ALLEN & MAJOR ASSOCIATES, INC.

DRAINAGE REPORT

Parcel H Development
Warehouse/Distribution Facility
Northborough, MA

Prepared: 12/24/2019

Site Locus – Not to Scale

CLIENT:
The Gutierrez Company
200 Summit Drive, Suite 400
Burlington, MA 01803

PREPARED BY:
Allen & Major Associates, Inc.
Carlton Quinn, PE
100 Commerce Way, Suite 5
Woburn, Massachusetts 01801

DRAINAGE REPORT

Parcel H Warehouse/Distribution Facility
0 & 301 Bartlett Street
Map 51 Parcel 3 & Map 66 Lot 16
Northborough, MA

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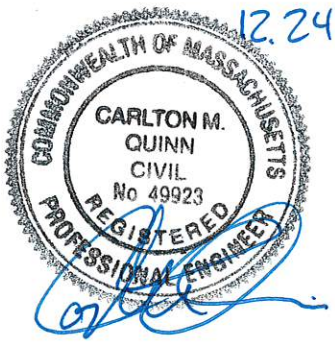

12.24.19

ISSUED:
12/24/2019

REVISED:
N/A

A&M PROJECT NO.:
1145-09

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SECTION 1.0

INTRODUCTION

The purpose of this drainage report is to provide an overview of the proposed stormwater management system (SMS) for the proposed warehouse/distribution facility development located at 0 & 301 Bartlett Street, Northborough, MA and identified on Town of Marlborough Assessors Map 51 Lot 3 and Assessors Map 66 Lot 16, and located entirely within the Town of Northborough. The report will show by means of narrative calculations and exhibits that the proposed stormwater management system will meet or exceed the 10 Massachusetts Department of Environmental Protection (MassDEP) stormwater standards.

The proposed site improvements include a 150,900+/- square foot (s.f.) industrial warehouse/distribution facility with associated parking lot, truck court with loading bays, stormwater management system, utilities and associated infrastructure as well as site landscaping and lighting. The project will be serviced by municipal sewer, and water and private gas and electric services.

The SMS incorporates structural and non-structural Best Management Practices (BMPs) to provide stormwater peak flow mitigation, quality treatment, and conveyance. The SMS includes street sweeping, catch basins with deep sumps and hoods, drain manholes, infiltration ponds and water quality units.

SITE CATEGORIZATION FOR STORMWATER REGULATIONS

The proposed site improvements at 0 & 301 Bartlett Street is considered a new development under the DEP Stormwater Management Standards due to the net increase in impervious area. A "new development" project is required to meet all of the Stormwater Management Standards listed within the MA DEP Stormwater Handbook.

SITE LOCATION AND ACCESS

The subject parcel is 0 and 301 Bartlett Street. The parcels are 66.08 total acres and are located in the town of Northborough, on the Northborough/Marlborough town line.

Northborough is located in Worcester County and is approximately 30 miles west of Boston. The site is also approximately located 2 miles west of Interstate 495.

EXISTING SITE CONDITIONS

The site currently includes Assessors Map 51 Lot 3, Assessors Map 66 Lot 16. The project site is 66.08 acres and is currently an undeveloped lot with forested uplands, wetlands, a stream known as Stirrup Brook which runs along the northernmost property lines, and priority habitat PH-1286.

The lot is bordered by Stirrup Brook to the north and west, industrial lots on Hayes Memorial Drive in Marlborough to the east, and a DRC aqueduct that abuts an industrial lot on Bartlett Street.

The highest point on the site is along Bartlett Street at approximately elevation 290. The site topography for the 0 Bartlett Street parcel has a localized high point near the center at approximately elevation 273. From the center of the 0 Bartlett subject site, steep slopes run down toward wetlands on all sides. The wetlands which surround the subject property are the low points on-site, and vary in elevation, but typically fall in elevation range of Elev. 240 to the north to Elev. 254 to the west.

WATERSHED

The subject property is located within the Sudbury-Assabet-Concord Watershed which consists of a large network of tributaries that flow into the Merrimack River. The three major rivers that flow through the watershed - the Sudbury, the Assabet, and the Concord - have been recognized for their outstanding ecological, historical, and recreational values. The watershed is also home to the two largest wetlands in Central Massachusetts, the Great Meadows NWR and the Great Cedar Swamp. The SuAsCo watershed has a total drainage area of 377 square miles, encompasses all or part of 36 cities and towns, supports a population of close to 365,000 people and is comprised of 29 miles of free-flowing river in the watershed.

EXISTING SOIL CONDITIONS

The on-site soils were identified using the USDA Natural Resources Conservation Services (NRCS) Soil Survey for Worcester County. The site soil types and corresponding Hydrologic Soil Groups (HSG) include:

- SCS 31A – Walpole sandy loam, 0 to 3 percent slopes, HSG B/D
- SCS 51A - Swansea muck, 0 to 1 percent slopes, HSG B/D
- SCS 245C - Hinckley loamy sand, 8 to 15 percent slopes, HSG A
- SCS 254B – Merrimac Fine Sandy Loam, 3-8 percent slopes, HSG A
- SCS 311B - Woodbridge fine sandy loam, 0 to 8 percent slopes, HSG C/D

Soils on-site include types A, B/D, and C/D. A copy of the soil mapping from the NRCS website is included in the Appendix of this report. Soils within the proposed development and stormwater management system include HSG "A" and HSG "B". The HydroCAD model reflects these HSG groups.

FEMA FLOODPLAIN/ENVIRONMENTAL DUE DILIGENCE

The Flood Insurance Rate Map (FIRM) (Map Number 25027C0653F) for the town of Northborough dated 07/16/2014 indicates that the parcel lies within the FEMA A Zone, as well as Zone X (unshaded). The FEMA A Zone in this area is defined as "areas subject to inundation by the 1-percent-annual-chance flood event". Zone X (unshaded) lie outside of the 1-percent-annual-chance and 0.2-percent-annual-chance flood event

zones. No Base Flood Elevations (BFEs) are identified for the subject site. The subject parcel site is outside of the 500-year Floodplain. No work is proposed within the Zone A flood event zone. See the Appendix of this report for a copy of the FEMA FIRM.

ENVIRONMENTALLY SENSITIVE ZONES

The Commonwealth of Massachusetts asserts control over numerous protected and regulated areas including: Areas of Critical Environmental Concern (ACEC); Outstanding Resource Waters (ORWs); areas protected under the Wetlands Protection Act and the Rivers Protection Act, as well as Priority and Protected Habitat for rare and endangered species. According to the MassGIS online map viewer OLIVER, the subject property is not located within ACEC or ORW areas.

EXISTING WATERSHED DESCRIPTION

To study peak flow rates the site is broken into 2 study points and 4 watersheds. Under existing conditions, study point 1 is the bordering vegetated wetland to the northwest of the watershed, while study point 2 is the wetlands to the northeast of the watershed.

Under existing conditions, runoff directed to study point 1 is collected from watersheds E-1 and E-1A. The total area draining to the study point is 357,005 square feet, of which, 0% is directed from impervious areas. See existing watershed plan for more information.

Runoff from watersheds E-2 and E-2A is directed to Study point 2. The total area draining to the study point is 317,101 square feet, of this area 0.13% is impervious. See existing watershed plan for more information.

DRAINAGE ANALYSIS METHODOLOGY

A peak rate of runoff will be determined using techniques and data found in the following:

1. Urban Hydrology for Small Watersheds – Technical Release 55 by the United States Department of Agriculture Soils Conservation Service, June 1986. Runoff curve numbers and 24-hour precipitation values were obtained from this reference.
2. HydroCAD© Stormwater Modeling System by HydroCAD Software Solutions LLC, version 10.00, 2013. The HydroCAD program was used to generate the runoff hydrographs for the watershed areas, to determine discharge/ stage/storage characteristics for the stormwater BMPs, to perform drainage routing and to combine the results of the runoff hydrographs. HydroCAD uses the TR-20 methodology of the SCS Unit Hydrograph procedure (SCS-UH).

PROPOSED CONDITIONS – PEAK RATE OF RUNOFF

The storm water runoff analysis of the existing and proposed conditions includes an estimate of the peak rate of runoff from various rainfall events. Peak runoff rates were developed using TR55 Urban Hydrology for Small Watersheds, developed by the U.S. Department of Commerce, Engineering Division and the HydroCAD computer program. Further, the analysis has been prepared in accordance with the MassDEP and standard engineering practices. The peak rate of runoff has been estimated for each watershed during the 2, 10 and 100-year storm events.

Study point 1 receives runoff from the following watersheds: P-7, P-8, P-9, P-10, P-11, P-13, P-14, P-15A, and P-17. The total area draining to the study point is 324,231 square feet, and of this area, 39.05% is impervious. See proposed watershed plan and grading and drainage plan for more information.

Study point 2 receives runoff from the following watersheds: P-1, P-2, P-3, P-4, P-5, P-12, P-15B, P-16, P-18, P-19, P-20, P-21, P-22, P-23, P-24, and P-25. The total area draining to the study point is 349,875 square feet, of this area 50.91% is impervious. See proposed watershed plan and grading and drainage plan for more information.

Peak Flow Rates

Study Point #1 (Flow to wetlands)

	2-Year	10-Year	100-Year
Existing Runoff (CFS)	0.03	0.24	0.77
Proposed Runoff (CFS)	0.00	0.13	0.74
% REDUCTION	100%	46%	4%

Study Point #2 (Flow to wetlands)

	2-Year	10-Year	100-Year
Existing Runoff (CFS)	0.21	1.15	3.44
Proposed Runoff (CFS)	0.14	1.05	3.44
% REDUCTION	33%	9%	0%

MASSDEP STORMWATER PERFORMANCE STANDARDS

The MA DEP Stormwater Management Policy was developed to improve water quality by implementing performance standards for storm water management. The intent is to implement the stormwater management standards through the review of Notice of Intent filings by the issuing authority (Conservation Commission or DEP). The following section outlines how the proposed Stormwater Management System meets the standards set forth by the Policy.

BMP's implemented in the design include –

- Deep-sump, hooded catch basins
- Street sweeping
- Hydro-dynamic (Proprietary) separators
- Surface infiltration systems
- Specific maintenance schedule

Stormwater Best Management Practices have been incorporated into the design of the project to mitigate the anticipated pollutant loading. An Operations and Maintenance Plan has been developed for the project, which addresses the long-term maintenance requirements of the proposed system.

Temporary erosion and sedimentation controls will be incorporated into the construction phase of the project. These temporary controls may include straw bale and/or silt fence barriers, inlet sediment traps, slope stabilization, and stabilized construction entrances.

The Massachusetts Department of Environmental Protection has established ten (10) Stormwater Management Standards. A project that meets or exceeds the standards is presumed to satisfy the regulatory requirements regarding stormwater management. The Standards are enumerated below as well as descriptions and supporting calculations as to how the Project will comply with the Standards:

1. *No new stormwater conveyances (e.g. outfalls) may discharge untreated stormwater directly to or cause erosion in wetlands or waters of the Commonwealth.*

   The proposed development will not introduce any new stormwater conveyances (e.g. outfalls) that discharge untreated stormwater directly to or cause erosion in wetlands or waters of the Commonwealth.

2. *Stormwater management systems shall be designed so that post-development peak discharge rates do not exceed pre-development peak discharge rates. This Standard may be waived for discharges to land subject to coastal storm flowage as defined in 310 CMR 10.04.*

   The proposed development will be designed so that the post-development peak discharge rates and volumes do not exceed the pre-development peak discharge rates and volumes. See the peak flow rates table above.

3. *Loss of annual recharge to groundwater shall be eliminated or minimized through the use of infiltration measures including environmentally sensitive site design, low impact development techniques, stormwater best management practices, and good operation and maintenance. At a minimum, the annual recharge from the post-development site shall approximate the annual recharge from pre-development*

conditions based on soil type. This Standard is met when the stormwater management system is designed to infiltrate the required recharge volume as determined in accordance with the Massachusetts Stormwater Handbook.

The existing annual recharge for the site will be exceeded in the developed condition. Infiltration basins will be designed to meet this requirement. All Infiltration Systems were designed using the Static Method per the MassDEP Stormwater Management Standards, Volume 3, Chapter 1. See Section 6.5 for water quality/recharge calculations in the DEP Standard calculations located in the Appendix of this Drainage report for more detailed information.

4. *Stormwater management systems shall be designed to remove 80% of the average annual post-construction load of Total Suspended Solids (TSS). This standard is met when:*
    - *Suitable practices for source control and pollution prevention are identified in a long-term pollution prevention plan, and thereafter are implemented and maintained;*
    - *Structural stormwater best management practices are sized to capture the required water quality volume determined in accordance with the Massachusetts Stormwater Handbook; and*
    - *Pretreatment is provided in accordance with the Massachusetts Stormwater Handbook.*

    The proposed stormwater management system will be designed so that effluent will meet the 80% TSS treatment removal standard. Standard #4 is met when structural stormwater best management practices are sized to capture and treat the required water quality volume in accordance with the Massachusetts Stormwater Handbook. Standard #4 also requires that suitable source control measures are identified in the Long-Term Pollution Prevention Plan. The 80% total TSS removal standard will be met using some combination of the following: deep-sump, hooded catch basins, infiltration basins and proprietary separators.

    The water quality volume for the site development will be captured and treated using proprietary separators and infiltration basins. All systems will be sized to meet the water quality flow rate for the 1/2" storm event. See DEP Calculations in the appendix of this report for water quality flow rate and volume calculations, as well as the TSS treatment train.

5. *For land uses with higher potential pollutant loads, source control and pollution prevention shall be implemented in accordance with the Massachusetts Stormwater Handbook to eliminate or reduce the discharge of stormwater runoff from such land uses to the maximum extent practicable. If through source control and/or pollution prevention all land uses with higher potential pollutant loads cannot be*

completely protected from exposure to rain, snow, snow melt, and stormwater runoff, the proponent shall use the specific structural stormwater BMPs determined by the Department to be suitable for such uses as provided in the Massachusetts Stormwater Handbook. Stormwater discharges from land uses with higher potential pollutant loads shall also comply with the requirements of the Massachusetts Clean Waters Act, M.G.L. c. 21, §§ 26-53 and the regulations promulgated thereunder at 314 CMR 3.00, 314 CMR 4.00 and 314 CMR 5.00.

The proposed development is not considered a source of higher potential pollutant loads and the drainage system will be designed to treat 1/2" water quality volume. The SMS will be designed with deep-sump, hooded catch basins, proprietary separators, and infiltration basins.

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

   The proposed project is not located within a critical area.

7. *A redevelopment project is required to meet the following Stormwater Management Standards only to the maximum extent practicable: Standard 2, Standard 3, and the pretreatment and structural best management practice requirements of Standards 4, 5, and 6. Existing stormwater discharges shall comply with Standard 1 only to the maximum extent practicable. A redevelopment project shall also comply with all other requirements of the Stormwater Management Standards and improve existing conditions.*

   The proposed project is not considered a re-development project under the Stormwater Management Handbook guidelines as there is an increase in the amount of impervious area. A "new development" project is required to meet all of the ten Stormwater Standards listed within the MA DEP Stormwater Handbook.

8. *A plan to control construction-related impacts including erosion, sedimentation and other pollutant sources during construction and land disturbance activities (construction period erosion, sedimentation, and pollution prevention plan) shall be developed and implemented.*

   A plan to control construction-related impacts, including erosion, sedimentation and other pollutant sources during construction and land disturbance activities will be developed. The proponent will prepare and submit a Stormwater Pollution Prevention Plan (SWPPP) prior to commencement of construction activities for this project as it will result in the disturbance of one acre of land or more.

9. *A long-term operation and maintenance plan shall be developed and implemented to ensure that stormwater management systems function as designed.*

   A Long-Term Operation & Maintenance (O&M) Plan has been developed for the proposed stormwater management system and is included within this document. See Section 2.0 of this report.

10. *All illicit discharges to the stormwater management system are prohibited.*

    There are no expected illicit discharges to the stormwater management system. The applicant has submitted the Illicit Discharge Compliance Statement with this report.

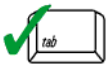
See the next page for the MassDEP Stormwater Checklist.

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

Checklist for Stormwater Report

A. Introduction

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



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

The Stormwater Report must include:

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

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

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

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

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

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

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

Checklist for Stormwater Report

B. Stormwater Checklist and Certification

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

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

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

Registered Professional Engineer's Certification

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

Registered Professional Engineer Block and Signature

12.24.19

Signature and Date

Checklist

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

☒ New development

☐ Redevelopment

☐ Mix of New Development and Redevelopment

Checklist for Stormwater Report

Checklist (continued)

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

☒ No disturbance to any Wetland Resource Areas

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

☐ Reduced Impervious Area (Redevelopment Only)

☒ Minimizing disturbance to existing trees and shrubs

☐ LID Site Design Credit Requested:

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

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

☐ Bioretention Cells (includes Rain Gardens)

☐ Constructed Stormwater Wetlands (includes Gravel Wetlands designs)

☐ Treebox Filter

☐ Water Quality Swale

☐ Grass Channel

☐ Green Roof

☒ Other (describe): Surface Infiltration Ponds; Hydrodynamic Separators, Catch Basins with Deep Sumps and Hoods, Street Sweeping

Standard 1: No New Untreated Discharges

☒ No new untreated discharges

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

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

Checklist for Stormwater Report

Checklist (continued)

Standard 2: Peak Rate Attenuation

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

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

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

Standard 3: Recharge

☒ Soil Analysis provided.

☒ Required Recharge Volume calculation provided.

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

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

☒ Static ☐ Simple Dynamic ☐ Dynamic Field[1]

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

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

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

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

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

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

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

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

Checklist for Stormwater Report

Checklist (continued)

Standard 3: Recharge (continued)

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

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

Standard 4: Water Quality

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

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

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

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

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

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

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

Checklist for Stormwater Report

Checklist (continued)

Standard 4: Water Quality (continued)

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

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

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

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

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

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

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

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

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

☐ All exposure has been eliminated.

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

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

Standard 6: Critical Areas

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

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

Checklist for Stormwater Report

Checklist (continued)

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

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

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

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

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

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

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

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

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

Checklist for Stormwater Report

Checklist (continued)

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

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

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

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

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

Standard 9: Operation and Maintenance Plan

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

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

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

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

Standard 10: Prohibition of Illicit Discharges

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

☒ An Illicit Discharge Compliance Statement is attached;

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

SECTION 2.0

OPERATION & MAINTENANCE PLAN

OPERATIONS AND MAINTENANCE PLAN

In accordance with the standards set forth by the Stormwater Management Policy issued by the Department of Environmental Protection (DEP), Allen & Major Associates, Inc. (A&M) has prepared the following Operation and Maintenance plan for the 0 & 301 Bartlett Street drainage improvements.

This plan is broken into two major sections. The first section describes construction-related erosion and sedimentation controls. The second section is devoted to a post-development operation and maintenance plan. An operation and maintenance schedule is included with this report.

Stormwater Management System Owner: The Gutierrez Company
200 Summit Drive, Suite 400
Burlington, MA 01803

Emergency Contact Information:

The Gutierrez Company	Phone: (781) 272-7000
Allen & Major Associates, Inc. (Site Civil Engineer)	Phone: (781) 935-6889
Northborough Public Works Department	Phone: (508) 393-5030
Northborough Fire Department	Phone: (508) 393-1537

INTRODUCTION

The stormwater management system (SMS) for this project is owned by the Gutierrez Company, and shall be legally responsible for long-term operation and maintenance for this SMS as outlined in this Operation and Maintenance (O&M) Plan. Should ownership of the SMS change, the succeeding owner will be presented with this O&M Plan and supporting attachments at or before legal conveyance of ownership and will assume the obligations of the O&M Plan.

In the event that the SMS will be operated and maintained by an entity other than that listed in this document, the applicant shall provide a plan and easement deed that provides a right of access for the legal entity to be able to perform said operation and maintenance functions. In the event the SMS will serve multiple lots/owners, the applicant shall also provide 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 entire SMS.

DEMOLITION & CONSTRUCTION MAINTENANCE PLAN

1. Call Digsafe: 1-888-344-7233
2. Contact the city at least three (3) days prior to start of demolition and/or construction activities.
3. Install Erosion Control measures as shown on the Plans prepared by A&M. The municipality shall review the installation of straw bales and silt fencing prior to the start of any site demolition work. Install construction fencing if determined to be necessary at the commencement of construction.
4. Install construction entrances, straw bales, and silt fence at the locations shown on the Erosion Control Plan prepared by A&M.
5. Site access shall be achieved only from the designated construction entrances.
6. Cut and clear trees in construction areas only (within the limit of work; see plans).
7. Stockpiles of materials subject to erosion shall be stabilized with erosion control matting or temporary seeding whenever practicable, but in no case more than 14 days after the construction activity in that portion of the site has temporarily or permanently ceased.
8. Install silt sacks and straw bales around each drain inlet prior to any demolition and or construction activities and within downgradient areas along Bartlett Street.
9. All erosion control measures shall be inspected weekly and after every rainfall event as well as per the NPDES SWPPP regulations and the Conservation Commission Order of Conditions. Records of these inspections shall be kept on-site for review.
10. All erosion control measures shall be maintained, repaired, or replaced as required or at the direction of the owner's engineer or the municipality.
11. Sediment accumulation up-gradient of the straw bales, silt fence, and stone check dams greater than 6" in depth shall be removed and disposed of in accordance with all applicable regulations.
12. If it appears that sediment is exiting the site, silt sacks shall be installed in all catch basins adjacent to the site. Sediment accumulation on all adjacent catch basin inlets shall be removed and the silt sack replaced if torn or damaged.
13. Install stone check dams on-site during construction as needed. Refer to the erosion control details. Temporary sediment basins combined with stone check damns shall be installed on-site during construction to control and collect runoff from upland areas of this site during demolition and construction activities.

14. The contractor shall comply with the Sedimentation and Erosion Control Notes as shown on the Site Development Plans and Specifications.
15. The stabilized construction entrances shall be inspected weekly and records of inspections kept. The entrances shall be maintained by adding additional clean, angular, durable stone to remove the soil from the construction vehicle's tires when exiting the site. If soil is still leaving the site via the construction vehicle tires, adjacent roadways shall be kept clean by street sweeping.
16. Dust pollution shall be controlled using on-site water trucks and/or an approved soil stabilization product.
17. During demolition and construction activities, Status Reports on compliance with this O&M Document shall be submitted weekly. The report shall document any deficiencies and corrective actions taken by the applicant.

POST CONSTRUCTION MAINTENANCE PLAN

The SMS shall be inspected immediately after construction. A maintenance log will be kept (i.e. report) summarizing inspections, maintenance, and any corrective actions taken. The log will include the date on which each inspection or maintenance task was performed, a description of the inspection findings or maintenance completed, and the name of the inspector or maintenance personnel performing the task. If a maintenance task requires the clean-out of any sediments or debris, the location where the sediment and debris was disposed after removal will be indicated. The log will be made accessible to department staff and a copy provided to the department upon request.

Inspection and Maintenance Frequency and Corrective Measures

The following areas, facilities, and measures will be inspected and the identified deficiencies will be corrected. Clean-out must include the removal and legal disposal of any accumulated sediments, trash, and debris. In any and all cases, operations, inspections, and maintenance activities shall utilize best practical measures to avoid and minimize impacts to wetland resource areas outside the foot print of the SMS.

The following SMS components that will require continuing inspection as outlined in the document:

- *Deep Sump Catch Basins*
- *Proprietary Separators*
- *Surface Infiltration Ponds*
- *Outlet Control Structures*
- *Emergency Spillways/Overflow*

Monthly Post Construction Inspection (first three months only)

- **Surface Detention/Infiltration Systems**: Inspect the pond after all rainfalls greater than 1" to ensure that the system to ensure the slopes are not washing out and that the basin is draining within 72 hours. Repair as required.

Quarterly Inspections (specifically after foliage and snow season)

- **Deep Sump Catch Basins**: Inspect catch basins to ensure that the catch basins are working in their intended fashion and that they are free of debris. Structures will be skimmed of floatable debris at each inspection and sediment will be removed at a minimum once per year (typically after snow season) or when sediment has accumulated to within 2 feet of the outlet invert. If the basin outlet is designed with a hood to trap floatable materials (i.e. Snout), check to ensure watertight seal is working.
- **Proprietary Separators**: Separators shall be operated in strict accordance with manufacturer's recommended practices. Available manufacturer specific O&M plans attached as Appendix. Separators shall be inspected to ensure that they are working in their intended fashion and that they are free of debris. Structures shall be cleaned with a vacuum truck at least once annually (typically after snow season) or when sediment has accumulated to a depth of six inches (6"), whichever is more frequent.

Semi-Annual Inspection (specifically after foliage and snow season)

- **Culverts**: Inspect culverts to ensure that the culverts are working in their intended fashion and that they are free of debris. Remove any obstructions to flow; remove accumulated sediments and debris at the inlet, at the outlet, and within the conduit and to repair any erosion damage at the culvert's inlet and outlet.
- **Vegetated Areas:** Inspect slopes and embankments early in the growing season to identify active or potential erosion problems. Replant bare areas or areas with sparse growth. Where rill erosion is evident, armor the area with an appropriate lining or divert the erosive flows to on-site areas able to withstand the concentrated flows.
- **Roadway and Parking Surfaces:** Sweep paved areas as soon as possible after snow melt and no less than four times annually. Clear accumulations of winter sand in parking lots and along roadways at least once a year, preferably in the spring. Accumulations on pavement may be removed by pavement sweeping. Accumulations of sand along road shoulders may be removed by grading excess sand to the pavement edge and removing it manually or by a front-end loader.

- Level Spreaders, Check Dams, Rip-Rap: These accessories will be inspected for erosion, debris accumulation, and unwanted vegetation. Erosion will be stabilized and sediment, debris, and woody vegetation will be removed.

LANDSCAPE MANAGEMENT PLAN

It should be recognized that this is a general guideline towards achieving high quality and well-groomed landscaped areas. The grounds staff/landscape contractor must recognize the shortcomings of a general maintenance program such as this, and modify and/or augment it based on weekly, monthly, and yearly observations. In order to assure the highest quality conditions, the staff must also recognize and appreciate the need to be award of the constantly changing conditions of the landscaping and be able to respond to them on a proactive basis.

- **Fertilizer**: Maintenance practices should be aimed at reducing environmental, mechanical, and pest stresses to promote healthy and vigorous growth. When necessary, pest outbreaks should be treated with the most sensitive control measure available. Synthetic chemical controls should be used only as a last resort to organic and biological control methods. Fertilizer, synthetic chemical controls and pest management applications (when necessary) should be used as conservatively as possible.
- **Suggested Aeration Program**: In-season aeration of lawn areas is good cultural practice, and is recommended whenever feasible. It should be accomplished with a solid thin tine aeration method to reduce disruption to the use of the area. The depth of solid tine aeration is similar to core type, but should be performed when the soil is somewhat drier for a greater overall effect.
    - *Depending on the intensity of use, it can be expected that all landscaped lawn areas will need aeration to reduce compaction at least once per year. The first operation should occur in late May following the spring season. Methods of reducing compaction will vary based on the nature of the compaction. Compaction on newly established landscape areas is generally limited to the top 2-3" and can be alleviated using hollow core or thin tine aeration methods.*
    - *The spring aeration should consist of two passes at opposite directions with ¼" hollow core tines penetrating 3-5" into the soil profile. Aeration should occur when the soil is moist but not saturated. The cores should be shattered in place and dragged or swept back into the turf to control thatch. If desired the cores may also be removed and the area top-dressed with sand or sandy loam. If the area drains on average too slowly, the topdressing should contain a higher percentage of sand. If it is draining on average too quickly, the top dressing should contain a higher percentage of soil or organic matter.*

Landscape Maintenance Program Practices

Lawn

- Mow a minimum of once a week in spring, to a height of 2" to 2 ½" high. Mowing should be frequent enough so that no more than 1/3 of grass blade is removed at each mowing. The top growth supports the roots; the shorter the grass is cut, the less the roots will grow. Short cutting also dries out the soil and encourages weeds to germinate.
- Mow approximately once every two weeks from July 1st to August 15th depending on lawn growth.
- Mow on a ten-day cycle in fall, when growth is stimulated by cooler nights and increased moisture.
- Do not remove grass clippings after mowing (Except in Drainage BMP's).
- Keep mower blades sharp to prevent ragged cuts on grass leaves, which cause a brownish appearance and increase the chance for disease to enter a leaf.
- Supplemental irrigation of lawn areas should provide 1" of water per week in two watering's per week—when no natural rainfall has occurred.

Shrubs

- Mulch not more than 3" depth with shredded pine or fir bark.
- Hand pruning shall be performed annually based on the natural growth characteristics of each species to keep plants from overgrowing walks and windows. NO SHEARING OF SHRUBS IS PERMITTED. Typically, pruning of each variety shall be immediately after blooming.
- Fertilize with ½ lb. slow-release fertilizer (see above section on Fertilizer) every second year.
- Hand-prune evergreen shrubs only as needed to remove dead and damaged wood and to maintain the naturalistic form of the shrub. Never mechanically shear evergreen shrubs.

Trees

- Provide aftercare for new tree plantings for the first three years.
- Do not fertilize trees, it artificially stimulates them (unless tree health warrants).
- Water once a week for the first year; twice a month the second year; once a month the third year.
- Prune trees on a four-year cycle.

Maintenance Phase

By the fourth growing season, the planted grasslands should be reaching maturity. At this time, half of the grassland habitat area should be mown annually in mid- August to maintain the grassland habitat, limiting the opportunity for shrubs and late-blooming forbs to spread, and allowing the grasses time to recover before dormancy.

Management of Deicing Chemicals and Snow

Snow shall not be plowed towards any area protected by the Massachusetts Wetlands Protection Act. Additionally, it is prohibited to dump snow into the bioretention swales, or gravel swales. If the stockpiles of snow do not fit on-site, then snow will be disposed off-site. It will be the responsibility of the snow removal contractor to properly dispose of transported snow according to the Massachusetts Department of Environmental Protection, Bureau of Resource Protection – Snow Disposal Guideline #BRPG01-0, governing the proper disposal of snow. It will be the responsibility of the snow removal contractor to follow these guidelines and all applicable laws and regulations. A copy of the MassDEP Snow Disposal Guideline #BRPG01-01 has been included at the end of Section 2 for reference.

The site's maintenance staff (or its designee) will be responsible for the clearing of the sidewalk and building entrances. The site may be required to use a de-icing agent such as potassium chloride (or approved equal) to maintain a safe walking surface; however, these are to be used at the minimum amount practicable. The de-icing agent for the walkways and building entrances will be kept within the storage rooms located within the buildings. De-icing agents will not be stored outside.

Spill Prevention and Response

Sources of potential spill hazards include vehicle fluids, liquid fuels, pesticides, paints, solvents, and liquid cleaning products. The majority of the spill hazards would likely occur within the building and would not enter the stormwater drainage system. However, there are spill hazards from vehicle fluids or liquid fuels located outside of the buildings. These exterior spill hazards have the potential to enter the stormwater drainage system and are to be addressed as follows:

- *Spill Hazards of pesticides, paints, and solvents shall be remediated using the Manufacturers' recommended spill cleanup protocol.*
- *Vehicle fluids and liquid fuel spill shall be remediated according to the local and state regulations governing fuel spills.*
- *The owner shall have the following equipment and materials on hand to address a spill clean-up: brooms, dust pans, mops, rags, gloves, absorptive material, sand, sawdust, plastic and metal trash containers.*

- *All spills shall be cleaned up immediately after discovery.*
- *Spills of toxic or hazardous material shall be reported, regardless of size, to the Massachusetts Department of Environmental Protection at 888-304-1133.*
- *Should a spill occur, the pollution prevention plan will be adjusted to include measures to prevent another spill of a similar nature. A description of the spill, along with the causes and cleanup measures will be included in the updated pollution prevention plan.*

OPERATION & MAINTENANCE PLAN SCHEDULE

Project: Parcel H Warehouse/Distribution Center Development
Address: 0 & 301 Barltett Street
Northborough, MA

Responsible for O & M Plan: The Gutierrez Company
Address: 200 Summit Drive, Suite 400
Burlington, MA 01803

Phone: 781-272-7000

Date: 12/24/2019
Revised: N/A

Structure or Task	Maintenance Activity	Schedule/Notes	Annual Maintenance Cost	Inspection Performed	
				Date:	By:
Street Sweeping	Sweep, power broom or vacuum paved areas.	Sweep paved areas as needed, but not less than four times annually.	$2,000		
		Submit information that confirms that all street sweepings have been disposed in accordance with state and local requirements			
Deep Sump Catch Basins(s)	Clam shell or vacuum sumps	Inspect at least twice annually. Clean when sediment is within 2 feet of the outlet invert.	$500		
		Submit information that confirms that all catch basin sediments have been disposed in accordance with state and local requirements			
Proprietary Stormwater Separator	Vactor trucks or manual cleaning. Clean units in accordance with manufacturers recommendations and requirements. Clam shell not recommended for these units.	Inspect in accordance with manufacturers requirements, but no less than monthly for the first year following installation, and no less than once a year thereafter. Remove sediment and other trapped pollutants at frequency or level specified by manufacturer or when the sediment depth in the chamber reaches 12 inches.	$2,000		
Storm Water Management System					
Surface Basins	Inspect to ensure it is draining properly. Inspect inlets, outlets and riprap and repair immediately	Perform every other month as well as after every storm event over 1/2". See also note #1 below.	$2,500		
	Side slopes mowed at least twice during growing season				
	Inspect system bottoms and remove any accumulated sediment greater than 6 inches	On a semi-annual basis.			
Outlet Control Structure(s)	Vacuum.	Periodic cleaning of Outlet Control Structures as needed.	$500		
Mosquito Control	CB management targeted larviciding treatment to CB's and all storm drains to control mosquitoes in their aquatic stages.	Surveillance is a non chemical inspection method that involves classification of mosquito breeding sites, larval presents, and survey.	$100		
Snow Storage	Debris shall be cleared from the site and properly disposed of at the end of the snow season, but shall be cleared no later than May 15.	Avoid dumping snow removal over catch basins, in detention ponds, sediment forebays, rivers, wetlands, and flood plain. It is also prohibited to dump snow in the bioretention basins or gravel swales.	$500		

Snow Disposal Guidance

A to Z Quick Links

Water Resources Index

Effective Date: March 8, 2001

Guideline No. BRPG01-01

Applicability: Applies to all federal, state, regional and local agencies, as well as to private businesses.

Supersedes: BRP Snow Disposal Guideline BRPG97-1 issued 12/19/97, and all previous snow disposal guidance

Approved by: Glenn Haas, Assistant Commissioner for Resource Protection

PURPOSE: To provide guidelines to all government agencies and private businesses regarding snow disposal site selection, site preparation and maintenance, and emergency snow disposal options that are acceptable to the Department of Environmental Protection, Bureau of Resource Protection.

APPLICABILITY: These Guidelines are issued by the Bureau of Resource Protection on behalf of all Bureau Programs (including Drinking Water Supply, Wetlands and Waterways, Wastewater Management, and Watershed Planning and Permitting). They apply to public agencies and private businesses disposing of snow in the Commonwealth of Massachusetts.

INTRODUCTION

Finding a place to dispose of collected snow poses a challenge to municipalities and businesses as they clear roads, parking lots, bridges, and sidewalks. While we are all aware of the threats to public safety caused by snow, collected snow that is contaminated with road salt, sand, litter, and automotive pollutants such as oil also threatens public health and the environment.

As snow melts, road salt, sand, litter, and other pollutants are transported into surface water or through the soil where they may eventually reach the groundwater. Road salt and other pollutants can contaminate water supplies and are toxic to aquatic life at certain levels. Sand washed into waterbodies can create sand bars or fill in wetlands and ponds, impacting aquatic life, causing flooding, and affecting our use of these resources.

There are several steps that communities can take to minimize the impacts of snow disposal on public health and the environment. These steps will help communities avoid the costs of a contaminated water supply, degraded waterbodies, and flooding. Everything we do on the land has the potential to impact our water resources. Given the authority of local government over the use of the land, municipal officials and staff have a critically important role to play in protecting our water resources.

The purpose of these guidelines is to help municipalities and businesses select, prepare, and maintain appropriate snow disposal sites before the snow begins to accumulate through the winter.

RECOMMENDED GUIDELINES

These snow disposal guidelines address: (1) site selection; (2) site preparation and maintenance; and (3) emergency snow disposal.

1. SITE SELECTION

The key to selecting effective snow disposal sites is to locate them adjacent to or on pervious surfaces in upland areas away from water resources and wells. At these locations, the snow meltwater can filter in to the soil, leaving behind sand and debris which can be removed in the springtime. The following areas should be avoided:

- Avoid dumping of snow into any waterbody, including rivers, the ocean, reservoirs, ponds, or wetlands. In addition to water quality impacts and flooding, snow disposed of in open water can cause navigational hazards when it freezes into ice blocks.
- Do not dump snow within a Zone II or Interim Wellhead Protection Area (IWPA) of a public water supply well or within 75 feet of a private well, where road salt may contaminate water supplies.
- Avoid dumping snow on MassDEP-designated high and medium-yield aquifers where it may contaminate groundwater (see the next page for information on ordering maps from MassGIS showing the locations of aquifers, Zone II's, and IWPAs in your community).
- Avoid dumping snow in sanitary landfills and gravel pits. Snow meltwater will create more contaminated leachate in landfills posing a greater risk to groundwater, and in gravel pits, there is little opportunity for pollutants to be filtered out of the meltwater because groundwater is close to the land surface.

- Avoid disposing of snow on top of storm drain catch basins or in stormwater drainage swales or ditches. Snow combined with sand and debris may block a storm drainage system, causing localized flooding. A high volume of sand, sediment, and litter released from melting snow also may be quickly transported through the system into surface water.

Site Selection Procedures

1. It is important that the municipal Department of Public Works or Highway Department, Conservation Commission, and Board of Health work together to select appropriate snow disposal sites. The following steps should be taken:
2. Estimate how much snow disposal capacity is needed for the season so that an adequate number of disposal sites can be selected and prepared.
3. Identify sites that could potentially be used for snow disposal such as municipal open space (e.g., parking lots or parks).
4. Sites located in upland locations that are not likely to impact sensitive environmental resources should be selected first.
5. If more storage space is still needed, prioritize the sites with the least environmental impact (using the site selection criteria, and local or MassGIS maps as a guide).

MassGIS Maps of Open Space and Water Resources

If local maps do not show the information you need to select appropriate snow disposal sites, you may order maps from MassGIS (Massachusetts Geographic Information System) which show publicly owned open spaces and approximate locations of sensitive environmental resources (locations should be field-verified where possible). Different coverages or map themes depicting sensitive environmental resources are available from MassGIS on the map you order. At a minimum, you should order the Priority Resources Map. The Priority Resources Map includes aquifers, public water supplies, MassDEP-approved Zone II's, Interim Wellhead Protection Areas, Wetlands, Open Space, Areas of Critical Environmental Concern, NHESP Wetlands Habitats, MassDEP Permitted Solid Waste facilities, Surface Water Protection areas (Zone A's) and base map features. The cost of this map is $25.00. Other coverages or map themes you may consider, depending on the location of your city or town, include Outstanding Resource Waters and MassDEP Eelgrass Resources. These are available at $25.00 each, with each map theme being depicted on a separate map. Maps should be ordered from MassGIS . Maps may also be ordered by fax at 617-626-1249 (order form available from the MassGIS web site) or mail. For further information, contact MassGIS at 617-626-1189.

2. SITE PREPARATION AND MAINTENANCE

In addition to carefully selecting disposal sites before the winter begins, it is important to prepare and maintain these sites to maximize their effectiveness. The following maintenance measures should be undertaken for all snow disposal sites:

- A silt fence or equivalent barrier should be placed securely on the downgradient side of the snow disposal site.
- To filter pollutants out of the meltwater, a 50-foot vegetative buffer strip should be maintained during the growth season between the disposal site and adjacent waterbodies.
- Debris should be cleared from the site prior to using the site for snow disposal.
- Debris should be cleared from the site and properly disposed of at the end of the snow season and no later than May 15.

3. EMERGENCY SNOW DISPOSAL

As mentioned earlier, it is important to estimate the amount of snow disposal capacity you will need so that an adequate number of upland disposal sites can be selected and prepared.

If despite your planning, upland disposal sites have been exhausted, snow may be disposed of near waterbodies. A vegetated buffer of at least 50 feet should still be maintained between the site and the waterbody in these situations. Furthermore, it is essential that the other guidelines for preparing and maintaining snow disposal sites be followed to minimize the threat to adjacent waterbodies.

Under extraordinary conditions, when all land-based snow disposal options are exhausted, disposal of snow that is not obviously contaminated with road salt, sand, and other pollutants may be allowed in certain waterbodies under certain conditions. In these dire situations, notify your Conservation Commission and the appropriate MassDEP Regional Service Center before disposing of snow in a waterbody.

Use the following guidelines in these emergency situations:

- Dispose of snow in open water with adequate flow and mixing to prevent ice dams from forming.
- Do not dispose of snow in saltmarshes, vegetated wetlands, certified vernal pools, shellfish beds, mudflats, drinking water reservoirs and their tributaries, Zone IIs or IWPAs of public water supply wells, Outstanding Resource Waters, or Areas of Critical Environmental Concern.
- Do not dispose of snow where trucks may cause shoreline damage or erosion.
- Consult with the municipal Conservation Commission to ensure that snow disposal in open water complies with local

ordinances and bylaws.

FOR MORE INFORMATION

If you need more information, contact one of MassDEP's Regional Service Centers:

Northeast Regional Office, Wilmington, 978-694-3200
Southeast Regional Office, Lakeville, 508-946-2714
Central Regional Office, Worcester, 508-792-7683
Western Regional Office, Springfield, 413-755-2214

or

Call Thomas Maguire of DEP's Bureau of Resource Protection in Boston at 617-292-5602.

Chapter 5
Miscellaneous Stormwater Topics

Mosquito Control in Stormwater Management Practices

Both aboveground and underground stormwater BMPs have the potential to serve as mosquito breeding areas. Good design, proper operation and maintenance and treatment with larvicides can minimize this potential.

EPA recommends that stormwater treatment practices dewater within 3 days (72 hours) to reduce the number of mosquitoes that mature to adults, since the aquatic stage of many mosquito species is 7 to 10 days. Massachusetts has had a 72-hour dewatering rule in its Stormwater Management Standards since 1996. The 2008 technical specifications for BMPs set forth in Volume 2, Chapter 2 of the Massachusetts Stormwater Handbook also concur with this practice by requiring that all stormwater practices designed to drain do so within 72 hours.

Some stormwater practices are designed to include permanent wet pools. These practices – if maintained properly – can limit mosquito breeding by providing habitat for mosquito predators. Additional measures that can be taken to reduce mosquito populations include increasing water circulation, attracting mosquito predators by adding suitable habitat, and applying larvicides.

The Massachusetts State Reclamation and Mosquito Control Board (SRMCB), through the Massachusetts Mosquito Control Districts, can undertake further mosquito control actions specifically for the purpose of mosquito control pursuant to Massachusetts General Law Chapter 252. The Mosquito Control Board, http://www.mass.gov/agr/mosquito/, describes mosquito control methods and is in the process of developing guidance documents that describe Best Management Practices for mosquito control projects.

The SRMCB and Mosquito Control Districts are not responsible for operating and maintaining stormwater BMPs to reduce mosquito populations. The owners of property that construct the stormwater BMPs or municipalities that "accept" them through local subdivision approval are responsible for their maintenance.[1] The SRMCB is composed of officials from MassDEP, Department of Agricultural Resources, and Department of Conservation and Recreation. The nine (9) Mosquito Control Districts overseen by the SRMCB are located throughout Massachusetts, covering 176 municipalities.

Construction Period Best Management Practices for Mosquito Control

To minimize mosquito breeding during construction, it is essential that the following actions be taken to minimize the creation of standing pools by taking the following actions:

- ***Minimize Land Disturbance:*** Minimizing land disturbance reduces the likelihood of mosquito breeding by reducing silt in runoff that will cause construction period controls to clog and retain standing pools of water for more than 72 hours.
- ***Catch Basin inlets:*** Inspect and refresh filter fabric, hay bales, filter socks or stone dams on a regular basis to ensure that any stormwater ponded at the inlet drains within 8 hours after precipitation stops. Shorter periods may be necessary to avoid hydroplaning in roads

[1] MassDEP and MassHighway understand that the numerous stormwater BMPs along state highways pose a unique challenge. To address this challenge, the 2004 MassHighway Stormwater Handbook will provide additional information on appropriate operation and maintenance practices for mosquito control when the Handbook is revised to reflect the 2008 changes to the Stormwater Management Standards..

caused by water ponded at the catch basin inlet. Treat catch basin sumps with larvicides such as *Bacillus sphaericus* (*Bs*) using a licensed pesticide applicator.

- ***Check Dams:*** If temporary check dams are used during the construction period to lag peak rate of runoff or pond runoff for exfiltration, inspect and repair the check dams on a regular basis to ensure that any stormwater ponded behind the check dam drains within 72 hours.
- ***Design construction period sediment traps*** to dewater within 72 hours after precipitation. Because these traps are subject to high silt loads and tend to clog, treat them with the larvicide *Bs* after it rains from June through October, until the first frost occurs.
- ***Construction period open conveyances:*** When temporary manmade ditches are used for channelizing construction period runoff, inspect them on a regular basis to remove any accumulated sediment to restore flow capacity to the temporary ditch.
- ***Revegetating Disturbed Surfaces:*** Revegetating disturbed surfaces reduces sediment in runoff that will cause construction period controls to clog and retain standing pools of water for greater than 72 hours.
- ***Sediment fences/hay bale barriers:*** When inspections find standing pools of water beyond the 24-hour period after a storm, take action to restore barrier to its normal function.

<u>Post-Construction Stormwater Treatment Practices</u>

- Mosquito control begins with the environmentally sensitive site design. Environmentally sensitive site design that minimizes impervious surfaces reduces the amount of stormwater runoff. Disconnecting runoff using the LID Site Design credits outlined in the Massachusetts Stormwater Handbook reduces the amount of stormwater that must be conveyed to a treatment practice. Utilizing green roofs minimizes runoff from smaller storms. Storage media must be designed to dewater within 72 hours after precipitation.
- Mosquito control continues with the selection of structural stormwater BMPs that are unlikely to become breeding grounds for mosquitoes, such as:
    - ***Bioretention Areas/Rain Gardens/Sand Filter:*** These practices tend not to result in mosquito breeding. If any level spreaders, weirs or sediment forebays are used as part of the design, inspect them and correct them as necessary to prevent standing pools of water for more than 72 hours.
    - ***Infiltration Trenches:*** This practice tends not to result in mosquito breeding. If any level spreaders, weirs, or sediment forebays are used as part of the design, inspect them and correct them as necessary to prevent standing pools of water for more than 72 hours.
- Another mosquito control strategy is to select BMPs that can become habitats for mosquito predators, such as:
    - ***Constructed Stormwater Wetlands:*** Habitat features can be incorporated in constructed stormwater wetlands to attract dragonflies, amphibians, turtles, birds, bats, and other natural predators of mosquitoes.
    - ***Wet Basins:*** Wet basins can be designed to incorporate fish habitat features, such as deep pools. Introduce fish in consultation with Massachusetts Division of Fisheries and Wildlife. Vegetation within wet basins designed as fish habitat must be properly managed to ensure that vegetation does not overtake the habitat. Proper design to ensure that no low circulation or "dead" zones are created may reduce the potential for mosquito breeding. Introducing bubblers may increase water circulation in the wet basin.

Effective mosquito controls require proponents to design structural BMPs to prevent ponding and facilitate maintenance and, if necessary, the application of larvicides. Examples of such design practices include the following:

- ***Basins:*** Provide perimeter access around wet basins, extended dry detention basins and dry detention basins for both larviciding and routine maintenance. Control vegetation to ensure that access pathways stay open.
- ***BMPs without a permanent pool of water:*** All structural BMPs that do not rely on a permanent pool of water must drain and completely dewater within 72 hours after precipitation. This includes dry detention basins, extended dry detention basins, infiltration basins, and dry water quality swales. Use underdrains at extended dry detention basins to drain the small pools that form due to accumulation of silts. Wallace indicates that extended dry extended detention basins may breed more mosquitoes than wet basins. It is, therefore, imperative to design outlets from extended dry detention basins to completely dewater within the 72-hour period.
- ***Energy Dissipators and Flow Spreaders:*** Currier and Moeller, 2000 indicate that shallow recesses in energy dissipators and flow spreaders trap water where mosquitoes breed. Set the riprap in grout to reduce the shallow recesses and minimize mosquito breeding.
- ***Outlet control structures:*** Debris trapped in small orifices or on trash racks of outlet control structures such as multiple stage outlet risers may clog the orifices or the trash rack, causing a standing pool of water. Optimize the orifice size or trash rack mesh size to provide required peak rate attenuation/water quality detention/retention time while minimizing clogging.
- ***Rain Barrels and Cisterns:*** Seal lids to reduce the likelihood of mosquitoes laying eggs in standing water. Install mosquito netting over inlets. The cistern system should be designed to ensure that all collected water is drained into it within 72 hours.
- ***Subsurface Structures, Deep Sump Catch Basins, Oil Grit Separators, and Leaching Catch Basins:*** Seal all manhole covers to reduce likelihood of mosquitoes laying eggs in standing water. Install mosquito netting over the outlet (CALTRANS 2004).

The Operation and Maintenance Plan should provide for mosquito prevention and control.

- ***Check dams:*** Inspect permanent check dams on the schedule set forth in the O&M Plan. Inspect check dams 72 hours after storms for standing water ponding behind the dam. Take corrective action if standing water is found.
- ***Cisterns:*** Apply *Bs* larvicide in the cistern if any evidence of mosquitoes is found. The Operation and Maintenance Plan shall specify how often larvicides should be applied to waters in the cistern.
- ***Water quality swales:*** Remove and properly dispose of any accumulated sediment as scheduled in the Operation and Maintenance Plan.
- ***Larvicide Treatment:*** The Operation and Maintenance Plan must include measures to minimize mosquito breeding, including larviciding.
- The party identified in the Operation and Maintenance Plan as responsible for maintenance shall see that larvicides are applied as necessary to the following stormwater treatment practices: catch basins, oil/grit separators, wet basins, wet water quality swales, dry extended detention basins, infiltration basins, and constructed stormwater wetlands. The Operation and Maintenance Plan must ensure that all larvicides are applied by a licensed pesticide applicator and in compliance with all pesticide label requirements.
- The Operation and Maintenance Plan should identify the appropriate larvicide and the time and method of application. For example, *Bacillus sphaericus (Bs*), the preferred

larvicide for stormwater BMPs, should be hand-broadcast.[2] Alternatively, Altosid, a Methopren product, may be used. Because some practices are designed to dewater between storms, such as dry extended detention and infiltration basins, the Operation and Maintenance Plan should provide that larviciding must be conducted during or immediately after wet weather, when the detention or infiltration basin has a standing pool of water, unless a product is used that can withstand extended dry periods.

