Crocker Design Group

February 14, 2022

Attn: Beth Suedmeyer
Environmental Planner
Planning and Community Development
Town of Sudbury
278 Old Sudbury Road
Sudbury, Massachusetts 01776

RE: Initial Peer Review
Herb Chambers Mercedes of Sudbury
141 Boston Post Road / Route 20, Sudbury, MA

Dear Ms. Suedmeyer and Board Members,

This letter is being submitted in response to the initial peer review comments provided by the Horsley Witten Group, Inc. (HWG) via email on December 16, 2021, regarding the proposed Herb Chambers Mercedes of Sudbury - 141 Boston Post Road / Route 20, Sudbury, Massachusetts. Crocker Design Group, LLC (CDG) offers the following responses to each comment below. In addition, the following revised and supporting documents are enclosed:

Enclosure 1: Proposed Site Development Plans for Mercedes of Sudbury 2/14/22 (under separate cover)
Enclosure 2: Stormwater Management Report, revised 2/14/22 (Under separate cover)

Original comments provided by HWG indicated below in standard text with CDG's response in **bold text**.

COMMENTS

1. Standard 1: No new stormwater conveyances (e.g., outfalls) may discharge untreated stormwater directly to or cause erosion in wetlands or waters of the Commonwealth.
   a. The project proposes a new outfall ("OUTLET" / design point 3) approximately ten feet from wetland flag WF BANK-5. HW recommends that the Applicant clarify and/or provide additional detail for what is being proposed with respect to the following:
      (1) Sheet C-4.1 does not show any grading in the vicinity of the proposed outfall. Please add contours or spot elevations to show how the outlet will grade out beyond the bank delineated by wetland flags WF BANK-1 through 6 and toward wetland flags WF BVW-36 through 38. If no grading is proposed, please provide additional detail to explain how the proposed wall and outfall will grade out without changing the existing grades or impacting the existing bank.

CDG Response: There is an existing drainage outfall at the jurisdictional channel. The project proposes to remove the existing outfall and install a new outfall from the underground infiltration system. The peak flows from the proposed new outfall are less than in the existing condition. The existing jurisdictional channel is in poor condition and is littered with trash and debris. The Applicant proposes to remove the existing retaining walls, install new walls, regrade the channel and install a plunge pool for the relocated outfall. Please see Sheet C-4.1 for the proposed grading at the outlet near the jurisdictional channel.

(2) Sheet C-4.1 depicts a plunge pool/splash pad to stabilize the flow from what appears to be a 12" pipe out falling through the retaining wall. A detail is shown on Sheet C-8.2 for a "LEVEL SPREADER/PLUNGE POOL/ENERGY DISSIPATER," which calls for a 12" drainpipe with an invert elevation of 124.25. However, a detail is also provided on Sheet C-8.2 for a "PRECAST CONCRETE OUTLET STRUCTURE," which calls for a 12" reinforced concrete pipe with an outlet invert of 124.18. It does not appear that this precast concrete outlet structure is shown on the plans. HW recommends that the Applicant clarify where this structure and/or the headwall is proposed to be installed and clarify the invert elevation(s) for the 12" pipe.

CDG Response: The "Level Spreader/Plunge Pool/Energy Dissipater" refers to the plunge pool at the outfall at the jurisdictional bank. The invert of the pipe at the plunge pool is 124.18 and this has been revised on the Detail Sheet C-8.2 and has also been labeled on Sheet C-4.1.

The "Precast Concrete Outlet" refers to the outlet control structure at the grass swale. This has been labeled as "OCS#1" on Sheet C-4.1 and on Detail Sheet C-8.2. The outlet control structure has an invert in elevation of 125.00 and an invert out elevation of 124.18.

(3) The "PRECAST CONCRETE OUTLET STRUCTURE" detail on Sheet C-8.2 shows a proposed 12" outlet pipe with an invert elevation of 124.18, and an 18" inlet with trash rack at an invert elevation of 125.00. There is also an emergency spillway weir shown at an invert elevation of 126.45. It does not appear that these features are shown on the drawings, nor is it clear how the pipes and invert elevations provided for the precast concrete structure will function, i.e., is the 18" pipe with the trash rack really an inlet? How will the weir interface with the retaining wall? HW recommends that the Applicant provide additional detail to clarify these features of the outlet structure and where it will be installed on the plan.

CDG Response: The "Precast Concrete Outlet Structure" refers to "OCS#1" at the grass swale. The detail on Sheet C-8.2 has been labeled as such. The intent of the swale (bottom elevation 124.00) is to collect stormwater runoff from

subwatershed P1-B, and the control structure will reduce the flow of stormwater into the closed pipe system, allowing stormwater to pond within the swale and sediment to settle out. The trash rack prevents debris from entering the drainage system and the weir acts as an emergency overflow in case stormwater reaches the top of the swale.

(4) The "PRECAST CONCRETE OUTLET STRUCTURE" detail on C-8.2 provides dimensions for the width and height of the structure, but not the depth of the structure, the wall thickness, nor any information about what kind of top will be required, i.e., reinforcement and loading specifications. On sheet C-4.2, the structure table "DRAINAGE OUTFALLS" mentions a 4-foot-wide weir, but the structure is shown to be 3 foot wide. HW recommends that the Applicant provide additional detail to clarify these features and ensure that the correct geometry is shown on the plan view, called out on the structure table, and shown correctly on any applicable details.

CDG Response: The "Precast Concrete Outlet Structure" Detail (OCS#1) on C-8.2 has been revised to include the dimensions of the structure as follows:

Depth, Width: 5FT
Height: 3FT
Weir Width: 4FT
Wall Thickness: 0.5FT
Inv In: 125.00
Inv. Out: 124.18

2. Standard 2: Stormwater management systems shall be designed so that post-development peak discharge rates do not exceed pre-development peak discharge rates.

   a. To manage the increase in impervious area that will be created, the project proposes an underground Retain-It system. A large parking area will also be constructed of porous pavement, which generates significantly less runoff than traditional bituminous asphalt paving. The peak runoff rate and volume discharged to wetland A is reduced compared to existing conditions.

      CDG Response: Acknowledged.

   b. HW recommends that the Applicant clarify the drainpipe within the MassDOT easement and whether any runoff from the site discharges via this drainpipe. If so how is the runoff being treated prior to discharging?

      CDG Response: The drainpipe within the MassDOT easement conveys stormwater collected on Route 20 via a 30-inch RCP pipe, to the existing wetland to the south of the project. In the site's existing and proposed condition, there is a small portion of land (Subwatershed E-3 and E-2, P-4A and P-4B) that flows onto Route 20 and into a catch basin

within the right of way that connects to the MassDOT drainage system.

In the proposed condition, subwatersheds P-4A and P-4B (0.090 acres) remains completely pervious and unchanged from its existing condition.

c. The Applicant has used "fair" as a cover condition for portions of the existing and proposed grass and woods area. HW recommends that the Applicant use "good" as the cover condition or justify the use of fair.

CDG Response: Acknowledged. The existing and proposed HydroCAD models have been modified to reflect the existing woods and grass as in "good condition" as recommended.

d. The project proposes an underground infiltration system, "UG-1," shown in plan view on Sheet C-4.1, in section view on Sheet C-8.2, and a layout plan is provided on Sheet C-8.4. HW recommends that the Applicant clarify the following:

(1) The relevant elevations (bottom of stone, top of chambers) do not appear to be shown on the drawings. HW recommends that the Applicant provide, at a minimum, the bottom and top elevations of the system. Furthermore, HW recommends that the Applicant include the minimum cover requirements for the infiltration system.

CDG Response: The elevations of the UG-1 infiltration system are noted on detail Sheet C-8.2. Without any cover, the Retain-it units are H-20 rated, so the Bituminous Pavement section as shown on Detail Sheet 8.1 will be installed directly on the Retain-it structures.

(2) The section detail on Sheet C-8.2 shows a 4-inch perforated underdrain, but it does not appear to be shown on the plan nor is it clear how this pipe connects to the rest of the drainage network; HW recommends that the Applicant clarify the intention of the 4-inch underdrain.

CDG Response: The 4-inch underdrain has been removed from the details.

(3) There appears to be only one access point for the underground infiltration system, drain manhole UG#1. HW recommends that the Applicant install additional observation ports or manholes to provide access when maintenance is required.

CDG Response: Acknowledged. Please refer to UG-1 on Sheet C-4.1. Four (4) additional maintenance ports/access manholes have been added to provide maintenance access to the Retain-it system. Typically, access manholes are installed at each inlet and outlet from the system.

(4) The Applicant has labeled the Retain-It system as an infiltration system, however, it has not included exfiltration in the HydroCAD model. For clarity HW recommends that the Applicant label the system as a detention system.

CDG Response: Acknowledged. Since the Retain-it system is not lined, it is technically an infiltration system, however, we are not modeling exfiltration in the HydroCAD model and simply identifying that that it provides infiltration to the maximum extent practicable.

e. The project proposes porous asphalt pavement, shown in plan view on Sheet C-4.1, and various components are shown in section view on Sheets C-8.1 and 8.2. HW recommends that the Applicant clarify and/or provide additional detail for the following items:

(1) The detail "POROUS ASPHALT PAVEMENT CELL DIVIDER," on Sheet C-8.1, refers to the plan for locations of porous asphalt cell dividers, but the information does not appear to be shown on the plan. Also, HW recommends that the Applicant consider clean crushed stone free of fines instead of dense grade crushed stone to surround and support the perforated pipe as dense grade typically contains a significant amount of fines.

CDG Response: Porous pavement cell dividers have been added to the plans. CDG has removed the note for dense grade crushed stone at the perforated pipe and has instead specified clean crushed stone free of fines. Refer to the revised Sheets C-4.1 and C-8.1.

(2) The detail "POROUS PAVEMENT OBSERVATION WELL DETAIL," on Sheet C-8.1, shows cleanout ring/curb box and cover to be installed atop the observation well. HW recommends that the Applicant clarify how many observation wells are proposed and where they are to be installed on the plan.

CDG Response: Acknowledged. Six (6) observation wells are now proposed at the porous pavement, please see Sheet C-4.1.

(3) Sheet C-4.1 shows an underdrain offset from the perimeter of the edge of the porous pavement. HW recommends that the Applicant provide dimensions for the required separation of underdrain(s) from the edge of the porous pavement section and/or retaining wall.

CDG Response: Acknowledged. The underdrain shall be offset a minimum of 10 FT from the edge of porous pavement and/or retaining wall. A note has been added to the plans on Sheet C-4.1.

