



**Stormwater Report
For
Herring Brook Solar Project
Pembroke, Massachusetts**

**Prepared for:
Centrica Business Solutions
7484 Candlewood Road, Suite T-W
Hanover, MD 21076**

Prepared by:
Atlantic Design Engineers, Inc.
P.O. Box 1051
Sandwich, Massachusetts 02563



May 31, 2019
Atlantic Project No. 3086.00



*Stormwater Report
Herring Brook Solar Project
Pembroke, Massachusetts
May 31, 2019*

TABLE OF CONTENTS

- 1.0 Introduction
- 2.0 Proposed Stormwater Management System
- 3.0 Compliance with Stormwater Management Standards

APPENDICES

- A. MassDEP Checklist for Stormwater Report
- B. Pre- and Post-Development HydroCAD Stormwater Analysis
- C. Miscellaneous Calculations
- D. Pre- and Post-Development Watershed Plans
- E. Long Term Stormwater Operation and Maintenance Plan
- F. NRCS Soil Survey Maps and Soil Group Descriptions



TABLE OF CONTENTS

- 1.0 Introduction
- 2.0 Proposed Stormwater Management System
- 3.0 Compliance with Stormwater Management Standards

APPENDICES

- A. MassDEP Checklist for Stormwater Report
- B. Pre- and Post-Development HydroCAD Stormwater Analysis
- C. Miscellaneous Calculations
- D. Pre- and Post-Development Watershed Plans
- E. Long Term Stormwater Operation and Maintenance Plan
- F. NRCS Soil Survey Maps and Soil Group Descriptions

1.0 INTRODUCTION

This report analyzes the hydrological impacts of the Herring Brook Solar Project, a proposed ground-mounted, solar photovoltaic solar array located on the ±45.3-acre property located at 0 Hobomock Street in Pembroke, Massachusetts (the “Site”) (Map D6, Lot 1).

The site is a previously developed, partially wooded property consisting of an abandoned gravel pit, an abandoned cranberry bog, a manmade irrigation pond, dirt roads/paths and wooded areas surrounding on-site wetlands, ponds and streams. A 150’ wide utility easement with overhead utility lines and poles runs through the middle of the site. Glover Mill Pond, Herring Brook Pond and Herring Brook are located on the western and northwest portions of the property.

The site lies primarily within the Residence A Zoning District and does not fall within any DEP mapped surface or groundwater protection areas, or Town designated Aquifer Protection or Watershed Protection Overlay Districts. The site is partially located within a FEMA Flood Zone AE with elevations ranging from 53 to 49 on the northwest portion of the site, based upon the FEMA Floodway study of Herring Brook. The site is not within an Estimated Habitat of Rare Wildlife or Priority Habitat of Rare Species, as mapped by the Natural Heritage and Endangered Species Program (NHESP). In addition, the site is not located within any Area of Critical Environmental Concern (ACEC).

The site has bordering vegetated wetlands (BVW) systems located throughout the northern, eastern and western portions of the site, associated with USGS mapped streams and ponds. In addition, there are two perennial streams (Herring Brook and an un-named stream) along the northwest and eastern portions of the site as well as Glover Mill Pond, Herring Brook Pond and an un-named pond (drainage easement) on the western edge of the site.

Topography in the center of the site, where development is proposed, is flat, pitching very slightly toward the wetland systems to the east, north and west. Steep banks exist along the edges of the wetlands, separated from the flat area of the site by earthen berms and/or ditches. Vegetation is thickly forested in and immediately adjacent to the wetland areas but the remaining area of the site consists of brush and sparse, scattered scrub shrub and low growth trees, all overgrown from the abandoned bog and gravel pit operations.

The proposed ±44.5-acre solar development project is comprised of two solar arrays separated on the site by the existing 150’ wide utility easement. The arrays consist of perimeter fencing, photovoltaic solar panels, racking systems, inverters and transformers with accommodating concrete pads, above and below ground utilities, and a gravel road to access to the solar fields. Presently the areas selected for the ground-mounted solar arrays are flat, vacant, and open, with scattered shrubs, low growth trees and brush. Starting at Hobomock Street, just west of the existing Hobomock Arena parking area, a gravel access drive will be extended approximately 1,500 feet up to and into the solar fields where it will connect with the existing dirt vehicle path system located within the project site. The initial 80 feet of the access drive will be 20 feet wide and will be paved to meet utility company standards. Beyond that, it will reduce to 12’ wide gravel up to and throughout the site, with turnarounds provided for maintenance and emergency vehicles.

All work has been kept out of the limits of the Flood Zone AE (Bordering Land Subject to Flooding) so there will be no impacts on the ability of these lands to store/channel the 100-year flood as calculated by FEMA.

2.0 PROPOSED STORMWATER MANAGEMENT SYSTEM

The Stormwater system for the project has been evaluated and designed based upon DEP Wetland Program Policy 17.1: Photovoltaic System Solar Array Review, as well as the DEP Stormwater Policy of encouraging environmentally-sensitive design with minimal point source discharges.

Grading proposed for the solar development will be limited to the initial 450 feet of proposed access road at the entrance to the site. This section of the access road will be graded in such a way that stormwater runoff from the paved portion of the road will be directed to a series of stormwater Best Management Practices (BMPs), including a grassed swale, forebay, and an infiltration basin. These BMP's will prevent direct discharge of untreated stormwater to the wetlands areas at the front of the Site.

The remaining gravel access road and the main area of development (the 2 solar arrays), will not require any grading and will be constructed over the existing topography in the sparsely vegetated, flat areas of the abandoned gravel pit and bog. Therefore, the proposed work beyond the initial 450 feet of access road will not modify stormwater flow patterns or existing watersheds. The topography and existing drainage ditches/culverts associated with the abandoned bog that are within the proposed solar arrays, will not be revised, regraded, or modified and therefore pre and post-development watershed boundaries are the same. In addition, since the solar arrays are proposed entirely within the presently cleared, sparsely vegetated areas of the site, there will be no increase in runoff from this area as a result of the arrays being vegetated with a meadow style seed mix, the same as what presently exists on the site. There are small areas of gravel access roads and concrete equipment pads, but based on the results of the calculations provided in Appendix C, these de minimis areas have no affect on the ground cover CN Value of the 13 acre watershed. Therefore, there will be no increase in runoff rates after development and, as a result, typical stormwater basins to attenuate peak rate increases are not required for the area of the arrays. Stormwater measures for the area of the arrays will therefore be limited to a rain garden with forebay at the entrance to provide the recharge and water quality volumes required by the DEP for the minimal new impervious area on the project site.

3.0 COMPLIANCE WITH DEP STORMWATER MANAGEMENT STANDARDS

Standard 1: No New Untreated Discharges

There are no new impervious surfaces proposed as part of the solar arrays that will generate suspended solids or other measurable stormwater contaminants. The only measurable impervious surface in the arrays is the concrete electrical equipment pads and those will be limited to foot

traffic only. All access roads in the arrays will be gravel which, DEP Program Policy 17.1 does not consider impervious and the area under the arrays will be comprised of meadow-style grasses. Therefore, there will be no untreated discharge and it is our opinion that Standard 1 has been met.

In regard to the paved portion of the access road at the entrance to the site off of Hobomock Street, runoff from this paved surface will be treated with a series of BMP's, including a grassed swale, forebay and Infiltration Basin. Therefore, it is our opinion that Standard 1 has been met.

Standard 2: Peak Rate Attenuation

In regard to the initial 450 feet of access road, where limited pavement and grading is proposed, a Design Point (DP-1) was determined from existing contours and runoff patterns in the area. DP-1 was evaluated to demonstrate that the proposed BMPs are appropriately sized and provide peak rate attenuation. Pre- and Post-Development stormwater calculations were performed for the 2, 10, 25 and 100-year, Type III storm events. A comparison of the Pre- vs. Post-Development peak runoff rates for each storm event at the Design Point is summarized in the table below:

<i>Design Point #1 – Glover Mill Pond</i>		
<i>Storm Event</i>	<i>Pre-Development</i>	<i>Post-Development</i>
2-year	6.45 cfs	5.87 cfs
10-year	15.05 cfs	14.10 cfs
25-year	21.11 cfs	19.94 cfs
100-year	30.95 cfs	29.60 cfs

As shown in the table, the peak rates for stormwater runoff generated under Post Development condition will be equal to or less than the peak rates generated under Pre-Development conditions for the all storm events. In addition, the attached HydroCAD analysis demonstrates that the proposed rain garden is sized adequately for each storm event.

For the remaining 4 design points there will be no increase in runoff from as a result of the arrays being vegetated. A meadow style seed mix will be used in an effort to enhance the existing degraded buffer zone/riverfront area, however for the purposes of stormwater calculations a grass cover was modeled. There are small areas of gravel access roads and concrete equipment pads, but based on the results of the calculations provided in Appendix C, these de minimis areas have no affect on the ground cover CN Value of the 13 acre watershed. Therefore, there will be no increase in runoff rates after development and, as a result, typical stormwater basins to attenuate peak rate increases are not required for the area of the arrays.

Complete runoff calculations for the 2, 10, 25 and 100-year Type III storm events including ground cover, soils types and times of concentration paths for the Pre-Development conditions and Post-Development conditions are provided in Appendix B.

Standard 3: Groundwater Recharge

Based upon a review of the Web Soil Survey, soils within the proposed development area have been identified as Udorthents (8 to 15 percent slopes, gravelly), Plymouth Carver Complex (15 to 35 percent slopes) and Swansea muck (0 to 1 percent slopes). Hydrologic Soil Groups B, A, B. The groundwater recharge volume required for the proposed impervious surfaces is calculated by the following formula:

$$R_v = (F)(A_{IMP})$$

R_v = Required Recharge Volume

F = Target Depth Factor: 0.60 inch

A_{IMP} = Proposed Impervious Area

(A Target Depth Factor of 0.6 has been applied over the entire site as a conservative approach)

The only measurable impervious surface on the site is the concrete electrical equipment pads and the initial 80 feet of pavement proposed at the access road near Hobomock Street (2,914 SF total). The calculations in Appendix C show that the BMP recharge volumes provided of 758 CF exceeds the required recharge volume of 146 CF. As a result, it is our opinion that Standard 3 has been met.

Standard 4: Water Quality

In regard to the solar arrays, there are no new impervious surfaces proposed as part of the solar project that will generate suspended solids or other measurable stormwater contaminants. The only measurable impervious surface on the site is the concrete electrical equipment pads (960 SF) and those will be limited to foot traffic only. All access roads in the arrays will be gravel, which DEP Program Policy 17.1 does not consider impervious, and the area under the arrays will be comprised of meadow-style grasses. Therefore, it is our opinion that Standard 4 has been met without the need for water quality BMP's for the area of the solar arrays.

In regard to the initial 80 feet of access road to be paved (1,954 SF), the required Water Quality volume for this area has been calculated based upon the first 1" of runoff from the impervious surfaces because the proposed work does not discharge to areas which are classified as "Critical Areas" under the Stormwater Management Standards.

A sediment forebay has been sized to provide Water Quality Volume for 2,914 SF (1,954SF of impervious/paved roadway at the entrance to the site plus 960 SF of equipment pads). The required Water Quality Volume is as follows:

$$V_{WQ} = (1 \text{ in}/12 \text{ in}/\text{ft}) * (2,914 \text{ SF})$$

$$V_{WQ} = 243 \text{ CF}$$

The required Water Quality Volume is provided within the sediment forebay, which has a volume of 425 cf (see calculations in Appendix C). Additionally, per the calculations in Appendix C, 90% of the Total Suspended Solids will be removed prior to discharge. As a result, it is our opinion that Standard 4 has been met.

Standard 5: Land Uses with Higher Pollutant Loads (LUHPPLs)

The proposed development is not a LUHPPL and therefore Standard 5 is not applicable.

Standard 6: Critical Areas

The project does not have any discharges within a Zone II, Interim Wellhead Protection Areas or near or to any Critical Areas as defined by the Massachusetts Stormwater Handbook. Therefore, it is our opinion that Standard 6 is not applicable.

Standard 7: Redevelopment Projects

The proposed project is not a redevelopment project and therefore Standard 7 is not applicable.

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

Construction Period Erosion and Sedimentation Control notes are provided on the Site plans along with notes/instructions for the contractor and details/location of all erosion control measures. The project will be covered under a NPDES CGP and a SWPPP will be submitted before land disturbance begins.

Standard 9: Long Term Operation and Maintenance Plan

A Long Term Pollution Prevention and Stormwater Operation and Maintenance Plan is provided in Appendix E.

Standard 10: Prohibition of Illicit Discharges

To our knowledge, there are no existing illicit discharges to existing stormwater systems on the Site and measures to prevent illicit discharges from the proposed development to proposed stormwater systems on the Site is included within the Long Term Pollution Prevention Plan. As required, the Illicit Discharge Compliance Statement will be signed by the Responsible Party prior to the start of construction.

APPENDIX A

MassDEP Checklist for Stormwater Report



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 8²
- Operation and Maintenance Plan required by Standard 9

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

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

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

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

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



Checklist for Stormwater Report

B. Stormwater Checklist and Certification

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

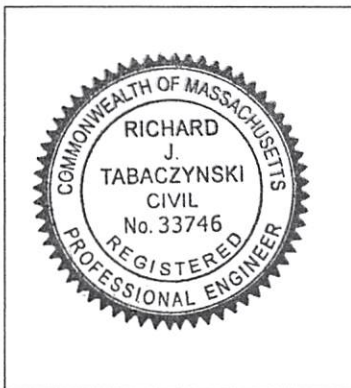
Note: Because stormwater requirements vary from project to project, it is possible that a complete Stormwater Report may not include information on some of the subjects specified in the Checklist. If it is determined that a specific item does not apply to the project under review, please note that the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

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

Registered Professional Engineer's Certification

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

Registered Professional Engineer Block and Signature



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): Forebay for pretreatment

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 Field¹
- ☒ Runoff from all impervious areas at the site discharging to the infiltration BMP.
- ☐ Runoff from all impervious areas at the site is *not* discharging to the infiltration BMP and calculations are provided showing that the drainage area contributing runoff to the infiltration BMPs is sufficient to generate the required recharge volume.
- ☒ Recharge BMPs have been sized to infiltrate the Required Recharge Volume.
- ☐ Recharge BMPs have been sized to infiltrate the Required Recharge Volume *only* to the maximum extent practicable for the following reason:
 - ☐ Site is comprised solely of C and D soils and/or bedrock at the land surface
 - ☐ M.G.L. c. 21E sites pursuant to 310 CMR 40.0000
 - ☐ Solid Waste Landfill pursuant to 310 CMR 19.000
 - ☐ Project is otherwise subject to Stormwater Management Standards only to the maximum extent practicable.
- ☒ Calculations showing that the infiltration BMPs will drain in 72 hours are provided.
- ☐ Property includes a M.G.L. c. 21E site or a solid waste landfill and a mounding analysis is included.

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



Checklist for Stormwater Report

Checklist (continued)

Standard 3: Recharge (continued)

- ☐ The infiltration BMP is used to attenuate peak flows during storms greater than or equal to the 10-year 24-hour storm and separation to seasonal high groundwater is less than 4 feet and a mounding analysis is provided.
- ☐ Documentation is provided showing that infiltration BMPs do not adversely impact nearby wetland resource areas.

Standard 4: Water Quality

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

- Good housekeeping practices;
 - Provisions for storing materials and waste products inside or under cover;
 - Vehicle washing controls;
 - Requirements for routine inspections and maintenance of stormwater BMPs;
 - Spill prevention and response plans;
 - Provisions for maintenance of lawns, gardens, and other landscaped areas;
 - Requirements for storage and use of fertilizers, herbicides, and pesticides;
 - Pet waste management provisions;
 - Provisions for operation and management of septic systems;
 - Provisions for solid waste management;
 - Snow disposal and plowing plans relative to Wetland Resource Areas;
 - Winter Road Salt and/or Sand Use and Storage restrictions;
 - Street sweeping schedules;
 - Provisions for prevention of illicit discharges to the stormwater management system;
 - Documentation that Stormwater BMPs are designed to provide for shutdown and containment in the event of a spill or discharges to or near critical areas or from LUHPPL;
 - Training for staff or personnel involved with implementing Long-Term Pollution Prevention Plan;
 - List of Emergency contacts for implementing Long-Term Pollution Prevention Plan.
- ☒ A Long-Term Pollution Prevention Plan is attached to Stormwater Report and is included as an attachment to the Wetlands Notice of Intent.
 - ☐ Treatment BMPs subject to the 44% TSS removal pretreatment requirement and the one inch rule for calculating the water quality volume are included, and discharge:
 - ☐ is within the Zone II or Interim Wellhead Protection Area
 - ☐ is near or to other critical areas
 - ☐ is within soils with a rapid infiltration rate (greater than 2.4 inches per hour)
 - ☐ involves runoff from land uses with higher potential pollutant loads.
 - ☐ The Required Water Quality Volume is reduced through use of the LID site Design Credits.
 - ☒ Calculations documenting that the treatment train meets the 80% TSS removal requirement and, if applicable, the 44% TSS removal pretreatment requirement, are provided.



Checklist for Stormwater Report

Checklist (continued)

Standard 4: Water Quality (continued)

- ☒ The BMP is sized (and calculations provided) based on:
 - ☒ The ½" or 1" Water Quality Volume or
 - ☐ The equivalent flow rate associated with the Water Quality Volume and documentation is provided showing that the BMP treats the required water quality volume.
- ☐ The applicant proposes to use proprietary BMPs, and documentation supporting use of proprietary BMP and proposed TSS removal rate is provided. This documentation may be in the form of the propriety BMP checklist found in Volume 2, Chapter 4 of the Massachusetts Stormwater Handbook and submitting copies of the TARP Report, STEP Report, and/or other third party studies verifying performance of the proprietary BMPs.
- ☐ A TMDL exists that indicates a need to reduce pollutants other than TSS and documentation showing that the BMPs selected are consistent with the TMDL is provided.

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

- ☐ The NPDES Multi-Sector General Permit covers the land use and the Stormwater Pollution Prevention Plan (SWPPP) has been included with the Stormwater Report.
- ☐ The NPDES Multi-Sector General Permit covers the land use and the SWPPP will be submitted **prior to** the discharge of stormwater to the post-construction stormwater BMPs.
- ☐ The NPDES Multi-Sector General Permit does **not** cover the land use.
- ☐ LUHPPLs are located at the site and industry specific source control and pollution prevention measures have been proposed to reduce or eliminate the exposure of LUHPPLs to rain, snow, snow melt and runoff, and been included in the long term Pollution Prevention Plan.
- ☐ All exposure has been eliminated.
- ☐ All exposure has **not** been eliminated and all BMPs selected are on MassDEP LUHPPL list.
- ☐ The LUHPPL has the potential to generate runoff with moderate to higher concentrations of oil and grease (e.g. all parking lots with >1000 vehicle trips per day) and the treatment train includes an oil grit separator, a filtering bioretention area, a sand filter or equivalent.

Standard 6: Critical Areas

- ☐ The discharge is near or to a critical area and the treatment train includes only BMPs that MassDEP has approved for stormwater discharges to or near that particular class of critical area.
- ☐ Critical areas and BMPs are identified in the Stormwater Report.



Checklist for Stormwater Report

Checklist (continued)

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

- ☐ The project is subject to the Stormwater Management Standards only to the maximum Extent Practicable as a:
 - ☐ Limited Project
 - ☐ Small Residential Projects: 5-9 single family houses or 5-9 units in a multi-family development provided there is no discharge that may potentially affect a critical area.
 - ☐ Small Residential Projects: 2-4 single family houses or 2-4 units in a multi-family development with a discharge to a critical area
 - ☐ Marina and/or boatyard provided the hull painting, service and maintenance areas are protected from exposure to rain, snow, snow melt and runoff
 - ☐ Bike Path and/or Foot Path
 - ☐ Redevelopment Project
 - ☐ Redevelopment portion of mix of new and redevelopment.
- ☐ Certain standards are not fully met (Standard No. 1, 8, 9, and 10 must always be fully met) and an explanation of why these standards are not met is contained in the Stormwater Report.
- ☐ The project involves redevelopment and a description of all measures that have been taken to improve existing conditions is provided in the Stormwater Report. The redevelopment checklist found in Volume 2 Chapter 3 of the Massachusetts Stormwater Handbook may be used to document that the proposed stormwater management system (a) complies with Standards 2, 3 and the pretreatment and structural BMP requirements of Standards 4-6 to the maximum extent practicable and (b) improves existing conditions.

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

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

- Narrative;
 - Construction Period Operation and Maintenance Plan;
 - Names of Persons or Entity Responsible for Plan Compliance;
 - Construction Period Pollution Prevention Measures;
 - Erosion and Sedimentation Control Plan Drawings;
 - Detail drawings and specifications for erosion control BMPs, including sizing calculations;
 - Vegetation Planning;
 - Site Development Plan;
 - Construction Sequencing Plan;
 - Sequencing of Erosion and Sedimentation Controls;
 - Operation and Maintenance of Erosion and Sedimentation Controls;
 - Inspection Schedule;
 - Maintenance Schedule;
 - Inspection and Maintenance Log Form.
- ☐ A Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan containing the information set forth above has been included in the Stormwater Report.



Checklist for Stormwater Report

Checklist (continued)

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

- ☐ The project is highly complex and information is included in the Stormwater Report that explains why it is not possible to submit the Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan with the application. A Construction Period Pollution Prevention and Erosion and Sedimentation Control has **not** been included in the Stormwater Report but will be submitted **before** land disturbance begins.
- ☐ The project is **not** covered by a NPDES Construction General Permit.
- ☐ The project is covered by a NPDES Construction General Permit and a copy of the SWPPP is in the Stormwater Report.
- ☒ The project is covered by a NPDES Construction General Permit but no SWPPP been submitted. The SWPPP will be submitted BEFORE land disturbance begins.

Standard 9: Operation and Maintenance Plan

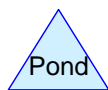
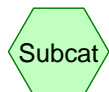
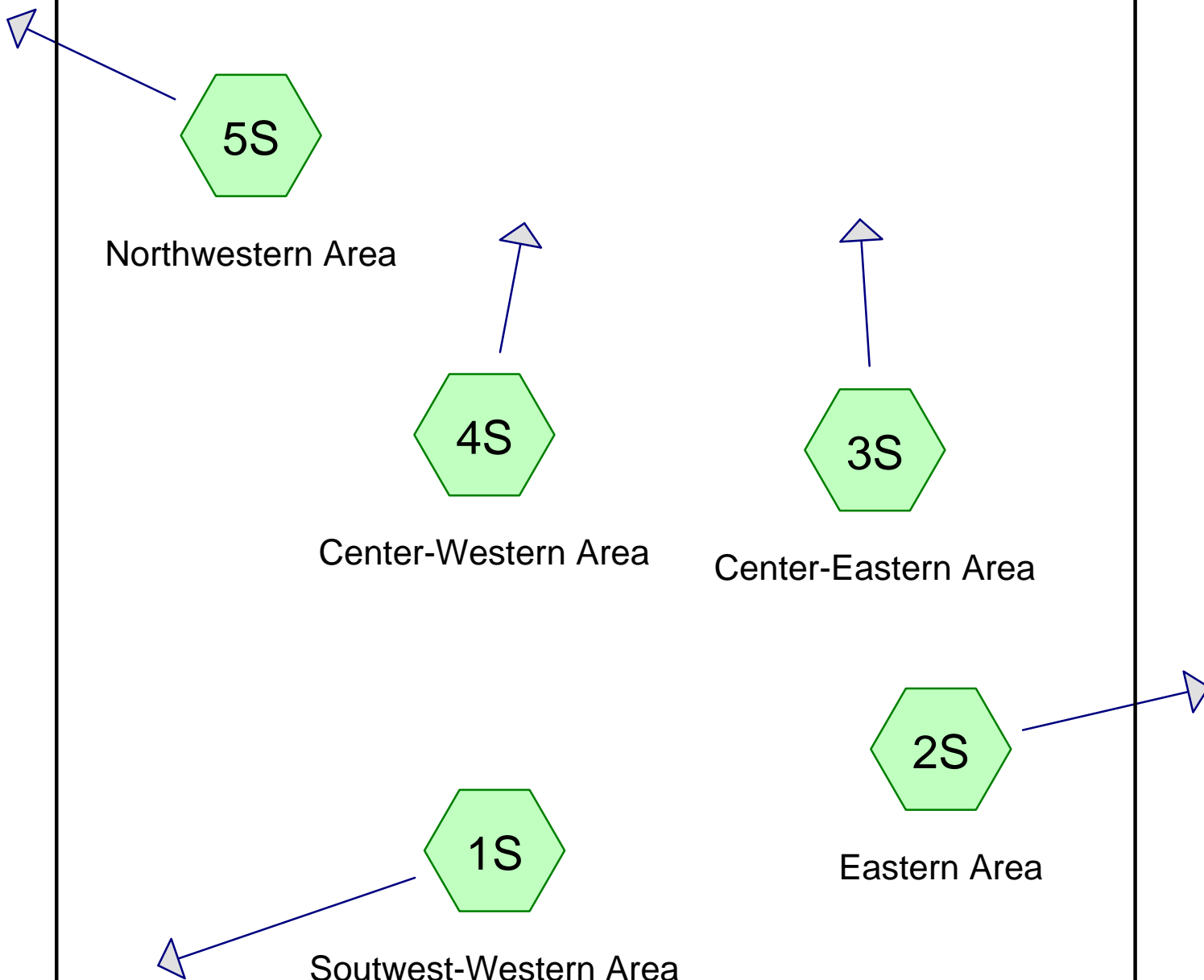
- ☒ The Post Construction Operation and Maintenance Plan is included in the Stormwater Report and includes the following information:
 - ☒ Name of the stormwater management system owners;
 - ☒ Party responsible for operation and maintenance;
 - ☒ Schedule for implementation of routine and non-routine maintenance tasks;
 - ☐ Plan showing the location of all stormwater BMPs maintenance access areas;
 - ☐ Description and delineation of public safety features;
 - ☐ Estimated operation and maintenance budget; and
 - ☐ Operation and Maintenance Log Form.
- ☐ The responsible party is **not** the owner of the parcel where the BMP is located and the Stormwater Report includes the following submissions:
 - ☐ A copy of the legal instrument (deed, homeowner's association, utility trust or other legal entity) that establishes the terms of and legal responsibility for the operation and maintenance of the project site stormwater BMPs;
 - ☐ A plan and easement deed that allows site access for the legal entity to operate and maintain BMP functions.

Standard 10: Prohibition of Illicit Discharges

- ☒ The Long-Term Pollution Prevention Plan includes measures to prevent illicit discharges;
- ☒ An Illicit Discharge Compliance Statement is attached;
- ☐ NO Illicit Discharge Compliance Statement is attached but will be submitted **prior to** the discharge of any stormwater to post-construction BMPs.

APPENDIX B

Pre- and Post-Development HydroCAD Stormwater Analysis



3086.00 - Hydrocad Calculations - PRE

Type III 24-hr 2-yr Rainfall=3.41"

Prepared by Atlantic Design Engineers, Inc.

Printed 5/31/2019

HydroCAD® 10.00-25 s/n 00480 © 2019 HydroCAD Software Solutions LLC

Page 2

Summary for Subcatchment 1S: Southwest-Western Area

Runoff = 6.45 cfs @ 12.41 hrs, Volume= 36,593 cf, Depth= 0.95"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-yr Rainfall=3.41"

Area (sf)	CN	Description
7,444	85	Gravel roads, HSG B
14,768	98	Paved parking, HSG A
103,603	98	Paved parking, HSG B
26,501	98	Roofs, HSG B
96,435	30	Woods, Good, HSG A
3,370	55	Woods, Good, HSG B
25,348	73	Woods/grass comb., Poor, HSG B
183,303	67	Brush, Poor, HSG B
460,772	70	Weighted Average
315,900		68.56% Pervious Area
144,872		31.44% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
20.2	50	0.0050	0.04		Sheet Flow, Woods: Light underbrush n= 0.400 P2= 3.60"
2.2	150	0.0050	1.14		Shallow Concentrated Flow, Unpaved Kv= 16.1 fps
2.2	400	0.0225	3.04		Shallow Concentrated Flow, Paved Kv= 20.3 fps
1.8	371	0.0455	3.43		Shallow Concentrated Flow, Unpaved Kv= 16.1 fps
26.4	971	Total			

3086.00 - Hydrocad Calculations - PRE

Prepared by Atlantic Design Engineers, Inc.

HydroCAD® 10.00-25 s/n 00480 © 2019 HydroCAD Software Solutions LLC

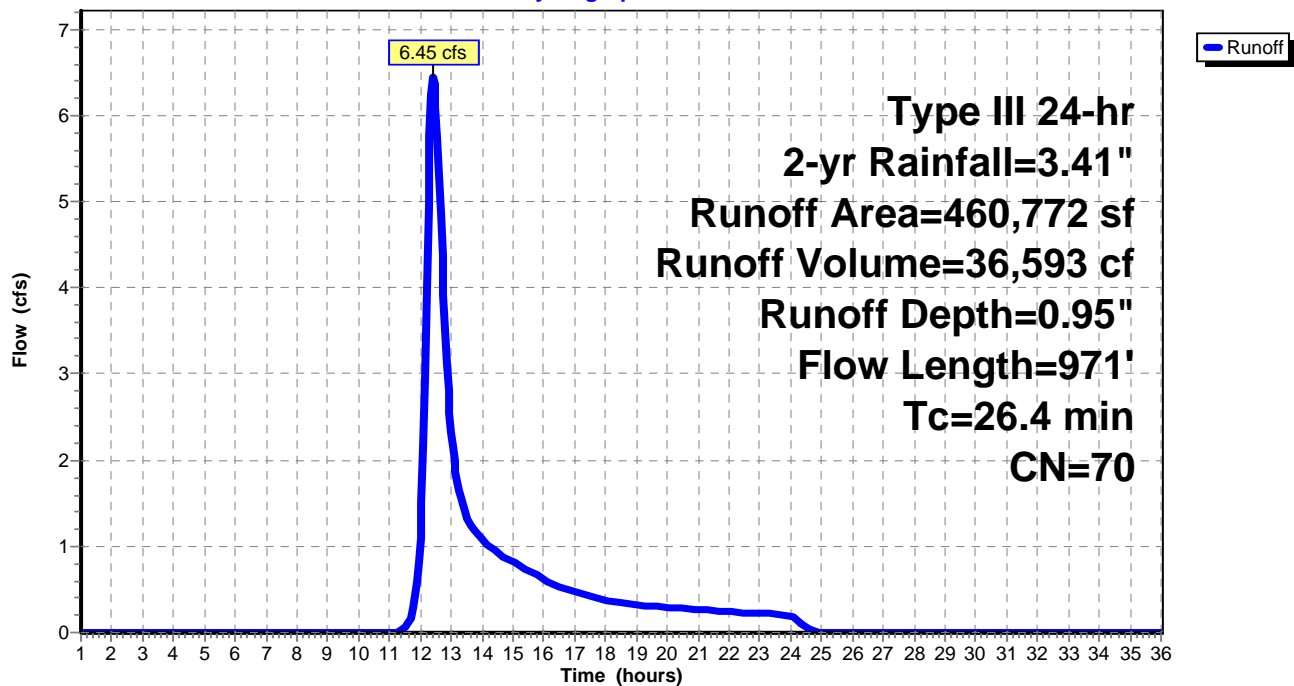
Type III 24-hr 2-yr Rainfall=3.41"

Printed 5/31/2019

Page 3

Subcatchment 1S: Southwest-Western Area

Hydrograph



3086.00 - Hydrocad Calculations - PRE

Prepared by Atlantic Design Engineers, Inc.

HydroCAD® 10.00-25 s/n 00480 © 2019 HydroCAD Software Solutions LLC

Type III 24-hr 2-yr Rainfall=3.41"

Printed 5/31/2019

Page 4

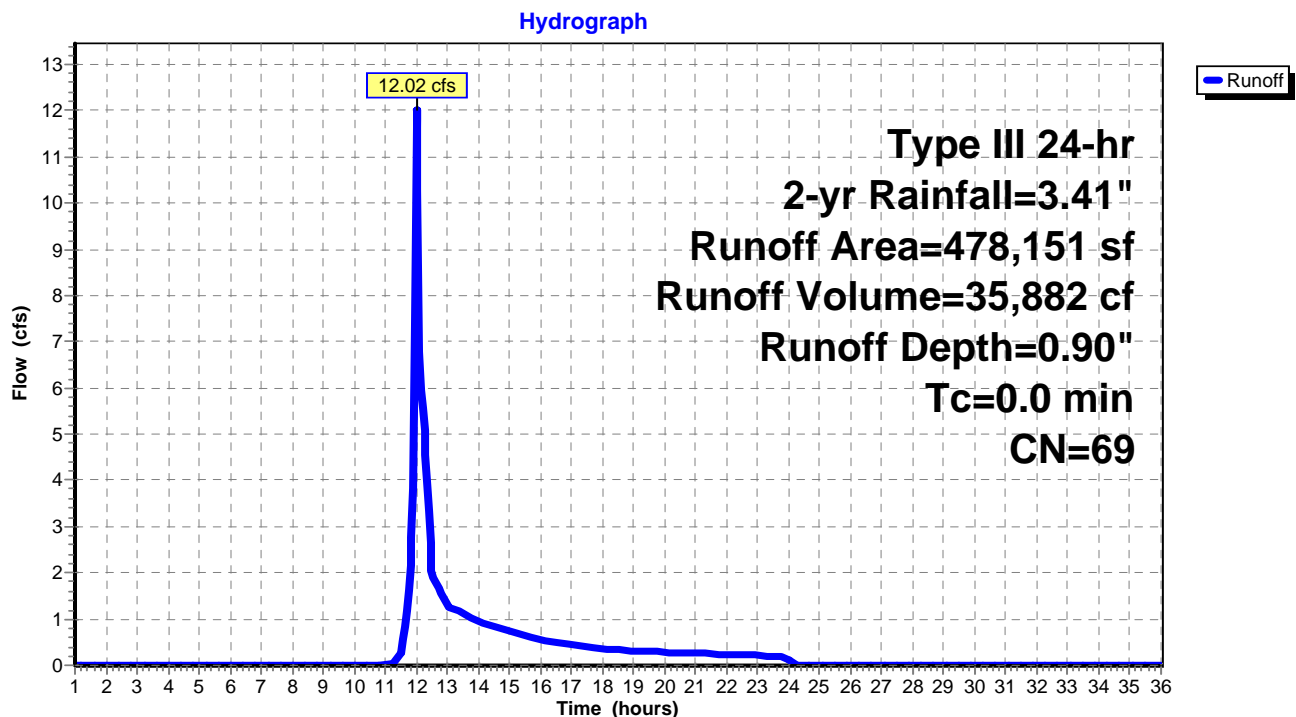
Summary for Subcatchment 2S: Eastern Area

Runoff = 12.02 cfs @ 12.01 hrs, Volume= 35,882 cf, Depth= 0.90"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-yr Rainfall=3.41"

Area (sf)	CN	Description
21,716	82	Dirt roads, HSG B
28,164	85	Gravel roads, HSG B
14,392	98	Roofs, HSG B
871	30	Woods, Good, HSG A
30,185	55	Woods, Good, HSG B
382,823	67	Brush, Poor, HSG B
478,151	69	Weighted Average
463,759		96.99% Pervious Area
14,392		3.01% Impervious Area

Subcatchment 2S: Eastern Area



3086.00 - Hydrocad Calculations - PRE

Prepared by Atlantic Design Engineers, Inc.