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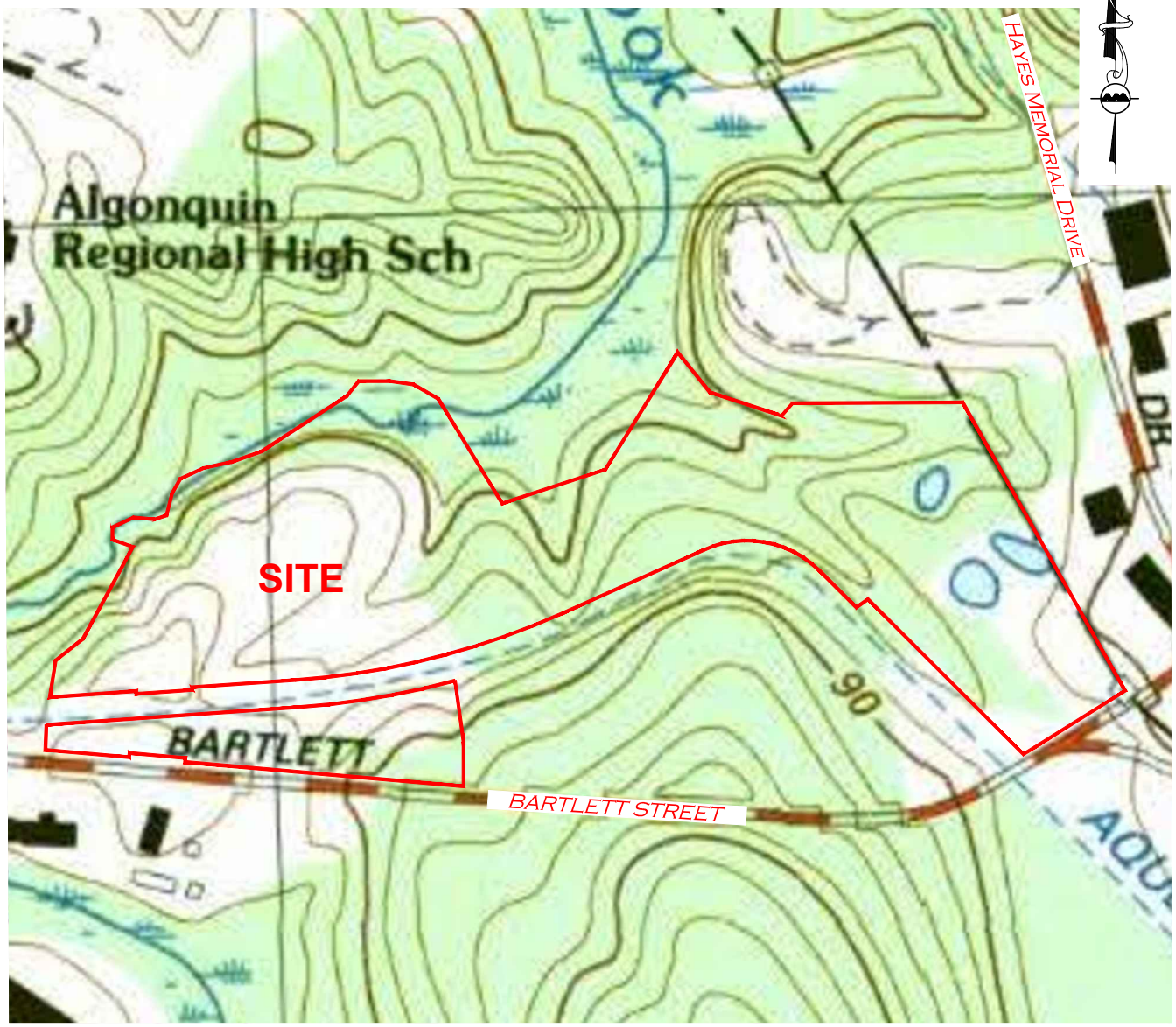
[2] *Bacillus thuringienis israelensis* or *Bti* is usually applied by helicopter to wetlands and floodplains

SECTION 3.0

EXHIBITS



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PROJECT:
PARCEL H DEVELOPMENT

NORTHBOROUGH, MA

USGS SITE LOCUS MAP

PROJECT NO.	1145-09	DATE:	12/24/2019
SCALE:	NTS	DWG. NAME:	C-1145-09
DESIGNED BY:	DMR	CHECKED BY:	WAK

SHEET No.
USGS-1

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PROJECT:
PARCEL H DEVELOPMENT

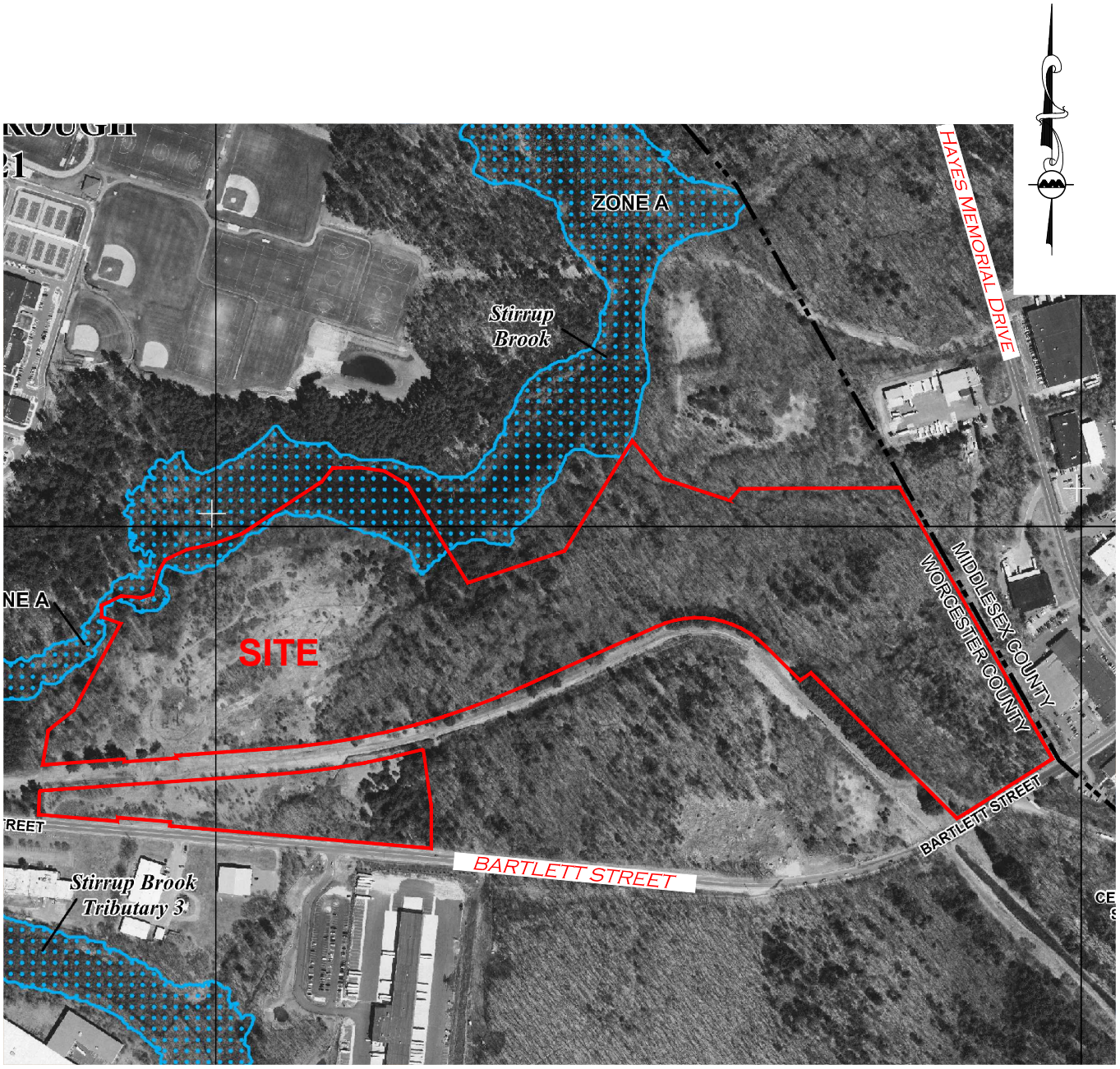
NORTHBOROUGH, MA

AERIAL PHOTO

PROJECT NO.	1145-09	DATE:	12/24/2019
SCALE:	NTS	DWG. NAME:	C-1145-09
DESIGNED BY:	DMR	CHECKED BY:	WAK

SHEET No.

EX-2



FEMA FLOOD INSURANCE RATE MAP
NORTHBORO, MIDDLESEX COUNTY, MASSACHUSETTS
MAP NUMBER: 25027C0653F
JULY 16, 2014

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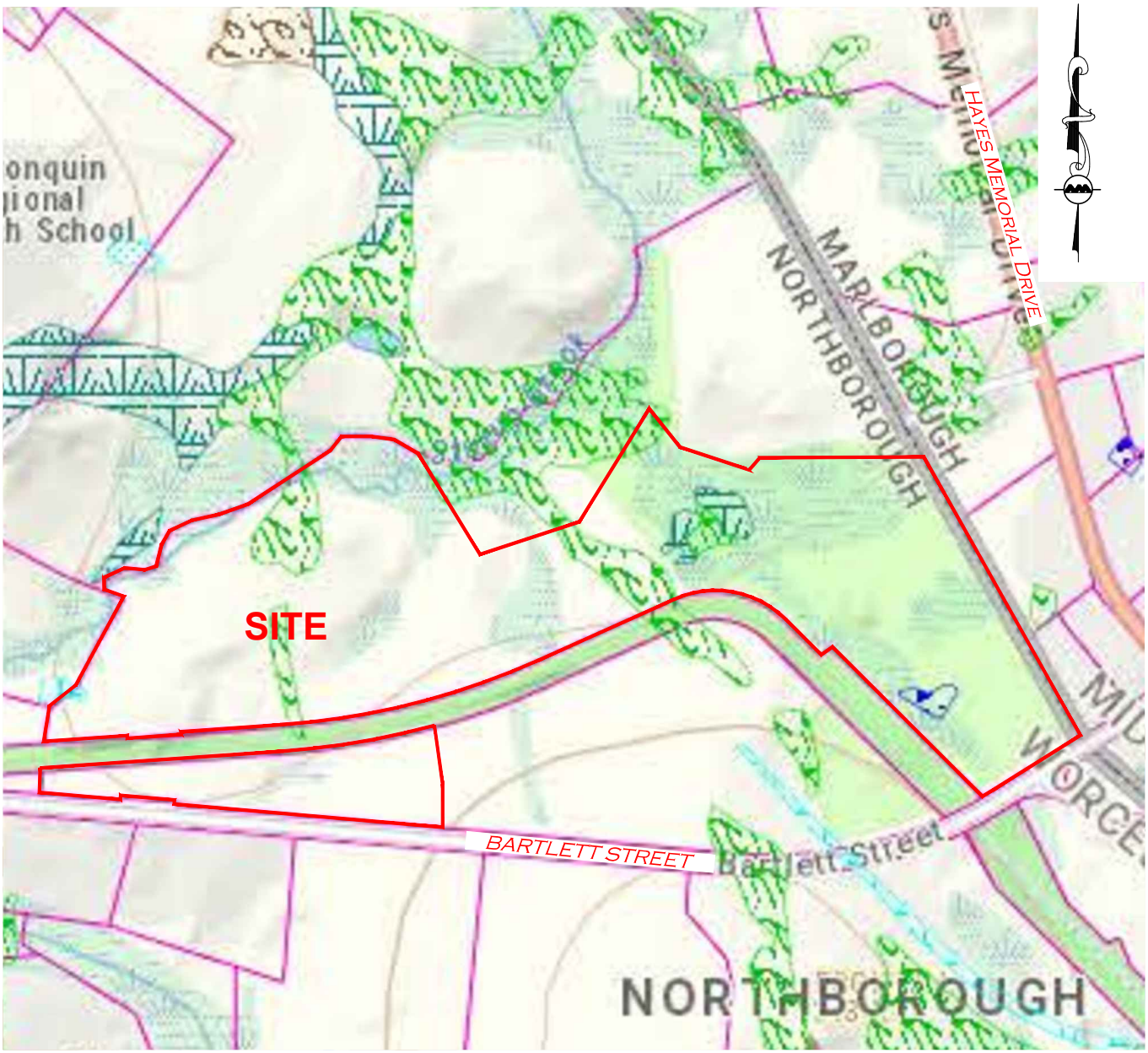
PROJECT:
PARCEL H DEVELOPMENT

NORTHBOROUGH, MA

FEMA FIRM MAP

PROJECT NO.	1145-09	DATE:	12/24/2019
SCALE:	NTS	DWG. NAME:	C-1145-09
DESIGNED BY:	DMR	CHECKED BY:	WAK

SHEET No.
EX-3A



WETLANDS LEGEND

- Salt Marsh
- Shallow Marsh Meadow or Fen
- Shrub Swamp
- Tidal Flat
- Wooded Swamp Coniferous
- Wooded Swamp Deciduous
- Wooded Swamp Mixed Trees

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PROJECT:
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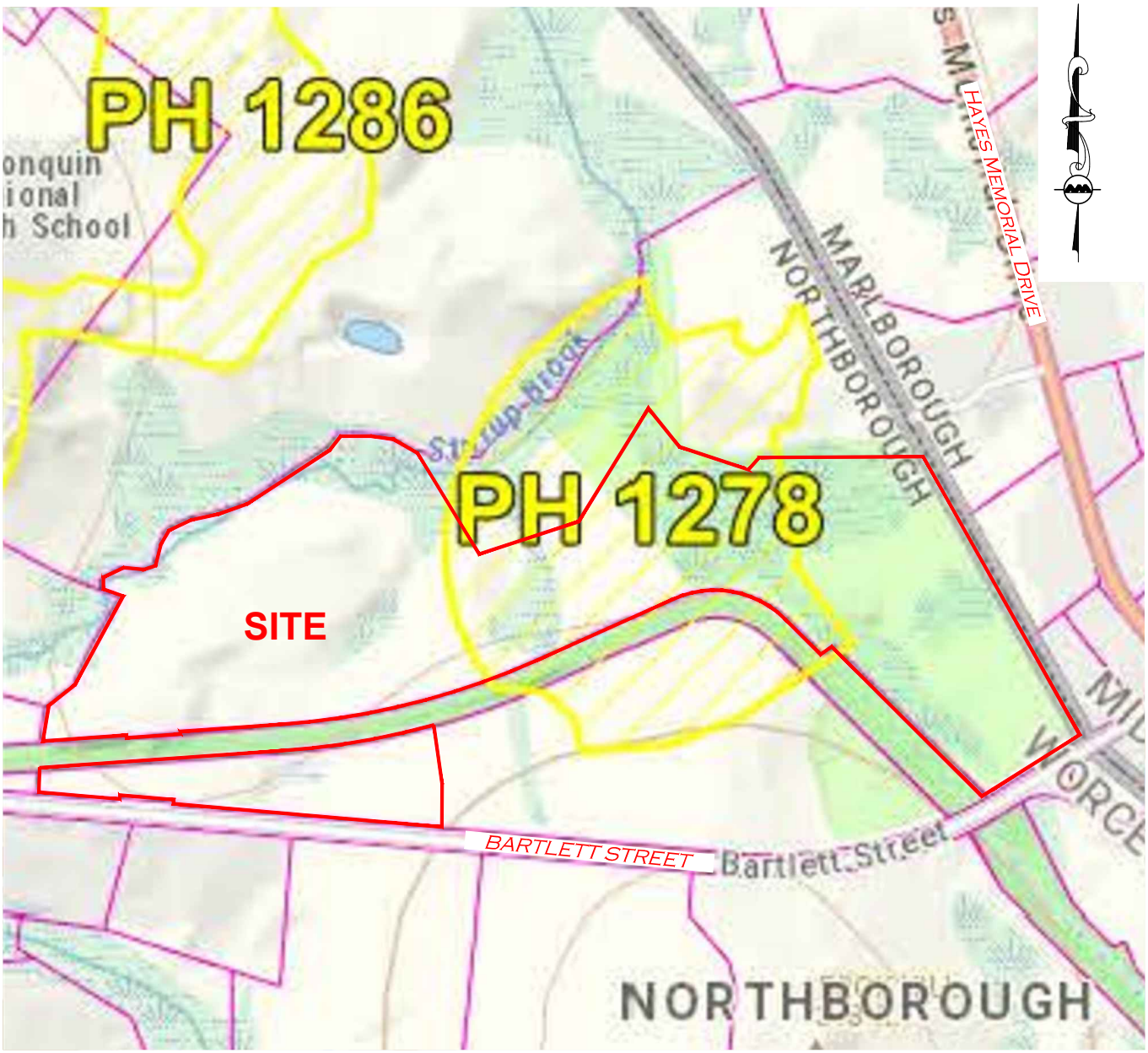
NORTHBOROUGH, MA

WETLANDS MAP

PROJECT NO.	1145-09	DATE:	12/24/2019
SCALE:	NTS	DWG. NAME:	C-1145-09
DESIGNED BY:	DMR	CHECKED BY:	WAK

SHEET No.
EX-4



NHESP ON-SITE:

PRIORITY HABITAT PH-1286
PRIORITY HABITAT PH-1278

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PROJECT:
PARCEL H DEVELOPMENT

NORTHBOROUGH, MA

NHESP MAP

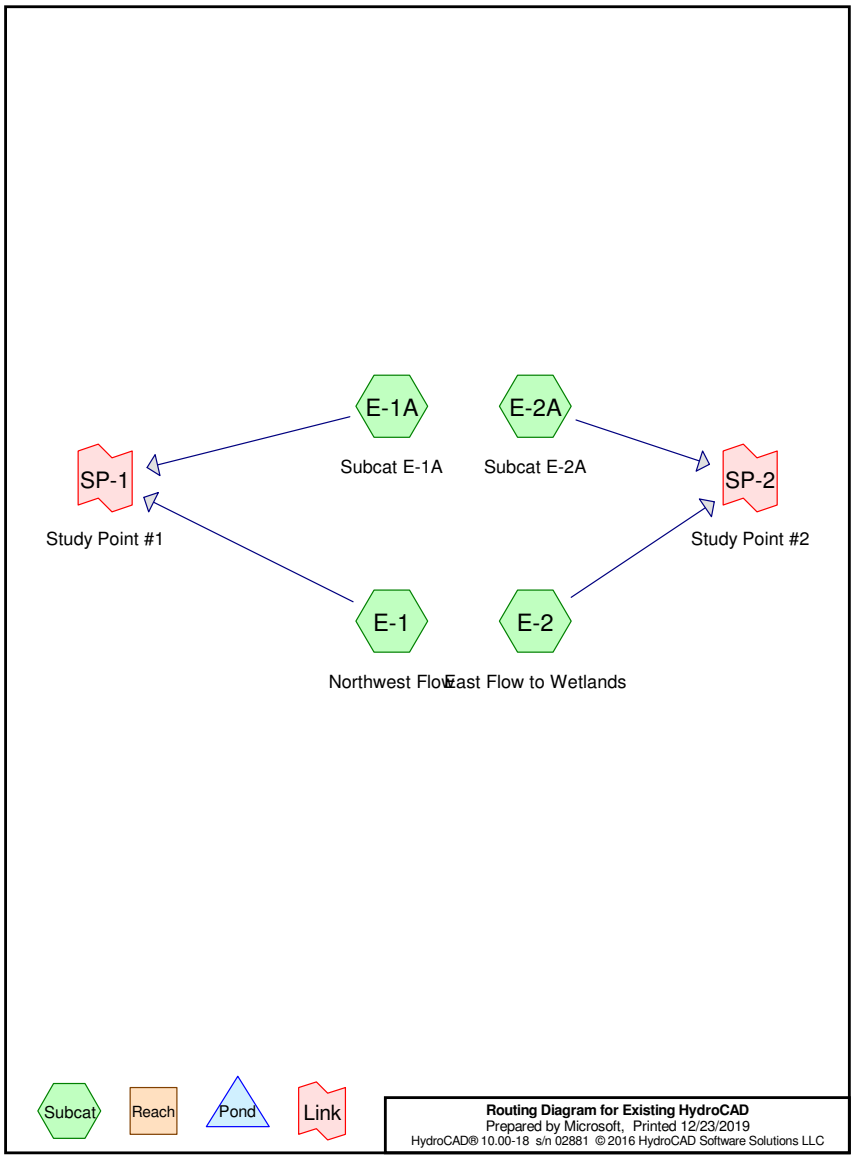
PROJECT NO.	1145-09	DATE:	12/24/2019
SCALE:	NTS	DWG. NAME:	C-1145-09
DESIGNED BY:	DMR	CHECKED BY:	WAK

SHEET No.
EX-5

SECTION 4.0

HYDROCAD

EXISTING HYDROCAD



Area Listing (all nodes)

Area (sq-ft)	CN	Description (subcatchment-numbers)
295,081	39	>75% Grass cover, Good, HSG A (E-1, E-2, E-2A)
36,047	61	>75% Grass cover, Good, HSG B (E-2A)
424	98	Paved parking, HSG A (E-2)
278,594	30	Woods, Good, HSG A (E-1, E-2, E-2A)
63,960	55	Woods, Good, HSG B (E-1A, E-2A)
674,106	**38**	**TOTAL AREA**

Soil Listing (all nodes)

Area (sq-ft)	Soil Group	Subcatchment Numbers
574,099	HSG A	E-1, E-2, E-2A
100,007	HSG B	E-1A, E-2A
0	HSG C	
0	HSG D	
0	Other	
674,106		**TOTAL AREA**

Ground Covers (all nodes)

HSG-A (sq-ft)	HSG-B (sq-ft)	HSG-C (sq-ft)	HSG-D (sq-ft)	Other (sq-ft)	Total (sq-ft)	Ground Cover	Subcatch Numbers
295,081	36,047	0	0	0	331,128	>75% Grass cover, Good	
424	0	0	0	0	424	Paved parking	
278,594	63,960	0	0	0	342,554	Woods, Good	
574,099	**100,007**	**0**	**0**	**0**	**674,106**	**TOTAL AREA**	

Summary for Subcatchment E-1: Northwest Flow

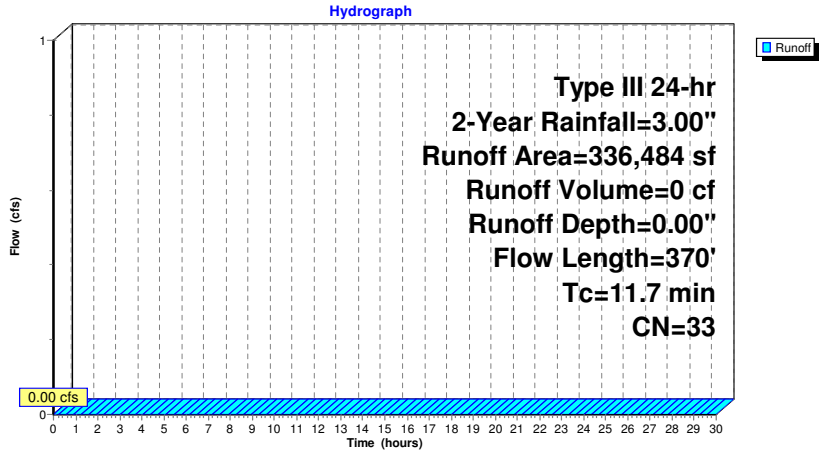
Runoff = 0.00 cfs @ 0.00 hrs, Volume= 0 cf, Depth= 0.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.00"

Area (sf)	CN	Description
127,387	39	>75% Grass cover, Good, HSG A
209,097	30	Woods, Good, HSG A
336,484	33	Weighted Average
336,484		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.6	50	0.0180	0.10		**Sheet Flow,** Grass: Dense n= 0.240 P2= 3.16"
1.2	104	0.0440	1.47		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
1.9	216	0.1390	1.86		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
11.7	370	Total			

Subcatchment E-1: Northwest Flow



Summary for Subcatchment E-1A: Subcat E-1A

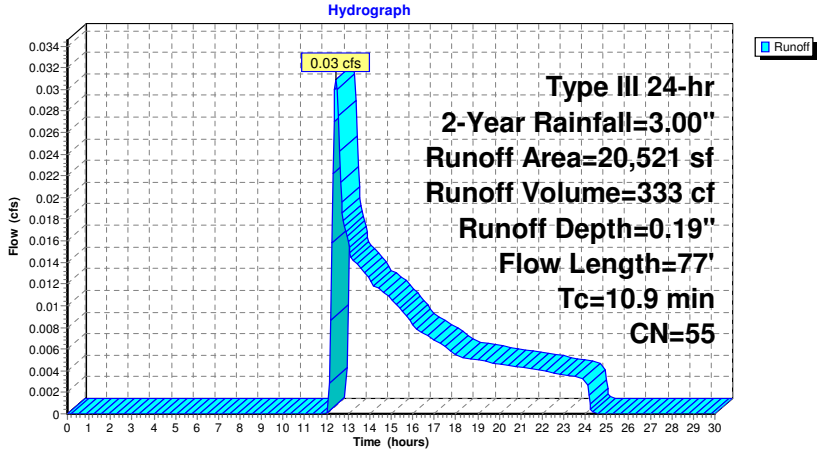
Runoff = 0.03 cfs @ 12.45 hrs, Volume= 333 cf, Depth= 0.19"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.00"

Area (sf)	CN	Description
20,521	55	Woods, Good, HSG B
20,521		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.6	50	0.1200	0.08		**Sheet Flow,** Woods: Dense underbrush n= 0.800 P2= 3.16"
0.3	27	0.1000	1.58		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
10.9	77	Total			

Subcatchment E-1A: Subcat E-1A



Summary for Subcatchment E-2: East Flow to Wetlands

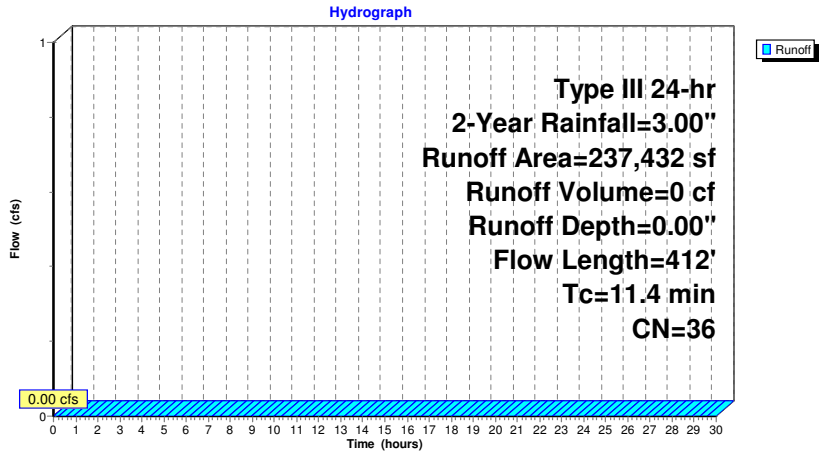
Runoff = 0.00 cfs @ 0.00 hrs, Volume= 0 cf, Depth= 0.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.00"

Area (sf)	CN	Description
167,587	39	>75% Grass cover, Good, HSG A
424	98	Paved parking, HSG A
69,421	30	Woods, Good, HSG A
237,432	36	Weighted Average
237,008		99.82% Pervious Area
424		0.18% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.8	50	0.0320	0.12		**Sheet Flow,** Grass: Dense n= 0.240 P2= 3.16"
4.0	314	0.0347	1.30		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.6	48	0.0833	1.44		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
11.4	412	Total			

Subcatchment E-2: East Flow to Wetlands



Summary for Subcatchment E-2A: Subcat E-2A

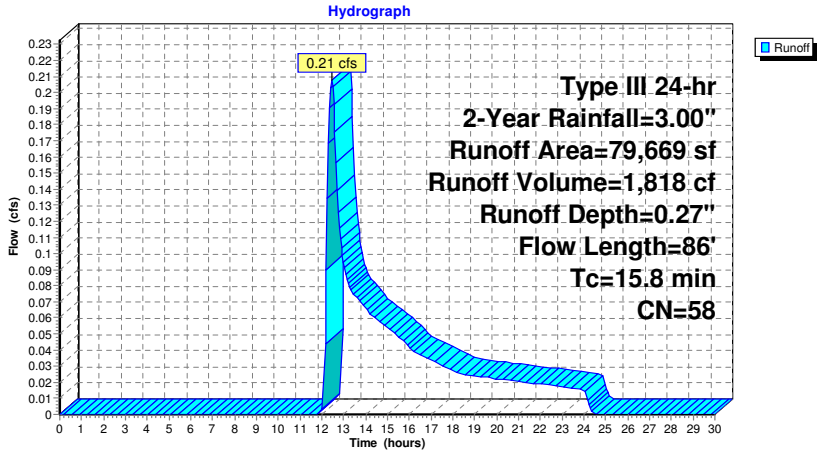
Runoff = 0.21 cfs @ 12.45 hrs, Volume= 1,818 cf, Depth= 0.27"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.00"

Area (sf)	CN	Description
108	39	>75% Grass cover, Good, HSG A
36,047	61	>75% Grass cover, Good, HSG B
75	30	Woods, Good, HSG A
43,439	55	Woods, Good, HSG B
79,669	58	Weighted Average
79,669		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
15.0	50	0.0500	0.06		**Sheet Flow,** Woods: Dense underbrush n= 0.800 P2= 3.16"
0.8	36	0.0200	0.71		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
15.8	86	Total			

Subcatchment E-2A: Subcat E-2A

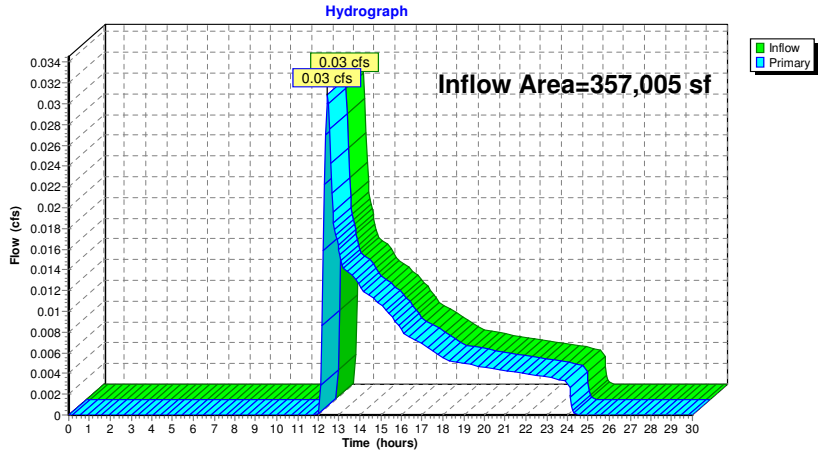


Summary for Link SP-1: Study Point #1

Inflow Area = 357,005 sf, 0.00% Impervious, Inflow Depth = 0.01" for 2-Year event
Inflow = 0.03 cfs @ 12.45 hrs, Volume= 333 cf
Primary = 0.03 cfs @ 12.45 hrs, Volume= 333 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs

Link SP-1: Study Point #1

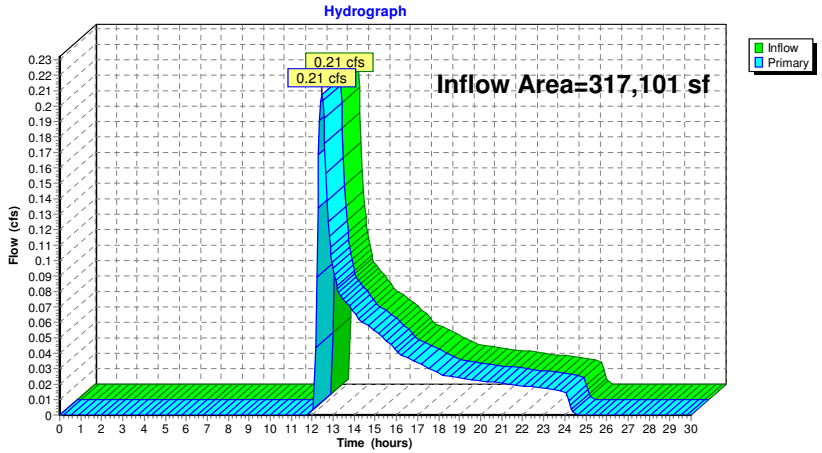


Summary for Link SP-2: Study Point #2

Inflow Area = 317,101 sf, 0.13% Impervious, Inflow Depth = 0.07" for 2-Year event
Inflow = 0.21 cfs @ 12.45 hrs, Volume= 1,818 cf
Primary = 0.21 cfs @ 12.45 hrs, Volume= 1,818 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs

Link SP-2: Study Point #2



Summary for Subcatchment E-1: Northwest Flow

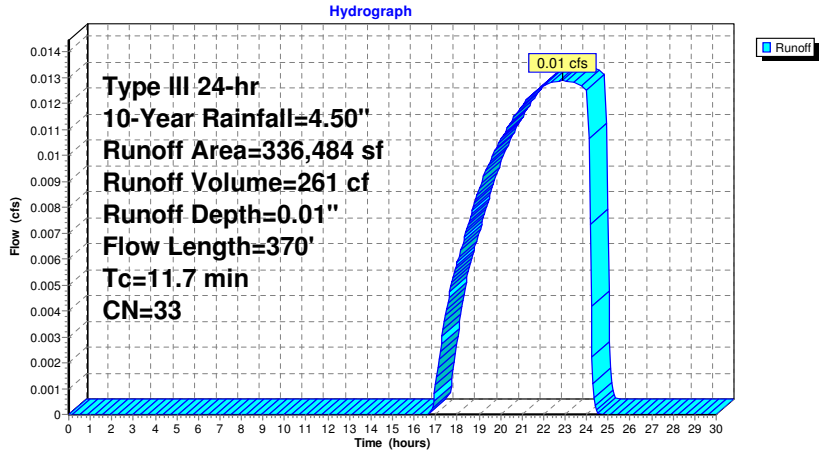
Runoff = 0.01 cfs @ 22.88 hrs, Volume= 261 cf, Depth= 0.01"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.50"

Area (sf)	CN	Description
127,387	39	>75% Grass cover, Good, HSG A
209,097	30	Woods, Good, HSG A
336,484	33	Weighted Average
336,484		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.6	50	0.0180	0.10		**Sheet Flow,** Grass: Dense n= 0.240 P2= 3.16"
1.2	104	0.0440	1.47		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
1.9	216	0.1390	1.86		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
11.7	370	Total			

Subcatchment E-1: Northwest Flow



Summary for Subcatchment E-1A: Subcat E-1A

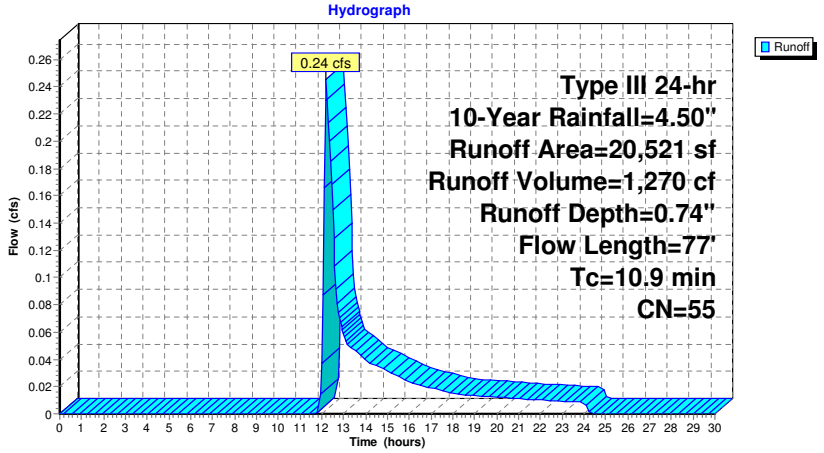
Runoff = 0.24 cfs @ 12.20 hrs, Volume= 1,270 cf, Depth= 0.74"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.50"

Area (sf)	CN	Description
20,521	55	Woods, Good, HSG B
20,521		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.6	50	0.1200	0.08		**Sheet Flow,** Woods: Dense underbrush n= 0.800 P2= 3.16"
0.3	27	0.1000	1.58		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
10.9	77	Total			

Subcatchment E-1A: Subcat E-1A



Summary for Subcatchment E-2: East Flow to Wetlands

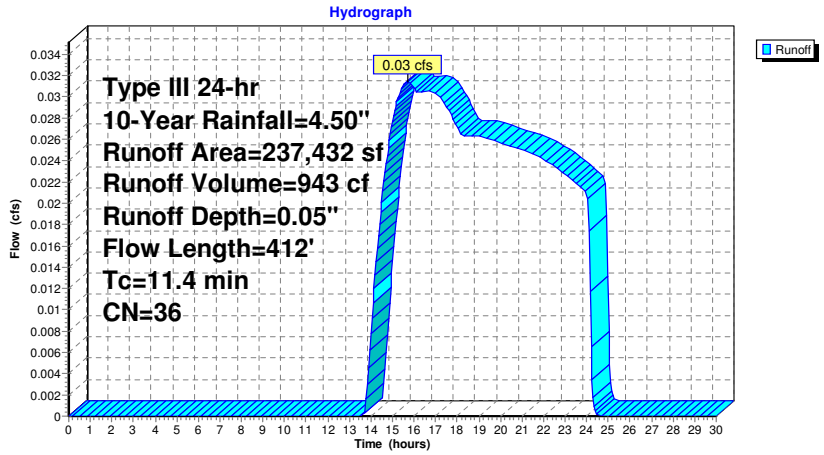
Runoff = 0.03 cfs @ 15.72 hrs, Volume= 943 cf, Depth= 0.05"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.50"

Area (sf)	CN	Description
167,587	39	>75% Grass cover, Good, HSG A
424	98	Paved parking, HSG A
69,421	30	Woods, Good, HSG A
237,432	36	Weighted Average
237,008		99.82% Pervious Area
424		0.18% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.8	50	0.0320	0.12		**Sheet Flow,** Grass: Dense n= 0.240 P2= 3.16"
4.0	314	0.0347	1.30		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.6	48	0.0833	1.44		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
11.4	412	Total			

Subcatchment E-2: East Flow to Wetlands



Summary for Subcatchment E-2A: Subcat E-2A

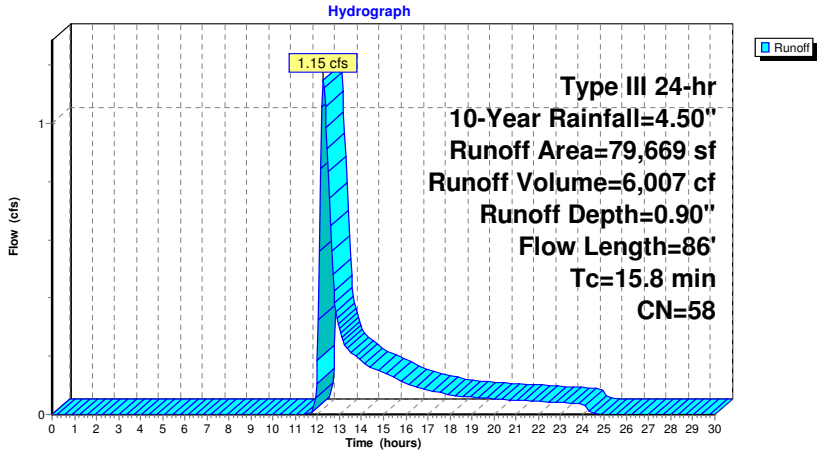
Runoff = 1.15 cfs @ 12.27 hrs, Volume= 6,007 cf, Depth= 0.90"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.50"

Area (sf)	CN	Description
108	39	>75% Grass cover, Good, HSG A
36,047	61	>75% Grass cover, Good, HSG B
75	30	Woods, Good, HSG A
43,439	55	Woods, Good, HSG B
79,669	58	Weighted Average
79,669		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
15.0	50	0.0500	0.06		**Sheet Flow,** Woods: Dense underbrush n= 0.800 P2= 3.16"
0.8	36	0.0200	0.71		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
15.8	86	Total			

Subcatchment E-2A: Subcat E-2A

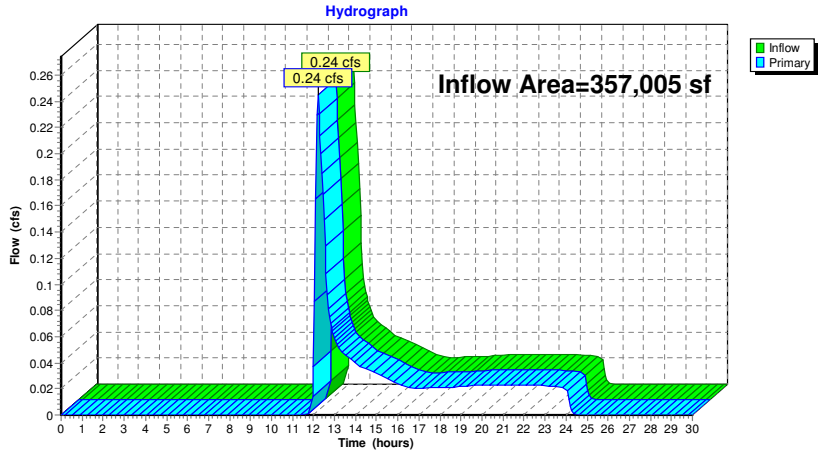


Summary for Link SP-1: Study Point #1

Inflow Area = 357,005 sf, 0.00% Impervious, Inflow Depth = 0.05" for 10-Year event
Inflow = 0.24 cfs @ 12.20 hrs, Volume= 1,531 cf
Primary = 0.24 cfs @ 12.20 hrs, Volume= 1,531 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs

Link SP-1: Study Point #1

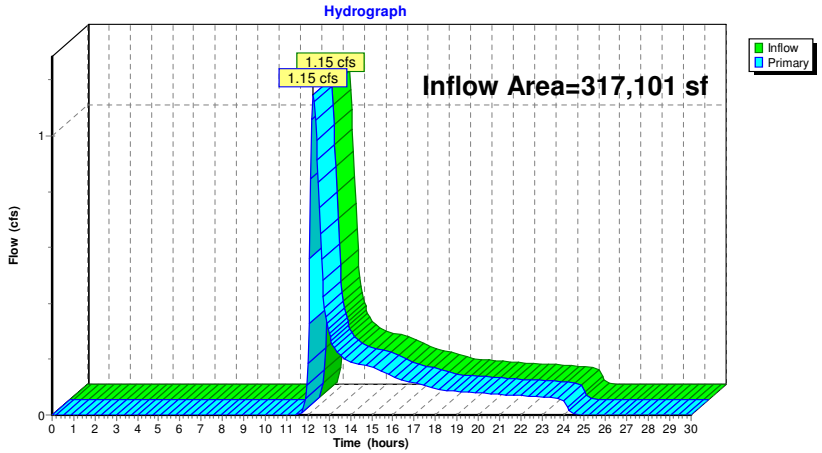


Summary for Link SP-2: Study Point #2

Inflow Area = 317,101 sf, 0.13% Impervious, Inflow Depth = 0.26" for 10-Year event
Inflow = 1.15 cfs @ 12.27 hrs, Volume= 6,950 cf
Primary = 1.15 cfs @ 12.27 hrs, Volume= 6,950 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs

Link SP-2: Study Point #2



Summary for Subcatchment E-1: Northwest Flow

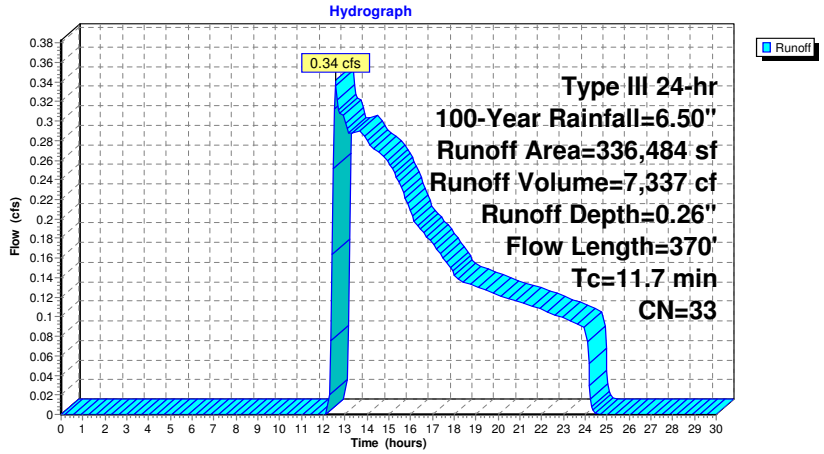
Runoff = 0.34 cfs @ 12.57 hrs, Volume= 7,337 cf, Depth= 0.26"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=6.50"

Area (sf)	CN	Description
127,387	39	>75% Grass cover, Good, HSG A
209,097	30	Woods, Good, HSG A
336,484	33	Weighted Average
336,484		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.6	50	0.0180	0.10		**Sheet Flow,** Grass: Dense n= 0.240 P2= 3.16"
1.2	104	0.0440	1.47		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
1.9	216	0.1390	1.86		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
11.7	370	Total			

Subcatchment E-1: Northwest Flow



Summary for Subcatchment E-1A: Subcat E-1A

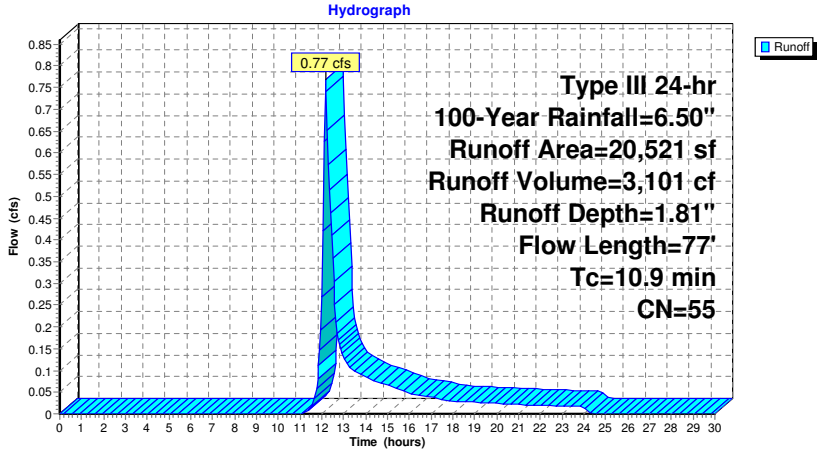
Runoff = 0.77 cfs @ 12.17 hrs, Volume= 3,101 cf, Depth= 1.81"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=6.50"

Area (sf)	CN	Description
20,521	55	Woods, Good, HSG B
20,521		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.6	50	0.1200	0.08		**Sheet Flow,** Woods: Dense underbrush n= 0.800 P2= 3.16"
0.3	27	0.1000	1.58		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
10.9	77	Total			

Subcatchment E-1A: Subcat E-1A



Summary for Subcatchment E-2: East Flow to Wetlands

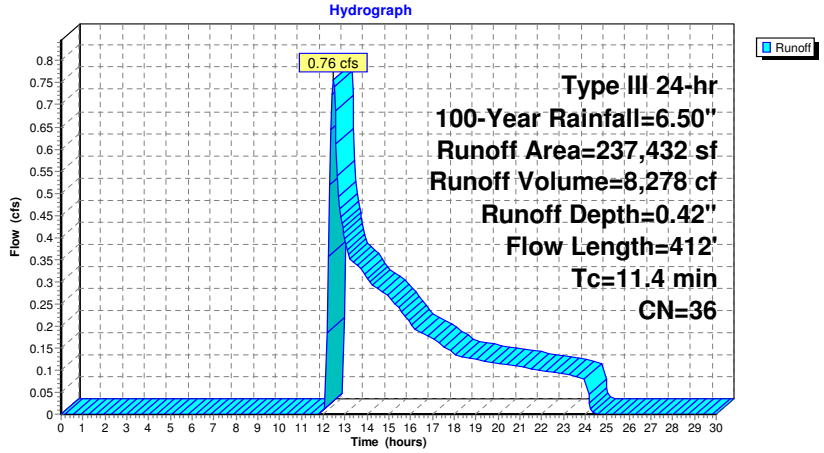
Runoff = 0.76 cfs @ 12.46 hrs, Volume= 8,278 cf, Depth= 0.42"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=6.50"

Area (sf)	CN	Description
167,587	39	>75% Grass cover, Good, HSG A
424	98	Paved parking, HSG A
69,421	30	Woods, Good, HSG A
237,432	36	Weighted Average
237,008		99.82% Pervious Area
424		0.18% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.8	50	0.0320	0.12		**Sheet Flow,** Grass: Dense n= 0.240 P2= 3.16"
4.0	314	0.0347	1.30		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.6	48	0.0833	1.44		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
11.4	412	Total			

Subcatchment E-2: East Flow to Wetlands



Summary for Subcatchment E-2A: Subcat E-2A

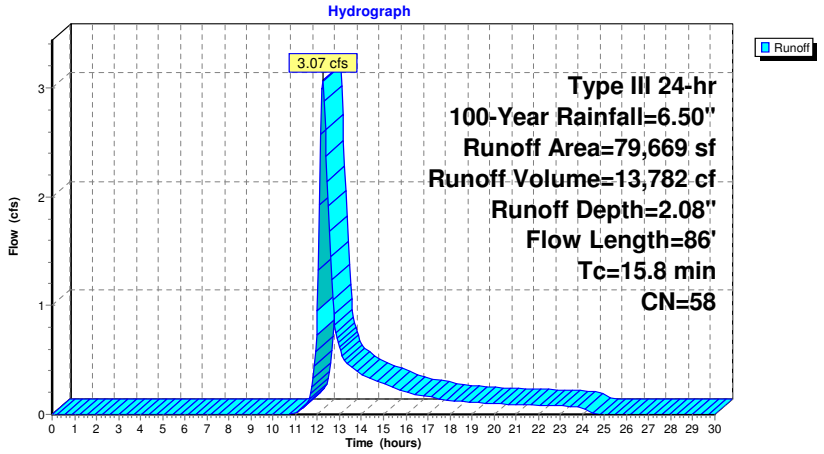
Runoff = 3.07 cfs @ 12.24 hrs, Volume= 13,782 cf, Depth= 2.08"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=6.50"

Area (sf)	CN	Description
108	39	>75% Grass cover, Good, HSG A
36,047	61	>75% Grass cover, Good, HSG B
75	30	Woods, Good, HSG A
43,439	55	Woods, Good, HSG B
79,669	58	Weighted Average
79,669		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
15.0	50	0.0500	0.06		**Sheet Flow,** Woods: Dense underbrush n= 0.800 P2= 3.16"
0.8	36	0.0200	0.71		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
15.8	86	Total			

Subcatchment E-2A: Subcat E-2A

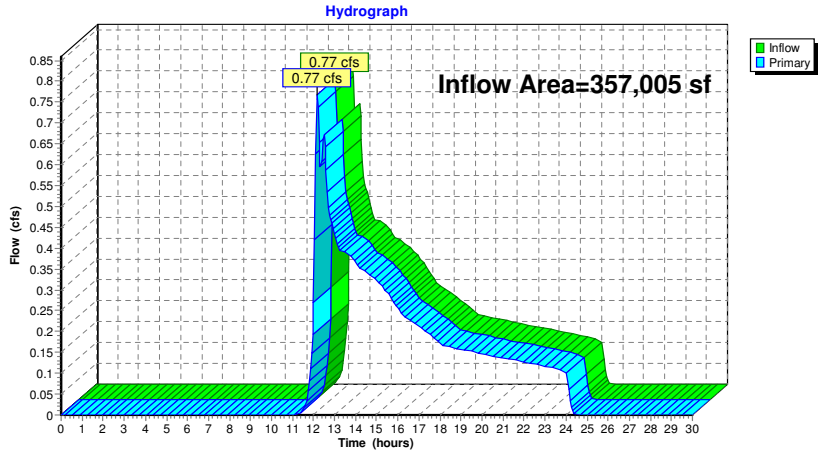


Summary for Link SP-1: Study Point #1

Inflow Area = 357,005 sf, 0.00% Impervious, Inflow Depth = 0.35" for 100-Year event
Inflow = 0.77 cfs @ 12.17 hrs, Volume= 10,438 cf
Primary = 0.77 cfs @ 12.17 hrs, Volume= 10,438 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs

Link SP-1: Study Point #1

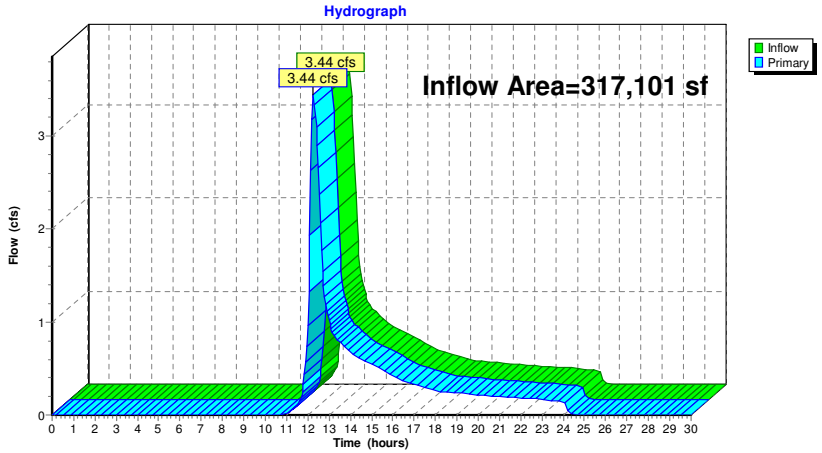


Summary for Link SP-2: Study Point #2

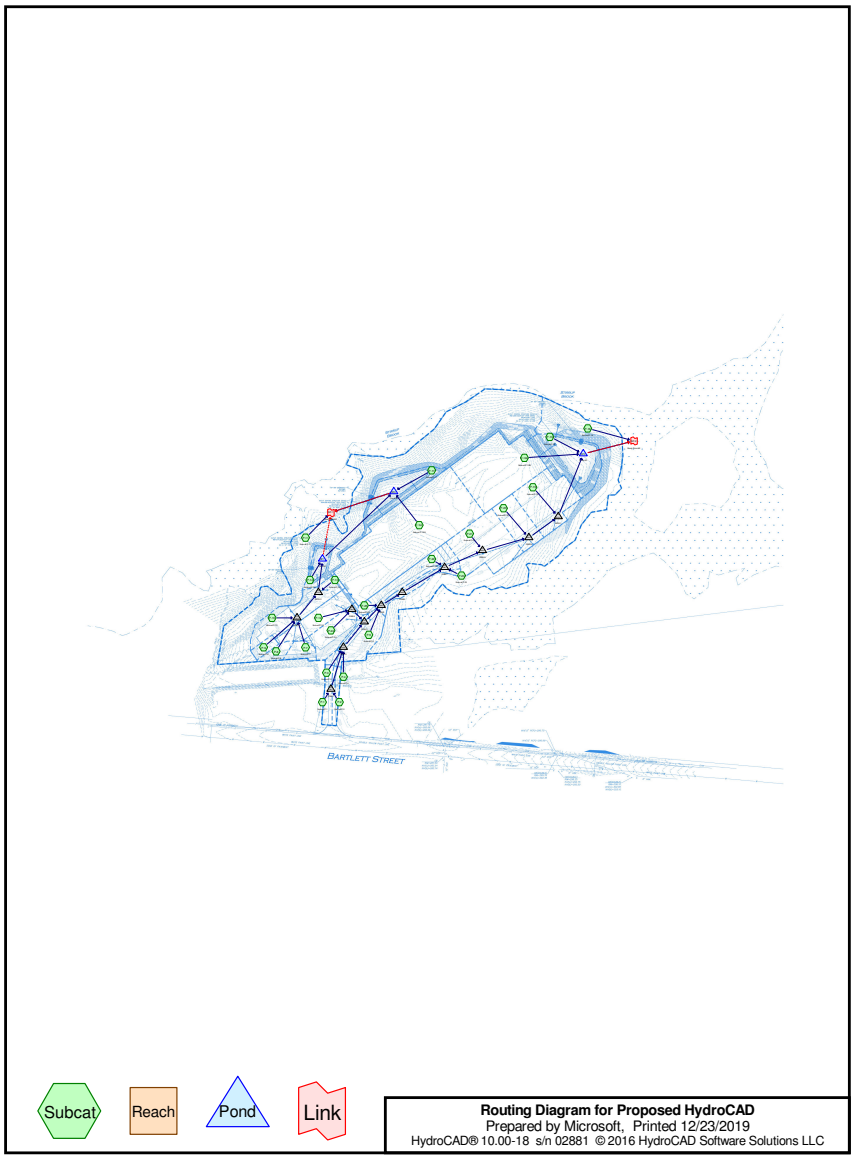
Inflow Area = 317,101 sf, 0.13% Impervious, Inflow Depth = 0.83" for 100-Year event
Inflow = 3.44 cfs @ 12.27 hrs, Volume= 22,060 cf
Primary = 3.44 cfs @ 12.27 hrs, Volume= 22,060 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs

Link SP-2: Study Point #2



PROPOSED HYDROCAD



Area Listing (all nodes)

Area (sq-ft)	CN	Description (subcatchment-numbers)
171,274	39	>75% Grass cover, Good, HSG A (P-1, P-10, P-11, P-12, P-13, P-14, P-16, P-17, P-18, P-2, P-22, P-23, P-24, P-25, P-3, P-4, P-5, P-7, P-8, P-9)
46,745	61	>75% Grass cover, Good, HSG B (P-16, P-18, P-23, P-5)
152,817	98	Paved parking, HSG A (P-1, P-10, P-12, P-13, P-14, P-16, P-19, P-2, P-20, P-21, P-22, P-23, P-24, P-25, P-3, P-4, P-5, P-7, P-8, P-9)
1,030	98	Paved parking, HSG B (P-16, P-19)
150,902	98	Roofs, HSG A (P-15A, P-15B)
99,106	30	Woods, Good, HSG A (P-11, P-18, P-5)
52,232	55	Woods, Good, HSG B (P-11, P-18)
674,106	**67**	**TOTAL AREA**

Soil Listing (all nodes)

Area (sq-ft)	Soil Group	Subcatchment Numbers
574,099	HSG A	P-1, P-10, P-11, P-12, P-13, P-14, P-15A, P-15B, P-16, P-17, P-18, P-19, P-2, P-20, P-21, P-22, P-23, P-24, P-25, P-3, P-4, P-5, P-7, P-8, P-9
100,007	HSG B	P-11, P-16, P-18, P-19, P-23, P-5
0	HSG C	
0	HSG D	
0	Other	
674,106		**TOTAL AREA**

Ground Covers (all nodes)

HSG-A (sq-ft)	HSG-B (sq-ft)	HSG-C (sq-ft)	HSG-D (sq-ft)	Other (sq-ft)	Total (sq-ft)	Ground Cover	Subcatch Numbers
171,274	46,745	0	0	0	218,019	>75% Grass cover, Good	
152,817	1,030	0	0	0	153,848	Paved parking	
150,902	0	0	0	0	150,902	Roofs	
99,106	52,232	0	0	0	151,337	Woods, Good	
574,099	**100,007**	**0**	**0**	**0**	**674,106**	**TOTAL AREA**	

Summary for Subcatchment P-1: Subcat P-1

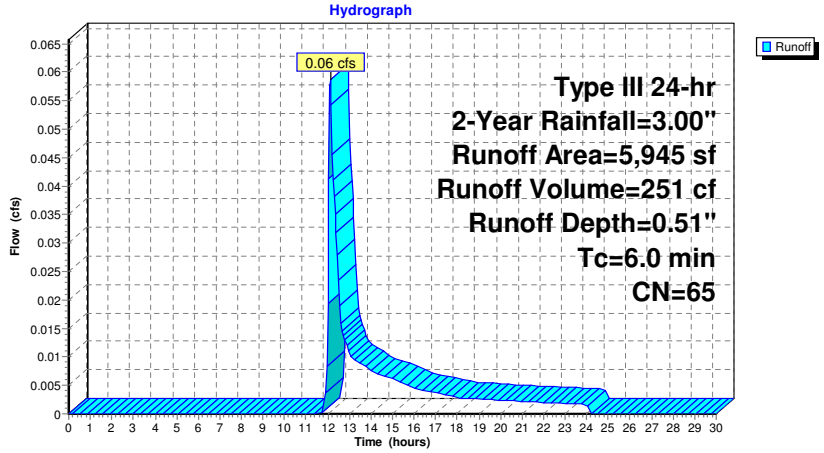
Runoff = 0.06 cfs @ 12.12 hrs, Volume= 251 cf, Depth= 0.51"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.00"

Area (sf)	CN	Description
3,307	39	>75% Grass cover, Good, HSG A
2,637	98	Paved parking, HSG A
5,945	65	Weighted Average
3,307		55.63% Pervious Area
2,637		44.37% Impervious Area

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

Subcatchment P-1: Subcat P-1



Summary for Subcatchment P-10: Subcat P-10

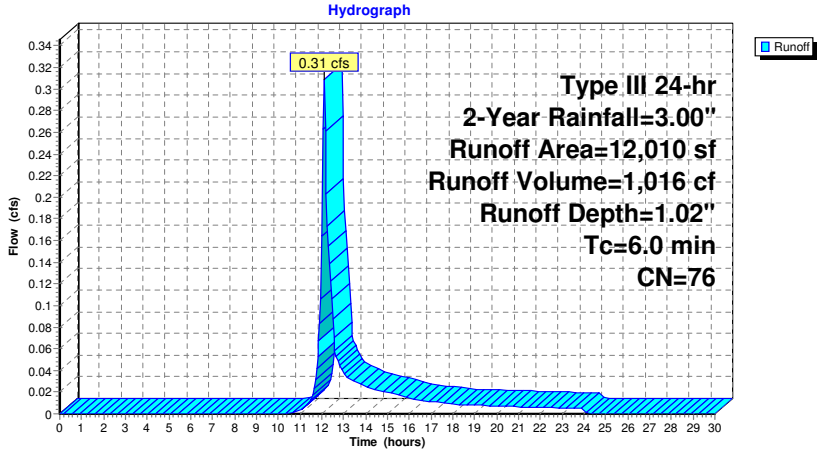
Runoff = 0.31 cfs @ 12.10 hrs, Volume= 1,016 cf, Depth= 1.02"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.00"

Area (sf)	CN	Description
4,394	39	>75% Grass cover, Good, HSG A
7,616	98	Paved parking, HSG A
12,010	76	Weighted Average
4,394		36.58% Pervious Area
7,616		63.42% Impervious Area

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

Subcatchment P-10: Subcat P-10



Summary for Subcatchment P-11: Subcat P-11

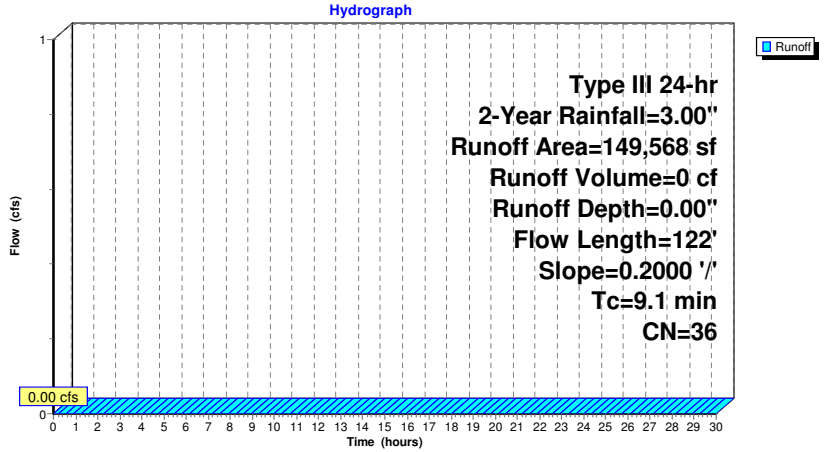
Runoff = 0.00 cfs @ 0.00 hrs, Volume= 0 cf, Depth= 0.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.00"

Area (sf)	CN	Description
35,319	39	>75% Grass cover, Good, HSG A
93,727	30	Woods, Good, HSG A
20,521	55	Woods, Good, HSG B
149,568	36	Weighted Average
149,568		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.6	50	0.2000	0.10		**Sheet Flow,** Woods: Dense underbrush n= 0.800 P2= 3.16"
0.5	72	0.2000	2.24		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
9.1	122	Total			

Subcatchment P-11: Subcat P-11



Summary for Subcatchment P-12: Subcat P-12

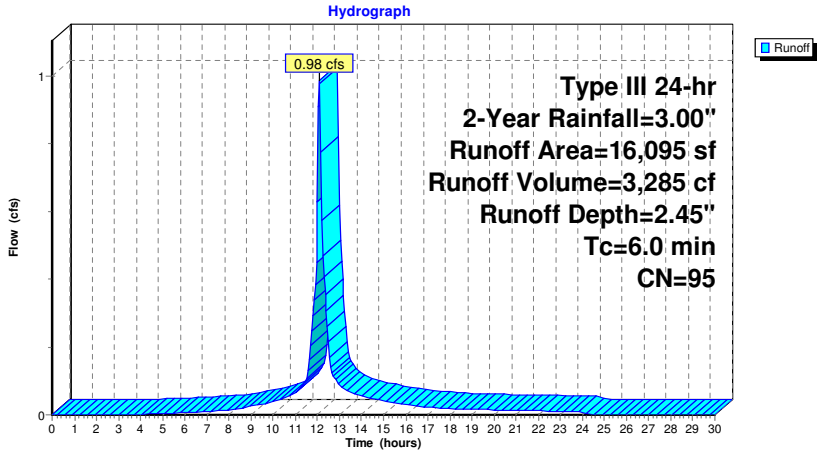
Runoff = 0.98 cfs @ 12.09 hrs, Volume= 3,285 cf, Depth= 2.45"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.00"

Area (sf)	CN	Description
949	39	>75% Grass cover, Good, HSG A
15,146	98	Paved parking, HSG A
16,095	95	Weighted Average
949		5.90% Pervious Area
15,146		94.10% Impervious Area

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

Subcatchment P-12: Subcat P-12



Summary for Subcatchment P-13: Subcat P-13

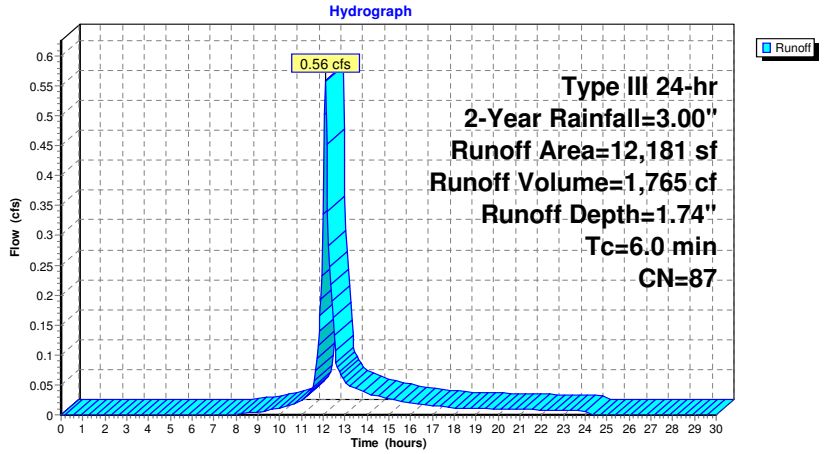
Runoff = 0.56 cfs @ 12.09 hrs, Volume= 1,765 cf, Depth= 1.74"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.00"

Area (sf)	CN	Description
2,356	39	>75% Grass cover, Good, HSG A
9,825	98	Paved parking, HSG A
12,181	87	Weighted Average
2,356		19.34% Pervious Area
9,825		80.66% Impervious Area

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

Subcatchment P-13: Subcat P-13



Summary for Subcatchment P-14: Subcat P-14

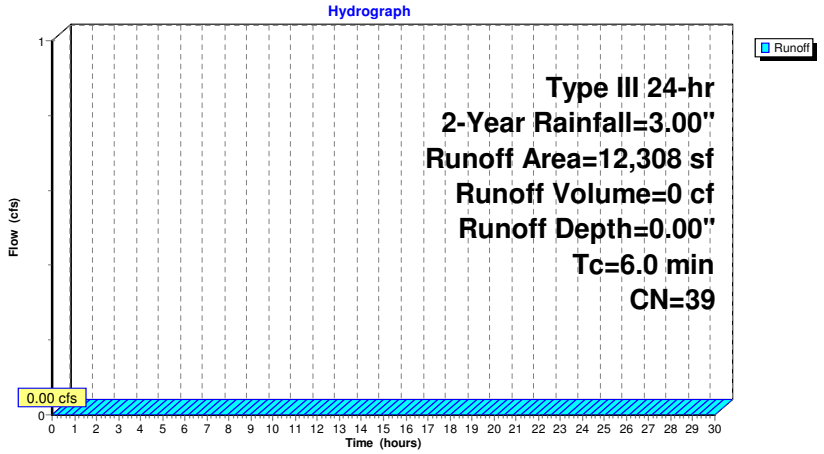
Runoff = 0.00 cfs @ 0.00 hrs, Volume= 0 cf, Depth= 0.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.00"

Area (sf)	CN	Description
12,257	39	>75% Grass cover, Good, HSG A
51	98	Paved parking, HSG A
12,308	39	Weighted Average
12,257		99.59% Pervious Area
51		0.41% Impervious Area

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

Subcatchment P-14: Subcat P-14



Summary for Subcatchment P-15A: Subcat P-15A

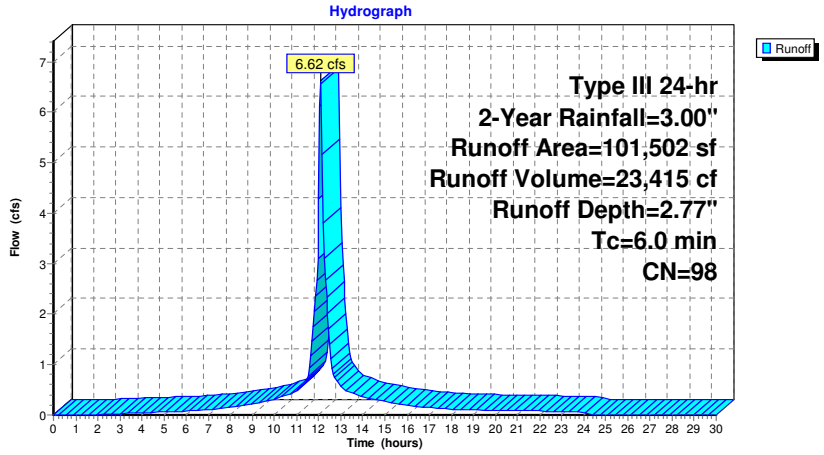
Runoff = 6.62 cfs @ 12.09 hrs, Volume= 23,415 cf, Depth= 2.77"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.00"

Area (sf)	CN	Description
101,502	98	Roofs, HSG A
101,502		100.00% Impervious Area

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

Subcatchment P-15A: Subcat P-15A



Summary for Subcatchment P-15B: Subcat P-15B

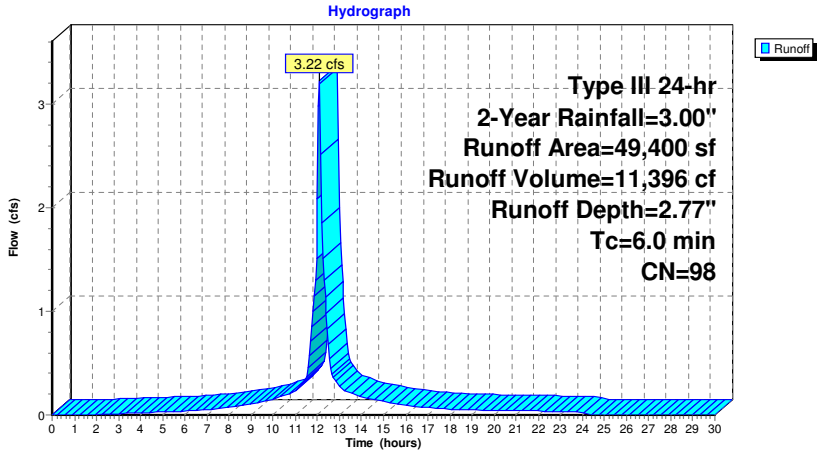
Runoff = 3.22 cfs @ 12.09 hrs, Volume= 11,396 cf, Depth= 2.77"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.00"

Area (sf)	CN	Description
49,400	98	Roofs, HSG A
49,400		100.00% Impervious Area

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

Subcatchment P-15B: Subcat P-15B



Summary for Subcatchment P-16: Subcat P-16

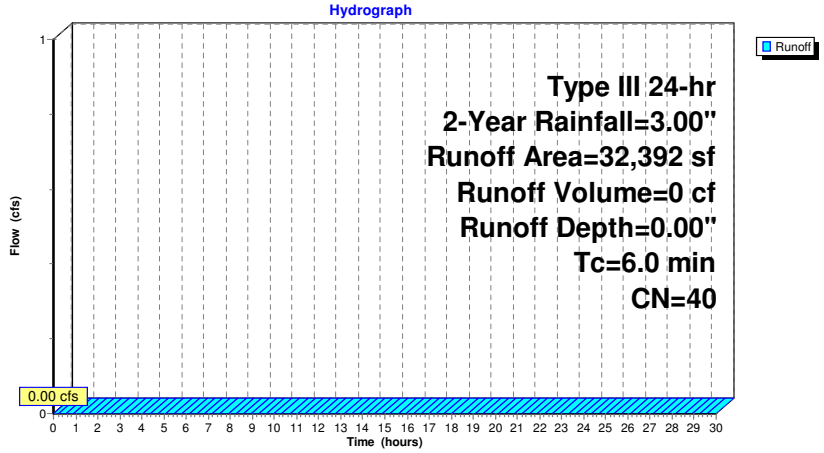
Runoff = 0.00 cfs @ 0.00 hrs, Volume= 0 cf, Depth= 0.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.00"

Area (sf)	CN	Description
31,821	39	>75% Grass cover, Good, HSG A
472	61	>75% Grass cover, Good, HSG B
99	98	Paved parking, HSG A
1	98	Paved parking, HSG B
32,392	40	Weighted Average
32,292		99.69% Pervious Area
100		0.31% Impervious Area

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

Subcatchment P-16: Subcat P-16



Summary for Subcatchment P-17: Subcat P-17

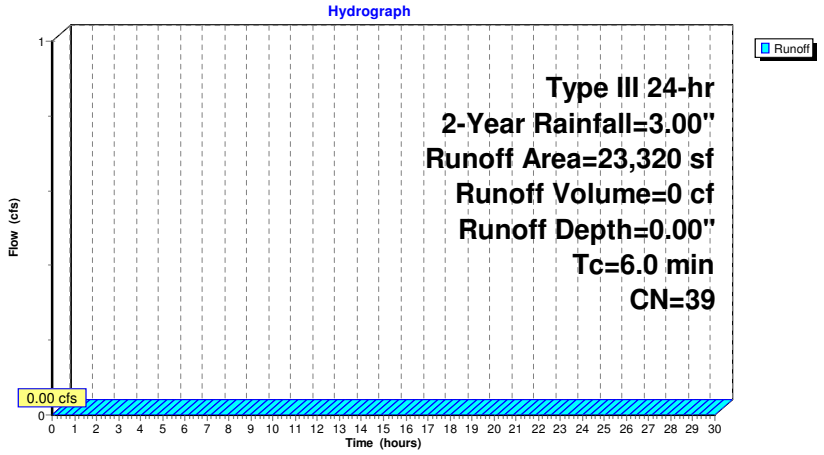
Runoff = 0.00 cfs @ 0.00 hrs, Volume= 0 cf, Depth= 0.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.00"

Area (sf)	CN	Description
23,320	39	>75% Grass cover, Good, HSG A
23,320		100.00% Pervious Area

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

Subcatchment P-17: Subcat P-17



Summary for Subcatchment P-18: Subcat P-18

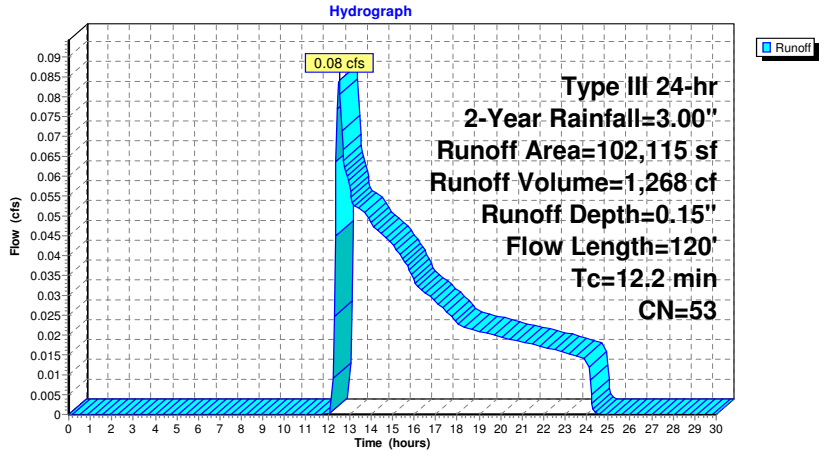
Runoff = 0.08 cfs @ 12.52 hrs, Volume= 1,268 cf, Depth= 0.15"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.00"

Area (sf)	CN	Description
23,317	39	>75% Grass cover, Good, HSG A
41,898	61	>75% Grass cover, Good, HSG B
5,189	30	Woods, Good, HSG A
31,710	55	Woods, Good, HSG B
102,115	53	Weighted Average
102,115		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.4	50	0.1000	0.07		**Sheet Flow,** Woods: Dense underbrush n= 0.800 P2= 3.16"
0.8	70	0.0800	1.41		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
12.2	120	Total			

Subcatchment P-18: Subcat P-18



Summary for Subcatchment P-19: Subcat P-19

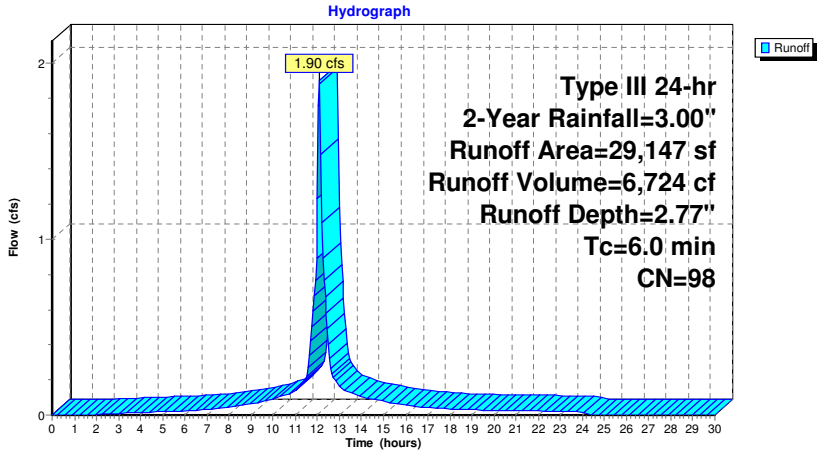
Runoff = 1.90 cfs @ 12.09 hrs, Volume= 6,724 cf, Depth= 2.77"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.00"

Area (sf)	CN	Description
28,117	98	Paved parking, HSG A
1,030	98	Paved parking, HSG B
29,147	98	Weighted Average
29,147		100.00% Impervious Area

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

Subcatchment P-19: Subcat P-19



Summary for Subcatchment P-2: Subcat P-2

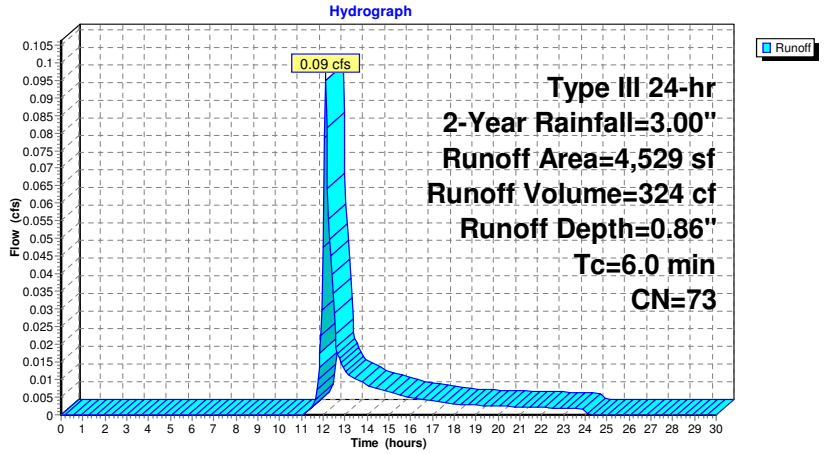
Runoff = 0.09 cfs @ 12.10 hrs, Volume= 324 cf, Depth= 0.86"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.00"

Area (sf)	CN	Description
1,914	39	>75% Grass cover, Good, HSG A
2,615	98	Paved parking, HSG A
4,529	73	Weighted Average
1,914		42.26% Pervious Area
2,615		57.74% Impervious Area

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

Subcatchment P-2: Subcat P-2



Summary for Subcatchment P-20: Subcat P-20

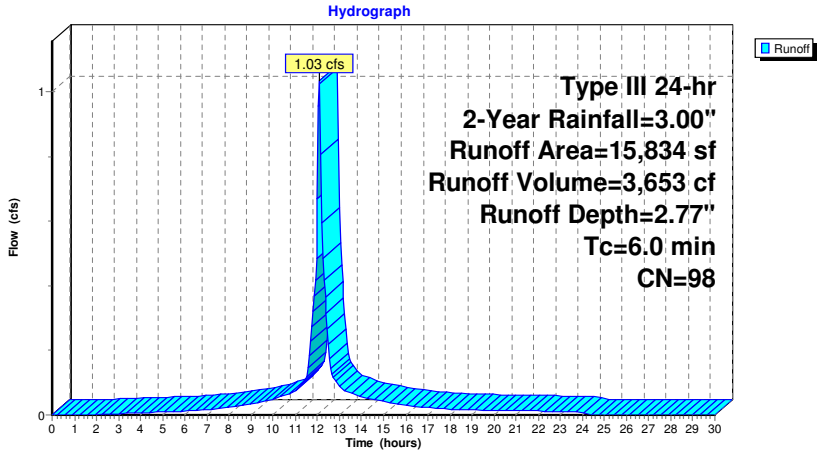
Runoff = 1.03 cfs @ 12.09 hrs, Volume= 3,653 cf, Depth= 2.77"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.00"

Area (sf)	CN	Description
15,834	98	Paved parking, HSG A
15,834		100.00% Impervious Area

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

Subcatchment P-20: Subcat P-20



Summary for Subcatchment P-21: Subcat P-21

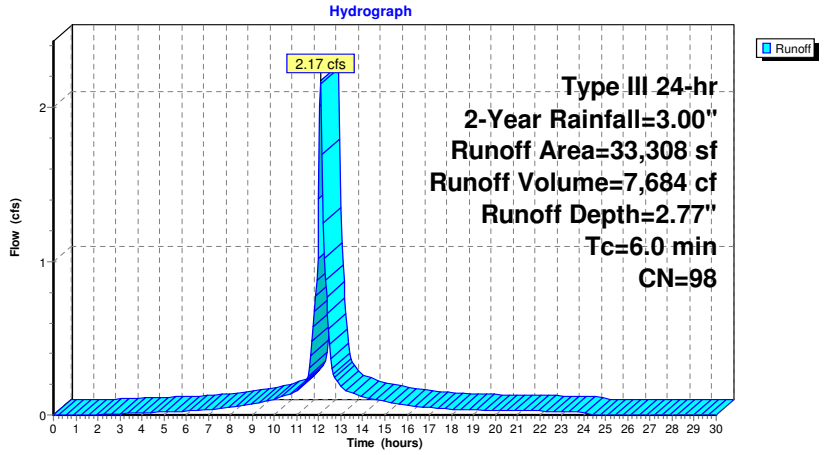
Runoff = 2.17 cfs @ 12.09 hrs, Volume= 7,684 cf, Depth= 2.77"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.00"

Area (sf)	CN	Description
33,308	98	Paved parking, HSG A
33,308		100.00% Impervious Area

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

Subcatchment P-21: Subcat P-21



Summary for Subcatchment P-22: Subcat P-22

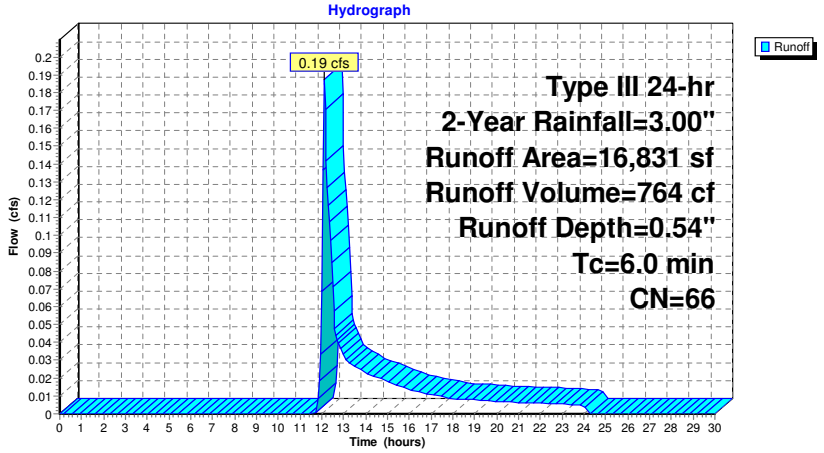
Runoff = 0.19 cfs @ 12.11 hrs, Volume= 764 cf, Depth= 0.54"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.00"

Area (sf)	CN	Description
9,035	39	>75% Grass cover, Good, HSG A
7,796	98	Paved parking, HSG A
16,831	66	Weighted Average
9,035		53.68% Pervious Area
7,796		46.32% Impervious Area

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

Subcatchment P-22: Subcat P-22



Summary for Subcatchment P-23: Subcat P-23

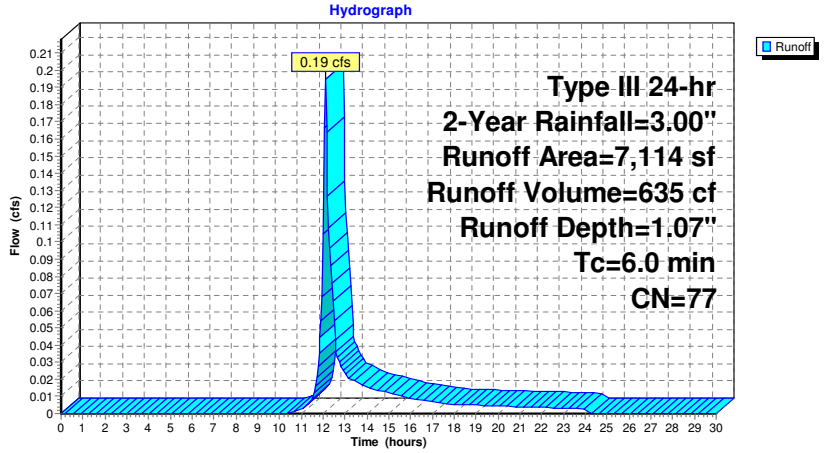
Runoff = 0.19 cfs @ 12.10 hrs, Volume= 635 cf, Depth= 1.07"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.00"

Area (sf)	CN	Description
2,239	39	>75% Grass cover, Good, HSG A
448	61	>75% Grass cover, Good, HSG B
4,427	98	Paved parking, HSG A
7,114	77	Weighted Average
2,687		37.77% Pervious Area
4,427		62.23% Impervious Area

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

Subcatchment P-23: Subcat P-23



Summary for Subcatchment P-24: Subcat P-24

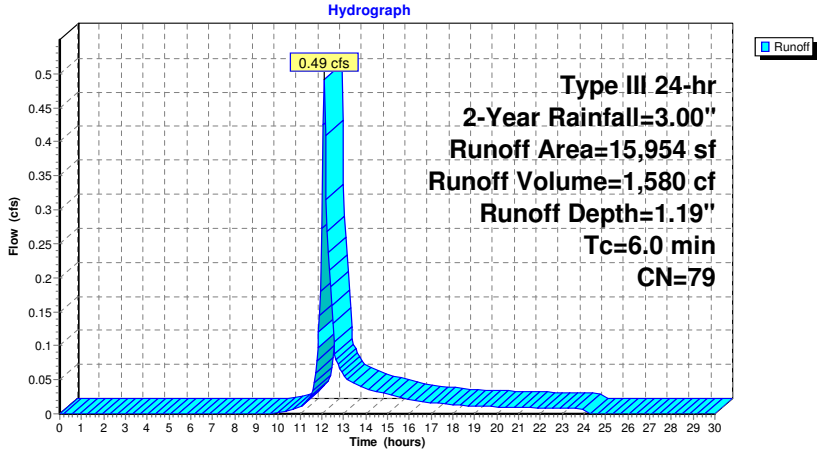
Runoff = 0.49 cfs @ 12.10 hrs, Volume= 1,580 cf, Depth= 1.19"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.00"

Area (sf)	CN	Description
5,144	39	>75% Grass cover, Good, HSG A
10,810	98	Paved parking, HSG A
15,954	79	Weighted Average
5,144		32.24% Pervious Area
10,810		67.76% Impervious Area

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

Subcatchment P-24: Subcat P-24



Summary for Subcatchment P-25: Subcat P-25

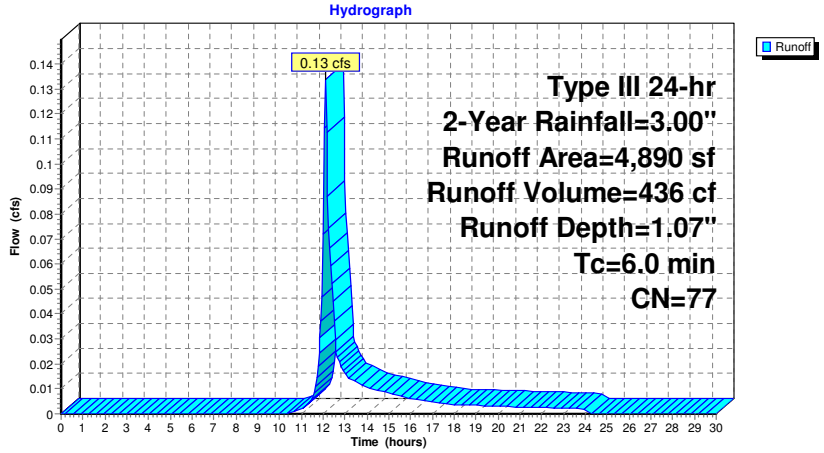
Runoff = 0.13 cfs @ 12.10 hrs, Volume= 436 cf, Depth= 1.07"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.00"

Area (sf)	CN	Description
1,767	39	>75% Grass cover, Good, HSG A
3,123	98	Paved parking, HSG A
4,890	77	Weighted Average
1,767		36.14% Pervious Area
3,123		63.86% Impervious Area

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

Subcatchment P-25: Subcat P-25



Summary for Subcatchment P-3: Subcat P-3

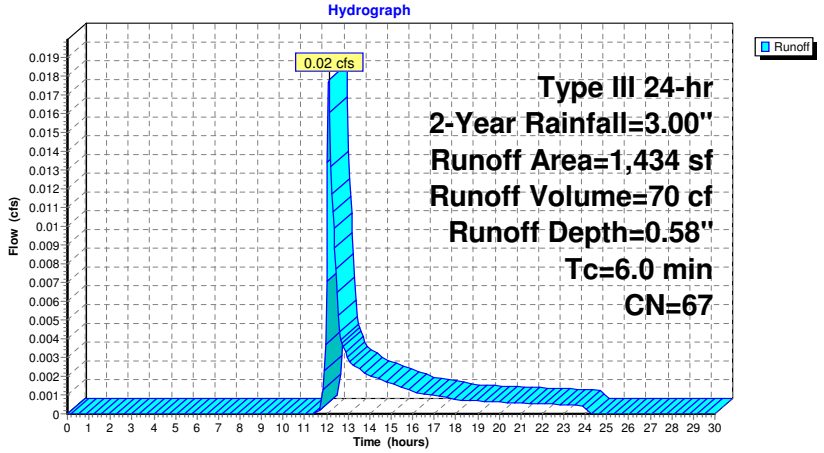
Runoff = 0.02 cfs @ 12.11 hrs, Volume= 70 cf, Depth= 0.58"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.00"

Area (sf)	CN	Description
742	39	>75% Grass cover, Good, HSG A
692	98	Paved parking, HSG A
1,434	67	Weighted Average
742		51.75% Pervious Area
692		48.25% Impervious Area

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

Subcatchment P-3: Subcat P-3



Summary for Subcatchment P-4: Subcat P-4

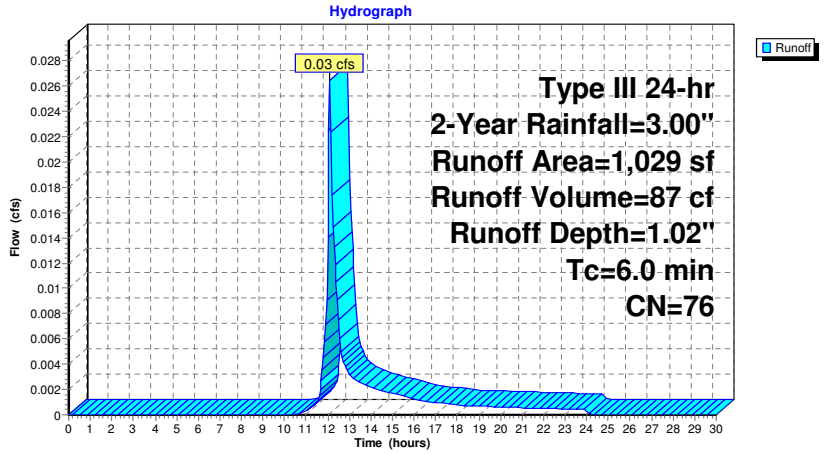
Runoff = 0.03 cfs @ 12.10 hrs, Volume= 87 cf, Depth= 1.02"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.00"

Area (sf)	CN	Description
377	39	>75% Grass cover, Good, HSG A
652	98	Paved parking, HSG A
1,029	76	Weighted Average
377		36.60% Pervious Area
652		63.40% Impervious Area

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

Subcatchment P-4: Subcat P-4



Summary for Subcatchment P-5: Subcat P-5

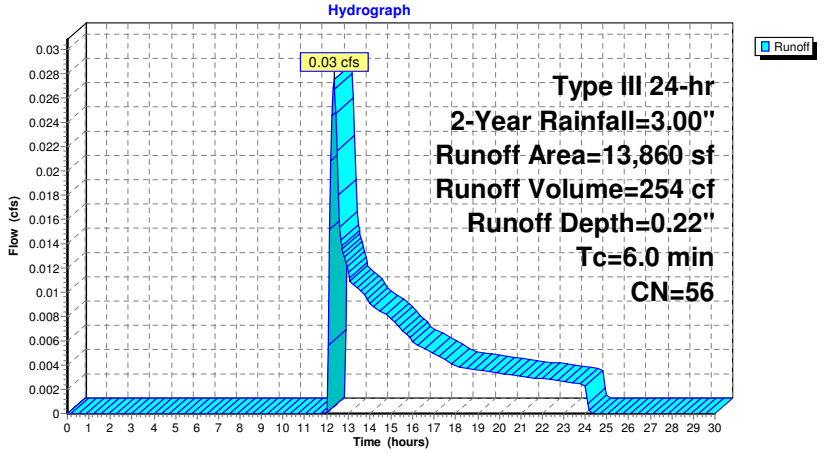
Runoff = 0.03 cfs @ 12.35 hrs, Volume= 254 cf, Depth= 0.22"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.00"

Area (sf)	CN	Description
7,297	39	>75% Grass cover, Good, HSG A
3,927	61	>75% Grass cover, Good, HSG B
2,447	98	Paved parking, HSG A
189	30	Woods, Good, HSG A
13,860	56	Weighted Average
11,413		82.34% Pervious Area
2,447		17.66% Impervious Area

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

Subcatchment P-5: Subcat P-5



Summary for Subcatchment P-7: Subcat P-7

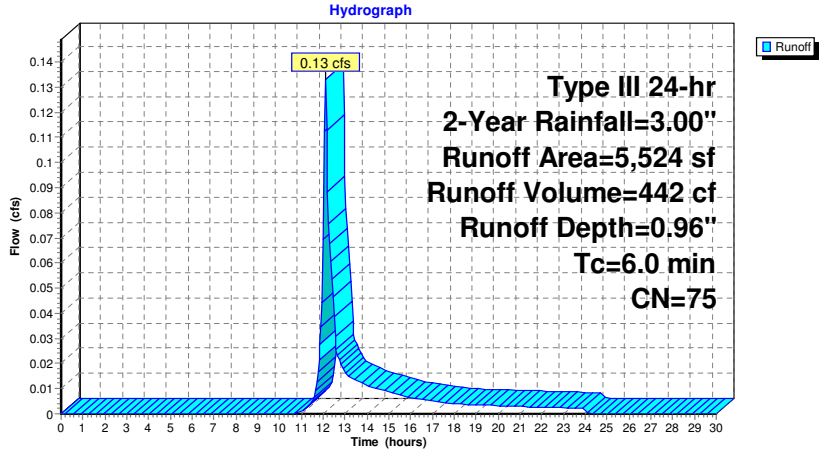
Runoff = 0.13 cfs @ 12.10 hrs, Volume= 442 cf, Depth= 0.96"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.00"

Area (sf)	CN	Description
2,121	39	>75% Grass cover, Good, HSG A
3,402	98	Paved parking, HSG A
5,524	75	Weighted Average
2,121		38.41% Pervious Area
3,402		61.59% Impervious Area

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

Subcatchment P-7: Subcat P-7



Summary for Subcatchment P-8: Subcat P-8

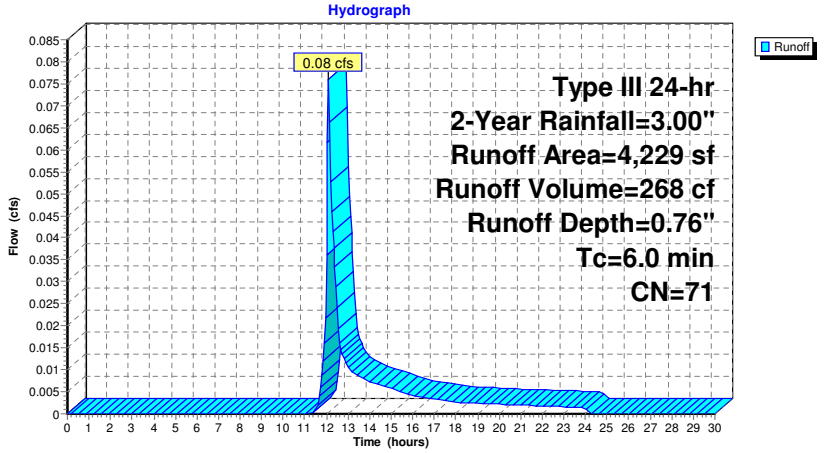
Runoff = 0.08 cfs @ 12.10 hrs, Volume= 268 cf, Depth= 0.76"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.00"

Area (sf)	CN	Description
1,911	39	>75% Grass cover, Good, HSG A
2,318	98	Paved parking, HSG A
4,229	71	Weighted Average
1,911		45.19% Pervious Area
2,318		54.81% Impervious Area

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

Subcatchment P-8: Subcat P-8



Summary for Subcatchment P-9: Subcat P-9

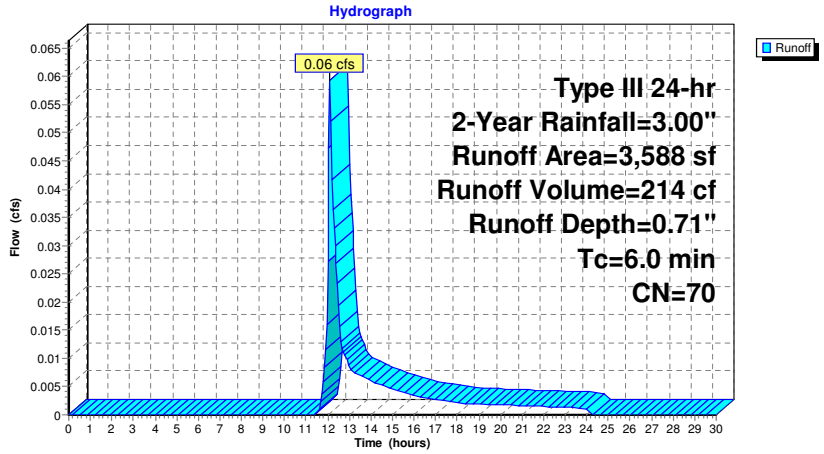
Runoff = 0.06 cfs @ 12.11 hrs, Volume= 214 cf, Depth= 0.71"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.00"

Area (sf)	CN	Description
1,687	39	>75% Grass cover, Good, HSG A
1,901	98	Paved parking, HSG A
3,588	70	Weighted Average
1,687		47.01% Pervious Area
1,901		52.99% Impervious Area

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

Subcatchment P-9: Subcat P-9



Summary for Pond DMH1: DMH1

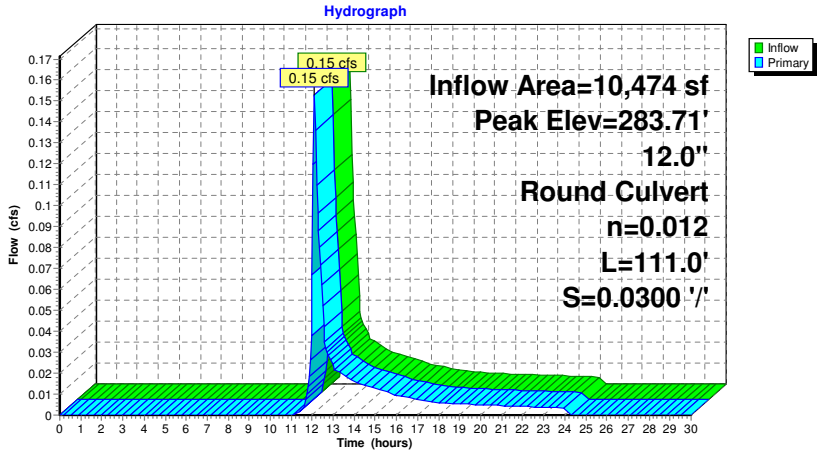
Inflow Area = 10,474 sf, 50.15% Impervious, Inflow Depth = 0.66" for 2-Year event
Inflow = 0.15 cfs @ 12.11 hrs, Volume= 574 cf
Outflow = 0.15 cfs @ 12.11 hrs, Volume= 574 cf, Atten= 0%, Lag= 0.0 min
Primary = 0.15 cfs @ 12.11 hrs, Volume= 574 cf

