Nitsch Engineering

June 14, 2021

STORMWATER REPORT

For
DAVID MINDESS ELEMENTARY SCHOOL
90 CONCORD STREET
Ashland, MA

Owner:

The Town of Ashland
101 Main Street
Ashland, MA 01721

Prepared by:

NITSCH ENGINEERING, INC.
370 Main Street, Suite 850
Worcester, MA 01608

Nitsch Project #13609

TABLE OF CONTENTS

1.0 INTRODUCTION

Nitsch Engineering has prepared this Stormwater Report to support the Site Plan review, Stormwater Management Permit, and Notice of Intent application to Ashland for the new David Mindess Elementary School located at 90 Concord Street (subsequently referred to as the "Site").

The site improvements include the following:

1. Construction of a new elementary school building;
2. Construction of parking facilities and pedestrian walkways;
3. Demolition of the existing building;
4. Installation of new utilities to support the proposed building; and
5. Construction of a new stormwater management system.

The proposed stormwater management system has been designed to comply with the requirements of the Town of Ashland Stormwater Management Bylaws and the Massachusetts Department of Environmental Protection (MassDEP) Stormwater Management Standards.

2.0 EXISTING CONDITIONS

The Site is located at 90 Concord Street. The property is bordered by Concord Street to the South, residential abutters and Fiske Road to the north, an intermittent stream and residential abutters to the west, and residential abutters to the east. There is an existing pond and wetlands located along Concord Street that the intermittent stream to the west discharges to. A culvert discharges out of the pond and underneath Concord Street. Vehicular access to the site is through two curb cuts, one to the east of the pond and one to the west of the pond.

The existing school building is located in the central area of the property with playfields and developed wooded areas to the north of the building. Parking areas and vehicular access to the site are located to the south of the building along with additional play fields.

2.1 Existing Drainage Infrastructure

Stormwater generated by the existing site is collected using catch basins and is piped via a closed drainage system to the intermittent stream to the east, the pond, and a closed drainage system in Concord Street. There is also overland flow to all four of the discharge points. The existing stormwater management system was constructed prior to the 2008 MassDEP Stormwater Management Standards, and the Site provides minimal peak flow attenuation, water quality treatment, and groundwater recharge.

The intermittent stream to the west of the site discharges into the pond/wetland along Concord Street, which discharges to a culvert underneath Concord Street and eventually flows to the Sudbury River. The intermittent stream to the east of the site discharges into the closed drainage system in Concord Street and also discharges to the Sudbury River.

Record plans show stormwater runoff from the neighborhood to the north of the site on Fiske Road discharges to the school property. Stormwater runoff enters the site via overland flow and point discharges. There are two existing detention systems offsite that discharge through the site. Stormwater runoff from these three sources flow through the existing site and eventually discharge to either the intermittent stream to the east of the property or to the closed drainage system in Concord Street.

2.2 NRSC Soil Designations

The Soil Classification Summary (Table 1) outlines the Natural Resources Conservation Services (NRCS) designation of the soil series at the Site. The majority of soils are classified as Udorthents, Loamy with an unclassified hydrologic soil group (HSG) (refer to the NRCS Soil Maps and Descriptions in Appendix G). The majority of the site consist of the Udorthent with areas of Whiteman Fine Sand Loam, Hollis Rock Outcrop Charlton Complex, and Paxton Fine Sandy Loam to the north (HSG C-D) and Scarboro Mucky Fine Sandy Loam and Narragansett Silt Loam to the south (HSG A and D) to the south.

Table 1. NRCS Soil Classification Summary

Soil Unit	Soil Series	Hydrologic Soil Group
654	Udorthents, Loamy	--
104C	Hollis-Rock outcrop-Charlton complex	D
73B	Whitman Fine Sandy Loam	D
307C	Paxton Fine Sandy Loam	C
6A	Scarboro Mucky Fine Sandy Loam	A/D
416B	Narragansett Silt Loam	A

2.3 On-Site Soil Investigations

Approximately 52 test pits and 13 borings were performed on the Mindess School Site by Lahlaf Geotechnical Consulting Inc (LGCI). The results of the test pits were consistent throughout the Site and indicated silty sand, sandy silt, and silt, which are classified as HSG C. Ledge was encountered in some of the test pits. Groundwater was found in most of the pits at variable depths.

Nitsch Engineering performed sixteen (16) test pits on December 8, 2020 to support the stormwater management design. The results of the test pits were consistent with C soils. Groundwater depth was variable throughout. These test pit logs are provided in Appendix G.

2.4 Wetland Resource Areas

One Bordering Vegetated Wetland (BVW) and two intermittent streams jurisdictional under the Massachusetts Wetlands Protection Act are located on or near the site. A pond and the BVW are located along Concord Street on the southern end of the site. One intermittent stream is located to the west of the site and flows into the pond/BVW. The other intermittent stream is located to the east of the existing site.

There is a FEMA floodplain associated with pond on the southern portion of the site. The flood elevation is Elevation 183 to 184 and a portion of the proposed work is located within Bordering Land Subject to Flooding.

The very southern portion of the site is located within the 200-foot Riverfront Area from the Sudbury River although none of the river is located onsite.

Refer to the Order of Resource Area Delineation (Attachment C in the NOI) for more information.

3.0 PROPOSED CONDITIONS

3.1 Project Description

The proposed Project includes the construction of a new school building. The proposed site improvements include the following:

1. Construction of a new elementary school building;
2. Construction of parking facilities and pedestrian walkways;
3. Demolition of the existing building;
4. Installation of new utilities to support the proposed building; and
5. Construction of a new stormwater management system.

The Project is a mix of new and redevelopment. The Project is anticipated to increase the overall impervious area for the Project by approximately 3.6 acres. The portion of the site considered a redevelopment is the western entrance driveway to the site where impervious area is being decreased.

Table 2. Proposed Land Use for 90 Concord Street (in acres)

Land Use	Existing Site (acres)	Proposed Site (acres)	Change
Buildings	0.67	1.64	0.97
Site Pavement	3.72	6.35	2.63
Pond	0.81	0.81	0
Landscaped Areas	11.12	10.38	-0.74
Undeveloped Areas	10.03	7.17	-2.86
Total	26.35	26.35	---

3.2 Stormwater Management System

The Site will include the installation of a stormwater management system that is being designed to meet the MassDEP Stormwater Management Standards and the Town of Ashland Stormwater Management Bylaw. As a mix of new and redevelopment, the Project is required to provide peak flow mitigation, water quality treatment, and groundwater recharge.

The proposed stormwater management system for the Project will include deep-sump and hooded catch basins, infiltrating bioretention basins with sediment forebays, surface infiltration basins, subsurface infiltration systems, and proprietary water quality structures. Overflow from the proposed BMPs will be discharged to the adjacent intermittent streams, bordering vegetated wetlands, and closed drainage system. Overflows to the BVW/Pond will use stormwater outfalls with level spreaders.

Deep Sump and Hooded Catch Basins

Deep-sump and hooded catch basins are proposed to provide pretreatment in the impervious areas of the parking lot and driveways. Stormwater captured in the catch basins will be directed to another treatment or infiltration BMP prior to discharge.

Subsurface Infiltration/Detention Systems

Stormwater will be collected and infiltrated using five (5) subsurface infiltration systems. Subsurface Infiltration Systems #1 and #5 consist of 16" Plastic arch chambers enveloped by crushed stone. Subsurface System #2 consists of 30" plastic arch chambers enveloped by crushed stone. Subsurface Systems #3 and 4 consist of 24" Perforated Pipe enveloped in crushed stone.

The systems are sized to provide infiltration and to mitigate the peak runoff rate in the 2-, 10-, and 100-year storms.

Infiltration Basin with Sediment Forebay

An infiltration basin is proposed to infiltrate stormwater runoff generated by the main parking area. The basin will provide pollutant removal and will provide infiltration to the maximum extent practicable.

Pretreatment for the infiltration basin will be provided by a sediment forebay. The sediment forebay was designed in accordance with the MassDEP Stormwater Management Handbook to provide a water quality volume (WQV) equivalent to 0.1 inches per impervious acre:

Tributary Vehicular Impervious Area = 24,550 square feet
WQV = (24,550 SF) * (0.1 in. / 12 in./ft) = 205 cubic feet

Bioretention Basin with Sediment Forebay

A bioretention basin is proposed to treat stormwater runoff generated by the bus loop to the south of the building and building roof. The bioretention basin includes a minimum 24-inch media filter to provide TSS and nutrient pollutant removal and will provide infiltration to the maximum extent practicable. The bioretention basin will be constructed with an underdrain.

Pretreatment for the bioretention basin will be provided by three sediment forebays. The sediment forebays were designed in accordance with the MassDEP Stormwater Management Handbook to provide a water quality volume (WQV) equivalent to 0.1 inches per impervious acre:

Tributary Vehicular Impervious Area Sediment Forebay 1
Tributary Vehicular Impervious Area = 3,150 square feet
WQV = (3,150 SF) * (0.1 in. / 12 in./ft) = 26 cubic feet

Tributary Vehicular Impervious Area Sediment Forebay 2
Tributary Vehicular Impervious Area = 3,500 square feet
WQV = (3,500 SF) * (0.1 in. / 12 in./ft) = 30 cubic feet

Tributary Vehicular Impervious Area Sediment Forebay 3
Tributary Vehicular Impervious Area = 2,020 square feet
WQV = (2,020 SF) * (0.1 in. / 12 in./ft) = 20 cubic feet

Water Quality Structures

Proprietary water quality structures are proposed for water quality pretreatment in areas of the Site where space additional pretreatment is required prior to infiltration. These BMPs have been designed to remove greater than 80% TSS in conjunction with their associated deep sump and hooded catch basins. Sizing calculations are provided in Appendix A.

Stormwater Outfalls with Level Spreaders

A level spreader will be included at stormwater discharge locations. These level spreaders will receive concentrated flow and convert it to sheet flow so it can disperse uniformly across a stable slope. The level spreaders will improve the efficiency of all other on-site BMPs.

Refer to the TSS Removal spreadsheets in Appendix A for TSS removal summaries for each treatment train.

3.3 Stormwater Management During Construction

The Site Contractor will be responsible for stormwater management of the active construction site and is required to adhere to the conditions of the 2017 Construction General Permit under the Environmental Protection Agency through the preparation and implementation of a Stormwater Pollution Prevention Plan (SWPPP). A draft SWPPP has been prepared in accordance with the MassDEP Stormwater Management Standards and the 2017 Construction General Permit (Appendix F).

4.0 STORMWATER MANAGEMENT ANALYSIS

4.1 Methodology

Nitsch Engineering completed a hydrologic analysis of the existing project site utilizing Soil Conservation Service (SCS) Runoff Curve Number (CN) methodology. The SCS method calculates the rate at which the runoff reaches the design point considering several factors: the slope and flow lengths of the subcatchment area, the soil type of the subcatchment area, and the type of surface cover in the subcatchment area. HydroCAD Version 10.00 computer modeling software was used in conjunction with the SCS method to determine the peak runoff rates and runoff volumes for the 2-, 10-, and 100-year, 24-hour storm events. The proposed project site is being analyzed with the same methodology.

The Site was divided into multiple drainage areas, or subcatchments, which drain to the design points along the property boundary and within the site. For each subcatchment area, SCS Runoff Curve Numbers (CNs) were selected by using the cover type and hydrologic soil group of each area. The peak runoff rates and runoff volumes for the 2-, 10-, and 100-year 24-hour storm events were then determined by inputting the drainage areas, CNs, and time of concentration (T_c) paths into the HydroCAD model.

The National Oceanic and Atmospheric Administration Atlas 14 precipitation frequency estimates were used to calculate the 2-, 10-, and 100-year 24-hour storm events in HydroCAD. Refer to the HydroCAD calculations in Appendix B and C for rainfall information.

4.2 HydroCAD Version 10.00

The HydroCAD computer program uses SCS and TR-20 methods to model drainage systems. TR-20 (Technical Release 20) was developed by the Soil Conservation Service to estimate runoff and peak discharges in small watersheds. TR-20 is generally accepted by engineers and reviewing authorities as the standard method for estimating runoff and peak discharges.

HydroCAD Version 10.00 uses up to four types of components to analyze the hydrology of a given site: subcatchments, reaches, basins, and links. Subcatchments are areas of land that produce surface runoff. The area, weighted CN, and T_c characterize each individual subcatchment area. Reaches are generally uniform streams, channels, or pipes that convey water from one point to another. A basin is any impoundment that fills with water from one or more sources and empties via an outlet structure. Links are used to introduce hydrographs into a project from another source or to provide a junction for more than one hydrograph within a project. The time span for the model was set for 0-48 hours in order to prevent truncation of the hydrograph.

4.3 Existing Hydrologic Conditions

As summarized in Section 2.1, Nitsch Engineering delineated the project site into four (4) on-site subcatchment (watershed) areas discharging to four (4) design points utilizing an existing conditions survey and on-site observations (See Figure DR-1). The design points (DP) are defined as the closed intermittent stream to the east of the property (DP-A), the closed drainage system in Concord Street (DP-B), the western intermittent stream (DP-C2), and the pond/BVW (DP-C1). The HydroCAD model for existing conditions is provided in Appendix B and results from the HydroCAD calculations are summarized below in Table 3.

4.4 Proposed Hydrologic Conditions

The proposed project has been designed to mitigate the change in stormwater runoff at each of the design points as required by the DEP Stormwater Management Standards and the Town of Ashland Stormwater Management Bylaw. The existing watershed areas were modified to reflect the proposed topography, storm drainage structures and BMPs, and roof areas. (See Figure DR-2). The HydroCAD model for proposed conditions is provided in Appendix C and results from the calculations are summarized in Table 3.

4.5 Peak Flow Rates

The proposed stormwater management system is expected to reduce the proposed peak runoff rates to at or below the existing rates for Design Points DP-A, DP-B, DP-C1, and DP-C2. Table 3 below summarize the existing and proposed hydrologic analyses for the site at each design point.

Table 3 – Peak Rates of Runoff in Cubic Feet per Second (cfs)

	Storm Event	2-year	10-year	100-year
DP-A	Existing	3.61	8.83	18.15
	Proposed	2.67	6.68	13.93
DP-B	Existing	8.87	20.49	40.86
	Proposed	8.84	19.22	37.12
DP-C1	Existing	24.59	48.64	88.28
	Proposed	23.81	47.50	85.17
DP-C2	Existing	4.40	9.32	17.88
	Proposed	2.08	5.36	11.39

5.0 MassDEP Stormwater Management Standards

The Project is considered a mix of ***new development and redevelopment*** under the DEP Stormwater Management System. As such, the project is required to meet Standards 2, 3, and the pretreatment and structural best management practice requirements of Standards 4,5, and 6 only to the maximum extent practicable. Existing stormwater discharges need to comply with Standard 1 only to the maximum extent practicable. The project will comply with all other Standards. The site will be designed to meet or meet to the maximum extent practicable the MassDEP Stormwater Management Standards as summarized below:

Standard 1: No New Untreated Discharges

The Project will not discharge any new untreated stormwater directly to or cause erosion in wetlands or waters of the Commonwealth. Stormwater from the Site will be collected and treated in accordance with the MassDEP Stormwater Management Standards and stormwater outfalls will be stabilized to prevent erosion.

A small portion of the western access drive (3,000 SF) will sheet flow off the road and over approximately 100 feet of vegetation before discharging into the BVW. Although this runoff will be untreated, it is an improvement over the existing condition where approximately 30,000 SF of the western access roadway was discharged untreated into the BVW.

It is not feasible to treat this stormwater runoff without changing the flow patterns of the site because of the high estimated seasonal high groundwater and limited elevation of the roadway above the wetlands. This area is considered a redevelopment and therefore we are meeting this standard to the maximum extent practicable.

Standard 2: Peak Rate Attenuation

The proposed stormwater management system will be designed so that the post-development peak discharge rates do not exceed pre-development peak discharge rates. To prevent storm damage and downstream flooding, the proposed stormwater management practices will mitigate peak runoff rates for the 2-, 10-, and 100-year, 24-hour storm events. Refer to Table 3 for a pre- and post- development peak runoff rate comparison.

Standard 3: Groundwater Recharge

The Site was designed using environmentally-sensitive site design, low impact development techniques, and stormwater BMP treatment trains to minimize the loss of annual recharge to groundwater. The annual recharge from the post-development site will approximate the annual recharge from pre-development conditions based on soil type using the guidelines provided in the MassDEP Stormwater Management Handbook.

Impervious Area in HSG C	= 343,776 square feet
Rv (Recharge Volume)	= 343,776 x 0.25 in. / (12 inches/ft)
	= 7,162 cubic feet

7.30 acres of 7.89 impervious acres, or 92%, are directed to the infiltrations BMPs. An adjustment calculation was performed to ensure the entire recharge requirement can be met by this area.

Adjusted Required Recharge Volume	= [1/ (% to recharge system)] x Required Recharge Volume
	= [1/0.92] x 7,162 cubic feet
	= 1.08 x 7,162 cubic feet
	= 7,735 cubic feet

The infiltration BMPs are sized to exceed the recharge volume required under the MassDEP Stormwater Management Standards (Table 4)

Table 4 – Proposed Recharge Volumes for Stormwater BMPs

Infiltration BMP	Recharge Volume (cf)
Subsurface Infiltration System 1	1,168
Subsurface Infiltration System 2	1,104
Subsurface Infiltration System 3	1,296
Subsurface Infiltration System 4	1,324
Subsurface Infiltration System 5	913
Surface Infiltration System 1	2,060
Bioretention Basin	2,138
Total	**10,003**

The HydroCAD reports provided in Appendix C indicate that all proposed infiltration BMPs will drain within 72 hours for the 2-, 10-, and 100-year storm events, meeting the 72-hour MassDEP drawdown requirement. 72-hour draw down calculations have been provided in Appendix A.

A minimum 2 feet but less than 4 feet of separation has been maintained between the bottom of the infiltration system and seasonal high groundwater. Groundwater mounding calculations have been provided in Appendix A.

Standard 4: Water Quality Treatment

The proposed stormwater management system will be designed to remove greater than 80% of the average annual post-construction load of Total Suspended Solids (TSS). Structural stormwater BMPs including deep sump and hooded catch basins, a bioretention basin, water quality units are sized to capture the required water quality volume (1-inch) and remove a minimum of 80% of total suspended solids.

Table 5. Proposed Treatment Train Summary

Watershed	Treatment Train
DA2	Deep Sump and Hooded Catch Basin → Water Quality Structure
DA3	Sediment Forebay → Surface Infiltration
DA10	Sediment Forebay → Bioretention
DA4, DA6, DA7, DA8, DA12	Deep Sump and Hooded Catch Basin → Water Quality Structure → Subsurface Infiltration
DA11	Water Quality Swale

TSS removal calculation spreadsheets and water quality structure sizing calculations are provided in Appendix A.

Source control and pollution prevention measures, such as vacuum cleaning, street sweeping, proper snow management, and stabilization of eroded surfaces, are included in the Long-Term Pollution Prevention Plan and Operation and Maintenance Plan (Appendix E).

Standard 5: Land Uses with Higher Potential Pollutant Loads

The project is not considered a LUHPPL and therefore, this standard is not applicable.

Standard 6: Critical Areas

The Project is not located within any critical areas. Therefore, this standard is not applicable.

Standard 7: Redevelopments

The Project is considered a mix of new and redevelopment under the MassDEP Stormwater Management Standards. The project is meeting Standards 2-10. The project is meeting Standard 1 for the new development portion of the site and meeting it to the maximum extent practicable for the redevelopment portion of the site.

Standard 8: Construction Period Pollution Prevention and Sedimentation Control

A plan to control construction-related impacts, including erosion, sedimentation, and other pollutant sources during construction and land disturbance activities (construction period erosion, sedimentation, and pollution prevention plan) will be developed and implemented during the Notice of Intent permitting process.

Because the Project will disturb more than one (1) acre of land, a Notice of Intent will be submitted to the Environmental Protection Agency (EPA) for coverage under the National Pollution Discharge Elimination System (NPDES) Construction General Permit. As part of this application the Applicant is required to prepare a Stormwater Pollution Prevention Plan (SWPPP) and implement the measures in the SWPPP. The SWPPP, which is to be kept on site, includes erosion and sediment controls (stabilization practices and structural practices), temporary and permanent stormwater management measures, Contractor inspection schedules and reporting of all SWPPP features, materials management, waste disposal, off-site vehicle tracking, spill prevention and response, sanitation, and non-stormwater discharges. A draft SWPPP is provided in Appendix F.

Standard 9: Operation and Maintenance Plan

A post-construction operation and maintenance plan has been prepared and will be implemented to ensure that stormwater management systems function as designed. Source control and stormwater BMP operation requirements for the site are summarized in the Long-Term Pollution Prevention Plan and Operation and Maintenance Plan provided in Appendix E.

Standard 10: Prohibition of Illicit Discharges

There will be no illicit discharges to the stormwater management system associated with the Project. An Illicit Discharge Compliance Statement is provided in Appendix A.

6.0 Town of Ashland Post-Development Stormwater Management Criteria

Criteria 1: No Untreated Discharges
The stormwater runoff from the site is meeting the MassDEP Stormwater Standards for stormwater treatment from impervious and vehicular areas. Stormwater runoff from the majority of the site will be treated prior to discharge to the wetlands.

A small portion of the western access drive (3,000 SF) will sheet flow off the road and over approximately 100 feet of vegetation before discharging into the BVW. Although this runoff will be untreated, it is an improvement over the existing condition where approximately 30,000 SF of the western access roadway was discharged untreated into the BVW.

It is not feasible to treat this stormwater runoff without changing the flow patterns of the site because of the high estimated seasonal high groundwater and limited elevation of the roadway above the wetlands.

Criteria 2: Channel Protection
The post-construction peak runoff rates to each design points will be less than or equal to the existing condition peak runoff rates for the 2-year storm. Refer to Table 3.

Criteria 3: Overbank Flooding Protection
The post-construction peak runoff rates to each design points will be less than or equal to the existing condition peak runoff rates for the 10-year storm. Refer to Table 3.

Criteria 4: Extreme Flooding Protection
The post-construction peak runoff rates to each design points will be less than or equal to the existing condition peak runoff rates for the 100-year storm. Refer to Table 3.

Criteria 5: Recharge
The project will meet the MassDEP stormwater requirements for recharge volume in order to maintain the volume of recharge in the post-construction condition. Refer to Section 5 Standard 3 for a full description of the recharge volume provided onsite.

Criteria 6: Structural Practices for Water Quality

A. <u>Sized to capture the prescribed water quality volume</u>

   The stormwater management BMPs were sized to treat the 1” water quality volume

B. <u>Designed according to the specific performance criteria outlines in the Massachusetts Stormwater Management Manual</u>

The stormwater Management BMPs were designed according to the BMP manual. Refer to Appendix A for Stormwater BMP design information and to Section 5 for a description of how the site meets the Mass DEP Stormwater Standards.

C. Constructed Properly
The engineering team will provide the contractor with details for all aspects of the stormwater management system. The engineering team will perform site visits throughout construction to observe general construction progress. The contractor will be required to submit as-built documents to the engineering team for review to confirm the site is built in accordance with the Construction Documents.

D. Maintained Regularly
An Operations and Maintenance Plan was prepared as part of the NOI submission. The Town will be required to maintain the stormwater infrastructure per the O&M plan.

Criteria 7: Sensitive Areas
The site does not discharge to any sensitive areas.

Criteria 8: Hotspots
The land use for the project site is not considered a “hot spot” that has higher potential pollutant loading.

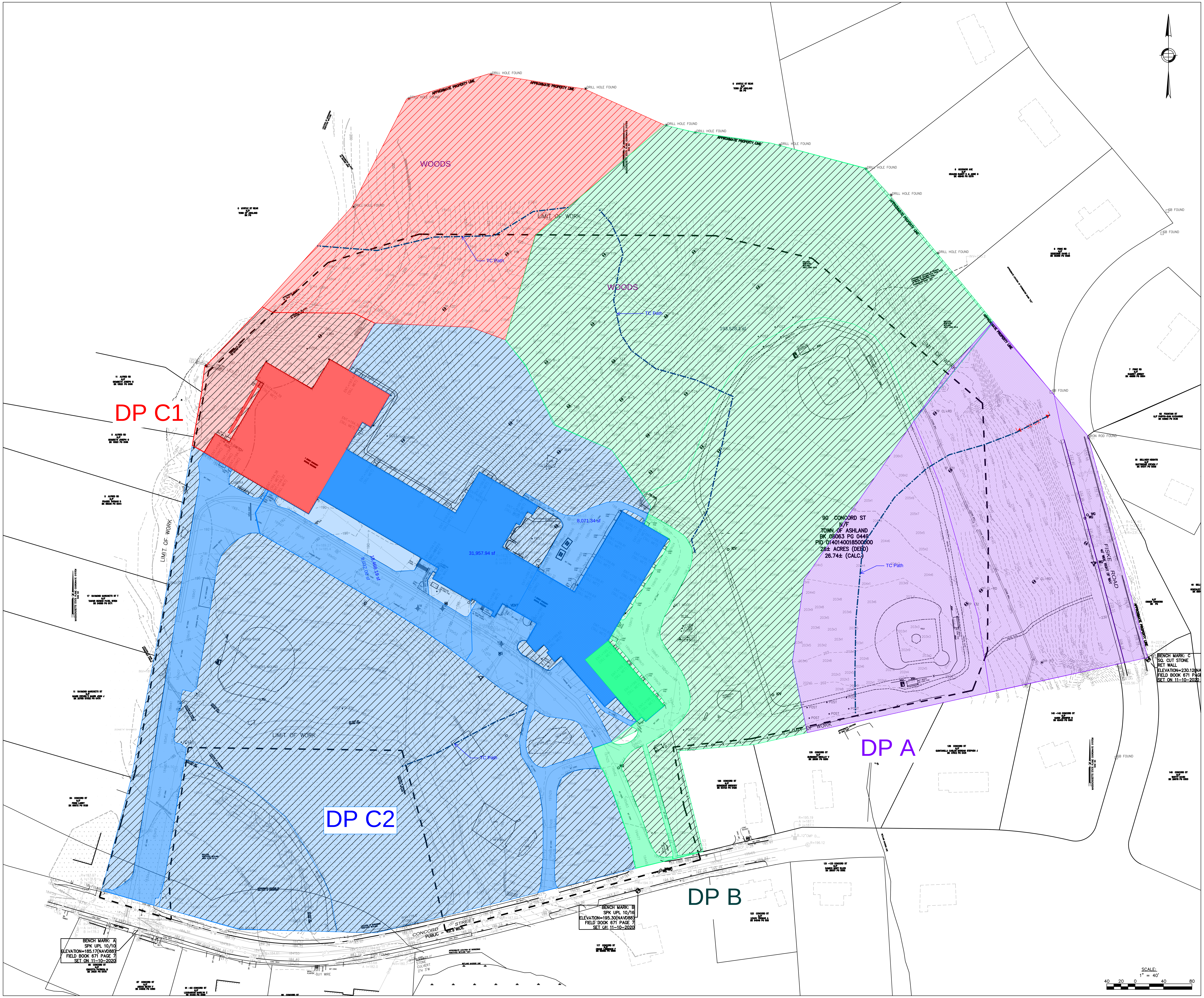
7.0 CLOSED DRAINAGE SYSTEM DESIGN

The proposed closed drainage system consists of area drains, deep-sump and hooded catch basins, drainage manholes, and proprietary water quality treatment units connected with corrugated polyethylene pipe. The closed drainage system was designed to convey the 25-year storm event using the Rational method. Refer to Appendix D for more information.

8.0 CONCLUSION

In conclusion, the Project’s stormwater management system will reduce or maintain peak runoff rates and volumes through the widespread use of infiltration BMPs and improve the water quality of stormwater being discharged from the Site. The Project is being designed to meet and exceed the MassDEP Stormwater Management Standards and the Town of Ashland Stormwater Management Bylaw.

FIGURES



90 Concord Street, Ashland, MA#

FLANSBURGH

77 NORTH WASHINGTON STREET
BOSTON, MA 02114-1910

FLANSBURGH.COM

Consultants

No.	Date	Note

REVISIONS

No.	Date	Note

ISSUE

Stamp

Schematic Design

Key Plan

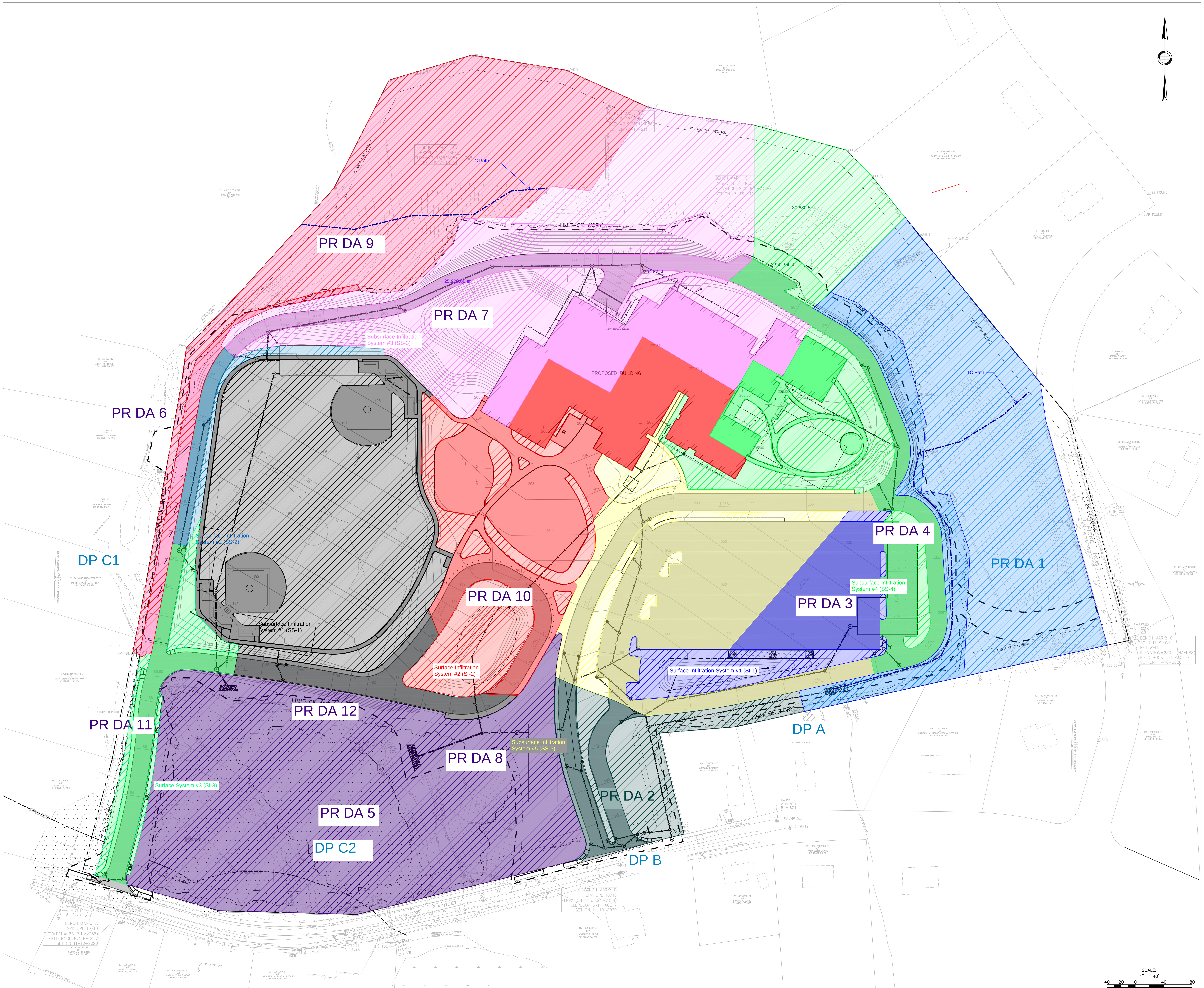
Sheet Title

EXISTING DRAINAGE AREA

Drawn By: NJB	Project ID: 13609
Reviewed By: BMV/JEG	Scale: 1" = 40'
Issue Date: 02.04.2021	Plot Date: 02.04.2021

Sheet No.

DA-EX



90 Concord Street, Ashland, MA

FLANSBURGH
77 NORTH WASHINGTON STREET
BOSTON, MA 02114-1910
FLANSBURGH.COM

Owner Project Manager

Compass Project Management, Inc.
Owners' Project Manager
One Edgewater Drive, Suite 204
Norwood, MA 02062

Consultants

Nitsch Engineering, Inc.
Land Survey/ Traffic/ Civil Engineers
2 Center Plaza
Boston, MA 02108

Stimson Studio
Landscape Architect
288 Norfolk Street
Cambridge, MA 02139

Engineers Design Group Inc
Structural Engineer
350 Main Street
Malden, MA 02148

Stefura Associates, Inc.
FF&E and Casework
77 North Washington Street
Boston, MA 02114

Crabtree McGrath Associates, Inc.
FF&E and Casework
161 West Main Street
Georgetown, MA 01833

Vanderweil Engineers, LLP
Mechanical Electrical Technology Plumbing & Fire Protection Engineers
274 Summer Street
Boston, MA 02210

Fuss and O'Neill, Inc.
Hazardous Materials
108 Myrtle Street, Suite 502
Quincy, MA 02171

AM Fogarty
Cost Estimators
175 Derby St, Ste 5
Hingham, Massachusetts 02043

No.	Date	Note

REVISIONS

No.	Date	Note

ISSUE

Stamp

Pricing Set
Design Development

Key Plan

Sheet Title

PROPOSED DRAINAGE AREA

Drawn By NJB	Project ID 1914.00
Reviewed By BMV/JEG	Scale 1" = 40'
Issue Date 04.12.2021	Plot Date 04.08.2021

Sheet No.

DA-PR

APPENDIX A

Stormwater Management Standards Documentation

MassDEP Checklist for Stormwater Report

Standard 3: 72-Hour Drawdown Calcs

Standard 3: Mounding Analysis

Standard 4: TSS Removal Calculations

Standard 4: Proprietary Water Quality Structure Calculations

Standard 10: Illicit Discharge Compliance Statement

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

Checklist for Stormwater Report

A. Introduction

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

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

The Stormwater Report must include:

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

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

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

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

---

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

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

Checklist for Stormwater Report

B. Stormwater Checklist and Certification

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

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

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

Registered Professional Engineer's Certification

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

Registered Professional Engineer Block and Signature

NITSCH PROJECT #13609

COMMONWEALTH OF MASSACHUSETTS
JARED E. GENTILUCCI
CIVIL
No. 48079
REGISTERED
PROFESSIONAL ENGINEER

6/11/21

Jared Gentilucci 6/11/21

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): Subsurface Infiltration System

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.

[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 for Stormwater Report

Checklist (continued)

Standard 4: Water Quality (continued)

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

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

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

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

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

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

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

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

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

☐ All exposure has been eliminated.

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

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

Standard 6: Critical Areas

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

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

Checklist (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.

Nitsch Engineering

2 Center Plaza, Suite 430
Boston, MA 02108-1928
T: 617-338-0063
F: 617-338-6472
www.nitscheng.com

Form S3-G: Standard 3 – Recharge
72-Hour Drawdown Calculation

Project Name: Mindess School	Nitsch Project #: 13609
Location: Ashland, MA	Checked by: JEG
Prepared by: BMV	Sheet No. 1 of
Date: 6/14/2021	SS-1

INSTRUCTIONS:
1. In 'Method' Column, Click on Blue Cell to Activate Drop Down Menu
2. Enter the "Required recharge Volume" (in cubic feet) in Blue Cell for the appropriate chosen Method
3. Enter the "Bottom Area" (in square feet) in the blue cell as the maximum infiltration surface area. Do not use sidewalls.
4. **For "Dynamic: In-Situ Method" ONLY** (if other go to 4b) Enter hydraulic Conductivity Rate in Blue Cell
5. In 'Texture Class' Column, Click on Blue Cell to Activate Drop Down Menu

Step No.				
1	Method:	Static		
2	Required Recharge Volume (in cubic feet):	*1168*	as determined by the	Static Method
3	Bottom Area (in Sq.Ft.)	*4919.04*		
		Hydraulic Conductivity Rate:	In-Situ Saturated Hydraulic Conductivity Rate	
4a	ONLY - If using Dynamic: In-Situ Method --> Enter Hydraulic Conductivity Rate		0	
	Texture Class	NRCS Hydrologic Soil Group (HSG)	Infiltration Rate (Inches/Hour)	
4b	Silt Loam	C	0.27	**Hours**
			$Time_{drawdown}$ =	10.55
			72-Hour Drawdown Requirement Check:	***OK***

Nitsch Engineering

2 Center Plaza, Suite 430
Boston, MA 02108-1928
T: 617-338-0063
F: 617-338-6472
www.nitscheng.com

Form S3-G: Standard 3 – Recharge
72-Hour Drawdown Calculation

Project Name: Mindess School	Nitsch Project #: 13609
Location: Ashland, MA	Checked by: JEG
Prepared by: BMV	Sheet No. 2 of 7
Date: 6/14/2021	SS-2

INSTRUCTIONS:

6. In 'Method' Column, Click on Blue Cell to Activate Drop Down Menu
7. Enter the "Required recharge Volume" (in cubic feet) in Blue Cell for the appropriate chosen Method
8. Enter the "Bottom Area" (in square feet) in the blue cell as the maximum infiltration surface area. Do not use sidewalls.
9. **For "Dynamic: In-Situ Method" ONLY** (if other go to 4b) Enter hydraulic Conductivity Rate in Blue Cell
10. In 'Texture Class' Column, Click on Blue Cell to Activate Drop Down Menu

Step No.				
1	Method:	**Static**		
2	Required Recharge Volume (in cubic feet):	*1104*	as determined by the	Static Method
3	Bottom Area (in Sq.Ft.)	*1780*		
		Hydraulic Conductivity Rate:	In-Situ Saturated Hydraulic Conductivity Rate	
4a	ONLY - If using Dynamic: In-Situ Method --> Enter Hydraulic Conductivity Rate		0	
	Texture Class	NRCS Hydrologic Soil Group (HSG)	Infiltration Rate (Inches/Hour)	
4b	Silt Loam	C	0.27	**Hours**
			$Time_{drawdown}$ =	27.57
	72-Hour Drawdown Requirement Check:			***OK***

Nitsch Engineering

2 Center Plaza, Suite 430
Boston, MA 02108-1928
T: 617-338-0063
F: 617-338-6472
www.nitscheng.com

Form S3-G: Standard 3 – Recharge
72-Hour Drawdown Calculation

Project Name: Mindess School	Nitsch Project #: 13609
Location: Ashland, MA	Checked by: JEG
Prepared by: BMV	Sheet No. 3 of 7
Date: 6/14/2021	SS-3

INSTRUCTIONS:
11. In 'Method' Column, Click on Blue Cell to Activate Drop Down Menu
12. Enter the "Required recharge Volume" (in cubic feet) in Blue Cell for the appropriate chosen Method
13. Enter the "Bottom Area" (in square feet) in the blue cell as the maximum infiltration surface area. Do not use sidewalls.
14. **For "Dynamic: In-Situ Method" ONLY** (if other go to 4b) Enter hydraulic Conductivity Rate in Blue Cell
15. In 'Texture Class' Column, Click on Blue Cell to Activate Drop Down Menu

Step No.				
1	Method:	Static		
2	Required Recharge Volume (in cubic feet):	*1296*	as determined by the	Static Method
3	Bottom Area (in Sq.Ft.)	*7990.4*		
		Hydraulic Conductivity Rate:	In-Situ Saturated Hydraulic Conductivity Rate	
4a	ONLY - If using Dynamic: In-Situ Method --> Enter Hydraulic Conductivity Rate		0	
	Texture Class	NRCS Hydrologic Soil Group (HSG)	Infiltration Rate (Inches/Hour)	
4b	Silt Loam	C	0.27	**Hours**
			$Time_{drawdown}$ =	7.21
	72-Hour Drawdown Requirement Check:			***OK***

Nitsch Engineering

2 Center Plaza, Suite 430
Boston, MA 02108-1928
T: 617-338-0063
F: 617-338-6472
www.nitscheng.com

Form S3-G: Standard 3 – Recharge
72-Hour Drawdown Calculation

Project Name: Mindess School	Nitsch Project #: 13609
Location: Ashland, MA	Checked by: JEG
Prepared by: BMV	Sheet No. 4 of 7
Date: 6/14/2021	SS-4

INSTRUCTIONS:

16. In 'Method' Column, Click on Blue Cell to Activate Drop Down Menu
17. Enter the "Required recharge Volume" (in cubic feet) in Blue Cell for the appropriate chosen Method
18. Enter the "Bottom Area" (in square feet) in the blue cell as the maximum infiltration surface area. Do not use sidewalls.
19. **For "Dynamic: In-Situ Method" ONLY** (if other go to 4b) Enter hydraulic Conductivity Rate in Blue Cell
20. In 'Texture Class' Column, Click on Blue Cell to Activate Drop Down Menu

Step No.				
1	Method:	Static		
2	Required Recharge Volume (in cubic feet):	*1324*	as determined by the	Static Method
3	Bottom Area (in Sq.Ft.)	*5542*		
		Hydraulic Conductivity Rate:	In-Situ Saturated Hydraulic Conductivity Rate	
4a	ONLY - If using Dynamic: In-Situ Method --> Enter Hydraulic Conductivity Rate		0	
	Texture Class	NRCS Hydrologic Soil Group (HSG)	Infiltration Rate (Inches/Hour)	
4b	Silt Loam	C	0.27	**Hours**
			$Time_{drawdown}$ =	10.62
	72-Hour Drawdown Requirement Check:			***OK***

Nitsch Engineering

2 Center Plaza, Suite 430
Boston, MA 02108-1928
T: 617-338-0063
F: 617-338-6472
www.nitscheng.com

Form S3-G: Standard 3 – Recharge
72-Hour Drawdown Calculation

Project Name: Mindess School	Nitsch Project #: 13609
Location: Ashland, MA	Checked by: JEG
Prepared by: BMV	Sheet No. 5 of 7
Date: 6/14/2021	SS-5

INSTRUCTIONS:
21. In 'Method' Column, Click on Blue Cell to Activate Drop Down Menu
22. Enter the "Required recharge Volume" (in cubic feet) in Blue Cell for the appropriate chosen Method
23. Enter the "Bottom Area" (in square feet) in the blue cell as the maximum infiltration surface area. Do not use sidewalls.
24. **For "Dynamic: In-Situ Method" ONLY** (if other go to 4b) Enter hydraulic Conductivity Rate in Blue Cell
25. In 'Texture Class' Column, Click on Blue Cell to Activate Drop Down Menu

Step No.				
1	Method:	Static		
2	Required Recharge Volume (in cubic feet):	913	as determined by the	Static Method
3	Bottom Area (in Sq.Ft.)	4620		
		Hydraulic Conductivity Rate:	In-Situ Saturated Hydraulic Conductivity Rate	
4a	ONLY - If using Dynamic: In-Situ Method --> Enter Hydraulic Conductivity Rate		0	
	Texture Class	NRCS Hydrologic Soil Group (HSG)	Infiltration Rate (Inches/Hour)	
4b	Silt Loam	C	0.27	Hours
			$Time_{drawdown}$ =	8.78
	72-Hour Drawdown Requirement Check:			OK

Nitsch Engineering
2 Center Plaza, Suite 430
Boston, MA 02108-1928
T: 617-338-0063
F: 617-338-6472
www.nitscheng.com

Form S3-G: Standard 3 – Recharge
72-Hour Drawdown Calculation

Project Name: Mindess School	Nitsch Project #: 13609
Location: Ashland, MA	Checked by: JEG
Prepared by: BMV	Sheet No. 6 of 7
Date: 6/14/2021	SI-1

INSTRUCTIONS:
26. In 'Method' Column, Click on Blue Cell to Activate Drop Down Menu
27. Enter the "Required recharge Volume" (in cubic feet) in Blue Cell for the appropriate chosen Method
28. Enter the "Bottom Area" (in square feet) in the blue cell as the maximum infiltration surface area. Do not use sidewalls.
29. **For "Dynamic: In-Situ Method" ONLY** (if other go to 4b) Enter hydraulic Conductivity Rate in Blue Cell
30. In 'Texture Class' Column, Click on Blue Cell to Activate Drop Down Menu

Step No.				
1	Method:	**Static**		
2	Required Recharge Volume (in cubic feet):	*3365*	as determined by the	Static Method
3	Bottom Area (in Sq.Ft.)	*6950*		
		Hydraulic Conductivity Rate:	In-Situ Saturated Hydraulic Conductivity Rate	
4a	ONLY - If using Dynamic: In-Situ Method --> Enter Hydraulic Conductivity Rate		0	
	Texture Class	NRCS Hydrologic Soil Group (HSG)	Infiltration Rate (Inches/Hour)	
4b	Silt Loam	C	0.27	**Hours**
			$Time_{drawdown}$ =	21.52
	72-Hour Drawdown Requirement Check:			***OK***

Nitsch Engineering
2 Center Plaza, Suite 430
Boston, MA 02108-1928
T: 617-338-0063
F: 617-338-6472
www.nitscheng.com

Form S3-G: Standard 3 – Recharge
72-Hour Drawdown Calculation

Project Name: Mindess School	Nitsch Project #: 13609
Location: Ashland, MA	Checked by: JEG
Prepared by: BMV	Sheet No. 7 of 7
Date: 6/14/2021	SI-2

INSTRUCTIONS:

31. In 'Method' Column, Click on Blue Cell to Activate Drop Down Menu
32. Enter the "Required recharge Volume" (in cubic feet) in Blue Cell for the appropriate chosen Method
33. Enter the "Bottom Area" (in square feet) in the blue cell as the maximum infiltration surface area. Do not use sidewalls.
34. **For "Dynamic: In-Situ Method" ONLY** (if other go to 4b) Enter hydraulic Conductivity Rate in Blue Cell
35. In 'Texture Class' Column, Click on Blue Cell to Activate Drop Down Menu

Step No.				
1	Method:	Static		
2	Required Recharge Volume (in cubic feet):	2138	as determined by the	Static Method
3	Bottom Area (in Sq.Ft.)	7092		
		Hydraulic Conductivity Rate:	In-Situ Saturated Hydraulic Conductivity Rate	
4a	ONLY - If using Dynamic: In-Situ Method --> Enter Hydraulic Conductivity Rate		0	
	Texture Class	NRCS Hydrologic Soil Group (HSG)	Infiltration Rate (Inches/Hour)	
4b	Silt Loam	C	0.27	Hours
			$Time_{drawdown}$ =	13.40
	72-Hour Drawdown Requirement Check:			**OK**

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

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

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

Input Values

0.1700	***R***	**Recharge (infiltration) rate (feet/day)**
0.080	**Sy**	**Specific yield, Sy (dimensionless, between 0 and 1]**
3.60	**K**	**Horizontal hydraulic conductivity, Kh (feet/day)***
20.750	**x**	**1/2 length of basin (x direction, in feet)**
58.500	**y**	**1/2 width of basin (y direction, in feet)**
1.000	**t**	**duration of infiltration period (days)**
4.000	**hi(0)**	**initial thickness of saturated zone (feet)**

Conversion Table

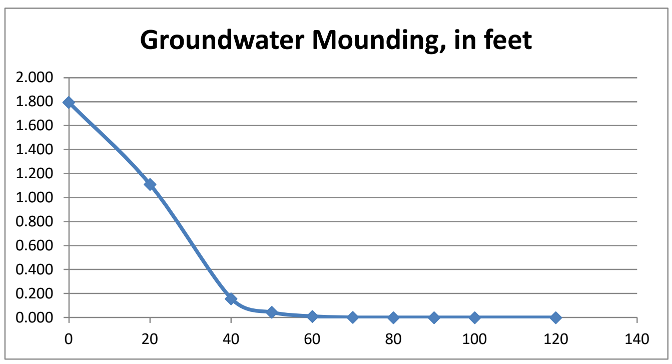
inch/hour	**feet/day**
0.67	1.33
2.00	4.00
hours	**days**
36	1.50

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

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

Ground-water Mounding, in feet	**Distance from center of basin in x direction, in feet**
1.795	**0**
1.111	**20**
0.159	**40**
0.045	**50**
0.011	**60**
0.003	**70**
0.001	**80**
0.001	**90**
0.001	**100**
0.001	**120**

Re-Calculate Now



Disclaimer

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

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

The user must specify infiltration rate (R), specific yield (Sy), horizontal hydraulic conductivity (Kh), basin dimensions (x, y), duration of infiltration period (t), and the initial thickness of the saturated zone (hi(0), height of the water table if the bottom of the aquifer is the datum). For a square basin the half width equals the half length (x = y). For a rectangular basin, if the user wants the water-table changes perpendicular to the long side, specify x as the short dimension and y as the long dimension. Conversely, if the user wants the values perpendicular to the short side, specify y as the short dimension, x as the long dimension. All distances are from the center of the basin. Users can change the distances from the center of the basin at which water-table aquifer thickness are calculated.

Cells highlighted in yellow are values that can be changed by the user. Cells highlighted in red are output values based on user-specified inputs. The user MUST click the blue "Re-Calculate Now" button each time ANY of the user-specified inputs are changed otherwise necessary iterations to converge on the correct solution will not be done and values shown will be incorrect. Use consistent units for all input values (for example, feet and days)

Input Values		use consistent units (e.g. feet & days **or** inches & hours)
0.1100	***R***	**Recharge (infiltration) rate (feet/day)**
0.080	**Sy**	**Specific yield, Sy (dimensionless, between 0 and 1]**
3.60	**K**	**Horizontal hydraulic conductivity, Kh (feet/day)***
89.100	**x**	**1/2 length of basin (x direction, in feet)**
20.500	**y**	**1/2 width of basin (y direction, in feet)**
1.000	**t**	**duration of infiltration period (days)**
4.000	**hi(0)**	**initial thickness of saturated zone (feet)**

Conversion Table

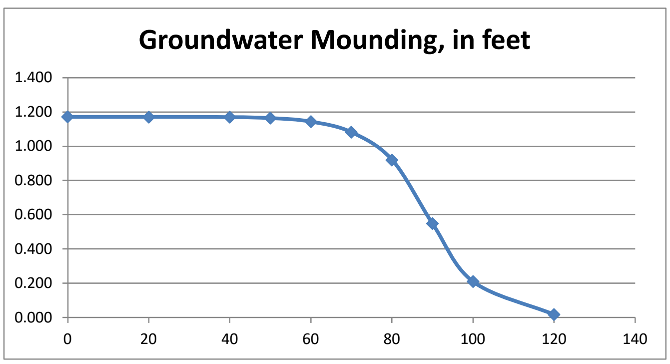
inch/hour	**feet/day**
0.67	1.33
2.00	4.00
hours	**days**
36	1.50

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

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

Ground-water Mounding, in feet	**Distance from center of basin in x direction, in feet**
1.172	**0**
1.172	**20**
1.170	**40**
1.165	**50**
1.144	**60**
1.082	**70**
0.921	**80**
0.550	**90**
0.211	**100**
0.018	**120**

Re-Calculate Now



Disclaimer

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

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

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

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

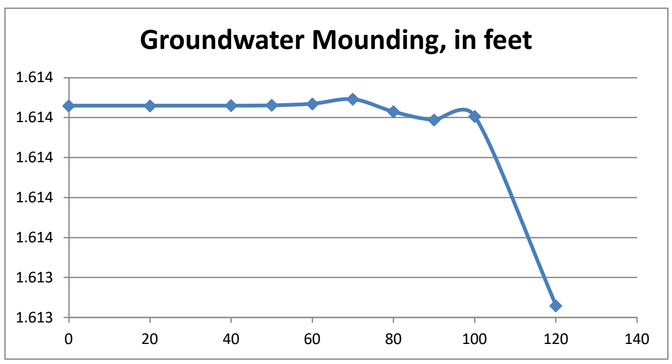
Input Values			Conversion Table	
			inch/hour	**feet/day**
0.1300	***R***	**Recharge (infiltration) rate (feet/day)**	0.67	1.33
0.080	**Sy**	**Specific yield, Sy (dimensionless, between 0 and 1]**		
3.60	**K**	**Horizontal hydraulic conductivity, Kh (feet/day)***	2.00	4.00
176.330	**x**	**1/2 length of basin (x direction, in feet)**		
45.400	**y**	**1/2 width of basin (y direction, in feet)**	**hours**	**days**
1.000	**t**	**duration of infiltration period (days)**	36	1.50
4.000	**hi(0)**	**initial thickness of saturated zone (feet)**		

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

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

Ground-water Mounding, in feet	**Distance from center of basin in x direction, in feet**
1.614	**0**
1.614	**20**
1.614	**40**
1.614	**50**
1.614	**60**
1.614	**70**
1.614	**80**
1.614	**90**
1.614	**100**
1.613	**120**

Re-Calculate Now



Disclaimer

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

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

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

Input Values		use consistent units (e.g. feet & days **or** inches & hours)
0.1600	***R***	**Recharge (infiltration) rate (feet/day)**
0.080	**Sy**	**Specific yield, Sy (dimensionless, between 0 and 1]**
3.60	**K**	**Horizontal hydraulic conductivity, Kh (feet/day)***
80.000	**x**	**1/2 length of basin (x direction, in feet)**
138.000	**y**	**1/2 width of basin (y direction, in feet)**
1.000	**t**	**duration of infiltration period (days)**
4.000	**hi(0)**	**initial thickness of saturated zone (feet)**
6.000	**h(max)**	**maximum thickness of saturated zone (beneath center of basin at end of infiltration period)**
2.000	**Δh(max)**	**maximum groundwater mounding (beneath center of basin at end of infiltration period)**

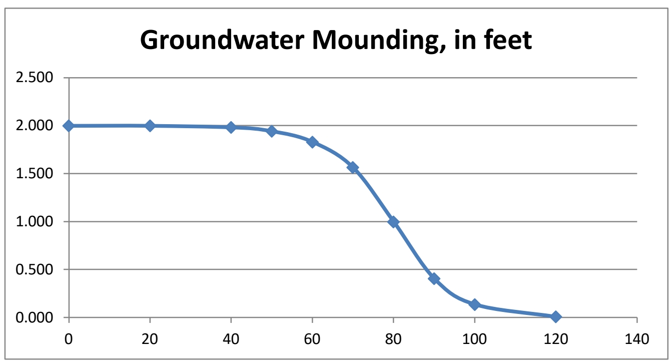
Conversion Table

inch/hour	**feet/day**
0.67	1.33
2.00	4.00
hours	**days**
36	1.50

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

Ground-water Mounding, in feet	**Distance from center of basin in x direction, in feet**
2.000	**0**
1.999	**20**
1.984	**40**
1.944	**50**
1.832	**60**
1.566	**70**
1.000	**80**
0.409	**90**
0.137	**100**
0.009	**120**

Re-Calculate Now



Disclaimer

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

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

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

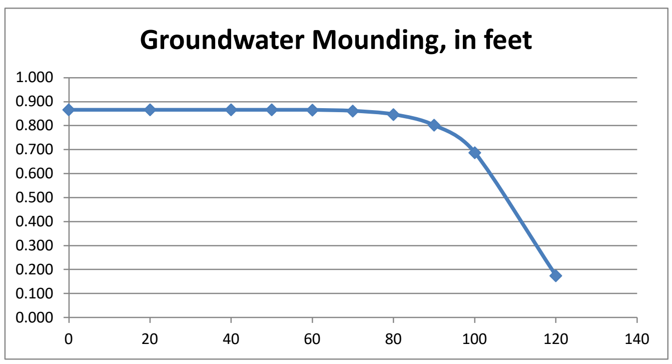
Input Values		use consistent units (e.g. feet & days **or** inches & hours)	**Conversion Table**	
			inch/hour	**feet/day**
0.0700	***R***	**Recharge (infiltration) rate (feet/day)**	0.67	1.33
0.080	**Sy**	**Specific yield, Sy (dimensionless, between 0 and 1]**		
3.60	**K**	**Horizontal hydraulic conductivity, Kh (feet/day)***	2.00	4.00
110.000	**x**	**1/2 length of basin (x direction, in feet)**		
41.500	**y**	**1/2 width of basin (y direction, in feet)**	**hours**	**days**
1.000	**t**	**duration of infiltration period (days)**	36	1.50
4.000	**hi(0)**	**initial thickness of saturated zone (feet)**		

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

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

Ground-water Mounding, in feet	**Distance from center of basin in x direction, in feet**
0.867	**0**
0.867	**20**
0.867	**40**
0.867	**50**
0.866	**60**
0.862	**70**
0.848	**80**
0.803	**90**
0.688	**100**
0.175	**120**

Re-Calculate Now



Disclaimer

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

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

The user must specify infiltration rate (R), specific yield (Sy), horizontal hydraulic conductivity (Kh), basin dimensions (x, y), duration of infiltration period (t), and the initial thickness of the saturated zone (hi(0), height of the water table if the bottom of the aquifer is the datum). For a square basin the half width equals the half length (x = y). For a rectangular basin, if the user wants the water-table changes perpendicular to the long side, specify x as the short dimension and y as the long dimension. Conversely, if the user wants the values perpendicular to the short side, specify y as the short dimension, x as the long dimension. All distances are from the center of the basin. Users can change the distances from the center of the basin at which water-table aquifer thickness are calculated.

Cells highlighted in yellow are values that can be changed by the user. Cells highlighted in red are output values based on user-specified inputs. The user MUST click the blue "Re-Calculate Now" button each time ANY of the user-specified inputs are changed otherwise necessary iterations to converge on the correct solution will not be done and values shown will be incorrect. Use consistent units for all input values (for example, feet and days)

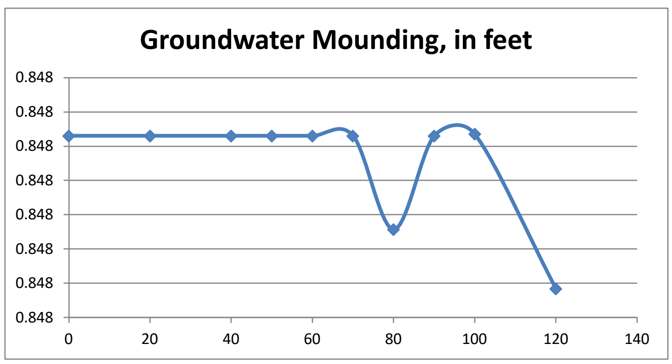
Input Values		use consistent units (e.g. feet & days **or** inches & hours)	Conversion Table	
			inch/hour	**feet/day**
0.0700	***R***	**Recharge (infiltration) rate (feet/day)**	0.67	1.33
0.080	**Sy**	**Specific yield, Sy (dimensionless, between 0 and 1]**		
3.60	**K**	**Horizontal hydraulic conductivity, Kh (feet/day)***	2.00	4.00
182.000	**x**	**1/2 length of basin (x direction, in feet)**		
33.000	**y**	**1/2 width of basin (y direction, in feet)**	**hours**	**days**
1.000	**t**	**duration of infiltration period (days)**	36	1.50
4.000	**hi(0)**	**initial thickness of saturated zone (feet)**		

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

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

Ground-water Mounding, in feet	**Distance from center of basin in x direction, in feet**
0.848	**0**
0.848	**20**
0.848	**40**
0.848	**50**
0.848	**60**
0.848	**70**
0.848	**80**
0.848	**90**
0.848	**100**
0.848	**120**

Re-Calculate Now



Disclaimer

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

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

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

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

Input Values				
0.1400	***R***	**Recharge (infiltration) rate (feet/day)**		
0.080	**Sy**	**Specific yield, Sy (dimensionless, between 0 and 1]**		
3.60	**K**	**Horizontal hydraulic conductivity, Kh (feet/day)***		
125.000	**x**	**1/2 length of basin (x direction, in feet)**		
55.000	**y**	**1/2 width of basin (y direction, in feet)**		
1.000	**t**	**duration of infiltration period (days)**		
4.000	**hi(0)**	**initial thickness of saturated zone (feet)**		

Conversion Table

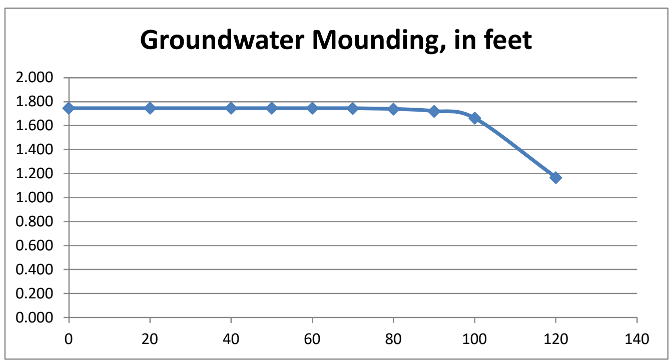
inch/hour	**feet/day**
0.67	1.33
2.00	4.00
hours	**days**
36	1.50

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

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

Ground-water Mounding, in feet	**Distance from center of basin in x direction, in feet**
1.747	**0**
1.747	**20**
1.747	**40**
1.747	**50**
1.747	**60**
1.746	**70**
1.741	**80**
1.722	**90**
1.664	**100**
1.168	**120**

Re-Calculate Now



Disclaimer

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

Nitsch Engineering

2 Center Plaza, Suite 430
Boston, MA 02108-1928
T: 617-338-0063
F: 617-338-6472
www.nitscheng.com

MINDESS ELEMENTARY SCHOOL
WATER QUALITY TREATMENT SUMMARY (06/14/2021)

Nitsch Engineering has prepared this Water Quality Treatment Summary for the proposed Mindess Elementary School. In compliance with MassDEP Stormwater Management Standard #4, the proposed stormwater management system is designed to remove at least 80% of the average annual post-construction load of TSS prior to discharge. The stormwater management system is designed to remove at least 44% of the average annual post-construction TSS load prior to discharge to the infiltration systems because the infiltration systems are located within areas where soils with rapid infiltration rates were observed.

A summary of treatment trains proposed to provide water quantity control and water quality improvement at the proposed project site is provided below.

Treatment Train A
Catchment Areas: DA2
Deep Sump & Hooded Catch Basin → Water Quality Structure→ Discharge

Treatment Train B
Catchment Areas: DA3
Sediment Forebay → Infiltration Basin → Discharge

Treatment Train C
Catchment Areas: DA10
Sediment Forebay → Bioretention Basin→ Discharge

Treatment Train D
Catchment Areas: DA 4, 6, 7, 8 12
Deep Sump & Hooded Catch Basin → Water Quality Structure → Subsurface Infiltration → Discharge

Treatment Train E
Catchment Areas: DA11
Water Quality Swale → Discharge

Mindess School
90 Concord Street, Ashland, MA
June 14, 2021

Nitsch Project No. 13609

Nitsch Engineering

Nitsch Engineering

<u>Treatment Train A:</u>
Deep Sump & Hooded Catch Basin → Water Quality Structure→ Discharge

Treatment Spreadsheet

B BMP	C TSS Removal Rate	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**
Water Quality Structure	**0.80**	**0.75**	**0.60**	**0.15**

Total TSS Removal = **85%** **Meets 80% TSS removal requirement**

Mindess School
90 Concord Street, Ashland, MA
June 14, 2021
Treatment Train B :
Sediment Forebay → Infiltration Basin → Discharge

Nitsch Project No. 13609

Treatment Spreadsheet

B BMP	C TSS Removal Rate	D Starting TSS Load	E Amount Removed (C*D)	F Remaining Load (D-E)
Infiltration Basin (with Pretreatment)	**0.80**	**1.00**	**0.80**	**0.20**

Total TSS Removal = 80%

Meets 80% TSS removal requirement

Mindess School
90 Concord Street, Ashland, MA
June 14, 2021

Nitsch Project No. 13609

Treatment Train C :

Sediment Forebay → Bioretention Basin→ Discharge

Treatment Spreadsheet

B BMP	C TSS Removal Rate	D Starting TSS Load	E Amount Removed (C*D)	F Remaining Load (D-E)
Bioretention Basin (with Pretreatment)	**0.90**	**1.00**	**0.90**	**0.10**

Total TSS Removal = 90%

Meets 80% TSS removal requirement

Mindess School
90 Concord Street, Ashland, MA
June 14, 2021

Nitsch Project No. 13609

Treatment Train D:

Deep Sump & Hooded Catch Basin → Water Quality Structure → Subsurface Infiltration → Discharge

Treatment Spreadsheet

B BMP	C TSS Removal Rate	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**
Water Quality Structure	**0.80**	**0.75**	**0.60**	**0.15**
Subsurface Infiltration System	**0.80**	**0.15**	**0.12**	**0.03**

Total TSS Removal = 97%

Meets 80% TSS removal requirement

Mindess School
90 Concord Street, Ashland, MA
June 14, 2021
<u>Treatment Train E:</u>
Biofilter Swale → Discharge

Nitsch Project No. 13609

Nitsch Engineering

Nitsch Engineering

Treatment Spreadsheet

B BMP	C TSS Removal Rate	D Starting TSS Load	E Amount Removed (C*D)	F Remaining Load (D-E)
Biofilter Swale	**0.50**	**1.00**	**0.50**	**0.50**

Total TSS Removal = 50%

Does not meet 80% TSS Removal requirement, but this is a redevelopment area.

Nitsch Engineering

2 Center Plaza, Suite 430
Boston, MA 02108-1928
T: 617-338-0063
F: 617-338-6472
www.nitscheng.com

1" Calculation Sheet

Nitsch Job #	13609
Calc:	NB
Date:	6/14/2021

This spreadsheet should be used to convert water quality volume to an equivilent water quality peak flow rate as outlined in the new MA DEP guidelines that take effect on October 15, 2013.

Glossary

Water Quality Flow Rate =	WQF
Water Quality Volume =	WQV*
unit peak discharge (csm/in) =	qu**
Impervious Area in watershed (square miles) =	Ai

*WQV is expressed in watershed inches (you must use 1.0-inches in all cases with this method and not 0.5-inches)
** calculate the qu based on the time of concentration (see 1" - qu Table)

Compute Water Quality Flow with the following Equation

WQF = (qu)(A)(WQV)

Input Information (in colored cells only)

Site Plan Callout		Enter qu (from 1" - qu Table)	Enter Impervious Area (SF)	Ai (sq/mi)	WQV		WQF	
WQS#200	=	774	19380	0.000695	1	=	0.54	cfs
WQS#201	=	774	6160	0.000221	1	=	0.17	cfs
WQS#202	=	774	12679	0.000455	1	=	0.35	cfs
WQS#203	=	774	11927	0.000428	1	=	0.33	cfs
WQS#204	=	774	14076	0.000505	1	=	0.39	cfs
WQS#205	=	774	11200	0.000402	1	=	0.31	cfs
WQS#206	=	774	15800	0.000567	1	=	0.44	cfs
WQS#207	=	774	67951	0.002437	1	=	1.89	cfs
WQS#208	=	774	2443	0.000088	1	=	0.07	cfs
	=			0.000000	1	=	0.00	cfs

Nitsch Engineering

2 Center Plaza, Suite 430
Boston, MA 02108-1928
T: 617-338-0063
F: 617-338-6472
www.nitscheng.com

STANDARD 10: Illicit Discharge Compliance Statement

Project Name: Mindess School	Nitsch Project #: 13609
Location: Ashland, MA	Checked by: JEG
Prepared by: BMV	Sheet No. 1 of 1
Date: 06/15/2021	

Standard 10 states: All illicit discharges to the stormwater management system are prohibited.

This is to verify:

1. Based on the information available there are no known or suspected illicit discharges to the stormwater management system at the Mindess School site as defined in the MassDEP Stormwater Handbook.

2. The design of the stormwater system includes no proposed illicit discharges.

Jared Gentilucci

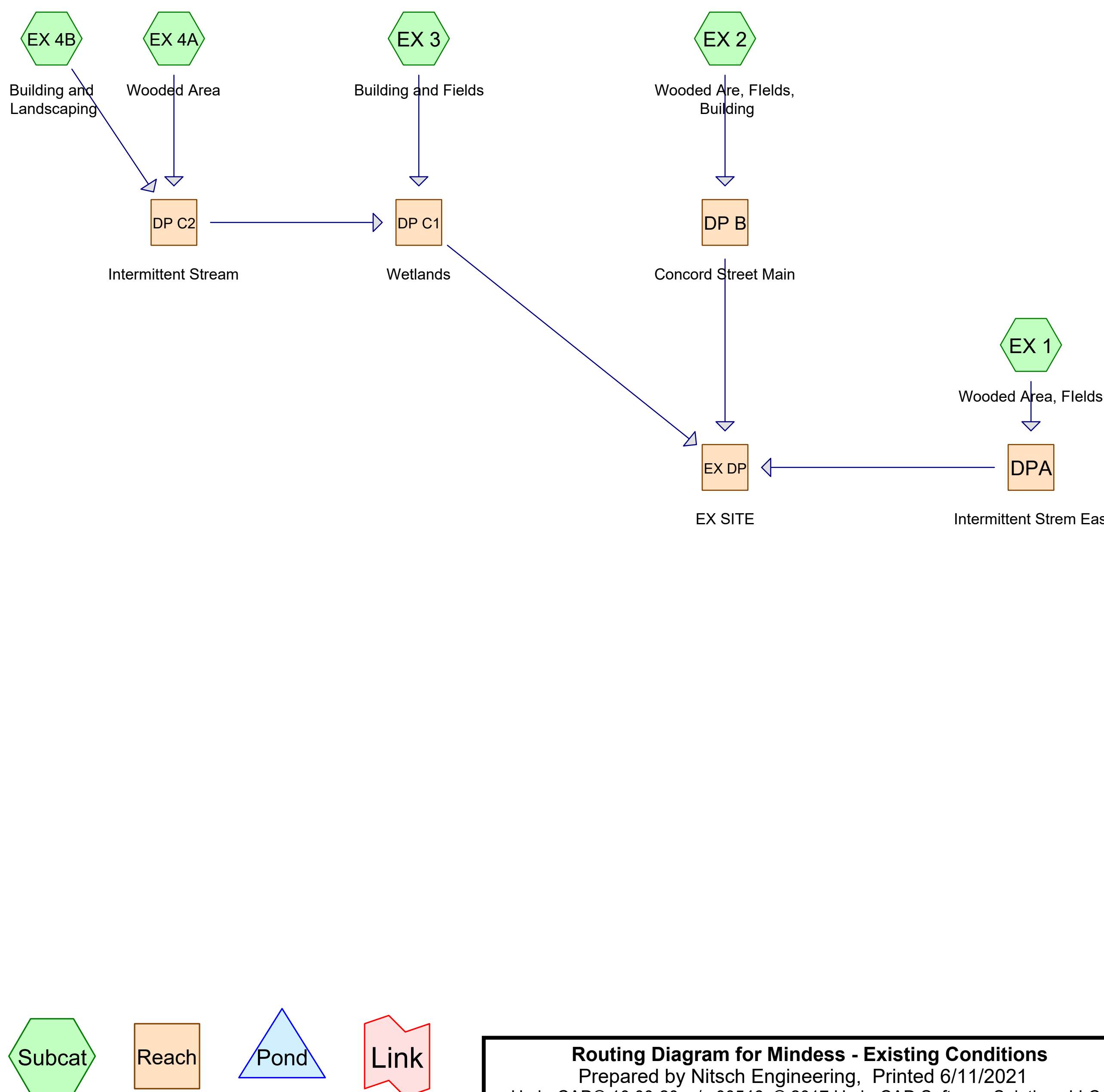
Jared Gentilucci, PE

6/15/21

Date

APPENDIX B

Pre-Development Conditions – HydroCAD Calculations



Routing Diagram for Mindess - Existing Conditions
Prepared by Nitsch Engineering, Printed 6/11/2021
HydroCAD® 10.00-20 s/n 00546 © 2017 HydroCAD Software Solutions LLC

Area Listing (selected nodes)

Area (sq-ft)	CN	Description (subcatchment-numbers)
484,219	74	>75% Grass cover, Good, HSG C (EX 1, EX 2, EX 3, EX 4B)
161,850	98	Paved parking, HSG C (EX 2, EX 3)
35,348	98	Pond (EX 3)
29,314	98	Roof (EX 4B)
436,929	70	Woods, Good, HSG C (EX 1, EX 2, EX 3, EX 4A)
1,147,660	**77**	**TOTAL AREA**

Soil Listing (selected nodes)

Area (sq-ft)	Soil Group	Subcatchment Numbers
0	HSG A	
0	HSG B	
1,082,998	HSG C	EX 1, EX 2, EX 3, EX 4A, EX 4B
0	HSG D	
64,662	Other	EX 3, EX 4B
1,147,660		**TOTAL AREA**

Ground Covers (selected 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	484,219	0	0	484,219	>75% Grass cover, Good	
0	0	161,850	0	0	161,850	Paved parking	
0	0	0	0	35,348	35,348	Pond	
0	0	0	0	29,314	29,314	Roof	
0	0	436,929	0	0	436,929	Woods, Good	
0	**0**	**1,082,998**	**0**	**64,662**	**1,147,660**	**TOTAL AREA**	

Time span=0.00-72.00 hrs, dt=0.05 hrs, 1441 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

SubcatchmentEX 1: Wooded Area, FIelds Runoff Area=160,523 sf 0.00% Impervious Runoff Depth=1.02"
Flow Length=570' Tc=9.4 min CN=72 Runoff=3.61 cfs 13,698 cf

SubcatchmentEX 2: Wooded Are, FIelds, Runoff Area=359,819 sf 7.91% Impervious Runoff Depth=1.14"
Flow Length=589' Tc=10.5 min CN=74 Runoff=8.87 cfs 34,109 cf

SubcatchmentEX 3: Building and Fields Runoff Area=466,439 sf 36.18% Impervious Runoff Depth=1.66"
Flow Length=190' Tc=6.0 min CN=82 Runoff=20.26 cfs 64,506 cf

SubcatchmentEX 4A: Wooded Area Runoff Area=109,254 sf 0.00% Impervious Runoff Depth=0.92"
Flow Length=366' Tc=12.4 min CN=70 Runoff=1.96 cfs 8,347 cf

SubcatchmentEX 4B: Building and Runoff Area=51,625 sf 56.78% Impervious Runoff Depth=2.13"
Tc=6.0 min CN=88 Runoff=2.83 cfs 9,174 cf

Reach DP B: Concord Street Main Inflow=8.87 cfs 34,109 cf
Outflow=8.87 cfs 34,109 cf

Reach DP C1: Wetlands Inflow=24.59 cfs 82,026 cf
Outflow=24.59 cfs 82,026 cf

Reach DP C2: Intermittent Stream Inflow=4.40 cfs 17,520 cf
Outflow=4.40 cfs 17,520 cf

Reach DPA: Intermittent Strem Eas Inflow=3.61 cfs 13,698 cf
Outflow=3.61 cfs 13,698 cf

Reach EX DP: EX SITE Inflow=36.06 cfs 129,834 cf
Outflow=36.06 cfs 129,834 cf

Total Runoff Area = 1,147,660 sf Runoff Volume = 129,834 cf Average Runoff Depth = 1.36"
80.26% Pervious = 921,148 sf 19.74% Impervious = 226,512 sf

Summary for Subcatchment EX 1: Wooded Area, Fields

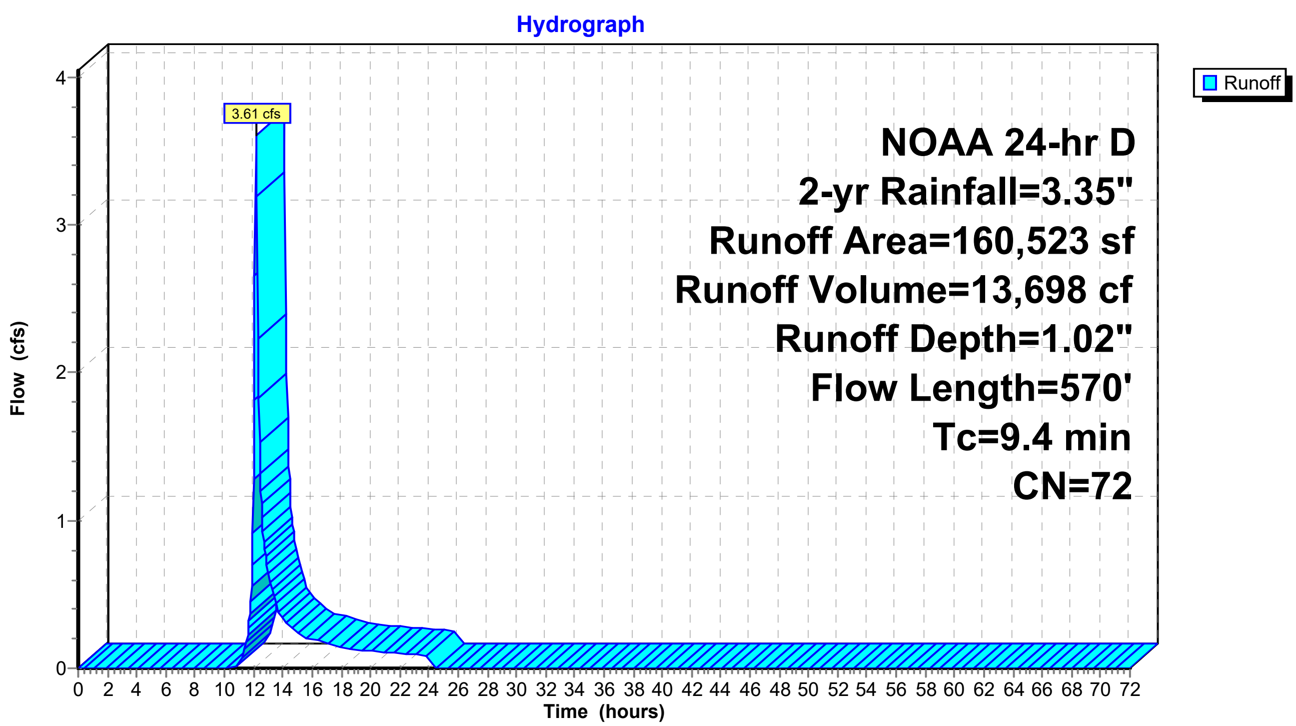
Runoff = 3.61 cfs @ 12.18 hrs, Volume= 13,698 cf, Depth= 1.02"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
NOAA 24-hr D 2-yr Rainfall=3.35"

Area (sf)	CN	Description
75,399	74	>75% Grass cover, Good, HSG C
85,124	70	Woods, Good, HSG C
160,523	72	Weighted Average
160,523		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.1	50	0.1700	0.16		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.35"
1.2	138	0.1400	1.87		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
3.1	382	0.0160	2.04		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
9.4	570	Total			

Subcatchment EX 1: Wooded Area, Fields



Summary for Subcatchment EX 2: Wooded Are, Flelds, Building

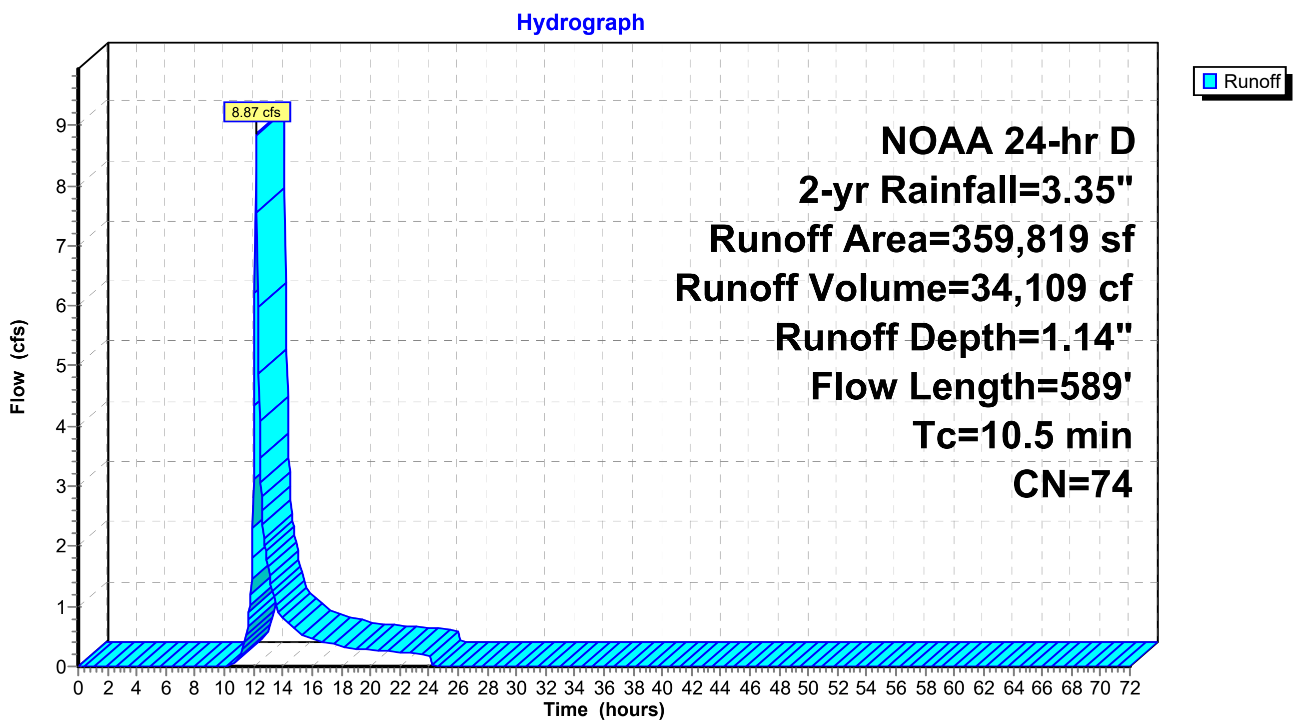
Runoff = 8.87 cfs @ 12.19 hrs, Volume= 34,109 cf, Depth= 1.14"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
NOAA 24-hr D 2-yr Rainfall=3.35"

Area (sf)	CN	Description
28,463	98	Paved parking, HSG C
138,936	74	>75% Grass cover, Good, HSG C
192,420	70	Woods, Good, HSG C
359,819	74	Weighted Average
331,356		92.09% Pervious Area
28,463		7.91% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.2	50	0.1600	0.16		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.35"
3.6	309	0.0800	1.41		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
1.6	191	0.0160	2.04		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
0.1	39	0.1280	5.76		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
10.5	589	Total			

Subcatchment EX 2: Wooded Are, Flelds, Building



Summary for Subcatchment EX 3: Building and Fields

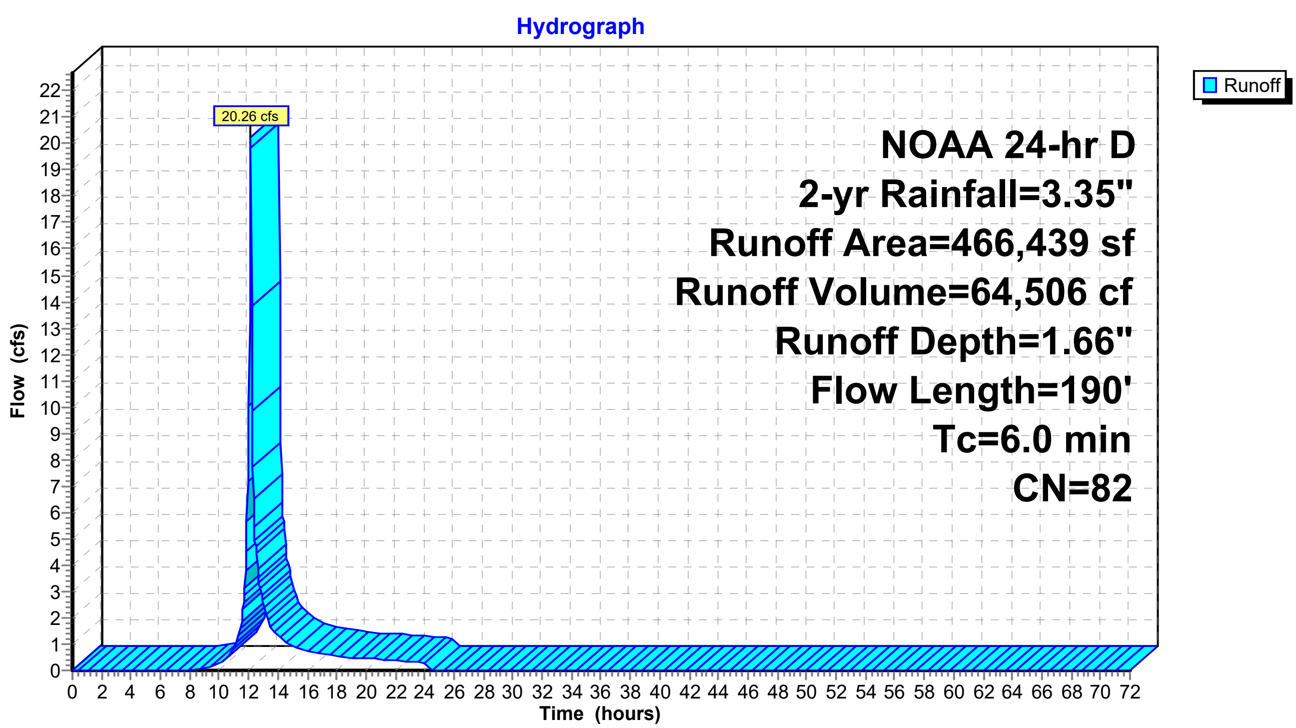
Runoff = 20.26 cfs @ 12.13 hrs, Volume= 64,506 cf, Depth= 1.66"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
NOAA 24-hr D 2-yr Rainfall=3.35"

	Area (sf)	CN	Description
	133,387	98	Paved parking, HSG C
	247,573	74	>75% Grass cover, Good, HSG C
	50,131	70	Woods, Good, HSG C
*	35,348	98	Pond
	466,439	82	Weighted Average
	297,704		63.82% Pervious Area
	168,735		36.18% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.2	50	0.0400	0.20		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.35"
0.5	140	0.0700	4.26		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
1.3					**Direct Entry,**
6.0	190	Total			

Subcatchment EX 3: Building and Fields



Summary for Subcatchment EX 4A: Wooded Area

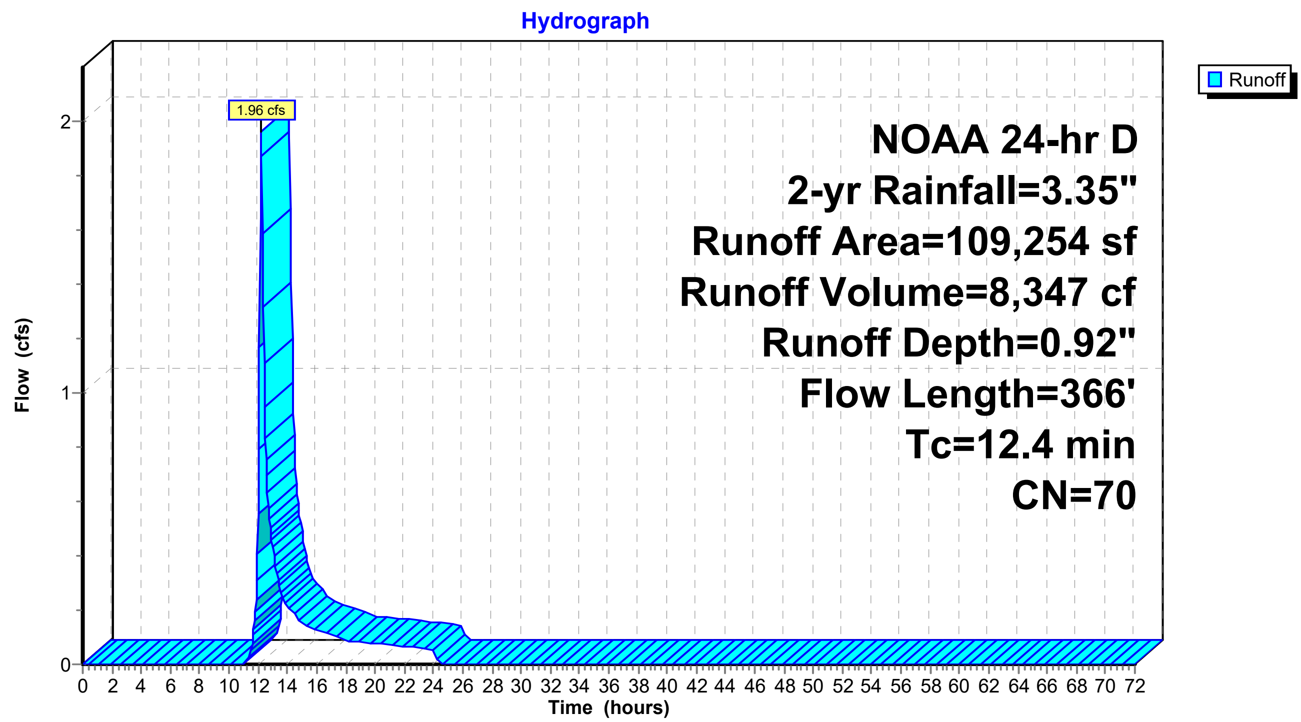
Runoff = 1.96 cfs @ 12.21 hrs, Volume= 8,347 cf, Depth= 0.92"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
NOAA 24-hr D 2-yr Rainfall=3.35"