HydroCAD® 10.00-25 s/n 00480 © 2019 HydroCAD Software Solutions LLC

Type III 24-hr 2-yr Rainfall=3.41"

Printed 5/31/2019

Page 5

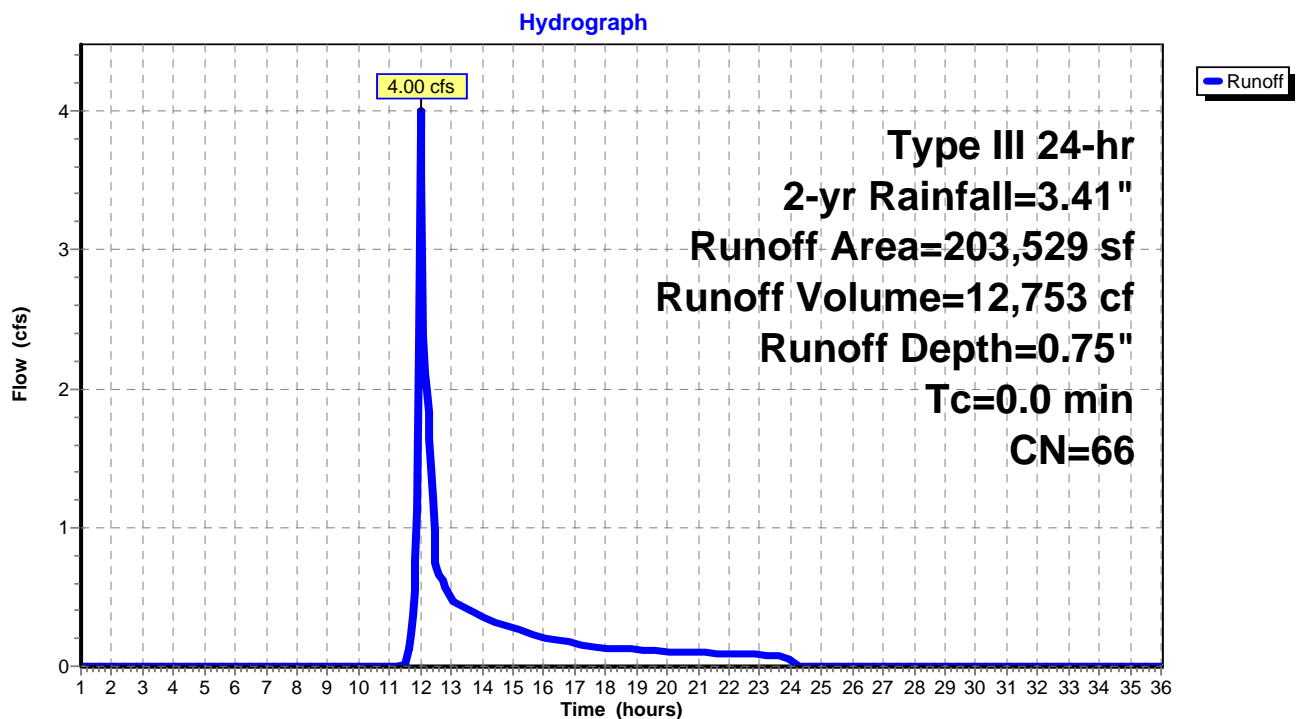
Summary for Subcatchment 3S: Center-Eastern Area

Runoff = 4.00 cfs @ 12.02 hrs, Volume= 12,753 cf, Depth= 0.75"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-yr Rainfall=3.41"

	Area (sf)	CN	Description
*	178,530	65	Upland Bog Area
	1,742	72	Dirt roads, HSG A
	10,138	82	Dirt roads, HSG B
	604	30	Woods, Good, HSG A
	12,515	67	Brush, Poor, HSG B
	203,529	66	Weighted Average
	203,529		100.00% Pervious Area

Subcatchment 3S: Center-Eastern Area



3086.00 - Hydrocad Calculations - PRE

Prepared by Atlantic Design Engineers, Inc.

HydroCAD® 10.00-25 s/n 00480 © 2019 HydroCAD Software Solutions LLC

Type III 24-hr 2-yr Rainfall=3.41"

Printed 5/31/2019

Page 6

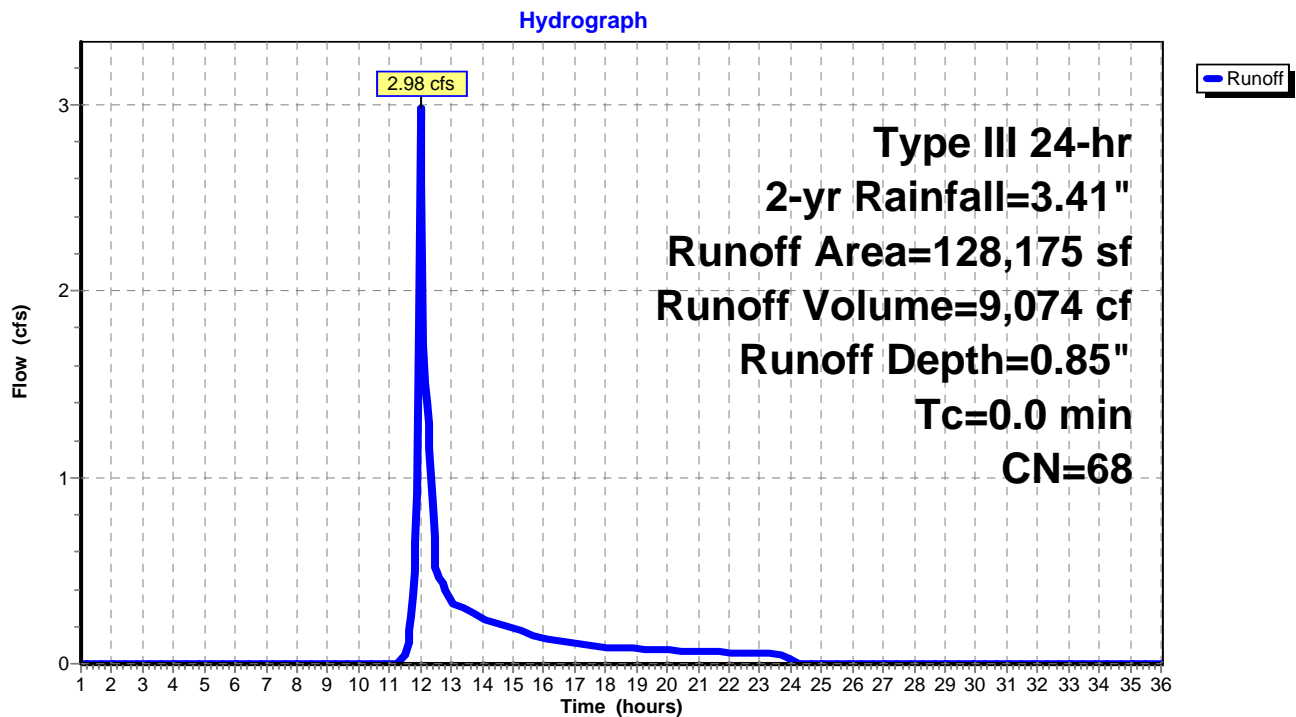
Summary for Subcatchment 4S: Center-Western Area

Runoff = 2.98 cfs @ 12.01 hrs, Volume= 9,074 cf, Depth= 0.85"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-yr Rainfall=3.41"

Area (sf)	CN	Description
10,682	82	Dirt roads, HSG B
953	30	Woods, Good, HSG A
465	55	Woods, Good, HSG B
116,075	67	Brush, Poor, HSG B
128,175	68	Weighted Average
128,175		100.00% Pervious Area

Subcatchment 4S: Center-Western Area



3086.00 - Hydrocad Calculations - PRE

Prepared by Atlantic Design Engineers, Inc.

HydroCAD® 10.00-25 s/n 00480 © 2019 HydroCAD Software Solutions LLC

Type III 24-hr 2-yr Rainfall=3.41"

Printed 5/31/2019

Page 7

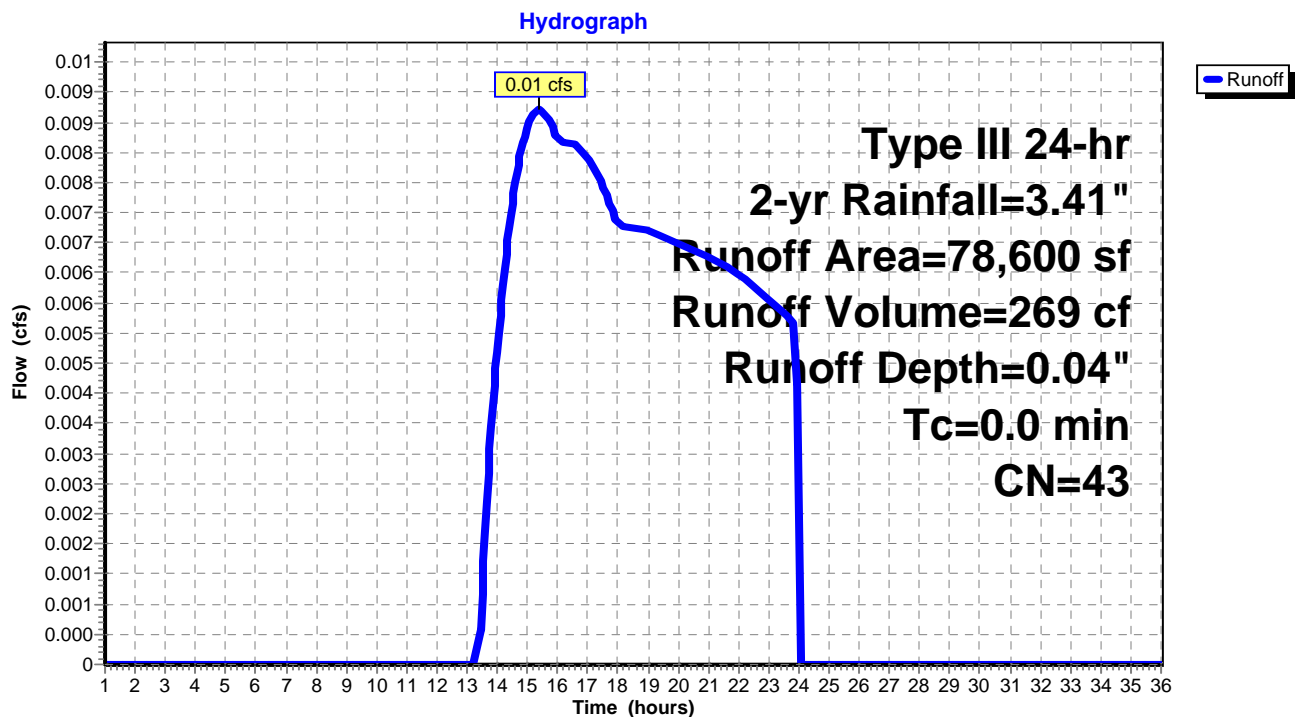
Summary for Subcatchment 5S: Northwestern Area

Runoff = 0.01 cfs @ 15.40 hrs, Volume= 269 cf, Depth= 0.04"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-yr Rainfall=3.41"

Area (sf)	CN	Description
51,381	30	Woods, Good, HSG A
821	55	Woods, Good, HSG B
26,398	67	Brush, Poor, HSG B
78,600	43	Weighted Average
78,600		100.00% Pervious Area

Subcatchment 5S: Northwestern Area



3086.00 - Hydrocad Calculations - PRE

Type III 24-hr 10-yr Rainfall=5.05"

Prepared by Atlantic Design Engineers, Inc.

Printed 5/31/2019

HydroCAD® 10.00-25 s/n 00480 © 2019 HydroCAD Software Solutions LLC

Page 8

Summary for Subcatchment 1S: Southwest-Western Area

Runoff = 15.05 cfs @ 12.39 hrs, Volume= 79,616 cf, Depth= 2.07"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-yr Rainfall=5.05"

Area (sf)	CN	Description
7,444	85	Gravel roads, HSG B
14,768	98	Paved parking, HSG A
103,603	98	Paved parking, HSG B
26,501	98	Roofs, HSG B
96,435	30	Woods, Good, HSG A
3,370	55	Woods, Good, HSG B
25,348	73	Woods/grass comb., Poor, HSG B
183,303	67	Brush, Poor, HSG B
460,772	70	Weighted Average
315,900		68.56% Pervious Area
144,872		31.44% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
20.2	50	0.0050	0.04		Sheet Flow, Woods: Light underbrush n= 0.400 P2= 3.60"
2.2	150	0.0050	1.14		Shallow Concentrated Flow, Unpaved Kv= 16.1 fps
2.2	400	0.0225	3.04		Shallow Concentrated Flow, Paved Kv= 20.3 fps
1.8	371	0.0455	3.43		Shallow Concentrated Flow, Unpaved Kv= 16.1 fps
26.4	971	Total			

3086.00 - Hydrocad Calculations - PRE

Prepared by Atlantic Design Engineers, Inc.

HydroCAD® 10.00-25 s/n 00480 © 2019 HydroCAD Software Solutions LLC

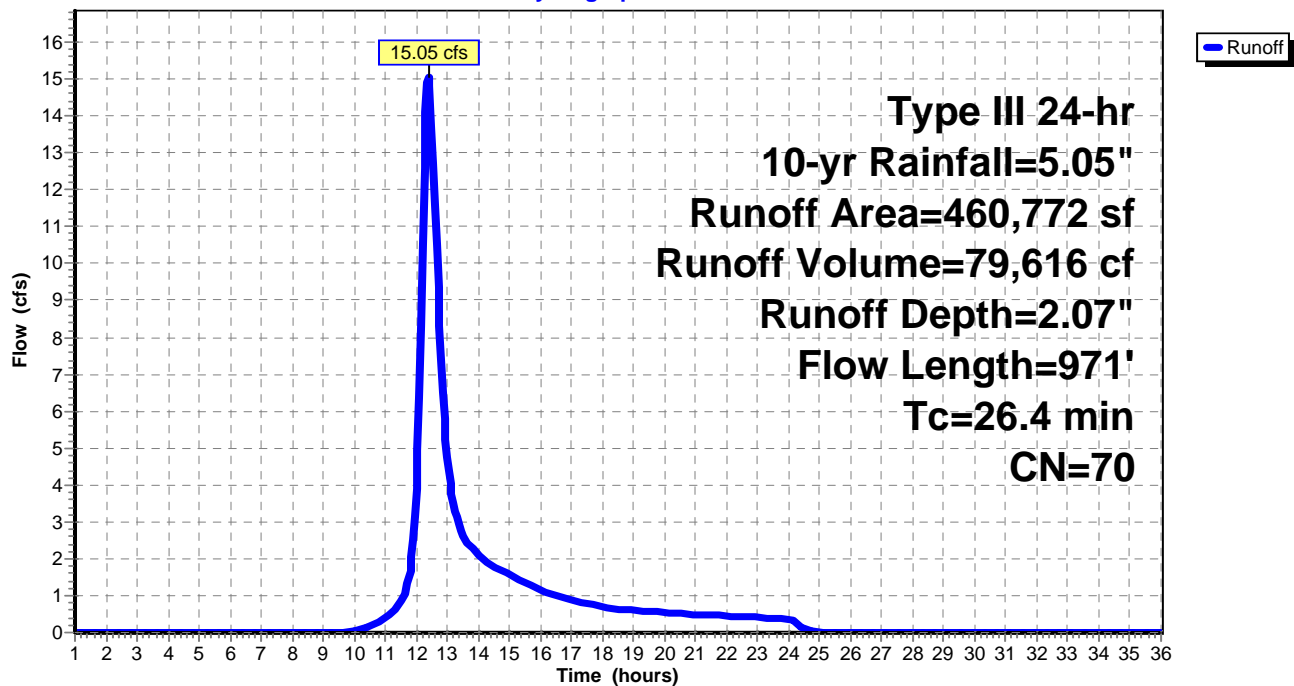
Type III 24-hr 10-yr Rainfall=5.05"

Printed 5/31/2019

Page 9

Subcatchment 1S: Southwest-Western Area

Hydrograph



3086.00 - Hydrocad Calculations - PRE

Prepared by Atlantic Design Engineers, Inc.

HydroCAD® 10.00-25 s/n 00480 © 2019 HydroCAD Software Solutions LLC

Type III 24-hr 10-yr Rainfall=5.05"

Printed 5/31/2019

Page 10

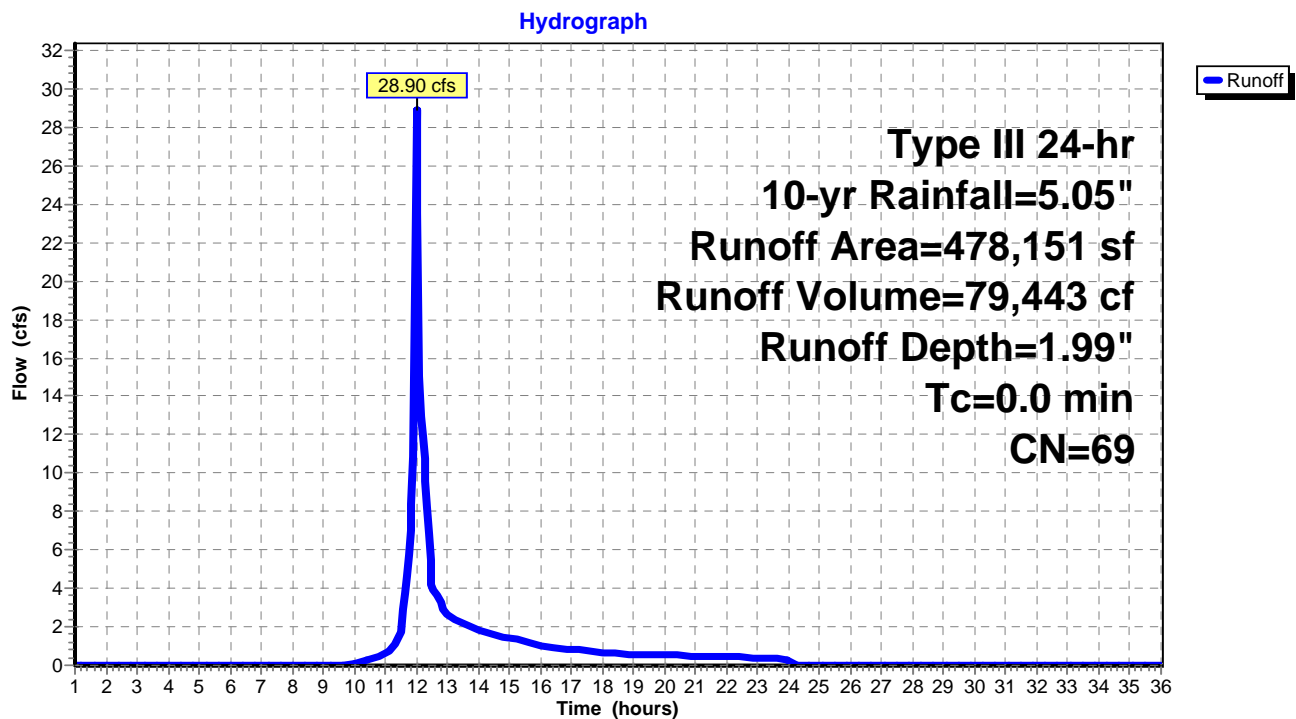
Summary for Subcatchment 2S: Eastern Area

Runoff = 28.90 cfs @ 12.01 hrs, Volume= 79,443 cf, Depth= 1.99"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-yr Rainfall=5.05"

Area (sf)	CN	Description
21,716	82	Dirt roads, HSG B
28,164	85	Gravel roads, HSG B
14,392	98	Roofs, HSG B
871	30	Woods, Good, HSG A
30,185	55	Woods, Good, HSG B
382,823	67	Brush, Poor, HSG B
478,151	69	Weighted Average
463,759		96.99% Pervious Area
14,392		3.01% Impervious Area

Subcatchment 2S: Eastern Area



3086.00 - Hydrocad Calculations - PRE

Prepared by Atlantic Design Engineers, Inc.

HydroCAD® 10.00-25 s/n 00480 © 2019 HydroCAD Software Solutions LLC

Type III 24-hr 10-yr Rainfall=5.05"

Printed 5/31/2019

Page 11

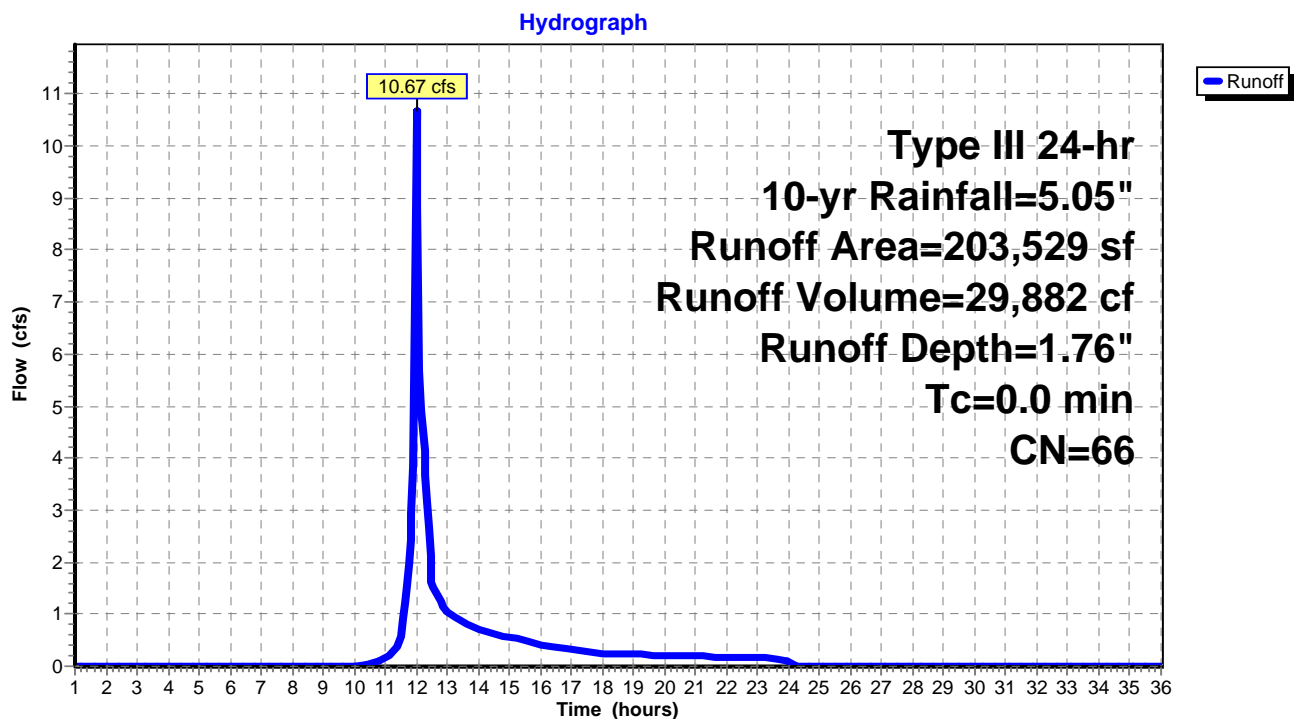
Summary for Subcatchment 3S: Center-Eastern Area

Runoff = 10.67 cfs @ 12.01 hrs, Volume= 29,882 cf, Depth= 1.76"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-yr Rainfall=5.05"

	Area (sf)	CN	Description
*	178,530	65	Upland Bog Area
	1,742	72	Dirt roads, HSG A
	10,138	82	Dirt roads, HSG B
	604	30	Woods, Good, HSG A
	12,515	67	Brush, Poor, HSG B
	203,529	66	Weighted Average
	203,529		100.00% Pervious Area

Subcatchment 3S: Center-Eastern Area



3086.00 - Hydrocad Calculations - PRE

Prepared by Atlantic Design Engineers, Inc.

HydroCAD® 10.00-25 s/n 00480 © 2019 HydroCAD Software Solutions LLC

Type III 24-hr 10-yr Rainfall=5.05"

Printed 5/31/2019

Page 12

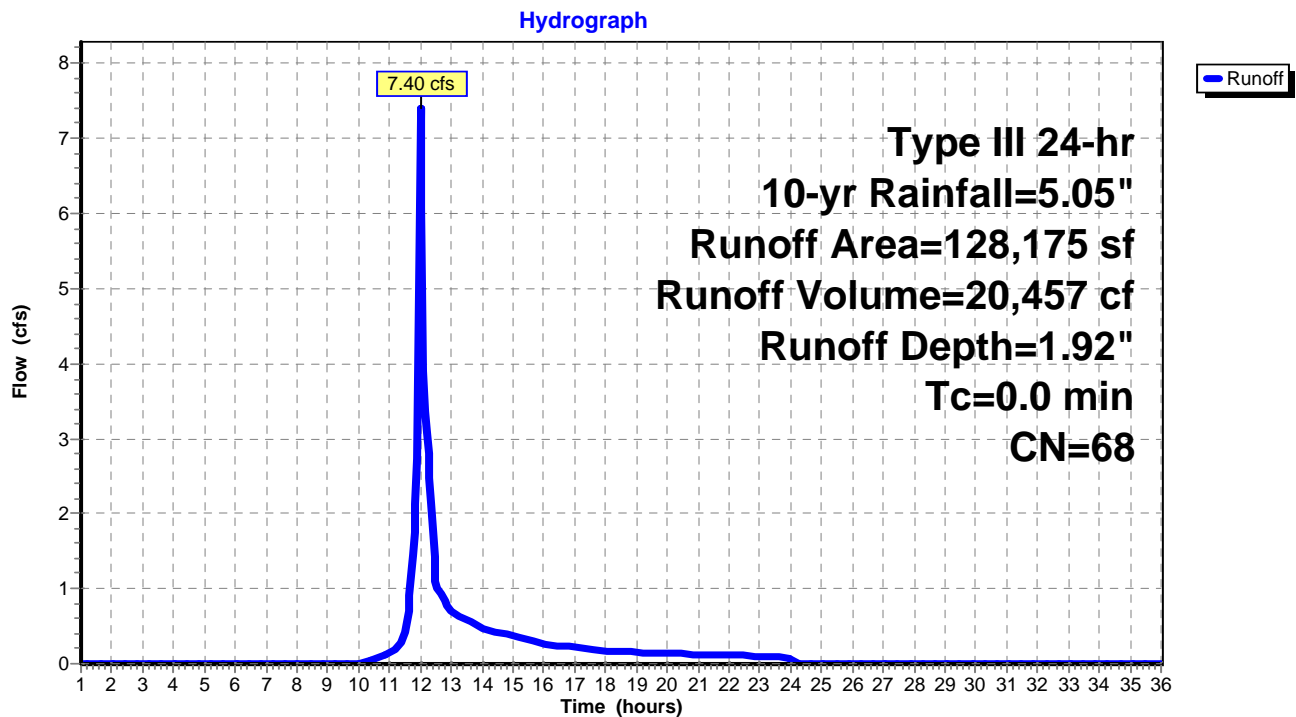
Summary for Subcatchment 4S: Center-Western Area

Runoff = 7.40 cfs @ 12.01 hrs, Volume= 20,457 cf, Depth= 1.92"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-yr Rainfall=5.05"

Area (sf)	CN	Description
10,682	82	Dirt roads, HSG B
953	30	Woods, Good, HSG A
465	55	Woods, Good, HSG B
116,075	67	Brush, Poor, HSG B
128,175	68	Weighted Average
128,175		100.00% Pervious Area

Subcatchment 4S: Center-Western Area



3086.00 - Hydrocad Calculations - PRE

Prepared by Atlantic Design Engineers, Inc.

HydroCAD® 10.00-25 s/n 00480 © 2019 HydroCAD Software Solutions LLC

Type III 24-hr 10-yr Rainfall=5.05"

Printed 5/31/2019

Page 13

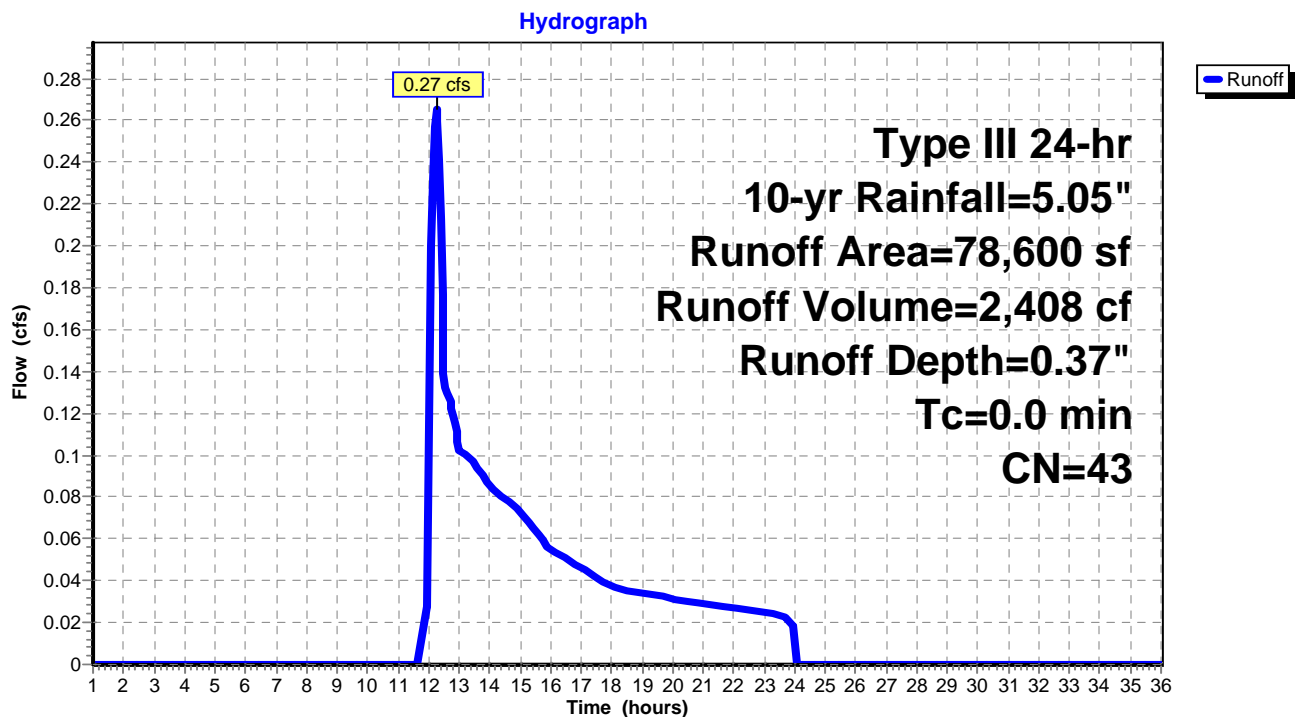
Summary for Subcatchment 5S: Northwestern Area

Runoff = 0.27 cfs @ 12.25 hrs, Volume= 2,408 cf, Depth= 0.37"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-yr Rainfall=5.05"

Area (sf)	CN	Description
51,381	30	Woods, Good, HSG A
821	55	Woods, Good, HSG B
26,398	67	Brush, Poor, HSG B
78,600	43	Weighted Average
78,600		100.00% Pervious Area

Subcatchment 5S: Northwestern Area



3086.00 - Hydrocad Calculations - PRE

Type III 24-hr 25-yr Rainfall=6.08"

Prepared by Atlantic Design Engineers, Inc.