3. Standard 3 requires that the annual recharge from post-development shall approximate annual recharge from pre-development conditions.

a. The Applicant states that "the porous pavement can be credited for the 26,208 SF of increased impervious area. This amounts to 100% of the increased proposed site impervious […] we feel that this design recharges to the maximum extent practicable."

(1) Upon review of the area listings for all nodes on pages 36 and 152, it appears that the existing impervious area adds up to 4.176 acres, while the impervious area under proposed conditions totals 4.515 acres. HW recommends that the

Applicant clarify what the additional 0.339 acres of impervious is.

CDG Response: Based on the revised layout/design, the proposed impervious area is 4.213 acres (inclusive of the porous pavement). The existing impervious area is 3.667 acres (revised after recalculating the original areas)

(2) HW recommends that this project be classified as new development, rather than redevelopment, and therefore must meet the stormwater standards as written.

CDG Response: The project has been classified as a new development, and meets the stormwater standards as such.

4. Standard 4 requires that the stormwater system be designed to remove 80% Total Suspended Solids (TSS) and to treat 1.0-inch of volume from the impervious area for water quality.

   a. The Applicant has proposed deep sump catch basins with hoods, oil-grit separators, cyclonic hydrodynamic separators, and permeable pavement to provide the required pre-treatment.

      CDG Response: We concur.

   b. There appear to be a few existing catch basins that will remain. A large portion of the runoff to these catch basins is currently grass/vegetation and is proposed to be a parking lot. HW recommends that the Applicant clarify that adequate treatment will be provided prior to discharging to the constructed wetland.

      CDG Response: There are several existing catch basins that currently discharge runoff from grass/vegetation to the sediment forebay, and then to the constructed stormwater wetland. In the proposed condition, a portion of the grass/vegetation is proposed to be converted to pavement and will continue to discharge to the sediment forebay and then to the constructed stormwater wetland. Per the MA Stormwater Standards, a Constructed Stormwater Wetland provides 80% TSS Removal when combined with a sediment forebay.

5. Standard 5 is related to projects with a Land Use of Higher Potential Pollutant Loads (LUHPPL).

   a. The Applicant states that this project is not a LUHPPL, therefore Standard 5 is not applicable. The proposed project is a new automobile dealership, which includes sales, leasing and service. A LUHPPL includes exterior fleet storage areas, exterior vehicle service and equipment cleaning areas, and commercial vehicle washing. HW recommends that the property owner and on-site management state to the Planning Board that they understand that activities including exterior vehicle service, and equipment cleaning, and commercial vehicle washing are not allowed on this property.

CDG Response: The Applicant acknowledges and agrees/confirms that on-site activities do not include any exterior vehicle service, equipment cleaning nor commercial vehicle washing.

6. Standard 6 is related to projects with stormwater discharging into a critical area, a Zone II or an Interim Wellhead Protection Area of a public water supply.
   a. It does not appear that the site is located within a critical area, therefore Standard 6 is not applicable.

   CDG Response: We concur. The project is not located within a Critical Area.

7. Standard 7 is related to projects considered Redevelopment.
   a. HW recommends that the proposed application be considered new development and is therefore required to fully meet all stormwater standards.

   CDG Response: The Applicant has revised the stormwater checklist to reflect the project as "New Development". The project fully complies the applicable stormwater standards.

8. Standard 8 requires a plan to control construction related impacts including erosion, sedimentation or other pollutant sources.

   The Applicant has provided an Erosion Control Plan on Sheet C-4 of the plan set including erosion control details.

   a. The Applicant has provided a Soil Erosion and Sediment Control Plan as Sheet C-2 of the plan set. The plan includes notes and details. Furthermore, the Applicant has included a draft Stormwater Pollution Prevention Plan (SWPPP) as part of the Application for Stormwater Management Permit.

      The Applicant appears to comply with Standard 8.

      CDG Response: We concur.

9. Standard 9 requires a Long-Term Operation and Maintenance (O & M) Plan to be provided.
   a. The Applicant has included a Long-Term Stormwater Operation and Maintenance (O&M) Plan as a standalone document. The document includes a simple sketch as well as documentation on maintaining the proprietary separators and the porous pavement.

      The Applicant appears to comply with Standard 9.

      CDG Response: We concur.

10. Standard 10 requires an Illicit Discharge Compliance Statement be provided.
    a. The Applicant has provided a signed Illicit Discharge Compliance Statement signed by the Engineer. HW recommends that this document be signed by the property owner and

provided to the Planning Board.

CDG Response: The illicit discharge statement has been revised and will be signed by the property owner after construction is complete.

11. HW offers the following additional comments regarding the stormwater and drainage design:

a. Sheet C-4.2 states that OCS#1 has a rim elevation of 127.30, which appears to be approximately two feet above the bottom of the depression and approximately 6" above the low point on the pavement. HW recommends that the Applicant ensure this elevation is accurate.

CDG Response: Sheet C-4.2 has been revised so that OCS #1 has a rim elevation of 127.0.

b. Sheet C-8.4 shows a detail for "STONE TRENCH WITH STEPPED BOTTOM" and "GRASSED SWALE," but these features do not appear to be called out on the plan. There is a gravel hatch shown around a depression near the eastern entrance, which is referred to on the sheet C-3 as landscape area. HW recommends that the Applicant explain where these features are to be installed and add a dimension to the stone trench detail showing the required depth of "3-4 INCH PEA GRAVEL."

CDG Response: The Stone Trench and the Grassed Swale are located at the western edge of the property, near the entrance from the Buddy Dog property. The "Stone Trench with Stepped Bottom" detail has been revised to show a required depth of 4 inches for the 3-4 inch pea gravel.

c. Sheet C-8.4 includes a detail for a "TYPICAL DIVERSION MANHOLE" with a Rim at 128.58. HW was not able to locate this structure on the plan set.

CDG Response: Acknowledged. Diversion manholes are now labeled on the Grading and Drainage Plans, Sheets C-4.1 and C-4.2.

d. It does not appear that the Applicant has included a dog house manhole as called out on Sheet C-4.1. HW recommends that this detail be included in the plan set.

CDG Response: Acknowledged. A dog house manhole detail has been added to Sheet C-8.3.

e. A 129' contour is shown to the west of the building to remain that does not appear to tie out to anything. HW recommends that the Applicant revisit this contour and adjust accordingly.

CDG Response: This has been revised on the revised Grading and Drainage plan, Sheet C-4.1.

f. The 122' and 123' contours below the curb bounding the west edge of the parking area do not appear to tie out correctly. HW recommends that the Applicant revisit these contours and adjust accordingly.

CDG Response: This has been revised on the revised Grading and Drainage plan, Sheet C-4.1.

g. A concrete retaining wall, with a foundation that protrudes 1' beyond the face of the wall according to the detail on Sheet C-8.4, is proposed at several locations on the site. It appears that the wall will necessitate grading inside of the resource areas at the following locations:

   (1) Near wetland flags WF BVW A-17 through A-19

   (2) Near wetland flags WF BVW-38 through 40

   (3) Near wetland flags WF BVW-34 and 35

   (4) Near wetland flags WF BVW-29 through 31

   HW recommends that the Applicant expand the limit of work and grading activities shown on the plan to accurately reflect the area that will be required to construct the wall(s). If grading or disturbance will occur within the wetland resource area itself, compensatory plantings or restoration may be required by the Sudbury Conservation Commission.

   CDG Response: It is likely that the installation of the retaining walls at the locations mentioned above may result in minor temporary impacts to the adjacent wetlands. The Applicant is amenable to working with the Sudbury Conservation Commission to restore these potential minor impacts and provide compensatory plantings and restoration.

h. It appears that a slope of approximately 1:1 will be created by the grading near wetland flags WF BVW-29 through 31, which is likely to cause erosion. HW recommends that the Applicant provide additional detail to explain how the wetland resource area will be protected, both during and after construction.

   CDG Response: The proposed parking in this location has been revised to maintain the existing limits of pavement. The grading near wetland flag WF BVW-29 through 31 will remain as it is in the existing condition.

i. During the December 15, 2021, Planning Board hearing, the Board members noted that its preference would be for the existing grass area on the east side of the site to remain grass and not become a parking lot. HW recommends that the Applicant take the concerns of the Board into consideration for the proposed site development.

   CDG Response: The Applicant has revised the parking layout to scale back the proposed parking in the existing grass area

Should you have any questions or require any further information, please do not hesitate to contact Gabe Crocker, P.E. at gabecrocker@crockerdesigngroup.com or 781-919-0808. We look forward to presenting to the Board at the upcoming hearing on Wednesday February 23, 2022.

Sincerely,
Crocker Design Group LLC



Gabe Crocker P.E.
President

Stormwater Management Report
For

Herb Chambers Mercedes of Sudbury
141 Boston Post Road- Route 20
Sudbury, MA

November 15, 2021
Revised February 14, 2022

Prepared for:
Herb Chambers 43 Braintree Street, LLC
259 McGrath Highway
Somerville, MA 02143

Prepared by:
Crocker Design Group, LLC
2 Sharp Street Unit A
Hingham, MA 02043
781-919-0808



Gabe Crocker
Massachusetts P.E. License #47917

TABLE OF CONTENTS

1. **NARRATIVE**
   - 1.1 Executive Summary
   - 1.2 Approvals Being Sought
   - 1.3 FEMA Floodplain Summary
   - 1.4 On-Site Soil Information
   - 1.5 Calculations of Earth Volumes to be Removed
   - 1.6 Wetlands and Environmental Resource Areas Analysis
   - 1.7 Objective of Calculations
   - 1.8 Methodology
   - 1.9 Site Hydrology
   - 1.10 Stormwater Management
   - 1.11 Best Management Practices
   - 1.12 Pipe Sizing
   - 1.13 Conclusion
   - 1.14 Figures:
     - FIG 1 ORTHOGRAPHIC MAP
     - FIG 2 FEMA FLOODPLAIN MAP
     - FIG 3 MASSDEP WETLANDS MAP
     - FIG 4 USGS MAP
     - FIG 5 NHESP HABITAT MAP
     - CF-1 CUT & FILL PLAN

2. **MA DEP CHECKLIST FOR STORMWATER REPORT**
   - 2.1 DEP Stormwater Checklist
   - 2.2 Illicit Discharge Statement

3. **HYDROCAD MODEL**
   - 3.1 Pre Development Watershed Map
   - 3.2 Existing Hydrology HydroCAD Model
   - 3.3 Post Development Watershed Map
   - 3.4 Proposed Hydrology HydroCAD Model

4. **STORMWATER MANAGEMENT CALCULATIONS**
   - 4.1 Recharge Calculations
   - 4.2 Drawdown Calculations
   - 4.3 Water Quality Calculations
   - Water Quality Catchment Map
   - Diversion Manhole Weir Calculations

SciClone NJCAT/NJDEP Certification and Sizing Info
SciClone NJCAT Testing Data
4.4 Rip Rap Splash Pad Calculations
4.5 Total Suspended Solids Calculations

5. LONG-TERM POLLUTION PREVENTION AND OPERATION & MAINTENANCE PLAN (Under Separate Cover)

6. SOILS TESTING DATA

6.1 Test Pit Logs
6.2 NRCS Web Soil Survey

7. HYDRAULIC PIPE ANALYSIS & SIZING

8. DRAFT STORMWATER POLLUTION PREVENTION PLAN (SWPPP) (Under Separate Cover)

9. PROJECT PLANS – DATED 11/15/2021 (Under Separate Cover)

Crocker Design Group

1.1 EXECUTIVE SUMMARY

In accordance with the provisions of the Town of Sudbury Zoning Bylaws, the Applicant, Herb Chambers 43 Braintree Street, LLC (HC), proposes a new Mercedes of Sudbury dealership at 141 Boston Post Road in Sudbury, MA. The proposed scope includes renovating and converting the existing two-story health club facility (formerly Bosse Sports) into a new automobile dealership for the sales and display of new vehicles as well as vehicle service. Site renovations include reconfigured parking for employees, customers and vehicle inventory storage, as well as upgrades to stormwater management systems, utilities and landscaping.

