Nitsch Engineering

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# STORMWATER REPORT

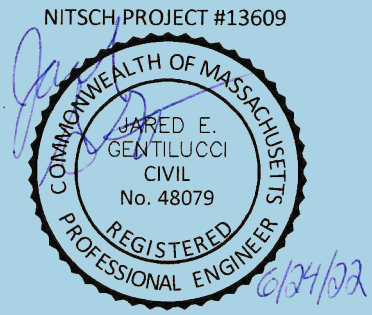
For
**DAVID MINDESS ELEMENTARY SCHOOL**
90 CONCORD STREET
Ashland, MA

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

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## 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 Notice of Intent and 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 four (4) subsurface infiltration systems. Subsurface Infiltration Systems #1 consists 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

Two infiltration basins are proposed on the site. One is proposed to infiltrate stormwater runoff generated by the main parking area. The other basin is proposed to infiltrate stormwater runoff by the main parking area and adjacent driveways. Both basins 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:

Infiltration Basin #1
Tributary Vehicular Impervious Area = 19,367 square feet
Required WQV = (19,367 SF) * (0.1 in. / 12 in./ft) = 161 cubic feet
Provided WQV = 168 cubic feet

Infiltration Basin #2
Tributary Vehicular Impervious Area = 61,520 square feet
Required WQV = (61,520 SF) * (0.1 in. / 12 in./ft) = 513 cubic feet
Provided WQV = 844 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 = 3,130 square feet
Required WQV = (3,130 SF) * (0.1 in. / 12 in./ft) = 26 cubic feet
Provided WQV = 44 cubic feet

Tributary Vehicular Impervious Area Sediment Forebay 2
Tributary Vehicular Impervious Area = 1,730 square feet
Required WQV = (1,730 SF) * (0.1 in. / 12 in./ft) = 15 cubic feet
Provided WQV = 50 cubic feet

Tributary Vehicular Impervious Area Sediment Forebay 3
Tributary Vehicular Impervious Area = 4,230 square feet
Required WQV = (4,230 SF) * (0.1 in. / 12 in./ft) = 35 cubic feet
Provided WQV = 77 cubic feet

Sediment Forebay and Filter Strip

Stormwater runoff from the proposed driveway on the western side of the site will be collected in either a sediment forebay and overflow to an existing detention pond or will sheet flow off the roadway and through a 25-foot vegetated filter strip and to the existing detention basin. The sediment forebay is sized as follows:

Tributary Vehicular Impervious Area = 13,000 square feet
Required WQV = (13,000 SF) * (0.1 in. / 12 in./ft) = 110 cubic feet
Provided WQV = 162 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 are also used for TSS removal in conjunction with deep-sump and hooded catch basins in areas of the site where infiltration is not feasible. 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 | 4.38 | 11.00 | 22.95 |
| | Proposed | 3.08 | 7.99 | 17.46 |
| **DP-B** | Existing | 7.71 | 17.81 | 35.51 |
| | Proposed | 7.46 | 16.05 | 32.30 |
| **DP-C1** | Existing | 24.59 | 48.64 | 88.28 |
| | Proposed | 18.44 | 46.09 | 83.49 |
| **DP-C2** | Existing | 4.40 | 9.32 | 17.88 |
| | Proposed | 2.05 | 5.29 | 11.23 |

## 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 |

6.94 acres of 7.89 impervious acres, or 88%, 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 |
| | = [1/0.88] x 7,162 cubic feet |
| | = 1.14 x 7,162 cubic feet |
| | = 8,139 cubic feet |

The proposed Recharge volume for each BMP was calculated using the simple dynamic method as follows:

**SA=Rv/(D+KT) so Rv=SA(D+KT)** where
Rv=Recharge Volume
d=Depth of infiltration facility (with stone)
n=% porosity of stone
D=dn=Depth of infiltration facility (no stone)
SA= Surface area of the infiltration system
K=Saturated hydraulic conductivity
T=Allowable drawdown during the peak of the storm (2 hours)

Subsurface Infiltration System #1
SA(dn+KT)=Rv
145 x 45 (0.85 x 0.4 + 0.27 x 2) = **5,742 cf**

Subsurface Infiltration System #2
SA(dn+KT)=Rv
89 x 20 (0.5 x 0.4 + 0.27 x 2) = **1,350 cf**

Subsurface Infiltration System #3
SA(dn+KT)=Rv
216 x 48 (0.85 x 0.4 + 0.27 x 2) = **9,124 cf**

Subsurface Infiltration System #4
SA(dn+KT)=Rv
(67 x 16 + 44 x 107 + 47 x 15) (0.65 x 0.4 + 0.27 x 2) = **5,188 cf**

Surface Infiltration System #1
SA(dn+KT)=Rv
3,854 (0.4 x 1 + 0.27 x 2) = **3,623 cf**

Surface Infiltration System #2
SA(dn+KT)=Rv
2,832 (0.9 x 1 + 0.27 x 2) = **4,078 cf**

Bioretention Basin
SA(dn+KT)=Rv
4,000 (0.5 x 0.4 + 0.27 x 2) = **2,960 cf**

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 | 5,742 |
| Subsurface Infiltration System 2 | 1,350 |
| Subsurface Infiltration System 3 | 9,124 |
| Subsurface Infiltration System 4 | 5,188 |
| Surface Infiltration System 1 | 3,623 |
| Surface Infiltration System 2 | 4,078 |
| Bioretention Basin | 2,960 |
| **Total** | **32,065** |

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, and 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. Sized to capture the prescribed water quality volume
   The stormwater management BMPs were sized to treat the 1" water quality volume
B. Designed according to the specific performance criteria outlines in the Massachusetts Stormwater Management Manual
   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.

**Runoff Volumes**

Per the Ashland Town Bylaws, the runoff volume from the site should not increase in the proposed condition. Table 6 below shows the existing and proposed runoff volumes in the 1-inch storm and 2-, 10- and 100-year storms.

Table 6: Existing and Proposed Runoff Volumes (CF)

| | Storm Event | 1-inch | 2-year | 10-year | 100-year |
|---|---|---|---|---|---|
| **DP-A** | Existing | 100 | 16,800 | 39,700 | 82,600 |
| | Proposed | 100 | 13,200 | 31,800 | 66,700 |
| | % Change | - | -21% | -20% | -20% |
| **DP-B** | Existing | 600 | 29,600 | 66,400 | 133,500 |
| | Proposed | 1,540 | 33,260 | 67,850 | 125,260 |
| | % Change | +157% | +12% | +2% | -6% |
| **DP-C1** | Existing | 5,600 | 82,000 | 164,500 | 307,500 |
| | Proposed | 1,500 | 78,100 | 173,500 | 340,000 |
| | % Change | -73% | -5% | +5% | +10% |
| **DP-C2** | Existing | 1,100 | 17,500 | 36,800 | 71,600 |
| | Proposed | 40 | 8,700 | 21,000 | 44,200 |
| | % Change | -96% | -50% | -43% | -39% |
| **Total** | Existing | 6,300 | 128,500 | 270,600 | 523,500 |
| | Proposed | 3,010 | 124,520 | 273,130 | 531,920 |
| | % Change | -52% | -3% | +0.01% | +0.02% |

The project is decreasing the runoff volume from the total site in the 1-inch (approximately the 90$^{th}$ percentile storm) as well as 2- year storm and will have a minimal increase in runoff volume in the 10-year storm (a 0.01% increase in runoff) and 100-year (0.02% increase in runoff). Although overall there is a decrease in runoff volume from the site, there are some individual design points where there will be a slight increase in runoff volume in some of the storm events.

In order to have a decrease in stormwater runoff volume from the site in every storm event to every design point, the increase in stormwater runoff volume generated by the site needs to be stored and infiltrated onsite. The project is constrained in how much stormwater runoff is feasible to detain and infiltrate due to poor soils and high estimated seasonal high groundwater. Because of the poor soils and high groundwater, creating systems large enough to match the existing runoff volumes from the site is cost prohibitive.

The project will exceed MassDEP stormwater standards for recharge volume provided onsite and will create a reduction in the peak runoff rate to each of the design points onsite. As such, Nitsch Engineering believes that the increase in runoff volume to some of the design points in the larger storm events will have minimal impact overall.

## 7.0 CLOSED DRAINAGE SYSTEM DESIGN

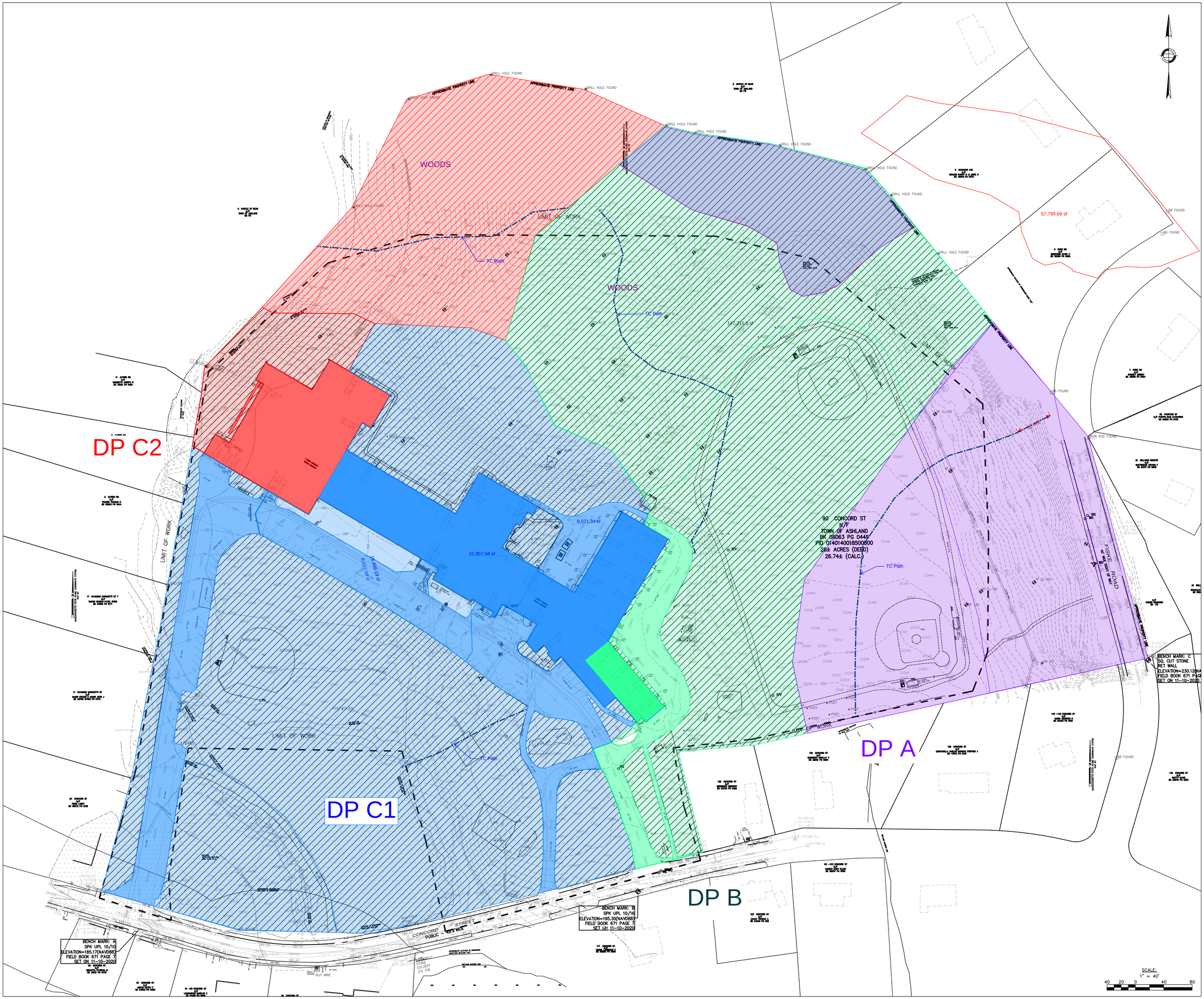
The proposed closed drainage system consists of area drains, deep-sump and hooded catch basins, drainage manholes, and proprietary water quality treatment units connected with corrugated polyethylene pipe. The closed drainage system was designed to convey the 25-year storm event using the Rational method.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

DR-1 Existing Watershed Areas
DR-2 Proposed Watershed Areas

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BOSTON, MA 02114-1910

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Consultants

| No. | Date | Note |
|---|---|---|
| REVISIONS | | |

| No. | Date | Note |
|---|---|---|
| ISSUE | | |

Stamp

Schematic Design

Key Plan

Sheet Title

EXISTING DRAINAGE AREA

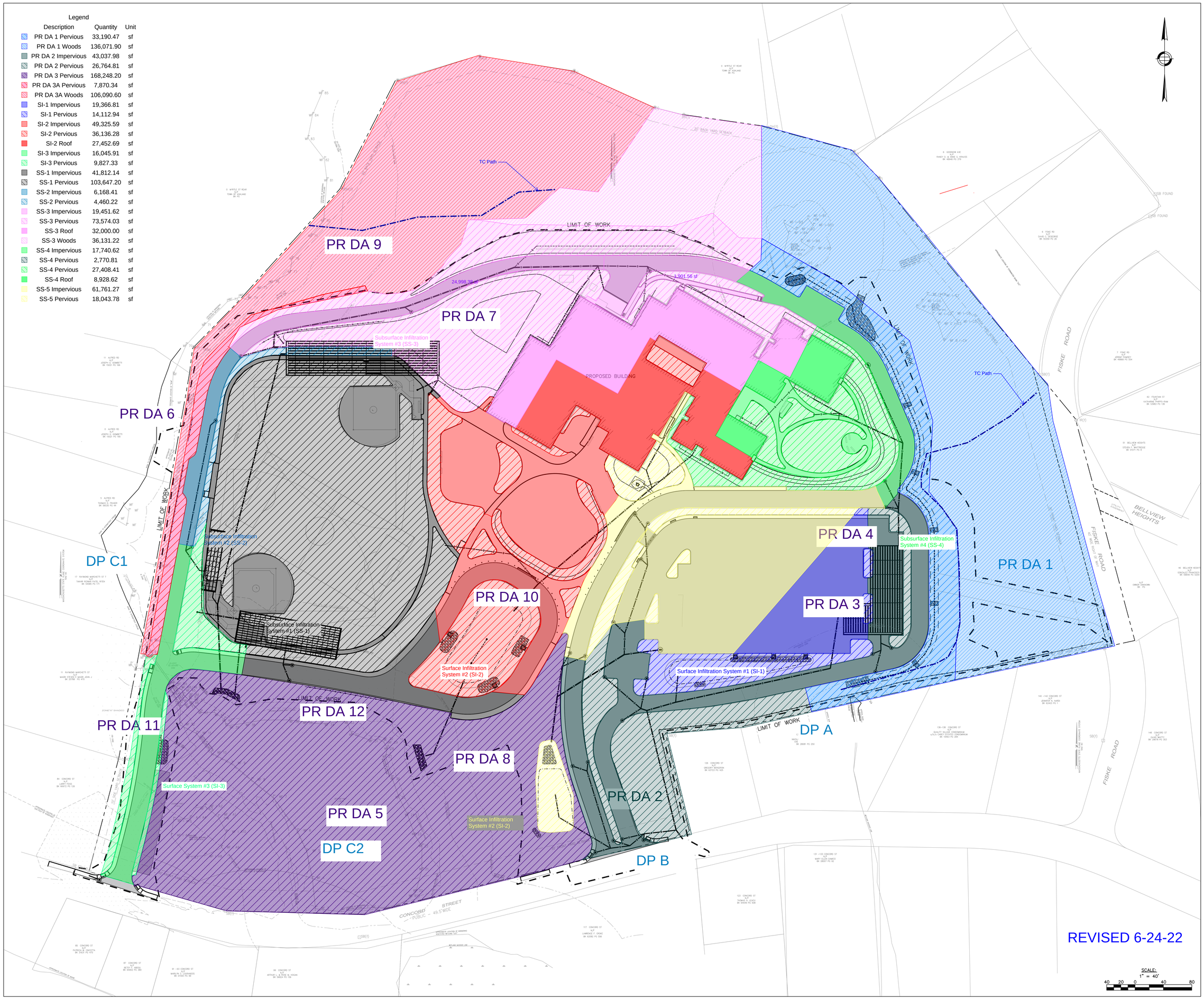
| | |
|---|---|
| Drawn By: NJB | Project ID: 13609 |
| Reviewed By: BMV/JEG | Scale: 1" = 40' |
| Issue Date: 02.04.2021 | Plot Date: 02.04.2021 |

Sheet No.

DA-EX

Legend

| Description | Quantity | Unit |
|---|---|---|
| PR DA 1 Pervious | 33,190.47 | sf |
| PR DA 1 Woods | 136,071.90 | sf |
| PR DA 2 Impervious | 43,037.98 | sf |
| PR DA 2 Pervious | 26,764.81 | sf |
| PR DA 3 Pervious | 168,248.20 | sf |
| PR DA 3A Pervious | 7,870.34 | sf |
| PR DA 3A Woods | 106,090.60 | sf |
| SI-1 Impervious | 19,366.81 | sf |
| SI-1 Pervious | 14,112.94 | sf |
| SI-2 Impervious | 49,325.59 | sf |
| SI-2 Pervious | 36,136.28 | sf |
| SI-2 Roof | 27,452.69 | sf |
| SI-3 Impervious | 16,045.91 | sf |
| SI-3 Pervious | 9,827.33 | sf |
| SS-1 Impervious | 41,812.14 | sf |
| SS-1 Pervious | 103,647.20 | sf |
| SS-2 Impervious | 6,168.41 | sf |
| SS-2 Pervious | 4,460.22 | sf |
| SS-3 Impervious | 19,451.62 | sf |
| SS-3 Pervious | 73,574.03 | sf |
| SS-3 Roof | 32,000.00 | sf |
| SS-3 Woods | 36,131.22 | sf |
| SS-4 Impervious | 17,740.62 | sf |
| SS-4 Pervious | 2,770.81 | sf |
| SS-4 Pervious | 27,408.41 | sf |
| SS-4 Roof | 8,928.62 | sf |
| SS-5 Impervious | 61,761.27 | sf |
| SS-5 Pervious | 18,043.78 | sf |





ASHLAND, MASSACHUSETTS Incorporated 1846

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

60% Construction Documents

Key Plan

Sheet Title

PROPOSED DRAINAGE AREA

| | |
|---|---|
| Drawn By: NJB | Project ID: 1914.00 |
| Reviewed By: BMV/JEG | Scale: 1" = 40' |
| Issue Date: 09.08.2021 | Plot Date: 09.08.2021 |

Sheet No:

**DA-PR**

Nitsch Project #19059

## APPENDIX A

**Stormwater Management Standards Documentation**

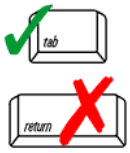
- MassDEP Checklist for Stormwater Report
- Standard 3: 72-Hour Drawdown Calcs
- Standard 3: Mounding Analysis
- Standard 4: TSS Removal Calculations
- Standard 4: Proprietary Water Quality Structure Calculations
- Standard 10: Illicit Discharge Compliance Statement

**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.

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

# Checklist for Stormwater Report

## B. Stormwater Checklist and Certification

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

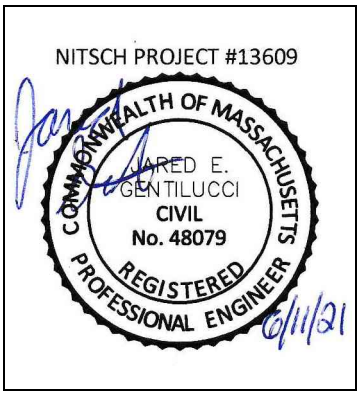
*Note:* Because stormwater requirements vary from project to project, it is possible that a complete Stormwater Report may not include information on some of the subjects specified in the Checklist. If it is determined that a specific item does not apply to the project under review, please note that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

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

## Registered Professional Engineer's Certification

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

Registered Professional Engineer Block and Signature




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 for Stormwater Report

## Checklist (continued)

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

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

## Checklist (continued)

**Standard 2: Peak Rate Attenuation**

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

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

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

**Standard 3: Recharge**

☒ Soil Analysis provided.

☒ Required Recharge Volume calculation provided.

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

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

☒ Static ☐ Simple Dynamic ☐ Dynamic Field[1]

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

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

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

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

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

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

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

---

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

# Checklist for Stormwater Report

## Checklist (continued)

**Standard 3: Recharge** (continued)

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

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

**Standard 4: Water Quality**

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

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

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

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

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

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

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

# Checklist for Stormwater Report

## Checklist (continued)

**Standard 4: Water Quality** (continued)

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

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

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

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

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

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

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

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

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

☐ All exposure has been eliminated.

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

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

**Standard 6: Critical Areas**

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

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

# Checklist for Stormwater Report

## Checklist (continued)

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

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

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

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

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

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

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

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

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

# Checklist for Stormwater Report

## Checklist (continued)

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

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

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

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

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

**Standard 9: Operation and Maintenance Plan**

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

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

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

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

**Standard 10: Prohibition of Illicit Discharges**

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

☒ An Illicit Discharge Compliance Statement is attached;

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

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 7 |
| Date: 9/1/2021 | 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): | *3120* | as determined by the | Static Method |
| 3 | Bottom Area (in Sq.Ft.) | *6380* | | |

| Step No. | | Hydraulic Conductivity Rate: | In-Situ Saturated Hydraulic Conductivity Rate |
|---|---|---|---|
| 4a | ONLY - If using Dynamic: In-Situ Method --> Enter Hydraulic Conductivity Rate | | 0 |

| Step No. | Texture Class | NRCS Hydrologic Soil Group (HSG) | Infiltration Rate (Inches/Hour) | |
|---|---|---|---|---|
| 4b | Silt Loam | C | 0.27 | Hours |

$Time_{drawdown}$ = 21.73

**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: 9/1/2021 | SS-2 |

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): | *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*** |

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## 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: 9/1/2021 | SS-3 |

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): | *3895* | as determined by the | Static Method |
| 3 | Bottom Area (in Sq.Ft.) | *10584* | | |

| | | 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 |

$Time_{drawdown}$ = 16.36

**72-Hour Drawdown Requirement Check:** ***OK***

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## 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: 9/1/2021 | SI-2 |

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): | *2829* | as determined by the | Static Method |
| 3 | Bottom Area (in Sq.Ft.) | *2832* | | |

| Step No. | | Hydraulic Conductivity Rate: | In-Situ Saturated Hydraulic Conductivity Rate |
|---|---|---|---|
| 4a | ONLY - If using Dynamic: In-Situ Method --> Enter Hydraulic Conductivity Rate | | 0 |

| Step No. | Texture Class | NRCS Hydrologic Soil Group (HSG) | Infiltration Rate (Inches/Hour) | |
|---|---|---|---|---|
| 4b | Silt Loam | C | 0.27 | Hours |

$Time_{drawdown}$ = 44.40

**72-Hour Drawdown Requirement Check:** ***OK***

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## 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: 9/1/2021, Revised 6/24/2022 | SI-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): | *1742* | as determined by the | Static Method |
| 3 | Bottom Area (in Sq.Ft.) | *3854* | | |

| Step No. | | Hydraulic Conductivity Rate: | In-Situ Saturated Hydraulic Conductivity Rate |
|---|---|---|---|
| 4a | ONLY - If using Dynamic: In-Situ Method --> Enter Hydraulic Conductivity Rate | | 0 |

| Step No. | Texture Class | NRCS Hydrologic Soil Group (HSG) | Infiltration Rate (Inches/Hour) | |
|---|---|---|---|---|
| 4b | Silt Loam | C | 0.27 | Hours |

$Time_{drawdown}$ = 20.09

**72-Hour Drawdown Requirement Check:** ***OK***

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## 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: 9/1/2021 | BIO-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): | *2379* | as determined by the | Static Method |
| 3 | Bottom Area (in Sq.Ft.) | *4470* | | |

| Step No. | | Hydraulic Conductivity Rate: | In-Situ Saturated Hydraulic Conductivity Rate |
|---|---|---|---|
| 4a | ONLY - If using Dynamic: In-Situ Method --> Enter Hydraulic Conductivity Rate | | 0 |

| Step No. | Texture Class | NRCS Hydrologic Soil Group (HSG) | Infiltration Rate (Inches/Hour) | |
|---|---|---|---|---|
| 4b | Silt Loam | C | 0.27 | **Hours** |

$Time_{drawdown}$ = 23.65

**72-Hour Drawdown Requirement Check:** ***OK***

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## 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: 9/1/2021, Revised 6/24/2022 | SS-4 |

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): | *1631* | as determined by the | Static Method |
| 3 | Bottom Area (in Sq.Ft.) | *6449* | | |

| Step No. | | Hydraulic Conductivity Rate: | In-Situ Saturated Hydraulic Conductivity Rate |
|---|---|---|---|
| 4a | ONLY - If using Dynamic: In-Situ Method --> Enter Hydraulic Conductivity Rate | | 0 |

| Step No. | Texture Class | NRCS Hydrologic Soil Group (HSG) | Infiltration Rate (Inches/Hour) | |
|---|---|---|---|---|
| 4b | Silt Loam | C | 0.27 | Hours |

$Time_{drawdown}$ = 11.24

**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)

# SS-1

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)*** |
| **22.000** | **x** | **1/2 length of basin (x direction, in feet)** |
| **72.500** | **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 |

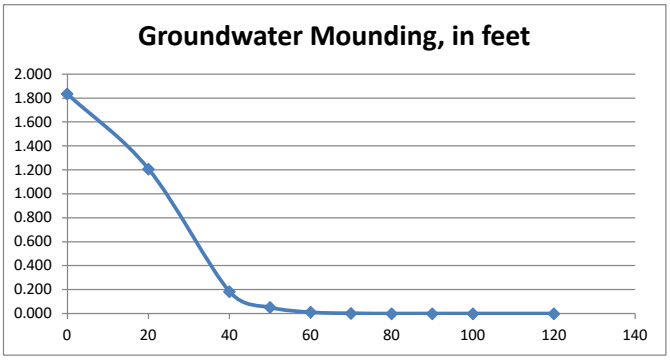
| **hours** | **days** |
|---|---|
| 36 | 1.50 |

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).

| | | |
|---|---|---|
| **5.836** | **h(max)** | **maximum thickness of saturated zone (beneath center of basin at end of infiltration period)** |
| **1.836** | **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** |
|---|---|
| 1.836 | **0** |
| 1.209 | **20** |
| 0.184 | **40** |
| 0.053 | **50** |
| 0.013 | **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.
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# SS-2

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 |

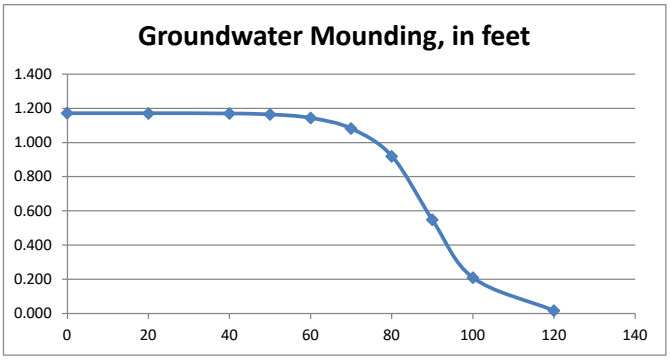
| **hours** | **days** |
|---|---|
| 36 | 1.50 |

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**

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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.
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# SS-3

Input Values

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

| | | |
|---|---|---|
| ***0.0860*** | ***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)*** |
| **108.000** | **x** | **1/2 length of basin (x direction, in feet)** |
| **24.400** | **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)** |

| | | |
|---|---|---|
| **4.976** | **h(max)** | **maximum thickness of saturated zone (beneath center of basin at end of infiltration period)** |
| **0.976** | **Δh(max)** | **maximum groundwater mounding (beneath center of basin at end of infiltration period)** |

**Conversion Table**

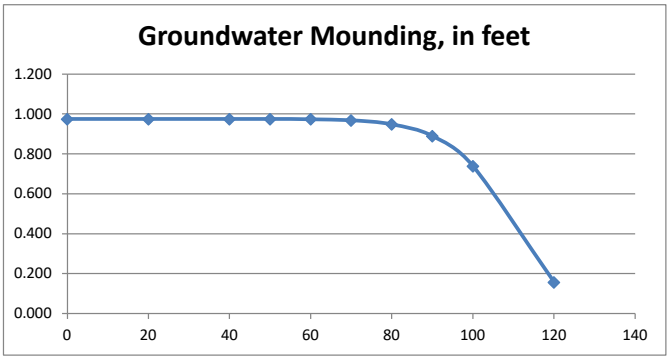
| **inch/hour** | **feet/day** |
|---|---|
| 0.67 | 1.33 |
| 2.00 | 4.00 |

| **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** |
|---|---|
| 0.976 | **0** |
| 0.976 | **20** |
| 0.976 | **40** |
| 0.975 | **50** |
| 0.974 | **60** |
| 0.969 | **70** |
| 0.949 | **80** |
| 0.890 | **90** |
| 0.740 | **100** |
| 0.157 | **120** |

**Re-Calculate Now**




## Disclaimer

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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.
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## SS-4

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)*** |
| **22.000** | **x** | **1/2 length of basin (x direction, in feet)** |
| **82.000** | **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 |

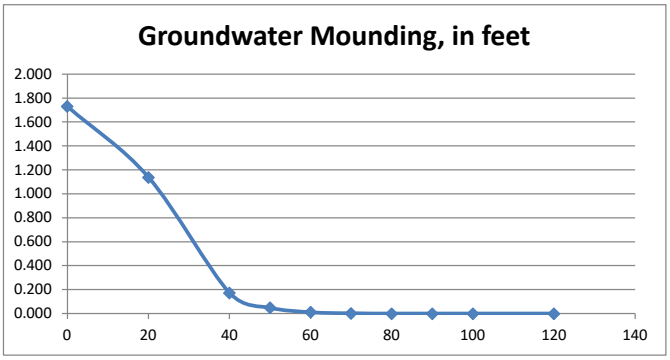
| **hours** | **days** |
|---|---|
| 36 | 1.50 |

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).

| | | |
|---|---|---|
| **5.731** | **h(max)** | **maximum thickness of saturated zone (beneath center of basin at end of infiltration period)** |
| **1.731** | **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** |
|---|---|
| 1.731 | **0** |
| 1.139 | **20** |
| 0.173 | **40** |
| 0.050 | **50** |
| 0.012 | **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.
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# BIO

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

**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).

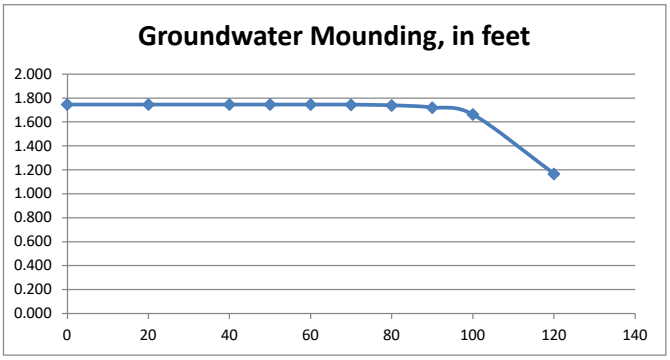
Input Values

| | | |
|---|---|---|
| *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)** |

| | | |
|---|---|---|
| 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.

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)

## SI-1

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

Input Values

| | | |
|---|---|---|
| ***0.0700*** | ***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)*** |
| **84.000** | **x** | **1/2 length of basin (x direction, in feet)** |
| **15.000** | **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 |

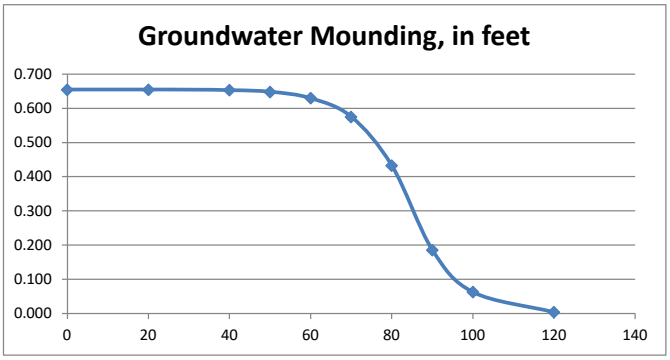
| hours | days |
|---|---|
| 36 | 1.50 |

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).

| | | |
|---|---|---|
| **4.655** | **h(max)** | **maximum thickness of saturated zone (beneath center of basin at end of infiltration period)** |
| **0.655** | **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 |
|---|---|
| 0.655 | **0** |
| 0.655 | **20** |
| 0.654 | **40** |
| 0.648 | **50** |
| 0.630 | **60** |
| 0.575 | **70** |
| 0.433 | **80** |
| 0.187 | **90** |
| 0.063 | **100** |
| 0.005 | **120** |

**Re-Calculate Now**




## Disclaimer

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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)

SI-2

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

Input Values

| | | |
|---|---|---|
| ***0.0600*** | ***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)*** |
| **25.000** | **x** | **1/2 length of basin (x direction, in feet)** |
| **77.000** | **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 |

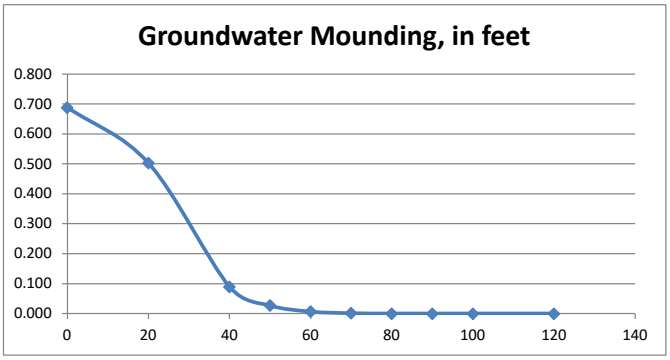
| **hours** | **days** |
|---|---|
| 36 | 1.50 |

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).

| | | |
|---|---|---|
| **4.689** | **h(max)** | **maximum thickness of saturated zone (beneath center of basin at end of infiltration period)** |
| **0.689** | **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** |
|---|---|
| 0.689 | **0** |
| 0.503 | **20** |
| 0.090 | **40** |
| 0.027 | **50** |
| 0.007 | **60** |
| 0.002 | **70** |
| 0.000 | **80** |
| 0.000 | **90** |
| 0.000 | **100** |
| 0.000 | **120** |

**Re-Calculate Now**




## Disclaimer

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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 Revised 8/31/2021)**

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**
Sediment Forebay or Vegetated Filter Strip → Discharge

Mindess School
90 Concord Street, Ashland, MA
June 14, 2021 Revised August 31, 2021

Nitsch Project No. 13609

**Treatment Train A:**
Deep Sump & Hooded Catch Basin → Water Quality Structure→ Discharge

**Treatment Spreadsheet**

| B<br>BMP | C<br>TSS Removal Rate | D<br>Starting TSS Load | E<br>Amount Removed (C*D) | F<br>Remaining Load (D-E) |
|---|---|---|---|---|
| **Deep Sump and Hooded Catch Basin** | **0.25** | **1.00** | **0.25** | **0.75** |
| **Water Quality Structure** | **0.50** | **0.75** | **0.375** | **0.375** |
| | | **Total TSS Removal =** | **62.5%** | **Does not meet 80% TSS Removal requirement, but a portion of the site is a redevelopment** |

Mindess School
90 Concord Street, Ashland, MA
June 14, 2021 Revised August 31, 2021
Nitsch Project No. 13609

**Treatment Train B :**
Sediment Forebay → Infiltration Basin → Discharge

**Treatment Spreadsheet**

| B | C | D | E | F |
|---|---|---|---|---|
| BMP | TSS Removal Rate | Starting TSS Load | Amount Removed (C*D) | 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 Revised August 31, 2021
Nitsch Project No. 13609

**Treatment Train C :**
Sediment Forebay → Bioretention Basin→ Discharge

**Treatment Spreadsheet**

| B | C | D | E | F |
|---|---|---|---|---|
| BMP | TSS Removal Rate | Starting TSS Load | Amount Removed (C*D) | 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
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June 14, 2021 Revised August 31, 2021

Nitsch Project No. 13609

**Treatment Train D:**
Deep Sump & Hooded Catch Basin → Water Quality Structure → Subsurface Infiltration → Discharge

**Treatment Spreadsheet**

| B | C | D | E | F |
|---|---|---|---|---|
| BMP | TSS Removal Rate | Starting TSS Load | Amount Removed (C*D) | Remaining Load (D-E) |
| **Deep Sump and Hooded Catch Basin** | **0.25** | **1.00** | **0.25** | **0.75** |
| **Water Quality Structure** | **0.50** | **0.75** | **0.375** | **0.375** |
| **Subsurface Infiltration System** | **0.80** | **0.15** | **0.30** | **0.075** |

**Total TSS Removal =** **93%**

**Meets 80% TSS removal requirement**

Mindess School
90 Concord Street, Ashland, MA
June 14, 2021 Revised August 31, 2021
Nitsch Project No. 13609

**Treatment Train E:**
Sediment Forebay or Vegetated Filter Strip → Discharge

**Treatment Spreadsheet**

| B | C | D | E | F |
|---|---|---|---|---|
| BMP | TSS Removal Rate | Starting TSS Load | Amount Removed (C*D) | Remaining Load (D-E) |
| **Sediment Forebay or Vegetated Filter Strip** | **0.25** | **1.00** | **0.25** | **0.75** |

**Total TSS Removal =** **25%**

**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 |
| WQI#130 | = | 774 | 2443 | 0.000088 | 1 | = | 0.07 | cfs |
| | = | | | 0.000000 | 1 | = | 0.00 | cfs |

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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

## Rainfall Events Listing (selected events)

| Event# | Event Name | Storm Type | Curve | Mode | Duration (hours) | B/B | Depth (inches) | AMC |
|---|---|---|---|---|---|---|---|---|
| 1 | 1-inch | NOAA 24-hr | D | Default | 24.00 | 1 | 1.00 | 2 |
| 2 | 2-yr | NOAA 24-hr | D | Default | 24.00 | 1 | 3.35 | 2 |
| 3 | 10-yr | NOAA 24-hr | D | Default | 24.00 | 1 | 5.23 | 2 |
| 4 | 100-yr | NOAA 24-hr | D | Default | 24.00 | 1 | 8.22 | 2 |

## 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** |

## Summary for Subcatchment EX 1: Wooded Area, Flelds

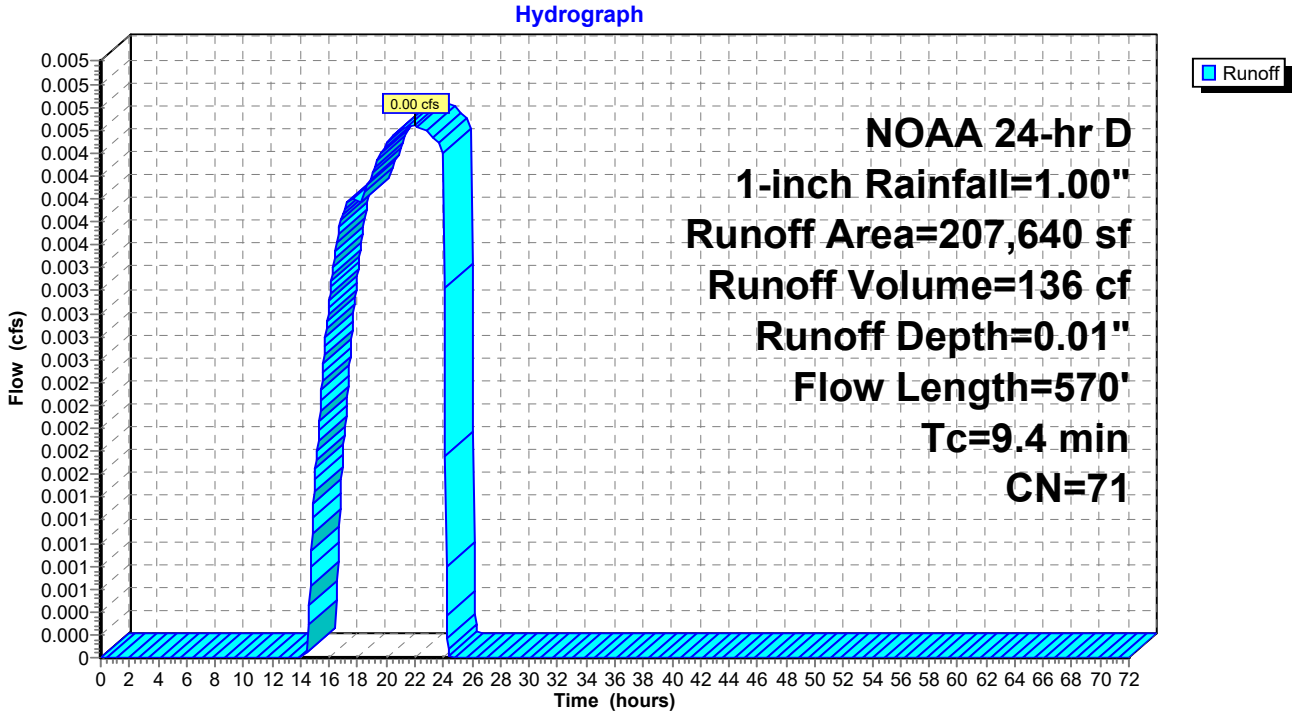
Runoff = 0.00 cfs @ 22.03 hrs, Volume= 136 cf, Depth= 0.01"
Routed to Reach DPA : Intermittent Strem Eas

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 1-inch Rainfall=1.00"

| Area (sf) | CN | Description |
|---|---|---|
| 75,399 | 74 | >75% Grass cover, Good, HSG C |
| 132,241 | 70 | Woods, Good, HSG C |
| 207,640 | 71 | Weighted Average |
| 207,640 | | 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, Flelds, Building

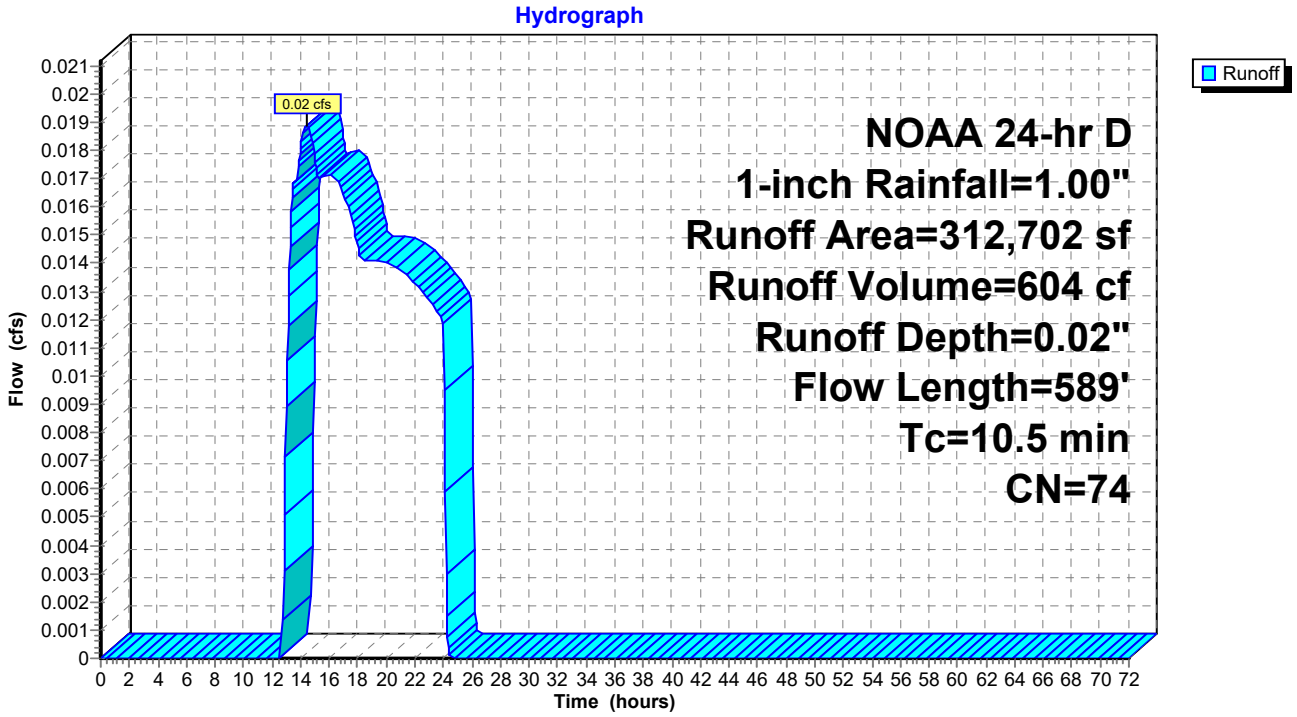
Runoff = 0.02 cfs @ 14.42 hrs, Volume= 604 cf, Depth= 0.02"
Routed to Reach DP B : Concord Street Main

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 1-inch Rainfall=1.00"

| Area (sf) | CN | Description |
|---|---|---|
| 28,463 | 98 | Paved parking, HSG C |
| 138,936 | 74 | >75% Grass cover, Good, HSG C |
| 145,303 | 70 | Woods, Good, HSG C |
| 312,702 | 74 | Weighted Average |
| 284,239 | | 90.90% Pervious Area |
| 28,463 | | 9.10% 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

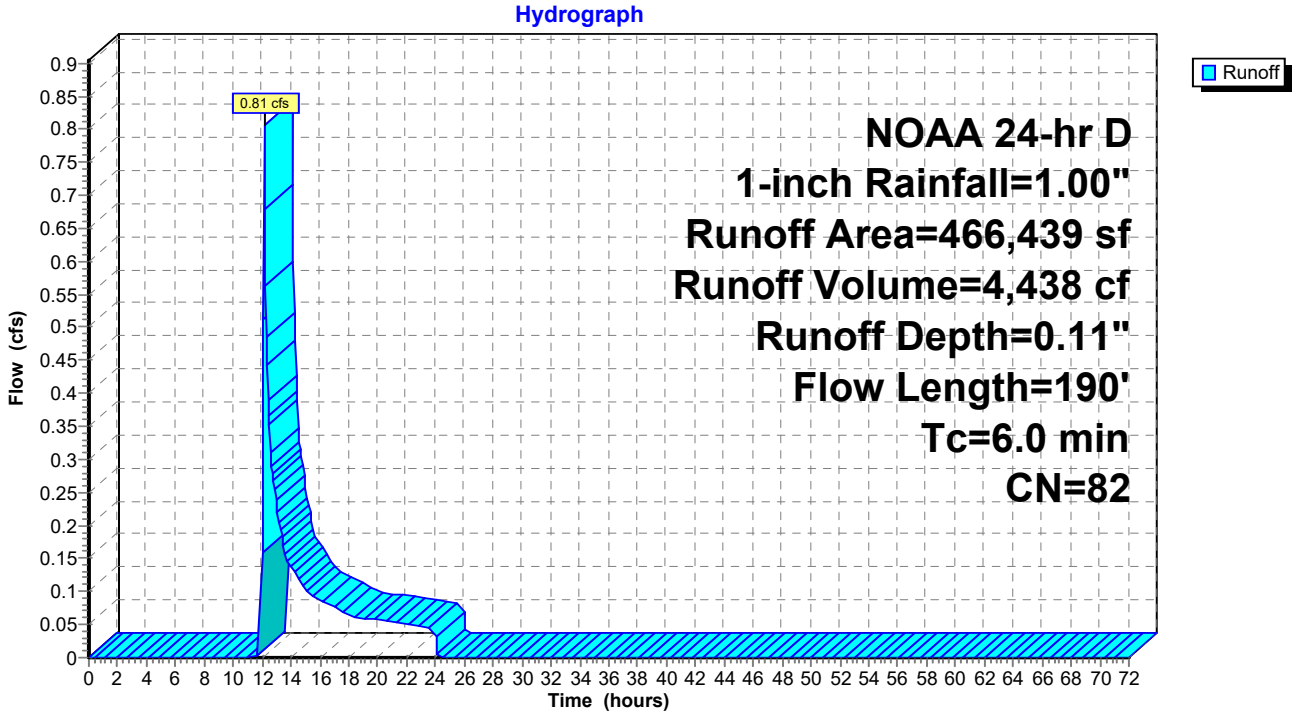
Runoff = 0.81 cfs @ 12.16 hrs, Volume= 4,438 cf, Depth= 0.11"
Routed to Reach DP C1 : Wetlands

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 1-inch Rainfall=1.00"

| | 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

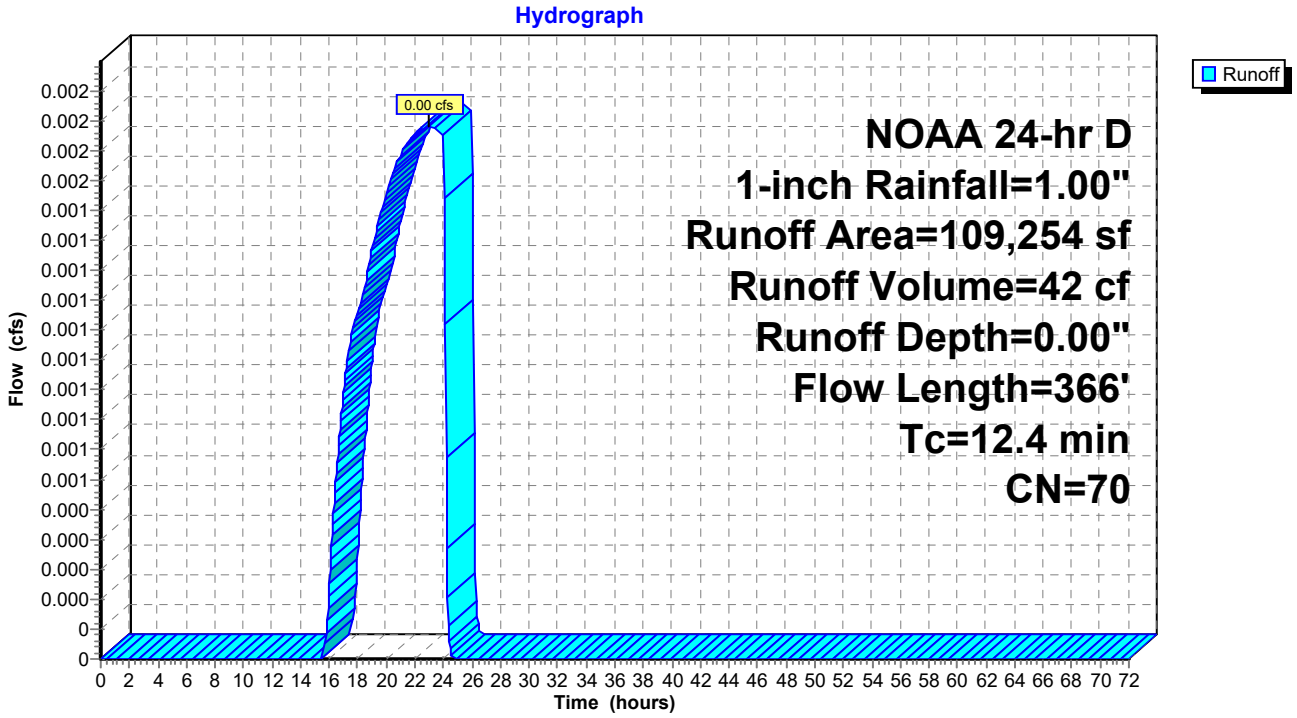
Runoff = 0.00 cfs @ 22.95 hrs, Volume= 42 cf, Depth= 0.00"
Routed to Reach DP C2 : Intermittent Stream

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 1-inch Rainfall=1.00"

| 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

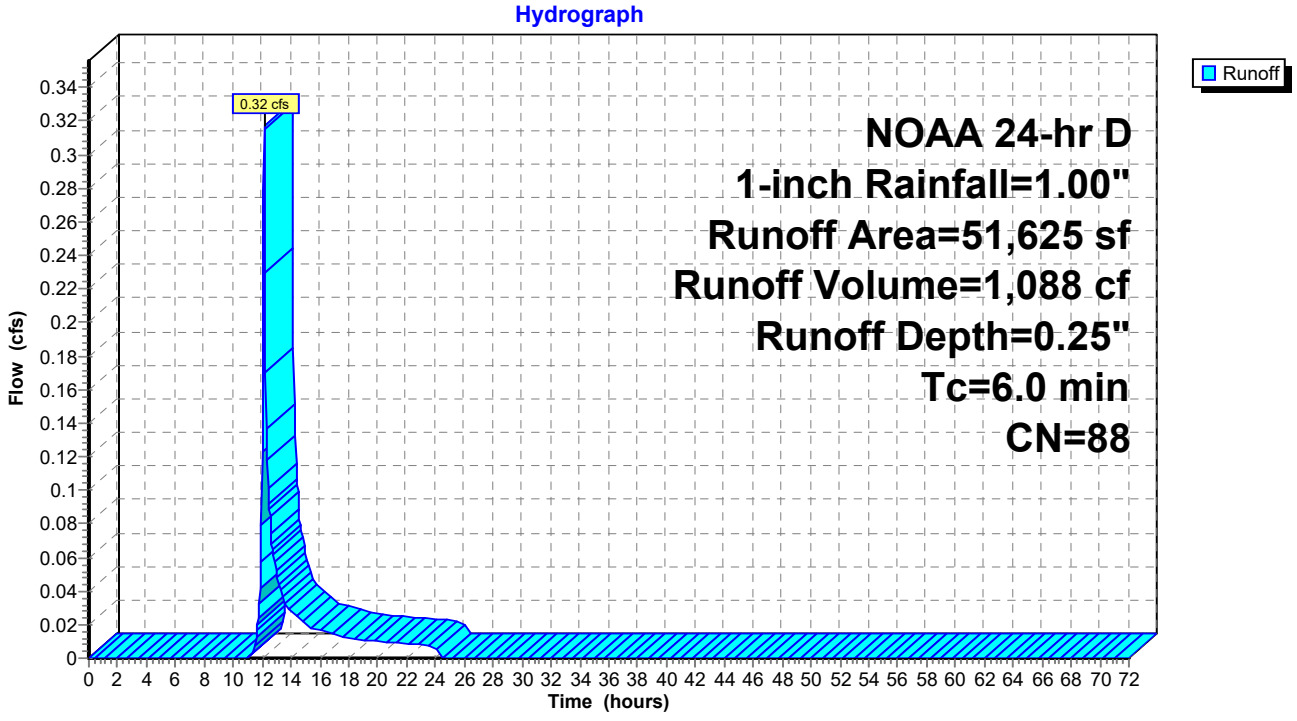
Runoff = 0.32 cfs @ 12.14 hrs, Volume= 1,088 cf, Depth= 0.25"
Routed to Reach DP C2 : Intermittent Stream

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 1-inch Rainfall=1.00"

| | 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



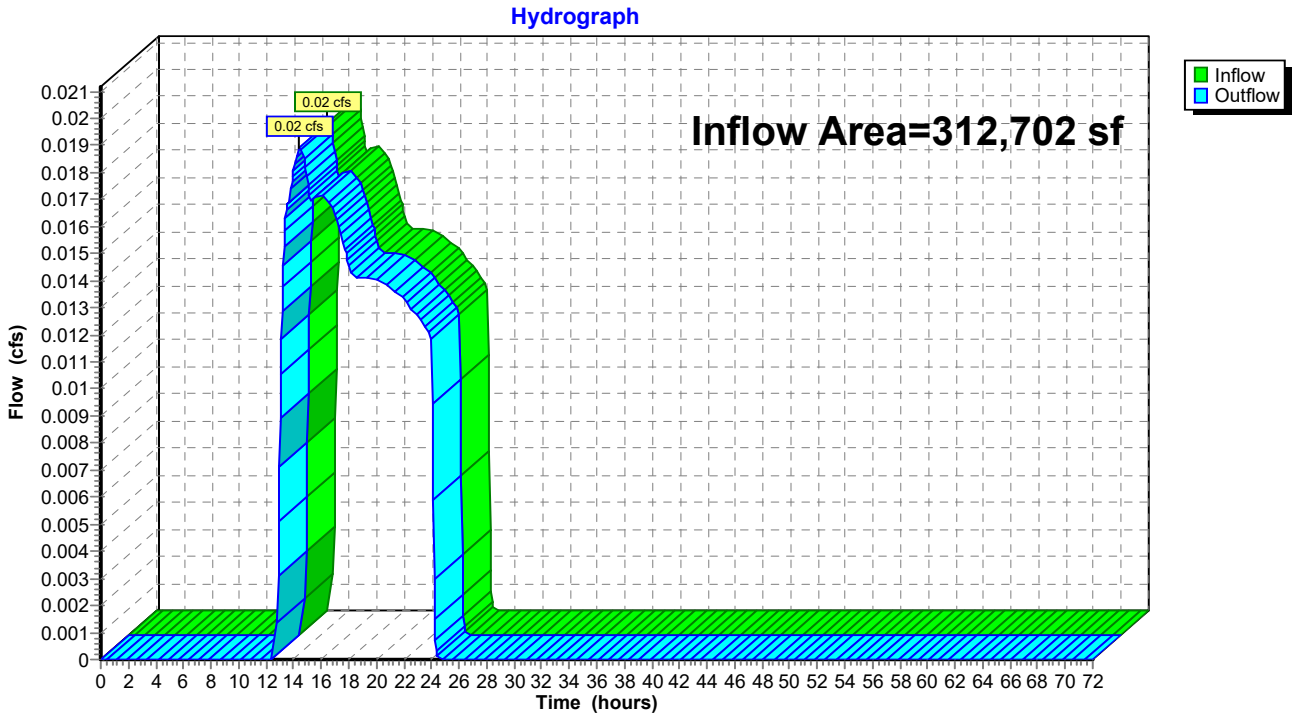
## Summary for Reach DP B: Concord Street Main

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

Inflow Area = 312,702 sf, 9.10% Impervious, Inflow Depth = 0.02" for 1-inch event
Inflow = 0.02 cfs @ 14.42 hrs, Volume= 604 cf
Outflow = 0.02 cfs @ 14.42 hrs, Volume= 604 cf, Atten= 0%, Lag= 0.0 min
Routed to Reach EX DP : EX SITE

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

### Reach DP B: Concord Street Main



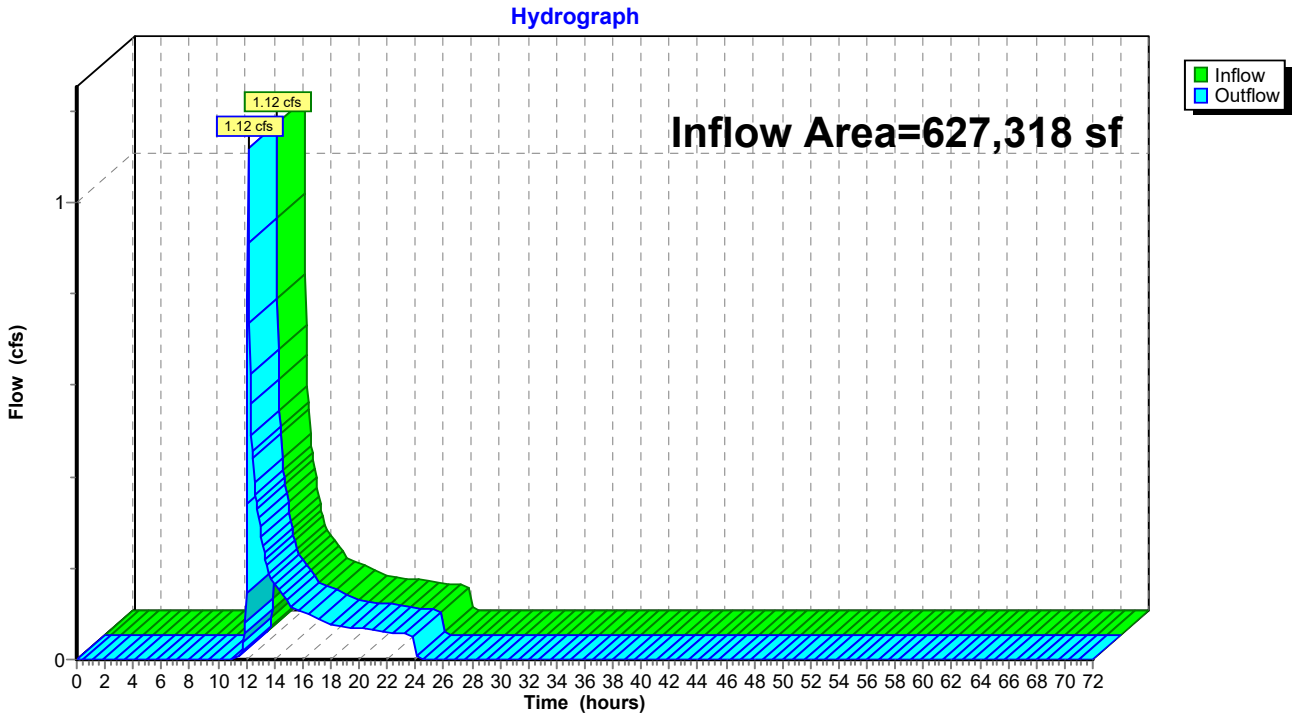
## Summary for Reach DP C1: Wetlands

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

Inflow Area = 627,318 sf, 31.57% Impervious, Inflow Depth = 0.11" for 1-inch event
Inflow = 1.12 cfs @ 12.16 hrs, Volume= 5,568 cf
Outflow = 1.12 cfs @ 12.16 hrs, Volume= 5,568 cf, Atten= 0%, Lag= 0.0 min
Routed to Reach EX DP : EX SITE

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

### Reach DP C1: Wetlands



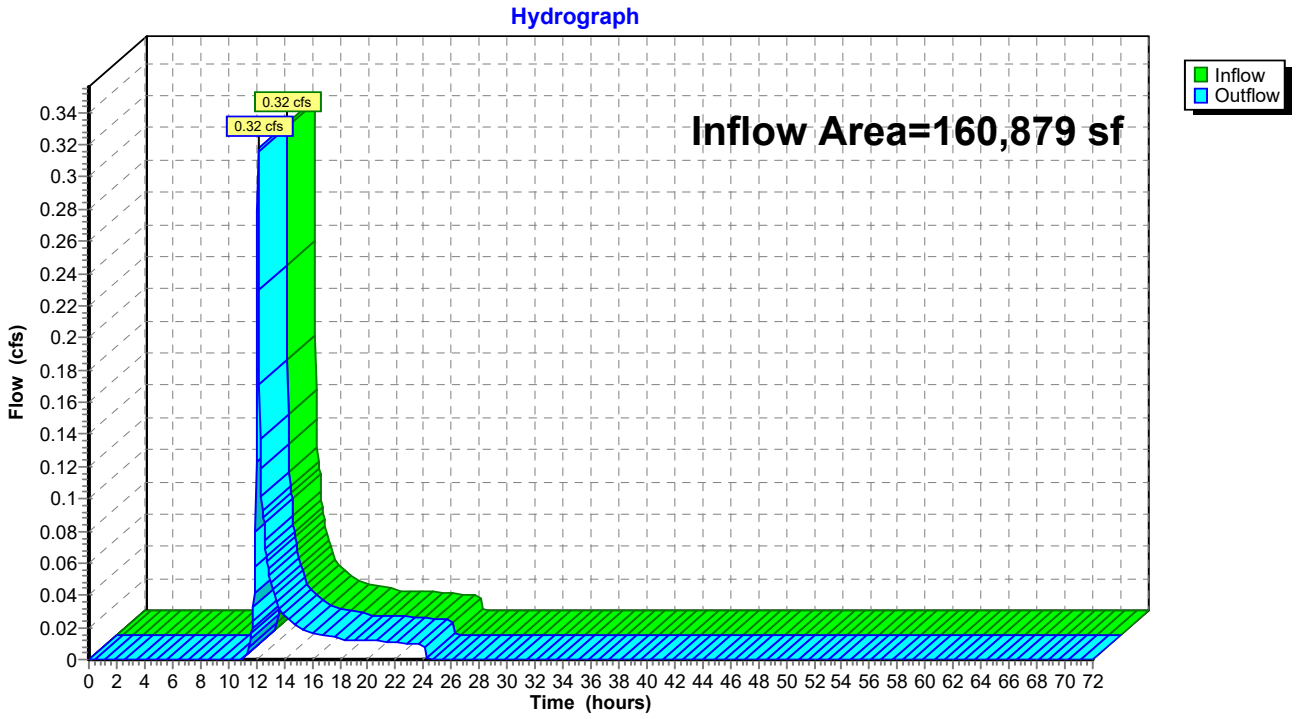
## Summary for Reach DP C2: Intermittent Stream

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

Inflow Area = 160,879 sf, 18.22% Impervious, Inflow Depth = 0.08" for 1-inch event
Inflow = 0.32 cfs @ 12.14 hrs, Volume= 1,130 cf
Outflow = 0.32 cfs @ 12.14 hrs, Volume= 1,130 cf, Atten= 0%, Lag= 0.0 min
Routed to Reach DP C1 : Wetlands

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

### Reach DP C2: Intermittent Stream



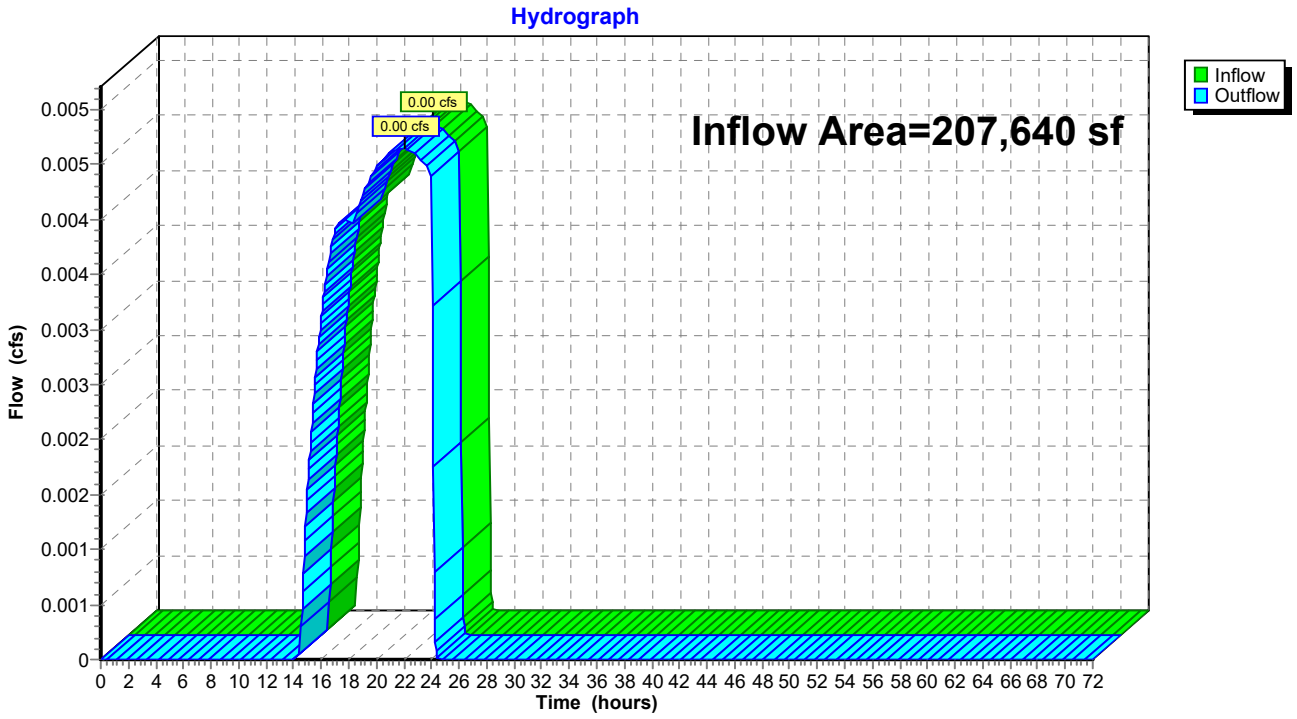
## Summary for Reach DPA: Intermittent Strem Eas

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

Inflow Area = 207,640 sf, 0.00% Impervious, Inflow Depth = 0.01" for 1-inch event
Inflow = 0.00 cfs @ 22.03 hrs, Volume= 136 cf
Outflow = 0.00 cfs @ 22.03 hrs, Volume= 136 cf, Atten= 0%, Lag= 0.0 min
Routed to Reach EX DP : EX SITE

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

### Reach DPA: Intermittent Strem Eas



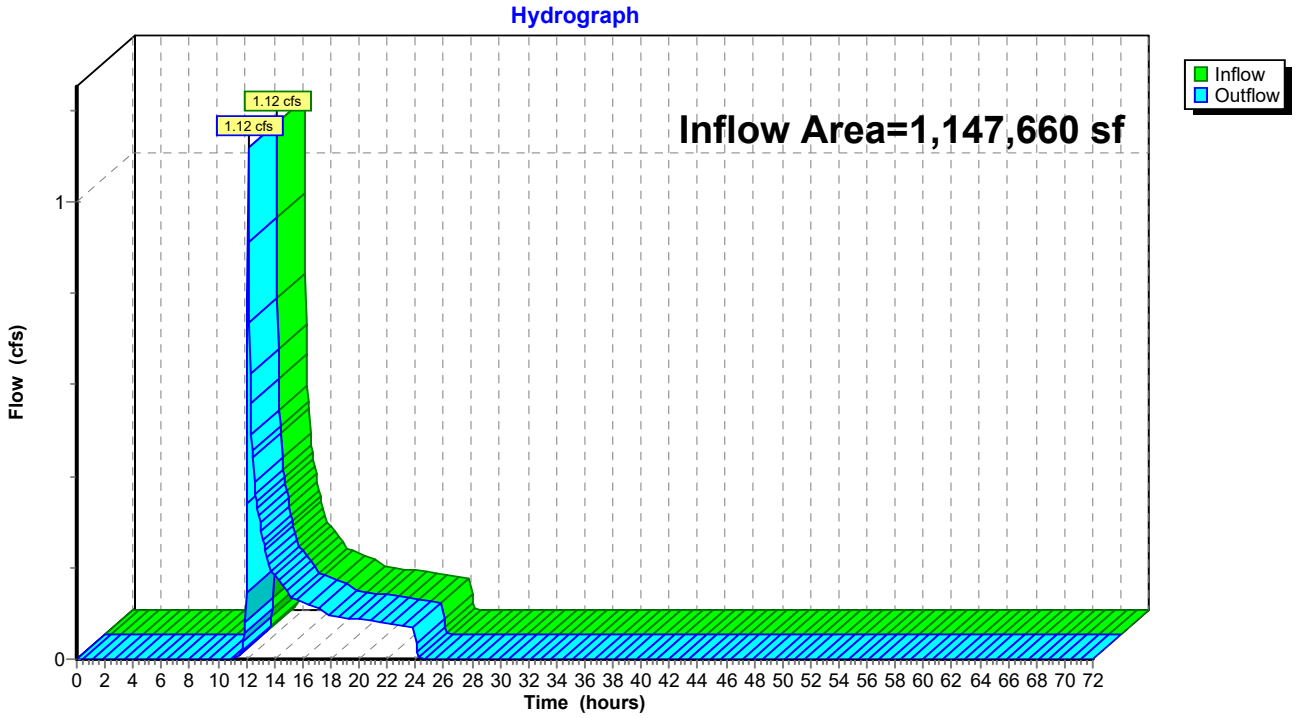
## Summary for Reach EX DP: EX SITE

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

Inflow Area = 1,147,660 sf, 19.74% Impervious, Inflow Depth = 0.07" for 1-inch event
Inflow = 1.12 cfs @ 12.16 hrs, Volume= 6,309 cf
Outflow = 1.12 cfs @ 12.16 hrs, Volume= 6,309 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



## Summary for Subcatchment EX 1: Wooded Area, Flelds

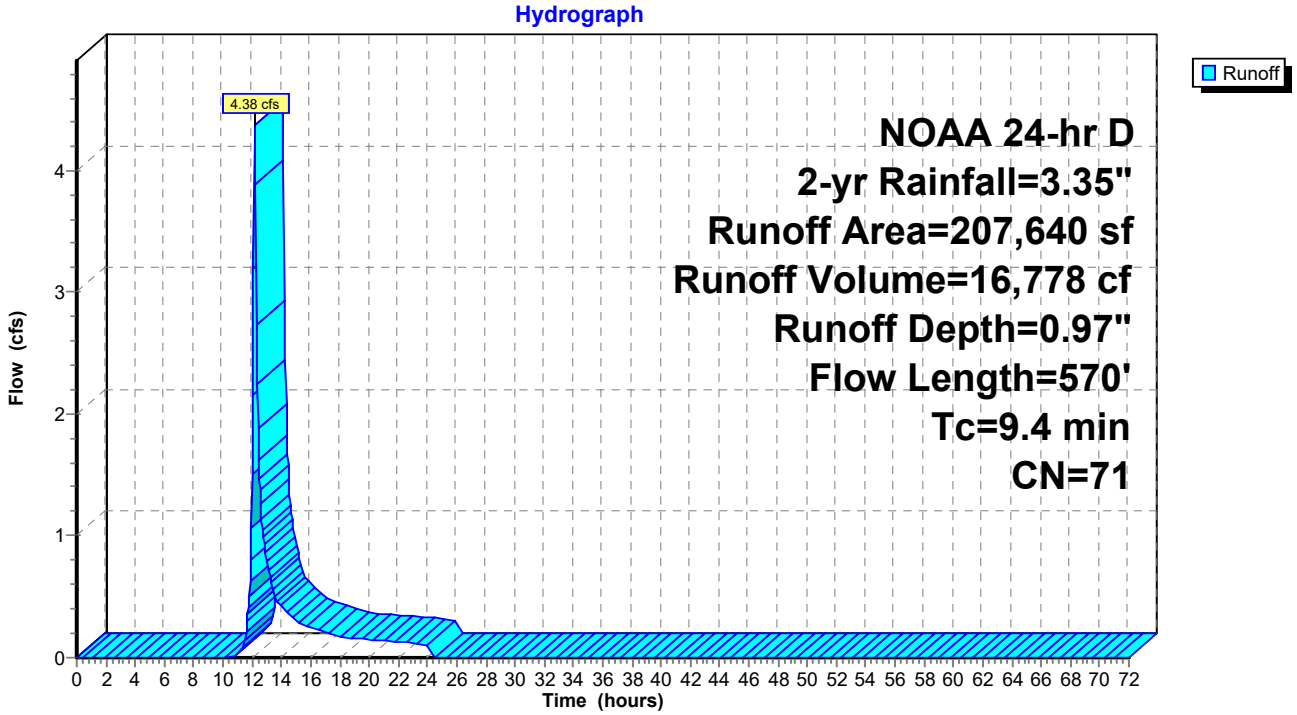
Runoff = 4.38 cfs @ 12.18 hrs, Volume= 16,778 cf, Depth= 0.97"
Routed to Reach DPA : Intermittent Strem Eas

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 |
| 132,241 | 70 | Woods, Good, HSG C |
| 207,640 | 71 | Weighted Average |
| 207,640 | | 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, Flelds, Building

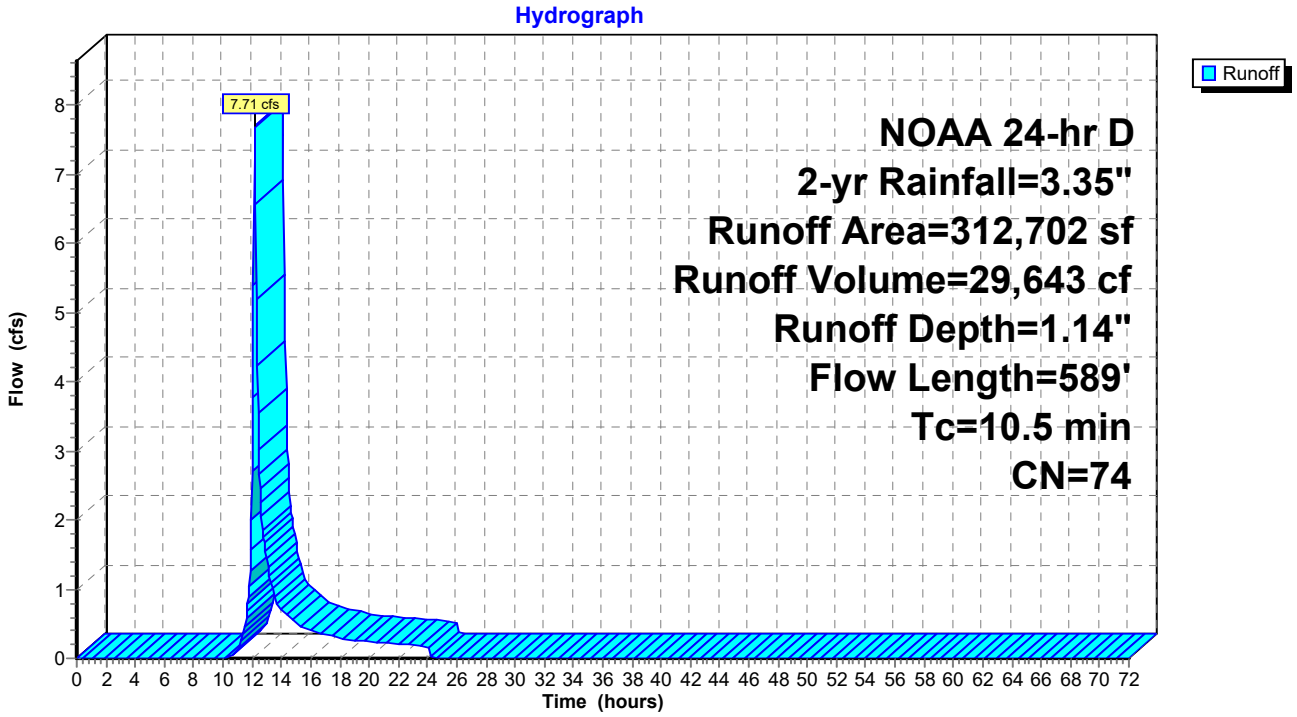
Runoff = 7.71 cfs @ 12.19 hrs, Volume= 29,643 cf, Depth= 1.14"
Routed to Reach DP B : Concord Street Main

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 |
| 145,303 | 70 | Woods, Good, HSG C |
| 312,702 | 74 | Weighted Average |
| 284,239 | | 90.90% Pervious Area |
| 28,463 | | 9.10% 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

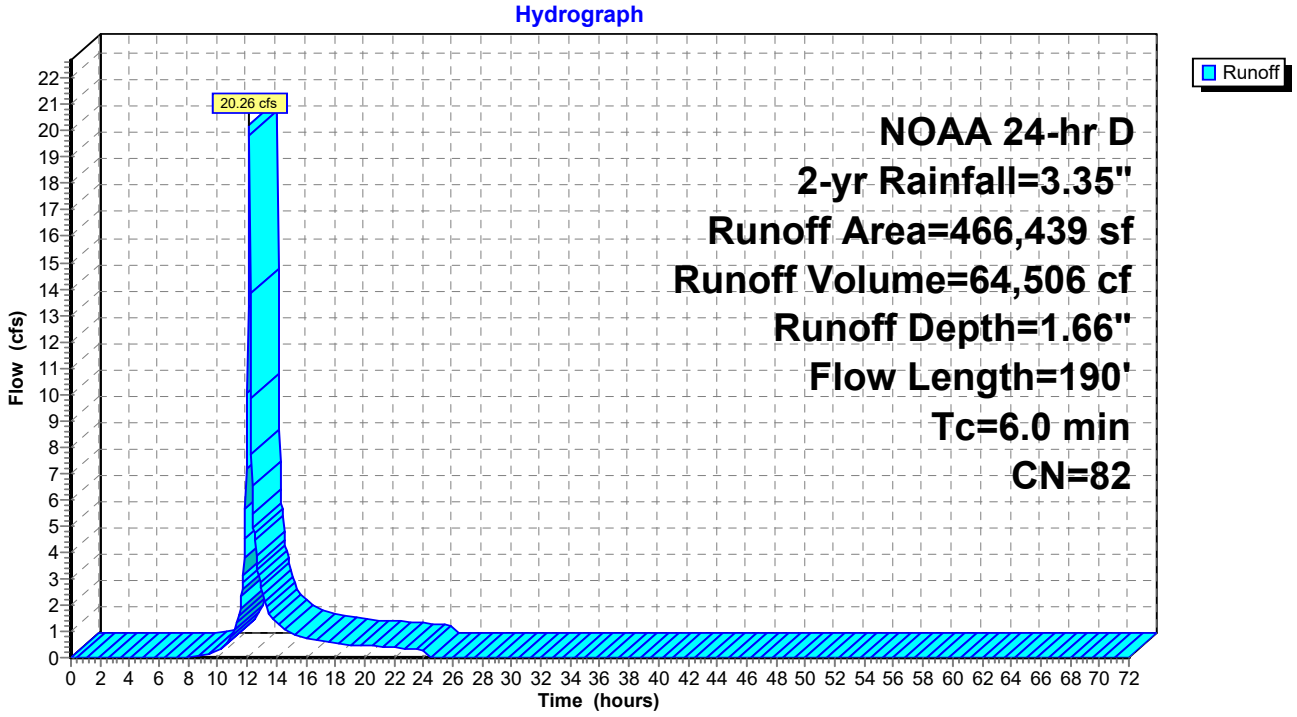
Runoff = 20.26 cfs @ 12.13 hrs, Volume= 64,506 cf, Depth= 1.66"
Routed to Reach DP C1 : Wetlands

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

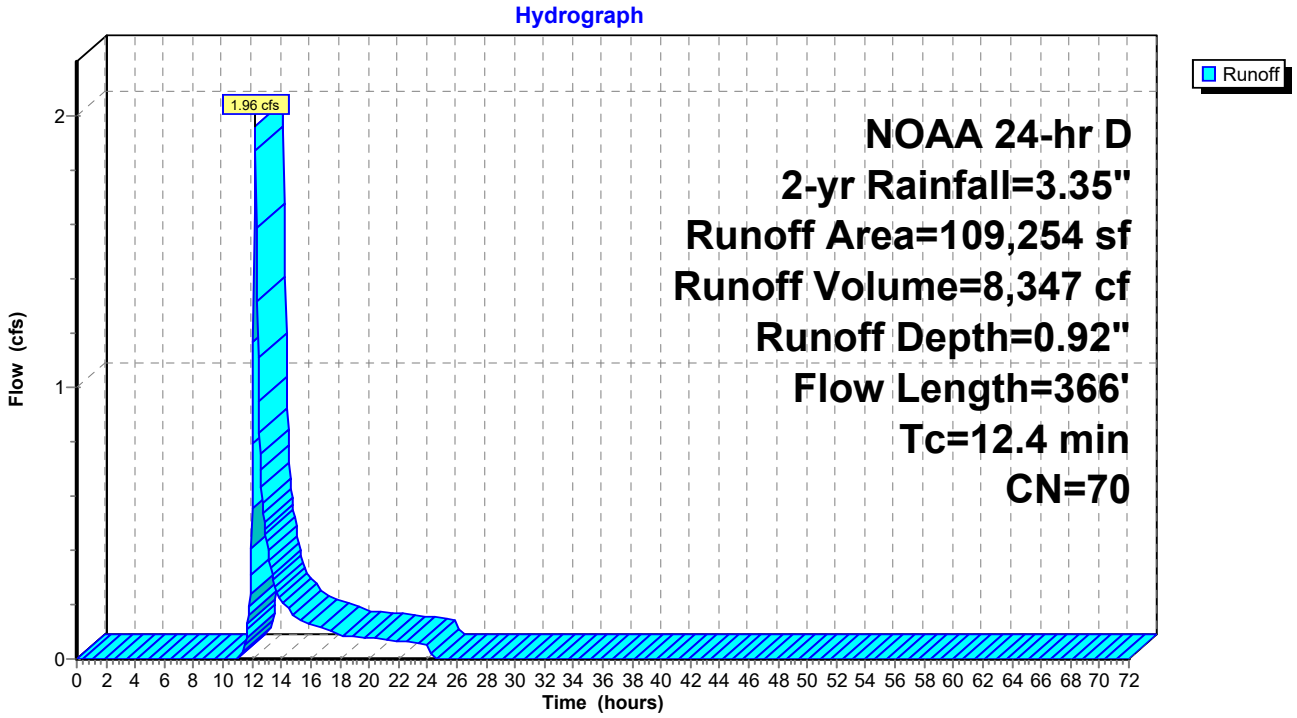
Runoff = 1.96 cfs @ 12.21 hrs, Volume= 8,347 cf, Depth= 0.92"
Routed to Reach DP C2 : Intermittent Stream

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

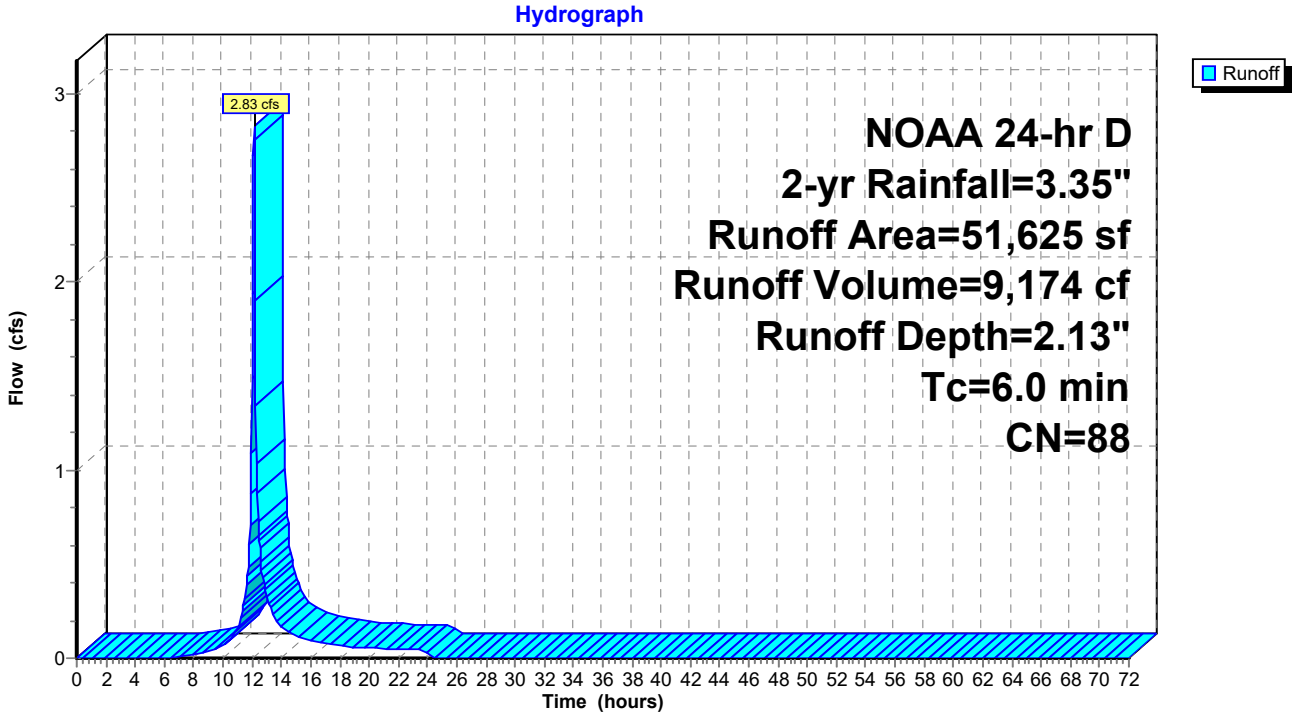
Runoff = 2.83 cfs @ 12.13 hrs, Volume= 9,174 cf, Depth= 2.13"
Routed to Reach DP C2 : Intermittent Stream

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



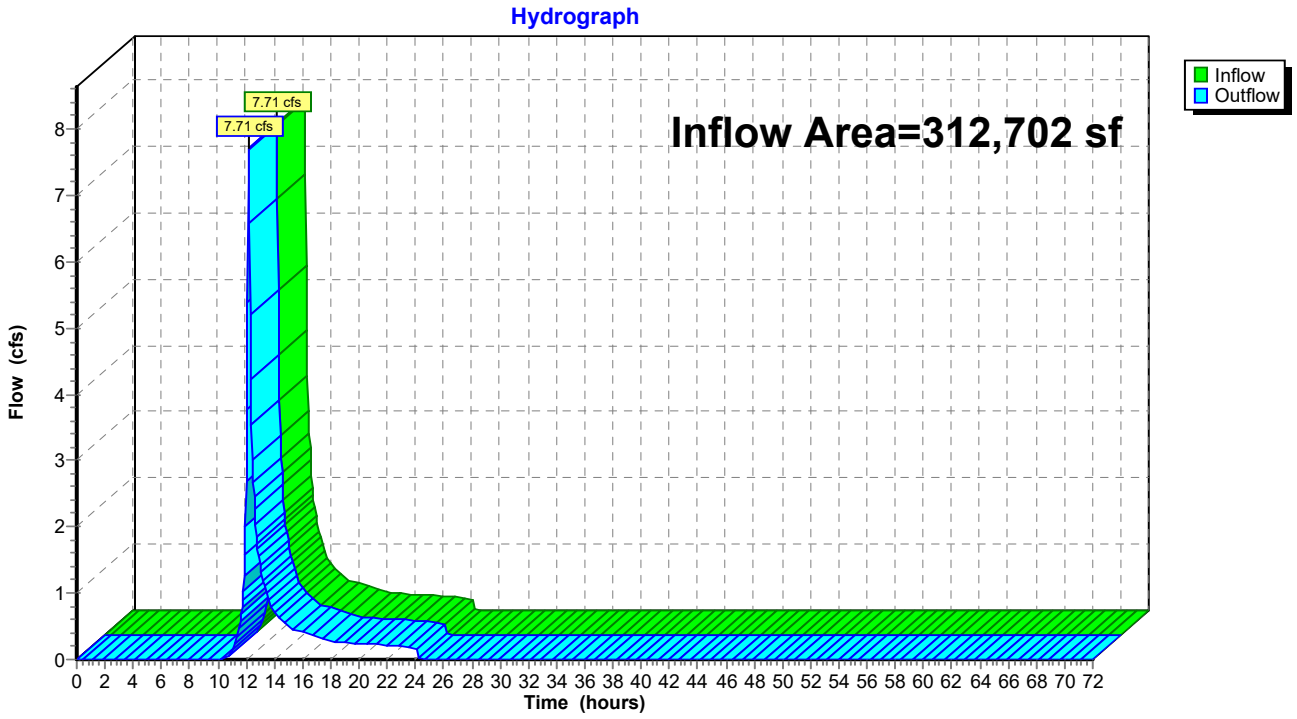
## Summary for Reach DP B: Concord Street Main

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

Inflow Area = 312,702 sf, 9.10% Impervious, Inflow Depth = 1.14" for 2-yr event
Inflow = 7.71 cfs @ 12.19 hrs, Volume= 29,643 cf
Outflow = 7.71 cfs @ 12.19 hrs, Volume= 29,643 cf, Atten= 0%, Lag= 0.0 min
Routed to Reach EX DP : EX SITE

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

### Reach DP B: Concord Street Main



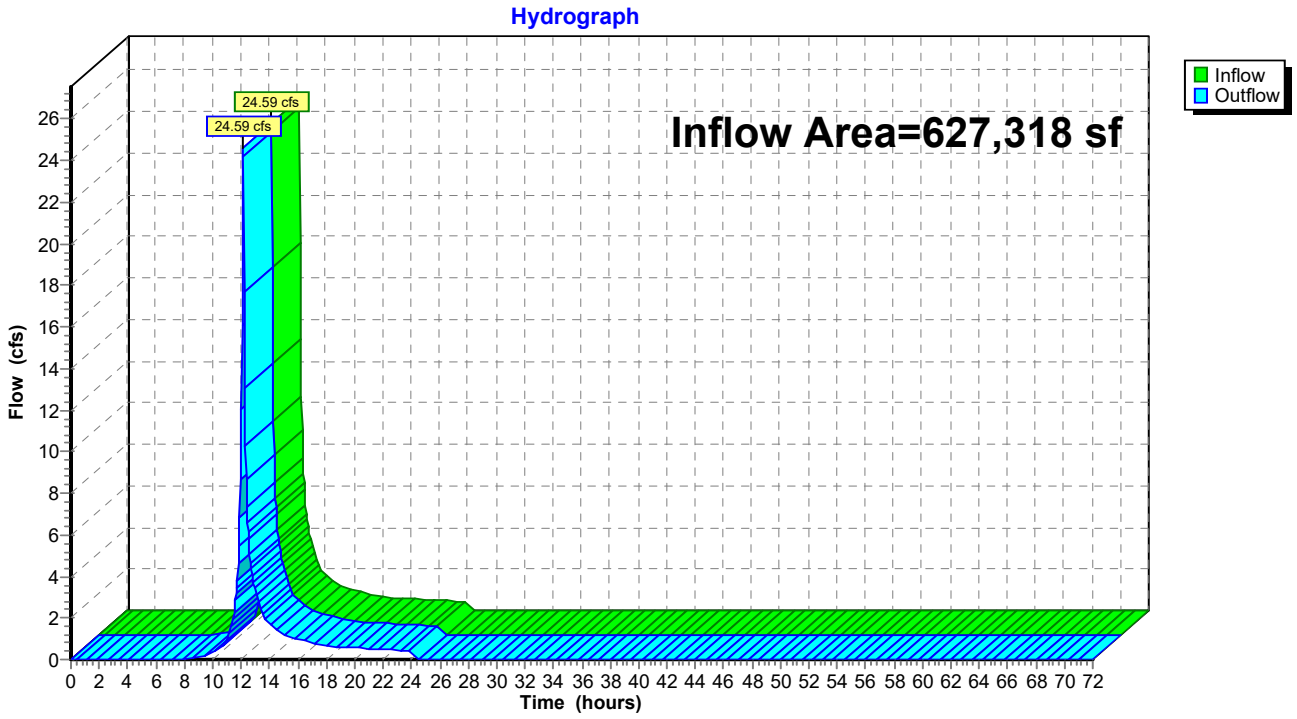
## Summary for Reach DP C1: Wetlands

[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
Routed to Reach EX DP : EX SITE

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

### Reach DP C1: Wetlands



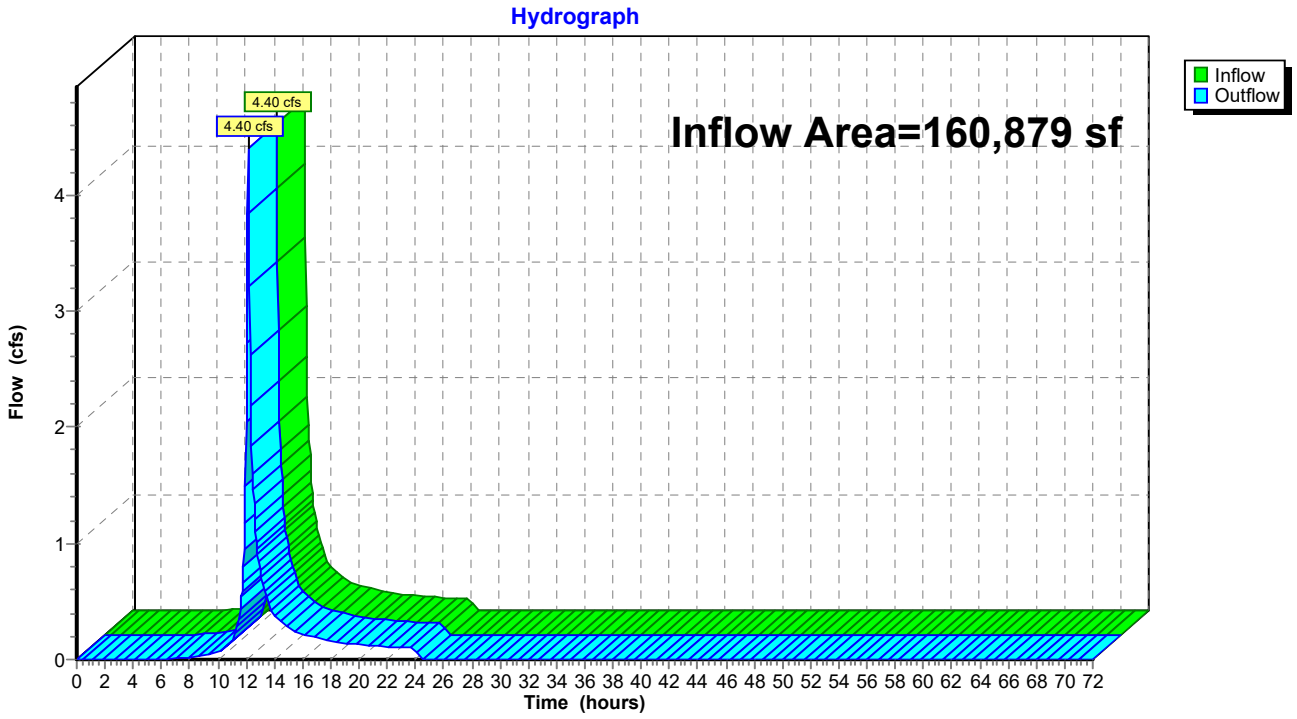
## Summary for Reach DP C2: Intermittent Stream

[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
Routed to Reach DP C1 : Wetlands

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

### Reach DP C2: Intermittent Stream



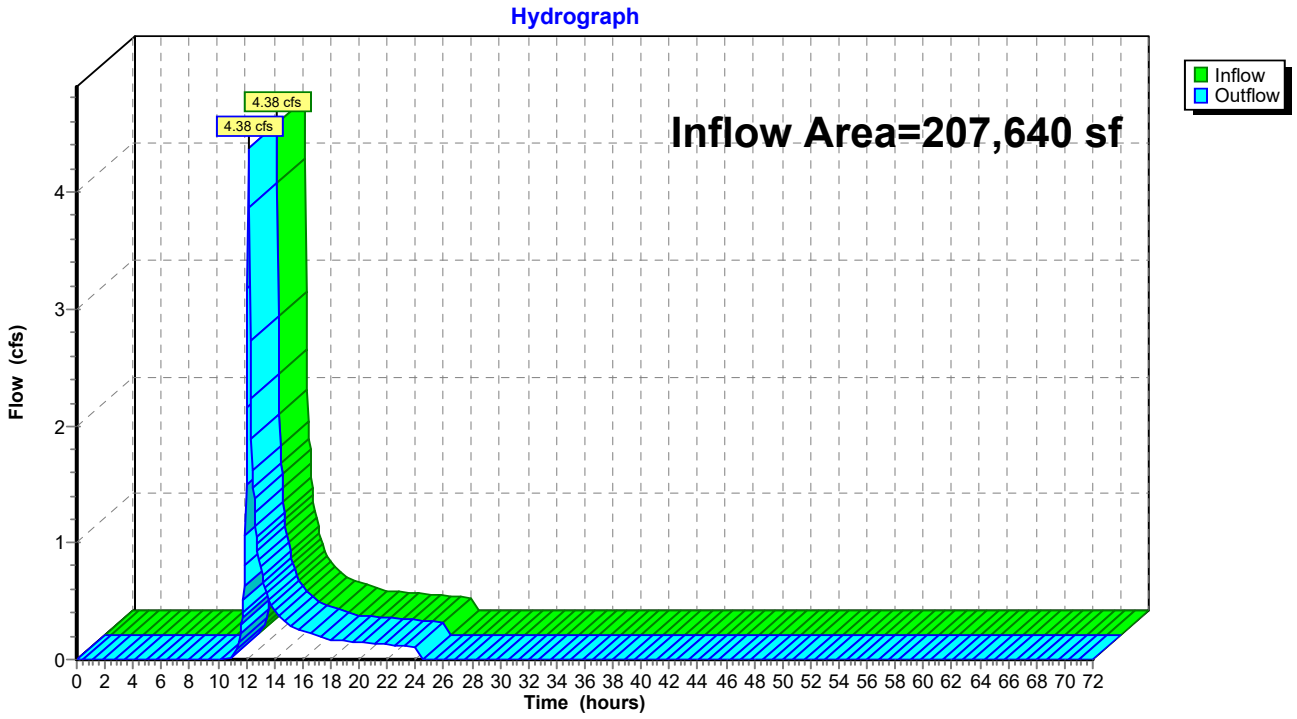
## Summary for Reach DPA: Intermittent Strem Eas

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

Inflow Area = 207,640 sf, 0.00% Impervious, Inflow Depth = 0.97" for 2-yr event
Inflow = 4.38 cfs @ 12.18 hrs, Volume= 16,778 cf
Outflow = 4.38 cfs @ 12.18 hrs, Volume= 16,778 cf, Atten= 0%, Lag= 0.0 min
Routed to Reach EX DP : EX SITE