Printed 5/31/2019

HydroCAD® 10.00-25 s/n 00480 © 2019 HydroCAD Software Solutions LLC

Page 14

Summary for Subcatchment 1S: Southwest-Western Area

Runoff = 21.11 cfs @ 12.38 hrs, Volume= 110,155 cf, Depth= 2.87"

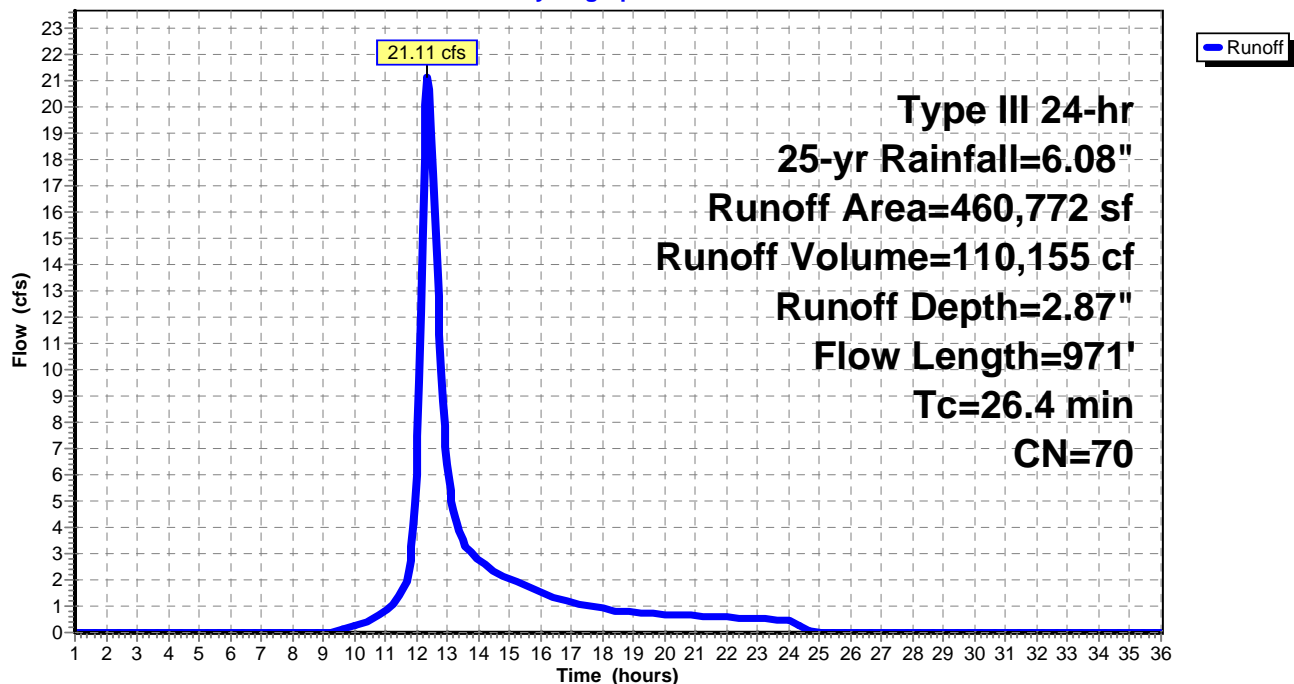
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-yr Rainfall=6.08"

Area (sf)	CN	Description
7,444	85	Gravel roads, HSG B
14,768	98	Paved parking, HSG A
103,603	98	Paved parking, HSG B
26,501	98	Roofs, HSG B
96,435	30	Woods, Good, HSG A
3,370	55	Woods, Good, HSG B
25,348	73	Woods/grass comb., Poor, HSG B
183,303	67	Brush, Poor, HSG B
460,772	70	Weighted Average
315,900		68.56% Pervious Area
144,872		31.44% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
20.2	50	0.0050	0.04		Sheet Flow, Woods: Light underbrush n= 0.400 P2= 3.60"
2.2	150	0.0050	1.14		Shallow Concentrated Flow, Unpaved Kv= 16.1 fps
2.2	400	0.0225	3.04		Shallow Concentrated Flow, Paved Kv= 20.3 fps
1.8	371	0.0455	3.43		Shallow Concentrated Flow, Unpaved Kv= 16.1 fps
26.4	971	Total			

Subcatchment 1S: Southwest-Western Area

Hydrograph



3086.00 - Hydrocad Calculations - PRE

Prepared by Atlantic Design Engineers, Inc.

HydroCAD® 10.00-25 s/n 00480 © 2019 HydroCAD Software Solutions LLC

Type III 24-hr 25-yr Rainfall=6.08"

Printed 5/31/2019

Page 16

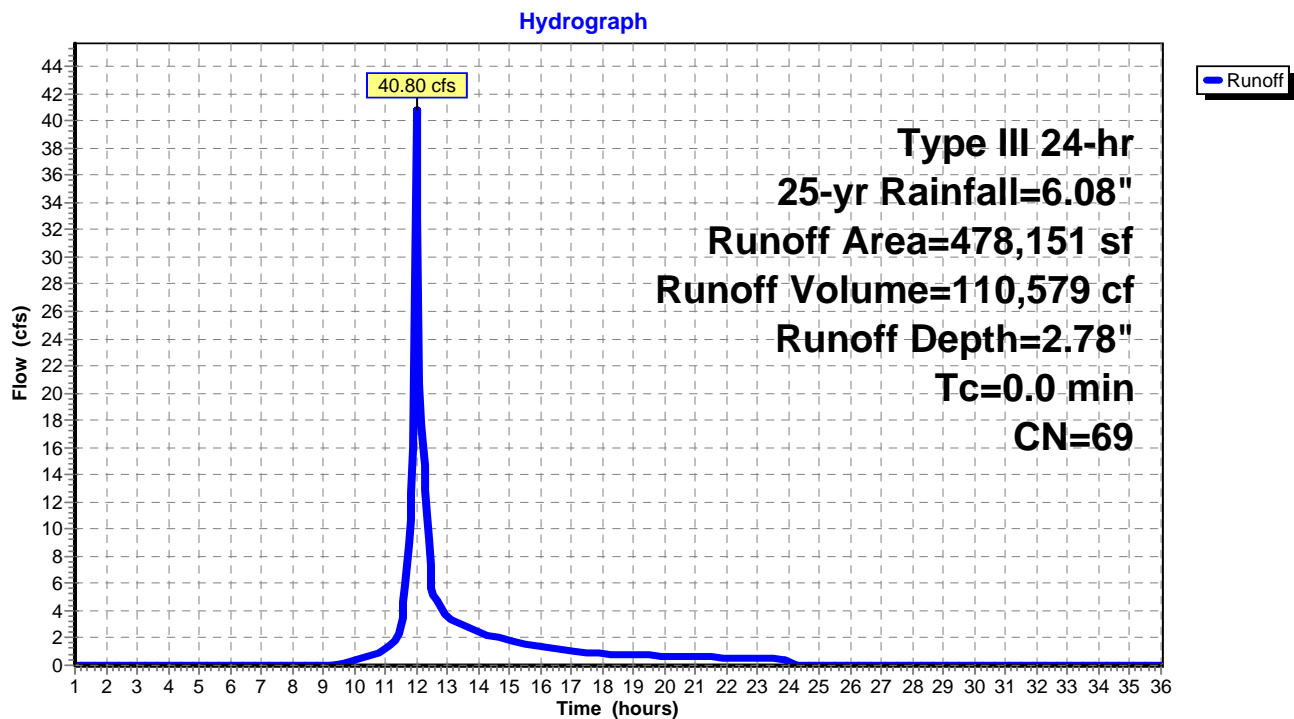
Summary for Subcatchment 2S: Eastern Area

Runoff = 40.80 cfs @ 12.01 hrs, Volume= 110,579 cf, Depth= 2.78"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-yr Rainfall=6.08"

Area (sf)	CN	Description
21,716	82	Dirt roads, HSG B
28,164	85	Gravel roads, HSG B
14,392	98	Roofs, HSG B
871	30	Woods, Good, HSG A
30,185	55	Woods, Good, HSG B
382,823	67	Brush, Poor, HSG B
478,151	69	Weighted Average
463,759		96.99% Pervious Area
14,392		3.01% Impervious Area

Subcatchment 2S: Eastern Area



3086.00 - Hydrocad Calculations - PRE

Prepared by Atlantic Design Engineers, Inc.

HydroCAD® 10.00-25 s/n 00480 © 2019 HydroCAD Software Solutions LLC

Type III 24-hr 25-yr Rainfall=6.08"

Printed 5/31/2019

Page 17

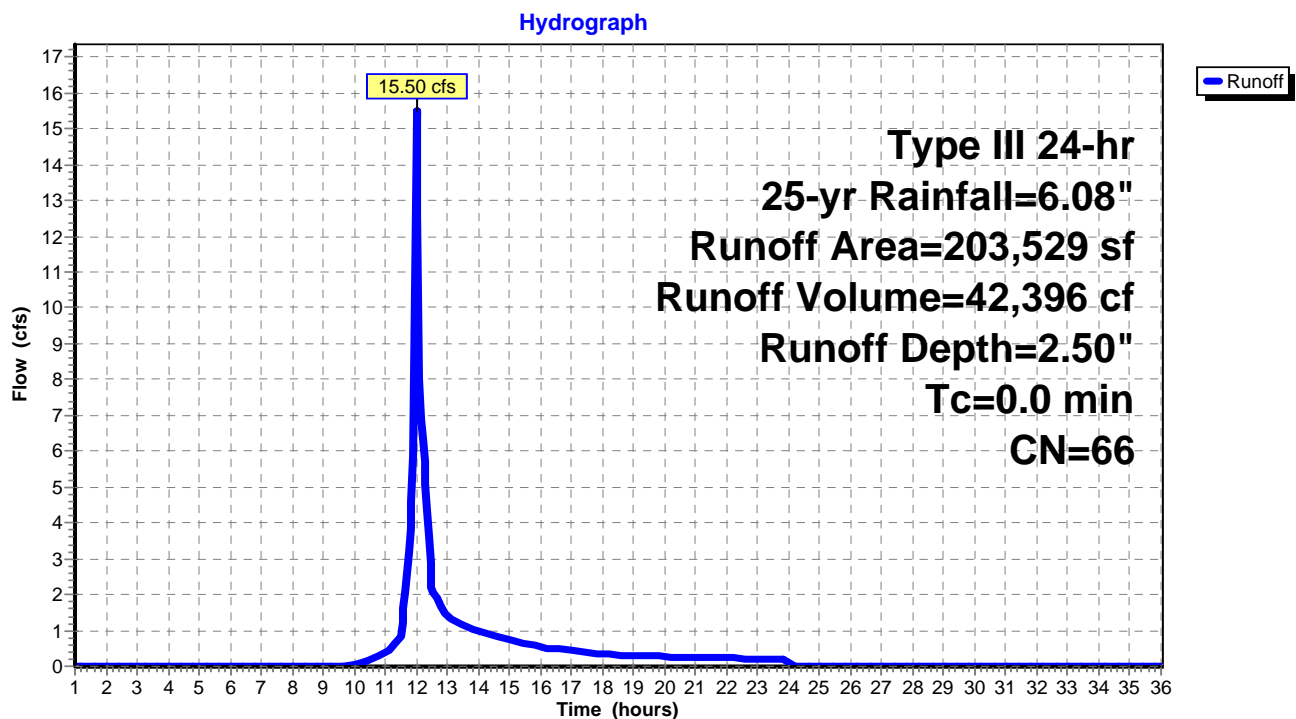
Summary for Subcatchment 3S: Center-Eastern Area

Runoff = 15.50 cfs @ 12.01 hrs, Volume= 42,396 cf, Depth= 2.50"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-yr Rainfall=6.08"

	Area (sf)	CN	Description
*	178,530	65	Upland Bog Area
	1,742	72	Dirt roads, HSG A
	10,138	82	Dirt roads, HSG B
	604	30	Woods, Good, HSG A
	12,515	67	Brush, Poor, HSG B
	203,529	66	Weighted Average
	203,529		100.00% Pervious Area

Subcatchment 3S: Center-Eastern Area



3086.00 - Hydrocad Calculations - PRE

Prepared by Atlantic Design Engineers, Inc.

HydroCAD® 10.00-25 s/n 00480 © 2019 HydroCAD Software Solutions LLC

Type III 24-hr 25-yr Rainfall=6.08"

Printed 5/31/2019

Page 18

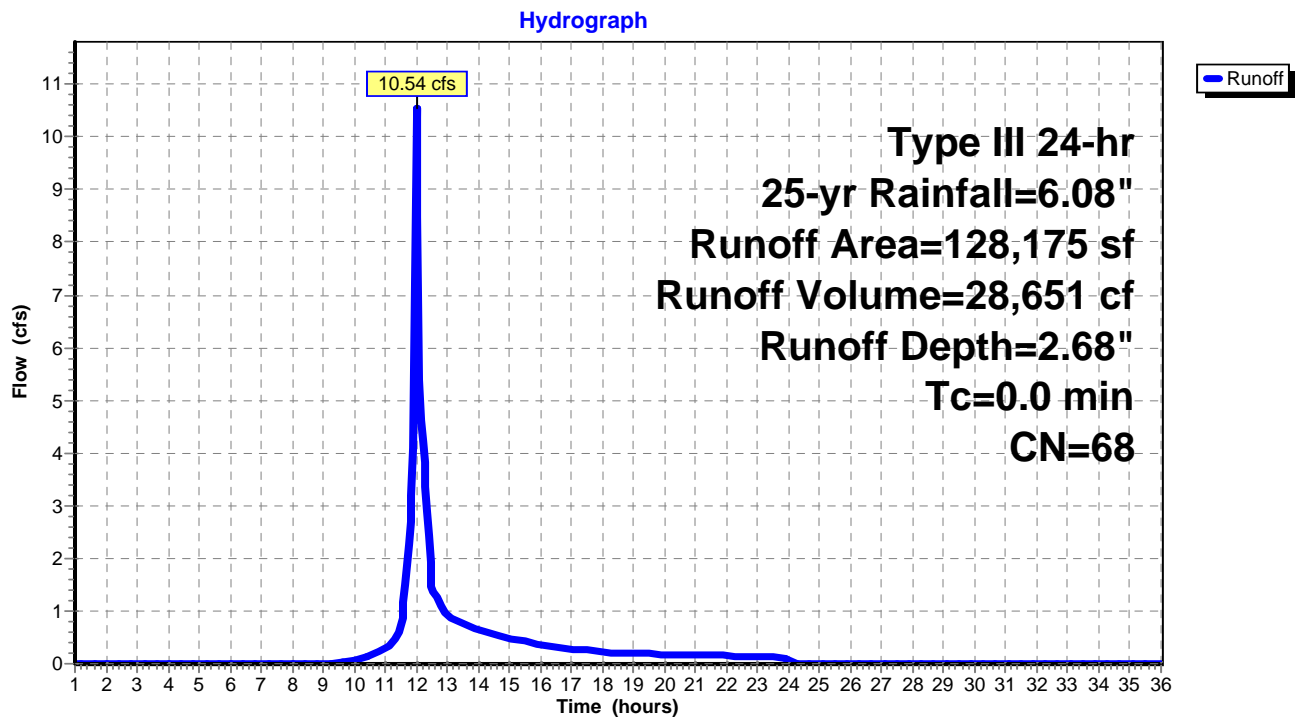
Summary for Subcatchment 4S: Center-Western Area

Runoff = 10.54 cfs @ 12.01 hrs, Volume= 28,651 cf, Depth= 2.68"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-yr Rainfall=6.08"

Area (sf)	CN	Description
10,682	82	Dirt roads, HSG B
953	30	Woods, Good, HSG A
465	55	Woods, Good, HSG B
116,075	67	Brush, Poor, HSG B
128,175	68	Weighted Average
128,175		100.00% Pervious Area

Subcatchment 4S: Center-Western Area



3086.00 - Hydrocad Calculations - PRE

Prepared by Atlantic Design Engineers, Inc.

HydroCAD® 10.00-25 s/n 00480 © 2019 HydroCAD Software Solutions LLC

Type III 24-hr 25-yr Rainfall=6.08"

Printed 5/31/2019

Page 19

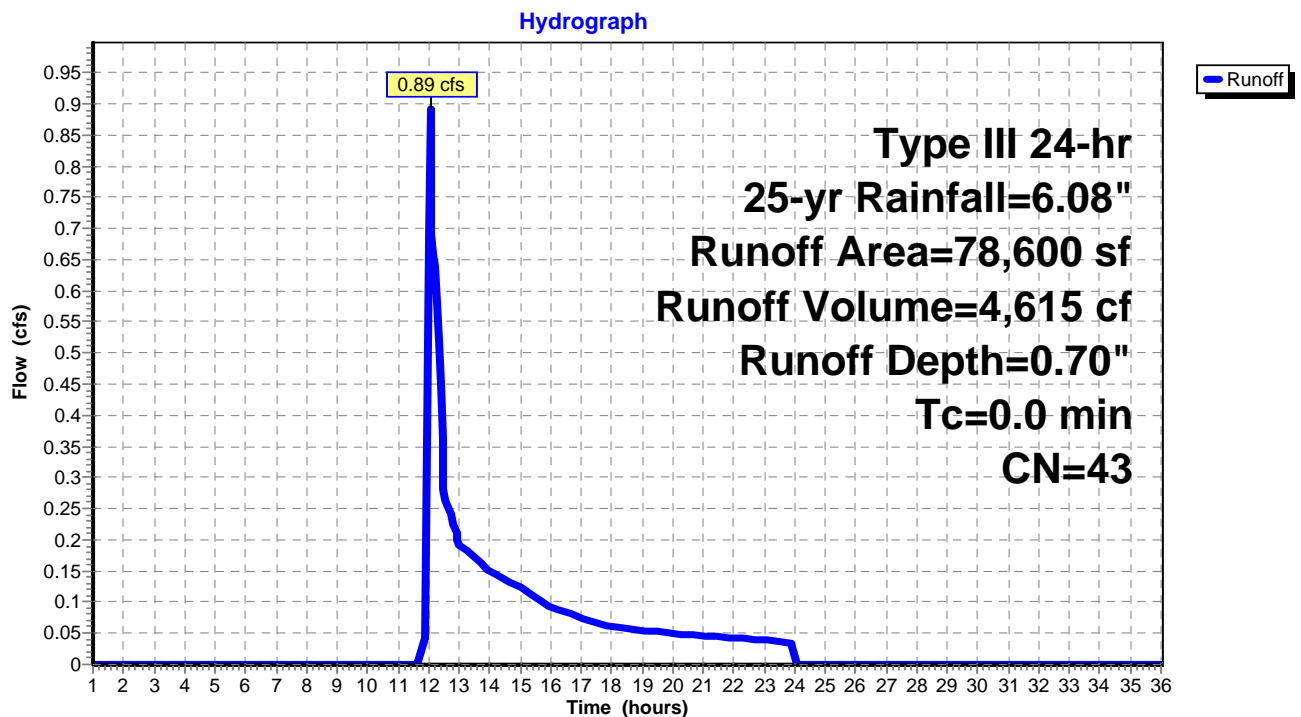
Summary for Subcatchment 5S: Northwestern Area

Runoff = 0.89 cfs @ 12.05 hrs, Volume= 4,615 cf, Depth= 0.70"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-yr Rainfall=6.08"

Area (sf)	CN	Description
51,381	30	Woods, Good, HSG A
821	55	Woods, Good, HSG B
26,398	67	Brush, Poor, HSG B
78,600	43	Weighted Average
78,600		100.00% Pervious Area

Subcatchment 5S: Northwestern Area



3086.00 - Hydrocad Calculations - PRE

Type III 24-hr 100-yr Rainfall=7.66"

Prepared by Atlantic Design Engineers, Inc.

Printed 5/31/2019

HydroCAD® 10.00-25 s/n 00480 © 2019 HydroCAD Software Solutions LLC

Page 20

Summary for Subcatchment 1S: Southwest-Western Area

Runoff = 30.95 cfs @ 12.37 hrs, Volume= 160,255 cf, Depth= 4.17"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-yr Rainfall=7.66"

Area (sf)	CN	Description
7,444	85	Gravel roads, HSG B
14,768	98	Paved parking, HSG A
103,603	98	Paved parking, HSG B
26,501	98	Roofs, HSG B
96,435	30	Woods, Good, HSG A
3,370	55	Woods, Good, HSG B
25,348	73	Woods/grass comb., Poor, HSG B
183,303	67	Brush, Poor, HSG B
460,772	70	Weighted Average
315,900		68.56% Pervious Area
144,872		31.44% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
20.2	50	0.0050	0.04		Sheet Flow, Woods: Light underbrush n= 0.400 P2= 3.60"
2.2	150	0.0050	1.14		Shallow Concentrated Flow, Unpaved Kv= 16.1 fps
2.2	400	0.0225	3.04		Shallow Concentrated Flow, Paved Kv= 20.3 fps
1.8	371	0.0455	3.43		Shallow Concentrated Flow, Unpaved Kv= 16.1 fps
26.4	971	Total			

3086.00 - Hydrocad Calculations - PRE

Prepared by Atlantic Design Engineers, Inc.

HydroCAD® 10.00-25 s/n 00480 © 2019 HydroCAD Software Solutions LLC

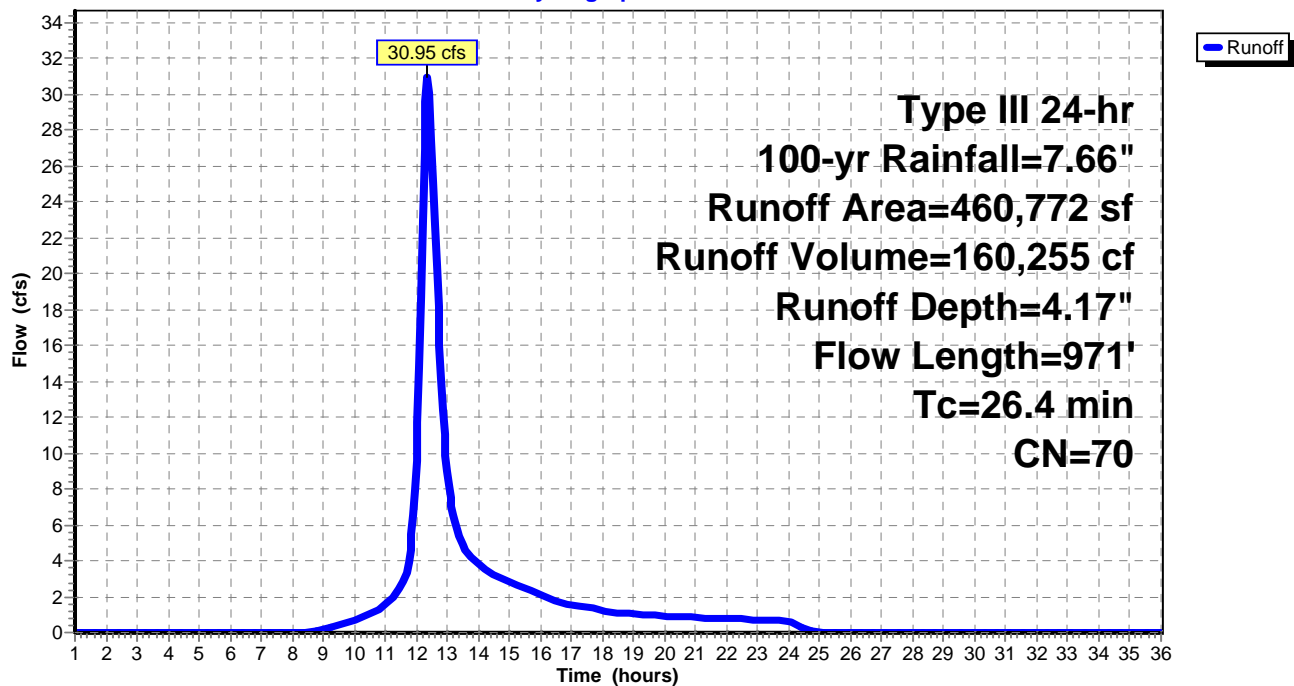
Type III 24-hr 100-yr Rainfall=7.66"

Printed 5/31/2019

Page 21

Subcatchment 1S: Southwest-Western Area

Hydrograph



3086.00 - Hydrocad Calculations - PRE

Prepared by Atlantic Design Engineers, Inc.

HydroCAD® 10.00-25 s/n 00480 © 2019 HydroCAD Software Solutions LLC

Type III 24-hr 100-yr Rainfall=7.66"

Printed 5/31/2019

Page 22

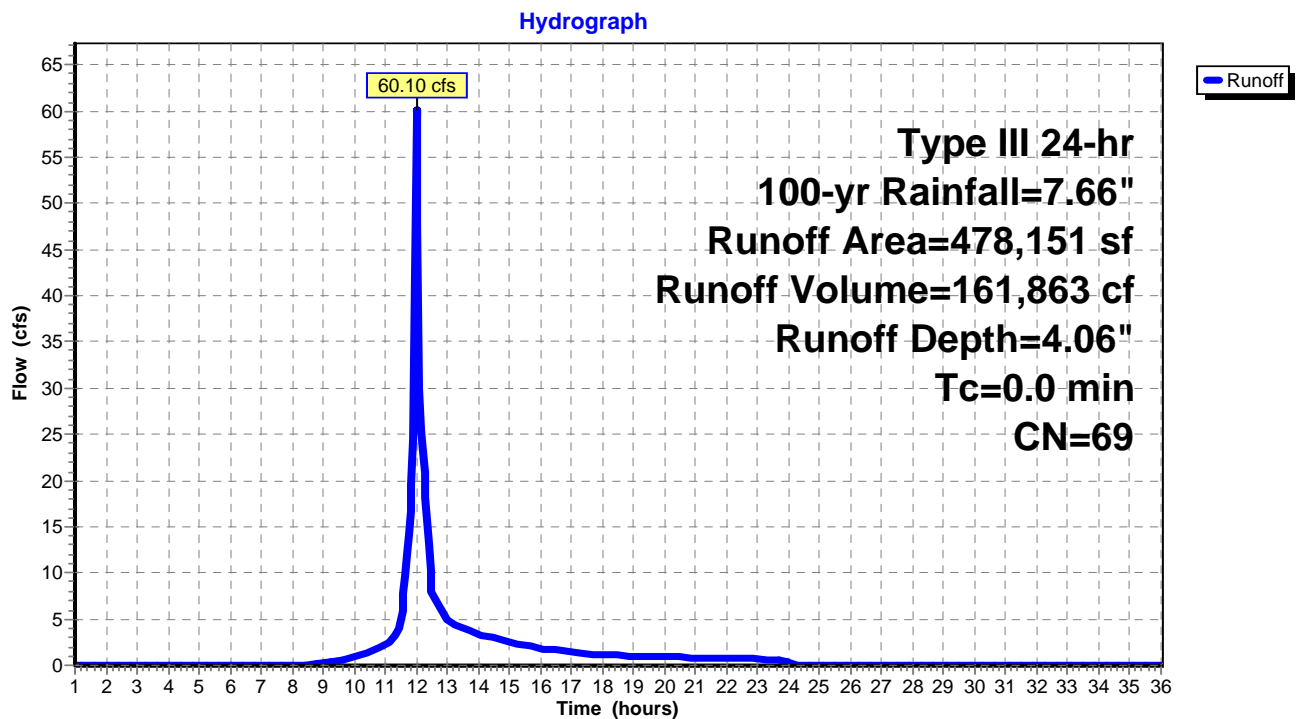
Summary for Subcatchment 2S: Eastern Area

Runoff = 60.10 cfs @ 12.00 hrs, Volume= 161,863 cf, Depth= 4.06"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-yr Rainfall=7.66"

Area (sf)	CN	Description
21,716	82	Dirt roads, HSG B
28,164	85	Gravel roads, HSG B
14,392	98	Roofs, HSG B
871	30	Woods, Good, HSG A
30,185	55	Woods, Good, HSG B
382,823	67	Brush, Poor, HSG B
478,151	69	Weighted Average
463,759		96.99% Pervious Area
14,392		3.01% Impervious Area

Subcatchment 2S: Eastern Area



3086.00 - Hydrocad Calculations - PRE

Prepared by Atlantic Design Engineers, Inc.

HydroCAD® 10.00-25 s/n 00480 © 2019 HydroCAD Software Solutions LLC

Type III 24-hr 100-yr Rainfall=7.66"

Printed 5/31/2019

Page 23

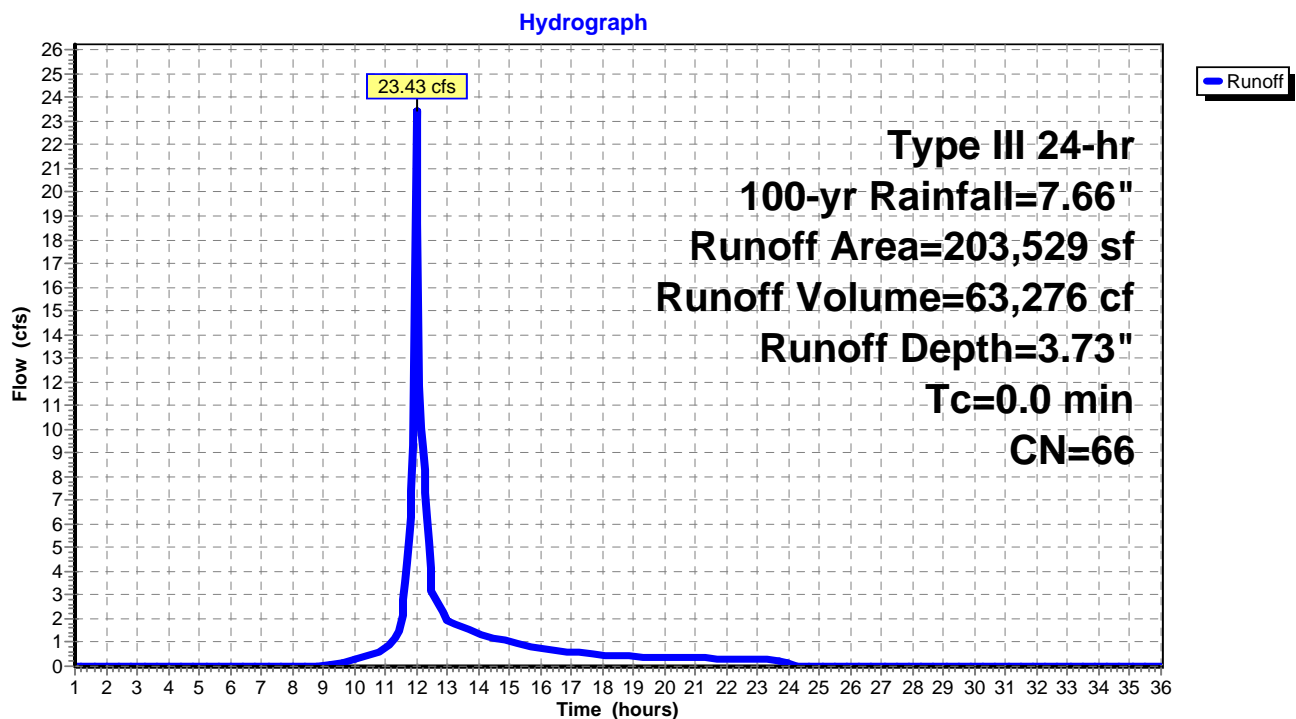
Summary for Subcatchment 3S: Center-Eastern Area

Runoff = 23.43 cfs @ 12.01 hrs, Volume= 63,276 cf, Depth= 3.73"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-yr Rainfall=7.66"

	Area (sf)	CN	Description
*	178,530	65	Upland Bog Area
	1,742	72	Dirt roads, HSG A
	10,138	82	Dirt roads, HSG B
	604	30	Woods, Good, HSG A
	12,515	67	Brush, Poor, HSG B
	203,529	66	Weighted Average
	203,529		100.00% Pervious Area

Subcatchment 3S: Center-Eastern Area



3086.00 - Hydrocad Calculations - PRE

Prepared by Atlantic Design Engineers, Inc.

HydroCAD® 10.00-25 s/n 00480 © 2019 HydroCAD Software Solutions LLC

Type III 24-hr 100-yr Rainfall=7.66"

Printed 5/31/2019

Page 24

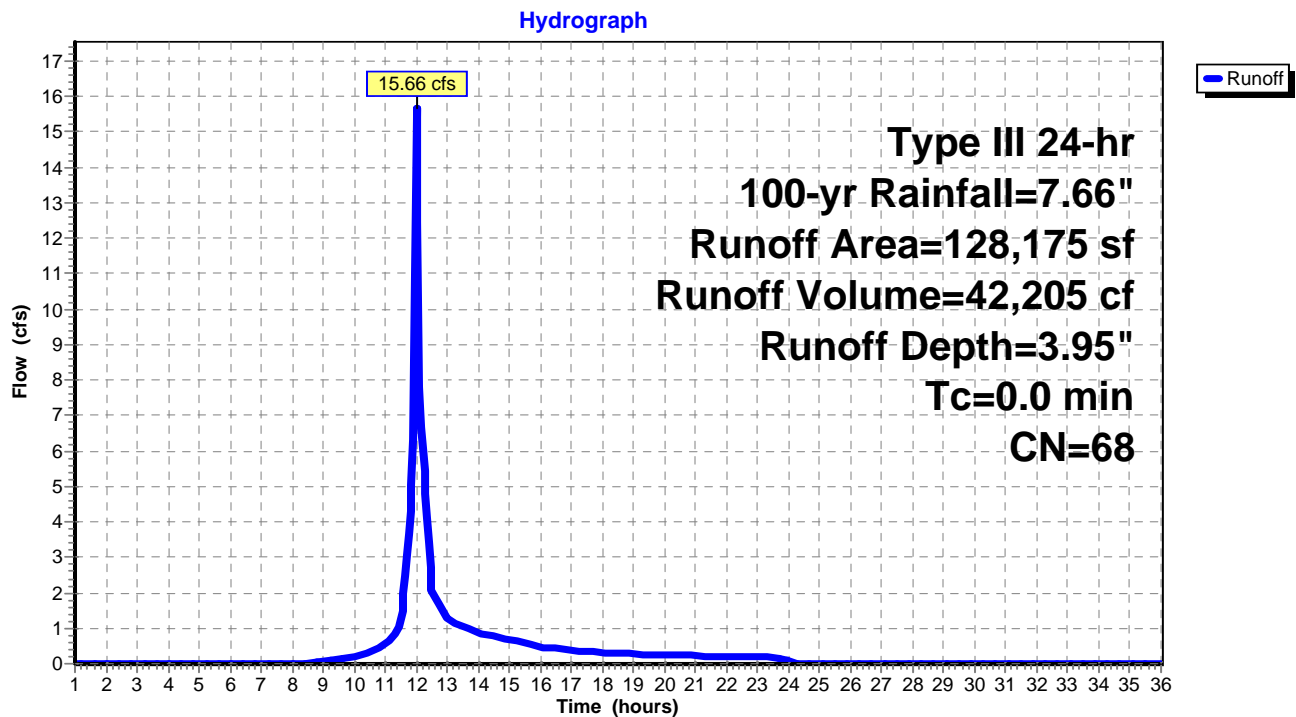
Summary for Subcatchment 4S: Center-Western Area

Runoff = 15.66 cfs @ 12.00 hrs, Volume= 42,205 cf, Depth= 3.95"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-yr Rainfall=7.66"

Area (sf)	CN	Description
10,682	82	Dirt roads, HSG B
953	30	Woods, Good, HSG A
465	55	Woods, Good, HSG B
116,075	67	Brush, Poor, HSG B
128,175	68	Weighted Average
128,175		100.00% Pervious Area

Subcatchment 4S: Center-Western Area



3086.00 - Hydrocad Calculations - PRE

Prepared by Atlantic Design Engineers, Inc.