The site is bound by Boston Post Road (Route 20) to the north, east and west by commercial properties (Frank's Spoke'n Wheel, Seth F Johnson Sales, and Buddy Dog Humane Society). An undeveloped portion of the parcel extends to the South which is mostly comprised of wetlands, and borders the Great Meadows National Wildlife Refuge and the former CSX Railway, which was recently purchased by the Town of Sudbury. The site is located on Parcel K11-0019 and is 15.67 acres. The property is located within the Industrial Zoning District.

1.2 APPROVALS BEING SOUGHT

This Stormwater Report is being filed in conjunction with the Stormwater Management Permit, Notice of Intent (NOI) is being filed with the Sudbury Planning Board, the Sudbury Conservation Commission (SCC) and the Massachusetts Department of Environmental Protection (MA DEP) for the proposed work. The Applicant requests that the permit approvals encompass the entirety of the scope listed below, and as shown in the accompanying plan set:

- Upgrade of the existing parking lot to provide employee parking and vehicle storage
- The renovation of the existing two-story structure to be used for vehicle sales and maintenance
- Stormwater BMP's
- Upgrades to utilities, landscaping and lighting

An Order of Resource Area Delineation (ORAD) (MA DEP# 301-1319) was issued on December 15, 2020 and is still active. The delineation shown in the accompanying plans reflects the ORAD delineation.

This Stormwater Report will also be filed with the Sudbury Planning Board as part of the Site Plan Review submission that requires a Stormwater Management Permit.

1.3 FEMA – FLOODPLAIN SUMMARY

The parcel is shown on FEMA Flood Insurance Rate Map Panel 25017C0507F dated 7/7/2014. A portion of the developed land on the property is located within Zone X, which is defined as areas determined to be outside the 500-year floodplain and determined to be outside the 1% and 0.2% annual chance floodplain. There is a Zone AE within proximity of the work proposed. Zone AE is defined as an area inundated by 1% annual chance flooding, where Base Flood Elevations (BFE's) have been determined. The

BFE of the Zone AE is elevation 121.0. The work proposed is entirely outside the limits of the FEMA Zone AE.

1.4 ON-SITE SOIL INFORMATION

The Natural Resource Conservation Service (NRCS) maps the entirety of on-site soil as Udorthents-Urban land complex, Soil Map Unit 656, which is defined as "excavated and filled land."

Haley Aldrich performed three (3) test pits on December 4, 2020 within the limit of work. The test pits revealed a subsurface comprised of a brown silty sand. The next layer was comprised of yellow-brown, clayey sand with gravel, which was classified as fill. The subsurface soil conditions in the area of the expanded parking lot and drainage improvements are consistent with a "C" soil. The proposed infiltration area is located fully within the limits of the HSG C soils and an infiltration rate of 0.27 inches per hour was used as this rate is consistent with silty loam.

Depth to groundwater was noted in the upper right corner of each test pit log and appears to vary throughout the site. In the location of the permeable pavement (TP-3), groundwater was noted at 3.8ft below existing grade, or at elevation 119.5±. In the area of the proposed infiltration Retain-It System (TP-2), groundwater was entering the test pit at 4.4ft below existing grade, or at elevation 119.6±. During the Wetland delineation, a test pit was conducted at the wetland line, adjacent to the proposed permeable pavement location. On the existing conditions plan, this is labeled T2-P1. Groundwater was observed 17 inches below existing grade, or at approximately 120.3±. For more information on the separation of groundwater at each of the infiltration BMP's, please refer to Section 4, Stormwater Calculations.

Refer to Section 6 for complete soil information.

1.5 CALCULATIONS OF EARTH VOLUMES TO BE REMOVED

Based on the calculations derived from Civil 3D software analysis, we estimate a net import of approximately 10,537± cubic yards of material to the site. Please refer to the Cut & Fill Plan (CF-1) enclosed within this Stormwater Report.

1.6 WETLANDS AND ENVIRONMENTAL RESOURCE AREAS ANALYSIS

The project does contain environmental resource areas, and therefore the project must be permitted through MassDEP and the Sudbury Conservation Commission. Per the ORAD, there is a Bordering Vegetated Wetland (BVW) to the Southeast of the site containing shallow marshes. There is also a Bank within the limit of work. According to the latest Mass. Division of Fisheries and Wildlife – Natural Heritage Program mapping, the southeastern portion of the site is within a Priority Habitat of Rare Species (PHRS) as designated by the Natural Heritage and Endangered Species Program of the Division of Fisheries and Wildlife. There is a potential vernal pool within the PHRS, approximately 515±' from any proposed work. The limit of work is entirely out of the FEMA 100-year floodplain, however, a portion of the property is within the Zone X. The proposed project area is entirely developed. The priority Habitat Mapping by NHESP shows the boundary of Priority Habitat covering a portion of the property that is not proposed for

development and is within the Great Meadows National Wildlife Refuge. The site does not appear to contain any certified vernal pools or areas of critical environmental concern.

The wetland resource areas located to the south of the property were delineated by James Hall, PWS of CHA Consultants in October 2019, and DGT Associates, Inc. performed a review of the delineation boundaries. The Abbreviated Notice of Resource Area Delineation (ANRAD) submission was filed on December 4, 2020, and an Order of Resource Area Delineation (ORAD) (MA DEP# 301-1319), was issued on December 15, 2020.

The following is a summary of the buffer and protection zones that portions of the project are proposed within:

1) 100' Bordering Vegetated Wetland (BVW) Buffer (310 CMR 10.55).

   Work within the 100' Bordering Vegetated Wetland (BVW) Buffer includes but is not limited to sections of the impermeable and permeable pavement parking lots, retaining walls, some of the existing to be renovated building, as well as a portion of the building addition. The proposed scope is an improvement over the existing, which consists of two (2) pneumatic structures and provides far greater pervious surface and stormwater treatment.

2) Bank

   There is a Bank located to the south of the existing gymnasium building where a drainage pipe outlets. There are no alterations proposed for the bank, and stormwater flow to this location (DP-3) decreases in the proposed condition.

3) Bordering Land Subject to Flooding

   The site is located near a BLSF, associated with the Sudbury River. The elevation of the 100 year (1% chance of flooding) has been determined by the FEMA Flood Study Profile Data as elevation 121.0 (NAVD 88). The boundary of the BLSF is the 121-foot contour and this contour is to the south of the limit of work.

4) Priority Habitat of Rare Species (PHRS)

   None of the proposed improvements are proposed within the PHRS. As mentioned above, there is a potential vernal pool located within the PHRS, approximately 500±' to the southeast of the limit of work. A copy of the Notice of Intent Application package including the plans will be submitted to NHESP for review.

Crocker Design Group

1.7 OBJECTIVE OF CALCULATIONS

The purpose of this stormwater analysis is to examine the stormwater runoff from the proposed site based upon the Massachusetts Department of Environmental Protection Stormwater Management Policy and the applicable provisions of the Town of Sudbury Bylaws and regulations.

The goal of the stormwater management system design on this project is to comply with the MA Stormwater Management Requirements as well as the Town of Sudbury's Stormwater Management Permit Regulations and provide improved water quality, reduce post-development peak runoff rates below pre-development peak flow rates, maximize the opportunities for recharge and infiltration, and protect the surrounding area from any potential flooding and/or environmental impacts associated with the unmitigated condition. The following stormwater hydrology calculations were performed using the 1-inch, 1-year, 2-year, 5-year, 10-year, 25-year, and 100-year frequency, Type III, 24-hour SCS design storms and were compared for both pre-development and post-development conditions. The 1, 2, 5, 10, 25 and 100-year storms and 1-inch storm were evaluated to demonstrate the proposed peak rates of discharge and volumes do not exceed pre-development peak rates and volumes.

1.8 METHODOLOGY

We utilized the latest version of Hydro CAD for the overall stormwater hydrology/routing analysis to assess and compare peak rates of runoff and volumes at the various discharge points from the subject property. We then used Hydraflow Storm Sewers Extension Pack through AutoCAD Civil 3D to analyze the pipe design and to select appropriate pipe sizing.

Refer to Section 3 – HydroCAD Model, which includes the detailed print-out of the HydroCAD Model Reports for the 1, 2, 5, 10, 25 and 100-year storms as well as Section 7 – Hydraulic Pipe Analysis / Sizing, which includes reports for the 10, and 100-year storms for pipe capacity analysis and sizing.

1.9 SITE HYDROLOGY

Existing Conditions

Please refer to the attached Existing Conditions Watershed Analysis Plan in Section 3.1. The property has been divided into nine (9) subcatchment areas based on the existing site topography and flow paths. These subcatchment then combine where appropriate from an analysis standpoint where they ultimately discharge toward the wetland resource areas. Each subcatchment area has been analyzed and assigned an appropriate Curve Number to represent the existing vegetative cover and underlying soils conditions. Times of concentration have been computed and the extent of pervious vs. impervious cover computed. This data was then input into HydroCAD to determine peak rates of runoff at the various design points which provide the locations for which to compare existing versus proposed conditions to document compliance that the peak rates have been reduced in the regulatory storm events as required. A summary table is provided in the Hydrology Model Results and Conclusions Section below.

