5Y 6/3	SL	32"		Very Compact

Weeping Observed	none
Standing Water Observed	none
Redox Observed	32"

Test Hole No.: TH-3 Ground Elevation at Hole = 328.50

Time: 11:45 AM Groundwater Elevation = 326.00

Depth (inches)	Horizon	Color	Texture	Redox Depth	Redox Color	Comments
0-12	A	10YR 2/2	SL			
12-28	B	10YR 5/6	SL			
28-72	C1	2.5Y 6/3	SL	30"		Very Compact

Weeping Observed	none
Standing Water Observed	none
Redox Observed	30"

Project No: 2081.00 **Soil Evaluator** Adam Hunt E.I.T. SE# 12794
Project: 15 Liberty Way Franklin **Temp** 68F Sunny
Date of Testing 10/4/23

Test Hole No.: TH-4 Ground Elevation at Hole = 325.65
Time: 9:45 AM Groundwater Elevation = 323.32

Depth (inches)	Horizon	Color	Texture	Redox Depth	Redox Color	Comments
0-10	A	10YR 2/2	SL			
10-20	B	10YR 5/6	SL			
20-100	C1	2.5Y 6/3	SL	28"		Very Compact

Weeping Observed	98"
Standing Water Observed	
Redox Observed	28"

Test Hole No.: TH-5 Ground Elevation at Hole = 326.45
Time: 10:30 AM Groundwater Elevation = 323.03

Depth (inches)	Horizon	Color	Texture	Redox Depth	Redox Color	Comments
0-12	A	10YR 2/2	SL			
12-18	B	10YR 5/6	SL			
18-76	C1	2.5Y 6/3	SL	41"		Very Compact

Weeping Observed	41"
Standing Water Observed	69"
Redox Observed	41"

Test Hole No.: TH-6 Ground Elevation at Hole = 325.70
Time: 11:15 AM Groundwater Elevation = 323.45

Depth (inches)	Horizon	Color	Texture	Redox Depth	Redox Color	Comments
0-12	A	10YR 2/2	SL			
12-24	B	10YR 5/6	SL			
24-84	C1	2.5Y 6/3	SL	27"		Very Compact

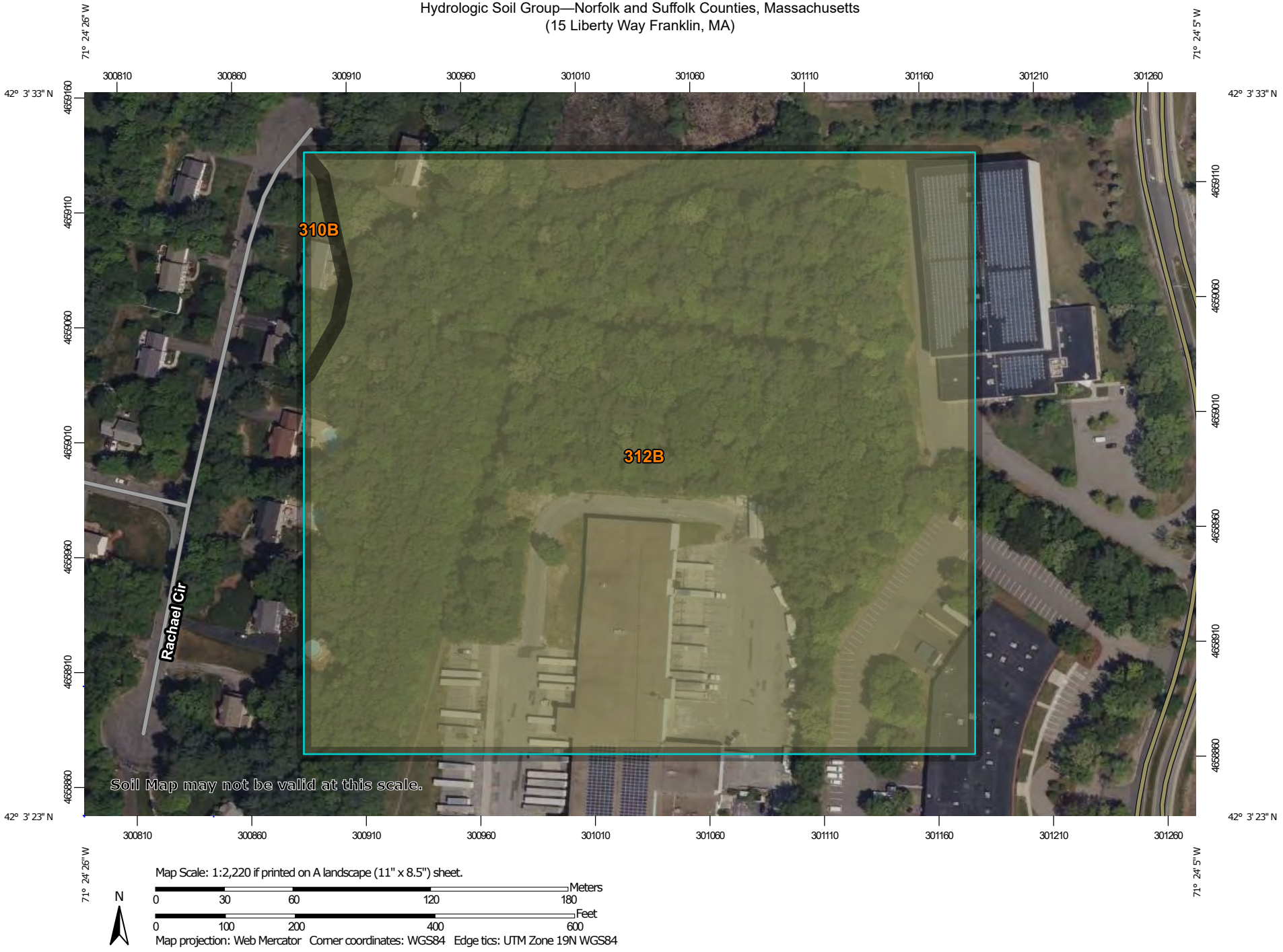
Weeping Observed	36"
Standing Water Observed	82"
Redox Observed	27"

Test Hole No.: TH-7 Ground Elevation at Hole = 324.90
Time: 12:00 AM Groundwater Elevation = 322.65

Depth (inches)	Horizon	Color	Texture	Redox Depth	Redox Color	Comments
0-10	A	10YR 2/2	SL			
10-20	B	10YR 5/6	SL			
20-90	C1	2.5Y 6/3	SL	27"		Very Compact

Weeping Observed	50"
Standing Water Observed	
Redox Observed	27"

Hydrologic Soil Group—Norfolk and Suffolk Counties, Massachusetts
(15 Liberty Way Franklin, MA)



Map Scale: 1:2,220 if printed on A landscape (11" x 8.5") sheet.

N

Meters
0 30 60 120 180

Feet
0 100 200 400 600

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

MAP LEGEND

Area of Interest (AOI)

- Area of Interest (AOI)

Soils

Soil Rating Polygons

- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Lines

- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Points

- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Water Features

- Streams and Canals

Transportation

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

Background

- Aerial Photography

MAP INFORMATION

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

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: Norfolk and Suffolk Counties, Massachusetts
Survey Area Data: Version 18, Sep 9, 2022

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

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

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

Hydrologic Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
310B	Woodbridge fine sandy loam, 3 to 8 percent slopes	C/D	0.3	1.5%
312B	Woodbridge fine sandy loam, 0 to 8 percent slopes, extremely stony	C/D	18.8	98.5%
Totals for Area of Interest			**19.0**	**100.0%**

Description

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

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

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

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

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

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

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

Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

LEVEL
DESIGN GROUP

Stormwater Treatment Unit Information

249 SOUTH STREET UNIT 1 PLAINVILLE MA 02762
TEL508 695 2221 FAX508 695 2219 CONTACT@LEVELDG.COM LEVELDG.COM

STORM WATER TREATMENT DEVICE

1.0 GENERAL

1.1 This item shall govern the furnishing and installation of the CDS® by Contech Engineered Solutions LLC, complete and operable as shown and as specified herein, in accordance with the requirements of the plans and contract documents.

1.2 The Contractor shall furnish all labor, equipment and materials necessary to install the storm water treatment device(s) (SWTD) and appurtenances specified in the Drawings and these specifications.

1.3 The manufacturer of the SWTD shall be one that is regularly engaged in the engineering design and production of systems deployed for the treatment of storm water runoff for at least five (5) years and which have a history of successful production, acceptable to the Engineer. In accordance with the Drawings, the SWTD(s) shall be a CDS® device manufactured by:

Contech Engineered Solutions LLC
9025 Centre Pointe Drive
West Chester, OH, 45069
Tel: 1 800 338 1122

1.4 Related Sections

1.4.1 Section 02240: Dewatering
1.4.2 Section 02260: Excavation Support and Protection
1.4.3 Section 02315: Excavation and Fill
1.4.4 Section 02340: Soil Stabilization

1.5 All components shall be subject to inspection by the engineer at the place of manufacture and/or installation. All components are subject to being rejected or identified for repair if the quality of materials and manufacturing do not comply with the requirements of this specification. Components which have been identified as defective may be subject for repair where final acceptance of the component is contingent on the discretion of the Engineer.

1.6 The manufacturer shall guarantee the SWTD components against all manufacturer originated defects in materials or workmanship for a period of twelve (12) months from the date the components are delivered to the owner for installation. The manufacturer shall upon its determination repair, correct or replace any manufacturer originated defects advised in writing to the manufacturer within the referenced warranty period. The use of SWTD components shall be limited to the application for which it was specifically designed.

1.7 The SWTD manufacturer shall submit to the Engineer of Record a “Manufacturer’s Performance Certification” certifying that each SWTD is capable of achieving the specified removal efficiencies listed in these specifications. The certification shall be supported by independent third-party research

1.8 No product substitutions shall be accepted unless submitted 10 days prior to project bid date, or as directed by the Engineer of Record. Submissions for substitutions require review and approval by the Engineer of Record, for hydraulic performance, impact to project designs, equivalent treatment performance, and any required project plan and report (hydrology/hydraulic, water quality, stormwater pollution) modifications that would be required by the approving jurisdictions/agencies. Contractor to coordinate with the Engineer of Record any applicable modifications to the project estimates of cost, bonding amount determinations, plan check fees for changes to approved documents, and/or any other regulatory requirements resulting from the product substitution.

2.0 MATERIALS

2.1 Housing unit of stormwater treatment device shall be constructed of pre-cast or cast-in-place concrete, no exceptions. Precast concrete components shall conform to applicable sections of ASTM C 478, ASTM C 857 and ASTM C 858 and the following:

- 2.1.1 Concrete shall achieve a minimum 28-day compressive strength of 4,000 pounds per square-inch (psi);
- 2.1.2 Unless otherwise noted, the precast concrete sections shall be designed to withstand lateral earth and AASHTO H-20 traffic loads;
- 2.1.3 Cement shall be Type III Portland Cement conforming to ASTM C 150;
- 2.1.4 Aggregates shall conform to ASTM C 33;
- 2.1.5 Reinforcing steel shall be deformed billet-steel bars, welded steel wire or deformed welded steel wire conforming to ASTM A 615, A 185, or A 497.
- 2.1.6 Joints shall be sealed with preformed joint sealing compound conforming to ASTM C 990.
- 2.1.7 Shipping of components shall not be initiated until a minimum compressive strength of 4,000 psi is attained or five (5) calendar days after fabrication has expired, whichever occurs first.

2.2 Internal Components and appurtenances shall conform to the following:

- 2.2.1 Screen and support structure shall be manufactured of Type 316 and 316L stainless steel conforming to ASTM F 1267-01;
- 2.2.2 Hardware shall be manufactured of Type 316 stainless steel conforming to ASTM A 320;
- 2.2.3 Fiberglass components shall conform to the ASTM D-4097
- 2.2.4 Access system(s) conform to the following:
- 2.2.5 Manhole castings shall be designed to withstand AASHTO H-20 loadings and manufactured of cast-iron conforming to ASTM A 48 Class 30.

3.0 PERFORMANCE

3.1 The SWTD shall be sized to either achieve an 80 percent average annual reduction in the total suspended solid load or treat a flow rate designated by the jurisdiction in which the project is located. Both methods should be sized using a particle size distribution having a mean particle size (d_{50}) of 125 microns unless otherwise stated.

3.2 The SWTD shall be capable of capturing and retaining 100 percent of pollutants greater than or equal to 2.4 millimeters (mm) regardless of the pollutant's specific gravity (i.e.: floatable and neutrally buoyant materials) for flows up to the device's rated-treatment capacity. The SWTD shall be designed to retain all previously captured pollutants addressed by this

subsection under all flow conditions. The SWTD shall be capable of capturing and retaining total petroleum hydrocarbons. The SWTD shall be capable of achieving a removal efficiency of 92 and 78 percent when the device is operating at 25 and 50 percent of its rated-treatment capacity. These removal efficiencies shall be based on independent third-party research for influent oil concentrations representative of storm water runoff (20 ± 5 mg/L). The SWTD shall be greater than 99 percent effective in controlling dry-weather accidental oil spills.

3.3 The SWTD shall be designed with a sump chamber for the storage of captured sediments and other negatively buoyant pollutants in between maintenance cycles. The minimum storage capacity provided by the sump chamber shall be in accordance with the volume listed in Table 1. The boundaries of the sump chamber shall be limited to that which do not degrade the SWTD's treatment efficiency as captured pollutants accumulate. The sump chamber shall be separate from the treatment processing portion(s) of the SWTD to minimize the probability of fine particle re-suspension. In order to not restrict the Owner's ability to maintain the SWTD, the minimum dimension providing access from the ground surface to the sump chamber shall be 16 inches in diameter.

3.4 The SWTD shall be designed to capture and retain Total Petroleum Hydrocarbons generated by wet-weather flow and dry-weather gross spills and have a capacity listed in Table 1 of the required unit.

3.5 The SWTD shall convey the flow from the peak storm event of the drainage network, in accordance with required hydraulic upstream conditions as defined by the Engineer. If a substitute SWTD is proposed, supporting documentation shall be submitted that demonstrates equal or better upstream hydraulic conditions compared to that specified herein. This documentation shall be signed and sealed by a Professional Engineer registered in the State of the work. All costs associated with preparing and certifying this documentation shall be born solely by the Contractor.

3.6 The SWTD shall have completed field tested following TARP Tier II protocol requirements

4.0 EXECUTION

4.1 The contractor shall exercise care in the storage and handling of the SWTD components prior to and during installation. Any repair or replacement costs associated with events occurring after delivery is accepted and unloading has commenced shall be borne by the contractor.

4.2 The SWTD shall be installed in accordance with the manufacturer's recommendations and related sections of the contract documents. The manufacturer shall provide the contractor installation instructions and offer on-site guidance during the important stages of the installation as identified by the manufacturer at no additional expense. A minimum of 72 hours notice shall be provided to the manufacturer prior to their performance of the services included under this subsection.

4.3 The contractor shall fill all voids associated with lifting provisions provided by the manufacturer. These voids shall be filled with non-shrinking grout providing a finished surface consistent with adjacent surfaces. The contractor shall trim all protruding lifting provisions flush with the adjacent concrete surface in a manner, which leaves no sharp points or edges.

4.4 The contractor shall removal all loose material and pooling water from the SWTD prior to the transfer of operational responsibility to the Owner.

TABLE 1
Storm Water Treatment Device
Storage Capacities

CDS Model	Minimum Sump Storage Capacity $(yd^3)/(m^3)$	Minimum Oil Storage Capacity (gal)/(L)
CDS2015-4	0.9(0.7)	61(232)
CDS2015-5	1.5(1.1)	83(313)
CDS2020-5	1.5(1.1)	99(376)
CDS2025-5	1.5(1.1)	116(439)
CDS3020-6	2.1 (1.6)	184(696)
CDS3025-6	2.1(1.6)	210(795)
CDS3030-6	2.1 (1.6)	236(895)
CDS3035-6	2.1 (1.6)	263(994)
CDS3535-7	2.9(2.2)	377(1426)
CDS4030-8	5.6(4.3)	426(1612)
CDS4040-8	5.6 (4.3)	520(1970)
CDS4045-8	5.6 (4.3)	568(2149)
CDS5640-10	8.7(6.7)	758(2869)
CDS5653-10	8.7(6.7)	965(3652)
CDS5668-10	8.7(6.7)	1172(4435)
CDS5678-10	8.7(6.7)	1309(4956)
CDS7070-DV	3.6(2.8)	914 (3459)
CDS10060-DV	5.0 (3.8)	792 (2997)
CDS10080-DV	5.0 (3.8)	1057 (4000)
CDS100100-DV	5.0 (3.8)	1320 (4996)

END OF SECTION

CONTECH®
ENGINEERED SOLUTIONS

Hydrodynamic Separation
Southern New England

The experts you need to solve your stormwater challenges

Contech is the leader in stormwater solutions, helping engineers, contractors and owners with infrastructure and land development projects throughout North America.

With our responsive team of stormwater experts, local regulatory expertise and flexible solutions, Contech is the trusted partner you can count on for stormwater management solutions.

Your Contech Team

STORMWATER CONSULTANT

It's my job to recommend the best solution to meet permitting requirements.

STORMWATER DESIGN ENGINEER

I work with consultants to design the best approved solution to meet your project's needs.

REGULATORY MANAGER

I understand the local stormwater regulations and what solutions will be approved.

SALES ENGINEER

I make sure our solutions meet the needs of the contractor during construction.

Contech is your partner in stormwater management solutions

Removing Pollutants using Hydrodynamic Separation

Utilize high-performance hydrodynamic separation to effectively remove finer sediment, oil and grease, and floating and sinking debris.

CASCADE separator®

CDS®

Vortechs®

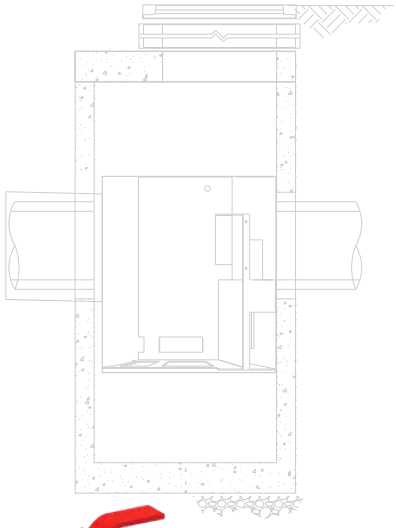
Stormceptor® STC

HDS systems play a vital role in protecting our waterways by removing high levels of sediment, trash, debris, and hydrocarbons from stormwater runoff.

Frequently used as end-of-pipe solutions, they are also used to provide stormwater quality treatment in places where space is limited.

HDS systems capture and retain a variety of stormwater pollutants and are very easy to maintain. These two key benefits have resulted in new uses for HDS technologies, such as pretreating detention, Low Impact Development, and green infrastructure practices, as well as other land-based stormwater treatment systems.

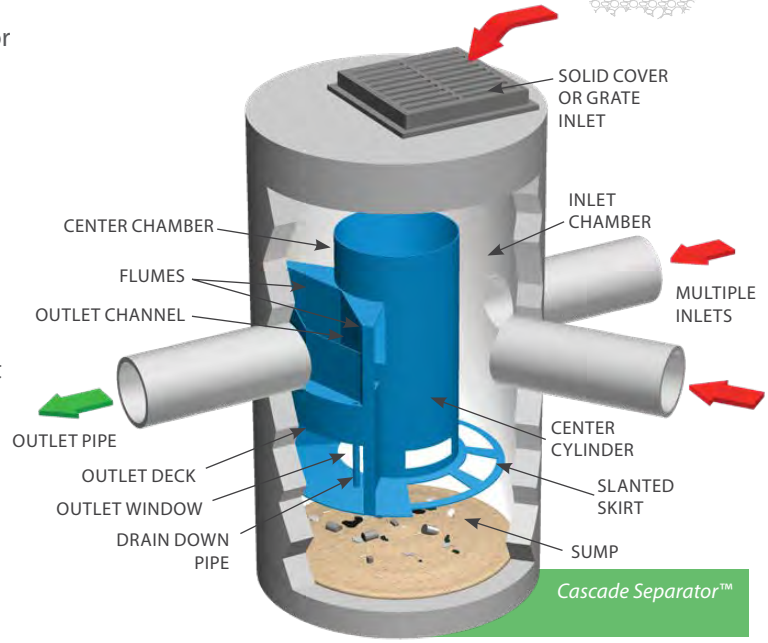
The Cascade Separator® System



Advanced Sediment Capture Technology ...

The Cascade Separator® is the newest innovation in stormwater treatment from Contech. The Cascade Separator was developed by Contech's stormwater experts using advanced modeling tools and Contech's industry leading stormwater laboratory.

This innovative hydrodynamic separator excels at sediment capture and retention while also removing hydrocarbons, trash, and debris from stormwater runoff. What makes the Cascade Separator unique is the use of opposing vortices that enhance particle settling and a unique skirt design that allows for sediment transport into the sump while reducing turbulence and resuspension of previously captured material. These two factors allow the Cascade Separator to treat high flow rates in a small footprint, resulting in an efficient and economical solution for any site.



FEATURE	BENEFIT
Unique skirt design & opposing vortices	Superior TSS removal; reduced system size and costs
Inlet area accepts wide range of inlet pipe angles	Design and installation flexibility
Accepts multiple inlet pipes*	Eliminates the need for separate junction structure
Grate inlet option*	Eliminates the need for a separate grate inlet structure
Internal bypass	Eliminates the need for a separate bypass structure
Clear access to sump and stored pollutants	Fast, easy maintenance

** NJDEP testing based on Cascade Separator with one inlet pipe and no grate inlet*

Learn More:
www.ContechES.com/cascade

SELECT CASCADE APPROVALS

- New Jersey Department of Environmental Protection Certification (NJDEP)

CASCADE MAINTENANCE

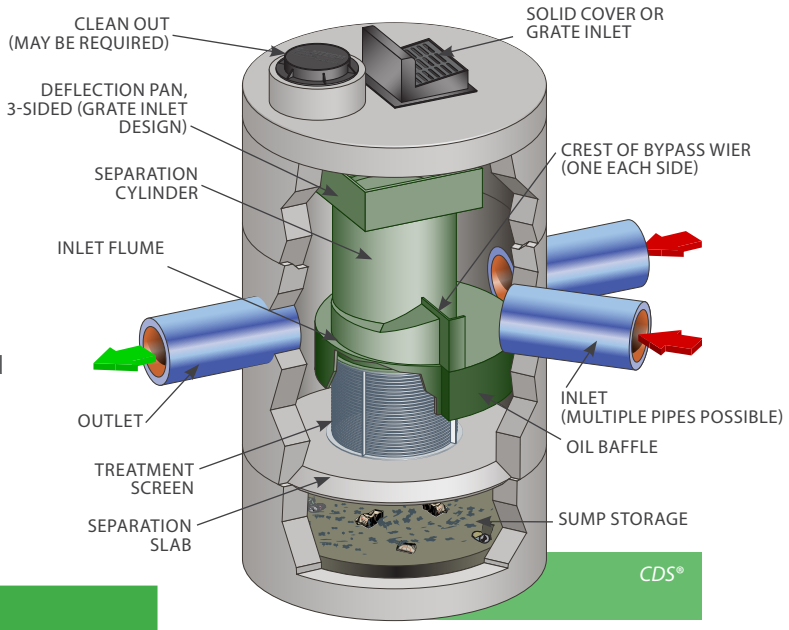
Cascade provides unobstructed access to stored pollutants, making it easy to maintain using a vacuum truck, with no requirement to enter the unit.

The CDS® System

Superior TSS and Trash Removal ...

The CDS is a hybrid technology that uses a combination of swirl concentration and indirect screening to separate and trap sediment, trash, debris, and hydrocarbons from stormwater runoff.

At the heart of the CDS system is a unique screening technology used to capture and retain sediment. The screen face is louvered so that it is smooth in the downstream direction. The effect created is called "Continuous Deflective Separation." The power of the incoming flow is harnessed to continually shear debris off the screen and to direct trash and sediment toward the center of the separation cylinder. This results in a screen that is self-cleaning and provides 100% removal of floatables and neutrally buoyant material debris 2.4 mm or larger, without blinding.



FEATURE	BENEFIT
Unique flow path and isolated storage sump	Excellent TSS capture and retention
Captures and retains 100% of floatables and neutrally buoyant debris 2.4 MM or larger	Superior trash removal
Self-cleaning screen	Ease of maintenance
Inline, offline, multiple inlet pipes, grate inlet, and drop inlet configurations available	Design flexibility
Internal bypass	Eliminates the need for additional structures
Clear access to sump and stored pollutants	Fast, easy maintenance

Learn More:
www.ContechES.com/cds

SELECT CDS APPROVALS

- Washington Department of Ecology (GULD) – Pretreatment
- New Jersey Department of Environmental Protection Certification (NJDEP)
- Canadian Environmental Technology Verification (ETV)
- MASTEP
- Connecticut DOT

The CDS system has been accepted and used extensively in all New England states for over 20 years with thousands of installations.

The Vortechs® System

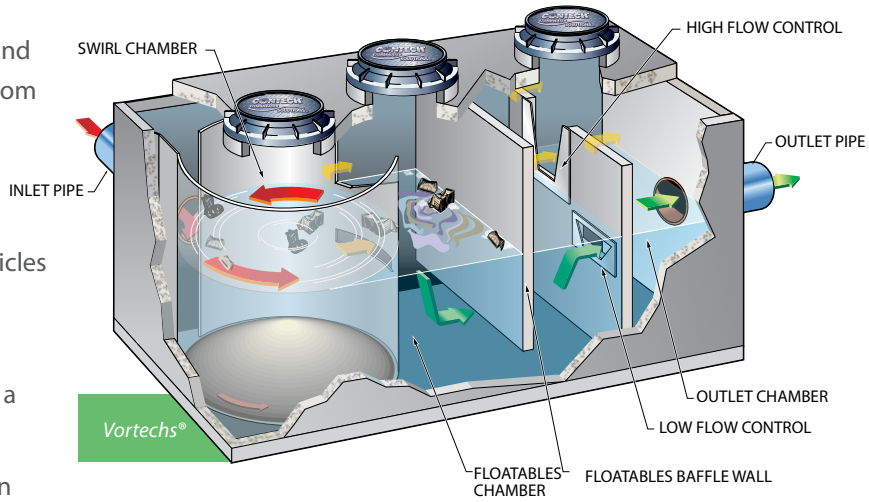
Stormwater Treatment in a Shallow Footprint ....

Vortechs combines swirl concentration and flow controls into a single treatment unit that captures and retains trash, debris, sediment, and hydrocarbons from stormwater runoff.

The Vortechs system's large swirl chamber and flow controls work together to create a low energy environment, ideal for capturing and retaining particles down to 50 microns.

Vortechs is the ideal solution for sites with high groundwater, bedrock, utility conflicts, or sites with a large volume runoff.

The Vortechs System is approved by the Washington Department of Ecology (GULD) - Pretreatment.



Learn More:
www.ContechES.com/vortechs

SELECT VORTECHS APPROVALS

- Washington Department of Ecology (GULD) – Pretreatment
- MASTEP
- Connecticut DOT

FEATURE	BENEFIT
Large swirl chamber	Fine particle removal down to 50 microns
Shallow profile – Typical depth below pipe invert is only 3 feet.	Can be used on sites with high groundwater, bedrock, or utility conflicts
Unobstructed access to stored pollutants	Fast, easy maintenance

The Vortechs System was developed in New England and has been used extensively in the region for over 20 years.

The ideal solution for sites with high groundwater

Stormceptor® STC

Stormceptor STC is the recognized leader in stormwater treatment, offering a range of versatile treatment systems that effectively remove pollutants from stormwater and snowmelt runoff. Stormceptor is flexibly designed to protect waterways from hazardous material spills and stormwater pollution, including suspended sediment, free oils, and other pollutants that attach to particles, no matter how fierce the storm.

Stormceptor's scour prevention technology ensures pollutants are captured and contained during all rainfall events.

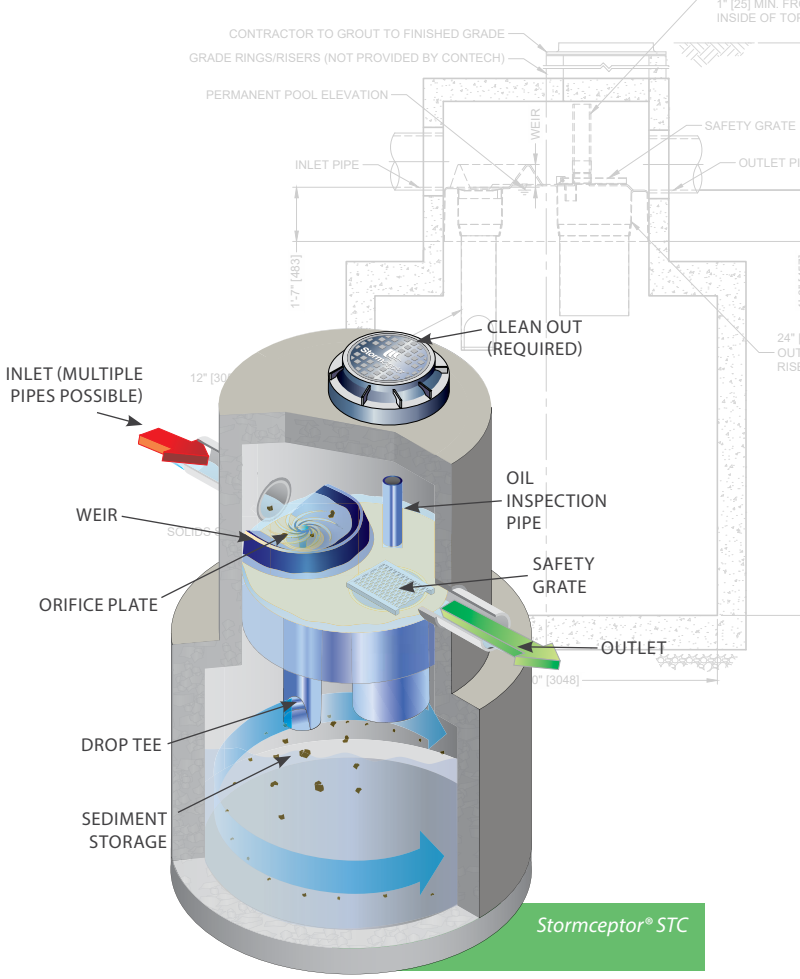
Ideal uses

- Sediment (TSS) removal
- Spill control
- Debris and small floatables capture
- Pretreatment for filtration, detention/retention systems, ponds, wetlands, Low Impact Development (LID), green infrastructure, and water-sensitive urban design

Proven performance

With more than 20 years of industry experience, Stormceptor has been performance tested and verified by some of the most stringent technology evaluation programs in North America.

- NJCAT
- Washington Ecology to Washington Department of Ecology (GULD) – Pretreatment
- EN858 Class 2



Learn More:
www.ContechES.com/stormceptor

FEATURE	BENEFIT
Patented scour prevention technology	Superior pollutant removal and retention
Can take the place of a conventional junction or inlet structure	Eliminates the need for additional structures
Minimal drop between inlet and outlet	Site flexibility
Multiple inlets can connect to a single unit	Design flexibility
3rd party tested and verified performance (Sediment & Oil)	Eliminates the need for a separate bypass structure

With over 40,000 units operating worldwide, Stormceptor performs and protects every day, in every storm.

Product Flow Rates

CASCADE

Model	Treatment Rate (cfs)	Sediment Capacity[1] (CF)
CS-3	1.02	11
CS-4	2.00	19
CS-5	3.50	29
CS-6	5.60	42
CS-8	12.00	75
CS-10	18.00	118

CDS

Model	Treatment Rate[2] (cfs)	Sediment Capacity[1] (CF)
1515-3	1.00	14
2015-4	1.40	25
2015-5	1.40	39
2015-6	1.40	57
2020-5	2.20	39
2020-6	2.20	57
2025-5	3.20	39
2025-6	3.20	57
3020-6	3.90	57
3025-6	5.00	57
3030-6	5.70	57
3035-6	6.50	57
4030-8	7.50	151
4040-8	9.50	151

VORTECHS

Model	Treatment Rate (cfs)	Sediment Capacity[3] (CF)
1000	1.60	16
2000	2.80	32
3000	4.50	49
4000	6.00	65
5000	8.50	86
7000	11.00	108
9000	14.00	130
11000	17.5	151
16000	25	192

STORMCEPTOR STC

Model	Treatment Rate (cfs)	Sediment Capacity[1] (CF)
STC 450i	0.40	46
STC 900	0.89	89
STC 2400	1.58	205
STC 4800	2.47	543
STC 7200	3.56	839
STC 11000	4.94	1086
STC 16000	7.12	1677

1 Additional sediment storage capacity available – Check with your local representative for information.

2 Treatment Capacity is based on laboratory testing using OK-110 (average D50 particle size of approximately 100 microns) and a 2400 micron screen.

3 Maintenance recommended when sediment depth has accumulated to within 12-18 inches of the dry weather water surface elevation.

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PIPE SOLUTIONS

STRUCTURES SOLUTIONS

CONTECH® ENGINEERED SOLUTIONS

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MADEP TSS Removal Calculation Sheets

249 SOUTH STREET UNIT 1 PLAINVILLE MA 02762
TEL508 695 2221 FAX508 695 2219 CONTACT@LEVELDG.COM LEVELDG.COM

INSTRUCTIONS:

Non-automated: Mar. 4, 2008

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

Location: CB#1 to SSI-1 (full treatment)

TSS Removal Calculation Worksheet

A BMP[1]	B TSS Removal Rate[1]	C Starting TSS Load*	D Amount Removed (B*C)	E Remaining Load (C-D)
Deep Sump & Hooded CBs	0.25	1.00	0.25	0.75
CDS Unit	0.74	0.75	0.55	0.20
SSI-1	0.80	0.20	0.16	0.04

Total TSS Removal = 96%

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

Project: 15 Liberty Way

Prepared By: APH

Date: 10/17/23

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

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

1. From MassDEP Stormwater Handbook Vol. 1

INSTRUCTIONS:

Non-automated: Mar. 4, 2008

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

Location: STC Unit (full treatment)

TSS Removal Calculation Worksheet

A BMP[1]	B TSS Removal Rate[1]	C Starting TSS Load*	D Amount Removed (B*C)	E Remaining Load (C-D)
CDS Unit	0.74	1.00	0.74	0.26

Total TSS Removal = 74%

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

Project: 15 Liberty Way

Prepared By: APH

Date: 1/25/23

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

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

1. From MassDEP Stormwater Handbook Vol. 1

INSTRUCTIONS:

Non-automated: Mar. 4, 2008

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

Location: CB#1 to CDS 2020-5 (pretreatment)

TSS Removal Calculation Worksheet

A BMP[1]	B TSS Removal Rate[1]	C Starting TSS Load*	D Amount Removed (B*C)	E Remaining Load (C-D)
Deep Sump & Hooded CBs	0.25	1.00	0.25	0.75
CDS Unit	0.74	0.75	0.55	0.20

Total TSS Removal = 80%

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

Project: 15 Liberty Way

Prepared By: APH

Date: 10/17/23

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

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

1. From MassDEP Stormwater Handbook Vol. 1

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Phosphorous Removal Calculations

249 SOUTH STREET UNIT 1 PLAINVILLE MA 02762
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LEVEL DESIGN GROUP

PHOSPHORUS LOAD REDUCTION CALCUATION – STORMTECH SYTEM 1

Note - Phosphorus Load Reductions Calculations are based on MA MS4 General Permit (Effective July 1, 2018 with Modification Effective January 6, 2021) - ATTACHMENT 3 TO APPENDIX F - Methods to Calculate Phosphorus and Nitrogen Load Reductions for Structural Stormwater Best Management Practices

1) Phosphorous Load reduction target (P_{target}) = 60%

2) Infiltration Basin. Information for the contributing impervious (IA) and pervious (PA) areas are summarized below:

Impervious Area Draining to SSI-Basin-1: 1.633 Ac. HSG C
Pervious Area Draining to SSI-Basin-1: 0.007 Ac. HSG C

3) Infiltration Rate = 0.27 in./hr.

4) BMP Volume (IA-in) = 0.25 in. (From Table 3-11 & Figure 3.8)

5) Pervious Area runoff depth = 0.01 (From Table 3-4)
BMP Volume (PA-ft^3)= (0.007 acre) x (0.01 in) x (3,630 ft^3/acre-in) = 0.25 ft^3

BMP Volume (IA&PA-ft^3)= (0.25 ft^3 + ((1.663 acre x 0.25 in) x (3,630 ft^3/acre-in)) = 1,509.4 ft^3

The available storage volume (ft^3) of the infiltration basin (BMP-Volume ft^3) below the lowest proposed outlet is 1,801 ft^3 (taken from HydroCAD summary of node SSI-1)

1,801 ft^3 > 1,509.4 ft^3

Groundwater Mounding Calculations

249 SOUTH STREET UNIT 1 PLAINVILLE MA 02762
TEL508 695 2221 FAX508 695 2219 CONTACT@LEVELDG.COM LEVELDG.COM

Gilbert Street Warehouse
Mansfield, MA

Bioretention Basin
Mounding Analysis

Level Design Group, LLC
249 South Street
Plainville, MA 02762

This spreadsheet will calculate the height of a groundwater mound beneath a stormwater infiltration basin. More information can be found in the U.S. Geological Survey Scientific Investigations Report 2010-5102 "Simulation of groundwater mounding beneath hypothetical stormwater infiltration basins".

The user must specify infiltration rate (R), specific yield (Sy), horizontal hydraulic conductivity (Kh), basin dimensions (x, y), duration of infiltration period (t), and the initial thickness of the saturated zone (hi(0), height of the water table if the bottom of the aquifer is the datum). For a square basin the half width equals the half length (x = y). For a rectangular basin, if the user wants the water-table changes perpendicular to the long side, specify x as the short dimension and y as the long dimension. Conversely, if the user wants the values perpendicular to the short side, specify y as the short dimension, x as the long dimension. All distances are from the center of the basin. Users can change the distances from the center of the basin at which water-table aquifer thickness are calculated.
Cells highlighted in yellow are values that can be changed by the user. Cells highlighted in red are output values based on user-specified inputs. The user MUST click the blue "Re-Calculate Now" button each time ANY of the user-specified inputs are changed otherwise necessary iterations to converge on the correct solution will not be done and values shown will be incorrect. Use consistent units for all input values (for example, feet and days)

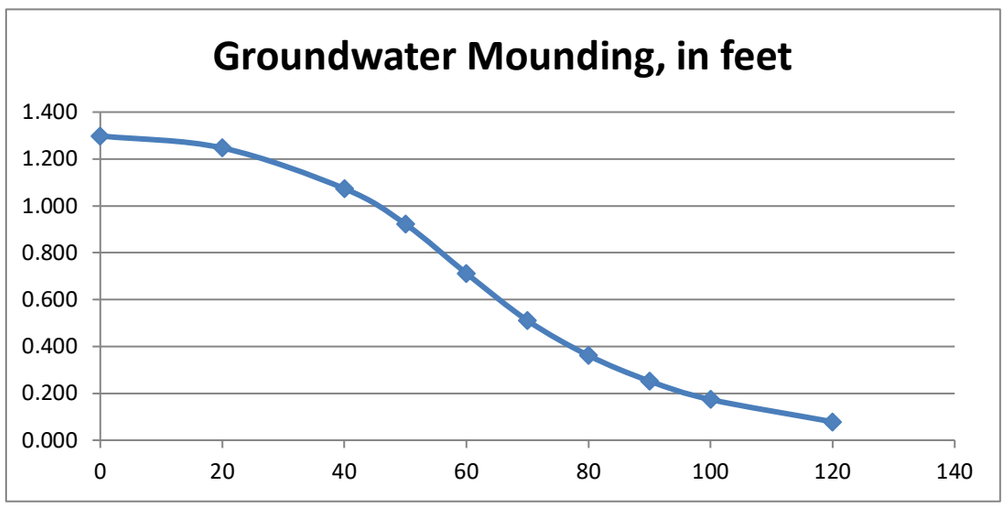
use consistent units (e.g. feet & days **or** inches & hours)

Input Values		
0.0808	***R***	**Recharge (infiltration) rate (feet/day)**
0.100	**Sy**	**Specific yield, Sy (dimensionless, between 0 and 1)**
5.40	**K**	**Horizontal hydraulic conductivity, Kh (feet/day)***
58.770	**x**	**1/2 length of basin (x direction, in feet)**
31.625	**y**	**1/2 width of basin (y direction, in feet)**
3.000	**t**	**duration of infiltration period (days)**
10.000	**hi(0)**	**initial thickness of saturated zone (feet)**

11.298	**h(max)**	**maximum thickness of saturated zone (beneath center of basin at end of infiltration period)**
1.298	**Δh(max)**	**maximum groundwater mounding (beneath center of basin at end of infiltration period)**

Ground-water Mounding, in feet	**Distance from center of basin in x direction, in feet**
1.298	**0**
1.247	**20**
1.073	**40**
0.922	**50**
0.712	**60**
0.511	**70**
0.361	**80**
0.252	**90**
0.174	**100**
0.078	**120**

Re-Calculate Now



Conversion Table

inch/hour	feet/day
0.67	1.33
2.00	4.00

hours	days
36	1.50

In the report accompanying this spreadsheet (USGS SIR 2010-5102), vertical soil permeability (ft/d) is assumed to be one-tenth horizontal hydraulic conductivity (ft/d).

Disclaimer

This spreadsheet solving the Hantush (1967) equation for ground-water mounding beneath an infiltration basin is made available to the general public as a convenience for those wishing to replicate values documented in the USGS Scientific Investigations Report 2010-5102 "Groundwater mounding beneath hypothetical stormwater infiltration basins" or to calculate values based on user-specified site conditions. Any changes made to the spreadsheet (other than values identified as user-specified) after transmission from the USGS could have unintended, undesirable consequences. These consequences could include, but may not be limited to: erroneous output, numerical instabilities, and violations of underlying assumptions that are inherent in results presented in the accompanying USGS published report. The USGS assumes no responsibility for the consequences of any changes made to the spreadsheet. If changes are made to the spreadsheet, the user is responsible for documenting the changes and justifying the results and conclusions.

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R	Design Storm Depth / Infiltration Period	**0.1**	(1,801 cu ft vol. below outlet / 7,434 sq.ft syst. footprint) / 3 days
Sy	Specific yield (dimensionless constant) =	**0.1**	
K	Hydraulic conductivity (feet/day) 2.41 in/hr =	**5.4**	ft/day = 0.27 in/hr (24 hr/day * 1 ft/12 in) = 4.82 ft/day * 10
x	1/2 legth basin (feet) =	**58.77**	ft. = 100/2 (conv. Vert Perm to Horz Perm)
y	1/2 width basin (feet) =	**31.625**	ft. = 40/2
t	t Duration of infiltration period (days) =	**3**	day = (MADEP req. time for basin to empy)
hi	hi(o) Initial saturated thickness	**10**	ft

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Illicit Discharge Statement

249 SOUTH STREET UNIT 1 PLAINVILLE MA 02762
TEL508 695 2221 FAX508 695 2219 CONTACT@LEVELDG.COM LEVELDG.COM

Illicit Discharge Statement

Under the Massachusetts Wetlands Protection Act – Stormwater Management Standards
For
15 LIBERTY WAY
FRANKLIN, MA

All illicit discharges to the Stormwater Management System are prohibited. The Stormwater Management System is the system for conveying, treating, and infiltrating stormwater. Illicit discharges to Stormwater Management Systems are discharges that are not entirely comprised of stormwater, but do not include discharges from the following activities or facilities:

- Firefighting
- Water Line Flushing
- Potable Water Sources
- Landscape Irrigation
- Potable Water Sources
- Uncontaminated Groundwater
- Air-conditioning Condensation
- Dechlorinated Water from Swimming Pools
- Water used for street washing
- Water used for clean residential buildings without detergents
- Foundation Drains

The site will be operated and maintained in accordance with the Operation and Maintenance Plan dated January 17, 2023 prepared by Level Design Group, LLC.

I, Atlantic Oliver 15 Liberty Way, LLC ***(Applicant)*** do hereby agree to comply with requirements set forth within the Illicit Discharge Statement and will not knowingly discharge illicit materials to the stormwater management system once it is brought online **upon** completion of construction.