HydroCAD® 10.00-25 s/n 00480 © 2019 HydroCAD Software Solutions LLC

Type III 24-hr 100-yr Rainfall=7.66"

Printed 5/31/2019

Page 25

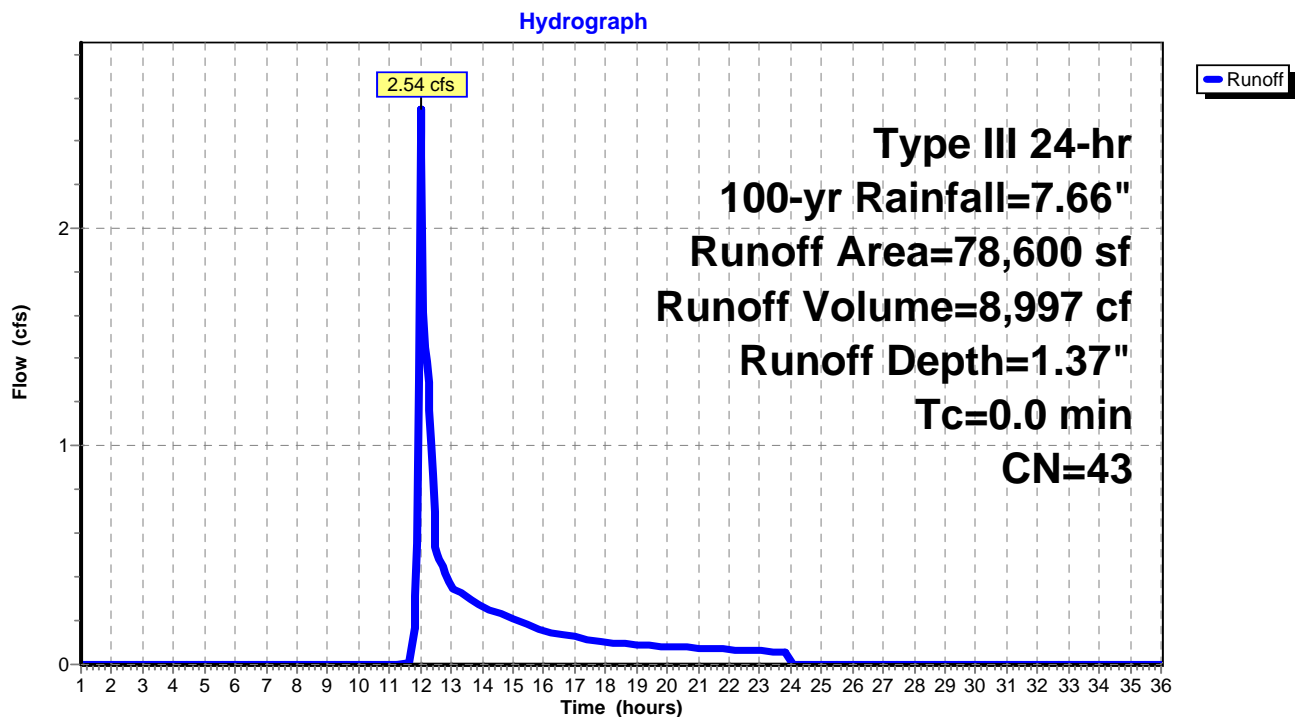
Summary for Subcatchment 5S: Northwestern Area

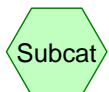
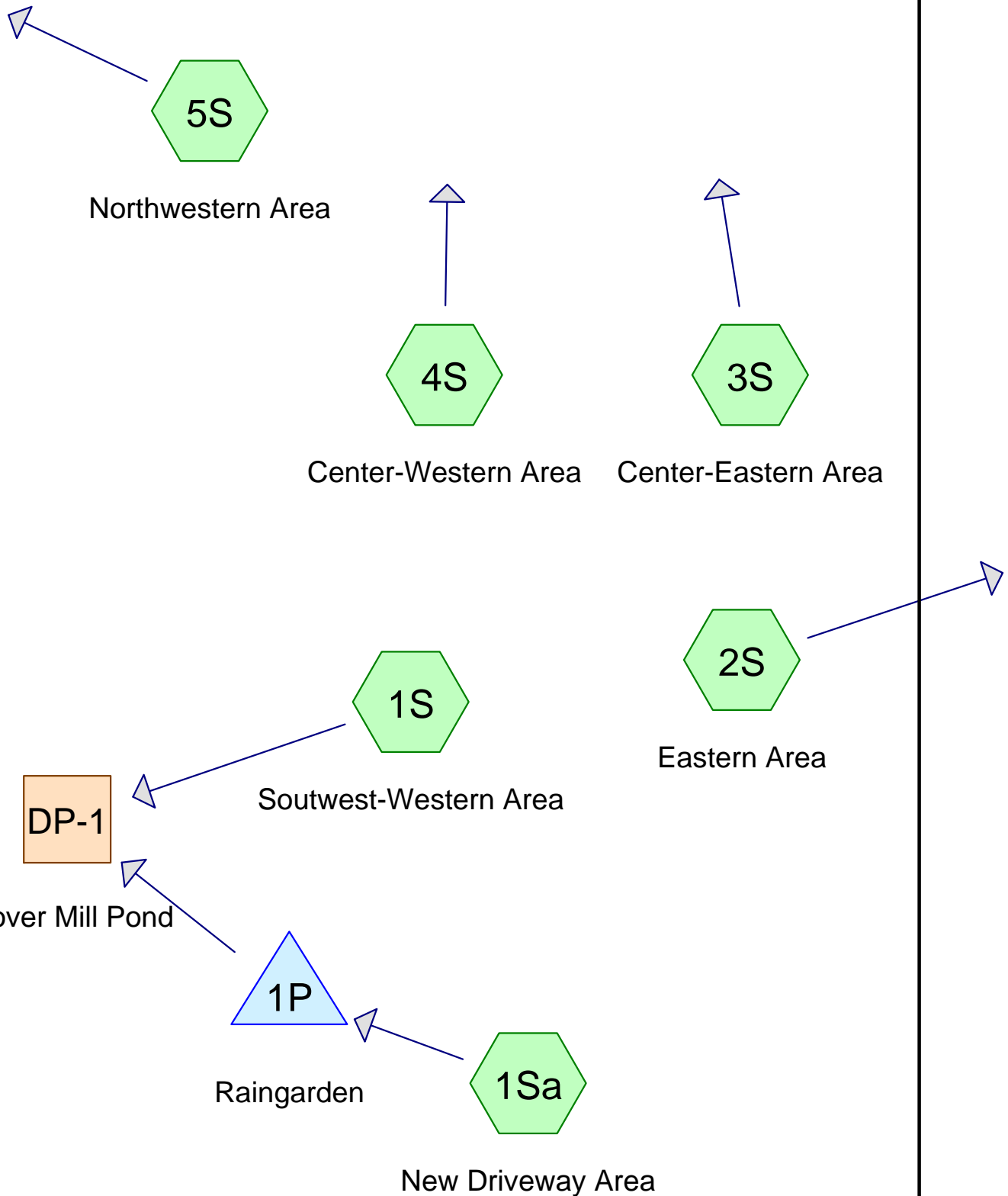
Runoff = 2.54 cfs @ 12.02 hrs, Volume= 8,997 cf, Depth= 1.37"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-yr Rainfall=7.66"

Area (sf)	CN	Description
51,381	30	Woods, Good, HSG A
821	55	Woods, Good, HSG B
26,398	67	Brush, Poor, HSG B
78,600	43	Weighted Average
78,600		100.00% Pervious Area

Subcatchment 5S: Northwestern Area

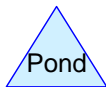




Subcat



Reach



Pond



Link

Routing Diagram for 3086.00 - Hydrocad Calculations - POST
Prepared by Atlantic Design Engineers, Inc., Printed 5/31/2019
HydroCAD® 10.00-25 s/n 00480 © 2019 HydroCAD Software Solutions LLC

3086.00 - Hydrocad Calculations - POST

Type III 24-hr 2-yr Rainfall=3.41"

Prepared by Atlantic Design Engineers, Inc.

Printed 5/31/2019

HydroCAD® 10.00-25 s/n 00480 © 2019 HydroCAD Software Solutions LLC

Page 2

Summary for Subcatchment 1S: Southwest-Western Area

Runoff = 5.87 cfs @ 12.42 hrs, Volume= 33,927 cf, Depth= 0.90"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-yr Rainfall=3.41"

Area (sf)	CN	Description
3,887	76	Gravel roads, HSG A
9,914	85	Gravel roads, HSG B
4,046	39	>75% Grass cover, Good, HSG A
139,352	61	>75% Grass cover, Good, HSG B
14,765	98	Paved parking, HSG A
103,603	98	Paved parking, HSG B
26,501	98	Roofs, HSG B
76,367	30	Woods, Good, HSG A
175	55	Woods, Good, HSG B
73,488	67	Brush, Poor, HSG B
452,098	69	Weighted Average
307,229		67.96% Pervious Area
144,869		32.04% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
20.2	50	0.0050	0.04		Sheet Flow, Woods: Light underbrush n= 0.400 P2= 3.60"
2.2	150	0.0050	1.14		Shallow Concentrated Flow, Unpaved Kv= 16.1 fps
2.1	380	0.0230	3.08		Shallow Concentrated Flow, Paved Kv= 20.3 fps
2.0	405	0.0420	3.30		Shallow Concentrated Flow, Unpaved Kv= 16.1 fps
26.5	985	Total			

3086.00 - Hydrocad Calculations - POST

Prepared by Atlantic Design Engineers, Inc.

HydroCAD® 10.00-25 s/n 00480 © 2019 HydroCAD Software Solutions LLC

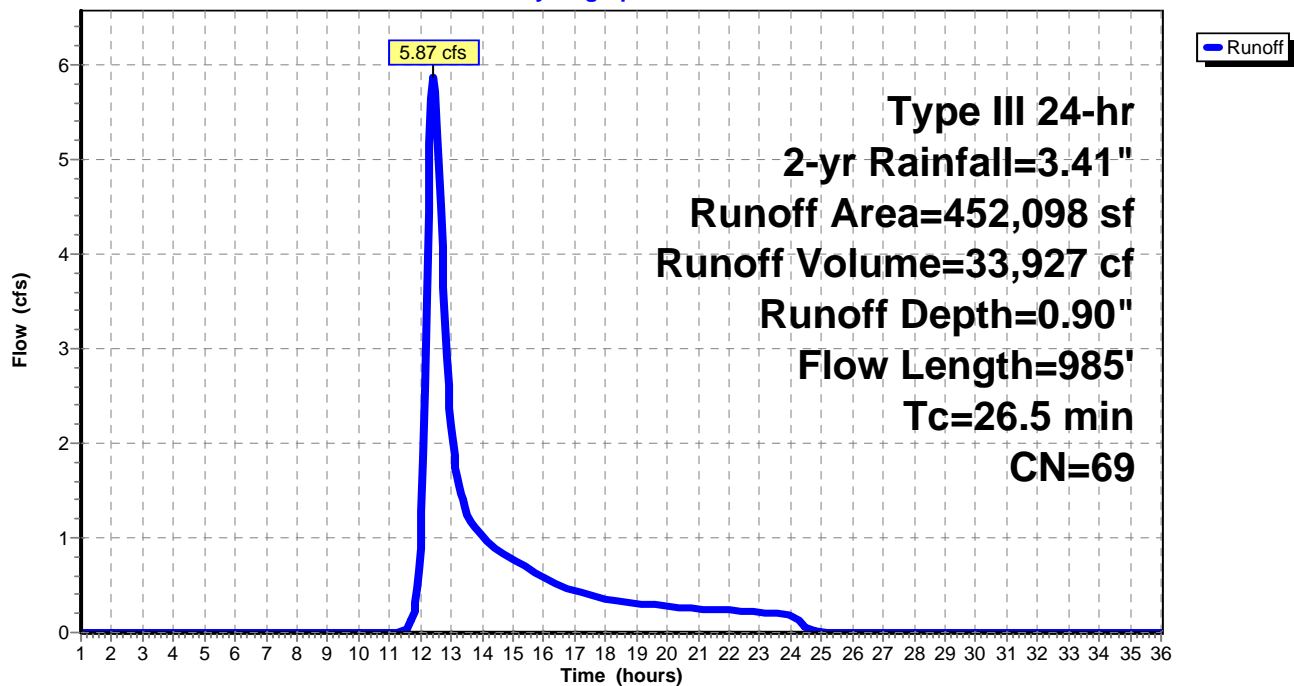
Type III 24-hr 2-yr Rainfall=3.41"

Printed 5/31/2019

Page 3

Subcatchment 1S: Southwest-Western Area

Hydrograph



3086.00 - Hydrocad Calculations - POST

Prepared by Atlantic Design Engineers, Inc.

HydroCAD® 10.00-25 s/n 00480 © 2019 HydroCAD Software Solutions LLC

Type III 24-hr 2-yr Rainfall=3.41"

Printed 5/31/2019

Page 4

Summary for Subcatchment 1Sa: New Driveway Area

Runoff = 0.05 cfs @ 12.15 hrs, Volume= 302 cf, Depth= 0.42"

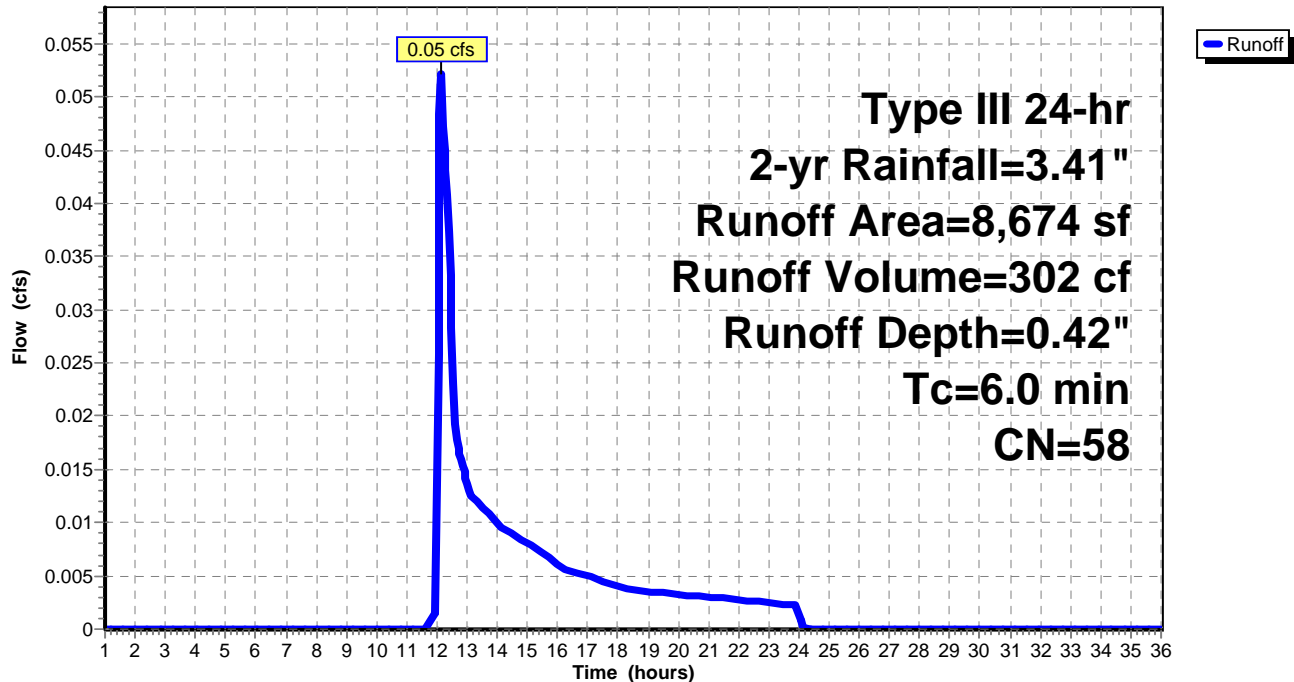
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-yr Rainfall=3.41"

Area (sf)	CN	Description
239	76	Gravel roads, HSG A
* 1,954	98	New Driveway Area, HSG A
2,628	30	Woods, Good, HSG A
1,067	98	Water Surface, HSG A
2,786	39	>75% Grass cover, Good, HSG A
8,674	58	Weighted Average
5,653		65.17% Pervious Area
3,021		34.83% Impervious Area

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

Subcatchment 1Sa: New Driveway Area

Hydrograph



3086.00 - Hydrocad Calculations - POST

Prepared by Atlantic Design Engineers, Inc.

HydroCAD® 10.00-25 s/n 00480 © 2019 HydroCAD Software Solutions LLC

Type III 24-hr 2-yr Rainfall=3.41"

Printed 5/31/2019

Page 5

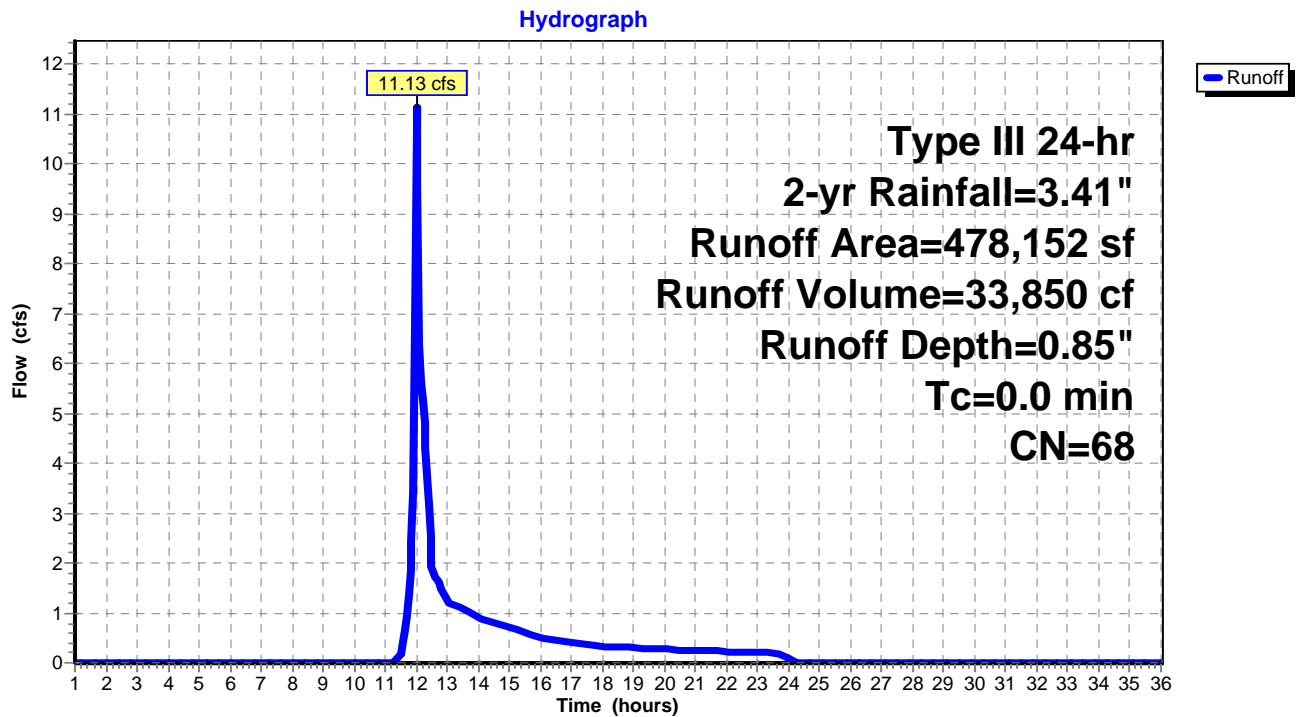
Summary for Subcatchment 2S: Eastern Area

Runoff = 11.13 cfs @ 12.01 hrs, Volume= 33,850 cf, Depth= 0.85"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-yr Rainfall=3.41"

Area (sf)	CN	Description
9,662	82	Dirt roads, HSG B
* 960	98	Equipment Pads
50,553	85	Gravel roads, HSG B
166,878	61	>75% Grass cover, Good, HSG B
14,392	98	Roofs, HSG B
23,117	55	Woods, Good, HSG B
212,590	67	Brush, Poor, HSG B
478,152	68	Weighted Average
462,800		96.79% Pervious Area
15,352		3.21% Impervious Area

Subcatchment 2S: Eastern Area



3086.00 - Hydrocad Calculations - POST

Prepared by Atlantic Design Engineers, Inc.

HydroCAD® 10.00-25 s/n 00480 © 2019 HydroCAD Software Solutions LLC

Type III 24-hr 2-yr Rainfall=3.41"

Printed 5/31/2019

Page 6

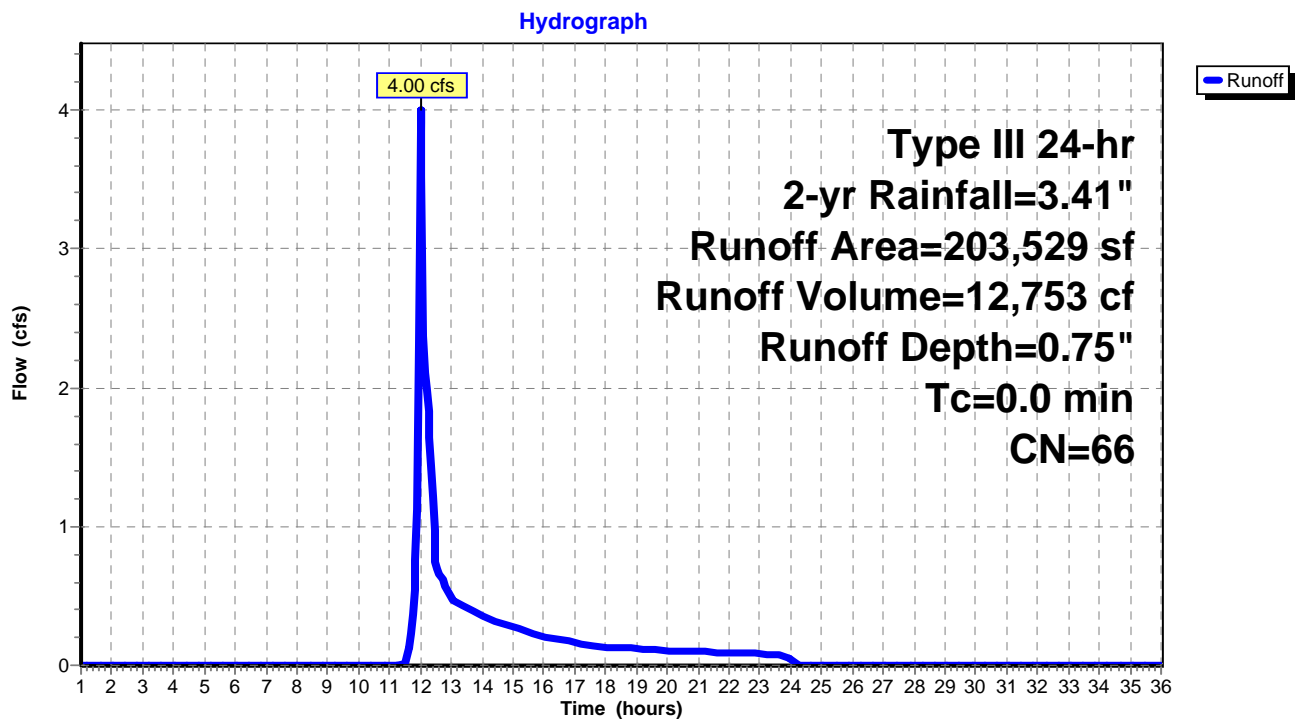
Summary for Subcatchment 3S: Center-Eastern Area

Runoff = 4.00 cfs @ 12.02 hrs, Volume= 12,753 cf, Depth= 0.75"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-yr Rainfall=3.41"

	Area (sf)	CN	Description
*	172,845	65	Upland Bog Area
	1,176	72	Dirt roads, HSG A
	7,998	82	Dirt roads, HSG B
	2,102	85	Gravel roads, HSG B
	1,434	61	>75% Grass cover, Good, HSG B
	604	30	Woods, Good, HSG A
	17,370	67	Brush, Poor, HSG B
	203,529	66	Weighted Average
	203,529		100.00% Pervious Area

Subcatchment 3S: Center-Eastern Area



3086.00 - Hydrocad Calculations - POST

Prepared by Atlantic Design Engineers, Inc.

HydroCAD® 10.00-25 s/n 00480 © 2019 HydroCAD Software Solutions LLC

Type III 24-hr 2-yr Rainfall=3.41"

Printed 5/31/2019

Page 7

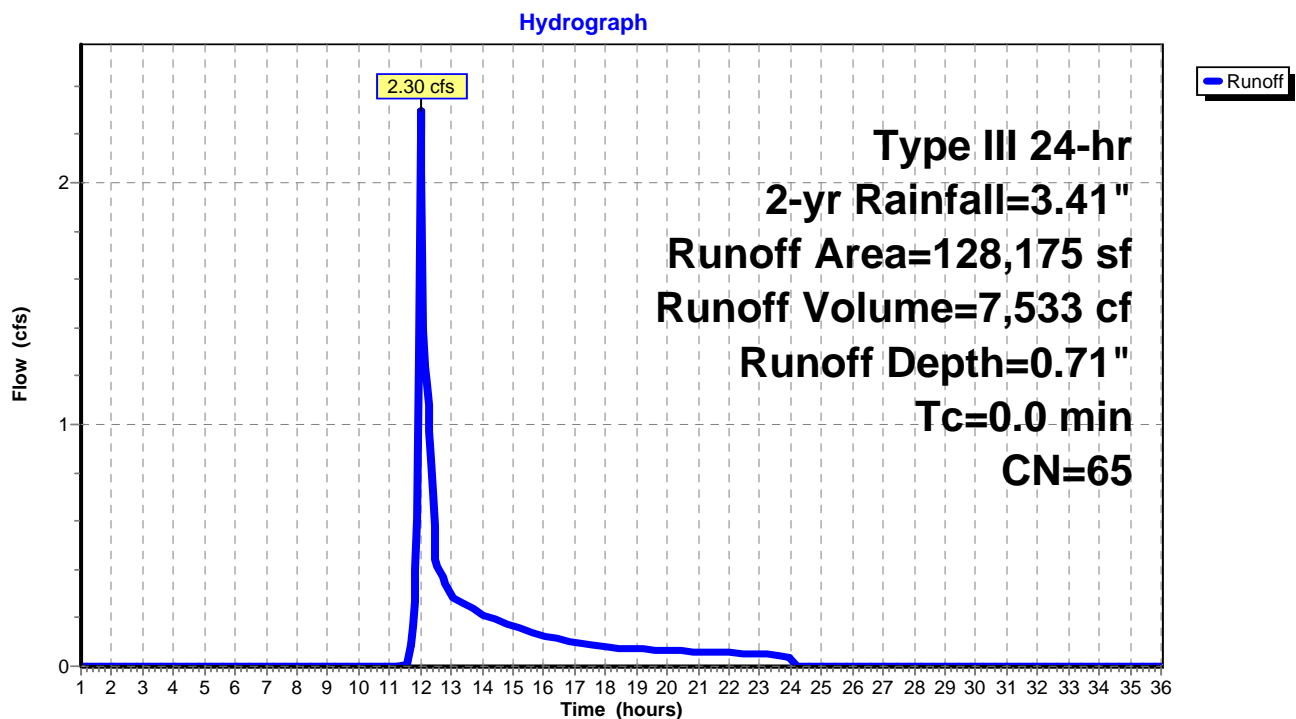
Summary for Subcatchment 4S: Center-Western Area

Runoff = 2.30 cfs @ 12.02 hrs, Volume= 7,533 cf, Depth= 0.71"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-yr Rainfall=3.41"

Area (sf)	CN	Description
227	39	>75% Grass cover, Good, HSG A
28,879	61	>75% Grass cover, Good, HSG B
954	30	Woods, Good, HSG A
465	55	Woods, Good, HSG B
97,650	67	Brush, Poor, HSG B
128,175	65	Weighted Average
128,175		100.00% Pervious Area

Subcatchment 4S: Center-Western Area



3086.00 - Hydrocad Calculations - POST

Prepared by Atlantic Design Engineers, Inc.

HydroCAD® 10.00-25 s/n 00480 © 2019 HydroCAD Software Solutions LLC

Type III 24-hr 2-yr Rainfall=3.41"

Printed 5/31/2019

Page 8

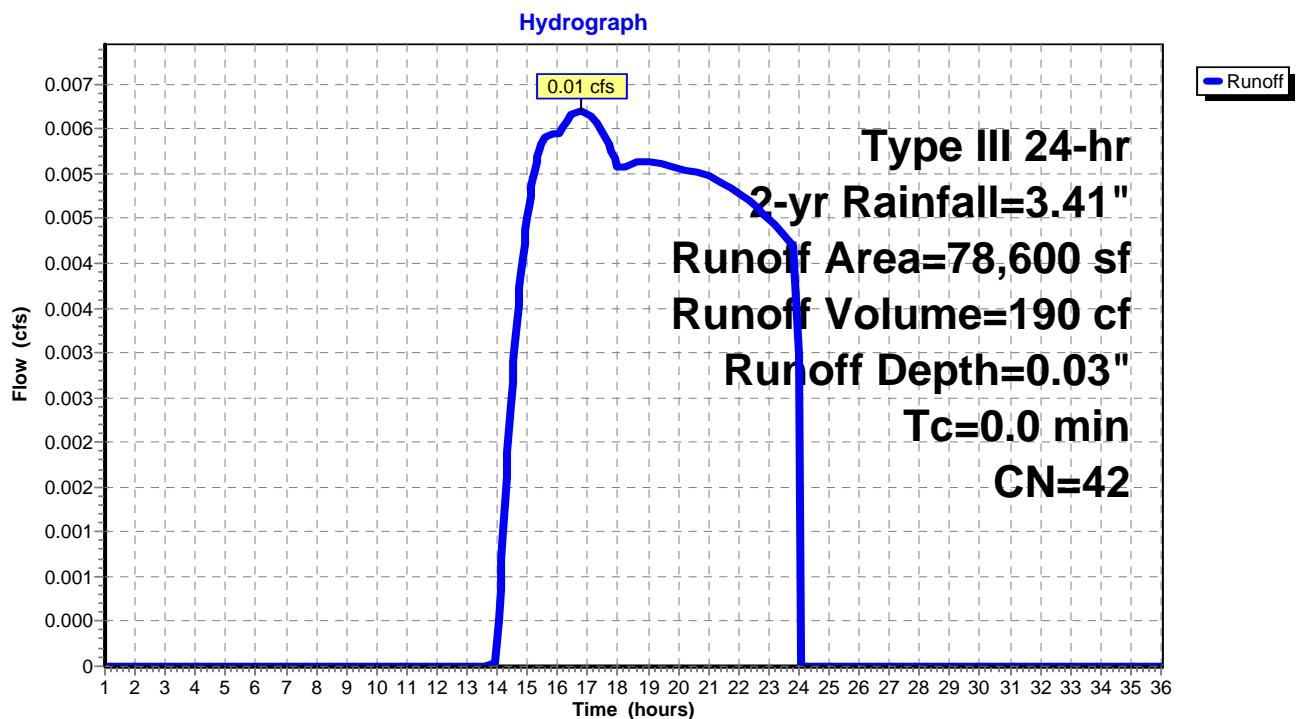
Summary for Subcatchment 5S: Northwestern Area

Runoff = 0.01 cfs @ 16.77 hrs, Volume= 190 cf, Depth= 0.03"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-yr Rainfall=3.41"

Area (sf)	CN	Description
778	39	>75% Grass cover, Good, HSG A
10,099	61	>75% Grass cover, Good, HSG B
50,691	30	Woods, Good, HSG A
821	55	Woods, Good, HSG B
16,211	67	Brush, Poor, HSG B
78,600	42	Weighted Average
78,600		100.00% Pervious Area

Subcatchment 5S: Northwestern Area



3086.00 - Hydrocad Calculations - POST

Prepared by Atlantic Design Engineers, Inc.