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

### Reach DPA: Intermittent Strem Eas



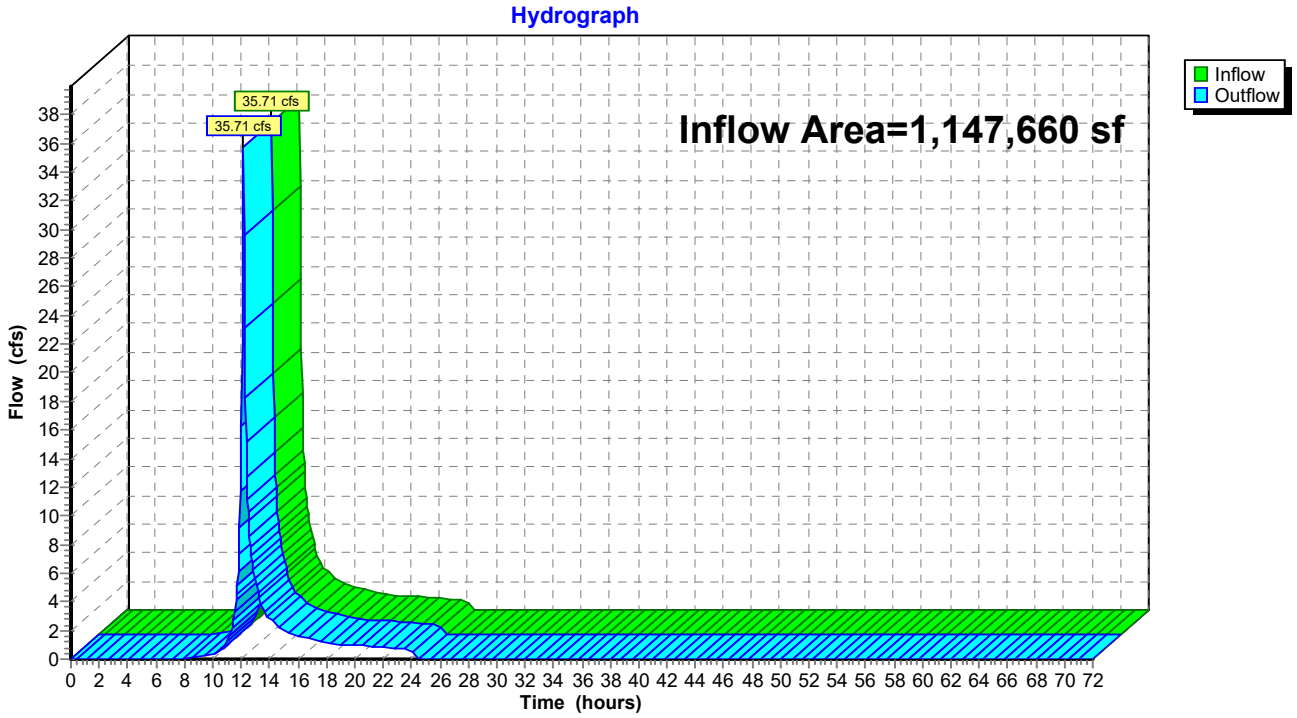
## Summary for Reach EX DP: EX SITE

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

Inflow Area = 1,147,660 sf, 19.74% Impervious, Inflow Depth = 1.34" for 2-yr event
Inflow = 35.71 cfs @ 12.15 hrs, Volume= 128,447 cf
Outflow = 35.71 cfs @ 12.15 hrs, Volume= 128,447 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



## Summary for Subcatchment EX 1: Wooded Area, Flelds

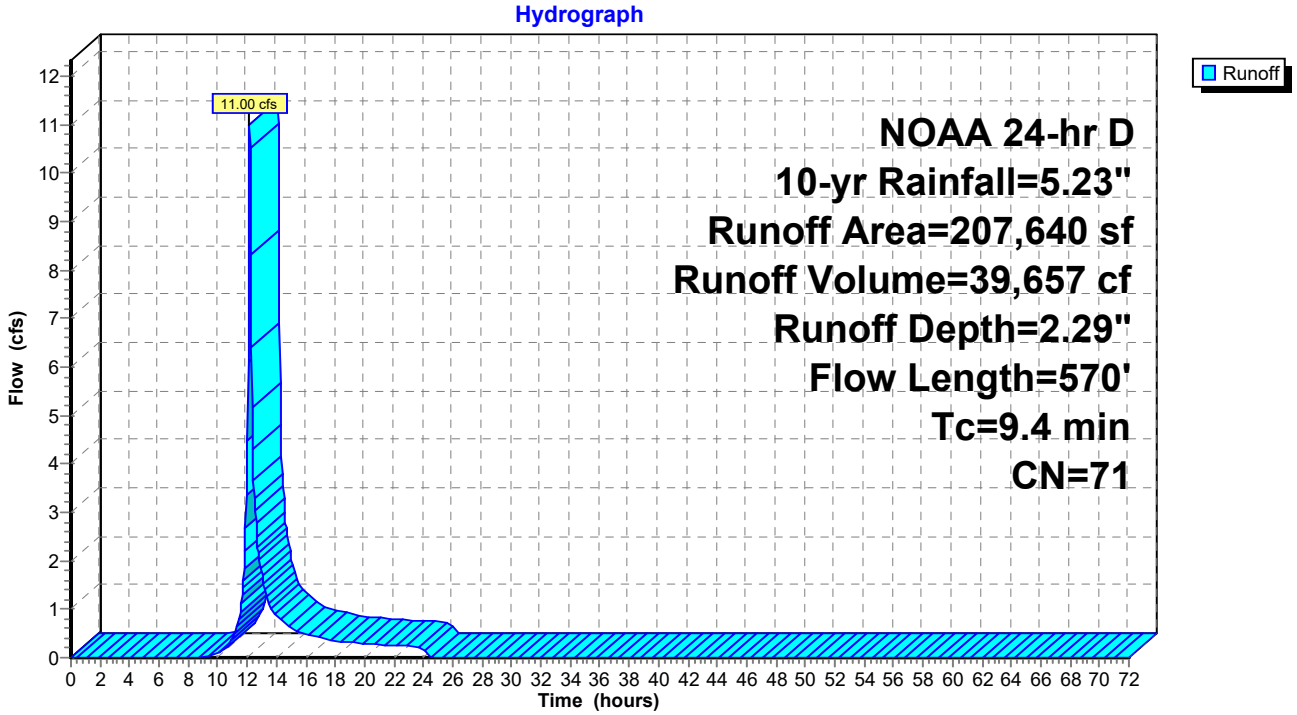
Runoff = 11.00 cfs @ 12.17 hrs, Volume= 39,657 cf, Depth= 2.29"
Routed to Reach DPA : Intermittent Strem Eas

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 |
| 132,241 | 70 | Woods, Good, HSG C |
| 207,640 | 71 | Weighted Average |
| 207,640 | | 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, Flelds, Building

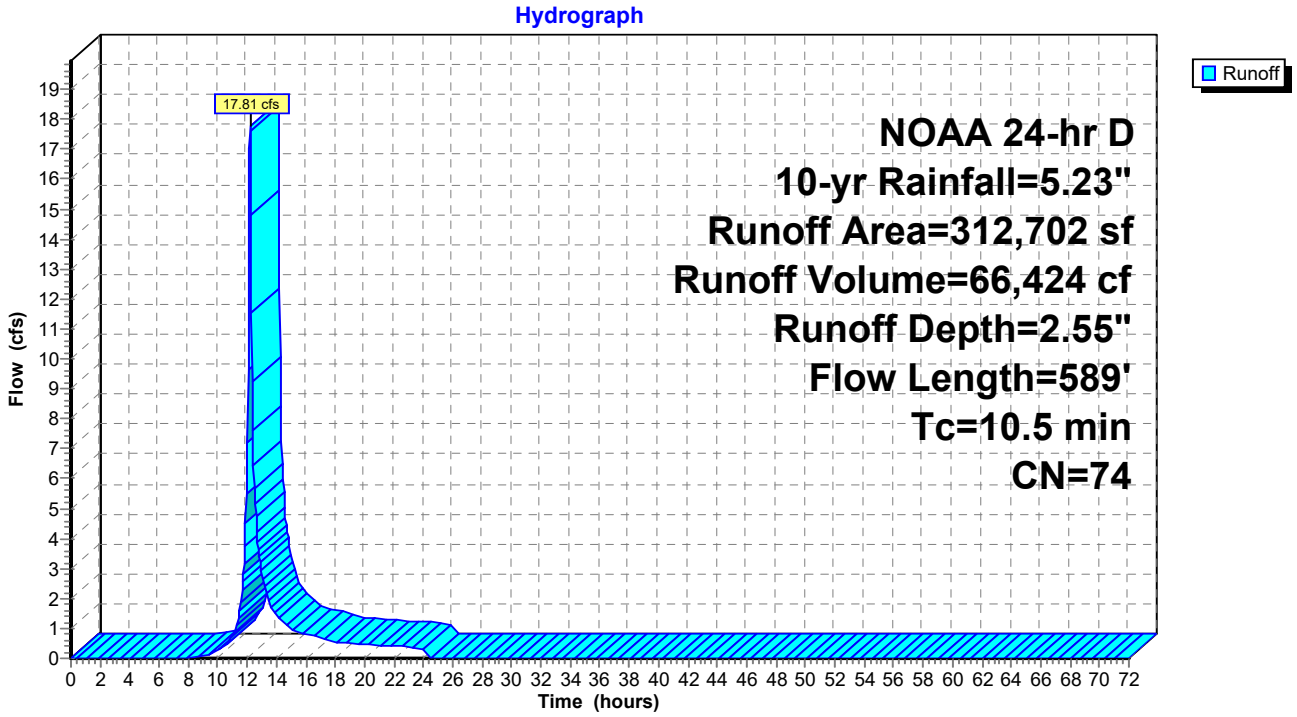
Runoff = 17.81 cfs @ 12.18 hrs, Volume= 66,424 cf, Depth= 2.55"
Routed to Reach DP B : Concord Street Main

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 |
| 145,303 | 70 | Woods, Good, HSG C |
| 312,702 | 74 | Weighted Average |
| 284,239 | | 90.90% Pervious Area |
| 28,463 | | 9.10% 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

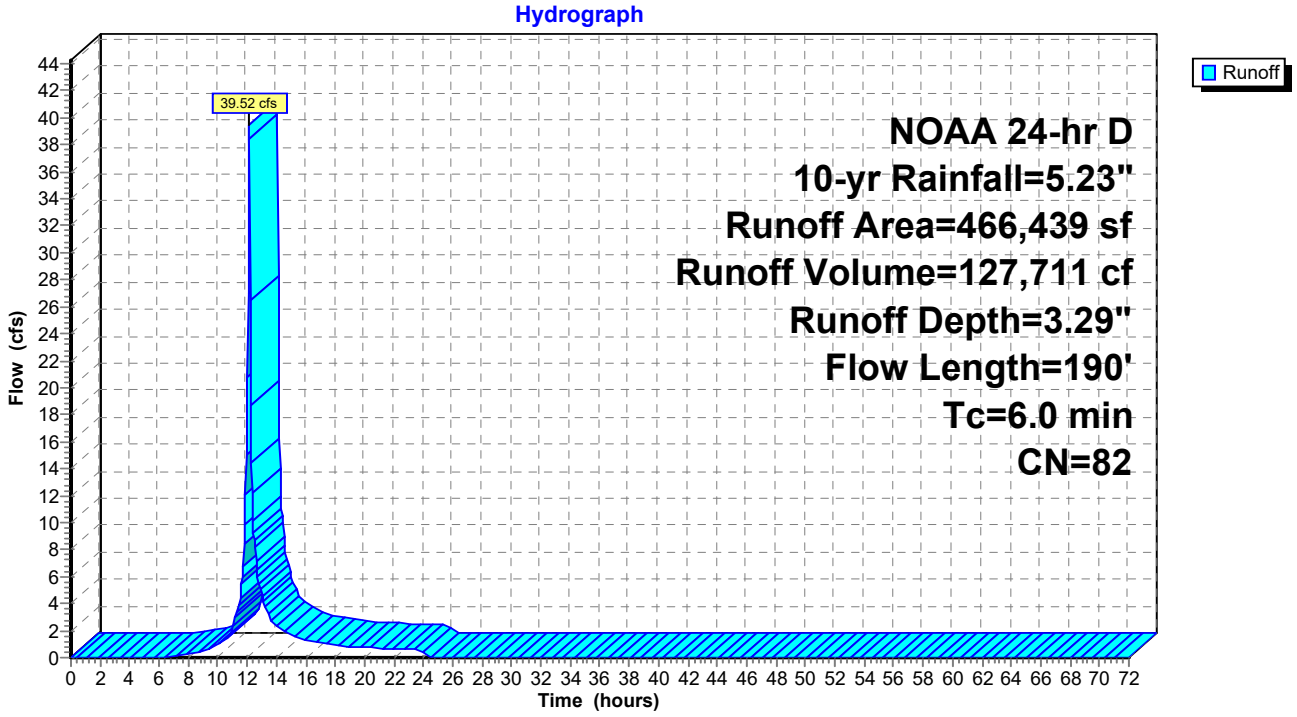
Runoff = 39.52 cfs @ 12.13 hrs, Volume= 127,711 cf, Depth= 3.29"
Routed to Reach DP C1 : Wetlands

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

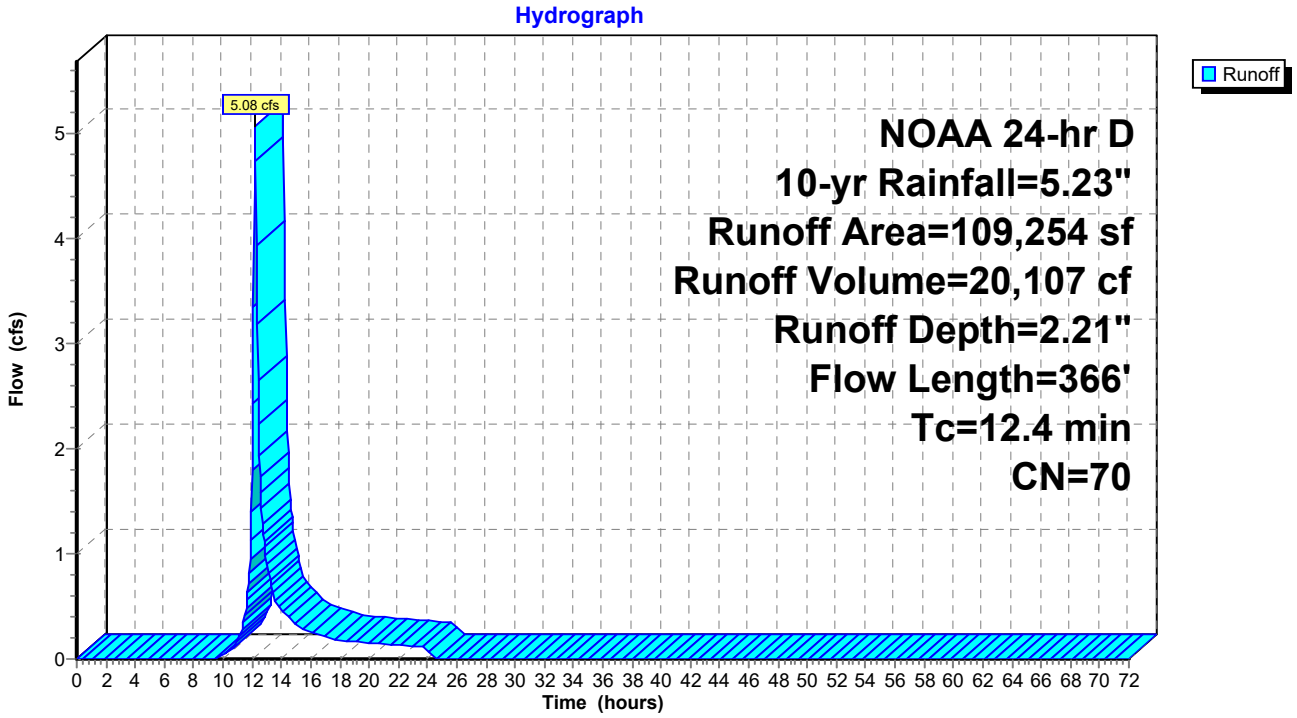
Runoff = 5.08 cfs @ 12.21 hrs, Volume= 20,107 cf, Depth= 2.21"
Routed to Reach DP C2 : Intermittent Stream

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

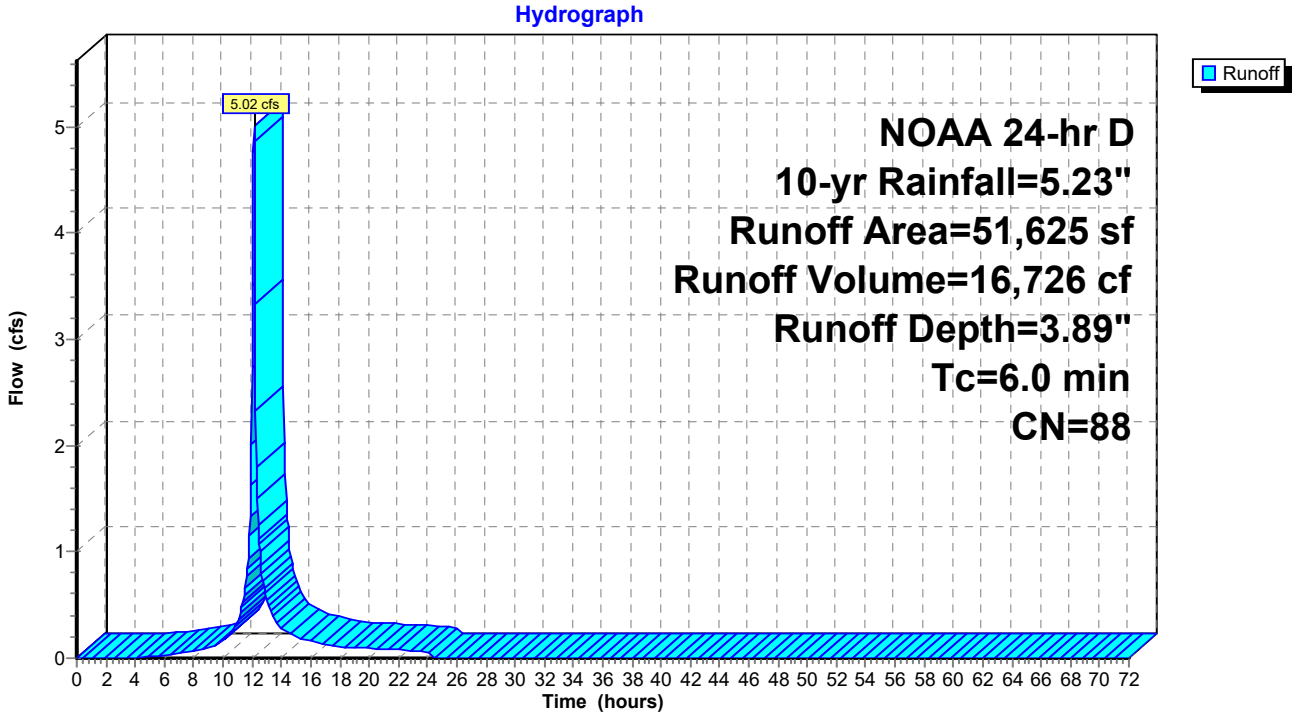
Runoff = 5.02 cfs @ 12.13 hrs, Volume= 16,726 cf, Depth= 3.89"
Routed to Reach DP C2 : Intermittent Stream

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



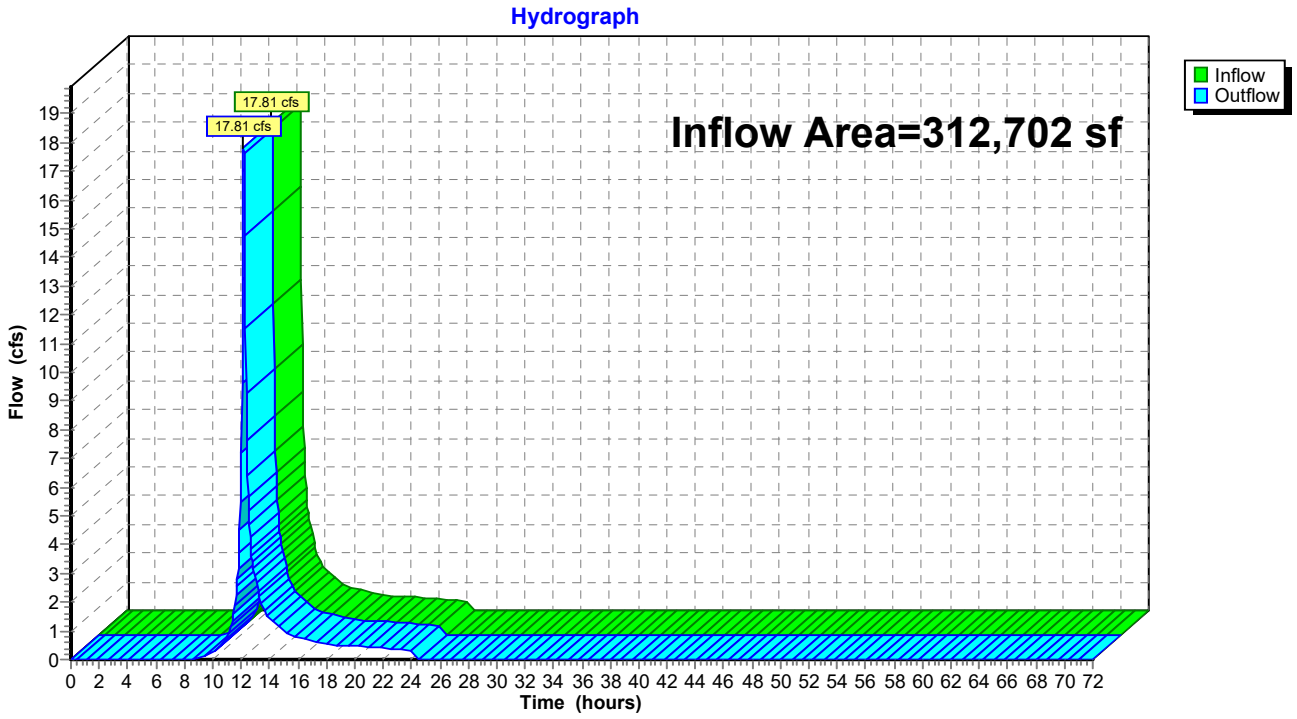
## Summary for Reach DP B: Concord Street Main

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

Inflow Area = 312,702 sf, 9.10% Impervious, Inflow Depth = 2.55" for 10-yr event
Inflow = 17.81 cfs @ 12.18 hrs, Volume= 66,424 cf
Outflow = 17.81 cfs @ 12.18 hrs, Volume= 66,424 cf, Atten= 0%, Lag= 0.0 min
Routed to Reach EX DP : EX SITE

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

### Reach DP B: Concord Street Main



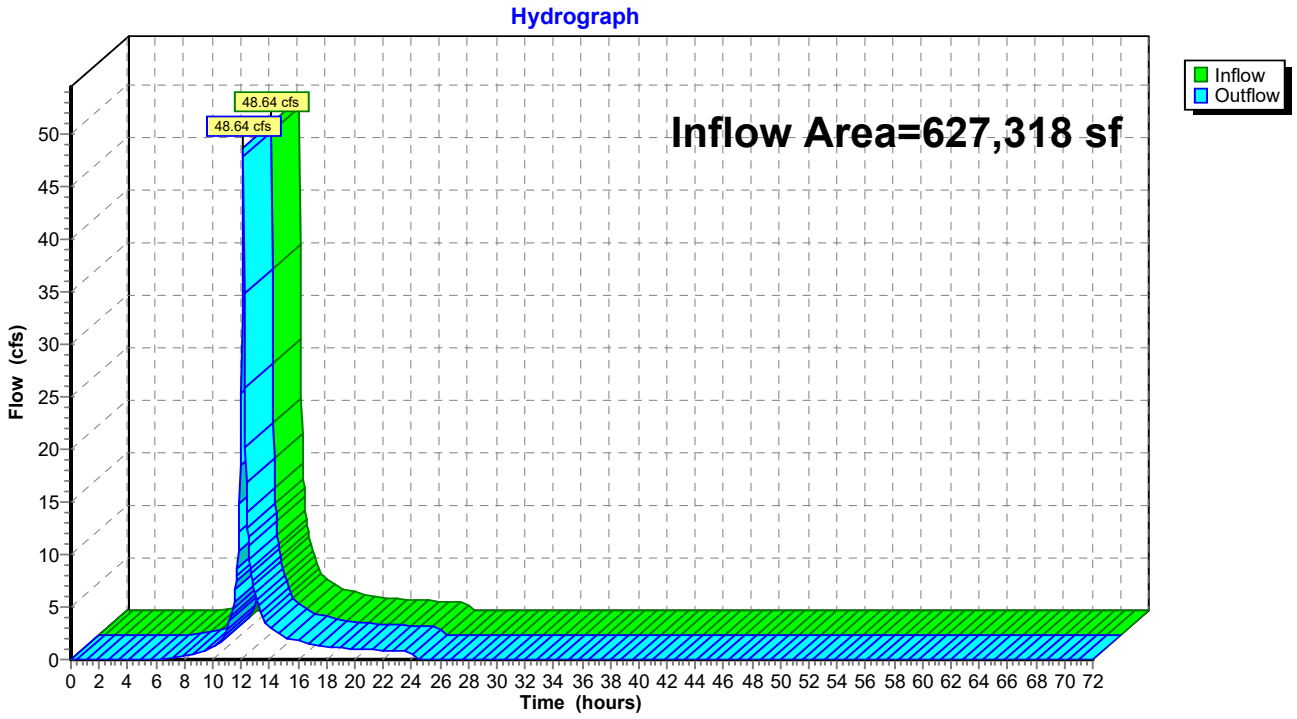
## Summary for Reach DP C1: Wetlands

[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
Routed to Reach EX DP : EX SITE

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

### Reach DP C1: Wetlands



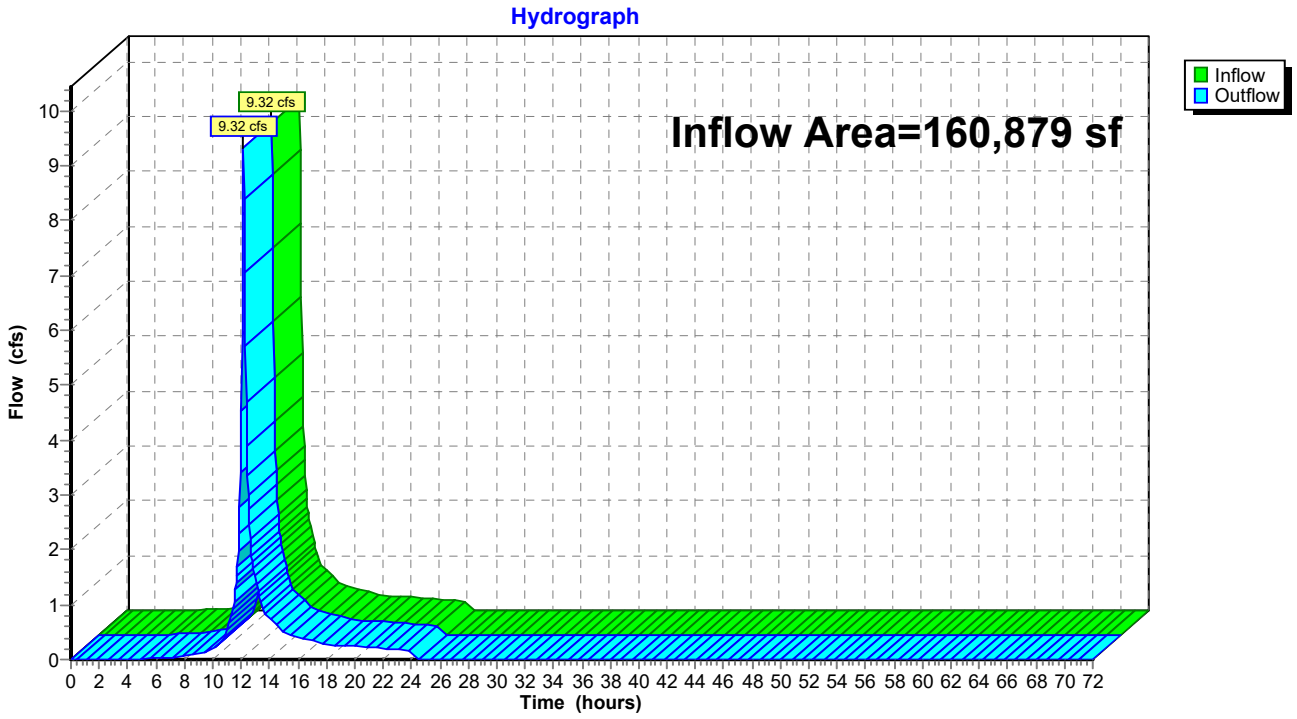
## Summary for Reach DP C2: Intermittent Stream

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

Inflow Area = 160,879 sf, 18.22% Impervious, Inflow Depth = 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
Routed to Reach DP C1 : Wetlands

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

### Reach DP C2: Intermittent Stream



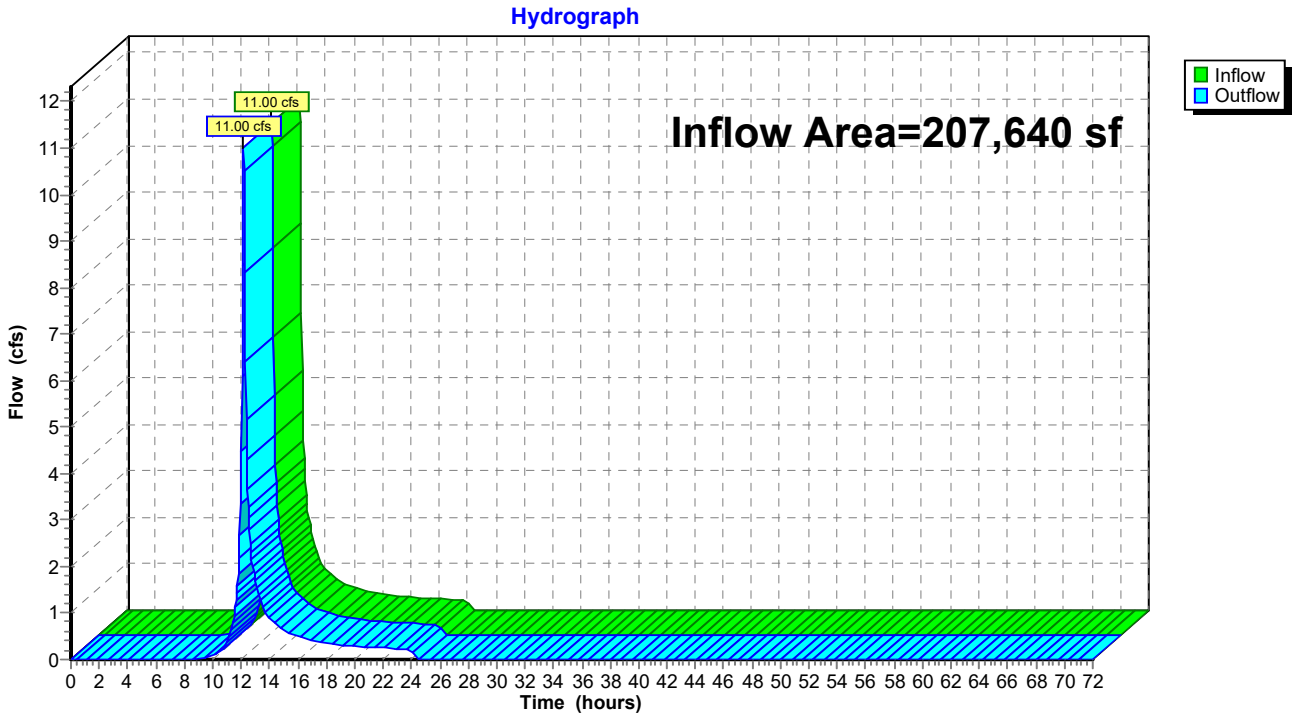
## Summary for Reach DPA: Intermittent Strem Eas

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

Inflow Area = 207,640 sf, 0.00% Impervious, Inflow Depth = 2.29" for 10-yr event
Inflow = 11.00 cfs @ 12.17 hrs, Volume= 39,657 cf
Outflow = 11.00 cfs @ 12.17 hrs, Volume= 39,657 cf, Atten= 0%, Lag= 0.0 min
Routed to Reach EX DP : EX SITE

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

### Reach DPA: Intermittent Strem Eas



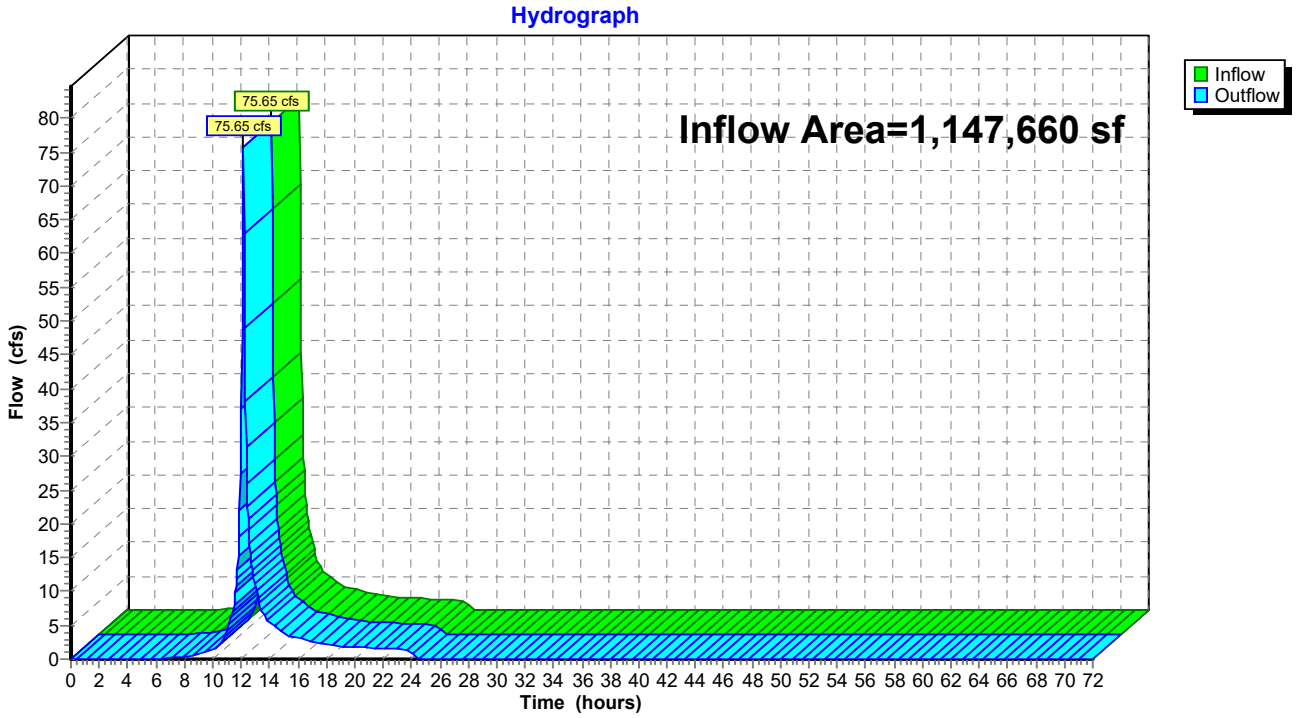
## Summary for Reach EX DP: EX SITE

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

Inflow Area = 1,147,660 sf, 19.74% Impervious, Inflow Depth = 2.83" for 10-yr event
Inflow = 75.65 cfs @ 12.15 hrs, Volume= 270,624 cf
Outflow = 75.65 cfs @ 12.15 hrs, Volume= 270,624 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



## Summary for Subcatchment EX 1: Wooded Area, Flelds

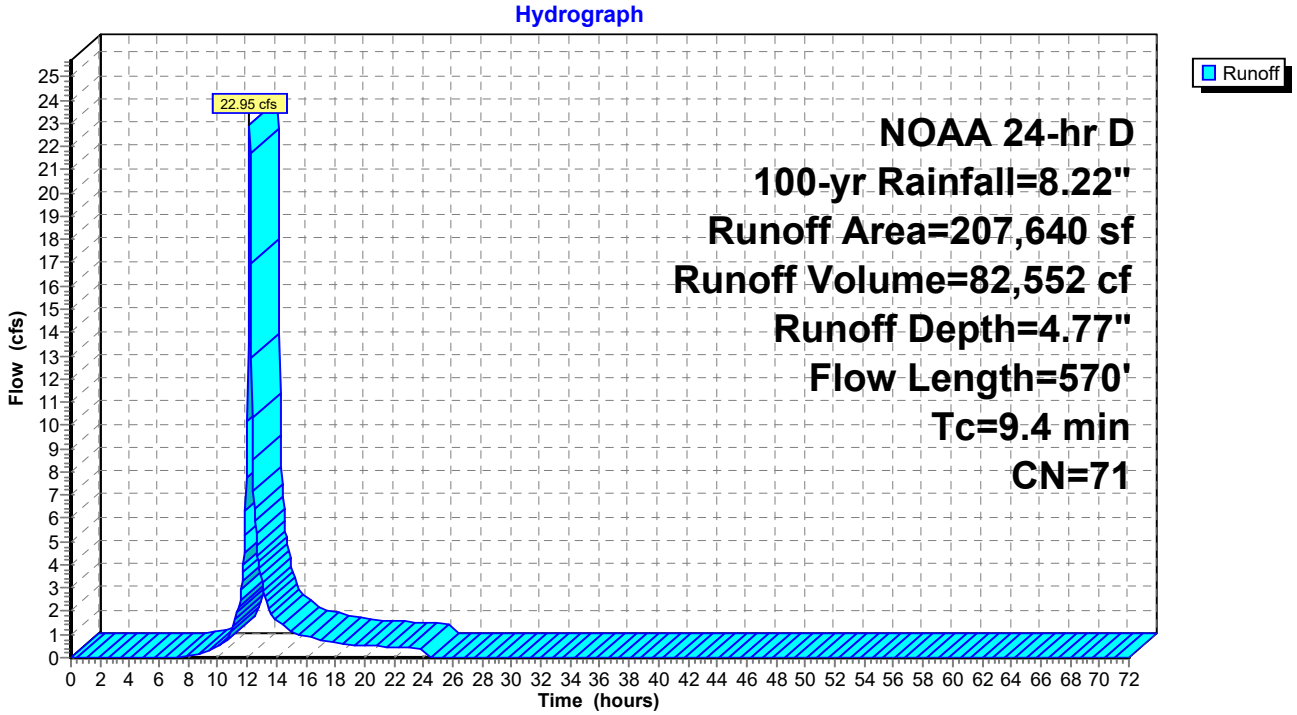
Runoff = 22.95 cfs @ 12.17 hrs, Volume= 82,552 cf, Depth= 4.77"
Routed to Reach DPA : Intermittent Strem Eas

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 |
| 132,241 | 70 | Woods, Good, HSG C |
| 207,640 | 71 | Weighted Average |
| 207,640 | | 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, Flelds, Building

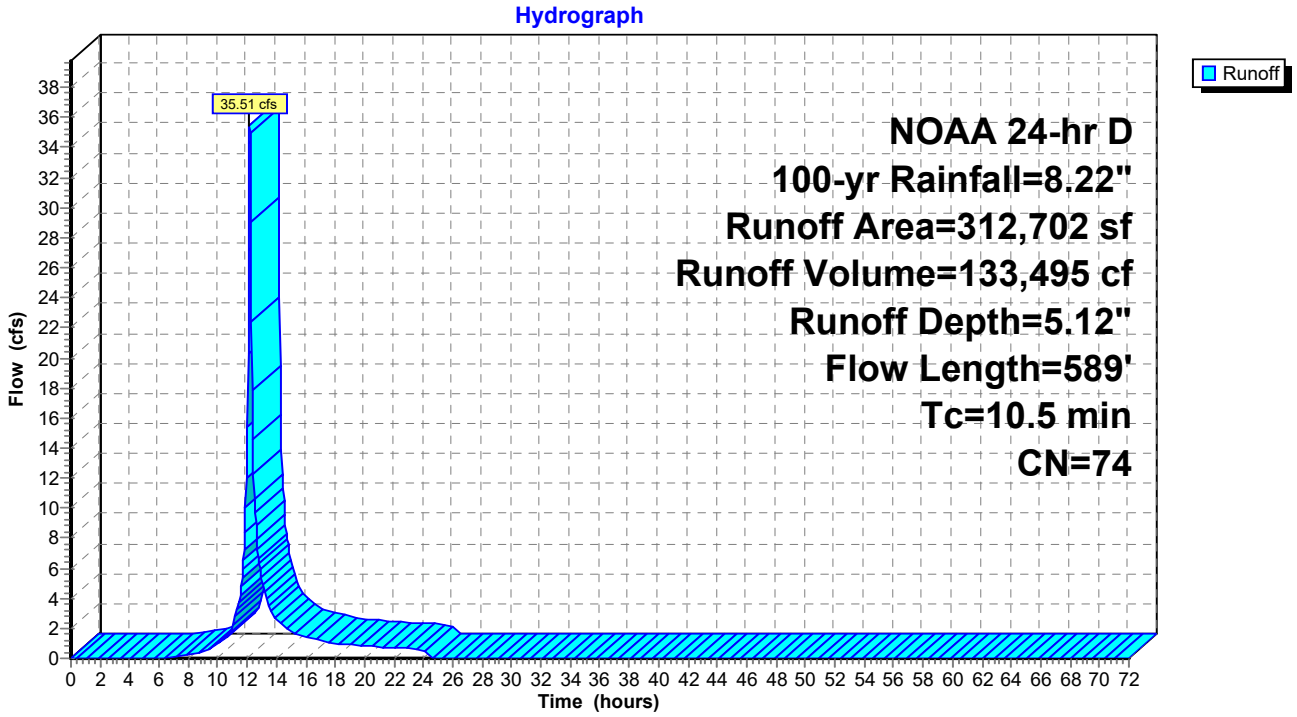
Runoff = 35.51 cfs @ 12.18 hrs, Volume= 133,495 cf, Depth= 5.12"
Routed to Reach DP B : Concord Street Main

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 |
| 145,303 | 70 | Woods, Good, HSG C |
| 312,702 | 74 | Weighted Average |
| 284,239 | | 90.90% Pervious Area |
| 28,463 | | 9.10% 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

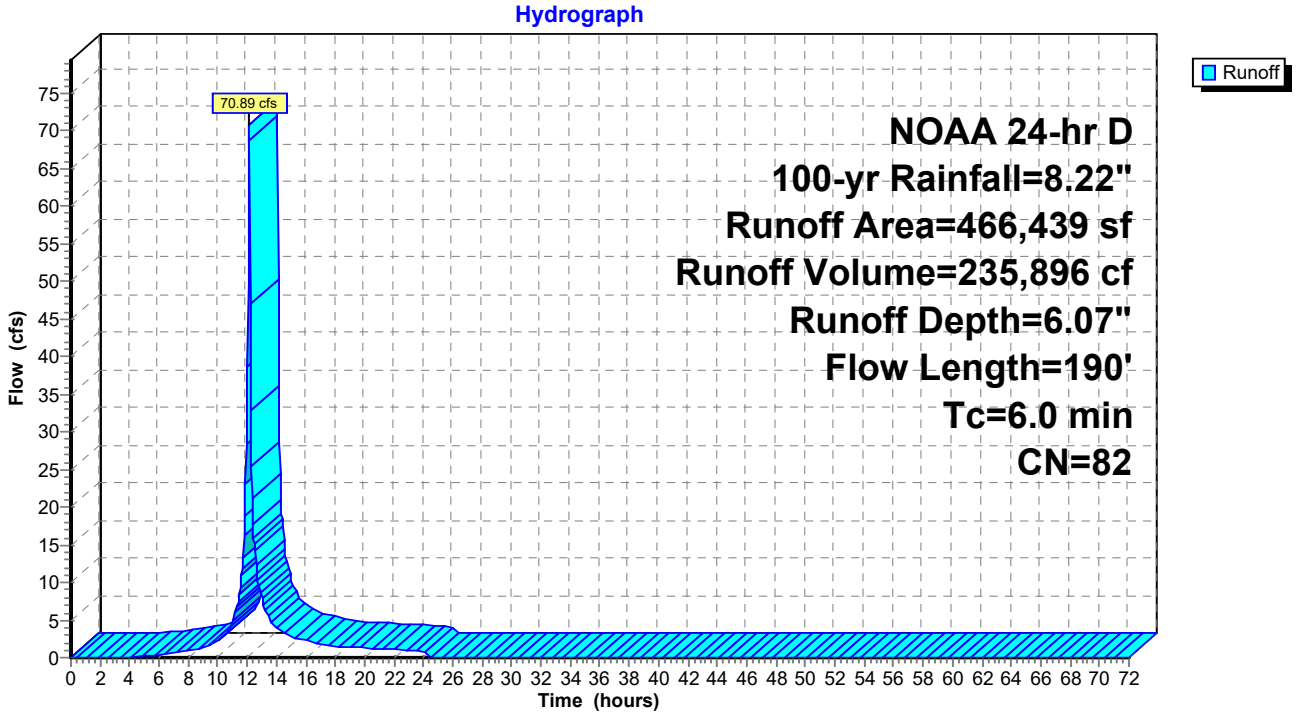
Runoff = 70.89 cfs @ 12.13 hrs, Volume= 235,896 cf, Depth= 6.07"
Routed to Reach DP C1 : Wetlands

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

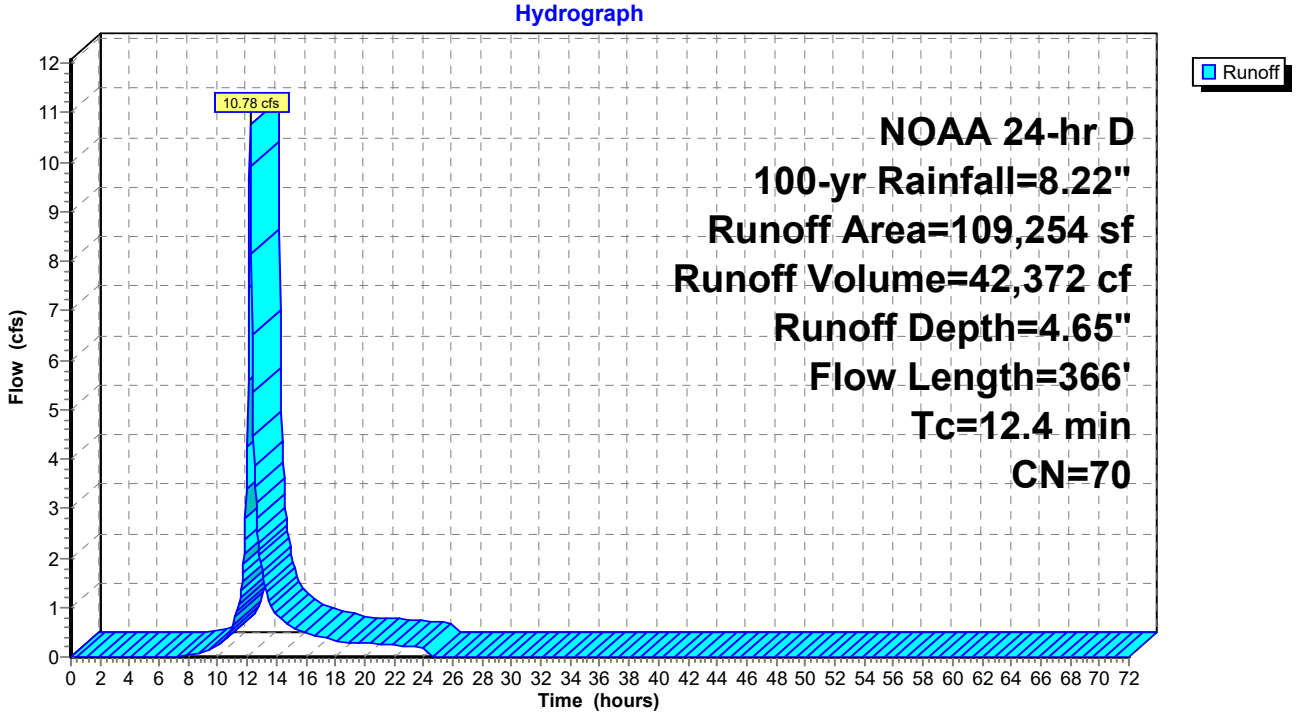
Runoff = 10.78 cfs @ 12.20 hrs, Volume= 42,372 cf, Depth= 4.65"
Routed to Reach DP C2 : Intermittent Stream

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

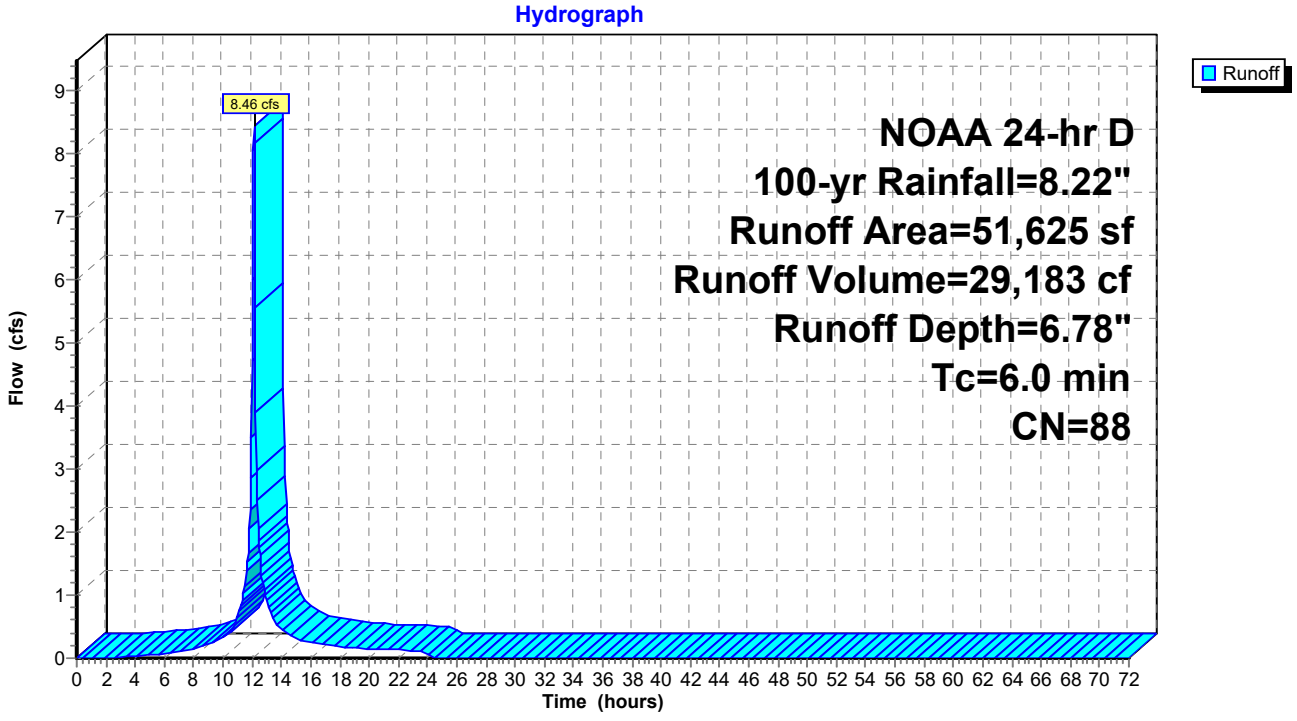
Runoff = 8.46 cfs @ 12.13 hrs, Volume= 29,183 cf, Depth= 6.78"
Routed to Reach DP C2 : Intermittent Stream

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



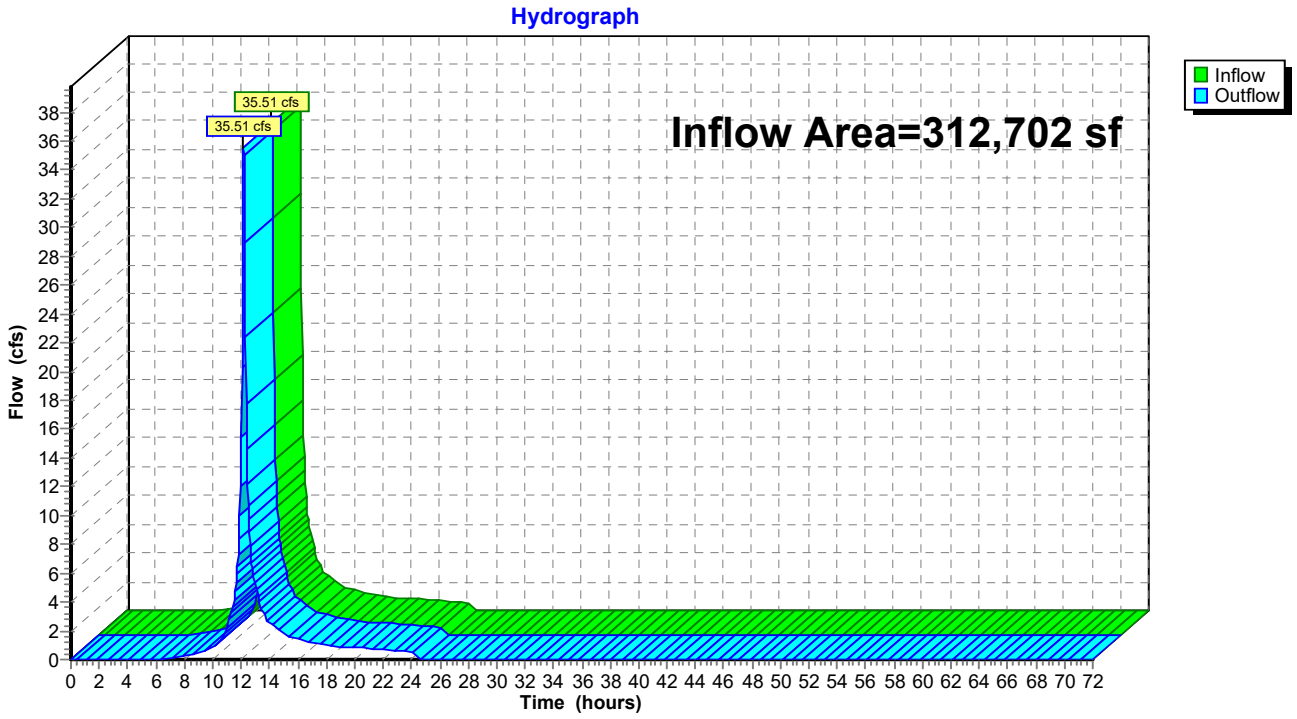
## Summary for Reach DP B: Concord Street Main

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

Inflow Area = 312,702 sf, 9.10% Impervious, Inflow Depth = 5.12" for 100-yr event
Inflow = 35.51 cfs @ 12.18 hrs, Volume= 133,495 cf
Outflow = 35.51 cfs @ 12.18 hrs, Volume= 133,495 cf, Atten= 0%, Lag= 0.0 min
Routed to Reach EX DP : EX SITE

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

### Reach DP B: Concord Street Main



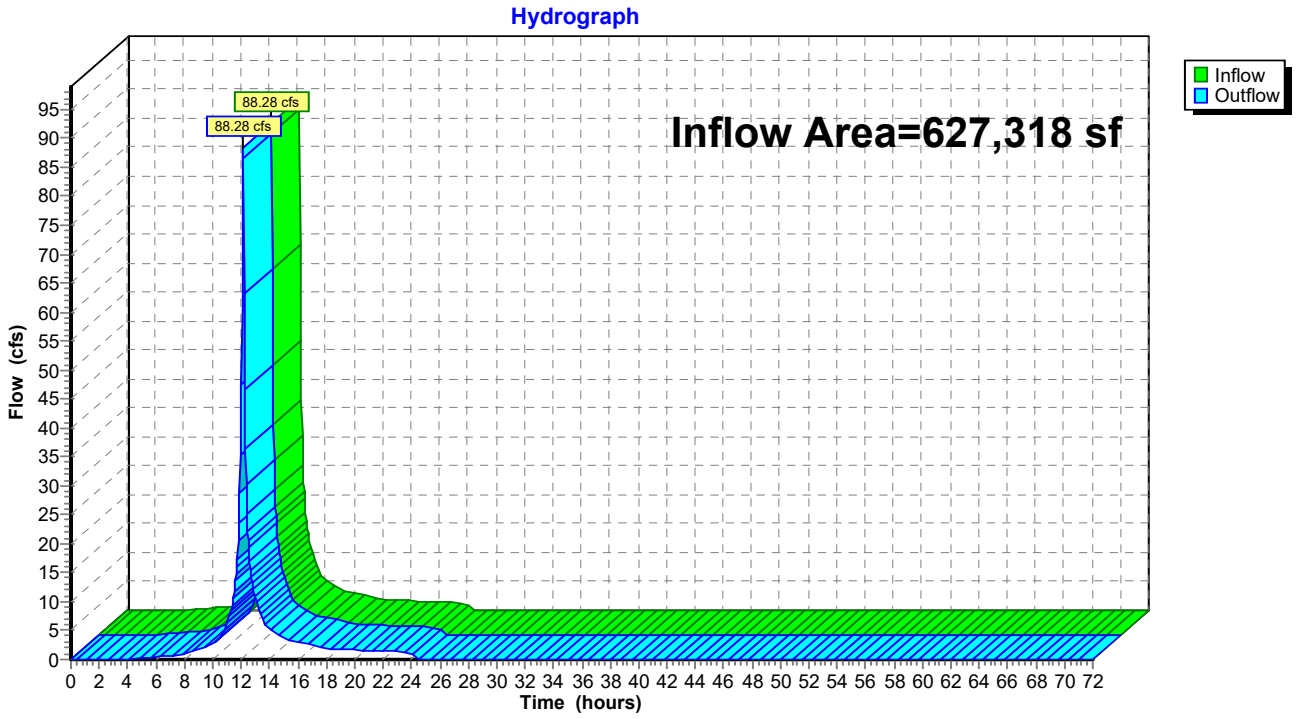
## Summary for Reach DP C1: Wetlands

[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
Routed to Reach EX DP : EX SITE

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

### Reach DP C1: Wetlands



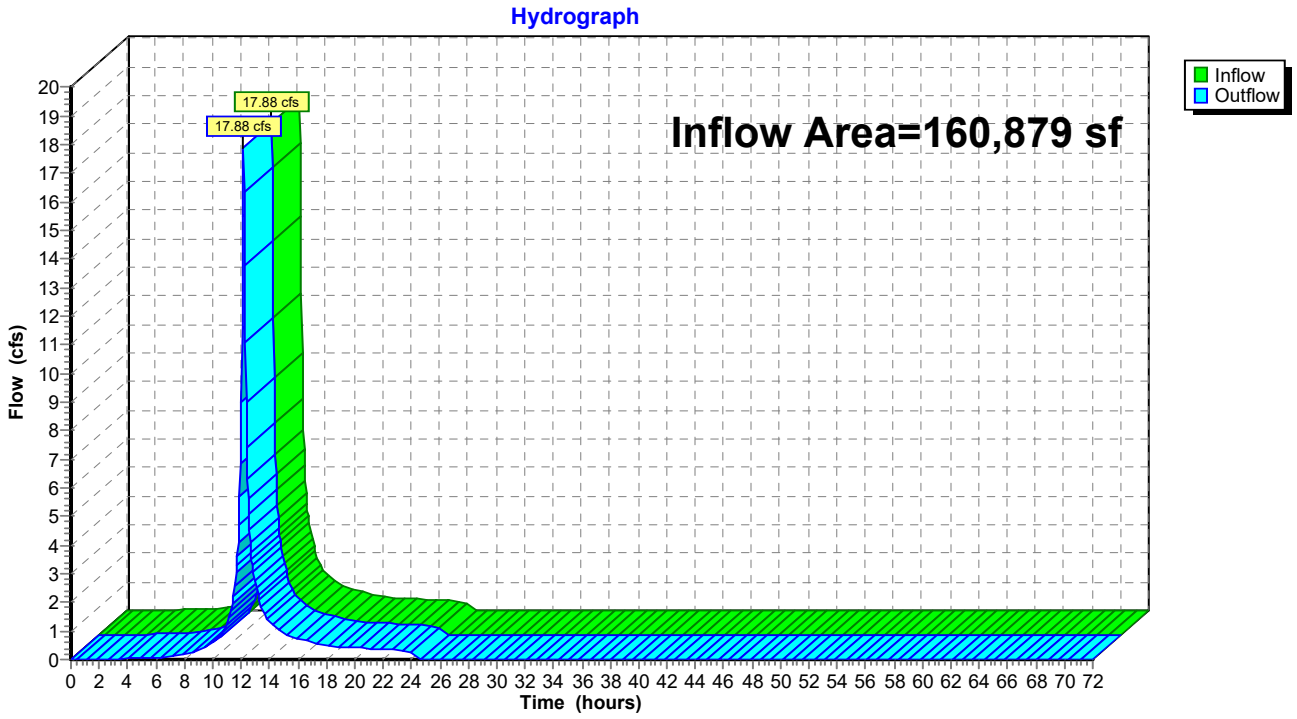
## Summary for Reach DP C2: Intermittent Stream

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

Inflow Area = 160,879 sf, 18.22% Impervious, Inflow Depth = 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
Routed to Reach DP C1 : Wetlands

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

### Reach DP C2: Intermittent Stream



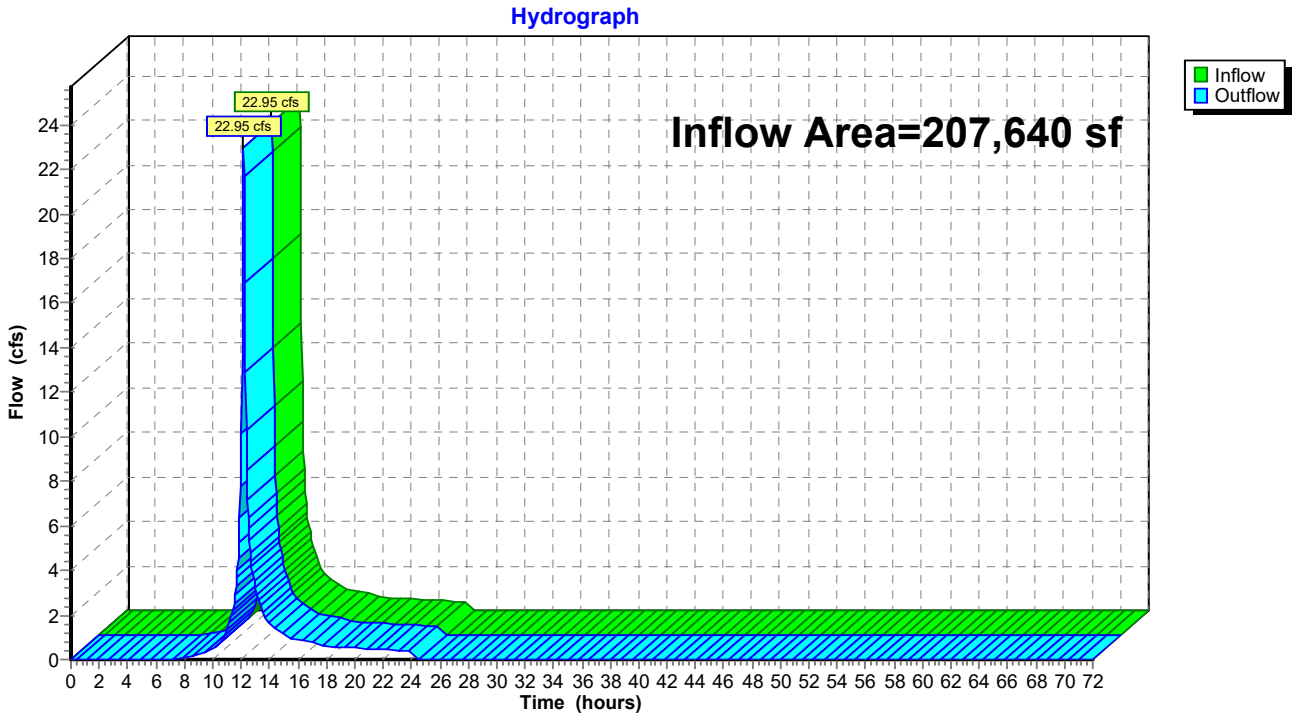
## Summary for Reach DPA: Intermittent Strem Eas

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

Inflow Area = 207,640 sf, 0.00% Impervious, Inflow Depth = 4.77" for 100-yr event
Inflow = 22.95 cfs @ 12.17 hrs, Volume= 82,552 cf
Outflow = 22.95 cfs @ 12.17 hrs, Volume= 82,552 cf, Atten= 0%, Lag= 0.0 min
Routed to Reach EX DP : EX SITE

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

## Reach DPA: Intermittent Strem Eas



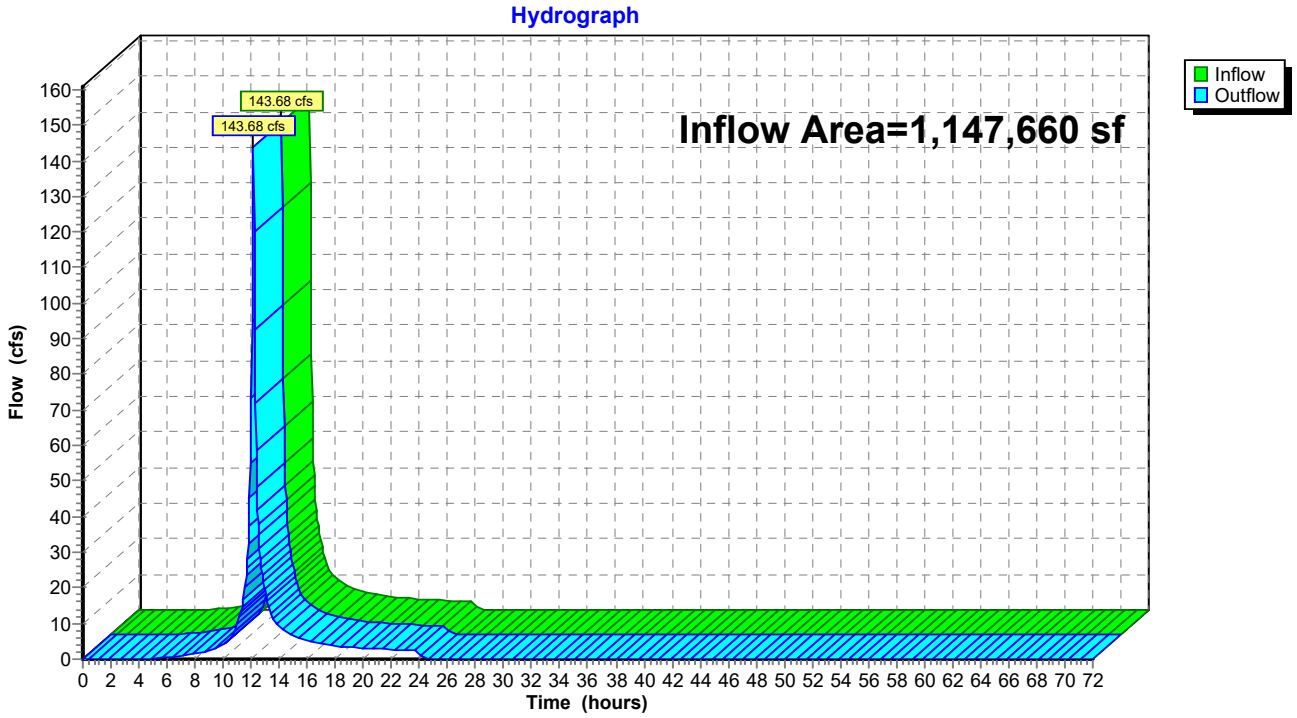
## Summary for Reach EX DP: EX SITE

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

Inflow Area = 1,147,660 sf, 19.74% Impervious, Inflow Depth = 5.47" for 100-yr event
Inflow = 143.68 cfs @ 12.14 hrs, Volume= 523,498 cf
Outflow = 143.68 cfs @ 12.14 hrs, Volume= 523,498 cf, Atten= 0%, Lag= 0.0 min

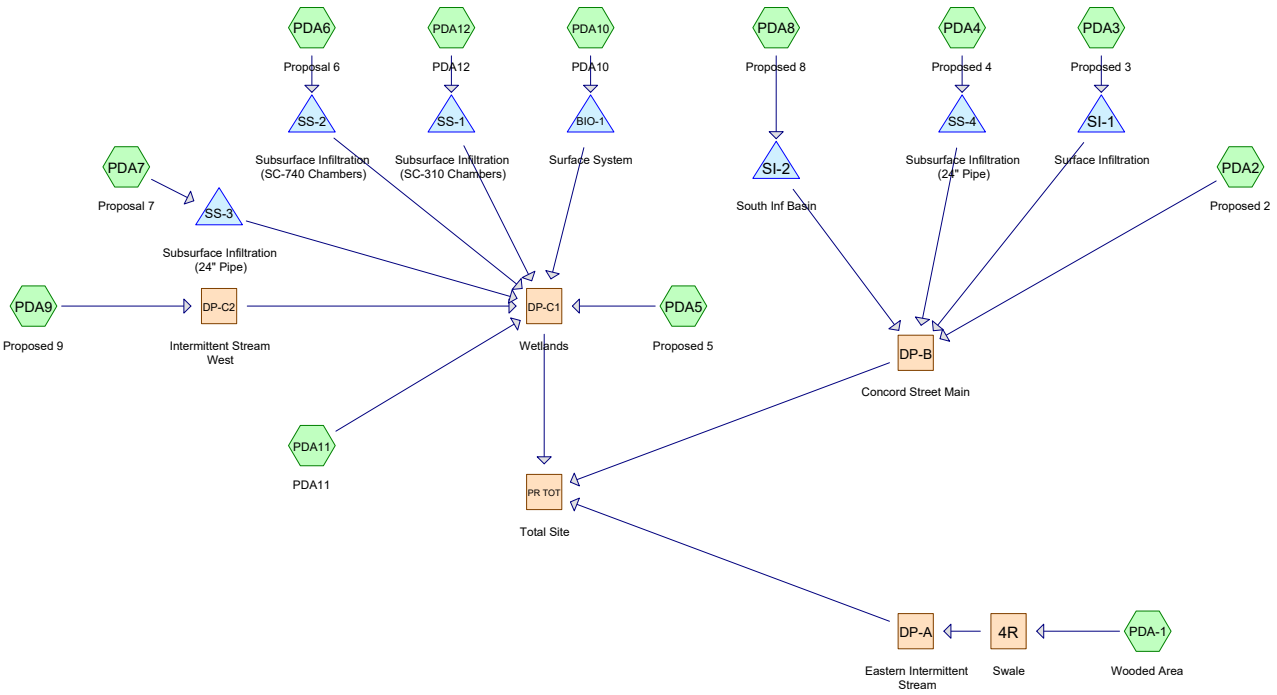
Routing by Stor-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

## Reach EX DP: EX SITE



## APPENDIX C

## Post-Development Conditions – HydroCAD Calculations




Subcat Reach Pond Link

**Routing Diagram for Mindess - Proposed Conditions**

Prepared by {enter your company name here}, Printed 6/24/2022

HydroCAD® 10.10-7a s/n 00546 © 2021 HydroCAD Software Solutions LLC

## Area Listing (selected nodes)

| Area (sq-ft) | CN | Description (subcatchment-numbers) |
|---|---|---|
| 451,058 | 74 | >75% Grass cover, Good, HSG C (PDA-1, PDA10, PDA11, PDA12, PDA2, PDA3, PDA4, PDA5, PDA6, PDA7, PDA8, PDA9) |
| 49,325 | 98 | Paved Parking and Walkways, HSG C (PDA10) |
| 207,886 | 98 | Paved parking, HSG C (PDA11, PDA12, PDA2, PDA3, PDA6, PDA7, PDA8) |
| 17,739 | 98 | Paved roads w/curbs & sewers, HSG C (PDA4) |
| 35,348 | 98 | Pond (PDA5) |
| 68,382 | 98 | Roofs, HSG C (PDA10, PDA4, PDA7) |
| 317,922 | 70 | Woods, Good, HSG C (PDA-1, PDA5, PDA7, PDA9) |
| **1,147,660** | **81** | **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=169,240 sf 0.00% Impervious Runoff Depth=0.01"
Flow Length=642' Tc=9.3 min CN=71 Runoff=0.00 cfs 111 cf

**Subcatchment PDA10: PDA10** Runoff Area=112,914 sf 68.00% Impervious Runoff Depth=0.32"
Tc=6.0 min CN=90 Runoff=0.92 cfs 3,013 cf

**Subcatchment PDA11: PDA11** Runoff Area=25,873 sf 62.02% Impervious Runoff Depth=0.28"
Tc=6.0 min CN=89 Runoff=0.18 cfs 614 cf

**Subcatchment PDA12: PDA12** Runoff Area=145,461 sf 28.75% Impervious Runoff Depth=0.10"
Tc=6.0 min CN=81 Runoff=0.17 cfs 1,188 cf

**Subcatchment PDA2: Proposed 2** Runoff Area=72,814 sf 59.44% Impervious Runoff Depth=0.25"
Tc=6.0 min CN=88 Runoff=0.45 cfs 1,535 cf

**Subcatchment PDA3: Proposed 3** Runoff Area=33,480 sf 57.85% Impervious Runoff Depth=0.25"
Tc=6.0 min CN=88 Runoff=0.21 cfs 706 cf

**Subcatchment PDA4: Proposed 4** Runoff Area=54,076 sf 49.32% Impervious Runoff Depth=0.20"
Tc=6.0 min CN=86 Runoff=0.24 cfs 890 cf

**Subcatchment PDA5: Proposed 5** Runoff Area=168,248 sf 21.01% Impervious Runoff Depth=0.06"
Tc=6.0 min CN=78 Runoff=0.05 cfs 818 cf

**Subcatchment PDA6: Proposal 6** Runoff Area=10,629 sf 58.03% Impervious Runoff Depth=0.25"
Tc=6.0 min CN=88 Runoff=0.07 cfs 224 cf

**Subcatchment PDA7: Proposal 7** Runoff Area=161,157 sf 31.93% Impervious Runoff Depth=0.10"
Tc=6.0 min CN=81 Runoff=0.19 cfs 1,316 cf

**Subcatchment PDA8: Proposed 8** Runoff Area=79,806 sf 77.39% Impervious Runoff Depth=0.45"
Tc=6.0 min CN=93 Runoff=0.94 cfs 2,995 cf

**Subcatchment PDA9: Proposed 9** Runoff Area=113,962 sf 0.00% Impervious Runoff Depth=0.00"
Flow Length=366' Tc=12.4 min CN=70 Runoff=0.00 cfs 44 cf

**Reach 4R: Swale** Avg. Flow Depth=0.00' Max Vel=0.00 fps Inflow=0.00 cfs 0 cf
n=0.022 L=726.0' S=0.0069 '/' Capacity=49.00 cfs Outflow=0.00 cfs 0 cf

**Reach DP-A: Eastern Intermittent Stream** Inflow=0.00 cfs 0 cf
Outflow=0.00 cfs 0 cf

**Reach DP-B: Concord Street Main** Inflow=0.45 cfs 1,535 cf
Outflow=0.45 cfs 1,535 cf

**Reach DP-C1: Wetlands** Inflow=0.19 cfs 1,476 cf
Outflow=0.19 cfs 1,476 cf

**Reach DP-C2: Intermittent Stream West** Inflow=0.00 cfs 44 cf
Outflow=0.00 cfs 44 cf

**Reach PR TOT: Total Site** Inflow=0.64 cfs 3,011 cf
Outflow=0.64 cfs 3,011 cf

**Pond BIO-1: Surface System** Peak Elev=193.98' Storage=1,785 cf Inflow=0.92 cfs 3,013 cf
Discarded=0.03 cfs 3,014 cf Primary=0.00 cfs 0 cf Outflow=0.03 cfs 3,014 cf

**Pond SI-1: Surface Infiltration** Peak Elev=200.06' Storage=226 cf Inflow=0.21 cfs 706 cf
Discarded=0.02 cfs 706 cf Primary=0.00 cfs 0 cf Outflow=0.02 cfs 706 cf

**Pond SI-2: South Inf Basin** Peak Elev=194.17' Storage=2,040 cf Inflow=0.94 cfs 2,995 cf
Discarded=0.02 cfs 2,995 cf Primary=0.00 cfs 0 cf Outflow=0.02 cfs 2,995 cf

**Pond SS-1: Subsurface Infiltration (SC-310** Peak Elev=184.08' Storage=218 cf Inflow=0.17 cfs 1,188 cf
Discarded=0.04 cfs 1,188 cf Primary=0.00 cfs 0 cf Outflow=0.04 cfs 1,188 cf

**Pond SS-2: Subsurface Infiltration (SC-740** Peak Elev=186.08' Storage=60 cf Inflow=0.07 cfs 224 cf
Discarded=0.01 cfs 224 cf Primary=0.00 cfs 0 cf Outflow=0.01 cfs 224 cf

**Pond SS-3: Subsurface Infiltration (24" Pipe)** Peak Elev=193.54' Storage=168 cf Inflow=0.19 cfs 1,316 cf
Discarded=0.07 cfs 1,316 cf Primary=0.00 cfs 0 cf Outflow=0.07 cfs 1,316 cf

**Pond SS-4: Subsurface Infiltration (24" Pipe)** Peak Elev=200.29' Storage=224 cf Inflow=0.24 cfs 890 cf
Discarded=0.04 cfs 890 cf Primary=0.00 cfs 0 cf Outflow=0.04 cfs 890 cf

**Total Runoff Area = 1,147,660 sf Runoff Volume = 13,454 cf Average Runoff Depth = 0.14"**
**67.00% Pervious = 768,980 sf 33.00% Impervious = 378,680 sf**

## Summary for Subcatchment PDA-1: Wooded Area

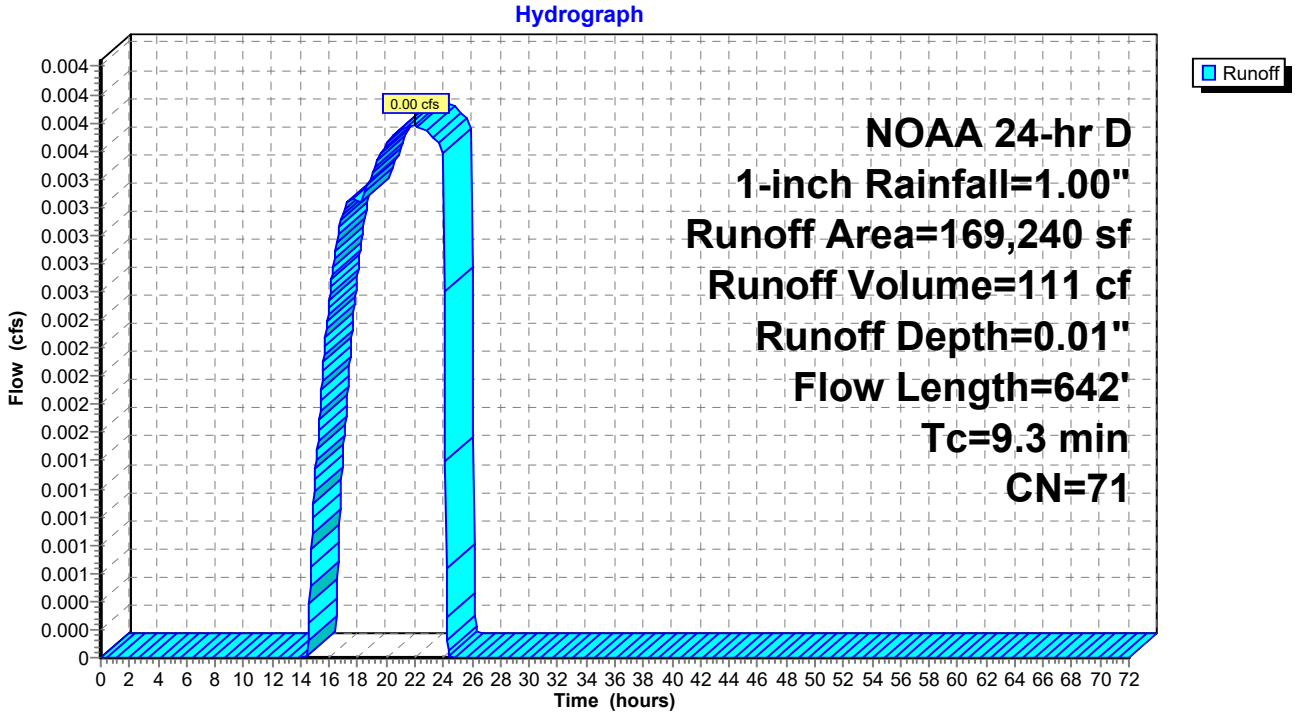
Runoff = 0.00 cfs @ 22.00 hrs, Volume= 111 cf, Depth= 0.01"
Routed to Reach 4R : Swale

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 1-inch Rainfall=1.00"

| Area (sf) | CN | Description |
|---|---|---|
| 33,190 | 74 | >75% Grass cover, Good, HSG C |
| 136,050 | 70 | Woods, Good, HSG C |
| 169,240 | 71 | Weighted Average |
| 169,240 | | 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

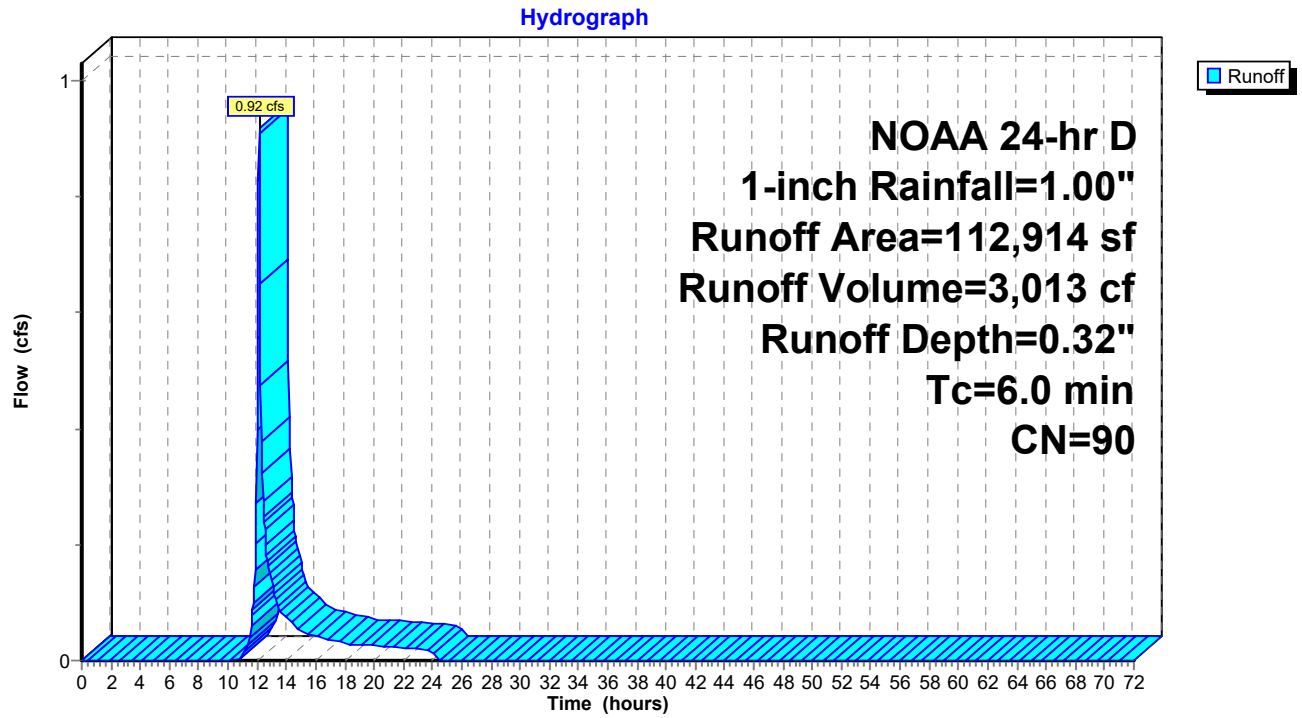
Runoff = 0.92 cfs @ 12.14 hrs, Volume= 3,013 cf, Depth= 0.32"
Routed to Pond BIO-1 : Surface System

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 1-inch Rainfall=1.00"

| | Area (sf) | CN | Description |
|---|---|---|---|
| | 36,136 | 74 | >75% Grass cover, Good, HSG C |
| | 27,453 | 98 | Roofs, HSG C |
| * | 49,325 | 98 | Paved Parking and Walkways, HSG C |
| | 112,914 | 90 | Weighted Average |
| | 36,136 | | 32.00% Pervious Area |
| | 76,778 | | 68.00% 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

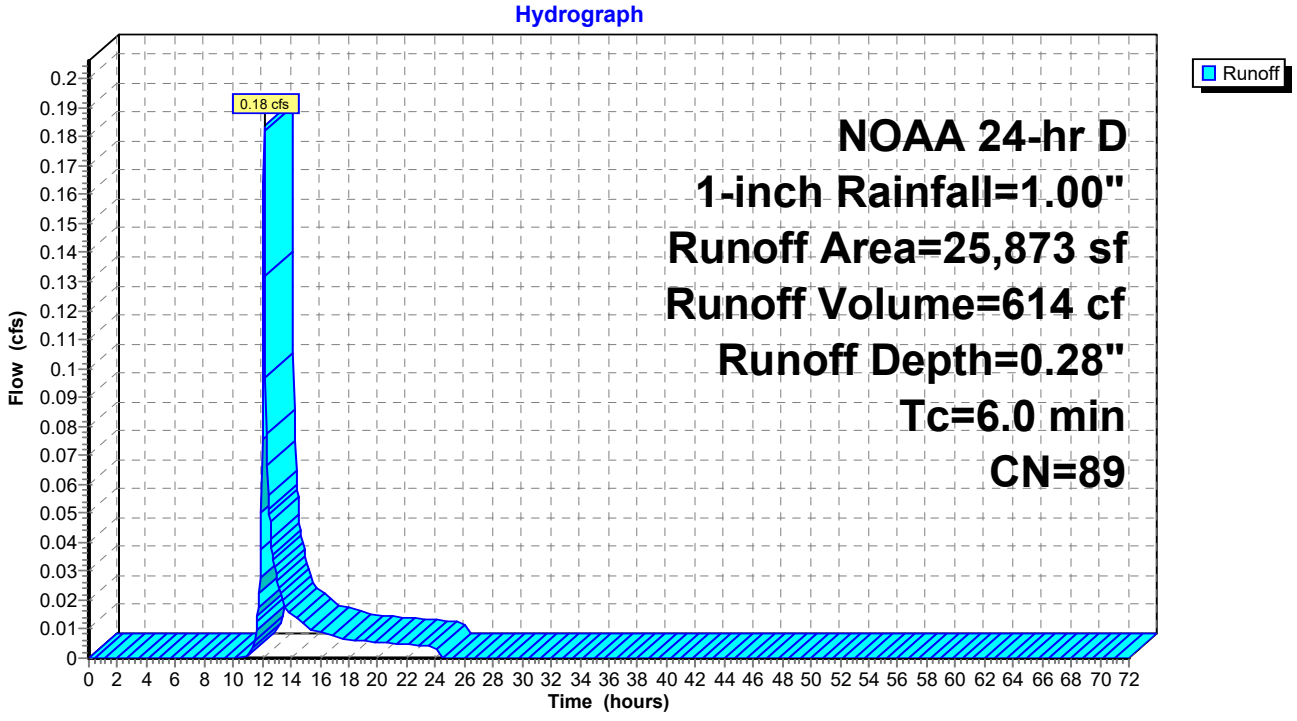
Runoff = 0.18 cfs @ 12.14 hrs, Volume= 614 cf, Depth= 0.28"
Routed to Reach DP-C1 : Wetlands

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 1-inch Rainfall=1.00"

| Area (sf) | CN | Description |
|---|---|---|
| 9,827 | 74 | >75% Grass cover, Good, HSG C |
| 16,046 | 98 | Paved parking, HSG C |
| 25,873 | 89 | Weighted Average |
| 9,827 | | 37.98% Pervious Area |
| 16,046 | | 62.02% 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

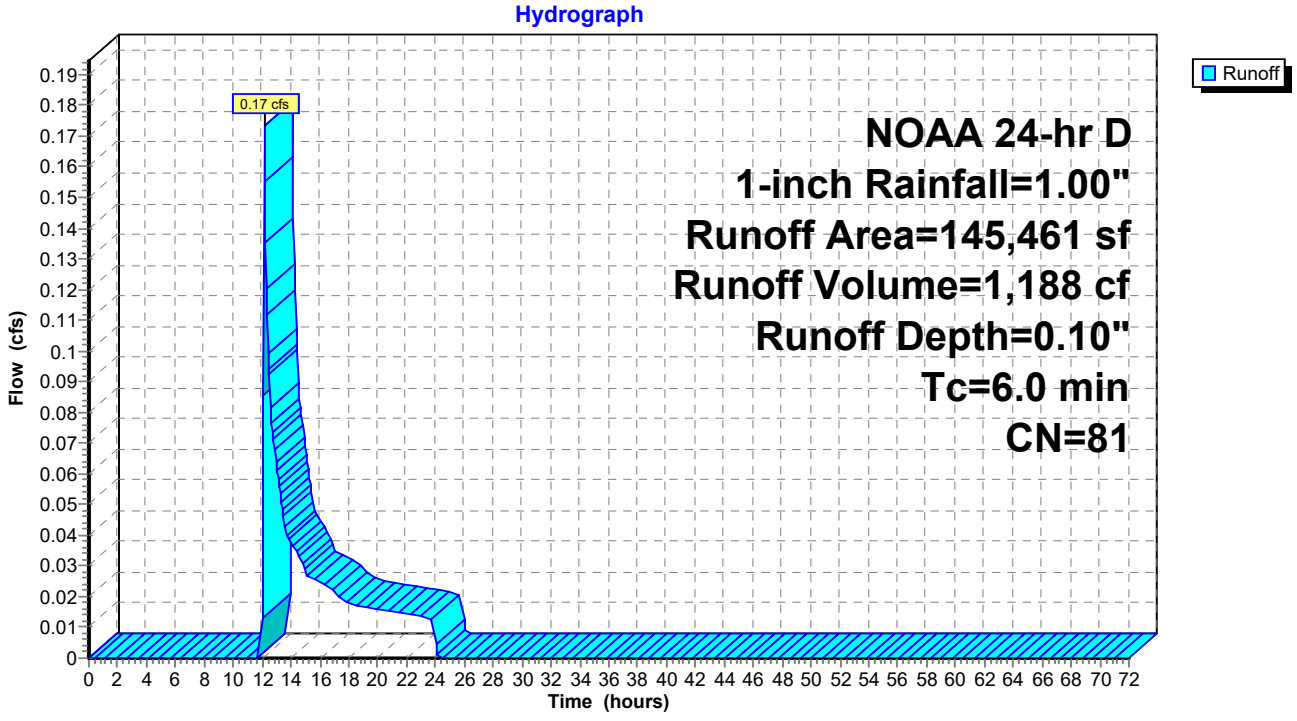
Runoff = 0.17 cfs @ 12.17 hrs, Volume= 1,188 cf, Depth= 0.10"
Routed to Pond SS-1 : Subsurface Infiltration (SC-310 Chambers)

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 1-inch Rainfall=1.00"

| Area (sf) | CN | Description |
|---|---|---|
| 103,648 | 74 | >75% Grass cover, Good, HSG C |
| 41,813 | 98 | Paved parking, HSG C |
| 145,461 | 81 | Weighted Average |
| 103,648 | | 71.25% Pervious Area |
| 41,813 | | 28.75% 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

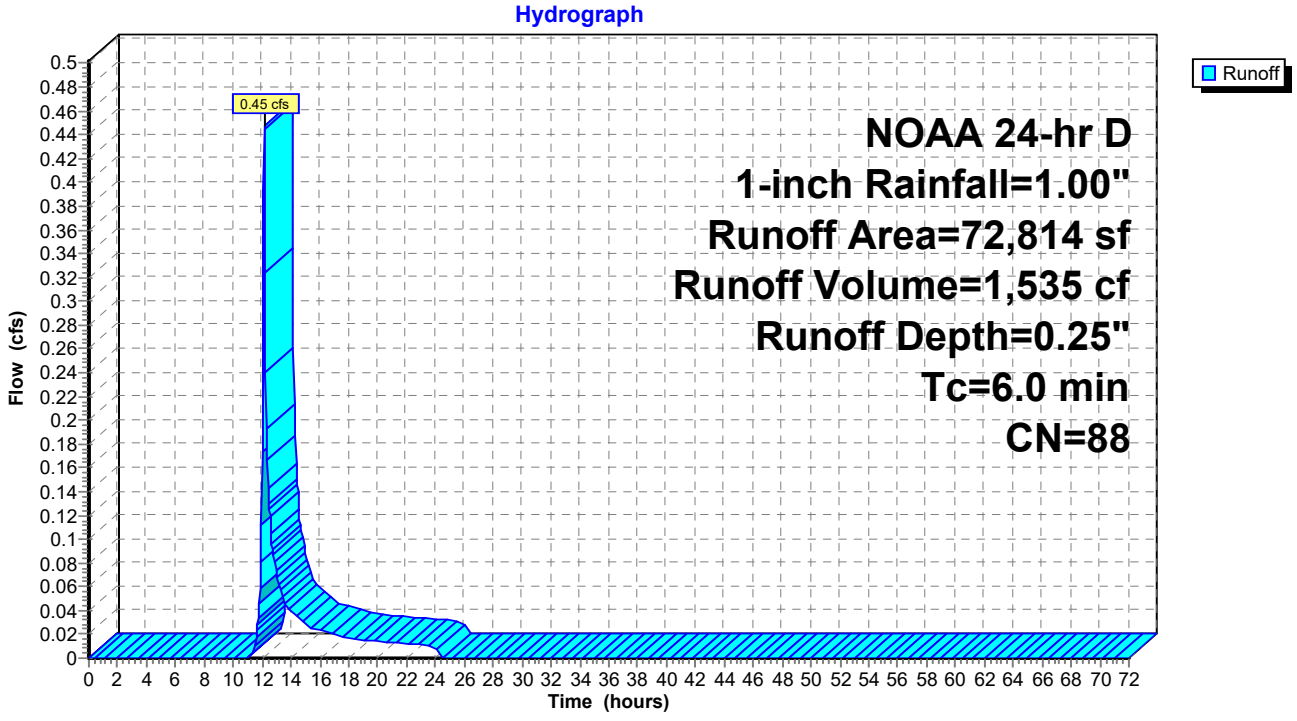
Runoff = 0.45 cfs @ 12.14 hrs, Volume= 1,535 cf, Depth= 0.25"
Routed to Reach DP-B : Concord Street Main

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 1-inch Rainfall=1.00"

| Area (sf) | CN | Description |
|---|---|---|
| 29,536 | 74 | >75% Grass cover, Good, HSG C |
| 43,278 | 98 | Paved parking, HSG C |
| 72,814 | 88 | Weighted Average |
| 29,536 | | 40.56% Pervious Area |
| 43,278 | | 59.44% 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

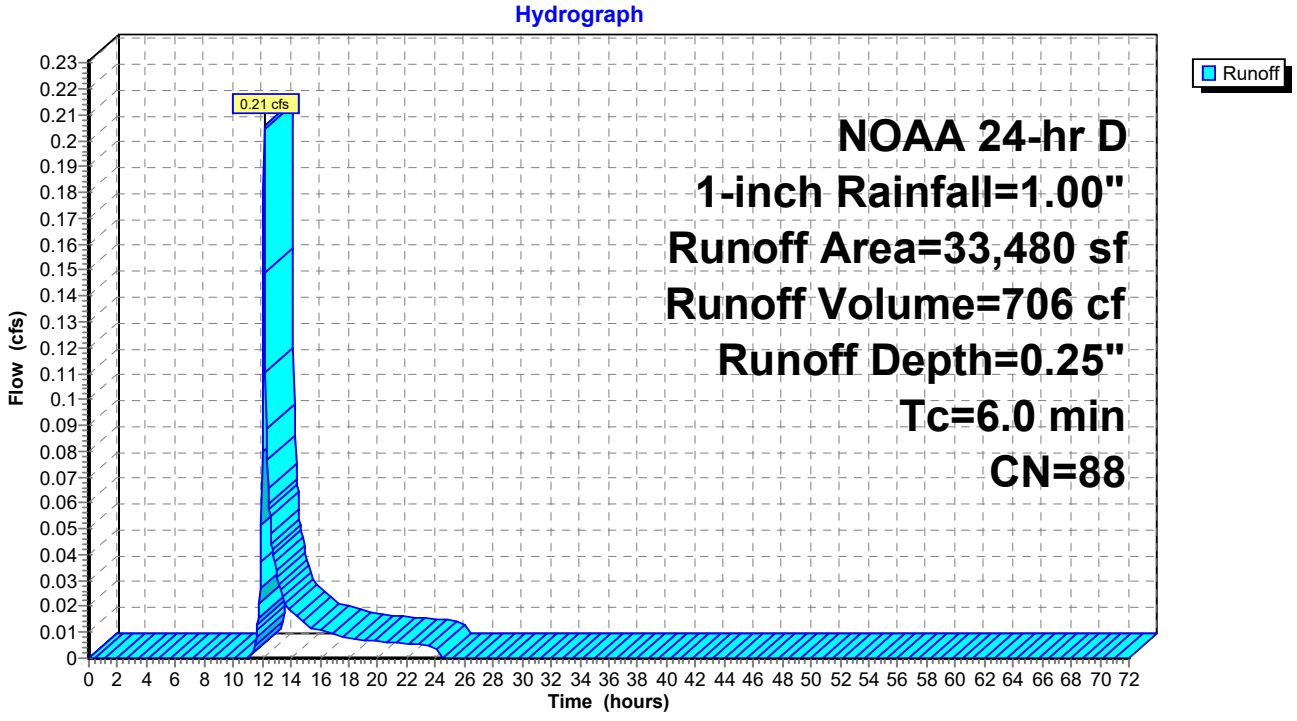
Runoff = 0.21 cfs @ 12.14 hrs, Volume= 706 cf, Depth= 0.25"
Routed to Pond SI-1 : Surface Infiltration

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 1-inch Rainfall=1.00"

| Area (sf) | CN | Description |
|---|---|---|
| 19,367 | 98 | Paved parking, HSG C |
| 14,113 | 74 | >75% Grass cover, Good, HSG C |
| 33,480 | 88 | Weighted Average |
| 14,113 | | 42.15% Pervious Area |
| 19,367 | | 57.85% 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

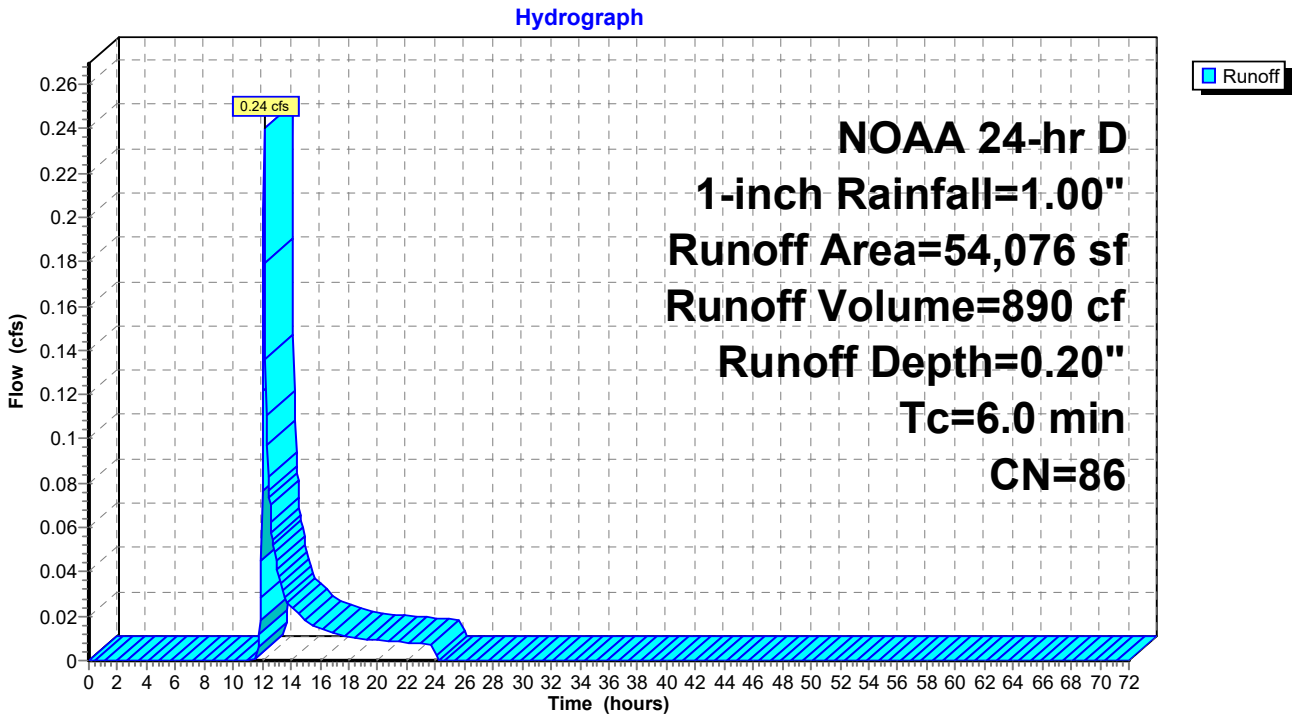
Runoff = 0.24 cfs @ 12.14 hrs, Volume= 890 cf, Depth= 0.20"
Routed to Pond SS-4 : Subsurface Infiltration (24" Pipe)

