Utility and Stormwater Report

Walnut Street & Commercial Street
Foxborough, Massachusetts 02035

Walnut Street Senior Development

January 13, 2023
Revised March 24, 2023

JOB NO: ENG22-0480

COMMONWEALTH OF MASSACHUSETTS
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Massachusetts Department of Environmental Protection
Bureau of Resource Protection - Wetlands Program

Checklist for Stormwater Report

A. Introduction

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

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

The Stormwater Report must include:

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

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

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

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

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[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.

B. Stormwater Checklist and Certification

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

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

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

Registered Professional Engineer's Certification

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

Registered Professional Engineer Block and Signature

Signature and Date

Checklist

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

☒ New development

☐ Redevelopment

☐ Mix of New Development and Redevelopment

Checklist (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): Infiltration Basin

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 (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.

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

Checklist (continued)

Standard 3: Recharge (continued)

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

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

Standard 4: Water Quality

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

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

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

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

  ☐ is within the Zone II or Interim Wellhead Protection Area

  ☐ is near or to other critical areas

  ☐ is within soils with a rapid infiltration rate (greater than 2.4 inches per hour)

  ☐ involves runoff from land uses with higher potential pollutant loads.

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

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

Checklist (continued)

Standard 4: Water Quality (continued)

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

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

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

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

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

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

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

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

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

☐ All exposure has been eliminated.

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

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

Standard 6: Critical Areas

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

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

Checklist for Stormwater Report

Checklist (continued)

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

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

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

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

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

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

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

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

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

Checklist (continued)

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

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

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

☐ The project is covered by a NPDES Construction General Permit and a copy of the SWPPP is in the Stormwater Report.
☒ The project is covered by a NPDES Construction General Permit but no SWPPP been submitted. The SWPPP will be submitted BEFORE land disturbance begins.

Standard 9: Operation and Maintenance Plan

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

  ☒ Name of the stormwater management system owners;

  ☒ Party responsible for operation and maintenance;

  ☒ Schedule for implementation of routine and non-routine maintenance tasks;

  ☒ Plan showing the location of all stormwater BMPs maintenance access areas;

  ☒ Description and delineation of public safety features;

  ☒ Estimated operation and maintenance budget; and

  ☒ Operation and Maintenance Log Form.

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

  ☐ A copy of the legal instrument (deed, homeowner's association, utility trust or other legal entity) that establishes the terms of and legal responsibility for the operation and maintenance of the project site stormwater BMPs;

  ☐ A plan and easement deed that allows site access for the legal entity to operate and maintain BMP functions.

Standard 10: Prohibition of Illicit Discharges

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

☒ An Illicit Discharge Compliance Statement is attached;

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

1.0 Introduction:

The purpose of this report is to review, in a manner consistent with 760 CMR 56.05(2)(f), the utility and drainage systems that will serve the proposed development. The proposed location and types of sewerage, drainage, and water facilities will be discussed. The project applicant, OnyxGroup Realty & Development LLC, proposes a new senior housing development project at Walnut Street and Commercial Street in Foxborough. The project site is a 15.57 acre parcel of land bounded by Walnut Street to the north, Interstate 95 to the south, Route 140/Commercial Street to the east, and North High Street to the west (See Attachment A for locus plan).

2.0 General:

The proposed housing development will consist of three residential buildings with a total of 200 units along with outdoor amenity spaces and vehicular parking areas. Site work will include, but is not limited to, grading, drainage, utilities, paving and landscaping. Demolition efforts will primarily consist of tree clearing, as the site is mostly wooded. The site is currently undeveloped, consisting of an isolated wetland area surrounded by woodlands. The topography of the drainage study area slopes from west to east, with elevations ranging from 274-FT at North High Street to a low of approximately 236-FT at the northeast, at the intersection of Walnut Street and Commercial Street. NRCS soil mapping describes the site as being a mixture of Ridgebury FSL (HSG-D), Paxton FSL (HSG-C), and Woodbridge FSL (HSG-D). Test pits conducted on-site generally support the presence of HSG-C soils through the site. Soil mapping can be found in Attachment C of this report.

3.0 Water:

There is an 8-inch water main located in Walnut Street which abuts the project site. There is no data available at the Foxborough Water Department on the available volume and pressure within the main. Each of the three proposed buildings will be fully sprinklered, as a new 8” water main loop is proposed for the site. The proposed 8” main will connect to the existing 8” main at both the east and west entrances to the site. There are 4” domestic services and 6” fire services proposed for each building, along with four hydrants that will be located throughout the development. A flow test will be necessary to determine the adequacy of the existing water system to service the property.

4.0 Sewage Disposal:

There will be a total of 200 one-bedroom units on site which will produce 22,000 gpd of new sewer flow from the project. The estimated flow is based on the State Sanitary Code (Title 5). There is a proposed extension of a 3” low-pressure sewer force main that will be installed prior to the construction of the Walnut Street Senior Development. There are 8” gravity sewer services for each building that will discharge flows to 2,000 gallon septic tanks prior to entering E/One grinder pumps. Each building is proposed to have its own respective septic tank and grinder pump. Sewer flows will then enter the grinder pump and proceed to a proposed 3” force main, which will then connect to the force main extension in Walnut Street. The 3” forcemain is maintained throughout the development in an effort to maintain a pressurized sewerage system.

5.0 *Gas/Electric:*

An extension of the existing gas main adjacent to the Walnut Street – North High Street intersection is proposed to provide gas services to the proposed development. The proposed gas main extension will run from west to east and will enter the proposed development at the proposed western entrance to the site. Columbia Gas is the local utility and will determine the necessary main and service sizes after reviewing the required gas demand for the site. The site is served by above ground power lines located on poles within the right of way of Walnut Street. Electric services will be provided to the site via a connection to an existing utility pole north of the development. Each proposed building will require its own respective transformer. The local power company is NSTAR.

6.0 Stormwater Management

A summary of how DEP Stormwater Management Standards will be addressed can be found below. Associated stormwater supporting data, exhibits, and calculations can be found in Attachments B through F.

Standard 1: No New Untreated Discharges

The proposed project will create no new untreated discharges. Within the drainage study area, total impervious area will be increased in comparison with existing conditions by approximately 214,000-SF. Approximately 213,000-SF± of impervious area will now undergo treatment via street sweeping, deep sump hooded catch basins, or infiltration basins. As such, existing stormwater discharges will meet Standard 1 to the maximum extent practicable. HydroCAD modeling of the site is provided in Attachment E.

Standard 2: Peak Rate Attenuation

Existing and proposed conditions were modeled using HydroCAD computer software and the most current NOAA Atlas 14 rainfall data. A table, summarizing peak discharges for the 2-Yr, 10-Yr, 25-Yr, 50-Yr and 100-Yr storm events can be found in Attachment F.1. The proposed design is such that peak runoff volumes and peak discharge rates do not exceed pre-development rates, even in the 100-year storm scenario.

To ensure that the work incorporates the performance standards recommended in the DEP's Stormwater Management Policy, necessary erosion and sedimentation control measures will be utilized during construction, as depicted on the site plans.

Standard 3: Recharge

Standard 3 will be met by proposing two infiltration practices to provide recharge on site. The BMPs are designed to capture and infiltrate the required recharge volume for the increase in impervious area being proposed. Supporting calculations can be found in Attachment F.3 of this report.

Standard 4: Water Quality

All of the stormwater from impervious parking and driveway areas on the site will undergo treatment to bring TSS levels within regulated limits (>80% removal). Stormwater will undergo treatment from deep sump catch basins and infiltration basins with sediment forebays. Infiltration basins have been designed to provide treatment for the required Water Quality Volume. During construction, appropriate BMPs will be used to minimize sedimentation and soil erosion.

Although these areas do not generate a significant TSS load, runoff from all pedestrian/non-vehicular areas will be collected and discharged to either of the two proposed infiltration basins.

During the project, appropriate BMPs will be used to minimize sedimentation and soil erosion.

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

This site is not considered a LUHPPL, as such, Standard 5 does not apply.

Standard 6: Critical Areas

There will be no new discharge to critical areas.

Standard 7: Redevelopments and Other Projects Subject to the Standards Only to the Maximum Extent Practicable

The proposed project is not a redevelopment and the requirements of Standard 7 are not applicable.

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

A detailed Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan is included in Attachment H. To ensure that the work incorporates the performance standards recommended in the DEP's Stormwater Management Policy, necessary erosion and sedimentation control measures will be utilized during construction.

Standard 9: Operation and Maintenance Plan

An operations and maintenance plan is included in Attachment I.

Standard 10: Prohibition of Illicit Discharges

An illicit discharge compliance statement has been included in Attachment J.

Attachment A - Locus Map

500 250 0 500

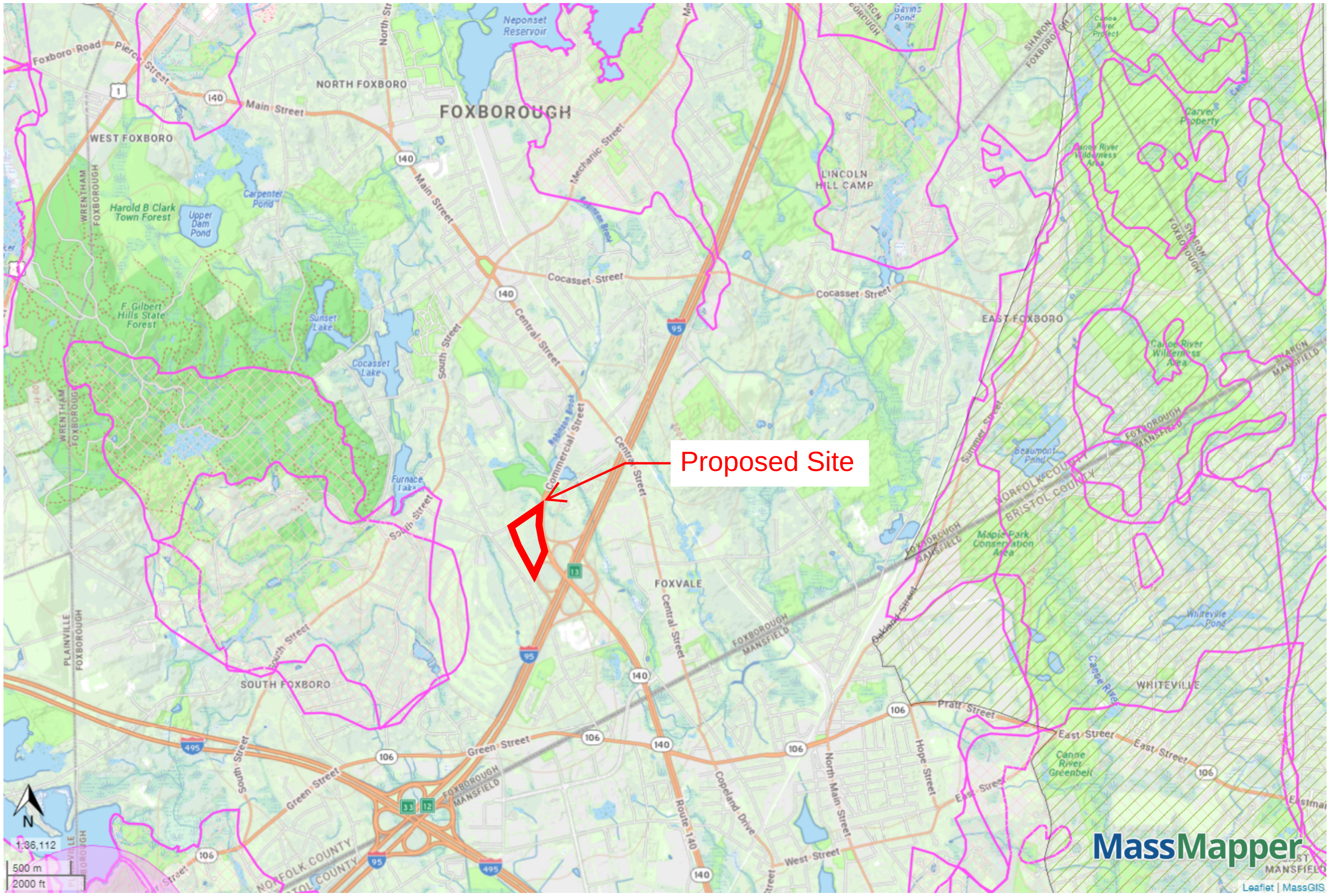
SCALE 1"= 500'

LOCUS MAP

Weston & Sampson℠

Weston & Sampson Engineers, Inc.

55 Walkers Brook Drive, Suite 100, Reading MA 01867



Areas of Critical Environmental Concern ACECs Boundaries

- ROAD/RAIL BASED
- RIVER BASED
- WETLAND BASED
- FLOODPLAIN BASED
- TIDAL BASED
- CONTOUR BASED
- POLITICAL BOUNDARY
- PROPERTY LINE BASED
- OTHER
- NOT DEFINED

Areas of Critical Environmental Concern ACECs

☐

IWPAs

☐

Zone IIs

☐

Property Tax Parcels

The proposed project will not discharge into a critical area, Zone II, or an Interim Wellhead Protection Area of a public water supply

Attachment B - NRCS Soils Map, Soils Report, and HSG Classifications

United States
Department of
Agriculture

Natural
Resources
Conservation
Service

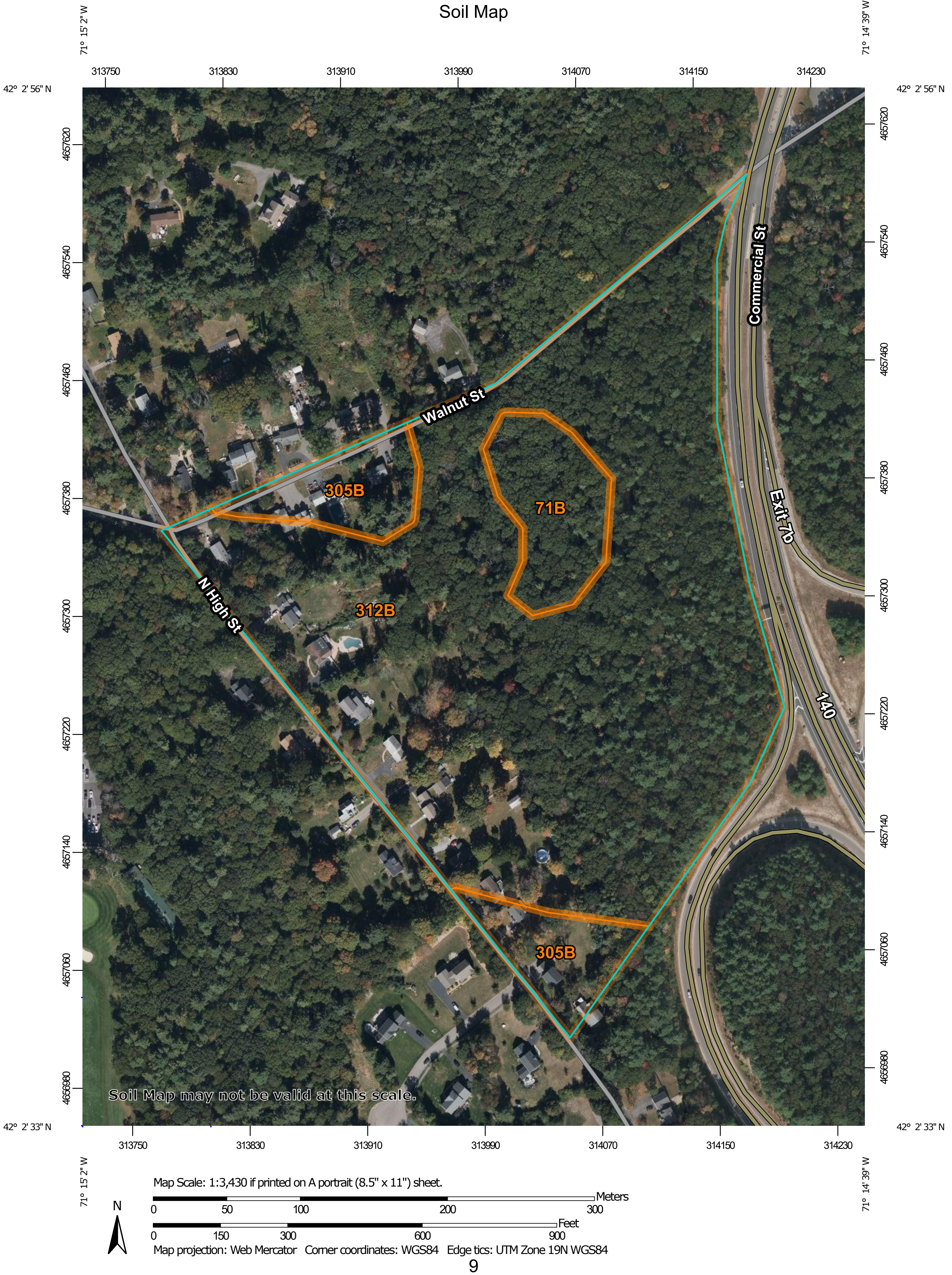
A product of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local participants

Custom Soil Resource Report for

Norfolk and Suffolk Counties, Massachusetts

June 3, 2022

Soil Map



Map Scale: 1:3,430 if printed on A portrait (8.5" x 11") sheet.

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

MAP LEGEND

Area of Interest (AOI)

- Area of Interest (AOI)

Soils

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

Special Point Features

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

Water Features

- Streams and Canals

Transportation

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

Background

- Aerial Photography

MAP INFORMATION

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

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

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

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

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

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

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

Soil Survey Area: Norfolk and Suffolk Counties, Massachusetts
Survey Area Data: Version 17, Sep 3, 2021

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

Date(s) aerial images were photographed: Oct 4, 2020—Oct 19, 2020

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

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
71B	Ridgebury fine sandy loam, 3 to 8 percent slopes, extremely stony	2.0	6.9%
305B	Paxton fine sandy loam, 3 to 8 percent slopes	2.8	9.7%
312B	Woodbridge fine sandy loam, 0 to 8 percent slopes, extremely stony	24.3	83.4%
Totals for Area of Interest		**29.2**	**100.0%**

Map Unit Descriptions

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

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

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

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

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

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

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

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

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

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

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

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

Norfolk and Suffolk Counties, Massachusetts

71B—Ridgebury fine sandy loam, 3 to 8 percent slopes, extremely stony

Map Unit Setting

National map unit symbol: 2w69c
Elevation: 0 to 1,290 feet
Mean annual precipitation: 36 to 71 inches
Mean annual air temperature: 39 to 55 degrees F
Frost-free period: 140 to 240 days
Farmland classification: Not prime farmland

Map Unit Composition

Ridgebury, extremely stony, and similar soils: 80 percent
Minor components: 20 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Ridgebury, Extremely Stony

Setting

Landform: Drumlins, depressions, ground moraines, hills, drainageways
Landform position (two-dimensional): Footslope, toeslope
Landform position (three-dimensional): Head slope, base slope
Down-slope shape: Concave
Across-slope shape: Concave
Parent material: Coarse-loamy lodgment till derived from gneiss, granite, and/or schist

Typical profile

Oe - 0 to 1 inches: moderately decomposed plant material
A - 1 to 6 inches: fine sandy loam
Bw - 6 to 10 inches: sandy loam
Bg - 10 to 19 inches: gravelly sandy loam
Cd - 19 to 66 inches: gravelly sandy loam

Properties and qualities

Slope: 3 to 8 percent
Surface area covered with cobbles, stones or boulders: 9.0 percent
Depth to restrictive feature: 15 to 35 inches to densic material
Drainage class: Poorly drained
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.14 in/hr)
Depth to water table: About 0 to 6 inches
Frequency of flooding: None
Frequency of ponding: None
Maximum salinity: Nonsaline (0.0 to 1.9 mmhos/cm)
Available water supply, 0 to 60 inches: Low (about 3.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7s
Hydrologic Soil Group: D
Ecological site: F144AY009CT - Wet Till Depressions
Hydric soil rating: Yes

Minor Components

Woodbridge, extremely stony
Percent of map unit: 10 percent
Landform: Ground moraines, hills, drumlins
Landform position (two-dimensional): Summit, backslope, footslope
Landform position (three-dimensional): Side slope, crest
Down-slope shape: Convex
Across-slope shape: Linear
Hydric soil rating: No

Whitman, extremely stony
Percent of map unit: 8 percent
Landform: Depressions
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

Paxton, extremely stony
Percent of map unit: 2 percent
Landform: Ground moraines, hills, drumlins
Landform position (two-dimensional): Summit, shoulder, backslope
Landform position (three-dimensional): Side slope, crest
Down-slope shape: Convex, linear
Across-slope shape: Linear, convex
Hydric soil rating: No

305B—Paxton fine sandy loam, 3 to 8 percent slopes

Map Unit Setting

National map unit symbol: 2t2qp
Elevation: 0 to 1,570 feet
Mean annual precipitation: 36 to 71 inches
Mean annual air temperature: 39 to 55 degrees F
Frost-free period: 140 to 240 days
Farmland classification: All areas are prime farmland

Map Unit Composition

Paxton and similar soils: 80 percent
Minor components: 20 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Paxton

Setting
Landform: Ground moraines, drumlins, hills
Landform position (two-dimensional): Summit, shoulder, backslope
Landform position (three-dimensional): Nose slope, side slope, crest
Down-slope shape: Convex, linear
Across-slope shape: Convex

Parent material: Coarse-loamy lodgment till derived from gneiss, granite, and/or schist

Typical profile

Ap - 0 to 8 inches: fine sandy loam
Bw1 - 8 to 15 inches: fine sandy loam
Bw2 - 15 to 26 inches: fine sandy loam
Cd - 26 to 65 inches: gravelly fine sandy loam

Properties and qualities

Slope: 3 to 8 percent
Depth to restrictive feature: 18 to 39 inches to densic material
Drainage class: Well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.14 in/hr)
Depth to water table: About 18 to 37 inches
Frequency of flooding: None
Frequency of ponding: None
Maximum salinity: Nonsaline (0.0 to 1.9 mmhos/cm)
Available water supply, 0 to 60 inches: Low (about 3.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2s
Hydrologic Soil Group: C
Ecological site: F144AY007CT - Well Drained Dense Till Uplands
Hydric soil rating: No

Minor Components

Woodbridge

Percent of map unit: 9 percent
Landform: Ground moraines, drumlins, hills
Landform position (two-dimensional): Summit, backslope, footslope
Landform position (three-dimensional): Side slope
Down-slope shape: Concave
Across-slope shape: Linear
Hydric soil rating: No

Ridgebury

Percent of map unit: 6 percent
Landform: Depressions, ground moraines, hills, drainageways
Landform position (two-dimensional): Toeslope, backslope, footslope
Landform position (three-dimensional): Base slope, head slope, dip
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

Charlton

Percent of map unit: 5 percent
Landform: Hills
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: No

312B—Woodbridge fine sandy loam, 0 to 8 percent slopes, extremely stony

Map Unit Setting

National map unit symbol: 2t2qs
Elevation: 0 to 1,580 feet
Mean annual precipitation: 36 to 71 inches
Mean annual air temperature: 39 to 55 degrees F
Frost-free period: 140 to 240 days
Farmland classification: Not prime farmland

Map Unit Composition

Woodbridge, extremely stony, and similar soils: 82 percent
Minor components: 18 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Woodbridge, Extremely Stony

Setting

Landform: Ground moraines, hills, drumlins
Landform position (two-dimensional): Summit, backslope, footslope
Landform position (three-dimensional): Side slope
Down-slope shape: Concave
Across-slope shape: Linear
Parent material: Coarse-loamy lodgment till derived from gneiss, granite, and/or schist

Typical profile

Oe - 0 to 2 inches: moderately decomposed plant material
A - 2 to 9 inches: fine sandy loam
Bw1 - 9 to 20 inches: fine sandy loam
Bw2 - 20 to 32 inches: fine sandy loam
Cd - 32 to 67 inches: gravelly fine sandy loam

Properties and qualities

Slope: 0 to 8 percent
Surface area covered with cobbles, stones or boulders: 9.0 percent
Depth to restrictive feature: 20 to 43 inches to densic material
Drainage class: Moderately well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.14 in/hr)
Depth to water table: About 19 to 27 inches
Frequency of flooding: None
Frequency of ponding: None
Maximum salinity: Nonsaline (0.0 to 1.9 mmhos/cm)
Available water supply, 0 to 60 inches: Low (about 4.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 7s
Hydrologic Soil Group: C/D
Ecological site: F144AY037MA - Moist Dense Till Uplands
Hydric soil rating: No

Minor Components

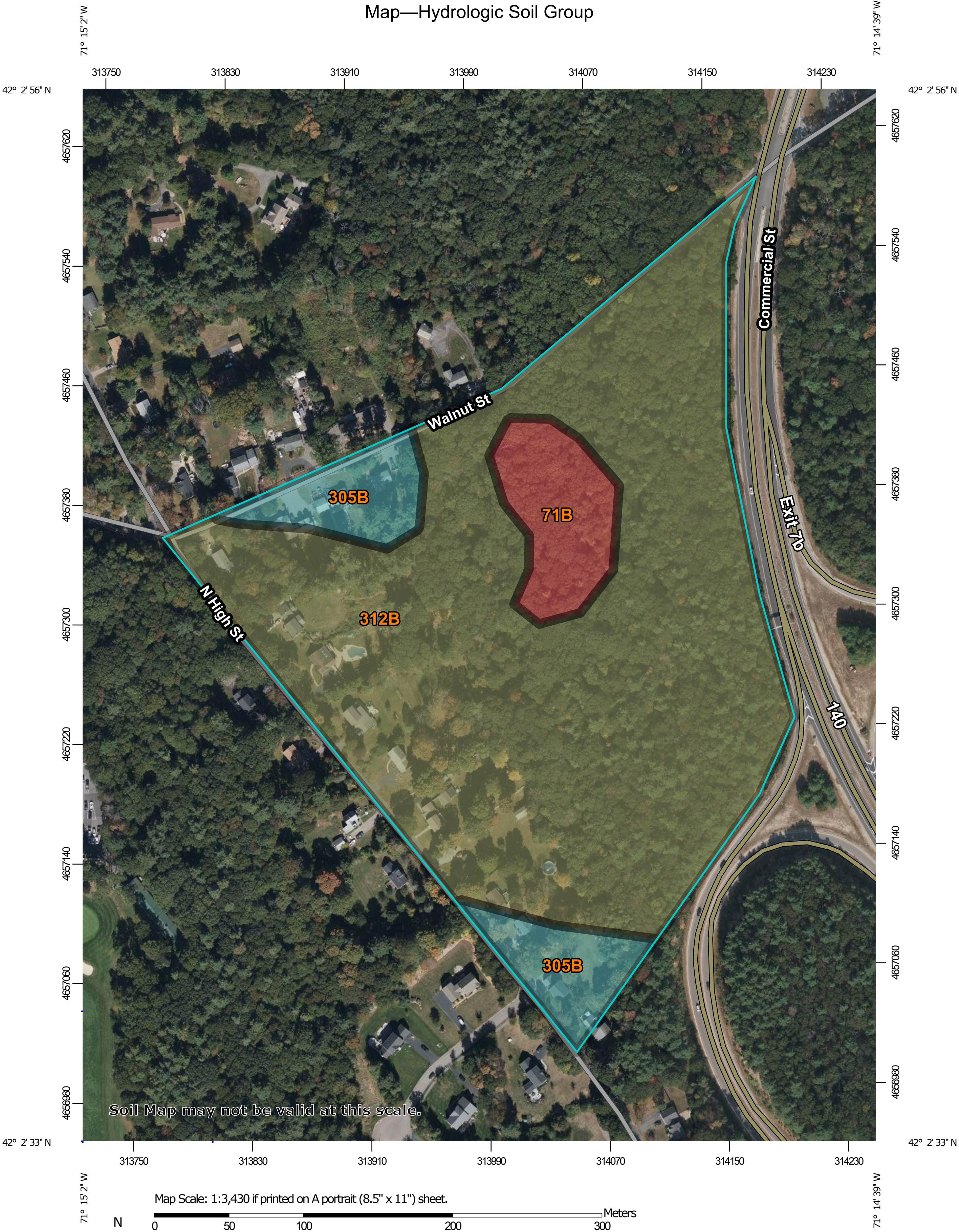
Paxton, extremely stony

Percent of map unit: 10 percent
Landform: Ground moraines, hills, drumlins
Landform position (two-dimensional): Summit, shoulder, backslope
Landform position (three-dimensional): Side slope, crest
Down-slope shape: Convex, linear
Across-slope shape: Linear, convex
Hydric soil rating: No

Ridgebury, extremely stony

Percent of map unit: 8 percent
Landform: Hills, drainageways, drumlins, depressions, ground moraines
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Head slope, base slope
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

Map—Hydrologic Soil Group



Map Scale: 1:3,430 if printed on A portrait (8.5" x 11") sheet.

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

MAP LEGEND

Area of Interest (AOI)

▭ Area of Interest (AOI)

Soils

Soil Rating Polygons

■ A

■ A/D

■ B

■ B/D

■ C

■ C/D

■ D

□ Not rated or not available

Soil Rating Lines

〰 A

〰 A/D

〰 B

〰 B/D

〰 C

〰 C/D

〰 D

〰 Not rated or not available

Soil Rating Points

■ A

■ A/D

■ B

■ B/D

■ C

■ C/D

■ D

□ Not rated or not available

Water Features

〰 Streams and Canals

Transportation

┼┼┼ Rails

〰 Interstate Highways

〰 US Routes

〰 Major Roads

〰 Local Roads

Background

▨ Aerial Photography

MAP INFORMATION

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

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

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

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

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

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

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

Soil Survey Area: Norfolk and Suffolk Counties, Massachusetts
Survey Area Data: Version 17, Sep 3, 2021

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

Date(s) aerial images were photographed: Oct 4, 2020—Oct 19, 2020

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

Table—Hydrologic Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
71B	Ridgebury fine sandy loam, 3 to 8 percent slopes, extremely stony	D	2.0	6.9%
305B	Paxton fine sandy loam, 3 to 8 percent slopes	C	2.8	9.7%
312B	Woodbridge fine sandy loam, 0 to 8 percent slopes, extremely stony	C/D	24.3	83.4%
Totals for Area of Interest			**29.2**	**100.0%**

Rating Options—Hydrologic Soil Group

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

Attachment C - Test Pit and Soil Boring Logs

Bay Colony Group, Inc.
Professional Civil Engineers & Land Surveyors

4 School Street, P. O. Box 9136
Foxborough, Massachusetts 02035
Telephone (508) 543-3939 • Fax (508) 543-8866
E-mail: mailbox@baycolonygroup.com

Perc Test 05/27/92
Walnut Street
Foxborough, MA
(Museum of Discovery)

Engineer: Karl Drown, R.S.

TH1

0 - 30	Topsoil & Subsoil
30 -120	Silty Sand & Gravel

Water @ 84" Rust @ 60" Depth: 54" Rate: 13 mpi

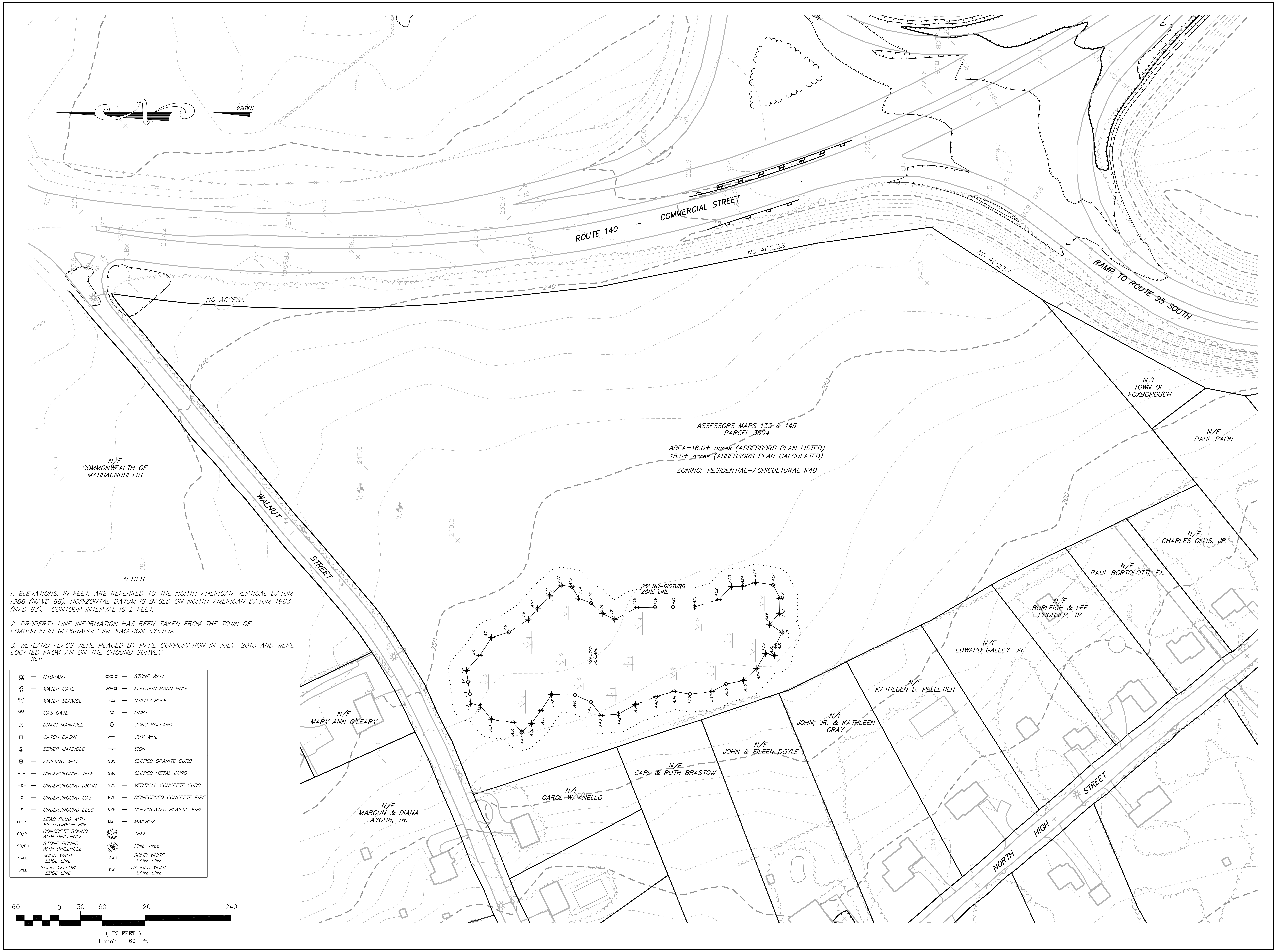
soak	11:55
start	12:11
12-9	12:34
9-6	1:11:37

TH2

0 - 40	Topsoil & Subsoil
40 -108	Silty Sand & Gravel

Water @ 84" Depth: 60" Rate: 10 mpi

soak	1:02
start	1:17
12-9	1:35
9-6	2:06



NOTES

1. ELEVATIONS, IN FEET, ARE REFERRED TO THE NORTH AMERICAN VERTICAL DATUM 1988 (NAVD 88). HORIZONTAL DATUM IS BASED ON NORTH AMERICAN DATUM 1983 (NAD 83). CONTOUR INTERVAL IS 2 FEET.

2. PROPERTY LINE INFORMATION HAS BEEN TAKEN FROM THE TOWN OF FOXBOROUGH GEOGRAPHIC INFORMATION SYSTEM.

3. WETLAND FLAGS WERE PLACED BY PARE CORPORATION IN JULY, 2013 AND WERE LOCATED FROM AN ON THE GROUND SURVEY.

KEY:

☼	— HYDRANT	○○○	— STONE WALL
WG	— WATER GATE	HH□	— ELECTRIC HAND HOLE
WS	— WATER SERVICE	⊶	— UTILITY POLE
GG	— GAS GATE	☼	— LIGHT
Ⓓ	— DRAIN MANHOLE	◎	— CONC BOLLARD
□	— CATCH BASIN	≻	— GUY WIRE
Ⓢ	— SEWER MANHOLE	⊸	— SIGN
Ⓦ	— EXISTING WELL	SGC	— SLOPED GRANITE CURB
-T-	— UNDERGROUND TELE.	SMC	— SLOPED METAL CURB
-D-	— UNDERGROUND DRAIN	VCC	— VERTICAL CONCRETE CURB
-G-	— UNDERGROUND GAS	RCP	— REINFORCED CONCRETE PIPE
-E-	— UNDERGROUND ELEC.	CPP	— CORRUGATED PLASTIC PIPE
EPLP	— LEAD PLUG WITH ESCUTCHEON PIN	MB	— MAILBOX
CB/DH	— CONCRETE BOUND WITH DRILLHOLE	✿	— TREE
SB/DH	— STONE BOUND WITH DRILLHOLE	✳	— PINE TREE
SWEL	— SOLID WHITE EDGE LINE	SWLL	— SOLID WHITE LANE LINE
SYEL	— SOLID YELLOW EDGE LINE	DWLL	— DASHED WHITE LANE LINE

PROJECT:

Parcel 3604
Walnut Street
Foxborough
Massachusetts

PREPARED FOR:

Foxborough Housing
Authority
90 N. Carl Annon Court
Foxborough, MA 02035

Bay Colony Group, Inc.
Professional Civil Engineers &
Professional Land Surveyors

FOUR SCHOOL STREET
P.O. BOX 9136
FOXBOROUGH, MA 02035
508-543-3939

LOCUS 1"=1000'

STAMP

DRAWING TITLE

EXISTING
CONDITIONS PLAN

SCALE: 1" = 60'

AUGUST 8, 2013	SHEET NUMBER
13-0172-WET	1

Weston & Sampson

55 Walkers Brook Drive, Suite 100 Reading, MA 01867 (HQ)
Tel: 978.532.1900

November 1, 2022

Mr. Michael J. Mattos
Executive Director
Affordable Housing and Services Collaborative, Inc.
536 Granite Street
Braintree, MA 02184

RE: Preliminary Geotechnical Engineering Report
Proposed Walnut Street and Commercial Street (Route 140) Development
Foxborough, Massachusetts

Weston & Sampson Engineers, Inc. (Weston & Sampson) is pleased to present our geotechnical engineering report for the proposed residential development referenced above. Our project understanding is based on a site plan dated September 22, 2022 prepared by Weston & Sampson. Our services were completed in general accordance with our September 28, 2022 Proposal for Preliminary Geotechnical Engineering Services.

Information on the use of this report is provided in the document titled "Important Information about this Geotechnical Engineering Report" by Geoprofessional Business Association (GBA), Inc., as described in the Limitations section of this report.

PROJECT UNDERSTANDING

The proposed residential development is a currently undeveloped, heavily wooded parcel bound by Walnut Street to the north, Commercial Street (Route 140) to then east and south, and residential properties along North High Street to the west. The site location is shown on *Figure 1: Locus Map.*

The current development plan shows residential buildings, parking areas, and outdoor recreation areas on the eastern side of the parcel with wetland and undeveloped areas on the western side of the parcel. It has not yet been determined if the proposed buildings will include a below grade level. Proposed grading has also not been developed at this time

Ground surface elevations in the parcel slope downward from west to east from about El. 259. to El. 242. Elevations in this report reference the North American Vertical Datum of 1988 (NAVD88) and are in feet.

SUBSURFACE CONDITIONS

Geologic Setting

The United States Geological Survey (USG) "Surficial Material Map of the Mansfield Quandrangle" (2018) compiled by Byron D. Stone and Mary L. DiGiacomo-Cohen indicates the site is located in an area of thin glacial till deposits composed predominantly of a nonsorted, non-stratified maxtrix of sand, silt, and clay with scattered cobbles and extending to depths between 10 and 15 feet. Occasional cobbles and boulders up to 4 feet (exposed dimension) were observed at the ground surface across the site. The buried portion of the boulders may be larger than the exposed dimension.

Test Pit Excavations by Others

Four test pits were excavated on the southern side of the parcel on May 16, 2022 by Bay Colony Group as part of the stormwater design. The test pit logs are included in *Appendix A: Test Pit Logs* and the locations are shown in *Figure 2: Site Plan.*

The test pits extended to depths between 11.0 and 12.8 feet. In each of the test pits below a depth of about 2 feet, the logs indicate that the sandy loam soils are very gravelly and cobbly.

Recent Subsurface Exploration Program

Subsurface conditions were explored on October 13, 2022 by advancing two borings (B-1 and B-2/B-2A) within the westbound lane of Walnut Street near to the site. Approximate boring locations are shown in *Figure 2: Boring Location Plan*. Weston & Sampson geotechnical engineering staff monitored boring activities, measured boring locations relative to existing site features, and prepared logs for each boring.

The borings were completed by Northern Drill Services, Inc. of Northborough, MA. Standard penetration tests (SPTs) were conducted in each boring by driving a split spoon sampler with an automatic hammer in general accordance with ASTM D1586. The borings were advanced to refusal. Copies of the boring logs along with the Guide to Subsurface Exploration Logs are included in *Appendix B*.

Following completion of drilling, the borings were backfilled with cuttings and the surface patched with asphalt cold patch.

Encountered Subsurface Conditions

Subsurface conditions encountered in the borings were generally consisted of pavement overlying fill, glacial till, and rock. The subsurface conditions encountered in the borings were generally consistent with mapped surficial geology.

Subsurface soil and groundwater conditions described below have been interpreted based on a limited number of explorations that were observed by Weston & Sampson. Variations may occur and should be expected between locations. The strata boundaries shown in our boring logs are based on our interpretations and the actual transitions may be gradual. Refer to the boring logs included in *Attachment B* for detailed descriptions of the soil samples collected. The general Unified Soil Classification System (USCS) designation(s) for each stratum is included in the descriptions below in parentheses. Depths provided below are relative to the existing ground surface at the time of drilling.

Surficial Materials – Surficial materials encountered in the borings which were advanced within Walnut Street consisted of 3 inches of asphalt concrete (AC) pavement or topsoil.

Fill – Dense fill was encountered below the AC pavement in both borings and extended to about 2.5 feet. The fill was generally comprised of varying amounts of fine to coarse sand, gravel, and non-plastic fines (SM and ML).

Glacial Till – Dense to very dense, native glacial till was encountered below the fill in both of the borings. The retrieved samples were generally described as fine to coarse SAND with few to some gravel and little to some non-plastic fines (SM) or fine to coarse gravel with few fines and trace sand (GM). In boring B-1, the glacial till extended to about 18.5 feet. Boring B-2 was terminated at about 9 feet at sampler and casing refusal within the till. This boring was offset to boring B-2A which terminated at sampler refusal within the glacial till at a depth of 22 feet.

Weathered Rock – Very dense weathered rock was encountered below the glacial till in boring B-1. The retrieved samples were generally described as fine to coarse SAND with some clayey fines and little fine (SC) and fine to coarse gravel with few fines and trace sand (GP-GM). Boring B-1 was terminated in the weathered rock at sampler refusal at a depth of 25.2 feet

Groundwater – Groundwater was not encountered in the borings. Groundwater was observed in the test pits at depths between 9 and 11.3 feet below existing grade. However, additional time may be required for groundwater to become evident in dense soil conditions. We anticipate that groundwater levels will fluctuate with season, variations in precipitation, construction in the area, and other factors. Perched groundwater conditions could exist close to the ground surface, especially during and after extended periods of wet weather.

PRELIMINARY GEOTECHNICAL RECOMMENDATIONS

Based upon the borings advanced within Walnut Street adjacent to the northern side of the site, conditions encountered in the test pits, review of the regional geology and observations when walking the site, we anticipate that the subsurface conditions at the site will consist of forest mat overlying glacial till with cobbles and boulders. It is assumed that the fill encountered in the borings is related to the road construction and does not extend into the site. A bedrock outcrop is noted on the existing conditions plan to the southwest of the wetland area The extent of fill within the site is currently unknown.

These conditions are anticipated to be suitable for support of the proposed buildings on shallow spread footings bearing on the glacial till or bedrock with slabs on grade.

Forest mat, topsoil, fill, and other unsuitable soils, as determined by the engineer, should be completely removed from within the zone-of-influence (ZOI) beneath proposed structures and slabs, and the resulting excavation backfilled with compacted Structural Fill. The ZOI is defined by a plane extending horizontally away from the bottom edges of footings and slabs a distance of two feet in all directions and then down and away at 1Horizontal:1Vertical (1H:1V) slopes to the intersection with native, undisturbed soils.

Excavations to construct the proposed buildings will likely encounter cobbles and boulders,and may encounter bedrock. Cobbles, boulders, and bedrock should be removed from within 6 inches of the bottom of concrete structures. Therefore, over excavation should be anticipated for foundations and slabs.

Based on our understanding of the site conditions, we recommend performing a combination of test pits and borings. The location and quantity of the additional explorations will be based upon the proposed development plan and can be performed once access to the site is provided. Detailed geotechnical design and construction considerations can be provided following additional geotechnical explorations within the footprint of the proposed development.

LIMITATIONS

Observation of Construction

Satisfactory earthwork and foundation performance depends to a large degree on the quality of construction. Subsurface conditions observed during construction should be compared with those encountered during the subsurface explorations. Recognition of changed conditions often requires experience; therefore, qualified personnel should visit the site with sufficient frequency to evaluate whether actual subsurface conditions differ from those anticipated. In addition, full-time construction observation of the contractor’s activities is a key part of determining that the work is completed in accordance with the construction drawings and specifications.

The recommendations in this report are preliminary as actual subsurface conditions may differ from those interpreted based on our subsurface explorations. In order for our recommendations to be considered final, we must be retained to observe the actual subsurface conditions encountered during construction. Our observations will allow us to interpret the actual conditions present during construction and adapt our recommendations if needed.

Variations of Subsurface Conditions and Use of Report

We have prepared this report for use by the owner, members of the design and construction team for the subject project and site, only. The data and report can be used for estimating purposes, but our report, conclusions, and interpretations should not be construed as a warranty of the subsurface conditions and are not applicable to other sites.

Explorations indicate soil conditions only at specific locations and only to the depths penetrated. They do not necessarily reflect subsurface conditions that may exist outside or between exploration locations. If subsurface conditions differing from those described are noted during the course of excavation and construction, reevaluation will be necessary and we should be consulted.

Site development plans and design details were considered preliminary at the time this report was prepared. If changes are made in site grades, configuration, design loads, or type of construction for the structure, the conclusions and recommendations may not be applicable. We should be consulted to provide additional geotechnical explorations, review final design drawings and specifications to see that our recommendations are suitably followed. If design changes are made, we should be retained to review our conclusions and recommendations and provide a written evaluation or modification. Additional geotechnical engineering analyses and explorations may be necessary.

Within the limitations of scope, schedule, and budget, our services have been executed in accordance with generally accepted practices in this area at the time this report was prepared. No warranty or other conditions, expressed or implied, is given. For additional information on the use of this report, please refer to the document titled "Important Information about This Geotechnical-Engineering Report" included in *Appendix C*.

It has been a pleasure assisting you with this project and we look forward to our continued involvement. Please call if you have any questions.

Sincerely,

WESTON & SAMPSON ENGINEERS, INC.

Jennifer MacGregor, PE
Technical Leader

Joseph P. Laird

Joseph P. Laird, PE
Senior Project Manager

Attachments:
Figure 1: Locus Map
Figure 2: Site Plan
Attachment A: Test Pit Log
Attachment B: Boring Logs
Attachment C: Important Information about This Geotechnical-Engineering Report (2 pages)

Prep byJACM:Rev by JPL

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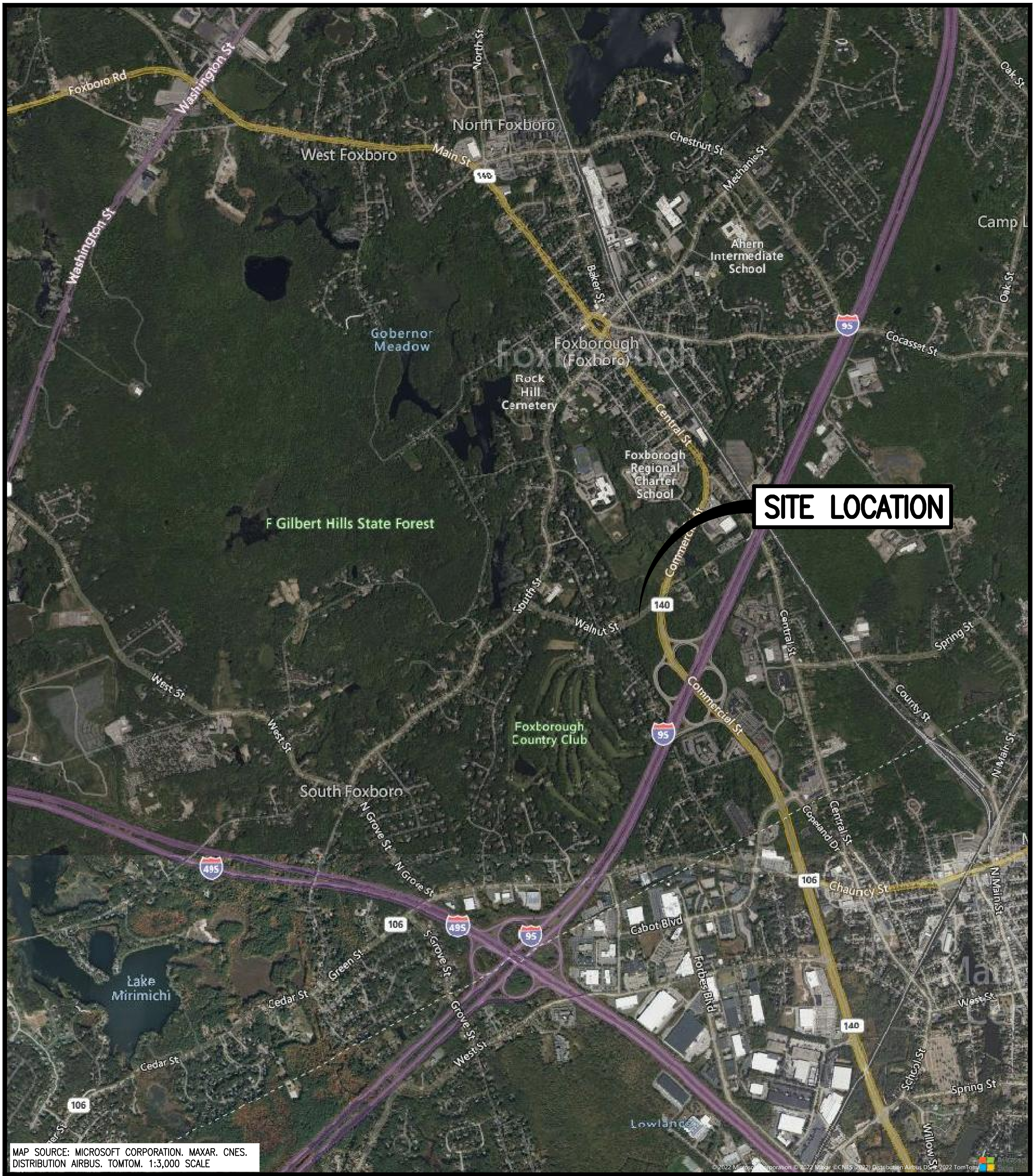


MAP SOURCE: MICROSOFT CORPORATION. MAXAR. CNES. DISTRIBUTION AIRBUS. TOMTOM. 1:3,000 SCALE

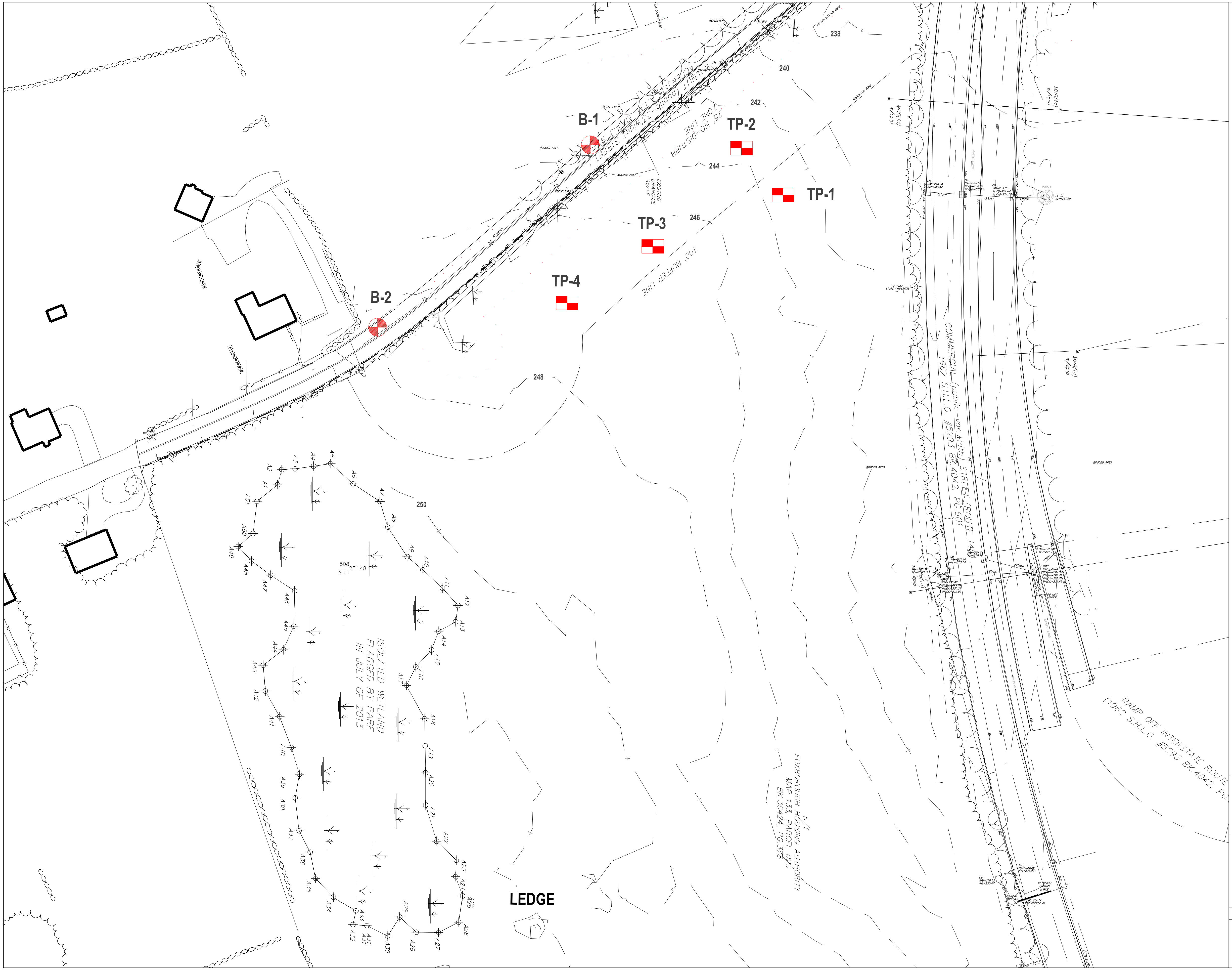
FIGURE 1
WALNUT STREET AND COMMERICAL STREET DEVELOPMENT
WALNUT STREET, FOXBOROUGH, MA

LOCUS MAP

SCALE: 1"=3000'

0 3000 6000

\\wse03.local\WSE\Projects\Private\NextGrid Inc\Maine Geotechnical Support - 4 sites\Lewiston, ME Site\2.0 Technical Information\2.8 - Technical-CADD Figures\Figure 1 _Locus Map.dwg



\\wse03.local\WSE\Projects\Private\Foxborough Housing Development\Geotech\3.1 CADD\Figure 2_Foxborough Site Plan.dwg

NOTES:

1. THIS PLAN IS BASED ON THE SURVEY ENTITLED 'EXISTING CONDITIONS PLAN' PREPARED BY BAY COLONY GROUP, INC. DATED MAY 25, 2022
2. BORINGS WERE COMPLETED BY NORTHERN DRILL SERVICE, INC. OF NORTHBOROUGH MASSACHUSETTS AND OBSERVED BY WESTON & SAMPSON ENGINEERS, INC. ON OCTOBER, 13 2022.
3. TEST PITS WERE COMPLETED BY BAY COLONY GROUP, INC. ON MAY 16, 2022.
4. BORING LOCATIONS SHOWN ON THIS PLAN ARE APPROXIMATE AND BASED ON FIELD MEASUREMENTS RELATIVE TO EXISTING SITE FEATURES.

LEGEND:

B-# ◕	TEST BORING DESIGNATION AND APPROXIMATE LOCATION
TP-# 🟥	TEST PIT DESIGNATION AND APPROXIMATE LOCATION

N

180 45 0 90 180

SCALE: 1"=90'

FIGURE 2
SITE PLAN

WALNUT STREET AND COMMERICAL
STREET DEVELOPMENT
WALNUT STREET, FOXBOROUGH, MA

DESIGNED BY: JW	CHECKED BY: JM	DATE: OCTOBER 2022

Weston & Sampson℠

Attachment A

Test Pit Logs

No. 22-0133

Date: May 16, 2022

Commonwealth of Massachusetts

Foxborough , Massachusetts

Soil Suitability Assessment for On-Site Sewage Disposal

Performed By: Cameron Gray

Date: May 16, 2022

Witnessed By: ____________________

Location Address or Lot #: Walnut Street Foxborough, MA New Construction: ☑ Repair ☐	Owner's Name, Address, and , Telephone #: Weston and Sampson 55 Walkers Brook Drive Reading, MA 978.532.1900

Office Review

Published Soil Survey Available: No ☐ Yes ☑

Year Published 1989 Publication Scale 1:25,000 Soil Map Unit Woodbridge FSL

Drainage Class C Soil Limitations Bedrock

Surficial Geology Report Available: No ☐ Yes ☑

Year Published 1992 Publication Scale 1:250,000

Geologic Material (Map Unit) Thin Till

Landform Glacial Outwash Plain

Flood Insurance Rate Map:

Above 500 year flood boundary No ☐ Yes ☑

Within 500 year flood boundary No ☑ Yes ☐

Within 100 year flood boundary No ☑ Yes ☐

Wetland Area:

National Wetland Inventory Map (map unit) ____________________

Wetlands Conservancy Program Map (map unit) ____________________

Current Water Resource Conditions (USGS): Month April, 2022

Range: Above Normal ☐ Normal ☑ Below Normal ☐

Other References Reviewed: ____________________

Location Address or Lot No. Walnut Street Foxborough, MA

On-site Review

Deep Hole Number: 1-2022 Date: 5/16/2022 Time: 0900 Weather: 65°/Cloudy

Location (identify on site plan) See site plan

Land Use Woods Slope (%) 1% Surface Stones Some

Vegetation Wooded

Landform Glacial Outwash Plain

Position on landscape (sketch on back) See site plan

Distances from:

Open Water Body	>200'	Drainageway	>100'
Possible Wet Area	>100'	Property Line	25'+/-
Drinking Water Well	>100'	Other	

DEEP OBSERVATION HOLE LOG*

Depth from Surface (inches)	Soil Horizon	Soil Texture (USDA)	Soil Color (Munsell)	Soil Mottling	Other (Structure, Stones, Boulders, Consistency, % Gravel)
0" - 5"	A	Sandy Loam	10YR3/2		
5" - 26"	B	Sandy Loam	10YR5/6		
26" - 150"	C	Sandy Loam	2.5Y5/4		V-Gravelly, V-Cobbly, Few Stones

*MINIMUM OF TWO HOLES REQUIRED AT EVERY DISPOSAL AREA

Parent Material (geologic) Glacial outwash Depth to Bedrock:

Depth to Groundwater Standing Water in Hole: 146" Weeping from Pit Face: 136"

Estimated Seasonal High Groundwater: 136"

Location Address or Lot No. Walnut Street Foxborough, MA

On-site Review

Deep Hole Number: 2-2022 Date: 5/16/2022 Time: 0930 Weather: 65°/Cloudy

Location (identify on site plan) See site plan

Land Use Woods Slope (%) 1% Surface Stones Some

Vegetation Wooded

Landform Glacial Outwash Plain

Position on landscape (sketch on back) See site plan

Distances from:

Open Water Body	>200'	Drainageway	>100'
Possible Wet Area	>100'	Property Line	25'+/-
Drinking Water Well	>100'	Other	

DEEP OBSERVATION HOLE LOG*

Depth from Surface (inches)	Soil Horizon	Soil Texture (USDA)	Soil Color (Munsell)	Soil Mottling	Other (Structure, Stones, Boulders, Consistency, % Gravel)
0" - 5"	A	Sandy Loam	10YR3/2		
5" - 25"	B	Sandy Loam	10YR5/6		
25" - 154"	C	Sandy Loam	2.5Y5/4		V-Gravelly, V-Cobbly, Few Stones

*MINIMUM OF TWO HOLES REQUIRED AT EVERY DISPOSAL AREA

Parent Material (geologic) Glacial outwash Depth to Bedrock:

Depth to Groundwater Standing Water in Hole: 144" Weeping from Pit Face:

Estimated Seasonal High Groundwater: 144"

REPRODUCTION OF DEP APPROVED FORM DATED 12-07-95

Location Address or Lot No. Walnut Street Foxborough, MA

On-site Review

Deep Hole Number: 3-2022 Date: 5/16/2022 Time: 1000 Weather: 65°/Cloudy

Location (identify on site plan) See site plan

Land Use Woods Slope (%) 1% Surface Stones Some

Vegetation Wooded

Landform Glacial Outwash Plain

Position on landscape (sketch on back) See site plan

Distances from:

Open Water Body	>200'	Drainageway	>100'
Possible Wet Area	>100'	Property Line	25'+/-
Drinking Water Well	>100'	Other	

DEEP OBSERVATION HOLE LOG*

Depth from Surface (inches)	Soil Horizon	Soil Texture (USDA)	Soil Color (Munsell)	Soil Mottling	Other (Structure, Stones, Boulders, Consistency, % Gravel)
0" - 5"	A	Sandy Loam	10YR3/2		
5" - 26"	B	Sandy Loam	10YR5/6		
26" - 132"	C	Sandy Loam	2.5Y5/4		V-Gravelly, V-Cobbly, Pockets of dense material with variegated color

*MINIMUM OF TWO HOLES REQUIRED AT EVERY DISPOSAL AREA

Parent Material (geologic) Glacial outwash Depth to Bedrock:

Depth to Groundwater Standing Water in Hole: 128" Weeping from Pit Face: 106"

Estimated Seasonal High Groundwater: 106"

REPRODUCTION OF DEP APPROVED FORM DATED 12-07-95

Location Address or Lot No. Walnut Street Foxborough, MA

On-site Review

Deep Hole Number: 4-2022 Date: 5/16/2022 Time: 1030 Weather: 65°/Cloudy

Location (identify on site plan) See site plan

Land Use Woods Slope (%) 1% Surface Stones Some

Vegetation Wooded

Landform Glacial Outwash Plain

Position on landscape (sketch on back) See site plan

Distances from:

Open Water Body	>200'	Drainageway	>100'
Possible Wet Area	>100'	Property Line	25'+/-
Drinking Water Well	>100'	Other	

DEEP OBSERVATION HOLE LOG*

Depth from Surface (inches)	Soil Horizon	Soil Texture (USDA)	Soil Color (Munsell)	Soil Mottling	Other (Structure, Stones, Boulders, Consistency, % Gravel)
0" - 5"	A	Sandy Loam	10YR3/2		
5" - 27"	B	Sandy Loam	10YR5/6		
27" - 136"	C	Sandy Loam	2.5Y5/4		V-Gravelly, V-Cobbly, Pockets of dense material with variegated color

*MINIMUM OF TWO HOLES REQUIRED AT EVERY DISPOSAL AREA

Parent Material (geologic) Glacial outwash Depth to Bedrock:

Depth to Groundwater Standing Water in Hole: 125" Weeping from Pit Face: 108"

Estimated Seasonal High Groundwater: 108"

Attachment B

Boring Logs

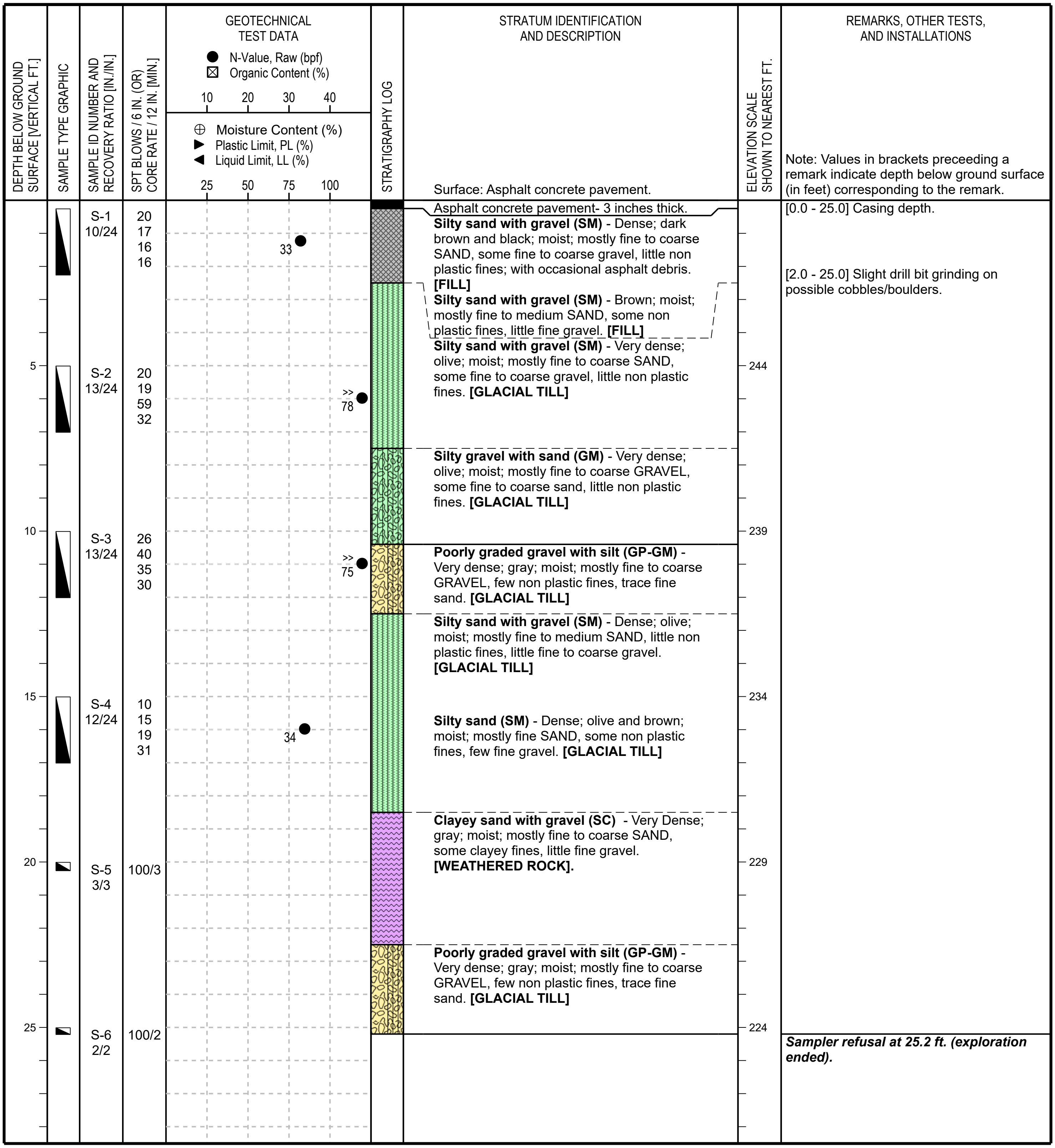
Foxborough Housing Development
Walnut Street, Foxborough, MA

BORING ID: B-1

WSE Project: ENG22-0467

Page 1 of 1

CONTRACTOR:	**Northern Drill Services, Inc.**	BORING LOCATION:	**See attached figure**	DATE START:	**October 13, 2022**
FOREMAN:	**Carl Beirlhom**	ADVANCE METHOD:	**Drive and Wash**	DATE FINISH:	**October 13, 2022**
LOGGED BY:	**J. Westgate, EIT**	AUGER DIAMETER:	**N/A**	GROUND EL:	**249.0 ± (NAVD88)**
CHECKED BY:	**J. MacGregor, PE**	SUPPORT CASING:	**Flush-Joint Casing (4" ID)**	FINAL DEPTH:	**25.2 ft. (Refusal)**
EQUIPMENT:	**Diedrich D-120, Truck Mounted**	CORING METHOD:	**N/A**	GRID COORDS:	
SPT HAMMER:	**Automatic (140-lb.)**	BACKFILL MATERIAL:	**Drill Cuttings and Asphalt Patch**	GRID SYSTEM:	**NAD83 State Plane (MA)**



SAMPLE ID NUMBER AND RECOVERY RATIO [IN./IN.]	SPT BLOWS / 6 IN. (OR) CORE RATE / 12 IN. [MIN.]
S-1 10/24	20 17 16 16
S-2 13/24	20 19 59 32
S-3 13/24	26 40 35 30
S-4 12/24	10 15 19 31
S-5 3/3	100/3
S-6 2/2	100/2

STRATUM IDENTIFICATION AND DESCRIPTION

Surface: Asphalt concrete pavement.

Asphalt concrete pavement- 3 inches thick.

Silty sand with gravel (SM) - Dense; dark brown and black; moist; mostly fine to coarse SAND, some fine to coarse gravel, little non plastic fines; with occasional asphalt debris. **[FILL]**

Silty sand with gravel (SM) - Brown; moist; mostly fine to medium SAND, some non plastic fines, little fine gravel. **[FILL]**

Silty sand with gravel (SM) - Very dense; olive; moist; mostly fine to coarse SAND, some fine to coarse gravel, little non plastic fines. **[GLACIAL TILL]**

Silty gravel with sand (GM) - Very dense; olive; moist; mostly fine to coarse GRAVEL, some fine to coarse sand, little non plastic fines. **[GLACIAL TILL]**

Poorly graded gravel with silt (GP-GM) - Very dense; gray; moist; mostly fine to coarse GRAVEL, few non plastic fines, trace fine sand. **[GLACIAL TILL]**

Silty sand with gravel (SM) - Dense; olive; moist; mostly fine to medium SAND, little non plastic fines, little fine to coarse gravel. **[GLACIAL TILL]**

Silty sand (SM) - Dense; olive and brown; moist; mostly fine SAND, some non plastic fines, few fine gravel. **[GLACIAL TILL]**

Clayey sand with gravel (SC) - Very Dense; gray; moist; mostly fine to coarse SAND, some clayey fines, little fine gravel. **[WEATHERED ROCK].**

Poorly graded gravel with silt (GP-GM) - Very dense; gray; moist; mostly fine to coarse GRAVEL, few non plastic fines, trace fine sand. **[GLACIAL TILL]**

REMARKS, OTHER TESTS, AND INSTALLATIONS

Note: Values in brackets preceeding a remark indicate depth below ground surface (in feet) corresponding to the remark.

[0.0 - 25.0] Casing depth.

[2.0 - 25.0] Slight drill bit grinding on possible cobbles/boulders.

Sampler refusal at 25.2 ft. (exploration ended).

Refer to the attached index sheets for important information about this log including general notes, legends, and guidance on description methods and procedures.

Weston & Sampson

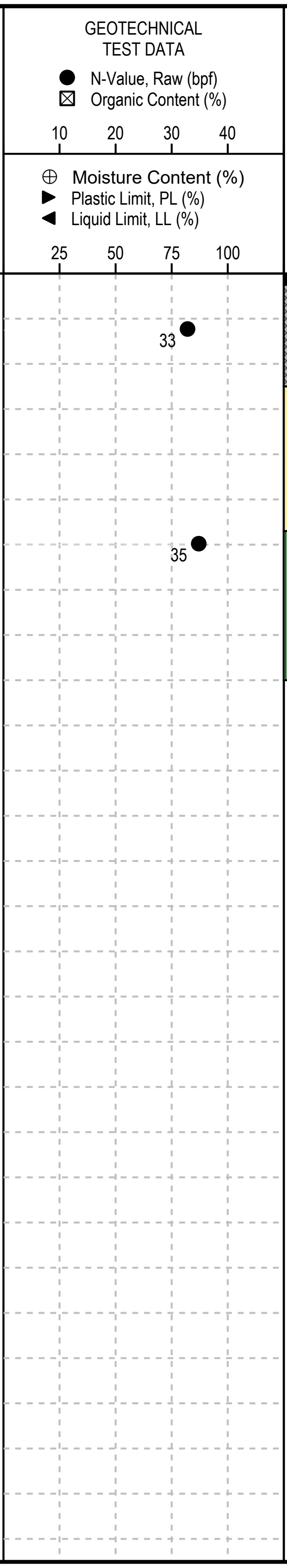
Foxborough Housing Development
Walnut Street, Foxborough, MA

BORING ID: B-2

WSE Project: ENG22-0467

Page 1 of 1

CONTRACTOR:	**Northern Drill Services, Inc.**	BORING LOCATION:	**See attached figure**	DATE START:	**October 13, 2022**
FOREMAN:	**Carl Beirlhom**	ADVANCE METHOD:	**Drive and Wash**	DATE FINISH:	**October 13, 2022**
LOGGED BY:	**J. Westgate, EIT**	AUGER DIAMETER:	**N/A**	GROUND EL:	**243.5 ± (NAVD88)**
CHECKED BY:	**J. MacGregor, PE**	SUPPORT CASING:	**Flush-Joint Casing (4" ID)**	FINAL DEPTH:	**9.0 ft. (Refusal)**
EQUIPMENT:	**Diedrich D-120, Truck Mounted**	CORING METHOD:	**N/A**	GRID COORDS:	
SPT HAMMER:	**Automatic (140-lb.)**	BACKFILL MATERIAL:	**Drill Cuttings and Asphalt Patch**	GRID SYSTEM:	**NAD83 State Plane (MA)**



DEPTH BELOW GROUND SURFACE [VERTICAL FT.]	SAMPLE TYPE GRAPHIC	SAMPLE ID NUMBER AND RECOVERY RATIO [IN./IN.]	SPT BLOWS / 6 IN. (OR) CORE RATE / 12 IN. [MIN.]	STRATIGRAPHY LOG	STRATUM IDENTIFICATION AND DESCRIPTION	ELEVATION SCALE SHOWN TO NEAREST FT.	REMARKS, OTHER TESTS, AND INSTALLATIONS
					Surface: Asphalt concrete pavement.		Note: Values in brackets preceeding a remark indicate depth below ground surface (in feet) corresponding to the remark.
0		S-1 11/24	19 18 15 12		Asphalt concrete pavement- 3 inches thick. **Silty sand (SM)** - Dense; dark brown to brown; moist; mostly fine to coarse SAND, little non plastic fines, few fine gravel. **[FILL]**		[0.0 - 9.0] Casing depth. [2.0 - 9.0] Slight drill bit grinding on possible cobbles/boulders.
					Poorly graded sand with silt and gravel (SP-SM) - Dense; orange and brown; moist; mostly fine to coarse SAND, little fine to coarse gravel, few non plastic fines. **[GLACIAL TILL]**	239	
5		S-2 13/24	12 17 18 34		**Silty sand (SM)** - Dense; orange; moist; mostly fine to medium SAND, some non plastic fines, trace fine gravel. **[GLACIAL TILL]**		
10						234	***Sampler and casing refusal at 9.0 ft. Boring relocated 1.5 ft to the southwest. Refere to B-2A.***
15						229	
20						224	
25						219	

Refer to the attached index sheets for important information about this log including general notes, legends, and guidance on description methods and procedures.

Weston & Sampson

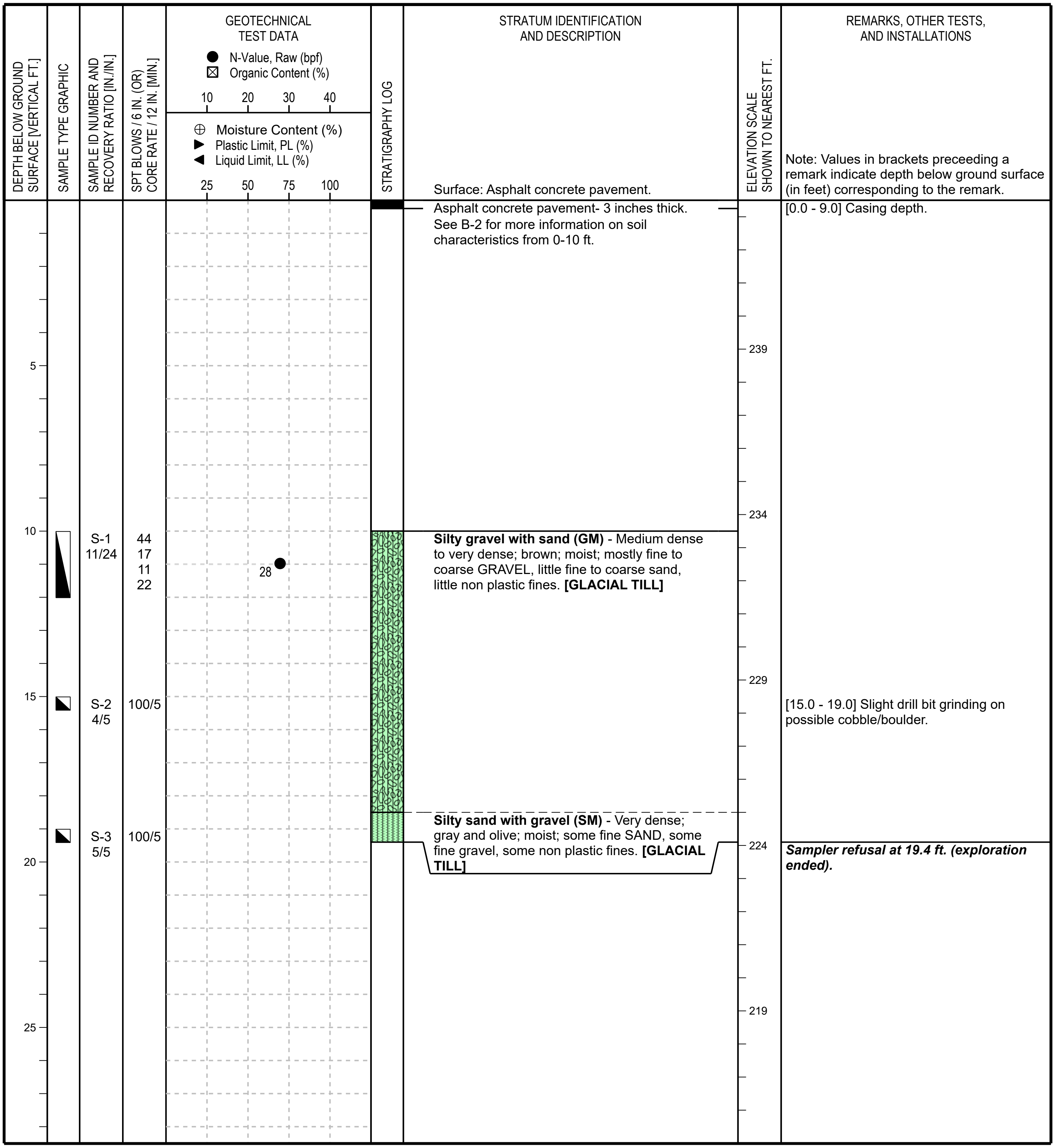
Foxborough Housing Development
Walnut Street, Foxborough, MA

BORING ID: B-2A

WSE Project: ENG22-0467

Page 1 of 1

CONTRACTOR:	**Northern Drill Services, Inc.**	BORING LOCATION:	**See attached figure**	DATE START:	**October 13, 2022**
FOREMAN:	**Carl Beirlhom**	ADVANCE METHOD:	**Drive and Wash**	DATE FINISH:	**October 13, 2022**
LOGGED BY:	**J. Westgate, EIT**	AUGER DIAMETER:	**N/A**	GROUND EL:	**243.5 ± (NAVD88)**
CHECKED BY:	**J. MacGregor, PE**	SUPPORT CASING:	**Flush-Joint Casing (4" ID)**	FINAL DEPTH:	**19.4 ft. (Refusal)**
EQUIPMENT:	**Diedrich D-120, Truck Mounted**	CORING METHOD:	**N/A**	GRID COORDS:	
SPT HAMMER:	**Automatic (140-lb.)**	BACKFILL MATERIAL:	**Drill Cuttings and Asphalt Patch**	GRID SYSTEM:	**NAD83 State Plane (MA)**



Depth (ft)	Sample ID	Recovery	SPT Blows
10	S-1	11/24	44 17 11 22
15	S-2	4/5	100/5
19	S-3	5/5	100/5

Surface: Asphalt concrete pavement.

Asphalt concrete pavement- 3 inches thick. See B-2 for more information on soil characteristics from 0-10 ft.

Silty gravel with sand (GM) - Medium dense to very dense; brown; moist; mostly fine to coarse GRAVEL, little fine to coarse sand, little non plastic fines. **[GLACIAL TILL]**

Silty sand with gravel (SM) - Very dense; gray and olive; moist; some fine SAND, some fine gravel, some non plastic fines. **[GLACIAL TILL]**

Note: Values in brackets preceeding a remark indicate depth below ground surface (in feet) corresponding to the remark.

[0.0 - 9.0] Casing depth.

[15.0 - 19.0] Slight drill bit grinding on possible cobble/boulder.

Sampler refusal at 19.4 ft. (exploration ended).

Refer to the attached index sheets for important information about this log including general notes, legends, and guidance on description methods and procedures.

GUIDE TO SUBSURFACE EXPLORATION LOGS

Weston & Sampson℠

INDEX SHEET 1
GENERAL INFORMATION

GENERAL NOTES AND USE OF LOGS

1.) Explorations were made by ordinary and conventional methods and with care adequate for Weston & Sampson's study and/or design purposes. The exploration logs are part of a specific report prepared by Weston & Sampson for the referenced project and client, and are an integral part of that report. Information and interpretations are subject to the explanations and limitations stated in the report. Weston & Sampson is not responsible for any interpretations, assumptions, projections, or interpolations made by others.

2.) Exploration logs represent general conditions observed at the point of exploration on the date(s) stated. Boundary lines separating soil and rock layers (strata) represent approximate boundaries only and are shown as solid lines where observed and dashed lines where inferred based on drilling action. Actual transitions may be gradual and changes may occur over time.

3.) Soil and rock descriptions are based on visual-manual examination of recovered samples, direct observation in test pits (when permissible), and laboratory testing (when conducted).

4.) Water level observations were made at the times and under the conditions stated. Fluctuations should be be expected to vary with seasons and other factors. Use of fluids during drilling may affect water level observations. The absence of water level observations does not necessarily mean the exploration was dry or that subsurface water will not be encountered during construction.

5.) Standard split spoon samplers may not recover particles with any dimension larger than 1-3/8 inches. Reported gravel conditions or poor sample recovery may not reflect actual in-situ conditions.

6.) Sections of this guide provide a general overview of Weston & Sampson's practices and procedures for *identifying* and *describing* soil and rock. These procedures are predominantly based on ASTM D2488, *Standard Practice for Description and Identification of Soils (Visual-Manual Procedures)*, the International Society of Rock Mechanics (ISRM) standards, and the *Engineering Geology Field Manual* published by the Bureau of Reclamation. Not all aspects of this guide relating to description and identification procedures of soil and rock may be applicable in all circumstances.

SAMPLER GRAPHICS

◪	Split Spoon (Standard) 2" OD, 1-3/8" ID
⧗	Split Spoon (Oversize) 3" OD, 2-3/8" ID
■	Shelby or Piston Tube 3" OD, 2-7/8" ID
▯	Double-Tube Rock Core Barrel 2" Core Diameter
◨	Direct Push with Acetate Liner Various Liner Sizes
A	Auger Sample *(from cuttings or hand auger)*
G	Grab Sample *(manual, from discrete point)*
C	Composite Sample *(multiple grab samples)*

WELL GRAPHICS

▒	Cement concrete seal around casing or riser pipe
▨	Bentonite seal around casing or riser pipe
░	Cement grout seal around casing or riser pipe
▩	Soil backfill around riser pipe or beneath screen
▓	Gravel backfill around screen or riser pipe
▦	Sand backfill around screen or riser pipe (filter sand)
▥	Solid-wall riser; Sch. 40 PVC, 1" ID unless noted otherwise
▤	Slotted screen; Sch. 40 PVC, 1" ID with machined slots

CAVING / SEEPAGE TERMS

The following caving and/or seepage terms may appear on a test pit log.

Caving Term	Criteria
Minor	less than 1 cubic ft.
Moderate	1 to 3 cubic ft.
Severe	greater than 3 cubic ft.

Seepage Term	Criteria
Slow	less than 1 gpm
Moderate	1 to 3 gpm
Fast	greater than 3 gpm

KEY TO WATER LEVELS

▼	Observed in exploration during advancement.
▽	Measured in exploration at completion, prior to backfilling or well installation.
⧨	Measured in exploration after the stated stabilization period, prior to backfilling, or in well installation if noted.

DEFINITIONS OF COMMON TERMS

Sample Recovery Ratio - The length of material recovered in a drive or push type sampler over the length of sampler penetration, in inches (e.g. 18/24).

Standard Penetration Test (*SPT*) - An in-situ test where a standard split-spoon sampler is driven a distance of 12 or 18 inches (after an initial 6-inch seating interval) using a 140-lb. hammer falling 30 inches for each blow.

SPT Blows - The number of hammer blows required to drive a split-spoon sampler each consecutive 6-inch interval during a *Standard Penetration Test*. If no discernable advancement of a split spoon sampler is made after 50 consecutive hammer blows, 50/X indicates *sampler refusal* and is the number of blows required to drive the sampler X inches.

SPT N-Value (*N*) - The uncorrected blow count representation of a soil's penetration resistance over a 12-inch interval after an initial 6-in. seating interval, reported in blows per foot (bpf). The N-value is correlated to soil engineering properties.

Auger Refusal - No discernable advancement of the auger over a period of 5 minutes with full rig down pressure applied.

Casing Refusal (Driven) - Casing penetration of less than 6 inches after a minimum 50 blows of a drop hammer weighing 300 lbs. or a minimum 100 blows of a drop hammer weighing 140 lbs.

PID Measurement - A measurement (electronic reading) taken in the field using a photoionization detector (PID) to detect the presence of volatile organic compounds in a soil sample. Values are reported as benzene equivalent units in parts per million (ppm) unless noted otherwise.