Area (sf)	CN	Description
109,254	70	Woods, Good, HSG C
109,254		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.1	50	0.0400	0.09		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.35"
3.3	316	0.1000	1.58		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
12.4	366	Total			

Subcatchment EX 4A: Wooded Area



Summary for Subcatchment EX 4B: Building and Landscaping

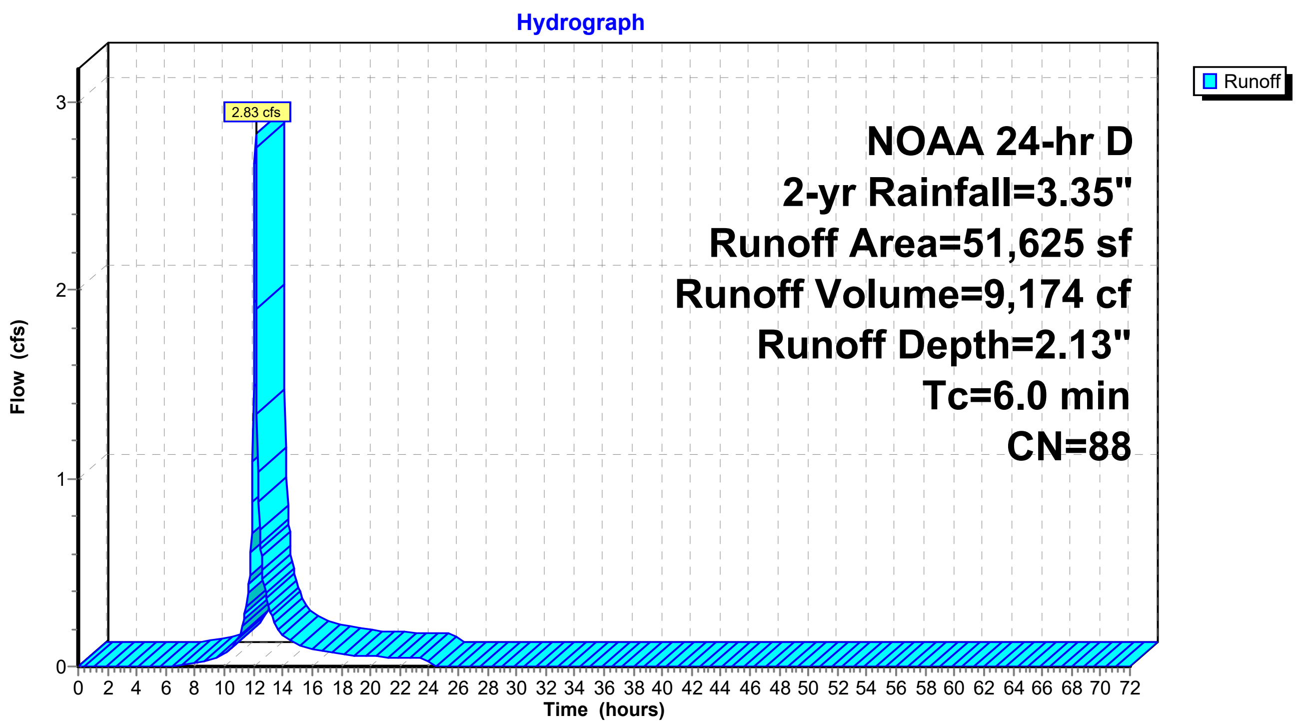
Runoff = 2.83 cfs @ 12.13 hrs, Volume= 9,174 cf, Depth= 2.13"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
NOAA 24-hr D 2-yr Rainfall=3.35"

	Area (sf)	CN	Description
	22,311	74	>75% Grass cover, Good, HSG C
*	29,314	98	Roof
	51,625	88	Weighted Average
	22,311		43.22% Pervious Area
	29,314		56.78% Impervious Area

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

Subcatchment EX 4B: Building and Landscaping



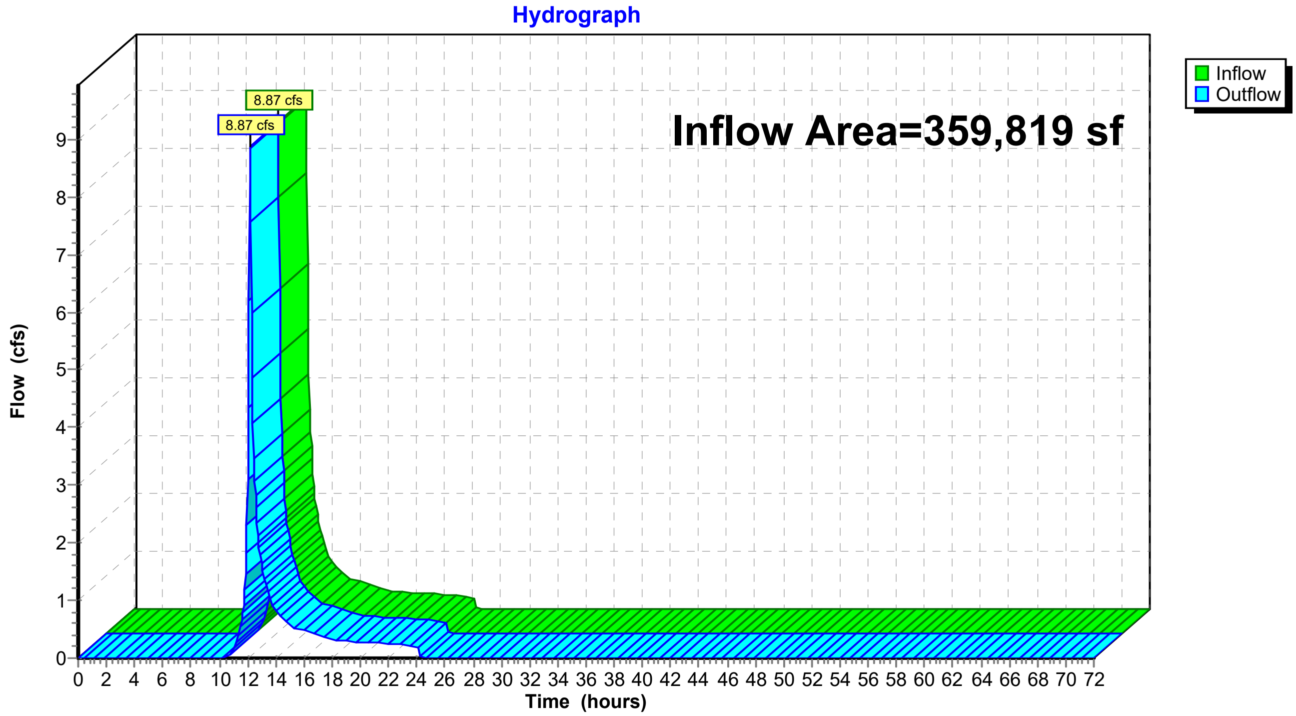
Summary for Reach DP B: Concord Street Main

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

Inflow Area = 359,819 sf, 7.91% Impervious, Inflow Depth = 1.14" for 2-yr event
Inflow = 8.87 cfs @ 12.19 hrs, Volume= 34,109 cf
Outflow = 8.87 cfs @ 12.19 hrs, Volume= 34,109 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

Reach DP B: Concord Street Main



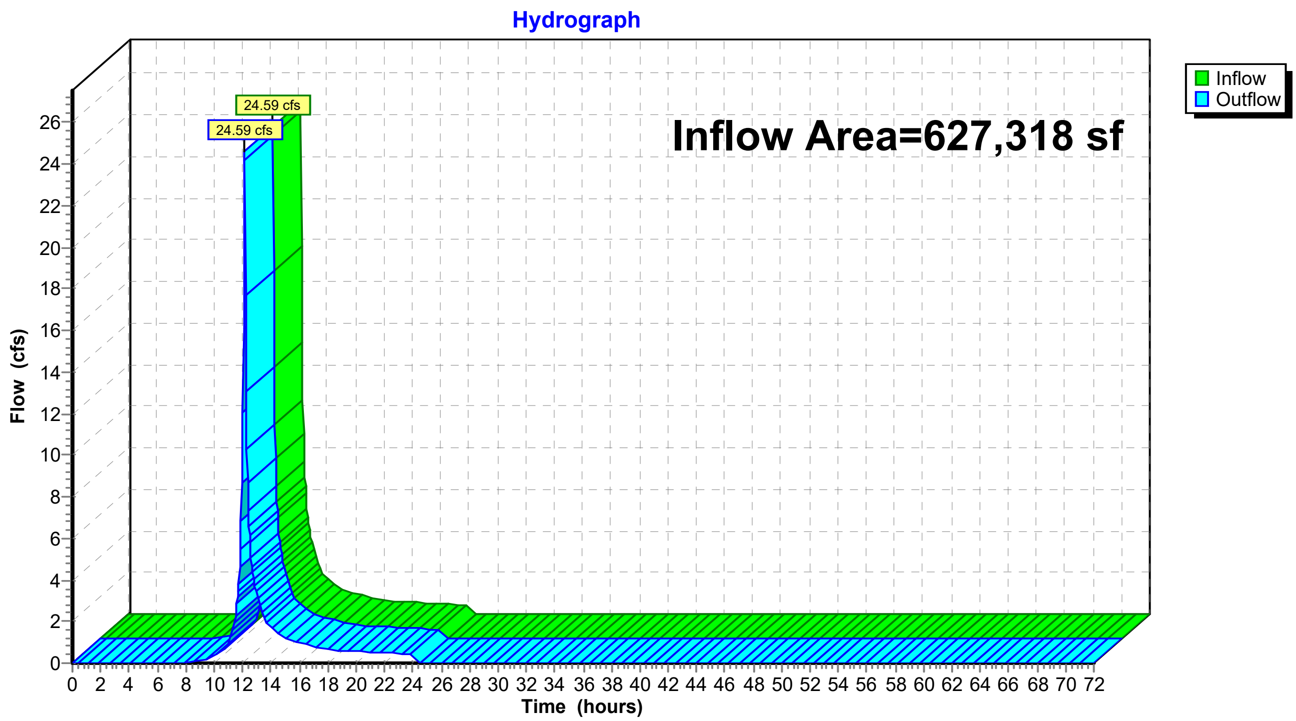
Summary for Reach DP C1: Wetlands

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

Inflow Area =	627,318 sf,	31.57% Impervious,	Inflow Depth = 1.57"	for 2-yr event
Inflow =	24.59 cfs @	12.13 hrs, Volume=	82,026 cf	
Outflow =	24.59 cfs @	12.13 hrs, Volume=	82,026 cf,	Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

Reach DP C1: Wetlands



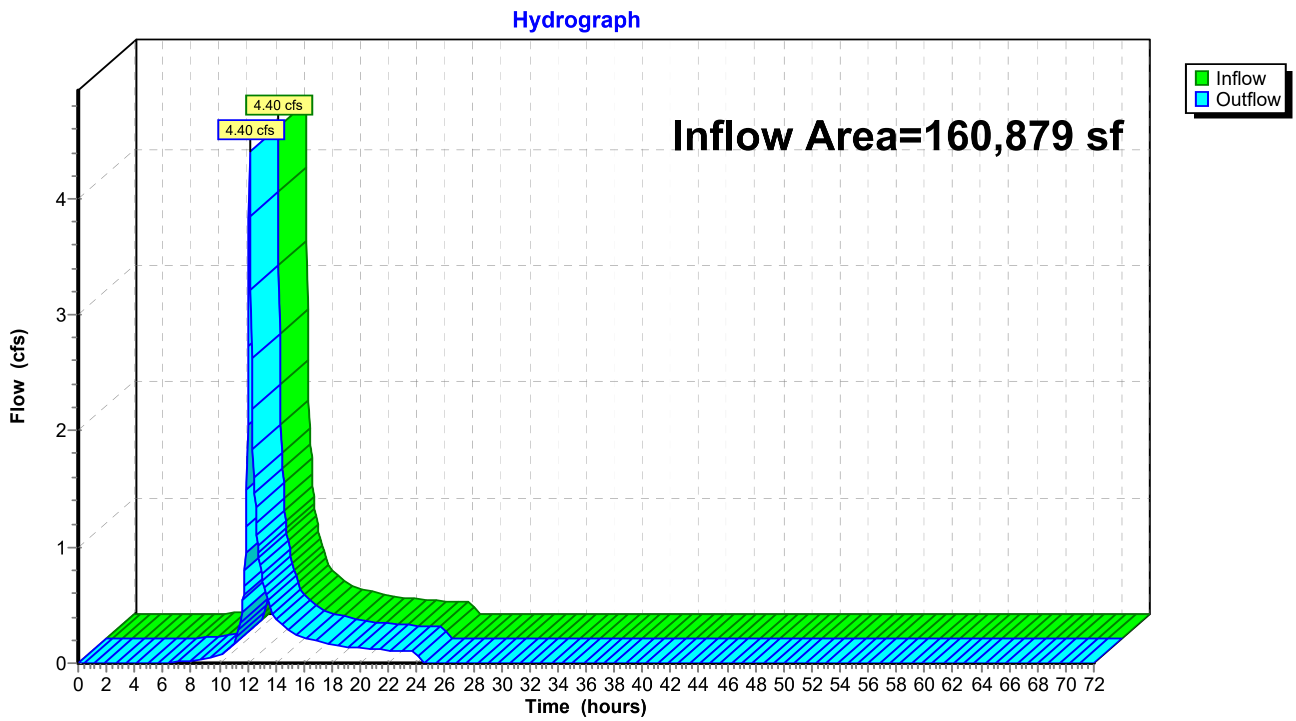
Summary for Reach DP C2: Intermittent Stream

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

Inflow Area =	160,879 sf, 18.22% Impervious,	Inflow Depth = 1.31"	for 2-yr event
Inflow =	4.40 cfs @ 12.15 hrs, Volume=	17,520 cf	
Outflow =	4.40 cfs @ 12.15 hrs, Volume=	17,520 cf, Atten= 0%, Lag= 0.0 min	

Routing by Stor-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

Reach DP C2: Intermittent Stream



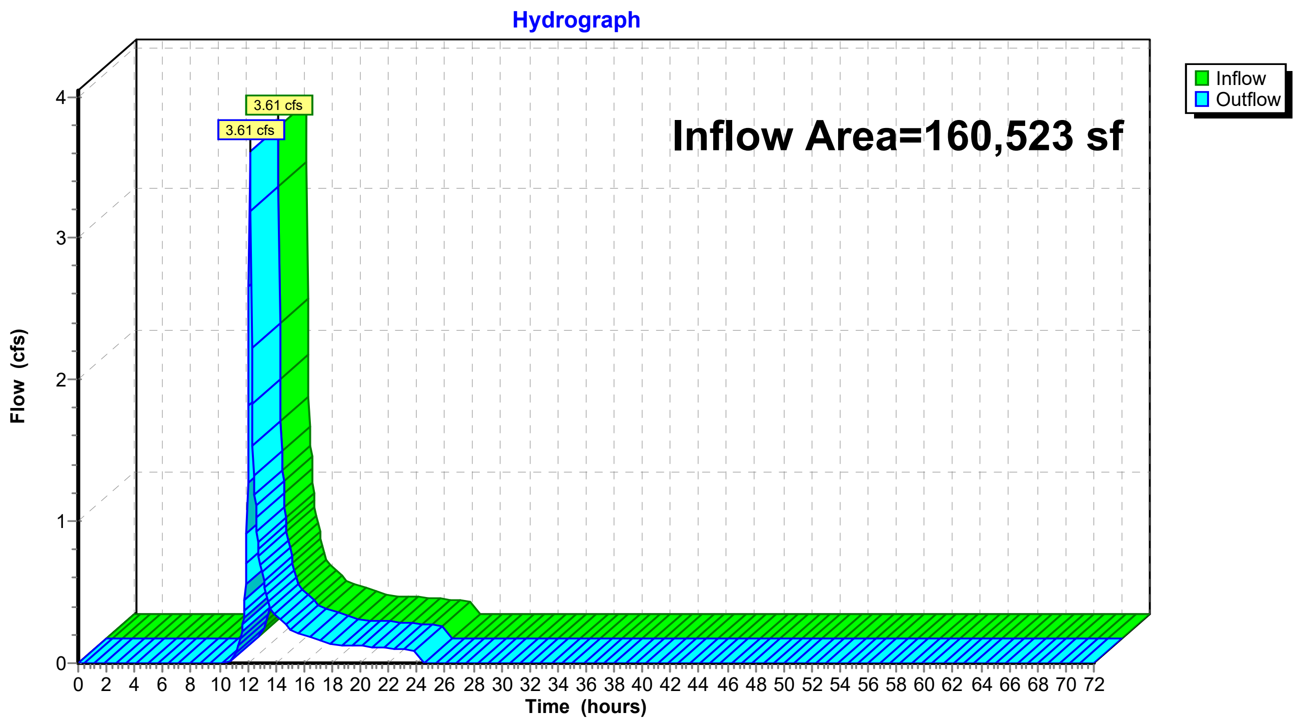
Summary for Reach DPA: Intermittent Strem Eas

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

Inflow Area =	160,523 sf,	0.00% Impervious,	Inflow Depth = 1.02"	for 2-yr event
Inflow =	3.61 cfs @	12.18 hrs, Volume=	13,698 cf	
Outflow =	3.61 cfs @	12.18 hrs, Volume=	13,698 cf,	Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

Reach DPA: Intermittent Strem Eas



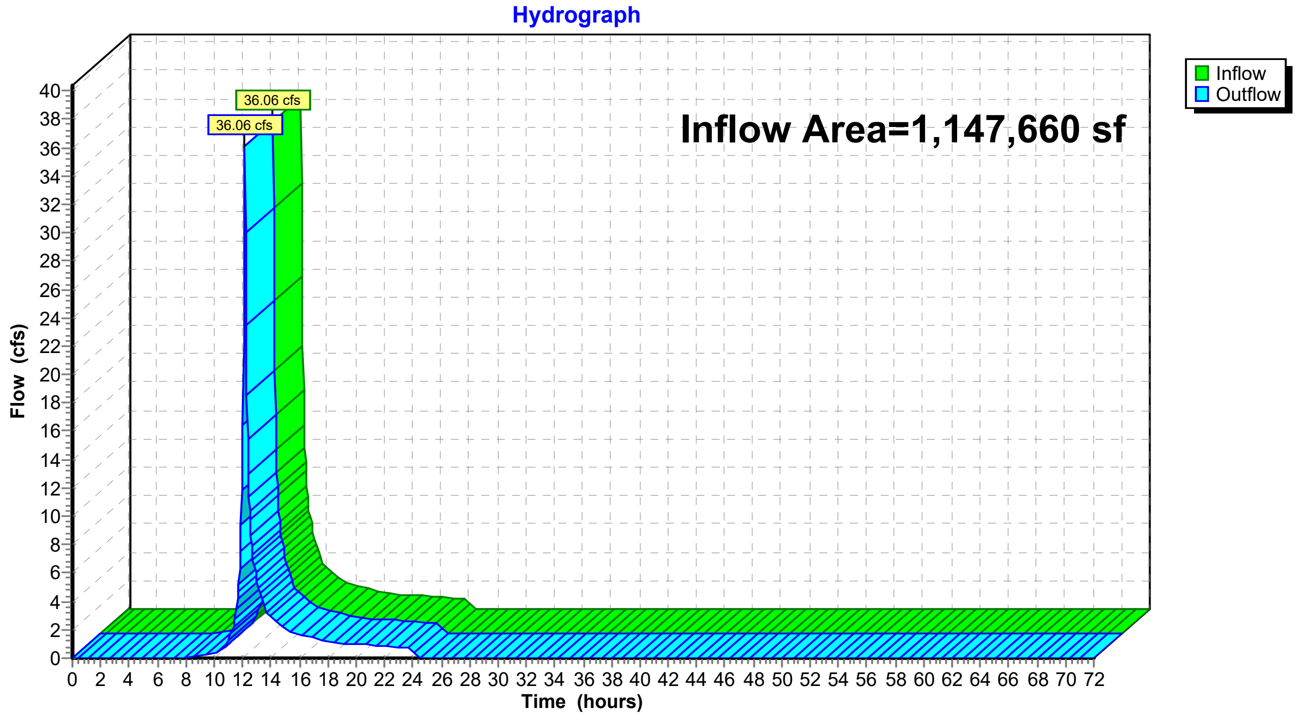
Summary for Reach EX DP: EX SITE

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

Inflow Area =	1,147,660 sf,	19.74% Impervious,	Inflow Depth = 1.36"	for 2-yr event
Inflow =	36.06 cfs @	12.15 hrs, Volume=	129,834 cf	
Outflow =	36.06 cfs @	12.15 hrs, Volume=	129,834 cf,	Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

Reach EX DP: EX SITE



Time span=0.00-72.00 hrs, dt=0.05 hrs, 1441 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

SubcatchmentEX 1: Wooded Area, FIelds Runoff Area=160,523 sf 0.00% Impervious Runoff Depth=2.38"
Flow Length=570' Tc=9.4 min CN=72 Runoff=8.83 cfs 31,790 cf

SubcatchmentEX 2: Wooded Are, FIelds, Runoff Area=359,819 sf 7.91% Impervious Runoff Depth=2.55"
Flow Length=589' Tc=10.5 min CN=74 Runoff=20.49 cfs 76,433 cf

SubcatchmentEX 3: Building and Fields Runoff Area=466,439 sf 36.18% Impervious Runoff Depth=3.29"
Flow Length=190' Tc=6.0 min CN=82 Runoff=39.52 cfs 127,711 cf

SubcatchmentEX 4A: Wooded Area Runoff Area=109,254 sf 0.00% Impervious Runoff Depth=2.21"
Flow Length=366' Tc=12.4 min CN=70 Runoff=5.08 cfs 20,107 cf

SubcatchmentEX 4B: Building and Runoff Area=51,625 sf 56.78% Impervious Runoff Depth=3.89"
Tc=6.0 min CN=88 Runoff=5.02 cfs 16,726 cf

Reach DP B: Concord Street Main Inflow=20.49 cfs 76,433 cf
Outflow=20.49 cfs 76,433 cf

Reach DP C1: Wetlands Inflow=48.64 cfs 164,543 cf
Outflow=48.64 cfs 164,543 cf

Reach DP C2: Intermittent Stream Inflow=9.32 cfs 36,832 cf
Outflow=9.32 cfs 36,832 cf

Reach DPA: Intermittent Strem Eas Inflow=8.83 cfs 31,790 cf
Outflow=8.83 cfs 31,790 cf

Reach EX DP: EX SITE Inflow=76.09 cfs 272,766 cf
Outflow=76.09 cfs 272,766 cf

Total Runoff Area = 1,147,660 sf Runoff Volume = 272,766 cf Average Runoff Depth = 2.85"
80.26% Pervious = 921,148 sf 19.74% Impervious = 226,512 sf

Summary for Subcatchment EX 1: Wooded Area, Flelds

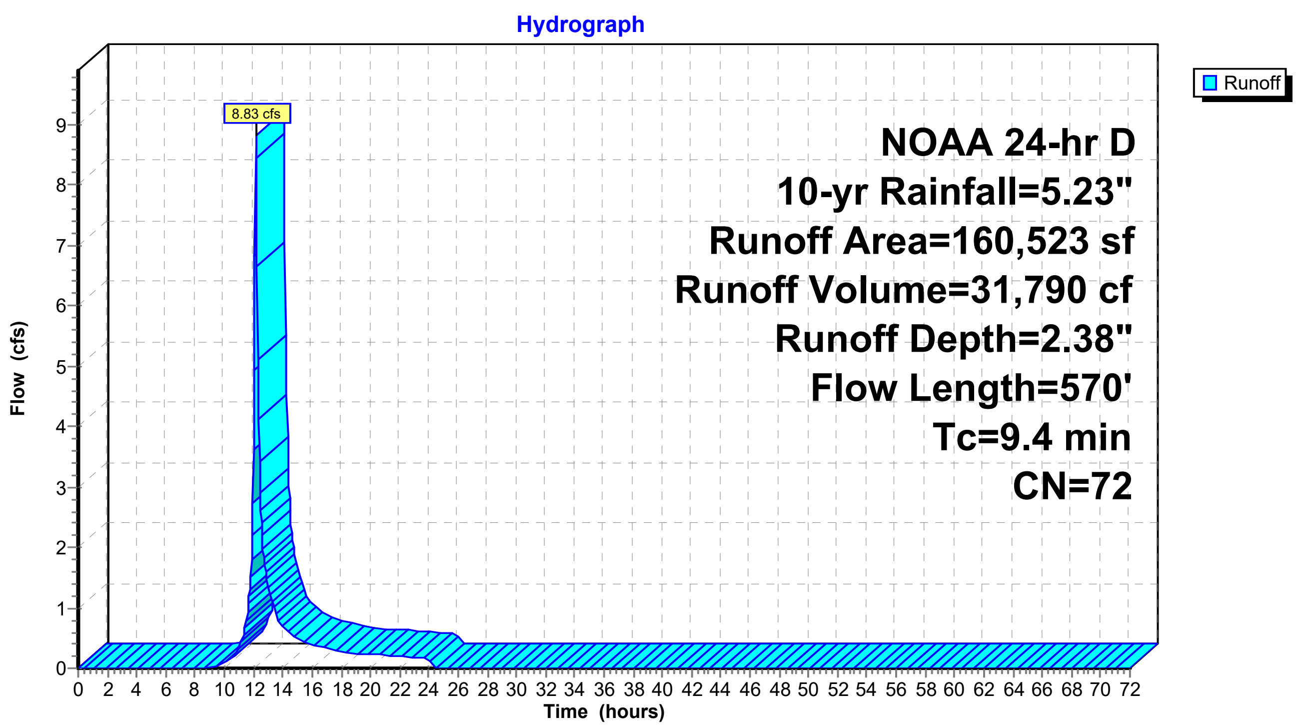
Runoff = 8.83 cfs @ 12.17 hrs, Volume= 31,790 cf, Depth= 2.38"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
NOAA 24-hr D 10-yr Rainfall=5.23"

Area (sf)	CN	Description
75,399	74	>75% Grass cover, Good, HSG C
85,124	70	Woods, Good, HSG C
160,523	72	Weighted Average
160,523		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.1	50	0.1700	0.16		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.35"
1.2	138	0.1400	1.87		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
3.1	382	0.0160	2.04		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
9.4	570	Total			

Subcatchment EX 1: Wooded Area, Flelds



Summary for Subcatchment EX 2: Wooded Are, Fields, Building

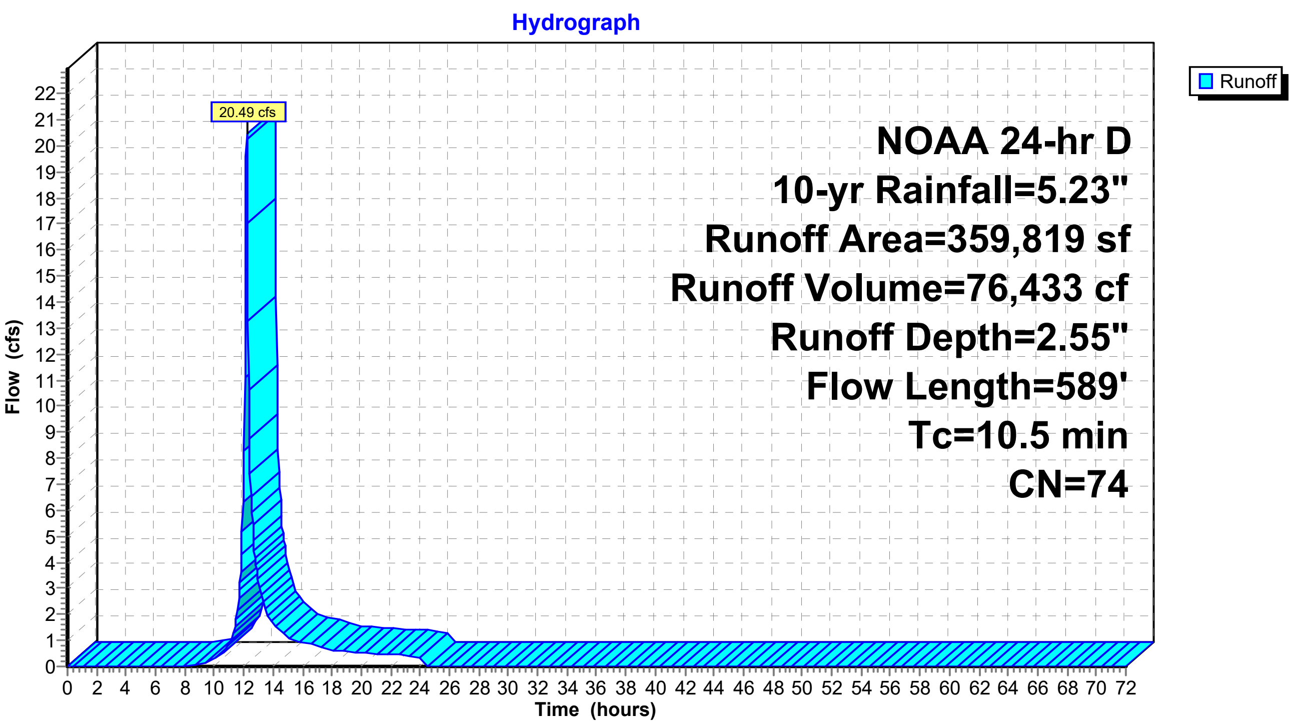
Runoff = 20.49 cfs @ 12.18 hrs, Volume= 76,433 cf, Depth= 2.55"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
NOAA 24-hr D 10-yr Rainfall=5.23"

Area (sf)	CN	Description
28,463	98	Paved parking, HSG C
138,936	74	>75% Grass cover, Good, HSG C
192,420	70	Woods, Good, HSG C
359,819	74	Weighted Average
331,356		92.09% Pervious Area
28,463		7.91% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.2	50	0.1600	0.16		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.35"
3.6	309	0.0800	1.41		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
1.6	191	0.0160	2.04		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
0.1	39	0.1280	5.76		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
10.5	589	Total			

Subcatchment EX 2: Wooded Are, Fields, Building



Summary for Subcatchment EX 3: Building and Fields

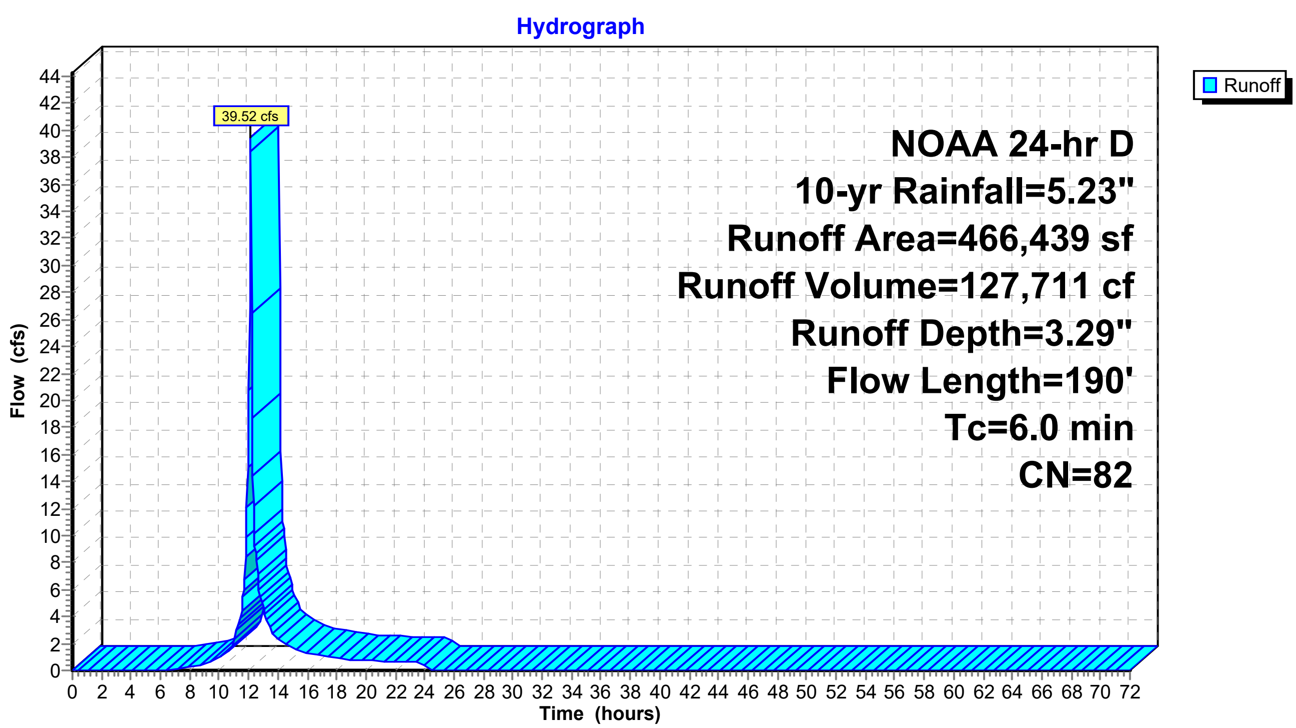
Runoff = 39.52 cfs @ 12.13 hrs, Volume= 127,711 cf, Depth= 3.29"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
NOAA 24-hr D 10-yr Rainfall=5.23"

	Area (sf)	CN	Description
	133,387	98	Paved parking, HSG C
	247,573	74	>75% Grass cover, Good, HSG C
	50,131	70	Woods, Good, HSG C
*	35,348	98	Pond
	466,439	82	Weighted Average
	297,704		63.82% Pervious Area
	168,735		36.18% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.2	50	0.0400	0.20		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.35"
0.5	140	0.0700	4.26		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
1.3					**Direct Entry,**
6.0	190	Total			

Subcatchment EX 3: Building and Fields



Summary for Subcatchment EX 4A: Wooded Area

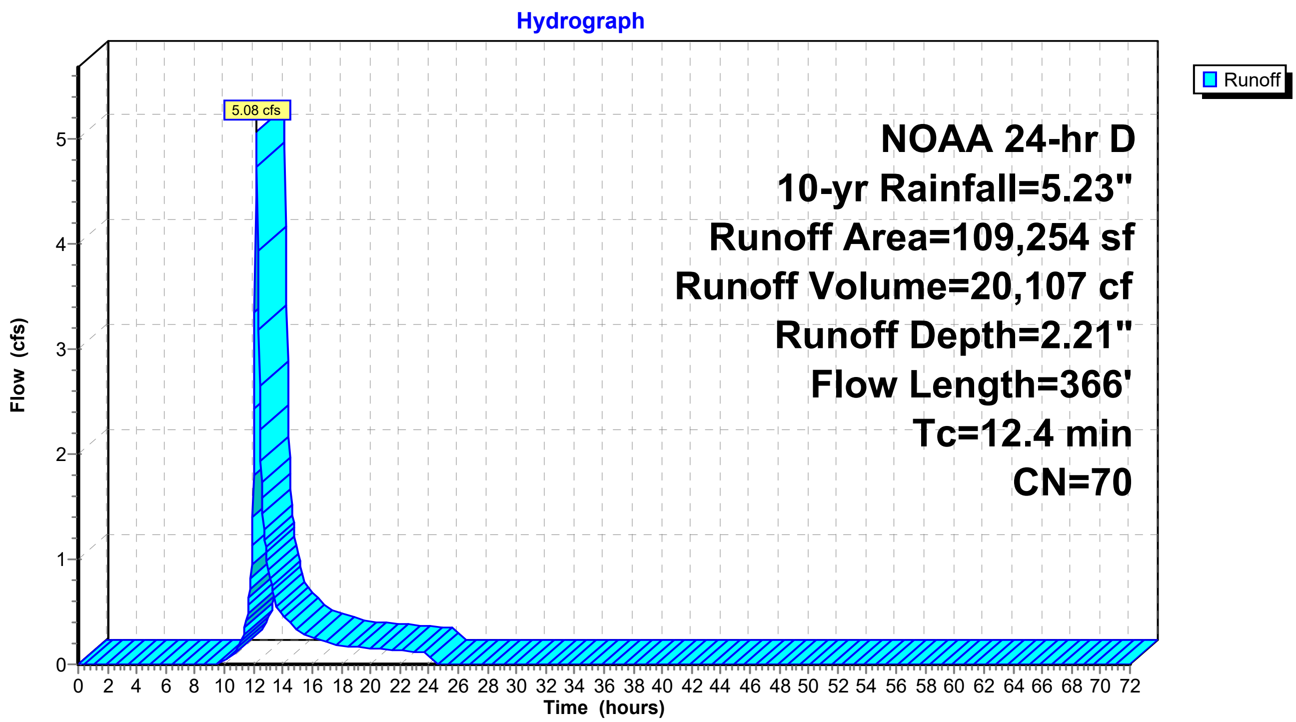
Runoff = 5.08 cfs @ 12.21 hrs, Volume= 20,107 cf, Depth= 2.21"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
NOAA 24-hr D 10-yr Rainfall=5.23"

Area (sf)	CN	Description
109,254	70	Woods, Good, HSG C
109,254		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.1	50	0.0400	0.09		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.35"
3.3	316	0.1000	1.58		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
12.4	366	Total			

Subcatchment EX 4A: Wooded Area



Summary for Subcatchment EX 4B: Building and Landscaping

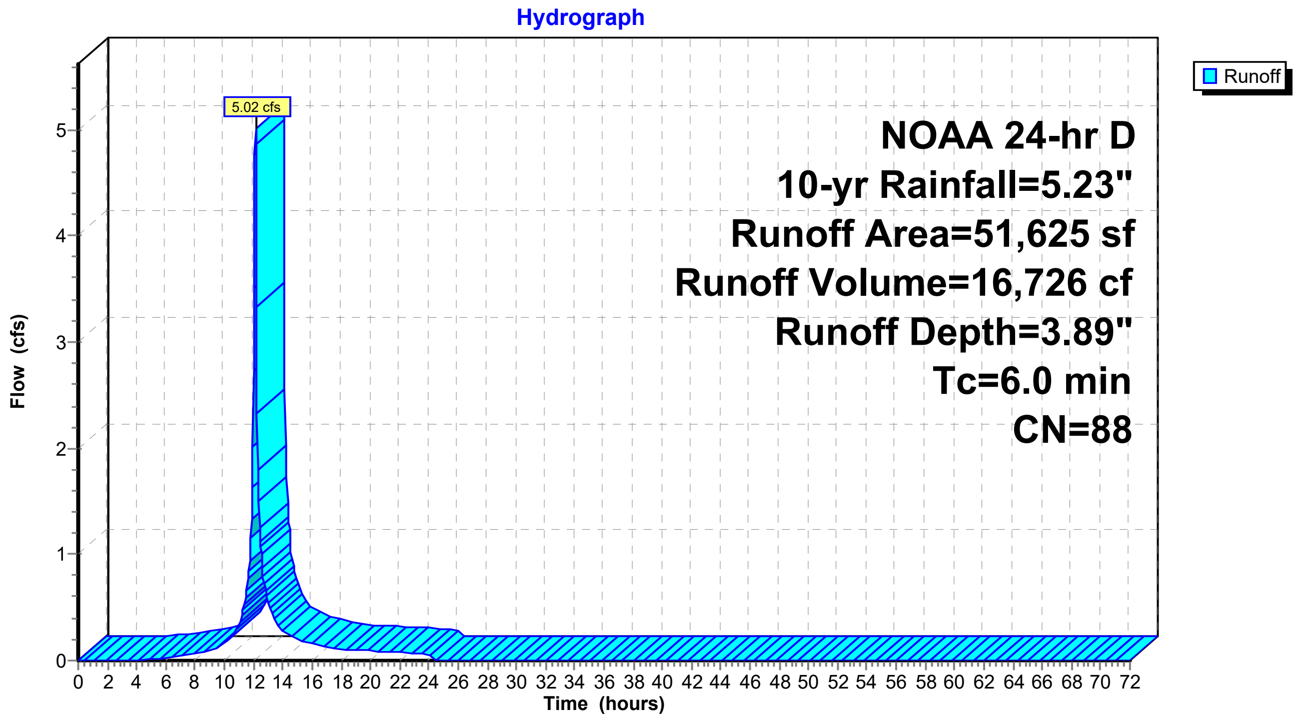
Runoff = 5.02 cfs @ 12.13 hrs, Volume= 16,726 cf, Depth= 3.89"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
NOAA 24-hr D 10-yr Rainfall=5.23"

	Area (sf)	CN	Description
	22,311	74	>75% Grass cover, Good, HSG C
*	29,314	98	Roof
	51,625	88	Weighted Average
	22,311		43.22% Pervious Area
	29,314		56.78% Impervious Area

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

Subcatchment EX 4B: Building and Landscaping



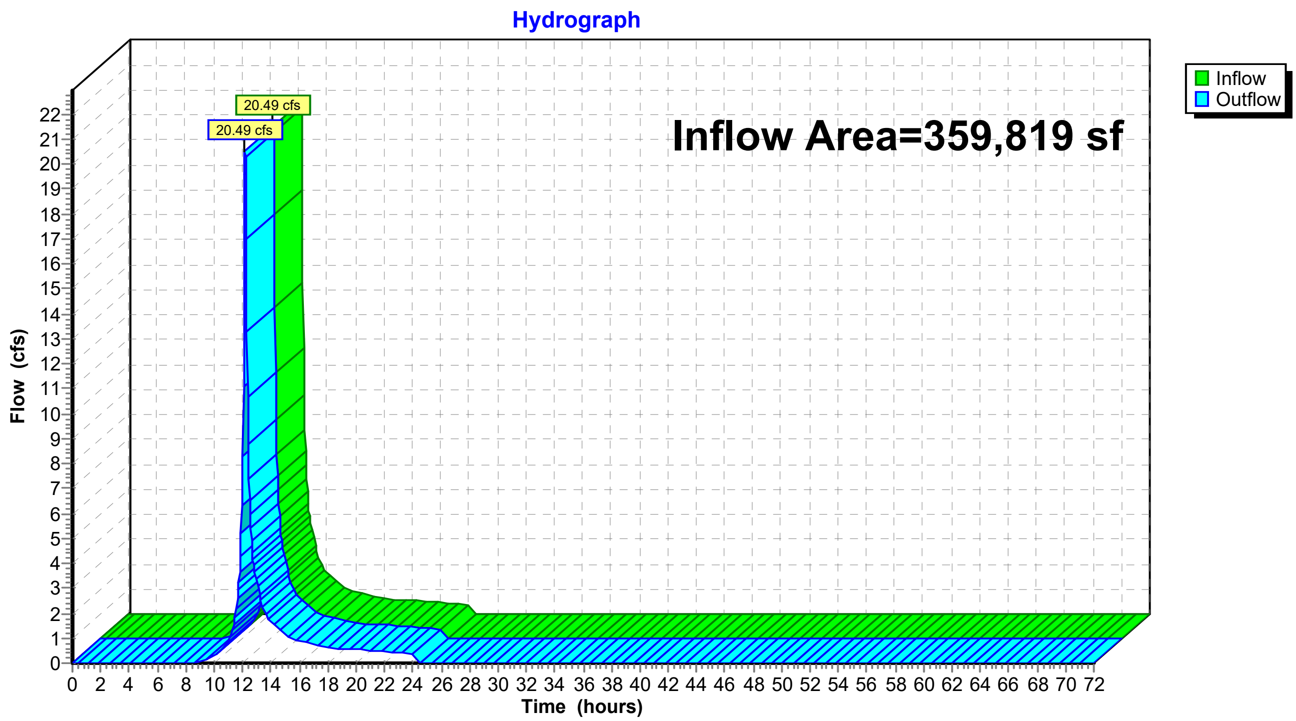
Summary for Reach DP B: Concord Street Main

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

Inflow Area =	359,819 sf,	7.91% Impervious,	Inflow Depth = 2.55"	for 10-yr event
Inflow =	20.49 cfs @	12.18 hrs, Volume=	76,433 cf	
Outflow =	20.49 cfs @	12.18 hrs, Volume=	76,433 cf,	Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

Reach DP B: Concord Street Main

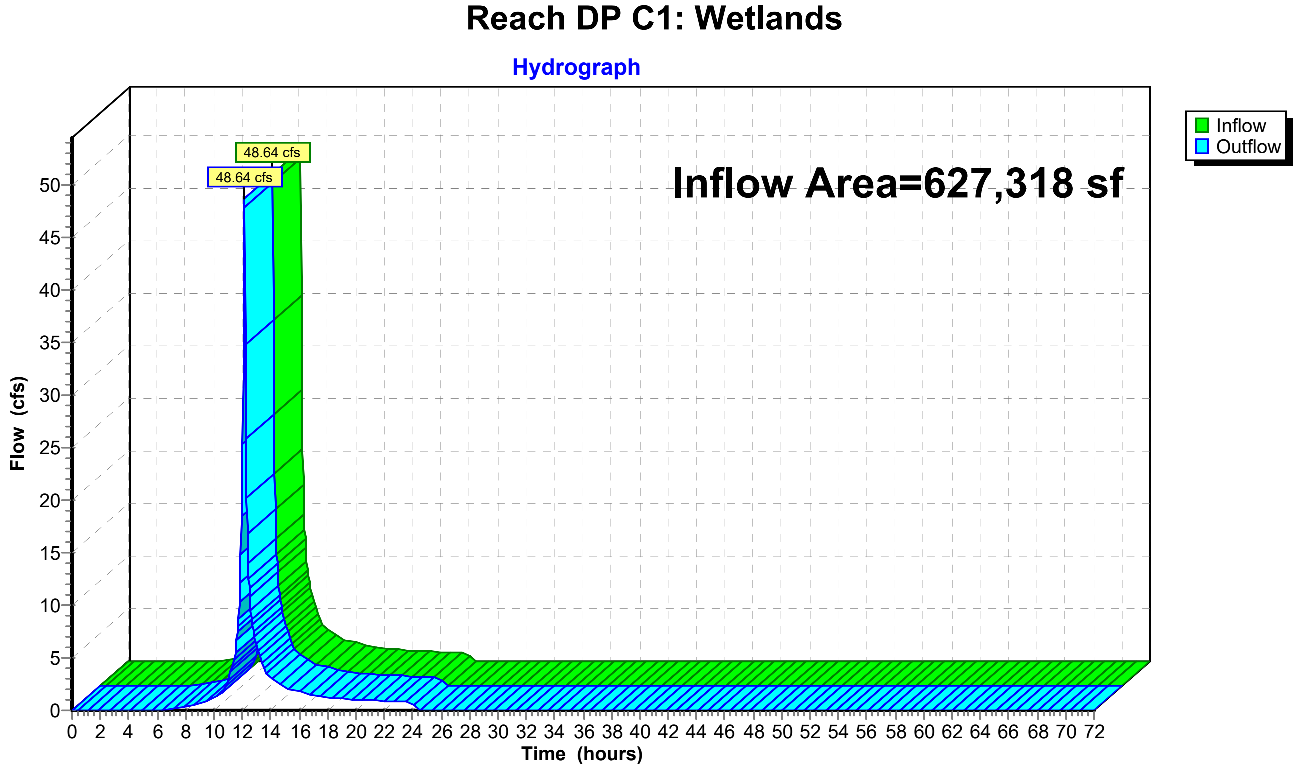


Summary for Reach DP C1: Wetlands

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

Inflow Area = 627,318 sf, 31.57% Impervious, Inflow Depth = 3.15" for 10-yr event
Inflow = 48.64 cfs @ 12.13 hrs, Volume= 164,543 cf
Outflow = 48.64 cfs @ 12.13 hrs, Volume= 164,543 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs



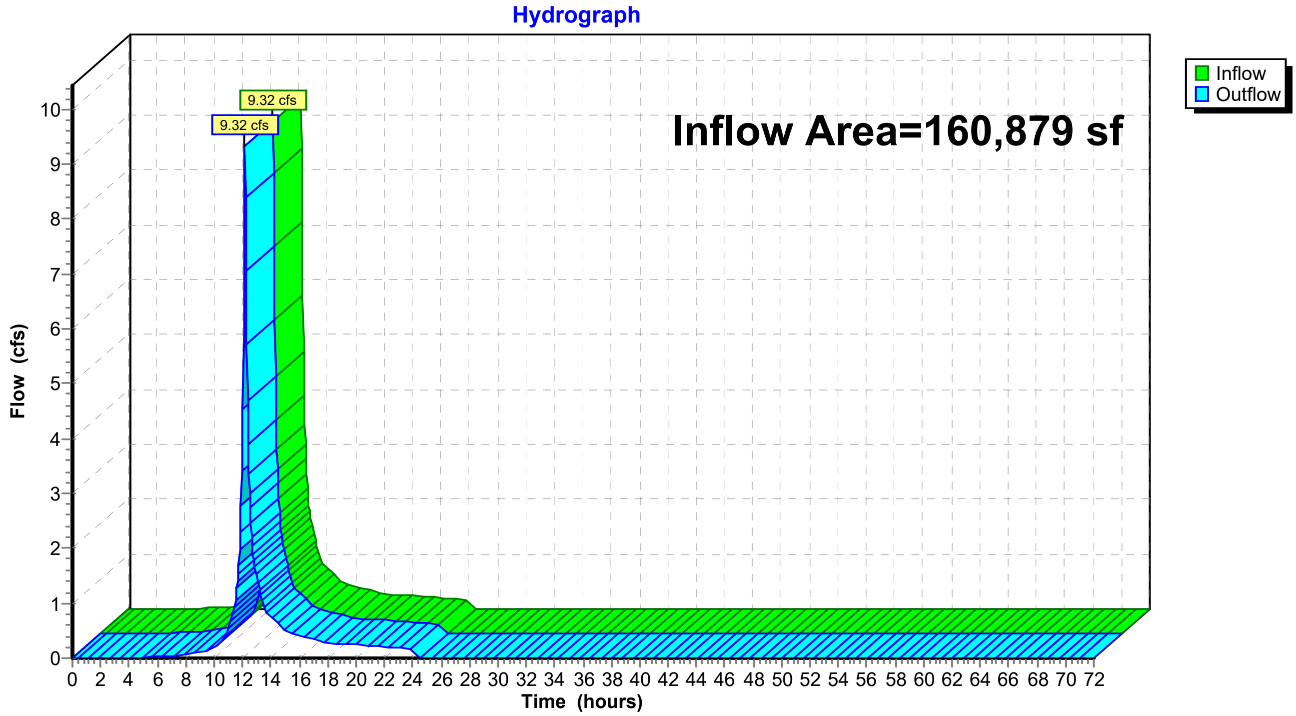
Summary for Reach DP C2: Intermittent Stream

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

Inflow Area = 160,879 sf, 18.22% Impervious, Inflow Depth = 2.75" for 10-yr event
Inflow = 9.32 cfs @ 12.15 hrs, Volume= 36,832 cf
Outflow = 9.32 cfs @ 12.15 hrs, Volume= 36,832 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

Reach DP C2: Intermittent Stream



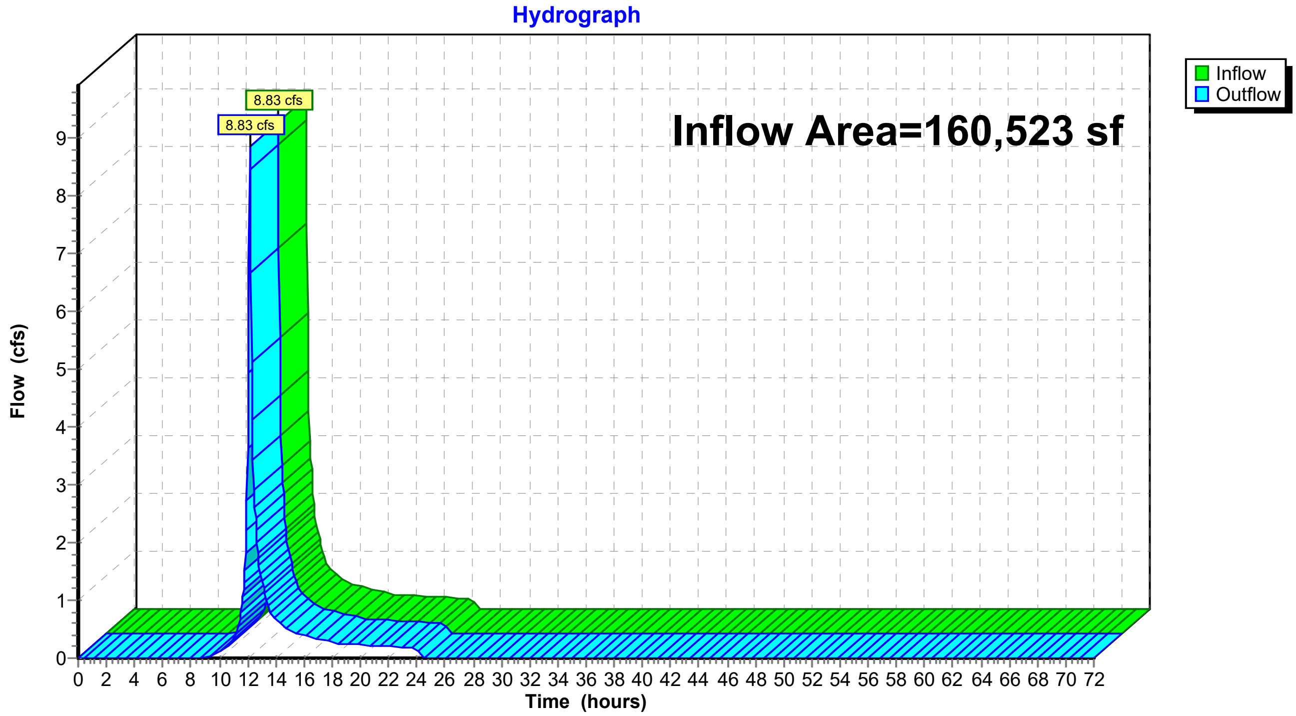
Summary for Reach DPA: Intermittent Strem Eas

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

Inflow Area =	160,523 sf,	0.00% Impervious,	Inflow Depth = 2.38"	for 10-yr event
Inflow =	8.83 cfs @	12.17 hrs, Volume=	31,790 cf	
Outflow =	8.83 cfs @	12.17 hrs, Volume=	31,790 cf,	Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

Reach DPA: Intermittent Strem Eas



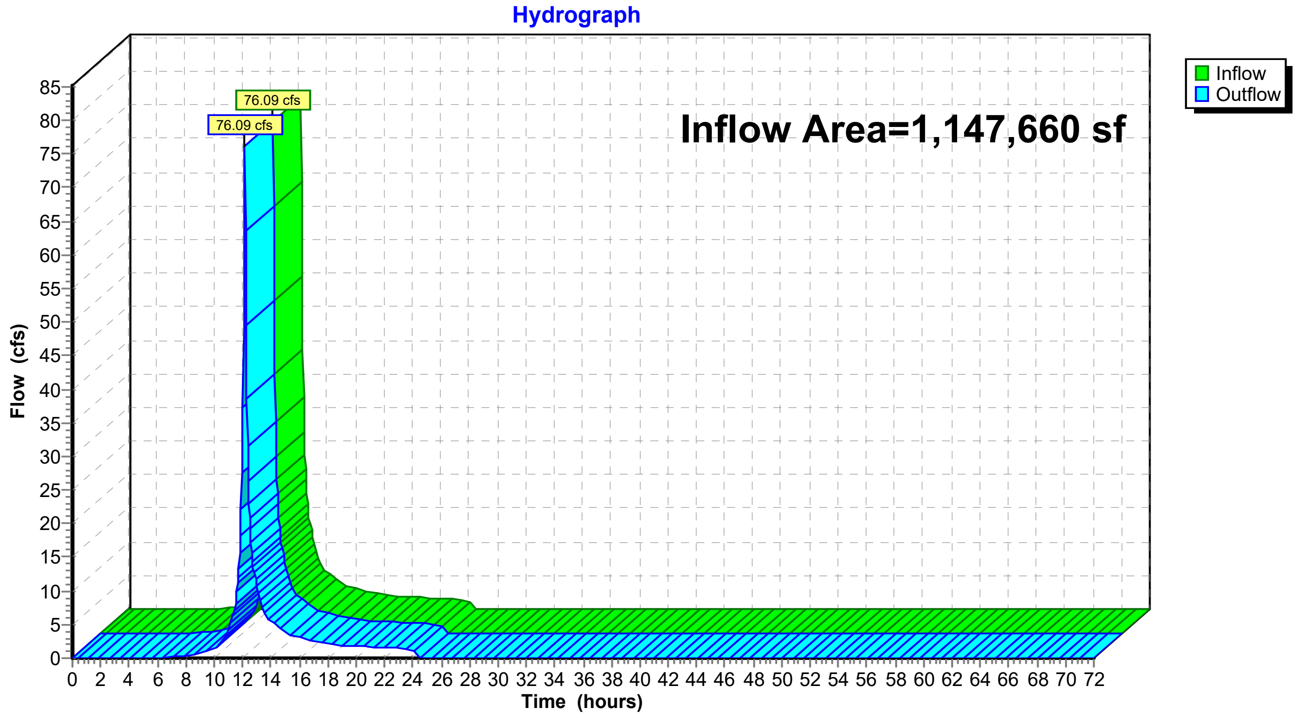
Summary for Reach EX DP: EX SITE

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

Inflow Area = 1,147,660 sf, 19.74% Impervious, Inflow Depth = 2.85" for 10-yr event
Inflow = 76.09 cfs @ 12.15 hrs, Volume= 272,766 cf
Outflow = 76.09 cfs @ 12.15 hrs, Volume= 272,766 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

Reach EX DP: EX SITE



Time span=0.00-72.00 hrs, dt=0.05 hrs, 1441 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

SubcatchmentEX 1: Wooded Area, FIelds Runoff Area=160,523 sf 0.00% Impervious Runoff Depth=4.89"
Flow Length=570' Tc=9.4 min CN=72 Runoff=18.15 cfs 65,387 cf

SubcatchmentEX 2: Wooded Are, FIelds, Runoff Area=359,819 sf 7.91% Impervious Runoff Depth=5.12"
Flow Length=589' Tc=10.5 min CN=74 Runoff=40.86 cfs 153,610 cf

SubcatchmentEX 3: Building and Fields Runoff Area=466,439 sf 36.18% Impervious Runoff Depth=6.07"
Flow Length=190' Tc=6.0 min CN=82 Runoff=70.89 cfs 235,896 cf

SubcatchmentEX 4A: Wooded Area Runoff Area=109,254 sf 0.00% Impervious Runoff Depth=4.65"
Flow Length=366' Tc=12.4 min CN=70 Runoff=10.78 cfs 42,372 cf

SubcatchmentEX 4B: Building and Runoff Area=51,625 sf 56.78% Impervious Runoff Depth=6.78"
Tc=6.0 min CN=88 Runoff=8.46 cfs 29,183 cf

Reach DP B: Concord Street Main Inflow=40.86 cfs 153,610 cf
Outflow=40.86 cfs 153,610 cf

Reach DP C1: Wetlands Inflow=88.28 cfs 307,451 cf
Outflow=88.28 cfs 307,451 cf

Reach DP C2: Intermittent Stream Inflow=17.88 cfs 71,554 cf
Outflow=17.88 cfs 71,554 cf

Reach DPA: Intermittent Strem Eas Inflow=18.15 cfs 65,387 cf
Outflow=18.15 cfs 65,387 cf

Reach EX DP: EX SITE Inflow=144.10 cfs 526,447 cf
Outflow=144.10 cfs 526,447 cf

Total Runoff Area = 1,147,660 sf Runoff Volume = 526,447 cf Average Runoff Depth = 5.50"
80.26% Pervious = 921,148 sf 19.74% Impervious = 226,512 sf

Summary for Subcatchment EX 1: Wooded Area, Fields

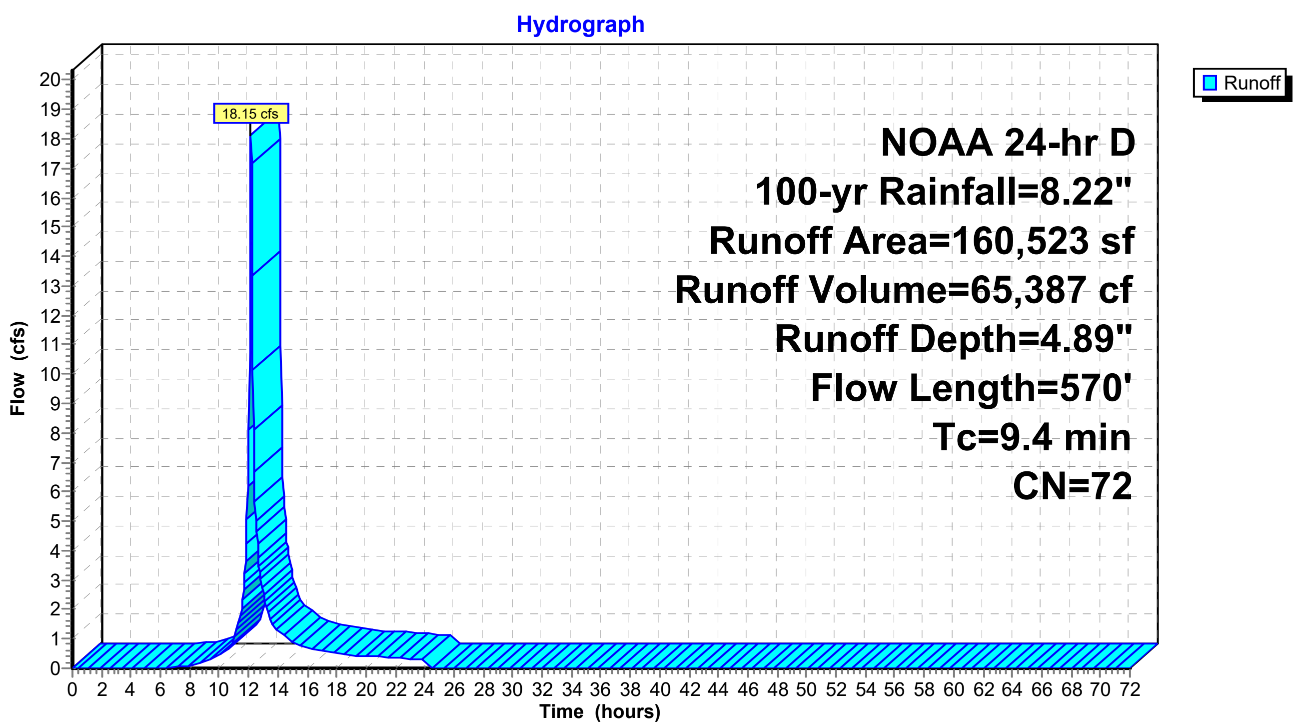
Runoff = 18.15 cfs @ 12.17 hrs, Volume= 65,387 cf, Depth= 4.89"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
NOAA 24-hr D 100-yr Rainfall=8.22"

Area (sf)	CN	Description
75,399	74	>75% Grass cover, Good, HSG C
85,124	70	Woods, Good, HSG C
160,523	72	Weighted Average
160,523		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.1	50	0.1700	0.16		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.35"
1.2	138	0.1400	1.87		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
3.1	382	0.0160	2.04		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
9.4	570	Total			

Subcatchment EX 1: Wooded Area, Fields



Summary for Subcatchment EX 2: Wooded Are, FIelds, Building

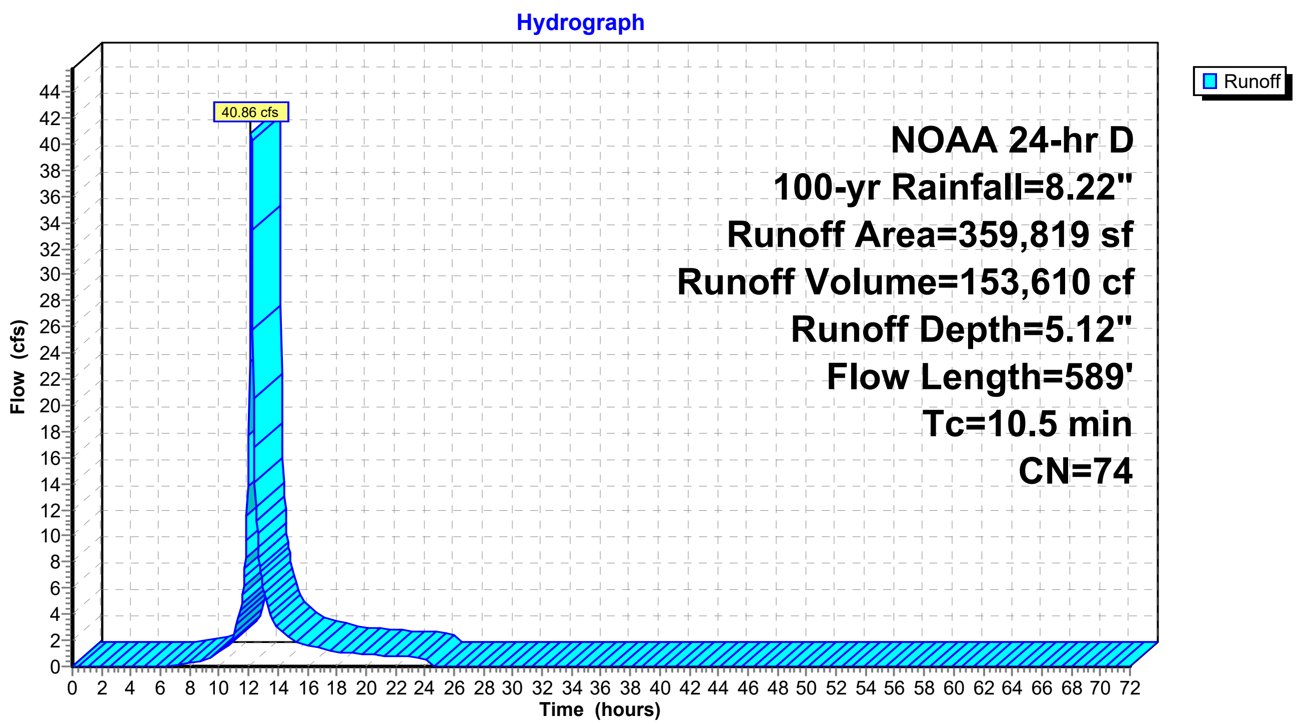
Runoff = 40.86 cfs @ 12.18 hrs, Volume= 153,610 cf, Depth= 5.12"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
NOAA 24-hr D 100-yr Rainfall=8.22"

Area (sf)	CN	Description
28,463	98	Paved parking, HSG C
138,936	74	>75% Grass cover, Good, HSG C
192,420	70	Woods, Good, HSG C
359,819	74	Weighted Average
331,356		92.09% Pervious Area
28,463		7.91% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.2	50	0.1600	0.16		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.35"
3.6	309	0.0800	1.41		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
1.6	191	0.0160	2.04		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
0.1	39	0.1280	5.76		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
10.5	589	Total			

Subcatchment EX 2: Wooded Are, FIelds, Building



Summary for Subcatchment EX 3: Building and Fields

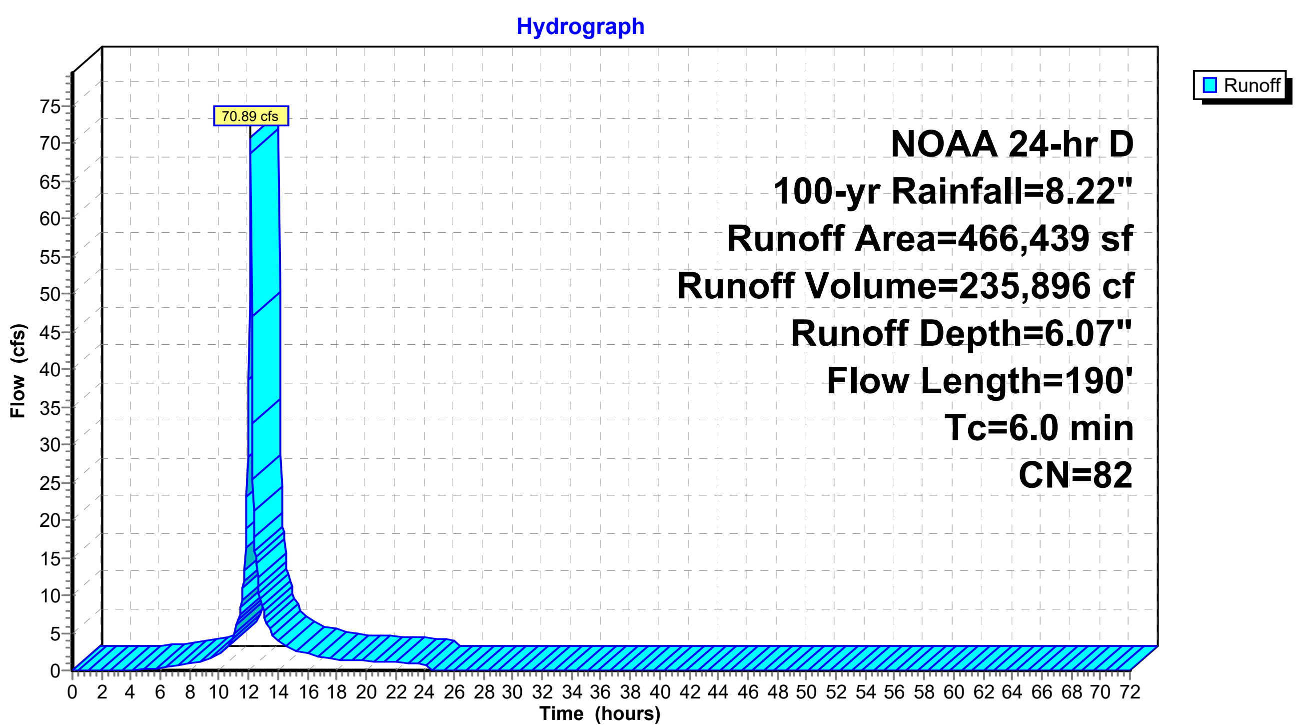
Runoff = 70.89 cfs @ 12.13 hrs, Volume= 235,896 cf, Depth= 6.07"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
NOAA 24-hr D 100-yr Rainfall=8.22"

	Area (sf)	CN	Description
	133,387	98	Paved parking, HSG C
	247,573	74	>75% Grass cover, Good, HSG C
	50,131	70	Woods, Good, HSG C
*	35,348	98	Pond
	466,439	82	Weighted Average
	297,704		63.82% Pervious Area
	168,735		36.18% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.2	50	0.0400	0.20		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.35"
0.5	140	0.0700	4.26		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
1.3					**Direct Entry,**
6.0	190	Total			

Subcatchment EX 3: Building and Fields



Summary for Subcatchment EX 4A: Wooded Area

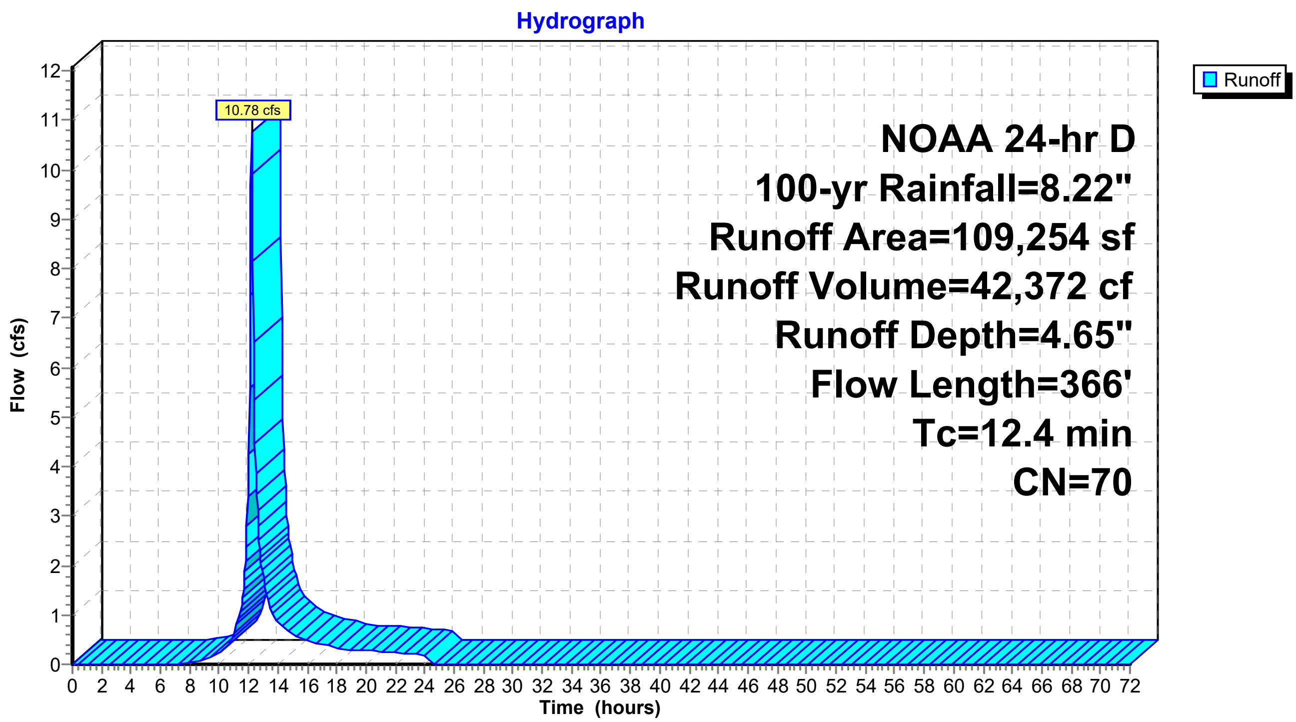
Runoff = 10.78 cfs @ 12.20 hrs, Volume= 42,372 cf, Depth= 4.65"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
NOAA 24-hr D 100-yr Rainfall=8.22"

Area (sf)	CN	Description
109,254	70	Woods, Good, HSG C
109,254		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.1	50	0.0400	0.09		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.35"
3.3	316	0.1000	1.58		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
12.4	366	Total			

Subcatchment EX 4A: Wooded Area



Summary for Subcatchment EX 4B: Building and Landscaping

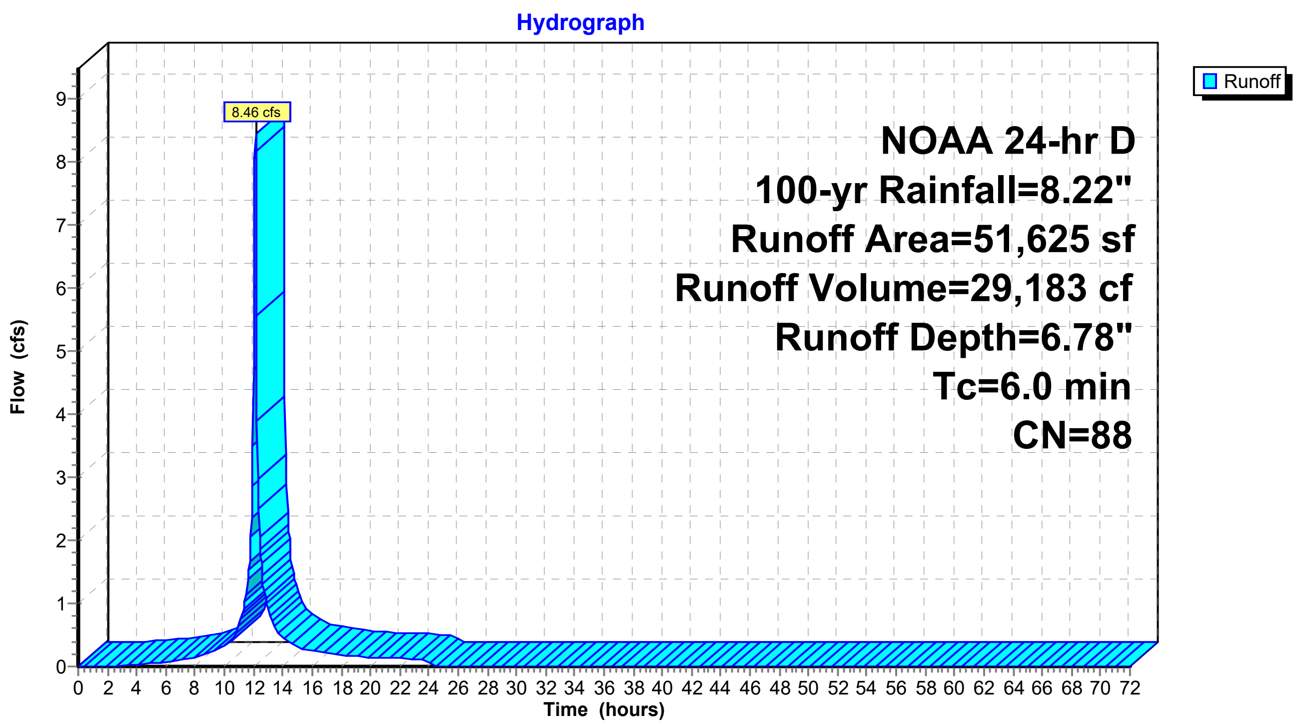
Runoff = 8.46 cfs @ 12.13 hrs, Volume= 29,183 cf, Depth= 6.78"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
NOAA 24-hr D 100-yr Rainfall=8.22"

	Area (sf)	CN	Description
	22,311	74	>75% Grass cover, Good, HSG C
*	29,314	98	Roof
	51,625	88	Weighted Average
	22,311		43.22% Pervious Area
	29,314		56.78% Impervious Area

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

Subcatchment EX 4B: Building and Landscaping



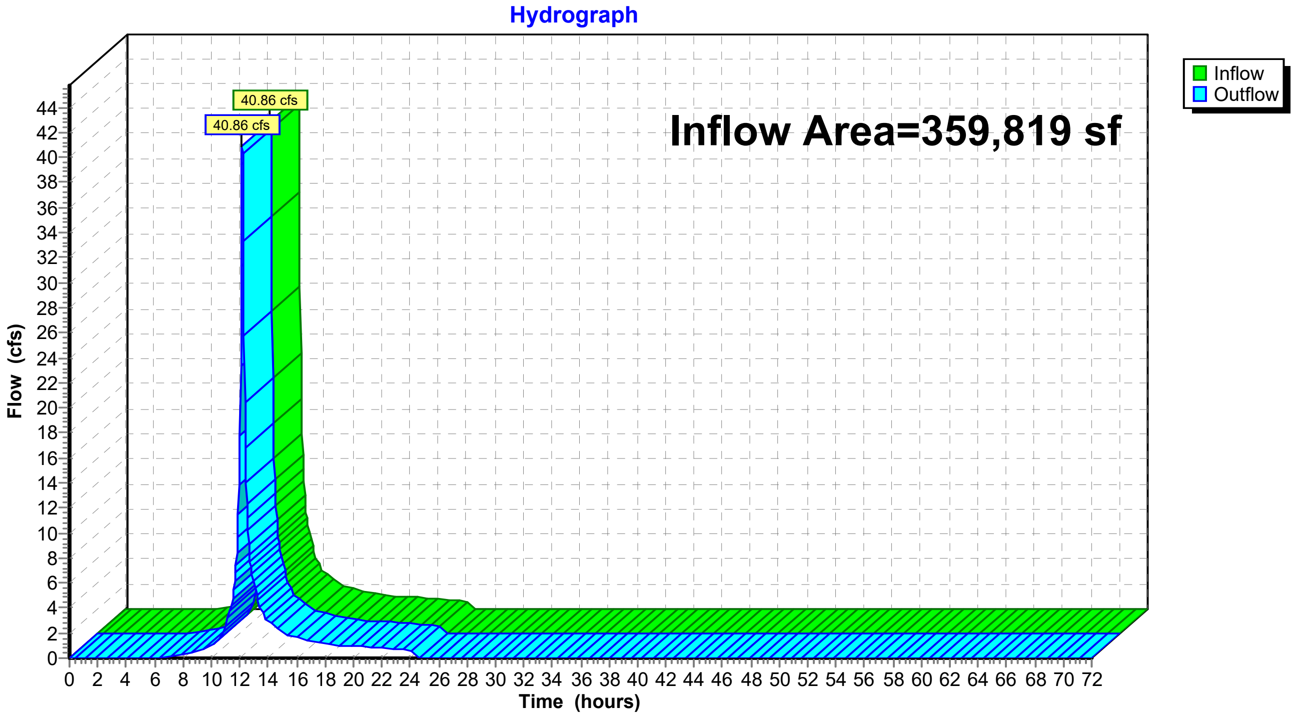
Summary for Reach DP B: Concord Street Main

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

Inflow Area = 359,819 sf, 7.91% Impervious, Inflow Depth = 5.12" for 100-yr event
Inflow = 40.86 cfs @ 12.18 hrs, Volume= 153,610 cf
Outflow = 40.86 cfs @ 12.18 hrs, Volume= 153,610 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

Reach DP B: Concord Street Main

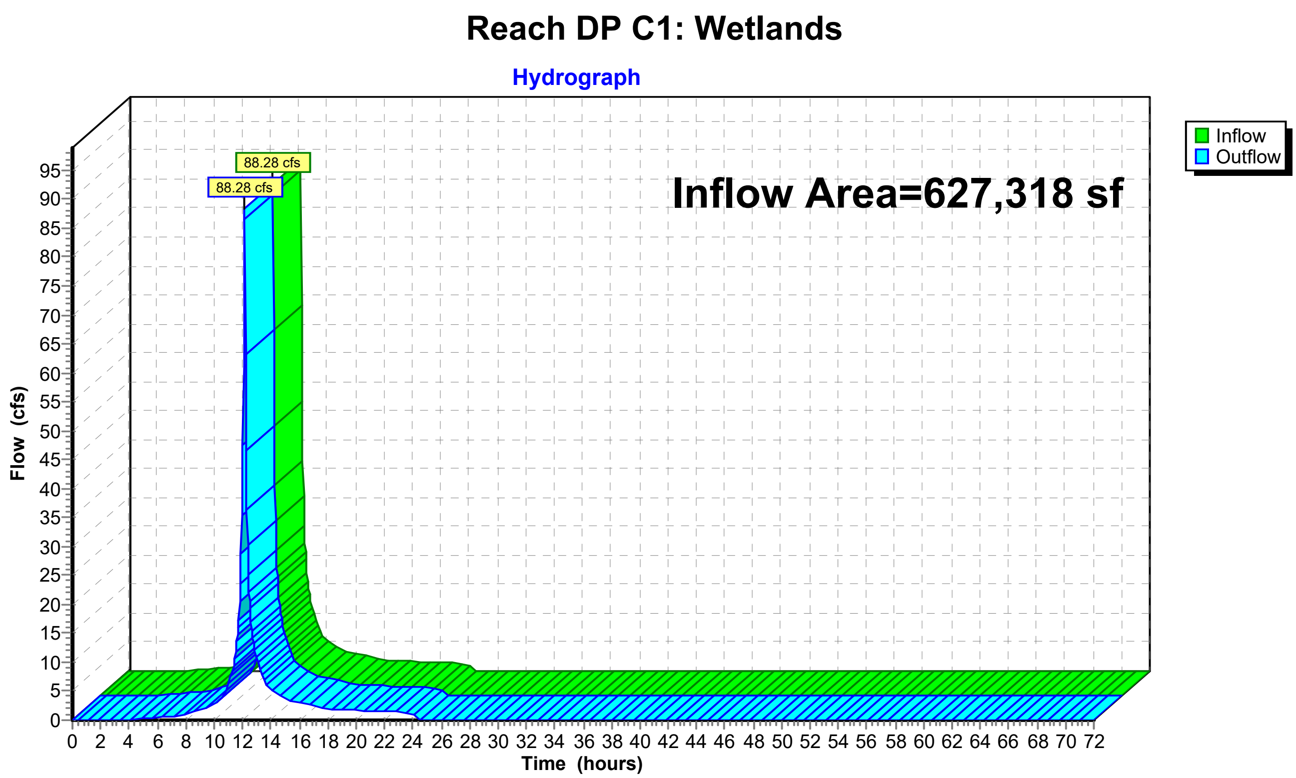


Summary for Reach DP C1: Wetlands

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

Inflow Area =	627,318 sf, 31.57% Impervious,	Inflow Depth = 5.88"	for 100-yr event
Inflow =	88.28 cfs @ 12.13 hrs,	Volume=	307,451 cf
Outflow =	88.28 cfs @ 12.13 hrs,	Volume=	307,451 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs



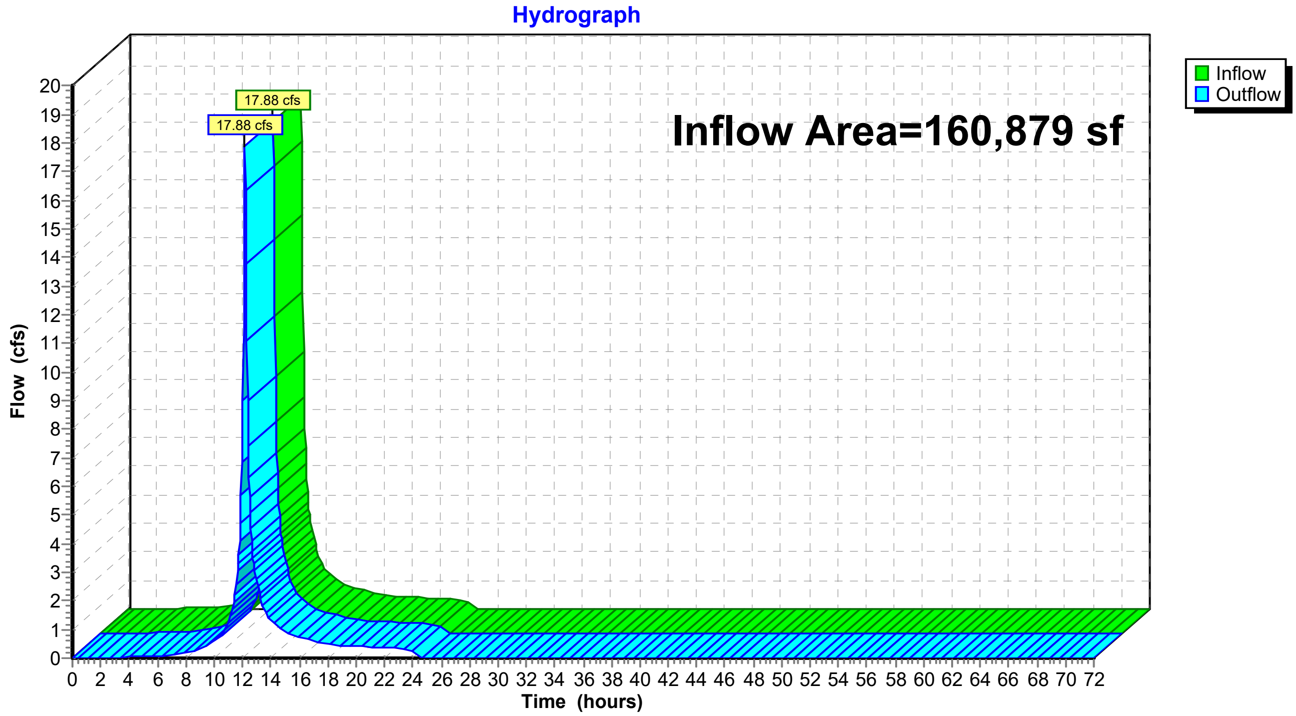
Summary for Reach DP C2: Intermittent Stream