Crocker Design Group

For the purposes of this analysis, the pre- and post- development drainage conditions were analyzed at six (6) "design points" or points of discharge where stormwater runoff currently drains to under existing conditions. The design points are described below:

- Design Point #1 (PD-1) is the BVW (flagged as Wetland B) located to the southwest of the proposed work. This BVW ultimately discharges to Wetland A (PD-6).
- Design Point #2 (PD-2) is the outlet of the 15-inch RCP pipe that drains Wetland B to Wetland A. The flow to this design point ultimately discharges to Wetland A (PD-6).
- Design Point #3 (PD-3) is the jurisdictional channel to the east of the existing parking lot. The channel ultimately discharges to Wetland A (PD-6).
- Design Point #4 (PD-4) is the MA DOT 30-inch RCP discharge pipe that discharges drainage from Boston Post Road (Route 20) to Wetland A (DP-6).
- Design Point #5 (PD-5) is the outlet to the Constructed Stormwater Wetland basin. The constructed stormwater wetland does have an overflow to Wetland A (PD-6).
- Design Point #6 (PD-6) is Wetland A, which is where all the design/discharge points ultimately drain to.

The parcel that the proposed project on is approximately 15.7± acres, however the limit of work being analyzed is approximately 5.94 acres of land consisting of an existing two-story building, two (2) pneumatic structures and a bituminous driveway and parking area. The site generally conveys stormwater in a southerly direction towards Wetlands. A more comprehensive description of the existing subcatchment areas is provided below:

- Subcatchment E-1 is approximately 0.753AC (32,801 SF) and is comprised of a portion of one (1) existing air structure building, which appears to shed water to the west. E-1 also includes a portion of the paved drive, some compacted gravel areas, and some undeveloped woodland area. Stormwater from these surfaces flow overland and undetained to Wetland B, or DP-1. This area is a mix of pervious and impervious surfaces (CN: 88) and the minimum time of concentration of 6.0 minutes is used.
- Subcatchment E-2 is approximately 0.108 AC (4,704 SF) and is comprised of a portion of the landscaped area at the front of the parcel adjacent to Boston Post Road. The surface is assumed to be grass cover, good. The runoff from this area flows into a catchbasin that connects into the MA DOT drainage system, and discharges at DP-4. The area is entirely permeable (CN: 74) and a calculated time of concentration of 7.8 minutes is used.
- Subcatchment E-3 is approximately 0.072 AC (3,142 SF) of the landscaped area, above the existing septic system. The ground surface is considered grass cover, good. The runoff from this area flows into a catchbasin that connects into the MA DOT drainage system, and discharges at DP-4. The area is entirely permeable (CN: 74) and the minimum time of concentration of 6.0 minutes is used.

- Subcatchment E-4A is approximately 1.199 AC (52,236 SF) of the existing gymnasium building. The roof runoff is collected and drains to PD-5, which is a constructed stormwater wetland with a sediment forebay for pretreatment. This surface is entirely impervious (CN: 98) and a minimum time of concentration of 6.0 minutes is used.
- Subcatchment E-4B is approximately 2.103 AC (91,607 SF) and consists of the existing parking lot, the landscaped area/septic field, and the existing wooded area, which is classified as being in "good" condition. The runoff from this area is collected into a series of catchbasins, and drains to DP-5, or the constructed stormwater wetland. This surface is a mix of pervious and impervious surfaces (CN: 86). The time of concentration was calculated to be 9.5 minutes.
- Subcatchment E-5A is approximately 0.102 AC (4,443 SF) and primarily consists of the landscaped area at the entrance to the gymnasium. The runoff from this location is collected into catchbasins, and then discharges at DP-3, or the jurisdictional channel/bank. The surface is a mix of mulch and grass (CN: 72). The time of concentration was calculated to be 7.4 minutes.
- Subcatchment E-5B is approximately 0.087 AC (3,809 SF) and consists of pavement. The runoff from this location is collected into a catchbasin, and then discharges at DP-3, or the jurisdictional channel/bank. The surface is pavement (CN: 98). The minimum time of concentration of 6.0 minutes is used.
- Subcatchment E-5C is approximately 0.346AC (15,072 SF) and is comprised of a portion of one (1) existing pneumatic building, which appears to shed water to the west. E-1 also includes a portion of the paved drive, and some undeveloped woodland area. Stormwater from these surfaces flow overland and undetained to the jurisdictional channel, or DP-3. This area is impervious (CN: 95) and the minimum time of concentration of 6.0 minutes is used.
- Subcatchment E-6 is approximately 1.094 AC (47,654 SF) and is comprised of the southern air structure, the surrounding impervious surface, a portion of the conservation restriction area (modeled as grass), and a portion of the woods adjacent to wetland A. Stormwater in this subwatershed flows undetained to Wetland A, or Design Point 6. This area is a mix of surfaces (CN: 92) and a calculated time of concentration of 6.8 minutes is used.

Proposed Conditions

The proposed project consists of reconfigured and expanded parking for vehicle inventory, the removal of the two (2) pneumatic structures and the renovation of gymnasium into a car dealership which shall include a vehicle service center and consists of 41 service bays and an internal vehicle wash bay. Construction will also include landscaping upgrades, stormwater treatment, drainage improvements and other associated utilities. The site, including the proposed parking areas, have been designed to drain to deep sump hooded catch basins or trench drains. The catch basins will capture and convey stormwater runoff, via an underground pipe system, to offline oil/grit separators, to proprietary treatment units and then to an underground infiltration system. The rooftop runoff has been designed to flow directly to the

infiltration system, or to flow to the existing constructed stormwater wetland. Permeable pavement has also been included in the portion of the parking lot closest to environmentally jurisdictional areas.

Please refer to the attached Proposed Conditions Watershed Plan. The proposed project has been divided into ten (10) subcatchment areas and the various stormwater treatment and infiltration BMPs have been modeled. Appropriate Times of Concentration and Curve Numbers have been assigned for each catchment area. A more comprehensive description of the proposed subcatchment areas is provided below:

- Subcatchment P-1A is approximately 0.146 acres (6,360 SF) consisting of the undetained portion of the site to the west of the proposed expanded parking lot. This area consists of woods and grass (CN:72). Stormwater runoff from this area flows overland into Wetland B, or DP-1. The minimum time of concentration of 6.0 minutes is used.
- Subcatchment P-1B is approximately 0.471 acres (20,534 SF) consisting of a portion of the bituminous driveway, landscaped area adjacent to Boston Post Road, a stone trench and a conveyance swale. Stormwater from this location flows overland through the stone trench and then into the conveyance swale. The conveyance swale is proposed to have an outlet control structure that transports water to an offline proprietary water quality unit before discharging to an infiltration system. The area is primarily impervious (CN: 86) and the minimum time of concentration of 6.0 minutes is used.
- Subcatchment P-1C is approximately 0.538 acres (23,435 SF) consisting of permeable pavement and landscaped area. Stormwater in this area drains vertically into the permeable pavement system where it is treated and infiltrated in the underlying base layers. The permeable pavement is modeled with a curve number of 98, and the BMP is then modeled as a pond. This area has a CN: 97 and the minimum time of concentration of 6.0 minutes is used.
- Subcatchment P-2 is approximately 0.299 acres (13,024 SF) is at the southern end of the limit of work, between the edge of the permeable pavement and the wetlands. This area consists of grass/landscaped surface, and woods. Stormwater in this area infiltrates or travels overland to the wetlands. This area has a CN: 73, and a calculated time of concentration of 13.6 minutes is used.
- Subcatchment P-3A is approximately 1.192 acres (51,910 SF) is comprised of a portion of the existing gymnasium building, the two (2) building additions and the new impervious portion of the parking lot. The roof runoff is collected and is piped into the infiltration system. The runoff from the impervious pavement flows into trench drains and deep sump catch basins, then to oil grit separators and offline proprietary separator water quality units before entering the infiltration system. Stormwater eventually flows out of the infiltration system and into the existing bank/channel. An oversized rip rap plunge pool is proposed in this location to dissipate flow. This area has a CN: 97 and a minimum time of concentration of 6.0 minutes is used.

- Subcatchment P-3B is approximately 0.865 acres (37,682 SF) consisting of a portion of the existing gymnasium building. The roof runoff from this portion of the building is collected and flows through an existing series of pipes and manholes, and eventually discharges at the sediment forebay and constructed stormwater wetland (DP-5). This area only includes the roof (CN: 98). A minimum time of concentration of 6.0 minutes is used.
- Subcatchment P-4 is approximately 1.973 acres (85,944 SF) consisting of the existing and expanded parking lot to the east, landscaped area (with the septic system underground in this location) and a portion of the wooded area to the east adjacent to Wetland A, which is considered to be in "good" condition. This watershed is collected by a series of deep sump catch basins and discharges to the constructed stormwater wetland (DP-5). This area is a mixture of pervious and impervious surfaces (CN: 89) and a calculated time of concentration of 7.3 minutes is used.
- Subcatchment P-4A is approximately 0.040 acres (1,753 SF) consisting of a portion of the landscaped area adjacent to Boston Post Road. This area flows into a catch basin that is part of the MA DOT drainage system. The system discharges at the 30-inch RCP at Wetland A (DP-4). This area is primarily pervious and has a CN:74, and a minimum time of concentration of 6.0 minutes is used.
- Subcatchment P-4B is approximately 0.049 acres (2,134 SF) consisting of the northeast corner of the limit of work which is proposed to be a grass surface. The stormwater in this location flows overland to a catch basin that is part of the MA DOT drainage system. The system discharges at the 30-inch RCP at Wetland A (DP-4). This area is primarily pervious and has a CN:74, and a minimum time of concentration of 6.0 minutes is used.
- Subcatchment 5 is approximately 0.291 acres (12,691 SF) consisting of the area surrounding the channel/bank. This area is comprised of grass, impervious walkways and woods, and it has a CN: 88. The minimum time of concentration of 6.0 minutes is used.

Hydrology Model Results and Conclusions

The goal of the stormwater design is to comply to the maximum extent practicable with the Massachusetts Stormwater Policy and the Town of Sudbury Stormwater Management Regulations. The existing site contains 159,734 SF (3.67AC) of impervious area. The proposed site contains 183,518 SF (4.21 AC) of impervious area, which is an increase of 23,783 SF. Because there is an increase in impervious area, the project is considered a new and development. This analysis confirms that the stormwater system is receiving proper treatment and most peak rates of runoff have been reduced to below pre-development rates using stormwater Best Management Practices including deep sump hooded catch basins, oil/grit separators, SciClone Water Quality Units, underground infiltration systems and permeable pavement. The discharge points from the site have been engineered to employ properly designed rip-rap splash pads to further reduce discharge velocities and to spread out the discharge to

prevent scour and point discharge erosion. The water quality units have been properly sized in accordance with MADEP guidance for water quality flows. Please refer to Section 4 of the Stormwater Report for calculations associated with the sizing.