Signature: _____ Date: 2/7/23

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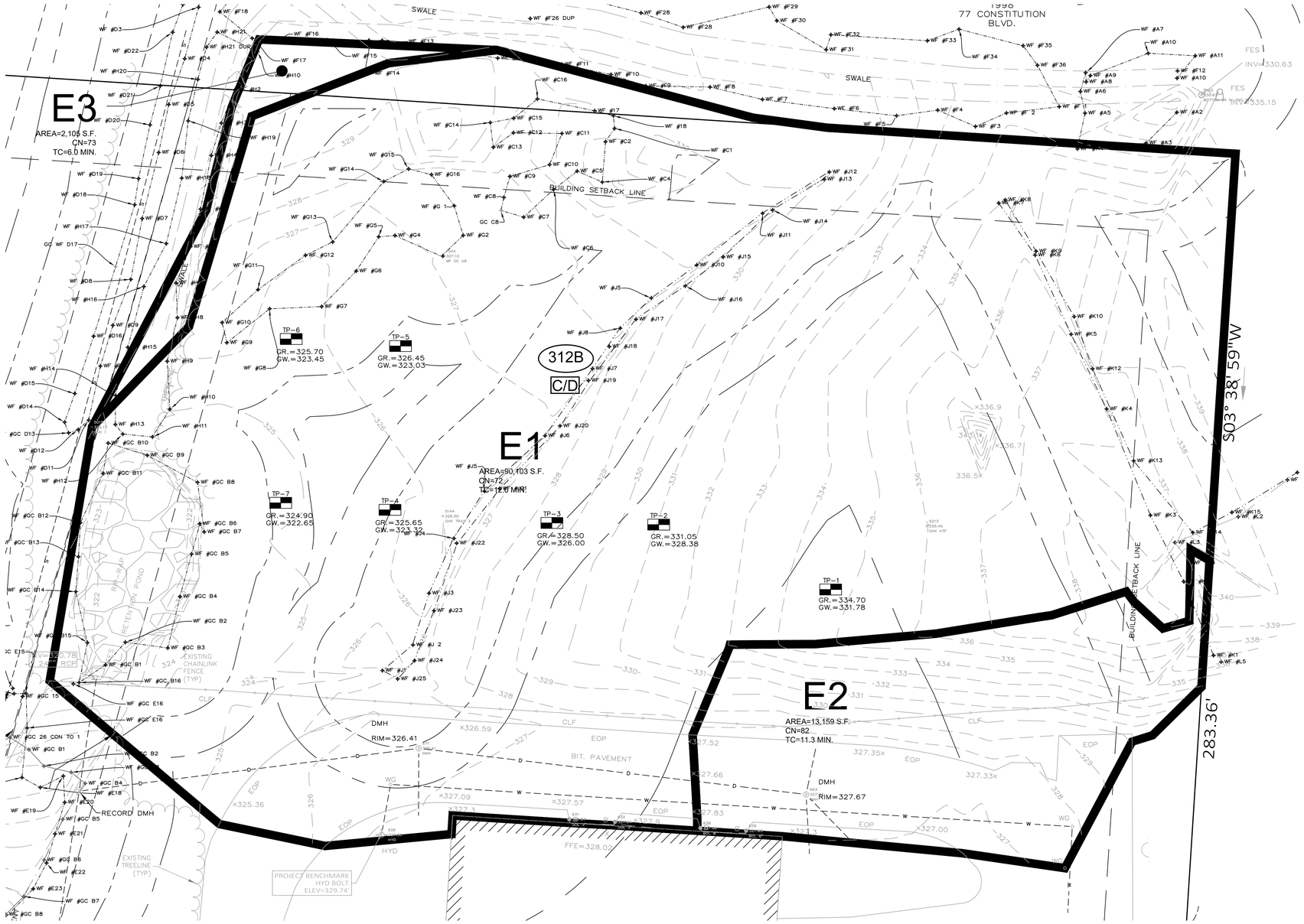
Existing Drainage Plan & HydroCAD Diagram

249 SOUTH STREET UNIT 1 PLAINVILLE MA 02762
TEL508 695 2221 FAX508 695 2219 CONTACT@LEVELDG.COM LEVELDG.COM



WATERSHED LEGEND

XXXX — SOIL TYPE

X — HYDROLOGIC SOIL GROUP

SOILS

312B — WOODBRIDGE FINE SANDY LOAM

NO	DATE	REVISIONS
1	10/17/2023	RESOURCE AREA FLAGS

SEAL

DATE : JANUARY 13, 2023
DRAWN : AH / DRC
SCALE : 1" = 20'

LIBERTY PARKING EXPANSION

MAP SHEET 320, PARCEL 004
15 LIBERTY WAY
FRANKLIN, MASSACHUSETTS

LEVEL DESIGN GROUP
Civil Engineers & Land Surveyors
249 SOUTH STREET, UNIT 1
PLAINVILLE, MA 02762
TEL. (508) 695-2221 FAX. (508) 695-2219

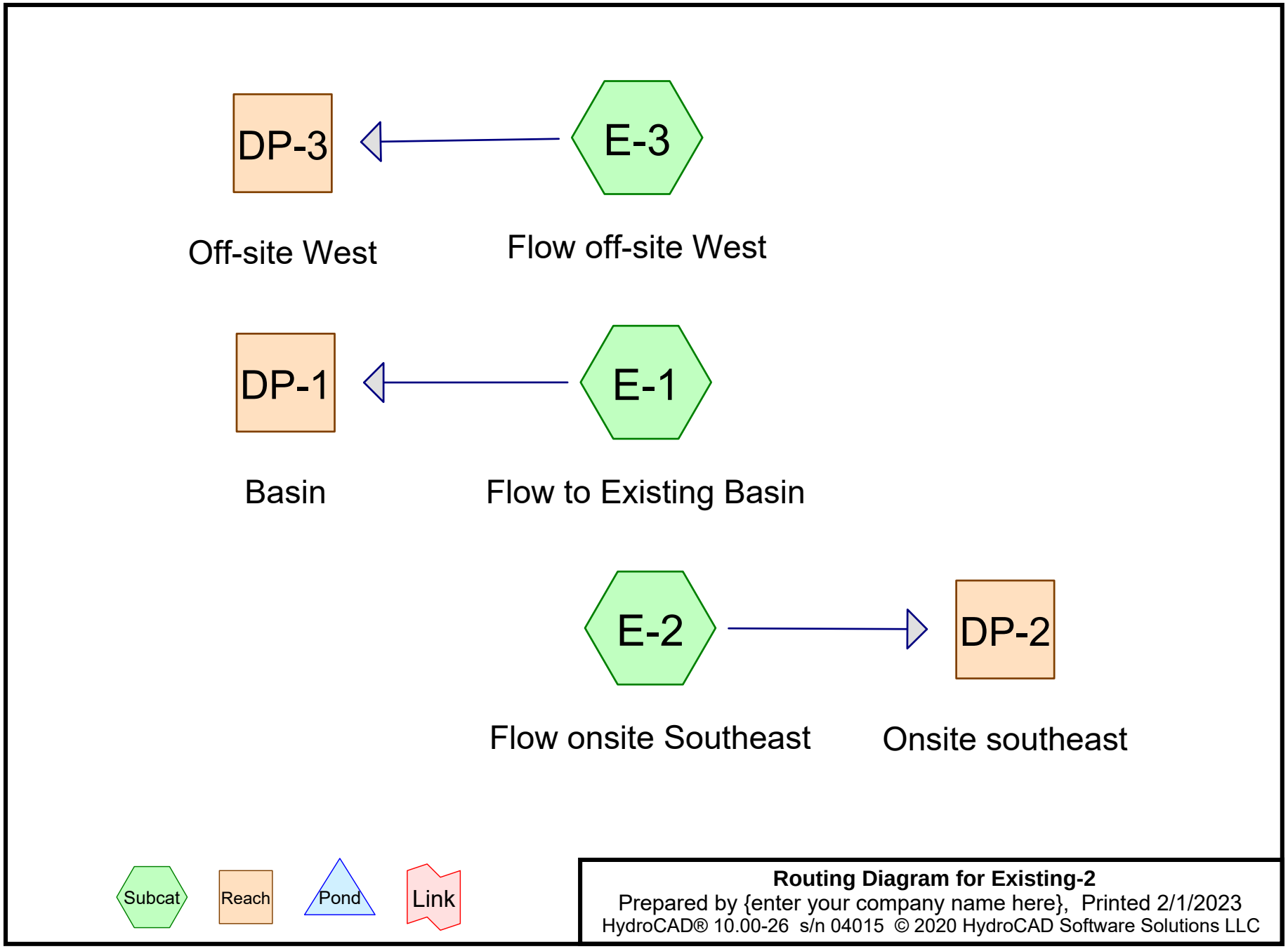
EXISTING DRAINAGE

D-1.0

SHEET 1 OF 2

0' 10' 20' 40'

2081.00



Routing Diagram for Existing-2

Prepared by {enter your company name here}, Printed 2/1/2023

HydroCAD Analysis

Existing Conditions – 2 Year Storm

249 SOUTH STREET UNIT 1 PLAINVILLE MA 02762
TEL508 695 2221 FAX508 695 2219 CONTACT@LEVELDG.COM LEVELDG.COM

Area Listing (all nodes)

Area (sq-ft)	CN	Description (subcatchment-numbers)
9,896	79	50-75% Grass cover, Fair, HSG C (E-1, E-2, E-3)
10,479	98	Paved parking (E-1, E-2)
84,992	70	Woods, Good, HSG C (E-1, E-2, E-3)
105,367	**74**	**TOTAL AREA**

Soil Listing (all nodes)

Area (sq-ft)	Soil Group	Subcatchment Numbers
0	HSG A	
0	HSG B	
94,888	HSG C	E-1, E-2, E-3
0	HSG D	
10,479	Other	E-1, E-2
105,367		**TOTAL AREA**

Ground Covers (all nodes)

HSG-A (sq-ft)	HSG-B (sq-ft)	HSG-C (sq-ft)	HSG-D (sq-ft)	Other (sq-ft)	Total (sq-ft)	Ground Cover	Subcatchment Numbers
0	0	9,896	0	0	9,896	50-75% Grass cover, Fair	E-1, E-2, E-3
0	0	0	0	10,479	10,479	Paved parking	E-1, E-2
0	0	84,992	0	0	84,992	Woods, Good	E-1, E-2, E-3
0	**0**	**94,888**	**0**	**10,479**	**105,367**	**TOTAL AREA**	

Time span=0.00-80.00 hrs, dt=0.05 hrs, 1601 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment E-1: Flow to Existing Basin Runoff Area=90,103 sf 6.06% Impervious Runoff Depth=0.84"
Flow Length=553' Tc=12.0 min CN=72 Runoff=1.49 cfs 6,292 cf

Subcatchment E-2: Flow onsite Southeast Runoff Area=13,159 sf 38.16% Impervious Runoff Depth=1.42"
Flow Length=140' Tc=11.3 min CN=82 Runoff=0.42 cfs 1,555 cf

Subcatchment E-3: Flow off-site West Runoff Area=2,105 sf 0.00% Impervious Runoff Depth=0.89"
Tc=6.0 min CN=73 Runoff=0.05 cfs 156 cf

Reach DP-1: Basin Inflow=1.49 cfs 6,292 cf
Outflow=1.49 cfs 6,292 cf

Reach DP-2: Onsite southeast Inflow=0.42 cfs 1,555 cf
Outflow=0.42 cfs 1,555 cf

Reach DP-3: Off-site West Inflow=0.05 cfs 156 cf
Outflow=0.05 cfs 156 cf

Total Runoff Area = 105,367 sf Runoff Volume = 8,003 cf Average Runoff Depth = 0.91"
90.05% Pervious = 94,888 sf 9.95% Impervious = 10,479 sf

Summary for Subcatchment E-1: Flow to Existing Basin

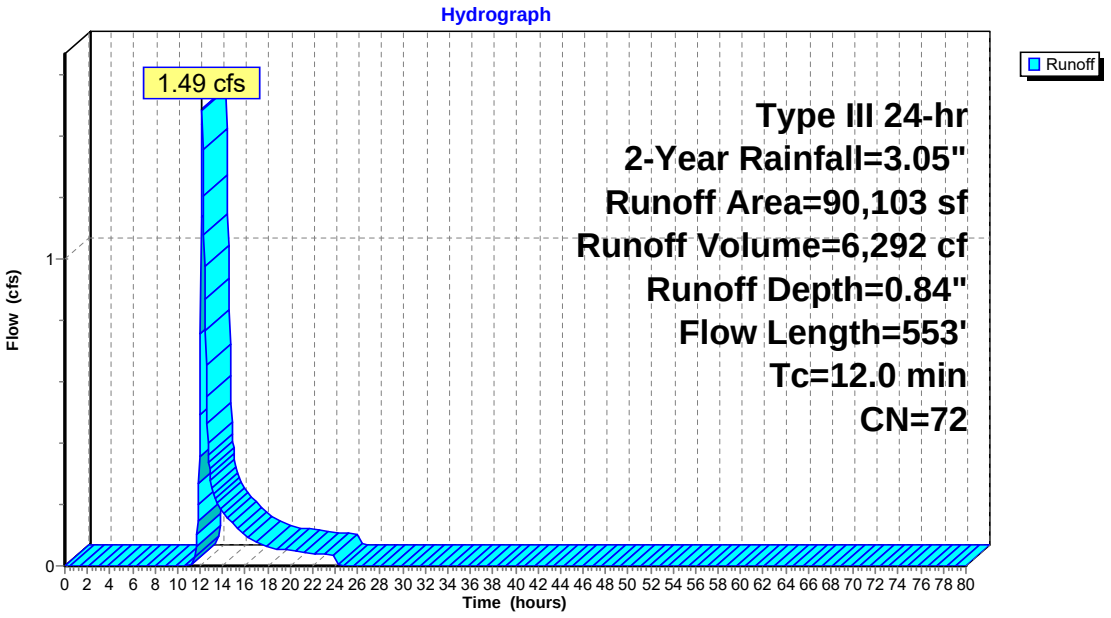
Runoff = 1.49 cfs @ 12.19 hrs, Volume= 6,292 cf, Depth= 0.84"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-80.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.05"

	Area (sf)	CN	Description
*	5,457	98	Paved parking
	76,777	70	Woods, Good, HSG C
	7,869	79	50-75% Grass cover, Fair, HSG C
	90,103	72	Weighted Average
	84,646		93.94% Pervious Area
	5,457		6.06% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.6	50	0.0530	0.10		**Sheet Flow, Sheet Flow** Woods: Light underbrush n= 0.400 P2= 3.05"
3.4	503	0.0240	2.49		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
12.0	553	Total			

Subcatchment E-1: Flow to Existing Basin



Summary for Subcatchment E-2: Flow onsite Southeast

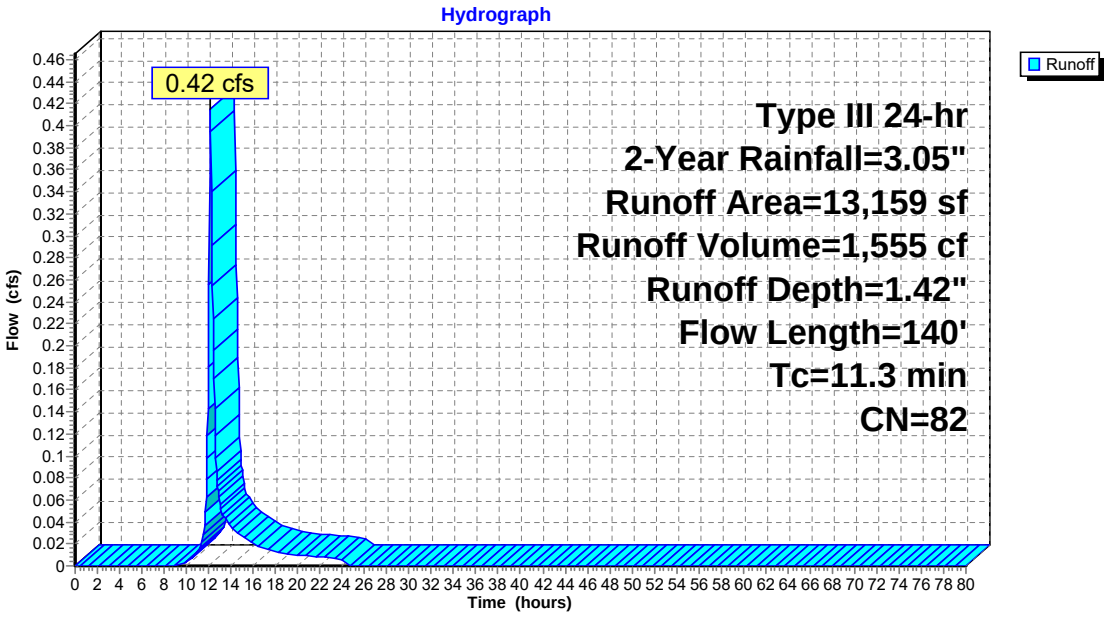
Runoff = 0.42 cfs @ 12.16 hrs, Volume= 1,555 cf, Depth= 1.42"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-80.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.05"

	Area (sf)	CN	Description
*	5,022	98	Paved parking
	6,746	70	Woods, Good, HSG C
	1,391	79	50-75% Grass cover, Fair, HSG C
	13,159	82	Weighted Average
	8,137		61.84% Pervious Area
	5,022		38.16% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.0	50	0.0280	0.08		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.05"
0.1	45	0.1750	6.74		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
0.0	11	0.1640	6.52		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
0.2	34	0.0240	3.14		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
11.3	140	Total			

Subcatchment E-2: Flow onsite Southeast



Summary for Subcatchment E-3: Flow off-site West

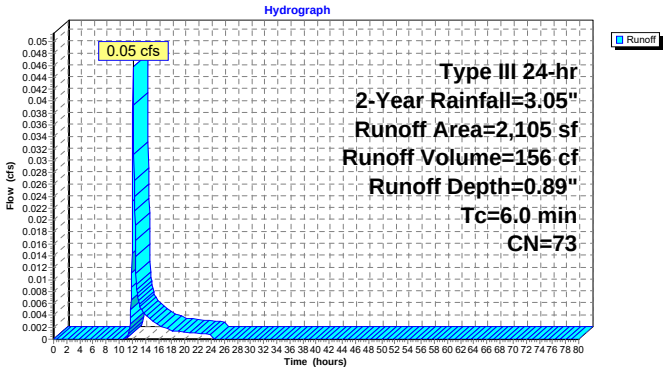
Runoff = 0.05 cfs @ 12.10 hrs, Volume= 156 cf, Depth= 0.89"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-80.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.05"

Area (sf)	CN	Description
1,469	70	Woods, Good, HSG C
636	79	50-75% Grass cover, Fair, HSG C
2,105	73	Weighted Average
2,105		100.00% Pervious Area

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

Subcatchment E-3: Flow off-site West



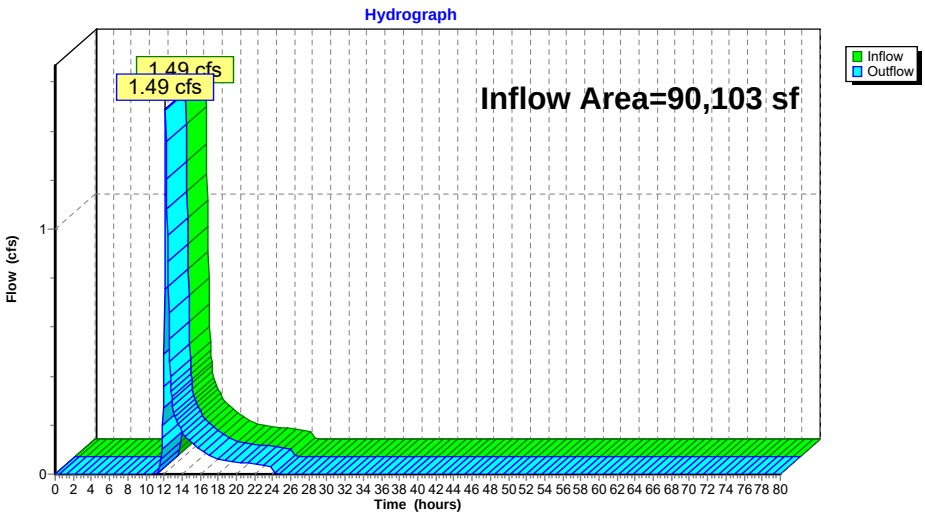
Summary for Reach DP-1: Basin

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

Inflow Area = 90,103 sf, 6.06% Impervious, Inflow Depth = 0.84" for 2-Year event
Inflow = 1.49 cfs @ 12.19 hrs, Volume= 6,292 cf
Outflow = 1.49 cfs @ 12.19 hrs, Volume= 6,292 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-80.00 hrs, dt= 0.05 hrs

Reach DP-1: Basin



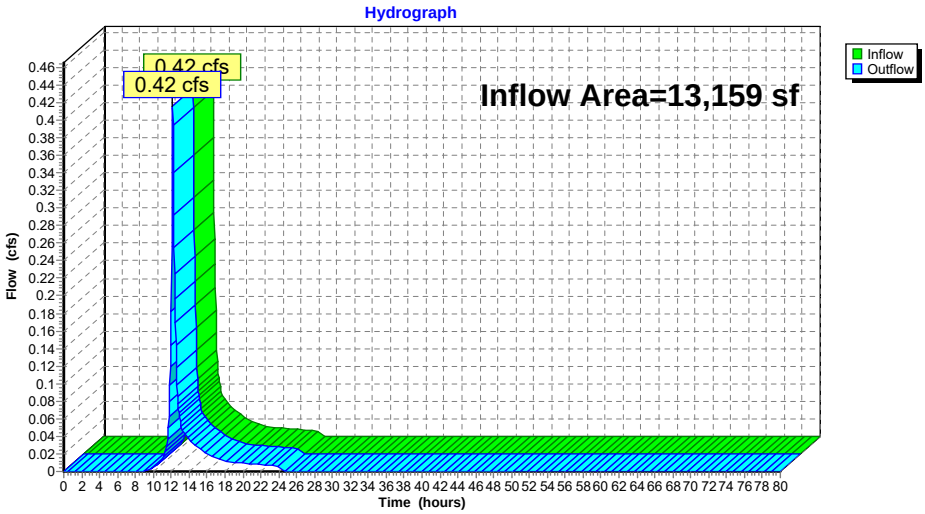
Summary for Reach DP-2: Onsite southeast

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

Inflow Area = 13,159 sf, 38.16% Impervious, Inflow Depth = 1.42" for 2-Year event
Inflow = 0.42 cfs @ 12.16 hrs, Volume= 1,555 cf
Outflow = 0.42 cfs @ 12.16 hrs, Volume= 1,555 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-80.00 hrs, dt= 0.05 hrs

Reach DP-2: Onsite southeast



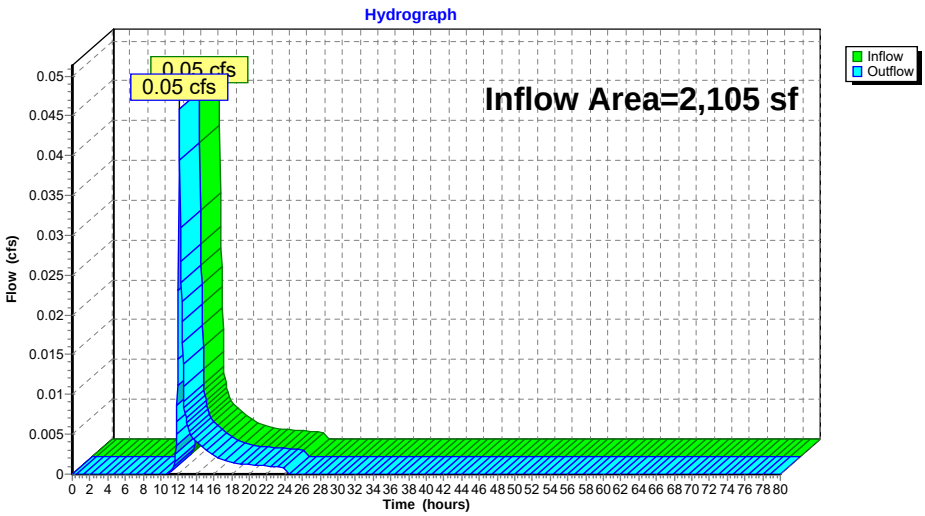
Summary for Reach DP-3: Off-site West

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

Inflow Area = 2,105 sf, 0.00% Impervious, Inflow Depth = 0.89" for 2-Year event
Inflow = 0.05 cfs @ 12.10 hrs, Volume= 156 cf
Outflow = 0.05 cfs @ 12.10 hrs, Volume= 156 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-80.00 hrs, dt= 0.05 hrs

Reach DP-3: Off-site West



HydroCAD Analysis

Existing Conditions – 10 Year Storm

249 SOUTH STREET UNIT 1 PLAINVILLE MA 02762
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Area Listing (all nodes)

Area (sq-ft)	CN	Description (subcatchment-numbers)
9,896	79	50-75% Grass cover, Fair, HSG C (E-1, E-2, E-3)
10,479	98	Paved parking (E-1, E-2)
84,992	70	Woods, Good, HSG C (E-1, E-2, E-3)
105,367	**74**	**TOTAL AREA**

Soil Listing (all nodes)

Area (sq-ft)	Soil Group	Subcatchment Numbers
0	HSG A	
0	HSG B	
94,888	HSG C	E-1, E-2, E-3
0	HSG D	
10,479	Other	E-1, E-2
105,367		**TOTAL AREA**

Ground Covers (all nodes)

HSG-A (sq-ft)	HSG-B (sq-ft)	HSG-C (sq-ft)	HSG-D (sq-ft)	Other (sq-ft)	Total (sq-ft)	Ground Cover	Subcatchment Numbers
0	0	9,896	0	0	9,896	50-75% Grass cover, Fair	E-1, E-2, E-3
0	0	0	0	10,479	10,479	Paved parking	E-1, E-2
0	0	84,992	0	0	84,992	Woods, Good	E-1, E-2, E-3
0	**0**	**94,888**	**0**	**10,479**	**105,367**	**TOTAL AREA**	

Time span=0.00-80.00 hrs, dt=0.05 hrs, 1601 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment E-1: Flow to Existing Basin Runoff Area=90,103 sf 6.06% Impervious Runoff Depth=2.31"
Flow Length=553' Tc=12.0 min CN=72 Runoff=4.53 cfs 17,375 cf

Subcatchment E-2: Flow onsite Southeast Runoff Area=13,159 sf 38.16% Impervious Runoff Depth=3.21"
Flow Length=140' Tc=11.3 min CN=82 Runoff=0.95 cfs 3,524 cf

Subcatchment E-3: Flow off-site West Runoff Area=2,105 sf 0.00% Impervious Runoff Depth=2.40"
Tc=6.0 min CN=73 Runoff=0.13 cfs 421 cf

Reach DP-1: Basin Inflow=4.53 cfs 17,375 cf
Outflow=4.53 cfs 17,375 cf

Reach DP-2: Onsite southeast Inflow=0.95 cfs 3,524 cf
Outflow=0.95 cfs 3,524 cf

Reach DP-3: Off-site West Inflow=0.13 cfs 421 cf
Outflow=0.13 cfs 421 cf

Total Runoff Area = 105,367 sf Runoff Volume = 21,320 cf Average Runoff Depth = 2.43"
90.05% Pervious = 94,888 sf 9.95% Impervious = 10,479 sf

Summary for Subcatchment E-1: Flow to Existing Basin

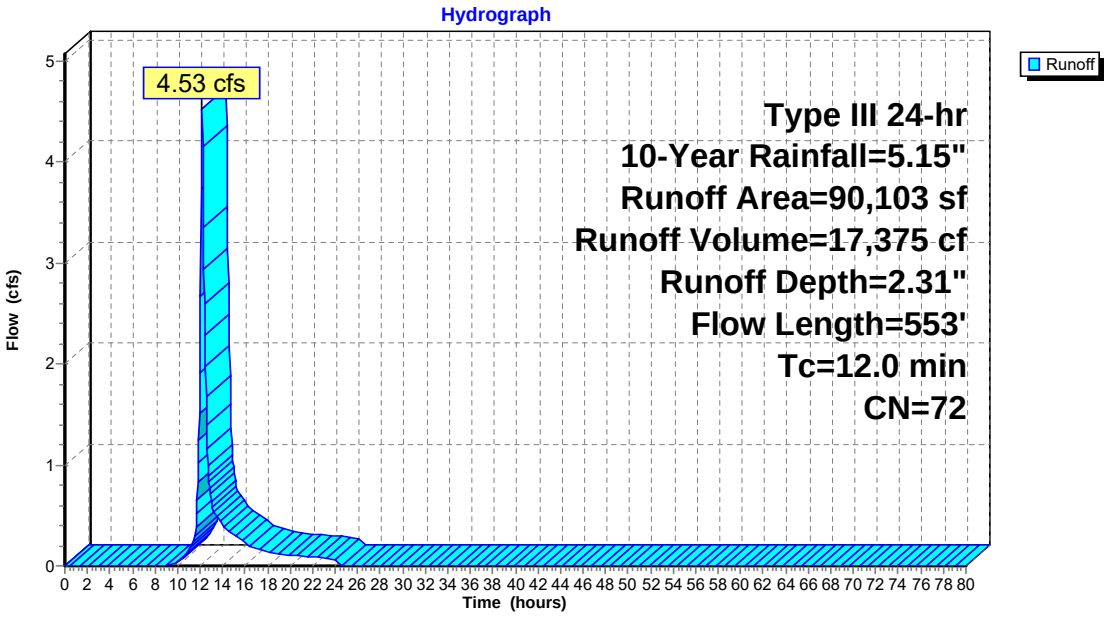
Runoff = 4.53 cfs @ 12.17 hrs, Volume= 17,375 cf, Depth= 2.31"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-80.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=5.15"

	Area (sf)	CN	Description
*	5,457	98	Paved parking
	76,777	70	Woods, Good, HSG C
	7,869	79	50-75% Grass cover, Fair, HSG C
	90,103	72	Weighted Average
	84,646		93.94% Pervious Area
	5,457		6.06% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.6	50	0.0530	0.10		**Sheet Flow, Sheet Flow** Woods: Light underbrush n= 0.400 P2= 3.05"
3.4	503	0.0240	2.49		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
12.0	553	Total			

Subcatchment E-1: Flow to Existing Basin



Summary for Subcatchment E-2: Flow onsite Southeast

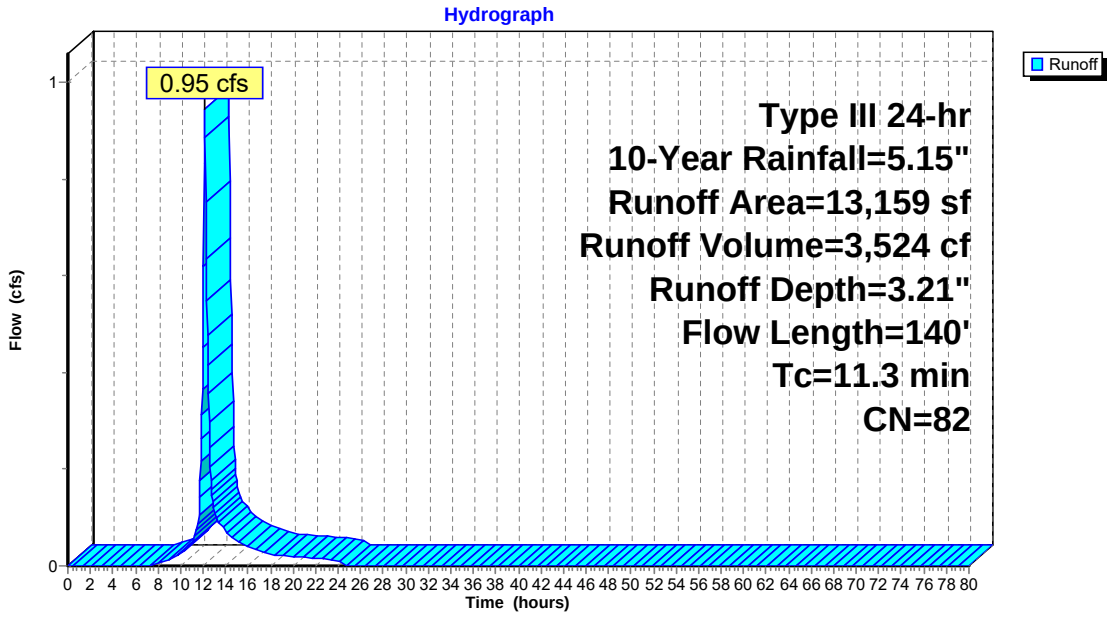
Runoff = 0.95 cfs @ 12.16 hrs, Volume= 3,524 cf, Depth= 3.21"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-80.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=5.15"

	Area (sf)	CN	Description
*	5,022	98	Paved parking
	6,746	70	Woods, Good, HSG C
	1,391	79	50-75% Grass cover, Fair, HSG C
	13,159	82	Weighted Average
	8,137		61.84% Pervious Area
	5,022		38.16% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.0	50	0.0280	0.08		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.05"
0.1	45	0.1750	6.74		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
0.0	11	0.1640	6.52		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
0.2	34	0.0240	3.14		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
11.3	140	Total			

Subcatchment E-2: Flow onsite Southeast



Summary for Subcatchment E-3: Flow off-site West

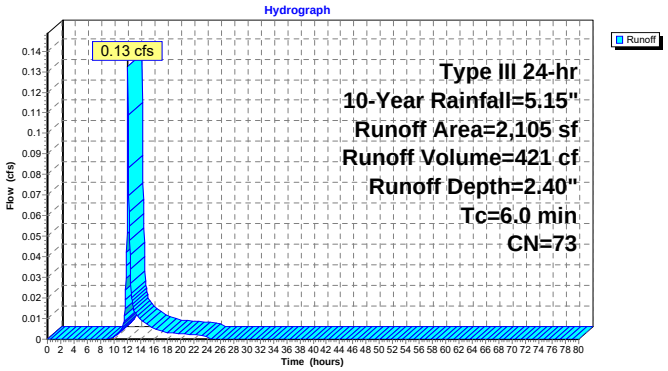
Runoff = 0.13 cfs @ 12.10 hrs, Volume= 421 cf, Depth= 2.40"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-80.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=5.15"

Area (sf)	CN	Description
1,469	70	Woods, Good, HSG C
636	79	50-75% Grass cover, Fair, HSG C
2,105	73	Weighted Average
2,105		100.00% Pervious Area

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

Subcatchment E-3: Flow off-site West



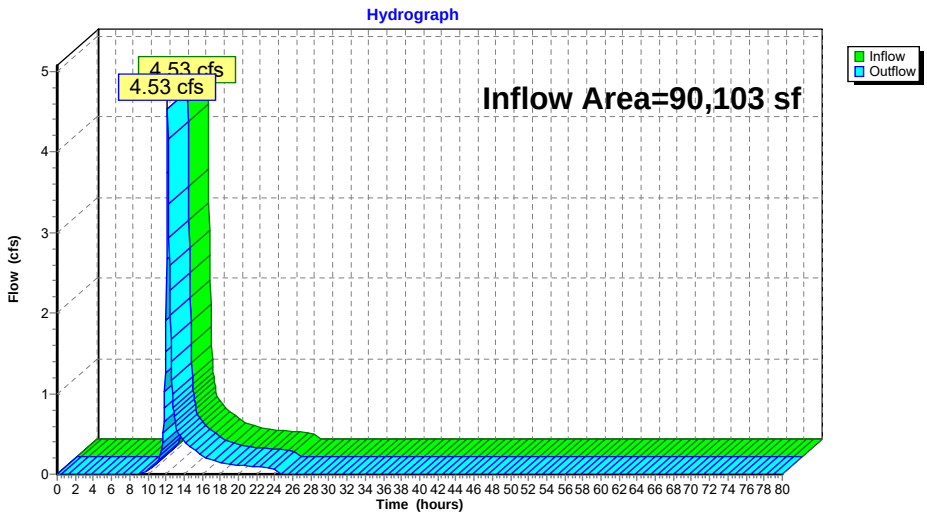
Summary for Reach DP-1: Basin

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

Inflow Area = 90,103 sf, 6.06% Impervious, Inflow Depth = 2.31" for 10-Year event
Inflow = 4.53 cfs @ 12.17 hrs, Volume= 17,375 cf
Outflow = 4.53 cfs @ 12.17 hrs, Volume= 17,375 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-80.00 hrs, dt= 0.05 hrs

Reach DP-1: Basin



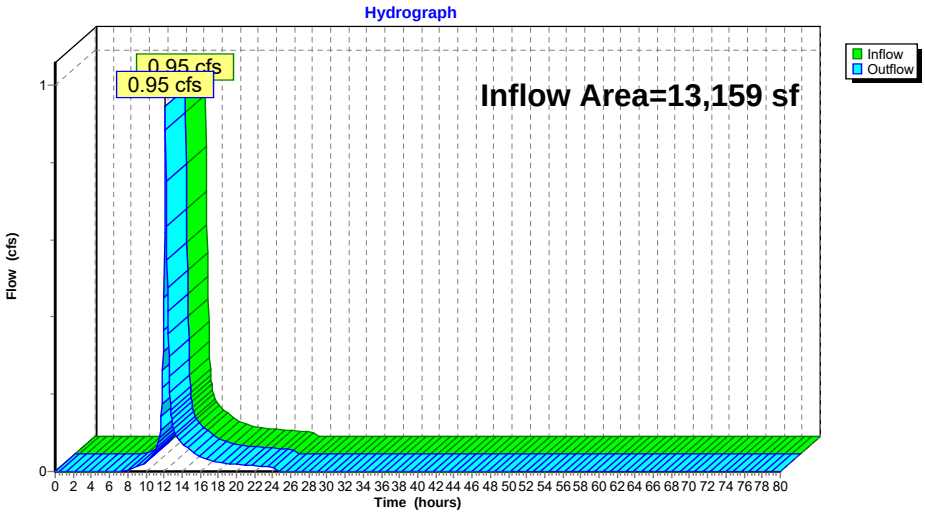
Summary for Reach DP-2: Onsite southeast

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

Inflow Area = 13,159 sf, 38.16% Impervious, Inflow Depth = 3.21" for 10-Year event
Inflow = 0.95 cfs @ 12.16 hrs, Volume= 3,524 cf
Outflow = 0.95 cfs @ 12.16 hrs, Volume= 3,524 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-80.00 hrs, dt= 0.05 hrs

Reach DP-2: Onsite southeast



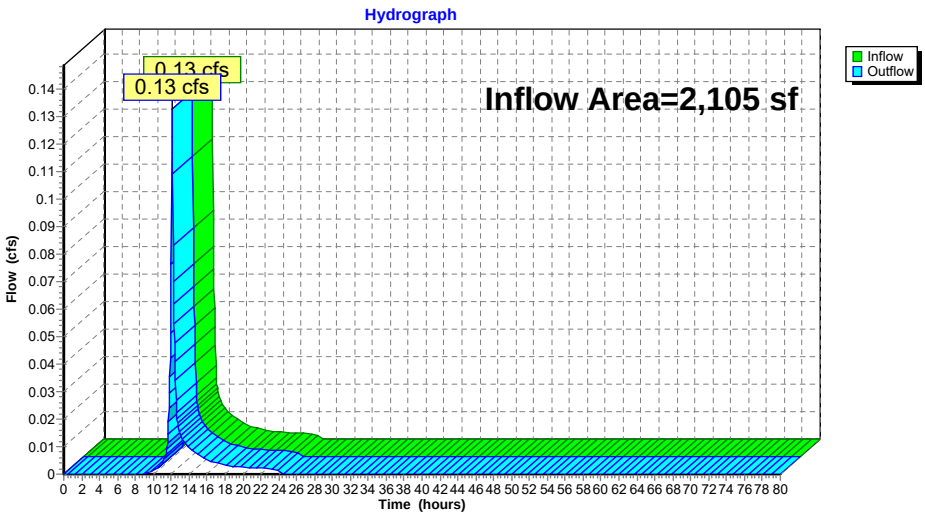
Summary for Reach DP-3: Off-site West

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

Inflow Area = 2,105 sf, 0.00% Impervious, Inflow Depth = 2.40" for 10-Year event
Inflow = 0.13 cfs @ 12.10 hrs, Volume= 421 cf
Outflow = 0.13 cfs @ 12.10 hrs, Volume= 421 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-80.00 hrs, dt= 0.05 hrs

Reach DP-3: Off-site West



LEVEL
DESIGN GROUP

HydroCAD Analysis

Existing Conditions - 25 Year Storm

249 SOUTH STREET UNIT 1 PLAINVILLE MA 02762
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Area Listing (all nodes)

Area (sq-ft)	CN	Description (subcatchment-numbers)
9,896	79	50-75% Grass cover, Fair, HSG C (E-1, E-2, E-3)
10,479	98	Paved parking (E-1, E-2)
84,992	70	Woods, Good, HSG C (E-1, E-2, E-3)
105,367	**74**	**TOTAL AREA**

Soil Listing (all nodes)

Area (sq-ft)	Soil Group	Subcatchment Numbers
0	HSG A	
0	HSG B	
94,888	HSG C	E-1, E-2, E-3
0	HSG D	
10,479	Other	E-1, E-2
105,367		**TOTAL AREA**

Ground Covers (all nodes)

HSG-A (sq-ft)	HSG-B (sq-ft)	HSG-C (sq-ft)	HSG-D (sq-ft)	Other (sq-ft)	Total (sq-ft)	Ground Cover	Subcatchment Numbers
0	0	9,896	0	0	9,896	50-75% Grass cover, Fair	E-1, E-2, E-3
0	0	0	0	10,479	10,479	Paved parking	E-1, E-2
0	0	84,992	0	0	84,992	Woods, Good	E-1, E-2, E-3
0	**0**	**94,888**	**0**	**10,479**	**105,367**	**TOTAL AREA**	

Time span=0.00-80.00 hrs, dt=0.05 hrs, 1601 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment E-1: Flow to Existing Basin Runoff Area=90,103 sf 6.06% Impervious Runoff Depth=3.28"
Flow Length=553' Tc=12.0 min CN=72 Runoff=6.49 cfs 24,642 cf

Subcatchment E-2: Flow onsite Southeast Runoff Area=13,159 sf 38.16% Impervious Runoff Depth=4.31"
Flow Length=140' Tc=11.3 min CN=82 Runoff=1.26 cfs 4,727 cf

Subcatchment E-3: Flow off-site West Runoff Area=2,105 sf 0.00% Impervious Runoff Depth=3.38"
Tc=6.0 min CN=73 Runoff=0.19 cfs 593 cf

Reach DP-1: Basin Inflow=6.49 cfs 24,642 cf
Outflow=6.49 cfs 24,642 cf

Reach DP-2: Onsite southeast Inflow=1.26 cfs 4,727 cf
Outflow=1.26 cfs 4,727 cf

Reach DP-3: Off-site West Inflow=0.19 cfs 593 cf
Outflow=0.19 cfs 593 cf

Total Runoff Area = 105,367 sf Runoff Volume = 29,962 cf Average Runoff Depth = 3.41"
90.05% Pervious = 94,888 sf 9.95% Impervious = 10,479 sf

Summary for Subcatchment E-1: Flow to Existing Basin

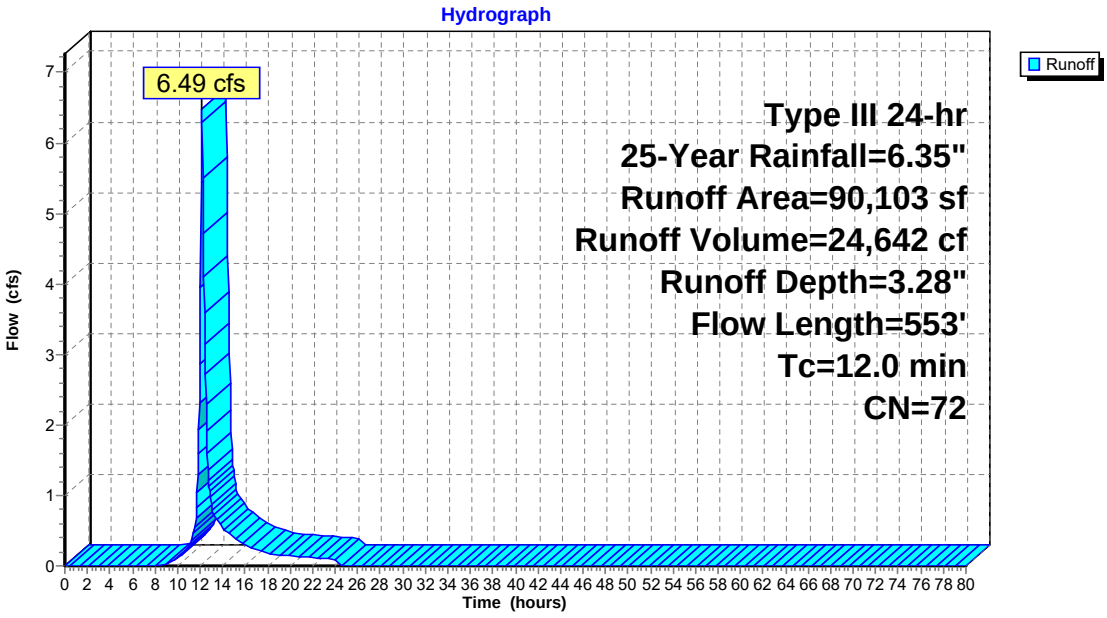
Runoff = 6.49 cfs @ 12.17 hrs, Volume= 24,642 cf, Depth= 3.28"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-80.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=6.35"

	Area (sf)	CN	Description
*	5,457	98	Paved parking
	76,777	70	Woods, Good, HSG C
	7,869	79	50-75% Grass cover, Fair, HSG C
	90,103	72	Weighted Average
	84,646		93.94% Pervious Area
	5,457		6.06% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.6	50	0.0530	0.10		**Sheet Flow, Sheet Flow** Woods: Light underbrush n= 0.400 P2= 3.05"
3.4	503	0.0240	2.49		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
12.0	553	Total			

Subcatchment E-1: Flow to Existing Basin



Summary for Subcatchment E-2: Flow onsite Southeast

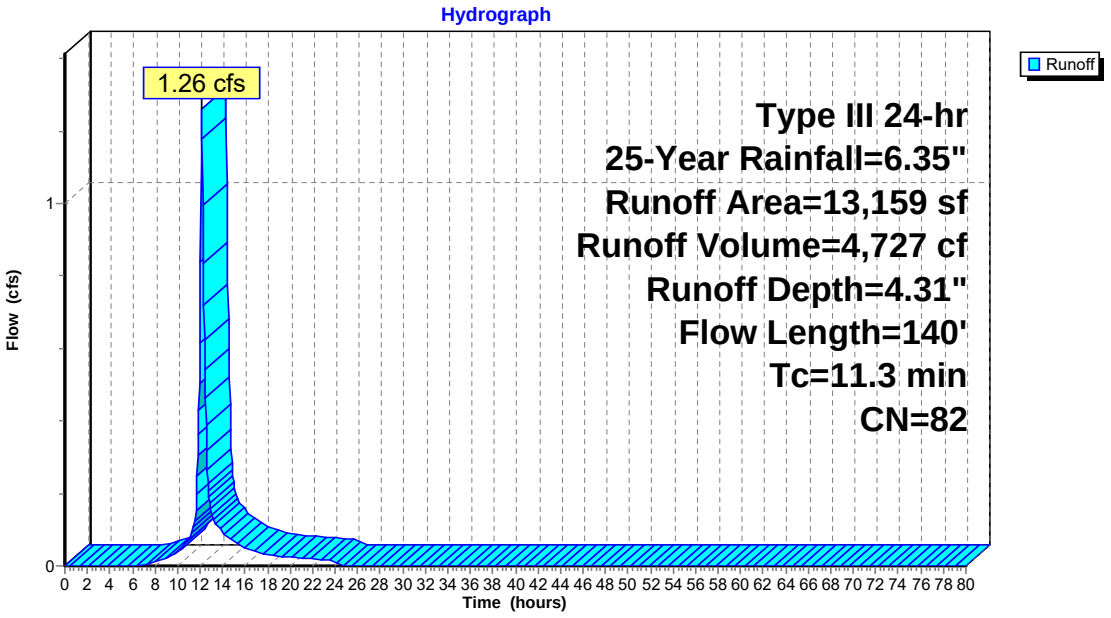
Runoff = 1.26 cfs @ 12.16 hrs, Volume= 4,727 cf, Depth= 4.31"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-80.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=6.35"