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 1-inch Rainfall=1.00"

| | Area (sf) | CN | Description |
|---|---|---|---|
| | 27,408 | 74 | >75% Grass cover, Good, HSG C |
| | 17,739 | 98 | Paved roads w/curbs & sewers, HSG C |
| * | 8,929 | 98 | Roofs, HSG C |
| | 54,076 | 86 | Weighted Average |
| | 27,408 | | 50.68% Pervious Area |
| | 26,668 | | 49.32% 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

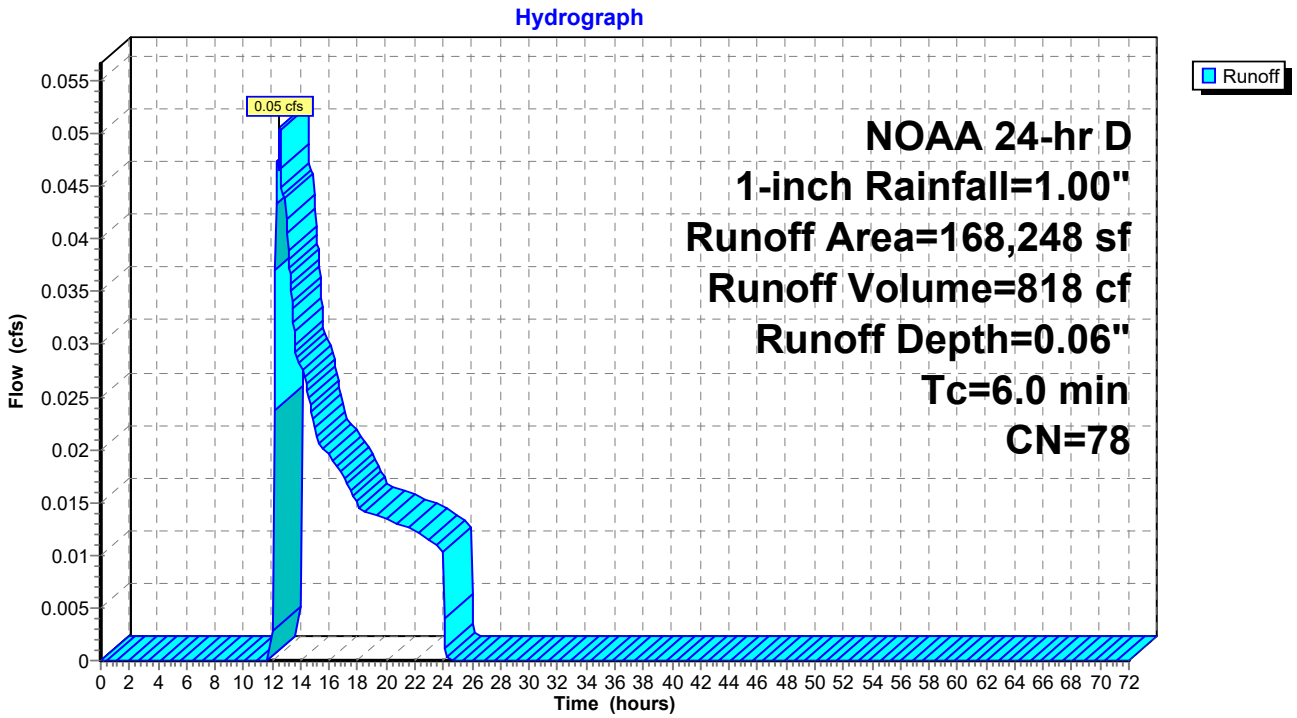
Runoff = 0.05 cfs @ 12.53 hrs, Volume= 818 cf, Depth= 0.06"
Routed to Reach DP-C1 : Wetlands

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 1-inch Rainfall=1.00"

| | Area (sf) | CN | Description |
|---|---|---|---|
| | 93,250 | 74 | >75% Grass cover, Good, HSG C |
| | 39,650 | 70 | Woods, Good, HSG C |
| * | 35,348 | 98 | Pond |
| | 168,248 | 78 | Weighted Average |
| | 132,900 | | 78.99% Pervious Area |
| | 35,348 | | 21.01% 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

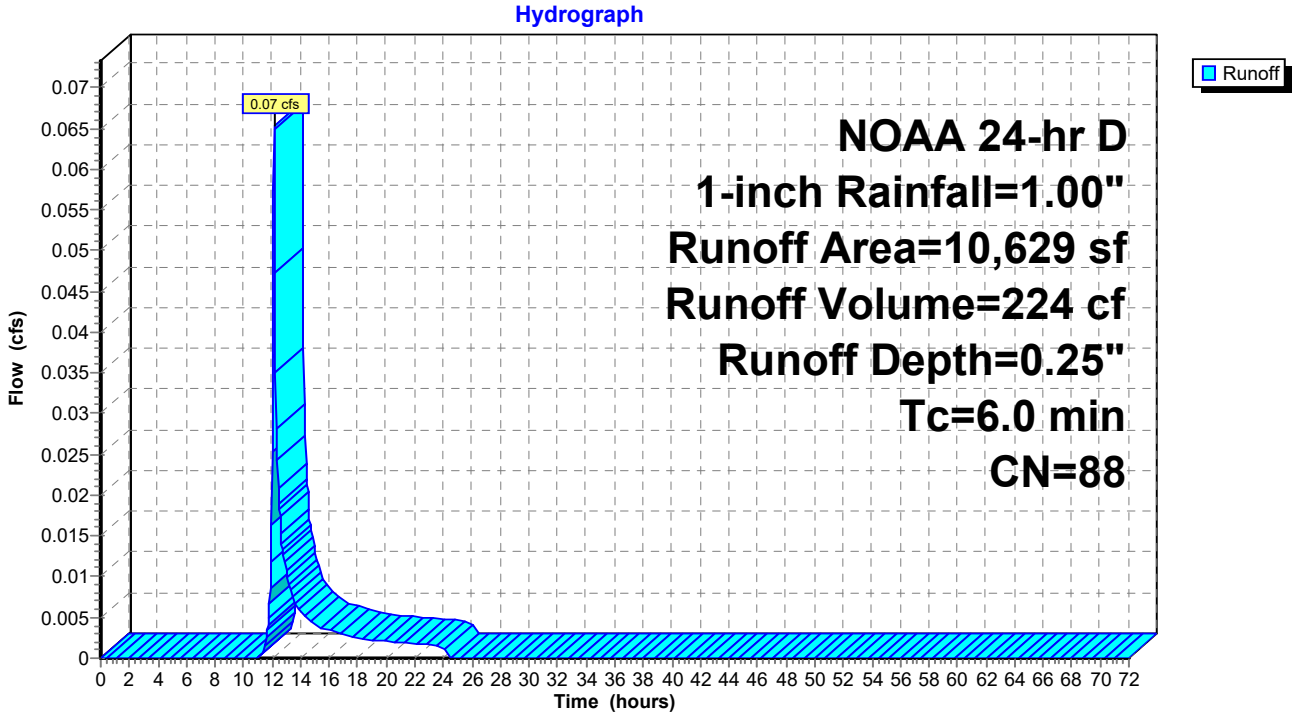
Runoff = 0.07 cfs @ 12.14 hrs, Volume= 224 cf, Depth= 0.25"
Routed to Pond SS-2 : Subsurface Infiltration (SC-740 Chambers)

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 1-inch Rainfall=1.00"

| Area (sf) | CN | Description |
|---|---|---|
| 6,168 | 98 | Paved parking, HSG C |
| 4,461 | 74 | >75% Grass cover, Good, HSG C |
| 10,629 | 88 | Weighted Average |
| 4,461 | | 41.97% Pervious Area |
| 6,168 | | 58.03% 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

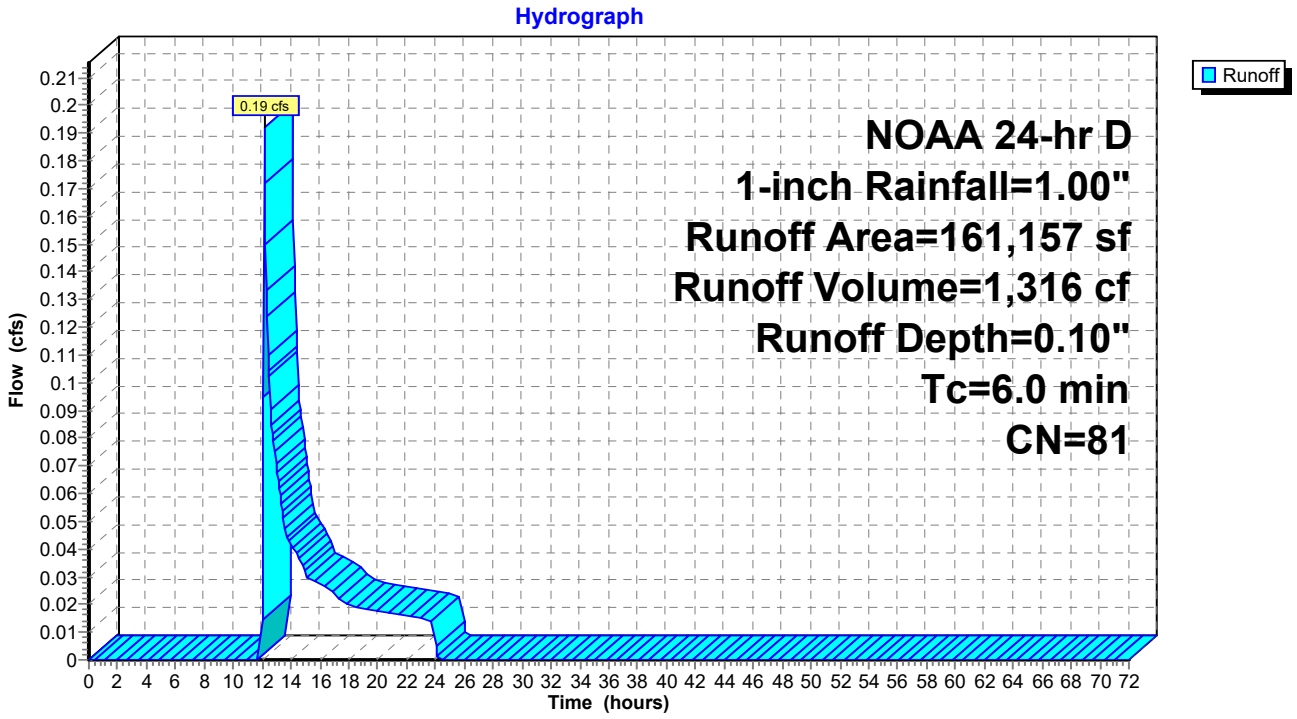
Runoff = 0.19 cfs @ 12.17 hrs, Volume= 1,316 cf, Depth= 0.10"
Routed to Pond SS-3 : Subsurface Infiltration (24" Pipe)

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 1-inch Rainfall=1.00"

| Area (sf) | CN | Description |
|---|---|---|
| 32,000 | 98 | Roofs, HSG C |
| 73,574 | 74 | >75% Grass cover, Good, HSG C |
| 19,452 | 98 | Paved parking, HSG C |
| 36,131 | 70 | Woods, Good, HSG C |
| 161,157 | 81 | Weighted Average |
| 109,705 | | 68.07% Pervious Area |
| 51,452 | | 31.93% 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

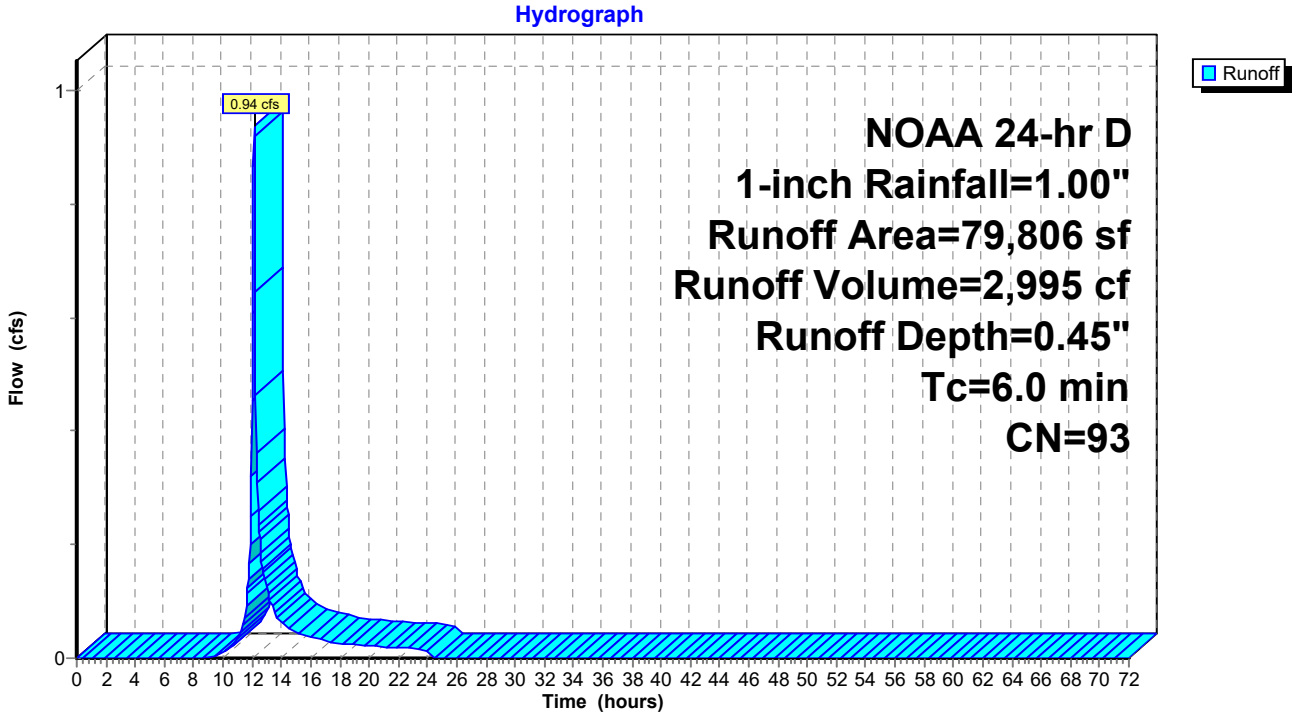
Runoff = 0.94 cfs @ 12.13 hrs, Volume= 2,995 cf, Depth= 0.45"
Routed to Pond SI-2 : South Inf Basin

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 1-inch Rainfall=1.00"

| Area (sf) | CN | Description |
|---|---|---|
| 61,762 | 98 | Paved parking, HSG C |
| 18,044 | 74 | >75% Grass cover, Good, HSG C |
| 79,806 | 93 | Weighted Average |
| 18,044 | | 22.61% Pervious Area |
| 61,762 | | 77.39% 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

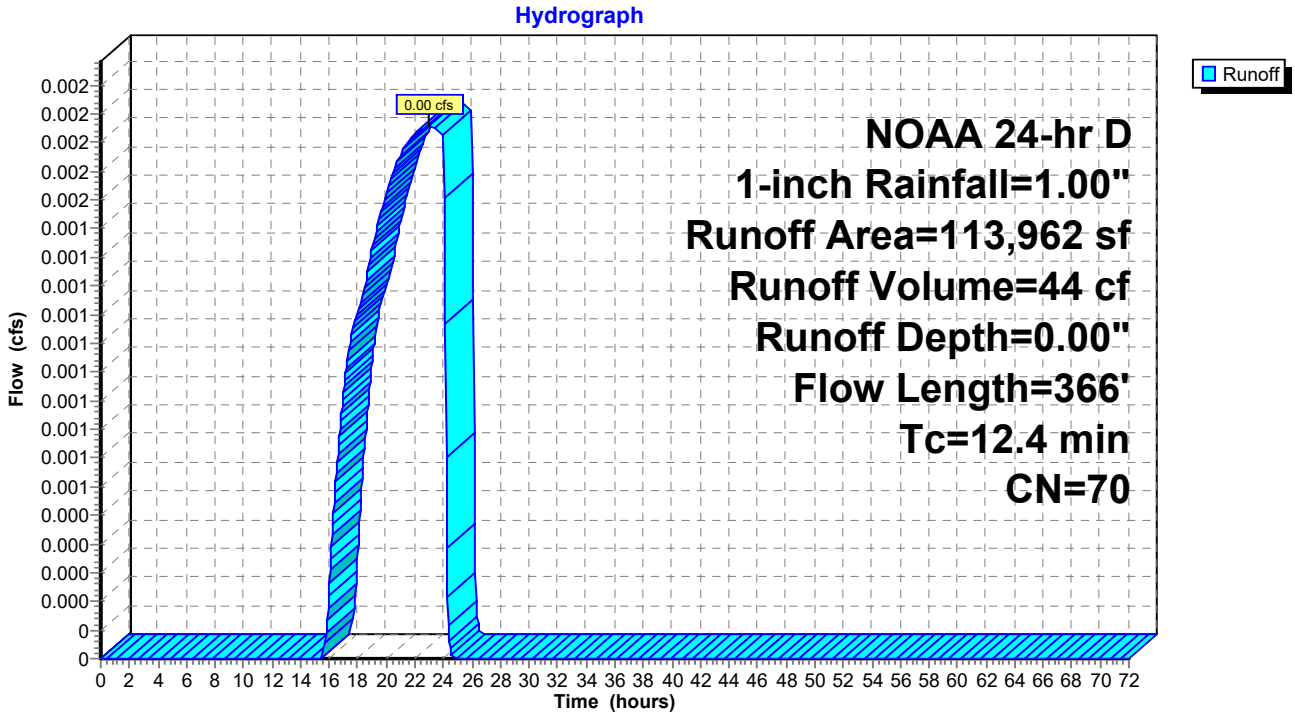
Runoff = 0.00 cfs @ 22.95 hrs, Volume= 44 cf, Depth= 0.00"
Routed to Reach DP-C2 : Intermittent Stream West

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 1-inch Rainfall=1.00"

| Area (sf) | CN | Description |
|---|---|---|
| 106,091 | 70 | Woods, Good, HSG C |
| 7,871 | 74 | >75% Grass cover, Good, HSG C |
| 113,962 | 70 | Weighted Average |
| 113,962 | | 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 4R: Swale

Inflow Area = 169,240 sf, 0.00% Impervious, Inflow Depth = 0.00" for 1-inch event
Inflow = 0.00 cfs @ 0.00 hrs, Volume= 0 cf, Incl. 0.01 cfs Inflow Loss
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0 cf, Atten= 0%, Lag= 0.0 min
Routed to Reach DP-A : Eastern Intermittent Stream

Routing by Stor-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Max. Velocity= 0.00 fps, Min. Travel Time= 0.0 min
Avg. Velocity = 0.00 fps, Avg. Travel Time= 0.0 min

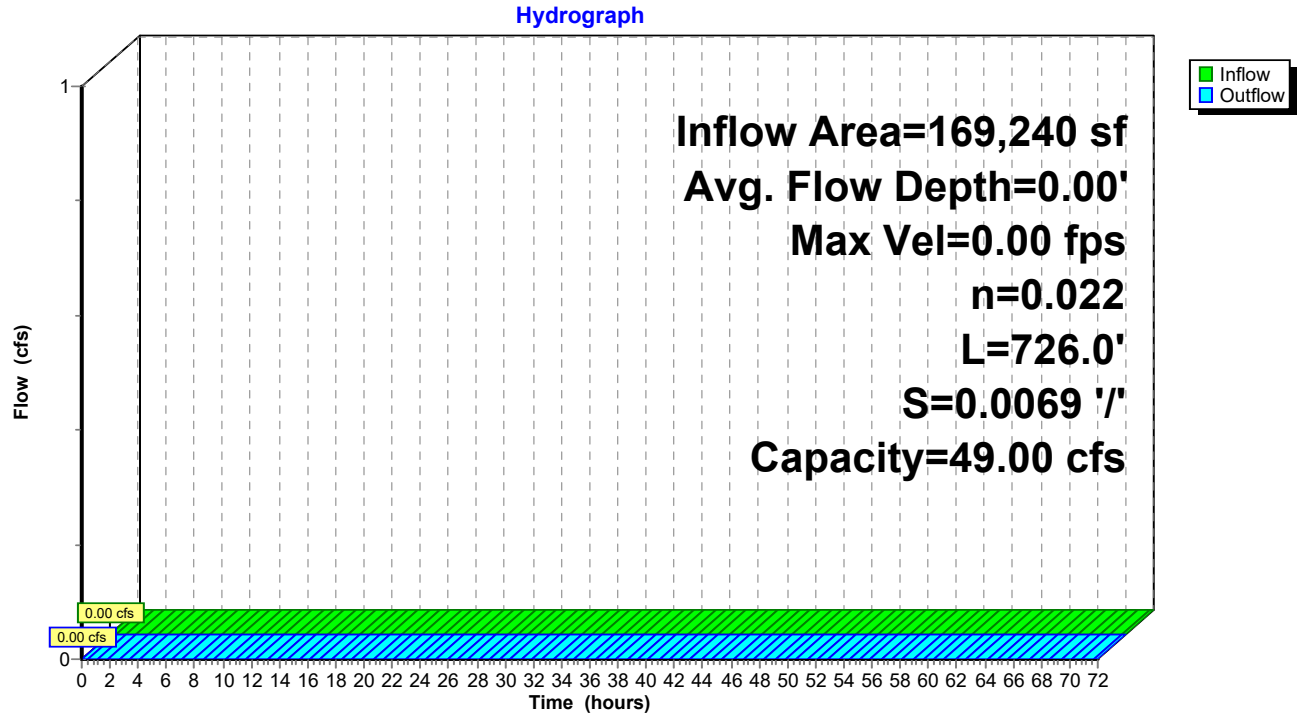
Peak Storage= 0 cf @ 0.00 hrs
Average Depth at Peak Storage= 0.00'
Bank-Full Depth= 1.50' Flow Area= 9.8 sf, Capacity= 49.00 cfs

2.00' x 1.50' deep channel, n= 0.022
Side Slope Z-value= 3.0 '/' Top Width= 11.00'
Length= 726.0' Slope= 0.0069 '/'
Inlet Invert= 207.00', Outlet Invert= 202.00'

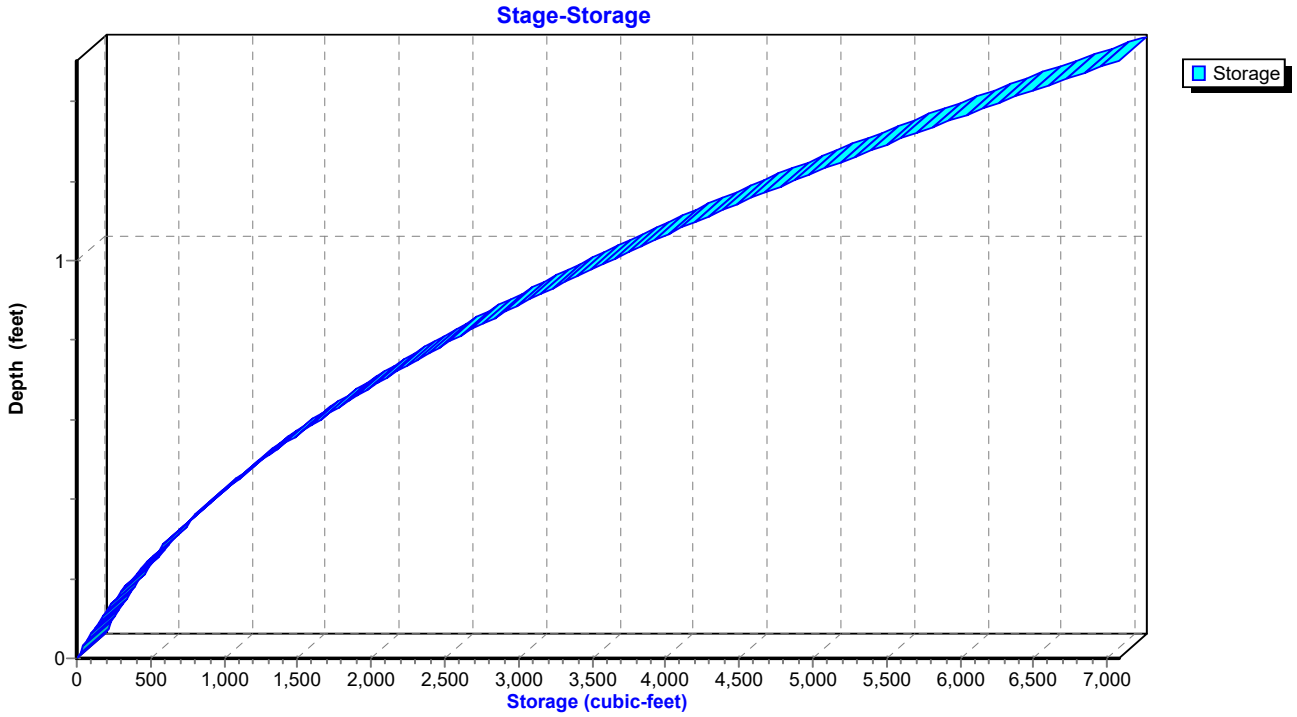


‡

### Reach 4R: Swale



## Reach 4R: Swale

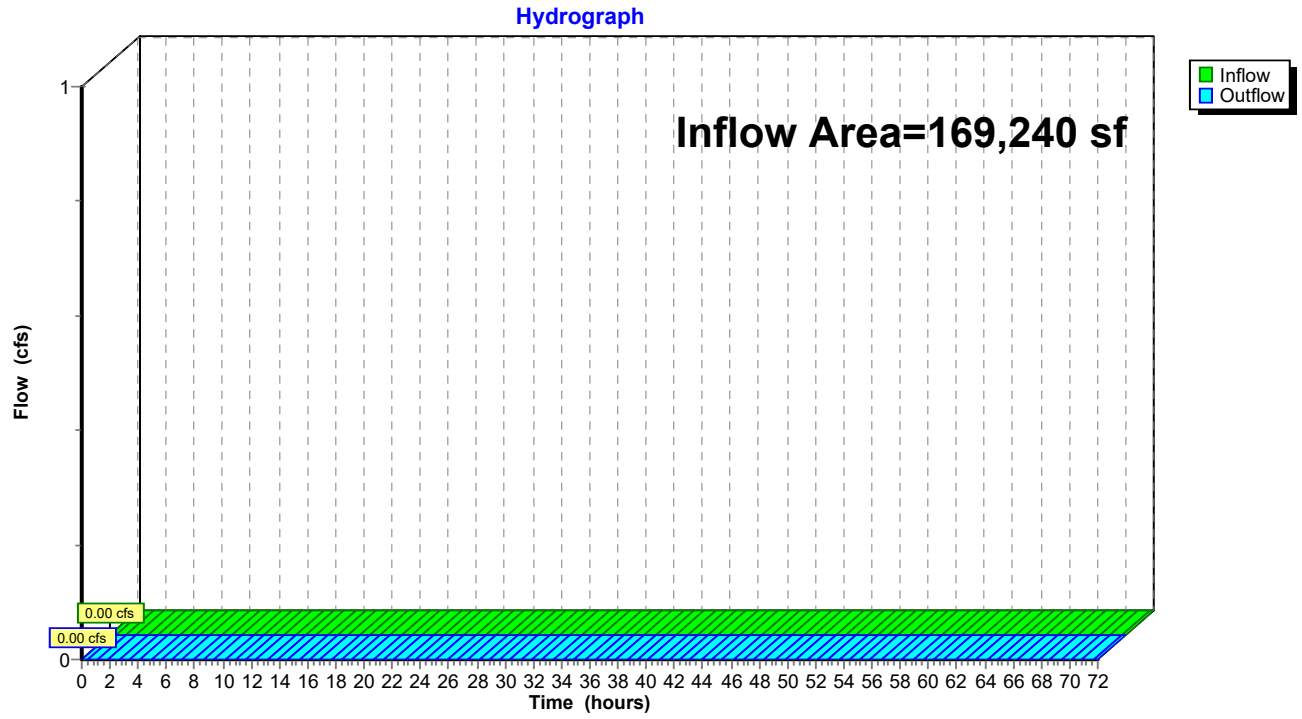


## Summary for Reach DP-A: Eastern Intermittent Stream

Inflow Area = 169,240 sf, 0.00% Impervious, Inflow Depth = 0.00" for 1-inch event
Inflow = 0.00 cfs @ 0.00 hrs, Volume= 0 cf
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0 cf, Atten= 0%, Lag= 0.0 min
Routed to Reach PR TOT : Total Site

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

## Reach DP-A: Eastern Intermittent Stream

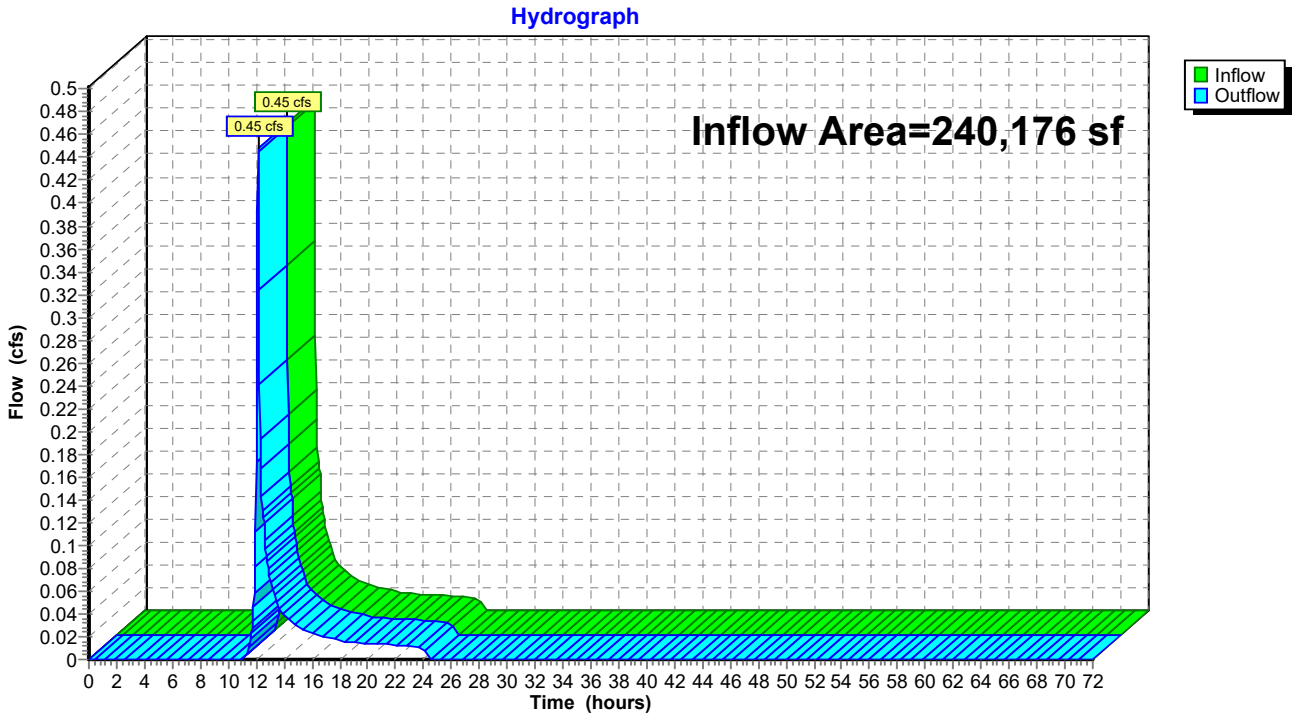


## Summary for Reach DP-B: Concord Street Main

Inflow Area = 240,176 sf, 62.90% Impervious, Inflow Depth = 0.08" for 1-inch event
Inflow = 0.45 cfs @ 12.14 hrs, Volume= 1,535 cf
Outflow = 0.45 cfs @ 12.14 hrs, Volume= 1,535 cf, Atten= 0%, Lag= 0.0 min
Routed to Reach PR TOT : Total Site

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

## Reach DP-B: Concord Street Main

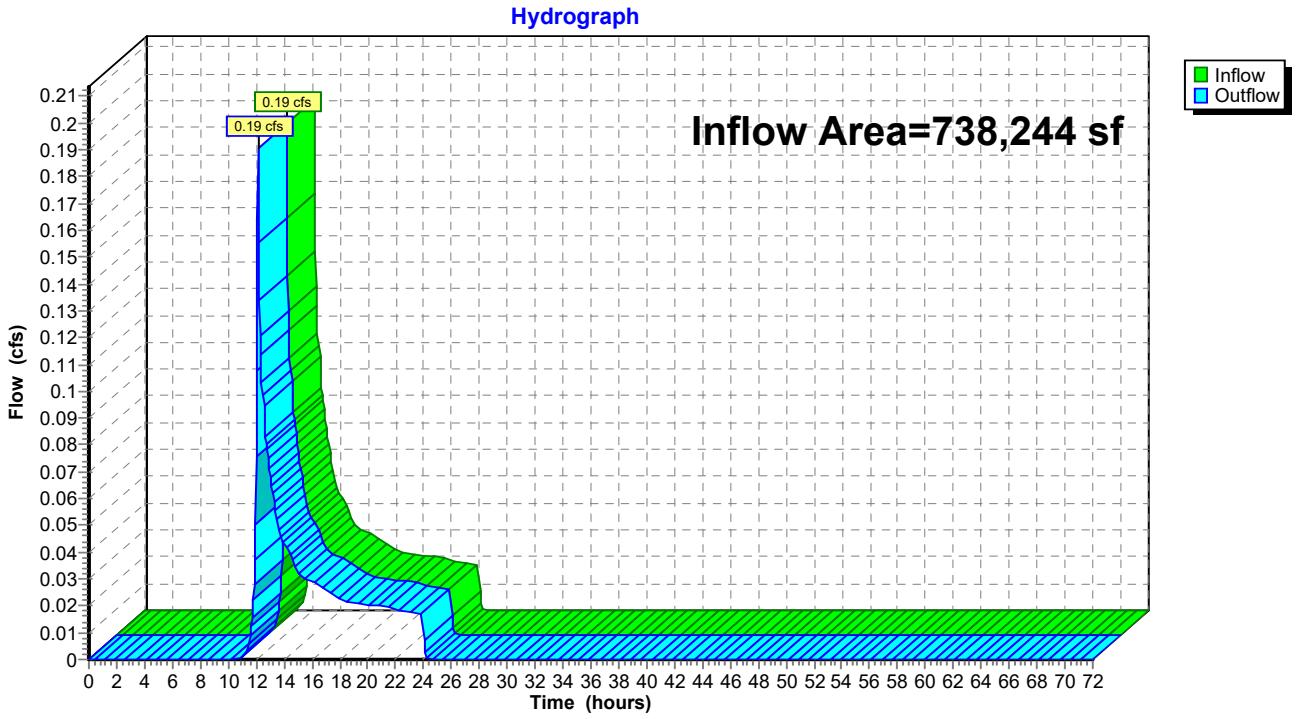


## Summary for Reach DP-C1: Wetlands

Inflow Area = 738,244 sf, 30.83% Impervious, Inflow Depth = 0.02" for 1-inch event
Inflow = 0.19 cfs @ 12.15 hrs, Volume= 1,476 cf
Outflow = 0.19 cfs @ 12.15 hrs, Volume= 1,476 cf, Atten= 0%, Lag= 0.0 min
Routed to Reach PR TOT : Total Site

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

## Reach DP-C1: Wetlands

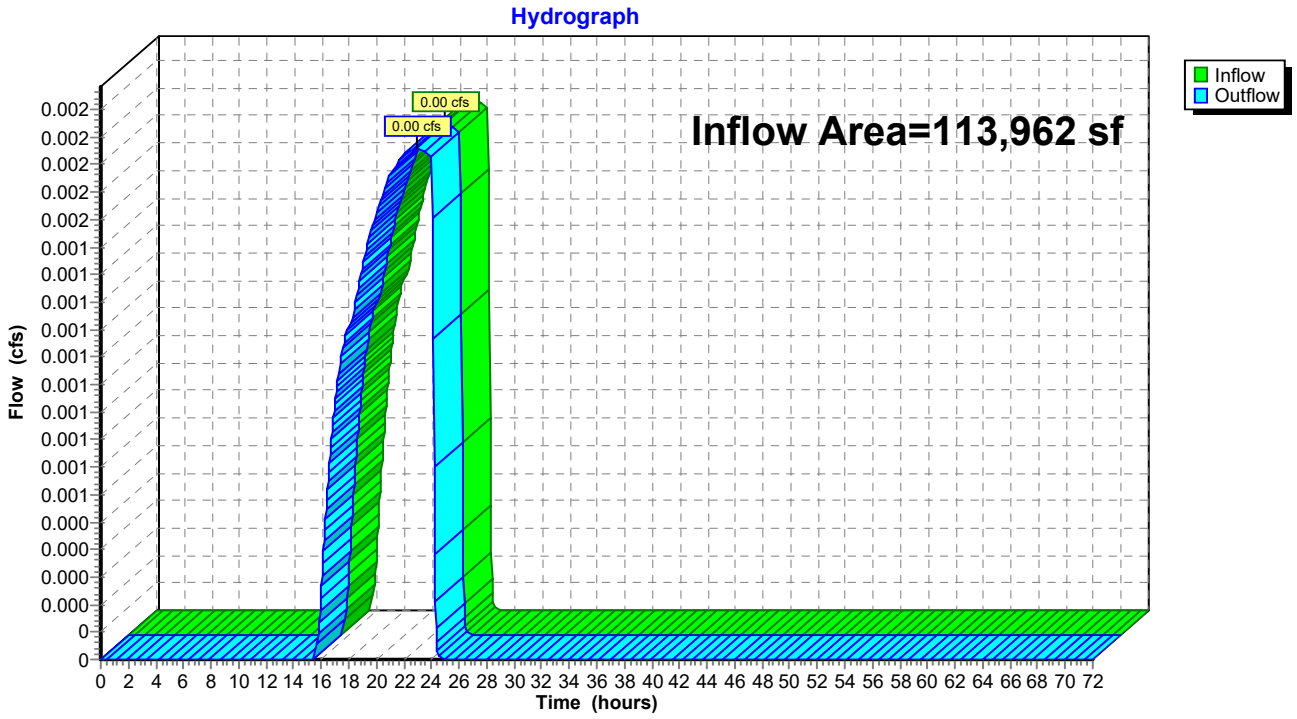


## Summary for Reach DP-C2: Intermittent Stream West

Inflow Area = 113,962 sf, 0.00% Impervious, Inflow Depth = 0.00" for 1-inch event
Inflow = 0.00 cfs @ 22.95 hrs, Volume= 44 cf
Outflow = 0.00 cfs @ 22.95 hrs, Volume= 44 cf, Atten= 0%, Lag= 0.0 min
Routed to Reach DP-C1 : Wetlands

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

## Reach DP-C2: Intermittent Stream West

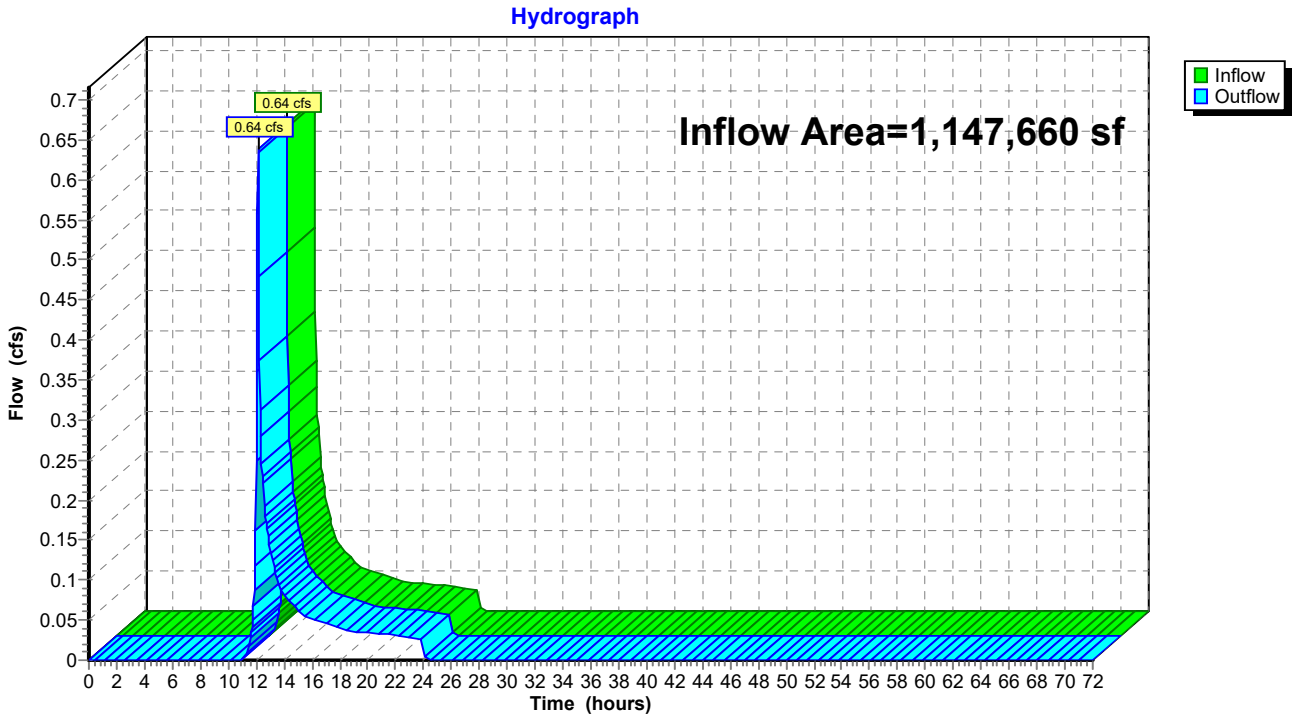


## Summary for Reach PR TOT: Total Site

Inflow Area = 1,147,660 sf, 33.00% Impervious, Inflow Depth = 0.03" for 1-inch event
Inflow = 0.64 cfs @ 12.14 hrs, Volume= 3,011 cf
Outflow = 0.64 cfs @ 12.14 hrs, Volume= 3,011 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 Pond BIO-1: Surface System

Inflow Area = 112,914 sf, 68.00% Impervious, Inflow Depth = 0.32" for 1-inch event
Inflow = 0.92 cfs @ 12.14 hrs, Volume= 3,013 cf
Outflow = 0.03 cfs @ 17.82 hrs, Volume= 3,014 cf, Atten= 97%, Lag= 341.1 min
Discarded = 0.03 cfs @ 17.82 hrs, Volume= 3,014 cf
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf
Routed to Reach DP-C1 : Wetlands

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 193.98' @ 17.82 hrs Surf.Area= 4,908 sf Storage= 1,785 cf

Plug-Flow detention time= 648.5 min calculated for 3,011 cf (100% of inflow)
Center-of-Mass det. time= 648.9 min ( 1,524.8 - 876.0 )

| Volume | Invert | Avail.Storage | Storage Description |
|---|---|---|---|
| #1 | 193.60' | 14,265 cf | **Custom Stage Data (Prismatic)** Listed below (Recalc) |

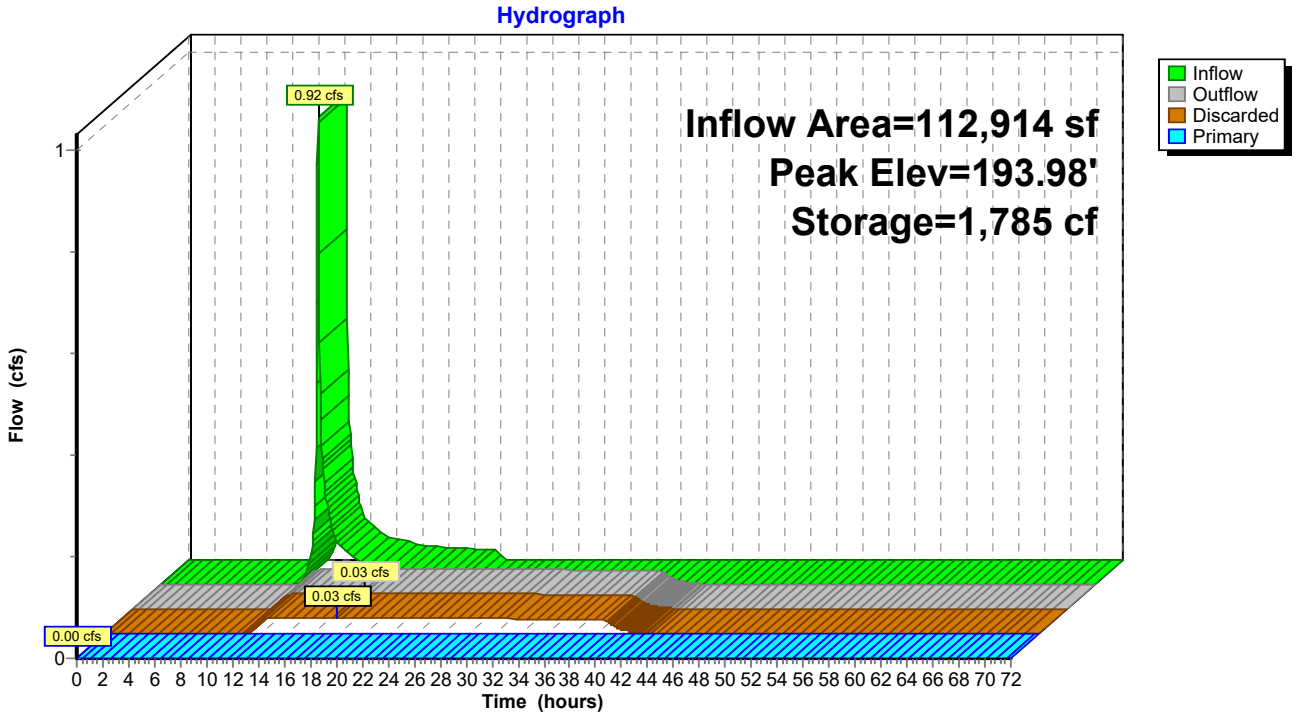
| Elevation (feet) | Surf.Area (sq-ft) | Inc.Store (cubic-feet) | Cum.Store (cubic-feet) |
|---|---|---|---|
| 193.60 | 4,470 | 0 | 0 |
| 194.00 | 4,930 | 1,880 | 1,880 |
| 195.00 | 6,160 | 5,545 | 7,425 |
| 196.00 | 7,520 | 6,840 | 14,265 |

| Device | Routing | Invert | Outlet Devices |
|---|---|---|---|
| #1 | Primary | 189.50' | **15.0" Round Culvert**<br>L= 50.0' CPP, square edge headwall, Ke= 0.500<br>Inlet / Outlet Invert= 189.50' / 189.00' S= 0.0100 '/' Cc= 0.900<br>n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.23 sf |
| #2 | Device 1 | 194.10' | **24.0" Horiz. 2-24" Area Drains X 1.20** C= 0.600<br>Limited to weir flow at low heads |
| #3 | Discarded | 193.60' | **0.270 in/hr Exfiltration over Surface area** |

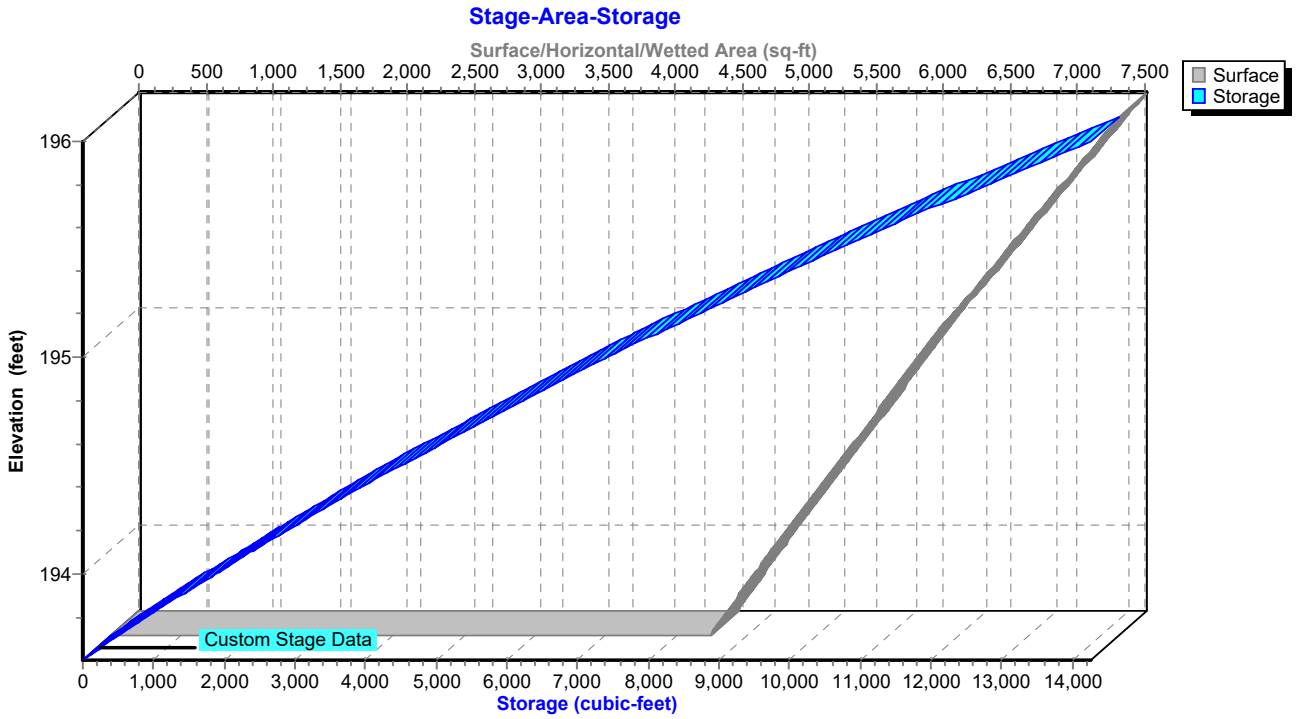
**Discarded OutFlow** Max=0.03 cfs @ 17.82 hrs HW=193.98' (Free Discharge)
↑ **3=Exfiltration** (Exfiltration Controls 0.03 cfs)

**Primary OutFlow** Max=0.00 cfs @ 0.00 hrs HW=193.60' (Free Discharge)
↑ **1=Culvert** (Passes 0.00 cfs of 11.01 cfs potential flow)
↑ **2=2-24" Area Drains** ( Controls 0.00 cfs)

## Pond BIO-1: Surface System




## Pond BIO-1: Surface System



## Summary for Pond SI-1: Surface Infiltration

Inflow Area = 33,480 sf, 57.85% Impervious, Inflow Depth = 0.25" for 1-inch event
Inflow = 0.21 cfs @ 12.14 hrs, Volume= 706 cf
Outflow = 0.02 cfs @ 13.37 hrs, Volume= 706 cf, Atten= 88%, Lag= 73.8 min
Discarded = 0.02 cfs @ 13.37 hrs, Volume= 706 cf
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf
Routed to Reach DP-B : Concord Street Main

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 200.06' @ 13.37 hrs Surf.Area= 3,998 sf Storage= 226 cf

Plug-Flow detention time= 84.3 min calculated for 705 cf (100% of inflow)
Center-of-Mass det. time= 84.3 min ( 975.9 - 891.6 )

| Volume | Invert | Avail.Storage | Storage Description |
|---|---|---|---|
| #1 | 200.00' | 5,105 cf | **Custom Stage Data (Prismatic)** Listed below (Recalc) |

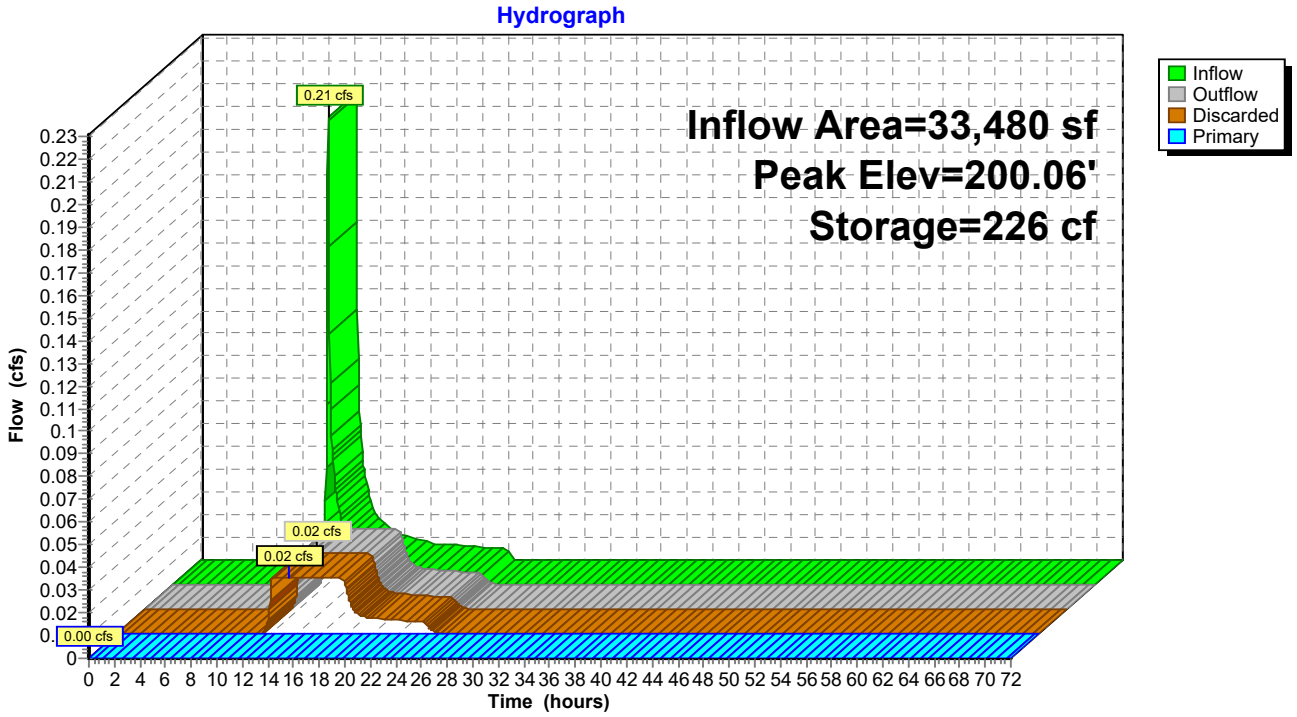
| Elevation (feet) | Surf.Area (sq-ft) | Inc.Store (cubic-feet) | Cum.Store (cubic-feet) |
|---|---|---|---|
| 200.00 | 3,854 | 0 | 0 |
| 201.00 | 6,356 | 5,105 | 5,105 |

| Device | Routing | Invert | Outlet Devices |
|---|---|---|---|
| #1 | Primary | 196.36' | **12.0" Round Culvert**<br>L= 37.6' CPP, mitered to conform to fill, Ke= 0.700<br>Inlet / Outlet Invert= 196.36' / 195.20' S= 0.0309 '/' Cc= 0.900<br>n= 0.013, Flow Area= 0.79 sf |
| #2 | Device 1 | 200.40' | **12.0" Horiz. 12" Area Drain X 0.73** C= 0.600<br>Limited to weir flow at low heads |
| #3 | Device 1 | 200.40' | **18.0" Horiz. 18" Area Drain X 0.69** C= 0.600<br>Limited to weir flow at low heads |
| #4 | Discarded | 200.00' | **0.270 in/hr Exfiltration over Surface area** |

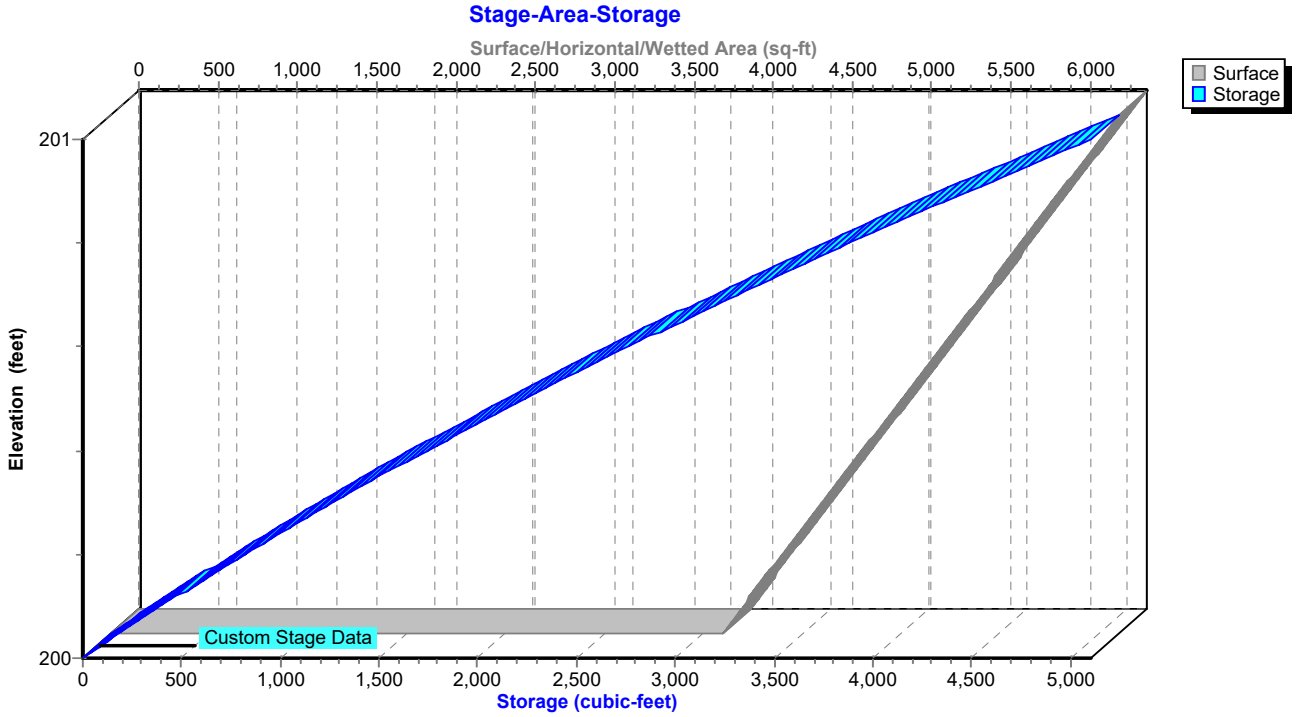
**Discarded OutFlow** Max=0.02 cfs @ 13.37 hrs HW=200.06' (Free Discharge)
└**4=Exfiltration** (Exfiltration Controls 0.02 cfs)

**Primary OutFlow** Max=0.00 cfs @ 0.00 hrs HW=200.00' (Free Discharge)
└**1=Culvert** (Passes 0.00 cfs of 5.91 cfs potential flow)
  ├**2=12" Area Drain** ( Controls 0.00 cfs)
  └**3=18" Area Drain** ( Controls 0.00 cfs)

## Pond SI-1: Surface Infiltration




## Pond SI-1: Surface Infiltration



## Summary for Pond SI-2: South Inf Basin

Inflow Area = 79,806 sf, 77.39% Impervious, Inflow Depth = 0.45" for 1-inch event
Inflow = 0.94 cfs @ 12.13 hrs, Volume= 2,995 cf
Outflow = 0.02 cfs @ 20.82 hrs, Volume= 2,995 cf, Atten= 98%, Lag= 521.2 min
Discarded = 0.02 cfs @ 20.82 hrs, Volume= 2,995 cf
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf
Routed to Reach DP-B : Concord Street Main

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 194.17' @ 20.82 hrs Surf.Area= 3,295 sf Storage= 2,040 cf

Plug-Flow detention time= 1,036.6 min calculated for 2,993 cf (100% of inflow)
Center-of-Mass det. time= 1,037.3 min ( 1,889.1 - 851.9 )

| Volume | Invert | Avail.Storage | Storage Description |
|---|---|---|---|
| #1 | 193.50' | 7,532 cf | **Custom Stage Data (Prismatic)** Listed below (Recalc) |

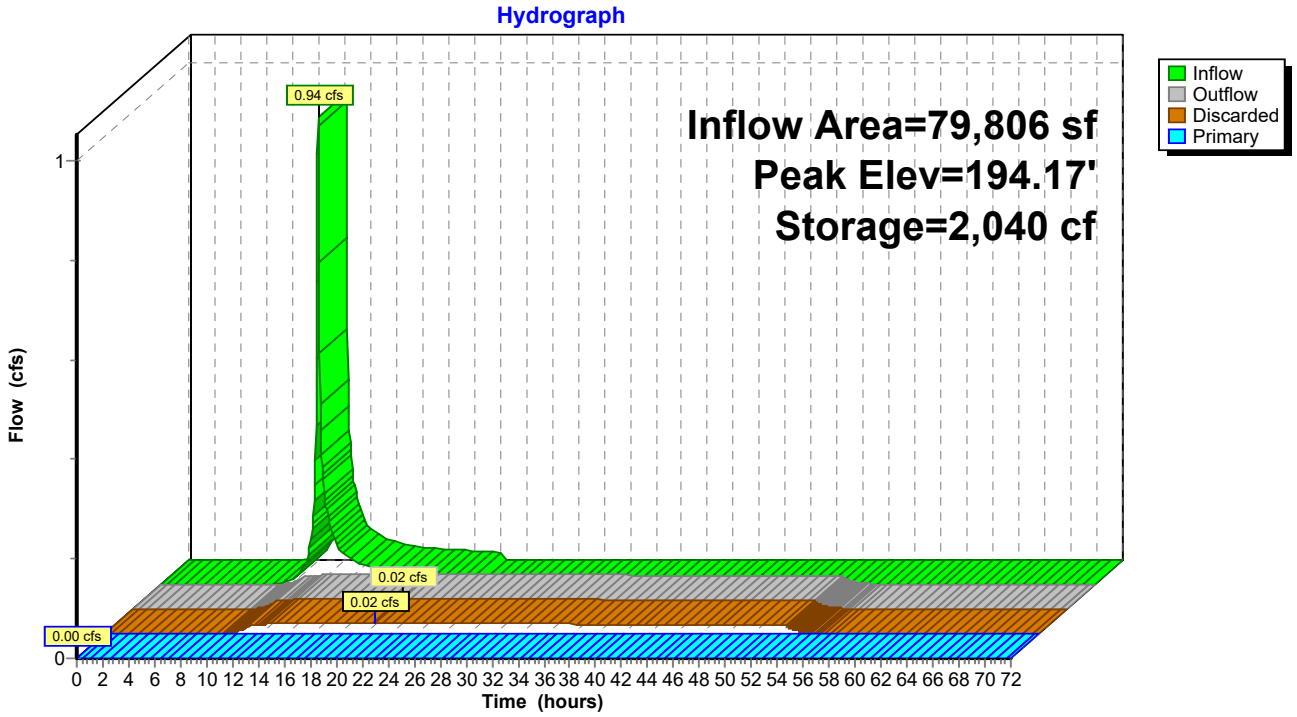
| Elevation (feet) | Surf.Area (sq-ft) | Inc.Store (cubic-feet) | Cum.Store (cubic-feet) |
|---|---|---|---|
| 193.50 | 2,832 | 0 | 0 |
| 194.00 | 3,174 | 1,502 | 1,502 |
| 195.00 | 3,899 | 3,537 | 5,038 |
| 195.60 | 4,414 | 2,494 | 7,532 |

| Device | Routing | Invert | Outlet Devices |
|---|---|---|---|
| #1 | Primary | 194.40' | **12.0" Horiz. 12" Area Drain X 0.73** C= 0.600<br>Limited to weir flow at low heads |
| #2 | Primary | 194.80' | **24.0" Horiz. 24" Area Drain X 0.60** C= 0.600<br>Limited to weir flow at low heads |
| #3 | Discarded | 193.50' | **0.270 in/hr Exfiltration over Surface area** |

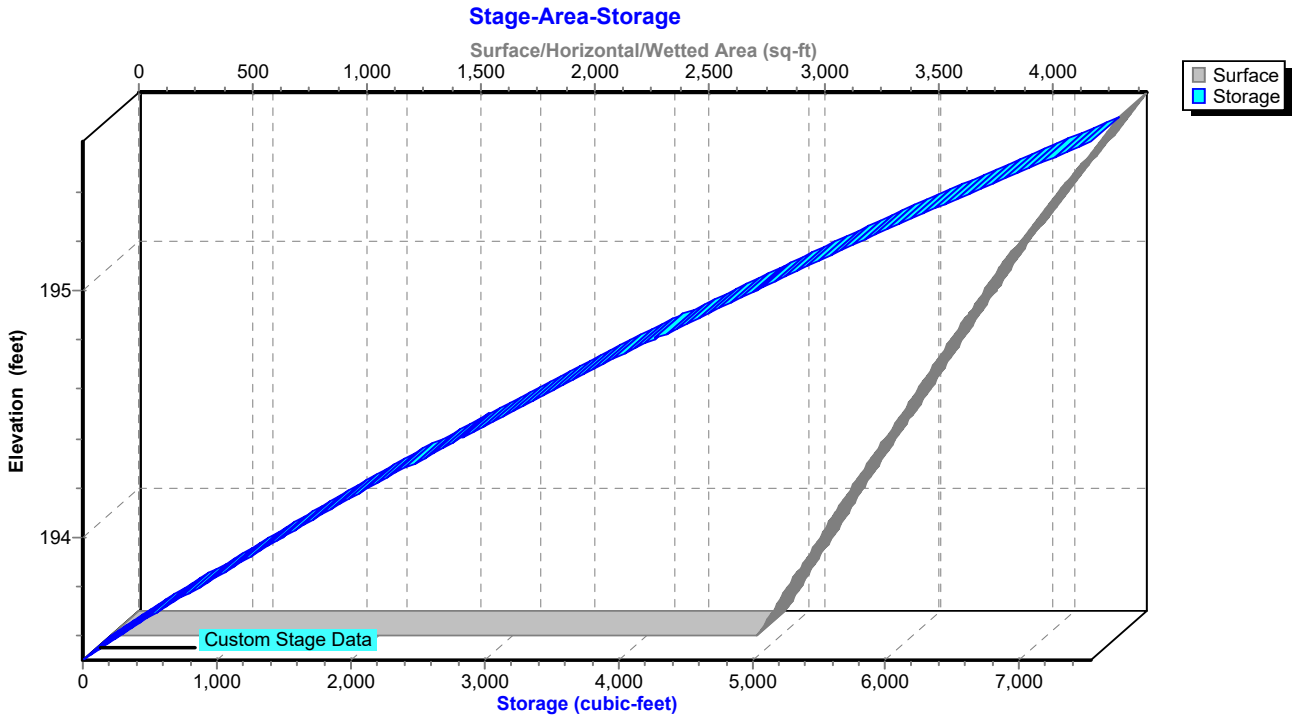
**Discarded OutFlow** Max=0.02 cfs @ 20.82 hrs HW=194.17' (Free Discharge)
└**3=Exfiltration** (Exfiltration Controls 0.02 cfs)

**Primary OutFlow** Max=0.00 cfs @ 0.00 hrs HW=193.50' (Free Discharge)
├**1=12" Area Drain** ( Controls 0.00 cfs)
└**2=24" Area Drain** ( Controls 0.00 cfs)

## Pond SI-2: South Inf Basin




## Pond SI-2: South Inf Basin



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

Inflow Area = 145,461 sf, 28.75% Impervious, Inflow Depth = 0.10" for 1-inch event
Inflow = 0.17 cfs @ 12.17 hrs, Volume= 1,188 cf
Outflow = 0.04 cfs @ 12.25 hrs, Volume= 1,188 cf, Atten= 77%, Lag= 4.9 min
Discarded = 0.04 cfs @ 12.25 hrs, Volume= 1,188 cf
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf
Routed to Reach DP-C1 : Wetlands

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 184.08' @ 13.65 hrs Surf.Area= 6,528 sf Storage= 218 cf

Plug-Flow detention time= 50.8 min calculated for 1,188 cf (100% of inflow)
Center-of-Mass det. time= 50.6 min ( 1,009.2 - 958.6 )

| Volume | Invert | Avail.Storage | Storage Description |
|---|---|---|---|
| #1A | 184.00' | 4,559 cf | **44.83'W x 145.60'L x 2.33'H Field A**<br>15,231 cf Overall - 3,833 cf Embedded = 11,398 cf x 40.0% Voids |
| #2A | 184.50' | 3,833 cf | **ADS_StormTech SC-310 +Cap** x 260 Inside #1<br>Effective Size= 28.9"W x 16.0"H => 2.07 sf x 7.12'L = 14.7 cf<br>Overall Size= 34.0"W x 16.0"H x 7.56'L with 0.44' Overlap<br>260 Chambers in 13 Rows |
| | | 8,392 cf | Total Available Storage |

Storage Group A created with Chamber Wizard

| Device | Routing | Invert | Outlet Devices |
|---|---|---|---|
| #1 | Primary | 184.85' | **38.0" W x 8.0" H Vert. Orifice/Grate** C= 0.600<br>Limited to weir flow at low heads |
| #2 | Primary | 185.55' | **5.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s) |
| #3 | Discarded | 184.00' | **0.270 in/hr Exfiltration over Surface area** |

**Discarded OutFlow** Max=0.04 cfs @ 12.25 hrs HW=184.03' (Free Discharge)
└**3=Exfiltration** (Exfiltration Controls 0.04 cfs)

**Primary OutFlow** Max=0.00 cfs @ 0.00 hrs HW=184.00' (Free Discharge)
├**1=Orifice/Grate** ( Controls 0.00 cfs)
└**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

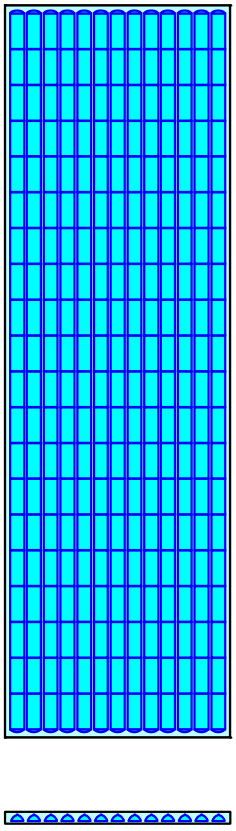
20 Chambers/Row x 7.12' Long +0.60' Cap Length x 2 = 143.60' Row Length +12.0" End Stone x 2 = 145.60' Base Length
13 Rows x 34.0" Wide + 6.0" Spacing x 12 + 12.0" Side Stone x 2 = 44.83' Base Width
6.0" Stone Base + 16.0" Chamber Height + 6.0" Stone Cover = 2.33' Field Height

260 Chambers x 14.7 cf = 3,832.9 cf Chamber Storage

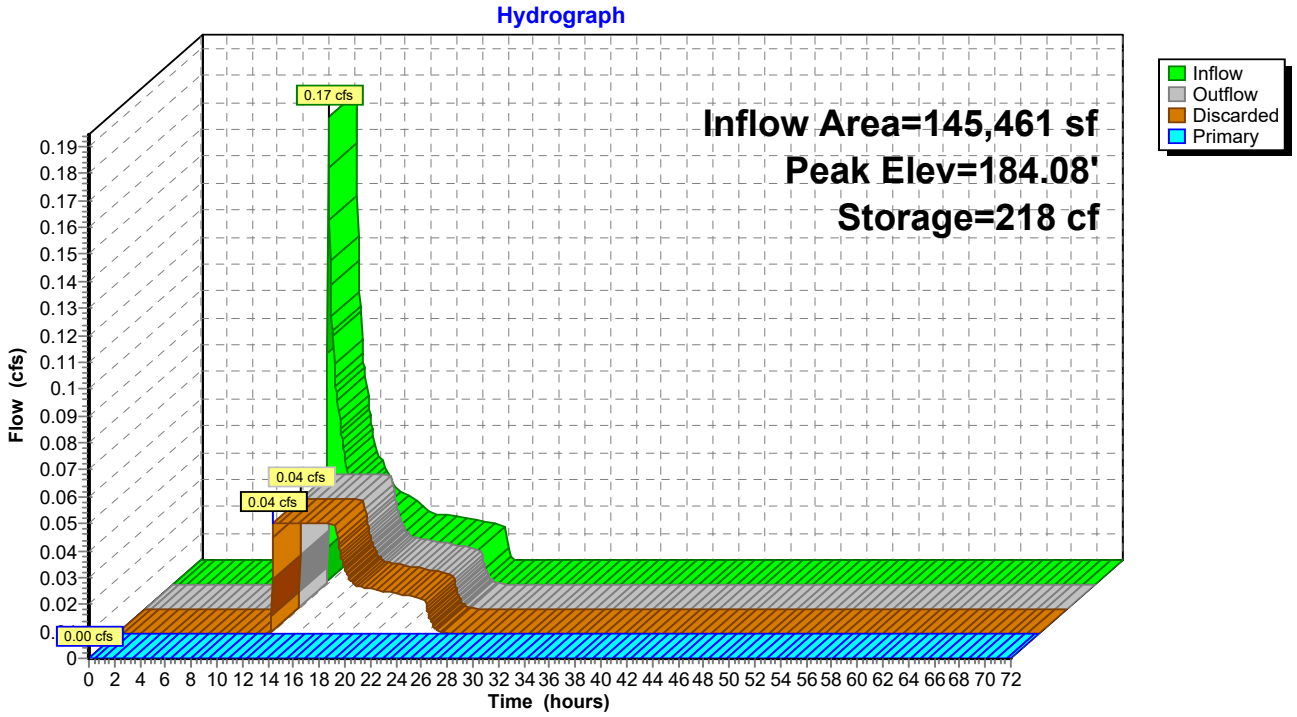
15,231.4 cf Field - 3,832.9 cf Chambers = 11,398.5 cf Stone x 40.0% Voids = 4,559.4 cf Stone Storage

Chamber Storage + Stone Storage = 8,392.3 cf = 0.193 af
Overall Storage Efficiency = 55.1%
Overall System Size = 145.60' x 44.83' x 2.33'

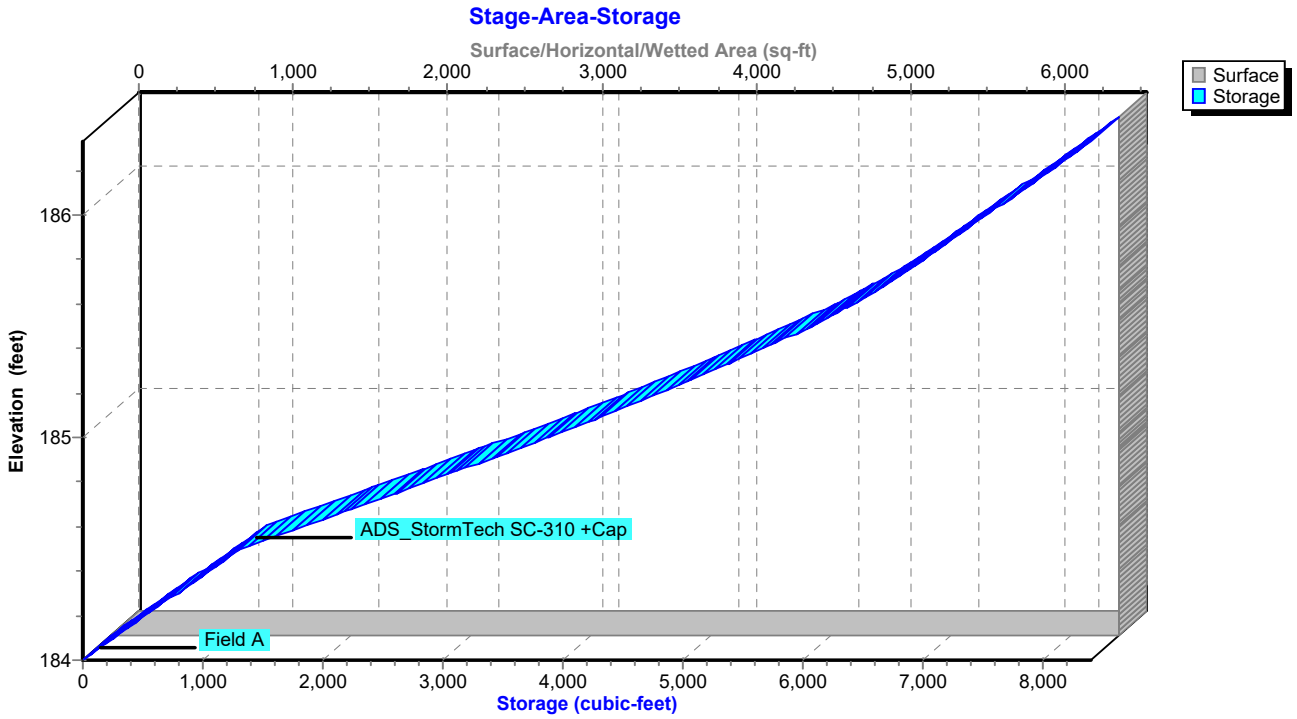
260 Chambers
564.1 cy Field
422.2 cy Stone



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




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



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

Inflow Area = 10,629 sf, 58.03% Impervious, Inflow Depth = 0.25" for 1-inch event
Inflow = 0.07 cfs @ 12.14 hrs, Volume= 224 cf
Outflow = 0.01 cfs @ 12.15 hrs, Volume= 224 cf, Atten= 83%, Lag= 0.6 min
Discarded = 0.01 cfs @ 12.15 hrs, Volume= 224 cf
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf
Routed to Reach DP-C1 : Wetlands

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 186.08' @ 12.91 hrs Surf.Area= 1,826 sf Storage= 60 cf

Plug-Flow detention time= 54.3 min calculated for 224 cf (100% of inflow)
Center-of-Mass det. time= 54.0 min ( 945.6 - 891.6 )

| 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**<br>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<br>Effective Size= 44.6"W x 30.0"H => 6.45 sf x 7.12'L = 45.9 cf<br>Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap<br>48 Chambers in 4 Rows |
| | | 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 Limited to weir flow at low heads |
| #2 | Primary | 188.80' | **5.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s) |
| #3 | Discarded | 186.00' | **0.270 in/hr Exfiltration over Surface area** |

**Discarded OutFlow** Max=0.01 cfs @ 12.15 hrs HW=186.04' (Free Discharge)
└**3=Exfiltration** (Exfiltration Controls 0.01 cfs)

**Primary OutFlow** Max=0.00 cfs @ 0.00 hrs HW=186.00' (Free Discharge)
├**1=Orifice/Grate** ( Controls 0.00 cfs)
└**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

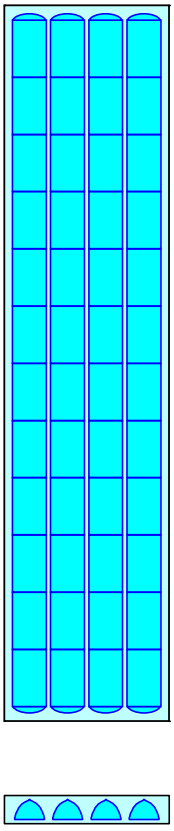
12 Chambers/Row x 7.12' Long +0.81' Cap Length x 2 = 87.06' Row Length +12.0" End Stone x 2 = 89.06' Base Length
4 Rows x 51.0" Wide + 6.0" Spacing x 3 + 12.0" Side Stone x 2 = 20.50' Base Width
6.0" Stone Base + 30.0" Chamber Height + 6.0" Stone Cover = 3.50' Field Height

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

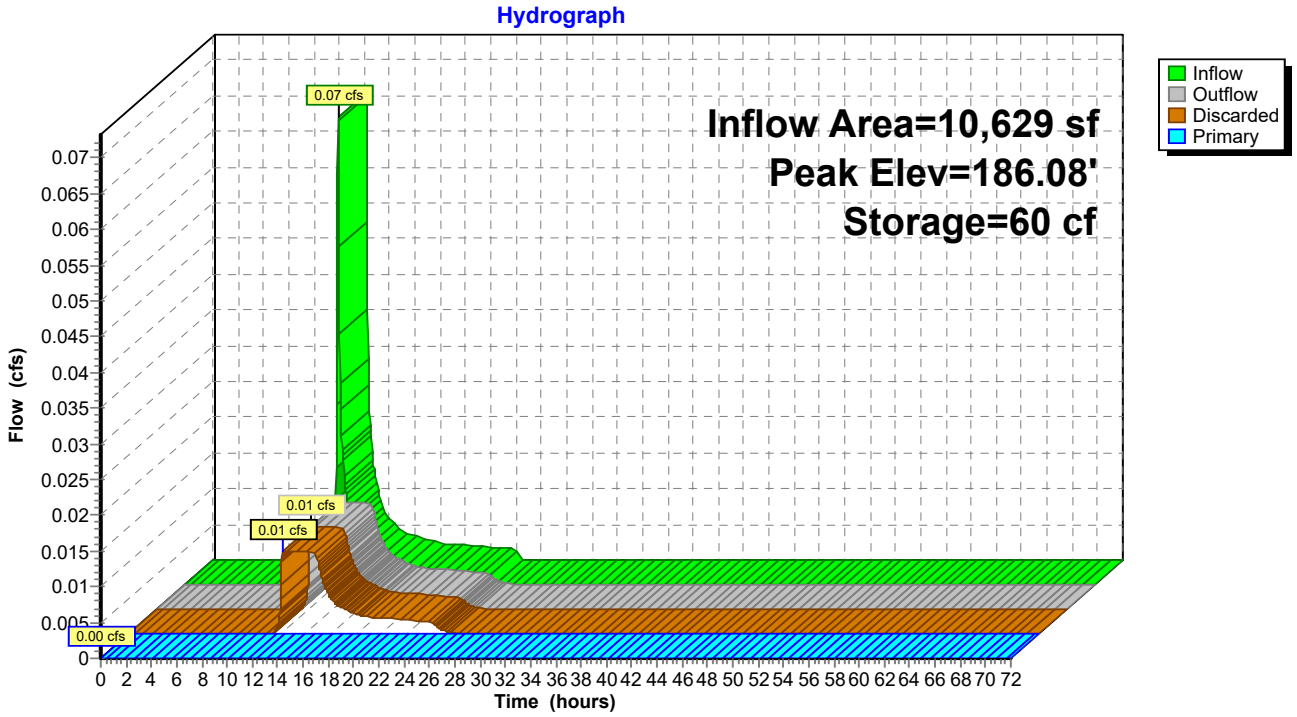
6,389.8 cf Field - 2,205.1 cf Chambers = 4,184.7 cf Stone x 40.0% Voids = 1,673.9 cf Stone Storage

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'

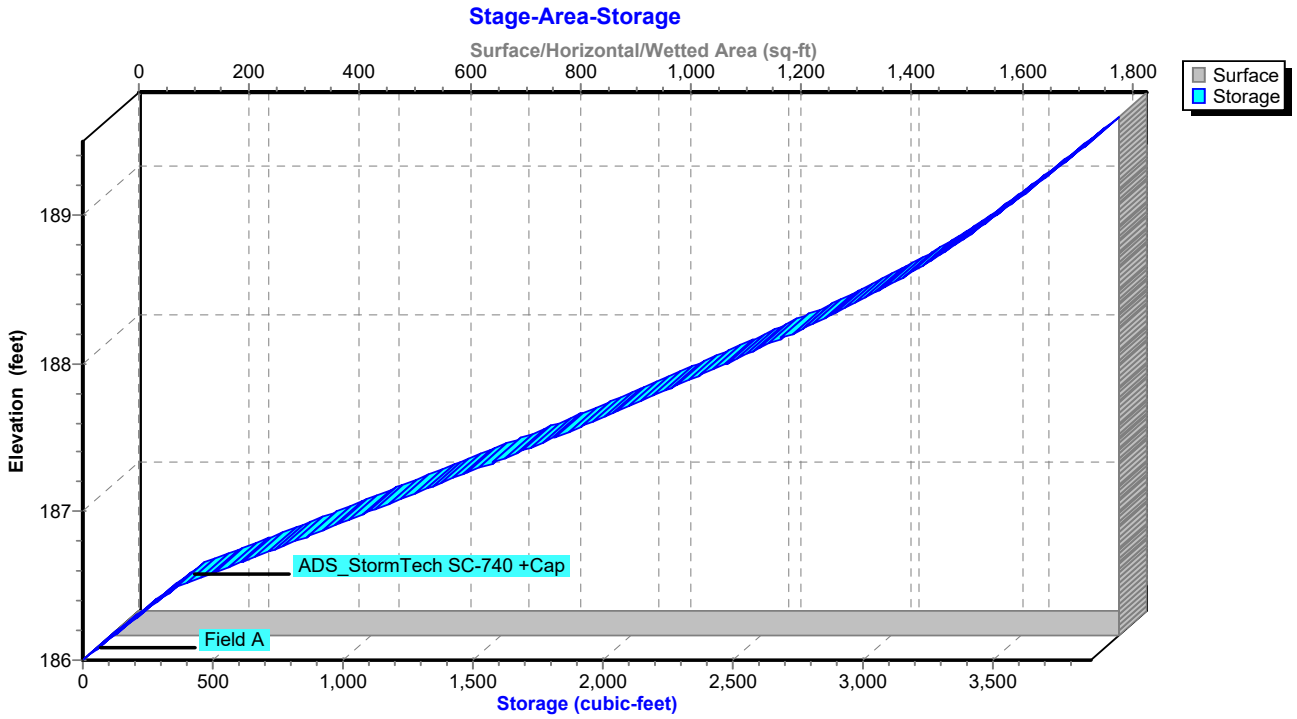
48 Chambers
236.7 cy Field
155.0 cy Stone



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




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



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

Inflow Area = 161,157 sf, 31.93% Impervious, Inflow Depth = 0.10" for 1-inch event
Inflow = 0.19 cfs @ 12.17 hrs, Volume= 1,316 cf
Outflow = 0.07 cfs @ 12.45 hrs, Volume= 1,316 cf, Atten= 66%, Lag= 16.9 min
Discarded = 0.07 cfs @ 12.45 hrs, Volume= 1,316 cf
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf
Routed to Reach DP-C1 : Wetlands

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 193.54' @ 13.07 hrs Surf.Area= 10,568 sf Storage= 168 cf

Plug-Flow detention time= 33.8 min calculated for 1,315 cf (100% of inflow)
Center-of-Mass det. time= 33.8 min ( 992.4 - 958.6 )

| Volume | Invert | Avail.Storage | Storage Description |
|---|---|---|---|
| #1A | 193.50' | 7,922 cf | **48.85'W x 216.33'L x 3.00'H Field A**<br>31,705 cf Overall - 11,899 cf Embedded = 19,806 cf x 40.0% Voids |
| #2A | 193.83' | 9,407 cf | **ADS N-12 24"** x 154 Inside #1<br>Inside= 23.8"W x 23.8"H => 3.10 sf x 20.00'L = 62.0 cf<br>Outside= 28.0"W x 28.0"H => 3.92 sf x 20.00'L = 78.4 cf<br>Row Length Adjustment= -10.00' x 3.10 sf x 14 rows<br>47.18' Header x 3.10 sf x 2 = 292.5 cf Inside |
| | | 17,329 cf | Total Available Storage |

Storage Group A created with Chamber Wizard

| Device | Routing | Invert | Outlet Devices |
|---|---|---|---|
| #1 | Primary | 194.35' | **30.0" W x 8.0" H Vert. Orifice/Grate** C= 0.600<br>Limited to weir flow at low heads |
| #2 | Primary | 195.00' | **10.0" W x 6.0" H Vert. Orifice/Grate** C= 0.600<br>Limited to weir flow at low heads |
| #3 | Primary | 196.15' | **5.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s) |
| #4 | Discarded | 193.50' | **0.270 in/hr Exfiltration over Surface area** |

**Discarded OutFlow** Max=0.07 cfs @ 12.45 hrs HW=193.53' (Free Discharge)
└**4=Exfiltration** (Exfiltration Controls 0.07 cfs)

**Primary OutFlow** Max=0.00 cfs @ 0.00 hrs HW=193.50' (Free Discharge)
├**1=Orifice/Grate** ( Controls 0.00 cfs)
├**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 14 rows

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

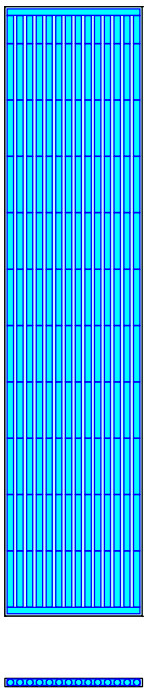
11 Chambers/Row x 20.00' Long -10.00' Row Adjustment +2.33' Header x 2 = 214.67' Row Length +10.0" End Stone x 2 = 216.33' Base Length
14 Rows x 28.0" Wide + 13.4" Spacing x 13 + 10.0" Side Stone x 2 = 48.85' Base Width
4.0" Stone Base + 28.0" Chamber Height + 4.0" Stone Cover = 3.00' Field Height

154 Chambers x 62.0 cf -10.00' Row Adjustment x 3.10 sf x 14 Rows + 47.18' Header x 3.10 sf x 2 = 9,406.5 cf Chamber Storage
154 Chambers x 78.4 cf -10.00' Row Adjustment x 3.92 sf x 14 Rows + 47.18' Header x 3.92 sf x 2 = 11,893.6 cf Displacement

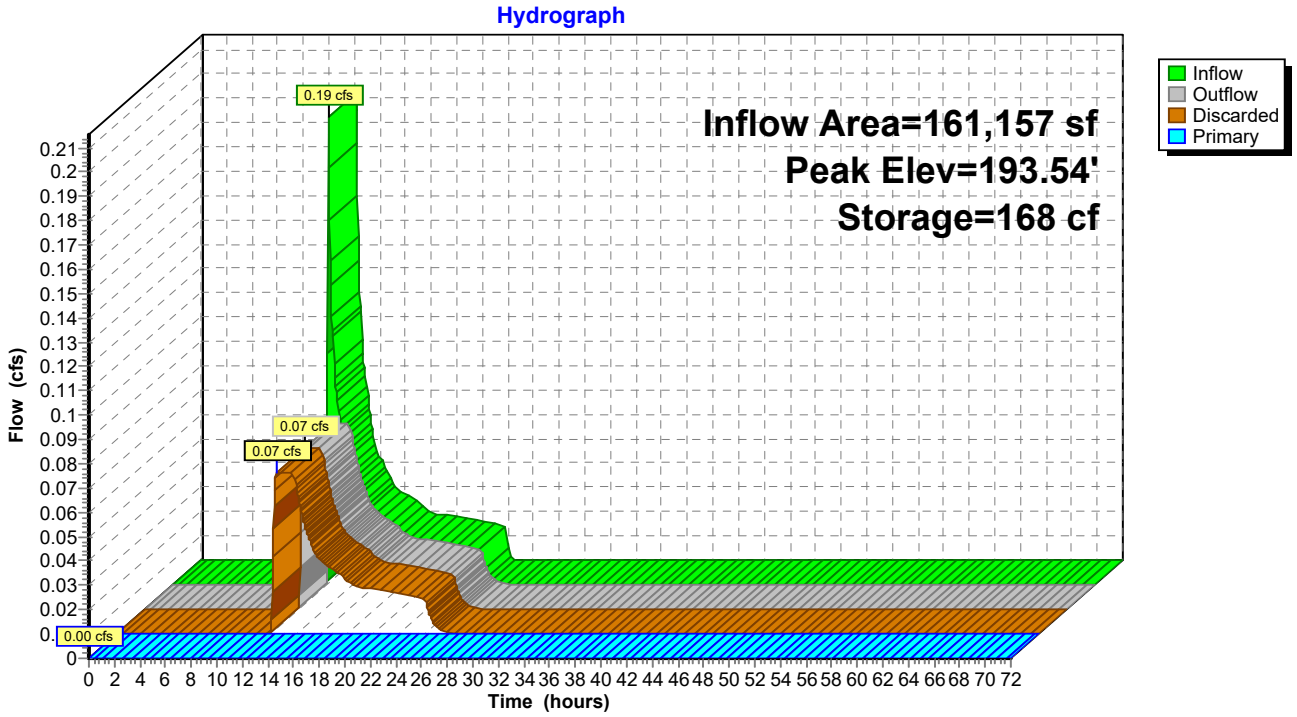
31,704.6 cf Field - 11,893.6 cf Chambers = 19,811.0 cf Stone x 40.0% Voids = 7,924.4 cf Stone Storage

Chamber Storage + Stone Storage = 17,330.9 cf = 0.398 af
Overall Storage Efficiency = 54.7%
Overall System Size = 216.33' x 48.85' x 3.00'

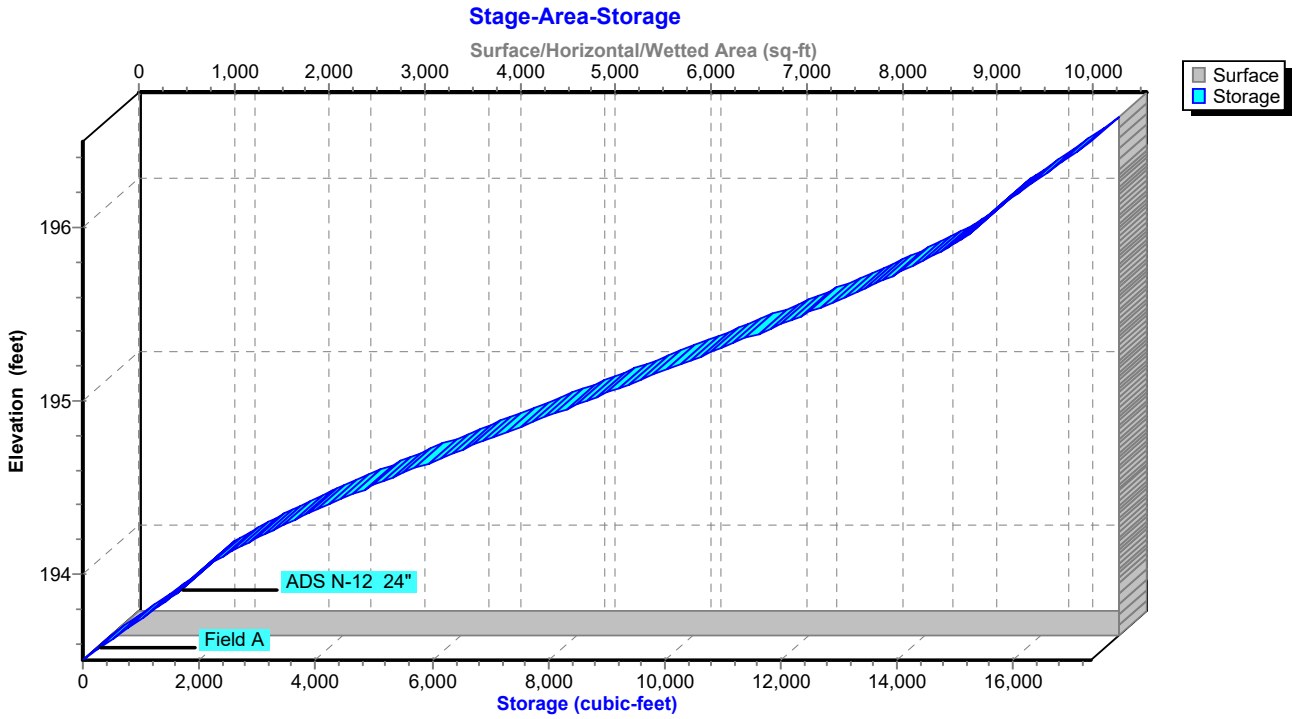
154 Chambers
1,174.2 cy Field
733.7 cy Stone



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




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



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

Inflow Area = 54,076 sf, 49.32% Impervious, Inflow Depth = 0.20" for 1-inch event
Inflow = 0.24 cfs @ 12.14 hrs, Volume= 890 cf
Outflow = 0.04 cfs @ 12.15 hrs, Volume= 890 cf, Atten= 83%, Lag= 0.4 min
Discarded = 0.04 cfs @ 12.15 hrs, Volume= 890 cf
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf
Routed to Reach DP-B : Concord Street Main

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 200.29' @ 13.10 hrs Surf.Area= 6,449 sf Storage= 224 cf

Plug-Flow detention time= 53.9 min calculated for 890 cf (100% of inflow)
Center-of-Mass det. time= 53.9 min ( 962.0 - 908.0 )

| Volume | Invert | Avail.Storage | Storage Description |
|---|---|---|---|
| #1A | 200.20' | 870 cf | **16.13'W x 66.67'L x 3.00'H Field A**<br>3,227 cf Overall - 1,052 cf Embedded = 2,175 cf x 40.0% Voids |
| #2A | 200.53' | 832 cf | **ADS N-12 24"** x 12 Inside #1<br>Inside= 23.8"W x 23.8"H => 3.10 sf x 20.00'L = 62.0 cf<br>Outside= 28.0"W x 28.0"H => 3.92 sf x 20.00'L = 78.4 cf<br>12 Chambers in 4 Rows<br>14.13' Header x 3.10 sf x 2 = 87.6 cf Inside |
| #3B | 200.20' | 3,733 cf | **43.67'W x 106.67'L x 3.00'H Field B**<br>13,974 cf Overall - 4,640 cf Embedded = 9,334 cf x 40.0% Voids |
| #4B | 200.53' | 3,668 cf | **ADS N-12 24"** x 55 Inside #3<br>Inside= 23.8"W x 23.8"H => 3.10 sf x 20.00'L = 62.0 cf<br>Outside= 28.0"W x 28.0"H => 3.92 sf x 20.00'L = 78.4 cf<br>55 Chambers in 11 Rows<br>41.67' Header x 3.10 sf x 2 = 258.3 cf Inside |
| #5C | 200.20' | 563 cf | **15.33'W x 46.67'L x 3.00'H Field C**<br>2,147 cf Overall - 738 cf Embedded = 1,408 cf x 40.0% Voids |
| #6C | 200.53' | 584 cf | **ADS N-12 24"** x 8 Inside #5<br>Inside= 23.8"W x 23.8"H => 3.10 sf x 20.00'L = 62.0 cf<br>Outside= 28.0"W x 28.0"H => 3.92 sf x 20.00'L = 78.4 cf<br>8 Chambers in 4 Rows<br>14.13' Header x 3.10 sf x 2 = 87.6 cf Inside |
| | | 10,250 cf | Total Available Storage |

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

| Device | Routing | Invert | Outlet Devices |
|---|---|---|---|
| #1 | Primary | 200.33' | **15.0" Round Culvert**<br>L= 142.0' CPP, mitered to conform to fill, Ke= 0.700<br>Inlet / Outlet Invert= 200.33' / 198.30' S= 0.0143 '/' Cc= 0.900<br>n= 0.013, Flow Area= 1.23 sf |
| #2 | Device 1 | 200.85' | **4.0" W x 5.0" H Vert. Orifice/Grate** C= 0.600<br>Limited to weir flow at low heads |
| #3 | Device 1 | 201.80' | **33.0" W x 8.0" H Vert. Orifice/Grate** C= 0.600 |

Limited to weir flow at low heads

| | | | |
|---|---|---|---|
| #4 | Device 1 | 202.70' | **5.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s) |
| #5 | Discarded | 200.20' | **0.270 in/hr Exfiltration over Surface area** |