The results of the pre- and post-development hydrology calculations provided in Section 3 are summarized in the following tables:

Table 1.9.1 shows the peak rate of runoff at each design point for the existing site as well as for the developed site at 1, 2, 5, 10, 25, 100-year and 1-inch design storms.

Point of	1-in Storm (cfs)			1-Yr Storm (cfs)			2-Yr Storm (cfs)			5-Yr Storm (cfs)			10-Yr Storm (cfs)			25-Yr Storm (cfs)			100-Yr Storm (cfs)		
Analysis	Pre	Post	Δ	Pre	Post	Δ	Pre	Post	Δ	Pre	Post	Δ	Pre	Post	Δ	Pre	Post	Δ	Pre	Post	Δ
PD-1	0.20	0.00	-0.20	1.25	0.08	-1.17	1.72	0.14	-1.58	2.25	0.23	-2.02	2.94	0.34	-2.60	3.85	0.50	-3.35	5.82	0.87	-4.95
PD-2	0.20	0.00	-0.20	1.25	0.08	-1.17	1.72	0.14	-1.58	2.25	0.23	-2.02	2.94	0.34	-2.60	3.85	0.50	-3.35	5.82	0.87	-4.95
PD-3	0.30	0.00	-0.30	1.04	0.00	-1.04	1.35	0.00	-1.35	1.70	0.00	-1.70	2.16	0.00	-2.16	2.77	0.18	-2.59	4.12	1.04	-3.08
PD-4	0.00	0.00	0.00	0.12	0.06	-0.06	0.20	0.10	-0.10	0.31	0.15	-0.16	0.45	0.23	-0.22	0.65	0.33	-0.32	1.10	0.56	-0.54
PD-5	1.32	1.31	-0.01	5.56	5.40	-0.16	7.38	7.11	-0.27	9.47	9.05	-0.42	12.18	11.54	-0.64	15.81	14.85	-0.96	23.63	21.97	-1.66
PD-6	2.30	1.31	-0.99	10.09	5.64	-4.45	13.43	7.53	-5.90	17.26	9.71	-7.55	22.21	12.53	-9.68	28.82	16.32	-12.50	43.10	24.54	-18.56

Table 1.9.1

As shown in Table 1.9.1, the peak stormwater runoff generated by the development are the same or less in post development conditions versus the existing conditions at all design points, for every storm with the exception of the 1-inch storm at PD-5. All stormwater ultimately discharges to Wetland A (PD-6) In all storms, the peak stormwater runoff to PD-6 is significantly reduced. Refer to Section 3 for the complete HydroCAD Analysis that documents the above results as well as the Existing and Proposed Conditions Watershed Plans, also enclosed in Section 3.

Table 1.9.2 shows the total volume discharge at each design point for the existing site as well as for the developed site at 1, 2, 5, 10, 25, 100-year and 1-inch design storms.

Point of	1-in Storm (ac-ft)			1-Yr Storm (ac-ft)			2-Yr Storm (ac-ft)			5-Yr Storm (ac-ft)			10-Yr Storm (ac-ft)			25-Yr Storm (ac-ft)			100-Yr Storm (ac-ft)		
Analysis	Pre	Post	Δ	Pre	Post	Δ	Pre	Post	Δ	Pre	Post	Δ	Pre	Post	Δ	Pre	Post	Δ	Pre	Post	Δ
PD-1	0.016	0.000	-0.016	0.091	0.007	-0.084	0.125	0.011	-0.114	0.165	0.017	-0.148	0.218	0.025	-0.193	0.290	0.036	-0.254	0.448	0.064	-0.384
PD-2	0.016	0.000	-0.016	0.091	0.007	-0.084	0.125	0.011	-0.114	0.165	0.017	-0.148	0.218	0.025	-0.193	0.290	0.037	-0.253	0.448	0.131	-0.317
PD-3	0.022	0.000	-0.022	0.081	0.000	-0.081	0.106	0.000	-0.106	0.134	0.000	-0.134	0.172	0.000	-0.172	0.223	0.122	-0.101	0.335	0.540	0.205
PD-4	0.000	0.000	0.000	0.010	0.005	-0.005	0.016	0.008	-0.008	0.024	0.011	-0.013	0.034	0.016	-0.018	0.049	0.024	-0.025	0.083	0.041	-0.042
PD-5	0.114	0.104	-0.010	0.464	0.420	-0.044	0.618	0.556	-0.062	0.796	0.713	-0.083	1.030	0.918	-0.112	1.347	1.194	-0.153	2.046	1.799	-0.247
PD-6	0.188	0.105	-0.083	0.806	0.447	-0.359	1.078	0.600	-0.478	1.394	0.778	-0.616	1.809	1.012	-0.797	2.371	1.454	-0.917	3.608	2.644	-0.964

As shown in Table 1.9.2, the total volume discharge generated by the development are the same or less in post development conditions versus the existing conditions at all design points, for every storm. Refer to Section 3 for the complete HydroCAD Analysis that documents the above results as well as the Existing and Proposed Conditions Watershed Plans, also enclosed in Section 3.

1.10 STORMWATER MANAGEMENT

The following section describes each of the ten (10) Massachusetts Stormwater Management Standards and describes how the project complies with each.

Crocker Design Group

Standard 1: No New Untreated Discharges – No new stormwater conveyances (e.g. outfalls) may discharge untreated stormwater directly to or cause erosion in wetlands or waters of the Commonwealth.

All new stormwater system conveyances are treated prior to discharge and result in no erosion occurring on site. The drainage system has been designed to direct stormwater runoff from impervious areas through various stormwater systems designed to capture, convey, treat, detain, recharge and infiltrate (where appropriate) the runoff prior to discharge. The outfalls have no erosion issues and the flows will not be increased.

Standard 2: Peak Rate Attenuation – Stormwater management systems should be designed so that post-development peak discharge rates do not exceed pre-development peak discharge rates.

Please refer to Table 1.8.1 above. The stormwater management system reduces peak rates of runoff to below pre-development levels. All stormwater ultimately discharges to Wetland A (PD-6), and in all storms, the peak stormwater runoff to PD-6 is significantly reduced. This Standard has been met.

Standard 3: Recharge – Loss of annual recharge to groundwater shall be eliminated or minimized through the use of infiltration measures including environmentally sensitive site design, low impact development techniques, stormwater best management practices, and good operation and maintenance. At a minimum, the annual recharge from the post-development site shall approximate the annual recharge from pre-development conditions based on soil type. This standard is met when the stormwater management system is designed to infiltrate the required recharge volume as determined in accordance with the Massachusetts Stormwater Handbook.

The stormwater system includes two (2) infiltration BMP's: permeable pavement and subsurface infiltration chambers. The stormwater system has been designed to comply with the recharge requirements of the MA Stormwater Management Regulations. Refer to Section 4.0 for a summary of the stormwater recharge calculations.

Standard 4: Water Quality – Stormwater management systems shall be designed to remove 80% of the average annual post-construction load of Total Suspended Solids (TSS).

The project utilizes deep sump hooded catch basins, oil/grit separators, SciClone Water Quality Units, subsurface infiltration systems and permeable pavement. Please refer to Section 4.4 for the TSS calculation spreadsheets.

Per the Town of Sudbury Stormwater Management Bylaw, water quality volume for sizing of BMP's is based on 1-inch of runoff from the tributary area. Please refer to Section 4 of this report for Stormwater Management Calculations.

Standard 5: Land Uses with Higher Potential Pollutant Loads (LUHPPL) – For land uses with higher potential pollutant loads, source control and pollution prevention shall be implemented in accordance with the Massachusetts Stormwater Handbook to eliminate or reduce the discharge of stormwater runoff from such land uses to the maximum extent practicable.

The proposed project is an automobile dealership and includes new and used vehicle sales, display and inventory storage and service. No exterior vehicle service or repair exterior equipment cleaning nor commercial vehicle washing are proposed. As such, the project is not a LUHPPL.

Standard 6: Critical Areas – Stormwater discharges within the Zone II or Interim Wellhead Protection Area of a public water supply, and stormwater discharges near or to any other critical area, require the use of the specific source control and pollution prevention measures and the specific structural stormwater best management practices determined by the Department to be suitable for managing discharges to such areas, as provided in the Massachusetts Stormwater Handbook.

The project is not located near a critical area, however, the project BMP's have been designed to treat stormwater as if they were discharging to a critical area.

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

The existing site contains 159,734 SF (3.667AC) of impervious area. The proposed site contains 183,518 SF (4.213 AC) of impervious area, which is an increase of 23,738 SF.

The project is considered a new development. This standard does not apply.

Standard 8: Construction Period Pollution Prevention Plan and Erosion 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) shall be developed and implemented.

An Erosion and Sedimentation Controls Plan has been incorporated into the Site Plans. A draft SWPPP is also enclosed in Section 8.

Standard 9: Operation and Maintenance Plan – A long-term operation and maintenance plan shall be developed and implemented to ensure that stormwater management systems function as designed.

The plan set includes an erosion and sediment control plan (Sheet C-2). A draft SWPPP was prepared and provided with the Stormwater Management Permit Application

Standard 10: Prohibition of Illicit Discharges – All illicit discharges to the stormwater management system are prohibited.

An Illicit Discharge Compliance Statement is included as required and is enclosed in Section 2.2.

1.11 BEST MANAGEMENT PRACTICES (BMP'S)

A system of deep sump hooded catch basins, oil/grit separators, SciClone Hydrodynamic Separators, subsurface infiltration systems, and permeable pavement will be used to treat stormwater runoff on the site. See Section 4 for stormwater management calculations.

1.12 PIPE SIZING

Refer to Section 7 for the Hydraulic Pipe Analysis/Sizing calculations, which utilizes the Hydraflow Storm Sewers Extension Pack through AutoCAD Civil 3D to analyze the pipe design and to select appropriate pipe sizing. Reports are included for the 10 and 100-year storms for pipe capacity analysis and sizing.