	Area (sf)	CN	Description
*	5,022	98	Paved parking
	6,746	70	Woods, Good, HSG C
	1,391	79	50-75% Grass cover, Fair, HSG C
	13,159	82	Weighted Average
	8,137		61.84% Pervious Area
	5,022		38.16% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.0	50	0.0280	0.08		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.05"
0.1	45	0.1750	6.74		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
0.0	11	0.1640	6.52		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
0.2	34	0.0240	3.14		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
11.3	140	Total			

Subcatchment E-2: Flow onsite Southeast



Summary for Subcatchment E-3: Flow off-site West

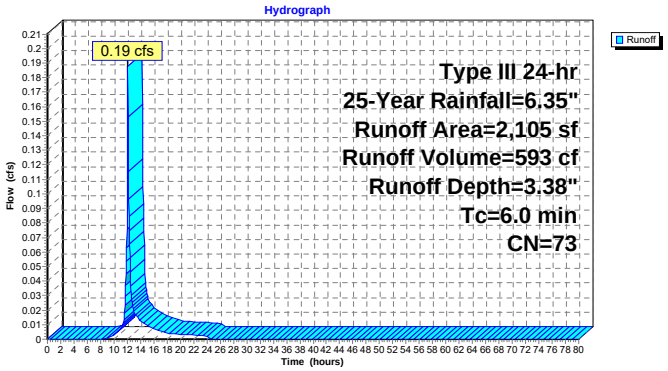
Runoff = 0.19 cfs @ 12.09 hrs, Volume= 593 cf, Depth= 3.38"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-80.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=6.35"

Area (sf)	CN	Description
1,469	70	Woods, Good, HSG C
636	79	50-75% Grass cover, Fair, HSG C
2,105	73	Weighted Average
2,105		100.00% Pervious Area

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

Subcatchment E-3: Flow off-site West



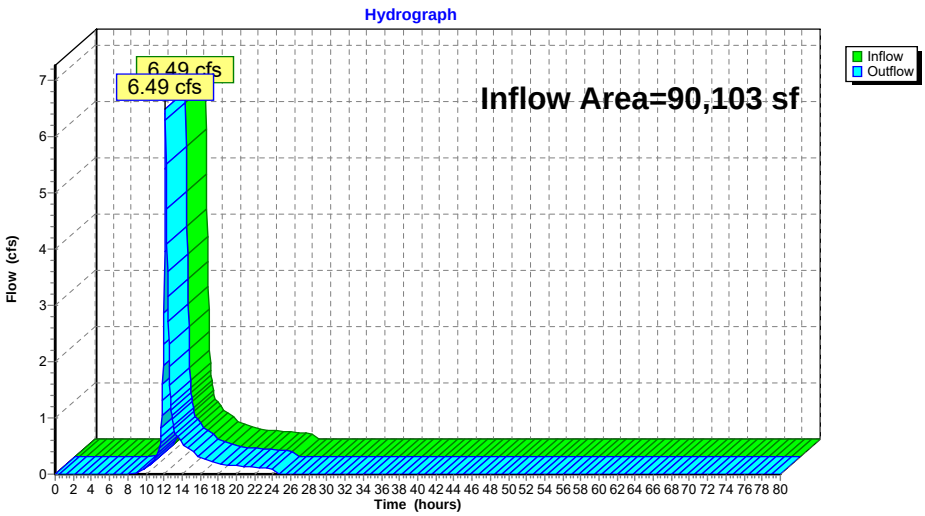
Summary for Reach DP-1: Basin

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

Inflow Area = 90,103 sf, 6.06% Impervious, Inflow Depth = 3.28" for 25-Year event
Inflow = 6.49 cfs @ 12.17 hrs, Volume= 24,642 cf
Outflow = 6.49 cfs @ 12.17 hrs, Volume= 24,642 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-80.00 hrs, dt= 0.05 hrs

Reach DP-1: Basin



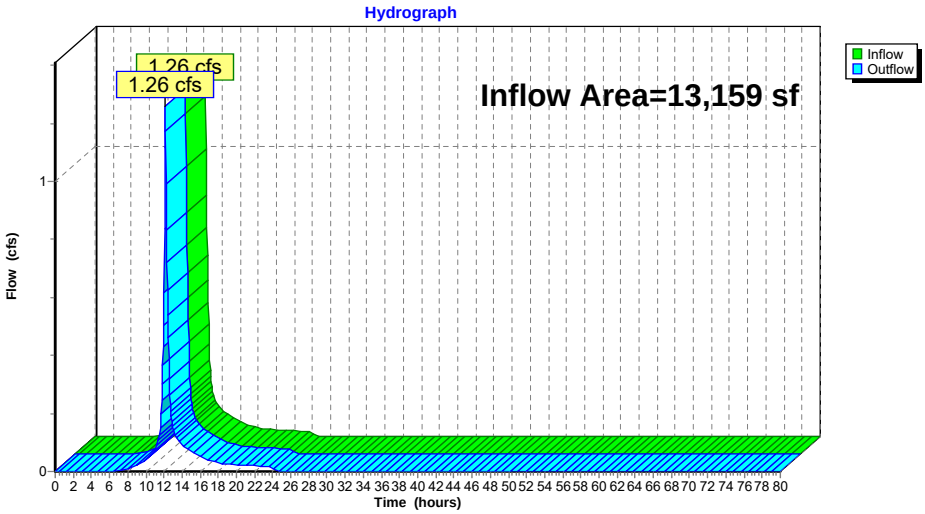
Summary for Reach DP-2: Onsite southeast

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

Inflow Area = 13,159 sf, 38.16% Impervious, Inflow Depth = 4.31" for 25-Year event
Inflow = 1.26 cfs @ 12.16 hrs, Volume= 4,727 cf
Outflow = 1.26 cfs @ 12.16 hrs, Volume= 4,727 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-80.00 hrs, dt= 0.05 hrs

Reach DP-2: Onsite southeast



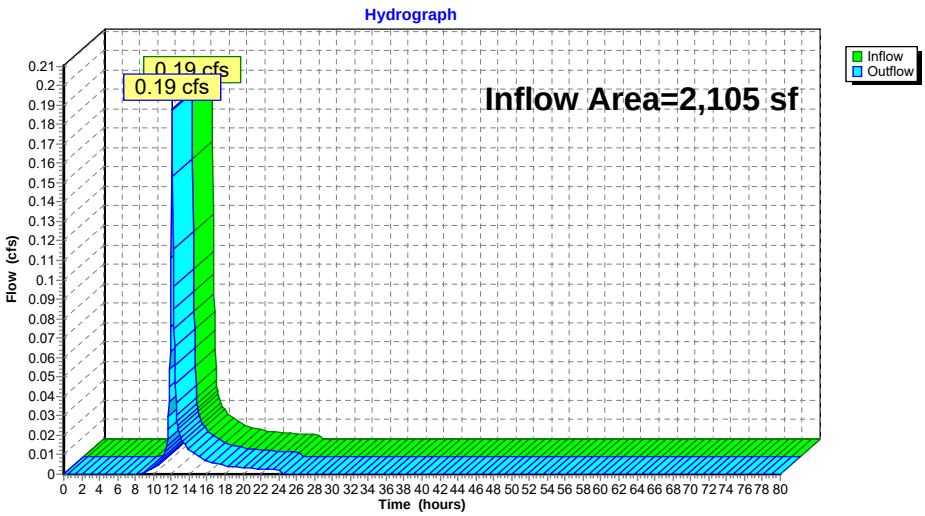
Summary for Reach DP-3: Off-site West

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

Inflow Area = 2,105 sf, 0.00% Impervious, Inflow Depth = 3.38" for 25-Year event
Inflow = 0.19 cfs @ 12.09 hrs, Volume= 593 cf
Outflow = 0.19 cfs @ 12.09 hrs, Volume= 593 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-80.00 hrs, dt= 0.05 hrs

Reach DP-3: Off-site West



HydroCAD Analysis

Existing Conditions - 100 Year Storm

LEVEL DESIGN GROUP

249 SOUTH STREET UNIT 1 PLAINVILLE MA 02762
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Area Listing (all nodes)

Area (sq-ft)	CN	Description (subcatchment-numbers)
9,896	79	50-75% Grass cover, Fair, HSG C (E-1, E-2, E-3)
10,479	98	Paved parking (E-1, E-2)
84,992	70	Woods, Good, HSG C (E-1, E-2, E-3)
105,367	**74**	**TOTAL AREA**

Soil Listing (all nodes)

Area (sq-ft)	Soil Group	Subcatchment Numbers
0	HSG A	
0	HSG B	
94,888	HSG C	E-1, E-2, E-3
0	HSG D	
10,479	Other	E-1, E-2
105,367		**TOTAL AREA**

Ground Covers (all nodes)

HSG-A (sq-ft)	HSG-B (sq-ft)	HSG-C (sq-ft)	HSG-D (sq-ft)	Other (sq-ft)	Total (sq-ft)	Ground Cover	Subcatchment Numbers
0	0	9,896	0	0	9,896	50-75% Grass cover, Fair	E-1, E-2, E-3
0	0	0	0	10,479	10,479	Paved parking	E-1, E-2
0	0	84,992	0	0	84,992	Woods, Good	E-1, E-2, E-3
0	**0**	**94,888**	**0**	**10,479**	**105,367**	**TOTAL AREA**	

Time span=0.00-80.00 hrs, dt=0.05 hrs, 1601 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment E-1: Flow to Existing Basin Runoff Area=90,103 sf 6.06% Impervious Runoff Depth=4.84"
Flow Length=553' Tc=12.0 min CN=72 Runoff=9.57 cfs 36,305 cf

Subcatchment E-2: Flow onsite Southeast Runoff Area=13,159 sf 38.16% Impervious Runoff Depth=6.01"
Flow Length=140' Tc=11.3 min CN=82 Runoff=1.74 cfs 6,592 cf

Subcatchment E-3: Flow off-site West Runoff Area=2,105 sf 0.00% Impervious Runoff Depth=4.95"
Tc=6.0 min CN=73 Runoff=0.27 cfs 869 cf

Reach DP-1: Basin Inflow=9.57 cfs 36,305 cf
Outflow=9.57 cfs 36,305 cf

Reach DP-2: Onsite southeast Inflow=1.74 cfs 6,592 cf
Outflow=1.74 cfs 6,592 cf

Reach DP-3: Off-site West Inflow=0.27 cfs 869 cf
Outflow=0.27 cfs 869 cf

Total Runoff Area = 105,367 sf Runoff Volume = 43,766 cf Average Runoff Depth = 4.98"
90.05% Pervious = 94,888 sf 9.95% Impervious = 10,479 sf

Summary for Subcatchment E-1: Flow to Existing Basin

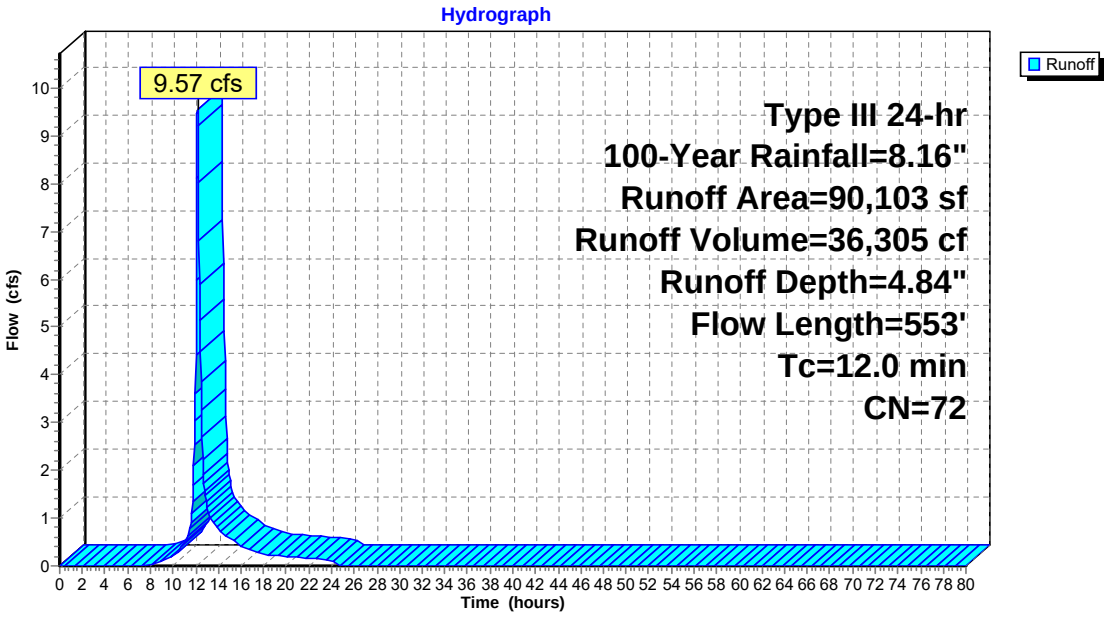
Runoff = 9.57 cfs @ 12.17 hrs, Volume= 36,305 cf, Depth= 4.84"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-80.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=8.16"

	Area (sf)	CN	Description
*	5,457	98	Paved parking
	76,777	70	Woods, Good, HSG C
	7,869	79	50-75% Grass cover, Fair, HSG C
	90,103	72	Weighted Average
	84,646		93.94% Pervious Area
	5,457		6.06% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.6	50	0.0530	0.10		**Sheet Flow, Sheet Flow** Woods: Light underbrush n= 0.400 P2= 3.05"
3.4	503	0.0240	2.49		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
12.0	553	Total			

Subcatchment E-1: Flow to Existing Basin



Summary for Subcatchment E-2: Flow onsite Southeast

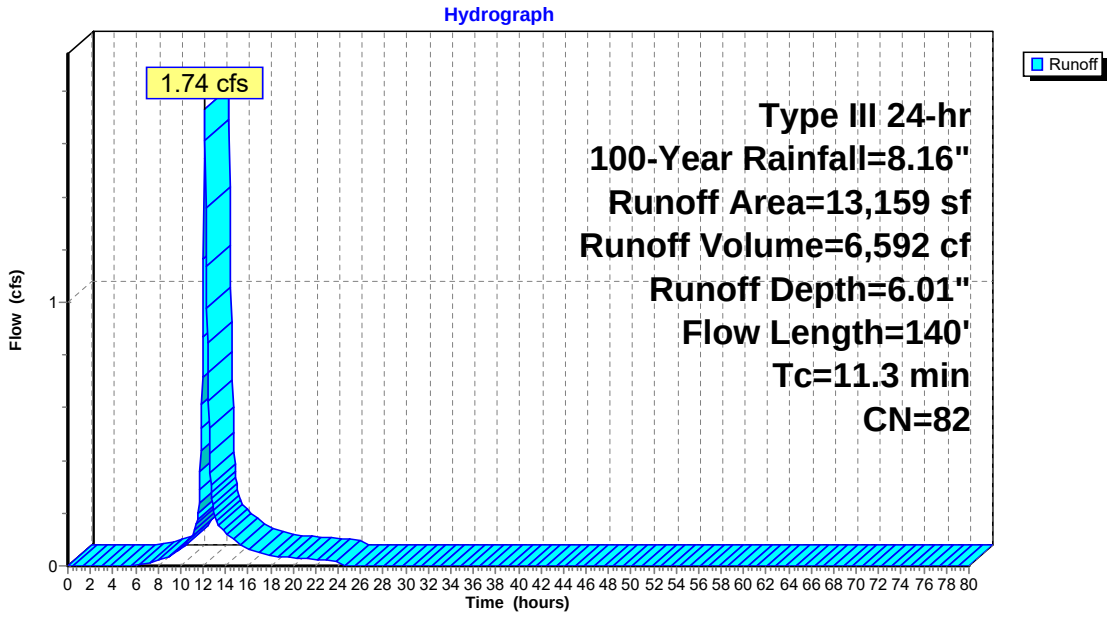
Runoff = 1.74 cfs @ 12.16 hrs, Volume= 6,592 cf, Depth= 6.01"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-80.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=8.16"

	Area (sf)	CN	Description
*	5,022	98	Paved parking
	6,746	70	Woods, Good, HSG C
	1,391	79	50-75% Grass cover, Fair, HSG C
	13,159	82	Weighted Average
	8,137		61.84% Pervious Area
	5,022		38.16% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.0	50	0.0280	0.08		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.05"
0.1	45	0.1750	6.74		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
0.0	11	0.1640	6.52		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
0.2	34	0.0240	3.14		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
11.3	140	Total			

Subcatchment E-2: Flow onsite Southeast



Summary for Subcatchment E-3: Flow off-site West

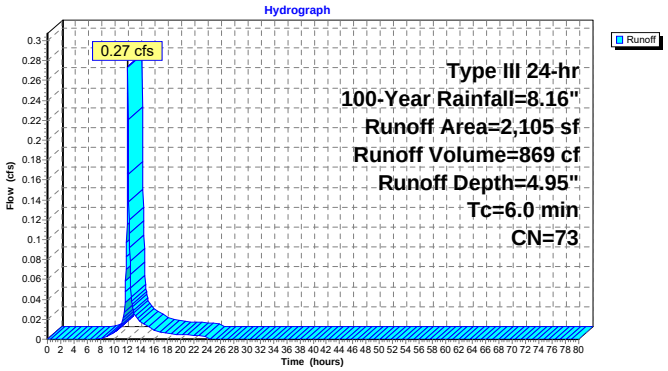
Runoff = 0.27 cfs @ 12.09 hrs, Volume= 869 cf, Depth= 4.95"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-80.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=8.16"

Area (sf)	CN	Description
1,469	70	Woods, Good, HSG C
636	79	50-75% Grass cover, Fair, HSG C
2,105	73	Weighted Average
2,105		100.00% Pervious Area

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

Subcatchment E-3: Flow off-site West



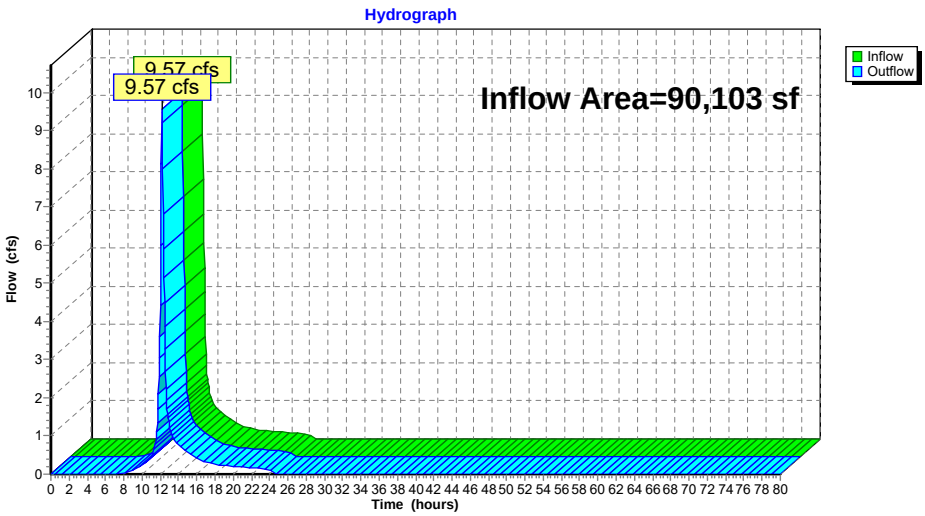
Summary for Reach DP-1: Basin

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

Inflow Area = 90,103 sf, 6.06% Impervious, Inflow Depth = 4.84" for 100-Year event
Inflow = 9.57 cfs @ 12.17 hrs, Volume= 36,305 cf
Outflow = 9.57 cfs @ 12.17 hrs, Volume= 36,305 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-80.00 hrs, dt= 0.05 hrs

Reach DP-1: Basin



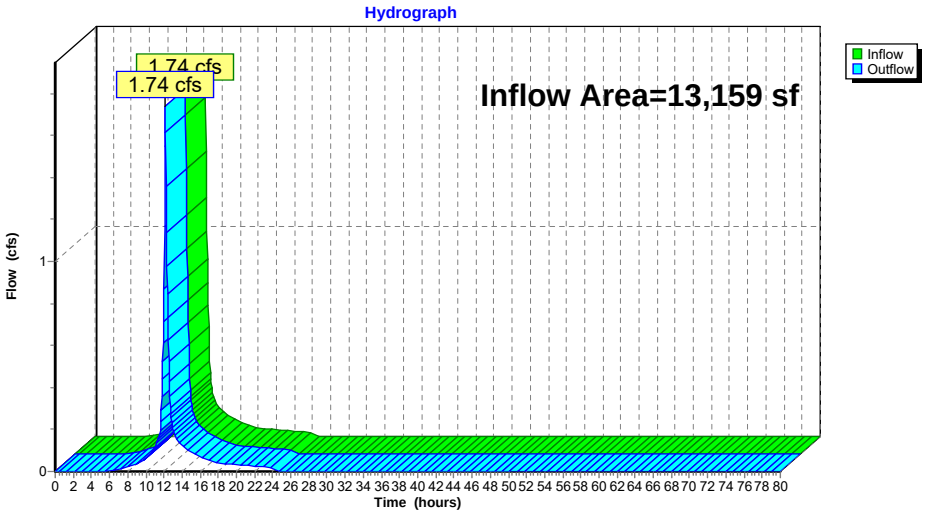
Summary for Reach DP-2: Onsite southeast

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

Inflow Area = 13,159 sf, 38.16% Impervious, Inflow Depth = 6.01" for 100-Year event
Inflow = 1.74 cfs @ 12.16 hrs, Volume= 6,592 cf
Outflow = 1.74 cfs @ 12.16 hrs, Volume= 6,592 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-80.00 hrs, dt= 0.05 hrs

Reach DP-2: Onsite southeast



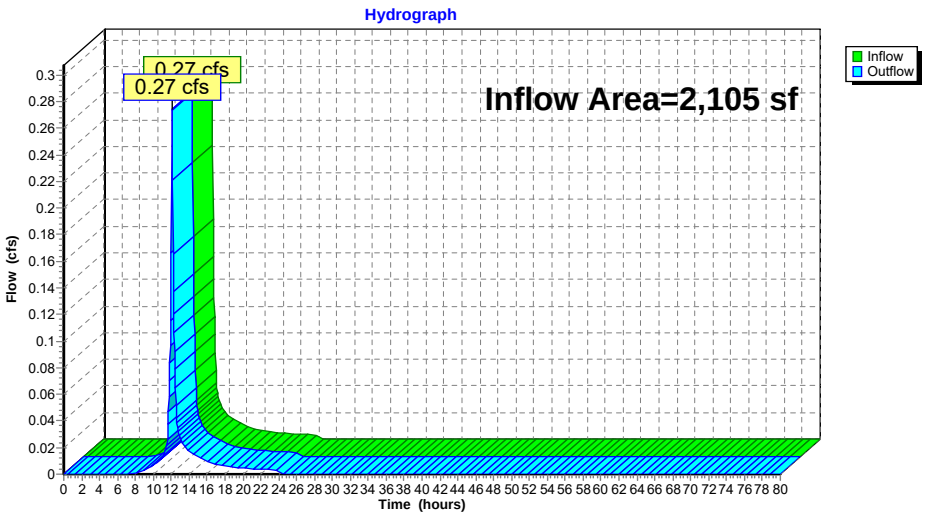
Summary for Reach DP-3: Off-site West

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

Inflow Area = 2,105 sf, 0.00% Impervious, Inflow Depth = 4.95" for 100-Year event
Inflow = 0.27 cfs @ 12.09 hrs, Volume= 869 cf
Outflow = 0.27 cfs @ 12.09 hrs, Volume= 869 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-80.00 hrs, dt= 0.05 hrs

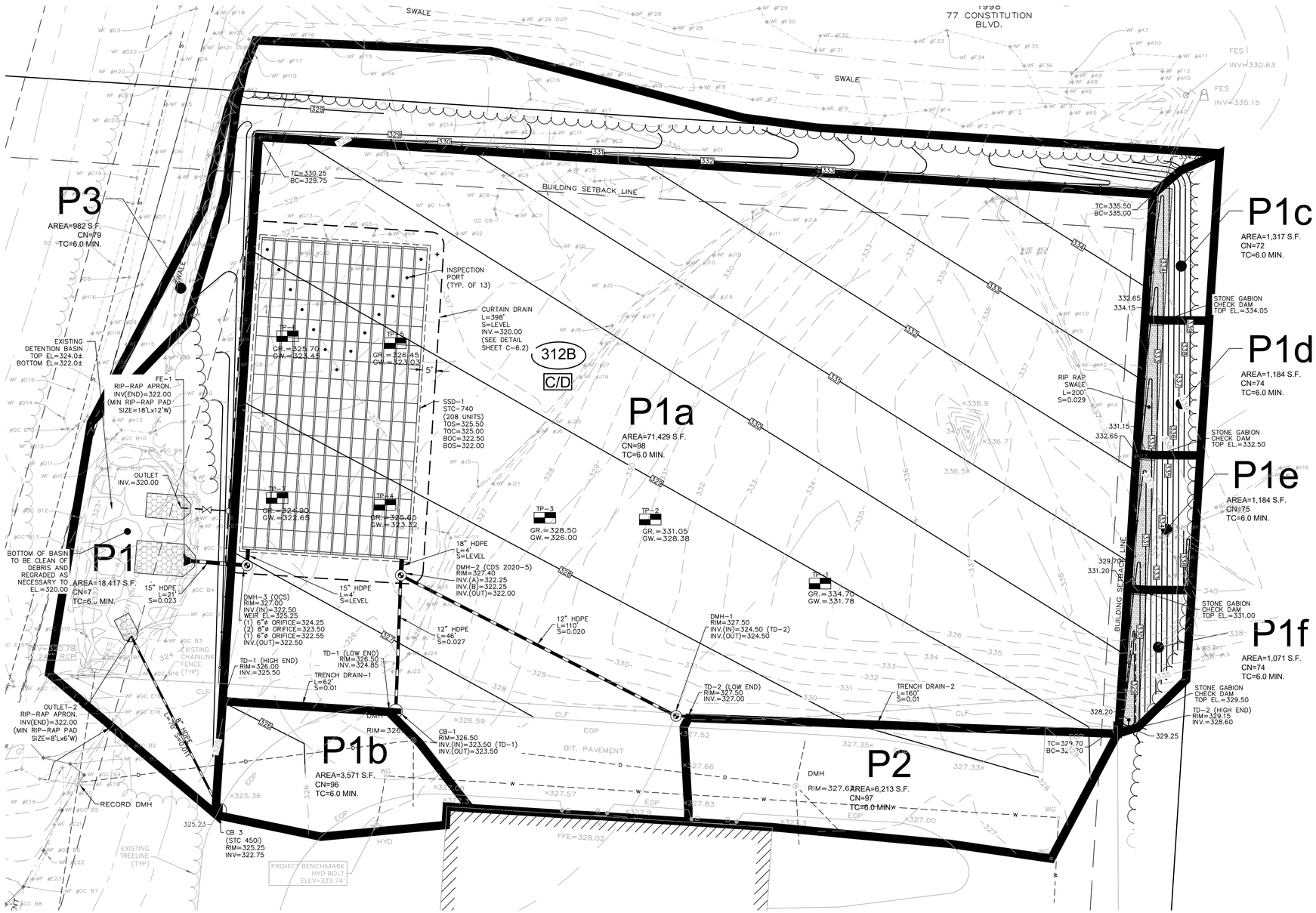
Reach DP-3: Off-site West



LEVEL
DESIGN GROUP

Proposed Drainage Plan & HydroCAD Diagram

249 SOUTH STREET UNIT 1 PLAINVILLE MA 02762
TEL508 695 2221 FAX508 695 2219 CONTACT@LEVELDG.COM LEVELDG.COM



WATERSHED LEGEND

(XXXX) SOIL TYPE

[X] HYDROLOGIC SOIL GROUP

SOILS

(312B) WOODBRIDGE FINE SANDY LOAM

NO	DATE	REVISIONS
1	10/17/2023	RESOURCE AREA FLAGS

SEAL

DATE : JANUARY 13, 2023
DRAWN : AH / DRC
SCALE : 1" = 20'

LIBERTY PARKING EXPANSION

MAP SHEET 320, PARCEL 004
15 LIBERTY WAY
FRANKLIN, MASSACHUSETTS

LEVEL DESIGN GROUP
Civil Engineers & Land Surveyors
249 SOUTH STREET, UNIT 1
PLAINVILLE, MA 02762
TEL. (508) 695-2221 FAX. (508) 695-2219

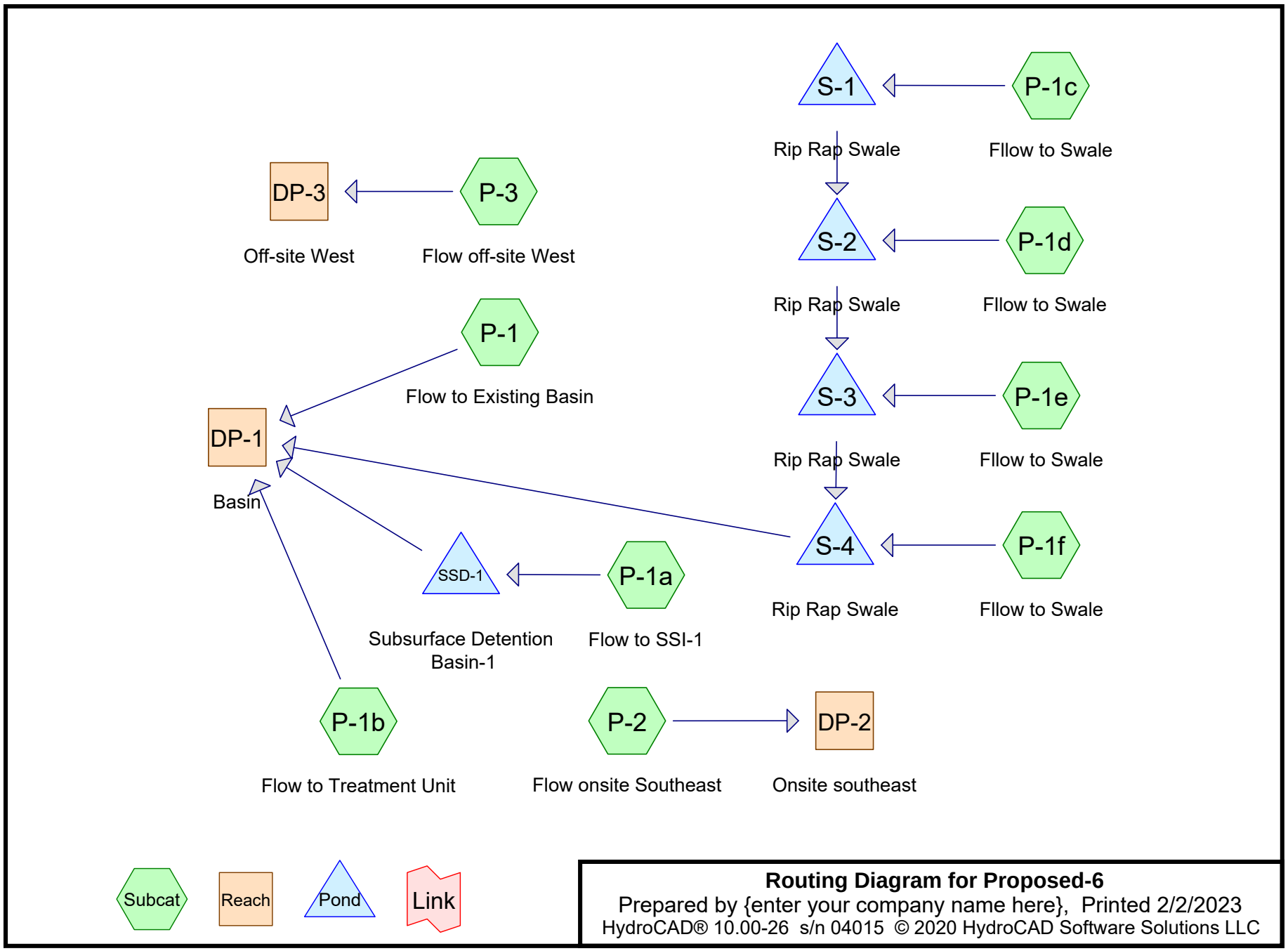
PROPOSED DRAINAGE

D-2.0

SHEET 2 OF 2

0' 10' 20' 40'

2081.00



Routing Diagram for Proposed-6

Prepared by {enter your company name here}, Printed 2/2/2023

HydroCAD Analysis

Proposed Conditions - 2 Year Storm

249 SOUTH STREET UNIT 1 PLAINVILLE MA 02762
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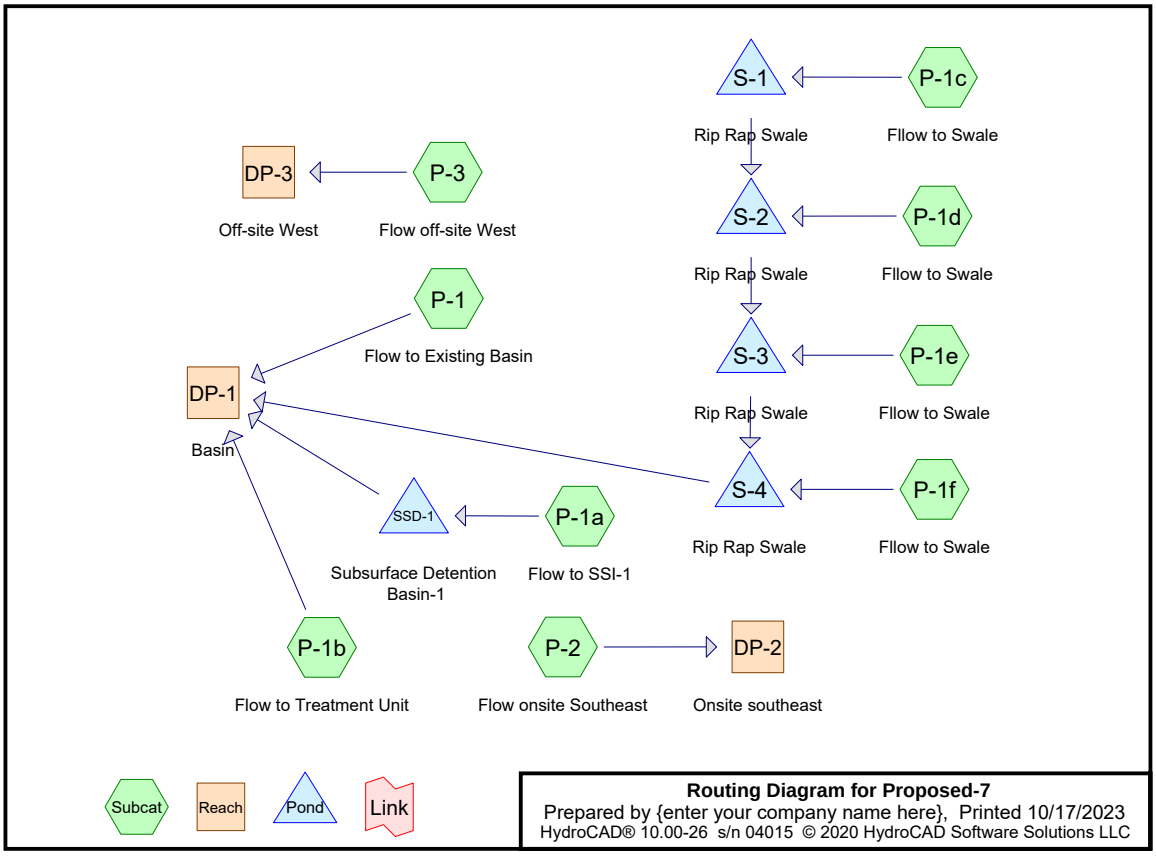


Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
0.426	79	50-75% Grass cover, Fair, HSG C (P-1, P-1a, P-1b, P-1c, P-1d, P-1e, P-1f, P-2, P-3)
1.838	98	Paved parking (P-1a, P-1b, P-2)
0.032	66	Rip Rap Swale (P-1c, P-1d, P-1e, P-1f)
0.123	70	Woods, Good, HSG C (P-1, P-1c, P-1d, P-1e, P-1f, P-3)
2.419	**93**	**TOTAL AREA**

Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.000	HSG A	
0.000	HSG B	
0.549	HSG C	P-1, P-1a, P-1b, P-1c, P-1d, P-1e, P-1f, P-2, P-3
0.000	HSG D	
1.870	Other	P-1a, P-1b, P-1c, P-1d, P-1e, P-1f, P-2
2.419		**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
0.000	0.000	0.426	0.000	0.000	0.426	50-75% Grass cover, Fair	P-1, P-1a, P-1b, P-1c, P-1d, P-1e, P-1f, P-2, P-3
0.000	0.000	0.000	0.000	1.838	1.838	Paved parking	P-1a, P-1b, P-2
0.000	0.000	0.000	0.000	0.032	0.032	Rip Rap Swale	P-1c, P-1d, P-1e, P-1f
0.000	0.000	0.123	0.000	0.000	0.123	Woods, Good	P-1, P-1c, P-1d, P-1e, P-1f, P-3
0.000	**0.000**	**0.549**	**0.000**	**1.870**	**2.419**	**TOTAL AREA**	

Pipe Listing (all nodes)

Line#	Node Number	In-Invert (feet)	Out-Invert (feet)	Length (feet)	Slope (ft/ft)	n	Diam/Width (inches)	Height (inches)	Inside-Fill (inches)
1	SSD-1	322.50	322.00	21.3	0.0235	0.013	15.0	0.0	0.0

Time span=0.00-80.00 hrs, dt=0.05 hrs, 1601 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment P-1: Flow to Existing Basin Runoff Area=18,417 sf 0.00% Impervious Runoff Depth=1.11"
Flow Length=461' Tc=10.0 min CN=77 Runoff=0.46 cfs 0.039 af

Subcatchment P-1a: Flow to SSI-1 Runoff Area=71,428 sf 99.59% Impervious Runoff Depth=2.82"
Tc=6.0 min CN=98 Runoff=4.74 cfs 0.385 af

Subcatchment P-1b: Flow to Treatment Unit Runoff Area=3,571 sf 87.17% Impervious Runoff Depth=2.60"
Tc=6.0 min CN=96 Runoff=0.23 cfs 0.018 af

Subcatchment P-1c: Fllow to Swale Runoff Area=1,317 sf 0.00% Impervious Runoff Depth=0.84"
Tc=6.0 min CN=72 Runoff=0.03 cfs 0.002 af

Subcatchment P-1d: Fllow to Swale Runoff Area=1,184 sf 0.00% Impervious Runoff Depth=0.94"
Tc=6.0 min CN=74 Runoff=0.03 cfs 0.002 af

Subcatchment P-1e: Fllow to Swale Runoff Area=1,184 sf 0.00% Impervious Runoff Depth=0.99"
Tc=6.0 min CN=75 Runoff=0.03 cfs 0.002 af

Subcatchment P-1f: Fllow to Swale Runoff Area=1,071 sf 0.00% Impervious Runoff Depth=0.94"
Tc=6.0 min CN=74 Runoff=0.03 cfs 0.002 af

Subcatchment P-2: Flow onsite Southeast Runoff Area=6,213 sf 93.87% Impervious Runoff Depth=2.71"
Tc=6.0 min CN=97 Runoff=0.41 cfs 0.032 af

Subcatchment P-3: Flow off-site West Runoff Area=982 sf 0.00% Impervious Runoff Depth=1.23"
Tc=6.0 min CN=79 Runoff=0.03 cfs 0.002 af

Reach DP-1: Basin Inflow=1.31 cfs 0.292 af
Outflow=1.31 cfs 0.292 af

Reach DP-2: Onsite southeast Inflow=0.41 cfs 0.032 af
Outflow=0.41 cfs 0.032 af

Reach DP-3: Off-site West Inflow=0.03 cfs 0.002 af
Outflow=0.03 cfs 0.002 af

Pond S-1: Rip Rap Swale Peak Elev=333.17' Storage=92 cf Inflow=0.03 cfs 0.002 af
Outflow=0.00 cfs 0.000 af

Pond S-2: Rip Rap Swale Peak Elev=331.73' Storage=93 cf Inflow=0.03 cfs 0.002 af
Outflow=0.00 cfs 0.000 af

Pond S-3: Rip Rap Swale Peak Elev=330.29' Storage=98 cf Inflow=0.03 cfs 0.002 af
Outflow=0.00 cfs 0.000 af

Pond S-4: Rip Rap Swale Peak Elev=328.70' Storage=84 cf Inflow=0.03 cfs 0.002 af
Outflow=0.00 cfs 0.000 af

Pond SSD-1: Subsurface Detention Basin-1 Peak Elev=323.55' Storage=7,838 cf Inflow=4.74 cfs 0.385 af
Discarded=0.08 cfs 0.149 af Primary=0.83 cfs 0.236 af Outflow=0.92 cfs 0.385 af

Total Runoff Area = 2.419 ac Runoff Volume = 0.485 af Average Runoff Depth = 2.40"
24.00% Pervious = 0.581 ac 76.00% Impervious = 1.838 ac

Summary for Subcatchment P-1: Flow to Existing Basin

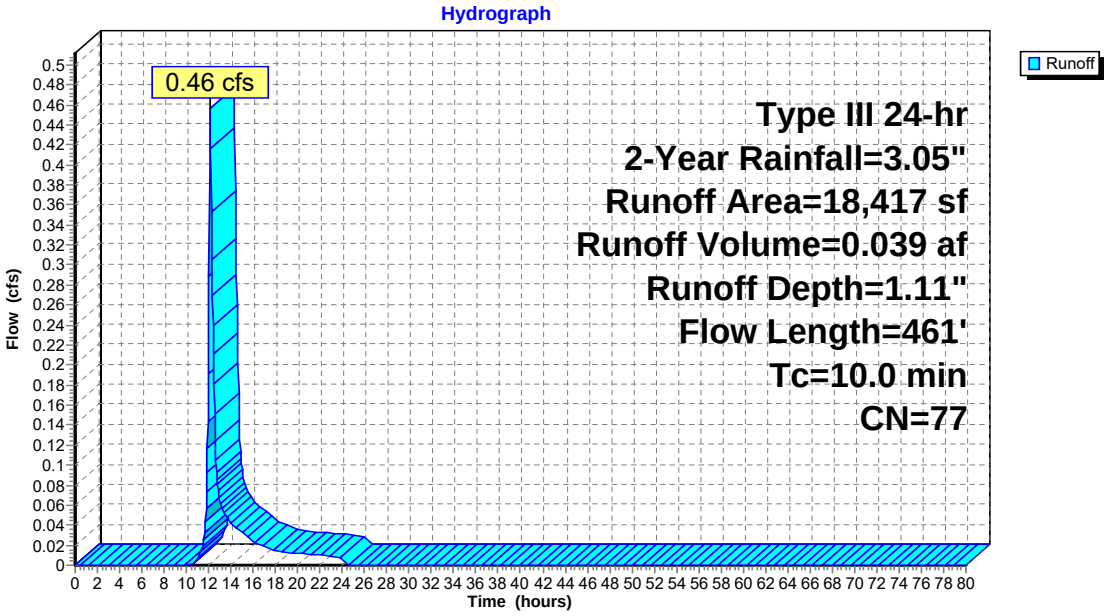
Runoff = 0.46 cfs @ 12.15 hrs, Volume= 0.039 af, Depth= 1.11"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-80.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.05"

Area (sf)	CN	Description
4,454	70	Woods, Good, HSG C
13,963	79	50-75% Grass cover, Fair, HSG C
18,417	77	Weighted Average
18,417		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.3	50	0.0800	0.11		**Sheet Flow, Sheet Flow** Woods: Light underbrush n= 0.400 P2= 3.05"
2.7	411	0.0240	2.49		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
10.0	461	Total			

Subcatchment P-1: Flow to Existing Basin



Summary for Subcatchment P-1a: Flow to SSI-1

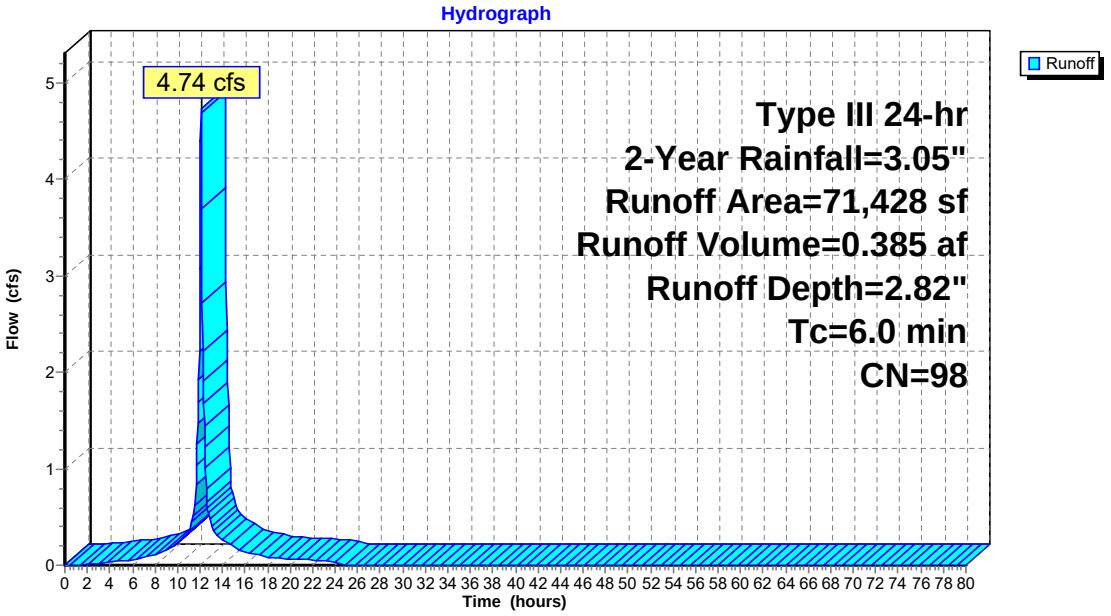
Runoff = 4.74 cfs @ 12.09 hrs, Volume= 0.385 af, Depth= 2.82"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-80.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.05"