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

Inflow Area = 160,879 sf, 18.22% Impervious, Inflow Depth = 5.34" for 100-yr event
Inflow = 17.88 cfs @ 12.16 hrs, Volume= 71,554 cf
Outflow = 17.88 cfs @ 12.16 hrs, Volume= 71,554 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

Reach DP C2: Intermittent Stream



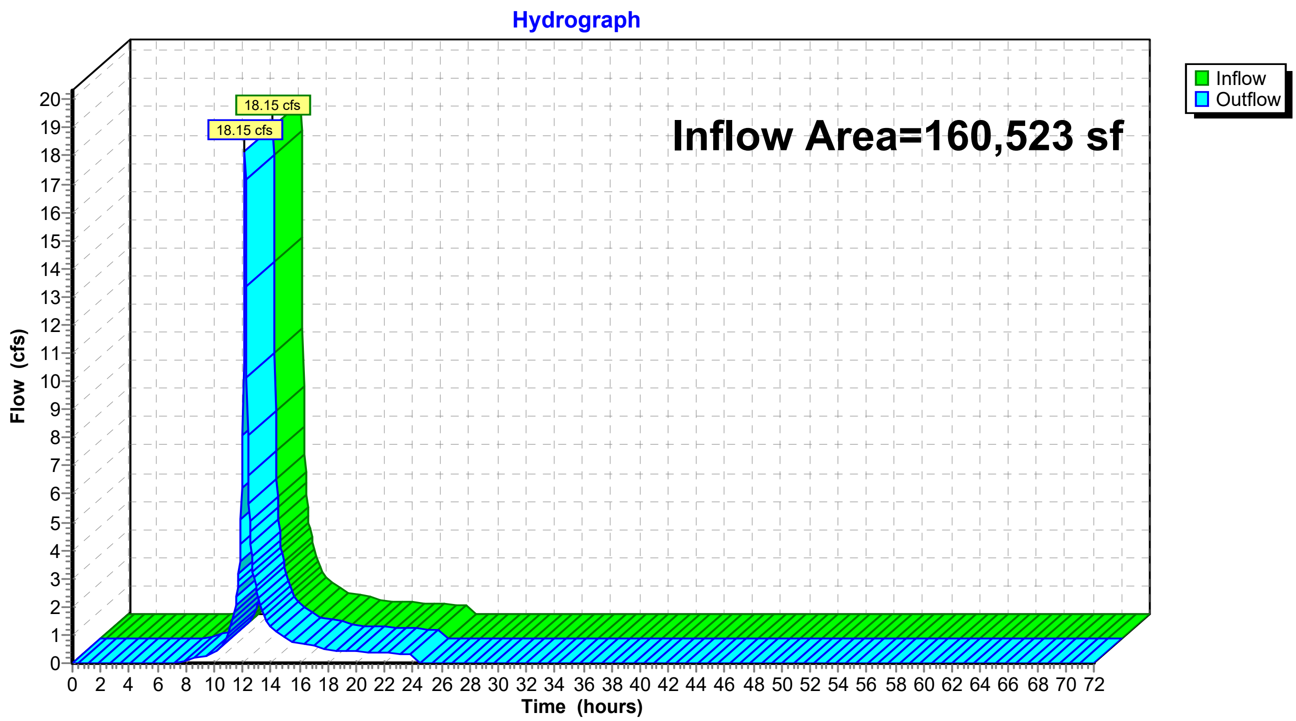
Summary for Reach DPA: Intermittent Strem Eas

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

Inflow Area = 160,523 sf, 0.00% Impervious, Inflow Depth = 4.89" for 100-yr event
Inflow = 18.15 cfs @ 12.17 hrs, Volume= 65,387 cf
Outflow = 18.15 cfs @ 12.17 hrs, Volume= 65,387 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

Reach DPA: Intermittent Strem Eas



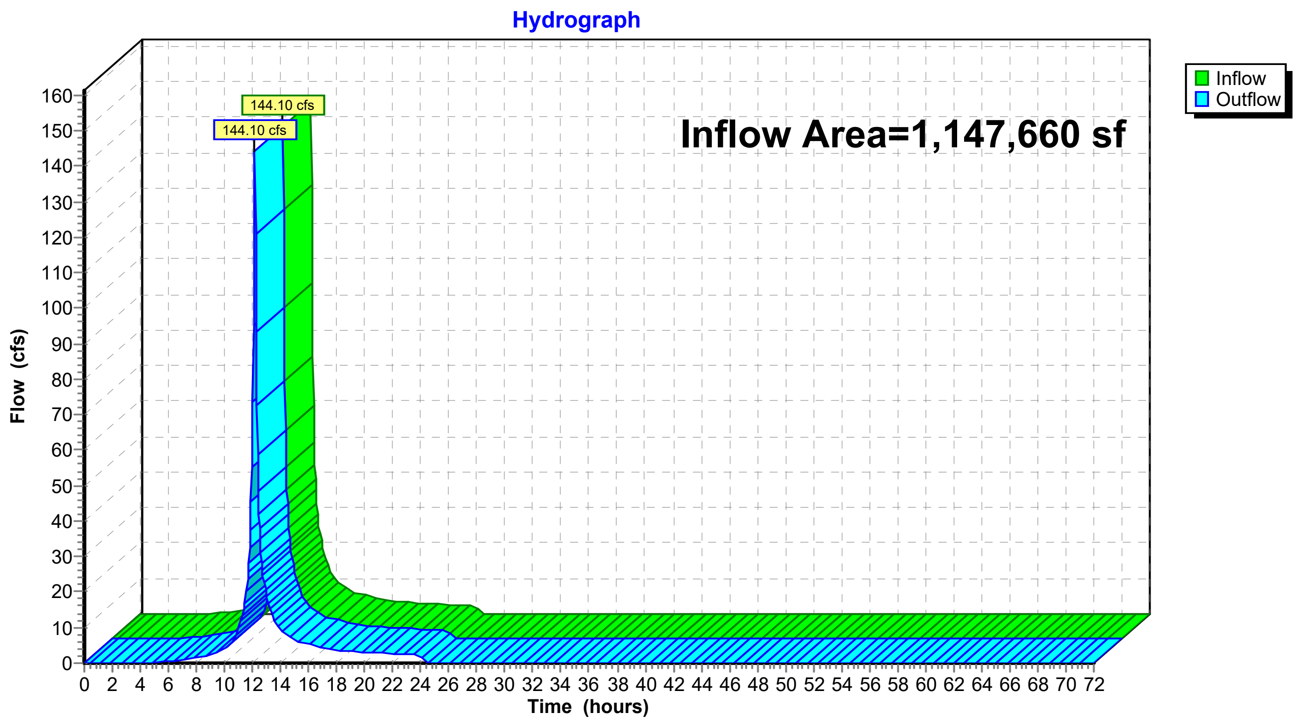
Summary for Reach EX DP: EX SITE

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

Inflow Area = 1,147,660 sf, 19.74% Impervious, Inflow Depth = 5.50" for 100-yr event
Inflow = 144.10 cfs @ 12.14 hrs, Volume= 526,447 cf
Outflow = 144.10 cfs @ 12.14 hrs, Volume= 526,447 cf, Atten= 0%, Lag= 0.0 min

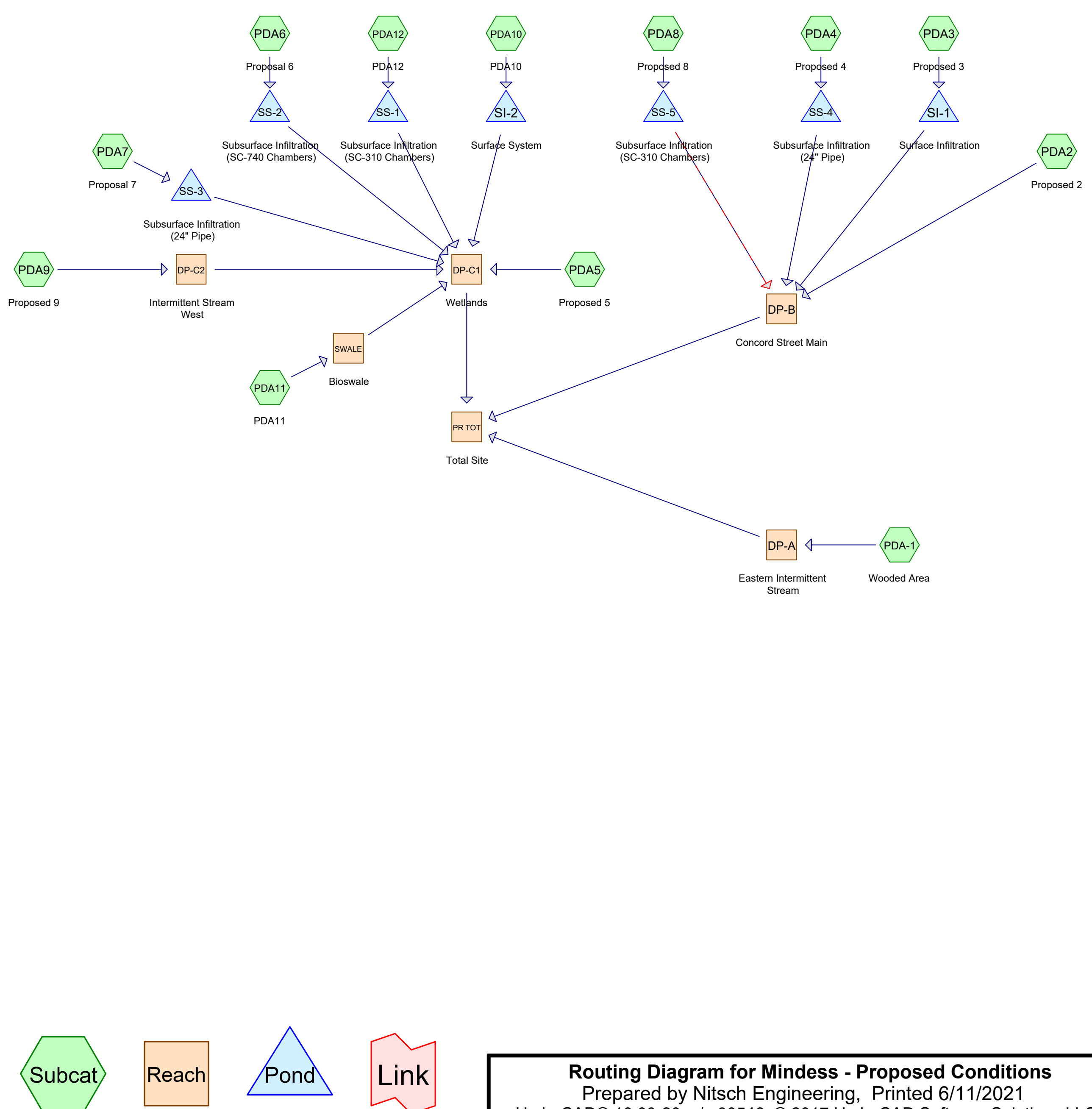
Routing by Stor-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

Reach EX DP: EX SITE



APPENDIX C

Post-Development Conditions – HydroCAD Calculations



Routing Diagram for Mindess - Proposed Conditions
Prepared by Nitsch Engineering, Printed 6/11/2021
HydroCAD® 10.00-20 s/n 00546 © 2017 HydroCAD Software Solutions LLC

Area Listing (selected nodes)

Area (sq-ft)	CN	Description (subcatchment-numbers)
451,959	74	>75% Grass cover, Good, HSG C (PDA-1, PDA10, PDA11, PDA12, PDA2, PDA3, PDA4, PDA5, PDA6, PDA7, PDA8, PDA9)
243,297	98	Paved parking, HSG C (PDA10, PDA11, PDA12, PDA2, PDA3, PDA6, PDA7, PDA8)
33,354	98	Paved roads w/curbs & sewers, HSG C (PDA4)
35,348	98	Pond (PDA5)
71,509	98	Roofs, HSG C (PDA10, PDA4, PDA7)
312,193	70	Woods, Good, HSG C (PDA-1, PDA4, PDA5, PDA7, PDA9)
1,147,660	**81**	**TOTAL AREA**

Soil Listing (selected nodes)

Area (sq-ft)	Soil Group	Subcatchment Numbers
0	HSG A	
0	HSG B	
1,112,312	HSG C	PDA-1, PDA10, PDA11, PDA12, PDA2, PDA3, PDA4, PDA5, PDA6, PDA7, PDA8, PDA9
0	HSG D	
35,348	Other	PDA5
1,147,660		**TOTAL AREA**

Ground Covers (selected 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
0	0	451,959	0	0	451,959	>75% Grass cover, Good
0	0	243,297	0	0	243,297	Paved parking
0	0	33,354	0	0	33,354	Paved roads w/curbs & sewers
0	0	0	0	35,348	35,348	Pond
0	0	71,509	0	0	71,509	Roofs
0	0	312,193	0	0	312,193	Woods, Good
0	**0**	**1,112,312**	**0**	**35,348**	**1,147,660**	**TOTAL AREA**

Time span=0.00-72.00 hrs, dt=0.05 hrs, 1441 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment PDA-1: Wooded Area Runoff Area=125,686 sf 0.00% Impervious Runoff Depth=0.97"
Flow Length=642' Tc=9.3 min CN=71 Runoff=2.67 cfs 10,156 cf

Subcatchment PDA10: PDA10 Runoff Area=110,656 sf 69.66% Impervious Runoff Depth=2.40"
Tc=6.0 min CN=91 Runoff=6.70 cfs 22,126 cf

Subcatchment PDA11: PDA11 Runoff Area=26,182 sf 63.13% Impervious Runoff Depth=2.22"
Tc=6.0 min CN=89 Runoff=1.49 cfs 4,841 cf

Subcatchment PDA12: PDA12 Runoff Area=146,011 sf 28.74% Impervious Runoff Depth=1.59"
Tc=6.0 min CN=81 Runoff=6.07 cfs 19,321 cf

Subcatchment PDA2: Proposed 2 Runoff Area=36,252 sf 38.40% Impervious Runoff Depth=1.73"
Tc=6.0 min CN=83 Runoff=1.64 cfs 5,236 cf

Subcatchment PDA3: Proposed 3 Runoff Area=41,814 sf 58.47% Impervious Runoff Depth=2.13"
Tc=6.0 min CN=88 Runoff=2.30 cfs 7,430 cf

Subcatchment PDA4: Proposed 4 Runoff Area=108,864 sf 38.92% Impervious Runoff Depth=1.66"
Tc=6.0 min CN=82 Runoff=4.73 cfs 15,055 cf

Subcatchment PDA5: Proposed 5 Runoff Area=173,681 sf 20.35% Impervious Runoff Depth=1.38"
Tc=6.0 min CN=78 Runoff=6.27 cfs 20,036 cf

Subcatchment PDA6: Proposal 6 Runoff Area=10,283 sf 56.37% Impervious Runoff Depth=2.13"
Tc=6.0 min CN=88 Runoff=0.56 cfs 1,827 cf

Subcatchment PDA7: Proposal 7 Runoff Area=162,554 sf 31.31% Impervious Runoff Depth=1.59"
Tc=6.0 min CN=81 Runoff=6.75 cfs 21,510 cf

Subcatchment PDA8: Proposed 8 Runoff Area=90,263 sf 83.25% Impervious Runoff Depth=2.69"
Tc=6.0 min CN=94 Runoff=5.93 cfs 20,231 cf

Subcatchment PDA9: Proposed 9 Runoff Area=115,414 sf 0.00% Impervious Runoff Depth=0.92"
Flow Length=366' Tc=12.4 min CN=70 Runoff=2.08 cfs 8,817 cf

Reach DP-A: Eastern Intermittent Stream Inflow=2.67 cfs 10,156 cf
Outflow=2.67 cfs 10,156 cf

Reach DP-B: Concord Street Main Inflow=8.84 cfs 43,571 cf
Outflow=8.84 cfs 43,571 cf

Reach DP-C1: Wetlands Inflow=23.81 cfs 92,581 cf
Outflow=23.81 cfs 92,581 cf

Reach DP-C2: Intermittent Stream West Inflow=2.08 cfs 8,817 cf
Outflow=2.08 cfs 8,817 cf

Reach PR TOT: Total Site Inflow=35.33 cfs 146,308 cf
Outflow=35.33 cfs 146,308 cf

Reach SWALE: Bioswale Avg. Flow Depth=0.34' Max Vel=1.45 fps Inflow=1.49 cfs 4,841 cf
n=0.040 L=100.0' S=0.0100 '/' Capacity=7.19 cfs Outflow=1.40 cfs 4,841 cf

Pond SI-1: Surface Infiltration Peak Elev=200.01' Storage=2,727 cf Inflow=2.30 cfs 7,430 cf
Outflow=1.50 cfs 5,371 cf

Pond SI-2: Surface System Peak Elev=194.32' Storage=3,157 cf Inflow=6.70 cfs 22,126 cf
Outflow=6.29 cfs 19,988 cf

Pond SS-1: Subsurface Infiltration (SC-310 Peak Elev=185.17' Storage=3,445 cf Inflow=6.07 cfs 19,321 cf
Outflow=4.65 cfs 18,153 cf

Pond SS-2: Subsurface Infiltration (SC-740 Peak Elev=187.13' Storage=1,295 cf Inflow=0.56 cfs 1,827 cf
Outflow=0.02 cfs 722 cf

Pond SS-3: Subsurface Infiltration (24" Peak Elev=194.66' Storage=4,611 cf Inflow=6.75 cfs 21,510 cf
Outflow=4.30 cfs 20,023 cf

Pond SS-4: Subsurface Infiltration (24" Peak Elev=200.58' Storage=4,890 cf Inflow=4.73 cfs 15,055 cf
Outflow=1.63 cfs 13,647 cf

Pond SS-5: Subsurface Infiltration (SC-310 Peak Elev=194.48' Storage=3,290 cf Inflow=5.93 cfs 20,231 cf
Primary=2.86 cfs 13,632 cf Secondary=1.83 cfs 5,686 cf Outflow=4.69 cfs 19,318 cf

Total Runoff Area = 1,147,660 sf Runoff Volume = 156,587 cf Average Runoff Depth = 1.64"
66.58% Pervious = 764,152 sf 33.42% Impervious = 383,508 sf

Summary for Subcatchment PDA-1: Wooded Area

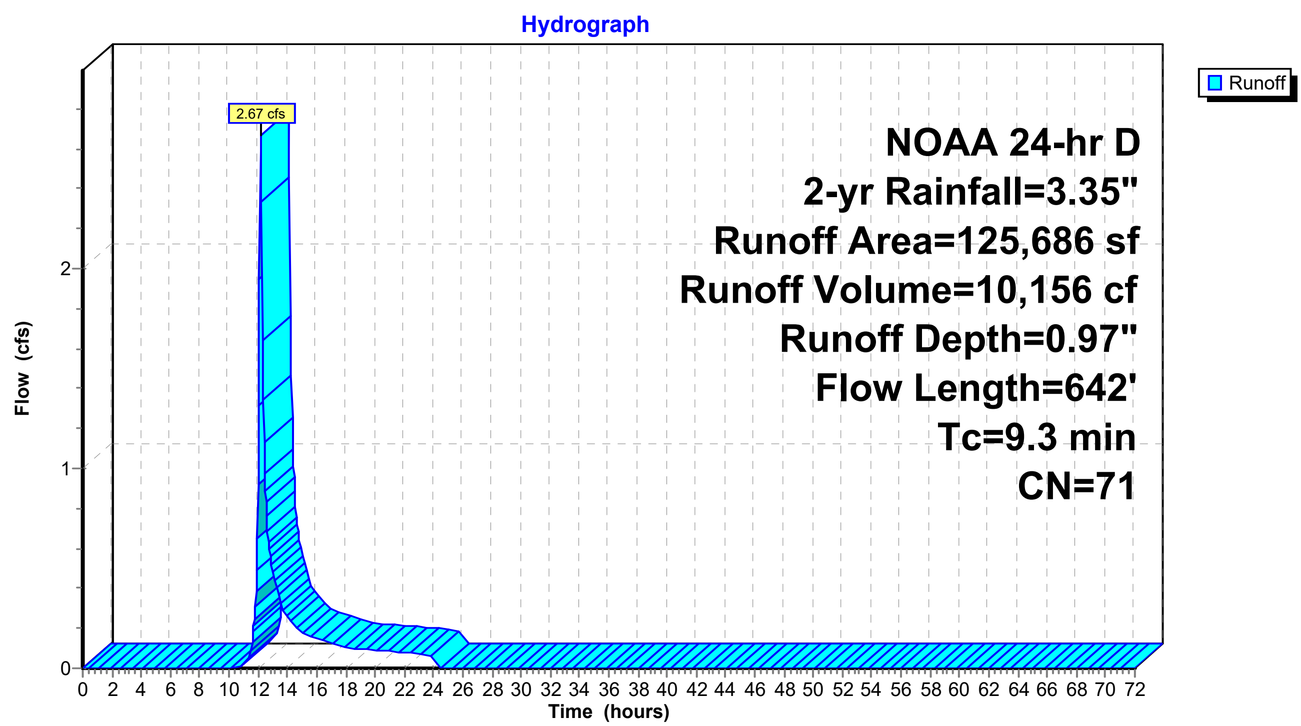
Runoff = 2.67 cfs @ 12.17 hrs, Volume= 10,156 cf, Depth= 0.97"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
NOAA 24-hr D 2-yr Rainfall=3.35"

Area (sf)	CN	Description
25,856	74	>75% Grass cover, Good, HSG C
99,830	70	Woods, Good, HSG C
125,686	71	Weighted Average
125,686		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.1	50	0.1700	0.16		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.35"
0.3	130	0.1600	6.44		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
3.9	462	0.0150	1.97		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
9.3	642	Total			

Subcatchment PDA-1: Wooded Area



Summary for Subcatchment PDA10: PDA10

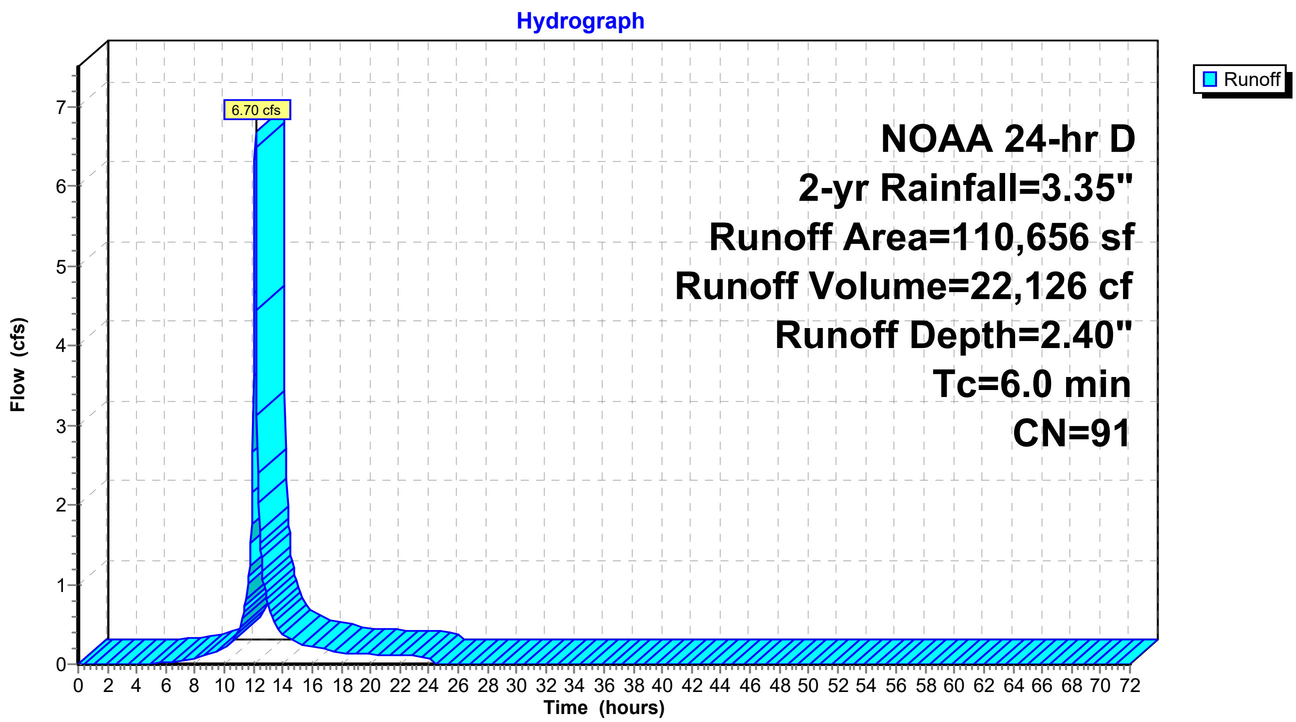
Runoff = 6.70 cfs @ 12.13 hrs, Volume= 22,126 cf, Depth= 2.40"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
NOAA 24-hr D 2-yr Rainfall=3.35"

Area (sf)	CN	Description
33,569	74	>75% Grass cover, Good, HSG C
30,240	98	Roofs, HSG C
46,847	98	Paved parking, HSG C
110,656	91	Weighted Average
33,569		30.34% Pervious Area
77,087		69.66% Impervious Area

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

Subcatchment PDA10: PDA10



Summary for Subcatchment PDA11: PDA11

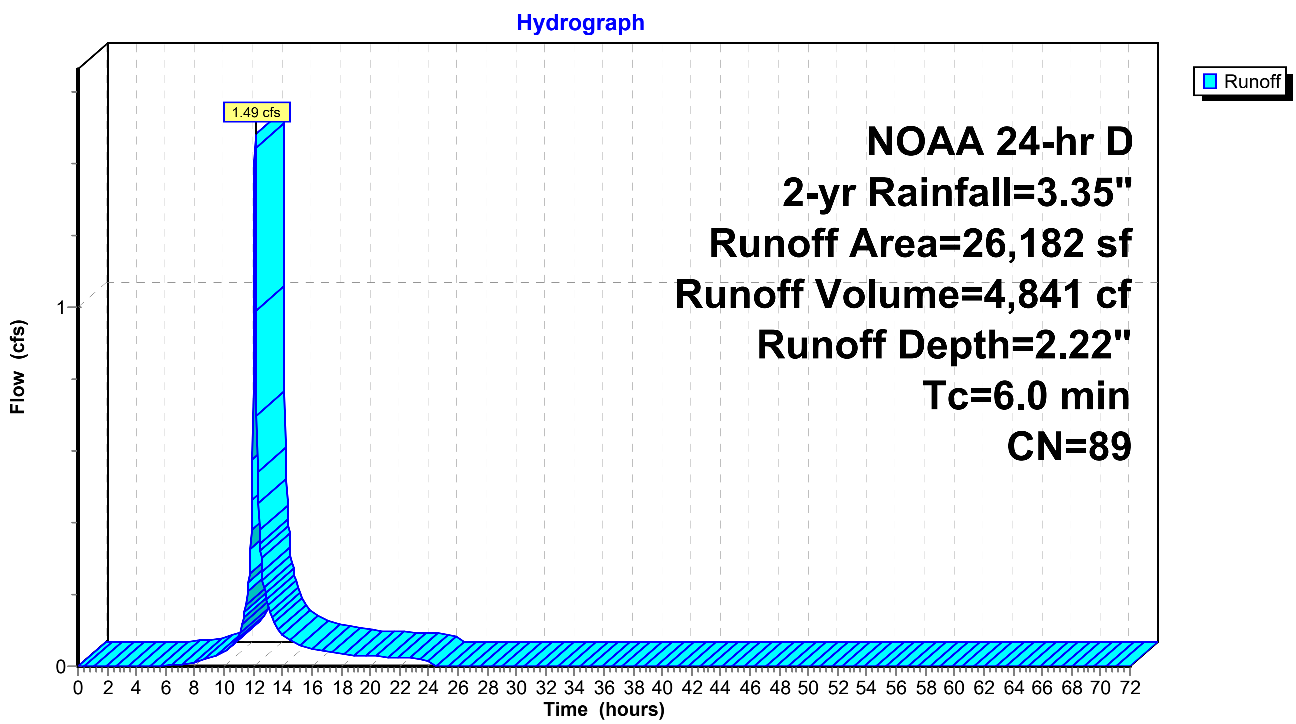
Runoff = 1.49 cfs @ 12.13 hrs, Volume= 4,841 cf, Depth= 2.22"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
NOAA 24-hr D 2-yr Rainfall=3.35"

Area (sf)	CN	Description
9,652	74	>75% Grass cover, Good, HSG C
16,530	98	Paved parking, HSG C
26,182	89	Weighted Average
9,652		36.87% Pervious Area
16,530		63.13% Impervious Area

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

Subcatchment PDA11: PDA11



Summary for Subcatchment PDA12: PDA12

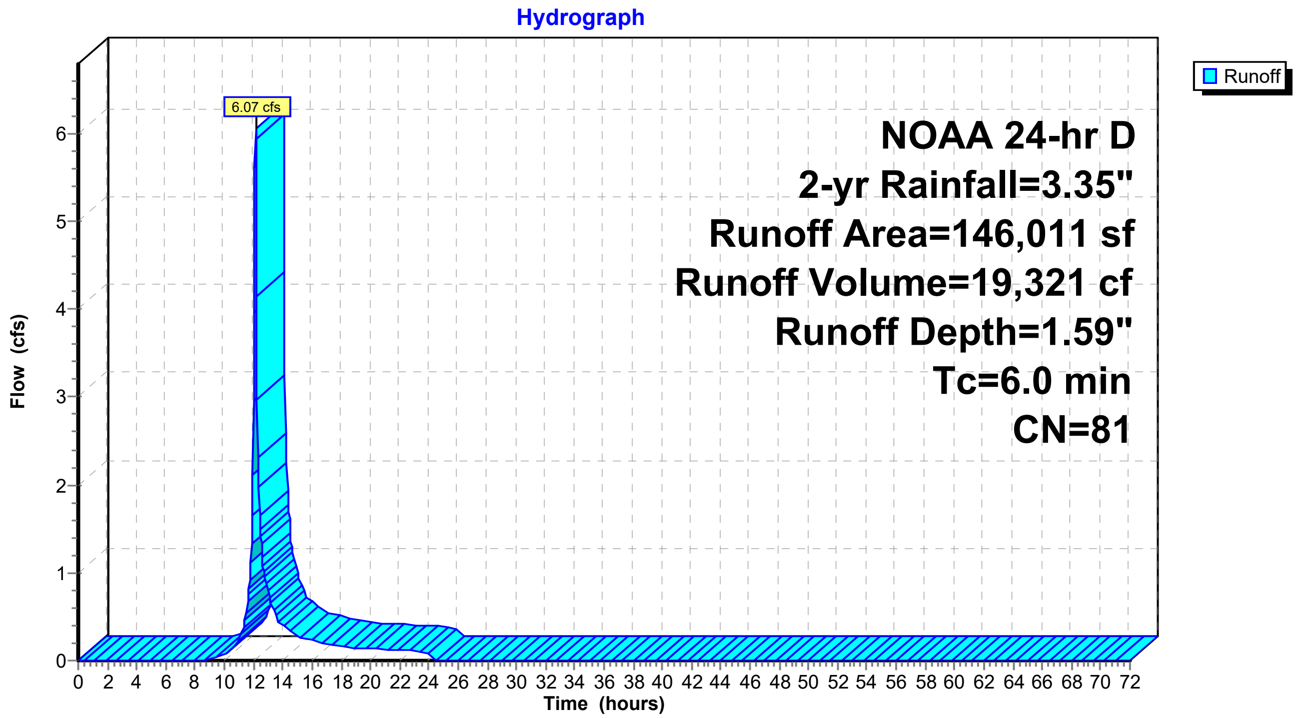
Runoff = 6.07 cfs @ 12.13 hrs, Volume= 19,321 cf, Depth= 1.59"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
NOAA 24-hr D 2-yr Rainfall=3.35"

Area (sf)	CN	Description
104,041	74	>75% Grass cover, Good, HSG C
41,970	98	Paved parking, HSG C
146,011	81	Weighted Average
104,041		71.26% Pervious Area
41,970		28.74% Impervious Area

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

Subcatchment PDA12: PDA12



Summary for Subcatchment PDA2: Proposed 2

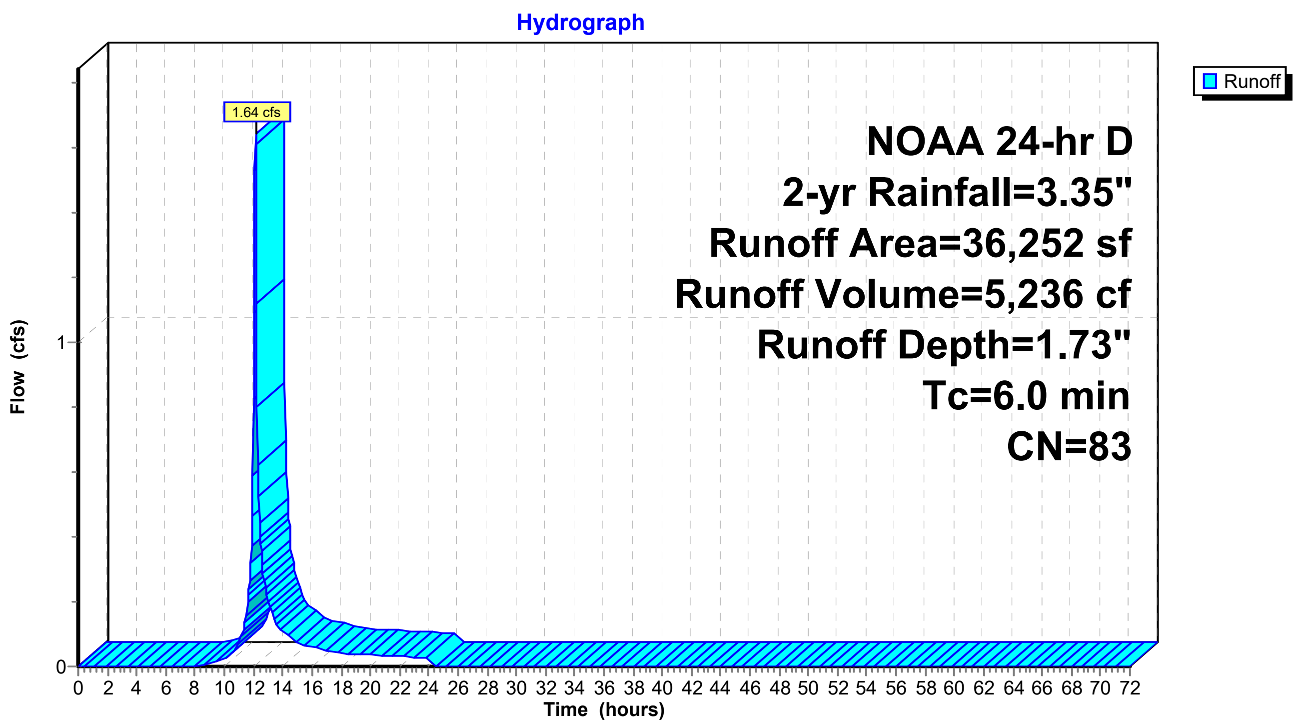
Runoff = 1.64 cfs @ 12.13 hrs, Volume= 5,236 cf, Depth= 1.73"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
NOAA 24-hr D 2-yr Rainfall=3.35"

Area (sf)	CN	Description
22,332	74	>75% Grass cover, Good, HSG C
13,920	98	Paved parking, HSG C
36,252	83	Weighted Average
22,332		61.60% Pervious Area
13,920		38.40% Impervious Area

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

Subcatchment PDA2: Proposed 2



Summary for Subcatchment PDA3: Proposed 3

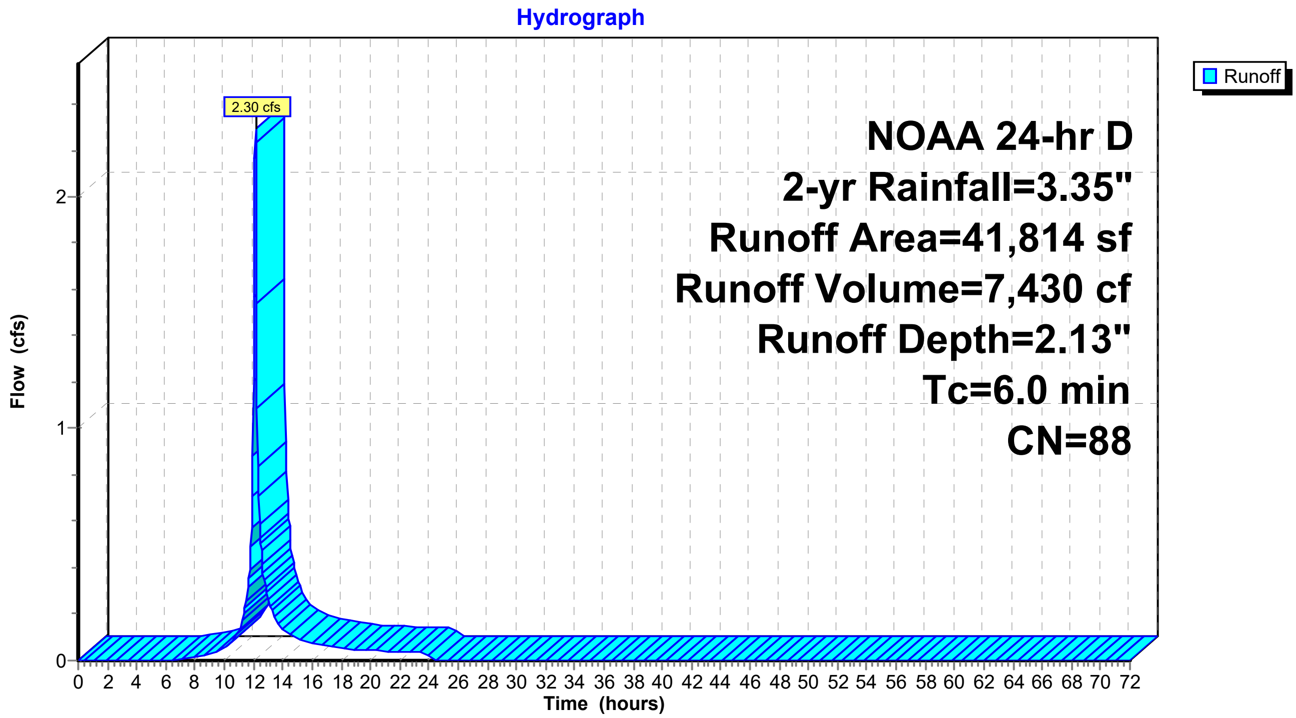
Runoff = 2.30 cfs @ 12.13 hrs, Volume= 7,430 cf, Depth= 2.13"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
NOAA 24-hr D 2-yr Rainfall=3.35"

Area (sf)	CN	Description
24,450	98	Paved parking, HSG C
17,364	74	>75% Grass cover, Good, HSG C
41,814	88	Weighted Average
17,364		41.53% Pervious Area
24,450		58.47% Impervious Area

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

Subcatchment PDA3: Proposed 3



Summary for Subcatchment PDA4: Proposed 4

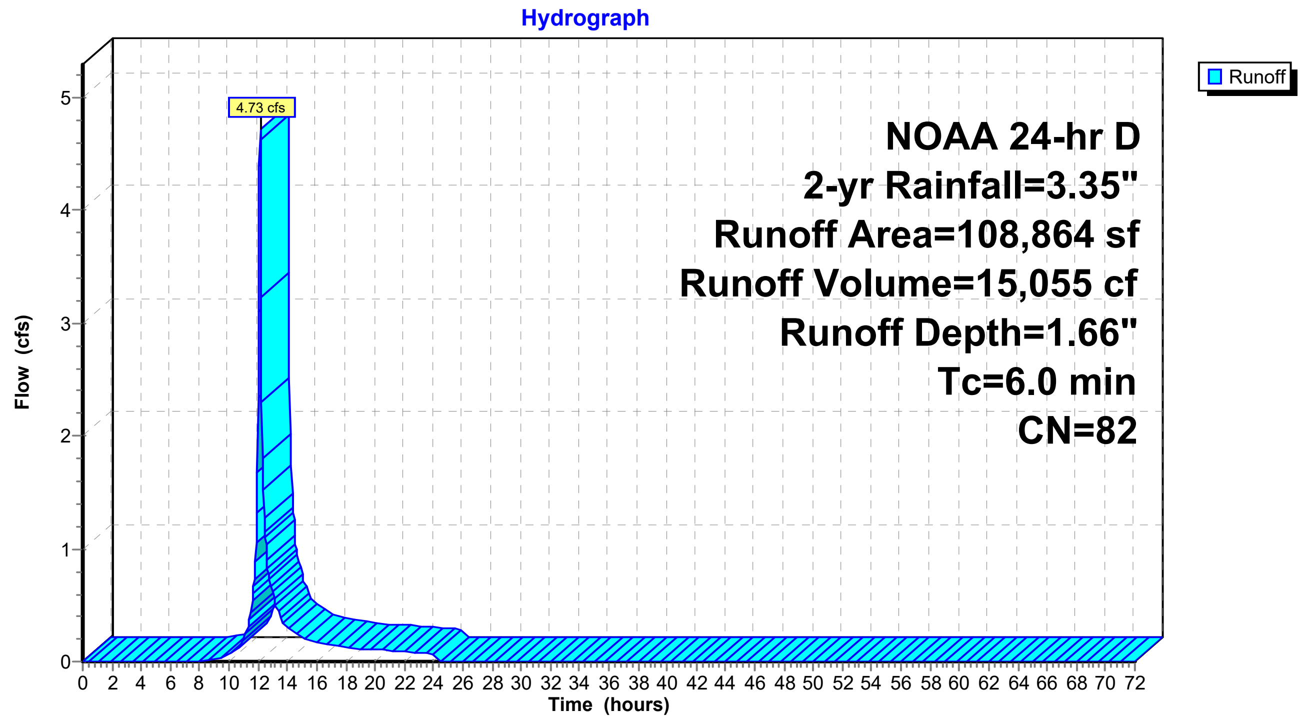
Runoff = 4.73 cfs @ 12.13 hrs, Volume= 15,055 cf, Depth= 1.66"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
NOAA 24-hr D 2-yr Rainfall=3.35"

	Area (sf)	CN	Description
	35,864	74	>75% Grass cover, Good, HSG C
	33,354	98	Paved roads w/curbs & sewers, HSG C
	30,631	70	Woods, Good, HSG C
*	9,015	98	Roofs, HSG C
	108,864	82	Weighted Average
	66,495		61.08% Pervious Area
	42,369		38.92% Impervious Area

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

Subcatchment PDA4: Proposed 4



Summary for Subcatchment PDA5: Proposed 5

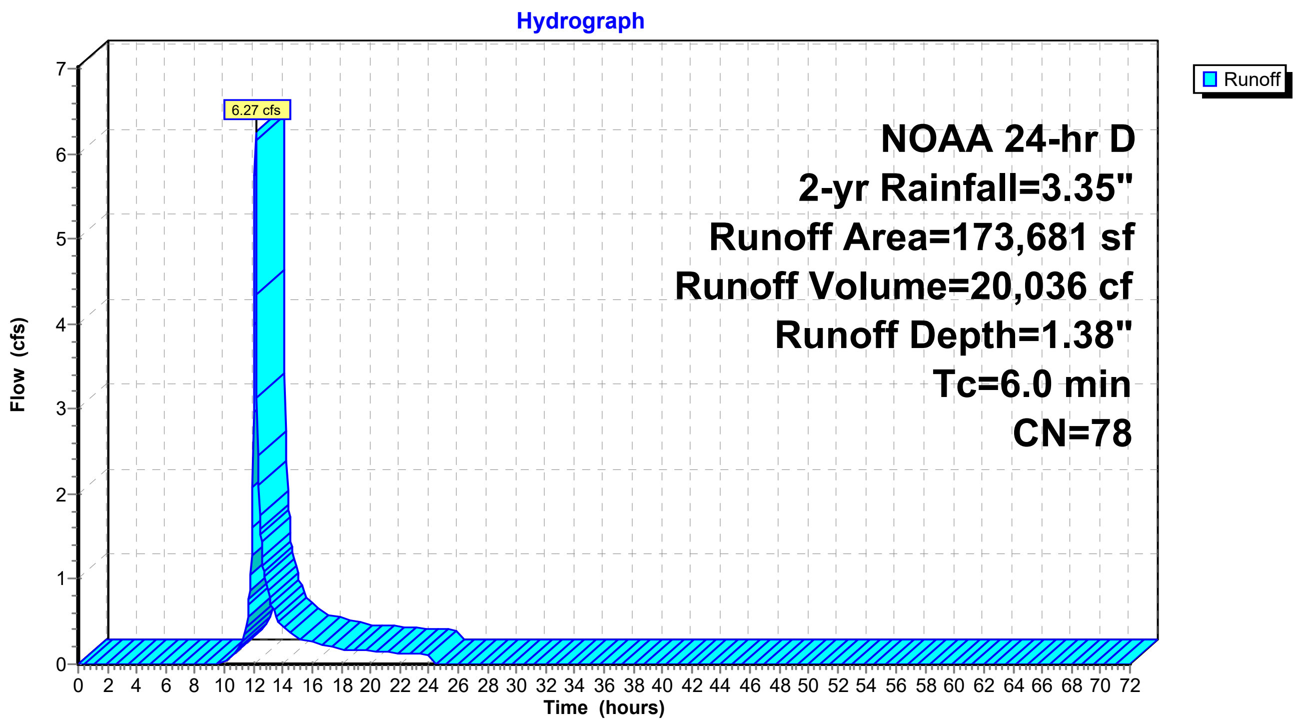
Runoff = 6.27 cfs @ 12.13 hrs, Volume= 20,036 cf, Depth= 1.38"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
NOAA 24-hr D 2-yr Rainfall=3.35"

	Area (sf)	CN	Description
	98,683	74	>75% Grass cover, Good, HSG C
	39,650	70	Woods, Good, HSG C
*	35,348	98	Pond
	173,681	78	Weighted Average
	138,333		79.65% Pervious Area
	35,348		20.35% Impervious Area

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

Subcatchment PDA5: Proposed 5



Summary for Subcatchment PDA6: Proposal 6

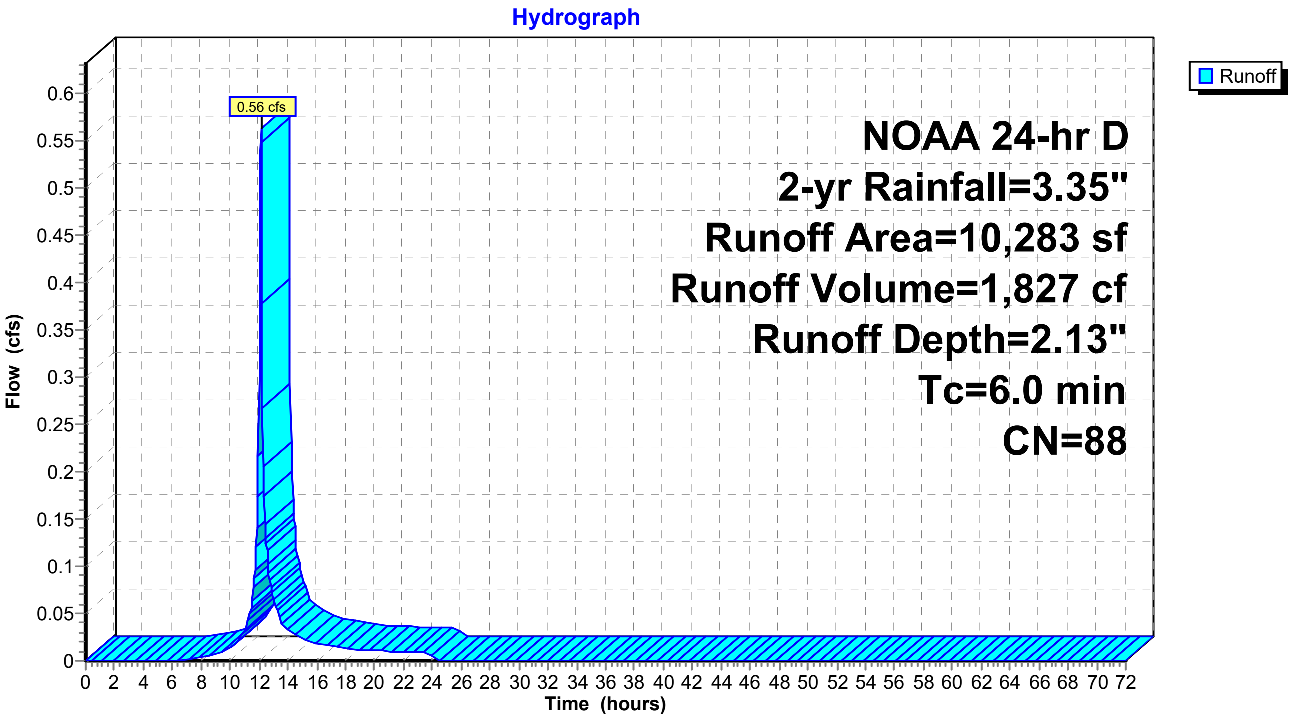
Runoff = 0.56 cfs @ 12.13 hrs, Volume= 1,827 cf, Depth= 2.13"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
NOAA 24-hr D 2-yr Rainfall=3.35"

Area (sf)	CN	Description
5,797	98	Paved parking, HSG C
4,486	74	>75% Grass cover, Good, HSG C
10,283	88	Weighted Average
4,486		43.63% Pervious Area
5,797		56.37% Impervious Area

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

Subcatchment PDA6: Proposal 6



Summary for Subcatchment PDA7: Proposal 7

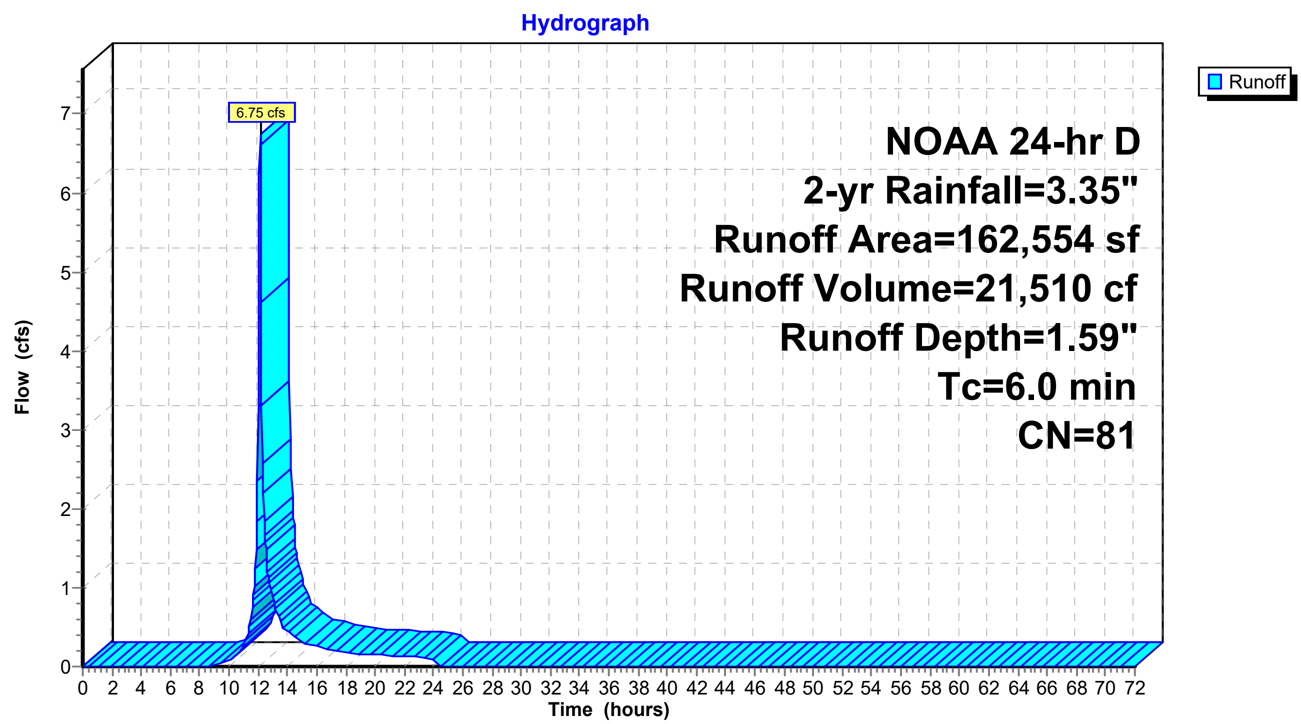
Runoff = 6.75 cfs @ 12.13 hrs, Volume= 21,510 cf, Depth= 1.59"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
NOAA 24-hr D 2-yr Rainfall=3.35"

Area (sf)	CN	Description
32,254	98	Roofs, HSG C
75,527	74	>75% Grass cover, Good, HSG C
18,642	98	Paved parking, HSG C
36,131	70	Woods, Good, HSG C
162,554	81	Weighted Average
111,658		68.69% Pervious Area
50,896		31.31% Impervious Area

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

Subcatchment PDA7: Proposal 7



Summary for Subcatchment PDA8: Proposed 8

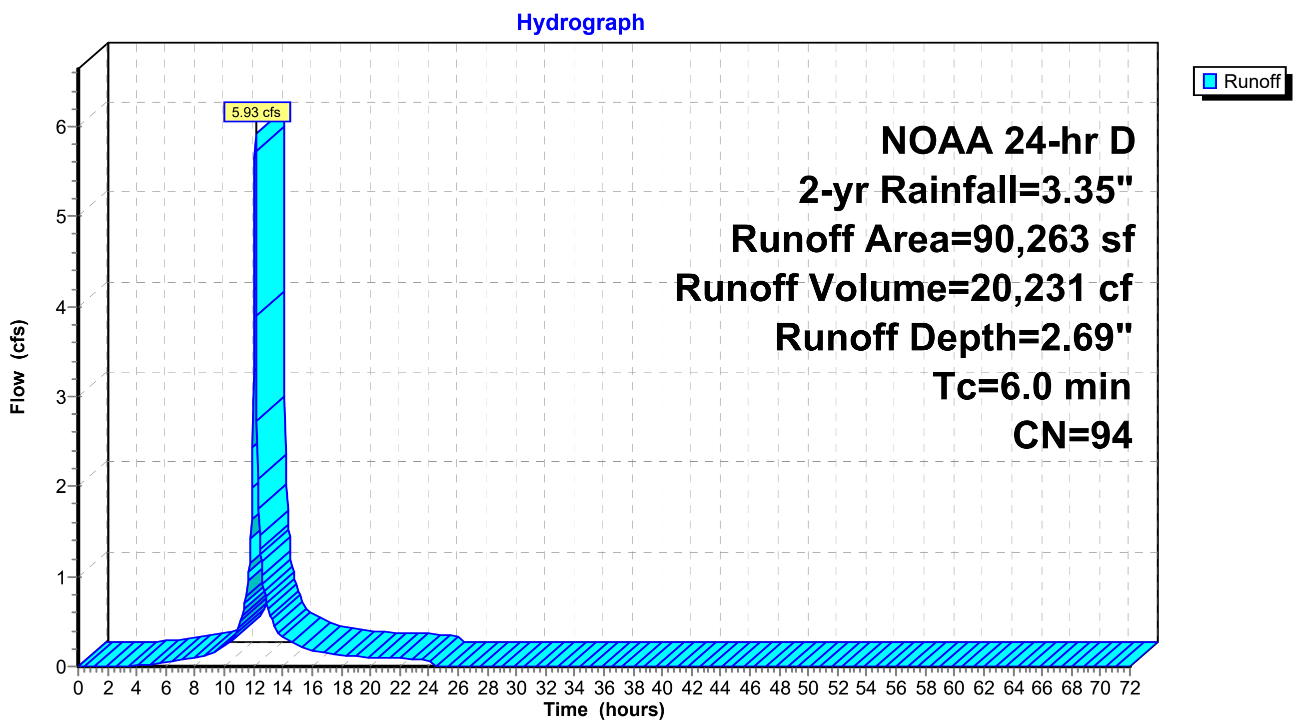
Runoff = 5.93 cfs @ 12.13 hrs, Volume= 20,231 cf, Depth= 2.69"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
NOAA 24-hr D 2-yr Rainfall=3.35"

Area (sf)	CN	Description
75,141	98	Paved parking, HSG C
15,122	74	>75% Grass cover, Good, HSG C
90,263	94	Weighted Average
15,122		16.75% Pervious Area
75,141		83.25% Impervious Area

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

Subcatchment PDA8: Proposed 8



Summary for Subcatchment PDA9: Proposed 9

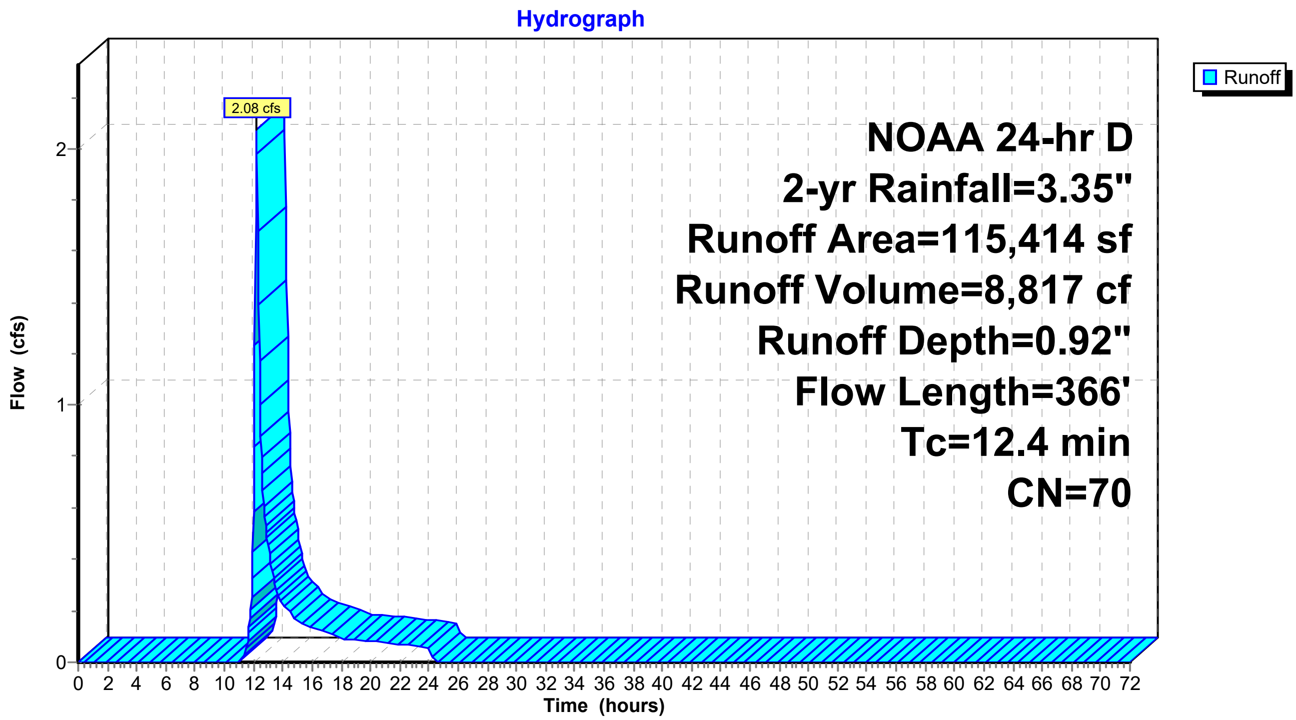
Runoff = 2.08 cfs @ 12.21 hrs, Volume= 8,817 cf, Depth= 0.92"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
NOAA 24-hr D 2-yr Rainfall=3.35"

Area (sf)	CN	Description
105,951	70	Woods, Good, HSG C
9,463	74	>75% Grass cover, Good, HSG C
115,414	70	Weighted Average
115,414		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.1	50	0.0400	0.09		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.35"
3.3	316	0.1000	1.58		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
12.4	366	Total			

Subcatchment PDA9: Proposed 9



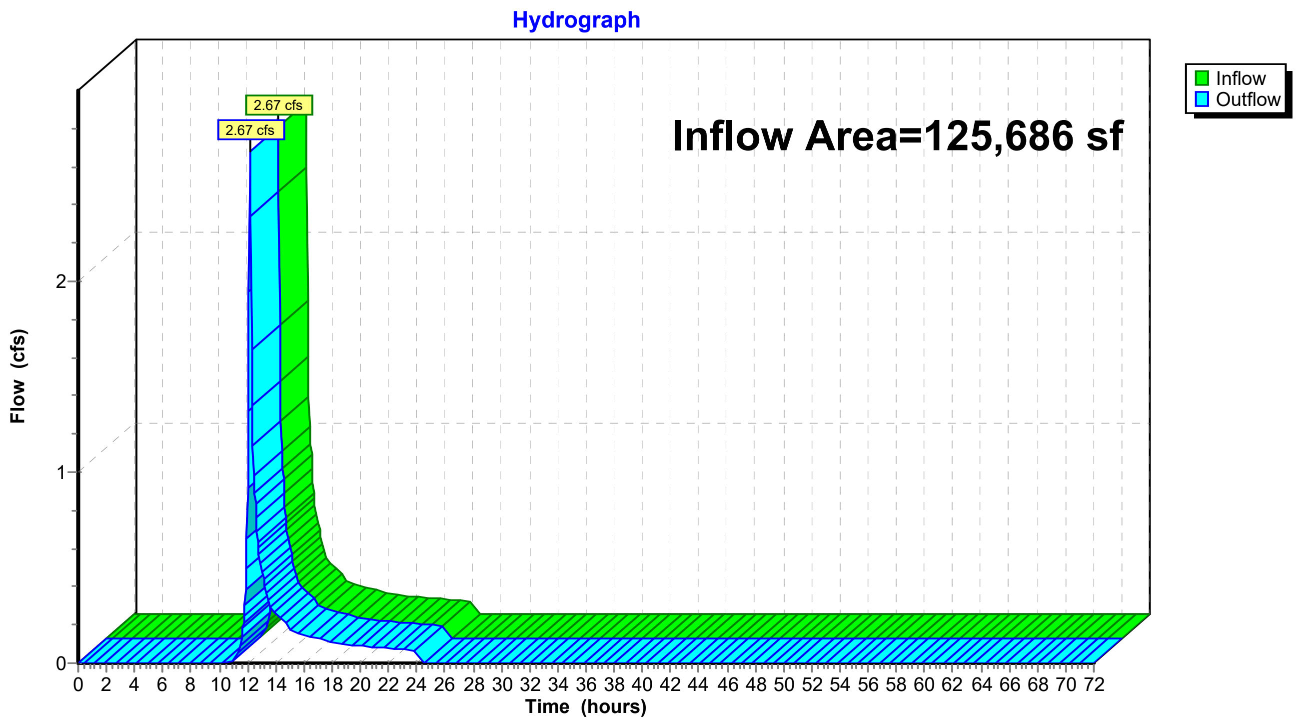
Summary for Reach DP-A: Eastern Intermittent Stream

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

Inflow Area = 125,686 sf, 0.00% Impervious, Inflow Depth = 0.97" for 2-yr event
Inflow = 2.67 cfs @ 12.17 hrs, Volume= 10,156 cf
Outflow = 2.67 cfs @ 12.17 hrs, Volume= 10,156 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

Reach DP-A: Eastern Intermittent Stream



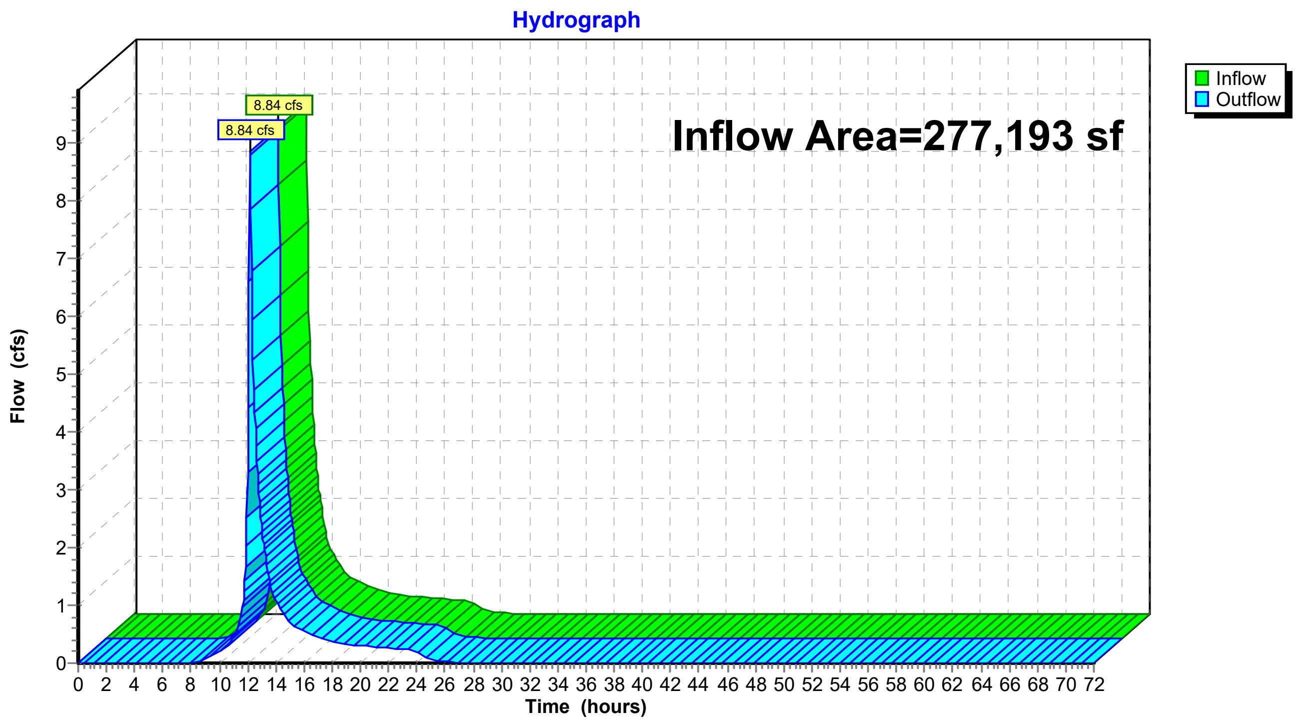
Summary for Reach DP-B: Concord Street Main

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

Inflow Area = 277,193 sf, 56.24% Impervious, Inflow Depth = 1.89" for 2-yr event
Inflow = 8.84 cfs @ 12.18 hrs, Volume= 43,571 cf
Outflow = 8.84 cfs @ 12.18 hrs, Volume= 43,571 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

Reach DP-B: Concord Street Main

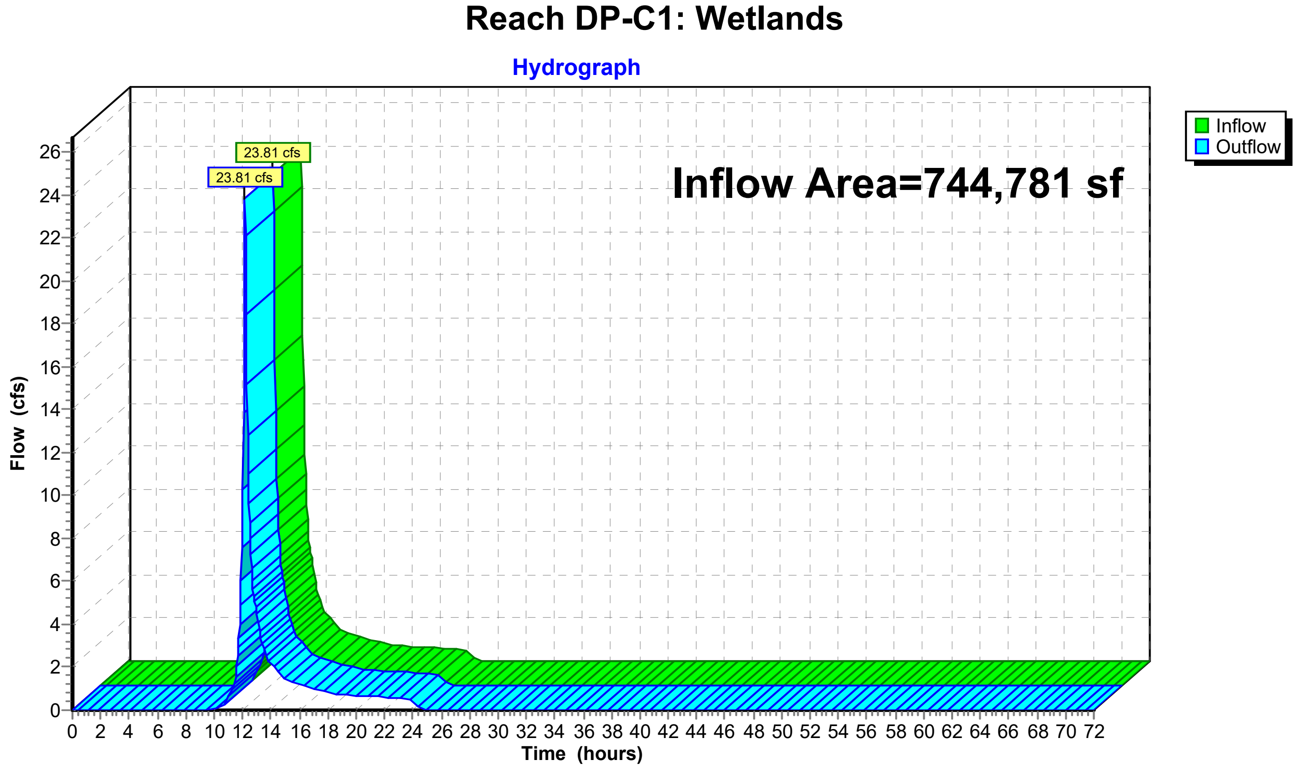


Summary for Reach DP-C1: Wetlands

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

Inflow Area = 744,781 sf, 30.56% Impervious, Inflow Depth = 1.49" for 2-yr event
Inflow = 23.81 cfs @ 12.16 hrs, Volume= 92,581 cf
Outflow = 23.81 cfs @ 12.16 hrs, Volume= 92,581 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

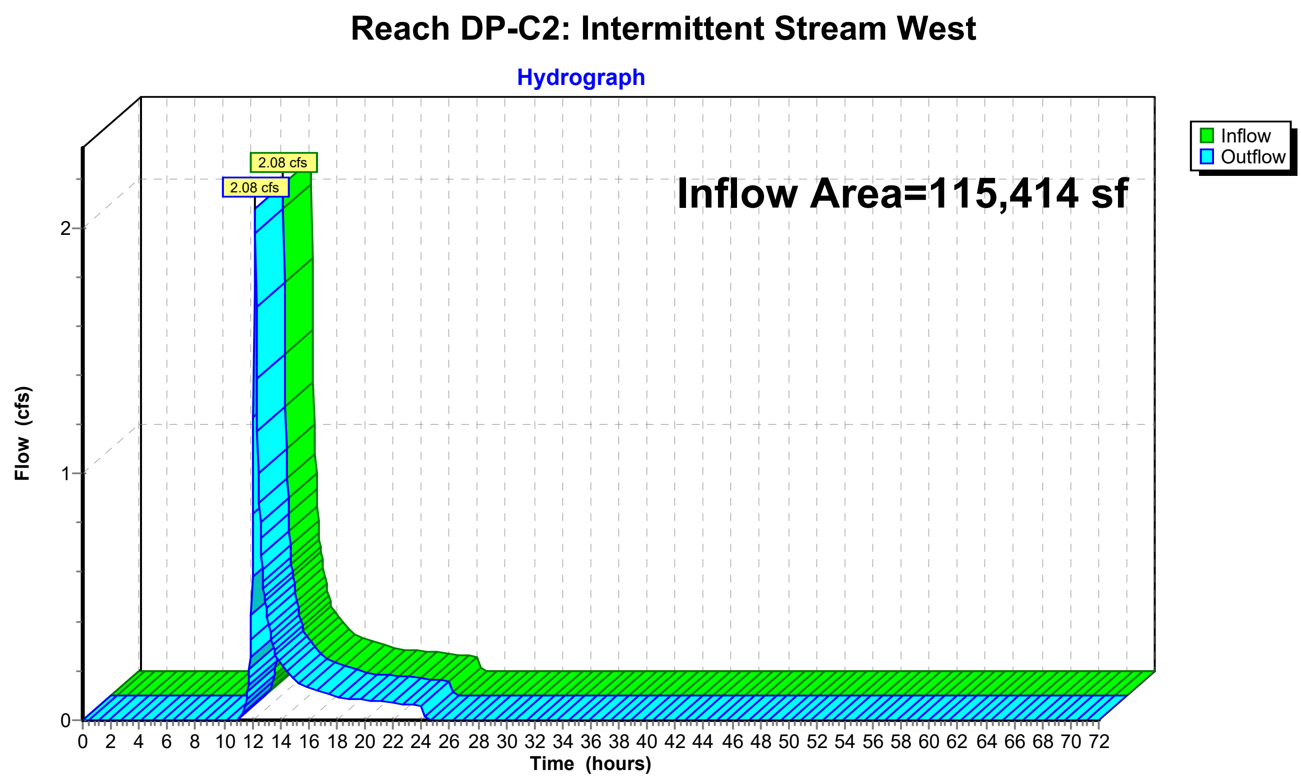


Summary for Reach DP-C2: Intermittent Stream West

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

Inflow Area =	115,414 sf,	0.00% Impervious,	Inflow Depth = 0.92"	for 2-yr event
Inflow =	2.08 cfs @	12.21 hrs, Volume=	8,817 cf	
Outflow =	2.08 cfs @	12.21 hrs, Volume=	8,817 cf, Atten= 0%, Lag= 0.0 min	

Routing by Stor-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs



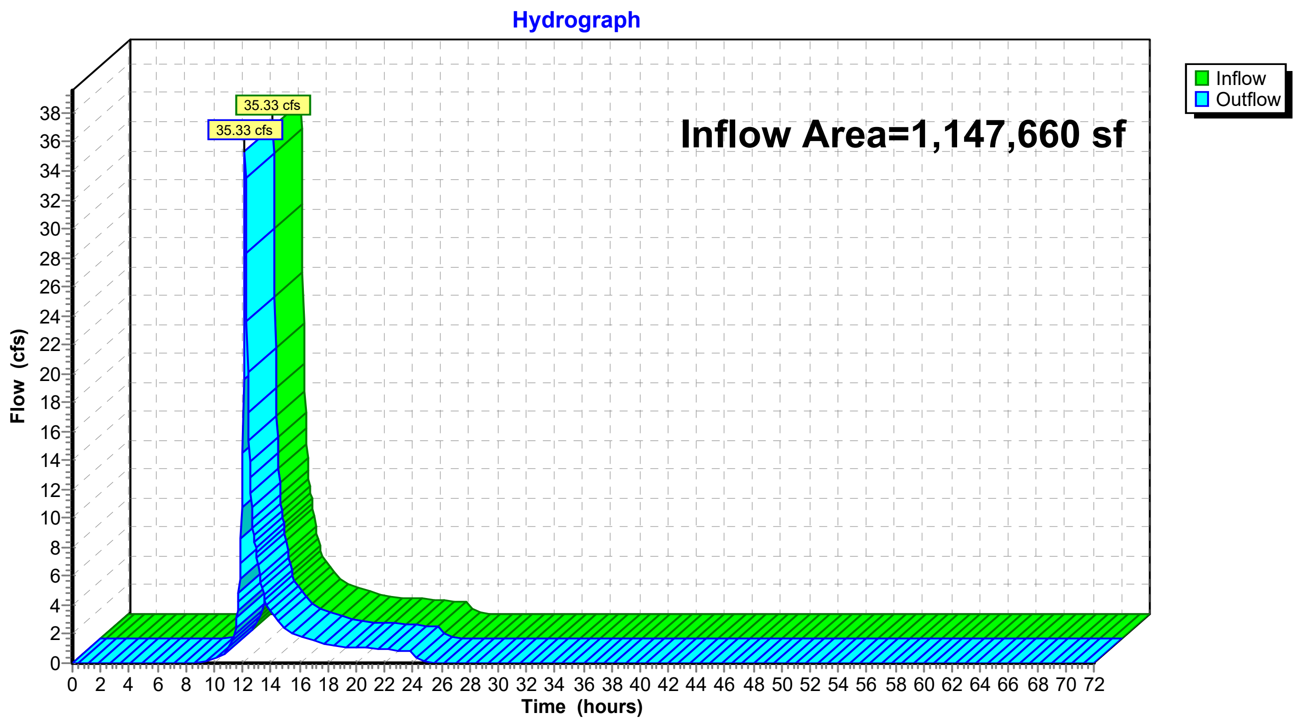
Summary for Reach PR TOT: Total Site

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

Inflow Area = 1,147,660 sf, 33.42% Impervious, Inflow Depth = 1.53" for 2-yr event
Inflow = 35.33 cfs @ 12.17 hrs, Volume= 146,308 cf
Outflow = 35.33 cfs @ 12.17 hrs, Volume= 146,308 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

Reach PR TOT: Total Site



Summary for Reach SWALE: Bioswale

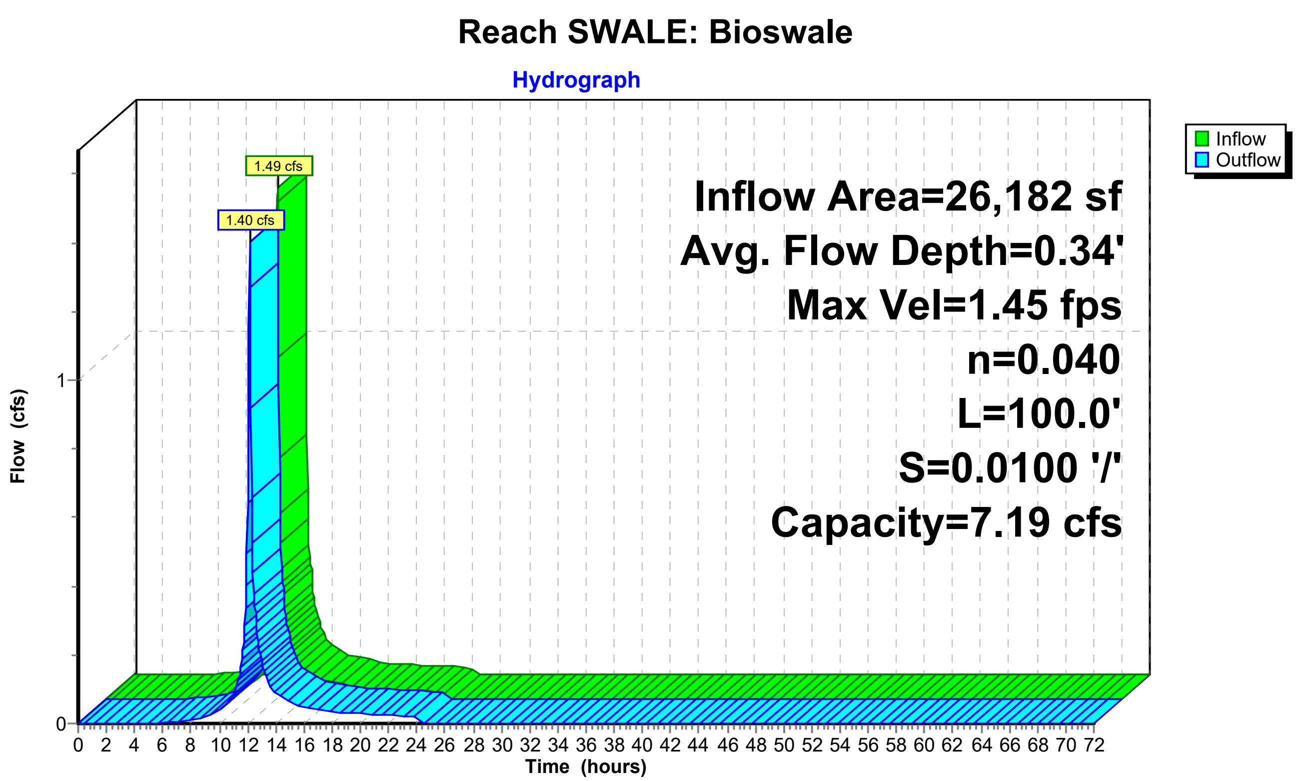
Inflow Area = 26,182 sf, 63.13% Impervious, Inflow Depth = 2.22" for 2-yr event
Inflow = 1.49 cfs @ 12.13 hrs, Volume= 4,841 cf
Outflow = 1.40 cfs @ 12.16 hrs, Volume= 4,841 cf, Atten= 6%, Lag= 1.7 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Max. Velocity= 1.45 fps, Min. Travel Time= 1.1 min
Avg. Velocity = 0.43 fps, Avg. Travel Time= 3.9 min

Peak Storage= 101 cf @ 12.14 hrs
Average Depth at Peak Storage= 0.34'
Bank-Full Depth= 0.75' Flow Area= 3.2 sf, Capacity= 7.19 cfs

2.00' x 0.75' deep channel, n= 0.040 Earth, cobble bottom, clean sides
Side Slope Z-value= 3.0 '/' Top Width= 6.50'
Length= 100.0' Slope= 0.0100 '/'
Inlet Invert= 185.00', Outlet Invert= 184.00'

‡



Summary for Pond SI-1: Surface Infiltration

Inflow Area = 41,814 sf, 58.47% Impervious, Inflow Depth = 2.13" for 2-yr event
Inflow = 2.30 cfs @ 12.13 hrs, Volume= 7,430 cf
Outflow = 1.50 cfs @ 12.22 hrs, Volume= 5,371 cf, Atten= 35%, Lag= 5.1 min
Primary = 1.50 cfs @ 12.22 hrs, Volume= 5,371 cf

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 200.01' @ 12.22 hrs Surf.Area= 3,319 sf Storage= 2,727 cf

Plug-Flow detention time= 171.2 min calculated for 5,367 cf (72% of inflow)
Center-of-Mass det. time= 72.5 min (893.8 - 821.3)

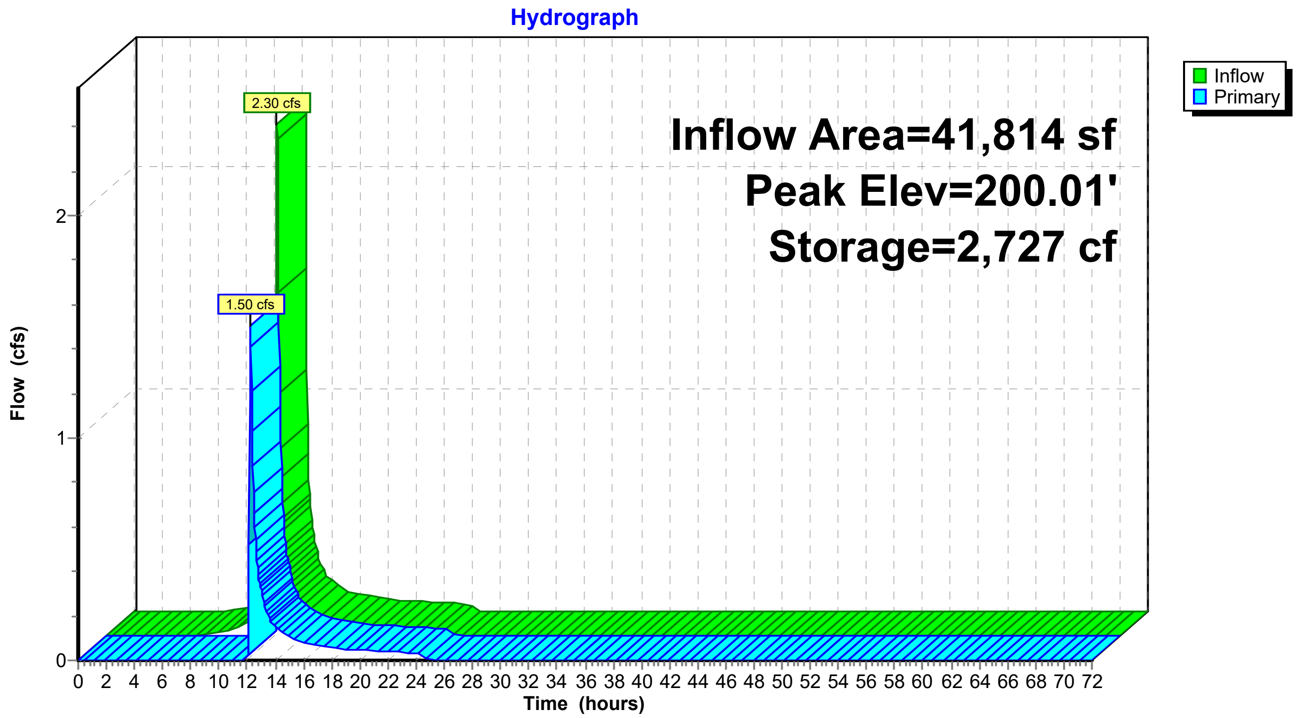
Volume	Invert	Avail.Storage	Storage Description
#1	198.90'	5,612 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
198.90	1,600	0	0
199.75	2,900	1,912	1,912
200.75	4,500	3,700	5,612

Device	Routing	Invert	Outlet Devices
#1	Primary	196.00'	**12.0" Round Culvert** L= 50.0' CPP, mitered to conform to fill, Ke= 0.700 Inlet / Outlet Invert= 196.00' / 195.50' S= 0.0100 '/' Cc= 0.900 n= 0.013, Flow Area= 0.79 sf
#2	Device 1	199.80'	**12.0" Horiz. Orifice/Grate X 1.50** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=1.46 cfs @ 12.22 hrs HW=200.01' (Free Discharge)
↑—**1=Culvert** (Passes 1.46 cfs of 6.25 cfs potential flow)
  ↑—**2=Orifice/Grate** (Weir Controls 1.46 cfs @ 2.24 fps)

Pond SI-1: Surface Infiltration



Summary for Pond SI-2: Surface System

Inflow Area = 110,656 sf, 69.66% Impervious, Inflow Depth = 2.40" for 2-yr event
Inflow = 6.70 cfs @ 12.13 hrs, Volume= 22,126 cf
Outflow = 6.29 cfs @ 12.15 hrs, Volume= 19,988 cf, Atten= 6%, Lag= 1.6 min
Primary = 6.29 cfs @ 12.15 hrs, Volume= 19,988 cf

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 194.32' @ 12.15 hrs Surf.Area= 4,790 sf Storage= 3,157 cf

Plug-Flow detention time= 82.0 min calculated for 19,974 cf (90% of inflow)
Center-of-Mass det. time= 32.3 min (839.8 - 807.5)