Rock Quality Designation (RQD) - A qualitative index measure of the degree of jointing and fracture of a rock core taken from a borehole. The RQD is defined as the sum length of solid core pieces 4 inches or longer divided by the run (cored) length, expressed as a percentage. Higher RQD values may indicate fewer joints and fractures in the rock mass.

Fill (Made Ground) - A deposit of soil and/or artificial waste materials that has been placed or altered by human processes.

LABORATORY TESTS AND FIELD MEASUREMENTS

MC	Moisture Content	IC	1D Incremental Consolidation
OC	Organic Content	VS	Laboratory Vane Shear
PL	Plastic Limit	US	Unconfined Compression
LL	Liquid Limit	TC	Triaxial Compression
GC	Gravel Content	PP	Pocket (Hand) Penetrometer
SC	Sand Content	TV	Torvane (Hand Vane)
FC	Fines Content	PID	Photoionization Detector
DS	Direct Shear	FID	Flame Ionization Detector

BORING ADVANCEMENT METHODS

Hollow-Stem Auger Drilling - Utilizes continuous flight auger sections with hollow stems to advance the borehole. Drill rods and a plug are inserted into the auger stem to prevent the entrance of soil cuttings into the augers.

Rotary Wash Drilling - Utilizes downward pressure and rotary action applied to a non-coring bit while washing the cuttings to the surface using a circulating fluid injected down the drill rods. The borehole is supported with either steel casing or the drilling fluid. Where a casing is used, the borehole is advanced sequentially by driving the casing to the desired depth and then cleaning out the casing. The process of driving and cleaning the casing is commonly referred to as the 'drive-and-wash' technique.

Continuous Sampling - Includes a variety of methods and procedures during which the borehole is advanced via continuous recovery of soil samples. *Direct Push* sampling is a common method that uses static downward pressure combined with percussive energy to drive a steel mandrel into the ground at continuous intervals while recovering soil samples in disposable acetate liners.

Rock Coring - Utilizes downward pressure and rotary action applied to a core barrel equipped with a diamond-set or tungsten carbide coring bit. During conventional coring, the entire barrel is retrieved from the hole upon completion of a core run. Wireline coring allows for removal of the inner barrel assembly containing the actual core while the the drill rods and outer barrel remain in the hole. Various types and sizes of core barrels and bits are used.

GUIDE TO SUBSURFACE EXPLORATION LOGS

Weston & Sampson

INDEX SHEET 2
SOIL DESCRIPTION

SOIL CONSTITUENTS

Naturally occurring soils consist of one or more of the following matrix constituents defined in terms of particle size.

Constituent		U.S. Sieve Size			Observed Size (in.)		
Gravel	(Coarse)	3/4 in.	-	3 in.	3/4	-	3
Gravel	(Fine)	No. 4	-	3/4 in.	1/5	-	3/4
Sand	(Coarse)	No. 10	-	No. 40	1/16	-	1/5
Sand	(Medium)	No. 40	-	No. 10	1/64	-	1/16
Sand	(Fine)	No. 200	-	No. 40	1/300	-	1/64
Fines	(Silt or Clay)	Smaller than		No. 200	Less than		1/300

SOIL IDENTIFICATION

Soil identification refers to the grouping of soils with similar physical characteristics into a category defined by a **group name** and corresponding **group symbol** based on estimation of the matrix soil constituents to the nearest 5% and simple manual tests. Proportions of cobbles, boulders, and other non-matrix soil materials are not considered during this procedure but are included in the overall soil description if observed or thought to be present. Refer to the following descriptions and tables adapted from ASTM D2488.

<u>**Coarse-Grained Soil**</u> - Coarse-grained soils contain fewer than 50% fines and are identified based on the following table.

Primary Constituent	Fines Percent	Type of Fines and Gradation		Group Symbol	Group Name [1]
GRAVEL	≤ 5%	well graded		GW	Well graded gravel
% gravel		poorly graded		GP	Poorly graded gravel
>	10%	clayey	well graded	GW-GC	Well graded gravel with clay
% sand		fines	poorly graded	GP-GC	Poorly graded gravel with clay
		silty	well graded	GW-GM	Well graded gravel wth silt
		fines	poorly graded	GP-GM	Poorly graded gravel with silt
	15% to	clay fines		GC	Clayey gravel
	45%	silt fines		GM	Silty gravel
SAND	≤ 5%	well graded		SW	Well graded sand
% sand		poorly graded		SP	Poorly graded sand
≥	10%	clayey	well graded	SW-SC	Well graded sand with clay
% gravel		fines	poorly graded	SP-SC	Poorly graded sand with clay
		silty	well graded	SW-SM	Well graded sand with silt
		fines	poorly graded	SP-SM	Poorly graded sand with silt
	15% to	clay fines		SC	Clayey sand
	45%	silt fines		SM	Silty sand

(1) If soil is a gravel and contains 15% or more sand, add "with sand" to the group name. If soil is a sand and contains 15% of more gravel, add "with gravel" to the group name.

<u>**Inorganic Fine-Grained Soil**</u> - Fine-grained soils contain 50% or more fines and are identified based on the following table.

Plasticity Criteria	Dry Strength	Coarse Fraction S = Sand, G = Gravel		Group Symbol	Group Name [1]
Medium	Medium	< 15% S + G		CL	Lean clay
	to high	≥ 30%	% S ≥ % G	CL	Sandy lean clay
		S + G	% S < % G	CL	Gravelly lean clay
Non-plastic	None to low	< 15% S + G		ML	Silt
		≥ 30%	% S ≥ % G	ML	Sandy silt
		S + G	% S < % G	ML	Gravelly silt
High	High to very high	< 15% S + G		CH	Fat clay
		≥ 30%	% S ≥ % G	CH	Sandy fat clay
		S + G	% S < % G	CH	Gravelly fat clay
Low to Medium	Low to medium	< 15% S + G		MH	Elastic silt
		≥ 30%	% S ≥ % G	MH	Sandy elastic silt
		S + G	% S < % G	MH	Gravelly elastic silt

(1) If soil contains 15% to 25% sand or gravel, add "with sand" or "with gravel" to the group name.

<u>**Organic Fine-Grained Soil**</u> - Fine-grained soils that contain enough organic particles to influence the soil properties are identified as Organic Soil and assigned the group symbol **OL** or **OH**.

<u>**Highly Organic Soil (Peat)**</u> - Soils composed primarily of plant remains in various stages of decomposition are identified as Peat and given the group symbol **PT**. Peat usually has an organic odor, a dark brown to black color, and a texture ranging from fibrous (original plant structure intact or mostly intact) to amorphous (plant structure decomposed to fine particles).

SOIL DESCRIPTION

Soils are *described* in the following general sequence. Deviations may occur in some instances.

Identification Components

(1) Group Name and Group Symbol

Description Components

(2) Consistency (Fine-Grained) or Apparent Density (Coarse-Grained)
(3) Color (*note, the term "to" may be used to indicate a gradational change*)
(4) Soil Moisture
(5) Matrix Soil Constituents (Gravel, Sand, Fines)
   └→ Proportion (*by weight*), particle size, plasticity of fines, angularity, etc.
(6) Non-Matrix Soil Materials and Proportions (*by volume*)
(7) Other Descriptive Information (Unusual Odor, Structure, Texture, etc.)
(8) [Geologic Formation Name or Soil Survey Unit]

SPT N-VALUE CORRELATIONS

Consistency	SPT N-Value	Apparent Density	SPT N-Value
Very soft	0 - 2	Very loose	0 - 5
Soft	2 - 4	Loose	5 - 10
Medium stiff	4 - 8	Medium dense	10 - 30
Stiff	8 - 15	Dense	30 - 50
Very stiff	15 - 30	Very dense	> 50
Hard	> 30		

SOIL MOISTURE

Dry............................... Apparent absence of moisture; dry to the touch.
Moist............................Damp but no visible water.
Wet............................. Visible free water; saturated.

PROPORTIONS / PERCENTAGES

Proportions of gravel, sand, and fines (excluding cobbles, boulders, and other constituents) are stated in the following terms indicating a range of percentages <u>by weight</u> (to nearest 5%) of the minus 3-in. soil fraction and add up to 100%.

Mostly	50%	-	100%
Some	30%	-	45%
Little	15%	-	25%
Few	5%	-	10%
Trace........................	Less than		5%

Proportions of cobbles, boulders, and other non-matrix soil materials including artificial debris, roots, plant fibers, etc. are stated in the following terms indicating a range of percentages <u>by volume</u> (to the nearest 5%) of the total soil.

Numerous	40%	-	50%
Common	25%	-	35%
Occasional	10%	-	20%
Trace.......................	Less than		5%

PLASTICITY (FINES ONLY)

Non-plastic..................Dry specimen ball falls apart easily. Cannot be rolled into thread at any moisture content.
Low.............................Dry specimen ball easily crushed with fingers. Can be rolled into 1/8-in. thread with some difficulty.
Medium.......................Difficult to crush dry specimen ball with fingers. Easily rolled into 1/8-in. thread.
High............................ Cannot crush dry specimen ball with fingers. Easily rolled and re-rolled into 1/8-in. thread.

COBBLES AND BOULDERS

Cobbles - Particles of rock that will pass a 12-in. square opening and be retained on a 3-in. sieve.

Boulders - Particles of rock that will not pass a 12-in. square opening.

Note: Where the percentage (by volume) of cobbles and/or boulders cannot be accurately or reliably estimated, the terms "with cobbles", "with boulders", or "with cobbles and boulders" may be used to indicate observed or inferred presence.

GUIDE TO SUBSURFACE EXPLORATION LOGS

Weston & Sampson℠

INDEX SHEET 3
ROCK DESCRIPTION

ROCK DEFINITION

Where reported on an exploration log, *rock* is defined as any naturally formed aggregate of mineral matter occurring in larges masses or fragments. This definition of rock should not be taken as a replacement for any definitions relating to rock and/or rock excavation defined in construction documents. Intensely weathered or decomposed rock that is friable and can be reduced to gravel size particles or smaller by normal hand pressure is identified and described as soil. Poorly indurated formational materials which display both rock-like and soil-like properties are identified and described as rock followed by the soil description. In such cases, the term "poorly indurated" or "weakly cemented" is added to the rock name (e.g. weakly cemented sandstone).

ROCK IDENTIFICATION

Rock is identified by a combination of *rock type* (igneous, metamorphic, or sedimentary) followed by the the *rock name* (e.g. granite, schist, sandstone).

ROCK DESCRIPTION

Rock descriptions are presented in the following general sequence. The detail of description is dictated by the complexity and objectives of the project.

Identification Components

(1) Rock Type and Name

Description Components

(2) Rock Grain Size (*for clastic sedimentary rock*)
(3) Crystal Size (*for igneous and metamorphic rock*)
(4) Bedding Spacing (*for sedimentary rock*)
(5) Color
(6) Hardness and Weathering Descriptors
(7) Fracture Density
(8) [Geologic Formation Name]

ROCK QUALITY DESIGNATION

$$\text{RQD (\%)} = \frac{\Sigma \text{ Length of intact core pieces} \geq 4 \text{ inches}}{\text{Total length of core run (inches)}} \times 100$$

The RQD should correlate with the fracture density in most cases. Higher RDQ values generally indicate fewer joints and fractures.

GRAIN / CRYSTAL SIZE

Grain Size for Clastic Sedimentary Rock

The names of clastic sedimentary rocks are generally based on their predominant clast or grain size (e.g. fine sandstone, medium sandstone, coarse gravel conglomerate, cobble conglomerate, siltstone, claystone).

Crystal Size for Igneous and Metamorphic Rock

Grain Size Description	Average Crystal Size (in.)
Very coarse grained (pegmatitic)	Greater than or equal to 3/8
Coarse-grained	Between 3/16 and 3/8
Medium-grained	Between 1/32 and 3/16
Fine-grained	Between 1/250 and 1/32
Aphanitic	Less than or equal to 1/250

BEDDING SPACING

Bedding Description	Thickness / Spacing
Massive	Less than 10 ft.
Very thickly bedded	3 ft. to 10 ft.
Thickly bedded	1 ft. to 3 ft.
Moderately bedded	4 in. to 1 ft.
Thinly bedded	1 in. to 4 in.
Very thinly bedded	1/4 in. to 1 in.
Laminated	Less than 1/4 in.

Note: Bedding is generally only applicable to sedimentary or bedded volcanic rocks.

HARDNESS

Hardness	Criteria
Extremely hard	Cannot be scratched with a pocketknife or sharp pick. Can only be chipped with repeated heavy hammer blows.
Very hard	Cannot be scratched with a pocketknife or sharp pick with difficulty. Breaks with repeated heavy hammer blows.
Hard	Can be scratched with with a pocketknife or sharp pick with difficulty. Breaks with heavy hammer blows.
Moderately hard	Can be scratched with a pocketknife or sharp pick with light or moderate pressure. Breaks with moderate hammer blows.
Moderately soft	Can be grooved 1/16 in. deep with a pocketknife or sharp pick with moderate or heavy pressure. Breaks with light hammer blow or heavy manual pressure.
Soft	Can be grooved or gouged easily with a pocketknife or sharp pick. Breaks with light to moderate manual pressure.
Very soft	Can be readily indented, grooved, or gouged with fingernail, or carved with a pocketknife. Breaks with light manual pressure.

WEATHERING (INTACT ROCK)

Weathering Description	Discoloration and/or Oxidation	General Characteristics
Fresh	Body of rock and fracture surfaces are not discolored or oxidized.	Rock texture unchanged. Hammer rings when crystalline rocks are struck.
Slightly weathered	Discoloration or oxidation limited to surface of, or short distance from, fractures. Most surfaces exhibit minor to complete discoloration.	Rock texture preserved. Hammer rings when crystalline rocks are struck. Body of rock not weakened.
Moderately weathered	Discoloration or oxidation extends usually throughout. Fe-Mg minerals appear rusty. All fracture surfaces are discolored or oxidized.	Rock texture generally preserved. Hammer does not ring when rock is struck. Body of rock slightly weakened.
Intensely weathered	Discoloration or oxidation throughout. Feldspar and Fe-Mg minerals altered to clay to some extent. All fracture surfaces are discolored or oxidized and friable.	Rock texture altered by chemical disintegration. Can usually be broken with moderate to heavy manual pressure or by light hammer blow . Body of rock is significantly weakened.
Decomposed	Discoloration or oxidation throughout but resistant minerals such as quartz may be unaltered. All feldspar and Fe-Mg minerals are completely altered to clay.	Resembles a soil; partial or complete remnant rock structure may be preserved. Can be granulated by hand. Resistant minerals may present as stringers or dikes.

FRACTURE DENSITY

Description	Observed Fracture Density
Unfractured	No fractures
Very slightly fractured	Core lengths greater than 3 ft.
Slightly fractured	Core lengths mostly from 1 ft. to 3 ft.
Moderately fractured	Core lengths mostly from 4 in. to 1 ft.
Intensely fractured	Core lengths mostly from 1 in. to 4 in.
Very intensely fractured	Mostly chips and fragments

Note: Fracture density is based on the fracture spacing in recovered core, measured along the core axis (excluding mechanical breaks).

Attachment C

Important Information about This Geotechnical-Engineering Report

Important Information about This

Geotechnical-Engineering Report

Subsurface problems are a principal cause of construction delays, cost overruns, claims, and disputes.

While you cannot eliminate all such risks, you can manage them. The following information is provided to help.

The Geoprofessional Business Association (GBA) has prepared this advisory to help you – assumedly a client representative – interpret and apply this geotechnical-engineering report as effectively as possible. In that way, you can benefit from a lowered exposure to problems associated with subsurface conditions at project sites and development of them that, for decades, have been a principal cause of construction delays, cost overruns, claims, and disputes. If you have questions or want more information about any of the issues discussed herein, contact your GBA-member geotechnical engineer. Active engagement in GBA exposes geotechnical engineers to a wide array of risk-confrontation techniques that can be of genuine benefit for everyone involved with a construction project.

Understand the Geotechnical-Engineering Services Provided for this Report

Geotechnical-engineering services typically include the planning, collection, interpretation, and analysis of exploratory data from widely spaced borings and/or test pits. Field data are combined with results from laboratory tests of soil and rock samples obtained from field exploration (if applicable), observations made during site reconnaissance, and historical information to form one or more models of the expected subsurface conditions beneath the site. Local geology and alterations of the site surface and subsurface by previous and proposed construction are also important considerations. Geotechnical engineers apply their engineering training, experience, and judgment to adapt the requirements of the prospective project to the subsurface model(s). Estimates are made of the subsurface conditions that will likely be exposed during construction as well as the expected performance of foundations and other structures being planned and/or affected by construction activities.

The culmination of these geotechnical-engineering services is typically a geotechnical-engineering report providing the data obtained, a discussion of the subsurface model(s), the engineering and geologic engineering assessments and analyses made, and the recommendations developed to satisfy the given requirements of the project. These reports may be titled investigations, explorations, studies, assessments, or evaluations. Regardless of the title used, the geotechnical-engineering report is an engineering interpretation of the subsurface conditions within the context of the project and does not represent a close examination, systematic inquiry, or thorough investigation of all site and subsurface conditions.

Geotechnical-Engineering Services are Performed for Specific Purposes, Persons, and Projects, and At Specific Times

Geotechnical engineers structure their services to meet the specific needs, goals, and risk management preferences of their clients. A geotechnical-engineering study conducted for a given civil engineer will not likely meet the needs of a civil-works constructor or even a different civil engineer. Because each geotechnical-engineering study is unique, each geotechnical-engineering report is unique, prepared *solely* for the client.

Likewise, geotechnical-engineering services are performed for a specific project and purpose. For example, it is unlikely that a geotechnical-engineering study for a refrigerated warehouse will be the same as one prepared for a parking garage; and a few borings drilled during a preliminary study to evaluate site feasibility will not be adequate to develop geotechnical design recommendations for the project.

Do not rely on this report if your geotechnical engineer prepared it:

- for a different client;
- for a different project or purpose;
- for a different site (that may or may not include all or a portion of the original site); or
- before important events occurred at the site or adjacent to it; e.g., man-made events like construction or environmental remediation, or natural events like floods, droughts, earthquakes, or groundwater fluctuations.

Note, too, the reliability of a geotechnical-engineering report can be affected by the passage of time, because of factors like changed subsurface conditions; new or modified codes, standards, or regulations; or new techniques or tools. *If you are the least bit uncertain* about the continued reliability of this report, contact your geotechnical engineer before applying the recommendations in it. A minor amount of additional testing or analysis after the passage of time – if any is required at all – could prevent major problems.

Read this Report in Full

Costly problems have occurred because those relying on a geotechnical-engineering report did not read the report in its entirety. Do not rely on an executive summary. Do not read selective elements only. *Read and refer to the report in full.*

You Need to Inform Your Geotechnical Engineer About Change

Your geotechnical engineer considered unique, project-specific factors when developing the scope of study behind this report and developing the confirmation-dependent recommendations the report conveys. Typical changes that could erode the reliability of this report include those that affect:

- the site's size or shape;
- the elevation, configuration, location, orientation, function or weight of the proposed structure and the desired performance criteria;
- the composition of the design team; or
- project ownership.

As a general rule, *always* inform your geotechnical engineer of project or site changes – even minor ones – and request an assessment of their impact. *The geotechnical engineer who prepared this report cannot accept* *responsibility or liability for problems that arise because the geotechnical engineer was not informed about developments the engineer otherwise would have considered.*

Most of the "Findings" Related in This Report Are Professional Opinions

Before construction begins, geotechnical engineers explore a site's subsurface using various sampling and testing procedures. *Geotechnical engineers can observe actual subsurface conditions only at those specific locations where sampling and testing is performed.* The data derived from that sampling and testing were reviewed by your geotechnical engineer, who then applied professional judgement to form opinions about subsurface conditions throughout the site. Actual sitewide-subsurface conditions may differ – maybe significantly – from those indicated in this report. Confront that risk by retaining your geotechnical engineer to serve on the design team through project completion to obtain informed guidance quickly, whenever needed.

This Report's Recommendations Are Confirmation-Dependent

The recommendations included in this report – including any options or alternatives – are confirmation-dependent. In other words, they are <u>not</u> final, because the geotechnical engineer who developed them relied heavily on judgement and opinion to do so. Your geotechnical engineer can finalize the recommendations *only after observing actual subsurface conditions* exposed during construction. If through observation your geotechnical engineer confirms that the conditions assumed to exist actually do exist, the recommendations can be relied upon, assuming no other changes have occurred. *The geotechnical engineer who prepared this report cannot assume responsibility or liability for confirmation-dependent recommendations if you fail to retain that engineer to perform construction observation.*

This Report Could Be Misinterpreted

Other design professionals' misinterpretation of geotechnical-engineering reports has resulted in costly problems. Confront that risk by having your geotechnical engineer serve as a continuing member of the design team, to:

- confer with other design-team members;
- help develop specifications;
- review pertinent elements of other design professionals' plans and specifications; and
- be available whenever geotechnical-engineering guidance is needed.

You should also confront the risk of constructors misinterpreting this report. Do so by retaining your geotechnical engineer to participate in prebid and preconstruction conferences and to perform construction-phase observations.

Give Constructors a Complete Report and Guidance

Some owners and design professionals mistakenly believe they can shift unanticipated-subsurface-conditions liability to constructors by limiting the information they provide for bid preparation. To help prevent the costly, contentious problems this practice has caused, include the complete geotechnical-engineering report, along with any attachments or appendices, with your contract documents, *but be certain to note conspicuously that you've included the material for information purposes only.* To avoid misunderstanding, you may also want to note that "informational purposes" means constructors have no right to rely on the interpretations, opinions, conclusions, or recommendations in the report. Be certain that constructors know they may learn about specific project requirements, including options selected from the report, *only* from the design drawings and specifications. Remind constructors that they may perform their own studies if they want to, and *be sure to allow enough time* to permit them to do so. Only then might you be in a position to give constructors the information available to you, while requiring them to at least share some of the financial responsibilities stemming from unanticipated conditions. Conducting prebid and preconstruction conferences can also be valuable in this respect.

Read Responsibility Provisions Closely

Some client representatives, design professionals, and constructors do not realize that geotechnical engineering is far less exact than other engineering disciplines. This happens in part because soil and rock on project sites are typically heterogeneous and not manufactured materials with well-defined engineering properties like steel and concrete. That lack of understanding has nurtured unrealistic expectations that have resulted in disappointments, delays, cost overruns, claims, and disputes. To confront that risk, geotechnical engineers commonly include explanatory provisions in their reports. Sometimes labeled "limitations," many of these provisions indicate where geotechnical engineers' responsibilities begin and end, to help others recognize their own responsibilities and risks. *Read these provisions closely.* Ask questions. Your geotechnical engineer should respond fully and frankly.

Geoenvironmental Concerns Are <u>Not</u> Covered

The personnel, equipment, and techniques used to perform an environmental study – e.g., a "phase-one" or "phase-two" environmental site assessment – differ significantly from those used to perform a geotechnical-engineering study. For that reason, a geotechnical-engineering report does not usually provide environmental findings, conclusions, or recommendations; e.g., about the likelihood of encountering underground storage tanks or regulated contaminants. *Unanticipated subsurface environmental problems have led to project failures.* If you have not obtained your own environmental information about the project site, ask your geotechnical consultant for a recommendation on how to find environmental risk-management guidance.

Obtain Professional Assistance to Deal with Moisture Infiltration and Mold

While your geotechnical engineer may have addressed groundwater, water infiltration, or similar issues in this report, the engineer's services were not designed, conducted, or intended to prevent migration of moisture – including water vapor – from the soil through building slabs and walls and into the building interior, where it can cause mold growth and material-performance deficiencies. Accordingly, ***proper implementation of the geotechnical engineer's recommendations will <u>not</u> of itself be sufficient to prevent moisture infiltration. Confront the risk of moisture infiltration*** by including building-envelope or mold specialists on the design team. ***Geotechnical engineers are <u>not</u> building-envelope or mold specialists.***

GBA
GEOPROFESSIONAL
BUSINESS
ASSOCIATION

Telephone: 301/565-2733
e-mail: info@geoprofessional.org www.geoprofessional.org

Professional Service Industries, Inc.
480 Neponset Street, Suite 9C
Canton, MA 02021

Phone: (781) 821-2355
Fax: (781) 821-6276

Report No: DFR:0446516-61/1
Issue No: 1

These test results apply only to the specific locations and materials noted and may not represent any other locations or elevations. This report may not be reproduced, except in full, without written permission by Professional Service Industries, Inc. If a non-compliance appears on this report, to the extent that the reported non-compliance impacts the project, the resolution is outside the PSI scope of engagement.

Approved Signatory: Yannick Lastennet (Department Manager)
Date of Issue: 6/15/2022

Daily Field Report

Client:
BAY COLONY GROUP
4 SCHOOL ST.
P.O. BOX 9136
FOXBORO, MA 02035

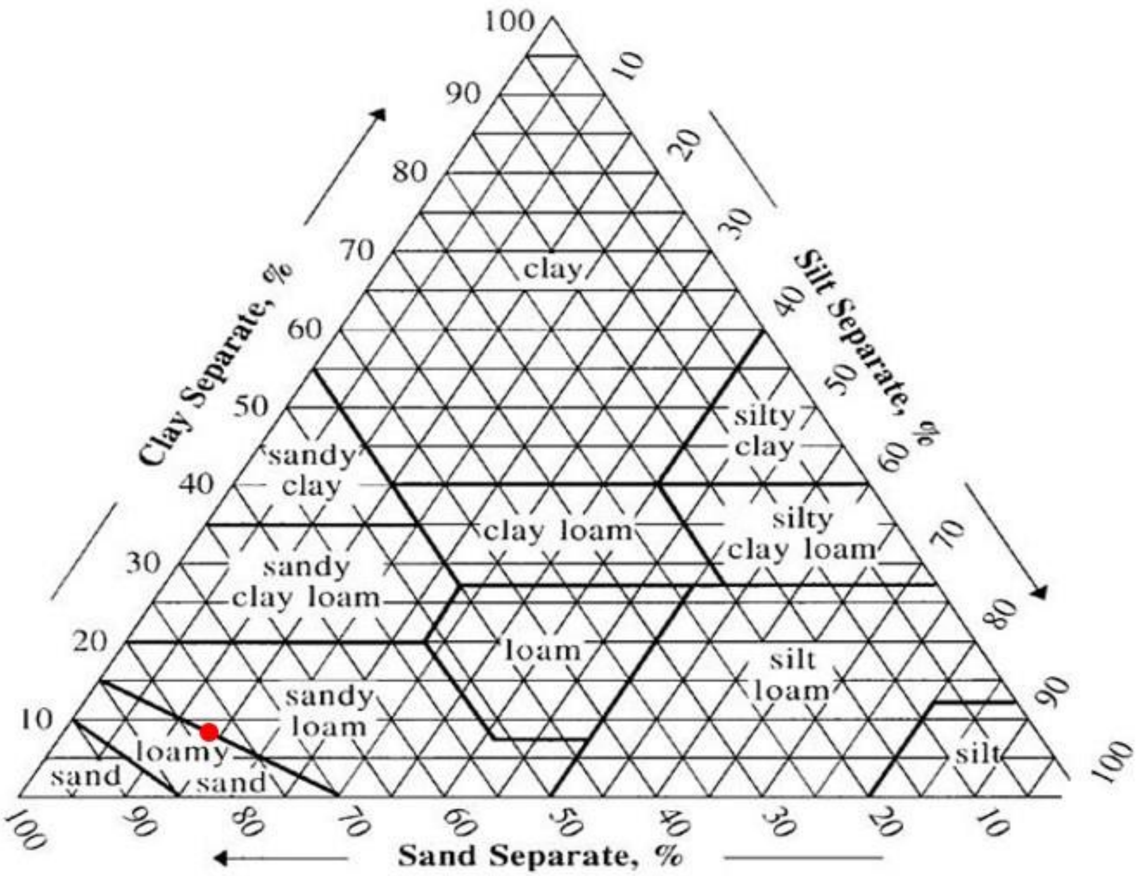
CC:

Project: BAY COLONY GROUP - LAB TESTIN
CANTON, MA

Date: 6/14/2022

PSI Representative: Gary Brooks

Soil Texture Triangle



SOIL DATA

	Source	Sample No.	Percentages From Material Passing a #10 Sieve			Classification
			Sand	Silt	Clay	
●	Walnut Street, Foxboro, MA (TP#2-2022 60")	S1	77.94	13.97	8.09	Sandy Loam

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Report No: DFR:0446516-61/2
Issue No: 1

Daily Field Report

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Client: BAY COLONY GROUP
4 SCHOOL ST.
P.O. BOX 9136
FOXBORO, MA 02035

CC:

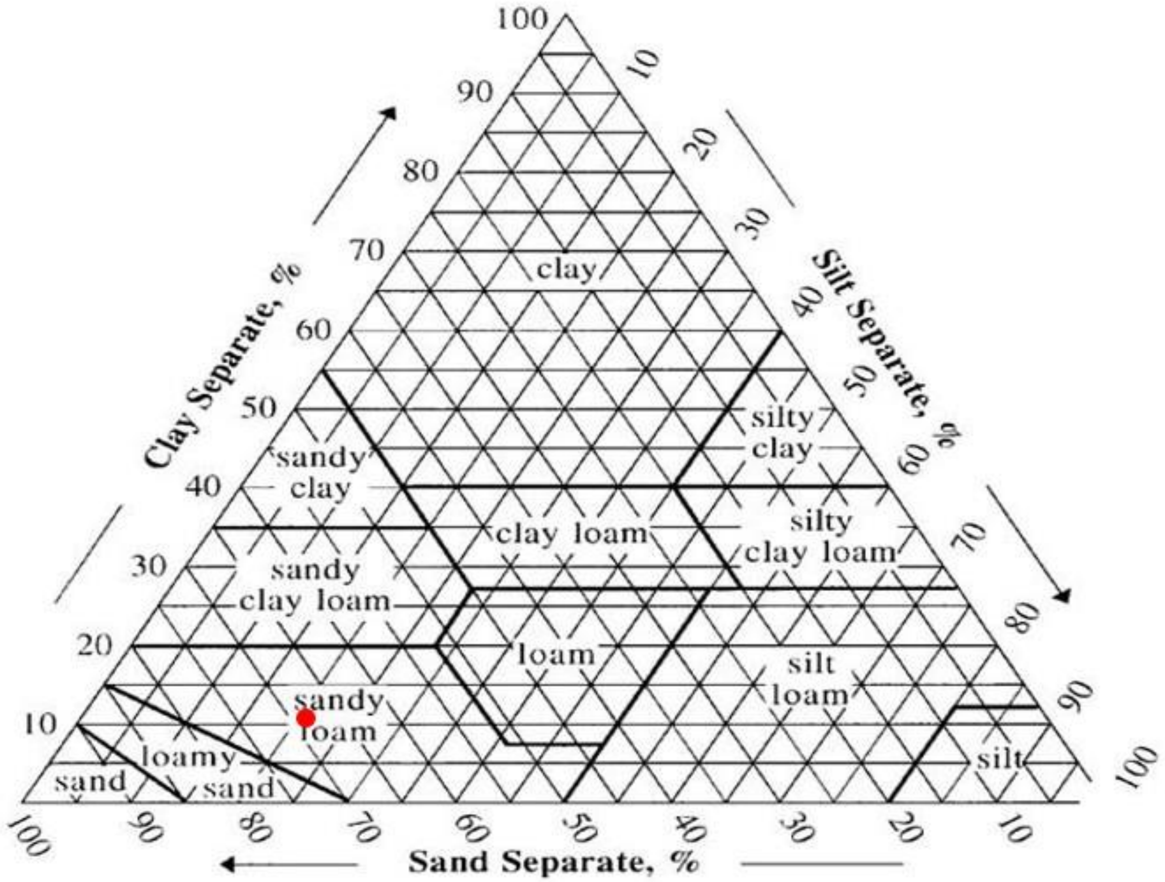
Project: BAY COLONY GROUP - LAB TESTIN
CANTON, MA

Approved Signatory: Yannick Lastennet (Department Manager)
Date of Issue: 6/15/2022

Date: 6/14/2022

PSI Representative: Gary Brooks

Soil Texture Triangle



SOIL DATA						
	Source	Sample No.	Percentages From Material Passing a #10 Sieve			Classification
			Sand	Silt	Clay	
●	Walnut Street, Foxboro, MA (TP#4-2022 60")	S2	68.42	21.23	10.35	Sandy Loam

intertek
psi

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Report No: MAT:0446516-61-S1
Issue No: 1

Approved Signatory: Yannick Lastennet (Department Manager)
Date of Issue: 6/15/2022

Material Test Report

Client: BAY COLONY GROUP
4 SCHOOL ST., P.O. BOX 9136
FOXBORO, MA 02035

CC:

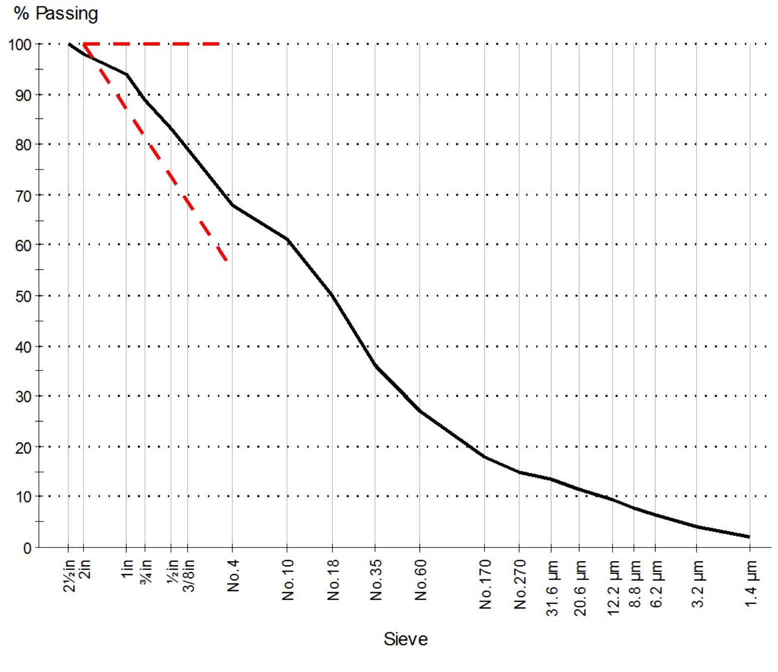
Project: BAY COLONY GROUP - LAB TESTING
CANTON, MA

Sample Details

Sample ID:	0446516-61-S1
Client Sample ID:	
Date Sampled:	05/16/22
Sampled By:	Client
Specification:	Title V Hydrometer
Supplier:	
Source:	On Site Soils
Material:	
Sampling Method:	
General Location:	Walnut St, Foxboro, MA
Location:	TP #2 - 2022, 60"
Lift:	

Sample Description:

Particle Size Distribution



COBBLES	GRAVEL		SAND			FINES	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
(0.0%)	(10.6%)	(21.3%)	(7.2%)	(27.5%)	(16.5%)	(11.6%)	(5.5%)

Grading: ASTM D 422

Date Tested:
Tested By:

Sieve Size	% Passing	Limits
2½in (63.0mm)	100	
2in (50.0mm)	98*	100
1in (25.0mm)	94	
¾in (19.0mm)	89	
½in (12.5mm)	83	
3/8in (9.5mm)	79	
No.4 (4.75mm)	68	55 to 100
No.10 (2.0mm)	61	
No.18 (1.0mm)	50	
No.35 (500µm)	36	
No.60 (250µm)	27	
No.170 (90µm)	18	
No.270 (53µm)	15	
31.6 µm	13.5	
20.6 µm	11.5	
12.2 µm	9.4	
8.8 µm	7.8	
6.2 µm	6.3	
3.2 µm	4.2	
1.4 µm	2.1	

D85: 14.3722 **D60:** 1.8779 **D50:** 1.0000
D30: 0.3150 **D15:** 0.0530 **D10:** 0.0142
Cu: 132.53 **Cc:** 3.73

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Report No: MAT:0446516-61-S1
Issue No: 1

Material Test Report

Client: BAY COLONY GROUP
4 SCHOOL ST., P.O. BOX 9136
FOXBORO, MA 02035

CC:

Project: BAY COLONY GROUP - LAB TESTING
CANTON, MA

Approved Signatory: Yannick Lastennet (Department Manager)
Date of Issue: 6/15/2022

Sample Details

Sample ID:	0446516-61-S1
Client Sample ID:	
Date Sampled:	05/16/22
Sampled By:	Client
Specification:	Title V Hydrometer
Supplier:	
Source:	On Site Soils
Material:	
Sampling Method:	
General Location:	Walnut St, Foxboro, MA
Location:	TP #2 - 2022, 60"
Lift:	

Other Test Results

Description	Method	Result	Limits
Dispersion device	ASTM D 422	Dispersant by hand	
Dispersion time (min)			
Shape			
Hardness			

Comments

* = Result does not meet the specification

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Report No: MAT:0446516-61-S2
Issue No: 1

Material Test Report

Client: BAY COLONY GROUP
4 SCHOOL ST., P.O. BOX 9136
FOXBORO, MA 02035

CC:

Project: BAY COLONY GROUP - LAB TESTING
CANTON, MA

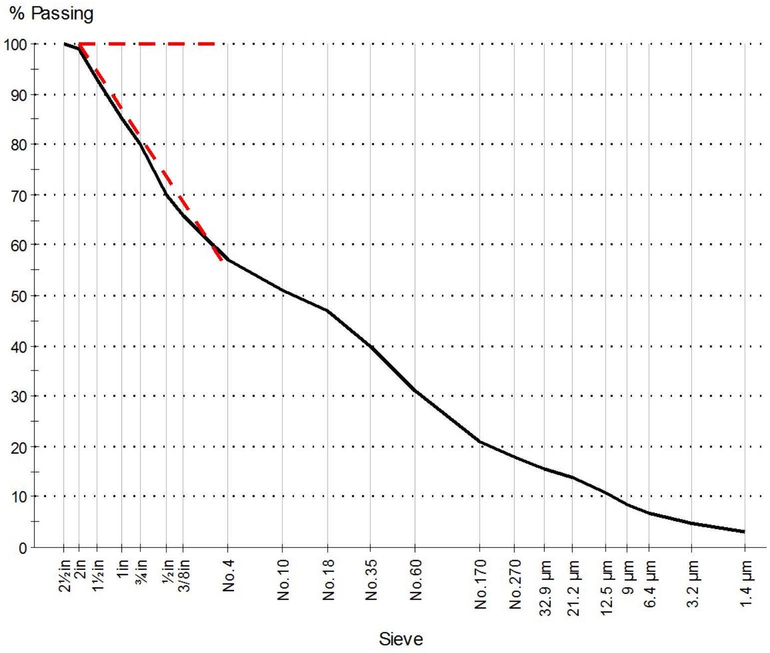
Approved Signatory: Yannick Lastennet (Department Manager)
Date of Issue: 6/15/2022

Sample Details

Sample ID:	0446516-61-S2
Client Sample ID:	
Date Sampled:	05/16/22
Sampled By:	Client
Specification:	Title V Hydrometer
Supplier:	
Source:	On Site Soils
Material:	
Sampling Method:	
General Location:	Walnut St, Foxboro, MA
Location:	TP #4 - 2022, 60"
Lift:	

Sample Description:

Particle Size Distribution



COBBLES	GRAVEL		SAND			FINES	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
(0.0%)	(20.4%)	(22.8%)	(6.0%)	(13.4%)	(17.5%)	(13.9%)	(5.9%)

Grading: ASTM D 422

Date Tested: 6/14/2022
Tested By: Gary Brooks

Sieve Size	% Passing	Limits
2½in (63.0mm)	100	
2in (50.0mm)	99*	100
1½in (37.5mm)	93	
1in (25.0mm)	85	
¾in (19.0mm)	80	
½in (12.5mm)	70	
3/8in (9.5mm)	66	
No.4 (4.75mm)	57	55 to 100
No.10 (2.0mm)	51	
No.18 (1.0mm)	47	
No.35 (500µm)	40	
No.60 (250µm)	31	
No.170 (90µm)	21	
No.270 (53µm)	18	
32.9 µm	15.4	
21.2 µm	13.9	
12.5 µm	10.8	
9.0 µm	8.5	
6.4 µm	6.9	
3.2 µm	4.6	
1.4 µm	3.1	

D85: 25.0000 **D60:** 5.9846 **D50:** 1.6818
D30: 0.2257 **D15:** 0.0293 **D10:** 0.0112
Cu: 536.72 **Cc:** 0.76

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Report No: MAT:0446516-61-S2
Issue No: 1

Material Test Report

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CANTON, MA

Approved Signatory: Yannick Lastennet (Department Manager)
Date of Issue: 6/15/2022

Sample Details

Sample ID: 0446516-61-S2
Client Sample ID:
Date Sampled: 05/16/22
Sampled By: Client
Specification: Title V Hydrometer
Supplier:
Source: On Site Soils
Material:
Sampling Method:
General Location: Walnut St, Foxboro, MA
Location: TP #4 - 2022, 60"
Lift:

Other Test Results

Description	Method	Result	Limits
Dispersion device	ASTM D 422	Dispersant by hand	
Dispersion time (min)			
Shape			
Hardness			

Comments

* = Result does not meet the specification

Attachment D - Existing & Proposed Hydrologic Maps

P:\Private\Foxborough Housing Development\Stormwater\CAD\EX-HYDRO.dwg

Project:

WALNUT STREET SENIOR DEVELOPMENT

WALNUT STREET AND
COMMERCIAL STREET,
FOXBOROUGH, MA 02035

Weston & Sampson Engineers, Inc.
55 Walkers Brook Drive, Suite 100
Reading, MA 01867
978.532.1900 800.SAMPSON
www.westonandsampson.com

CLIENT:

OnyxGroup Realty &
Development LLC
50 Moreland Street,
Roxbury, MA 02119
Phone (617)-249-3081

Revisions:

No.	Date	Description

Seal:

Issued For:

REVIEW
(NOT FOR CONSTRUCTION)

Scale: AS SHOWN

Date: JUNE 20, 2022
Drawn By: REB
Reviewed By: JIP
Approved By: JMJ

W&S Project No: ENG22-0467
W&S File No: -

Drawing Title:

EXISTING HYDROLOGIC MAP

Sheet Number:

FIG-1

Project:

WALNUT STREET SENIOR DEVELOPMENT

WALNUT STREET AND COMMERCIAL STREET, FOXBOROUGH, MA 02035

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Drawn By: REB
Reviewed By: JIP
Approved By: JMJ

W&S Project No: ENG22-0467
W&S File No: -

Drawing Title:

PROPOSED
HYDROLOGIC MAP

Sheet Number:

FIG-2

\\wse03.local\WSE\Projects\Private\Foxborough Housing Development\Stormwater\CAD\PR-HYDRO.dwg

Attachment E - HydroCAD Reports

NOAA Atlas 14, Volume 10, Version 3
Location name: Town of Foxborough, Massachusetts, USA*
Latitude: 42.046°, Longitude: -71.2465°
Elevation: 252.02 ft**
* source: ESRI Maps
** source: USGS

POINT PRECIPITATION FREQUENCY ESTIMATES

Sanja Perica, Sandra Pavlovic, Michael St. Laurent, Carl Trypaluk, Dale Unruh, Orlan Wilhite

NOAA, National Weather Service, Silver Spring, Maryland

PF_tabular | PF_graphical | Maps_&_aerials

PF tabular

PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches)[1]

Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	**0.312** (0.245-0.392)	**0.384** (0.301-0.482)	**0.501** (0.392-0.631)	**0.598** (0.465-0.758)	**0.732** (0.552-0.974)	**0.831** (0.614-1.13)	**0.938** (0.675-1.33)	**1.07** (0.718-1.53)	**1.25** (0.814-1.87)	**1.42** (0.897-2.16)
10-min	**0.442** (0.348-0.555)	**0.544** (0.427-0.683)	**0.710** (0.555-0.895)	**0.848** (0.659-1.07)	**1.04** (0.781-1.38)	**1.18** (0.870-1.61)	**1.33** (0.956-1.89)	**1.51** (1.02-2.17)	**1.78** (1.15-2.65)	**2.01** (1.27-3.05)
15-min	**0.520** (0.409-0.653)	**0.640** (0.502-0.804)	**0.835** (0.653-1.05)	**0.997** (0.775-1.26)	**1.22** (0.919-1.62)	**1.39** (1.02-1.89)	**1.56** (1.13-2.22)	**1.78** (1.20-2.56)	**2.09** (1.36-3.12)	**2.36** (1.50-3.59)
30-min	**0.719** (0.565-0.902)	**0.888** (0.697-1.12)	**1.16** (0.910-1.47)	**1.39** (1.08-1.77)	**1.71** (1.29-2.27)	**1.94** (1.43-2.64)	**2.19** (1.58-3.11)	**2.49** (1.68-3.59)	**2.94** (1.90-4.38)	**3.32** (2.10-5.04)
60-min	**0.918** (0.721-1.15)	**1.14** (0.891-1.43)	**1.49** (1.17-1.88)	**1.79** (1.39-2.27)	**2.19** (1.65-2.92)	**2.50** (1.84-3.40)	**2.82** (2.03-4.00)	**3.21** (2.16-4.62)	**3.78** (2.45-5.64)	**4.27** (2.70-6.50)
2-hr	**1.17** (0.924-1.45)	**1.47** (1.16-1.83)	**1.96** (1.54-2.45)	**2.37** (1.85-2.98)	**2.93** (2.22-3.87)	**3.34** (2.49-4.53)	**3.79** (2.75-5.36)	**4.34** (2.94-6.19)	**5.17** (3.36-7.63)	**5.88** (3.74-8.85)
3-hr	**1.35** (1.08-1.68)	**1.71** (1.35-2.12)	**2.28** (1.80-2.84)	**2.75** (2.17-3.45)	**3.41** (2.60-4.49)	**3.89** (2.91-5.25)	**4.42** (3.22-6.22)	**5.06** (3.44-7.18)	**6.04** (3.94-8.87)	**6.88** (4.38-10.3)
6-hr	**1.77** (1.42-2.18)	**2.21** (1.76-2.72)	**2.91** (2.32-3.60)	**3.50** (2.77-4.35)	**4.30** (3.30-5.61)	**4.90** (3.68-6.54)	**5.55** (4.06-7.71)	**6.32** (4.32-8.89)	**7.50** (4.92-10.9)	**8.51** (5.45-12.6)
12-hr	**2.32** (1.87-2.83)	**2.82** (2.27-3.45)	**3.64** (2.92-4.47)	**4.33** (3.45-5.34)	**5.27** (4.06-6.80)	**5.97** (4.50-7.87)	**6.72** (4.93-9.21)	**7.60** (5.23-10.6)	**8.92** (5.88-12.8)	**10.0** (6.45-14.7)
24-hr	**2.82** (2.29-3.42)	**3.43** (2.78-4.16)	**4.42** (3.57-5.38)	**5.24** (4.21-6.41)	**6.37** (4.94-8.15)	**7.21** (5.48-9.43)	**8.11** (5.99-11.0)	**9.18** (6.35-12.6)	**10.8** (7.15-15.3)	**12.1** (7.85-17.6)
2-day	**3.20** (2.62-3.85)	**3.95** (3.23-4.76)	**5.17** (4.21-6.25)	**6.19** (5.00-7.52)	**7.58** (5.94-9.66)	**8.61** (6.61-11.2)	**9.74** (7.27-13.2)	**11.1** (7.72-15.2)	**13.2** (8.81-18.6)	**15.1** (9.78-21.6)
3-day	**3.49** (2.87-4.19)	**4.30** (3.53-5.16)	**5.62** (4.59-6.75)	**6.71** (5.45-8.11)	**8.21** (6.45-10.4)	**9.32** (7.18-12.1)	**10.5** (7.89-14.2)	**12.0** (8.37-16.3)	**14.3** (9.57-20.1)	**16.3** (10.6-23.3)
4-day	**3.77** (3.10-4.50)	**4.60** (3.78-5.50)	**5.96** (4.88-7.14)	**7.09** (5.77-8.54)	**8.64** (6.81-10.9)	**9.79** (7.56-12.6)	**11.0** (8.29-14.8)	**12.6** (8.78-17.0)	**14.9** (10.0-20.8)	**17.0** (11.1-24.1)
7-day	**4.52** (3.75-5.37)	**5.40** (4.47-6.41)	**6.82** (5.62-8.12)	**8.00** (6.55-9.58)	**9.63** (7.62-12.0)	**10.8** (8.39-13.8)	**12.1** (9.13-16.1)	**13.7** (9.62-18.3)	**16.1** (10.8-22.2)	**18.1** (11.9-25.5)
10-day	**5.24** (4.36-6.20)	**6.14** (5.10-7.26)	**7.60** (6.29-9.02)	**8.82** (7.25-10.5)	**10.5** (8.33-13.0)	**11.7** (9.11-14.9)	**13.1** (9.82-17.2)	**14.6** (10.3-19.5)	**16.9** (11.4-23.3)	**18.9** (12.4-26.4)
20-day	**7.38** (6.19-8.66)	**8.35** (6.98-9.80)	**9.92** (8.27-11.7)	**11.2** (9.30-13.3)	**13.0** (10.4-15.9)	**14.4** (11.2-17.9)	**15.8** (11.8-20.3)	**17.3** (12.3-22.8)	**19.4** (13.2-26.3)	**21.0** (13.9-29.0)
30-day	**9.15** (7.70-10.7)	**10.2** (8.55-11.9)	**11.8** (9.91-13.9)	**13.2** (11.0-15.6)	**15.1** (12.1-18.3)	**16.6** (12.9-20.5)	**18.0** (13.5-22.8)	**19.5** (13.9-25.5)	**21.4** (14.6-28.8)	**22.8** (15.1-31.3)
45-day	**11.4** (9.60-13.2)	**12.4** (10.5-14.5)	**14.2** (11.9-16.6)	**15.7** (13.1-18.4)	**17.7** (14.2-21.3)	**19.3** (15.0-23.6)	**20.8** (15.5-26.0)	**22.2** (15.9-28.8)	**23.9** (16.4-32.0)	**25.1** (16.7-34.2)
60-day	**13.2** (11.2-15.3)	**14.3** (12.1-16.6)	**16.2** (13.7-18.8)	**17.7** (14.9-20.7)	**19.8** (16.0-23.8)	**21.5** (16.8-26.2)	**23.1** (17.3-28.7)	**24.5** (17.6-31.6)	**26.1** (17.9-34.7)	**27.1** (18.1-36.8)

[1] Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS).

Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values.

Please refer to NOAA Atlas 14 document for more information.

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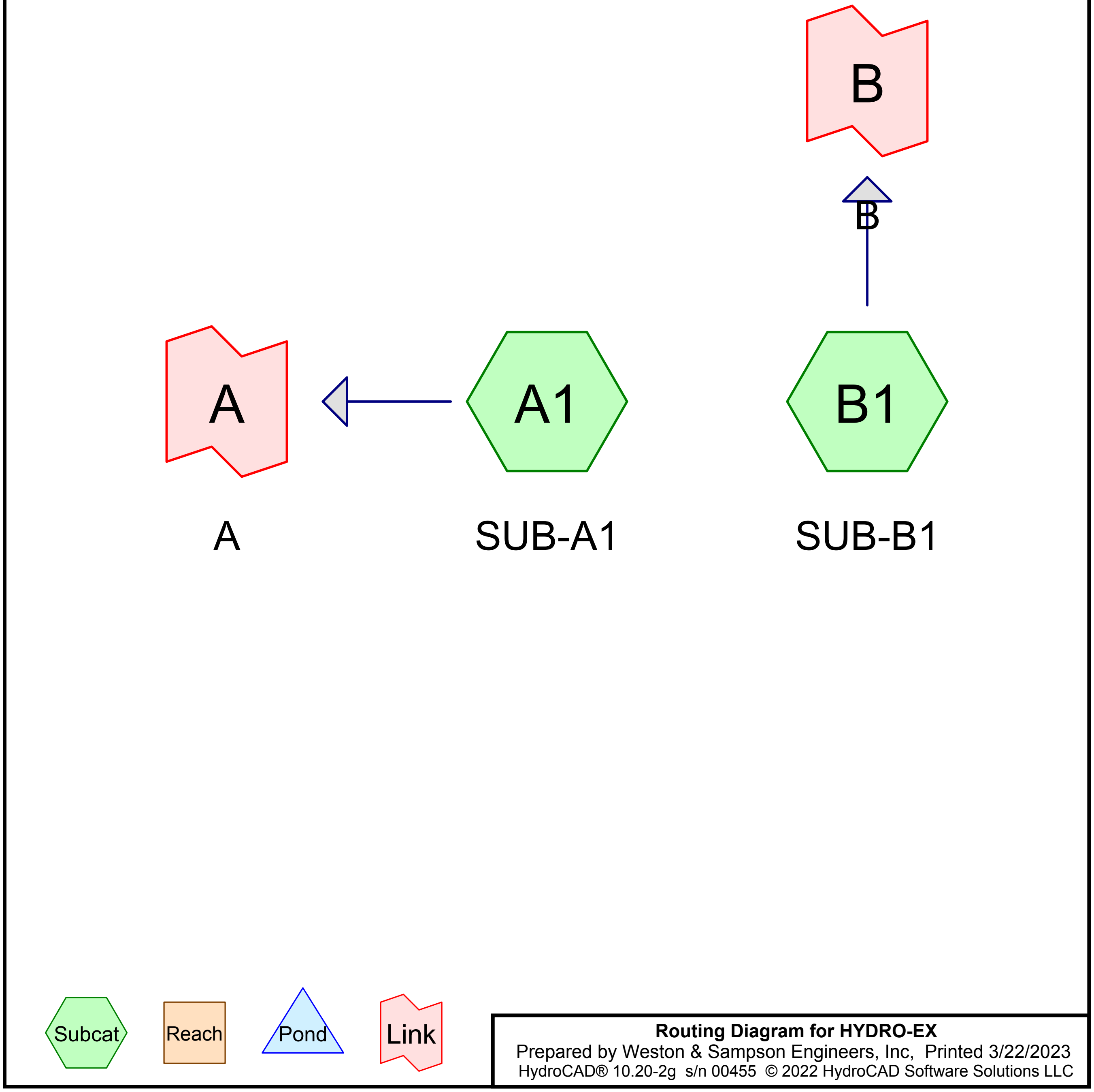
PF graphical



Routing Diagram for HYDRO-EX

Prepared by Weston & Sampson Engineers, Inc, Printed 3/22/2023

Rainfall Events Listing

Event#	Event Name	Storm Type	Curve	Mode	Duration (hours)	B/B	Depth (inches)	AMC
1	2-year	Type III 24-hr		Default	24.00	1	3.43	2
2	10-year	Type III 24-hr		Default	24.00	1	5.24	2
3	25-year	Type III 24-hr		Default	24.00	1	6.37	2
4	50-year	Type III 24-hr		Default	24.00	1	7.21	2
5	100-year	Type III 24-hr		Default	24.00	1	8.11	2

Area Listing (all nodes)

Area (sq-ft)	CN	Description (subcatchment-numbers)
154,730	74	>75% Grass cover, Good, HSG C (A1, B1)
30,059	98	Impervious Area (A1, B1)
778,490	70	Woods, Good, HSG C (A1, B1)
70,139	77	Woods, Good, HSG D (A1)
1,033,418	**72**	**TOTAL AREA**

Soil Listing (all nodes)

Area (sq-ft)	Soil Group	Subcatchment Numbers
0	HSG A	
0	HSG B	
933,220	HSG C	A1, B1
70,139	HSG D	A1
30,059	Other	A1, B1
1,033,418		**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	Su Nu
0	0	154,730	0	0	154,730	>75% Grass cover, Good	
0	0	0	0	30,059	30,059	Impervious Area	
0	0	778,490	70,139	0	848,629	Woods, Good	
0	**0**	**933,220**	**70,139**	**30,059**	**1,033,418**	**TOTAL AREA**	

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

```
SubcatchmentA1: SUB-A1          Runoff Area=566,702 sf   4.04% Impervious   Runoff Depth=1.13"
                         Flow Length=1,620'   Tc=32.8 min   CN=73   Runoff=8.90 cfs  53,498 cf

SubcatchmentB1: SUB-B1          Runoff Area=466,716 sf   1.54% Impervious   Runoff Depth=1.02"
                         Flow Length=1,046'   Tc=25.7 min   CN=71   Runoff=7.18 cfs  39,652 cf

Link A: A                                                          Inflow=8.90 cfs  53,498 cf
                                                                  Primary=8.90 cfs  53,498 cf

Link B: B                                                          Inflow=7.18 cfs  39,652 cf
                                                                  Primary=7.18 cfs  39,652 cf
```

Total Runoff Area = 1,033,418 sf Runoff Volume = 93,150 cf Average Runoff Depth = 1.08"
97.09% Pervious = 1,003,359 sf 2.91% Impervious = 30,059 sf

Summary for Subcatchment A1: SUB-A1

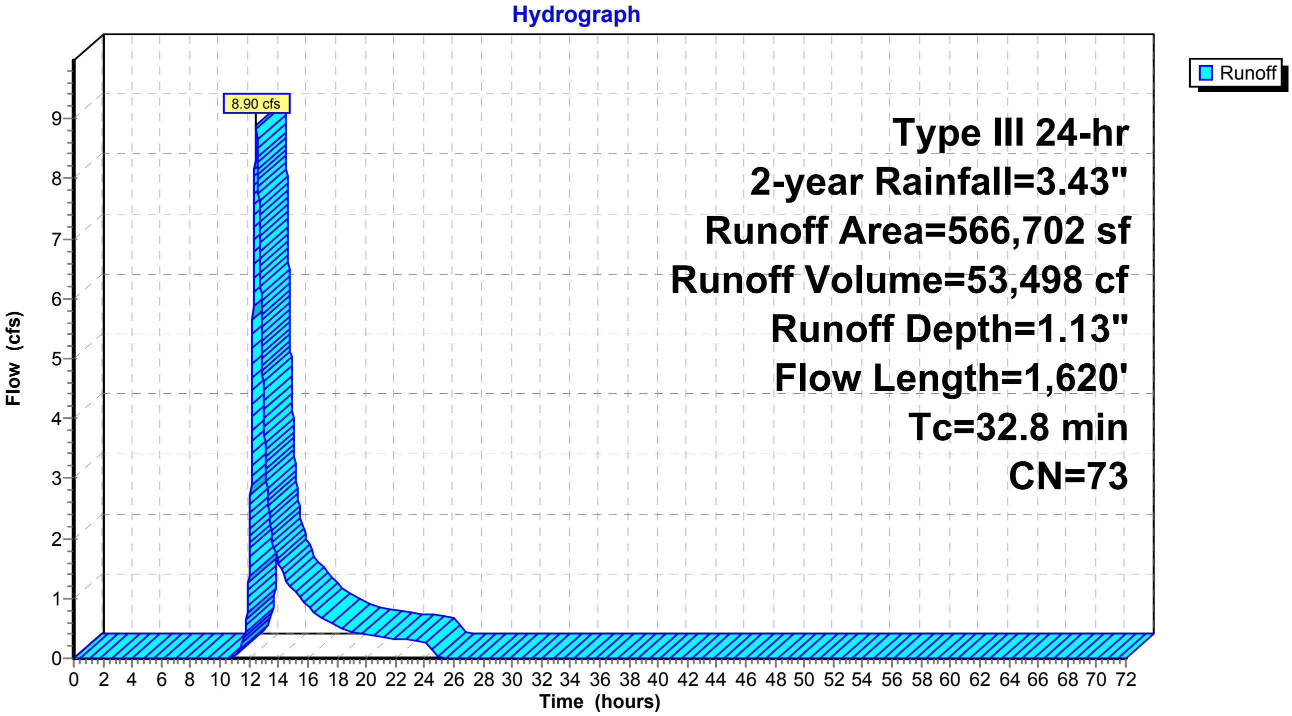
```
Runoff      =        8.90 cfs @   12.50 hrs,  Volume=          53,498 cf,  Depth=  1.13"
    Routed to Link A : A
```

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-year Rainfall=3.43"

	Area (sf)	CN	Description
*	22,880	98	Impervious Area
	106,349	74	>75% Grass cover, Good, HSG C
	367,334	70	Woods, Good, HSG C
	70,139	77	Woods, Good, HSG D
	566,702	73	Weighted Average
	543,822		95.96% Pervious Area
	22,880		4.04% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.9	50	0.0200	0.07		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.43"
19.4	1,010	0.0300	0.87		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
1.5	560	0.0200	6.38	76.61	**Trap/Vee/Rect Channel Flow,** Bot.W=2.00' D=2.00' Z= 2.0 '/' Top.W=10.00' n= 0.035 Earth, dense weeds
32.8	1,620	Total			

Subcatchment A1: SUB-A1



Summary for Subcatchment B1: SUB-B1

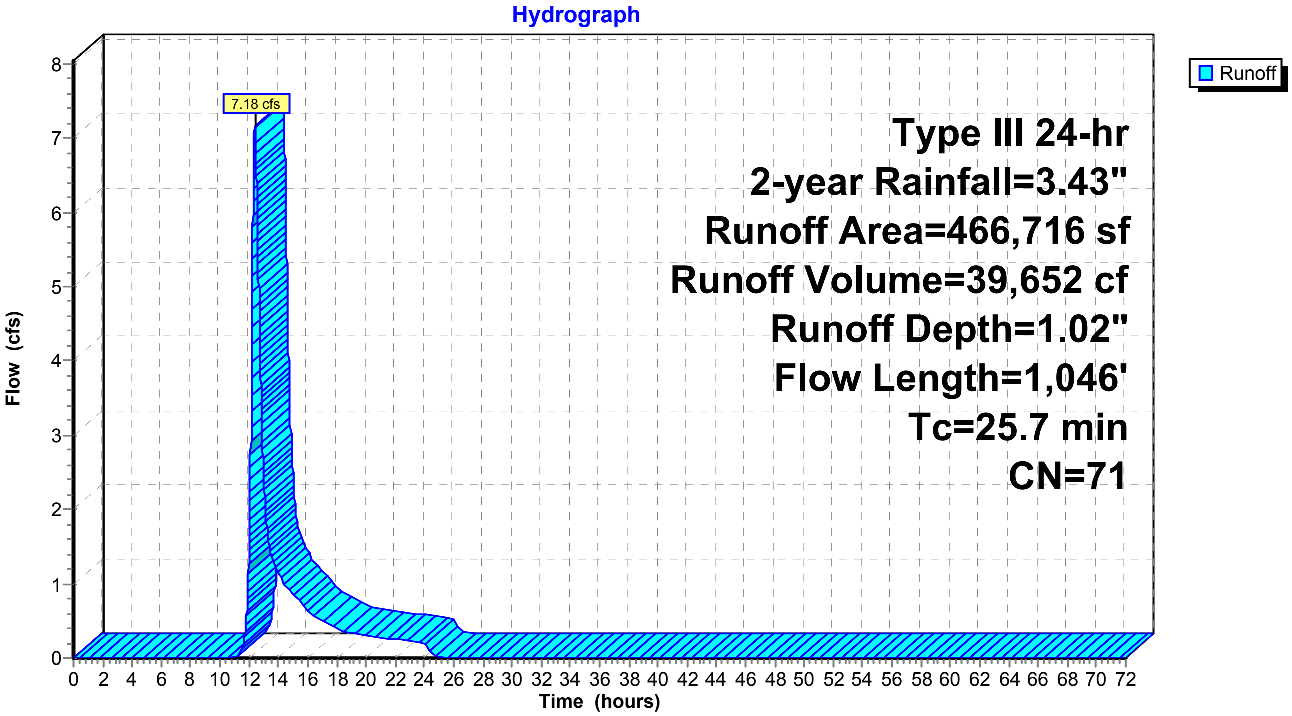
Runoff = 7.18 cfs @ 12.39 hrs, Volume= 39,652 cf, Depth= 1.02"
Routed to Link B : B

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-year Rainfall=3.43"

	Area (sf)	CN	Description
*	7,179	98	Impervious Area
	48,381	74	>75% Grass cover, Good, HSG C
	411,156	70	Woods, Good, HSG C
	466,716	71	Weighted Average
	459,537		98.46% Pervious Area
	7,179		1.54% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.6	50	0.0300	0.18		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.43"
2.9	208	0.0300	1.21		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.9	77	0.0900	1.50		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
13.1	431	0.0120	0.55		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
4.2	280	0.0500	1.12		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
25.7	1,046	Total			

Subcatchment B1: SUB-B1

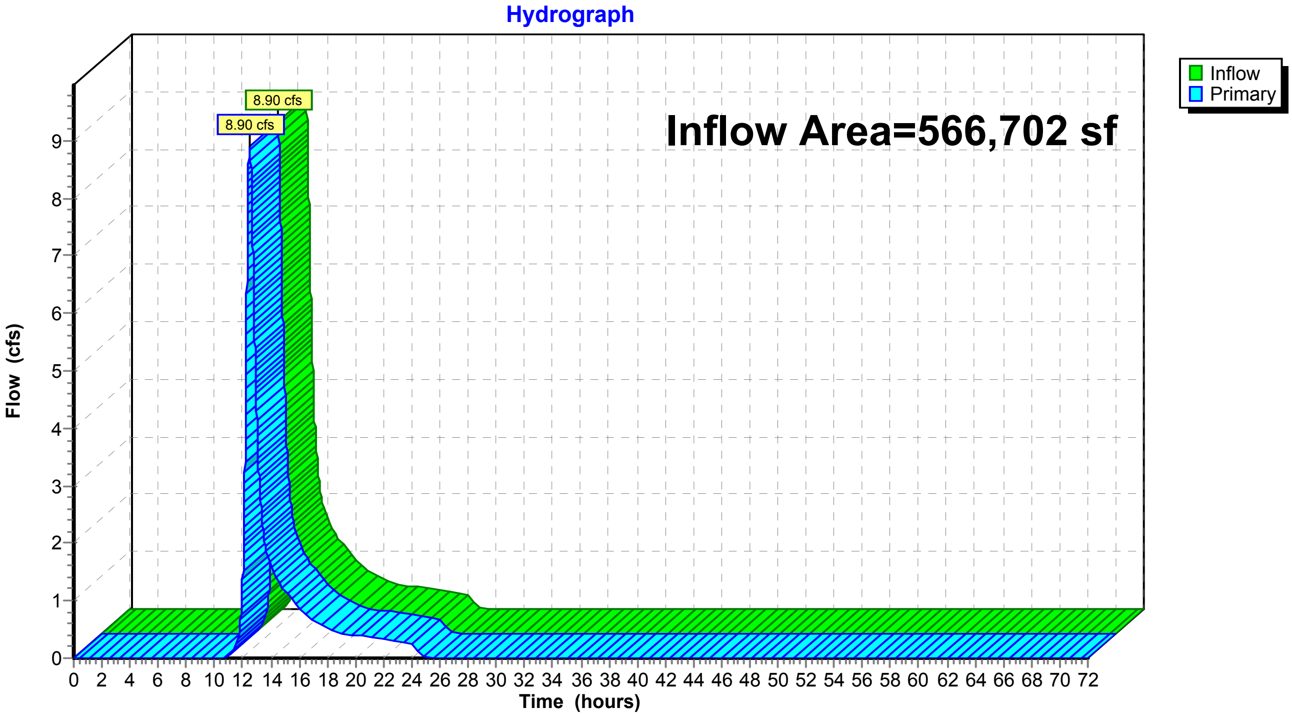


Summary for Link A: A

Inflow Area = 566,702 sf, 4.04% Impervious, Inflow Depth = 1.13" for 2-year event
Inflow = 8.90 cfs @ 12.50 hrs, Volume= 53,498 cf
Primary = 8.90 cfs @ 12.50 hrs, Volume= 53,498 cf, Atten= 0%, Lag= 0.0 min

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

Link A: A

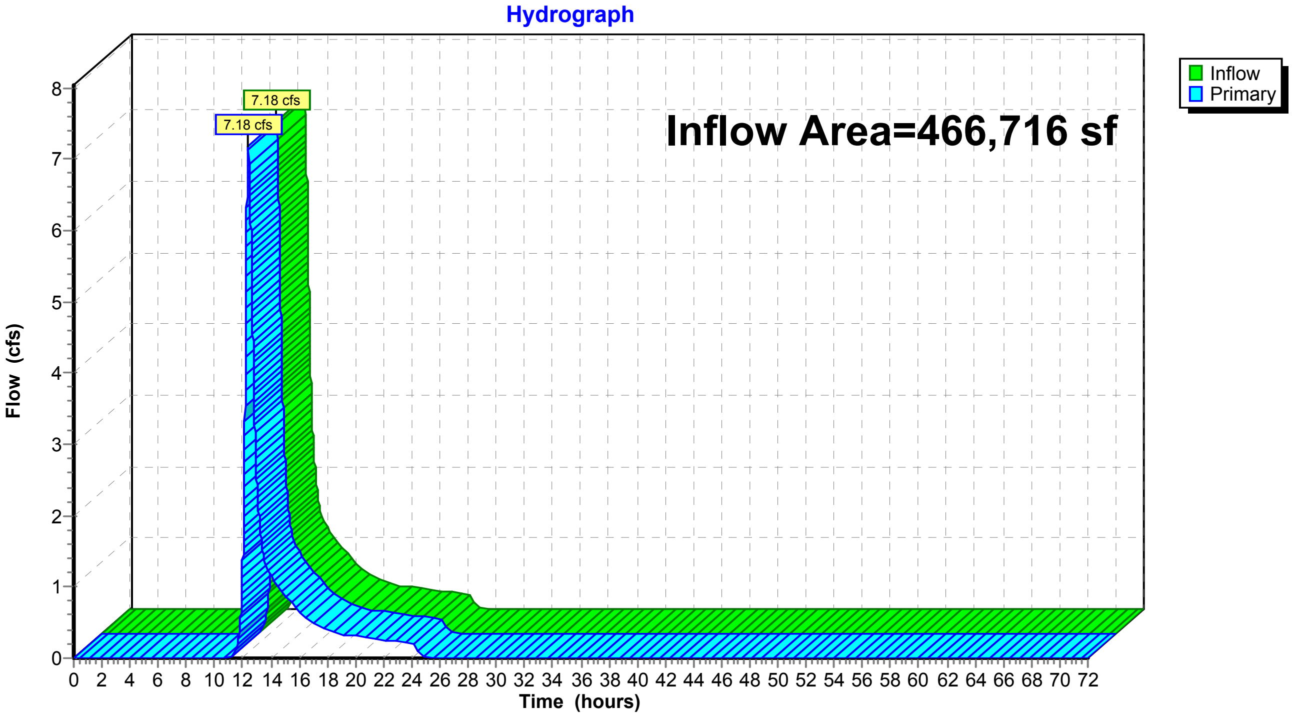


Summary for Link B: B

Inflow Area = 466,716 sf, 1.54% Impervious, Inflow Depth = 1.02" for 2-year event
Inflow = 7.18 cfs @ 12.39 hrs, Volume= 39,652 cf
Primary = 7.18 cfs @ 12.39 hrs, Volume= 39,652 cf, Atten= 0%, Lag= 0.0 min

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

Link B: B



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

SubcatchmentA1: SUB-A1            Runoff Area=566,702 sf   4.04% Impervious   Runoff Depth=2.47"
                          Flow Length=1,620'   Tc=32.8 min   CN=73   Runoff=20.27 cfs  116,653 cf

SubcatchmentB1: SUB-B1            Runoff Area=466,716 sf   1.54% Impervious   Runoff Depth=2.30"
                           Flow Length=1,046'   Tc=25.7 min   CN=71   Runoff=17.28 cfs  89,437 cf

Link A: A                                                          Inflow=20.27 cfs  116,653 cf
                                                                   Primary=20.27 cfs  116,653 cf

Link B: B                                                          Inflow=17.28 cfs  89,437 cf
                                                                   Primary=17.28 cfs  89,437 cf

     Total Runoff Area = 1,033,418 sf   Runoff Volume = 206,090 cf   Average Runoff Depth = 2.39"
                               97.09% Pervious = 1,003,359 sf     2.91% Impervious = 30,059 sf
```

Summary for Subcatchment A1: SUB-A1

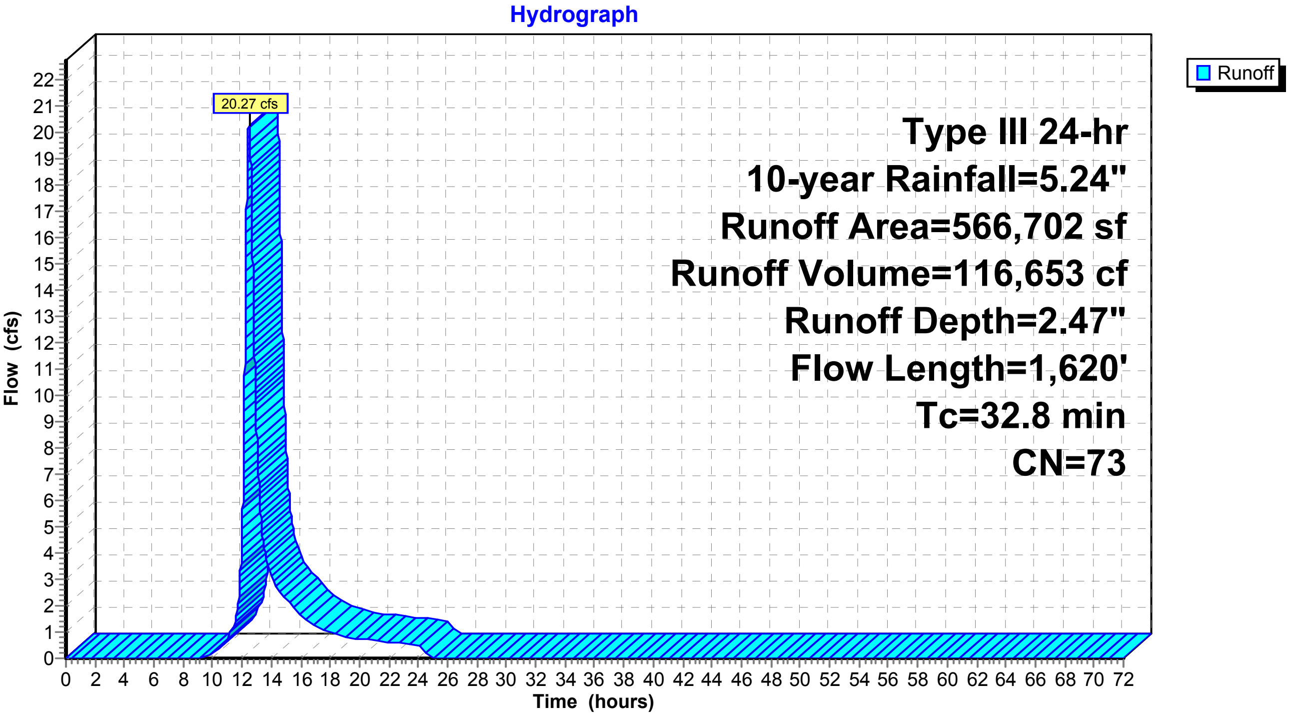
Runoff = 20.27 cfs @ 12.47 hrs, Volume= 116,653 cf, Depth= 2.47"
Routed to Link A : A

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-year Rainfall=5.24"

	Area (sf)	CN	Description
*	22,880	98	Impervious Area
	106,349	74	>75% Grass cover, Good, HSG C
	367,334	70	Woods, Good, HSG C
	70,139	77	Woods, Good, HSG D
	566,702	73	Weighted Average
	543,822		95.96% Pervious Area
	22,880		4.04% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.9	50	0.0200	0.07		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.43"
19.4	1,010	0.0300	0.87		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
1.5	560	0.0200	6.38	76.61	**Trap/Vee/Rect Channel Flow,** Bot.W=2.00' D=2.00' Z= 2.0 '/' Top.W=10.00' n= 0.035 Earth, dense weeds
32.8	1,620	Total			

Subcatchment A1: SUB-A1



Summary for Subcatchment B1: SUB-B1

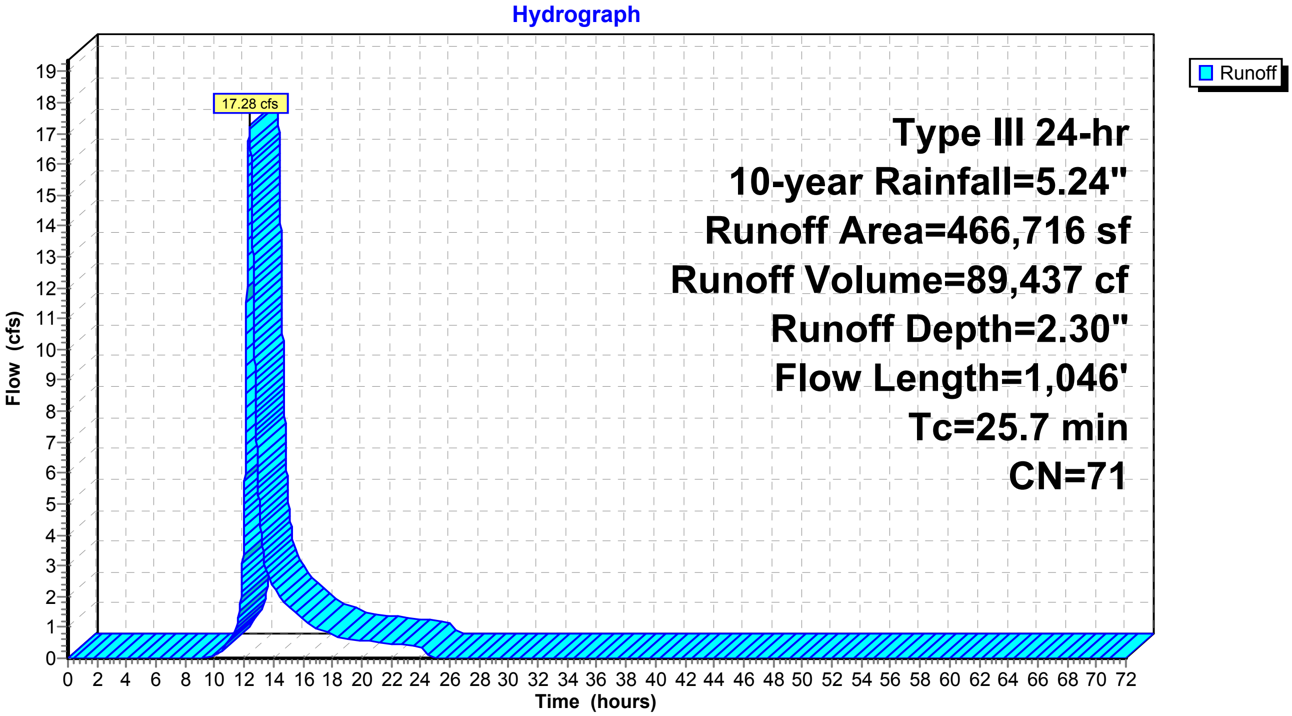
Runoff = 17.28 cfs @ 12.37 hrs, Volume= 89,437 cf, Depth= 2.30"
Routed to Link B : B

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-year Rainfall=5.24"

	Area (sf)	CN	Description
*	7,179	98	Impervious Area
	48,381	74	>75% Grass cover, Good, HSG C
	411,156	70	Woods, Good, HSG C
	466,716	71	Weighted Average
	459,537		98.46% Pervious Area
	7,179		1.54% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.6	50	0.0300	0.18		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.43"
2.9	208	0.0300	1.21		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.9	77	0.0900	1.50		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
13.1	431	0.0120	0.55		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
4.2	280	0.0500	1.12		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
25.7	1,046	Total			

Subcatchment B1: SUB-B1

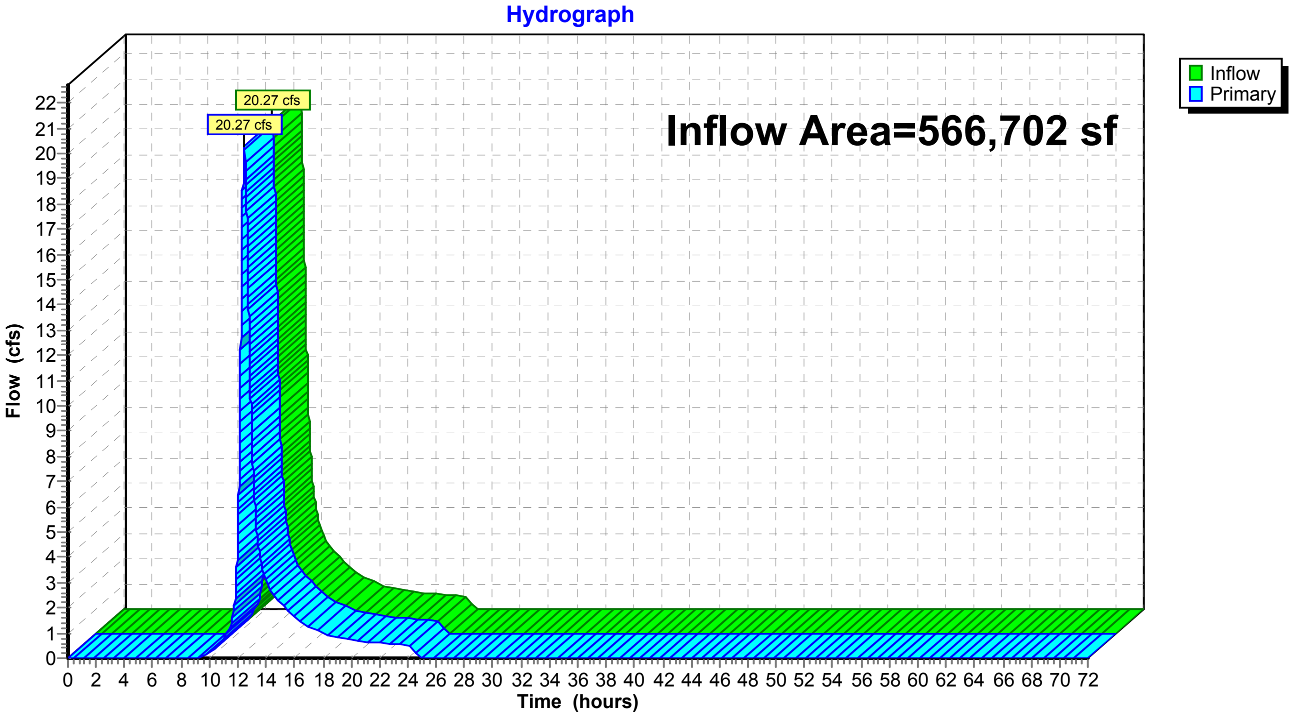


Summary for Link A: A

```
Inflow Area =       566,702 sf,   4.04% Impervious,  Inflow Depth =   2.47"    for  10-year event
Inflow      =     20.27 cfs @   12.47 hrs,  Volume=          116,653 cf
Primary     =     20.27 cfs @   12.47 hrs,  Volume=          116,653 cf,  Atten= 0%,  Lag= 0.0 min
```

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

Link A: A

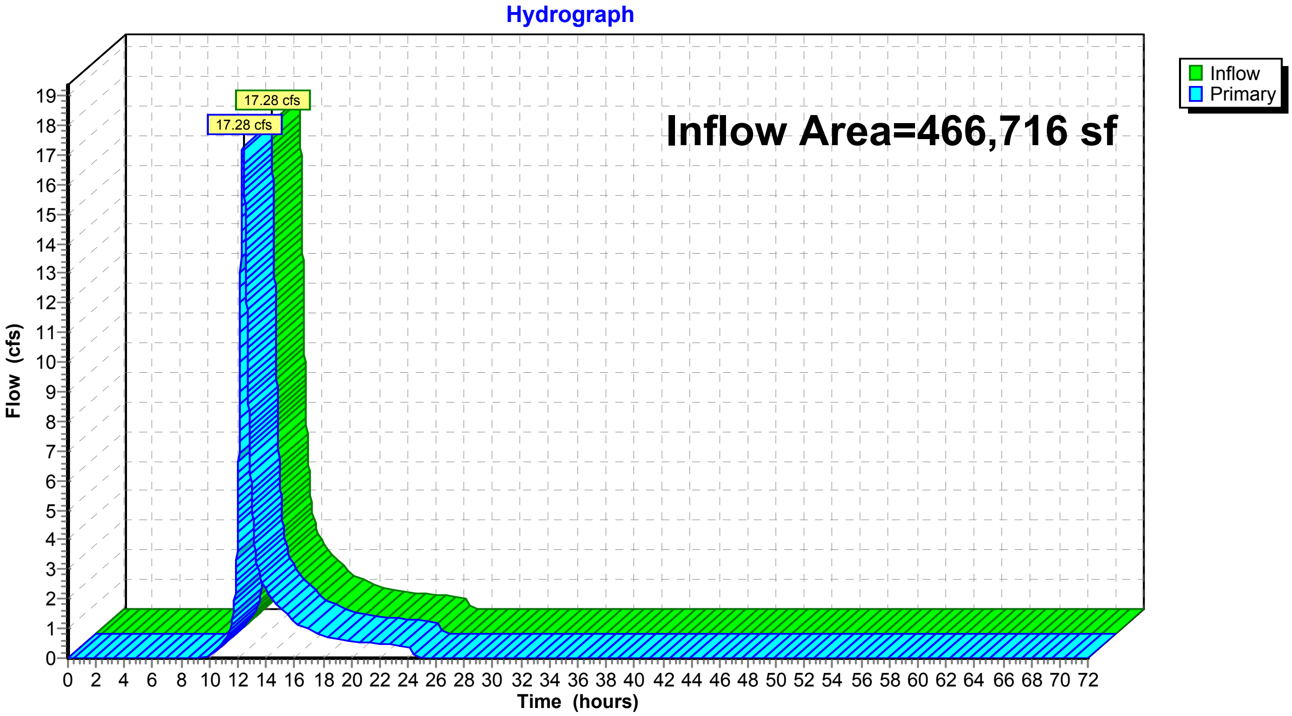


Summary for Link B: B

Inflow Area =	466,716 sf,	1.54% Impervious,	Inflow Depth = 2.30"	for 10-year event	
Inflow =	17.28 cfs @	12.37 hrs,	Volume=	89,437 cf	
Primary =	17.28 cfs @	12.37 hrs,	Volume=	89,437 cf,	Atten= 0%, Lag= 0.0 min

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

Link B: B



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

SubcatchmentA1: SUB-A1            Runoff Area=566,702 sf   4.04% Impervious   Runoff Depth=3.40"
                          Flow Length=1,620'   Tc=32.8 min   CN=73   Runoff=28.07 cfs  160,473 cf

SubcatchmentB1: SUB-B1            Runoff Area=466,716 sf   1.54% Impervious   Runoff Depth=3.20"
                          Flow Length=1,046'   Tc=25.7 min   CN=71   Runoff=24.30 cfs  124,444 cf

Link A: A                                                        Inflow=28.07 cfs  160,473 cf
                                                                Primary=28.07 cfs  160,473 cf

Link B: B                                                        Inflow=24.30 cfs  124,444 cf
                                                                Primary=24.30 cfs  124,444 cf

      Total Runoff Area = 1,033,418 sf   Runoff Volume = 284,917 cf   Average Runoff Depth = 3.31"
                                 97.09% Pervious = 1,003,359 sf     2.91% Impervious = 30,059 sf
```