	Area (sf)	CN	Description
*	71,133	98	Paved parking
	295	79	50-75% Grass cover, Fair, HSG C
	71,428	98	Weighted Average
	295		0.41% Pervious Area
	71,133		99.59% Impervious Area

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

Subcatchment P-1a: Flow to SSI-1



Summary for Subcatchment P-1b: Flow to Treatment Unit

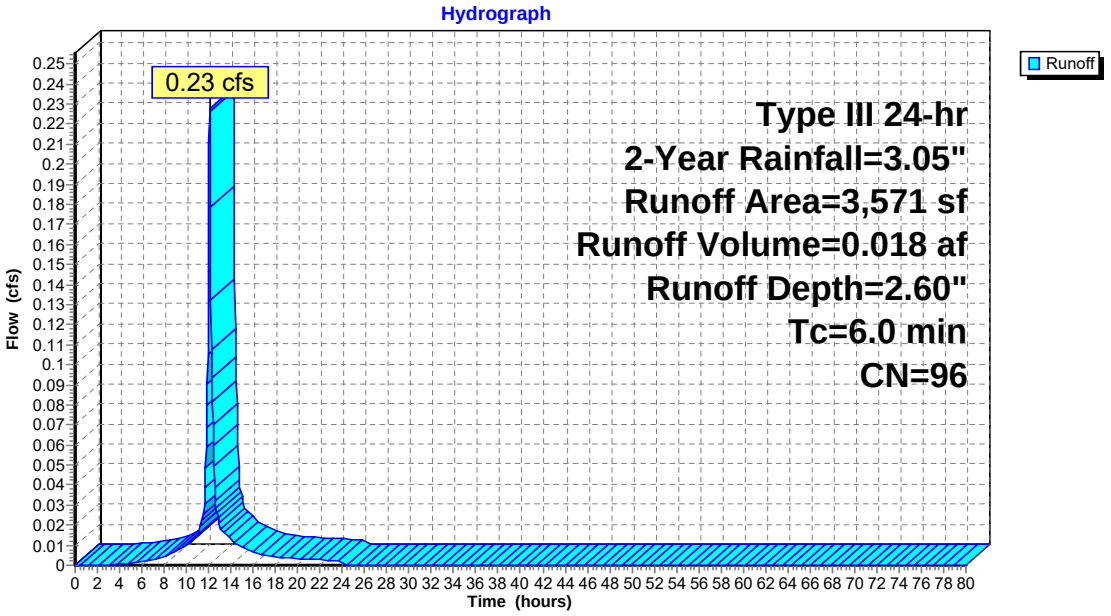
Runoff = 0.23 cfs @ 12.09 hrs, Volume= 0.018 af, Depth= 2.60"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-80.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.05"

	Area (sf)	CN	Description
*	3,113	98	Paved parking
	458	79	50-75% Grass cover, Fair, HSG C
	3,571	96	Weighted Average
	458		12.83% Pervious Area
	3,113		87.17% Impervious Area

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

Subcatchment P-1b: Flow to Treatment Unit



Summary for Subcatchment P-1c: Fllow to Swale

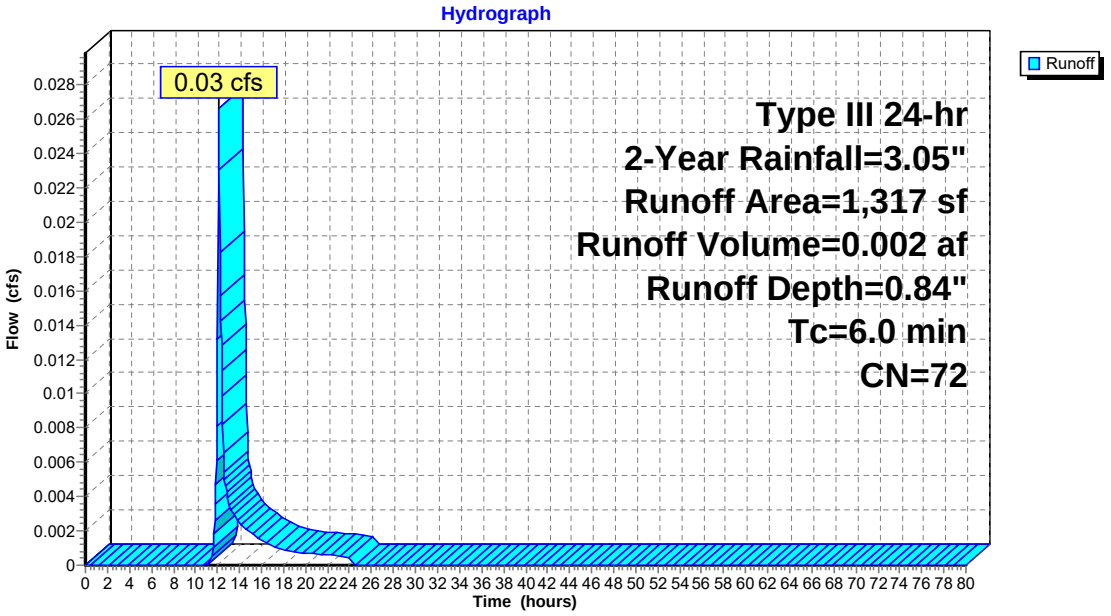
Runoff = 0.03 cfs @ 12.10 hrs, Volume= 0.002 af, Depth= 0.84"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-80.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.05"

	Area (sf)	CN	Description
*	339	66	Rip Rap Swale
	476	70	Woods, Good, HSG C
	502	79	50-75% Grass cover, Fair, HSG C
	1,317	72	Weighted Average
	1,317		100.00% Pervious Area

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

Subcatchment P-1c: Fllow to Swale



Summary for Subcatchment P-1d: Fllow to Swale

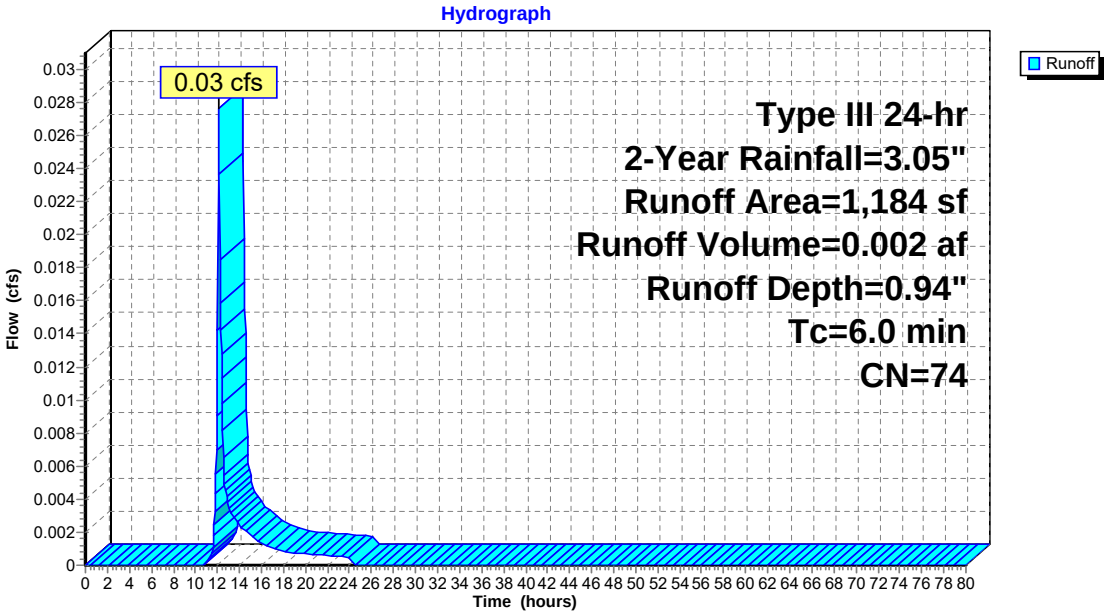
Runoff = 0.03 cfs @ 12.10 hrs, Volume= 0.002 af, Depth= 0.94"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-80.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.05"

	Area (sf)	CN	Description
*	350	66	Rip Rap Swale
	216	70	Woods, Good, HSG C
	618	79	50-75% Grass cover, Fair, HSG C
	1,184	74	Weighted Average
	1,184		100.00% Pervious Area

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

Subcatchment P-1d: Fllow to Swale



Summary for Subcatchment P-1e: Fllow to Swale

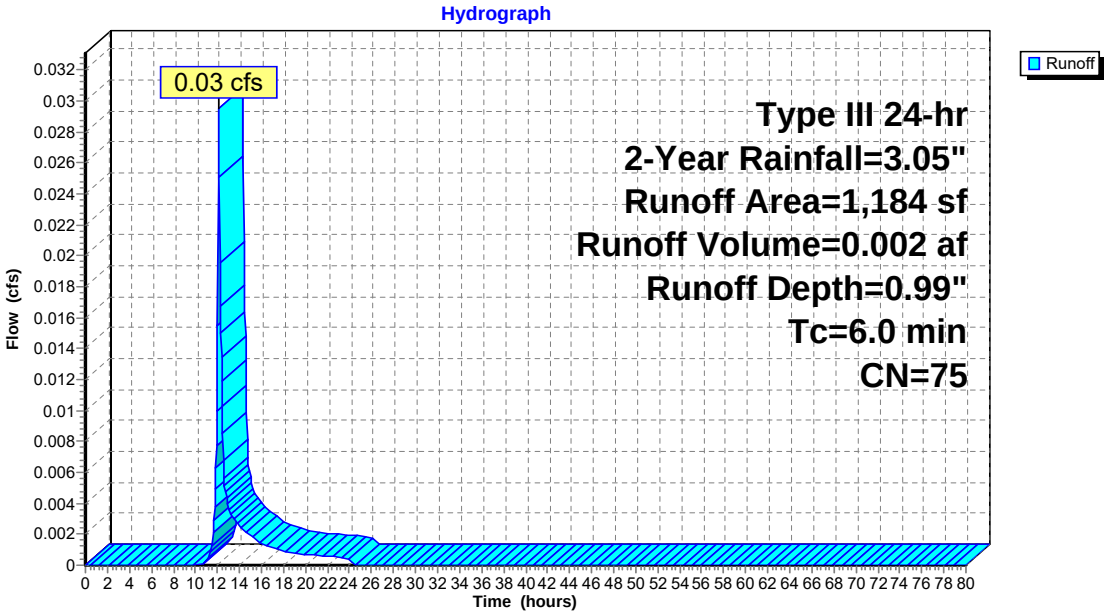
Runoff = 0.03 cfs @ 12.10 hrs, Volume= 0.002 af, Depth= 0.99"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-80.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.05"

	Area (sf)	CN	Description
*	350	66	Rip Rap Swale
	58	70	Woods, Good, HSG C
	776	79	50-75% Grass cover, Fair, HSG C
	1,184	75	Weighted Average
	1,184		100.00% Pervious Area

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

Subcatchment P-1e: Fllow to Swale



Summary for Subcatchment P-1f: Fllow to Swale

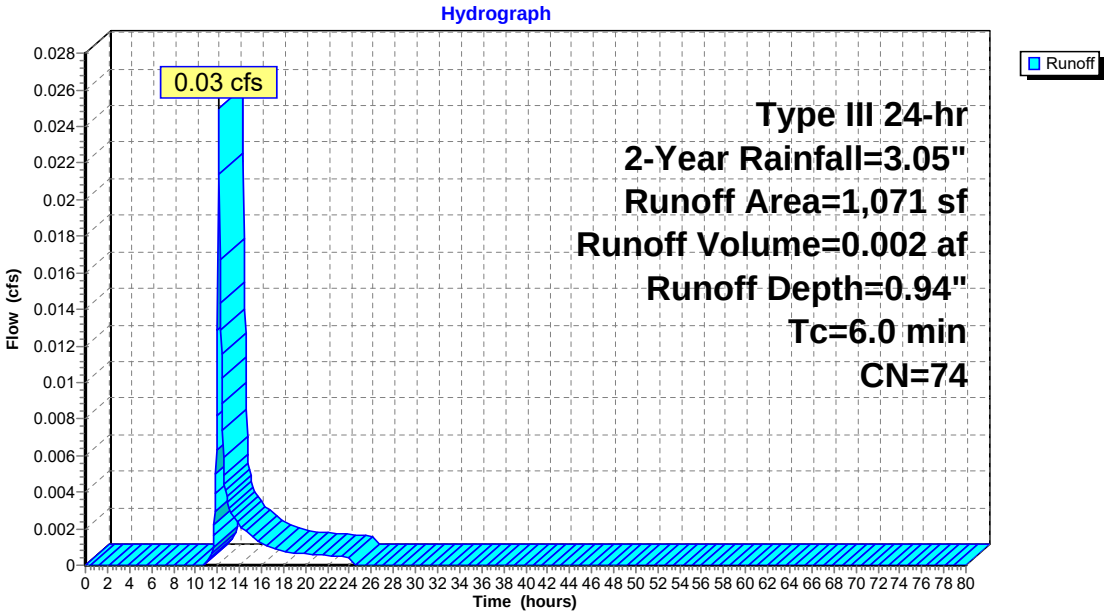
Runoff = 0.03 cfs @ 12.10 hrs, Volume= 0.002 af, Depth= 0.94"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-80.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.05"

	Area (sf)	CN	Description
*	357	66	Rip Rap Swale
	124	70	Woods, Good, HSG C
	590	79	50-75% Grass cover, Fair, HSG C
	1,071	74	Weighted Average
	1,071		100.00% Pervious Area

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

Subcatchment P-1f: Fllow to Swale



Summary for Subcatchment P-2: Flow onsite Southeast

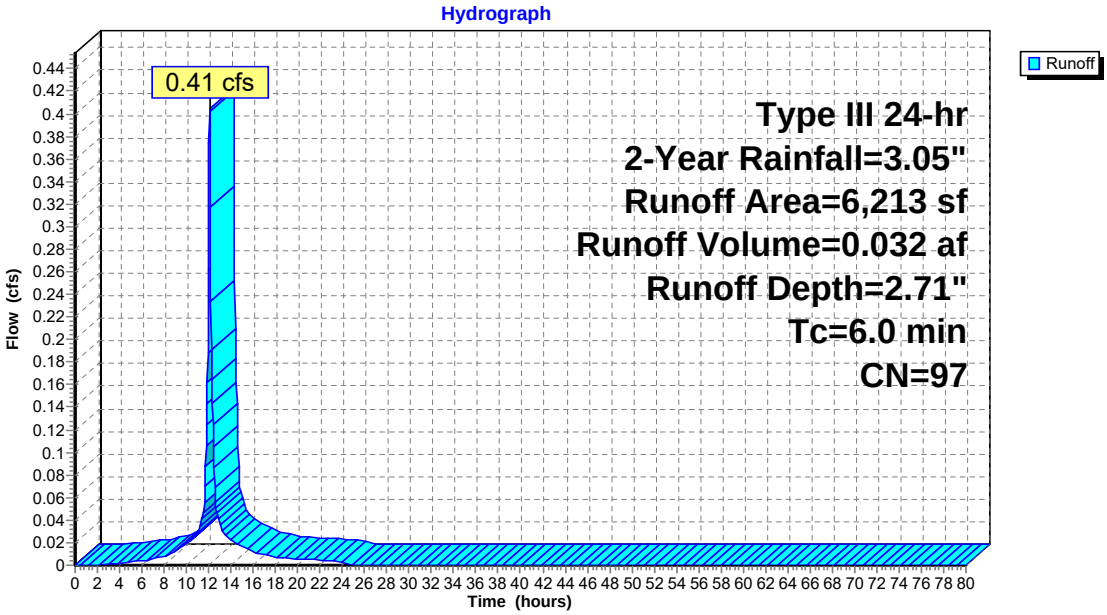
Runoff = 0.41 cfs @ 12.09 hrs, Volume= 0.032 af, Depth= 2.71"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-80.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.05"

	Area (sf)	CN	Description
*	5,832	98	Paved parking
	381	79	50-75% Grass cover, Fair, HSG C
	6,213	97	Weighted Average
	381		6.13% Pervious Area
	5,832		93.87% Impervious Area

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

Subcatchment P-2: Flow onsite Southeast



Summary for Subcatchment P-3: Flow off-site West

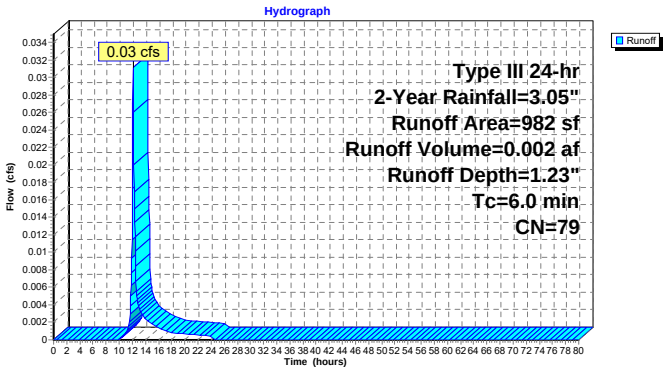
Runoff = 0.03 cfs @ 12.10 hrs, Volume= 0.002 af, Depth= 1.23"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-80.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.05"

Area (sf)	CN	Description
10	70	Woods, Good, HSG C
972	79	50-75% Grass cover, Fair, HSG C
982	79	Weighted Average
982		100.00% Pervious Area

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

Subcatchment P-3: Flow off-site West



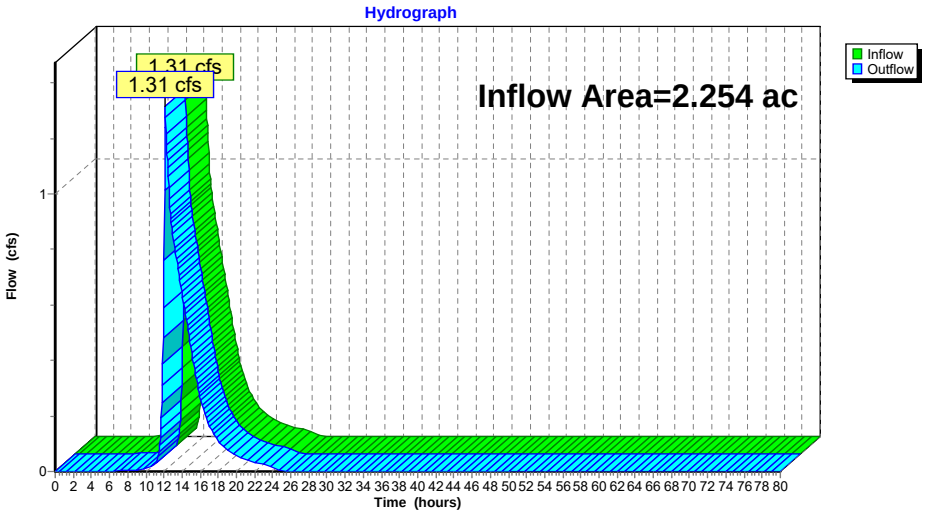
Summary for Reach DP-1: Basin

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

Inflow Area = 2.254 ac, 75.63% Impervious, Inflow Depth = 1.56" for 2-Year event
Inflow = 1.31 cfs @ 12.16 hrs, Volume= 0.292 af
Outflow = 1.31 cfs @ 12.16 hrs, Volume= 0.292 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-80.00 hrs, dt= 0.05 hrs

Reach DP-1: Basin



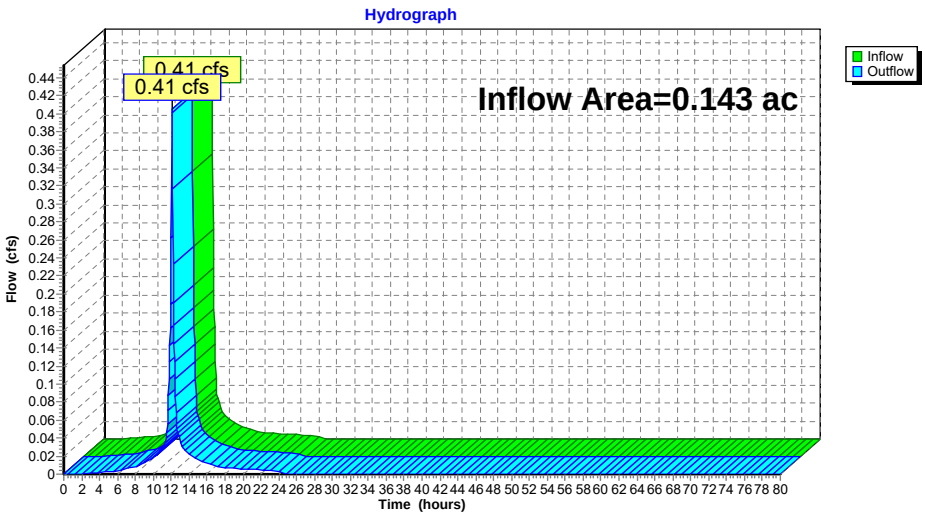
Summary for Reach DP-2: Onsite southeast

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

Inflow Area = 0.143 ac, 93.87% Impervious, Inflow Depth = 2.71" for 2-Year event
Inflow = 0.41 cfs @ 12.09 hrs, Volume= 0.032 af
Outflow = 0.41 cfs @ 12.09 hrs, Volume= 0.032 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-80.00 hrs, dt= 0.05 hrs

Reach DP-2: Onsite southeast



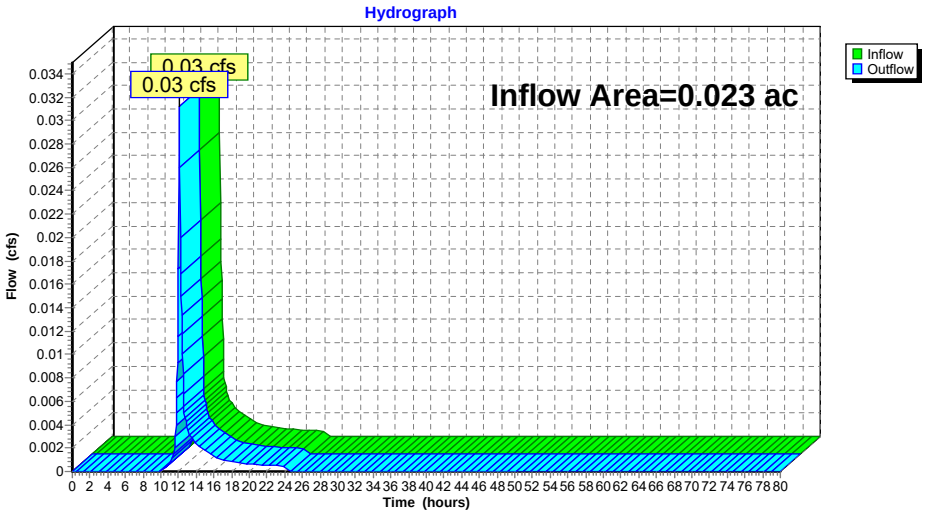
Summary for Reach DP-3: Off-site West

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

Inflow Area = 0.023 ac, 0.00% Impervious, Inflow Depth = 1.23" for 2-Year event
Inflow = 0.03 cfs @ 12.10 hrs, Volume= 0.002 af
Outflow = 0.03 cfs @ 12.10 hrs, Volume= 0.002 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-80.00 hrs, dt= 0.05 hrs

Reach DP-3: Off-site West



Summary for Pond S-1: Rip Rap Swale

Inflow Area = 0.030 ac, 0.00% Impervious, Inflow Depth = 0.84" for 2-Year event
Inflow = 0.03 cfs @ 12.10 hrs, Volume= 0.002 af
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 100%, Lag= 0.0 min
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-80.00 hrs, dt= 0.05 hrs / 6
Peak Elev= 333.17' @ 24.40 hrs Surf.Area= 200 sf Storage= 92 cf

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

Volume	Invert	Avail.Storage	Storage Description
#1	331.15'	120 cf	**Custom Stage Data (Irregular)** Listed below (Recalc) 414 cf Overall - 114 cf Embedded = 300 cf x 40.0% Voids
#2	332.65'	114 cf	**Custom Stage Data (Irregular)** Listed below (Recalc) Inside #1
		234 cf	Total Available Storage

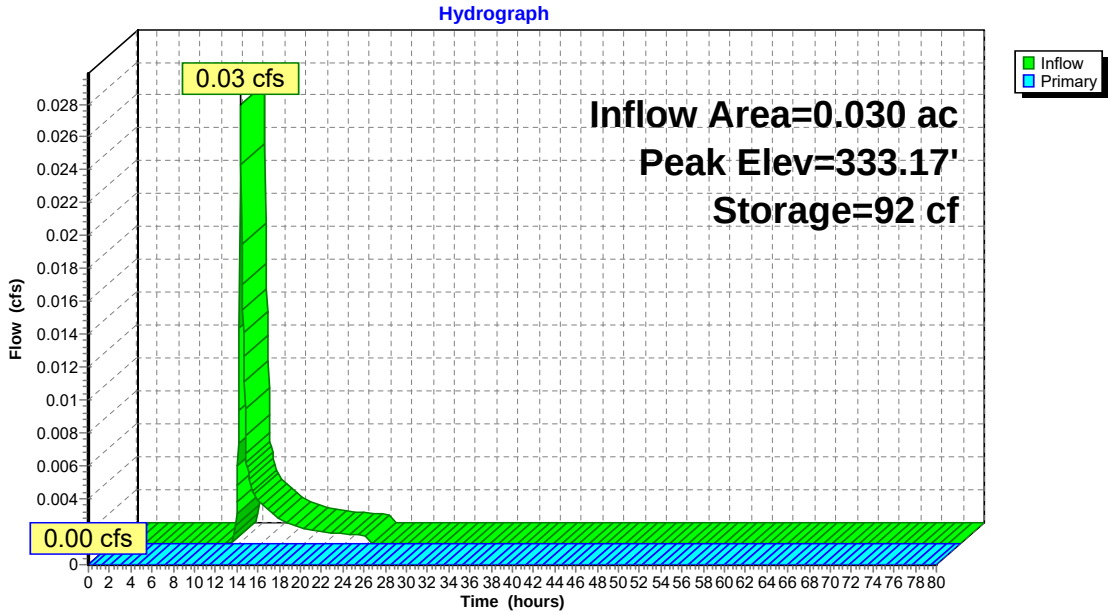
Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
331.15	0	0.0	0	0	0
331.50	21	27.2	2	2	59
332.50	171	99.3	84	86	788
332.65	200	104.4	28	114	872
334.15	200	104.4	300	414	1,028

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
332.65	0	0.0	0	0	0
333.00	21	27.2	2	2	59
334.00	171	99.3	84	86	788
334.15	200	104.4	28	114	872

Device	Routing	Invert	Outlet Devices
#1	Primary	334.05'	**7.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=331.15' (Free Discharge)
1=Sharp-Crested Rectangular Weir (Controls 0.00 cfs)

Pond S-1: Rip Rap Swale



Summary for Pond S-2: Rip Rap Swale

Inflow Area = 0.057 ac, 0.00% Impervious, Inflow Depth = 0.45" for 2-Year event
Inflow = 0.03 cfs @ 12.10 hrs, Volume= 0.002 af
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 100%, Lag= 0.0 min
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-80.00 hrs, dt= 0.05 hrs / 6
Peak Elev= 331.73' @ 24.40 hrs Surf.Area= 200 sf Storage= 93 cf

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

Volume	Invert	Avail.Storage	Storage Description
#1	329.65'	120 cf	**Custom Stage Data (Irregular)** Listed below (Recalc) 407 cf Overall - 107 cf Embedded = 300 cf x 40.0% Voids
#2	331.15'	107 cf	**Custom Stage Data (Irregular)** Listed below (Recalc) Inside #1
		227 cf	Total Available Storage

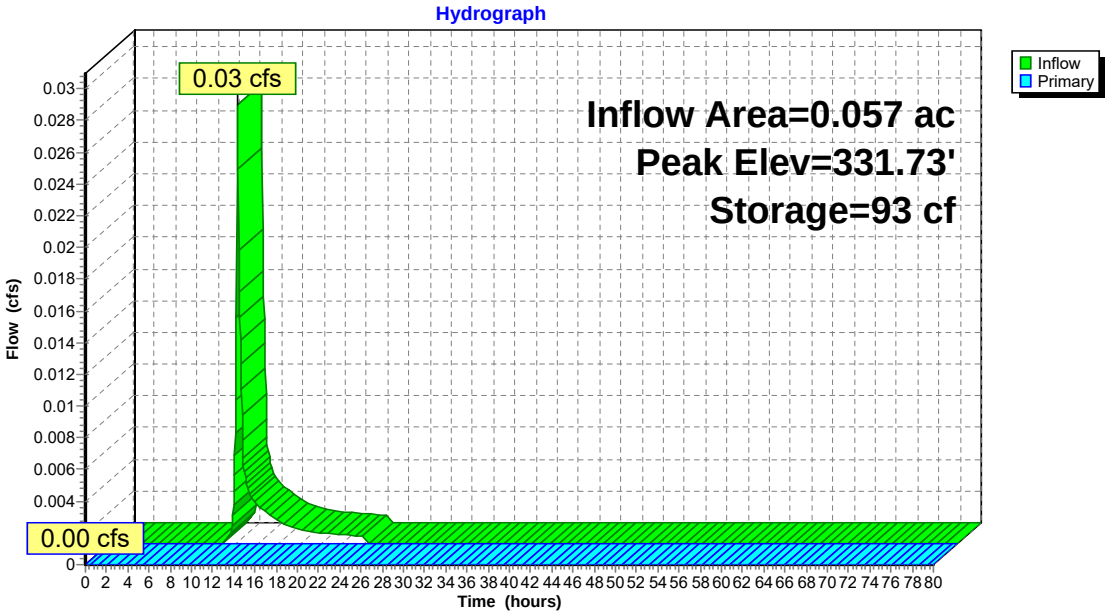
Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
329.65	0	0.0	0	0	0
330.50	74	61.1	21	21	298
331.15	200	104.5	86	107	873
332.65	200	104.5	300	407	1,029

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
331.15	0	0.0	0	0	0
332.00	74	61.1	21	21	298
332.65	200	104.5	86	107	873

Device	Routing	Invert	Outlet Devices
#1	Primary	332.50'	**7.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=329.65' (Free Discharge)
1=Sharp-Crested Rectangular Weir (Controls 0.00 cfs)

Pond S-2: Rip Rap Swale



Summary for Pond S-3: Rip Rap Swale

Inflow Area = 0.085 ac, 0.00% Impervious, Inflow Depth = 0.32" for 2-Year event
Inflow = 0.03 cfs @ 12.10 hrs, Volume= 0.002 af
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 100%, Lag= 0.0 min
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-80.00 hrs, dt= 0.05 hrs / 6
Peak Elev= 330.29' @ 24.40 hrs Surf.Area= 200 sf Storage= 98 cf

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

Volume	Invert	Avail.Storage	Storage Description
#1	329.70'	112 cf	**Custom Stage Data (Irregular)** Listed below (Recalc) Inside #2
#2	328.20'	120 cf	**Custom Stage Data (Irregular)** Listed below (Recalc) 412 cf Overall - 112 cf Embedded = 300 cf x 40.0% Voids
		232 cf	Total Available Storage

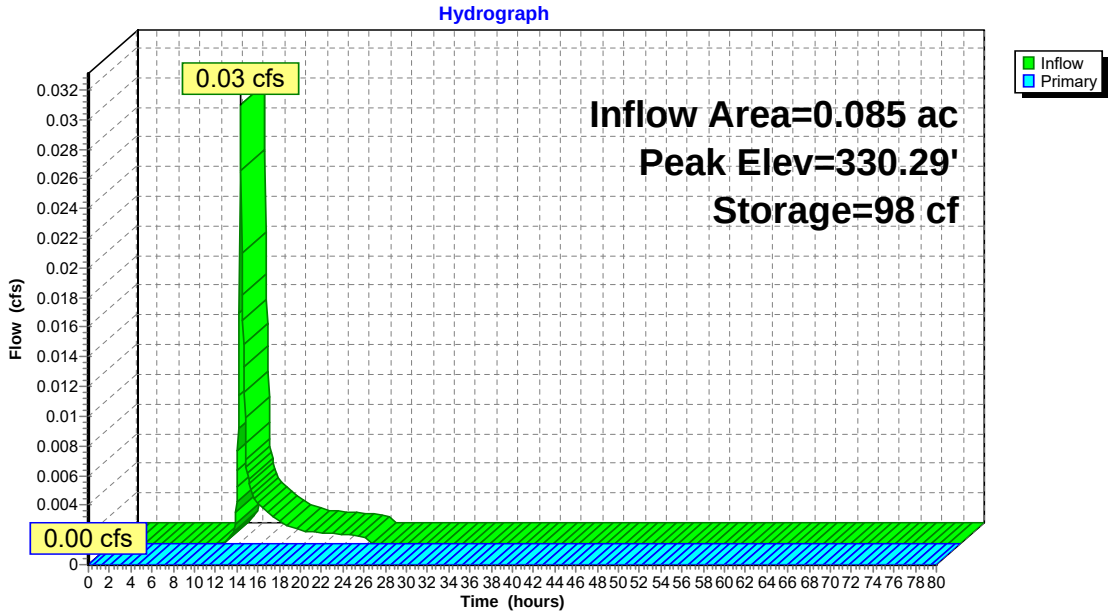
Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
329.70	0	0.0	0	0	0
330.00	16	23.0	2	2	42
331.00	158	95.1	75	76	722
331.20	200	104.5	36	112	873

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
328.20	0	0.0	0	0	0
328.50	16	23.0	2	2	42
329.50	158	95.1	75	76	722
329.70	200	104.5	36	112	873
331.20	200	104.5	300	412	1,030

Device	Routing	Invert	Outlet Devices
#1	Primary	331.00'	**7.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=328.20' (Free Discharge)
1=Sharp-Crested Rectangular Weir (Controls 0.00 cfs)

Pond S-3: Rip Rap Swale



Summary for Pond S-4: Rip Rap Swale

Inflow Area = 0.109 ac, 0.00% Impervious, Inflow Depth = 0.21" for 2-Year event
Inflow = 0.03 cfs @ 12.10 hrs, Volume= 0.002 af
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 100%, Lag= 0.0 min
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-80.00 hrs, dt= 0.05 hrs / 6
Peak Elev= 328.70' @ 24.40 hrs Surf.Area= 188 sf Storage= 84 cf

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

Volume	Invert	Avail.Storage	Storage Description
#1	328.20'	108 cf	**Custom Stage Data (Irregular)** Listed below (Recalc) Inside #2
#2	326.70'	113 cf	**Custom Stage Data (Irregular)** Listed below (Recalc) 390 cf Overall - 108 cf Embedded = 282 cf x 40.0% Voids
		221 cf	Total Available Storage

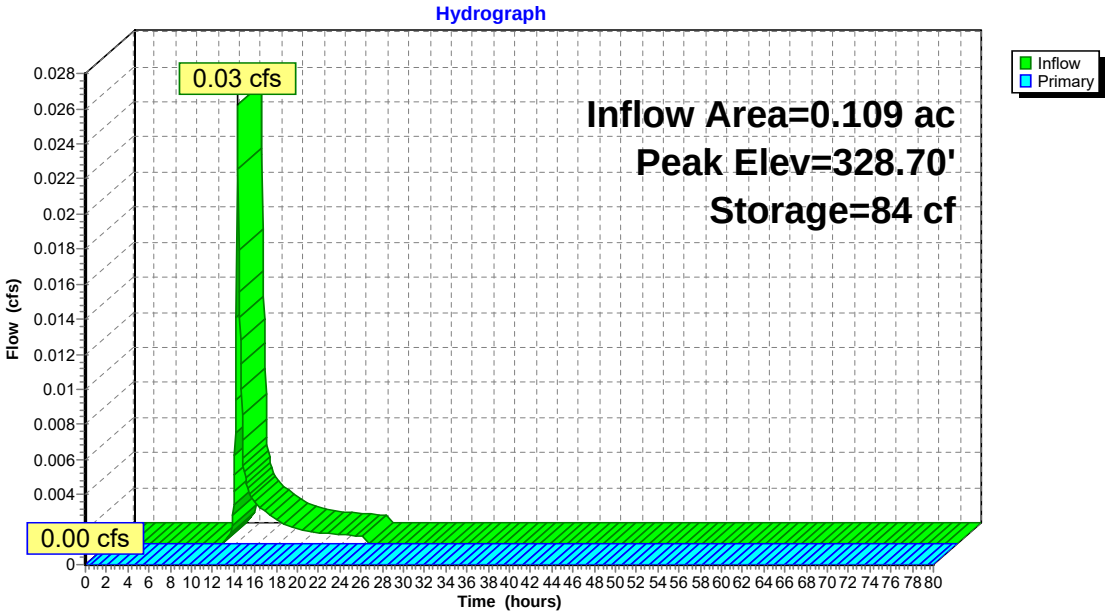
Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
328.20	0	0.0	0	0	0
329.00	71	56.9	19	19	259
329.25	112	76.4	23	42	466
329.70	188	102.0	67	108	832

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
326.70	0	0.0	0	0	0
327.50	71	56.9	19	19	259
327.75	112	76.4	23	42	466
328.20	188	102.0	67	108	832
329.70	188	102.0	282	390	985

Device	Routing	Invert	Outlet Devices
#1	Primary	329.25'	**7.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=326.70' (Free Discharge)
1=Sharp-Crested Rectangular Weir (Controls 0.00 cfs)

Pond S-4: Rip Rap Swale



Summary for Pond SSD-1: Subsurface Detention Basin-1

Inflow Area = 1.640 ac, 99.59% Impervious, Inflow Depth = 2.82" for 2-Year event
Inflow = 4.74 cfs @ 12.09 hrs, Volume= 0.385 af
Outflow = 0.92 cfs @ 12.52 hrs, Volume= 0.385 af, Atten= 81%, Lag= 26.1 min
Discarded = 0.08 cfs @ 12.52 hrs, Volume= 0.149 af
Primary = 0.83 cfs @ 12.52 hrs, Volume= 0.236 af

Routing by Stor-Ind method, Time Span= 0.00-80.00 hrs, dt= 0.05 hrs / 6
Peak Elev= 323.55' @ 12.52 hrs Surf.Area= 7,434 sf Storage= 7,838 cf

Plug-Flow detention time= 219.3 min calculated for 0.385 af (100% of inflow)
Center-of-Mass det. time= 219.7 min (977.1 - 757.4)

Volume	Invert	Avail.Storage	Storage Description
#1A	322.00'	6,586 cf	**63.25'W x 117.54'L x 3.50'H Field A** 26,020 cf Overall - 9,556 cf Embedded = 16,464 cf x 40.0% Voids
#2A	322.50'	9,556 cf	**ADS_StormTech SC-740 +Cap** x 208 Inside #1 Effective Size= 44.6"W x 30.0"H => 6.45 sf x 7.12'L = 45.9 cf Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap 208 Chambers in 13 Rows
		16,141 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	322.50'	**15.0" Round Culvert** L= 21.3' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 322.50' / 322.00' S= 0.0235 '/' Cc= 0.900 n= 0.013, Flow Area= 1.23 sf
#2	Device 1	325.25'	**4.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)
#3	Device 1	324.25'	**6.0" Vert. Orifice/Grate** C= 0.600
#4	Device 1	323.50'	**8.0" Vert. Orifice/Grate X 2.00** C= 0.600
#5	Device 1	322.55'	**6.0" Vert. Orifice/Grate** C= 0.600
#6	Discarded	322.00'	**0.270 in/hr Exfiltration over Surface area** Conductivity to Groundwater Elevation = 320.00'

Discarded OutFlow Max=0.08 cfs @ 12.52 hrs HW=323.55' (Free Discharge)
└**6=Exfiltration** (Controls 0.08 cfs)

Primary OutFlow Max=0.83 cfs @ 12.52 hrs HW=323.55' (Free Discharge)
└**1=Culvert** (Passes 0.83 cfs of 3.82 cfs potential flow)
  ├**2=Sharp-Crested Rectangular Weir** (Controls 0.00 cfs)
  ├**3=Orifice/Grate** (Controls 0.00 cfs)
  ├**4=Orifice/Grate** (Orifice Controls 0.02 cfs @ 0.73 fps)
  └**5=Orifice/Grate** (Orifice Controls 0.82 cfs @ 4.16 fps)

Pond SSD-1: Subsurface Detention Basin-1 - Chamber Wizard Field A

Chamber Model = ADS_StormTech SC-740 +Cap (ADS StormTech® SC-740 with cap length)
Effective Size= 44.6"W x 30.0"H => 6.45 sf x 7.12'L = 45.9 cf
Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap

51.0" Wide + 6.0" Spacing = 57.0" C-C Row Spacing

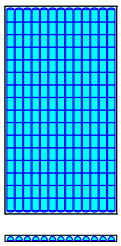
16 Chambers/Row x 7.12' Long +0.81' Cap Length x 2 = 115.54' Row Length +12.0" End Stone x 2 = 117.54' Base Length
13 Rows x 51.0" Wide + 6.0" Spacing x 12 + 12.0" Side Stone x 2 = 63.25' Base Width
6.0" Base + 30.0" Chamber Height + 6.0" Cover = 3.50' Field Height

208 Chambers x 45.9 cf = 9,555.5 cf Chamber Storage

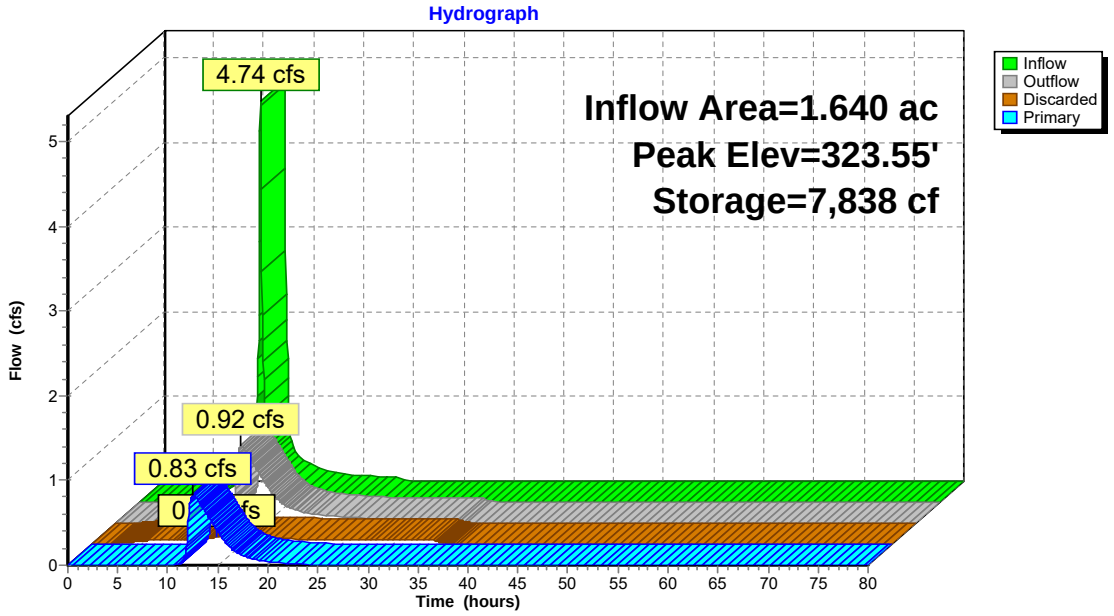
26,019.7 cf Field - 9,555.5 cf Chambers = 16,464.2 cf Stone x 40.0% Voids = 6,585.7 cf Stone Storage

Chamber Storage + Stone Storage = 16,141.2 cf = 0.371 af
Overall Storage Efficiency = 62.0%
Overall System Size = 117.54' x 63.25' x 3.50'

208 Chambers
963.7 cy Field
609.8 cy Stone



Pond SSD-1: Subsurface Detention Basin-1

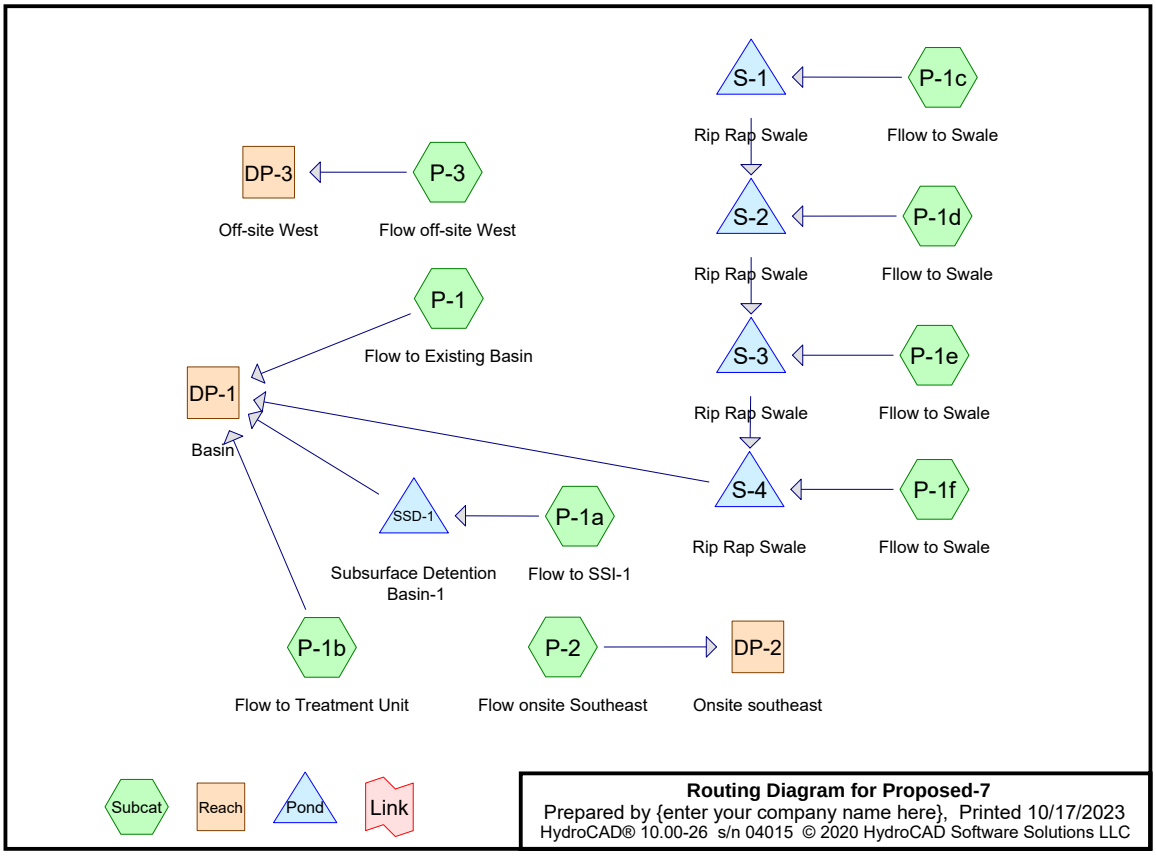


LEVEL
DESIGN GROUP

HydroCAD Analysis

Proposed Conditions - 10 Year Storm

249 SOUTH STREET UNIT 1 PLAINVILLE MA 02762
TEL508 695 2221 FAX508 695 2219 CONTACT@LEVELDG.COM LEVELDG.COM



Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
0.426	79	50-75% Grass cover, Fair, HSG C (P-1, P-1a, P-1b, P-1c, P-1d, P-1e, P-1f, P-2, P-3)
1.838	98	Paved parking (P-1a, P-1b, P-2)
0.032	66	Rip Rap Swale (P-1c, P-1d, P-1e, P-1f)
0.123	70	Woods, Good, HSG C (P-1, P-1c, P-1d, P-1e, P-1f, P-3)
2.419	**93**	**TOTAL AREA**

Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.000	HSG A	
0.000	HSG B	
0.549	HSG C	P-1, P-1a, P-1b, P-1c, P-1d, P-1e, P-1f, P-2, P-3
0.000	HSG D	
1.870	Other	P-1a, P-1b, P-1c, P-1d, P-1e, P-1f, P-2
2.419		**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
0.000	0.000	0.426	0.000	0.000	0.426	50-75% Grass cover, Fair	P-1, P-1a, P-1b, P-1c, P-1d, P-1e, P-1f, P-2, P-3
0.000	0.000	0.000	0.000	1.838	1.838	Paved parking	P-1a, P-1b, P-2
0.000	0.000	0.000	0.000	0.032	0.032	Rip Rap Swale	P-1c, P-1d, P-1e, P-1f
0.000	0.000	0.123	0.000	0.000	0.123	Woods, Good	P-1, P-1c, P-1d, P-1e, P-1f, P-3
0.000	**0.000**	**0.549**	**0.000**	**1.870**	**2.419**	**TOTAL AREA**	

Pipe Listing (all nodes)

Line#	Node Number	In-Invert (feet)	Out-Invert (feet)	Length (feet)	Slope (ft/ft)	n	Diam/Width (inches)	Height (inches)	Inside-Fill (inches)
1	SSD-1	322.50	322.00	21.3	0.0235	0.013	15.0	0.0	0.0

Time span=0.00-80.00 hrs, dt=0.05 hrs, 1601 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment P-1: Flow to Existing Basin Runoff Area=18,417 sf 0.00% Impervious Runoff Depth=2.75"
Flow Length=461' Tc=10.0 min CN=77 Runoff=1.18 cfs 0.097 af

Subcatchment P-1a: Flow to SSI-1 Runoff Area=71,428 sf 99.59% Impervious Runoff Depth=4.91"
Tc=6.0 min CN=98 Runoff=8.07 cfs 0.671 af

Subcatchment P-1b: Flow to Treatment Unit Runoff Area=3,571 sf 87.17% Impervious Runoff Depth=4.68"
Tc=6.0 min CN=96 Runoff=0.40 cfs 0.032 af

Subcatchment P-1c: Fllow to Swale Runoff Area=1,317 sf 0.00% Impervious Runoff Depth=2.31"
Tc=6.0 min CN=72 Runoff=0.08 cfs 0.006 af

Subcatchment P-1d: Fllow to Swale Runoff Area=1,184 sf 0.00% Impervious Runoff Depth=2.48"
Tc=6.0 min CN=74 Runoff=0.08 cfs 0.006 af

Subcatchment P-1e: Fllow to Swale Runoff Area=1,184 sf 0.00% Impervious Runoff Depth=2.57"
Tc=6.0 min CN=75 Runoff=0.08 cfs 0.006 af

Subcatchment P-1f: Fllow to Swale Runoff Area=1,071 sf 0.00% Impervious Runoff Depth=2.48"
Tc=6.0 min CN=74 Runoff=0.07 cfs 0.005 af

Subcatchment P-2: Flow onsite Southeast Runoff Area=6,213 sf 93.87% Impervious Runoff Depth=4.80"
Tc=6.0 min CN=97 Runoff=0.70 cfs 0.057 af

Subcatchment P-3: Flow off-site West Runoff Area=982 sf 0.00% Impervious Runoff Depth=2.93"
Tc=6.0 min CN=79 Runoff=0.08 cfs 0.006 af

Reach DP-1: Basin Inflow=4.15 cfs 0.636 af
Outflow=4.15 cfs 0.636 af

Reach DP-2: Onsite southeast Inflow=0.70 cfs 0.057 af
Outflow=0.70 cfs 0.057 af

Reach DP-3: Off-site West Inflow=0.08 cfs 0.006 af
Outflow=0.08 cfs 0.006 af

Pond S-1: Rip Rap Swale Peak Elev=334.05' Storage=215 cf Inflow=0.08 cfs 0.006 af
Outflow=0.00 cfs 0.001 af

Pond S-2: Rip Rap Swale Peak Elev=332.50' Storage=198 cf Inflow=0.08 cfs 0.007 af
Outflow=0.00 cfs 0.002 af

Pond S-3: Rip Rap Swale Peak Elev=331.00' Storage=195 cf Inflow=0.08 cfs 0.008 af
Outflow=0.01 cfs 0.003 af

Pond S-4: Rip Rap Swale Peak Elev=329.25' Storage=148 cf Inflow=0.07 cfs 0.008 af
Outflow=0.01 cfs 0.005 af

Pond SSD-1: Subsurface Detention Basin-1 Peak Elev=324.17' Storage=11,223 cf Inflow=8.07 cfs 0.671 af
Discarded=0.10 cfs 0.169 af Primary=3.05 cfs 0.502 af Outflow=3.15 cfs 0.671 af

Total Runoff Area = 2.419 ac Runoff Volume = 0.885 af Average Runoff Depth = 4.39"
24.00% Pervious = 0.581 ac 76.00% Impervious = 1.838 ac

Summary for Subcatchment P-1: Flow to Existing Basin

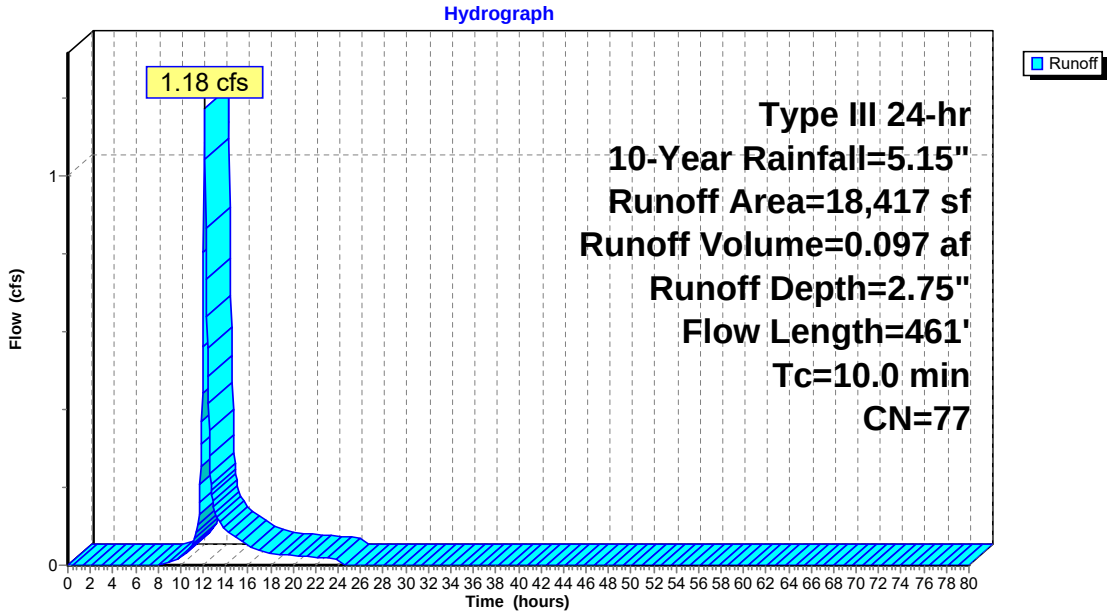
Runoff = 1.18 cfs @ 12.15 hrs, Volume= 0.097 af, Depth= 2.75"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-80.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=5.15"

Area (sf)	CN	Description
4,454	70	Woods, Good, HSG C
13,963	79	50-75% Grass cover, Fair, HSG C
18,417	77	Weighted Average
18,417		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.3	50	0.0800	0.11		**Sheet Flow, Sheet Flow** Woods: Light underbrush n= 0.400 P2= 3.05"
2.7	411	0.0240	2.49		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
10.0	461	Total			

Subcatchment P-1: Flow to Existing Basin



Summary for Subcatchment P-1a: Flow to SSI-1

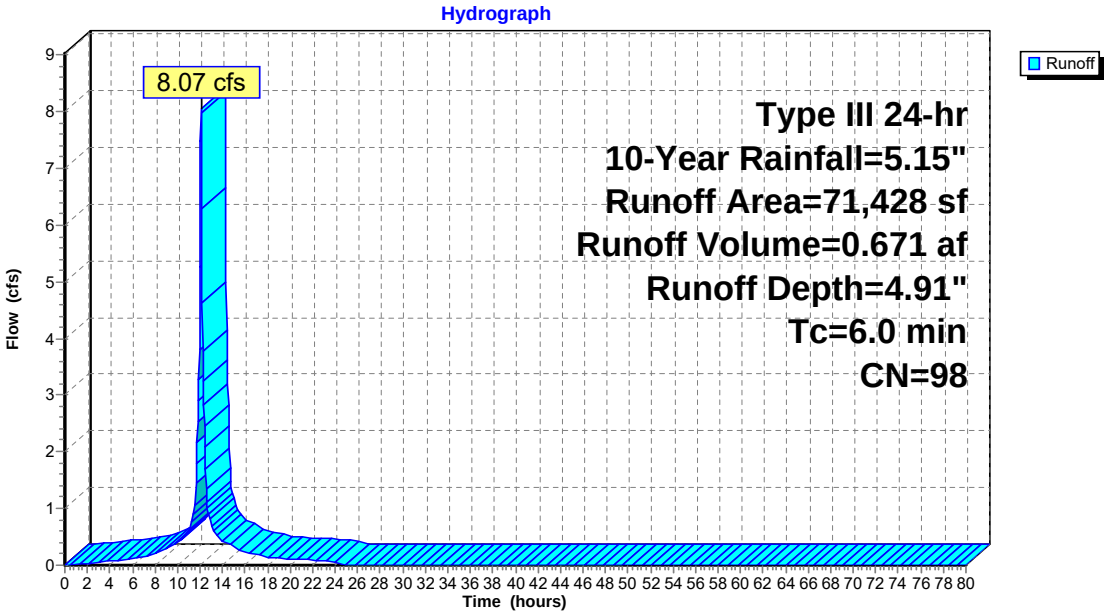
Runoff = 8.07 cfs @ 12.09 hrs, Volume= 0.671 af, Depth= 4.91"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-80.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=5.15"

	Area (sf)	CN	Description
*	71,133	98	Paved parking
	295	79	50-75% Grass cover, Fair, HSG C
	71,428	98	Weighted Average
	295		0.41% Pervious Area
	71,133		99.59% Impervious Area

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

Subcatchment P-1a: Flow to SSI-1



Summary for Subcatchment P-1b: Flow to Treatment Unit

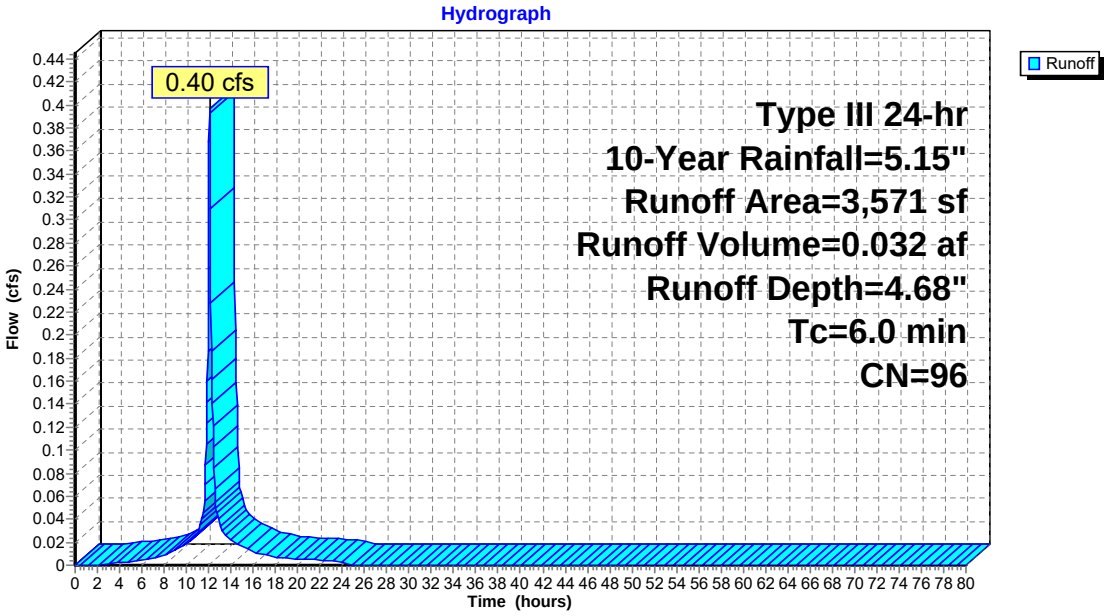
Runoff = 0.40 cfs @ 12.09 hrs, Volume= 0.032 af, Depth= 4.68"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-80.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=5.15"

	Area (sf)	CN	Description
*	3,113	98	Paved parking
	458	79	50-75% Grass cover, Fair, HSG C
	3,571	96	Weighted Average
	458		12.83% Pervious Area
	3,113		87.17% Impervious Area

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

Subcatchment P-1b: Flow to Treatment Unit



Summary for Subcatchment P-1c: Fllow to Swale

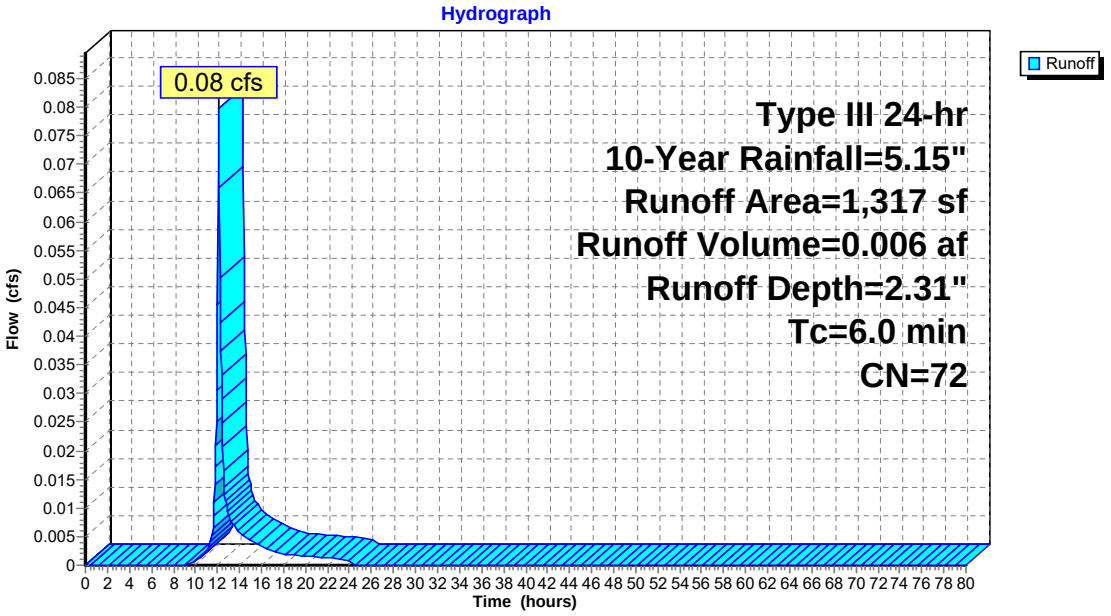
Runoff = 0.08 cfs @ 12.10 hrs, Volume= 0.006 af, Depth= 2.31"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-80.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=5.15"

	Area (sf)	CN	Description
*	339	66	Rip Rap Swale
	476	70	Woods, Good, HSG C
	502	79	50-75% Grass cover, Fair, HSG C
	1,317	72	Weighted Average
	1,317		100.00% Pervious Area

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

Subcatchment P-1c: Fllow to Swale



Summary for Subcatchment P-1d: Fllow to Swale

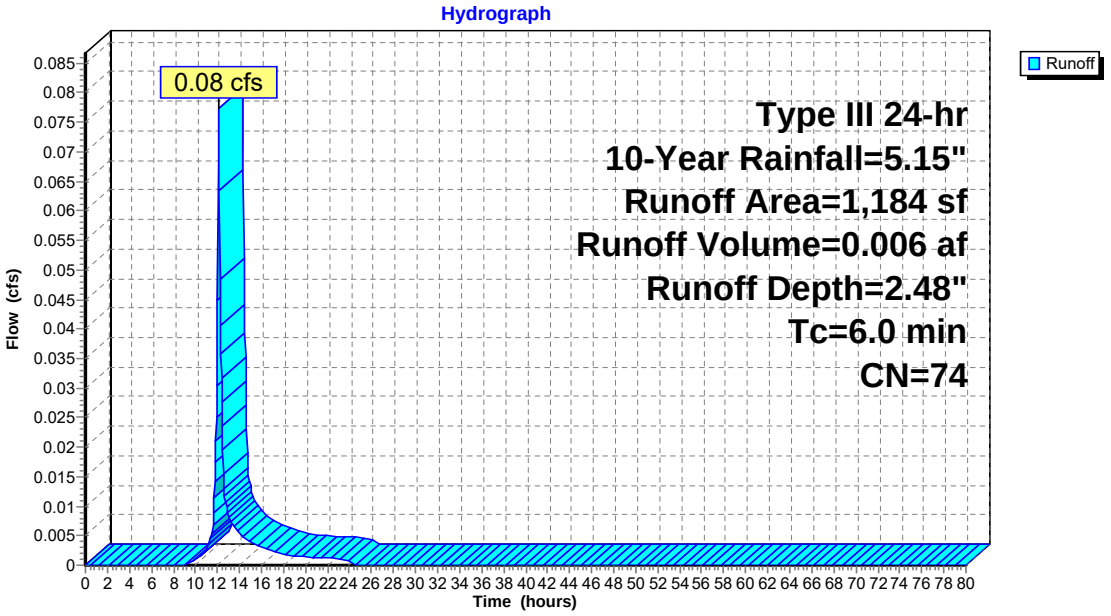
Runoff = 0.08 cfs @ 12.09 hrs, Volume= 0.006 af, Depth= 2.48"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-80.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=5.15"

	Area (sf)	CN	Description
*	350	66	Rip Rap Swale
	216	70	Woods, Good, HSG C
	618	79	50-75% Grass cover, Fair, HSG C
	1,184	74	Weighted Average
	1,184		100.00% Pervious Area

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

Subcatchment P-1d: Fllow to Swale



Summary for Subcatchment P-1e: Fllow to Swale

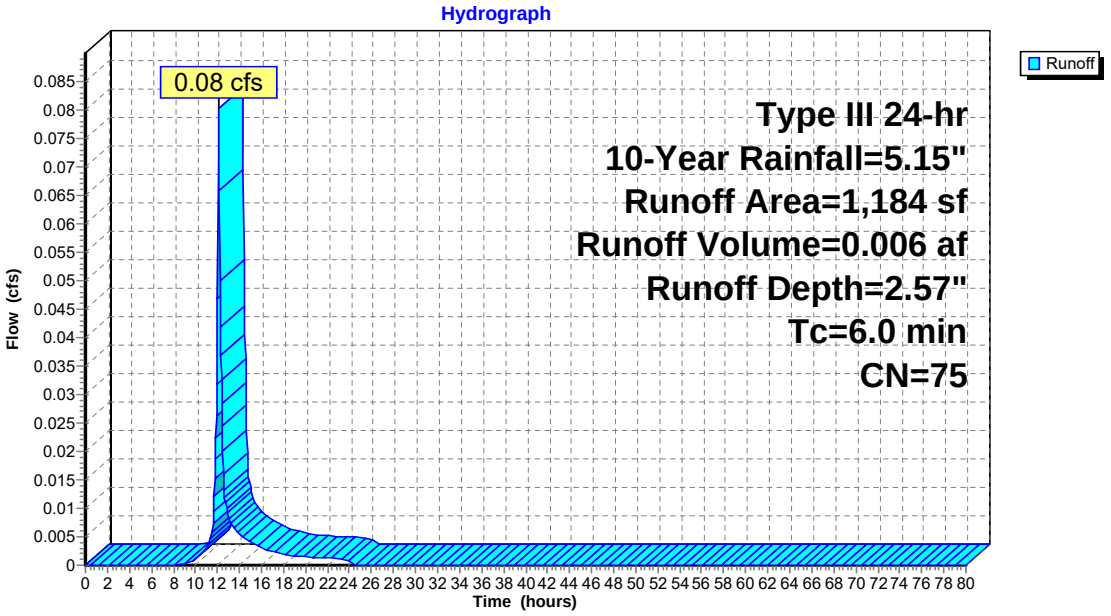
Runoff = 0.08 cfs @ 12.09 hrs, Volume= 0.006 af, Depth= 2.57"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-80.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=5.15"

	Area (sf)	CN	Description
*	350	66	Rip Rap Swale
	58	70	Woods, Good, HSG C
	776	79	50-75% Grass cover, Fair, HSG C
	1,184	75	Weighted Average
	1,184		100.00% Pervious Area

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

Subcatchment P-1e: Fllow to Swale



Summary for Subcatchment P-1f: Fllow to Swale

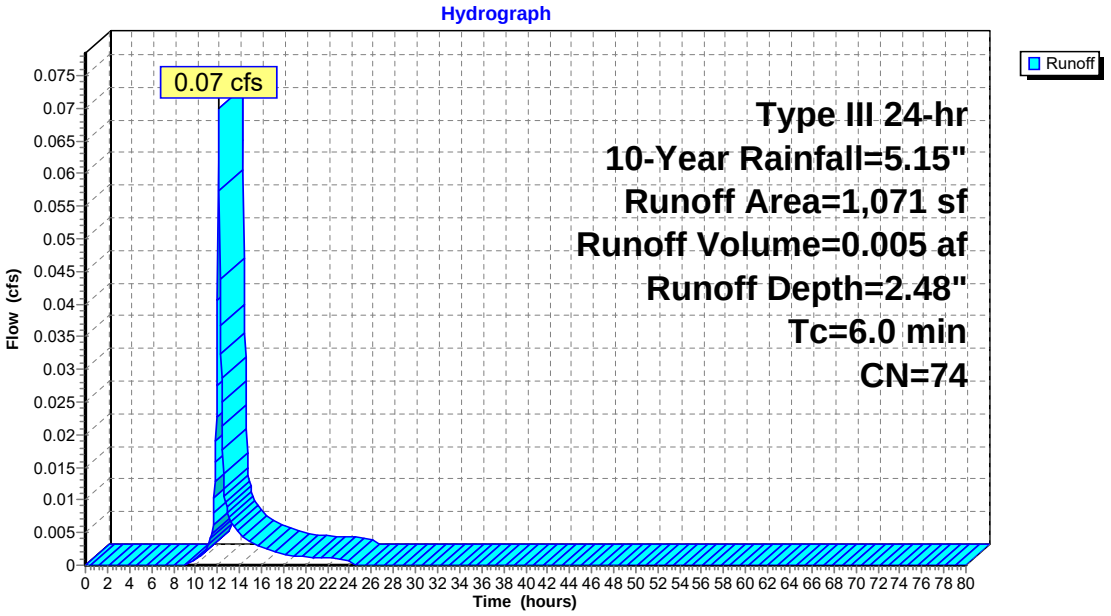
Runoff = 0.07 cfs @ 12.09 hrs, Volume= 0.005 af, Depth= 2.48"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-80.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=5.15"

	Area (sf)	CN	Description
*	357	66	Rip Rap Swale
	124	70	Woods, Good, HSG C
	590	79	50-75% Grass cover, Fair, HSG C
	1,071	74	Weighted Average
	1,071		100.00% Pervious Area

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

Subcatchment P-1f: Fllow to Swale



Summary for Subcatchment P-2: Flow onsite Southeast

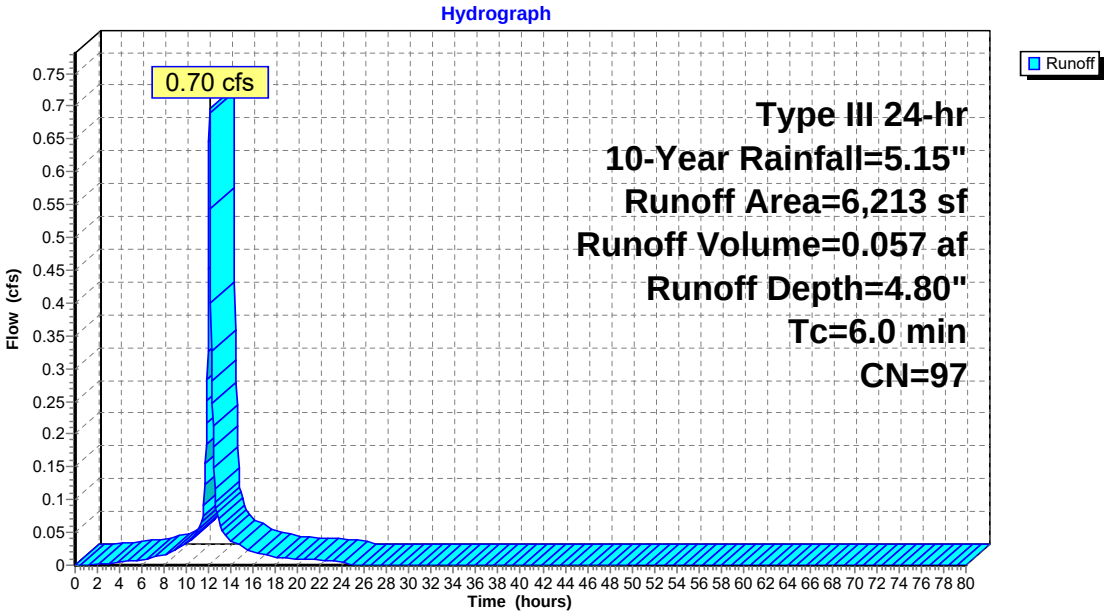
Runoff = 0.70 cfs @ 12.09 hrs, Volume= 0.057 af, Depth= 4.80"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-80.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=5.15"

	Area (sf)	CN	Description
*	5,832	98	Paved parking
	381	79	50-75% Grass cover, Fair, HSG C
	6,213	97	Weighted Average
	381		6.13% Pervious Area
	5,832		93.87% Impervious Area

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

Subcatchment P-2: Flow onsite Southeast



Summary for Subcatchment P-3: Flow off-site West

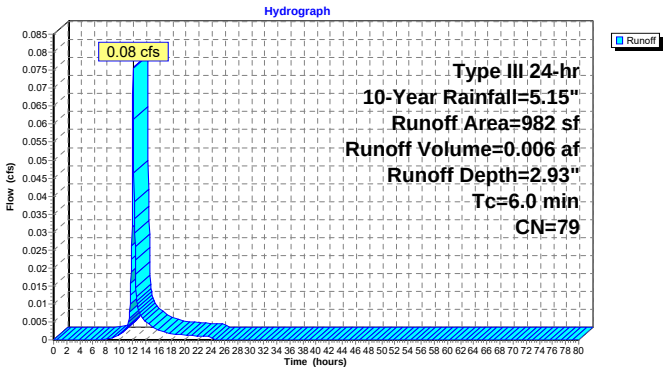
Runoff = 0.08 cfs @ 12.09 hrs, Volume= 0.006 af, Depth= 2.93"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-80.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=5.15"

Area (sf)	CN	Description
10	70	Woods, Good, HSG C
972	79	50-75% Grass cover, Fair, HSG C
982	79	Weighted Average
982		100.00% Pervious Area

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

Subcatchment P-3: Flow off-site West



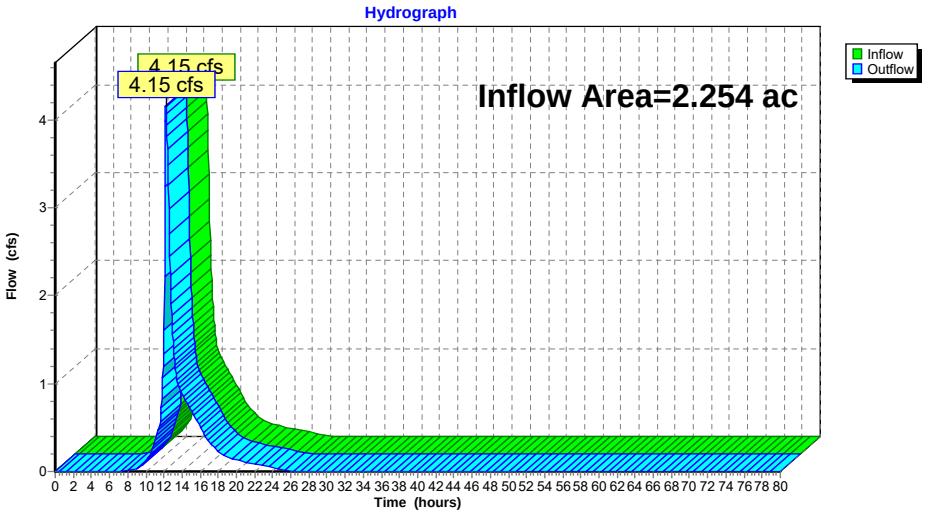
Summary for Reach DP-1: Basin

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

Inflow Area = 2.254 ac, 75.63% Impervious, Inflow Depth = 3.39" for 10-Year event
Inflow = 4.15 cfs @ 12.21 hrs, Volume= 0.636 af
Outflow = 4.15 cfs @ 12.21 hrs, Volume= 0.636 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-80.00 hrs, dt= 0.05 hrs

Reach DP-1: Basin



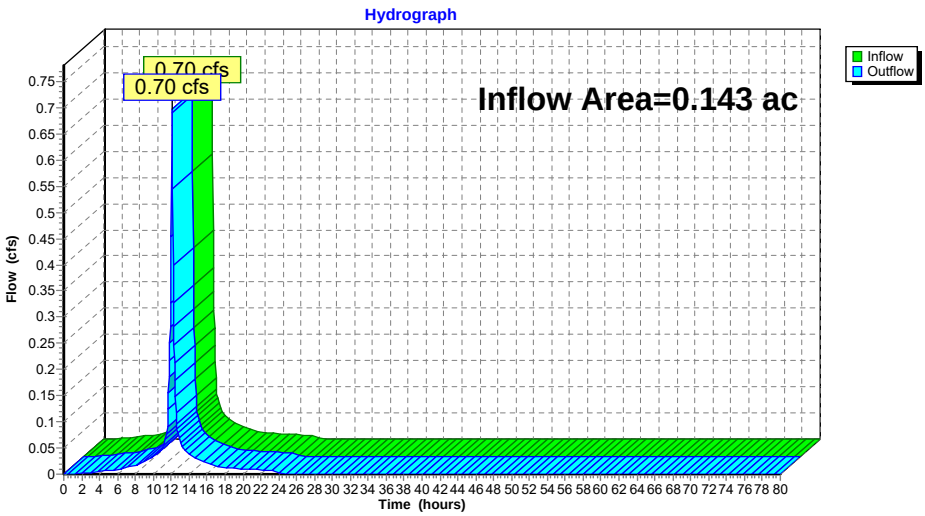
Summary for Reach DP-2: Onsite southeast

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

Inflow Area = 0.143 ac, 93.87% Impervious, Inflow Depth = 4.80" for 10-Year event
Inflow = 0.70 cfs @ 12.09 hrs, Volume= 0.057 af
Outflow = 0.70 cfs @ 12.09 hrs, Volume= 0.057 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-80.00 hrs, dt= 0.05 hrs

Reach DP-2: Onsite southeast



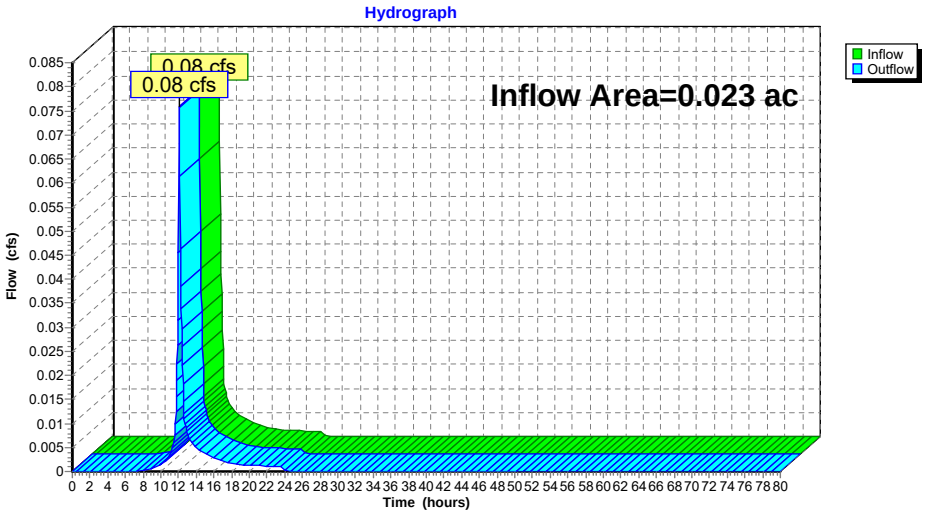
Summary for Reach DP-3: Off-site West

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

Inflow Area = 0.023 ac, 0.00% Impervious, Inflow Depth = 2.93" for 10-Year event
Inflow = 0.08 cfs @ 12.09 hrs, Volume= 0.006 af
Outflow = 0.08 cfs @ 12.09 hrs, Volume= 0.006 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-80.00 hrs, dt= 0.05 hrs

Reach DP-3: Off-site West



Summary for Pond S-1: Rip Rap Swale

Inflow Area = 0.030 ac, 0.00% Impervious, Inflow Depth = 2.31" for 10-Year event
Inflow = 0.08 cfs @ 12.10 hrs, Volume= 0.006 af
Outflow = 0.00 cfs @ 17.20 hrs, Volume= 0.001 af, Atten= 97%, Lag= 306.3 min
Primary = 0.00 cfs @ 17.20 hrs, Volume= 0.001 af

Routing by Stor-Ind method, Time Span= 0.00-80.00 hrs, dt= 0.05 hrs / 6
Peak Elev= 334.05' @ 17.20 hrs Surf.Area= 200 sf Storage= 215 cf

Plug-Flow detention time= 517.4 min calculated for 0.001 af (15% of inflow)
Center-of-Mass det. time= 369.3 min (1,210.3 - 841.0)

Volume	Invert	Avail.Storage	Storage Description
#1	331.15'	120 cf	**Custom Stage Data (Irregular)** Listed below (Recalc) 414 cf Overall - 114 cf Embedded = 300 cf x 40.0% Voids
#2	332.65'	114 cf	**Custom Stage Data (Irregular)** Listed below (Recalc) Inside #1
		234 cf	Total Available Storage

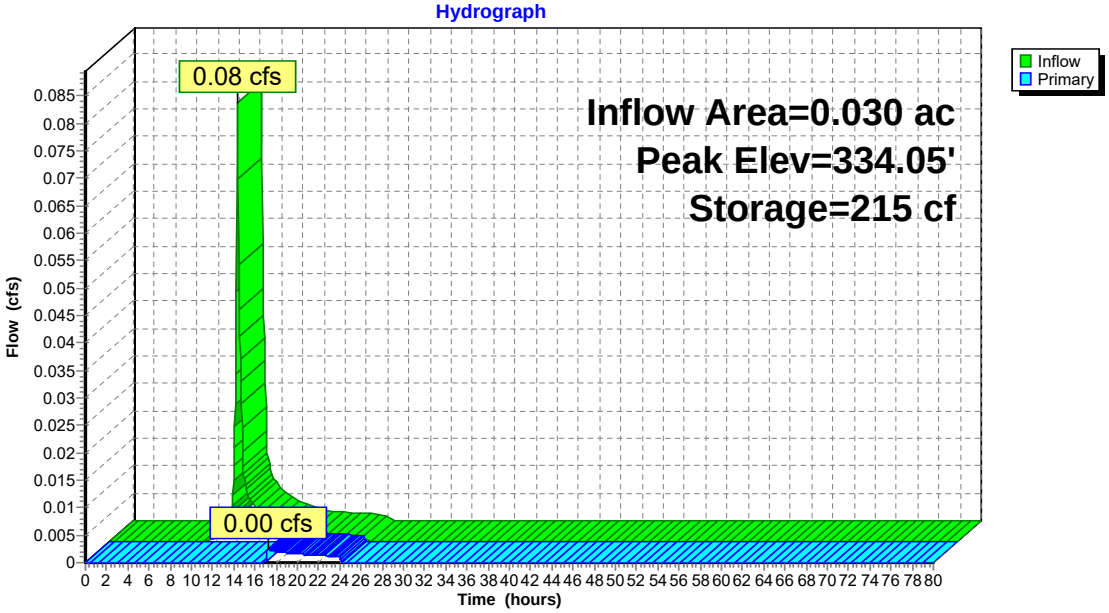
Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
331.15	0	0.0	0	0	0
331.50	21	27.2	2	2	59
332.50	171	99.3	84	86	788
332.65	200	104.4	28	114	872
334.15	200	104.4	300	414	1,028

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
332.65	0	0.0	0	0	0
333.00	21	27.2	2	2	59
334.00	171	99.3	84	86	788
334.15	200	104.4	28	114	872

Device	Routing	Invert	Outlet Devices
#1	Primary	334.05'	**7.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)

Primary OutFlow Max=0.00 cfs @ 17.20 hrs HW=334.05' (Free Discharge)
└**1=Sharp-Crested Rectangular Weir** (Weir Controls 0.00 cfs @ 0.11 fps)

Pond S-1: Rip Rap Swale



Summary for Pond S-2: Rip Rap Swale

Inflow Area = 0.057 ac, 0.00% Impervious, Inflow Depth = 1.36" for 10-Year event
Inflow = 0.08 cfs @ 12.09 hrs, Volume= 0.007 af
Outflow = 0.00 cfs @ 17.23 hrs, Volume= 0.002 af, Atten= 94%, Lag= 308.2 min
Primary = 0.00 cfs @ 17.23 hrs, Volume= 0.002 af

Routing by Stor-Ind method, Time Span= 0.00-80.00 hrs, dt= 0.05 hrs / 6
Peak Elev= 332.50' @ 17.23 hrs Surf.Area= 200 sf Storage= 198 cf

Plug-Flow detention time= 475.9 min calculated for 0.002 af (30% of inflow)
Center-of-Mass det. time= 296.3 min (1,183.8 - 887.5)

Volume	Invert	Avail.Storage	Storage Description
#1	329.65'	120 cf	**Custom Stage Data (Irregular)** Listed below (Recalc) 407 cf Overall - 107 cf Embedded = 300 cf x 40.0% Voids
#2	331.15'	107 cf	**Custom Stage Data (Irregular)** Listed below (Recalc) Inside #1
		227 cf	Total Available Storage

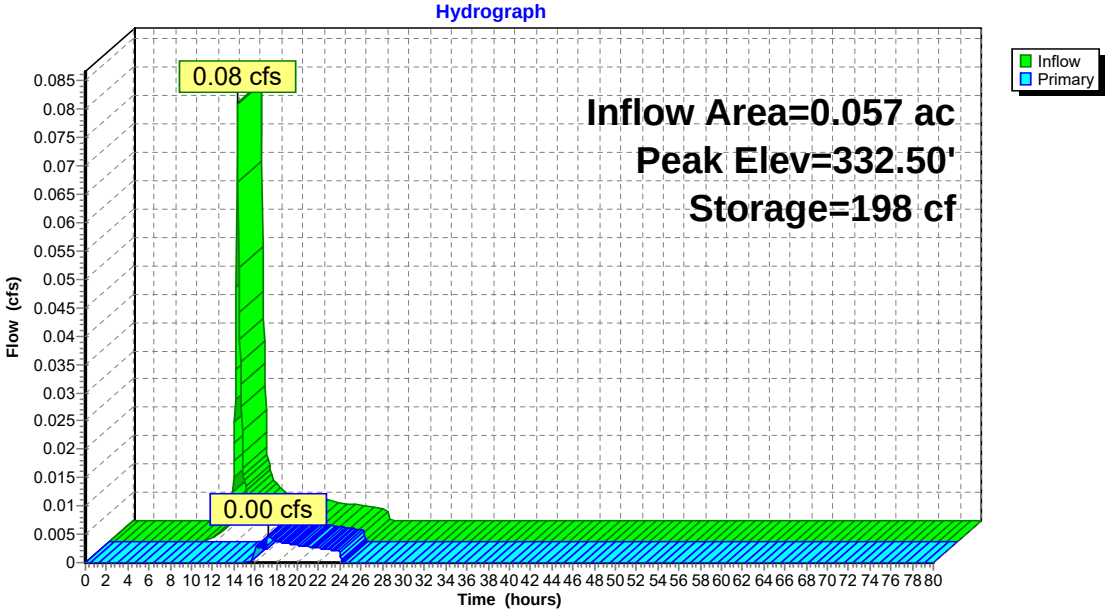
Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
329.65	0	0.0	0	0	0
330.50	74	61.1	21	21	298
331.15	200	104.5	86	107	873
332.65	200	104.5	300	407	1,029

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
331.15	0	0.0	0	0	0
332.00	74	61.1	21	21	298
332.65	200	104.5	86	107	873

Device	Routing	Invert	Outlet Devices
#1	Primary	332.50'	**7.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)

Primary OutFlow Max=0.00 cfs @ 17.23 hrs HW=332.50' (Free Discharge)
└**1=Sharp-Crested Rectangular Weir** (Weir Controls 0.00 cfs @ 0.11 fps)

Pond S-2: Rip Rap Swale



Summary for Pond S-3: Rip Rap Swale

Inflow Area = 0.085 ac, 0.00% Impervious, Inflow Depth = 1.11" for 10-Year event
Inflow = 0.08 cfs @ 12.09 hrs, Volume= 0.008 af
Outflow = 0.01 cfs @ 17.26 hrs, Volume= 0.003 af, Atten= 91%, Lag= 309.9 min
Primary = 0.01 cfs @ 17.26 hrs, Volume= 0.003 af

Routing by Stor-Ind method, Time Span= 0.00-80.00 hrs, dt= 0.05 hrs / 6
Peak Elev= 331.00' @ 17.26 hrs Surf.Area= 200 sf Storage= 195 cf

Plug-Flow detention time= 438.1 min calculated for 0.003 af (43% of inflow)
Center-of-Mass det. time= 235.3 min (1,157.5 - 922.2)

Volume	Invert	Avail.Storage	Storage Description
#1	329.70'	112 cf	**Custom Stage Data (Irregular)** Listed below (Recalc) Inside #2
#2	328.20'	120 cf	**Custom Stage Data (Irregular)** Listed below (Recalc) 412 cf Overall - 112 cf Embedded = 300 cf x 40.0% Voids
		232 cf	Total Available Storage

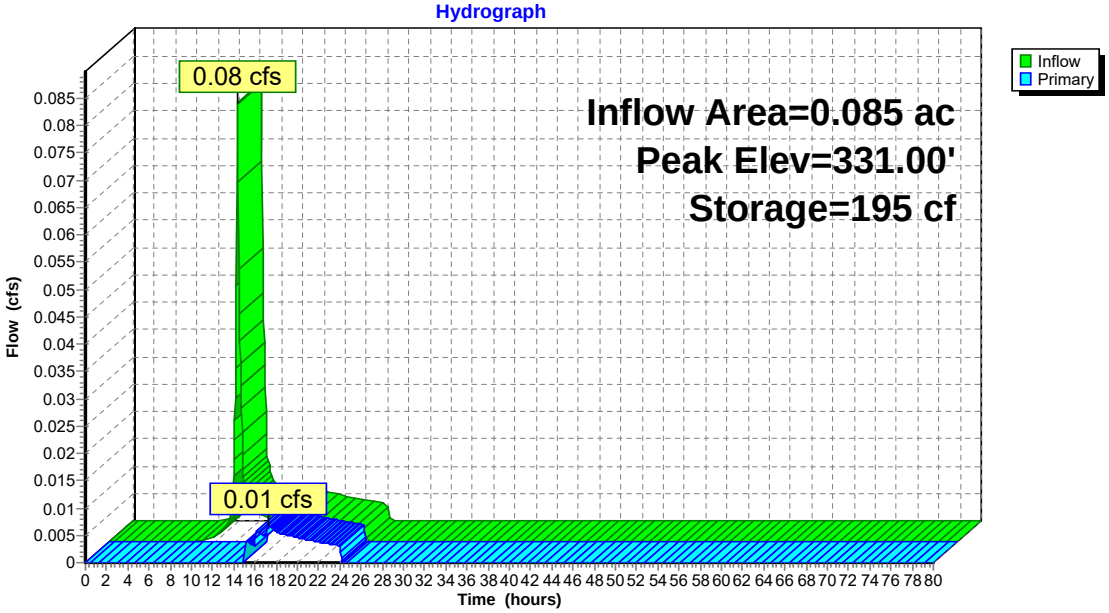
Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
329.70	0	0.0	0	0	0
330.00	16	23.0	2	2	42
331.00	158	95.1	75	76	722
331.20	200	104.5	36	112	873