**Discarded OutFlow** Max=0.04 cfs @ 12.15 hrs HW=200.24' (Free Discharge)
└**5=Exfiltration** (Exfiltration Controls 0.04 cfs)

**Primary OutFlow** Max=0.00 cfs @ 0.00 hrs HW=200.20' (Free Discharge)
└**1=Culvert** ( Controls 0.00 cfs)
  ├**2=Orifice/Grate** ( Controls 0.00 cfs)
  ├**3=Orifice/Grate** ( Controls 0.00 cfs)
  └**4=Sharp-Crested Rectangular Weir** ( 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

28.0" Wide + 19.2" Spacing = 47.2" C-C Row Spacing

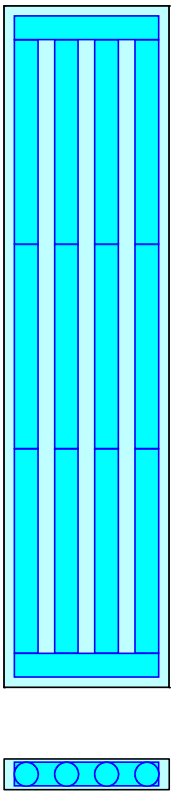
3 Chambers/Row x 20.00' Long +2.33' Header x 2 = 64.67' Row Length +12.0" End Stone x 2 = 66.67' Base Length
4 Rows x 28.0" Wide + 19.2" Spacing x 3 + 12.0" Side Stone x 2 = 16.13' Base Width
4.0" Stone Base + 28.0" Chamber Height + 4.0" Stone Cover = 3.00' Field Height

12 Chambers x 62.0 cf + 14.13' Header x 3.10 sf x 2 = 831.6 cf Chamber Storage
12 Chambers x 78.4 cf + 14.13' Header x 3.92 sf x 2 = 1,051.5 cf Displacement

3,226.8 cf Field - 1,051.5 cf Chambers = 2,175.3 cf Stone x 40.0% Voids = 870.1 cf Stone Storage

Chamber Storage + Stone Storage = 1,701.7 cf = 0.039 af
Overall Storage Efficiency = 52.7%
Overall System Size = 66.67' x 16.13' x 3.00'

12 Chambers
119.5 cy Field
80.6 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 + 19.2" Spacing = 47.2" C-C Row Spacing

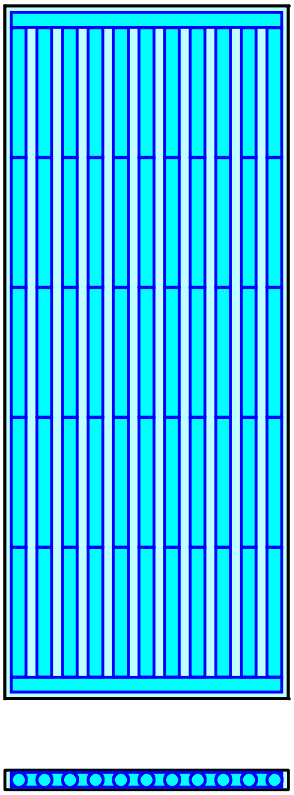
5 Chambers/Row x 20.00' Long +2.33' Header x 2 = 104.67' Row Length +12.0" End Stone x 2 = 106.67' Base Length
11 Rows x 28.0" Wide + 19.2" Spacing x 10 + 12.0" Side Stone x 2 = 43.67' Base Width
4.0" Stone Base + 28.0" Chamber Height + 4.0" Stone Cover = 3.00' Field Height

55 Chambers x 62.0 cf + 41.67' Header x 3.10 sf x 2 = 3,668.3 cf Chamber Storage
55 Chambers x 78.4 cf + 41.67' Header x 3.92 sf x 2 = 4,638.2 cf Displacement

13,973.8 cf Field - 4,638.2 cf Chambers = 9,335.5 cf Stone x 40.0% Voids = 3,734.2 cf Stone Storage

Chamber Storage + Stone Storage = 7,402.5 cf = 0.170 af
Overall Storage Efficiency = 53.0%
Overall System Size = 106.67' x 43.67' x 3.00'

55 Chambers
517.5 cy Field
345.8 cy Stone



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

**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 + 19.2" Spacing = 47.2" C-C Row Spacing

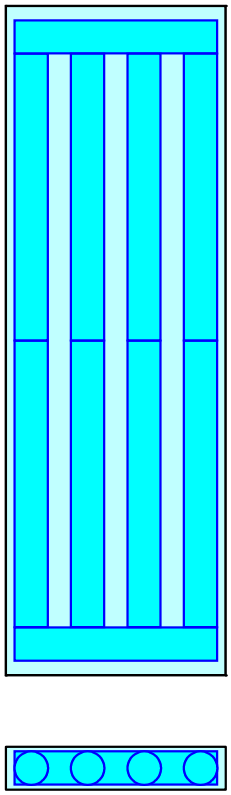
2 Chambers/Row x 20.00' Long +2.33' Header x 2 = 44.67' Row Length +12.0" End Stone x 2 = 46.67' Base Length
4 Rows x 28.0" Wide + 19.2" Spacing x 3 + 7.2" Side Stone x 2 = 15.33' Base Width
4.0" Stone Base + 28.0" Chamber Height + 4.0" Stone Cover = 3.00' Field Height

8 Chambers x 62.0 cf + 14.13' Header x 3.10 sf x 2 = 583.6 cf Chamber Storage
8 Chambers x 78.4 cf + 14.13' Header x 3.92 sf x 2 = 737.9 cf Displacement

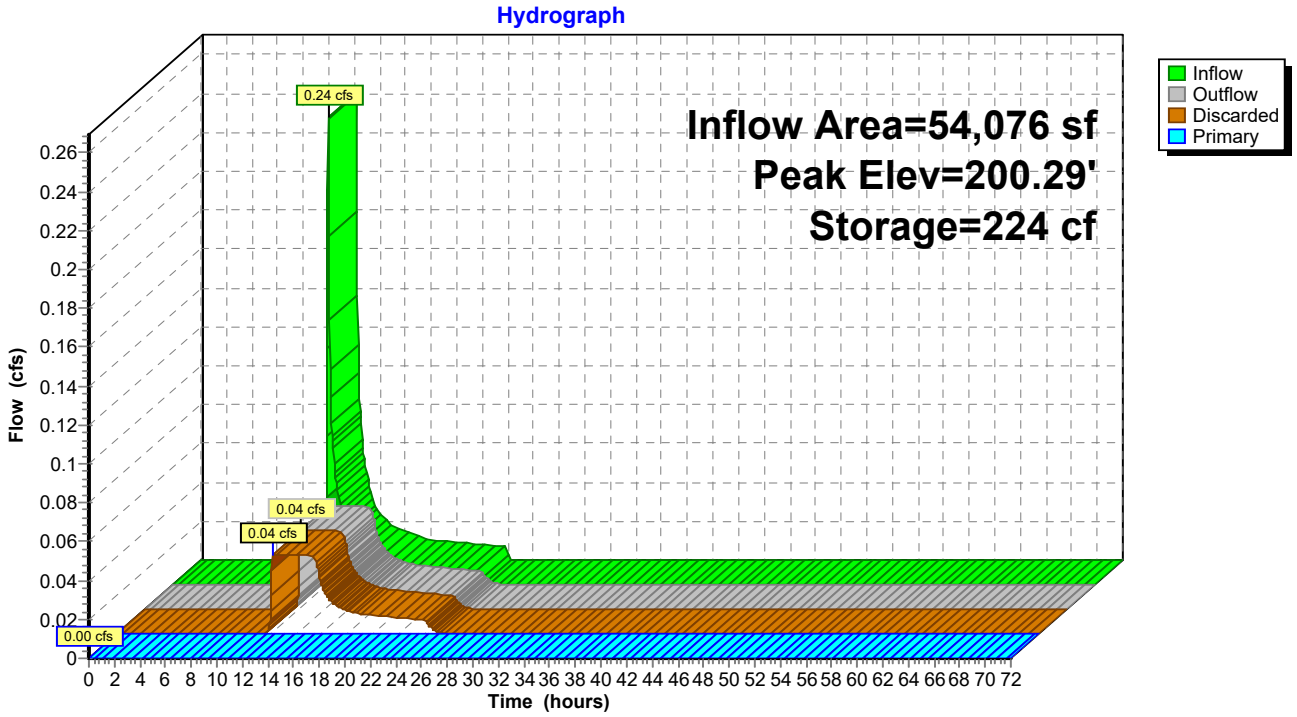
2,146.7 cf Field - 737.9 cf Chambers = 1,408.8 cf Stone x 40.0% Voids = 563.5 cf Stone Storage

Chamber Storage + Stone Storage = 1,147.1 cf = 0.026 af
Overall Storage Efficiency = 53.4%
Overall System Size = 46.67' x 15.33' x 3.00'

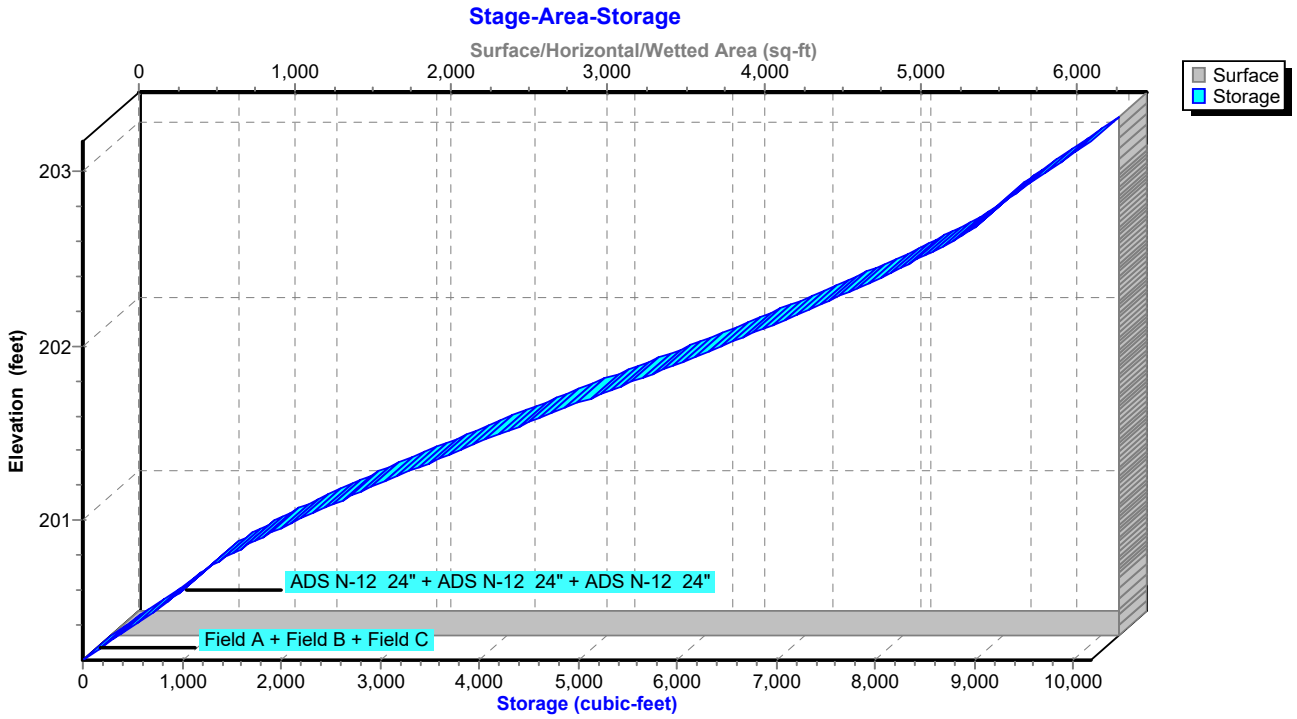
8 Chambers
79.5 cy Field
52.2 cy Stone



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




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



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=169,240 sf 0.00% Impervious Runoff Depth=0.97"
Flow Length=642' Tc=9.3 min CN=71 Runoff=3.60 cfs 13,675 cf

**Subcatchment PDA10: PDA10** Runoff Area=112,914 sf 68.00% Impervious Runoff Depth=2.31"
Tc=6.0 min CN=90 Runoff=6.63 cfs 21,716 cf

**Subcatchment PDA11: PDA11** Runoff Area=25,873 sf 62.02% Impervious Runoff Depth=2.22"
Tc=6.0 min CN=89 Runoff=1.47 cfs 4,784 cf

**Subcatchment PDA12: PDA12** Runoff Area=145,461 sf 28.75% Impervious Runoff Depth=1.59"
Tc=6.0 min CN=81 Runoff=6.04 cfs 19,248 cf

**Subcatchment PDA2: Proposed 2** Runoff Area=72,814 sf 59.44% Impervious Runoff Depth=2.13"
Tc=6.0 min CN=88 Runoff=4.00 cfs 12,939 cf

**Subcatchment PDA3: Proposed 3** Runoff Area=33,480 sf 57.85% Impervious Runoff Depth=2.13"
Tc=6.0 min CN=88 Runoff=1.84 cfs 5,949 cf

**Subcatchment PDA4: Proposed 4** Runoff Area=54,076 sf 49.32% Impervious Runoff Depth=1.97"
Tc=6.0 min CN=86 Runoff=2.76 cfs 8,860 cf

**Subcatchment PDA5: Proposed 5** Runoff Area=168,248 sf 21.01% Impervious Runoff Depth=1.38"
Tc=6.0 min CN=78 Runoff=6.07 cfs 19,409 cf

**Subcatchment PDA6: Proposal 6** Runoff Area=10,629 sf 58.03% Impervious Runoff Depth=2.13"
Tc=6.0 min CN=88 Runoff=0.58 cfs 1,889 cf

**Subcatchment PDA7: Proposal 7** Runoff Area=161,157 sf 31.93% Impervious Runoff Depth=1.59"
Tc=6.0 min CN=81 Runoff=6.70 cfs 21,325 cf

**Subcatchment PDA8: Proposed 8** Runoff Area=79,806 sf 77.39% Impervious Runoff Depth=2.59"
Tc=6.0 min CN=93 Runoff=5.11 cfs 17,226 cf

**Subcatchment PDA9: Proposed 9** Runoff Area=113,962 sf 0.00% Impervious Runoff Depth=0.92"
Flow Length=366' Tc=12.4 min CN=70 Runoff=2.05 cfs 8,706 cf

**Reach 4R: Swale** Avg. Flow Depth=0.40' Max Vel=2.41 fps Inflow=3.59 cfs 13,195 cf
n=0.022 L=726.0' S=0.0069 '/' Capacity=49.00 cfs Outflow=3.08 cfs 13,195 cf

**Reach DP-A: Eastern Intermittent Stream** Inflow=3.08 cfs 13,195 cf
Outflow=3.08 cfs 13,195 cf

**Reach DP-B: Concord Street Main** Inflow=7.46 cfs 33,258 cf
Outflow=7.46 cfs 33,258 cf

**Reach DP-C1: Wetlands** Inflow=18.44 cfs 78,069 cf
Outflow=18.44 cfs 78,069 cf

**Reach DP-C2: Intermittent Stream West** Inflow=2.05 cfs 8,706 cf
Outflow=2.05 cfs 8,706 cf

**Reach PR TOT: Total Site** Inflow=27.38 cfs 124,522 cf
Outflow=27.38 cfs 124,522 cf

**Pond BIO-1: Surface System** Peak Elev=194.47' Storage=4,309 cf Inflow=6.63 cfs 21,716 cf
Discarded=0.03 cfs 4,386 cf Primary=5.45 cfs 17,330 cf Outflow=5.48 cfs 21,716 cf

**Pond SI-1: Surface Infiltration** Peak Elev=200.50' Storage=2,253 cf Inflow=1.84 cfs 5,949 cf
Discarded=0.03 cfs 3,403 cf Primary=0.60 cfs 2,547 cf Outflow=0.63 cfs 5,949 cf

**Pond SI-2: South Inf Basin** Peak Elev=195.04' Storage=5,177 cf Inflow=5.11 cfs 17,226 cf
Discarded=0.02 cfs 4,332 cf Primary=3.61 cfs 12,893 cf Outflow=3.64 cfs 17,226 cf

**Pond SS-1: Subsurface Infiltration (SC-310** Peak Elev=185.34' Storage=5,391 cf Inflow=6.04 cfs 19,248 cf
Discarded=0.04 cfs 5,385 cf Primary=3.44 cfs 13,864 cf Outflow=3.48 cfs 19,248 cf

**Pond SS-2: Subsurface Infiltration (SC-740** Peak Elev=187.07' Storage=1,202 cf Inflow=0.58 cfs 1,889 cf
Discarded=0.01 cfs 1,744 cf Primary=0.01 cfs 144 cf Outflow=0.02 cfs 1,889 cf

**Pond SS-3: Subsurface Infiltration (24"** Peak Elev=194.78' Storage=6,984 cf Inflow=6.70 cfs 21,325 cf
Discarded=0.07 cfs 7,495 cf Primary=2.26 cfs 13,830 cf Outflow=2.33 cfs 21,325 cf

**Pond SS-4: Subsurface Infiltration (24" Pipe)** Peak Elev=201.39' Storage=3,760 cf Inflow=2.76 cfs 8,860 cf
Discarded=0.04 cfs 3,981 cf Primary=0.38 cfs 4,880 cf Outflow=0.42 cfs 8,860 cf

**Total Runoff Area = 1,147,660 sf Runoff Volume = 155,728 cf Average Runoff Depth = 1.63"**
**67.00% Pervious = 768,980 sf 33.00% Impervious = 378,680 sf**

## Summary for Subcatchment PDA-1: Wooded Area

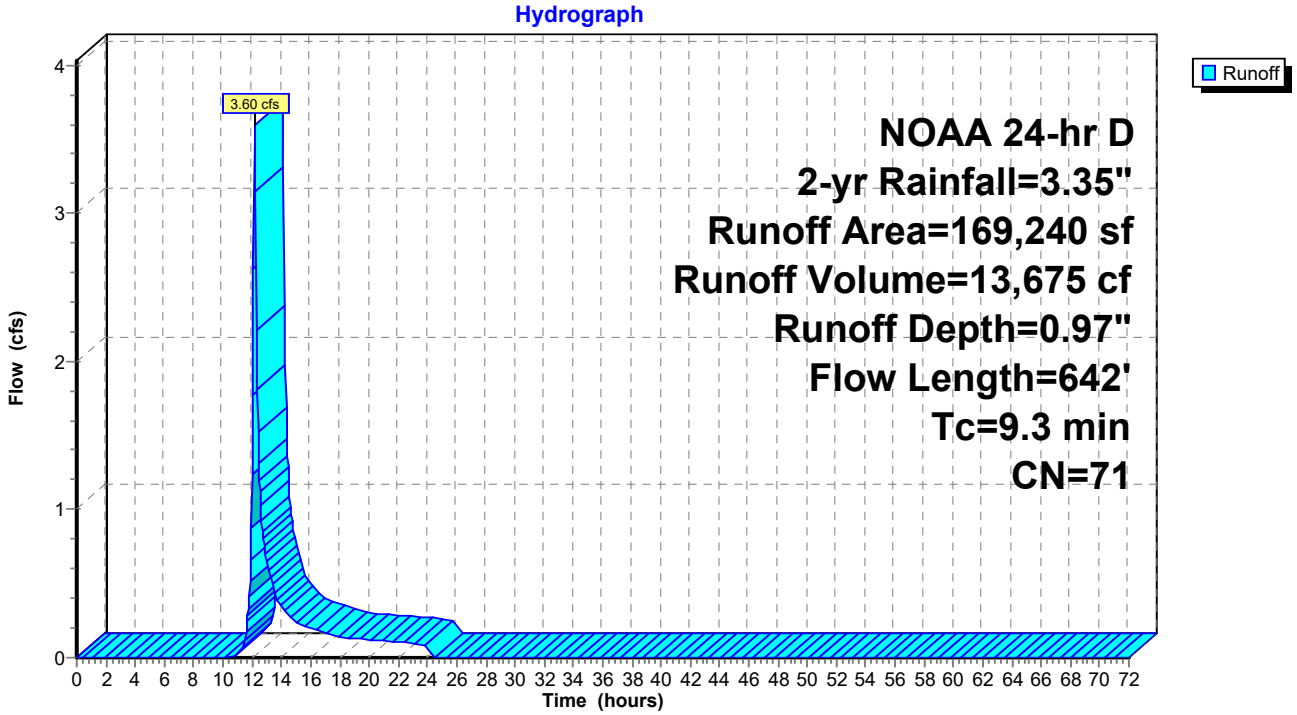
Runoff = 3.60 cfs @ 12.17 hrs, Volume= 13,675 cf, Depth= 0.97"
Routed to Reach 4R : Swale

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 |
|---|---|---|
| 33,190 | 74 | >75% Grass cover, Good, HSG C |
| 136,050 | 70 | Woods, Good, HSG C |
| 169,240 | 71 | Weighted Average |
| 169,240 | | 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

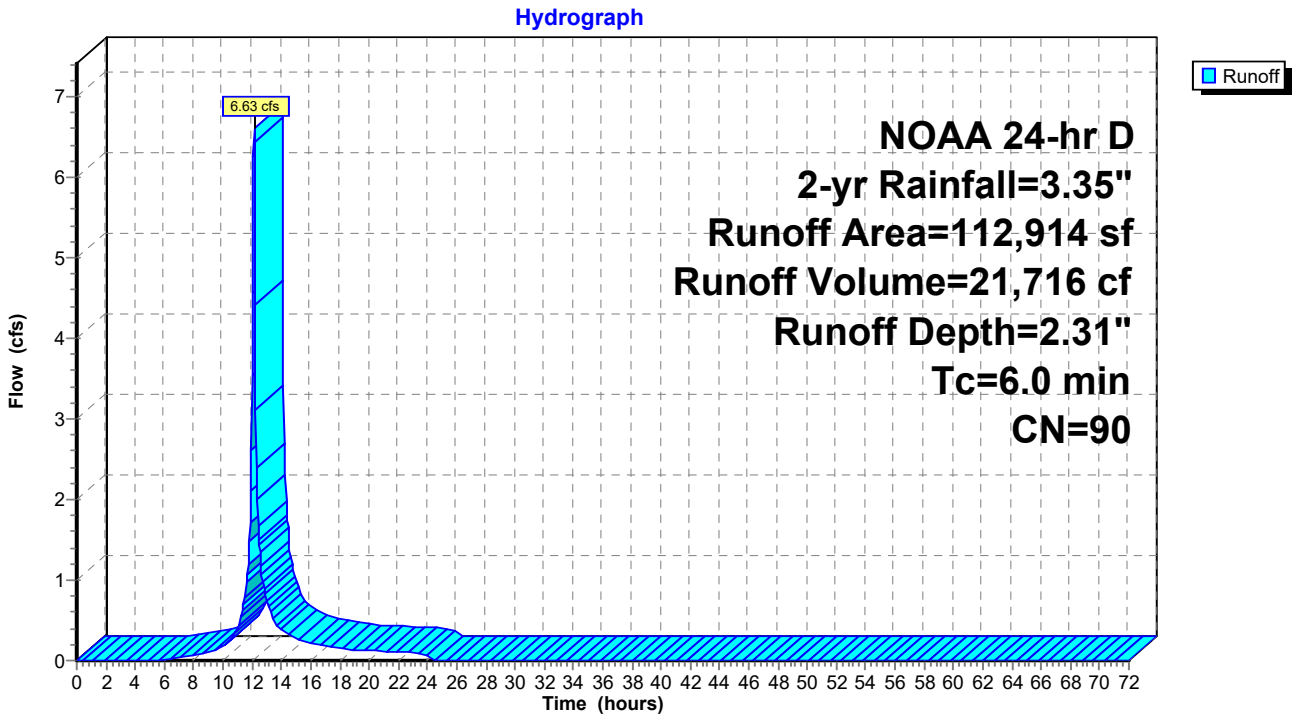
Runoff = 6.63 cfs @ 12.13 hrs, Volume= 21,716 cf, Depth= 2.31"
Routed to Pond BIO-1 : Surface System

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 |
|---|---|---|---|
| | 36,136 | 74 | >75% Grass cover, Good, HSG C |
| | 27,453 | 98 | Roofs, HSG C |
| * | 49,325 | 98 | Paved Parking and Walkways, HSG C |
| | 112,914 | 90 | Weighted Average |
| | 36,136 | | 32.00% Pervious Area |
| | 76,778 | | 68.00% 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

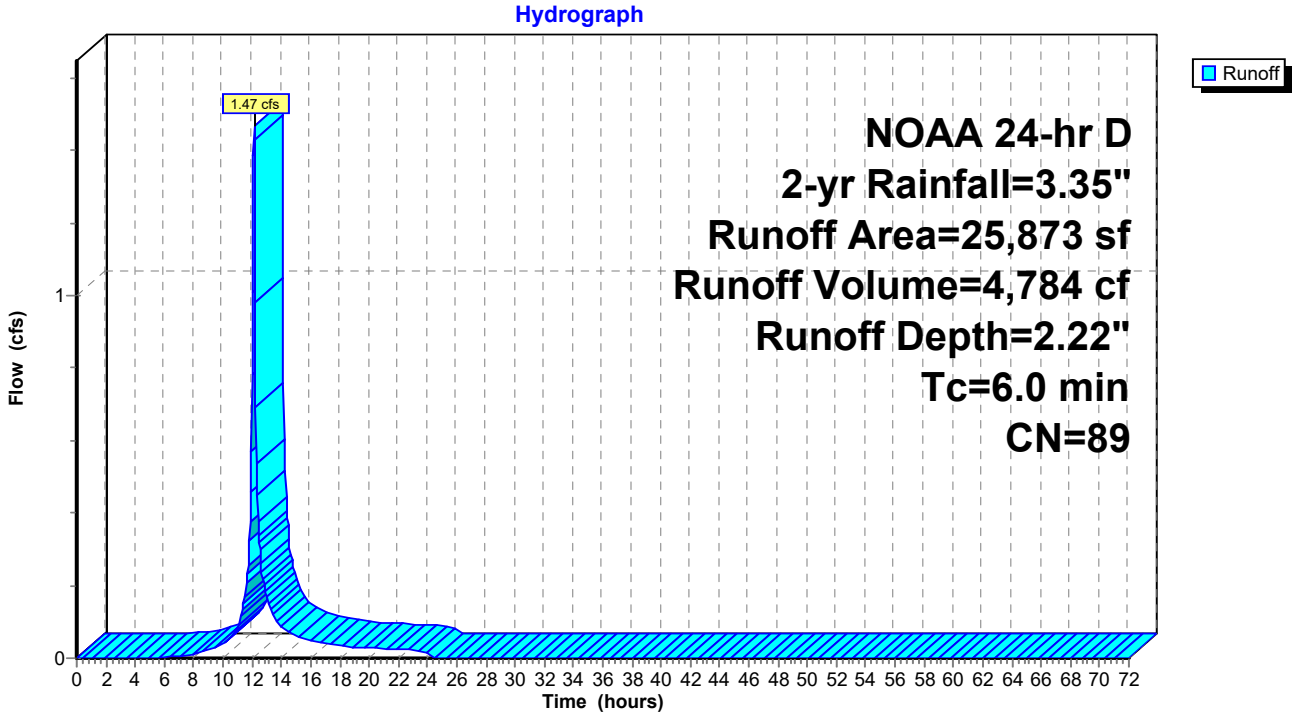
Runoff = 1.47 cfs @ 12.13 hrs, Volume= 4,784 cf, Depth= 2.22"
Routed to Reach DP-C1 : Wetlands

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 |
|---|---|---|
| 9,827 | 74 | >75% Grass cover, Good, HSG C |
| 16,046 | 98 | Paved parking, HSG C |
| 25,873 | 89 | Weighted Average |
| 9,827 | | 37.98% Pervious Area |
| 16,046 | | 62.02% 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

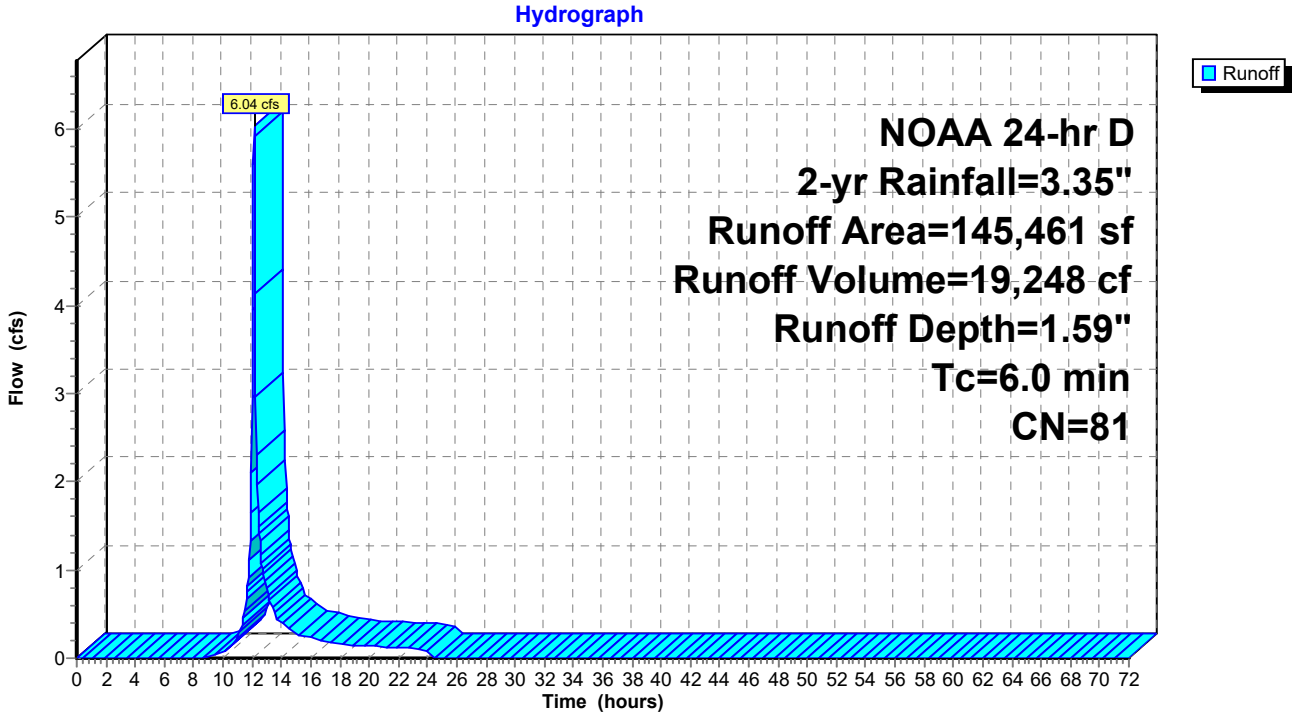
Runoff = 6.04 cfs @ 12.13 hrs, Volume= 19,248 cf, Depth= 1.59"
Routed to Pond SS-1 : Subsurface Infiltration (SC-310 Chambers)

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 |
|---|---|---|
| 103,648 | 74 | >75% Grass cover, Good, HSG C |
| 41,813 | 98 | Paved parking, HSG C |
| 145,461 | 81 | Weighted Average |
| 103,648 | | 71.25% Pervious Area |
| 41,813 | | 28.75% 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

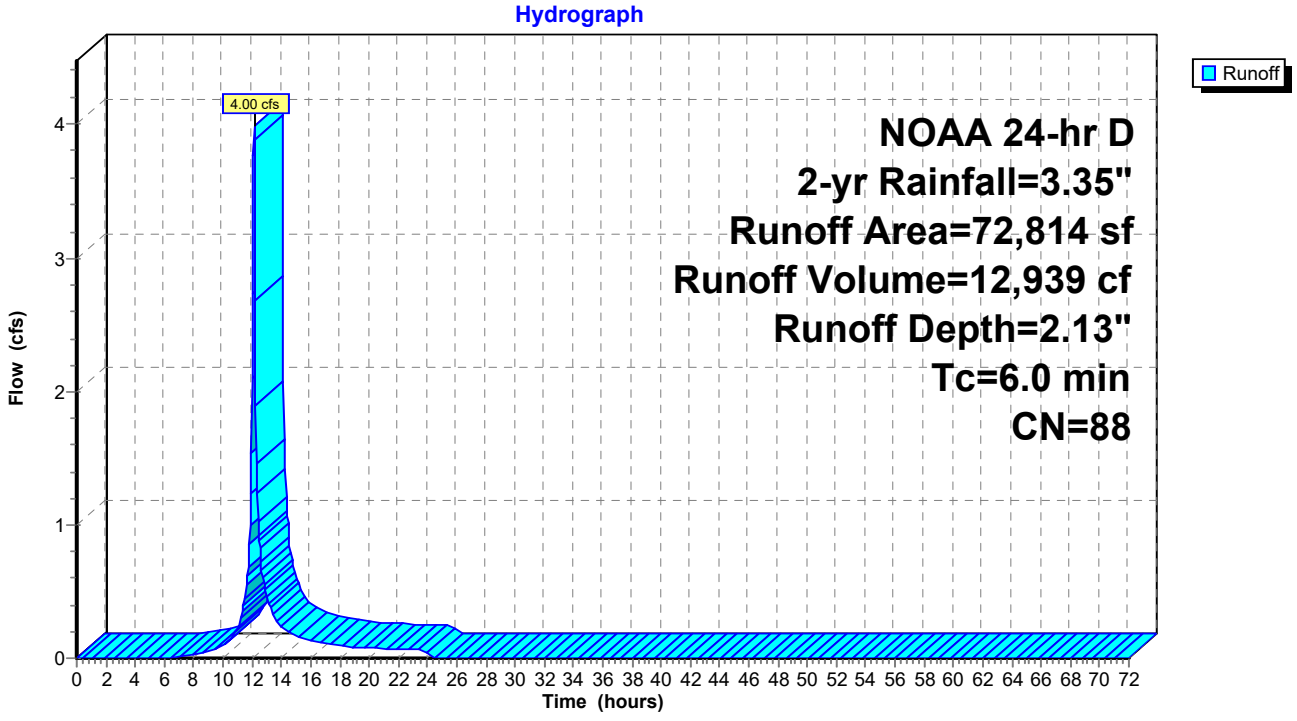
Runoff = 4.00 cfs @ 12.13 hrs, Volume= 12,939 cf, Depth= 2.13"
Routed to Reach DP-B : Concord Street Main

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 |
|---|---|---|
| 29,536 | 74 | >75% Grass cover, Good, HSG C |
| 43,278 | 98 | Paved parking, HSG C |
| 72,814 | 88 | Weighted Average |
| 29,536 | | 40.56% Pervious Area |
| 43,278 | | 59.44% 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

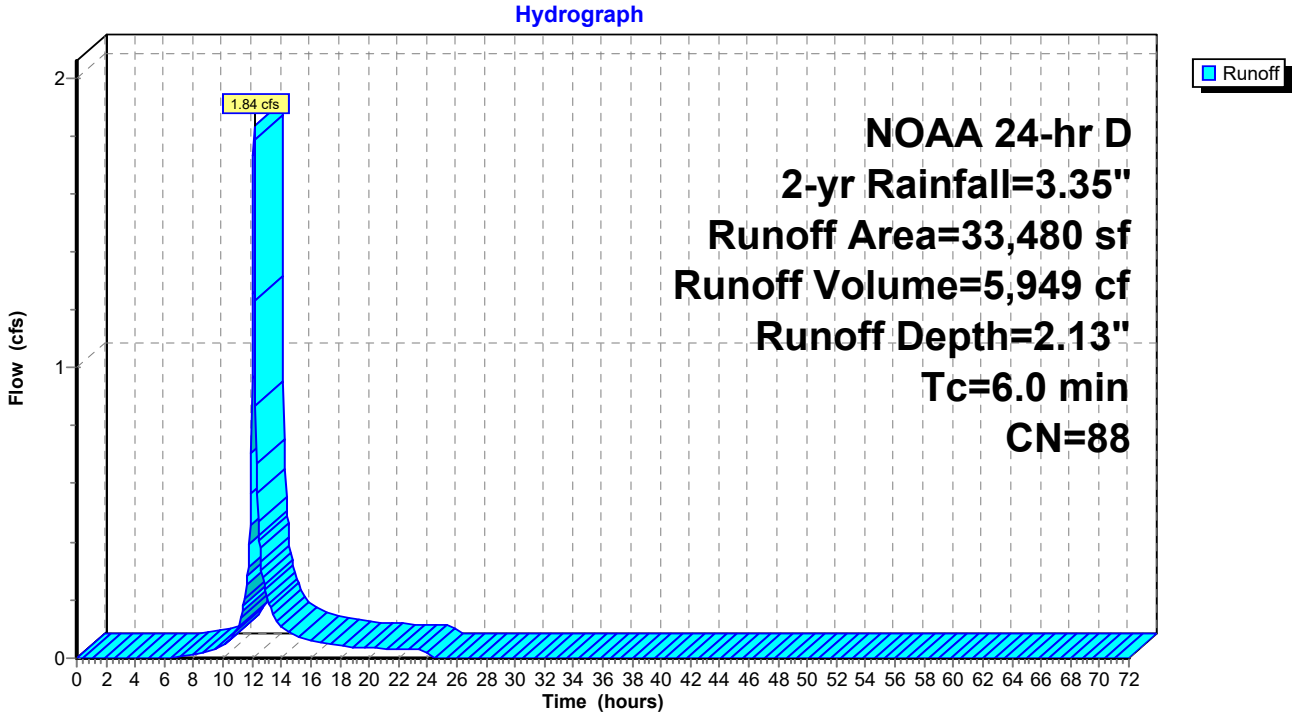
Runoff = 1.84 cfs @ 12.13 hrs, Volume= 5,949 cf, Depth= 2.13"
Routed to Pond SI-1 : Surface Infiltration

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 |
|---|---|---|
| 19,367 | 98 | Paved parking, HSG C |
| 14,113 | 74 | >75% Grass cover, Good, HSG C |
| 33,480 | 88 | Weighted Average |
| 14,113 | | 42.15% Pervious Area |
| 19,367 | | 57.85% 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

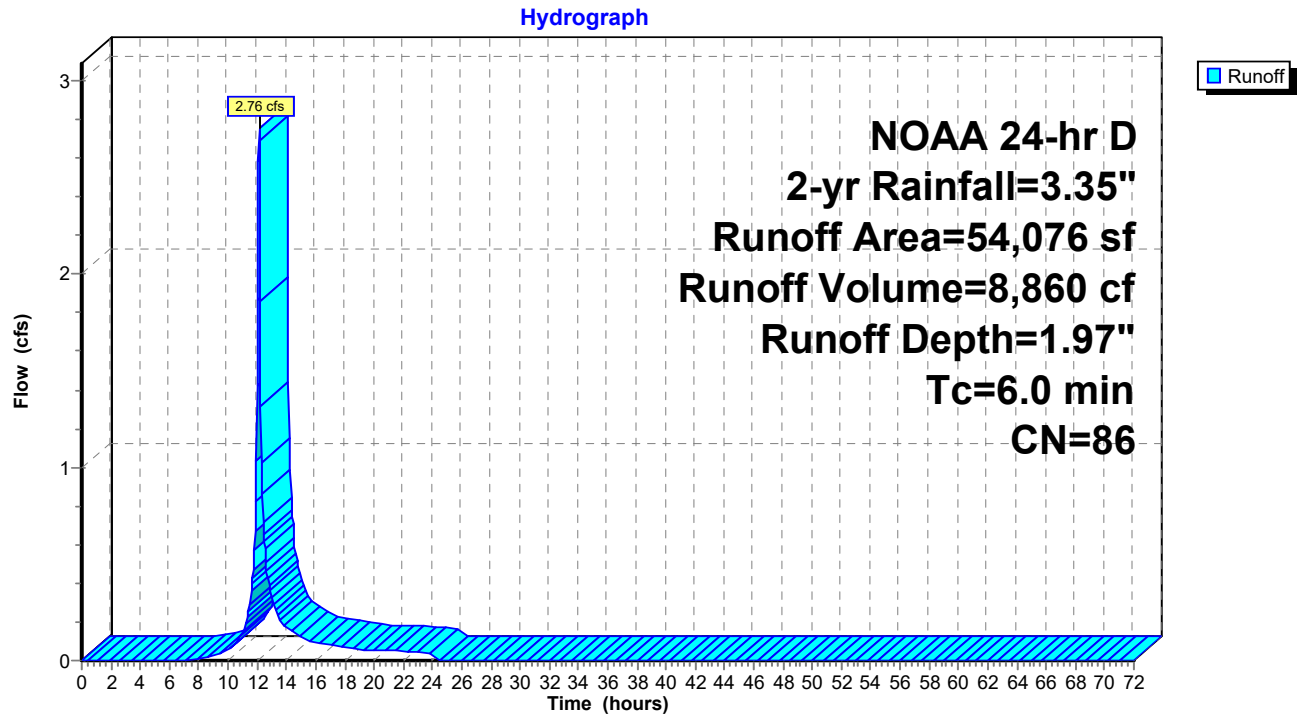
Runoff = 2.76 cfs @ 12.13 hrs, Volume= 8,860 cf, Depth= 1.97"
Routed to Pond SS-4 : Subsurface Infiltration (24" Pipe)

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 |
|---|---|---|---|
| | 27,408 | 74 | >75% Grass cover, Good, HSG C |
| | 17,739 | 98 | Paved roads w/curbs & sewers, HSG C |
| * | 8,929 | 98 | Roofs, HSG C |
| | 54,076 | 86 | Weighted Average |
| | 27,408 | | 50.68% Pervious Area |
| | 26,668 | | 49.32% 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

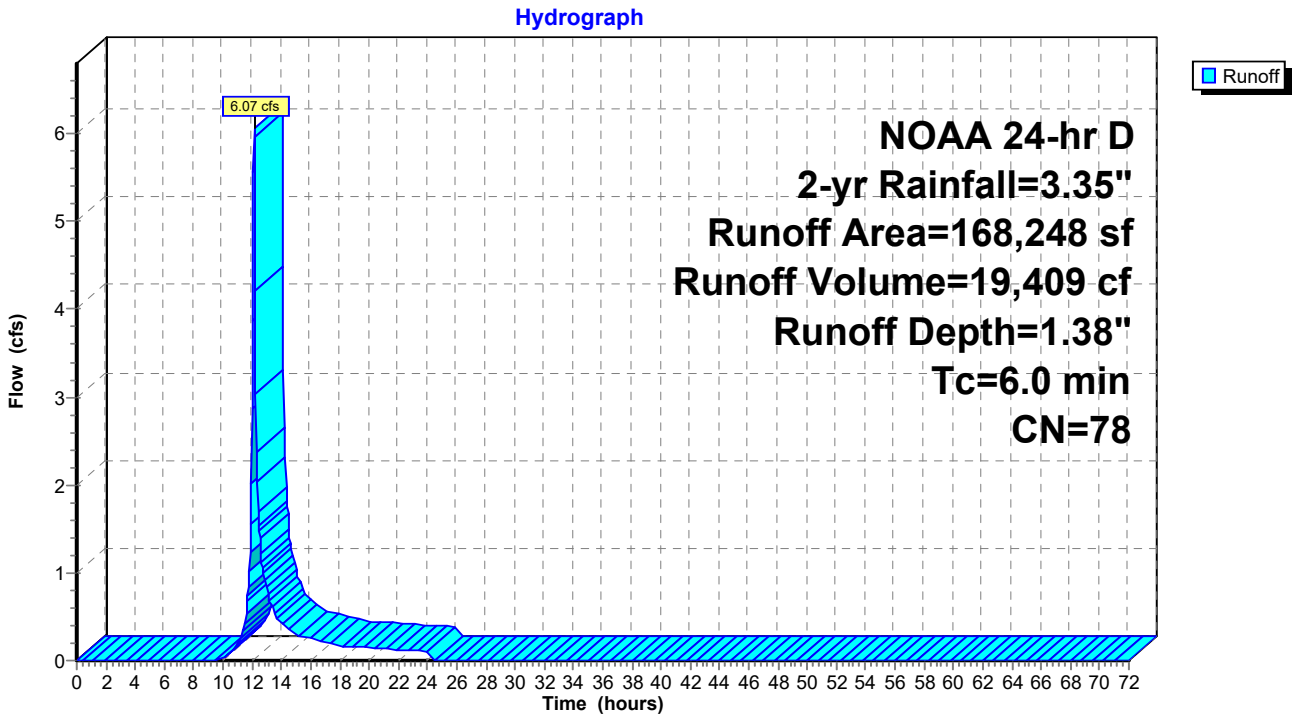
Runoff = 6.07 cfs @ 12.13 hrs, Volume= 19,409 cf, Depth= 1.38"
Routed to Reach DP-C1 : Wetlands

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 |
|---|---|---|---|
| | 93,250 | 74 | >75% Grass cover, Good, HSG C |
| | 39,650 | 70 | Woods, Good, HSG C |
| * | 35,348 | 98 | Pond |
| | 168,248 | 78 | Weighted Average |
| | 132,900 | | 78.99% Pervious Area |
| | 35,348 | | 21.01% 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

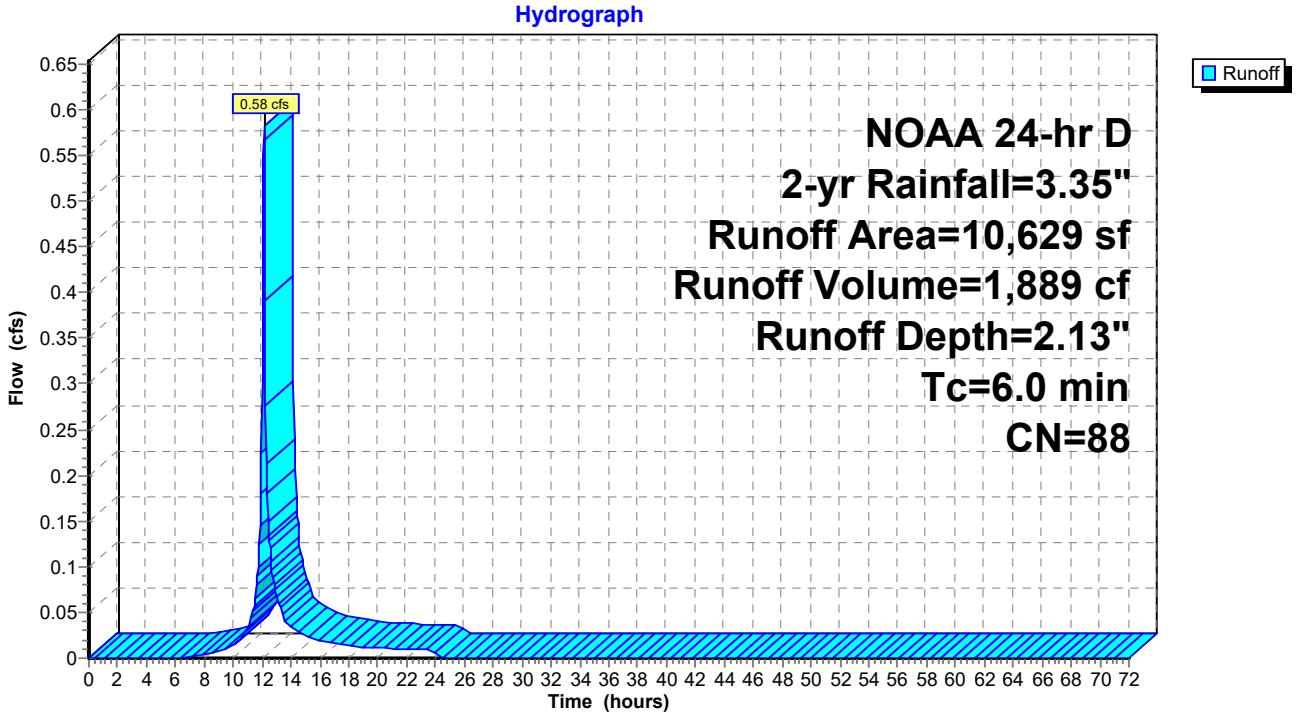
Runoff = 0.58 cfs @ 12.13 hrs, Volume= 1,889 cf, Depth= 2.13"
Routed to Pond SS-2 : Subsurface Infiltration (SC-740 Chambers)

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 |
|---|---|---|
| 6,168 | 98 | Paved parking, HSG C |
| 4,461 | 74 | >75% Grass cover, Good, HSG C |
| 10,629 | 88 | Weighted Average |
| 4,461 | | 41.97% Pervious Area |
| 6,168 | | 58.03% 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

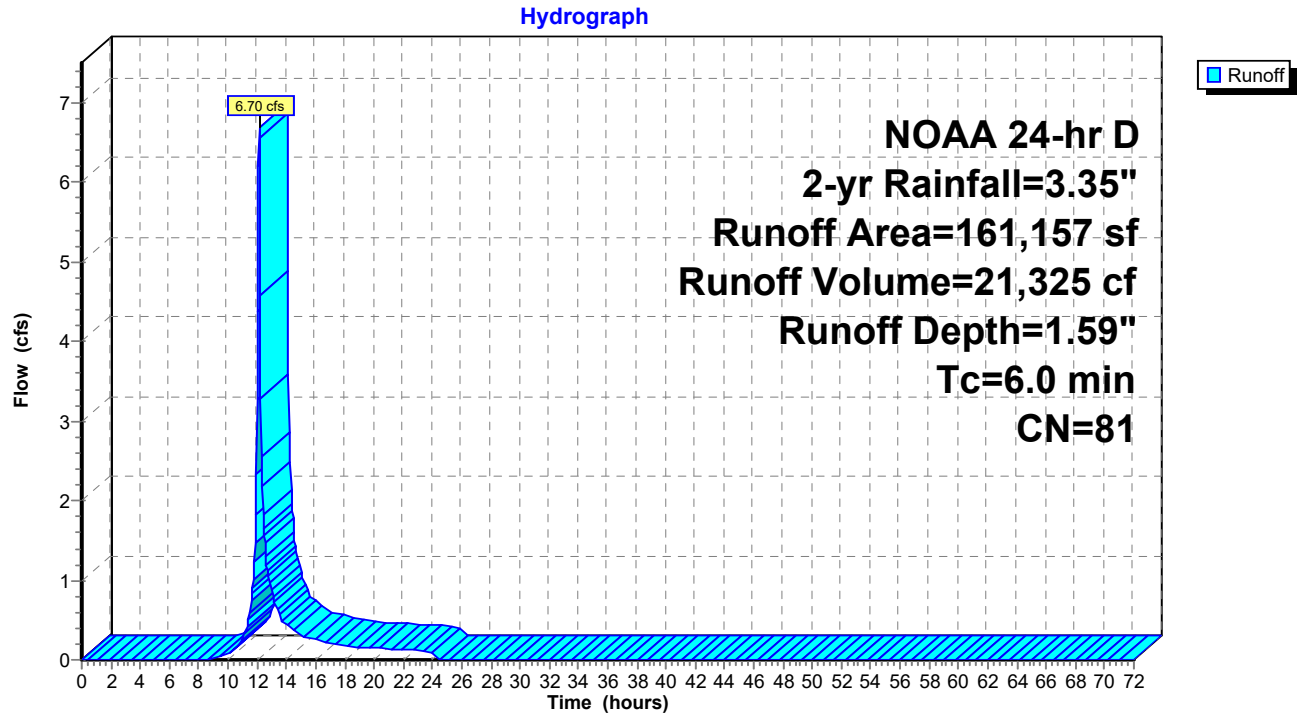
Runoff = 6.70 cfs @ 12.13 hrs, Volume= 21,325 cf, Depth= 1.59"
Routed to Pond SS-3 : Subsurface Infiltration (24" Pipe)

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 |
|---|---|---|
| 32,000 | 98 | Roofs, HSG C |
| 73,574 | 74 | >75% Grass cover, Good, HSG C |
| 19,452 | 98 | Paved parking, HSG C |
| 36,131 | 70 | Woods, Good, HSG C |
| 161,157 | 81 | Weighted Average |
| 109,705 | | 68.07% Pervious Area |
| 51,452 | | 31.93% 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

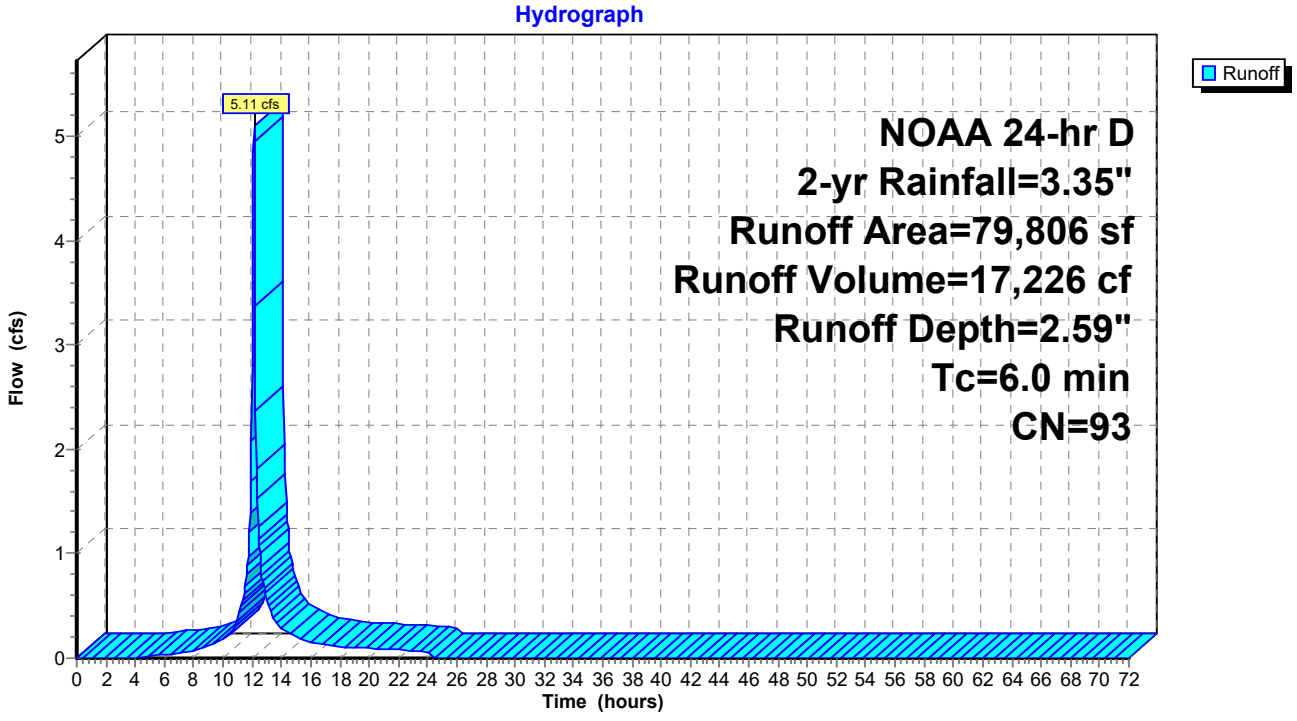
Runoff = 5.11 cfs @ 12.13 hrs, Volume= 17,226 cf, Depth= 2.59"
Routed to Pond SI-2 : South Inf Basin

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 |
|---|---|---|
| 61,762 | 98 | Paved parking, HSG C |
| 18,044 | 74 | >75% Grass cover, Good, HSG C |
| 79,806 | 93 | Weighted Average |
| 18,044 | | 22.61% Pervious Area |
| 61,762 | | 77.39% 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

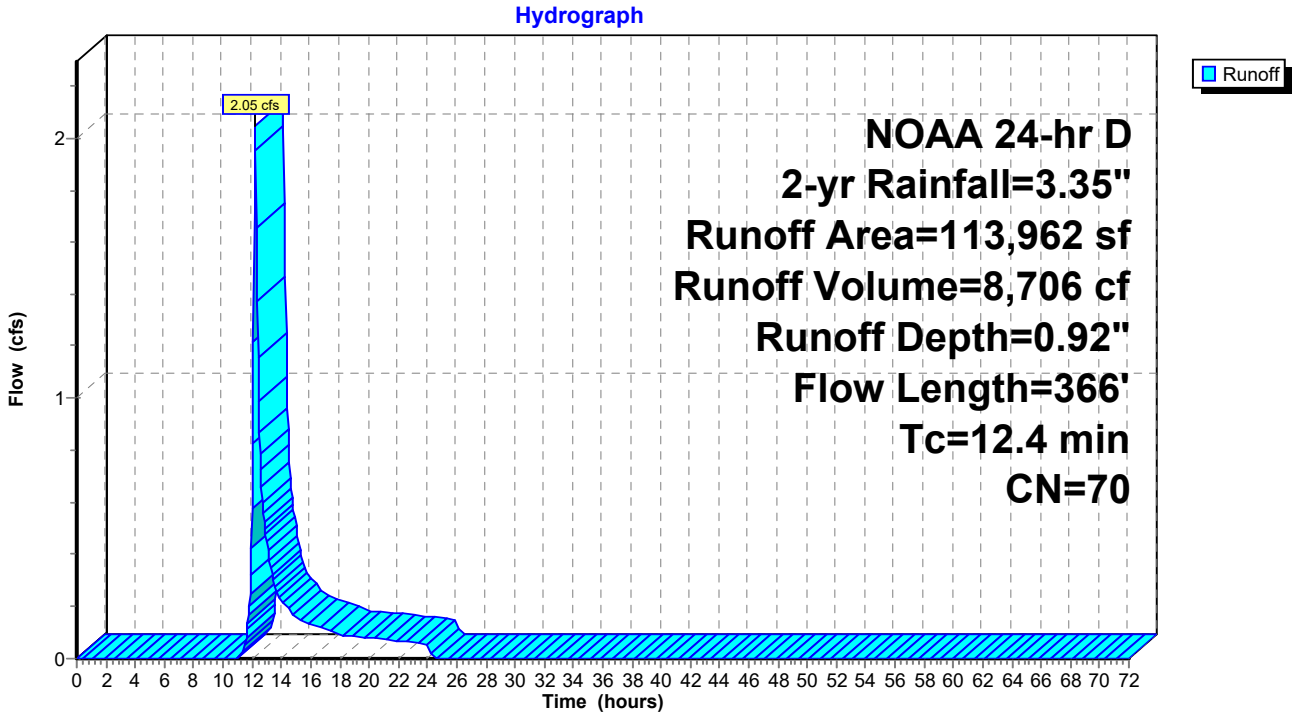
Runoff = 2.05 cfs @ 12.21 hrs, Volume= 8,706 cf, Depth= 0.92"
Routed to Reach DP-C2 : Intermittent Stream West

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 |
|---|---|---|
| 106,091 | 70 | Woods, Good, HSG C |
| 7,871 | 74 | >75% Grass cover, Good, HSG C |
| 113,962 | 70 | Weighted Average |
| 113,962 | | 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 4R: Swale

Inflow Area = 169,240 sf, 0.00% Impervious, Inflow Depth = 0.94" for 2-yr event
Inflow = 3.59 cfs @ 12.17 hrs, Volume= 13,195 cf, Incl. 0.01 cfs Inflow Loss
Outflow = 3.08 cfs @ 12.32 hrs, Volume= 13,195 cf, Atten= 14%, Lag= 8.6 min
Routed to Reach DP-A : Eastern Intermittent Stream

Routing by Stor-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Max. Velocity= 2.41 fps, Min. Travel Time= 5.0 min
Avg. Velocity = 0.85 fps, Avg. Travel Time= 14.3 min

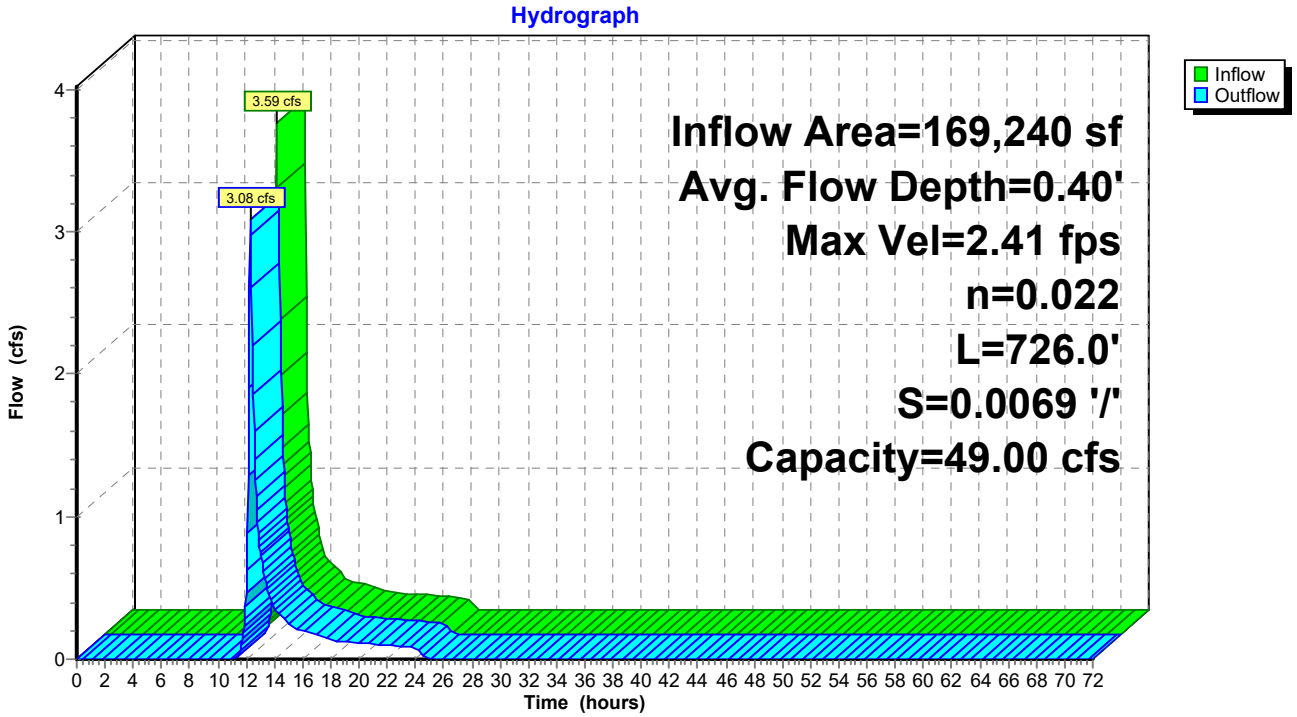
Peak Storage= 935 cf @ 12.23 hrs
Average Depth at Peak Storage= 0.40' , Surface Width= 4.41'
Bank-Full Depth= 1.50' Flow Area= 9.8 sf, Capacity= 49.00 cfs

2.00' x 1.50' deep channel, n= 0.022
Side Slope Z-value= 3.0 '/' Top Width= 11.00'
Length= 726.0' Slope= 0.0069 '/'
Inlet Invert= 207.00', Outlet Invert= 202.00'

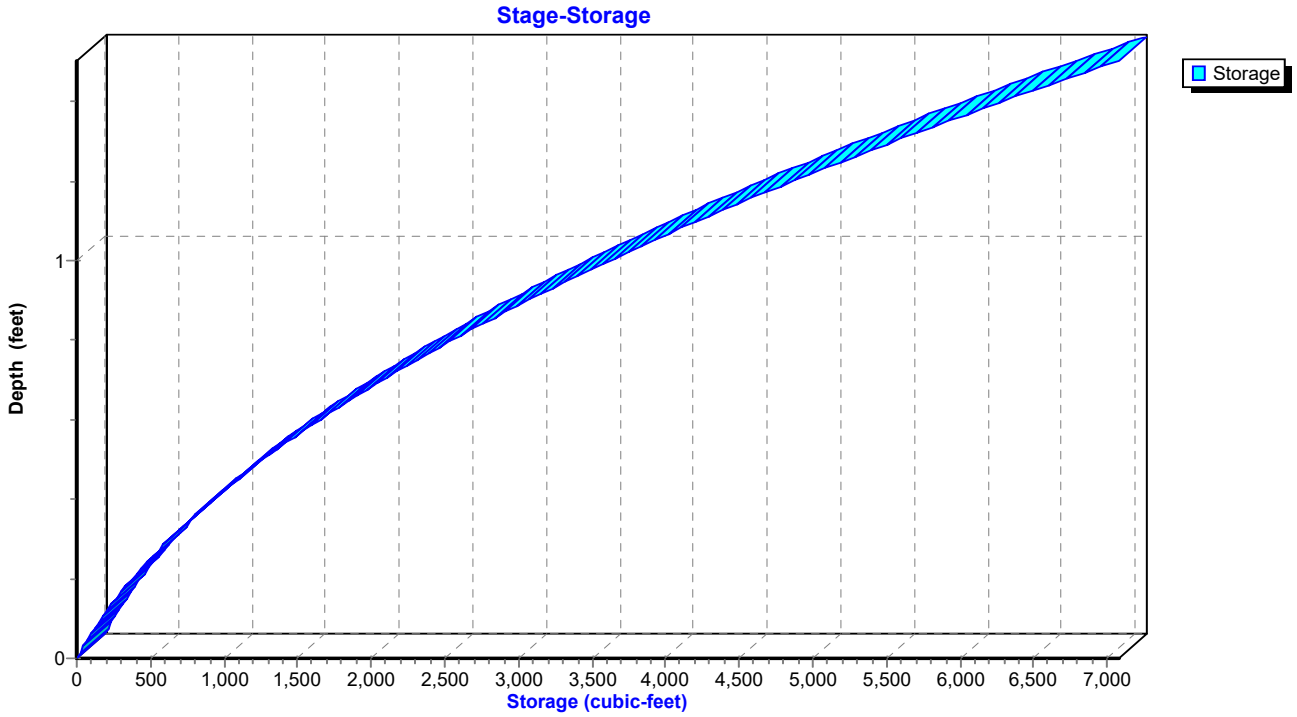


‡

### Reach 4R: Swale



## Reach 4R: Swale

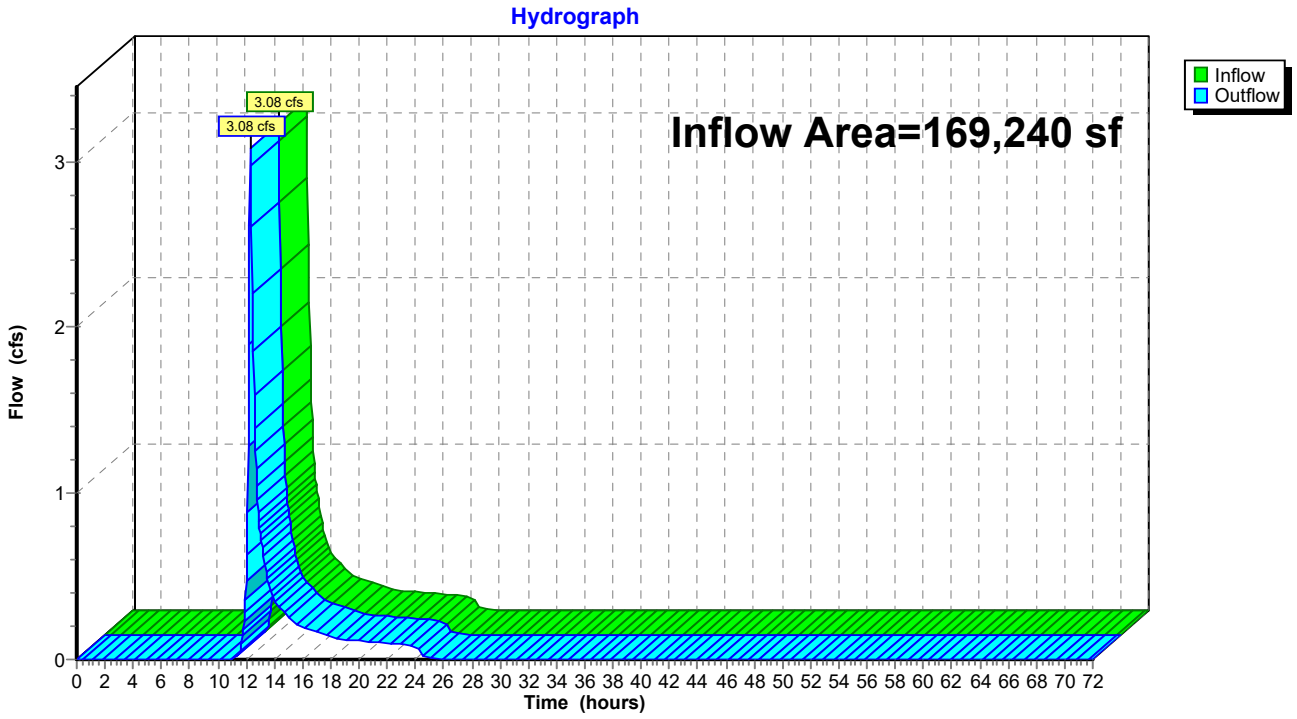


## Summary for Reach DP-A: Eastern Intermittent Stream

Inflow Area = 169,240 sf, 0.00% Impervious, Inflow Depth = 0.94" for 2-yr event
Inflow = 3.08 cfs @ 12.32 hrs, Volume= 13,195 cf
Outflow = 3.08 cfs @ 12.32 hrs, Volume= 13,195 cf, Atten= 0%, Lag= 0.0 min
Routed to Reach PR TOT : Total Site

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

## Reach DP-A: Eastern Intermittent Stream

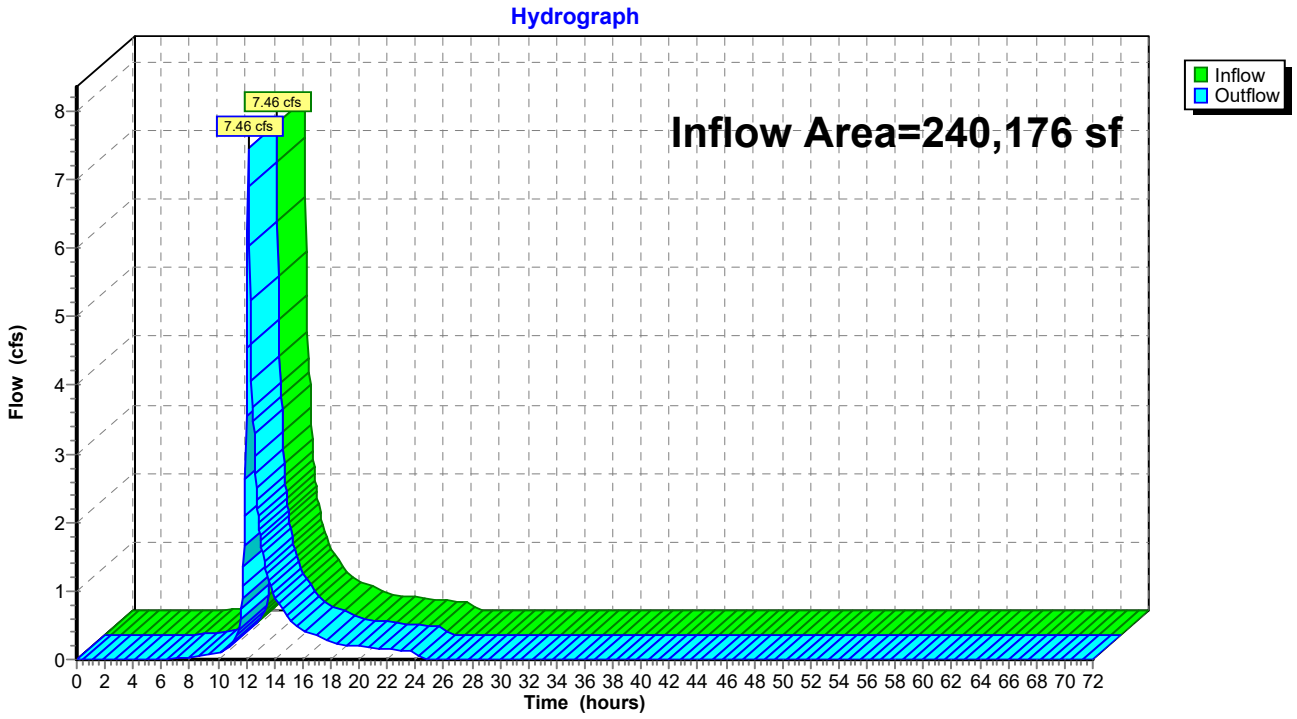


## Summary for Reach DP-B: Concord Street Main

Inflow Area = 240,176 sf, 62.90% Impervious, Inflow Depth = 1.66" for 2-yr event
Inflow = 7.46 cfs @ 12.16 hrs, Volume= 33,258 cf
Outflow = 7.46 cfs @ 12.16 hrs, Volume= 33,258 cf, Atten= 0%, Lag= 0.0 min
Routed to Reach PR TOT : Total Site

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

## Reach DP-B: Concord Street Main

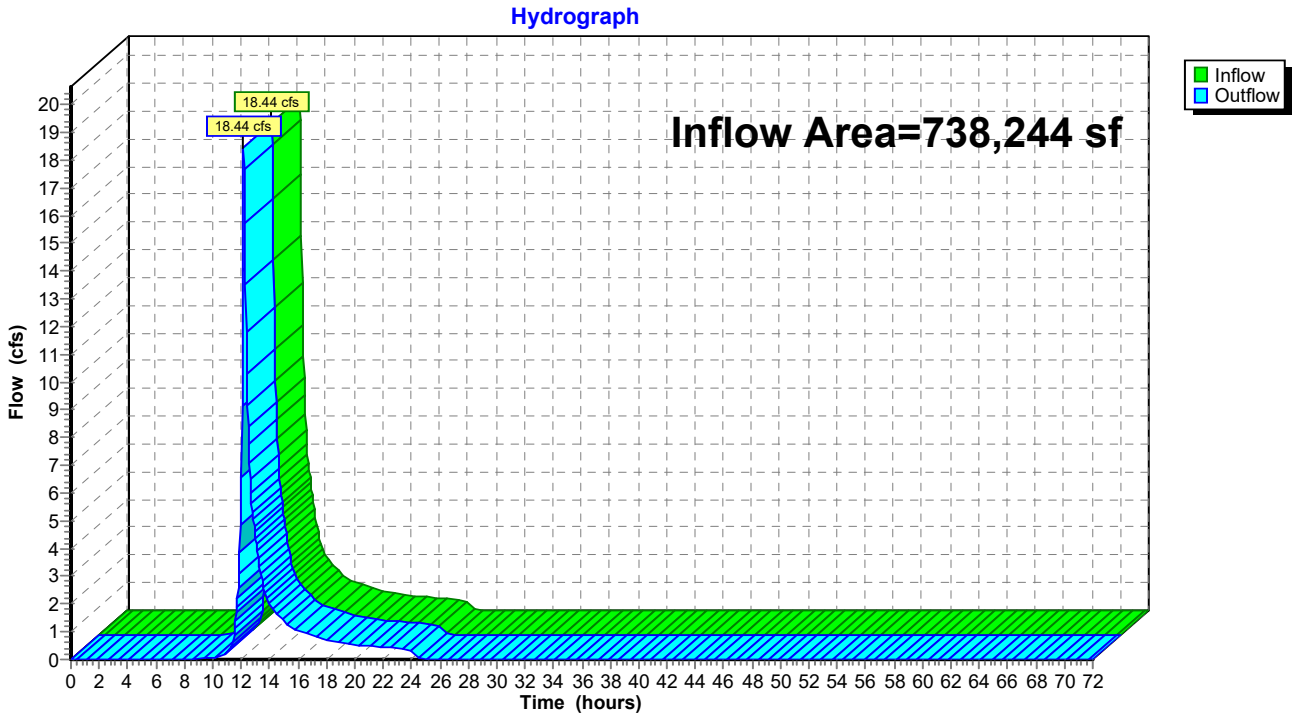


## Summary for Reach DP-C1: Wetlands

Inflow Area = 738,244 sf, 30.83% Impervious, Inflow Depth = 1.27" for 2-yr event
Inflow = 18.44 cfs @ 12.17 hrs, Volume= 78,069 cf
Outflow = 18.44 cfs @ 12.17 hrs, Volume= 78,069 cf, Atten= 0%, Lag= 0.0 min
Routed to Reach PR TOT : Total Site

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

## Reach DP-C1: Wetlands

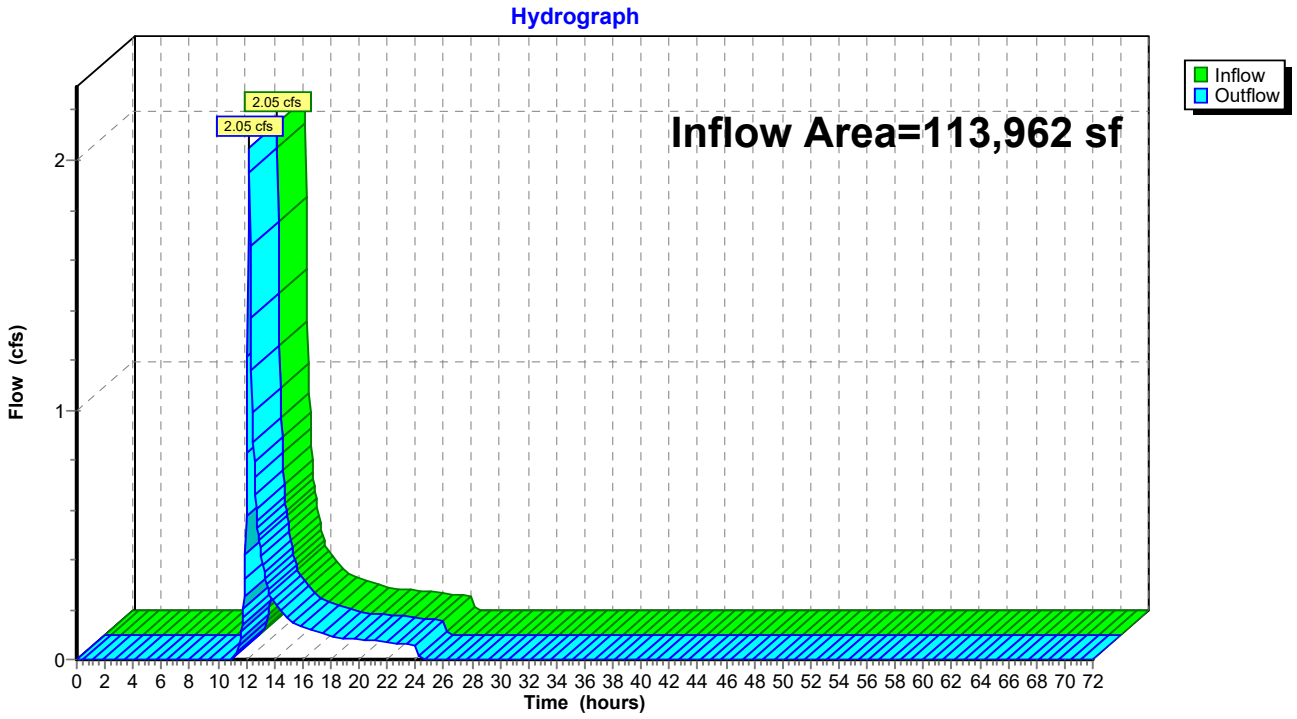


## Summary for Reach DP-C2: Intermittent Stream West

Inflow Area = 113,962 sf, 0.00% Impervious, Inflow Depth = 0.92" for 2-yr event
Inflow = 2.05 cfs @ 12.21 hrs, Volume= 8,706 cf
Outflow = 2.05 cfs @ 12.21 hrs, Volume= 8,706 cf, Atten= 0%, Lag= 0.0 min
Routed to Reach DP-C1 : Wetlands

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

## Reach DP-C2: Intermittent Stream West

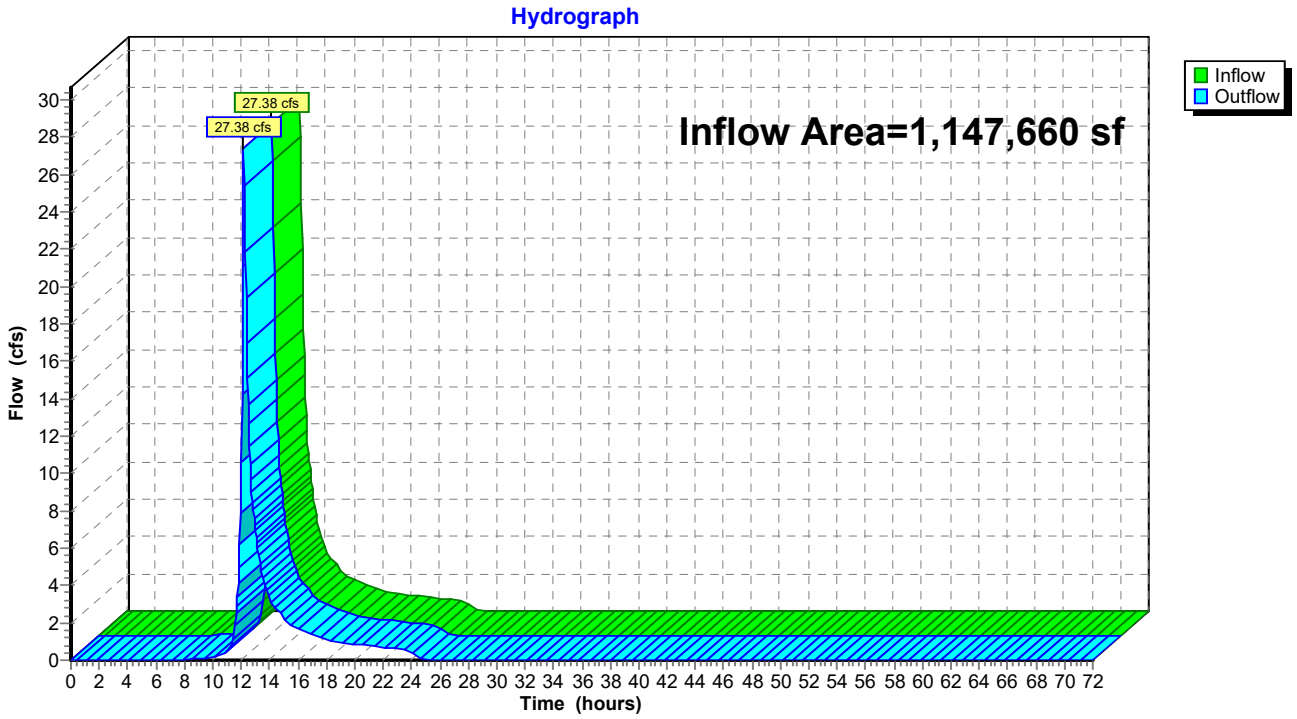


## Summary for Reach PR TOT: Total Site

Inflow Area = 1,147,660 sf, 33.00% Impervious, Inflow Depth = 1.30" for 2-yr event
Inflow = 27.38 cfs @ 12.17 hrs, Volume= 124,522 cf
Outflow = 27.38 cfs @ 12.17 hrs, Volume= 124,522 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 Pond BIO-1: Surface System

Inflow Area = 112,914 sf, 68.00% Impervious, Inflow Depth = 2.31" for 2-yr event
Inflow = 6.63 cfs @ 12.13 hrs, Volume= 21,716 cf
Outflow = 5.48 cfs @ 12.18 hrs, Volume= 21,716 cf, Atten= 17%, Lag= 2.9 min
Discarded = 0.03 cfs @ 12.18 hrs, Volume= 4,386 cf
Primary = 5.45 cfs @ 12.18 hrs, Volume= 17,330 cf
Routed to Reach DP-C1 : Wetlands

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 194.47' @ 12.18 hrs Surf.Area= 5,503 sf Storage= 4,309 cf

Plug-Flow detention time= 174.1 min calculated for 21,701 cf (100% of inflow)
Center-of-Mass det. time= 175.0 min ( 987.4 - 812.3 )

| Volume | Invert | Avail.Storage | Storage Description |
|---|---|---|---|
| #1 | 193.60' | 14,265 cf | **Custom Stage Data (Prismatic)** Listed below (Recalc) |

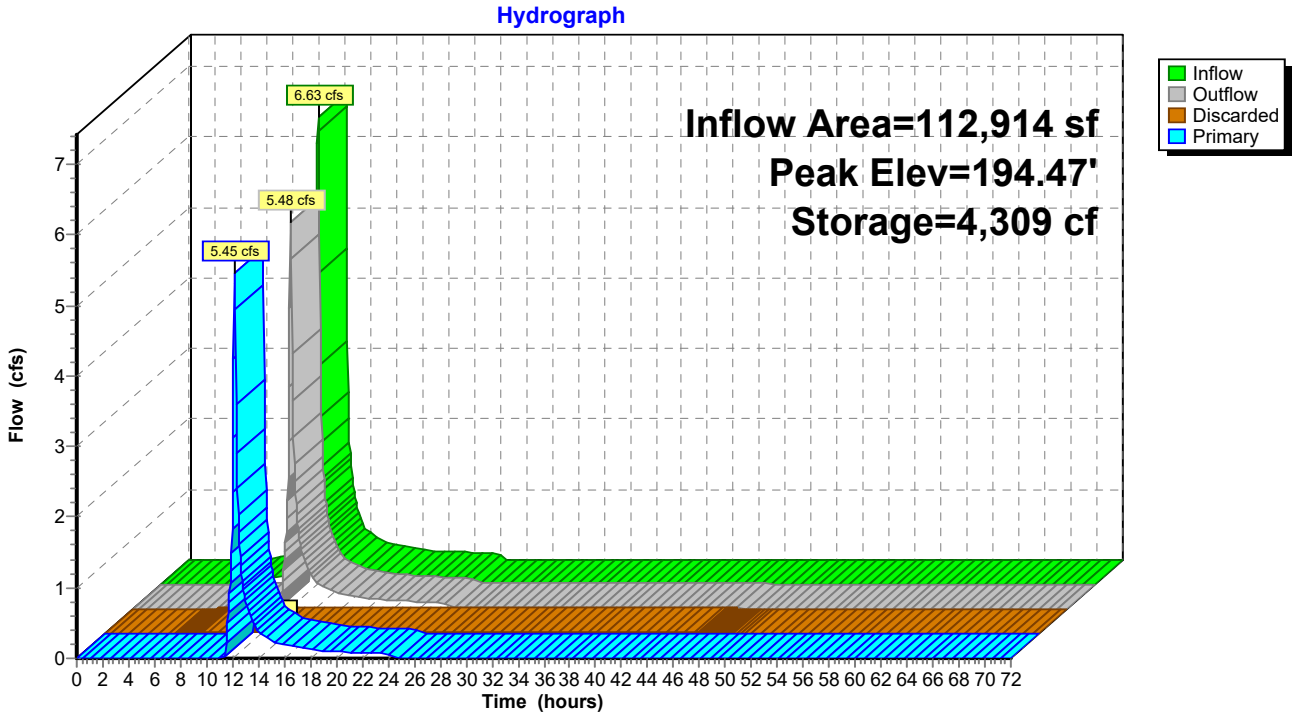
| Elevation (feet) | Surf.Area (sq-ft) | Inc.Store (cubic-feet) | Cum.Store (cubic-feet) |
|---|---|---|---|
| 193.60 | 4,470 | 0 | 0 |
| 194.00 | 4,930 | 1,880 | 1,880 |
| 195.00 | 6,160 | 5,545 | 7,425 |
| 196.00 | 7,520 | 6,840 | 14,265 |

| Device | Routing | Invert | Outlet Devices |
|---|---|---|---|
| #1 | Primary | 189.50' | **15.0" Round Culvert**<br>L= 50.0' CPP, square edge headwall, Ke= 0.500<br>Inlet / Outlet Invert= 189.50' / 189.00' S= 0.0100 '/' Cc= 0.900<br>n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.23 sf |
| #2 | Device 1 | 194.10' | **24.0" Horiz. 2-24" Area Drains X 1.20** C= 0.600<br>Limited to weir flow at low heads |
| #3 | Discarded | 193.60' | **0.270 in/hr Exfiltration over Surface area** |

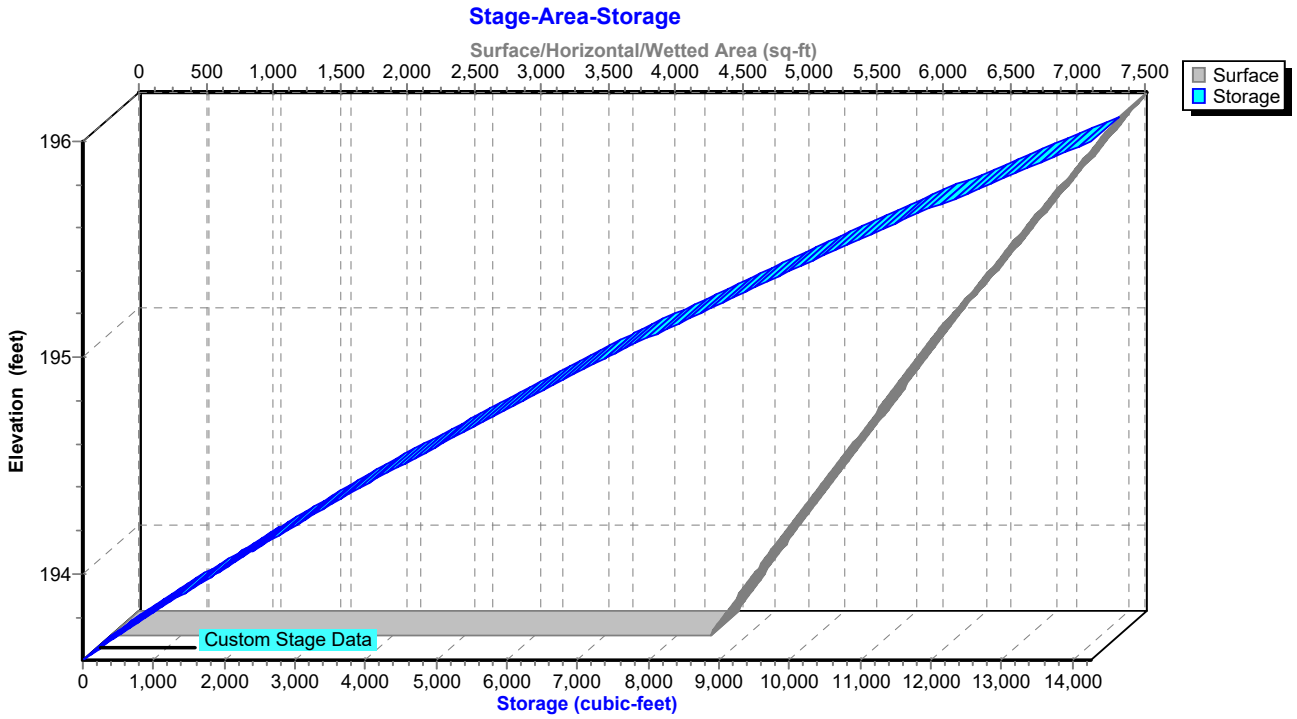
**Discarded OutFlow** Max=0.03 cfs @ 12.18 hrs HW=194.46' (Free Discharge)
↑ **3=Exfiltration** (Exfiltration Controls 0.03 cfs)

**Primary OutFlow** Max=5.34 cfs @ 12.18 hrs HW=194.46' (Free Discharge)
↑ **1=Culvert** (Passes 5.34 cfs of 12.30 cfs potential flow)
↑ **2=2-24" Area Drains** (Weir Controls 5.34 cfs @ 2.36 fps)

## Pond BIO-1: Surface System




## Pond BIO-1: Surface System



## Summary for Pond SI-1: Surface Infiltration

Inflow Area = 33,480 sf, 57.85% Impervious, Inflow Depth = 2.13" for 2-yr event
Inflow = 1.84 cfs @ 12.13 hrs, Volume= 5,949 cf
Outflow = 0.63 cfs @ 12.32 hrs, Volume= 5,949 cf, Atten= 66%, Lag= 11.7 min
Discarded = 0.03 cfs @ 12.32 hrs, Volume= 3,403 cf
Primary = 0.60 cfs @ 12.32 hrs, Volume= 2,547 cf
Routed to Reach DP-B : Concord Street Main

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 200.50' @ 12.32 hrs Surf.Area= 5,111 sf Storage= 2,253 cf

Plug-Flow detention time= 376.4 min calculated for 5,945 cf (100% of inflow)
Center-of-Mass det. time= 377.0 min ( 1,198.2 - 821.3 )

| Volume | Invert | Avail.Storage | Storage Description |
|---|---|---|---|
| #1 | 200.00' | 5,105 cf | **Custom Stage Data (Prismatic)** Listed below (Recalc) |

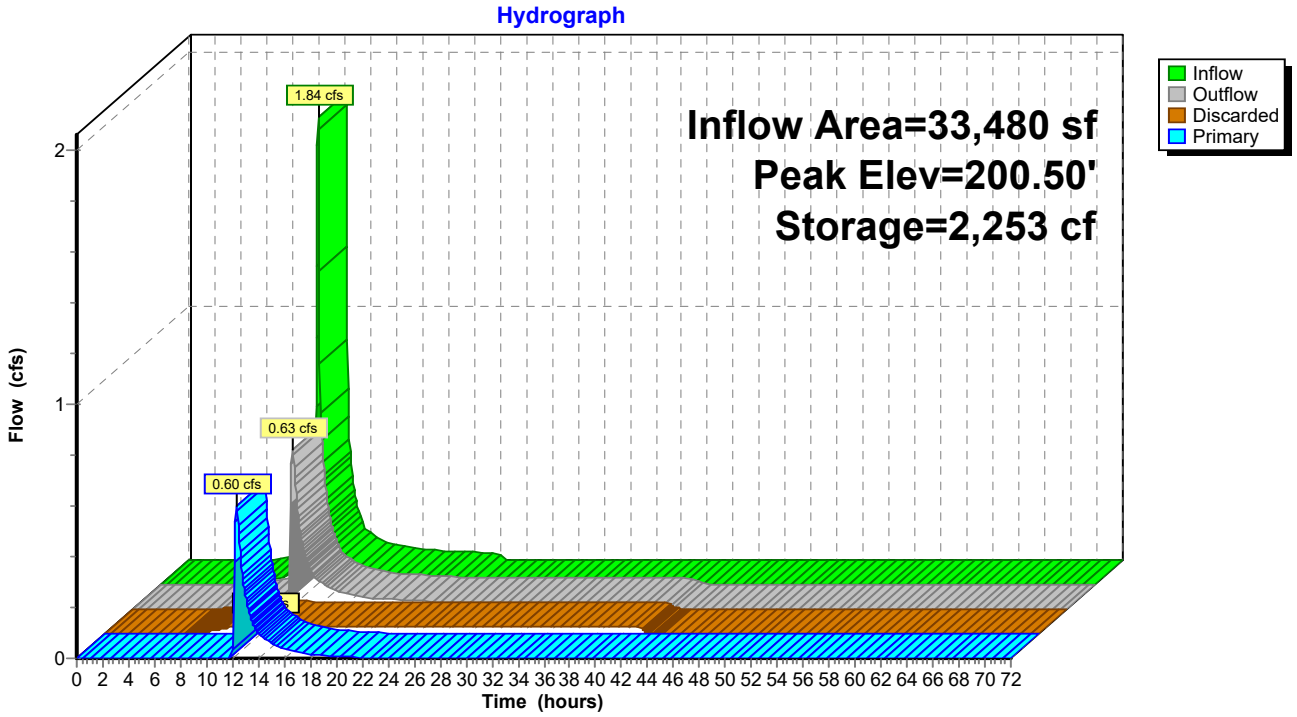
| Elevation (feet) | Surf.Area (sq-ft) | Inc.Store (cubic-feet) | Cum.Store (cubic-feet) |
|---|---|---|---|
| 200.00 | 3,854 | 0 | 0 |
| 201.00 | 6,356 | 5,105 | 5,105 |

| Device | Routing | Invert | Outlet Devices |
|---|---|---|---|
| #1 | Primary | 196.36' | **12.0" Round Culvert**<br>L= 37.6' CPP, mitered to conform to fill, Ke= 0.700<br>Inlet / Outlet Invert= 196.36' / 195.20' S= 0.0309 '/' Cc= 0.900<br>n= 0.013, Flow Area= 0.79 sf |
| #2 | Device 1 | 200.40' | **12.0" Horiz. 12" Area Drain X 0.73** C= 0.600<br>Limited to weir flow at low heads |
| #3 | Device 1 | 200.40' | **18.0" Horiz. 18" Area Drain X 0.69** C= 0.600<br>Limited to weir flow at low heads |
| #4 | Discarded | 200.00' | **0.270 in/hr Exfiltration over Surface area** |

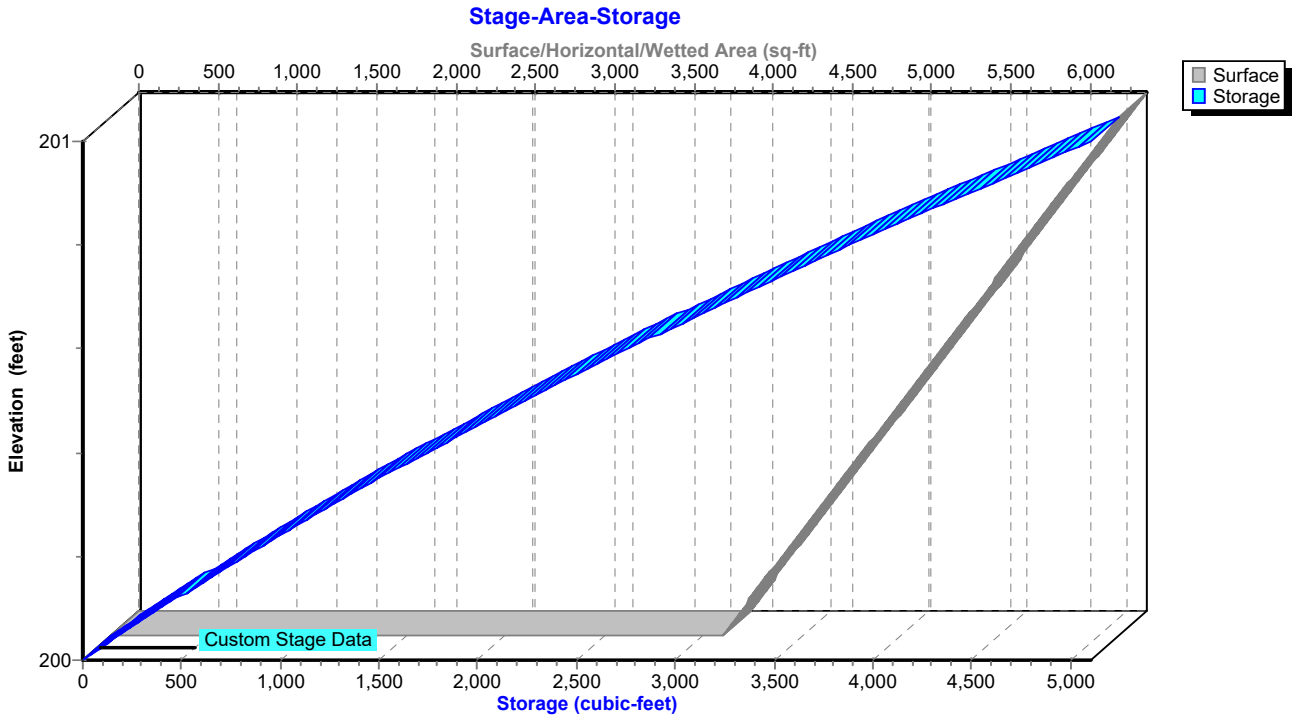
**Discarded OutFlow** Max=0.03 cfs @ 12.32 hrs HW=200.50' (Free Discharge)
└**4=Exfiltration** (Exfiltration Controls 0.03 cfs)

**Primary OutFlow** Max=0.59 cfs @ 12.32 hrs HW=200.50' (Free Discharge)
└**1=Culvert** (Passes 0.59 cfs of 6.37 cfs potential flow)
  ├**2=12" Area Drain** (Weir Controls 0.24 cfs @ 0.76 fps)
  └**3=18" Area Drain** (Weir Controls 0.35 cfs @ 0.72 fps)

## Pond SI-1: Surface Infiltration




## Pond SI-1: Surface Infiltration



## Summary for Pond SI-2: South Inf Basin

Inflow Area = 79,806 sf, 77.39% Impervious, Inflow Depth = 2.59" for 2-yr event
Inflow = 5.11 cfs @ 12.13 hrs, Volume= 17,226 cf
Outflow = 3.64 cfs @ 12.20 hrs, Volume= 17,226 cf, Atten= 29%, Lag= 4.4 min
Discarded = 0.02 cfs @ 12.20 hrs, Volume= 4,332 cf
Primary = 3.61 cfs @ 12.20 hrs, Volume= 12,893 cf
Routed to Reach DP-B : Concord Street Main

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 195.04' @ 12.20 hrs Surf.Area= 3,930 sf Storage= 5,177 cf