Summary for Subcatchment A1: SUB-A1

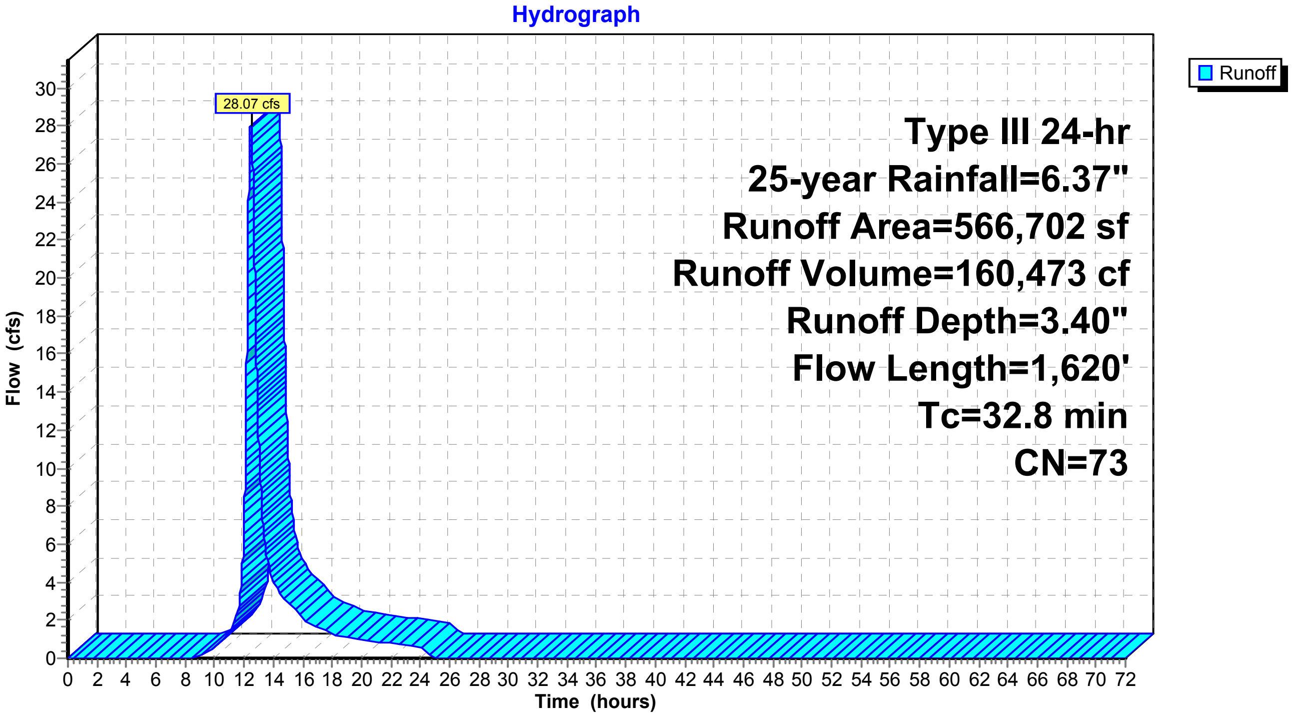
Runoff = 28.07 cfs @ 12.46 hrs, Volume= 160,473 cf, Depth= 3.40"
Routed to Link A : A

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-year Rainfall=6.37"

	Area (sf)	CN	Description
*	22,880	98	Impervious Area
	106,349	74	>75% Grass cover, Good, HSG C
	367,334	70	Woods, Good, HSG C
	70,139	77	Woods, Good, HSG D
	566,702	73	Weighted Average
	543,822		95.96% Pervious Area
	22,880		4.04% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.9	50	0.0200	0.07		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.43"
19.4	1,010	0.0300	0.87		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
1.5	560	0.0200	6.38	76.61	**Trap/Vee/Rect Channel Flow,** Bot.W=2.00' D=2.00' Z= 2.0 '/' Top.W=10.00' n= 0.035 Earth, dense weeds
32.8	1,620	Total			

Subcatchment A1: SUB-A1



Summary for Subcatchment B1: SUB-B1

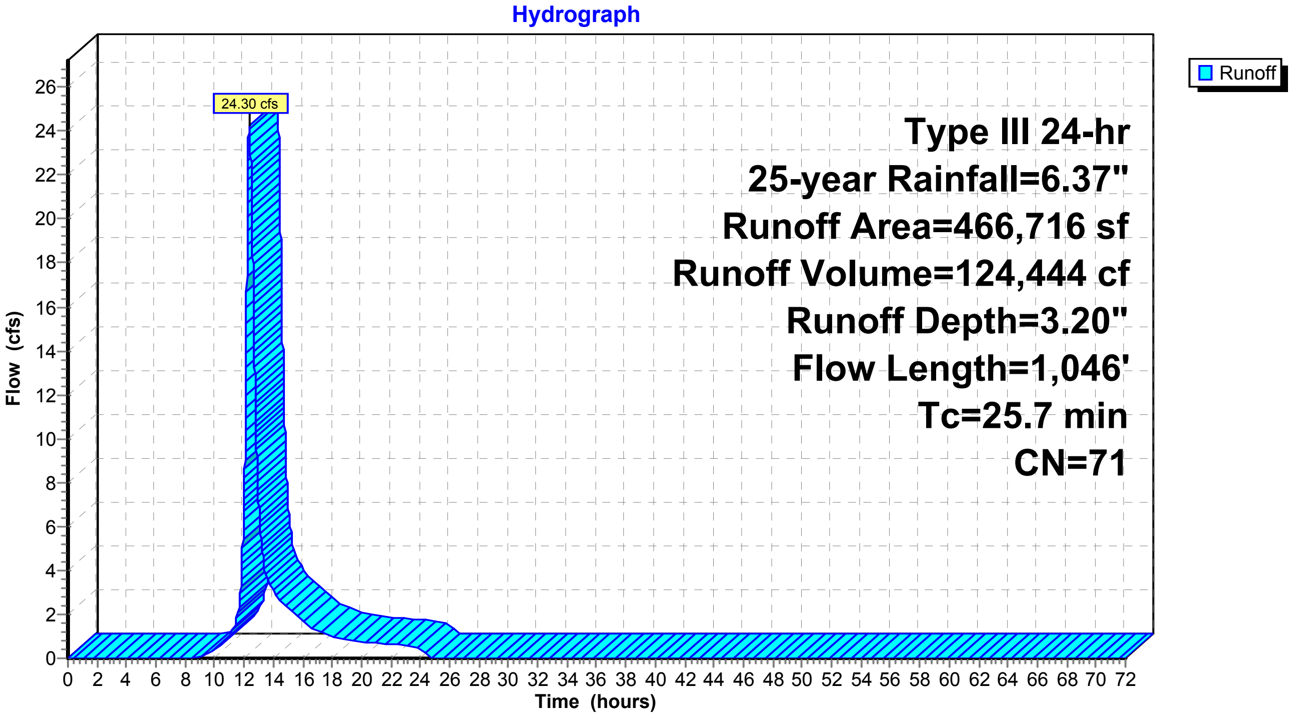
Runoff = 24.30 cfs @ 12.36 hrs, Volume= 124,444 cf, Depth= 3.20"
Routed to Link B : B

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-year Rainfall=6.37"

	Area (sf)	CN	Description
*	7,179	98	Impervious Area
	48,381	74	>75% Grass cover, Good, HSG C
	411,156	70	Woods, Good, HSG C
	466,716	71	Weighted Average
	459,537		98.46% Pervious Area
	7,179		1.54% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.6	50	0.0300	0.18		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.43"
2.9	208	0.0300	1.21		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.9	77	0.0900	1.50		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
13.1	431	0.0120	0.55		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
4.2	280	0.0500	1.12		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
25.7	1,046	Total			

Subcatchment B1: SUB-B1

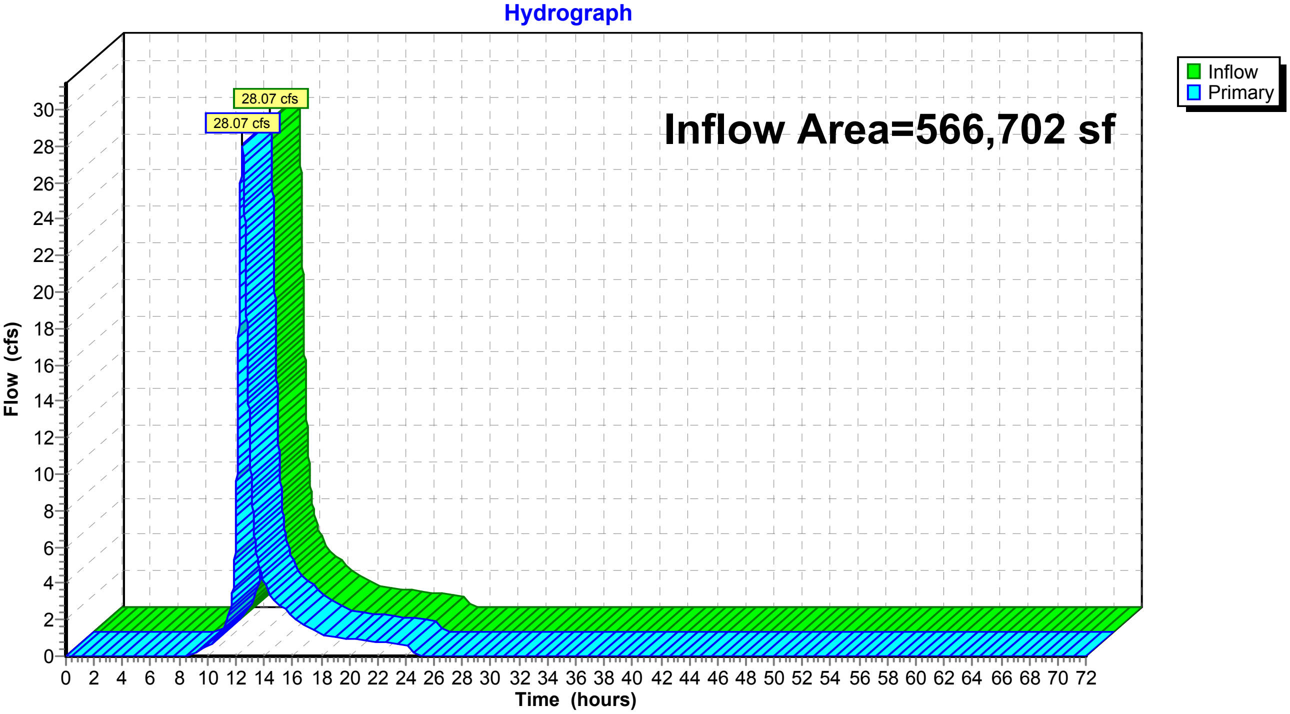


Summary for Link A: A

Inflow Area = 566,702 sf, 4.04% Impervious, Inflow Depth = 3.40" for 25-year event
Inflow = 28.07 cfs @ 12.46 hrs, Volume= 160,473 cf
Primary = 28.07 cfs @ 12.46 hrs, Volume= 160,473 cf, Atten= 0%, Lag= 0.0 min

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

Link A: A

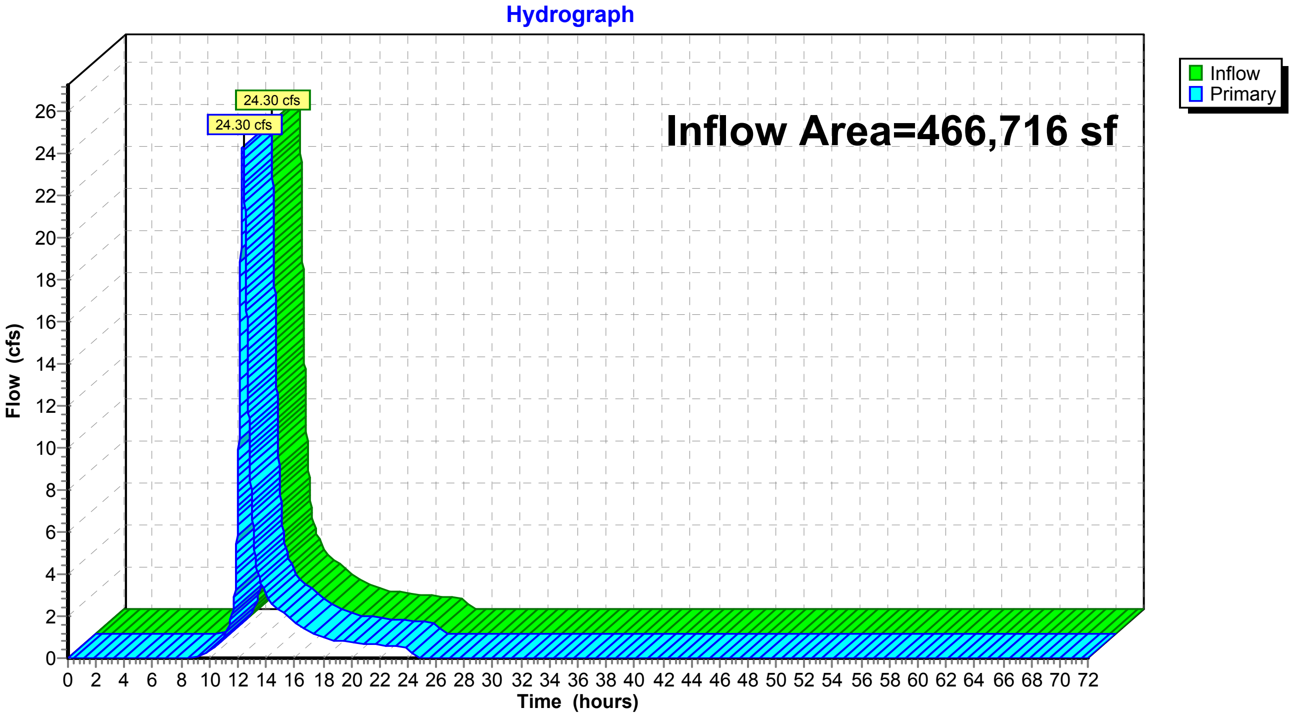


Summary for Link B: B

```
Inflow Area =         466,716 sf,    1.54% Impervious,  Inflow Depth =   3.20"    for  25-year event
Inflow       =       24.30 cfs @   12.36 hrs,  Volume=           124,444 cf
Primary      =       24.30 cfs @   12.36 hrs,  Volume=           124,444 cf,  Atten= 0%,  Lag= 0.0 min
```

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

Link B: B



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

SubcatchmentA1: SUB-A1 Runoff Area=566,702 sf 4.04% Impervious Runoff Depth=4.12"
Flow Length=1,620' Tc=32.8 min CN=73 Runoff=34.04 cfs 194,422 cf

SubcatchmentB1: SUB-B1 Runoff Area=466,716 sf 1.54% Impervious Runoff Depth=3.90"
Flow Length=1,046' Tc=25.7 min CN=71 Runoff=29.70 cfs 151,716 cf

Link A: A Inflow=34.04 cfs 194,422 cf
Primary=34.04 cfs 194,422 cf

Link B: B Inflow=29.70 cfs 151,716 cf
Primary=29.70 cfs 151,716 cf

Total Runoff Area = 1,033,418 sf Runoff Volume = 346,138 cf Average Runoff Depth = 4.02"
97.09% Pervious = 1,003,359 sf 2.91% Impervious = 30,059 sf

Summary for Subcatchment A1: SUB-A1

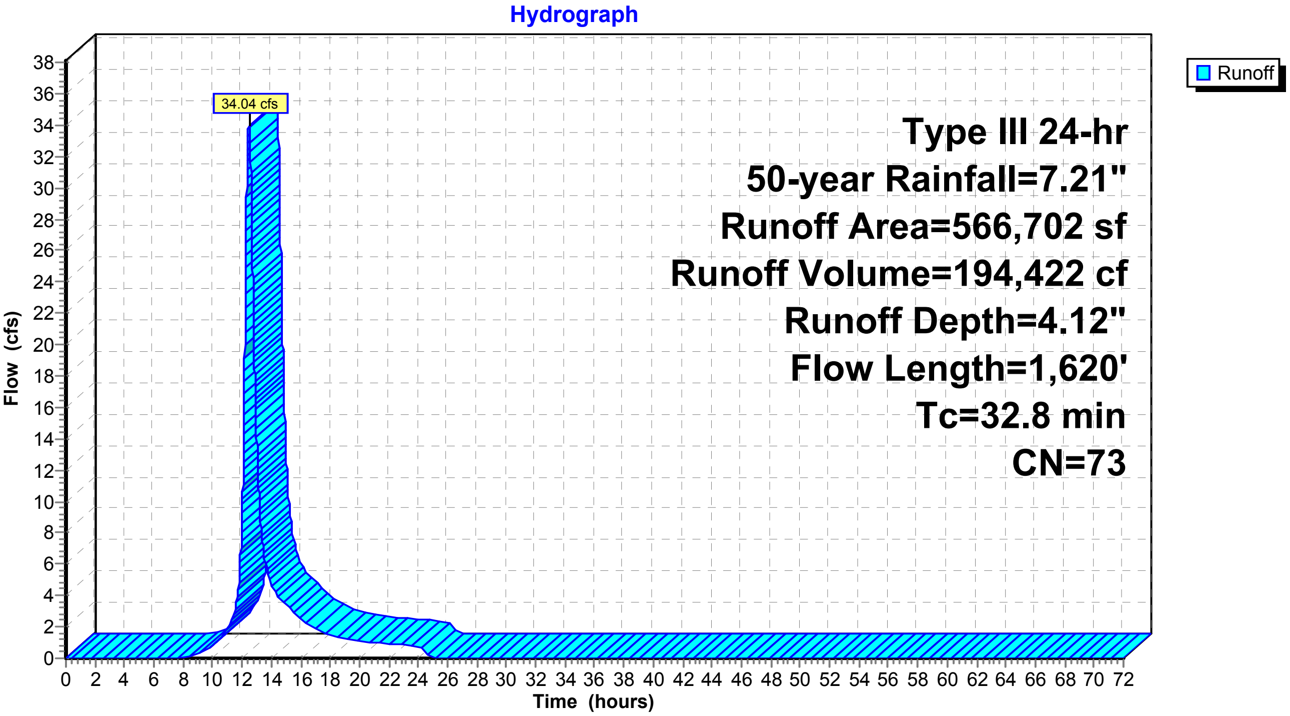
Runoff = 34.04 cfs @ 12.46 hrs, Volume= 194,422 cf, Depth= 4.12"
Routed to Link A : A

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 50-year Rainfall=7.21"

	Area (sf)	CN	Description
*	22,880	98	Impervious Area
	106,349	74	>75% Grass cover, Good, HSG C
	367,334	70	Woods, Good, HSG C
	70,139	77	Woods, Good, HSG D
	566,702	73	Weighted Average
	543,822		95.96% Pervious Area
	22,880		4.04% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.9	50	0.0200	0.07		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.43"
19.4	1,010	0.0300	0.87		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
1.5	560	0.0200	6.38	76.61	**Trap/Vee/Rect Channel Flow,** Bot.W=2.00' D=2.00' Z= 2.0 '/' Top.W=10.00' n= 0.035 Earth, dense weeds
32.8	1,620	Total			

Subcatchment A1: SUB-A1



Summary for Subcatchment B1: SUB-B1

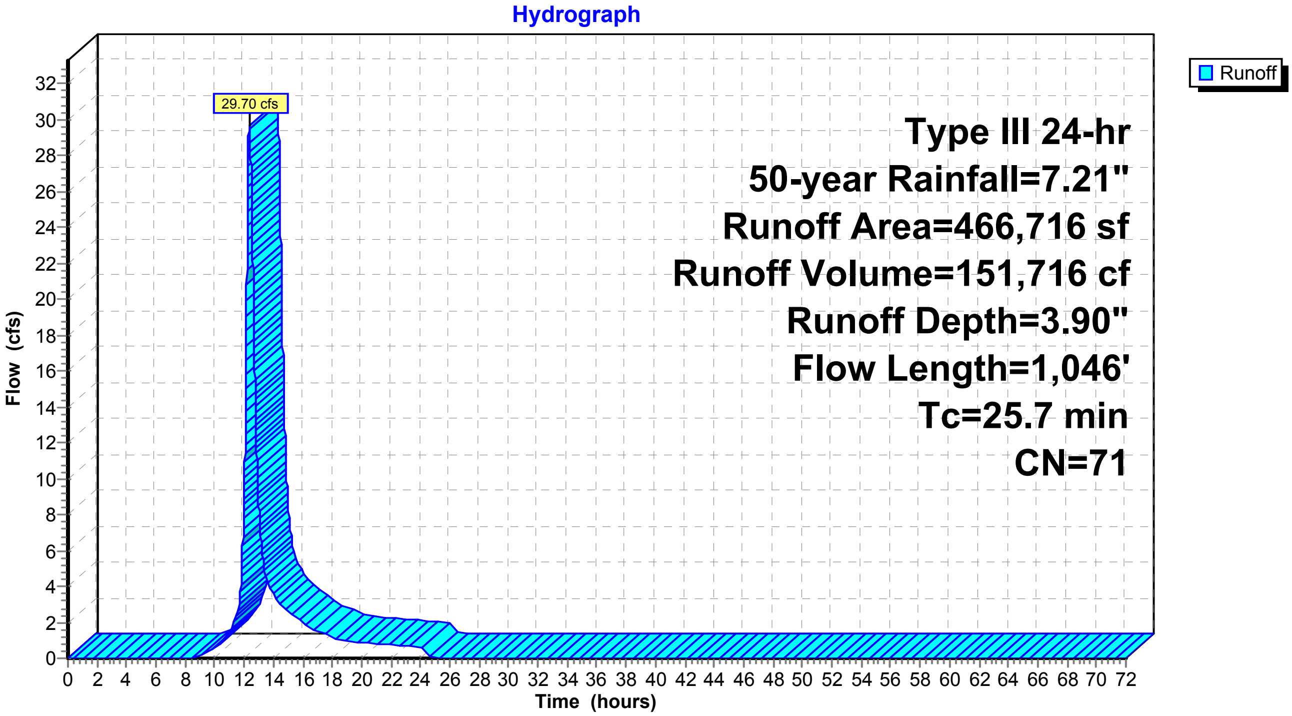
Runoff = 29.70 cfs @ 12.36 hrs, Volume= 151,716 cf, Depth= 3.90"
Routed to Link B : B

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 50-year Rainfall=7.21"

	Area (sf)	CN	Description
*	7,179	98	Impervious Area
	48,381	74	>75% Grass cover, Good, HSG C
	411,156	70	Woods, Good, HSG C
	466,716	71	Weighted Average
	459,537		98.46% Pervious Area
	7,179		1.54% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.6	50	0.0300	0.18		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.43"
2.9	208	0.0300	1.21		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.9	77	0.0900	1.50		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
13.1	431	0.0120	0.55		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
4.2	280	0.0500	1.12		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
25.7	1,046	Total			

Subcatchment B1: SUB-B1

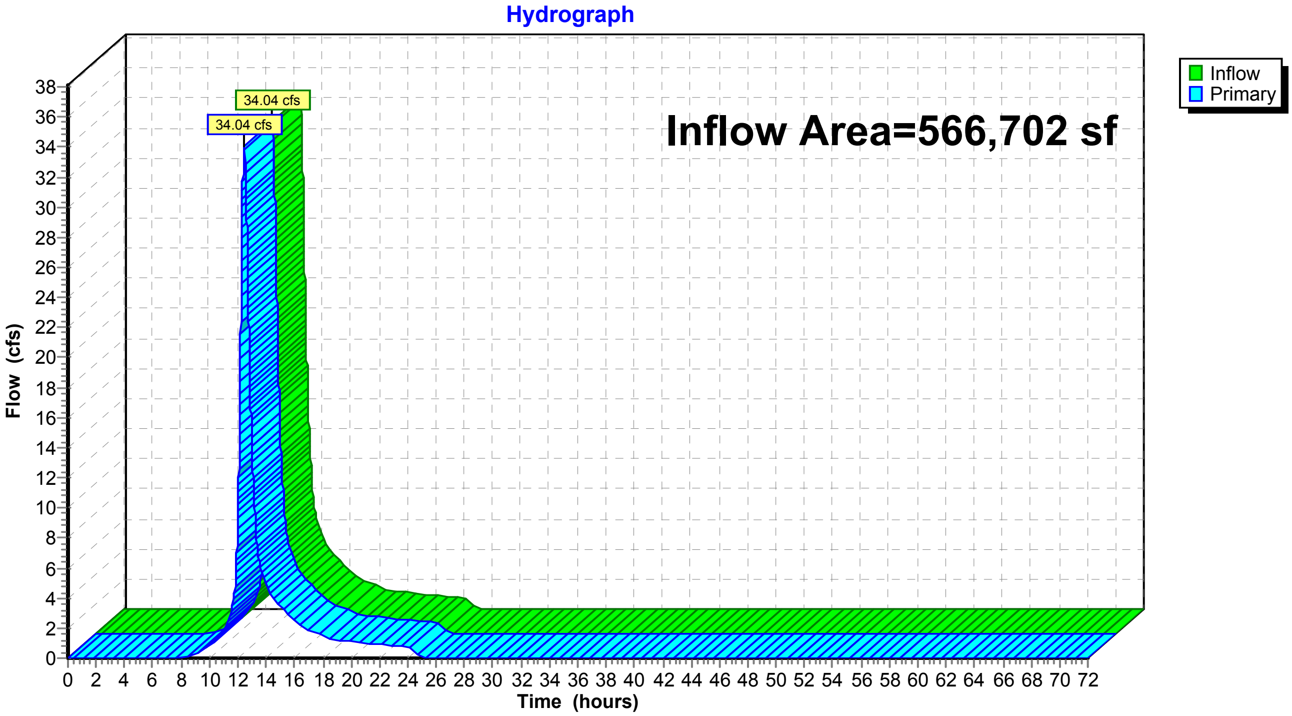


Summary for Link A: A

```
Inflow Area =        566,702 sf,    4.04% Impervious,  Inflow Depth =   4.12"    for  50-year event
Inflow       =       34.04 cfs @   12.46 hrs,  Volume=          194,422 cf
Primary      =       34.04 cfs @   12.46 hrs,  Volume=          194,422 cf,  Atten= 0%,  Lag= 0.0 min
```

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

Link A: A

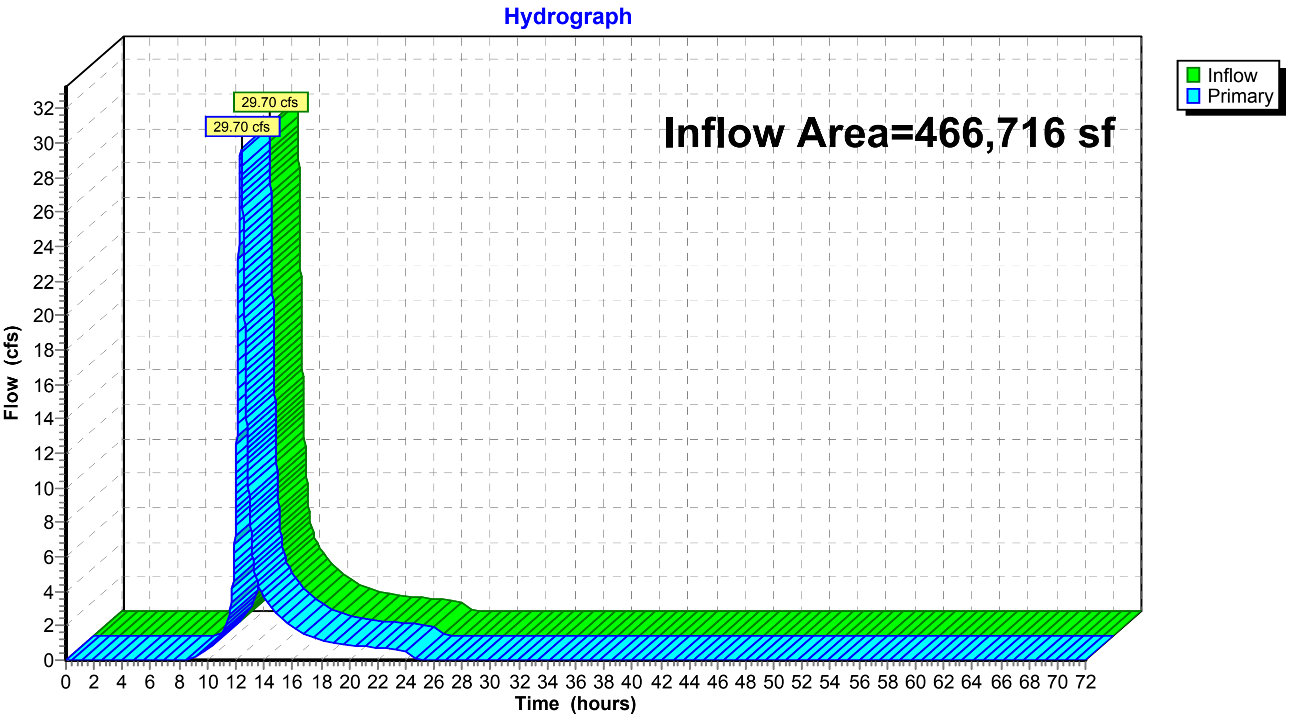


Summary for Link B: B

```
Inflow Area =         466,716 sf,    1.54% Impervious,  Inflow Depth =   3.90"    for  50-year event
Inflow       =       29.70 cfs @   12.36 hrs,  Volume=          151,716 cf
Primary      =       29.70 cfs @   12.36 hrs,  Volume=          151,716 cf,  Atten= 0%,  Lag= 0.0 min
```

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

Link B: B



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

SubcatchmentA1: SUB-A1              Runoff Area=566,702 sf   4.04% Impervious   Runoff Depth=4.91"
                             Flow Length=1,620'   Tc=32.8 min   CN=73   Runoff=40.55 cfs  231,759 cf

SubcatchmentB1: SUB-B1              Runoff Area=466,716 sf   1.54% Impervious   Runoff Depth=4.67"
                             Flow Length=1,046'   Tc=25.7 min   CN=71   Runoff=35.62 cfs  181,821 cf

Link A: A                                                          Inflow=40.55 cfs  231,759 cf
                                                                  Primary=40.55 cfs  231,759 cf

Link B: B                                                          Inflow=35.62 cfs  181,821 cf
                                                                  Primary=35.62 cfs  181,821 cf

      Total Runoff Area = 1,033,418 sf   Runoff Volume = 413,580 cf   Average Runoff Depth = 4.80"
                                   97.09% Pervious = 1,003,359 sf     2.91% Impervious = 30,059 sf
```

Summary for Subcatchment A1: SUB-A1

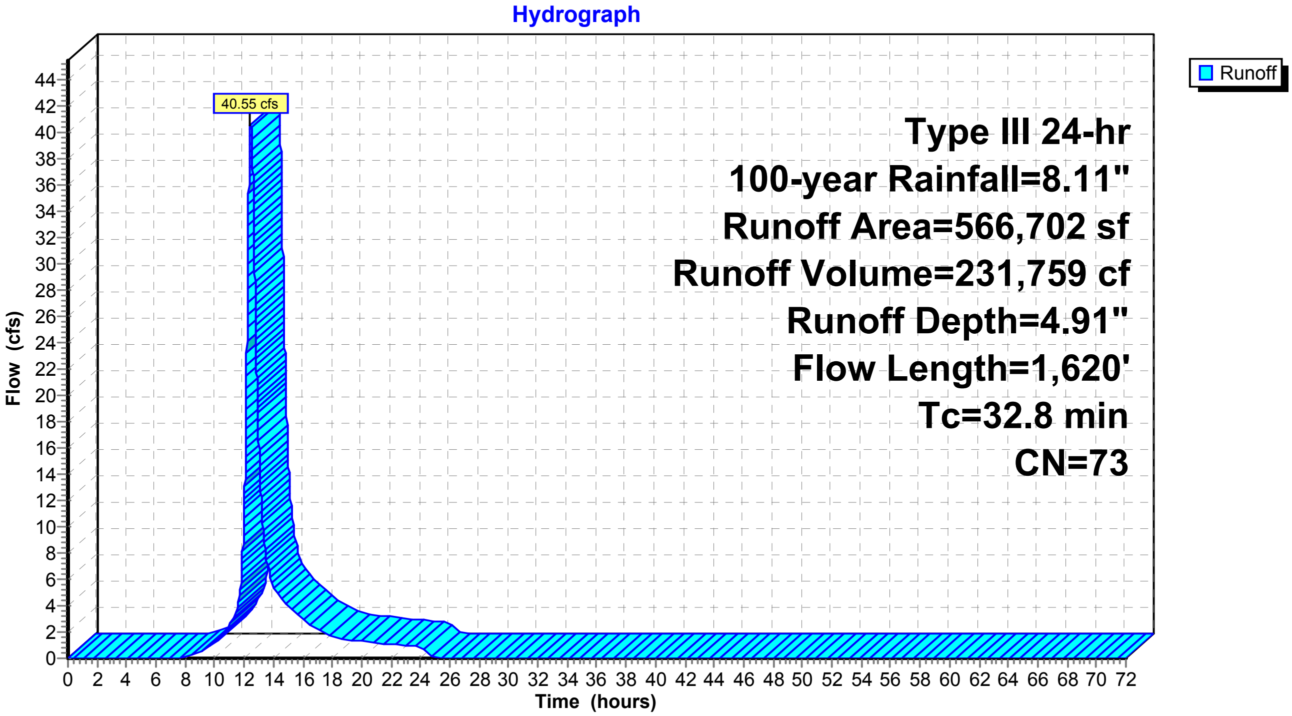
Runoff = 40.55 cfs @ 12.44 hrs, Volume= 231,759 cf, Depth= 4.91"
Routed to Link A : A

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-year Rainfall=8.11"

	Area (sf)	CN	Description
*	22,880	98	Impervious Area
	106,349	74	>75% Grass cover, Good, HSG C
	367,334	70	Woods, Good, HSG C
	70,139	77	Woods, Good, HSG D
	566,702	73	Weighted Average
	543,822		95.96% Pervious Area
	22,880		4.04% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.9	50	0.0200	0.07		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.43"
19.4	1,010	0.0300	0.87		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
1.5	560	0.0200	6.38	76.61	**Trap/Vee/Rect Channel Flow,** Bot.W=2.00' D=2.00' Z= 2.0 '/' Top.W=10.00' n= 0.035 Earth, dense weeds
32.8	1,620	Total			

Subcatchment A1: SUB-A1



Summary for Subcatchment B1: SUB-B1

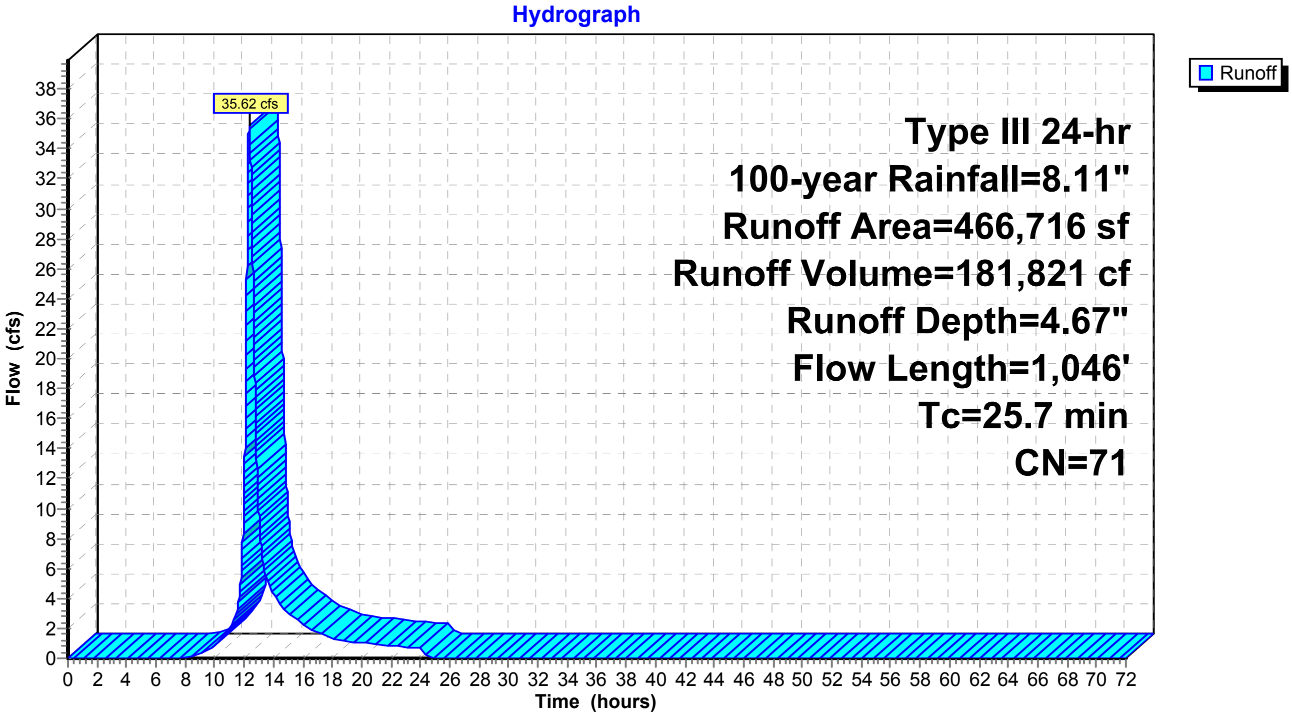
Runoff = 35.62 cfs @ 12.36 hrs, Volume= 181,821 cf, Depth= 4.67"
Routed to Link B : B

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-year Rainfall=8.11"

	Area (sf)	CN	Description
*	7,179	98	Impervious Area
	48,381	74	>75% Grass cover, Good, HSG C
	411,156	70	Woods, Good, HSG C
	466,716	71	Weighted Average
	459,537		98.46% Pervious Area
	7,179		1.54% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.6	50	0.0300	0.18		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.43"
2.9	208	0.0300	1.21		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.9	77	0.0900	1.50		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
13.1	431	0.0120	0.55		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
4.2	280	0.0500	1.12		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
25.7	1,046	Total			

Subcatchment B1: SUB-B1

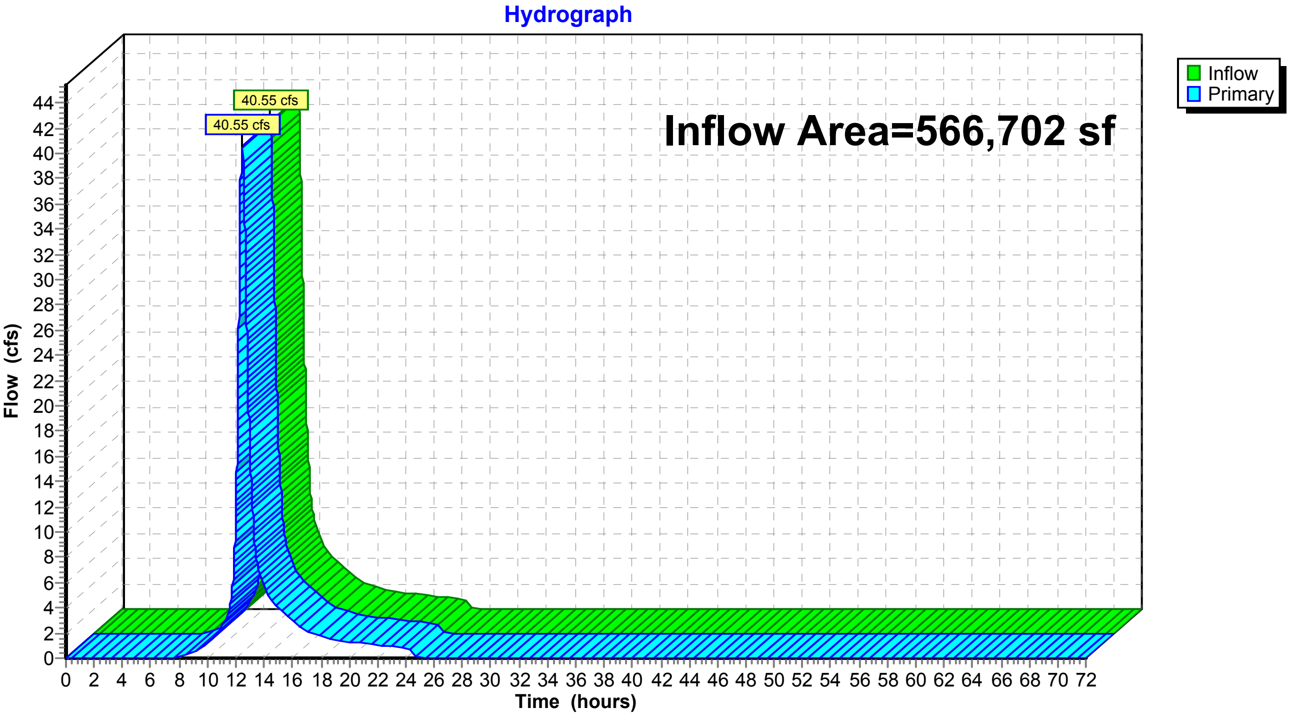


Summary for Link A: A

Inflow Area = 566,702 sf, 4.04% Impervious, Inflow Depth = 4.91" for 100-year event
Inflow = 40.55 cfs @ 12.44 hrs, Volume= 231,759 cf
Primary = 40.55 cfs @ 12.44 hrs, Volume= 231,759 cf, Atten= 0%, Lag= 0.0 min

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

Link A: A

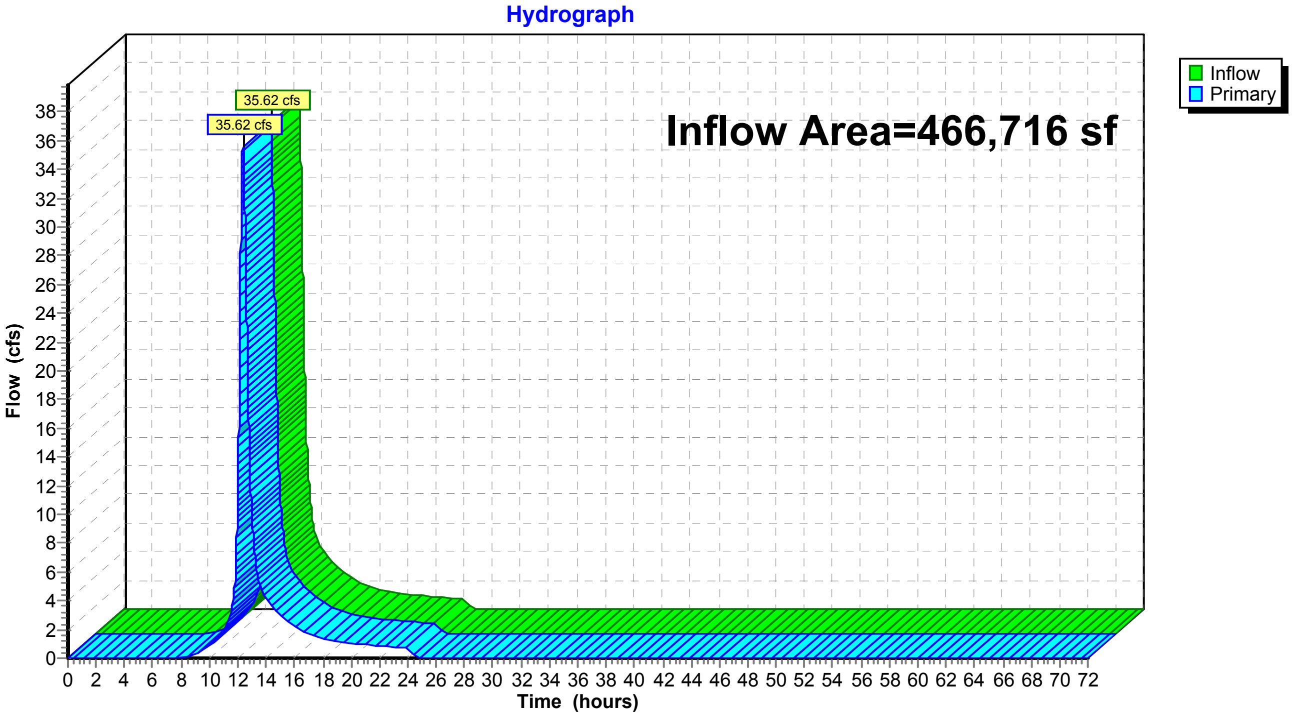


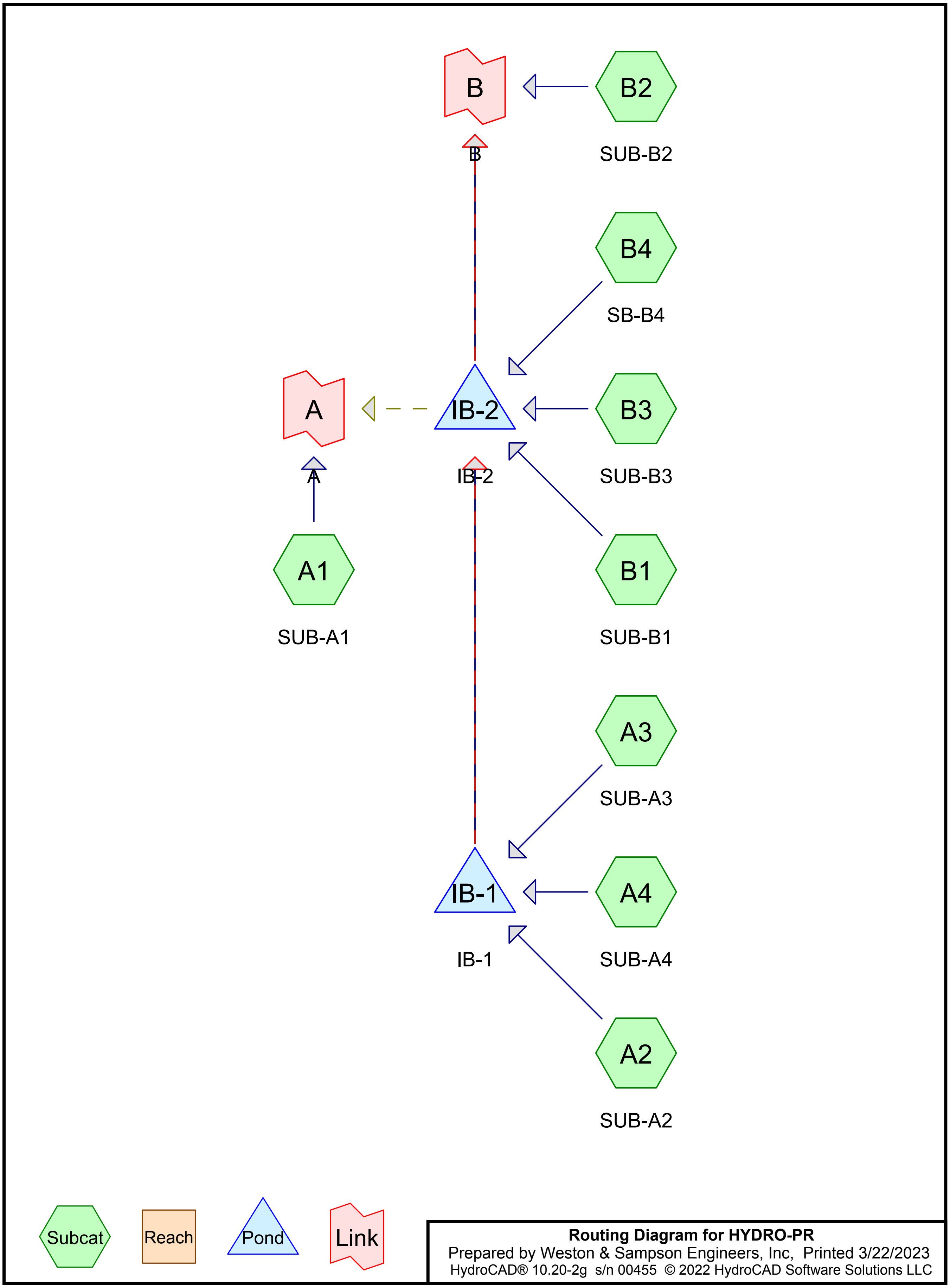
Summary for Link B: B

Inflow Area = 466,716 sf, 1.54% Impervious, Inflow Depth = 4.67" for 100-year event
Inflow = 35.62 cfs @ 12.36 hrs, Volume= 181,821 cf
Primary = 35.62 cfs @ 12.36 hrs, Volume= 181,821 cf, Atten= 0%, Lag= 0.0 min

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

Link B: B





Routing Diagram for HYDRO-PR
Prepared by Weston & Sampson Engineers, Inc, Printed 3/22/2023

Rainfall Events Listing

Event#	Event Name	Storm Type	Curve	Mode	Duration (hours)	B/B	Depth (inches)	AMC
1	2-year	Type III 24-hr		Default	24.00	1	3.43	2
2	10-year	Type III 24-hr		Default	24.00	1	5.24	2
3	25-year	Type III 24-hr		Default	24.00	1	6.37	2
4	50-year	Type III 24-hr		Default	24.00	1	7.21	2
5	100-year	Type III 24-hr		Default	24.00	1	8.11	2

Area Listing (all nodes)

Area (sq-ft)	CN	Description (subcatchment-numbers)
382,287	74	>75% Grass cover, Good, HSG C (A1, A2, A4, B1, B2, B3)
1,864	96	Gravel surface, HSG C (A1, A2)
244,401	98	Impervious Area (A1, A2, A3, A4, B1, B3, B4)
9,648	98	Infiltration Basin Floor (A2, B1)
325,724	70	Woods, Good, HSG C (A1, A2, B1, B2)
69,494	77	Woods, Good, HSG D (A1, A2)
1,033,418	**79**	**TOTAL AREA**

Soil Listing (all nodes)

Area (sq-ft)	Soil Group	Subcatchment Numbers
0	HSG A	
0	HSG B	
709,875	HSG C	A1, A2, A4, B1, B2, B3
69,494	HSG D	A1, A2
254,049	Other	A1, A2, A3, A4, B1, B3, B4
1,033,418		**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	Su Nu
0	0	382,287	0	0	382,287	>75% Grass cover, Good	
0	0	1,864	0	0	1,864	Gravel surface	
0	0	0	0	244,401	244,401	Impervious Area	
0	0	0	0	9,648	9,648	Infiltration Basin Floor	
0	0	325,724	69,494	0	395,218	Woods, Good	
0	**0**	**709,875**	**69,494**	**254,049**	**1,033,418**	**TOTAL AREA**	

Pipe Listing (all nodes)

Line#	Node Number	In-Invert (feet)	Out-Invert (feet)	Length (feet)	Slope (ft/ft)	n	Width (inches)	Diam/Height (inches)	Inside-Fill (inches)
1	A2	0.00	0.00	835.0	0.0050	0.013	0.0	12.0	0.0
2	A4	0.00	0.00	330.0	0.0050	0.013	0.0	12.0	0.0
3	B1	0.00	0.00	983.0	0.0050	0.013	0.0	12.0	0.0
4	B3	0.00	0.00	580.0	0.0050	0.013	0.0	12.0	0.0
5	IB-1	241.38	241.00	70.0	0.0054	0.013	0.0	24.0	0.0
6	IB-2	241.28	241.13	30.0	0.0050	0.013	0.0	24.0	0.0
7	IB-2	238.25	238.00	50.0	0.0050	0.013	0.0	12.0	0.0

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

SubcatchmentA1: SUB-A1 Runoff Area=422,091 sf 5.83% Impervious Runoff Depth=1.19"
Flow Length=1,620' Tc=32.8 min CN=74 Runoff=7.04 cfs 41,923 cf

SubcatchmentA2: SUB-A2 Runoff Area=197,483 sf 24.49% Impervious Runoff Depth=1.51"
Flow Length=1,333' Tc=13.6 min CN=79 Runoff=6.23 cfs 24,880 cf

SubcatchmentA3: SUB-A3 Runoff Area=45,304 sf 100.00% Impervious Runoff Depth=3.20"
Flow Length=51' Slope=0.0200 '/' Tc=6.0 min CN=98 Runoff=3.47 cfs 12,069 cf

SubcatchmentA4: SUB-A4 Runoff Area=38,793 sf 28.18% Impervious Runoff Depth=1.65"
Flow Length=515' Tc=8.4 min CN=81 Runoff=1.58 cfs 5,341 cf

SubcatchmentB1: SUB-B1 Runoff Area=187,914 sf 46.61% Impervious Runoff Depth=1.96"
Flow Length=1,482' Tc=20.5 min CN=85 Runoff=6.61 cfs 30,623 cf

SubcatchmentB2: SUB-B2 Runoff Area=67,056 sf 0.00% Impervious Runoff Depth=1.08"
Flow Length=438' Tc=14.5 min CN=72 Runoff=1.39 cfs 6,009 cf

SubcatchmentB3: SUB-B3 Runoff Area=48,216 sf 22.19% Impervious Runoff Depth=1.51"
Flow Length=766' Tc=10.5 min CN=79 Runoff=1.67 cfs 6,074 cf

SubcatchmentB4: SB-B4 Runoff Area=26,561 sf 100.00% Impervious Runoff Depth=3.20"
Flow Length=51' Slope=0.0200 '/' Tc=6.0 min CN=98 Runoff=2.03 cfs 7,076 cf

Pond IB-1: IB-1 Peak Elev=245.73' Storage=15,609 cf Inflow=10.07 cfs 42,289 cf
Discarded=0.29 cfs 22,701 cf Primary=3.75 cfs 19,588 cf Secondary=0.00 cfs 0 cf Outflow=4.04 cfs 42,289 cf

Pond IB-2: IB-2 Peak Elev=242.32' Storage=29,175 cf Inflow=11.05 cfs 63,361 cf
cfs 39,017 cf Primary=2.34 cfs 16,865 cf Secondary=0.00 cfs 0 cf Tertiary=0.57 cfs 7,481 cf Outflow=3.32 cfs 63,363 cf

Link A: A Inflow=7.07 cfs 49,404 cf
Primary=7.07 cfs 49,404 cf

Link B: B Inflow=2.57 cfs 22,874 cf
Primary=2.57 cfs 22,874 cf

Total Runoff Area = 1,033,418 sf Runoff Volume = 133,994 cf Average Runoff Depth = 1.56"
75.42% Pervious = 779,369 sf 24.58% Impervious = 254,049 sf

Summary for Subcatchment A1: SUB-A1

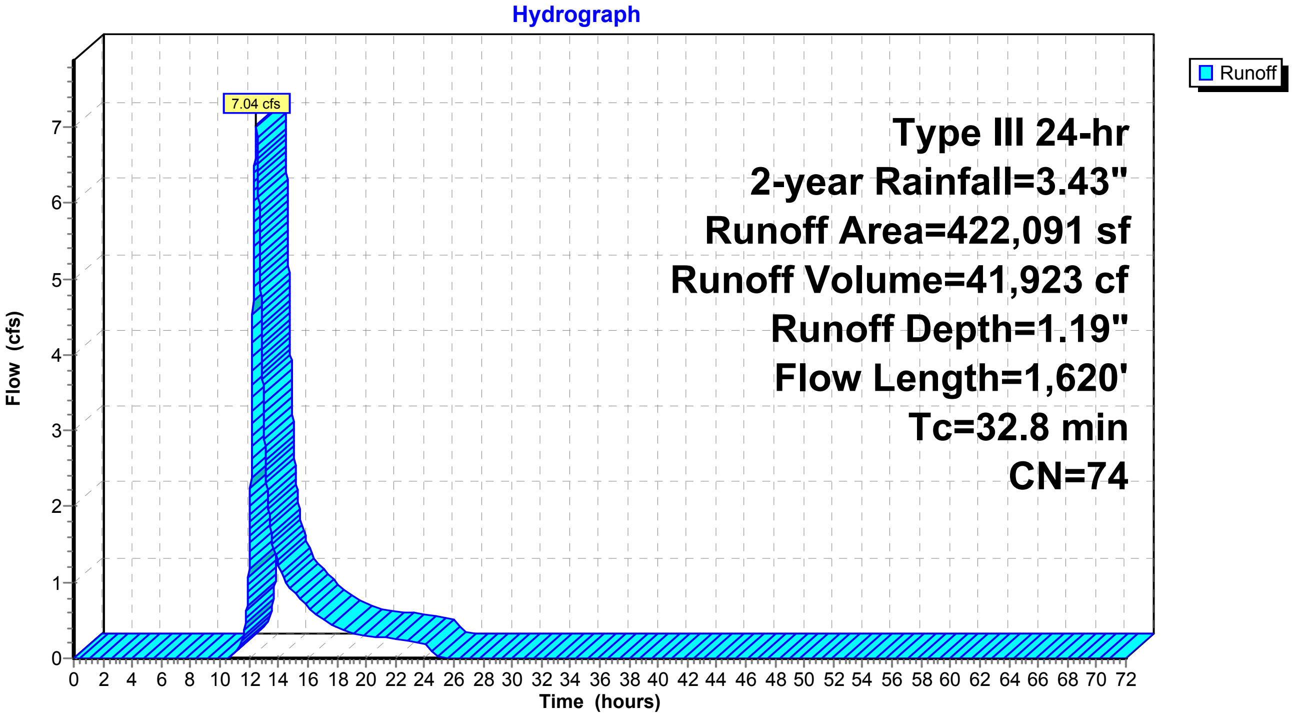
Runoff = 7.04 cfs @ 12.50 hrs, Volume= 41,923 cf, Depth= 1.19"
Routed to Link A : A

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-year Rainfall=3.43"

	Area (sf)	CN	Description
	127,217	74	>75% Grass cover, Good, HSG C
	211,698	70	Woods, Good, HSG C
*	24,606	98	Impervious Area
	716	96	Gravel surface, HSG C
	57,854	77	Woods, Good, HSG D
	422,091	74	Weighted Average
	397,485		94.17% Pervious Area
	24,606		5.83% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.9	50	0.0200	0.07		**Sheet Flow, Sheet** Woods: Light underbrush n= 0.400 P2= 3.43"
19.4	1,010	0.0300	0.87		**Shallow Concentrated Flow, Shallow** Woodland Kv= 5.0 fps
1.5	560	0.0200	6.38	76.61	**Trap/Vee/Rect Channel Flow,** Bot.W=2.00' D=2.00' Z= 2.0 '/' Top.W=10.00' n= 0.035 Earth, dense weeds
32.8	1,620	Total			

Subcatchment A1: SUB-A1



Summary for Subcatchment A2: SUB-A2

[47] Hint: Peak is 247% of capacity of segment #6

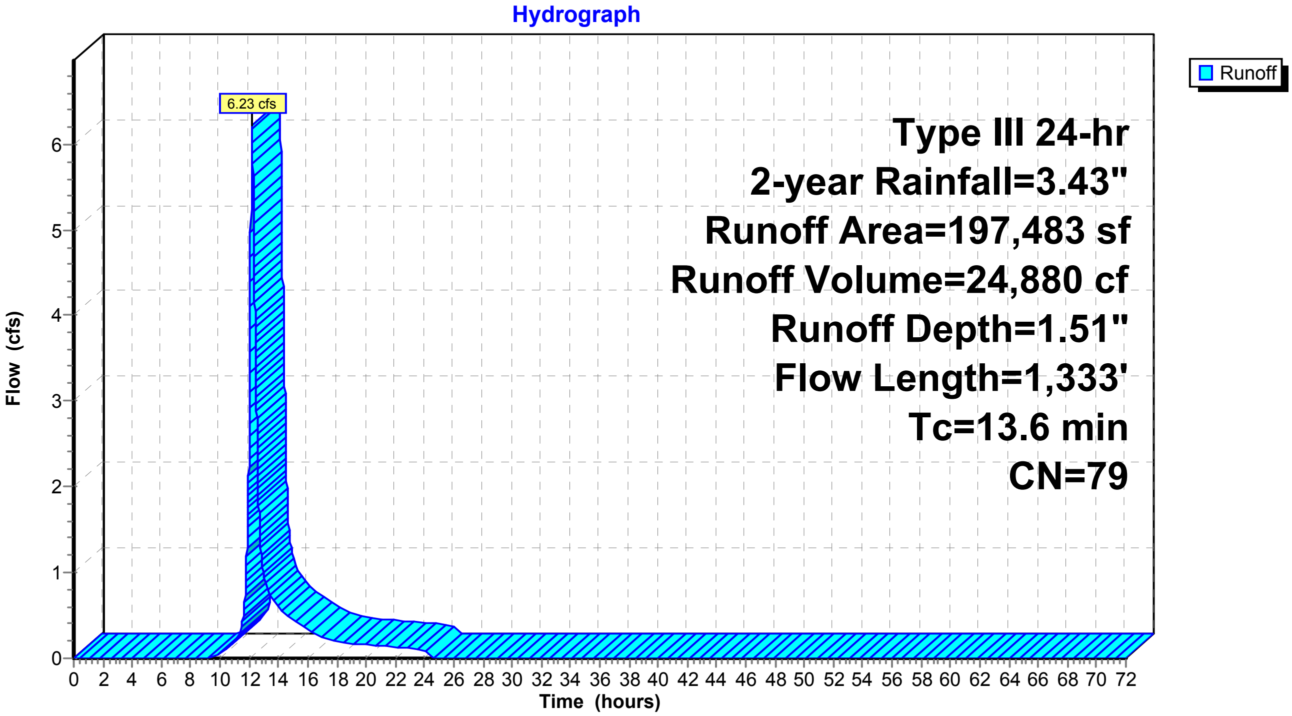
Runoff = 6.23 cfs @ 12.19 hrs, Volume= 24,880 cf, Depth= 1.51"
Routed to Pond IB-1 : IB-1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-year Rainfall=3.43"

	Area (sf)	CN	Description
	83,784	74	>75% Grass cover, Good, HSG C
	52,545	70	Woods, Good, HSG C
*	44,663	98	Impervious Area
	1,148	96	Gravel surface, HSG C
*	3,703	98	Infiltration Basin Floor
	11,640	77	Woods, Good, HSG D
	197,483	79	Weighted Average
	149,117		75.51% Pervious Area
	48,366		24.49% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.6	50	0.0300	0.18		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.43"
2.9	208	0.0300	1.21		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.9	77	0.0900	1.50		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
0.1	22	0.2500	3.50		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.8	141	0.0200	2.87		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
4.3	835	0.0050	3.21	2.52	**Pipe Channel,** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.013 Corrugated PE, smooth interior
13.6	1,333	Total			

Subcatchment A2: SUB-A2



Summary for Subcatchment A3: SUB-A3

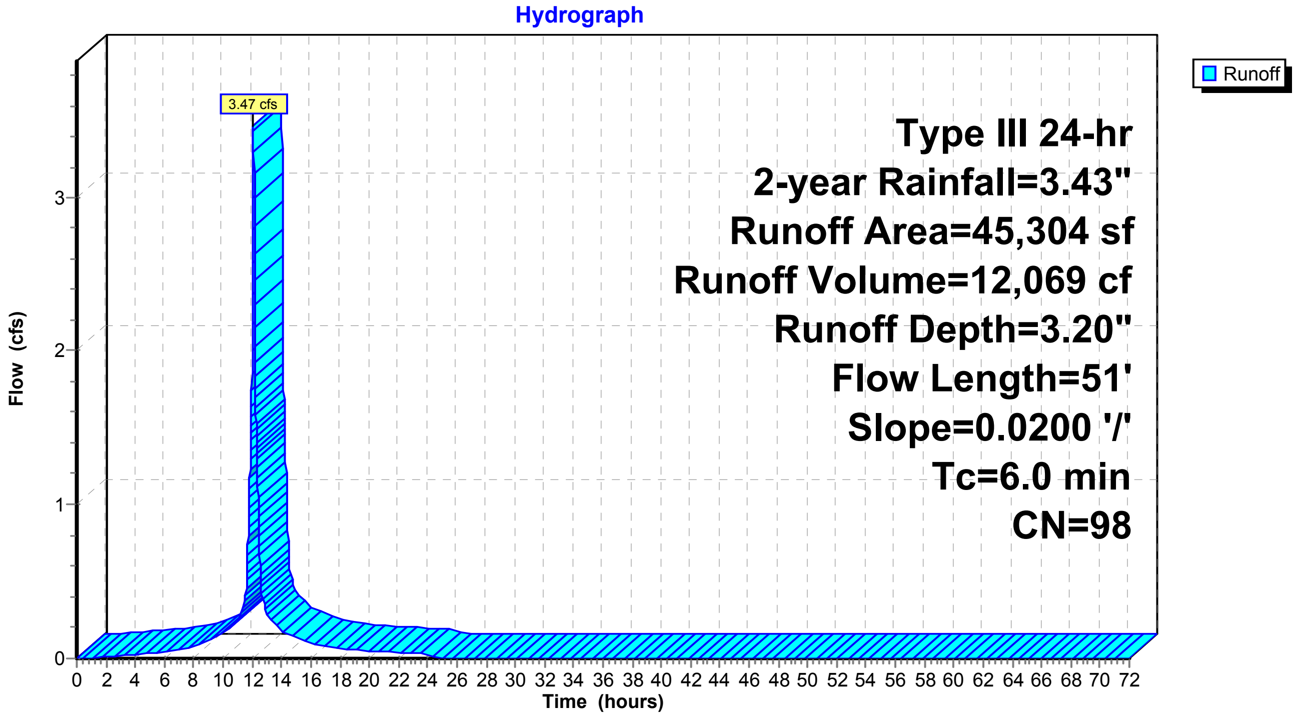
Runoff = 3.47 cfs @ 12.08 hrs, Volume= 12,069 cf, Depth= 3.20"
Routed to Pond IB-1 : IB-1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-year Rainfall=3.43"

	Area (sf)	CN	Description
*	45,304	98	Impervious Area
	45,304		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.7	50	0.0200	1.24		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.43"
0.0	1	0.0200	2.87		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
0.7	51	Total, Increased to minimum Tc = 6.0 min			

Subcatchment A3: SUB-A3



Summary for Subcatchment A4: SUB-A4

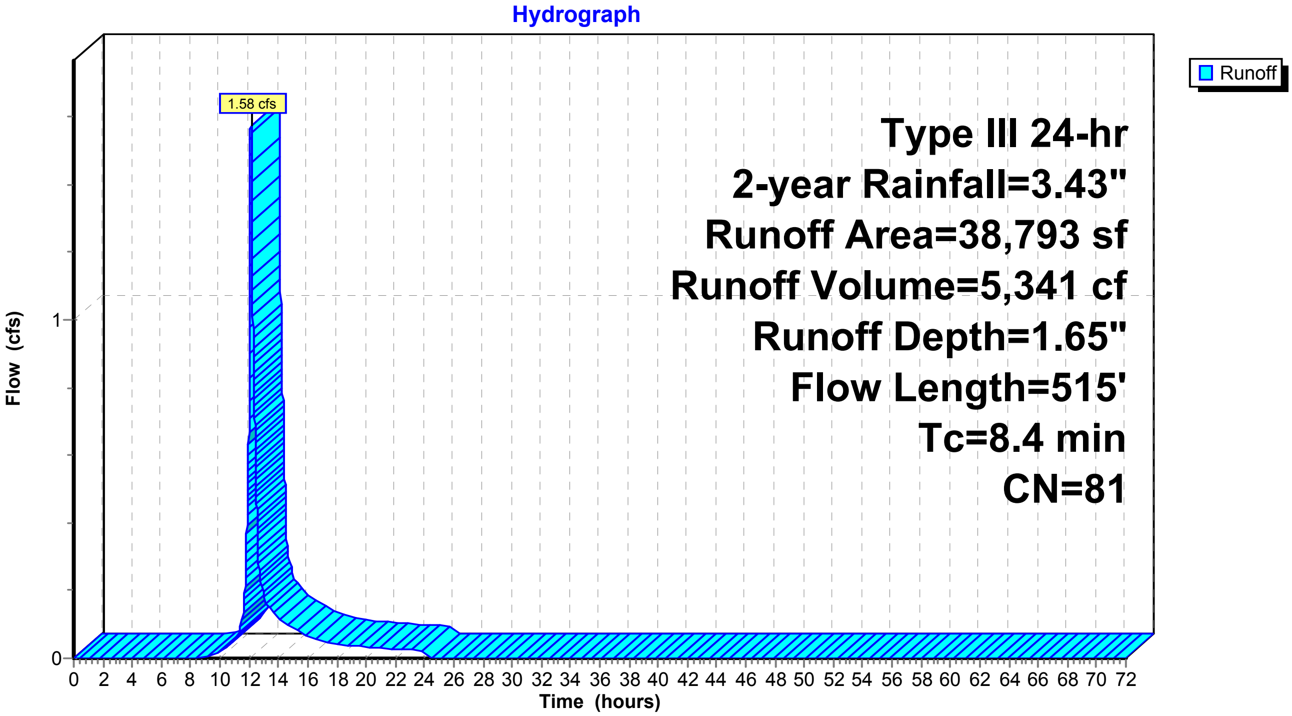
Runoff = 1.58 cfs @ 12.12 hrs, Volume= 5,341 cf, Depth= 1.65"
Routed to Pond IB-1 : IB-1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-year Rainfall=3.43"

	Area (sf)	CN	Description
	27,860	74	>75% Grass cover, Good, HSG C
*	10,933	98	Impervious Area
	38,793	81	Weighted Average
	27,860		71.82% Pervious Area
	10,933		28.18% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.8	50	0.0280	0.18		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.43"
0.0	8	0.0200	2.87		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
1.0	70	0.0294	1.20		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.9	57	0.0221	1.04		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
1.7	330	0.0050	3.21	2.52	**Pipe Channel,** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.013 Corrugated PE, smooth interior
8.4	515	Total			

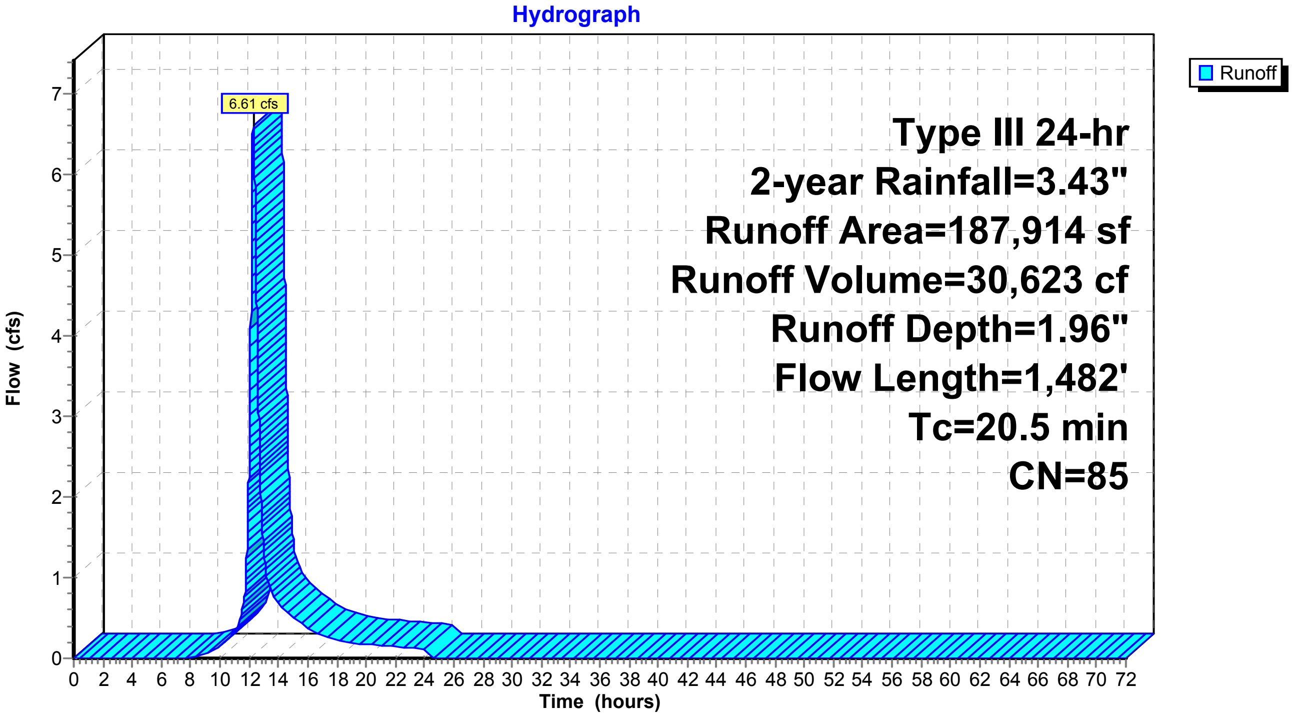
Subcatchment A4: SUB-A4



Summary for Subcatchment B1: SUB-B1

```
[47] Hint: Peak is 262% of capacity of segment #5

Runoff      =         6.61 cfs @   12.28 hrs,  Volume=           30,623 cf,  Depth=  1.96"
    Routed to Pond IB-2 : IB-2

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr  2-year Rainfall=3.43"

      Area (sf)   CN   Description
      76,568   74   >75% Grass cover, Good, HSG C
      23,764   70   Woods, Good, HSG C
*     81,637   98   Impervious Area
*      5,945   98   Infiltration Basin Floor
     187,914   85   Weighted Average
     100,332        53.39% Pervious Area
      87,582        46.61% Impervious Area

    Tc  Length   Slope  Velocity  Capacity  Description
 (min)  (feet)  (ft/ft)  (ft/sec)     (cfs)
   9.6      50  0.0340      0.09            Sheet Flow,
                                            Woods: Light underbrush   n= 0.400   P2= 3.43"
   5.1     319  0.0435      1.04            Shallow Concentrated Flow,
                                            Woodland   Kv= 5.0 fps
   0.2      28  0.1535      2.74            Shallow Concentrated Flow,
                                            Short Grass Pasture   Kv= 7.0 fps
   0.5     102  0.0245      3.18            Shallow Concentrated Flow,
                                            Paved   Kv= 20.3 fps
   5.1     983  0.0050      3.21      2.52  Pipe Channel,
                                            12.0"  Round  Area= 0.8 sf  Perim= 3.1'  r= 0.25'
                                            n= 0.013  Corrugated PE, smooth interior
  20.5   1,482  Total
```

Subcatchment B1: SUB-B1



Summary for Subcatchment B2: SUB-B2

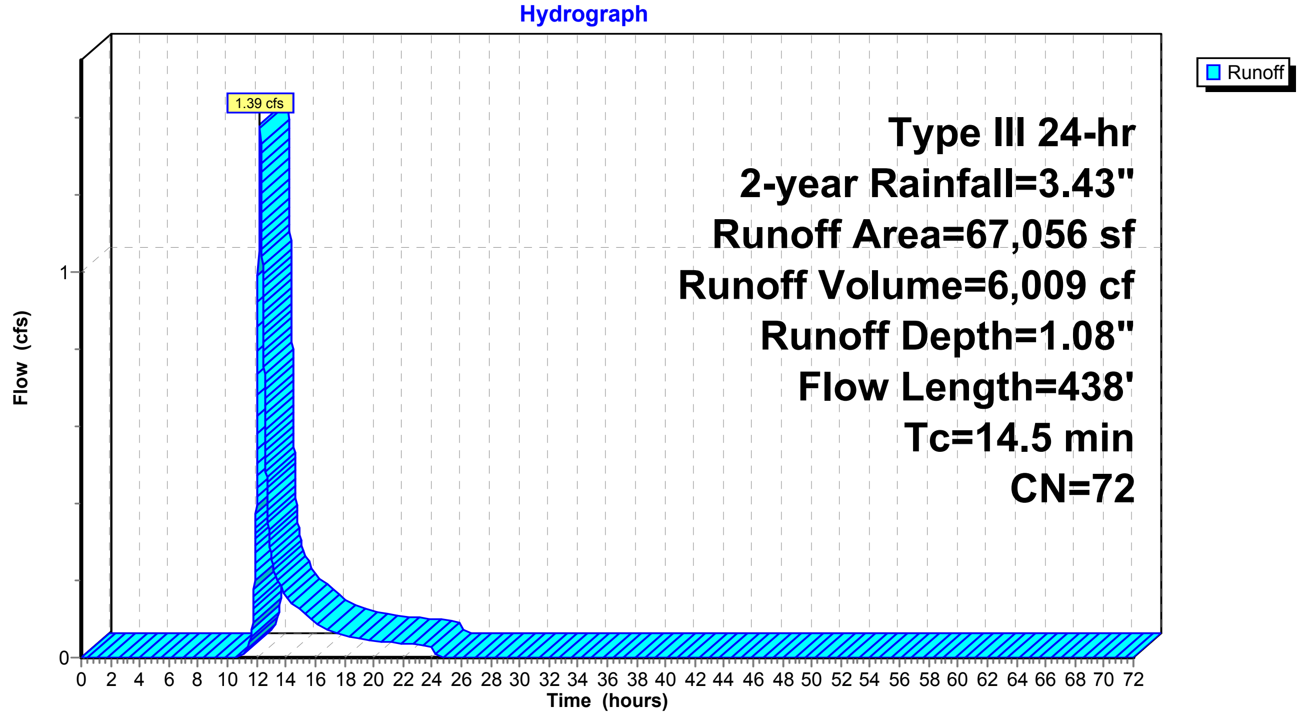
Runoff = 1.39 cfs @ 12.22 hrs, Volume= 6,009 cf, Depth= 1.08"
Routed to Link B : B

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-year Rainfall=3.43"

Area (sf)	CN	Description
29,339	74	>75% Grass cover, Good, HSG C
37,717	70	Woods, Good, HSG C
67,056	72	Weighted Average
67,056		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.3	50	0.0500	0.10		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.43"
6.2	388	0.0438	1.05		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
14.5	438	Total			

Subcatchment B2: SUB-B2



Summary for Subcatchment B3: SUB-B3

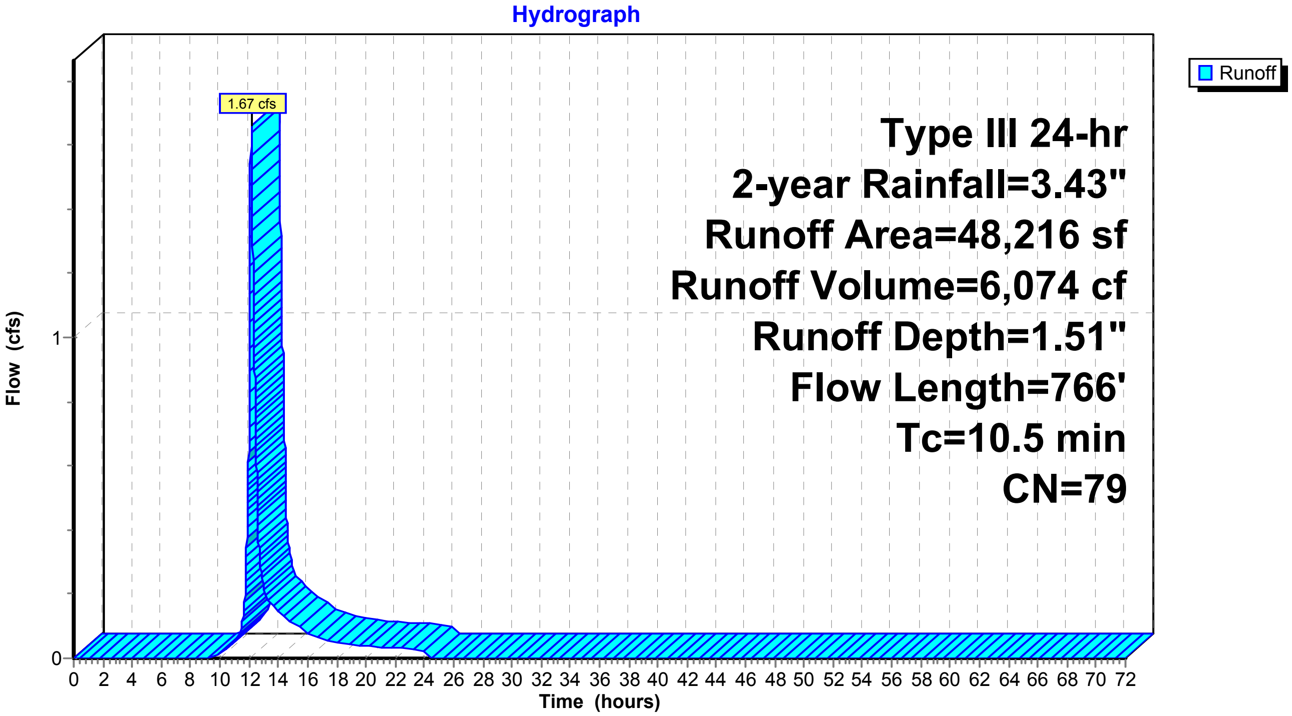
Runoff = 1.67 cfs @ 12.15 hrs, Volume= 6,074 cf, Depth= 1.51"
Routed to Pond IB-2 : IB-2

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-year Rainfall=3.43"

	Area (sf)	CN	Description
	37,519	74	>75% Grass cover, Good, HSG C
*	10,697	98	Impervious Area
	48,216	79	Weighted Average
	37,519		77.81% Pervious Area
	10,697		22.19% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.4	50	0.0200	0.15		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.43"
0.6	40	0.0275	1.16		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.0	7	0.0200	2.87		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
1.5	89	0.0202	0.99		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
3.0	580	0.0050	3.21	2.52	**Pipe Channel,** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.013 Corrugated PE, smooth interior
10.5	766	Total			

Subcatchment B3: SUB-B3



Summary for Subcatchment B4: SB-B4

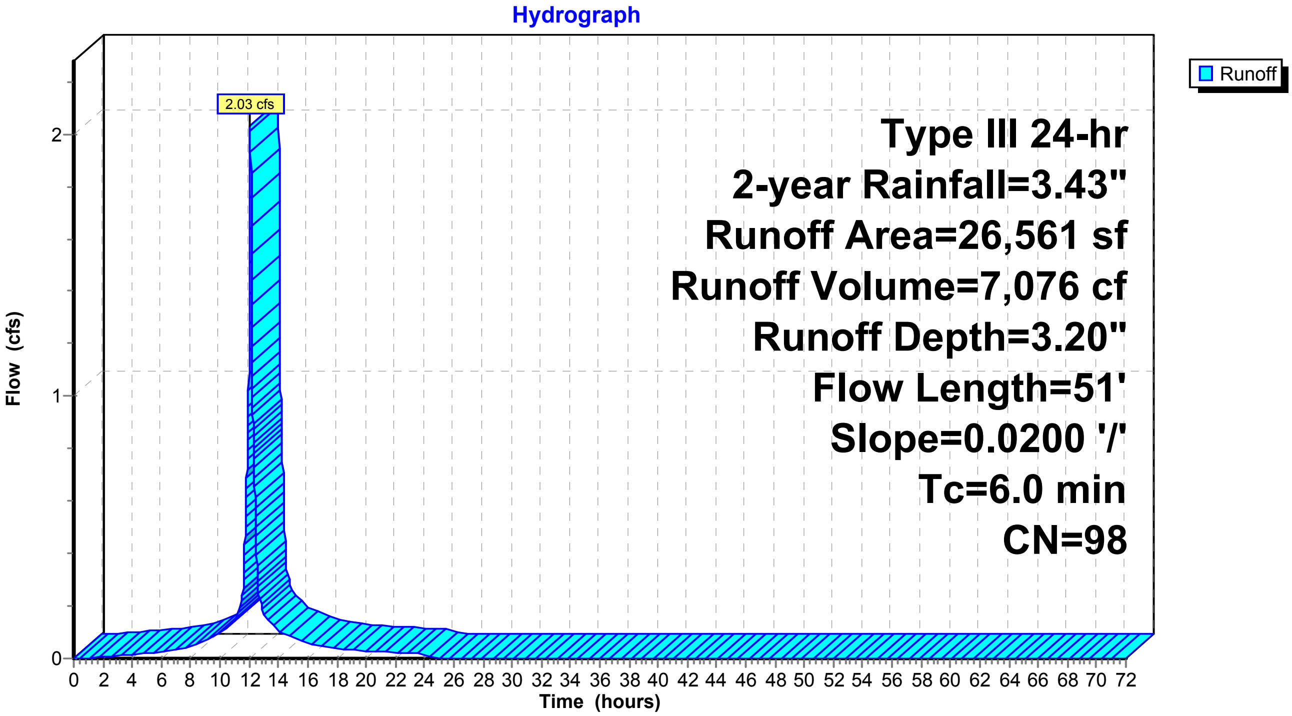
Runoff = 2.03 cfs @ 12.08 hrs, Volume= 7,076 cf, Depth= 3.20"
Routed to Pond IB-2 : IB-2

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-year Rainfall=3.43"

	Area (sf)	CN	Description
*	26,561	98	Impervious Area
	26,561		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.7	50	0.0200	1.24		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.43"
0.0	1	0.0200	2.87		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
0.7	51	Total, Increased to minimum Tc = 6.0 min			

Subcatchment B4: SB-B4



Summary for Pond IB-1: IB-1