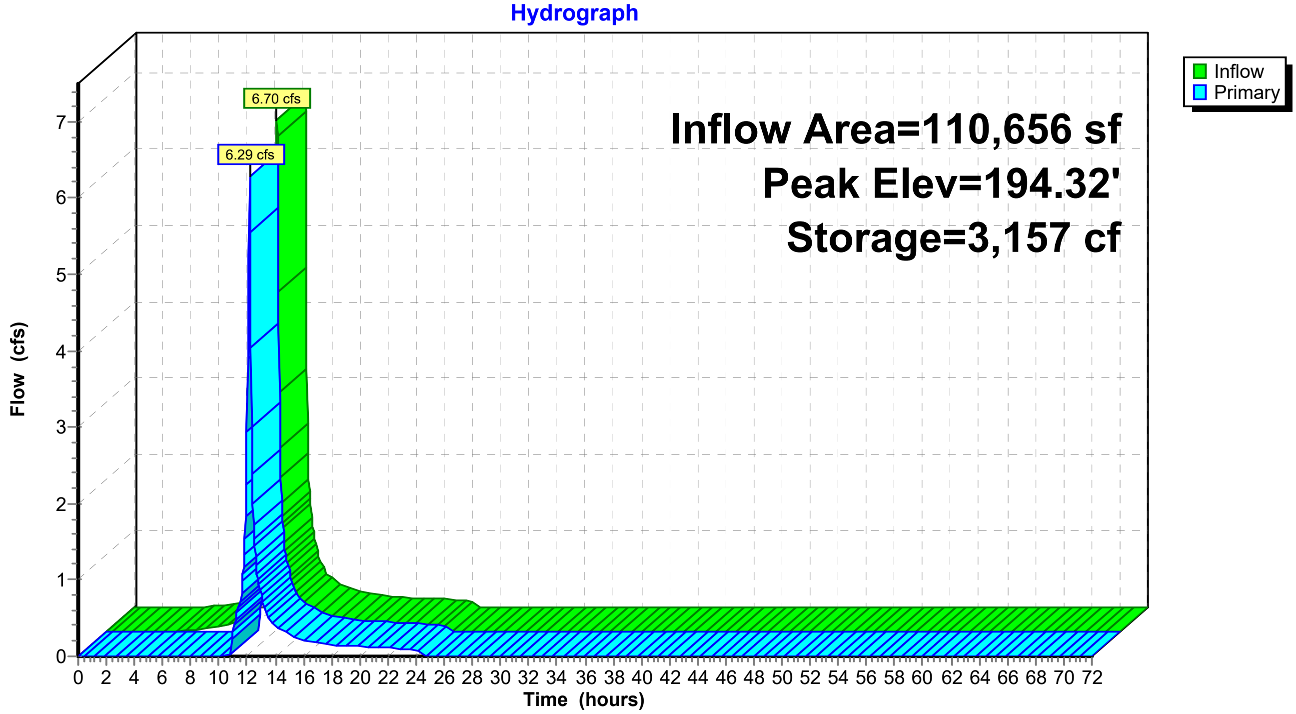
Volume	Invert	Avail.Storage	Storage Description
#1	193.60'	10,350 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
193.60	4,000	0	0
194.60	5,100	4,550	4,550
195.60	6,500	5,800	10,350

Device	Routing	Invert	Outlet Devices
#1	Primary	189.50'	**15.0" Round Culvert** L= 50.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 189.50' / 189.00' S= 0.0100 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.23 sf
#2	Device 1	194.10'	**24.0" Horiz. Orifice/Grate X 3.00** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=6.21 cfs @ 12.15 hrs HW=194.32' (Free Discharge)
└─**1=Culvert** (Passes 6.21 cfs of 12.10 cfs potential flow)
  └─**2=Orifice/Grate** (Weir Controls 6.21 cfs @ 1.52 fps)

Pond SI-2: Surface System



Summary for Pond SS-1: Subsurface Infiltration (SC-310 Chambers)

Inflow Area = 146,011 sf, 28.74% Impervious, Inflow Depth = 1.59" for 2-yr event
Inflow = 6.07 cfs @ 12.13 hrs, Volume= 19,321 cf
Outflow = 4.65 cfs @ 12.20 hrs, Volume= 18,153 cf, Atten= 23%, Lag= 3.8 min
Primary = 4.65 cfs @ 12.20 hrs, Volume= 18,153 cf

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 185.17' @ 12.20 hrs Surf.Area= 4,860 sf Storage= 3,445 cf

Plug-Flow detention time= 63.3 min calculated for 18,153 cf (94% of inflow)
Center-of-Mass det. time= 30.1 min (878.0 - 847.9)

Volume	Invert	Avail.Storage	Storage Description
#1A	184.00'	3,404 cf	**41.50'W x 117.12'L x 2.33'H Field A**
			11,341 cf Overall - 2,830 cf Embedded = 8,511 cf x 40.0% Voids
#2A	184.50'	2,830 cf	**ADS_StormTech SC-310 +Cap** x 192 Inside #1
			Effective Size= 28.9"W x 16.0"H => 2.07 sf x 7.12'L = 14.7 cf
			Overall Size= 34.0"W x 16.0"H x 7.56'L with 0.44' Overlap
			12 Rows of 16 Chambers
		6,235 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	184.55'	**36.0" W x 9.0" H Vert. Orifice/Grate** C= 0.600
#2	Primary	185.65'	**5.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)

Primary OutFlow Max=4.62 cfs @ 12.20 hrs HW=185.16' (Free Discharge)
↑—**1=Orifice/Grate** (Orifice Controls 4.62 cfs @ 2.51 fps)
└—**2=Sharp-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond SS-1: Subsurface Infiltration (SC-310 Chambers) - Chamber Wizard Field A

Chamber Model = ADS_StormTechSC-310 +Cap (ADS StormTech®SC-310 with cap length)
Effective Size= 28.9"W x 16.0"H => 2.07 sf x 7.12'L = 14.7 cf
Overall Size= 34.0"W x 16.0"H x 7.56'L with 0.44' Overlap

34.0" Wide + 6.0" Spacing = 40.0" C-C Row Spacing

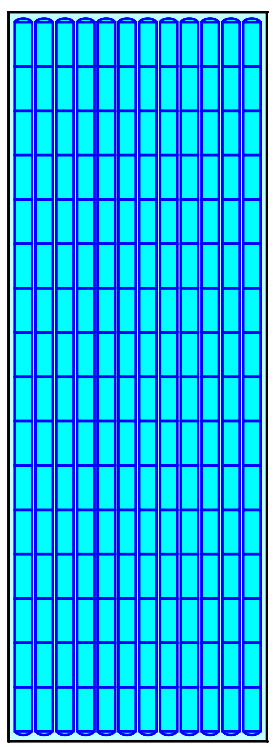
16 Chambers/Row x 7.12' Long +0.60' Cap Length x 2 = 115.12' Row Length +12.0" End Stone x 2 = 117.12' Base Length
12 Rows x 34.0" Wide + 6.0" Spacing x 11 + 12.0" Side Stone x 2 = 41.50' Base Width
6.0" Base + 16.0" Chamber Height + 6.0" Cover = 2.33' Field Height

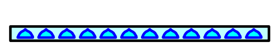
192 Chambers x 14.7 cf = 2,830.5 cf Chamber Storage

11,341.1 cf Field - 2,830.5 cf Chambers = 8,510.7 cf Stone x 40.0% Voids = 3,404.3 cf Stone Storage

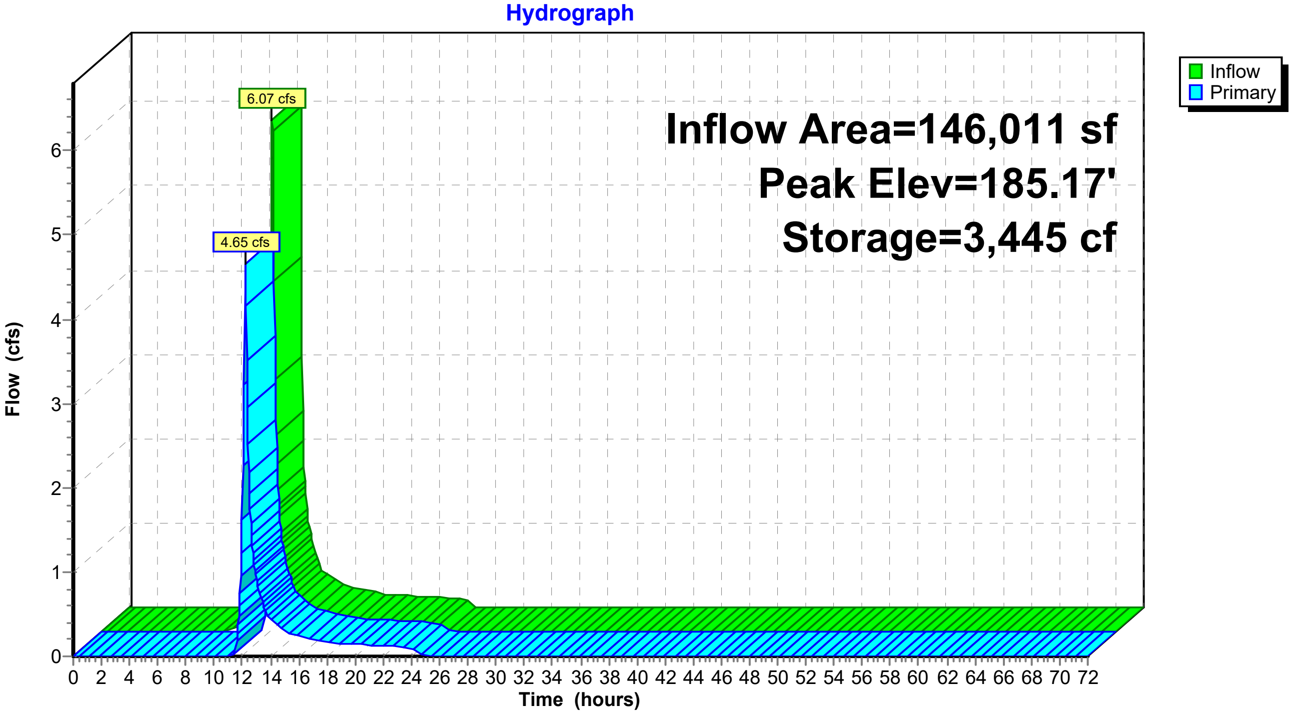
Chamber Storage + Stone Storage = 6,234.7 cf = 0.143 af
Overall Storage Efficiency = 55.0%
Overall System Size = 117.12' x 41.50' x 2.33'

192 Chambers
420.0 cy Field
315.2 cy Stone





Pond SS-1: Subsurface Infiltration (SC-310 Chambers)



Summary for Pond SS-2: Subsurface Infiltration (SC-740 Chambers)

Inflow Area = 10,283 sf, 56.37% Impervious, Inflow Depth = 2.13" for 2-yr event
Inflow = 0.56 cfs @ 12.13 hrs, Volume= 1,827 cf
Outflow = 0.02 cfs @ 15.03 hrs, Volume= 722 cf, Atten= 96%, Lag= 174.0 min
Primary = 0.02 cfs @ 15.03 hrs, Volume= 722 cf

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 187.13' @ 15.03 hrs Surf.Area= 1,826 sf Storage= 1,295 cf

Plug-Flow detention time= 502.5 min calculated for 722 cf (39% of inflow)
Center-of-Mass det. time= 367.7 min (1,189.0 - 821.3)

Volume	Invert	Avail.Storage	Storage Description
#1A	186.00'	1,674 cf	**20.50'W x 89.06'L x 3.50'H Field A** 6,390 cf Overall - 2,205 cf Embedded = 4,185 cf x 40.0% Voids
#2A	186.50'	2,205 cf	**ADS_StormTech SC-740 +Cap** x 48 Inside #1 Effective Size= 44.6"W x 30.0"H => 6.45 sf x 7.12'L = 45.9 cf Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap 4 Rows of 12 Chambers
		3,879 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	187.00'	**2.0" Vert. Orifice/Grate** C= 0.600
#2	Primary	189.00'	**5.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)

Primary OutFlow Max=0.02 cfs @ 15.03 hrs HW=187.13' (Free Discharge)
├—**1=Orifice/Grate** (Orifice Controls 0.02 cfs @ 1.24 fps)
└—**2=Sharp-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond SS-2: Subsurface Infiltration (SC-740 Chambers) - Chamber Wizard Field A

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

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

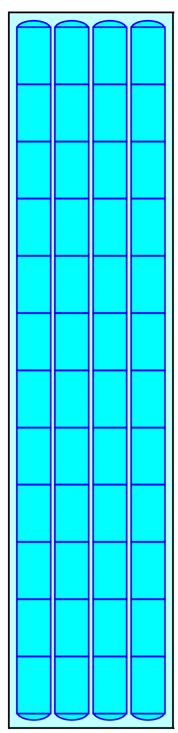
12 Chambers/Row x 7.12' Long +0.81' Cap Length x 2 = 87.06' Row Length +12.0" End Stone x 2 = 89.06' Base Length
4 Rows x 51.0" Wide + 6.0" Spacing x 3 + 12.0" Side Stone x 2 = 20.50' Base Width
6.0" Base + 30.0" Chamber Height + 6.0" Cover = 3.50' Field Height

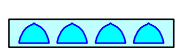
48 Chambers x 45.9 cf = 2,205.1 cf Chamber Storage

6,389.8 cf Field - 2,205.1 cf Chambers = 4,184.7 cf Stone x 40.0% Voids = 1,673.9 cf Stone Storage

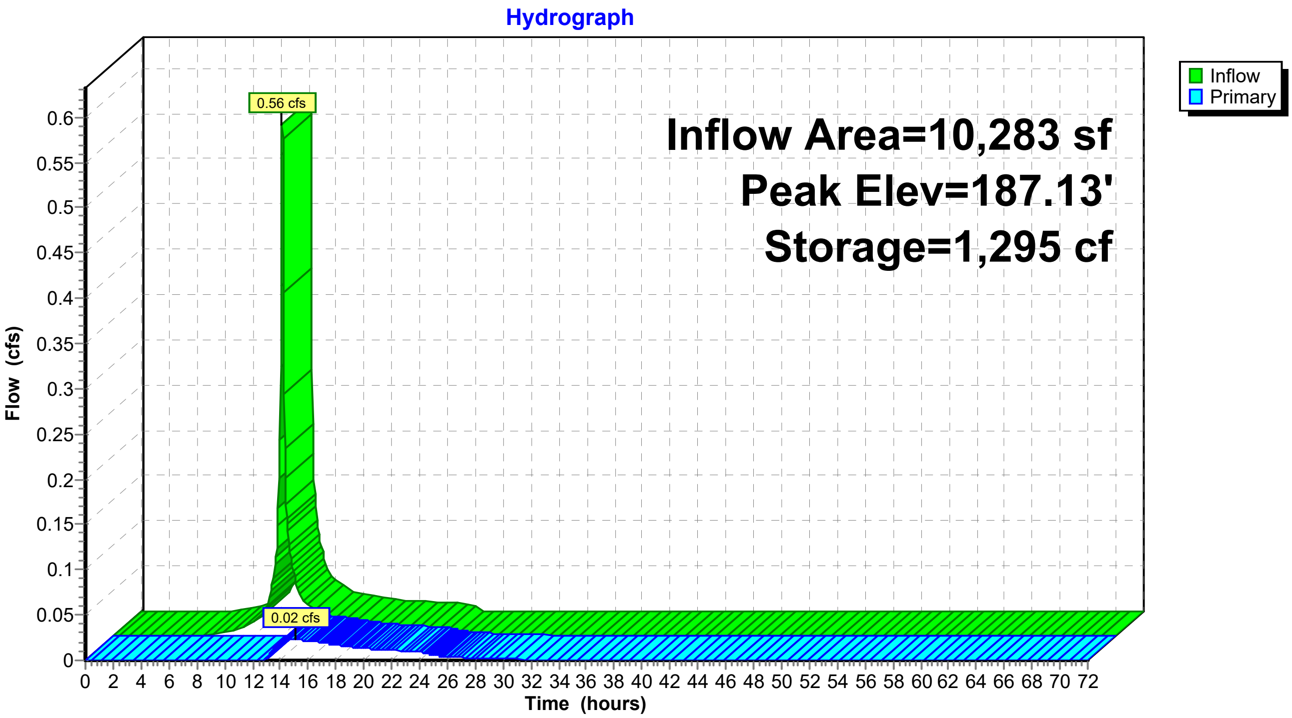
Chamber Storage + Stone Storage = 3,879.0 cf = 0.089 af
Overall Storage Efficiency = 60.7%
Overall System Size = 89.06' x 20.50' x 3.50'

48 Chambers
236.7 cy Field
155.0 cy Stone





Pond SS-2: Subsurface Infiltration (SC-740 Chambers)



Summary for Pond SS-3: Subsurface Infiltration (24" Pipe)

Inflow Area = 162,554 sf, 31.31% Impervious, Inflow Depth = 1.59" for 2-yr event
Inflow = 6.75 cfs @ 12.13 hrs, Volume= 21,510 cf
Outflow = 4.30 cfs @ 12.22 hrs, Volume= 20,023 cf, Atten= 36%, Lag= 5.1 min
Primary = 4.30 cfs @ 12.22 hrs, Volume= 20,023 cf

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 194.66' @ 12.22 hrs Surf.Area= 8,006 sf Storage= 4,611 cf

Plug-Flow detention time= 69.3 min calculated for 20,023 cf (93% of inflow)
Center-of-Mass det. time= 32.2 min (880.1 - 847.9)

Volume	Invert	Avail.Storage	Storage Description
#1A	193.50'	6,003 cf	**45.40'W x 176.33'L x 3.00'H Field A** 24,017 cf Overall - 9,009 cf Embedded = 15,008 cf x 40.0% Voids
#2A	193.83'	7,122 cf	**ADS N-12 24"** x 117 Inside #1 Inside= 23.8"W x 23.8"H => 3.10 sf x 20.00'L = 62.0 cf Outside= 28.0"W x 28.0"H => 3.92 sf x 20.00'L = 78.4 cf Row Length Adjustment= -10.00' x 3.10 sf x 13 rows 43.73' Header x 3.10 sf x 2 = 271.2 cf Inside
		13,125 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	194.00'	**30.0" W x 8.0" H Vert. Orifice/Grate** C= 0.600
#2	Primary	194.75'	**10.0" W x 6.0" H Vert. Orifice/Grate** C= 0.600
#3	Primary	196.35'	**5.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)

Primary OutFlow Max=4.23 cfs @ 12.22 hrs HW=194.65' (Free Discharge)
1=Orifice/Grate (Orifice Controls 4.23 cfs @ 2.59 fps)
2=Orifice/Grate (Controls 0.00 cfs)
3=Sharp-Crested Rectangular Weir (Controls 0.00 cfs)

Pond SS-3: Subsurface Infiltration (24" Pipe) - Chamber Wizard Field A

Chamber Model = ADS N-12 24" (ADS N-12® Pipe)
Inside= 23.8"W x 23.8"H => 3.10 sf x 20.00'L = 62.0 cf
Outside= 28.0"W x 28.0"H => 3.92 sf x 20.00'L = 78.4 cf
Row Length Adjustment= -10.00' x 3.10 sf x 13 rows

28.0" Wide + 13.4" Spacing = 41.4" C-C Row Spacing

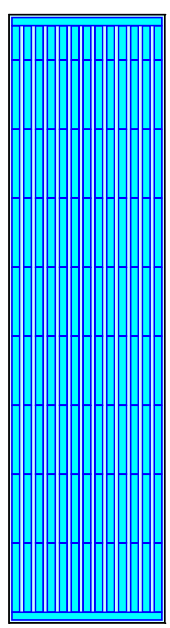
9 Chambers/Row x 20.00' Long -10.00' Row Adjustment +2.33' Header x 2 = 174.67' Row Length +10.0" End Stone x 2 = 176.33' Base Length
13 Rows x 28.0" Wide + 13.4" Spacing x 12 + 10.0" Side Stone x 2 = 45.40' Base Width
4.0" Base + 28.0" Chamber Height + 4.0" Cover = 3.00' Field Height

117 Chambers x 62.0 cf -10.00' Row Adjustment x 3.10 sf x 13 Rows + 43.73' Header x 3.10 sf x 2 = 7,122.2 cf Chamber Storage
117 Chambers x 78.4 cf -10.00' Row Adjustment x 3.92 sf x 13 Rows + 43.73' Header x 3.92 sf x 2 = 9,005.3 cf Displacement

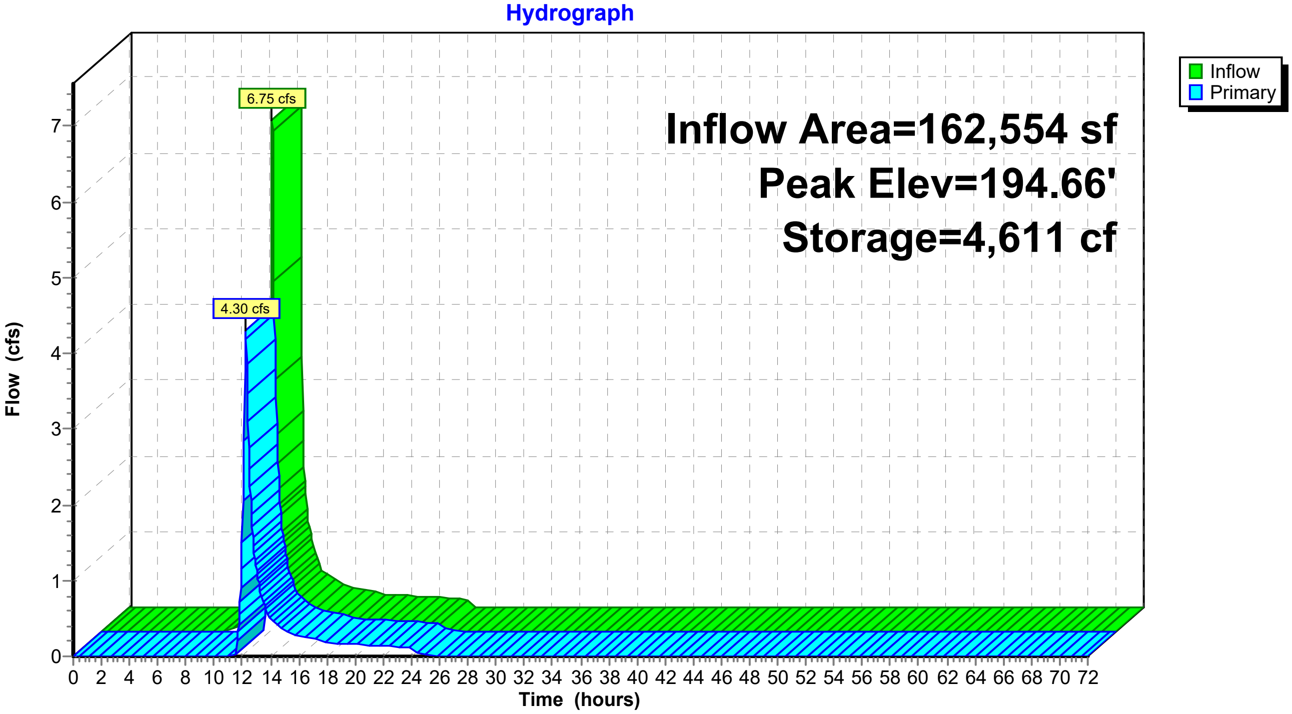
24,017.4 cf Field - 9,005.3 cf Chambers = 15,012.1 cf Stone x 40.0% Voids = 6,004.8 cf Stone Storage

Chamber Storage + Stone Storage = 13,127.0 cf = 0.301 af
Overall Storage Efficiency = 54.7%
Overall System Size = 176.33' x 45.40' x 3.00'

117 Chambers
889.5 cy Field
556.0 cy Stone



Pond SS-3: Subsurface Infiltration (24" Pipe)



Summary for Pond SS-4: Subsurface Infiltration (24" Pipe)

Inflow Area = 108,864 sf, 38.92% Impervious, Inflow Depth = 1.66" for 2-yr event
Inflow = 4.73 cfs @ 12.13 hrs, Volume= 15,055 cf
Outflow = 1.63 cfs @ 12.33 hrs, Volume= 13,647 cf, Atten= 66%, Lag= 12.0 min
Primary = 1.63 cfs @ 12.33 hrs, Volume= 13,647 cf

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 200.58' @ 12.33 hrs Surf.Area= 5,587 sf Storage= 4,890 cf

Plug-Flow detention time= 114.8 min calculated for 13,638 cf (91% of inflow)
Center-of-Mass det. time= 67.6 min (912.0 - 844.4)

Volume	Invert	Avail.Storage	Storage Description
#1A	199.00'	2,748 cf	**83.35'W x 44.33'L x 3.00'H Field A** 11,086 cf Overall - 4,217 cf Embedded = 6,869 cf x 40.0% Voids
#2A	199.33'	3,334 cf	**ADS N-12 24"** x 48 Inside #1 Inside= 23.8"W x 23.8"H => 3.10 sf x 20.00'L = 62.0 cf Outside= 28.0"W x 28.0"H => 3.92 sf x 20.00'L = 78.4 cf Row Length Adjustment= -2.00' x 3.10 sf x 24 rows 81.68' Header x 3.10 sf x 2 = 506.4 cf Inside
#3B	199.00'	1,454 cf	**45.40'W x 41.67'L x 3.00'H Field B** 5,675 cf Overall - 2,039 cf Embedded = 3,636 cf x 40.0% Voids
#4B	199.33'	1,612 cf	**ADS N-12 24"** x 26 Inside #3 Inside= 23.8"W x 23.8"H => 3.10 sf x 20.00'L = 62.0 cf Outside= 28.0"W x 28.0"H => 3.92 sf x 20.00'L = 78.4 cf 13 Rows of 2 Chambers
		9,148 cf	Total Available Storage

Storage Group A created with Chamber Wizard
Storage Group B created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	199.50'	**15.0" Round Culvert** L= 50.0' CPP, mitered to conform to fill, Ke= 0.700 Inlet / Outlet Invert= 199.50' / 199.00' S= 0.0100 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.23 sf
#2	Device 1	199.65'	**8.0" W x 8.0" H Vert. Orifice/Grate** C= 0.600
#3	Primary	200.75'	**30.0" W x 8.0" H Vert. Orifice/Grate** C= 0.600
#4	Device 1	201.50'	**5.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)

Primary OutFlow Max=1.63 cfs @ 12.33 hrs HW=200.58' (Free Discharge)
1=Culvert (Passes 1.63 cfs of 3.51 cfs potential flow)
2=Orifice/Grate (Orifice Controls 1.63 cfs @ 3.66 fps)
4=Sharp-Crested Rectangular Weir (Controls 0.00 cfs)
3=Orifice/Grate (Controls 0.00 cfs)

Pond SS-4: Subsurface Infiltration (24" Pipe) - Chamber Wizard Field A

Chamber Model = ADS N-12 24" (ADS N-12® Pipe)
Inside= 23.8"W x 23.8"H => 3.10 sf x 20.00'L = 62.0 cf
Outside= 28.0"W x 28.0"H => 3.92 sf x 20.00'L = 78.4 cf
Row Length Adjustment= -2.00' x 3.10 sf x 24 rows

28.0" Wide + 13.4" Spacing = 41.4" C-C Row Spacing

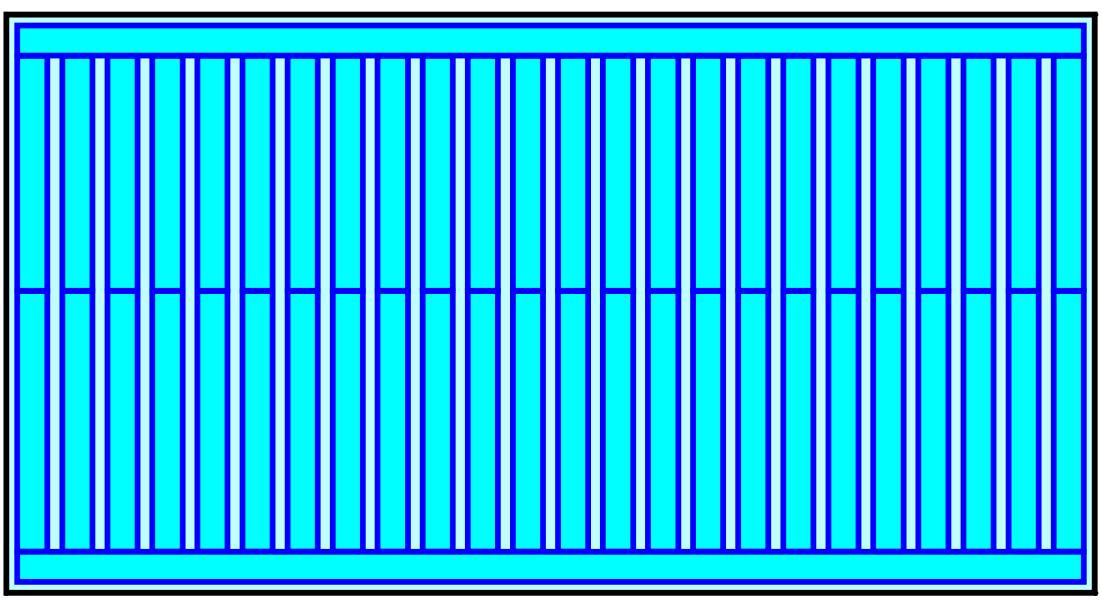
2 Chambers/Row x 20.00' Long -2.00' Row Adjustment +2.33' Header x 2 = 42.67' Row Length +10.0" End Stone x 2 = 44.33' Base Length
24 Rows x 28.0" Wide + 13.4" Spacing x 23 + 10.0" Side Stone x 2 = 83.35' Base Width
4.0" Base + 28.0" Chamber Height + 4.0" Cover = 3.00' Field Height

48 Chambers x 62.0 cf -2.00' Row Adjustment x 3.10 sf x 24 Rows + 81.68' Header x 3.10 sf x 2 = 3,333.6 cf Chamber Storage
48 Chambers x 78.4 cf -2.00' Row Adjustment x 3.92 sf x 24 Rows + 81.68' Header x 3.92 sf x 2 = 4,215.1 cf Displacement

11,085.9 cf Field - 4,215.1 cf Chambers = 6,870.9 cf Stone x 40.0% Voids = 2,748.3 cf Stone Storage

Chamber Storage + Stone Storage = 6,082.0 cf = 0.140 af
Overall Storage Efficiency = 54.9%
Overall System Size = 44.33' x 83.35' x 3.00'

48 Chambers
410.6 cy Field
254.5 cy Stone



Pond SS-4: Subsurface Infiltration (24" Pipe) - Chamber Wizard Field B

Chamber Model = ADS N-12 24" (ADS N-12® Pipe)
Inside= 23.8"W x 23.8"H => 3.10 sf x 20.00'L = 62.0 cf
Outside= 28.0"W x 28.0"H => 3.92 sf x 20.00'L = 78.4 cf

28.0" Wide + 13.4" Spacing = 41.4" C-C Row Spacing

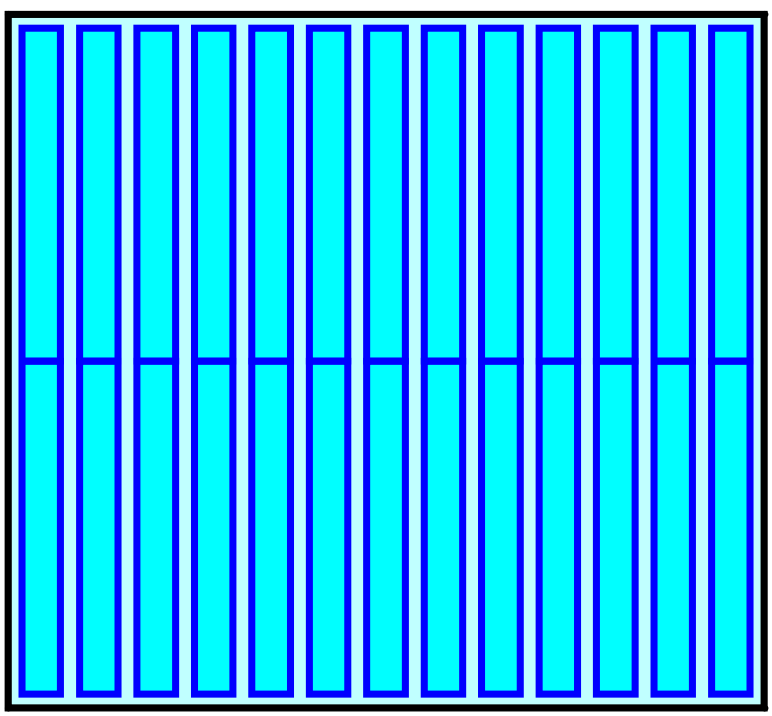
2 Chambers/Row x 20.00' Long = 40.00' Row Length +10.0" End Stone x 2 = 41.67' Base Length
13 Rows x 28.0" Wide + 13.4" Spacing x 12 + 10.0" Side Stone x 2 = 45.40' Base Width
4.0" Base + 28.0" Chamber Height + 4.0" Cover = 3.00' Field Height

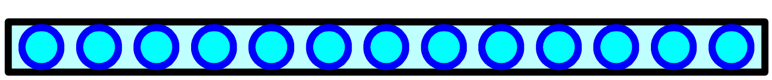
26 Chambers x 62.0 cf = 1,612.0 cf Chamber Storage
26 Chambers x 78.4 cf = 2,038.2 cf Displacement

5,675.2 cf Field - 2,038.2 cf Chambers = 3,637.0 cf Stone x 40.0% Voids = 1,454.8 cf Stone Storage

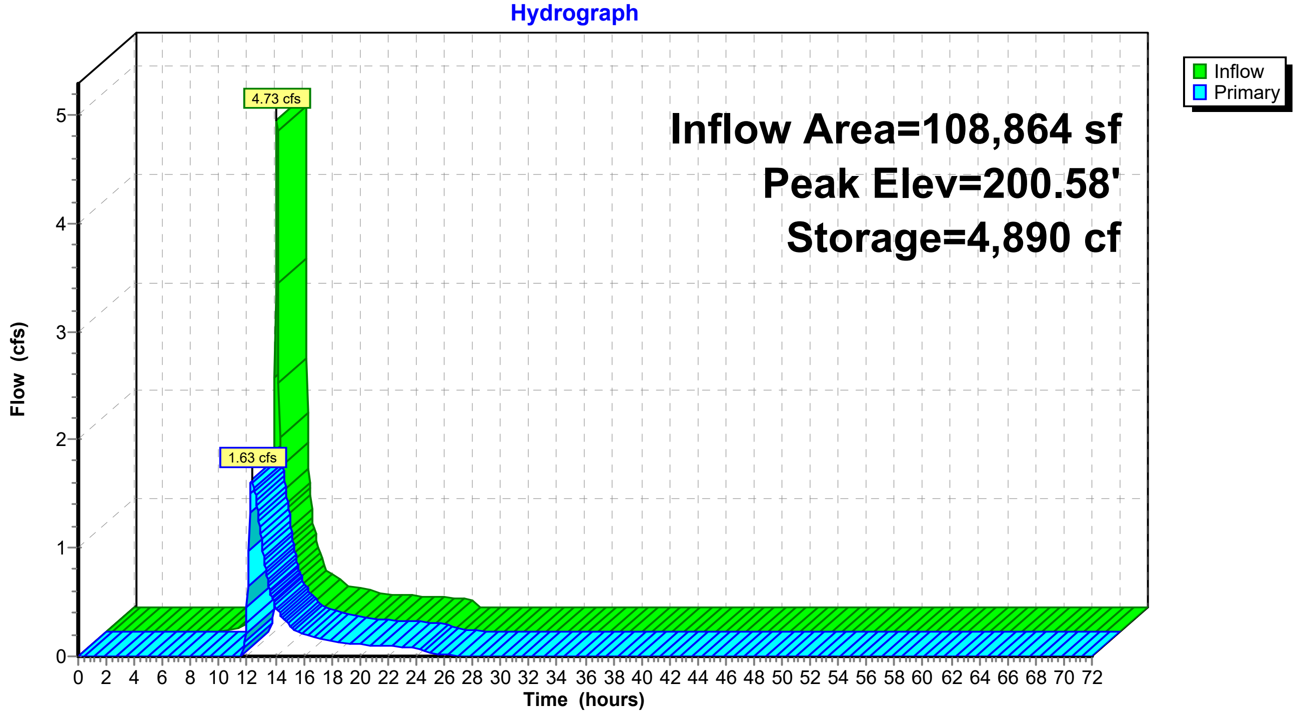
Chamber Storage + Stone Storage = 3,066.8 cf = 0.070 af
Overall Storage Efficiency = 54.0%
Overall System Size = 41.67' x 45.40' x 3.00'

26 Chambers
210.2 cy Field
134.7 cy Stone





Pond SS-4: Subsurface Infiltration (24" Pipe)



Summary for Pond SS-5: Subsurface Infiltration (SC-310 Chambers)

Inflow Area =	90,263 sf, 83.25% Impervious,	Inflow Depth = 2.69" for 2-yr event		
Inflow =	5.93 cfs @	12.13 hrs, Volume=	20,231 cf	
Outflow =	4.69 cfs @	12.18 hrs, Volume=	19,318 cf,	Atten= 21%, Lag= 3.4 min
Primary =	2.86 cfs @	12.18 hrs, Volume=	13,632 cf	
Secondary =	1.83 cfs @	12.18 hrs, Volume=	5,686 cf	

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 194.48' @ 12.18 hrs Surf.Area= 4,565 sf Storage= 3,290 cf

Plug-Flow detention time= 65.8 min calculated for 19,318 cf (95% of inflow)
Center-of-Mass det. time= 38.7 min (829.3 - 790.6)

Volume	Invert	Avail.Storage	Storage Description
#1A	193.30'	3,199 cf	**41.50'W x 110.00'L x 2.33'H Field A** 10,652 cf Overall - 2,654 cf Embedded = 7,998 cf x 40.0% Voids
#2A	193.80'	2,654 cf	**ADS_StormTech SC-310 +Cap** x 180 Inside #1 Effective Size= 28.9"W x 16.0"H => 2.07 sf x 7.12'L = 14.7 cf Overall Size= 34.0"W x 16.0"H x 7.56'L with 0.44' Overlap 12 Rows of 15 Chambers
		5,853 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	193.80'	**19.0" W x 8.0" H Vert. Orifice/Grate** C= 0.600
#2	Primary	195.45'	**5.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)
#3	Secondary	193.80'	**14.0" Vert. Orifice/Grate** C= 0.600

Primary OutFlow Max=2.82 cfs @ 12.18 hrs HW=194.48' (Free Discharge)
1=Orifice/Grate (Orifice Controls 2.82 cfs @ 2.67 fps)
2=Sharp-Crested Rectangular Weir (Controls 0.00 cfs)

Secondary OutFlow Max=1.80 cfs @ 12.18 hrs HW=194.48' (Free Discharge)
3=Orifice/Grate (Orifice Controls 1.80 cfs @ 2.80 fps)

Pond SS-5: Subsurface Infiltration (SC-310 Chambers) - Chamber Wizard Field A

Chamber Model = ADS_StormTechSC-310 +Cap (ADS StormTech®SC-310 with cap length)
Effective Size= 28.9"W x 16.0"H => 2.07 sf x 7.12'L = 14.7 cf
Overall Size= 34.0"W x 16.0"H x 7.56'L with 0.44' Overlap

34.0" Wide + 6.0" Spacing = 40.0" C-C Row Spacing

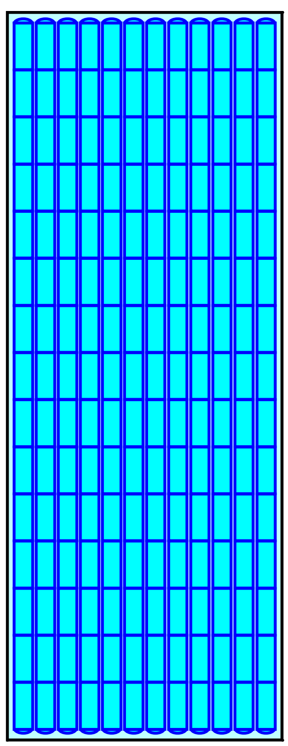
15 Chambers/Row x 7.12' Long +0.60' Cap Length x 2 = 108.00' Row Length +12.0" End Stone x 2 = 110.00' Base Length
12 Rows x 34.0" Wide + 6.0" Spacing x 11 + 12.0" Side Stone x 2 = 41.50' Base Width
6.0" Base + 16.0" Chamber Height + 6.0" Cover = 2.33' Field Height

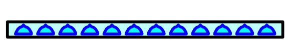
180 Chambers x 14.7 cf = 2,653.6 cf Chamber Storage

10,651.7 cf Field - 2,653.6 cf Chambers = 7,998.1 cf Stone x 40.0% Voids = 3,199.2 cf Stone Storage

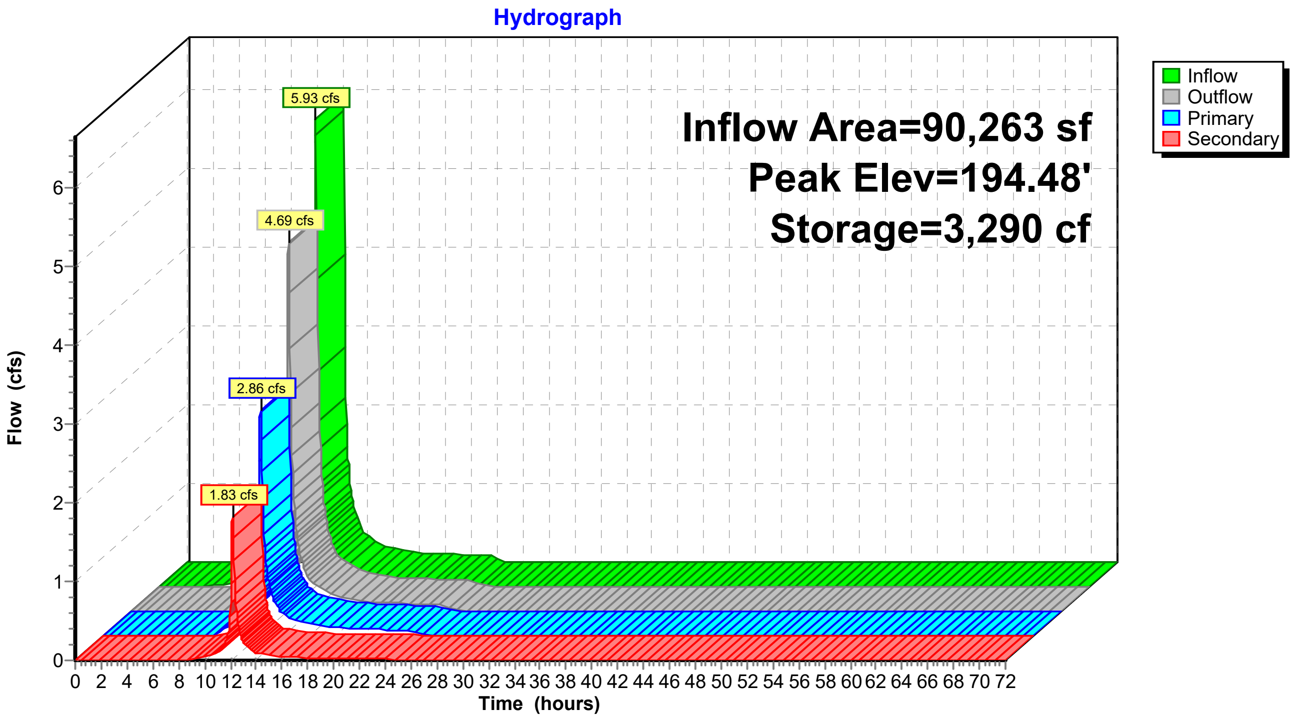
Chamber Storage + Stone Storage = 5,852.8 cf = 0.134 af
Overall Storage Efficiency = 54.9%
Overall System Size = 110.00' x 41.50' x 2.33'

180 Chambers
394.5 cy Field
296.2 cy Stone





Pond SS-5: Subsurface Infiltration (SC-310 Chambers)



Time span=0.00-72.00 hrs, dt=0.05 hrs, 1441 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment PDA-1: Wooded Area Runoff Area=125,686 sf 0.00% Impervious Runoff Depth=2.29"
Flow Length=642' Tc=9.3 min CN=71 Runoff=6.68 cfs 24,005 cf

Subcatchment PDA10: PDA10 Runoff Area=110,656 sf 69.66% Impervious Runoff Depth=4.21"
Tc=6.0 min CN=91 Runoff=11.35 cfs 38,782 cf

Subcatchment PDA11: PDA11 Runoff Area=26,182 sf 63.13% Impervious Runoff Depth=3.99"
Tc=6.0 min CN=89 Runoff=2.59 cfs 8,711 cf

Subcatchment PDA12: PDA12 Runoff Area=146,011 sf 28.74% Impervious Runoff Depth=3.19"
Tc=6.0 min CN=81 Runoff=12.05 cfs 38,808 cf

Subcatchment PDA2: Proposed 2 Runoff Area=36,252 sf 38.40% Impervious Runoff Depth=3.38"
Tc=6.0 min CN=83 Runoff=3.15 cfs 10,220 cf

Subcatchment PDA3: Proposed 3 Runoff Area=41,814 sf 58.47% Impervious Runoff Depth=3.89"
Tc=6.0 min CN=88 Runoff=4.06 cfs 13,547 cf

Subcatchment PDA4: Proposed 4 Runoff Area=108,864 sf 38.92% Impervious Runoff Depth=3.29"
Tc=6.0 min CN=82 Runoff=9.22 cfs 29,807 cf

Subcatchment PDA5: Proposed 5 Runoff Area=173,681 sf 20.35% Impervious Runoff Depth=2.91"
Tc=6.0 min CN=78 Runoff=13.17 cfs 42,089 cf

Subcatchment PDA6: Proposal 6 Runoff Area=10,283 sf 56.37% Impervious Runoff Depth=3.89"
Tc=6.0 min CN=88 Runoff=1.00 cfs 3,332 cf

Subcatchment PDA7: Proposal 7 Runoff Area=162,554 sf 31.31% Impervious Runoff Depth=3.19"
Tc=6.0 min CN=81 Runoff=13.42 cfs 43,205 cf

Subcatchment PDA8: Proposed 8 Runoff Area=90,263 sf 83.25% Impervious Runoff Depth=4.54"
Tc=6.0 min CN=94 Runoff=9.67 cfs 34,112 cf

Subcatchment PDA9: Proposed 9 Runoff Area=115,414 sf 0.00% Impervious Runoff Depth=2.21"
Flow Length=366' Tc=12.4 min CN=70 Runoff=5.36 cfs 21,240 cf

Reach DP-A: Eastern Intermittent Stream Inflow=6.68 cfs 24,005 cf
Outflow=6.68 cfs 24,005 cf

Reach DP-B: Concord Street Main Inflow=19.22 cfs 83,305 cf
Outflow=19.22 cfs 83,305 cf

Reach DP-C1: Wetlands Inflow=47.50 cfs 190,267 cf
Outflow=47.50 cfs 190,267 cf

Reach DP-C2: Intermittent Stream West Inflow=5.36 cfs 21,240 cf
Outflow=5.36 cfs 21,240 cf

Reach PR TOT: Total Site Inflow=73.18 cfs 297,577 cf
Outflow=73.18 cfs 297,577 cf

Reach SWALE: Bioswale Avg. Flow Depth=0.45' Max Vel=1.70 fps Inflow=2.59 cfs 8,711 cf
n=0.040 L=100.0' S=0.0100 '/' Capacity=7.19 cfs Outflow=2.47 cfs 8,711 cf

Pond SI-1: Surface Infiltration Peak Elev=200.16' Storage=3,244 cf Inflow=4.06 cfs 13,547 cf
Outflow=3.36 cfs 11,488 cf

Pond SI-2: Surface System Peak Elev=194.41' Storage=3,619 cf Inflow=11.35 cfs 38,782 cf
Outflow=10.83 cfs 36,644 cf

Pond SS-1: Subsurface Infiltration Peak Elev=185.70' Storage=4,991 cf Inflow=12.05 cfs 38,808 cf
Outflow=9.60 cfs 37,640 cf

Pond SS-2: Subsurface Infiltration (SC-740 Peak Elev=187.64' Storage=2,006 cf Inflow=1.00 cfs 3,332 cf
Outflow=0.08 cfs 2,226 cf

Pond SS-3: Subsurface Infiltration (24" Peak Elev=195.20' Storage=7,696 cf Inflow=13.42 cfs 43,205 cf
Outflow=8.20 cfs 41,718 cf

Pond SS-4: Subsurface Infiltration (24" Peak Elev=201.34' Storage=7,695 cf Inflow=9.22 cfs 29,807 cf
Outflow=6.07 cfs 28,399 cf

Pond SS-5: Subsurface Infiltration (SC-310 Peak Elev=194.83' Storage=4,305 cf Inflow=9.67 cfs 34,112 cf
Primary=4.21 cfs 22,547 cf Secondary=3.47 cfs 10,652 cf Outflow=7.68 cfs 33,199 cf

Total Runoff Area = 1,147,660 sf Runoff Volume = 307,856 cf Average Runoff Depth = 3.22"
66.58% Pervious = 764,152 sf 33.42% Impervious = 383,508 sf

Summary for Subcatchment PDA-1: Wooded Area

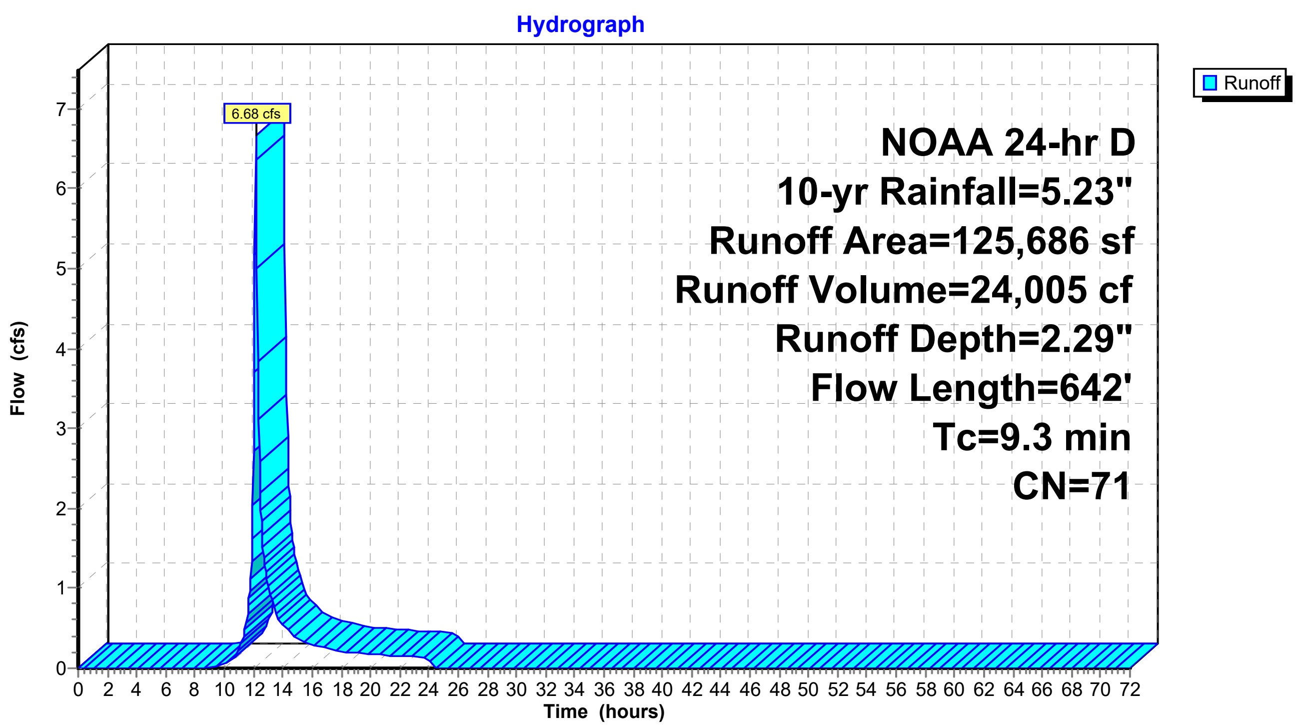
Runoff = 6.68 cfs @ 12.17 hrs, Volume= 24,005 cf, Depth= 2.29"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
NOAA 24-hr D 10-yr Rainfall=5.23"

Area (sf)	CN	Description
25,856	74	>75% Grass cover, Good, HSG C
99,830	70	Woods, Good, HSG C
125,686	71	Weighted Average
125,686		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.1	50	0.1700	0.16		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.35"
0.3	130	0.1600	6.44		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
3.9	462	0.0150	1.97		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
9.3	642	Total			

Subcatchment PDA-1: Wooded Area



Summary for Subcatchment PDA10: PDA10

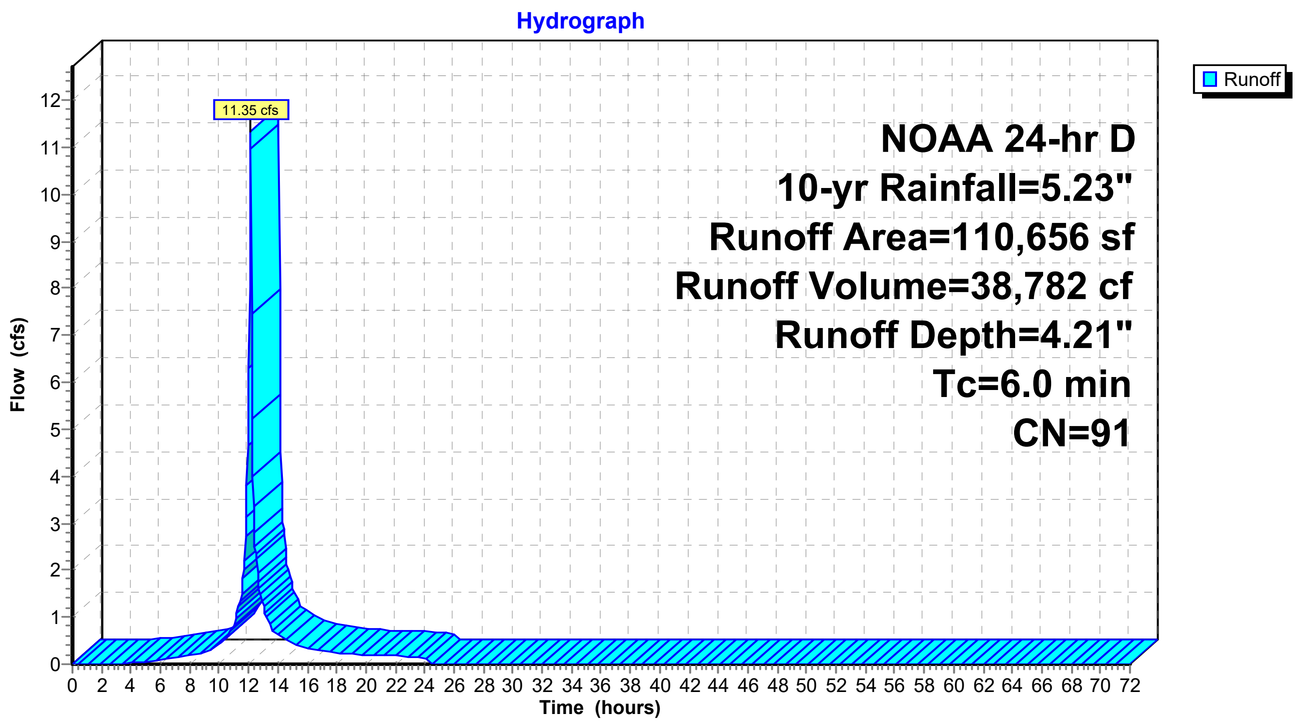
Runoff = 11.35 cfs @ 12.13 hrs, Volume= 38,782 cf, Depth= 4.21"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
NOAA 24-hr D 10-yr Rainfall=5.23"

Area (sf)	CN	Description
33,569	74	>75% Grass cover, Good, HSG C
30,240	98	Roofs, HSG C
46,847	98	Paved parking, HSG C
110,656	91	Weighted Average
33,569		30.34% Pervious Area
77,087		69.66% Impervious Area

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

Subcatchment PDA10: PDA10



Summary for Subcatchment PDA11: PDA11

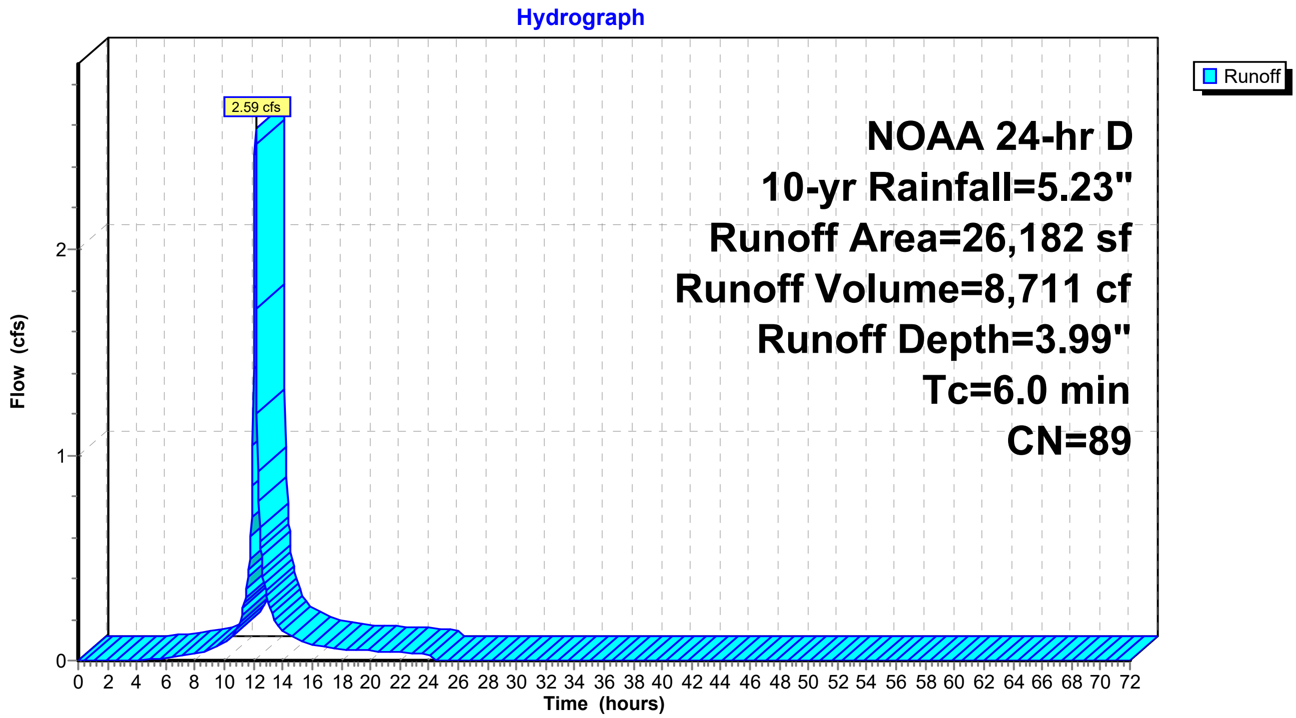
Runoff = 2.59 cfs @ 12.13 hrs, Volume= 8,711 cf, Depth= 3.99"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
NOAA 24-hr D 10-yr Rainfall=5.23"

Area (sf)	CN	Description
9,652	74	>75% Grass cover, Good, HSG C
16,530	98	Paved parking, HSG C
26,182	89	Weighted Average
9,652		36.87% Pervious Area
16,530		63.13% Impervious Area

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

Subcatchment PDA11: PDA11



Summary for Subcatchment PDA12: PDA12

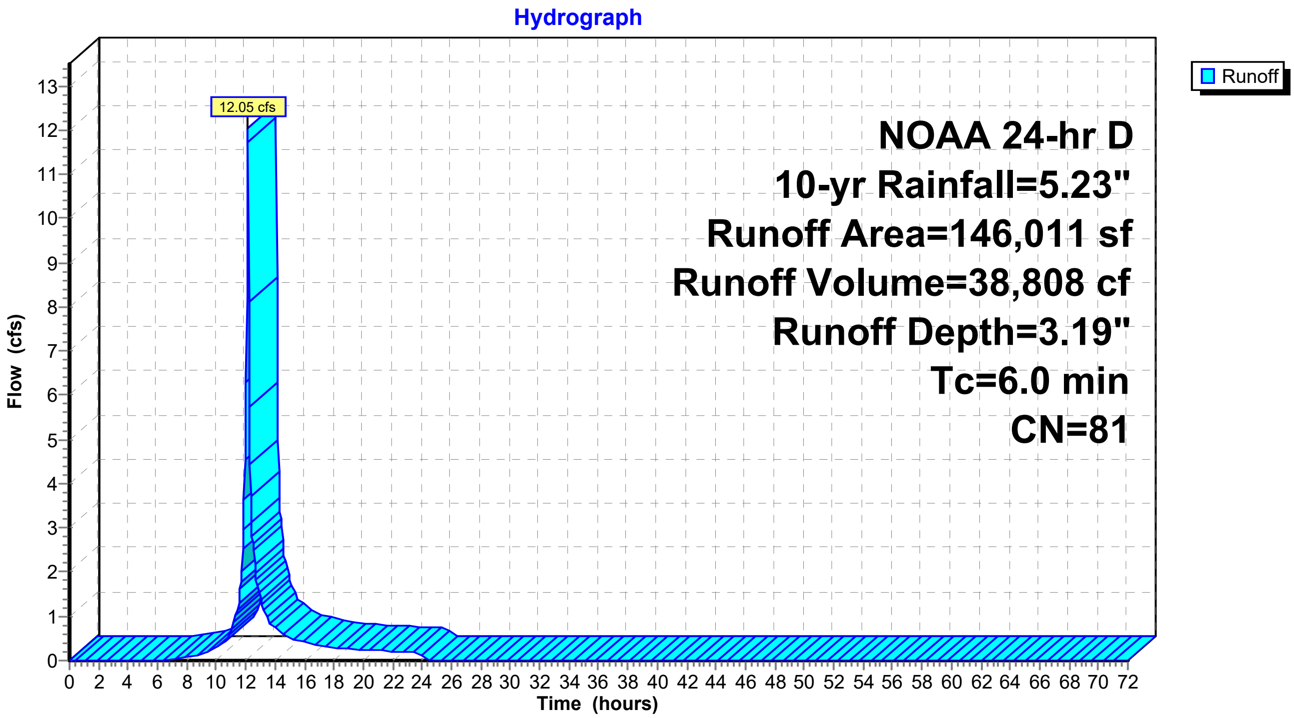
Runoff = 12.05 cfs @ 12.13 hrs, Volume= 38,808 cf, Depth= 3.19"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
NOAA 24-hr D 10-yr Rainfall=5.23"

Area (sf)	CN	Description
104,041	74	>75% Grass cover, Good, HSG C
41,970	98	Paved parking, HSG C
146,011	81	Weighted Average
104,041		71.26% Pervious Area
41,970		28.74% Impervious Area

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

Subcatchment PDA12: PDA12



Summary for Subcatchment PDA2: Proposed 2

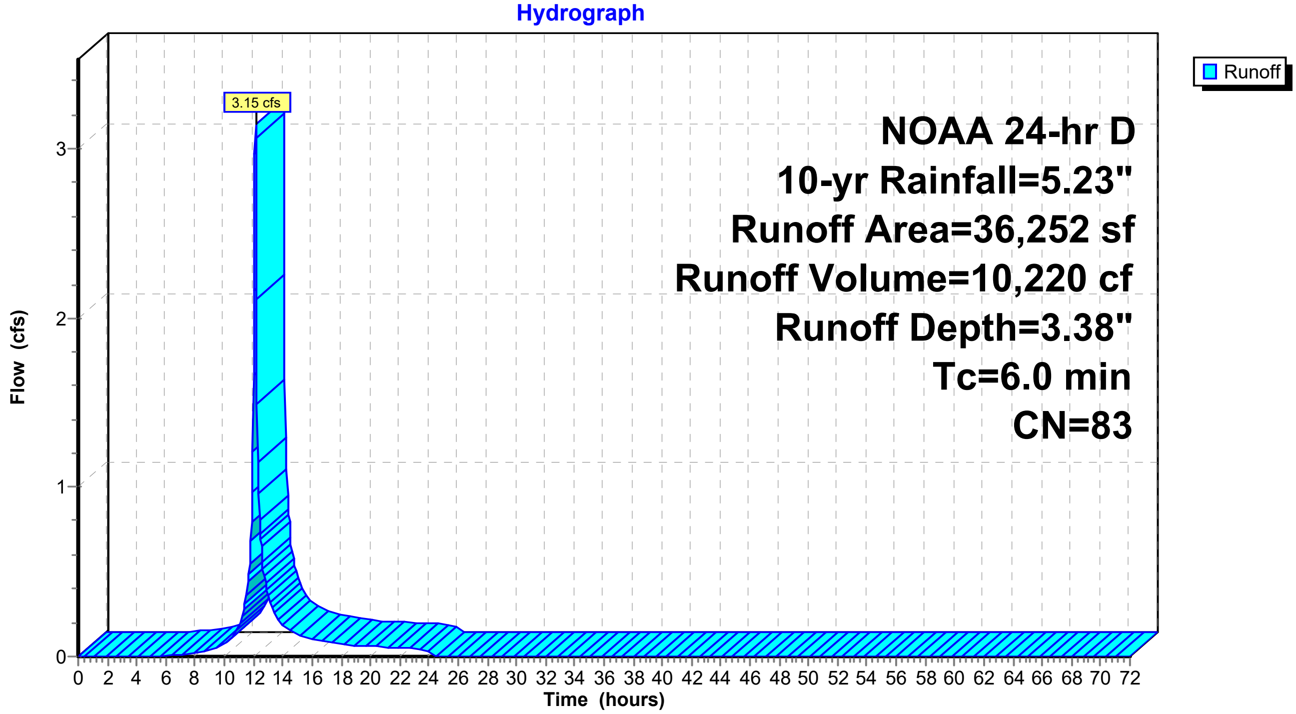
Runoff = 3.15 cfs @ 12.13 hrs, Volume= 10,220 cf, Depth= 3.38"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
NOAA 24-hr D 10-yr Rainfall=5.23"

Area (sf)	CN	Description
22,332	74	>75% Grass cover, Good, HSG C
13,920	98	Paved parking, HSG C
36,252	83	Weighted Average
22,332		61.60% Pervious Area
13,920		38.40% Impervious Area

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

Subcatchment PDA2: Proposed 2



Summary for Subcatchment PDA3: Proposed 3

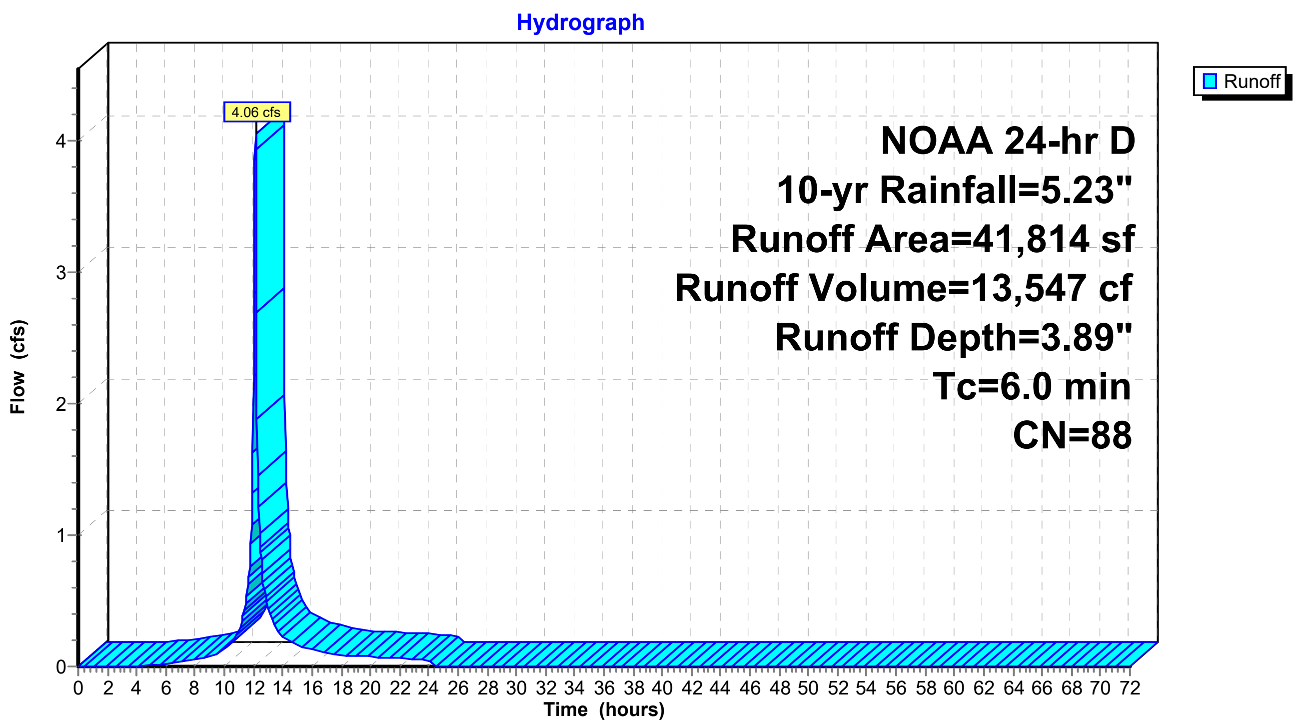
Runoff = 4.06 cfs @ 12.13 hrs, Volume= 13,547 cf, Depth= 3.89"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
NOAA 24-hr D 10-yr Rainfall=5.23"

Area (sf)	CN	Description
24,450	98	Paved parking, HSG C
17,364	74	>75% Grass cover, Good, HSG C
41,814	88	Weighted Average
17,364		41.53% Pervious Area
24,450		58.47% Impervious Area

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

Subcatchment PDA3: Proposed 3



Summary for Subcatchment PDA4: Proposed 4

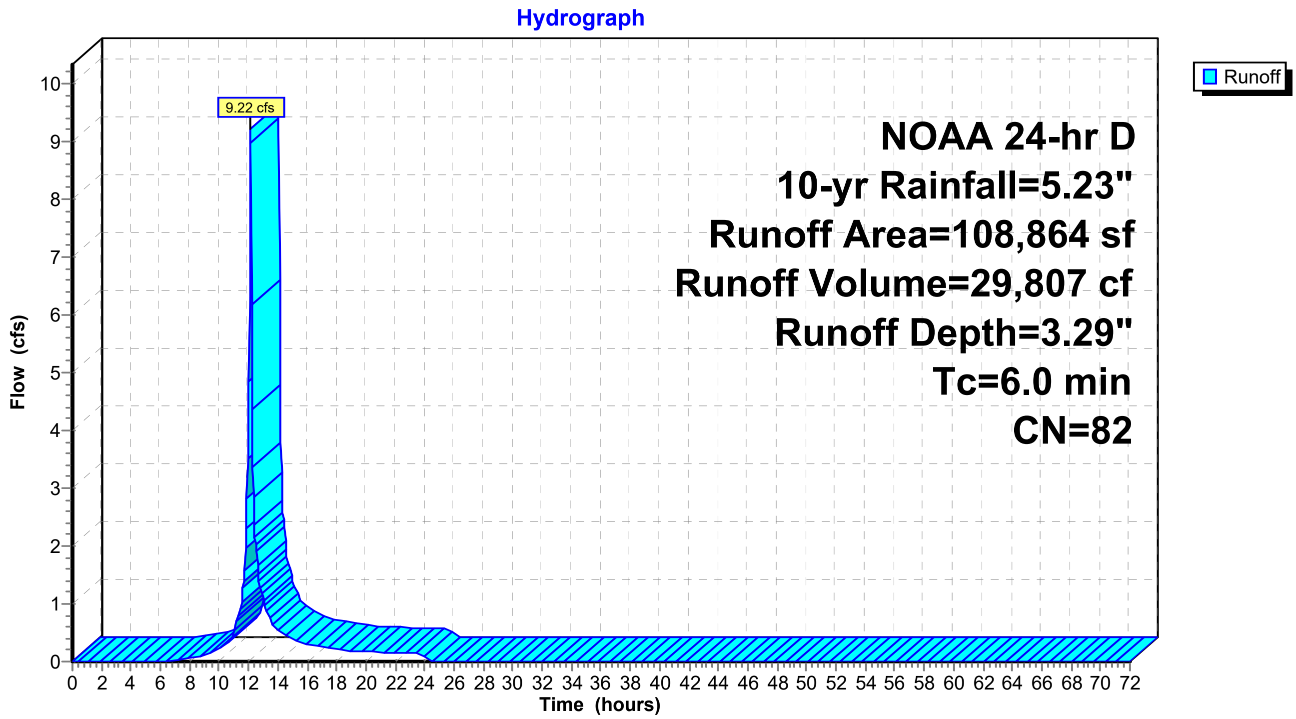
Runoff = 9.22 cfs @ 12.13 hrs, Volume= 29,807 cf, Depth= 3.29"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
NOAA 24-hr D 10-yr Rainfall=5.23"

	Area (sf)	CN	Description
	35,864	74	>75% Grass cover, Good, HSG C
	33,354	98	Paved roads w/curbs & sewers, HSG C
	30,631	70	Woods, Good, HSG C
*	9,015	98	Roofs, HSG C
	108,864	82	Weighted Average
	66,495		61.08% Pervious Area
	42,369		38.92% Impervious Area

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

Subcatchment PDA4: Proposed 4



Summary for Subcatchment PDA5: Proposed 5

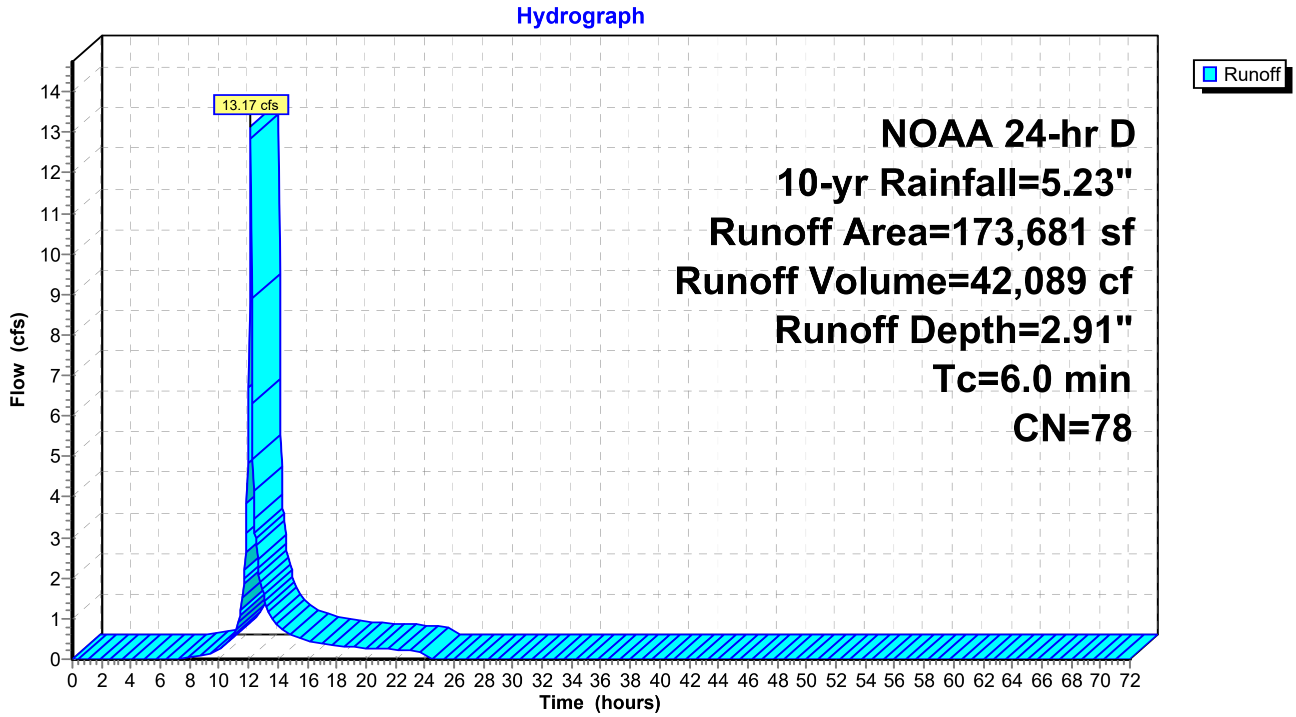
Runoff = 13.17 cfs @ 12.13 hrs, Volume= 42,089 cf, Depth= 2.91"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
NOAA 24-hr D 10-yr Rainfall=5.23"

	Area (sf)	CN	Description
	98,683	74	>75% Grass cover, Good, HSG C
	39,650	70	Woods, Good, HSG C
*	35,348	98	Pond
	173,681	78	Weighted Average
	138,333		79.65% Pervious Area
	35,348		20.35% Impervious Area

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

Subcatchment PDA5: Proposed 5



Summary for Subcatchment PDA6: Proposal 6

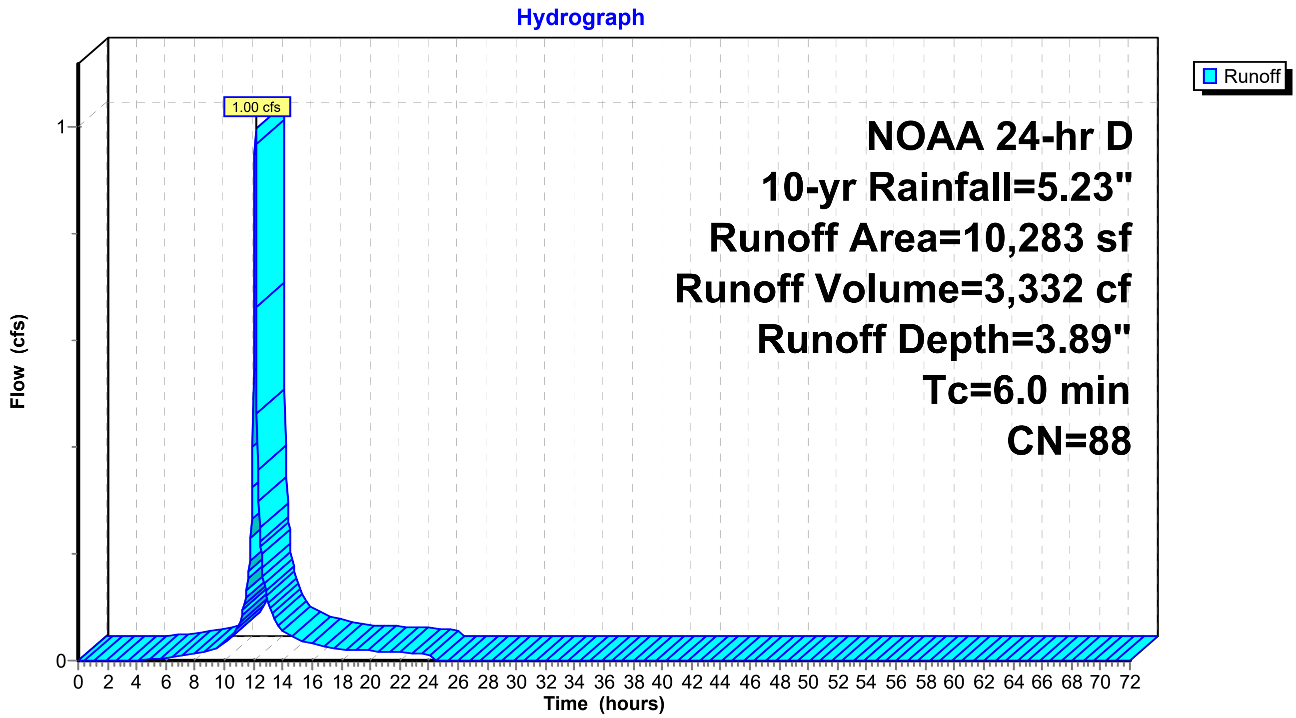
Runoff = 1.00 cfs @ 12.13 hrs, Volume= 3,332 cf, Depth= 3.89"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
NOAA 24-hr D 10-yr Rainfall=5.23"

Area (sf)	CN	Description
5,797	98	Paved parking, HSG C
4,486	74	>75% Grass cover, Good, HSG C
10,283	88	Weighted Average
4,486		43.63% Pervious Area
5,797		56.37% Impervious Area

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

Subcatchment PDA6: Proposal 6



Summary for Subcatchment PDA7: Proposal 7

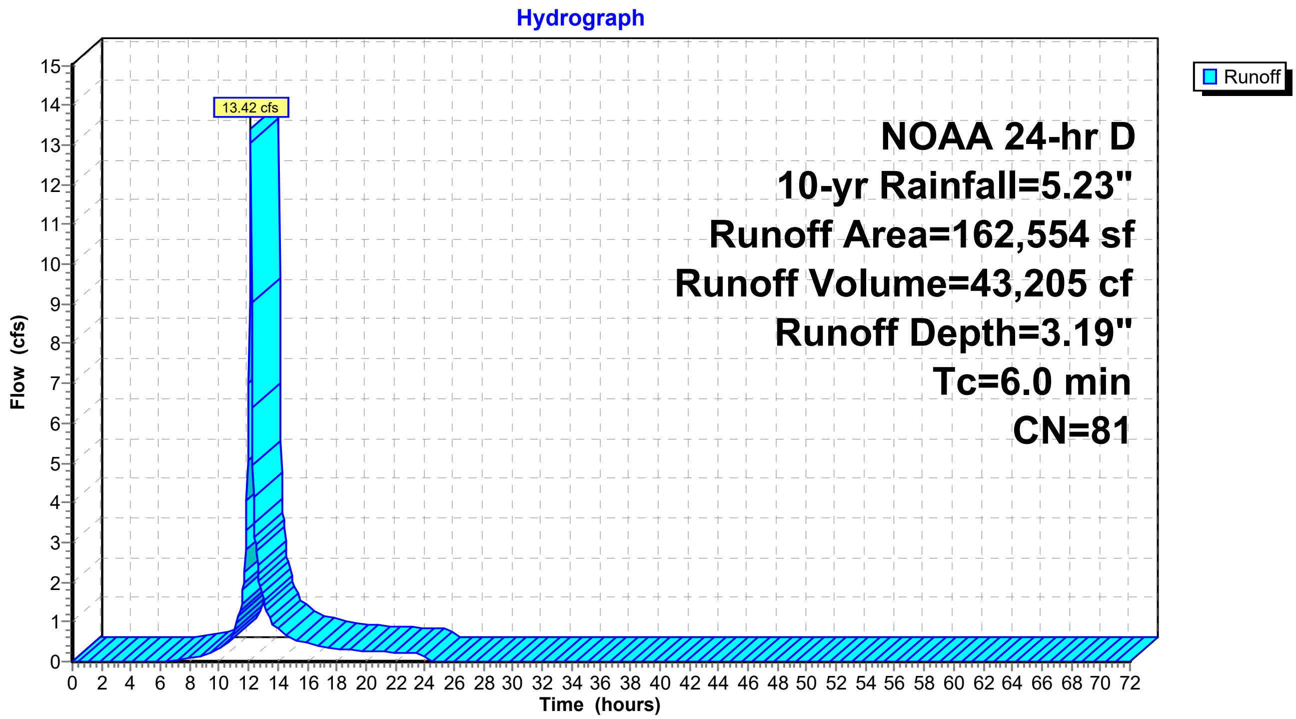
Runoff = 13.42 cfs @ 12.13 hrs, Volume= 43,205 cf, Depth= 3.19"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
NOAA 24-hr D 10-yr Rainfall=5.23"

Area (sf)	CN	Description
32,254	98	Roofs, HSG C
75,527	74	>75% Grass cover, Good, HSG C
18,642	98	Paved parking, HSG C
36,131	70	Woods, Good, HSG C
162,554	81	Weighted Average
111,658		68.69% Pervious Area
50,896		31.31% Impervious Area

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

Subcatchment PDA7: Proposal 7



Summary for Subcatchment PDA8: Proposed 8

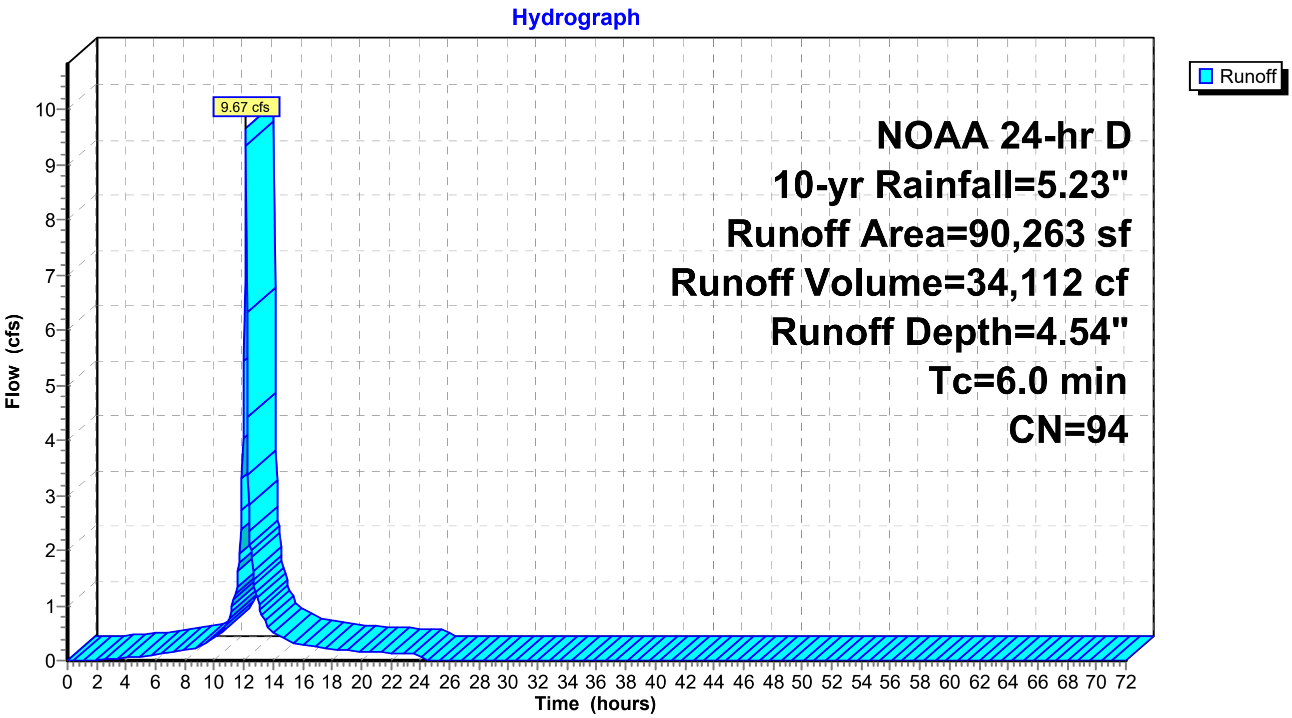
Runoff = 9.67 cfs @ 12.13 hrs, Volume= 34,112 cf, Depth= 4.54"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
NOAA 24-hr D 10-yr Rainfall=5.23"

Area (sf)	CN	Description
75,141	98	Paved parking, HSG C
15,122	74	>75% Grass cover, Good, HSG C
90,263	94	Weighted Average
15,122		16.75% Pervious Area
75,141		83.25% Impervious Area

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

Subcatchment PDA8: Proposed 8



Summary for Subcatchment PDA9: Proposed 9

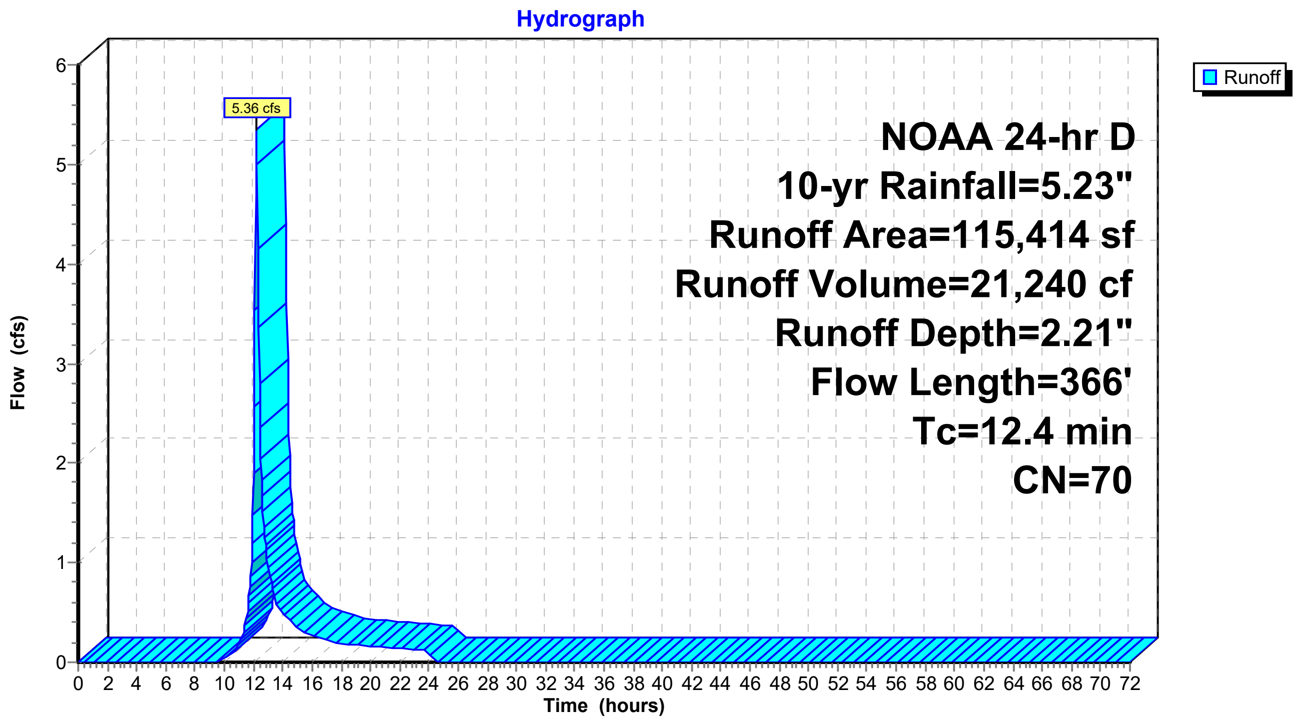
Runoff = 5.36 cfs @ 12.21 hrs, Volume= 21,240 cf, Depth= 2.21"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
NOAA 24-hr D 10-yr Rainfall=5.23"