Plug-Flow detention time= 351.9 min calculated for 17,226 cf (100% of inflow)
Center-of-Mass det. time= 351.8 min ( 1,148.5 - 796.7 )

| Volume | Invert | Avail.Storage | Storage Description |
|---|---|---|---|
| #1 | 193.50' | 7,532 cf | **Custom Stage Data (Prismatic)** Listed below (Recalc) |

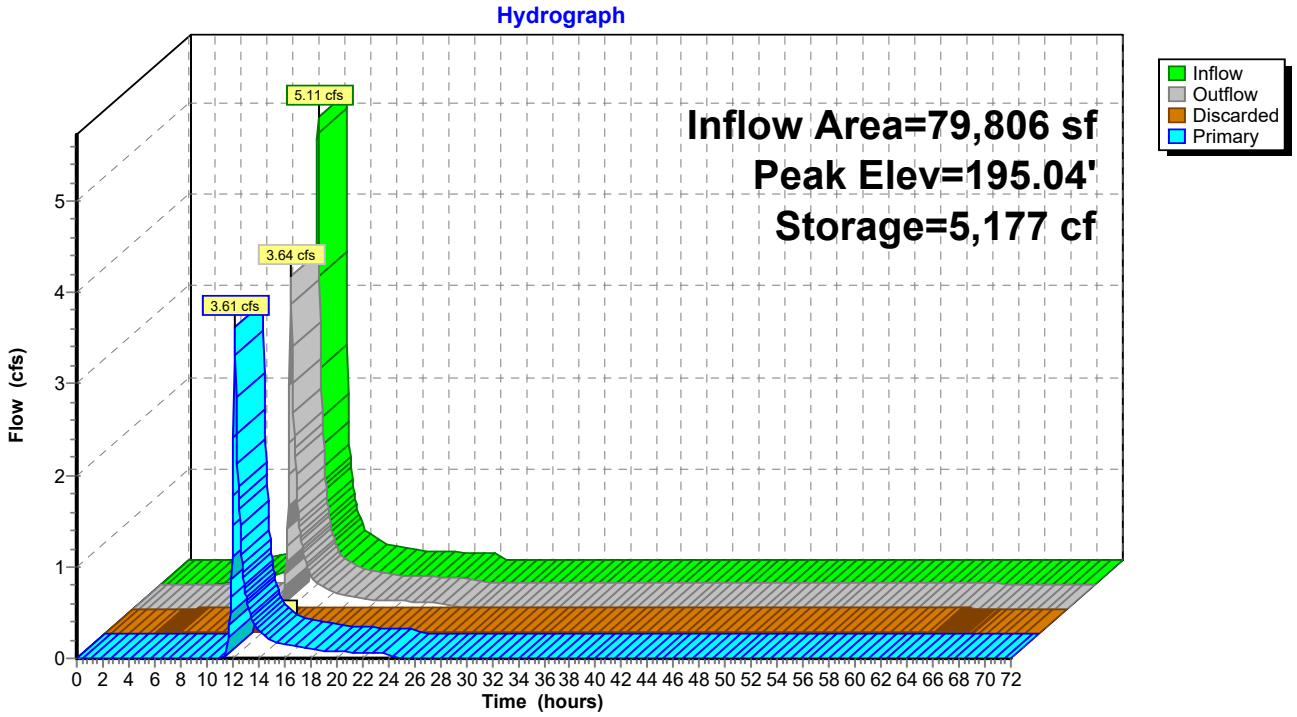
| Elevation (feet) | Surf.Area (sq-ft) | Inc.Store (cubic-feet) | Cum.Store (cubic-feet) |
|---|---|---|---|
| 193.50 | 2,832 | 0 | 0 |
| 194.00 | 3,174 | 1,502 | 1,502 |
| 195.00 | 3,899 | 3,537 | 5,038 |
| 195.60 | 4,414 | 2,494 | 7,532 |

| Device | Routing | Invert | Outlet Devices |
|---|---|---|---|
| #1 | Primary | 194.40' | **12.0" Horiz. 12" Area Drain X 0.73** C= 0.600<br>Limited to weir flow at low heads |
| #2 | Primary | 194.80' | **24.0" Horiz. 24" Area Drain X 0.60** C= 0.600<br>Limited to weir flow at low heads |
| #3 | Discarded | 193.50' | **0.270 in/hr Exfiltration over Surface area** |

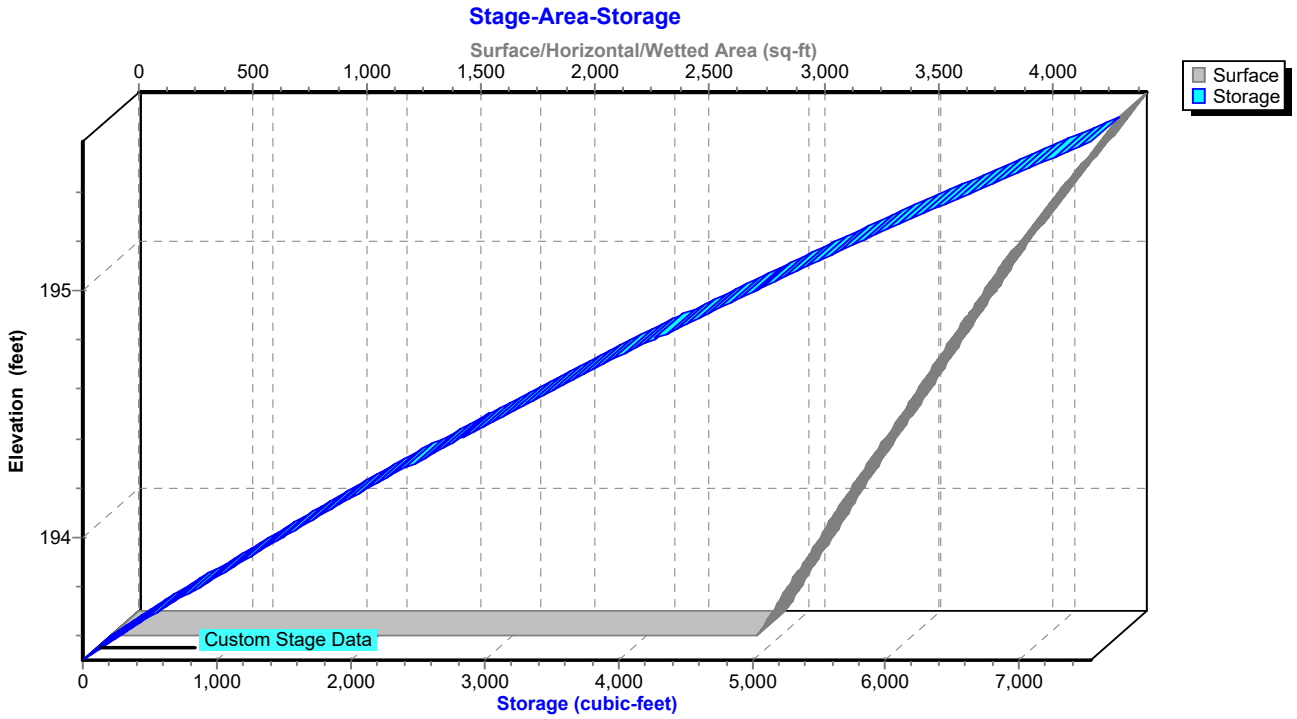
**Discarded OutFlow** Max=0.02 cfs @ 12.20 hrs HW=195.03' (Free Discharge)
└**3=Exfiltration** (Exfiltration Controls 0.02 cfs)

**Primary OutFlow** Max=3.60 cfs @ 12.20 hrs HW=195.03' (Free Discharge)
├**1=12" Area Drain** (Orifice Controls 2.20 cfs @ 2.80 fps)
└**2=24" Area Drain** (Weir Controls 1.40 cfs @ 0.95 fps)

## Pond SI-2: South Inf Basin




## Pond SI-2: South Inf Basin



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

Inflow Area = 145,461 sf, 28.75% Impervious, Inflow Depth = 1.59" for 2-yr event
Inflow = 6.04 cfs @ 12.13 hrs, Volume= 19,248 cf
Outflow = 3.48 cfs @ 12.23 hrs, Volume= 19,248 cf, Atten= 42%, Lag= 6.0 min
Discarded = 0.04 cfs @ 9.95 hrs, Volume= 5,385 cf
Primary = 3.44 cfs @ 12.23 hrs, Volume= 13,864 cf
Routed to Reach DP-C1 : Wetlands

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 185.34' @ 12.23 hrs Surf.Area= 6,528 sf Storage= 5,391 cf

Plug-Flow detention time= 248.5 min calculated for 19,248 cf (100% of inflow)
Center-of-Mass det. time= 248.3 min ( 1,096.2 - 847.9 )

| Volume | Invert | Avail.Storage | Storage Description |
|---|---|---|---|
| #1A | 184.00' | 4,559 cf | **44.83'W x 145.60'L x 2.33'H Field A**<br>15,231 cf Overall - 3,833 cf Embedded = 11,398 cf x 40.0% Voids |
| #2A | 184.50' | 3,833 cf | **ADS_StormTech SC-310 +Cap** x 260 Inside #1<br>Effective Size= 28.9"W x 16.0"H => 2.07 sf x 7.12'L = 14.7 cf<br>Overall Size= 34.0"W x 16.0"H x 7.56'L with 0.44' Overlap<br>260 Chambers in 13 Rows |
| | | 8,392 cf | Total Available Storage |

Storage Group A created with Chamber Wizard

| Device | Routing | Invert | Outlet Devices |
|---|---|---|---|
| #1 | Primary | 184.85' | **38.0" W x 8.0" H Vert. Orifice/Grate** C= 0.600<br>Limited to weir flow at low heads |
| #2 | Primary | 185.55' | **5.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s) |
| #3 | Discarded | 184.00' | **0.270 in/hr Exfiltration over Surface area** |

**Discarded OutFlow** Max=0.04 cfs @ 9.95 hrs HW=184.02' (Free Discharge)
└**3=Exfiltration** (Exfiltration Controls 0.04 cfs)

**Primary OutFlow** Max=3.40 cfs @ 12.23 hrs HW=185.33' (Free Discharge)
├**1=Orifice/Grate** (Orifice Controls 3.40 cfs @ 2.23 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

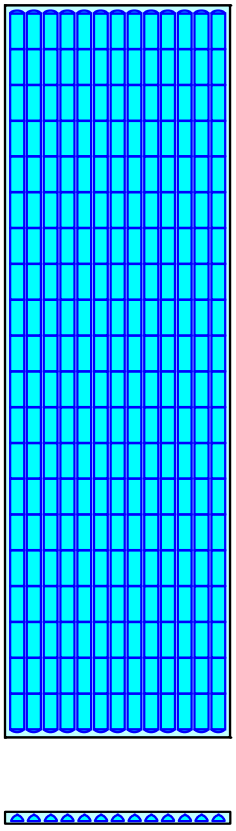
20 Chambers/Row x 7.12' Long +0.60' Cap Length x 2 = 143.60' Row Length +12.0" End Stone x 2 = 145.60' Base Length
13 Rows x 34.0" Wide + 6.0" Spacing x 12 + 12.0" Side Stone x 2 = 44.83' Base Width
6.0" Stone Base + 16.0" Chamber Height + 6.0" Stone Cover = 2.33' Field Height

260 Chambers x 14.7 cf = 3,832.9 cf Chamber Storage

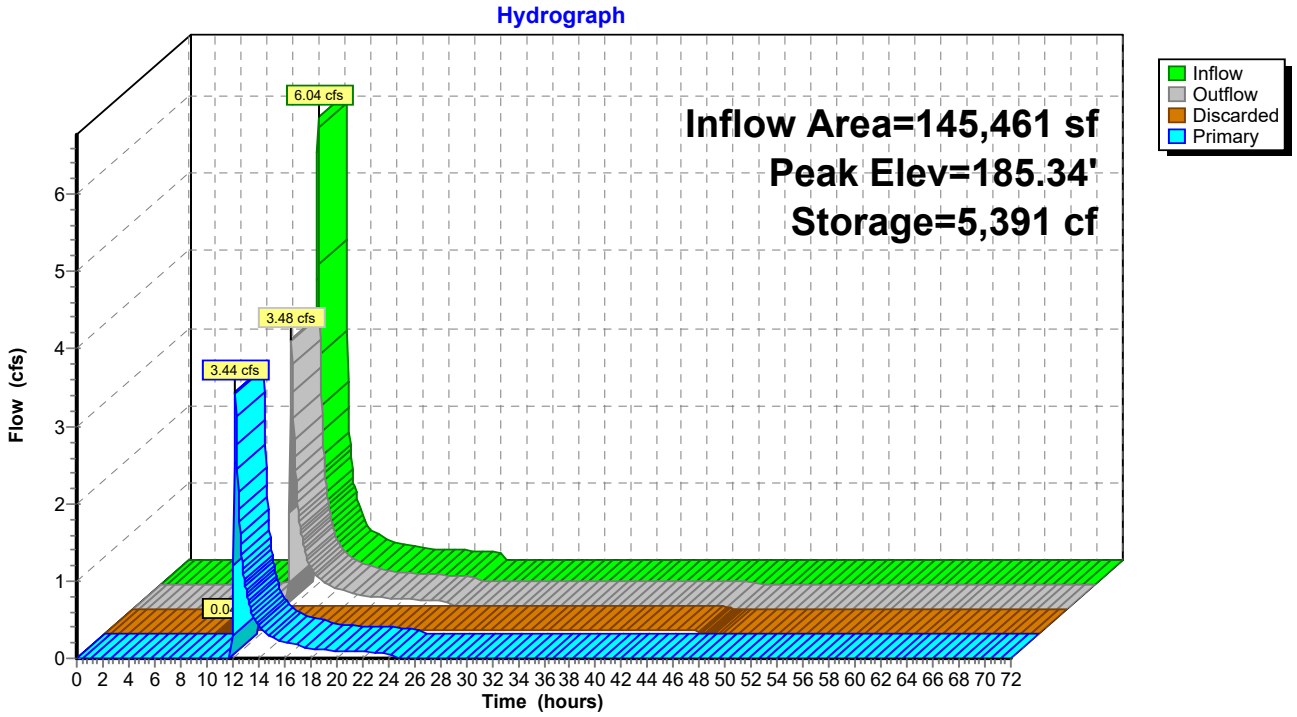
15,231.4 cf Field - 3,832.9 cf Chambers = 11,398.5 cf Stone x 40.0% Voids = 4,559.4 cf Stone Storage

Chamber Storage + Stone Storage = 8,392.3 cf = 0.193 af
Overall Storage Efficiency = 55.1%
Overall System Size = 145.60' x 44.83' x 2.33'

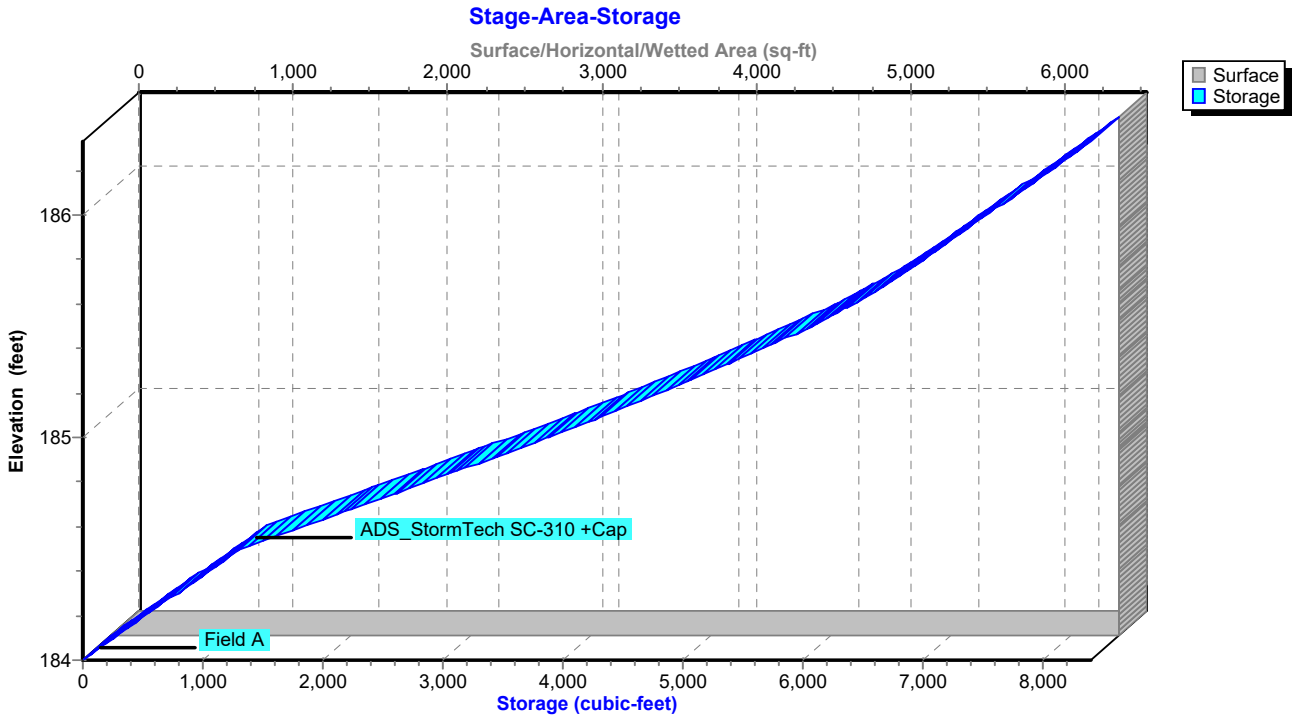
260 Chambers
564.1 cy Field
422.2 cy Stone



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




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



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

Inflow Area = 10,629 sf, 58.03% Impervious, Inflow Depth = 2.13" for 2-yr event
Inflow = 0.58 cfs @ 12.13 hrs, Volume= 1,889 cf
Outflow = 0.02 cfs @ 16.21 hrs, Volume= 1,889 cf, Atten= 97%, Lag= 244.7 min
Discarded = 0.01 cfs @ 10.15 hrs, Volume= 1,744 cf
Primary = 0.01 cfs @ 16.21 hrs, Volume= 144 cf
Routed to Reach DP-C1 : Wetlands

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 187.07' @ 16.21 hrs Surf.Area= 1,826 sf Storage= 1,202 cf

Plug-Flow detention time= 923.7 min calculated for 1,889 cf (100% of inflow)
Center-of-Mass det. time= 923.5 min ( 1,744.7 - 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**<br>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<br>Effective Size= 44.6"W x 30.0"H => 6.45 sf x 7.12'L = 45.9 cf<br>Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap<br>48 Chambers in 4 Rows |
| | | 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 Limited to weir flow at low heads |
| #2 | Primary | 188.80' | **5.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s) |
| #3 | Discarded | 186.00' | **0.270 in/hr Exfiltration over Surface area** |

**Discarded OutFlow** Max=0.01 cfs @ 10.15 hrs HW=186.04' (Free Discharge)
└**3=Exfiltration** (Exfiltration Controls 0.01 cfs)

**Primary OutFlow** Max=0.01 cfs @ 16.21 hrs HW=187.07' (Free Discharge)
├**1=Orifice/Grate** (Orifice Controls 0.01 cfs @ 0.89 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

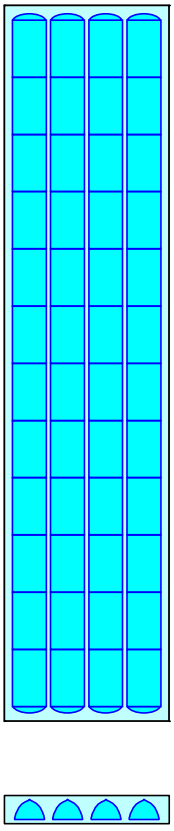
12 Chambers/Row x 7.12' Long +0.81' Cap Length x 2 = 87.06' Row Length +12.0" End Stone x 2 = 89.06' Base Length
4 Rows x 51.0" Wide + 6.0" Spacing x 3 + 12.0" Side Stone x 2 = 20.50' Base Width
6.0" Stone Base + 30.0" Chamber Height + 6.0" Stone Cover = 3.50' Field Height

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

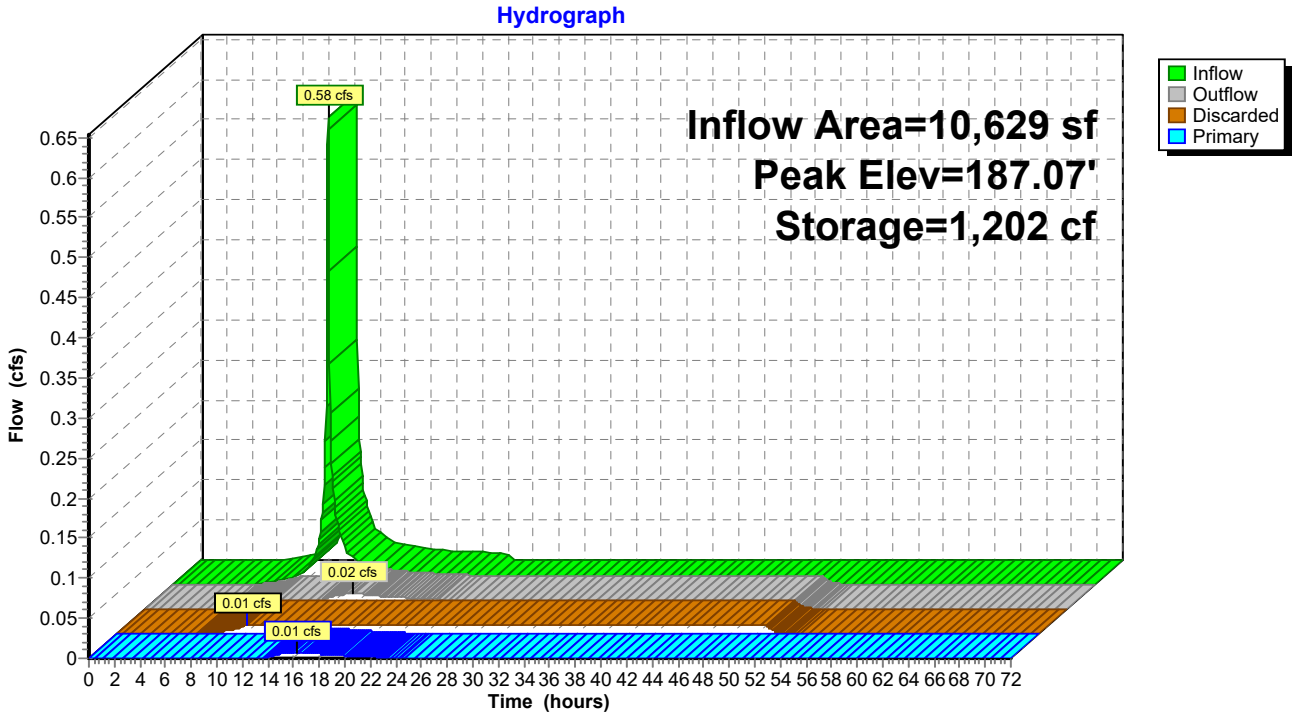
6,389.8 cf Field - 2,205.1 cf Chambers = 4,184.7 cf Stone x 40.0% Voids = 1,673.9 cf Stone Storage

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'

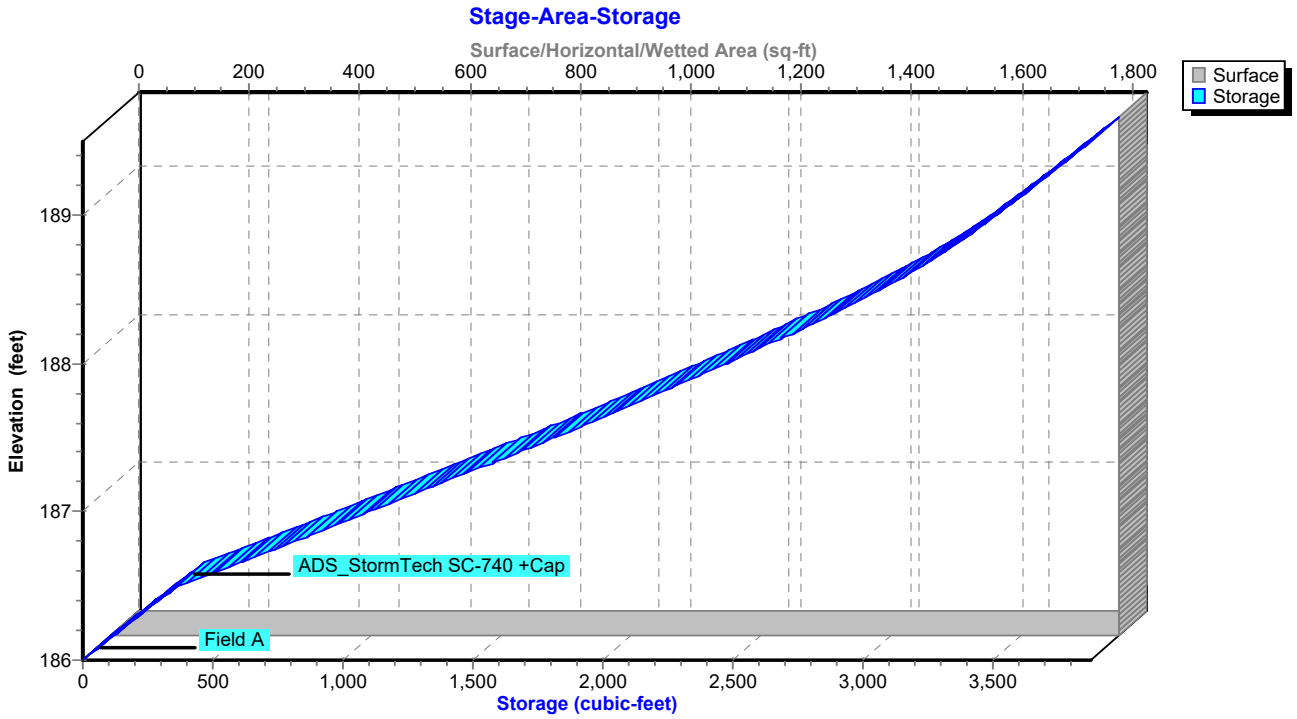
48 Chambers
236.7 cy Field
155.0 cy Stone



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




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



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

Inflow Area = 161,157 sf, 31.93% Impervious, Inflow Depth = 1.59" for 2-yr event
Inflow = 6.70 cfs @ 12.13 hrs, Volume= 21,325 cf
Outflow = 2.33 cfs @ 12.33 hrs, Volume= 21,325 cf, Atten= 65%, Lag= 12.0 min
Discarded = 0.07 cfs @ 10.30 hrs, Volume= 7,495 cf
Primary = 2.26 cfs @ 12.33 hrs, Volume= 13,830 cf
Routed to Reach DP-C1 : Wetlands

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 194.78' @ 12.33 hrs Surf.Area= 10,568 sf Storage= 6,984 cf

Plug-Flow detention time= 258.3 min calculated for 21,325 cf (100% of inflow)
Center-of-Mass det. time= 258.1 min ( 1,106.0 - 847.9 )

| Volume | Invert | Avail.Storage | Storage Description |
|---|---|---|---|
| #1A | 193.50' | 7,922 cf | **48.85'W x 216.33'L x 3.00'H Field A**<br>31,705 cf Overall - 11,899 cf Embedded = 19,806 cf x 40.0% Voids |
| #2A | 193.83' | 9,407 cf | **ADS N-12 24"** x 154 Inside #1<br>Inside= 23.8"W x 23.8"H => 3.10 sf x 20.00'L = 62.0 cf<br>Outside= 28.0"W x 28.0"H => 3.92 sf x 20.00'L = 78.4 cf<br>Row Length Adjustment= -10.00' x 3.10 sf x 14 rows<br>47.18' Header x 3.10 sf x 2 = 292.5 cf Inside |
| | | 17,329 cf | Total Available Storage |

Storage Group A created with Chamber Wizard

| Device | Routing | Invert | Outlet Devices |
|---|---|---|---|
| #1 | Primary | 194.35' | **30.0" W x 8.0" H Vert. Orifice/Grate** C= 0.600<br>Limited to weir flow at low heads |
| #2 | Primary | 195.00' | **10.0" W x 6.0" H Vert. Orifice/Grate** C= 0.600<br>Limited to weir flow at low heads |
| #3 | Primary | 196.15' | **5.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s) |
| #4 | Discarded | 193.50' | **0.270 in/hr Exfiltration over Surface area** |

**Discarded OutFlow** Max=0.07 cfs @ 10.30 hrs HW=193.53' (Free Discharge)
└**4=Exfiltration** (Exfiltration Controls 0.07 cfs)

**Primary OutFlow** Max=2.25 cfs @ 12.33 hrs HW=194.78' (Free Discharge)
├**1=Orifice/Grate** (Orifice Controls 2.25 cfs @ 2.10 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 14 rows

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

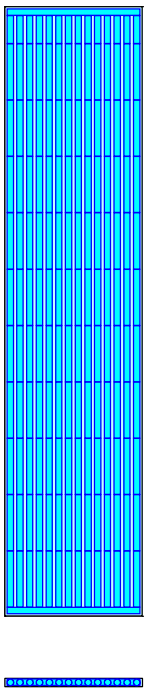
11 Chambers/Row x 20.00' Long -10.00' Row Adjustment +2.33' Header x 2 = 214.67' Row Length +10.0" End Stone x 2 = 216.33' Base Length
14 Rows x 28.0" Wide + 13.4" Spacing x 13 + 10.0" Side Stone x 2 = 48.85' Base Width
4.0" Stone Base + 28.0" Chamber Height + 4.0" Stone Cover = 3.00' Field Height

154 Chambers x 62.0 cf -10.00' Row Adjustment x 3.10 sf x 14 Rows + 47.18' Header x 3.10 sf x 2 = 9,406.5 cf Chamber Storage
154 Chambers x 78.4 cf -10.00' Row Adjustment x 3.92 sf x 14 Rows + 47.18' Header x 3.92 sf x 2 = 11,893.6 cf Displacement

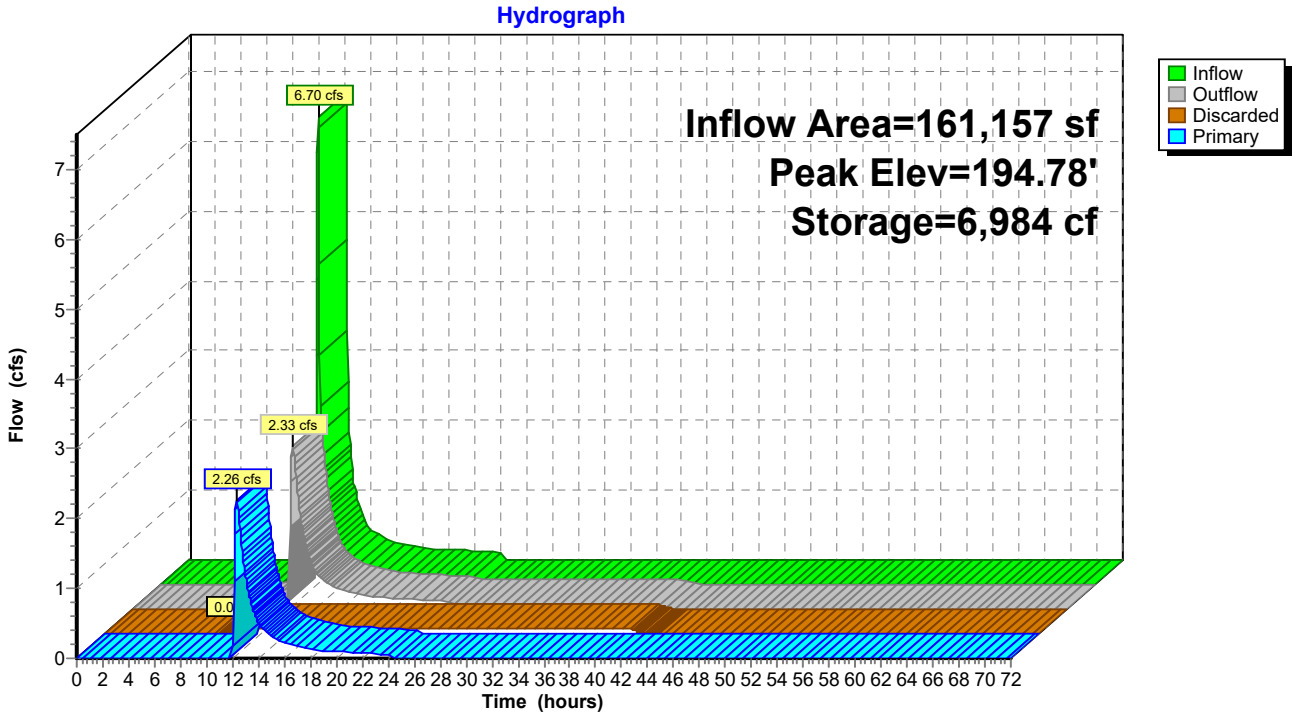
31,704.6 cf Field - 11,893.6 cf Chambers = 19,811.0 cf Stone x 40.0% Voids = 7,924.4 cf Stone Storage

Chamber Storage + Stone Storage = 17,330.9 cf = 0.398 af
Overall Storage Efficiency = 54.7%
Overall System Size = 216.33' x 48.85' x 3.00'

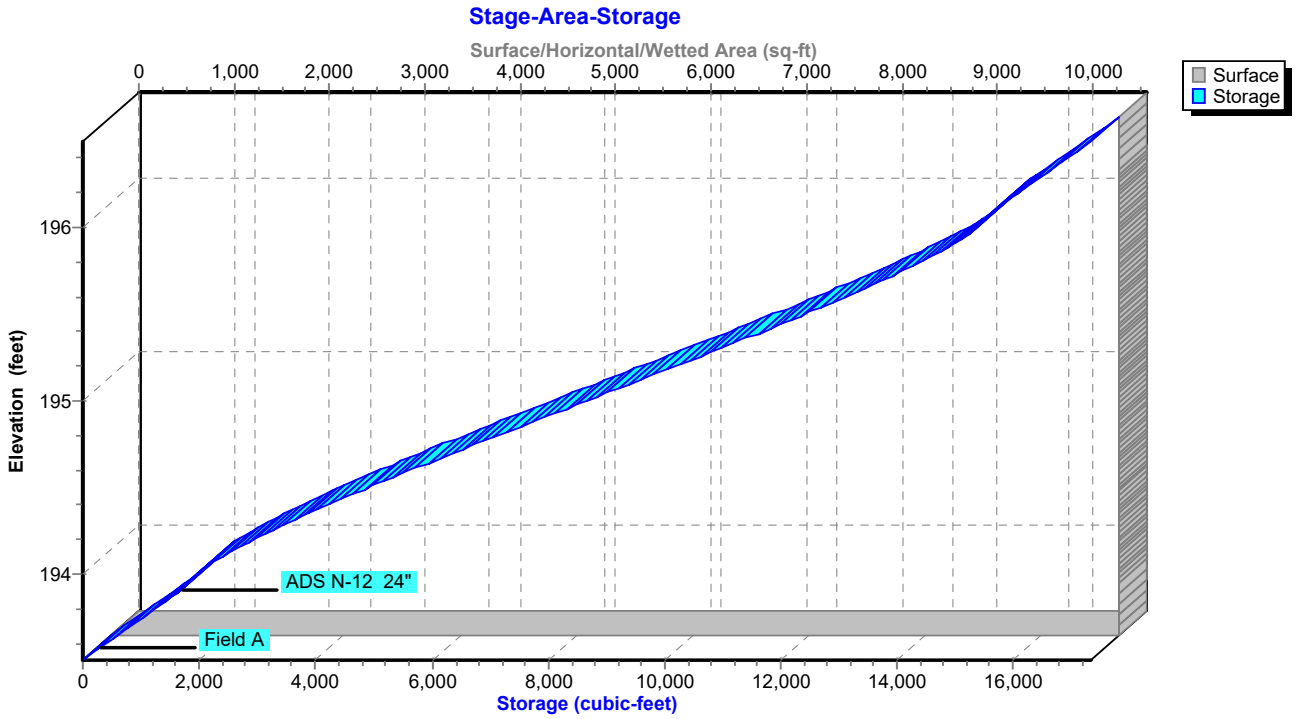
154 Chambers
1,174.2 cy Field
733.7 cy Stone



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




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



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

Inflow Area = 54,076 sf, 49.32% Impervious, Inflow Depth = 1.97" for 2-yr event
Inflow = 2.76 cfs @ 12.13 hrs, Volume= 8,860 cf
Outflow = 0.42 cfs @ 12.75 hrs, Volume= 8,860 cf, Atten= 85%, Lag= 37.0 min
Discarded = 0.04 cfs @ 10.00 hrs, Volume= 3,981 cf
Primary = 0.38 cfs @ 12.75 hrs, Volume= 4,880 cf
Routed to Reach DP-B : Concord Street Main

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 201.39' @ 12.75 hrs Surf.Area= 6,449 sf Storage= 3,760 cf

Plug-Flow detention time= 274.7 min calculated for 8,860 cf (100% of inflow)
Center-of-Mass det. time= 274.5 min ( 1,104.0 - 829.5 )

| Volume | Invert | Avail.Storage | Storage Description |
|---|---|---|---|
| #1A | 200.20' | 870 cf | **16.13'W x 66.67'L x 3.00'H Field A**<br>3,227 cf Overall - 1,052 cf Embedded = 2,175 cf x 40.0% Voids |
| #2A | 200.53' | 832 cf | **ADS N-12 24"** x 12 Inside #1<br>Inside= 23.8"W x 23.8"H => 3.10 sf x 20.00'L = 62.0 cf<br>Outside= 28.0"W x 28.0"H => 3.92 sf x 20.00'L = 78.4 cf<br>12 Chambers in 4 Rows<br>14.13' Header x 3.10 sf x 2 = 87.6 cf Inside |
| #3B | 200.20' | 3,733 cf | **43.67'W x 106.67'L x 3.00'H Field B**<br>13,974 cf Overall - 4,640 cf Embedded = 9,334 cf x 40.0% Voids |
| #4B | 200.53' | 3,668 cf | **ADS N-12 24"** x 55 Inside #3<br>Inside= 23.8"W x 23.8"H => 3.10 sf x 20.00'L = 62.0 cf<br>Outside= 28.0"W x 28.0"H => 3.92 sf x 20.00'L = 78.4 cf<br>55 Chambers in 11 Rows<br>41.67' Header x 3.10 sf x 2 = 258.3 cf Inside |
| #5C | 200.20' | 563 cf | **15.33'W x 46.67'L x 3.00'H Field C**<br>2,147 cf Overall - 738 cf Embedded = 1,408 cf x 40.0% Voids |
| #6C | 200.53' | 584 cf | **ADS N-12 24"** x 8 Inside #5<br>Inside= 23.8"W x 23.8"H => 3.10 sf x 20.00'L = 62.0 cf<br>Outside= 28.0"W x 28.0"H => 3.92 sf x 20.00'L = 78.4 cf<br>8 Chambers in 4 Rows<br>14.13' Header x 3.10 sf x 2 = 87.6 cf Inside |
| | | 10,250 cf | Total Available Storage |

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

| Device | Routing | Invert | Outlet Devices |
|---|---|---|---|
| #1 | Primary | 200.33' | **15.0" Round Culvert**<br>L= 142.0' CPP, mitered to conform to fill, Ke= 0.700<br>Inlet / Outlet Invert= 200.33' / 198.30' S= 0.0143 '/' Cc= 0.900<br>n= 0.013, Flow Area= 1.23 sf |
| #2 | Device 1 | 200.85' | **4.0" W x 5.0" H Vert. Orifice/Grate** C= 0.600<br>Limited to weir flow at low heads |
| #3 | Device 1 | 201.80' | **33.0" W x 8.0" H Vert. Orifice/Grate** C= 0.600 |

Limited to weir flow at low heads

| | | | |
|---|---|---|---|
| #4 | Device 1 | 202.70' | **5.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s) |
| #5 | Discarded | 200.20' | **0.270 in/hr Exfiltration over Surface area** |

**Discarded OutFlow** Max=0.04 cfs @ 10.00 hrs HW=200.23' (Free Discharge)
└**5=Exfiltration** (Exfiltration Controls 0.04 cfs)

**Primary OutFlow** Max=0.38 cfs @ 12.75 hrs HW=201.39' (Free Discharge)
└**1=Culvert** (Passes 0.38 cfs of 3.43 cfs potential flow)
  ├**2=Orifice/Grate** (Orifice Controls 0.38 cfs @ 2.72 fps)
  ├**3=Orifice/Grate** ( Controls 0.00 cfs)
  └**4=Sharp-Crested Rectangular Weir** ( 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

28.0" Wide + 19.2" Spacing = 47.2" C-C Row Spacing

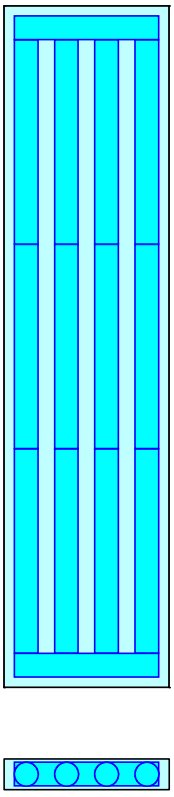
3 Chambers/Row x 20.00' Long +2.33' Header x 2 = 64.67' Row Length +12.0" End Stone x 2 = 66.67' Base Length
4 Rows x 28.0" Wide + 19.2" Spacing x 3 + 12.0" Side Stone x 2 = 16.13' Base Width
4.0" Stone Base + 28.0" Chamber Height + 4.0" Stone Cover = 3.00' Field Height

12 Chambers x 62.0 cf + 14.13' Header x 3.10 sf x 2 = 831.6 cf Chamber Storage
12 Chambers x 78.4 cf + 14.13' Header x 3.92 sf x 2 = 1,051.5 cf Displacement

3,226.8 cf Field - 1,051.5 cf Chambers = 2,175.3 cf Stone x 40.0% Voids = 870.1 cf Stone Storage

Chamber Storage + Stone Storage = 1,701.7 cf = 0.039 af
Overall Storage Efficiency = 52.7%
Overall System Size = 66.67' x 16.13' x 3.00'

12 Chambers
119.5 cy Field
80.6 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 + 19.2" Spacing = 47.2" C-C Row Spacing

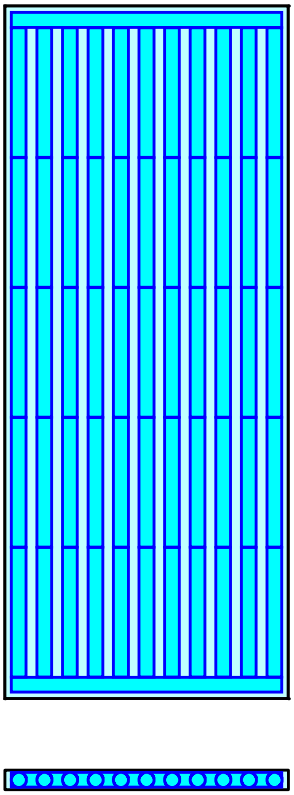
5 Chambers/Row x 20.00' Long +2.33' Header x 2 = 104.67' Row Length +12.0" End Stone x 2 = 106.67' Base Length
11 Rows x 28.0" Wide + 19.2" Spacing x 10 + 12.0" Side Stone x 2 = 43.67' Base Width
4.0" Stone Base + 28.0" Chamber Height + 4.0" Stone Cover = 3.00' Field Height

55 Chambers x 62.0 cf + 41.67' Header x 3.10 sf x 2 = 3,668.3 cf Chamber Storage
55 Chambers x 78.4 cf + 41.67' Header x 3.92 sf x 2 = 4,638.2 cf Displacement

13,973.8 cf Field - 4,638.2 cf Chambers = 9,335.5 cf Stone x 40.0% Voids = 3,734.2 cf Stone Storage

Chamber Storage + Stone Storage = 7,402.5 cf = 0.170 af
Overall Storage Efficiency = 53.0%
Overall System Size = 106.67' x 43.67' x 3.00'

55 Chambers
517.5 cy Field
345.8 cy Stone



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

**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 + 19.2" Spacing = 47.2" C-C Row Spacing

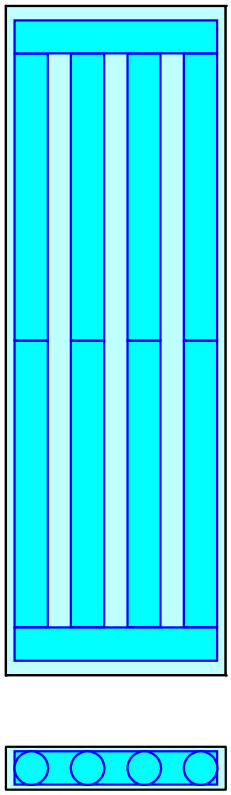
2 Chambers/Row x 20.00' Long +2.33' Header x 2 = 44.67' Row Length +12.0" End Stone x 2 = 46.67' Base Length
4 Rows x 28.0" Wide + 19.2" Spacing x 3 + 7.2" Side Stone x 2 = 15.33' Base Width
4.0" Stone Base + 28.0" Chamber Height + 4.0" Stone Cover = 3.00' Field Height

8 Chambers x 62.0 cf + 14.13' Header x 3.10 sf x 2 = 583.6 cf Chamber Storage
8 Chambers x 78.4 cf + 14.13' Header x 3.92 sf x 2 = 737.9 cf Displacement

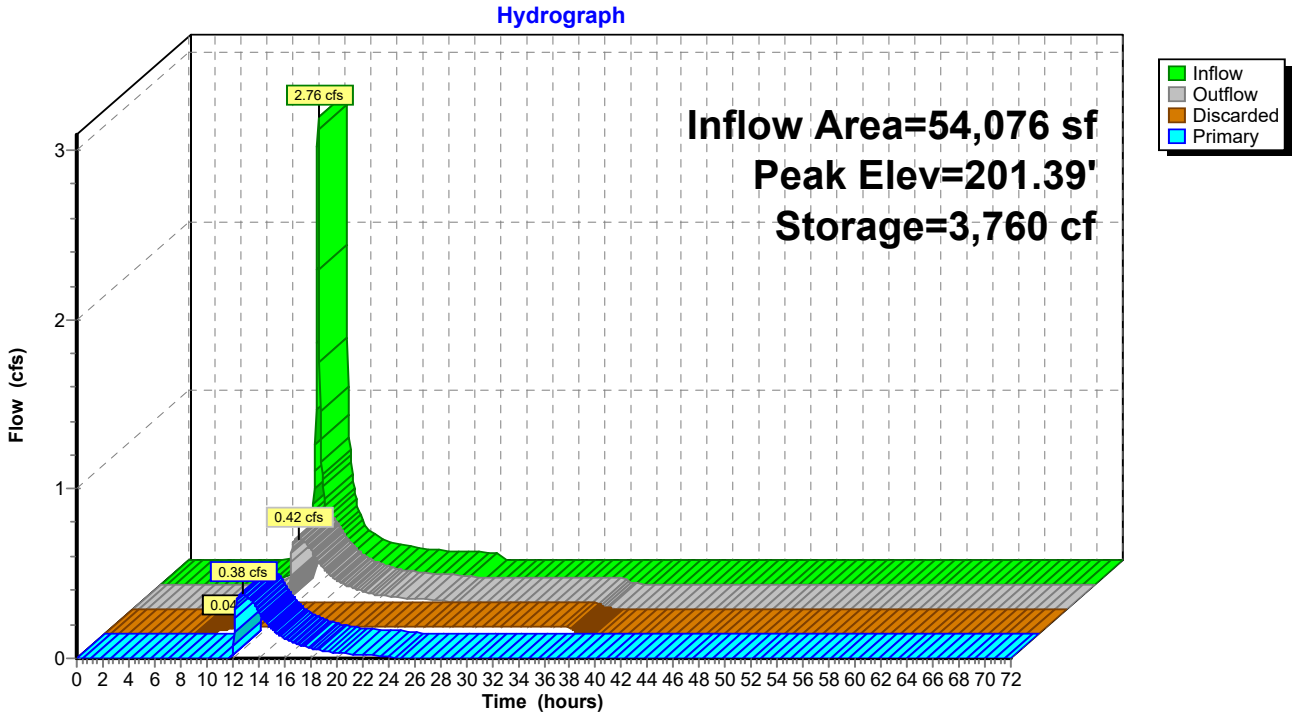
2,146.7 cf Field - 737.9 cf Chambers = 1,408.8 cf Stone x 40.0% Voids = 563.5 cf Stone Storage

Chamber Storage + Stone Storage = 1,147.1 cf = 0.026 af
Overall Storage Efficiency = 53.4%
Overall System Size = 46.67' x 15.33' x 3.00'

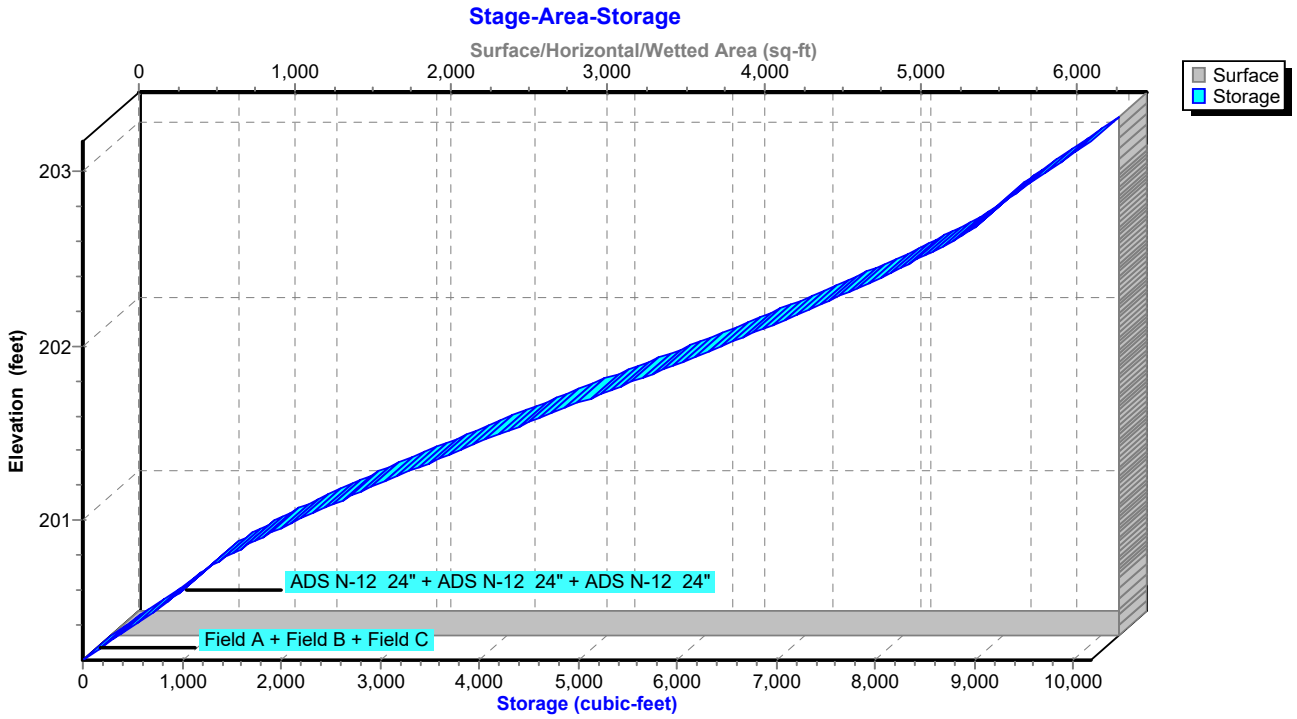
8 Chambers
79.5 cy Field
52.2 cy Stone



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




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



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=169,240 sf 0.00% Impervious Runoff Depth=2.29"
Flow Length=642' Tc=9.3 min CN=71 Runoff=8.99 cfs 32,323 cf

**Subcatchment PDA10: PDA10** Runoff Area=112,914 sf 68.00% Impervious Runoff Depth=4.10"
Tc=6.0 min CN=90 Runoff=11.39 cfs 38,564 cf

**Subcatchment PDA11: PDA11** Runoff Area=25,873 sf 62.02% Impervious Runoff Depth=3.99"
Tc=6.0 min CN=89 Runoff=2.56 cfs 8,608 cf

**Subcatchment PDA12: PDA12** Runoff Area=145,461 sf 28.75% Impervious Runoff Depth=3.19"
Tc=6.0 min CN=81 Runoff=12.00 cfs 38,661 cf

**Subcatchment PDA2: Proposed 2** Runoff Area=72,814 sf 59.44% Impervious Runoff Depth=3.89"
Tc=6.0 min CN=88 Runoff=7.08 cfs 23,591 cf

**Subcatchment PDA3: Proposed 3** Runoff Area=33,480 sf 57.85% Impervious Runoff Depth=3.89"
Tc=6.0 min CN=88 Runoff=3.25 cfs 10,847 cf

**Subcatchment PDA4: Proposed 4** Runoff Area=54,076 sf 49.32% Impervious Runoff Depth=3.68"
Tc=6.0 min CN=86 Runoff=5.04 cfs 16,593 cf

**Subcatchment PDA5: Proposed 5** Runoff Area=168,248 sf 21.01% Impervious Runoff Depth=2.91"
Tc=6.0 min CN=78 Runoff=12.75 cfs 40,772 cf

**Subcatchment PDA6: Proposal 6** Runoff Area=10,629 sf 58.03% Impervious Runoff Depth=3.89"
Tc=6.0 min CN=88 Runoff=1.03 cfs 3,444 cf

**Subcatchment PDA7: Proposal 7** Runoff Area=161,157 sf 31.93% Impervious Runoff Depth=3.19"
Tc=6.0 min CN=81 Runoff=13.30 cfs 42,833 cf

**Subcatchment PDA8: Proposed 8** Runoff Area=79,806 sf 77.39% Impervious Runoff Depth=4.42"
Tc=6.0 min CN=93 Runoff=8.44 cfs 29,421 cf

**Subcatchment PDA9: Proposed 9** Runoff Area=113,962 sf 0.00% Impervious Runoff Depth=2.21"
Flow Length=366' Tc=12.4 min CN=70 Runoff=5.29 cfs 20,973 cf

**Reach 4R: Swale** Avg. Flow Depth=0.66' Max Vel=3.15 fps Inflow=8.98 cfs 31,776 cf
n=0.022 L=726.0' S=0.0069 '/' Capacity=49.00 cfs Outflow=7.99 cfs 31,776 cf

**Reach DP-A: Eastern Intermittent Stream** Inflow=7.99 cfs 31,776 cf
Outflow=7.99 cfs 31,776 cf

**Reach DP-B: Concord Street Main** Inflow=16.05 cfs 67,850 cf
Outflow=16.05 cfs 67,850 cf

**Reach DP-C1: Wetlands** Inflow=46.09 cfs 173,498 cf
Outflow=46.09 cfs 173,498 cf

**Reach DP-C2: Intermittent Stream West** Inflow=5.29 cfs 20,973 cf
Outflow=5.29 cfs 20,973 cf

**Reach PR TOT: Total Site** Inflow=67.17 cfs 273,125 cf
Outflow=67.17 cfs 273,125 cf

**Pond BIO-1: Surface System** Peak Elev=194.64' Storage=5,287 cf Inflow=11.39 cfs 38,564 cf
Discarded=0.04 cfs 4,643 cf Primary=9.78 cfs 33,921 cf Outflow=9.81 cfs 38,564 cf

**Pond SI-1: Surface Infiltration** Peak Elev=200.65' Storage=3,057 cf Inflow=3.25 cfs 10,847 cf
Discarded=0.03 cfs 3,671 cf Primary=2.33 cfs 7,176 cf Outflow=2.36 cfs 10,847 cf

**Pond SI-2: South Inf Basin** Peak Elev=195.28' Storage=6,164 cf Inflow=8.44 cfs 29,421 cf
Discarded=0.03 cfs 4,491 cf Primary=6.69 cfs 24,930 cf Outflow=6.71 cfs 29,421 cf

**Pond SS-1: Subsurface Infiltration** Peak Elev=185.84' Storage=7,095 cf Inflow=12.00 cfs 38,661 cf
Discarded=0.04 cfs 5,736 cf Primary=10.58 cfs 32,926 cf Outflow=10.62 cfs 38,661 cf

**Pond SS-2: Subsurface Infiltration (SC-740** Peak Elev=187.53' Storage=1,856 cf Inflow=1.03 cfs 3,444 cf
Discarded=0.01 cfs 1,890 cf Primary=0.07 cfs 1,554 cf Outflow=0.08 cfs 3,444 cf

**Pond SS-3: Subsurface Infiltration (24"** Peak Elev=195.37' Storage=11,483 cf Inflow=13.30 cfs 42,833 cf
Discarded=0.07 cfs 8,090 cf Primary=7.21 cfs 34,743 cf Outflow=7.27 cfs 42,833 cf

**Pond SS-4: Subsurface Infiltration (24"** Peak Elev=202.02' Storage=6,523 cf Inflow=5.04 cfs 16,593 cf
Discarded=0.04 cfs 4,440 cf Primary=1.55 cfs 12,153 cf Outflow=1.59 cfs 16,593 cf

**Total Runoff Area = 1,147,660 sf Runoff Volume = 306,631 cf Average Runoff Depth = 3.21"**
**67.00% Pervious = 768,980 sf 33.00% Impervious = 378,680 sf**

## Summary for Subcatchment PDA-1: Wooded Area

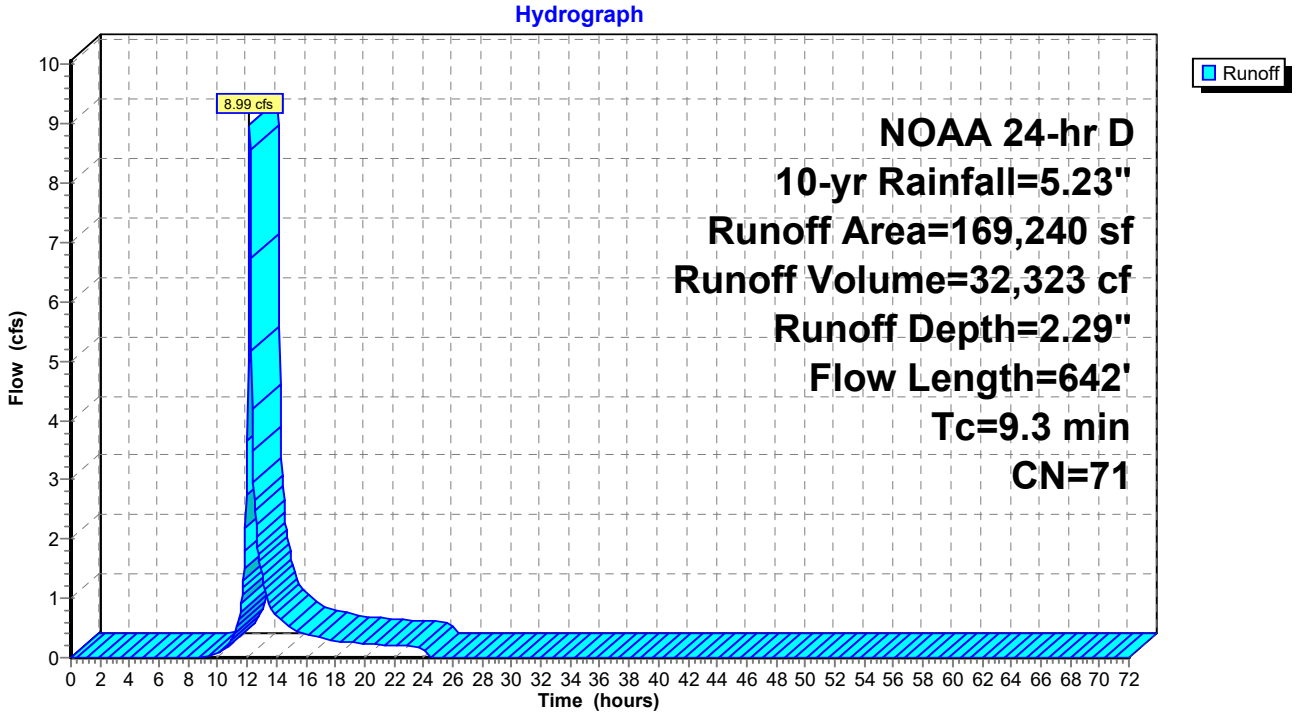
Runoff = 8.99 cfs @ 12.17 hrs, Volume= 32,323 cf, Depth= 2.29"
Routed to Reach 4R : Swale

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 |
|---|---|---|
| 33,190 | 74 | >75% Grass cover, Good, HSG C |
| 136,050 | 70 | Woods, Good, HSG C |
| 169,240 | 71 | Weighted Average |
| 169,240 | | 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

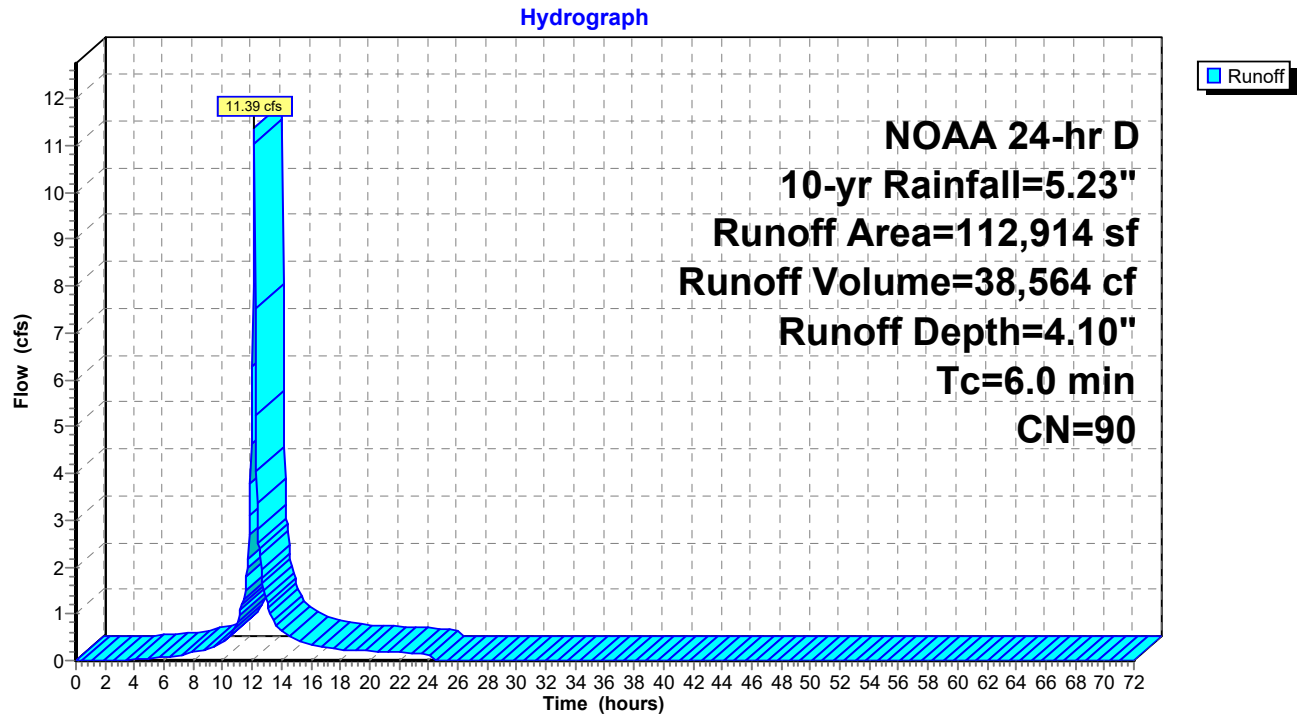
Runoff = 11.39 cfs @ 12.13 hrs, Volume= 38,564 cf, Depth= 4.10"
Routed to Pond BIO-1 : Surface System

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 |
|---|---|---|---|
| | 36,136 | 74 | >75% Grass cover, Good, HSG C |
| | 27,453 | 98 | Roofs, HSG C |
| * | 49,325 | 98 | Paved Parking and Walkways, HSG C |
| | 112,914 | 90 | Weighted Average |
| | 36,136 | | 32.00% Pervious Area |
| | 76,778 | | 68.00% 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

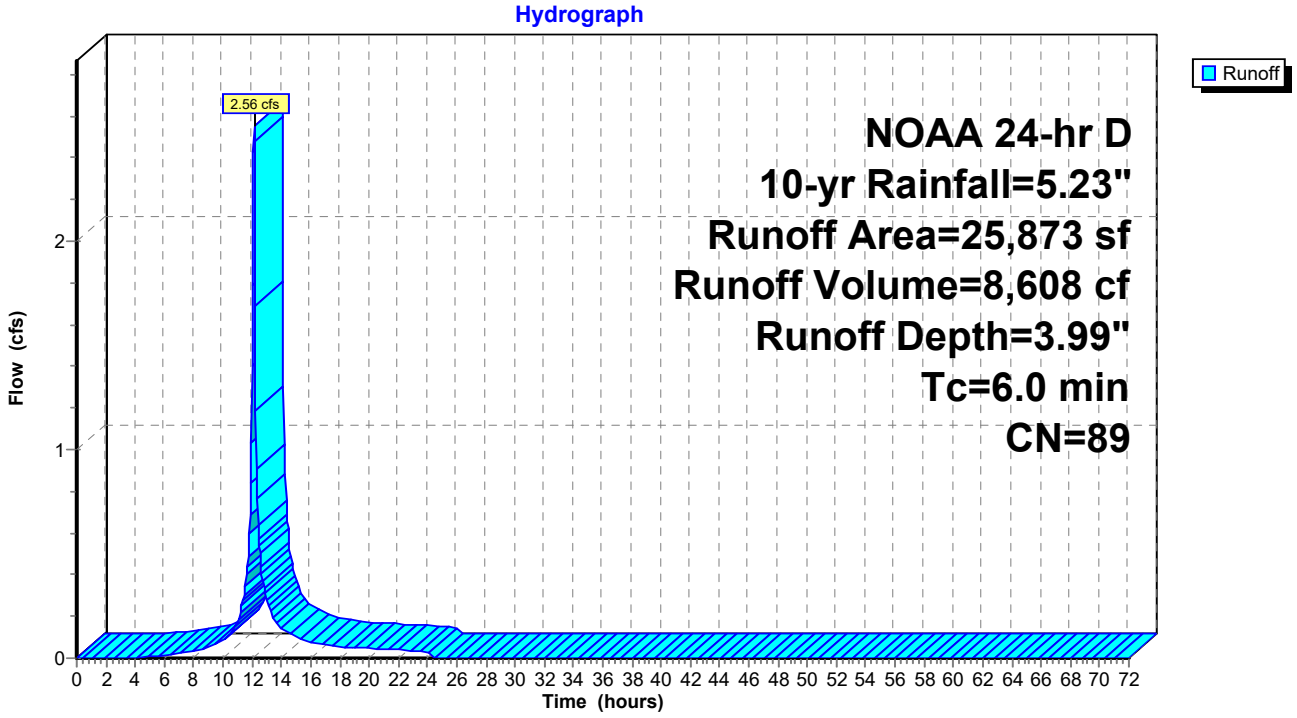
Runoff = 2.56 cfs @ 12.13 hrs, Volume= 8,608 cf, Depth= 3.99"
Routed to Reach DP-C1 : Wetlands

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 |
|---|---|---|
| 9,827 | 74 | >75% Grass cover, Good, HSG C |
| 16,046 | 98 | Paved parking, HSG C |
| 25,873 | 89 | Weighted Average |
| 9,827 | | 37.98% Pervious Area |
| 16,046 | | 62.02% 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

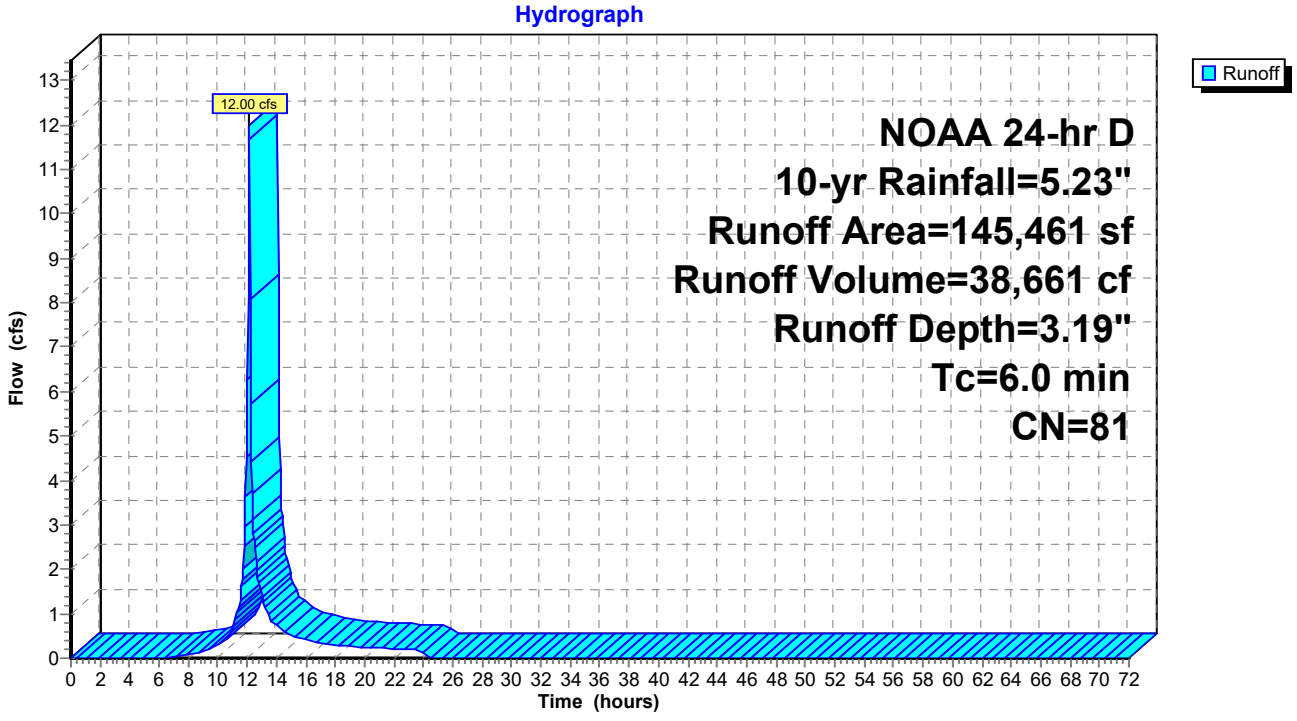
Runoff = 12.00 cfs @ 12.13 hrs, Volume= 38,661 cf, Depth= 3.19"
Routed to Pond SS-1 : Subsurface Infiltration (SC-310 Chambers)

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 |
|---|---|---|
| 103,648 | 74 | >75% Grass cover, Good, HSG C |
| 41,813 | 98 | Paved parking, HSG C |
| 145,461 | 81 | Weighted Average |
| 103,648 | | 71.25% Pervious Area |
| 41,813 | | 28.75% 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

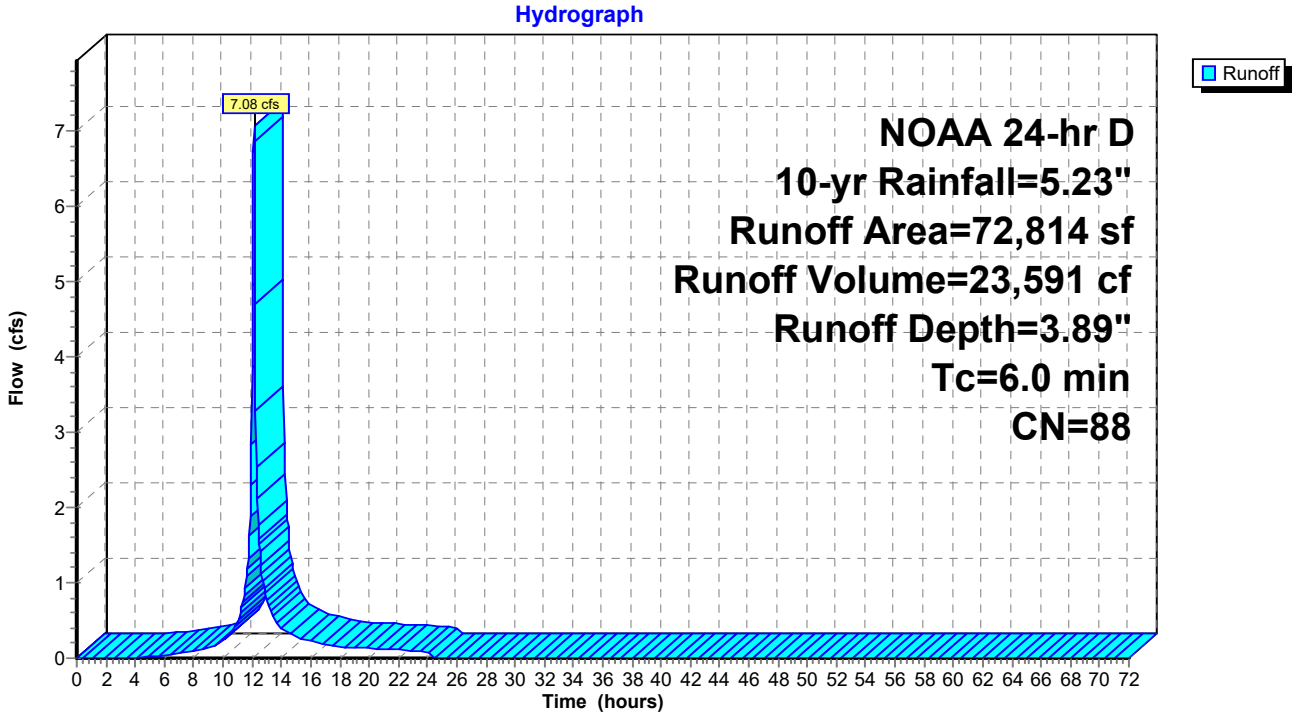
Runoff = 7.08 cfs @ 12.13 hrs, Volume= 23,591 cf, Depth= 3.89"
Routed to Reach DP-B : Concord Street Main

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 |
|---|---|---|
| 29,536 | 74 | >75% Grass cover, Good, HSG C |
| 43,278 | 98 | Paved parking, HSG C |
| 72,814 | 88 | Weighted Average |
| 29,536 | | 40.56% Pervious Area |
| 43,278 | | 59.44% 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

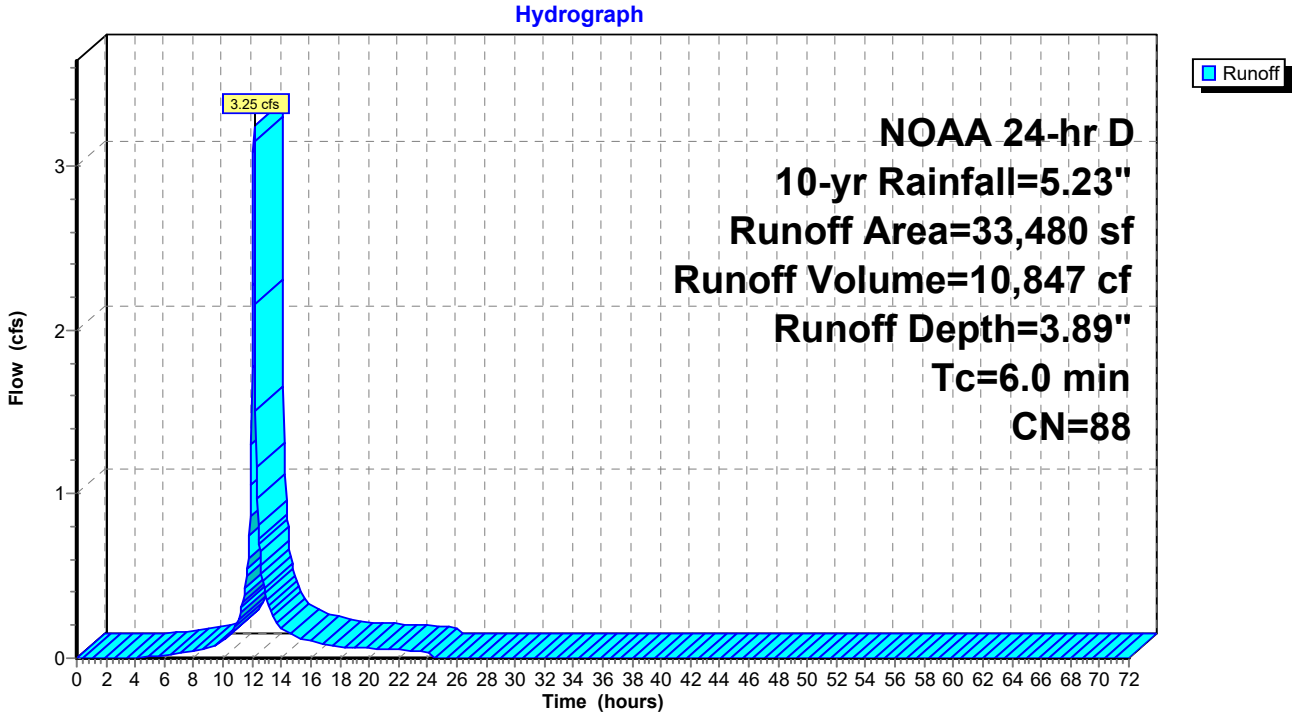
Runoff = 3.25 cfs @ 12.13 hrs, Volume= 10,847 cf, Depth= 3.89"
Routed to Pond SI-1 : Surface Infiltration

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 |
|---|---|---|
| 19,367 | 98 | Paved parking, HSG C |
| 14,113 | 74 | >75% Grass cover, Good, HSG C |
| 33,480 | 88 | Weighted Average |
| 14,113 | | 42.15% Pervious Area |
| 19,367 | | 57.85% 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

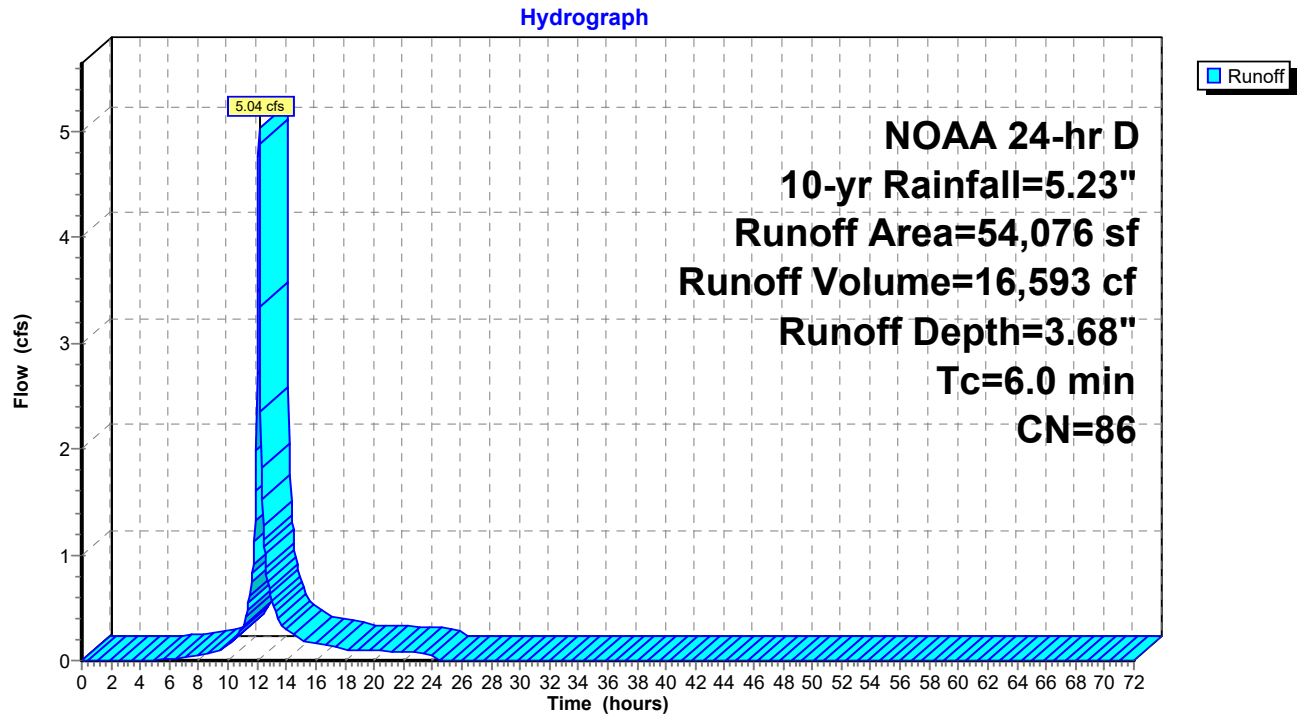
Runoff = 5.04 cfs @ 12.13 hrs, Volume= 16,593 cf, Depth= 3.68"
Routed to Pond SS-4 : Subsurface Infiltration (24" Pipe)

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 |
|---|---|---|---|
| | 27,408 | 74 | >75% Grass cover, Good, HSG C |
| | 17,739 | 98 | Paved roads w/curbs & sewers, HSG C |
| * | 8,929 | 98 | Roofs, HSG C |
| | 54,076 | 86 | Weighted Average |
| | 27,408 | | 50.68% Pervious Area |
| | 26,668 | | 49.32% 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

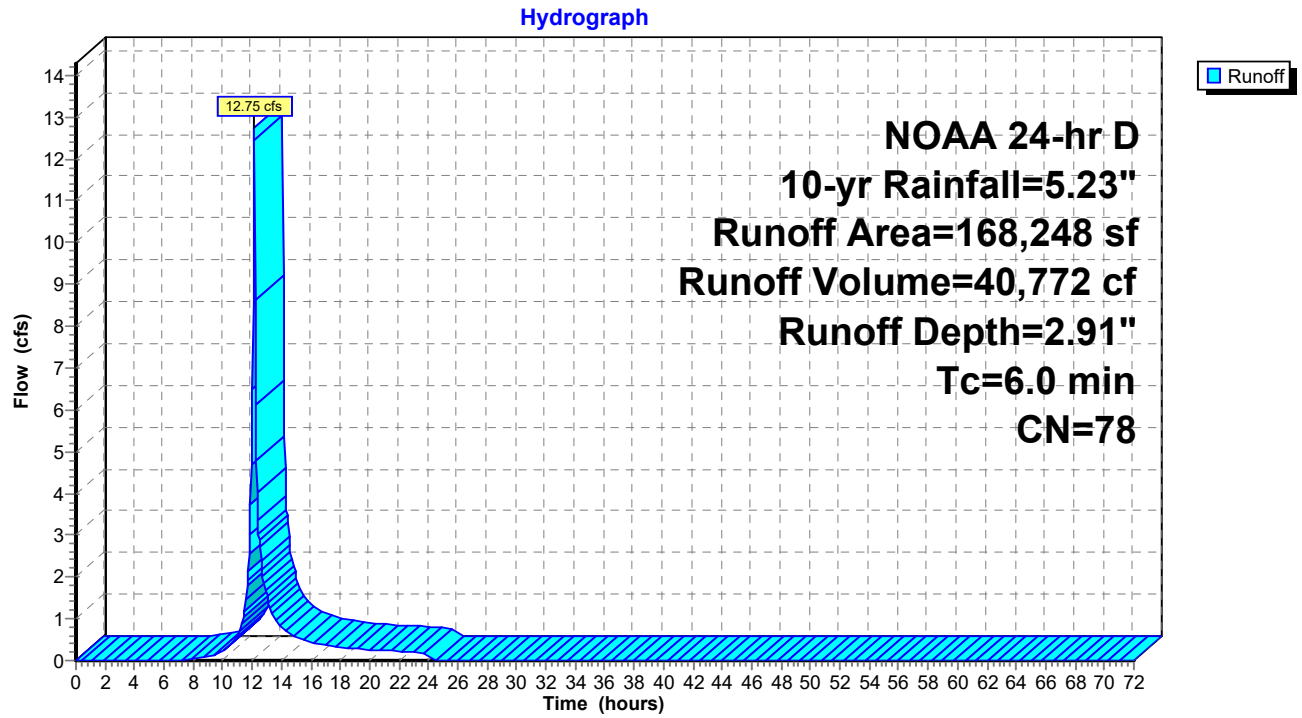
Runoff = 12.75 cfs @ 12.13 hrs, Volume= 40,772 cf, Depth= 2.91"
Routed to Reach DP-C1 : Wetlands

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 |
|---|---|---|---|
| | 93,250 | 74 | >75% Grass cover, Good, HSG C |
| | 39,650 | 70 | Woods, Good, HSG C |
| * | 35,348 | 98 | Pond |
| | 168,248 | 78 | Weighted Average |
| | 132,900 | | 78.99% Pervious Area |
| | 35,348 | | 21.01% 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

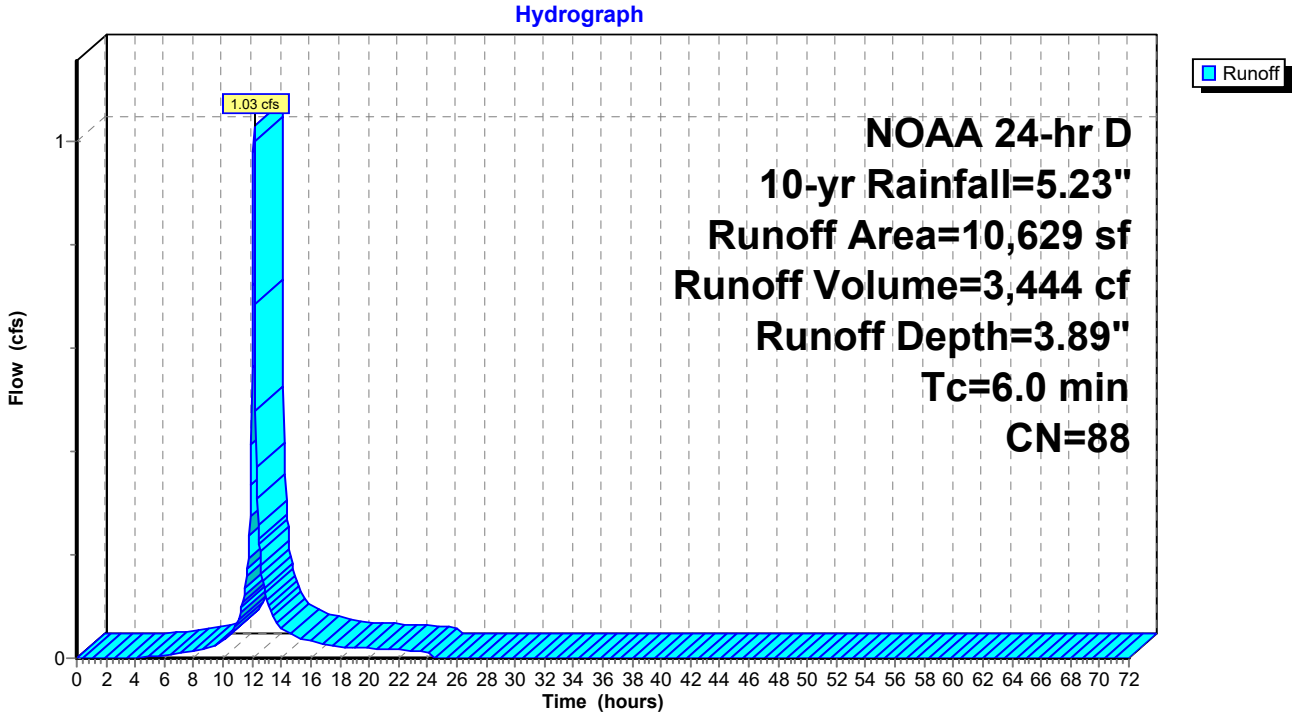
Runoff = 1.03 cfs @ 12.13 hrs, Volume= 3,444 cf, Depth= 3.89"
Routed to Pond SS-2 : Subsurface Infiltration (SC-740 Chambers)

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 |
|---|---|---|
| 6,168 | 98 | Paved parking, HSG C |
| 4,461 | 74 | >75% Grass cover, Good, HSG C |
| 10,629 | 88 | Weighted Average |
| 4,461 | | 41.97% Pervious Area |
| 6,168 | | 58.03% 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

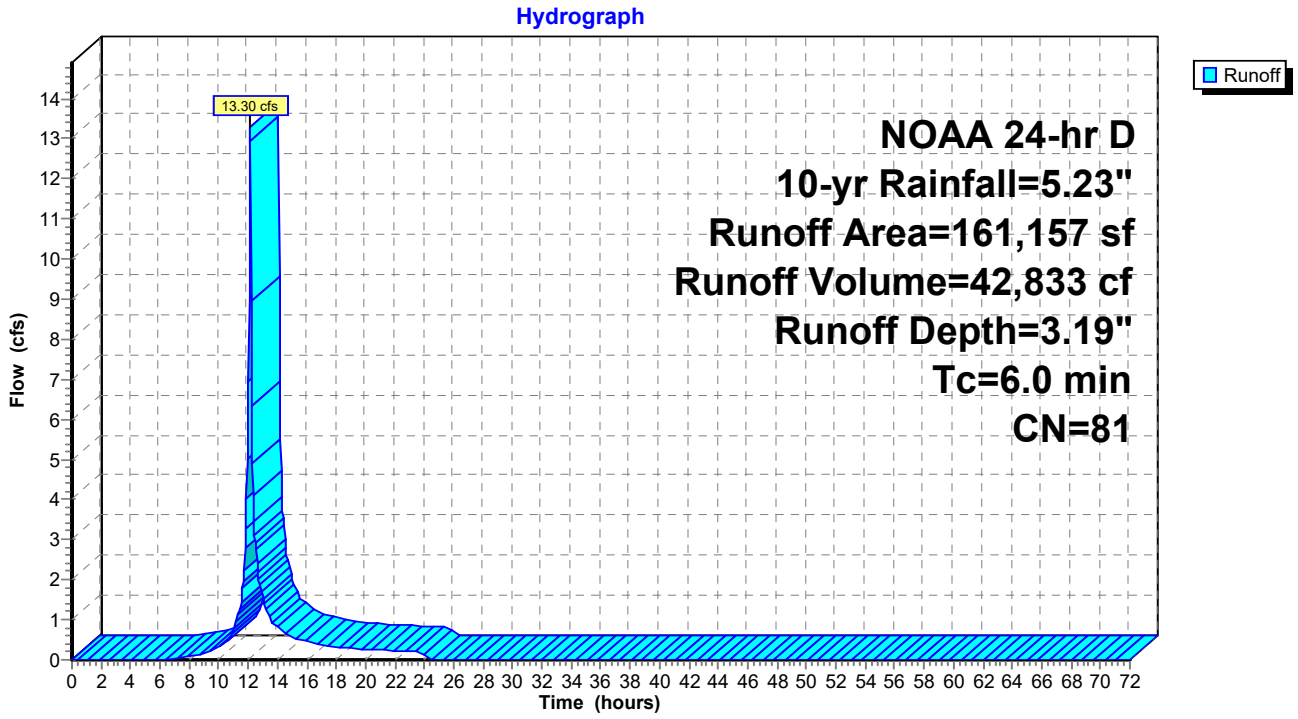
Runoff = 13.30 cfs @ 12.13 hrs, Volume= 42,833 cf, Depth= 3.19"
Routed to Pond SS-3 : Subsurface Infiltration (24" Pipe)

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 |
|---|---|---|
| 32,000 | 98 | Roofs, HSG C |
| 73,574 | 74 | >75% Grass cover, Good, HSG C |
| 19,452 | 98 | Paved parking, HSG C |
| 36,131 | 70 | Woods, Good, HSG C |
| 161,157 | 81 | Weighted Average |
| 109,705 | | 68.07% Pervious Area |
| 51,452 | | 31.93% 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

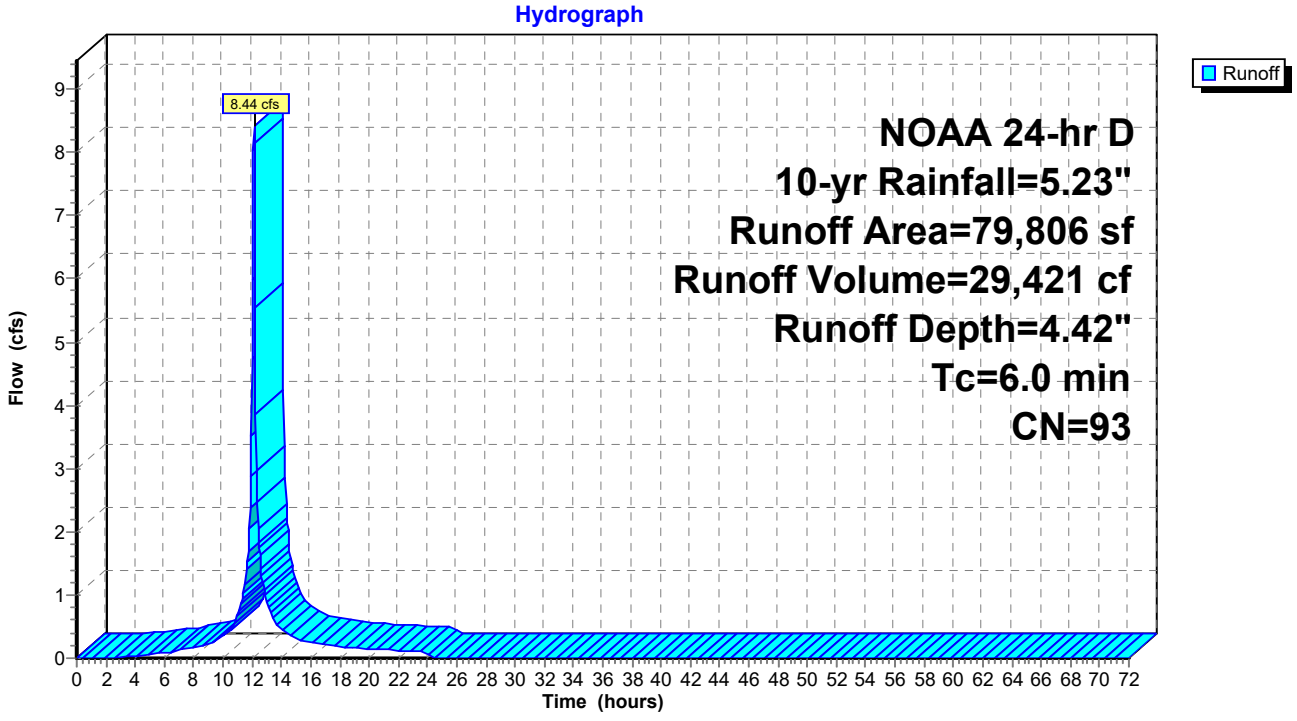
Runoff = 8.44 cfs @ 12.13 hrs, Volume= 29,421 cf, Depth= 4.42"
Routed to Pond SI-2 : South Inf Basin

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 |
|---|---|---|
| 61,762 | 98 | Paved parking, HSG C |
| 18,044 | 74 | >75% Grass cover, Good, HSG C |
| 79,806 | 93 | Weighted Average |
| 18,044 | | 22.61% Pervious Area |
| 61,762 | | 77.39% 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

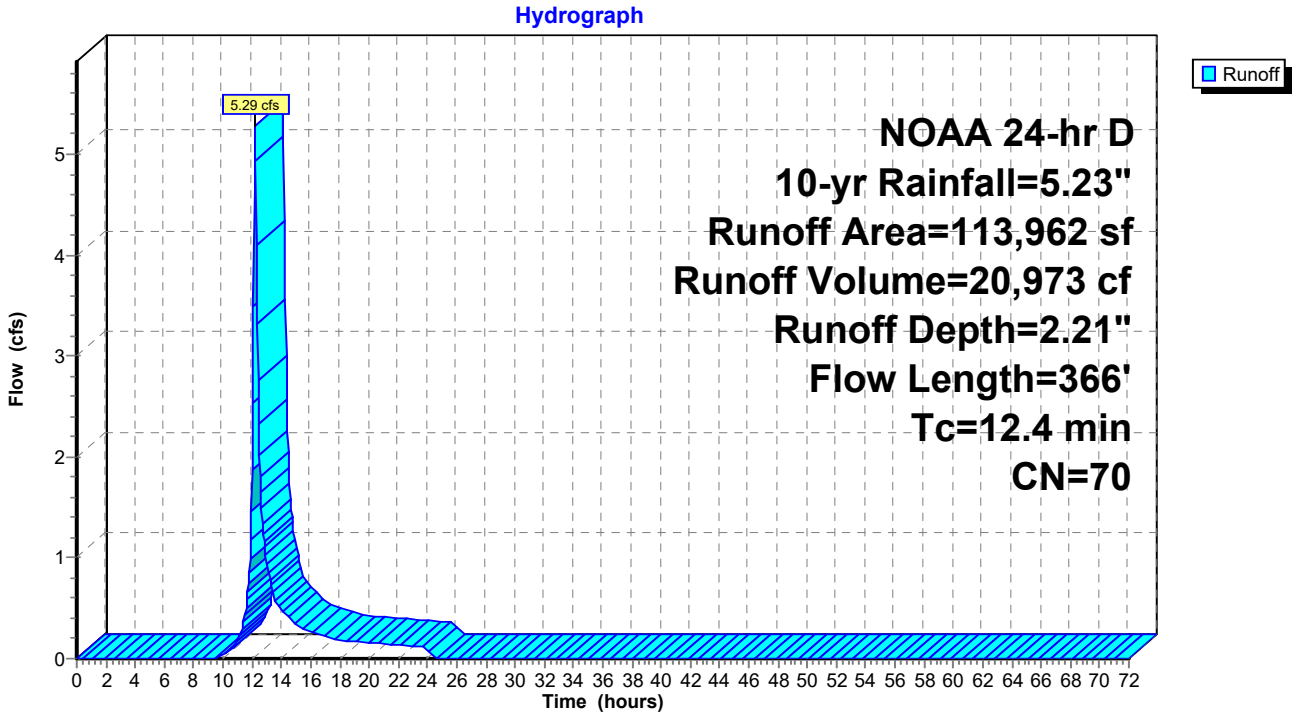
Runoff = 5.29 cfs @ 12.21 hrs, Volume= 20,973 cf, Depth= 2.21"
Routed to Reach DP-C2 : Intermittent Stream West

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 |
|---|---|---|
| 106,091 | 70 | Woods, Good, HSG C |
| 7,871 | 74 | >75% Grass cover, Good, HSG C |
| 113,962 | 70 | Weighted Average |
| 113,962 | | 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 4R: Swale

Inflow Area = 169,240 sf, 0.00% Impervious, Inflow Depth = 2.25" for 10-yr event
Inflow = 8.98 cfs @ 12.17 hrs, Volume= 31,776 cf, Incl. 0.01 cfs Inflow Loss
Outflow = 7.99 cfs @ 12.28 hrs, Volume= 31,776 cf, Atten= 11%, Lag= 6.6 min
Routed to Reach DP-A : Eastern Intermittent Stream

Routing by Stor-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Max. Velocity= 3.15 fps, Min. Travel Time= 3.8 min
Avg. Velocity = 1.06 fps, Avg. Travel Time= 11.5 min