```
Inflow Area =         281,580 sf,  37.15% Impervious,  Inflow Depth =   1.80"    for  2-year event
Inflow      =       10.07 cfs @  12.14 hrs,  Volume=          42,289 cf
Outflow     =        4.04 cfs @  12.52 hrs,  Volume=          42,289 cf,  Atten= 60%,  Lag= 22.7 min
Discarded   =        0.29 cfs @  12.52 hrs,  Volume=          22,701 cf
Primary     =        3.75 cfs @  12.52 hrs,  Volume=          19,588 cf
    Routed to Pond IB-2 : IB-2
Secondary =          0.00 cfs @   0.00 hrs,  Volume=               0 cf
    Routed to Pond IB-2 : IB-2
```

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 245.73' @ 12.52 hrs Surf.Area= 12,248 sf Storage= 15,609 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 245.7 min (1,066.7 - 821.1)

Volume	Invert	Avail.Storage	Storage Description
#1	244.00'	44,476 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)
244.00	3,703	0	0	3,703
245.00	11,077	7,062	7,062	11,083
246.00	12,689	11,874	18,935	12,740
247.00	14,351	13,511	32,447	14,453
247.80	15,732	12,029	44,476	15,877

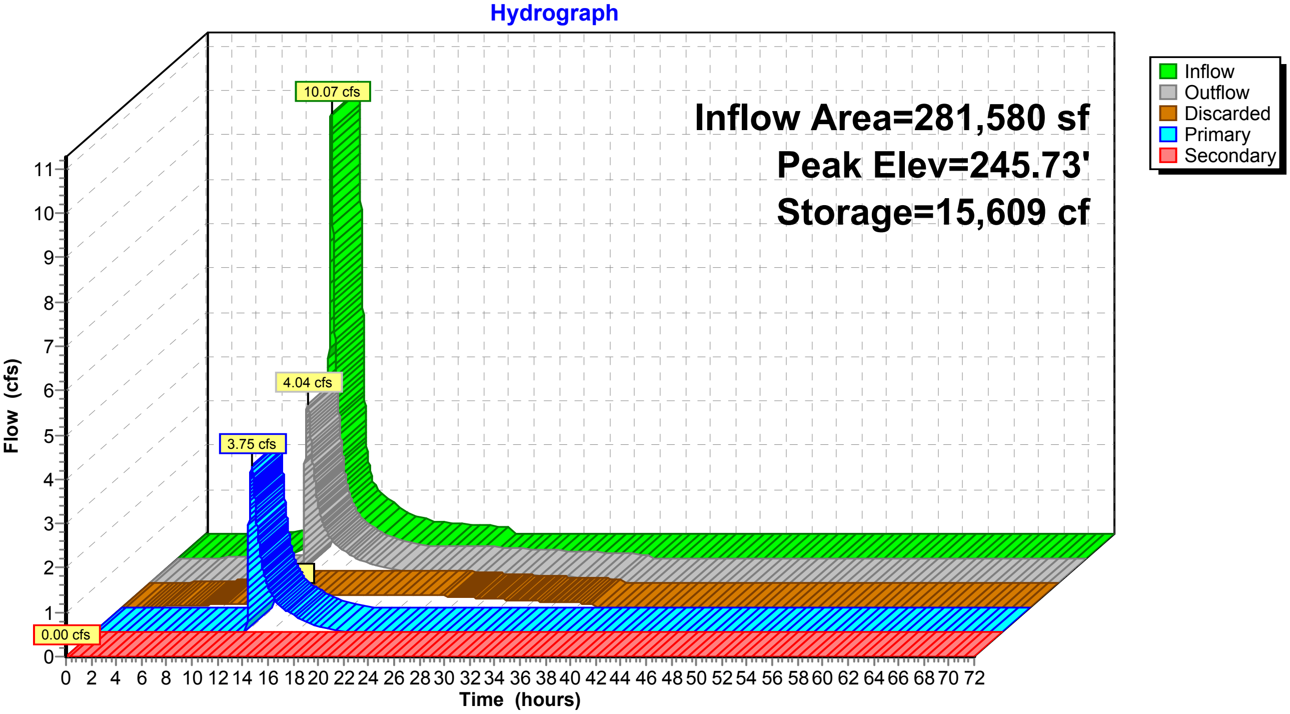
Device	Routing	Invert	Outlet Devices
#1	Secondary	246.80'	**10.0' long x 6.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.37 2.51 2.70 2.68 2.68 2.67 2.65 2.65 2.65 2.65 2.66 2.66 2.67 2.69 2.72 2.76 2.83
#2	Discarded	244.00'	**1.020 in/hr Exfiltration over Wetted area**
#3	Device 4	246.20'	**48.0" x 48.0" Horiz. Orifice/Grate (OCS-1)** C= 0.600 Limited to weir flow at low heads
#4	Primary	241.38'	**24.0" Round Culvert (OCS-1)** L= 70.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 241.38' / 241.00' S= 0.0054 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 3.14 sf
#5	Device 4	245.20'	**36.0" W x 12.0" H Vert. Orifice/Grate (OCS-1)** C= 0.600 Limited to weir flow at low heads

Discarded OutFlow Max=0.29 cfs @ 12.52 hrs HW=245.73' (Free Discharge)
└─**2=Exfiltration** (Exfiltration Controls 0.29 cfs)

Primary OutFlow Max=3.75 cfs @ 12.52 hrs HW=245.73' TW=241.87' (Dynamic Tailwater)
└─**4=Culvert (OCS-1)** (Passes 3.75 cfs of 27.06 cfs potential flow)
  ├─**3=Orifice/Grate (OCS-1)** (Controls 0.00 cfs)
  └─**5=Orifice/Grate (OCS-1)** (Orifice Controls 3.75 cfs @ 2.34 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=244.00' TW=240.00' (Dynamic Tailwater)
└─**1=Broad-Crested Rectangular Weir**(Controls 0.00 cfs)

Pond IB-1: IB-1



Summary for Pond IB-2: IB-2

Inflow Area = 544,271 sf, 42.16% Impervious, Inflow Depth = 1.40" for 2-year event
Inflow = 11.05 cfs @ 12.32 hrs, Volume= 63,361 cf
Outflow = 3.32 cfs @ 13.14 hrs, Volume= 63,363 cf, Atten= 70%, Lag= 49.3 min
Discarded = 0.41 cfs @ 13.14 hrs, Volume= 39,017 cf
Primary = 2.34 cfs @ 13.14 hrs, Volume= 16,865 cf
Routed to Link B : B
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf
Routed to Link B : B
Tertiary = 0.57 cfs @ 13.14 hrs, Volume= 7,481 cf
Routed to Link A : A

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 242.32' @ 13.14 hrs Surf.Area= 17,433 sf Storage= 29,175 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 431.6 min (1,255.8 - 824.2)

Volume	Invert	Avail.Storage	Storage Description
#1	240.00'	103,342 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)
240.00	5,945	0	0	5,945
241.00	12,658	9,093	9,093	12,666
242.00	16,770	14,666	23,758	16,801
243.00	18,908	17,828	41,587	18,990
244.00	21,137	20,012	61,599	21,275
245.00	23,418	22,268	83,867	23,617
245.80	25,283	19,476	103,342	25,533

Device	Routing	Invert	Outlet Devices
#1	Secondary	244.80'	**10.0' long x 6.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.37 2.51 2.70 2.68 2.68 2.67 2.65 2.65 2.65 2.65 2.66 2.66 2.67 2.69 2.72 2.76 2.83
#2	Discarded	240.00'	**1.020 in/hr Exfiltration over Wetted area**
#3	Device 5	242.00'	**4.0' long x 1.50' rise Sharp-Crested Vee/Trap Weir** Cv= 2.62 (C= 3.28)
#4	Device 5	243.50'	**48.0" x 48.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#5	Primary	241.28'	**24.0" Round Culvert** L= 30.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 241.28' / 241.13' S= 0.0050 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 3.14 sf
#6	Device 8	244.30'	**24.0" x 24.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#7	Device 8	241.60'	**Custom Weir/Orifice, Cv= 2.62 (C= 3.28)** Head (feet) 0.00 1.50

			Width (feet) 0.00 1.50
#8	Tertiary	238.25'	**12.0" Round Culvert** L= 50.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 238.25' / 238.00' S= 0.0050 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

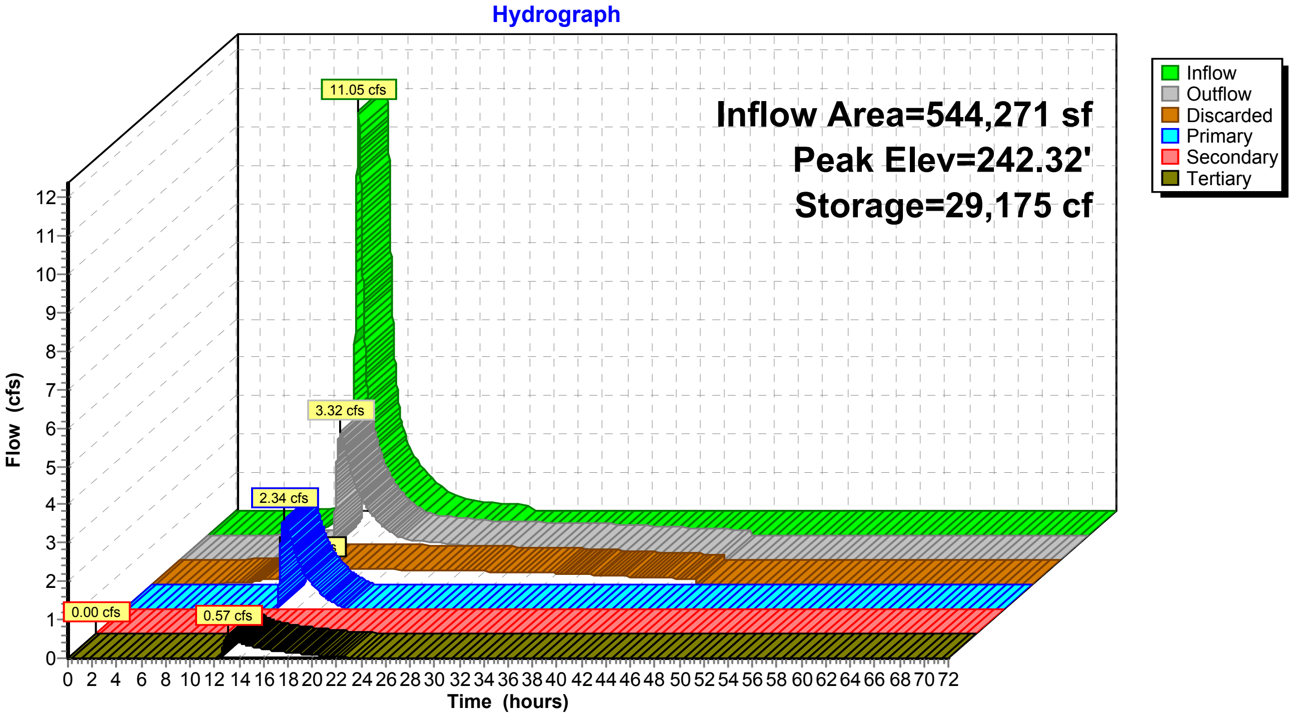
Discarded OutFlow Max=0.41 cfs @ 13.14 hrs HW=242.32' (Free Discharge)
└─**2=Exfiltration** (Exfiltration Controls 0.41 cfs)

Primary OutFlow Max=2.34 cfs @ 13.14 hrs HW=242.32' TW=0.00' (Dynamic Tailwater)
└─**5=Culvert** (Passes 2.34 cfs of 4.13 cfs potential flow)
  ├─**3=Sharp-Crested Vee/Trap Weir** (Weir Controls 2.34 cfs @ 1.84 fps)
  └─**4=Orifice/Grate** (Controls 0.00 cfs)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=240.00' TW=0.00' (Dynamic Tailwater)
└─**1=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Tertiary OutFlow Max=0.57 cfs @ 13.14 hrs HW=242.32' TW=0.00' (Dynamic Tailwater)
└─**8=Culvert** (Passes 0.57 cfs of 6.55 cfs potential flow)
  ├─**6=Orifice/Grate** (Controls 0.00 cfs)
  └─**7=Custom Weir/Orifice** (Weir Controls 0.57 cfs @ 2.22 fps)

Pond IB-2: IB-2

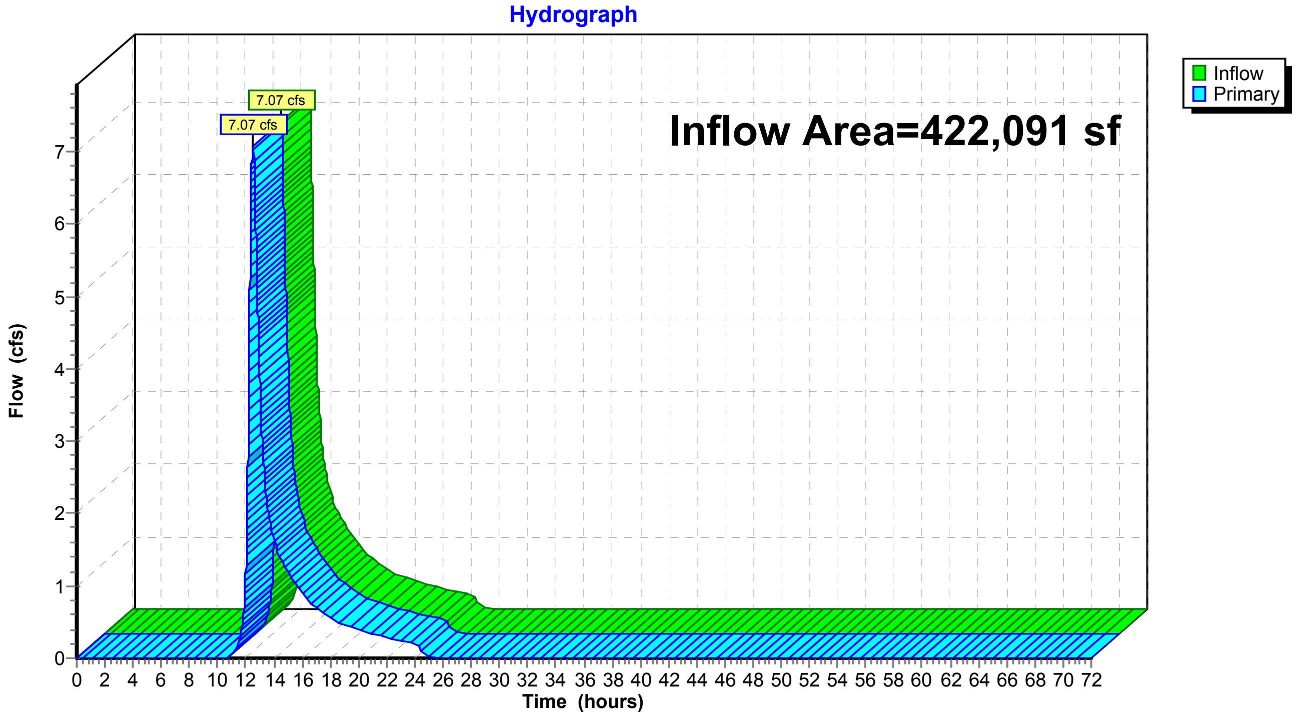


Summary for Link A: A

Inflow Area = 422,091 sf, 5.83% Impervious, Inflow Depth = 1.40" for 2-year event
Inflow = 7.07 cfs @ 12.50 hrs, Volume= 49,404 cf
Primary = 7.07 cfs @ 12.50 hrs, Volume= 49,404 cf, Atten= 0%, Lag= 0.0 min

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

Link A: A

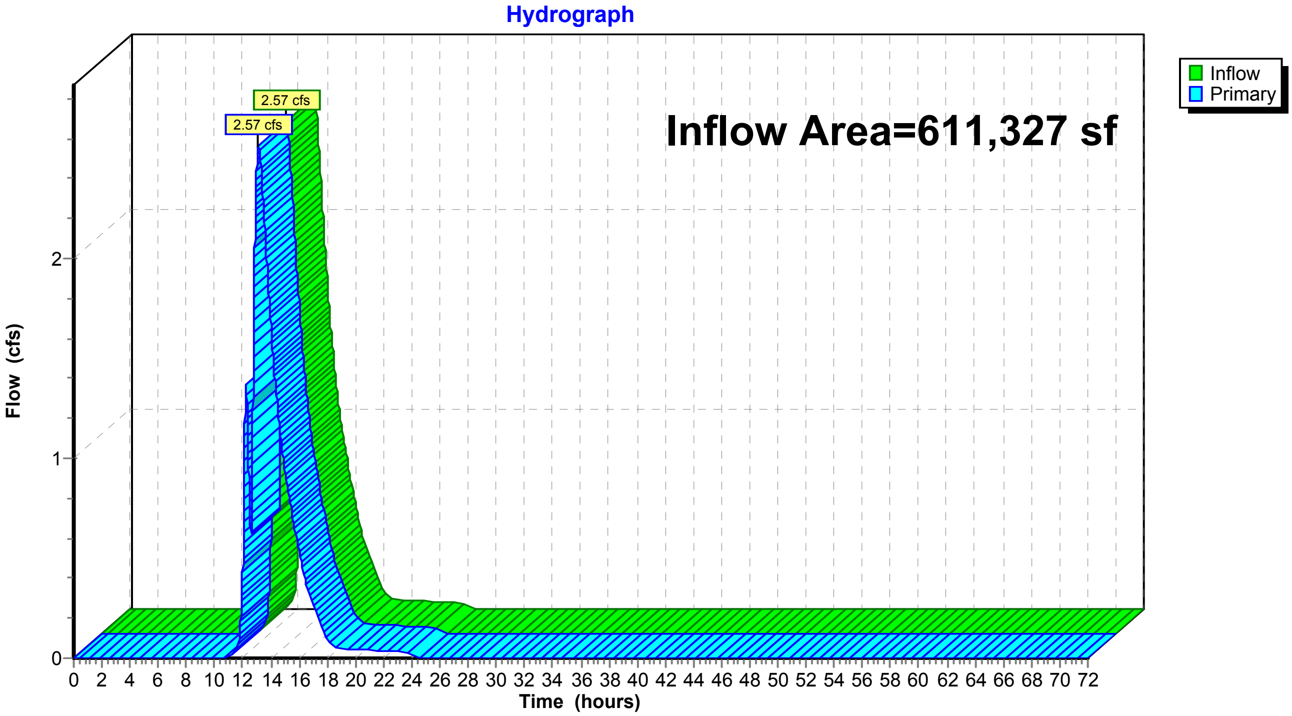


Summary for Link B: B

Inflow Area =	611,327 sf,	37.53% Impervious,	Inflow Depth = 0.45"	for 2-year event
Inflow =	2.57 cfs @	13.12 hrs, Volume=	22,874 cf	
Primary =	2.57 cfs @	13.12 hrs, Volume=	22,874 cf,	Atten= 0%, Lag= 0.0 min

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

Link B: B



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

SubcatchmentA1: SUB-A1 Runoff Area=422,091 sf 5.83% Impervious Runoff Depth=2.56"
Flow Length=1,620' Tc=32.8 min CN=74 Runoff=15.67 cfs 89,946 cf

SubcatchmentA2: SUB-A2 Runoff Area=197,483 sf 24.49% Impervious Runoff Depth=3.01"
Flow Length=1,333' Tc=13.6 min CN=79 Runoff=12.57 cfs 49,525 cf

SubcatchmentA3: SUB-A3 Runoff Area=45,304 sf 100.00% Impervious Runoff Depth=5.00"
Flow Length=51' Slope=0.0200 '/' Tc=6.0 min CN=98 Runoff=5.33 cfs 18,887 cf

SubcatchmentA4: SUB-A4 Runoff Area=38,793 sf 28.18% Impervious Runoff Depth=3.20"
Flow Length=515' Tc=8.4 min CN=81 Runoff=3.07 cfs 10,339 cf

SubcatchmentB1: SUB-B1 Runoff Area=187,914 sf 46.61% Impervious Runoff Depth=3.59"
Flow Length=1,482' Tc=20.5 min CN=85 Runoff=12.03 cfs 56,226 cf

SubcatchmentB2: SUB-B2 Runoff Area=67,056 sf 0.00% Impervious Runoff Depth=2.38"
Flow Length=438' Tc=14.5 min CN=72 Runoff=3.27 cfs 13,323 cf

SubcatchmentB3: SUB-B3 Runoff Area=48,216 sf 22.19% Impervious Runoff Depth=3.01"
Flow Length=766' Tc=10.5 min CN=79 Runoff=3.36 cfs 12,092 cf

SubcatchmentB4: SB-B4 Runoff Area=26,561 sf 100.00% Impervious Runoff Depth=5.00"
Flow Length=51' Slope=0.0200 '/' Tc=6.0 min CN=98 Runoff=3.13 cfs 11,073 cf

Pond IB-1: IB-1 Peak Elev=246.30' Storage=22,867 cf Inflow=19.03 cfs 78,751 cf
Discarded=0.31 cfs 25,368 cf Primary=12.60 cfs 53,384 cf Secondary=0.00 cfs 0 cf Outflow=12.91 cfs 78,752 cf

Pond IB-2: IB-2 Peak Elev=243.16' Storage=44,567 cf Inflow=27.88 cfs 132,775 cf
4,046 cf Primary=11.12 cfs 66,508 cf Secondary=0.00 cfs 0 cf Tertiary=3.89 cfs 22,222 cf Outflow=15.47 cfs 132,776 cf

Link A: A Inflow=19.21 cfs 112,168 cf
Primary=19.21 cfs 112,168 cf

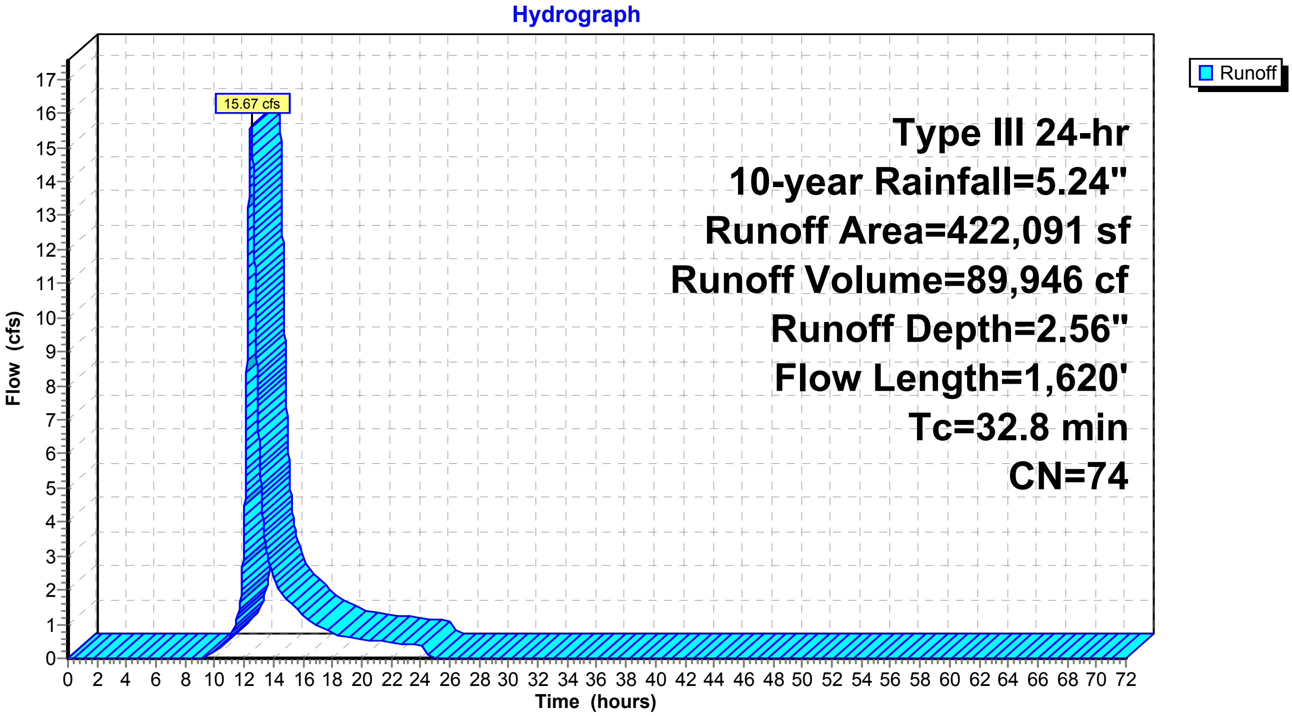
Link B: B Inflow=12.42 cfs 79,832 cf
Primary=12.42 cfs 79,832 cf

Total Runoff Area = 1,033,418 sf Runoff Volume = 261,411 cf Average Runoff Depth = 3.04"
75.42% Pervious = 779,369 sf 24.58% Impervious = 254,049 sf

Summary for Subcatchment A1: SUB-A1

```
Runoff      =       15.67 cfs @   12.46 hrs,  Volume=           89,946 cf,  Depth=  2.56"
    Routed to Link A : A

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr  10-year Rainfall=5.24"

       Area (sf)   CN   Description
 ---------------------------------------------------------------------
         127,217   74   >75% Grass cover, Good, HSG C
         211,698   70   Woods, Good, HSG C
*         24,606   98   Impervious Area
             716   96   Gravel surface, HSG C
          57,854   77   Woods, Good, HSG D
 ---------------------------------------------------------------------
         422,091   74   Weighted Average
         397,485        94.17% Pervious Area
          24,606        5.83% Impervious Area