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Peak Elev= 283.71' @ 12.11 hrs
Flood Elev= 287.50'

Device	Routing	Invert	Outlet Devices
#1	Primary	283.50'	**12.0" Round Culvert** L= 111.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 283.50' / 280.17' S= 0.0300 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=0.15 cfs @ 12.11 hrs HW=283.71' (Free Discharge)
1=Culvert (Inlet Controls 0.15 cfs @ 1.23 fps)

Pond DMH1: DMH1



Summary for Pond DMH10: DMH10

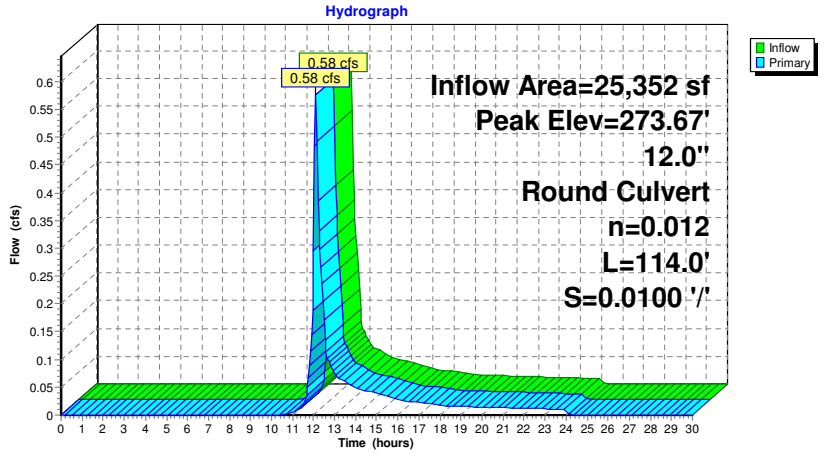
Inflow Area = 25,352 sf, 60.11% Impervious, Inflow Depth = 0.92" for 2-Year event
Inflow = 0.58 cfs @ 12.10 hrs, Volume= 1,940 cf
Outflow = 0.58 cfs @ 12.10 hrs, Volume= 1,940 cf, Atten= 0%, Lag= 0.0 min
Primary = 0.58 cfs @ 12.10 hrs, Volume= 1,940 cf

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Peak Elev= 273.67' @ 12.10 hrs
Flood Elev= 278.08'

Device	Routing	Invert	Outlet Devices
#1	Primary	273.24'	**12.0" Round Culvert** L= 114.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 273.24' / 272.10' S= 0.0100 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=0.57 cfs @ 12.10 hrs HW=273.67' (Free Discharge)
1=Culvert (Inlet Controls 0.57 cfs @ 1.77 fps)

Pond DMH10: DMH10



Summary for Pond DMH2: DMH2

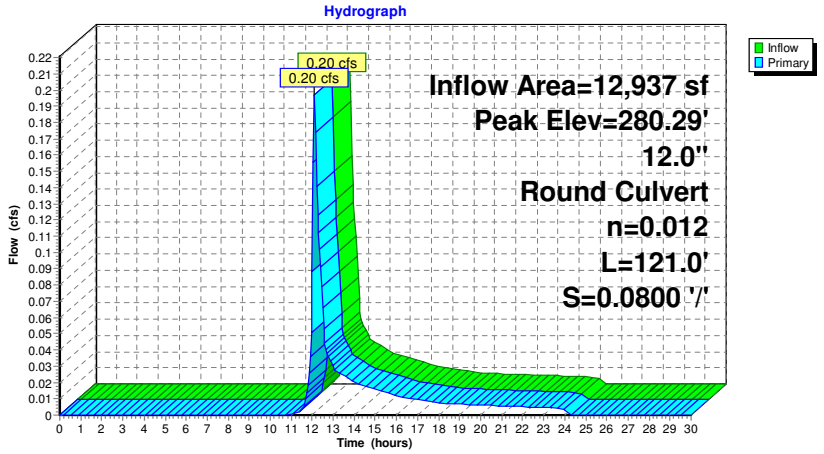
Inflow Area = 12,937 sf, 50.99% Impervious, Inflow Depth = 0.68" for 2-Year event
Inflow = 0.20 cfs @ 12.11 hrs, Volume= 731 cf
Outflow = 0.20 cfs @ 12.11 hrs, Volume= 731 cf, Atten= 0%, Lag= 0.0 min
Primary = 0.20 cfs @ 12.11 hrs, Volume= 731 cf

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Peak Elev= 280.29' @ 12.11 hrs
Flood Elev= 284.16'

Device	Routing	Invert	Outlet Devices
#1	Primary	280.05'	**12.0" Round Culvert** L= 121.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 280.05' / 270.37' S= 0.0800 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=0.19 cfs @ 12.11 hrs HW=280.29' (Free Discharge)
1=Culvert (Inlet Controls 0.19 cfs @ 1.32 fps)

Pond DMH2: DMH2



Summary for Pond DMH3: DMH3

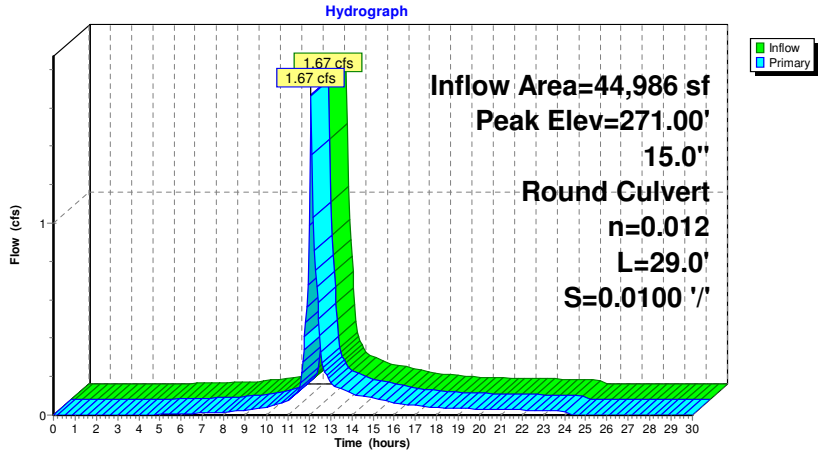
Inflow Area = 44,986 sf, 72.36% Impervious, Inflow Depth = 1.49" for 2-Year event
Inflow = 1.67 cfs @ 12.09 hrs, Volume= 5,597 cf
Outflow = 1.67 cfs @ 12.09 hrs, Volume= 5,597 cf, Atten= 0%, Lag= 0.0 min
Primary = 1.67 cfs @ 12.09 hrs, Volume= 5,597 cf

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Peak Elev= 271.00' @ 12.09 hrs
Flood Elev= 276.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	270.28'	**15.0" Round Culvert** L= 29.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 270.28' / 269.99' S= 0.0100 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 1.23 sf

Primary OutFlow Max=1.64 cfs @ 12.09 hrs HW=270.99' (Free Discharge)
1=Culvert (Inlet Controls 1.64 cfs @ 2.27 fps)

Pond DMH3: DMH3



Summary for Pond DMH4: DMH4

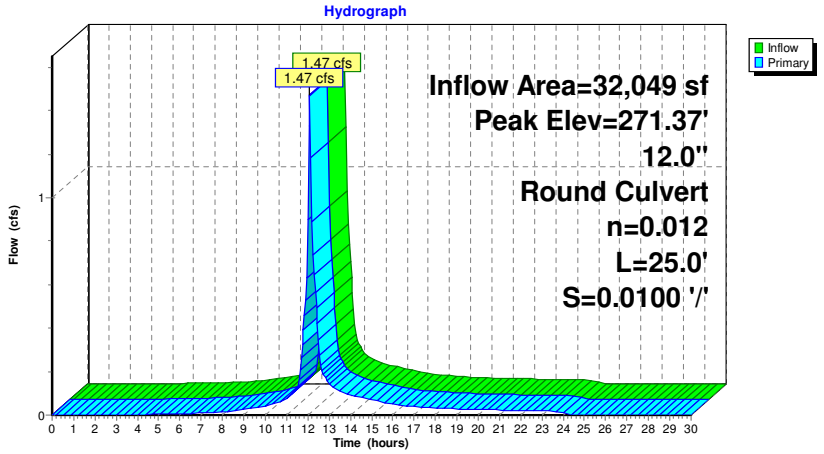
Inflow Area = 32,049 sf, 80.99% Impervious, Inflow Depth = 1.82" for 2-Year event
Inflow = 1.47 cfs @ 12.09 hrs, Volume= 4,865 cf
Outflow = 1.47 cfs @ 12.09 hrs, Volume= 4,865 cf, Atten= 0%, Lag= 0.0 min
Primary = 1.47 cfs @ 12.09 hrs, Volume= 4,865 cf

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Peak Elev= 271.37' @ 12.09 hrs
Flood Elev= 275.50'

Device	Routing	Invert	Outlet Devices
#1	Primary	270.62'	**12.0" Round Culvert** L= 25.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 270.62' / 270.37' S= 0.0100 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=1.44 cfs @ 12.09 hrs HW=271.36' (Free Discharge)
1=Culvert (Inlet Controls 1.44 cfs @ 2.31 fps)

Pond DMH4: DMH4



Summary for Pond DMH5: DMH5

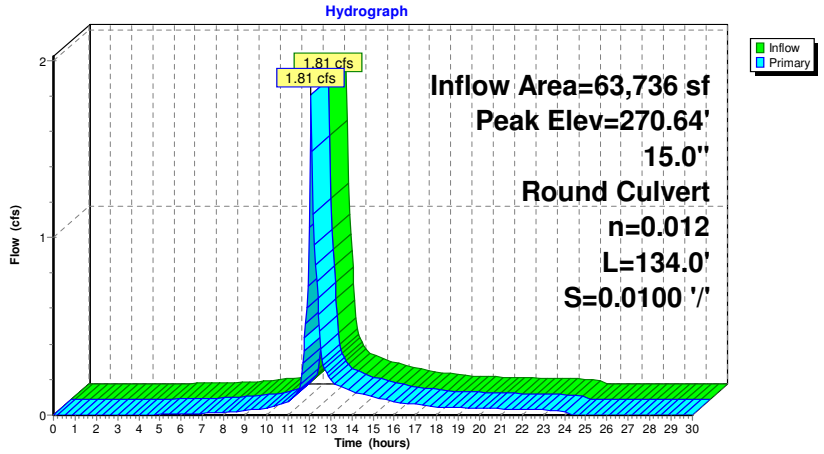
Inflow Area = 63,736 sf, 59.81% Impervious, Inflow Depth = 1.18" for 2-Year event
Inflow = 1.81 cfs @ 12.09 hrs, Volume= 6,287 cf
Outflow = 1.81 cfs @ 12.09 hrs, Volume= 6,287 cf, Atten= 0%, Lag= 0.0 min
Primary = 1.81 cfs @ 12.09 hrs, Volume= 6,287 cf

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Peak Elev= 270.64' @ 12.09 hrs
Flood Elev= 275.40'

Device	Routing	Invert	Outlet Devices
#1	Primary	269.89'	**15.0" Round Culvert** L= 134.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 269.89' / 268.55' S= 0.0100 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 1.23 sf

Primary OutFlow Max=1.78 cfs @ 12.09 hrs HW=270.64' (Free Discharge)
1=Culvert (Inlet Controls 1.78 cfs @ 2.32 fps)

Pond DMH5: DMH5



Summary for Pond DMH6: DMH6

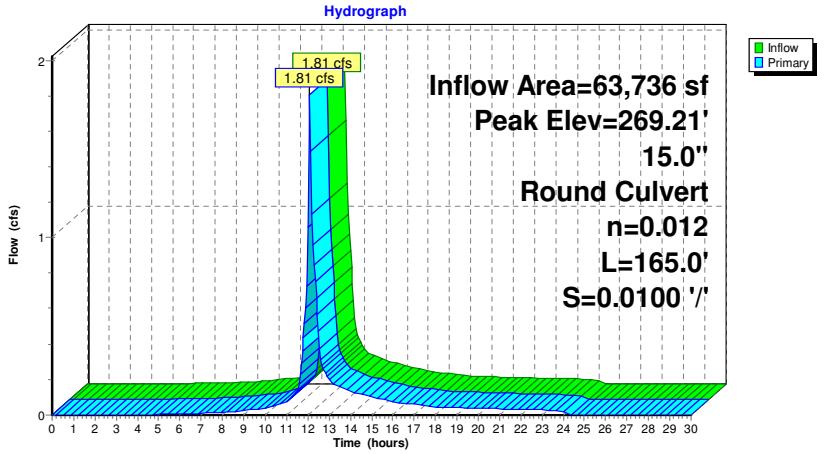
Inflow Area = 63,736 sf, 59.81% Impervious, Inflow Depth = 1.18" for 2-Year event
Inflow = 1.81 cfs @ 12.09 hrs, Volume= 6,287 cf
Outflow = 1.81 cfs @ 12.09 hrs, Volume= 6,287 cf, Atten= 0%, Lag= 0.0 min
Primary = 1.81 cfs @ 12.09 hrs, Volume= 6,287 cf

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Peak Elev= 269.21' @ 12.09 hrs
Flood Elev= 273.80'

Device	Routing	Invert	Outlet Devices
#1	Primary	268.46'	**15.0" Round Culvert** L= 165.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 268.46' / 266.81' S= 0.0100 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 1.23 sf

Primary OutFlow Max=1.78 cfs @ 12.09 hrs HW=269.21' (Free Discharge)
1=Culvert (Inlet Controls 1.78 cfs @ 2.32 fps)

Pond DMH6: DMH6



Summary for Pond DMH7: DMH7

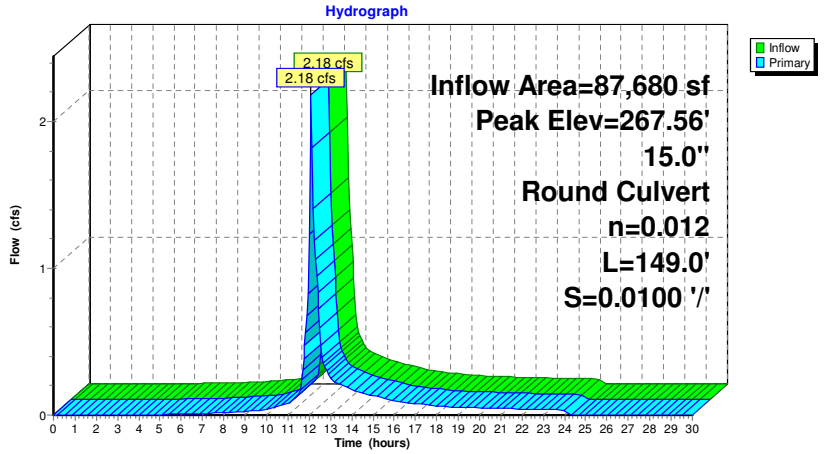
Inflow Area = 87,680 sf, 57.42% Impervious, Inflow Depth = 1.05" for 2-Year event
Inflow = 2.18 cfs @ 12.10 hrs, Volume= 7,686 cf
Outflow = 2.18 cfs @ 12.10 hrs, Volume= 7,686 cf, Atten= 0%, Lag= 0.0 min
Primary = 2.18 cfs @ 12.10 hrs, Volume= 7,686 cf

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Peak Elev= 267.56' @ 12.10 hrs
Flood Elev= 270.85'

Device	Routing	Invert	Outlet Devices
#1	Primary	266.71'	**15.0" Round Culvert** L= 149.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 266.71' / 265.22' S= 0.0100 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 1.23 sf

Primary OutFlow Max=2.16 cfs @ 12.10 hrs HW=267.55' (Free Discharge)
1=Culvert (Inlet Controls 2.16 cfs @ 2.46 fps)

Pond DMH7: DMH7



Summary for Pond DMH8: DMH8

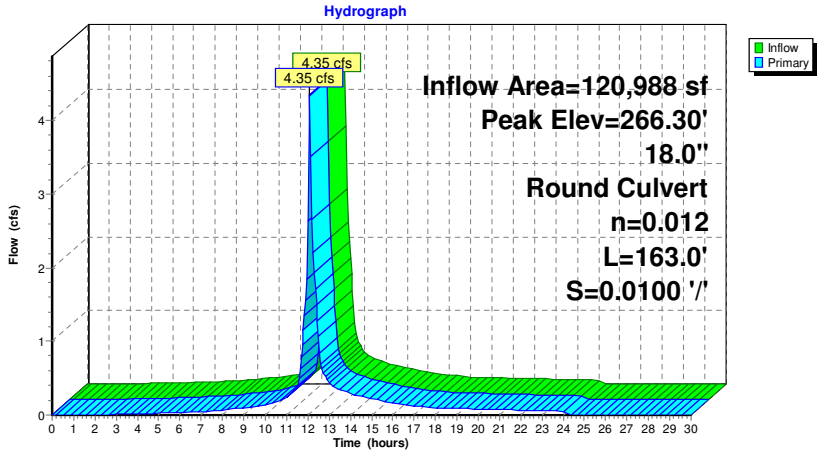
Inflow Area = 120,988 sf, 69.14% Impervious, Inflow Depth = 1.52" for 2-Year event
Inflow = 4.35 cfs @ 12.09 hrs, Volume= 15,370 cf
Outflow = 4.35 cfs @ 12.09 hrs, Volume= 15,370 cf, Atten= 0%, Lag= 0.0 min
Primary = 4.35 cfs @ 12.09 hrs, Volume= 15,370 cf

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Peak Elev= 266.30' @ 12.09 hrs
Flood Elev= 269.88'

Device	Routing	Invert	Outlet Devices
#1	Primary	265.12'	**18.0" Round Culvert** L= 163.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 265.12' / 263.49' S= 0.0100 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 1.77 sf

Primary OutFlow Max=4.26 cfs @ 12.09 hrs HW=266.28' (Free Discharge)
1=Culvert (Inlet Controls 4.26 cfs @ 2.90 fps)

Pond DMH8: DMH8



Summary for Pond DMH9: DMH9

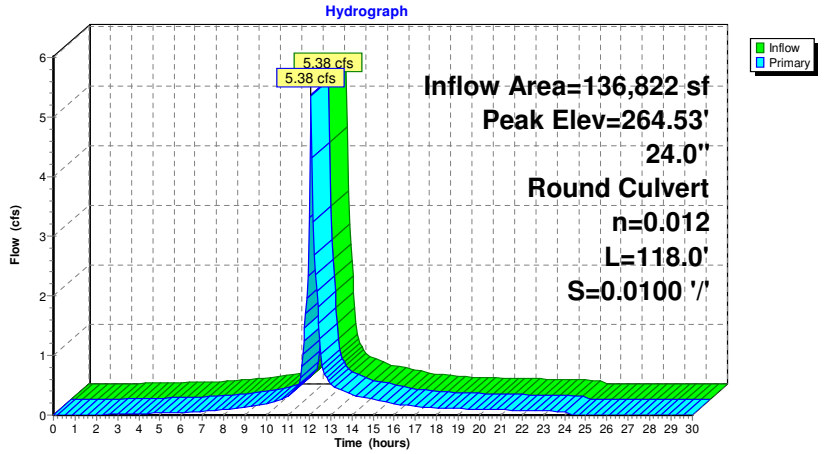
Inflow Area = 136,822 sf, 72.71% Impervious, Inflow Depth = 1.67" for 2-Year event
Inflow = 5.38 cfs @ 12.09 hrs, Volume= 19,022 cf
Outflow = 5.38 cfs @ 12.09 hrs, Volume= 19,022 cf, Atten= 0%, Lag= 0.0 min
Primary = 5.38 cfs @ 12.09 hrs, Volume= 19,022 cf

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Peak Elev= 264.53' @ 12.09 hrs
Flood Elev= 268.83'

Device	Routing	Invert	Outlet Devices
#1	Primary	263.38'	**24.0" Round Culvert** L= 118.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 263.38' / 262.20' S= 0.0100 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 3.14 sf

Primary OutFlow Max=5.26 cfs @ 12.09 hrs HW=264.51' (Free Discharge)
└**1=Culvert** (Inlet Controls 5.26 cfs @ 2.86 fps)

Pond DMH9: DMH9



Summary for Pond DP1: Pond #1

Inflow Area = 49,841 sf, 50.39% Impervious, Inflow Depth = 0.89" for 2-Year event
Inflow = 1.13 cfs @ 12.10 hrs, Volume= 3,705 cf
Outflow = 0.09 cfs @ 13.88 hrs, Volume= 3,705 cf, Atten= 92%, Lag= 107.1 min
Discarded = 0.09 cfs @ 13.88 hrs, Volume= 3,705 cf
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Peak Elev= 271.33' @ 13.88 hrs Surf.Area= 1,594 sf Storage= 1,623 cf
Flood Elev= 275.00' Surf.Area= 4,336 sf Storage= 12,246 cf

Plug-Flow detention time= 204.5 min calculated for 3,705 cf (100% of inflow)
Center-of-Mass det. time= 204.3 min (1,048.6 - 844.3)

Volume	Invert	Avail.Storage	Storage Description
#1	270.00'	12,246 cf	**Custom Stage Data (Conic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
270.00	878	0	0	878
271.00	1,400	1,129	1,129	1,413
272.00	2,026	1,703	2,832	2,056
273.00	2,742	2,375	5,207	2,793
274.00	3,515	3,121	8,328	3,591
275.00	4,336	3,918	12,246	4,441

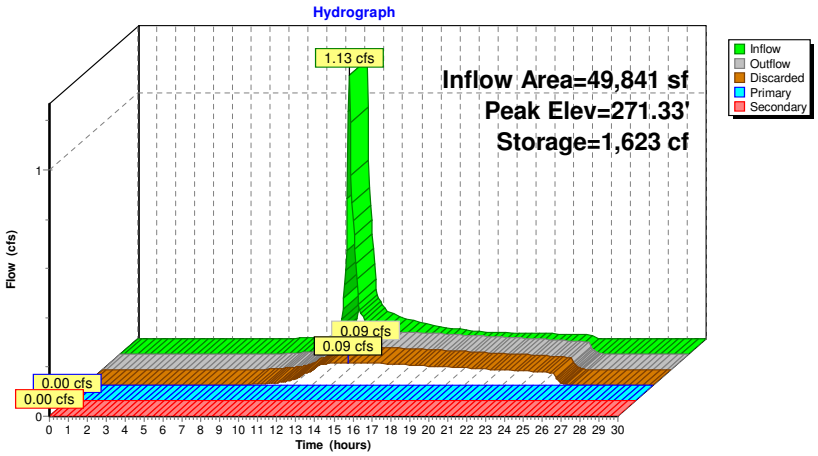
Device	Routing	Invert	Outlet Devices
#1	Primary	270.28'	**12.0" Round Culvert** L= 116.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 270.28' / 269.12' S= 0.0100 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 0.79 sf
#2	Device 1	273.80'	**24.0" x 24.0" Horiz. Top Grate** C= 0.600 in 24.0" x 24.0" Grate (100% open area) Limited to weir flow at low heads
#3	Secondary	274.50'	**10.0' long x 10.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.49 2.56 2.70 2.69 2.68 2.69 2.67 2.64
#4	Discarded	270.00'	**2.410 in/hr Exfiltration over Wetted area**

Discarded OutFlow Max=0.09 cfs @ 13.88 hrs HW=271.33' (Free Discharge)
└**4=Exfiltration** (Exfiltration Controls 0.09 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=270.00' (Free Discharge)
└**1=Culvert** (Controls 0.00 cfs)
└**2=Top Grate** (Controls 0.00 cfs)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=270.00' (Free Discharge)
└**3=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond DP1: Pond #1



Summary for Pond DP2: Pond #2

Inflow Area = 174,663 sf, 72.49% Impervious, Inflow Depth = 1.61" for 2-Year event
Inflow = 6.62 cfs @ 12.09 hrs, Volume= 23,415 cf
Outflow = 0.37 cfs @ 13.91 hrs, Volume= 23,414 cf, Atten= 94%, Lag= 109.6 min
Discarded = 0.37 cfs @ 13.91 hrs, Volume= 23,414 cf
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Peak Elev= 267.24' @ 13.91 hrs Surf.Area= 6,639 sf Storage= 11,529 cf
Flood Elev= 270.00' Surf.Area= 11,000 sf Storage= 35,778 cf

Plug-Flow detention time= 304.7 min calculated for 23,375 cf (100% of inflow)
Center-of-Mass det. time= 304.7 min (1,062.5 - 757.8)

Volume	Invert	Avail.Storage	Storage Description
#1	265.00'	35,778 cf	**Custom Stage Data (Conic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
265.00	3,792	0	0	3,792
266.00	4,968	4,367	4,367	4,991
267.00	6,299	5,620	9,987	6,348
268.00	7,785	7,029	17,016	7,864
269.00	9,393	8,576	25,592	9,505
270.00	11,000	10,186	35,778	11,151

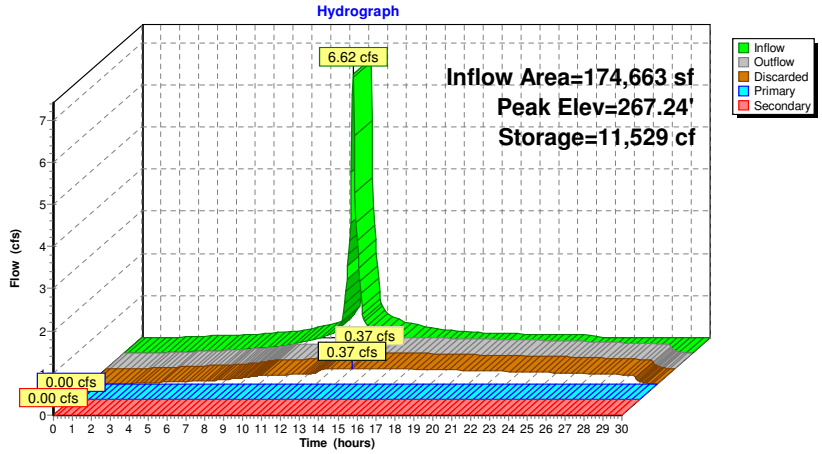
Device	Routing	Invert	Outlet Devices
#1	Primary	265.00'	**12.0" Round Culvert** L= 23.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 265.00' / 264.77' S= 0.0100 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 0.79 sf
#2	Device 1	267.80'	**3.0" Vert. Orifice** C= 0.600
#3	Device 1	269.40'	**24.0" x 24.0" Horiz. Top Grate** C= 0.600 in 24.0" x 24.0" Grate (100% open area) Limited to weir flow at low heads
#4	Secondary	269.50'	**10.0' long x 10.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.49 2.56 2.70 2.69 2.68 2.69 2.67 2.64
#5	Discarded	265.00'	**2.410 in/hr Exfiltration over Wetted area**

Discarded OutFlow Max=0.37 cfs @ 13.91 hrs HW=267.24' (Free Discharge)
└**5=Exfiltration** (Exfiltration Controls 0.37 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=265.00' (Free Discharge)
└**1=Culvert** (Controls 0.00 cfs)
  └**2=Orifice** (Controls 0.00 cfs)
  └**3=Top Grate** (Controls 0.00 cfs)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=265.00' (Free Discharge)
└**4=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond DP2: Pond #2



Summary for Pond DP3: Pond #3

Inflow Area =	247,761 sf,	71.90% Impervious,	Inflow Depth =	1.80"	for 2-Year event
Inflow =	10.50 cfs @	12.09 hrs,	Volume=	37,142 cf	
Outflow =	0.66 cfs @	13.86 hrs,	Volume=	37,142 cf,	Atten= 94%, Lag= 106.3 min
Discarded =	0.58 cfs @	13.86 hrs,	Volume=	35,955 cf	
Primary =	0.08 cfs @	13.86 hrs,	Volume=	1,187 cf	
Secondary =	0.00 cfs @	0.00 hrs,	Volume=	0 cf	

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Peak Elev= 256.87' @ 13.86 hrs Surf.Area= 10,272 sf Storage= 16,946 cf
Flood Elev= 260.00' Surf.Area= 14,828 sf Storage= 55,948 cf

Plug-Flow detention time= 260.8 min calculated for 37,080 cf (100% of inflow)
Center-of-Mass det. time= 260.7 min (1,034.2 - 773.4)

Volume	Invert	Avail.Storage	Storage Description
#1	255.00'	55,948 cf	**Custom Stage Data (Conic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
255.00	7,916	0	0	7,916
256.00	9,155	8,528	8,528	9,197
257.00	10,449	9,795	18,323	10,538
258.00	11,800	11,118	29,441	11,940
259.00	13,208	12,497	41,938	13,403
260.00	14,828	14,010	55,948	15,076

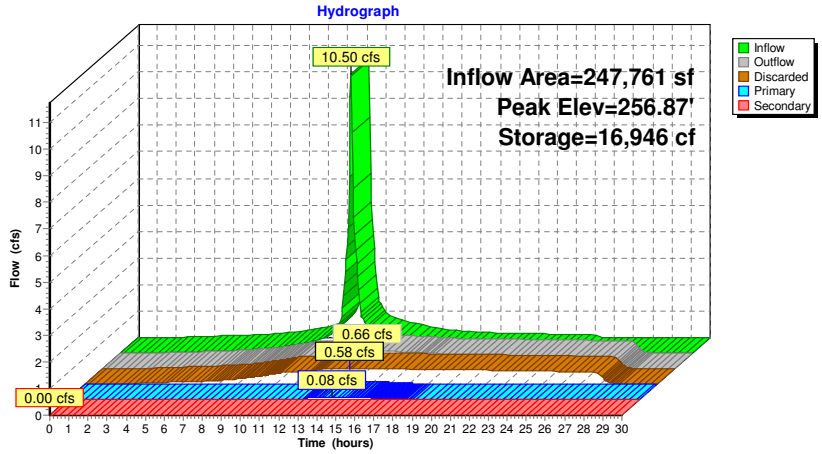
Device	Routing	Invert	Outlet Devices
#1	Primary	255.00'	**12.0" Round Culvert** L= 38.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 255.00' / 254.62' S= 0.0100 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 0.79 sf
#2	Device 1	256.50'	**2.5" Vert. Orifice** C= 0.600
#3	Device 1	259.80'	**24.0" x 24.0" Horiz. Top Grate** C= 0.600 in 24.0" x 24.0" Grate (100% open area) Limited to weir flow at low heads
#4	Secondary	259.90'	**10.0' long x 10.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.49 2.56 2.70 2.69 2.68 2.69 2.67 2.64
#5	Discarded	255.00'	**2.410 in/hr Exfiltration over Wetted area**

Discarded OutFlow Max=0.58 cfs @ 13.86 hrs HW=256.87' (Free Discharge)
└**5=Exfiltration** (Exfiltration Controls 0.58 cfs)

Primary OutFlow Max=0.08 cfs @ 13.86 hrs HW=256.87' (Free Discharge)
└**1=Culvert** (Passes 0.08 cfs of 3.49 cfs potential flow)
  └**2=Orifice** (Orifice Controls 0.08 cfs @ 2.47 fps)
  └**3=Top Grate** (Controls 0.00 cfs)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=255.00' (Free Discharge)
└**4=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond DP3: Pond #3



Summary for Pond WQU1: WQU1

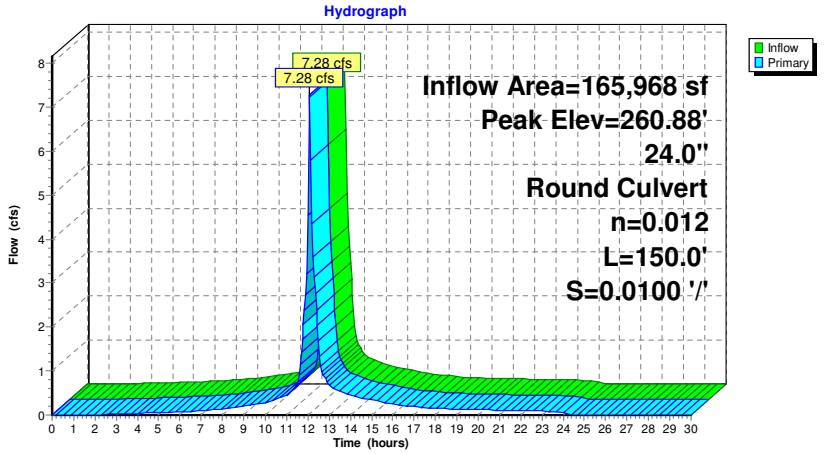
Inflow Area = 165,968 sf, 77.51% Impervious, Inflow Depth = 1.86" for 2-Year event
Inflow = 7.28 cfs @ 12.09 hrs, Volume= 25,746 cf
Outflow = 7.28 cfs @ 12.09 hrs, Volume= 25,746 cf, Atten= 0%, Lag= 0.0 min
Primary = 7.28 cfs @ 12.09 hrs, Volume= 25,746 cf

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Peak Elev= 260.88' @ 12.09 hrs
Flood Elev= 268.90'

Device	Routing	Invert	Outlet Devices
#1	Primary	259.50'	**24.0" Round Culvert** L= 150.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 259.50' / 258.00' S= 0.0100 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 3.14 sf

Primary OutFlow Max=7.11 cfs @ 12.09 hrs HW=260.86' (Free Discharge)
└**1=Culvert** (Inlet Controls 7.11 cfs @ 3.13 fps)

Pond WQU1: WQU1



Summary for Pond WQU2: WQU2

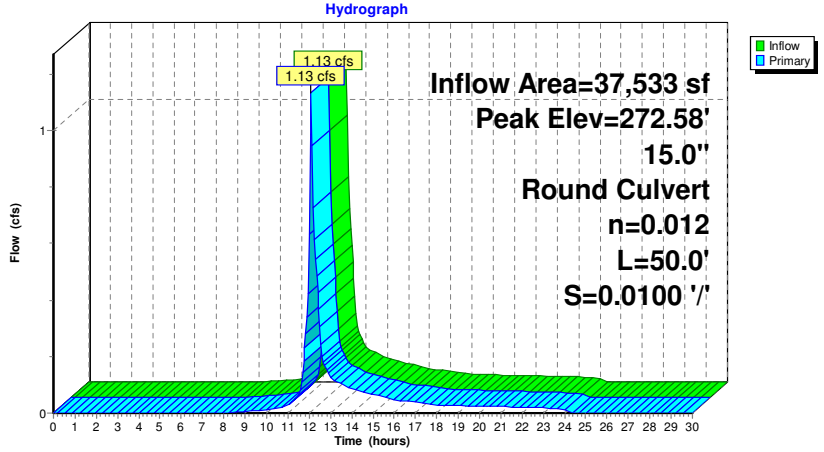
Inflow Area = 37,533 sf, 66.78% Impervious, Inflow Depth = 1.18" for 2-Year event
Inflow = 1.13 cfs @ 12.10 hrs, Volume= 3,705 cf
Outflow = 1.13 cfs @ 12.10 hrs, Volume= 3,705 cf, Atten= 0%, Lag= 0.0 min
Primary = 1.13 cfs @ 12.10 hrs, Volume= 3,705 cf

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Peak Elev= 272.58' @ 12.10 hrs
Flood Elev= 275.35'

Device	Routing	Invert	Outlet Devices
#1	Primary	272.00'	**15.0" Round Culvert** L= 50.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 272.00' / 271.50' S= 0.0100 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 1.23 sf

Primary OutFlow Max=1.12 cfs @ 12.10 hrs HW=272.57' (Free Discharge)
1=Culvert (Inlet Controls 1.12 cfs @ 2.04 fps)

Pond WQU2: WQU2

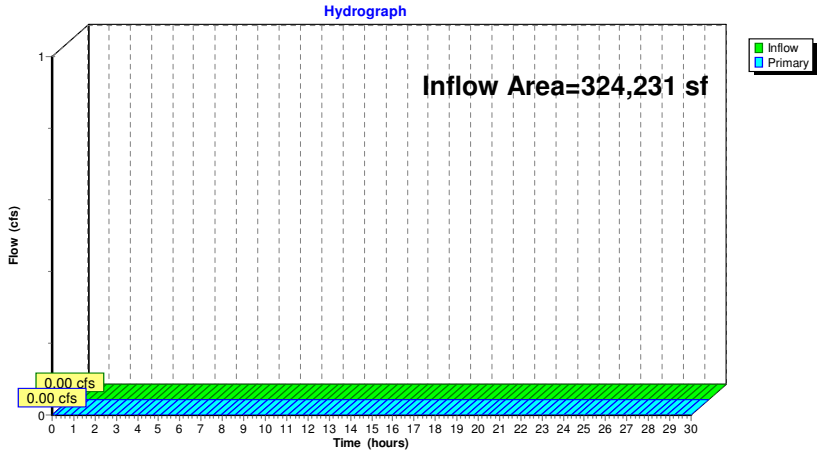


Summary for Link SP-1: Study Point #1

Inflow Area = 324,231 sf, 39.05% Impervious, Inflow Depth = 0.00" for 2-Year event
Inflow = 0.00 cfs @ 0.00 hrs, Volume= 0 cf
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs

Link SP-1: Study Point #1

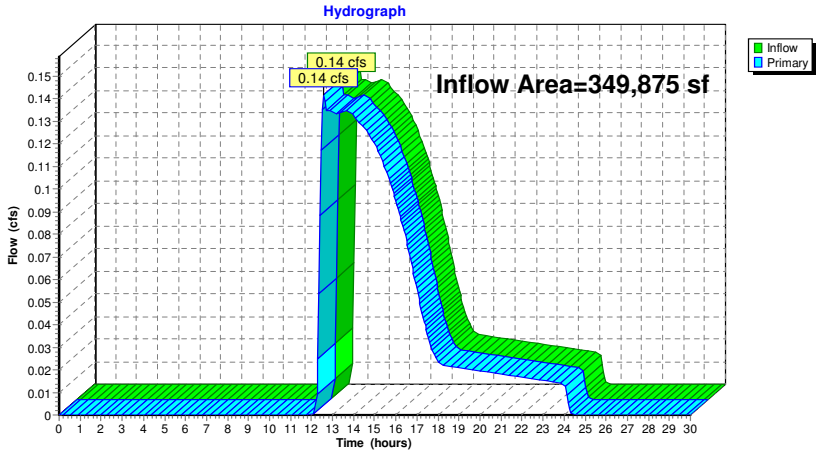


Summary for Link SP-2: Study Point #2

Inflow Area = 349,875 sf, 50.91% Impervious, Inflow Depth = 0.08" for 2-Year event
Inflow = 0.14 cfs @ 12.57 hrs, Volume= 2,455 cf
Primary = 0.14 cfs @ 12.57 hrs, Volume= 2,455 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs

Link SP-2: Study Point #2



Summary for Subcatchment P-1: Subcat P-1

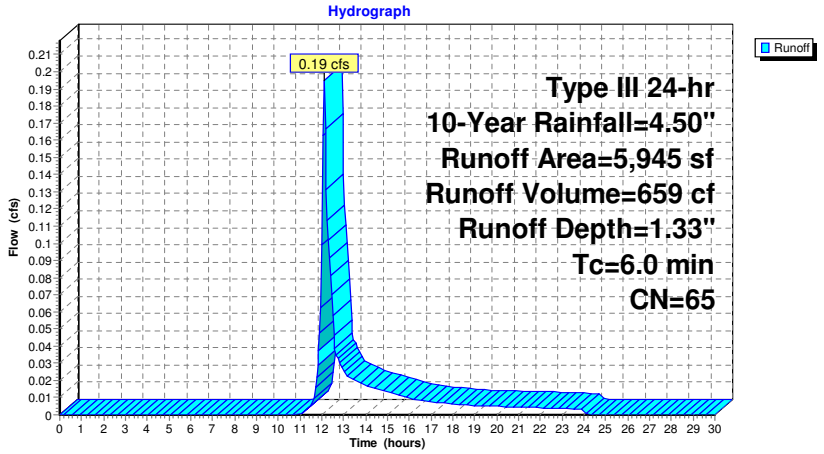
Runoff = 0.19 cfs @ 12.10 hrs, Volume= 659 cf, Depth= 1.33"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.50"

Area (sf)	CN	Description
3,307	39	>75% Grass cover, Good, HSG A
2,637	98	Paved parking, HSG A
5,945	65	Weighted Average
3,307		55.63% Pervious Area
2,637		44.37% Impervious Area

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

Subcatchment P-1: Subcat P-1



Summary for Subcatchment P-10: Subcat P-10

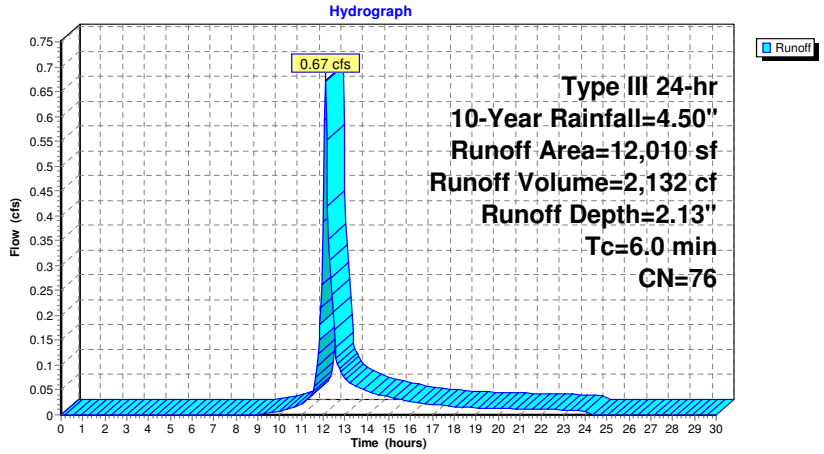
Runoff = 0.67 cfs @ 12.09 hrs, Volume= 2,132 cf, Depth= 2.13"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.50"

Area (sf)	CN	Description
4,394	39	>75% Grass cover, Good, HSG A
7,616	98	Paved parking, HSG A
12,010	76	Weighted Average
4,394		36.58% Pervious Area
7,616		63.42% Impervious Area

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

Subcatchment P-10: Subcat P-10



Summary for Subcatchment P-11: Subcat P-11

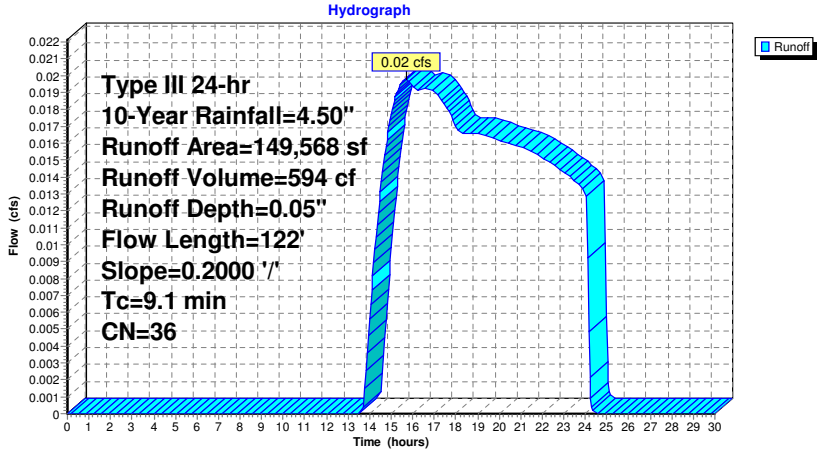
Runoff = 0.02 cfs @ 15.68 hrs, Volume= 594 cf, Depth= 0.05"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.50"

Area (sf)	CN	Description
35,319	39	>75% Grass cover, Good, HSG A
93,727	30	Woods, Good, HSG A
20,521	55	Woods, Good, HSG B
149,568	36	Weighted Average
149,568		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.6	50	0.2000	0.10		**Sheet Flow,** Woods: Dense underbrush n= 0.800 P2= 3.16"
0.5	72	0.2000	2.24		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
9.1	122	Total			

Subcatchment P-11: Subcat P-11



Summary for Subcatchment P-12: Subcat P-12

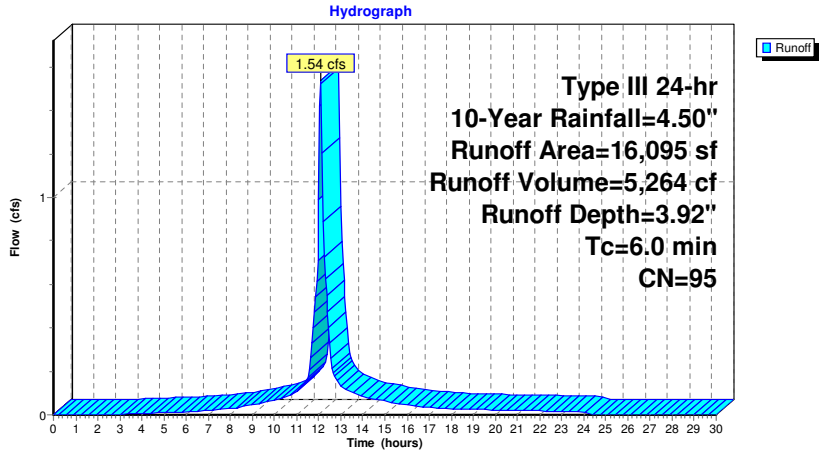
Runoff = 1.54 cfs @ 12.09 hrs, Volume= 5,264 cf, Depth= 3.92"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.50"

Area (sf)	CN	Description
949	39	>75% Grass cover, Good, HSG A
15,146	98	Paved parking, HSG A
16,095	95	Weighted Average
949		5.90% Pervious Area
15,146		94.10% Impervious Area

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

Subcatchment P-12: Subcat P-12



Summary for Subcatchment P-13: Subcat P-13

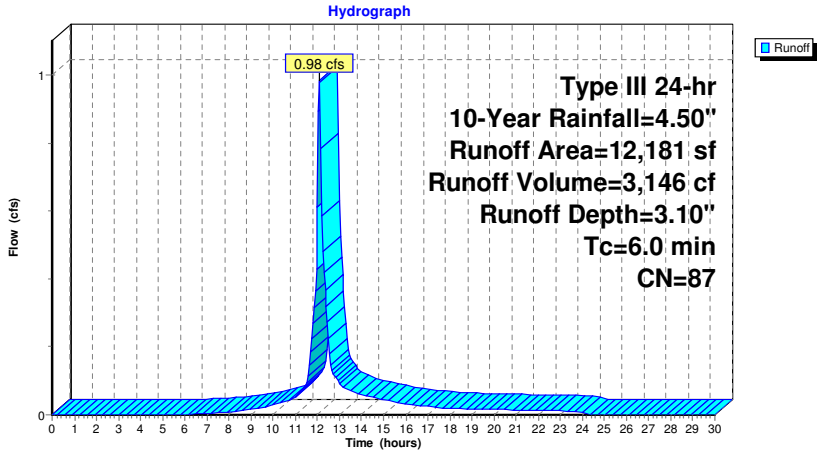
Runoff = 0.98 cfs @ 12.09 hrs, Volume= 3,146 cf, Depth= 3.10"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.50"

Area (sf)	CN	Description
2,356	39	>75% Grass cover, Good, HSG A
9,825	98	Paved parking, HSG A
12,181	87	Weighted Average
2,356		19.34% Pervious Area
9,825		80.66% Impervious Area

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

Subcatchment P-13: Subcat P-13



Summary for Subcatchment P-14: Subcat P-14

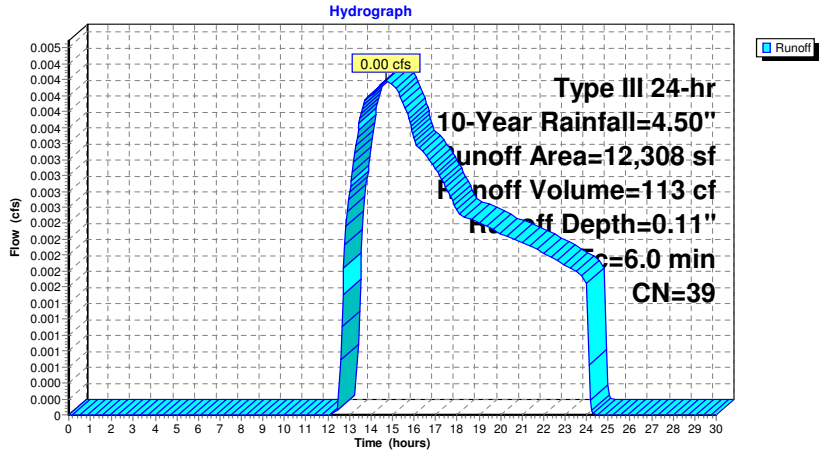
Runoff = 0.00 cfs @ 14.71 hrs, Volume= 113 cf, Depth= 0.11"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.50"

Area (sf)	CN	Description
12,257	39	>75% Grass cover, Good, HSG A
51	98	Paved parking, HSG A
12,308	39	Weighted Average
12,257		99.59% Pervious Area
51		0.41% Impervious Area

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

Subcatchment P-14: Subcat P-14



Summary for Subcatchment P-15A: Subcat P-15A

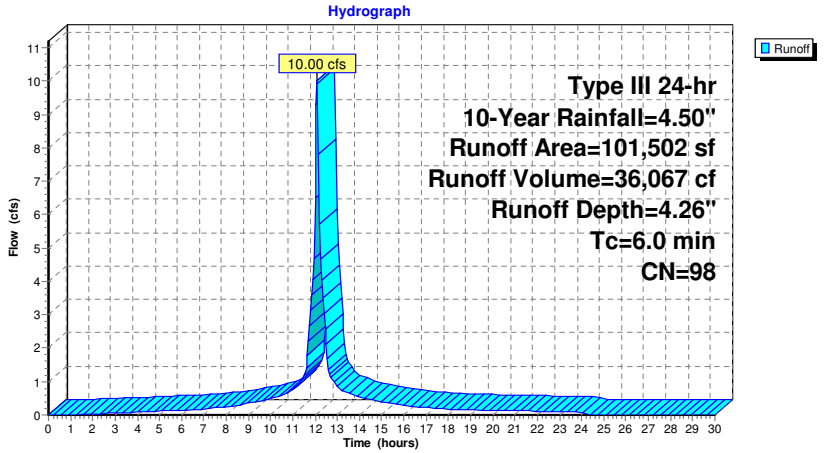
Runoff = 10.00 cfs @ 12.09 hrs, Volume= 36,067 cf, Depth= 4.26"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.50"

Area (sf)	CN	Description
101,502	98	Roofs, HSG A
101,502		100.00% Impervious Area

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

Subcatchment P-15A: Subcat P-15A



Summary for Subcatchment P-15B: Subcat P-15B

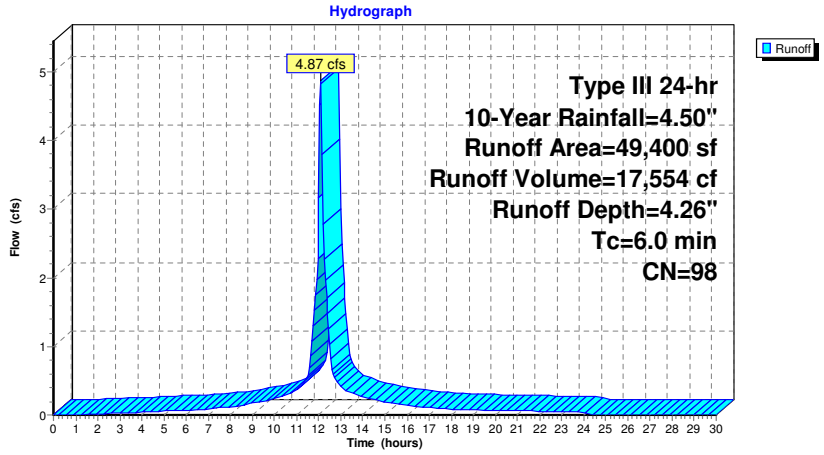
Runoff = 4.87 cfs @ 12.09 hrs, Volume= 17,554 cf, Depth= 4.26"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.50"