Area (sf)	CN	Description
105,951	70	Woods, Good, HSG C
9,463	74	>75% Grass cover, Good, HSG C
115,414	70	Weighted Average
115,414		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.1	50	0.0400	0.09		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.35"
3.3	316	0.1000	1.58		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
12.4	366	Total			

Subcatchment PDA9: Proposed 9



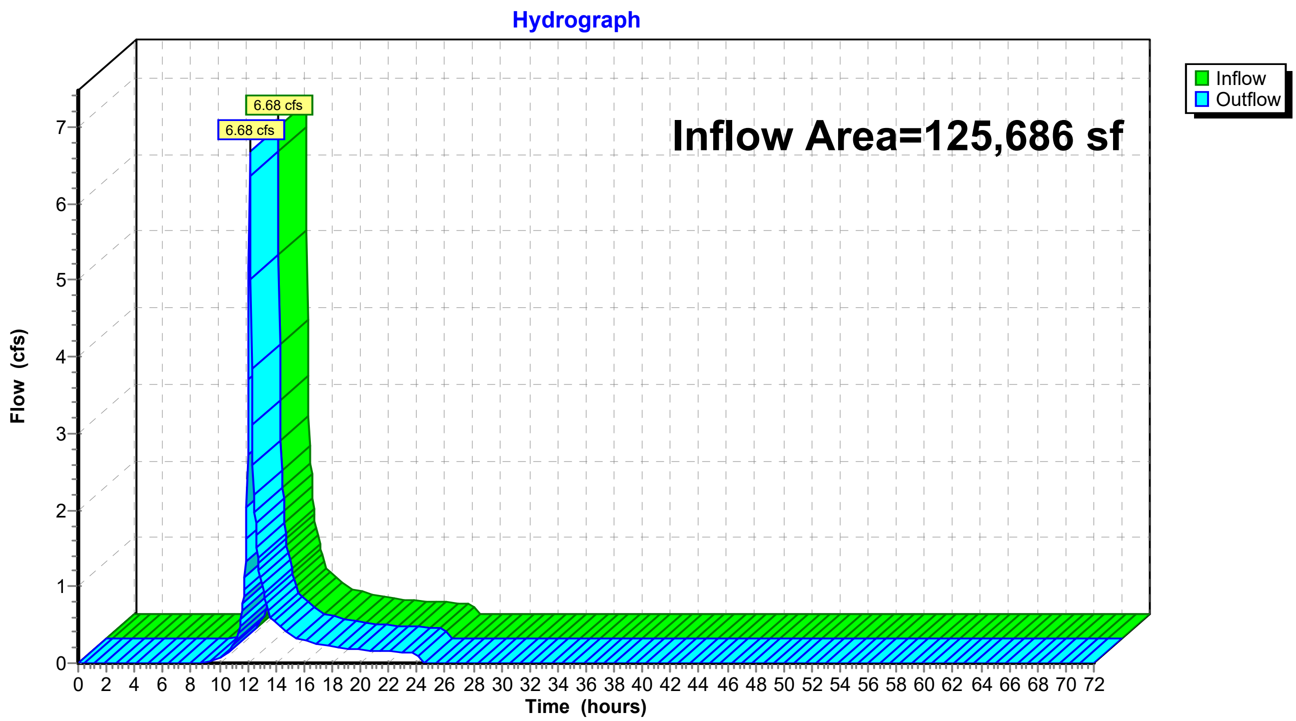
Summary for Reach DP-A: Eastern Intermittent Stream

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

Inflow Area =	125,686 sf,	0.00% Impervious,	Inflow Depth = 2.29"	for 10-yr event
Inflow =	6.68 cfs @	12.17 hrs, Volume=	24,005 cf	
Outflow =	6.68 cfs @	12.17 hrs, Volume=	24,005 cf,	Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

Reach DP-A: Eastern Intermittent Stream



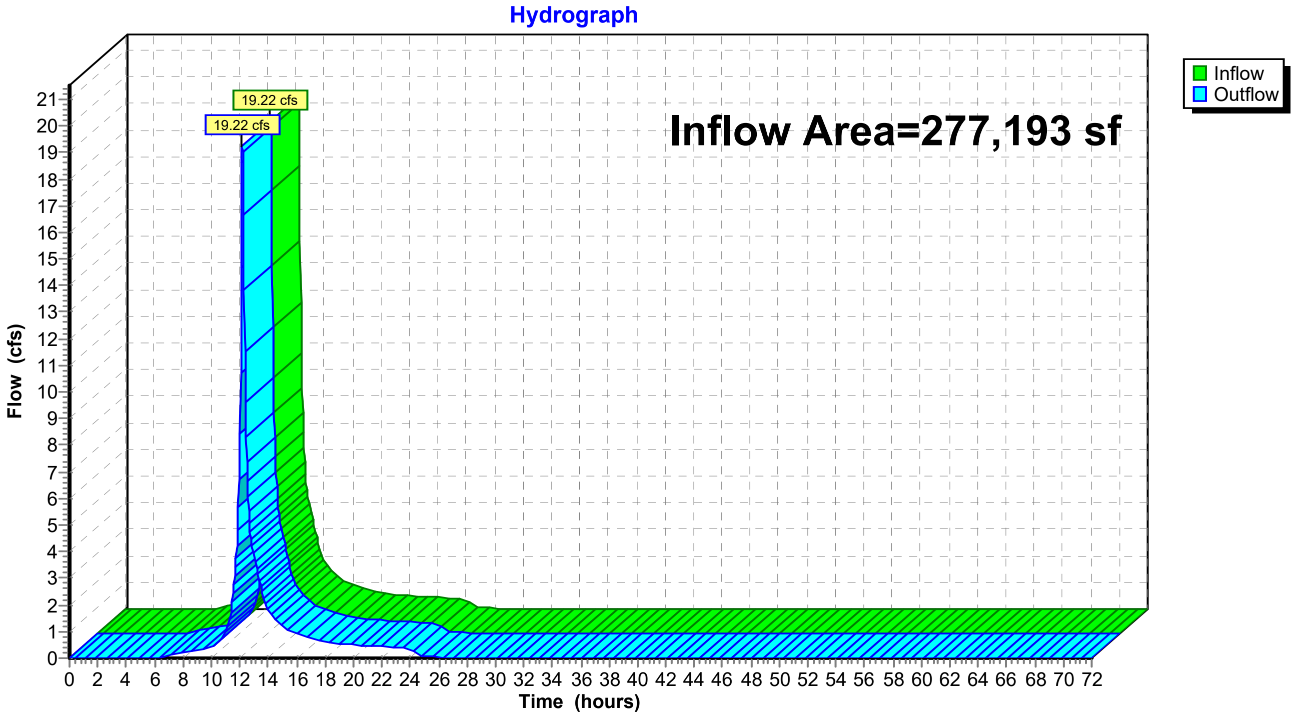
Summary for Reach DP-B: Concord Street Main

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

Inflow Area = 277,193 sf, 56.24% Impervious, Inflow Depth = 3.61" for 10-yr event
Inflow = 19.22 cfs @ 12.18 hrs, Volume= 83,305 cf
Outflow = 19.22 cfs @ 12.18 hrs, Volume= 83,305 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

Reach DP-B: Concord Street Main



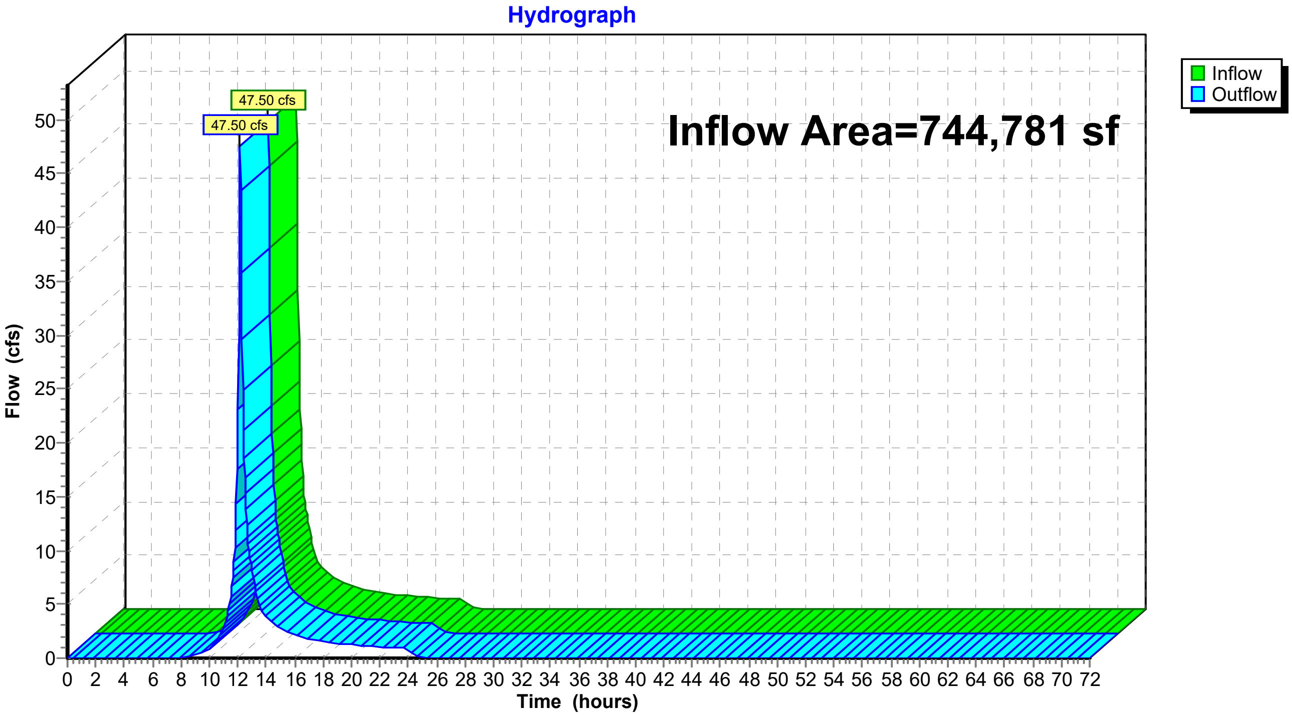
Summary for Reach DP-C1: Wetlands

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

Inflow Area = 744,781 sf, 30.56% Impervious, Inflow Depth = 3.07" for 10-yr event
Inflow = 47.50 cfs @ 12.16 hrs, Volume= 190,267 cf
Outflow = 47.50 cfs @ 12.16 hrs, Volume= 190,267 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

Reach DP-C1: Wetlands

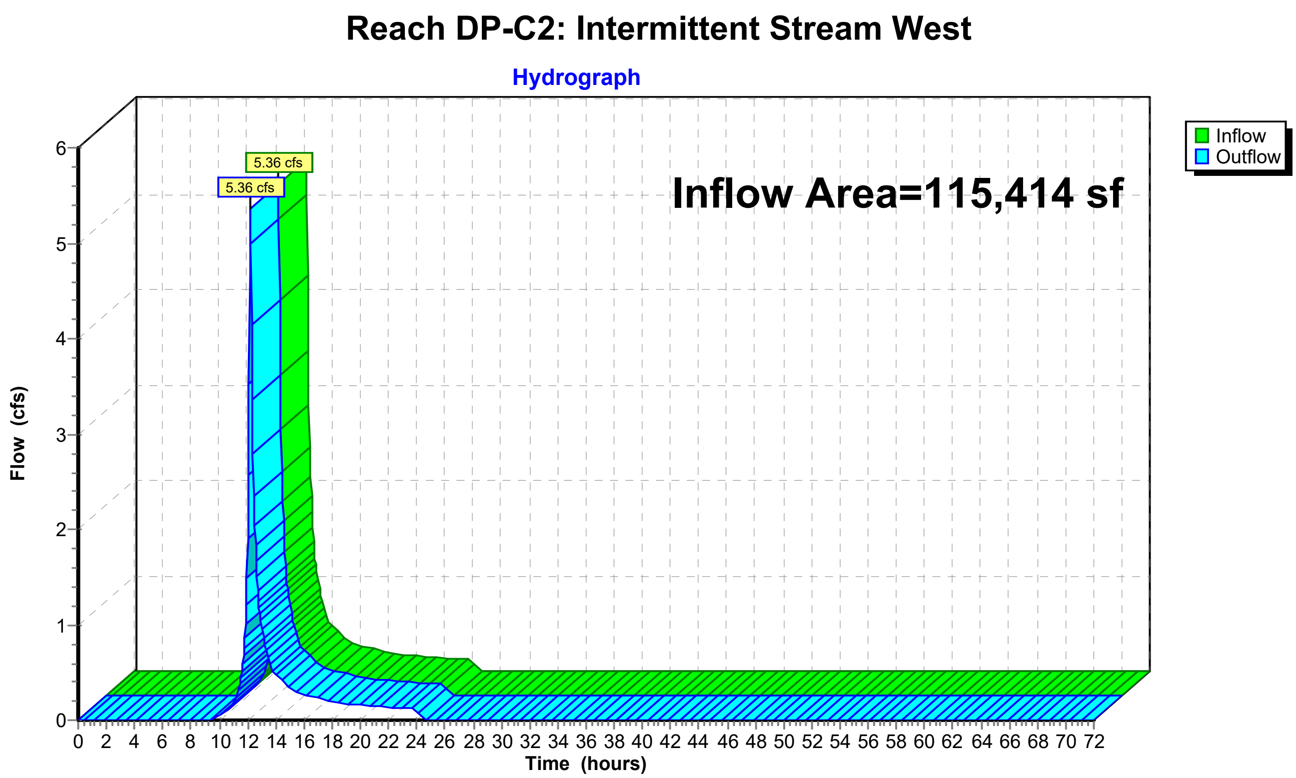


Summary for Reach DP-C2: Intermittent Stream West

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

Inflow Area =	115,414 sf,	0.00% Impervious,	Inflow Depth = 2.21"	for 10-yr event
Inflow =	5.36 cfs @	12.21 hrs, Volume=	21,240 cf	
Outflow =	5.36 cfs @	12.21 hrs, Volume=	21,240 cf,	Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs



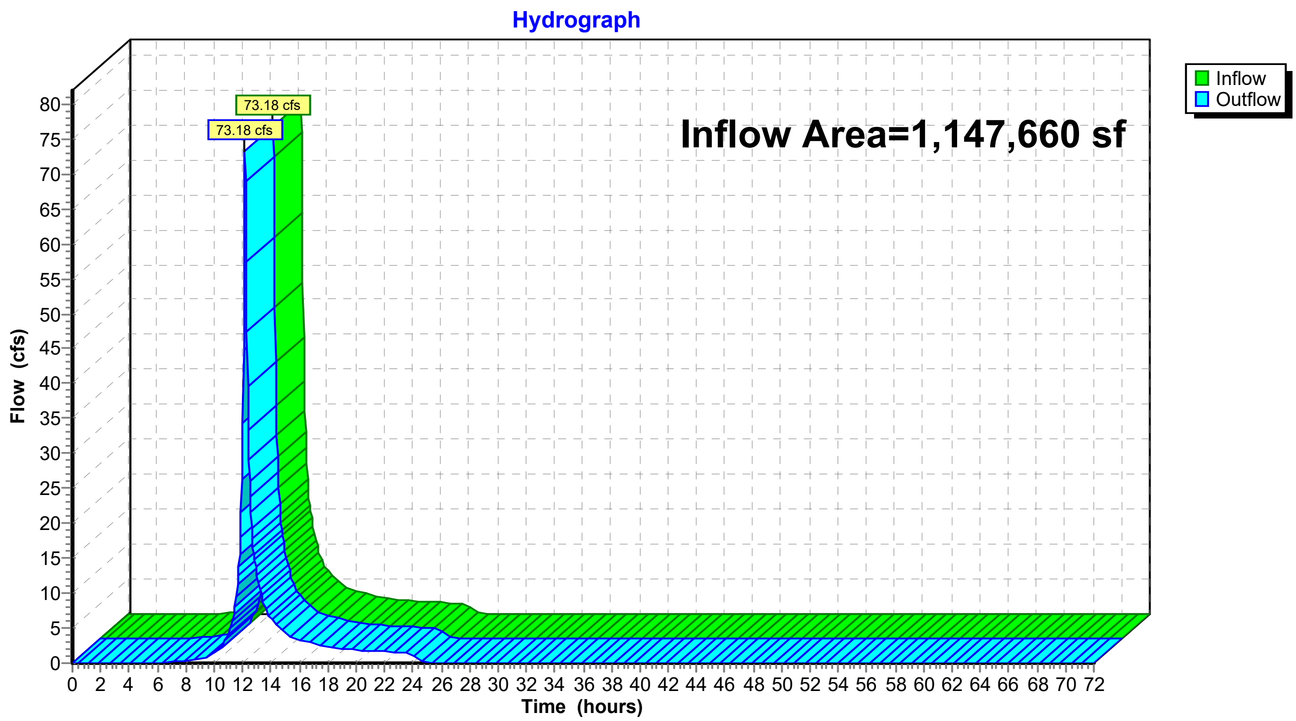
Summary for Reach PR TOT: Total Site

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

Inflow Area = 1,147,660 sf, 33.42% Impervious, Inflow Depth = 3.11" for 10-yr event
Inflow = 73.18 cfs @ 12.16 hrs, Volume= 297,577 cf
Outflow = 73.18 cfs @ 12.16 hrs, Volume= 297,577 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

Reach PR TOT: Total Site



Summary for Reach SWALE: Bioswale

Inflow Area = 26,182 sf, 63.13% Impervious, Inflow Depth = 3.99" for 10-yr event
Inflow = 2.59 cfs @ 12.13 hrs, Volume= 8,711 cf
Outflow = 2.47 cfs @ 12.15 hrs, Volume= 8,711 cf, Atten= 5%, Lag= 1.5 min

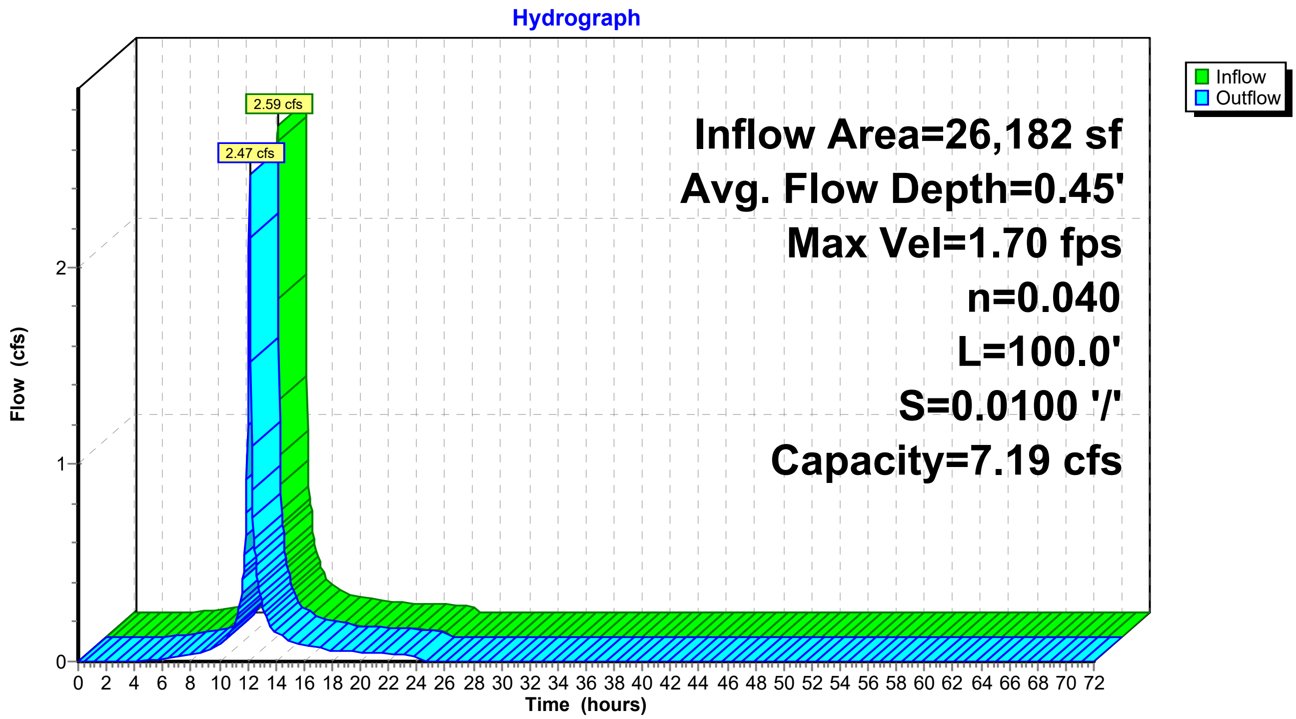
Routing by Stor-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Max. Velocity= 1.70 fps, Min. Travel Time= 1.0 min
Avg. Velocity = 0.51 fps, Avg. Travel Time= 3.3 min

Peak Storage= 151 cf @ 12.14 hrs
Average Depth at Peak Storage= 0.45'
Bank-Full Depth= 0.75' Flow Area= 3.2 sf, Capacity= 7.19 cfs

2.00' x 0.75' deep channel, n= 0.040 Earth, cobble bottom, clean sides
Side Slope Z-value= 3.0 '/' Top Width= 6.50'
Length= 100.0' Slope= 0.0100 '/'
Inlet Invert= 185.00', Outlet Invert= 184.00'

‡

Reach SWALE: Bioswale



Summary for Pond SI-1: Surface Infiltration

Inflow Area =	41,814 sf,	58.47% Impervious,	Inflow Depth = 3.89"	for 10-yr event
Inflow =	4.06 cfs @	12.13 hrs, Volume=	13,547 cf	
Outflow =	3.36 cfs @	12.18 hrs, Volume=	11,488 cf,	Atten= 17%, Lag= 2.9 min
Primary =	3.36 cfs @	12.18 hrs, Volume=	11,488 cf	

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 200.16' @ 12.18 hrs Surf.Area= 3,559 sf Storage= 3,244 cf

Plug-Flow detention time= 120.0 min calculated for 11,488 cf (85% of inflow)
Center-of-Mass det. time= 50.2 min (852.7 - 802.4)

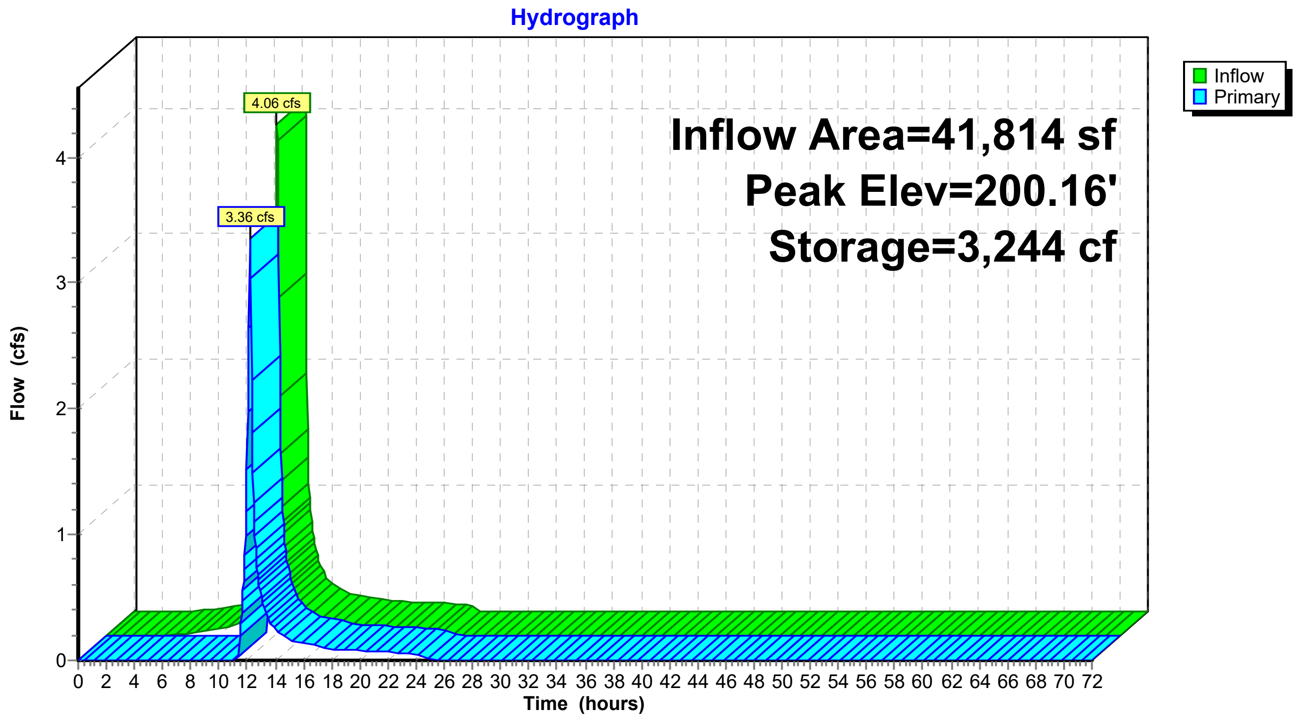
Volume	Invert	Avail.Storage	Storage Description
#1	198.90'	5,612 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
198.90	1,600	0	0
199.75	2,900	1,912	1,912
200.75	4,500	3,700	5,612

Device	Routing	Invert	Outlet Devices
#1	Primary	196.00'	**12.0" Round Culvert** L= 50.0' CPP, mitered to conform to fill, Ke= 0.700 Inlet / Outlet Invert= 196.00' / 195.50' S= 0.0100 '/' Cc= 0.900 n= 0.013, Flow Area= 0.79 sf
#2	Device 1	199.80'	**12.0" Horiz. Orifice/Grate X 1.50** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=3.29 cfs @ 12.18 hrs HW=200.16' (Free Discharge)
└─**1=Culvert** (Passes 3.29 cfs of 6.38 cfs potential flow)
  └─**2=Orifice/Grate** (Weir Controls 3.29 cfs @ 2.93 fps)

Pond SI-1: Surface Infiltration



Summary for Pond SI-2: Surface System

Inflow Area = 110,656 sf, 69.66% Impervious, Inflow Depth = 4.21" for 10-yr event
Inflow = 11.35 cfs @ 12.13 hrs, Volume= 38,782 cf
Outflow = 10.83 cfs @ 12.15 hrs, Volume= 36,644 cf, Atten= 5%, Lag= 1.4 min
Primary = 10.83 cfs @ 12.15 hrs, Volume= 36,644 cf

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 194.41' @ 12.15 hrs Surf.Area= 4,895 sf Storage= 3,619 cf

Plug-Flow detention time= 57.4 min calculated for 36,644 cf (94% of inflow)
Center-of-Mass det. time= 25.7 min (816.0 - 790.3)

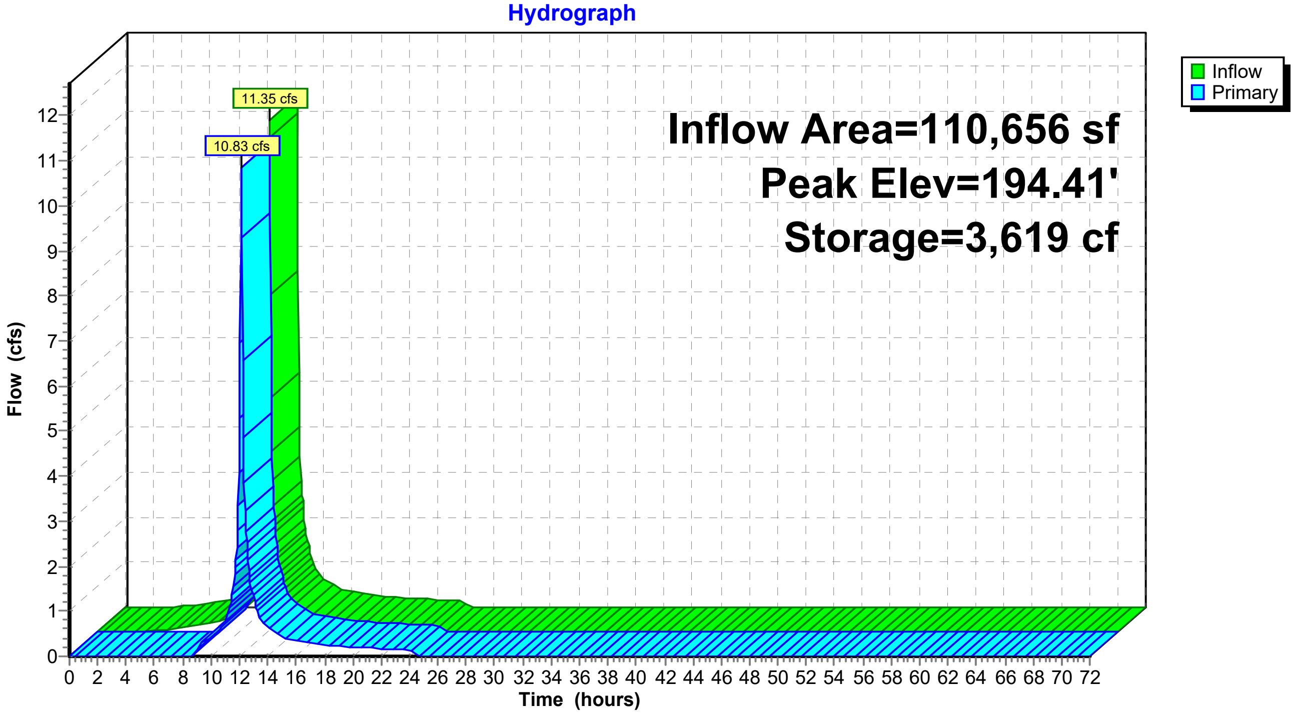
Volume	Invert	Avail.Storage	Storage Description
#1	193.60'	10,350 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
193.60	4,000	0	0
194.60	5,100	4,550	4,550
195.60	6,500	5,800	10,350

Device	Routing	Invert	Outlet Devices
#1	Primary	189.50'	**15.0" Round Culvert** L= 50.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 189.50' / 189.00' S= 0.0100 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.23 sf
#2	Device 1	194.10'	**24.0" Horiz. Orifice/Grate X 3.00** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=10.82 cfs @ 12.15 hrs HW=194.41' (Free Discharge)
└─**1=Culvert** (Passes 10.82 cfs of 12.24 cfs potential flow)
  └─**2=Orifice/Grate** (Weir Controls 10.82 cfs @ 1.83 fps)

Pond SI-2: Surface System



Summary for Pond SS-1: Subsurface Infiltration (SC-310 Chambers)

Inflow Area = 146,011 sf, 28.74% Impervious, Inflow Depth = 3.19" for 10-yr event
Inflow = 12.05 cfs @ 12.13 hrs, Volume= 38,808 cf
Outflow = 9.60 cfs @ 12.19 hrs, Volume= 37,640 cf, Atten= 20%, Lag= 3.5 min
Primary = 9.60 cfs @ 12.19 hrs, Volume= 37,640 cf

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 185.70' @ 12.19 hrs Surf.Area= 4,860 sf Storage= 4,991 cf

Plug-Flow detention time= 40.1 min calculated for 37,614 cf (97% of inflow)
Center-of-Mass det. time= 22.7 min (848.4 - 825.7)

Volume	Invert	Avail.Storage	Storage Description
#1A	184.00'	3,404 cf	**41.50'W x 117.12'L x 2.33'H Field A** 11,341 cf Overall - 2,830 cf Embedded = 8,511 cf x 40.0% Voids
#2A	184.50'	2,830 cf	**ADS_StormTech SC-310 +Cap** x 192 Inside #1 Effective Size= 28.9"W x 16.0"H => 2.07 sf x 7.12'L = 14.7 cf Overall Size= 34.0"W x 16.0"H x 7.56'L with 0.44' Overlap 12 Rows of 16 Chambers
		6,235 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	184.55'	**36.0" W x 9.0" H Vert. Orifice/Grate** C= 0.600
#2	Primary	185.65'	**5.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)

Primary OutFlow Max=9.44 cfs @ 12.19 hrs HW=185.68' (Free Discharge)
├─**1=Orifice/Grate** (Orifice Controls 9.34 cfs @ 4.15 fps)
└─**2=Sharp-Crested Rectangular Weir** (Weir Controls 0.10 cfs @ 0.60 fps)

Pond SS-1: Subsurface Infiltration (SC-310 Chambers) - Chamber Wizard Field A

Chamber Model = ADS_StormTechSC-310 +Cap (ADS StormTech®SC-310 with cap length)
Effective Size= 28.9"W x 16.0"H => 2.07 sf x 7.12'L = 14.7 cf
Overall Size= 34.0"W x 16.0"H x 7.56'L with 0.44' Overlap

34.0" Wide + 6.0" Spacing = 40.0" C-C Row Spacing

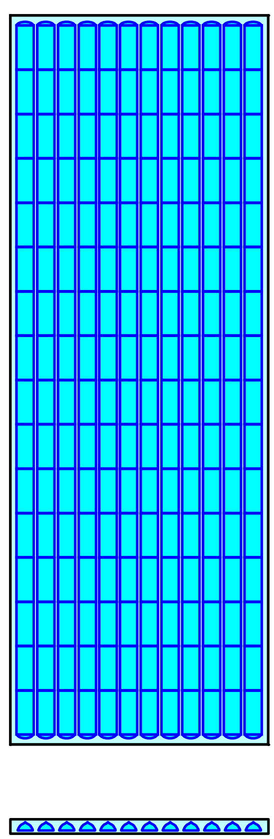
16 Chambers/Row x 7.12' Long +0.60' Cap Length x 2 = 115.12' Row Length +12.0" End Stone x 2 = 117.12' Base Length
12 Rows x 34.0" Wide + 6.0" Spacing x 11 + 12.0" Side Stone x 2 = 41.50' Base Width
6.0" Base + 16.0" Chamber Height + 6.0" Cover = 2.33' Field Height

192 Chambers x 14.7 cf = 2,830.5 cf Chamber Storage

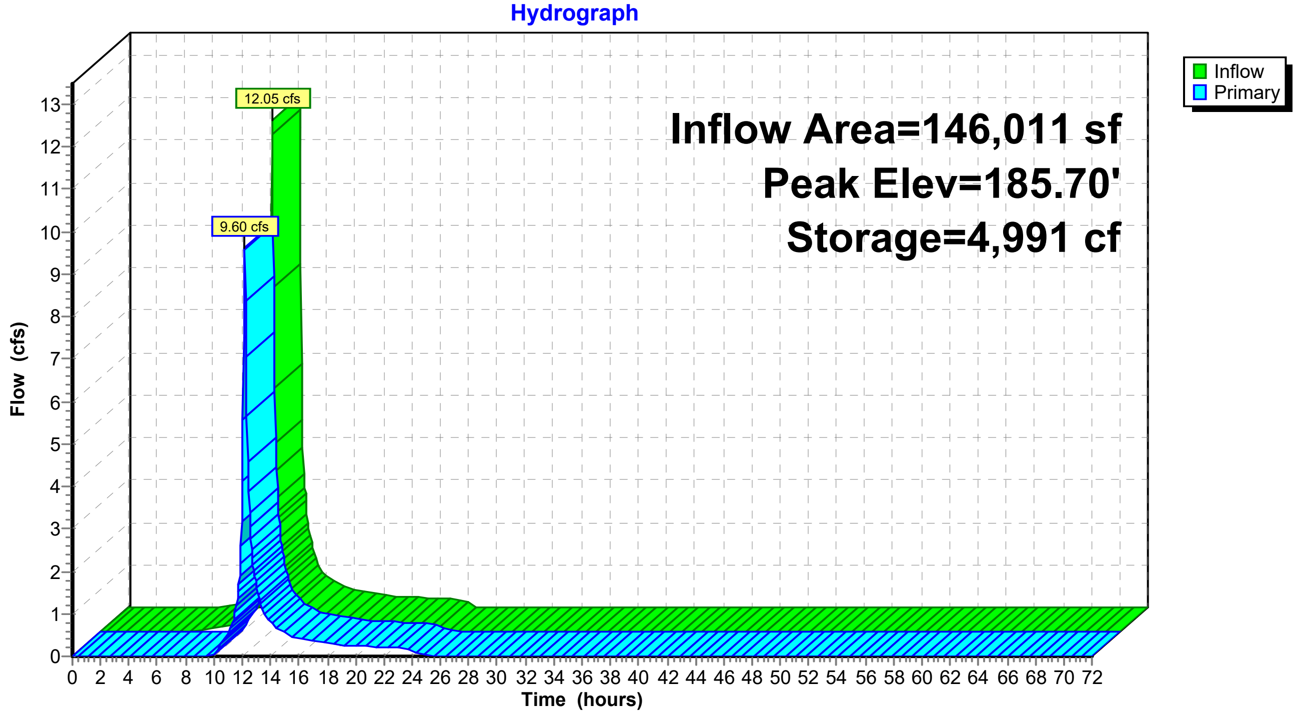
11,341.1 cf Field - 2,830.5 cf Chambers = 8,510.7 cf Stone x 40.0% Voids = 3,404.3 cf Stone Storage

Chamber Storage + Stone Storage = 6,234.7 cf = 0.143 af
Overall Storage Efficiency = 55.0%
Overall System Size = 117.12' x 41.50' x 2.33'

192 Chambers
420.0 cy Field
315.2 cy Stone



Pond SS-1: Subsurface Infiltration (SC-310 Chambers)



Summary for Pond SS-2: Subsurface Infiltration (SC-740 Chambers)

Inflow Area = 10,283 sf, 56.37% Impervious, Inflow Depth = 3.89" for 10-yr event
Inflow = 1.00 cfs @ 12.13 hrs, Volume= 3,332 cf
Outflow = 0.08 cfs @ 13.41 hrs, Volume= 2,226 cf, Atten= 92%, Lag= 77.1 min
Primary = 0.08 cfs @ 13.41 hrs, Volume= 2,226 cf

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 187.64' @ 13.41 hrs Surf.Area= 1,826 sf Storage= 2,006 cf

Plug-Flow detention time= 354.2 min calculated for 2,226 cf (67% of inflow)
Center-of-Mass det. time= 248.8 min (1,051.3 - 802.4)

Volume	Invert	Avail.Storage	Storage Description
#1A	186.00'	1,674 cf	**20.50'W x 89.06'L x 3.50'H Field A** 6,390 cf Overall - 2,205 cf Embedded = 4,185 cf x 40.0% Voids
#2A	186.50'	2,205 cf	**ADS_StormTech SC-740 +Cap** x 48 Inside #1 Effective Size= 44.6"W x 30.0"H => 6.45 sf x 7.12'L = 45.9 cf Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap 4 Rows of 12 Chambers
		3,879 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	187.00'	**2.0" Vert. Orifice/Grate** C= 0.600
#2	Primary	189.00'	**5.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)

Primary OutFlow Max=0.08 cfs @ 13.41 hrs HW=187.64' (Free Discharge)
1=Orifice/Grate (Orifice Controls 0.08 cfs @ 3.60 fps)
2=Sharp-Crested Rectangular Weir (Controls 0.00 cfs)

Pond SS-2: Subsurface Infiltration (SC-740 Chambers) - Chamber Wizard Field A

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

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

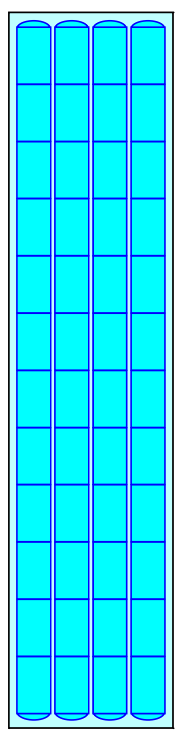
12 Chambers/Row x 7.12' Long +0.81' Cap Length x 2 = 87.06' Row Length +12.0" End Stone x 2 = 89.06' Base Length
4 Rows x 51.0" Wide + 6.0" Spacing x 3 + 12.0" Side Stone x 2 = 20.50' Base Width
6.0" Base + 30.0" Chamber Height + 6.0" Cover = 3.50' Field Height

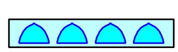
48 Chambers x 45.9 cf = 2,205.1 cf Chamber Storage

6,389.8 cf Field - 2,205.1 cf Chambers = 4,184.7 cf Stone x 40.0% Voids = 1,673.9 cf Stone Storage

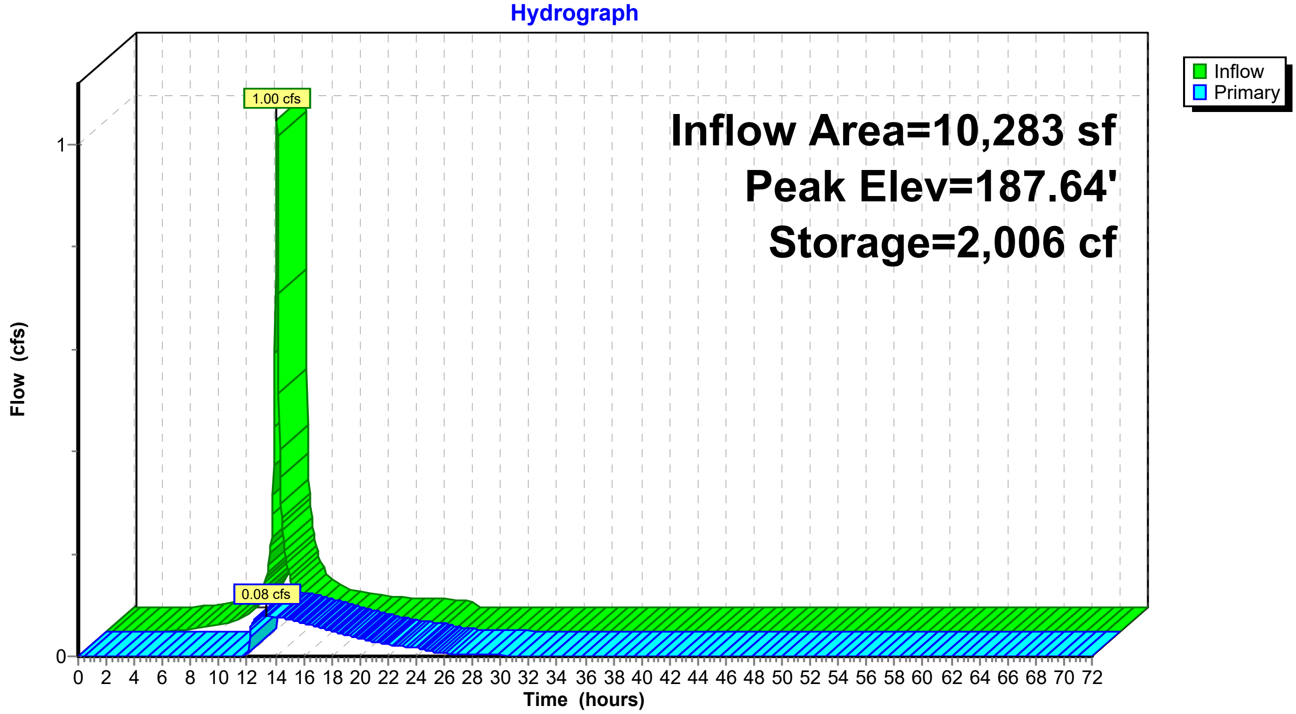
Chamber Storage + Stone Storage = 3,879.0 cf = 0.089 af
Overall Storage Efficiency = 60.7%
Overall System Size = 89.06' x 20.50' x 3.50'

48 Chambers
236.7 cy Field
155.0 cy Stone





Pond SS-2: Subsurface Infiltration (SC-740 Chambers)



Summary for Pond SS-3: Subsurface Infiltration (24" Pipe)

Inflow Area = 162,554 sf, 31.31% Impervious, Inflow Depth = 3.19" for 10-yr event
Inflow = 13.42 cfs @ 12.13 hrs, Volume= 43,205 cf
Outflow = 8.20 cfs @ 12.22 hrs, Volume= 41,718 cf, Atten= 39%, Lag= 5.4 min
Primary = 8.20 cfs @ 12.22 hrs, Volume= 41,718 cf

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 195.20' @ 12.22 hrs Surf.Area= 8,006 sf Storage= 7,696 cf

Plug-Flow detention time= 45.5 min calculated for 41,689 cf (96% of inflow)
Center-of-Mass det. time= 25.8 min (851.5 - 825.7)

Volume	Invert	Avail.Storage	Storage Description
#1A	193.50'	6,003 cf	**45.40'W x 176.33'L x 3.00'H Field A** 24,017 cf Overall - 9,009 cf Embedded = 15,008 cf x 40.0% Voids
#2A	193.83'	7,122 cf	**ADS N-12 24"** x 117 Inside #1 Inside= 23.8"W x 23.8"H => 3.10 sf x 20.00'L = 62.0 cf Outside= 28.0"W x 28.0"H => 3.92 sf x 20.00'L = 78.4 cf Row Length Adjustment= -10.00' x 3.10 sf x 13 rows 43.73' Header x 3.10 sf x 2 = 271.2 cf Inside
		13,125 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	194.00'	**30.0" W x 8.0" H Vert. Orifice/Grate** C= 0.600
#2	Primary	194.75'	**10.0" W x 6.0" H Vert. Orifice/Grate** C= 0.600
#3	Primary	196.35'	**5.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)

Primary OutFlow Max=8.11 cfs @ 12.22 hrs HW=195.18' (Free Discharge)
├─**1=Orifice/Grate** (Orifice Controls 7.35 cfs @ 4.41 fps)
├─**2=Orifice/Grate** (Orifice Controls 0.76 cfs @ 2.11 fps)
└─**3=Sharp-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond SS-3: Subsurface Infiltration (24" Pipe) - Chamber Wizard Field A

Chamber Model = ADS N-12 24" (ADS N-12® Pipe)
Inside= 23.8"W x 23.8"H => 3.10 sf x 20.00'L = 62.0 cf
Outside= 28.0"W x 28.0"H => 3.92 sf x 20.00'L = 78.4 cf
Row Length Adjustment= -10.00' x 3.10 sf x 13 rows

28.0" Wide + 13.4" Spacing = 41.4" C-C Row Spacing

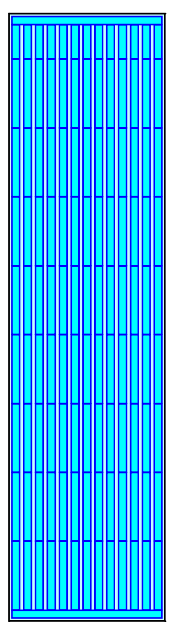
9 Chambers/Row x 20.00' Long -10.00' Row Adjustment +2.33' Header x 2 = 174.67' Row Length +10.0" End Stone x 2 = 176.33' Base Length
13 Rows x 28.0" Wide + 13.4" Spacing x 12 + 10.0" Side Stone x 2 = 45.40' Base Width
4.0" Base + 28.0" Chamber Height + 4.0" Cover = 3.00' Field Height

117 Chambers x 62.0 cf -10.00' Row Adjustment x 3.10 sf x 13 Rows + 43.73' Header x 3.10 sf x 2 = 7,122.2 cf Chamber Storage
117 Chambers x 78.4 cf -10.00' Row Adjustment x 3.92 sf x 13 Rows + 43.73' Header x 3.92 sf x 2 = 9,005.3 cf Displacement

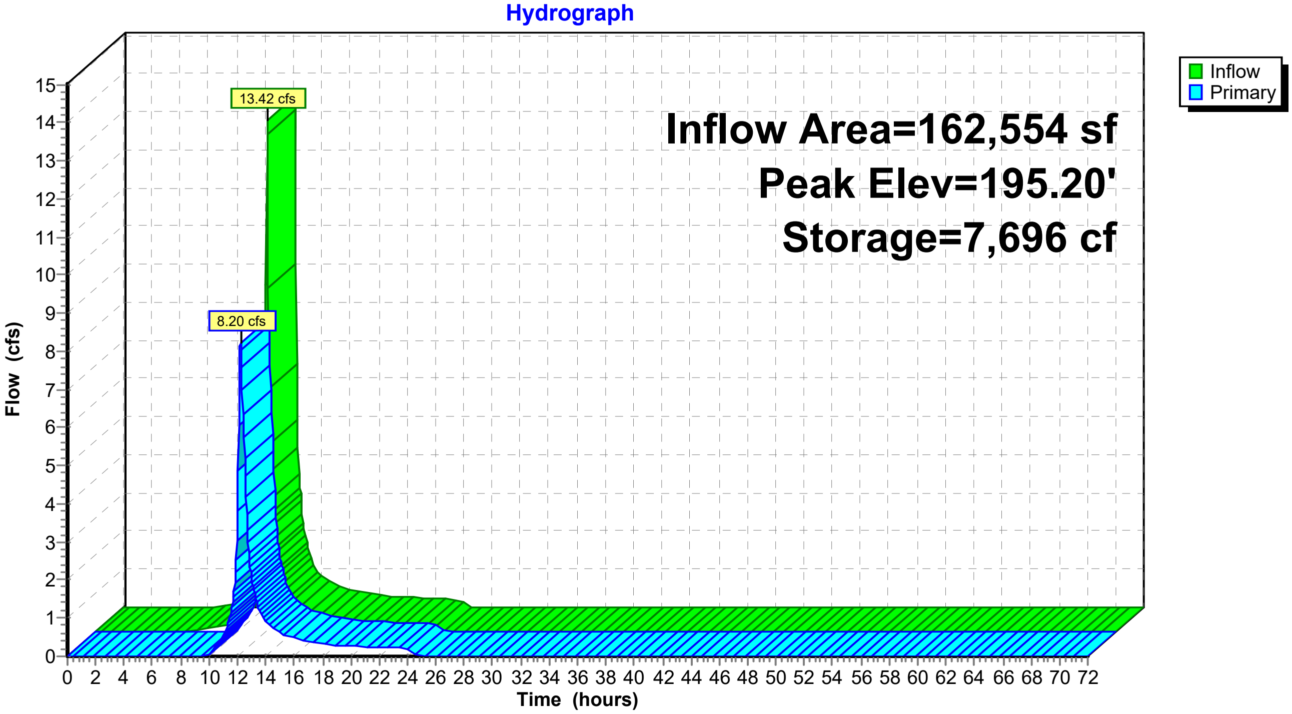
24,017.4 cf Field - 9,005.3 cf Chambers = 15,012.1 cf Stone x 40.0% Voids = 6,004.8 cf Stone Storage

Chamber Storage + Stone Storage = 13,127.0 cf = 0.301 af
Overall Storage Efficiency = 54.7%
Overall System Size = 176.33' x 45.40' x 3.00'

117 Chambers
889.5 cy Field
556.0 cy Stone



Pond SS-3: Subsurface Infiltration (24" Pipe)



Summary for Pond SS-4: Subsurface Infiltration (24" Pipe)

Inflow Area = 108,864 sf, 38.92% Impervious, Inflow Depth = 3.29" for 10-yr event
Inflow = 9.22 cfs @ 12.13 hrs, Volume= 29,807 cf
Outflow = 6.07 cfs @ 12.21 hrs, Volume= 28,399 cf, Atten= 34%, Lag= 5.0 min
Primary = 6.07 cfs @ 12.21 hrs, Volume= 28,399 cf

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 201.34' @ 12.21 hrs Surf.Area= 5,587 sf Storage= 7,695 cf

Plug-Flow detention time= 78.6 min calculated for 28,379 cf (95% of inflow)
Center-of-Mass det. time= 52.4 min (875.1 - 822.7)

Volume	Invert	Avail.Storage	Storage Description
#1A	199.00'	2,748 cf	**83.35'W x 44.33'L x 3.00'H Field A** 11,086 cf Overall - 4,217 cf Embedded = 6,869 cf x 40.0% Voids
#2A	199.33'	3,334 cf	**ADS N-12 24"** x 48 Inside #1 Inside= 23.8"W x 23.8"H => 3.10 sf x 20.00'L = 62.0 cf Outside= 28.0"W x 28.0"H => 3.92 sf x 20.00'L = 78.4 cf Row Length Adjustment= -2.00' x 3.10 sf x 24 rows 81.68' Header x 3.10 sf x 2 = 506.4 cf Inside
#3B	199.00'	1,454 cf	**45.40'W x 41.67'L x 3.00'H Field B** 5,675 cf Overall - 2,039 cf Embedded = 3,636 cf x 40.0% Voids
#4B	199.33'	1,612 cf	**ADS N-12 24"** x 26 Inside #3 Inside= 23.8"W x 23.8"H => 3.10 sf x 20.00'L = 62.0 cf Outside= 28.0"W x 28.0"H => 3.92 sf x 20.00'L = 78.4 cf 13 Rows of 2 Chambers
		9,148 cf	Total Available Storage

Storage Group A created with Chamber Wizard
Storage Group B created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	199.50'	**15.0" Round Culvert** L= 50.0' CPP, mitered to conform to fill, Ke= 0.700 Inlet / Outlet Invert= 199.50' / 199.00' S= 0.0100 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.23 sf
#2	Device 1	199.65'	**8.0" W x 8.0" H Vert. Orifice/Grate** C= 0.600
#3	Primary	200.75'	**30.0" W x 8.0" H Vert. Orifice/Grate** C= 0.600
#4	Device 1	201.50'	**5.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)

Primary OutFlow Max=5.92 cfs @ 12.21 hrs HW=201.32' (Free Discharge)
—**1=Culvert** (Passes 2.47 cfs of 5.70 cfs potential flow)
  —**2=Orifice/Grate** (Orifice Controls 2.47 cfs @ 5.55 fps)
  —**4=Sharp-Crested Rectangular Weir** (Controls 0.00 cfs)
—**3=Orifice/Grate** (Orifice Controls 3.45 cfs @ 2.42 fps)

Pond SS-4: Subsurface Infiltration (24" Pipe) - Chamber Wizard Field A

Chamber Model = ADS N-12 24" (ADS N-12® Pipe)
Inside= 23.8"W x 23.8"H => 3.10 sf x 20.00'L = 62.0 cf
Outside= 28.0"W x 28.0"H => 3.92 sf x 20.00'L = 78.4 cf
Row Length Adjustment= -2.00' x 3.10 sf x 24 rows

28.0" Wide + 13.4" Spacing = 41.4" C-C Row Spacing

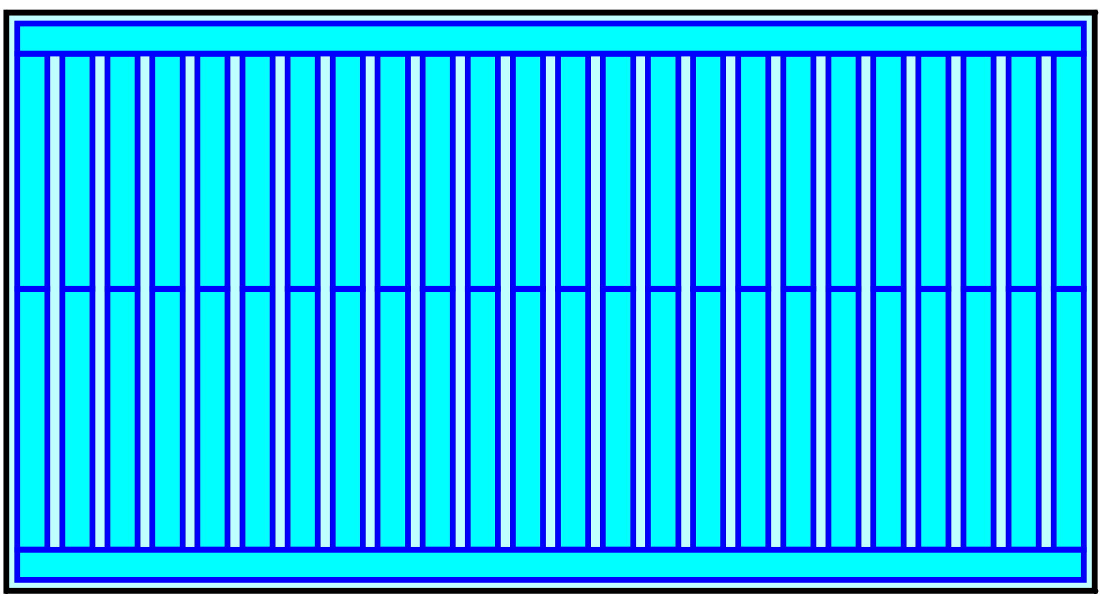
2 Chambers/Row x 20.00' Long -2.00' Row Adjustment +2.33' Header x 2 = 42.67' Row Length +10.0" End Stone x 2 = 44.33' Base Length
24 Rows x 28.0" Wide + 13.4" Spacing x 23 + 10.0" Side Stone x 2 = 83.35' Base Width
4.0" Base + 28.0" Chamber Height + 4.0" Cover = 3.00' Field Height

48 Chambers x 62.0 cf -2.00' Row Adjustment x 3.10 sf x 24 Rows + 81.68' Header x 3.10 sf x 2 = 3,333.6 cf Chamber Storage
48 Chambers x 78.4 cf -2.00' Row Adjustment x 3.92 sf x 24 Rows + 81.68' Header x 3.92 sf x 2 = 4,215.1 cf Displacement

11,085.9 cf Field - 4,215.1 cf Chambers = 6,870.9 cf Stone x 40.0% Voids = 2,748.3 cf Stone Storage

Chamber Storage + Stone Storage = 6,082.0 cf = 0.140 af
Overall Storage Efficiency = 54.9%
Overall System Size = 44.33' x 83.35' x 3.00'

48 Chambers
410.6 cy Field
254.5 cy Stone



Pond SS-4: Subsurface Infiltration (24" Pipe) - Chamber Wizard Field B

Chamber Model = ADS N-12 24" (ADS N-12® Pipe)
Inside= 23.8"W x 23.8"H => 3.10 sf x 20.00'L = 62.0 cf
Outside= 28.0"W x 28.0"H => 3.92 sf x 20.00'L = 78.4 cf

28.0" Wide + 13.4" Spacing = 41.4" C-C Row Spacing

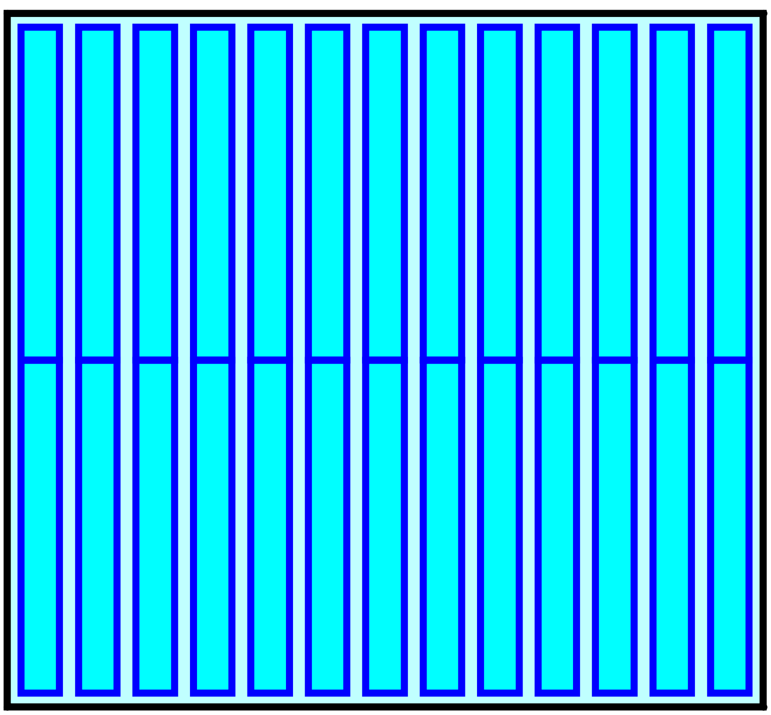
2 Chambers/Row x 20.00' Long = 40.00' Row Length +10.0" End Stone x 2 = 41.67' Base Length
13 Rows x 28.0" Wide + 13.4" Spacing x 12 + 10.0" Side Stone x 2 = 45.40' Base Width
4.0" Base + 28.0" Chamber Height + 4.0" Cover = 3.00' Field Height

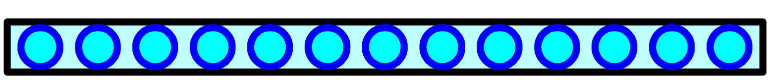
26 Chambers x 62.0 cf = 1,612.0 cf Chamber Storage
26 Chambers x 78.4 cf = 2,038.2 cf Displacement

5,675.2 cf Field - 2,038.2 cf Chambers = 3,637.0 cf Stone x 40.0% Voids = 1,454.8 cf Stone Storage

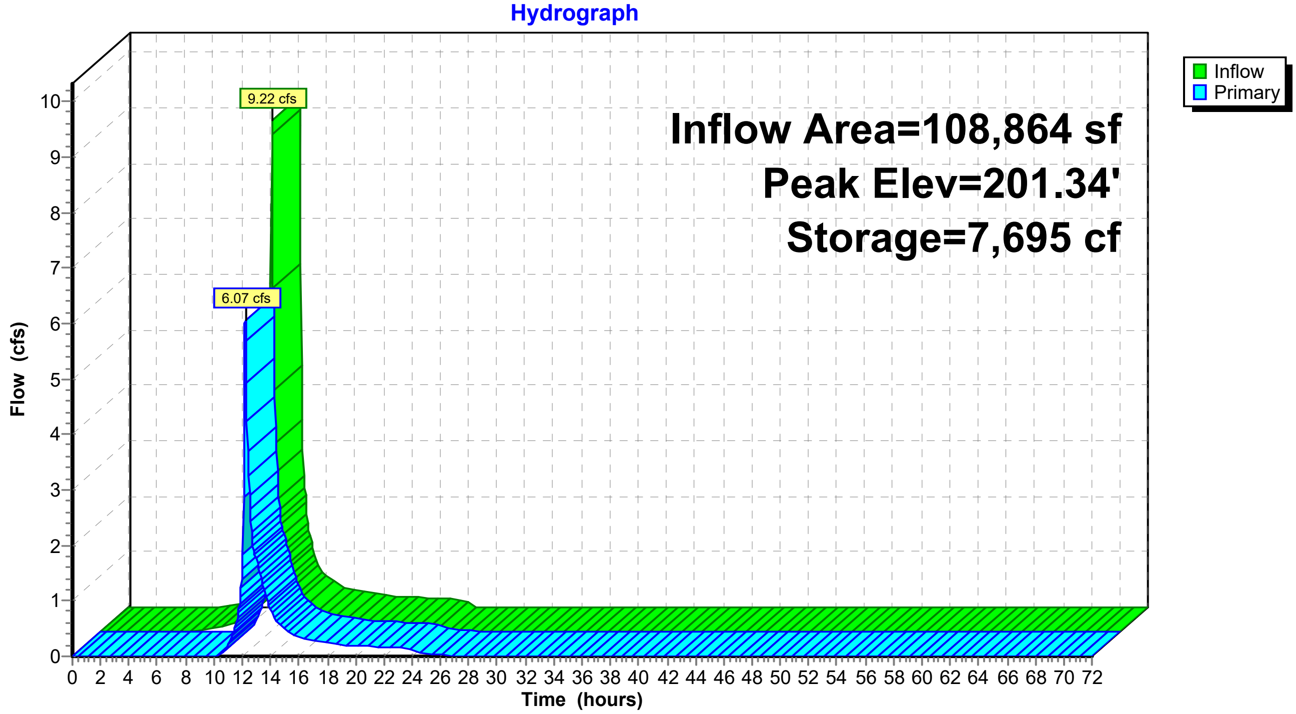
Chamber Storage + Stone Storage = 3,066.8 cf = 0.070 af
Overall Storage Efficiency = 54.0%
Overall System Size = 41.67' x 45.40' x 3.00'

26 Chambers
210.2 cy Field
134.7 cy Stone





Pond SS-4: Subsurface Infiltration (24" Pipe)



Summary for Pond SS-5: Subsurface Infiltration (SC-310 Chambers)

Inflow Area =	90,263 sf, 83.25% Impervious,	Inflow Depth = 4.54" for 10-yr event	
Inflow =	9.67 cfs @ 12.13 hrs, Volume=	34,112 cf	
Outflow =	7.68 cfs @ 12.18 hrs, Volume=	33,199 cf,	Atten= 21%, Lag= 3.3 min
Primary =	4.21 cfs @ 12.18 hrs, Volume=	22,547 cf	
Secondary =	3.47 cfs @ 12.18 hrs, Volume=	10,652 cf	

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 194.83' @ 12.18 hrs Surf.Area= 4,565 sf Storage= 4,305 cf

Plug-Flow detention time= 47.3 min calculated for 33,176 cf (97% of inflow)
Center-of-Mass det. time= 30.9 min (806.6 - 775.7)

Volume	Invert	Avail.Storage	Storage Description
#1A	193.30'	3,199 cf	**41.50'W x 110.00'L x 2.33'H Field A** 10,652 cf Overall - 2,654 cf Embedded = 7,998 cf x 40.0% Voids
#2A	193.80'	2,654 cf	**ADS_StormTech SC-310 +Cap** x 180 Inside #1 Effective Size= 28.9"W x 16.0"H => 2.07 sf x 7.12'L = 14.7 cf Overall Size= 34.0"W x 16.0"H x 7.56'L with 0.44' Overlap 12 Rows of 15 Chambers
		5,853 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	193.80'	**19.0" W x 8.0" H Vert. Orifice/Grate** C= 0.600
#2	Primary	195.45'	**5.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)
#3	Secondary	193.80'	**14.0" Vert. Orifice/Grate** C= 0.600

Primary OutFlow Max=4.16 cfs @ 12.18 hrs HW=194.82' (Free Discharge)
1=Orifice/Grate (Orifice Controls 4.16 cfs @ 3.94 fps)
2=Sharp-Crested Rectangular Weir (Controls 0.00 cfs)

Secondary OutFlow Max=3.40 cfs @ 12.18 hrs HW=194.82' (Free Discharge)
3=Orifice/Grate (Orifice Controls 3.40 cfs @ 3.43 fps)

Pond SS-5: Subsurface Infiltration (SC-310 Chambers) - Chamber Wizard Field A

Chamber Model = ADS_StormTechSC-310 +Cap (ADS StormTech®SC-310 with cap length)
Effective Size= 28.9"W x 16.0"H => 2.07 sf x 7.12'L = 14.7 cf
Overall Size= 34.0"W x 16.0"H x 7.56'L with 0.44' Overlap

34.0" Wide + 6.0" Spacing = 40.0" C-C Row Spacing

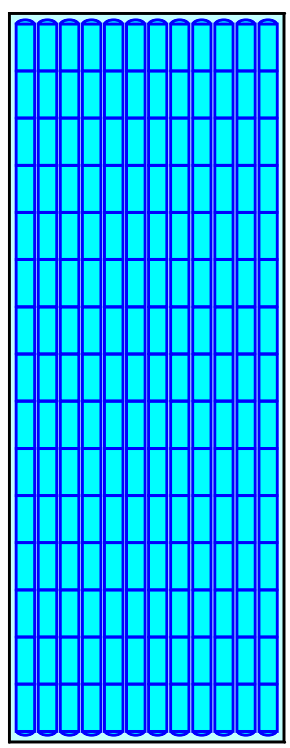
15 Chambers/Row x 7.12' Long +0.60' Cap Length x 2 = 108.00' Row Length +12.0" End Stone x 2 = 110.00' Base Length
12 Rows x 34.0" Wide + 6.0" Spacing x 11 + 12.0" Side Stone x 2 = 41.50' Base Width
6.0" Base + 16.0" Chamber Height + 6.0" Cover = 2.33' Field Height

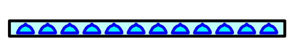
180 Chambers x 14.7 cf = 2,653.6 cf Chamber Storage

10,651.7 cf Field - 2,653.6 cf Chambers = 7,998.1 cf Stone x 40.0% Voids = 3,199.2 cf Stone Storage

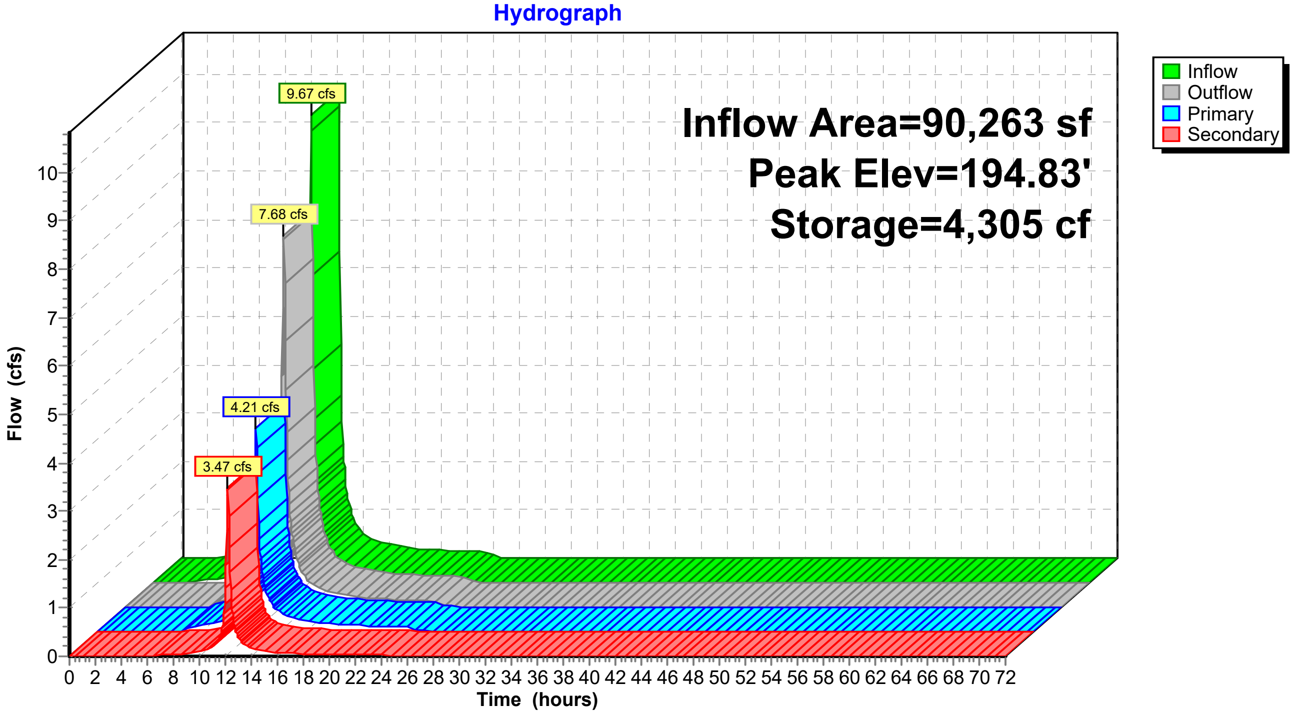
Chamber Storage + Stone Storage = 5,852.8 cf = 0.134 af
Overall Storage Efficiency = 54.9%
Overall System Size = 110.00' x 41.50' x 2.33'

180 Chambers
394.5 cy Field
296.2 cy Stone





Pond SS-5: Subsurface Infiltration (SC-310 Chambers)



Time span=0.00-72.00 hrs, dt=0.05 hrs, 1441 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment PDA-1: Wooded Area Runoff Area=125,686 sf 0.00% Impervious Runoff Depth=4.77"
Flow Length=642' Tc=9.3 min CN=71 Runoff=13.93 cfs 49,969 cf

Subcatchment PDA10: PDA10 Runoff Area=110,656 sf 69.66% Impervious Runoff Depth=7.14"
Tc=6.0 min CN=91 Runoff=18.64 cfs 65,856 cf

Subcatchment PDA11: PDA11 Runoff Area=26,182 sf 63.13% Impervious Runoff Depth=6.90"
Tc=6.0 min CN=89 Runoff=4.33 cfs 15,061 cf

Subcatchment PDA12: PDA12 Runoff Area=146,011 sf 28.74% Impervious Runoff Depth=5.95"
Tc=6.0 min CN=81 Runoff=21.86 cfs 72,399 cf

Subcatchment PDA2: Proposed 2 Runoff Area=36,252 sf 38.40% Impervious Runoff Depth=6.19"
Tc=6.0 min CN=83 Runoff=5.59 cfs 18,693 cf

Subcatchment PDA3: Proposed 3 Runoff Area=41,814 sf 58.47% Impervious Runoff Depth=6.78"
Tc=6.0 min CN=88 Runoff=6.85 cfs 23,637 cf

Subcatchment PDA4: Proposed 4 Runoff Area=108,864 sf 38.92% Impervious Runoff Depth=6.07"
Tc=6.0 min CN=82 Runoff=16.55 cfs 55,057 cf

Subcatchment PDA5: Proposed 5 Runoff Area=173,681 sf 20.35% Impervious Runoff Depth=5.59"
Tc=6.0 min CN=78 Runoff=24.76 cfs 80,975 cf

Subcatchment PDA6: Proposal 6 Runoff Area=10,283 sf 56.37% Impervious Runoff Depth=6.78"
Tc=6.0 min CN=88 Runoff=1.68 cfs 5,813 cf

Subcatchment PDA7: Proposal 7 Runoff Area=162,554 sf 31.31% Impervious Runoff Depth=5.95"
Tc=6.0 min CN=81 Runoff=24.34 cfs 80,602 cf

Subcatchment PDA8: Proposed 8 Runoff Area=90,263 sf 83.25% Impervious Runoff Depth=7.50"
Tc=6.0 min CN=94 Runoff=15.53 cfs 56,420 cf

Subcatchment PDA9: Proposed 9 Runoff Area=115,414 sf 0.00% Impervious Runoff Depth=4.65"
Flow Length=366' Tc=12.4 min CN=70 Runoff=11.39 cfs 44,761 cf

Reach DP-A: Eastern Intermittent Stream Inflow=13.93 cfs 49,969 cf
Outflow=13.93 cfs 49,969 cf

Reach DP-B: Concord Street Main Inflow=37.12 cfs 149,425 cf
Outflow=37.12 cfs 149,425 cf

Reach DP-C1: Wetlands Inflow=85.17 cfs 359,567 cf
Outflow=85.17 cfs 359,567 cf

Reach DP-C2: Intermittent Stream West Inflow=11.39 cfs 44,761 cf
Outflow=11.39 cfs 44,761 cf

Reach PR TOT: Total Site Inflow=136.06 cfs 558,962 cf
Outflow=136.06 cfs 558,962 cf

Reach SWALE: Bioswale Avg. Flow Depth=0.58' Max Vel=1.96 fps Inflow=4.33 cfs 15,061 cf
n=0.040 L=100.0' S=0.0100 '/' Capacity=7.19 cfs Outflow=4.16 cfs 15,061 cf

Pond SI-1: Surface Infiltration Peak Elev=200.44' Storage=4,300 cf Inflow=6.85 cfs 23,637 cf
Outflow=4.54 cfs 21,577 cf

Pond SI-2: Surface System Peak Elev=194.82' Storage=5,707 cf Inflow=18.64 cfs 65,856 cf
Outflow=12.80 cfs 63,719 cf

Pond SS-1: Subsurface Infiltration Peak Elev=186.30' Storage=6,172 cf Inflow=21.86 cfs 72,399 cf
Outflow=21.03 cfs 71,231 cf

Pond SS-2: Subsurface Infiltration (SC-740 Peak Elev=188.94' Storage=3,469 cf Inflow=1.68 cfs 5,813 cf
Outflow=0.14 cfs 4,707 cf

Pond SS-3: Subsurface Infiltration (24" Peak Elev=196.50' Storage=13,125 cf Inflow=24.34 cfs 80,602 cf
Outflow=14.99 cfs 79,115 cf

Pond SS-4: Subsurface Infiltration (24" Peak Elev=202.00' Storage=9,144 cf Inflow=16.55 cfs 55,057 cf
Outflow=14.87 cfs 53,649 cf

Pond SS-5: Subsurface Infiltration Peak Elev=195.61' Storage=5,819 cf Inflow=15.53 cfs 56,420 cf
Primary=7.04 cfs 36,340 cf Secondary=5.72 cfs 19,167 cf Outflow=12.76 cfs 55,507 cf

Total Runoff Area = 1,147,660 sf Runoff Volume = 569,241 cf Average Runoff Depth = 5.95"
66.58% Pervious = 764,152 sf 33.42% Impervious = 383,508 sf

Summary for Subcatchment PDA-1: Wooded Area

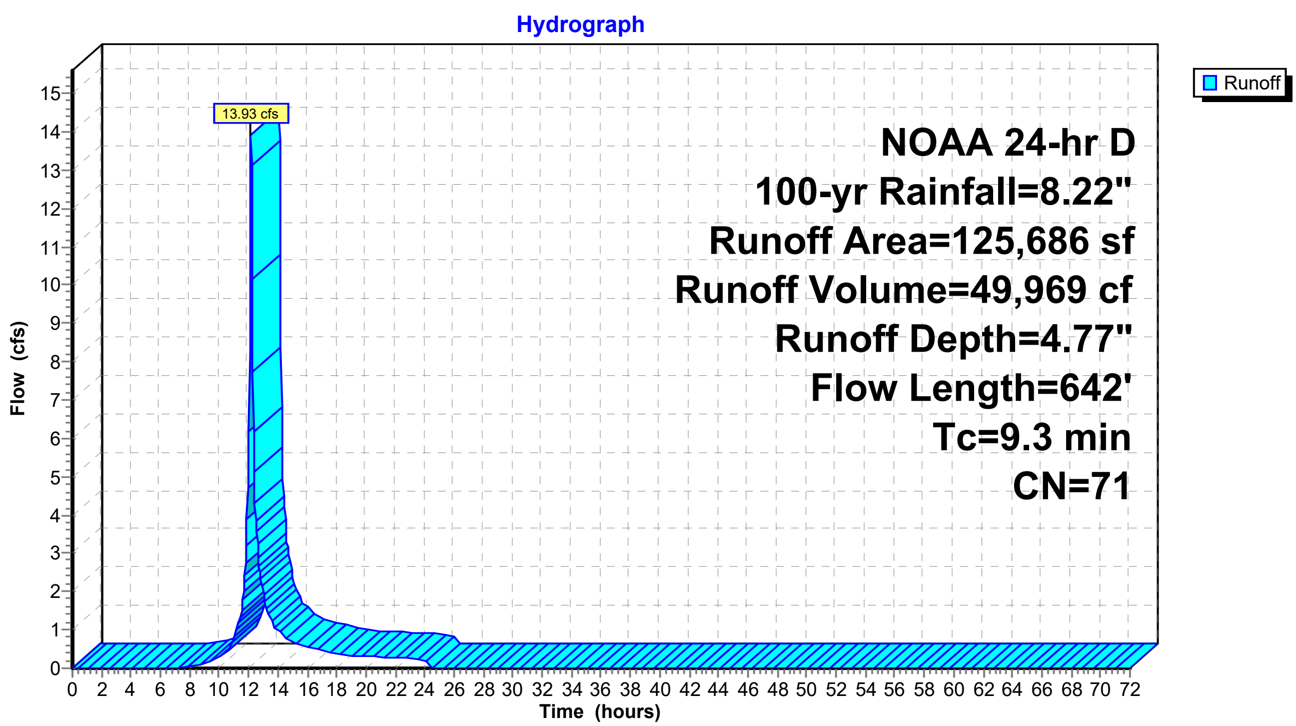
Runoff = 13.93 cfs @ 12.17 hrs, Volume= 49,969 cf, Depth= 4.77"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
NOAA 24-hr D 100-yr Rainfall=8.22"

Area (sf)	CN	Description
25,856	74	>75% Grass cover, Good, HSG C
99,830	70	Woods, Good, HSG C
125,686	71	Weighted Average
125,686		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.1	50	0.1700	0.16		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.35"
0.3	130	0.1600	6.44		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
3.9	462	0.0150	1.97		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
9.3	642	Total			

Subcatchment PDA-1: Wooded Area



Summary for Subcatchment PDA10: PDA10

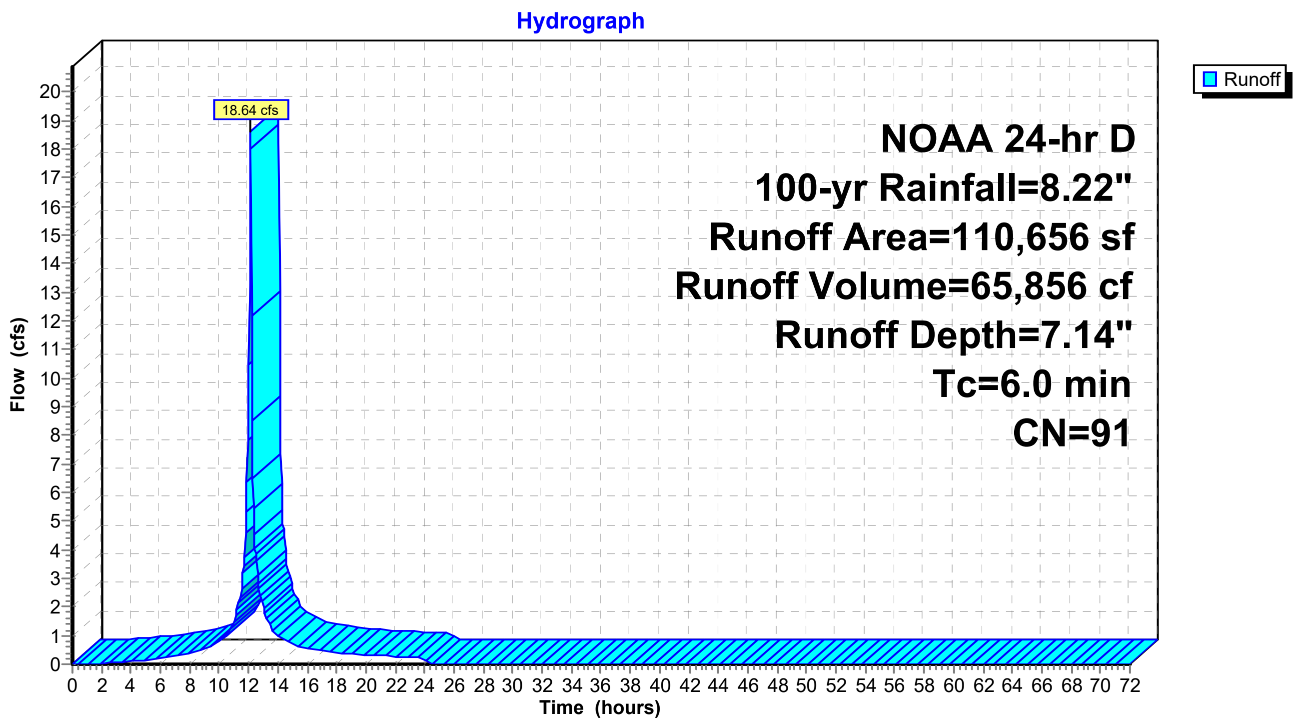
Runoff = 18.64 cfs @ 12.13 hrs, Volume= 65,856 cf, Depth= 7.14"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
NOAA 24-hr D 100-yr Rainfall=8.22"

Area (sf)	CN	Description
33,569	74	>75% Grass cover, Good, HSG C
30,240	98	Roofs, HSG C
46,847	98	Paved parking, HSG C
110,656	91	Weighted Average
33,569		30.34% Pervious Area
77,087		69.66% Impervious Area

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

Subcatchment PDA10: PDA10



Summary for Subcatchment PDA11: PDA11

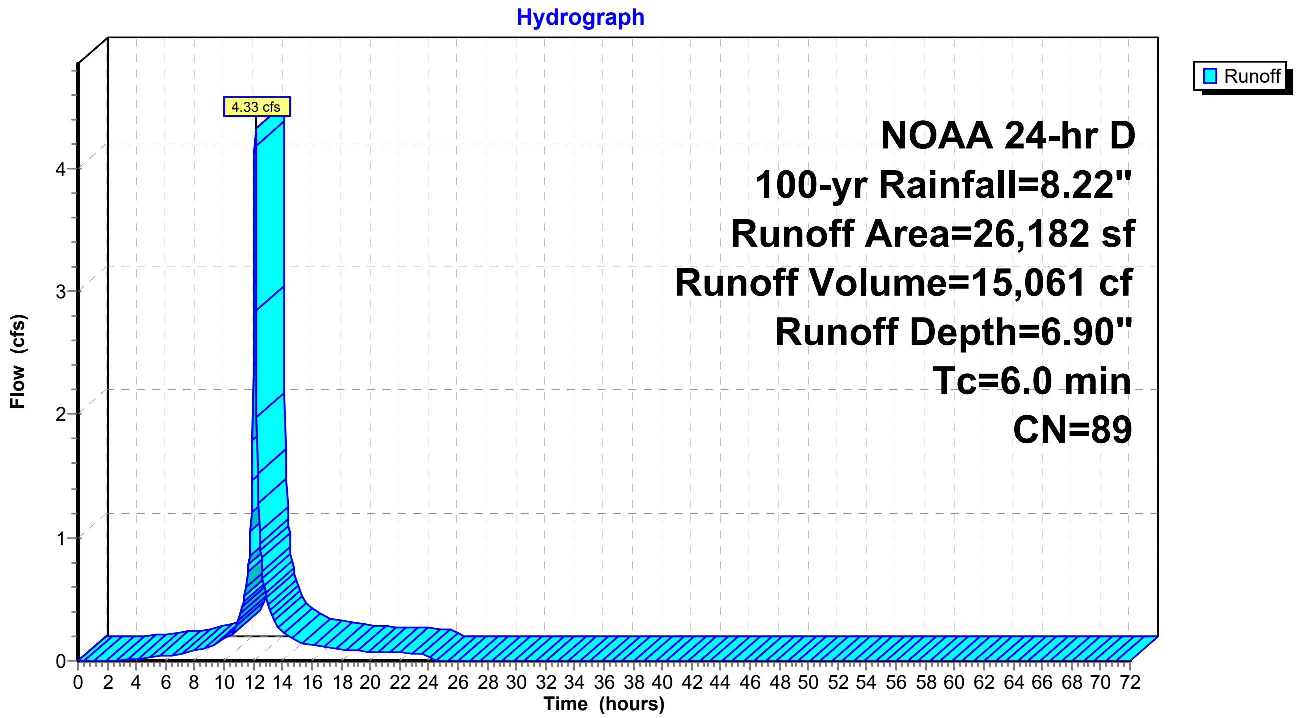
Runoff = 4.33 cfs @ 12.13 hrs, Volume= 15,061 cf, Depth= 6.90"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
NOAA 24-hr D 100-yr Rainfall=8.22"

Area (sf)	CN	Description
9,652	74	>75% Grass cover, Good, HSG C
16,530	98	Paved parking, HSG C
26,182	89	Weighted Average
9,652		36.87% Pervious Area
16,530		63.13% Impervious Area