    Tc  Length    Slope  Velocity  Capacity  Description
 (min)  (feet)  (ft/ft)  (ft/sec)     (cfs)
 ---------------------------------------------------------------------
  11.9      50   0.0200      0.07            Sheet Flow, Sheet
                                             Woods: Light underbrush   n= 0.400   P2= 3.43"
  19.4   1,010   0.0300      0.87            Shallow Concentrated Flow, Shallow
                                             Woodland   Kv= 5.0 fps
   1.5     560   0.0200      6.38     76.61  Trap/Vee/Rect Channel Flow,
                                             Bot.W=2.00'  D=2.00'  Z= 2.0 '/'  Top.W=10.00'
                                             n= 0.035  Earth, dense weeds
 ---------------------------------------------------------------------
  32.8   1,620   Total
```

Subcatchment A1: SUB-A1



Summary for Subcatchment A2: SUB-A2

[47] Hint: Peak is 499% of capacity of segment #6

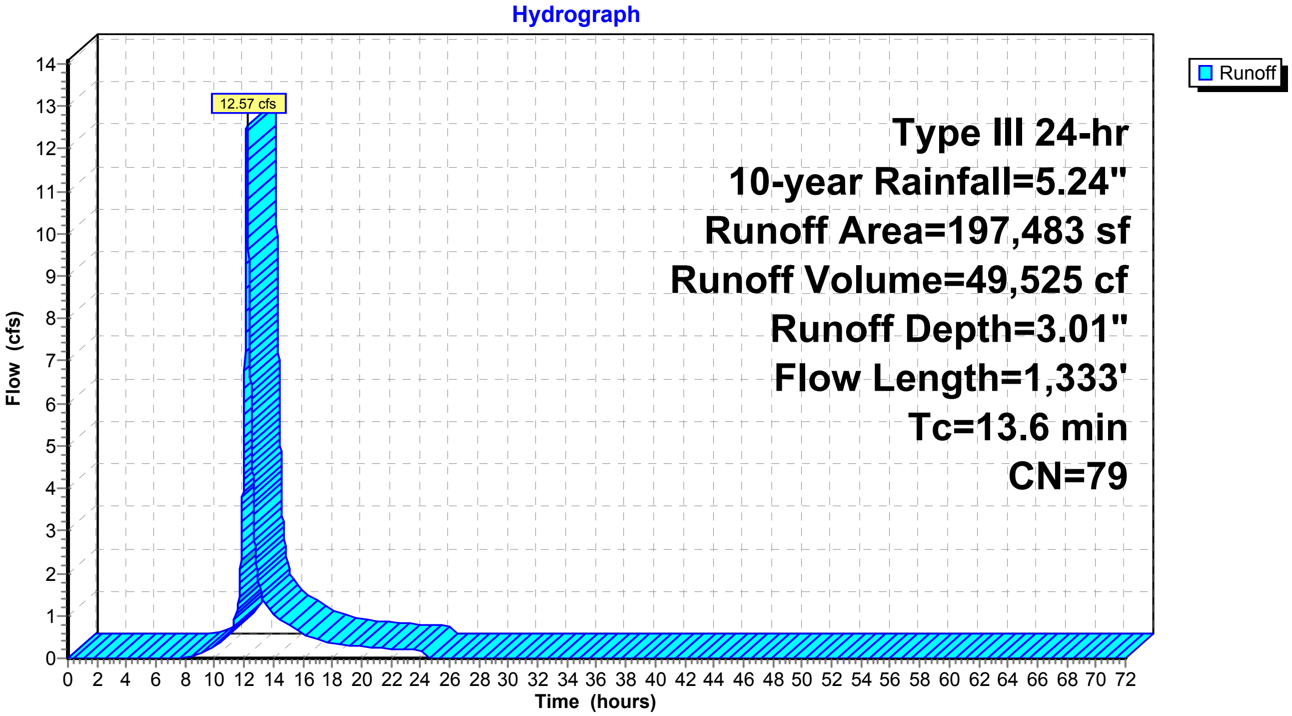
Runoff = 12.57 cfs @ 12.19 hrs, Volume= 49,525 cf, Depth= 3.01"
Routed to Pond IB-1 : IB-1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-year Rainfall=5.24"

	Area (sf)	CN	Description
	83,784	74	>75% Grass cover, Good, HSG C
	52,545	70	Woods, Good, HSG C
*	44,663	98	Impervious Area
	1,148	96	Gravel surface, HSG C
*	3,703	98	Infiltration Basin Floor
	11,640	77	Woods, Good, HSG D
	197,483	79	Weighted Average
	149,117		75.51% Pervious Area
	48,366		24.49% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.6	50	0.0300	0.18		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.43"
2.9	208	0.0300	1.21		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.9	77	0.0900	1.50		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
0.1	22	0.2500	3.50		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.8	141	0.0200	2.87		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
4.3	835	0.0050	3.21	2.52	**Pipe Channel,** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.013 Corrugated PE, smooth interior
13.6	1,333	Total			

Subcatchment A2: SUB-A2



Summary for Subcatchment A3: SUB-A3

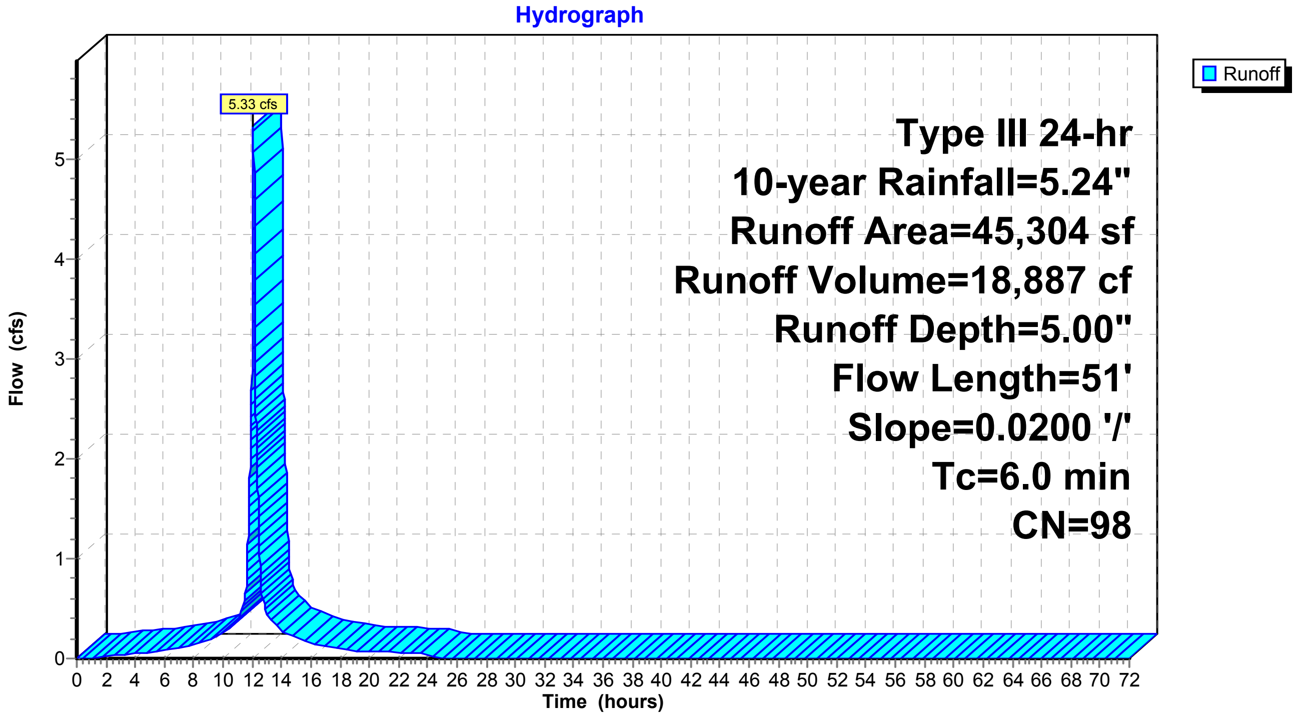
Runoff = 5.33 cfs @ 12.08 hrs, Volume= 18,887 cf, Depth= 5.00"
Routed to Pond IB-1 : IB-1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-year Rainfall=5.24"

	Area (sf)	CN	Description
*	45,304	98	Impervious Area
	45,304		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.7	50	0.0200	1.24		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.43"
0.0	1	0.0200	2.87		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
0.7	51	Total, Increased to minimum Tc = 6.0 min			

Subcatchment A3: SUB-A3



Summary for Subcatchment A4: SUB-A4

[47] Hint: Peak is 122% of capacity of segment #5

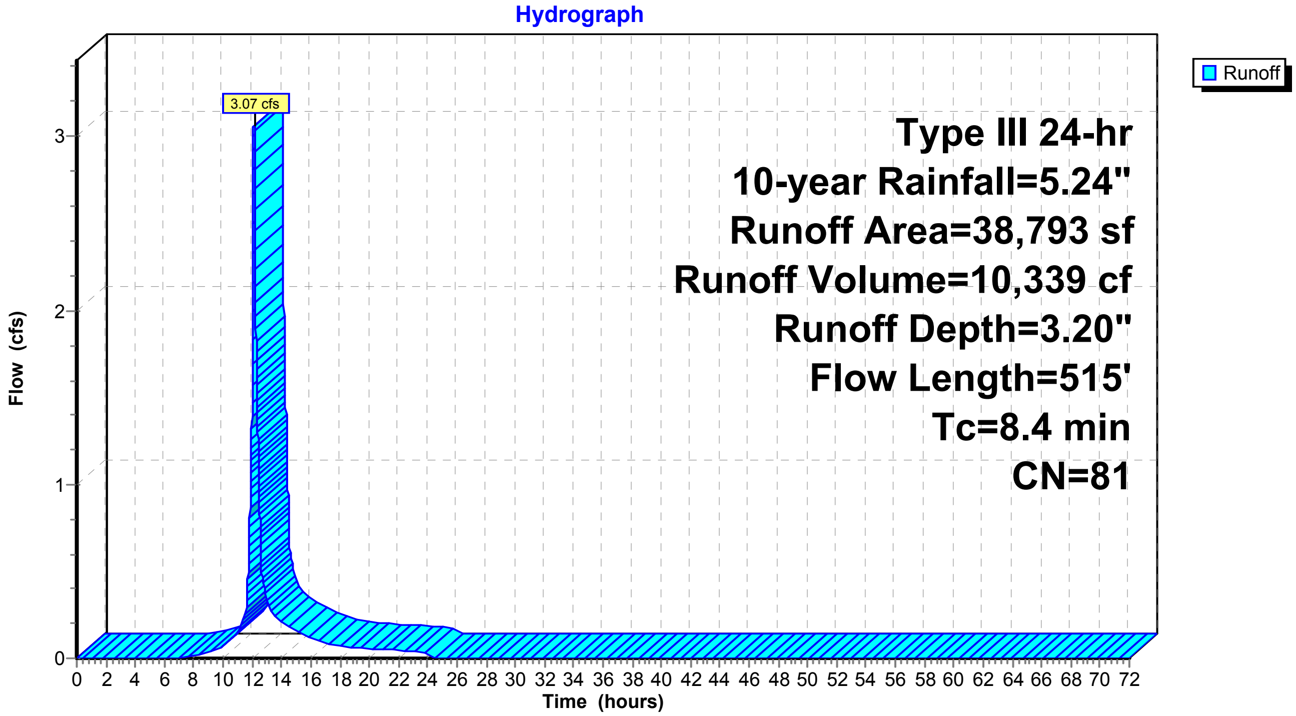
Runoff = 3.07 cfs @ 12.12 hrs, Volume= 10,339 cf, Depth= 3.20"
Routed to Pond IB-1 : IB-1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-year Rainfall=5.24"

	Area (sf)	CN	Description
	27,860	74	>75% Grass cover, Good, HSG C
*	10,933	98	Impervious Area
	38,793	81	Weighted Average
	27,860		71.82% Pervious Area
	10,933		28.18% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.8	50	0.0280	0.18		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.43"
0.0	8	0.0200	2.87		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
1.0	70	0.0294	1.20		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.9	57	0.0221	1.04		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
1.7	330	0.0050	3.21	2.52	**Pipe Channel,** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.013 Corrugated PE, smooth interior
8.4	515	Total			

Subcatchment A4: SUB-A4



Summary for Subcatchment B1: SUB-B1

[47] Hint: Peak is 478% of capacity of segment #5

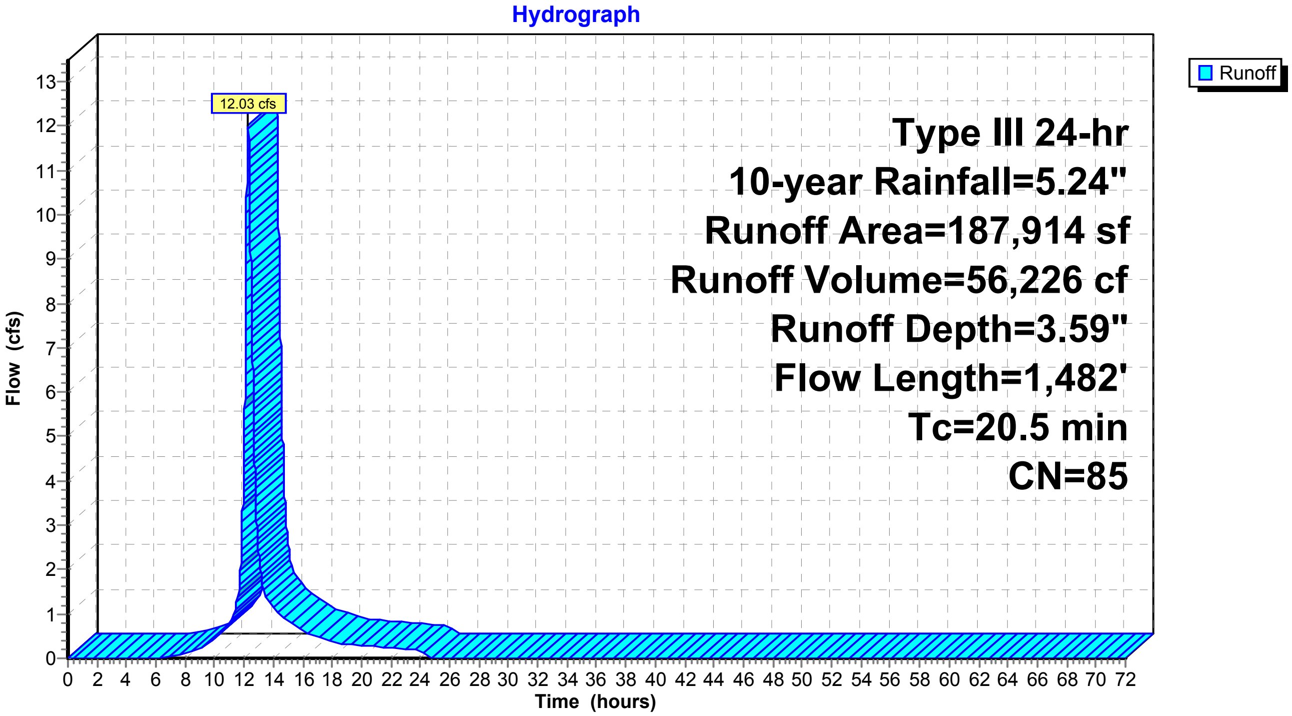
Runoff = 12.03 cfs @ 12.28 hrs, Volume= 56,226 cf, Depth= 3.59"
Routed to Pond IB-2 : IB-2

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-year Rainfall=5.24"

	Area (sf)	CN	Description
	76,568	74	>75% Grass cover, Good, HSG C
	23,764	70	Woods, Good, HSG C
*	81,637	98	Impervious Area
*	5,945	98	Infiltration Basin Floor
	187,914	85	Weighted Average
	100,332		53.39% Pervious Area
	87,582		46.61% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.6	50	0.0340	0.09		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.43"
5.1	319	0.0435	1.04		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
0.2	28	0.1535	2.74		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.5	102	0.0245	3.18		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
5.1	983	0.0050	3.21	2.52	**Pipe Channel,** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.013 Corrugated PE, smooth interior
20.5	1,482	Total			

Subcatchment B1: SUB-B1



Summary for Subcatchment B2: SUB-B2

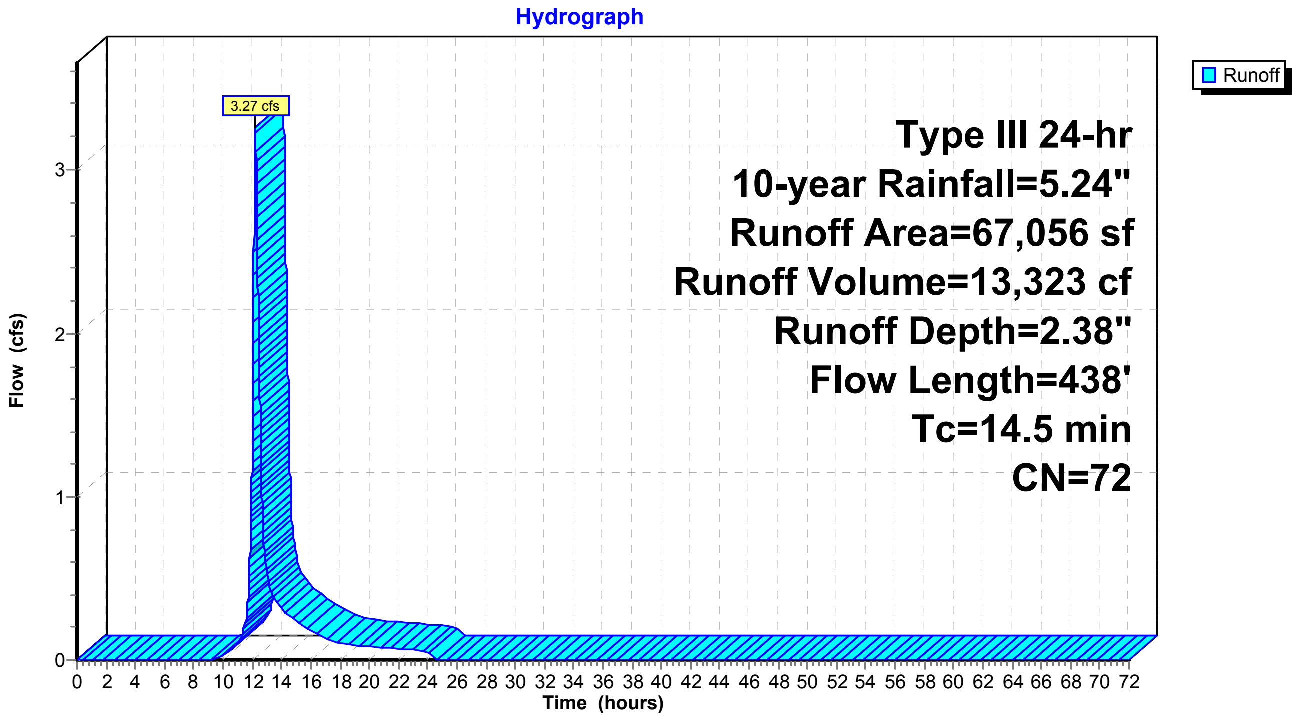
Runoff = 3.27 cfs @ 12.20 hrs, Volume= 13,323 cf, Depth= 2.38"
Routed to Link B : B

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-year Rainfall=5.24"

Area (sf)	CN	Description
29,339	74	>75% Grass cover, Good, HSG C
37,717	70	Woods, Good, HSG C
67,056	72	Weighted Average
67,056		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.3	50	0.0500	0.10		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.43"
6.2	388	0.0438	1.05		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
14.5	438	Total			

Subcatchment B2: SUB-B2



Summary for Subcatchment B3: SUB-B3

[47] Hint: Peak is 133% of capacity of segment #5

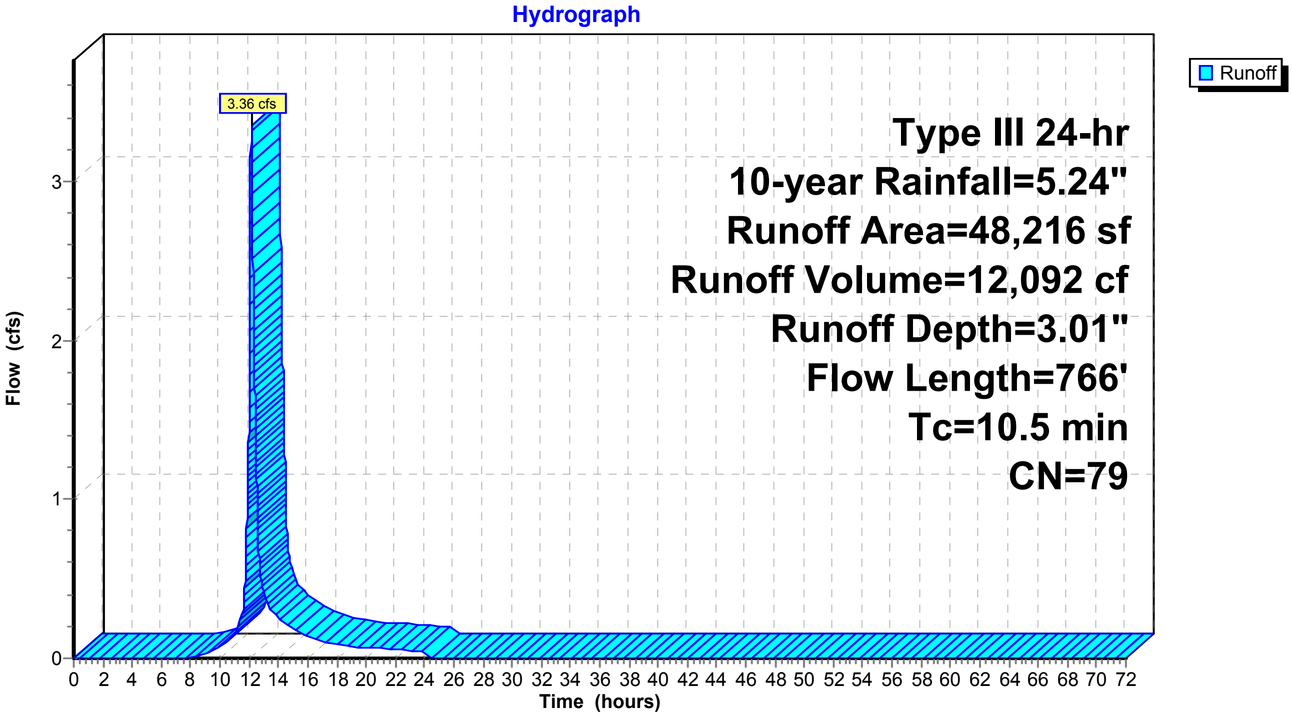
Runoff = 3.36 cfs @ 12.15 hrs, Volume= 12,092 cf, Depth= 3.01"
Routed to Pond IB-2 : IB-2

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-year Rainfall=5.24"

	Area (sf)	CN	Description
	37,519	74	>75% Grass cover, Good, HSG C
*	10,697	98	Impervious Area
	48,216	79	Weighted Average
	37,519		77.81% Pervious Area
	10,697		22.19% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.4	50	0.0200	0.15		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.43"
0.6	40	0.0275	1.16		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.0	7	0.0200	2.87		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
1.5	89	0.0202	0.99		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
3.0	580	0.0050	3.21	2.52	**Pipe Channel,** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.013 Corrugated PE, smooth interior
10.5	766	Total			

Subcatchment B3: SUB-B3



Summary for Subcatchment B4: SB-B4

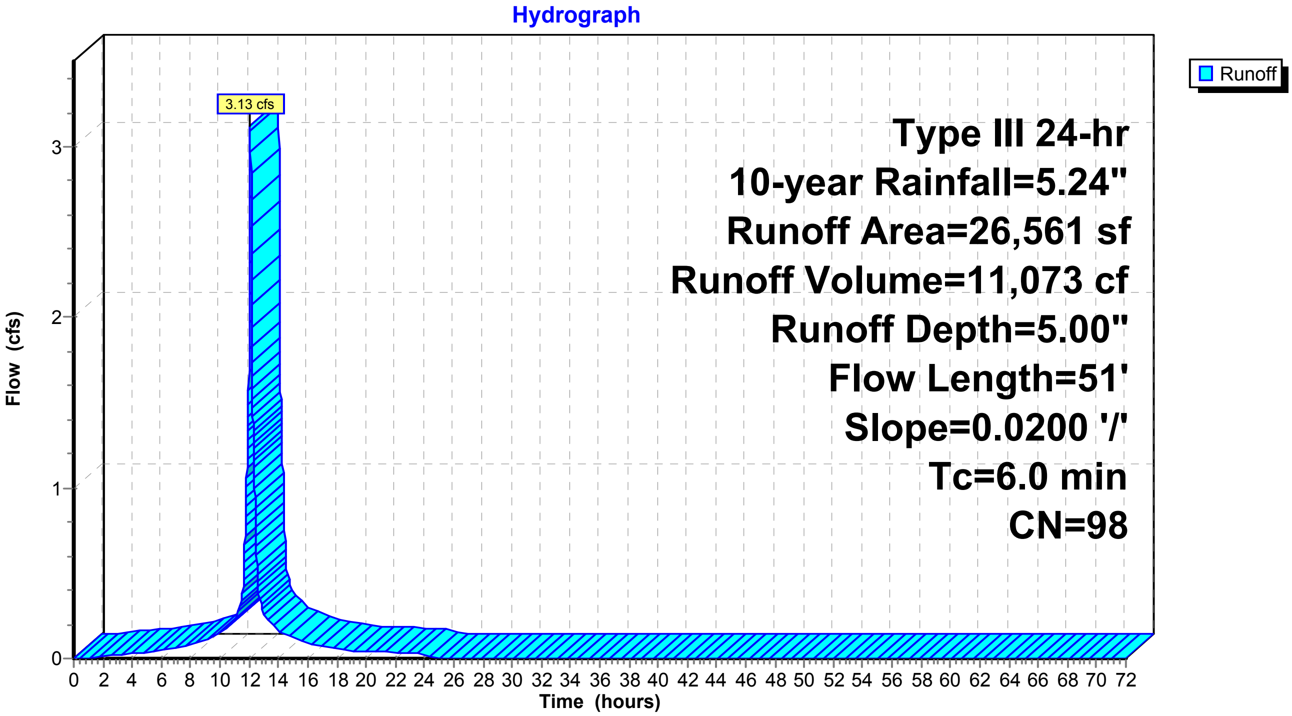
Runoff = 3.13 cfs @ 12.08 hrs, Volume= 11,073 cf, Depth= 5.00"
Routed to Pond IB-2 : IB-2

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-year Rainfall=5.24"

	Area (sf)	CN	Description
*	26,561	98	Impervious Area
	26,561		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.7	50	0.0200	1.24		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.43"
0.0	1	0.0200	2.87		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
0.7	51	Total, Increased to minimum Tc = 6.0 min			

Subcatchment B4: SB-B4



Summary for Pond IB-1: IB-1

Inflow Area = 281,580 sf, 37.15% Impervious, Inflow Depth = 3.36" for 10-year event
Inflow = 19.03 cfs @ 12.14 hrs, Volume= 78,751 cf
Outflow = 12.91 cfs @ 12.32 hrs, Volume= 78,752 cf, Atten= 32%, Lag= 10.7 min
Discarded = 0.31 cfs @ 12.32 hrs, Volume= 25,368 cf
Primary = 12.60 cfs @ 12.32 hrs, Volume= 53,384 cf
Routed to Pond IB-2 : IB-2
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf
Routed to Pond IB-2 : IB-2

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 246.30' @ 12.32 hrs Surf.Area= 13,183 sf Storage= 22,867 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 159.0 min (967.4 - 808.4)

Volume	Invert	Avail.Storage	Storage Description
#1	244.00'	44,476 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)
244.00	3,703	0	0	3,703
245.00	11,077	7,062	7,062	11,083
246.00	12,689	11,874	18,935	12,740
247.00	14,351	13,511	32,447	14,453
247.80	15,732	12,029	44,476	15,877

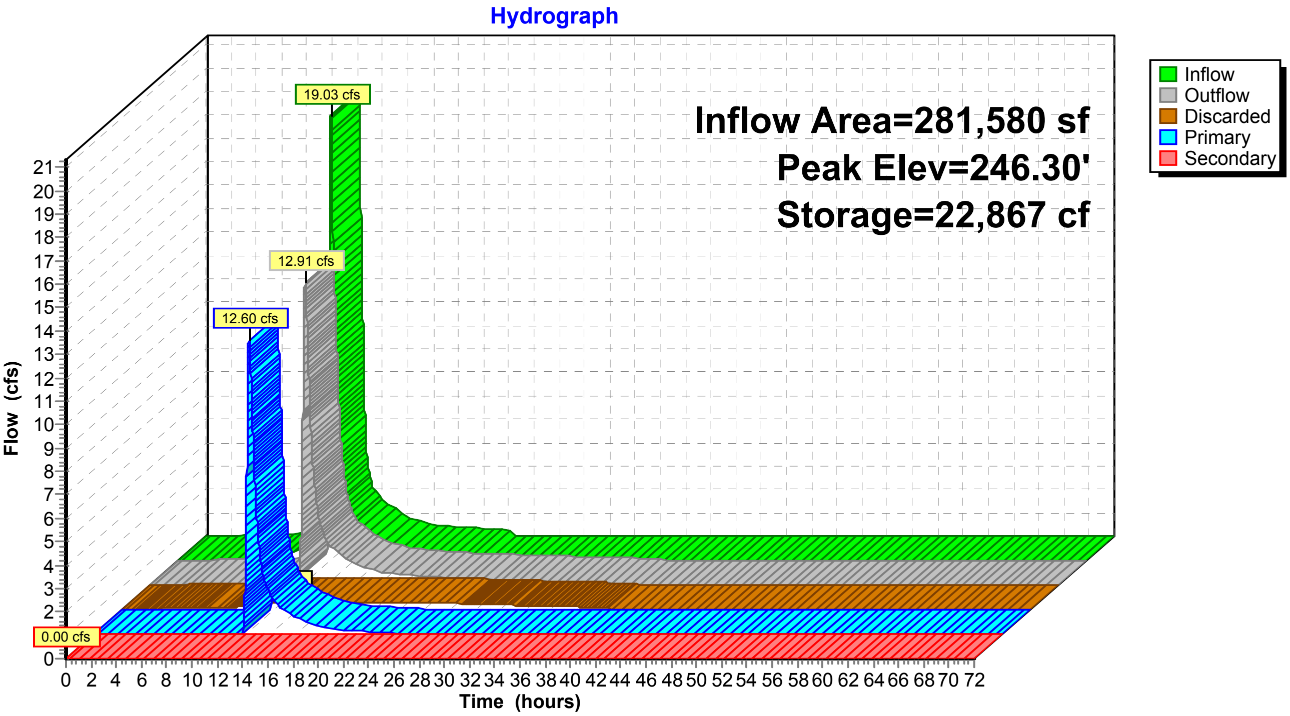
Device	Routing	Invert	Outlet Devices
#1	Secondary	246.80'	**10.0' long x 6.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.37 2.51 2.70 2.68 2.68 2.67 2.65 2.65 2.65 2.65 2.66 2.66 2.67 2.69 2.72 2.76 2.83
#2	Discarded	244.00'	**1.020 in/hr Exfiltration over Wetted area**
#3	Device 4	246.20'	**48.0" x 48.0" Horiz. Orifice/Grate (OCS-1)** C= 0.600 Limited to weir flow at low heads
#4	Primary	241.38'	**24.0" Round Culvert (OCS-1)** L= 70.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 241.38' / 241.00' S= 0.0054 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 3.14 sf
#5	Device 4	245.20'	**36.0" W x 12.0" H Vert. Orifice/Grate (OCS-1)** C= 0.600 Limited to weir flow at low heads

Discarded OutFlow Max=0.31 cfs @ 12.32 hrs HW=246.30' (Free Discharge)
└─**2=Exfiltration** (Exfiltration Controls 0.31 cfs)

Primary OutFlow Max=12.60 cfs @ 12.32 hrs HW=246.30' TW=242.69' (Dynamic Tailwater)
└─**4=Culvert (OCS-1)** (Passes 12.60 cfs of 28.74 cfs potential flow)
  ├─**3=Orifice/Grate (OCS-1)** (Weir Controls 1.75 cfs @ 1.05 fps)
  └─**5=Orifice/Grate (OCS-1)** (Orifice Controls 10.85 cfs @ 3.62 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=244.00' TW=240.00' (Dynamic Tailwater)
└─**1=Broad-Crested Rectangular Weir**(Controls 0.00 cfs)

Pond IB-1: IB-1



Summary for Pond IB-2: IB-2

[95] Warning: Outlet Device #7 rise exceeded

Inflow Area = 544,271 sf, 42.16% Impervious, Inflow Depth = 2.93" for 10-year event
Inflow = 27.88 cfs @ 12.28 hrs, Volume= 132,775 cf
Outflow = 15.47 cfs @ 12.62 hrs, Volume= 132,776 cf, Atten= 45%, Lag= 20.2 min
Discarded = 0.46 cfs @ 12.62 hrs, Volume= 44,046 cf
Primary = 11.12 cfs @ 12.62 hrs, Volume= 66,508 cf
Routed to Link B : B
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf
Routed to Link B : B
Tertiary = 3.89 cfs @ 12.62 hrs, Volume= 22,222 cf
Routed to Link A : A

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 243.16' @ 12.62 hrs Surf.Area= 19,248 sf Storage= 44,567 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 249.3 min (1,065.1 - 815.8)

Volume	Invert	Avail.Storage	Storage Description
#1	240.00'	103,342 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)
240.00	5,945	0	0	5,945
241.00	12,658	9,093	9,093	12,666
242.00	16,770	14,666	23,758	16,801
243.00	18,908	17,828	41,587	18,990
244.00	21,137	20,012	61,599	21,275
245.00	23,418	22,268	83,867	23,617
245.80	25,283	19,476	103,342	25,533

Device	Routing	Invert	Outlet Devices
#1	Secondary	244.80'	**10.0' long x 6.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.37 2.51 2.70 2.68 2.68 2.67 2.65 2.65 2.65 2.65 2.66 2.66 2.67 2.69 2.72 2.76 2.83
#2	Discarded	240.00'	**1.020 in/hr Exfiltration over Wetted area**
#3	Device 5	242.00'	**4.0' long x 1.50' rise Sharp-Crested Vee/Trap Weir** Cv= 2.62 (C= 3.28)
#4	Device 5	243.50'	**48.0" x 48.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#5	Primary	241.28'	**24.0" Round Culvert** L= 30.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 241.28' / 241.13' S= 0.0050 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 3.14 sf
#6	Device 8	244.30'	**24.0" x 24.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

#7	Device 8	241.60'	**Custom Weir/Orifice, Cv= 2.62 (C= 3.28)** Head (feet) 0.00 1.50 Width (feet) 0.00 1.50
#8	Tertiary	238.25'	**12.0" Round Culvert** L= 50.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 238.25' / 238.00' S= 0.0050 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

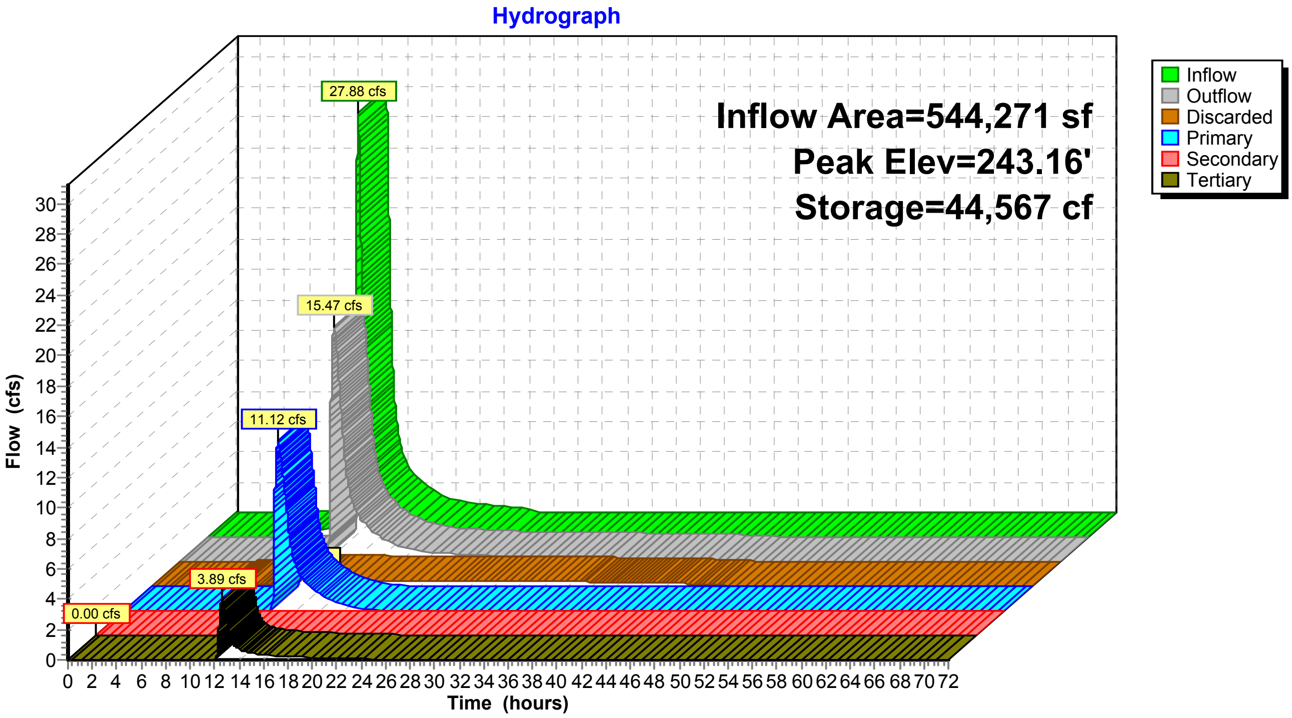
Discarded OutFlow Max=0.46 cfs @ 12.62 hrs HW=243.16' (Free Discharge)
↑—**2=Exfiltration** (Exfiltration Controls 0.46 cfs)

Primary OutFlow Max=11.12 cfs @ 12.62 hrs HW=243.16' TW=0.00' (Dynamic Tailwater)
↑—**5=Culvert** (Barrel Controls 11.12 cfs @ 4.71 fps)
  ↑—**3=Sharp-Crested Vee/Trap Weir** (Passes 11.12 cfs of 16.29 cfs potential flow)
  └—**4=Orifice/Grate** (Controls 0.00 cfs)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=240.00' TW=0.00' (Dynamic Tailwater)
↑—**1=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Tertiary OutFlow Max=3.89 cfs @ 12.62 hrs HW=243.16' TW=0.00' (Dynamic Tailwater)
↑—**8=Culvert** (Passes 3.89 cfs of 7.33 cfs potential flow)
  ↑—**6=Orifice/Grate** (Controls 0.00 cfs)
  └—**7=Custom Weir/Orifice** (Orifice Controls 3.89 cfs @ 3.46 fps)

Pond IB-2: IB-2

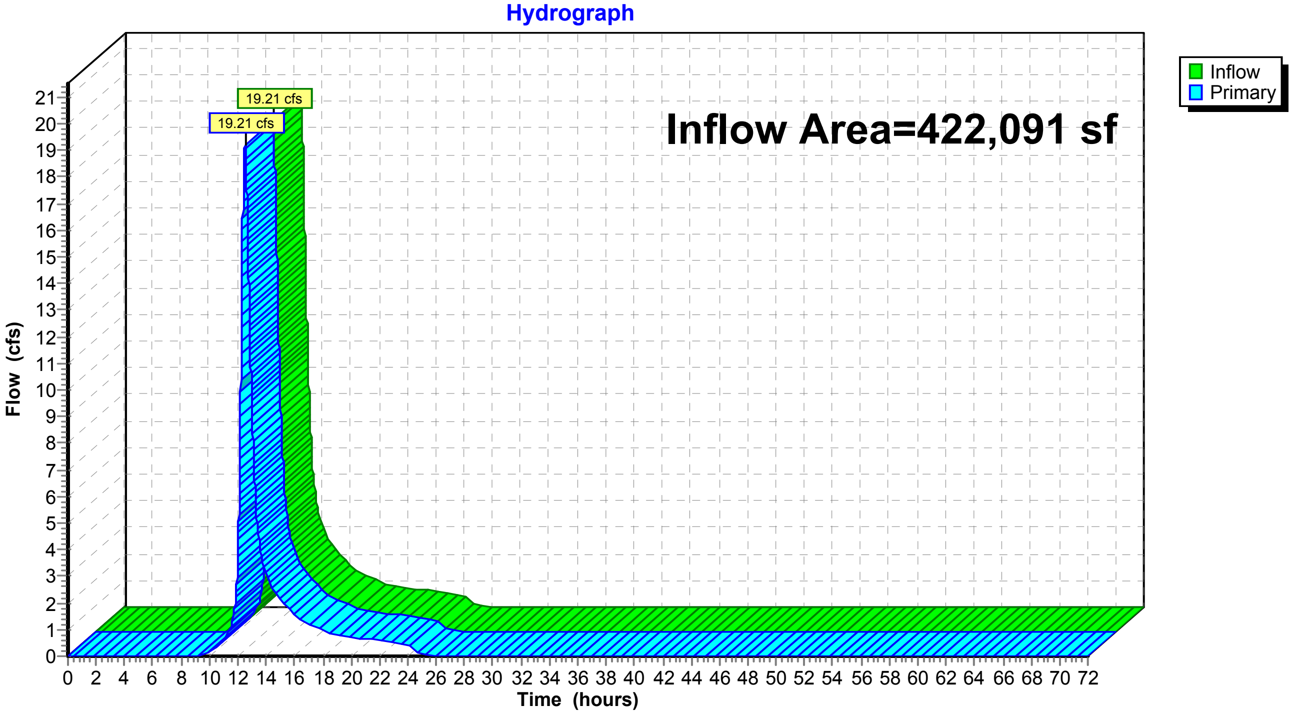


Summary for Link A: A

Inflow Area = 422,091 sf, 5.83% Impervious, Inflow Depth = 3.19" for 10-year event
Inflow = 19.21 cfs @ 12.50 hrs, Volume= 112,168 cf
Primary = 19.21 cfs @ 12.50 hrs, Volume= 112,168 cf, Atten= 0%, Lag= 0.0 min

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

Link A: A

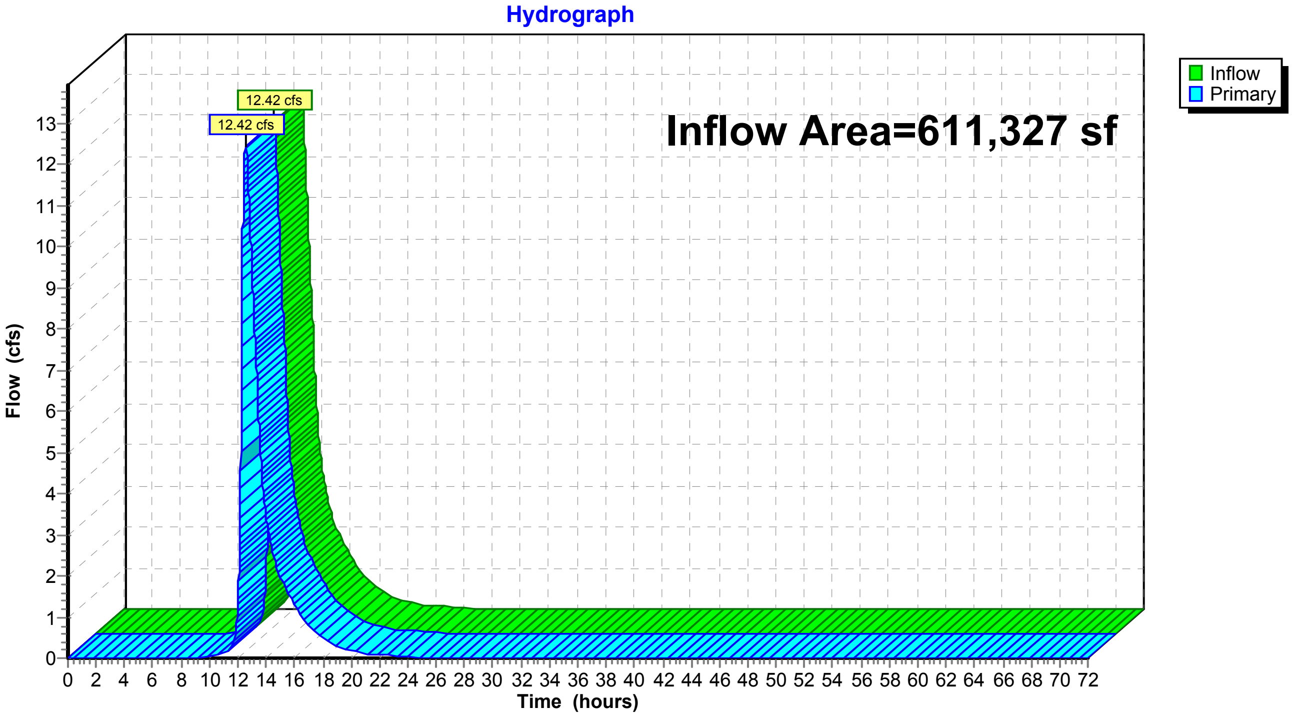


Summary for Link B: B

Inflow Area = 611,327 sf, 37.53% Impervious, Inflow Depth = 1.57" for 10-year event
Inflow = 12.42 cfs @ 12.55 hrs, Volume= 79,832 cf
Primary = 12.42 cfs @ 12.55 hrs, Volume= 79,832 cf, Atten= 0%, Lag= 0.0 min

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

Link B: B



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

SubcatchmentA1: SUB-A1 Runoff Area=422,091 sf 5.83% Impervious Runoff Depth=3.50"
Flow Length=1,620' Tc=32.8 min CN=74 Runoff=21.54 cfs 123,054 cf

SubcatchmentA2: SUB-A2 Runoff Area=197,483 sf 24.49% Impervious Runoff Depth=4.01"
Flow Length=1,333' Tc=13.6 min CN=79 Runoff=16.71 cfs 66,021 cf

SubcatchmentA3: SUB-A3 Runoff Area=45,304 sf 100.00% Impervious Runoff Depth=6.13"
Flow Length=51' Slope=0.0200 '/' Tc=6.0 min CN=98 Runoff=6.50 cfs 23,148 cf

SubcatchmentA4: SUB-A4 Runoff Area=38,793 sf 28.18% Impervious Runoff Depth=4.22"
Flow Length=515' Tc=8.4 min CN=81 Runoff=4.03 cfs 13,650 cf

SubcatchmentB1: SUB-B1 Runoff Area=187,914 sf 46.61% Impervious Runoff Depth=4.65"
Flow Length=1,482' Tc=20.5 min CN=85 Runoff=15.45 cfs 72,857 cf

SubcatchmentB2: SUB-B2 Runoff Area=67,056 sf 0.00% Impervious Runoff Depth=3.30"
Flow Length=438' Tc=14.5 min CN=72 Runoff=4.56 cfs 18,432 cf

SubcatchmentB3: SUB-B3 Runoff Area=48,216 sf 22.19% Impervious Runoff Depth=4.01"
Flow Length=766' Tc=10.5 min CN=79 Runoff=4.46 cfs 16,119 cf

SubcatchmentB4: SB-B4 Runoff Area=26,561 sf 100.00% Impervious Runoff Depth=6.13"
Flow Length=51' Slope=0.0200 '/' Tc=6.0 min CN=98 Runoff=3.81 cfs 13,572 cf

Pond IB-1: IB-1 Peak Elev=246.48' Storage=25,178 cf Inflow=24.85 cfs 102,820 cf
Discarded=0.32 cfs 26,408 cf Primary=20.14 cfs 76,412 cf Secondary=0.00 cfs 0 cf Outflow=20.46 cfs 102,821 cf

Pond IB-2: IB-2 Peak Elev=243.76' Storage=56,578 cf Inflow=40.50 cfs 178,960 cf
6,106 cf Primary=15.96 cfs 98,892 cf Secondary=0.00 cfs 0 cf Tertiary=5.88 cfs 33,963 cf Outflow=22.33 cfs 178,961 cf

Link A: A Inflow=27.30 cfs 157,017 cf
Primary=27.30 cfs 157,017 cf

Link B: B Inflow=18.21 cfs 117,324 cf
Primary=18.21 cfs 117,324 cf

Total Runoff Area = 1,033,418 sf Runoff Volume = 346,853 cf Average Runoff Depth = 4.03"
75.42% Pervious = 779,369 sf 24.58% Impervious = 254,049 sf

Summary for Subcatchment A1: SUB-A1

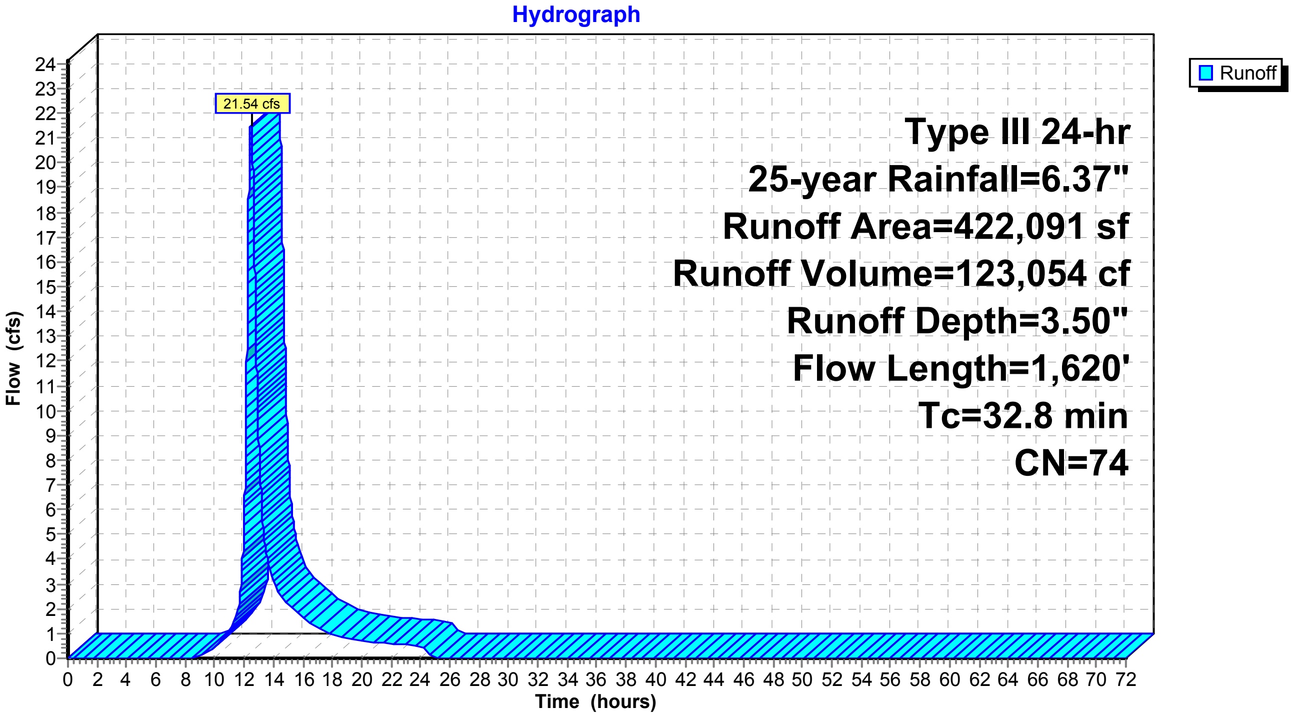
Runoff = 21.54 cfs @ 12.46 hrs, Volume= 123,054 cf, Depth= 3.50"
Routed to Link A : A

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-year Rainfall=6.37"

	Area (sf)	CN	Description
	127,217	74	>75% Grass cover, Good, HSG C
	211,698	70	Woods, Good, HSG C
*	24,606	98	Impervious Area
	716	96	Gravel surface, HSG C
	57,854	77	Woods, Good, HSG D
	422,091	74	Weighted Average
	397,485		94.17% Pervious Area
	24,606		5.83% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.9	50	0.0200	0.07		**Sheet Flow, Sheet** Woods: Light underbrush n= 0.400 P2= 3.43"
19.4	1,010	0.0300	0.87		**Shallow Concentrated Flow, Shallow** Woodland Kv= 5.0 fps
1.5	560	0.0200	6.38	76.61	**Trap/Vee/Rect Channel Flow,** Bot.W=2.00' D=2.00' Z= 2.0 '/' Top.W=10.00' n= 0.035 Earth, dense weeds
32.8	1,620	Total			

Subcatchment A1: SUB-A1



Summary for Subcatchment A2: SUB-A2

[47] Hint: Peak is 663% of capacity of segment #6

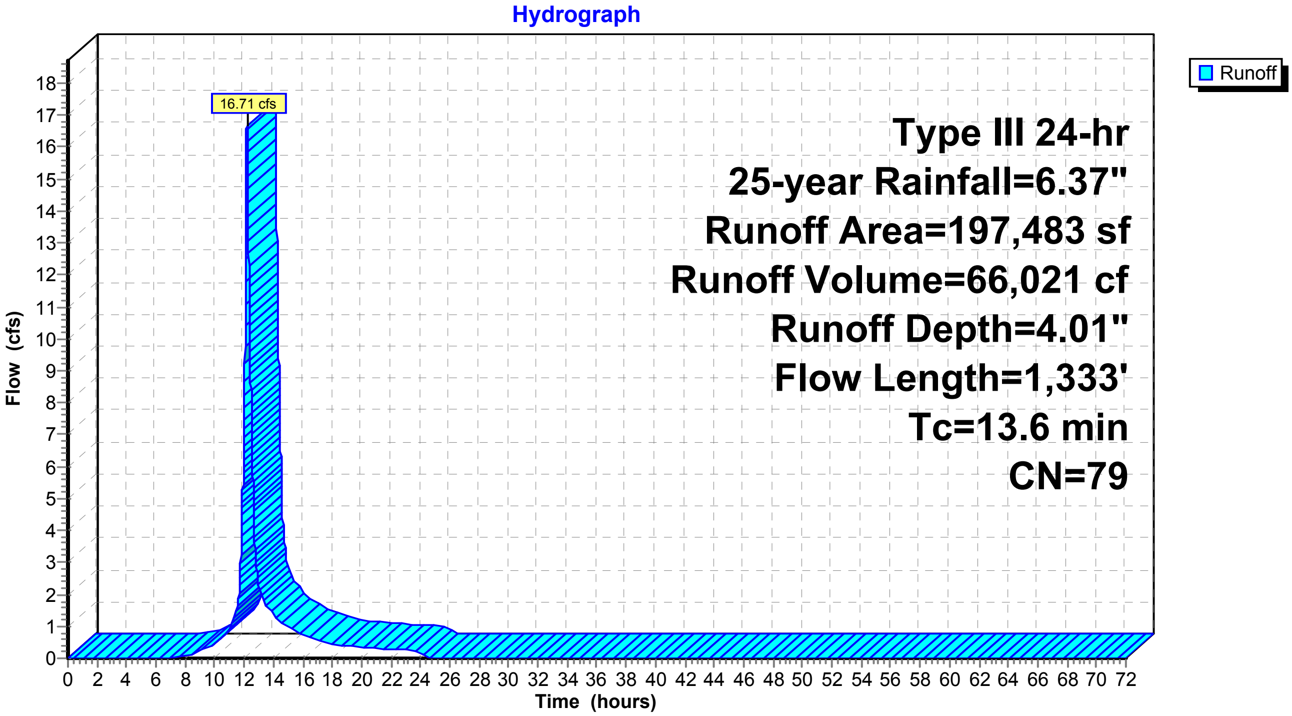
Runoff = 16.71 cfs @ 12.19 hrs, Volume= 66,021 cf, Depth= 4.01"
Routed to Pond IB-1 : IB-1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-year Rainfall=6.37"

	Area (sf)	CN	Description
	83,784	74	>75% Grass cover, Good, HSG C
	52,545	70	Woods, Good, HSG C
*	44,663	98	Impervious Area
	1,148	96	Gravel surface, HSG C
*	3,703	98	Infiltration Basin Floor
	11,640	77	Woods, Good, HSG D
	197,483	79	Weighted Average
	149,117		75.51% Pervious Area
	48,366		24.49% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.6	50	0.0300	0.18		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.43"
2.9	208	0.0300	1.21		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.9	77	0.0900	1.50		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
0.1	22	0.2500	3.50		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.8	141	0.0200	2.87		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
4.3	835	0.0050	3.21	2.52	**Pipe Channel,** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.013 Corrugated PE, smooth interior
13.6	1,333	Total			

Subcatchment A2: SUB-A2



Summary for Subcatchment A3: SUB-A3

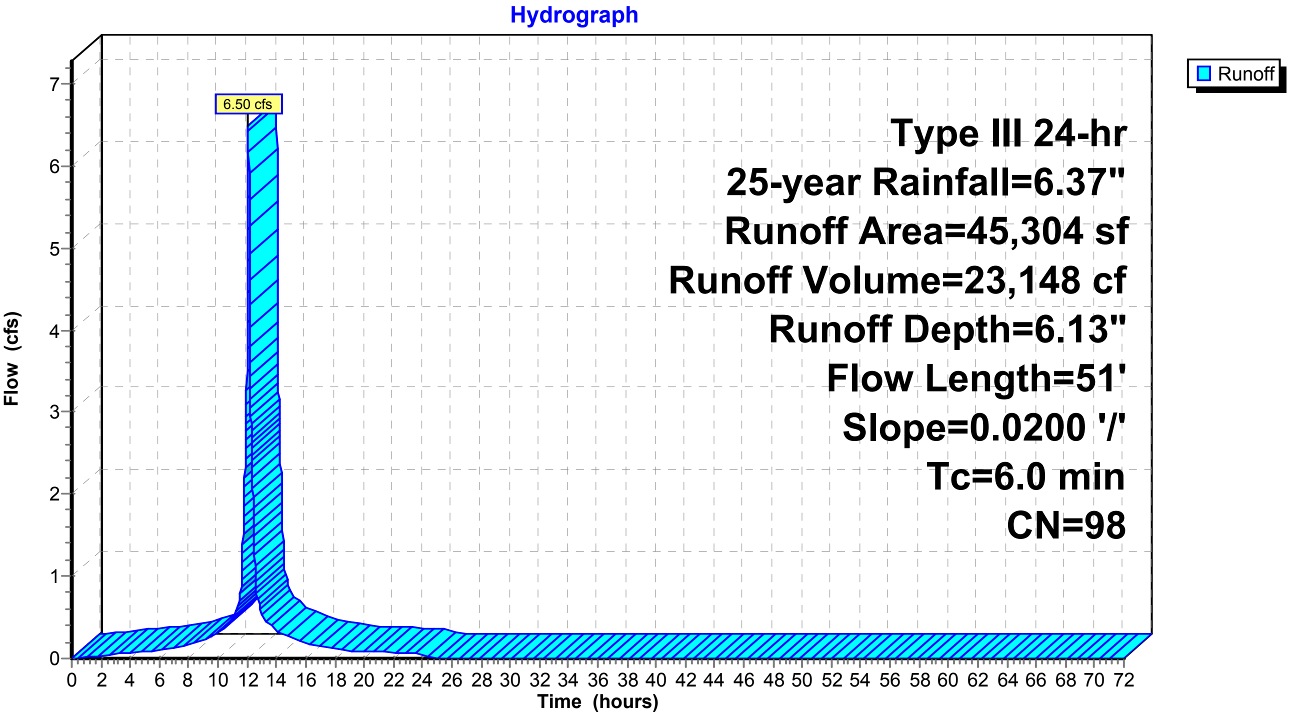
Runoff = 6.50 cfs @ 12.08 hrs, Volume= 23,148 cf, Depth= 6.13"
Routed to Pond IB-1 : IB-1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-year Rainfall=6.37"

	Area (sf)	CN	Description
*	45,304	98	Impervious Area
	45,304		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.7	50	0.0200	1.24		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.43"
0.0	1	0.0200	2.87		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
0.7	51	Total, Increased to minimum Tc = 6.0 min			

Subcatchment A3: SUB-A3



Summary for Subcatchment A4: SUB-A4

[47] Hint: Peak is 160% of capacity of segment #5

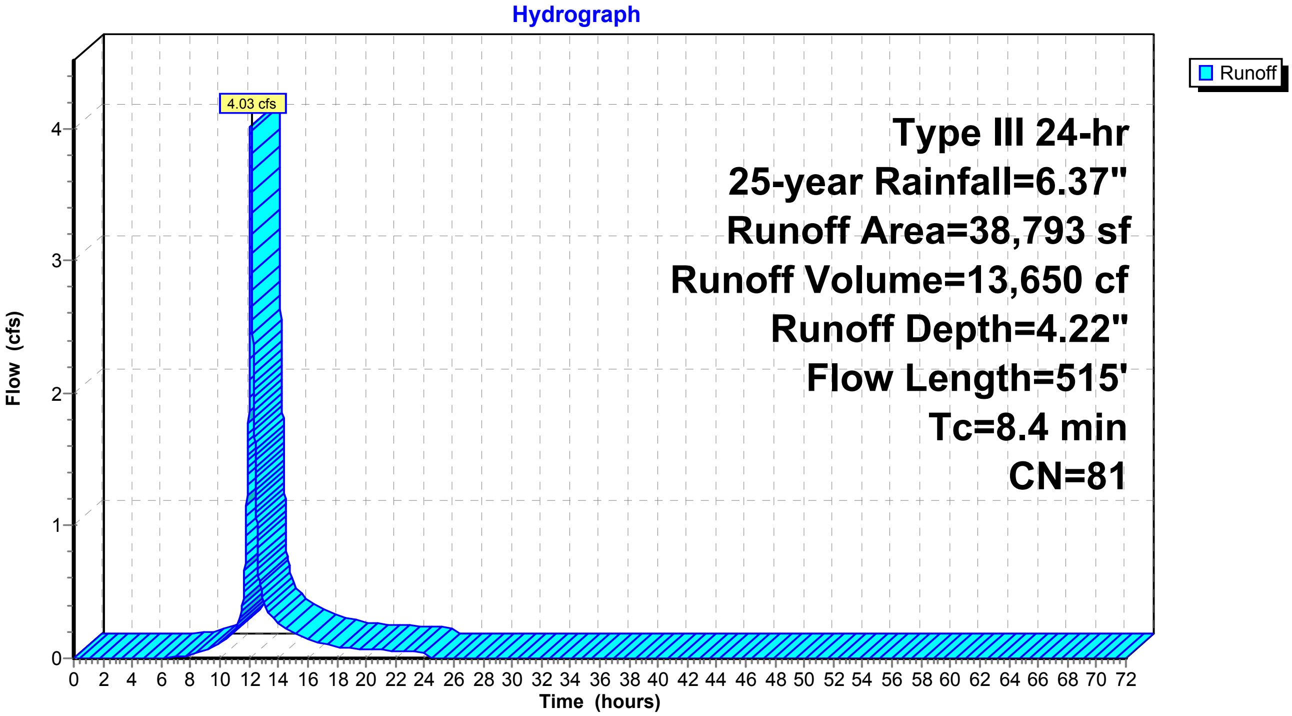
Runoff = 4.03 cfs @ 12.12 hrs, Volume= 13,650 cf, Depth= 4.22"
Routed to Pond IB-1 : IB-1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-year Rainfall=6.37"

	Area (sf)	CN	Description
	27,860	74	>75% Grass cover, Good, HSG C
*	10,933	98	Impervious Area
	38,793	81	Weighted Average
	27,860		71.82% Pervious Area
	10,933		28.18% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.8	50	0.0280	0.18		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.43"
0.0	8	0.0200	2.87		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
1.0	70	0.0294	1.20		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.9	57	0.0221	1.04		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
1.7	330	0.0050	3.21	2.52	**Pipe Channel,** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.013 Corrugated PE, smooth interior
8.4	515	Total			

Subcatchment A4: SUB-A4



Summary for Subcatchment B1: SUB-B1

[47] Hint: Peak is 613% of capacity of segment #5

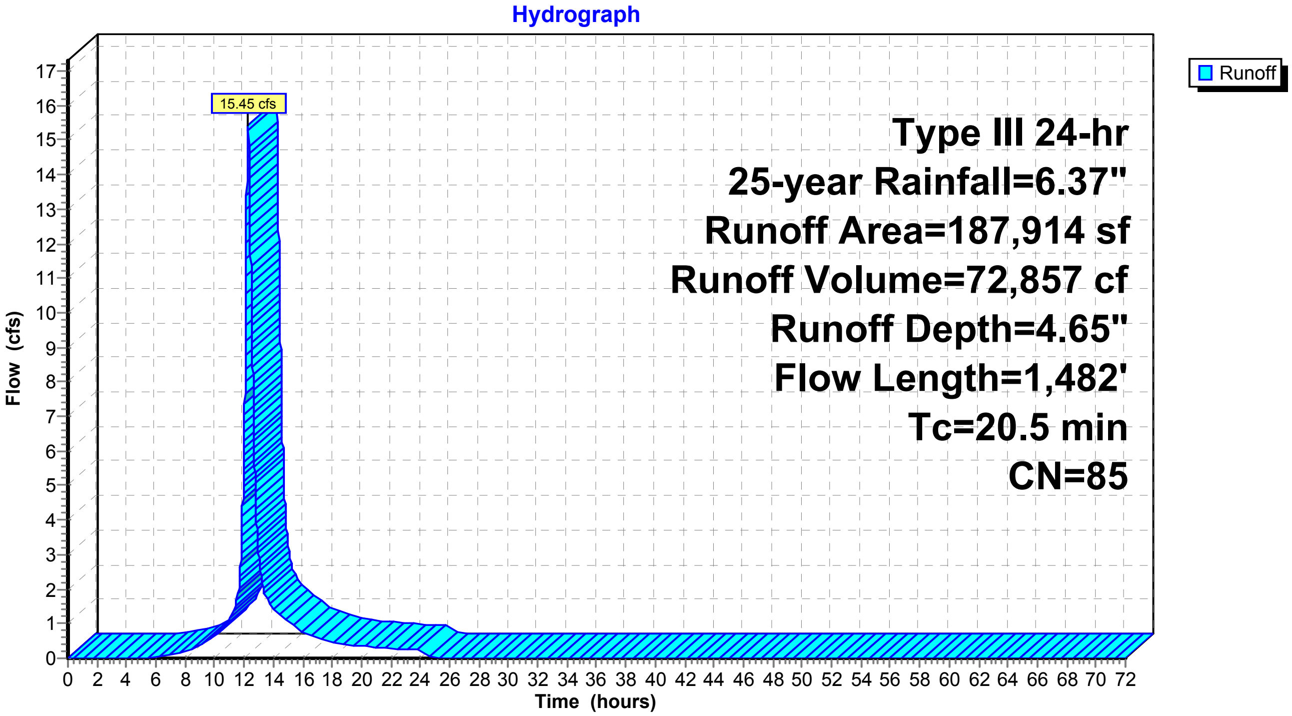
Runoff = 15.45 cfs @ 12.28 hrs, Volume= 72,857 cf, Depth= 4.65"
Routed to Pond IB-2 : IB-2

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-year Rainfall=6.37"

	Area (sf)	CN	Description
	76,568	74	>75% Grass cover, Good, HSG C
	23,764	70	Woods, Good, HSG C
*	81,637	98	Impervious Area
*	5,945	98	Infiltration Basin Floor
	187,914	85	Weighted Average
	100,332		53.39% Pervious Area
	87,582		46.61% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.6	50	0.0340	0.09		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.43"
5.1	319	0.0435	1.04		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
0.2	28	0.1535	2.74		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.5	102	0.0245	3.18		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
5.1	983	0.0050	3.21	2.52	**Pipe Channel,** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.013 Corrugated PE, smooth interior
20.5	1,482	Total			

Subcatchment B1: SUB-B1



Summary for Subcatchment B2: SUB-B2

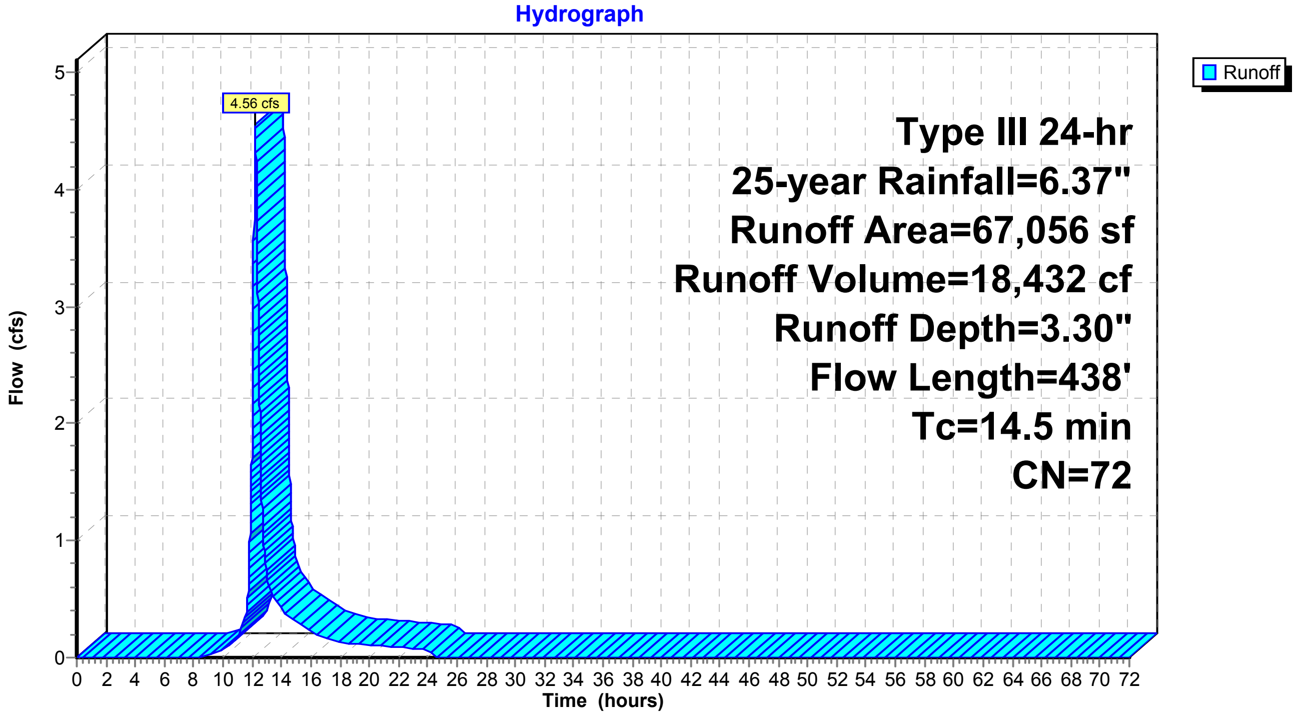
Runoff = 4.56 cfs @ 12.20 hrs, Volume= 18,432 cf, Depth= 3.30"
Routed to Link B : B

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-year Rainfall=6.37"

Area (sf)	CN	Description
29,339	74	>75% Grass cover, Good, HSG C
37,717	70	Woods, Good, HSG C
67,056	72	Weighted Average
67,056		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.3	50	0.0500	0.10		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.43"
6.2	388	0.0438	1.05		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
14.5	438	Total			

Subcatchment B2: SUB-B2



Summary for Subcatchment B3: SUB-B3

[47] Hint: Peak is 177% of capacity of segment #5

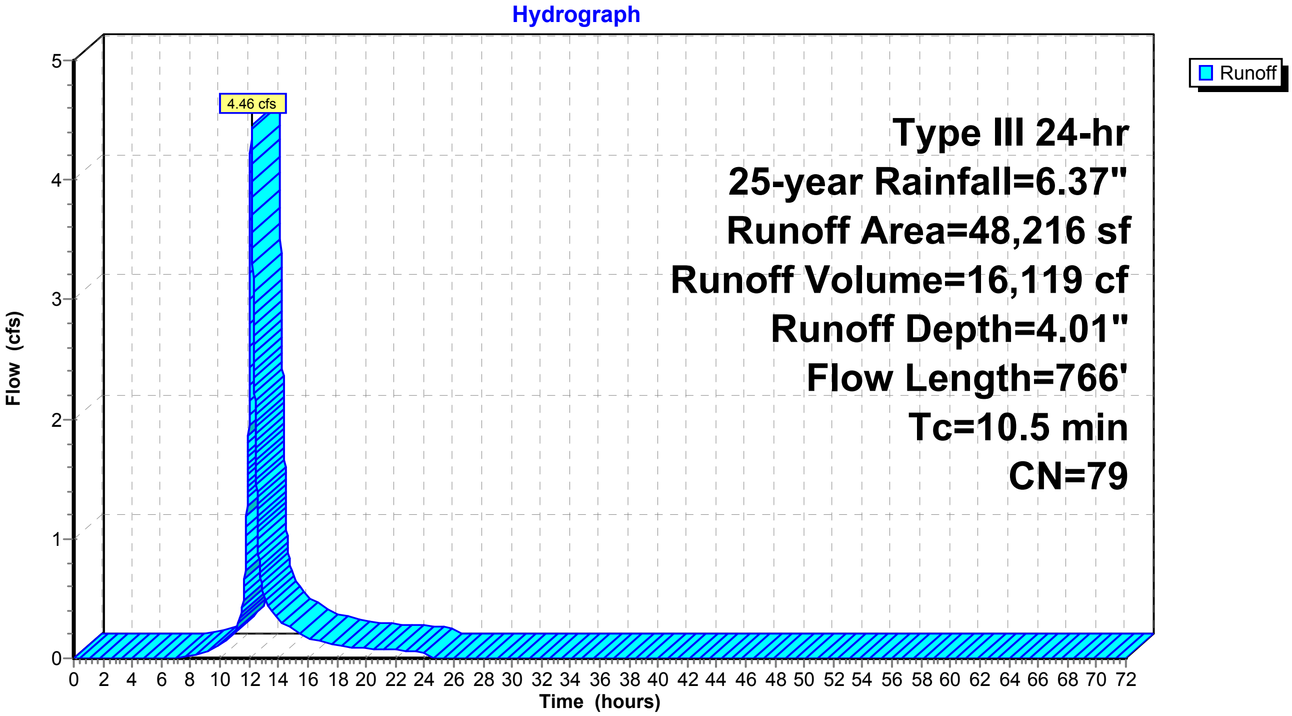
Runoff = 4.46 cfs @ 12.14 hrs, Volume= 16,119 cf, Depth= 4.01"
Routed to Pond IB-2 : IB-2

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-year Rainfall=6.37"

	Area (sf)	CN	Description
	37,519	74	>75% Grass cover, Good, HSG C
*	10,697	98	Impervious Area
	48,216	79	Weighted Average
	37,519		77.81% Pervious Area
	10,697		22.19% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.4	50	0.0200	0.15		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.43"
0.6	40	0.0275	1.16		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.0	7	0.0200	2.87		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
1.5	89	0.0202	0.99		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
3.0	580	0.0050	3.21	2.52	**Pipe Channel,** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.013 Corrugated PE, smooth interior
10.5	766	Total			

Subcatchment B3: SUB-B3



Summary for Subcatchment B4: SB-B4

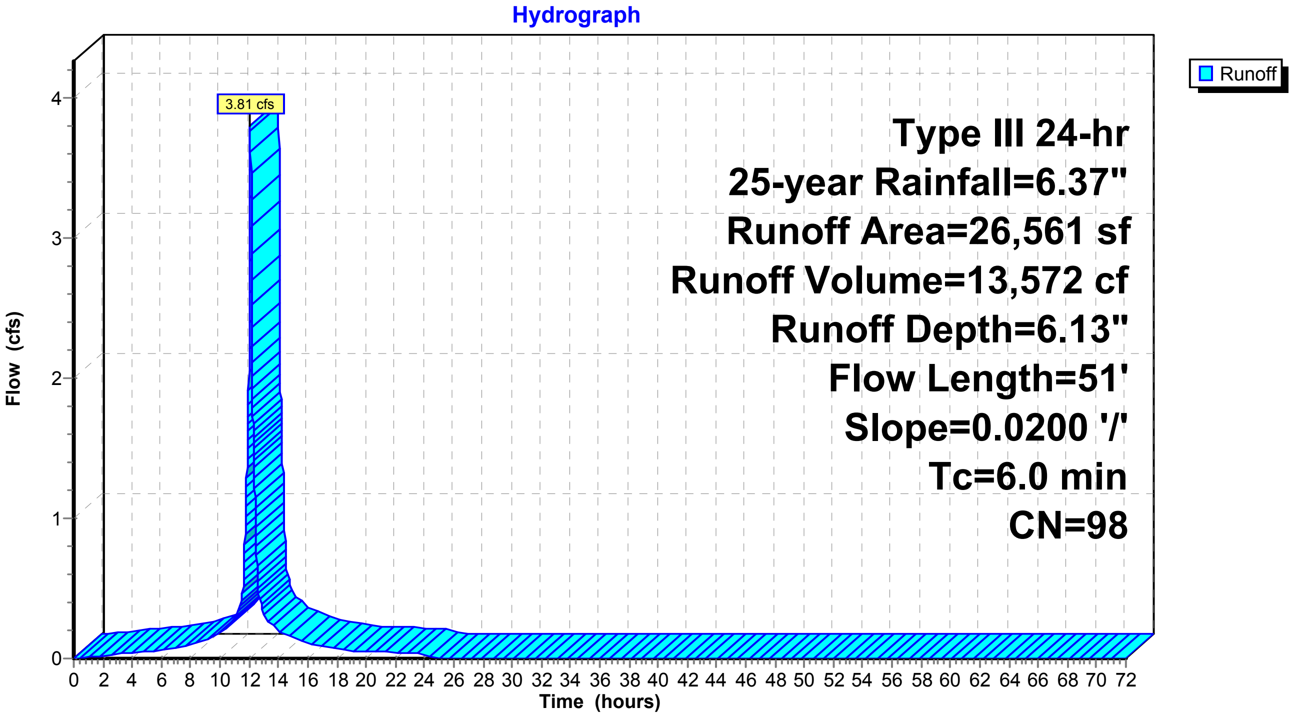
Runoff = 3.81 cfs @ 12.08 hrs, Volume= 13,572 cf, Depth= 6.13"
Routed to Pond IB-2 : IB-2

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-year Rainfall=6.37"

	Area (sf)	CN	Description
*	26,561	98	Impervious Area
	26,561		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.7	50	0.0200	1.24		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.43"
0.0	1	0.0200	2.87		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
0.7	51	Total, Increased to minimum Tc = 6.0 min			

Subcatchment B4: SB-B4



Summary for Pond IB-1: IB-1

Inflow Area = 281,580 sf, 37.15% Impervious, Inflow Depth = 4.38" for 25-year event
Inflow = 24.85 cfs @ 12.14 hrs, Volume= 102,820 cf
Outflow = 20.46 cfs @ 12.25 hrs, Volume= 102,821 cf, Atten= 18%, Lag= 6.6 min
Discarded = 0.32 cfs @ 12.25 hrs, Volume= 26,408 cf
Primary = 20.14 cfs @ 12.25 hrs, Volume= 76,412 cf
Routed to Pond IB-2 : IB-2
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf
Routed to Pond IB-2 : IB-2

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 246.48' @ 12.25 hrs Surf.Area= 13,470 sf Storage= 25,178 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 131.0 min (933.7 - 802.6)

Volume	Invert	Avail.Storage	Storage Description
#1	244.00'	44,476 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)
244.00	3,703	0	0	3,703
245.00	11,077	7,062	7,062	11,083
246.00	12,689	11,874	18,935	12,740
247.00	14,351	13,511	32,447	14,453
247.80	15,732	12,029	44,476	15,877

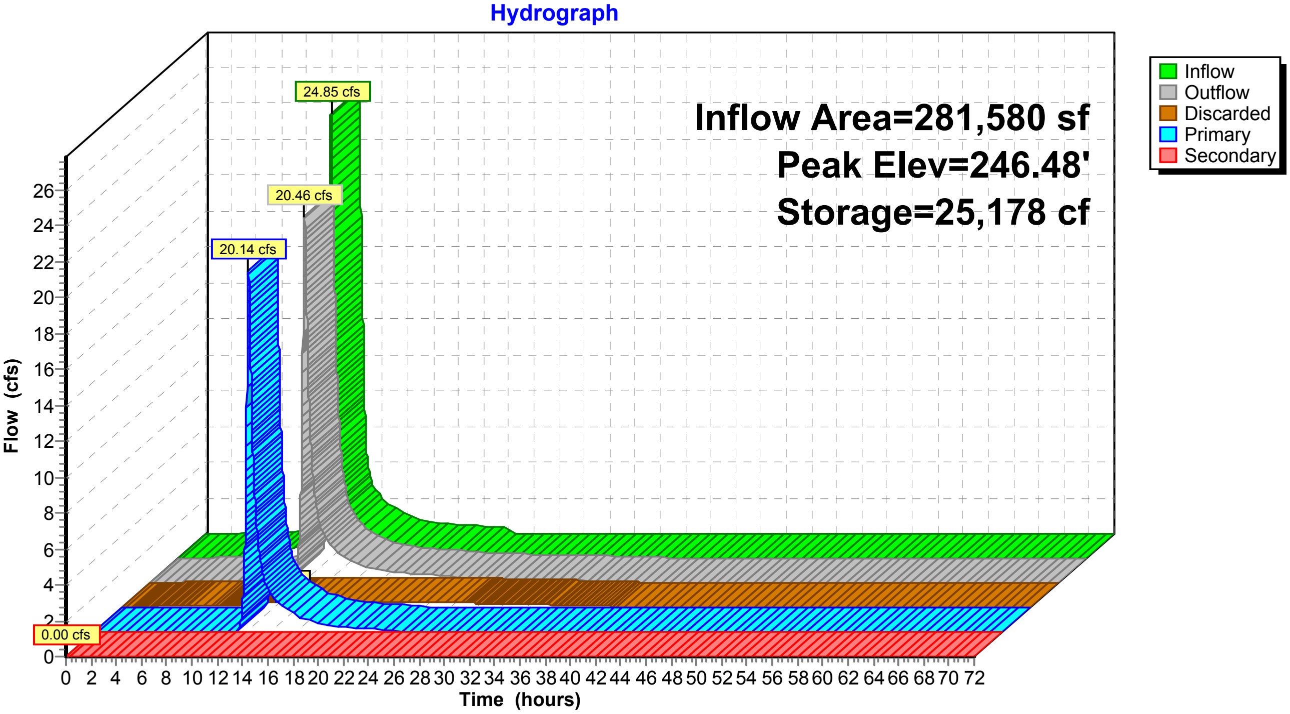
Device	Routing	Invert	Outlet Devices
#1	Secondary	246.80'	**10.0' long x 6.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.37 2.51 2.70 2.68 2.68 2.67 2.65 2.65 2.65 2.65 2.66 2.66 2.67 2.69 2.72 2.76 2.83
#2	Discarded	244.00'	**1.020 in/hr Exfiltration over Wetted area**
#3	Device 4	246.20'	**48.0" x 48.0" Horiz. Orifice/Grate (OCS-1)** C= 0.600 Limited to weir flow at low heads
#4	Primary	241.38'	**24.0" Round Culvert (OCS-1)** L= 70.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 241.38' / 241.00' S= 0.0054 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 3.14 sf
#5	Device 4	245.20'	**36.0" W x 12.0" H Vert. Orifice/Grate (OCS-1)** C= 0.600 Limited to weir flow at low heads

Discarded OutFlow Max=0.32 cfs @ 12.25 hrs HW=246.48' (Free Discharge)
↑—**2=Exfiltration** (Exfiltration Controls 0.32 cfs)

Primary OutFlow Max=20.13 cfs @ 12.25 hrs HW=246.48' TW=243.11' (Dynamic Tailwater)
↑—**4=Culvert (OCS-1)** (Passes 20.13 cfs of 27.74 cfs potential flow)
  ↑—**3=Orifice/Grate (OCS-1)** (Weir Controls 7.64 cfs @ 1.72 fps)
  └—**5=Orifice/Grate (OCS-1)** (Orifice Controls 12.49 cfs @ 4.16 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=244.00' TW=240.00' (Dynamic Tailwater)
↑—**1=Broad-Crested Rectangular Weir**(Controls 0.00 cfs)

Pond IB-1: IB-1



Summary for Pond IB-2: IB-2

[95] Warning: Outlet Device #7 rise exceeded

Inflow Area = 544,271 sf, 42.16% Impervious, Inflow Depth = 3.95" for 25-year event
Inflow = 40.50 cfs @ 12.24 hrs, Volume= 178,960 cf
Outflow = 22.33 cfs @ 12.55 hrs, Volume= 178,961 cf, Atten= 45%, Lag= 18.4 min
Discarded = 0.49 cfs @ 12.55 hrs, Volume= 46,106 cf
Primary = 15.96 cfs @ 12.55 hrs, Volume= 98,892 cf
Routed to Link B : B
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf
Routed to Link B : B
Tertiary = 5.88 cfs @ 12.55 hrs, Volume= 33,963 cf
Routed to Link A : A

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 243.76' @ 12.55 hrs Surf.Area= 20,589 sf Storage= 56,578 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 200.2 min (1,012.5 - 812.3)

Volume	Invert	Avail.Storage	Storage Description
#1	240.00'	103,342 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)
240.00	5,945	0	0	5,945
241.00	12,658	9,093	9,093	12,666
242.00	16,770	14,666	23,758	16,801
243.00	18,908	17,828	41,587	18,990
244.00	21,137	20,012	61,599	21,275
245.00	23,418	22,268	83,867	23,617
245.80	25,283	19,476	103,342	25,533

Device	Routing	Invert	Outlet Devices
#1	Secondary	244.80'	**10.0' long x 6.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.37 2.51 2.70 2.68 2.68 2.67 2.65 2.65 2.65 2.65 2.66 2.66 2.67 2.69 2.72 2.76 2.83
#2	Discarded	240.00'	**1.020 in/hr Exfiltration over Wetted area**
#3	Device 5	242.00'	**4.0' long x 1.50' rise Sharp-Crested Vee/Trap Weir** Cv= 2.62 (C= 3.28)
#4	Device 5	243.50'	**48.0" x 48.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#5	Primary	241.28'	**24.0" Round Culvert** L= 30.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 241.28' / 241.13' S= 0.0050 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 3.14 sf
#6	Device 8	244.30'	**24.0" x 24.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

#7	Device 8	241.60'	**Custom Weir/Orifice, Cv= 2.62 (C= 3.28)** Head (feet) 0.00 1.50 Width (feet) 0.00 1.50
#8	Tertiary	238.25'	**12.0" Round Culvert** L= 50.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 238.25' / 238.00' S= 0.0050 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

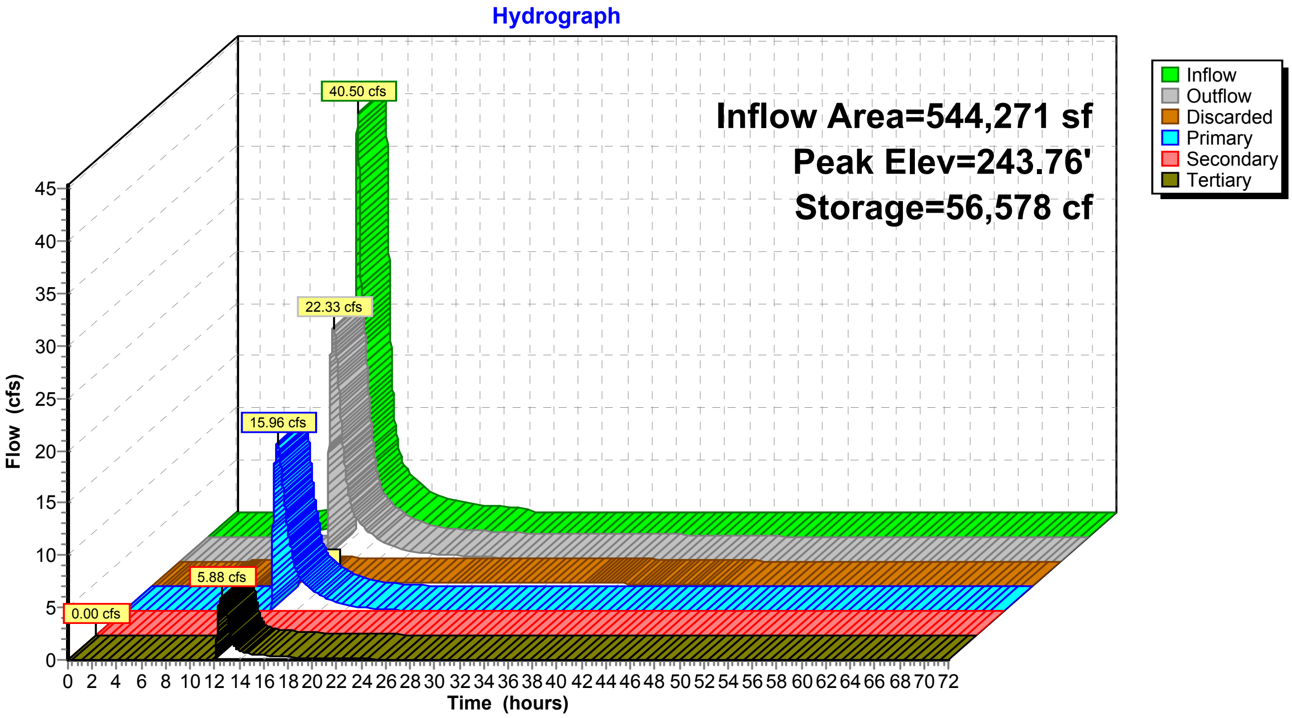
Discarded OutFlow Max=0.49 cfs @ 12.55 hrs HW=243.76' (Free Discharge)
└─**2=Exfiltration** (Exfiltration Controls 0.49 cfs)

Primary OutFlow Max=15.96 cfs @ 12.55 hrs HW=243.76' TW=0.00' (Dynamic Tailwater)
└─**5=Culvert** (Barrel Controls 15.96 cfs @ 5.24 fps)
  ├─**3=Sharp-Crested Vee/Trap Weir** (Passes < 28.84 cfs potential flow)
  └─**4=Orifice/Grate** (Passes < 6.91 cfs potential flow)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=240.00' TW=0.00' (Dynamic Tailwater)
└─**1=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Tertiary OutFlow Max=5.88 cfs @ 12.55 hrs HW=243.76' TW=0.00' (Dynamic Tailwater)
└─**8=Culvert** (Passes 5.88 cfs of 7.85 cfs potential flow)
  ├─**6=Orifice/Grate** (Controls 0.00 cfs)
  └─**7=Custom Weir/Orifice** (Orifice Controls 5.88 cfs @ 5.23 fps)

Pond IB-2: IB-2

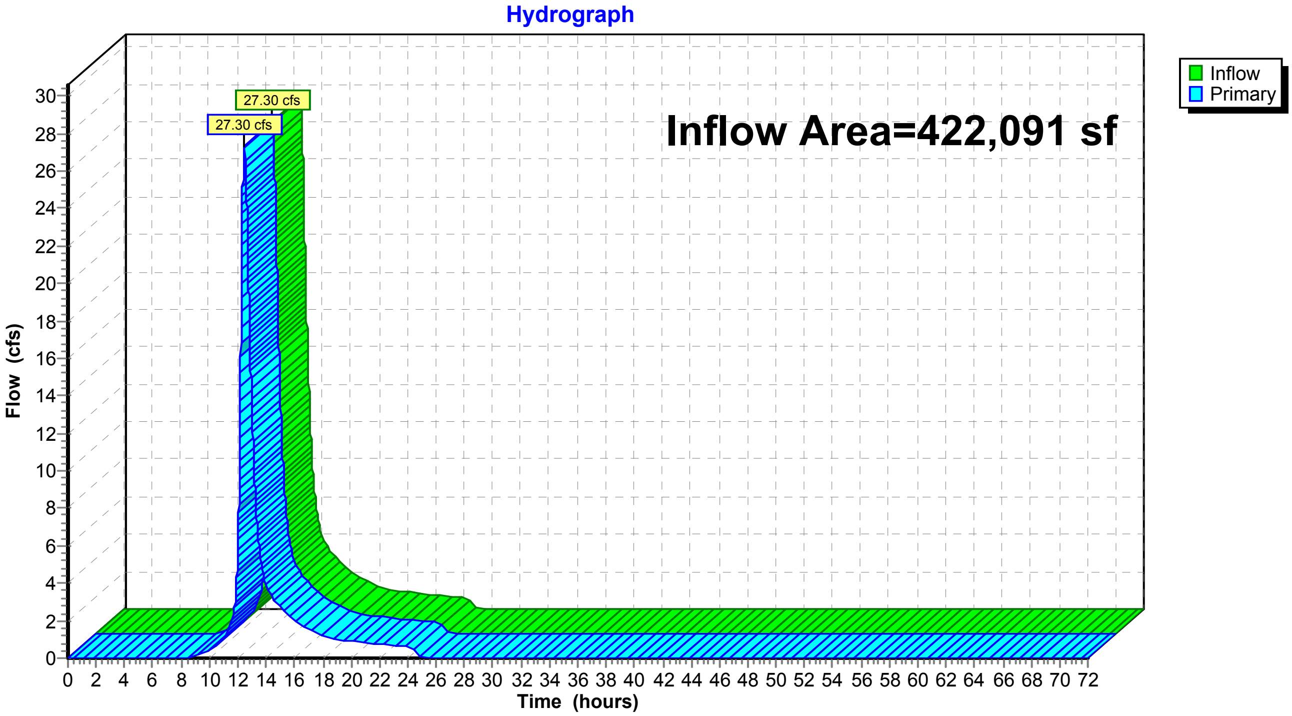


Summary for Link A: A

Inflow Area = 422,091 sf, 5.83% Impervious, Inflow Depth = 4.46" for 25-year event
Inflow = 27.30 cfs @ 12.47 hrs, Volume= 157,017 cf
Primary = 27.30 cfs @ 12.47 hrs, Volume= 157,017 cf, Atten= 0%, Lag= 0.0 min

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

Link A: A

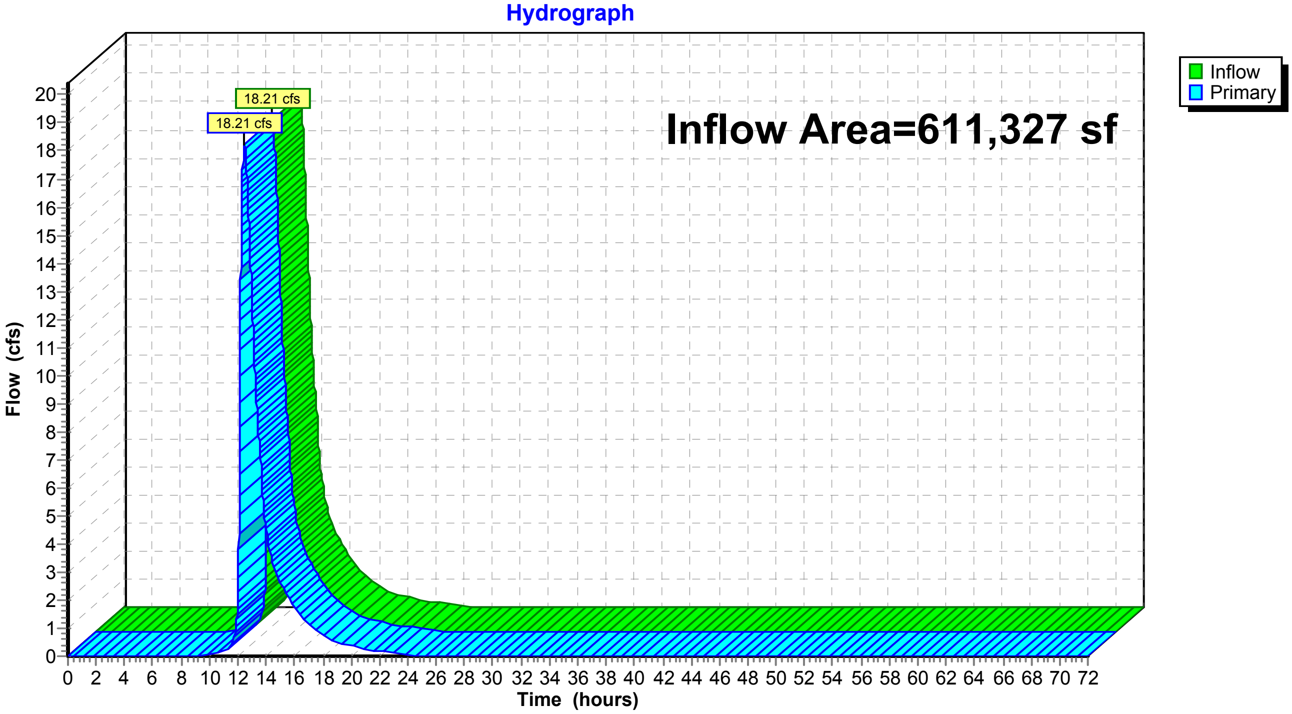


Summary for Link B: B

Inflow Area =	611,327 sf, 37.53% Impervious, Inflow Depth = 2.30" for 25-year event	
Inflow =	18.21 cfs @ 12.46 hrs, Volume=	117,324 cf
Primary =	18.21 cfs @ 12.46 hrs, Volume=	117,324 cf, Atten= 0%, Lag= 0.0 min

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

Link B: B



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

SubcatchmentA1: SUB-A1 Runoff Area=422,091 sf 5.83% Impervious Runoff Depth=4.23"
Flow Length=1,620' Tc=32.8 min CN=74 Runoff=26.02 cfs 148,636 cf

SubcatchmentA2: SUB-A2 Runoff Area=197,483 sf 24.49% Impervious Runoff Depth=4.78"
Flow Length=1,333' Tc=13.6 min CN=79 Runoff=19.82 cfs 78,614 cf

SubcatchmentA3: SUB-A3 Runoff Area=45,304 sf 100.00% Impervious Runoff Depth=6.97"
Flow Length=51' Slope=0.0200 '/' Tc=6.0 min CN=98 Runoff=7.36 cfs 26,317 cf

SubcatchmentA4: SUB-A4 Runoff Area=38,793 sf 28.18% Impervious Runoff Depth=5.00"
Flow Length=515' Tc=8.4 min CN=81 Runoff=4.75 cfs 16,166 cf

SubcatchmentB1: SUB-B1 Runoff Area=187,914 sf 46.61% Impervious Runoff Depth=5.45"
Flow Length=1,482' Tc=20.5 min CN=85 Runoff=18.00 cfs 85,400 cf

SubcatchmentB2: SUB-B2 Runoff Area=67,056 sf 0.00% Impervious Runoff Depth=4.01"
Flow Length=438' Tc=14.5 min CN=72 Runoff=5.55 cfs 22,400 cf

SubcatchmentB3: SUB-B3 Runoff Area=48,216 sf 22.19% Impervious Runoff Depth=4.78"
Flow Length=766' Tc=10.5 min CN=79 Runoff=5.30 cfs 19,194 cf

SubcatchmentB4: SB-B4 Runoff Area=26,561 sf 100.00% Impervious Runoff Depth=6.97"
Flow Length=51' Slope=0.0200 '/' Tc=6.0 min CN=98 Runoff=4.31 cfs 15,429 cf

Pond IB-1: IB-1 Peak Elev=246.57' Storage=26,454 cf Inflow=29.22 cfs 121,097 cf
Discarded=0.32 cfs 27,060 cf Primary=25.14 cfs 94,039 cf Secondary=0.00 cfs 0 cf Outflow=25.46 cfs 121,098 cf

Pond IB-2: IB-2 Peak Elev=244.23' Storage=66,536 cf Inflow=48.98 cfs 214,062 cf
252 cf Primary=19.32 cfs 124,236 cf Secondary=0.00 cfs 0 cf Tertiary=7.02 cfs 42,576 cf Outflow=26.86 cfs 214,064 cf

Link A: A Inflow=32.95 cfs 191,211 cf
Primary=32.95 cfs 191,211 cf

Link B: B Inflow=22.06 cfs 146,636 cf
Primary=22.06 cfs 146,636 cf

Total Runoff Area = 1,033,418 sf Runoff Volume = 412,156 cf Average Runoff Depth = 4.79"
75.42% Pervious = 779,369 sf 24.58% Impervious = 254,049 sf

Summary for Subcatchment A1: SUB-A1

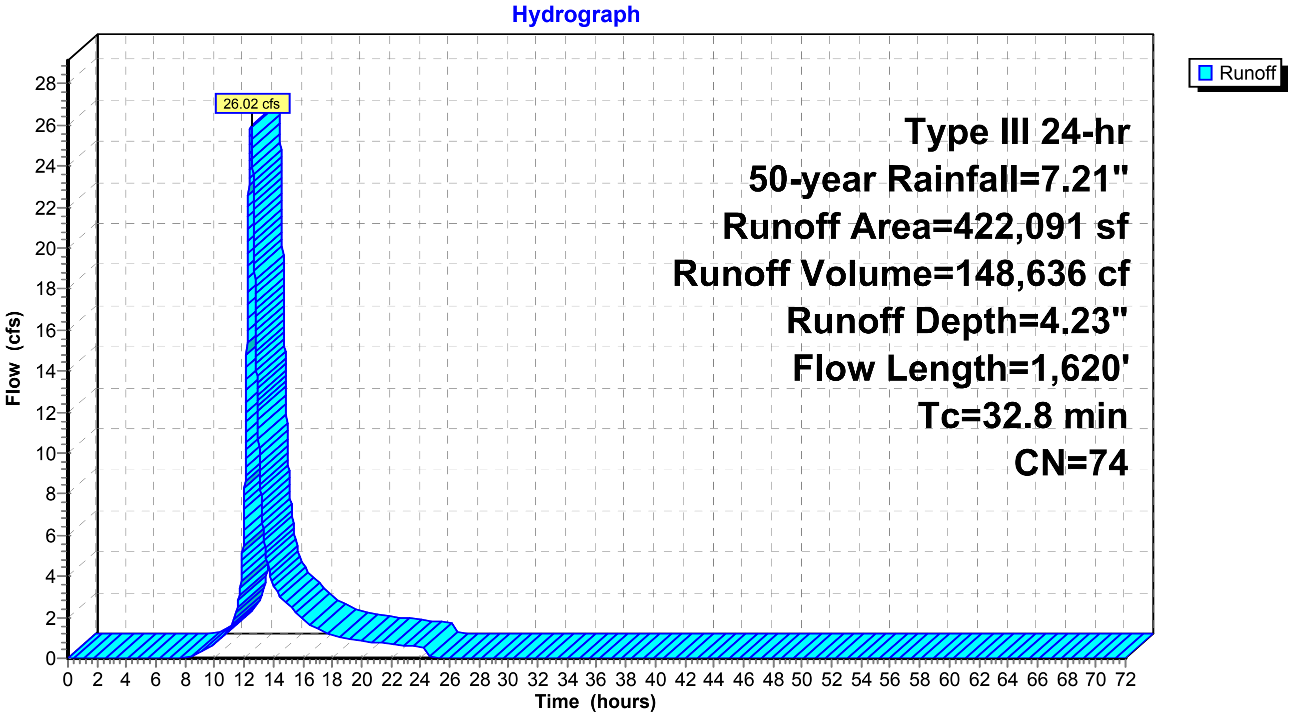
Runoff = 26.02 cfs @ 12.46 hrs, Volume= 148,636 cf, Depth= 4.23"
Routed to Link A : A

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 50-year Rainfall=7.21"

	Area (sf)	CN	Description
	127,217	74	>75% Grass cover, Good, HSG C
	211,698	70	Woods, Good, HSG C
*	24,606	98	Impervious Area
	716	96	Gravel surface, HSG C
	57,854	77	Woods, Good, HSG D
	422,091	74	Weighted Average
	397,485		94.17% Pervious Area
	24,606		5.83% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.9	50	0.0200	0.07		**Sheet Flow, Sheet** Woods: Light underbrush n= 0.400 P2= 3.43"
19.4	1,010	0.0300	0.87		**Shallow Concentrated Flow, Shallow** Woodland Kv= 5.0 fps
1.5	560	0.0200	6.38	76.61	**Trap/Vee/Rect Channel Flow,** Bot.W=2.00' D=2.00' Z= 2.0 '/' Top.W=10.00' n= 0.035 Earth, dense weeds
32.8	1,620	Total			

Subcatchment A1: SUB-A1



Summary for Subcatchment A2: SUB-A2

[47] Hint: Peak is 787% of capacity of segment #6

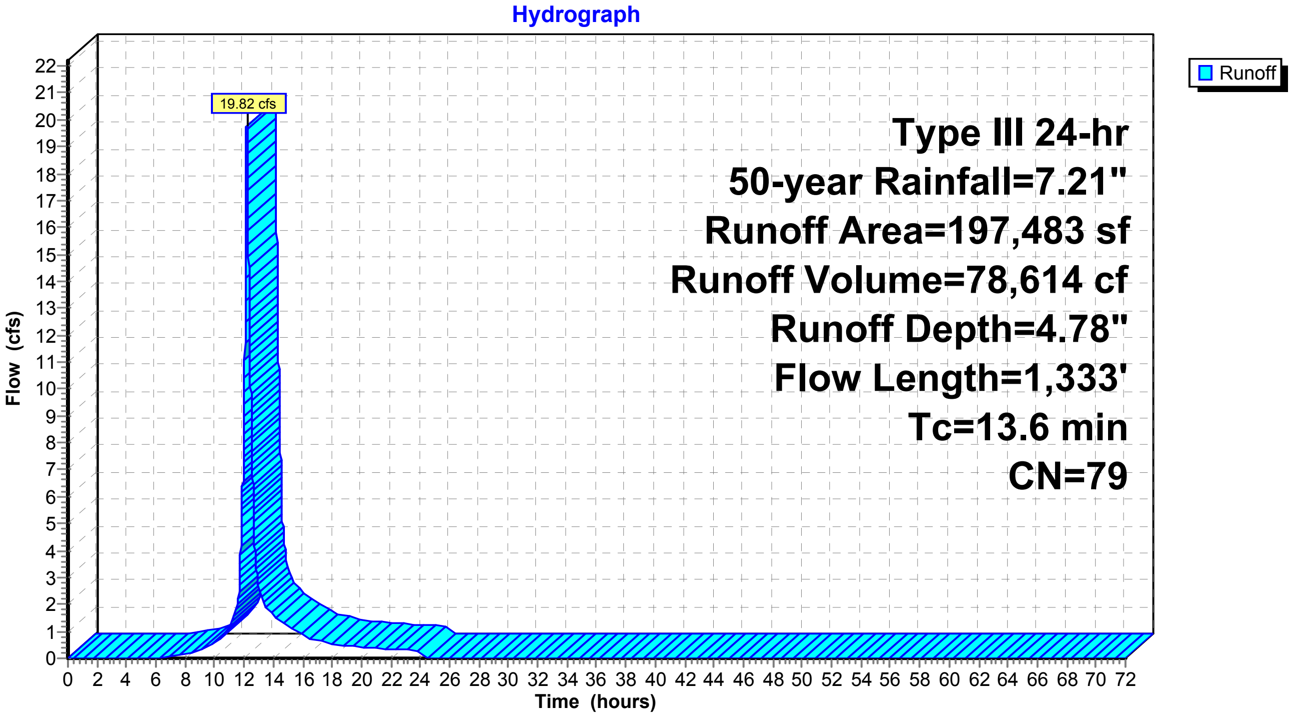
Runoff = 19.82 cfs @ 12.19 hrs, Volume= 78,614 cf, Depth= 4.78"
Routed to Pond IB-1 : IB-1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 50-year Rainfall=7.21"

	Area (sf)	CN	Description
	83,784	74	>75% Grass cover, Good, HSG C
	52,545	70	Woods, Good, HSG C
*	44,663	98	Impervious Area
	1,148	96	Gravel surface, HSG C
*	3,703	98	Infiltration Basin Floor
	11,640	77	Woods, Good, HSG D
	197,483	79	Weighted Average
	149,117		75.51% Pervious Area
	48,366		24.49% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.6	50	0.0300	0.18		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.43"
2.9	208	0.0300	1.21		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.9	77	0.0900	1.50		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
0.1	22	0.2500	3.50		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.8	141	0.0200	2.87		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
4.3	835	0.0050	3.21	2.52	**Pipe Channel,** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.013 Corrugated PE, smooth interior
13.6	1,333	Total			

Subcatchment A2: SUB-A2



Summary for Subcatchment A3: SUB-A3

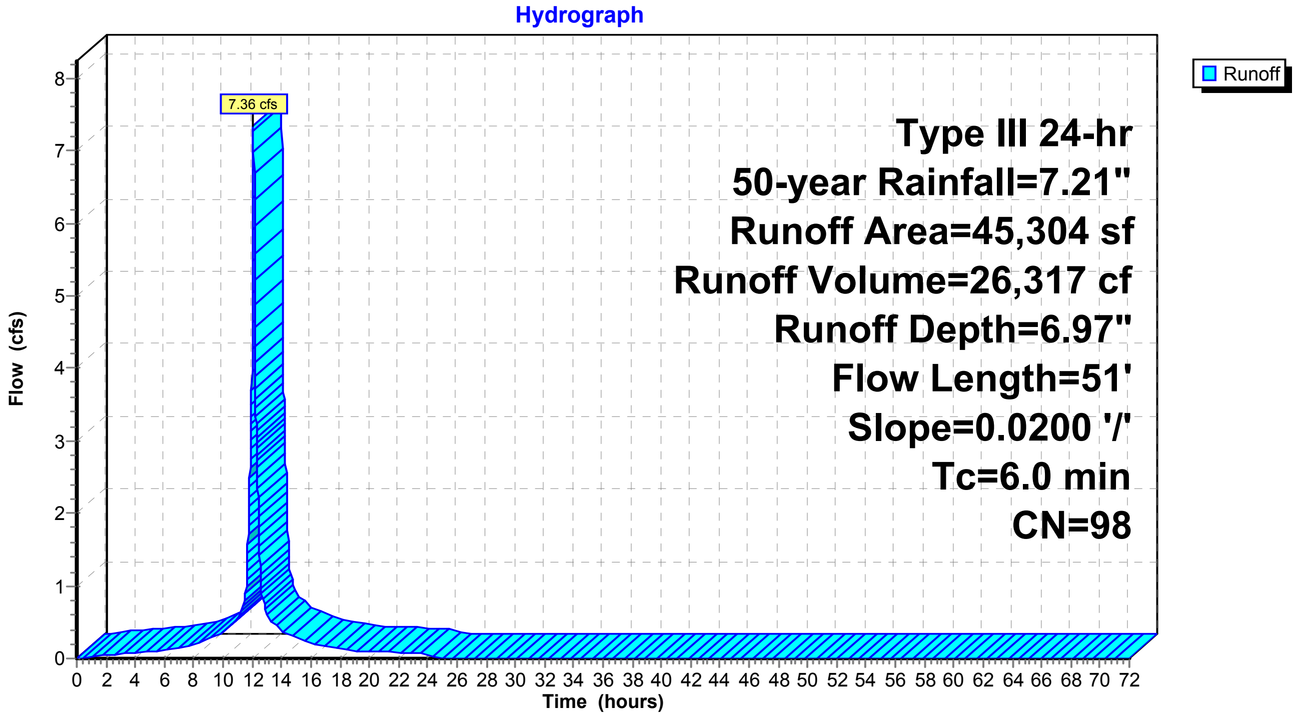
Runoff = 7.36 cfs @ 12.08 hrs, Volume= 26,317 cf, Depth= 6.97"
Routed to Pond IB-1 : IB-1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 50-year Rainfall=7.21"

	Area (sf)	CN	Description
*	45,304	98	Impervious Area
	45,304		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.7	50	0.0200	1.24		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.43"
0.0	1	0.0200	2.87		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
0.7	51	Total, Increased to minimum Tc = 6.0 min			

Subcatchment A3: SUB-A3



Summary for Subcatchment A4: SUB-A4

[47] Hint: Peak is 188% of capacity of segment #5

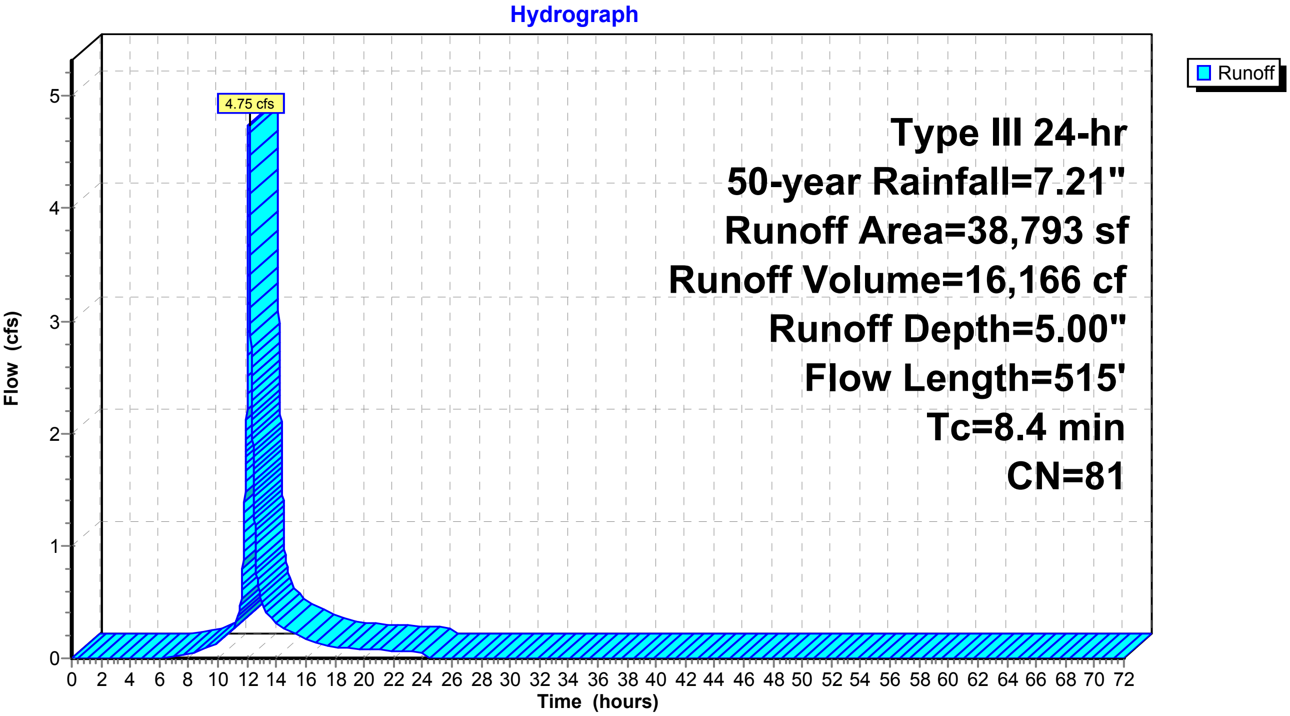
Runoff = 4.75 cfs @ 12.12 hrs, Volume= 16,166 cf, Depth= 5.00"
Routed to Pond IB-1 : IB-1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 50-year Rainfall=7.21"

	Area (sf)	CN	Description
	27,860	74	>75% Grass cover, Good, HSG C
*	10,933	98	Impervious Area
	38,793	81	Weighted Average
	27,860		71.82% Pervious Area
	10,933		28.18% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.8	50	0.0280	0.18		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.43"
0.0	8	0.0200	2.87		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
1.0	70	0.0294	1.20		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.9	57	0.0221	1.04		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
1.7	330	0.0050	3.21	2.52	**Pipe Channel,** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.013 Corrugated PE, smooth interior
8.4	515	Total			

Subcatchment A4: SUB-A4



Summary for Subcatchment B1: SUB-B1

[47] Hint: Peak is 714% of capacity of segment #5

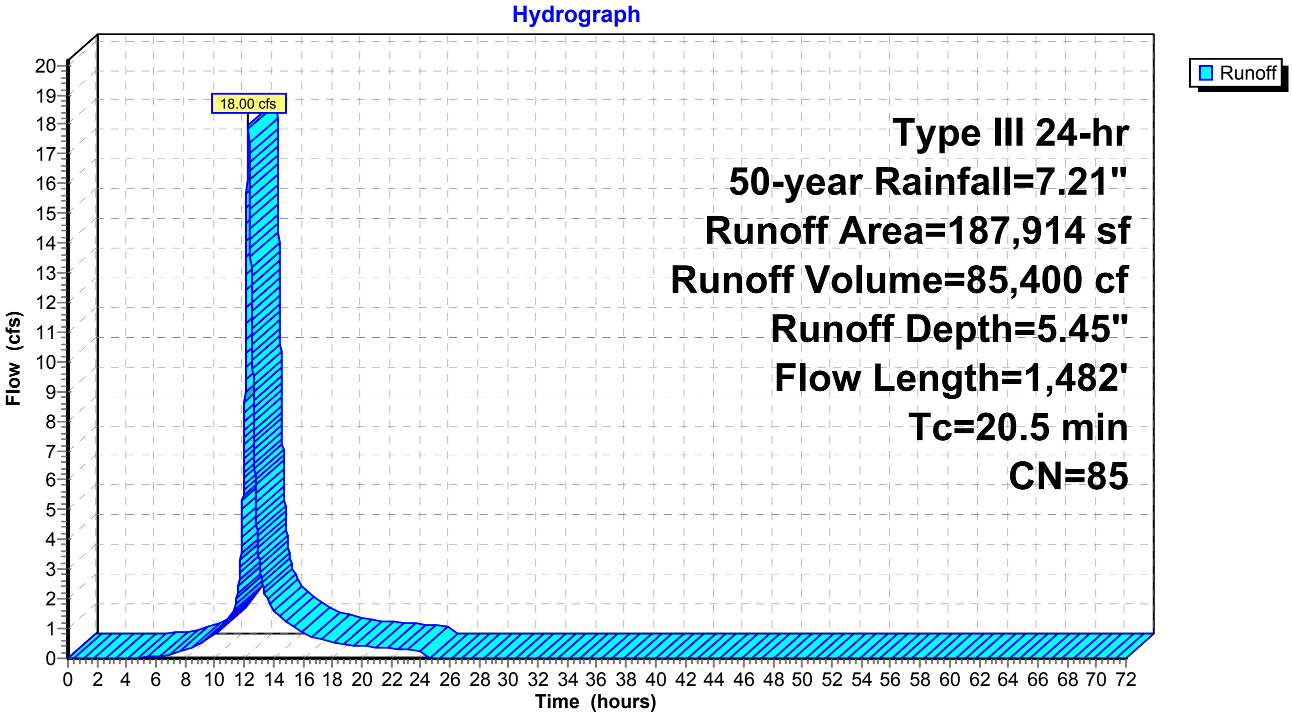
Runoff = 18.00 cfs @ 12.28 hrs, Volume= 85,400 cf, Depth= 5.45"
Routed to Pond IB-2 : IB-2

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 50-year Rainfall=7.21"

	Area (sf)	CN	Description
	76,568	74	>75% Grass cover, Good, HSG C
	23,764	70	Woods, Good, HSG C
*	81,637	98	Impervious Area
*	5,945	98	Infiltration Basin Floor
	187,914	85	Weighted Average
	100,332		53.39% Pervious Area
	87,582		46.61% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.6	50	0.0340	0.09		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.43"
5.1	319	0.0435	1.04		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
0.2	28	0.1535	2.74		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.5	102	0.0245	3.18		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
5.1	983	0.0050	3.21	2.52	**Pipe Channel,** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.013 Corrugated PE, smooth interior
20.5	1,482	Total			

Subcatchment B1: SUB-B1



Summary for Subcatchment B2: SUB-B2

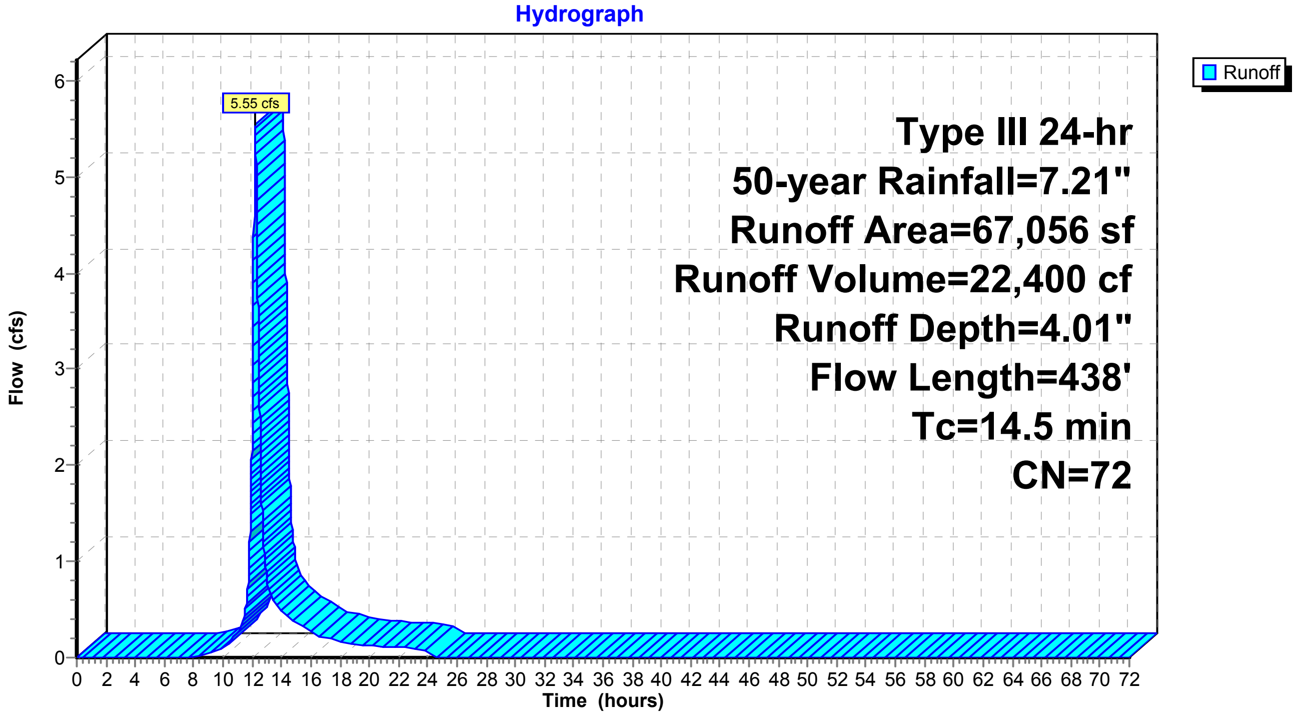
Runoff = 5.55 cfs @ 12.20 hrs, Volume= 22,400 cf, Depth= 4.01"
Routed to Link B : B

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 50-year Rainfall=7.21"

Area (sf)	CN	Description
29,339	74	>75% Grass cover, Good, HSG C
37,717	70	Woods, Good, HSG C
67,056	72	Weighted Average
67,056		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.3	50	0.0500	0.10		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.43"
6.2	388	0.0438	1.05		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
14.5	438	Total			

Subcatchment B2: SUB-B2



Summary for Subcatchment B3: SUB-B3

[47] Hint: Peak is 210% of capacity of segment #5

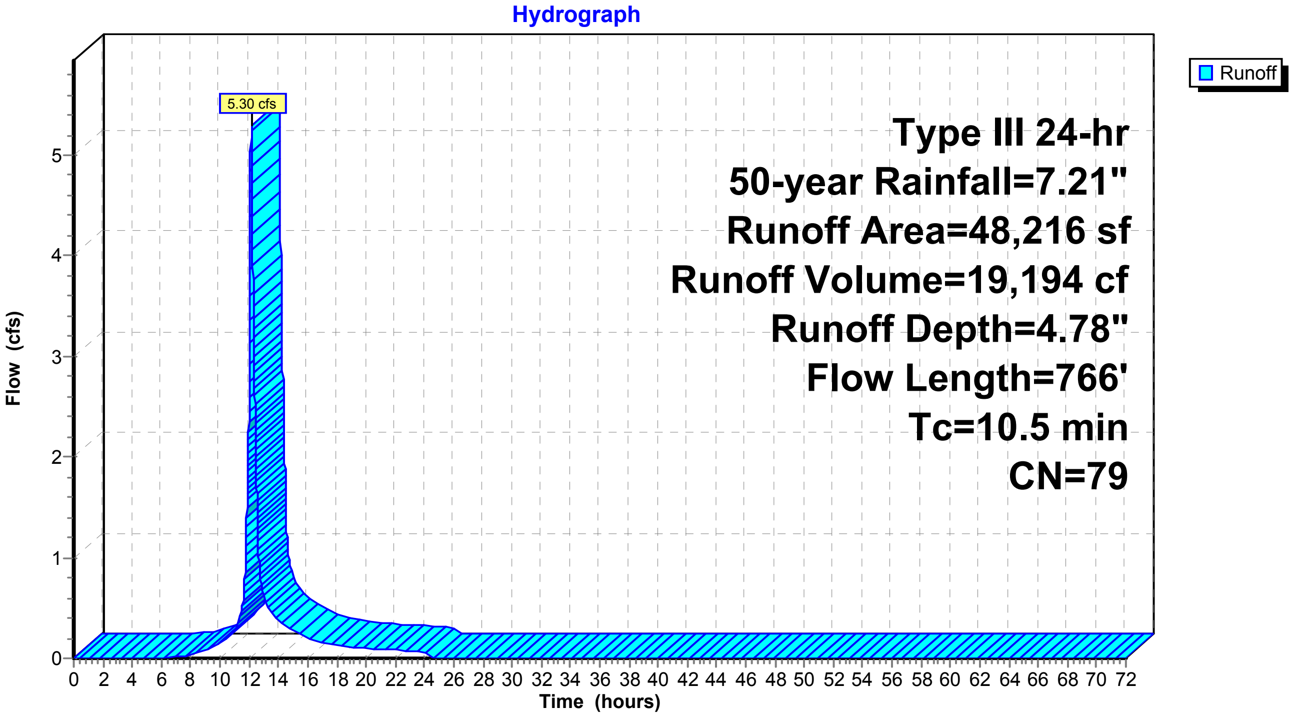
Runoff = 5.30 cfs @ 12.14 hrs, Volume= 19,194 cf, Depth= 4.78"
Routed to Pond IB-2 : IB-2

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 50-year Rainfall=7.21"

	Area (sf)	CN	Description
	37,519	74	>75% Grass cover, Good, HSG C
*	10,697	98	Impervious Area
	48,216	79	Weighted Average
	37,519		77.81% Pervious Area
	10,697		22.19% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.4	50	0.0200	0.15		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.43"
0.6	40	0.0275	1.16		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.0	7	0.0200	2.87		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
1.5	89	0.0202	0.99		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
3.0	580	0.0050	3.21	2.52	**Pipe Channel,** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.013 Corrugated PE, smooth interior
10.5	766	Total			

Subcatchment B3: SUB-B3



Summary for Subcatchment B4: SB-B4

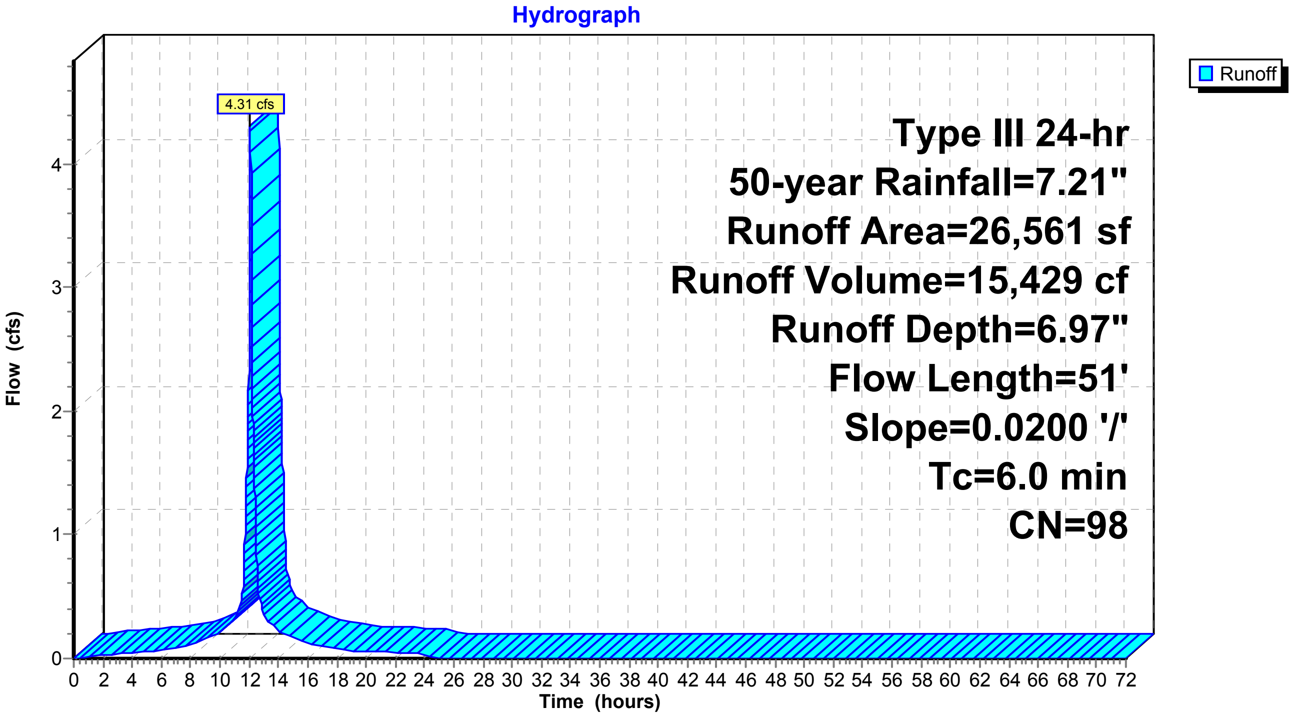
Runoff = 4.31 cfs @ 12.08 hrs, Volume= 15,429 cf, Depth= 6.97"
Routed to Pond IB-2 : IB-2

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 50-year Rainfall=7.21"

	Area (sf)	CN	Description
*	26,561	98	Impervious Area
	26,561		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.7	50	0.0200	1.24		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.43"
0.0	1	0.0200	2.87		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
0.7	51	Total, Increased to minimum Tc = 6.0 min			

Subcatchment B4: SB-B4



Summary for Pond IB-1: IB-1

Inflow Area = 281,580 sf, 37.15% Impervious, Inflow Depth = 5.16" for 50-year event
Inflow = 29.22 cfs @ 12.14 hrs, Volume= 121,097 cf
Outflow = 25.46 cfs @ 12.23 hrs, Volume= 121,098 cf, Atten= 13%, Lag= 5.3 min
Discarded = 0.32 cfs @ 12.23 hrs, Volume= 27,060 cf
Primary = 25.14 cfs @ 12.23 hrs, Volume= 94,039 cf
Routed to Pond IB-2 : IB-2
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf
Routed to Pond IB-2 : IB-2

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 246.57' @ 12.23 hrs Surf.Area= 13,626 sf Storage= 26,454 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 116.7 min (915.7 - 799.0)

Volume	Invert	Avail.Storage	Storage Description
#1	244.00'	44,476 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)
244.00	3,703	0	0	3,703
245.00	11,077	7,062	7,062	11,083
246.00	12,689	11,874	18,935	12,740
247.00	14,351	13,511	32,447	14,453
247.80	15,732	12,029	44,476	15,877

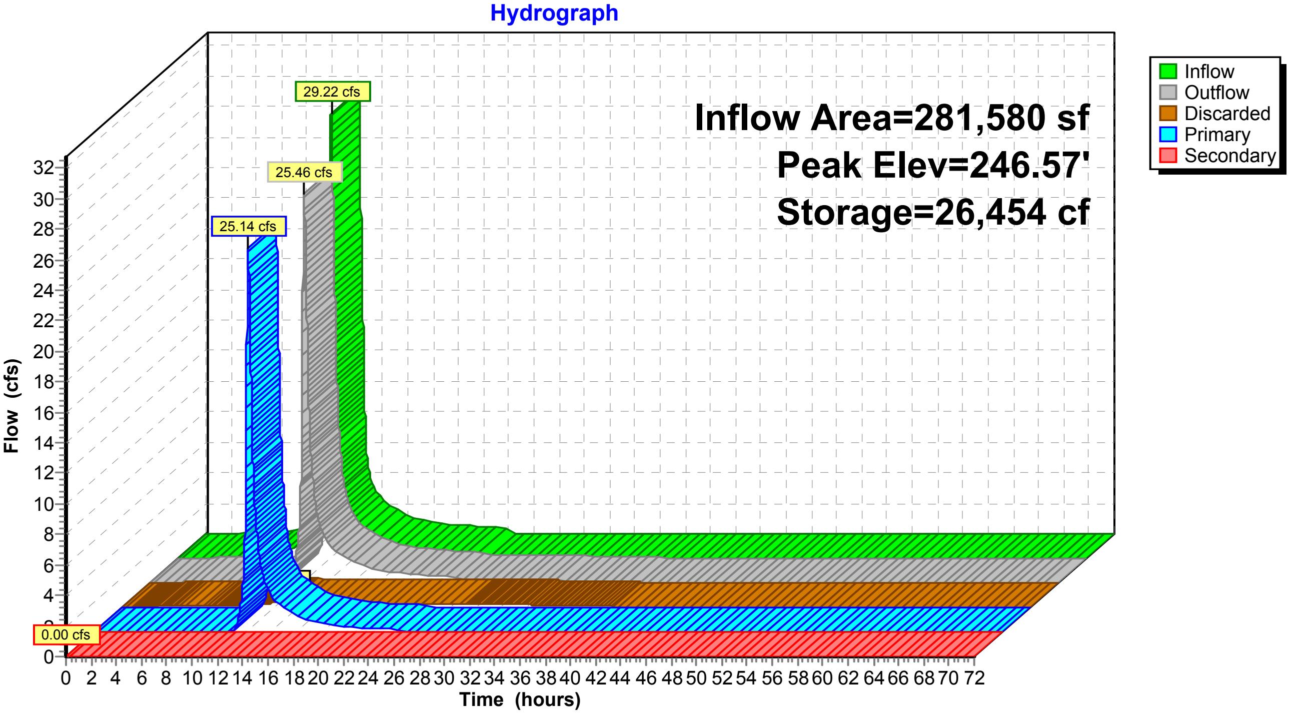
Device	Routing	Invert	Outlet Devices
#1	Secondary	246.80'	**10.0' long x 6.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.37 2.51 2.70 2.68 2.68 2.67 2.65 2.65 2.65 2.65 2.66 2.66 2.67 2.69 2.72 2.76 2.83
#2	Discarded	244.00'	**1.020 in/hr Exfiltration over Wetted area**
#3	Device 4	246.20'	**48.0" x 48.0" Horiz. Orifice/Grate (OCS-1)** C= 0.600 Limited to weir flow at low heads
#4	Primary	241.38'	**24.0" Round Culvert (OCS-1)** L= 70.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 241.38' / 241.00' S= 0.0054 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 3.14 sf
#5	Device 4	245.20'	**36.0" W x 12.0" H Vert. Orifice/Grate (OCS-1)** C= 0.600 Limited to weir flow at low heads

Discarded OutFlow Max=0.32 cfs @ 12.23 hrs HW=246.57' (Free Discharge)
↑—**2=Exfiltration** (Exfiltration Controls 0.32 cfs)

Primary OutFlow Max=25.14 cfs @ 12.23 hrs HW=246.57' TW=243.46' (Dynamic Tailwater)
↑—**4=Culvert (OCS-1)** (Passes 25.14 cfs of 26.67 cfs potential flow)
  ↑—**3=Orifice/Grate (OCS-1)** (Weir Controls 11.85 cfs @ 1.99 fps)
  └—**5=Orifice/Grate (OCS-1)** (Orifice Controls 13.29 cfs @ 4.43 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=244.00' TW=240.00' (Dynamic Tailwater)
↑—**1=Broad-Crested Rectangular Weir**(Controls 0.00 cfs)

Pond IB-1: IB-1



Summary for Pond IB-2: IB-2

[95] Warning: Outlet Device #7 rise exceeded

Inflow Area = 544,271 sf, 42.16% Impervious, Inflow Depth = 4.72" for 50-year event
Inflow = 48.98 cfs @ 12.23 hrs, Volume= 214,062 cf
Outflow = 26.86 cfs @ 12.53 hrs, Volume= 214,064 cf, Atten= 45%, Lag= 18.2 min
Discarded = 0.51 cfs @ 12.53 hrs, Volume= 47,252 cf
Primary = 19.32 cfs @ 12.53 hrs, Volume= 124,236 cf
    Routed to Link B : B
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf
    Routed to Link B : B
Tertiary = 7.02 cfs @ 12.53 hrs, Volume= 42,576 cf
    Routed to Link A : A

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 244.23' @ 12.53 hrs Surf.Area= 21,653 sf Storage= 66,536 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 175.9 min (985.6 - 809.7)

Volume	Invert	Avail.Storage	Storage Description
#1	240.00'	103,342 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)
240.00	5,945	0	0	5,945
241.00	12,658	9,093	9,093	12,666
242.00	16,770	14,666	23,758	16,801
243.00	18,908	17,828	41,587	18,990
244.00	21,137	20,012	61,599	21,275
245.00	23,418	22,268	83,867	23,617
245.80	25,283	19,476	103,342	25,533

Device	Routing	Invert	Outlet Devices
#1	Secondary	244.80'	**10.0' long x 6.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.37 2.51 2.70 2.68 2.68 2.67 2.65 2.65 2.65 2.65 2.66 2.66 2.67 2.69 2.72 2.76 2.83
#2	Discarded	240.00'	**1.020 in/hr Exfiltration over Wetted area**
#3	Device 5	242.00'	**4.0' long x 1.50' rise Sharp-Crested Vee/Trap Weir** Cv= 2.62 (C= 3.28)
#4	Device 5	243.50'	**48.0" x 48.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#5	Primary	241.28'	**24.0" Round Culvert** L= 30.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 241.28' / 241.13' S= 0.0050 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 3.14 sf
#6	Device 8	244.30'	**24.0" x 24.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

#7	Device 8	241.60'	**Custom Weir/Orifice, Cv= 2.62 (C= 3.28)** Head (feet) 0.00 1.50 Width (feet) 0.00 1.50
#8	Tertiary	238.25'	**12.0" Round Culvert** L= 50.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 238.25' / 238.00' S= 0.0050 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

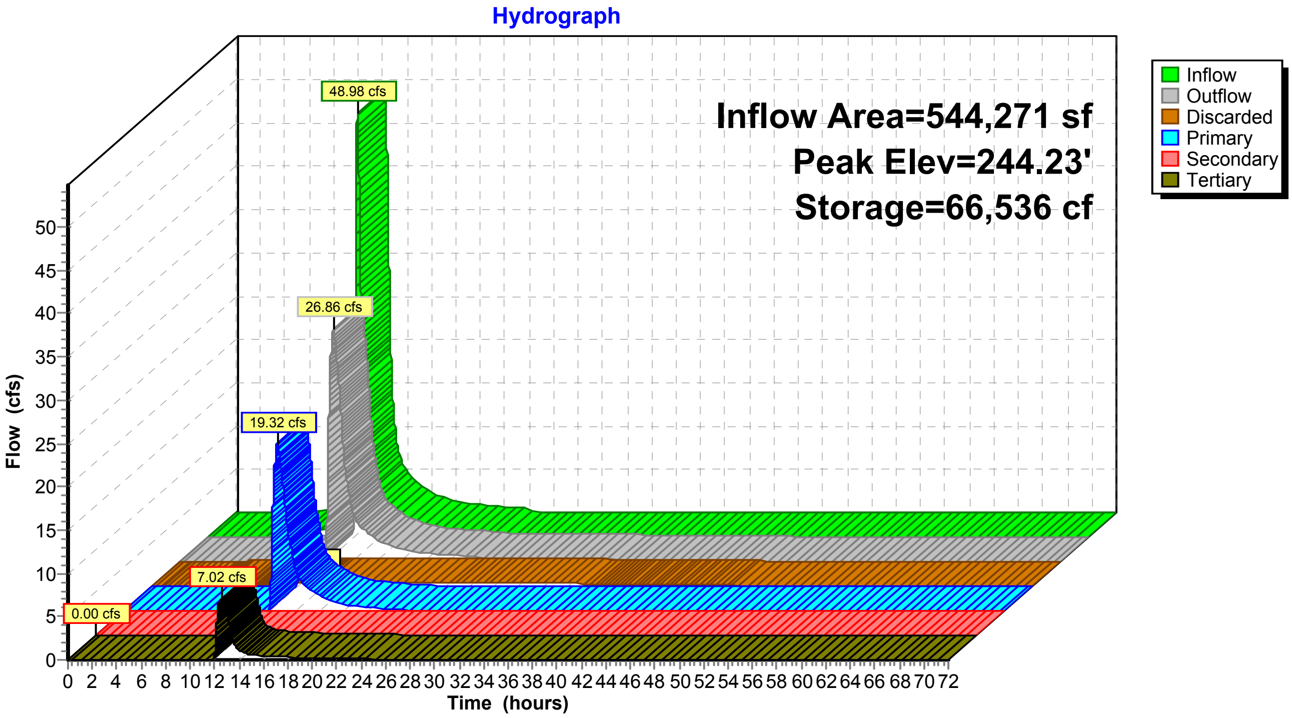
Discarded OutFlow Max=0.51 cfs @ 12.53 hrs HW=244.23' (Free Discharge)
└—**2=Exfiltration** (Exfiltration Controls 0.51 cfs)

Primary OutFlow Max=19.32 cfs @ 12.53 hrs HW=244.23' TW=0.00' (Dynamic Tailwater)
└—**5=Culvert** (Barrel Controls 19.32 cfs @ 6.15 fps)
  —**3=Sharp-Crested Vee/Trap Weir** (Passes < 35.46 cfs potential flow)
  └—**4=Orifice/Grate** (Passes < 32.68 cfs potential flow)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=240.00' TW=0.00' (Dynamic Tailwater)
└—**1=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Tertiary OutFlow Max=7.02 cfs @ 12.53 hrs HW=244.23' TW=0.00' (Dynamic Tailwater)
└—**8=Culvert** (Passes 7.02 cfs of 8.23 cfs potential flow)
  —**6=Orifice/Grate** (Controls 0.00 cfs)
  └—**7=Custom Weir/Orifice** (Orifice Controls 7.02 cfs @ 6.24 fps)

Pond IB-2: IB-2

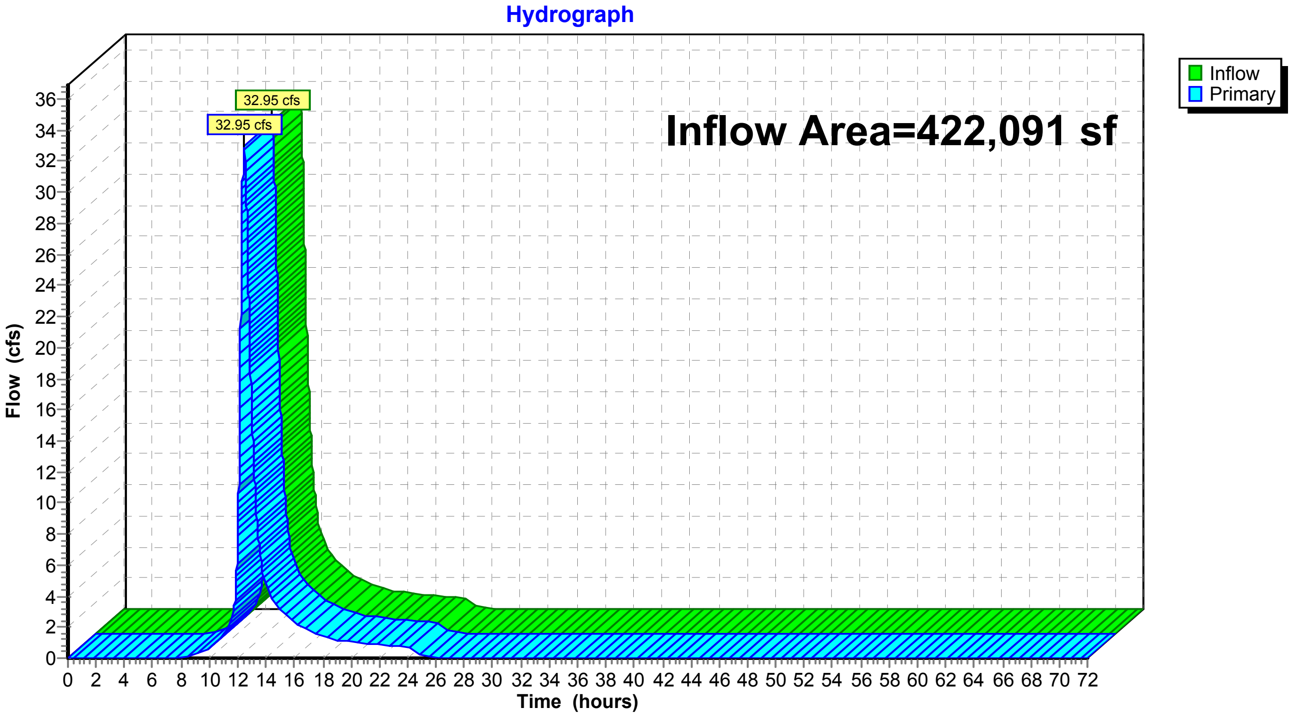


Summary for Link A: A

Inflow Area =	422,091 sf,	5.83% Impervious,	Inflow Depth = 5.44" for 50-year event
Inflow =	32.95 cfs @	12.46 hrs, Volume=	191,211 cf
Primary =	32.95 cfs @	12.46 hrs, Volume=	191,211 cf, Atten= 0%, Lag= 0.0 min

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

Link A: A

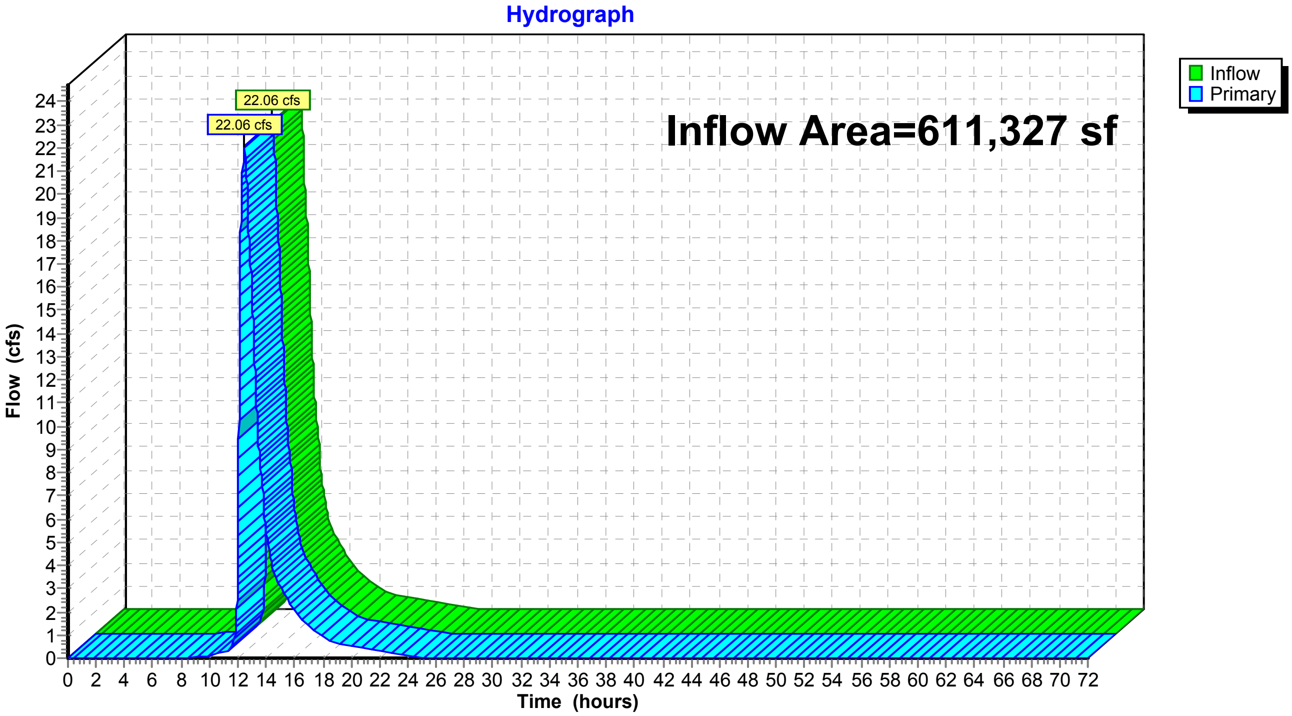


Summary for Link B: B