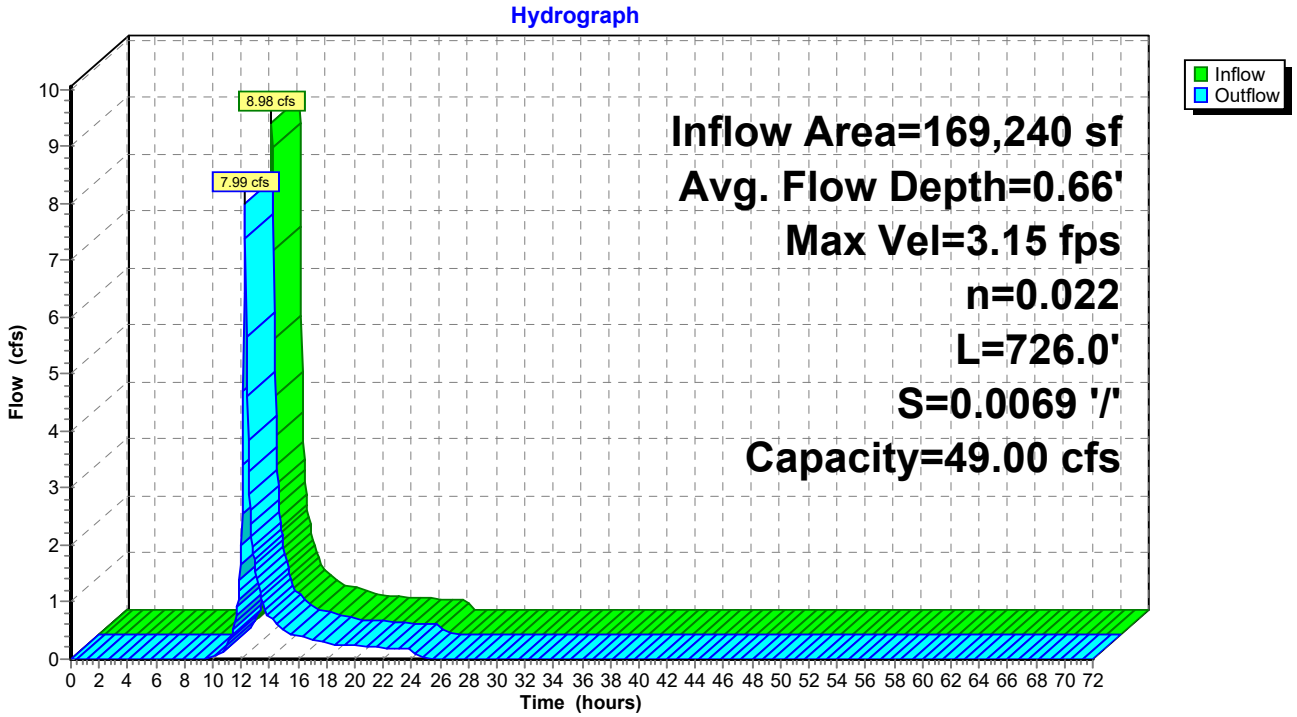
Peak Storage= 1,887 cf @ 12.21 hrs
Average Depth at Peak Storage= 0.66' , Surface Width= 5.93'
Bank-Full Depth= 1.50' Flow Area= 9.8 sf, Capacity= 49.00 cfs

2.00' x 1.50' deep channel, n= 0.022
Side Slope Z-value= 3.0 '/' Top Width= 11.00'
Length= 726.0' Slope= 0.0069 '/'
Inlet Invert= 207.00', Outlet Invert= 202.00'

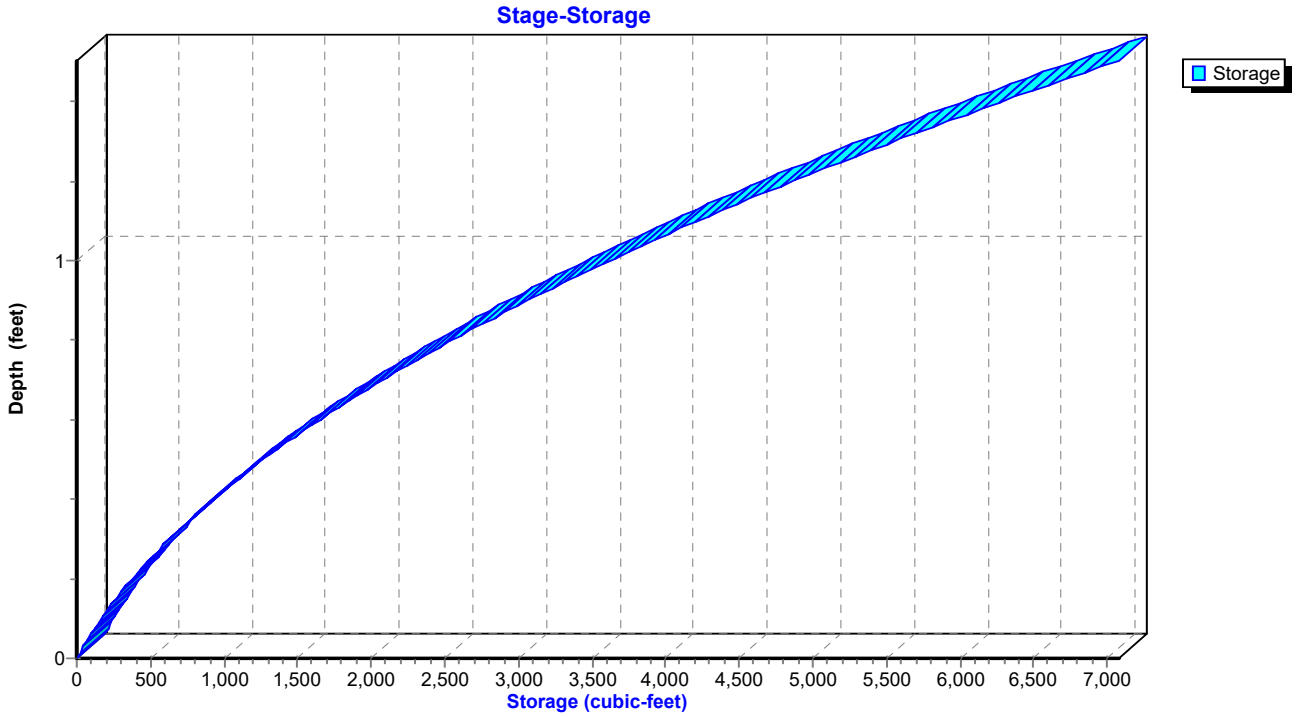


‡

### Reach 4R: Swale



## Reach 4R: Swale

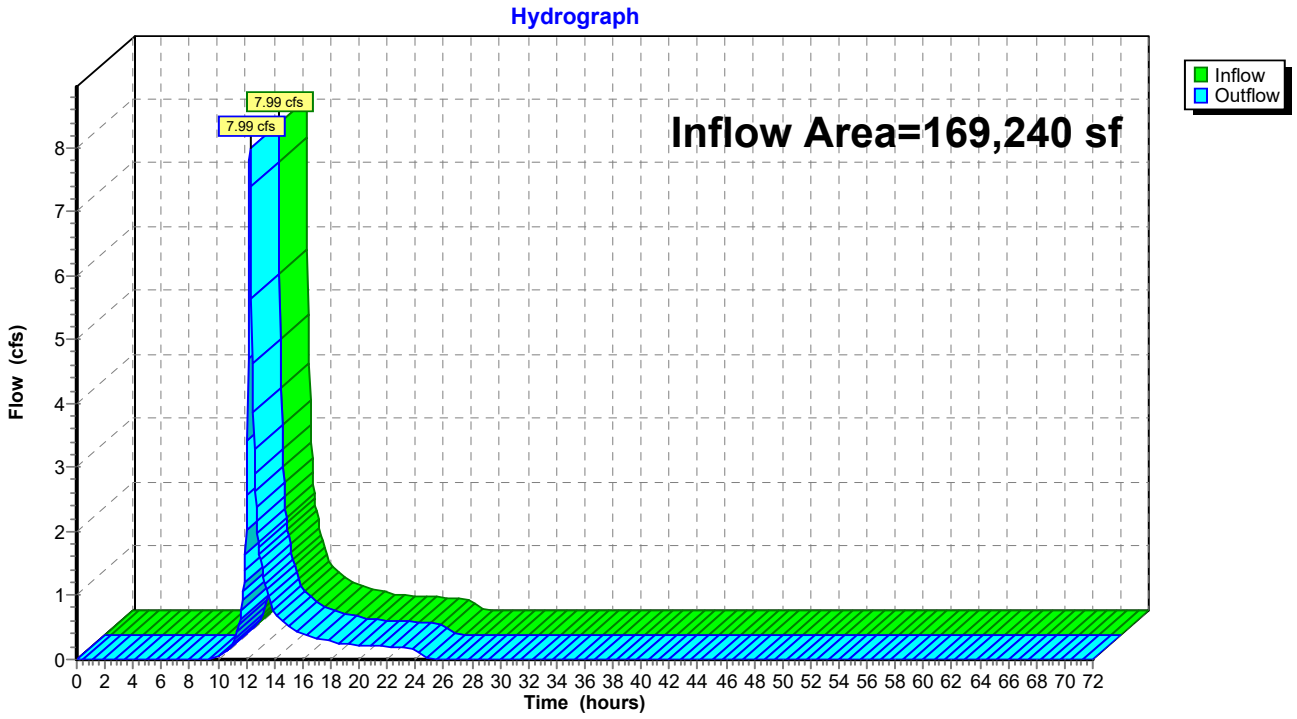


## Summary for Reach DP-A: Eastern Intermittent Stream

Inflow Area = 169,240 sf, 0.00% Impervious, Inflow Depth = 2.25" for 10-yr event
Inflow = 7.99 cfs @ 12.28 hrs, Volume= 31,776 cf
Outflow = 7.99 cfs @ 12.28 hrs, Volume= 31,776 cf, Atten= 0%, Lag= 0.0 min
Routed to Reach PR TOT : Total Site

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

## Reach DP-A: Eastern Intermittent Stream

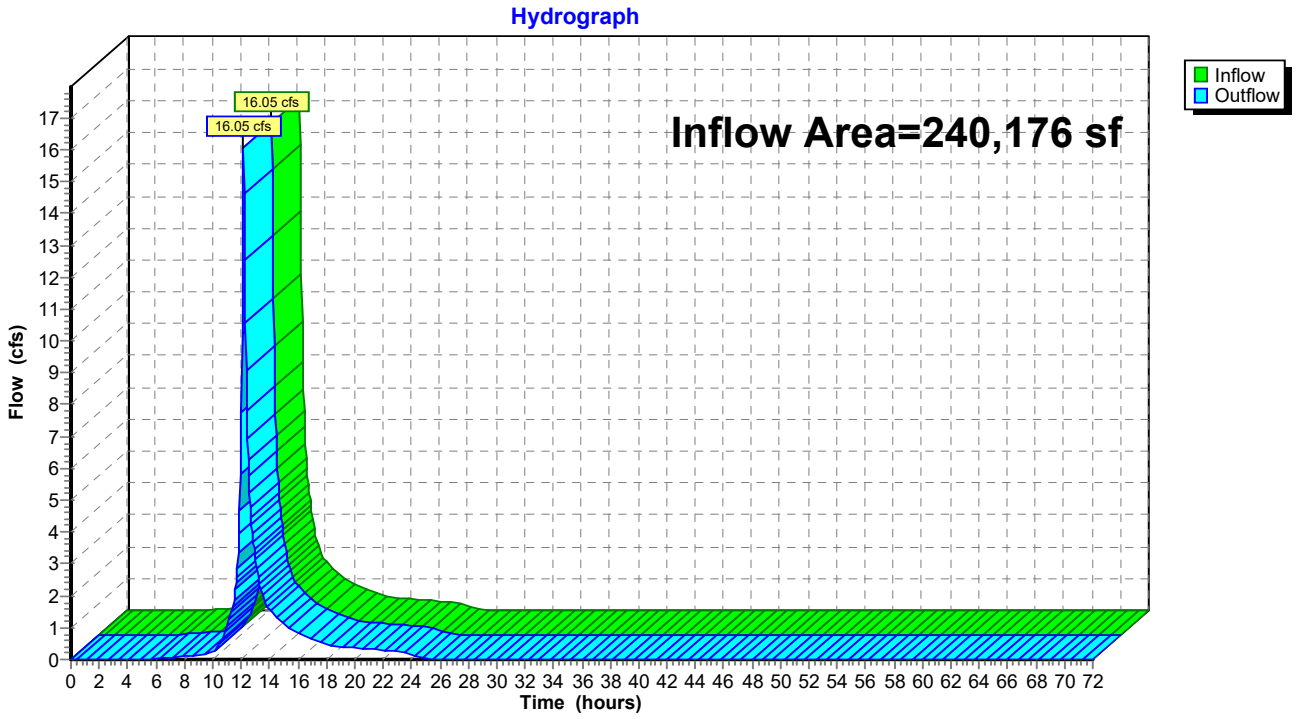


## Summary for Reach DP-B: Concord Street Main

Inflow Area = 240,176 sf, 62.90% Impervious, Inflow Depth = 3.39" for 10-yr event
Inflow = 16.05 cfs @ 12.15 hrs, Volume= 67,850 cf
Outflow = 16.05 cfs @ 12.15 hrs, Volume= 67,850 cf, Atten= 0%, Lag= 0.0 min
Routed to Reach PR TOT : Total Site

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

## Reach DP-B: Concord Street Main

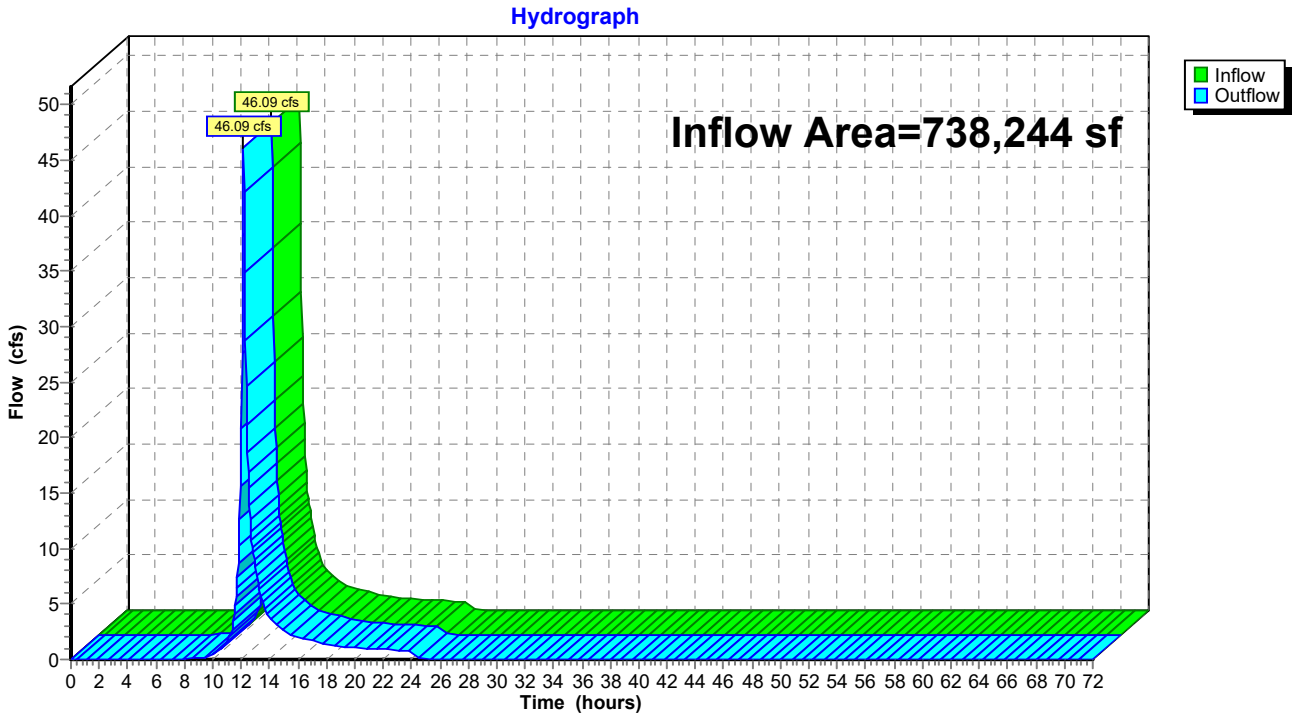


## Summary for Reach DP-C1: Wetlands

Inflow Area = 738,244 sf, 30.83% Impervious, Inflow Depth = 2.82" for 10-yr event
Inflow = 46.09 cfs @ 12.16 hrs, Volume= 173,498 cf
Outflow = 46.09 cfs @ 12.16 hrs, Volume= 173,498 cf, Atten= 0%, Lag= 0.0 min
Routed to Reach PR TOT : Total Site

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

### Reach DP-C1: Wetlands

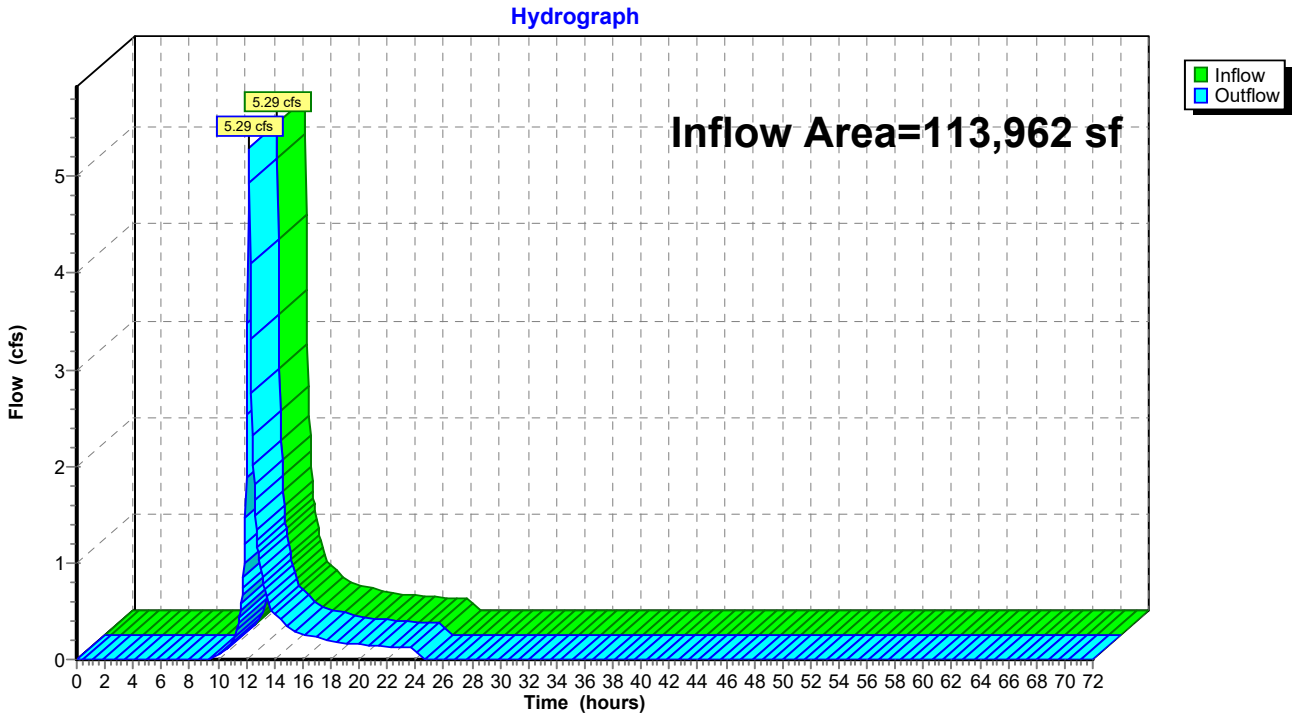


## Summary for Reach DP-C2: Intermittent Stream West

Inflow Area = 113,962 sf, 0.00% Impervious, Inflow Depth = 2.21" for 10-yr event
Inflow = 5.29 cfs @ 12.21 hrs, Volume= 20,973 cf
Outflow = 5.29 cfs @ 12.21 hrs, Volume= 20,973 cf, Atten= 0%, Lag= 0.0 min
Routed to Reach DP-C1 : Wetlands

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

## Reach DP-C2: Intermittent Stream West

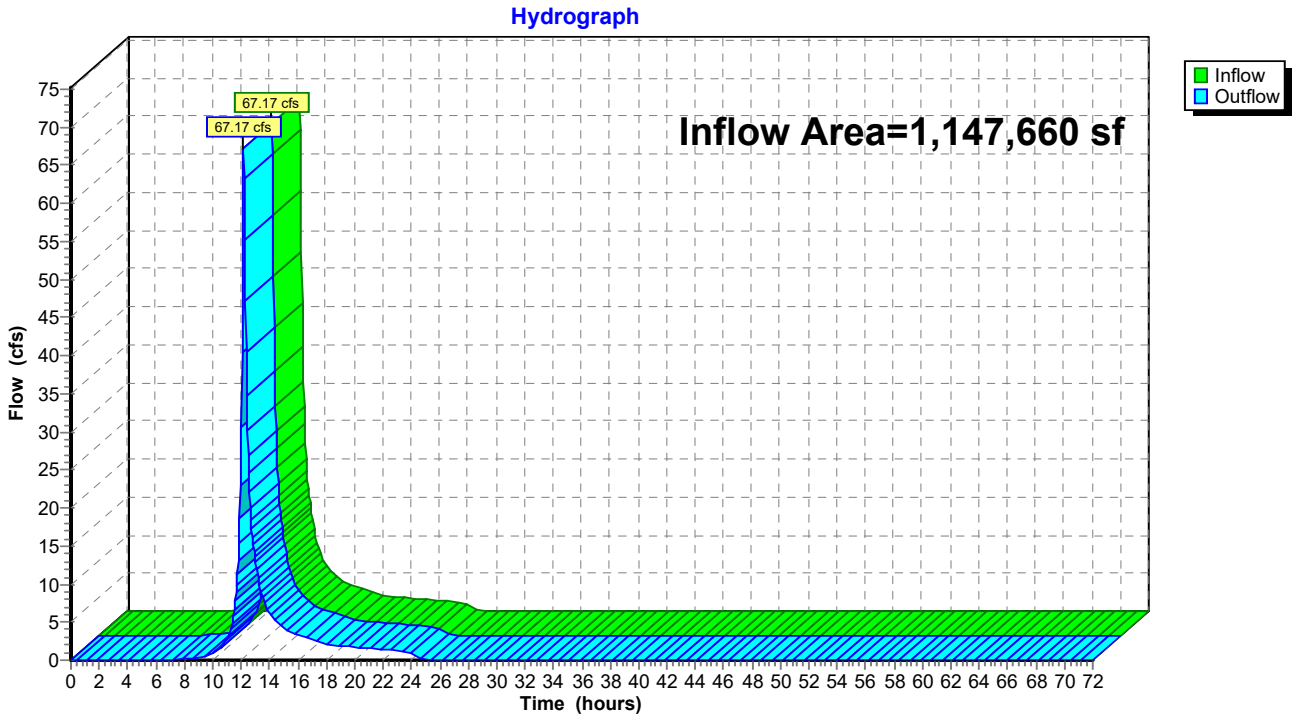


## Summary for Reach PR TOT: Total Site

Inflow Area = 1,147,660 sf, 33.00% Impervious, Inflow Depth = 2.86" for 10-yr event
Inflow = 67.17 cfs @ 12.16 hrs, Volume= 273,125 cf
Outflow = 67.17 cfs @ 12.16 hrs, Volume= 273,125 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 Pond BIO-1: Surface System

Inflow Area = 112,914 sf, 68.00% Impervious, Inflow Depth = 4.10" for 10-yr event
Inflow = 11.39 cfs @ 12.13 hrs, Volume= 38,564 cf
Outflow = 9.81 cfs @ 12.17 hrs, Volume= 38,564 cf, Atten= 14%, Lag= 2.5 min
Discarded = 0.04 cfs @ 12.17 hrs, Volume= 4,643 cf
Primary = 9.78 cfs @ 12.17 hrs, Volume= 33,921 cf
Routed to Reach DP-C1 : Wetlands

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 194.64' @ 12.17 hrs Surf.Area= 5,717 sf Storage= 5,287 cf

Plug-Flow detention time= 108.8 min calculated for 38,537 cf (100% of inflow)
Center-of-Mass det. time= 109.8 min ( 904.3 - 794.6 )

| Volume | Invert | Avail.Storage | Storage Description |
|---|---|---|---|
| #1 | 193.60' | 14,265 cf | **Custom Stage Data (Prismatic)** Listed below (Recalc) |

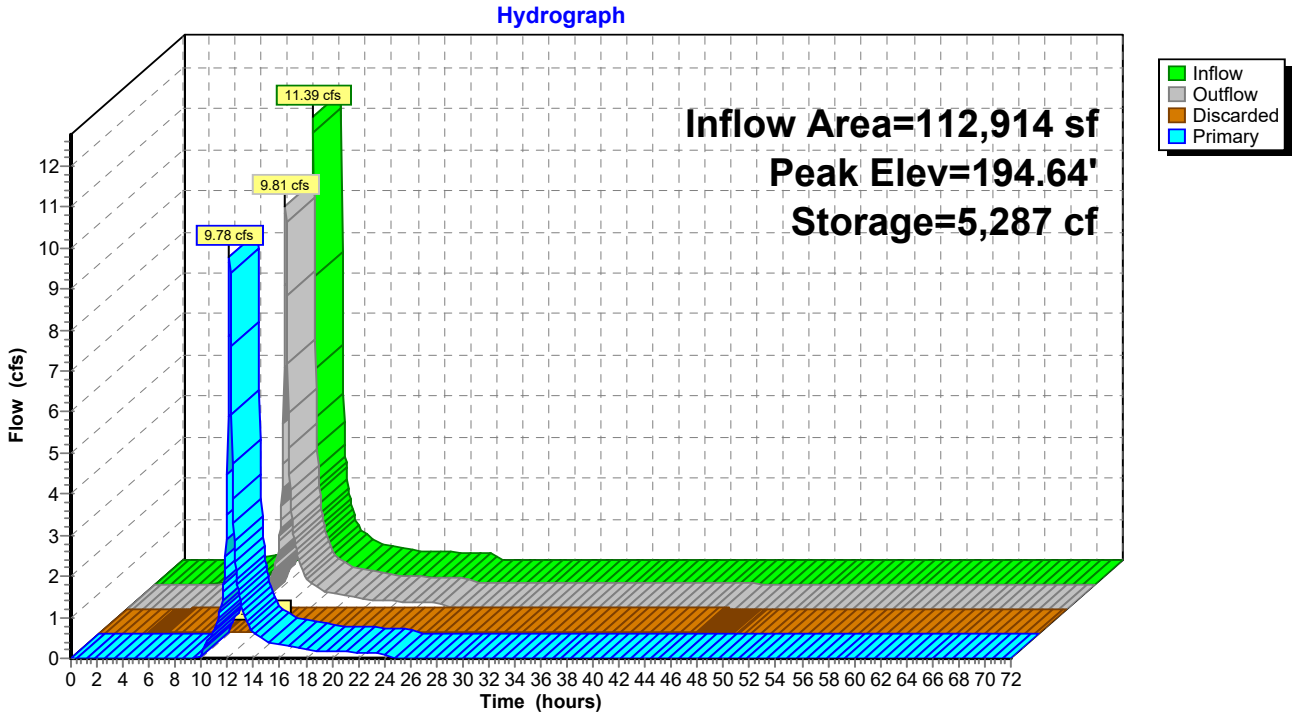
| Elevation (feet) | Surf.Area (sq-ft) | Inc.Store (cubic-feet) | Cum.Store (cubic-feet) |
|---|---|---|---|
| 193.60 | 4,470 | 0 | 0 |
| 194.00 | 4,930 | 1,880 | 1,880 |
| 195.00 | 6,160 | 5,545 | 7,425 |
| 196.00 | 7,520 | 6,840 | 14,265 |

| Device | Routing | Invert | Outlet Devices |
|---|---|---|---|
| #1 | Primary | 189.50' | **15.0" Round Culvert**<br>L= 50.0' CPP, square edge headwall, Ke= 0.500<br>Inlet / Outlet Invert= 189.50' / 189.00' S= 0.0100 '/' Cc= 0.900<br>n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.23 sf |
| #2 | Device 1 | 194.10' | **24.0" Horiz. 2-24" Area Drains X 1.20** C= 0.600<br>Limited to weir flow at low heads |
| #3 | Discarded | 193.60' | **0.270 in/hr Exfiltration over Surface area** |

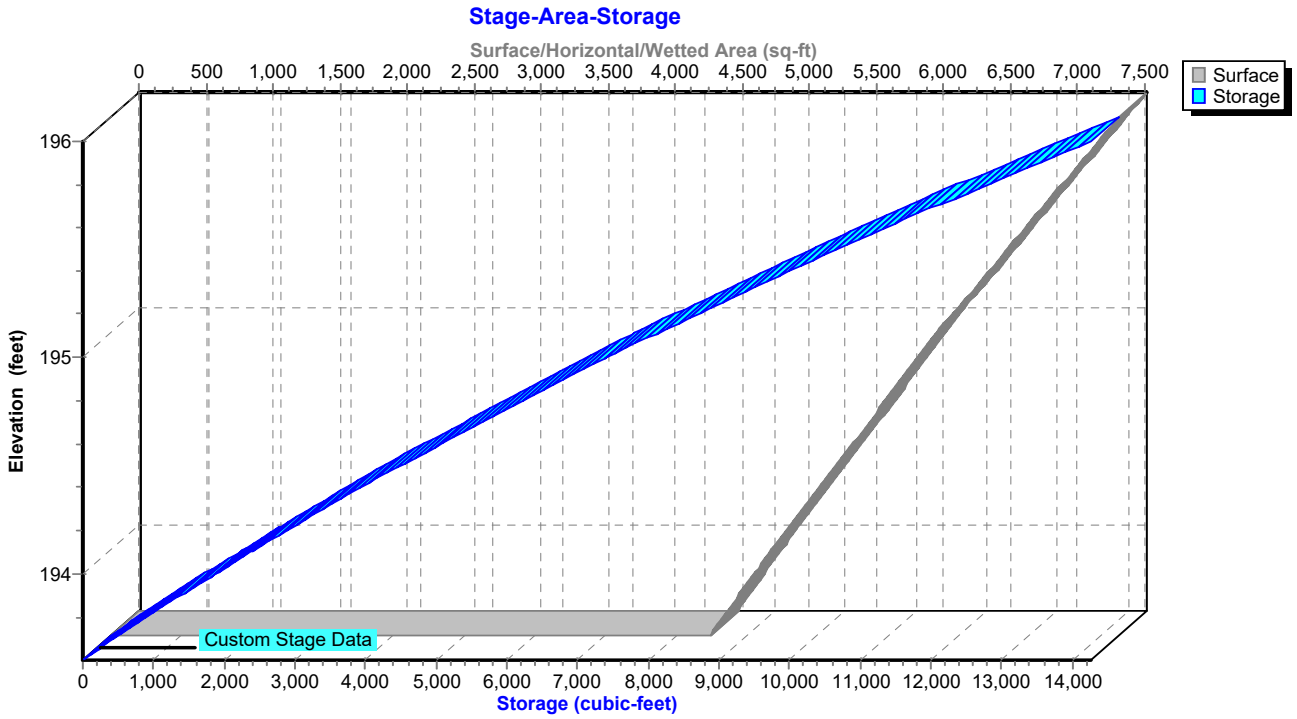
**Discarded OutFlow** Max=0.04 cfs @ 12.17 hrs HW=194.63' (Free Discharge)
↑—**3=Exfiltration** (Exfiltration Controls 0.04 cfs)

**Primary OutFlow** Max=9.54 cfs @ 12.17 hrs HW=194.63' (Free Discharge)
↑—**1=Culvert** (Passes 9.54 cfs of 12.54 cfs potential flow)
↑—**2=2-24" Area Drains** (Weir Controls 9.54 cfs @ 2.86 fps)

## Pond BIO-1: Surface System




## Pond BIO-1: Surface System



## Summary for Pond SI-1: Surface Infiltration

Inflow Area = 33,480 sf, 57.85% Impervious, Inflow Depth = 3.89" for 10-yr event
Inflow = 3.25 cfs @ 12.13 hrs, Volume= 10,847 cf
Outflow = 2.36 cfs @ 12.20 hrs, Volume= 10,847 cf, Atten= 27%, Lag= 4.2 min
Discarded = 0.03 cfs @ 12.20 hrs, Volume= 3,671 cf
Primary = 2.33 cfs @ 12.20 hrs, Volume= 7,176 cf
Routed to Reach DP-B : Concord Street Main

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 200.65' @ 12.20 hrs Surf.Area= 5,491 sf Storage= 3,057 cf

Plug-Flow detention time= 226.4 min calculated for 10,847 cf (100% of inflow)
Center-of-Mass det. time= 226.2 min ( 1,028.7 - 802.4 )

| Volume | Invert | Avail.Storage | Storage Description |
|---|---|---|---|
| #1 | 200.00' | 5,105 cf | **Custom Stage Data (Prismatic)** Listed below (Recalc) |

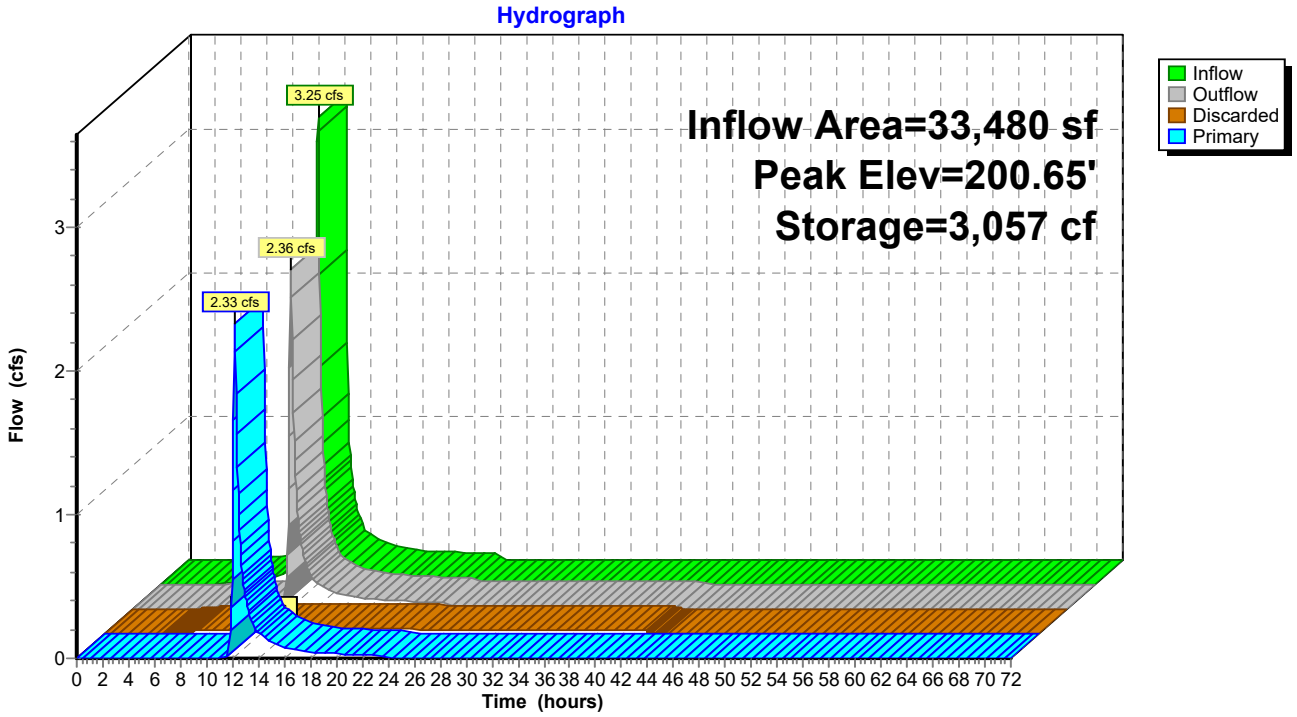
| Elevation (feet) | Surf.Area (sq-ft) | Inc.Store (cubic-feet) | Cum.Store (cubic-feet) |
|---|---|---|---|
| 200.00 | 3,854 | 0 | 0 |
| 201.00 | 6,356 | 5,105 | 5,105 |

| Device | Routing | Invert | Outlet Devices |
|---|---|---|---|
| #1 | Primary | 196.36' | **12.0" Round Culvert**<br>L= 37.6' CPP, mitered to conform to fill, Ke= 0.700<br>Inlet / Outlet Invert= 196.36' / 195.20' S= 0.0309 '/' Cc= 0.900<br>n= 0.013, Flow Area= 0.79 sf |
| #2 | Device 1 | 200.40' | **12.0" Horiz. 12" Area Drain X 0.73** C= 0.600<br>Limited to weir flow at low heads |
| #3 | Device 1 | 200.40' | **18.0" Horiz. 18" Area Drain X 0.69** C= 0.600<br>Limited to weir flow at low heads |
| #4 | Discarded | 200.00' | **0.270 in/hr Exfiltration over Surface area** |

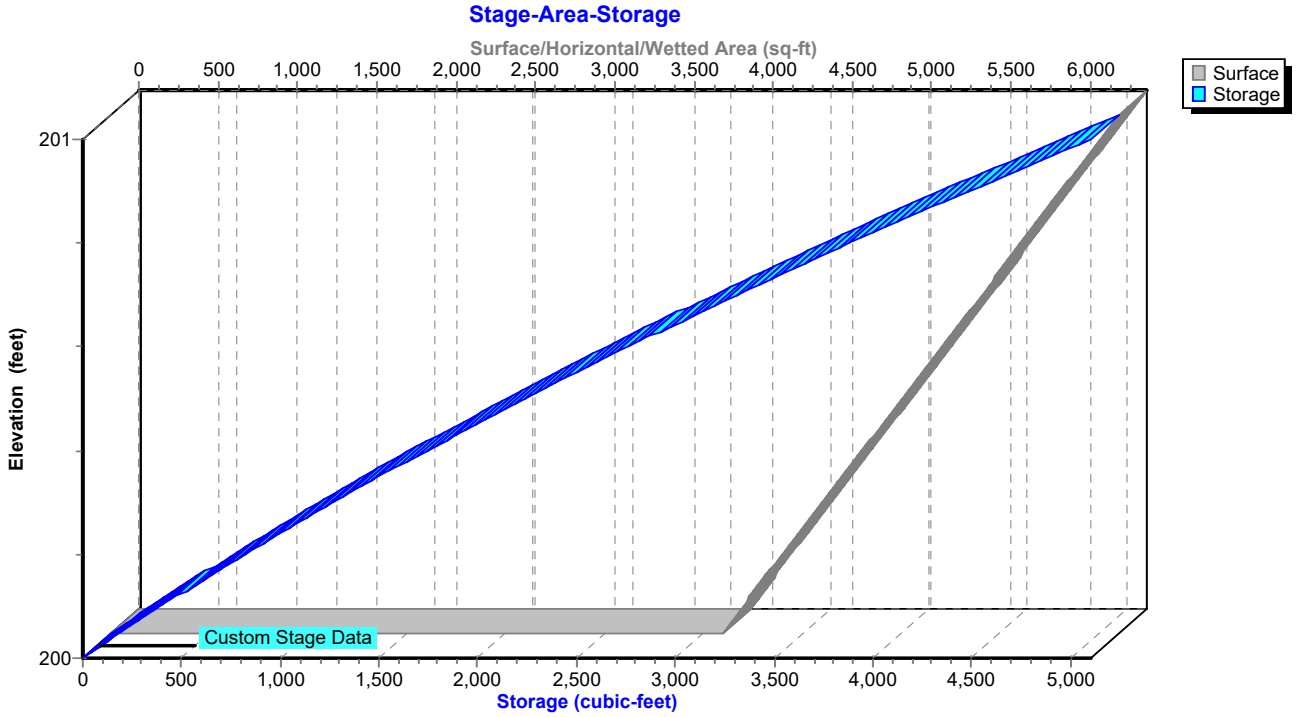
**Discarded OutFlow** Max=0.03 cfs @ 12.20 hrs HW=200.65' (Free Discharge)
└**4=Exfiltration** (Exfiltration Controls 0.03 cfs)

**Primary OutFlow** Max=2.32 cfs @ 12.20 hrs HW=200.65' (Free Discharge)
└**1=Culvert** (Passes 2.32 cfs of 6.50 cfs potential flow)
  ├**2=12" Area Drain** (Weir Controls 0.96 cfs @ 1.20 fps)
  └**3=18" Area Drain** (Weir Controls 1.36 cfs @ 1.14 fps)

## Pond SI-1: Surface Infiltration




## Pond SI-1: Surface Infiltration



## Summary for Pond SI-2: South Inf Basin

Inflow Area = 79,806 sf, 77.39% Impervious, Inflow Depth = 4.42" for 10-yr event
Inflow = 8.44 cfs @ 12.13 hrs, Volume= 29,421 cf
Outflow = 6.71 cfs @ 12.18 hrs, Volume= 29,421 cf, Atten= 20%, Lag= 3.4 min
Discarded = 0.03 cfs @ 12.18 hrs, Volume= 4,491 cf
Primary = 6.69 cfs @ 12.18 hrs, Volume= 24,930 cf
Routed to Reach DP-B : Concord Street Main

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 195.28' @ 12.18 hrs Surf.Area= 4,139 sf Storage= 6,164 cf

Plug-Flow detention time= 222.2 min calculated for 29,401 cf (100% of inflow)
Center-of-Mass det. time= 223.8 min ( 1,004.7 - 780.9 )

| Volume | Invert | Avail.Storage | Storage Description |
|---|---|---|---|
| #1 | 193.50' | 7,532 cf | **Custom Stage Data (Prismatic)** Listed below (Recalc) |

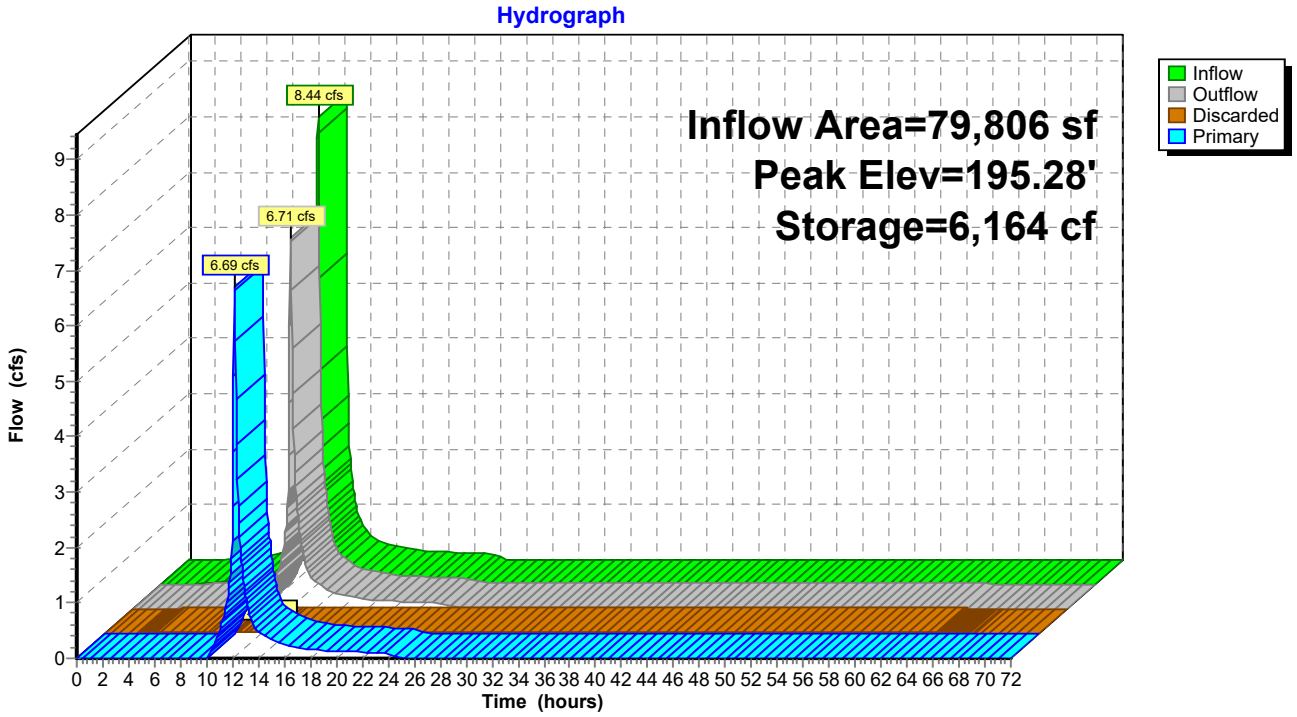
| Elevation (feet) | Surf.Area (sq-ft) | Inc.Store (cubic-feet) | Cum.Store (cubic-feet) |
|---|---|---|---|
| 193.50 | 2,832 | 0 | 0 |
| 194.00 | 3,174 | 1,502 | 1,502 |
| 195.00 | 3,899 | 3,537 | 5,038 |
| 195.60 | 4,414 | 2,494 | 7,532 |

| Device | Routing | Invert | Outlet Devices |
|---|---|---|---|
| #1 | Primary | 194.40' | **12.0" Horiz. 12" Area Drain X 0.73** C= 0.600<br>Limited to weir flow at low heads |
| #2 | Primary | 194.80' | **24.0" Horiz. 24" Area Drain X 0.60** C= 0.600<br>Limited to weir flow at low heads |
| #3 | Discarded | 193.50' | **0.270 in/hr Exfiltration over Surface area** |

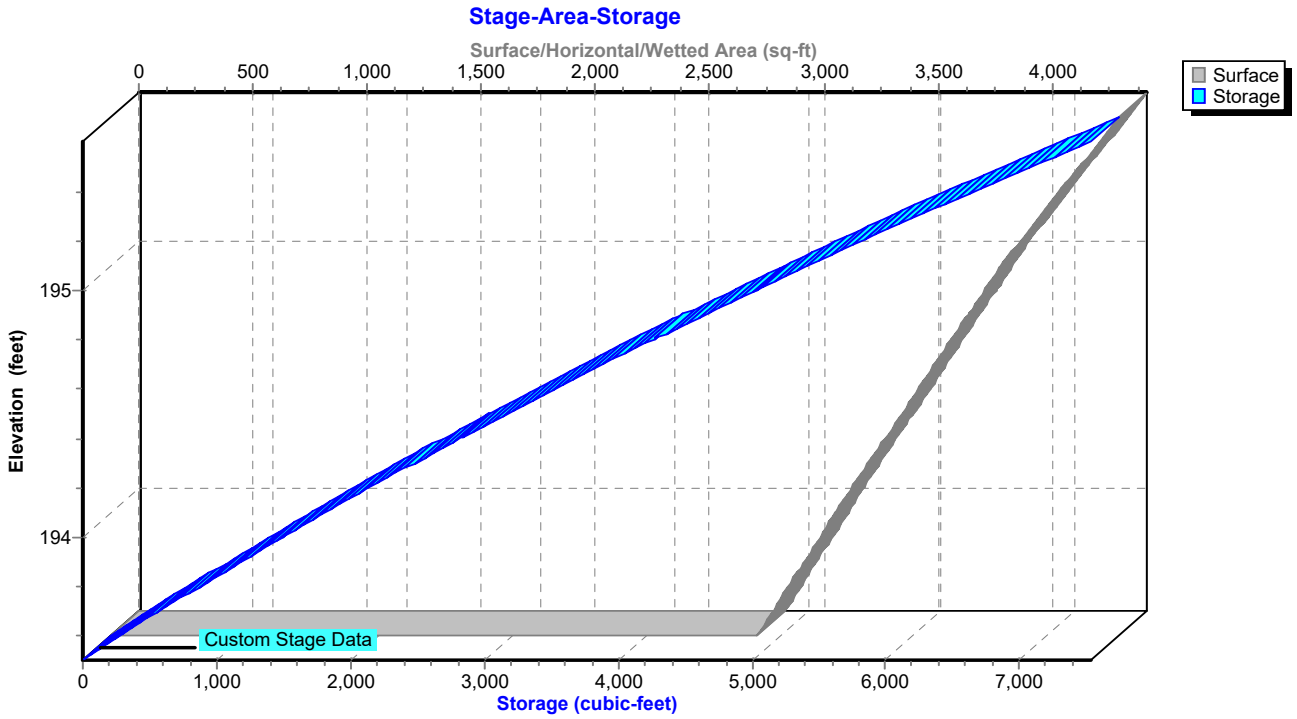
**Discarded OutFlow** Max=0.03 cfs @ 12.18 hrs HW=195.27' (Free Discharge)
└**3=Exfiltration** (Exfiltration Controls 0.03 cfs)

**Primary OutFlow** Max=6.57 cfs @ 12.18 hrs HW=195.27' (Free Discharge)
├**1=12" Area Drain** (Orifice Controls 2.58 cfs @ 3.28 fps)
└**2=24" Area Drain** (Weir Controls 3.99 cfs @ 1.35 fps)

## Pond SI-2: South Inf Basin




## Pond SI-2: South Inf Basin



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

Inflow Area = 145,461 sf, 28.75% Impervious, Inflow Depth = 3.19" for 10-yr event
Inflow = 12.00 cfs @ 12.13 hrs, Volume= 38,661 cf
Outflow = 10.62 cfs @ 12.17 hrs, Volume= 38,661 cf, Atten= 12%, Lag= 2.3 min
Discarded = 0.04 cfs @ 7.85 hrs, Volume= 5,736 cf
Primary = 10.58 cfs @ 12.17 hrs, Volume= 32,926 cf
Routed to Reach DP-C1 : Wetlands

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 185.84' @ 12.17 hrs Surf.Area= 6,528 sf Storage= 7,095 cf

Plug-Flow detention time= 136.5 min calculated for 38,661 cf (100% of inflow)
Center-of-Mass det. time= 136.3 min ( 962.0 - 825.7 )

| Volume | Invert | Avail.Storage | Storage Description |
|---|---|---|---|
| #1A | 184.00' | 4,559 cf | **44.83'W x 145.60'L x 2.33'H Field A**<br>15,231 cf Overall - 3,833 cf Embedded = 11,398 cf x 40.0% Voids |
| #2A | 184.50' | 3,833 cf | **ADS_StormTech SC-310 +Cap** x 260 Inside #1<br>Effective Size= 28.9"W x 16.0"H => 2.07 sf x 7.12'L = 14.7 cf<br>Overall Size= 34.0"W x 16.0"H x 7.56'L with 0.44' Overlap<br>260 Chambers in 13 Rows |
| | | 8,392 cf | Total Available Storage |

Storage Group A created with Chamber Wizard

| Device | Routing | Invert | Outlet Devices |
|---|---|---|---|
| #1 | Primary | 184.85' | **38.0" W x 8.0" H Vert. Orifice/Grate** C= 0.600<br>Limited to weir flow at low heads |
| #2 | Primary | 185.55' | **5.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s) |
| #3 | Discarded | 184.00' | **0.270 in/hr Exfiltration over Surface area** |

**Discarded OutFlow** Max=0.04 cfs @ 7.85 hrs HW=184.02' (Free Discharge)
└**3=Exfiltration** (Exfiltration Controls 0.04 cfs)

**Primary OutFlow** Max=10.19 cfs @ 12.17 hrs HW=185.82' (Free Discharge)
├**1=Orifice/Grate** (Orifice Controls 7.98 cfs @ 3.78 fps)
└**2=Sharp-Crested Rectangular Weir** (Weir Controls 2.21 cfs @ 1.68 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

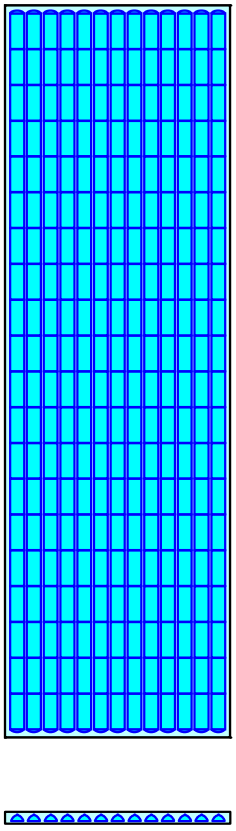
20 Chambers/Row x 7.12' Long +0.60' Cap Length x 2 = 143.60' Row Length +12.0" End Stone x 2 = 145.60' Base Length
13 Rows x 34.0" Wide + 6.0" Spacing x 12 + 12.0" Side Stone x 2 = 44.83' Base Width
6.0" Stone Base + 16.0" Chamber Height + 6.0" Stone Cover = 2.33' Field Height

260 Chambers x 14.7 cf = 3,832.9 cf Chamber Storage

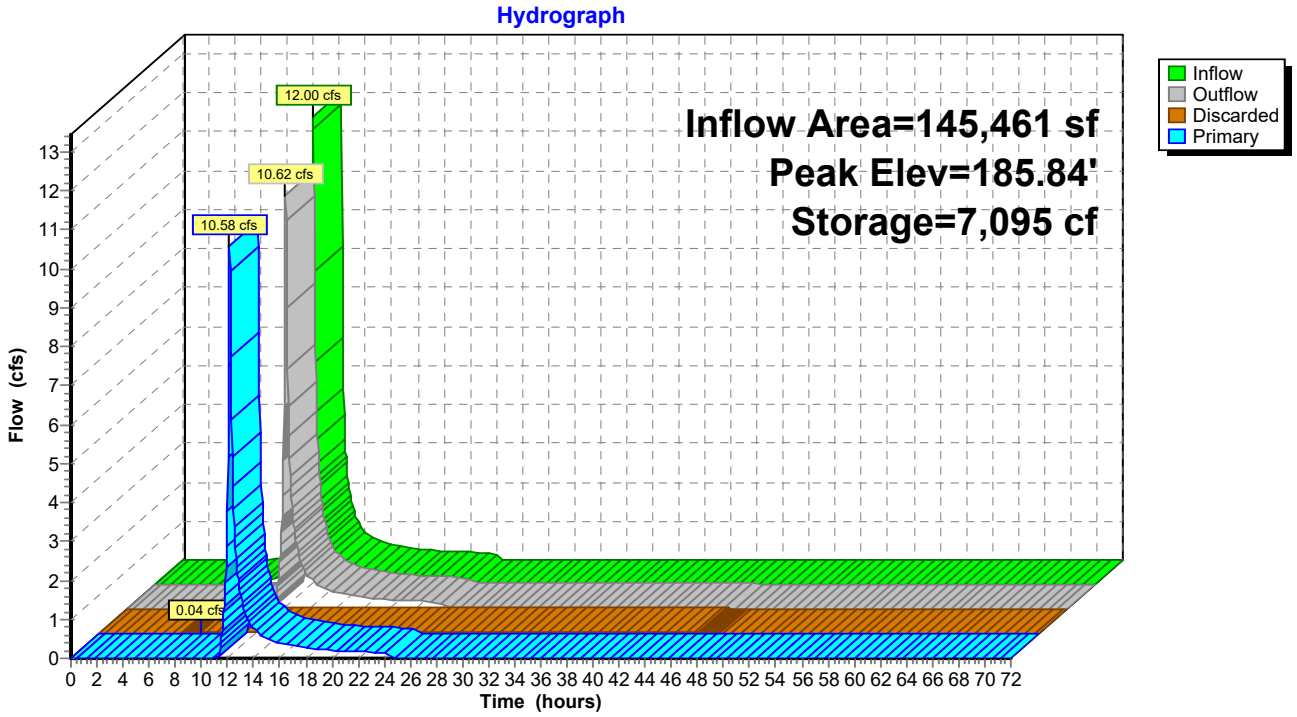
15,231.4 cf Field - 3,832.9 cf Chambers = 11,398.5 cf Stone x 40.0% Voids = 4,559.4 cf Stone Storage

Chamber Storage + Stone Storage = 8,392.3 cf = 0.193 af
Overall Storage Efficiency = 55.1%
Overall System Size = 145.60' x 44.83' x 2.33'

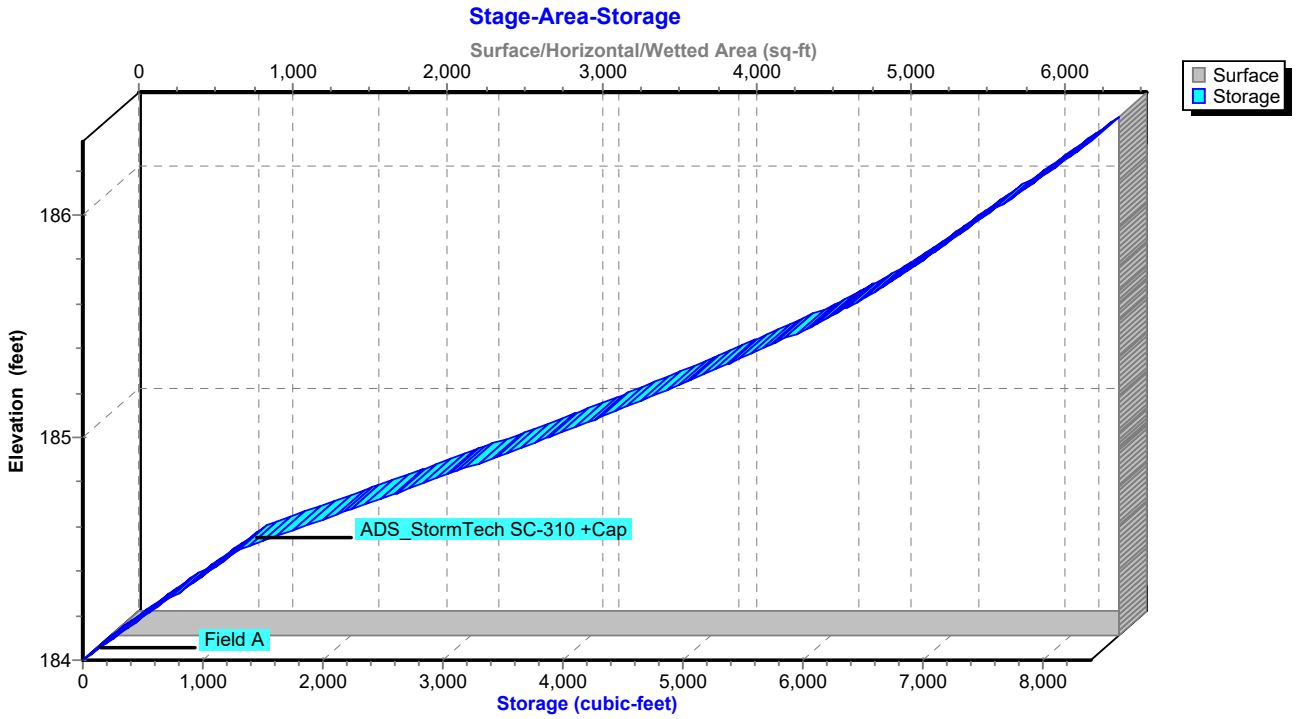
260 Chambers
564.1 cy Field
422.2 cy Stone



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




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



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

Inflow Area = 10,629 sf, 58.03% Impervious, Inflow Depth = 3.89" for 10-yr event
Inflow = 1.03 cfs @ 12.13 hrs, Volume= 3,444 cf
Outflow = 0.08 cfs @ 13.40 hrs, Volume= 3,444 cf, Atten= 92%, Lag= 76.6 min
Discarded = 0.01 cfs @ 8.20 hrs, Volume= 1,890 cf
Primary = 0.07 cfs @ 13.40 hrs, Volume= 1,554 cf
Routed to Reach DP-C1 : Wetlands

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 187.53' @ 13.40 hrs Surf.Area= 1,826 sf Storage= 1,856 cf

Plug-Flow detention time= 608.4 min calculated for 3,441 cf (100% of inflow)
Center-of-Mass det. time= 609.2 min ( 1,411.7 - 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**<br>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<br>Effective Size= 44.6"W x 30.0"H => 6.45 sf x 7.12'L = 45.9 cf<br>Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap<br>48 Chambers in 4 Rows |
| | | 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 Limited to weir flow at low heads |
| #2 | Primary | 188.80' | **5.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s) |
| #3 | Discarded | 186.00' | **0.270 in/hr Exfiltration over Surface area** |

**Discarded OutFlow** Max=0.01 cfs @ 8.20 hrs HW=186.04' (Free Discharge)
└**3=Exfiltration** (Exfiltration Controls 0.01 cfs)

**Primary OutFlow** Max=0.07 cfs @ 13.40 hrs HW=187.53' (Free Discharge)
├**1=Orifice/Grate** (Orifice Controls 0.07 cfs @ 3.22 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

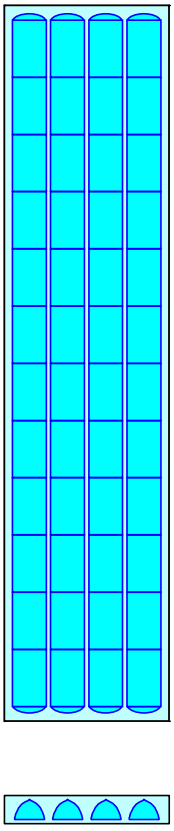
12 Chambers/Row x 7.12' Long +0.81' Cap Length x 2 = 87.06' Row Length +12.0" End Stone x 2 = 89.06' Base Length
4 Rows x 51.0" Wide + 6.0" Spacing x 3 + 12.0" Side Stone x 2 = 20.50' Base Width
6.0" Stone Base + 30.0" Chamber Height + 6.0" Stone Cover = 3.50' Field Height

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

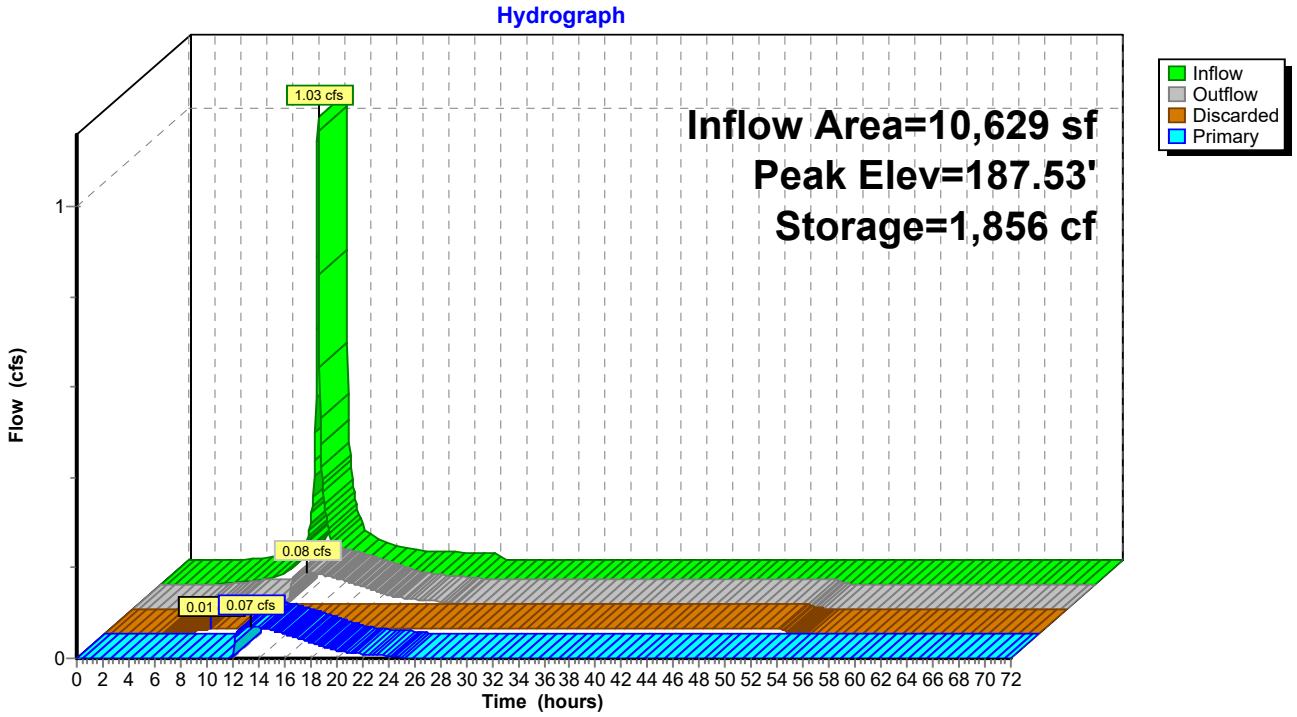
6,389.8 cf Field - 2,205.1 cf Chambers = 4,184.7 cf Stone x 40.0% Voids = 1,673.9 cf Stone Storage

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'

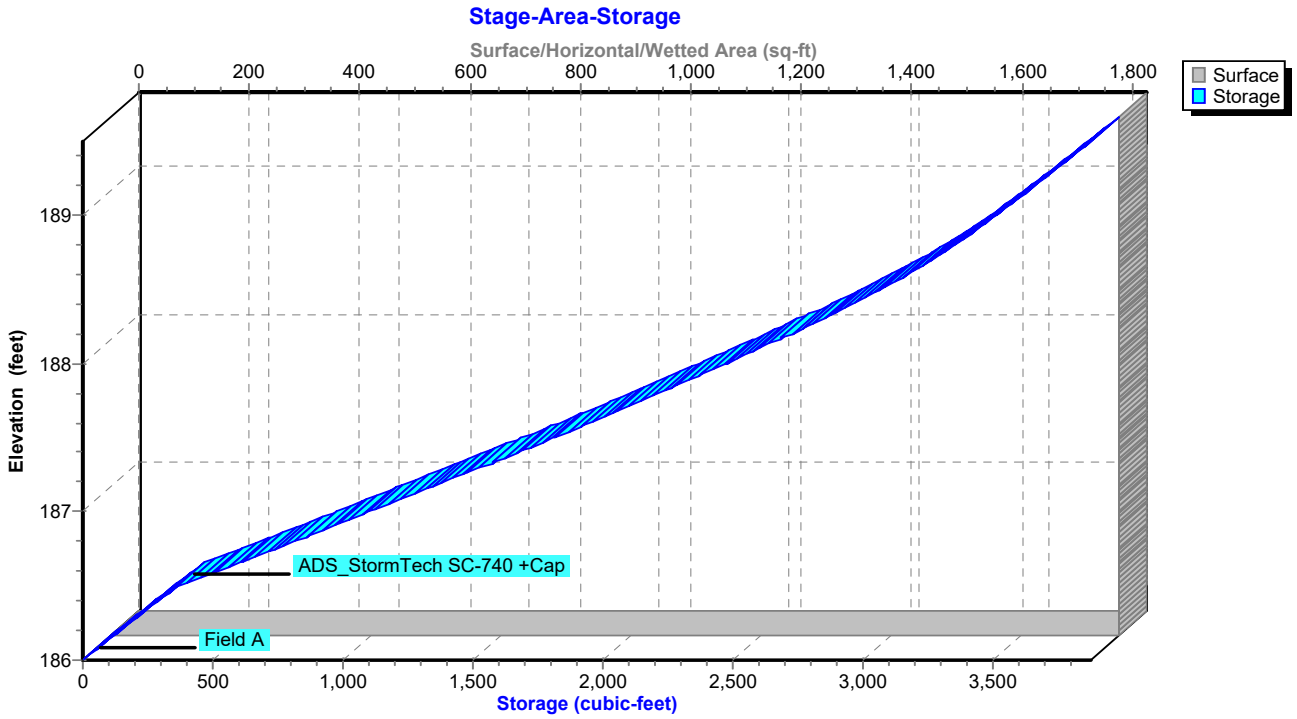
48 Chambers
236.7 cy Field
155.0 cy Stone



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




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



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

Inflow Area = 161,157 sf, 31.93% Impervious, Inflow Depth = 3.19" for 10-yr event
Inflow = 13.30 cfs @ 12.13 hrs, Volume= 42,833 cf
Outflow = 7.27 cfs @ 12.24 hrs, Volume= 42,833 cf, Atten= 45%, Lag= 6.3 min
Discarded = 0.07 cfs @ 8.35 hrs, Volume= 8,090 cf
Primary = 7.21 cfs @ 12.24 hrs, Volume= 34,743 cf
Routed to Reach DP-C1 : Wetlands

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 195.37' @ 12.24 hrs Surf.Area= 10,568 sf Storage= 11,483 cf

Plug-Flow detention time= 147.2 min calculated for 42,833 cf (100% of inflow)
Center-of-Mass det. time= 147.0 min ( 972.7 - 825.7 )

| Volume | Invert | Avail.Storage | Storage Description |
|---|---|---|---|
| #1A | 193.50' | 7,922 cf | **48.85'W x 216.33'L x 3.00'H Field A**<br>31,705 cf Overall - 11,899 cf Embedded = 19,806 cf x 40.0% Voids |
| #2A | 193.83' | 9,407 cf | **ADS N-12 24"** x 154 Inside #1<br>Inside= 23.8"W x 23.8"H => 3.10 sf x 20.00'L = 62.0 cf<br>Outside= 28.0"W x 28.0"H => 3.92 sf x 20.00'L = 78.4 cf<br>Row Length Adjustment= -10.00' x 3.10 sf x 14 rows<br>47.18' Header x 3.10 sf x 2 = 292.5 cf Inside |
| | | 17,329 cf | Total Available Storage |

Storage Group A created with Chamber Wizard

| Device | Routing | Invert | Outlet Devices |
|---|---|---|---|
| #1 | Primary | 194.35' | **30.0" W x 8.0" H Vert. Orifice/Grate** C= 0.600<br>Limited to weir flow at low heads |
| #2 | Primary | 195.00' | **10.0" W x 6.0" H Vert. Orifice/Grate** C= 0.600<br>Limited to weir flow at low heads |
| #3 | Primary | 196.15' | **5.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s) |
| #4 | Discarded | 193.50' | **0.270 in/hr Exfiltration over Surface area** |

**Discarded OutFlow** Max=0.07 cfs @ 8.35 hrs HW=193.53' (Free Discharge)
└**4=Exfiltration** (Exfiltration Controls 0.07 cfs)

**Primary OutFlow** Max=7.17 cfs @ 12.24 hrs HW=195.37' (Free Discharge)
├**1=Orifice/Grate** (Orifice Controls 6.57 cfs @ 3.94 fps)
├**2=Orifice/Grate** (Orifice Controls 0.60 cfs @ 1.95 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 14 rows

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

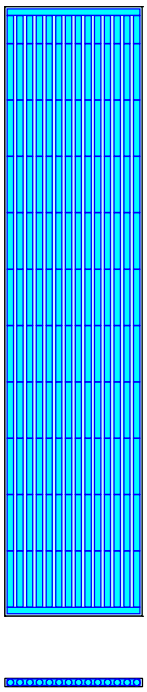
11 Chambers/Row x 20.00' Long -10.00' Row Adjustment +2.33' Header x 2 = 214.67' Row Length +10.0" End Stone x 2 = 216.33' Base Length
14 Rows x 28.0" Wide + 13.4" Spacing x 13 + 10.0" Side Stone x 2 = 48.85' Base Width
4.0" Stone Base + 28.0" Chamber Height + 4.0" Stone Cover = 3.00' Field Height

154 Chambers x 62.0 cf -10.00' Row Adjustment x 3.10 sf x 14 Rows + 47.18' Header x 3.10 sf x 2 = 9,406.5 cf Chamber Storage
154 Chambers x 78.4 cf -10.00' Row Adjustment x 3.92 sf x 14 Rows + 47.18' Header x 3.92 sf x 2 = 11,893.6 cf Displacement

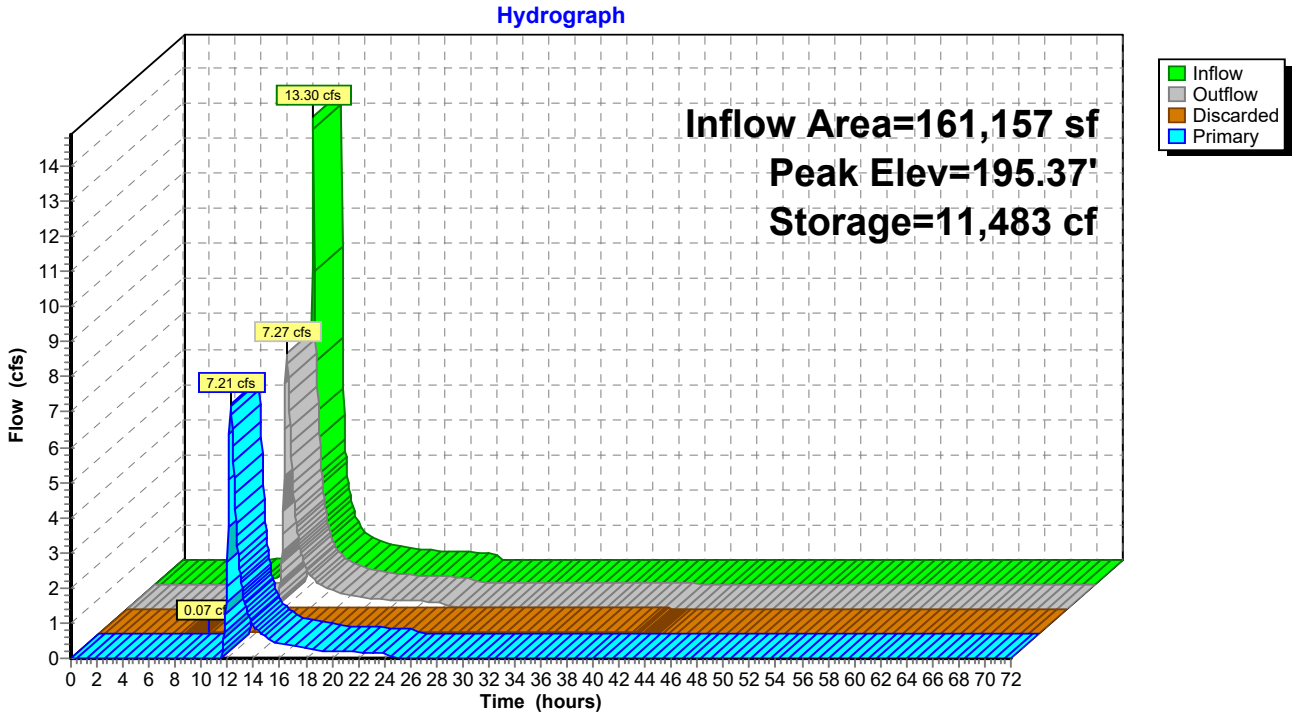
31,704.6 cf Field - 11,893.6 cf Chambers = 19,811.0 cf Stone x 40.0% Voids = 7,924.4 cf Stone Storage

Chamber Storage + Stone Storage = 17,330.9 cf = 0.398 af
Overall Storage Efficiency = 54.7%
Overall System Size = 216.33' x 48.85' x 3.00'

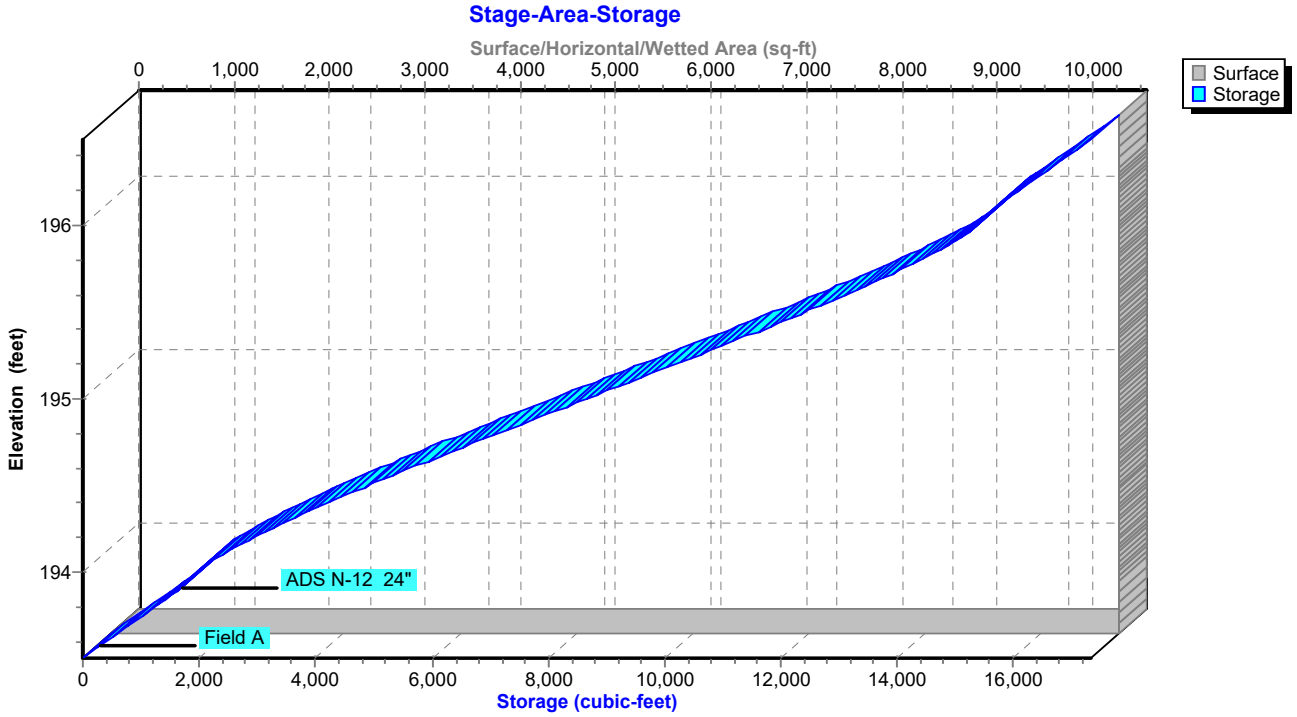
154 Chambers
1,174.2 cy Field
733.7 cy Stone



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




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



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

Inflow Area = 54,076 sf, 49.32% Impervious, Inflow Depth = 3.68" for 10-yr event
Inflow = 5.04 cfs @ 12.13 hrs, Volume= 16,593 cf
Outflow = 1.59 cfs @ 12.34 hrs, Volume= 16,593 cf, Atten= 68%, Lag= 12.8 min
Discarded = 0.04 cfs @ 7.95 hrs, Volume= 4,440 cf
Primary = 1.55 cfs @ 12.34 hrs, Volume= 12,153 cf
Routed to Reach DP-B : Concord Street Main

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 202.02' @ 12.34 hrs Surf.Area= 6,449 sf Storage= 6,523 cf

Plug-Flow detention time= 197.3 min calculated for 16,582 cf (100% of inflow)
Center-of-Mass det. time= 197.7 min ( 1,007.4 - 809.6 )

| Volume | Invert | Avail.Storage | Storage Description |
|---|---|---|---|
| #1A | 200.20' | 870 cf | **16.13'W x 66.67'L x 3.00'H Field A**<br>3,227 cf Overall - 1,052 cf Embedded = 2,175 cf x 40.0% Voids |
| #2A | 200.53' | 832 cf | **ADS N-12 24"** x 12 Inside #1<br>Inside= 23.8"W x 23.8"H => 3.10 sf x 20.00'L = 62.0 cf<br>Outside= 28.0"W x 28.0"H => 3.92 sf x 20.00'L = 78.4 cf<br>12 Chambers in 4 Rows<br>14.13' Header x 3.10 sf x 2 = 87.6 cf Inside |
| #3B | 200.20' | 3,733 cf | **43.67'W x 106.67'L x 3.00'H Field B**<br>13,974 cf Overall - 4,640 cf Embedded = 9,334 cf x 40.0% Voids |
| #4B | 200.53' | 3,668 cf | **ADS N-12 24"** x 55 Inside #3<br>Inside= 23.8"W x 23.8"H => 3.10 sf x 20.00'L = 62.0 cf<br>Outside= 28.0"W x 28.0"H => 3.92 sf x 20.00'L = 78.4 cf<br>55 Chambers in 11 Rows<br>41.67' Header x 3.10 sf x 2 = 258.3 cf Inside |
| #5C | 200.20' | 563 cf | **15.33'W x 46.67'L x 3.00'H Field C**<br>2,147 cf Overall - 738 cf Embedded = 1,408 cf x 40.0% Voids |
| #6C | 200.53' | 584 cf | **ADS N-12 24"** x 8 Inside #5<br>Inside= 23.8"W x 23.8"H => 3.10 sf x 20.00'L = 62.0 cf<br>Outside= 28.0"W x 28.0"H => 3.92 sf x 20.00'L = 78.4 cf<br>8 Chambers in 4 Rows<br>14.13' Header x 3.10 sf x 2 = 87.6 cf Inside |
| | | 10,250 cf | Total Available Storage |

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

| Device | Routing | Invert | Outlet Devices |
|---|---|---|---|
| #1 | Primary | 200.33' | **15.0" Round Culvert**<br>L= 142.0' CPP, mitered to conform to fill, Ke= 0.700<br>Inlet / Outlet Invert= 200.33' / 198.30' S= 0.0143 '/' Cc= 0.900<br>n= 0.013, Flow Area= 1.23 sf |
| #2 | Device 1 | 200.85' | **4.0" W x 5.0" H Vert. Orifice/Grate** C= 0.600<br>Limited to weir flow at low heads |
| #3 | Device 1 | 201.80' | **33.0" W x 8.0" H Vert. Orifice/Grate** C= 0.600 |

Limited to weir flow at low heads

| | | | |
|---|---|---|---|
| #4 | Device 1 | 202.70' | **5.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s) |
| #5 | Discarded | 200.20' | **0.270 in/hr Exfiltration over Surface area** |

**Discarded OutFlow** Max=0.04 cfs @ 7.95 hrs HW=200.23' (Free Discharge)
└**5=Exfiltration** (Exfiltration Controls 0.04 cfs)

**Primary OutFlow** Max=1.55 cfs @ 12.34 hrs HW=202.02' (Free Discharge)
└**1=Culvert** (Passes 1.55 cfs of 5.37 cfs potential flow)
  ├**2=Orifice/Grate** (Orifice Controls 0.65 cfs @ 4.71 fps)
  ├**3=Orifice/Grate** (Orifice Controls 0.89 cfs @ 1.50 fps)
  └**4=Sharp-Crested Rectangular Weir** ( 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

28.0" Wide + 19.2" Spacing = 47.2" C-C Row Spacing

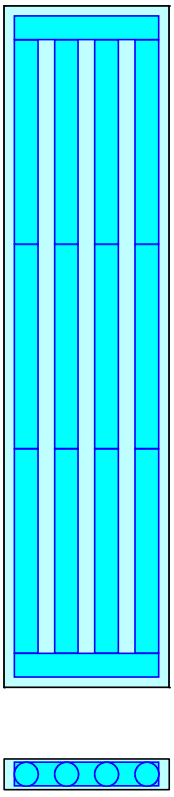
3 Chambers/Row x 20.00' Long +2.33' Header x 2 = 64.67' Row Length +12.0" End Stone x 2 = 66.67' Base Length
4 Rows x 28.0" Wide + 19.2" Spacing x 3 + 12.0" Side Stone x 2 = 16.13' Base Width
4.0" Stone Base + 28.0" Chamber Height + 4.0" Stone Cover = 3.00' Field Height

12 Chambers x 62.0 cf + 14.13' Header x 3.10 sf x 2 = 831.6 cf Chamber Storage
12 Chambers x 78.4 cf + 14.13' Header x 3.92 sf x 2 = 1,051.5 cf Displacement

3,226.8 cf Field - 1,051.5 cf Chambers = 2,175.3 cf Stone x 40.0% Voids = 870.1 cf Stone Storage

Chamber Storage + Stone Storage = 1,701.7 cf = 0.039 af
Overall Storage Efficiency = 52.7%
Overall System Size = 66.67' x 16.13' x 3.00'

12 Chambers
119.5 cy Field
80.6 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 + 19.2" Spacing = 47.2" C-C Row Spacing

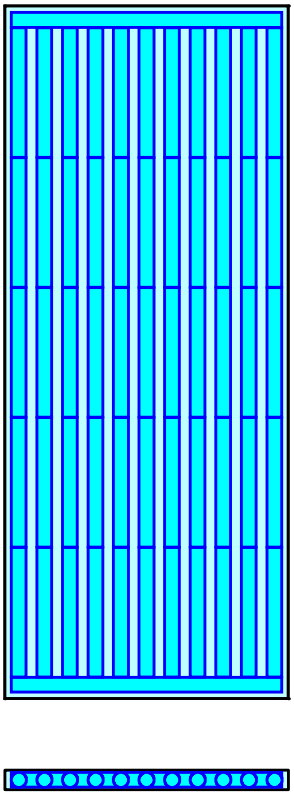
5 Chambers/Row x 20.00' Long +2.33' Header x 2 = 104.67' Row Length +12.0" End Stone x 2 = 106.67' Base Length
11 Rows x 28.0" Wide + 19.2" Spacing x 10 + 12.0" Side Stone x 2 = 43.67' Base Width
4.0" Stone Base + 28.0" Chamber Height + 4.0" Stone Cover = 3.00' Field Height

55 Chambers x 62.0 cf + 41.67' Header x 3.10 sf x 2 = 3,668.3 cf Chamber Storage
55 Chambers x 78.4 cf + 41.67' Header x 3.92 sf x 2 = 4,638.2 cf Displacement

13,973.8 cf Field - 4,638.2 cf Chambers = 9,335.5 cf Stone x 40.0% Voids = 3,734.2 cf Stone Storage

Chamber Storage + Stone Storage = 7,402.5 cf = 0.170 af
Overall Storage Efficiency = 53.0%
Overall System Size = 106.67' x 43.67' x 3.00'

55 Chambers
517.5 cy Field
345.8 cy Stone



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

**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 + 19.2" Spacing = 47.2" C-C Row Spacing

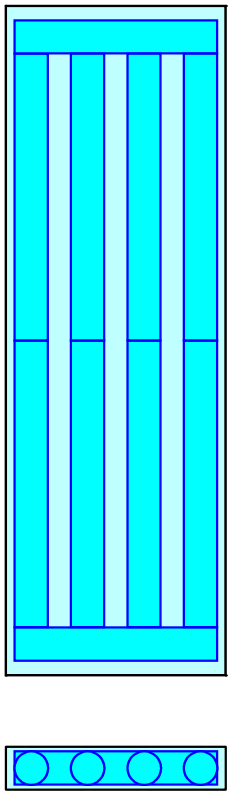
2 Chambers/Row x 20.00' Long +2.33' Header x 2 = 44.67' Row Length +12.0" End Stone x 2 = 46.67' Base Length
4 Rows x 28.0" Wide + 19.2" Spacing x 3 + 7.2" Side Stone x 2 = 15.33' Base Width
4.0" Stone Base + 28.0" Chamber Height + 4.0" Stone Cover = 3.00' Field Height

8 Chambers x 62.0 cf + 14.13' Header x 3.10 sf x 2 = 583.6 cf Chamber Storage
8 Chambers x 78.4 cf + 14.13' Header x 3.92 sf x 2 = 737.9 cf Displacement

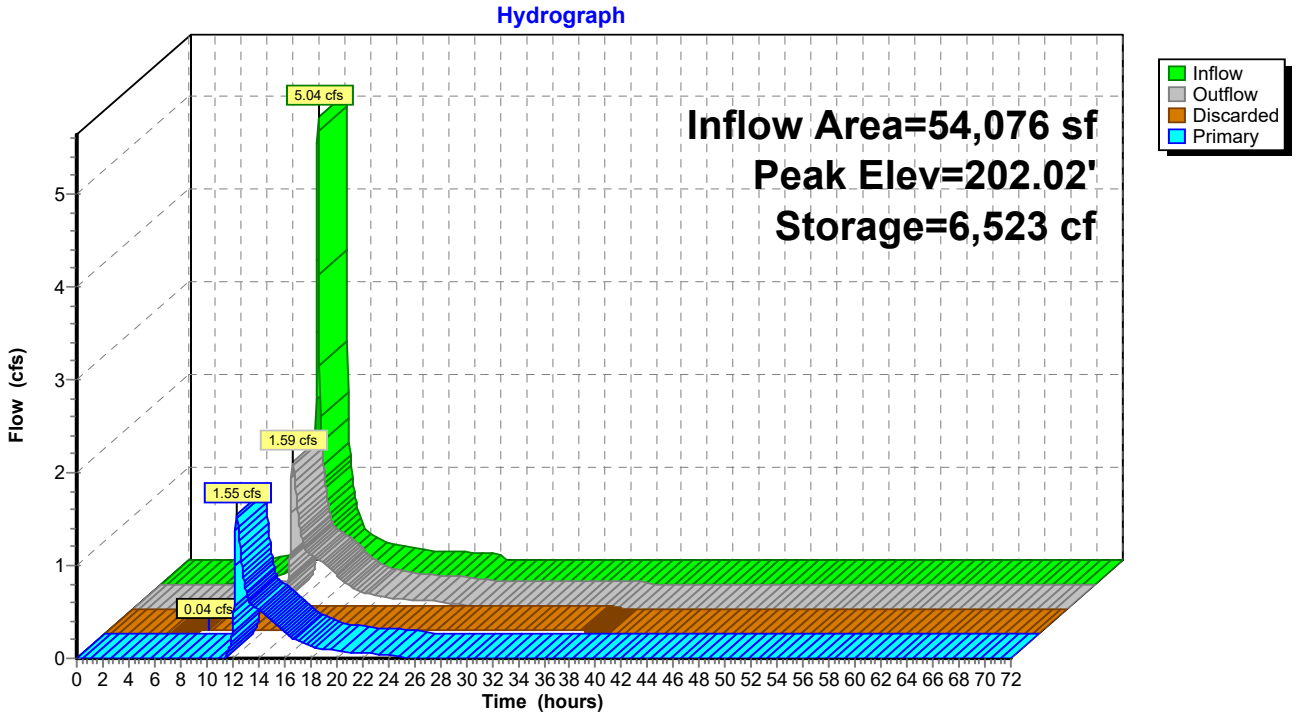
2,146.7 cf Field - 737.9 cf Chambers = 1,408.8 cf Stone x 40.0% Voids = 563.5 cf Stone Storage

Chamber Storage + Stone Storage = 1,147.1 cf = 0.026 af
Overall Storage Efficiency = 53.4%
Overall System Size = 46.67' x 15.33' x 3.00'

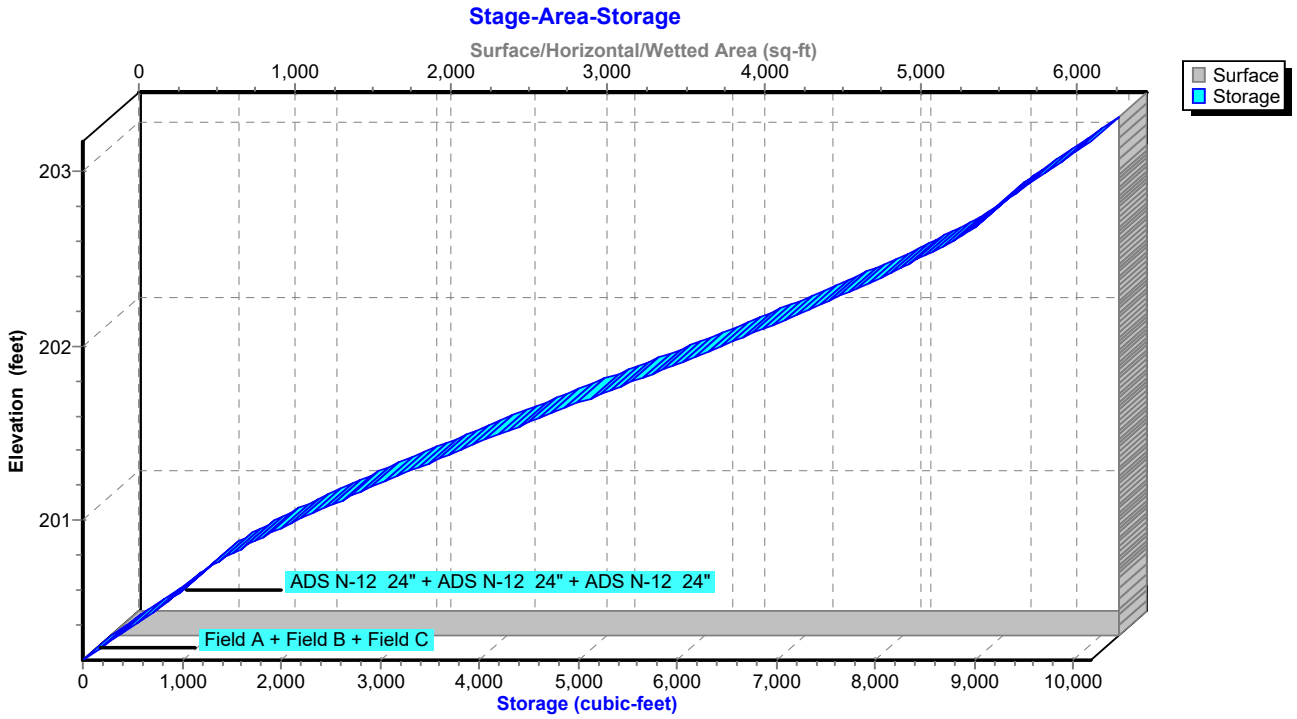
8 Chambers
79.5 cy Field
52.2 cy Stone



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




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



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=169,240 sf 0.00% Impervious Runoff Depth=4.77"
Flow Length=642' Tc=9.3 min CN=71 Runoff=18.76 cfs 67,285 cf

**Subcatchment PDA10: PDA10** Runoff Area=112,914 sf 68.00% Impervious Runoff Depth=7.02"
Tc=6.0 min CN=90 Runoff=18.86 cfs 66,075 cf

**Subcatchment PDA11: PDA11** Runoff Area=25,873 sf 62.02% Impervious Runoff Depth=6.90"
Tc=6.0 min CN=89 Runoff=4.28 cfs 14,883 cf

**Subcatchment PDA12: PDA12** Runoff Area=145,461 sf 28.75% Impervious Runoff Depth=5.95"
Tc=6.0 min CN=81 Runoff=21.78 cfs 72,126 cf

**Subcatchment PDA2: Proposed 2** Runoff Area=72,814 sf 59.44% Impervious Runoff Depth=6.78"
Tc=6.0 min CN=88 Runoff=11.93 cfs 41,160 cf

**Subcatchment PDA3: Proposed 3** Runoff Area=33,480 sf 57.85% Impervious Runoff Depth=6.78"
Tc=6.0 min CN=88 Runoff=5.49 cfs 18,926 cf

**Subcatchment PDA4: Proposed 4** Runoff Area=54,076 sf 49.32% Impervious Runoff Depth=6.54"
Tc=6.0 min CN=86 Runoff=8.67 cfs 29,493 cf

**Subcatchment PDA5: Proposed 5** Runoff Area=168,248 sf 21.01% Impervious Runoff Depth=5.59"
Tc=6.0 min CN=78 Runoff=23.99 cfs 78,442 cf

**Subcatchment PDA6: Proposal 6** Runoff Area=10,629 sf 58.03% Impervious Runoff Depth=6.78"
Tc=6.0 min CN=88 Runoff=1.74 cfs 6,008 cf

**Subcatchment PDA7: Proposal 7** Runoff Area=161,157 sf 31.93% Impervious Runoff Depth=5.95"
Tc=6.0 min CN=81 Runoff=24.13 cfs 79,909 cf

**Subcatchment PDA8: Proposed 8** Runoff Area=79,806 sf 77.39% Impervious Runoff Depth=7.38"
Tc=6.0 min CN=93 Runoff=13.65 cfs 49,087 cf

**Subcatchment PDA9: Proposed 9** Runoff Area=113,962 sf 0.00% Impervious Runoff Depth=4.65"
Flow Length=366' Tc=12.4 min CN=70 Runoff=11.24 cfs 44,198 cf

**Reach 4R: Swale** Avg. Flow Depth=0.94' Max Vel=3.86 fps Inflow=18.75 cfs 66,658 cf
n=0.022 L=726.0' S=0.0069 '/' Capacity=49.00 cfs Outflow=17.46 cfs 66,658 cf

**Reach DP-A: Eastern Intermittent Stream** Inflow=17.46 cfs 66,658 cf
Outflow=17.46 cfs 66,658 cf

**Reach DP-B: Concord Street Main** Inflow=32.30 cfs 125,256 cf
Outflow=32.30 cfs 125,256 cf

**Reach DP-C1: Wetlands** Inflow=83.49 cfs 340,007 cf
Outflow=83.49 cfs 340,007 cf

**Reach DP-C2: Intermittent Stream West** Inflow=11.24 cfs 44,198 cf
Outflow=11.24 cfs 44,198 cf

**Reach PR TOT: Total Site** Inflow=128.05 cfs 531,921 cf
Outflow=128.05 cfs 531,921 cf

**Pond BIO-1: Surface System** Peak Elev=195.01' Storage=7,478 cf Inflow=18.86 cfs 66,075 cf
Discarded=0.04 cfs 4,852 cf Primary=13.06 cfs 61,224 cf Outflow=13.10 cfs 66,075 cf

**Pond SI-1: Surface Infiltration** Peak Elev=200.78' Storage=3,759 cf Inflow=5.49 cfs 18,926 cf
Discarded=0.04 cfs 3,927 cf Primary=4.18 cfs 14,999 cf Outflow=4.22 cfs 18,926 cf

**Pond SI-2: South Inf Basin** Peak Elev=195.58' Storage=7,446 cf Inflow=13.65 cfs 49,087 cf
Discarded=0.03 cfs 4,624 cf Primary=11.12 cfs 44,463 cf Outflow=11.15 cfs 49,087 cf

**Pond SS-1: Subsurface Infiltration** Peak Elev=186.28' Storage=8,253 cf Inflow=21.78 cfs 72,126 cf
Discarded=0.04 cfs 6,073 cf Primary=20.50 cfs 66,053 cf Outflow=20.55 cfs 72,126 cf

**Pond SS-2: Subsurface Infiltration (SC-740** Peak Elev=188.76' Storage=3,322 cf Inflow=1.74 cfs 6,008 cf
Discarded=0.01 cfs 2,041 cf Primary=0.14 cfs 3,967 cf Outflow=0.15 cfs 6,008 cf

**Pond SS-3: Subsurface Infiltration (24"** Peak Elev=196.48' Storage=17,245 cf Inflow=24.13 cfs 79,909 cf
Discarded=0.07 cfs 8,668 cf Primary=15.97 cfs 71,241 cf Outflow=16.04 cfs 79,909 cf

**Pond SS-4: Subsurface Infiltration (24"** Peak Elev=202.54' Storage=8,579 cf Inflow=8.67 cfs 29,493 cf
Discarded=0.04 cfs 4,859 cf Primary=6.24 cfs 24,634 cf Outflow=6.28 cfs 29,493 cf

**Total Runoff Area = 1,147,660 sf Runoff Volume = 567,593 cf Average Runoff Depth = 5.93"**
**67.00% Pervious = 768,980 sf 33.00% Impervious = 378,680 sf**

## Summary for Subcatchment PDA-1: Wooded Area

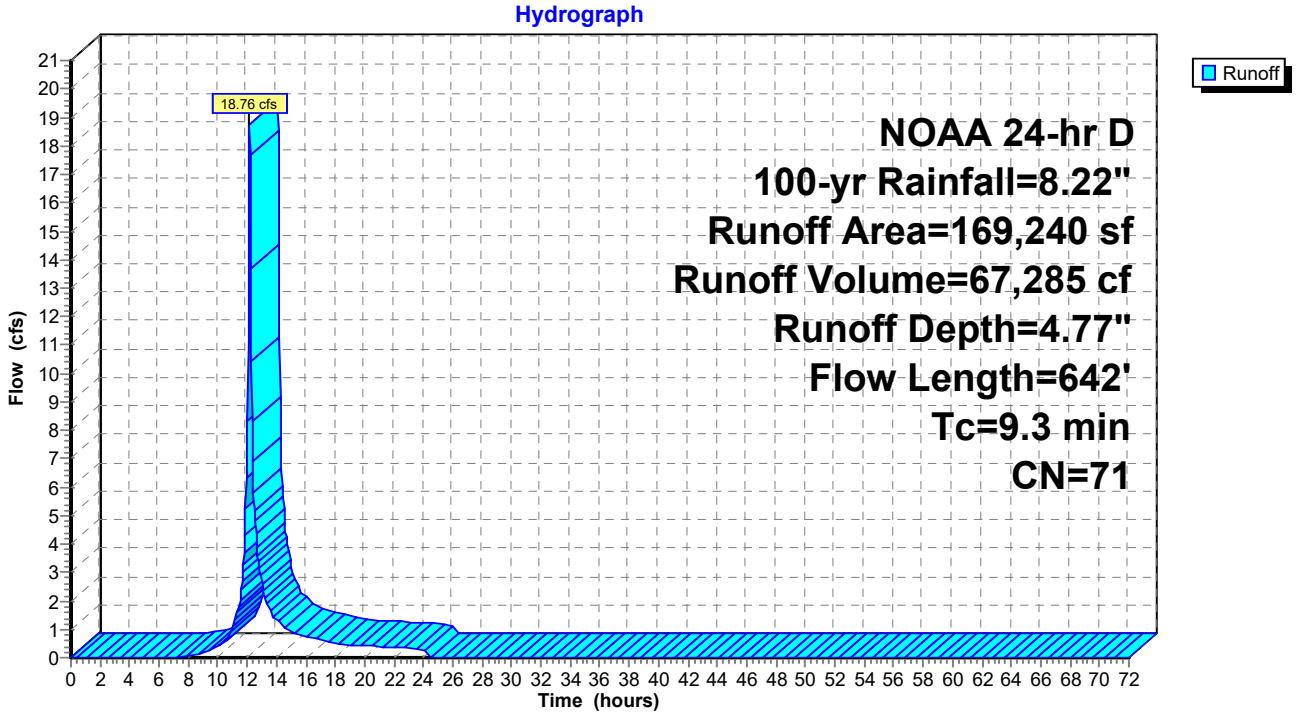
Runoff = 18.76 cfs @ 12.17 hrs, Volume= 67,285 cf, Depth= 4.77"
Routed to Reach 4R : Swale