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

Subcatchment PDA11: PDA11



Summary for Subcatchment PDA12: PDA12

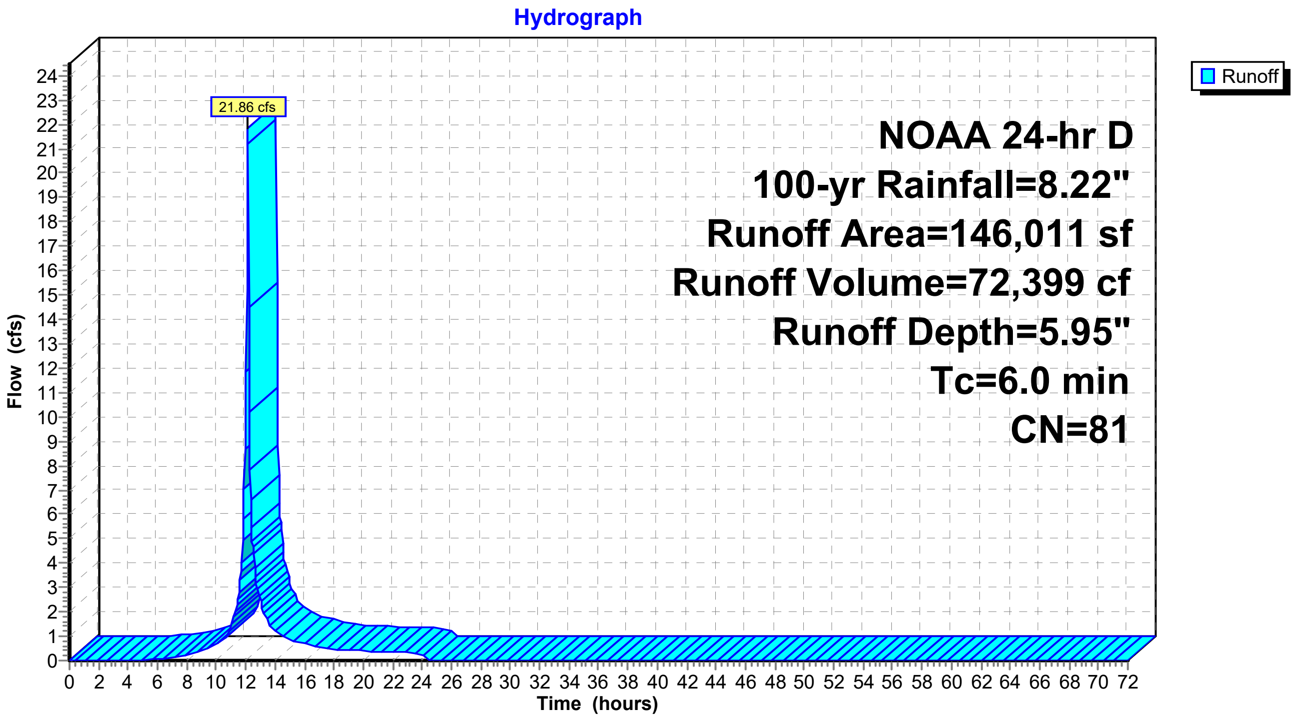
Runoff = 21.86 cfs @ 12.13 hrs, Volume= 72,399 cf, Depth= 5.95"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
NOAA 24-hr D 100-yr Rainfall=8.22"

Area (sf)	CN	Description
104,041	74	>75% Grass cover, Good, HSG C
41,970	98	Paved parking, HSG C
146,011	81	Weighted Average
104,041		71.26% Pervious Area
41,970		28.74% Impervious Area

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

Subcatchment PDA12: PDA12



Summary for Subcatchment PDA2: Proposed 2

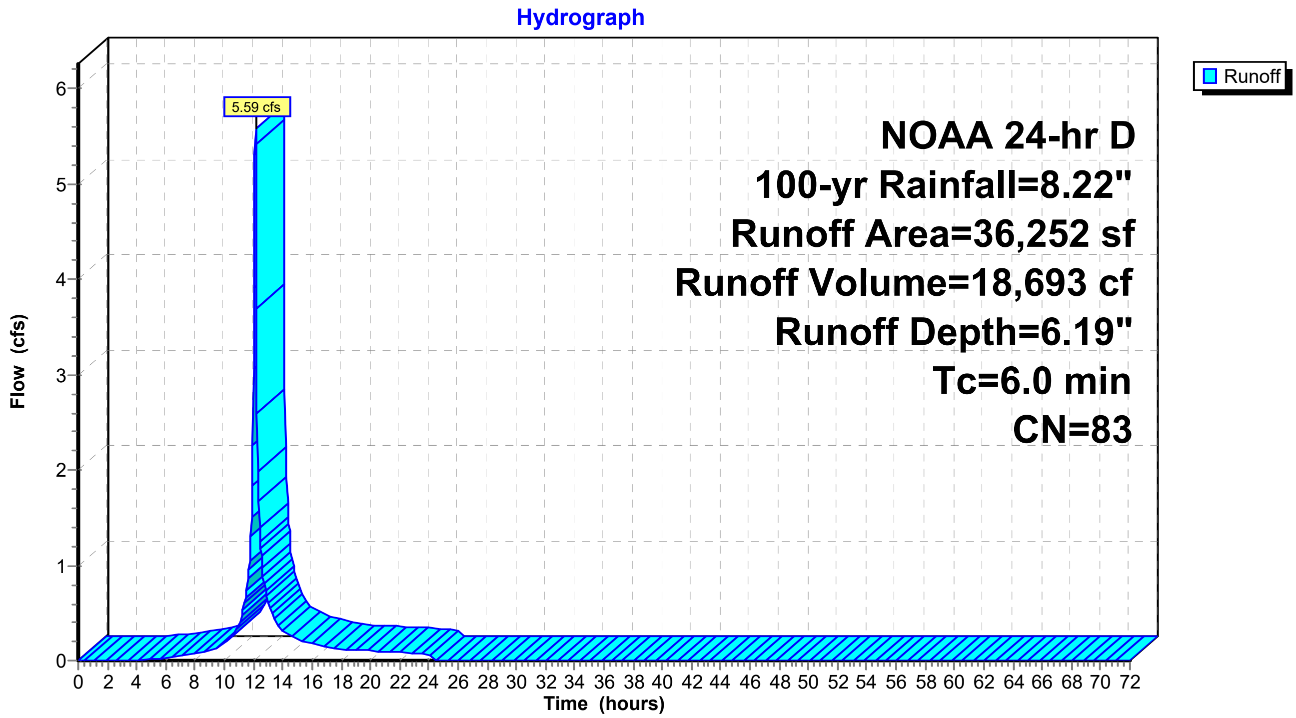
Runoff = 5.59 cfs @ 12.13 hrs, Volume= 18,693 cf, Depth= 6.19"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
NOAA 24-hr D 100-yr Rainfall=8.22"

Area (sf)	CN	Description
22,332	74	>75% Grass cover, Good, HSG C
13,920	98	Paved parking, HSG C
36,252	83	Weighted Average
22,332		61.60% Pervious Area
13,920		38.40% Impervious Area

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

Subcatchment PDA2: Proposed 2



Summary for Subcatchment PDA3: Proposed 3

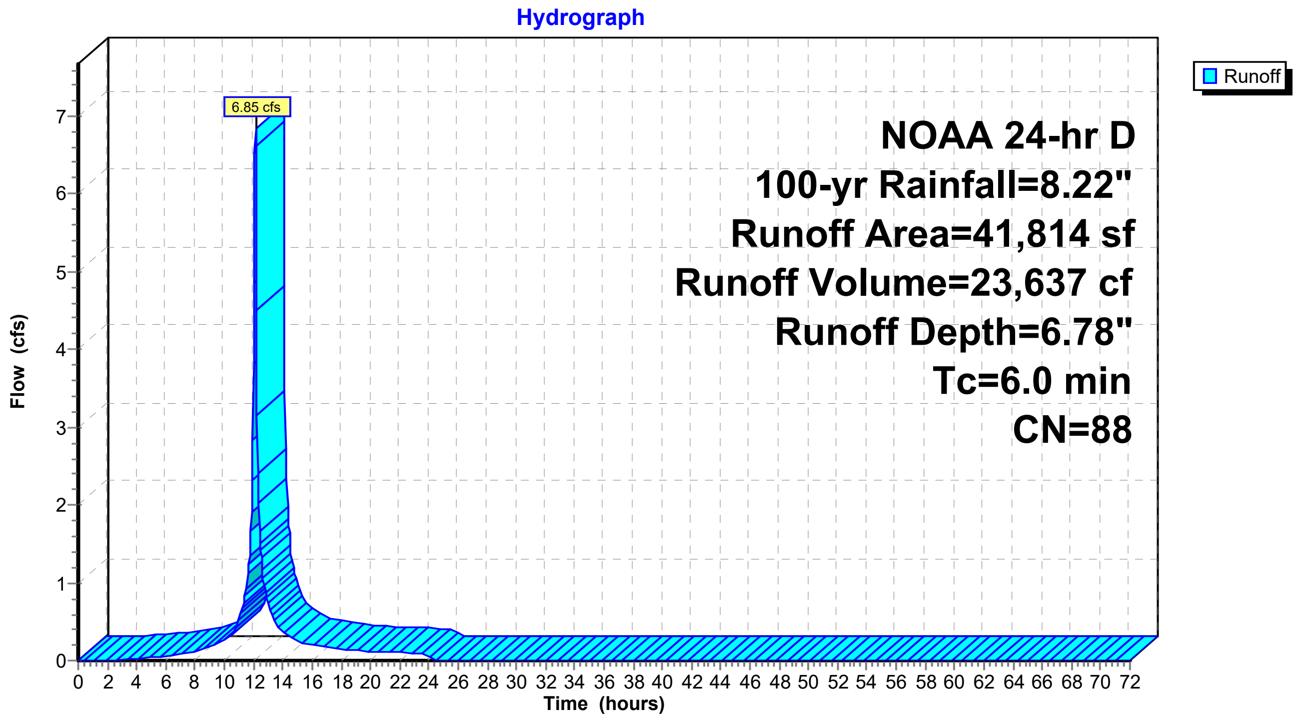
Runoff = 6.85 cfs @ 12.13 hrs, Volume= 23,637 cf, Depth= 6.78"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
NOAA 24-hr D 100-yr Rainfall=8.22"

Area (sf)	CN	Description
24,450	98	Paved parking, HSG C
17,364	74	>75% Grass cover, Good, HSG C
41,814	88	Weighted Average
17,364		41.53% Pervious Area
24,450		58.47% Impervious Area

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

Subcatchment PDA3: Proposed 3



Summary for Subcatchment PDA4: Proposed 4

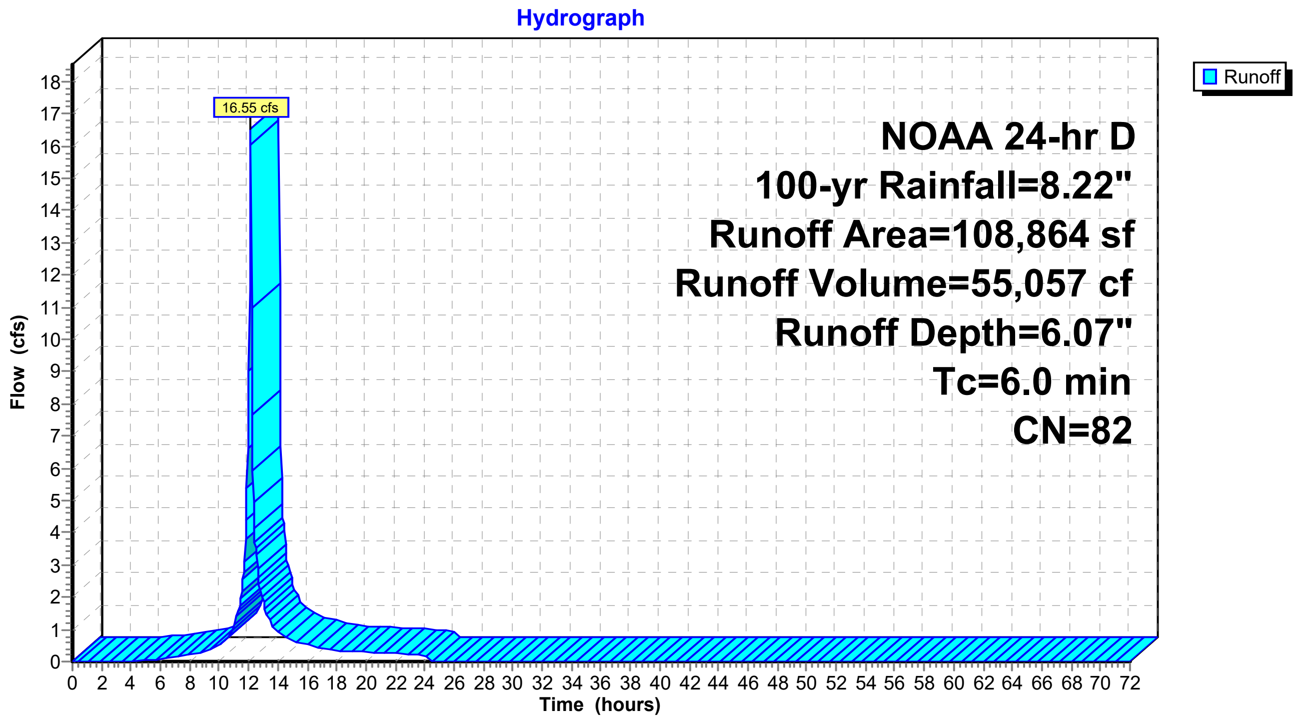
Runoff = 16.55 cfs @ 12.13 hrs, Volume= 55,057 cf, Depth= 6.07"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
NOAA 24-hr D 100-yr Rainfall=8.22"

	Area (sf)	CN	Description
	35,864	74	>75% Grass cover, Good, HSG C
	33,354	98	Paved roads w/curbs & sewers, HSG C
	30,631	70	Woods, Good, HSG C
*	9,015	98	Roofs, HSG C
	108,864	82	Weighted Average
	66,495		61.08% Pervious Area
	42,369		38.92% Impervious Area

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

Subcatchment PDA4: Proposed 4



Summary for Subcatchment PDA5: Proposed 5

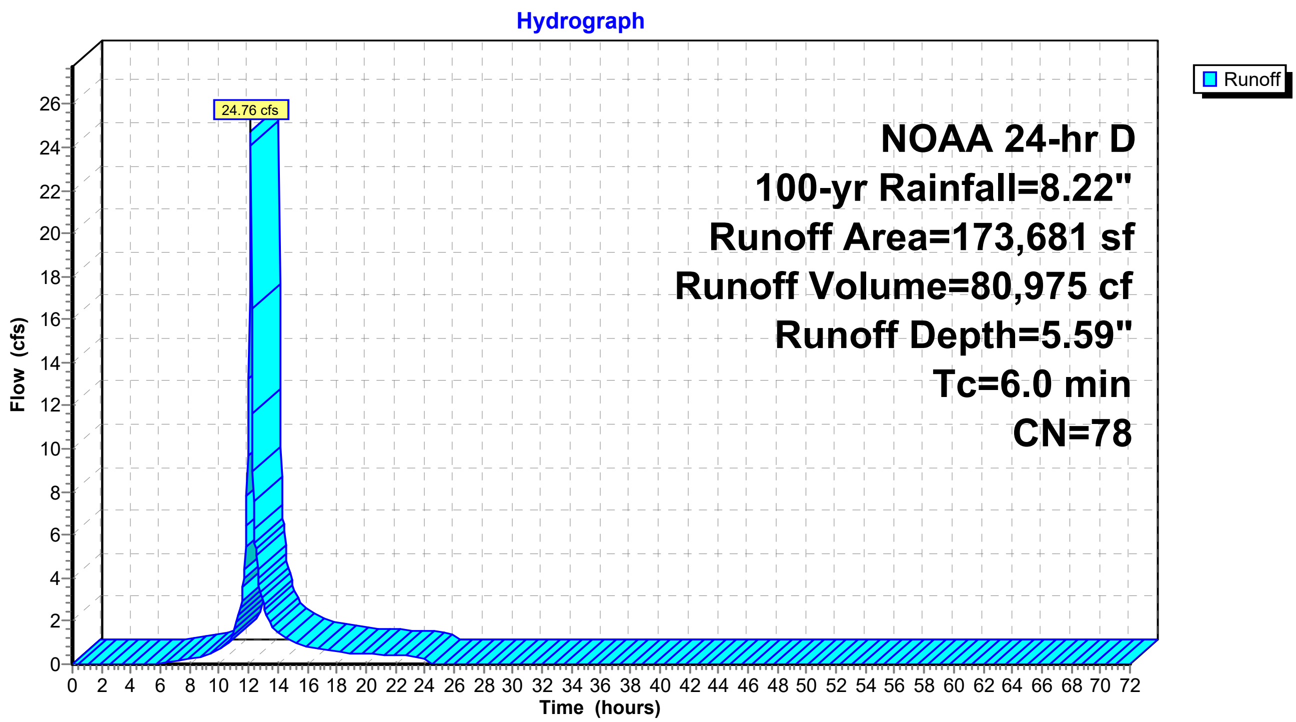
Runoff = 24.76 cfs @ 12.13 hrs, Volume= 80,975 cf, Depth= 5.59"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
NOAA 24-hr D 100-yr Rainfall=8.22"

	Area (sf)	CN	Description
	98,683	74	>75% Grass cover, Good, HSG C
	39,650	70	Woods, Good, HSG C
*	35,348	98	Pond
	173,681	78	Weighted Average
	138,333		79.65% Pervious Area
	35,348		20.35% Impervious Area

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

Subcatchment PDA5: Proposed 5



Summary for Subcatchment PDA6: Proposal 6

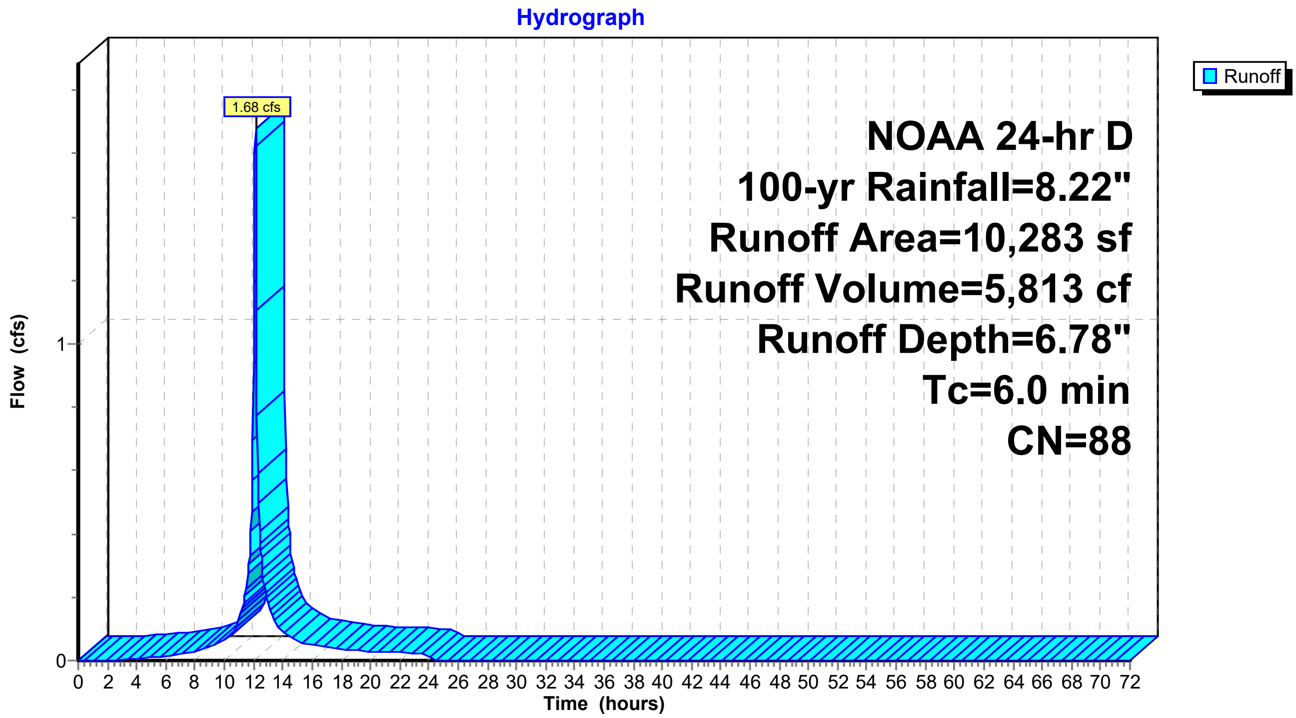
Runoff = 1.68 cfs @ 12.13 hrs, Volume= 5,813 cf, Depth= 6.78"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
NOAA 24-hr D 100-yr Rainfall=8.22"

Area (sf)	CN	Description
5,797	98	Paved parking, HSG C
4,486	74	>75% Grass cover, Good, HSG C
10,283	88	Weighted Average
4,486		43.63% Pervious Area
5,797		56.37% Impervious Area

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

Subcatchment PDA6: Proposal 6



Summary for Subcatchment PDA7: Proposal 7

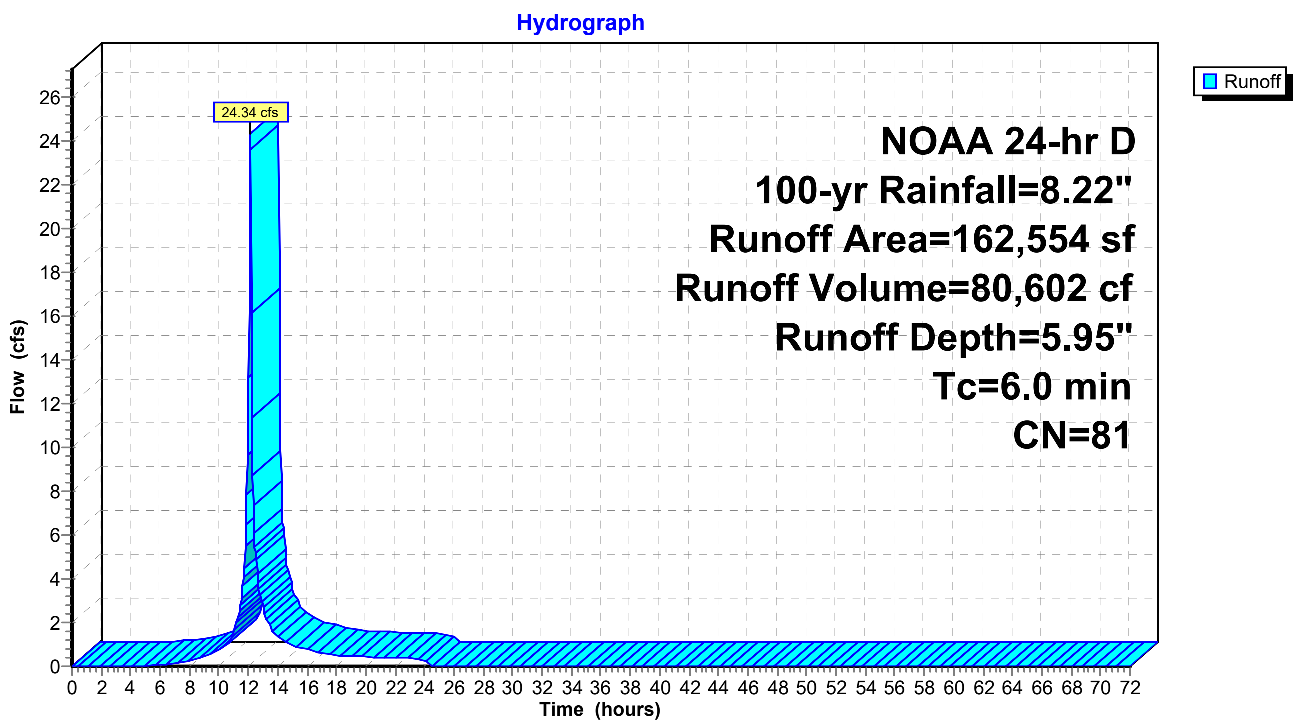
Runoff = 24.34 cfs @ 12.13 hrs, Volume= 80,602 cf, Depth= 5.95"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
NOAA 24-hr D 100-yr Rainfall=8.22"

Area (sf)	CN	Description
32,254	98	Roofs, HSG C
75,527	74	>75% Grass cover, Good, HSG C
18,642	98	Paved parking, HSG C
36,131	70	Woods, Good, HSG C
162,554	81	Weighted Average
111,658		68.69% Pervious Area
50,896		31.31% Impervious Area

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

Subcatchment PDA7: Proposal 7



Summary for Subcatchment PDA8: Proposed 8

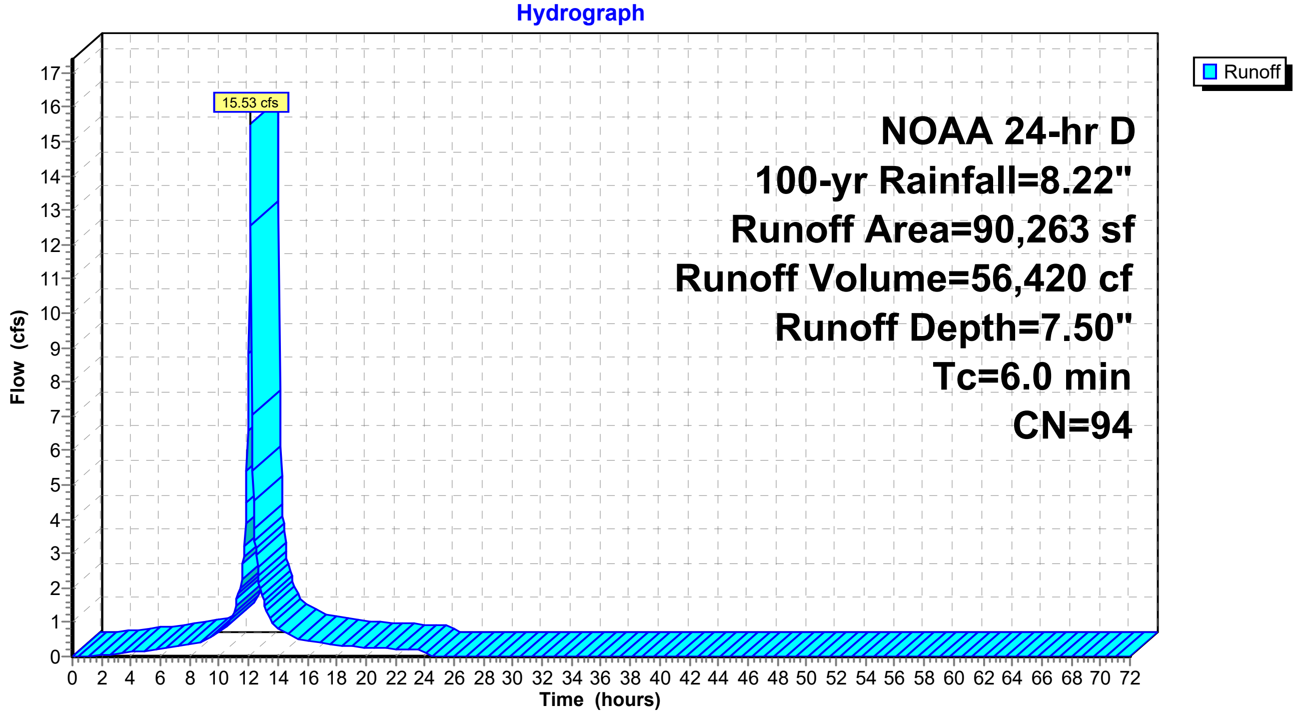
Runoff = 15.53 cfs @ 12.13 hrs, Volume= 56,420 cf, Depth= 7.50"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
NOAA 24-hr D 100-yr Rainfall=8.22"

Area (sf)	CN	Description
75,141	98	Paved parking, HSG C
15,122	74	>75% Grass cover, Good, HSG C
90,263	94	Weighted Average
15,122		16.75% Pervious Area
75,141		83.25% Impervious Area

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

Subcatchment PDA8: Proposed 8



Summary for Subcatchment PDA9: Proposed 9

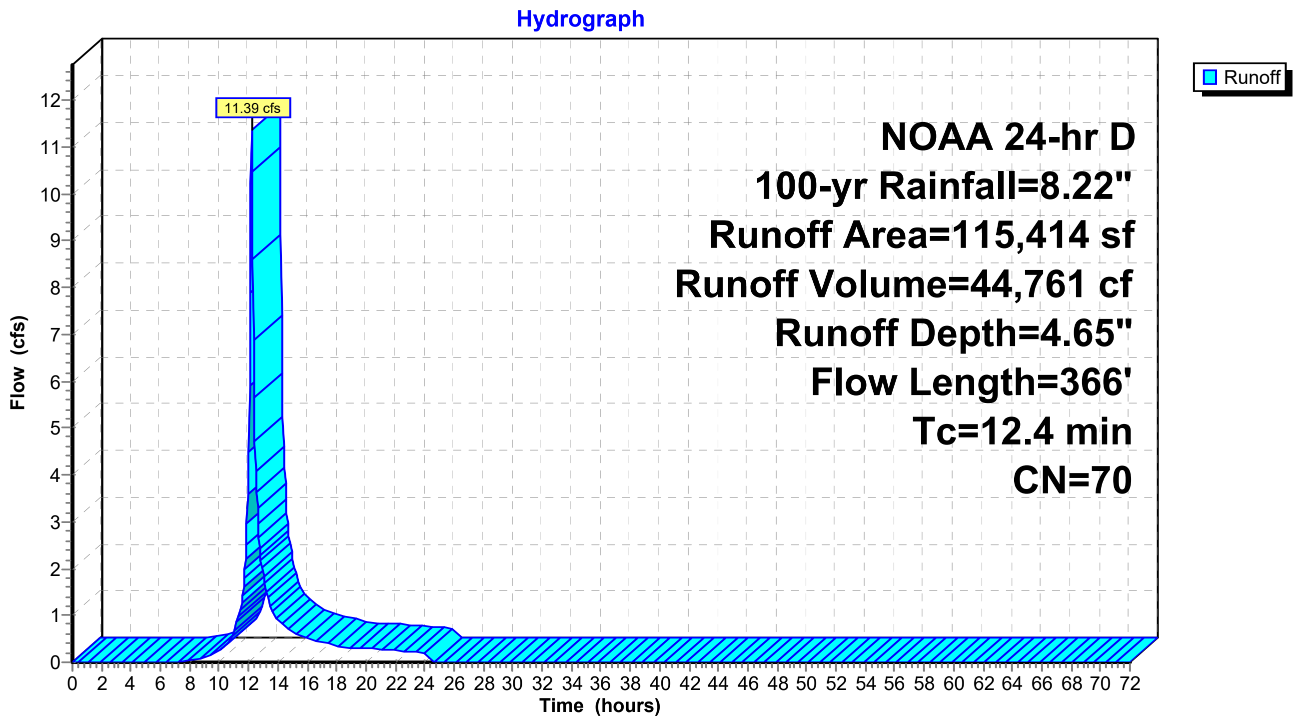
Runoff = 11.39 cfs @ 12.20 hrs, Volume= 44,761 cf, Depth= 4.65"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
NOAA 24-hr D 100-yr Rainfall=8.22"

Area (sf)	CN	Description
105,951	70	Woods, Good, HSG C
9,463	74	>75% Grass cover, Good, HSG C
115,414	70	Weighted Average
115,414		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.1	50	0.0400	0.09		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.35"
3.3	316	0.1000	1.58		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
12.4	366	Total			

Subcatchment PDA9: Proposed 9

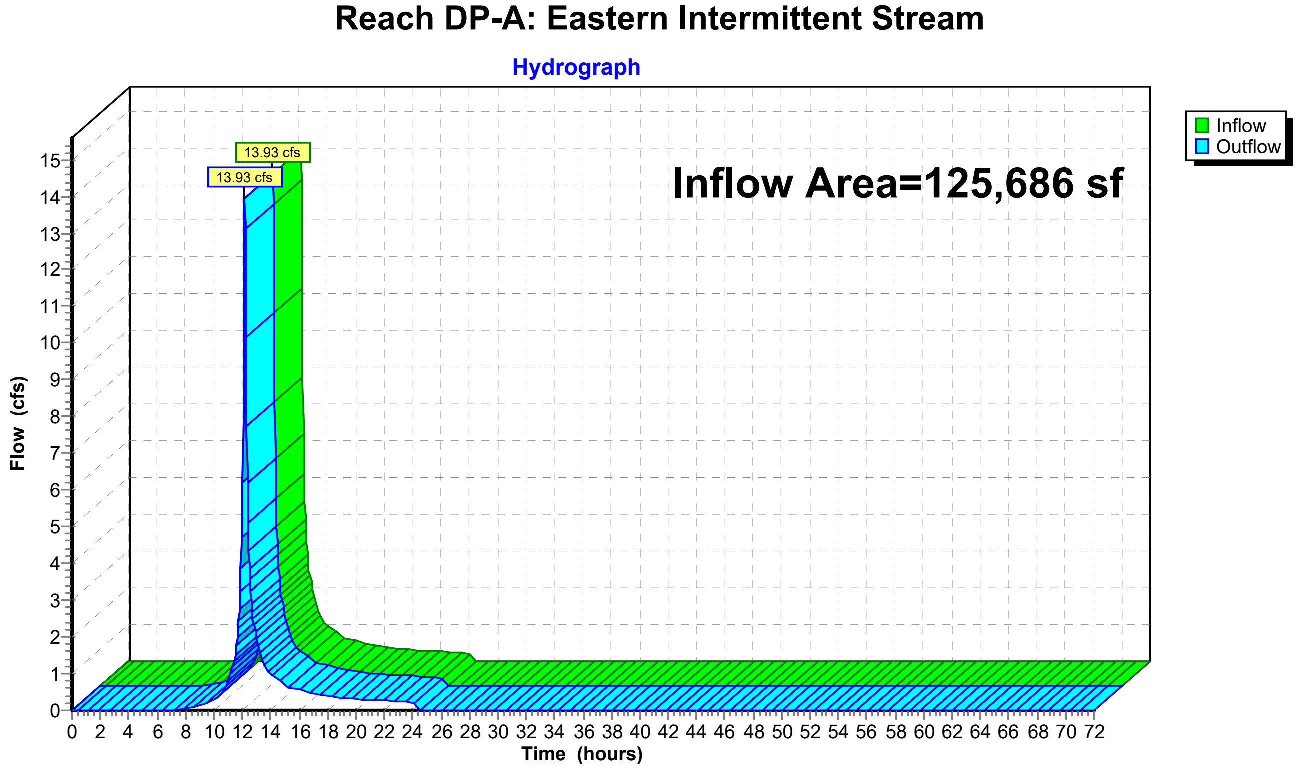


Summary for Reach DP-A: Eastern Intermittent Stream

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

Inflow Area =	125,686 sf,	0.00% Impervious,	Inflow Depth = 4.77"	for 100-yr event
Inflow =	13.93 cfs @	12.17 hrs, Volume=	49,969 cf	
Outflow =	13.93 cfs @	12.17 hrs, Volume=	49,969 cf,	Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs



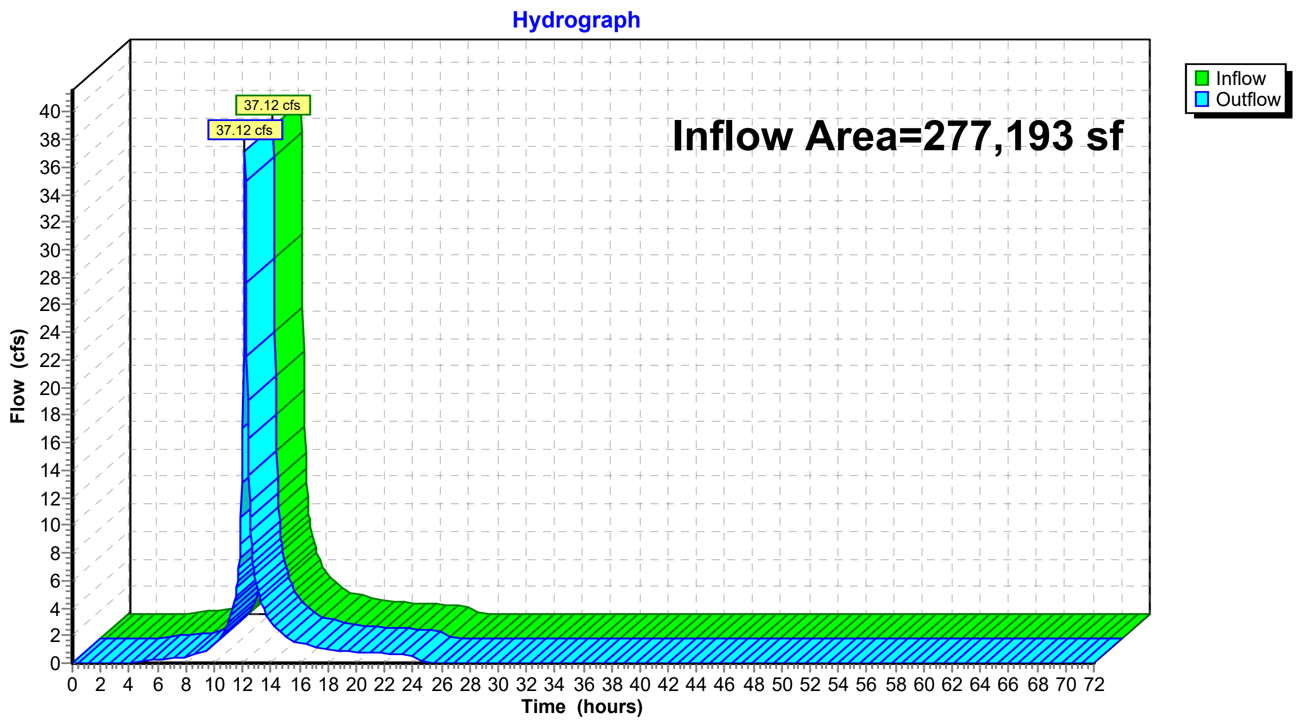
Summary for Reach DP-B: Concord Street Main

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

Inflow Area = 277,193 sf, 56.24% Impervious, Inflow Depth = 6.47" for 100-yr event
Inflow = 37.12 cfs @ 12.16 hrs, Volume= 149,425 cf
Outflow = 37.12 cfs @ 12.16 hrs, Volume= 149,425 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

Reach DP-B: Concord Street Main

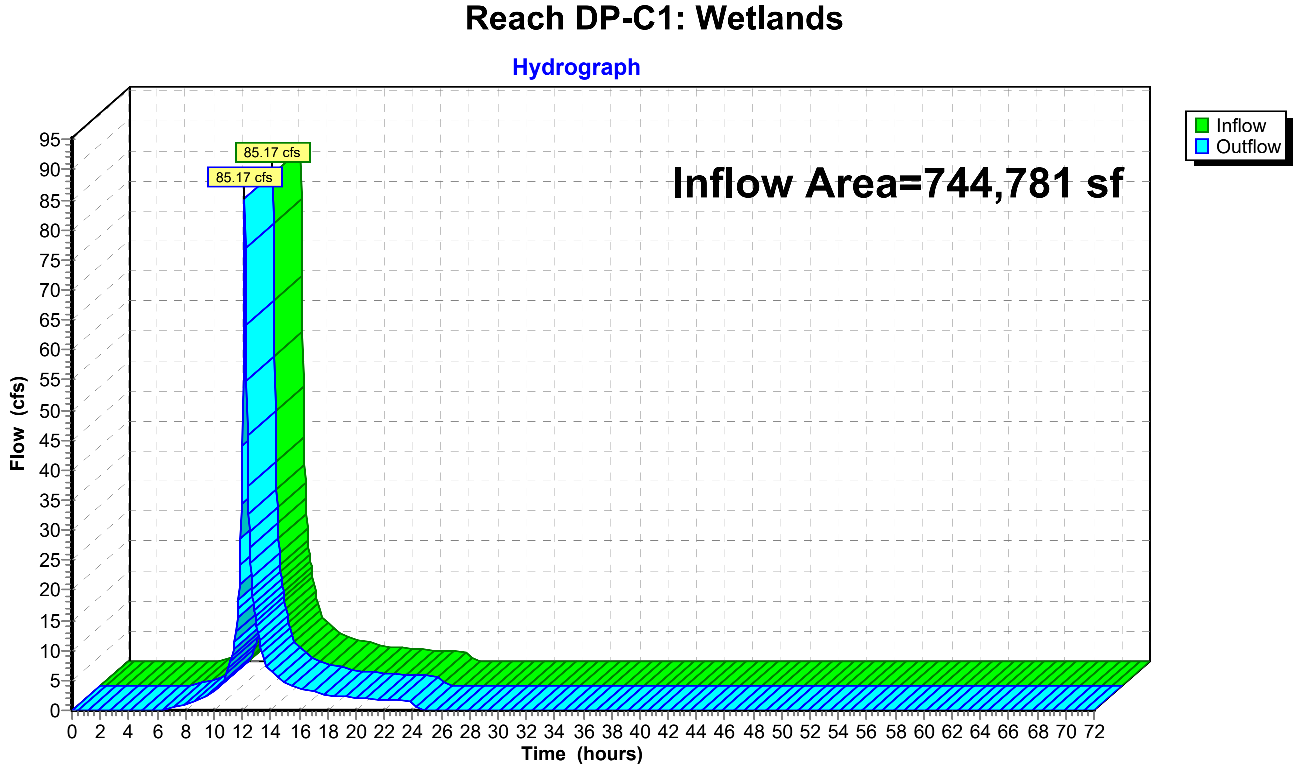


Summary for Reach DP-C1: Wetlands

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

Inflow Area = 744,781 sf, 30.56% Impervious, Inflow Depth = 5.79" for 100-yr event
Inflow = 85.17 cfs @ 12.15 hrs, Volume= 359,567 cf
Outflow = 85.17 cfs @ 12.15 hrs, Volume= 359,567 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs



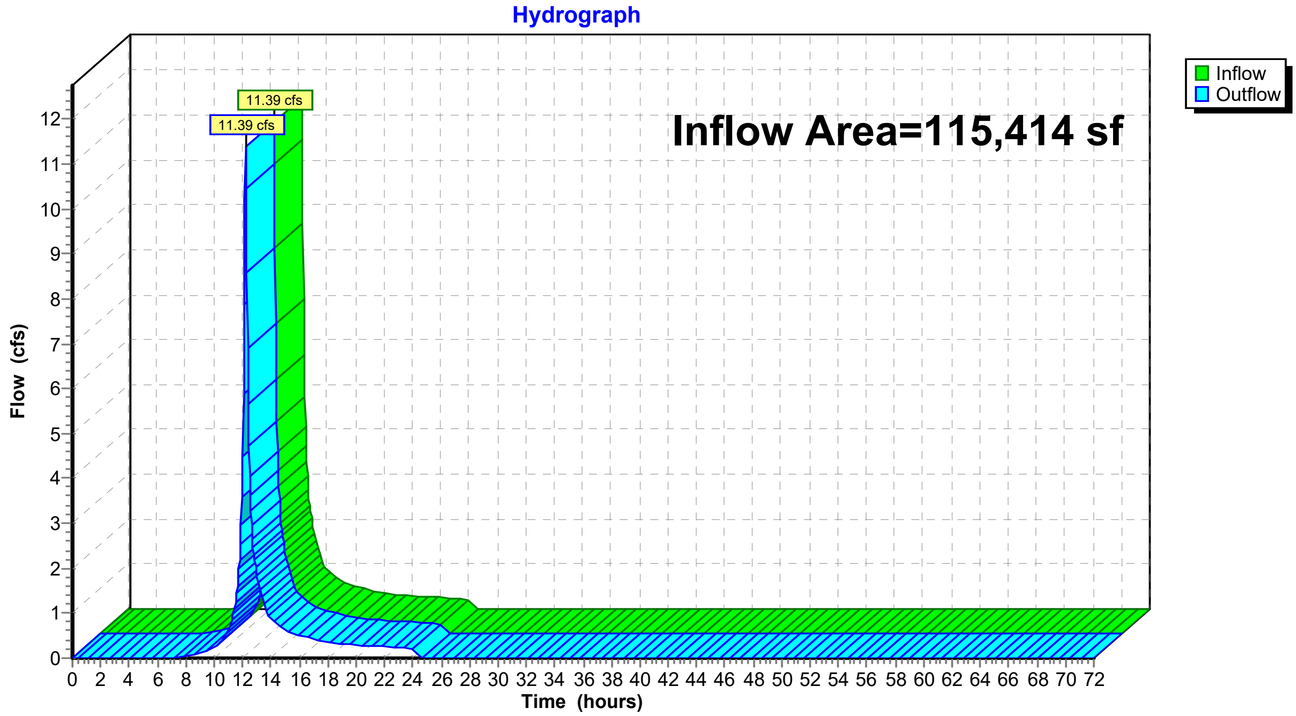
Summary for Reach DP-C2: Intermittent Stream West

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

Inflow Area =	115,414 sf,	0.00% Impervious,	Inflow Depth = 4.65"	for 100-yr event
Inflow =	11.39 cfs @	12.20 hrs, Volume=	44,761 cf	
Outflow =	11.39 cfs @	12.20 hrs, Volume=	44,761 cf, Atten= 0%, Lag= 0.0 min	

Routing by Stor-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

Reach DP-C2: Intermittent Stream West

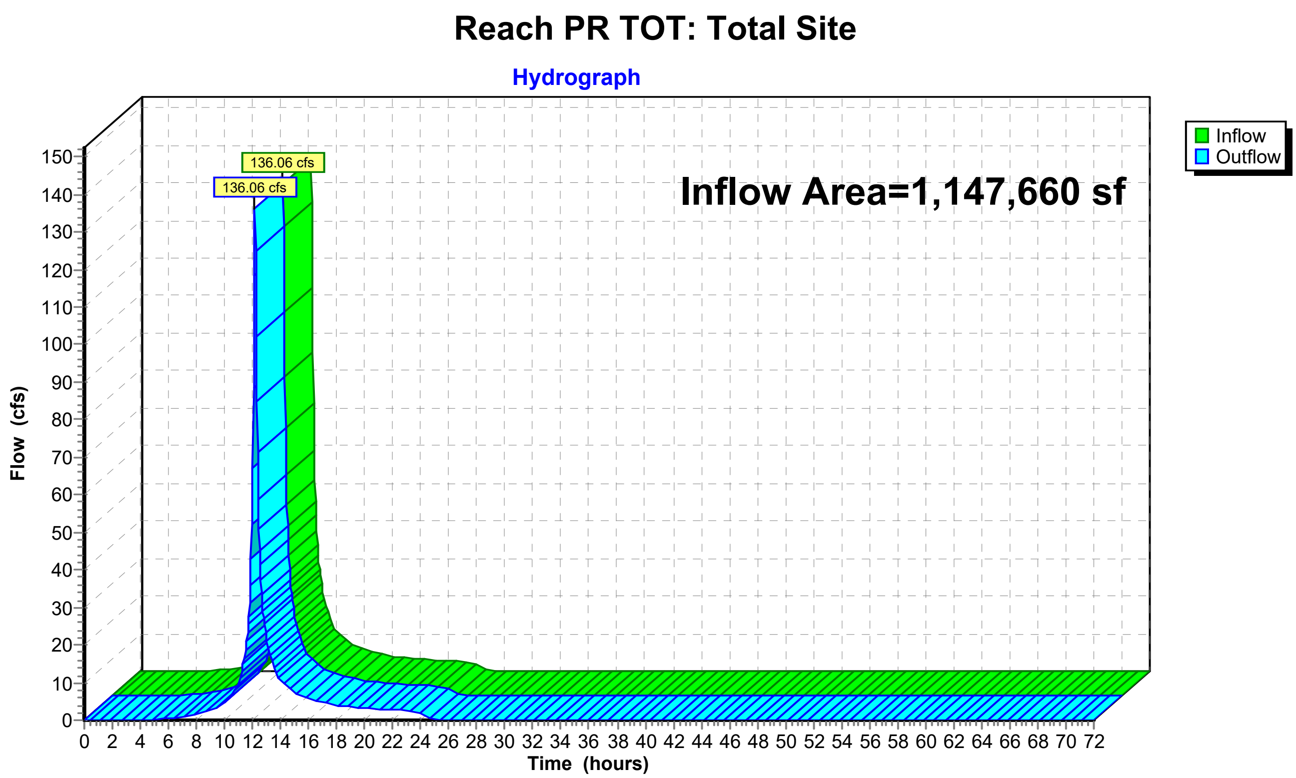


Summary for Reach PR TOT: Total Site

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

Inflow Area = 1,147,660 sf, 33.42% Impervious, Inflow Depth = 5.84" for 100-yr event
Inflow = 136.06 cfs @ 12.16 hrs, Volume= 558,962 cf
Outflow = 136.06 cfs @ 12.16 hrs, Volume= 558,962 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs



Summary for Reach SWALE: Bioswale

Inflow Area = 26,182 sf, 63.13% Impervious, Inflow Depth = 6.90" for 100-yr event
Inflow = 4.33 cfs @ 12.13 hrs, Volume= 15,061 cf
Outflow = 4.16 cfs @ 12.15 hrs, Volume= 15,061 cf, Atten= 4%, Lag= 1.3 min

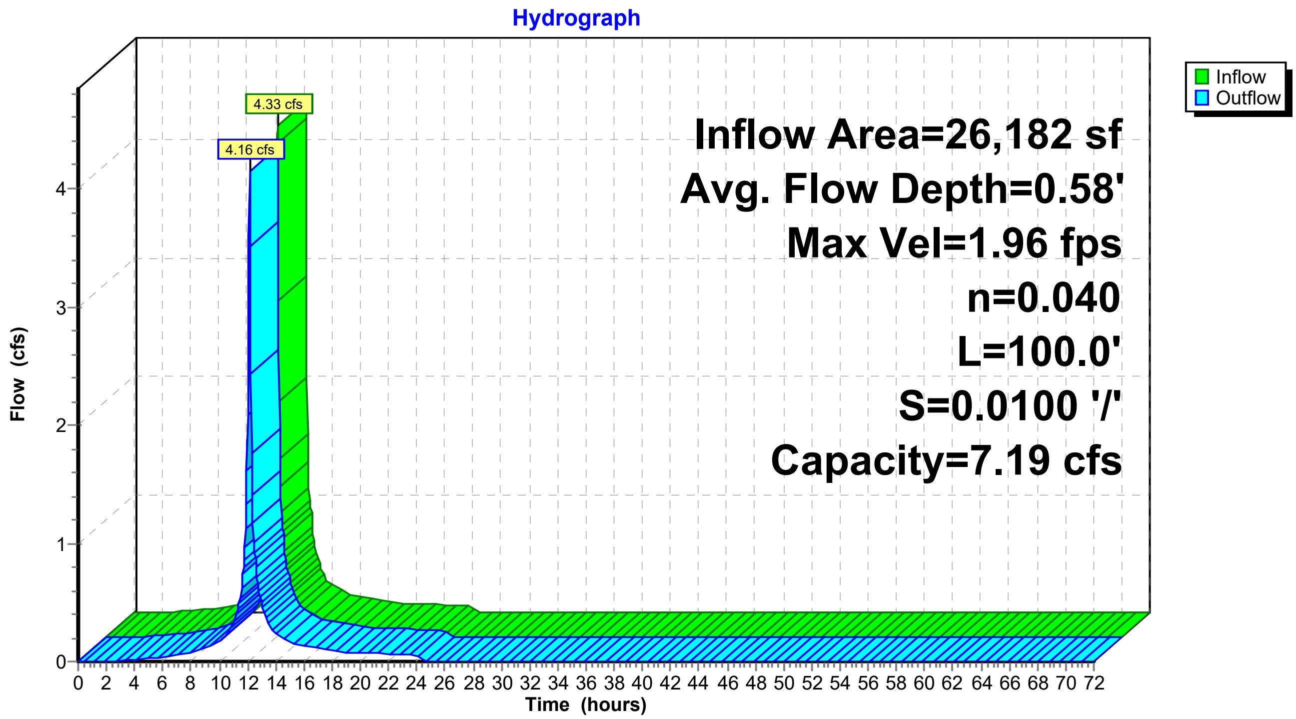
Routing by Stor-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Max. Velocity= 1.96 fps, Min. Travel Time= 0.8 min
Avg. Velocity = 0.61 fps, Avg. Travel Time= 2.8 min

Peak Storage= 219 cf @ 12.14 hrs
Average Depth at Peak Storage= 0.58'
Bank-Full Depth= 0.75' Flow Area= 3.2 sf, Capacity= 7.19 cfs

2.00' x 0.75' deep channel, n= 0.040 Earth, cobble bottom, clean sides
Side Slope Z-value= 3.0 '/' Top Width= 6.50'
Length= 100.0' Slope= 0.0100 '/'
Inlet Invert= 185.00', Outlet Invert= 184.00'

‡

Reach SWALE: Bioswale



Summary for Pond SI-1: Surface Infiltration

Inflow Area = 41,814 sf, 58.47% Impervious, Inflow Depth = 6.78" for 100-yr event
Inflow = 6.85 cfs @ 12.13 hrs, Volume= 23,637 cf
Outflow = 4.54 cfs @ 12.21 hrs, Volume= 21,577 cf, Atten= 34%, Lag= 4.8 min
Primary = 4.54 cfs @ 12.21 hrs, Volume= 21,577 cf

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 200.44' @ 12.21 hrs Surf.Area= 4,006 sf Storage= 4,300 cf

Plug-Flow detention time= 87.5 min calculated for 21,577 cf (91% of inflow)
Center-of-Mass det. time= 40.6 min (826.3 - 785.7)

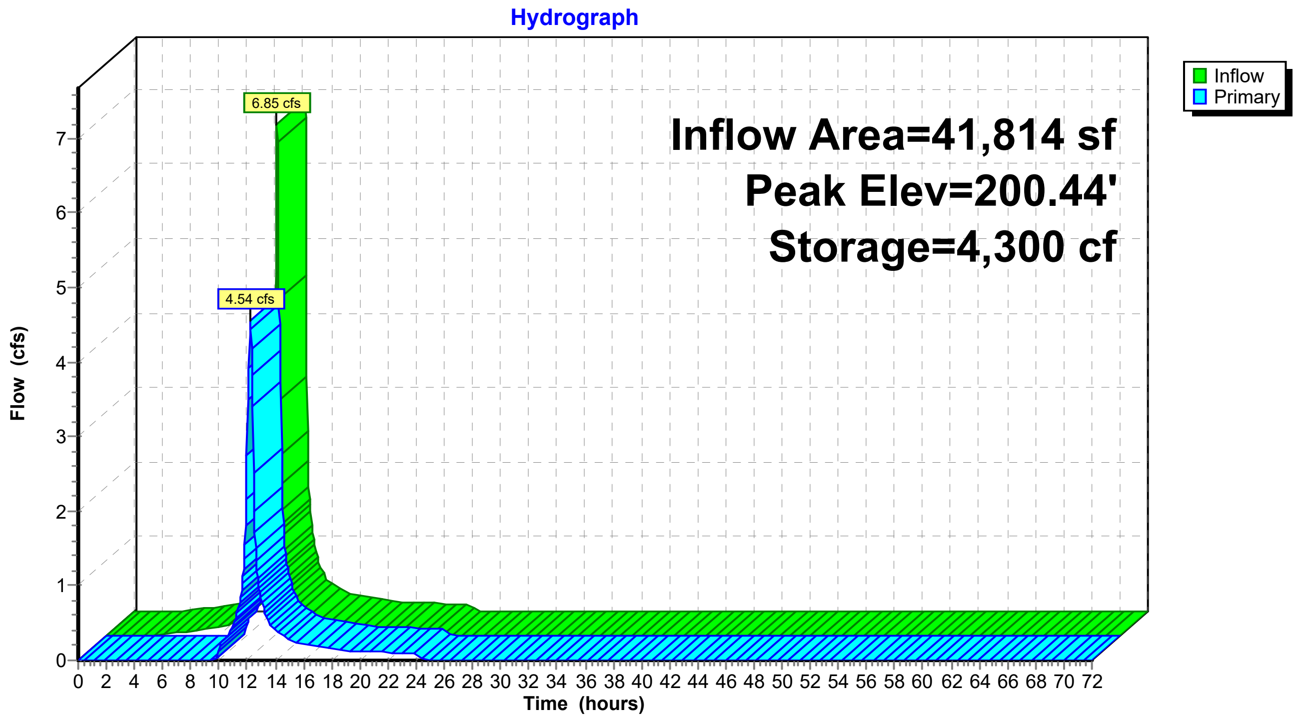
Volume	Invert	Avail.Storage	Storage Description
#1	198.90'	5,612 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
198.90	1,600	0	0
199.75	2,900	1,912	1,912
200.75	4,500	3,700	5,612

Device	Routing	Invert	Outlet Devices
#1	Primary	196.00'	**12.0" Round Culvert** L= 50.0' CPP, mitered to conform to fill, Ke= 0.700 Inlet / Outlet Invert= 196.00' / 195.50' S= 0.0100 '/' Cc= 0.900 n= 0.013, Flow Area= 0.79 sf
#2	Device 1	199.80'	**12.0" Horiz. Orifice/Grate X 1.50** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=4.53 cfs @ 12.21 hrs HW=200.44' (Free Discharge)
└─**1=Culvert** (Passes 4.53 cfs of 6.62 cfs potential flow)
  └─**2=Orifice/Grate** (Orifice Controls 4.53 cfs @ 5.76 fps)

Pond SI-1: Surface Infiltration



Summary for Pond SI-2: Surface System

Inflow Area = 110,656 sf, 69.66% Impervious, Inflow Depth = 7.14" for 100-yr event
Inflow = 18.64 cfs @ 12.13 hrs, Volume= 65,856 cf
Outflow = 12.80 cfs @ 12.20 hrs, Volume= 63,719 cf, Atten= 31%, Lag= 4.4 min
Primary = 12.80 cfs @ 12.20 hrs, Volume= 63,719 cf

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 194.82' @ 12.20 hrs Surf.Area= 5,408 sf Storage= 5,707 cf

Plug-Flow detention time= 39.9 min calculated for 63,675 cf (97% of inflow)
Center-of-Mass det. time= 20.0 min (795.3 - 775.3)

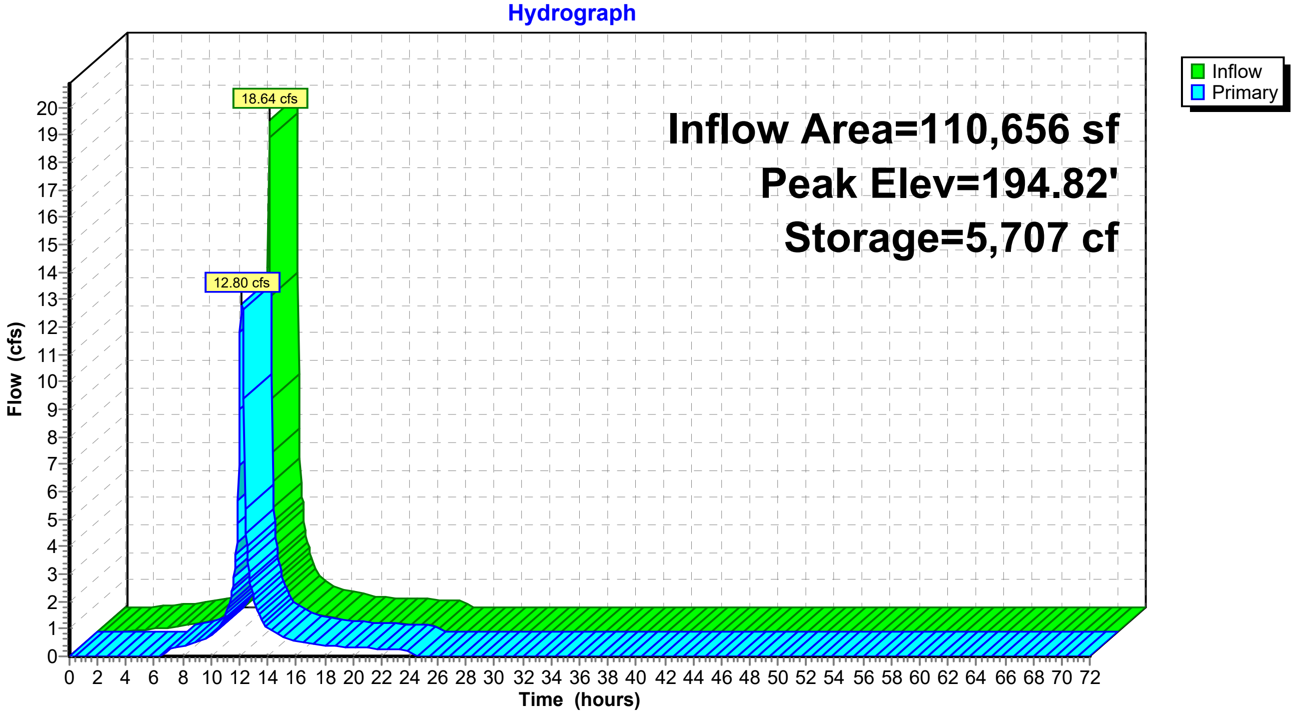
Volume	Invert	Avail.Storage	Storage Description
#1	193.60'	10,350 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
193.60	4,000	0	0
194.60	5,100	4,550	4,550
195.60	6,500	5,800	10,350

Device	Routing	Invert	Outlet Devices
#1	Primary	189.50'	**15.0" Round Culvert** L= 50.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 189.50' / 189.00' S= 0.0100 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.23 sf
#2	Device 1	194.10'	**24.0" Horiz. Orifice/Grate X 3.00** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=12.80 cfs @ 12.20 hrs HW=194.82' (Free Discharge)
└─**1=Culvert** (Inlet Controls 12.80 cfs @ 10.43 fps)
  └─**2=Orifice/Grate** (Passes 12.80 cfs of 37.65 cfs potential flow)

Pond SI-2: Surface System



Summary for Pond SS-1: Subsurface Infiltration (SC-310 Chambers)

Inflow Area = 146,011 sf, 28.74% Impervious, Inflow Depth = 5.95" for 100-yr event
Inflow = 21.86 cfs @ 12.13 hrs, Volume= 72,399 cf
Outflow = 21.03 cfs @ 12.15 hrs, Volume= 71,231 cf, Atten= 4%, Lag= 1.3 min
Primary = 21.03 cfs @ 12.15 hrs, Volume= 71,231 cf

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 186.30' @ 12.15 hrs Surf.Area= 4,860 sf Storage= 6,172 cf

Plug-Flow detention time= 28.2 min calculated for 71,231 cf (98% of inflow)
Center-of-Mass det. time= 17.8 min (823.9 - 806.1)

Volume	Invert	Avail.Storage	Storage Description
#1A	184.00'	3,404 cf	**41.50'W x 117.12'L x 2.33'H Field A** 11,341 cf Overall - 2,830 cf Embedded = 8,511 cf x 40.0% Voids
#2A	184.50'	2,830 cf	**ADS_StormTech SC-310 +Cap** x 192 Inside #1 Effective Size= 28.9"W x 16.0"H => 2.07 sf x 7.12'L = 14.7 cf Overall Size= 34.0"W x 16.0"H x 7.56'L with 0.44' Overlap 12 Rows of 16 Chambers
		6,235 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	184.55'	**36.0" W x 9.0" H Vert. Orifice/Grate** C= 0.600
#2	Primary	185.65'	**5.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)

Primary OutFlow Max=20.97 cfs @ 12.15 hrs HW=186.30' (Free Discharge)
1=Orifice/Grate (Orifice Controls 12.66 cfs @ 5.62 fps)
2=Sharp-Crested Rectangular Weir (Weir Controls 8.31 cfs @ 2.63 fps)

Pond SS-1: Subsurface Infiltration (SC-310 Chambers) - Chamber Wizard Field A

Chamber Model = ADS_StormTechSC-310 +Cap (ADS StormTech®SC-310 with cap length)
Effective Size= 28.9"W x 16.0"H => 2.07 sf x 7.12'L = 14.7 cf
Overall Size= 34.0"W x 16.0"H x 7.56'L with 0.44' Overlap

34.0" Wide + 6.0" Spacing = 40.0" C-C Row Spacing

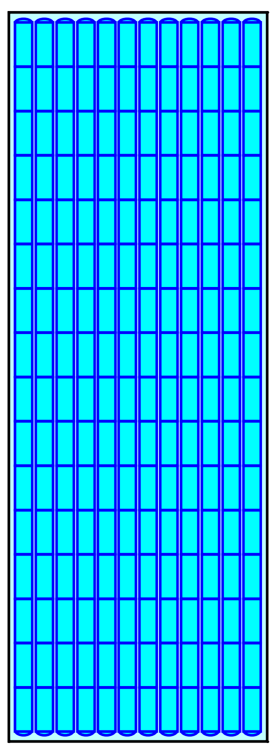
16 Chambers/Row x 7.12' Long +0.60' Cap Length x 2 = 115.12' Row Length +12.0" End Stone x 2 = 117.12' Base Length
12 Rows x 34.0" Wide + 6.0" Spacing x 11 + 12.0" Side Stone x 2 = 41.50' Base Width
6.0" Base + 16.0" Chamber Height + 6.0" Cover = 2.33' Field Height

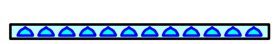
192 Chambers x 14.7 cf = 2,830.5 cf Chamber Storage

11,341.1 cf Field - 2,830.5 cf Chambers = 8,510.7 cf Stone x 40.0% Voids = 3,404.3 cf Stone Storage

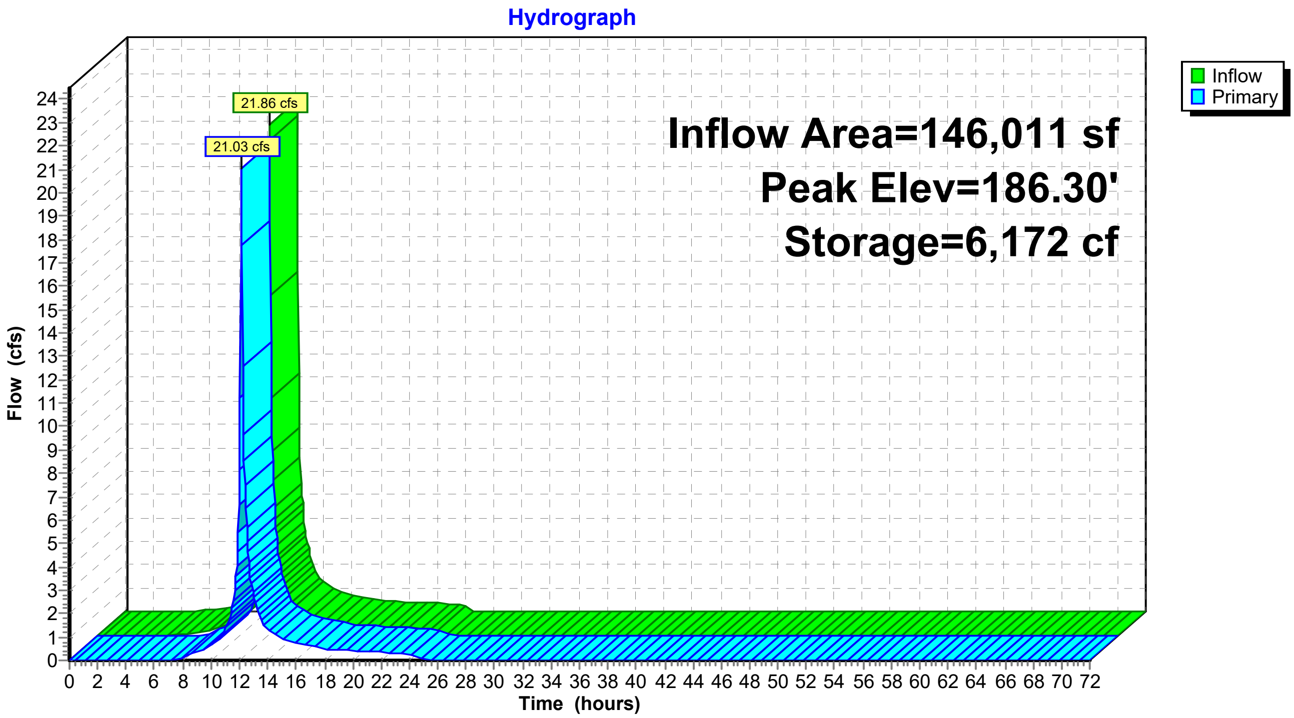
Chamber Storage + Stone Storage = 6,234.7 cf = 0.143 af
Overall Storage Efficiency = 55.0%
Overall System Size = 117.12' x 41.50' x 2.33'

192 Chambers
420.0 cy Field
315.2 cy Stone





Pond SS-1: Subsurface Infiltration (SC-310 Chambers)



Summary for Pond SS-2: Subsurface Infiltration (SC-740 Chambers)

Inflow Area = 10,283 sf, 56.37% Impervious, Inflow Depth = 6.78" for 100-yr event
Inflow = 1.68 cfs @ 12.13 hrs, Volume= 5,813 cf
Outflow = 0.14 cfs @ 13.28 hrs, Volume= 4,707 cf, Atten= 92%, Lag= 69.0 min
Primary = 0.14 cfs @ 13.28 hrs, Volume= 4,707 cf

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 188.94' @ 13.28 hrs Surf.Area= 1,826 sf Storage= 3,469 cf

Plug-Flow detention time= 361.5 min calculated for 4,707 cf (81% of inflow)
Center-of-Mass det. time= 281.5 min (1,067.2 - 785.7)

Volume	Invert	Avail.Storage	Storage Description
#1A	186.00'	1,674 cf	**20.50'W x 89.06'L x 3.50'H Field A** 6,390 cf Overall - 2,205 cf Embedded = 4,185 cf x 40.0% Voids
#2A	186.50'	2,205 cf	**ADS_StormTech SC-740 +Cap** x 48 Inside #1 Effective Size= 44.6"W x 30.0"H => 6.45 sf x 7.12'L = 45.9 cf Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap 4 Rows of 12 Chambers
		3,879 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	187.00'	**2.0" Vert. Orifice/Grate** C= 0.600
#2	Primary	189.00'	**5.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)

Primary OutFlow Max=0.14 cfs @ 13.28 hrs HW=188.94' (Free Discharge)
1=Orifice/Grate (Orifice Controls 0.14 cfs @ 6.56 fps)
2=Sharp-Crested Rectangular Weir (Controls 0.00 cfs)

Pond SS-2: Subsurface Infiltration (SC-740 Chambers) - Chamber Wizard Field A

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

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

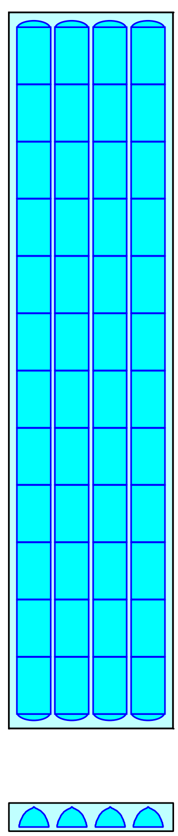
12 Chambers/Row x 7.12' Long +0.81' Cap Length x 2 = 87.06' Row Length +12.0" End Stone x 2 = 89.06' Base Length
4 Rows x 51.0" Wide + 6.0" Spacing x 3 + 12.0" Side Stone x 2 = 20.50' Base Width
6.0" Base + 30.0" Chamber Height + 6.0" Cover = 3.50' Field Height

48 Chambers x 45.9 cf = 2,205.1 cf Chamber Storage

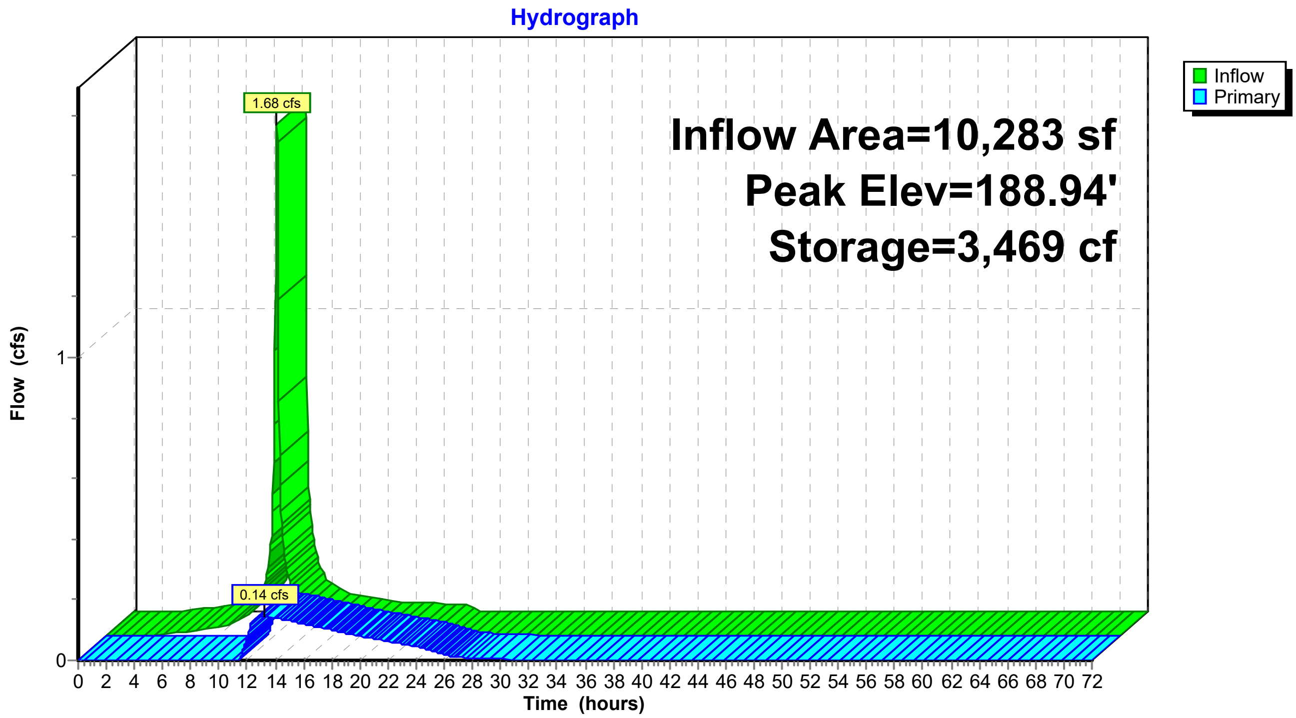
6,389.8 cf Field - 2,205.1 cf Chambers = 4,184.7 cf Stone x 40.0% Voids = 1,673.9 cf Stone Storage

Chamber Storage + Stone Storage = 3,879.0 cf = 0.089 af
Overall Storage Efficiency = 60.7%
Overall System Size = 89.06' x 20.50' x 3.50'

48 Chambers
236.7 cy Field
155.0 cy Stone



Pond SS-2: Subsurface Infiltration (SC-740 Chambers)



Summary for Pond SS-3: Subsurface Infiltration (24" Pipe)

Inflow Area =	162,554 sf,	31.31% Impervious,	Inflow Depth = 5.95"	for 100-yr event
Inflow =	24.34 cfs @	12.13 hrs, Volume=	80,602 cf	
Outflow =	14.99 cfs @	12.21 hrs, Volume=	79,115 cf,	Atten= 38%, Lag= 5.1 min
Primary =	14.99 cfs @	12.21 hrs, Volume=	79,115 cf	

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 196.50' @ 12.22 hrs Surf.Area= 8,006 sf Storage= 13,125 cf

Plug-Flow detention time= 33.4 min calculated for 79,060 cf (98% of inflow)
Center-of-Mass det. time= 22.2 min (828.3 - 806.1)

Volume	Invert	Avail.Storage	Storage Description
#1A	193.50'	6,003 cf	**45.40'W x 176.33'L x 3.00'H Field A**
			24,017 cf Overall - 9,009 cf Embedded = 15,008 cf x 40.0% Voids
#2A	193.83'	7,122 cf	**ADS N-12 24"** x 117 Inside #1
			Inside= 23.8"W x 23.8"H => 3.10 sf x 20.00'L = 62.0 cf
			Outside= 28.0"W x 28.0"H => 3.92 sf x 20.00'L = 78.4 cf
			Row Length Adjustment= -10.00' x 3.10 sf x 13 rows
			43.73' Header x 3.10 sf x 2 = 271.2 cf Inside
		13,125 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	194.00'	**30.0" W x 8.0" H Vert. Orifice/Grate** C= 0.600
#2	Primary	194.75'	**10.0" W x 6.0" H Vert. Orifice/Grate** C= 0.600
#3	Primary	196.35'	**5.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)

Primary OutFlow Max=14.72 cfs @ 12.21 hrs HW=196.46' (Free Discharge)
—**1=Orifice/Grate** (Orifice Controls 11.69 cfs @ 7.02 fps)
—**2=Orifice/Grate** (Orifice Controls 2.42 cfs @ 5.81 fps)
—**3=Sharp-Crested Rectangular Weir** (Weir Controls 0.60 cfs @ 1.09 fps)

Pond SS-3: Subsurface Infiltration (24" Pipe) - Chamber Wizard Field A

Chamber Model = ADS N-12 24" (ADS N-12® Pipe)
Inside= 23.8"W x 23.8"H => 3.10 sf x 20.00'L = 62.0 cf
Outside= 28.0"W x 28.0"H => 3.92 sf x 20.00'L = 78.4 cf
Row Length Adjustment= -10.00' x 3.10 sf x 13 rows

28.0" Wide + 13.4" Spacing = 41.4" C-C Row Spacing

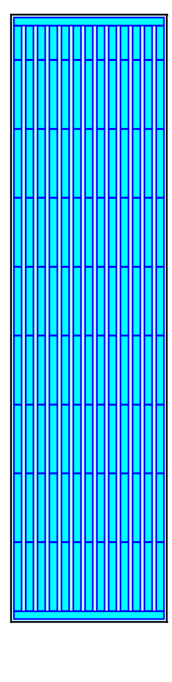
9 Chambers/Row x 20.00' Long -10.00' Row Adjustment +2.33' Header x 2 = 174.67' Row Length +10.0" End Stone x 2 = 176.33' Base Length
13 Rows x 28.0" Wide + 13.4" Spacing x 12 + 10.0" Side Stone x 2 = 45.40' Base Width
4.0" Base + 28.0" Chamber Height + 4.0" Cover = 3.00' Field Height

117 Chambers x 62.0 cf -10.00' Row Adjustment x 3.10 sf x 13 Rows + 43.73' Header x 3.10 sf x 2 = 7,122.2 cf Chamber Storage
117 Chambers x 78.4 cf -10.00' Row Adjustment x 3.92 sf x 13 Rows + 43.73' Header x 3.92 sf x 2 = 9,005.3 cf Displacement

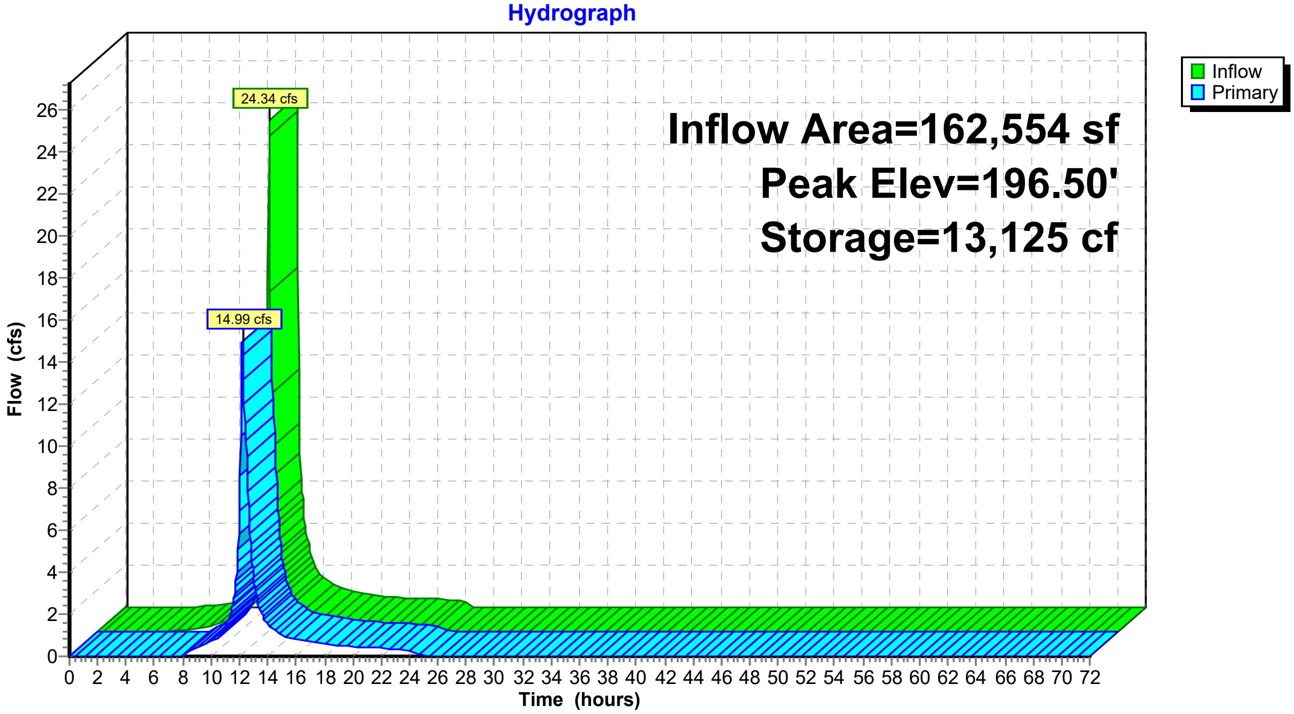
24,017.4 cf Field - 9,005.3 cf Chambers = 15,012.1 cf Stone x 40.0% Voids = 6,004.8 cf Stone Storage

Chamber Storage + Stone Storage = 13,127.0 cf = 0.301 af
Overall Storage Efficiency = 54.7%
Overall System Size = 176.33' x 45.40' x 3.00'

117 Chambers
889.5 cy Field
556.0 cy Stone



Pond SS-3: Subsurface Infiltration (24" Pipe)



Summary for Pond SS-4: Subsurface Infiltration (24" Pipe)

Inflow Area =	108,864 sf,	38.92% Impervious,	Inflow Depth = 6.07"	for 100-yr event
Inflow =	16.55 cfs @	12.13 hrs, Volume=	55,057 cf	
Outflow =	14.87 cfs @	12.17 hrs, Volume=	53,649 cf,	Atten= 10%, Lag= 2.2 min
Primary =	14.87 cfs @	12.17 hrs, Volume=	53,649 cf	

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 202.00' @ 12.16 hrs Surf.Area= 5,587 sf Storage= 9,144 cf

Plug-Flow detention time= 56.5 min calculated for 53,611 cf (97% of inflow)
Center-of-Mass det. time= 41.5 min (844.9 - 803.4)

Volume	Invert	Avail.Storage	Storage Description
#1A	199.00'	2,748 cf	**83.35'W x 44.33'L x 3.00'H Field A**
			11,086 cf Overall - 4,217 cf Embedded = 6,869 cf x 40.0% Voids
#2A	199.33'	3,334 cf	**ADS N-12 24"** x 48 Inside #1
			Inside= 23.8"W x 23.8"H => 3.10 sf x 20.00'L = 62.0 cf
			Outside= 28.0"W x 28.0"H => 3.92 sf x 20.00'L = 78.4 cf
			Row Length Adjustment= -2.00' x 3.10 sf x 24 rows
			81.68' Header x 3.10 sf x 2 = 506.4 cf Inside
#3B	199.00'	1,454 cf	**45.40'W x 41.67'L x 3.00'H Field B**
			5,675 cf Overall - 2,039 cf Embedded = 3,636 cf x 40.0% Voids
#4B	199.33'	1,612 cf	**ADS N-12 24"** x 26 Inside #3
			Inside= 23.8"W x 23.8"H => 3.10 sf x 20.00'L = 62.0 cf
			Outside= 28.0"W x 28.0"H => 3.92 sf x 20.00'L = 78.4 cf
			13 Rows of 2 Chambers
		9,148 cf	Total Available Storage

Storage Group A created with Chamber Wizard
Storage Group B created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	199.50'	**15.0" Round Culvert**
			L= 50.0' CPP, mitered to conform to fill, Ke= 0.700
			Inlet / Outlet Invert= 199.50' / 199.00' S= 0.0100 '/' Cc= 0.900
			n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.23 sf
#2	Device 1	199.65'	**8.0" W x 8.0" H Vert. Orifice/Grate** C= 0.600
#3	Primary	200.75'	**30.0" W x 8.0" H Vert. Orifice/Grate** C= 0.600
#4	Device 1	201.50'	**5.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)

Primary OutFlow Max=14.59 cfs @ 12.17 hrs HW=201.97' (Free Discharge)
—**1=Culvert** (Inlet Controls 7.08 cfs @ 5.77 fps)
  —**2=Orifice/Grate** (Passes < 3.01 cfs potential flow)
  —**4=Sharp-Crested Rectangular Weir** (Passes < 5.15 cfs potential flow)
—**3=Orifice/Grate** (Orifice Controls 7.51 cfs @ 4.50 fps)

Pond SS-4: Subsurface Infiltration (24" Pipe) - Chamber Wizard Field A

Chamber Model = ADS N-12 24" (ADS N-12® Pipe)
Inside= 23.8"W x 23.8"H => 3.10 sf x 20.00'L = 62.0 cf
Outside= 28.0"W x 28.0"H => 3.92 sf x 20.00'L = 78.4 cf
Row Length Adjustment= -2.00' x 3.10 sf x 24 rows

28.0" Wide + 13.4" Spacing = 41.4" C-C Row Spacing

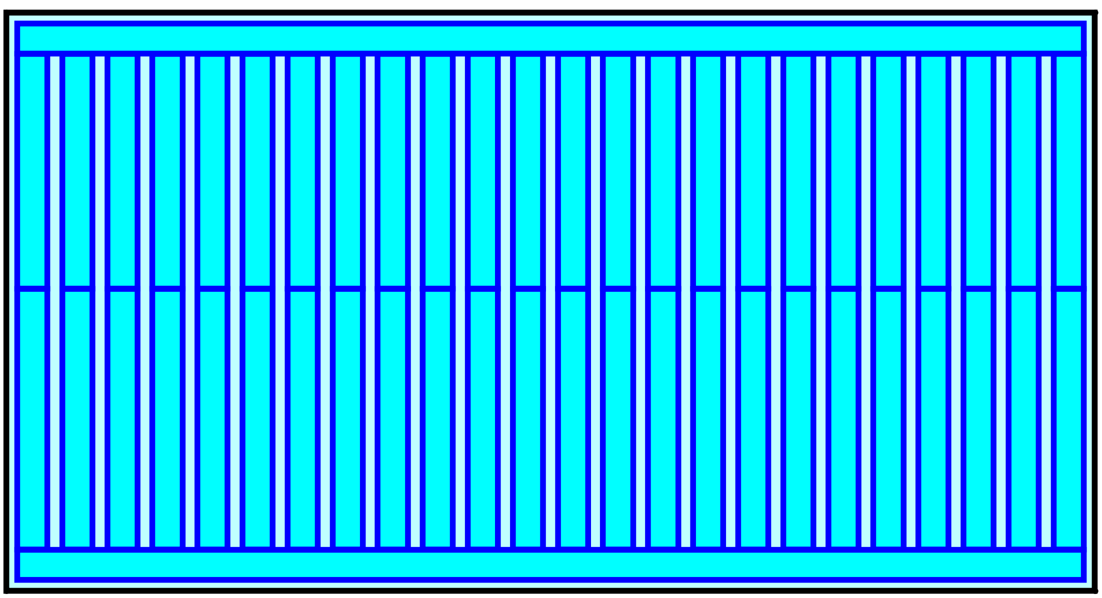
2 Chambers/Row x 20.00' Long -2.00' Row Adjustment +2.33' Header x 2 = 42.67' Row Length +10.0" End Stone x 2 = 44.33' Base Length
24 Rows x 28.0" Wide + 13.4" Spacing x 23 + 10.0" Side Stone x 2 = 83.35' Base Width
4.0" Base + 28.0" Chamber Height + 4.0" Cover = 3.00' Field Height