```
Inflow Area =         611,327 sf,  37.53% Impervious,  Inflow Depth =   2.88"    for  50-year event
Inflow      =       22.06 cfs @   12.46 hrs,  Volume=           146,636 cf
Primary     =       22.06 cfs @   12.46 hrs,  Volume=           146,636 cf,  Atten= 0%,  Lag= 0.0 min
```

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

Link B: B



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

SubcatchmentA1: SUB-A1 Runoff Area=422,091 sf 5.83% Impervious Runoff Depth=5.02"
Flow Length=1,620' Tc=32.8 min CN=74 Runoff=30.92 cfs 176,722 cf

SubcatchmentA2: SUB-A2 Runoff Area=197,483 sf 24.49% Impervious Runoff Depth=5.61"
Flow Length=1,333' Tc=13.6 min CN=79 Runoff=23.17 cfs 92,330 cf

SubcatchmentA3: SUB-A3 Runoff Area=45,304 sf 100.00% Impervious Runoff Depth=7.87"
Flow Length=51' Slope=0.0200 '/' Tc=6.0 min CN=98 Runoff=8.28 cfs 29,712 cf

SubcatchmentA4: SUB-A4 Runoff Area=38,793 sf 28.18% Impervious Runoff Depth=5.85"
Flow Length=515' Tc=8.4 min CN=81 Runoff=5.51 cfs 18,899 cf

SubcatchmentB1: SUB-B1 Runoff Area=187,914 sf 46.61% Impervious Runoff Depth=6.32"
Flow Length=1,482' Tc=20.5 min CN=85 Runoff=20.71 cfs 98,959 cf

SubcatchmentB2: SUB-B2 Runoff Area=67,056 sf 0.00% Impervious Runoff Depth=4.79"
Flow Length=438' Tc=14.5 min CN=72 Runoff=6.63 cfs 26,773 cf

SubcatchmentB3: SUB-B3 Runoff Area=48,216 sf 22.19% Impervious Runoff Depth=5.61"
Flow Length=766' Tc=10.5 min CN=79 Runoff=6.19 cfs 22,543 cf

SubcatchmentB4: SB-B4 Runoff Area=26,561 sf 100.00% Impervious Runoff Depth=7.87"
Flow Length=51' Slope=0.0200 '/' Tc=6.0 min CN=98 Runoff=4.86 cfs 17,420 cf

Pond IB-1: IB-1 Peak Elev=246.74' Storage=28,720 cf Inflow=33.91 cfs 140,942 cf
Discarded=0.33 cfs 27,677 cf Primary=27.19 cfs 113,265 cf Secondary=0.00 cfs 0 cf Outflow=27.52 cfs 140,942 cf

Pond IB-2: IB-2 Peak Elev=244.66' Storage=76,133 cf Inflow=53.79 cfs 252,187 cf
309 cf Primary=22.81 cfs 151,776 cf Secondary=0.00 cfs 0 cf Tertiary=8.56 cfs 52,104 cf Outflow=31.91 cfs 252,189 cf

Link A: A Inflow=39.39 cfs 228,826 cf
Primary=39.39 cfs 228,826 cf

Link B: B Inflow=25.91 cfs 178,548 cf
Primary=25.91 cfs 178,548 cf

Total Runoff Area = 1,033,418 sf Runoff Volume = 483,357 cf Average Runoff Depth = 5.61"
75.42% Pervious = 779,369 sf 24.58% Impervious = 254,049 sf

Summary for Subcatchment A1: SUB-A1

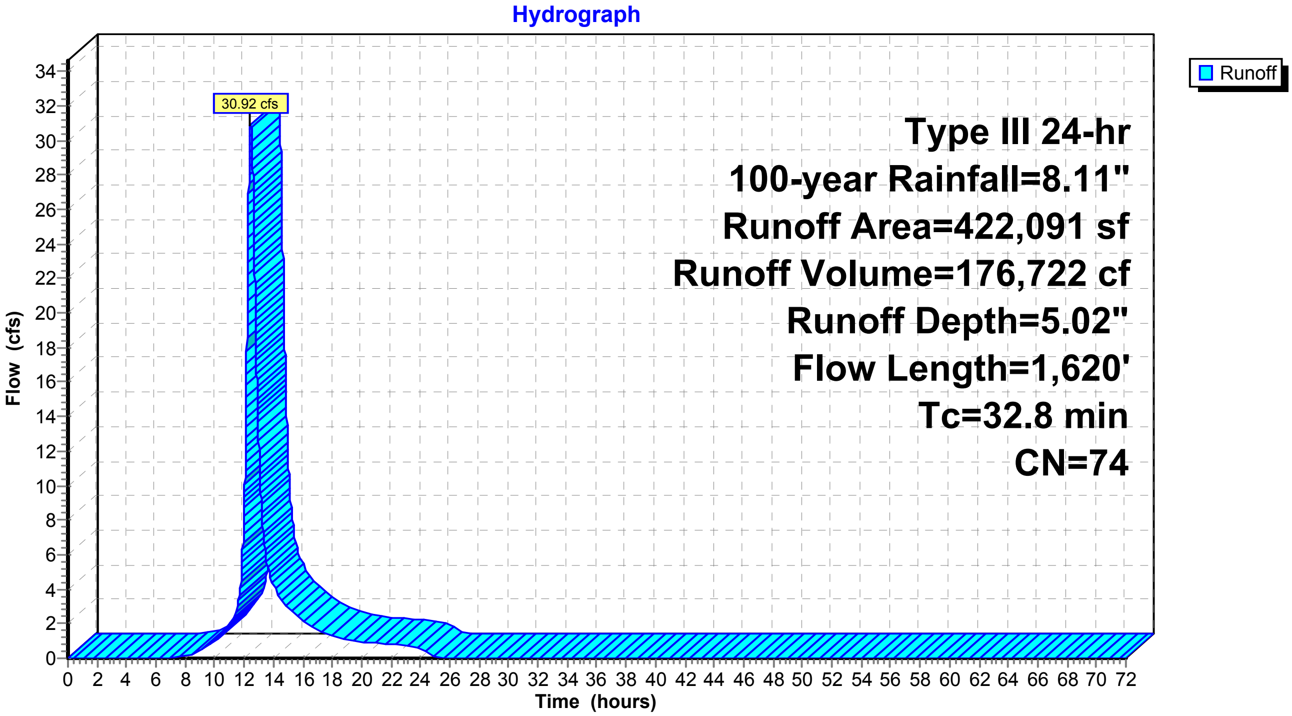
Runoff = 30.92 cfs @ 12.43 hrs, Volume= 176,722 cf, Depth= 5.02"
Routed to Link A : A

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-year Rainfall=8.11"

	Area (sf)	CN	Description
	127,217	74	>75% Grass cover, Good, HSG C
	211,698	70	Woods, Good, HSG C
*	24,606	98	Impervious Area
	716	96	Gravel surface, HSG C
	57,854	77	Woods, Good, HSG D
	422,091	74	Weighted Average
	397,485		94.17% Pervious Area
	24,606		5.83% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.9	50	0.0200	0.07		**Sheet Flow, Sheet** Woods: Light underbrush n= 0.400 P2= 3.43"
19.4	1,010	0.0300	0.87		**Shallow Concentrated Flow, Shallow** Woodland Kv= 5.0 fps
1.5	560	0.0200	6.38	76.61	**Trap/Vee/Rect Channel Flow,** Bot.W=2.00' D=2.00' Z= 2.0 '/' Top.W=10.00' n= 0.035 Earth, dense weeds
32.8	1,620	Total			

Subcatchment A1: SUB-A1



Summary for Subcatchment A2: SUB-A2

[47] Hint: Peak is 920% of capacity of segment #6

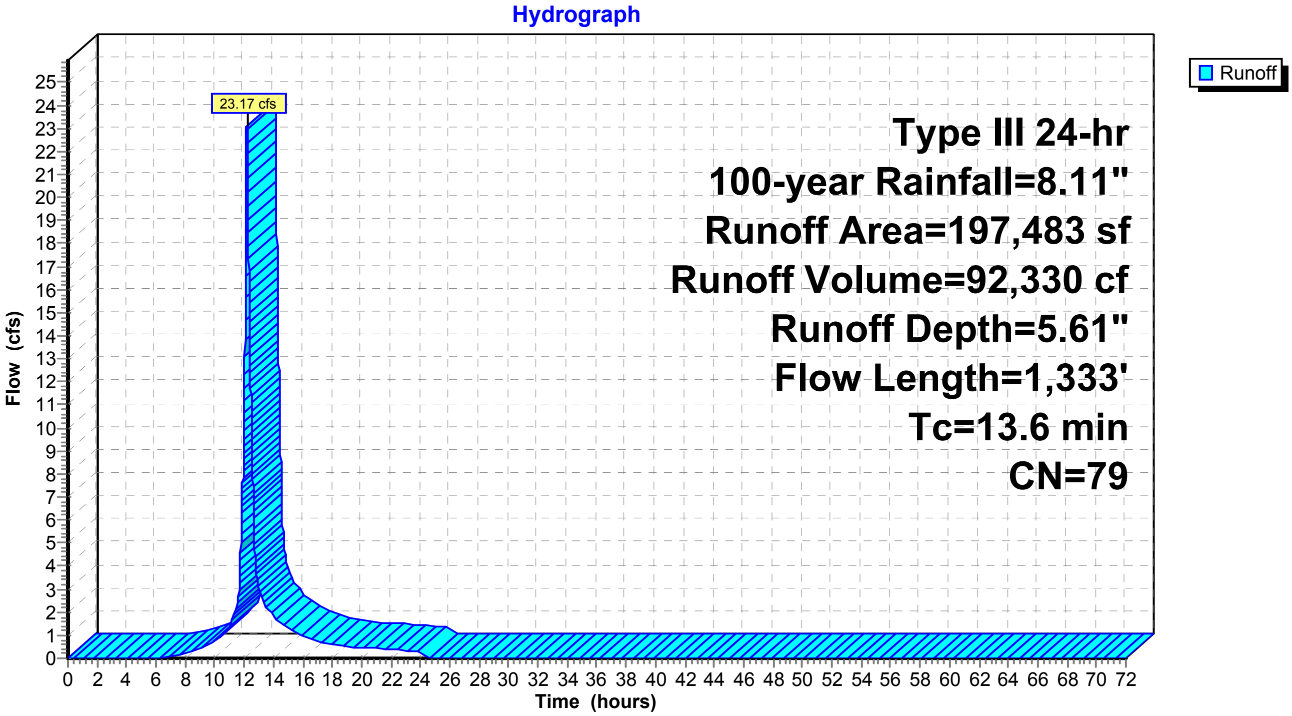
Runoff = 23.17 cfs @ 12.18 hrs, Volume= 92,330 cf, Depth= 5.61"
Routed to Pond IB-1 : IB-1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-year Rainfall=8.11"

	Area (sf)	CN	Description
	83,784	74	>75% Grass cover, Good, HSG C
	52,545	70	Woods, Good, HSG C
*	44,663	98	Impervious Area
	1,148	96	Gravel surface, HSG C
*	3,703	98	Infiltration Basin Floor
	11,640	77	Woods, Good, HSG D
	197,483	79	Weighted Average
	149,117		75.51% Pervious Area
	48,366		24.49% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.6	50	0.0300	0.18		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.43"
2.9	208	0.0300	1.21		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.9	77	0.0900	1.50		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
0.1	22	0.2500	3.50		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.8	141	0.0200	2.87		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
4.3	835	0.0050	3.21	2.52	**Pipe Channel,** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.013 Corrugated PE, smooth interior
13.6	1,333	Total			

Subcatchment A2: SUB-A2



Summary for Subcatchment A3: SUB-A3

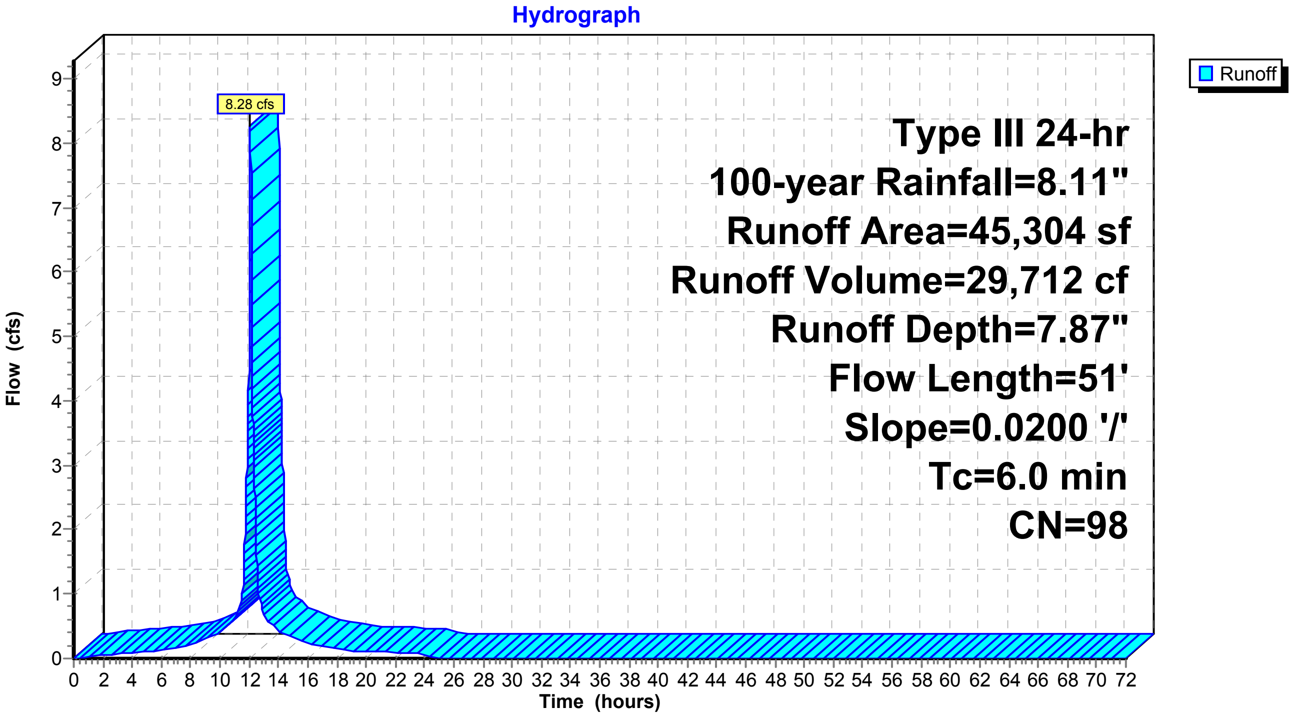
Runoff = 8.28 cfs @ 12.08 hrs, Volume= 29,712 cf, Depth= 7.87"
Routed to Pond IB-1 : IB-1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-year Rainfall=8.11"

	Area (sf)	CN	Description
*	45,304	98	Impervious Area
	45,304		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.7	50	0.0200	1.24		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.43"
0.0	1	0.0200	2.87		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
0.7	51	Total, Increased to minimum Tc = 6.0 min			

Subcatchment A3: SUB-A3



Summary for Subcatchment A4: SUB-A4

[47] Hint: Peak is 219% of capacity of segment #5

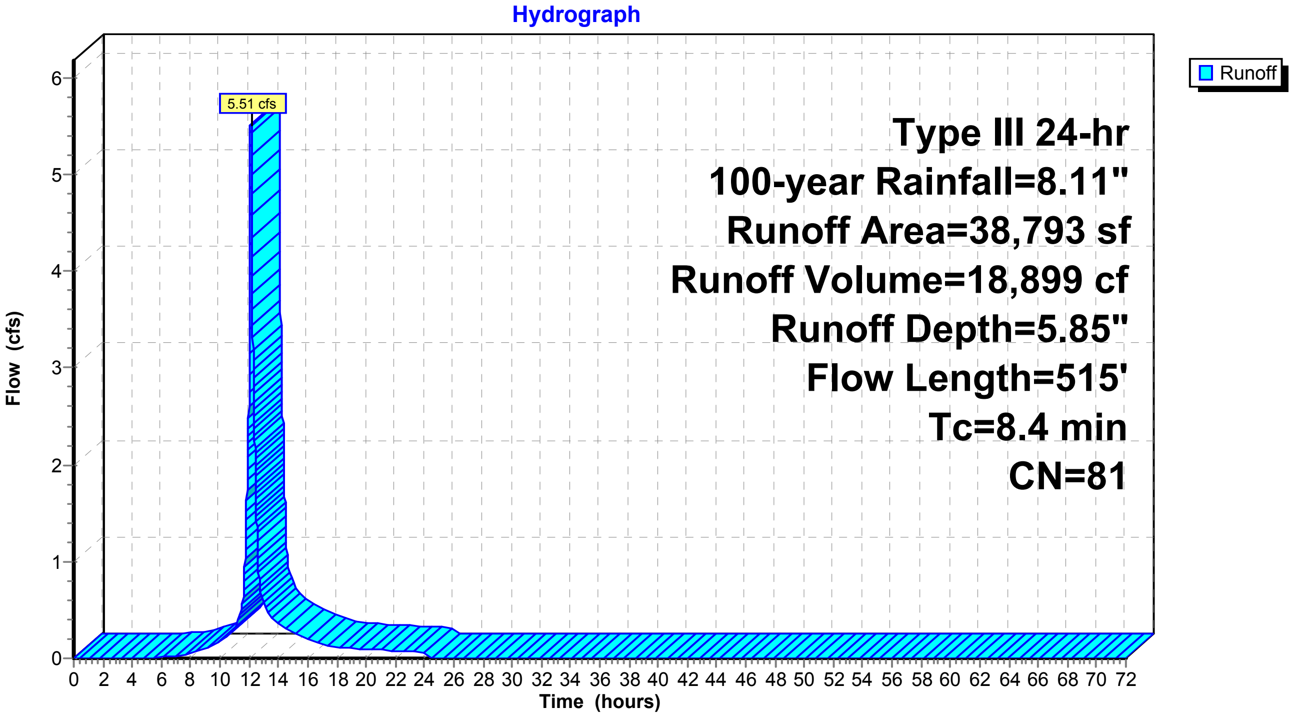
Runoff = 5.51 cfs @ 12.12 hrs, Volume= 18,899 cf, Depth= 5.85"
Routed to Pond IB-1 : IB-1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-year Rainfall=8.11"

	Area (sf)	CN	Description
	27,860	74	>75% Grass cover, Good, HSG C
*	10,933	98	Impervious Area
	38,793	81	Weighted Average
	27,860		71.82% Pervious Area
	10,933		28.18% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.8	50	0.0280	0.18		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.43"
0.0	8	0.0200	2.87		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
1.0	70	0.0294	1.20		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.9	57	0.0221	1.04		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
1.7	330	0.0050	3.21	2.52	**Pipe Channel,** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.013 Corrugated PE, smooth interior
8.4	515	Total			

Subcatchment A4: SUB-A4



Summary for Subcatchment B1: SUB-B1

[47] Hint: Peak is 822% of capacity of segment #5

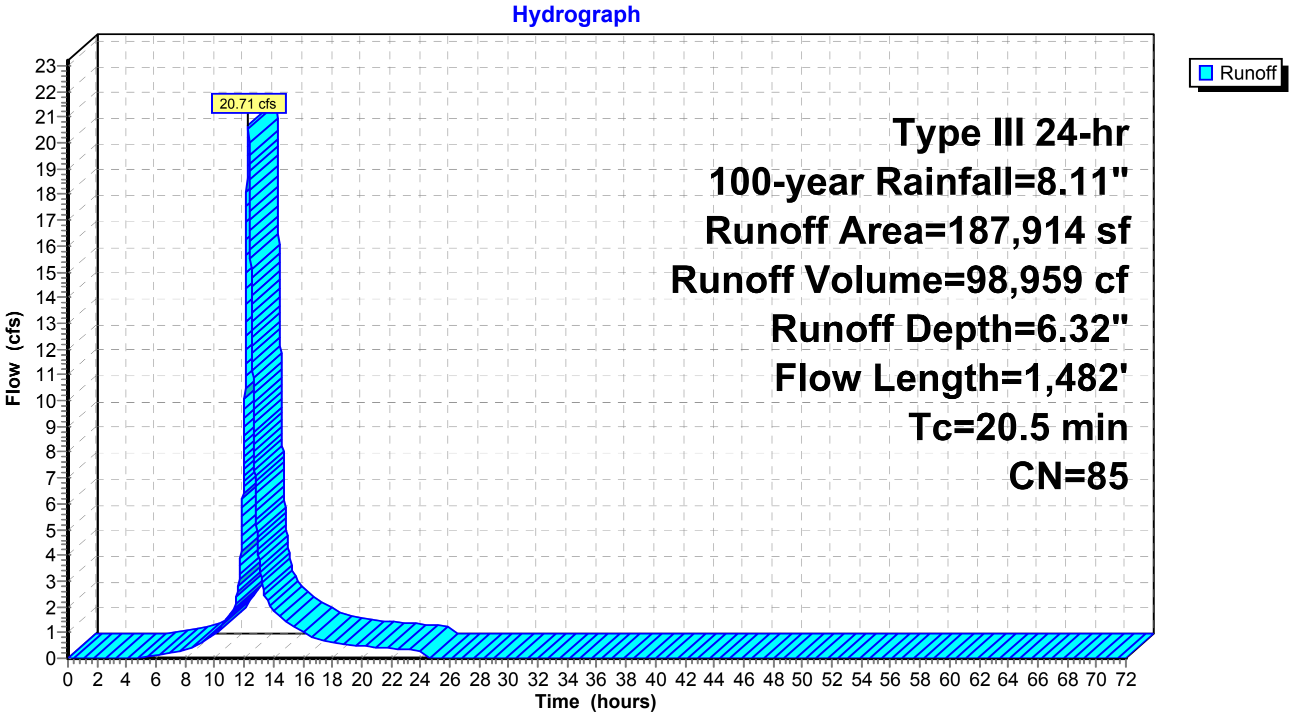
```
Runoff      =       20.71 cfs @   12.28 hrs,  Volume=          98,959 cf,  Depth=  6.32"
    Routed to Pond IB-2 : IB-2
```

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-year Rainfall=8.11"

	Area (sf)	CN	Description
	76,568	74	>75% Grass cover, Good, HSG C
	23,764	70	Woods, Good, HSG C
*	81,637	98	Impervious Area
*	5,945	98	Infiltration Basin Floor
	187,914	85	Weighted Average
	100,332		53.39% Pervious Area
	87,582		46.61% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.6	50	0.0340	0.09		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.43"
5.1	319	0.0435	1.04		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
0.2	28	0.1535	2.74		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.5	102	0.0245	3.18		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
5.1	983	0.0050	3.21	2.52	**Pipe Channel,** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.013 Corrugated PE, smooth interior
20.5	1,482	Total			

Subcatchment B1: SUB-B1



Summary for Subcatchment B2: SUB-B2

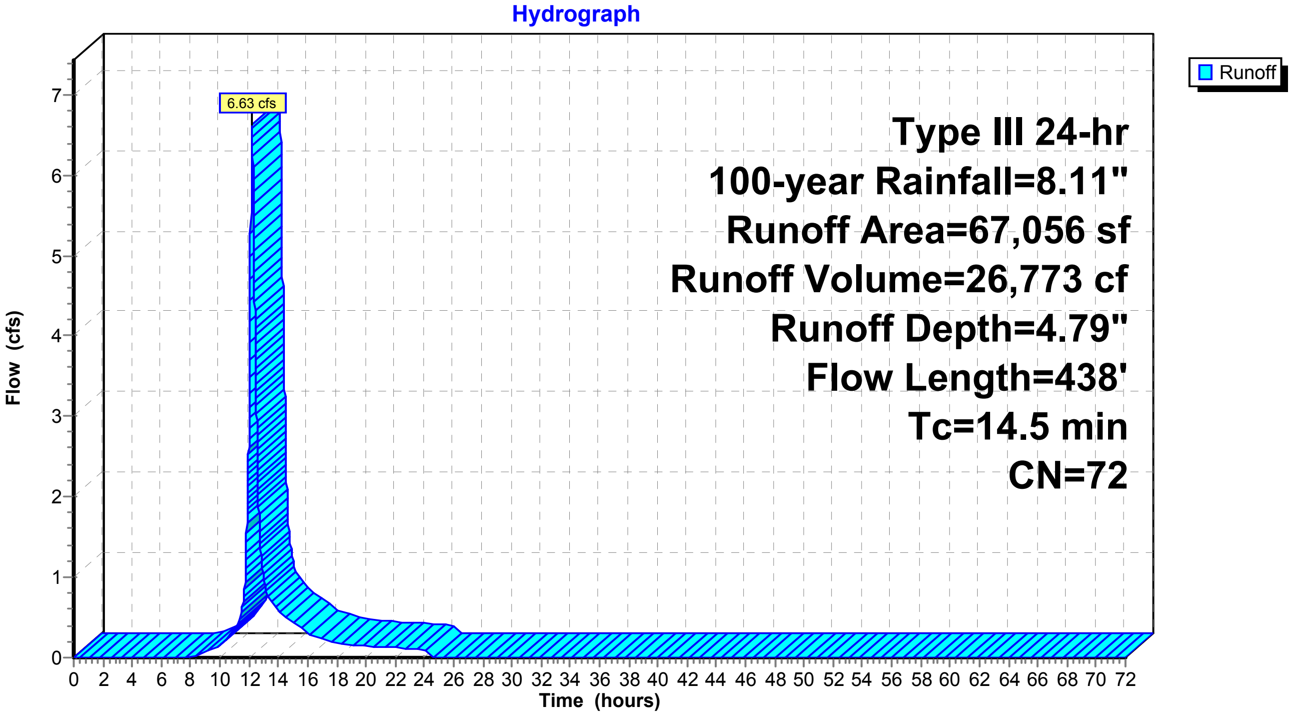
Runoff = 6.63 cfs @ 12.20 hrs, Volume= 26,773 cf, Depth= 4.79"
Routed to Link B : B

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-year Rainfall=8.11"

Area (sf)	CN	Description
29,339	74	>75% Grass cover, Good, HSG C
37,717	70	Woods, Good, HSG C
67,056	72	Weighted Average
67,056		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.3	50	0.0500	0.10		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.43"
6.2	388	0.0438	1.05		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
14.5	438	Total			

Subcatchment B2: SUB-B2



Summary for Subcatchment B3: SUB-B3

[47] Hint: Peak is 246% of capacity of segment #5

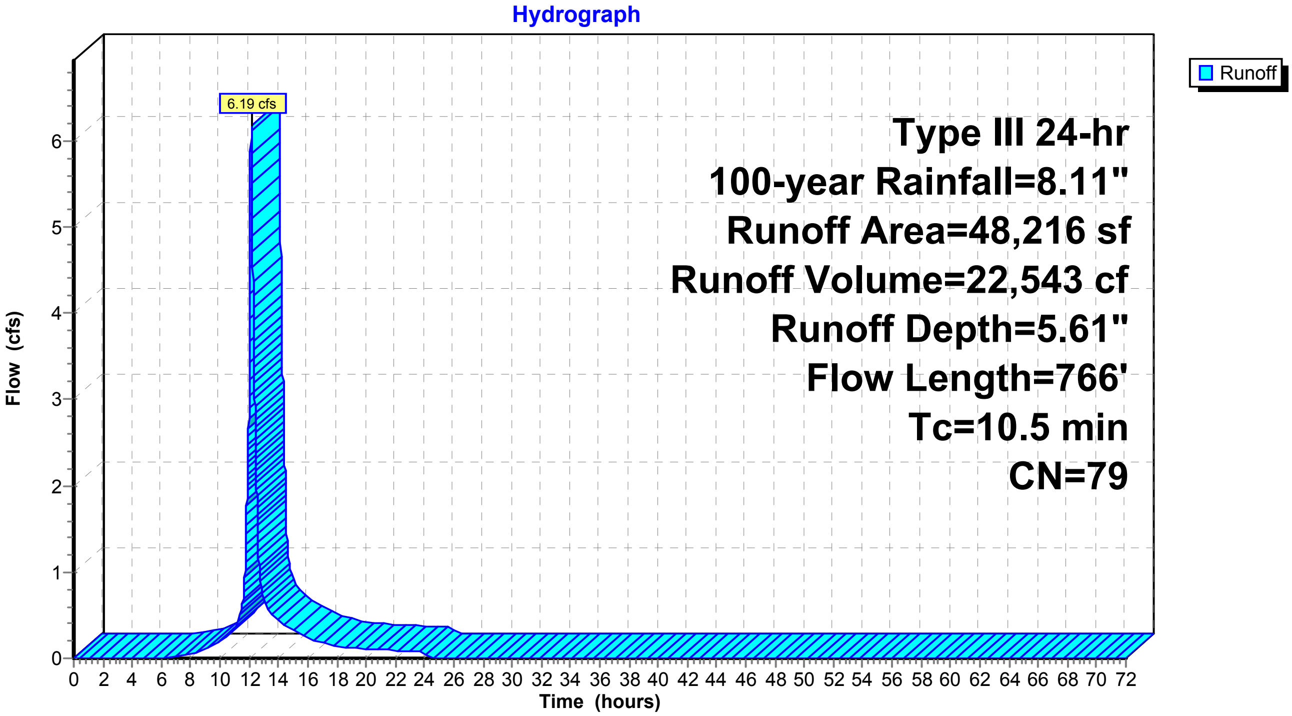
Runoff = 6.19 cfs @ 12.14 hrs, Volume= 22,543 cf, Depth= 5.61"
Routed to Pond IB-2 : IB-2

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-year Rainfall=8.11"

	Area (sf)	CN	Description
	37,519	74	>75% Grass cover, Good, HSG C
*	10,697	98	Impervious Area
	48,216	79	Weighted Average
	37,519		77.81% Pervious Area
	10,697		22.19% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.4	50	0.0200	0.15		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.43"
0.6	40	0.0275	1.16		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.0	7	0.0200	2.87		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
1.5	89	0.0202	0.99		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
3.0	580	0.0050	3.21	2.52	**Pipe Channel,** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.013 Corrugated PE, smooth interior
10.5	766	Total			

Subcatchment B3: SUB-B3



Summary for Subcatchment B4: SB-B4

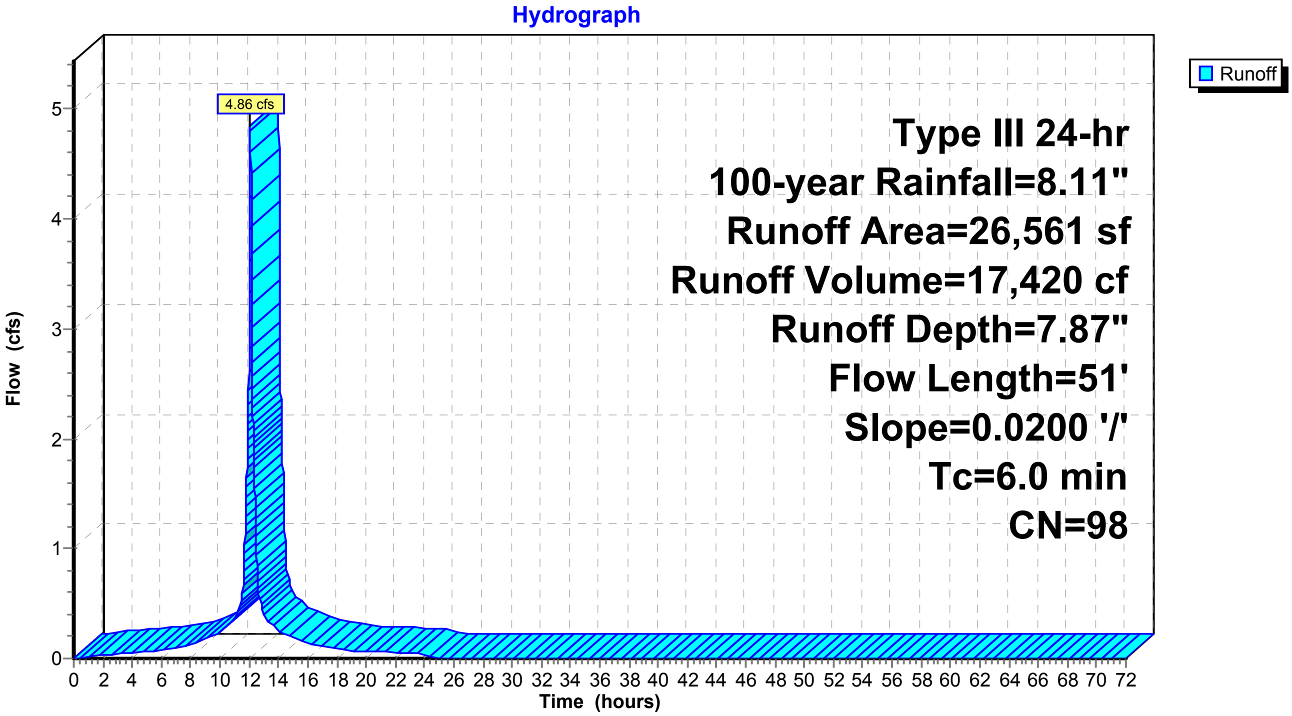
Runoff = 4.86 cfs @ 12.08 hrs, Volume= 17,420 cf, Depth= 7.87"
Routed to Pond IB-2 : IB-2

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-year Rainfall=8.11"

	Area (sf)	CN	Description
*	26,561	98	Impervious Area
	26,561		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.7	50	0.0200	1.24		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.43"
0.0	1	0.0200	2.87		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
0.7	51	Total, Increased to minimum Tc = 6.0 min			

Subcatchment B4: SB-B4



Summary for Pond IB-1: IB-1

```
Inflow Area =         281,580 sf,  37.15% Impervious,  Inflow Depth =   6.01"    for  100-year event
Inflow      =       33.91 cfs @   12.14 hrs,  Volume=          140,942 cf
Outflow     =       27.52 cfs @   12.16 hrs,  Volume=          140,942 cf,  Atten= 19%,  Lag= 1.1 min
Discarded   =        0.33 cfs @   12.29 hrs,  Volume=           27,677 cf
Primary     =       27.19 cfs @   12.16 hrs,  Volume=          113,265 cf
    Routed to Pond IB-2 : IB-2
Secondary =          0.00 cfs @    0.00 hrs,  Volume=                0 cf
    Routed to Pond IB-2 : IB-2