The tributary area for each inlet/subcatchment area has been computed along with pipe length, slope and friction coefficient. This approach was used to size the pipes such that the 10-year

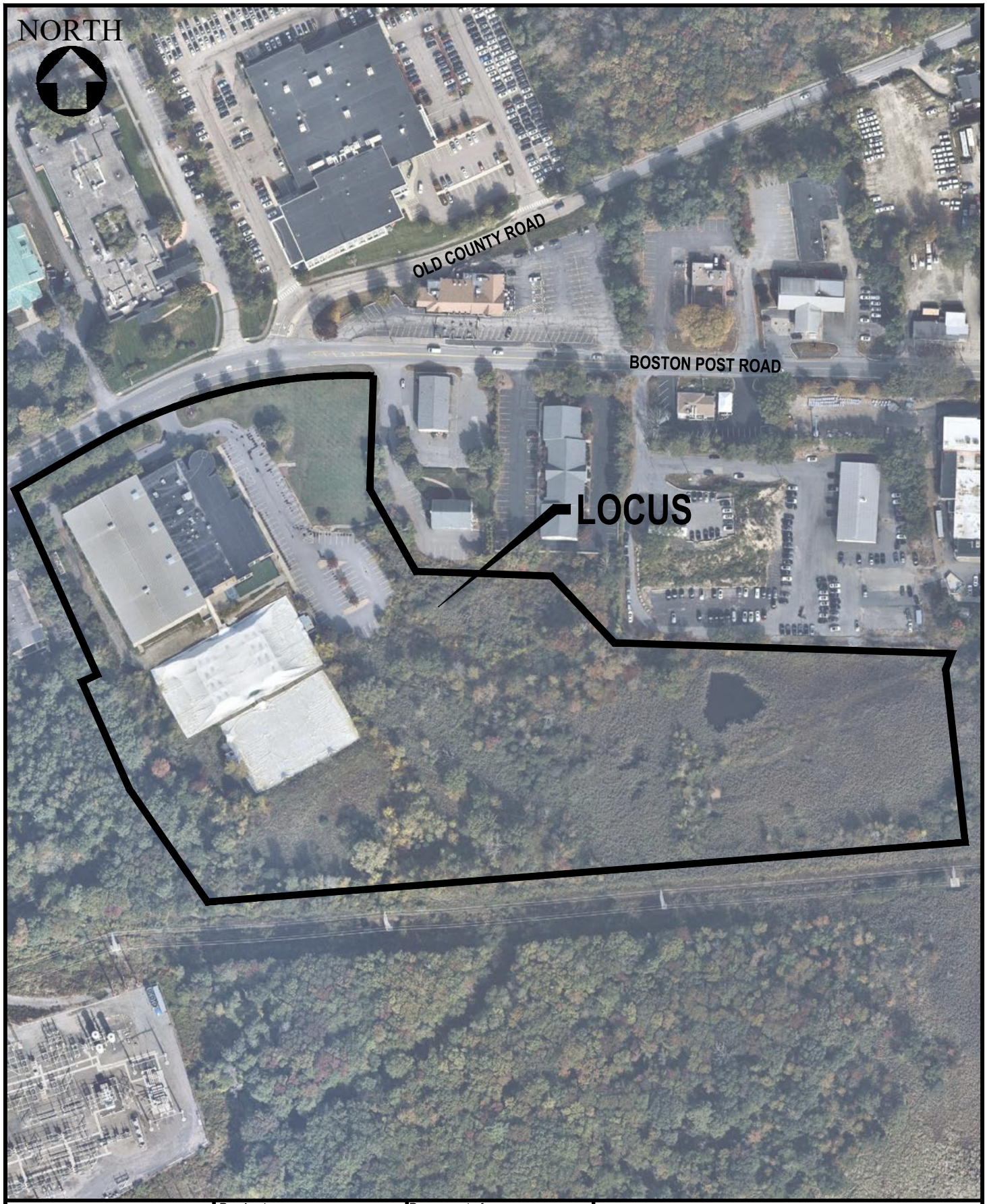
storm event is contained within the pipe. The 100-year storm was then checked to confirm the hydraulic grade line for the pipe network does not exceed the rim elevations of the drainage structures. In addition, pipe velocities were checked to be within the range of 2fps to 10 fps flowing 1/3 full. Those calculations are included in Section 7 herein.

1.13 CONCLUSION

In conclusion, the project has been designed in accordance with the requirements of the MA DEP's Stormwater Management Standards and in compliance with the Town of Sudbury's Conservation Commission Wetland Regulations and Stormwater Management Bylaw.

1.14 Figures

FIG 1 ORTHOGRAPHIC MAP
FIG 2 FEMA FLOODPLAIN MAP
FIG 3 MASSDEP WETLANDS MAP
FIG 4 USGS MAP
FIG 5 NHESP HABITAT MAP



Crocker Design Group
2 SHARP STREET, UNIT B
HINGHAM, MA 02043

Project
HERB CHAMBERS MERCEDES OF SUDBURY
141 BOSTON POST ROAD, SUDBURY, MA

Prepared for
HERB CHAMBERS 43 BRAINTREE STREET, LLC
#259 MCGRATH HIGHWAY - ROUTE 28 SOMERVILLE, MA 02143

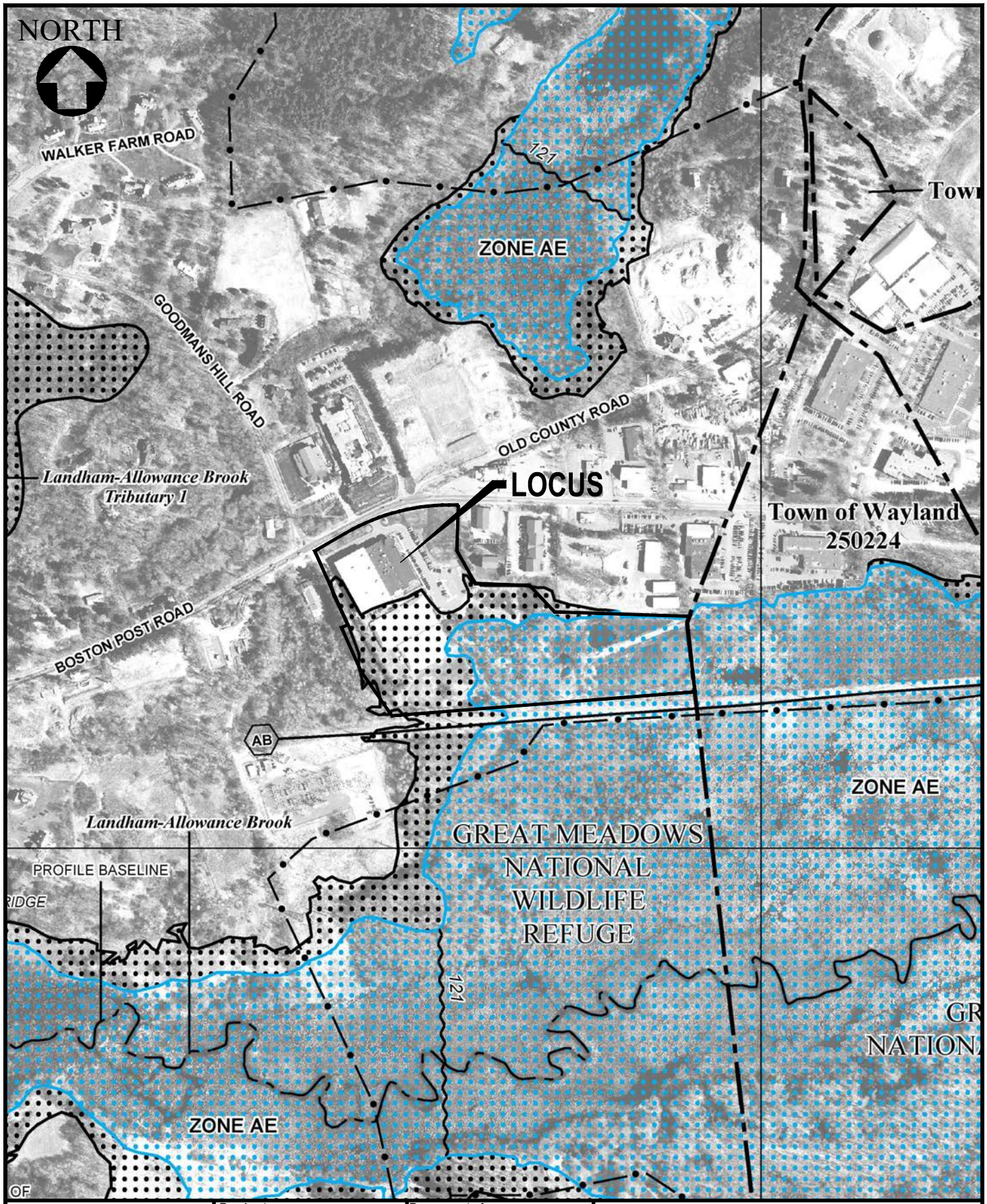
Drawing Title
AERIAL MAP

DATE: 11.15.2021	DRAWN: SVP
JOB NO.:100–107	CHECK: ML

SCALE: 200 100 0 200

1

C:\CDG\Crocker Design Group, LLC\Gabriel Crocker – Projects\100–107 Sudbury – Mercedes\Permitting\Stormwater Report\Figures\, 100–107 Aerial Map.dwg, AERIAL, Nov 10, 2021 14:58