48 Chambers x 62.0 cf -2.00' Row Adjustment x 3.10 sf x 24 Rows + 81.68' Header x 3.10 sf x 2 = 3,333.6 cf Chamber Storage
48 Chambers x 78.4 cf -2.00' Row Adjustment x 3.92 sf x 24 Rows + 81.68' Header x 3.92 sf x 2 = 4,215.1 cf Displacement

11,085.9 cf Field - 4,215.1 cf Chambers = 6,870.9 cf Stone x 40.0% Voids = 2,748.3 cf Stone Storage

Chamber Storage + Stone Storage = 6,082.0 cf = 0.140 af
Overall Storage Efficiency = 54.9%
Overall System Size = 44.33' x 83.35' x 3.00'

48 Chambers
410.6 cy Field
254.5 cy Stone



Pond SS-4: Subsurface Infiltration (24" Pipe) - Chamber Wizard Field B

Chamber Model = ADS N-12 24" (ADS N-12® Pipe)
Inside= 23.8"W x 23.8"H => 3.10 sf x 20.00'L = 62.0 cf
Outside= 28.0"W x 28.0"H => 3.92 sf x 20.00'L = 78.4 cf

28.0" Wide + 13.4" Spacing = 41.4" C-C Row Spacing

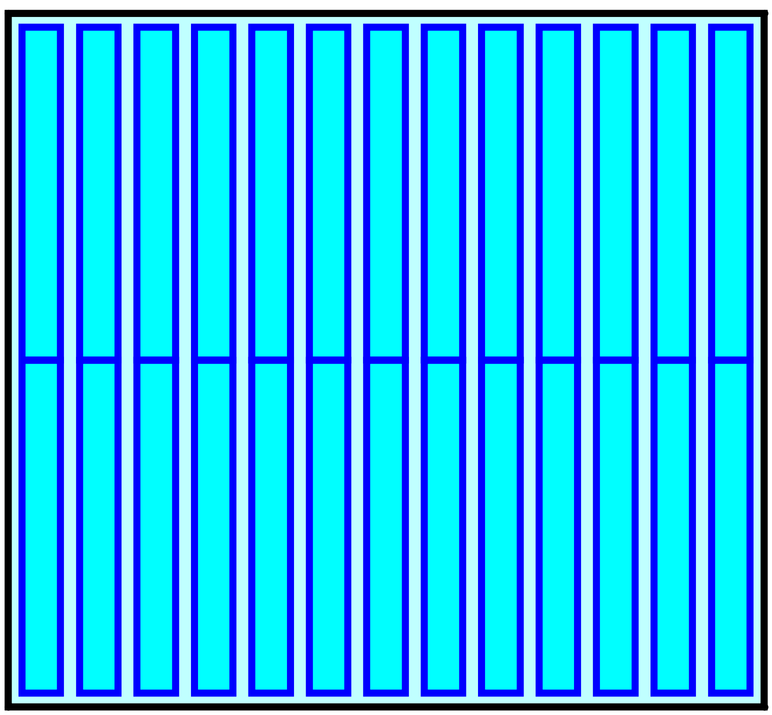
2 Chambers/Row x 20.00' Long = 40.00' Row Length +10.0" End Stone x 2 = 41.67' Base Length
13 Rows x 28.0" Wide + 13.4" Spacing x 12 + 10.0" Side Stone x 2 = 45.40' Base Width
4.0" Base + 28.0" Chamber Height + 4.0" Cover = 3.00' Field Height

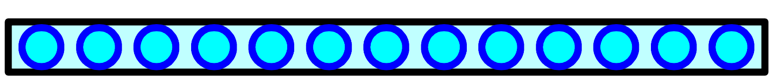
26 Chambers x 62.0 cf = 1,612.0 cf Chamber Storage
26 Chambers x 78.4 cf = 2,038.2 cf Displacement

5,675.2 cf Field - 2,038.2 cf Chambers = 3,637.0 cf Stone x 40.0% Voids = 1,454.8 cf Stone Storage

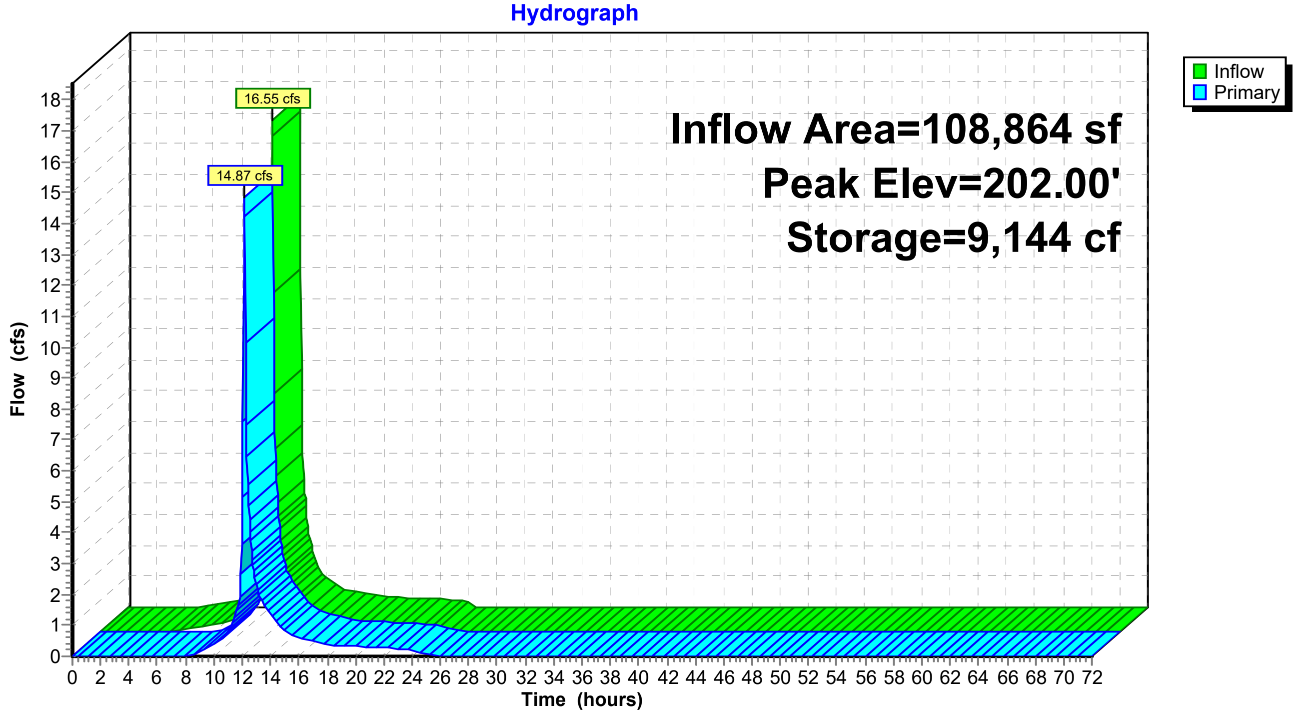
Chamber Storage + Stone Storage = 3,066.8 cf = 0.070 af
Overall Storage Efficiency = 54.0%
Overall System Size = 41.67' x 45.40' x 3.00'

26 Chambers
210.2 cy Field
134.7 cy Stone





Pond SS-4: Subsurface Infiltration (24" Pipe)



Summary for Pond SS-5: Subsurface Infiltration (SC-310 Chambers)

Inflow Area = 90,263 sf, 83.25% Impervious, Inflow Depth = 7.50" for 100-yr event
Inflow = 15.53 cfs @ 12.13 hrs, Volume= 56,420 cf
Outflow = 12.76 cfs @ 12.18 hrs, Volume= 55,507 cf, Atten= 18%, Lag= 3.1 min
Primary = 7.04 cfs @ 12.18 hrs, Volume= 36,340 cf
Secondary = 5.72 cfs @ 12.18 hrs, Volume= 19,167 cf

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 195.61' @ 12.18 hrs Surf.Area= 4,565 sf Storage= 5,819 cf

Plug-Flow detention time= 35.5 min calculated for 55,507 cf (98% of inflow)
Center-of-Mass det. time= 24.3 min (787.4 - 763.1)

Volume	Invert	Avail.Storage	Storage Description
#1A	193.30'	3,199 cf	**41.50'W x 110.00'L x 2.33'H Field A** 10,652 cf Overall - 2,654 cf Embedded = 7,998 cf x 40.0% Voids
#2A	193.80'	2,654 cf	**ADS_StormTech SC-310 +Cap** x 180 Inside #1 Effective Size= 28.9"W x 16.0"H => 2.07 sf x 7.12'L = 14.7 cf Overall Size= 34.0"W x 16.0"H x 7.56'L with 0.44' Overlap 12 Rows of 15 Chambers
		5,853 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	193.80'	**19.0" W x 8.0" H Vert. Orifice/Grate** C= 0.600
#2	Primary	195.45'	**5.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)
#3	Secondary	193.80'	**14.0" Vert. Orifice/Grate** C= 0.600

Primary OutFlow Max=6.85 cfs @ 12.18 hrs HW=195.58' (Free Discharge)
└─**1=Orifice/Grate** (Orifice Controls 6.10 cfs @ 5.78 fps)
└─**2=Sharp-Crested Rectangular Weir** (Weir Controls 0.75 cfs @ 1.17 fps)

Secondary OutFlow Max=5.63 cfs @ 12.18 hrs HW=195.58' (Free Discharge)
└─**3=Orifice/Grate** (Orifice Controls 5.63 cfs @ 5.26 fps)

Pond SS-5: Subsurface Infiltration (SC-310 Chambers) - Chamber Wizard Field A

Chamber Model = ADS_StormTechSC-310 +Cap (ADS StormTech®SC-310 with cap length)
Effective Size= 28.9"W x 16.0"H => 2.07 sf x 7.12'L = 14.7 cf
Overall Size= 34.0"W x 16.0"H x 7.56'L with 0.44' Overlap

34.0" Wide + 6.0" Spacing = 40.0" C-C Row Spacing

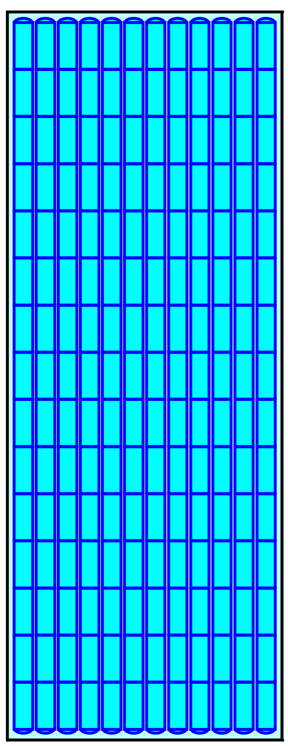
15 Chambers/Row x 7.12' Long +0.60' Cap Length x 2 = 108.00' Row Length +12.0" End Stone x 2 = 110.00' Base Length
12 Rows x 34.0" Wide + 6.0" Spacing x 11 + 12.0" Side Stone x 2 = 41.50' Base Width
6.0" Base + 16.0" Chamber Height + 6.0" Cover = 2.33' Field Height

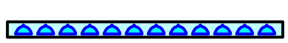
180 Chambers x 14.7 cf = 2,653.6 cf Chamber Storage

10,651.7 cf Field - 2,653.6 cf Chambers = 7,998.1 cf Stone x 40.0% Voids = 3,199.2 cf Stone Storage

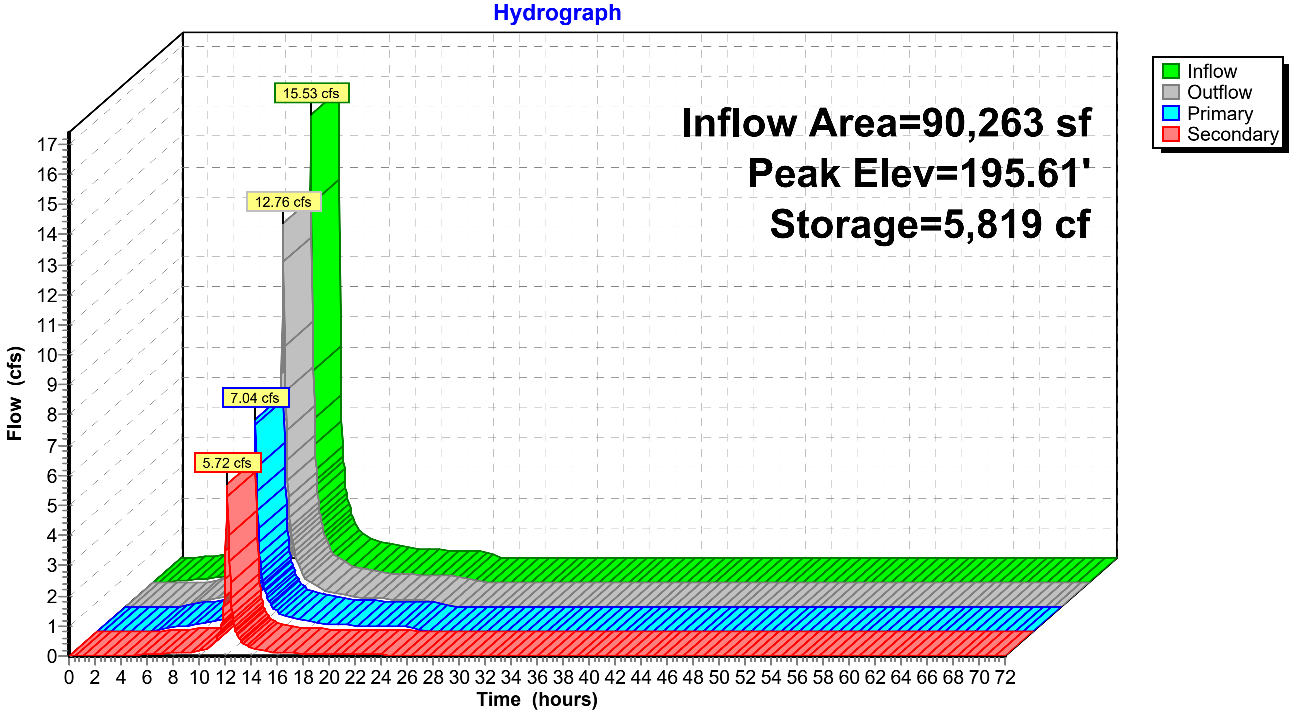
Chamber Storage + Stone Storage = 5,852.8 cf = 0.134 af
Overall Storage Efficiency = 54.9%
Overall System Size = 110.00' x 41.50' x 2.33'

180 Chambers
394.5 cy Field
296.2 cy Stone





Pond SS-5: Subsurface Infiltration (SC-310 Chambers)



APPENDIX D

Closed Drainage System Design

Link Summary

From (Inlet) Node	To (Outlet) Node	Pipe Length (ft)	Inlet Invert Elevation (ft)	Outlet Invert Elevation (ft)	Pipe Slope (%)	Pipe Diameter (in)	Manning's Roughness	Peak Flow Q (cfs)	Design Flow Capacity Qf (cfs)	Q/Qf Ratio	Peak Flow Velocity V (ft/sec)	Peak Flow Depth (ft)	Peak Flow Depth/ Total Depth Ratio
AD#102	DMH#205	19.76	196.79	196.00	4.00	10	0.012	0.60	4.75	0.13	4.75	0.51	0.61
CB#113	WQS#205	73.36	194.35	193.80	0.75	12	0.012	0.89	3.34	0.27	1.53	1.00	1.00
CB#123	DMH#225	15.33	197.91	197.75	1.04	12	0.012	0.45	3.94	0.11	1.75	0.88	0.89
CB#112	WQS#204	14.37	200.00	199.60	2.78	12	0.012	0.45	6.44	0.07	3.67	0.26	0.26
DMH#225	DMH#226	97.92	197.65	196.09	1.59	12	0.012	2.56	4.87	0.53	5.04	1.00	1.00
CB#104	DMH#208	10.02	187.00	186.95	0.50	12	0.012	0.77	2.73	0.28	2.41	0.44	0.44
CB#103	DMH#207	9.88	191.50	191.30	2.02	12	0.012	0.45	5.49	0.08	3.51	0.22	0.22
DMH#207	DMH#208	180.26	190.85	186.95	2.16	12	0.012	0.44	5.68	0.08	2.49	0.30	0.30
DMH#208	WQS#201	33.73	186.85	186.65	0.59	12	0.012	1.14	2.97	0.38	3.14	0.47	0.47
WQS#201	Out-1Pipe - (185)	6.86	186.55	186.50	0.73	12	0.012	1.14	3.30	0.35	3.15	0.47	0.47
CB#101	DMH#204	10.68	206.91	206.80	1.03	12	0.012	1.48	3.92	0.38	3.82	0.49	0.49
DMH#204	DMH#205	186.90	197.45	195.41	1.09	18	0.012	7.83	11.88	0.66	5.21	1.20	0.80
WQS#200	Out-1Pipe - (193)	18.13	194.10	194.00	0.55	24	0.012	8.86	18.20	0.49	4.74	1.15	0.58
CB#100	DMH#200	8.78	202.73	202.60	1.48	12	0.012	0.72	4.70	0.15	3.50	0.31	0.31
DMH#213	WQS#203	80.35	201.00	200.60	0.50	15	0.012	5.94	4.95	1.20	4.84	1.25	1.00
CB#124	DMH#226	22.73	196.24	196.00	1.06	12	0.012	1.25	3.97	0.32	2.95	1.00	1.00
CB#128	DMH#229	34.83	195.71	195.20	1.46	12	0.012	0.49	4.67	0.11	3.19	0.54	0.54
CB#127	DMH#229	40.68	195.70	195.20	1.23	12	0.012	1.56	4.28	0.36	4.35	0.62	0.62
DMH#229	WQS#207	71.10	193.35	193.15	0.28	18	0.012	9.60	8.05	1.19	5.43	1.50	1.00
CB#116	DMH#219	12.53	193.30	193.15	1.20	12	0.012	2.70	4.22	0.64	4.36	1.00	1.00
CB#115	DMH#219	21.45	193.25	193.05	0.93	12	0.012	0.76	3.73	0.20	1.34	1.00	1.00
CB#117	DMH#220	19.61	191.87	191.72	0.77	12	0.012	0.41	3.38	0.12	1.74	1.00	1.00
DMH#220	DMH#221	27.52	191.50	191.30	0.73	12	0.012	3.43	3.29	1.04	4.36	1.00	1.00
CB#118	DMH#221	24.08	191.87	191.60	1.12	12	0.012	0.51	4.09	0.12	1.95	1.00	1.00
DMH#228	DMH#229	37.13	193.70	193.45	0.67	15	0.012	8.40	5.74	1.46	6.85	1.25	1.00
WQS#207	Out-1Pipe - (213)	7.41	193.05	193.00	0.67	18	0.012	9.60	9.35	1.03	5.63	1.50	1.00
CB#120	DMH#222	8.97	192.07	191.97	1.11	12	0.012	0.46	4.07	0.11	2.34	1.00	1.00
CB#119	DMH#222	32.01	192.07	191.80	0.84	12	0.012	0.52	3.54	0.15	2.24	1.00	1.00
CB#130	WQS#208	9.10	180.40	180.30	1.10	12	0.012	2.00	4.05	0.49	4.17	0.59	0.59
CB#129	WQS#208	24.12	180.40	180.18	0.91	12	0.012	0.15	3.69	0.04	0.99	0.49	0.49
WQS#208	EX DHM#201	12.59	180.08	179.95	1.03	12	0.012	2.06	3.92	0.53	4.06	0.62	0.62
EX DHM#201	Out-1Pipe - (224)	19.56	179.85	179.60	1.28	12	0.012	2.06	4.36	0.47	4.55	0.56	0.56
CB#106	WQS#202	12.85	185.15	184.89	2.02	12	0.012	0.86	5.49	0.16	3.28	0.39	0.39
CB#105	WQS#202	23.91	185.11	184.86	1.05	12	0.012	0.80	3.95	0.20	2.61	0.41	0.42
WQS#202	Out-1Pipe - (231)	19.74	184.76	184.50	1.32	12	0.012	1.65	4.43	0.37	4.37	0.48	0.49
OCS#402	DMH#210	19.56	184.50	184.20	1.53	24	0.012	15.54	30.35	0.51	7.33	2.00	1.00
OCS#401	DMH#210	109.44	186.80	184.20	2.38	18	0.012	10.47	17.54	0.60	6.35	1.32	0.88
OCS#400	OCS#401	317.98	194.00	187.66	1.99	15	0.012	10.36	9.88	1.05	8.50	1.22	0.98
DMH#211	DMH#212	119.60	203.00	201.80	1.00	12	0.012	1.25	3.87	0.32	2.74	0.77	0.78
DMH#212	DMH#213	87.29	201.70	201.10	0.69	15	0.012	4.27	5.80	0.74	3.48	1.25	1.00
DMH#215	DMH#216	227.53	196.50	193.60	1.27	15	0.012	6.57	7.90	0.83	5.88	1.25	1.00
CB#110	DMH#214	28.08	199.80	199.60	0.71	12	0.012	0.96	3.26	0.30	2.69	0.48	0.48
DMH#232	DMH#233	222.61	197.40	195.40	0.90	15	0.012	3.91	6.63	0.59	4.82	0.78	0.63
DMH#233	Out-1Pipe - (303) (5)	45.03	195.40	195.00	0.90	15	0.012	3.81	6.63	0.58	4.87	0.76	0.61
DMH#234	DMH#235	42.74	188.90	187.00	4.45	15	0.012	11.83	14.76	0.80	10.76	1.15	0.93
DMH#206	Out-1Pipe - (311)	4.69	196.55	196.00	11.72	12	0.012	1.18	13.21	0.09	6.83	0.27	0.27
TD#1	DMH#202	34.14	200.85	200.45	1.17	12	0.015	0.61	3.34	0.18	1.85	0.76	0.76
DMH#203	DMH#204	143.07	199.30	197.55	1.22	18	0.012	6.38	12.59	0.51	6.28	0.86	0.57
CB#125	DMH#227	44.72	194.88	194.35	1.19	12	0.012	1.55	4.20	0.37	2.33	1.00	1.00
DMH#226	DMH#227	43.61	195.90	195.20	1.61	12	0.012	3.37	4.89	0.69	5.27	1.00	1.00
CB#114	WQS#205	24.04	194.50	194.35	0.62	12	0.012	0.70	3.05	0.23	2.21	1.00	1.00
DCB#100	DMH#227	42.89	195.70	195.20	1.17	12	0.012	3.50	4.17	0.84	4.85	1.00	1.00
WQS#205	DMH#217	15.00	193.70	193.50	1.33	15	0.012	1.51	8.08	0.19	1.23	1.25	1.00
DMH#227	DMH#228	21.52	194.25	193.95	1.39	15	0.012	7.71	8.26	0.93	6.29	1.25	1.00
AD#100	AB#200	69.62	203.00	202.30	1.01	8	0.012	0.68	1.31	0.52	3.23	0.40	0.59
AB#200	DMH#200	83.84	202.20	201.30	1.07	8	0.012	1.13	1.36	0.84	4.08	0.50	0.74
DMH#202	DMH#203	140.97	200.35	199.40	0.67	18	0.012	6.36	9.34	0.68	5.24	0.98	0.65
CB#109	DMH#213	9.51	202.40	202.14	2.73	12	0.012	1.75	6.38	0.27	5.11	0.83	0.84

Link Summary

From (Inlet) Node	To (Outlet) Node	Pipe Length (ft)	Inlet Invert Elevation (ft)	Outlet Invert Elevation (ft)	Pipe Slope (%)	Pipe Diameter (in)	Manning's Roughness	Peak Flow Q (cfs)	Design Flow Capacity Qf (cfs)	Q/Qf Ratio	Peak Flow Velocity V (ft/sec)	Peak Flow Depth (ft)	Peak Flow Depth/ Total Depth Ratio
CB#108	DMH#213	37.97	202.40	202.00	1.05	12	0.012	0.96	3.96	0.24	3.35	0.86	0.87
CB#111	DMH#214	17.63	199.70	199.60	0.57	12	0.012	0.56	2.91	0.19	1.86	0.47	0.47
CB#126	DMH#228	61.52	194.50	193.80	1.14	12	0.012	0.69	4.12	0.17	1.71	1.00	1.00
DMH#221	DMH#222	26.25	191.20	191.00	0.76	15	0.012	3.74	6.11	0.61	3.05	1.25	1.00
OCS#404	DMH#235	49.64	190.20	189.50	1.41	15	0.012	0.00	8.31	0.00	0.00	0.00	0.00
DMH#235	Out-1Pipe - (367)	94.12	186.90	185.00	2.02	24	0.012	13.72	34.82	0.39	9.16	0.99	0.50
CB#121	DMH#224	20.78	199.15	198.74	1.97	12	0.012	1.51	5.42	0.28	4.43	0.47	0.47
CB#122	DMH#224	10.58	198.94	198.74	1.89	12	0.012	0.56	5.31	0.11	2.46	0.39	0.39
DMH#224	DMH#225	63.18	198.64	197.85	1.25	12	0.012	2.04	4.32	0.47	4.86	0.67	0.67
CB#102	WQS#200	45.84	194.44	194.20	0.52	12	0.012	0.85	6.24	0.14	3.52	0.62	0.62
AD#104	DMH#206	22.75	196.89	196.75	0.62	12	0.012	0.59	3.03	0.20	2.68	0.32	0.33
AD#103	DMH#206	38.94	196.78	196.55	0.59	12	0.012	0.59	2.97	0.20	2.48	0.34	0.34
AD#105	Out-1Pipe - (237)	48.42	188.30	185.00	6.82	15	0.012	9.40	18.27	0.51	12.21	0.75	0.60
AD#106	Out-01	16.80	187.63	184.50	18.63	15	0.012	12.32	30.20	0.41	14.77	0.81	0.65
DMH#216	DMH#217	35.05	193.50	192.60	2.57	15	0.012	8.70	11.21	0.78	7.09	1.25	1.00
DMH#217	DMH#218	17.29	192.55	192.35	1.14	15	0.012	9.05	7.47	1.21	7.38	1.25	1.00
DMH#218	DMH#223	149.32	192.35	190.55	1.21	15	0.012	9.06	7.69	1.18	7.38	1.25	1.00
AD#109	DMH#216	40.03	195.90	195.46	1.10	12	0.012	2.65	4.05	0.66	4.79	1.00	1.00
DMH#214	WQS#204	10.80	199.50	199.33	1.57	12	0.012	1.49	4.84	0.31	3.09	0.59	0.59
CB#107	DMH#211	9.17	203.17	203.07	1.09	12	0.012	1.24	4.03	0.31	3.68	0.49	0.49
DMH#200	DMH#202	70.20	201.20	200.45	1.07	12	0.012	1.80	3.99	0.45	3.01	0.72	0.72
DMH#201	DMH#202	43.79	202.00	201.50	1.14	12	0.012	4.26	4.12	1.03	5.58	0.93	0.93
AD#101	AB#200	11.04	203.47	203.35	1.09	8	0.012	0.50	1.36	0.36	3.07	0.31	0.47
DMH#210	Out-1Pipe - (457)	25.44	184.15	184.00	0.59	30	0.012	24.97	34.12	0.73	6.17	1.92	0.77
DMH#222	WQS#206	8.16	190.90	190.83	0.88	15	0.012	4.72	6.57	0.72	3.85	1.25	1.00
WQS#206	DMH#223	37.20	190.78	190.60	0.48	15	0.012	4.72	4.95	0.95	3.85	1.25	1.00
DMH#219	DMH#220	113.74	193.00	191.60	1.23	12	0.012	3.07	4.28	0.72	4.04	1.00	1.00
OCS#403	DMH#215	72.07	199.33	198.50	1.15	15	0.012	6.20	7.51	0.83	5.98	1.25	1.00
DMH#223	Out-1Pipe - (498)	9.51	190.50	190.15	3.68	15	0.012	13.43	8.79	1.53	10.94	1.25	1.00
OCI#101	DMH#218	256.42	197.00	192.50	1.75	12	0.012	0.00	5.11	0.00	0.00	0.50	0.50
DMH#205	WQS#200	38.20	195.31	195.09	0.58	18	0.012	8.19	8.68	0.94	5.02	1.30	0.87
RD#3	AB#202	42.41	202.25	202.00	0.59	12	0.015	1.13	2.37	0.48	1.68	1.00	1.00
AB#202	DMH#212	101.51	202.00	201.00	0.99	15	0.012	3.34	4.95	0.67	3.06	1.25	1.00
AD#111	AB#202	35.54	202.00	201.60	1.13	10	0.012	1.30	1.68	0.78	2.39	0.83	1.00
AD#110	AB#202	8.68	202.00	201.90	1.15	10	0.012	1.14	1.68	0.68	2.71	0.83	1.00
WQS#204	Out-1Pipe - (527)	6.35	199.23	199.17	1.00	12	0.012	1.93	3.86	0.50	3.99	0.59	0.59
WQS#203	Out-1Pipe - (530)	8.55	200.50	200.45	0.58	15	0.012	5.94	5.35	1.11	4.84	1.25	1.00

APPENDIX E

Long-Term Pollution Prevention and Stormwater Operation and Maintenance Plan

Nitsch Engineering

2 Center Plaza, Suite 430
Boston, MA 02108-1928
T: 617-338-0063
F: 617-338-6472
www.nitscheng.com

LONG-TERM POLLUTION PREVENTION PLAN AND STORMWATER OPERATION AND MAINTENANCE PLAN

Mindess Elementary School, Ashland, MA

TABLE OF CONTENTS

FIGURES

1.0 INTRODUCTION

The purpose of this document is to specify the pollution prevention measures and stormwater management system operation and maintenance for the Mindess Elementary School site. The Responsible Party indicated below shall implement the management practices outlined in this document and proactively conduct operations at the project site in an environmentally responsible manner. Compliance with this Manual does not in any way dismiss the responsible party, owner, property manager, or occupants from compliance with other applicable federal, state or local laws.

Responsible Party: Town of Ashland
101 Main Street, Ashland, MA

This Document has been prepared in compliance with Standards 4 and 9 of the 2008 Massachusetts Department of Environmental Protection (MassDEP) Stormwater Management Standards, which state:

Standard 4:
The Long Term Pollution Prevention Plan shall include the proper procedures for the following:

- Good housekeeping
- Storing materials and waste products inside or under cover
- Vehicle washing
- Routine inspections of stormwater best management practices
- Spill prevention and response
- Maintenance of lawns, gardens, and other landscaped areas
- Storage and use of fertilizers, herbicides, and pesticides
- Pet waste management
- Operation and management of septic systems
- Proper management of deicing chemicals and snow

Standard 9:
The Long-Term Operation and Maintenance Plan shall at a minimum include:

- Stormwater management system(s) owner(s)
- The party or parties responsible for operation and maintenance, including how future property owners shall be notified of the presence of the stormwater management system and the requirement for operation and maintenance
- The routine and non-routine maintenance tasks to be undertaken after construction is complete and a schedule for implementing those tasks
- A plan that is drawn to scale and shows the location of all stormwater BMPs in each treatment train along with the discharge point
- A description and delineation of public safety features
- An estimated operations and maintenance budget

2.0 LONG-TERM POLLUTION PREVENTION PLAN

The Responsible Party shall implement the following good housekeeping procedures at the project site to reduce the possibility of accidental releases and to reduce safety hazards.

2.1 Storage of Hazardous Materials

To prevent leaks and spills, keep hazardous materials and waste products under cover or inside. Use drip pans or spill containment systems to prevent chemicals from entering the drainage system. Inspect storage areas for materials and waste products at least once per year to determine amount and type of the material on site, and if the material requires disposal.

Securely store liquid petroleum products and other liquid chemicals in federally- and state-approved containers. Restrict access to maintenance personnel and administrators.

2.2 Storage of Waste Products

Collect and store all waste materials in securely lidded dumpster(s) or other secure containers as applicable to the material. Keep dumpster lids closed and the areas around them clean. Do not fill the dumpsters with liquid waste or hose them out. Sweep areas around the dumpster regularly and put the debris in the garbage, instead of sweeping or hosing it into the parking lot. Legally dispose of collected waste on a regular basis.

Segregate liquid wastes, including motor oil, antifreeze, solvents, and lubricants, from solid waste and recycle through hazardous waste disposal companies, whenever possible. Separate oil filters, batteries, tires, and metal filings from grinding and polishing metal parts from common trash items and recycle. These items are not trash and are illegal to dump. Contact a hazardous waste hauler for proper disposal to a hazardous waste collection center.

2.3 Spill Prevention and Response

Implement spill response procedures for releases of significant materials such as fuels, oils, or chemical materials onto the ground or other area that could reasonably be expected to discharge to surface or groundwater.

- For minor spills, keep fifty (50) gallon spill control kits and Speedy Dry at all shop and work areas.
- Immediately contact applicable Federal, State, and local agencies for reportable quantities as required by law.
- Immediately perform applicable containment and cleanup procedures following a spill release.
- Promptly remove and dispose of all material collected during the response in accordance with Federal, State and local requirements. A licensed emergency response contractor may be required to assist in cleanup of releases depending on the amount of the release, and the ability of the Contractor to perform the required response.
- Reportable quantities of chemicals, fuels, or oils are established under the Clean Water Act and enforced through Massachusetts Department of Environmental Protection (DEP).

2.4 Minimize Soil Erosion

Soil erosion facilitates mechanical transport of nutrients, pathogens, and organic matter to surface water bodies. Repair all areas where erosion is occurring throughout the project site. Stabilize bare soil with riprap, seed, mulch, or vegetation.

2.5 Vehicle Washing

Vehicle washing will occur onsite only in areas that discharge to pretreatment and treatment Stormwater Management BMPs.

2.6 Maintenance of Lawns, Gardens, and other Landscaped Areas

Pesticides and fertilizers shall not be used in the landscaped areas within any resource area or within the 100-foot buffer to BVW associated with the project site. Dumping of lawn wastes, brush or leaves or other materials or debris is not permitted in any Resource Area. Grass clippings, pruned branches and any other landscaped waste should be disposed of or composted in an appropriate location.

2.7 Management of Deicing Chemicals and Snow

The qualified contractor selected for snow plowing and deicing shall be made fully aware of the requirements of this section.

No road salt (sodium chloride) shall be stored on-site. The use of magnesium chloride de-icing product with a 0.5 to 1.0 percent sodium chloride mix for snow and ice treatment is permitted. The product shall be stored in a locked room inside the building and shall be used at exterior stairs and walkways. The snow plow contractor shall adhere to these magnesium chloride use and storage requirements.

During typical snow plowing operations, snow shall be pushed to the designated snow removal areas noted on the Snow Storage Plan (Figure 2). Snow shall not be stockpiled in wetland resource areas, catch basins, or bioretention basins. In severe conditions where snow cannot be stockpiled on site, the snow shall be removed from the site and properly disposed of in accordance with DEP Guideline BRP601-01.

Before winter begins, the property owner and the contractor shall review snow plowing, deicing, and stockpiling procedures. Areas designated for stockpiling should be cleaned of any debris. Street and parking lot sweeping should be followed in accordance with the Operation and Maintenance Plan.

2.8 Coordination with other Permits and Requirements

Certain conditions of other approvals affecting the long-term management of the property shall be considered part of this Long Term Pollution Prevention Plan. The Owner shall become familiar with those documents and comply with the guidelines set forth in those documents.

3.0 STORMWATER MANAGEMENT SYSTEM OPERATION AND MAINTENANCE PLAN

3.1 Introduction

This Operation and Maintenance Plan (O&M Plan) for Mindess Elementary School site is required under Standard 9 of the 2008 MassDEP Stormwater Handbook to provide best management practices for implementing maintenance activities for the stormwater management system in a manner that minimizes impacts to wetland resource areas.

The Owner shall implement this O&M Plan and proactively conduct operations at the site in an environmentally responsible manner. Compliance with this O&M Plan does not in any way dismiss the Owner from compliance with other applicable Federal, State or local laws.

Routine maintenance during construction and post-development phases of the project, as defined in the Operation and Maintenance Plan, shall be permitted without amendment to the Order of Conditions. A continuing condition in the Certificate of Compliance shall ensure that maintenance can be performed without triggering further filings under the Wetlands Protection Act.

All stormwater best management practices (BMPs) shall be operated and maintained in accordance with the design plans and the Operation and Maintenance Plan approved by the issuing authority. The Owner shall:

a. Maintain an operation and maintenance log for the last three years, including inspections, repairs, replacement and disposal (for disposal the log shall indicate the type of material and the disposal location). This is a rolling log in which the responsible party records all operation and maintenance activities for the past three years.

b. Make this log available to MassDEP and the Conservation Commission upon request; and

c. Allow members and agents of the MassDEP and the Conservation Commission to enter and inspect the premises to evaluate and ensure that the Owner complies with the Operation and Maintenance requirements for each BMP.

3.2 Stormwater Operation and Maintenance Requirements

Inspect and maintain the stormwater management system as directed below. Refer to the Stormwater Management System Location Map (Figure 1) for the location of each component of the system. Repairs to any component of the system shall be made as soon as possible to prevent any potential pollutants (including silt) from entering the resource areas.

<u>Deep Sump and Hooded Catch Basins</u>

Inspect or clean catch basins four times per year and at the end of foliage and snow-removal seasons. Other inspection and maintenance requirements include:

- Remove organic material, sediment and hydrocarbons four times per year or 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.
- Always clean out catch basins after street sweeping. If any evidence of hydrocarbons is found during inspection, immediately remove the material using absorbent pads or other suitable measures and dispose of legally. Remove other accumulated debris as necessary.
- If handling runoff from land uses with higher potential pollutant loads or discharging runoff near or to a critical area, more frequent cleaning may be necessary.

- Transport and disposal of accumulated sediment off-site shall be in accordance with applicable local, state and federal guidelines and regulations.

Area Drains

Inspect area drains at least once per month and remove debris from the grate. Clean out accumulated sediments at least once per year and more frequently as necessary.

Water Quality Units (Proprietary Separators)

Maintain water quality units according the recommendations set forth by the manufacturer. General inspection and maintenance procedures for proprietary devices are provided below:

- Inspect units following completion of construction, prior to being put into service.
- Inspect units at least twice per year following installation and no less than once per year thereafter.
- Inspect units immediately after any oil, fuel or chemical spill.
- All inspections shall include checking the oil level and sediment depth in the unit. Removal of sediments/oils shall occur per manufacturer recommendations.
- A licensed waste management company shall remove captured petroleum waste products from any oil, chemical or fuel spills and dispose.
- OSHA confined space entry protocols shall be followed if entry into the unit is required.

Vegetated Swales

Vegetated swales shall be inspected twice per year during the first year after construction. In subsequent years, the swales shall be inspected annually and after rain events greater than 3 inches in 24 hours. Inspection and maintenance procedures for drainage channels are provided below:

- Inspect the riprap on the channel bottom and side slopes for signs of erosion and formation of rills and gullies. Replace riprap as necessary.
- Inspect channels the first few months after construction and twice per year thereafter to make sure vegetation is adequate and for signs of rilling and gullying. Repair any rills or gullies. Replace dead vegetation.
- Remove accumulated trash and debris annually.
- Remove sediment as needed at least once per year. Use hand methods (i.e. a person with a shovel) when cleaning to minimize disturbance to vegetation and underlying soils.
- Mow as necessary. Grass height shall be between 3 and 6 inches.
- Reseed as necessary
- Check Dams: Inspect check dams after every significant rainfall event. Repair damage as needed. Remove sediment as needed.

Level Spreaders

Inspect level spreaders regularly, especially after major storm events (rainfall totals greater than 2.5 inches in 24 hours). Repair any erosion or low spots in the level spreader.

Subsurface Detention/Infiltration Structures

- Inspect subsurface detention/infiltration structures twice per year. Inspect the inlets and observation ports to determine if there is accumulated sediment within the system. Remove all debris and accumulated sediment that may clog the system.

Infiltration Basins

The infiltration basins shall be inspected and maintained after major storm events (rainfall totals greater than 2.5 inches in 24 hours) during the first three months of operation and twice a year and when there are discharges through the outlet control structure thereafter. Additionally, all pretreatment BMPs shall be inspected in accordance with the minimal requirements specified for those practices and after all major storm events. Inspections shall include the following measures:

- During and after major storm events, the length of time standing water remains in the basin shall be recorded.
    - If the time is greater than 72 hours, thoroughly inspect the basin for signs of clogging.
    - A corrective action plan shall be developed by a qualified professional to restore infiltrative function. The Site Owner shall take immediate action to implement these corrective measures.
- Examine the outlet structure for evidence of clogging or outflow release velocities that are greater than the design velocity.
- Identify areas of sediment accumulation, differential settlement, cracking, and erosion within the basin.
- Inspect embankments for leakage and tree growth.
- Examine the health of the vegetation within the basin and on the embankments.
- Examine condition of riprap.

Corrective measures shall be taken immediately as warranted by the inspections. If any evidence of hydrocarbons is found during inspection, the material shall be immediately removed using absorbent pads or other suitable measures and legally disposed.

Preventative maintenance shall be done at least twice per year and shall include the following activities:

- Mow the buffer area and basin bottom and side slopes, if vegetated.
- Rake, if stone bottom.
- Remove trash, debris, and accumulated sediment that may clog the system.
- Remove grass clippings and accumulated organic matter.
- Use deep tilling to break up clogged surfaces and revegetate immediately.

Detention Basin

Inspect the detention basin at least once per year to ensure that the basin is operating as intended. Inspect the detention basin during and after major storms to determine if the basin is meeting the expected detention times.

- Examine the outlet structure for evidence of clogging or outflow release velocities that are greater than design flow.
    - Potential problems that should be checked include: subsidence, erosion, cracking or tree growth on the embankment; damage to the emergency spillway; sediment accumulation around the outlet; inadequacy of the inlet/outlet channel erosion control measures; changes in the condition of the pilot channel; and erosion within the basin and banks. Make any necessary repairs immediately.
- During inspections, note any changes to the extended dry detention basin or the contributing

watershed, because these could affect basin performance.

- Inspect basins to ensure they are operating as designed at least once per year
- Mow the upper-stage, side slopes, embankment, and emergency spillway at least twice per year. Also remove trash and debris at this time.
- Check the sediment forebay for accumulated sediment, trash and debris and remove it at least twice per year.
- Remove sediment from the extended dry detention basin as necessary, but at least once every 5 years. Providing an on-site sediment disposal area will reduce the overall sediment removal costs.

Bioretention Areas

Perform annual maintenance of all components of the bioretention area, including plants, soil, and mulch. Table 1, below, outlines recommended maintenance activities.

Table 1. Bioretention area maintenance recommendations

Location	Description	Frequency	Time of Year
Surface	Inspect and remove trash	Monthly	Year round
Soil	Inspect and repair erosion	Monthly	Year round
Organic Layer	Remulch void areas	Annually	Spring
	Remove previous mulch layer before applying new layer (optional)	Annually	Spring
Plants	Water vegetation at end of day for 14 consecutive days after planting	Immediately after planting	As needed
	Fertilize	Annually	Spring
	Mow grass	2 to 12 times per year	As needed
	Remove and replace all dead and diseased vegetation that cannot be treated	Annually	Spring
	Treat all diseased trees and shrubs	As needed	Variable

During and after storm events, record the length of time standing water remains in the bioretention areas. If the time is greater than 72 hours, thoroughly inspect the basins for signs of clogging and develop a corrective action plan. The corrective action plan, prepared by a qualified professional, will outline procedures to restore infiltrative function. The owner of the site shall take immediate action to implement these corrective measures. Inspect pretreatment devices and bioretention cells regularly for sediment build-up, structural damage, and standing water. Never store snow in bioretention areas.

Stormwater Outfalls

Inspect flared end sections and associated riprap spillways at least once per year and after major storm events (rainfall totals greater than 2.5 inches in 24 hours) to ensure that the stability of the outlet area is maintained. Keep the outfall area clear of debris such as trash, branches, and sediment. Make repairs immediately if riprap displacement or downstream channel scour is observed.

3.3 Street Sweeping

Perform street sweeping at least twice per year, whenever there is significant debris present on roads and parking lots. Street sweeping shall occur in the spring and fall. Sweepings must be handled and disposed of properly according to the Ashland Conservation Commission.

3.4 Repair of the Stormwater Management System

The stormwater management system shall be maintained. The repair of any component of the system shall be made as soon as possible to prevent any potential pollutants including silt from entering the resource areas or the existing closed drainage system.

3.5 Reporting

The Owner shall maintain a record of drainage system inspections and maintenance (per this Plan) and submit a yearly report to the Ashland Conservation Commission.

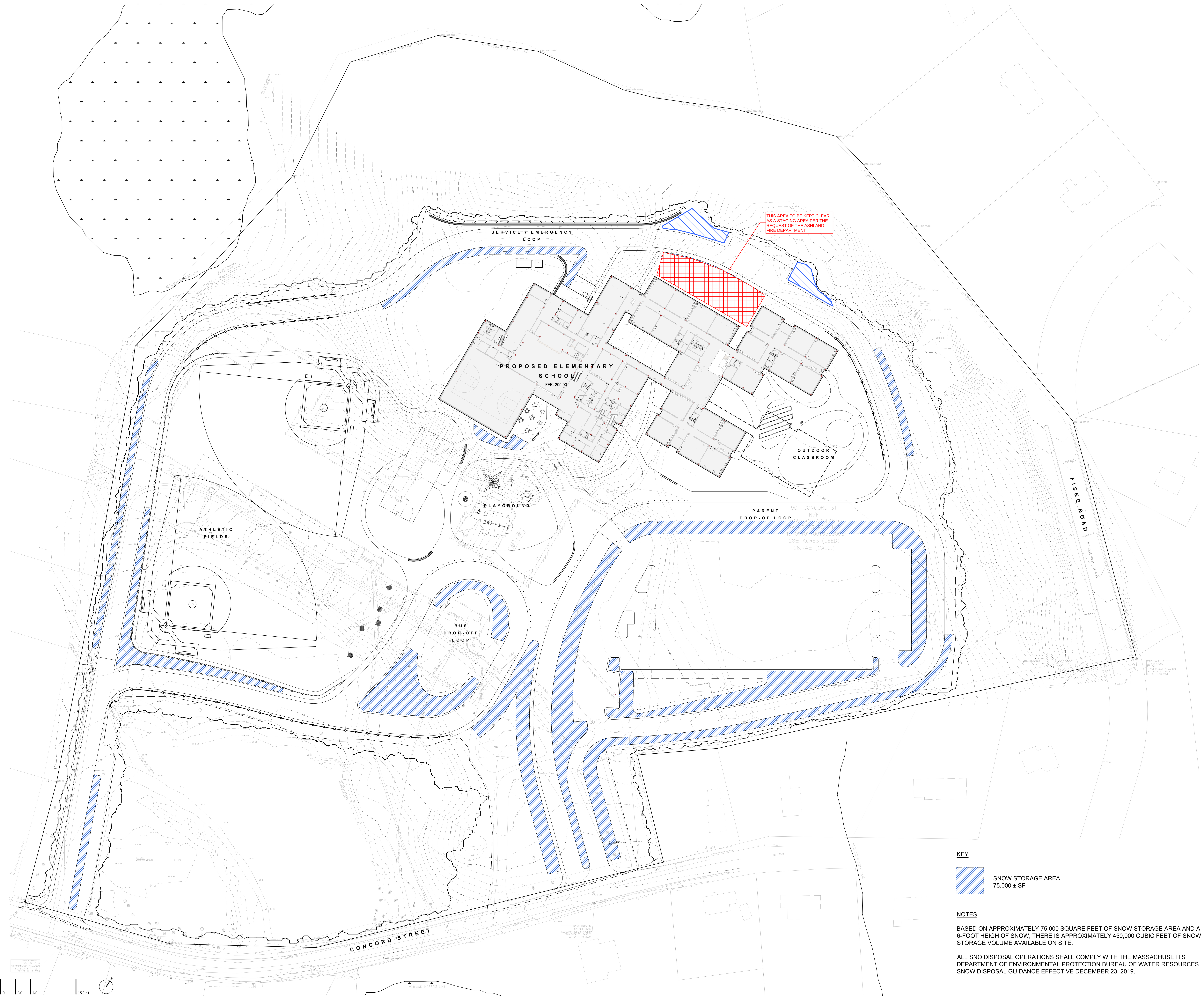
STORMWATER MANAGEMENT SYSTEM INSPECTION FORM

Mindess Elementary School
Ashland, MA

Inspected by:____________
Date:____________

Component	Status/Inspection	Action Taken
Deep Sump Catch Basins, Area Drains and Drain Manholes		
Bioretention Basin		
Infiltration Basin		
Subsurface Infiltration System		
Water Quality Units		
Stormwater Outfalls & Level Spreaders		
General site conditions – evidence of erosion, etc.		

SUBMIT COPIES OF STORMWATER MANAGEMENT SYSTEM INSPECTION FORM TO THE ASHLAND CONSERVATION COMMISSION WITH THE YEARLY REPORT.



KEY

SNOW STORAGE AREA
75,000 ± SF

NOTES

BASED ON APPROXIMATELY 75,000 SQUARE FEET OF SNOW STORAGE AREA AND A 6-FOOT HEIGH OF SNOW, THERE IS APPROXIMATELY 450,000 CUBIC FEET OF SNOW STORAGE VOLUME AVAILABLE ON SITE.

ALL SNO DISPOSAL OPERATIONS SHALL COMPLY WITH THE MASSACHUSETTS DEPARTMENT OF ENVIRONMENTAL PROTECTION BUREAU OF WATER RESOURCES SNOW DISPOSAL GUIDANCE EFFECTIVE DECEMBER 23, 2019.

90 Concord Street, Ashland, MA

FLANSBURGH

77 NORTH WASHINGTON STREET
BOSTON, MA 02114-1910

FLANSBURGH.COM

Consultants

No.	Date	Note

REVISIONS

No.	Date	Note

ISSUE

Stamp

Schematic Design

Key Plan

Sheet Title

Snow Storage Plan

Drawn By RI	Project ID
Reviewed By EM	Scale 1" = 40'-0"
Issue Date 09.09.2020	Plot Date 09.09.2020
Sheet No.	

APPENDIX F

DRAFT Stormwater Pollution Prevention Plan (SWPPP)

DRAFT Stormwater Pollution Prevention Plan (SWPPP)

For Construction Activities At:

Mindess Elementary School
90 Concord Street
Ashland, MA, 01721
Site Telephone Number: xxx-xxx-xxxx

SWPPP Prepared For:

Client Name
Contact Person
Street Address
Town/City, State, Zip Code
T: xxx-xxx-xxxx
Email Address/Fax Number

SWPPP Prepared By:

Nitsch Engineering
Jared Gentilucci
Nick Buttitta
370 Main Street, Suite 850,
Worcester, MA 01608
T: 617-338-0063
F: 617-338-6472

SWPPP Preparation Date:

04/19/2021

Estimated Project Dates:

Project Start Date: 12/2021
Project Completion Date: 05/2024

Nitsch Engineering

Contents

SECTION 1: CONTACT INFORMATION/RESPONSIBLE PARTIES

1.1 Operator(s) / Subcontractor(s)

Operator(s):

Construction Manager Responsibilities:
Construction Manager shall maintain the Stormwater Pollution Prevention Plan (SWPPP) documentation and will conduct and document self-inspections required under the 2017 Construction General Permit (CGP) once every 7 days and within 24 hours of a storm event 0.25”. Construction Manager will provide copies of inspections reports to the Owner’s Representative within 24 hours following each inspection. Incidents of non-compliance will be immediately brought to the attention of the Owner’s Representative. Construction Manager shall be responsible for maintaining compliance with the SWPPP, including all requirements in the CGP and will maintain erosion and sediment control Best Management Practices (BMPs) in all areas of the site under its day-to-day control.

Construction Manager shall file a Notice of Intent (NOI) to be covered by the CGP and obtain coverage by the Environmental Protection Agency (EPA) before beginning construction at the project. Permit coverage will be maintained throughout the project. Construction Manager shall not file a Notice of Termination (NOT) until all disturbed areas of the site under its day-to-day control have been fully stabilized with permanent erosion controls that satisfy the final stabilization requirements in the CGP or have met another criteria of the NOT. Construction Manager will maintain a clean site and construction trash and debris will be picked up and disposed of properly by the end of each day.

Each Operator is responsible for advising employees and subcontractors working on this project of the requirements in the CGP and SWPPP. Particular emphasis should be placed on ensuring that employees and subcontractors do not damage BMPs and maintain compliance with the CGP.

Construction Manager Company Name
Construction Manager Contact Person, Position
Street Address
Town, State, Zip Code
T: xxx-xxx-xxxx
Email address:

Owner's Representative Responsibilities:
Owner's Representative shall provide general oversight of the project including review of the SWPPP and any amendments, inspection reports, and corrective actions. Owner's Representative shall file a NOI to be covered by the CGP and obtain coverage by the EPA before beginning construction at the project. Permit coverage will be maintained throughout the project. Owner's Representative shall not file a notice of Termination until all disturbed areas of the site have been fully stabilized with permanent erosion controls that satisfy the final stabilization requirements in the CGP. Owner's Representative will coordinate with the Construction Manager to maintain a clean site so that trash and debris will be picked up and disposed of properly by the end of the day.

Each Operator is responsible for advising employees and subcontractors working on this project of the requirements in the CGP and SWPPP. Particular emphasis should be placed on ensuring that employees and subcontractors do not damage BMPs and maintain compliance with the CGP.

Owner's Representative Company Name
Owner's Representative Contact person, Position
Street Address
Town, State, Zip Code
T: xxx-xxx-xxxx
Email Address:

Site Contractor:

Company Name
Contact person, Position
Street Address
Town, State, Zip Code
T: xxx-xxx-xxxx
Email Address:

Emergency 24-Hour Contact:

Company
Emergency Contact person, Position
T: xxx-xxx-xxxx

1.2 Stormwater Team

Construction Manager: Shawmut Design and Construction

Stormwater Role/Responsibility: Responsible for overseeing the development of the SWPPP, modifications and updates to the SWPPP, and for compliance with the requirements in the CGP (e.g., installing and maintaining stormwater controls, conducting site inspections, picking up trash, taking corrective actions where required, etc.).

Contact:
Construction Manager Contact Person, Position
T: xxx-xxx-xxxx
Email address

I, Construction Manager Contact Person, have read the CGP and Understand the Applicable Requirements
☐ Yes
Date: ___________

Site Contractor: Shawmut Design and Construction

Stormwater Role/Responsibility: Responsible for compliance with the requirements in this permit (e.g., installing and maintaining stormwater controls, conducting site inspections, taking corrective actions where required, etc.).

Contact:
Contact Person, Position
T: xxx-xxx-xxxx
Email Address

Refer to the Subcontractor Certifications/Agreements in Attachment G.

SECTION 2: SITE EVALUATION, ASSESSMENT, AND PLANNING

2.1 Project/Site Information

Project Name and Address

Project/Site Name: Mindess Elementary School
Project Street/Location: 90 Concord Street
City/Town: Ashland
State: Massachusetts
ZIP Code: 01721
County or Similar Subdivision: Middlesex

Project Latitude/Longitude

(Use **one** of three possible formats, and specify method)

Latitude:	Longitude:
1. 42º 15' 48'' N (degrees, minutes, seconds)	1. 71º 27' 36'' W (degrees, minutes, seconds)

Method for determining latitude/longitude:
☐ USGS topographic map (specify scale: ____________) ☐ GPS
☒ Other (please specify): Google Earth

Horizontal Reference Datum:
☐ NAD 27 ☒ NAD 83 ☐ WGS 84

If you used a U.S.G.S topographic map, what was the scale? ____________________________

Additional Project Information

Is the project/site located on Indian country lands, or located on a property of religious or cultural significance to an Indian tribe? ☐ Yes ☒ No

Are you applying for permit coverage as a “federal operator” as defined in Appendix A of the CGP?
☐ Yes ☒ No

Will there be demolition of any structure built or renovated before January 1, 1980?
☒ Yes ☐ No

If yes, do any of the structures being demolished have at least 10,000 square feet of floor space?
☒ Yes ☐ No

Was pre-development land use used for agriculture (see Appendix A of the CGP for definition of “agricultural land”)?
☐ Yes ☒ No

Type of Construction Site (check all that apply): ☐ Single-Family Residential
☐ Multi-Family Residential ☐ Commercial ☐ Industrial ☒ Institutional ☐ Highway or Road
☐ Utility ☐ Other _____________

2.2 Discharge Information

Does your project/site discharge stormwater into a Municipal Separate Storm Sewer System (MS4)?
☐ Yes ☒ No

Are there any surface waters that are located within 50 feet of your construction disturbances?
☒ Yes ☐ No

Table 1 – Names of Receiving Waters

Name(s) of the first surface water that receives stormwater directly from your site and/or from the MS4 (note: multiple rows provided where your site has more than one point of discharge that flows to different surface waters)
001. Sudbury River
002.
003.

Table 2 – Impaired Waters / TMDLs (Answer the following for each surface water listed in Table 1 above)

	Is this surface water listed as "impaired" on the CWA303(d) list?	If you answered yes, then answer the following:			
		What pollutant(s) are causing the impairment?	Has a TMDL been completed?	Title of the TMDL document	Pollutant(s) for which there is a TMDL
001.	☒ YES ☐ NO	**Mercury in Fish Tissue**	☐ YES ☒ NO		
002.	☐ YES ☐ NO				
003.	☐ YES ☐ NO				

MA82A-25 (Waterbody ID)

Table 3 – Tier 2, 2.5, or 3 Waters (Answer the following for each surface water listed in Table 1 above)

	Is this surface water designated as a Tier 2, Tier 2.5, or Tier 3 water?	If you answered yes, specify which Tier (2, 2.5, or 3) the surface water is designated as?
001.	☐ YES ☒ NO	
002.	☐ YES ☐ NO	
003.	☐ YES ☐ NO	

2.3 Nature of the Construction Activity

General Description of Project
Provide a general description of the construction project:

The project includes construction of a new school building, building utility services, site utility systems (water, sewer, drain, gas, electric, and tele-communications), stormwater management utilities, access drives and parking facilities, an artificial turf sports field and related structures, and landscaping hardscape and softscape.

Size of Construction Project
Size of Property: 28 acres
Total Area of Construction Disturbances: 17.1 acres
Maximum Area to be Disturbed at Any One Time: 10 acres

Construction Support Activities

Include a description of the construction support activities or reference Site Maps in Attachment A that include this information.

Contact Information for Construction Support Activity:
Name: XXX
Telephone: XXX-XXX-XXXX
Email: XXXX
Address and/or Latitude and Longitude:

Business Hours
Day-Day Xa.m-Xp.m.

2.4 Sequence and Estimated Dates of Construction Activities

Phase 1: New Construction

This Phase consists of the construction of the School with Utilities, Partial Completion of Drainage System, Rough Grading, Geothermal System, Retaining Walls, Outdoor Classroom, Critical Pedestrian Circulation, and Partial Completion of Main Parking Lot

- Schedule: December 2021 – June 2023
- Area Disturbed During Phase: 10 acres
- This phase will include the installation of part of the stormwater control measures as shown on the Site Preparation Plan and Phasing Plans provided in Attachment A. The proposed roof runoff will outfall into (2) separate temporary sediment basins until the existing building is demolished and the rest of the stormwater infrastructure are able to be installed Phase 2B. The Stormwater controls will be removed at the end of Phase 2B upon stabilization of the site.

Phase 2A: Demolition and Sight Preparation

This Phase consists of the demolition of the existing school and the construction of the parking lot, parent drop-off loop, service/emergency access and partial portion of the pedestrian entrance plaza.

- Schedule: July 2023 – August 2023
- Area Disturbed During Phase: 9 acres
- There will not be any installation of stormwater control measures in this stage.

Phase 2B: School Opens

This Phase consists of the construction of the entry plaza, hard top and play area, bus drop off loop, ball fields, and the rest of the stormwater infrastructure.

- Schedule: September 2023
- Area Disturbed During Phase: 6.5 acres
- This phase will include the installation of the rest of the stormwater control measures as shown on the Site Preparation Plan and Phasing Plans provided in Attachment A. Stormwater controls will remain in place until site work is complete and the site is stabilized.

Phase 2C: Completion of Site Work

This Phase consists of the completion of the construction of the playgrounds and bus drop-off loop and the ball fields will require one full growing period before use.

- Schedule: September 2023 – May 2024
- Area Disturbed During Phase: 5 acres

2.5 Allowable Non-Stormwater Discharges

List of Allowable Non-Stormwater Discharges Present at the Site

Type of Allowable Non-Stormwater Discharge	**Likely to be Present at Your Site?**
Discharges from emergency fire-fighting activities	☒ YES ☐ NO
Fire hydrant flushings	☒ YES ☐ NO
Landscape irrigation	☒ YES ☐ NO
Waters used to wash vehicles and equipment, provided that there is no discharge of soaps, solvents, or detergents used for such purposes	☒ YES ☐ NO
Water used to control dust	☒ YES ☐ NO
Potable water including uncontaminated water line flushings	☒ YES ☐ NO
External building washdown, provided soaps, solvents, and detergents are not used, and external surfaces do not contain hazardous substances (as defined in Appendix A of the CGP) (e.g., paint or caulk containing polychlorinated biphenyls (PCBs))	☒ YES ☐ NO
Pavement wash waters, provided spills or leaks of toxic or hazardous substances have not occurred (unless all spill material has been removed) and where soaps, solvents, and detergents are not used.	☒ YES ☐ NO
Uncontaminated air conditioning or compressor condensate	☐ YES ☒ NO
Uncontaminated, non-turbid discharges of ground water or spring water	☒ YES ☐ NO
Foundation or footing drains where flows are not contaminated with process materials such as solvents or contaminated groundwater	☒ YES ☐ NO
Construction dewatering water discharged in accordance with Part 2.4 of the CGP	☒ YES ☐ NO

Note: You are prohibited from directing pavement wash waters directly into any water of the U.S., storm drain inlet, or stormwater conveyance, unless the conveyance is connected to a sediment basin, sediment trap, or similarly effective control.

2.6 Site Maps

Site Maps must include the following:

a) Boundaries of the property. The map(s) in the SWPPP must show the overall boundary of the property.
b) Locations where construction activities will occur. The map(s) in the SWPPP must show the locations where construction activities will occur, including
    i. Locations where earth-disturbing activities will occur (note any phasing), including any demolition activities;
    ii. Approximate slopes before and after major grading activities (note any steep slopes);
    iii. Locations where sediment, soil, or other construction materials will be stockpiled;
    iv. Any water of the U.S. crossings;
    v. Designated points where vehicles will exit onto paved roads;
    vi. Locations of structures and other impervious surfaces upon completion of construction; and
    vii. Locations of onsite and off-site construction support activity areas covered by the permit (see Part 1.2.1.c).
c) Locations of all waters of the U.S. within and one mile downstream of the site's discharge point. Also identify if any are listed as impaired, or are identified as a Tier 2, Tier 2.5, or Tier 3 water.
d) Areas of federally listed critical habitats within the site and/or at discharge locations.
e) Type and extent of pre-construction cover on the site (e.g., vegetative cover, forest, pasture, pavement, structures).
f) Drainage patterns of stormwater and authorized non-stormwater before and after major grading activities.
g) Stormwater and authorized non-stormwater discharge locations. The permit requires the site map to show information pertaining to discharge locations including:
    i. Locations where stormwater and/or authorized non-stormwater will be discharges to storm drain inlets; and
    ii. Locations where stormwater and/or authorized non-stormwater will be discharged directly to waters of the U.S.
h) Locations of all potential pollutant-generating activities identified in Part 7.2.3.g. The permit requires identification in the site map of all potential pollutant-generating activities identified in Part 7.2.3.g.
i) Locations of stormwater controls, including natural buffer areas and any shared controls utilized to comply with this permit. The permit requires identification on the site map of the location of stormwater control measures.
j) Locations where polymers, flocculants, or other treatment chemicals will be used and stored. The permit requires identification on the site map of the locations where polymers, flocculants, or other treatment chemicals will be used and stored.

Refer to Attachment A

SECTION 3: DOCUMENTATION OF COMPLIANCE WITH OTHER FEDERAL REQUIREMENTS

3.1 Endangered Species Protection

Eligibility Criterion

Under which criterion listed in Appendix D of the CGP are you eligible for coverage under this permit?

☐ **A** ☐ **B** ☒ **C** ☐ **D** ☐ **E**

For reference purposes, the eligibility criteria listed in Appendix D of the CGP are as follows:

Criterion A. No federally-listed threatened or endangered species or their designated critical habitat(s) are likely to occur in your site's "action area" as defined in Appendix A of the CGP.

Criterion B. The construction site's discharges and discharge-related activities were already addressed in another operator's valid certification of eligibility for your action area under eligibility Criterion A, C, D, E, or F and there is no reason to believe that federally-listed species or federally-designated critical habitat not considered in the prior certification may be present or located in the "action area". To certify your eligibility under this Criterion, there must be no lapse of NPDES permit coverage in the other operator's certification. By certifying eligibility under this Criterion, you agree to comply with any effluent limitations or conditions upon which the other operator's certification was based. You must include in your NOI the tracking number from the other operator's notification of authorization under this permit. If your certification is based on another operator's certification under Criterion C, you must provide EPA with the relevant supporting information required of existing dischargers in Criterion C in your NOI form.

Criterion C. Federally-listed threatened or endangered species or their designated critical habitat(s) are likely to occur in or near your site's "action area," and your site's discharges and discharge-related activities are not likely to adversely affect listed threatened or endangered species or critical habitat. This determination may include consideration of any stormwater controls and/or management practices you will adopt to ensure that your discharges and discharge-related activities are not likely to adversely affect listed species and critical habitat. To make this certification, you must include the following in your NOI: 1) any federally listed species and/or designated habitat located in your "action area"; and 2) the distance between your site and the listed species or designated critical habitat (in miles). You must also include a copy of your site map with your NOI.

Criterion D. Coordination between you and the Services has been concluded. The coordination must have addressed the effects of your site's discharges and discharge-related activities on federally-listed threatened or endangered species and federally-designated critical habitat, and must have resulted in a written concurrence from the relevant Service(s) that your site's discharges and discharge-related activities are not likely to adversely affect listed species or critical habitat. You must include copies of the correspondence between yourself and the Services in your SWPPP and your NOI.

Criterion E. Consultation between a Federal Agency and the U.S. Fish and Wildlife Service and/or the National Marine Fisheries Service under section 7 of the ESA has been concluded. The consultation must have addressed the effects of the construction site's discharges and discharge-related activities on federally-listed threatened or endangered species and federally-designated critical habitat. The result of this consultation must be either:

i. a biological opinion that concludes that the action in question (taking into account the effects of your site's discharges and discharge-related activities) is not likely to jeopardize the continued existence of listed species, nor the destruction or adverse modification of critical habitat; or

ii. written concurrence from the applicable Service(s) with a finding that the site's discharges and discharge-related activities are not likely to adversely affect federally-listed species or federally-designated habitat.

You must include copies of the correspondence between yourself and the Services in your SWPPP and your NOI.

Criterion F. Your construction activities are authorized through the issuance of a permit under section 10 of the ESA, and this authorization addresses the effects of the site's discharges and discharge-related activities on federally-listed species and federally-designated critical habitat. You must include copies of the correspondence between yourself and the Services in your SWPPP and your NOI.

For criterion C, provide the following information:

- Northern Long-Eared Bat

☐ Specific communication with staff of the U.S. Fish & Wildlife Service or National Marine Fisheries Service.
☐ Publicly available species list.
☒ Other source: NHESP data layer (August 2017 or as amended) from MassGIS, U.S. Fish and Wildlife online system Information for Planning and Conservation (IPaC) – Refer to Attachment K.

3.2 Historic Preservation

Appendix E (of the CGP), Step 1

Do you plan on installing any of the following stormwater controls at your site? Check all that apply below, and proceed to Appendix E, Step 2.

☐ Dike
☐ Berm
☒ Catch Basin
☐ Pond
☒ Stormwater Conveyance Channel (e.g., ditch, trench, perimeter drain, swale, etc.)
☐ Culvert
☒ Other type of ground-disturbing stormwater control: Water Quality Structures, Outlet Control Structure, Subsurface Infiltration System, Drain Manhole, Trench Drain

If you will not be installing any ground-disturbing stormwater controls, no further documentation is required for Section 3.2 of the Template.

Appendix E, Step 2

If you answered yes in Step 1, have prior cultural resource surveys or other evaluations determined that historic properties do not exist, or that prior disturbances at the site have precluded the existence of historic properties? ☒ YES ☐ NO

If yes, provide documentation of the basis for your determination. If no, proceed to Appendix E, Step 3.

Appendix E, Step 3

If you are installing any stormwater controls that require subsurface earth disturbance, you must determine if these activities will have an effect on historic properties. This assessment may be based on historical sources, knowledge of the area, an assessment of the types of earth-disturbing activities you are engaging in, considerations of any controls and/or management practices you will adopt to ensure that your stormwater control related earth-disturbing activities will not have an effect on historic properties, and any other relevant factors.

Does your determination demonstrate that earth disturbances related to the installation of your stormwater controls will have no effect on historic properties? ☒ YES ☐ NO

If yes, provide documentation of the basis for your determination.

3.3 Safe Drinking Water Act Underground Injection Control Requirements

Do you plan to install any of the following controls? Check all that apply below.

☒ Infiltration trenches (if stormwater is directed to any bored, drilled, driven shaft or dug hole that is deeper than its widest surface dimension, or has a subsurface fluid distribution system);

☐ Commercially manufactured pre-cast or pre-built proprietary subsurface detention vaults, chambers, or other devices designed to capture and infiltrate stormwater flow; and

☐ Drywells, seepage pits, or improved sinkholes (if stormwater is directed to any bored, drilled, driven shaft or dug hole that is deeper than its widest surface dimension, or has a subsurface fluid distribution system)

If one or more of the above apply, then, INSERT COPIES OF LETTERS, EMAILS, OR OTHER COMMUNICATION BETWEEN YOU AND THE STATE AGENCY OR EPA REGIONAL OFFICE

SECTION 4: EROSION AND SEDIMENT CONTROLS REQUIREMENTS

Section 4 of this document describes the stormwater controls that will be implemented throughout construction. The operator must install and maintain all stormwater controls in compliance with Parts 2.2 and 2.3 of the CGP. The operator must install stormwater controls by the time construction activity in any givern portion of the site begins.

The stormwater controls shall be designed and installed in accordance with good engineering practices and applicable design specifications. Specifications titled “312500- Erosion and Sedimentation Controls,” dated 04/12/2021 and prepared by Nitsch Engineering and details titled “Erosion and Sedimentation Control Details,” dated 04/12/2021 and prepared by Nitsch Engineering have been provided to the contractor under separate cover.

4.1 Natural Buffers or Equivalent Sediment Controls

Buffer Compliance Alternatives

Are there any surface waters within 50 feet of your project’s earth disturbances? ☒ YES ☐ NO

(Note: If no, no further documentation is required for Part 4.1 in the SWPPP Template. Continue to Part 4.2.)

Check the compliance alternative that you have chosen:

☐ I will provide and maintain a 50-foot undisturbed natural buffer.

(Note [1]: You must show the 50-foot boundary line of the natural buffer on your site map.)

(Note [2]: You must show on your site map how all discharges from your construction disturbances through the natural buffer area will first be treated by the site’s erosion and sediment controls. Also, show on the site map any velocity dissipation devices used to prevent erosion within the natural buffer area.)

☐ I will provide and maintain an undisturbed natural buffer that is less than 50 feet and is supplemented by additional erosion and sediment controls, which in combination achieves the sediment load reduction equivalent to a 50-foot undisturbed natural buffer.

(Note [1]: You must show the boundary line of the natural buffer on your site map.)

(Note [2]: You must show on your site map how all discharges from your construction disturbances through the natural buffer area will first be treated by the site’s erosion and sediment controls. Also, show on the site map any velocity dissipation devices used to prevent erosion within the natural buffer area.)

- INSERT WIDTH OF NATURAL BUFFER TO BE RETAINED
- INSERT EITHER ONE OF THE FOLLOWING:

  (1) THE ESTIMATED SEDIMENT REMOVAL FROM A 50-FOOT BUFFER USING APPLICABLE TABLES IN APP. K. OF THE CGP INCLUDE INFORMATION ABOUT THE BUFFER VEGETATION AND SOIL TYPE THAT PREDOMINATE AT YOUR SITE

  OR

  (2) IF YOU CONDUCTED A SITE-SPECIFIC CALCULATION FOR THE ESTIMATED SEDIMENT REMOVAL OF A 50-FOOT BUFFER, PROVIDE THE SPECIFIC REMOVAL EFFICIENCY, AND INFORMATION YOU RELIED UPON TO MAKE YOUR SITE-SPECIFIC CALCULATION.
- INSERT DESCRIPTION OF ADDITIONAL EROSION AND SEDIMENT CONTROLS TO BE USED IN COMBINATION WITH NATURAL BUFFER AREA
- INSERT THE FOLLOWING INFORMATION:
  a. (1) SPECIFY THE MODEL OR OTHER TOOL USED TO ESTIMATE SEDIMENT LOAD REDUCTIONS FROM THE COMBINATION OF THE BUFFER AREA AND ADDITIONAL EROSION AND SEDIMENT CONTROLS INSTALLED AT YOUR SITE, AND
  b. (2) INCLUDE THE RESULTS OF CALCULATIONS SHOWING THAT THE COMBINATION OF YOUR BUFFER AREA AND THE ADDITIONAL EROSION AND SEDIMENT CONTROLS

INSTALLED AT YOUR SITE WILL MEET OR EXCEED THE SEDIMENT REMOVAL EFFICIENCY OF A 50-FOOT BUFFER

☐ It is infeasible to provide and maintain an undisturbed natural buffer of any size, therefore I will implement erosion and sediment controls that achieve the sediment load reduction equivalent to a 50-foot undisturbed natural buffer.

- INSERT RATIONALE FOR CONCLUDING THAT IT IS INFEASIBLE TO PROVIDE AND MAINTAIN A NATURAL BUFFER OF ANY SIZE
- INSERT EITHER ONE OF THE FOLLOWING:

  (1) THE ESTIMATED SEDIMENT REMOVAL FROM A 50-FOOT BUFFER USING APPLICABLE TABLES IN APP. K OF THE CGP, ATTACHMENT 1. INCLUDE INFORMATION ABOUT THE BUFFER VEGETATION AND SOIL TYPE THAT PREDOMINATE AT YOUR SITE

  OR

  (2) IF YOU CONDUCTED A SITE-SPECIFIC CALCULATION FOR THE ESTIMATED SEDIMENT REMOVAL OF A 50-FOOT BUFFER, PROVIDE THE SPECIFIC REMOVAL EFFICIENCY, AND INFORMATION YOU RELIED UPON TO MAKE YOUR SITE-SPECIFIC CALCULATION.
- INSERT DESCRIPTION OF ADDITIONAL EROSION AND SEDIMENT CONTROLS TO BE USED IN COMBINATION WITH NATURAL BUFFER AREA
- INSERT THE FOLLOWING INFORMATION:
  a. (1) SPECIFY THE MODEL OR OTHER TOOL USED TO ESTIMATE SEDIMENT LOAD REDUCTIONS FROM THE EROSION AND SEDIMENT CONTROLS INSTALLED AT YOUR SITE, AND
  b. (2) INCLUDE THE RESULTS OF CALCULATIONS SHOWING THAT THE ADDITIONAL EROSION AND SEDIMENT CONTROLS INSTALLED AT YOUR SITE WILL MEET OR EXCEED THE SEDIMENT REMOVAL EFFICIENCY OF A 50-FOOT BUFFER

☐ I qualify for one of the exceptions in Appendix G Section G.2.2 of the CGP. (If you have checked this box, provide information on the applicable buffer exception that applies, below.)

4.2 Perimeter Controls

General
The site will be enclosed by a temporary construction fence as shown on the Erosion and Sedimentation Control Plan in Attachment A. Construction gates will be located at the entrance to the site as shown on the Erosion and Sedimentation Control Plan and all entrances will have stabilized construction entrances. All gates and entrances to the site will be secured during non-working hours. The areas of the site that will receive pollutant discharges will be surrounded by a Specific Perimeter Control listed below as shown on the Erosion and Sedimentation Control Plan in Attachment A. Sediment tracked offsite must be removed by the end of the same workday.

Specific Perimeter Controls

Perimeter Control # 1

- BMP Description: Silt Fence.
- Installation Schedule: Prior to the Start of Construction.
- Inspection Schedule: Once every 7 days and within 24 hours of a storm event 0.25” or greater.
- Maintenance: Ensure that all stormwater controls remain in effective condition as described in part 2.1.4 of the CGP.

Remove any sediment before it has accumulated to one-half of the above-ground height of any perimeter control.

- Responsible Staff: Construction Manager and Site Contractor(s).

Perimeter Control # 2

- BMP Description: Silt Fence with Wattles.
- Installation Schedule: Prior to the Start of Construction.
- Inspection Schedule: Once every 7 days and within 24 hours of a storm event 0.25" or greater. OR
- Maintenance: Ensure that all stormwater controls remain in effective condition as described in part 2.1.4 of the CGP. Remove any sediment before it has accumulated to one-half of the above-ground height of any perimeter control.
- Responsible Staff: Construction Manager and Site Contractor(s).

Perimeter Control # 3

- BMP Description: Super Silt Fence.
- Installation Schedule: Prior to the Start of Construction.
- Inspection Schedule: Once every 7 days and within 24 hours of a storm event 0.25" or greater.
- Maintenance: Ensure that all stormwater controls remain in effective condition as described in part 2.1.4 of the CGP. Remove any sediment before it has accumulated to one-half of the above-ground height of any perimeter control.
- Responsible Staff: Construction Manager and Site Contractor(s).

Perimeter Control # 4

- BMP Description: Wattles.
- Installation Schedule: Prior to the Start of Construction.
- Inspection Schedule: Once every 7 days and within 24 hours of a storm event 0.25" or greater.
- Maintenance: Ensure that all stormwater controls remain in effective condition as described in part 2.1.4 of the CGP. Remove any sediment before it has accumulated to one-half of the above-ground height of any perimeter control.
- Responsible Staff: Construction Manager and Site Contractor(s).

Perimeter Control # 5

- BMP Description: Silt Fence with Straw Bales.
- Installation Schedule: Prior to the Start of Construction and/or immediately after stockpile is established.
- Inspection Schedule: Once every 7 days and within 24 hours of a storm event 0.25" or greater.
- Maintenance: Ensure that all stormwater controls remain in effective condition as decribed in part 2.1.4 of the CGP. Remove any sediment before it has accumulated to one-half of the above-ground height of any perimeter control.
- Responsible Staff: Construction Manager and Site Contractor(s).

4.3 Sediment Track-Out

General

Gates will be located as shown on the Erosion and Sedimentation Control Plan in Attachment A to allow for construction vehicle access. Construction access points will have a stabilized construction entrance station or wheel wash station to minimize the track-out of sediment onto off-site streets, other paved areas, and sidewalks from vehicles exiting the construction site. Where sediment has been tracked out from your site onto paved roads, sidewalks, or other paved areas outside of your site, remove the deposited sediment by the end of the same business day in which the track-out occurs or by the end of the next business day if track-out occurs on a non-business day. Remove the track-out by sweeping, shoveling, or vacuuming these surfaces, or by using other similarly effective means of sediment removal. You are prohibited from hosing or sweeping tracked out sediment into any stormwater conveyance, storm drain inlet, or water of the U.S.

Specific Track-Out Controls

Track-Out Control # 1

- BMP Description: Street Sweeping.
- Installation Schedule: Start of construction.
- Inspection Schedule: The areas adjacent to the site should be inspected daily to determine if street sweeping is required.
- Responsible Staff Construction Manager and Site Contractor(s).

Track-Out Control # 2

- BMP Description: Stabilized Construction Entrance.
- Installation Schedule: Start of construction.
- Inspection Schedule: Once every 7 days and within 24 hours of a storm event 0.25” or greater.
- Maintenance: Ensure that all stormwater controls remain in effective condition as described in part 2.1.4 of the CGP.
- Responsible Staff: Construction Manager and Site Contractor(s).

Track-Out Control # 3

- BMP Description: Wheel Wash Station.
- Installation Schedule: Start of construction.
- Inspection Schedule: Once every 7 days and within 24 hours of a storm event 0.25” or greater.
- Maintenance: Ensure that all stormwater controls remain in effective. condition as described in part 2.1.4 of the CGP(s). The operator must provide an effective means of minimizing the discharge of pollutants from equipment and vehicle washing, wheel wash water, and other types of wash waters. The operator must ensure there is no discharge of soaps, solvents, or detergents in equipment and vehicle wash water. For storage of soaps, detergents, or solvents, the operator shall provide either a cover to minimze the exposure of these detergents to precipitation and to stormwater, or a similarily effective means designed to minimze discharge of pollutants from these areas.
- Responsible Staff: Construction Manager and Site Contractor.

4.4 Stockpiled Sediment or Soil

General
All soil stockpiles will be located outside of any natural buffers and away from existing and proposed catch basins and area drains and outside of proposed infiltration system footprints. A sediment barrier shall be installed along all downgradient perimeter areas. Examples of sediment barriers include silt fence, super silt fence, or wattles.

You are prohibited from hosing down or sweeping soil or sediment accumulated on pavement or other impervious surfaces into any stormwater conveyance, storm drain inlet, or water of the U.S.

For stockpiles that will be unused for 14 or more days, a cover such as a tarp or blown straw shall be provided or temporary stabilization should be provided (consistent with Part 2.2.14 of the CGP).

Specific Stockpile Controls

Stockpile Control # 1
- BMP Description: Silt Fence.
- Installation Schedule: Immediately after stockpile is established.
- Inspection Schedule: Once every 7 days and within 24 hours of a storm event 0.25" or greater.
- Maintenance: Ensure that all stormwater controls remain in effective condition as decribed in part 2.1.4 of the CGP. Remove any sediment before it has accumulated to one-half of the above-ground height of any perimeter control.
- Responsible Staff: Construction Manager and Site Contractor(s).

Stockpile Control # 2
- BMP Description: Wattles.
- Installation Schedule: Immediately after stockpile is established.
- Inspection Schedule: Once every 7 days and within 24 hours of a storm event 0.25" or greater.
- Maintenance: Ensure that all stormwater controls remain in effective condition as decribed in part 2.1.4 of the CGP. Remove any sediment before it has accumulated to one-half of the above-ground height of any perimeter control.
- Responsible Staff: Construction Manager and Site Contractor(s).

Stockpile Control # 3
- BMP Description: Tarp.
- Installation Schedule: When stockpile will remain inactive for 14 or more calendar days.
- Inspection Schedule: Once every 7 days and within 24 hours of a storm event 0.25" or greater.
- Maintenance: Ensure that all stormwater controls remain in effective condition as decribed in part 2.1.4 of the CGP. Remove any sediment before it has accumulated to one-half of the above-ground height of any perimeter control.
- Responsible Staff: Construction Manager and Site Contractor(s).

Stockpile Control # 4
- BMP Description: Straw Bales.
- Installation Schedule: Immediately after stockpile is established.
- Inspection Schedule: Once every 7 days and within 24 hours of a storm event 0.25" or

greater.

- Maintenance: Ensure that all stormwater controls remain in effective condition as decribed in part 2.1.4 of the CGP.
  Remove any sediment before it has accumulated to one-half of the above-ground height of any perimeter control.
- Responsible Staff: Construction Manager and Site Contractor(s).

Stockpile Control # 5

- BMP Description: Blown Straw.
- Installation Schedule: When stockpile will remain inactive for 14 or more calendar days.
- Inspection Schedule: Once every 7 days and within 24 hours of a storm event 0.25" or greater.
- Maintenance: Ensure that all stormwater controls remain in effective condition as decribed in part 2.1.4 of the CGP.
  Remove any sediment before it has accumulated to one-half of the above-ground height of any perimeter control.
- Responsible Staff: Construction Manager and Site Contractor(s).

Stockpile Control # 6

- BMP Description: Hydroseeding.
- Installation Schedule: When stockpile will remain inactive for 14 or more calendar days.
- Inspection Schedule: Once every 7 days and within 24 hours of a storm event 0.25" or greater.
- Maintenance: Ensure that all stormwater controls remain in effective condition as decribed in part 2.1.4 of the CGP.
  Remove any sediment before it has accumulated to one-half of the above-ground height of any perimeter control.
- Responsible Staff: Construction Manager and Site Contractor(s).

4.5 Minimize Dust

General
Disturbed land will be temporarily stabilized as required by the CGP. Dust will be minimized using measures including sprinkling/irrigation, vegetative cover, mulch, and/or stone. Stockpiles will be handled in accordance with section 4.4 of the SWPPP.

Earth-disturbing activities are considered temporarily ceased when work will not resume for a period of 14 or more calendar days. Stabilization shall be initiated when earth-disturbing activities are temporarily or permanently ceased. Stabilization activities shall be complete within 7 calendar days after the initiation of soil stabilization measures.

Specific Dust Controls

Dust Control # 1

- BMP Description: Sprinkling/Irrigation.
- Installation Schedule: As needed throughout earthwork activities as determined by the site contractor and construction manager.
- Inspection Schedule: Once every 7 days and within 24 hours of a storm event 0.25" or greater. Maintenance: Ensure that all stormwater controls remain in effective condition as decribed in part 2.1.4 of the CGP.

- Responsible Staff: Construction Manager and Site Contractor(s).

Dust Control # 2

- BMP Description: Straw or Mulch.
- Installation Schedule: As needed throughout earthwork activities as determined by the site contractor and construction manager. When disturbed land will remain inactive for 14 or more calendar days.
- Inspection Schedule: Once every 7 days and within 24 hours of a storm event 0.25" or greater.
- Maintenance: Ensure that all stormwater controls remain in effective condition as decribed in part 2.1.4 of the CGP.
- Responsible Staff: Construction Manager and Site Contractor(s).

4.6 Minimize the Disturbance of Steep Slopes

General

Steep slopes (defined as slopes of 15% or greater in grade) are expected to be disturbed onsite. Disturbances to steep slopes will be minimized by phasing disturbances to those areas and by using stabilization practices designed to be used on steep grades.

Specific Steep Slope Controls

Steep Slope Control # 1

- BMP Description: Straw or Mulch.
- Installation Schedule: When disturbed land will remain inactive for 14 or more calendar days.
- Inspection Schedule: Once every 7 days and within 24 hours of a storm event 0.25" or greater.
- Maintenance: Ensure that all stormwater controls remain in effective. condition as decribed in part 2.1.4 of the CGP.
- Responsible Staff: Construction Manager and Site Contractor(s).

Steep Slope Control # 2

- BMP Description: Hydroseeding.
- Installation Schedule: When disturbed land will remain inactive for 14 or more calendar days.
- Inspection Schedule: Once every 7 days and within 24 hours of a storm event 0.25" or greater.
- Maintenance: Ensure that all stormwater controls remain in effective condition as decribed in part 2.1.4 of the CGP.
- Responsible Staff: Construction Manager and Site Contractor(s).

Steep Slope Control # 3

- BMP Description: Soil Stabilization Mats.
- Installation Schedule: When disturbed land will remain inactive for 14 or more calendar days.
- Inspection Schedule: Once every 7 days and within 24 hours of a storm event 0.25" or greater.
- Maintenance: Ensure that all stormwater controls remain in effective condition as decribed in part 2.1.4 of the CGP.
- Responsible Staff: Construction Manager and Site Contractor(s).

Steep Slope Control # 4

- BMP Description: Rip-Rap.

- Installation Schedule: When disturbed land will remain inactive for 14 or more calendar days.
- Inspection Schedule: Once every 7 days and within 24 hours of a storm event 0.25” or greater.
- Maintenance: Ensure that all stormwater controls remain in effective condition as decribed in part 2.1.4 of the CGP.
- Responsible Staff: Construction Manager and Site Contractor(s).

4.7 Preserve Native Topsoil

Onsite native topsoil shall be preserved, unless infeasible. Preserving native topsoil is not required where the intended function of a specific area of the site dictates that the topsoil be disturbed or removed.