HydroCAD® 10.00-25 s/n 00480 © 2019 HydroCAD Software Solutions LLC

Type III 24-hr 2-yr Rainfall=3.41"

Printed 5/31/2019

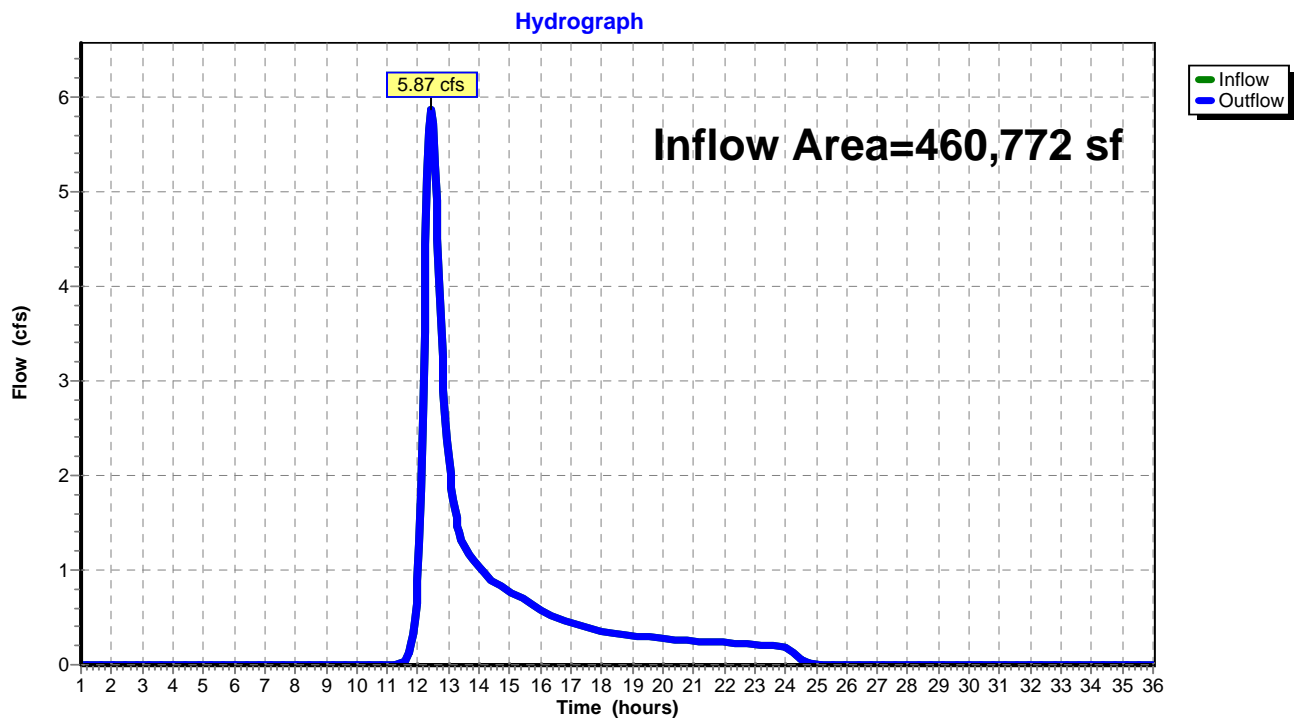
Page 9

Summary for Reach DP-1: Glover Mill Pond

Inflow Area = 460,772 sf, 32.10% Impervious, Inflow Depth = 0.88" for 2-yr event
Inflow = 5.87 cfs @ 12.42 hrs, Volume= 33,927 cf
Outflow = 5.87 cfs @ 12.42 hrs, Volume= 33,927 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 1.00-36.00 hrs, dt= 0.05 hrs

Reach DP-1: Glover Mill Pond



3086.00 - Hydrocad Calculations - POST

Type III 24-hr 2-yr Rainfall=3.41"

Prepared by Atlantic Design Engineers, Inc.

Printed 5/31/2019

HydroCAD® 10.00-25 s/n 00480 © 2019 HydroCAD Software Solutions LLC

Page 10

Summary for Pond 1P: Raingarden

Inflow Area = 8,674 sf, 34.83% Impervious, Inflow Depth = 0.42" for 2-yr event
 Inflow = 0.05 cfs @ 12.15 hrs, Volume= 302 cf
 Outflow = 0.03 cfs @ 12.46 hrs, Volume= 302 cf, Atten= 38%, Lag= 18.7 min
 Discarded = 0.03 cfs @ 12.46 hrs, Volume= 302 cf
 Primary = 0.00 cfs @ 1.00 hrs, Volume= 0 cf

Routing by Stor-Ind method, Time Span= 1.00-36.00 hrs, dt= 0.05 hrs
 Peak Elev= 65.04' @ 12.46 hrs Surf.Area= 571 sf Storage= 24 cf

Plug-Flow detention time= 8.2 min calculated for 302 cf (100% of inflow)
 Center-of-Mass det. time= 8.1 min (931.1 - 923.1)

Volume	Invert	Avail.Storage	Storage Description		
#1	65.00'	3,082 cf	Custom Stage Data (Irregular) Listed below (Recalc)		
Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
65.00	552	158.0	0	0	552
66.00	1,067	181.0	795	795	1,195
67.00	1,660	206.0	1,353	2,148	1,989
67.50	2,084	219.0	934	3,082	2,441

Device	Routing	Invert	Outlet Devices
#1	Discarded	65.00'	2.410 in/hr Exfiltration over Wetted area
#2	Primary	65.50'	4.0" Round Culvert L= 20.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 65.50' / 65.30' S= 0.0100 1' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.09 sf
#3	Primary	66.80'	10.0' long x 4.0' breadth Broad-Crested Rectangular Weir Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.38 2.54 2.69 2.68 2.67 2.67 2.65 2.66 2.66 2.68 2.72 2.73 2.76 2.79 2.88 3.07 3.32

Discarded OutFlow Max=0.03 cfs @ 12.46 hrs HW=65.04' (Free Discharge)
 ↑ **1=Exfiltration** (Exfiltration Controls 0.03 cfs)

Primary OutFlow Max=0.00 cfs @ 1.00 hrs HW=65.00' (Free Discharge)
 ↑ **2=Culvert** (Controls 0.00 cfs)
 ↑ **3=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

3086.00 - Hydrocad Calculations - POST

Prepared by Atlantic Design Engineers, Inc.

HydroCAD® 10.00-25 s/n 00480 © 2019 HydroCAD Software Solutions LLC

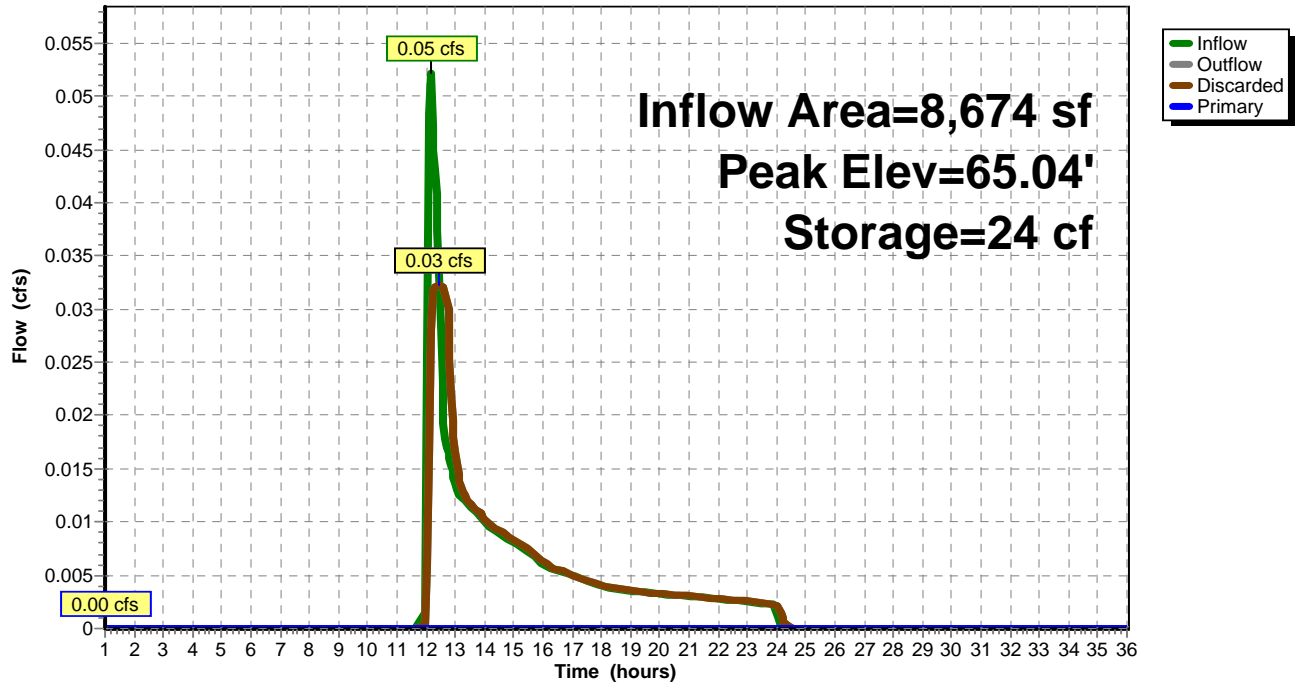
Type III 24-hr 2-yr Rainfall=3.41"

Printed 5/31/2019

Page 11

Pond 1P: Raingarden

Hydrograph



3086.00 - Hydrocad Calculations - POST

Type III 24-hr 10-yr Rainfall=5.05"

Prepared by Atlantic Design Engineers, Inc.

Printed 5/31/2019

HydroCAD® 10.00-25 s/n 00480 © 2019 HydroCAD Software Solutions LLC

Page 12

Summary for Subcatchment 1S: Southwest-Western Area

Runoff = 14.10 cfs @ 12.39 hrs, Volume= 75,115 cf, Depth= 1.99"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-yr Rainfall=5.05"

Area (sf)	CN	Description
3,887	76	Gravel roads, HSG A
9,914	85	Gravel roads, HSG B
4,046	39	>75% Grass cover, Good, HSG A
139,352	61	>75% Grass cover, Good, HSG B
14,765	98	Paved parking, HSG A
103,603	98	Paved parking, HSG B
26,501	98	Roofs, HSG B
76,367	30	Woods, Good, HSG A
175	55	Woods, Good, HSG B
73,488	67	Brush, Poor, HSG B
452,098	69	Weighted Average
307,229		67.96% Pervious Area
144,869		32.04% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
20.2	50	0.0050	0.04		Sheet Flow, Woods: Light underbrush n= 0.400 P2= 3.60"
2.2	150	0.0050	1.14		Shallow Concentrated Flow, Unpaved Kv= 16.1 fps
2.1	380	0.0230	3.08		Shallow Concentrated Flow, Paved Kv= 20.3 fps
2.0	405	0.0420	3.30		Shallow Concentrated Flow, Unpaved Kv= 16.1 fps
26.5	985	Total			

3086.00 - Hydrocad Calculations - POST

Prepared by Atlantic Design Engineers, Inc.

HydroCAD® 10.00-25 s/n 00480 © 2019 HydroCAD Software Solutions LLC

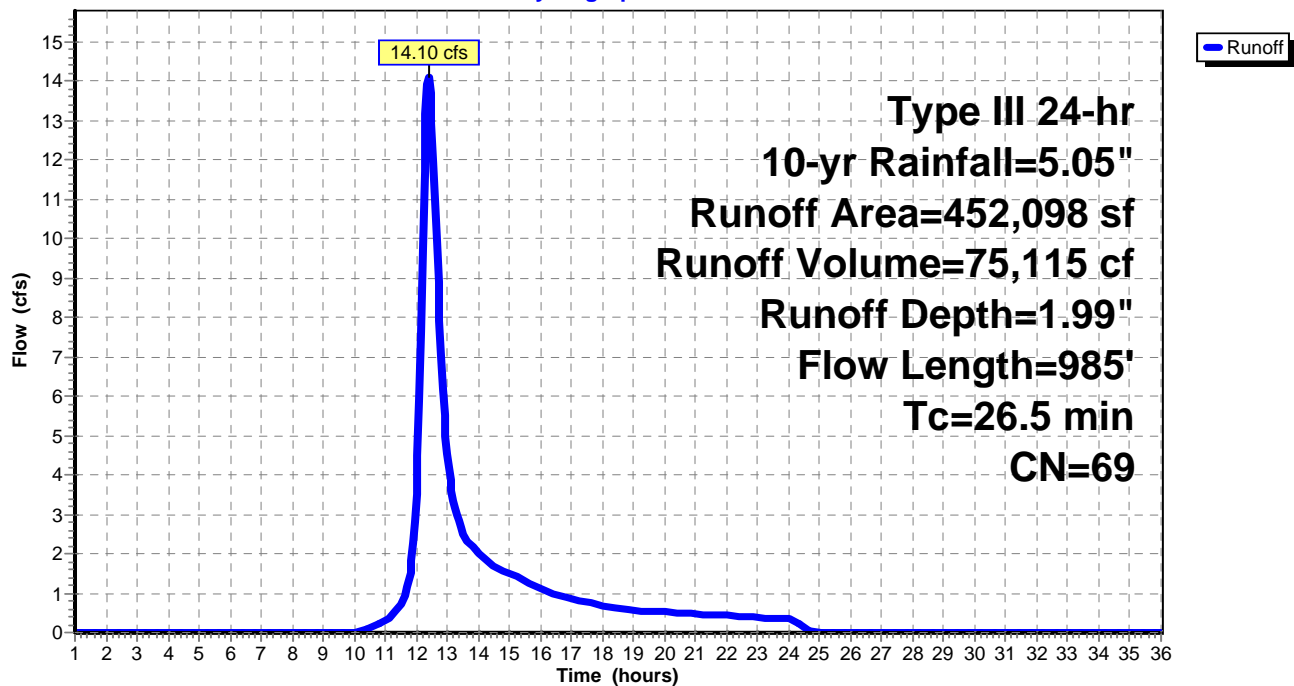
Type III 24-hr 10-yr Rainfall=5.05"

Printed 5/31/2019

Page 13

Subcatchment 1S: Southwest-Western Area

Hydrograph



3086.00 - Hydrocad Calculations - POST

Prepared by Atlantic Design Engineers, Inc.

HydroCAD® 10.00-25 s/n 00480 © 2019 HydroCAD Software Solutions LLC

Type III 24-hr 10-yr Rainfall=5.05"

Printed 5/31/2019

Page 14

Summary for Subcatchment 1Sa: New Driveway Area

Runoff = 0.24 cfs @ 12.11 hrs, Volume= 865 cf, Depth= 1.20"

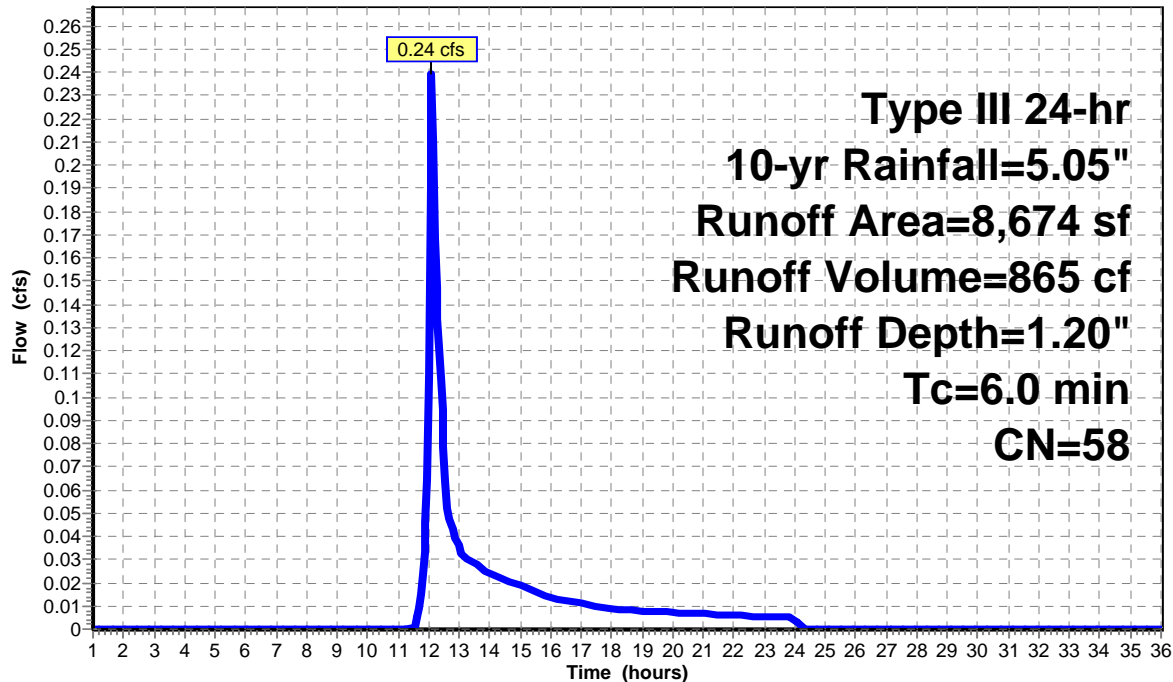
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-yr Rainfall=5.05"

Area (sf)	CN	Description
239	76	Gravel roads, HSG A
* 1,954	98	New Driveway Area, HSG A
2,628	30	Woods, Good, HSG A
1,067	98	Water Surface, HSG A
2,786	39	>75% Grass cover, Good, HSG A
8,674	58	Weighted Average
5,653		65.17% Pervious Area
3,021		34.83% Impervious Area

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

Subcatchment 1Sa: New Driveway Area

Hydrograph



3086.00 - Hydrocad Calculations - POST

Prepared by Atlantic Design Engineers, Inc.

HydroCAD® 10.00-25 s/n 00480 © 2019 HydroCAD Software Solutions LLC

Type III 24-hr 10-yr Rainfall=5.05"

Printed 5/31/2019

Page 15

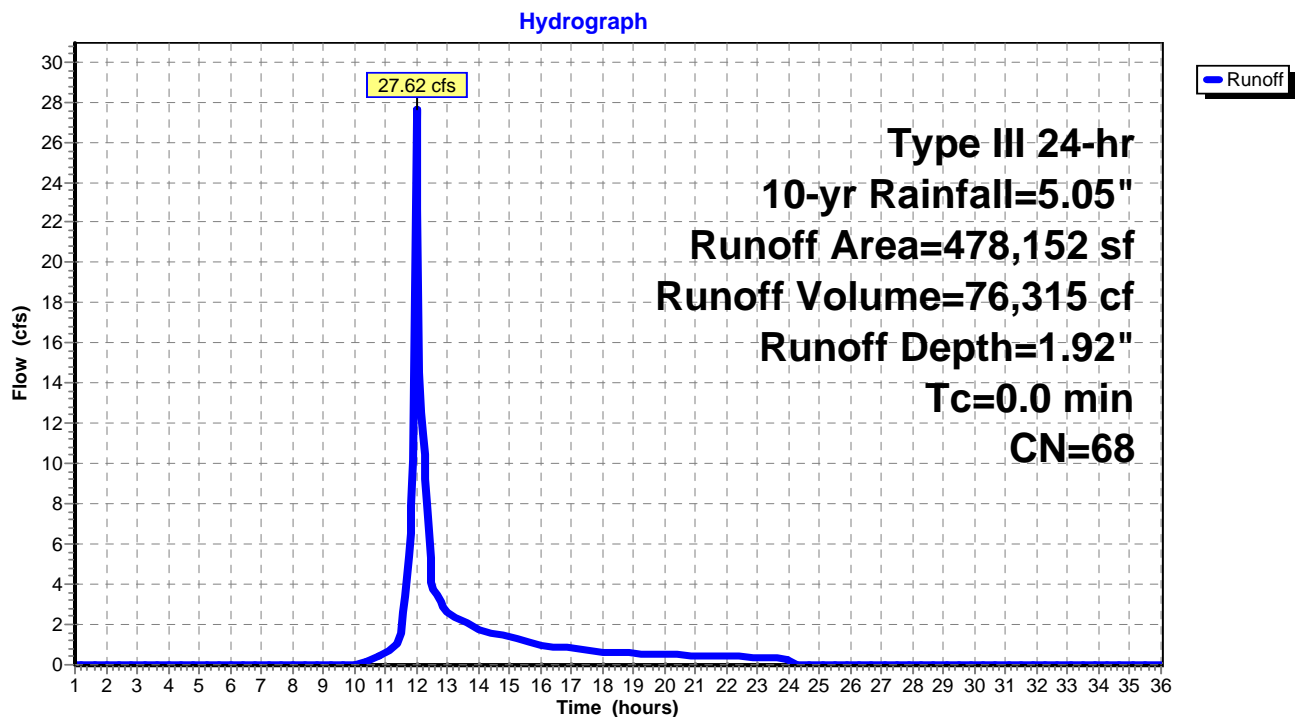
Summary for Subcatchment 2S: Eastern Area

Runoff = 27.62 cfs @ 12.01 hrs, Volume= 76,315 cf, Depth= 1.92"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-yr Rainfall=5.05"

Area (sf)	CN	Description
9,662	82	Dirt roads, HSG B
* 960	98	Equipment Pads
50,553	85	Gravel roads, HSG B
166,878	61	>75% Grass cover, Good, HSG B
14,392	98	Roofs, HSG B
23,117	55	Woods, Good, HSG B
212,590	67	Brush, Poor, HSG B
478,152	68	Weighted Average
462,800		96.79% Pervious Area
15,352		3.21% Impervious Area

Subcatchment 2S: Eastern Area



3086.00 - Hydrocad Calculations - POST

Prepared by Atlantic Design Engineers, Inc.

HydroCAD® 10.00-25 s/n 00480 © 2019 HydroCAD Software Solutions LLC

Type III 24-hr 10-yr Rainfall=5.05"

Printed 5/31/2019

Page 16

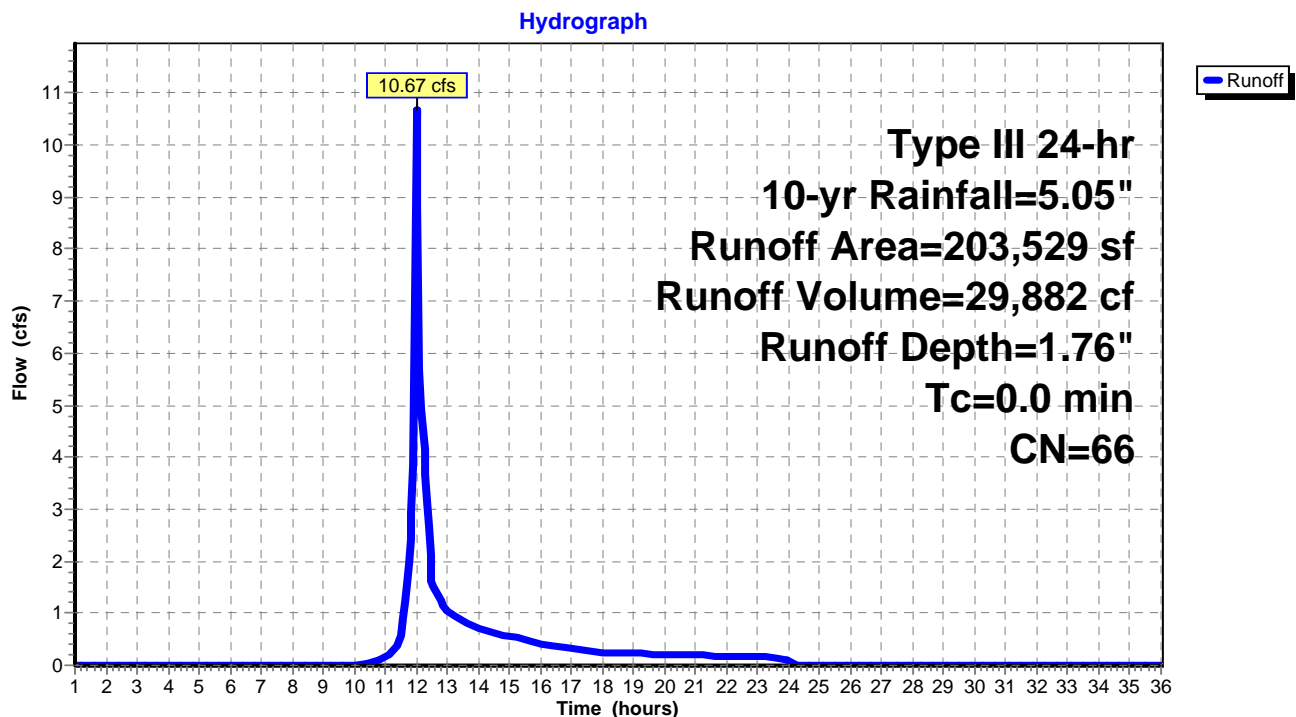
Summary for Subcatchment 3S: Center-Eastern Area

Runoff = 10.67 cfs @ 12.01 hrs, Volume= 29,882 cf, Depth= 1.76"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-yr Rainfall=5.05"

	Area (sf)	CN	Description
*	172,845	65	Upland Bog Area
	1,176	72	Dirt roads, HSG A
	7,998	82	Dirt roads, HSG B
	2,102	85	Gravel roads, HSG B
	1,434	61	>75% Grass cover, Good, HSG B
	604	30	Woods, Good, HSG A
	17,370	67	Brush, Poor, HSG B
	203,529	66	Weighted Average
	203,529		100.00% Pervious Area

Subcatchment 3S: Center-Eastern Area



3086.00 - Hydrocad Calculations - POST

Prepared by Atlantic Design Engineers, Inc.

HydroCAD® 10.00-25 s/n 00480 © 2019 HydroCAD Software Solutions LLC

Type III 24-hr 10-yr Rainfall=5.05"

Printed 5/31/2019

Page 17

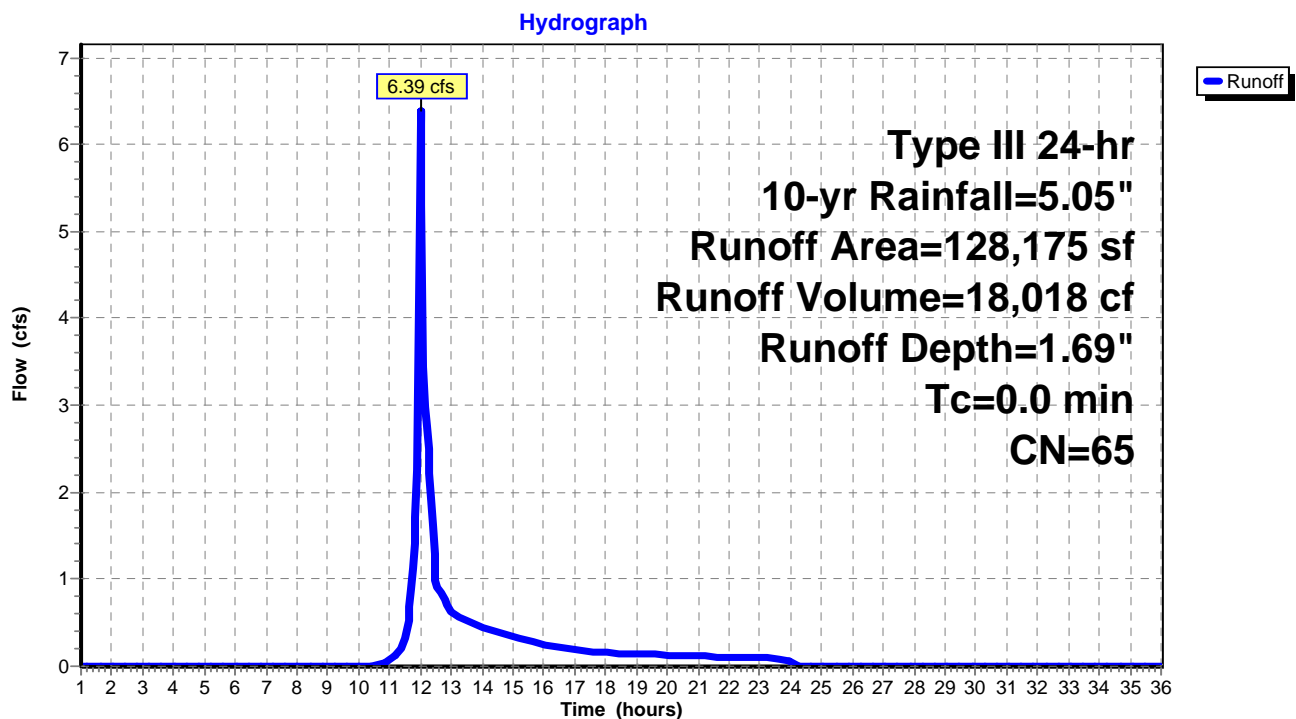
Summary for Subcatchment 4S: Center-Western Area

Runoff = 6.39 cfs @ 12.01 hrs, Volume= 18,018 cf, Depth= 1.69"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-yr Rainfall=5.05"

Area (sf)	CN	Description
227	39	>75% Grass cover, Good, HSG A
28,879	61	>75% Grass cover, Good, HSG B
954	30	Woods, Good, HSG A
465	55	Woods, Good, HSG B
97,650	67	Brush, Poor, HSG B
128,175	65	Weighted Average
128,175		100.00% Pervious Area

Subcatchment 4S: Center-Western Area



3086.00 - Hydrocad Calculations - POST

Prepared by Atlantic Design Engineers, Inc.

HydroCAD® 10.00-25 s/n 00480 © 2019 HydroCAD Software Solutions LLC

Type III 24-hr 10-yr Rainfall=5.05"

Printed 5/31/2019

Page 18

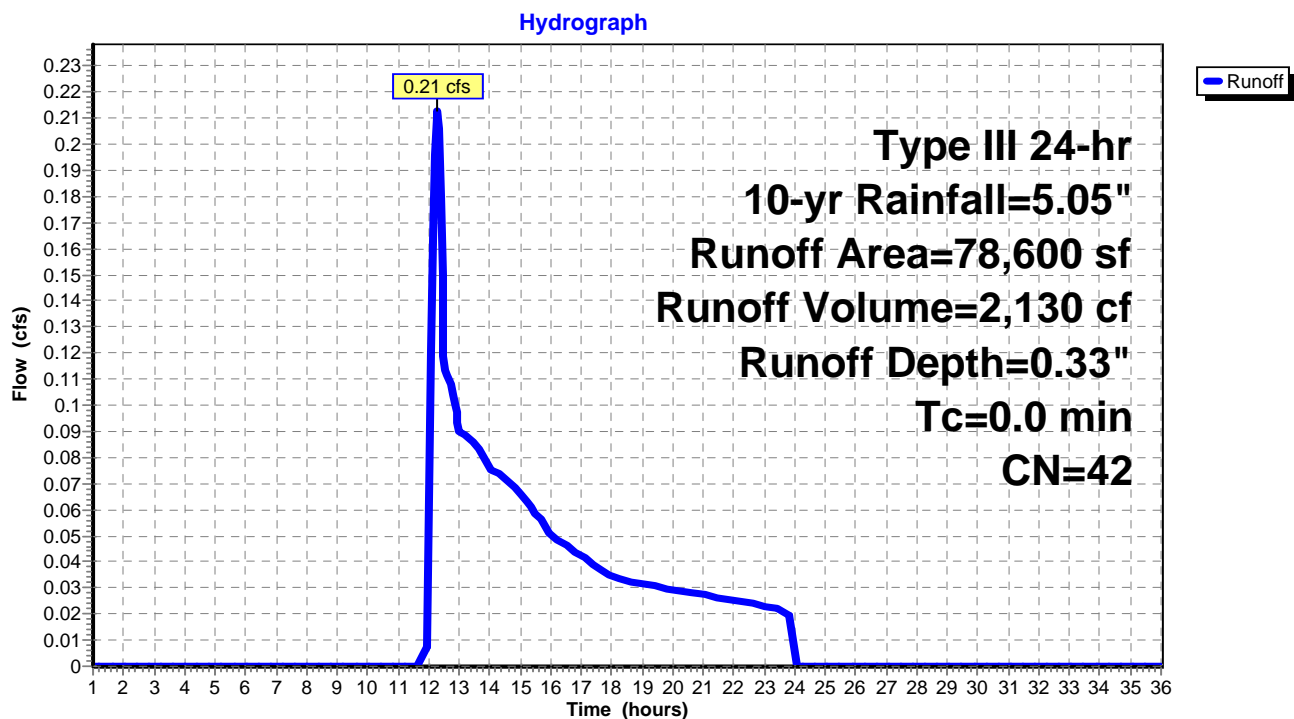
Summary for Subcatchment 5S: Northwestern Area

Runoff = 0.21 cfs @ 12.28 hrs, Volume= 2,130 cf, Depth= 0.33"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-yr Rainfall=5.05"

Area (sf)	CN	Description
778	39	>75% Grass cover, Good, HSG A
10,099	61	>75% Grass cover, Good, HSG B
50,691	30	Woods, Good, HSG A
821	55	Woods, Good, HSG B
16,211	67	Brush, Poor, HSG B
78,600	42	Weighted Average
78,600		100.00% Pervious Area

Subcatchment 5S: Northwestern Area



3086.00 - Hydrocad Calculations - POST

Prepared by Atlantic Design Engineers, Inc.