Area (sf)	CN	Description
49,400	98	Roofs, HSG A
49,400		100.00% Impervious Area

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

Subcatchment P-15B: Subcat P-15B



Summary for Subcatchment P-16: Subcat P-16

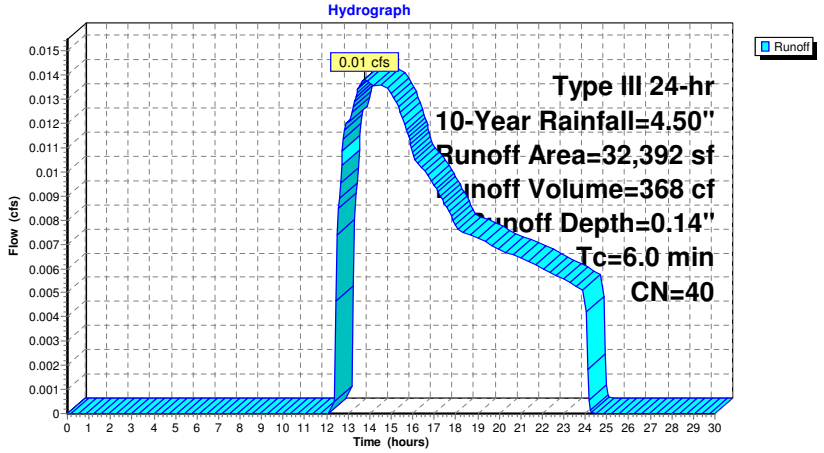
Runoff = 0.01 cfs @ 13.77 hrs, Volume= 368 cf, Depth= 0.14"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.50"

Area (sf)	CN	Description
31,821	39	>75% Grass cover, Good, HSG A
472	61	>75% Grass cover, Good, HSG B
99	98	Paved parking, HSG A
1	98	Paved parking, HSG B
32,392	40	Weighted Average
32,292		99.69% Pervious Area
100		0.31% Impervious Area

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

Subcatchment P-16: Subcat P-16



Summary for Subcatchment P-17: Subcat P-17

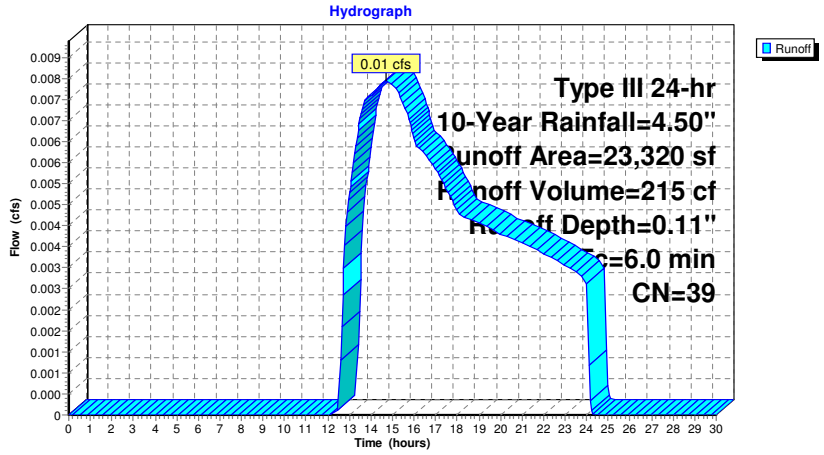
Runoff = 0.01 cfs @ 14.71 hrs, Volume= 215 cf, Depth= 0.11"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.50"

Area (sf)	CN	Description
23,320	39	>75% Grass cover, Good, HSG A
23,320		100.00% Pervious Area

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

Subcatchment P-17: Subcat P-17



Summary for Subcatchment P-18: Subcat P-18

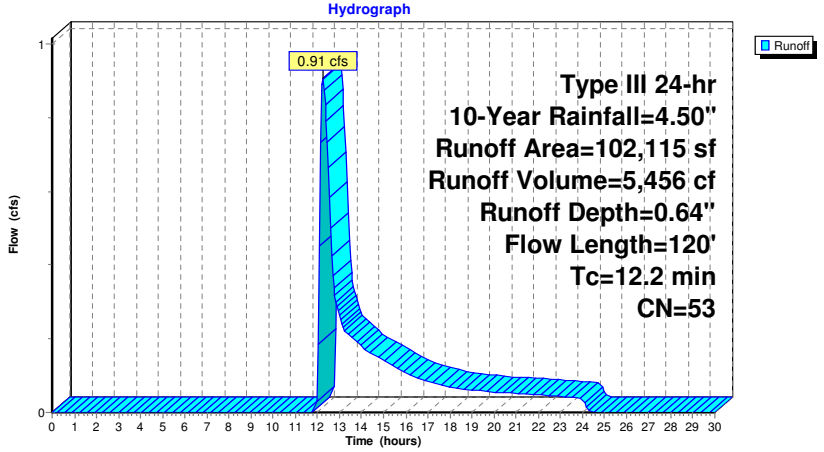
Runoff = 0.91 cfs @ 12.24 hrs, Volume= 5,456 cf, Depth= 0.64"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.50"

Area (sf)	CN	Description
23,317	39	>75% Grass cover, Good, HSG A
41,898	61	>75% Grass cover, Good, HSG B
5,189	30	Woods, Good, HSG A
31,710	55	Woods, Good, HSG B
102,115	53	Weighted Average
102,115		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.4	50	0.1000	0.07		**Sheet Flow,** Woods: Dense underbrush n= 0.800 P2= 3.16"
0.8	70	0.0800	1.41		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
12.2	120	Total			

Subcatchment P-18: Subcat P-18



Summary for Subcatchment P-19: Subcat P-19

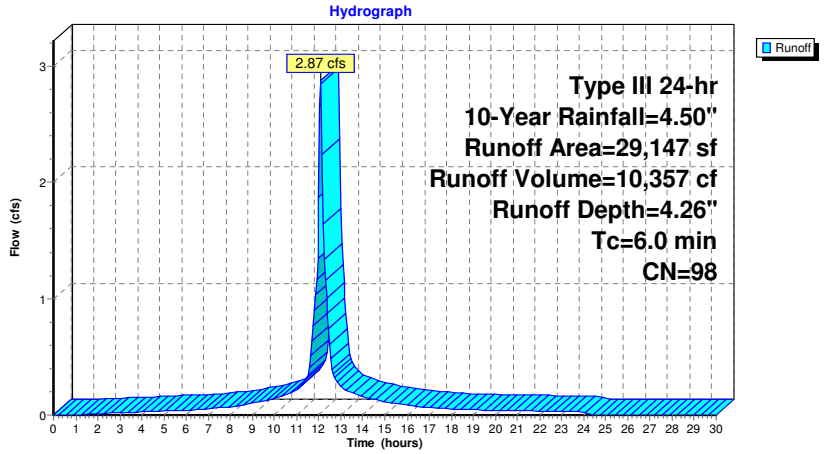
Runoff = 2.87 cfs @ 12.09 hrs, Volume= 10,357 cf, Depth= 4.26"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.50"

Area (sf)	CN	Description
28,117	98	Paved parking, HSG A
1,030	98	Paved parking, HSG B
29,147	98	Weighted Average
29,147		100.00% Impervious Area

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

Subcatchment P-19: Subcat P-19



Summary for Subcatchment P-2: Subcat P-2

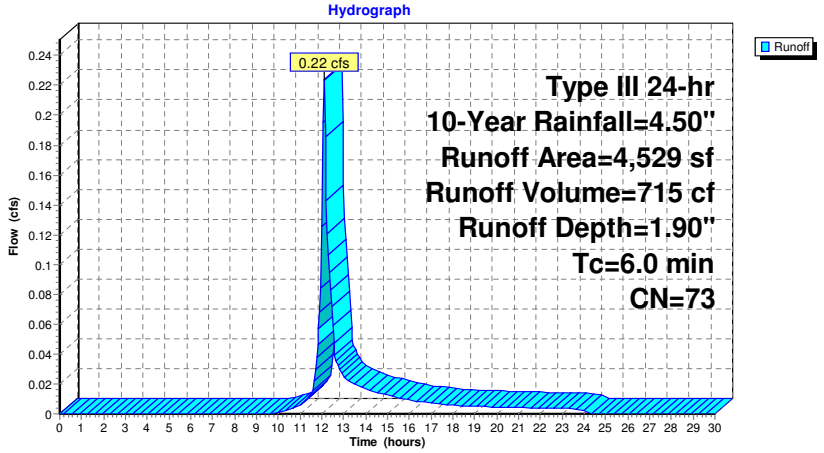
Runoff = 0.22 cfs @ 12.10 hrs, Volume= 715 cf, Depth= 1.90"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.50"

Area (sf)	CN	Description
1,914	39	>75% Grass cover, Good, HSG A
2,615	98	Paved parking, HSG A
4,529	73	Weighted Average
1,914		42.26% Pervious Area
2,615		57.74% Impervious Area

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

Subcatchment P-2: Subcat P-2



Summary for Subcatchment P-20: Subcat P-20

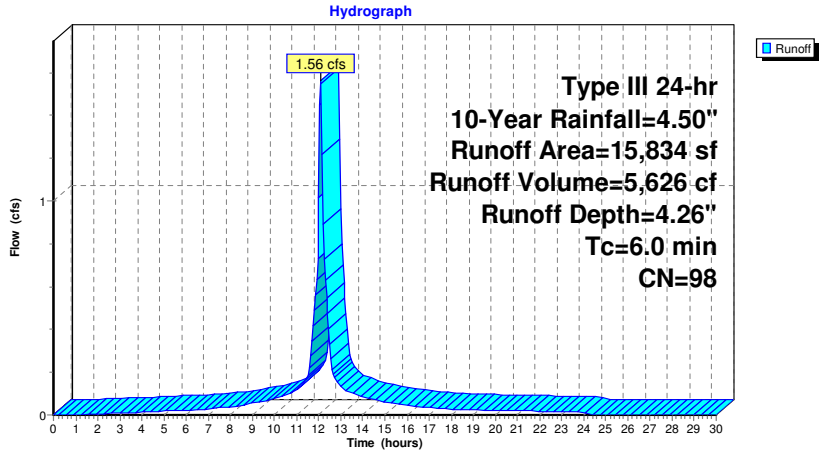
Runoff = 1.56 cfs @ 12.09 hrs, Volume= 5,626 cf, Depth= 4.26"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.50"

Area (sf)	CN	Description
15,834	98	Paved parking, HSG A
15,834		100.00% Impervious Area

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

Subcatchment P-20: Subcat P-20



Summary for Subcatchment P-21: Subcat P-21

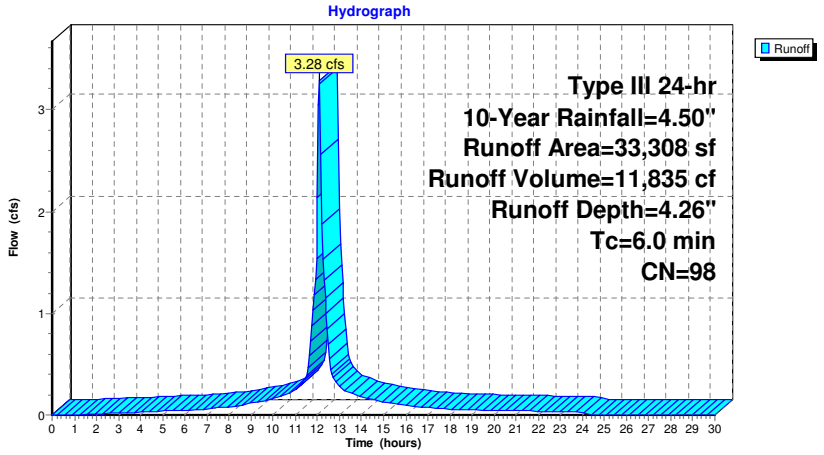
Runoff = 3.28 cfs @ 12.09 hrs, Volume= 11,835 cf, Depth= 4.26"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.50"

Area (sf)	CN	Description
33,308	98	Paved parking, HSG A
33,308		100.00% Impervious Area

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

Subcatchment P-21: Subcat P-21



Summary for Subcatchment P-22: Subcat P-22

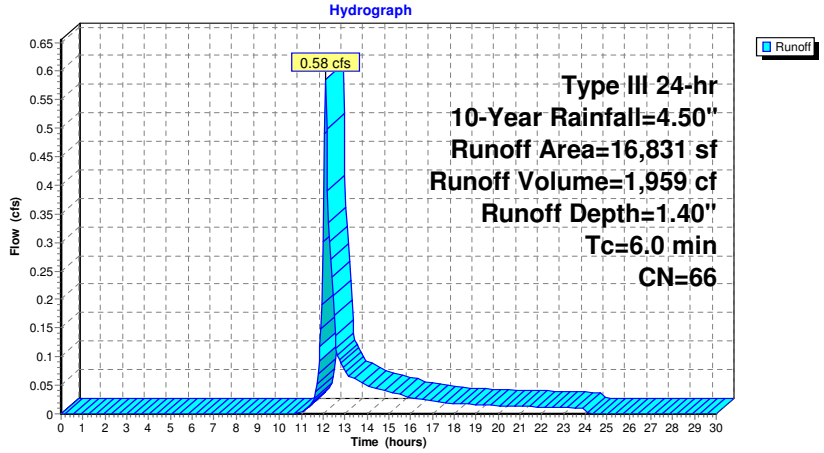
Runoff = 0.58 cfs @ 12.10 hrs, Volume= 1,959 cf, Depth= 1.40"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.50"

Area (sf)	CN	Description
9,035	39	>75% Grass cover, Good, HSG A
7,796	98	Paved parking, HSG A
16,831	66	Weighted Average
9,035		53.68% Pervious Area
7,796		46.32% Impervious Area

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

Subcatchment P-22: Subcat P-22



Summary for Subcatchment P-23: Subcat P-23

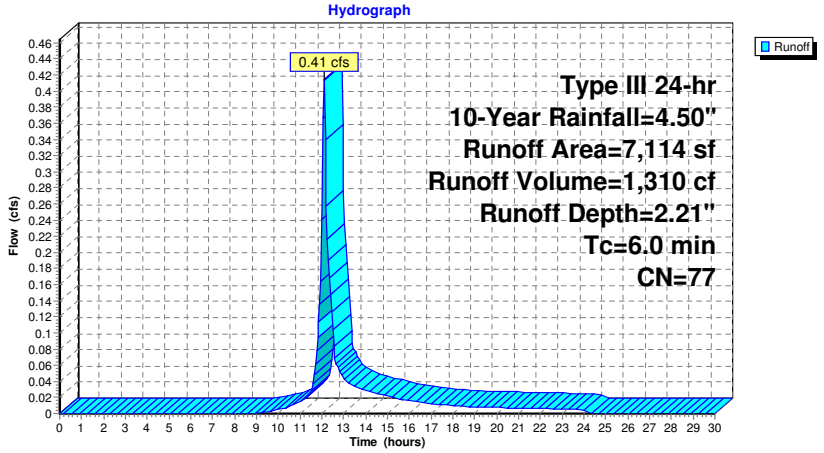
Runoff = 0.41 cfs @ 12.09 hrs, Volume= 1,310 cf, Depth= 2.21"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.50"

Area (sf)	CN	Description
2,239	39	>75% Grass cover, Good, HSG A
448	61	>75% Grass cover, Good, HSG B
4,427	98	Paved parking, HSG A
7,114	77	Weighted Average
2,687		37.77% Pervious Area
4,427		62.23% Impervious Area

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

Subcatchment P-23: Subcat P-23



Summary for Subcatchment P-24: Subcat P-24

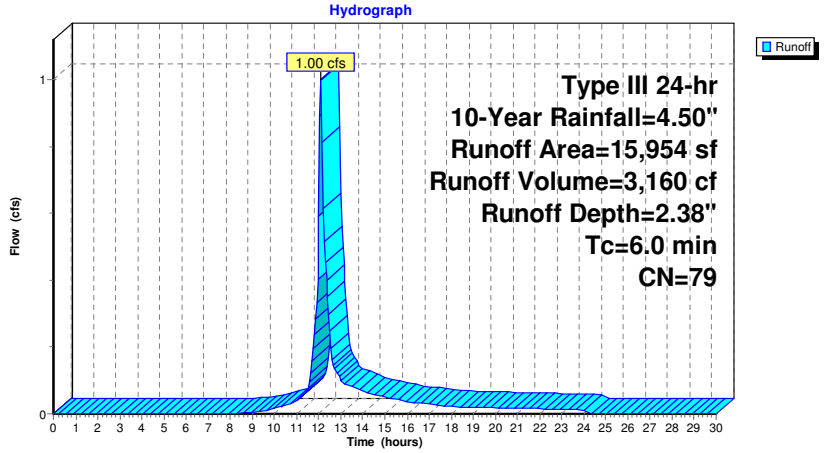
Runoff = 1.00 cfs @ 12.09 hrs, Volume= 3,160 cf, Depth= 2.38"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.50"

Area (sf)	CN	Description
5,144	39	>75% Grass cover, Good, HSG A
10,810	98	Paved parking, HSG A
15,954	79	Weighted Average
5,144		32.24% Pervious Area
10,810		67.76% Impervious Area

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

Subcatchment P-24: Subcat P-24



Summary for Subcatchment P-25: Subcat P-25

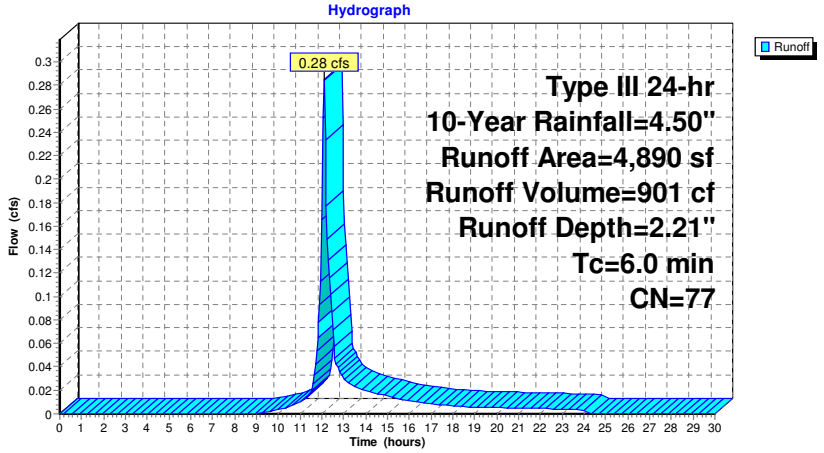
Runoff = 0.28 cfs @ 12.09 hrs, Volume= 901 cf, Depth= 2.21"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.50"

Area (sf)	CN	Description
1,767	39	>75% Grass cover, Good, HSG A
3,123	98	Paved parking, HSG A
4,890	77	Weighted Average
1,767		36.14% Pervious Area
3,123		63.86% Impervious Area

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

Subcatchment P-25: Subcat P-25



Summary for Subcatchment P-3: Subcat P-3

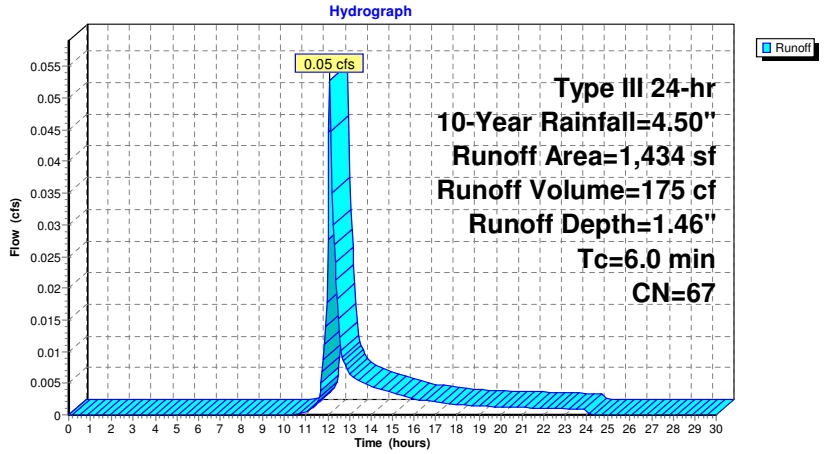
Runoff = 0.05 cfs @ 12.10 hrs, Volume= 175 cf, Depth= 1.46"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.50"

Area (sf)	CN	Description
742	39	>75% Grass cover, Good, HSG A
692	98	Paved parking, HSG A
1,434	67	Weighted Average
742		51.75% Pervious Area
692		48.25% Impervious Area

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

Subcatchment P-3: Subcat P-3



Summary for Subcatchment P-4: Subcat P-4

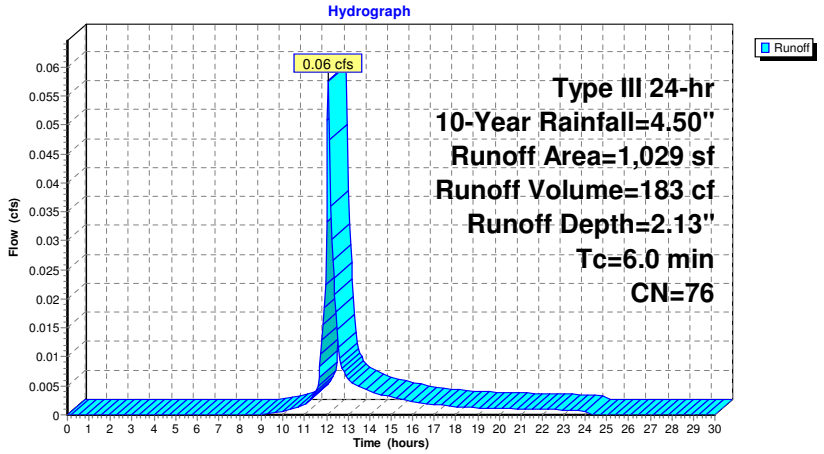
Runoff = 0.06 cfs @ 12.09 hrs, Volume= 183 cf, Depth= 2.13"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.50"

Area (sf)	CN	Description
377	39	>75% Grass cover, Good, HSG A
652	98	Paved parking, HSG A
1,029	76	Weighted Average
377		36.60% Pervious Area
652		63.40% Impervious Area

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

Subcatchment P-4: Subcat P-4



Summary for Subcatchment P-5: Subcat P-5

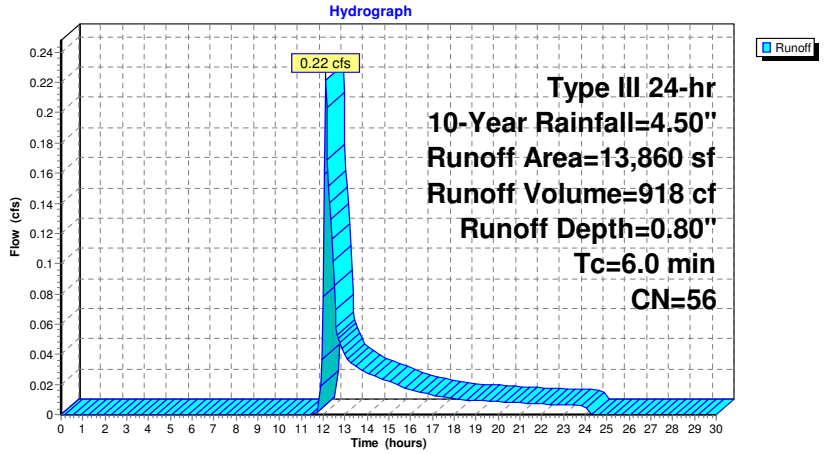
Runoff = 0.22 cfs @ 12.11 hrs, Volume= 918 cf, Depth= 0.80"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.50"

Area (sf)	CN	Description
7,297	39	>75% Grass cover, Good, HSG A
3,927	61	>75% Grass cover, Good, HSG B
2,447	98	Paved parking, HSG A
189	30	Woods, Good, HSG A
13,860	56	Weighted Average
11,413		82.34% Pervious Area
2,447		17.66% Impervious Area

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

Subcatchment P-5: Subcat P-5



Summary for Subcatchment P-7: Subcat P-7

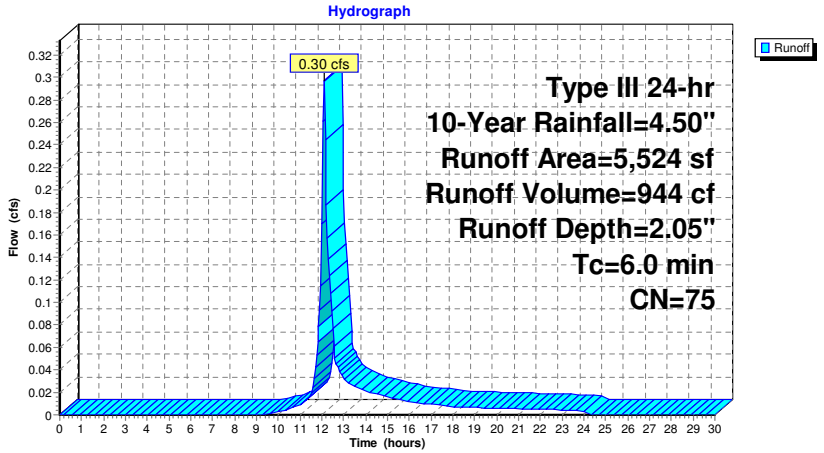
Runoff = 0.30 cfs @ 12.10 hrs, Volume= 944 cf, Depth= 2.05"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.50"

Area (sf)	CN	Description
2,121	39	>75% Grass cover, Good, HSG A
3,402	98	Paved parking, HSG A
5,524	75	Weighted Average
2,121		38.41% Pervious Area
3,402		61.59% Impervious Area

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

Subcatchment P-7: Subcat P-7



Summary for Subcatchment P-8: Subcat P-8

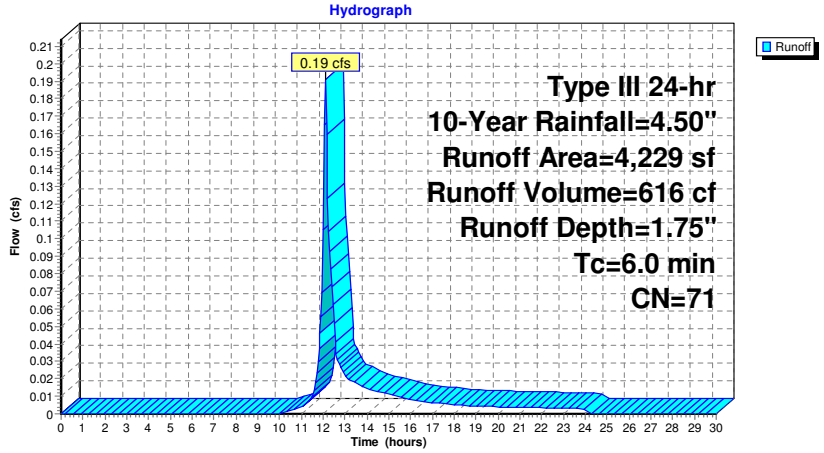
Runoff = 0.19 cfs @ 12.10 hrs, Volume= 616 cf, Depth= 1.75"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.50"

Area (sf)	CN	Description
1,911	39	>75% Grass cover, Good, HSG A
2,318	98	Paved parking, HSG A
4,229	71	Weighted Average
1,911		45.19% Pervious Area
2,318		54.81% Impervious Area

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

Subcatchment P-8: Subcat P-8



Summary for Subcatchment P-9: Subcat P-9

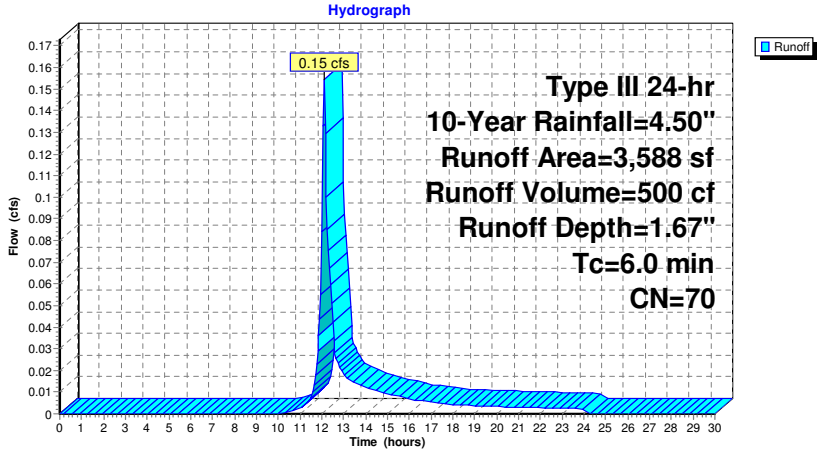
Runoff = 0.15 cfs @ 12.10 hrs, Volume= 500 cf, Depth= 1.67"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.50"

Area (sf)	CN	Description
1,687	39	>75% Grass cover, Good, HSG A
1,901	98	Paved parking, HSG A
3,588	70	Weighted Average
1,687		47.01% Pervious Area
1,901		52.99% Impervious Area

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

Subcatchment P-9: Subcat P-9



Summary for Pond DMH1: DMH1

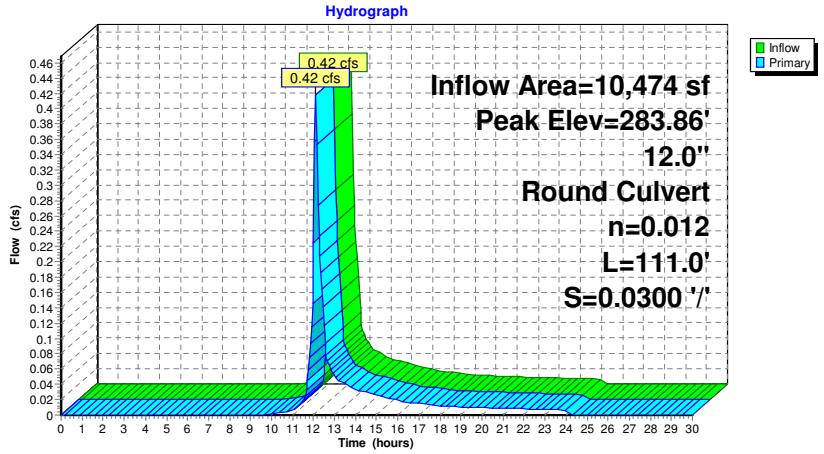
Inflow Area = 10,474 sf, 50.15% Impervious, Inflow Depth = 1.57" for 10-Year event
Inflow = 0.42 cfs @ 12.10 hrs, Volume= 1,375 cf
Outflow = 0.42 cfs @ 12.10 hrs, Volume= 1,375 cf, Atten= 0%, Lag= 0.0 min
Primary = 0.42 cfs @ 12.10 hrs, Volume= 1,375 cf

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Peak Elev= 283.86' @ 12.10 hrs
Flood Elev= 287.50'

Device	Routing	Invert	Outlet Devices
#1	Primary	283.50'	**12.0" Round Culvert** L= 111.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 283.50' / 280.17' S= 0.0300 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=0.42 cfs @ 12.10 hrs HW=283.86' (Free Discharge)
1=Culvert (Inlet Controls 0.42 cfs @ 1.62 fps)

Pond DMH1: DMH1



Summary for Pond DMH10: DMH10

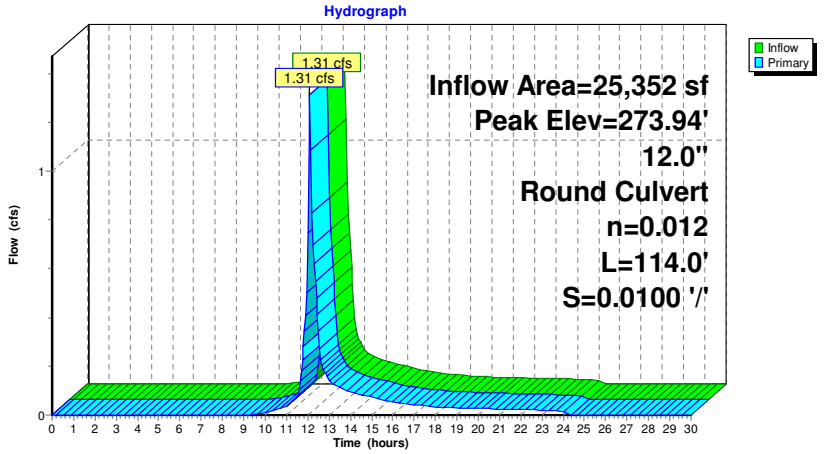
Inflow Area = 25,352 sf, 60.11% Impervious, Inflow Depth = 1.98" for 10-Year event
Inflow = 1.31 cfs @ 12.10 hrs, Volume= 4,191 cf
Outflow = 1.31 cfs @ 12.10 hrs, Volume= 4,191 cf, Atten= 0%, Lag= 0.0 min
Primary = 1.31 cfs @ 12.10 hrs, Volume= 4,191 cf

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Peak Elev= 273.94' @ 12.10 hrs
Flood Elev= 278.08'

Device	Routing	Invert	Outlet Devices
#1	Primary	273.24'	**12.0" Round Culvert** L= 114.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 273.24' / 272.10' S= 0.0100 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=1.30 cfs @ 12.10 hrs HW=273.93' (Free Discharge)
1=Culvert (Inlet Controls 1.30 cfs @ 2.24 fps)

Pond DMH10: DMH10



Summary for Pond DMH2: DMH2

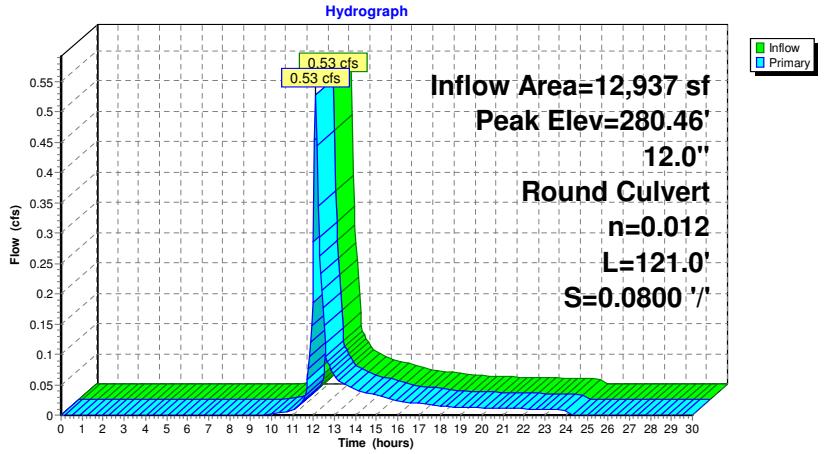
Inflow Area = 12,937 sf, 50.99% Impervious, Inflow Depth = 1.61" for 10-Year event
Inflow = 0.53 cfs @ 12.10 hrs, Volume= 1,732 cf
Outflow = 0.53 cfs @ 12.10 hrs, Volume= 1,732 cf, Atten= 0%, Lag= 0.0 min
Primary = 0.53 cfs @ 12.10 hrs, Volume= 1,732 cf

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Peak Elev= 280.46' @ 12.10 hrs
Flood Elev= 284.16'

Device	Routing	Invert	Outlet Devices
#1	Primary	280.05'	**12.0" Round Culvert** L= 121.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 280.05' / 270.37' S= 0.0800 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=0.53 cfs @ 12.10 hrs HW=280.46' (Free Discharge)
1=Culvert (Inlet Controls 0.53 cfs @ 1.73 fps)

Pond DMH2: DMH2



Summary for Pond DMH3: DMH3

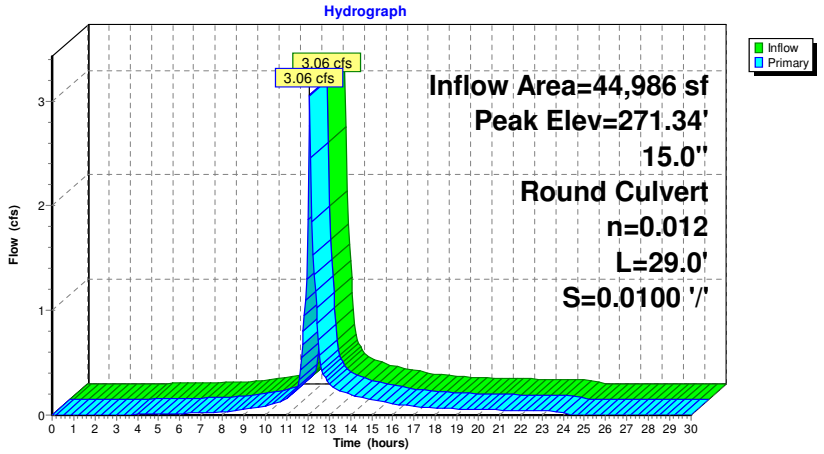
Inflow Area = 44,986 sf, 72.36% Impervious, Inflow Depth = 2.71" for 10-Year event
Inflow = 3.06 cfs @ 12.09 hrs, Volume= 10,156 cf
Outflow = 3.06 cfs @ 12.09 hrs, Volume= 10,156 cf, Atten= 0%, Lag= 0.0 min
Primary = 3.06 cfs @ 12.09 hrs, Volume= 10,156 cf

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Peak Elev= 271.34' @ 12.09 hrs
Flood Elev= 276.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	270.28'	**15.0" Round Culvert** L= 29.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 270.28' / 269.99' S= 0.0100 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 1.23 sf

Primary OutFlow Max=3.00 cfs @ 12.09 hrs HW=271.32' (Free Discharge)
1=Culvert (Inlet Controls 3.00 cfs @ 2.74 fps)

Pond DMH3: DMH3



Summary for Pond DMH4: DMH4

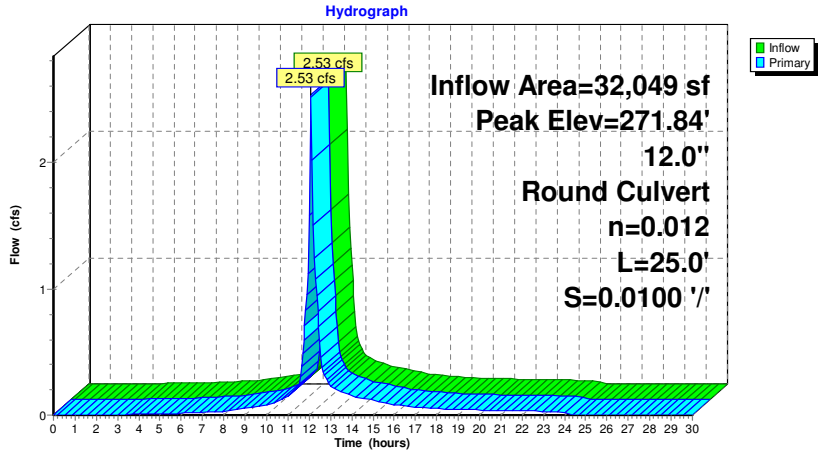
Inflow Area = 32,049 sf, 80.99% Impervious, Inflow Depth = 3.15" for 10-Year event
Inflow = 2.53 cfs @ 12.09 hrs, Volume= 8,424 cf
Outflow = 2.53 cfs @ 12.09 hrs, Volume= 8,424 cf, Atten= 0%, Lag= 0.0 min
Primary = 2.53 cfs @ 12.09 hrs, Volume= 8,424 cf

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Peak Elev= 271.84' @ 12.09 hrs
Flood Elev= 275.50'

Device	Routing	Invert	Outlet Devices
#1	Primary	270.62'	**12.0" Round Culvert** L= 25.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 270.62' / 270.37' S= 0.0100 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=2.48 cfs @ 12.09 hrs HW=271.81' (Free Discharge)
1=Culvert (Inlet Controls 2.48 cfs @ 3.15 fps)

Pond DMH4: DMH4



Summary for Pond DMH5: DMH5

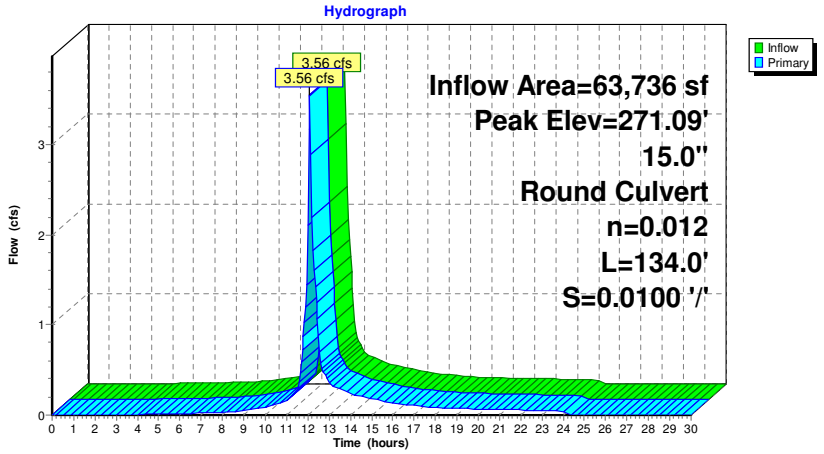
Inflow Area = 63,736 sf, 59.81% Impervious, Inflow Depth = 2.25" for 10-Year event
Inflow = 3.56 cfs @ 12.09 hrs, Volume= 11,975 cf
Outflow = 3.56 cfs @ 12.09 hrs, Volume= 11,975 cf, Atten= 0%, Lag= 0.0 min
Primary = 3.56 cfs @ 12.09 hrs, Volume= 11,975 cf

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Peak Elev= 271.09' @ 12.09 hrs
Flood Elev= 275.40'

Device	Routing	Invert	Outlet Devices
#1	Primary	269.89'	**15.0" Round Culvert** L= 134.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 269.89' / 268.55' S= 0.0100 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 1.23 sf

Primary OutFlow Max=3.51 cfs @ 12.09 hrs HW=271.07' (Free Discharge)
1=Culvert (Inlet Controls 3.51 cfs @ 2.92 fps)

Pond DMH5: DMH5



Summary for Pond DMH6: DMH6

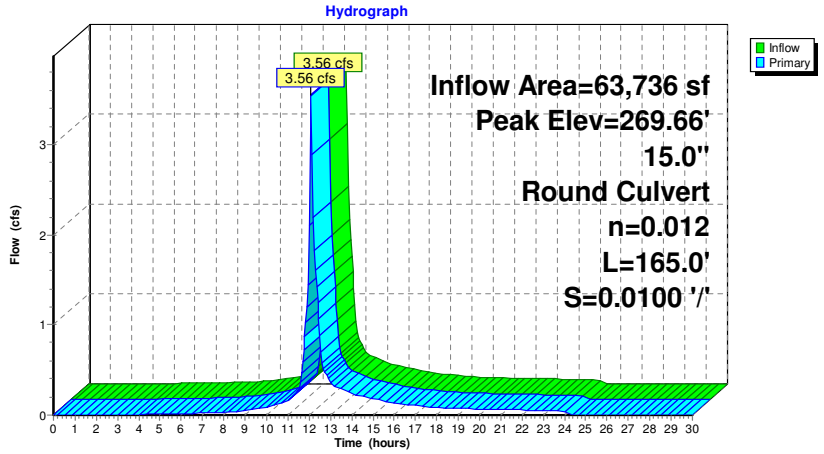
Inflow Area = 63,736 sf, 59.81% Impervious, Inflow Depth = 2.25" for 10-Year event
Inflow = 3.56 cfs @ 12.09 hrs, Volume= 11,975 cf
Outflow = 3.56 cfs @ 12.09 hrs, Volume= 11,975 cf, Atten= 0%, Lag= 0.0 min
Primary = 3.56 cfs @ 12.09 hrs, Volume= 11,975 cf

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Peak Elev= 269.66' @ 12.09 hrs
Flood Elev= 273.80'

Device	Routing	Invert	Outlet Devices
#1	Primary	268.46'	**15.0" Round Culvert** L= 165.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 268.46' / 266.81' S= 0.0100 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 1.23 sf

Primary OutFlow Max=3.51 cfs @ 12.09 hrs HW=269.64' (Free Discharge)
1=Culvert (Inlet Controls 3.51 cfs @ 2.92 fps)

Pond DMH6: DMH6



Summary for Pond DMH7: DMH7

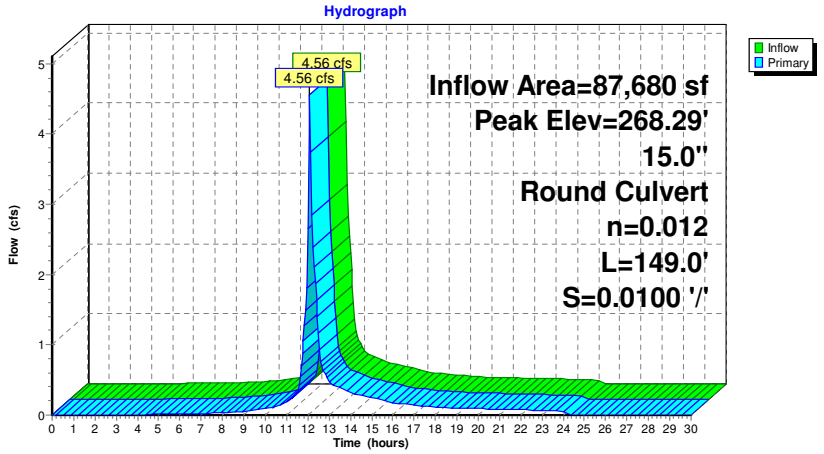
Inflow Area = 87,680 sf, 57.42% Impervious, Inflow Depth = 2.09" for 10-Year event
Inflow = 4.56 cfs @ 12.09 hrs, Volume= 15,244 cf
Outflow = 4.56 cfs @ 12.09 hrs, Volume= 15,244 cf, Atten= 0%, Lag= 0.0 min
Primary = 4.56 cfs @ 12.09 hrs, Volume= 15,244 cf

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Peak Elev= 268.29' @ 12.09 hrs
Flood Elev= 270.85'

Device	Routing	Invert	Outlet Devices
#1	Primary	266.71'	**15.0" Round Culvert** L= 149.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 266.71' / 265.22' S= 0.0100 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 1.23 sf

Primary OutFlow Max=4.49 cfs @ 12.09 hrs HW=268.26' (Free Discharge)
1=Culvert (Inlet Controls 4.49 cfs @ 3.66 fps)

Pond DMH7: DMH7



Summary for Pond DMH8: DMH8

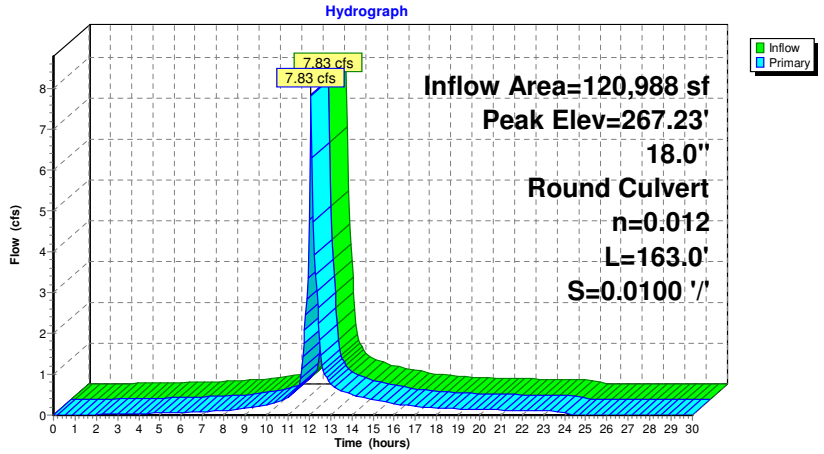
Inflow Area = 120,988 sf, 69.14% Impervious, Inflow Depth = 2.69" for 10-Year event
Inflow = 7.83 cfs @ 12.09 hrs, Volume= 27,079 cf
Outflow = 7.83 cfs @ 12.09 hrs, Volume= 27,079 cf, Atten= 0%, Lag= 0.0 min
Primary = 7.83 cfs @ 12.09 hrs, Volume= 27,079 cf

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Peak Elev= 267.23' @ 12.09 hrs
Flood Elev= 269.88'

Device	Routing	Invert	Outlet Devices
#1	Primary	265.12'	**18.0" Round Culvert** L= 163.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 265.12' / 263.49' S= 0.0100 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 1.77 sf

Primary OutFlow Max=7.68 cfs @ 12.09 hrs HW=267.18' (Free Discharge)
1=Culvert (Inlet Controls 7.68 cfs @ 4.34 fps)

Pond DMH8: DMH8



Summary for Pond DMH9: DMH9

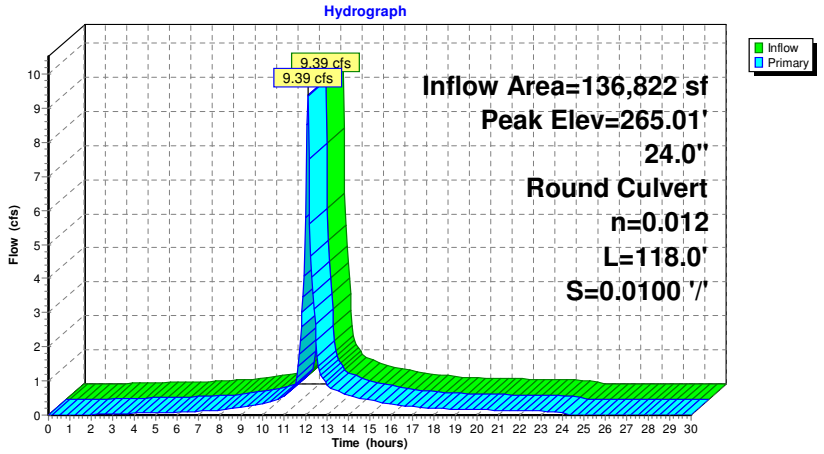
Inflow Area = 136,822 sf, 72.71% Impervious, Inflow Depth = 2.87" for 10-Year event
Inflow = 9.39 cfs @ 12.09 hrs, Volume= 32,706 cf
Outflow = 9.39 cfs @ 12.09 hrs, Volume= 32,706 cf, Atten= 0%, Lag= 0.0 min
Primary = 9.39 cfs @ 12.09 hrs, Volume= 32,706 cf

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Peak Elev= 265.01' @ 12.09 hrs
Flood Elev= 268.83'

Device	Routing	Invert	Outlet Devices
#1	Primary	263.38'	**24.0" Round Culvert** L= 118.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 263.38' / 262.20' S= 0.0100 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 3.14 sf

Primary OutFlow Max=9.19 cfs @ 12.09 hrs HW=264.98' (Free Discharge)
1=Culvert (Inlet Controls 9.19 cfs @ 3.40 fps)