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 246.74' @ 12.29 hrs   Surf.Area= 13,903 sf   Storage= 28,720 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 105.3 min ( 900.9 - 795.6 )
```

Volume	Invert	Avail.Storage	Storage Description
#1	244.00'	44,476 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)
244.00	3,703	0	0	3,703
245.00	11,077	7,062	7,062	11,083
246.00	12,689	11,874	18,935	12,740
247.00	14,351	13,511	32,447	14,453
247.80	15,732	12,029	44,476	15,877

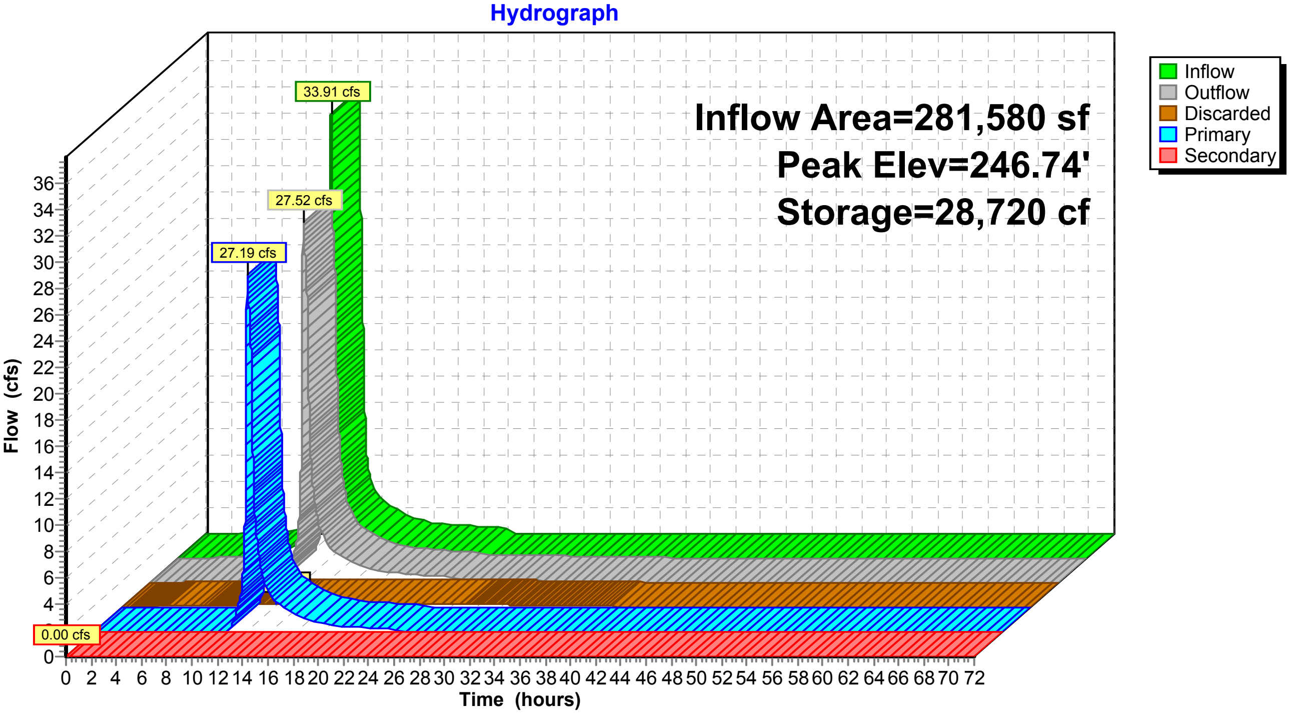
Device	Routing	Invert	Outlet Devices
#1	Secondary	246.80'	**10.0' long x 6.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.37 2.51 2.70 2.68 2.68 2.67 2.65 2.65 2.65 2.65 2.66 2.66 2.67 2.69 2.72 2.76 2.83
#2	Discarded	244.00'	**1.020 in/hr Exfiltration over Wetted area**
#3	Device 4	246.20'	**48.0" x 48.0" Horiz. Orifice/Grate (OCS-1)** C= 0.600 Limited to weir flow at low heads
#4	Primary	241.38'	**24.0" Round Culvert (OCS-1)** L= 70.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 241.38' / 241.00' S= 0.0054 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 3.14 sf
#5	Device 4	245.20'	**36.0" W x 12.0" H Vert. Orifice/Grate (OCS-1)** C= 0.600 Limited to weir flow at low heads

Discarded OutFlow Max=0.33 cfs @ 12.29 hrs HW=246.74' (Free Discharge)
└**2=Exfiltration** (Exfiltration Controls 0.33 cfs)

Primary OutFlow Max=26.91 cfs @ 12.16 hrs HW=246.62' TW=243.46' (Dynamic Tailwater)
└**4=Culvert (OCS-1)** (Inlet Controls 26.91 cfs @ 8.56 fps)
  ├**3=Orifice/Grate (OCS-1)** (Passes < 14.29 cfs potential flow)
  └**5=Orifice/Grate (OCS-1)** (Passes < 13.68 cfs potential flow)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=244.00' TW=240.00' (Dynamic Tailwater)
└**1=Broad-Crested Rectangular Weir**(Controls 0.00 cfs)

Pond IB-1: IB-1



Summary for Pond IB-2: IB-2

[95] Warning: Outlet Device #7 rise exceeded

Inflow Area = 544,271 sf, 42.16% Impervious, Inflow Depth = 5.56" for 100-year event
Inflow = 53.79 cfs @ 12.18 hrs, Volume= 252,187 cf
Outflow = 31.91 cfs @ 12.55 hrs, Volume= 252,189 cf, Atten= 41%, Lag= 21.7 min
Discarded = 0.54 cfs @ 12.55 hrs, Volume= 48,309 cf
Primary = 22.81 cfs @ 12.55 hrs, Volume= 151,776 cf
Routed to Link B : B
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf
Routed to Link B : B
Tertiary = 8.56 cfs @ 12.55 hrs, Volume= 52,104 cf
Routed to Link A : A

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 244.66' @ 12.55 hrs Surf.Area= 22,639 sf Storage= 76,133 cf

Plug-Flow detention time= 156.4 min calculated for 252,154 cf (100% of inflow)
Center-of-Mass det. time= 156.5 min (963.8 - 807.2)

Volume	Invert	Avail.Storage	Storage Description
#1	240.00'	103,342 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)
240.00	5,945	0	0	5,945
241.00	12,658	9,093	9,093	12,666
242.00	16,770	14,666	23,758	16,801
243.00	18,908	17,828	41,587	18,990
244.00	21,137	20,012	61,599	21,275
245.00	23,418	22,268	83,867	23,617
245.80	25,283	19,476	103,342	25,533

Device	Routing	Invert	Outlet Devices
#1	Secondary	244.80'	**10.0' long x 6.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.37 2.51 2.70 2.68 2.68 2.67 2.65 2.65 2.65 2.65 2.66 2.66 2.67 2.69 2.72 2.76 2.83
#2	Discarded	240.00'	**1.020 in/hr Exfiltration over Wetted area**
#3	Device 5	242.00'	**4.0' long x 1.50' rise Sharp-Crested Vee/Trap Weir** Cv= 2.62 (C= 3.28)
#4	Device 5	243.50'	**48.0" x 48.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#5	Primary	241.28'	**24.0" Round Culvert** L= 30.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 241.28' / 241.13' S= 0.0050 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 3.14 sf
#6	Device 8	244.30'	**24.0" x 24.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

#7	Device 8	241.60'	**Custom Weir/Orifice, Cv= 2.62 (C= 3.28)** Head (feet) 0.00 1.50 Width (feet) 0.00 1.50
#8	Tertiary	238.25'	**12.0" Round Culvert** L= 50.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 238.25' / 238.00' S= 0.0050 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

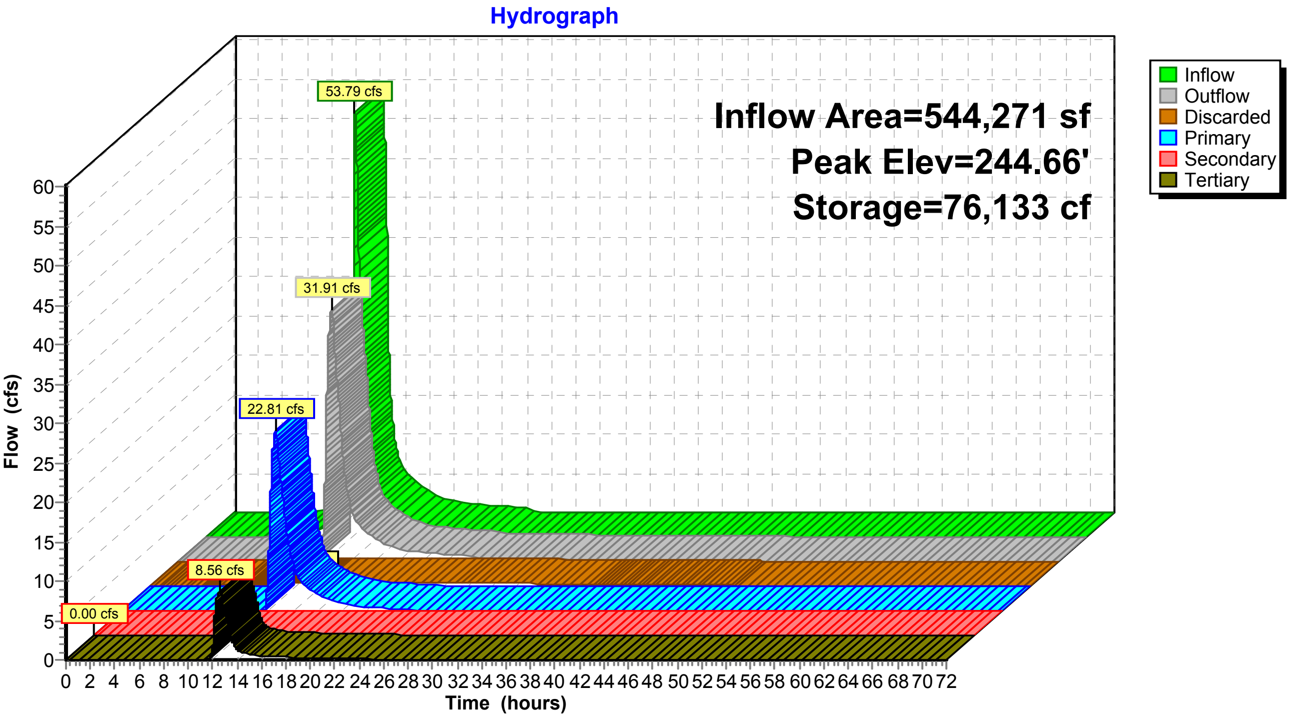
Discarded OutFlow Max=0.54 cfs @ 12.55 hrs HW=244.66' (Free Discharge)
↑—**2=Exfiltration** (Exfiltration Controls 0.54 cfs)

Primary OutFlow Max=22.81 cfs @ 12.55 hrs HW=244.66' TW=0.00' (Dynamic Tailwater)
↑—**5=Culvert** (Barrel Controls 22.81 cfs @ 7.26 fps)
  ↑—**3=Sharp-Crested Vee/Trap Weir** (Passes < 40.51 cfs potential flow)
  └—**4=Orifice/Grate** (Passes < 65.70 cfs potential flow)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=240.00' TW=0.00' (Dynamic Tailwater)
↑—**1=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Tertiary OutFlow Max=8.56 cfs @ 12.55 hrs HW=244.66' TW=0.00' (Dynamic Tailwater)
↑—**8=Culvert** (Barrel Controls 8.56 cfs @ 10.90 fps)
  ↑—**6=Orifice/Grate** (Passes < 5.74 cfs potential flow)
  └—**7=Custom Weir/Orifice** (Passes < 7.91 cfs potential flow)

Pond IB-2: IB-2

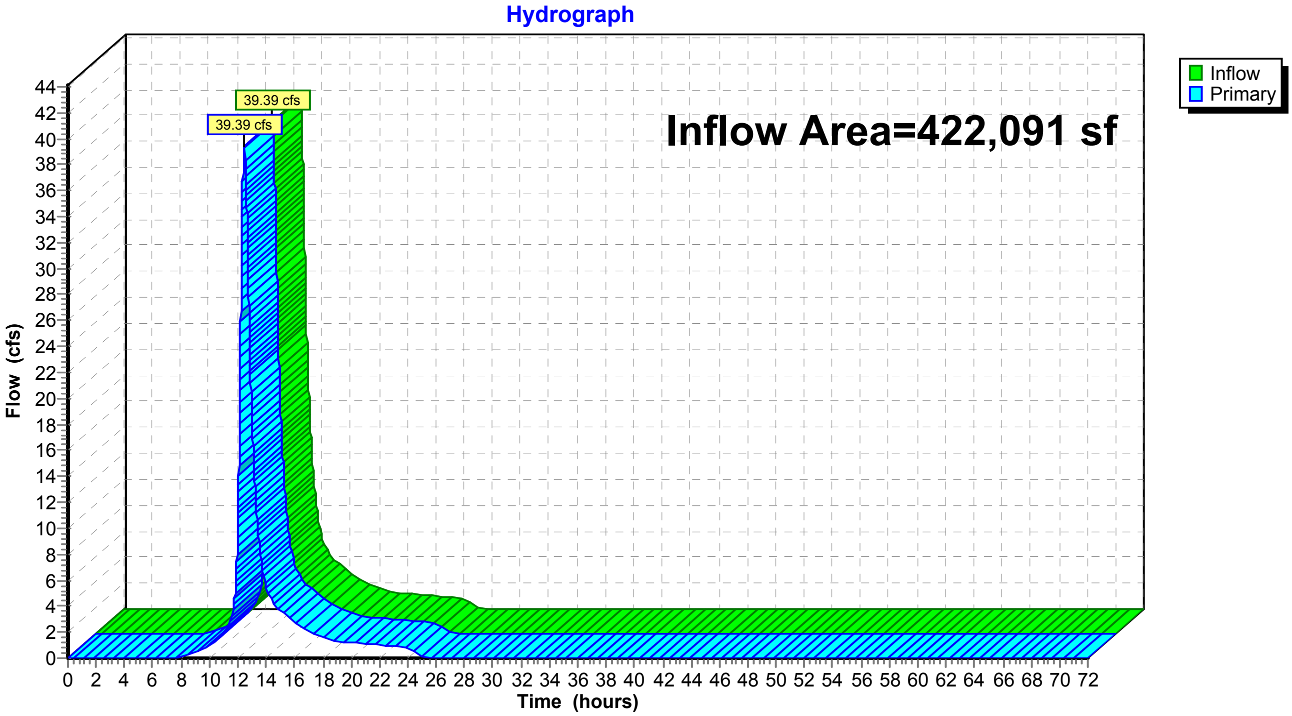


Summary for Link A: A

Inflow Area = 422,091 sf, 5.83% Impervious, Inflow Depth = 6.51" for 100-year event
Inflow = 39.39 cfs @ 12.45 hrs, Volume= 228,826 cf
Primary = 39.39 cfs @ 12.45 hrs, Volume= 228,826 cf, Atten= 0%, Lag= 0.0 min

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

Link A: A

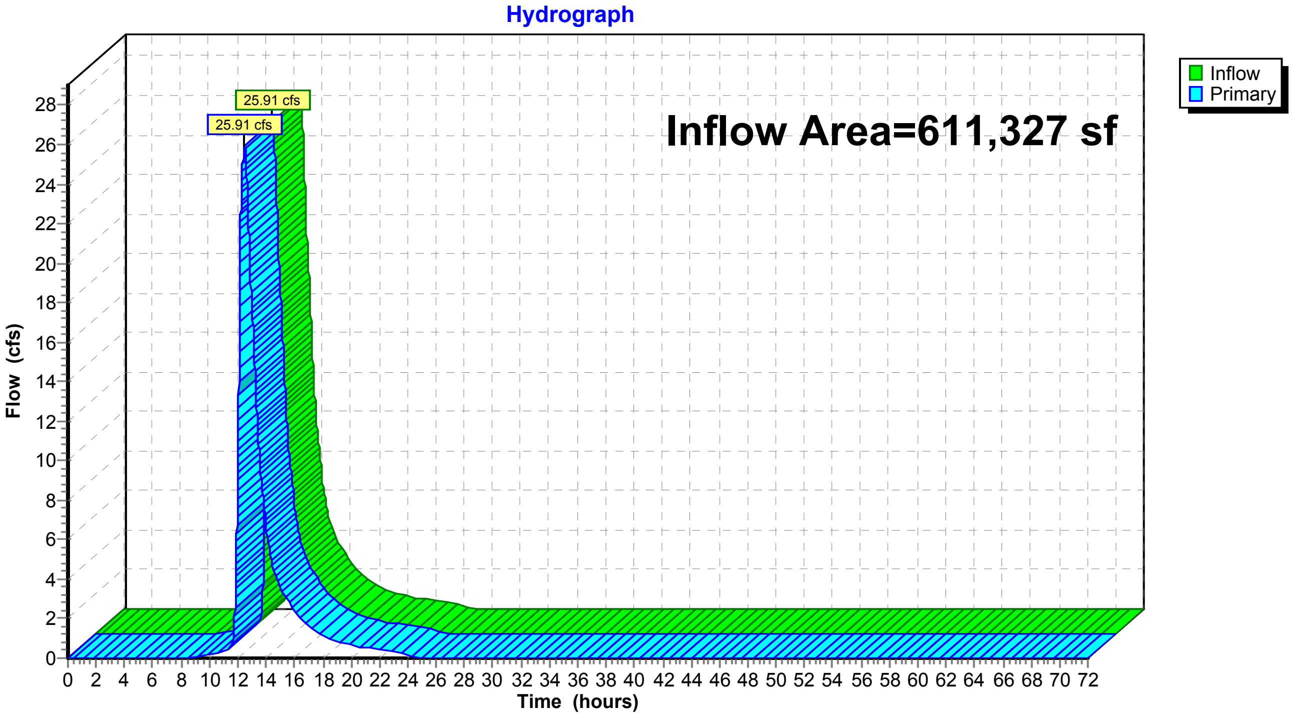


Summary for Link B: B

Inflow Area =	611,327 sf,	37.53% Impervious,	Inflow Depth = 3.50"	for 100-year event	
Inflow =	25.91 cfs @	12.47 hrs,	Volume=	178,548 cf	
Primary =	25.91 cfs @	12.47 hrs,	Volume=	178,548 cf,	Atten= 0%, Lag= 0.0 min

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

Link B: B



Attachment F - Calculations

Attachment F.1 - Peak Discharge Summary

Walnut Street Senior Development
Foxborough, MA
Stormwater Discharge Summary Table
9-Mar-23

		Peak Discharge (cfs)		**Runoff Volume (cf)**	
Analysis Point	**24 Hr Storm**	**Pre-Development**	**Post-Development**	**Pre-Development**	**Post-Development**
A	2yr	8.90	**7.07**	53,498	**49,404**
	10yr	20.27	**19.21**	116,653	**112,168**
	25yr	28.07	**27.30**	160,473	**157,017**
	50yr	34.04	**32.95**	194,422	**191,211**
	100yr	40.55	**39.39**	231,759	**228,826**
B	2yr	7.18	**2.57**	39,652	**22,874**
	10yr	17.28	**12.42**	89,437	**79,832**
	25yr	24.30	**18.21**	124,444	**117,324**
	50yr	29.70	**22.06**	151,716	**146,636**
	100yr	35.62	**25.91**	181,821	**178,548**

Attachment F.2 - TSS Removal Worksheets

V

INSTRUCTIONS:
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.

Version 1, Automated: Mar. 4, 2008

TSS Removal Calculation Worksheet

Location: Infiltration Basin 1 (IB-1)

B BMP[1]	C TSS Removal Rate[1]	D Starting TSS Load*	E Amount Removed (C*D)	F Remaining Load (D-E)
Deep Sump and Hooded Catch Basin	**0.25**	**1.00**	**0.25**	**0.75**
Infiltration Basin	**0.80**	**0.75**	**0.60**	**0.15**
	0.00	**0.15**	**0.00**	**0.15**
	0.00	**0.15**	**0.00**	**0.15**
	0.00	**0.15**	**0.00**	**0.15**

Total TSS Removal = **85%**

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

Project: **Walnut Street Senior Development**
Prepared By: **Dylan Erickson**
Date: **12/13/2022**

*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

Mass. Dept. of Environmental Protection

V

INSTRUCTIONS:
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.

Version 1, Automated: Mar. 4, 2008

Location: Infiltration Basin 2 (IB-2)

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)
Deep Sump and Hooded Catch Basin	**0.25**	**1.00**	**0.25**	**0.75**
Infiltration Basin	**0.80**	**0.75**	**0.60**	**0.15**
	0.00	**0.15**	**0.00**	**0.15**
	0.00	**0.15**	**0.00**	**0.15**
	0.00	**0.15**	**0.00**	**0.15**

Total TSS Removal = **85%**

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

Project: **Walnut Street Senior Development**
Prepared By: **Dylan Erickson**
Date: **12/13/2022**

*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

Mass. Dept. of Environmental Protection

Attachment F.3 – Recharge Volume Calculations

Walnut Street Senior Development
Recharge Volume Calculation

Required Recharge

Area Summary	
	Area (SF)*
Existing Impervious	30,059
Proposed Impervious	244,401
Required Recharge Area *(Proposed - Existing)*	214,342

* Areas calculated in HydroCAD

Hydrologic Soil Group Summary		
Group	Target Depth Factor (in)	Area (SF)
A	0.6	0
B	0.35	214,342
C	0.25	0
D	0.1	0

Required Recharge (*Rv*) Calculation:

Rv = Target Depth Factor x Δ Impervious Area
Rv = 0.35 x (1/12) x 214,342
Rv = 6,252 CF

Proposed Recharge Summary

Location	Volume (CF)*	Description
Infiltration Basin #1	9,308	IB-1
Infiltration Basin #2	17,396	IB-2
Total	26,704	

Rv = 6,252 CF
Provided recharge = 26,704 CF

Recharge Requirement is met.

*Note: Volume numbers listed above reflect static volume available in recharge systems. Actual volume of recharged water will be much higher due to dynamic action reflected in the HydroCAD analysis.

Attachment F.4 - Water Quality Volume Calculations

Walnut Street Senior Development
Water Quality Volume Calculation - IB#1

Dec-22

Required Water Quality Storage

Proposed Impervious Area sf x 1" x 1'/12"= Required WQ Storage CF

Location	Proposed Impervious Area (sqft)	Required WQ Storage (cf)	Provided WQ Storage (cf)	Description
Infiltration Basin One	96,149	8,012	9,308	IB-1

Walnut Street Senior Development
Water Quality Volume Calculation - IB#2

Dec-22

Required Water Quality Storage

Proposed Impervious Area sf x 1" x 1'/12"= Required WQ Storage CF

Location	Proposed Impervious Area (sqft)	Required WQ Storage (cf)	Provided WQ Storage (cf)	Description
Infiltration Basin Two	116,922	9,744	17,396	IB-2

Stage-Area-Storage for Pond IB-1: IB-1

Elevation (feet)	Surface (sq-ft)	Wetted (sq-ft)	Storage (cubic-feet)
244.00	3,703	3,703	0
244.01	3,757	3,757	37
244.02	3,812	3,812	75
244.03	3,867	3,867	114
244.04	3,922	3,922	152
244.05	3,978	3,978	192
244.06	4,034	4,035	232
244.07	4,091	4,091	273
244.08	4,148	4,148	314
244.09	4,205	4,206	356
244.10	4,263	4,263	398
244.11	4,321	4,322	441
244.12	4,380	4,380	484
244.13	4,439	4,439	528
244.14	4,498	4,499	573
244.15	4,558	4,558	618
244.16	4,618	4,619	664
244.17	4,678	4,679	711
244.18	4,739	4,740	758
244.19	4,801	4,802	806
244.20	4,862	4,863	854
244.21	4,925	4,926	903
244.22	4,987	4,988	952
244.23	5,050	5,051	1,003
244.24	5,113	5,114	1,053
244.25	5,177	5,178	1,105
244.26	5,241	5,242	1,157
244.27	5,306	5,307	1,210
244.28	5,370	5,372	1,263
244.29	5,436	5,437	1,317
244.30	5,501	5,503	1,372
244.31	5,567	5,569	1,427
244.32	5,634	5,635	1,483
244.33	5,701	5,702	1,540
244.34	5,768	5,770	1,597
244.35	5,836	5,837	1,655
244.36	5,904	5,905	1,714
244.37	5,972	5,974	1,773
244.38	6,041	6,043	1,833
244.39	6,110	6,112	1,894
244.40	6,180	6,182	1,955
244.41	6,250	6,252	2,018
244.42	6,320	6,322	2,080
244.43	6,391	6,393	2,144
244.44	6,462	6,464	2,208
244.45	6,533	6,536	2,273
244.46	6,605	6,608	2,339
244.47	6,678	6,680	2,405
244.48	6,751	6,753	2,473
244.49	6,824	6,826	2,540
244.50	6,897	6,900	2,609
244.51	6,971	6,974	2,678
244.52	7,046	7,048	2,748

Stage-Area-Storage for Pond IB-1: IB-1 (continued)

Elevation (feet)	Surface (sq-ft)	Wetted (sq-ft)	Storage (cubic-feet)
244.53	7,120	7,123	2,819
244.54	7,195	7,198	2,891
244.55	7,271	7,274	2,963
244.56	7,347	7,350	3,036
244.57	7,423	7,426	3,110
244.58	7,500	7,503	3,185
244.59	7,577	7,580	3,260
244.60	7,654	7,658	3,336
244.61	7,732	7,735	3,413
244.62	7,811	7,814	3,491
244.63	7,889	7,893	3,569
244.64	7,968	7,972	3,649
244.65	8,048	8,051	3,729
244.66	8,128	8,131	3,810
244.67	8,208	8,211	3,891
244.68	8,288	8,292	3,974
244.69	8,369	8,373	4,057
244.70	8,451	8,455	4,141
244.71	8,533	8,537	4,226
244.72	8,615	8,619	4,312
244.73	8,698	8,702	4,398
244.74	8,781	8,785	4,486
244.75	8,864	8,868	4,574
244.76	8,948	8,952	4,663
244.77	9,032	9,036	4,753
244.78	9,117	9,121	4,844
244.79	9,201	9,206	4,935
244.80	9,287	9,291	5,028
244.81	9,373	9,377	5,121
244.82	9,459	9,463	5,215
244.83	9,545	9,550	5,310
244.84	9,632	9,637	5,406
244.85	9,720	9,724	5,503
244.86	9,807	9,812	5,601
244.87	9,895	9,900	5,699
244.88	9,984	9,989	5,798
244.89	10,073	10,078	5,899
244.90	10,162	10,167	6,000
244.91	10,252	10,257	6,102
244.92	10,342	10,347	6,205
244.93	10,433	10,438	6,309
244.94	10,523	10,529	6,414
244.95	10,615	10,620	6,519
244.96	10,706	10,712	6,626
244.97	10,798	10,804	6,733
244.98	10,891	10,897	6,842
244.99	10,984	10,990	6,951
245.00	11,077	11,083	7,062
245.01	11,093	11,099	7,172
245.02	11,108	11,115	7,283
245.03	11,124	11,131	7,395
245.04	11,139	11,147	7,506
245.05	11,155	11,163	7,617

Stage-Area-Storage for Pond IB-1: IB-1 (continued)

Elevation (feet)	Surface (sq-ft)	Wetted (sq-ft)	Storage (cubic-feet)
245.06	11,171	11,179	7,729
245.07	11,186	11,195	7,841
245.08	11,202	11,211	7,953
245.09	11,218	11,227	8,065
245.10	11,233	11,244	8,177
245.11	11,249	11,260	8,289
245.12	11,265	11,276	8,402
245.13	11,280	11,292	8,515
245.14	11,296	11,308	8,628
245.15	11,312	11,324	8,741
245.16	11,328	11,341	8,854
245.17	11,343	11,357	8,967
245.18	11,359	11,373	9,081
245.19	11,375	11,389	9,194
245.20	11,391	11,405	9,308
245.21	11,406	11,422	9,422
245.22	11,422	11,438	9,536
245.23	11,438	11,454	9,651
245.24	11,454	11,470	9,765
245.25	11,470	11,487	9,880
245.26	11,486	11,503	9,994
245.27	11,501	11,519	10,109
245.28	11,517	11,536	10,225
245.29	11,533	11,552	10,340
245.30	11,549	11,568	10,455
245.31	11,565	11,585	10,571
245.32	11,581	11,601	10,686
245.33	11,597	11,617	10,802
245.34	11,613	11,634	10,918
245.35	11,629	11,650	11,035
245.36	11,645	11,667	11,151
245.37	11,661	11,683	11,268
245.38	11,677	11,700	11,384
245.39	11,693	11,716	11,501
245.40	11,709	11,732	11,618
245.41	11,725	11,749	11,735
245.42	11,741	11,765	11,853
245.43	11,757	11,782	11,970
245.44	11,773	11,798	12,088
245.45	11,789	11,815	12,205
245.46	11,805	11,831	12,323
245.47	11,821	11,848	12,442
245.48	11,837	11,864	12,560
245.49	11,853	11,881	12,678
245.50	11,869	11,898	12,797
245.51	11,885	11,914	12,916
245.52	11,902	11,931	13,035
245.53	11,918	11,947	13,154
245.54	11,934	11,964	13,273
245.55	11,950	11,981	13,392
245.56	11,966	11,997	13,512
245.57	11,982	12,014	13,632
245.58	11,999	12,031	13,752

Stage-Area-Storage for Pond IB-1: IB-1 (continued)

Elevation (feet)	Surface (sq-ft)	Wetted (sq-ft)	Storage (cubic-feet)
245.59	12,015	12,047	13,872
245.60	12,031	12,064	13,992
245.61	12,047	12,081	14,112
245.62	12,064	12,097	14,233
245.63	12,080	12,114	14,354
245.64	12,096	12,131	14,475
245.65	12,112	12,148	14,596
245.66	12,129	12,164	14,717
245.67	12,145	12,181	14,838
245.68	12,161	12,198	14,960
245.69	12,178	12,215	15,081
245.70	12,194	12,231	15,203
245.71	12,210	12,248	15,325
245.72	12,227	12,265	15,447
245.73	12,243	12,282	15,570
245.74	12,259	12,299	15,692
245.75	12,276	12,316	15,815
245.76	12,292	12,332	15,938
245.77	12,309	12,349	16,061
245.78	12,325	12,366	16,184
245.79	12,341	12,383	16,307
245.80	12,358	12,400	16,431
245.81	12,374	12,417	16,554
245.82	12,391	12,434	16,678
245.83	12,407	12,451	16,802
245.84	12,424	12,468	16,926
245.85	12,440	12,485	17,051
245.86	12,457	12,502	17,175
245.87	12,473	12,519	17,300
245.88	12,490	12,536	17,425
245.89	12,506	12,553	17,550
245.90	12,523	12,570	17,675
245.91	12,539	12,587	17,800
245.92	12,556	12,604	17,926
245.93	12,573	12,621	18,051
245.94	12,589	12,638	18,177
245.95	12,606	12,655	18,303
245.96	12,622	12,672	18,429
245.97	12,639	12,689	18,555
245.98	12,656	12,706	18,682
245.99	12,672	12,723	18,809
246.00	12,689	12,740	18,935
246.01	12,705	12,757	19,062
246.02	12,721	12,774	19,189
246.03	12,737	12,790	19,317
246.04	12,754	12,807	19,444
246.05	12,770	12,824	19,572
246.06	12,786	12,840	19,700
246.07	12,802	12,857	19,828
246.08	12,818	12,874	19,956
246.09	12,834	12,890	20,084
246.10	12,851	12,907	20,212
246.11	12,867	12,924	20,341

Stage-Area-Storage for Pond IB-1: IB-1 (continued)

Elevation (feet)	Surface (sq-ft)	Wetted (sq-ft)	Storage (cubic-feet)
246.12	12,883	12,940	20,470
246.13	12,899	12,957	20,599
246.14	12,916	12,974	20,728
246.15	12,932	12,991	20,857
246.16	12,948	13,007	20,986
246.17	12,964	13,024	21,116
246.18	12,981	13,041	21,246
246.19	12,997	13,058	21,375
246.20	13,013	13,075	21,506
246.21	13,030	13,091	21,636
246.22	13,046	13,108	21,766
246.23	13,062	13,125	21,897
246.24	13,079	13,142	22,027
246.25	13,095	13,159	22,158
246.26	13,111	13,176	22,289
246.27	13,128	13,192	22,420
246.28	13,144	13,209	22,552
246.29	13,160	13,226	22,683
246.30	13,177	13,243	22,815
246.31	13,193	13,260	22,947
246.32	13,210	13,277	23,079
246.33	13,226	13,294	23,211
246.34	13,243	13,311	23,343
246.35	13,259	13,328	23,476
246.36	13,276	13,345	23,609
246.37	13,292	13,362	23,741
246.38	13,309	13,379	23,874
246.39	13,325	13,396	24,008
246.40	13,342	13,413	24,141
246.41	13,358	13,430	24,274
246.42	13,375	13,447	24,408
246.43	13,391	13,464	24,542
246.44	13,408	13,481	24,676
246.45	13,424	13,498	24,810
246.46	13,441	13,515	24,944
246.47	13,457	13,532	25,079
246.48	13,474	13,549	25,214
246.49	13,491	13,566	25,348
246.50	13,507	13,583	25,483
246.51	13,524	13,601	25,619
246.52	13,540	13,618	25,754
246.53	13,557	13,635	25,889
246.54	13,574	13,652	26,025
246.55	13,590	13,669	26,161
246.56	13,607	13,686	26,297
246.57	13,624	13,704	26,433
246.58	13,641	13,721	26,569
246.59	13,657	13,738	26,706
246.60	13,674	13,755	26,842
246.61	13,691	13,772	26,979
246.62	13,707	13,790	27,116
246.63	13,724	13,807	27,253
246.64	13,741	13,824	27,391

Stage-Area-Storage for Pond IB-1: IB-1 (continued)

Elevation (feet)	Surface (sq-ft)	Wetted (sq-ft)	Storage (cubic-feet)
246.65	13,758	13,842	27,528
246.66	13,774	13,859	27,666
246.67	13,791	13,876	27,804
246.68	13,808	13,893	27,942
246.69	13,825	13,911	28,080
246.70	13,842	13,928	28,218
246.71	13,858	13,945	28,357
246.72	13,875	13,963	28,495
246.73	13,892	13,980	28,634
246.74	13,909	13,997	28,773
246.75	13,926	14,015	28,912
246.76	13,943	14,032	29,052
246.77	13,960	14,050	29,191
246.78	13,977	14,067	29,331
246.79	13,993	14,084	29,471
246.80	14,010	14,102	29,611
246.81	14,027	14,119	29,751
246.82	14,044	14,137	29,891
246.83	14,061	14,154	30,032
246.84	14,078	14,172	30,173
246.85	14,095	14,189	30,313
246.86	14,112	14,207	30,454
246.87	14,129	14,224	30,596
246.88	14,146	14,242	30,737
246.89	14,163	14,259	30,879
246.90	14,180	14,277	31,020
246.91	14,197	14,294	31,162
246.92	14,214	14,312	31,304
246.93	14,231	14,330	31,446
246.94	14,248	14,347	31,589
246.95	14,265	14,365	31,731
246.96	14,283	14,382	31,874
246.97	14,300	14,400	32,017
246.98	14,317	14,418	32,160
246.99	14,334	14,435	32,303
247.00	14,351	14,453	32,447
247.01	14,368	14,470	32,590
247.02	14,385	14,488	32,734
247.03	14,402	14,505	32,878
247.04	14,419	14,522	33,022
247.05	14,435	14,540	33,167
247.06	14,452	14,557	33,311
247.07	14,469	14,575	33,456
247.08	14,486	14,592	33,600
247.09	14,503	14,610	33,745
247.10	14,520	14,627	33,890
247.11	14,537	14,645	34,036
247.12	14,554	14,662	34,181
247.13	14,571	14,680	34,327
247.14	14,588	14,697	34,473
247.15	14,605	14,715	34,619
247.16	14,622	14,732	34,765
247.17	14,639	14,750	34,911

Stage-Area-Storage for Pond IB-1: IB-1 (continued)

Elevation (feet)	Surface (sq-ft)	Wetted (sq-ft)	Storage (cubic-feet)
247.18	14,656	14,768	35,057
247.19	14,673	14,785	35,204
247.20	14,690	14,803	35,351
247.21	14,707	14,820	35,498
247.22	14,724	14,838	35,645
247.23	14,742	14,856	35,792
247.24	14,759	14,873	35,940
247.25	14,776	14,891	36,088
247.26	14,793	14,908	36,235
247.27	14,810	14,926	36,383
247.28	14,827	14,944	36,532
247.29	14,844	14,961	36,680
247.30	14,861	14,979	36,829
247.31	14,879	14,997	36,977
247.32	14,896	15,015	37,126
247.33	14,913	15,032	37,275
247.34	14,930	15,050	37,424
247.35	14,947	15,068	37,574
247.36	14,965	15,086	37,723
247.37	14,982	15,103	37,873
247.38	14,999	15,121	38,023
247.39	15,016	15,139	38,173
247.40	15,034	15,157	38,323
247.41	15,051	15,174	38,474
247.42	15,068	15,192	38,624
247.43	15,085	15,210	38,775
247.44	15,103	15,228	38,926
247.45	15,120	15,246	39,077
247.46	15,137	15,264	39,228
247.47	15,155	15,282	39,380
247.48	15,172	15,299	39,531
247.49	15,189	15,317	39,683
247.50	15,207	15,335	39,835
247.51	15,224	15,353	39,987
247.52	15,241	15,371	40,140
247.53	15,259	15,389	40,292
247.54	15,276	15,407	40,445
247.55	15,294	15,425	40,598
247.56	15,311	15,443	40,751
247.57	15,328	15,461	40,904
247.58	15,346	15,479	41,057
247.59	15,363	15,497	41,211
247.60	15,381	15,515	41,365
247.61	15,398	15,533	41,519
247.62	15,416	15,551	41,673
247.63	15,433	15,569	41,827
247.64	15,451	15,587	41,981
247.65	15,468	15,605	42,136
247.66	15,486	15,623	42,291
247.67	15,503	15,641	42,446
247.68	15,521	15,659	42,601
247.69	15,538	15,677	42,756
247.70	15,556	15,695	42,911

Stage-Area-Storage for Pond IB-1: IB-1 (continued)

Elevation (feet)	Surface (sq-ft)	Wetted (sq-ft)	Storage (cubic-feet)
247.71	15,573	15,713	43,067
247.72	15,591	15,732	43,223
247.73	15,609	15,750	43,379
247.74	15,626	15,768	43,535
247.75	15,644	15,786	43,691
247.76	15,661	15,804	43,848
247.77	15,679	15,822	44,005
247.78	15,697	15,840	44,162
247.79	15,714	15,859	44,319
247.80	**15,732**	**15,877**	**44,476**

Stage-Area-Storage for Pond IB-2: IB-2

Elevation (feet)	Surface (sq-ft)	Wetted (sq-ft)	Storage (cubic-feet)
240.00	5,945	5,945	0
240.02	6,055	6,055	120
240.04	6,165	6,166	242
240.06	6,277	6,278	367
240.08	6,390	6,390	493
240.10	6,503	6,504	622
240.12	6,618	6,619	753
240.14	6,734	6,735	887
240.16	6,851	6,852	1,023
240.18	6,968	6,970	1,161
240.20	7,087	7,088	1,302
240.22	7,207	7,208	1,444
240.24	7,327	7,329	1,590
240.26	7,449	7,451	1,738
240.28	7,572	7,574	1,888
240.30	7,696	7,698	2,040
240.32	7,820	7,823	2,196
240.34	7,946	7,949	2,353
240.36	8,073	8,076	2,513
240.38	8,201	8,203	2,676
240.40	8,329	8,332	2,842
240.42	8,459	8,462	3,009
240.44	8,590	8,593	3,180
240.46	8,722	8,725	3,353
240.48	8,854	8,858	3,529
240.50	8,988	8,992	3,707
240.52	9,123	9,127	3,888
240.54	9,259	9,263	4,072
240.56	9,395	9,400	4,259
240.58	9,533	9,538	4,448
240.60	9,672	9,677	4,640
240.62	9,812	9,817	4,835
240.64	9,953	9,958	5,032
240.66	10,094	10,100	5,233
240.68	10,237	10,242	5,436
240.70	10,381	10,386	5,642
240.72	10,526	10,531	5,851
240.74	10,671	10,677	6,063
240.76	10,818	10,824	6,278
240.78	10,966	10,972	6,496
240.80	11,115	11,121	6,717
240.82	11,265	11,271	6,941
240.84	11,415	11,422	7,168
240.86	11,567	11,574	7,397
240.88	11,720	11,727	7,630
240.90	11,874	11,881	7,866
240.92	12,029	12,036	8,105
240.94	12,185	12,192	8,347
240.96	12,341	12,349	8,593
240.98	12,499	12,507	8,841
241.00	12,658	12,666	9,093
241.02	12,735	12,743	9,347
241.04	12,811	12,821	9,602

Stage-Area-Storage for Pond IB-2: IB-2 (continued)

Elevation (feet)	Surface (sq-ft)	Wetted (sq-ft)	Storage (cubic-feet)
241.06	12,888	12,898	9,859
241.08	12,966	12,976	10,118
241.10	13,043	13,054	10,378
241.12	13,121	13,132	10,639
241.14	13,199	13,210	10,902
241.16	13,277	13,289	11,167
241.18	13,356	13,368	11,434
241.20	13,434	13,447	11,701
241.22	13,513	13,526	11,971
241.24	13,592	13,606	12,242
241.26	13,672	13,685	12,515
241.28	13,751	13,765	12,789
241.30	13,831	13,846	13,065
241.32	13,911	13,926	13,342
241.34	13,991	14,007	13,621
241.36	14,072	14,088	13,902
241.38	14,153	14,169	14,184
241.40	14,234	14,250	14,468
241.42	14,315	14,332	14,753
241.44	14,396	14,414	15,040
241.46	14,478	14,496	15,329
241.48	14,560	14,578	15,620
241.50	14,642	14,661	15,912
241.52	14,724	14,744	16,205
241.54	14,807	14,827	16,501
241.56	14,890	14,910	16,797
241.58	14,973	14,994	17,096
241.60	15,056	15,077	17,396
241.62	15,139	15,161	17,698
241.64	15,223	15,245	18,002
241.66	15,307	15,330	18,307
241.68	15,391	15,415	18,614
241.70	15,476	15,499	18,923
241.72	15,560	15,585	19,233
241.74	15,645	15,670	19,545
241.76	15,730	15,756	19,859
241.78	15,816	15,841	20,175
241.80	15,901	15,927	20,492
241.82	15,987	16,014	20,811
241.84	16,073	16,100	21,131
241.86	16,160	16,187	21,454
241.88	16,246	16,274	21,778
241.90	16,333	16,361	22,103
241.92	16,420	16,449	22,431
241.94	16,507	16,536	22,760
241.96	16,594	16,624	23,091
241.98	16,682	16,712	23,424
242.00	16,770	16,801	23,758
242.02	16,812	16,843	24,094
242.04	16,853	16,886	24,431
242.06	16,895	16,928	24,768
242.08	16,936	16,971	25,107
242.10	16,978	17,014	25,446

Stage-Area-Storage for Pond IB-2: IB-2 (continued)

Elevation (feet)	Surface (sq-ft)	Wetted (sq-ft)	Storage (cubic-feet)
242.12	17,020	17,057	25,786
242.14	17,062	17,099	26,127
242.16	17,103	17,142	26,468
242.18	17,145	17,185	26,811
242.20	17,187	17,228	27,154
242.22	17,229	17,271	27,498
242.24	17,271	17,314	27,843
242.26	17,314	17,357	28,189
242.28	17,356	17,401	28,536
242.30	17,398	17,444	28,883
242.32	17,440	17,487	29,232
242.34	17,483	17,530	29,581
242.36	17,525	17,574	29,931
242.38	17,567	17,617	30,282
242.40	17,610	17,661	30,634
242.42	17,652	17,704	30,986
242.44	17,695	17,748	31,340
242.46	17,738	17,792	31,694
242.48	17,780	17,835	32,049
242.50	17,823	17,879	32,405
242.52	17,866	17,923	32,762
242.54	17,909	17,967	33,120
242.56	17,951	18,011	33,479
242.58	17,994	18,055	33,838
242.60	18,037	18,099	34,198
242.62	18,080	18,143	34,560
242.64	18,124	18,187	34,922
242.66	18,167	18,231	35,285
242.68	18,210	18,275	35,648
242.70	18,253	18,320	36,013
242.72	18,296	18,364	36,378
242.74	18,340	18,409	36,745
242.76	18,383	18,453	37,112
242.78	18,427	18,497	37,480
242.80	18,470	18,542	37,849
242.82	18,514	18,587	38,219
242.84	18,557	18,631	38,590
242.86	18,601	18,676	38,961
242.88	18,645	18,721	39,334
242.90	18,688	18,766	39,707
242.92	18,732	18,810	40,081
242.94	18,776	18,855	40,456
242.96	18,820	18,900	40,832
242.98	18,864	18,945	41,209
243.00	18,908	18,990	41,587
243.02	18,951	19,035	41,965
243.04	18,995	19,079	42,345
243.06	19,038	19,124	42,725
243.08	19,082	19,169	43,106
243.10	19,125	19,213	43,488
243.12	19,169	19,258	43,871
243.14	19,213	19,303	44,255
243.16	19,256	19,347	44,640

Stage-Area-Storage for Pond IB-2: IB-2 (continued)

Elevation (feet)	Surface (sq-ft)	Wetted (sq-ft)	Storage (cubic-feet)
243.18	19,300	19,392	45,025
243.20	19,344	19,437	45,412
243.22	19,388	19,482	45,799
243.24	19,432	19,527	46,187
243.26	19,476	19,572	46,576
243.28	19,520	19,617	46,966
243.30	19,564	19,663	47,357
243.32	19,608	19,708	47,749
243.34	19,652	19,753	48,142
243.36	19,696	19,798	48,535
243.38	19,740	19,844	48,929
243.40	19,785	19,889	49,325
243.42	19,829	19,935	49,721
243.44	19,873	19,980	50,118
243.46	19,918	20,026	50,516
243.48	19,962	20,071	50,915
243.50	20,007	20,117	51,314
243.52	20,052	20,163	51,715
243.54	20,096	20,208	52,116
243.56	20,141	20,254	52,519
243.58	20,186	20,300	52,922
243.60	20,230	20,346	53,326
243.62	20,275	20,392	53,731
243.64	20,320	20,438	54,137
243.66	20,365	20,484	54,544
243.68	20,410	20,530	54,952
243.70	20,455	20,576	55,360
243.72	20,500	20,623	55,770
243.74	20,546	20,669	56,180
243.76	20,591	20,715	56,592
243.78	20,636	20,762	57,004
243.80	20,681	20,808	57,417
243.82	20,727	20,855	57,831
243.84	20,772	20,901	58,246
243.86	20,817	20,948	58,662
243.88	20,863	20,994	59,079
243.90	20,909	21,041	59,497
243.92	20,954	21,088	59,915
243.94	21,000	21,135	60,335
243.96	21,045	21,181	60,755
243.98	21,091	21,228	61,177
244.00	21,137	21,275	61,599
244.02	21,181	21,321	62,022
244.04	21,226	21,367	62,446
244.06	21,271	21,412	62,871
244.08	21,315	21,458	63,297
244.10	21,360	21,504	63,724
244.12	21,405	21,550	64,151
244.14	21,449	21,596	64,580
244.16	21,494	21,642	65,009
244.18	21,539	21,688	65,440
244.20	21,584	21,734	65,871
244.22	21,629	21,780	66,303

Stage-Area-Storage for Pond IB-2: IB-2 (continued)

Elevation (feet)	Surface (sq-ft)	Wetted (sq-ft)	Storage (cubic-feet)
244.24	21,674	21,826	66,736
244.26	21,719	21,872	67,170
244.28	21,764	21,919	67,605
244.30	21,809	21,965	68,041
244.32	21,854	22,011	68,477
244.34	21,899	22,058	68,915
244.36	21,945	22,104	69,353
244.38	21,990	22,151	69,793
244.40	22,035	22,197	70,233
244.42	22,081	22,244	70,674
244.44	22,126	22,291	71,116
244.46	22,172	22,337	71,559
244.48	22,217	22,384	72,003
244.50	22,263	22,431	72,448
244.52	22,309	22,478	72,893
244.54	22,354	22,525	73,340
244.56	22,400	22,572	73,788
244.58	22,446	22,619	74,236
244.60	22,492	22,666	74,685
244.62	22,537	22,713	75,136
244.64	22,583	22,760	75,587
244.66	22,629	22,807	76,039
244.68	22,675	22,854	76,492
244.70	22,721	22,902	76,946
244.72	22,768	22,949	77,401
244.74	22,814	22,996	77,857
244.76	22,860	23,044	78,313
244.78	22,906	23,091	78,771
244.80	22,952	23,139	79,230
244.82	22,999	23,186	79,689
244.84	23,045	23,234	80,150
244.86	23,092	23,282	80,611
244.88	23,138	23,329	81,073
244.90	23,185	23,377	81,537
244.92	23,231	23,425	82,001
244.94	23,278	23,473	82,466
244.96	23,325	23,521	82,932
244.98	23,371	23,569	83,399
245.00	23,418	23,617	83,867
245.02	23,464	23,664	84,336
245.04	23,510	23,711	84,805
245.06	23,555	23,758	85,276
245.08	23,601	23,805	85,747
245.10	23,647	23,852	86,220
245.12	23,693	23,900	86,693
245.14	23,739	23,947	87,168
245.16	23,785	23,994	87,643
245.18	23,831	24,042	88,119
245.20	23,878	24,089	88,596
245.22	23,924	24,136	89,074
245.24	23,970	24,184	89,553
245.26	24,016	24,232	90,033
245.28	24,063	24,279	90,514

Stage-Area-Storage for Pond IB-2: IB-2 (continued)

Elevation (feet)	Surface (sq-ft)	Wetted (sq-ft)	Storage (cubic-feet)
245.30	24,109	24,327	90,996
245.32	24,155	24,375	91,478
245.34	24,202	24,422	91,962
245.36	24,248	24,470	92,446
245.38	24,295	24,518	92,932
245.40	24,342	24,566	93,418
245.42	24,388	24,614	93,905
245.44	24,435	24,662	94,394
245.46	24,482	24,710	94,883
245.48	24,528	24,758	95,373
245.50	24,575	24,806	95,864
245.52	24,622	24,854	96,356
245.54	24,669	24,902	96,849
245.56	24,716	24,951	97,343
245.58	24,763	24,999	97,837
245.60	24,810	25,047	98,333
245.62	24,857	25,096	98,830
245.64	24,904	25,144	99,327
245.66	24,951	25,193	99,826
245.68	24,999	25,241	100,325
245.70	25,046	25,290	100,826
245.72	25,093	25,338	101,327
245.74	25,141	25,387	101,830
245.76	25,188	25,436	102,333
245.78	25,236	25,485	102,837
245.80	**25,283**	**25,533**	**103,342**

Attachment F.5 - Forebay Sizing Calculations

Sediment Forebay Sizing: Infiltration Basin 1 (IB-1)

Forebay Volume:

Min. Required Volume = 0.1 Inch x Impervious Area

Impervious Area	44,663	sqft
Min. Required Volume	372	cuft
Volume Provided	1336	

Volume Provided Worksheet:

Contour El. (ft)	Area (sqft)	Inc. Volume (cuft)	Cum. Volume (cuft)
242.00	47	0	0
243.00	159	103	**103**
244.00	337	248	**351**
245.00	486	412	**763**
246.00	660	573	**1336**

Sediment Forebay Sizing: Infiltration Basin 2 (IB-2)

Forebay Volume:

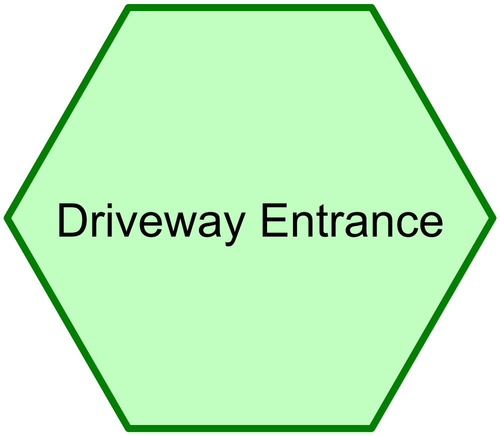
Min. Required Volume = 0.1 Inch x Impervious Area

Impervious Area	77,157	sqft
Min. Required Volume	643	cuft
Volume Provided	724	

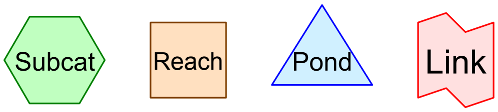
Volume Provided Worksheet:

Contour El. (ft)	Area (sqft)	Inc. Volume (cuft)	Cum. Volume (cuft)
241.00	13	0	0
242.00	162	88	**88**
243.00	308	235	**323**
244.00	495	402	**724**

Attachment F.6 – De Minimus Discharge Calculations



Driveway Entrance



Routing Diagram for DE MINIMUS CALC
Prepared by Weston & Sampson Engineers, Inc, Printed 3/8/2023
HydroCAD® 10.20-2g s/n 00455 © 2022 HydroCAD Software Solutions LLC

Rainfall Events Listing (selected events)

Event#	Event Name	Storm Type	Curve	Mode	Duration (hours)	B/B	Depth (inches)	AMC
1	2-year	Type III 24-hr		Default	24.00	1	3.43	2

Area Listing (all nodes)

Area (sq-ft)	CN	Description (subcatchment-numbers)
1,508	98	Impervious Area (Driveway Entrance)
1,508	**98**	**TOTAL AREA**

Soil Listing (all nodes)

Area (sq-ft)	Soil Group	Subcatchment Numbers
0	HSG A	
0	HSG B	
0	HSG C	
0	HSG D	
1,508	Other	Driveway Entrance
1,508		**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	Subcatchme Numbers
0	0	0	0	1,508	1,508	Impervious Area	
0	**0**	**0**	**0**	**1,508**	**1,508**	**TOTAL AREA**	

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

Subcatchment Driveway Entrance: Runoff Area=1,508 sf 100.00% Impervious Runoff Depth=3.20"
Flow Length=1,620' Tc=32.8 min CN=98 Runoff=0.06 cfs 402 cf

Total Runoff Area = 1,508 sf Runoff Volume = 402 cf Average Runoff Depth = 3.20"
0.00% Pervious = 0 sf 100.00% Impervious = 1,508 sf

Summary for Subcatchment Driveway Entrance: Driveway Entrance

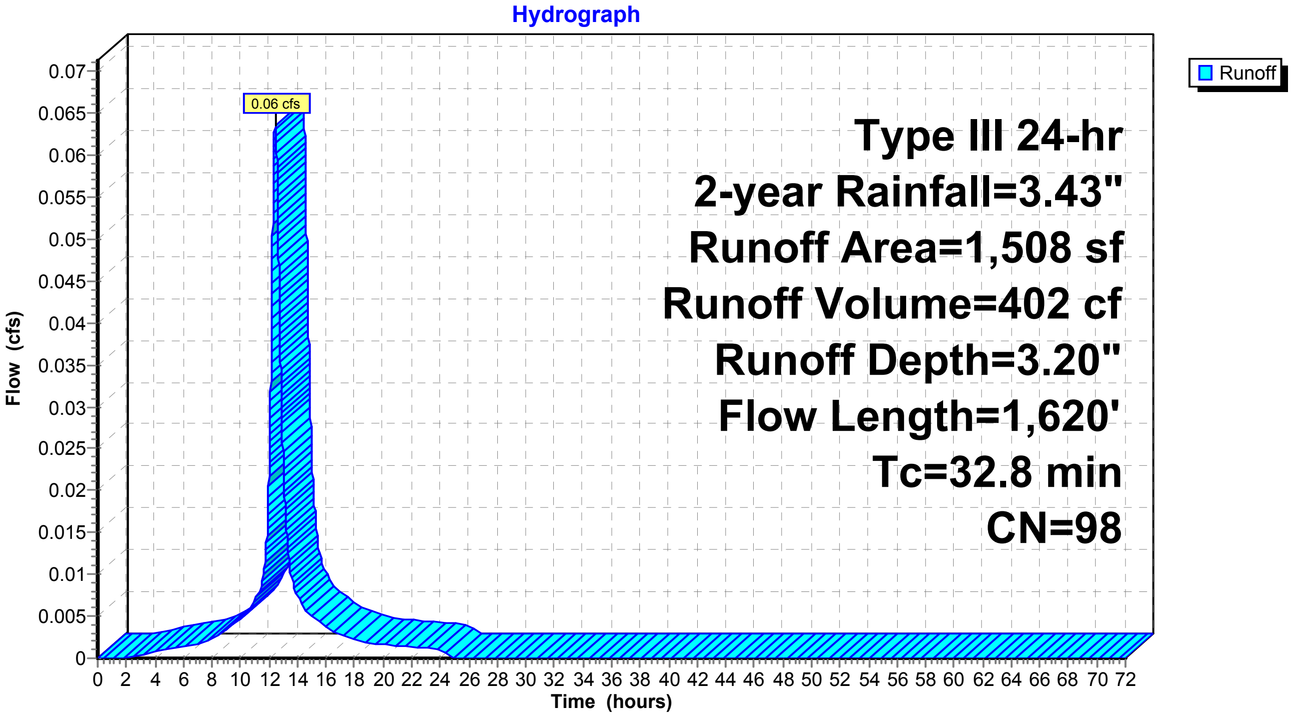
Runoff = 0.06 cfs @ 12.43 hrs, Volume= 402 cf, Depth= 3.20"
Routed to nonexistent node A

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-year Rainfall=3.43"

	Area (sf)	CN	Description
*	1,508	98	Impervious Area
	1,508		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.9	50	0.0200	0.07		**Sheet Flow, Sheet** Woods: Light underbrush n= 0.400 P2= 3.43"
19.4	1,010	0.0300	0.87		**Shallow Concentrated Flow, Shallow** Woodland Kv= 5.0 fps
1.5	560	0.0200	6.38	76.61	**Trap/Vee/Rect Channel Flow,** Bot.W=2.00' D=2.00' Z= 2.0 '/' Top.W=10.00' n= 0.035 Earth, dense weeds
32.8	1,620	Total			

Subcatchment Driveway Entrance: Driveway Entrance



De Minimus Discharge Calculation

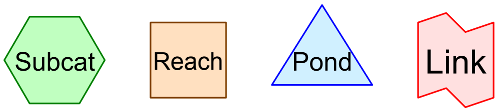
The runoff associated with the 2-year 24-hour storm from the proposed portion of the driveway entrance with TSS removal less than 80% is 0.06 CFS which is less than 1 CFS.

$$Weighted\ \ Average\,\% = \frac{\left(Area_1\right)\left(TSS_1\%\right) + (Area_2)(TSS_2\%) + (Area_n)(TSS_n\%))}{(Area_1 + Area_2 + Area_n)}$$

Equation (1)

$$\frac{((118{,}895)(0.85) + (100{,}900)(0.85) + (1{,}508)(0.10))}{(118{,}895 + 100{,}900 + 1{,}508)} = 0.84 = 84\%\ TSS\ Removal\ Site\ Wide$$

Attachment F.7 – Pipe Capacity Calculations



Routing Diagram for HYDRAFLOW
Prepared by Weston & Sampson Engineers, Inc, Printed 3/13/2023
HydroCAD® 10.20-2g s/n 00455 © 2022 HydroCAD Software Solutions LLC

Rainfall Events Listing (selected events)

Event#	Event Name	Storm Type	Curve	Mode	Duration (hours)	B/B	Depth (inches)	AMC
1	10-year	Type III 24-hr		Default	24.00	1	5.24	2

Area Listing (all nodes)

Area (sq-ft)	CN	Description (subcatchment-numbers)
274,715	74	>75% Grass cover, Good, HSG C (DB-2, DB-3, DMH1, DMH10, DMH11, DMH12, DMH13, DMH3, DMH4, DMH5, DMH6, DMH7, DMH9)
148,927	98	Paved parking, HSG A (CDS-1, DB-2, DB-3, DMH1, DMH10, DMH11, DMH12, DMH13, DMH3, DMH4, DMH5, DMH6, DMH7, DMH9)
71,846	98	Roofs, HSG A (DMH15, DMH17, DMH2)
495,488	**85**	**TOTAL AREA**

Soil Listing (all nodes)

Area (sq-ft)	Soil Group	Subcatchment Numbers
220,773	HSG A	CDS-1, DB-2, DB-3, DMH1, DMH10, DMH11, DMH12, DMH13, DMH15, DMH17, DMH2, DMH3, DMH4, DMH5, DMH6, DMH7, DMH9
0	HSG B	
274,715	HSG C	DB-2, DB-3, DMH1, DMH10, DMH11, DMH12, DMH13, DMH3, DMH4, DMH5, DMH6, DMH7, DMH9
0	HSG D	
0	Other	
495,488		**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	Su Nu
0	0	274,715	0	0	274,715	>75% Grass cover, Good	
148,927	0	0	0	0	148,927	Paved parking	
71,846	0	0	0	0	71,846	Roofs	
220,773	**0**	**274,715**	**0**	**0**	**495,488**	**TOTAL AREA**	

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

SubcatchmentCDS-1: CDS-1 Runoff Area=4,769 sf 100.00% Impervious Runoff Depth=5.00"
Tc=6.0 min CN=98 Runoff=0.56 cfs 1,988 cf

SubcatchmentDB-2: DB-2 Runoff Area=38,906 sf 28.10% Impervious Runoff Depth=3.20"
Tc=6.0 min CN=81 Runoff=3.34 cfs 10,370 cf

SubcatchmentDB-3: DB-2 Runoff Area=48,311 sf 22.14% Impervious Runoff Depth=3.01"
Tc=6.0 min CN=79 Runoff=3.91 cfs 12,115 cf

SubcatchmentDMH1: DMH1 Runoff Area=104,128 sf 22.16% Impervious Runoff Depth=3.01"
Tc=13.6 min CN=79 Runoff=6.63 cfs 26,113 cf

SubcatchmentDMH10: DMH10 Runoff Area=12,430 sf 90.05% Impervious Runoff Depth=4.77"
Tc=6.0 min CN=96 Runoff=1.44 cfs 4,942 cf

SubcatchmentDMH11: DMH11 Runoff Area=22,282 sf 79.95% Impervious Runoff Depth=4.43"
Tc=6.0 min CN=93 Runoff=2.49 cfs 8,233 cf

SubcatchmentDMH12: DMH12 Runoff Area=11,609 sf 88.56% Impervious Runoff Depth=4.66"
Tc=6.0 min CN=95 Runoff=1.33 cfs 4,506 cf

SubcatchmentDMH13: DMH13 Runoff Area=7,211 sf 71.24% Impervious Runoff Depth=4.22"
Tc=6.0 min CN=91 Runoff=0.78 cfs 2,533 cf

SubcatchmentDMH15: DMH15 Runoff Area=25,460 sf 100.00% Impervious Runoff Depth=5.00"
Tc=6.0 min CN=98 Runoff=3.00 cfs 10,614 cf

SubcatchmentDMH17: DMH17 Runoff Area=26,562 sf 100.00% Impervious Runoff Depth=5.00"
Tc=6.0 min CN=98 Runoff=3.13 cfs 11,074 cf

SubcatchmentDMH2: DMH2 Runoff Area=19,824 sf 100.00% Impervious Runoff Depth=5.00"
Tc=6.0 min CN=98 Runoff=2.33 cfs 8,265 cf

SubcatchmentDMH3: DMH3 Runoff Area=22,605 sf 26.67% Impervious Runoff Depth=3.10"
Tc=6.0 min CN=80 Runoff=1.89 cfs 5,846 cf

SubcatchmentDMH4: DMH4 Runoff Area=37,286 sf 24.57% Impervious Runoff Depth=3.10"
Tc=6.0 min CN=80 Runoff=3.11 cfs 9,642 cf

SubcatchmentDMH5: DMH5 Runoff Area=13,365 sf 55.50% Impervious Runoff Depth=3.79"
Tc=6.0 min CN=87 Runoff=1.34 cfs 4,225 cf

SubcatchmentDMH6: DMH6 Runoff Area=62,505 sf 18.45% Impervious Runoff Depth=2.92"
Tc=20.5 min CN=78 Runoff=3.28 cfs 15,192 cf

SubcatchmentDMH7: DMH7 Runoff Area=28,979 sf 52.79% Impervious Runoff Depth=3.79"
Tc=6.0 min CN=87 Runoff=2.90 cfs 9,162 cf

Subcatchment DMH9: DMH9 Runoff Area=9,256 sf 60.36% Impervious Runoff Depth=3.90"
Tc=6.0 min CN=88 Runoff=0.95 cfs 3,006 cf

Total Runoff Area = 495,488 sf Runoff Volume = 147,826 cf Average Runoff Depth = 3.58"
55.44% Pervious = 274,715 sf 44.56% Impervious = 220,773 sf

Summary for Subcatchment CDS-1: CDS-1

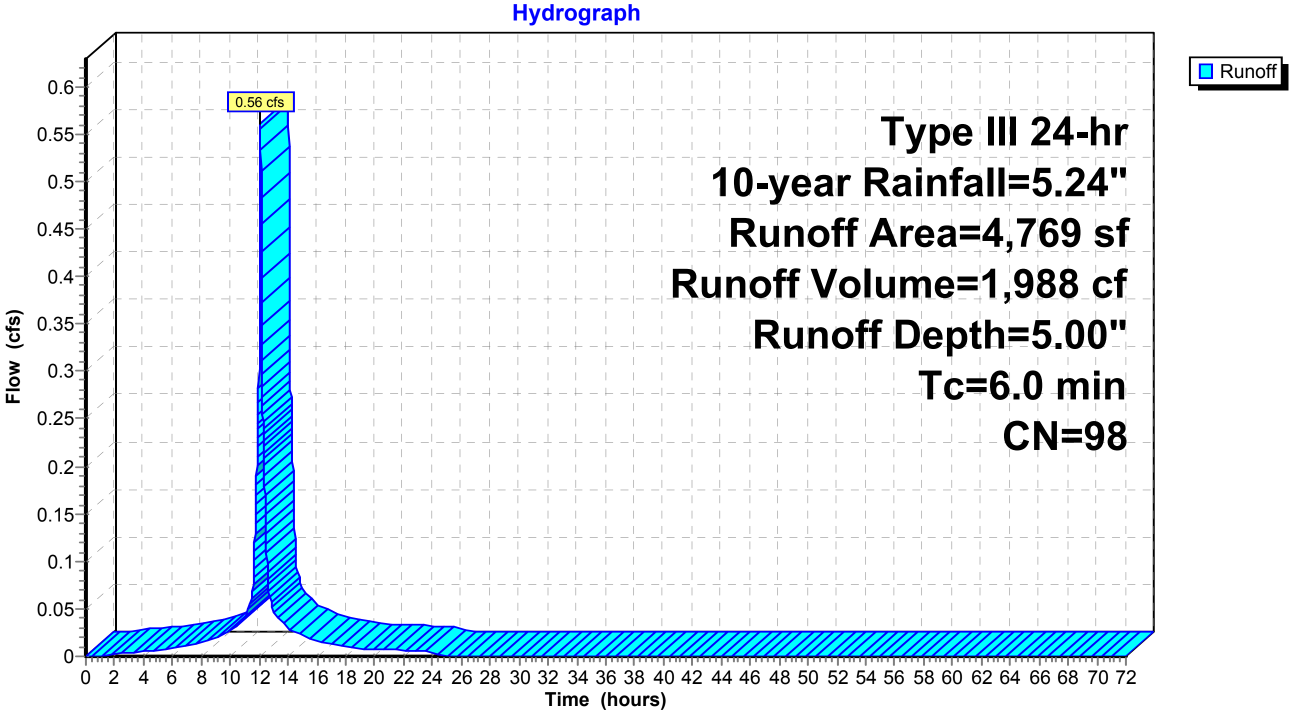
Runoff = 0.56 cfs @ 12.08 hrs, Volume= 1,988 cf, Depth= 5.00"
Routed to nonexistent node B

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-year Rainfall=5.24"

Area (sf)	CN	Description
4,769	98	Paved parking, HSG A
4,769		100.00% Impervious Area

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

Subcatchment CDS-1: CDS-1



Summary for Subcatchment DB-2: DB-2

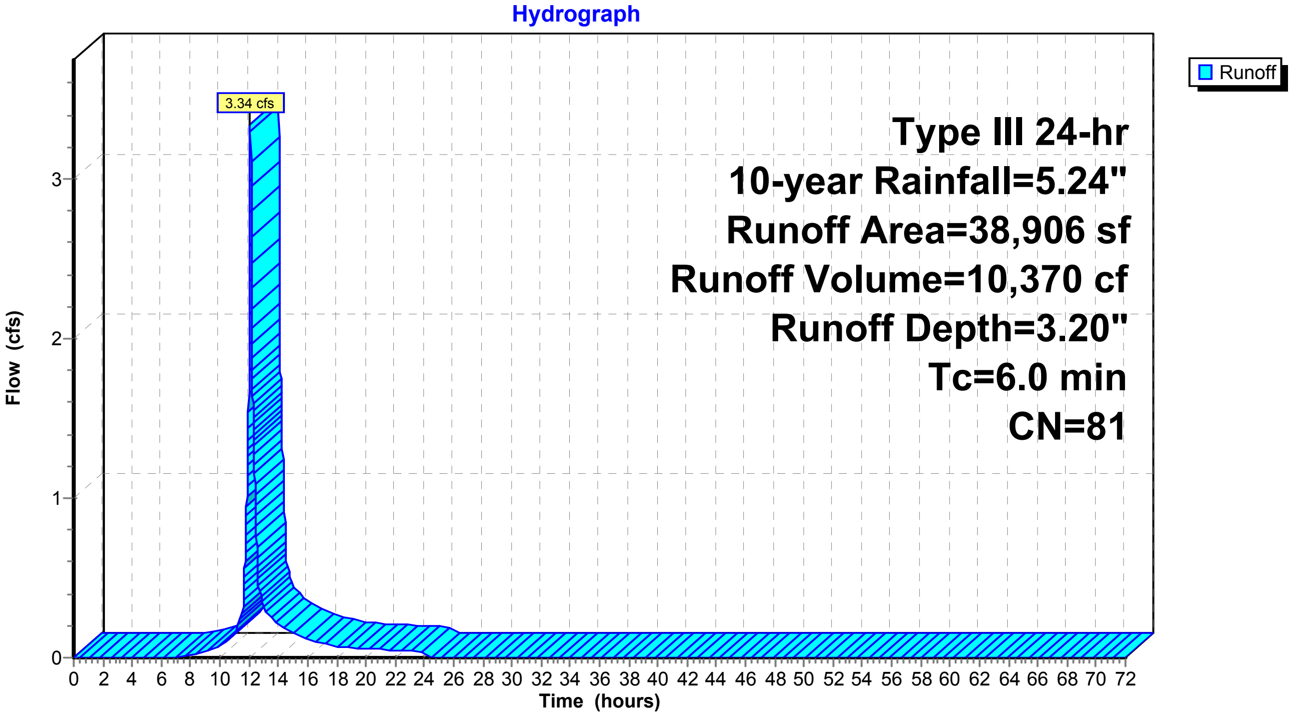
Runoff = 3.34 cfs @ 12.09 hrs, Volume= 10,370 cf, Depth= 3.20"
Routed to nonexistent node B

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-year Rainfall=5.24"

Area (sf)	CN	Description
10,934	98	Paved parking, HSG A
27,972	74	>75% Grass cover, Good, HSG C
38,906	81	Weighted Average
27,972		71.90% Pervious Area
10,934		28.10% Impervious Area

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

Subcatchment DB-2: DB-2



Summary for Subcatchment DB-3: DB-2

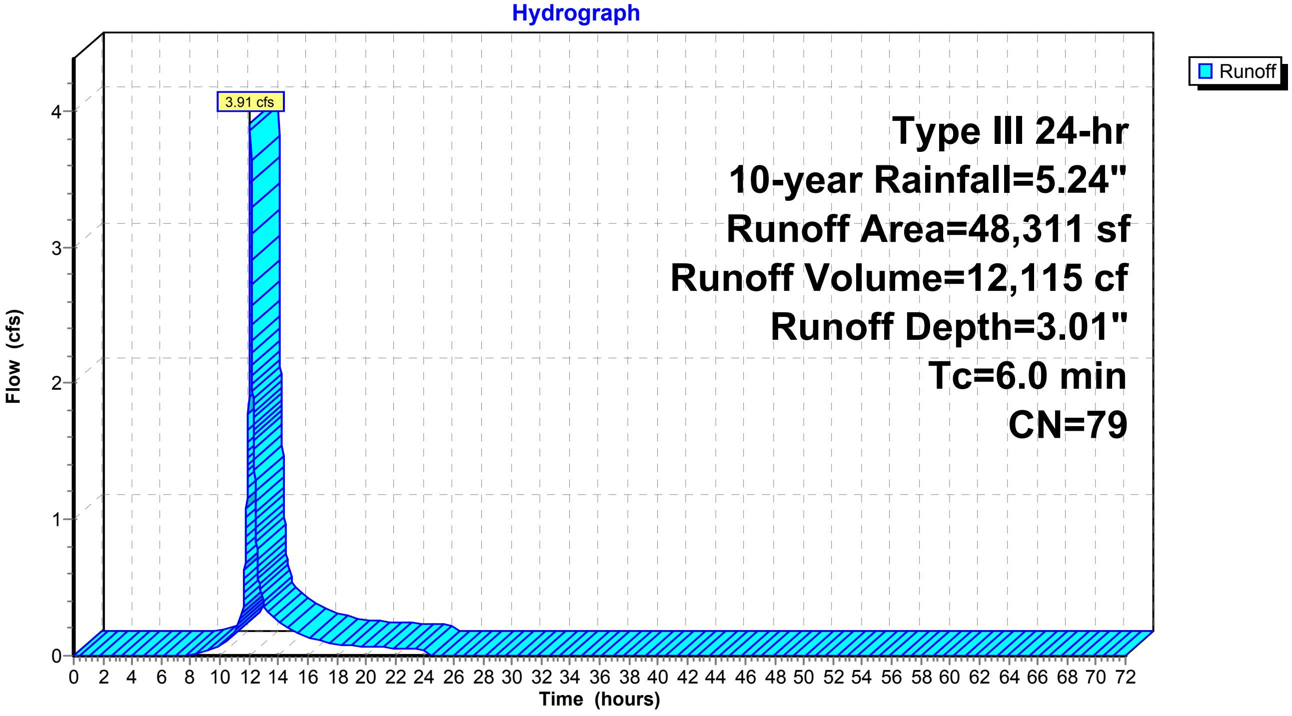
Runoff = 3.91 cfs @ 12.09 hrs, Volume= 12,115 cf, Depth= 3.01"
Routed to nonexistent node B

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-year Rainfall=5.24"

Area (sf)	CN	Description
10,697	98	Paved parking, HSG A
37,614	74	>75% Grass cover, Good, HSG C
48,311	79	Weighted Average
37,614		77.86% Pervious Area
10,697		22.14% Impervious Area

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

Subcatchment DB-3: DB-2



Summary for Subcatchment DMH1: DMH1

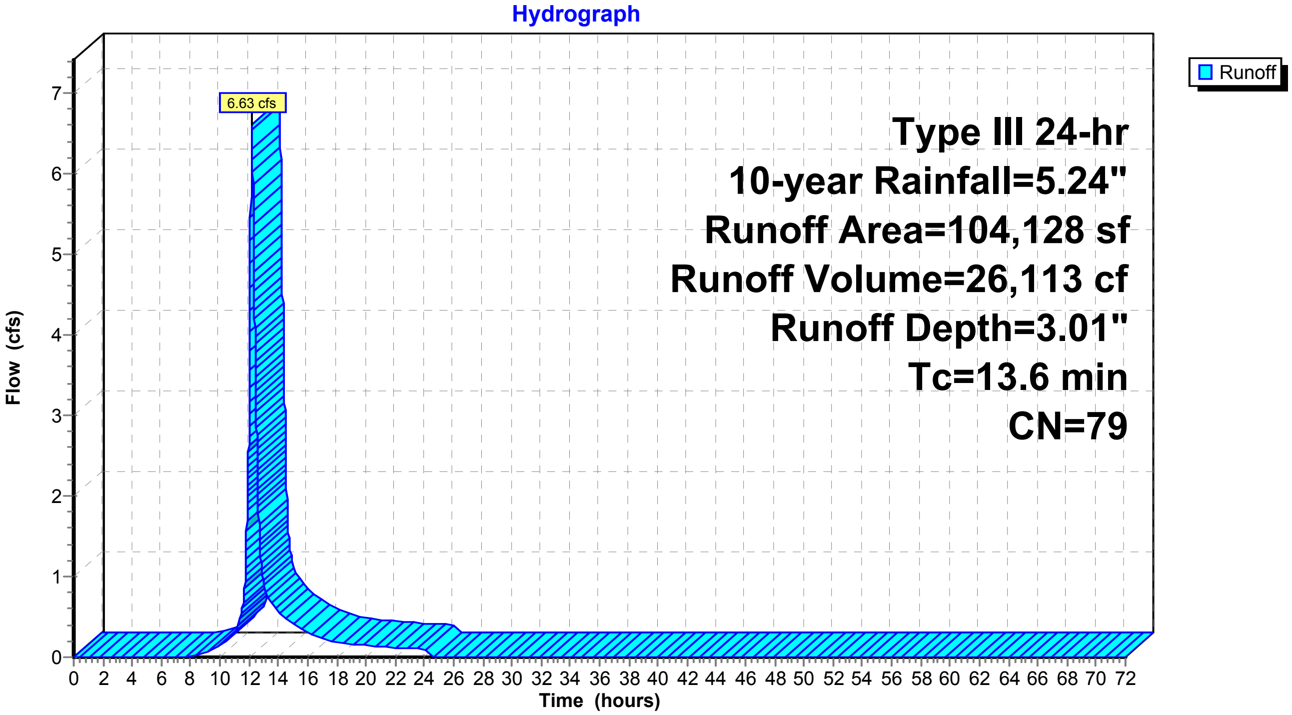
Runoff = 6.63 cfs @ 12.19 hrs, Volume= 26,113 cf, Depth= 3.01"
Routed to nonexistent node B

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-year Rainfall=5.24"

Area (sf)	CN	Description
23,075	98	Paved parking, HSG A
81,053	74	>75% Grass cover, Good, HSG C
104,128	79	Weighted Average
81,053		77.84% Pervious Area
23,075		22.16% Impervious Area

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

Subcatchment DMH1: DMH1



Summary for Subcatchment DMH10: DMH10

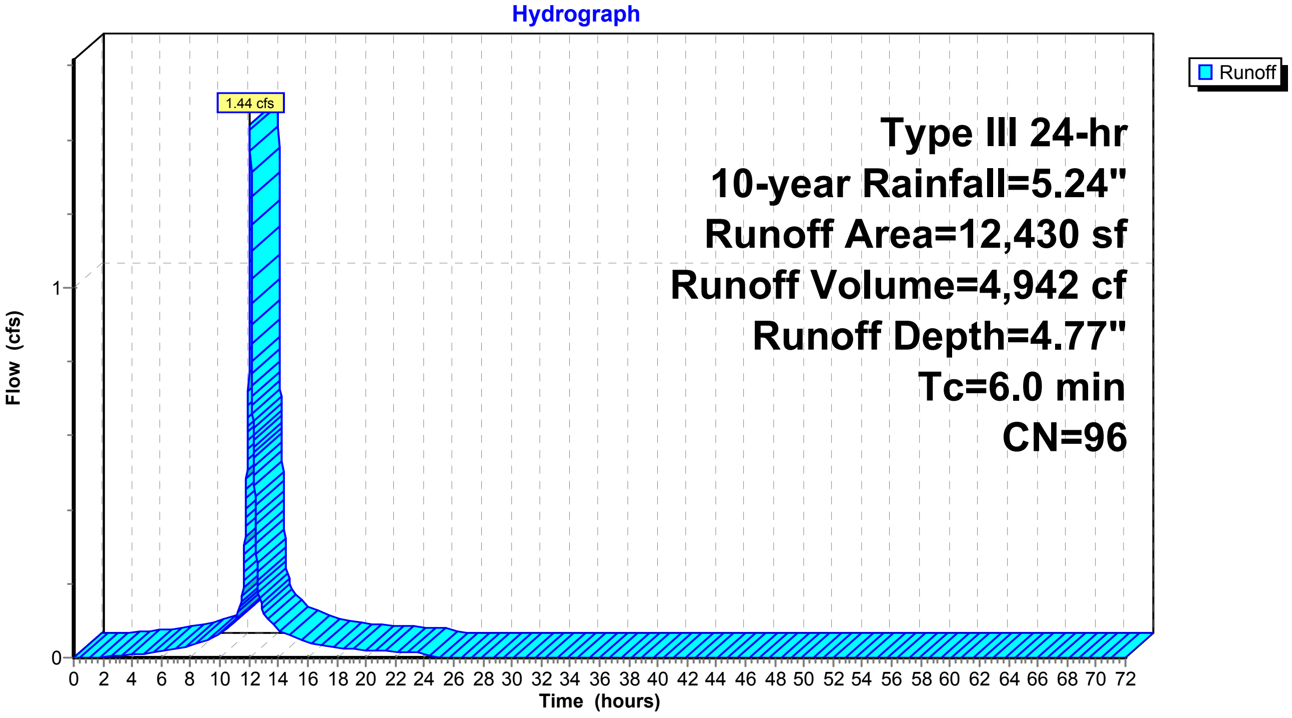
Runoff = 1.44 cfs @ 12.08 hrs, Volume= 4,942 cf, Depth= 4.77"
Routed to nonexistent node B

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-year Rainfall=5.24"

Area (sf)	CN	Description
11,193	98	Paved parking, HSG A
1,237	74	>75% Grass cover, Good, HSG C
12,430	96	Weighted Average
1,237		9.95% Pervious Area
11,193		90.05% Impervious Area

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

Subcatchment DMH10: DMH10



Summary for Subcatchment DMH11: DMH11

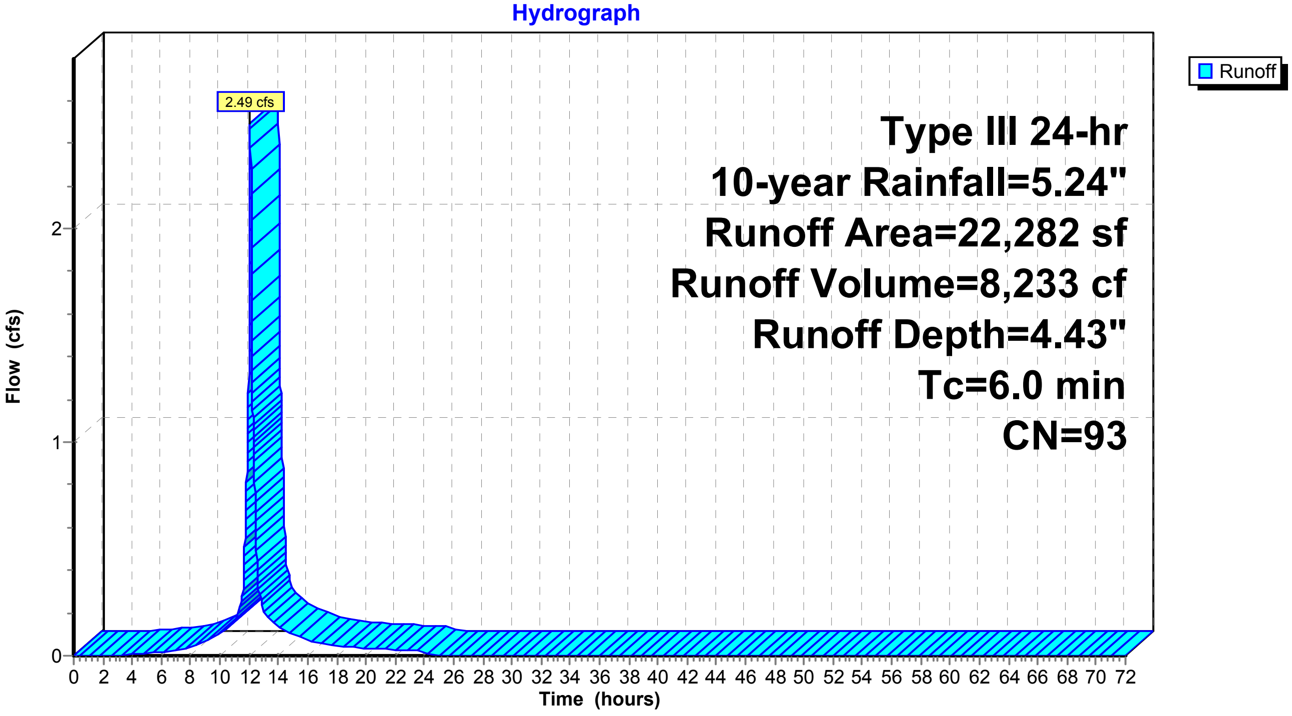
Runoff = 2.49 cfs @ 12.08 hrs, Volume= 8,233 cf, Depth= 4.43"
Routed to nonexistent node B

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-year Rainfall=5.24"

Area (sf)	CN	Description
17,814	98	Paved parking, HSG A
4,468	74	>75% Grass cover, Good, HSG C
22,282	93	Weighted Average
4,468		20.05% Pervious Area
17,814		79.95% Impervious Area

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

Subcatchment DMH11: DMH11



Summary for Subcatchment DMH12: DMH12

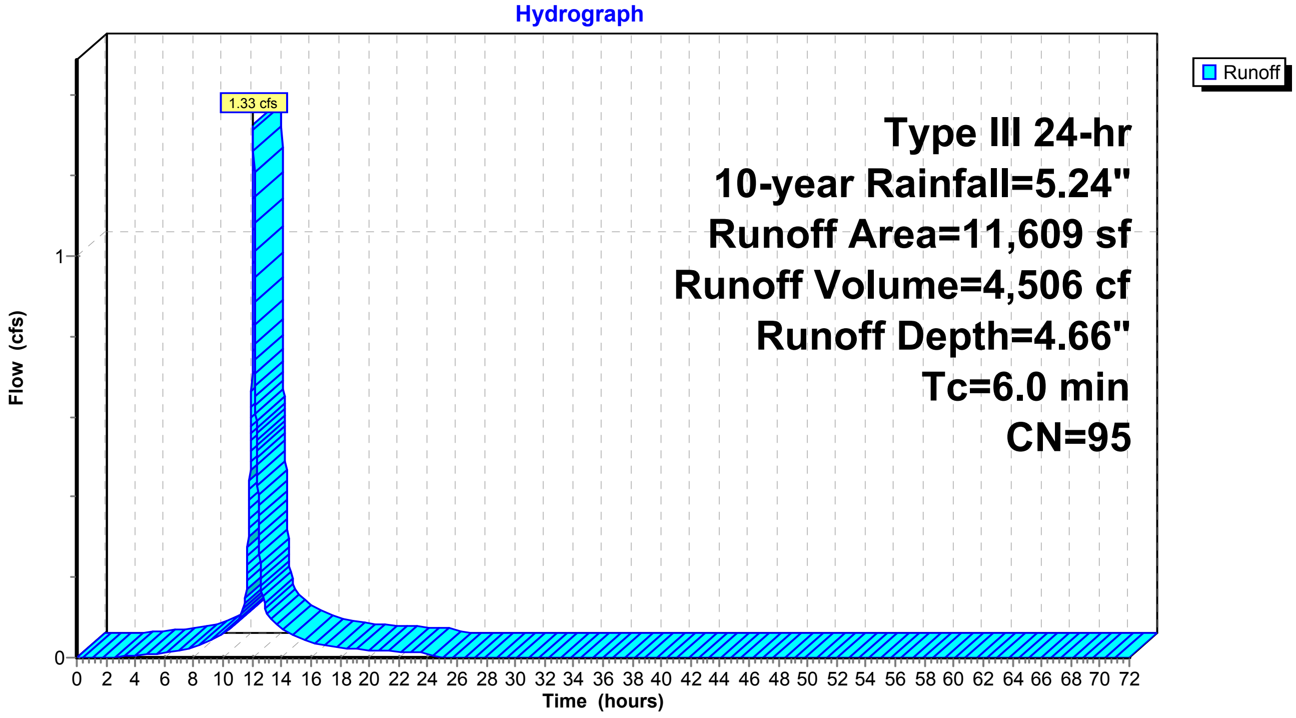
Runoff = 1.33 cfs @ 12.08 hrs, Volume= 4,506 cf, Depth= 4.66"
Routed to nonexistent node B

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-year Rainfall=5.24"

Area (sf)	CN	Description
10,281	98	Paved parking, HSG A
1,328	74	>75% Grass cover, Good, HSG C
11,609	95	Weighted Average
1,328		11.44% Pervious Area
10,281		88.56% Impervious Area

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

Subcatchment DMH12: DMH12



Summary for Subcatchment DMH13: DMH13

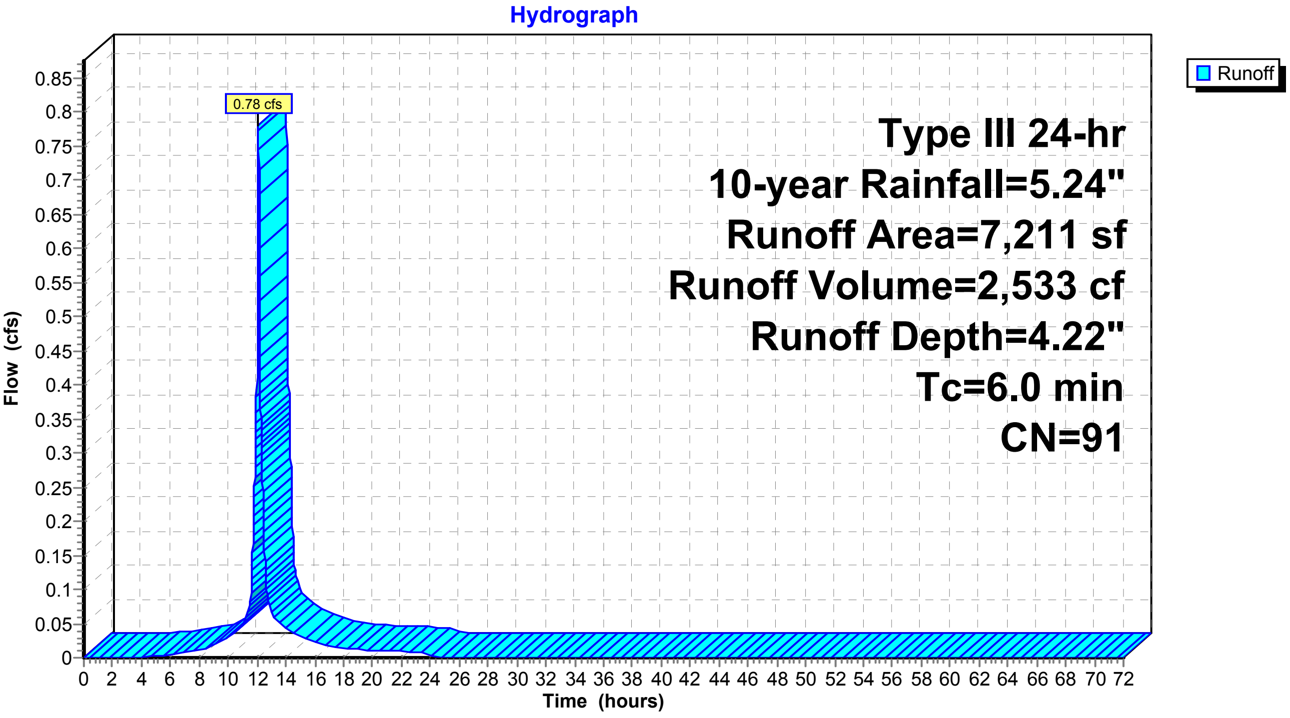
Runoff = 0.78 cfs @ 12.08 hrs, Volume= 2,533 cf, Depth= 4.22"
Routed to nonexistent node B

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-year Rainfall=5.24"

Area (sf)	CN	Description
5,137	98	Paved parking, HSG A
2,074	74	>75% Grass cover, Good, HSG C
7,211	91	Weighted Average
2,074		28.76% Pervious Area
5,137		71.24% Impervious Area

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

Subcatchment DMH13: DMH13



Summary for Subcatchment DMH15: DMH15

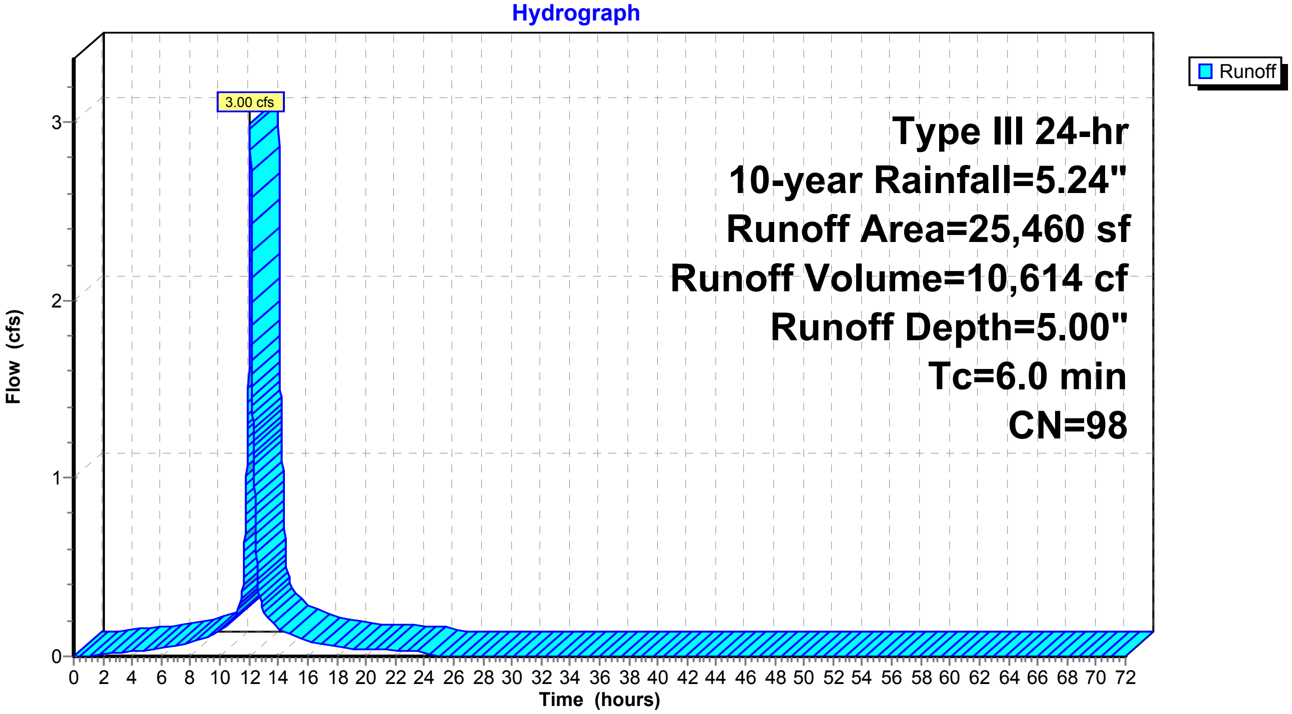
Runoff = 3.00 cfs @ 12.08 hrs, Volume= 10,614 cf, Depth= 5.00"
Routed to nonexistent node B

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-year Rainfall=5.24"

Area (sf)	CN	Description
25,460	98	Roofs, HSG A
25,460		100.00% Impervious Area

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

Subcatchment DMH15: DMH15



Summary for Subcatchment DMH17: DMH17

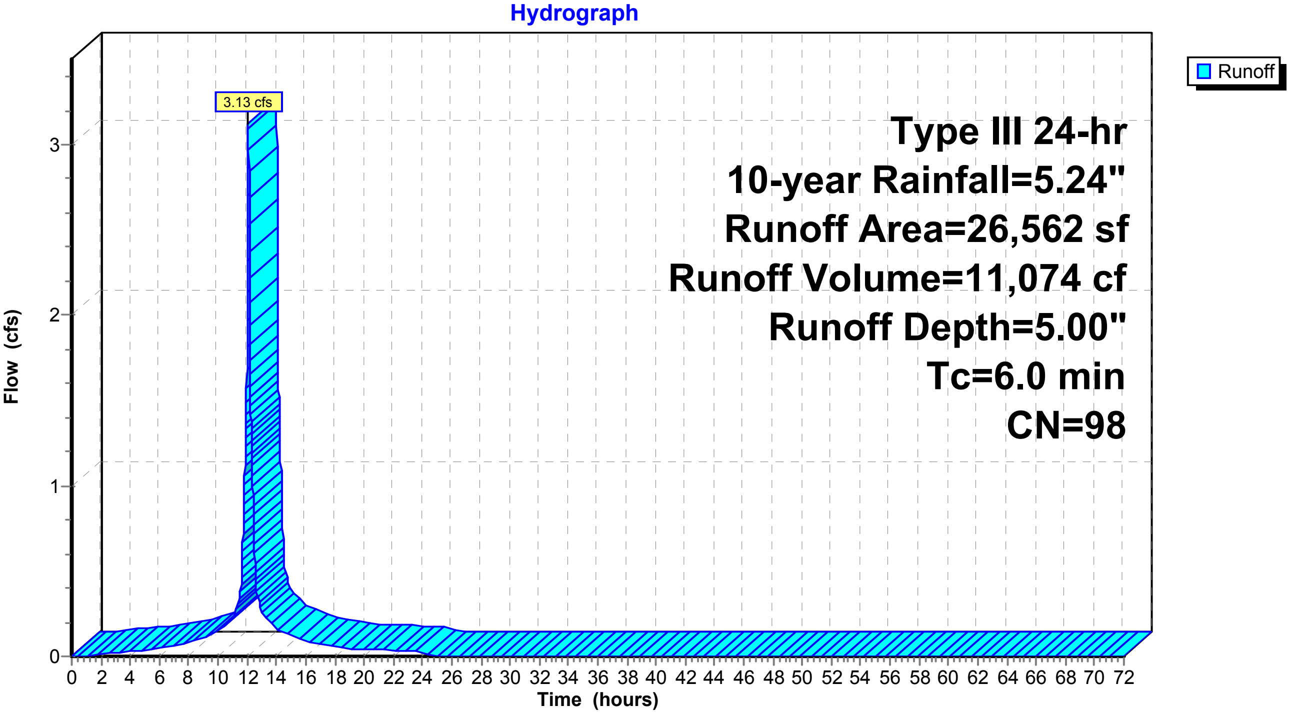
Runoff = 3.13 cfs @ 12.08 hrs, Volume= 11,074 cf, Depth= 5.00"
Routed to nonexistent node B

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-year Rainfall=5.24"

Area (sf)	CN	Description
26,562	98	Roofs, HSG A
26,562		100.00% Impervious Area

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

Subcatchment DMH17: DMH17



Summary for Subcatchment DMH2: DMH2

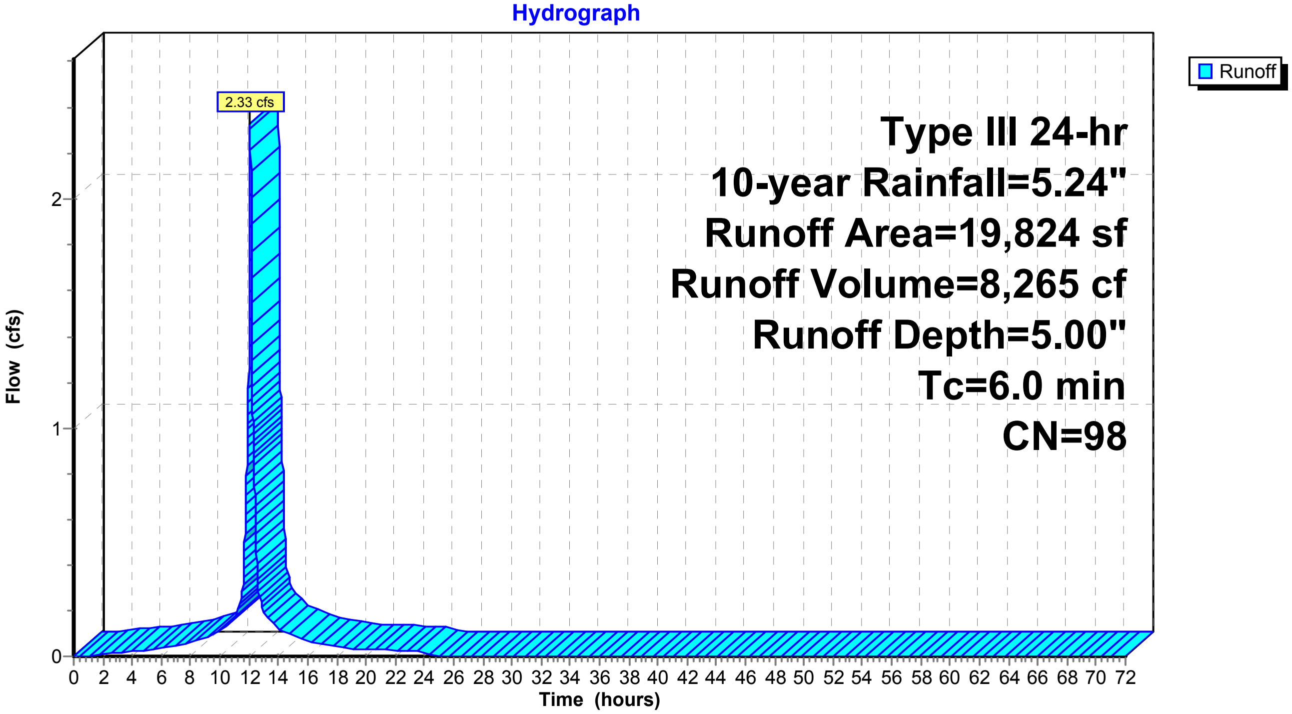
Runoff = 2.33 cfs @ 12.08 hrs, Volume= 8,265 cf, Depth= 5.00"
Routed to nonexistent node B

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-year Rainfall=5.24"

Area (sf)	CN	Description
19,824	98	Roofs, HSG A
19,824		100.00% Impervious Area

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

Subcatchment DMH2: DMH2



Summary for Subcatchment DMH3: DMH3

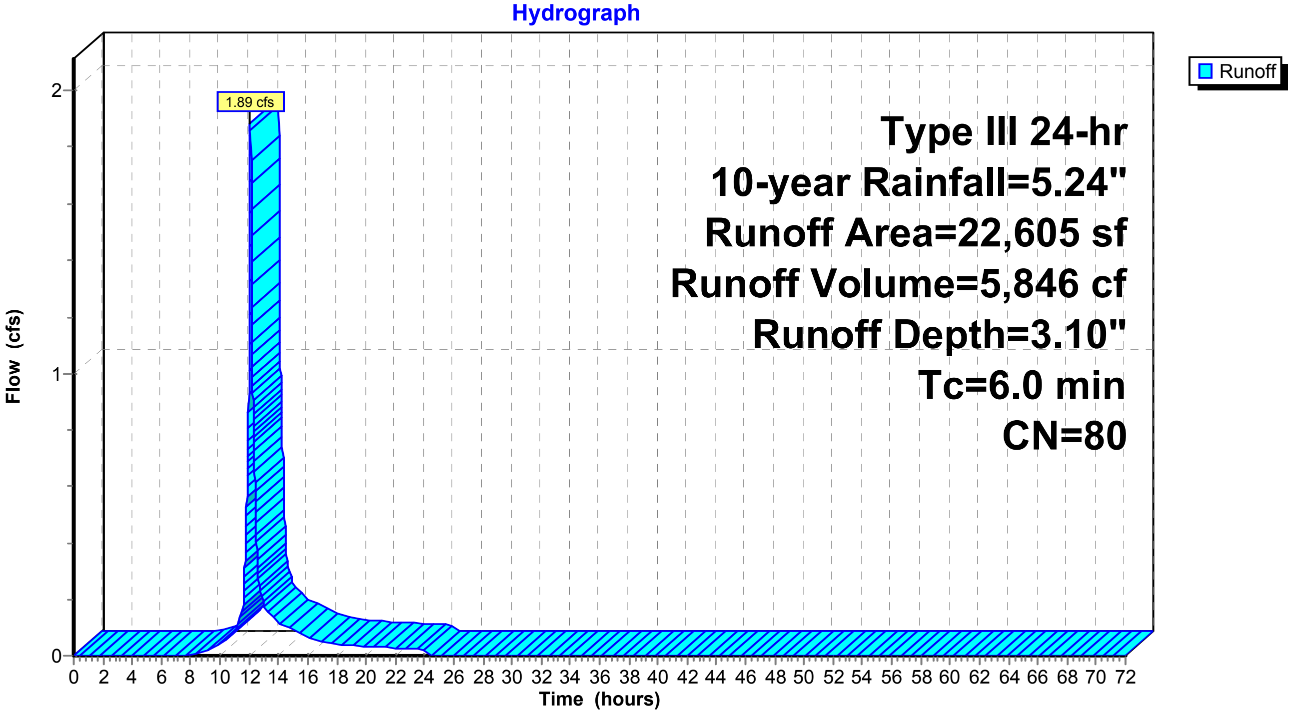
Runoff = 1.89 cfs @ 12.09 hrs, Volume= 5,846 cf, Depth= 3.10"
Routed to nonexistent node B

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-year Rainfall=5.24"

Area (sf)	CN	Description
6,029	98	Paved parking, HSG A
16,576	74	>75% Grass cover, Good, HSG C
22,605	80	Weighted Average
16,576		73.33% Pervious Area
6,029		26.67% Impervious Area

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

Subcatchment DMH3: DMH3



Summary for Subcatchment DMH4: DMH4

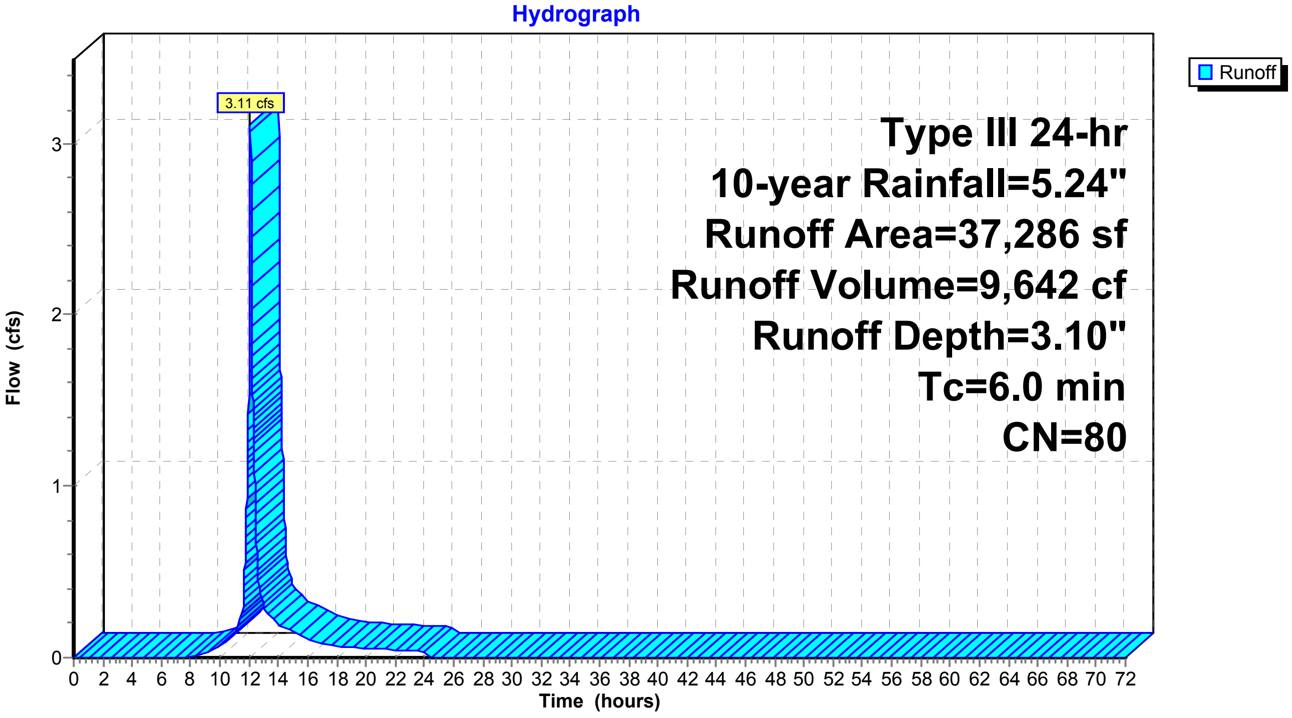
Runoff = 3.11 cfs @ 12.09 hrs, Volume= 9,642 cf, Depth= 3.10"
Routed to nonexistent node B

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-year Rainfall=5.24"

Area (sf)	CN	Description
9,160	98	Paved parking, HSG A
28,126	74	>75% Grass cover, Good, HSG C
37,286	80	Weighted Average
28,126		75.43% Pervious Area
9,160		24.57% Impervious Area

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

Subcatchment DMH4: DMH4



Summary for Subcatchment DMH5: DMH5

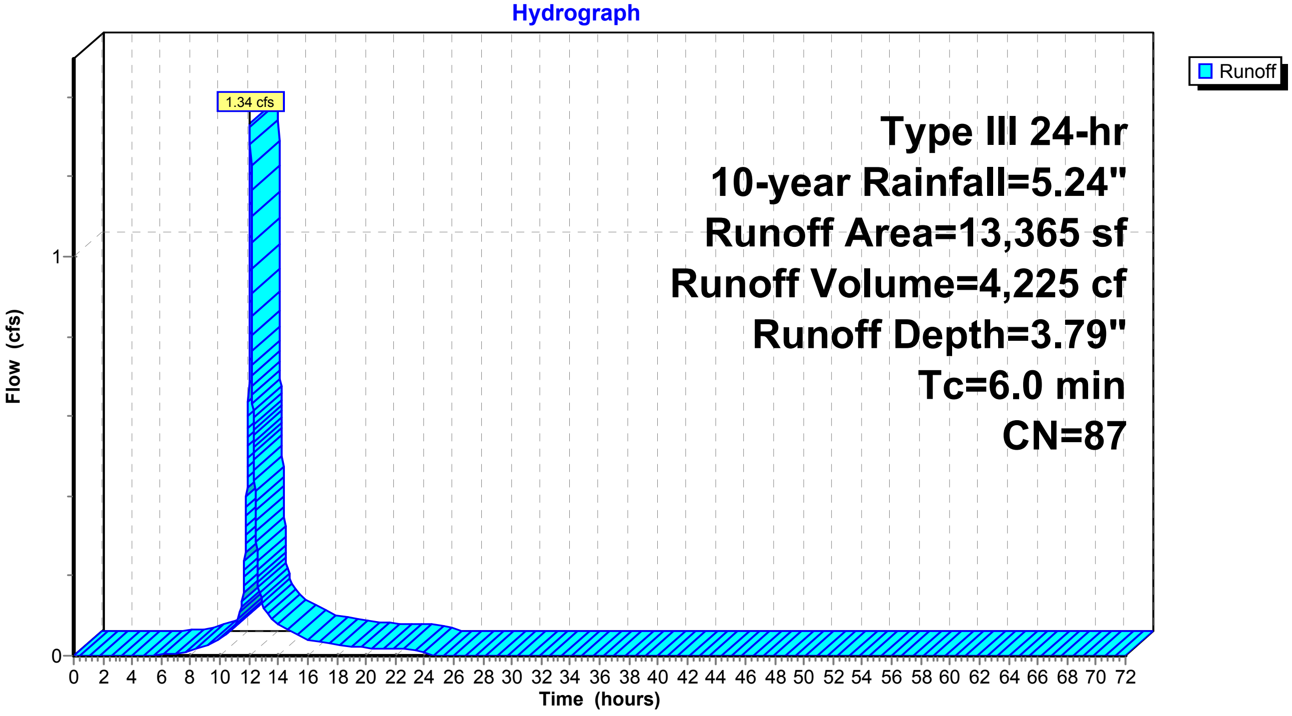
Runoff = 1.34 cfs @ 12.09 hrs, Volume= 4,225 cf, Depth= 3.79"
Routed to nonexistent node B

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-year Rainfall=5.24"

Area (sf)	CN	Description
7,418	98	Paved parking, HSG A
5,947	74	>75% Grass cover, Good, HSG C
13,365	87	Weighted Average
5,947		44.50% Pervious Area
7,418		55.50% Impervious Area

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

Subcatchment DMH5: DMH5



Summary for Subcatchment DMH6: DMH6

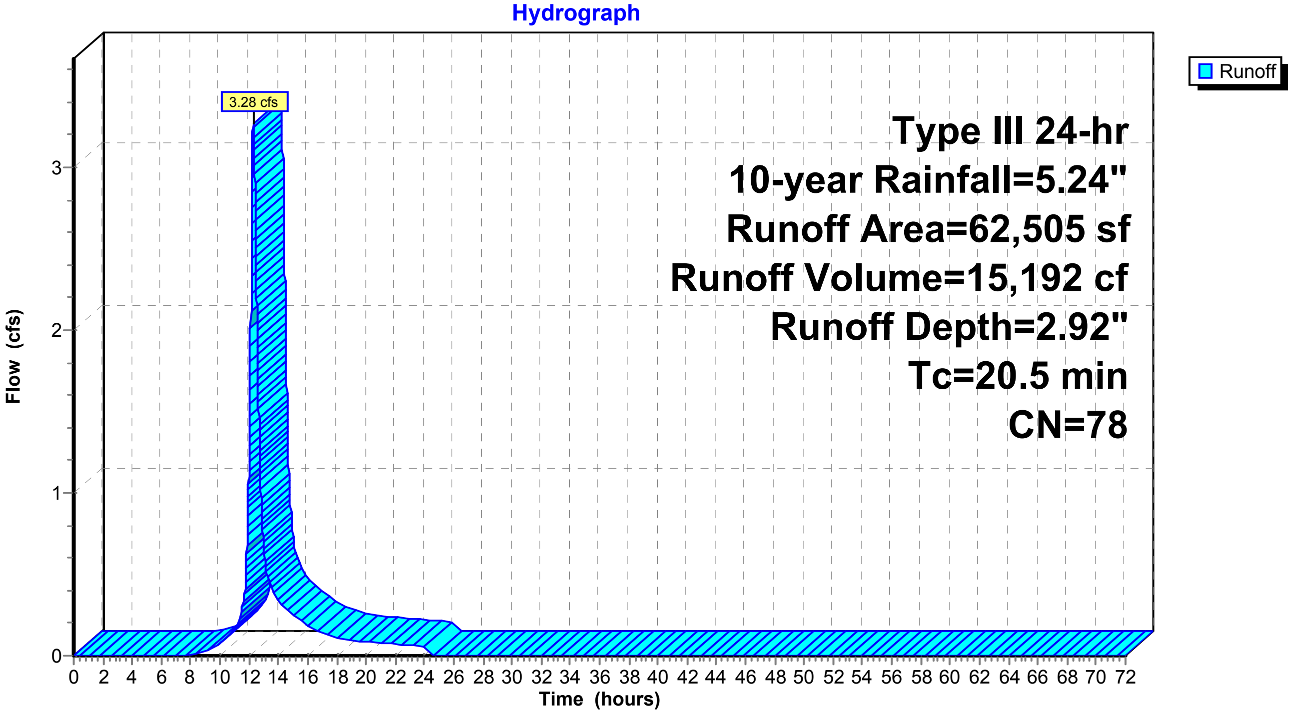
Runoff = 3.28 cfs @ 12.28 hrs, Volume= 15,192 cf, Depth= 2.92"
Routed to nonexistent node B

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-year Rainfall=5.24"

Area (sf)	CN	Description
11,534	98	Paved parking, HSG A
50,971	74	>75% Grass cover, Good, HSG C
62,505	78	Weighted Average
50,971		81.55% Pervious Area
11,534		18.45% Impervious Area

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

Subcatchment DMH6: DMH6



Summary for Subcatchment DMH7: DMH7

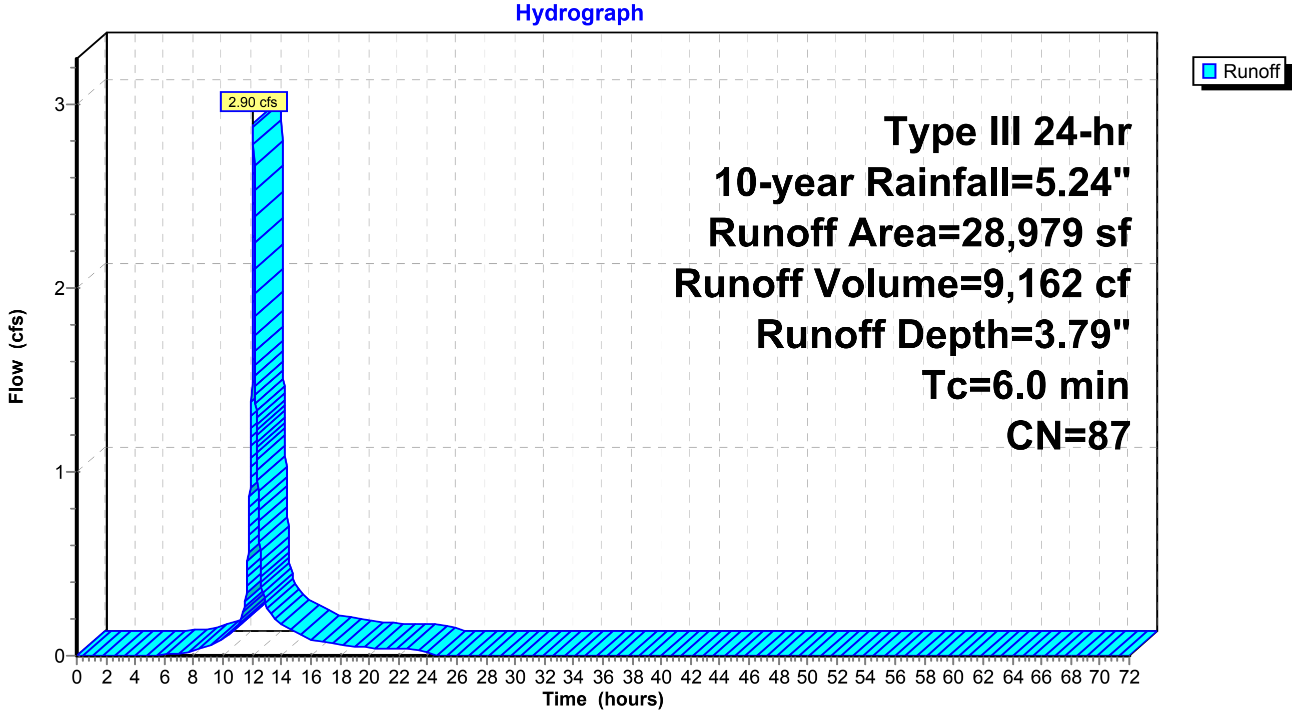
Runoff = 2.90 cfs @ 12.09 hrs, Volume= 9,162 cf, Depth= 3.79"
Routed to nonexistent node B

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-year Rainfall=5.24"

Area (sf)	CN	Description
15,299	98	Paved parking, HSG A
13,680	74	>75% Grass cover, Good, HSG C
28,979	87	Weighted Average
13,680		47.21% Pervious Area
15,299		52.79% Impervious Area

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

Subcatchment DMH7: DMH7



Summary for Subcatchment DMH9: DMH9

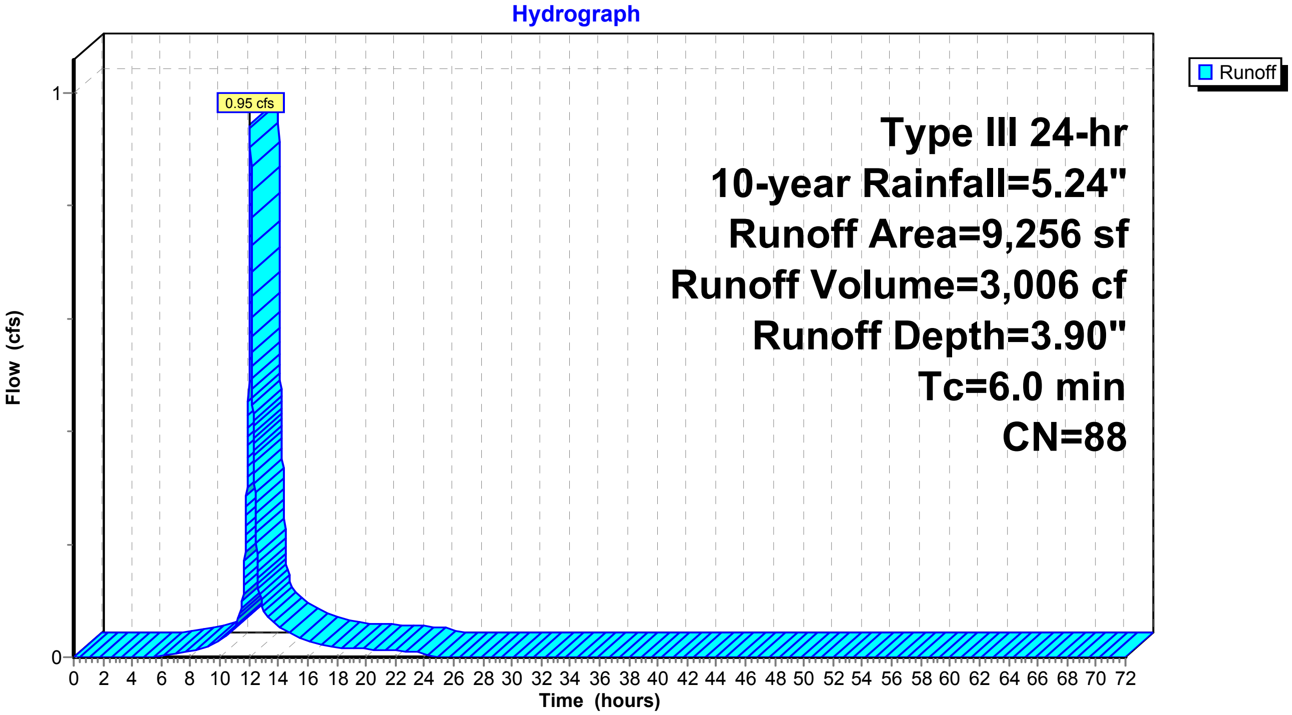
Runoff = 0.95 cfs @ 12.09 hrs, Volume= 3,006 cf, Depth= 3.90"
Routed to nonexistent node B

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-year Rainfall=5.24"

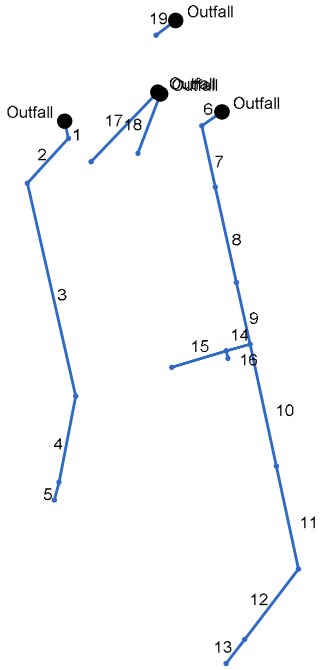
Area (sf)	CN	Description
5,587	98	Paved parking, HSG A
3,669	74	>75% Grass cover, Good, HSG C
9,256	88	Weighted Average
3,669		39.64% Pervious Area
5,587		60.36% Impervious Area

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

Subcatchment DMH9: DMH9



Hydraflow Storm Sewers Extension for Autodesk® Civil 3D® Plan



Project File: Hydraflow-10yr.stm	Number of lines: 19	Date: 3/13/2023

Structure Report

Struct No.	Structure ID	Junction Type	Rim Elev (ft)	Structure			Line Out			Line In		
				Shape	Length (ft)	Width (ft)	Size (in)	Shape	Invert (ft)	Size (in)	Shape	Invert (ft)
1	DMH-5	Manhole	246.92	Cir	4.00	4.00	24	Cir	242.89	24	Cir	244.43
2	DMH-4	Manhole	248.45	Cir	4.00	4.00	24	Cir	244.91	24	Cir	244.91
3	DMH-3	Manhole	249.95	Cir	4.00	4.00	24	Cir	246.65	18	Cir	247.42
4	DMH-2	Manhole	252.29	Cir	4.00	4.00	18	Cir	248.12	15	Cir	248.12
5	DMH-1	Manhole	252.89	Cir	4.00	4.00	15	Cir	248.27			
6	DMH-13	Manhole	247.30	Cir	4.00	4.00	24	Cir	241.42	24	Cir	241.42
7	DMH-12	Manhole	246.81	Cir	4.00	4.00	24	Cir	241.92	24	Cir	241.92
8	DMH-11	Manhole	246.48	Cir	4.00	4.00	24	Cir	242.70	24	Cir	242.97
9	DMH-10	Manhole	246.93	Cir	4.00	4.00	24	Cir	243.47	18 18	Cir Cir	243.47 244.53
10	DMH-9	Manhole	249.05	Cir	4.00	4.00	18	Cir	244.46	18	Cir	244.46
11	DMH-8	Manhole	250.92	Cir	4.00	4.00	18	Cir	245.30	15	Cir	245.30
12	DMH-7	Manhole	249.77	Cir	4.00	4.00	15	Cir	246.00	12	Cir	246.24
13	DMH-6	Manhole	250.28	Cir	4.00	4.00	12	Cir	246.48			
14	DMH-14	Manhole	247.53	Cir	4.00	4.00	18	Cir	244.73	15 15	Cir Cir	244.79 244.73
15	DB-3	Manhole	248.05	Cir	4.00	4.00	15	Cir	245.24			
16	DMH-17	Manhole	247.50	Cir	4.00	4.00	15	Cir	244.79			
17	DB-2	Manhole	247.88	Cir	4.00	4.00	12	Cir	244.42			
18	DMH-15	Manhole	247.60	Cir	4.00	4.00	12	Cir	244.02			
19	CDS-1	Manhole	244.40	Cir	4.00	4.00	12	Cir	241.30			

Project File: Hydraflow-10yr.stm

Number of Structures: 19

Run Date: 3/13/2023

Storm Sewer Summary Report

Line No.	Line ID	Flow rate (cfs)	Line Size (in)	Line shape	Line length (ft)	Invert EL Dn (ft)	Invert EL Up (ft)	Line Slope (%)	HGL Down (ft)	HGL Up (ft)	Minor loss (ft)	HGL Junct (ft)	Dns Line No.	Junction Type
1	P-7	15.30	24	Cir	28.214	242.75	242.89	0.496	244.16	244.37	0.50	244.87	End	Manhole
2	P-5	13.96	24	Cir	96.651	244.43	244.91	0.497	245.79	246.27	0.50	246.77	1	Manhole
3	P-4	10.85	24	Cir	347.159	244.91	246.65	0.501	246.77	247.83	n/a	247.83 j	2	Manhole
4	P-3	8.96	18	Cir	139.284	247.42	248.12	0.503	248.92*	249.78*	0.06	249.84	3	Manhole
5	P-2	6.63	15	Cir	29.259	248.12	248.27	0.513	249.84*	250.11*	0.45	250.56	4	Manhole
6	P-18	20.21	24	Cir	39.033	241.22	241.42	0.512	242.83	243.24	0.66	243.90	End	Manhole
7	P-45	19.43	24	Cir	100.000	241.42	241.92	0.500	243.90*	244.53*	0.09	244.62	6	Manhole
8	P-17	18.10	24	Cir	155.198	241.92	242.70	0.503	244.62*	245.47*	0.08	245.55	7	Manhole
9	P-16	15.61	24	Cir	100.772	242.97	243.47	0.496	245.55*	245.96*	0.38	246.34	8	Manhole
10	P-15	7.13	18	Cir	198.266	243.47	244.46	0.499	246.34*	247.12*	0.04	247.16	9	Manhole
11	P-14	6.18	18	Cir	167.265	244.46	245.30	0.502	247.16*	247.65*	0.15	247.80	10	Manhole
12	P-13	6.18	15	Cir	140.489	245.30	246.00	0.498	247.80*	248.90*	0.06	248.96	11	Manhole
13	P-12	3.28	12	Cir	48.631	246.24	246.48	0.493	248.96*	249.31*	0.27	249.58	12	Manhole
14	P-48	7.04	18	Cir	39.055	244.53	244.73	0.512	246.34*	246.49*	0.25	246.74	9	Manhole
15	P-47	3.91	15	Cir	90.451	244.79	245.24	0.498	246.74*	247.02*	0.16	247.18	14	Manhole
16	P-54	3.13	15	Cir	12.000	244.73	244.79	0.500	246.74*	246.76*	0.10	246.86	14	Manhole
17	P-31	3.34	12	Cir	152.906	243.66	244.42	0.497	244.44*	245.76*	0.28	246.04	End	Manhole
18	P-52	3.00	12	Cir	101.154	243.51	244.02	0.504	244.25	245.01	0.23	245.24	End	Manhole
19	P-43	0.56	12	Cir	38.907	241.11	241.30	0.488	241.42	241.61	0.11	241.61	End	Manhole

Project File: Hydraflow-10yr.stm

Number of lines: 19

Run Date: 3/13/2023

NOTES: Known Qs only ; *Surcharged (HGL above crown). ; j - Line contains hyd. jump.

Storm Sewer Tabulation

Station		Len	Drng Area		Rnoff coeff	Area x C		Tc		Rain (I)	Total flow	Cap full	Vel	Pipe		Invert Elev		HGL Elev		Grnd / Rim Elev		Line ID
Line	To Line	(ft)	Incr (ac)	Total (ac)	(C)	Incr	Total	Inlet (min)	Syst (min)	(in/hr)	(cfs)	(cfs)	(ft/s)	Size (in)	Slope (%)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	
1	End	28.214	0.00	0.00	0.00	0.00	0.00	0.0	2.6	0.0	15.30	17.26	6.31	24	0.50	242.75	242.89	244.16	244.37	243.85	246.92	P-7
2	1	96.651	0.00	0.00	0.00	0.00	0.00	0.0	2.2	0.0	13.96	17.27	6.12	24	0.50	244.43	244.91	245.79	246.27	246.92	248.45	P-5
3	2	347.159	0.00	0.00	0.00	0.00	0.00	0.0	0.5	0.0	10.85	17.35	4.60	24	0.50	244.91	246.65	246.77	247.83	248.45	249.95	P-4
4	3	139.284	0.00	0.00	0.00	0.00	0.00	0.0	0.1	0.0	8.96	8.06	5.07	18	0.50	247.42	248.12	248.92	249.78	249.95	252.29	P-3
5	4	29.259	0.00	0.00	0.00	0.00	0.00	0.0	0.0	0.0	6.63	5.01	5.40	15	0.51	248.12	248.27	249.84	250.11	252.29	252.89	P-2
6	End	39.033	0.00	0.00	0.00	0.00	0.00	0.0	3.3	0.0	20.21	17.54	7.08	24	0.51	241.22	241.42	242.83	243.24	242.33	247.30	P-18
7	6	100.000	0.00	0.00	0.00	0.00	0.00	0.0	3.1	0.0	19.43	17.33	6.19	24	0.50	241.42	241.92	243.90	244.53	247.30	246.81	P-45
8	7	155.198	0.00	0.00	0.00	0.00	0.00	0.0	2.6	0.0	18.10	17.37	5.76	24	0.50	241.92	242.70	244.62	245.47	246.81	246.48	P-17
9	8	100.772	0.00	0.00	0.00	0.00	0.00	0.0	2.3	0.0	15.61	17.26	4.97	24	0.50	242.97	243.47	245.55	245.96	246.48	246.93	P-16
10	9	198.266	0.00	0.00	0.00	0.00	0.00	0.0	1.5	0.0	7.13	8.04	4.04	18	0.50	243.47	244.46	246.34	247.12	246.93	249.05	P-15
11	10	167.265	0.00	0.00	0.00	0.00	0.00	0.0	0.7	0.0	6.18	8.06	3.50	18	0.50	244.46	245.30	247.16	247.65	249.05	250.92	P-14
12	11	140.489	0.00	0.00	0.00	0.00	0.00	0.0	0.2	0.0	6.18	4.94	5.04	15	0.50	245.30	246.00	247.80	248.90	250.92	249.77	P-13
13	12	48.631	0.00	0.00	0.00	0.00	0.00	0.0	0.0	0.0	3.28	2.71	4.18	12	0.49	246.24	246.48	248.96	249.31	249.77	250.28	P-12
14	9	39.055	0.00	0.00	0.00	0.00	0.00	0.0	0.5	0.0	7.04	8.14	3.98	18	0.51	244.53	244.73	246.34	246.49	246.93	247.53	P-48
15	14	90.451	0.00	0.00	0.00	0.00	0.00	0.0	0.0	0.0	3.91	4.93	3.19	15	0.50	244.79	245.24	246.74	247.02	247.53	248.05	P-47
16	14	12.000	0.00	0.00	0.00	0.00	0.00	0.0	0.0	0.0	3.13	4.95	2.55	15	0.50	244.73	244.79	246.74	246.76	247.53	247.50	P-54
17	End	152.906	0.00	0.00	0.00	0.00	0.00	0.0	0.0	0.0	3.34	2.72	4.66	12	0.50	243.66	244.42	244.44	245.76	244.76	247.88	P-31
18	End	101.154	0.00	0.00	0.00	0.00	0.00	0.0	0.0	0.0	3.00	2.74	4.32	12	0.50	243.51	244.02	244.25	245.01	244.62	247.60	P-52
19	End	38.907	0.00	0.00	0.00	0.00	0.00	0.0	0.0	0.0	0.56	2.70	2.70	12	0.49	241.11	241.30	241.42	241.61	242.21	244.40	P-43

Project File: Hydraflow-10yr.stm

Number of lines: 19

Run Date: 3/13/2023

NOTES:Known Qs only ; c = cir e = ellip b = box

Hydraulic Grade Line Computations

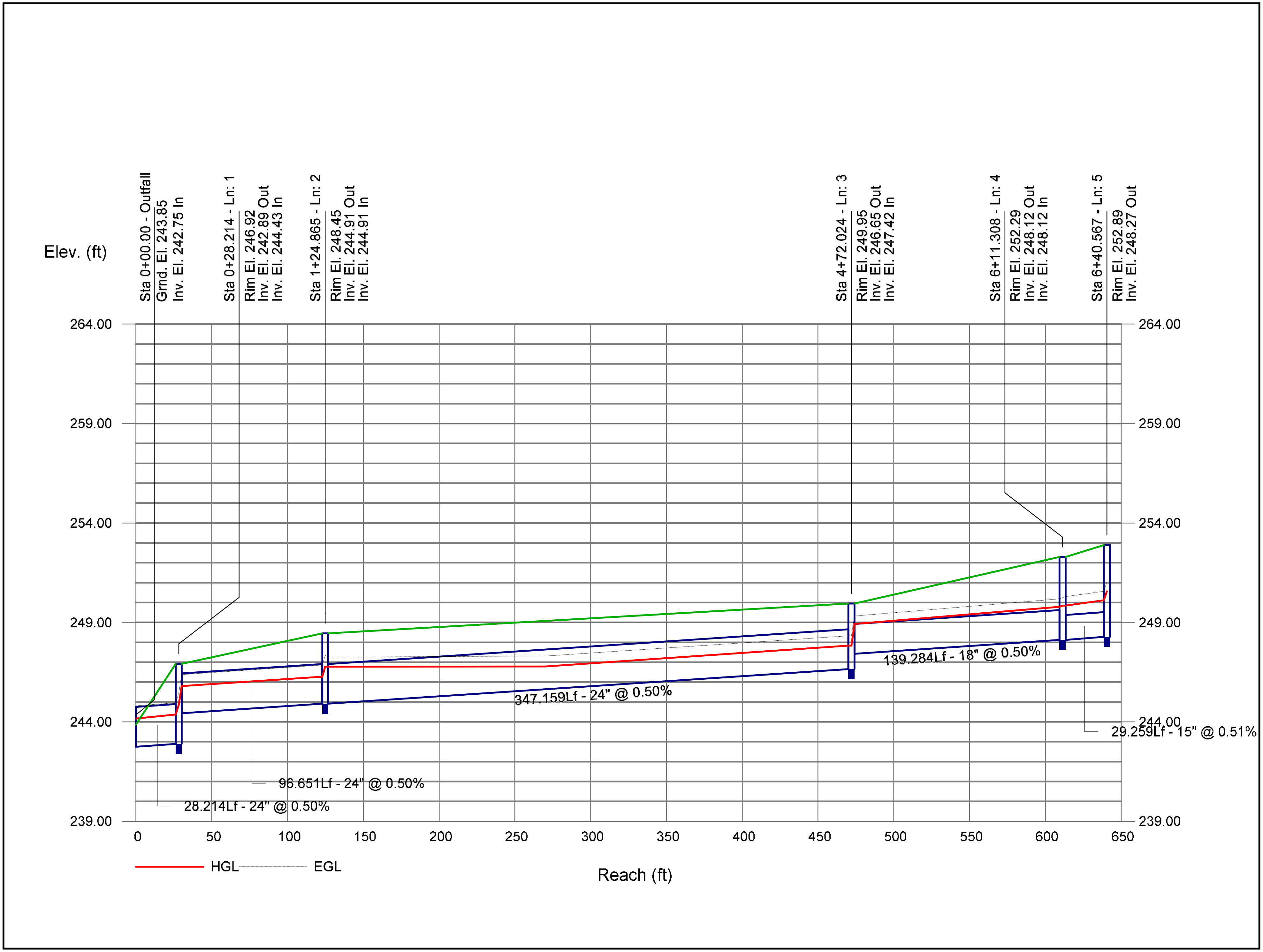
Line	Size	Q	Downstream								Len	Upstream								Check		JL coeff	Minor loss
	(in)	(cfs)	Invert elev (ft)	HGL elev (ft)	Depth (ft)	Area (sqft)	Vel (ft/s)	Vel head (ft)	EGL elev (ft)	Sf (%)	(ft)	Invert elev (ft)	HGL elev (ft)	Depth (ft)	Area (sqft)	Vel (ft/s)	Vel head (ft)	EGL elev (ft)	Sf (%)	Ave Sf (%)	Enrgy loss (ft)	(K)	(ft)
1	24	15.30	242.75	244.16	1.41	2.37	6.46	0.65	244.81	0.546	28.214	242.89	244.37	1.48	2.49	6.16	0.59	244.96	0.487	0.517	0.146	0.85	0.50
2	24	13.96	244.43	245.79	1.36*	2.28	6.12	0.58	246.38	0.496	96.651	244.91	246.27	1.36	2.28	6.12	0.58	246.86	0.497	0.497	0.480	0.85	0.50
3	24	10.85	244.91	246.77	1.86	1.93	3.57	0.49	247.26	0.000	347.159	246.65	247.83 j	1.18**	1.93	5.63	0.49	248.32	0.000	0.000	n/a	0.46	0.23
4	18	8.96	247.42	248.92	1.50*	1.77	5.07	0.40	249.32	0.621	139.284	248.12	249.78	1.50	1.77	5.07	0.40	250.18	0.620	0.620	0.864	0.15	0.06
5	15	6.63	248.12	249.84	1.25	1.23	5.40	0.45	250.30	0.899	29.259	248.27	250.11	1.25	1.23	5.40	0.45	250.56	0.898	0.898	0.263	1.00	0.45
6	24	20.21	241.22	242.83	1.61*	2.71	7.45	0.86	243.69	0.701	39.033	241.42	243.24	1.82	3.01	6.72	0.70	243.95	0.593	0.647	0.253	0.94	0.66
7	24	19.43	241.42	243.90	2.00	3.14	6.19	0.59	244.50	0.629	100.000	241.92	244.53	2.00	3.14	6.18	0.59	245.13	0.629	0.629	0.629	0.15	0.09
8	24	18.10	241.92	244.62	2.00	3.14	5.76	0.52	245.14	0.546	155.198	242.70	245.47	2.00	3.14	5.76	0.52	245.99	0.546	0.546	0.847	0.15	0.08
9	24	15.61	242.97	245.55	2.00	3.14	4.97	0.38	245.93	0.406	100.772	243.47	245.96	2.00	3.14	4.97	0.38	246.34	0.406	0.406	0.409	1.00	0.38
10	18	7.13	243.47	246.34	1.50	1.77	4.04	0.25	246.59	0.393	198.266	244.46	247.12	1.50	1.77	4.03	0.25	247.37	0.393	0.393	0.779	0.15	0.04
11	18	6.18	244.46	247.16	1.50	1.77	3.50	0.19	247.35	0.295	167.265	245.30	247.65	1.50	1.77	3.50	0.19	247.84	0.295	0.295	0.494	0.80	0.15
12	15	6.18	245.30	247.80	1.25	1.23	5.04	0.39	248.20	0.781	140.489	246.00	248.90	1.25	1.23	5.04	0.39	249.30	0.780	0.781	1.097	0.15	0.06
13	12	3.28	246.24	248.96	1.00	0.79	4.18	0.27	249.23	0.723	48.631	246.48	249.31	1.00	0.79	4.18	0.27	249.58	0.723	0.723	0.352	1.00	0.27
14	18	7.04	244.53	246.34	1.50	1.77	3.98	0.25	246.59	0.383	39.055	244.73	246.49	1.50	1.77	3.98	0.25	246.74	0.383	0.383	0.150	1.00	0.25
15	15	3.91	244.79	246.74	1.25	1.23	3.19	0.16	246.90	0.313	90.451	245.24	247.02	1.25	1.23	3.19	0.16	247.18	0.312	0.312	0.283	1.00	0.16
16	15	3.13	244.73	246.74	1.25	1.23	2.55	0.10	246.84	0.200	12.000	244.79	246.76	1.25	1.23	2.55	0.10	246.86	0.200	0.200	0.024	1.00	0.10
17	12	3.34	243.66	244.44	0.78*	0.66	5.07	0.40	244.84	0.823	152.906	244.42	245.76	1.00	0.79	4.25	0.28	246.04	0.750	0.786	1.202	1.00	0.28
18	12	3.00	243.51	244.25	0.74*	0.62	4.80	0.36	244.61	0.746	101.154	244.02	245.01	0.99	0.78	3.83	0.23	245.24	0.552	0.649	0.657	1.00	0.23
19	12	0.56	241.11	241.42	0.31	0.21	2.70	0.11	241.53	0.000	38.907	241.30	241.61	0.31**	0.21	2.69	0.11	241.72	0.000	0.000	n/a	1.00	0.11

Project File: Hydraflow-10yr.stm	Number of lines: 19	Run Date: 3/13/2023

Notes: * depth assumed; ** Critical depth.; j-Line contains hyd. jump ; c = cir e = ellip b = box

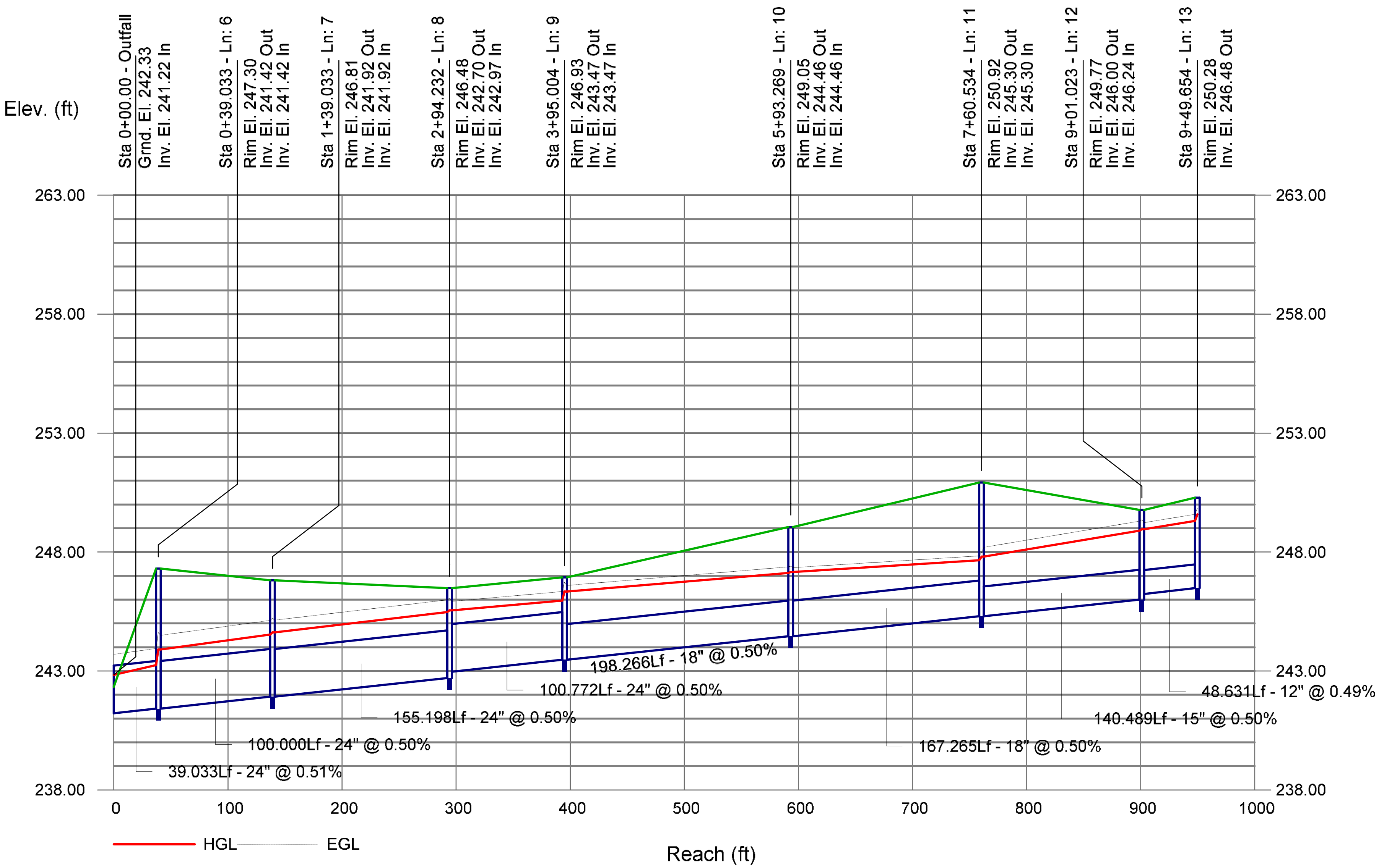
Storm Sewer Profile

Proj. file: Hydraflow-10yr.stm



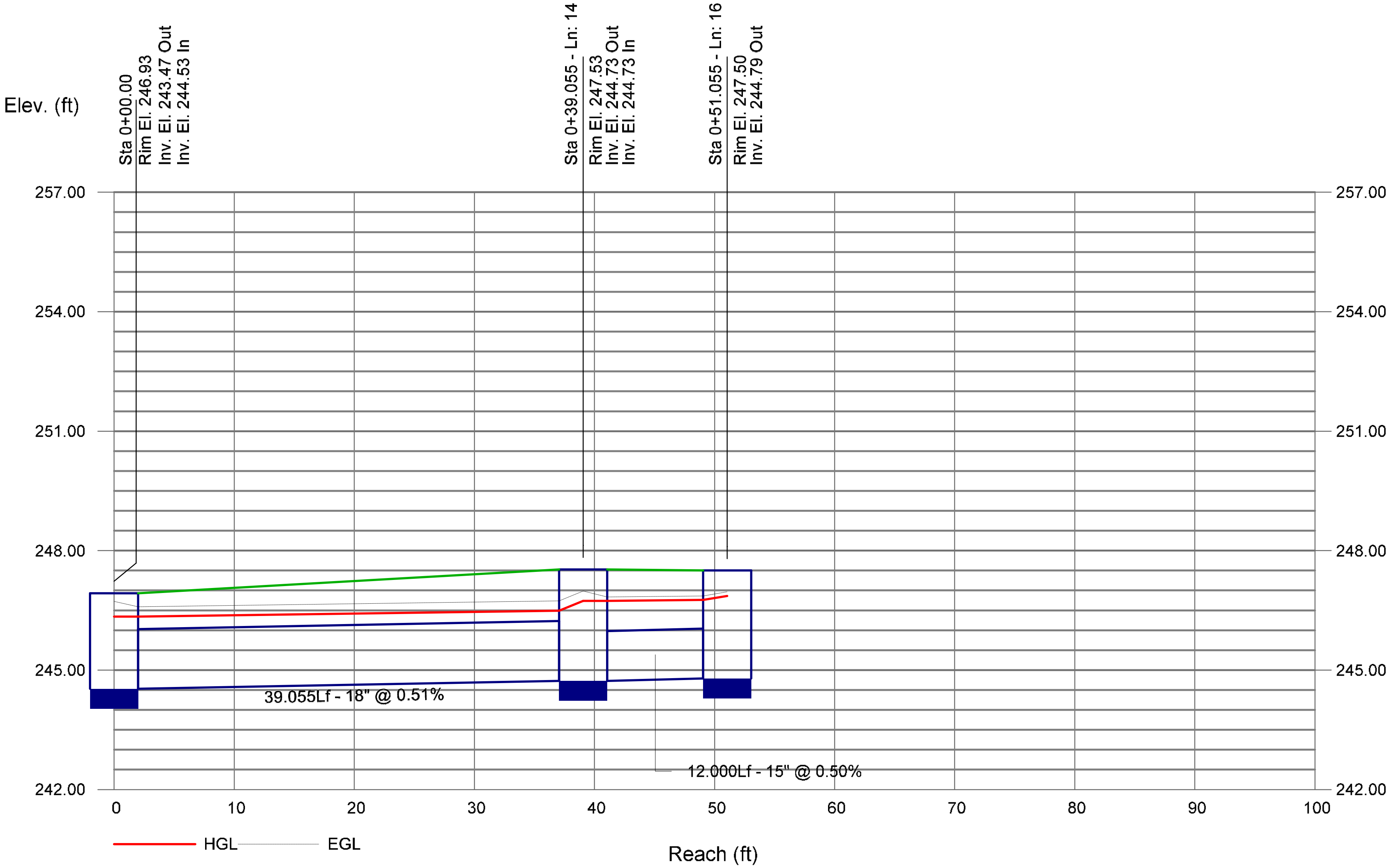
Storm Sewer Profile

Proj. file: Hydraflow-10yr.stm



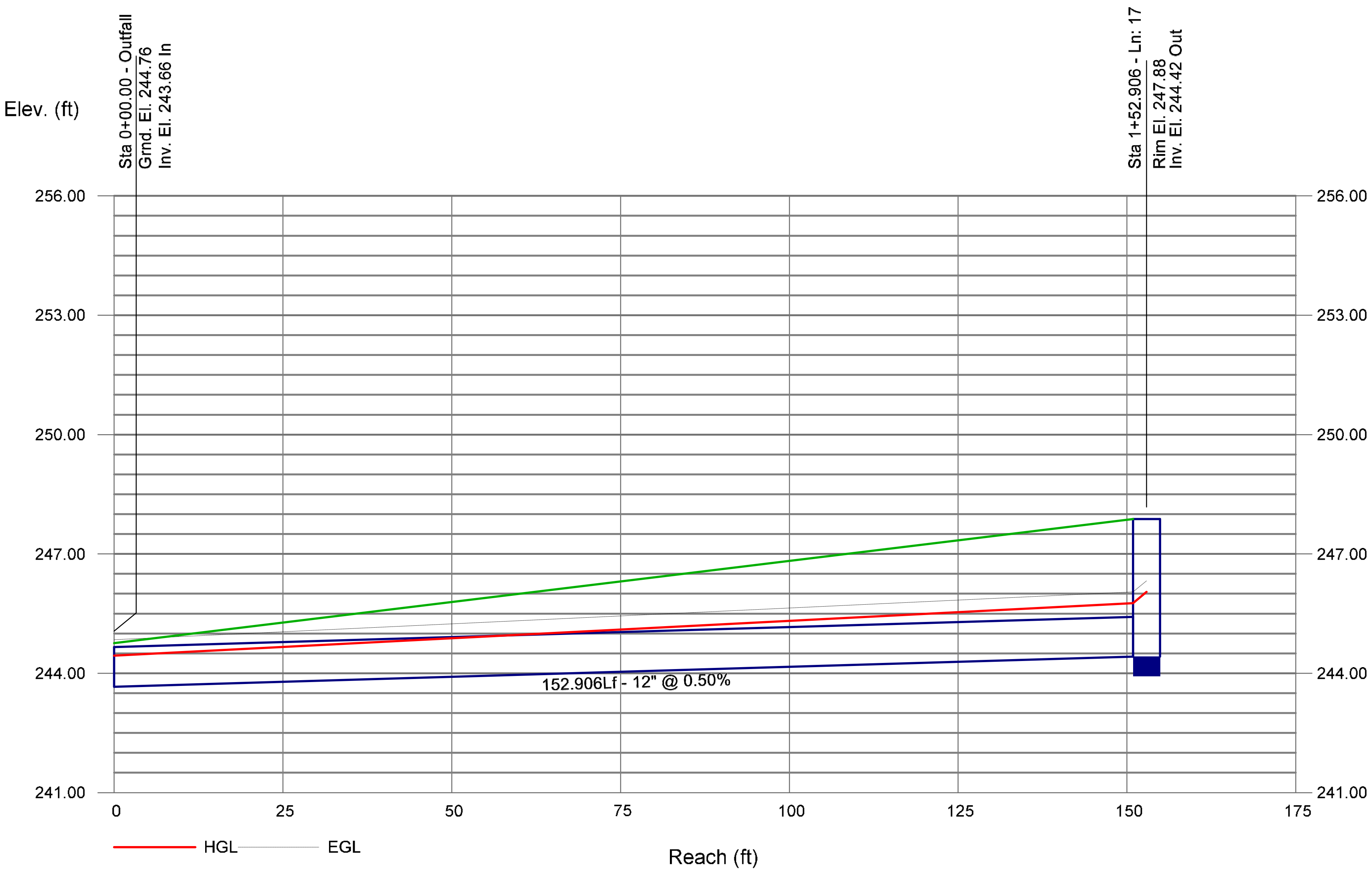
Storm Sewer Profile

Proj. file: Hydraflow-10yr.stm



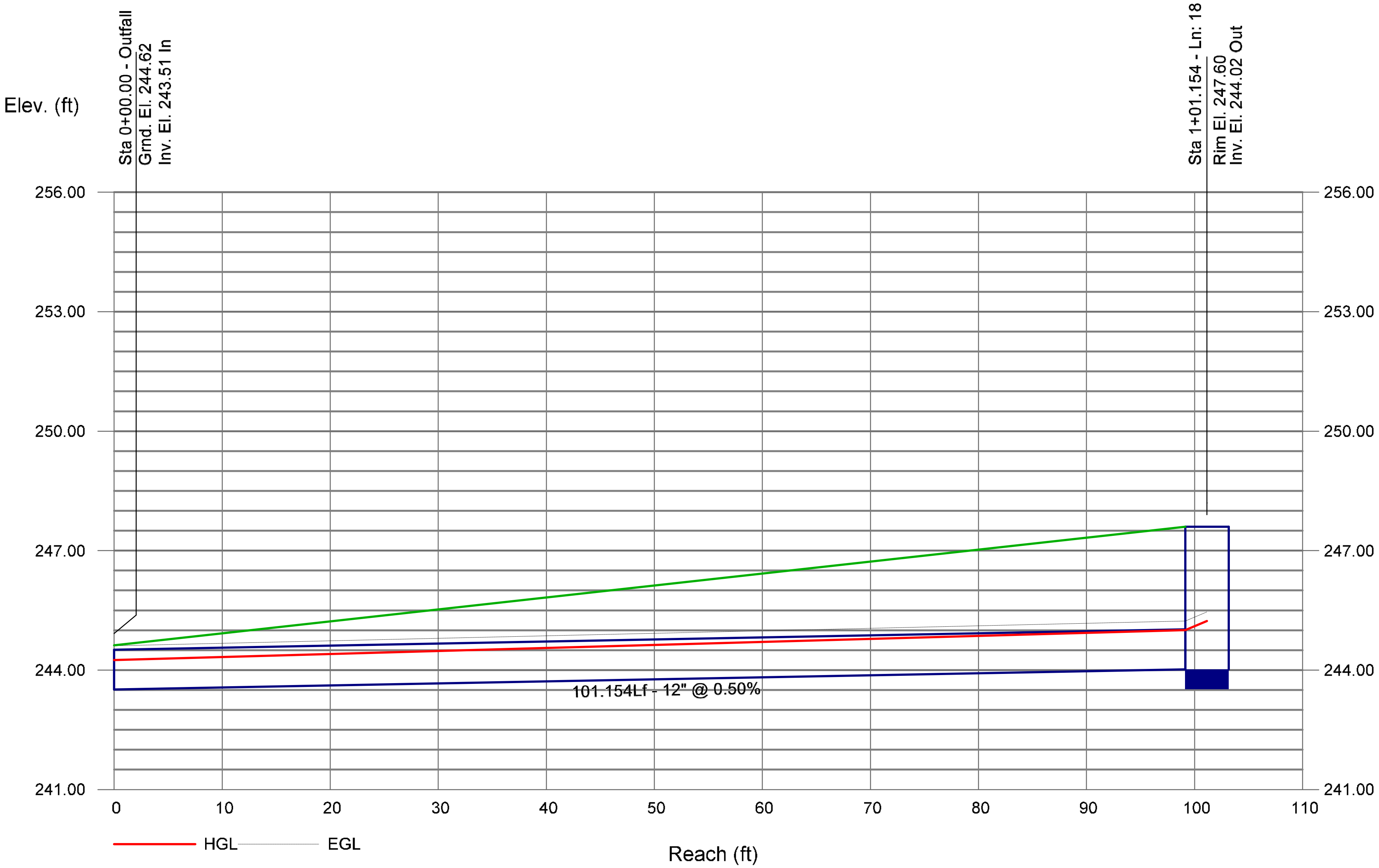
Storm Sewer Profile

Proj. file: Hydraflow-10yr.stm



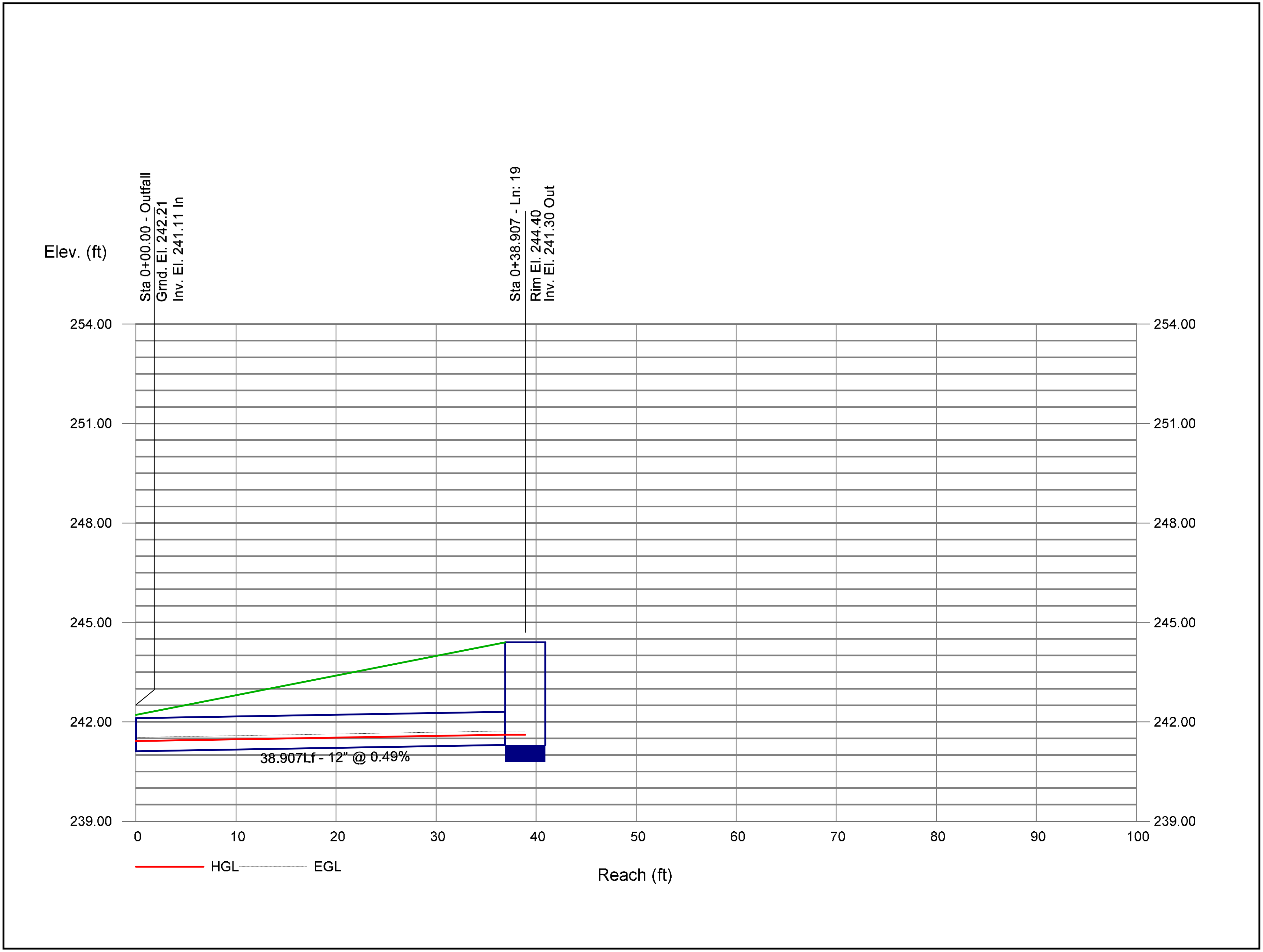
Storm Sewer Profile

Proj. file: Hydraflow-10yr.stm



Storm Sewer Profile

Proj. file: Hydraflow-10yr.stm



Storm Sewers

Attachment G - Long Term Pollution Prevention Plan

Long Term Pollution Prevention Plan
Walnut Street Senior Development
Foxborough, MA

To meet the requirements of Standard 4 of the Massachusetts Stormwater Handbook, this Long Term Pollution Prevention Plan is provided to identify the proper procedures of practices for source control and pollution prevention.

Storage and Handling of Oil and other Hazardous Materials

Any hazardous materials that will be used ancillary to the apartments will be stored inside, or off site.

Spill Prevention/Response

Spill kits will be kept on site, and spills shall be cleaned up immediately. Spills of any hazardous material over 10 gallons will be reported to the Massachusetts Department of Environmental Protection within 24 hours.

Operation and Maintenance of Stormwater Control Structures

Included in Attachment I of this appendix is the Operation and Maintenance plan for this site, which includes street sweeping of the paved areas as well as periodic cleaning of stormwater structures and infiltration practices. The owner will be responsible for the implementation of the plan.

Landscaping

The landscaped areas will be maintained by the owner. Use of fertilizers, herbicides, and pesticides shall be allowed for all vegetated areas on site. If kept on site, all chemicals shall be stored under cover. Any storage for fertilizers, herbicides and pesticides shall not be located within 100 feet of any wetland or within proximity to the stormwater management system where spills could enter the storm drain system.

Septic System

There will be no onsite septic facilities.

Vehicle Washing

Vehicle washing shall not be performed on site. Vehicles can be rinsed with a high volume of water at low pressure. This is considered dust water by the DEP and accounts for what may be rinsed off of the vehicle when it rains. Pre-treatment BMP’s downstream of these activities will include deep-sump hooded catch basins.

Non-Hazardous Waste Management/Good Housekeeping Practices