Crocker Design Group
2 SHARP STREET, UNIT B
HINGHAM, MA 02043

Project
HERB CHAMBERS MERCEDES OF SUDBURY
141 BOSTON POST ROAD,
SUDBURY, MA

Prepared for
HERB CHAMBERS 43 BRAINTREE STREET, LLC
#259 MCGRATH HIGHWAY - ROUTE 28
SOMERVILLE, MA 02143

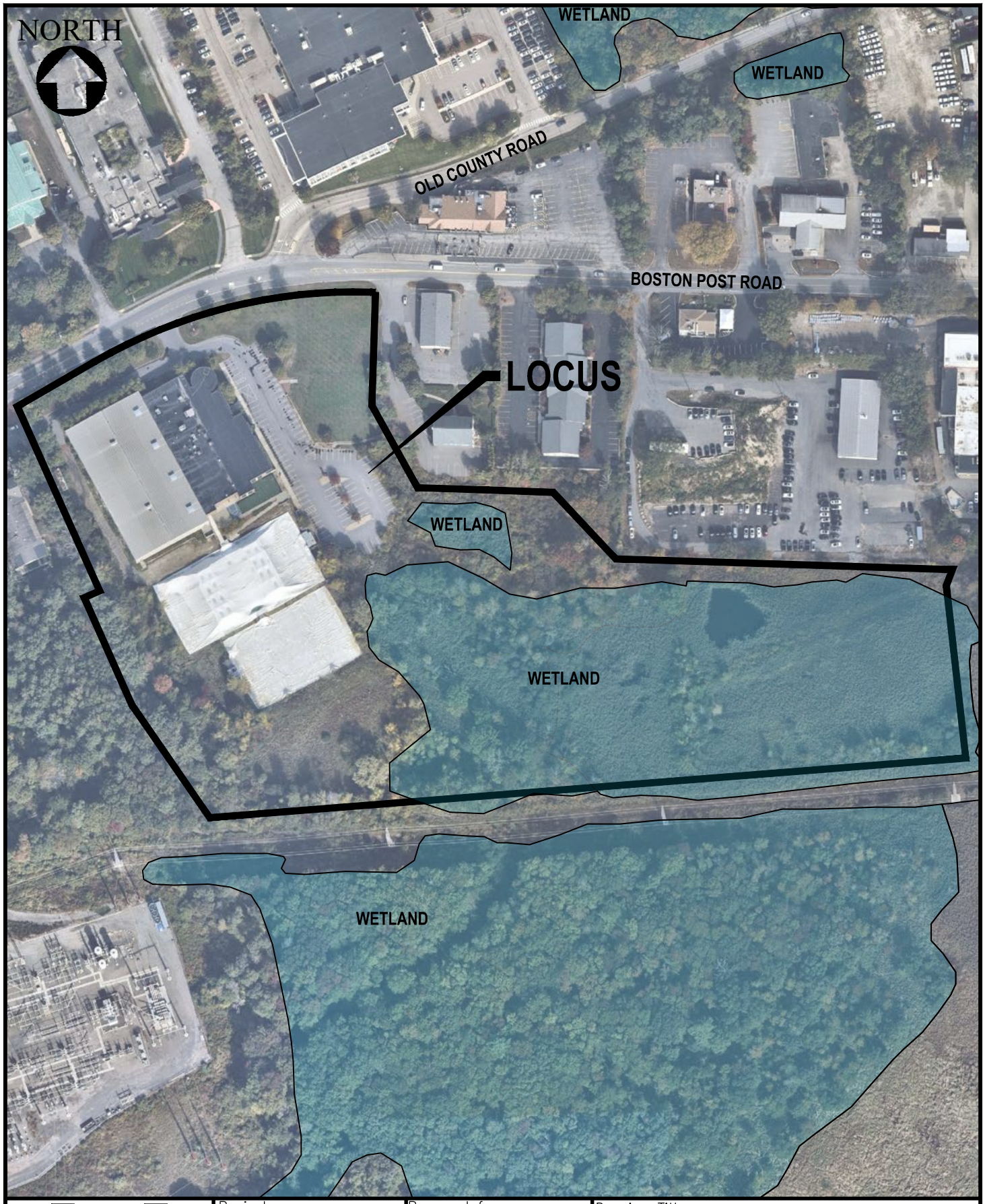
Drawing Title
FEMA MAP
EFFECTIVE PANEL 25017C0507F

DATE: 11.15.2021	DRAWN: SVP
JOB NO.:100–107	CHECK: ML

SCALE:
500 250 0 500

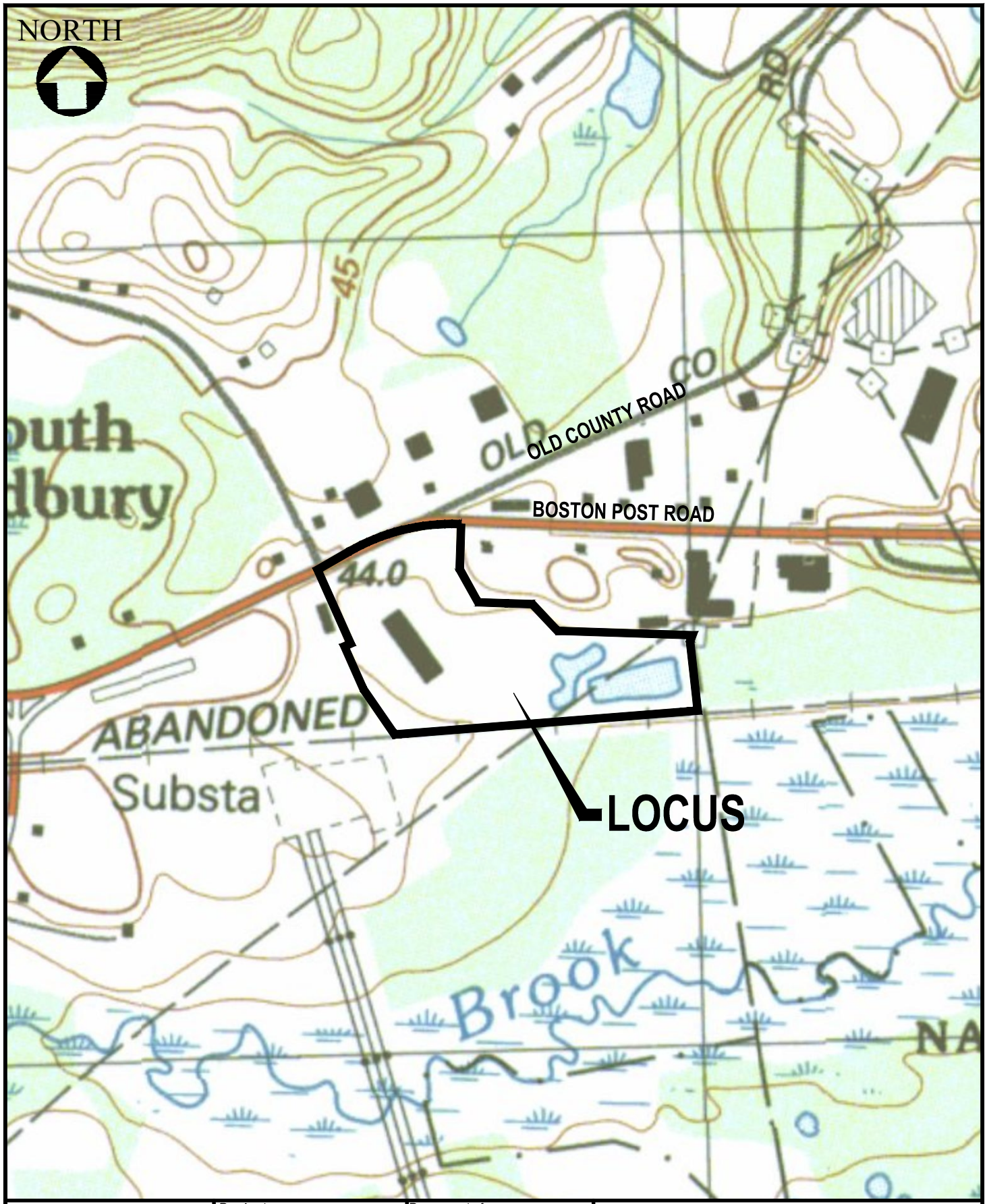
3

C:\CDG\Crocker Design Group, LLC\Gabriel Crocker – Projects\100–107 Sudbury – Mercedes\Permitting\Stormwater Report\Figures\, 100–107 FEMA MAP.dwg, Layout1, Nov 10, 2021 15:02



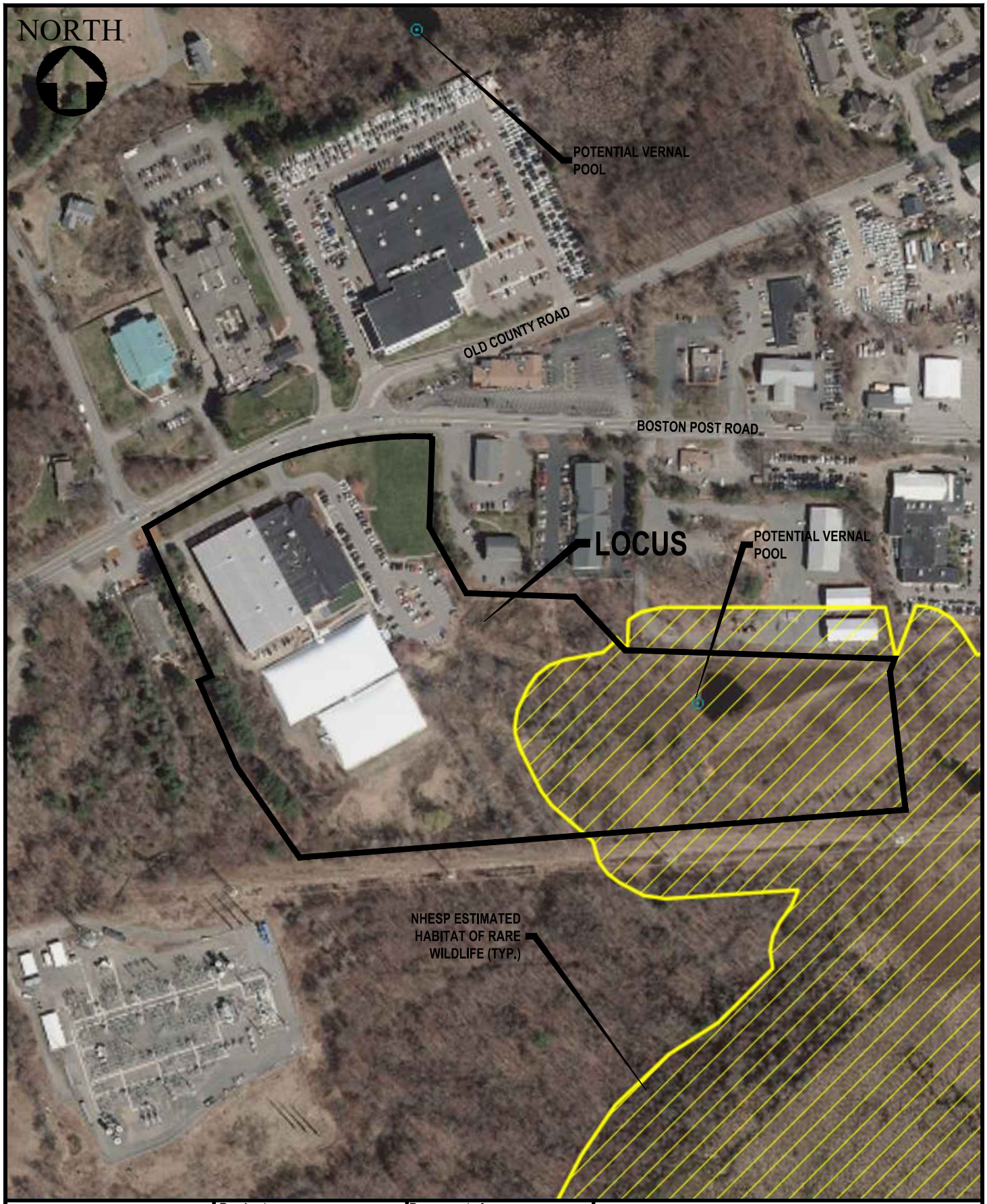
Crocker Design Group 2 SHARP STREET, UNIT B HINGHAM, MA 02043	Project **HERB CHAMBERS MERCEDES OF SUDBURY** 141 BOSTON POST ROAD, SUDBURY, MA	Prepared for **HERB CHAMBERS 43 BRAINTREE STREET, LLC** #259 MCGRATH HIGHWAY - ROUTE 28 SOMERVILLE, MA 02143	Drawing Title **MASSGIS WETLANDS MAP** DATE: 11.15.2021 DRAWN: SVP JOB NO.:100–107 CHECK: ML SCALE: 200 100 0 200 **2**