HydroCAD® 10.00-25 s/n 00480 © 2019 HydroCAD Software Solutions LLC

Type III 24-hr 10-yr Rainfall=5.05"

Printed 5/31/2019

Page 19

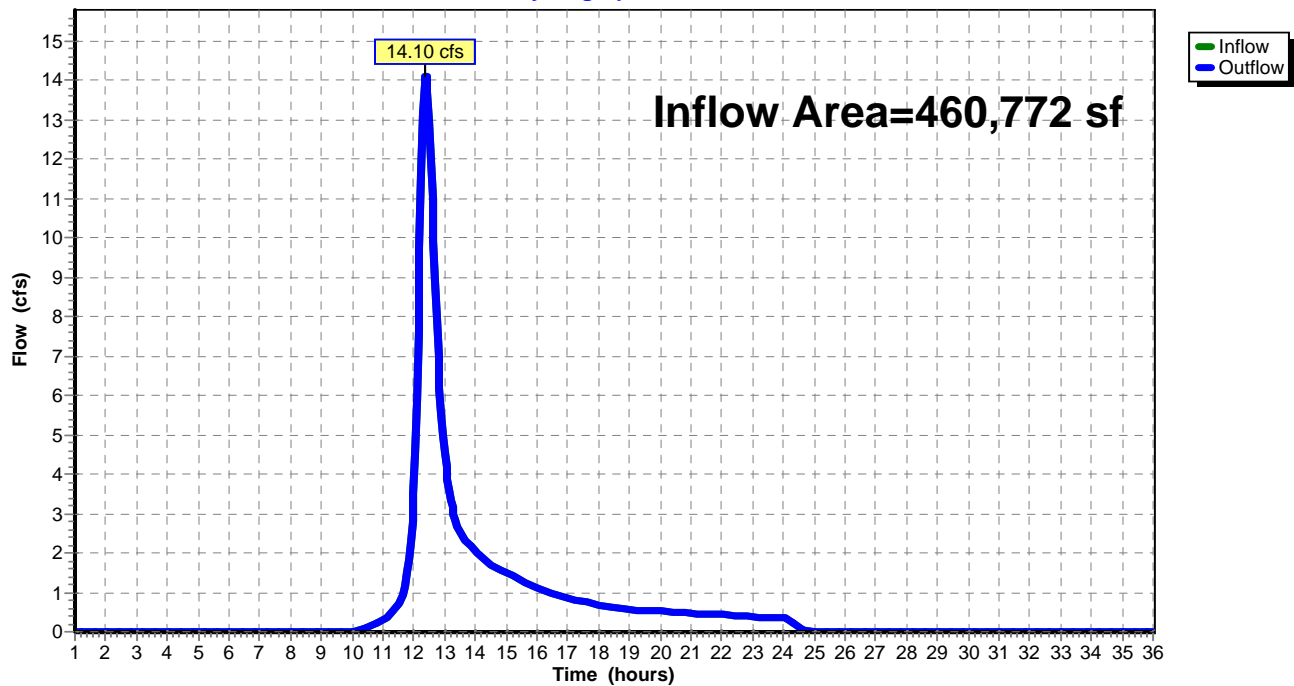
Summary for Reach DP-1: Glover Mill Pond

Inflow Area = 460,772 sf, 32.10% Impervious, Inflow Depth = 1.96" for 10-yr event
Inflow = 14.10 cfs @ 12.39 hrs, Volume= 75,115 cf
Outflow = 14.10 cfs @ 12.39 hrs, Volume= 75,115 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 1.00-36.00 hrs, dt= 0.05 hrs

Reach DP-1: Glover Mill Pond

Hydrograph



3086.00 - Hydrocad Calculations - POST

Type III 24-hr 10-yr Rainfall=5.05"

Prepared by Atlantic Design Engineers, Inc.

Printed 5/31/2019

HydroCAD® 10.00-25 s/n 00480 © 2019 HydroCAD Software Solutions LLC

Page 20

Summary for Pond 1P: Raingarden

Inflow Area = 8,674 sf, 34.83% Impervious, Inflow Depth = 1.20" for 10-yr event
 Inflow = 0.24 cfs @ 12.11 hrs, Volume= 865 cf
 Outflow = 0.04 cfs @ 12.75 hrs, Volume= 865 cf, Atten= 82%, Lag= 38.6 min
 Discarded = 0.04 cfs @ 12.75 hrs, Volume= 865 cf
 Primary = 0.00 cfs @ 1.00 hrs, Volume= 0 cf

Routing by Stor-Ind method, Time Span= 1.00-36.00 hrs, dt= 0.05 hrs
 Peak Elev= 65.37' @ 12.75 hrs Surf.Area= 724 sf Storage= 236 cf

Plug-Flow detention time= 47.4 min calculated for 864 cf (100% of inflow)
 Center-of-Mass det. time= 47.3 min (928.4 - 881.1)

Volume	Invert	Avail.Storage	Storage Description
#1	65.00'	3,082 cf	Custom Stage Data (Irregular) Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
65.00	552	158.0	0	0	552
66.00	1,067	181.0	795	795	1,195
67.00	1,660	206.0	1,353	2,148	1,989
67.50	2,084	219.0	934	3,082	2,441

Device	Routing	Invert	Outlet Devices
#1	Discarded	65.00'	2.410 in/hr Exfiltration over Wetted area
#2	Primary	65.50'	4.0" Round Culvert L= 20.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 65.50' / 65.30' S= 0.0100 1' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.09 sf
#3	Primary	66.80'	10.0' long x 4.0' breadth Broad-Crested Rectangular Weir Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.38 2.54 2.69 2.68 2.67 2.67 2.65 2.66 2.66 2.68 2.72 2.73 2.76 2.79 2.88 3.07 3.32

Discarded OutFlow Max=0.04 cfs @ 12.75 hrs HW=65.37' (Free Discharge)
 ↑ **1=Exfiltration** (Exfiltration Controls 0.04 cfs)

Primary OutFlow Max=0.00 cfs @ 1.00 hrs HW=65.00' (Free Discharge)
 ↑ **2=Culvert** (Controls 0.00 cfs)
 ↑ **3=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

3086.00 - Hydrocad Calculations - POST

Prepared by Atlantic Design Engineers, Inc.

HydroCAD® 10.00-25 s/n 00480 © 2019 HydroCAD Software Solutions LLC

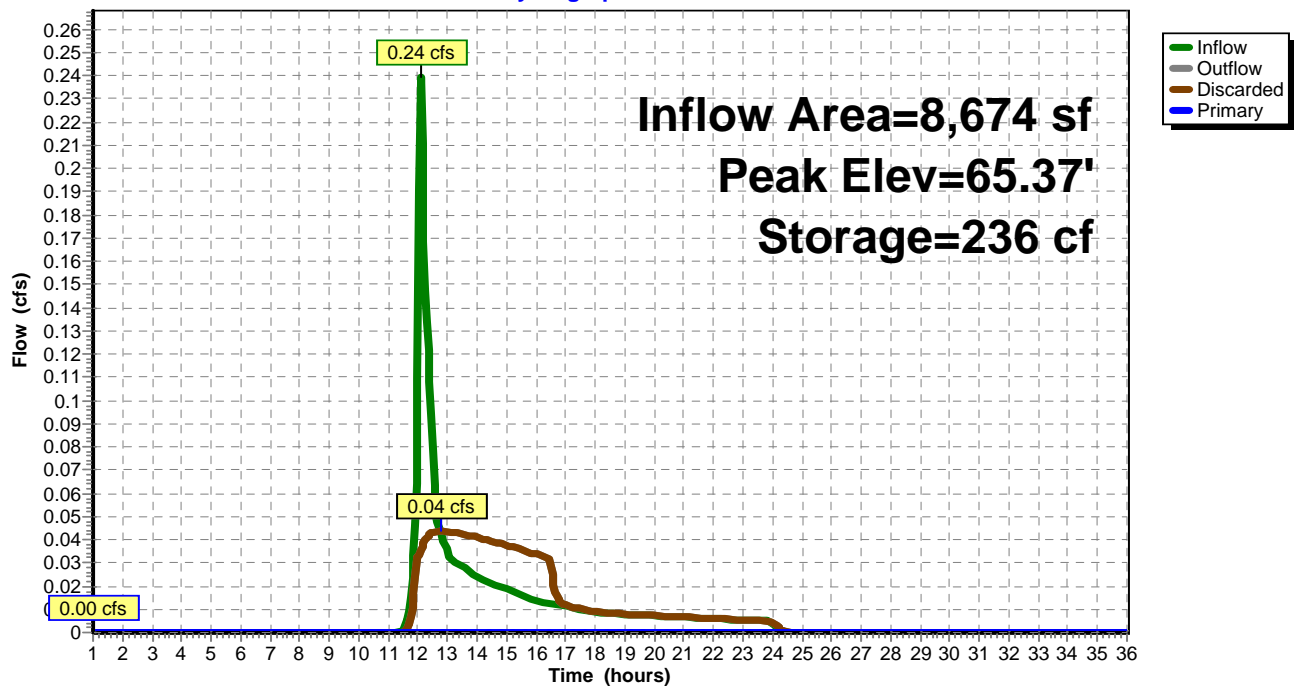
Type III 24-hr 10-yr Rainfall=5.05"

Printed 5/31/2019

Page 21

Pond 1P: Raingarden

Hydrograph



3086.00 - Hydrocad Calculations - POST

Type III 24-hr 25-yr Rainfall=6.08"

Prepared by Atlantic Design Engineers, Inc.

Printed 5/31/2019

HydroCAD® 10.00-25 s/n 00480 © 2019 HydroCAD Software Solutions LLC

Page 22

Summary for Subcatchment 1S: Southwest-Western Area

Runoff = 19.94 cfs @ 12.38 hrs, Volume= 104,554 cf, Depth= 2.78"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-yr Rainfall=6.08"

Area (sf)	CN	Description
3,887	76	Gravel roads, HSG A
9,914	85	Gravel roads, HSG B
4,046	39	>75% Grass cover, Good, HSG A
139,352	61	>75% Grass cover, Good, HSG B
14,765	98	Paved parking, HSG A
103,603	98	Paved parking, HSG B
26,501	98	Roofs, HSG B
76,367	30	Woods, Good, HSG A
175	55	Woods, Good, HSG B
73,488	67	Brush, Poor, HSG B
452,098	69	Weighted Average
307,229		67.96% Pervious Area
144,869		32.04% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
20.2	50	0.0050	0.04		Sheet Flow, Woods: Light underbrush n= 0.400 P2= 3.60"
2.2	150	0.0050	1.14		Shallow Concentrated Flow, Unpaved Kv= 16.1 fps
2.1	380	0.0230	3.08		Shallow Concentrated Flow, Paved Kv= 20.3 fps
2.0	405	0.0420	3.30		Shallow Concentrated Flow, Unpaved Kv= 16.1 fps
26.5	985	Total			

3086.00 - Hydrocad Calculations - POST

Prepared by Atlantic Design Engineers, Inc.

HydroCAD® 10.00-25 s/n 00480 © 2019 HydroCAD Software Solutions LLC

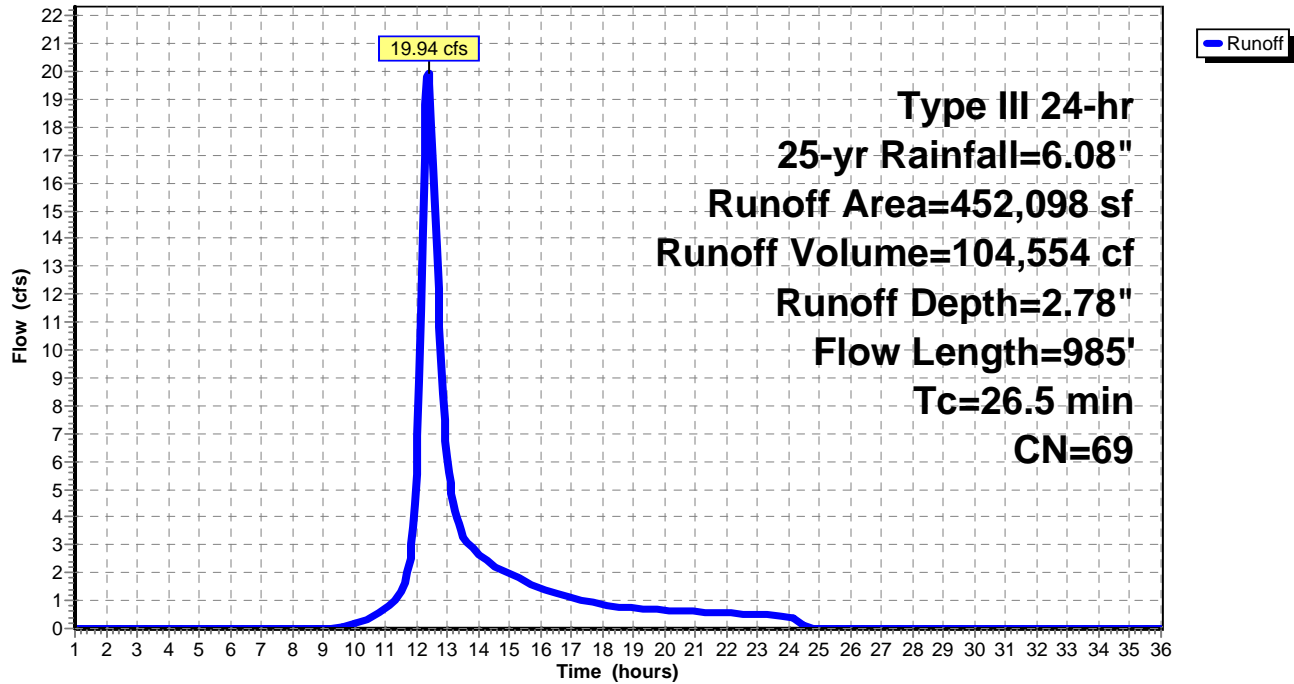
Type III 24-hr 25-yr Rainfall=6.08"

Printed 5/31/2019

Page 23

Subcatchment 1S: Southwest-Western Area

Hydrograph



3086.00 - Hydrocad Calculations - POST

Prepared by Atlantic Design Engineers, Inc.

HydroCAD® 10.00-25 s/n 00480 © 2019 HydroCAD Software Solutions LLC

Type III 24-hr 25-yr Rainfall=6.08"

Printed 5/31/2019

Page 24

Summary for Subcatchment 1Sa: New Driveway Area

Runoff = 0.39 cfs @ 12.10 hrs, Volume= 1,306 cf, Depth= 1.81"

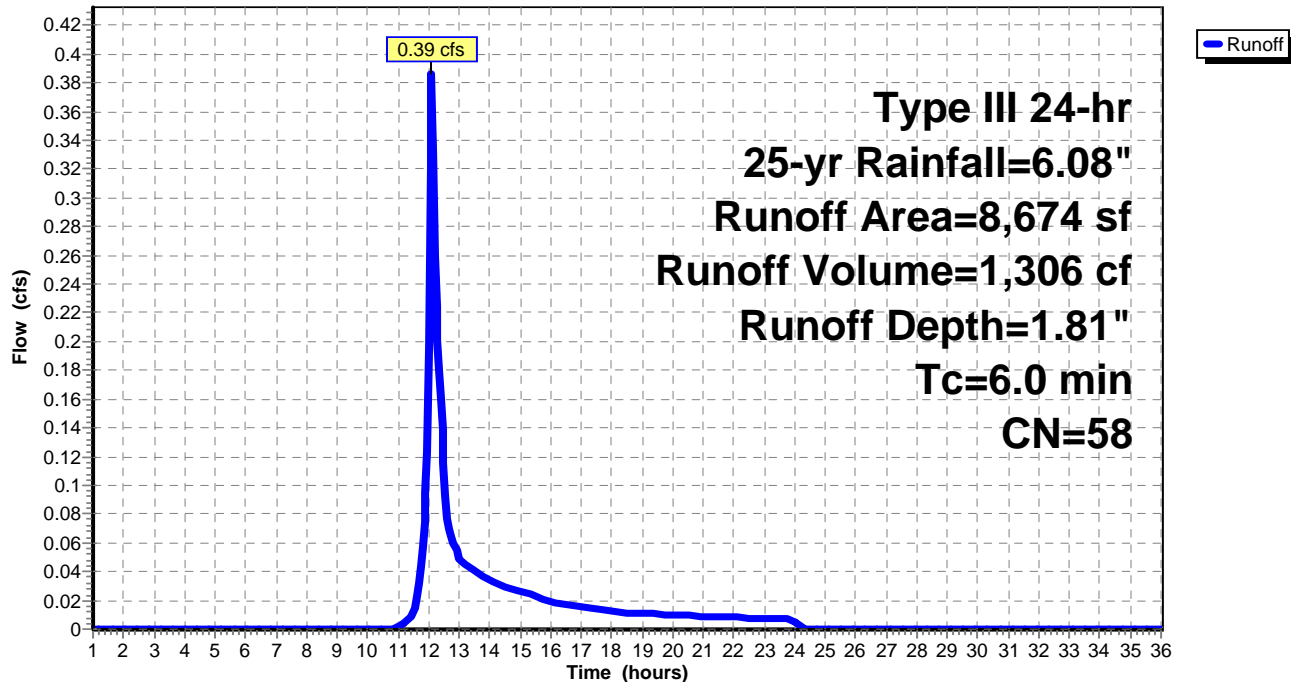
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-yr Rainfall=6.08"

Area (sf)	CN	Description
239	76	Gravel roads, HSG A
* 1,954	98	New Driveway Area, HSG A
2,628	30	Woods, Good, HSG A
1,067	98	Water Surface, HSG A
2,786	39	>75% Grass cover, Good, HSG A
8,674	58	Weighted Average
5,653		65.17% Pervious Area
3,021		34.83% Impervious Area

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

Subcatchment 1Sa: New Driveway Area

Hydrograph



3086.00 - Hydrocad Calculations - POST

Prepared by Atlantic Design Engineers, Inc.

HydroCAD® 10.00-25 s/n 00480 © 2019 HydroCAD Software Solutions LLC

Type III 24-hr 25-yr Rainfall=6.08"

Printed 5/31/2019

Page 25

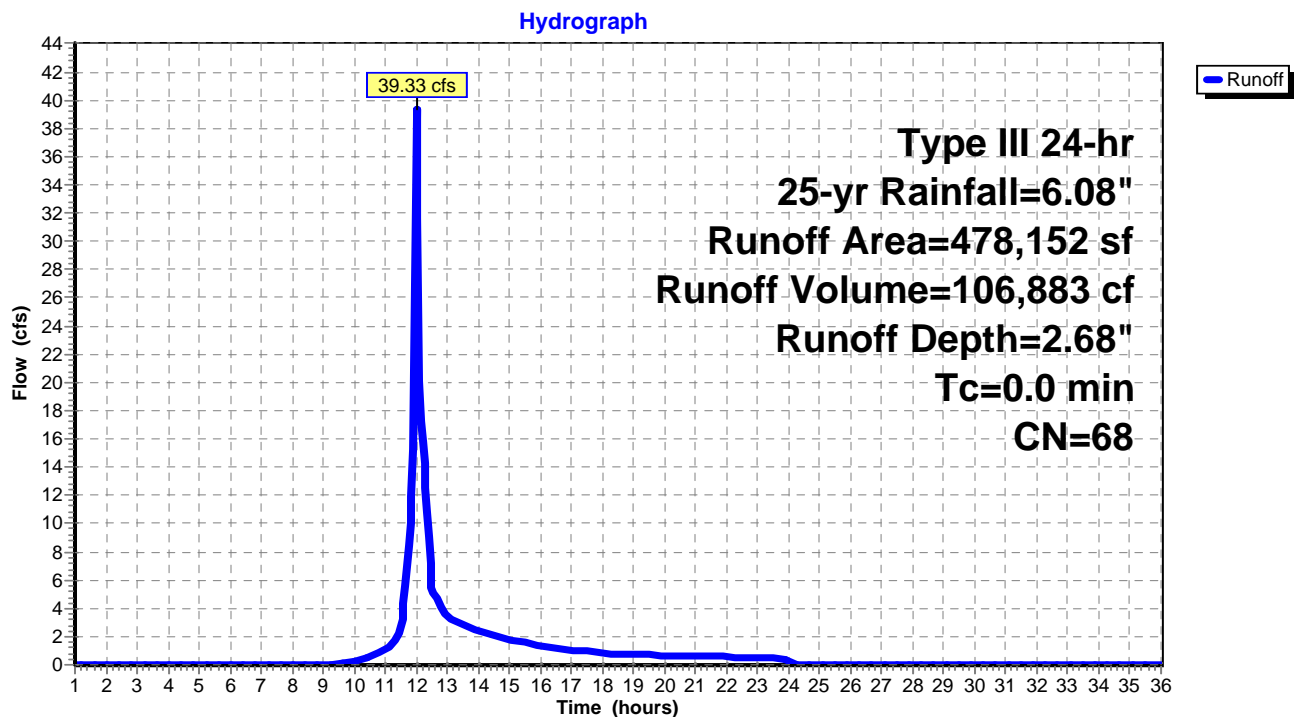
Summary for Subcatchment 2S: Eastern Area

Runoff = 39.33 cfs @ 12.01 hrs, Volume= 106,883 cf, Depth= 2.68"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-yr Rainfall=6.08"

Area (sf)	CN	Description
9,662	82	Dirt roads, HSG B
* 960	98	Equipment Pads
50,553	85	Gravel roads, HSG B
166,878	61	>75% Grass cover, Good, HSG B
14,392	98	Roofs, HSG B
23,117	55	Woods, Good, HSG B
212,590	67	Brush, Poor, HSG B
478,152	68	Weighted Average
462,800		96.79% Pervious Area
15,352		3.21% Impervious Area

Subcatchment 2S: Eastern Area



3086.00 - Hydrocad Calculations - POST

Prepared by Atlantic Design Engineers, Inc.

HydroCAD® 10.00-25 s/n 00480 © 2019 HydroCAD Software Solutions LLC

Type III 24-hr 25-yr Rainfall=6.08"

Printed 5/31/2019

Page 26

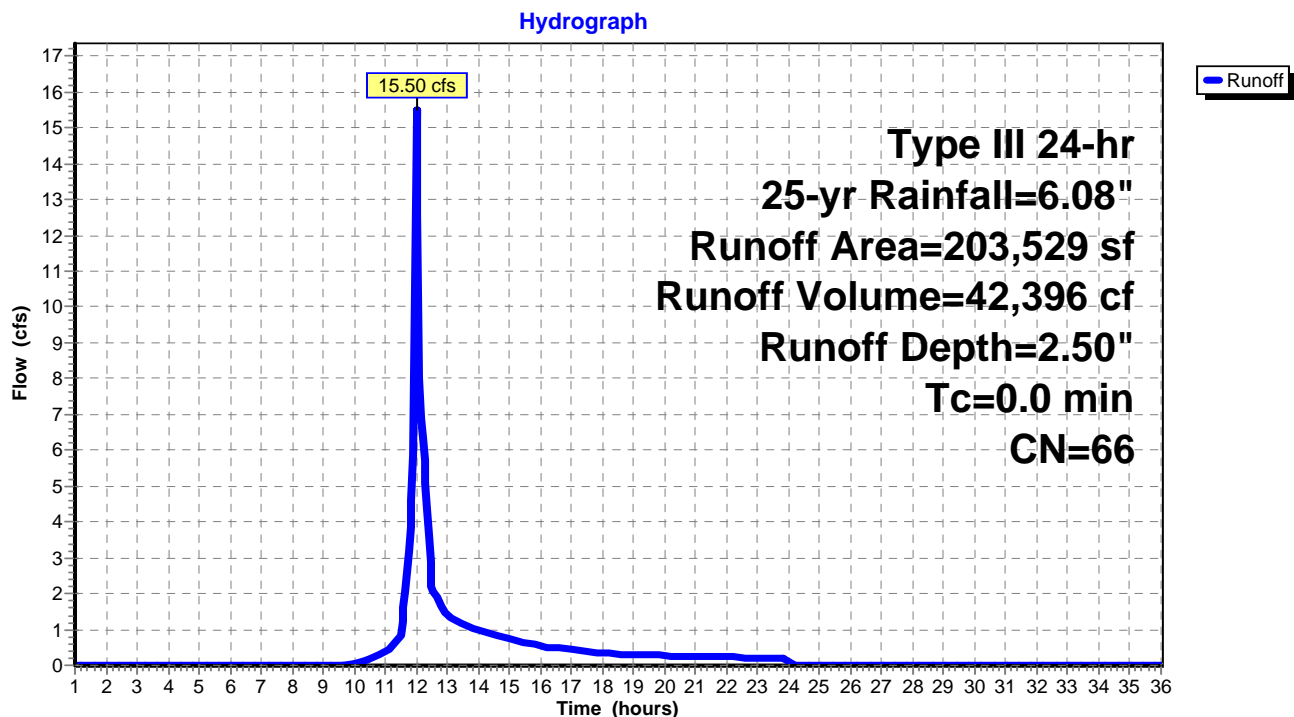
Summary for Subcatchment 3S: Center-Eastern Area

Runoff = 15.50 cfs @ 12.01 hrs, Volume= 42,396 cf, Depth= 2.50"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-yr Rainfall=6.08"

	Area (sf)	CN	Description
*	172,845	65	Upland Bog Area
	1,176	72	Dirt roads, HSG A
	7,998	82	Dirt roads, HSG B
	2,102	85	Gravel roads, HSG B
	1,434	61	>75% Grass cover, Good, HSG B
	604	30	Woods, Good, HSG A
	17,370	67	Brush, Poor, HSG B
	203,529	66	Weighted Average
	203,529		100.00% Pervious Area

Subcatchment 3S: Center-Eastern Area



3086.00 - Hydrocad Calculations - POST

Prepared by Atlantic Design Engineers, Inc.

HydroCAD® 10.00-25 s/n 00480 © 2019 HydroCAD Software Solutions LLC

Type III 24-hr 25-yr Rainfall=6.08"

Printed 5/31/2019

Page 27

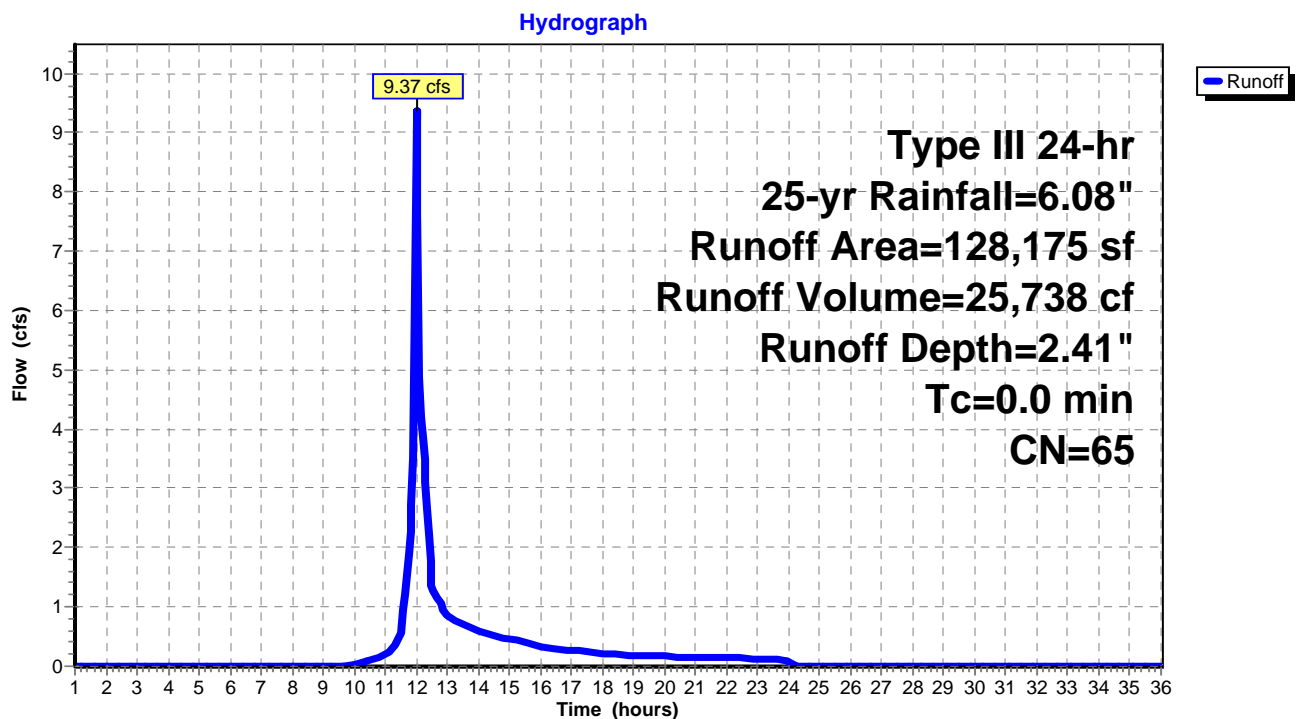
Summary for Subcatchment 4S: Center-Western Area

Runoff = 9.37 cfs @ 12.01 hrs, Volume= 25,738 cf, Depth= 2.41"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-yr Rainfall=6.08"

Area (sf)	CN	Description
227	39	>75% Grass cover, Good, HSG A
28,879	61	>75% Grass cover, Good, HSG B
954	30	Woods, Good, HSG A
465	55	Woods, Good, HSG B
97,650	67	Brush, Poor, HSG B
128,175	65	Weighted Average
128,175		100.00% Pervious Area

Subcatchment 4S: Center-Western Area



3086.00 - Hydrocad Calculations - POST

Prepared by Atlantic Design Engineers, Inc.

HydroCAD® 10.00-25 s/n 00480 © 2019 HydroCAD Software Solutions LLC

Type III 24-hr 25-yr Rainfall=6.08"

Printed 5/31/2019

Page 28

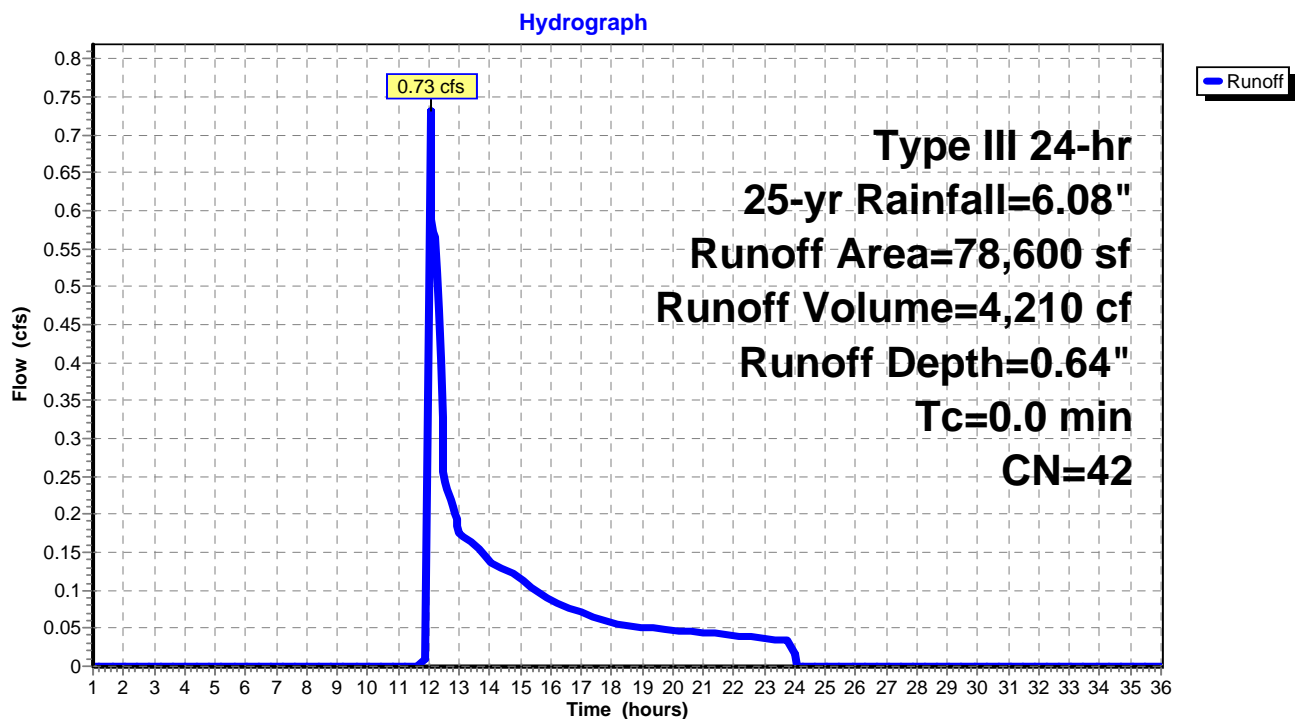
Summary for Subcatchment 5S: Northwestern Area

Runoff = 0.73 cfs @ 12.06 hrs, Volume= 4,210 cf, Depth= 0.64"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-yr Rainfall=6.08"

Area (sf)	CN	Description
778	39	>75% Grass cover, Good, HSG A
10,099	61	>75% Grass cover, Good, HSG B
50,691	30	Woods, Good, HSG A
821	55	Woods, Good, HSG B
16,211	67	Brush, Poor, HSG B
78,600	42	Weighted Average
78,600		100.00% Pervious Area

Subcatchment 5S: Northwestern Area



3086.00 - Hydrocad Calculations - POST

Prepared by Atlantic Design Engineers, Inc.