Stockpiling topsoil at off-site locations or transferring topsoil to other locations is an example of a way to preserve native topsoil.

The contractor shall perform construction sequencing such that earth materials are exposed for a minimum of time before they are covered, seeded, or otherwise stabilized.

4.8 Minimize Soil Compaction

General

In areas where infiltration practices will be installed or areas of the site where final vegetative stabilization will occur, soil compaction shall be minimized. This includes restricting vehicle access and equipment use.

Areas used for post-construction infiltration shall be constructed after all ground surfaces are fully stabilized when feasible. If proposed infiltration areas are constructed prior to the site being fully stabilized, additional erosion controls shall be installed. All stockpiled and material storage areas shall be located outside of the areas proposed for post-construction infiltration.

Areas of post-construction landscaping shall be constructed after all ground surface are fully stabilized. If proposed landscaped areas are constructed prior to the site being fully stabilized, additional erosion controls shall be installed. All soil stockpiles and material storage areas shall be located outside of the areas proposed for post-construction landscaping where feasible. Where this is not feasible, use techniques that rehabilitate and condition the soils as necessary to support vegetative growth prior to planting.

4.9 Storm Drain Inlets

General
All existing and proposed storm drain inlets affected by construction activities should be protected using an Inlet Sediment Filter as shown on the Erosion and Sedimentation Control Plan provided in Attachment A.

Clean or remove and replace the protection measures as sediment accumulates, the filter becomes clogged, and/or performance is compromised. Where there is evidence of sediment accumulation adjacent to the inlet protection measure, remove the deposited sediment by the end of the same business day in which it is found or by the end of the following business day if removal by the same business day is not feasible.

Specific Storm Drain Inlet Controls

<u>Storm Drain Inlet Control # 1</u>

- BMP Description: Inlet Sediment Filter.
- Installation Schedule: Prior to the Start of Construction.
- Inspection Schedule: Once every 7 days and within 24 hours of a storm event 0.25” or greater.
- Maintenance: Ensure that all stormwater controls remain in effective. condition as decribed in part 2.1.4 of the CGP.
- Responsible Staff: Construction Manager and Site Contractor(s).

Storm Drain Inlet Control # 2

- BMP Description: Inlet Protection with Gravel.
- Installation Schedule: Prior to the Start of Construction .
- Inspection Schedule: Once every 7 days and within 24 hours of a storm event 0.25” or greater.
- Maintenance: Ensure that all stormwater controls remain in effective condition as decribed in part 2.1.4 of the CGP.
- Responsible Staff: Construction Manager and Site Contractor(s).

Storm Drain Inlet Control # 3

- BMP Description: Inlet Protection with Block and Gravel.
- Installation Schedule: Prior to the Start of Construction.
- Inspection Schedule: Once every 7 days and within 24 hours of a storm event 0.25” or greater.
- Maintenance: Ensure that all stormwater controls remain in effective condition as decribed in part 2.1.4 of the CGP.
- Responsible Staff: Construction Manager and Site Contractor(s).

4.10 Minimize Erosion of Stormwater Conveyances

The contractor shall minimize erosion of stormwater conveyance channels and their embankments, outlets, adjacent streambanks, slopes, and downstream waters. The contractor shall install erosion controls and velocity dissipation devices within and along the length of any stormwater conveyance channel and at any outlet to slow down runoff to minimize erosion.

Stormwater Conveyance Control # 1

- BMP Description: Check Dam.
- Installation Schedule: Start of construction of stormwater conveyance channel.
- Inspection Schedule: Once every 7 days and within 24 hours of a storm event 0.25” or greater.
- Maintenance: Ensure that all stormwater controls remain in effective condition as decribed in part 2.1.4 of the CGP.
- Responsible Staff: Construction Manager and Site Contractor(s).

Stormwater Conveyance Control # 2

- BMP Description: Sediment Trap.
- Installation Schedule: Start of construction of stormwater conveyance channel.
- Inspection Schedule: Once every 7 days and within 24 hours of a storm event 0.25” or greater.
- Maintenance: Ensure that all stormwater controls remain in effective condition as decribed in part 2.1.4 of the CGP.
- Responsible Staff: Construction Manager and Site Contractor(s).

Stormwater Conveyance Control # 3

- BMP Description: Rip Rap.
- Installation Schedule: Start of construction of stormwater conveyance channel.
- Inspection Schedule: Once every 7 days and within 24 hours of a storm event 0.25” or greater.
- Maintenance: Ensure that all stormwater controls remain in effective condition as decribed in part 2.1.4 of the CGP.
- Responsible Staff: Construction Manager and Site Contractor(s).

Stormwater Conveyance Control # 4

- BMP Description: Grouted Rip Rap at outlets.
- Installation Schedule: Start of construction of stormwater conveyance channel.
- Inspection Schedule: Once every 7 days and within 24 hours of a storm event 0.25” or greater.
- Maintenance: Ensure that all stormwater controls remain in effective condition as decribed in part 2.1.4 of the CGP.
- Responsible Staff: Construction Manager and Site Contractor(s).

4.11 Sediment Basins

All sediment basins should be located outside of any waterbody, resource area, and buffer zones. Sediment basins shall be sized to provide storage for either the volume of runoff from a 2-year, 24-hour storm or 3,600 cubic feet per acre drained.

Where feasible, outlet structures that withdraw water from the surface of the sediment basin shall be used. Erosion and velocity dissipation devices shall be installed at inlets and outlets to prevent erosion.

Accumulated sediment shall be removed to maintain at least one-half of the design capacity. The basin shall be maintained so that it remains in effective operating condition.

Sediment Basin Control # 1

- BMP Description: Check Dam.
- Installation Schedule: Start of construction of stormwater conveyance channel.
- Inspection Schedule: Once every 7 days and within 24 hours of a storm event 0.25” or greater.
- Maintenance: Ensure that all stormwater controls remain in effective condition as decribed in part 2.1.4 of the CGP.
- Responsible Staff: Construction Manager and Site Contractor(s).

Sediment Basin Control # 2

- BMP Description: Sediment Trap.
- Installation Schedule: Start of construction of stormwater conveyance channel.
- Inspection Schedule: Once every 7 days and within 24 hours of a storm event 0.25” or greater.
- Maintenance: Ensure that all stormwater controls remain in effective condition as decribed in part 2.1.4 of the CGP.
- Responsible Staff: Construction Manager and Site Contractor(s)

Sediment Basin Control # 3

- BMP Description: Rip Rap.
- Installation Schedule: Start of construction of stormwater conveyance channel.
- Inspection Schedule: Once every 7 days and within 24 hours of a storm event 0.25” or greater.

- Maintenance: Ensure that all stormwater controls remain in effective condition as decribed in part 2.1.4 of the CGP.
- Responsible Staff: Construction Manager and Site Contractor(s).

Sediment Basin Control # 4

- BMP Description: Grouted Rip Rap at outlets.
- Installation Schedule: Start of construction of stormwater conveyance channel.
- Inspection Schedule: Once every 7 days and within 24 hours of a storm event 0.25” or greater.
- Maintenance: Ensure that all stormwater controls remain in effective condition as decribed in part 2.1.4 of the CGP.
- Responsible Staff: Construction Manager and Site Contractor(s).

4.12 Chemical Treatment

There are no proposed chemical treatments associated with this project.

4.13 Dewatering Practices

Dewatering will occur in a way that minimizes the discharge of pollutants in ground water or accumulated stormwater that is removed from excavations, trenches, foundations, vaults, or other similar points of accumulation. Dewatering water shall be treated in compliance with Section 2.4 of the CGP and water with visible floating solids or foam may not be discharged.

Any applicable permits shall be obtained from local permitting authorities.

Dewatering Control # 1

- BMP Description: Sediment basin or Sediment Trap.
- Installation Schedule: Start of construction of stormwater conveyance channel.
- Inspection Schedule: Once every 7 days and within 24 hours of a storm event 0.25” or greater.
- Maintenance: Ensure that all stormwater controls remain in effective condition as decribed in part 2.1.4 of the CGP.
- Responsible Staff: Construction Manager and Site Contractor(s).

Dewatering Control # 2

- BMP Description: Sediment socks.
- Installation Schedule: Start of construction of stormwater conveyance channel.
- Inspection Schedule: Once every 7 days and within 24 hours of a storm event 0.25” or greater.
- Maintenance: Ensure that all stormwater controls remain in effective condition as decribed in part 2.1.4 of the CGP.
- Responsible Staff: Construction Manager and Site Contractor(s).

Dewatering Control # 3

- BMP Description: Dewatering Tanks.
- Installation Schedule: Start of construction of stormwater conveyance channel.
- Inspection Schedule: Once every 7 days and within 24 hours of a storm event 0.25” or greater and as required by the manufacturer.
- Maintenance: Ensure that all stormwater controls remain in effective condition as decribed in part 2.1.4 of the CGP.
- Responsible Staff: Construction Manager and Site Contractor(s).

Dewatering Control # 4

- BMP Description: Filtration Systems.
- Installation Schedule: Start of construction of stormwater conveyance channel.
- Inspection Schedule: Once every 7 days and within 24 hours of a storm event 0.25” or Greater and as required by the manufacturer.
- Maintenance: Ensure that all stormwater controls remain in effective condition as decribed in part 2.1.4 of the CGP.
- Responsible Staff: Construction Manager and Site Contractor(s).

4.14 Other Stormwater Controls

Any changes in construction activity that that include means of stormwater control not included in this document will be identified, the SWPPP will be amended, and the appropriate erosion and sedimentation controls will be implemented.

4.15 Site Stabilization

Initiate the installation of stabilization measures immediately in any areas of exposed soil where construction activities have permanently ceased or will be temporarily inactive for 14 or more calendar days. Complete the installation of stabilization measures as soon as practicable, but no later than 7 calendar days after stabilization has been initiated.

Site Stabilization Practice #1

☐ *Vegetative* ☒ *Non-Vegetative*
☒ *Temporary* ☐ *Permanent*

- BMP Description: Soil Stabilization Mat.
- Installation Schedule: As/if required.
- Maintenance and Inspection: Once every 7 days and within 24 hours of a storm event 0.25” or greater.
- Responsible Staff: Construction Manager and Site Contractor(s).

Site Stabilization Practice #2

☒ *Vegetative* ☐ *Non-Vegetative*
☒ *Temporary* ☐ *Permanent*

- BMP Description: Temporary Seeding.
- Installation Schedule: As/if required.
- Maintenance and Inspection: Once every 7 days and within 24 hours of a storm event 0.25” or greater.
- Responsible Staff: Construction Manager and Site Contractor(s).

SECTION 5: POLLUTION PREVENTION STANDARDS

5.1 Potential Sources of Pollution

Potential sources of sediment to stormwater runoff:

- Stockpiles and construction staging
- Clearing and grubbing operations
- Grading and site excavation
- Topsoil stripping
- Landscape operations
- Soil tracking offsite from construction vehicles
- Runoff from unstabilized areas
- Construction debris

Potential pollutants and sources, other than sediment, to stormwater runoff:

- Combined Staging Area – fueling activities, equipment maintenance, sanitary facilities, and hazardous waste storage
- Materials Storage Area – building materials, solvents, adhesives, paving materials, paints, aggregates, trash, etc.
- Construction Activity-paving, curb installation, concrete pouring, and building construction

Staging areas are shown on the Erosion and Sedimentation Control Plan provided in Attachment A.

Construction Site Pollutants

Pollutant-Generating Activity	**Pollutants or Pollutant Constituents** (that could be discharged if exposed to stormwater)	**Location on Site** (or reference SWPPP site map where this is shown)
Pesticides (insecticides, fungicides, herbicides, rodenticides)	Chlorinated hydrocarbons, organophosphates, carbonates, arsenic	Herbicides used for noxious weed control
Fertilizers	Nitrogen, phosphorous	Newly seeded areas
Plaster	Calcium sulphate, calcium carbonate, sulfuric acid	Building construction
Cleaning Solvents	Perchloroethylene, methylene chloride, trichloroethylene, petroleum distillates	No equipment cleaning allowed in project limits
Asphalt	Oil, petroleum distillates	Streets and parking lots
Concrete	Limestone, sand pH, chromium	Curb and gutter, sidewalk, building construction
Glue, Adhesives	Polymers, epoxies	Building construction
Paints	Metal oxides, Stoddard solvent, talc, calcium carbonate, arsenic	Building construction
Curing compounds	Naphtha	Curb and gutter, building construction
Wood preservatives	Stoddard solvent, petroleum distillates, arsenic, copper, chromium	Timber pads, bracing, building construction
Hydraulic Oils/fluids	Mineral oil	Leaks/broken hoses from equipment
Gasoline	Benzene, ethyl benzene, toluene, xylene, MTBE	Secondary containment/staging area
Diesel Fuel	Petroleum distillate, oil & grease, naphthalene, xylenes	Secondary containment/staging area
Kerosene	Coal oil, petroleum distillates	Secondary containment/staging area
Antifreeze/coolant	Ethylene glycol, propylene glycol, heavy metals (copper, lead, zinc)	Leaks or broken hoses from equipment
Sanitary toilets	Bacteria, parasites, and viruses	Staging area

5.2 Spill Prevention and Response

BMP Description: Spill kit, vehicle washing, silt sack catch basin protection, silt fence
Installation Schedule: Start of construction activity
Maintenance and Inspection: Minimum weekly & as necessary
Responsible Staff: Construction Manager and Site Contractor

- Major vehicle maintenance onsite is prohibited
- Re-fueling of vehicles within 25 feet of a drainage structure is prohibited
- Spill kit shall be kept onsite consisting of:
    - Gloves
    - Absorbent mats
    - Drip pan

Spill Prevention and Control Plan

- Refer to contractor's Spill Plan.
- Manufacturers' recommended spill control methods will be posted onsite and site personnel will be made aware of the requirements.
- Cleanup supplies will be kept onsite in a materials storage area. This equipment will include: goggles, brooms, dustpans, mops, rags, gloves, oil absorbent, sawdust, plastic and metal trash cans, and other materials and supplies specifically designated for cleanup.
- All spills will be immediately cleaned up after discovery.
- The spill area will be well ventilated.
- Cleanup personnel will wear suitable protective clothing.
- Spills of toxic and/or hazardous material will be reported to state, local, and Federal authorities, as required by law. Spills shall also be reported immediately to the owner.
- A spill incident report will be filed detailing the amount and extent of the spill, material(s) involved, and effectiveness of the cleanup. This report will be on file at the Construction Manager/Site Contractor office, as well as kept onsite in the field office. A copy shall also be filed with the Hazard Communication Coordinator (HCC).

The Construction Manager/Site Contractor will designate someone onsite that will serve as the Spill Cleanup Coordinator. At least two other personnel will be designated as alternate spill coordinators. All spill control personnel will be trained in spill prevention, control, and cleanup. The names of the responsible personnel will be posted at the jobsite office of the Construction Manager/ Site Contractor.

5.3 Fueling and Maintenance of Equipment or Vehicles

General

Minor vehicle and equipment emergency maintenance can be performed onsite away from drainage structures. Major vehicle and equipment maintenance must be performed offsite. Equipment/vehicle storage areas and any onsite fuel tanks will be inspected weekly and after storm events. Equipment and vehicles will be inspected for leaks, equipment damage, and other service problems on each day of use. Any leaks will be repaired immediately or the equipment/vehicle will be removed from the site.

Minor vehicle and equipment emergency maintenance shall occur when a vehicle cannot be safely removed from the site. The vehicle should be repaired so it can be taken off-site so that the rest of the maintenance can occur.

Major vehicle maintenance onsite is prohibited. Re-fueling or maintenance of vehicles within 25 feet of a drainage structure shall be prohibited. Drip pans, drip cloths, or absorbent pads should be used when replacing spent fluids. The fluids should be collect and stored prior to being disposed of offsite.

Specific Pollution Prevention Practice #1

- BMP Description: Spill Kit.
- Installation Schedule: Onsite throughout construction.
- Responsible Staff: Construction Manager and Site Contractor.

Specific Pollution Prevention Practice #1

- BMP Description: Drip Pans, Drip Cloths, Absorbent Pads.
- Installation Schedule: Onsite throughout construction.
- Responsible Staff: Construction Manager and Site Contractor.

5.4 Washing of Equipment and Vehicles

General

Vehicle and equipment washout areas shall be constructed by the contractor so that no untreated water enters the storm drain system. Soaps, detergents, or solvents must be stored in a way to prevent these detergents from coming into contact with rainwater, or a similarly effective means designed to prevent the discharge of pollutants from these areas.

Specific Pollution Prevention Practices

Pollution Prevention Practice # 1

- BMP Description: Designated vehicle/equipment washing areas
- Installation Schedule: Start of construction.
- Inspection Schedule: Once every 7 days and within 24 hours of a storm event 0.25” or greater.
- Responsible Staff: Construction Manager and Site Contractor

Pollution Prevention Practice # 2

- BMP Description: Spill kit, vehicle washing, straw bale catch basin protection, silt fence
- Installation Schedule: Start of construction activity
- Inspection Schedule: Once every 7 days and within 24 hours of a storm event 0.25” or greater.
- Responsible Staff: Construction Manager and Site Contractor

5.5 Storage, Handling, and Disposal of Construction Products, Materials, and Wastes

5.5.1 Building Products

General

The contractor will recycle all construction materials possible. For materials that cannot be recycled, solid waste will be disposed of in accordance with DEP Regulations for Solid Waste Facilities, 310 CMR 10.00.

Any building materials required to be stored onsite will be stored at a combined staging and materials storage area as shown on the CMP. Larger items will be elevated by appropriate methods to minimize contact with runoff. The storage area will be inspected weekly and after storm events. It will be kept clean, organized, and equipped with appropriate cleaning supplies.

Building product usage shall follow the following good housekeeping BMPs:

- The Responsible Staff: Construction Manager or Site Contractor representative will inspect daily for inspection of the work area to ensure proper management of waste materials.
- Store only enough material onsite required for that job as to satisfy current construction needs.
- Store required materials in tightly lidded containers under cover.
- Store materials in original containers with clearly legible labels.
- Separate and store materials apart from each other.
- Do not mix materials unless specifically in accordance with manufacturers' recommendations.
- Use all products from a container before disposing of the container.
- Follow manufacturers' instructions for handling, storage, and disposing of all materials.
- All materials shall be stored in an area to prevent the discharge of pollutants from building products.

Specific Pollution Prevention Practices

<u>*Pollution Prevention Practice # 1*</u>

- BMP Description: Perimeter Protection control around Stockpiles.
- Installation Schedule: Start of construction/ Immediately after stockpile is established.
- Inspection Schedule: Once every 7 days and within 24 hours of a storm event 0.25" or greater.
- Maintenance: Ensure that all stormwater controls remain in effective condition as decribed in part 2.1.4 of the CGP.
  Remove any sediment before it has accumulated to one-half of the above-ground height of any perimeter control.
- Responsible Staff: Construction Manager and Site Contractor(s).

5.5.2 Pesticides, Herbicides, Insecticides, Fertilizers, and Landscape Materials

- In storage areas, provide either (1) cover to minimize the exposure of these chemicals to precipitation and to stormwater or (2) a similarly effective means designed to minimize the discharge of pollutants from these areas.
- Comply with all application and disposal requirements included on the registered pesticide, herbicide, insecticide, and fertilizer label.

5.5.3 Diesel Fuel, Oil, Hydraulic Fluids, Other Petroleum Products, and Other Chemicals

General

- Only skilled personnel in a designated area will perform fueling of vehicles onsite.
- Vehicles used onsite will be monitored for fuel and oil leaks.
- Vehicles used onsite will be maintained in good working order.
- Asphalt substances will be applied in accordance with manufacturers' recommendations.
- The use of petroleum products as a release agent for asphalt transport trucks is prohibited.
- Vehicle fueling will only be done in vehicle fueling areas located by the contractor. See section 5.3 of the SWPPP.
- The contractor shall be responsible for locating the fuel storage and re-fueling area onsite to minimize disturbance to construction activates and site area.
- Construction equipment not in active use for 5 minutes or more will be turned off.

5.5.4 Hazardous or Toxic Waste

(Note: Examples include paints, solvents, petroleum-based products, wood preservatives, additives, curing compounds, acids.)

General

- Keep products in their original containers.
- Original container labels should be clearly visible.
- Material safety data sheets will be kept onsite and be available.
- Follow all state, local, and Federal regulations regarding the handling, use, storage, and disposal of hazardous material.

Paints:

- All paint containers will be tightly sealed when not in use.
- Remove excess paint in original labeled containers from the jobsite.
- Paint will not be disposed of onsite. Remove excess paint material from the site and legally dispose of.
- Paint shall not be disposed of in the storm drain system.

5.5.5 Construction and Domestic Waste

General
The contractor will manage domestic waste onsite. The contractor will provide waste containers of sufficient size and number to contain construction and domestic wastes. The waste container lids will be kept closed when not in use and lids will be closed at the end of the business day for those containers that are actively used throughout the day. For waste containers that do not have lids, provide either a cover or a similarly effective means designed to minimize discharge of pollutants. Clean up immediately if containers overflow.

Pollution Prevention Practice # 1

- BMP Description: Dumpster.
- Installation Schedule: Start of construction.
- Maintenance and Inspection: Weekly and covered daily.
- Responsible Staff: Construction Manager and Site Contractor(s).

Pollution Prevention Practice # 2

- BMP Description: Litter/debris pick-up.
- Installation Schedule: Start of construction.
- Maintenance and Inspection: Daily.
- Responsible Staff: Construction Manager and Site Contractor(s).

5.5.6 Sanitary Waste

All sanitary waste portable toilets shall be positioned so that they are secure and will not be tipped or knocked over, and located away from any stormwater inlets or conveyances.

Pollution Prevention Practice # 1

- BMP Description: Porta John.
- Installation Schedule: Start of construction.
- Maintenance and Inspection: As manufacturer requires.
- Responsible Staff: Construction Manager and Site Contractor(s).

5.6 Washing of Applicators and Containers used for Paint, Concrete, or Other Materials

General
Washing of applicators and containers used for paint, concrete, or other materials shall follow the following good housekeeping BMPs:

- An effective means of eliminating the discharge of water from the washout and cleanout of stucco, paint, concrete, form release oils, curing compounds, and other construction materials.
- All washwater must be directed into a leak-proof container or leak-proof pit. The container or pit must be designed so that no overflows can occur due to inadequate sizing or precipitation.
- Washout and cleanout wastes should be handled as follows:
  - Do not dump liquid wastes into storm sewers.
  - Dispose of liquid wastes in accordance with applicable requirements.
  - Remove and dispose of hardened concrete waste consistent with the handling of other construction wastes.
- Locate any washout or cleanout activities as far away as possible from surface waters and stormwater inlets or conveyances, and to the extent practicable, designate areas to be used for these activities and conduct such activities only in these areas.

Pollution Prevention Practice # 1

- BMP Description: Designated applicator and container washing areas.
- Installation Schedule: Start of construction.
- Maintenance and Inspection: Daily.
- Responsible Staff: Construction Manager and Site Contractor(s).

5.7 Fertilizers

General
If fertilizer is required onsite, installation will follow the following guidelines:

- Fertilizers will be used at the application rates called for in the specifications for the project.
- Once applied, fertilizer will be worked into the soil to minimize wash off from irrigation and stormwater.
- Fertilizer will be stored under cover.
- The contents of partially used fertilizer bags will be transferred to re-sealable, watertight containers clearly labeled with their contents.
- Avoid applying before heavy rains.
- Never apply to frozen ground.
- Never apply to stormwater conveyance channels with flowing water.

SECTION 6: INSPECTION AND CORRECTIVE ACTION

6.1 Inspection Personnel and Procedures

Personnel Responsible for Inspections

Construction Manager
Contact Person

Site Contractor
Contact person

(Note: All personnel conducting inspections must be considered a "qualified person." CGP Part 4.1.1 clarifies that a "qualified person" is a person knowledgeable in the principles and practices of erosion and sediment controls and pollution prevention, who possesses the skills to assess conditions at the construction site that could impact stormwater quality, and the skills to assess the effectiveness of any stormwater controls selected and installed to meet the requirements of this permit.)

Inspection Schedule
Specific Inspection Frequency
The contractor shall inspect and maintain erosion control measures, and remove sediment therefrom, once every 7 days and within 24 hours of a storm event 0.25" or greater.

Rain Gauge Location:
NSAXM3 - Sudbury River at Saxonville, MA
Reductions in Inspection Frequency (if applicable):

Inspection frequency may be reduced to twice per month (no more than 14 days apart) for the first month in areas of the site where the stabilization steps outlines in Parts 2.2.14 of the CGP have been completed. After the first month, inspection frequency may be reduced to once per month. If construction activity resumes in this portion of the site at a later date, the inspection frequency immediately increases to that required in Parts 4.2 and 4.3 as applicable. You must document the beginning and ending dates of this period in the SWPPP.

Inspection frequency may be reduced to once per month and within 24 hours of the occurrence of a storm event of 0.25 inches or greater if the project is located in an arid, semi-arid, or drought-stricken area and construction is occurring during the seasonally dry period or a period in which drought is predicted to occur. If this inspection frequency is followed, you must document the beginning and ending dates of this period in the SWPPP.

Inspections can be temporarily suspended under the following conditions:

- Earth-disturbing activity is suspended due to frozen condition;
- Runoff is unlikely due to continuous frozen conditions that are likely to continue at the site for at least three months based on historic seasonal averaged. **If unexpected weather conditions make discharges likely, the operators must immediately resume the regular inspection schedule**;
- Land disturbances have been suspended; and
- All disturbed areas of the site have been stabilized in accordance with Part 2.2.14a of the CGP.

Inspection frequency may be reduced to once per month under the following conditions:

- The operator is still conducting earth disturbing activities under frozen conditions;
- Runoff is unlikely due to continuous frozen conditions that are likely to continue at the site for at least three months based on historic seasonal averages. **If unexpected weather conditions make discharges likely, the operator must immediately resume the regular inspection schedule**; and
- Except for areas in which the operator is conducting earth-disturbing activities, disturbed areas of the site have been stabilized in accordance with Part 2.2.14a of the CGP.

Inspection Report Forms
Copies of inspection reports are in Attachment D.

6.2 Corrective Action

Personnel Responsible for Corrective Actions
Contact Person, Construction Manager Company
Contact Person, Site Contractor

Corrective Action Forms
A copy of the Corrective Action Form is in Attachment E.

6.3 Delegation of Authority

Duly Authorized Representative(s) or Position(s):
Construction Manager Company
Contact Person
Contact Person Title
Street Address
Town/City, State Zip Code
xxx-xxx-xxxx
Email address

SECTION 7: TRAINING LOG

Refer to Attachment I for a Training Log to be completed for each SWPPP training session.

Table 7-1: Documentation for Completion of Training

Name	Date Training Completed

SECTION 8: CERTIFICATION AND NOTIFICATION

Operator – Owner's Representative

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gathered and evaluated the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I have no personal knowledge that the information submitted is other than true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Name: ______________________________ Title: ______________________________

Signature: ______________________________________ Date: __________________

Operator – Construction Manager

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gathered and evaluated the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I have no personal knowledge that the information submitted is other than true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Name: ______________________________ Title: ______________________________

Signature: ______________________________________ Date: __________________

SWPPP ATTACHMENTS

Attach the following documentation to the SWPPP:

Attachment A – Site Maps

Attachment B – 2017 Construction General Permit

Attachment C – NOI and EPA Authorization Email

Attachment D – Inspection Form

Attachment E – Corrective Action Form

Attachment F – SWPPP Amendment Log

Attachment G – Subcontractor Certifications/Agreements

Attachment H – Grading and Stabilization Activities Log

Attachment I – SWPPP Training Log

Attachment J – Delegation of Authority Form

Attachment K – Endangered Species Documentation

Attachment L – Historic Preservation Documentation

Attachment M – Rainfall Gauge

Attachment N – Order of Conditions

Attachment A – Site Maps

Site Maps must include the following:

a) Boundaries of the property. The map(s) in the SWPPP must show the overall boundary of the property.
b) Locations where construction activities will occur. The map(s) in the SWPPP must show the locations where construction activities will occur, including
   i. Locations where earth-disturbing activities will occur (note any phasing), including any demolition activities;
   ii. Approximate slopes before and after major grading activities (note any steep slopes);
   iii. Locations where sediment, soil, or other construction materials will be stockpiled;
   iv. Any water of the U.S. crossings;
   v. Designated points where vehicles will exit onto paved roads;
   vi. Locations of structures and other impervious surfaces upon completion of construction;
   vii. Locations of onsite and off-site construction support activity areas covered by the permit (see Part 1.2.1.c).
c) Locations of all waters of the U.S. within and one mile downstream of the site's discharge point. Also identify if any are listed as impaired, or are identified as a Tier 2, Tier 2.5, or Tier 3 water.
d) Areas of federally listed critical habitats within the site and/or at discharge locations.
e) Type and extent of pre-construction cover on the site (e.g., vegetative cover, forest, pasture, pavement, structures).
f) Drainage patterns of stormwater and authorized non-stormwater before and after major grading activities.
g) Stormwater and authorized non-stormwater discharge locations. The permit requires the site map to show information pertaining to discharge locations including:
   i. Locations where stormwater and/or authorized non-stormwater will be discharges to storm drain inlets; and
   ii. Locations where stormwater and/or authorized non-stormwater will be discharged directly to waters of the U.S.
h) Locations of all potential pollutant-generating activities identified in Part 7.2.3.g. The permit requires identification in the site map of all potential pollutant-generating activities identified in Part 7.2.3.g.
i) Locations of stormwater controls, including natural buffer areas and any shared controls utilized to comply with this permit. The permit requires identification on the site map of the location of stormwater control measures.
j) Locations where polymers, flocculants, or other treatment chemicals will be used and stored. The permit requires identification on the site map of the locations where polymers, flocculants, or other treatment chemicals will be used and stored.

Include the following if possible:

- LOCUS Map created with GIS
- USGS Map created with GIS
- Phasing Plans/Mobilization Plans/Construction Management Plans from the contractor
- Erosion and Sedimentation Control Plans

Attachment B – 2017 Construction General Permit

Attachment C – NOI and EPA Authorization e-mail

Attachment D – Inspection Form

Attachment E – Corrective Action Form

Attachment F – SWPPP Amendment Log

No.	Description of the Amendment	Date of Amendment	Amendment Prepared by [Name(s) and Title]

Attachment G –Subcontractor Certifications/Agreements

SUBCONTRACTOR CERTIFICATION
STORMWATER POLLUTION PREVENTION PLAN

Project Number: ____

Project Title: ____

Operator(s): ____

As a subcontractor, you are required to comply with the Stormwater Pollution Prevention Plan (SWPPP) for any work that you perform onsite. Any person or group who violates any condition of the SWPPP may be subject to substantial penalties or loss of contract. You are encouraged to advise each of your employees working on this project of the requirements of the SWPPP. A copy of the SWPPP is available for your review at the office trailer.

Each subcontractor engaged in activities at the construction site that could impact stormwater must be identified and sign the following certification statement:

I certify under the penalty of law that I have read and understand the terms and conditions of the SWPPP for the above designated project and agree to follow the practices described in the SWPPP.

This certification is hereby signed in reference to the above named project:

Company: ____

Address: ____

Telephone Number: ______________________

Type of construction service to be provided: ______________________

____

____

Signature: ______________________

Title: ______________________

Date: ______________________

Attachment H – Grading and Stabilization Activities Log

Date Grading Activity Initiated	**Description of Grading Activity**	**Description of Stabilization Measure and Location**	**Date Grading Activity Ceased** (Indicate Temporary or Permanent)	**Date When Stabilization Measures Initiated**

Attachment I – SWPPP Training Log

Stormwater Pollution Prevention Training Log

Project Name:

Project Location:

Instructor's Name(s):

Instructor's Title(s):

Course Location: ____ Date: _____________________

Course Length (hours): ___________________________________

Stormwater Training Topic: (*check as appropriate)*

- ❑ **Sediment and Erosion Controls**
- ❑ **Emergency Procedures**
- ❑ **Stabilization Controls**
- ❑ **Inspections/Corrective Actions**
- ❑ **Pollution Prevention Measures**

Specific Training Objective:____

____

Attendee Roster: (*attach additional pages as necessary)*

No.	**Name of Attendee**	**Company**
1		
2		
3		
4		
5		
6		
7		
8		

Attachment J – Delegation of Authority Form

Delegation of Authority

I, ________________________ (name), hereby designate the person or specifically described position below to be a duly authorized representative for the purpose of overseeing compliance with environmental requirements, including the Construction General Permit, at the ______________________________________ construction site. The designee is authorized to sign any reports, stormwater pollution prevention plans and all other documents required by the permit.

____ (name of person or position)
____ (company)
____ (address)
____ (city, state, zip)
____ (phone)

By signing this authorization, I confirm that I meet the requirements to make such a designation as set forth in Appendix I of EPA's Construction General Permit (CGP), and that the designee above meets the definition of a "duly authorized representative" as set forth in Appendix I.

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gathered and evaluated the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Name: ____

Company: ____

Title: ____

Signature: ____

Date: ____

Attachment K – Endangered Species Documentation

Attachment L – Historic Preservation Documentation

Attachment M – Rainfall Gauge Recording

Use the table below to record the rainfall gauge readings at the beginning and end of each work day. An example table follows.

Month/Year			Month/Year			Month/Year		
Day	Start time	End time	Day	Start time	End time	Day	Start time	End time
1			1			1		
2			2			2		
3			3			3		
4			4			4		
5			5			5		
6			6			6		
7			7			7		
8			8			8		
9			9			9		
10			10			10		
11			11			11		
12			12			12		
13			13			13		
14			14			14		
15			15			15		
16			16			16		
17			17			17		
18			18			18		
19			19			19		
20			20			20		
21			21			21		
22			22			22		
23			23			23		
24			24			24		
25			25			25		
26			26			26		
27			27			27		
28			28			28		
29			29			29		
30			30			30		
31			31			31		

Attachment N – Order of Conditions

APPENDIX G

Soil Investigations

NRCS Soil Maps and Descriptions
Soil Test Pit Logs

Middlesex County, Massachusetts

654—Udorthents, loamy

Map Unit Setting

National map unit symbol: vr1l
Elevation: 0 to 3,000 feet
Mean annual precipitation: 32 to 50 inches
Mean annual air temperature: 45 to 50 degrees F
Frost-free period: 110 to 200 days
Farmland classification: Not prime farmland

Map Unit Composition

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

Description of Udorthents, Loamy

Setting

Parent material: Loamy alluvium and/or sandy glaciofluvial deposits and/or loamy glaciolacustrine deposits and/or loamy marine deposits and/or loamy basal till and/or loamy lodgment till

Properties and qualities

Depth to restrictive feature: More than 80 inches
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None

Minor Components

Udorthents, sandy

Percent of map unit: 10 percent
Hydric soil rating: No

Udorthents, wet substratum

Percent of map unit: 5 percent
Hydric soil rating: Yes

Urban land

Percent of map unit: 5 percent
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Base slope
Down-slope shape: Linear
Across-slope shape: Linear

Data Source Information

Soil Survey Area: Middlesex County, Massachusetts
Survey Area Data: Version 20, Jun 9, 2020


71° 27' 49" W
71° 27' 18" W
42° 15' 56" N
42° 15' 41" N
296800
296870
296940
297010
297080
297150
297220
297290
297360
297430
297500
4682200
4682130
4682060
4681990
4681920
4681850
4681780
73B
104C
307C
654
416B
6A
260B
School Rd
Concord St
Raymond Marchetti St
Soil Map may not be valid at this scale.
Map Scale: 1:3,280 if printed on A landscape (11" x 8.5") sheet.
Meters
0 45 90 180 270
Feet
0 150 300 600 900
N
Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 19N WGS84

MAP LEGEND

Area of Interest (AOI)

Area of Interest (AOI)

Soils

Soil Map Unit Polygons

Soil Map Unit Lines

Soil Map Unit Points

Special Point Features

Blowout

Borrow Pit

Clay Spot

Closed Depression

Gravel Pit

Gravelly Spot

Landfill

Lava Flow

Marsh or swamp

Mine or Quarry

Miscellaneous Water

Perennial Water

Rock Outcrop

Saline Spot

Sandy Spot

Severely Eroded Spot

Sinkhole

Slide or Slip

Sodic Spot

Spoil Area

Stony Spot

Very Stony Spot

Wet Spot

Other

Special Line Features

Water Features

Streams and Canals

Transportation

Rails

Interstate Highways

US Routes

Major Roads

Local Roads

Background

Aerial Photography

MAP INFORMATION

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

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

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

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

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

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

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

Soil Survey Area: Middlesex County, Massachusetts
Survey Area Data: Version 20, Jun 9, 2020

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

Date(s) aerial images were photographed: Jul 28, 2019—Aug 15, 2019

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
6A	Scarboro mucky fine sandy loam, 0 to 3 percent slopes	1.4	5.4%
73B	Whitman fine sandy loam, 0 to 3 percent slopes, extremely stony	1.3	5.0%
104C	Hollis-Rock outcrop-Charlton complex, 0 to 15 percent slopes	3.4	12.8%
260B	Sudbury fine sandy loam, 3 to 8 percent slopes	0.0	0.1%
307C	Paxton fine sandy loam, 8 to 15 percent slopes, extremely stony	2.5	9.5%
416B	Narragansett silt loam, 3 to 8 percent slopes, very stony	2.7	10.1%
654	Udorthents, loamy	15.2	57.1%
Totals for Area of Interest		**26.6**	**100.0%**

Middlesex County, Massachusetts

6A—Scarboro mucky fine sandy loam, 0 to 3 percent slopes

Map Unit Setting

National map unit symbol: 2svky
Elevation: 0 to 1,320 feet
Mean annual precipitation: 36 to 71 inches
Mean annual air temperature: 39 to 55 degrees F
Frost-free period: 140 to 250 days
Farmland classification: Not prime farmland

Map Unit Composition

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

Description of Scarboro

Setting

Landform: Outwash terraces, outwash deltas, drainageways, depressions
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Base slope, tread, dip
Down-slope shape: Concave
Across-slope shape: Concave
Parent material: Sandy glaciofluvial deposits derived from schist and/or sandy glaciofluvial deposits derived from gneiss and/or sandy glaciofluvial deposits derived from granite

Typical profile

Oe - 0 to 3 inches: mucky peat
A - 3 to 11 inches: mucky fine sandy loam
Cg1 - 11 to 21 inches: sand
Cg2 - 21 to 65 inches: gravelly coarse sand

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Very poorly drained
Runoff class: Negligible
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (1.42 to 14.17 in/hr)
Depth to water table: About 0 to 2 inches
Frequency of flooding: None
Frequency of ponding: Frequent
Maximum salinity: Nonsaline (0.0 to 1.9 mmhos/cm)
Available water capacity: Low (about 4.7 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 5w
Hydrologic Soil Group: A/D
Ecological site: F144AY031MA - Very Wet Outwash
Hydric soil rating: Yes

Minor Components

Swansea

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

Walpole

Percent of map unit: 5 percent
Landform: Depressions, deltas, outwash plains, depressions, outwash terraces
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Tread, dip, talf
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

Wareham

Percent of map unit: 5 percent
Landform: Depressions
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

Data Source Information

Soil Survey Area: Middlesex County, Massachusetts
Survey Area Data: Version 20, Jun 9, 2020

Middlesex County, Massachusetts

73B—Whitman fine sandy loam, 0 to 3 percent slopes, extremely stony

Map Unit Setting

National map unit symbol: 2w695
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

Whitman, extremely stony, and similar soils: 81 percent
Minor components: 19 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Whitman, Extremely Stony

Setting

Landform: Depressions, drainageways, hills, ground moraines, drumlins
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): 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

Oi - 0 to 1 inches: peat
A - 1 to 10 inches: fine sandy loam
Bg - 10 to 17 inches: gravelly fine sandy loam
Cdg - 17 to 61 inches: fine sandy loam

Properties and qualities

Slope: 0 to 3 percent
Surface area covered with cobbles, stones or boulders: 9.0 percent
Depth to restrictive feature: 7 to 38 inches to densic material
Drainage class: Very poorly drained
Runoff class: Negligible
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: Frequent
Maximum salinity: Nonsaline (0.0 to 1.9 mmhos/cm)
Available water capacity: Low (about 3.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7s
Hydrologic Soil Group: D
Ecological site: F144AY041MA - Very Wet Till Depressions
Hydric soil rating: Yes

Minor Components

Ridgebury, extremely stony

Percent of map unit: 10 percent
Landform: Depressions, drumlins, drainageways, hills, ground moraines
Landform position (two-dimensional): Toeslope, footslope
Landform position (three-dimensional): Base slope, head slope
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

Scarboro

Percent of map unit: 5 percent
Landform: Outwash terraces, depressions, drainageways, outwash deltas
Landform position (three-dimensional): Tread
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

Swansea

Percent of map unit: 3 percent
Landform: Bogs, marshes, swamps
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

Woodbridge, extremely stony

Percent of map unit: 1 percent
Landform: Drumlins, hills, ground moraines
Landform position (two-dimensional): Backslope, footslope, summit
Landform position (three-dimensional): Side slope, crest
Down-slope shape: Concave
Across-slope shape: Linear
Hydric soil rating: No

Data Source Information

Soil Survey Area: Middlesex County, Massachusetts
Survey Area Data: Version 20, Jun 9, 2020

Middlesex County, Massachusetts

104C—Hollis-Rock outcrop-Charlton complex, 0 to 15 percent slopes

Map Unit Setting

National map unit symbol: 2w69p
Elevation: 0 to 1,270 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

Hollis, extremely stony, and similar soils: 35 percent
Charlton, extremely stony, and similar soils: 25 percent
Rock outcrop: 25 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Hollis, Extremely Stony

Setting

Landform: Hills, ridges
Landform position (two-dimensional): Backslope, shoulder, summit
Landform position (three-dimensional): Crest, side slope, nose slope
Down-slope shape: Convex
Across-slope shape: Linear, convex
Parent material: Coarse-loamy melt-out till derived from granite, gneiss, and/or schist

Typical profile

Oi - 0 to 2 inches: slightly decomposed plant material
A - 2 to 7 inches: gravelly fine sandy loam
Bw - 7 to 16 inches: gravelly fine sandy loam
2R - 16 to 26 inches: bedrock

Properties and qualities

Slope: 0 to 15 percent
Surface area covered with cobbles, stones or boulders: 9.0 percent
Depth to restrictive feature: 8 to 23 inches to lithic bedrock
Drainage class: Somewhat excessively drained
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Very low (0.00 to 0.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Maximum salinity: Nonsaline (0.0 to 1.9 mmhos/cm)
Available water capacity: Very low (about 2.7 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7s
Hydrologic Soil Group: D
Ecological site: F144AY033MA - Shallow Dry Till Uplands
Hydric soil rating: No

Description of Charlton, Extremely Stony

Setting

Landform: Ridges, hills
Landform position (two-dimensional): Summit, backslope, shoulder
Landform position (three-dimensional): Crest, side slope
Down-slope shape: Linear, convex
Across-slope shape: Convex
Parent material: Coarse-loamy melt-out till derived from granite, gneiss, and/or schist

Typical profile

Oe - 0 to 2 inches: moderately decomposed plant material
A - 2 to 4 inches: fine sandy loam
Bw - 4 to 27 inches: gravelly fine sandy loam
C - 27 to 65 inches: gravelly fine sandy loam

Properties and qualities

Slope: 0 to 15 percent
Surface area covered with cobbles, stones or boulders: 9.0 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to high (0.14 to 14.17 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Maximum salinity: Nonsaline (0.0 to 1.9 mmhos/cm)
Available water capacity: Moderate (about 8.7 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7s
Hydrologic Soil Group: B
Ecological site: F144AY034CT - Well Drained Till Uplands
Hydric soil rating: No

Description of Rock Outcrop

Setting

Landform: Hills, ridges
Parent material: Igneous and metamorphic rock

Typical profile

R - 0 to 79 inches: bedrock

Properties and qualities

Slope: 0 to 15 percent
Depth to restrictive feature: 0 inches to lithic bedrock
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Very low (0.00 to 0.00 in/hr)
Available water capacity: Very low (about 0.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 8
Hydrologic Soil Group: D
Hydric soil rating: No

Minor Components

Canton, extremely stony

Percent of map unit: 7 percent
Landform: Hills, moraines, ridges
Landform position (two-dimensional): Backslope, shoulder, summit
Landform position (three-dimensional): Side slope, crest
Down-slope shape: Convex, linear
Across-slope shape: Convex
Hydric soil rating: No

Chatfield, extremely stony

Percent of map unit: 6 percent
Landform: Hills, ridges
Landform position (two-dimensional): Backslope, shoulder, summit
Landform position (three-dimensional): Crest, side slope, nose slope
Down-slope shape: Convex
Across-slope shape: Linear, convex
Hydric soil rating: No

Montauk, extremely stony

Percent of map unit: 1 percent
Landform: Recessionial moraines, hills, drumlins, ground moraines
Landform position (two-dimensional): Summit, backslope, shoulder
Landform position (three-dimensional): Side slope, crest
Down-slope shape: Linear, convex
Across-slope shape: Convex
Hydric soil rating: No

Scituate, extremely stony

Percent of map unit: 1 percent
Landform: Drumlins, hills, ground moraines
Landform position (two-dimensional): Footslope, backslope, summit
Landform position (three-dimensional): Side slope, crest
Down-slope shape: Linear, convex
Across-slope shape: Convex

Hydric soil rating: No

Data Source Information

Soil Survey Area: Middlesex County, Massachusetts
Survey Area Data: Version 20, Jun 9, 2020

Middlesex County, Massachusetts

260B—Sudbury fine sandy loam, 3 to 8 percent slopes

Map Unit Setting

National map unit symbol: 9915
Elevation: 0 to 2,100 feet
Mean annual precipitation: 45 to 54 inches
Mean annual air temperature: 43 to 54 degrees F
Frost-free period: 145 to 240 days
Farmland classification: All areas are prime farmland

Map Unit Composition

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

Description of Sudbury

Setting

Landform: Terraces, plains
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Tread, dip
Down-slope shape: Linear
Across-slope shape: Concave
Parent material: Friable loamy eolian deposits over loose sandy glaciofluvial deposits

Typical profile

H1 - 0 to 8 inches: fine sandy loam
H2 - 8 to 20 inches: fine sandy loam
H3 - 20 to 27 inches: loamy sand
H4 - 27 to 65 inches: stratified gravelly coarse sand to sand

Properties and qualities

Slope: 2 to 8 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Moderately well drained
Capacity of the most limiting layer to transmit water (Ksat): High (2.00 to 6.00 in/hr)
Depth to water table: About 18 to 36 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: Low (about 4.9 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2e
Hydrologic Soil Group: B
Ecological site: F144AY027MA - Moist Sandy Outwash
Hydric soil rating: No

Minor Components

Merrimac

Percent of map unit: 8 percent
Landform: Plains, terraces
Landform position (two-dimensional): Shoulder
Landform position (three-dimensional): Tread, rise
Down-slope shape: Convex
Across-slope shape: Convex
Hydric soil rating: No

Wareham

Percent of map unit: 4 percent
Landform: Terraces, deltas, depressions
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Tread, dip
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

Windsor

Percent of map unit: 2 percent
Landform: Flats, terraces, deltas
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Tread, rise
Down-slope shape: Convex
Across-slope shape: Convex
Hydric soil rating: No

Unnamed

Percent of map unit: 1 percent

Data Source Information

Soil Survey Area: Middlesex County, Massachusetts
Survey Area Data: Version 20, Jun 9, 2020

Middlesex County, Massachusetts

307C—Paxton fine sandy loam, 8 to 15 percent slopes, extremely stony

Map Unit Setting

National map unit symbol: 2w676
Elevation: 0 to 1,490 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

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

Description of Paxton, Extremely Stony

Setting

Landform: Ground moraines, drumlins, hills
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Linear, convex
Across-slope shape: Convex, 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 10 inches: fine sandy loam
Bw1 - 10 to 17 inches: fine sandy loam
Bw2 - 17 to 28 inches: fine sandy loam
Cd - 28 to 67 inches: gravelly fine sandy loam

Properties and qualities

Slope: 8 to 15 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: 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 capacity: Low (about 4.7 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7s
Hydrologic Soil Group: C
Ecological site: F144AY007CT - Well Drained Dense Till Uplands
Hydric soil rating: No

Minor Components

Charlton, extremely stony

Percent of map unit: 8 percent
Landform: Hills
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex
Hydric soil rating: No

Woodbridge, extremely stony

Percent of map unit: 6 percent
Landform: Ground moraines, drumlins, hills
Landform position (two-dimensional): Backslope, footslope
Landform position (three-dimensional): Side slope
Down-slope shape: Concave
Across-slope shape: Linear
Hydric soil rating: No

Ridgebury, extremely stony

Percent of map unit: 1 percent
Landform: Ground moraines, depressions, drumlins, drainageways, hills
Landform position (two-dimensional): Toeslope, footslope
Landform position (three-dimensional): Head slope, base slope
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

Data Source Information

Soil Survey Area: Middlesex County, Massachusetts
Survey Area Data: Version 20, Jun 9, 2020

Middlesex County, Massachusetts

416B—Narragansett silt loam, 3 to 8 percent slopes, very stony

Map Unit Setting

National map unit symbol: 9940
Elevation: 0 to 1,000 feet
Mean annual precipitation: 45 to 54 inches
Mean annual air temperature: 43 to 54 degrees F
Frost-free period: 145 to 240 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

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

Description of Narragansett

Setting

Landform: Ground moraines
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Friable loamy eolian deposits and/or friable silty eolian deposits over loose sandy glaciofluvial deposits derived from metamorphic rock and/or friable sandy basal till derived from metamorphic rock

Typical profile

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

Properties and qualities

Slope: 3 to 8 percent
Surface area covered with cobbles, stones or boulders: 1.6 percent
Depth to restrictive feature: 18 to 35 inches to strongly contrasting textural stratification
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 6.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: Moderate (about 6.4 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6s
Hydrologic Soil Group: A
Ecological site: F144AY034CT - Well Drained Till Uplands
Hydric soil rating: No

Minor Components

Haven

Percent of map unit: 10 percent
Landform: Plains, terraces
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Tread, rise
Down-slope shape: Convex
Across-slope shape: Convex
Hydric soil rating: No

Scituate

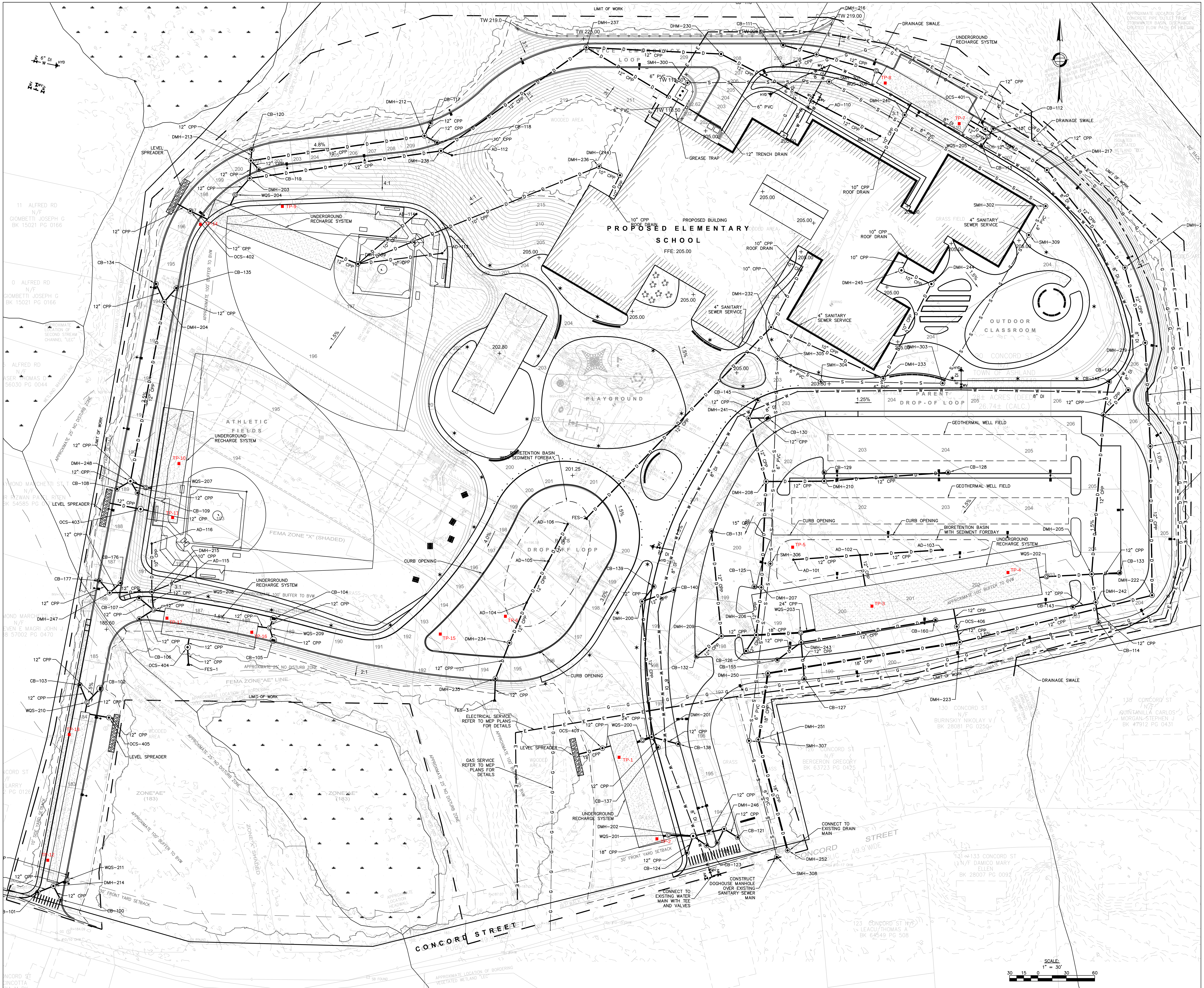
Percent of map unit: 5 percent
Landform: Depressions, hillslopes
Landform position (two-dimensional): Toeslope, summit
Landform position (three-dimensional): Base slope, head slope
Down-slope shape: Linear
Across-slope shape: Concave
Hydric soil rating: No

Canton

Percent of map unit: 5 percent
Landform: Hills
Landform position (two-dimensional): Backslope, toeslope
Landform position (three-dimensional): Side slope, base slope
Down-slope shape: Linear
Across-slope shape: Convex
Hydric soil rating: No

Data Source Information

Soil Survey Area: Middlesex County, Massachusetts
Survey Area Data: Version 20, Jun 9, 2020



90 Concord Street, Ashland, MA#

FLANSBURGH

77 NORTH WASHINGTON STREET
BOSTON, MA 02114-1910
FLANSBURGH.COM

Consultants

No.	Date	Note

REVISIONS

No.	Date	Note

ISSUE

Stamp

Schematic Design

Key Plan

TEST PIT LOCATION PLAN

Drawn By	Project ID
Reviewed By	Scale
Issue Date 07.24.2020	Plot Date 07.24.2020

Sheet No.

C4.0

Date: 6/8/20
File name: PSR Plans 05-27-2020.vwx

Commonwealth of Massachusetts
City/Town of

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

A. Facility Information

David Mindess Elementary School
Owner Name

90 Concord Street
Street Address

Map/Lot #

Ashland
City

MA
State

MA
Zip Code

B. Site Information

1. (Check one) ☒ New Construction ☐ Upgrade ☐ Repair

2. Soil Survey Available? ☒ Yes ☐ No If yes: USDA-NRCS Source 654 Soil Map Unit

Udorthents, loamy
Soil Name

Soil Limitations

Loamy alluvium and/or sandy glacioflucial deposits and/or loamy glaciolacustrine deposits and/or loamy marine deposits and/or loamy basal till and.or loamy lodgement till
Soil Parent material

Landform

3. Surficial Geological Report Available? ☐ Yes ☐ No If yes: Year Published/Source Map Unit

Description of Geologic Map Unit:

4. Flood Rate Insurance Map Within a regulatory floodway? ☐ Yes ☒ No

5. Within a velocity zone? ☐ Yes ☒ No

6. Within a Mapped Wetland Area? ☐ Yes ☒ No If yes, MassGIS Wetland Data Layer: Wetland Type

7. Current Water Resource Conditions (USGS): Month/Day/ Year Range: ☐ Above Normal ☐ Normal ☐ Below Normal

8. Other references reviewed:

Mindess Elementary School
Nitsch Project #13609
Performed by: Brian Biagini, SE#14419

Commonwealth of Massachusetts
City/Town of

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review (*minimum of two holes required at every proposed primary and reserve disposal area*)

Deep Observation Hole Number: TP-101 (Hole #) | 12/8/20 (Date) | 9:34 am (Time) | ______ (Weather) | ______ (Latitude) | ______ (Longitude:)

1. Land Use: Open Space (e.g., woodland, agricultural field, vacant lot, etc.) | Grass (Vegetation) | Stones & boulders, rockwalls, ledge outcrops (Surface Stones (e.g., cobbles, stones, boulders, etc.)) | 0-3 percent (Slope (%))

   Description of Location: Front of school

2. Soil Parent Material: ______ | ______ (Landform) | ______ (Position on Landscape (SU, SH, BS, FS, TS))

3. Distances from: Open Water Body ______ feet | Drainage Way ______ feet | Wetlands ______ feet
   Property Line ______ feet | Drinking Water Well ______ feet | Other ______ feet

4. Unsuitable Materials Present: ☒ Yes ☐ No If Yes: ☐ Disturbed Soil ☒ Fill Material ☐ Weathered/Fractured Rock ☒ Bedrock

5. Groundwater Observed: ☐ Yes ☒ No If yes: ______ Depth Weeping from Pit ______ Depth Standing Water in Hole

Soil Log

Depth (in)	Soil Horizon /Layer	Soil Texture (USDA	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features			Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
				Depth	Color	Percent	Gravel	Cobbles & Stones			
0-10	Ap	-	-	-	-	-	-	-	-	-	-
10-20	Fill	Sandy Loam	10YR 5/3	-	-	-	10	-	Massive	Friable	
20-53	C1	Sand	10YR 5/6	-	-	-	35	10	Single Grain	Loose	Very Gravelly

Additional Notes: No groundwater table observed
Ledge encountered at 53"

Mindess Elementary School
Nitsch Project #13609
Performed by: Brian Biagini, SE#14419

Commonwealth of Massachusetts
City/Town of

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review *(minimum of two holes required at every proposed primary and reserve disposal area)*

Deep Observation Hole Number: TP-102 (Hole #)   12/9/20 (Date)   1:00 pm (Time)   ______ (Weather)   ______ (Latitude)   Longitude: ______

1. Land Use: Open Space (e.g., woodland, agricultural field, vacant lot, etc.)   Grass (Vegetation)   Stones & boulders, rockwalls, ledge outcrops (Surface Stones (e.g., cobbles, stones, boulders, etc.))   3-5 percent (Slope (%))

   Description of Location: Front of school

2. Soil Parent Material: ______   ______ (Landform)   ______ (Position on Landscape (SU, SH, BS, FS, TS))

3. Distances from: Open Water Body ______ feet   Drainage Way ______ feet   Wetlands ______ feet
   Property Line ______ feet   Drinking Water Well ______ feet   Other ______ feet

4. Unsuitable Materials Present: ☒ Yes ☐ No   If Yes: ☐ Disturbed Soil ☒ Fill Material ☐ Weathered/Fractured Rock ☐ Bedrock

5. Groundwater Observed: ☒ Yes ☐ No   If yes: 99" Depth Weeping from Pit   N/A Depth Standing Water in Hole

Soil Log

Depth (in)	Soil Horizon /Layer	Soil Texture (USDA	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features			Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
				Depth	Color	Percent	Gravel	Cobbles & Stones			
0-14	Ap	-	-	-	-	-	-	-	-	-	-
14-30	Fill	Sandy Loam	10YR 5/4	-	-	-	-	-	Massive	Friable	
30-72	C1	Silt Loam	5Y 5/2	30-40"	2.5 YR 3/6	20%	10	10	Massive	Friable	
72-126	C2	Sandy Loam	10YR 4/6	-	-	-	40	10	Massive	Friable	Very Gravelly Very Moist, viscous

Additional Notes: Water weeping from pit @ 99"
Estimated seasonal high groundwater 30-40"

Commonwealth of Massachusetts
City/Town of

Mindess Elementary School
Nitsch Project #13609
Performed by: Brian Biagini, SE#14419

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review (*minimum of two holes required at every proposed primary and reserve disposal area*)

Deep Observation Hole Number: TP-103 (Hole #) 12/8/20 (Date) 9:01 am (Time) ______ (Weather) ______ (Latitude) ______ (Longitude:)

1. Land Use: Open Space/Athletic Field (e.g., woodland, agricultural field, vacant lot, etc.) Grass (Vegetation) None present (Surface Stones (e.g., cobbles, stones, boulders, etc.)) 0-3 percent (Slope (%))

   Description of Location: East of school in the athletic field

2. Soil Parent Material: ______ ______ (Landform) ______ (Position on Landscape (SU, SH, BS, FS, TS))

3. Distances from: Open Water Body ____ feet Drainage Way ____ feet Wetlands ____ feet

   Property Line ____ feet Drinking Water Well ____ feet Other ____ feet

4. Unsuitable Materials Present: ☒ Yes ☐ No If Yes: ☐ Disturbed Soil ☒ Fill Material ☐ Weathered/Fractured Rock ☒ Bedrock

5. Groundwater Observed: ☒ Yes ☐ No If yes: 55" Depth Weeping from Pit ____ Depth Standing Water in Hole

Soil Log

Depth (in)	Soil Horizon /Layer	Soil Texture (USDA	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features			Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
				Depth	Color	Percent	Gravel	Cobbles & Stones			
0-10	Ap	-	-	-	-	-	5-10	-	-	-	-
10-28	Fill	Sandy Loam	2.5Y 5/3	-	-	-	20	-	Massive	Friable	
28-55	C1	Silt Loam	10.5Y 5/3	-	-	-	20	-	Massive	Friable	Small gravel Moist

Additional Notes: Ledge encountered at 55" - some water seeping into pit

Mindess Elementary School
Nitsch Project #13609
Performed by: Brian Biagini, SE#14419

Commonwealth of Massachusetts
City/Town of

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review *(minimum of two holes required at every proposed primary and reserve disposal area)*

Deep Observation Hole Number: TP-104 (Hole #) 12/9/20 (Date) 1:30 pm (Time) ______ Weather ______ Latitude ______ Longitude:

1. Land Use Open Space/Athletic Field (e.g., woodland, agricultural field, vacant lot, etc.) Grass (Vegetation) None present (Surface Stones (e.g., cobbles, stones, boulders, etc.)) 0-3 percent (Slope (%))

Description of Location: East of school in the athletic field

2. Soil Parent Material: ______ Landform ______ Position on Landscape (SU, SH, BS, FS, TS) ______

3. Distances from: Open Water Body ______ feet Drainage Way ______ feet Wetlands ______ feet
Property Line ______ feet Drinking Water Well ______ feet Other ______ feet

4. Unsuitable Materials Present: ☒ Yes ☐ No If Yes: ☐ Disturbed Soil ☒ Fill Material ☐ Weathered/Fractured Rock ☐ Bedrock

5. Groundwater Observed: ☒ Yes ☐ No If yes: 65" Depth Weeping from Pit ______ Depth Standing Water in Hole

Soil Log

Depth (in)	Soil Horizon /Layer	Soil Texture (USDA	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features			Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
				Depth	Color	Percent	Gravel	Cobbles & Stones			
0-6	Ap	-	-	-	-	-	-	-	-	-	-
6-54	C1	Silt Loam	5Y 5/2	-	-	-	15	5	Massive	Friable	
54-120	C2	Loamy sand	10YR 5/6	-	-	-	25	-	Massive	Friable	Very moist towards bottom of pit

Additional Notes: Observed groundwater depth of 65"
The east side of the pit had a 2" layer of organic material at a depth from 54-56" that did not appear to be present on the west side of the pit

Commonwealth of Massachusetts
City/Town of

Mindess Elementary School
Nitsch Project #13609
Performed by: Brian Biagini, SE#14419

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review *(minimum of two holes required at every proposed primary and reserve disposal area)*

Deep Observation Hole Number: TP-106 (Hole #) 12/9/20 (Date) 10:40 am (Time) ____ (Weather) ____ (Latitude) ____ (Longitude:)

1. Land Use: Open Space (e.g., woodland, agricultural field, vacant lot, etc.) Grass (Vegetation) Stones & boulders, ledge outcrops (Surface Stones (e.g., cobbles, stones, boulders, etc.)) 10-15 percent (Slope (%))

Description of Location: Front of school behind firehydrant

2. Soil Parent Material: ____ ____ (Landform) ____ (Position on Landscape (SU, SH, BS, FS, TS))

3. Distances from: Open Water Body ____ feet Drainage Way ____ feet Wetlands ____ feet
Property Line ____ feet Drinking Water Well ____ feet Other ____ feet

4. Unsuitable Materials Present: ☒ Yes ☐ No If Yes: ☐ Disturbed Soil ☒ Fill Material ☐ Weathered/Fractured Rock ☐ Bedrock

5. Groundwater Observed: ☒ Yes ☐ No If yes: 96" Depth Weeping from Pit ____ Depth Standing Water in Hole

Soil Log

Depth (in)	Soil Horizon /Layer	Soil Texture (USDA	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features			Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
				Depth	Color	Percent	Gravel	Cobbles & Stones			
0-6	Ap	-	-	-	-	-	-	-	-	-	-
6-96	Fill	Sandy Loam	10YR 5/3	-	-	-	15	10	Massive	Friable	
96-104	Ab	Silt Loam	5Y 2.5/1	-	-	-	5	-	-	-	
104-134	C1	Silt Loam	5Y 5/1	-	-	-	5	-	Massive	Friable	Hard in place, friable out of place

Additional Notes: During excavation an unmarked sewer pipe was hit at 65". DPW came on-site and helped fix the issue. Moved pit back away from school 5-10 feet.
Ground water table observed at 96"
Some redox features present at approx 5' but not consistent.
There appeared to be a thin layer of gravel within the fill material at approx 4'

Commonwealth of Massachusetts
City/Town of

Mindess Elementary School
Nitsch Project #13609
Performed by: Brian Biagini, SE#14419

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review *(minimum of two holes required at every proposed primary and reserve disposal area)*

Deep Observation Hole Number: TP-107 (Hole #) 12/1/20 (Date) ______ (Time) ______ (Weather) ______ (Latitude) ______ (Longitude:)

1. Land Use: Overgrown Woodland (e.g., woodland, agricultural field, vacant lot, etc.) Brush (Vegetation) Stones & boulders, rockwalls (Surface Stones (e.g., cobbles, stones, boulders, etc.)) 0-3 percent (Slope (%))

   Description of Location: Benhind firstbase dugout, next to batting cage

2. Soil Parent Material: ______ ______ (Landform) ______ (Position on Landscape (SU, SH, BS, FS, TS))

3. Distances from: Open Water Body ______ feet Drainage Way ______ feet Wetlands ______ feet

   Property Line ______ feet Drinking Water Well ______ feet Other ______ feet

4. Unsuitable Materials Present: ☒ Yes ☐ No If Yes: ☐ Disturbed Soil ☒ Fill Material ☐ Weathered/Fractured Rock ☐ Bedrock

5. Groundwater Observed: ☐ Yes ☒ No If yes: ______ Depth Weeping from Pit ______ Depth Standing Water in Hole

Soil Log

Depth (in)	Soil Horizon /Layer	Soil Texture (USDA	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features			Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
				Depth	Color	Percent	Gravel	Cobbles & Stones			
0-12	Ap										
12-36	Fill	Sandy Loam	10YR 4/4				20	10	Massive	Friable	
36-42	Ab	Sandy Loam					10		Massive	Friable	Water seeping @ 36"
42-72	C1	Silt Loam	2.5Y 5/2				15	20	Massive	Friable	
72-126	C2	Silt Loam	2.5Y 5/3	72-84	7.5 YR 5/4	30	20	15	Massive	Friable	Formed ribbon

Additional Notes: No Groundwater Table observed
Estimated Seasonal High Groundwater 72"
Boulders present while excavating
Top layer of soil was very moist, pit initially filled with water after excavating 3-4 feet depth. Continued digging and observed water seeping in from upper layers (approx 36")
High water content in all soils

Mindess Elementary School
Nitsch Project #13609
Performed by: Brian Biagini, SE#14419

Commonwealth of Massachusetts
City/Town of

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review (*minimum of two holes required at every proposed primary and reserve disposal area*)

Deep Observation Hole Number: TP-108 (Hole #) 12/1/20 (Date) ____ Time ____ Weather ____ Latitude ____ Longitude:

1. Land Use: Woodland (e.g., woodland, agricultural field, vacant lot, etc.) ____ Vegetation Boulders Surface Stones (e.g., cobbles, stones, boulders, etc.) 5-10% Slope (%)

Description of Location: Wooded area behind school

2. Soil Parent Material: ____ ____ Landform ____ Position on Landscape (SU, SH, BS, FS, TS)

3. Distances from: Open Water Body ____ feet Drainage Way ____ feet Wetlands ____ feet
Property Line ____ feet Drinking Water Well ____ feet Other ____ feet

4. Unsuitable Materials Present: ☐ Yes ☒ No If Yes: ☐ Disturbed Soil ☐ Fill Material ☐ Weathered/Fractured Rock ☐ Bedrock

5. Groundwater Observed: ☒ Yes ☐ No If yes: 12-48" Depth Weeping from Pit 132" Depth Standing Water in Hole

Soil Log

Depth (in)	Soil Horizon /Layer	Soil Texture (USDA)	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features			Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
				Depth	Color	Percent	Gravel	Cobbles & Stones			
0-16	Ap										
16-24	B	Sandy Loam	10YR 5/4						Massive	Friable	Very Moist
24-48	C1	Sandy Loam	10YR 5/6	60"	7.5 YR 5/4	30	25	20	Massive	Friable	Very Moist
48-138	C2	Sandy Loam	2.5Y 5/4				25	20	Massive	Friable	Moist soil, but much drier than C1 and B layers

Additional Notes: Groundwater observed at bottom of pit (approx 132")
Estimated Seasonal High Groundwater at 60"
0-48" very moist with ponding water (similar to TP#107). Indicative of recent rainfall infiltrating.
Multiple 24" boulders encountered while excavating, surface stones present throughout wooded area.

Mindess Elementary School
Nitsch Project #13609
Performed by: Jared Gentilucci, SE#13143

Commonwealth of Massachusetts
City/Town of

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review *(minimum of two holes required at every proposed primary and reserve disposal area)*

Deep Observation Hole Number: TP-109 (Hole #) | 12/10/20 (Date) | 9:30 am (Time) | Cloudy, 38 degrees F (Weather) | ______ (Latitude) | ______ (Longitude:)

1. Land Use: Open Space (e.g., woodland, agricultural field, vacant lot, etc.) | Grass (Vegetation) | None present (Surface Stones (e.g., cobbles, stones, boulders, etc.)) | 0-3 percent (Slope (%))

   Description of Location: West wing of school

2. Soil Parent Material: ______ | ______ Landform | ______ Position on Landscape (SU, SH, BS, FS, TS)

3. Distances from: Open Water Body ____ feet | Drainage Way ____ feet | Wetlands ____ feet
   Property Line ____ feet | Drinking Water Well ____ feet | Other ____ feet

4. Unsuitable Materials Present: ☐ Yes ☒ No If Yes: ☐ Disturbed Soil ☐ Fill Material ☐ Weathered/Fractured Rock ☐ Bedrock

5. Groundwater Observed: ☒ Yes ☐ No If yes: 78" Depth Weeping from Pit 112" Depth Standing Water in Hole

Soil Log

Depth (in)	Soil Horizon /Layer	Soil Texture (USDA	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features			Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
				Depth	Color	Percent	Gravel	Cobbles & Stones			
0-7	Ap	Sandy Loam	-	-	-	-	-	-	-	-	-
7-120	C1	Sandy Loam	10YR 5/4	70"	7.5YR 5/6	15	25-30	15-20	Massive	Friable	Possible fill material

Additional Notes: Dig down 2'+/-, hit gravel/stone, possible utility pipe below, moved test pit 10' west
Fair amount of cobbles and stone, some 24"+ in diameter

Commonwealth of Massachusetts
City/Town of

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review *(minimum of two holes required at every proposed primary and reserve disposal area)*

Deep Observation Hole Number: TP-110 (Hole #) 12/10/20 (Date) 8:00 am (Time) Sunny, 35 degrees F (Weather) ____ (Latitude) ____ (Longitude:)

1. Land Use: Open Space (e.g., woodland, agricultural field, vacant lot, etc.) Grass (Vegetation) None present (Surface Stones (e.g., cobbles, stones, boulders, etc.)) 0-3 percent (Slope (%))

   Description of Location: Third base line of softball field in front of school

2. Soil Parent Material: ____ ____ (Landform) ____ (Position on Landscape (SU, SH, BS, FS, TS))

3. Distances from: Open Water Body ____ feet Drainage Way ____ feet Wetlands ____ feet
   Property Line ____ feet Drinking Water Well ____ feet Other ____ feet

4. Unsuitable Materials Present: ☒ Yes ☐ No If Yes: ☐ Disturbed Soil ☒ Fill Material ☐ Weathered/Fractured Rock ☐ Bedrock

5. Groundwater Observed: ☒ Yes ☐ No If yes: 60" Depth Weeping from Pit 140" Depth Standing Water in Hole

Soil Log

Depth (in)	Soil Horizon /Layer	Soil Texture (USDA	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features			Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
				Depth	Color	Percent	Gravel	Cobbles & Stones			
0-10	Ap	Sandy Loam	-	-	-	-	0-5	-	Massive	Friable	
10-27	Fill	Sandy Loam	10YR 5/4	-	-	-	0-5	-	Massive	Friable	
27-33	C1	Loamy Sand	10YR 6/4	-	-	-	5	-	Single Grain	Loose	
33-60	C2	Sandy Loam	10YR 6/4	-	-	-	0-5	-	Massive	Friable	
60-116	C3	Silt Loam	Gley 1 7/N	-	-	-	-	-	Platy	Firm	Very plastic material
116-144	C4	Sandy Loam	10YR 6/4	-	-	-	25	10	Massive	Friable	

Additional Notes: Upper soil layers are moist from recent snow melt
Some weeping at 30"-34", not consistent around pit, assume due to recent snow melt and texture change
Consistent weeping at top of C3 layer (60")
No redox features visible

Mindess Elementary School
Nitsch Project #13609
Performed by: Brian Biagini, SE#14419

Commonwealth of Massachusetts
City/Town of

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review (*minimum of two holes required at every proposed primary and reserve disposal area*)

Deep Observation Hole Number: TP-111 (Hole #) 12/9/20 (Date) 7:50 am (Time) ______ (Weather) ______ (Latitude) ______ (Longitude:)

1. Land Use: Open Space (e.g., woodland, agricultural field, vacant lot, etc.) Grass (Vegetation) ledge outcrops (Surface Stones (e.g., cobbles, stones, boulders, etc.)) 0-3 percent (Slope (%))

Description of Location: Third base line of softball field in front of school

2. Soil Parent Material: ______ ______ (Landform) ______ (Position on Landscape (SU, SH, BS, FS, TS))

3. Distances from: Open Water Body ______ feet Drainage Way ______ feet Wetlands ______ feet
Property Line ______ feet Drinking Water Well ______ feet Other ______ feet

4. Unsuitable Materials Present: ☒ Yes ☐ No If Yes: ☐ Disturbed Soil ☒ Fill Material ☐ Weathered/Fractured Rock ☐ Bedrock

5. Groundwater Observed: ☒ Yes ☐ No If yes: 88" Depth Weeping from Pit ______ Depth Standing Water in Hole

Soil Log

Depth (in)	Soil Horizon /Layer	Soil Texture (USDA	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features			Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
				Depth	Color	Percent	Gravel	Cobbles & Stones			
0-10	Ap	-	-	-	-	-	-	-	-	-	-
10-28	Fill	Loamy Sand	10YR 3/4	-	-	-	15	10	Single	Loose	
28-34	Ab	-	10YR 2/1	-	-	-	5	-	Massive	Very Firm	Hard in place -old bitumin?
34-60	C1	Loamy Sand	7.5YR 4/6	-	-	-	40	0-5	Single	Firm	Very gravelly, hard in place
60-88	C2	Silt Loam	10YR 3/3				0	0	Massive	Firm	relatively plastic material
88-144	C3	Silt Loam	Gley 1 4/10Y				0	0	Massive	N/A (plastic)	very plastic material

Additional Notes: First few buckets at original TP location appeared to consist of mostly imported gravel. Moved TP location approx 5-10 feet to the east to avoid possible conflict
Groundwater observed at approximately 88"
No pooled groundwater present at bottom of pit, likely trapped in silt layer.

Commonwealth of Massachusetts
City/Town of

Mindess Elementary School
Nitsch Project #13609
Performed by: Brian Biagini, SE#14419

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review *(minimum of two holes required at every proposed primary and reserve disposal area)*

Deep Observation Hole Number: TP-112 (Hole #) 12/9/20 (Date) 11:25 am (Time) ______ (Weather) ______ (Latitude) ______ (Longitude:)

1. Land Use: Woodland (e.g., woodland, agricultural field, vacant lot, etc.) woods (Vegetation) - (Surface Stones (e.g., cobbles, stones, boulders, etc.)) 0-3 percent (Slope (%))

   Description of Location: East side of access road exiting school near wetlands

2. Soil Parent Material: ______ ______ (Landform) ______ (Position on Landscape (SU, SH, BS, FS, TS))

3. Distances from: Open Water Body ______ feet Drainage Way ______ feet Wetlands 10 feet

   Property Line ______ feet Drinking Water Well ______ feet Other ______ feet

4. Unsuitable Materials Present: ☐ Yes ☒ No If Yes: ☐ Disturbed Soil ☐ Fill Material ☐ Weathered/Fractured Rock ☐ Bedrock

5. Groundwater Observed: ☒ Yes ☐ No If yes: 90" Depth Weeping from Pit ______ Depth Standing Water in Hole

Soil Log

Depth (in)	Soil Horizon /Layer	Soil Texture (USDA	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features			Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
				Depth	Color	Percent	Gravel	Cobbles & Stones			
0-28	Ap	-	-	-	-	-	-	-	-	-	-
28-42	B	Silt Loam	10YR 4/3	-	-	-	0-5	0	Massive	Friable	
42-108	C1	Loamy Sand	10YR 4/3	-	-	-	25	15	Massive	Friable	Gravelly
108-138	C2	Silt Loam	Gley 1 4/10Y	-	-	-	0	0	Massive	-	Plastic

Additional Notes: Water seeping at 10" from nearby wetlands
recent rain/snow storm increased surface water elevation of wetlands and froze over

Commonwealth of Massachusetts
City/Town of

Mindess Elementary School
Nitsch Project #13609
Performed by: Brian Biagini, SE#14419

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review *(minimum of two holes required at every proposed primary and reserve disposal area)*

Deep Observation Hole Number: TP-113 (Hole #) 12/9/20 (Date) 10:20 am (Time) ______ Weather ______ Latitude ______ Longitude:

1. Land Use Woodland (e.g., woodland, agricultural field, vacant lot, etc.) woods (Vegetation) - None present (Surface Stones (e.g., cobbles, stones, boulders, etc.)) 0-3 percent (Slope (%))

   Description of Location: West side of access road exiting school

2. Soil Parent Material: ______ Landform ______ Position on Landscape (SU, SH, BS, FS, TS) ______

3. Distances from: Open Water Body ______ feet Drainage Way ______ feet Wetlands ______ feet

   Property Line ______ feet Drinking Water Well ______ feet Other ______ feet

4. Unsuitable Materials Present: ☐ Yes ☒ No If Yes: ☐ Disturbed Soil ☐ Fill Material ☐ Weathered/Fractured Rock ☐ Bedrock

5. Groundwater Observed: ☒ Yes ☐ No If yes: 90" Depth Weeping from Pit ______ Depth Standing Water in Hole

Soil Log

Depth (in)	Soil Horizon /Layer	Soil Texture (USDA	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features			Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
				Depth	Color	Percent	Gravel	Cobbles & Stones			
0-13	Ap	-	-	-	-	-	-	-	-	-	-
13-40	B	Silt Loam	-	-			0	5	Massive	Friable	
40-68	C1	Loamy Sand	10YR 4/2	46-50"	10 YR 3/6	30	20	15	Massive	Friable	
68-132	C2	Silt Loam	Gley 1 4/10Y	-	-	-	0	0	Massive	Friable	

Additional Notes:

Commonwealth of Massachusetts
City/Town of

Mindess Elementary School
Nitsch Project #13609
Performed by: Brian Biagini, SE#14419

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review *(minimum of two holes required at every proposed primary and reserve disposal area)*

Deep Observation Hole Number: TP-114 (Hole #) 12/9/20 (Date) 2:00 pm (Time) ____ (Weather) ____ (Latitude) ____ (Longitude:)

1. Land Use: Open Space (e.g., woodland, agricultural field, vacant lot, etc.) Grass (Vegetation) None Present (Surface Stones (e.g., cobbles, stones, boulders, etc.)) 0-3 percent (Slope (%))

Description of Location: West wing of school

2. Soil Parent Material: ____ ____ (Landform) ____ (Position on Landscape (SU, SH, BS, FS, TS))

3. Distances from: Open Water Body ____ feet Drainage Way ____ feet Wetlands ____ feet
Property Line ____ feet Drinking Water Well ____ feet Other ____ feet

4. Unsuitable Materials Present: ☐ Yes ☒ No If Yes: ☐ Disturbed Soil ☐ Fill Material ☐ Weathered/Fractured Rock ☐ Bedrock

5. Groundwater Observed: ☒ Yes ☐ No If yes: 84" Depth Weeping from Pit ____ Depth Standing Water in Hole

Soil Log

Depth (in)	Soil Horizon /Layer	Soil Texture (USDA	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features			Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
				Depth	Color	Percent	Gravel	Cobbles & Stones			
0-10	Ap	-	-	-	-	-	-	-	-	-	-
10-126	C1	Silt Loam	2.5Y 5/3	-	-	-	5	-	Massive	Firm/Friable	Hard in place Possible fill material refusal at 126"

Additional Notes: Observed water table 84"
Bright colors throughout pit, inconsistent - Color 7.5 YR 5/8

Mindess Elementary School
Nitsch Project #13609
Performed by: Jared Gentilucci, SE#13143

Commonwealth of Massachusetts
City/Town of

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review (*minimum of two holes required at every proposed primary and reserve disposal area*)

Deep Observation Hole Number: TP-115 (Hole #) 12/10/20 (Date) 1:30 pm (Time) Cloudy, 44 degrees F (Weather) ______ (Latitude) ______ (Longitude:)

1. Land Use: Open Space (e.g., woodland, agricultural field, vacant lot, etc.) Grass (Vegetation) None present (Surface Stones (e.g., cobbles, stones, boulders, etc.)) 5 (Slope (%))

   Description of Location: Front of school behind fire hydrant

2. Soil Parent Material: ______ ______ (Landform) ______ (Position on Landscape (SU, SH, BS, FS, TS))

3. Distances from: Open Water Body ______ feet Drainage Way ______ feet Wetlands ______ feet
   Property Line ______ feet Drinking Water Well ______ feet Other ______ feet

4. Unsuitable Materials Present: ☒ Yes ☐ No If Yes: ☐ Disturbed Soil ☒ Fill Material ☐ Weathered/Fractured Rock ☐ Bedrock

5. Groundwater Observed: ☐ Yes ☐ No
   X
   If yes: XX" Depth Weeping from Pit ______ Depth Standing Water in Hole

Soil Log

Depth (in)	Soil Horizon /Layer	Soil Texture (USDA	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features			Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
				Depth	Color	Percent	Gravel	Cobbles & Stones			
0-12	Ap	Sandy Loam	-	-	-	-	-	-	-	-	-
12-60	Fill	Sandy Loam	10YR 6/4	-	-	-	10-15	0-5	Massive	Friable	

Additional Notes: Test pit terminated at 60", ran out of time to continue digging after infiltrometer test was complete

Commonwealth of Massachusetts
City/Town of

Mindess Elementary School
Nitsch Project #13609
Performed by: Brian Biagini, SE#14419

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review *(minimum of two holes required at every proposed primary and reserve disposal area)*

Deep Observation Hole Number: TP-116 (Hole #) 12/9/20 (Date) 1:10 pm (Time) ______ (Weather) ______ (Latitude) ______ (Longitude:)

1. Land Use: Open Space (e.g., woodland, agricultural field, vacant lot, etc.) Grass (Vegetation) ledge outcrops (Surface Stones (e.g., cobbles, stones, boulders, etc.)) 0-3 percent (Slope (%))

   Description of Location: Behind first base dugout of softball field in front of school

2. Soil Parent Material: ______ ______ (Landform) ______ (Position on Landscape (SU, SH, BS, FS, TS))

3. Distances from: Open Water Body ______ feet Drainage Way ______ feet Wetlands ______ feet
   Property Line ______ feet Drinking Water Well ______ feet Other ______ feet

4. Unsuitable Materials Present: ☐ Yes ☒ No If Yes: ☐ Disturbed Soil ☐ Fill Material ☐ Weathered/Fractured Rock ☐ Bedrock

5. Groundwater Observed: ☒ Yes ☐ No If yes: 96" Depth Weeping from Pit ______ Depth Standing Water in Hole

Soil Log

Depth (in)	Soil Horizon /Layer	Soil Texture (USDA	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features			Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
				Depth	Color	Percent	Gravel	Cobbles & Stones			
0-10	Ap	-	-	-	-	-	-	-	-	-	-
10-32	B	Silt Loam	10YR 5/1	-	-	-	5	0	Massive	Friable	
32-48	C1	Silt Loam	5Y 5/2	32-40"	10 YR 5/6	10	0-5	0	Massive	Friable	Root zone ends approx 32"
48-84	C2	Sandy Loam	7.5 YR 5/1	-	-	-	30	0	Massive	Friable	
84-126	C3	Loamy Sand	10YR 3/4	-	-	-	60	15	Single	Weak	Extremely Gravelly

Additional Notes: Observed water table 7'
Boulder at approx. 7' that extended to bottom of pit.

Commonwealth of Massachusetts
City/Town of

Mindess Elementary School
Nitsch Project #13609
Performed by: Brian Biagini, SE#14419

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review *(minimum of two holes required at every proposed primary and reserve disposal area)*

Deep Observation Hole Number: TP-117 Hole # | 12/9/20 Date | 9:30 am Time | ____ Weather | ____ Latitude | ____ Longitude:

1. Land Use: Open Space (e.g., woodland, agricultural field, vacant lot, etc.) | Grass Vegetation | ledge outcrops Surface Stones (e.g., cobbles, stones, boulders, etc.) | 3-5 percent Slope (%)

   Description of Location: Behind backstop of softball field in front of school

2. Soil Parent Material: ____ | ____ Landform | ____ Position on Landscape (SU, SH, BS, FS, TS)

3. Distances from: Open Water Body ____ feet | Drainage Way ____ feet | Wetlands ____ feet
   Property Line ____ feet | Drinking Water Well ____ feet | Other ____ feet

4. Unsuitable Materials Present: ☐ Yes ☒ No If Yes: ☐ Disturbed Soil ☐ Fill Material ☐ Weathered/Fractured Rock ☐ Bedrock

5. Groundwater Observed: ☒ Yes ☐ No If yes: 84" Depth Weeping from Pit ____ Depth Standing Water in Hole

Soil Log

Depth (in)	Soil Horizon /Layer	Soil Texture (USDA	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features			Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
				Depth	Color	Percent	Gravel	Cobbles & Stones			
0-8	Ap	-	-	-	-	-	-	-	-	-	-
8-28	B	Silt Loam	2.5Y 5/3	-	-	-	5	-	Massive	Friable	
28-132	C1	Loamy Sand	10YR 4/3	24-34	10 YR 5/6	20	35	15	Single	Weak	Very gravelly Gravel content increases with depth

Additional Notes: Observed water table 7'