All non-hazardous waste shall be stored in designated trash or recycling containers onsite for periodic collection by the local trash collector. The Owner shall have maintenance staff who monitor the site for the accumulation of trash. Any trash that is seen onsite shall immediately be collected and placed into designated trash or recycling containers. The owner's maintenance staff shall inspect the site once per week at minimum.

Prohibition of Illicit Discharges

Illicit discharges to the onsite stormwater management system shall be strictly prohibited. Illicit discharges are defined as any direct or indirect non-stormwater discharge to the onsite stormwater system. Requirements related to Illicit Discharges are further detailed in the attached Illicit Discharge Compliance Statement.

De-icing & Snow Disposal

The operation will utilize salt and sand to treat the paved surfaces of the site during snow and ice events. Snow will be temporarily stored within peripheral areas of the site and allowed to melt and drain back to onsite stormwater systems. When needed, snow shall be removed from the site and disposed of in accordance with all local, state and federal regulations.

Winter Sand/Salt Use & Storage

Any sand and/or salt to be used for de-icing purposes shall be stored inside or under cover and stabilized to prevent the discharge into nearby wetlands or waterbodies.

Emergency Contact Information

Owner/Operator:
The Walnut Street Joint Venture Group
536 Granite Street
Braintree, MA 02184

Engineer:
Jesse Johnson, P.E.
Weston & Sampson, Inc.
55 Walkers Brook Drive, Suite 100
Reading, MA 01867
978-532-1900

Attachment H - Construction Period Pollution and Erosion and Sedimentation Control Plan

Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan

SECTION 1: Introduction

The project applicant, OnyxGroup Realty & Development LLC, proposes a new senior housing development project at Walnut Street and Commercial Street in Foxborough. The proposed housing development will consist of three residential buildings with a total of 200 units along with outdoor amenity spaces and vehicular parking areas. Site work will include, but is not limited to, grading, drainage, utilities, paving and landscaping.

As part of this project, this “Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan” has been created to ensure that onsite erosion is prevented and sediment is controlled to prevent it from leaving the site.

SECTION 2: Construction Period Pollution Prevention Measures

Best Management Practices (BMPs) will be utilized as Construction Period Pollution Prevention Measures to reduce potential pollutants and prevent any off-site discharge. The objectives of the BMPs for construction activity are to minimize the disturbed areas, stabilize any disturbed areas, control the site perimeter and retain sediment. Both erosion and sedimentation controls and non-stormwater best management measures will be used to minimize site disturbance and ensure compliance with the performance standards of the WPA and Stormwater Standards. Measures will be taken to minimize the area disturbed by construction activities to reduce the potential for soil erosion and stormwater pollution problems. All pollution prevention and erosion control measures which are required on the site plans and in the SWPPP shall be followed along with the guidance in this document. In addition, good housekeeping measures will be followed for the day-to-day operation of the construction site under the control of the contractor to minimize the impact of construction. This section describes the control practices that will be in place during construction activities. All recommended control practices will comply with the standards set in the MA DEP Stormwater Policy Handbook.

2.1 Minimize Disturbed Area and Protect Natural Features and Soil

In order to minimize disturbed areas all work will be completed within well-defined work limits. These work limits are shown on the construction plans. The Contractor shall not disturb native vegetation in the undisturbed wooded area without prior approval from the Engineer. The Contractor will be responsible to make sure that all workers know the proper work limits and do not extend their work into the undisturbed areas. The protective measures are described in more detail in the following sections.

2.2 Control Stormwater Flowing onto and through the project

A portion of the perimeter around the construction area a will be lined with compost filter tubes and silt fence. The tubes/fence will be inspected daily and accumulated silt will be removed as appropriate. In addition, any storage of material will require a second level of protection by surrounding the areas with another row of compost filter tubes.

2.3 Stabilize Soils

The Contractor shall limit the area of land which is exposed and free from vegetation during construction. In areas where the period of exposure will be greater than two (2) months, mulching, the use of erosion control mats, or other protective measures shall be provided as specified.

The Contractor shall take account of the conditions of the soil where erosion control seeding will take place to ensure that materials used for re-vegetation are adaptive to the sediment control.

Following the completion of construction, embankment areas will be finished with topsoil and seed. The overland areas of the proposed construction staging areas will also be re-seeded.

2.4 Proper storage and cover of any stockpiles

The location of the Contractor's storage areas for equipment and/or materials shall be upon cleared portions of the job site or areas to be cleared as a part of this project and shall require written approval of the Engineer.

Adequate measures for erosion and sediment control such as the placement of compost filter tubes around the downstream perimeter of stockpiles shall be employed to protect any downstream areas from siltation.

The Engineer may designate a particular area or areas where the Contractor may store materials used in his operations.

2.5 Perimeter Controls and Sediment Barriers

Erosion control lines as described in Section 5 will be utilized to ensure that no sedimentation occurs outside the perimeter of the work area.

2.6 Storm Drain Inlet Protection

Storm drain inlets will be protected from sediment.

2.7 Retain Sediment On-Site

The Contractor will be responsible to monitor all erosion control measures. Whenever necessary the Contractor will clear all sediment from the compost filter tubes that have been silted up during construction. Daily monitoring should be conducted using the attached Monitoring Form.

The following good housekeeping practices will be followed on-site during the construction project.

2.8 Material Handling and Waste Management

All materials stored on-site will be stored in a neat, orderly manner in appropriate containers. All materials will be kept in their original containers with the original manufacturer's label. Substances will not be mixed with one another unless recommended by the manufacturer.

All waste materials will be collected and stored in a securely lidded metal container from a licensed management company. The waste and any construction debris from the site will be hauled off-site daily and disposed of properly. The contractor will be responsible for all waste removal. Manufacturer's recommendations for proper use and disposal will be followed for all materials. Sanitary waste will be collected from the portable units a minimum of once a week, by a licensed sanitary waste management contractor.

2.9 Designated Washout Areas

The Contractor shall perform washout into contained areas designated for that purpose to prevent cement-laden water from leaving the site.

2.10 Proper Equipment/Vehicle Fueling and Maintenance Practices

On-site vehicles will be monitored for leaks and receive regular preventative maintenance to reduce the risk of leakage. To ensure that leaks on stored equipment do not contaminate the site, oil-absorbing mats will be placed under all equipment during storage. Regular fueling and service of the equipment may be performed using approved methods and with care taken to minimize chance of spills. Any petroleum products will be stored in tightly sealed containers that are clearly labeled.

2.11 Equipment/Vehicle Washing

The Contractor will be responsible to ensure that no equipment is washed on-site.

SECTION 3: Spill Prevention and Control Plan

The Contractor will be responsible for preventing spills in accordance with the project specifications and applicable federal, state and local regulations. The Contractor will identify a properly trained site employee, involved with the day-to-day site operations to be the spill prevention and cleanup coordinator. The name(s) of the responsible spill personnel will be posted on-site. Each employee will be instructed that all spills are to be reported to the spill prevention and cleanup coordinator.

3.1 Spill Control Equipment

Spill control/containment equipment will be kept in the Work Area. Materials and equipment necessary for spill cleanup will be kept either in the Work Area or in an otherwise accessible on-site location. Equipment and materials will include, but not be limited to, absorbent booms/mats, brooms, dust pans, mops, rags, gloves, goggles, sand, plastic and metal containers specifically for this purpose. It is the responsibility of the Contractor to ensure the inventory will be readily accessible and maintained.

3.2 Notification

All workers will be directed to inform the on-site supervisor of a spill event. The supervisor will assess the incident and initiate proper containment and response procedures immediately upon notification. Workers should avoid direct contact with spilled materials during the containment procedures. Primary notification of a spill should be made to the local Fire Department and Police Departments. Secondary Notification will be to the certified cleanup contractor if deemed necessary by Fire and/or Police personnel. The third level of notification is to the DEP. The specific cleanup contractor to be used will be identified by the Contractor prior to commencement of construction activities.

3.3 Spill Containment and Clean-Up Measures

Spills will be contained with granular sorbent material, sand, sorbent pads, booms or all of the above to prevent spreading. Certified cleanup contractors should complete spill cleanup. The material manufacturer’s recommended methods for spill cleanup will be clearly posted and on-site personnel will be made aware of the procedures and the location of the information and cleanup supplies.

3.4 Hazardous Materials Spill Report

The Contractor will report and record any spill. The spill report will present a description of the release, including the quantity and type of material, date of the spill, circumstances leading to the release, location of spill, response actions and personnel, documentation of notifications and corrective measures implemented to prevent reoccurrence.

This document does not relieve the Contractor of the Federal reporting requirements of 40 CFR Part 110, 40 CFR Part 117, 40 CFR Part 302 and the State requirements specified under the Massachusetts Contingency Plan (M.C.P) relating to spills or other releases of oils or hazardous substances. Where a release containing a hazardous substance or oil in an amount equal to or in excess of a reportable quantity established under either 40 CFR Part 110, 40 CFR Part 117 or 40 CFR Part 302, occurs during a twenty-four (24) hour period, the Contractor is required to comply with the response requirements of the above mentioned regulations. Spills of oil or hazardous material in excess of the reportable quantity will be reported to the National Response Center (NRC).

SECTION 4: Contact Information/Responsible Parties

Owner/Operator:
The Walnut Street Joint Venture Group
536 Granite Street
Braintree, MA 02184

Engineer:
Jesse Johnson, P.E.
Weston & Sampson, Inc.
55 Walkers Brook Drive, Suite 100
Reading, MA 01867
978-532-1900

Site Inspector:
TBD

Contractor:
TBD

SECTION 5: Erosion and Sedimentation Control

Erosion and Sedimentation Controls are shown on the project plans. A Stormwater Pollution Prevention Plan (SWPPP) will be required for this project in accordance with EPA regulations. The contractor shall refer to the SWPPP for additional requirements.

SECTION 6: Site Development Plans

A full set of site development plans are included with this submittal.

SECTION 7: Operation and Maintenance of Erosion Control

If there is a failure to the controls the Contractor, under the supervision of the Engineer, will be required to stop work until the failure is repaired.

Periodically throughout the work, whenever the Engineer deems it necessary, the sediment that has been deposited against the controls will be removed to ensure that the controls are working properly.

SECTION 8: Inspection Schedule

During construction the erosion and sedimentation controls will be inspected daily. Once the Contractor is selected, an on site inspector will be selected to work closely with the Engineer to insure that all erosion and sedimentation controls are in place and working properly. An Inspection Form is included.

Inspection Form

Inspected By:______________________________ Date: ________Time:________

YES	NO	DOES NOT APPLY	ITEM
			Do any erosion/siltation control measures require repair or clean out to maintain adequate function?
			Is there any evidence that sediment is leaving the site and entering the wetlands?
			Are any temporary soil stockpiles or construction materials located in non-approved areas?
			Are on-site construction traffic routes, parking, and storage of equipment and supplies located in areas not specifically designed for them?
			Is there any evidence that sediment is entering subsurface stormwater chamber systems?

Specific location, current weather conditions, and action to be taken:

____

____

____

____

____

____

Other Comments:

____

____

____

Pending the actions noted above I certify that the site is in compliance with the Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan.

Signature:________________________________Date: ______________________

Attachment I - Long Term Operations & Maintenance Plan

1.0 Introduction

The following document has been written to comply with the stormwater guidelines set forth by the Massachusetts Department of Environmental Protection (MassDEP). The intent of these guidelines is to encourage Low Impact Development techniques to improve the quality of the stormwater runoff. These techniques, also known as Best Management Practices (BMPs) collect, store, and treat the runoff before discharging to adjacent environmental resources.

2.0 Purpose

This Operation and Maintenance Plan (O&M Plan) is intended to provide a mechanism for the consistent inspection and maintenance of each BMP installed on the project site. Included in this O&M Plan is a description of each BMP type and an inspection form for each BMP. The Walnut Street Joint Venture Group is the owner and operator of the system and is responsible for its upkeep and maintenance. This work will be funded on an annual basis through the owner's operating budget.

In the event the Owner sells the property, it is the Owner's responsibility to transfer this plan as well as the past three years of operation and maintenance records to the new property owner.

3.0 BMP Description and Locations

3.1 Street Sweeping

Street sweeping consists of using a high efficiency vacuum sweeper machine to clean impervious areas of accumulated sediment, debris, and trash at paved areas.

3.2 Deep Sump Catch Basins

Deep sump catch basins utilizing "SNOUT" catch basin hoods will be located throughout the site and used as pre-treatment before entering the infiltration systems. The deep sump catch basins are designed to remove trash, debris, hydrocarbons, and coarse sediment from the stormwater runoff.

3.3 Drain Manholes

Drain Manholes will be located throughout the site and used to convey and redirect stormwater collected from deep sump catch basins. They allow for access, connection points, and change-in-direction points in the underground drainage system.

3.4 Infiltration Basin

There are two infiltration basins on site that will receive stormwater on site. These structures also significantly mitigate TSS.

3.5 Outlet Control Structure

Outlet control structures are used to control discharges from captured stormwater. They release the water in a controlled manner to control peak discharges.

3.6 Flared End Sections and Rip Rap Aprons

The outlet pipes from the proposed subsurface chamber system are fitted with flared end sections and stone rip-rap aprons to release the water in a controlled manner and prevent scouring and erosion. See section 4.5 for information on flared end sections and rip rap aprons.

4.0 Inspection, Maintenance Checklist and Schedule

4.1 Street Sweeping

Street sweeping shall be performed on all impervious surfaces on a quarterly average, with sweeping performed primarily in the spring and fall. Street sweeping shall be performed using a high efficiency vacuum street sweeping machine or a regenerative air sweeper. A mechanical rotary broom sweeper may be used if sweeping is performed on a monthly basis.

In the event of contamination by a spill or other means, all street sweeping cleanings must be evaluated in accordance with the Hazardous Waste Regulations, 310 CMR 30.000 and handled as hazardous waste.

In the absence of evidence of contamination, street sweeping cleanings may be taken to a landfill or other facility permitted by MassDEP to accept Solid Waste without any prior approval by MassDEP. Please note that current MassDEP regulations prevent landfills from accepting materials that contain free-draining liquids.

4.2 Deep Sump Catch Basins and Outlet Control Structures

Inspect and/or clean catch basin and outlet control structures at least four times per year and at the end of foliage and snow removal seasons.

Sediments must be removed whenever the depth of deposits is greater than or equal to one half the depth from the bottom of the invert of the lowest pipe in the basin. The structures should be cleaned a minimum of four times per year regardless of the amount of sediment in the basin. The site is considered a land use with a higher potential pollutant load, therefore if Catch Basins are found to be filled to capacity with sediment during a cleaning, the frequency of cleaning shall be increased. Catch basins and outlet control structures shall be cleaned with clamshell buckets or by hand tools where necessary. SNOUT hoods shall be inspected annually. Open and close the access hatch and flush or rod the anti-siphon device to ensure proper operation.

In the event of contamination by a spill or other means, all cleanings must be evaluated in accordance with the Hazardous Waste Regulations, 310 CMR 30.000 and handled as hazardous waste.

In the absence of evidence of contamination, catch basin cleanings may be taken to a landfill or other facility permitted by MassDEP to accept Solid Waste without any prior approval by MassDEP. Please note that current MassDEP regulations prevent landfills from accepting materials that contain free-draining liquids.

4.3 Drain Manholes

Inspect and/or clean drain manholes at least four times per year while inspecting the catch basins. Remove all accumulated sediments and debris, and dispose of in accordance with local, state, and federal regulations. Drain Manholes shall be cleaned with clamshell buckets or by hand tools where necessary.

In the event of contamination by a spill or other means, all cleanings must be evaluated in accordance with the Hazardous Waste Regulations, 310 CMR 30.000 and handled as hazardous waste.

In the absence of evidence of contamination, manhole cleanings may be taken to a landfill or other facility permitted by MassDEP to accept Solid Waste without any prior approval by MassDEP. Please note that current MassDEP regulations prevent landfills from accepting materials that contain free-draining liquids.

4.4 Infiltration Basin

The infiltration basins shall be inspected every six months during the first year, and annually thereafter. All accumulated sediment and debris in the infiltration basin should be removed and disposed of according to local, state and federal regulations. During the growing season, vegetation should not exceed six inches in height in the infiltration basin and should be mowed as necessary. Any grassed areas in close proximity to any areas that use salt in deicing applications should be re-seeded in the spring. Bare spots should be re-seeded as needed.

4.5 Flared End Section with Rip Rap Apron

Pipe outfalls from stormwater basins shall be inspected for plugging or damage and cleaned in March, June, September and December. Any vegetation, soil or debris that forms a barrier to flow shall be removed. If any soil erosion is noted, erosion shall be repaired and bare spots shall be armored with stone riprap. All trash, debris, and sediments should be disposed of in accordance with local, state, and federal regulations.

4.6 Inspections and Record Keeping

- An inspection form should be filled out each and every time maintenance work is performed.

- A binder should be kept at the facility that contains all of the completed inspection forms and any other related materials.

- A review of all Operation & Maintenance actions should take place annually to ensure that these Stormwater BMPs are being taken care of in the manner illustrated in this Operation & Maintenance Plan.

- All operation and maintenance log forms for the last three years, at a minimum, shall be kept on site at the facility.

- The inspection and maintenance schedule may be refined in the future based on the findings and results of this operation and maintenance program or policy.

5.0 Public Safety Features

The two stormwater basins on site have been designed to be shallow in depth, thereby not presenting any harm to the public. They are also screened with dense plantings around their perimeter to deter any pedestrians.

6.0 Stormwater Management System Owner/Responsible Party

The stormwater management system shall be owned and maintained by the following party or its future designee/assigns:

The Walnut Street Joint Venture Group
536 Granite Street
Braintree, MA 02184

This operation and Maintenance Plan will be recorded with the registry of deeds so that current and future owners are aware of the requirement for proper operation and maintenance of the onsite stormwater system.

7.0 General Good Housekeeping Practices

All non-hazardous waste shall be stored in designated trash or recycling containers onsite for periodic collection by the local trash collector. The owner shall have maintenance staff who monitor the site for the accumulation of trash. Any trash that is seen onsite shall immediately be collected and placed into designated trash or recycling containers. The owners staff shall make an inspection of the site once per week at minimum.

8.0 Estimated Operations and Maintenance Budget

The estimated budget for annual operations and maintenance of this stormwater system is $2,000 per year.

Walnut Street Senior Development
Permanent BMP Inspection Checklist

☐ **Street Sweeping**

Frequency: Quarterly average, primarily in the spring and fall if using a high efficiency vacuum sweeper or regenerative air sweeper. Monthly, if using a mechanical rotary broom sweeper.

Location: Parking Areas, Driveways and Roadway

Inspected By: __________________ Date: _____________

Observations: _____________________________________
____
____

Actions Taken: _____________________________________
____
____

Instructions: Sweep all impervious areas, including parking lots, driveways, and roadways using high efficiency vacuum street sweeping machine, regenerative air sweeper, or mechanical rotary broom sweeper.
All trash, debris, and sediments should be disposed of in accordance with local, state, and federal regulations.

☐ **Deep Sump Catch Basins & Outlet Control Structures**

Frequency: Inspect and clean deep sump catch basins and outlet control structures in March, June, September and December.

Structure Number: ______________________________________

Inspected By: ___________________ Date: _____________

Observations: ______________________________________
____
____

Actions Taken: ______________________________________
____
____

Instructions: Clean units four times per year or whenever the depth of the deposits is greater than or equal to one half the depth from the bottom of the invert to the lowest pipe in the structure. Open and close SNOUT hood and check anti-siphon vent for clogging.

☐ **Drain Manholes**

Frequency: Inspect and clean drain manholes in March, June, September and December.

Structure Number: ______________________________________

Inspected By: __________________ Date: _____________

Observations: ______________________________________

____

____

Actions Taken: ______________________________________

____

____

Instructions: Clean units four times per year at a minimum, or whenever catch basins are inspected. Remove sediment and debris. All debris, and sediments should be disposed of in accordance with local, state, and federal regulations. Drain Manholes shall be cleaned with clamshell buckets or by hand tools where necessary.

☐ **Infiltration Basins**

Frequency: The Infiltration Basins should be inspected every six months during the first year and annually thereafter.

Structure No.: ________________________________

Inspected By: ________________ Date: ___________

Observations: _________________________________
____
____

Actions Taken: _________________________________
____
____

Instructions: Inspect grassed area. Mow grass as needed in infiltration basin. Remove accumulated trash and debris. Remove sediment and re-seed bare spots as needed. All trash, debris, and sediments should be disposed of in accordance with local, state, and federal regulations.

☐ Flared End Sections with Rip Rap Aprons

Frequency: Inspect and clean flared end sections and rip rap aprons in March, June, September and December.

Structure Number: ______________________________

Inspected By: ______________ Date: __________

Observations: ______________________________
____
____

Actions Taken: ______________________________
____
____

Instructions: Clean the system whenever the depth of the deposits averages three inches in depth across the bottom of the chambers. Inspect chambers via manholes or inspection ports. Use reverse water jet to pull sediment back into manhole. Remove sediment, trash and debris as noted above.

CDS Guide
Operation, Design, Performance and Maintenance

CDS®

Using patented continuous deflective separation technology, the CDS system screens, separates and traps debris, sediment, and oil and grease from stormwater runoff. The indirect screening capability of the system allows for 100% removal of floatables and neutrally buoyant material without blinding. Flow and screening controls physically separate captured solids, and minimize the re-suspension and release of previously trapped pollutants. Inline units can treat up to 6 cfs, and internally bypass flows in excess of 50 cfs (1416 L/s). Available precast or cast-in-place, offline units can treat flows from 1 to 300 cfs (28.3 to 8495 L/s). The pollutant removal capacity of the CDS system has been proven in lab and field testing.

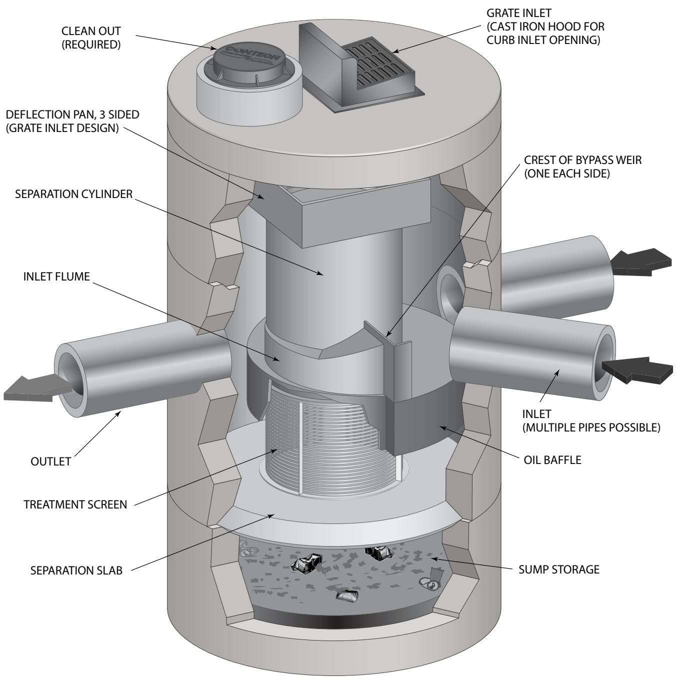
Operation Overview

Stormwater enters the diversion chamber where the diversion weir guides the flow into the unit's separation chamber and pollutants are removed from the flow. All flows up to the system's treatment design capacity enter the separation chamber and are treated.

Swirl concentration and screen deflection force floatables and solids to the center of the separation chamber where 100% of floatables and neutrally buoyant debris larger than the screen apertures are trapped.

Stormwater then moves through the separation screen, under the oil baffle and exits the system. The separation screen remains clog free due to continuous deflection.

During the flow events exceeding the treatment design capacity, the diversion weir bypasses excessive flows around the separation chamber, so captured pollutants are retained in the separation cylinder.



Design Basics

There are three primary methods of sizing a CDS system. The Water Quality Flow Rate Method determines which model size provides the desired removal efficiency at a given flow rate for a defined particle size. The Rational Rainfall Method™ or the and Probabilistic Method is used when a specific removal efficiency of the net annual sediment load is required.

Typically in the Unites States, CDS systems are designed to achieve an 80% annual solids load reduction based on lab generated performance curves for a gradation with an average particle size (d50) of 125 microns (μm). For some regulatory environments, CDS systems can also be designed to achieve an 80% annual solids load reduction based on an average particle size (d50) of 75 microns (μm) or 50 microns (μm).

Water Quality Flow Rate Method

In some cases, regulations require that a specific treatment rate, often referred to as the water quality design flow (WQQ), be treated. This WQQ represents the peak flow rate from either an event with a specific recurrence interval, e.g. the six-month storm, or a water quality depth, e.g. 1/2-inch (13 mm) of rainfall.

The CDS is designed to treat all flows up to the WQQ. At influent rates higher than the WQQ, the diversion weir will direct most flow exceeding the WQQ around the separation chamber. This allows removal efficiency to remain relatively constant in the separation chamber and eliminates the risk of washout during bypass flows regardless of influent flow rates.

Treatment flow rates are defined as the rate at which the CDS will remove a specific gradation of sediment at a specific removal efficiency. Therefore the treatment flow rate is variable, based on the gradation and removal efficiency specified by the design engineer.

Rational Rainfall Method™

Differences in local climate, topography and scale make every site hydraulically unique. It is important to take these factors into consideration when estimating the long-term performance of any stormwater treatment system. The Rational Rainfall Method combines site-specific information with laboratory generated performance data, and local historical precipitation records to estimate removal efficiencies as accurately as possible.

Short duration rain gauge records from across the United States and Canada were analyzed to determine the percent of the total annual rainfall that fell at a range of intensities. US stations' depths were totaled every 15 minutes, or hourly, and recorded in 0.01-inch increments. Depths were recorded hourly with 1-mm resolution at Canadian stations. One trend was consistent at all sites; the vast majority of precipitation fell at low intensities and high intensity storms contributed relatively little to the total annual depth.

These intensities, along with the total drainage area and runoff coefficient for each specific site, are translated into flow rates using the Rational Rainfall Method. Since most sites are relatively small and highly impervious, the Rational Rainfall Method is appropriate. Based on the runoff flow rates calculated for each intensity, operating rates within a proposed CDS system are determined. Performance efficiency curve determined from full scale laboratory tests on defined sediment PSDs is applied to calculate solids removal efficiency. The relative removal efficiency at each operating rate is added to produce a net annual pollutant removal efficiency estimate.

Probabilistic Rational Method

The Probabilistic Rational Method is a sizing program Contech developed to estimate a net annual sediment load reduction for a particular CDS model based on site size, site runoff coefficient, regional rainfall intensity distribution, and anticipated pollutant characteristics.

The Probabilistic Method is an extension of the Rational Method used to estimate peak discharge rates generated by storm events of varying statistical return frequencies (e.g. 2-year storm event). Under the Rational Method, an adjustment factor is used to adjust the runoff coefficient estimated for the 10-year event, correlating a known hydrologic parameter with the target storm event. The rainfall intensities vary depending on the return frequency of the storm event under consideration. In general, these two frequency dependent parameters (rainfall intensity and runoff coefficient) increase as the return frequency increases while the drainage area remains constant.

These intensities, along with the total drainage area and runoff coefficient for each specific site, are translated into flow rates using the Rational Method. Since most sites are relatively small and highly impervious, the Rational Method is appropriate. Based on the runoff flow rates calculated for each intensity, operating rates within a proposed CDS are determined. Performance efficiency curve on defined sediment PSDs is applied to calculate solids removal efficiency. The relative removal efficiency at each operating rate is added to produce a net annual pollutant removal efficiency estimate.

Treatment Flow Rate

The inlet throat area is sized to ensure that the WQQ passes through the separation chamber at a water surface elevation equal to the crest of the diversion weir. The diversion weir bypasses excessive flows around the separation chamber, thus preventing re-suspension or re-entrainment of previously captured particles.

Hydraulic Capacity

The hydraulic capacity of a CDS system is determined by the length and height of the diversion weir and by the maximum allowable head in the system. Typical configurations allow hydraulic capacities of up to ten times the treatment flow rate. The crest of the diversion weir may be lowered and the inlet throat may be widened to increase the capacity of the system at a given water surface elevation. The unit is designed to meet project specific hydraulic requirements.

Performance

Full-Scale Laboratory Test Results

A full-scale CDS system (Model CDS2020-5B) was tested at the facility of University of Florida, Gainesville, FL. This CDS unit was evaluated under controlled laboratory conditions of influent flow rate and addition of sediment.

Two different gradations of silica sand material (UF Sediment & OK-110) were used in the CDS performance evaluation. The particle size distributions (PSDs) of the test materials were analyzed using standard method "Gradation ASTM D-422 "Standard Test Method for Particle-Size Analysis of Soils" by a certified laboratory.

UF Sediment is a mixture of three different products produced by the U.S. Silica Company: "Sil-Co-Sil 106", "#1 DRY" and "20/40 Oil Frac". Particle size distribution analysis shows that the UF Sediment has a very fine gradation (d50 = 20 to 30 μm) covering a wide size range (Coefficient of Uniformity, C averaged at 10.6). In comparison with the hypothetical TSS gradation specified in the NJDEP (New Jersey Department of Environmental Protection) and NJCAT (New Jersey Corporation for Advanced Technology) protocol for lab testing, the UF Sediment covers a similar range of particle size but with a finer d50 (d50 for NJDEP is approximately 50 μm) (NJDEP, 2003).

The OK-110 silica sand is a commercial product of U.S. Silica Sand. The particle size distribution analysis of this material, also included in Figure 1, shows that 99.9% of the OK-110 sand is finer than 250 microns, with a mean particle size (d50) of 106 microns. The PSDs for the test material are shown in Figure 1.

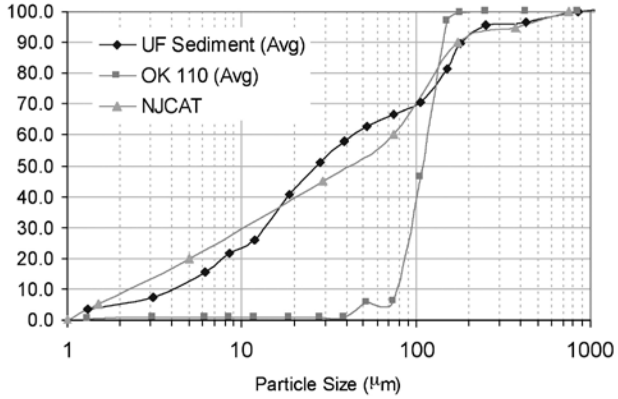


Figure 1. Particle size distributions

Tests were conducted to quantify the performance of a specific CDS unit (1.1 cfs (31.3-L/s) design capacity) at various flow rates, ranging from 1% up to 125% of the treatment design capacity of the unit, using the 2400 micron screen. All tests were conducted with controlled influent concentrations of approximately 200 mg/L. Effluent samples were taken at equal time intervals across the entire duration of each test run. These samples were then processed with a Dekaport Cone sample splitter to obtain representative sub-samples for Suspended Sediment Concentration (SSC) testing using ASTM D3977-97 "Standard Test Methods for Determining Sediment Concentration in Water Samples", and particle size distribution analysis.

Results and Modeling

Based on the data from the University of Florida, a performance model was developed for the CDS system. A regression analysis was used to develop a fitting curve representative of the scattered data points at various design flow rates. This model, which demonstrated good agreement with the laboratory data, can then be used to predict CDS system performance with respect to SSC removal for any particle size gradation, assuming the particles are inorganic sandy-silt. Figure 2 shows CDS predictive performance for two typical particle size gradations (NJCAT gradation and OK-110 sand) as a function of operating rate.

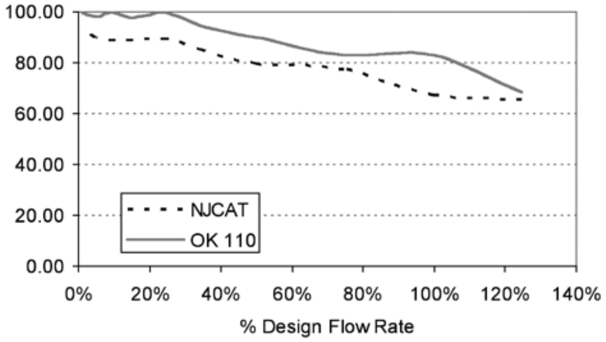


Figure 2. CDS stormwater treatment predictive performance for various particle gradations as a function of operating rate.

Many regulatory jurisdictions set a performance standard for hydrodynamic devices by stating that the devices shall be capable of achieving an 80% removal efficiency for particles having a mean particle size (d50) of 125 microns (e.g. Washington State Department of Ecology — WASDOE - 2008). The model can be used to calculate the expected performance of such a PSD (shown in Figure 3). The model indicates (Figure 4) that the CDS system with 2400 micron screen achieves approximately 80% removal at the design (100%) flow rate, for this particle size distribution (d50 = 125 µm).

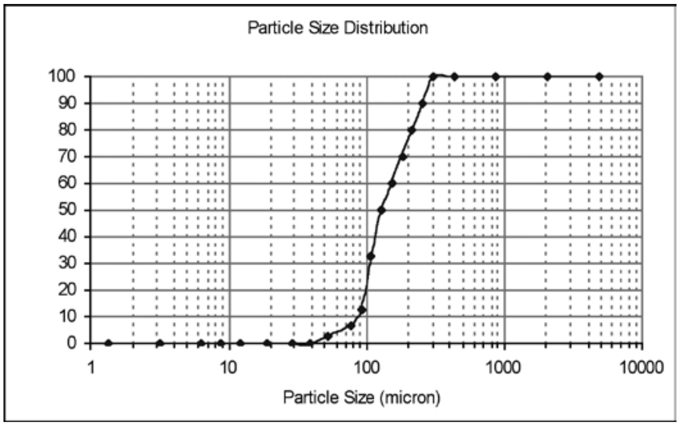


Figure 3. WASDOE PSD

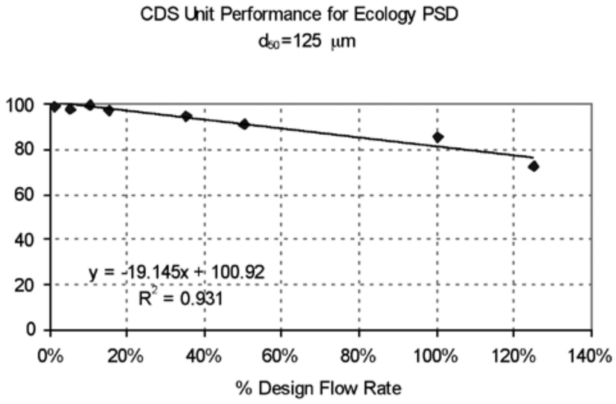


Figure 4. Modeled performance for WASDOE PSD.

Maintenance

The CDS system should be inspected at regular intervals and maintained when necessary to ensure optimum performance. The rate at which the system collects pollutants will depend more heavily on site activities than the size of the unit. For example, unstable soils or heavy winter sanding will cause the grit chamber to fill more quickly but regular sweeping of paved surfaces will slow accumulation.

Inspection

Inspection is the key to effective maintenance and is easily performed. Pollutant transport and deposition may vary from year to year and regular inspections will help ensure that the system is cleaned out at the appropriate time. At a minimum, inspections should be performed twice per year (e.g. spring and fall) however more frequent inspections may be necessary in climates where winter sanding operations may lead to rapid accumulations, or in equipment washdown areas. Installations should also be inspected more frequently where excessive amounts of trash are expected.

The visual inspection should ascertain that the system components are in working order and that there are no blockages or obstructions in the inlet and separation screen. The inspection should also quantify the accumulation of hydrocarbons, trash, and sediment in the system. Measuring pollutant accumulation can be done with a calibrated dipstick, tape measure or other measuring instrument. If absorbent material is used for enhanced removal of hydrocarbons, the level of discoloration of the sorbent material should also be identified

during inspection. It is useful and often required as part of an operating permit to keep a record of each inspection. A simple form for doing so is provided.

Access to the CDS unit is typically achieved through two manhole access covers. One opening allows for inspection and cleanout of the separation chamber (cylinder and screen) and isolated sump. The other allows for inspection and cleanout of sediment captured and retained outside the screen. For deep units, a single manhole access point would allows both sump cleanout and access outside the screen.

The CDS system should be cleaned when the level of sediment has reached 75% of capacity in the isolated sump or when an appreciable level of hydrocarbons and trash has accumulated. If absorbent material is used, it should be replaced when significant discoloration has occurred. Performance will not be impacted until 100% of the sump capacity is exceeded however it is recommended that the system be cleaned prior to that for easier removal of sediment. The level of sediment is easily determined by measuring from finished grade down to the top of the sediment pile. To avoid underestimating the level of sediment in the chamber, the measuring device must be lowered to the top of the sediment pile carefully. Particles at the top of the pile typically offer less resistance to the end of the rod than consolidated particles toward the bottom of the pile. Once this measurement is recorded, it should be compared to the as-built drawing for the unit to determine weather the height of the sediment pile off the bottom of the sump floor exceeds 75% of the total height of isolated sump.

Cleaning

Cleaning of a CDS systems should be done during dry weather conditions when no flow is entering the system. The use of a vacuum truck is generally the most effective and convenient method of removing pollutants from the system. Simply remove the manhole covers and insert the vacuum hose into the sump. The system should be completely drained down and the sump fully evacuated of sediment. The area outside the screen should also be cleaned out if pollutant build-up exists in this area.

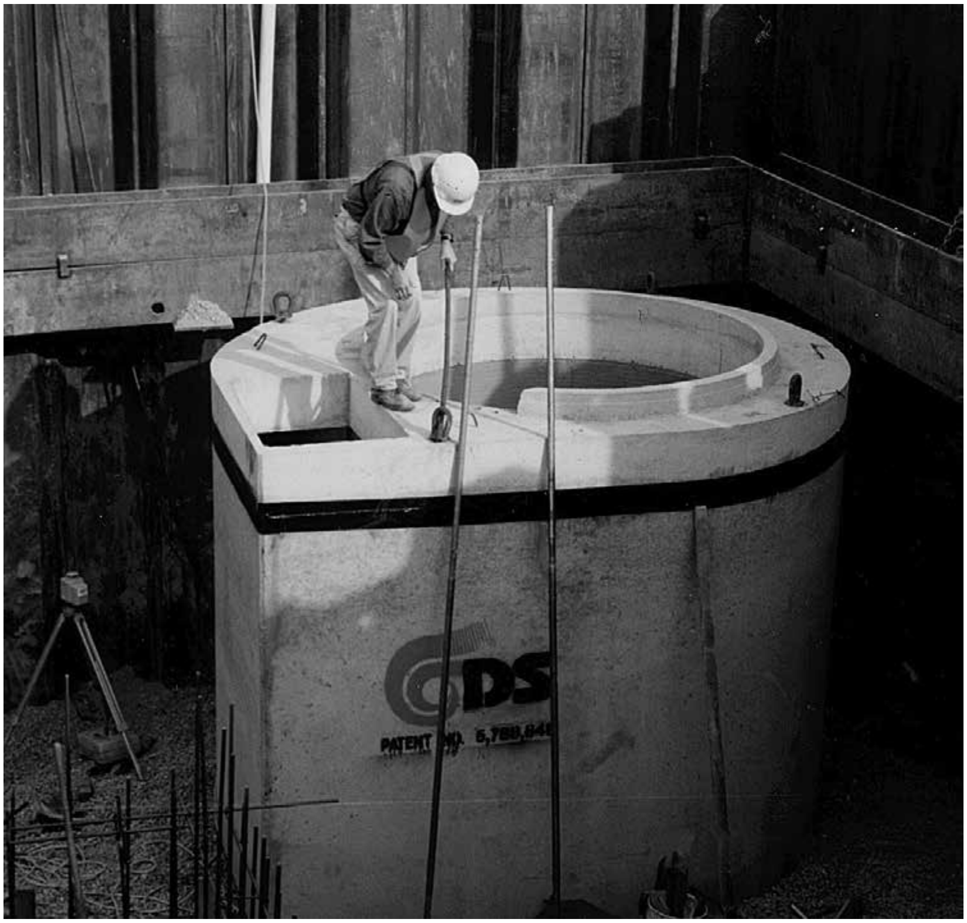
In installations where the risk of petroleum spills is small, liquid contaminants may not accumulate as quickly as sediment. However, the system should be cleaned out immediately in the event of an oil or gasoline spill. Motor oil and other hydrocarbons that accumulate on a more routine basis should be removed when an appreciable layer has been captured. To remove these pollutants, it may be preferable to use absorbent pads since they are usually less expensive to dispose than the oil/water emulsion that may be created by vacuuming the oily layer. Trash and debris can be netted out to separate it from the other pollutants. The screen should be cleaned to ensure it is free of trash and debris.

Manhole covers should be securely seated following cleaning activities to prevent leakage of runoff into the system from above and also to ensure that proper safety precautions have been followed. Confined space entry procedures need to be followed if physical access is required. Disposal of all material removed from the CDS system should be done in accordance with local regulations. In many jurisdictions, disposal of the sediments may be handled in the same manner as the disposal of sediments removed from catch basins or deep sump manholes. Check your local regulations for specific requirements on disposal.

CDS Model	Diameter		Distance from Water Surface to Top of Sediment Pile		Sediment Storage Capacity	
	ft	m	ft	m	y^3	m^3
CDS1515	3	0.9	3.0	0.9	0.5	0.4
CDS2015	4	1.2	3.0	0.9	0.9	0.7
CDS2015	5	1.5	3.0	0.9	1.3	1.0
CDS2020	5	1.5	3.5	1.1	1.3	1.0
CDS2025	5	1.5	4.0	1.2	1.3	1.0
CDS3020	6	1.8	4.0	1.2	2.1	1.6
CDS3025	6	1.8	4.0	1.2	2.1	1.6
CDS3030	6	1.8	4.6	1.4	2.1	1.6
CDS3035	6	1.8	5.0	1.5	2.1	1.6
CDS4030	8	2.4	4.6	1.4	5.6	4.3
CDS4040	8	2.4	5.7	1.7	5.6	4.3
CDS4045	8	2.4	6.2	1.9	5.6	4.3
CDS5640	10	3.0	6.3	1.9	8.7	6.7
CDS5653	10	3.0	7.7	2.3	8.7	6.7
CDS5668	10	3.0	9.3	2.8	8.7	6.7
CDS5678	10	3.0	10.3	3.1	8.7	6.7

Table 1: CDS Maintenance Indicators and Sediment Storage Capacities

Note: To avoid underestimating the volume of sediment in the chamber, carefully lower the measuring device to the top of the sediment pile. Finer silty particles at the top of the pile may be more difficult to feel with a measuring stick. These finer particles typically offer less resistance to the end of the rod than larger particles toward the bottom of the pile.



CDS Inspection & Maintenance Log

CDS Model: ______________________ Location: ______________________

Date	Water depth to sediment[1]	Floatable Layer Thickness[2]	Describe Maintenance Performed	Maintenance Personnel	Comments

1. The water depth to sediment is determined by taking two measurements with a stadia rod: one measurement from the manhole opening to the top of the sediment pile and the other from the manhole opening to the water surface. If the difference between these measurements is less than the values listed in table 1 the system should be cleaned out. **Note: to avoid underestimating the volume of sediment in the chamber, the measuring device must be carefully lowered to the top of the sediment pile**.

2. For optimum performance, the system should be cleaned out when the floating hydrocarbon layer accumulates to an appreciable thickness. In the event of an oil spill, the system should be cleaned immediately.

SUPPORT

- Drawings and specifications are available at www.ContechES.com.
- Site-specific design support is available from our engineers.

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The product(s) described may be protected by one or more of the following US patents: 5,322,629; 5,624,576; 5,707,527; 5,759,415; 5,788,848; 5,985,157; 6,027,639; 6,350,374; 6,406,218; 6,641,720; 6,511,595; 6,649,048; 6,991,114; 6,998,038; 7,186,058; 7,296,692; 7,297,266; related foreign patents or other patents pending.

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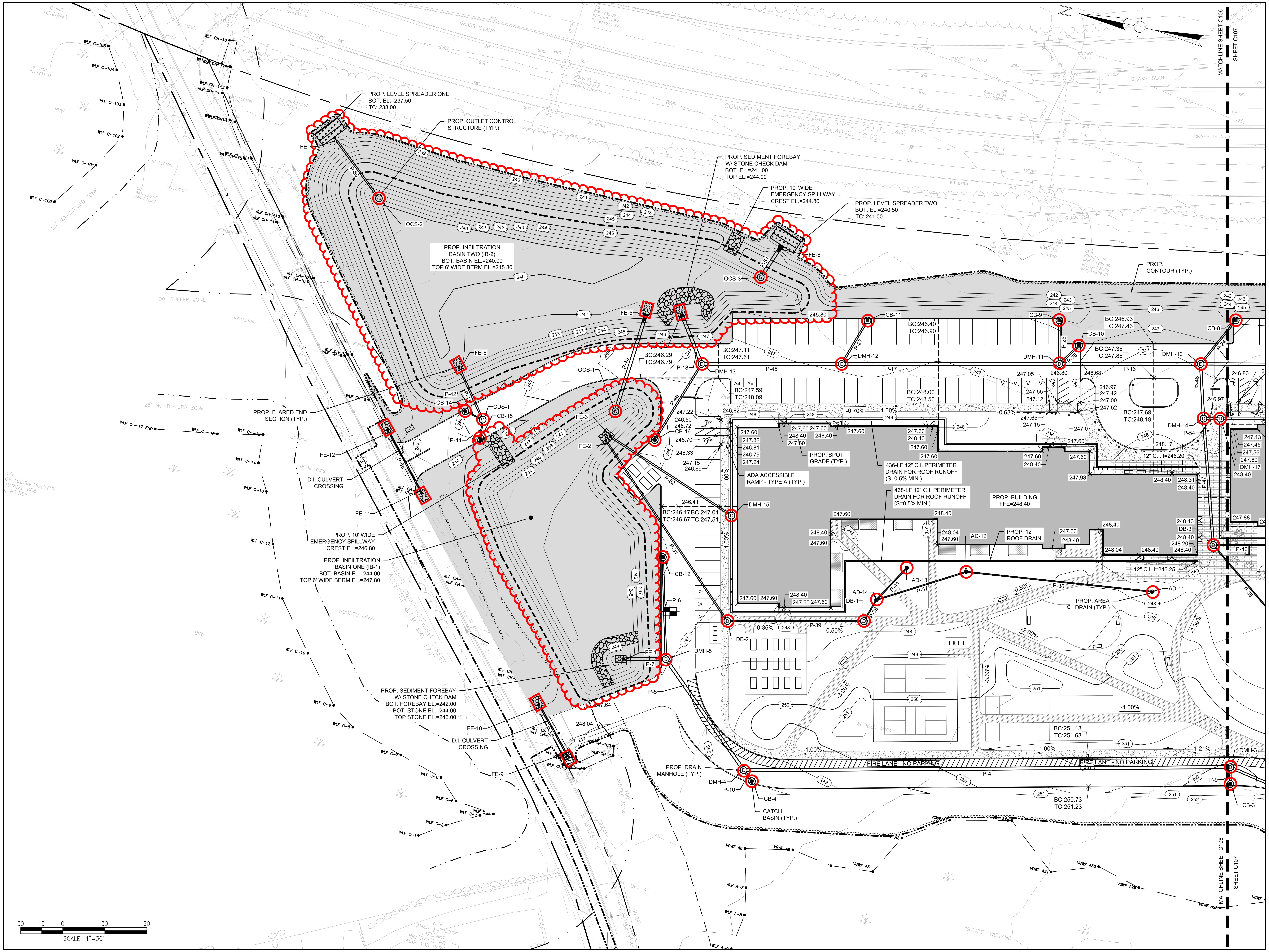

Walnut Street Affordable Housing

FOXBOROUGH, MA 02035

PROJECT

The Walnut Street Joint Venture Group

536 GRANITE ST
BRAINTREE, MA 02184
P 000 000.0000 F 000 000.0000

OWNER

utile
ARCHITECTURE + URBAN DESIGN

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utiledesign.com

ARCHITECT

Weston & Sampson

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P 978 532.1900

CIVIL & LANDSCAPE

BF&A

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P 978 870.5674

CODE

BLW ENGINEERS

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P 978 964.5477

M/E/P/FP

KALIN ASSOCIATES

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NEWTON, MA 02465
F 617 964 5477

SPECIFICATIONS

RSE ASSOCIATES

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WATERTOWN, MA 02472
P 617 926.9300

STRUCTURAL

STAMP

DATE	REVISION

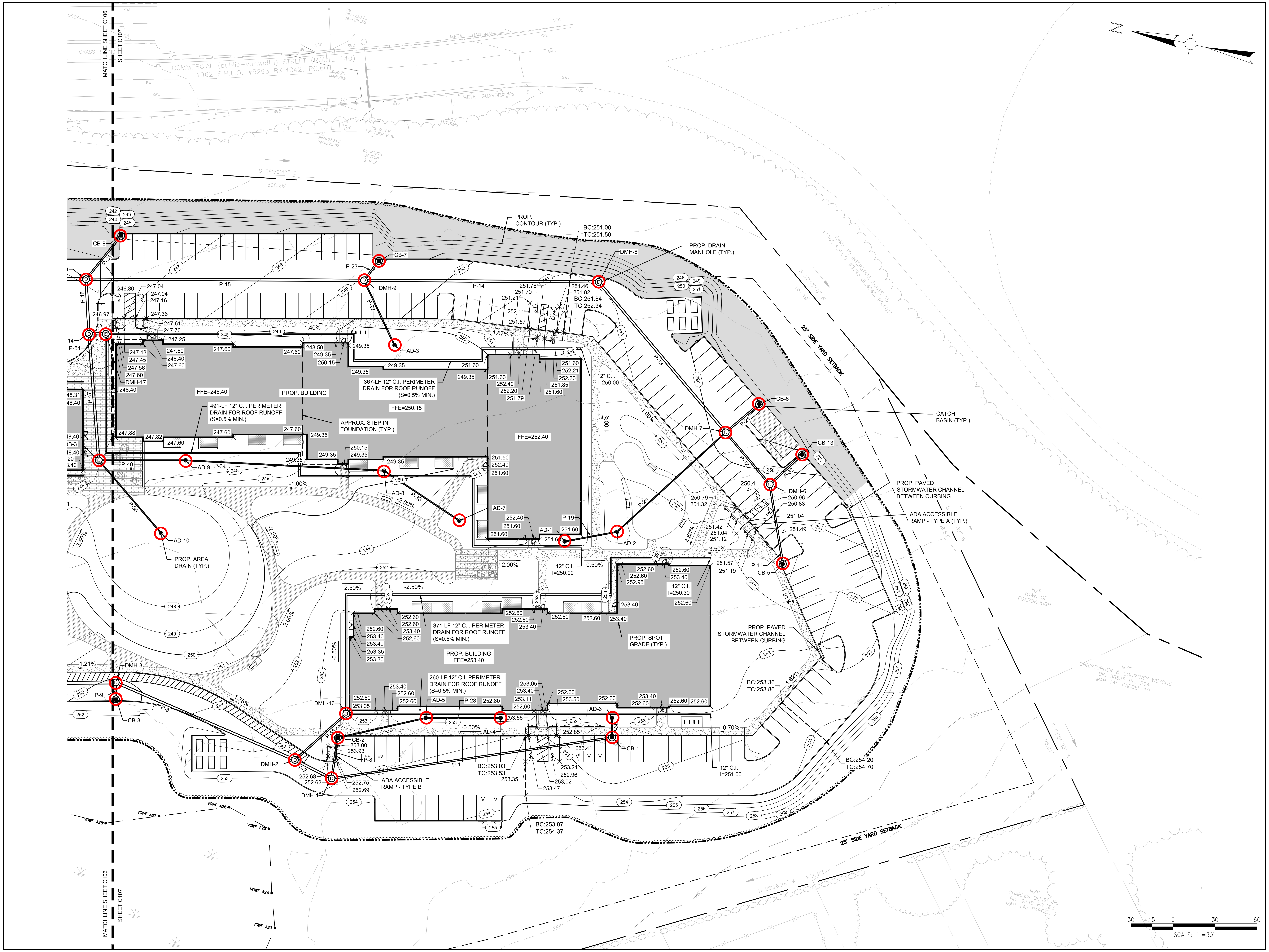
REVISIONS ON SHEET

SCALE

UTILE PROJECT NUMBER
2212

O&M KEY PLAN (BUILDING ONE)

FIG-3



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STRUCTURAL

STAMP

DATE	REVISION

REVISIONS ON SHEET

SCALE

UTILE PROJECT NUMBER
2212

O&M KEY PLAN (BUILDINGS TWO AND THREE)

FIG-3

Attachment J - Illicit Discharge Compliance Statement

Illicit Discharge Compliance Statement

Section I – Purpose/Intent

The purpose of this document is to provide for the health, safety, and general welfare of the citizens of Foxborough, Massachusetts through the regulation of non-stormwater discharges into existing outstanding resource areas near the site to the maximum extent practicable, as required by federal and state law. This document establishes methods for controlling the introduction of pollutants into existing outstanding resource areas to comply with requirements of the National Pollutant Discharge Elimination System (NPDES) permit process.

Section II - Definitions

For the purposes of this statement, the following shall mean:

Best Management Practices (BMPs): Schedules of activities, prohibitions of practices, general good housekeeping practices, pollution prevention and educational practices, maintenance procedures, and other management practices to prevent or reduce the discharge of pollutants directly or indirectly to stormwater, receiving waters, or stormwater conveyance systems. BMPs also include treatment practices, operating procedures, and practices to control site runoff, spillage or leaks, sludge or water disposal, or drainage from raw materials storage.

Clean Water Act: The federal Water Pollution Control Act (33 U.S.C § 1251 et seq.), and any subsequent amendments thereto.

Construction Activity: Activities subject to the Massachusetts Erosion and Sedimentation Control Act or NPDES Construction Permits. Such activities include but are not limited to clearing and grubbing, grading, excavating, and demolition.

Hazardous Materials: Any material, including any substance, waste, or combination thereof, which because of its quantity, concentration, or physical, chemical, or infectious characteristics may cause, or significantly contribute to, a substantial present or potential hazard to human health, safety, property, or the environment when improperly treated, stored, transported, disposed of, or otherwise managed.

Illegal Connection: An illegal connection is defined as either of the following:

a. Any pipe, open channel, drain or conveyance, whether on the surface or subsurface, which allows an illicit discharge to enter the outstanding resource area including but not limited to any conveyances which allow any non-stormwater discharge including sewage, process wastewater, and wash water, regardless of whether said drain or connection has been previously allowed, permitted, or approved by an authorized enforcement agency; or

b. Any pipe, open channel, drain or conveyance connected to the Town of Foxborough storm water treatment system which has not been documented in plans, maps, or equivalent records and approved by an authorized enforcement agency.

Illicit Discharge: Any direct or indirect non-stormwater discharge to the Town of Foxborough stormwater treatment system, except as exempted in Section III of this ordinance.

Industrial Activity: Activities subject to NPDES Industrial Permits as defined in 40CFR, Section 122.26 (b) (14).

National Pollutant Discharge Elimination System (NPDES) Stormwater Discharge Permit: A permit issued by MassDEP under authority delegated pursuant to 33 USC § 1342 (b) that authorizes the discharge of pollutants to waters of the United States, whether the permit is applicable on an individual, group, or general area-wide basis.

Town of Foxborough Stormwater Treatment System: Any facility, owned or maintained by the Town, designed or used for collecting and/or conveying stormwater, including but not limited to roads with drainage systems, Town of Foxborough streets, curbs, gutters, inlets, catch basins, piped storm drains, pumping facilities, infiltration, retention and detention basins, natural and man-made or altered drainage channels, reservoirs, and other drainage structures.

Non-Stormwater Discharge: Any discharge to the storm drain system that is not composed entirely of stormwater.

Person: Any individual, association, organization, partnership, firm, joint venture, public or private corporation, trust, estate, commission, board, public or private institution, utility, cooperative, Town, county or other political subdivision of the State, interstate body, or any other legal entity.

Pollutant: Anything which causes or contributes to pollution. Pollutants may include, but are not limited to: paints, varnishes, and solvents; petroleum hydrocarbons; automotive fluids; cooking grease; detergents (biodegradable or otherwise); degreasers; cleaning chemicals; non-hazardous liquid and solid wastes; refuse, rubbish, garbage, litter, or other discarded or abandoned objects and accumulations, so that same may cause or contribute to pollution; floatables; pesticides, herbicides, and fertilizers; liquid and solid wastes; sewage, fecal coliform and pathogens; dissolved and particulate metals; animal wastes; wastes and residues that result from constructing a building or structure; concrete and cement; and noxious or offensive matter of any kind.

Pollution: Contamination or other alteration of any water's physical, chemical, or biological properties by addition of any constituent including but not limited to a change in temperature, taste, color, turbidity, or odor of such waters, or the discharge of any liquid, gaseous, solid, radioactive, or other substance into any such waters as will or is likely to create a nuisance or render such waters harmful, detrimental, or injurious to the public health, safety, welfare, or environment, or to domestic, commercial, industrial, agricultural, recreational, or other legitimate beneficial uses, or to livestock, wild animals, birds, fish or other aquatic life.

Premises: Any building, lot, parcel of land, or portion of land whether improved or unimproved including adjacent sidewalks and parking strips.

Stormwater: Any surface flow, runoff, and drainage consisting entirely of water from any form of natural precipitation and resulting from such precipitation.

Wastewater: Any water or other liquid discharged from a facility, that has been used, as for washing, flushing, or in a manufacturing process, and so contains waste products.

Section III - Prohibitions

Prohibition of Illicit Discharges:

No person shall throw, drain, or otherwise discharge, cause or allow others under its control to throw, drain, or otherwise discharge into the Town of Foxborough stormwater treatment system or watercourses any materials, including but not limited to, any pollutants or waters containing any pollutants, other than stormwater. The commencement, conduct or continuance of any illicit discharge to the storm drain system is prohibited except as described as follows:

1. Water line flushing performed by a government agency, other potable water sources, landscape irrigation or lawn watering, diverted stream flows, rising ground water, ground water infiltration to storm drains, uncontaminated pumped ground water, foundation or footing drains (not including active groundwater dewatering systems), crawl space pumps, air conditioning condensation, springs, natural riparian habitat or wetland flows, and any other water source not containing pollutants;

2. Discharges or flows from fire fighting, and other discharges specified in writing by the Town of Foxborough as being necessary to protect public health and safety;

3. Dye testing is an allowable discharge, but requires a verbal notification to the Town of Foxborough prior to the time of the test;

4. Any non-stormwater discharge permitted under an NPDES permit, waiver, or waste discharge order issued to the discharger and administered under the authority of the Federal Environmental Protection Agency, provided that the discharger is in full compliance with all requirements of the permit, waiver, or order and other applicable laws and regulations, and provided that written approval has been granted for a discharge to the Town of Foxborough stormwater treatment system.

Section IV - Industrial or Construction Activity Discharges

Any person subject to an industrial or construction activity NPDES stormwater discharge permit shall comply with all provisions of such permit. Proof of compliance with said permit may be required in a form acceptable to the Town of Foxborough Department of Public Works prior to allowing discharges to the Town of Foxborough stormwater treatment system.

Section V - Notification of Spills and Accidental Discharges

Notwithstanding other requirements of law, as soon as any person responsible for a facility, activity or operation, or responsible for emergency response for a facility, activity or operation has information of any known or suspected release of pollutants or non-stormwater discharges from that facility, activity, or operation which are resulting or may result in illicit discharges or pollutants discharging into stormwater, the Town of Foxborough stormwater treatment system, State Waters, or Waters of the U.S., said person shall take all necessary steps to ensure the discovery, containment, and cleanup of such release so as to minimize the effects of the discharge. In the event of such a release of hazardous materials, said person shall immediately notify emergency response agencies of the occurrence via emergency dispatch services. In the event of a release of non-hazardous materials, said person shall notify the Town of Foxborough Highway Department in person or by phone no later than the next business day, including the nature, quantity and time of occurrence of the discharge. Notifications in person or by phone shall be confirmed by written notice, via certified mail return receipt requested addressed to the Town of Foxborough Department of Public Works within three (3) business days of the initial notice. If the discharge of prohibited materials emanates from a commercial or industrial establishment, the owner or operator of such establishment shall also retain an on-site written record of the discharge and the actions taken to prevent its recurrence. Such records shall be retained for at least three years.

IN WITNESS WHEREOF the parties hereto have executed copies of this Agreement on the ______ day of ____________________, ______.

____
Representative of Town of Foxborough Highway Department