HydroCAD® 10.00-25 s/n 00480 © 2019 HydroCAD Software Solutions LLC

Type III 24-hr 25-yr Rainfall=6.08"

Printed 5/31/2019

Page 29

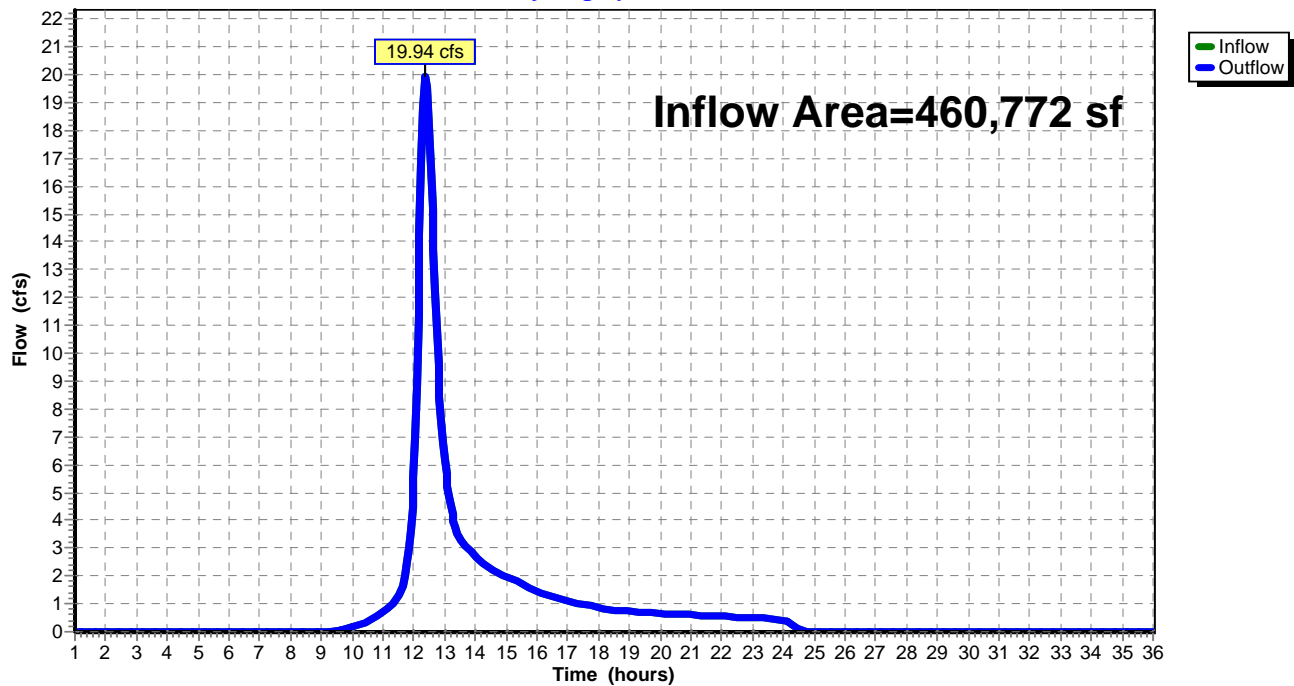
Summary for Reach DP-1: Glover Mill Pond

Inflow Area = 460,772 sf, 32.10% Impervious, Inflow Depth = 2.72" for 25-yr event
Inflow = 19.94 cfs @ 12.38 hrs, Volume= 104,612 cf
Outflow = 19.94 cfs @ 12.38 hrs, Volume= 104,612 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 1.00-36.00 hrs, dt= 0.05 hrs

Reach DP-1: Glover Mill Pond

Hydrograph



3086.00 - Hydrocad Calculations - POST

Type III 24-hr 25-yr Rainfall=6.08"

Prepared by Atlantic Design Engineers, Inc.

Printed 5/31/2019

HydroCAD® 10.00-25 s/n 00480 © 2019 HydroCAD Software Solutions LLC

Page 30

Summary for Pond 1P: Raingarden

Inflow Area = 8,674 sf, 34.83% Impervious, Inflow Depth = 1.81" for 25-yr event
 Inflow = 0.39 cfs @ 12.10 hrs, Volume= 1,306 cf
 Outflow = 0.07 cfs @ 12.65 hrs, Volume= 1,306 cf, Atten= 82%, Lag= 32.8 min
 Discarded = 0.05 cfs @ 12.65 hrs, Volume= 1,248 cf
 Primary = 0.02 cfs @ 12.65 hrs, Volume= 58 cf

Routing by Stor-Ind method, Time Span= 1.00-36.00 hrs, dt= 0.05 hrs
 Peak Elev= 65.60' @ 12.65 hrs Surf.Area= 841 sf Storage= 415 cf

Plug-Flow detention time= 72.8 min calculated for 1,304 cf (100% of inflow)
 Center-of-Mass det. time= 72.7 min (940.1 - 867.4)

Volume	Invert	Avail.Storage	Storage Description
#1	65.00'	3,082 cf	Custom Stage Data (Irregular) Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
65.00	552	158.0	0	0	552
66.00	1,067	181.0	795	795	1,195
67.00	1,660	206.0	1,353	2,148	1,989
67.50	2,084	219.0	934	3,082	2,441

Device	Routing	Invert	Outlet Devices
#1	Discarded	65.00'	2.410 in/hr Exfiltration over Wetted area
#2	Primary	65.50'	4.0" Round Culvert L= 20.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 65.50' / 65.30' S= 0.0100 '/ Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.09 sf
#3	Primary	66.80'	10.0' long x 4.0' breadth Broad-Crested Rectangular Weir Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.38 2.54 2.69 2.68 2.67 2.67 2.65 2.66 2.66 2.68 2.72 2.73 2.76 2.79 2.88 3.07 3.32

Discarded OutFlow Max=0.05 cfs @ 12.65 hrs HW=65.60' (Free Discharge)

↑ **1=Exfiltration** (Exfiltration Controls 0.05 cfs)

Primary OutFlow Max=0.02 cfs @ 12.65 hrs HW=65.60' (Free Discharge)

↑ **2=Culvert** (Inlet Controls 0.02 cfs @ 0.85 fps)

↑ **3=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

3086.00 - Hydrocad Calculations - POST

Prepared by Atlantic Design Engineers, Inc.

HydroCAD® 10.00-25 s/n 00480 © 2019 HydroCAD Software Solutions LLC

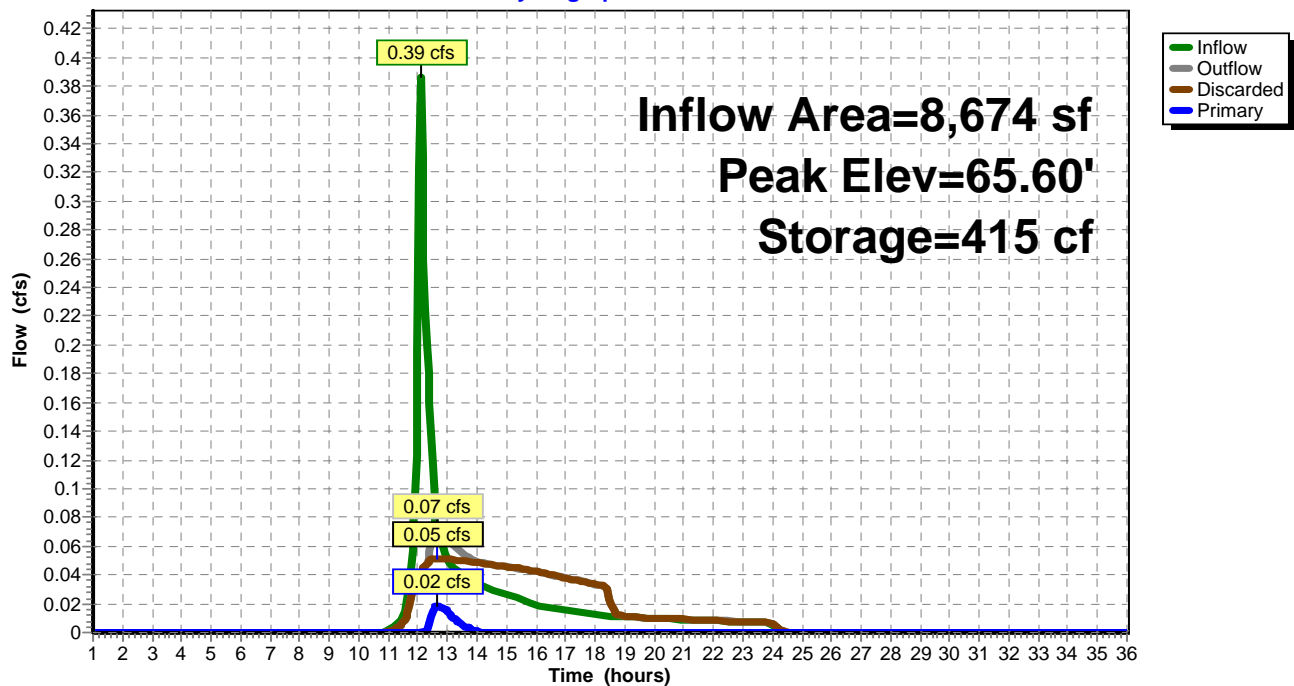
Type III 24-hr 25-yr Rainfall=6.08"

Printed 5/31/2019

Page 31

Pond 1P: Raingarden

Hydrograph



3086.00 - Hydrocad Calculations - POST

Type III 24-hr 100-yr Rainfall=7.66"

Prepared by Atlantic Design Engineers, Inc.

Printed 5/31/2019

HydroCAD® 10.00-25 s/n 00480 © 2019 HydroCAD Software Solutions LLC

Page 32

Summary for Subcatchment 1S: Southwest-Western Area

Runoff = 29.47 cfs @ 12.37 hrs, Volume= 153,044 cf, Depth= 4.06"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-yr Rainfall=7.66"

Area (sf)	CN	Description
3,887	76	Gravel roads, HSG A
9,914	85	Gravel roads, HSG B
4,046	39	>75% Grass cover, Good, HSG A
139,352	61	>75% Grass cover, Good, HSG B
14,765	98	Paved parking, HSG A
103,603	98	Paved parking, HSG B
26,501	98	Roofs, HSG B
76,367	30	Woods, Good, HSG A
175	55	Woods, Good, HSG B
73,488	67	Brush, Poor, HSG B
452,098	69	Weighted Average
307,229		67.96% Pervious Area
144,869		32.04% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
20.2	50	0.0050	0.04		Sheet Flow, Woods: Light underbrush n= 0.400 P2= 3.60"
2.2	150	0.0050	1.14		Shallow Concentrated Flow, Unpaved Kv= 16.1 fps
2.1	380	0.0230	3.08		Shallow Concentrated Flow, Paved Kv= 20.3 fps
2.0	405	0.0420	3.30		Shallow Concentrated Flow, Unpaved Kv= 16.1 fps
26.5	985	Total			

3086.00 - Hydrocad Calculations - POST

Prepared by Atlantic Design Engineers, Inc.

HydroCAD® 10.00-25 s/n 00480 © 2019 HydroCAD Software Solutions LLC

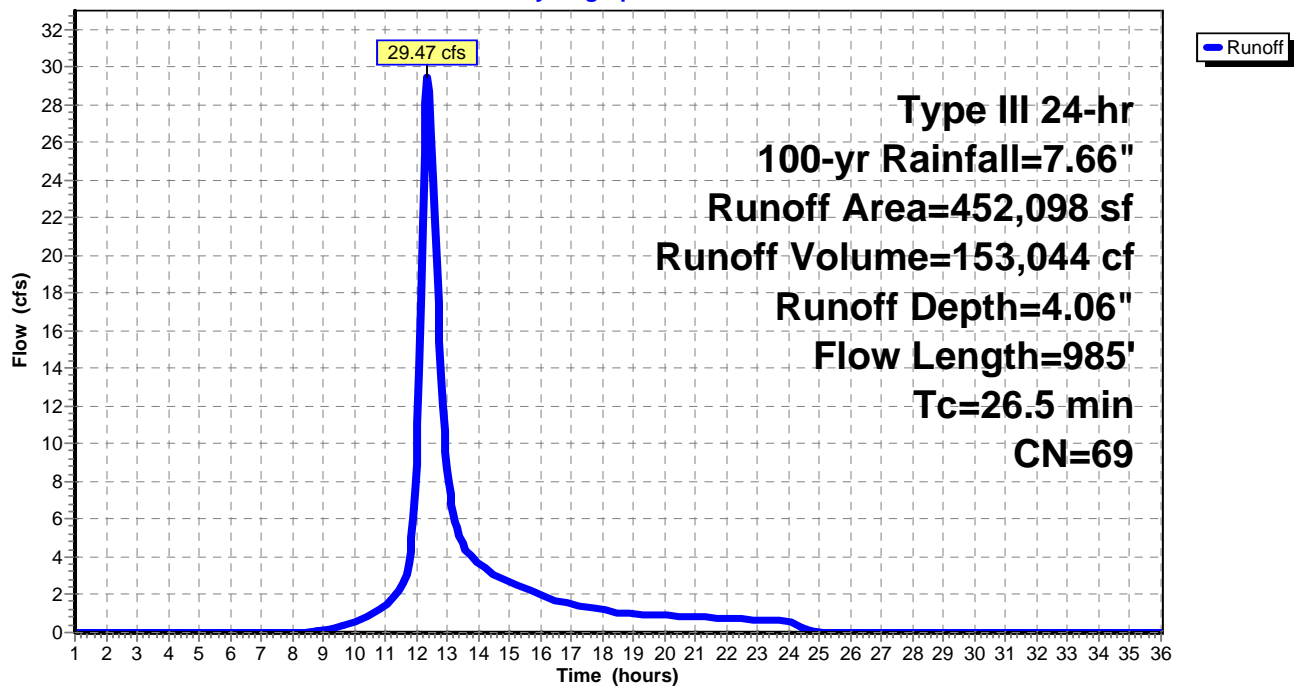
Type III 24-hr 100-yr Rainfall=7.66"

Printed 5/31/2019

Page 33

Subcatchment 1S: Southwest-Western Area

Hydrograph



3086.00 - Hydrocad Calculations - POST

Prepared by Atlantic Design Engineers, Inc.

HydroCAD® 10.00-25 s/n 00480 © 2019 HydroCAD Software Solutions LLC

Type III 24-hr 100-yr Rainfall=7.66"

Printed 5/31/2019

Page 34

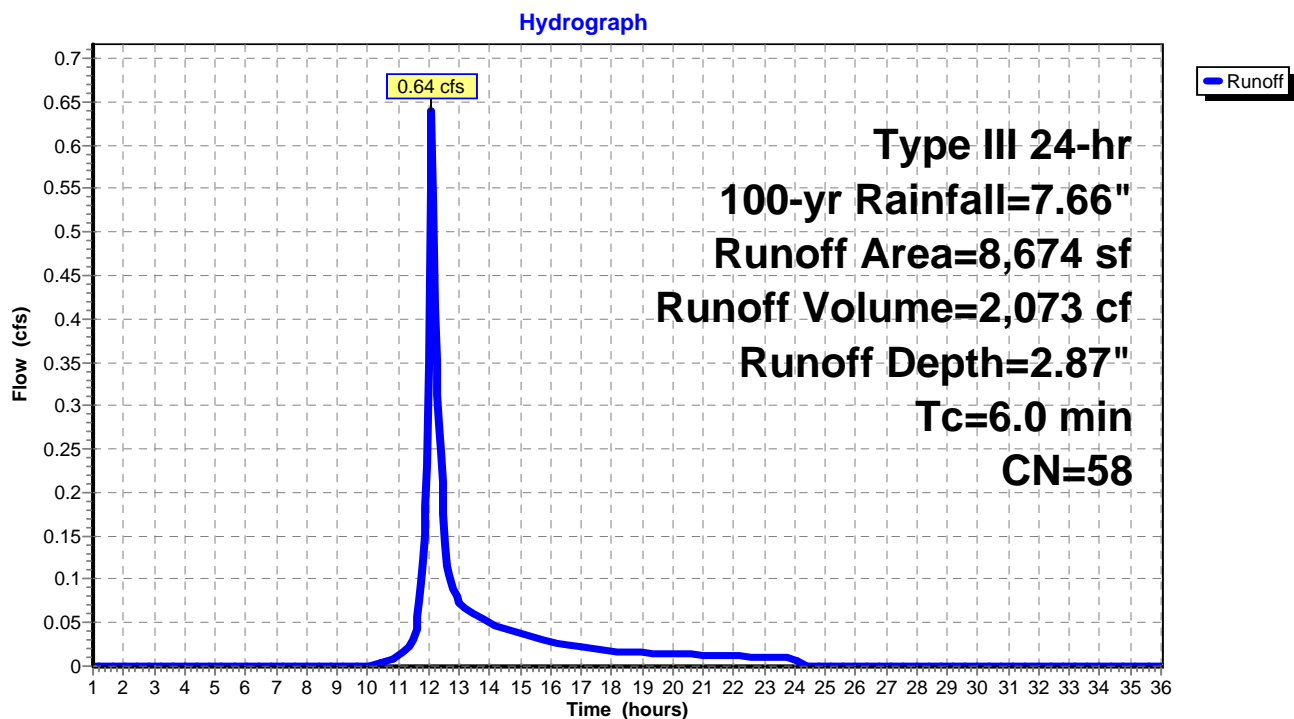
Summary for Subcatchment 1Sa: New Driveway Area

Runoff = 0.64 cfs @ 12.10 hrs, Volume= 2,073 cf, Depth= 2.87"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-yr Rainfall=7.66"

Area (sf)	CN	Description
239	76	Gravel roads, HSG A
* 1,954	98	New Driveway Area, HSG A
2,628	30	Woods, Good, HSG A
1,067	98	Water Surface, HSG A
2,786	39	>75% Grass cover, Good, HSG A
8,674	58	Weighted Average
5,653		65.17% Pervious Area
3,021		34.83% Impervious Area

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

Subcatchment 1Sa: New Driveway Area

3086.00 - Hydrocad Calculations - POST

Prepared by Atlantic Design Engineers, Inc.

HydroCAD® 10.00-25 s/n 00480 © 2019 HydroCAD Software Solutions LLC

Type III 24-hr 100-yr Rainfall=7.66"

Printed 5/31/2019

Page 35

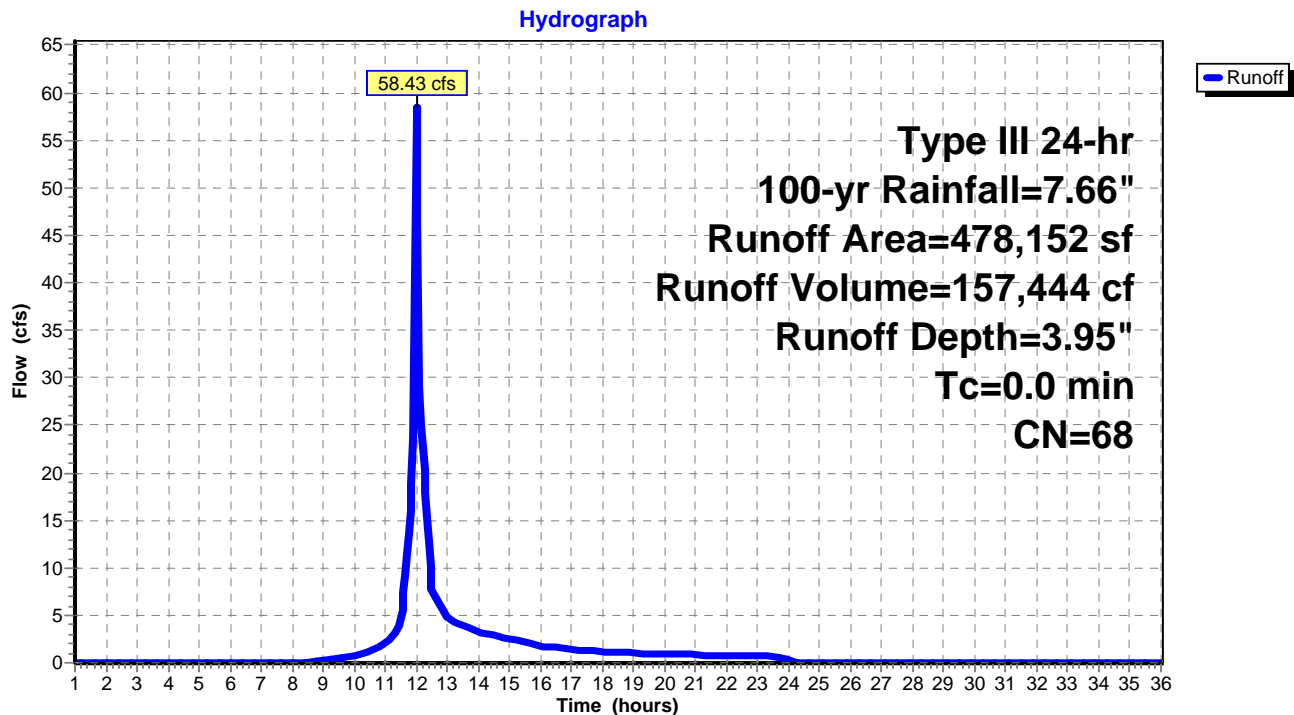
Summary for Subcatchment 2S: Eastern Area

Runoff = 58.43 cfs @ 12.00 hrs, Volume= 157,444 cf, Depth= 3.95"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-yr Rainfall=7.66"

Area (sf)	CN	Description
9,662	82	Dirt roads, HSG B
* 960	98	Equipment Pads
50,553	85	Gravel roads, HSG B
166,878	61	>75% Grass cover, Good, HSG B
14,392	98	Roofs, HSG B
23,117	55	Woods, Good, HSG B
212,590	67	Brush, Poor, HSG B
478,152	68	Weighted Average
462,800		96.79% Pervious Area
15,352		3.21% Impervious Area

Subcatchment 2S: Eastern Area



3086.00 - Hydrocad Calculations - POST

Prepared by Atlantic Design Engineers, Inc.

HydroCAD® 10.00-25 s/n 00480 © 2019 HydroCAD Software Solutions LLC

Type III 24-hr 100-yr Rainfall=7.66"

Printed 5/31/2019

Page 36

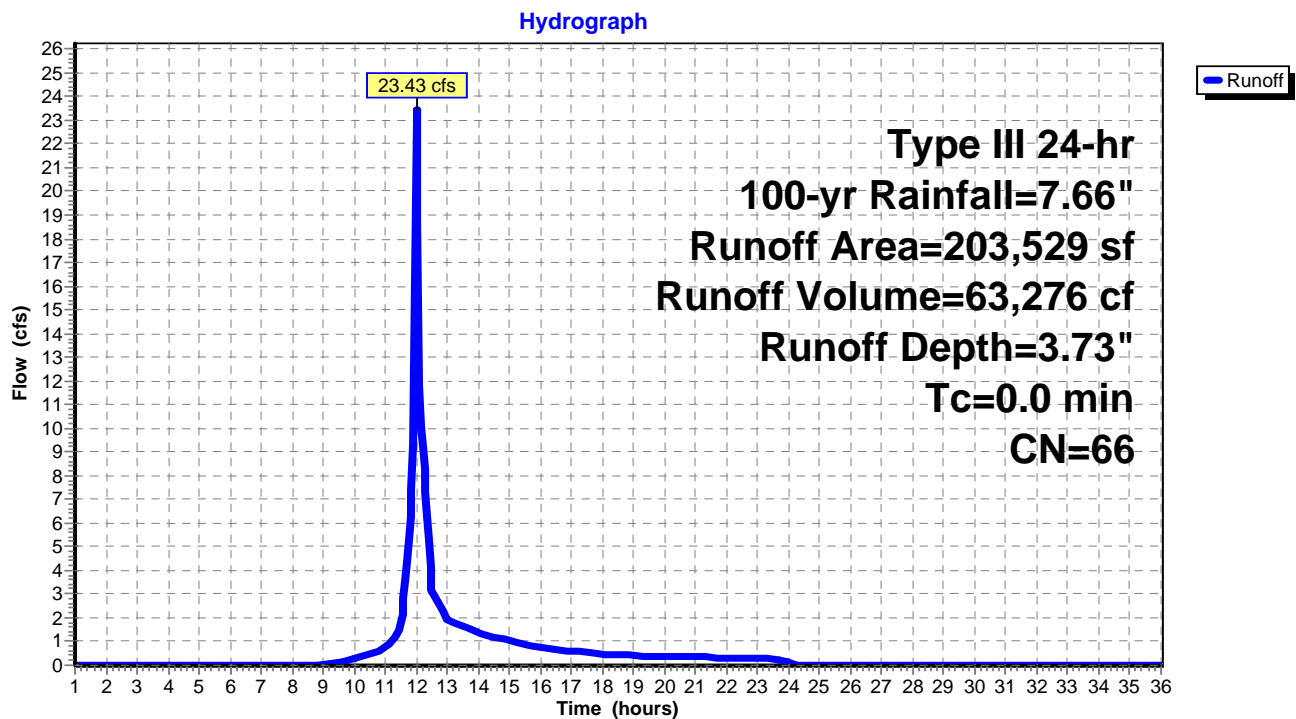
Summary for Subcatchment 3S: Center-Eastern Area

Runoff = 23.43 cfs @ 12.01 hrs, Volume= 63,276 cf, Depth= 3.73"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-yr Rainfall=7.66"

	Area (sf)	CN	Description
*	172,845	65	Upland Bog Area
	1,176	72	Dirt roads, HSG A
	7,998	82	Dirt roads, HSG B
	2,102	85	Gravel roads, HSG B
	1,434	61	>75% Grass cover, Good, HSG B
	604	30	Woods, Good, HSG A
	17,370	67	Brush, Poor, HSG B
	203,529	66	Weighted Average
	203,529		100.00% Pervious Area

Subcatchment 3S: Center-Eastern Area



3086.00 - Hydrocad Calculations - POST

Prepared by Atlantic Design Engineers, Inc.

HydroCAD® 10.00-25 s/n 00480 © 2019 HydroCAD Software Solutions LLC

Type III 24-hr 100-yr Rainfall=7.66"

Printed 5/31/2019

Page 37

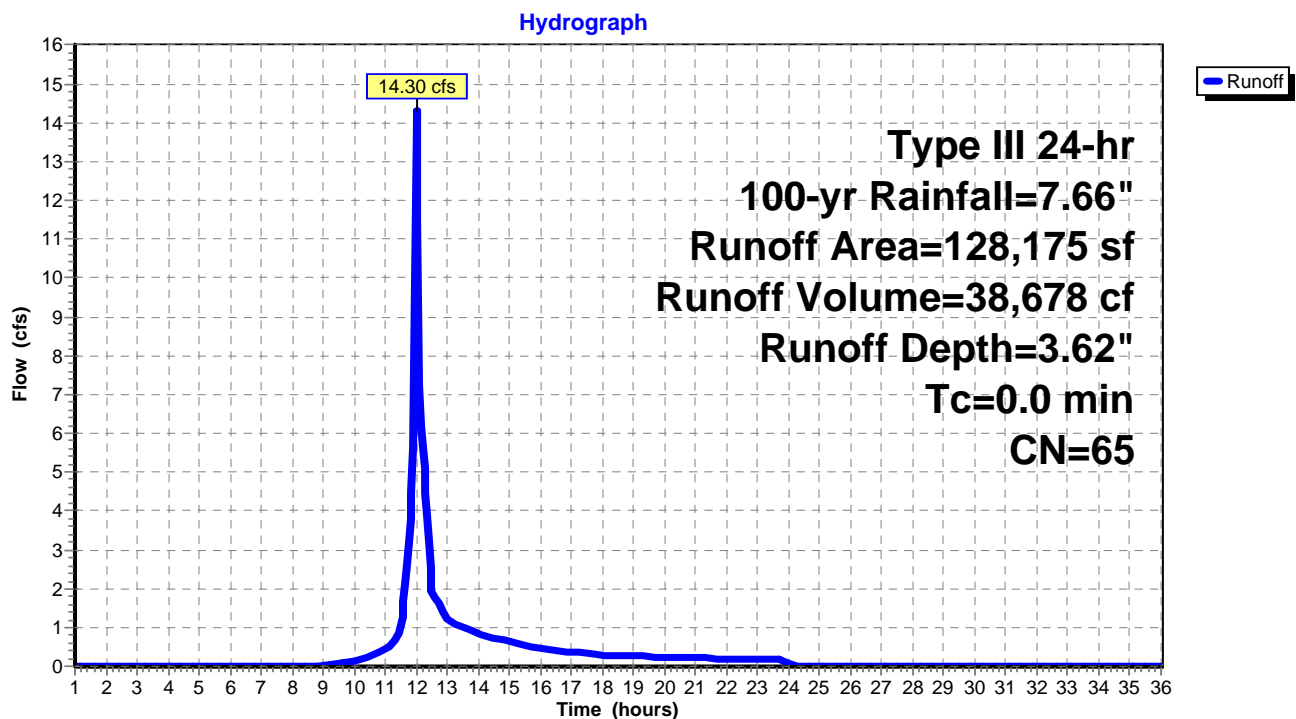
Summary for Subcatchment 4S: Center-Western Area

Runoff = 14.30 cfs @ 12.01 hrs, Volume= 38,678 cf, Depth= 3.62"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-yr Rainfall=7.66"

Area (sf)	CN	Description
227	39	>75% Grass cover, Good, HSG A
28,879	61	>75% Grass cover, Good, HSG B
954	30	Woods, Good, HSG A
465	55	Woods, Good, HSG B
97,650	67	Brush, Poor, HSG B
128,175	65	Weighted Average
128,175		100.00% Pervious Area

Subcatchment 4S: Center-Western Area



3086.00 - Hydrocad Calculations - POST

Prepared by Atlantic Design Engineers, Inc.

HydroCAD® 10.00-25 s/n 00480 © 2019 HydroCAD Software Solutions LLC

Type III 24-hr 100-yr Rainfall=7.66"

Printed 5/31/2019

Page 38

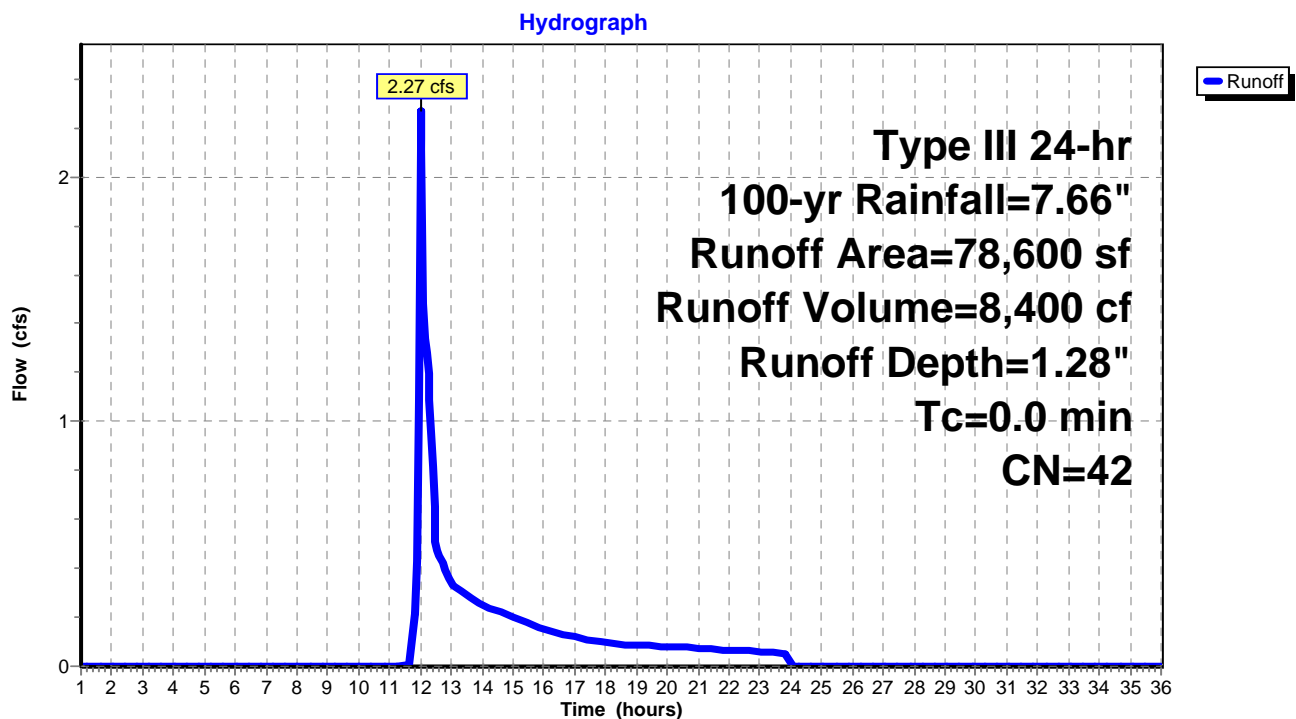
Summary for Subcatchment 5S: Northwestern Area

Runoff = 2.27 cfs @ 12.02 hrs, Volume= 8,400 cf, Depth= 1.28"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-yr Rainfall=7.66"

Area (sf)	CN	Description
778	39	>75% Grass cover, Good, HSG A
10,099	61	>75% Grass cover, Good, HSG B
50,691	30	Woods, Good, HSG A
821	55	Woods, Good, HSG B
16,211	67	Brush, Poor, HSG B
78,600	42	Weighted Average
78,600		100.00% Pervious Area

Subcatchment 5S: Northwestern Area



3086.00 - Hydrocad Calculations - POST

Prepared by Atlantic Design Engineers, Inc.