Pond DMH9: DMH9



Summary for Pond DP1: Pond #1

Inflow Area = 49,841 sf, 50.39% Impervious, Inflow Depth = 1.79" for 10-Year event
Inflow = 2.29 cfs @ 12.09 hrs, Volume= 7,451 cf
Outflow = 0.13 cfs @ 14.69 hrs, Volume= 7,223 cf, Atten= 94%, Lag= 155.5 min
Discarded = 0.13 cfs @ 14.69 hrs, Volume= 7,223 cf
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Peak Elev= 272.46' @ 14.69 hrs Surf.Area= 2,339 sf Storage= 3,825 cf
Flood Elev= 275.00' Surf.Area= 4,336 sf Storage= 12,246 cf

Plug-Flow detention time= 342.3 min calculated for 7,211 cf (97% of inflow)
Center-of-Mass det. time= 325.0 min (1,154.6 - 829.6)

Volume	Invert	Avail.Storage	Storage Description
#1	270.00'	12,246 cf	**Custom Stage Data (Conic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
270.00	878	0	0	878
271.00	1,400	1,129	1,129	1,413
272.00	2,026	1,703	2,832	2,056
273.00	2,742	2,375	5,207	2,793
274.00	3,515	3,121	8,328	3,591
275.00	4,336	3,918	12,246	4,441

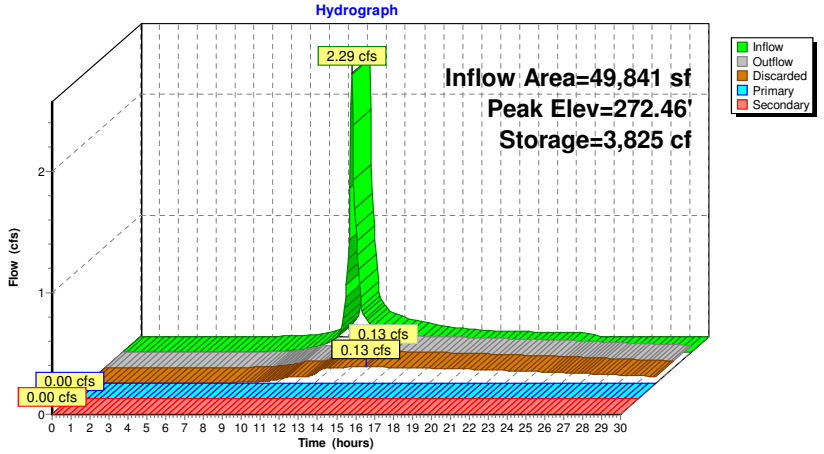
Device	Routing	Invert	Outlet Devices
#1	Primary	270.28'	**12.0" Round Culvert** L= 116.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 270.28' / 269.12' S= 0.0100 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 0.79 sf
#2	Device 1	273.80'	**24.0" x 24.0" Horiz. Top Grate** C= 0.600 in 24.0" x 24.0" Grate (100% open area) Limited to weir flow at low heads
#3	Secondary	274.50'	**10.0' long x 10.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.49 2.56 2.70 2.69 2.68 2.69 2.67 2.64
#4	Discarded	270.00'	**2.410 in/hr Exfiltration over Wetted area**

Discarded OutFlow Max=0.13 cfs @ 14.69 hrs HW=272.46' (Free Discharge)
└**4=Exfiltration** (Exfiltration Controls 0.13 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=270.00' (Free Discharge)
└**1=Culvert** (Controls 0.00 cfs)
└**2=Top Grate** (Controls 0.00 cfs)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=270.00' (Free Discharge)
└**3=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond DP1: Pond #1



Summary for Pond DP2: Pond #2

Inflow Area = 174,663 sf, 72.49% Impervious, Inflow Depth = 2.49" for 10-Year event
Inflow = 10.00 cfs @ 12.09 hrs, Volume= 36,282 cf
Outflow = 0.59 cfs @ 13.82 hrs, Volume= 32,724 cf, Atten= 94%, Lag= 104.2 min
Discarded = 0.46 cfs @ 13.82 hrs, Volume= 30,785 cf
Primary = 0.13 cfs @ 13.82 hrs, Volume= 1,940 cf
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Peak Elev= 268.24' @ 13.82 hrs Surf.Area= 8,156 sf Storage= 18,925 cf
Flood Elev= 270.00' Surf.Area= 11,000 sf Storage= 35,778 cf

Plug-Flow detention time= 361.6 min calculated for 32,670 cf (90% of inflow)
Center-of-Mass det. time= 312.7 min (1,064.3 - 751.6)

Volume	Invert	Avail.Storage	Storage Description
#1	265.00'	35,778 cf	**Custom Stage Data (Conic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
265.00	3,792	0	0	3,792
266.00	4,968	4,367	4,367	4,991
267.00	6,299	5,620	9,987	6,348
268.00	7,785	7,029	17,016	7,864
269.00	9,393	8,576	25,592	9,505
270.00	11,000	10,186	35,778	11,151

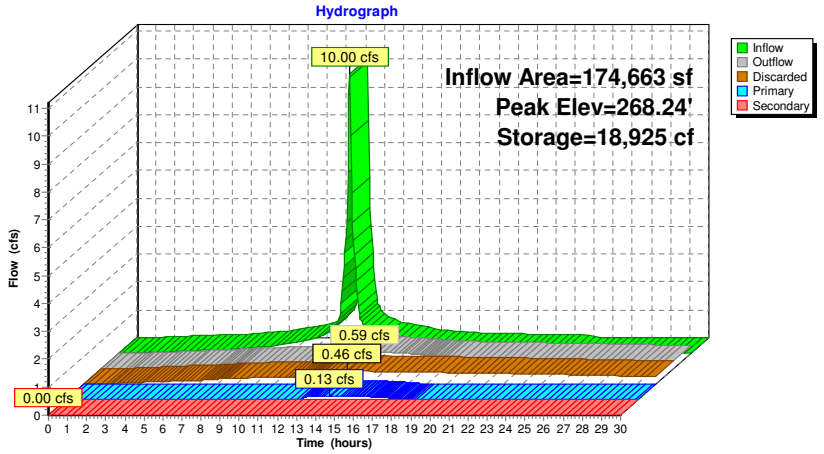
Device	Routing	Invert	Outlet Devices
#1	Primary	265.00'	**12.0" Round Culvert** L= 23.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 265.00' / 264.77' S= 0.0100 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 0.79 sf
#2	Device 1	267.80'	**3.0" Vert. Orifice** C= 0.600
#3	Device 1	269.40'	**24.0" x 24.0" Horiz. Top Grate** C= 0.600 in 24.0" x 24.0" Grate (100% open area) Limited to weir flow at low heads
#4	Secondary	269.50'	**10.0' long x 10.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.49 2.56 2.70 2.69 2.68 2.69 2.67 2.64
#5	Discarded	265.00'	**2.410 in/hr Exfiltration over Wetted area**

Discarded OutFlow Max=0.46 cfs @ 13.82 hrs HW=268.24' (Free Discharge)
└**5=Exfiltration** (Exfiltration Controls 0.46 cfs)

Primary OutFlow Max=0.13 cfs @ 13.82 hrs HW=268.24' (Free Discharge)
└**1=Culvert** (Passes 0.13 cfs of 4.94 cfs potential flow)
  └**2=Orifice** (Orifice Controls 0.13 cfs @ 2.70 fps)
  └**3=Top Grate** (Controls 0.00 cfs)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=265.00' (Free Discharge)
└**4=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond DP2: Pond #2



Summary for Pond DP3: Pond #3

Inflow Area = 247,761 sf, 71.90% Impervious, Inflow Depth = 2.95" for 10-Year event
Inflow = 17.13 cfs @ 12.09 hrs, Volume= 60,984 cf
Outflow = 0.88 cfs @ 14.49 hrs, Volume= 56,060 cf, Atten= 95%, Lag= 144.3 min
Discarded = 0.68 cfs @ 14.49 hrs, Volume= 48,773 cf
Primary = 0.20 cfs @ 14.49 hrs, Volume= 7,286 cf
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Peak Elev= 258.15' @ 14.49 hrs Surf.Area= 12,010 sf Storage= 31,261 cf
Flood Elev= 260.00' Surf.Area= 14,828 sf Storage= 55,948 cf

Plug-Flow detention time= 357.4 min calculated for 55,966 cf (92% of inflow)
Center-of-Mass det. time= 314.9 min (1,084.4 - 769.5)

Volume	Invert	Avail.Storage	Storage Description
#1	255.00'	55,948 cf	**Custom Stage Data (Conic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
255.00	7,916	0	0	7,916
256.00	9,155	8,528	8,528	9,197
257.00	10,449	9,795	18,323	10,538
258.00	11,800	11,118	29,441	11,940
259.00	13,208	12,497	41,938	13,403
260.00	14,828	14,010	55,948	15,076

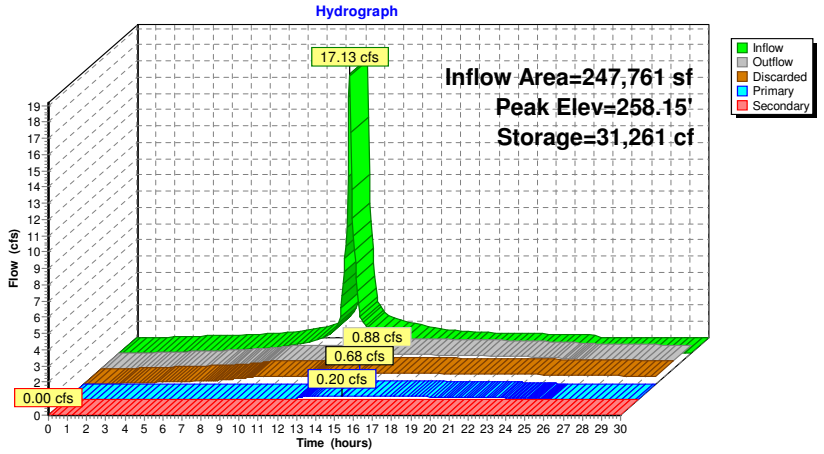
Device	Routing	Invert	Outlet Devices
#1	Primary	255.00'	**12.0" Round Culvert** L= 38.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 255.00' / 254.62' S= 0.0100 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 0.79 sf
#2	Device 1	256.50'	**2.5" Vert. Orifice** C= 0.600
#3	Device 1	259.80'	**24.0" x 24.0" Horiz. Top Grate** C= 0.600 in 24.0" x 24.0" Grate (100% open area) Limited to weir flow at low heads
#4	Secondary	259.90'	**10.0' long x 10.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.49 2.56 2.70 2.69 2.68 2.69 2.67 2.64
#5	Discarded	255.00'	**2.410 in/hr Exfiltration over Wetted area**

Discarded OutFlow Max=0.68 cfs @ 14.49 hrs HW=258.15' (Free Discharge)
└**5=Exfiltration** (Exfiltration Controls 0.68 cfs)

Primary OutFlow Max=0.20 cfs @ 14.49 hrs HW=258.15' (Free Discharge)
└**1=Culvert** (Passes 0.20 cfs of 4.86 cfs potential flow)
  └**2=Orifice** (Orifice Controls 0.20 cfs @ 5.99 fps)
  └**3=Top Grate** (Controls 0.00 cfs)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=255.00' (Free Discharge)
└**4=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond DP3: Pond #3



Summary for Pond WQU1: WQU1

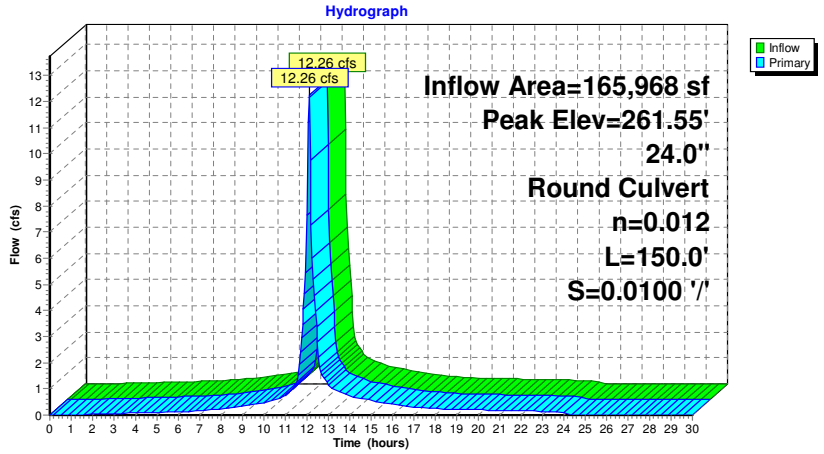
Inflow Area = 165,968 sf, 77.51% Impervious, Inflow Depth = 3.11" for 10-Year event
Inflow = 12.26 cfs @ 12.09 hrs, Volume= 43,062 cf
Outflow = 12.26 cfs @ 12.09 hrs, Volume= 43,062 cf, Atten= 0%, Lag= 0.0 min
Primary = 12.26 cfs @ 12.09 hrs, Volume= 43,062 cf

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Peak Elev= 261.55' @ 12.09 hrs
Flood Elev= 268.90'

Device	Routing	Invert	Outlet Devices
#1	Primary	259.50'	**24.0" Round Culvert** L= 150.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 259.50' / 258.00' S= 0.0100 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 3.14 sf

Primary OutFlow Max=11.96 cfs @ 12.09 hrs HW=261.50' (Free Discharge)
1=Culvert (Inlet Controls 11.96 cfs @ 3.81 fps)

Pond WQU1: WQU1



Summary for Pond WQU2: WQU2

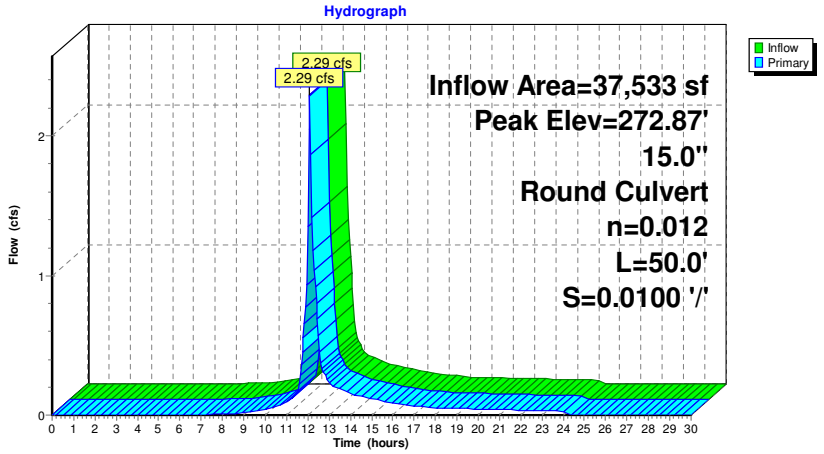
Inflow Area = 37,533 sf, 66.78% Impervious, Inflow Depth = 2.35" for 10-Year event
Inflow = 2.29 cfs @ 12.09 hrs, Volume= 7,337 cf
Outflow = 2.29 cfs @ 12.09 hrs, Volume= 7,337 cf, Atten= 0%, Lag= 0.0 min
Primary = 2.29 cfs @ 12.09 hrs, Volume= 7,337 cf

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Peak Elev= 272.87' @ 12.09 hrs
Flood Elev= 275.35'

Device	Routing	Invert	Outlet Devices
#1	Primary	272.00'	**15.0" Round Culvert** L= 50.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 272.00' / 271.50' S= 0.0100 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 1.23 sf

Primary OutFlow Max=2.26 cfs @ 12.09 hrs HW=272.86' (Free Discharge)
1=Culvert (Inlet Controls 2.26 cfs @ 2.50 fps)

Pond WQU2: WQU2

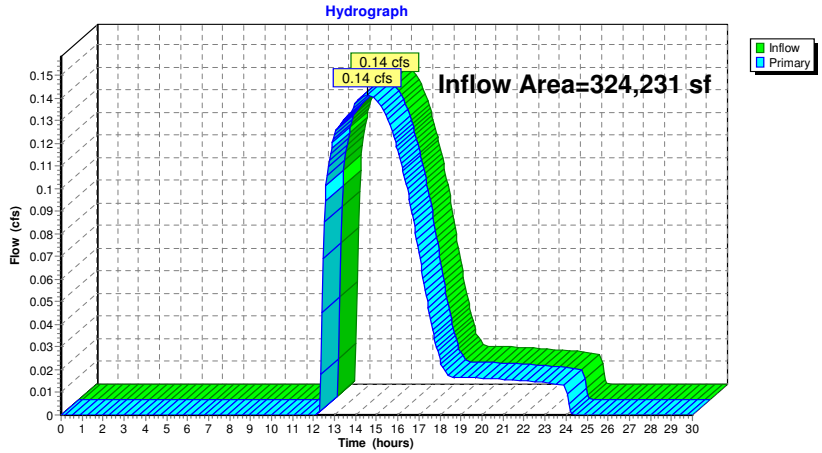


Summary for Link SP-1: Study Point #1

Inflow Area = 324,231 sf, 39.05% Impervious, Inflow Depth = 0.09" for 10-Year event
Inflow = 0.14 cfs @ 14.56 hrs, Volume= 2,534 cf
Primary = 0.14 cfs @ 14.56 hrs, Volume= 2,534 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs

Link SP-1: Study Point #1

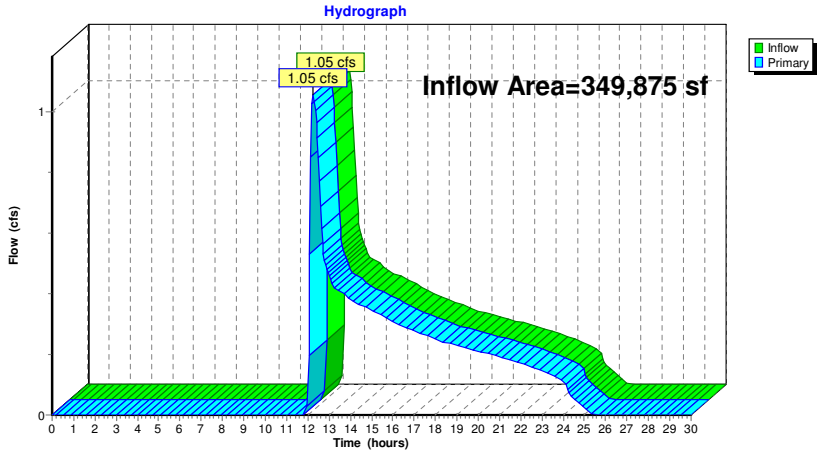


Summary for Link SP-2: Study Point #2

Inflow Area = 349,875 sf, 50.91% Impervious, Inflow Depth = 0.44" for 10-Year event
Inflow = 1.05 cfs @ 12.25 hrs, Volume= 12,742 cf
Primary = 1.05 cfs @ 12.25 hrs, Volume= 12,742 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs

Link SP-2: Study Point #2



Summary for Subcatchment P-1: Subcat P-1

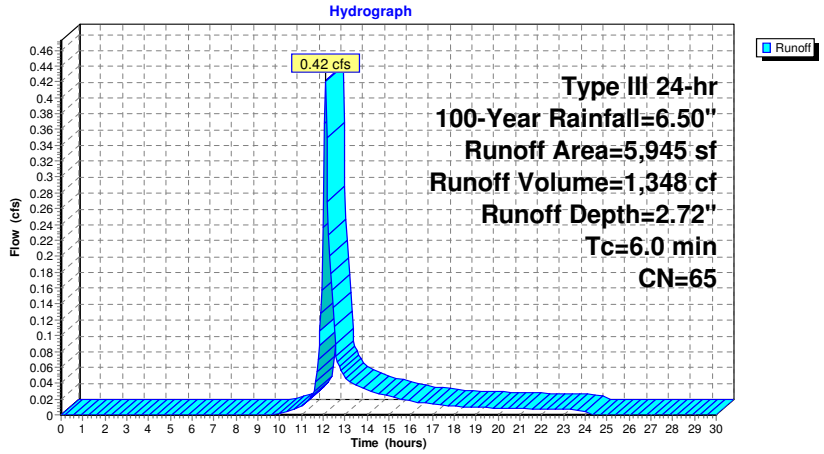
Runoff = 0.42 cfs @ 12.10 hrs, Volume= 1,348 cf, Depth= 2.72"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=6.50"

Area (sf)	CN	Description
3,307	39	>75% Grass cover, Good, HSG A
2,637	98	Paved parking, HSG A
5,945	65	Weighted Average
3,307		55.63% Pervious Area
2,637		44.37% Impervious Area

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

Subcatchment P-1: Subcat P-1



Summary for Subcatchment P-10: Subcat P-10

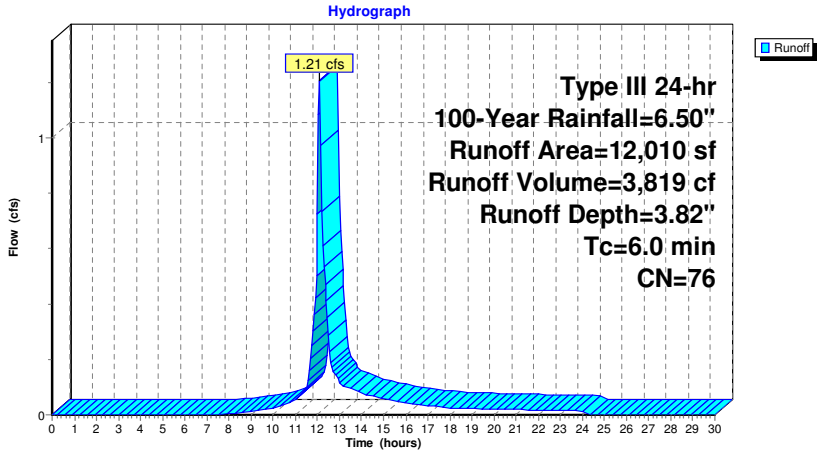
Runoff = 1.21 cfs @ 12.09 hrs, Volume= 3,819 cf, Depth= 3.82"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=6.50"

Area (sf)	CN	Description
4,394	39	>75% Grass cover, Good, HSG A
7,616	98	Paved parking, HSG A
12,010	76	Weighted Average
4,394		36.58% Pervious Area
7,616		63.42% Impervious Area

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

Subcatchment P-10: Subcat P-10



Summary for Subcatchment P-11: Subcat P-11

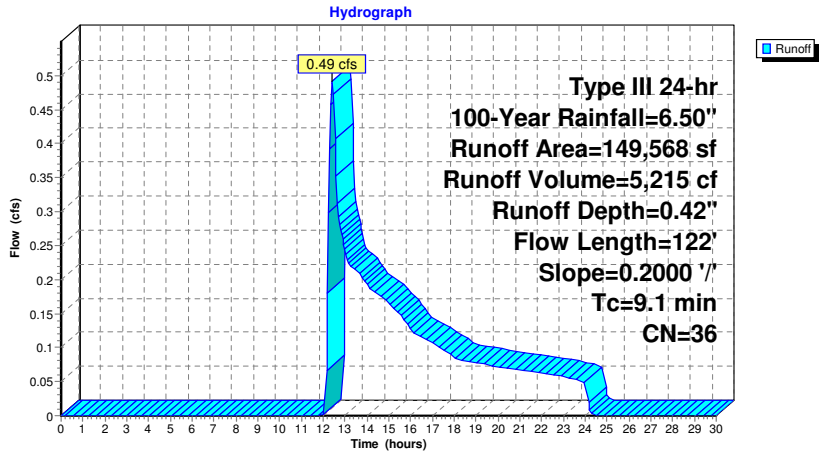
Runoff = 0.49 cfs @ 12.42 hrs, Volume= 5,215 cf, Depth= 0.42"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=6.50"

Area (sf)	CN	Description
35,319	39	>75% Grass cover, Good, HSG A
93,727	30	Woods, Good, HSG A
20,521	55	Woods, Good, HSG B
149,568	36	Weighted Average
149,568		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.6	50	0.2000	0.10		**Sheet Flow,** Woods: Dense underbrush n= 0.800 P2= 3.16"
0.5	72	0.2000	2.24		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
9.1	122	Total			

Subcatchment P-11: Subcat P-11



Summary for Subcatchment P-12: Subcat P-12

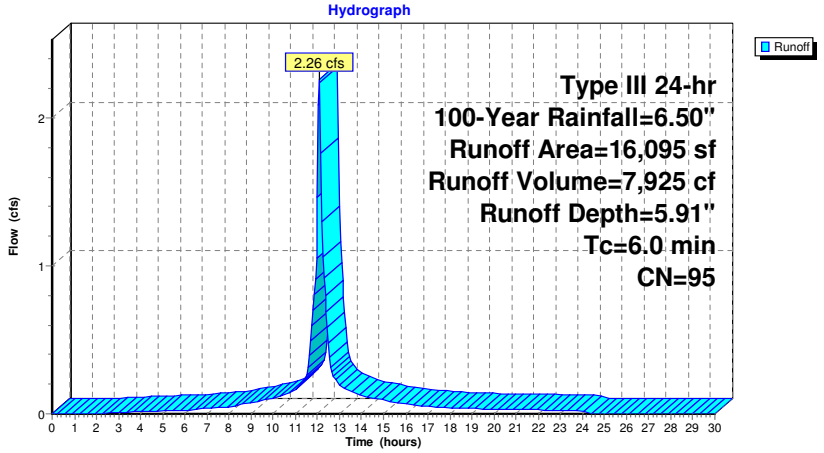
Runoff = 2.26 cfs @ 12.09 hrs, Volume= 7,925 cf, Depth= 5.91"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=6.50"

Area (sf)	CN	Description
949	39	>75% Grass cover, Good, HSG A
15,146	98	Paved parking, HSG A
16,095	95	Weighted Average
949		5.90% Pervious Area
15,146		94.10% Impervious Area

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

Subcatchment P-12: Subcat P-12



Summary for Subcatchment P-13: Subcat P-13

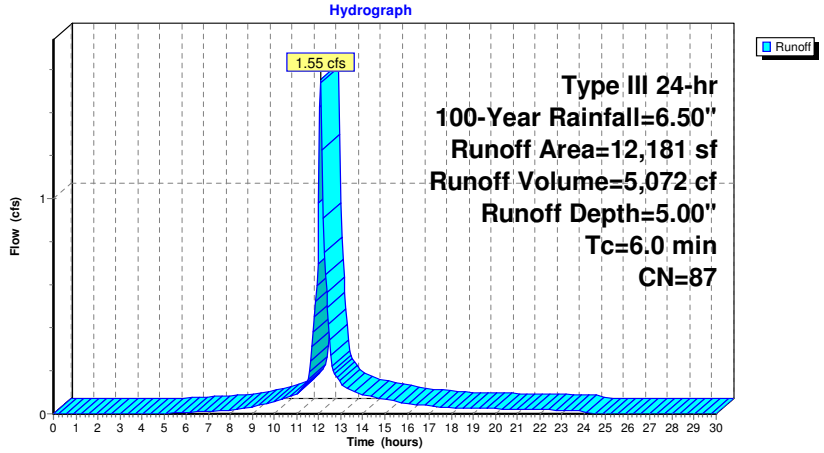
Runoff = 1.55 cfs @ 12.09 hrs, Volume= 5,072 cf, Depth= 5.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=6.50"

Area (sf)	CN	Description
2,356	39	>75% Grass cover, Good, HSG A
9,825	98	Paved parking, HSG A
12,181	87	Weighted Average
2,356		19.34% Pervious Area
9,825		80.66% Impervious Area

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

Subcatchment P-13: Subcat P-13



Summary for Subcatchment P-14: Subcat P-14

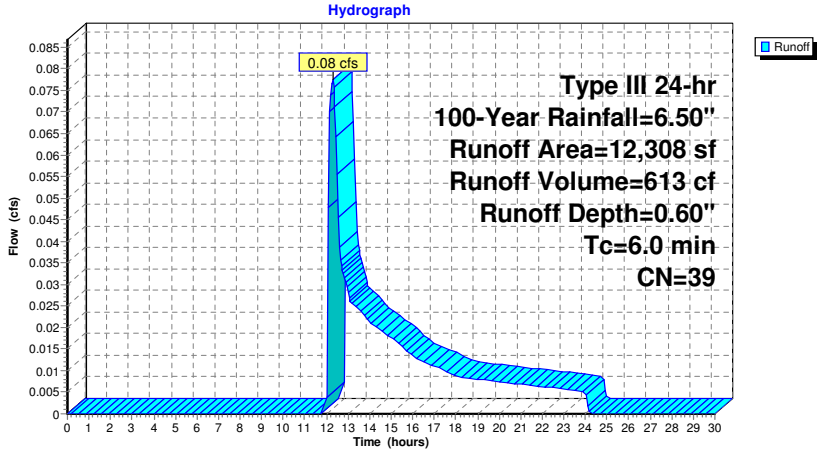
Runoff = 0.08 cfs @ 12.29 hrs, Volume= 613 cf, Depth= 0.60"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=6.50"

Area (sf)	CN	Description
12,257	39	>75% Grass cover, Good, HSG A
51	98	Paved parking, HSG A
12,308	39	Weighted Average
12,257		99.59% Pervious Area
51		0.41% Impervious Area

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

Subcatchment P-14: Subcat P-14



Summary for Subcatchment P-15A: Subcat P-15A

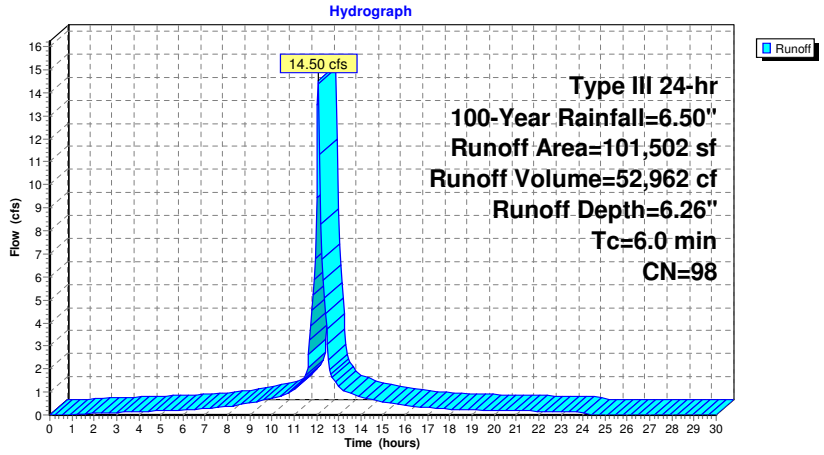
Runoff = 14.50 cfs @ 12.09 hrs, Volume= 52,962 cf, Depth= 6.26"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=6.50"

Area (sf)	CN	Description
101,502	98	Roofs, HSG A
101,502		100.00% Impervious Area

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

Subcatchment P-15A: Subcat P-15A



Summary for Subcatchment P-15B: Subcat P-15B

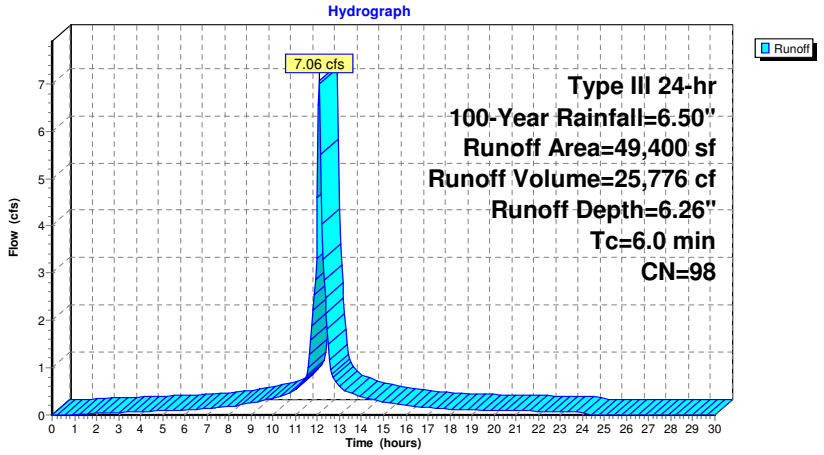
Runoff = 7.06 cfs @ 12.09 hrs, Volume= 25,776 cf, Depth= 6.26"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=6.50"

Area (sf)	CN	Description
49,400	98	Roofs, HSG A
49,400		100.00% Impervious Area

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

Subcatchment P-15B: Subcat P-15B



Summary for Subcatchment P-16: Subcat P-16

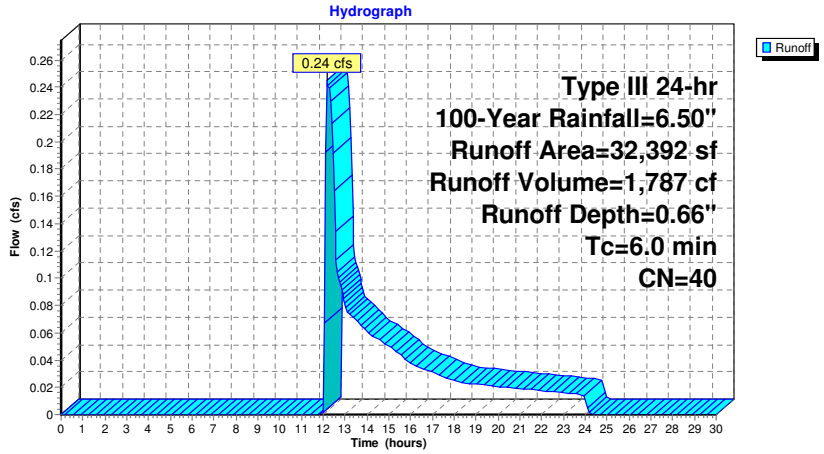
Runoff = 0.24 cfs @ 12.15 hrs, Volume= 1,787 cf, Depth= 0.66"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=6.50"

Area (sf)	CN	Description
31,821	39	>75% Grass cover, Good, HSG A
472	61	>75% Grass cover, Good, HSG B
99	98	Paved parking, HSG A
1	98	Paved parking, HSG B
32,392	40	Weighted Average
32,292		99.69% Pervious Area
100		0.31% Impervious Area

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

Subcatchment P-16: Subcat P-16



Summary for Subcatchment P-17: Subcat P-17

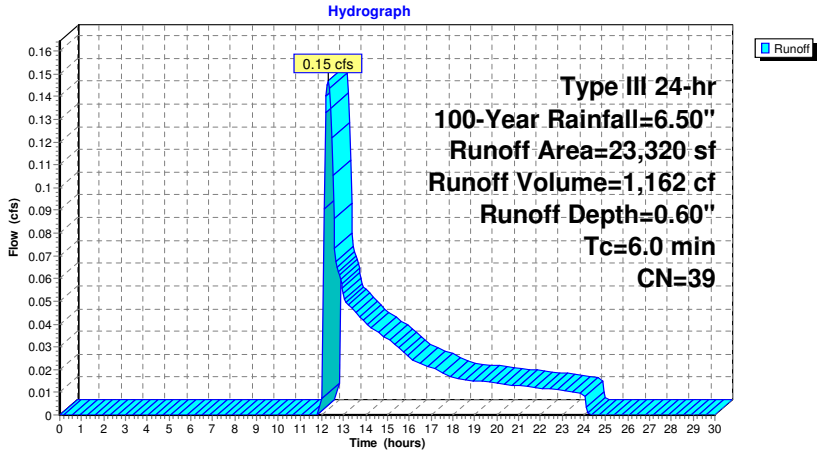
Runoff = 0.15 cfs @ 12.29 hrs, Volume= 1,162 cf, Depth= 0.60"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=6.50"

Area (sf)	CN	Description
23,320	39	>75% Grass cover, Good, HSG A
23,320		100.00% Pervious Area

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

Subcatchment P-17: Subcat P-17



Summary for Subcatchment P-18: Subcat P-18

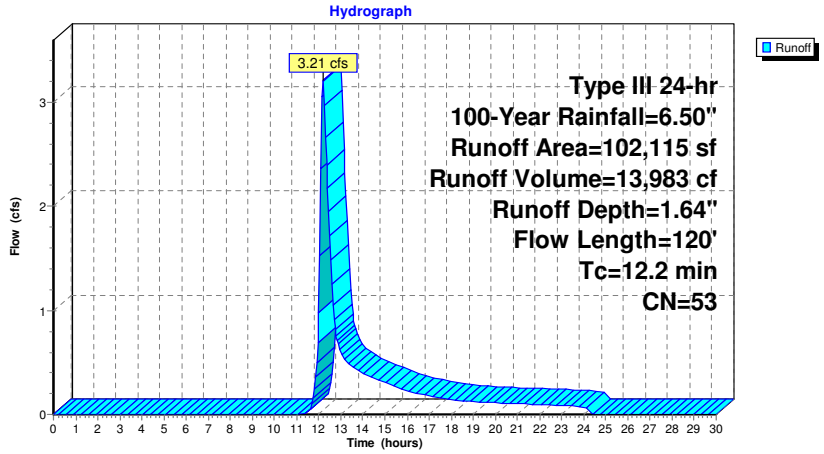
Runoff = 3.21 cfs @ 12.19 hrs, Volume= 13,983 cf, Depth= 1.64"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=6.50"

Area (sf)	CN	Description
23,317	39	>75% Grass cover, Good, HSG A
41,898	61	>75% Grass cover, Good, HSG B
5,189	30	Woods, Good, HSG A
31,710	55	Woods, Good, HSG B
102,115	53	Weighted Average
102,115		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.4	50	0.1000	0.07		**Sheet Flow,** Woods: Dense underbrush n= 0.800 P2= 3.16"
0.8	70	0.0800	1.41		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
12.2	120	Total			

Subcatchment P-18: Subcat P-18



Summary for Subcatchment P-19: Subcat P-19

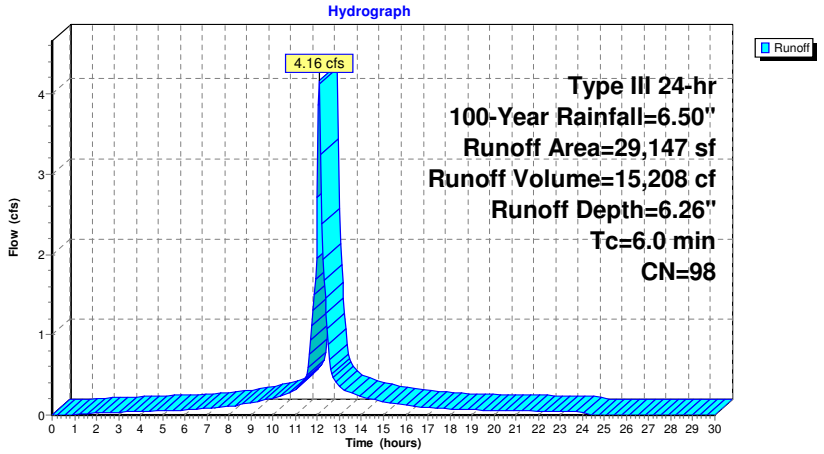
Runoff = 4.16 cfs @ 12.09 hrs, Volume= 15,208 cf, Depth= 6.26"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=6.50"

Area (sf)	CN	Description
28,117	98	Paved parking, HSG A
1,030	98	Paved parking, HSG B
29,147	98	Weighted Average
29,147		100.00% Impervious Area

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

Subcatchment P-19: Subcat P-19



Summary for Subcatchment P-2: Subcat P-2

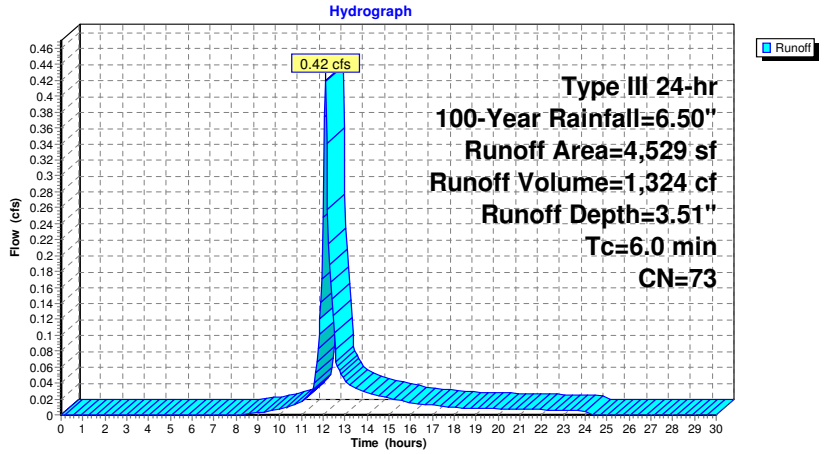
Runoff = 0.42 cfs @ 12.09 hrs, Volume= 1,324 cf, Depth= 3.51"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=6.50"

Area (sf)	CN	Description
1,914	39	>75% Grass cover, Good, HSG A
2,615	98	Paved parking, HSG A
4,529	73	Weighted Average
1,914		42.26% Pervious Area
2,615		57.74% Impervious Area

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

Subcatchment P-2: Subcat P-2



Summary for Subcatchment P-20: Subcat P-20

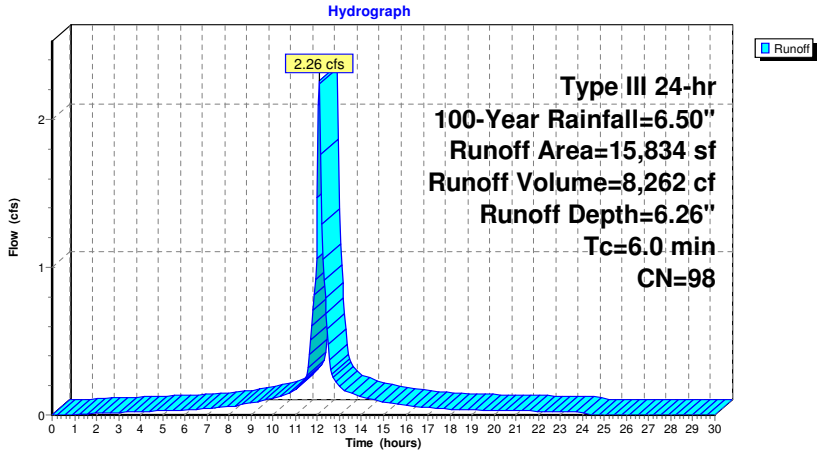
Runoff = 2.26 cfs @ 12.09 hrs, Volume= 8,262 cf, Depth= 6.26"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=6.50"

Area (sf)	CN	Description
15,834	98	Paved parking, HSG A
15,834		100.00% Impervious Area

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

Subcatchment P-20: Subcat P-20



Summary for Subcatchment P-21: Subcat P-21

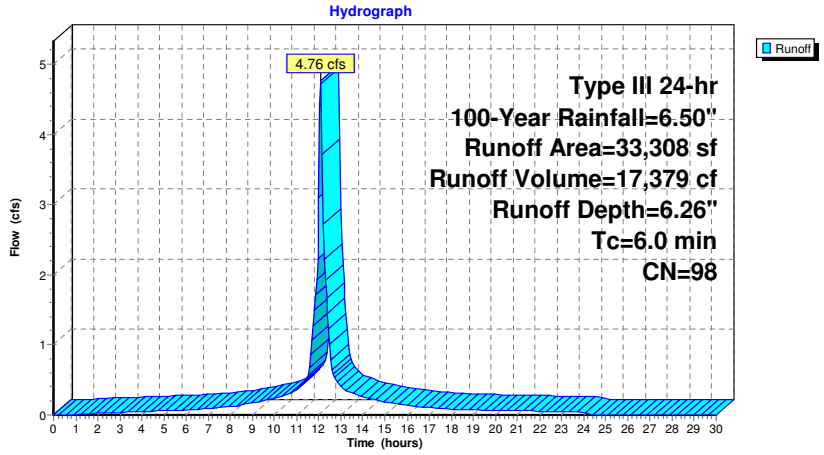
Runoff = 4.76 cfs @ 12.09 hrs, Volume= 17,379 cf, Depth= 6.26"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=6.50"

Area (sf)	CN	Description
33,308	98	Paved parking, HSG A
33,308		100.00% Impervious Area

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

Subcatchment P-21: Subcat P-21



Summary for Subcatchment P-22: Subcat P-22

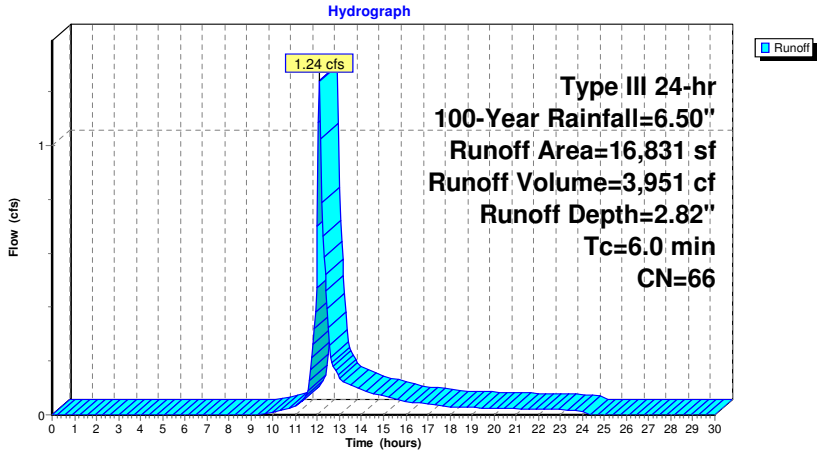
Runoff = 1.24 cfs @ 12.10 hrs, Volume= 3,951 cf, Depth= 2.82"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=6.50"

Area (sf)	CN	Description
9,035	39	>75% Grass cover, Good, HSG A
7,796	98	Paved parking, HSG A
16,831	66	Weighted Average
9,035		53.68% Pervious Area
7,796		46.32% Impervious Area

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

Subcatchment P-22: Subcat P-22



Summary for Subcatchment P-23: Subcat P-23

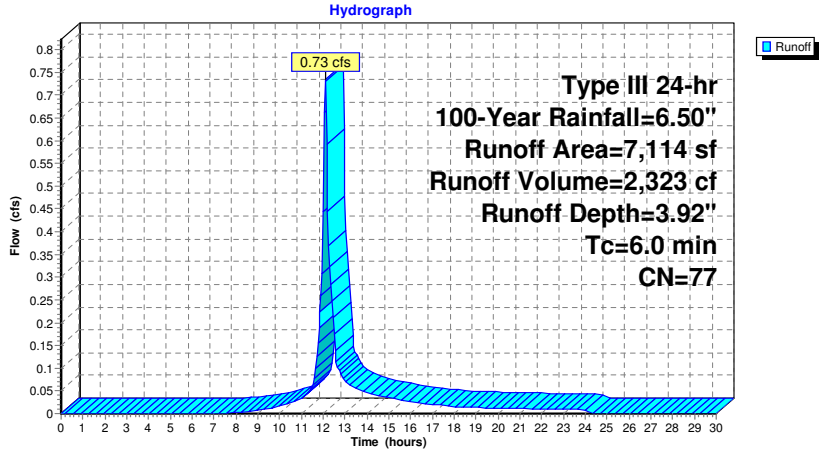
Runoff = 0.73 cfs @ 12.09 hrs, Volume= 2,323 cf, Depth= 3.92"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=6.50"

Area (sf)	CN	Description
2,239	39	>75% Grass cover, Good, HSG A
448	61	>75% Grass cover, Good, HSG B
4,427	98	Paved parking, HSG A
7,114	77	Weighted Average
2,687		37.77% Pervious Area
4,427		62.23% Impervious Area

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

Subcatchment P-23: Subcat P-23



Summary for Subcatchment P-24: Subcat P-24

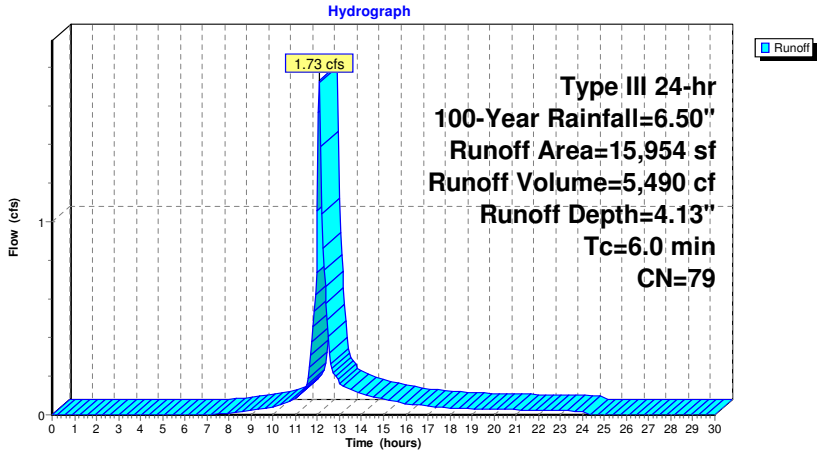
Runoff = 1.73 cfs @ 12.09 hrs, Volume= 5,490 cf, Depth= 4.13"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=6.50"

Area (sf)	CN	Description
5,144	39	>75% Grass cover, Good, HSG A
10,810	98	Paved parking, HSG A
15,954	79	Weighted Average
5,144		32.24% Pervious Area
10,810		67.76% Impervious Area

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

Subcatchment P-24: Subcat P-24



Summary for Subcatchment P-25: Subcat P-25

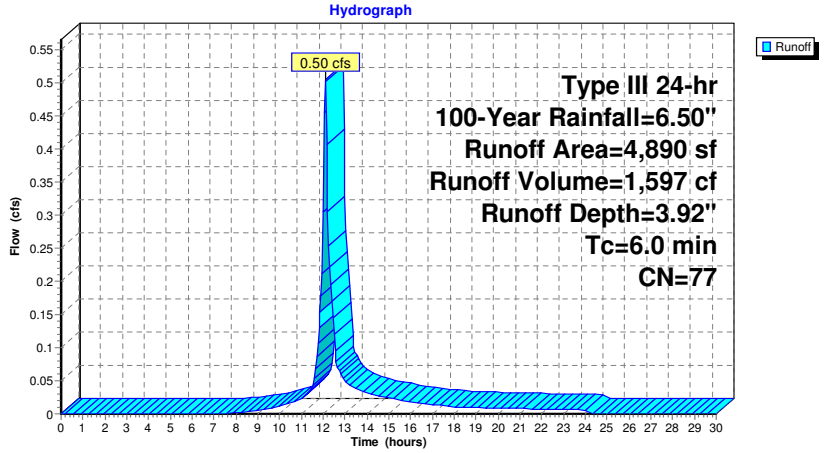
Runoff = 0.50 cfs @ 12.09 hrs, Volume= 1,597 cf, Depth= 3.92"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=6.50"

Area (sf)	CN	Description
1,767	39	>75% Grass cover, Good, HSG A
3,123	98	Paved parking, HSG A
4,890	77	Weighted Average
1,767		36.14% Pervious Area
3,123		63.86% Impervious Area