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
328.20	0	0.0	0	0	0
328.50	16	23.0	2	2	42
329.50	158	95.1	75	76	722
329.70	200	104.5	36	112	873
331.20	200	104.5	300	412	1,030

Device	Routing	Invert	Outlet Devices
#1	Primary	331.00'	**7.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)

Primary OutFlow Max=0.00 cfs @ 17.26 hrs HW=331.00' (Free Discharge)
└**1=Sharp-Crested Rectangular Weir** (Weir Controls 0.00 cfs @ 0.15 fps)

Pond S-3: Rip Rap Swale



Summary for Pond S-4: Rip Rap Swale

Inflow Area = 0.109 ac, 0.00% Impervious, Inflow Depth = 0.93" for 10-Year event
Inflow = 0.07 cfs @ 12.09 hrs, Volume= 0.008 af
Outflow = 0.01 cfs @ 17.27 hrs, Volume= 0.005 af, Atten= 87%, Lag= 310.3 min
Primary = 0.01 cfs @ 17.27 hrs, Volume= 0.005 af

Routing by Stor-Ind method, Time Span= 0.00-80.00 hrs, dt= 0.05 hrs / 6
Peak Elev= 329.25' @ 17.27 hrs Surf.Area= 188 sf Storage= 148 cf

Plug-Flow detention time= 320.0 min calculated for 0.005 af (60% of inflow)
Center-of-Mass det. time= 155.6 min (1,118.7 - 963.1)

Volume	Invert	Avail.Storage	Storage Description
#1	328.20'	108 cf	**Custom Stage Data (Irregular)** Listed below (Recalc) Inside #2
#2	326.70'	113 cf	**Custom Stage Data (Irregular)** Listed below (Recalc) 390 cf Overall - 108 cf Embedded = 282 cf x 40.0% Voids
		221 cf	Total Available Storage

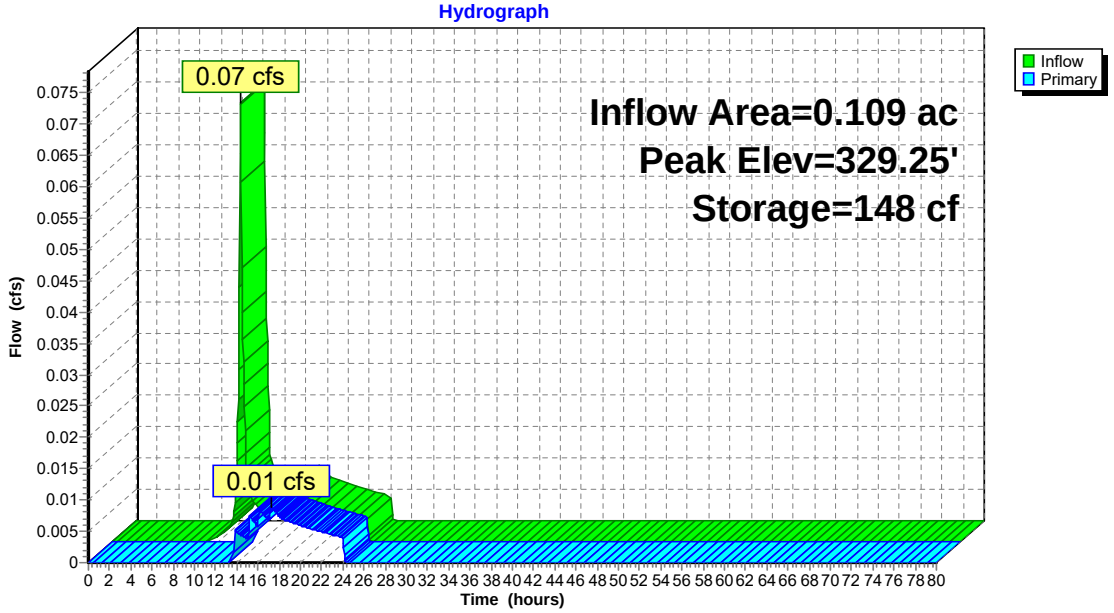
Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
328.20	0	0.0	0	0	0
329.00	71	56.9	19	19	259
329.25	112	76.4	23	42	466
329.70	188	102.0	67	108	832

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
326.70	0	0.0	0	0	0
327.50	71	56.9	19	19	259
327.75	112	76.4	23	42	466
328.20	188	102.0	67	108	832
329.70	188	102.0	282	390	985

Device	Routing	Invert	Outlet Devices
#1	Primary	329.25'	**7.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)

Primary OutFlow Max=0.00 cfs @ 17.27 hrs HW=329.25' (Free Discharge)
1=Sharp-Crested Rectangular Weir (Weir Controls 0.00 cfs @ 0.15 fps)

Pond S-4: Rip Rap Swale



Summary for Pond SSD-1: Subsurface Detention Basin-1

Inflow Area = 1.640 ac, 99.59% Impervious, Inflow Depth = 4.91" for 10-Year event
Inflow = 8.07 cfs @ 12.09 hrs, Volume= 0.671 af
Outflow = 3.15 cfs @ 12.31 hrs, Volume= 0.671 af, Atten= 61%, Lag= 13.6 min
Discarded = 0.10 cfs @ 12.31 hrs, Volume= 0.169 af
Primary = 3.05 cfs @ 12.31 hrs, Volume= 0.502 af

Routing by Stor-Ind method, Time Span= 0.00-80.00 hrs, dt= 0.05 hrs / 6
Peak Elev= 324.17' @ 12.31 hrs Surf.Area= 7,434 sf Storage= 11,223 cf

Plug-Flow detention time= 171.6 min calculated for 0.671 af (100% of inflow)
Center-of-Mass det. time= 171.3 min (918.8 - 747.5)

Volume	Invert	Avail.Storage	Storage Description
#1A	322.00'	6,586 cf	**63.25'W x 117.54'L x 3.50'H Field A** 26,020 cf Overall - 9,556 cf Embedded = 16,464 cf x 40.0% Voids
#2A	322.50'	9,556 cf	**ADS_StormTech SC-740 +Cap** x 208 Inside #1 Effective Size= 44.6"W x 30.0"H => 6.45 sf x 7.12'L = 45.9 cf Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap 208 Chambers in 13 Rows
		16,141 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	322.50'	**15.0" Round Culvert** L= 21.3' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 322.50' / 322.00' S= 0.0235 '/' Cc= 0.900 n= 0.013, Flow Area= 1.23 sf
#2	Device 1	325.25'	**4.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)
#3	Device 1	324.25'	**6.0" Vert. Orifice/Grate** C= 0.600
#4	Device 1	323.50'	**8.0" Vert. Orifice/Grate X 2.00** C= 0.600
#5	Device 1	322.55'	**6.0" Vert. Orifice/Grate** C= 0.600
#6	Discarded	322.00'	**0.270 in/hr Exfiltration over Surface area** Conductivity to Groundwater Elevation = 320.00'

Discarded OutFlow Max=0.10 cfs @ 12.31 hrs HW=324.17' (Free Discharge)
└**6=Exfiltration** (Controls 0.10 cfs)

Primary OutFlow Max=3.05 cfs @ 12.31 hrs HW=324.17' (Free Discharge)
└**1=Culvert** (Passes 3.05 cfs of 6.03 cfs potential flow)
  ├**2=Sharp-Crested Rectangular Weir** (Controls 0.00 cfs)
  ├**3=Orifice/Grate** (Controls 0.00 cfs)
  ├**4=Orifice/Grate** (Orifice Controls 1.94 cfs @ 2.78 fps)
  └**5=Orifice/Grate** (Orifice Controls 1.11 cfs @ 5.63 fps)

Pond SSD-1: Subsurface Detention Basin-1 - Chamber Wizard Field A

Chamber Model = ADS_StormTech SC-740 +Cap (ADS StormTech® SC-740 with cap length)
Effective Size= 44.6"W x 30.0"H => 6.45 sf x 7.12'L = 45.9 cf
Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap

51.0" Wide + 6.0" Spacing = 57.0" C-C Row Spacing

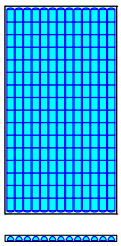
16 Chambers/Row x 7.12' Long +0.81' Cap Length x 2 = 115.54' Row Length +12.0" End Stone x 2 = 117.54' Base Length
13 Rows x 51.0" Wide + 6.0" Spacing x 12 + 12.0" Side Stone x 2 = 63.25' Base Width
6.0" Base + 30.0" Chamber Height + 6.0" Cover = 3.50' Field Height

208 Chambers x 45.9 cf = 9,555.5 cf Chamber Storage

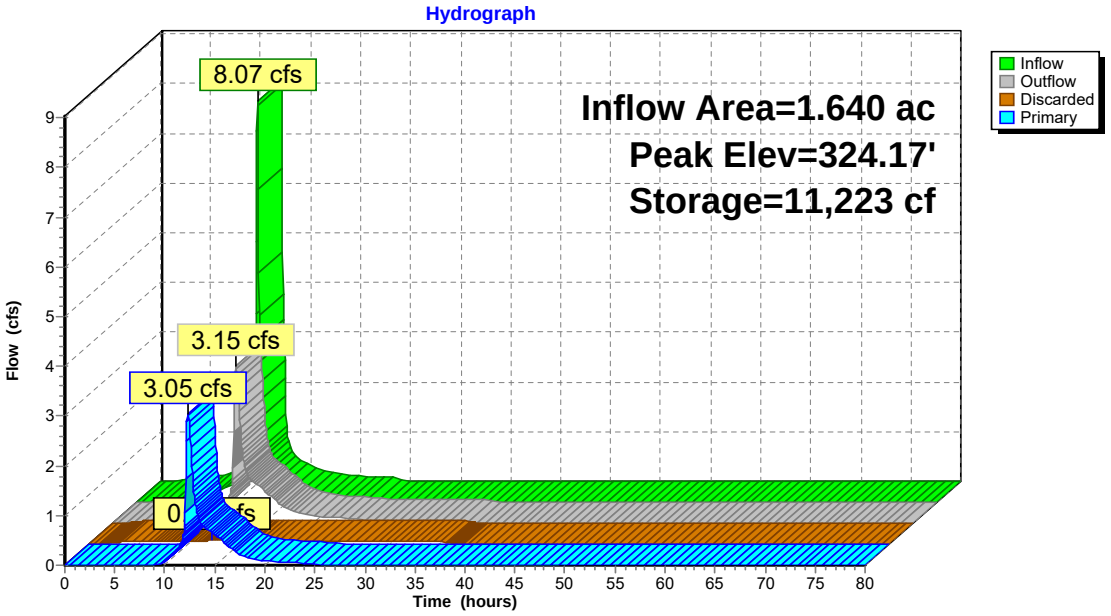
26,019.7 cf Field - 9,555.5 cf Chambers = 16,464.2 cf Stone x 40.0% Voids = 6,585.7 cf Stone Storage

Chamber Storage + Stone Storage = 16,141.2 cf = 0.371 af
Overall Storage Efficiency = 62.0%
Overall System Size = 117.54' x 63.25' x 3.50'

208 Chambers
963.7 cy Field
609.8 cy Stone



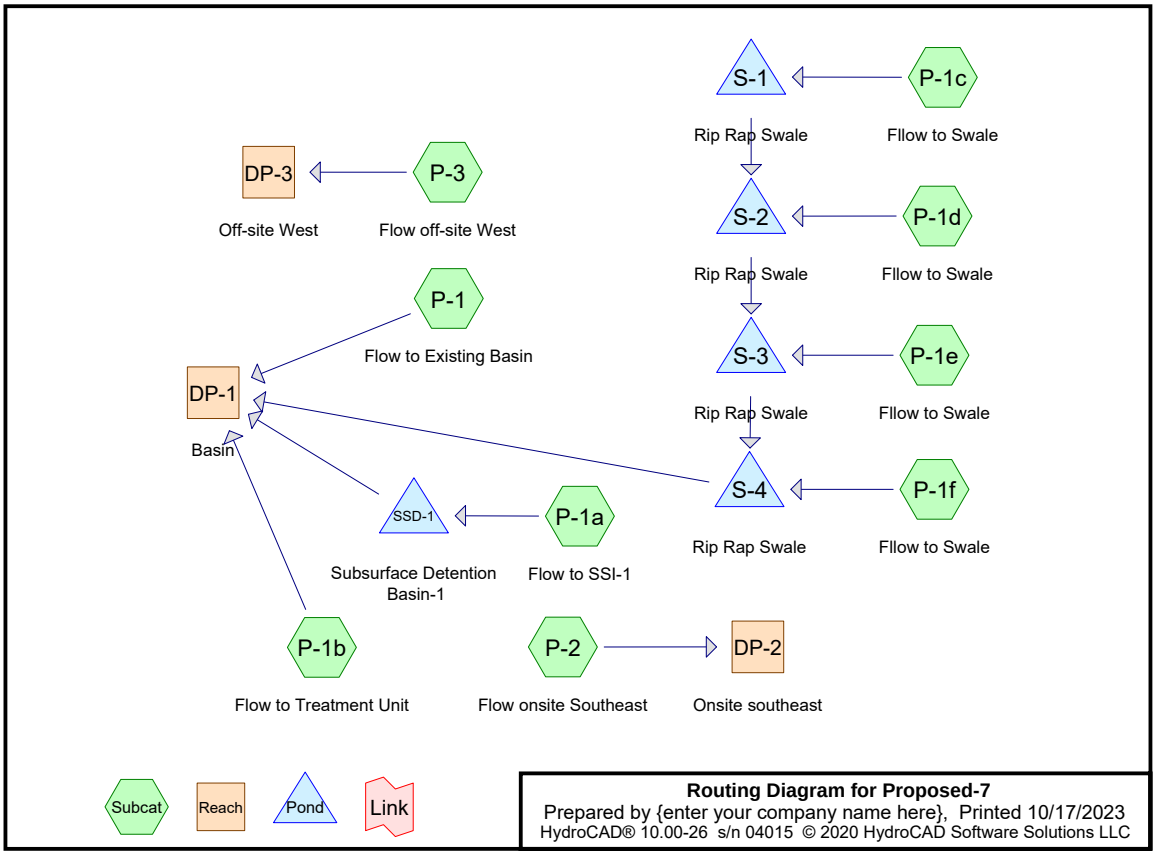
Pond SSD-1: Subsurface Detention Basin-1



HydroCAD Analysis

Proposed Conditions - 25 Year Storm

249 SOUTH STREET UNIT 1 PLAINVILLE MA 02762
TEL508 695 2221 FAX508 695 2219 CONTACT@LEVELDG.COM LEVELDG.COM



Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
0.426	79	50-75% Grass cover, Fair, HSG C (P-1, P-1a, P-1b, P-1c, P-1d, P-1e, P-1f, P-2, P-3)
1.838	98	Paved parking (P-1a, P-1b, P-2)
0.032	66	Rip Rap Swale (P-1c, P-1d, P-1e, P-1f)
0.123	70	Woods, Good, HSG C (P-1, P-1c, P-1d, P-1e, P-1f, P-3)
2.419	**93**	**TOTAL AREA**

Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.000	HSG A	
0.000	HSG B	
0.549	HSG C	P-1, P-1a, P-1b, P-1c, P-1d, P-1e, P-1f, P-2, P-3
0.000	HSG D	
1.870	Other	P-1a, P-1b, P-1c, P-1d, P-1e, P-1f, P-2
2.419		**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
0.000	0.000	0.426	0.000	0.000	0.426	50-75% Grass cover, Fair	P-1, P-1a, P-1b, P-1c, P-1d, P-1e, P-1f, P-2, P-3
0.000	0.000	0.000	0.000	1.838	1.838	Paved parking	P-1a, P-1b, P-2
0.000	0.000	0.000	0.000	0.032	0.032	Rip Rap Swale	P-1c, P-1d, P-1e, P-1f
0.000	0.000	0.123	0.000	0.000	0.123	Woods, Good	P-1, P-1c, P-1d, P-1e, P-1f, P-3
0.000	**0.000**	**0.549**	**0.000**	**1.870**	**2.419**	**TOTAL AREA**	

Pipe Listing (all nodes)

Line#	Node Number	In-Invert (feet)	Out-Invert (feet)	Length (feet)	Slope (ft/ft)	n	Diam/Width (inches)	Height (inches)	Inside-Fill (inches)
1	SSD-1	322.50	322.00	21.3	0.0235	0.013	15.0	0.0	0.0

Time span=0.00-80.00 hrs, dt=0.05 hrs, 1601 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment P-1: Flow to Existing Basin Runoff Area=18,417 sf 0.00% Impervious Runoff Depth=3.79"
Flow Length=461' Tc=10.0 min CN=77 Runoff=1.62 cfs 0.133 af

Subcatchment P-1a: Flow to SSI-1 Runoff Area=71,428 sf 99.59% Impervious Runoff Depth=6.11"
Tc=6.0 min CN=98 Runoff=9.97 cfs 0.835 af

Subcatchment P-1b: Flow to Treatment Unit Runoff Area=3,571 sf 87.17% Impervious Runoff Depth=5.88"
Tc=6.0 min CN=96 Runoff=0.49 cfs 0.040 af

Subcatchment P-1c: FIlow to Swale Runoff Area=1,317 sf 0.00% Impervious Runoff Depth=3.28"
Tc=6.0 min CN=72 Runoff=0.11 cfs 0.008 af

Subcatchment P-1d: FIlow to Swale Runoff Area=1,184 sf 0.00% Impervious Runoff Depth=3.48"
Tc=6.0 min CN=74 Runoff=0.11 cfs 0.008 af

Subcatchment P-1e: FIlow to Swale Runoff Area=1,184 sf 0.00% Impervious Runoff Depth=3.58"
Tc=6.0 min CN=75 Runoff=0.11 cfs 0.008 af

Subcatchment P-1f: FIlow to Swale Runoff Area=1,071 sf 0.00% Impervious Runoff Depth=3.48"
Tc=6.0 min CN=74 Runoff=0.10 cfs 0.007 af

Subcatchment P-2: Flow onsite Southeast Runoff Area=6,213 sf 93.87% Impervious Runoff Depth=5.99"
Tc=6.0 min CN=97 Runoff=0.86 cfs 0.071 af

Subcatchment P-3: Flow off-site West Runoff Area=982 sf 0.00% Impervious Runoff Depth=3.99"
Tc=6.0 min CN=79 Runoff=0.10 cfs 0.008 af

Reach DP-1: Basin Inflow=5.78 cfs 0.846 af
Outflow=5.78 cfs 0.846 af

Reach DP-2: Onsite southeast Inflow=0.86 cfs 0.071 af
Outflow=0.86 cfs 0.071 af

Reach DP-3: Off-site West Inflow=0.10 cfs 0.008 af
Outflow=0.10 cfs 0.008 af

Pond S-1: Rip Rap Swale Peak Elev=334.06' Storage=216 cf Inflow=0.11 cfs 0.008 af
Outflow=0.01 cfs 0.003 af

Pond S-2: Rip Rap Swale Peak Elev=332.51' Storage=199 cf Inflow=0.11 cfs 0.011 af
Outflow=0.02 cfs 0.007 af

Pond S-3: Rip Rap Swale Peak Elev=331.01' Storage=196 cf Inflow=0.11 cfs 0.015 af
Outflow=0.03 cfs 0.010 af

Pond S-4: Rip Rap Swale Peak Elev=329.26' Storage=149 cf Inflow=0.10 cfs 0.017 af
Outflow=0.04 cfs 0.014 af

Pond SSD-1: Subsurface Detention Basin-1 Peak Elev=324.52' Storage=12,891 cf Inflow=9.97 cfs 0.835 af
Discarded=0.10 cfs 0.177 af Primary=4.21 cfs 0.658 af Outflow=4.32 cfs 0.835 af

Total Runoff Area = 2.419 ac Runoff Volume = 1.119 af Average Runoff Depth = 5.55"
24.00% Pervious = 0.581 ac 76.00% Impervious = 1.838 ac

Summary for Subcatchment P-1: Flow to Existing Basin

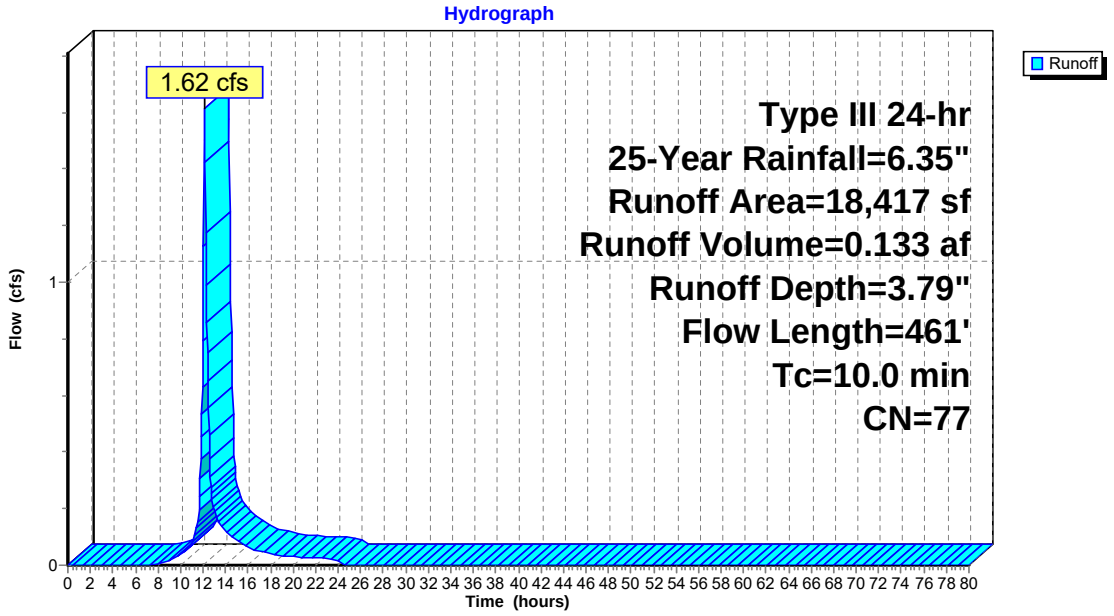
Runoff = 1.62 cfs @ 12.14 hrs, Volume= 0.133 af, Depth= 3.79"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-80.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=6.35"

Area (sf)	CN	Description
4,454	70	Woods, Good, HSG C
13,963	79	50-75% Grass cover, Fair, HSG C
18,417	77	Weighted Average
18,417		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.3	50	0.0800	0.11		**Sheet Flow, Sheet Flow** Woods: Light underbrush n= 0.400 P2= 3.05"
2.7	411	0.0240	2.49		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
10.0	461	Total			

Subcatchment P-1: Flow to Existing Basin



Summary for Subcatchment P-1a: Flow to SSI-1

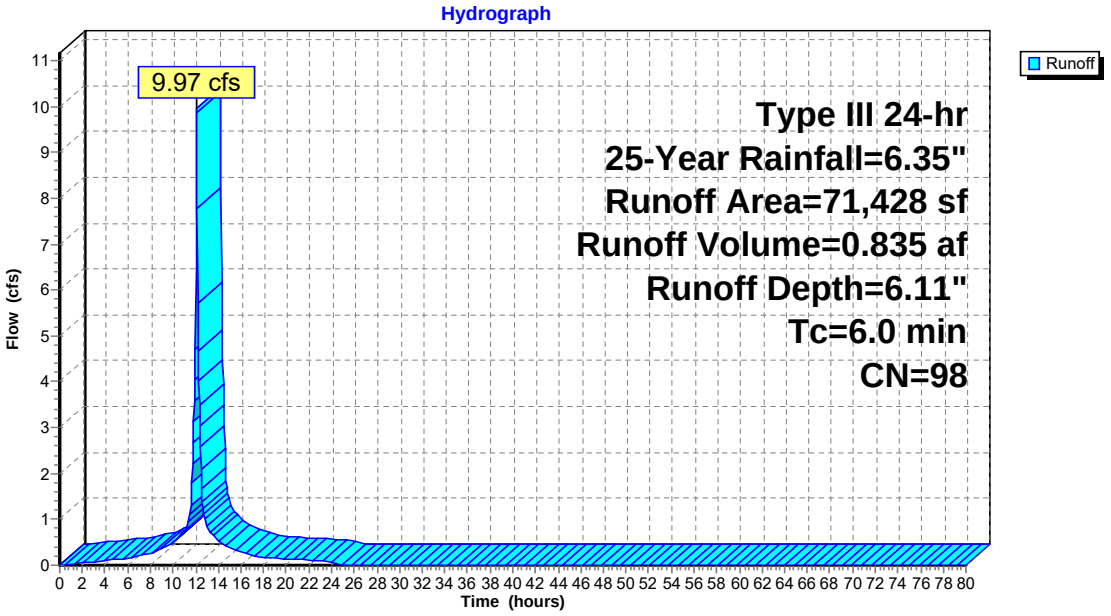
Runoff = 9.97 cfs @ 12.09 hrs, Volume= 0.835 af, Depth= 6.11"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-80.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=6.35"

	Area (sf)	CN	Description
*	71,133	98	Paved parking
	295	79	50-75% Grass cover, Fair, HSG C
	71,428	98	Weighted Average
	295		0.41% Pervious Area
	71,133		99.59% Impervious Area

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

Subcatchment P-1a: Flow to SSI-1



Summary for Subcatchment P-1b: Flow to Treatment Unit

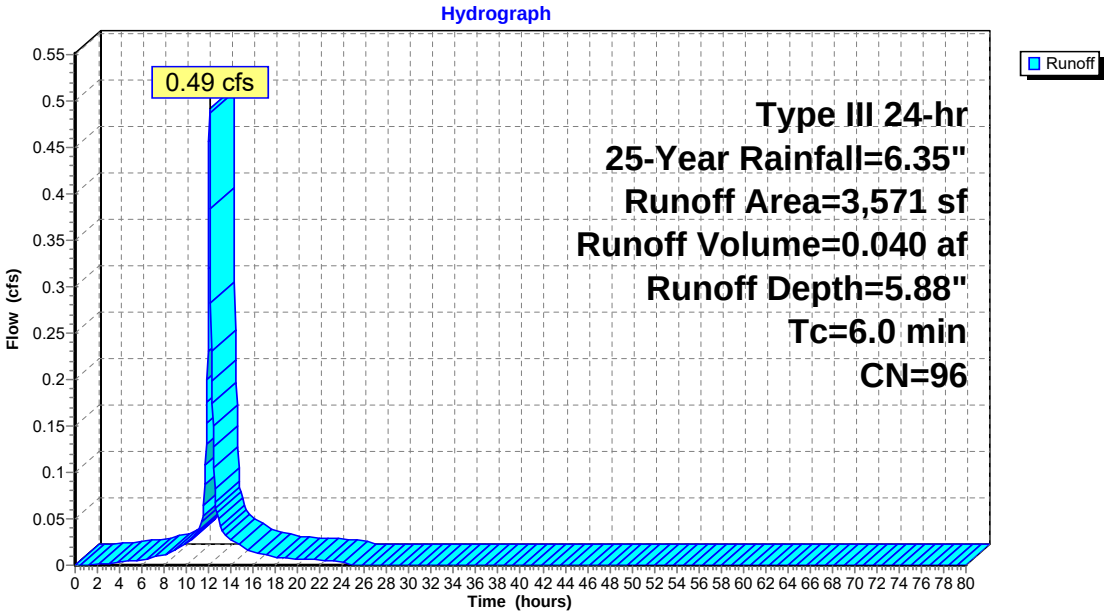
Runoff = 0.49 cfs @ 12.09 hrs, Volume= 0.040 af, Depth= 5.88"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-80.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=6.35"

	Area (sf)	CN	Description
*	3,113	98	Paved parking
	458	79	50-75% Grass cover, Fair, HSG C
	3,571	96	Weighted Average
	458		12.83% Pervious Area
	3,113		87.17% Impervious Area

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

Subcatchment P-1b: Flow to Treatment Unit



Summary for Subcatchment P-1c: Fllow to Swale

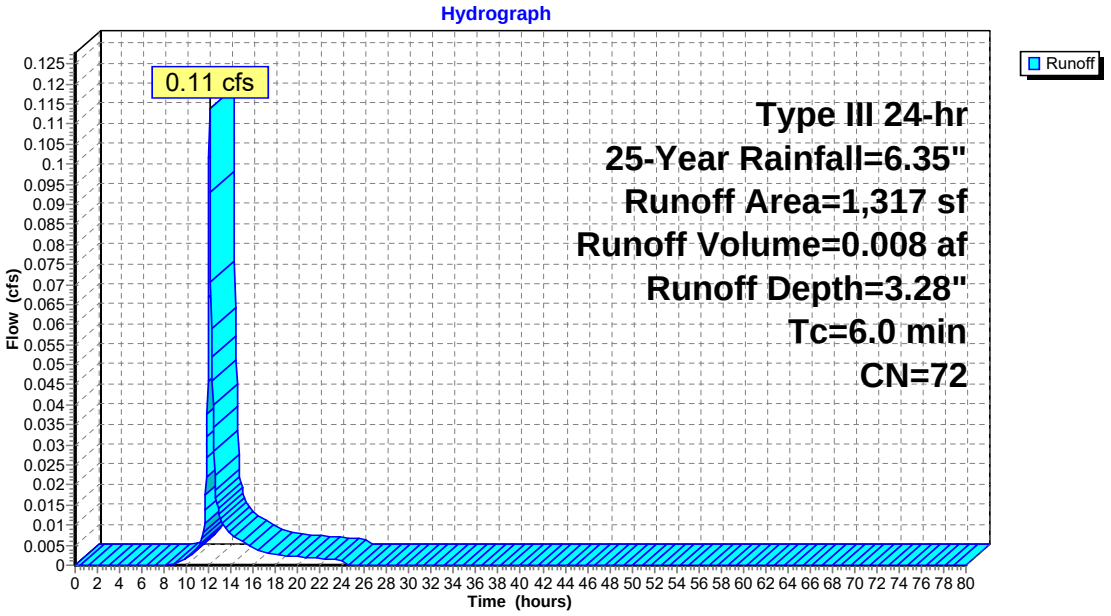
Runoff = 0.11 cfs @ 12.09 hrs, Volume= 0.008 af, Depth= 3.28"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-80.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=6.35"

	Area (sf)	CN	Description
*	339	66	Rip Rap Swale
	476	70	Woods, Good, HSG C
	502	79	50-75% Grass cover, Fair, HSG C
	1,317	72	Weighted Average
	1,317		100.00% Pervious Area

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

Subcatchment P-1c: Fllow to Swale



Summary for Subcatchment P-1d: Fllow to Swale

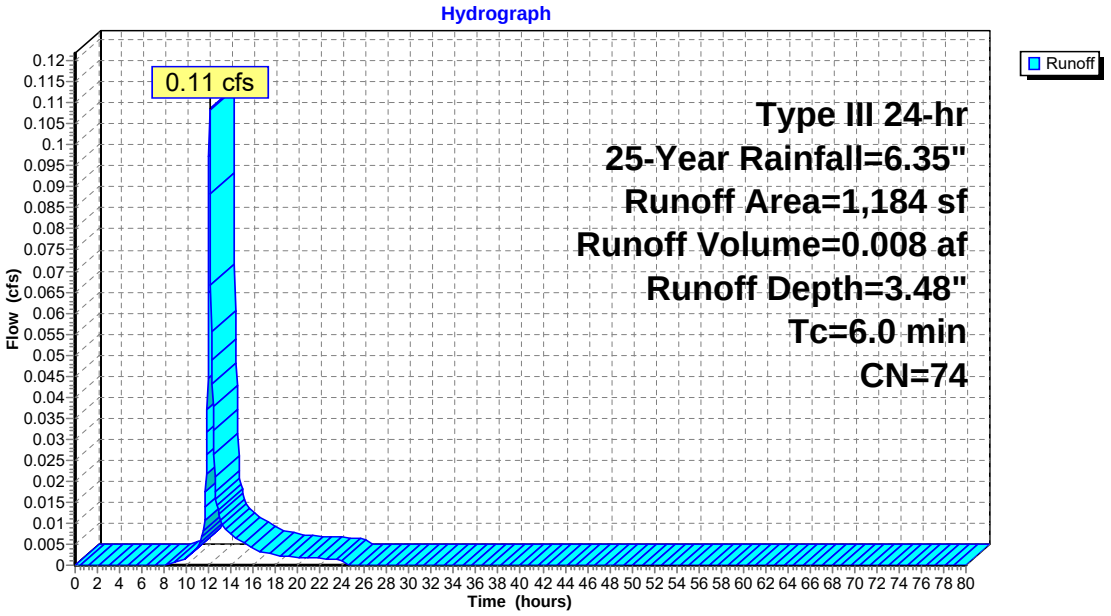
Runoff = 0.11 cfs @ 12.09 hrs, Volume= 0.008 af, Depth= 3.48"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-80.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=6.35"

	Area (sf)	CN	Description
*	350	66	Rip Rap Swale
	216	70	Woods, Good, HSG C
	618	79	50-75% Grass cover, Fair, HSG C
	1,184	74	Weighted Average
	1,184		100.00% Pervious Area

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

Subcatchment P-1d: Fllow to Swale



Summary for Subcatchment P-1e: Fllow to Swale

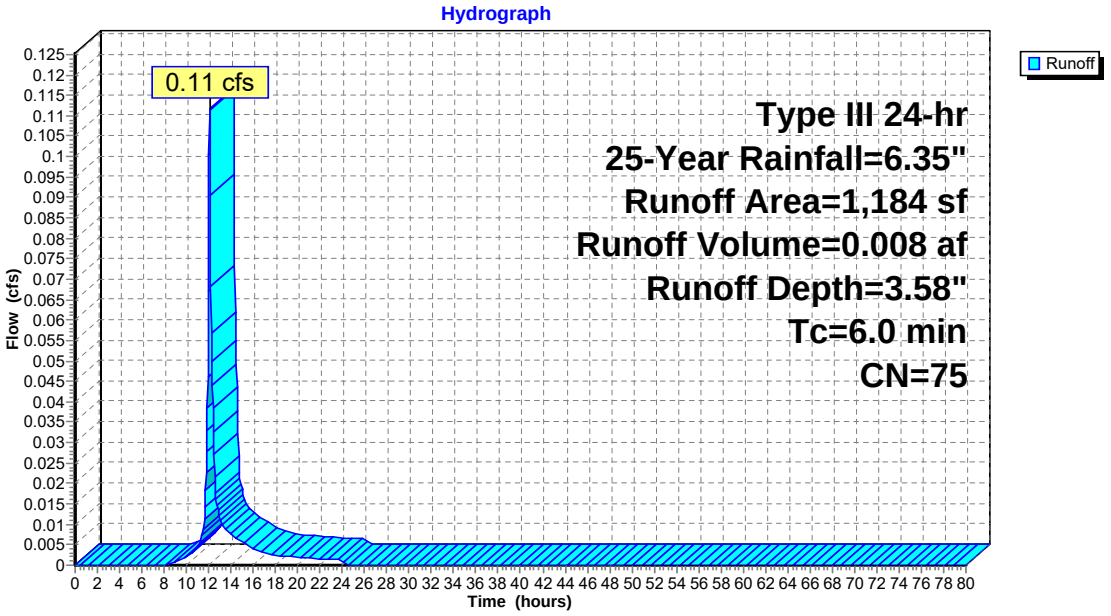
Runoff = 0.11 cfs @ 12.09 hrs, Volume= 0.008 af, Depth= 3.58"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-80.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=6.35"

	Area (sf)	CN	Description
*	350	66	Rip Rap Swale
	58	70	Woods, Good, HSG C
	776	79	50-75% Grass cover, Fair, HSG C
	1,184	75	Weighted Average
	1,184		100.00% Pervious Area

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

Subcatchment P-1e: Fllow to Swale



Summary for Subcatchment P-1f: Fllow to Swale

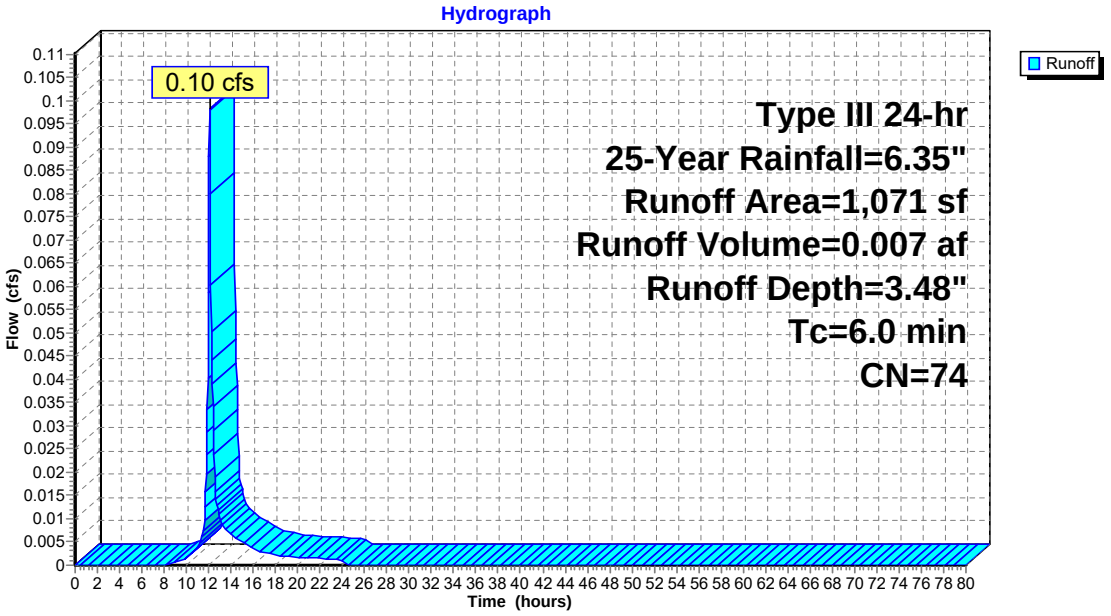
Runoff = 0.10 cfs @ 12.09 hrs, Volume= 0.007 af, Depth= 3.48"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-80.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=6.35"

	Area (sf)	CN	Description
*	357	66	Rip Rap Swale
	124	70	Woods, Good, HSG C
	590	79	50-75% Grass cover, Fair, HSG C
	1,071	74	Weighted Average
	1,071		100.00% Pervious Area

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

Subcatchment P-1f: Fllow to Swale



Summary for Subcatchment P-2: Flow onsite Southeast

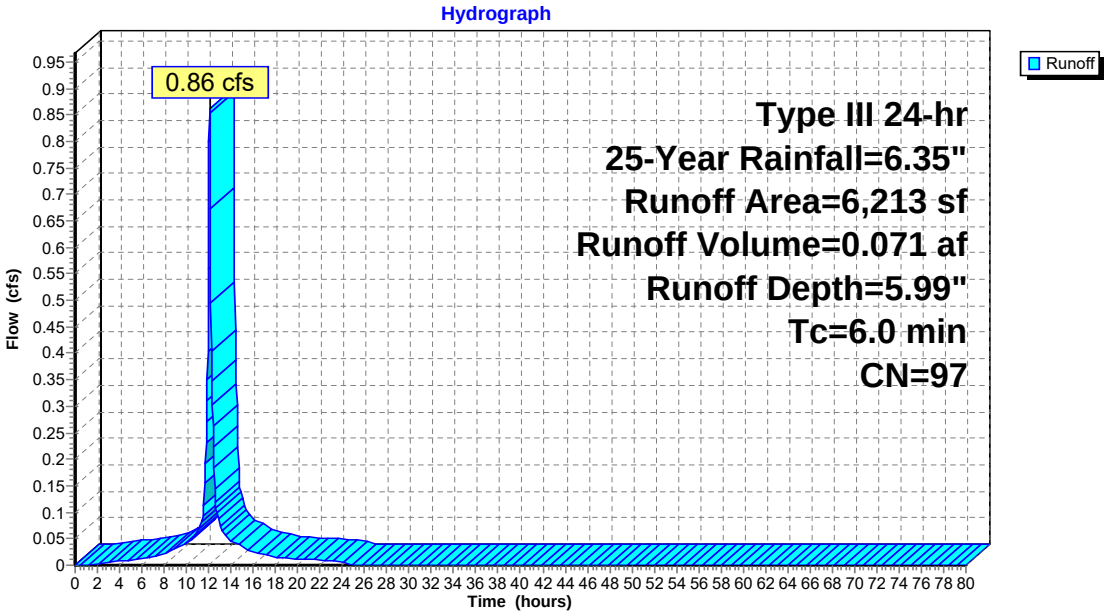
Runoff = 0.86 cfs @ 12.09 hrs, Volume= 0.071 af, Depth= 5.99"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-80.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=6.35"

	Area (sf)	CN	Description
*	5,832	98	Paved parking
	381	79	50-75% Grass cover, Fair, HSG C
	6,213	97	Weighted Average
	381		6.13% Pervious Area
	5,832		93.87% Impervious Area

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

Subcatchment P-2: Flow onsite Southeast



Summary for Subcatchment P-3: Flow off-site West

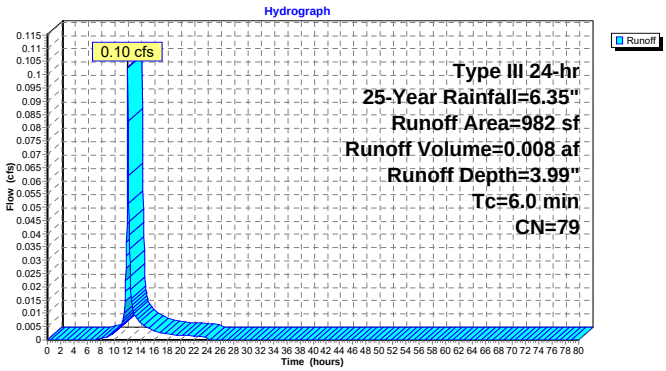
Runoff = 0.10 cfs @ 12.09 hrs, Volume= 0.008 af, Depth= 3.99"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-80.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=6.35"

Area (sf)	CN	Description
10	70	Woods, Good, HSG C
972	79	50-75% Grass cover, Fair, HSG C
982	79	Weighted Average
982		100.00% Pervious Area

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

Subcatchment P-3: Flow off-site West



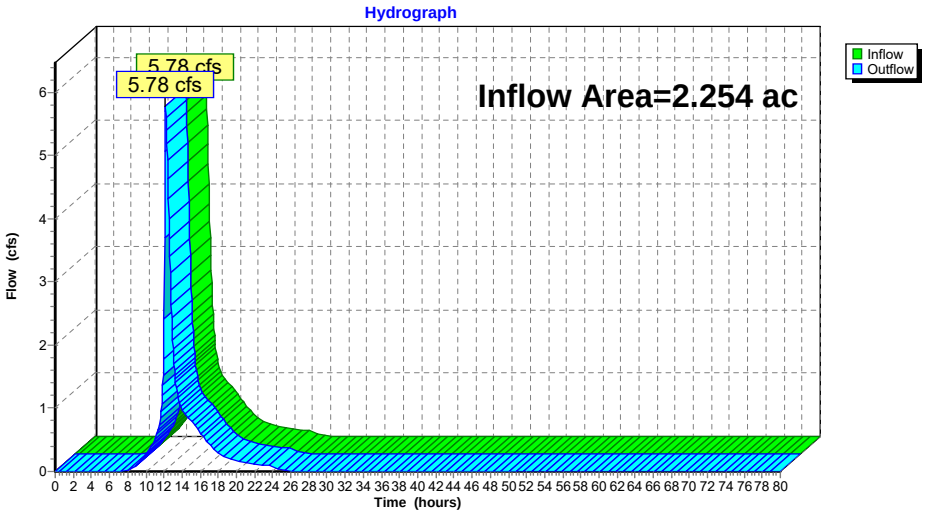
Summary for Reach DP-1: Basin

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

Inflow Area = 2.254 ac, 75.63% Impervious, Inflow Depth = 4.50" for 25-Year event
Inflow = 5.78 cfs @ 12.19 hrs, Volume= 0.846 af
Outflow = 5.78 cfs @ 12.19 hrs, Volume= 0.846 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-80.00 hrs, dt= 0.05 hrs

Reach DP-1: Basin



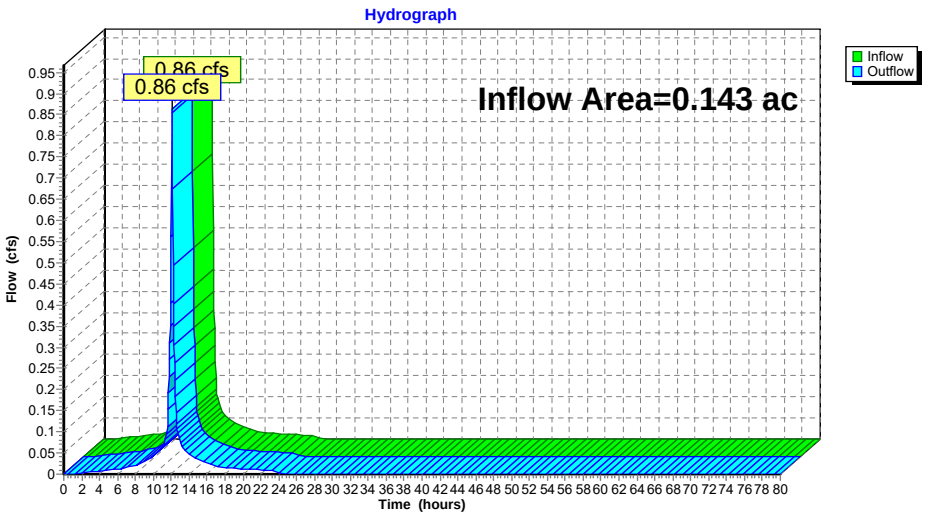
Summary for Reach DP-2: Onsite southeast

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

Inflow Area = 0.143 ac, 93.87% Impervious, Inflow Depth = 5.99" for 25-Year event
Inflow = 0.86 cfs @ 12.09 hrs, Volume= 0.071 af
Outflow = 0.86 cfs @ 12.09 hrs, Volume= 0.071 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-80.00 hrs, dt= 0.05 hrs