HydroCAD® 10.00-25 s/n 00480 © 2019 HydroCAD Software Solutions LLC

Type III 24-hr 100-yr Rainfall=7.66"

Printed 5/31/2019

Page 39

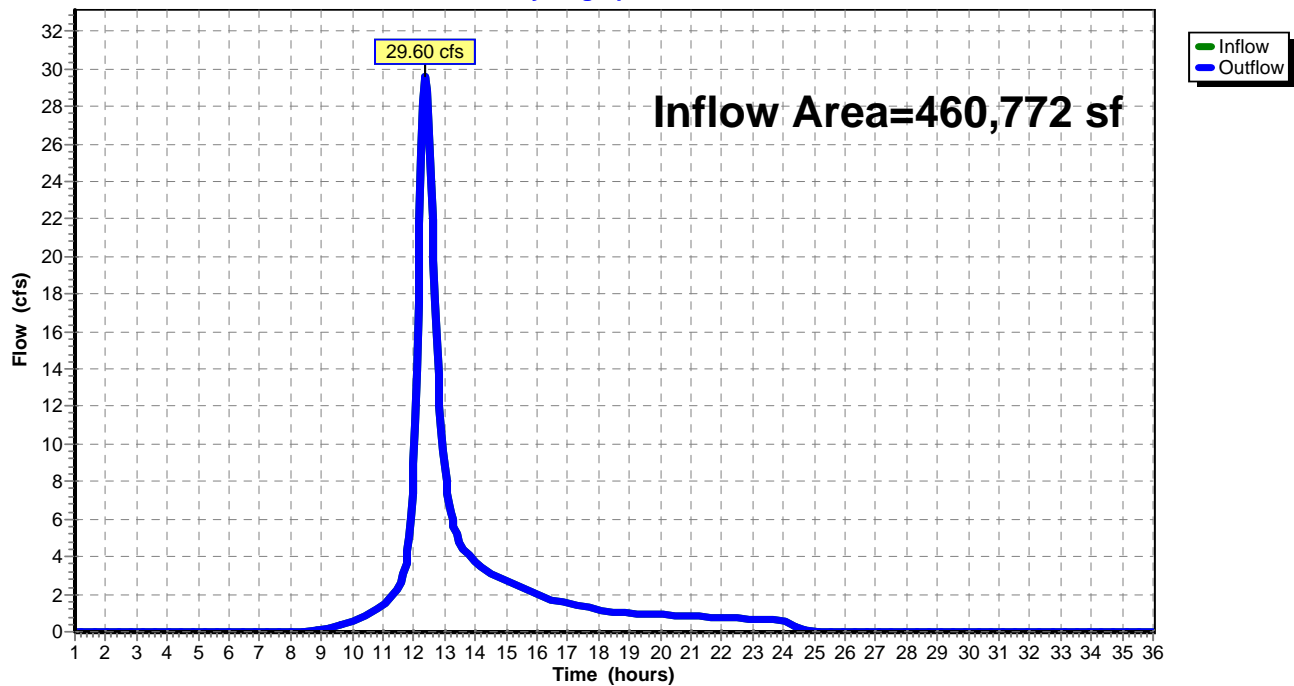
Summary for Reach DP-1: Glover Mill Pond

Inflow Area = 460,772 sf, 32.10% Impervious, Inflow Depth = 4.00" for 100-yr event
Inflow = 29.60 cfs @ 12.37 hrs, Volume= 153,522 cf
Outflow = 29.60 cfs @ 12.37 hrs, Volume= 153,522 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 1.00-36.00 hrs, dt= 0.05 hrs

Reach DP-1: Glover Mill Pond

Hydrograph



3086.00 - Hydrocad Calculations - POST

Type III 24-hr 100-yr Rainfall=7.66"

Prepared by Atlantic Design Engineers, Inc.

Printed 5/31/2019

HydroCAD® 10.00-25 s/n 00480 © 2019 HydroCAD Software Solutions LLC

Page 40

Summary for Pond 1P: Raingarden

Inflow Area = 8,674 sf, 34.83% Impervious, Inflow Depth = 2.87" for 100-yr event
 Inflow = 0.64 cfs @ 12.10 hrs, Volume= 2,073 cf
 Outflow = 0.19 cfs @ 12.48 hrs, Volume= 2,073 cf, Atten= 70%, Lag= 22.7 min
 Discarded = 0.06 cfs @ 12.48 hrs, Volume= 1,595 cf
 Primary = 0.13 cfs @ 12.48 hrs, Volume= 478 cf

Routing by Stor-Ind method, Time Span= 1.00-36.00 hrs, dt= 0.05 hrs
 Peak Elev= 65.82' @ 12.48 hrs Surf.Area= 965 sf Storage= 618 cf

Plug-Flow detention time= 68.3 min calculated for 2,073 cf (100% of inflow)
 Center-of-Mass det. time= 68.2 min (921.2 - 853.1)

Volume	Invert	Avail.Storage	Storage Description
#1	65.00'	3,082 cf	Custom Stage Data (Irregular) Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
65.00	552	158.0	0	0	552
66.00	1,067	181.0	795	795	1,195
67.00	1,660	206.0	1,353	2,148	1,989
67.50	2,084	219.0	934	3,082	2,441

Device	Routing	Invert	Outlet Devices
#1	Discarded	65.00'	2.410 in/hr Exfiltration over Wetted area
#2	Primary	65.50'	4.0" Round Culvert L= 20.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 65.50' / 65.30' S= 0.0100 1' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.09 sf
#3	Primary	66.80'	10.0' long x 4.0' breadth Broad-Crested Rectangular Weir Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.38 2.54 2.69 2.68 2.67 2.67 2.65 2.66 2.66 2.68 2.72 2.73 2.76 2.79 2.88 3.07 3.32

Discarded OutFlow Max=0.06 cfs @ 12.48 hrs HW=65.82' (Free Discharge)
 ↑ **1=Exfiltration** (Exfiltration Controls 0.06 cfs)

Primary OutFlow Max=0.13 cfs @ 12.48 hrs HW=65.82' (Free Discharge)
 ↑ **2=Culvert** (Inlet Controls 0.13 cfs @ 1.53 fps)
 ↑ **3=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

3086.00 - Hydrocad Calculations - POST

Prepared by Atlantic Design Engineers, Inc.

HydroCAD® 10.00-25 s/n 00480 © 2019 HydroCAD Software Solutions LLC

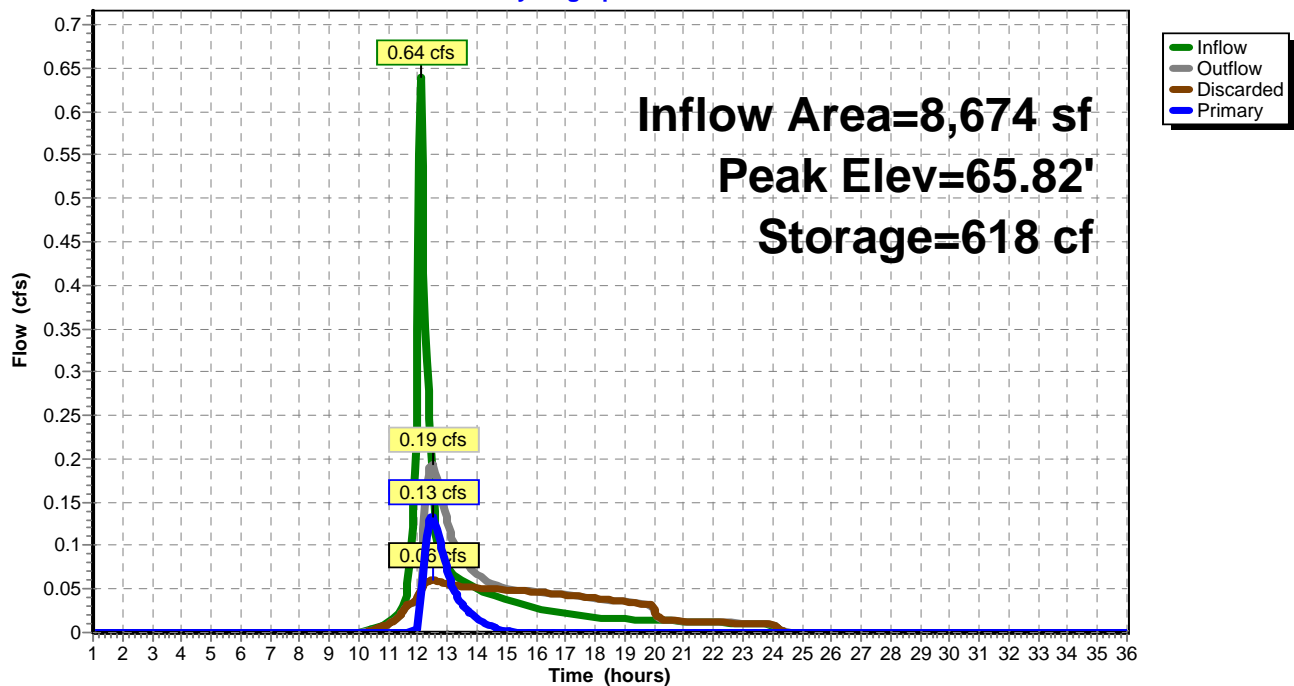
Type III 24-hr 100-yr Rainfall=7.66"

Printed 5/31/2019

Page 41

Pond 1P: Raingarden

Hydrograph



APPENDIX C
Miscellaneous Calculations

Required Recharge Volume

Design Engineer:	Atlantic Design Engineers, Inc	Job No.:	3086.00
Project Name:	Herring Brook Solar Project	Calc'd By:	CMK
Location:	Pembroke, MA	Date:	5/31/2019

The groundwater recharge volume is required for the proposed **impervious** surfaces. We consider gravel driveways to be pervious surface in this calculations. Entire site considered Hydrologic Group A for a conservative approach

$$R_v = (F) (A_{imp})$$

R_v = Required Recharge Volume
 A_{imp} = Impervious Area on site
 F = Target Depth Factor: 0.60 inch for A soils

Subcatchment Area: 1SA

Total New Impervious Area for the Site=	2,914	sf		
Required Recharge Volume (R_v)=	2,914	* 0.6" * (1/12)=	145.70	cf
Volume Provided in stormwater BMP=			425.00	cf
			333.00	cf

Forebay Raingarden
Volume below Raingarden outlet pipe

Total Required Recharge Volume on Site=	145.70	cf	
Total Recharge Volume Provided in stormwater BMPs on Site=	758.00	cf	Standard is Met

Water Quality Calculation Sheet

Design Engineer:	Atlantic Design Engineers, Inc	Job No.: 3086.00
Project Name:	Herring Brook Solar Project	Calc'd By: CMK
Location:	Pembroke, MA	Date: 5/31/2019

The required water quality treatment volume is calculated as follows:

$$\begin{aligned}Vwq &= (Dwq) * (Aimp) \\Vwq &= \text{Required Water Quality Volume} \\Dwq &= \text{Water Quality Depth} = 1.0" \text{ (Per Local Requirements)} \\Aimp &= \text{Area of New Impervious}\end{aligned}$$

Subcatchment Area: 1Sa

Total New Impervious Area for the Subcatchment= 1,954 sf
Water Quality Volume Required (Vwq)= 1,954 * 1.0" * (1/12)= 163 cf

Subcatchment Area: 2S

Total New Impervious Area for the Subcatchment= 960 sf
Water Quality Volume Required (Vwq)= 960 * 1.0" * (1/12)= 80 cf

Total New Impervious Area on the Site=	2,914	sf
Total Volume Quality Required=	243	cf
Total Volume Provided=	425	cf

Forebay Raingarden

Stage-Area-Storage for Pond F-1P: Forebay 1P

Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)
65.00	140	0
65.05	148	7
65.10	155	15
65.15	163	23
65.20	172	31
65.25	180	40
65.30	189	49
65.35	198	59
65.40	207	69
65.45	216	79
65.50	225	91
65.55	235	102
65.60	245	114
65.65	255	127
65.70	265	140
65.75	276	153
65.80	286	167
65.85	297	182
65.90	308	197
65.95	320	212
66.00	331	229
66.05	343	246
66.10	355	263
66.15	367	281
66.20	379	300
66.25	392	319
66.30	405	339
66.35	418	359
66.40	431	381
66.45	444	403
66.50	458	425
66.55	472	448
66.60	486	472
66.65	500	497
66.70	514	522
66.75	529	548
66.80	544	575
66.85	559	603
66.90	574	631
66.95	589	660
67.00	605	690
67.05	625	721
67.10	645	752
67.15	666	785
67.20	686	819
67.25	707	854
67.30	729	890
67.35	751	927
67.40	773	965
67.45	795	1,004
67.50	818	1,044

TSS REMOVAL CALCULATION SHEET

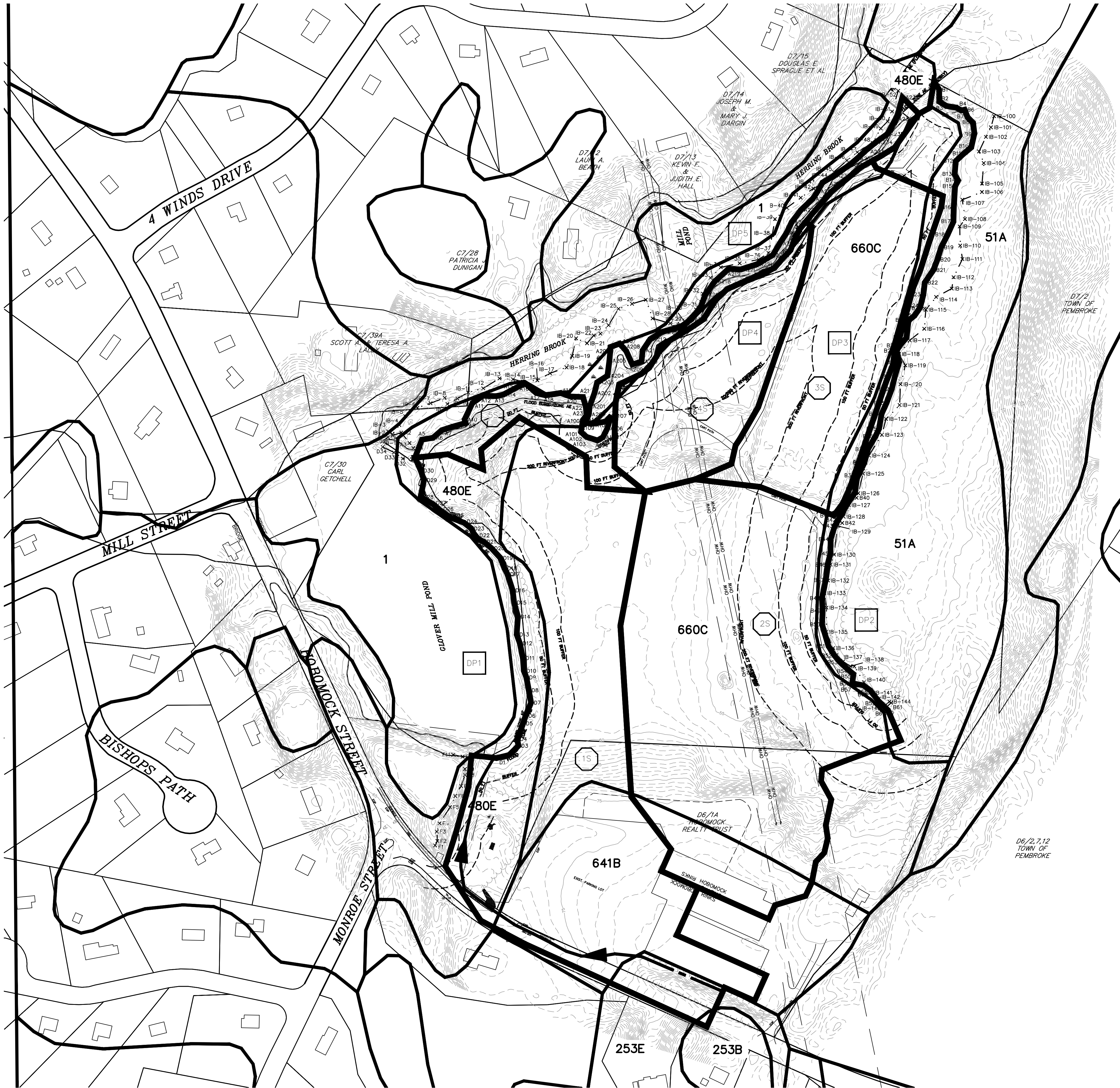
Design Engineer: Atlantic Design Engineers, Inc Job No.: 3086.00
Project Name: Herring Brook Solar Project Calc'd By: CMK
Location: Pembroke, MA Date: 5/31/2019

Treatment Train for 1Sa

BMP	Removal Rate	Starting TSS Load	TSS Removed	Remaining Load
Sediment Forebay (Pre-Treatment)	0%	100.0%	0%	100.0%
Rain Garden	90%	100.0%	90%	10.0%
Total Removed			90%	

APPENDIX D

Pre- and Post-Development Watershed Plans



LEGEND

1S

SUBCATCHMENT AREA

DP1

DESIGN POINT

Tc PATH

32A

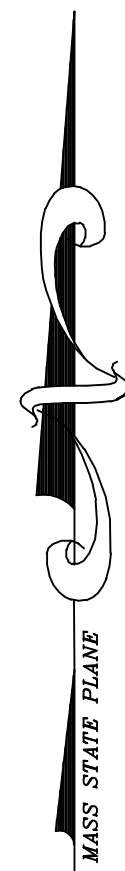
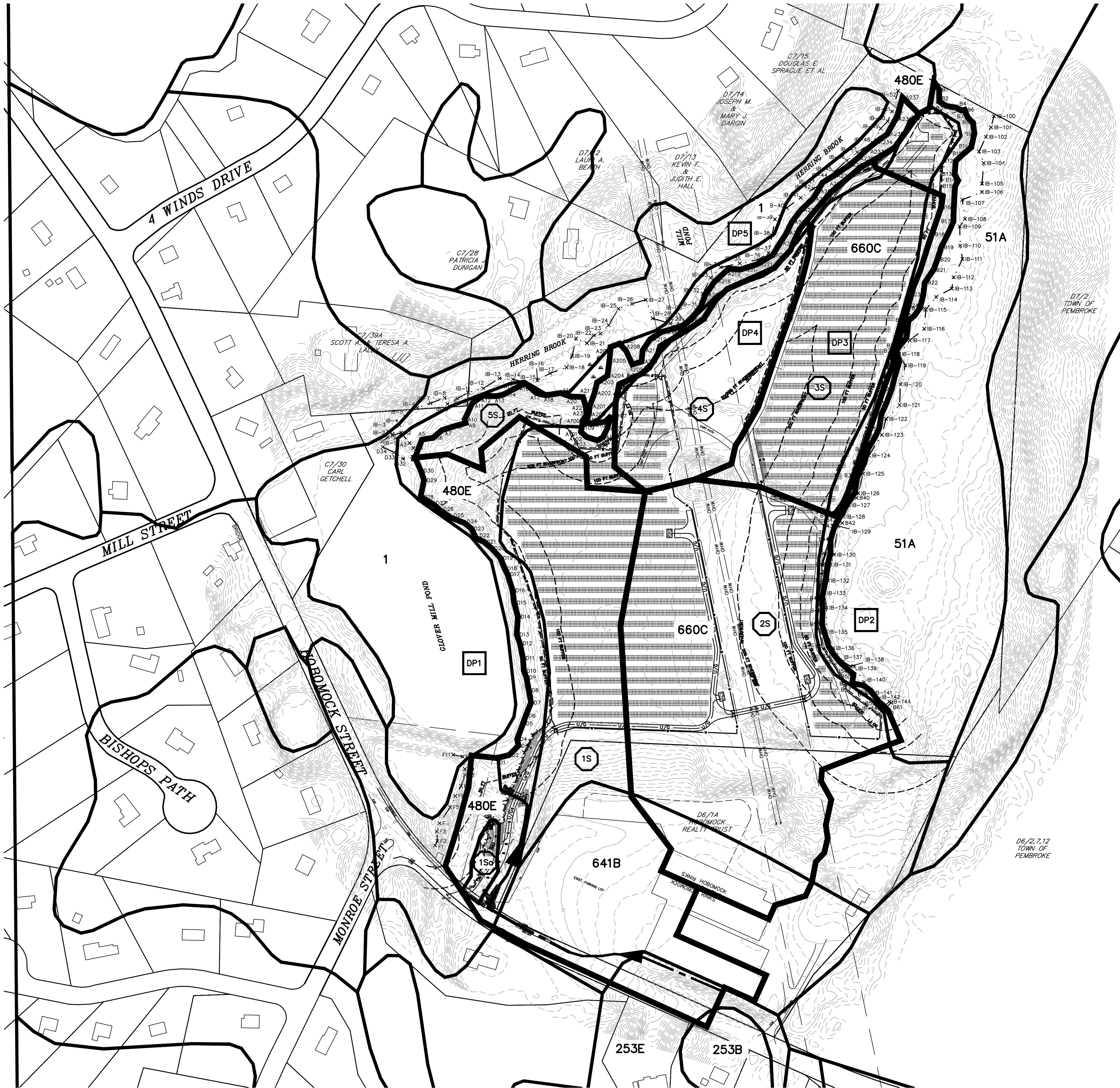
"D"

SUBCATCHMENT AND UNDISTURBED AREA BOUNDARY

32A

"D"

HYDROLOGIC SOIL GROUP AND BOUNDARY



LEGEND

1S

SUBCATCHMENT AREA

DP1

DESIGN POINT

Tc PATH

32A

"D"

SUBCATCHMENT AND UNDISTURBED AREA BOUNDARY

32A

"D"

HYDROLOGIC SOIL GROUP AND BOUNDARY

Atlantic

DESIGN ENGINEERS, INC.

P.O. Box 1051, Sandwich, MA 02563

(508) 888 - 9282

Designed by : _____

Drawn by : _____

Checked by : _____

Survey chk. by : _____

Approved by : _____

SCALE

SCALE 1" = 120'

0

60

120

240

DATE	NO.	BY	DATE	REVISION

PREPARED FOR:

CENTRICA BUSINESS SOLUTIONS

7484 CANDLEWOOD ROAD, SUITE T-W

HANOVER, MD 21076

POST-DEVELOPMENT WATERSHED PLAN

FOR

HERRING BROOK SOLAR

PEMBROKE, MASSACHUSETTS 02539

MAY 31, 2019

FILE: 3086--WSHD	Sheet	of
	1	1
JOB NUMBER	3086.00	

APPENDIX E

Long Term Stormwater Operation and Maintenance Plan

Herring Brook Solar Project
At
0 Hobomock Street, Pembroke, MA
Post-Construction
Long Term Stormwater Operation & Maintenance Plan
May 31, 2019

A. GENERAL NOTES

1. Upon completion of construction, the operation and maintenance of all components of the stormwater management system will be the responsibility (financially and otherwise) of the system owner (responsible party):

Centrica Business Solutions
7484 Candlewood Road, Suite T-W
(508) 259-5726
Charles.Kovacic@Centrica.com

Signature

Date

2. The responsible party shall file an inspection report with the Town of Pembroke Planning Board and Conservation Commission following each site inspection as recommended in the Operation & Maintenance (O&M) Schedule. The inspection report shall identify the date of inspection, name, and contact number of responsible party, specific structures inspected, specific maintenance and/or repairs required and general observations. Any deficiencies noted in the inspection report shall be corrected to the Town of Pembroke's Planning Board and Conservation Commission's satisfaction.
3. Disposal of accumulated sediment and hydrocarbons to be in accordance with the applicable local, state, and federal guidelines and regulations.
4. There shall be no illicit discharge of any waste or waste water into the stormwater management system. The maintenance of the facility shall be undertaken in such a manner as to prevent any discharge of waste or waste water into the stormwater management system. Any waste oil or other waste products generated during the maintenance shall be properly disposed of offsite.

Signature

Date

5. The Town will be notified of changes in project ownership or assignment of operation and maintenance financial responsibility.
6. The maintenance schedule in this operation and maintenance (O&M) Plan will only be amended by mutual agreement of the Town and the responsible party. Amendments will be made in writing and signed by the responsible party.

B. STORMWATER SYSTEM/BMPs

Grassed Swale with Check-Dams:

Grassed lined swales shall be inspected at a minimum of twice a year or after major storm events (2" or greater). Repair eroded spots immediately after inspection. Additional inspections should be scheduled during the first few months to ensure that the vegetation in the channels is established adequately. Accumulated sediment shall be removed at least once a year or before it exceeds 0.5' in depth, whichever occurs first.

Rain Gardens:

Inspect after every major storm event (2" or greater) for the first few months after construction to ensure proper stabilization and function. Thereafter, inspect at least twice per year during wet weather to ensure the bio-retention/rain gardens are draining properly and vegetation is thriving. Check for erosion, invasive tree growth, clogging and trash, and remove organic matter, weeds, trash and debris as necessary. Re-seed eroded or barren spots immediately after inspection. Remove sediment as necessary during construction, while dry and at least every five years after construction.

Forebays

Inspect forebays twice per year at a minimum, or after major storm events (2" or greater) after construction for erosion, excessive accumulation of sediment and trash. Repair eroded spots immediately after inspection. Accumulated sediment shall be removed at least once a year or before it exceeds 0.5' in depth, whichever occurs first. Sediment shall be disposed of in a suitable area and protected from erosion by either structural or vegetative means.

Outlet Pipes and Flared End Sections:

Inspect outlet pipes/culverts and flared end sections after every major storm event (2" or greater) for the first few months after construction to ensure proper stabilization and function, thereafter inspect twice a year for erosion, clogging, settling, and excessive accumulation of leaves, trash, debris or sediment and channelization of stormwater discharge.

Rip-rap aprons, Spreaders and Plunge Pools:

Inspect rip-rap aprons, spreaders and plunge pools after every major storm event (2" or greater) for the first few months after construction to ensure proper stabilization and function, thereafter inspect twice per year for erosion, excessive accumulation of sediment and trash. Repair eroded spots immediately after inspection. Accumulated sediment shall be removed at least once a year or before it exceeds 0.5' in depth, whichever occurs first. Sediment shall be disposed of in a suitable area and protected from erosion by either structural or vegetative means. Inspect rip-rap aprons for signs of excess sediment or signs of failure.

Miscellaneous:

Inspect all slopes, panel drip edges, and graded areas throughout the project twice per year. Look for formation of eroded channels, particularly at panel drip edges and on newly constructed slopes. Repair and/or re-seed any areas that are eroded or not stabilized.

APPENDIX F

NRCS Soil Survey Maps and Soil Group Descriptions

Soil Map—Plymouth County, Massachusetts
(Herring Brook Solar Project)

Map Scale: 1:13,300 if printed on A landscape (11" x 8.5") sheet.

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

Soil Map—Plymouth County, Massachusetts
(Herring Brook Solar Project)

MAP LEGEND

Area of Interest (AOI)

 Area of Interest (AOI)

Soils

 Soil Map Unit Polygons

 Soil Map Unit Lines

 Soil Map Unit Points

Special Point Features



Blowout



Borrow Pit



Clay Spot



Closed Depression



Gravel Pit



Gravelly Spot



Landfill



Lava Flow



Marsh or swamp



Mine or Quarry



Miscellaneous Water



Perennial Water



Rock Outcrop



Saline Spot



Sandy Spot



Severely Eroded Spot



Sinkhole



Slide or Slip



Sodic Spot



Spoil Area



Stony Spot



Very Stony Spot



Wet Spot



Other



Special Line Features

Water Features



Streams and Canals

Transportation



Rails



Interstate Highways



US Routes



Major Roads



Local Roads

Background



Aerial Photography

MAP INFORMATION

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

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

Source of Map: Natural Resources Conservation Service

Web Soil Survey URL:

Coordinate System: Web Mercator (EPSG:3857)

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

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

Soil Survey Area: Plymouth County, Massachusetts

Survey Area Data: Version 11, Sep 7, 2018

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

Date(s) aerial images were photographed: Aug 26, 2014—Sep 4, 2014

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.

Plymouth County, Massachusetts

660C—Udorthents, 8 to 15 percent slopes, gravelly

Map Unit Setting

National map unit symbol: bd07

Elevation: 0 to 390 feet

Mean annual precipitation: 41 to 54 inches

Mean annual air temperature: 43 to 54 degrees F

Frost-free period: 145 to 240 days

Farmland classification: Not prime farmland

Map Unit Composition

Udorthents, gravelly, and similar soils: 80 percent

Minor components: 20 percent

Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Udorthents, Gravelly

Setting

Landform position (two-dimensional): Shoulder, backslope

Landform position (three-dimensional): Riser

Down-slope shape: Linear

Across-slope shape: Linear

Parent material: Coarse-loamy human transported material

Typical profile

^A - 0 to 5 inches: loam

^C1 - 5 to 21 inches: gravelly loam

^C2 - 21 to 80 inches: gravelly sandy loam

Properties and qualities

Slope: 8 to 15 percent

Depth to restrictive feature: More than 80 inches

Natural drainage class: Well drained

Runoff class: Low

Capacity of the most limiting layer to transmit water (Ksat):

Moderately low to very high (0.01 to 14.17 in/hr)

Depth to water table: More than 80 inches

Frequency of flooding: None

Frequency of ponding: None

Available water storage in profile: Moderate (about 7.9 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 2s

Hydrologic Soil Group: B

Hydric soil rating: No

Minor Components

Udorthents, wet substratum

Percent of map unit: 10 percent

Landform position (two-dimensional): Footslope

Landform position (three-dimensional): Tread

Down-slope shape: Linear

Across-slope shape: Linear

Hydric soil rating: No

Udorthents, loamy

Percent of map unit: 10 percent

Landform position (three-dimensional): Tread

Down-slope shape: Linear

Across-slope shape: Linear

Hydric soil rating: No

Data Source Information

Soil Survey Area: Plymouth County, Massachusetts

Survey Area Data: Version 11, Sep 7, 2018

Plymouth County, Massachusetts

480E—Plymouth - Carver complex, 15 to 35 percent slopes

Map Unit Setting

National map unit symbol: bcyx

Elevation: 0 to 400 feet

Mean annual precipitation: 41 to 54 inches

Mean annual air temperature: 43 to 54 degrees F

Frost-free period: 145 to 240 days

Farmland classification: Not prime farmland

Map Unit Composition

Plymouth and similar soils: 45 percent

Carver and similar soils: 40 percent

Minor components: 15 percent

Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Plymouth

Setting

Landform: Outwash plains, moraines

Landform position (two-dimensional): Backslope

Landform position (three-dimensional): Side slope, riser

Down-slope shape: Linear

Across-slope shape: Convex

Parent material: Sandy and gravelly supraglacial meltout till over sandy and gravelly glaciofluvial deposits

Typical profile

Oi - 0 to 4 inches: slightly decomposed plant material

Oe - 4 to 6 inches: moderately decomposed plant material

A - 6 to 7 inches: loamy coarse sand

E - 7 to 11 inches: coarse sand

Bs - 11 to 15 inches: loamy coarse sand

Bw - 15 to 20 inches: coarse sand

BC - 20 to 29 inches: coarse sand

C - 29 to 64 inches: gravelly coarse sand

Properties and qualities

Slope: 15 to 35 percent

Depth to restrictive feature: More than 80 inches

Natural drainage class: Excessively drained

Runoff class: Very low

Capacity of the most limiting layer to transmit water (Ksat): High
(1.98 to 5.95 in/hr)

Depth to water table: More than 80 inches

Frequency of flooding: None

Frequency of ponding: None

Available water storage in profile: Low (about 3.3 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 6e

Hydrologic Soil Group: A

Hydric soil rating: No

Description of Carver

Setting

Landform: Outwash plains, pitted outwash plains, moraines

Landform position (two-dimensional): Backslope

Landform position (three-dimensional): Riser

Down-slope shape: Linear

Across-slope shape: Convex

Parent material: Sandy glaciofluvial deposits

Typical profile

Oi - 0 to 2 inches: slightly decomposed plant material

Oe - 2 to 3 inches: moderately decomposed plant material

A - 3 to 7 inches: coarse sand

E - 7 to 10 inches: coarse sand

Bw1 - 10 to 15 inches: coarse sand

Bw2 - 15 to 28 inches: coarse sand

BC - 28 to 32 inches: coarse sand

C - 32 to 67 inches: coarse sand

Properties and qualities

Slope: 15 to 35 percent

Depth to restrictive feature: More than 80 inches

Natural drainage class: Excessively drained

Runoff class: Very low

Capacity of the most limiting layer to transmit water (Ksat):

Moderately high to very high (1.42 to 14.17 in/hr)

Depth to water table: More than 80 inches

Frequency of flooding: None

Frequency of ponding: None

Available water storage in profile: Very low (about 2.6 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 7s

Hydrologic Soil Group: A

Hydric soil rating: No

Minor Components

Barnstable

Percent of map unit: 10 percent

Landform: Moraines

Landform position (two-dimensional): Backslope

Landform position (three-dimensional): Side slope

Down-slope shape: Linear

Across-slope shape: Convex

Hydric soil rating: No

Merrimac

Percent of map unit: 5 percent

Landform: Outwash plains, terraces, kames

Landform position (two-dimensional): Backslope

Landform position (three-dimensional): Riser

Down-slope shape: Linear

Across-slope shape: Convex

Hydric soil rating: No

Data Source Information

Soil Survey Area: Plymouth County, Massachusetts

Survey Area Data: Version 11, Sep 7, 2018

Plymouth County, Massachusetts

51A—Swansea muck, 0 to 1 percent slopes

Map Unit Setting

National map unit symbol: 2trl2

Elevation: 0 to 1,140 feet

Mean annual precipitation: 36 to 71 inches

Mean annual air temperature: 39 to 55 degrees F

Frost-free period: 140 to 240 days

Farmland classification: Not prime farmland

Map Unit Composition

Swansea and similar soils: 80 percent

Minor components: 20 percent

Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Swansea

Setting

Landform: Swamps, bogs

Landform position (three-dimensional): Dip

Down-slope shape: Concave

Across-slope shape: Concave

Parent material: Highly decomposed organic material over loose sandy and gravelly glaciofluvial deposits

Typical profile

Oa1 - 0 to 24 inches: muck

Oa2 - 24 to 34 inches: muck

Cg - 34 to 79 inches: coarse sand

Properties and qualities

Slope: 0 to 1 percent

Depth to restrictive feature: More than 80 inches

Natural drainage class: Very poorly drained

Runoff class: Negligible

Capacity of the most limiting layer to transmit water (Ksat):

Moderately low to high (0.14 to 14.17 in/hr)

Depth to water table: About 0 to 6 inches

Frequency of flooding: Rare

Frequency of ponding: Frequent

Available water storage in profile: Very high (about 16.5 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 8w

Hydrologic Soil Group: B/D

Hydric soil rating: Yes

Minor Components

Freetown

Percent of map unit: 10 percent
Landform: Swamps, bogs
Landform position (three-dimensional): Dip
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

Whitman

Percent of map unit: 5 percent
Landform: Depressions, drainageways
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Base slope
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

Scarboro

Percent of map unit: 5 percent
Landform: Depressions, drainageways
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Base slope, tread, dip
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

Data Source Information

Soil Survey Area: Plymouth County, Massachusetts
Survey Area Data: Version 11, Sep 7, 2018