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

Subcatchment P-25: Subcat P-25



Summary for Subcatchment P-3: Subcat P-3

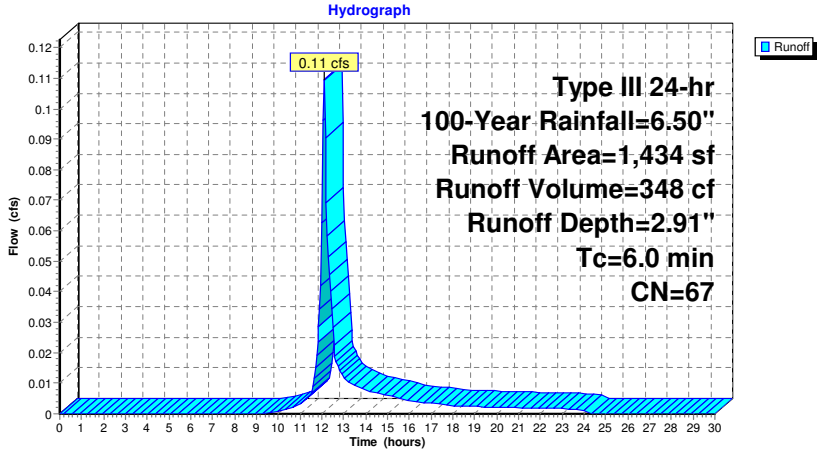
Runoff = 0.11 cfs @ 12.10 hrs, Volume= 348 cf, Depth= 2.91"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=6.50"

Area (sf)	CN	Description
742	39	>75% Grass cover, Good, HSG A
692	98	Paved parking, HSG A
1,434	67	Weighted Average
742		51.75% Pervious Area
692		48.25% Impervious Area

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

Subcatchment P-3: Subcat P-3



Summary for Subcatchment P-4: Subcat P-4

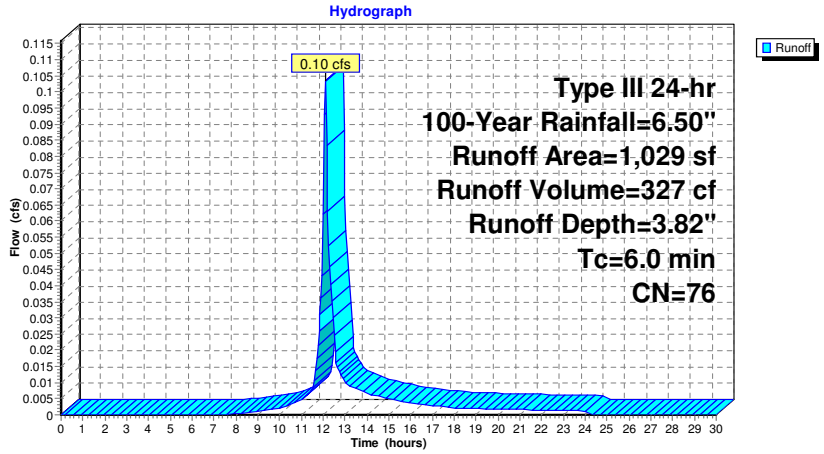
Runoff = 0.10 cfs @ 12.09 hrs, Volume= 327 cf, Depth= 3.82"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=6.50"

Area (sf)	CN	Description
377	39	>75% Grass cover, Good, HSG A
652	98	Paved parking, HSG A
1,029	76	Weighted Average
377		36.60% Pervious Area
652		63.40% Impervious Area

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

Subcatchment P-4: Subcat P-4



Summary for Subcatchment P-5: Subcat P-5

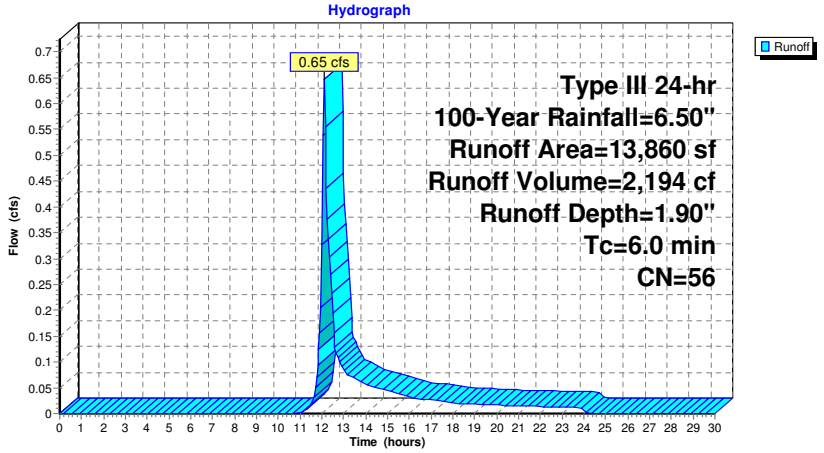
Runoff = 0.65 cfs @ 12.10 hrs, Volume= 2,194 cf, Depth= 1.90"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=6.50"

Area (sf)	CN	Description
7,297	39	>75% Grass cover, Good, HSG A
3,927	61	>75% Grass cover, Good, HSG B
2,447	98	Paved parking, HSG A
189	30	Woods, Good, HSG A
13,860	56	Weighted Average
11,413		82.34% Pervious Area
2,447		17.66% Impervious Area

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

Subcatchment P-5: Subcat P-5



Summary for Subcatchment P-7: Subcat P-7

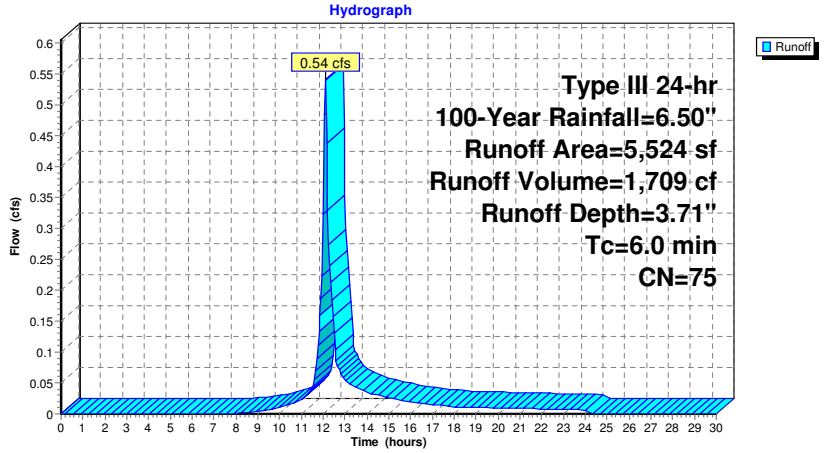
Runoff = 0.54 cfs @ 12.09 hrs, Volume= 1,709 cf, Depth= 3.71"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=6.50"

Area (sf)	CN	Description
2,121	39	>75% Grass cover, Good, HSG A
3,402	98	Paved parking, HSG A
5,524	75	Weighted Average
2,121		38.41% Pervious Area
3,402		61.59% Impervious Area

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

Subcatchment P-7: Subcat P-7



Summary for Subcatchment P-8: Subcat P-8

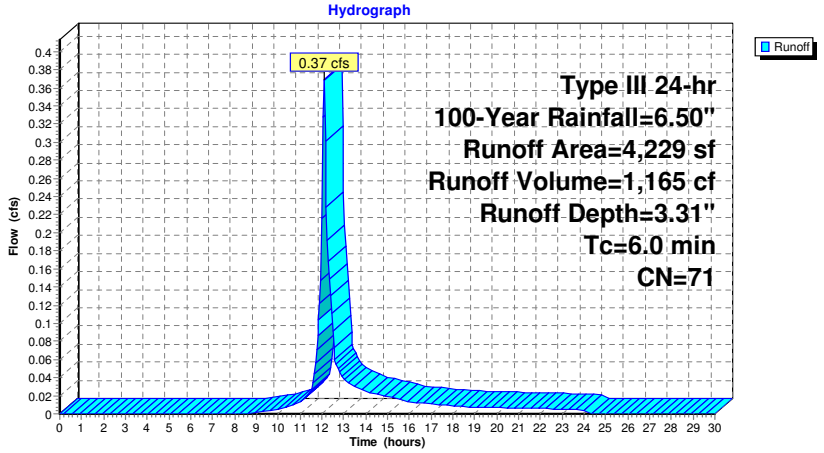
Runoff = 0.37 cfs @ 12.09 hrs, Volume= 1,165 cf, Depth= 3.31"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=6.50"

Area (sf)	CN	Description
1,911	39	>75% Grass cover, Good, HSG A
2,318	98	Paved parking, HSG A
4,229	71	Weighted Average
1,911		45.19% Pervious Area
2,318		54.81% Impervious Area

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

Subcatchment P-8: Subcat P-8



Summary for Subcatchment P-9: Subcat P-9

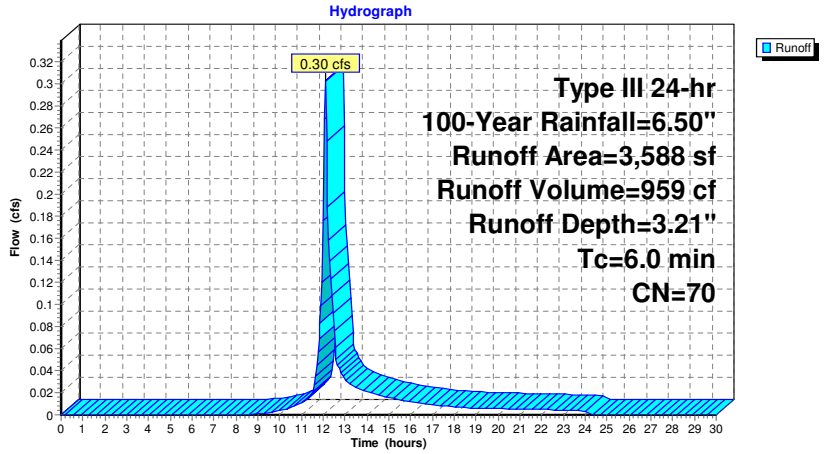
Runoff = 0.30 cfs @ 12.09 hrs, Volume= 959 cf, Depth= 3.21"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=6.50"

Area (sf)	CN	Description
1,687	39	>75% Grass cover, Good, HSG A
1,901	98	Paved parking, HSG A
3,588	70	Weighted Average
1,687		47.01% Pervious Area
1,901		52.99% Impervious Area

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

Subcatchment P-9: Subcat P-9



Summary for Pond DMH1: DMH1

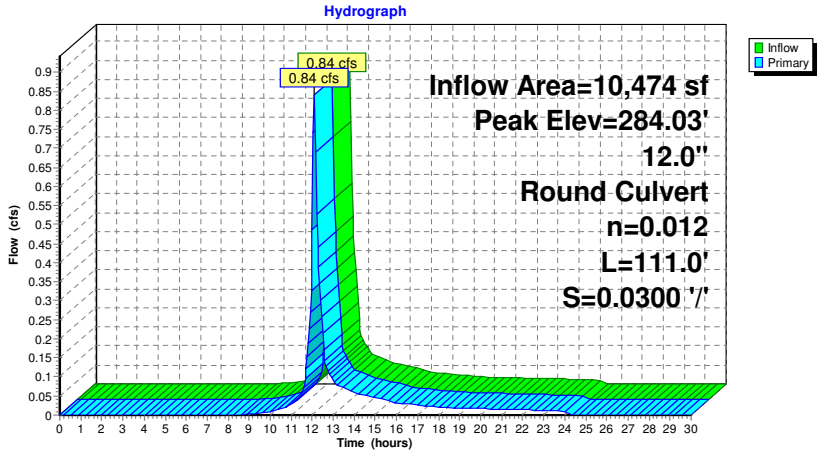
Inflow Area = 10,474 sf, 50.15% Impervious, Inflow Depth = 3.06" for 100-Year event
Inflow = 0.84 cfs @ 12.09 hrs, Volume= 2,672 cf
Outflow = 0.84 cfs @ 12.09 hrs, Volume= 2,672 cf, Atten= 0%, Lag= 0.0 min
Primary = 0.84 cfs @ 12.09 hrs, Volume= 2,672 cf

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Peak Elev= 284.03' @ 12.09 hrs
Flood Elev= 287.50'

Device	Routing	Invert	Outlet Devices
#1	Primary	283.50'	**12.0" Round Culvert** L= 111.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 283.50' / 280.17' S= 0.0300 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=0.83 cfs @ 12.09 hrs HW=284.03' (Free Discharge)
1=Culvert (Inlet Controls 0.83 cfs @ 1.96 fps)

Pond DMH1: DMH1



Summary for Pond DMH10: DMH10

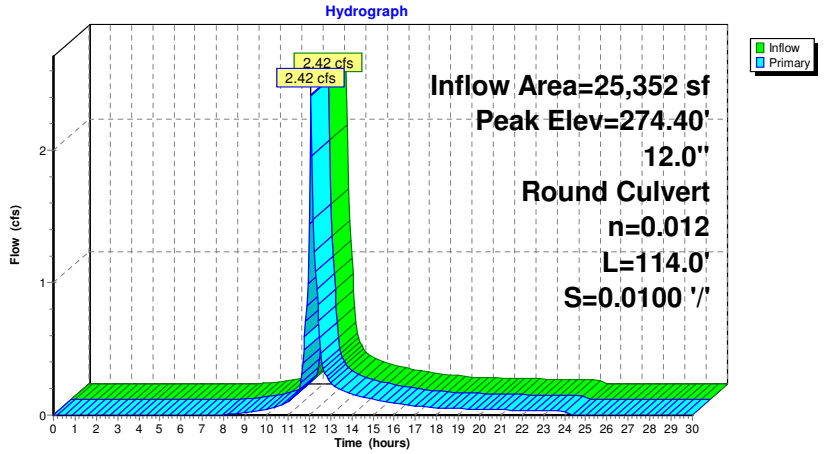
Inflow Area = 25,352 sf, 60.11% Impervious, Inflow Depth = 3.62" for 100-Year event
Inflow = 2.42 cfs @ 12.09 hrs, Volume= 7,652 cf
Outflow = 2.42 cfs @ 12.09 hrs, Volume= 7,652 cf, Atten= 0%, Lag= 0.0 min
Primary = 2.42 cfs @ 12.09 hrs, Volume= 7,652 cf

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Peak Elev= 274.40' @ 12.09 hrs
Flood Elev= 278.08'

Device	Routing	Invert	Outlet Devices
#1	Primary	273.24'	**12.0" Round Culvert** L= 114.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 273.24' / 272.10' S= 0.0100 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=2.38 cfs @ 12.09 hrs HW=274.37' (Free Discharge)
1=Culvert (Inlet Controls 2.38 cfs @ 3.03 fps)

Pond DMH10: DMH10



Summary for Pond DMH2: DMH2

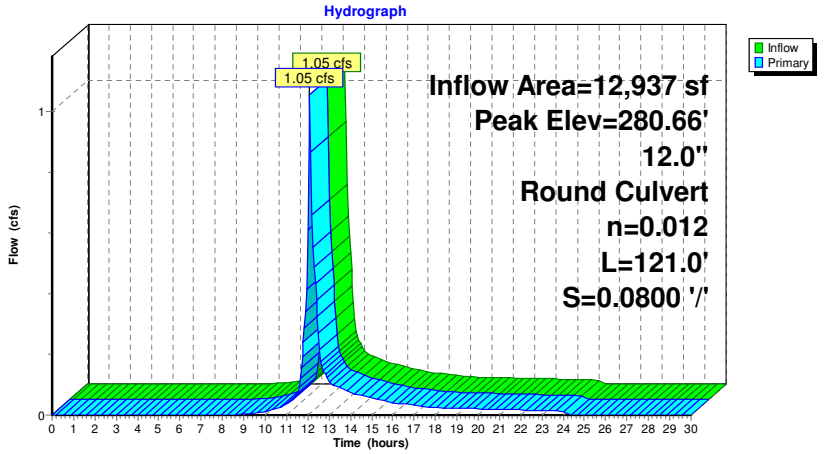
Inflow Area = 12,937 sf, 50.99% Impervious, Inflow Depth = 3.10" for 100-Year event
Inflow = 1.05 cfs @ 12.09 hrs, Volume= 3,347 cf
Outflow = 1.05 cfs @ 12.09 hrs, Volume= 3,347 cf, Atten= 0%, Lag= 0.0 min
Primary = 1.05 cfs @ 12.09 hrs, Volume= 3,347 cf

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Peak Elev= 280.66' @ 12.09 hrs
Flood Elev= 284.16'

Device	Routing	Invert	Outlet Devices
#1	Primary	280.05'	**12.0" Round Culvert** L= 121.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 280.05' / 270.37' S= 0.0800 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=1.04 cfs @ 12.09 hrs HW=280.65' (Free Discharge)
1=Culvert (Inlet Controls 1.04 cfs @ 2.09 fps)

Pond DMH2: DMH2



Summary for Pond DMH3: DMH3

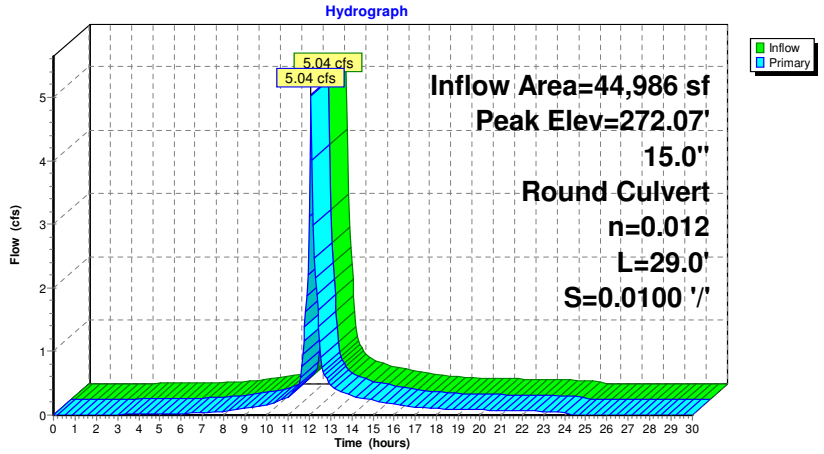
Inflow Area = 44,986 sf, 72.36% Impervious, Inflow Depth = 4.47" for 100-Year event
Inflow = 5.04 cfs @ 12.09 hrs, Volume= 16,762 cf
Outflow = 5.04 cfs @ 12.09 hrs, Volume= 16,762 cf, Atten= 0%, Lag= 0.0 min
Primary = 5.04 cfs @ 12.09 hrs, Volume= 16,762 cf

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Peak Elev= 272.07' @ 12.09 hrs
Flood Elev= 276.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	270.28'	**15.0" Round Culvert** L= 29.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 270.28' / 269.99' S= 0.0100 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 1.23 sf

Primary OutFlow Max=4.93 cfs @ 12.09 hrs HW=272.02' (Free Discharge)
1=Culvert (Inlet Controls 4.93 cfs @ 4.02 fps)

Pond DMH3: DMH3



Summary for Pond DMH4: DMH4

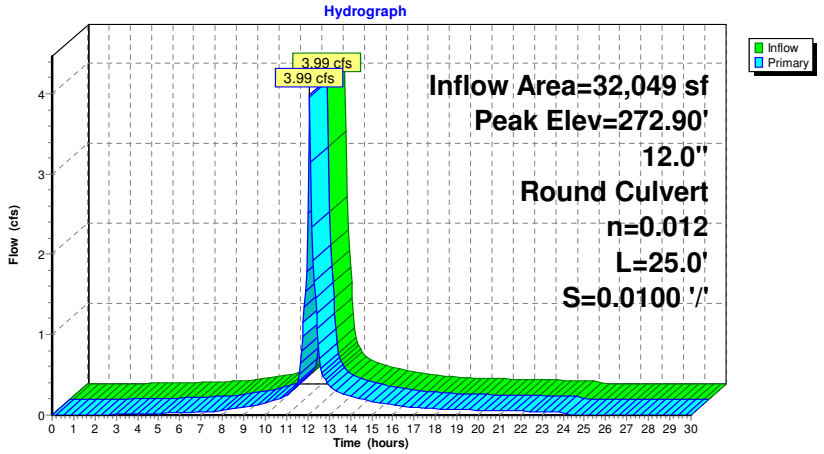
Inflow Area = 32,049 sf, 80.99% Impervious, Inflow Depth = 5.02" for 100-Year event
Inflow = 3.99 cfs @ 12.09 hrs, Volume= 13,415 cf
Outflow = 3.99 cfs @ 12.09 hrs, Volume= 13,415 cf, Atten= 0%, Lag= 0.0 min
Primary = 3.99 cfs @ 12.09 hrs, Volume= 13,415 cf

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Peak Elev= 272.90' @ 12.09 hrs
Flood Elev= 275.50'

Device	Routing	Invert	Outlet Devices
#1	Primary	270.62'	**12.0" Round Culvert** L= 25.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 270.62' / 270.37' S= 0.0100 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=3.89 cfs @ 12.09 hrs HW=272.82' (Free Discharge)
1=Culvert (Inlet Controls 3.89 cfs @ 4.95 fps)

Pond DMH4: DMH4



Summary for Pond DMH5: DMH5

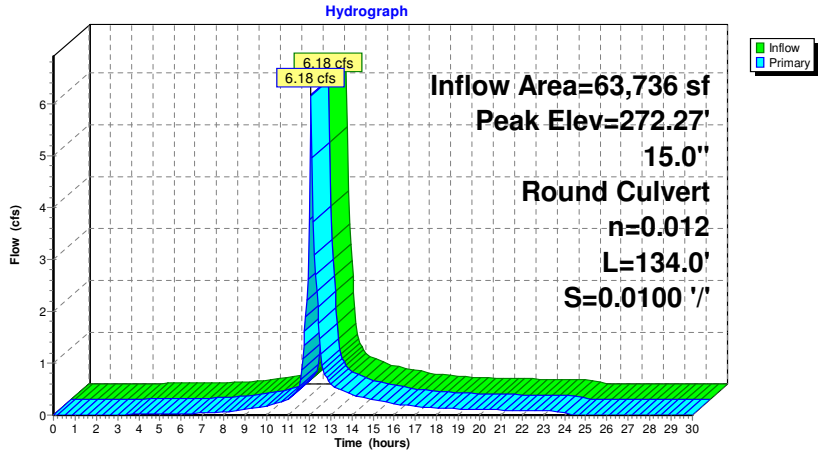
Inflow Area = 63,736 sf, 59.81% Impervious, Inflow Depth = 3.87" for 100-Year event
Inflow = 6.18 cfs @ 12.09 hrs, Volume= 20,553 cf
Outflow = 6.18 cfs @ 12.09 hrs, Volume= 20,553 cf, Atten= 0%, Lag= 0.0 min
Primary = 6.18 cfs @ 12.09 hrs, Volume= 20,553 cf

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Peak Elev= 272.27' @ 12.09 hrs
Flood Elev= 275.40'

Device	Routing	Invert	Outlet Devices
#1	Primary	269.89'	**15.0" Round Culvert** L= 134.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 269.89' / 268.55' S= 0.0100 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 1.23 sf

Primary OutFlow Max=6.06 cfs @ 12.09 hrs HW=272.20' (Free Discharge)
1=Culvert (Inlet Controls 6.06 cfs @ 4.94 fps)

Pond DMH5: DMH5



Summary for Pond DMH6: DMH6

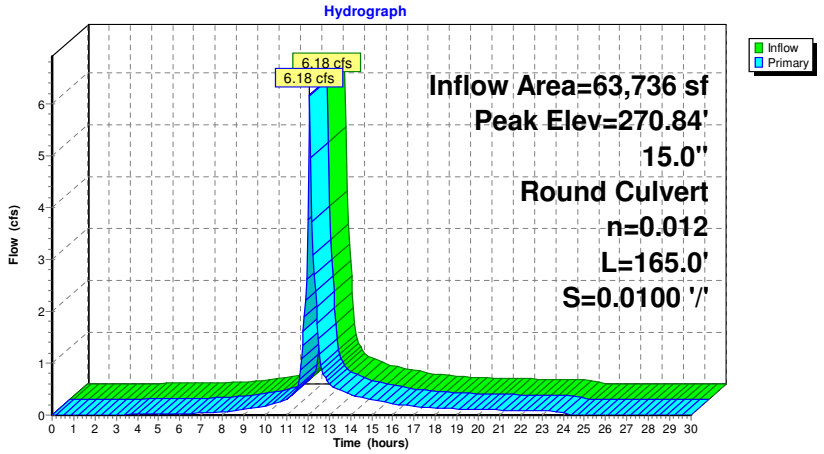
Inflow Area = 63,736 sf, 59.81% Impervious, Inflow Depth = 3.87" for 100-Year event
Inflow = 6.18 cfs @ 12.09 hrs, Volume= 20,553 cf
Outflow = 6.18 cfs @ 12.09 hrs, Volume= 20,553 cf, Atten= 0%, Lag= 0.0 min
Primary = 6.18 cfs @ 12.09 hrs, Volume= 20,553 cf

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Peak Elev= 270.84' @ 12.09 hrs
Flood Elev= 273.80'

Device	Routing	Invert	Outlet Devices
#1	Primary	268.46'	**15.0" Round Culvert** L= 165.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 268.46' / 266.81' S= 0.0100 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 1.23 sf

Primary OutFlow Max=6.06 cfs @ 12.09 hrs HW=270.77' (Free Discharge)
1=Culvert (Inlet Controls 6.06 cfs @ 4.94 fps)

Pond DMH6: DMH6



Summary for Pond DMH7: DMH7

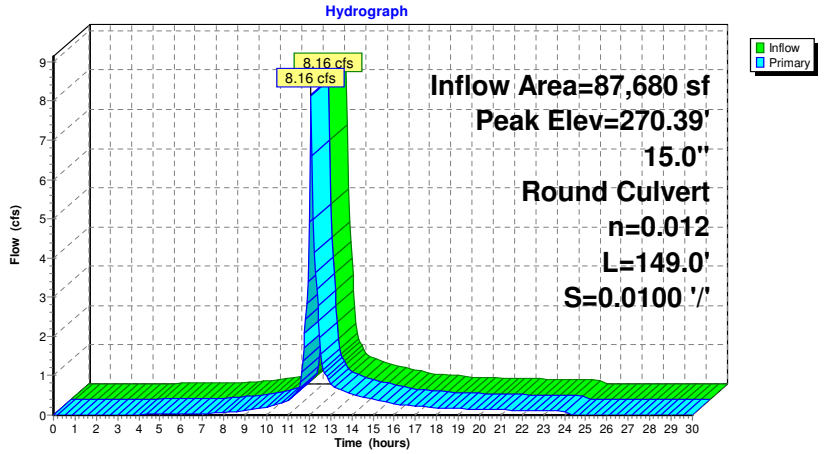
Inflow Area = 87,680 sf, 57.42% Impervious, Inflow Depth = 3.67" for 100-Year event
Inflow = 8.16 cfs @ 12.09 hrs, Volume= 26,827 cf
Outflow = 8.16 cfs @ 12.09 hrs, Volume= 26,827 cf, Atten= 0%, Lag= 0.0 min
Primary = 8.16 cfs @ 12.09 hrs, Volume= 26,827 cf

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Peak Elev= 270.39' @ 12.09 hrs
Flood Elev= 270.85'

Device	Routing	Invert	Outlet Devices
#1	Primary	266.71'	**15.0" Round Culvert** L= 149.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 266.71' / 265.22' S= 0.0100 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 1.23 sf

Primary OutFlow Max=8.01 cfs @ 12.09 hrs HW=270.28' (Free Discharge)
1=Culvert (Inlet Controls 8.01 cfs @ 6.52 fps)

Pond DMH7: DMH7



Summary for Pond DMH8: DMH8

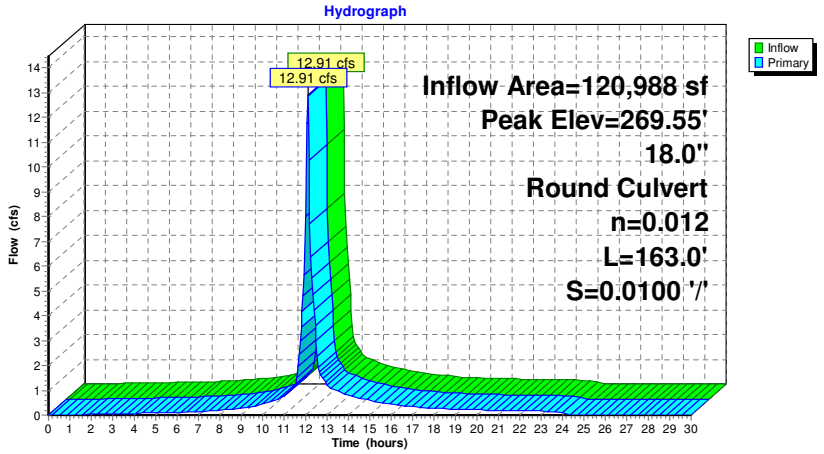
Inflow Area = 120,988 sf, 69.14% Impervious, Inflow Depth = 4.38" for 100-Year event
Inflow = 12.91 cfs @ 12.09 hrs, Volume= 44,206 cf
Outflow = 12.91 cfs @ 12.09 hrs, Volume= 44,206 cf, Atten= 0%, Lag= 0.0 min
Primary = 12.91 cfs @ 12.09 hrs, Volume= 44,206 cf

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Peak Elev= 269.55' @ 12.09 hrs
Flood Elev= 269.88'

Device	Routing	Invert	Outlet Devices
#1	Primary	265.12'	**18.0" Round Culvert** L= 163.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 265.12' / 263.49' S= 0.0100 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 1.77 sf

Primary OutFlow Max=12.63 cfs @ 12.09 hrs HW=269.40' (Free Discharge)
1=Culvert (Inlet Controls 12.63 cfs @ 7.15 fps)

Pond DMH8: DMH8



Summary for Pond DMH9: DMH9

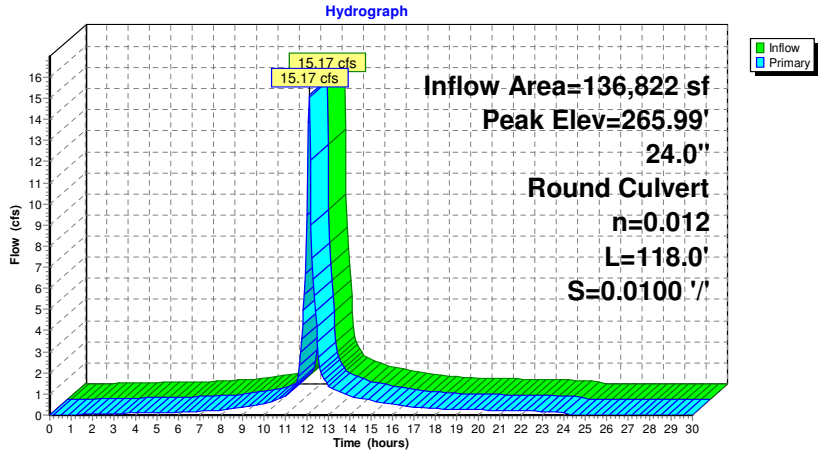
Inflow Area = 136,822 sf, 72.71% Impervious, Inflow Depth = 4.60" for 100-Year event
Inflow = 15.17 cfs @ 12.09 hrs, Volume= 52,468 cf
Outflow = 15.17 cfs @ 12.09 hrs, Volume= 52,468 cf, Atten= 0%, Lag= 0.0 min
Primary = 15.17 cfs @ 12.09 hrs, Volume= 52,468 cf

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Peak Elev= 265.99' @ 12.09 hrs
Flood Elev= 268.83'

Device	Routing	Invert	Outlet Devices
#1	Primary	263.38'	**24.0" Round Culvert** L= 118.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 263.38' / 262.20' S= 0.0100 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 3.14 sf

Primary OutFlow Max=14.83 cfs @ 12.09 hrs HW=265.92' (Free Discharge)
└**1=Culvert** (Inlet Controls 14.83 cfs @ 4.72 fps)

Pond DMH9: DMH9



Summary for Pond DP1: Pond #1

Inflow Area = 49,841 sf, 50.39% Impervious, Inflow Depth = 3.21" for 100-Year event
Inflow = 4.01 cfs @ 12.09 hrs, Volume= 13,337 cf
Outflow = 0.19 cfs @ 15.26 hrs, Volume= 11,147 cf, Atten= 95%, Lag= 190.1 min
Discarded = 0.19 cfs @ 15.26 hrs, Volume= 11,147 cf
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Peak Elev= 273.80' @ 15.26 hrs Surf.Area= 3,349 sf Storage= 7,625 cf
Flood Elev= 275.00' Surf.Area= 4,336 sf Storage= 12,246 cf

Plug-Flow detention time= 419.8 min calculated for 11,147 cf (84% of inflow)
Center-of-Mass det. time= 350.1 min (1,167.7 - 817.6)

Volume	Invert	Avail.Storage	Storage Description
#1	270.00'	12,246 cf	**Custom Stage Data (Conic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
270.00	878	0	0	878
271.00	1,400	1,129	1,129	1,413
272.00	2,026	1,703	2,832	2,056
273.00	2,742	2,375	5,207	2,793
274.00	3,515	3,121	8,328	3,591
275.00	4,336	3,918	12,246	4,441

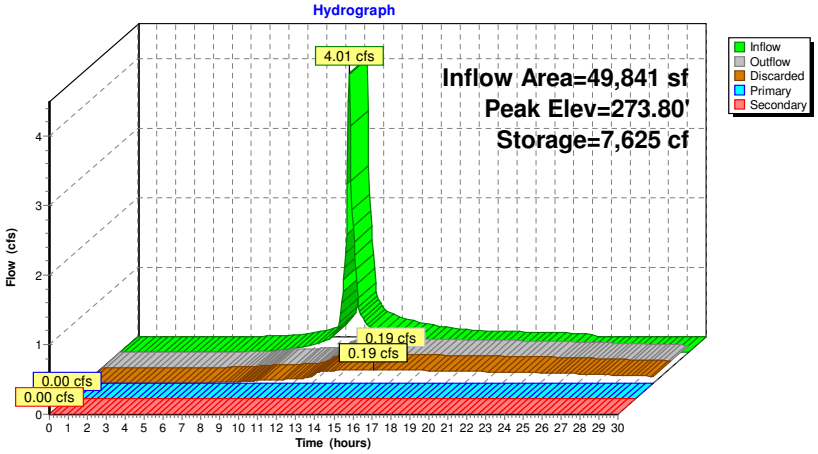
Device	Routing	Invert	Outlet Devices
#1	Primary	270.28'	**12.0" Round Culvert** L= 116.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 270.28' / 269.12' S= 0.0100 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 0.79 sf
#2	Device 1	273.80'	**24.0" x 24.0" Horiz. Top Grate** C= 0.600 in 24.0" x 24.0" Grate (100% open area) Limited to weir flow at low heads
#3	Secondary	274.50'	**10.0' long x 10.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.49 2.56 2.70 2.69 2.68 2.69 2.67 2.64
#4	Discarded	270.00'	**2.410 in/hr Exfiltration over Wetted area**

Discarded OutFlow Max=0.19 cfs @ 15.26 hrs HW=273.80' (Free Discharge)
└**4=Exfiltration** (Exfiltration Controls 0.19 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=270.00' (Free Discharge)
└**1=Culvert** (Controls 0.00 cfs)
└**2=Top Grate** (Controls 0.00 cfs)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=270.00' (Free Discharge)
└**3=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond DP1: Pond #1



Summary for Pond DP2: Pond #2

Inflow Area = 174,663 sf, 72.49% Impervious, Inflow Depth = 3.72" for 100-Year event
Inflow = 14.58 cfs @ 12.09 hrs, Volume= 54,124 cf
Outflow = 0.85 cfs @ 13.92 hrs, Volume= 46,378 cf, Atten= 94%, Lag= 109.8 min
Discarded = 0.57 cfs @ 13.92 hrs, Volume= 37,681 cf
Primary = 0.29 cfs @ 13.92 hrs, Volume= 8,697 cf
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Peak Elev= 269.40' @ 13.92 hrs Surf.Area= 10,018 sf Storage= 29,457 cf
Flood Elev= 270.00' Surf.Area= 11,000 sf Storage= 35,778 cf

Plug-Flow detention time= 367.5 min calculated for 46,378 cf (86% of inflow)
Center-of-Mass det. time= 303.0 min (1,051.3 - 748.3)

Volume	Invert	Avail.Storage	Storage Description
#1	265.00'	35,778 cf	**Custom Stage Data (Conic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
265.00	3,792	0	0	3,792
266.00	4,968	4,367	4,367	4,991
267.00	6,299	5,620	9,987	6,348
268.00	7,785	7,029	17,016	7,864
269.00	9,393	8,576	25,592	9,505
270.00	11,000	10,186	35,778	11,151

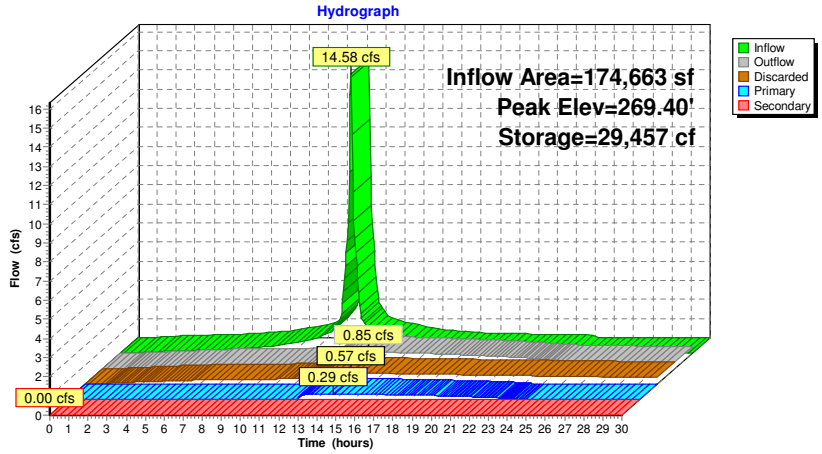
Device	Routing	Invert	Outlet Devices
#1	Primary	265.00'	**12.0" Round Culvert** L= 23.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 265.00' / 264.77' S= 0.0100 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 0.79 sf
#2	Device 1	267.80'	**3.0" Vert. Orifice** C= 0.600
#3	Device 1	269.40'	**24.0" x 24.0" Horiz. Top Grate** C= 0.600 in 24.0" x 24.0" Grate (100% open area) Limited to weir flow at low heads
#4	Secondary	269.50'	**10.0' long x 10.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.49 2.56 2.70 2.69 2.68 2.69 2.67 2.64
#5	Discarded	265.00'	**2.410 in/hr Exfiltration over Wetted area**

Discarded OutFlow Max=0.57 cfs @ 13.92 hrs HW=269.40' (Free Discharge)
└**5=Exfiltration** (Exfiltration Controls 0.57 cfs)

Primary OutFlow Max=0.29 cfs @ 13.92 hrs HW=269.40' (Free Discharge)
└**1=Culvert** (Passes 0.29 cfs of 5.89 cfs potential flow)
  └**2=Orifice** (Orifice Controls 0.29 cfs @ 5.84 fps)
  └**3=Top Grate** (Controls 0.00 cfs)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=265.00' (Free Discharge)
└**4=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond DP2: Pond #2



Summary for Pond DP3: Pond #3

Inflow Area =	247,761 sf,	71.90% Impervious,	Inflow Depth =	4.61"	for 100-Year event
Inflow =	26.56 cfs @	12.09 hrs,	Volume=	95,240 cf	
Outflow =	1.34 cfs @	14.60 hrs,	Volume=	76,823 cf,	Atten= 95%, Lag= 150.5 min
Discarded =	0.83 cfs @	14.60 hrs,	Volume=	60,304 cf	
Primary =	0.51 cfs @	14.60 hrs,	Volume=	16,519 cf	
Secondary =	0.00 cfs @	0.00 hrs,	Volume=	0 cf	

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Peak Elev= 259.84' @ 14.60 hrs Surf.Area= 14,557 sf Storage= 53,548 cf
Flood Elev= 260.00' Surf.Area= 14,828 sf Storage= 55,948 cf

Plug-Flow detention time= 410.7 min calculated for 76,823 cf (81% of inflow)
Center-of-Mass det. time= 332.7 min (1,099.0 - 766.3)

Volume	Invert	Avail.Storage	Storage Description
#1	255.00'	55,948 cf	**Custom Stage Data (Conic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
255.00	7,916	0	0	7,916
256.00	9,155	8,528	8,528	9,197
257.00	10,449	9,795	18,323	10,538
258.00	11,800	11,118	29,441	11,940
259.00	13,208	12,497	41,938	13,403
260.00	14,828	14,010	55,948	15,076

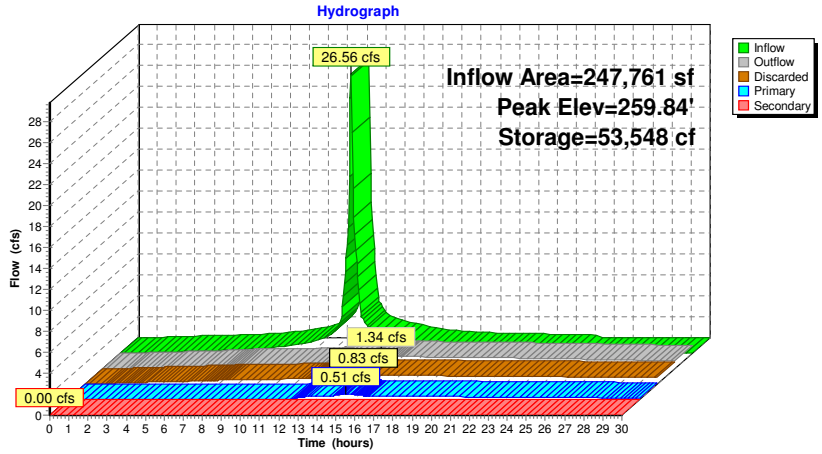
Device	Routing	Invert	Outlet Devices
#1	Primary	255.00'	**12.0" Round Culvert** L= 38.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 255.00' / 254.62' S= 0.0100 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 0.79 sf
#2	Device 1	256.50'	**2.5" Vert. Orifice** C= 0.600
#3	Device 1	259.80'	**24.0" x 24.0" Horiz. Top Grate** C= 0.600 in 24.0" x 24.0" Grate (100% open area) Limited to weir flow at low heads
#4	Secondary	259.90'	**10.0' long x 10.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.49 2.56 2.70 2.69 2.68 2.69 2.67 2.64
#5	Discarded	255.00'	**2.410 in/hr Exfiltration over Wetted area**

Discarded OutFlow Max=0.83 cfs @ 14.60 hrs HW=259.84' (Free Discharge)
└**5=Exfiltration** (Exfiltration Controls 0.83 cfs)

Primary OutFlow Max=0.48 cfs @ 14.60 hrs HW=259.84' (Free Discharge)
└**1=Culvert** (Passes 0.48 cfs of 6.22 cfs potential flow)
  └**2=Orifice** (Orifice Controls 0.30 cfs @ 8.66 fps)
  └**3=Top Grate** (Weir Controls 0.18 cfs @ 0.63 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=255.00' (Free Discharge)
└**4=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond DP3: Pond #3



Summary for Pond WQU1: WQU1

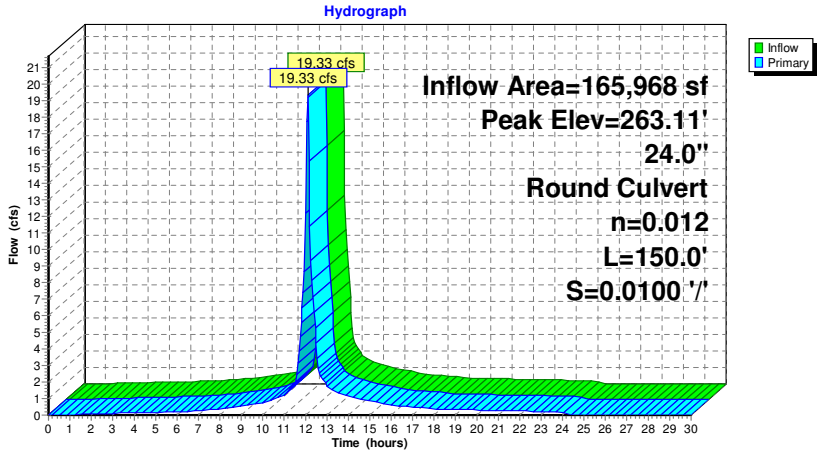
Inflow Area = 165,968 sf, 77.51% Impervious, Inflow Depth = 4.89" for 100-Year event
Inflow = 19.33 cfs @ 12.09 hrs, Volume= 67,676 cf
Outflow = 19.33 cfs @ 12.09 hrs, Volume= 67,676 cf, Atten= 0%, Lag= 0.0 min
Primary = 19.33 cfs @ 12.09 hrs, Volume= 67,676 cf

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Peak Elev= 263.11' @ 12.09 hrs
Flood Elev= 268.90'

Device	Routing	Invert	Outlet Devices
#1	Primary	259.50'	**24.0" Round Culvert** L= 150.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 259.50' / 258.00' S= 0.0100 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 3.14 sf

Primary OutFlow Max=18.88 cfs @ 12.09 hrs HW=263.00' (Free Discharge)
└**1=Culvert** (Inlet Controls 18.88 cfs @ 6.01 fps)

Pond WQU1: WQU1



Summary for Pond WQU2: WQU2

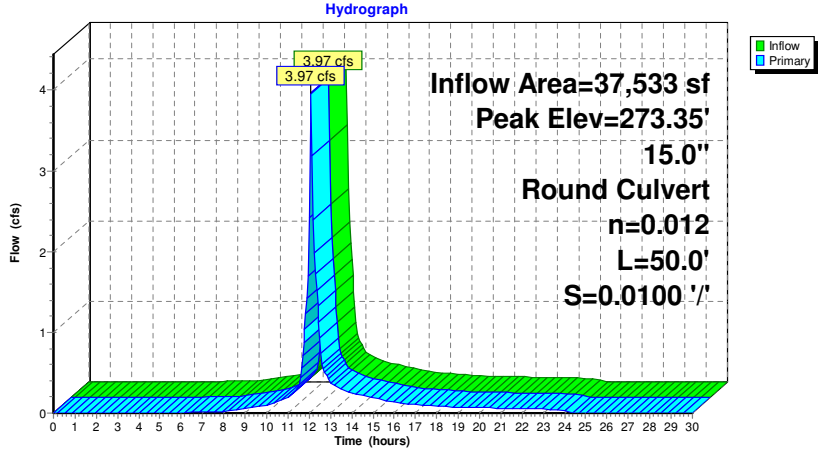
Inflow Area = 37,533 sf, 66.78% Impervious, Inflow Depth = 4.07" for 100-Year event
Inflow = 3.97 cfs @ 12.09 hrs, Volume= 12,724 cf
Outflow = 3.97 cfs @ 12.09 hrs, Volume= 12,724 cf, Atten= 0%, Lag= 0.0 min
Primary = 3.97 cfs @ 12.09 hrs, Volume= 12,724 cf

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Peak Elev= 273.35' @ 12.09 hrs
Flood Elev= 275.35'

Device	Routing	Invert	Outlet Devices
#1	Primary	272.00'	**15.0" Round Culvert** L= 50.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 272.00' / 271.50' S= 0.0100 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 1.23 sf

Primary OutFlow Max=3.88 cfs @ 12.09 hrs HW=273.32' (Free Discharge)
↑1=Culvert (Inlet Controls 3.88 cfs @ 3.16 fps)

Pond WQU2: WQU2

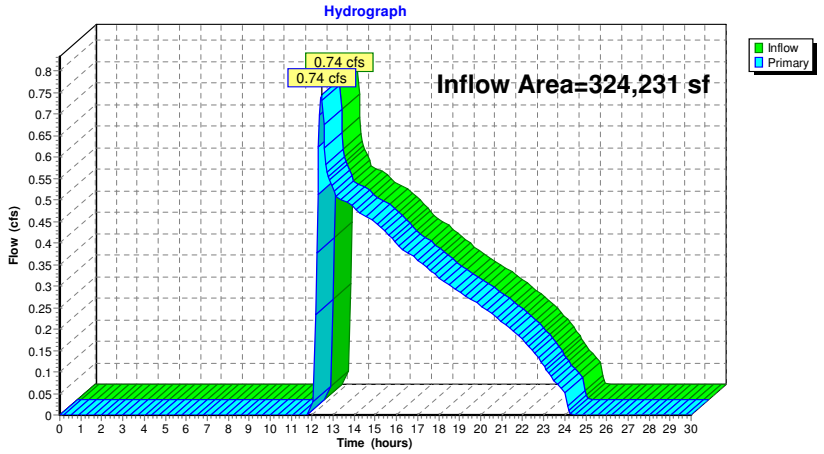


Summary for Link SP-1: Study Point #1

Inflow Area = 324,231 sf, 39.05% Impervious, Inflow Depth = 0.51" for 100-Year event
Inflow = 0.74 cfs @ 12.44 hrs, Volume= 13,912 cf
Primary = 0.74 cfs @ 12.44 hrs, Volume= 13,912 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs

Link SP-1: Study Point #1

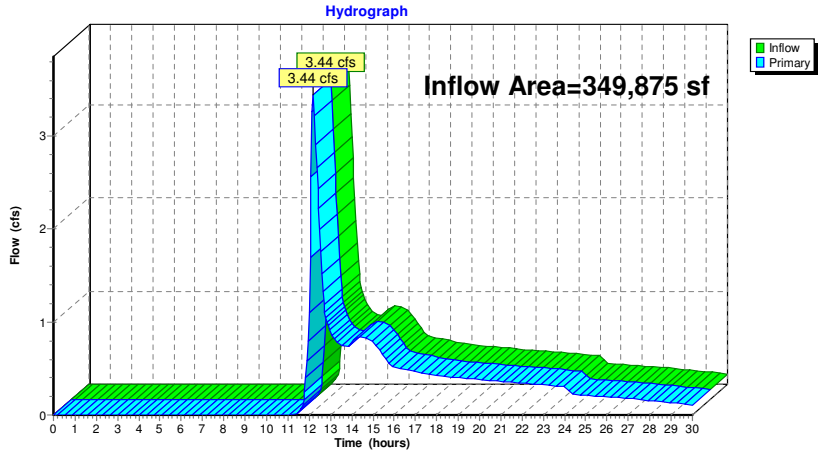


Summary for Link SP-2: Study Point #2

Inflow Area = 349,875 sf, 50.91% Impervious, Inflow Depth > 1.05" for 100-Year event
Inflow = 3.44 cfs @ 12.20 hrs, Volume= 30,503 cf
Primary = 3.44 cfs @ 12.20 hrs, Volume= 30,503 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs

Link SP-2: Study Point #2



SECTION 5.0
WATERSHED PLAN

EXISTING WATERSHED - LOCATED IN POCKET AT REAR

PROPOSED WATERSHED

(LOCATED IN REAR POCKET)

PROPOSED GRADING & DRAINAGE PLAN

(LOCATED IN REAR POCKET)

SECTION 6.0

APPENDIX

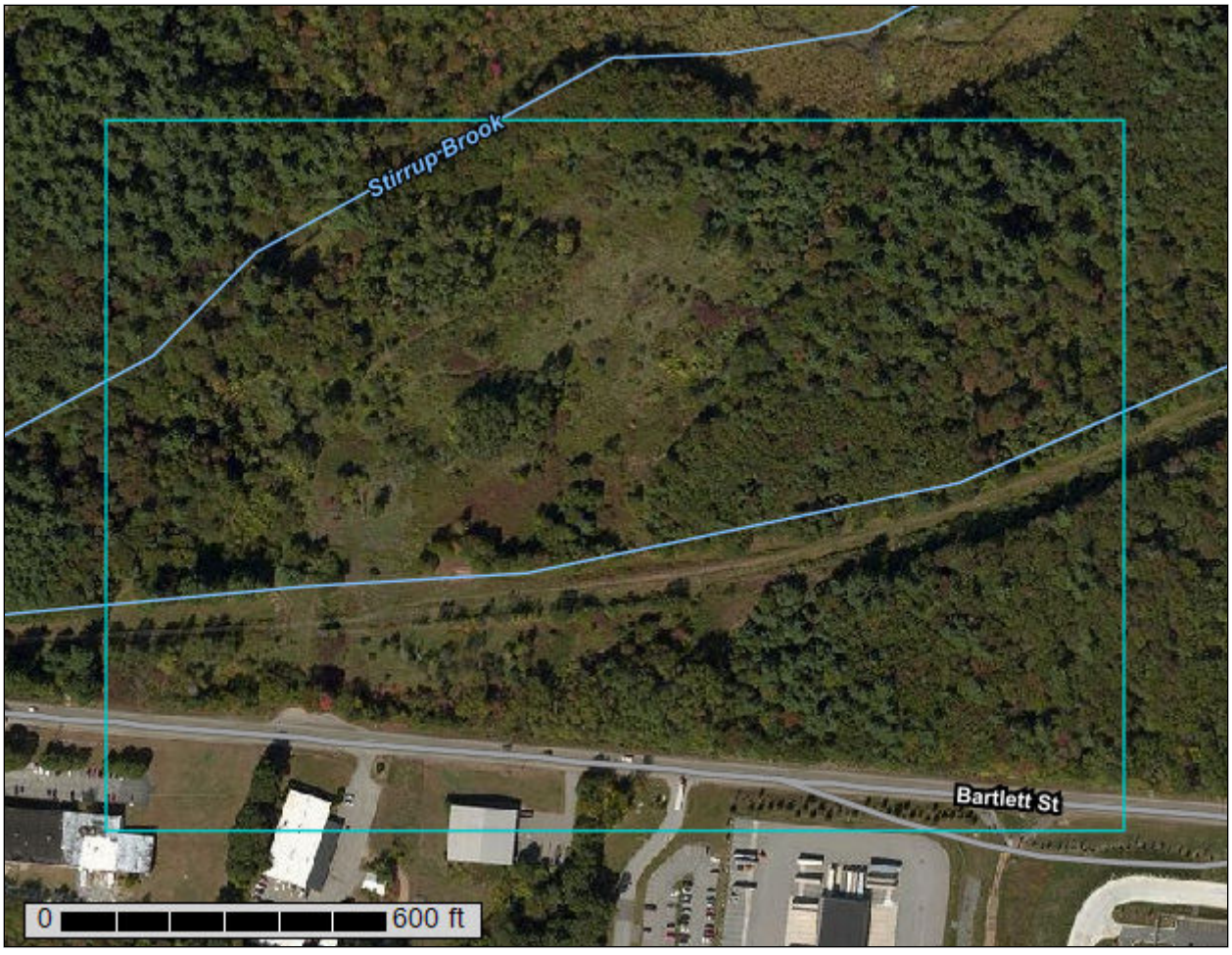
United States Department of Agriculture

NRCS

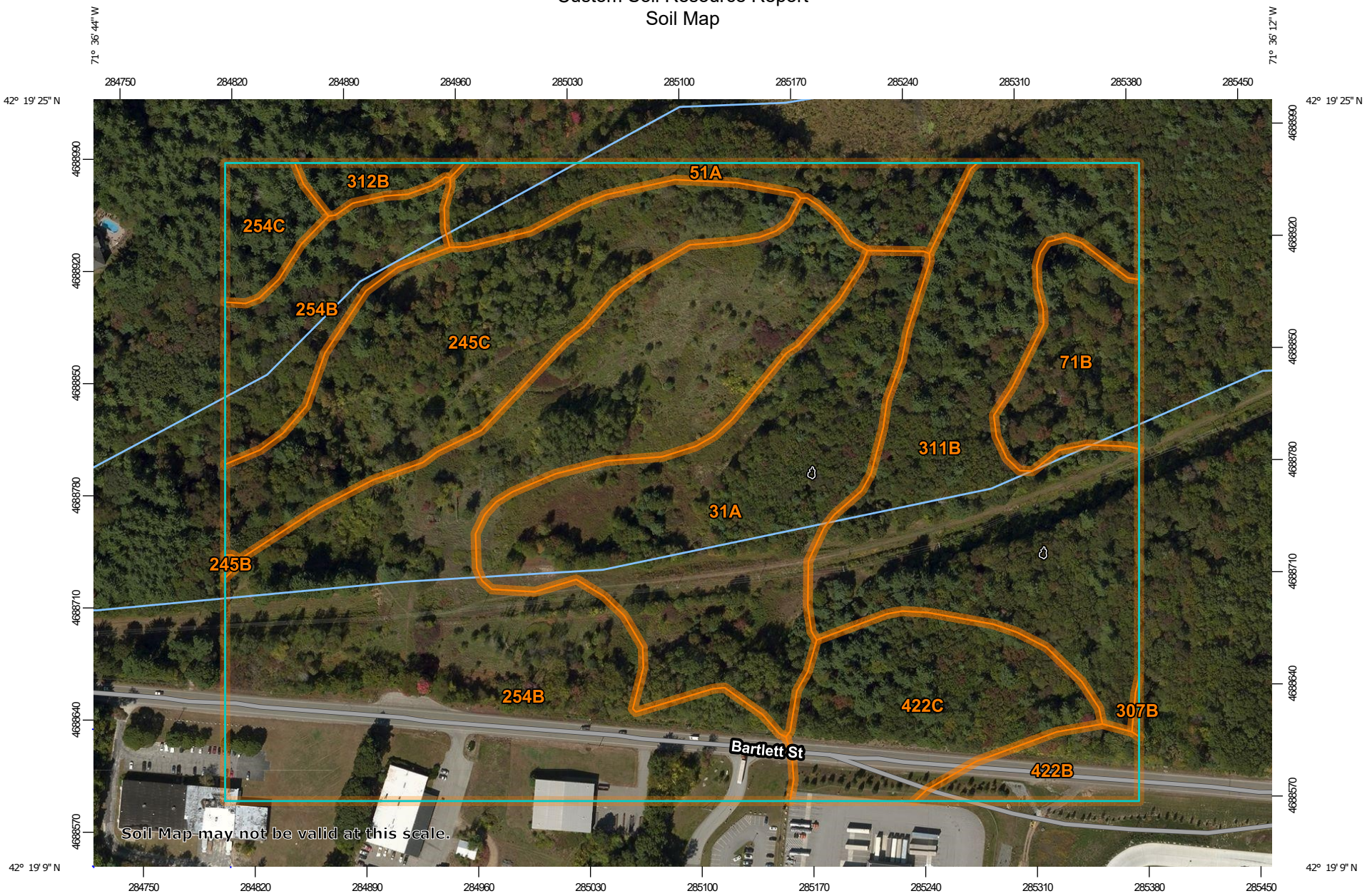
Natural Resources Conservation Service

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

Custom Soil Resource Report for Worcester County, Massachusetts, Northeastern Part



December 18, 2019



Map Scale: 1:3,370 if printed on A landscape (11" x 8.5") sheet.