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 |
|---|---|---|
| 33,190 | 74 | >75% Grass cover, Good, HSG C |
| 136,050 | 70 | Woods, Good, HSG C |
| 169,240 | 71 | Weighted Average |
| 169,240 | | 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

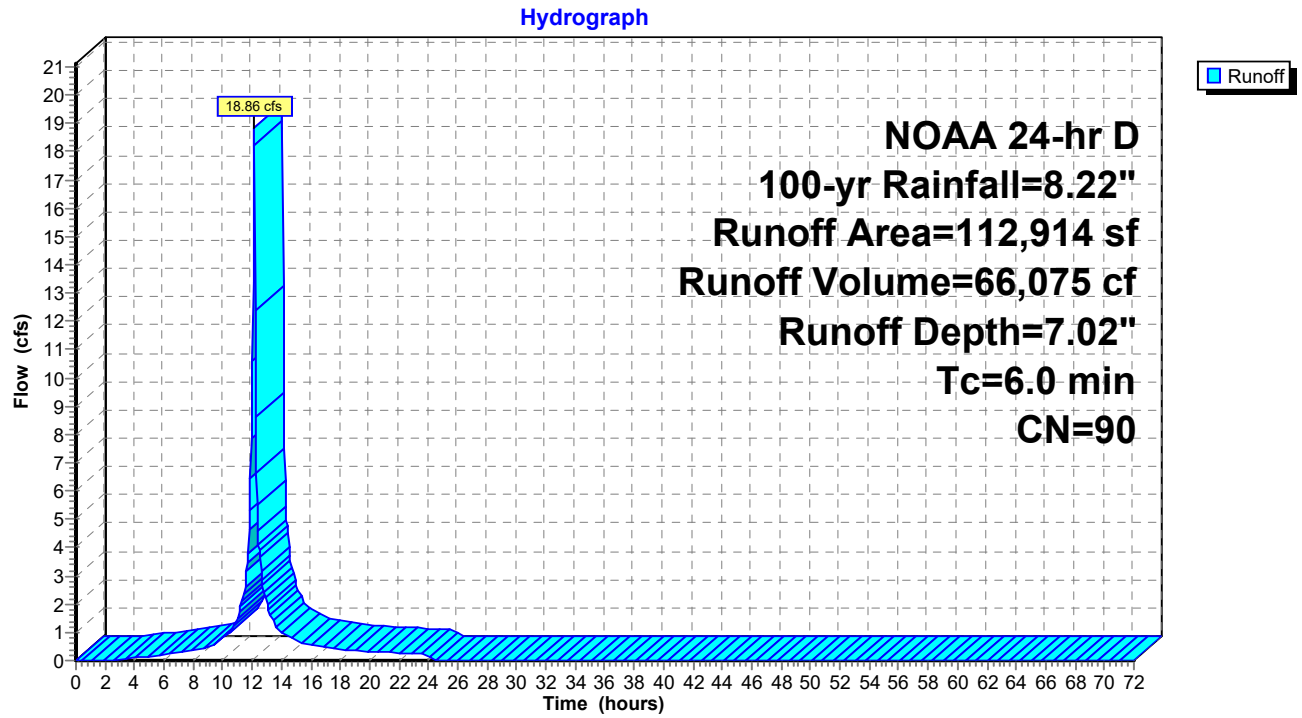
Runoff = 18.86 cfs @ 12.13 hrs, Volume= 66,075 cf, Depth= 7.02"
Routed to Pond BIO-1 : Surface System

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 |
|---|---|---|---|
| | 36,136 | 74 | >75% Grass cover, Good, HSG C |
| | 27,453 | 98 | Roofs, HSG C |
| * | 49,325 | 98 | Paved Parking and Walkways, HSG C |
| | 112,914 | 90 | Weighted Average |
| | 36,136 | | 32.00% Pervious Area |
| | 76,778 | | 68.00% 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

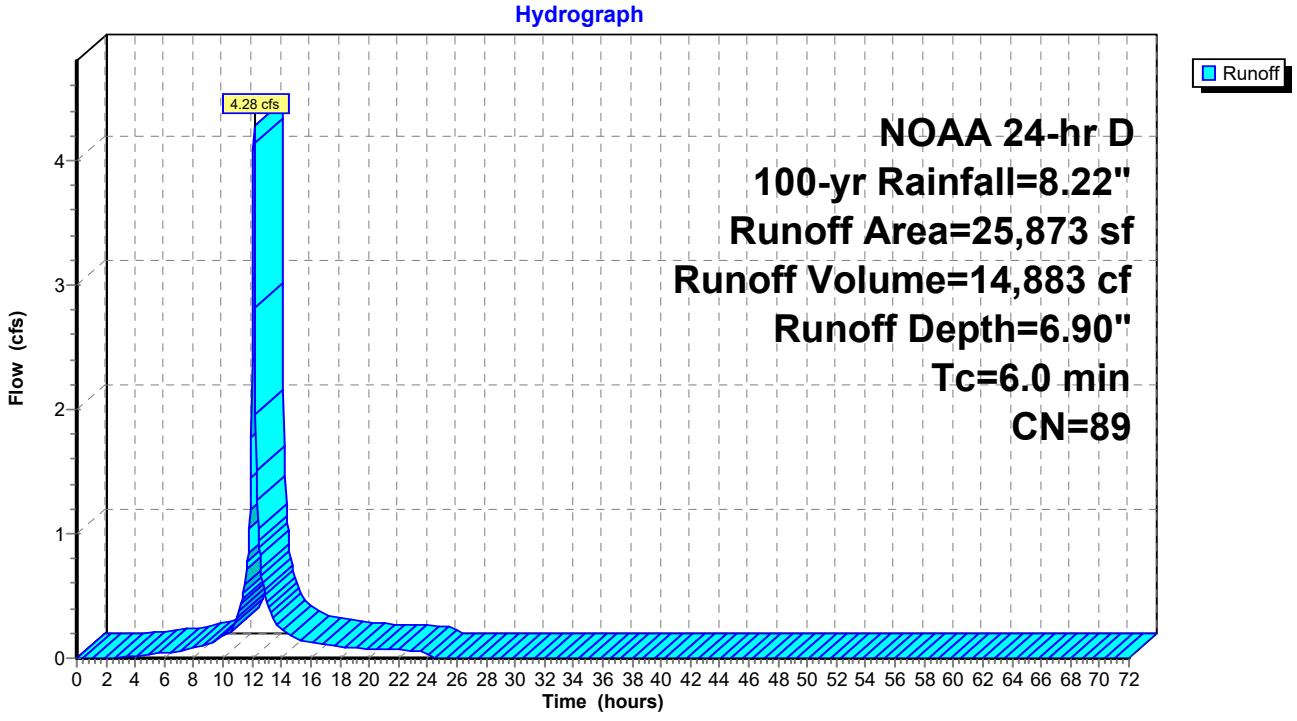
Runoff = 4.28 cfs @ 12.13 hrs, Volume= 14,883 cf, Depth= 6.90"
Routed to Reach DP-C1 : Wetlands

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 |
|---|---|---|
| 9,827 | 74 | >75% Grass cover, Good, HSG C |
| 16,046 | 98 | Paved parking, HSG C |
| 25,873 | 89 | Weighted Average |
| 9,827 | | 37.98% Pervious Area |
| 16,046 | | 62.02% 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

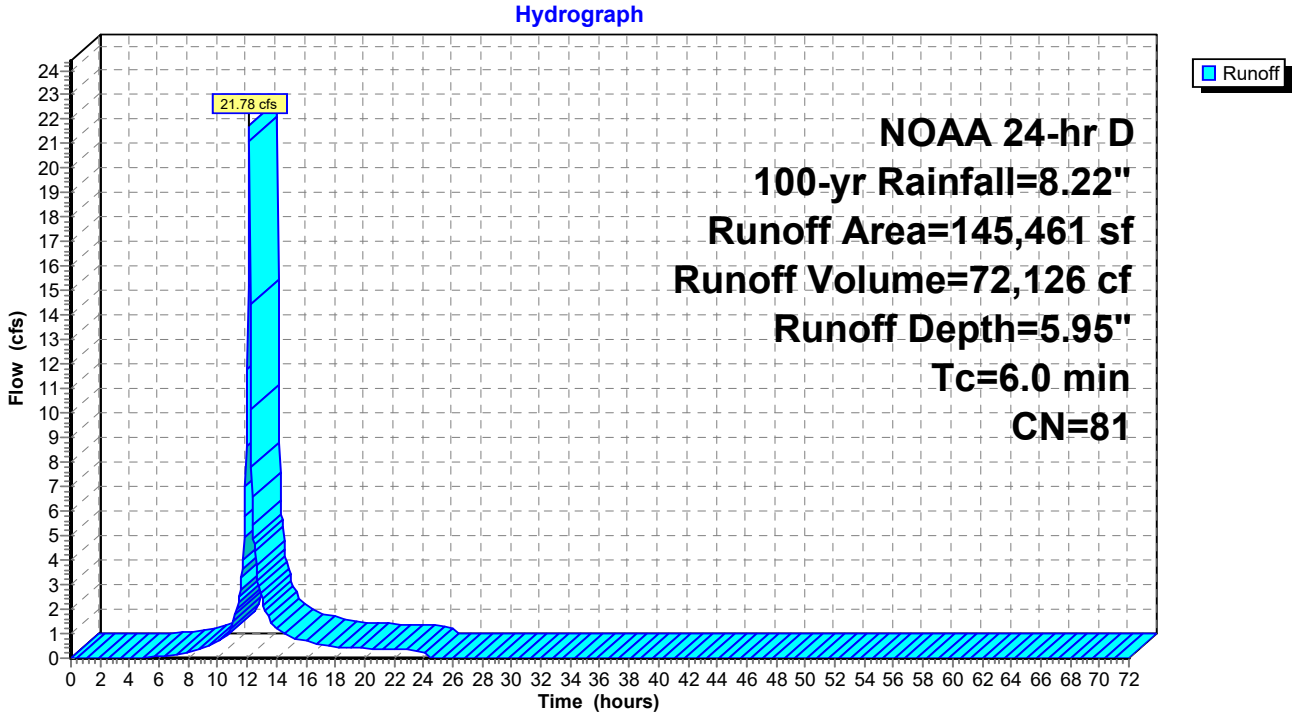
Runoff = 21.78 cfs @ 12.13 hrs, Volume= 72,126 cf, Depth= 5.95"
Routed to Pond SS-1 : Subsurface Infiltration (SC-310 Chambers)

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 |
|---|---|---|
| 103,648 | 74 | >75% Grass cover, Good, HSG C |
| 41,813 | 98 | Paved parking, HSG C |
| 145,461 | 81 | Weighted Average |
| 103,648 | | 71.25% Pervious Area |
| 41,813 | | 28.75% 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

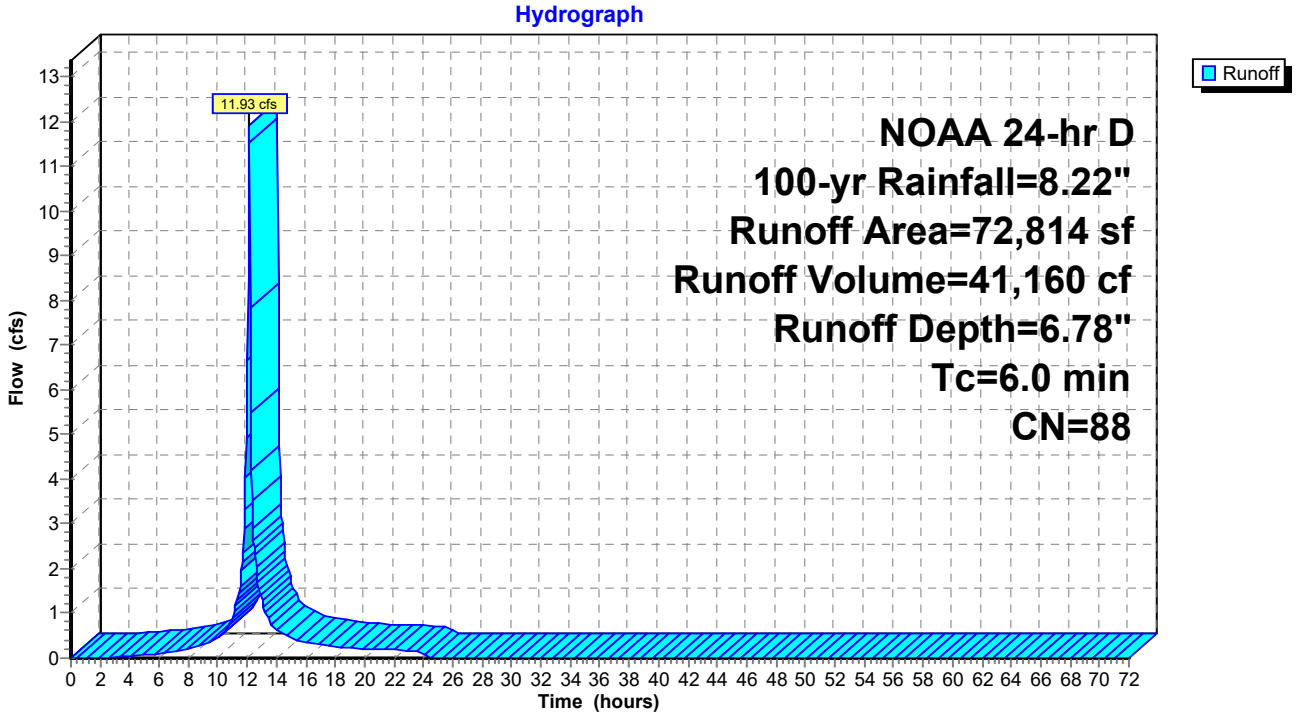
Runoff = 11.93 cfs @ 12.13 hrs, Volume= 41,160 cf, Depth= 6.78"
Routed to Reach DP-B : Concord Street Main

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 |
|---|---|---|
| 29,536 | 74 | >75% Grass cover, Good, HSG C |
| 43,278 | 98 | Paved parking, HSG C |
| 72,814 | 88 | Weighted Average |
| 29,536 | | 40.56% Pervious Area |
| 43,278 | | 59.44% 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

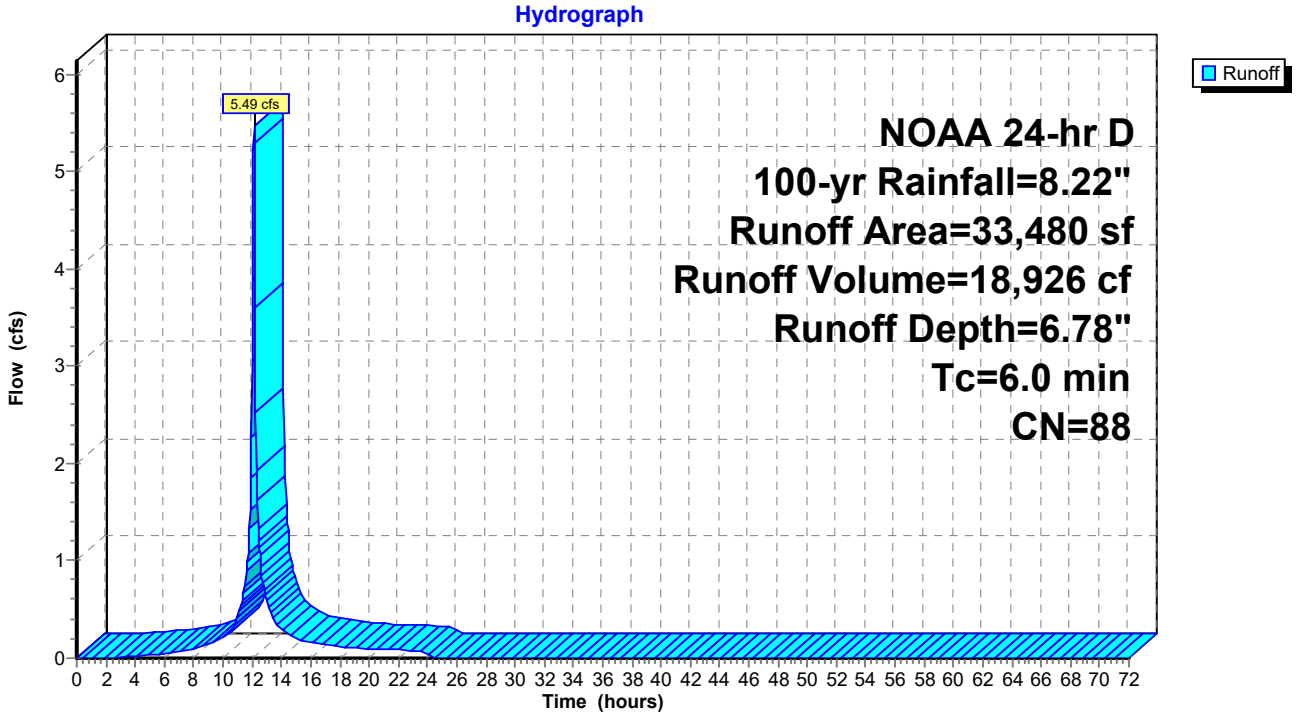
Runoff = 5.49 cfs @ 12.13 hrs, Volume= 18,926 cf, Depth= 6.78"
Routed to Pond SI-1 : Surface Infiltration

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 |
|---|---|---|
| 19,367 | 98 | Paved parking, HSG C |
| 14,113 | 74 | >75% Grass cover, Good, HSG C |
| 33,480 | 88 | Weighted Average |
| 14,113 | | 42.15% Pervious Area |
| 19,367 | | 57.85% 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

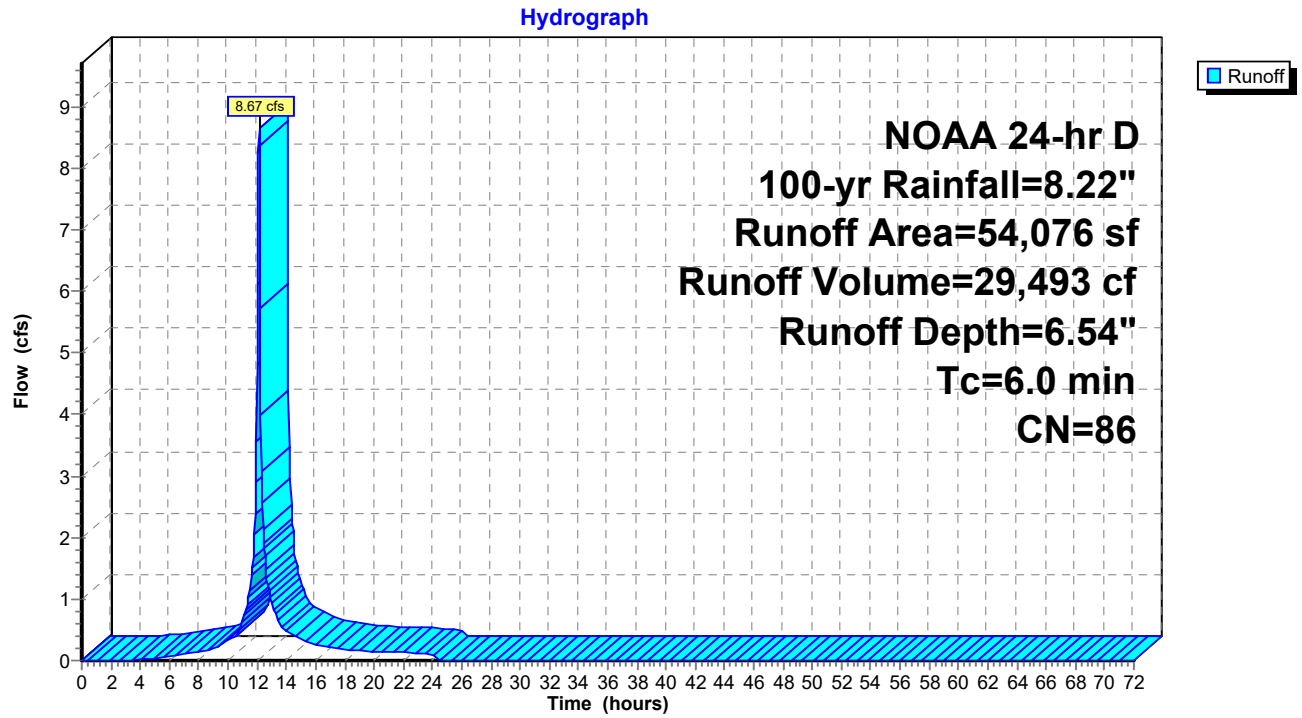
Runoff = 8.67 cfs @ 12.13 hrs, Volume= 29,493 cf, Depth= 6.54"
Routed to Pond SS-4 : Subsurface Infiltration (24" Pipe)

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 |
|---|---|---|---|
| | 27,408 | 74 | >75% Grass cover, Good, HSG C |
| | 17,739 | 98 | Paved roads w/curbs & sewers, HSG C |
| * | 8,929 | 98 | Roofs, HSG C |
| | 54,076 | 86 | Weighted Average |
| | 27,408 | | 50.68% Pervious Area |
| | 26,668 | | 49.32% 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

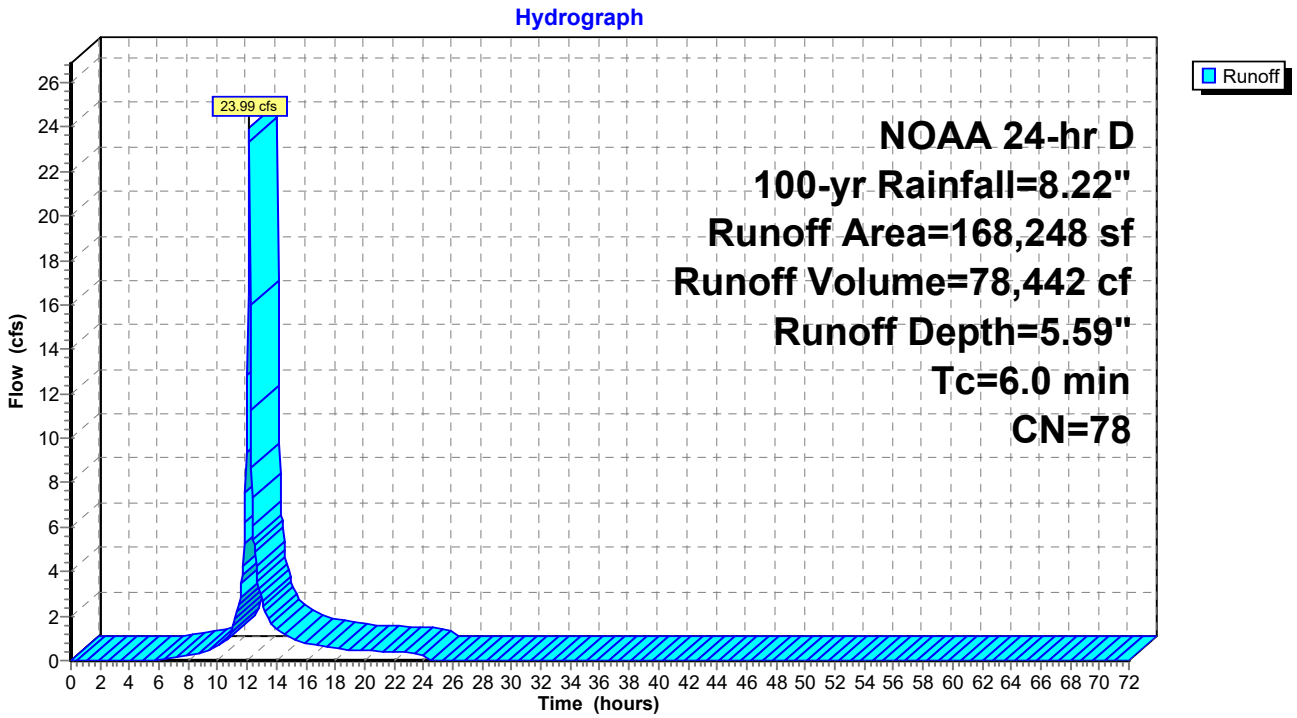
Runoff = 23.99 cfs @ 12.13 hrs, Volume= 78,442 cf, Depth= 5.59"
Routed to Reach DP-C1 : Wetlands

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 |
|---|---|---|---|
| | 93,250 | 74 | >75% Grass cover, Good, HSG C |
| | 39,650 | 70 | Woods, Good, HSG C |
| * | 35,348 | 98 | Pond |
| | 168,248 | 78 | Weighted Average |
| | 132,900 | | 78.99% Pervious Area |
| | 35,348 | | 21.01% 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

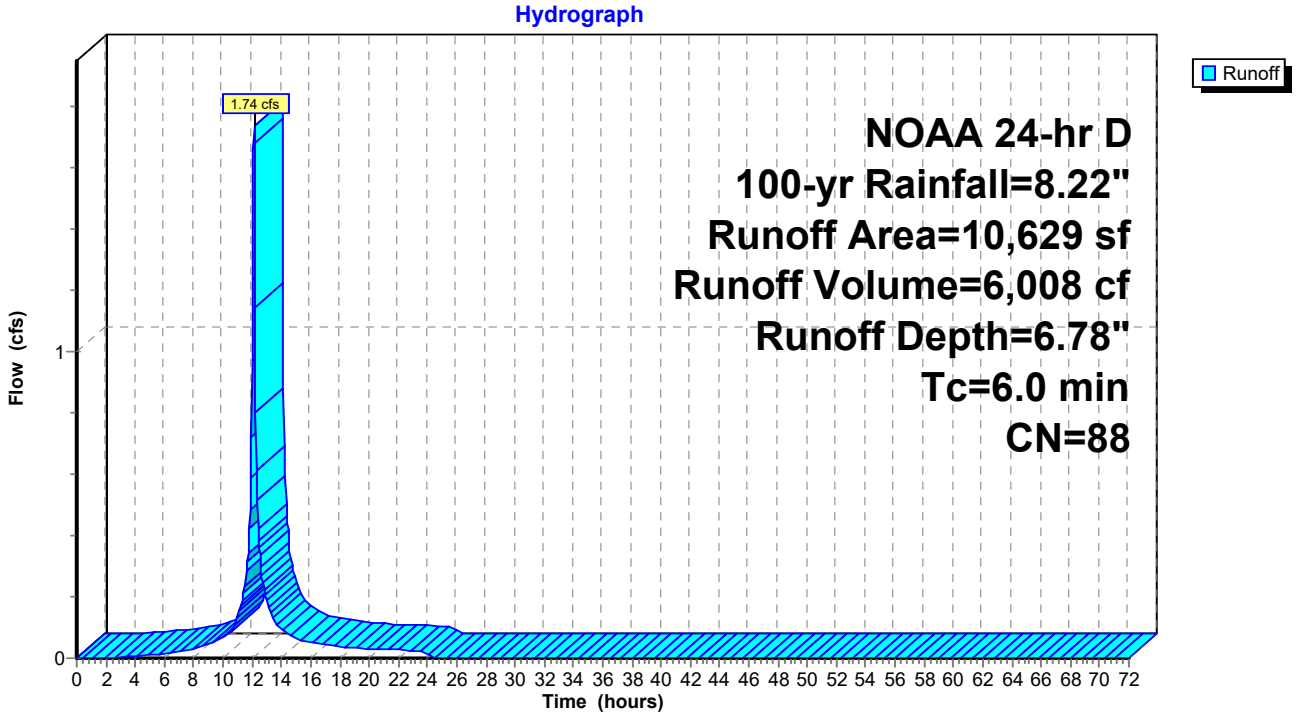
Runoff = 1.74 cfs @ 12.13 hrs, Volume= 6,008 cf, Depth= 6.78"
Routed to Pond SS-2 : Subsurface Infiltration (SC-740 Chambers)

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 |
|---|---|---|
| 6,168 | 98 | Paved parking, HSG C |
| 4,461 | 74 | >75% Grass cover, Good, HSG C |
| 10,629 | 88 | Weighted Average |
| 4,461 | | 41.97% Pervious Area |
| 6,168 | | 58.03% 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

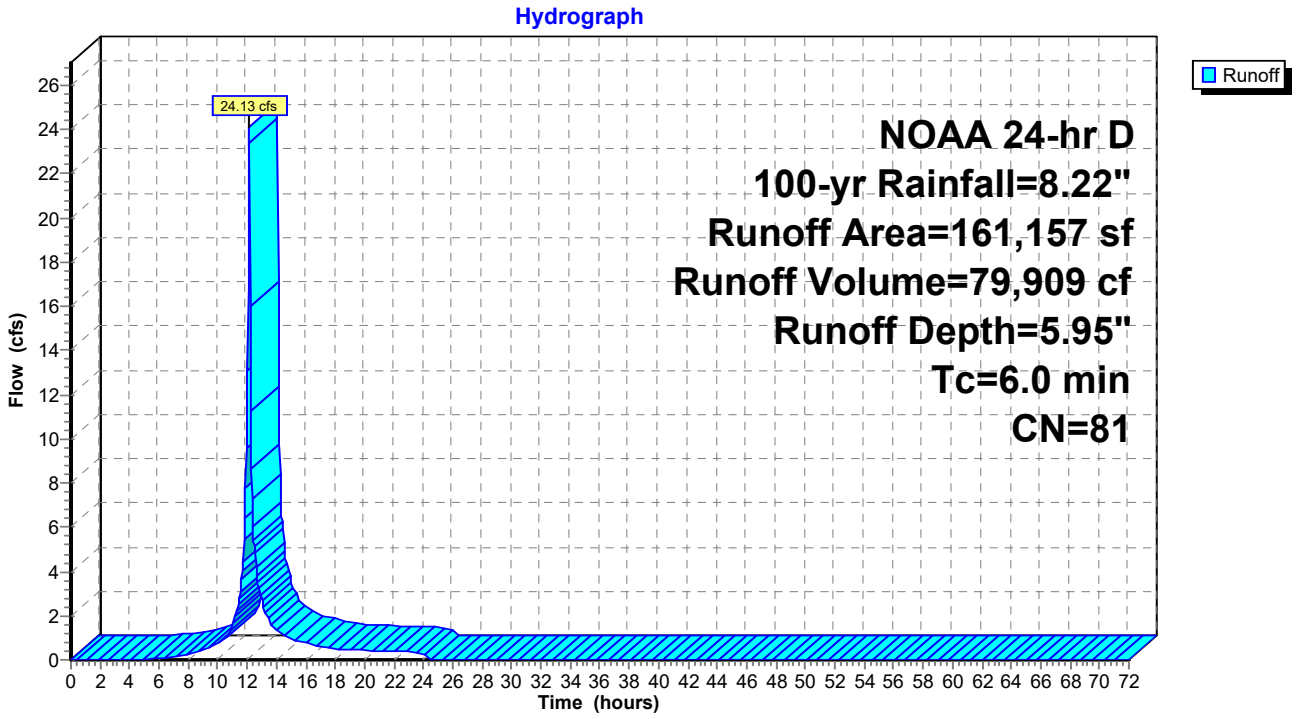
Runoff = 24.13 cfs @ 12.13 hrs, Volume= 79,909 cf, Depth= 5.95"
Routed to Pond SS-3 : Subsurface Infiltration (24" Pipe)

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 |
|---|---|---|
| 32,000 | 98 | Roofs, HSG C |
| 73,574 | 74 | >75% Grass cover, Good, HSG C |
| 19,452 | 98 | Paved parking, HSG C |
| 36,131 | 70 | Woods, Good, HSG C |
| 161,157 | 81 | Weighted Average |
| 109,705 | | 68.07% Pervious Area |
| 51,452 | | 31.93% 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

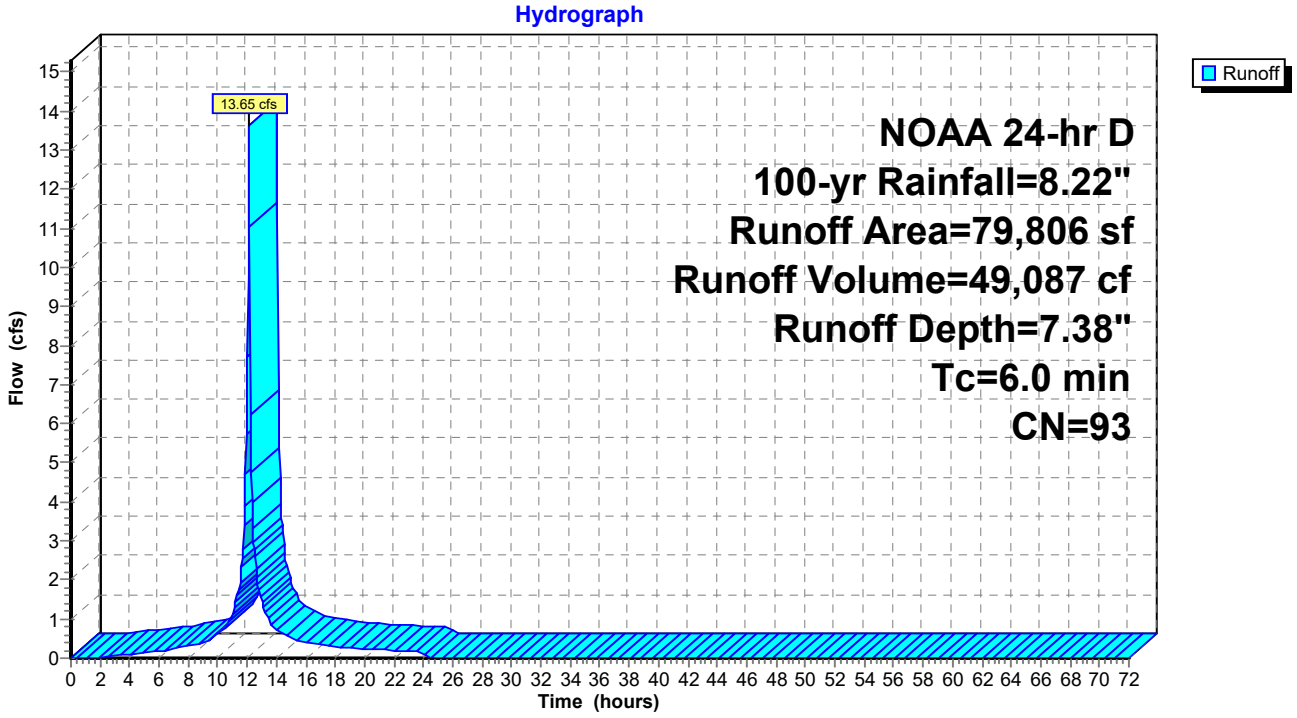
Runoff = 13.65 cfs @ 12.13 hrs, Volume= 49,087 cf, Depth= 7.38"
Routed to Pond SI-2 : South Inf Basin

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 |
|---|---|---|
| 61,762 | 98 | Paved parking, HSG C |
| 18,044 | 74 | >75% Grass cover, Good, HSG C |
| 79,806 | 93 | Weighted Average |
| 18,044 | | 22.61% Pervious Area |
| 61,762 | | 77.39% 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

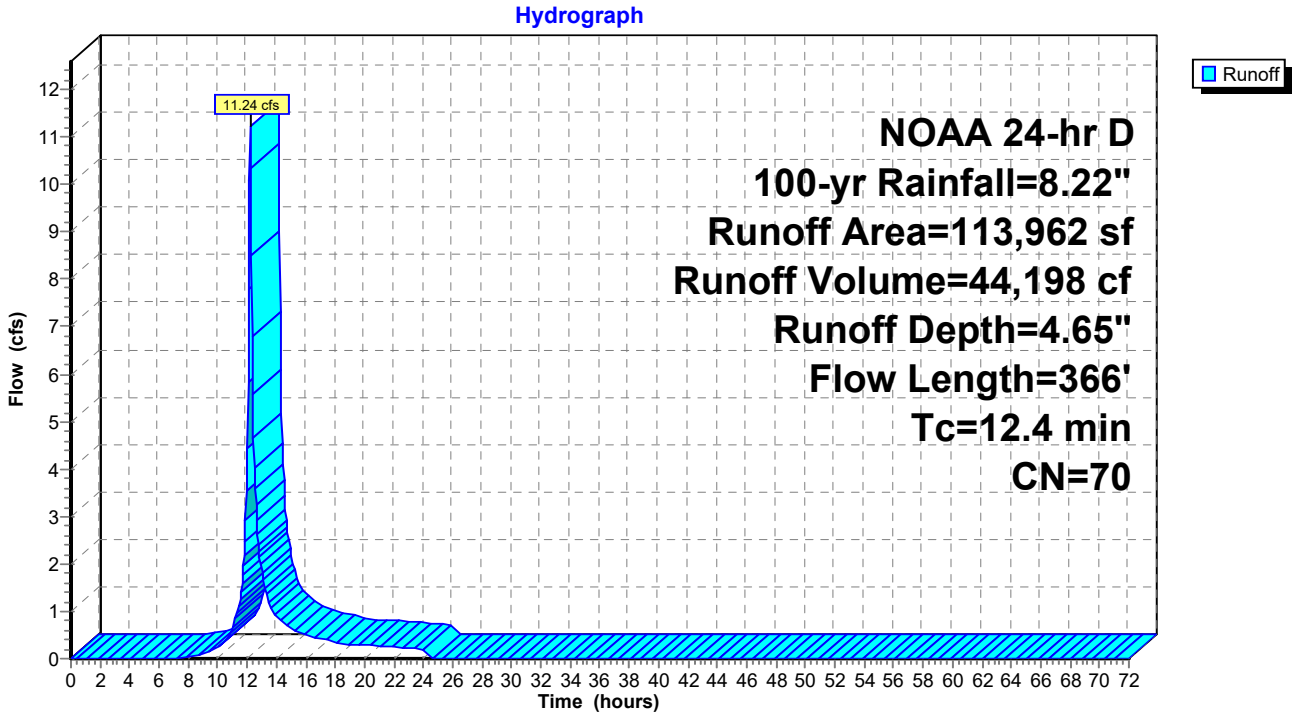
Runoff = 11.24 cfs @ 12.20 hrs, Volume= 44,198 cf, Depth= 4.65"
Routed to Reach DP-C2 : Intermittent Stream West

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 |
|---|---|---|
| 106,091 | 70 | Woods, Good, HSG C |
| 7,871 | 74 | >75% Grass cover, Good, HSG C |
| 113,962 | 70 | Weighted Average |
| 113,962 | | 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 4R: Swale

Inflow Area = 169,240 sf, 0.00% Impervious, Inflow Depth = 4.73" for 100-yr event
Inflow = 18.75 cfs @ 12.17 hrs, Volume= 66,658 cf, Incl. 0.01 cfs Inflow Loss
Outflow = 17.46 cfs @ 12.26 hrs, Volume= 66,658 cf, Atten= 7%, Lag= 5.4 min
Routed to Reach DP-A : Eastern Intermittent Stream

Routing by Stor-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Max. Velocity= 3.86 fps, Min. Travel Time= 3.1 min
Avg. Velocity = 1.26 fps, Avg. Travel Time= 9.6 min

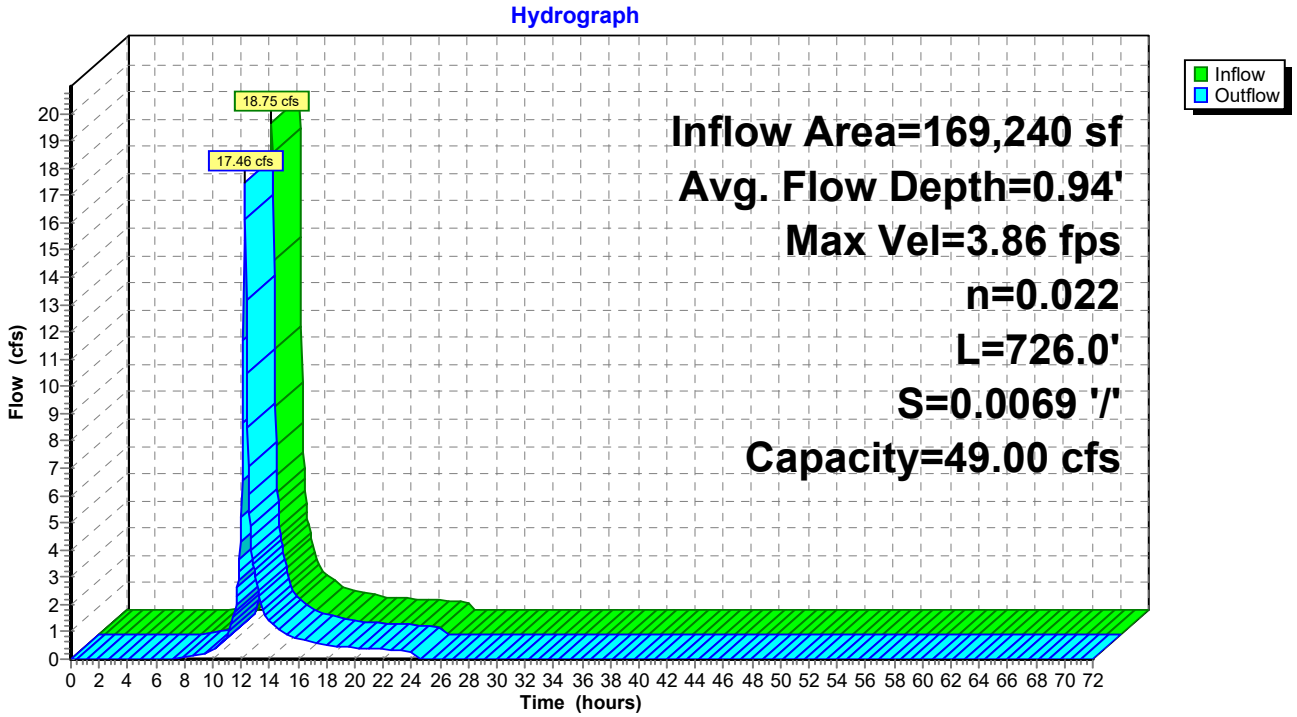
Peak Storage= 3,300 cf @ 12.20 hrs
Average Depth at Peak Storage= 0.94' , Surface Width= 7.65'
Bank-Full Depth= 1.50' Flow Area= 9.8 sf, Capacity= 49.00 cfs

2.00' x 1.50' deep channel, n= 0.022
Side Slope Z-value= 3.0 '/' Top Width= 11.00'
Length= 726.0' Slope= 0.0069 '/'
Inlet Invert= 207.00', Outlet Invert= 202.00'

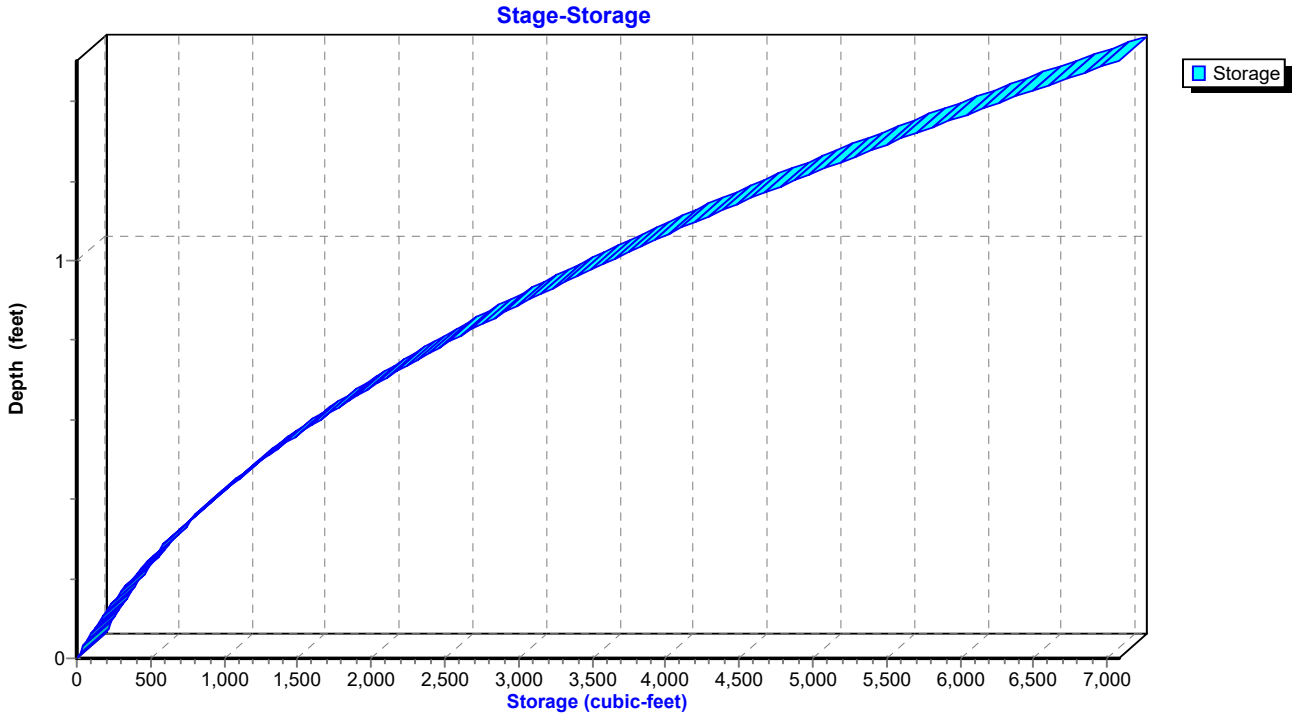


‡

### Reach 4R: Swale



## Reach 4R: Swale

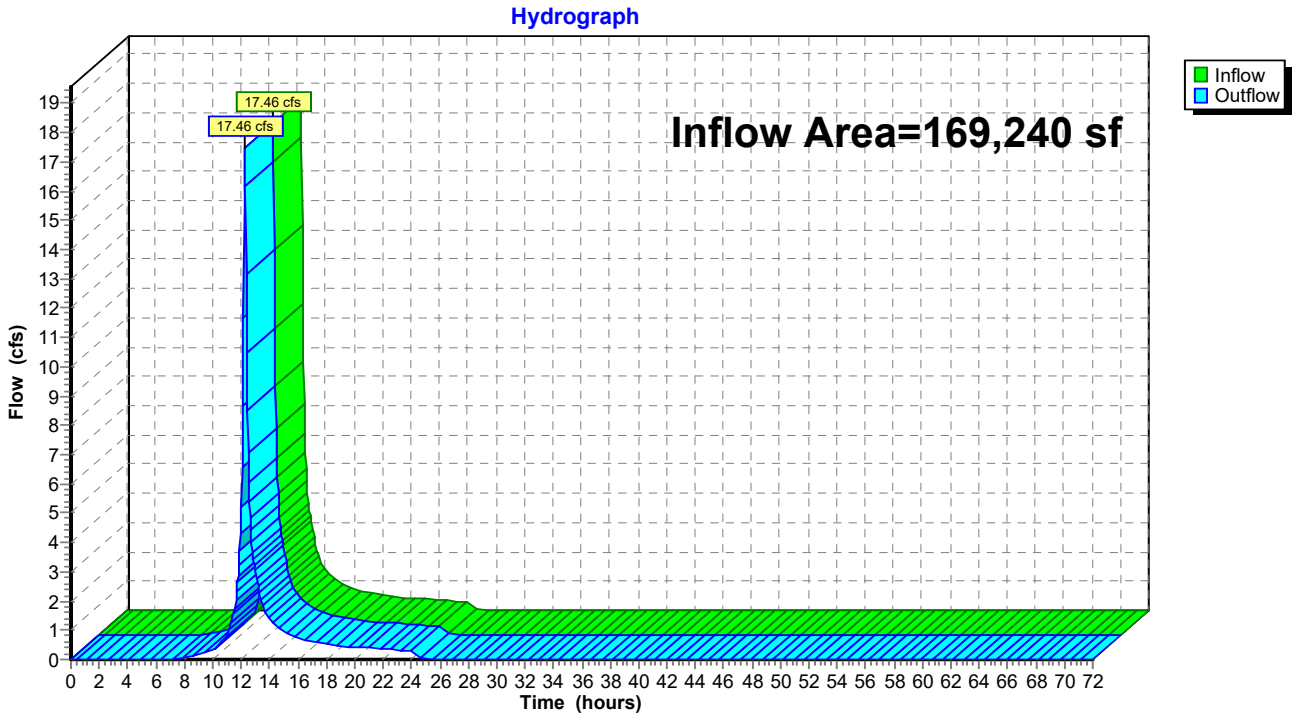


## Summary for Reach DP-A: Eastern Intermittent Stream

Inflow Area = 169,240 sf, 0.00% Impervious, Inflow Depth = 4.73" for 100-yr event
Inflow = 17.46 cfs @ 12.26 hrs, Volume= 66,658 cf
Outflow = 17.46 cfs @ 12.26 hrs, Volume= 66,658 cf, Atten= 0%, Lag= 0.0 min
Routed to Reach PR TOT : Total Site

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

## Reach DP-A: Eastern Intermittent Stream

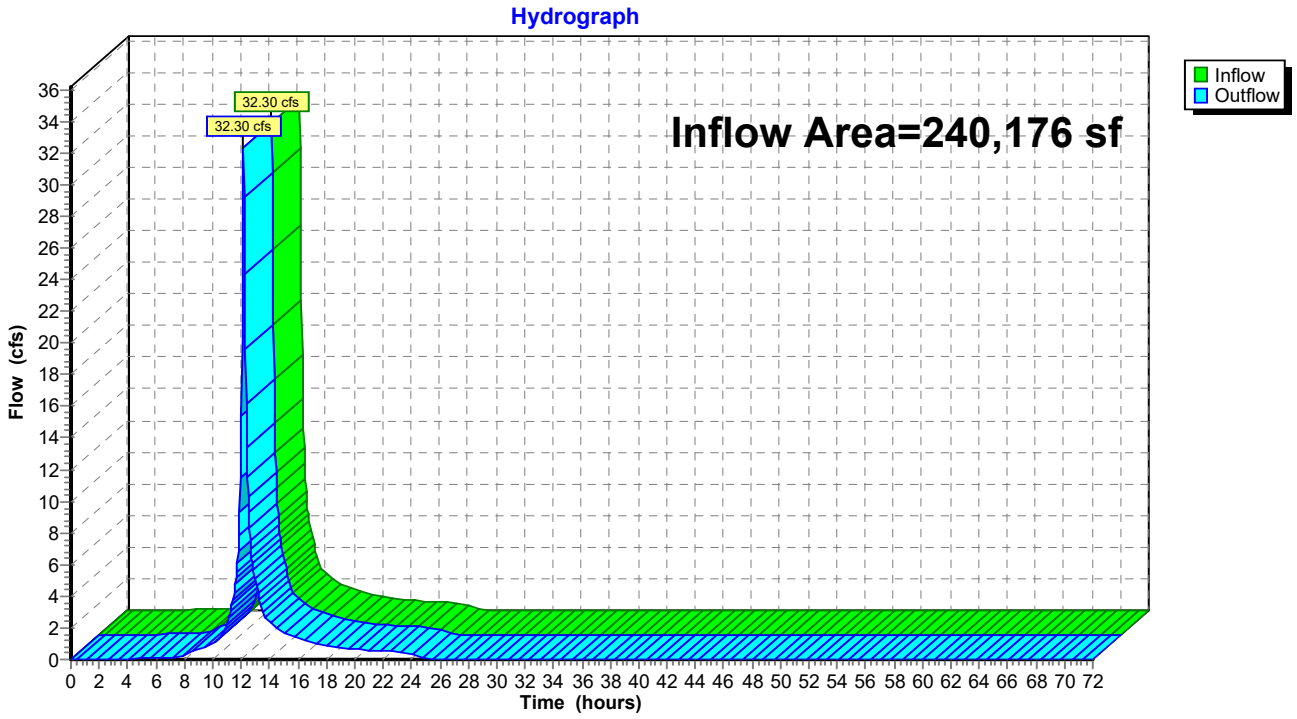


## Summary for Reach DP-B: Concord Street Main

Inflow Area = 240,176 sf, 62.90% Impervious, Inflow Depth = 6.26" for 100-yr event
Inflow = 32.30 cfs @ 12.15 hrs, Volume= 125,256 cf
Outflow = 32.30 cfs @ 12.15 hrs, Volume= 125,256 cf, Atten= 0%, Lag= 0.0 min
Routed to Reach PR TOT : Total Site

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

## Reach DP-B: Concord Street Main

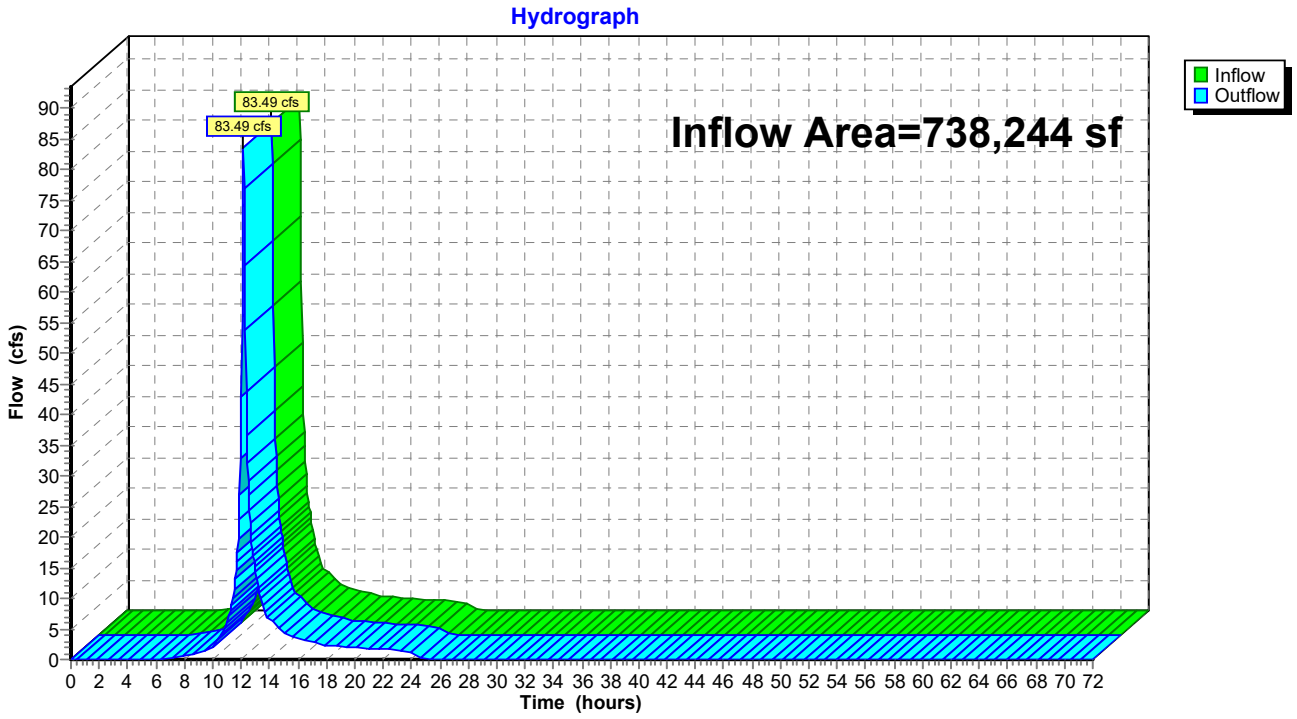


## Summary for Reach DP-C1: Wetlands

Inflow Area = 738,244 sf, 30.83% Impervious, Inflow Depth = 5.53" for 100-yr event
Inflow = 83.49 cfs @ 12.15 hrs, Volume= 340,007 cf
Outflow = 83.49 cfs @ 12.15 hrs, Volume= 340,007 cf, Atten= 0%, Lag= 0.0 min
Routed to Reach PR TOT : Total Site

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

## Reach DP-C1: Wetlands

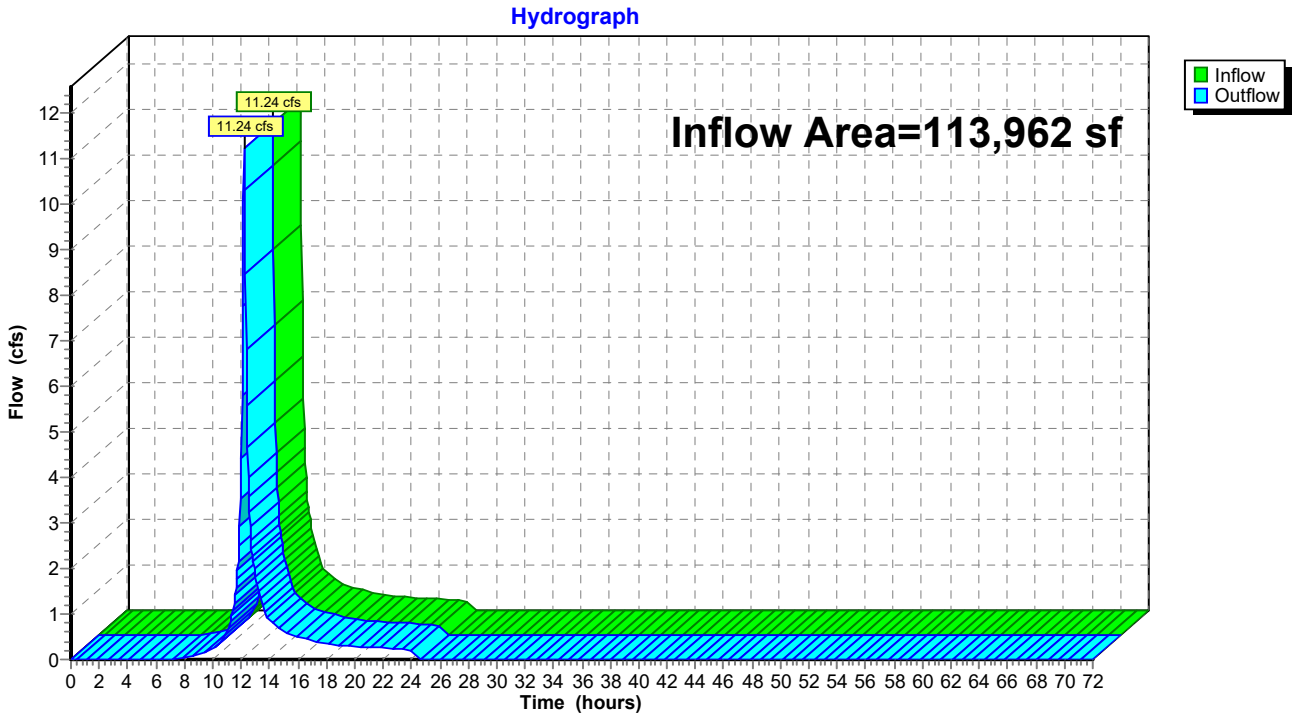


## Summary for Reach DP-C2: Intermittent Stream West

Inflow Area = 113,962 sf, 0.00% Impervious, Inflow Depth = 4.65" for 100-yr event
Inflow = 11.24 cfs @ 12.20 hrs, Volume= 44,198 cf
Outflow = 11.24 cfs @ 12.20 hrs, Volume= 44,198 cf, Atten= 0%, Lag= 0.0 min
Routed to Reach DP-C1 : Wetlands

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

### Reach DP-C2: Intermittent Stream West

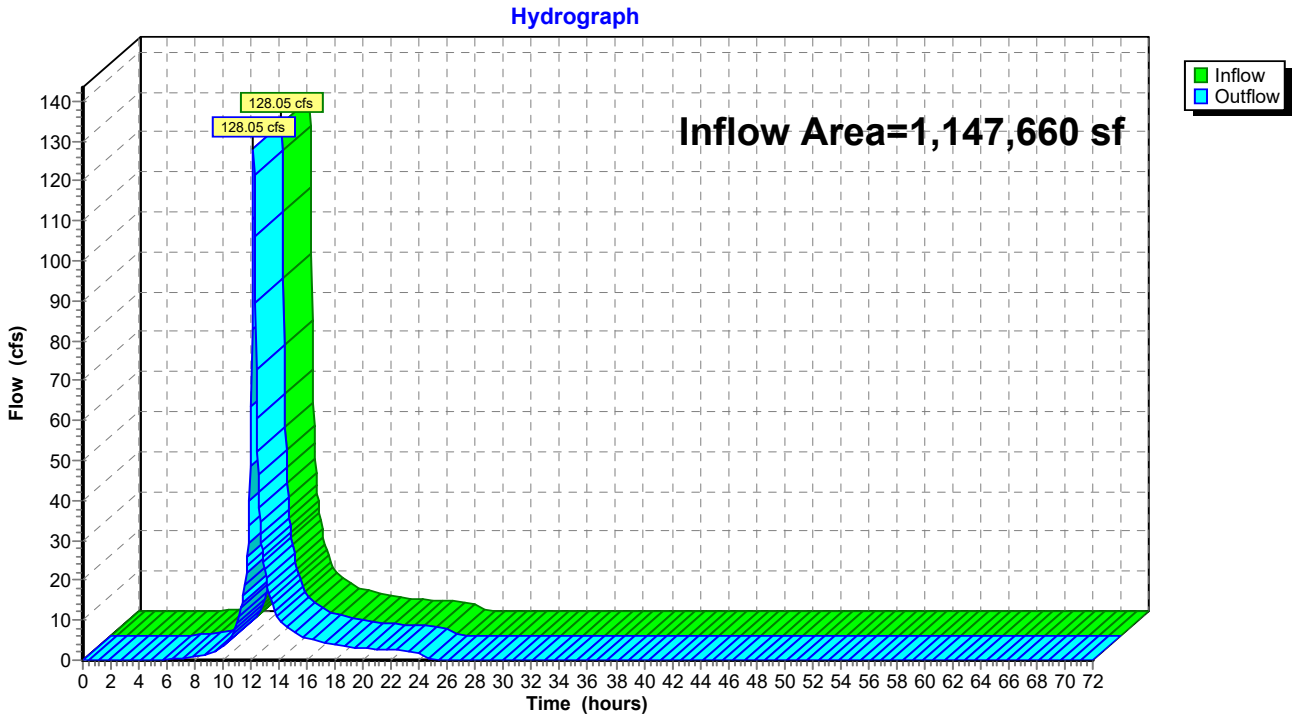


## Summary for Reach PR TOT: Total Site

Inflow Area = 1,147,660 sf, 33.00% Impervious, Inflow Depth = 5.56" for 100-yr event
Inflow = 128.05 cfs @ 12.16 hrs, Volume= 531,921 cf
Outflow = 128.05 cfs @ 12.16 hrs, Volume= 531,921 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 Pond BIO-1: Surface System

Inflow Area = 112,914 sf, 68.00% Impervious, Inflow Depth = 7.02" for 100-yr event
Inflow = 18.86 cfs @ 12.13 hrs, Volume= 66,075 cf
Outflow = 13.10 cfs @ 12.20 hrs, Volume= 66,075 cf, Atten= 31%, Lag= 4.3 min
Discarded = 0.04 cfs @ 12.20 hrs, Volume= 4,852 cf
Primary = 13.06 cfs @ 12.20 hrs, Volume= 61,224 cf
Routed to Reach DP-C1 : Wetlands

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 195.01' @ 12.20 hrs Surf.Area= 6,172 sf Storage= 7,478 cf

Plug-Flow detention time= 72.6 min calculated for 66,075 cf (100% of inflow)
Center-of-Mass det. time= 72.2 min ( 851.1 - 778.9 )

| Volume | Invert | Avail.Storage | Storage Description |
|---|---|---|---|
| #1 | 193.60' | 14,265 cf | **Custom Stage Data (Prismatic)** Listed below (Recalc) |

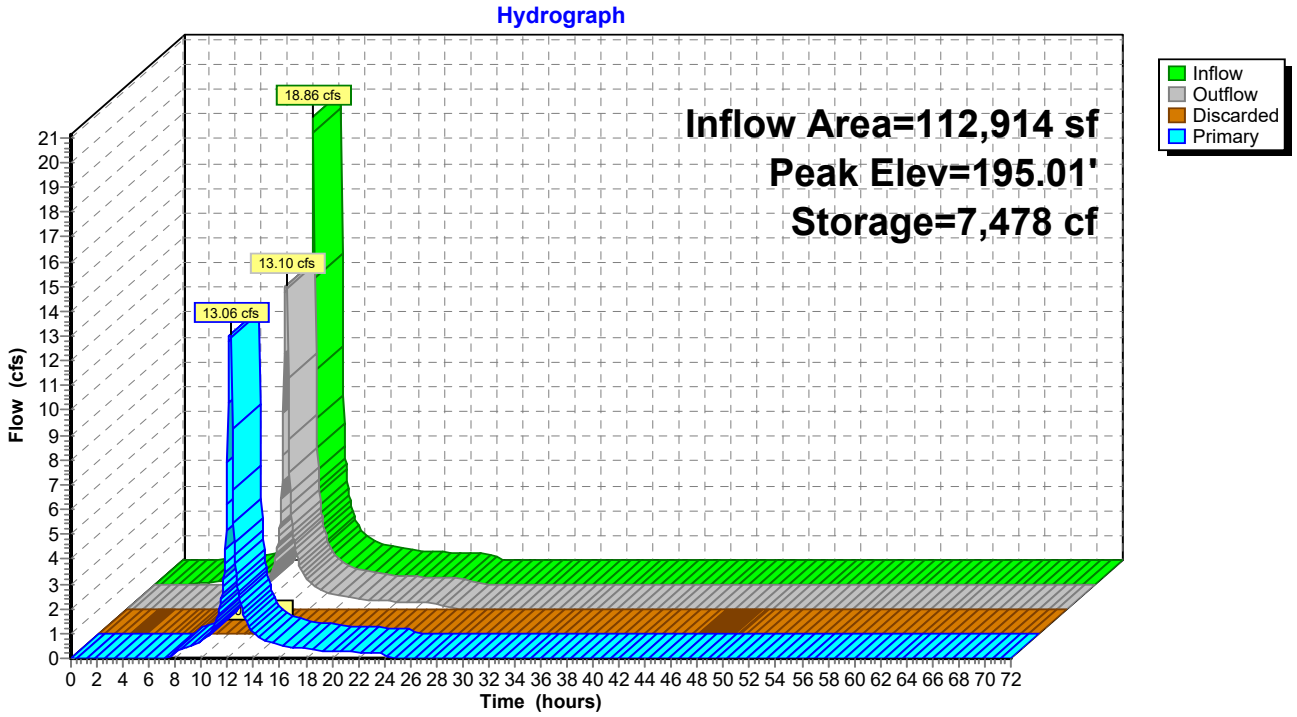
| Elevation (feet) | Surf.Area (sq-ft) | Inc.Store (cubic-feet) | Cum.Store (cubic-feet) |
|---|---|---|---|
| 193.60 | 4,470 | 0 | 0 |
| 194.00 | 4,930 | 1,880 | 1,880 |
| 195.00 | 6,160 | 5,545 | 7,425 |
| 196.00 | 7,520 | 6,840 | 14,265 |

| Device | Routing | Invert | Outlet Devices |
|---|---|---|---|
| #1 | Primary | 189.50' | **15.0" Round Culvert**<br>L= 50.0' CPP, square edge headwall, Ke= 0.500<br>Inlet / Outlet Invert= 189.50' / 189.00' S= 0.0100 '/' Cc= 0.900<br>n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.23 sf |
| #2 | Device 1 | 194.10' | **24.0" Horiz. 2-24" Area Drains X 1.20** C= 0.600<br>Limited to weir flow at low heads |
| #3 | Discarded | 193.60' | **0.270 in/hr Exfiltration over Surface area** |

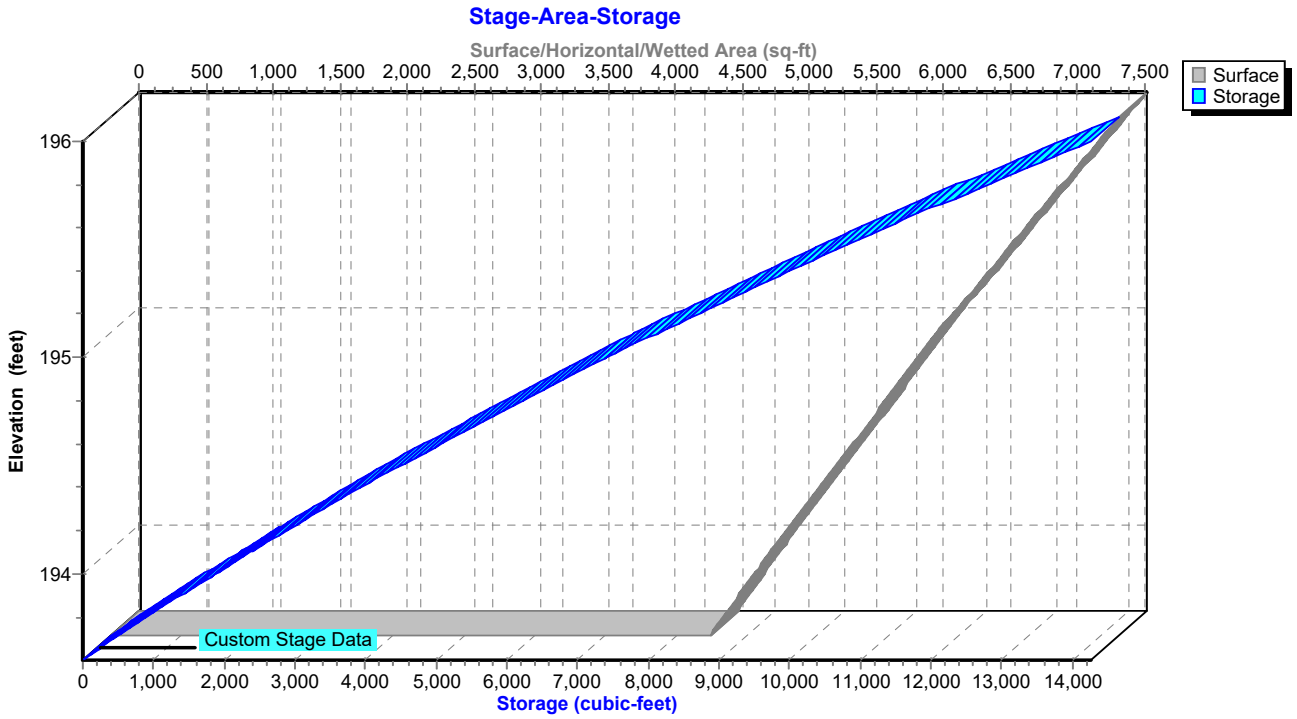
**Discarded OutFlow** Max=0.04 cfs @ 12.20 hrs HW=195.01' (Free Discharge)
└**3=Exfiltration** (Exfiltration Controls 0.04 cfs)

**Primary OutFlow** Max=13.05 cfs @ 12.20 hrs HW=195.01' (Free Discharge)
└**1=Culvert** (Inlet Controls 13.05 cfs @ 10.64 fps)
└**2=2-24" Area Drains** (Passes 13.05 cfs of 17.28 cfs potential flow)

## Pond BIO-1: Surface System




## Pond BIO-1: Surface System



## Summary for Pond SI-1: Surface Infiltration

Inflow Area = 33,480 sf, 57.85% Impervious, Inflow Depth = 6.78" for 100-yr event
Inflow = 5.49 cfs @ 12.13 hrs, Volume= 18,926 cf
Outflow = 4.22 cfs @ 12.19 hrs, Volume= 18,926 cf, Atten= 23%, Lag= 3.6 min
Discarded = 0.04 cfs @ 12.19 hrs, Volume= 3,927 cf
Primary = 4.18 cfs @ 12.19 hrs, Volume= 14,999 cf
Routed to Reach DP-B : Concord Street Main

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 200.78' @ 12.19 hrs Surf.Area= 5,802 sf Storage= 3,759 cf

Plug-Flow detention time= 145.0 min calculated for 18,912 cf (100% of inflow)
Center-of-Mass det. time= 145.7 min ( 931.4 - 785.7 )

| Volume | Invert | Avail.Storage | Storage Description |
|---|---|---|---|
| #1 | 200.00' | 5,105 cf | **Custom Stage Data (Prismatic)** Listed below (Recalc) |

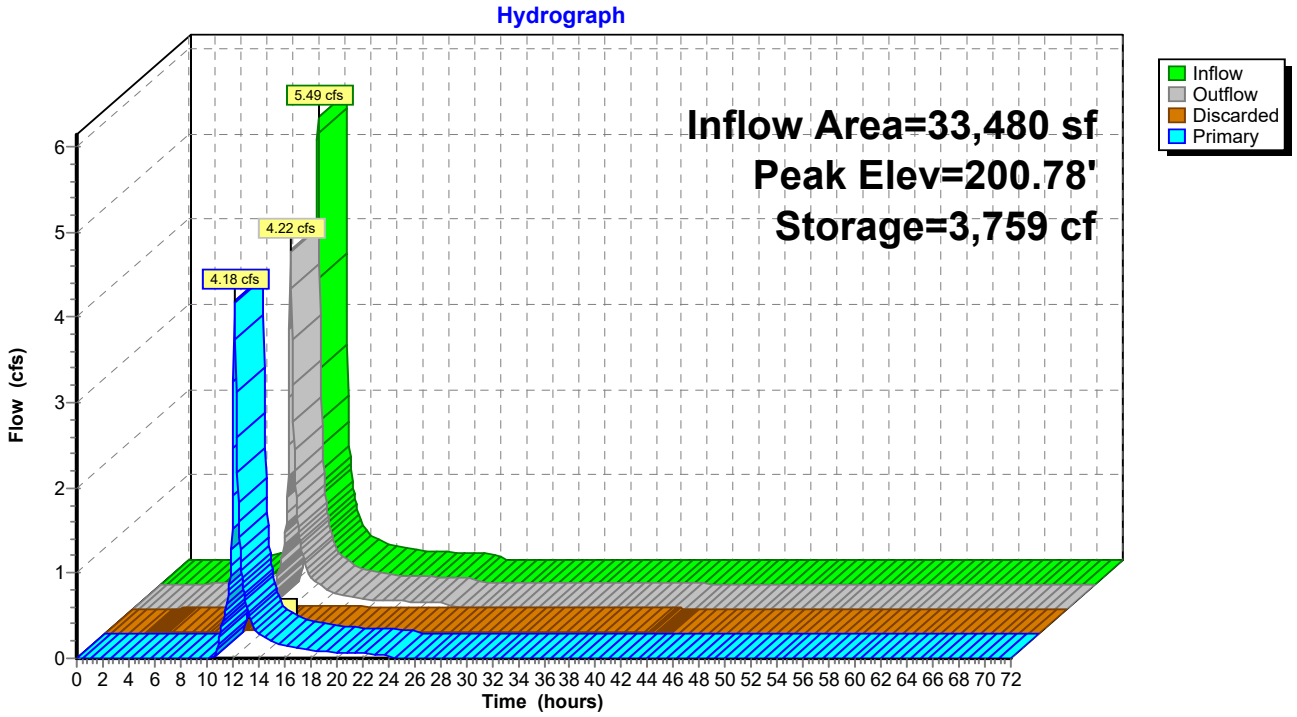
| Elevation (feet) | Surf.Area (sq-ft) | Inc.Store (cubic-feet) | Cum.Store (cubic-feet) |
|---|---|---|---|
| 200.00 | 3,854 | 0 | 0 |
| 201.00 | 6,356 | 5,105 | 5,105 |

| Device | Routing | Invert | Outlet Devices |
|---|---|---|---|
| #1 | Primary | 196.36' | **12.0" Round Culvert**<br>L= 37.6' CPP, mitered to conform to fill, Ke= 0.700<br>Inlet / Outlet Invert= 196.36' / 195.20' S= 0.0309 '/' Cc= 0.900<br>n= 0.013, Flow Area= 0.79 sf |
| #2 | Device 1 | 200.40' | **12.0" Horiz. 12" Area Drain X 0.73** C= 0.600<br>Limited to weir flow at low heads |
| #3 | Device 1 | 200.40' | **18.0" Horiz. 18" Area Drain X 0.69** C= 0.600<br>Limited to weir flow at low heads |
| #4 | Discarded | 200.00' | **0.270 in/hr Exfiltration over Surface area** |

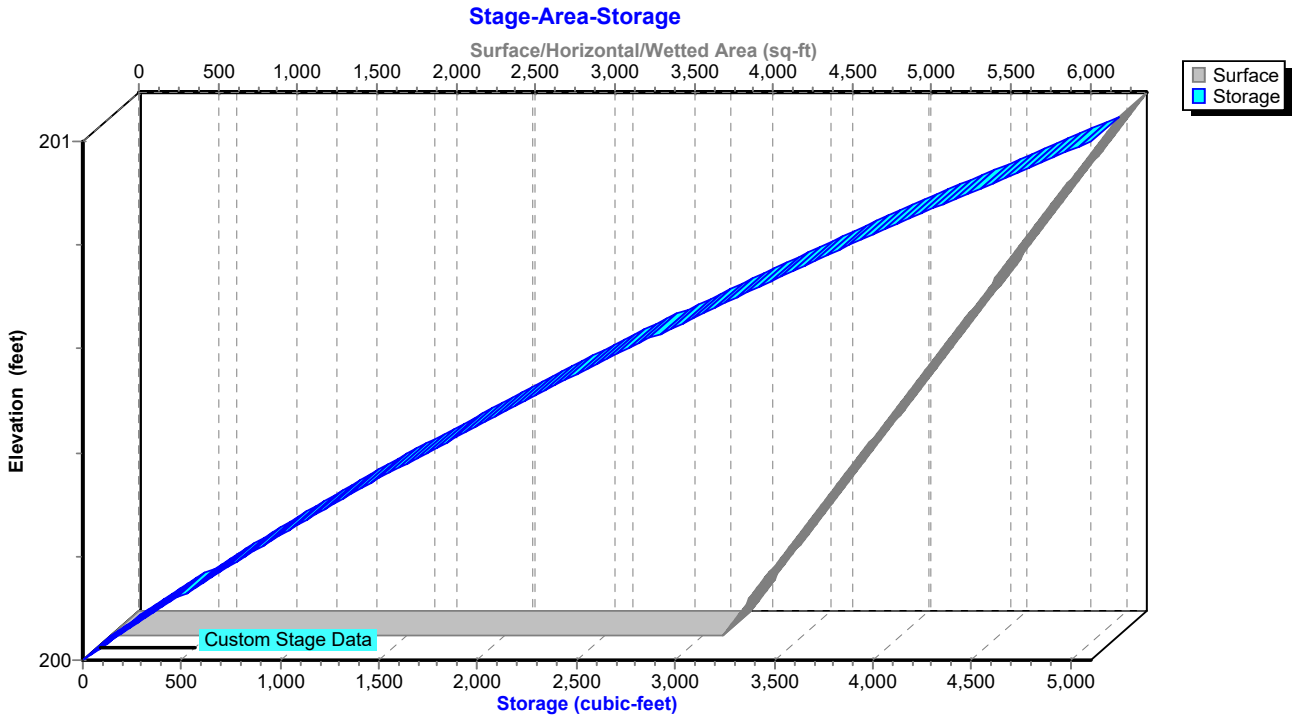
**Discarded OutFlow** Max=0.04 cfs @ 12.19 hrs HW=200.78' (Free Discharge)
└**4=Exfiltration** (Exfiltration Controls 0.04 cfs)

**Primary OutFlow** Max=4.13 cfs @ 12.19 hrs HW=200.77' (Free Discharge)
└**1=Culvert** (Passes 4.13 cfs of 6.60 cfs potential flow)
  ├**2=12" Area Drain** (Orifice Controls 1.69 cfs @ 2.15 fps)
  └**3=18" Area Drain** (Weir Controls 2.44 cfs @ 1.38 fps)

## Pond SI-1: Surface Infiltration




## Pond SI-1: Surface Infiltration



## Summary for Pond SI-2: South Inf Basin

Inflow Area = 79,806 sf, 77.39% Impervious, Inflow Depth = 7.38" for 100-yr event
Inflow = 13.65 cfs @ 12.13 hrs, Volume= 49,087 cf
Outflow = 11.15 cfs @ 12.18 hrs, Volume= 49,087 cf, Atten= 18%, Lag= 3.0 min
Discarded = 0.03 cfs @ 12.18 hrs, Volume= 4,624 cf
Primary = 11.12 cfs @ 12.18 hrs, Volume= 44,463 cf
Routed to Reach DP-B : Concord Street Main

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 195.58' @ 12.18 hrs Surf.Area= 4,397 sf Storage= 7,446 cf

Plug-Flow detention time= 145.3 min calculated for 49,053 cf (100% of inflow)
Center-of-Mass det. time= 147.0 min ( 914.4 - 767.4 )

| Volume | Invert | Avail.Storage | Storage Description |
|---|---|---|---|
| #1 | 193.50' | 7,532 cf | **Custom Stage Data (Prismatic)** Listed below (Recalc) |

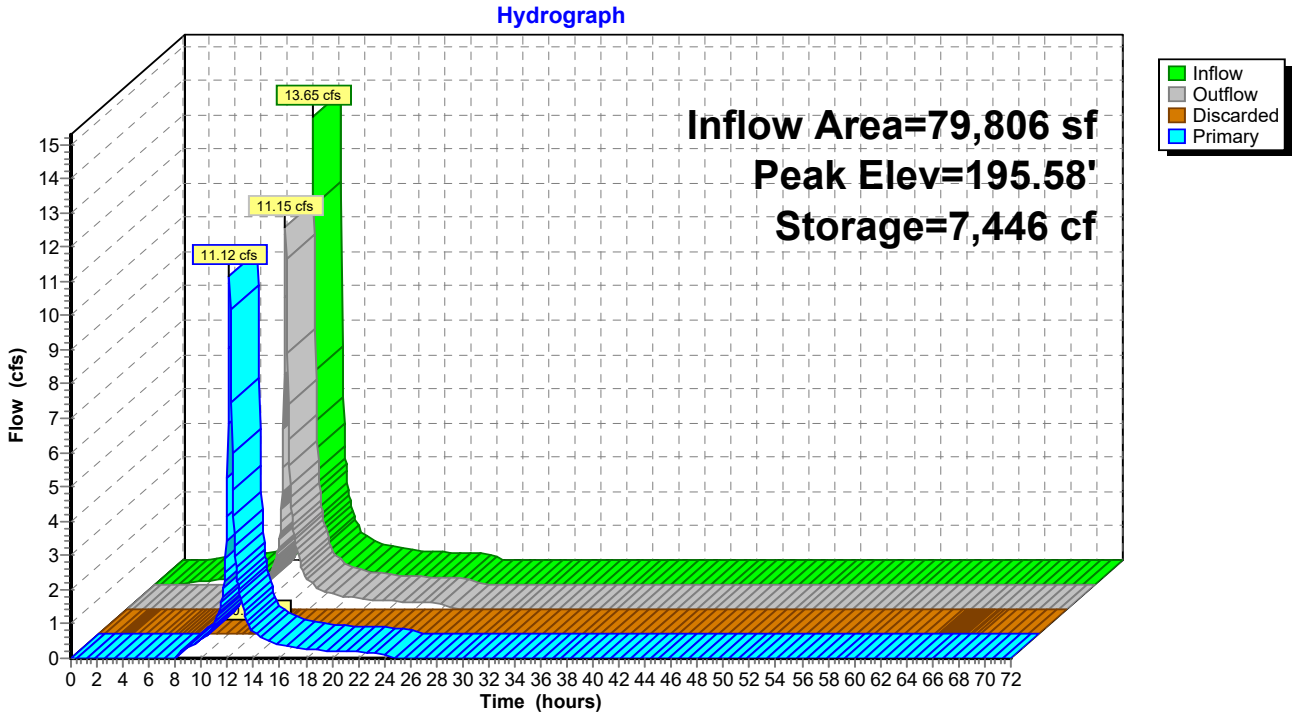
| Elevation (feet) | Surf.Area (sq-ft) | Inc.Store (cubic-feet) | Cum.Store (cubic-feet) |
|---|---|---|---|
| 193.50 | 2,832 | 0 | 0 |
| 194.00 | 3,174 | 1,502 | 1,502 |
| 195.00 | 3,899 | 3,537 | 5,038 |
| 195.60 | 4,414 | 2,494 | 7,532 |

| Device | Routing | Invert | Outlet Devices |
|---|---|---|---|
| #1 | Primary | 194.40' | **12.0" Horiz. 12" Area Drain X 0.73** C= 0.600<br>Limited to weir flow at low heads |
| #2 | Primary | 194.80' | **24.0" Horiz. 24" Area Drain X 0.60** C= 0.600<br>Limited to weir flow at low heads |
| #3 | Discarded | 193.50' | **0.270 in/hr Exfiltration over Surface area** |

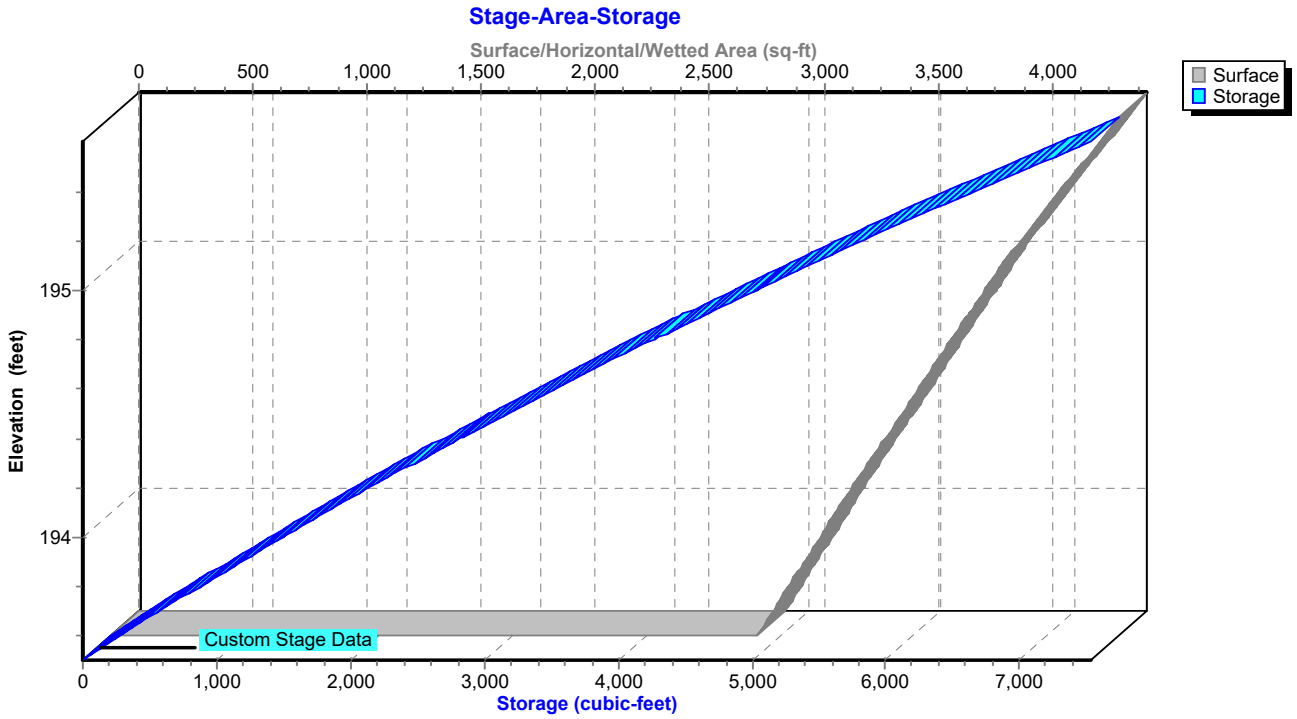
**Discarded OutFlow** Max=0.03 cfs @ 12.18 hrs HW=195.57' (Free Discharge)
└**3=Exfiltration** (Exfiltration Controls 0.03 cfs)

**Primary OutFlow** Max=10.93 cfs @ 12.18 hrs HW=195.57' (Free Discharge)
├**1=12" Area Drain** (Orifice Controls 2.98 cfs @ 3.80 fps)
└**2=24" Area Drain** (Orifice Controls 7.95 cfs @ 2.53 fps)

## Pond SI-2: South Inf Basin




## Pond SI-2: South Inf Basin



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

Inflow Area = 145,461 sf, 28.75% Impervious, Inflow Depth = 5.95" for 100-yr event
Inflow = 21.78 cfs @ 12.13 hrs, Volume= 72,126 cf
Outflow = 20.55 cfs @ 12.15 hrs, Volume= 72,126 cf, Atten= 6%, Lag= 1.5 min
Discarded = 0.04 cfs @ 5.65 hrs, Volume= 6,073 cf
Primary = 20.50 cfs @ 12.15 hrs, Volume= 66,053 cf
Routed to Reach DP-C1 : Wetlands

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 186.28' @ 12.15 hrs Surf.Area= 6,528 sf Storage= 8,253 cf

Plug-Flow detention time= 82.3 min calculated for 72,076 cf (100% of inflow)
Center-of-Mass det. time= 83.2 min ( 889.2 - 806.1 )

| Volume | Invert | Avail.Storage | Storage Description |
|---|---|---|---|
| #1A | 184.00' | 4,559 cf | **44.83'W x 145.60'L x 2.33'H Field A**<br>15,231 cf Overall - 3,833 cf Embedded = 11,398 cf x 40.0% Voids |
| #2A | 184.50' | 3,833 cf | **ADS_StormTech SC-310 +Cap** x 260 Inside #1<br>Effective Size= 28.9"W x 16.0"H => 2.07 sf x 7.12'L = 14.7 cf<br>Overall Size= 34.0"W x 16.0"H x 7.56'L with 0.44' Overlap<br>260 Chambers in 13 Rows |
| | | 8,392 cf | Total Available Storage |

Storage Group A created with Chamber Wizard

| Device | Routing | Invert | Outlet Devices |
|---|---|---|---|
| #1 | Primary | 184.85' | **38.0" W x 8.0" H Vert. Orifice/Grate** C= 0.600<br>Limited to weir flow at low heads |
| #2 | Primary | 185.55' | **5.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s) |
| #3 | Discarded | 184.00' | **0.270 in/hr Exfiltration over Surface area** |

**Discarded OutFlow** Max=0.04 cfs @ 5.65 hrs HW=184.02' (Free Discharge)
└**3=Exfiltration** (Exfiltration Controls 0.04 cfs)

**Primary OutFlow** Max=20.30 cfs @ 12.15 hrs HW=186.27' (Free Discharge)
├**1=Orifice/Grate** (Orifice Controls 10.56 cfs @ 5.00 fps)
└**2=Sharp-Crested Rectangular Weir** (Weir Controls 9.74 cfs @ 2.78 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

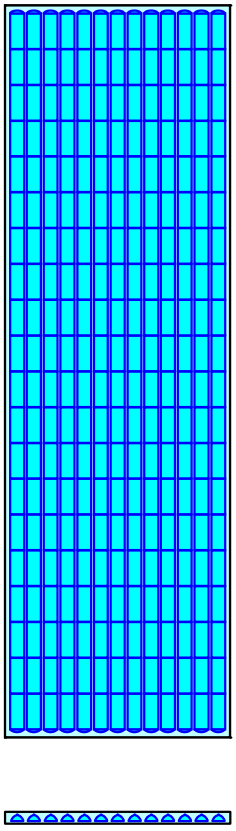
20 Chambers/Row x 7.12' Long +0.60' Cap Length x 2 = 143.60' Row Length +12.0" End Stone x 2 = 145.60' Base Length
13 Rows x 34.0" Wide + 6.0" Spacing x 12 + 12.0" Side Stone x 2 = 44.83' Base Width
6.0" Stone Base + 16.0" Chamber Height + 6.0" Stone Cover = 2.33' Field Height

260 Chambers x 14.7 cf = 3,832.9 cf Chamber Storage

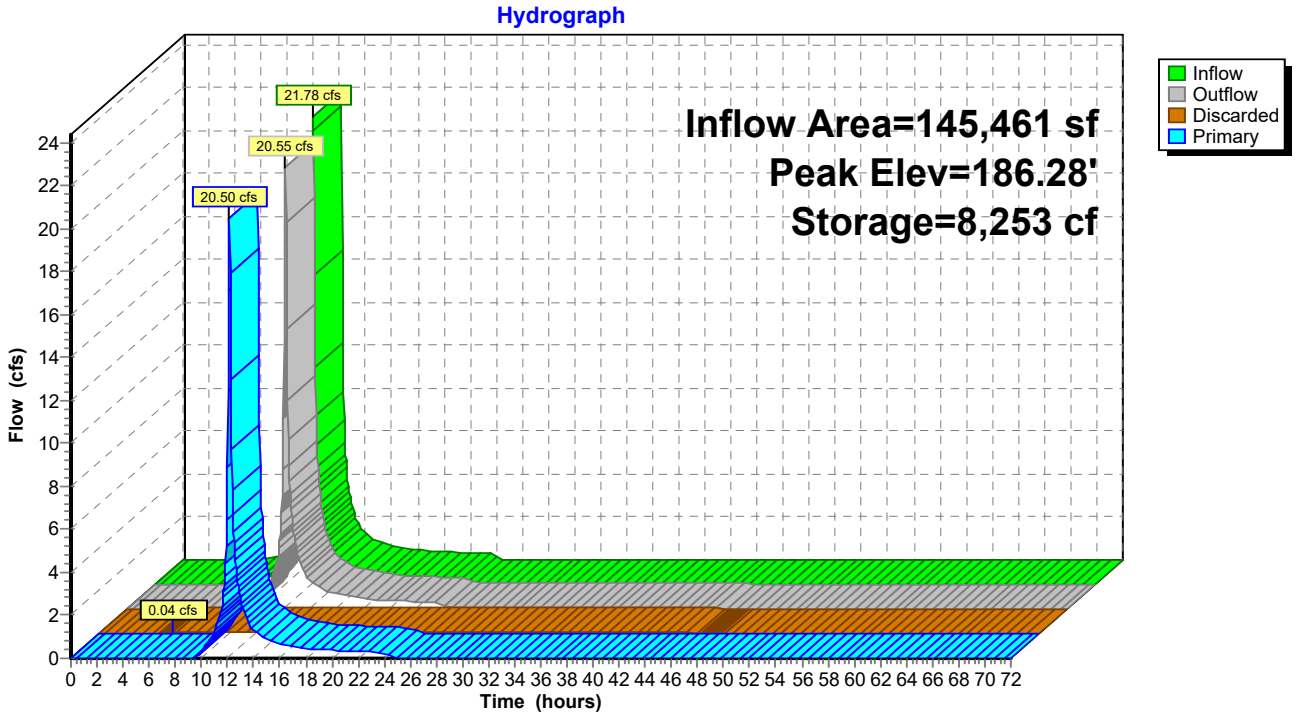
15,231.4 cf Field - 3,832.9 cf Chambers = 11,398.5 cf Stone x 40.0% Voids = 4,559.4 cf Stone Storage

Chamber Storage + Stone Storage = 8,392.3 cf = 0.193 af
Overall Storage Efficiency = 55.1%
Overall System Size = 145.60' x 44.83' x 2.33'

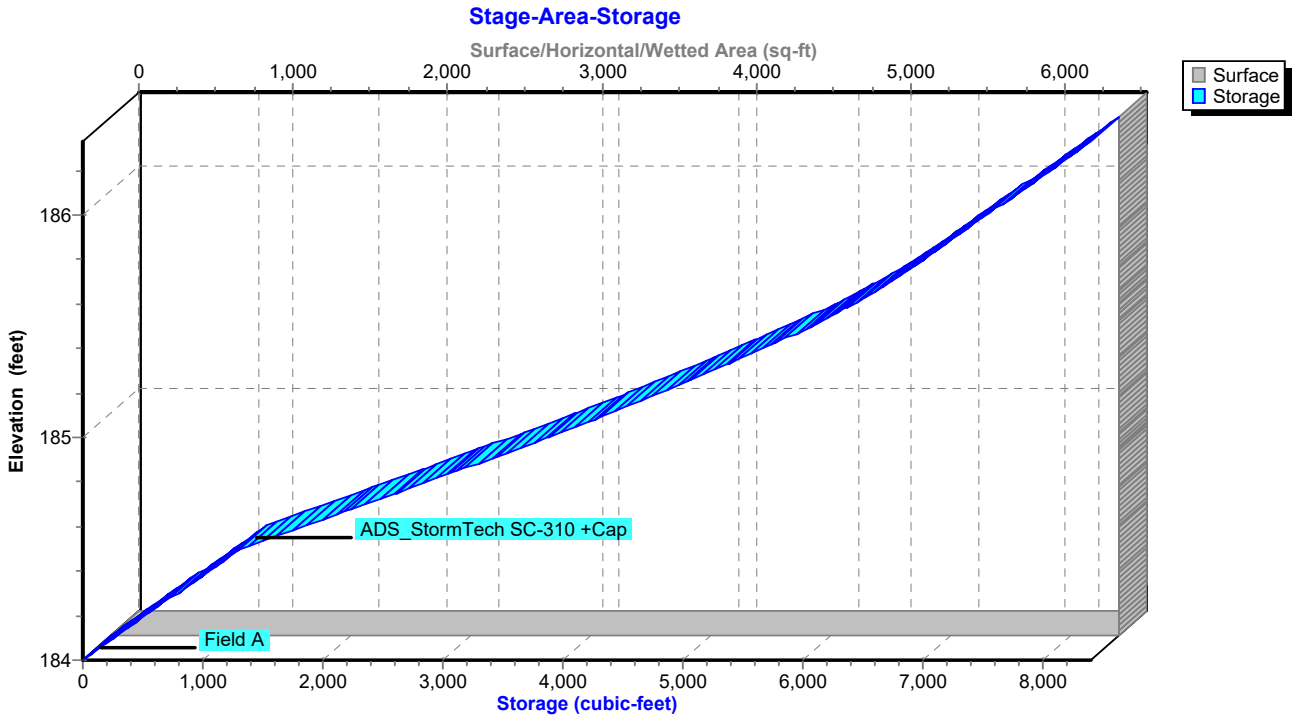
260 Chambers
564.1 cy Field
422.2 cy Stone



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




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



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

Inflow Area = 10,629 sf, 58.03% Impervious, Inflow Depth = 6.78" for 100-yr event
Inflow = 1.74 cfs @ 12.13 hrs, Volume= 6,008 cf
Outflow = 0.15 cfs @ 13.28 hrs, Volume= 6,008 cf, Atten= 92%, Lag= 69.3 min
Discarded = 0.01 cfs @ 5.90 hrs, Volume= 2,041 cf
Primary = 0.14 cfs @ 13.28 hrs, Volume= 3,967 cf
Routed to Reach DP-C1 : Wetlands

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 188.76' @ 13.28 hrs Surf.Area= 1,826 sf Storage= 3,322 cf

Plug-Flow detention time= 485.2 min calculated for 6,008 cf (100% of inflow)
Center-of-Mass det. time= 484.8 min ( 1,270.5 - 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**<br>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<br>Effective Size= 44.6"W x 30.0"H => 6.45 sf x 7.12'L = 45.9 cf<br>Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap<br>48 Chambers in 4 Rows |
| | | 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 Limited to weir flow at low heads |
| #2 | Primary | 188.80' | **5.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s) |
| #3 | Discarded | 186.00' | **0.270 in/hr Exfiltration over Surface area** |

**Discarded OutFlow** Max=0.01 cfs @ 5.90 hrs HW=186.04' (Free Discharge)
└**3=Exfiltration** (Exfiltration Controls 0.01 cfs)

**Primary OutFlow** Max=0.14 cfs @ 13.28 hrs HW=188.76' (Free Discharge)
├**1=Orifice/Grate** (Orifice Controls 0.14 cfs @ 6.23 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

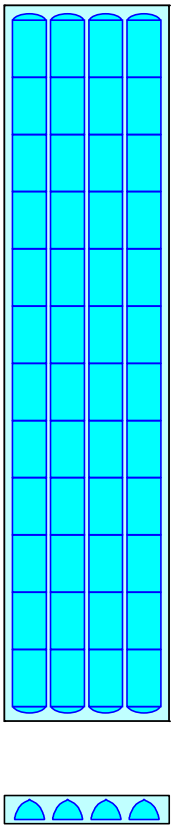
12 Chambers/Row x 7.12' Long +0.81' Cap Length x 2 = 87.06' Row Length +12.0" End Stone x 2 = 89.06' Base Length
4 Rows x 51.0" Wide + 6.0" Spacing x 3 + 12.0" Side Stone x 2 = 20.50' Base Width
6.0" Stone Base + 30.0" Chamber Height + 6.0" Stone Cover = 3.50' Field Height