Reach DP-2: Onsite southeast



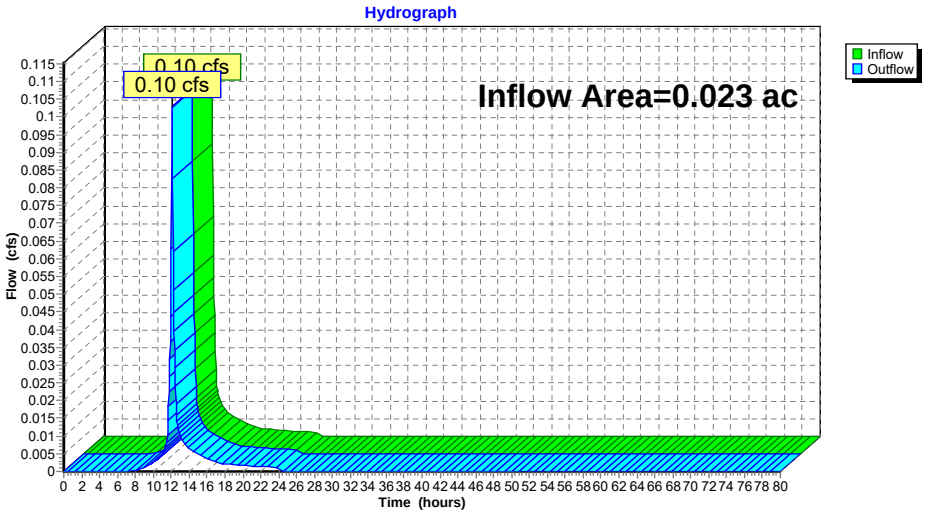
Summary for Reach DP-3: Off-site West

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

Inflow Area = 0.023 ac, 0.00% Impervious, Inflow Depth = 3.99" for 25-Year event
Inflow = 0.10 cfs @ 12.09 hrs, Volume= 0.008 af
Outflow = 0.10 cfs @ 12.09 hrs, Volume= 0.008 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-80.00 hrs, dt= 0.05 hrs

Reach DP-3: Off-site West



Summary for Pond S-1: Rip Rap Swale

Inflow Area = 0.030 ac, 0.00% Impervious, Inflow Depth = 3.28" for 25-Year event
Inflow = 0.11 cfs @ 12.09 hrs, Volume= 0.008 af
Outflow = 0.01 cfs @ 13.04 hrs, Volume= 0.003 af, Atten= 90%, Lag= 56.7 min
Primary = 0.01 cfs @ 13.04 hrs, Volume= 0.003 af

Routing by Stor-Ind method, Time Span= 0.00-80.00 hrs, dt= 0.05 hrs / 6
Peak Elev= 334.06' @ 13.04 hrs Surf.Area= 200 sf Storage= 216 cf

Plug-Flow detention time= 288.6 min calculated for 0.003 af (40% of inflow)
Center-of-Mass det. time= 164.1 min (994.9 - 830.9)

Volume	Invert	Avail.Storage	Storage Description
#1	331.15'	120 cf	**Custom Stage Data (Irregular)** Listed below (Recalc) 414 cf Overall - 114 cf Embedded = 300 cf x 40.0% Voids
#2	332.65'	114 cf	**Custom Stage Data (Irregular)** Listed below (Recalc) Inside #1
		234 cf	Total Available Storage

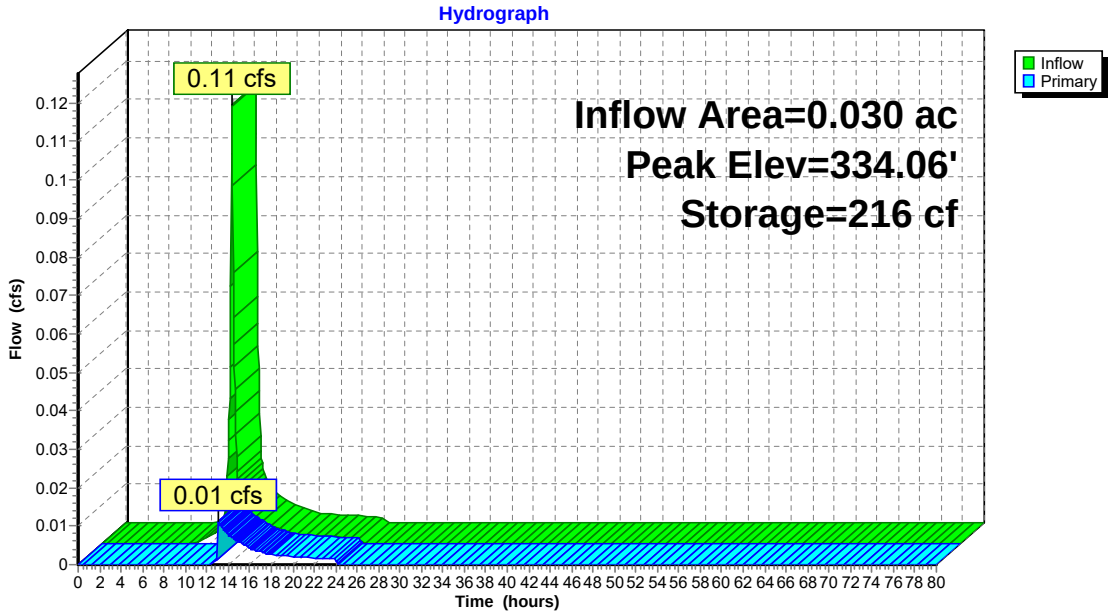
Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
331.15	0	0.0	0	0	0
331.50	21	27.2	2	2	59
332.50	171	99.3	84	86	788
332.65	200	104.4	28	114	872
334.15	200	104.4	300	414	1,028

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
332.65	0	0.0	0	0	0
333.00	21	27.2	2	2	59
334.00	171	99.3	84	86	788
334.15	200	104.4	28	114	872

Device	Routing	Invert	Outlet Devices
#1	Primary	334.05'	**7.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)

Primary OutFlow Max=0.01 cfs @ 13.04 hrs HW=334.05' (Free Discharge)
1=Sharp-Crested Rectangular Weir (Weir Controls 0.01 cfs @ 0.23 fps)

Pond S-1: Rip Rap Swale



Summary for Pond S-2: Rip Rap Swale

Inflow Area = 0.057 ac, 0.00% Impervious, Inflow Depth = 2.35" for 25-Year event
Inflow = 0.11 cfs @ 12.09 hrs, Volume= 0.011 af
Outflow = 0.02 cfs @ 13.06 hrs, Volume= 0.007 af, Atten= 80%, Lag= 57.8 min
Primary = 0.02 cfs @ 13.06 hrs, Volume= 0.007 af

Routing by Stor-Ind method, Time Span= 0.00-80.00 hrs, dt= 0.05 hrs / 6
Peak Elev= 332.51' @ 13.06 hrs Surf.Area= 200 sf Storage= 199 cf

Plug-Flow detention time= 242.6 min calculated for 0.007 af (59% of inflow)
Center-of-Mass det. time= 110.2 min (986.7 - 876.4)

Volume	Invert	Avail.Storage	Storage Description
#1	329.65'	120 cf	**Custom Stage Data (Irregular)** Listed below (Recalc) 407 cf Overall - 107 cf Embedded = 300 cf x 40.0% Voids
#2	331.15'	107 cf	**Custom Stage Data (Irregular)** Listed below (Recalc) Inside #1
		227 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
329.65	0	0.0	0	0	0
330.50	74	61.1	21	21	298
331.15	200	104.5	86	107	873
332.65	200	104.5	300	407	1,029

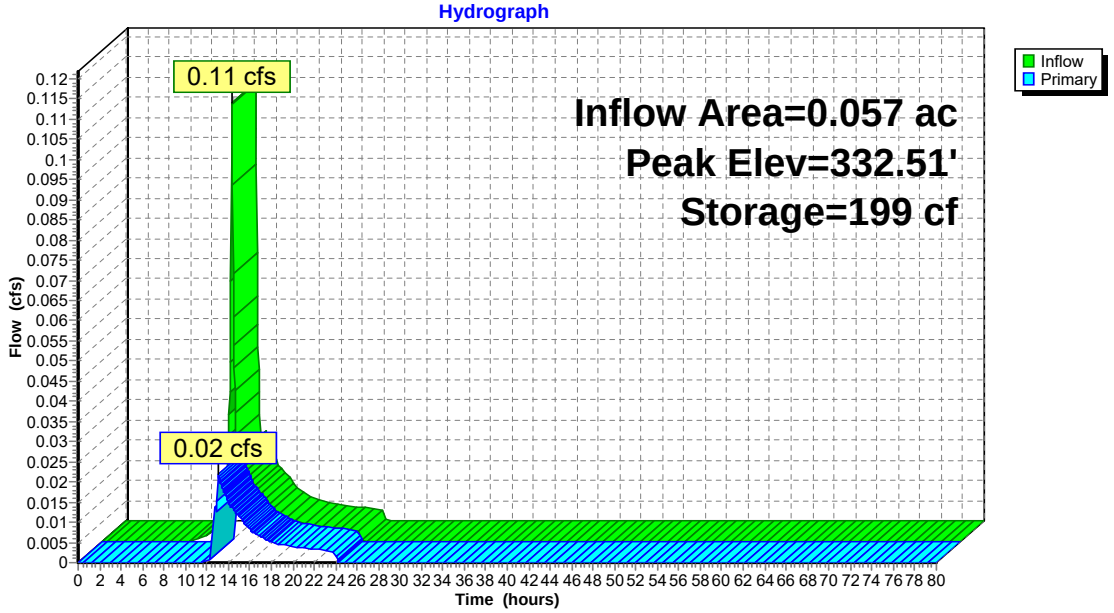
Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
331.15	0	0.0	0	0	0
332.00	74	61.1	21	21	298
332.65	200	104.5	86	107	873

Device	Routing	Invert	Outlet Devices
#1	Primary	332.50'	**7.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)

Primary OutFlow Max=0.01 cfs @ 13.06 hrs HW=332.51' (Free Discharge)
└**1=Sharp-Crested Rectangular Weir** (Weir Controls 0.01 cfs @ 0.24 fps)

Pond S-2: Rip Rap Swale

Hydrograph



Summary for Pond S-3: Rip Rap Swale

Inflow Area = 0.085 ac, 0.00% Impervious, Inflow Depth = 2.10" for 25-Year event
Inflow = 0.11 cfs @ 12.09 hrs, Volume= 0.015 af
Outflow = 0.03 cfs @ 13.06 hrs, Volume= 0.010 af, Atten= 71%, Lag= 58.2 min
Primary = 0.03 cfs @ 13.06 hrs, Volume= 0.010 af

Routing by Stor-Ind method, Time Span= 0.00-80.00 hrs, dt= 0.05 hrs / 6
Peak Elev= 331.01' @ 13.06 hrs Surf.Area= 200 sf Storage= 196 cf

Plug-Flow detention time= 192.8 min calculated for 0.010 af (70% of inflow)
Center-of-Mass det. time= 81.0 min (978.3 - 897.4)

Volume	Invert	Avail.Storage	Storage Description
#1	329.70'	112 cf	**Custom Stage Data (Irregular)** Listed below (Recalc) Inside #2
#2	328.20'	120 cf	**Custom Stage Data (Irregular)** Listed below (Recalc) 412 cf Overall - 112 cf Embedded = 300 cf x 40.0% Voids
		232 cf	Total Available Storage

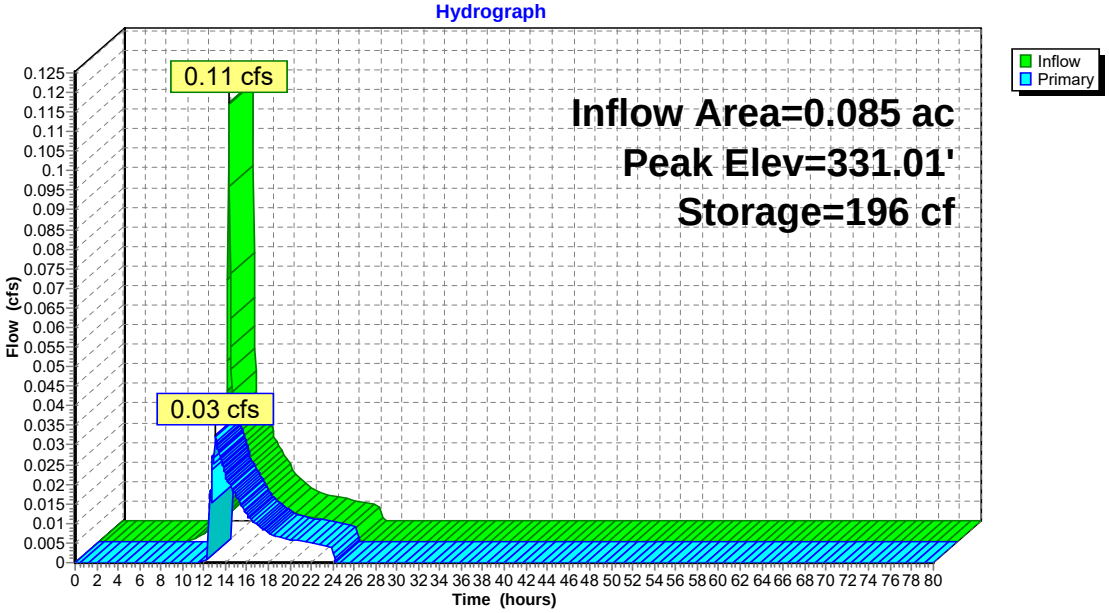
Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
329.70	0	0.0	0	0	0
330.00	16	23.0	2	2	42
331.00	158	95.1	75	76	722
331.20	200	104.5	36	112	873

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
328.20	0	0.0	0	0	0
328.50	16	23.0	2	2	42
329.50	158	95.1	75	76	722
329.70	200	104.5	36	112	873
331.20	200	104.5	300	412	1,030

Device	Routing	Invert	Outlet Devices
#1	Primary	331.00'	**7.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)

Primary OutFlow Max=0.02 cfs @ 13.06 hrs HW=331.01' (Free Discharge)
└**1=Sharp-Crested Rectangular Weir** (Weir Controls 0.02 cfs @ 0.33 fps)

Pond S-3: Rip Rap Swale



Summary for Pond S-4: Rip Rap Swale

Inflow Area = 0.109 ac, 0.00% Impervious, Inflow Depth = 1.92" for 25-Year event
Inflow = 0.10 cfs @ 12.09 hrs, Volume= 0.017 af
Outflow = 0.04 cfs @ 13.06 hrs, Volume= 0.014 af, Atten= 57%, Lag= 58.2 min
Primary = 0.04 cfs @ 13.06 hrs, Volume= 0.014 af

Routing by Stor-Ind method, Time Span= 0.00-80.00 hrs, dt= 0.05 hrs / 6
Peak Elev= 329.26' @ 13.06 hrs Surf.Area= 188 sf Storage= 149 cf

Plug-Flow detention time= 131.6 min calculated for 0.014 af (81% of inflow)
Center-of-Mass det. time= 50.0 min (966.2 - 916.2)

Volume	Invert	Avail.Storage	Storage Description
#1	328.20'	108 cf	**Custom Stage Data (Irregular)** Listed below (Recalc) Inside #2
#2	326.70'	113 cf	**Custom Stage Data (Irregular)** Listed below (Recalc) 390 cf Overall - 108 cf Embedded = 282 cf x 40.0% Voids
		221 cf	Total Available Storage

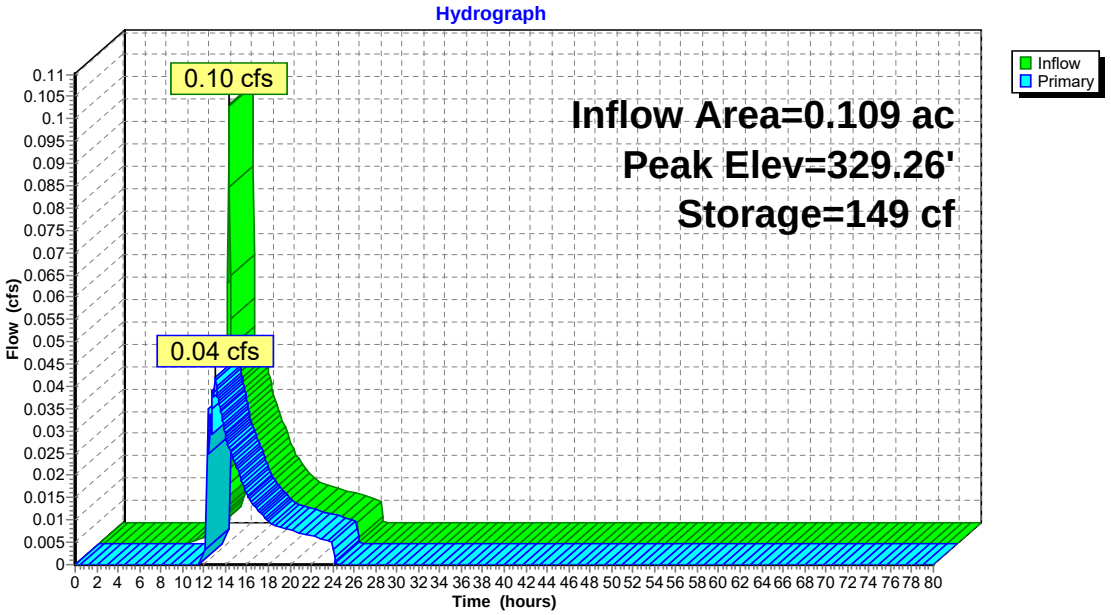
Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
328.20	0	0.0	0	0	0
329.00	71	56.9	19	19	259
329.25	112	76.4	23	42	466
329.70	188	102.0	67	108	832

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
326.70	0	0.0	0	0	0
327.50	71	56.9	19	19	259
327.75	112	76.4	23	42	466
328.20	188	102.0	67	108	832
329.70	188	102.0	282	390	985

Device	Routing	Invert	Outlet Devices
#1	Primary	329.25'	**7.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)

Primary OutFlow Max=0.02 cfs @ 13.06 hrs HW=329.26' (Free Discharge)
└**1=Sharp-Crested Rectangular Weir** (Weir Controls 0.02 cfs @ 0.34 fps)

Pond S-4: Rip Rap Swale



Summary for Pond SSD-1: Subsurface Detention Basin-1

Inflow Area = 1.640 ac, 99.59% Impervious, Inflow Depth = 6.11" for 25-Year event
Inflow = 9.97 cfs @ 12.09 hrs, Volume= 0.835 af
Outflow = 4.32 cfs @ 12.28 hrs, Volume= 0.835 af, Atten= 57%, Lag= 11.4 min
Discarded = 0.10 cfs @ 12.28 hrs, Volume= 0.177 af
Primary = 4.21 cfs @ 12.28 hrs, Volume= 0.658 af

Routing by Stor-Ind method, Time Span= 0.00-80.00 hrs, dt= 0.05 hrs / 6
Peak Elev= 324.52' @ 12.28 hrs Surf.Area= 7,434 sf Storage= 12,891 cf

Plug-Flow detention time= 154.8 min calculated for 0.835 af (100% of inflow)
Center-of-Mass det. time= 154.5 min (898.8 - 744.3)

Volume	Invert	Avail.Storage	Storage Description
#1A	322.00'	6,586 cf	**63.25'W x 117.54'L x 3.50'H Field A** 26,020 cf Overall - 9,556 cf Embedded = 16,464 cf x 40.0% Voids
#2A	322.50'	9,556 cf	**ADS_StormTech SC-740 +Cap** x 208 Inside #1 Effective Size= 44.6"W x 30.0"H => 6.45 sf x 7.12'L = 45.9 cf Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap 208 Chambers in 13 Rows
		16,141 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	322.50'	**15.0" Round Culvert** L= 21.3' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 322.50' / 322.00' S= 0.0235 '/' Cc= 0.900 n= 0.013, Flow Area= 1.23 sf
#2	Device 1	325.25'	**4.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)
#3	Device 1	324.25'	**6.0" Vert. Orifice/Grate** C= 0.600
#4	Device 1	323.50'	**8.0" Vert. Orifice/Grate X 2.00** C= 0.600
#5	Device 1	322.55'	**6.0" Vert. Orifice/Grate** C= 0.600
#6	Discarded	322.00'	**0.270 in/hr Exfiltration over Surface area** Conductivity to Groundwater Elevation = 320.00'

Discarded OutFlow Max=0.10 cfs @ 12.28 hrs HW=324.52' (Free Discharge)
└**6=Exfiltration** (Controls 0.10 cfs)

Primary OutFlow Max=4.20 cfs @ 12.28 hrs HW=324.52' (Free Discharge)
└**1=Culvert** (Passes 4.20 cfs of 6.97 cfs potential flow)
  ├**2=Sharp-Crested Rectangular Weir** (Controls 0.00 cfs)
  ├**3=Orifice/Grate** (Orifice Controls 0.19 cfs @ 1.76 fps)
  ├**4=Orifice/Grate** (Orifice Controls 2.78 cfs @ 3.98 fps)
  └**5=Orifice/Grate** (Orifice Controls 1.24 cfs @ 6.31 fps)

Pond SSD-1: Subsurface Detention Basin-1 - Chamber Wizard Field A

Chamber Model = ADS_StormTech SC-740 +Cap (ADS StormTech® SC-740 with cap length)
Effective Size= 44.6"W x 30.0"H => 6.45 sf x 7.12'L = 45.9 cf
Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap

51.0" Wide + 6.0" Spacing = 57.0" C-C Row Spacing

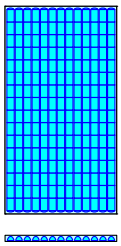
16 Chambers/Row x 7.12' Long +0.81' Cap Length x 2 = 115.54' Row Length +12.0" End Stone x 2 = 117.54' Base Length
13 Rows x 51.0" Wide + 6.0" Spacing x 12 + 12.0" Side Stone x 2 = 63.25' Base Width
6.0" Base + 30.0" Chamber Height + 6.0" Cover = 3.50' Field Height

208 Chambers x 45.9 cf = 9,555.5 cf Chamber Storage

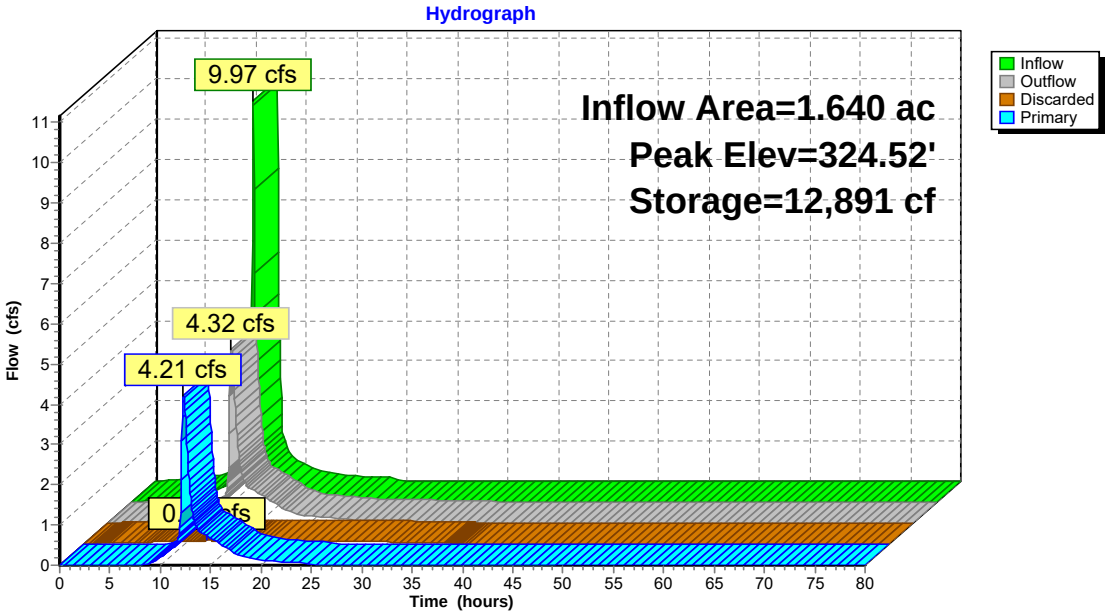
26,019.7 cf Field - 9,555.5 cf Chambers = 16,464.2 cf Stone x 40.0% Voids = 6,585.7 cf Stone Storage

Chamber Storage + Stone Storage = 16,141.2 cf = 0.371 af
Overall Storage Efficiency = 62.0%
Overall System Size = 117.54' x 63.25' x 3.50'

208 Chambers
963.7 cy Field
609.8 cy Stone



Pond SSD-1: Subsurface Detention Basin-1

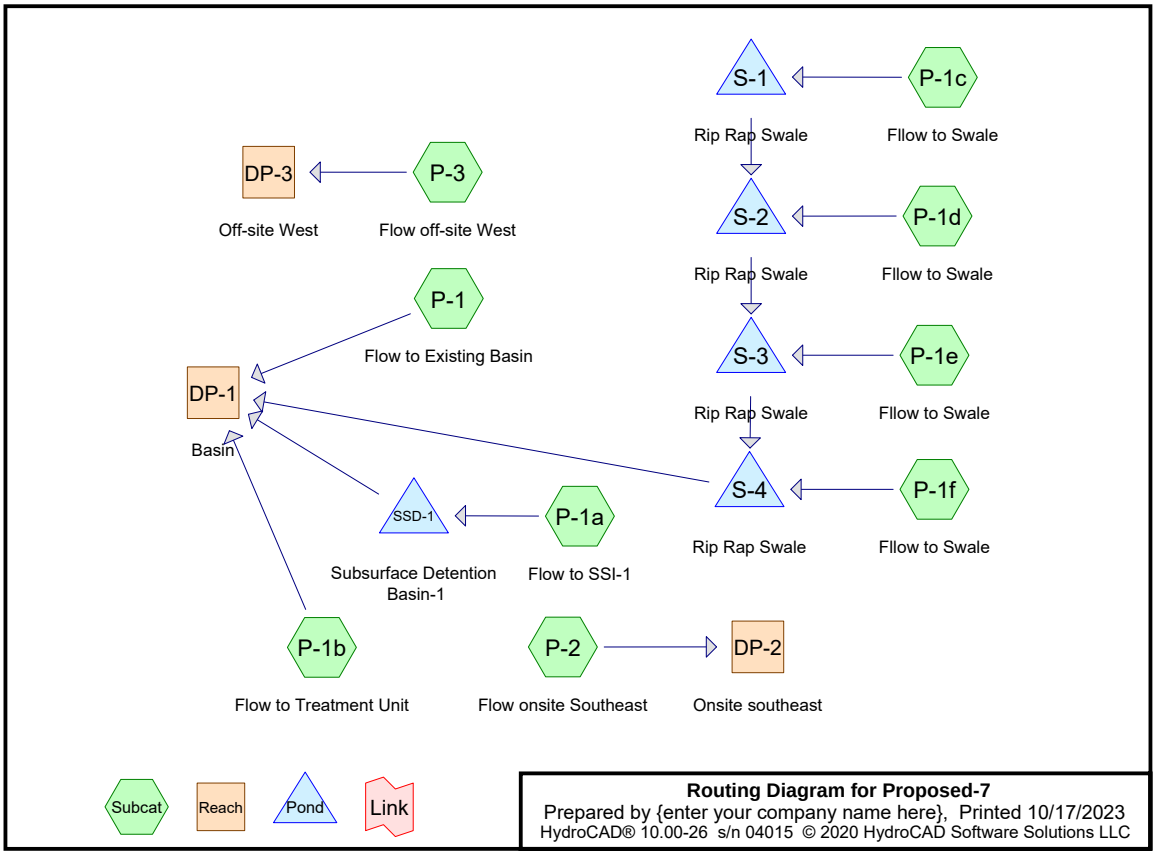


LEVEL
DESIGN GROUP

HydroCAD Analysis

Proposed Conditions - 100 Year Storm

249 SOUTH STREET UNIT 1 PLAINVILLE MA 02762
TEL508 695 2221 FAX508 695 2219 CONTACT@LEVELDG.COM LEVELDG.COM



Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
0.426	79	50-75% Grass cover, Fair, HSG C (P-1, P-1a, P-1b, P-1c, P-1d, P-1e, P-1f, P-2, P-3)
1.838	98	Paved parking (P-1a, P-1b, P-2)
0.032	66	Rip Rap Swale (P-1c, P-1d, P-1e, P-1f)
0.123	70	Woods, Good, HSG C (P-1, P-1c, P-1d, P-1e, P-1f, P-3)
2.419	**93**	**TOTAL AREA**

Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.000	HSG A	
0.000	HSG B	
0.549	HSG C	P-1, P-1a, P-1b, P-1c, P-1d, P-1e, P-1f, P-2, P-3
0.000	HSG D	
1.870	Other	P-1a, P-1b, P-1c, P-1d, P-1e, P-1f, P-2
2.419		**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
0.000	0.000	0.426	0.000	0.000	0.426	50-75% Grass cover, Fair	P-1, P-1a, P-1b, P-1c, P-1d, P-1e, P-1f, P-2, P-3
0.000	0.000	0.000	0.000	1.838	1.838	Paved parking	P-1a, P-1b, P-2
0.000	0.000	0.000	0.000	0.032	0.032	Rip Rap Swale	P-1c, P-1d, P-1e, P-1f
0.000	0.000	0.123	0.000	0.000	0.123	Woods, Good	P-1, P-1c, P-1d, P-1e, P-1f, P-3
0.000	**0.000**	**0.549**	**0.000**	**1.870**	**2.419**	**TOTAL AREA**	

Pipe Listing (all nodes)

Line#	Node Number	In-Invert (feet)	Out-Invert (feet)	Length (feet)	Slope (ft/ft)	n	Diam/Width (inches)	Height (inches)	Inside-Fill (inches)
1	SSD-1	322.50	322.00	21.3	0.0235	0.013	15.0	0.0	0.0

Time span=0.00-80.00 hrs, dt=0.05 hrs, 1601 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment P-1: Flow to Existing Basin Runoff Area=18,417 sf 0.00% Impervious Runoff Depth=5.42"
Flow Length=461' Tc=10.0 min CN=77 Runoff=2.30 cfs 0.191 af

Subcatchment P-1a: Flow to SSI-1 Runoff Area=71,428 sf 99.59% Impervious Runoff Depth=7.92"
Tc=6.0 min CN=98 Runoff=12.83 cfs 1.082 af

Subcatchment P-1b: Flow to Treatment Unit Runoff Area=3,571 sf 87.17% Impervious Runoff Depth=7.68"
Tc=6.0 min CN=96 Runoff=0.64 cfs 0.052 af

Subcatchment P-1c: Fllow to Swale Runoff Area=1,317 sf 0.00% Impervious Runoff Depth=4.84"
Tc=6.0 min CN=72 Runoff=0.17 cfs 0.012 af

Subcatchment P-1d: Fllow to Swale Runoff Area=1,184 sf 0.00% Impervious Runoff Depth=5.07"
Tc=6.0 min CN=74 Runoff=0.16 cfs 0.011 af

Subcatchment P-1e: Fllow to Swale Runoff Area=1,184 sf 0.00% Impervious Runoff Depth=5.19"
Tc=6.0 min CN=75 Runoff=0.16 cfs 0.012 af

Subcatchment P-1f: Fllow to Swale Runoff Area=1,071 sf 0.00% Impervious Runoff Depth=5.07"
Tc=6.0 min CN=74 Runoff=0.14 cfs 0.010 af

Subcatchment P-2: Flow onsite Southeast Runoff Area=6,213 sf 93.87% Impervious Runoff Depth=7.80"
Tc=6.0 min CN=97 Runoff=1.11 cfs 0.093 af

Subcatchment P-3: Flow off-site West Runoff Area=982 sf 0.00% Impervious Runoff Depth=5.66"
Tc=6.0 min CN=79 Runoff=0.14 cfs 0.011 af

Reach DP-1: Basin Inflow=8.73 cfs 1.169 af
Outflow=8.73 cfs 1.169 af

Reach DP-2: Onsite southeast Inflow=1.11 cfs 0.093 af
Outflow=1.11 cfs 0.093 af

Reach DP-3: Off-site West Inflow=0.14 cfs 0.011 af
Outflow=0.14 cfs 0.011 af

Pond S-1: Rip Rap Swale Peak Elev=334.07' Storage=219 cf Inflow=0.17 cfs 0.012 af
Outflow=0.09 cfs 0.007 af

Pond S-2: Rip Rap Swale Peak Elev=332.54' Storage=205 cf Inflow=0.18 cfs 0.019 af
Outflow=0.17 cfs 0.014 af

Pond S-3: Rip Rap Swale Peak Elev=331.05' Storage=203 cf Inflow=0.27 cfs 0.026 af
Outflow=0.25 cfs 0.022 af

Pond S-4: Rip Rap Swale Peak Elev=329.31' Storage=156 cf Inflow=0.34 cfs 0.032 af
Outflow=0.32 cfs 0.029 af

Pond SSD-1: Subsurface Detention Basin-1 Peak Elev=325.16' Storage=15,127 cf Inflow=12.83 cfs 1.082 af
Discarded=0.12 cfs 0.185 af Primary=6.09 cfs 0.897 af Outflow=6.21 cfs 1.082 af

Total Runoff Area = 2.419 ac Runoff Volume = 1.475 af Average Runoff Depth = 7.32"
24.00% Pervious = 0.581 ac 76.00% Impervious = 1.838 ac

Summary for Subcatchment P-1: Flow to Existing Basin

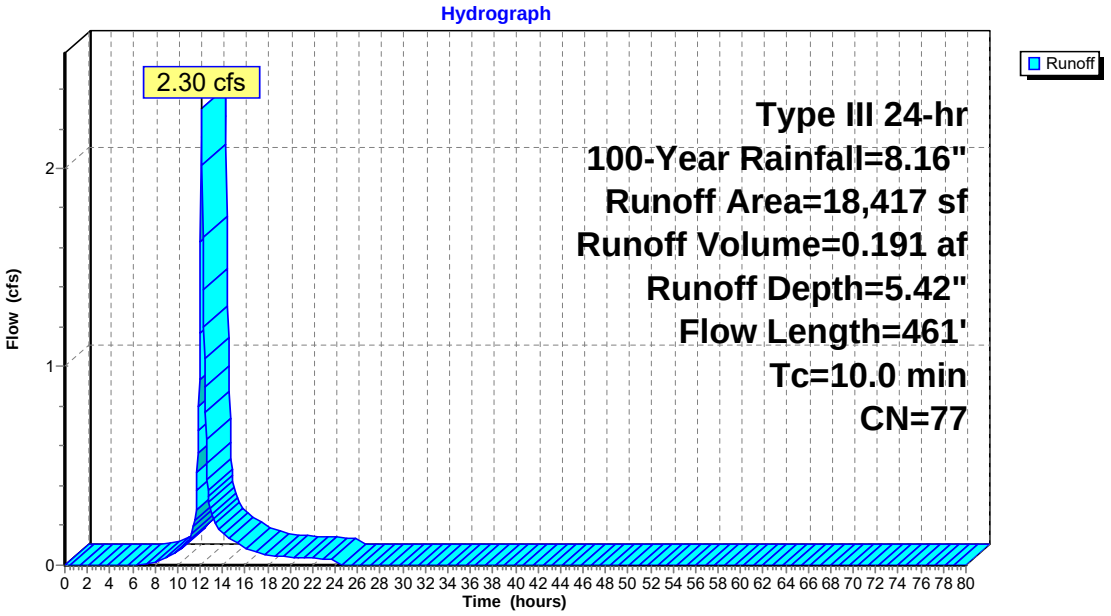
Runoff = 2.30 cfs @ 12.14 hrs, Volume= 0.191 af, Depth= 5.42"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-80.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=8.16"

Area (sf)	CN	Description
4,454	70	Woods, Good, HSG C
13,963	79	50-75% Grass cover, Fair, HSG C
18,417	77	Weighted Average
18,417		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.3	50	0.0800	0.11		**Sheet Flow, Sheet Flow** Woods: Light underbrush n= 0.400 P2= 3.05"
2.7	411	0.0240	2.49		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
10.0	461	Total			

Subcatchment P-1: Flow to Existing Basin



Summary for Subcatchment P-1a: Flow to SSI-1

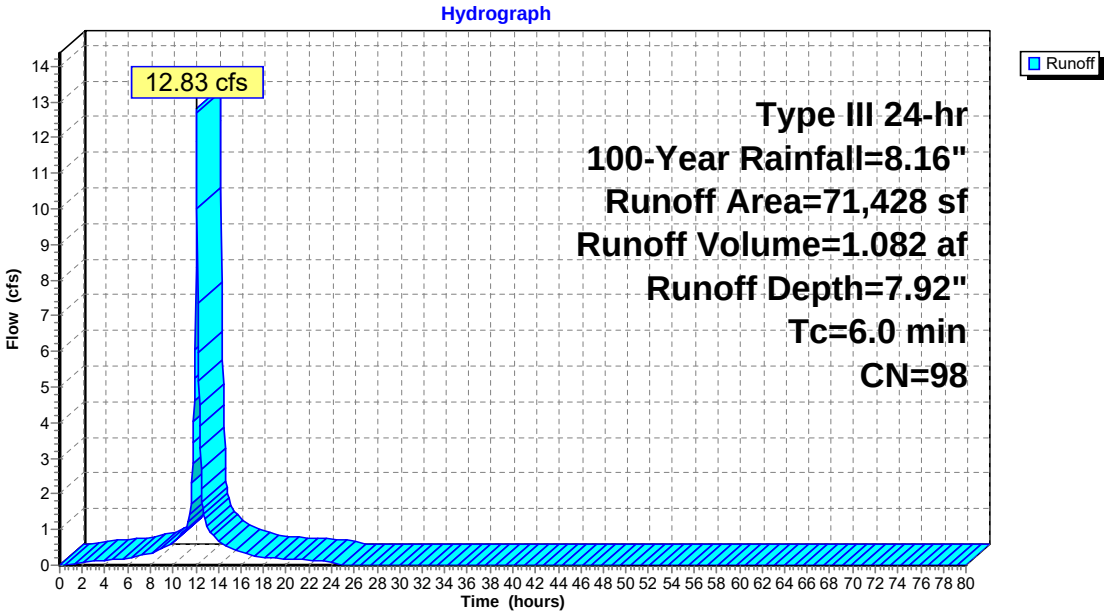
Runoff = 12.83 cfs @ 12.09 hrs, Volume= 1.082 af, Depth= 7.92"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-80.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=8.16"

	Area (sf)	CN	Description
*	71,133	98	Paved parking
	295	79	50-75% Grass cover, Fair, HSG C
	71,428	98	Weighted Average
	295		0.41% Pervious Area
	71,133		99.59% Impervious Area

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

Subcatchment P-1a: Flow to SSI-1



Summary for Subcatchment P-1b: Flow to Treatment Unit

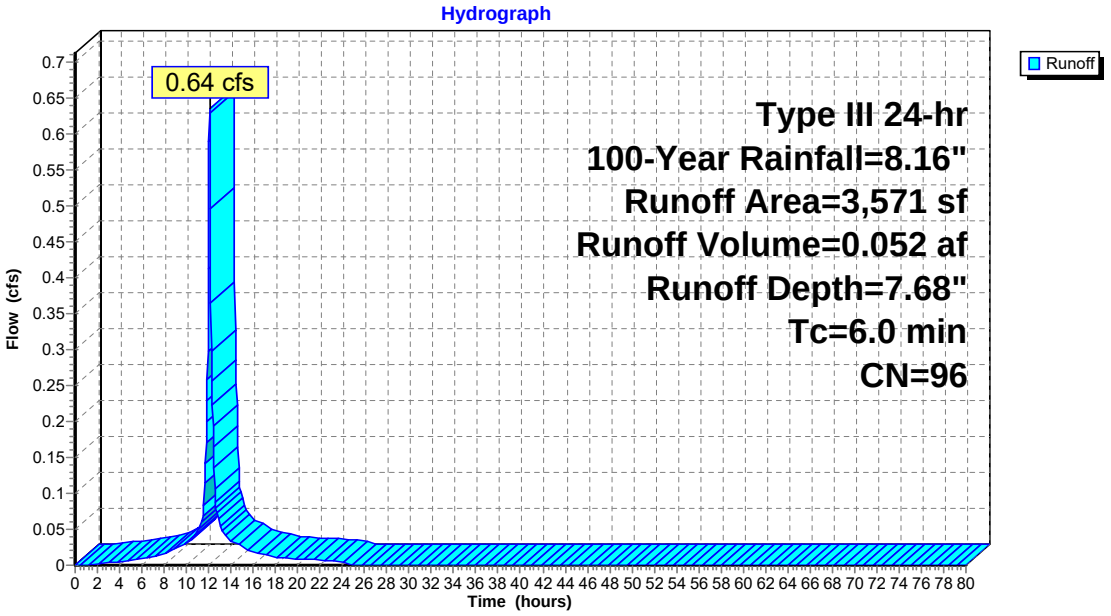
Runoff = 0.64 cfs @ 12.09 hrs, Volume= 0.052 af, Depth= 7.68"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-80.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=8.16"

	Area (sf)	CN	Description
*	3,113	98	Paved parking
	458	79	50-75% Grass cover, Fair, HSG C
	3,571	96	Weighted Average
	458		12.83% Pervious Area
	3,113		87.17% Impervious Area

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

Subcatchment P-1b: Flow to Treatment Unit



Summary for Subcatchment P-1c: Fllow to Swale

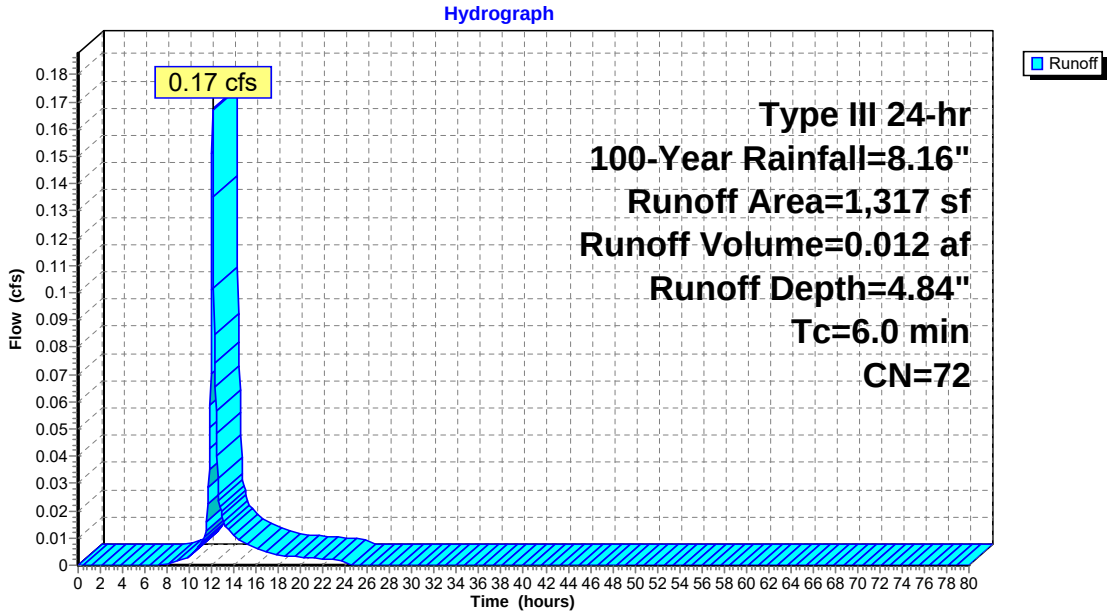
Runoff = 0.17 cfs @ 12.09 hrs, Volume= 0.012 af, Depth= 4.84"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-80.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=8.16"

	Area (sf)	CN	Description
*	339	66	Rip Rap Swale
	476	70	Woods, Good, HSG C
	502	79	50-75% Grass cover, Fair, HSG C
	1,317	72	Weighted Average
	1,317		100.00% Pervious Area

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

Subcatchment P-1c: Fllow to Swale



Summary for Subcatchment P-1d: Fllow to Swale

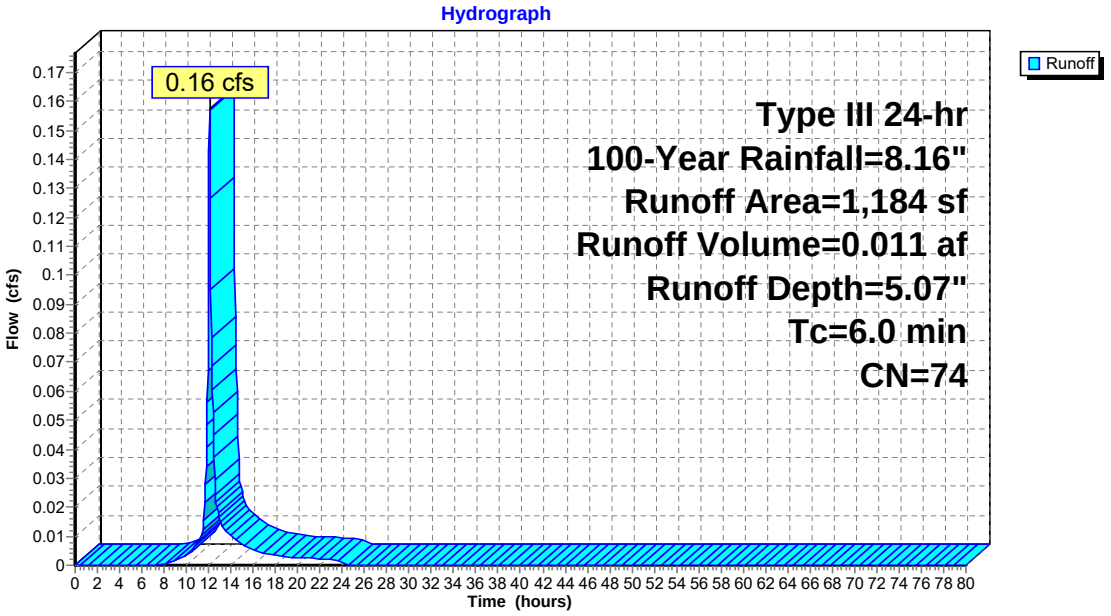
Runoff = 0.16 cfs @ 12.09 hrs, Volume= 0.011 af, Depth= 5.07"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-80.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=8.16"