N

0 45 90 180 270 Meters

0 150 300 600 900 Feet

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

MAP LEGEND

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

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

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

Water Features
- Streams and Canals

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

Background
- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:20,000.

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

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

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

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

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

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

Soil Survey Area: Worcester County, Massachusetts, Northeastern Part
Survey Area Data: Version 14, Sep 13, 2019

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

Date(s) aerial images were photographed: Sep 12, 2014—Sep 28, 2014

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background

Map Unit Legend

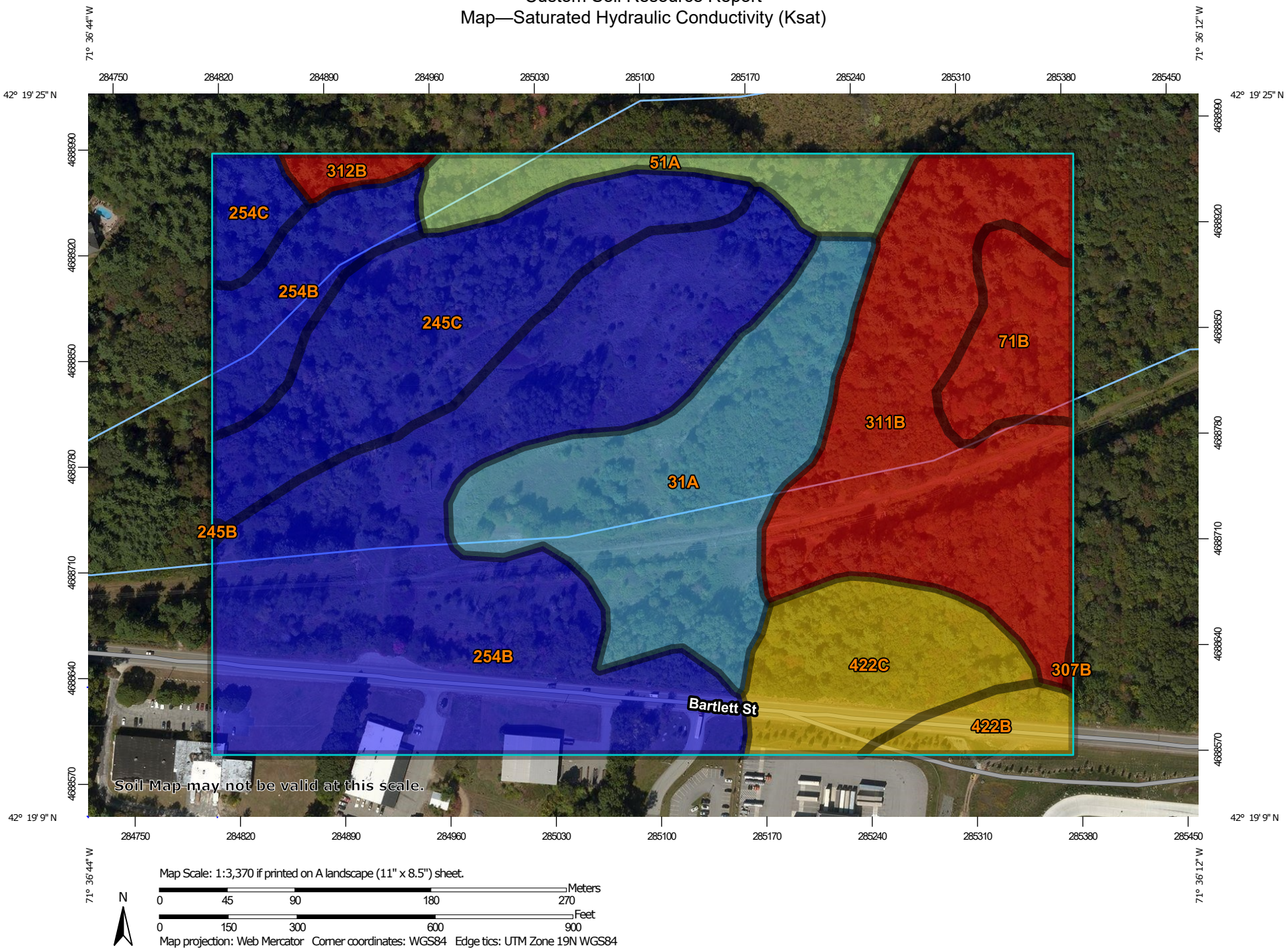
Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
31A	Walpole sandy loam, 0 to 3 percent slopes	8.5	15.1%
51A	Swansea muck, 0 to 1 percent slopes	2.5	4.4%
71B	Ridgebury fine sandy loam, 3 to 8 percent slopes, extremely stony	2.2	4.0%
245B	Hinckley loamy sand, 3 to 8 percent slopes	0.0	0.0%
245C	Hinckley loamy sand, 8 to 15 percent slopes	6.9	12.2%
254B	Merrimac fine sandy loam, 3 to 8 percent slopes	20.0	35.3%
254C	Merrimac fine sandy loam, 8 to 15 percent slopes	1.0	1.8%
307B	Paxton fine sandy loam, 0 to 8 percent slopes, extremely stony	0.0	0.0%
311B	Woodbridge fine sandy loam, 0 to 8 percent slopes, very stony	9.7	17.2%
312B	Woodbridge fine sandy loam, 0 to 8 percent slopes, extremely stony	0.5	0.9%
422B	Canton fine sandy loam, 0 to 8 percent slopes, extremely stony	1.1	2.0%
422C	Canton fine sandy loam, 8 to 15 percent slopes, extremely stony	4.1	7.2%
Totals for Area of Interest		**56.6**	**100.0%**

Map Unit Descriptions

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

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class.

Map—Saturated Hydraulic Conductivity (Ksat)



Map Scale: 1:3,370 if printed on A landscape (11" x 8.5") sheet.

N

Meters: 0 45 90 180 270

Feet: 0 150 300 600 900

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

MAP LEGEND

Area of Interest (AOI)

- Area of Interest (AOI)

Soils

Soil Rating Polygons

- <= 3.7064
- > 3.7064 and <= 58.8571
- > 58.8571 and <= 70.3529
- > 70.3529 and <= 78.0000
- > 78.0000 and <= 100.0000
- Not rated or not available

Soil Rating Lines

- <= 3.7064
- > 3.7064 and <= 58.8571
- > 58.8571 and <= 70.3529
- > 70.3529 and <= 78.0000
- > 78.0000 and <= 100.0000
- Not rated or not available

Soil Rating Points

- <= 3.7064
- > 3.7064 and <= 58.8571
- > 58.8571 and <= 70.3529
- > 70.3529 and <= 78.0000
- > 78.0000 and <= 100.0000
- Not rated or not available

Water Features

- Streams and Canals

Transportation

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

Background

- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:20,000.

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

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

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

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

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

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

Soil Survey Area: Worcester County, Massachusetts, Northeastern Part
Survey Area Data: Version 14, Sep 13, 2019

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

Date(s) aerial images were photographed: Sep 12, 2014—Sep 28, 2014

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background

Table—Saturated Hydraulic Conductivity (Ksat)

Map unit symbol	Map unit name	Rating (micrometers per second)	Acres in AOI	Percent of AOI
31A	Walpole sandy loam, 0 to 3 percent slopes	78.0000	8.5	15.1%
51A	Swansea muck, 0 to 1 percent slopes	70.3529	2.5	4.4%
71B	Ridgebury fine sandy loam, 3 to 8 percent slopes, extremely stony	1.4242	2.2	4.0%
245B	Hinckley loamy sand, 3 to 8 percent slopes	100.0000	0.0	0.0%
245C	Hinckley loamy sand, 8 to 15 percent slopes	100.0000	6.9	12.2%
254B	Merrimac fine sandy loam, 3 to 8 percent slopes	100.0000	20.0	35.3%
254C	Merrimac fine sandy loam, 8 to 15 percent slopes	100.0000	1.0	1.8%
307B	Paxton fine sandy loam, 0 to 8 percent slopes, extremely stony	2.9993	0.0	0.0%
311B	Woodbridge fine sandy loam, 0 to 8 percent slopes, very stony	3.7064	9.7	17.2%
312B	Woodbridge fine sandy loam, 0 to 8 percent slopes, extremely stony	3.7064	0.5	0.9%
422B	Canton fine sandy loam, 0 to 8 percent slopes, extremely stony	58.8571	1.1	2.0%
422C	Canton fine sandy loam, 8 to 15 percent slopes, extremely stony	58.8571	4.1	7.2%
Totals for Area of Interest			**56.6**	**100.0%**

Rating Options—Saturated Hydraulic Conductivity (Ksat)

Units of Measure: micrometers per second

Aggregation Method: Dominant Component

Component Percent Cutoff: None Specified

Tie-break Rule: Fastest

Interpret Nulls as Zero: No

Layer Options (Horizon Aggregation Method): Depth Range (Weighted Average)

Top Depth: 12

Bottom Depth: 200

Units of Measure: Inches

Soil Qualities and Features

Soil qualities are behavior and performance attributes that are not directly measured, but are inferred from observations of dynamic conditions and from soil properties. Example soil qualities include natural drainage, and frost action. Soil features are attributes that are not directly part of the soil. Example soil features include slope and depth to restrictive layer. These features can greatly impact the use and management of the soil.

Hydrologic Soil Group

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

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

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

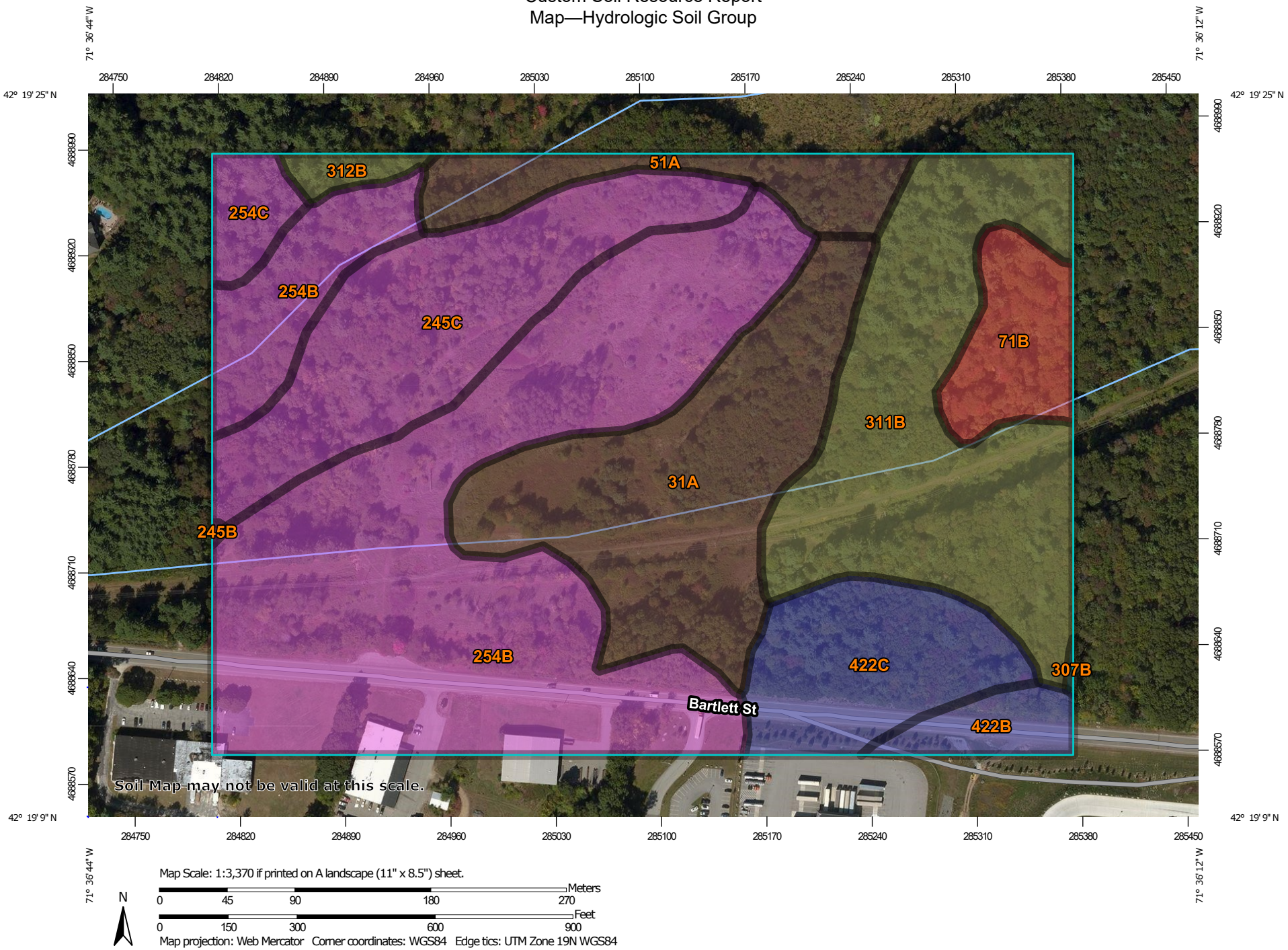
Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

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

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

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

Map—Hydrologic Soil Group



Map Scale: 1:3,370 if printed on A landscape (11" x 8.5") sheet.

N

Meters: 0 45 90 180 270

Feet: 0 150 300 600 900

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

MAP LEGEND

Area of Interest (AOI)

- Area of Interest (AOI)

Soils

Soil Rating Polygons

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

Soil Rating Lines

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

Soil Rating Points

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

Water Features

- Streams and Canals

Transportation

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

Background

- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:20,000.

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

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

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

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

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

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

Soil Survey Area: Worcester County, Massachusetts, Northeastern Part
Survey Area Data: Version 14, Sep 13, 2019

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

Date(s) aerial images were photographed: Sep 12, 2014—Sep 28, 2014

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background

Table—Hydrologic Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
31A	Walpole sandy loam, 0 to 3 percent slopes	B/D	8.5	15.1%
51A	Swansea muck, 0 to 1 percent slopes	B/D	2.5	4.4%
71B	Ridgebury fine sandy loam, 3 to 8 percent slopes, extremely stony	D	2.2	4.0%
245B	Hinckley loamy sand, 3 to 8 percent slopes	A	0.0	0.0%
245C	Hinckley loamy sand, 8 to 15 percent slopes	A	6.9	12.2%
254B	Merrimac fine sandy loam, 3 to 8 percent slopes	A	20.0	35.3%
254C	Merrimac fine sandy loam, 8 to 15 percent slopes	A	1.0	1.8%
307B	Paxton fine sandy loam, 0 to 8 percent slopes, extremely stony	C	0.0	0.0%
311B	Woodbridge fine sandy loam, 0 to 8 percent slopes, very stony	C/D	9.7	17.2%
312B	Woodbridge fine sandy loam, 0 to 8 percent slopes, extremely stony	C/D	0.5	0.9%
422B	Canton fine sandy loam, 0 to 8 percent slopes, extremely stony	B	1.1	2.0%
422C	Canton fine sandy loam, 8 to 15 percent slopes, extremely stony	B	4.1	7.2%
Totals for Area of Interest			**56.6**	**100.0%**

Rating Options—Hydrologic Soil Group

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

F-1. Rainfall Data for Massachusetts from *Rainfall Frequency Atlas of the United States* (TP-40)

- Users of this Handbook should note that current MA DEP written guidance (see DEP Waterlines newsletter -- Fall 2000) requires the use of TP-40 Rainfall Data for calculations under the Wetlands Protection Regulations and the Stormwater Management Policy. More stringent design storms may be used under a local bylaw or ordinance. However, DEP will continue to require the use of TP-40 in any case it reviews under the Wetlands Protection Act and Stormwater Management Policy.

Adjusted Technical Paper 40 Design Storms for 24-hour Event by County

County Name	1-yr 24-hr	2-yr 24-hr	5-yr 24-hr	10-yr 24-hr	25-yr 24-hr	50-yr 24-hr	100-yr 24-hr
Barnstable	2.5	3.6	4.5	4.8	5.7	6.4	7.1
Berkshire	2.5	2.9	3.8	4.4	5.1	5.9	6.4
Bristol	2.5	3.4	4.3	4.8	5.6	6.3	7.0
Dukes	2.5	3.6	4.6	4.9	5.8	6.5	7.2
Essex	2.5	3.1	3.9	4.5	5.4	5.9	6.5
Franklin	2.5	2.9	3.8	4.3	5.1	5.8	6.2
Hampden	2.5	3.0	4.0	4.6	5.3	6.0	6.5
Hampshire	2.5	3.0	3.9	4.5	5.2	5.9	6.4
Middlesex	2.5	3.1	4.0	4.5	5.3	5.9	6.5
Nantucket	2.5	3.6	4.6	4.9	5.8	6.5	7.2
Norfolk	2.5	3.2	4.1	4.7	5.5	6.1	6.7
Plymouth	2.5	3.4	4.3	4.7	5.6	6.2	7.0
Suffolk	2.5	3.2	4.0	4.6	5.5	6.0	6.6
Worcester	2.5	3.0	4.0	4.5	5.3	5.9	6.5

Manning's Roughness Coefficients ("n")

Conduit	Manning's Coefficients
Closed Conduits	
Asbestos-Cement Pipe	0.011 to 0.015
Brick	0.013 to 0.017
Cast Iron Pipe	
Cement-lined and seal-coated	0.011 to 0.015
Concrete (Monolithic)	
Smooth forms	0.012 to 0.014
Rough forms	0.015 to 0.017
Concrete Pipe	0.011 to 0.015
Corrugated-Metal Pipe (1/2 - STUL 34470 2 1/2-inch corrgtn.)	
Plain	0.022 to 0.026
Paved invert	0.018 to 0.022
Spun asphalt-lined	0.011 to 0.015
Plastic Pipe (Smooth)	0.011 to 0.015
Vitrified Clay	
Pipes	0.011 to 0.015
Liner channels	0.013 to 0.017
Open Channels	
Lined Channels	
Asphalt	0.013 to 0.017
Brick	0.012 to 0.018
Concrete	0.011 to 0.020
Rubble or riprap	0.020 to 0.035
Vegetal	0.030 to 0.040
Excavated or Dredged	
Earth, straight and uniform	0.020 to 0.030
Earth, winding, fairly uniform	0.025 to 0.040
Rock	0.030 to 0.045
Unmaintained	0.050 to 0.140
Natural Channels (minor streams, top width at flood state < 100 feet)	
Fairly regular section	0.030 to 0.070
Irregular section with pools	0.040 to 0.100

Source: Design and Construction of Sanitary and Storm Sewers, American Society of Civil Engineers and the Water Pollution Control Federation, 1969.

INSTRUCTIONS:

Version 1, Automated: Mar. 4, 2008

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

Location: Bartlett Street, Parcel H, Northborough MA

TSS Removal Calculation Worksheet

B BMP[1]	C TSS Removal Rate[1]	D Starting TSS Load*	E Amount Removed (C*D)	F Remaining Load (D-E)
Street Sweeping - 5%	**0.05**	**1.00**	**0.05**	**0.95**
Deep Sump and Hooded Catch Basin	**0.25**	**0.95**	**0.24**	**0.71**
Proprietary Treatment Practice	**0.00**	**0.71**	**0.00**	**0.71**
Infiltration Basin	**0.80**	**0.71**	**0.57**	**0.14**
	0.00	**0.14**	**0.00**	**0.14**

Total TSS Removal = **86%**

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

Project: Hayes Memorial Drive

Prepared By: ARM

Date: 24-Dec-19

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

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

1. From MassDEP Stormwater Handbook Vol. 1

Allen & Major Associates, Inc.			Computation Sheet	
Title	***MA DEP Standard Calculations***		By	ARM
Project	*Parcel H*		Chk'd	-
Location	Bartlett Street, Northborough MA		Apprv'd	-
Date	December 24, 2019			
Revised				

Stormwater Recharge/Water Quality Volume Table

Rv = F * Impervious Area

Rv *= Required Recharge Volume, expressed in ft^3, cubic yards or acre-feet*

F *= Target Depth Factor associated with each Hydraulic Soil Group*

Impervious Area *= pavement & rooftop area on site*

A_{WQ} *= Required Water Quality Treatment Volume, expressed in ft^3*

D_{WQ} *= Water Quality Depth*

A_{IMP} *= Impervious Area (excluding non-metal roofs)*

					Recharge Required			***Water Quality Volume Required***	
Watershed (Pond 1)	**Area (Sq. Ft.)**	**Landscaped**	**Impervious Area (Square Feet)**		***F Avg. (Inches)***	***Impervious Area (Feet)***	***Rv*** (ft^3)	D_{WQ} *(Inch)*	A_{WQ}
			HSG A (F=.6)	**HSG B (F=.35)**					
P-1	5,944	3,307	2,637	0	0.6	2,637	132	0.5	110
P-2	4,529	1,914	2,615	0	0.6	2,615	131	0.5	109
P-3	1,434	742	692	0	0.6	692	35	0.5	29
P-4	1,029	377	652	0	0.6	652	33	0.5	27
P-5	13,860	11,413	2,447	0	0.6	2,447	122	0.5	102
P-7	5,523	2,121	3,402	0	0.6	3,402	170	0.5	142
P-8	4,229	1,911	2,318	0	0.6	2,318	116	0.5	97
P-9	3,588	1,687	1,901	0	0.6	1,901	95	0.5	79
P-10	12,010	4,394	7,616	0	0.6	7,616	381	0.5	317
P-11	149,569	149,569	0	0	0.0	0	0	0.5	0
P-12	16,095	949	15,146	0	0.6	15,146	757	0.5	631
P-13	12,181	2,356	9,825	0	0.6	9,825	491	0.5	409
P-14	12,308	12,257	51	0	0.6	51	3	0.5	2
P-15A	101,502	0	101,502	0	0.6	101,502	5,075	0.5	4,229
P-15B	49,400	0	49,400	0	0.6	49,400	2,470	0.5	2,058
P-16	32,393	32,293	100	0	0.6	100	5	0.5	4
P-17	23,320	23,320	0	0	0.0	0	0	0.5	0
P-18	102,114	102,114	0	0	0.0	0	0	0.5	0
P-19	29,147	0	28,117	1,030	0.6	29,147	1,436	0.5	1,214
P-20	15,834	0	15,834	0	0.6	15,834	792	0.5	660
P-21	33,308	0	33,308	0	0.6	33,308	1,665	0.5	1,388
P-22	16,831	9,035	7,796	0	0.6	7,796	390	0.5	325
P-23	7,114	2,687	4,427	0	0.6	4,427	221	0.5	184
P-24	15,954	5,144	10,810	0	0.6	10,810	541	0.5	450
P-25	4,890	1,767	3,123	0	0.6	3,123	156	0.5	130
Total	**674,106**	**369,357**	**303,719**	**1,030**		**304,749**	**15,216**		**12,698**

Allen & Major Associates, Inc.			Computation Sheet	
Title	***MA DEP Standard Calculations***		By	ARM
Project	*Parcel H*		Chk'd	-
Location	Bartlett Street, Northborough MA		Apprv'd	-
Date	December 24, 2019			

Stormwater Recharge Summary

Rv = F * Impervious Area

Rv *= Required Recharge Volume, expressed in ft^3, cubic yards or acre-feet*

F *= Target Depth Factor associated with each Hydraulic Soil Group*

Impervious Area *= pavement & rooftop area on site*

	Required (cf)	***Provided (cf)***	
ARv =	***1,256***	***8,328***	***Infiltration Pond #1 (P-7, P-8, P-9, P-10, P-13, P-14)***
ARv =	***1,256***	***8,328***	***Total***

	Required (cf)	***Provided (cf)***	
ARv =	***5,075***	***15,490***	***Infiltration Pond #2 (P-15A, P-17)***
ARv =	***5,075***	***15,490***	***Total***

	Required (cf)	***Provided (cf)***	
ARv =	***8,885***	***13,264***	***Infiltration Pond #3 (P-1, P-2, P-3, P-4, P-5, P-12, P-24, P-25, P-22, P-23, P-21, P-20, P-19, P-15B, P-16)***
ARv =	***8,885***	***13,264***	***Total***

Water Quality Volume

A_{WQ} *= Required Water Quality Treatment Volume, expressed in ft^3*

D_{WQ} *= Water Quality Depth*

A_{IMP} *= Impervious Area (excluding non-metal roofs)*

	Required (cf)	***Provided (cf)***	
A_{WQ} =	***1,046***	***8,328***	***Infiltration Pond #1 (P-7, P-8, P-9, P-10, P-13, P-14)***
A_{WQ} =	***1,046***	***8,328***	***Total***

	Required (cf)	***Provided (cf)***	
A_{WQ} =	***4,229***	***15,490***	***Infiltration Pond #2 (P-15A, P-17)***
A_{WQ} =	***4,229***	***15,490***	***Total***

	Required (cf)	***Provided (cf)***	
A_{WQ} =	***7,422***	***13,264***	***Infiltration Pond #3 (P-1, P-2, P-3, P-4, P-5, P-12, P-24, P-25, P-22, P-23, P-21, P-20, P-19, P-15B, P-16)***
A_{WQ} =	***7,422***	***13,264***	***Total***

Allen & Major Associates, Inc.			Computation Sheet	
Title	***MA DEP Standard Calculations***		By	ARM
Project	*Parcel H*		Chk'd	-
Location	Bartlett Street, Northborough MA		Apprv'd	-
Date	December 24, 2019			

Draindown Within 72 Hours

Time$_{drawdown}$=(Rv) (1/Design Infiltration Rate in inches per hour) (Conversion for inches to feet) (1/bottom area in feet)

Infiltration Pond #1 (Fine Sandy Loam)	
Infiltration Rate (in/Hr)=	2.41
Bottom Area (ft^2) =	1,398
Infiltration Volume (ft^3) =	8,328
Time$_{drawdown}$ (Hours)=	29.66

Time$_{drawdown}$=(Rv) (1/Design Infiltration Rate in inches per hour) (Conversion for inches to feet) (1/bottom area in feet)

Infiltration Pond #2 (Fine Sandy Loam)	
Infiltration Rate (in/Hr)=	2.41
Bottom Area (ft^2) =	3,792
Infiltration Volume (ft^3) =	15,490
Time$_{drawdown}$ (Hours)=	20.34

Time$_{drawdown}$=(Rv) (1/Design Infiltration Rate in inches per hour) (Conversion for inches to feet) (1/bottom area in feet)

Infiltration Pond #3 (Fine Sandy Loam)	
Infiltration Rate (in/Hr)=	2.41
Bottom Area (ft^2) =	7,916
Infiltration Volume (ft^3) =	13,264
Time$_{drawdown}$ (Hours)=	8.34

Mounding Analysis

Infiltration Ponds	***Min. Water Table****	***System Bottom***	***Vertical Separation***	***Attenuated System***	***Mounding Analysis Required****
1	267.0	271.0	4.0	YES	NO
2	261.0	265.0	4.0	YES	NO
3	251.0	255.0	4.0	YES	**NO**

*Mounding analysis is required when the seasonal high ground water is within 4 feet of the bottom of the infiltration structure.

*Minimum Water table to be investigated by test pits in the spring of 2020 to validate assumed elevations.

Stage-Area-Storage for Pond DP1: Pond #1

Elevation (feet)	Surface (sq-ft)	Wetted (sq-ft)	Storage (cubic-feet)
270.00	878	878	0
270.05	901	902	44
270.10	925	926	90
270.15	949	950	137
270.20	973	975	185
270.25	997	1,000	234
270.30	1,022	1,026	285
270.35	1,047	1,051	336
270.40	1,072	1,077	389
270.45	1,098	1,104	444
270.50	1,124	1,130	499
270.55	1,150	1,157	556
270.60	1,177	1,184	614
270.65	1,204	1,212	674
270.70	1,231	1,240	735
270.75	1,258	1,268	797
270.80	1,286	1,296	860
270.85	1,314	1,325	925
270.90	1,342	1,354	992
270.95	1,371	1,384	1,060
271.00	1,400	1,413	1,129
271.05	1,429	1,443	1,200
271.10	1,457	1,472	1,272
271.15	1,487	1,502	1,345
271.20	1,516	1,532	1,420
271.25	1,546	1,563	1,497
271.30	1,576	1,594	1,575
271.35	1,606	1,625	1,655
271.40	1,637	1,656	1,736
271.45	1,667	1,688	1,818
271.50	1,699	1,720	1,902
271.55	1,730	1,752	1,988
271.60	1,762	1,785	2,075
271.65	1,794	1,818	2,164
271.70	1,826	1,851	2,255
271.75	1,859	1,884	2,347
271.80	1,892	1,918	2,441
271.85	1,925	1,952	2,536
271.90	1,958	1,987	2,633
271.95	1,992	2,021	2,732
272.00	2,026	2,056	2,832
272.05	2,059	2,090	2,934
272.10	2,093	2,125	3,038
272.15	2,127	2,160	3,144
272.20	2,161	2,195	3,251
272.25	2,195	2,230	3,360
272.30	2,229	2,265	3,470
272.35	2,264	2,301	3,583
272.40	2,299	2,337	3,697
272.45	2,335	2,374	3,813
272.50	2,370	2,411	3,930
272.55	2,406	2,447	4,050
272.60	2,443	2,485	4,171
272.65	2,479	2,522	4,294
272.70	2,516	2,560	4,419
272.75	2,553	2,598	4,546
272.80	2,590	2,636	4,674
272.85	2,628	2,675	4,805
272.90	2,666	2,714	4,937
272.95	2,704	2,753	5,071
273.00	2,742	2,793	5,207
273.05	2,778	2,830	5,345
273.10	2,815	2,868	5,485
273.15	2,852	2,906	5,627
273.20	2,889	2,944	5,770
273.25	2,926	2,983	5,916
273.30	2,964	3,022	6,063
273.35	3,002	3,061	6,212
273.40	3,040	3,100	6,363
273.45	3,078	3,140	6,516
273.50	3,117	3,179	6,671
273.55	3,155	3,219	6,828
273.60	3,194	3,260	6,986
273.65	3,234	3,300	7,147
273.70	3,273	3,341	7,310
273.75	3,313	3,382	7,474
273.80	3,353	3,423	7,641
273.85	3,393	3,465	7,810
273.90	3,433	3,506	7,980
273.95	3,474	3,548	8,153
274.00	3,515	3,591	8,328
274.05	3,554	3,631	8,505
274.10	3,593	3,672	8,683
274.15	3,633	3,712	8,864
274.20	3,672	3,754	9,046
274.25	3,712	3,795	9,231
274.30	3,752	3,836	9,418
274.35	3,793	3,878	9,606
274.40	3,833	3,920	9,797
274.45	3,874	3,962	9,990
274.50	3,915	4,005	10,184
274.55	3,956	4,047	10,381
274.60	3,997	4,090	10,580
274.65	4,039	4,133	10,781
274.70	4,081	4,177	10,984
274.75	4,123	4,220	11,189
274.80	4,165	4,264	11,396
274.85	4,207	4,308	11,605
274.90	4,250	4,352	11,817
274.95	4,293	4,396	12,030
275.00	**4,336**	**4,441**	**12,246**

Stage-Area-Storage for Pond DP2: Pond #2

Elevation (feet)	Surface (sq-ft)	Wetted (sq-ft)	Storage (cubic-feet)
265.00	3,792	3,792	0
265.05	3,847	3,848	191
265.10	3,902	3,905	385
265.15	3,958	3,962	581
265.20	4,015	4,019	781
265.25	4,071	4,077	983
265.30	4,128	4,135	1,188
265.35	4,186	4,193	1,396
265.40	4,243	4,252	1,606
265.45	4,302	4,312	1,820
265.50	4,360	4,371	2,036
265.55	4,419	4,431	2,256
265.60	4,479	4,492	2,478
265.65	4,538	4,553	2,704
265.70	4,599	4,614	2,932
265.75	4,659	4,676	3,164
265.80	4,720	4,738	3,398
265.85	4,781	4,801	3,636
265.90	4,843	4,864	3,876
265.95	4,905	4,927	4,120
266.00	4,968	4,991	4,367
266.05	5,031	5,055	4,617
266.10	5,094	5,120	4,870
266.15	5,158	5,184	5,126
266.20	5,222	5,250	5,386
266.25	5,286	5,315	5,648
266.30	5,351	5,381	5,914
266.35	5,416	5,448	6,183
266.40	5,481	5,515	6,456
266.45	5,547	5,582	6,732
266.50	5,614	5,650	7,011
266.55	5,681	5,718	7,293
266.60	5,748	5,786	7,579
266.65	5,815	5,855	7,868
266.70	5,883	5,924	8,160
266.75	5,951	5,994	8,456
266.80	6,020	6,064	8,755
266.85	6,089	6,134	9,058
266.90	6,159	6,205	9,364
266.95	6,229	6,277	9,674
267.00	6,299	6,348	9,987
267.05	6,370	6,420	10,304
267.10	6,441	6,493	10,624
267.15	6,512	6,565	10,948
267.20	6,584	6,639	11,275
267.25	6,656	6,712	11,606
267.30	6,728	6,786	11,941
267.35	6,801	6,860	12,279
267.40	6,875	6,935	12,621
267.45	6,948	7,010	12,967
267.50	7,022	7,086	13,316
267.55	7,097	7,162	13,669
267.60	7,172	7,238	14,026
267.65	7,247	7,315	14,386
267.70	7,323	7,392	14,750
267.75	7,399	7,470	15,118
267.80	7,475	7,548	15,490
267.85	7,552	7,626	15,866
267.90	7,629	7,705	16,245
267.95	7,707	7,784	16,629
268.00	7,785	7,864	17,016
268.05	7,862	7,942	17,407
268.10	7,939	8,021	17,802
268.15	8,017	8,100	18,201
268.20	8,095	8,180	18,604
268.25	8,173	8,260	19,011
268.30	8,252	8,340	19,421
268.35	8,331	8,421	19,836
268.40	8,410	8,502	20,254
268.45	8,490	8,583	20,677
268.50	8,570	8,665	21,103
268.55	8,651	8,747	21,534
268.60	8,732	8,830	21,968
268.65	8,813	8,913	22,407
268.70	8,895	8,996	22,850
268.75	8,977	9,080	23,296
268.80	9,059	9,164	23,747
268.85	9,142	9,249	24,202
268.90	9,225	9,334	24,662
268.95	9,309	9,419	25,125
269.00	9,393	9,505	25,592
269.05	9,470	9,584	26,064
269.10	9,548	9,664	26,540
269.15	9,626	9,744	27,019
269.20	9,704	9,824	27,502
269.25	9,783	9,904	27,989
269.30	9,862	9,985	28,480
269.35	9,941	10,066	28,975
269.40	10,021	10,148	29,475
269.45	10,100	10,230	29,978
269.50	10,181	10,312	30,485
269.55	10,261	10,394	30,996
269.60	10,342	10,477	31,511
269.65	10,423	10,560	32,030
269.70	10,505	10,644	32,553
269.75	10,586	10,727	33,080
269.80	10,668	10,812	33,612
269.85	10,751	10,896	34,147
269.90	10,834	10,981	34,687
269.95	10,917	11,066	35,230
270.00	**11,000**	**11,151**	**35,778**

Stage-Area-Storage for Pond DP3: Pond #3

Elevation (feet)	Surface (sq-ft)	Wetted (sq-ft)	Storage (cubic-feet)
255.00	7,916	7,916	0
255.05	7,976	7,978	397
255.10	8,036	8,040	798
255.15	8,096	8,102	1,201
255.20	8,157	8,165	1,607
255.25	8,217	8,228	2,017
255.30	8,278	8,291	2,429
255.35	8,339	8,354	2,844
255.40	8,401	8,417	3,263
255.45	8,462	8,481	3,684
255.50	8,524	8,545	4,109
255.55	8,586	8,609	4,537
255.60	8,649	8,674	4,968
255.65	8,711	8,738	5,402
255.70	8,774	8,803	5,839
255.75	8,837	8,868	6,279
255.80	8,900	8,934	6,723
255.85	8,963	8,999	7,169
255.90	9,027	9,065	7,619
255.95	9,091	9,131	8,072
256.00	9,155	9,197	8,528
256.05	9,218	9,262	8,987
256.10	9,281	9,328	9,450
256.15	9,344	9,393	9,915
256.20	9,407	9,459	10,384
256.25	9,470	9,524	10,856
256.30	9,534	9,590	11,331
256.35	9,598	9,657	11,809
256.40	9,662	9,723	12,291
256.45	9,727	9,790	12,776
256.50	9,791	9,857	13,264
256.55	9,856	9,924	13,755
256.60	9,921	9,991	14,249
256.65	9,986	10,059	14,747
256.70	10,052	10,127	15,248
256.75	10,117	10,195	15,752
256.80	10,183	10,263	16,260
256.85	10,249	10,331	16,771
256.90	10,316	10,400	17,285
256.95	10,382	10,469	17,802
257.00	10,449	10,538	18,323
257.05	10,515	10,606	18,847
257.10	10,580	10,675	19,374
257.15	10,646	10,743	19,905
257.20	10,713	10,812	20,439
257.25	10,779	10,881	20,976
257.30	10,846	10,950	21,517
257.35	10,913	11,019	22,061
257.40	10,980	11,089	22,608
257.45	11,047	11,158	23,159
257.50	11,114	11,228	23,713
257.55	11,182	11,299	24,270
257.60	11,250	11,369	24,831
257.65	11,318	11,440	25,395
257.70	11,386	11,510	25,963
257.75	11,455	11,582	26,534
257.80	11,523	11,653	27,108
257.85	11,592	11,724	27,686
257.90	11,661	11,796	28,267
257.95	11,730	11,868	28,852
258.00	11,800	11,940	29,441
258.05	11,869	12,011	30,032
258.10	11,937	12,082	30,627
258.15	12,006	12,154	31,226
258.20	12,075	12,226	31,828
258.25	12,145	12,298	32,433
258.30	12,214	12,370	33,042
258.35	12,284	12,443	33,655
258.40	12,354	12,515	34,271
258.45	12,424	12,588	34,890
258.50	12,494	12,661	35,513
258.55	12,565	12,734	36,140
258.60	12,635	12,808	36,770
258.65	12,706	12,881	37,403
258.70	12,777	12,955	38,040
258.75	12,849	13,029	38,681
258.80	12,920	13,103	39,325
258.85	12,992	13,178	39,973
258.90	13,064	13,253	40,624
258.95	13,136	13,328	41,279
259.00	13,208	13,403	41,938
259.05	13,287	13,484	42,600
259.10	13,366	13,566	43,267
259.15	13,445	13,647	43,937
259.20	13,525	13,730	44,611
259.25	13,604	13,812	45,289
259.30	13,684	13,894	45,972
259.35	13,764	13,977	46,658
259.40	13,845	14,060	47,348
259.45	13,925	14,144	48,042
259.50	14,006	14,227	48,741
259.55	14,087	14,311	49,443
259.60	14,169	14,395	50,149
259.65	14,250	14,479	50,860
259.70	14,332	14,564	51,574
259.75	14,414	14,649	52,293
259.80	14,497	14,734	53,016
259.85	14,579	14,819	53,743
259.90	14,662	14,904	54,474
259.95	14,745	14,990	55,209
260.00	**14,828**	**15,076**	**55,948**

storage below orifice

ALLEN & MAJOR ASSOCIATES, INC.

DRAINAGE PIPE DESIGN ANALYSIS

Manning's Formula

$V=1.486/n*R^{2/3}*S^{1/2}$
Q = V*A
(25-Year storm)

Where: V is the velocity in Ft/sec.
n is Manning's coefficient of friction
R is the Hydraulic Radius
S is the slope of the pipe

R=Area/Wetted Perimeter

Where: Area=Pi*(R/12)2
Wetted Perimeter=2*Pi*R/12

A&M Job No. 1145-09

Date: 12/20/2019

Project Location:
Parcel H Development
Bartlett Street
Northborough, MA

Prepared For:
The Gutierrez Company
200 Summit Drive
Suite 400
Burlington, MA 01803

PIPE	Q_{design} (cfs)	n	Diameter (inches)	A (ft^2)	Wp (ft)	R (ft)	S (feet/foot)	Q_{full} (cfs)	$Q_{full} \geq Q_{design}$	V_{full} (ft/s)	Q_d/Q_f	Results Fig. 4-4A	V_{design} (ft/s)	2 ft/s ≤ V_{design} ≤ 10 ft/s
DMH-01	0.58	0.013	12	0.79	3.14	0.25	0.030	6.17	OK	7.86	0.09	0.58	4.56	OK
DMH-02	0.73	0.013	12	0.79	3.14	0.25	0.080	10.08	OK	12.83	0.07	0.53	6.80	OK
DMH-03	3.84	0.013	15	1.23	3.93	0.31	0.010	6.46	OK	5.26	0.59	1.04	5.47	OK
DMH-04	3.11	0.013	12	0.79	3.14	0.25	0.010	3.56	OK	4.54	0.87	1.13	5.13	OK
DMH-05	4.58	0.013	15	1.23	3.93	0.31	0.010	6.46	OK	5.26	0.71	1.08	5.69	OK
DMH-06	4.58	0.013	15	1.23	3.93	0.31	0.010	6.46	OK	5.26	0.71	1.08	5.69	OK
DMH-07	5.96	0.013	15	1.23	3.93	0.31	0.010	6.46	OK	5.26	0.92	1.14	6.00	OK
DMH-08	9.82	0.013	18	1.77	4.71	0.38	0.010	10.50	OK	5.94	0.93	1.14	6.78	OK
DMH-09	11.66	0.013	24	3.14	6.28	0.50	0.010	22.62	OK	7.20	0.52	1.00	7.20	OK
DMH-10	1.75	0.013	12	0.79	3.14	0.25	0.010	3.56	OK	4.54	0.49	0.98	4.45	OK
WQU-1	15.05	0.013	24	3.14	6.28	0.50	0.010	22.62	OK	7.20	0.67	1.07	7.70	OK
WQU-2	2.95	0.013	12	0.79	3.14	0.25	0.010	3.56	OK	4.54	0.83	1.12	5.08	OK

Project: Parcel H Development
Location: Northborough, MA
Prepared For: Allen & Major Associates

Purpose: To calculate the water quality flow rate (WQF) over a given site area. In this situation the WQF is derived from the first 1" of runoff from the contributing impervious surface.

Reference: Massachusetts Dept. of Environmental Protection Wetlands Program / United States Department of Agriculture Natural Resources Conservation Service TR-55 Manual

Procedure: Determine unit peak discharge using Figure 1 or 2. Figure 2 is in tabular form so is preferred. Using the tc, read the unit peak discharge (qu) from Figure 1 or Table in Figure 2. qu is expressed in the following units: cfs/mi^2/watershed inches (csm/in).

Compute Q Rate using the following equation:

$$Q = (qu)\ (A)\ (WQV)$$

where:

Q = flow rate associated with first 1" of runoff
qu = the unit peak discharge, in csm/in.
A = impervious surface drainage area (in square miles)
WQV = water quality volume in watershed inches (1" in this case)

Structure Name	Impv. (acres)	A (miles^2)	t_c (min)	t_c (hr)	WQV (in)	qu (csm/in.)	Q (cfs)
WQU 1	3.81	0.0059531	6.0	0.100	1.00	774.00	4.61
WQU 2	0.86	0.0013469	6.0	0.100	1.00	774.00	1.04

Illicit Discharge Compliance Statement

Responsibility:

The Owner is responsible for ultimate compliance with all provisions of the Massachusetts Stormwater Management Policy, the USEPA NPDES Construction General Permit and responsible for identifying and eliminating illicit discharges (as defined by the USEPA).

OWNER NAME: The Gutierrez Company

ADDRESS: 200 Summit Drive, Suite 400

Burlington, MA 01803

TEL. NUMBER: (781) 272-7000

Engineer's Compliance Statement:

To the best of my knowledge, the attached plans, computations and specifications meet the requirements of Standard 10 of the Massachusetts Stormwater Handbook regarding illicit discharges to the stormwater management system and that no detectable illicit discharges exist on the site. All documents and attachments were prepared under my direction and qualified personnel properly gathered and evaluated the information submitted, to the best of my knowledge.

Included with this statement are site plans, drawn to scale, that identify the location of systems for conveying stormwater on the site and show that these systems do not allow the entry of any illicit discharges into the stormwater management system. The plans also show any systems for conveying wastewater and/or groundwater on the site and show that there are no connections between the stormwater and wastewater systems.

For a redevelopment project (if applicable), all actions taken to identify and remove illicit discharges, including without limitation, visual screening, dye or smoke testing, and the removal of any sources of illicit discharges to the stormwater management system are documented and included with this statement.