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

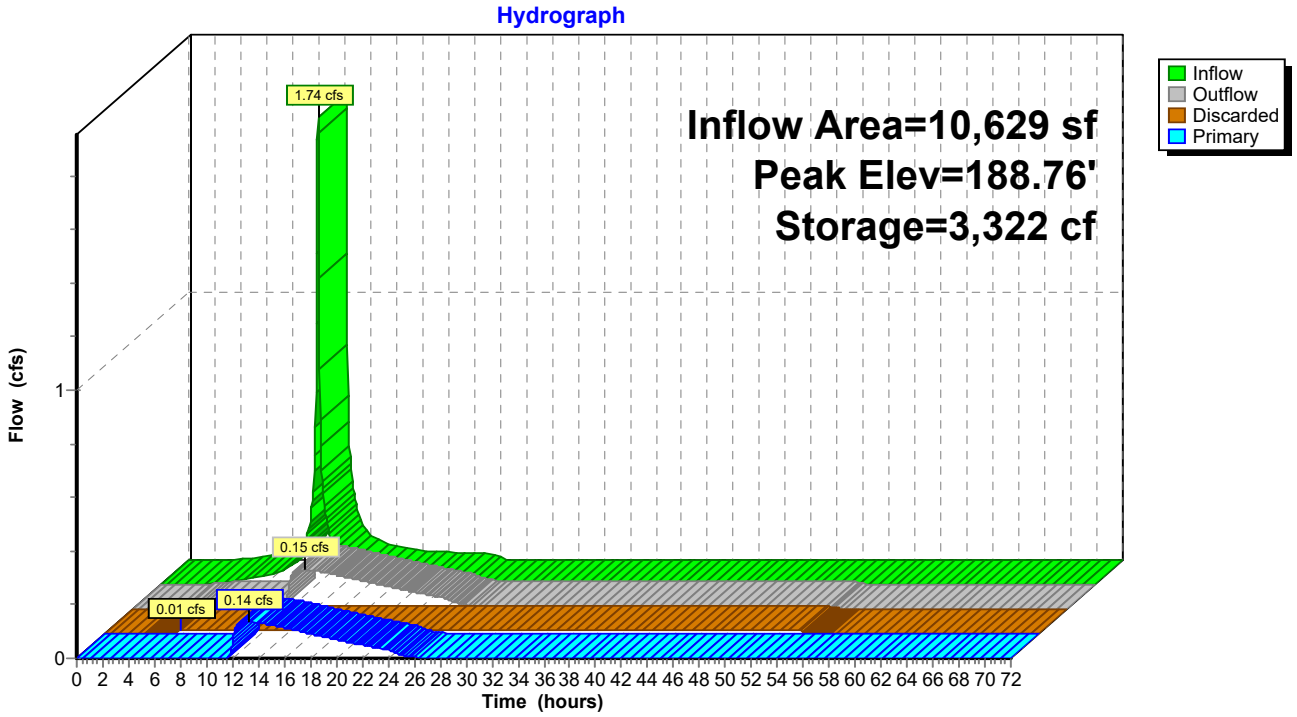
6,389.8 cf Field - 2,205.1 cf Chambers = 4,184.7 cf Stone x 40.0% Voids = 1,673.9 cf Stone Storage

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'

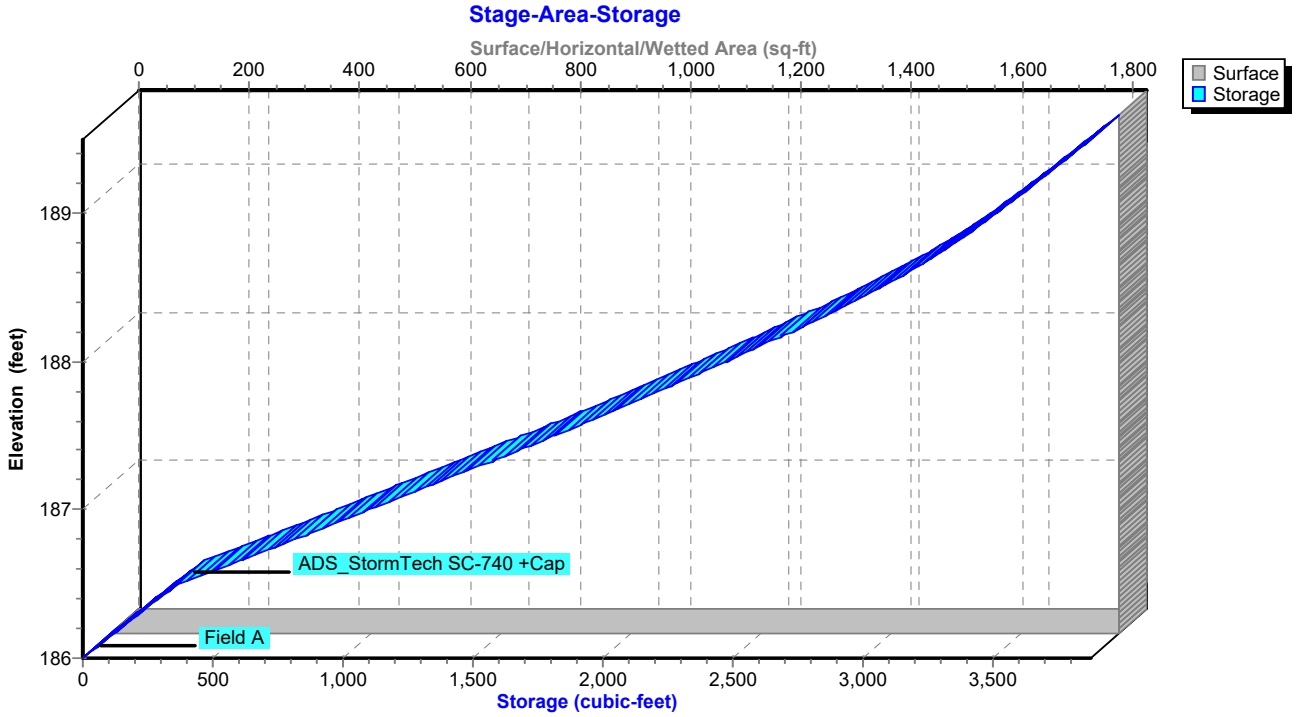
48 Chambers
236.7 cy Field
155.0 cy Stone



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




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



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

Inflow Area = 161,157 sf, 31.93% Impervious, Inflow Depth = 5.95" for 100-yr event
Inflow = 24.13 cfs @ 12.13 hrs, Volume= 79,909 cf
Outflow = 16.04 cfs @ 12.21 hrs, Volume= 79,909 cf, Atten= 34%, Lag= 5.0 min
Discarded = 0.07 cfs @ 6.15 hrs, Volume= 8,668 cf
Primary = 15.97 cfs @ 12.21 hrs, Volume= 71,241 cf
Routed to Reach DP-C1 : Wetlands

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 196.48' @ 12.21 hrs Surf.Area= 10,568 sf Storage= 17,245 cf

Plug-Flow detention time= 93.5 min calculated for 79,854 cf (100% of inflow)
Center-of-Mass det. time= 94.2 min ( 900.2 - 806.1 )

| Volume | Invert | Avail.Storage | Storage Description |
|---|---|---|---|
| #1A | 193.50' | 7,922 cf | **48.85'W x 216.33'L x 3.00'H Field A**<br>31,705 cf Overall - 11,899 cf Embedded = 19,806 cf x 40.0% Voids |
| #2A | 193.83' | 9,407 cf | **ADS N-12 24"** x 154 Inside #1<br>Inside= 23.8"W x 23.8"H => 3.10 sf x 20.00'L = 62.0 cf<br>Outside= 28.0"W x 28.0"H => 3.92 sf x 20.00'L = 78.4 cf<br>Row Length Adjustment= -10.00' x 3.10 sf x 14 rows<br>47.18' Header x 3.10 sf x 2 = 292.5 cf Inside |
| | | 17,329 cf | Total Available Storage |

Storage Group A created with Chamber Wizard

| Device | Routing | Invert | Outlet Devices |
|---|---|---|---|
| #1 | Primary | 194.35' | **30.0" W x 8.0" H Vert. Orifice/Grate** C= 0.600<br>Limited to weir flow at low heads |
| #2 | Primary | 195.00' | **10.0" W x 6.0" H Vert. Orifice/Grate** C= 0.600<br>Limited to weir flow at low heads |
| #3 | Primary | 196.15' | **5.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s) |
| #4 | Discarded | 193.50' | **0.270 in/hr Exfiltration over Surface area** |

**Discarded OutFlow** Max=0.07 cfs @ 6.15 hrs HW=193.53' (Free Discharge)
└**4=Exfiltration** (Exfiltration Controls 0.07 cfs)

**Primary OutFlow** Max=15.53 cfs @ 12.21 hrs HW=196.45' (Free Discharge)
├**1=Orifice/Grate** (Orifice Controls 10.66 cfs @ 6.39 fps)
├**2=Orifice/Grate** (Orifice Controls 2.20 cfs @ 5.27 fps)
└**3=Sharp-Crested Rectangular Weir** (Weir Controls 2.68 cfs @ 1.80 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 14 rows

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

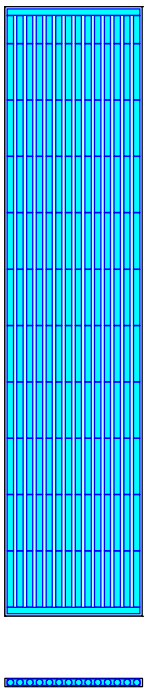
11 Chambers/Row x 20.00' Long -10.00' Row Adjustment +2.33' Header x 2 = 214.67' Row Length +10.0" End Stone x 2 = 216.33' Base Length
14 Rows x 28.0" Wide + 13.4" Spacing x 13 + 10.0" Side Stone x 2 = 48.85' Base Width
4.0" Stone Base + 28.0" Chamber Height + 4.0" Stone Cover = 3.00' Field Height

154 Chambers x 62.0 cf -10.00' Row Adjustment x 3.10 sf x 14 Rows + 47.18' Header x 3.10 sf x 2 = 9,406.5 cf Chamber Storage
154 Chambers x 78.4 cf -10.00' Row Adjustment x 3.92 sf x 14 Rows + 47.18' Header x 3.92 sf x 2 = 11,893.6 cf Displacement

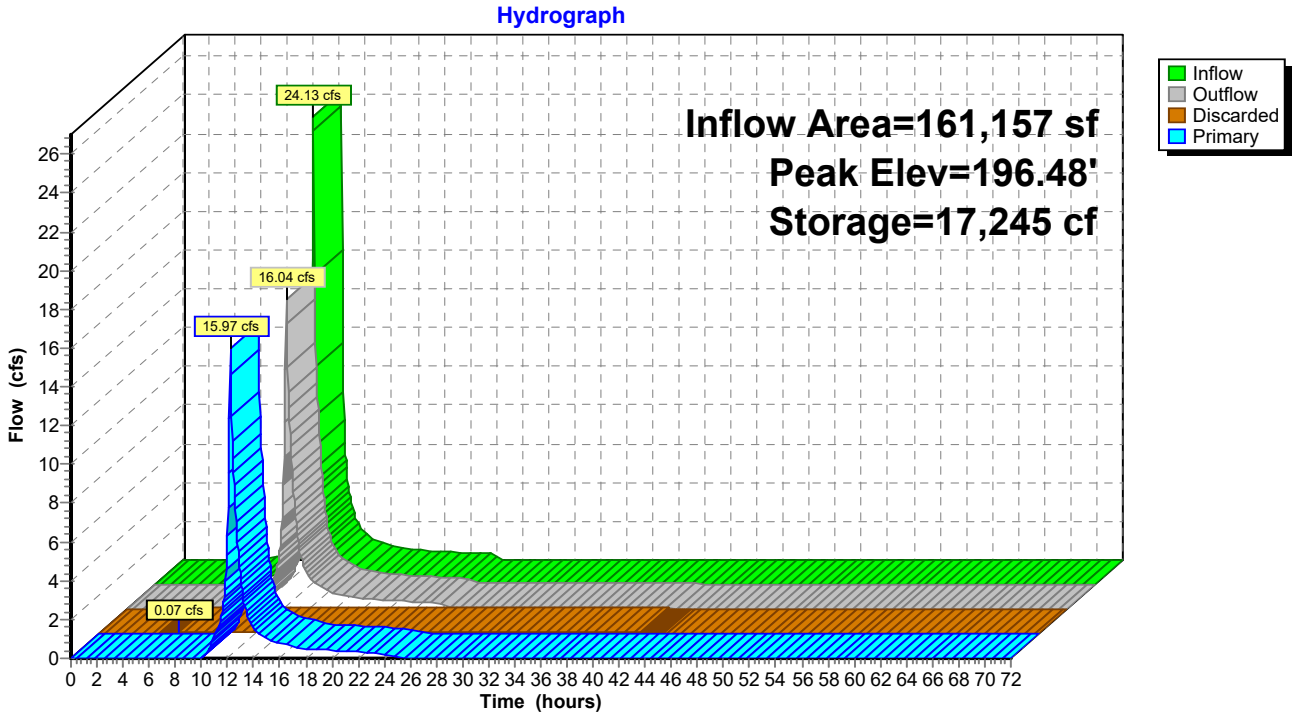
31,704.6 cf Field - 11,893.6 cf Chambers = 19,811.0 cf Stone x 40.0% Voids = 7,924.4 cf Stone Storage

Chamber Storage + Stone Storage = 17,330.9 cf = 0.398 af
Overall Storage Efficiency = 54.7%
Overall System Size = 216.33' x 48.85' x 3.00'

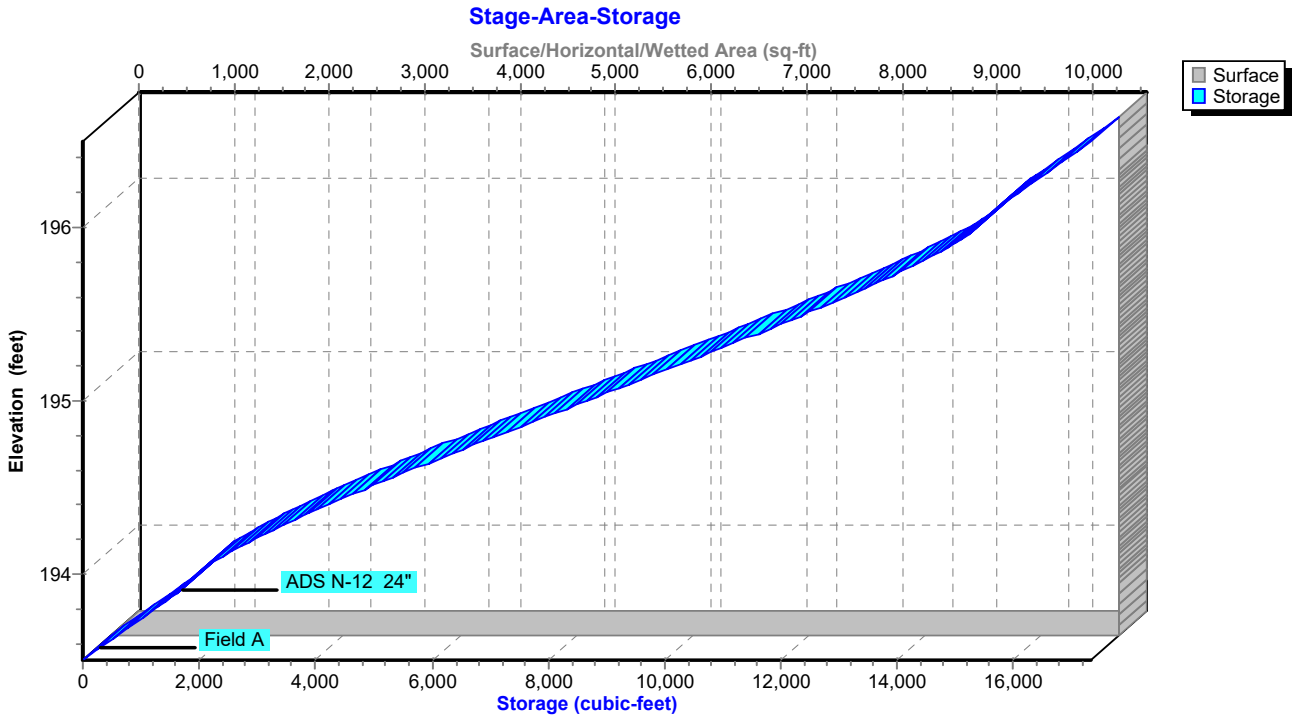
154 Chambers
1,174.2 cy Field
733.7 cy Stone



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




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



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

Inflow Area = 54,076 sf, 49.32% Impervious, Inflow Depth = 6.54" for 100-yr event
Inflow = 8.67 cfs @ 12.13 hrs, Volume= 29,493 cf
Outflow = 6.28 cfs @ 12.20 hrs, Volume= 29,493 cf, Atten= 28%, Lag= 4.2 min
Discarded = 0.04 cfs @ 5.65 hrs, Volume= 4,859 cf
Primary = 6.24 cfs @ 12.20 hrs, Volume= 24,634 cf
Routed to Reach DP-B : Concord Street Main

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 202.54' @ 12.20 hrs Surf.Area= 6,449 sf Storage= 8,579 cf

Plug-Flow detention time= 139.6 min calculated for 29,473 cf (100% of inflow)
Center-of-Mass det. time= 140.1 min ( 932.1 - 792.0 )

| Volume | Invert | Avail.Storage | Storage Description |
|---|---|---|---|
| #1A | 200.20' | 870 cf | **16.13'W x 66.67'L x 3.00'H Field A**<br>3,227 cf Overall - 1,052 cf Embedded = 2,175 cf x 40.0% Voids |
| #2A | 200.53' | 832 cf | **ADS N-12 24"** x 12 Inside #1<br>Inside= 23.8"W x 23.8"H => 3.10 sf x 20.00'L = 62.0 cf<br>Outside= 28.0"W x 28.0"H => 3.92 sf x 20.00'L = 78.4 cf<br>12 Chambers in 4 Rows<br>14.13' Header x 3.10 sf x 2 = 87.6 cf Inside |
| #3B | 200.20' | 3,733 cf | **43.67'W x 106.67'L x 3.00'H Field B**<br>13,974 cf Overall - 4,640 cf Embedded = 9,334 cf x 40.0% Voids |
| #4B | 200.53' | 3,668 cf | **ADS N-12 24"** x 55 Inside #3<br>Inside= 23.8"W x 23.8"H => 3.10 sf x 20.00'L = 62.0 cf<br>Outside= 28.0"W x 28.0"H => 3.92 sf x 20.00'L = 78.4 cf<br>55 Chambers in 11 Rows<br>41.67' Header x 3.10 sf x 2 = 258.3 cf Inside |
| #5C | 200.20' | 563 cf | **15.33'W x 46.67'L x 3.00'H Field C**<br>2,147 cf Overall - 738 cf Embedded = 1,408 cf x 40.0% Voids |
| #6C | 200.53' | 584 cf | **ADS N-12 24"** x 8 Inside #5<br>Inside= 23.8"W x 23.8"H => 3.10 sf x 20.00'L = 62.0 cf<br>Outside= 28.0"W x 28.0"H => 3.92 sf x 20.00'L = 78.4 cf<br>8 Chambers in 4 Rows<br>14.13' Header x 3.10 sf x 2 = 87.6 cf Inside |
| | | 10,250 cf | Total Available Storage |

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

| Device | Routing | Invert | Outlet Devices |
|---|---|---|---|
| #1 | Primary | 200.33' | **15.0" Round Culvert**<br>L= 142.0' CPP, mitered to conform to fill, Ke= 0.700<br>Inlet / Outlet Invert= 200.33' / 198.30' S= 0.0143 '/' Cc= 0.900<br>n= 0.013, Flow Area= 1.23 sf |
| #2 | Device 1 | 200.85' | **4.0" W x 5.0" H Vert. Orifice/Grate** C= 0.600<br>Limited to weir flow at low heads |
| #3 | Device 1 | 201.80' | **33.0" W x 8.0" H Vert. Orifice/Grate** C= 0.600 |

Limited to weir flow at low heads

| | | | |
|---|---|---|---|
| #4 | Device 1 | 202.70' | **5.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s) |
| #5 | Discarded | 200.20' | **0.270 in/hr Exfiltration over Surface area** |

**Discarded OutFlow** Max=0.04 cfs @ 5.65 hrs HW=200.23' (Free Discharge)
└**5=Exfiltration** (Exfiltration Controls 0.04 cfs)

**Primary OutFlow** Max=6.22 cfs @ 12.20 hrs HW=202.54' (Free Discharge)
└**1=Culvert** (Passes 6.22 cfs of 6.56 cfs potential flow)
  ├**2=Orifice/Grate** (Orifice Controls 0.81 cfs @ 5.85 fps)
  ├**3=Orifice/Grate** (Orifice Controls 5.41 cfs @ 2.95 fps)
  └**4=Sharp-Crested Rectangular Weir** ( 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

28.0" Wide + 19.2" Spacing = 47.2" C-C Row Spacing

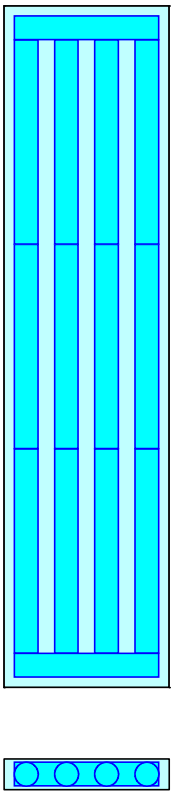
3 Chambers/Row x 20.00' Long +2.33' Header x 2 = 64.67' Row Length +12.0" End Stone x 2 = 66.67' Base Length
4 Rows x 28.0" Wide + 19.2" Spacing x 3 + 12.0" Side Stone x 2 = 16.13' Base Width
4.0" Stone Base + 28.0" Chamber Height + 4.0" Stone Cover = 3.00' Field Height

12 Chambers x 62.0 cf + 14.13' Header x 3.10 sf x 2 = 831.6 cf Chamber Storage
12 Chambers x 78.4 cf + 14.13' Header x 3.92 sf x 2 = 1,051.5 cf Displacement

3,226.8 cf Field - 1,051.5 cf Chambers = 2,175.3 cf Stone x 40.0% Voids = 870.1 cf Stone Storage

Chamber Storage + Stone Storage = 1,701.7 cf = 0.039 af
Overall Storage Efficiency = 52.7%
Overall System Size = 66.67' x 16.13' x 3.00'

12 Chambers
119.5 cy Field
80.6 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 + 19.2" Spacing = 47.2" C-C Row Spacing

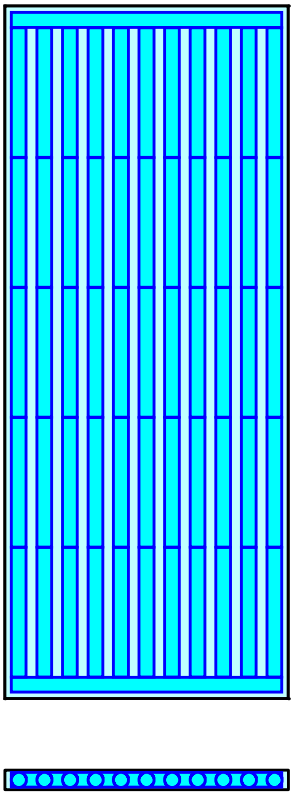
5 Chambers/Row x 20.00' Long +2.33' Header x 2 = 104.67' Row Length +12.0" End Stone x 2 = 106.67' Base Length
11 Rows x 28.0" Wide + 19.2" Spacing x 10 + 12.0" Side Stone x 2 = 43.67' Base Width
4.0" Stone Base + 28.0" Chamber Height + 4.0" Stone Cover = 3.00' Field Height

55 Chambers x 62.0 cf + 41.67' Header x 3.10 sf x 2 = 3,668.3 cf Chamber Storage
55 Chambers x 78.4 cf + 41.67' Header x 3.92 sf x 2 = 4,638.2 cf Displacement

13,973.8 cf Field - 4,638.2 cf Chambers = 9,335.5 cf Stone x 40.0% Voids = 3,734.2 cf Stone Storage

Chamber Storage + Stone Storage = 7,402.5 cf = 0.170 af
Overall Storage Efficiency = 53.0%
Overall System Size = 106.67' x 43.67' x 3.00'

55 Chambers
517.5 cy Field
345.8 cy Stone



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

**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 + 19.2" Spacing = 47.2" C-C Row Spacing

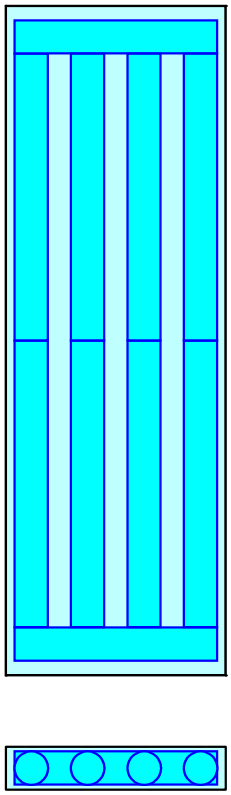
2 Chambers/Row x 20.00' Long +2.33' Header x 2 = 44.67' Row Length +12.0" End Stone x 2 = 46.67' Base Length
4 Rows x 28.0" Wide + 19.2" Spacing x 3 + 7.2" Side Stone x 2 = 15.33' Base Width
4.0" Stone Base + 28.0" Chamber Height + 4.0" Stone Cover = 3.00' Field Height

8 Chambers x 62.0 cf + 14.13' Header x 3.10 sf x 2 = 583.6 cf Chamber Storage
8 Chambers x 78.4 cf + 14.13' Header x 3.92 sf x 2 = 737.9 cf Displacement

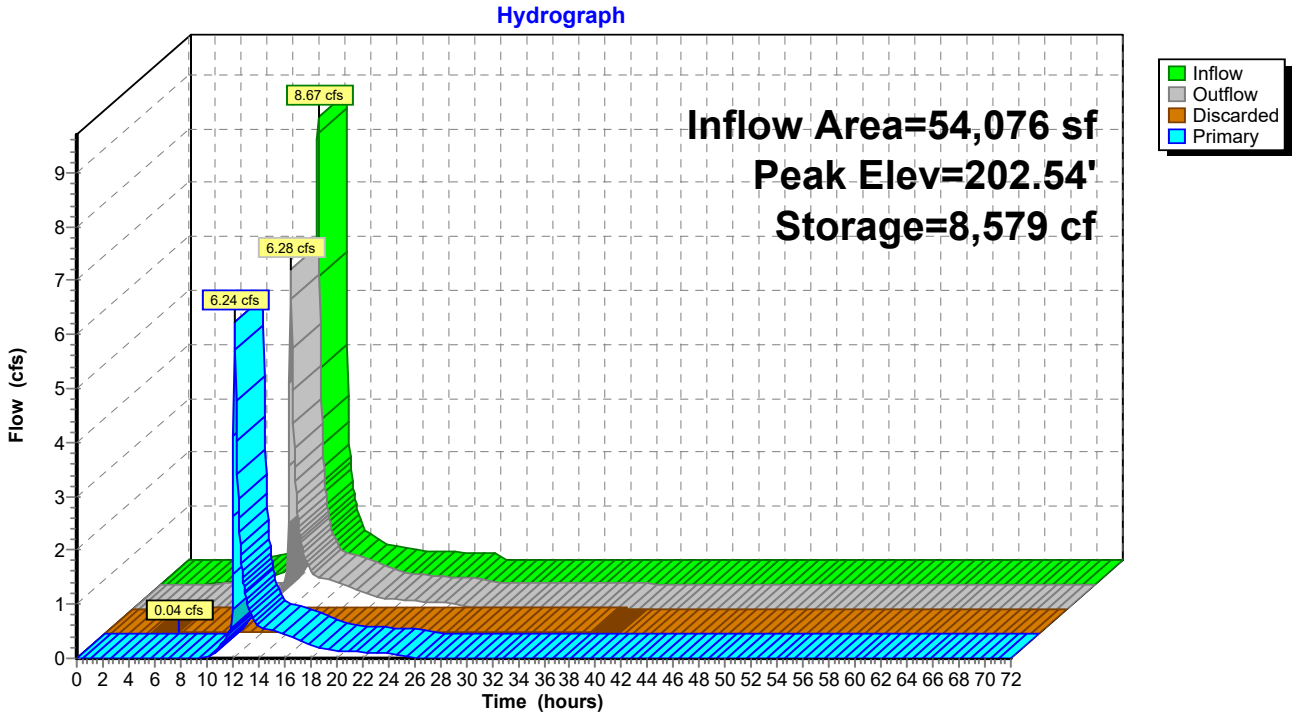
2,146.7 cf Field - 737.9 cf Chambers = 1,408.8 cf Stone x 40.0% Voids = 563.5 cf Stone Storage

Chamber Storage + Stone Storage = 1,147.1 cf = 0.026 af
Overall Storage Efficiency = 53.4%
Overall System Size = 46.67' x 15.33' x 3.00'

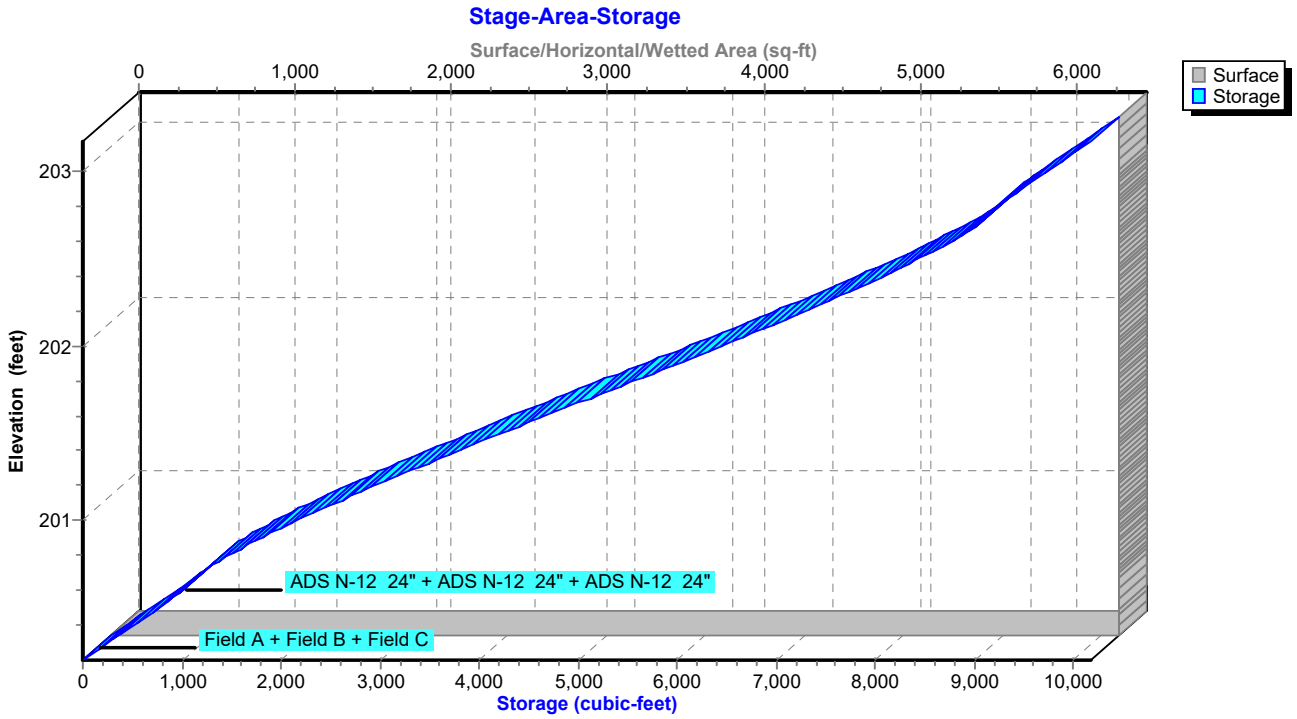
8 Chambers
79.5 cy Field
52.2 cy Stone



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




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



## APPENDIX D

## Closed Drainage System Design

## Project Description

| | |
|---|---|
| File Name | 13609-Mindess SSA.SPF |

## Project Options

| | |
|---|---|
| Flow Units | CFS |
| Elevation Type | Elevation |
| Hydrology Method | Rational |
| Time of Concentration (TOC) Method | SCS TR-55 |
| Link Routing Method | Hydrodynamic |
| Enable Overflow Ponding at Nodes | YES |
| Skip Steady State Analysis Time Periods | NO |

## Analysis Options

| | | |
|---|---|---|
| Start Analysis On | 00:00:00 | 0:00:00 |
| End Analysis On | 00:00:00 | 1:00:00 |
| Start Reporting On | 00:00:00 | 0:00:00 |
| Antecedent Dry Days | 0 | days |
| Runoff (Dry Weather) Time Step | 0 01:00:00 | days hh:mm:ss |
| Runoff (Wet Weather) Time Step | 0 00:05:00 | days hh:mm:ss |
| Reporting Time Step | 0 00:05:00 | days hh:mm:ss |
| Routing Time Step | 30 | seconds |

## Number of Elements

| | Qty |
|---|---|
| Rain Gages | 0 |
| Subbasins | 60 |
| Nodes | 142 |
| *Junctions* | 127 |
| *Outfalls* | 15 |
| *Flow Diversions* | 0 |
| *Inlets* | 0 |
| *Storage Nodes* | 0 |
| Links | 126 |
| *Channels* | 0 |
| *Pipes* | 126 |
| *Pumps* | 0 |
| *Orifices* | 0 |
| *Weirs* | 0 |
| *Outlets* | 0 |
| Pollutants | 0 |
| Land Uses | 0 |

## Rainfall Details

| | |
|---|---|
| Return Period | 25 year(s) |

# Subbasin Summary

| SN | Subbasin ID | Area (ac) | Weighted Runoff Coefficient | Total Rainfall (in) | Total Runoff (in) | Total Runoff Volume (ac-in) | Peak Runoff (cfs) | Time of Concentration (days hh:mm:ss) |
|---|---|---|---|---|---|---|---|---|
| 1 | AD-112 | 0.30 | 0.60 | 0.64 | 0.38 | 0.11 | 1.15 | 0 00:06:00 |
| 2 | Sub-01 | 0.14 | 0.90 | 0.64 | 0.58 | 0.08 | 0.81 | 0 00:06:00 |
| 3 | Sub-02 | 0.15 | 0.90 | 0.64 | 0.58 | 0.09 | 0.86 | 0 00:06:00 |
| 4 | Sub-03 | 2.69 | 0.61 | 0.96 | 0.59 | 1.57 | 9.44 | 0 00:10:00 |
| 5 | Sub-04 | 3.02 | 0.64 | 0.64 | 0.41 | 1.24 | 12.35 | 0 00:06:00 |
| 6 | Sub-05 | 0.13 | 0.53 | 0.64 | 0.34 | 0.05 | 0.45 | 0 00:06:00 |
| 7 | Sub-06 | 0.23 | 0.53 | 0.64 | 0.34 | 0.08 | 0.79 | 0 00:06:00 |
| 8 | Sub-07 | 0.31 | 0.30 | 0.64 | 0.19 | 0.06 | 0.60 | 0 00:06:00 |
| 9 | Sub-08 | 0.31 | 0.30 | 0.64 | 0.19 | 0.06 | 0.60 | 0 00:06:00 |
| 10 | Sub-09 | 0.74 | 0.90 | 0.64 | 0.58 | 0.43 | 4.26 | 0 00:06:00 |
| 11 | Sub-10 | 0.16 | 0.63 | 0.64 | 0.40 | 0.07 | 0.65 | 0 00:06:00 |
| 12 | Sub-11 | 0.17 | 0.63 | 0.64 | 0.40 | 0.07 | 0.69 | 0 00:06:00 |
| 13 | Sub-12 | 0.15 | 0.53 | 0.64 | 0.34 | 0.05 | 0.51 | 0 00:06:00 |
| 14 | Sub-13 | 0.21 | 0.53 | 0.64 | 0.34 | 0.07 | 0.73 | 0 00:06:00 |
| 15 | Sub-14 | 0.47 | 0.50 | 0.64 | 0.32 | 0.15 | 1.49 | 0 00:06:00 |
| 16 | Sub-15 | 0.31 | 0.30 | 0.64 | 0.19 | 0.06 | 0.60 | 0 00:06:00 |
| 17 | Sub-16 | 0.22 | 0.62 | 0.64 | 0.40 | 0.09 | 0.86 | 0 00:06:00 |
| 18 | Sub-17 | 0.35 | 0.90 | 0.64 | 0.58 | 0.20 | 2.01 | 0 00:06:00 |
| 19 | Sub-18 | 0.02 | 0.90 | 0.64 | 0.58 | 0.01 | 0.12 | 0 00:06:00 |
| 20 | Sub-19 | 0.45 | 0.53 | 0.64 | 0.34 | 0.15 | 1.52 | 0 00:06:00 |
| 21 | Sub-20 | 0.10 | 0.90 | 0.64 | 0.58 | 0.06 | 0.57 | 0 00:06:00 |
| 22 | Sub-21 | 0.06 | 0.71 | 0.64 | 0.45 | 0.03 | 0.25 | 0 00:06:00 |
| 23 | Sub-22 | 0.26 | 0.77 | 0.64 | 0.49 | 0.13 | 1.25 | 0 00:06:00 |
| 24 | Sub-23 | 0.63 | 0.87 | 0.64 | 0.56 | 0.35 | 3.50 | 0 00:06:00 |
| 25 | Sub-24 | 0.03 | 9.00 | 0.64 | 5.75 | 0.16 | 1.55 | 0 00:06:00 |
| 26 | Sub-25 | 0.12 | 0.90 | 0.64 | 0.58 | 0.07 | 0.69 | 0 00:06:00 |
| 27 | Sub-26 | 0.32 | 0.77 | 0.64 | 0.49 | 0.16 | 1.56 | 0 00:06:00 |
| 28 | Sub-27 | 0.06 | 0.90 | 0.64 | 0.58 | 0.04 | 0.37 | 0 00:06:00 |
| 29 | Sub-29 | 0.11 | 0.82 | 0.64 | 0.52 | 0.06 | 0.58 | 0 00:06:00 |
| 30 | Sub-30 | 0.21 | 0.73 | 0.64 | 0.47 | 0.10 | 0.98 | 0 00:06:00 |
| 31 | Sub-31 | 0.08 | 0.90 | 0.64 | 0.58 | 0.05 | 0.45 | 0 00:06:00 |
| 32 | Sub-33 | 0.30 | 0.68 | 0.64 | 0.43 | 0.13 | 1.30 | 0 00:06:00 |
| 33 | Sub-34 | 0.33 | 0.54 | 0.64 | 0.35 | 0.11 | 1.14 | 0 00:06:00 |
| 34 | Sub-35 | 0.23 | 0.84 | 0.64 | 0.54 | 0.12 | 1.25 | 0 00:06:00 |
| 35 | Sub-36 | 0.23 | 0.55 | 0.64 | 0.35 | 0.08 | 0.79 | 0 00:06:00 |
| 36 | Sub-37 | 0.31 | 0.90 | 0.64 | 0.58 | 0.18 | 1.78 | 0 00:06:00 |
| 37 | Sub-38 | 0.06 | 0.90 | 0.64 | 0.58 | 0.04 | 0.37 | 0 00:06:00 |
| 38 | Sub-39 | 0.47 | 0.90 | 0.64 | 0.58 | 0.27 | 2.70 | 0 00:06:00 |
| 39 | Sub-40 | 0.19 | 0.73 | 0.64 | 0.47 | 0.09 | 0.89 | 0 00:06:00 |
| 40 | Sub-41 | 0.16 | 0.75 | 0.64 | 0.48 | 0.08 | 0.77 | 0 00:06:00 |
| 41 | Sub-42 | 0.06 | 0.90 | 0.64 | 0.58 | 0.04 | 0.36 | 0 00:06:00 |
| 42 | Sub-43 | 0.08 | 0.65 | 0.64 | 0.42 | 0.03 | 0.31 | 0 00:06:00 |
| 43 | Sub-44 | 0.13 | 0.65 | 0.64 | 0.42 | 0.05 | 0.52 | 0 00:06:00 |
| 44 | Sub-45 | 0.09 | 0.76 | 0.64 | 0.49 | 0.05 | 0.46 | 0 00:06:00 |
| 45 | Sub-46 | 0.03 | 0.90 | 0.64 | 0.58 | 0.02 | 0.16 | 0 00:06:00 |
| 46 | Sub-47 | 0.52 | 0.60 | 0.64 | 0.38 | 0.20 | 1.99 | 0 00:06:00 |
| 47 | Sub-48 | 0.03 | 0.90 | 0.64 | 0.58 | 0.02 | 0.17 | 0 00:06:00 |
| 48 | Sub-49 | 0.03 | 0.90 | 0.64 | 0.58 | 0.02 | 0.18 | 0 00:06:00 |
| 49 | Sub-50 | 0.03 | 0.90 | 0.64 | 0.58 | 0.02 | 0.16 | 0 00:06:00 |
| 50 | Sub-51 | 0.03 | 0.90 | 0.64 | 0.58 | 0.02 | 0.16 | 0 00:06:00 |
| 51 | Sub-52 | 0.04 | 0.90 | 0.64 | 0.58 | 0.02 | 0.21 | 0 00:06:00 |
| 52 | Sub-53 | 0.03 | 0.90 | 0.64 | 0.58 | 0.01 | 0.14 | 0 00:06:00 |
| 53 | Sub-54 | 0.57 | 0.90 | 0.64 | 0.58 | 0.33 | 3.28 | 0 00:06:00 |
| 54 | Sub-55 | 0.34 | 0.90 | 0.64 | 0.58 | 0.19 | 1.94 | 0 00:06:00 |
| 55 | Sub-56 | 0.03 | 0.90 | 0.64 | 0.58 | 0.02 | 0.16 | 0 00:06:00 |
| 56 | Sub-57 | 0.03 | 0.90 | 0.64 | 0.58 | 0.01 | 0.14 | 0 00:06:00 |
| 57 | Sub-58 | 0.03 | 0.90 | 0.64 | 0.58 | 0.02 | 0.16 | 0 00:06:00 |
| 58 | Sub-59 | 0.02 | 0.90 | 0.64 | 0.58 | 0.01 | 0.10 | 0 00:06:00 |
| 59 | Sub-60 | 0.02 | 0.90 | 0.64 | 0.58 | 0.01 | 0.10 | 0 00:06:00 |
| 60 | Sub-61 | 0.02 | 0.90 | 0.64 | 0.58 | 0.01 | 0.12 | 0 00:06:00 |

# Junction Input

| SN | Element ID | Invert Elevation (ft) | Ground/Rim (Max) Elevation (ft) |
|---|---|---|---|
| 1 | AB#201 | 200.03 | 204.50 |
| 2 | AB#202 | 198.90 | 204.41 |
| 3 | AB#204 | 202.80 | 204.00 |
| 4 | AD#100 | 202.00 | 203.77 |
| 5 | AD#101 | 201.75 | 203.52 |
| 6 | AD#102 | 197.00 | 200.00 |
| 7 | AD#103 | 195.75 | 198.92 |
| 8 | AD#104 | 195.75 | 198.88 |
| 9 | AD#105 | 187.58 | 190.58 |
| 10 | AD#106 | 186.30 | 190.29 |
| 11 | AD#108 | 197.10 | 200.40 |
| 12 | AD#109 | 196.36 | 200.40 |
| 13 | AD#110 | 202.20 | 204.62 |
| 14 | AD#111 | 202.48 | 204.48 |
| 15 | AD#112 | 197.70 | 200.70 |
| 16 | AD#113 | 196.40 | 201.00 |
| 17 | AD#116 | 192.10 | 194.10 |
| 18 | AD#118 | 192.40 | 194.40 |
| 19 | AD#119 | 192.05 | 194.80 |
| 20 | CB#100 | 201.14 | 204.14 |
| 21 | CB#101 | 207.95 | 211.50 |
| 22 | CB#102 | 195.26 | 198.24 |
| 23 | CB#103 | 191.50 | 194.95 |
| 24 | CB#104 | 187.30 | 190.53 |
| 25 | CB#105 | 185.11 | 188.65 |
| 26 | CB#106 | 185.15 | 188.70 |
| 27 | CB#108 | 202.80 | 205.62 |
| 28 | CB#109 | 202.80 | 205.68 |
| 29 | CB#110 | 200.00 | 202.77 |
| 30 | CB#111 | 200.13 | 202.96 |
| 31 | CB#112 | 200.00 | 203.30 |
| 32 | CB#113 | 194.35 | 198.62 |
| 33 | CB#114 | 194.50 | 197.77 |
| 34 | CB#115 | 193.25 | 196.42 |
| 35 | CB#116 | 193.30 | 196.45 |
| 36 | CB#117 | 191.62 | 194.32 |
| 37 | CB#118 | 191.60 | 194.40 |
| 38 | CB#119 | 191.30 | 194.78 |
| 39 | CB#120 | 191.20 | 194.75 |
| 40 | CB#121 | 199.23 | 202.10 |
| 41 | CB#122 | 199.23 | 202.10 |
| 42 | CB#123 | 198.50 | 201.60 |
| 43 | CB#124 | 196.80 | 199.80 |
| 44 | CB#125 | 195.45 | 198.43 |
| 45 | CB#127 | 196.00 | 199.00 |
| 46 | CB#128 | 196.00 | 199.04 |
| 47 | CB#129 | 200.64 | 203.70 |
| 48 | DCB#100 | 196.50 | 199.50 |
| 49 | DCB#107 | 202.34 | 205.37 |
| 50 | DMH#200 | 200.90 | 204.14 |
| 51 | DMH#201 | 200.90 | 204.01 |
| 52 | DMH#202 | 199.90 | 204.54 |
| 53 | DMH#203 | 198.90 | 210.13 |
| 54 | DMH#204 | 197.35 | 211.33 |
| 55 | DMH#205 | 195.31 | 201.03 |
| 56 | DMH#206 | 195.40 | 199.33 |
| 57 | DMH#207 | 191.20 | 194.80 |
| 58 | DMH#208 | 187.10 | 190.35 |
| 59 | DMH#209 | 195.80 | 199.00 |
| 60 | DMH#210 | 201.90 | 204.11 |
| 61 | DMH#212 | 201.25 | 206.30 |
| 62 | DMH#213 | 200.70 | 205.60 |
| 63 | DMH#214 | 199.70 | 202.80 |
| 64 | DMH#215 | 198.20 | 202.25 |
| 65 | DMH#216 | 195.10 | 198.60 |
| 66 | DMH#217 | 193.40 | 197.90 |
| 67 | DMH#219 | 192.95 | 196.05 |
| 68 | DMH#220 | 191.40 | 194.50 |
| 69 | DMH#221 | 191.10 | 194.15 |
| 70 | DMH#222 | 190.75 | 194.69 |
| 71 | DMH#223 | 190.15 | 195.12 |
| 72 | DMH#224 | 199.05 | 202.09 |
| 73 | DMH#225 | 198.28 | 201.46 |
| 74 | DMH#226 | 196.50 | 199.53 |
| 75 | DMH#227 | 195.90 | 199.00 |

# Junction Input

| SN | Element ID | Invert Elevation (ft) | Ground/Rim (Max) Elevation (ft) |
|---|---|---|---|
| 76 | DMH#229 | 195.50 | 198.82 |
| 77 | DMH#231 | 197.67 | 204.50 |
| 78 | DMH#232 | 196.70 | 202.94 |
| 79 | DMH#233 | 195.30 | 200.57 |
| 80 | DMH#234 | 188.70 | 195.23 |
| 81 | DMH#237 | 185.70 | 191.28 |
| 82 | DS 7 & 8 | 202.80 | 203.58 |
| 83 | DS#10 | 203.00 | 203.39 |
| 84 | DS#11 | 203.00 | 203.57 |
| 85 | DS#12 | 203.00 | 203.57 |
| 86 | DS#13 | 203.00 | 203.39 |
| 87 | DS#13-14 | 202.70 | 203.27 |
| 88 | DS#14 | 203.00 | 203.39 |
| 89 | DS#15 | 203.00 | 203.39 |
| 90 | DS#16 | 203.50 | 203.39 |
| 91 | DS#17 | 203.20 | 203.39 |
| 92 | DS#18 | 203.00 | 203.39 |
| 93 | DS#7 | 203.01 | 203.57 |
| 94 | DS#8 | 203.00 | 203.57 |
| 95 | DS#9 | 203.00 | 203.39 |
| 96 | DS13-14 | 202.70 | 213.72 |
| 97 | NE ROOF | 202.70 | 202.80 |
| 98 | OCS#400 | 193.90 | 198.36 |
| 99 | OCS#401 | 186.40 | 191.23 |
| 100 | OCS#402 | 184.40 | 189.71 |
| 101 | OCS#403 | 200.33 | 204.75 |
| 102 | RD#1 | 200.25 | 205.00 |
| 103 | RD#2 | 198.00 | 205.00 |
| 104 | RD#3 | 202.80 | 214.55 |
| 105 | RD#7,8 | 203.00 | 203.57 |
| 106 | RD#7-8 | 203.00 | 203.57 |
| 107 | RETAINING WALL | 202.00 | 202.57 |
| 108 | ROOF DRAIN | 202.10 | 203.26 |
| 109 | SI#2 | 186.50 | 187.66 |
| 110 | SSD#1 | 203.33 | 203.90 |
| 111 | Structure - (624) | 202.80 | 203.40 |
| 112 | Structure - (711) | -3.37 | 213.71 |
| 113 | Structure - (714) | 202.95 | 203.52 |
| 114 | Structure - (725) | 202.90 | 203.29 |
| 115 | Structure - (846) | 203.47 | 203.34 |
| 116 | Structure - (847) | 202.85 | 203.11 |
| 117 | Structure - (849) | 203.10 | 203.27 |
| 118 | Structure - (882) | 202.50 | 202.55 |
| 119 | TD#1 | 200.85 | 202.01 |
| 120 | WQI#130 | 179.30 | 183.00 |
| 121 | WQS#200 | 194.20 | 199.99 |
| 122 | WQS#201 | 186.60 | 190.10 |
| 123 | WQS#202 | 184.76 | 189.00 |
| 124 | WQS#203 | 200.57 | 205.50 |
| 125 | WQS#204 | 199.50 | 202.60 |
| 126 | WQS#205 | 193.60 | 197.85 |
| 127 | WQS#206 | 190.35 | 195.40 |

# Link Summary

| From (Inlet) Node | To (Outlet) Node | Pipe Length | Inlet Invert Elevation | Outlet Invert Elevation | Pipe Slope | Pipe Diameter | Manning's Roughness | Peak Flow Q | Design Flow Capacity Qf | Q/Qf Ratio | Peak Flow Velocity V | Peak Flow Depth | Peak Flow Depth/ Total Depth Ratio |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | (ft) | (ft) | (ft) | (%) | (in) | | (cfs) | (cfs) | | (ft/sec) | (ft) | |
| AD#102 | DMH#205 | 28.43 | 197.00 | 196.00 | 3.52 | 10.0 | 0.012 | 0.60 | 4.45 | 0.13 | 4.76 | 0.33 | 0.40 |
| AD#101 | DMH#200 | 119.20 | 201.75 | 201.00 | 0.63 | 12.0 | 0.015 | 1.16 | 2.45 | 0.48 | 2.78 | 0.53 | 0.53 |
| CB#113 | WQS#205 | 67.66 | 194.35 | 193.70 | 0.96 | 12.0 | 0.012 | 0.87 | 3.78 | 0.23 | 1.94 | 0.56 | 0.56 |
| CB#123 | DMH#225 | 12.42 | 198.50 | 198.38 | 0.97 | 12.0 | 0.012 | 0.25 | 3.79 | 0.07 | 1.71 | 0.32 | 0.32 |
| CB#112 | DMH#214 | 31.50 | 200.00 | 199.80 | 0.63 | 12.0 | 0.012 | 0.43 | 3.08 | 0.14 | 1.45 | 0.50 | 0.50 |
| DMH#225 | DMH#226 | 101.18 | 198.28 | 196.65 | 1.61 | 12.0 | 0.012 | 2.25 | 4.90 | 0.46 | 4.58 | 0.74 | 0.74 |
| CB#104 | DMH#208 | 11.45 | 187.30 | 187.20 | 0.87 | 12.0 | 0.012 | 0.78 | 3.61 | 0.22 | 3.11 | 0.35 | 0.36 |
| CB#103 | DMH#207 | 9.88 | 191.50 | 191.30 | 2.02 | 12.0 | 0.012 | 0.45 | 5.49 | 0.08 | 3.51 | 0.22 | 0.22 |
| DMH#207 | DMH#208 | 181.36 | 191.20 | 187.20 | 2.21 | 12.0 | 0.012 | 0.44 | 5.73 | 0.08 | 3.38 | 0.23 | 0.23 |
| DMH#208 | WQS#201 | 8.97 | 187.10 | 186.70 | 4.46 | 12.0 | 0.012 | 1.19 | 8.15 | 0.15 | 4.33 | 0.38 | 0.38 |
| WQS#201 | Out-1Pipe - (185) | 9.22 | 186.60 | 186.50 | 1.08 | 12.0 | 0.012 | 1.18 | 4.02 | 0.29 | 3.64 | 0.43 | 0.43 |
| CB#101 | DMH#204 | 11.35 | 207.95 | 207.75 | 1.76 | 12.0 | 0.012 | 1.48 | 5.12 | 0.29 | 4.46 | 0.44 | 0.44 |
| DMH#204 | DMH#205 | 186.90 | 197.35 | 195.41 | 1.04 | 18.0 | 0.012 | 6.65 | 11.58 | 0.57 | 5.40 | 0.99 | 0.66 |
| WQS#200 | Out-1Pipe - (193) | 13.81 | 194.20 | 194.00 | 1.45 | 24.0 | 0.012 | 7.83 | 29.50 | 0.27 | 5.97 | 0.87 | 0.43 |
| CB#100 | DMH#200 | 15.35 | 201.14 | 201.00 | 0.91 | 12.0 | 0.012 | 0.71 | 3.69 | 0.19 | 2.52 | 0.51 | 0.51 |
| DMH#213 | WQS#203 | 5.68 | 200.70 | 200.67 | 0.53 | 15.0 | 0.012 | 5.53 | 5.09 | 1.09 | 4.51 | 1.25 | 1.00 |
| CB#124 | DMH#226 | 22.31 | 196.80 | 196.60 | 0.90 | 12.0 | 0.012 | 1.26 | 3.65 | 0.35 | 2.76 | 1.00 | 1.00 |
| CB#128 | DMH#209 | 36.33 | 196.00 | 195.90 | 0.28 | 12.0 | 0.012 | 0.35 | 2.03 | 0.17 | 1.07 | 0.99 | 0.99 |
| CB#127 | DMH#209 | 22.53 | 196.00 | 195.90 | 0.44 | 12.0 | 0.012 | 1.51 | 2.57 | 0.59 | 2.55 | 1.00 | 1.00 |
| DMH#209 | DMH#229 | 42.68 | 195.80 | 195.60 | 0.47 | 12.0 | 0.012 | 1.75 | 2.64 | 0.66 | 2.23 | 1.00 | 1.00 |
| DMH#229 | Out-1Pipe - (204) | 64.61 | 195.50 | 195.30 | 0.31 | 24.0 | 0.012 | 8.26 | 13.63 | 0.61 | 4.31 | 1.18 | 0.59 |
| CB#116 | DMH#219 | 18.29 | 193.30 | 193.15 | 0.82 | 12.0 | 0.012 | 2.70 | 3.50 | 0.77 | 3.44 | 1.00 | 1.00 |
| CB#115 | DMH#219 | 23.97 | 193.25 | 193.05 | 0.83 | 12.0 | 0.012 | 0.37 | 3.53 | 0.11 | 1.03 | 1.00 | 1.00 |
| CB#117 | DMH#220 | 15.06 | 191.62 | 191.50 | 0.80 | 12.0 | 0.012 | 1.64 | 3.45 | 0.47 | 2.42 | 1.00 | 1.00 |
| DMH#220 | DMH#221 | 22.71 | 191.40 | 191.20 | 0.88 | 12.0 | 0.012 | 5.04 | 3.62 | 1.39 | 6.42 | 1.00 | 1.00 |
| CB#118 | DMH#220 | 8.67 | 191.60 | 191.50 | 1.15 | 12.0 | 0.012 | 1.59 | 4.15 | 0.38 | 2.58 | 1.00 | 1.00 |
| DMH#227 | DMH#229 | 111.52 | 195.90 | 195.60 | 0.27 | 18.0 | 0.012 | 6.58 | 5.90 | 1.12 | 3.90 | 1.36 | 0.91 |
| CB#120 | DMH#222 | 20.74 | 191.20 | 191.00 | 0.96 | 12.0 | 0.012 | 0.70 | 3.79 | 0.18 | 1.67 | 1.00 | 1.00 |
| CB#119 | DMH#222 | 31.37 | 191.30 | 191.00 | 0.96 | 12.0 | 0.012 | 0.59 | 3.77 | 0.16 | 1.34 | 1.00 | 1.00 |
| WQI#130 | Out-1Pipe - (223) | 16.13 | 179.30 | 179.10 | 1.24 | 12.0 | 0.012 | 2.12 | 4.30 | 0.49 | 4.49 | 0.58 | 0.58 |
| CB#106 | WQS#202 | 7.95 | 185.15 | 184.89 | 3.27 | 12.0 | 0.012 | 0.86 | 6.98 | 0.12 | 3.56 | 0.39 | 0.39 |
| CB#105 | WQS#202 | 26.88 | 185.11 | 184.86 | 0.93 | 12.0 | 0.012 | 0.80 | 3.72 | 0.22 | 2.57 | 0.42 | 0.42 |
| WQS#202 | Out-1Pipe - (231) | 20.43 | 184.76 | 184.50 | 1.27 | 12.0 | 0.012 | 1.65 | 4.35 | 0.38 | 4.33 | 0.49 | 0.49 |
| OCS#402 | Out-1Pipe - (240) | 55.31 | 184.40 | 184.00 | 0.72 | 15.0 | 0.012 | 14.36 | 5.95 | 2.41 | 11.70 | 1.25 | 1.00 |
| DMH#237 | Out-1Pipe - (242) | 152.20 | 185.70 | 184.50 | 0.79 | 18.0 | 0.012 | 7.95 | 10.10 | 0.79 | 5.80 | 1.09 | 0.73 |
| SI#2 | OCS#401 | 7.28 | 186.50 | 186.50 | 0.00 | 12.0 | 0.012 | 0.11 | 1.22 | 0.09 | 1.19 | 0.18 | 0.18 |
| OCS#400 | DMH#237 | 331.72 | 193.90 | 188.07 | 1.76 | 15.0 | 0.012 | 9.51 | 9.28 | 1.03 | 8.02 | 1.21 | 0.97 |
| DCB#107 | DMH#212 | 120.19 | 202.34 | 201.35 | 0.82 | 12.0 | 0.012 | 1.21 | 3.50 | 0.35 | 2.74 | 0.70 | 0.70 |
| DMH#212 | DMH#213 | 90.08 | 201.25 | 200.80 | 0.50 | 15.0 | 0.012 | 3.45 | 4.95 | 0.70 | 2.81 | 1.25 | 1.00 |
| DMH#215 | DMH#216 | 223.22 | 198.20 | 195.20 | 1.34 | 15.0 | 0.012 | 5.19 | 8.11 | 0.64 | 6.64 | 0.76 | 0.61 |
| CB#110 | DMH#214 | 28.93 | 200.00 | 199.80 | 0.69 | 12.0 | 0.012 | 0.96 | 3.21 | 0.30 | 2.25 | 0.54 | 0.54 |
| AB#201 | AB#202 | 80.58 | 200.03 | 199.00 | 1.28 | 12.0 | 0.012 | 3.24 | 4.36 | 0.74 | 5.01 | 0.77 | 0.77 |
| RD#1 | AB#201 | 7.38 | 200.25 | 200.20 | 0.68 | 12.0 | 0.012 | 3.28 | 3.18 | 1.03 | 4.45 | 0.89 | 0.89 |
| AB#202 | DMH#232 | 35.49 | 198.90 | 198.50 | 1.13 | 12.0 | 0.012 | 3.21 | 4.10 | 0.78 | 4.97 | 0.77 | 0.77 |
| DMH#232 | DMH#233 | 215.57 | 196.70 | 195.40 | 0.60 | 15.0 | 0.012 | 4.89 | 5.43 | 0.90 | 4.00 | 1.25 | 1.00 |
| DMH#233 | Out-1Pipe - (303) (5) | 51.23 | 195.30 | 194.75 | 1.07 | 15.0 | 0.012 | 7.47 | 7.25 | 1.03 | 6.26 | 1.17 | 0.93 |
| AD#116 | DMH#234 | 81.98 | 192.10 | 188.80 | 4.03 | 15.0 | 0.012 | 11.50 | 14.04 | 0.82 | 9.40 | 1.25 | 1.00 |

# Link Summary

| From (Inlet) Node | To (Outlet) Node | Pipe Length | Inlet Invert Elevation | Outlet Invert Elevation | Pipe Slope | Pipe Diameter | Manning's Roughness | Peak Flow Q | Design Flow Capacity Qf | Q/Qf Ratio | Peak Flow Velocity V | Peak Flow Depth | Peak Flow Depth/ Total Depth Ratio |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | (ft) | (ft) | (ft) | (%) | (in) | | (cfs) | (cfs) | | (ft/sec) | (ft) | |
| TD#1 | DMH#202 | 40.62 | 200.85 | 200.45 | 0.98 | 12.0 | 0.012 | 0.64 | 3.83 | 0.17 | 2.58 | 0.36 | 0.36 |
| DMH#203 | DMH#204 | 174.30 | 198.90 | 197.50 | 0.80 | 18.0 | 0.012 | 5.48 | 10.20 | 0.54 | 5.48 | 0.83 | 0.55 |
| CB#125 | WQS#205 | 43.17 | 195.45 | 195.00 | 1.04 | 12.0 | 0.012 | 1.53 | 3.94 | 0.39 | 4.20 | 0.47 | 0.47 |
| DMH#226 | DMH#227 | 30.08 | 196.50 | 196.00 | 1.66 | 12.0 | 0.012 | 3.45 | 4.98 | 0.69 | 4.39 | 1.00 | 1.00 |
| CB#114 | WQS#205 | 31.21 | 194.50 | 194.20 | 0.96 | 12.0 | 0.012 | 1.44 | 3.78 | 0.38 | 3.94 | 0.47 | 0.47 |
| DCB#100 | DMH#227 | 50.80 | 196.50 | 196.00 | 0.98 | 15.0 | 0.012 | 3.28 | 6.94 | 0.47 | 3.64 | 1.21 | 0.97 |
| WQS#205 | DMH#217 | 8.74 | 193.60 | 193.50 | 1.14 | 15.0 | 0.012 | 3.82 | 7.48 | 0.51 | 4.86 | 0.76 | 0.61 |
| AD#100 | AD#101 | 27.14 | 202.00 | 201.85 | 0.55 | 12.0 | 0.012 | 0.68 | 2.87 | 0.24 | 2.35 | 0.41 | 0.41 |
| DMH#202 | DMH#203 | 109.57 | 199.90 | 199.00 | 0.82 | 18.0 | 0.012 | 5.50 | 10.31 | 0.53 | 5.39 | 0.84 | 0.56 |
| CB#109 | DMH#213 | 18.58 | 202.80 | 202.65 | 0.81 | 12.0 | 0.012 | 1.77 | 3.47 | 0.51 | 3.79 | 0.57 | 0.57 |
| CB#108 | DMH#213 | 41.41 | 202.80 | 202.40 | 0.97 | 12.0 | 0.012 | 0.78 | 3.79 | 0.20 | 3.47 | 0.33 | 0.33 |
| CB#111 | DMH#214 | 7.44 | 200.13 | 200.00 | 1.75 | 12.0 | 0.012 | 0.57 | 5.10 | 0.11 | 2.99 | 0.36 | 0.36 |
| DMH#221 | DMH#222 | 35.46 | 191.10 | 190.85 | 0.71 | 12.0 | 0.012 | 4.21 | 3.24 | 1.30 | 5.52 | 1.00 | 1.00 |
| DMH#234 | Out-1Pipe - (367) | 71.35 | 188.70 | 187.70 | 1.40 | 15.0 | 0.012 | 10.05 | 8.28 | 1.21 | 8.25 | 1.22 | 0.97 |
| CB#121 | DMH#224 | 23.81 | 199.23 | 199.00 | 0.97 | 12.0 | 0.012 | 1.50 | 3.36 | 0.45 | 2.89 | 0.63 | 0.63 |
| CB#122 | DMH#224 | 7.76 | 199.23 | 199.15 | 1.03 | 12.0 | 0.012 | 0.55 | 3.92 | 0.14 | 2.01 | 0.50 | 0.50 |
| DMH#224 | DMH#225 | 52.14 | 199.05 | 198.56 | 0.94 | 12.0 | 0.012 | 2.02 | 3.74 | 0.54 | 4.36 | 0.57 | 0.57 |
| CB#102 | WQS#200 | 48.86 | 195.26 | 195.00 | 0.53 | 12.0 | 0.012 | 0.83 | 2.82 | 0.30 | 2.87 | 0.40 | 0.40 |
| DMH#231 | DMH#232 | 69.09 | 197.67 | 196.95 | 1.04 | 12.0 | 0.012 | 2.38 | 3.94 | 0.60 | 3.95 | 0.93 | 0.93 |
| RD#2 | DMH#231 | 15.69 | 198.00 | 197.84 | 1.02 | 10.0 | 0.012 | 1.95 | 2.40 | 0.81 | 3.97 | 0.76 | 0.91 |
| AD#104 | DMH#206 | 25.98 | 195.75 | 195.50 | 0.96 | 12.0 | 0.012 | 0.59 | 3.79 | 0.16 | 2.80 | 0.32 | 0.32 |
| AD#103 | DMH#206 | 29.15 | 195.75 | 195.50 | 0.86 | 12.0 | 0.012 | 0.59 | 3.57 | 0.17 | 2.75 | 0.32 | 0.32 |
| AD#105 | Out-1Pipe - (411) | 40.31 | 187.58 | 184.50 | 7.64 | 12.0 | 0.012 | 9.44 | 10.67 | 0.88 | 13.06 | 0.87 | 0.87 |
| AD#106 | Out-1Pipe - (412) | 45.87 | 186.30 | 184.50 | 3.92 | 12.0 | 0.012 | 9.25 | 7.65 | 1.21 | 11.78 | 1.00 | 1.00 |
| DMH#216 | DMH#217 | 42.32 | 195.10 | 194.50 | 1.42 | 15.0 | 0.012 | 0.00 | 8.33 | 0.00 | 0.00 | 0.00 | 0.00 |
| DMH#217 | DMH#223 | 173.56 | 193.40 | 190.65 | 1.58 | 15.0 | 0.012 | 3.78 | 8.81 | 0.43 | 3.95 | 0.91 | 0.73 |
| AD#108 | AD#109 | 37.83 | 197.10 | 196.70 | 1.06 | 8.0 | 0.012 | 1.26 | 1.35 | 0.93 | 3.85 | 0.59 | 0.88 |
| AD#109 | DMH#216 | 40.60 | 196.36 | 195.20 | 2.86 | 12.0 | 0.012 | 3.04 | 6.52 | 0.47 | 6.96 | 0.54 | 0.54 |
| DMH#214 | WQS#204 | 11.47 | 199.70 | 199.60 | 0.87 | 12.0 | 0.012 | 1.91 | 3.60 | 0.53 | 3.87 | 0.60 | 0.60 |
| DMH#200 | DMH#202 | 79.48 | 200.90 | 200.40 | 0.63 | 12.0 | 0.012 | 1.92 | 3.06 | 0.63 | 3.78 | 0.62 | 0.62 |
| ROOF DRAIN | DMH#201 | 8.22 | 202.10 | 201.00 | 13.38 | 12.0 | 0.012 | 2.91 | 14.12 | 0.21 | 4.11 | 0.86 | 0.86 |
| DMH#201 | DMH#202 | 54.76 | 200.90 | 200.40 | 0.91 | 12.0 | 0.012 | 2.91 | 3.69 | 0.79 | 4.65 | 0.75 | 0.75 |
| DS#7 | RD#7-8 | 2.83 | 203.01 | 202.90 | 3.71 | 6.0 | 0.012 | 0.09 | 0.26 | 0.37 | 1.86 | 0.19 | 0.38 |
| RD#7-8 | DS 7 & 8 | 26.98 | 203.00 | 202.80 | 0.74 | 6.0 | 0.012 | 0.09 | 0.52 | 0.18 | 1.71 | 0.19 | 0.39 |
| DS#8 | DS 7 & 8 | 3.11 | 203.00 | 203.00 | 0.00 | 6.0 | 0.012 | 0.09 | 0.19 | 0.49 | 1.49 | 0.18 | 0.36 |
| DMH#222 | WQS#206 | 44.55 | 190.75 | 190.45 | 0.67 | 12.0 | 0.012 | 4.29 | 3.17 | 1.35 | 5.46 | 1.00 | 1.00 |
| WQS#206 | DMH#223 | 10.58 | 190.35 | 190.25 | 0.94 | 12.0 | 0.012 | 4.29 | 3.75 | 1.14 | 5.46 | 1.00 | 1.00 |
| DMH#219 | DMH#220 | 83.85 | 192.95 | 191.55 | 1.67 | 12.0 | 0.012 | 3.08 | 4.99 | 0.62 | 3.92 | 1.00 | 1.00 |
| OCS#403 | DMH#215 | 146.46 | 200.33 | 198.30 | 1.39 | 15.0 | 0.012 | 3.34 | 8.24 | 0.41 | 5.98 | 0.64 | 0.51 |
| DMH#223 | Out-1Pipe - (498) | 15.68 | 190.15 | 190.05 | 0.64 | 15.0 | 0.012 | 7.87 | 5.59 | 1.41 | 6.56 | 1.18 | 0.94 |
| SSD#1 | AB#202 | 8.95 | 203.33 | 203.20 | 1.45 | 6.0 | 0.012 | 0.00 | 0.73 | 0.00 | 0.00 | 0.00 | 0.00 |
| DMH#205 | WQS#200 | 19.87 | 195.31 | 195.10 | 1.08 | 18.0 | 0.012 | 7.11 | 11.81 | 0.60 | 5.66 | 1.00 | 0.67 |
| Structure - (711) | RD#3 | 32.25 | -3.37 | -3.69 | 1.00 | 8.0 | 0.012 | 1.14 | 33.10 | 0.03 | 29.78 | 0.33 | 0.50 |
| RD#3 | DMH#210 | 41.25 | 202.80 | 202.25 | 1.33 | 15.0 | 0.012 | 0.00 | 8.08 | 0.00 | 0.03 | 0.26 | 0.21 |
| Structure - (714) | AB#204 | 32.17 | 202.95 | 202.80 | 0.47 | 6.0 | 0.012 | 0.19 | 0.42 | 0.46 | 1.79 | 0.32 | 0.65 |
| DS#12 | AB#204 | 5.41 | 203.00 | 202.80 | 3.69 | 6.0 | 0.012 | 0.14 | 1.17 | 0.12 | 2.55 | 0.27 | 0.54 |
| DS#11 | Structure - (714) | 5.36 | 203.00 | 202.95 | 0.93 | 6.0 | 0.012 | 0.20 | 0.59 | 0.34 | 2.36 | 0.31 | 0.63 |

# Link Summary

| From (Inlet) Node | To (Outlet) Node | Pipe Length | Inlet Invert Elevation | Outlet Invert Elevation | Pipe Slope | Pipe Diameter | Manning's Roughness | Peak Flow Q | Design Flow Capacity Qf | Q/Qf Ratio | Peak Flow Velocity V | Peak Flow Depth | Peak Flow Depth/ Total Depth Ratio |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | (ft) | (ft) | (ft) | (%) | (in) | | (cfs) | (cfs) | | (ft/sec) | (ft) | |
| DS#9 | Structure - (711) | 5.52 | 203.00 | 203.00 | 0.00 | 4.0 | 0.012 | 0.16 | 0.07 | 2.46 | 2.05 | 0.28 | 0.84 |
| DS#10 | RD#3 | 5.47 | 203.00 | 203.00 | 0.00 | 4.0 | 0.012 | 0.16 | 0.07 | 2.46 | 2.05 | 0.28 | 0.84 |
| AB#204 | Structure - (711) | 76.08 | 202.80 | 202.40 | 0.53 | 6.0 | 0.012 | 0.31 | 0.44 | 0.70 | 2.42 | 0.31 | 0.62 |
| DMH#210 | DMH#212 | 98.95 | 201.90 | 201.35 | 0.56 | 15.0 | 0.012 | 2.49 | 5.22 | 0.48 | 3.26 | 1.06 | 0.85 |
| AD#111 | DMH#210 | 36.44 | 202.48 | 202.10 | 1.04 | 10.0 | 0.012 | 1.29 | 2.42 | 0.53 | 3.66 | 0.57 | 0.69 |
| AD#110 | DMH#210 | 8.68 | 202.20 | 202.10 | 1.15 | 10.0 | 0.012 | 1.12 | 2.55 | 0.44 | 3.27 | 0.66 | 0.79 |
| DS#13 | Structure - (725) | 4.58 | 203.00 | 202.90 | 2.18 | 4.0 | 0.012 | 0.14 | 0.30 | 0.46 | 2.33 | 0.32 | 0.96 |
| Structure - (725) | DS#13-14 | 32.16 | 202.90 | 202.70 | 0.62 | 4.0 | 0.012 | 0.13 | 0.16 | 0.79 | 1.48 | 0.33 | 1.00 |
| DS#14 | DS#13-14 | 4.66 | 203.00 | 202.70 | 6.43 | 4.0 | 0.012 | 0.18 | 0.52 | 0.34 | 2.51 | 0.33 | 1.00 |
| DS#15 | DS#15 | 5.65 | 203.00 | 203.00 | 0.00 | 4.0 | 0.012 | 0.00 | 0.07 | 0.00 | 0.00 | 0.33 | 1.00 |
| DS#15 | DMH#231 | 24.83 | 203.00 | 202.00 | 4.03 | 4.0 | 0.012 | 0.16 | 0.41 | 0.38 | 2.37 | 0.24 | 0.71 |
| DS#13-14 | DMH#231 | 23.08 | 202.70 | 202.00 | 3.03 | 6.0 | 0.012 | 0.27 | 1.06 | 0.26 | 2.59 | 0.28 | 0.56 |
| WQS#204 | DMH#215 | 48.88 | 199.50 | 198.30 | 2.46 | 12.0 | 0.012 | 1.92 | 6.05 | 0.32 | 4.20 | 0.56 | 0.56 |
| AD#112 | AD#113 | 109.44 | 197.70 | 196.50 | 1.10 | 8.0 | 0.012 | 1.15 | 1.37 | 0.84 | 3.29 | 0.67 | 1.00 |
| AD#113 | DMH#233 | 24.41 | 196.40 | 196.15 | 1.02 | 8.0 | 0.012 | 3.14 | 1.32 | 2.37 | 9.00 | 0.67 | 1.00 |
| WQS#203 | Out-1Pipe - (530) | 6.37 | 200.57 | 200.53 | 0.63 | 15.0 | 0.012 | 5.53 | 5.54 | 1.00 | 4.83 | 1.10 | 0.88 |
| OCS#401 | DMH#237 | 11.15 | 186.40 | 186.20 | 1.79 | 12.0 | 0.012 | 1.62 | 5.17 | 0.31 | 6.92 | 0.34 | 0.34 |
| RETAINING WALL | DMH#203 | 19.73 | 202.00 | 201.00 | 5.07 | 6.0 | 0.012 | 0.00 | 1.37 | 0.00 | 0.00 | 0.00 | 0.00 |
| DMH#206 | Out-1Pipe - (533) | 27.30 | 195.40 | 195.00 | 1.47 | 12.0 | 0.012 | 1.19 | 4.67 | 0.25 | 4.32 | 0.38 | 0.38 |
| DS 7 & 8 | Structure - (882) | 8.82 | 202.80 | 202.50 | 3.40 | 8.0 | 0.012 | 0.04 | 2.41 | 0.02 | 1.34 | 0.37 | 0.55 |
| AD#118 | AD#119 | 33.29 | 192.40 | 192.15 | 0.75 | 12.0 | 0.012 | 2.90 | 3.34 | 0.87 | 3.69 | 1.00 | 1.00 |
| AD#119 | DMH#220 | 64.32 | 192.05 | 191.50 | 0.86 | 12.0 | 0.012 | 5.42 | 3.57 | 1.52 | 6.94 | 1.00 | 1.00 |
| CB#129 | DMH#202 | 14.79 | 200.64 | 200.45 | 1.28 | 12.0 | 0.012 | 0.11 | 4.37 | 0.03 | 1.88 | 0.26 | 0.26 |
| DS#16 | Structure - (846) | 2.50 | 203.50 | 203.47 | 1.20 | 4.0 | 0.012 | 0.14 | 0.23 | 0.63 | 2.25 | 0.32 | 0.97 |
| Structure - (846) | Structure - (849) | 47.85 | 203.47 | 203.10 | 0.77 | 4.0 | 0.012 | 0.14 | 0.18 | 0.75 | 1.56 | 0.32 | 0.97 |
| Structure - (849) | Structure - (847) | 32.16 | 203.10 | 202.85 | 0.78 | 6.0 | 0.012 | 0.27 | 0.54 | 0.50 | 1.80 | 0.41 | 0.83 |
| DS#17 | Structure - (849) | 2.76 | 203.20 | 203.10 | 3.63 | 4.0 | 0.012 | 0.14 | 0.39 | 0.37 | 2.43 | 0.33 | 1.00 |
| DS#18 | Structure - (847) | 2.99 | 203.00 | 202.85 | 5.02 | 4.0 | 0.012 | 0.18 | 0.46 | 0.38 | 2.46 | 0.33 | 1.00 |
| Structure - (847) | NE ROOF | 22.01 | 202.85 | 202.70 | 0.68 | 8.0 | 0.012 | 0.43 | 1.08 | 0.40 | 2.70 | 0.43 | 0.65 |
| NE ROOF | DMH#210 | 80.80 | 202.70 | 202.10 | 0.74 | 8.0 | 0.012 | 0.42 | 1.13 | 0.37 | 2.36 | 0.55 | 0.82 |
| Structure - (882) | DS 7 & 8 | 6.78 | 202.50 | 202.80 | -4.42 | 8.0 | 0.012 | 0.04 | 2.75 | 0.02 | 1.34 | 0.37 | 0.55 |
| DS 7 & 8 | DMH#200 | 46.34 | 202.80 | 201.40 | 3.02 | 8.0 | 0.012 | 0.18 | 2.28 | 0.08 | 2.43 | 0.19 | 0.28 |

## 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

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## 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, Department of Public Works
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 catch basins with a deep-sump and hood and then to a water quality structure.

### 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. All fertilizers used onsite shall have a low nutrient content. 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 Filter Strips

Vegetated filter strips shall be inspected twice per year during the first year after construction. In subsequent years, they shall be inspected annually and after rain events greater than 2.5 inches in 24 hours. Inspection and maintenance procedures for vegetated filter strips are provided below:

- Inspect the vegetation for sediment buildup and signs of erosion, base spots, and overall health. 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.

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.

Sediment Forebays

- Inspect sediment forebay monthly. Inspect the basin for trash and sediment accumulation. Clean all sediment out of forebay at least four times a year. Stabilize the floor and sidewalls of the sediment forebay as required.

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 | Only for plant establishment | As needed |
| | 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.

Constructed Stormwater Wetland (Existing Isolated Vegetated Wetland)

Inspect constructed stormwater wetland at least once per year and after major storm events (rainfall totals greater than 2.5 inches in 24 hours). Check for general health of vegetation, signs of erosion, and presence of invasive species. Remove invasive species as needed to prevent their spread. Clean out wet sediment forebay at least once per year. Clean out sediment in basin/constructed stormwater wetland at least once every 10 years.

### 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. Street sweeping must be performed and sweepings disposed of as described in the MassDEP regulations.

### 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

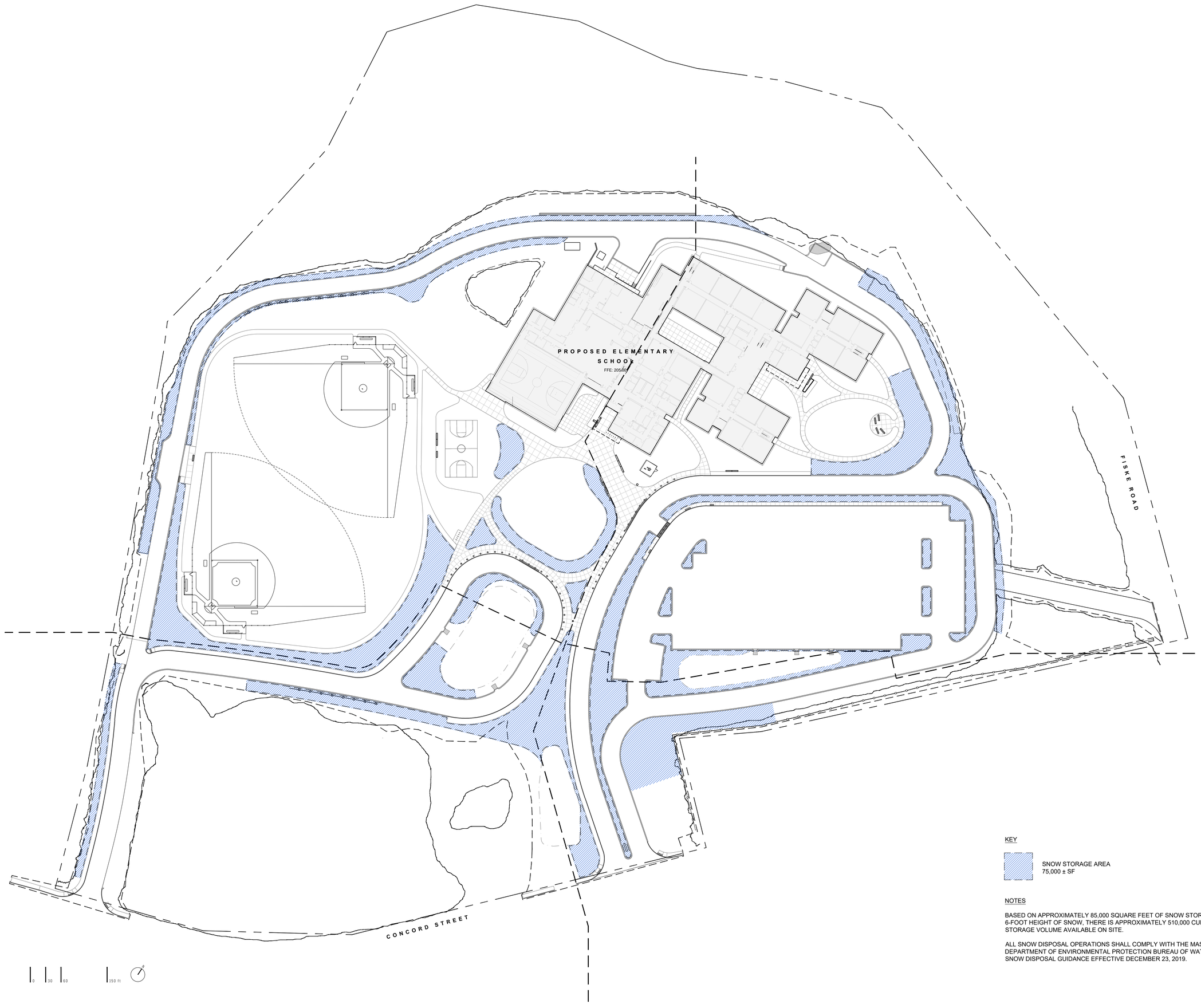
**Mindess Elementary School**
**Ashland, MA**

**Inspected by:_____**
**Date:_____**

| Component | Status/Inspection | Action Taken |
|---|---|---|
| Deep Sump Catch Basins, Area Drains and Drain Manholes | | |
| Sediment Forebay | | |
| Vegetated Filter Strip | | |
| Vegetated Swale | | |
| Bioretention Basin | | |
| Infiltration Basin | | |
| Subsurface Infiltration System | | |
| Water Quality Units | | |
| Stormwater Outfalls & Level Spreaders | | |

| | | |
|---|---|---|
| Constructed Stormwater Wetland | | |
| 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 85,000 SQUARE FEET OF SNOW STORAGE AREA AND A 6-FOOT HEIGHT OF SNOW, THERE IS APPROXIMATELY 510,000 CUBIC FEET OF SNOW STORAGE VOLUME AVAILABLE ON SITE.

ALL SNOW DISPOSAL OPERATIONS SHALL COMPLY WITH THE MASSACHUSETTS DEPARTMENT OF ENVIRONMENTAL PROTECTION BUREAU OF WATER RESOURCES SNOW DISPOSAL GUIDANCE EFFECTIVE DECEMBER 23, 2019.

ASHLAND, MASSACHUSETTS
Incorporated 1846

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 |
|---|---|---|
| 1 | 08.05.2021 | Resubmittal |
| 2 | 09.01.2021 | Resubmittal #2 |

REVISIONS

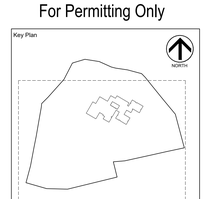
| No. | Date | Note |
|---|---|---|

ISSUE

Stamp

For Permitting Only

Key Plan




Sheet Title

# Snow Storage Plan

| | |
|---|---|
| Drawn By<br>RI/CCH/MV | Project ID<br>1914.00 |
| Reviewed By<br>EM/MSA | Scale<br>1" = 40'-0" |
| Issue Date<br>05.26.2021 | Plot Date<br>05.26.2021 |

Sheet No.

**SS1.00**

## 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

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## 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:
1. 42º 15' 48" N (degrees, minutes, seconds)

Longitude:
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.)

- Areas with less than a 50-foot buffer to surface water will have double erosion control barriers consisting of two rows of Compost Filter Tubes and erosion control fencing.

☐ 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 Compost Filter Tubes.
- 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: Compost Filter Tubes.
- 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).

### *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**

*Storm Drain Inlet Control # 1*

- 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**

*Pollution Prevention Practice # 1*

- 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 |
|---|---|
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## 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**

***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**

**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] |
|---|---|---|---|
| | | | |
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**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** |
|---|---|---|---|---|
| | | | | |
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**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




Map Scale: 1:3,280 if printed on A landscape (11" x 8.5") sheet.

N

Meters: 0 45 90 180 270

Feet: 0 150 300 600 900

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

## MAP LEGEND

**Area of Interest (AOI)**
- Area of Interest (AOI)

**Soils**
- Soil 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

# 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**

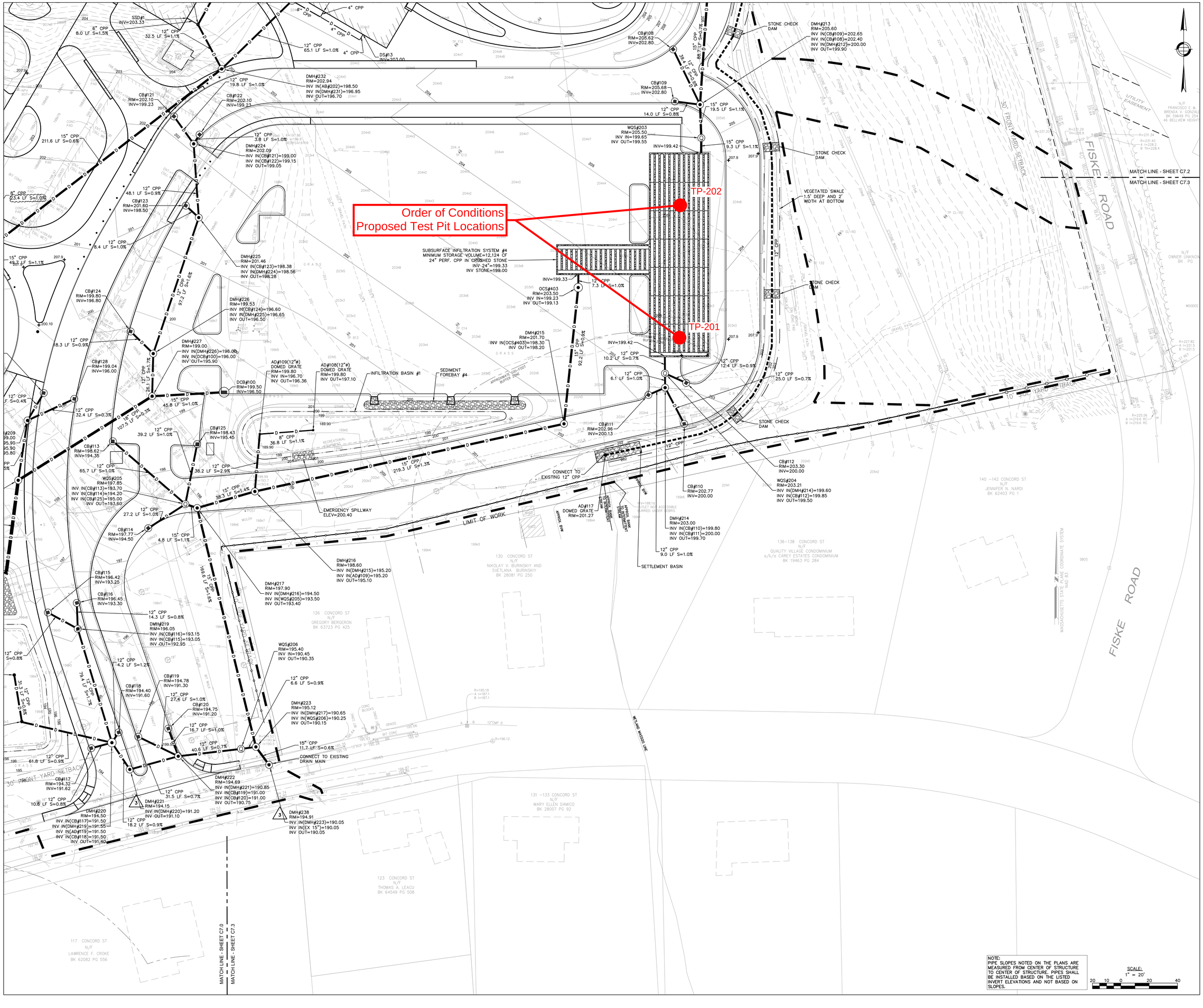
*Percent of map unit:* 5 percent
*Hydric soil rating:* Yes

**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


Order of Conditions
Proposed Test Pit Locations
TP-202
TP-201
LIMIT OF WORK
MATCH LINE - SHEET C7.2
MATCH LINE - SHEET C7.3
MATCH LINE - SHEET C7.0
MATCH LINE - SHEET C7.3
FISKE ROAD
30' FRONT YARD SETBACK
40' WIDE RIGHT OF WAY
10' SIDE YARD SETBACK
SUBSURFACE INFILTRATION SYSTEM #4
MINIMUM STORAGE VOLUME=12,124 CF
24" PERF. CPP IN CRUSHED STONE
INV=199.33
INV STONE=199.00
INFILTRATION BASIN #1
SEDIMENT FOREBAY #4
EMERGENCY SPILLWAY
ELEV=200.40
SETTLEMENT BASIN
CONNECT TO EXISTING 12" CPP
CONNECT TO EXISTING DRAIN MAIN
STONE CHECK DAM
VEGETATED SWALE
1.5' DEEP AND 2' WIDTH AT BOTTOM
WETLAND MARSES LINE
OUTLET NOT ACCESSIBLE BURRIED UNDER DEBRIS
130 CONCORD ST N/F NIKOLAY V. BURINSKIY AND SVETLANA BURINSKIY BK 28081 PG 250
126 CONCORD ST N/F GREGORY BERGERON BK 63723 PG 425
136-138 CONCORD ST N/F QUALITY VILLAGE CONDOMINIUM a/k/a CAREY ESTATES CONDOMINIUM BK 19463 PG 284
131 -133 CONCORD ST N/F MARY ELLEN DAMICO BK 28007 PG 92
123 CONCORD ST N/F THOMAS A. LEACU BK 64549 PG 508
117 CONCORD ST N/F LAWRENCE F. CROKE BK 62082 PG 556
140 -142 CONCORD ST N/F JENNIFER N. NARDI BK 62403 PG 1
N/F FRANCISCO E. & BRENDA V. GONZALEZ BK 59649 PG 254 46 BELLVIEW HEIGHTS
OWNER UNKNOWN BK PG
MASSACHUSETTS STATE PLANE COORDINATE SYSTEM NAD 83
DS#13 INV=203.00
DMH#232 RIM=202.94 INV IN(AB#202)=198.50 INV IN(DMH#231)=196.95 INV OUT=196.70
DMH#224 RIM=202.09 INV IN(CB#121)=199.00 INV IN(CB#122)=199.15 INV OUT=199.05
DMH#225 RIM=201.46 INV IN(CB#123)=198.38 INV IN(DMH#224)=198.56 INV OUT=198.28
DMH#226 RIM=199.53 INV IN(CB#124)=196.60 INV IN(DMH#225)=196.65 INV OUT=196.50
DMH#227 RIM=199.00 INV IN(DMH#226)=196.00 INV IN(DCB#100)=196.00 INV OUT=195.90
DMH#215 RIM=201.70 INV IN(OCS#403)=198.30 INV OUT=198.20
DMH#216 RIM=198.60 INV IN(DMH#215)=195.20 INV IN(AD#109)=195.20 INV OUT=195.10
DMH#217 RIM=197.90 INV IN(DMH#216)=194.50 INV IN(WQS#205)=193.50 INV OUT=193.40
DMH#219 RIM=196.05 INV IN(CB#116)=193.15 INV IN(CB#115)=193.05 INV OUT=192.95
DMH#220 RIM=194.50 INV IN(CB#117)=191.50 INV IN(DMH#219)=191.55 INV IN(AD#119)=191.50 INV IN(CB#118)=191.50 INV OUT=191.40
DMH#221 RIM=194.15 INV IN(DMH#220)=191.20 INV OUT=191.10
DMH#222 RIM=194.69 INV IN(DMH#221)=190.85 INV IN(CB#119)=191.00 INV IN(CB#120)=191.00 INV OUT=190.75
DMH#223 RIM=195.12 INV IN(DMH#217)=190.65 INV IN(WQS#206)=190.25 INV OUT=190.15
DMH#238 RIM=194.91 INV IN(DMH#223)=190.05 INV IN(EX 15")=190.05 INV OUT=190.05
DMH#213 RIM=205.60 INV IN(CB#109)=202.65 INV IN(CB#108)=202.40 INV IN(DMH#212)=200.00 INV OUT=199.90
DMH#214 RIM=203.00 INV IN(CB#110)=199.80 INV IN(CB#111)=200.00 INV OUT=199.70
WQS#203 RIM=205.50 INV IN=199.65 INV OUT=199.55
WQS#204 RIM=203.21 INV IN(DMH#214)=199.60 INV IN(CB#112)=199.85 INV OUT=199.50
WQS#205 RIM=197.85 INV IN(CB#113)=193.70 INV IN(CB#114)=194.20 INV IN(CB#125)=195.00 INV OUT=193.60
WQS#206 RIM=195.40 INV IN=190.45 INV OUT=190.35
OCS#403 RIM=203.50 INV IN=199.23 INV OUT=199.13
CB#108 RIM=205.62 INV=202.80
CB#109 RIM=205.68 INV=202.80
CB#110 RIM=202.77 INV=200.00
CB#111 RIM=202.96 INV=200.13
CB#112 RIM=203.30 INV=200.00
CB#113 RIM=198.62 INV=194.35
CB#114 RIM=197.77 INV=194.50
CB#115 RIM=196.42 INV=193.25
CB#116 RIM=196.45 INV=193.30
CB#117 RIM=194.32 INV=191.62
CB#118 RIM=194.40 INV=191.60
CB#119 RIM=194.78 INV=191.30
CB#120 RIM=194.75 INV=191.20
CB#121 RIM=202.10 INV=199.23
CB#122 RIM=202.10 INV=199.23
CB#123 RIM=201.60 INV=198.50
CB#124 RIM=199.80 INV=196.80
CB#125 RIM=198.43 INV=195.45
CB#128 RIM=199.04 INV=196.00
AD#109(12"ø) DOMED GRATE RIM=199.80 INV IN=196.70 INV OUT=196.36
AD#108(12"ø) DOMED GRATE RIM=199.80 INV OUT=197.10
AD#117 DOMED GRATE RIM=201.27
DCB#100 RIM=199.50 INV=196.50
SSD#1 INV=203.33
TP-F12
TP-B13
TP-A14
TP-A15
TP-A16
TP-A17
TP-A18
TP-A19
TP-A20
TP-A21
TP-A22
TP-A23
TP-A24
TP-A25
TP-A26
TP-A27
TP-A28
TP-A29
TP-A30
TP-A31
TP-A32
TP-A33
TP-A34
TP-A35
TP-A36
TP-A37
TP-A38
TP-A39
TP-A40
TP-A41
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TP-A43
TP-A44
TP-A45
TP-A46
TP-A47
TP-A48
TP-A49
TP-A50
TP-A51
TP-A52
TP-A53

Commonwealth of Massachusetts
~~City~~/Town of Ashland

Mindess Elementary School
Nitsch Project #13609
Performed by: Marc Gabriel, SE#2879

# 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-201 (Hole #) | 6/8/2022 (Date) | 8:00 am (Time) | Cloudy and 70degF (Weather) | _____ (Latitude) | _____ (Longitude:)

1. Land Use: Construction site (e.g., woodland, agricultural field, vacant lot, etc.) | None (Vegetation) | None present (Surface Stones (e.g., cobbles, stones, boulders, etc.)) | 0-3 percent (Slope (%))

Description of Location: Within future stormwater management system

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 | 60" 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 | | | |
| 0-32 | C1 | Fine SL with pockets LS | 2.5Y6/2 | 15" | Depl: 2.5Y6/2 Red: 7.5YR5/8 | 5% | 0 | 0 | Massive | Loose | |
| 32-48 | C2 | Fine SL with pockets LS | 2.5Y6/4 | ↓ | ↓ | ↓ | 0 | 0 | Massive | Loose | Mottles present but faint within the parent material. |
| 48-60 | C3 | Coarse Sand with pockets LS | 2.5Y6/4 | ↓ | ↓ | ↓ | 5 | 0 | Massive | Loose | Mottles present but faint within the loamy sand in the parent material. |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |

Additional Notes: Estimated seasonal high groundwater is approximately 15" below the existing excavated grade elevation at 198.05.
Existing grade was provided at elevation 199.30

**Commonwealth of Massachusetts**
**~~City~~/Town of** Ashland

Mindess Elementary School
Nitsch Project #13609
Performed by: Marc Gabriel, SE#2879

# 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-202 (Hole #) | 6/8/2022 (Date) | 9:00 am (Time) | Cloudy and 70degF (Weather) | (Latitude) | (Longitude:)

1. Land Use: Construction site (e.g., woodland, agricultural field, vacant lot, etc.) | None (Vegetation) | None present (Surface Stones (e.g., cobbles, stones, boulders, etc.)) | 0-3 percent (Slope (%))

Description of Location: Within future stormwater management system

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: 72" Depth Weeping from Pit 88" 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 | | | |
| 0-4 | F | - | - | - | - | - | - | - | - | - | |
| 4-20 | C1 | Fine SL with pockets LS | 2.5Y6/2 | - | - | - | 0 | 0 | Massive | Loose | Mottles present but layer represents perched water table. |
| 20-72 | C2 | Fine SL with pockets LS | 2.5Y6/4 | 65" | Depl: 2.5Y6/2 Red: 7.5YR5/8 | 5% | 0 | 0 | Massive | Loose | Mottles present but faint within the parent material. |
| 72-88 | C3 | Coarse Sand | 2.5Y6/4 | ↓ | ↓ | ↓ | 5 | 0 | Massive | Loose | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |

Additional Notes: Estimated seasonal high groundwater is approximately 65" below the existing excavated grade elevation at 197.98.
Existing grade was provided at elevation 203.4

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 | |

SCALE: 1" = 30'
30 15 0 30 60

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"

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-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<br>Very Moist, viscous |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |

Additional Notes: Water weeping from pit @ 99"
Estimated seasonal high groundwater 30-40"

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-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

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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-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

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# 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'

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# 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

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Performed by: Brian Biagini, SE#14419

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# 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.

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# 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

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# 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

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# 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.

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# 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

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# 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:

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# 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<br>Possible fill material<br>refusal at 126" |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |

Additional Notes: Observed water table 84"
Bright colors throughout pit, inconsistent - Color 7.5 YR 5/8

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Performed by: Jared Gentilucci, SE#13143

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# 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 If yes: XX" Depth Weeping from Pit _____ Depth Standing Water in Hole

X

**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 | |
| | | | | | | | | | | | |
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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.

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# 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<br>Gravel content increases with depth |
| | | | | | | | | | | | |
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Additional Notes: Observed water table 7'