	Area (sf)	CN	Description
*	350	66	Rip Rap Swale
	216	70	Woods, Good, HSG C
	618	79	50-75% Grass cover, Fair, HSG C
	1,184	74	Weighted Average
	1,184		100.00% Pervious Area

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

Subcatchment P-1d: Fllow to Swale



Summary for Subcatchment P-1e: Fllow to Swale

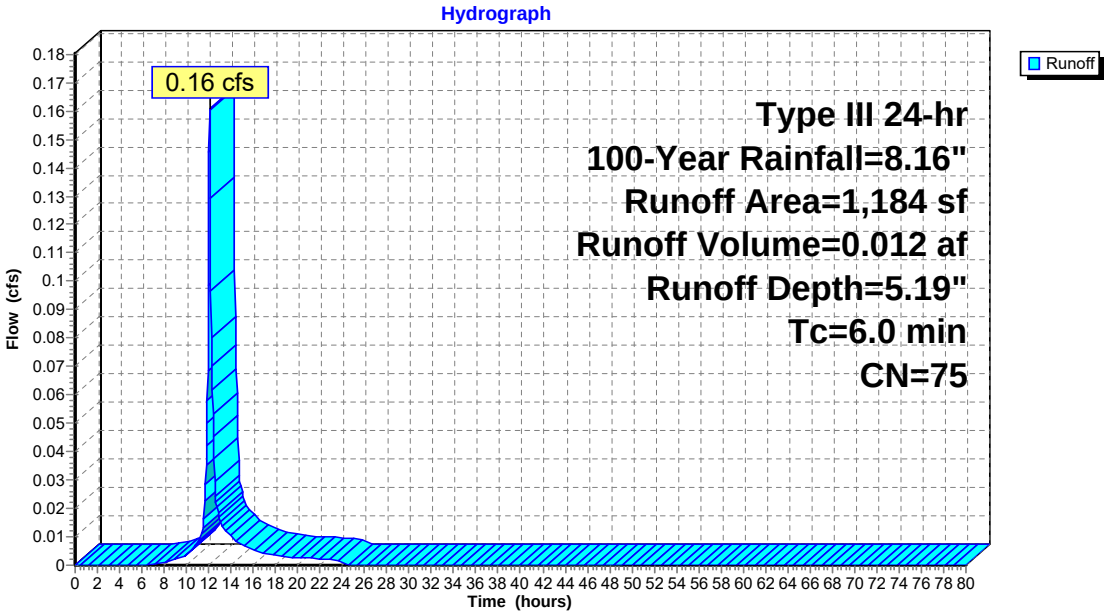
Runoff = 0.16 cfs @ 12.09 hrs, Volume= 0.012 af, Depth= 5.19"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-80.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=8.16"

	Area (sf)	CN	Description
*	350	66	Rip Rap Swale
	58	70	Woods, Good, HSG C
	776	79	50-75% Grass cover, Fair, HSG C
	1,184	75	Weighted Average
	1,184		100.00% Pervious Area

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

Subcatchment P-1e: Fllow to Swale



Summary for Subcatchment P-1f: Fllow to Swale

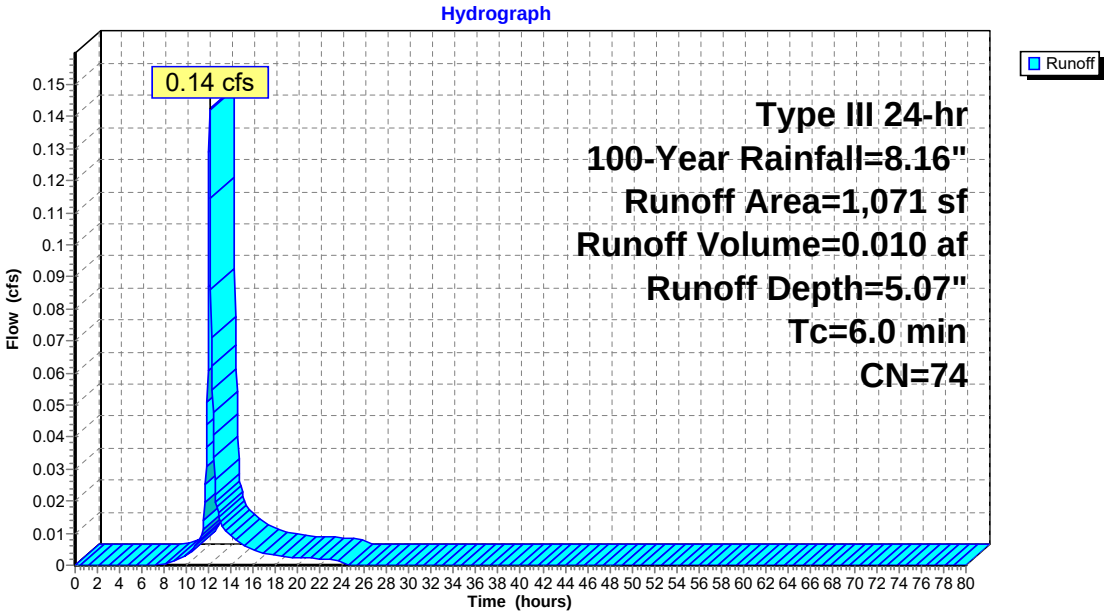
Runoff = 0.14 cfs @ 12.09 hrs, Volume= 0.010 af, Depth= 5.07"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-80.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=8.16"

	Area (sf)	CN	Description
*	357	66	Rip Rap Swale
	124	70	Woods, Good, HSG C
	590	79	50-75% Grass cover, Fair, HSG C
	1,071	74	Weighted Average
	1,071		100.00% Pervious Area

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

Subcatchment P-1f: Fllow to Swale



Summary for Subcatchment P-2: Flow onsite Southeast

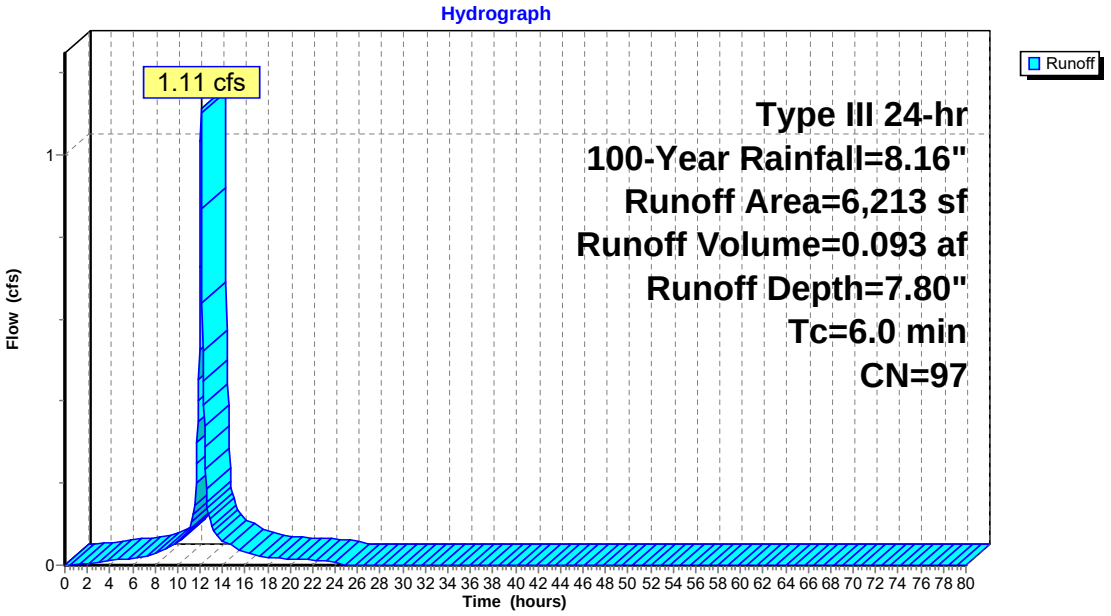
Runoff = 1.11 cfs @ 12.09 hrs, Volume= 0.093 af, Depth= 7.80"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-80.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=8.16"

	Area (sf)	CN	Description
*	5,832	98	Paved parking
	381	79	50-75% Grass cover, Fair, HSG C
	6,213	97	Weighted Average
	381		6.13% Pervious Area
	5,832		93.87% Impervious Area

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

Subcatchment P-2: Flow onsite Southeast



Summary for Subcatchment P-3: Flow off-site West

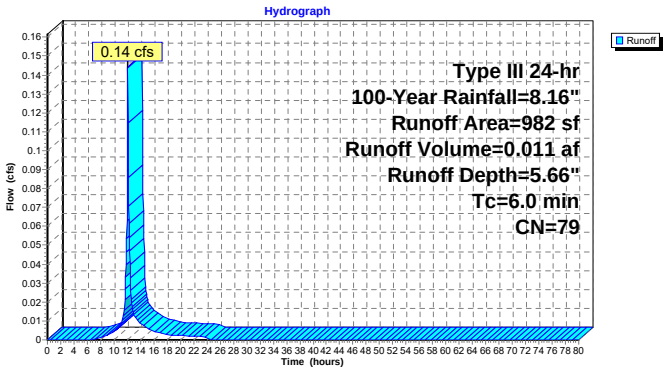
Runoff = 0.14 cfs @ 12.09 hrs, Volume= 0.011 af, Depth= 5.66"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-80.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=8.16"

Area (sf)	CN	Description
10	70	Woods, Good, HSG C
972	79	50-75% Grass cover, Fair, HSG C
982	79	Weighted Average
982		100.00% Pervious Area

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

Subcatchment P-3: Flow off-site West



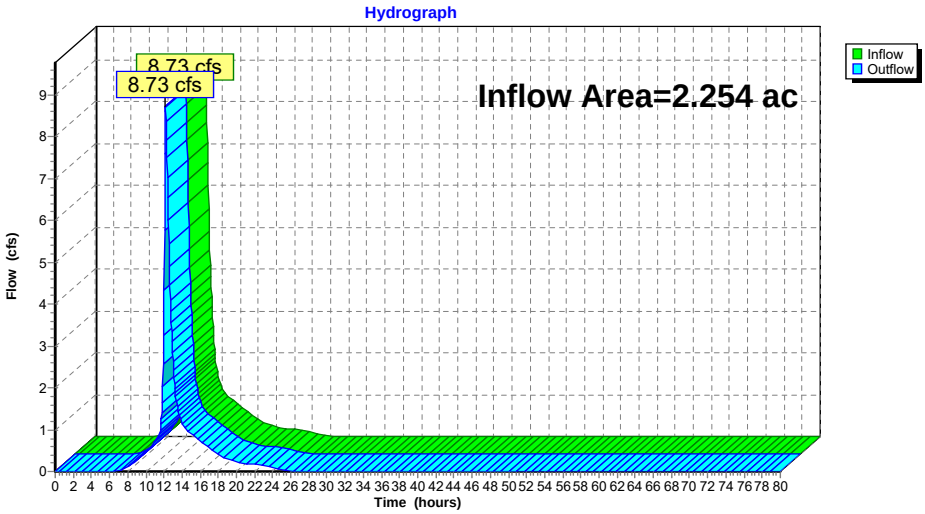
Summary for Reach DP-1: Basin

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

Inflow Area = 2.254 ac, 75.63% Impervious, Inflow Depth = 6.22" for 100-Year event
Inflow = 8.73 cfs @ 12.19 hrs, Volume= 1.169 af
Outflow = 8.73 cfs @ 12.19 hrs, Volume= 1.169 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-80.00 hrs, dt= 0.05 hrs

Reach DP-1: Basin



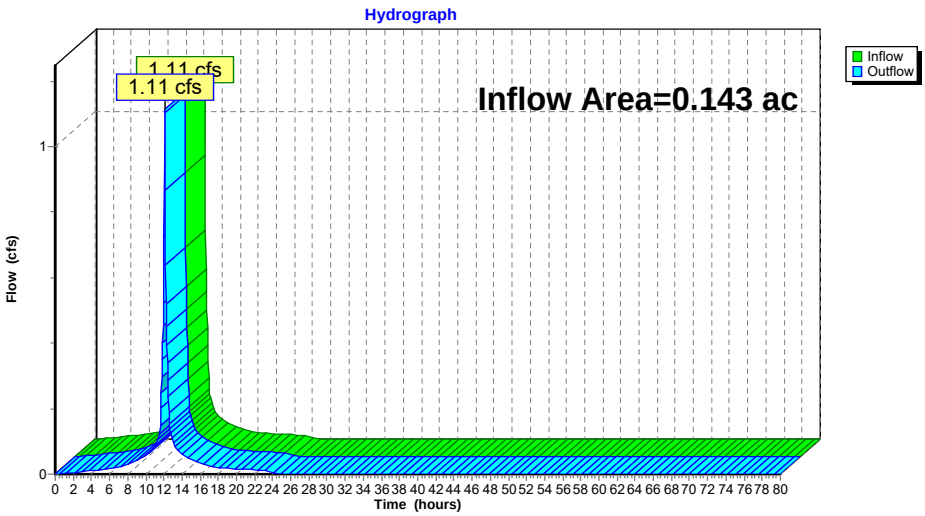
Summary for Reach DP-2: Onsite southeast

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

Inflow Area = 0.143 ac, 93.87% Impervious, Inflow Depth = 7.80" for 100-Year event
Inflow = 1.11 cfs @ 12.09 hrs, Volume= 0.093 af
Outflow = 1.11 cfs @ 12.09 hrs, Volume= 0.093 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-80.00 hrs, dt= 0.05 hrs

Reach DP-2: Onsite southeast



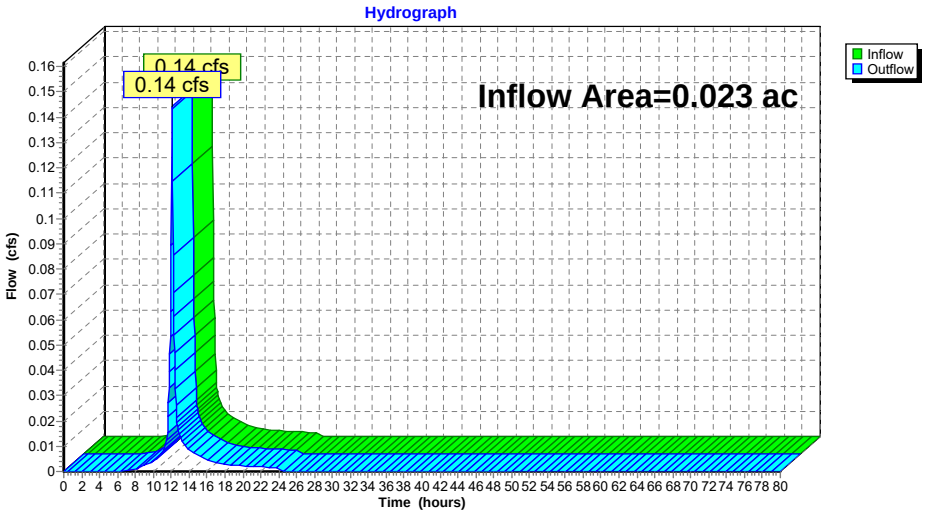
Summary for Reach DP-3: Off-site West

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

Inflow Area = 0.023 ac, 0.00% Impervious, Inflow Depth = 5.66" for 100-Year event
Inflow = 0.14 cfs @ 12.09 hrs, Volume= 0.011 af
Outflow = 0.14 cfs @ 12.09 hrs, Volume= 0.011 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-80.00 hrs, dt= 0.05 hrs

Reach DP-3: Off-site West



Summary for Pond S-1: Rip Rap Swale

Inflow Area = 0.030 ac, 0.00% Impervious, Inflow Depth = 4.84" for 100-Year event
Inflow = 0.17 cfs @ 12.09 hrs, Volume= 0.012 af
Outflow = 0.09 cfs @ 12.25 hrs, Volume= 0.007 af, Atten= 48%, Lag= 9.4 min
Primary = 0.09 cfs @ 12.25 hrs, Volume= 0.007 af

Routing by Stor-Ind method, Time Span= 0.00-80.00 hrs, dt= 0.05 hrs / 6
Peak Elev= 334.07' @ 12.25 hrs Surf.Area= 200 sf Storage= 219 cf

Plug-Flow detention time= 188.5 min calculated for 0.007 af (60% of inflow)
Center-of-Mass det. time= 82.2 min (901.9 - 819.7)

Volume	Invert	Avail.Storage	Storage Description
#1	331.15'	120 cf	**Custom Stage Data (Irregular)** Listed below (Recalc) 414 cf Overall - 114 cf Embedded = 300 cf x 40.0% Voids
#2	332.65'	114 cf	**Custom Stage Data (Irregular)** Listed below (Recalc) Inside #1
		234 cf	Total Available Storage

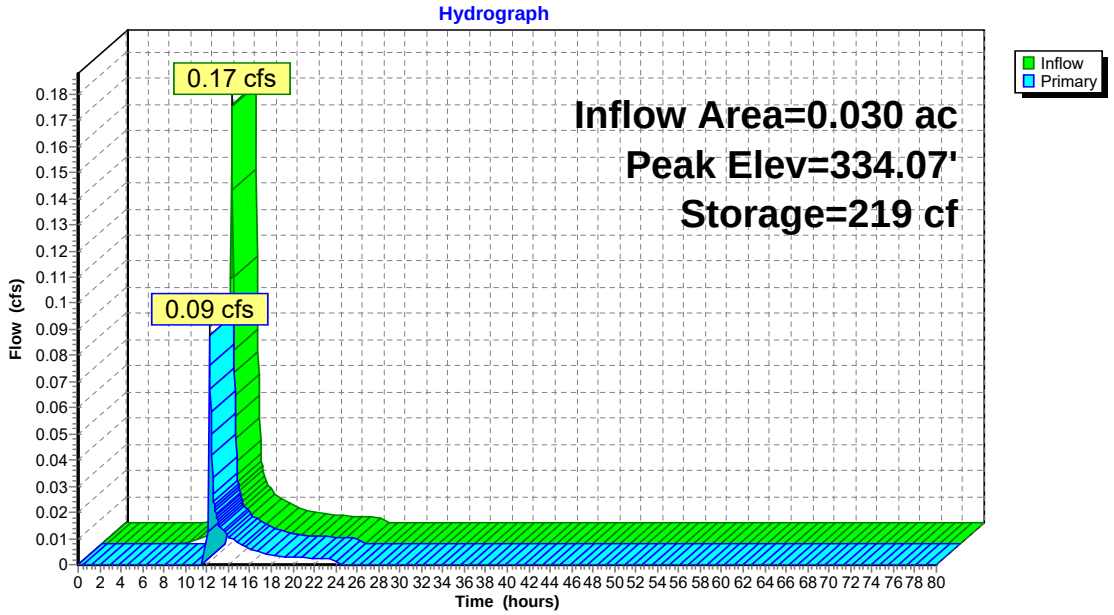
Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
331.15	0	0.0	0	0	0
331.50	21	27.2	2	2	59
332.50	171	99.3	84	86	788
332.65	200	104.4	28	114	872
334.15	200	104.4	300	414	1,028

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
332.65	0	0.0	0	0	0
333.00	21	27.2	2	2	59
334.00	171	99.3	84	86	788
334.15	200	104.4	28	114	872

Device	Routing	Invert	Outlet Devices
#1	Primary	334.05'	**7.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)

Primary OutFlow Max=0.08 cfs @ 12.25 hrs HW=334.07' (Free Discharge)
└**1=Sharp-Crested Rectangular Weir** (Weir Controls 0.08 cfs @ 0.49 fps)

Pond S-1: Rip Rap Swale



Summary for Pond S-2: Rip Rap Swale

Inflow Area = 0.057 ac, 0.00% Impervious, Inflow Depth = 3.93" for 100-Year event
Inflow = 0.18 cfs @ 12.22 hrs, Volume= 0.019 af
Outflow = 0.17 cfs @ 12.23 hrs, Volume= 0.014 af, Atten= 4%, Lag= 0.7 min
Primary = 0.17 cfs @ 12.23 hrs, Volume= 0.014 af

Routing by Stor-Ind method, Time Span= 0.00-80.00 hrs, dt= 0.05 hrs / 6
Peak Elev= 332.54' @ 12.23 hrs Surf.Area= 200 sf Storage= 205 cf

Plug-Flow detention time= 142.4 min calculated for 0.014 af (76% of inflow)
Center-of-Mass det. time= 51.0 min (900.2 - 849.2)

Volume	Invert	Avail.Storage	Storage Description
#1	329.65'	120 cf	**Custom Stage Data (Irregular)** Listed below (Recalc) 407 cf Overall - 107 cf Embedded = 300 cf x 40.0% Voids
#2	331.15'	107 cf	**Custom Stage Data (Irregular)** Listed below (Recalc) Inside #1
		227 cf	Total Available Storage

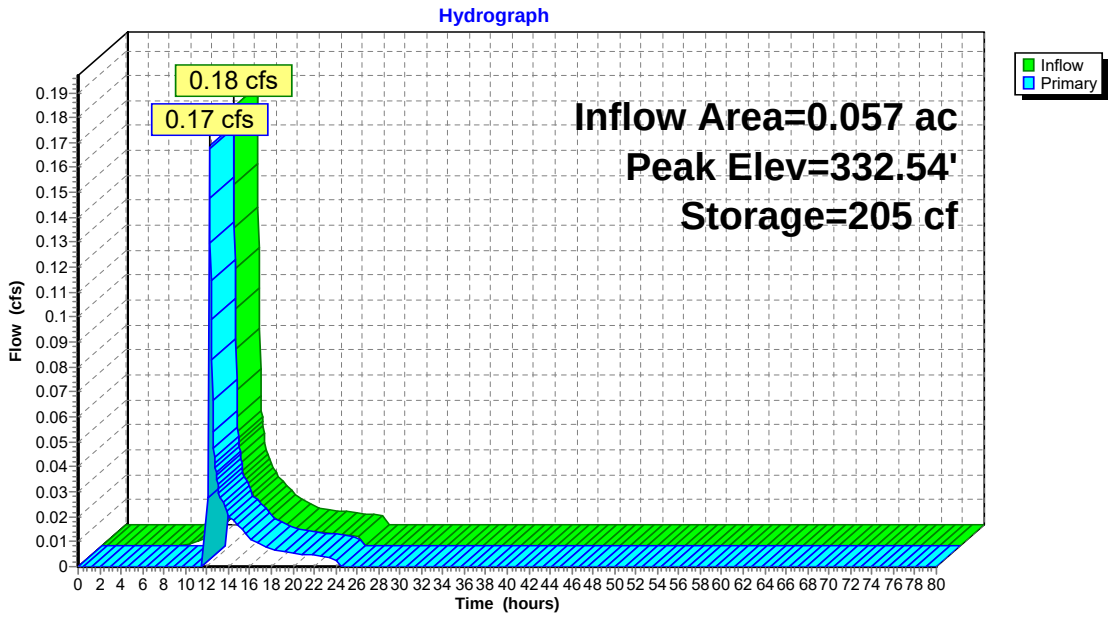
Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
329.65	0	0.0	0	0	0
330.50	74	61.1	21	21	298
331.15	200	104.5	86	107	873
332.65	200	104.5	300	407	1,029

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
331.15	0	0.0	0	0	0
332.00	74	61.1	21	21	298
332.65	200	104.5	86	107	873

Device	Routing	Invert	Outlet Devices
#1	Primary	332.50'	**7.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)

Primary OutFlow Max=0.16 cfs @ 12.23 hrs HW=332.54' (Free Discharge)
1=Sharp-Crested Rectangular Weir (Weir Controls 0.16 cfs @ 0.63 fps)

Pond S-2: Rip Rap Swale



Summary for Pond S-3: Rip Rap Swale

Inflow Area = 0.085 ac, 0.00% Impervious, Inflow Depth = 3.68" for 100-Year event
Inflow = 0.27 cfs @ 12.22 hrs, Volume= 0.026 af
Outflow = 0.25 cfs @ 12.24 hrs, Volume= 0.022 af, Atten= 8%, Lag= 1.0 min
Primary = 0.25 cfs @ 12.24 hrs, Volume= 0.022 af

Routing by Stor-Ind method, Time Span= 0.00-80.00 hrs, dt= 0.05 hrs / 6
Peak Elev= 331.05' @ 12.24 hrs Surf.Area= 200 sf Storage= 203 cf

Plug-Flow detention time= 108.5 min calculated for 0.022 af (83% of inflow)
Center-of-Mass det. time= 35.7 min (896.6 - 860.9)

Volume	Invert	Avail.Storage	Storage Description
#1	329.70'	112 cf	**Custom Stage Data (Irregular)** Listed below (Recalc) Inside #2
#2	328.20'	120 cf	**Custom Stage Data (Irregular)** Listed below (Recalc) 412 cf Overall - 112 cf Embedded = 300 cf x 40.0% Voids
		232 cf	Total Available Storage

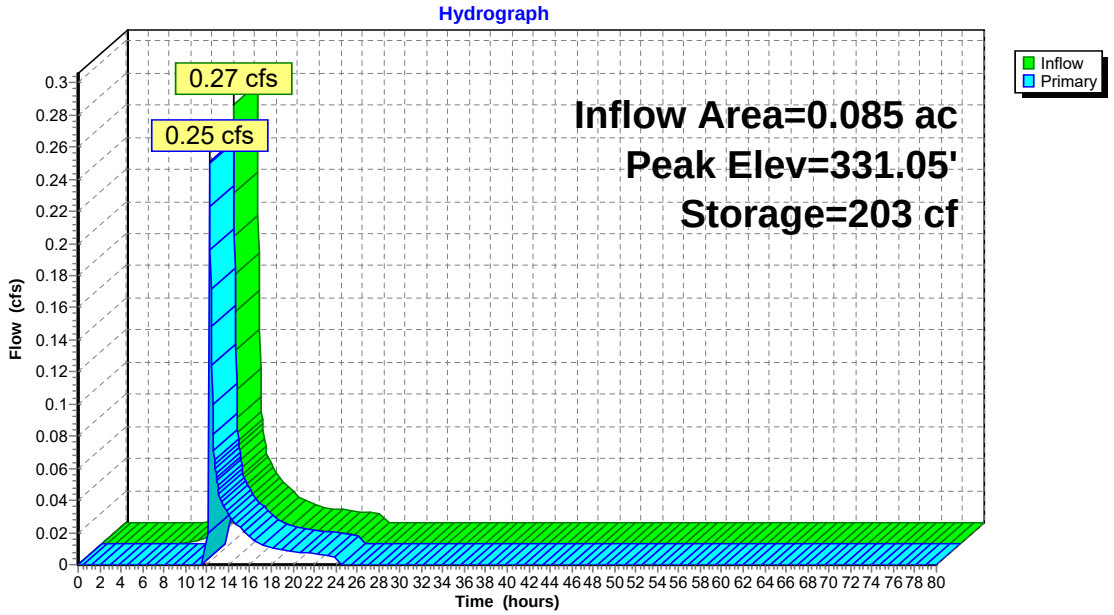
Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
329.70	0	0.0	0	0	0
330.00	16	23.0	2	2	42
331.00	158	95.1	75	76	722
331.20	200	104.5	36	112	873

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
328.20	0	0.0	0	0	0
328.50	16	23.0	2	2	42
329.50	158	95.1	75	76	722
329.70	200	104.5	36	112	873
331.20	200	104.5	300	412	1,030

Device	Routing	Invert	Outlet Devices
#1	Primary	331.00'	**7.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)

Primary OutFlow Max=0.25 cfs @ 12.24 hrs HW=331.05' (Free Discharge)
└**1=Sharp-Crested Rectangular Weir** (Weir Controls 0.25 cfs @ 0.72 fps)

Pond S-3: Rip Rap Swale



Summary for Pond S-4: Rip Rap Swale

Inflow Area = 0.109 ac, 0.00% Impervious, Inflow Depth = 3.51" for 100-Year event
Inflow = 0.34 cfs @ 12.22 hrs, Volume= 0.032 af
Outflow = 0.32 cfs @ 12.23 hrs, Volume= 0.029 af, Atten= 5%, Lag= 0.7 min
Primary = 0.32 cfs @ 12.23 hrs, Volume= 0.029 af

Routing by Stor-Ind method, Time Span= 0.00-80.00 hrs, dt= 0.05 hrs / 6
Peak Elev= 329.31' @ 12.23 hrs Surf.Area= 188 sf Storage= 156 cf

Plug-Flow detention time= 72.3 min calculated for 0.029 af (90% of inflow)
Center-of-Mass det. time= 21.9 min (892.2 - 870.3)

Volume	Invert	Avail.Storage	Storage Description
#1	328.20'	108 cf	**Custom Stage Data (Irregular)** Listed below (Recalc) Inside #2
#2	326.70'	113 cf	**Custom Stage Data (Irregular)** Listed below (Recalc) 390 cf Overall - 108 cf Embedded = 282 cf x 40.0% Voids
		221 cf	Total Available Storage

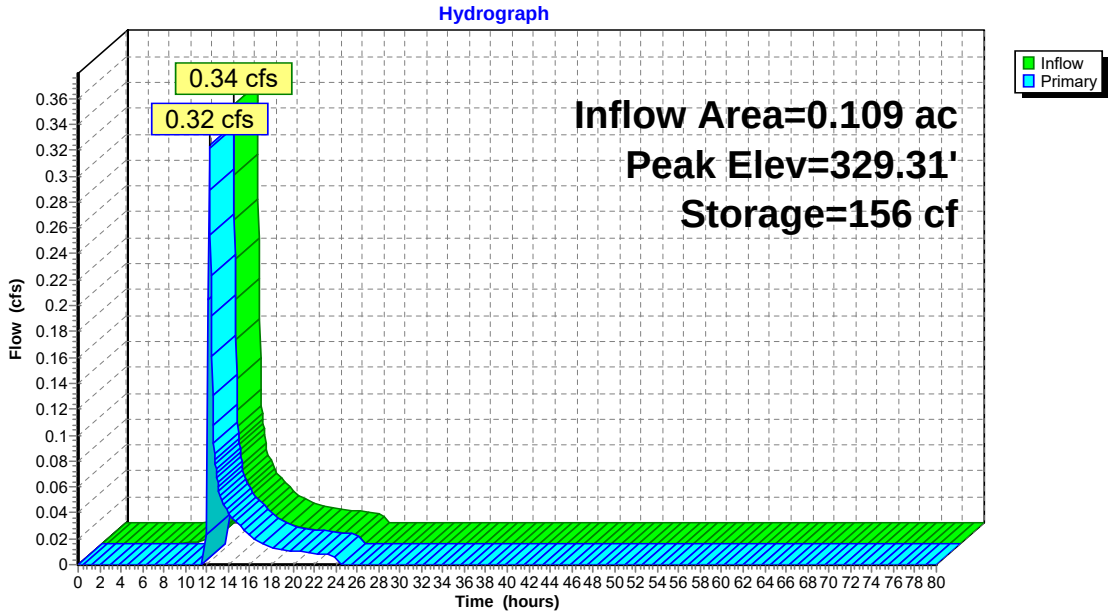
Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
328.20	0	0.0	0	0	0
329.00	71	56.9	19	19	259
329.25	112	76.4	23	42	466
329.70	188	102.0	67	108	832

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
326.70	0	0.0	0	0	0
327.50	71	56.9	19	19	259
327.75	112	76.4	23	42	466
328.20	188	102.0	67	108	832
329.70	188	102.0	282	390	985

Device	Routing	Invert	Outlet Devices
#1	Primary	329.25'	**7.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)

Primary OutFlow Max=0.32 cfs @ 12.23 hrs HW=329.31' (Free Discharge)
└**1=Sharp-Crested Rectangular Weir** (Weir Controls 0.32 cfs @ 0.79 fps)

Pond S-4: Rip Rap Swale



Summary for Pond SSD-1: Subsurface Detention Basin-1

Inflow Area = 1.640 ac, 99.59% Impervious, Inflow Depth = 7.92" for 100-Year event
Inflow = 12.83 cfs @ 12.09 hrs, Volume= 1.082 af
Outflow = 6.21 cfs @ 12.25 hrs, Volume= 1.082 af, Atten= 52%, Lag= 9.6 min
Discarded = 0.12 cfs @ 12.25 hrs, Volume= 0.185 af
Primary = 6.09 cfs @ 12.25 hrs, Volume= 0.897 af

Routing by Stor-Ind method, Time Span= 0.00-80.00 hrs, dt= 0.05 hrs / 6
Peak Elev= 325.16' @ 12.25 hrs Surf.Area= 7,434 sf Storage= 15,127 cf

Plug-Flow detention time= 136.1 min calculated for 1.082 af (100% of inflow)
Center-of-Mass det. time= 136.6 min (877.5 - 741.0)

Volume	Invert	Avail.Storage	Storage Description
#1A	322.00'	6,586 cf	**63.25'W x 117.54'L x 3.50'H Field A** 26,020 cf Overall - 9,556 cf Embedded = 16,464 cf x 40.0% Voids
#2A	322.50'	9,556 cf	**ADS_StormTech SC-740 +Cap** x 208 Inside #1 Effective Size= 44.6"W x 30.0"H => 6.45 sf x 7.12'L = 45.9 cf Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap 208 Chambers in 13 Rows
		16,141 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	322.50'	**15.0" Round Culvert** L= 21.3' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 322.50' / 322.00' S= 0.0235 '/' Cc= 0.900 n= 0.013, Flow Area= 1.23 sf
#2	Device 1	325.25'	**4.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)
#3	Device 1	324.25'	**6.0" Vert. Orifice/Grate** C= 0.600
#4	Device 1	323.50'	**8.0" Vert. Orifice/Grate X 2.00** C= 0.600
#5	Device 1	322.55'	**6.0" Vert. Orifice/Grate** C= 0.600
#6	Discarded	322.00'	**0.270 in/hr Exfiltration over Surface area** Conductivity to Groundwater Elevation = 320.00'

Discarded OutFlow Max=0.12 cfs @ 12.25 hrs HW=325.16' (Free Discharge)
└**6=Exfiltration** (Controls 0.12 cfs)

Primary OutFlow Max=6.09 cfs @ 12.25 hrs HW=325.16' (Free Discharge)
└**1=Culvert** (Passes 6.09 cfs of 8.42 cfs potential flow)
  ├**2=Sharp-Crested Rectangular Weir** (Controls 0.00 cfs)
  ├**3=Orifice/Grate** (Orifice Controls 0.77 cfs @ 3.90 fps)
  ├**4=Orifice/Grate** (Orifice Controls 3.87 cfs @ 5.54 fps)
  └**5=Orifice/Grate** (Orifice Controls 1.45 cfs @ 7.39 fps)

Pond SSD-1: Subsurface Detention Basin-1 - Chamber Wizard Field A

Chamber Model = ADS_StormTech SC-740 +Cap (ADS StormTech® SC-740 with cap length)
Effective Size= 44.6"W x 30.0"H => 6.45 sf x 7.12'L = 45.9 cf
Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap

51.0" Wide + 6.0" Spacing = 57.0" C-C Row Spacing

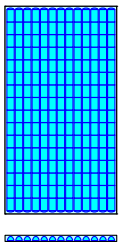
16 Chambers/Row x 7.12' Long +0.81' Cap Length x 2 = 115.54' Row Length +12.0" End Stone x 2 = 117.54' Base Length
13 Rows x 51.0" Wide + 6.0" Spacing x 12 + 12.0" Side Stone x 2 = 63.25' Base Width
6.0" Base + 30.0" Chamber Height + 6.0" Cover = 3.50' Field Height

208 Chambers x 45.9 cf = 9,555.5 cf Chamber Storage

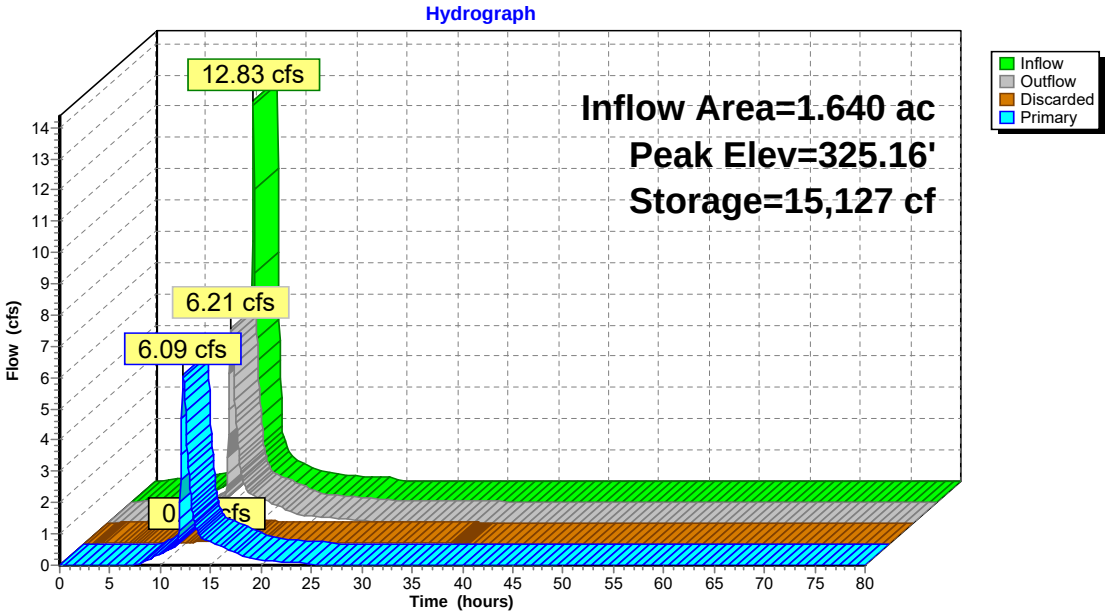
26,019.7 cf Field - 9,555.5 cf Chambers = 16,464.2 cf Stone x 40.0% Voids = 6,585.7 cf Stone Storage

Chamber Storage + Stone Storage = 16,141.2 cf = 0.371 af
Overall Storage Efficiency = 62.0%
Overall System Size = 117.54' x 63.25' x 3.50'

208 Chambers
963.7 cy Field
609.8 cy Stone



Pond SSD-1: Subsurface Detention Basin-1



LEVEL
DESIGN GROUP

Operation and Maintenance Plan

249 SOUTH STREET UNIT 1 PLAINVILLE MA 02762
TEL508 695 2221 FAX508 695 2219 CONTACT@LEVELDG.COM LEVELDG.COM

OPERATION AND MAINTENANCE PLAN

FOR

15 LIBERTY WAY

FRANKLIN, MA

DATED: JANUARY 17, 2023

REVISED: OCTOBER 17, 2023

Prepared By:

Level Design Group, L.L.C.

249 South Street, Unit 1

Plainville, MA 02762

Prepared For:

Oliver Street Capital

125 High Street, Suite 220

Boston, MA 02110

LDG Project No.:

2081.00

249 SOUTH STREET UNIT 1 PLAINVILLE MA 02762

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The proposed Stormwater Management System is designed to function properly provided that routine maintenance is performed. It is the responsibility during construction and until purchase of the units and turnover of the project to a Home Owners Association to be formed, that the Owner and Developer, Oliver Street Capital, shall be responsible for the long-term maintenance and to provide the required maintenance outlined in this plan for the site infiltration systems as well as the remainder of the on-site storm drainage system.

Upon completion of construction and the formation of the Home Owners Association, maintenance of driveways and the stormwater appurtenances required to ensure that sedimentation and pollution is controlled and that storm water detention and infiltration capacity is sustained are the on-going responsibility of the Home Owners Association. To ensure the proper functioning of these facilities the following maintenance practices will be used:

DRIVEWAYS AND PARKING AREAS

Spring Maintenance
Driveways and Parking Areas are to be swept monthly to remove sand which has accumulated. Sand shall be removed from the site and legally disposed of.

Summer & Fall Maintenance
Leaves and debris which accumulates within the Driveways and Parking Areas during the summer and fall shall be collected and legally disposed of.

Winter Maintenance & Snow Removal
Snow removal within Driveways and Parking Area shall be stockpiled in the designated Snow Stockpile Areas outside of the traveled driveways. These areas should be located within or adjacent to the parking surface and should drain to the stormwater management system. Under no circumstances shall snow be directed onto abutting parcels or into the on-site resource areas (wetlands, wetland buffer zone, and riverfront areas).

Estimated Yearly Cost $1,000.00 (not including cost for snow plowing)

DEEP SUMP CATCH BASINS

Catch basins shall be inspected and cleaned four times per year or when the sumps are 50% full.

Spring Maintenance
Catch basins require the removal of sediment each spring. This procedure is comprised of removing the catch basin grate followed by removal of sediment trapped in the structure with a clamshell shovel. The outlet pipe from the catch basin shall be inspected and any obstructions are to be removed. The sediment and debris removed from the catch basin shall be legally disposed of.

Fall Maintenance
Catch basin grates shall be cleared of leaves and debris so they may function properly.

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Estimated Yearly Cost $2,000.00

SUBSURFACE INFILTRATION BASIN

Spring Maintenance
The subsurface detention basin requires monthly inspections for accumulations of settled solids. If these materials have accumulated to a point where removal is necessary this shall be completed immediately. Accumulated trash and debris shall also be removed and legally disposed of during the monthly inspections.

Estimated Yearly Cost $500.00

PUBLIC SAFETY FEATURES

Many of the Public Safety Features of the Stormwater Management System are incorporated into its design. The Infiltration basin was designed to minimize its depth to 2-feet deep. This combined with sediment forebay being approximately 1-foot deep provide for a safe and effective system.

Despite all the well-designed safety features within the Stormwater Management System all components of the system must be properly maintained to be effective. All maintenance procedures detailed above must be done on schedule and documented. Standing or stagnant water provides mosquito-breeding habitat and increases the potential for disease transmission. The basin is designed to fully infiltrate within 72 hours after a storm even which will prevent standing water from becoming a safety hazard. Routine monitoring for and management of mosquito-breeding conditions by qualified maintenance staff is required during the peak breading season between April and September ensure that unforeseen conditions do not develop.

While risks can be mitigated through proper design and maintenance, it is impossible to entirely eliminate risk. Therefore, education regarding stormwater management facilities and their inherent risks is valuable and should be a part of every community's activity. Employees and tenants of the Facility shall be given an overview of the Stormwater System and which areas to avoid. Public participation also increases the level of maintenance as community members can notify staff if a component of the stormwater system is not functioning properly.

The O&M shall be recorded with the Home Owners Agreement or other approving maintenance agreement to properly notify future owners of maintenance requirements.

LEVEL
DESIGN GROUP

STORMWATER MANAGEMENT OPREATOIN AND MAINTENANCE LOG

It is the responsibility of the owner and developer, Oliver Street Capital, to provide the maintenance of the Stormwater Management System Maintenance in accordance with the Town of Franklin Stormwater Management Standards until such time as an entity is created for overall site management at which time the agreement will spell out responsibility with appropriate contact information for all parties. The log form below is a template and shall be reproduced as needed. Copies of all log forms shall be kept on file for a minimum of three years from the date of inspection.

Name of Inspector:
Date and Time of Inspection:
Weather Conditions:

Stormwater BMP	Observations	Action Required

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Long Term Pollution Prevention Plan

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LONG TERM POLLUTION PREVENTION PLAN

FOR

15 LIBERTY WAY

FRANKLIN, MA

DATED: JANUARY 13, 2023

Prepared By:

Level Design Group, L.L.C.
249 South Street, Unit 1
Plainville, MA 02762

Prepared For:

Oliver Street Capital
125 High Street, Suite 220
Boston, MA 02110

LDG Project No.:
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GOOD HOUSEKEEPING PRACTICES

It is the responsibility of the developer, Oliver Street Capital, to provide for maintenance of the parking areas and the storm drainage system until the site is turned over to the condominium association which will be created prior to the sale of any units. The Owner shall utilize good housekeeping practices as outlined in the Operation and Maintenance Plan required for the maintenance of the Stormwater Management System.

PROVISIONS FOR STORAGE OF MATERIALS AND WASTE PRODUCTS INSIDE OR UNDER COVER

The storage of hazardous materials and waste is prohibited from being stored outdoor at the site. Any hazardous materials shall be stored under cover.

VEHICLE WASHING CONTROLS

Outdoor vehicle washing is allowed only for occupants of the condominium development for non-commercial vehicles owned by the residents of the units. No commercial vehicle washing operations is allowed in this area.

REQUIREMENTS FOR ROUTINE INSPECTION AND MAINTENANCE OF STORMWATER BMPS

The Owner / Operator shall keep a Maintenance Log Sheets of scheduled tasks outlined Operation and Maintenance Plan.

SPILL PREVENTION AND RESPONSE PLANS

The risk of significant spills requiring action at this site is limited and will most likely be associated with motor vehicle use or maintenance. In the event of a significant spill contact:

> Massachusetts Department of Environmental Protection 24-hour emergency response notification line – (888) 304-1133

PROVISIONS FOR MAINTENANCE OF LAWNS, GARDENS, AND OTHER LANDSCAPED AREAS

The use of chemical fertilizers shall not be used on-site. If chemical fertilizers are required to be used, the fertilizers must be worked into the soil to prevent washouts and stormwater contamination of fertilizers.

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REQUIREMENTS FOR STORAGE AND USE OF FERTILIZERS, HERBICIDES, AND PESTICIDES

If fertilizers, herbicides, and pesticides are to be used and stored on site they are to be stored in their original containers and keep in a dry, safe area where children do not have access to.

PROVISIONS SOLID WASTE MANAGEMENT

Solid waste and recycling is to be disposed in designated areas in enclosed dumpsters and receptacles with covers and hauled by private certified waste management service operators. Solid waste management systems shall be inspected and maintained in accordance with state, local, and federal solid waste management regulations.

EMERGENCY AND REGULATORY CONTACTS

Franklin Fire Department:	911 / (508) 528-2323
Franklin Police Department:	911 / (508) 528-1212
Massachusetts Department of Environmental Protection – Central Regional Office:	(508) 792-7650
United State Environmental Protection Agency:	(617) 918-1111

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NPDES Stormwater Pollution Prevention Plan
(DRAFT – Under separate cover)

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