C:\CDG\Crocker Design Group, LLC\Gabriel Crocker - Projects\100-107 Sudbury - Mercedes\Permitting\Stormwater Report\Figures\, 100-107 WETLANDS MAP.dwg, Layout1, Nov 10, 2021 15:00



Crocker Design Group 2 SHARP STREET, UNIT B HINGHAM, MA 02043	Project **HERB CHAMBERS MERCEDES OF SUDBURY** 141 BOSTON POST ROAD, SUDBURY, MA	Prepared for **HERB CHAMBERS 43 BRAINTREE STREET, LLC** #259 MCGRATH HIGHWAY - ROUTE 28 SOMERVILLE, MA 02143	Drawing Title **USGS MAP** DATE: 11.15.2021 DRAWN: SVP JOB NO.:100–107 CHECK: ML SCALE: 500 250 0 500	**4**

C:\CDG\Crocker Design Group, LLC\Gabriel Crocker - Projects\100-107 Sudbury - Mercedes\Permitting\Stormwater Report\Figures\, 100-107 USGS MAP.dwg, Layout1, Nov 10, 2021 15:04



Crocker Design Group
2 SHARP STREET, UNIT B
HINGHAM, MA 02043

Project
HERB CHAMBERS MERCEDES OF SUDBURY
141 BOSTON POST ROAD, SUDBURY, MA

Prepared for
HERB CHAMBERS 43 BRAINTREE STREET, LLC
#259 MCGRATH HIGHWAY - ROUTE 28
SOMERVILLE, MA 02143

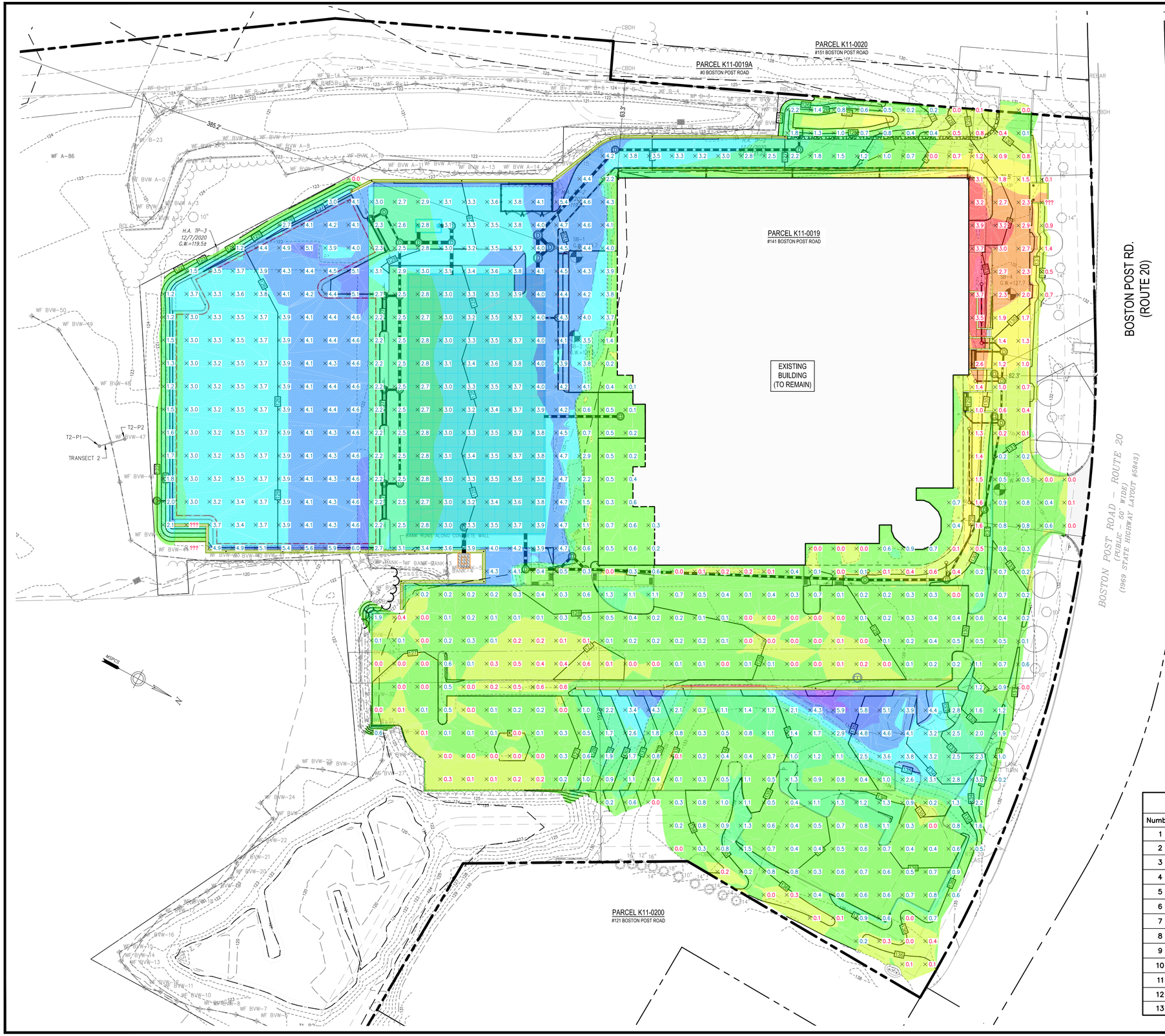
Drawing Title
NHESP MAP

DATE: 11.15.2021	DRAWN: SVP
JOB NO.:100-107	CHECK: ML

SCALE: 250 125 0 250

5

C:\CDG\Crocker Design Group, LLC\Gabriel Crocker - Projects\100-107 Sudbury - Mercedes\Permitting\Stormwater Report\Figures\, 100-107 NHESP MAP.dwg, Layout1, Nov 10, 2021 15:07



Volume

Minimum elevation	-4.775'
Maximum elevation	7.261'
Mean elevation	1.643'
Base Surface	Existing surface
Comparison	Proposed surface
Cut Factor	1.000
Fill Factor	1.000
Cut volume	807.44 Cu. Yd.
Fill volume	11,344.90 Cu. Yd.
Net volume	10,537.46 Cu. Yd.<Fill>

Elevations Table

Number	Min. Elevation	Max. Elevation	2D Area	Volume	Color
1	-5.00	-4.00	85.09	0.65	
2	-4.00	-3.00	986.60	16.97	
3	-3.00	-2.00	2,456.34	79.55	
4	-2.00	-1.00	4,832.76	211.39	
5	-1.00	0.00	22,869.69	541.16	
6	0.00	1.00	60,697.06	4,037.96	
7	1.00	2.00	12,412.46	2,898.73	
8	2.00	3.00	15,885.62	2,492.09	
9	3.00	4.00	33,804.68	1,527.80	
10	4.00	5.00	21,049.46	375.38	
11	5.00	6.00	2,335.34	45.21	
12	6.00	7.00	306.61	5.33	
13	7.00	8.00	40.45	0.16	

30 15 0 30 60

Date	Description	No.
	Revisions	

11-10-2021

COMMONWEALTH OF MASSACHUSETTS
GABRIEL R. CROCKER
CIVIL
No. 47917
REGISTERED PROFESSIONAL ENGINEER

GABRIEL R. CROCKER
PROFESSIONAL ENGINEER, MA REGISTRATION #47917

Crocker Design Group
2 SHARP STREET, UNIT B
HINGHAM, MA 02043
P: 781-919-0808

Project

MERCEDES OF SUDBURY

141 BOSTON POST ROAD,
SUDBURY, MA

Prepared for

HERB CHAMBERS 43 BRAINTREE STREET, LLC

#259 McGRATH HIGHWAY - ROUTE 28
SOMERVILLE, MA 02143

Drawing Title

CUT & FILL PLAN

Project No.	100-107
Date	11/10/2021
Scale	1"=30'
Drawn By	DJN / JPM
Approved By	GC

Drawing No.

CF-1

SECTION 2 – STORMWATER CHECKLIST

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

Checklist for Stormwater Report

A. Introduction

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



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

The Stormwater Report must include:

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

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

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

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

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

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

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

Checklist for Stormwater Report

B. Stormwater Checklist and Certification

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

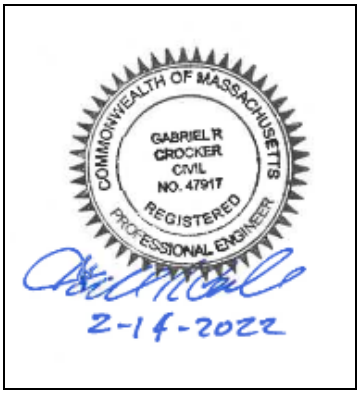
Note: Because stormwater requirements vary from project to project, it is possible that a complete Stormwater Report may not include information on some of the subjects specified in the Checklist. If it is determined that a specific item does not apply to the project under review, please note that the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

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

Registered Professional Engineer's Certification

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

Registered Professional Engineer Block and Signature



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): Permeable pavement

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.

ILLICIT DISCHARGE COMPLIANCE STATEMENT

Standard 10: Massachusetts Stormwater Standards Handbook

Illicit discharges are defined as discharges into waters of the State or municipal separate stormwater system (MS4) that are not entirely comprised of stormwater. Exclusions for non-stormwater discharges into drainage systems include activities or facilities for firefighting, water line flushing, landscape irrigation, uncontaminated groundwater discharge, potable water sources, foundation drains, air conditioning condensation, footing drains, individual resident car washing, water used to clean residential buildings without detergents, water used for street washing, and flows from riparian habitats/wetlands. These exclusions are subject to change and are under the discretion of the local governing authority.

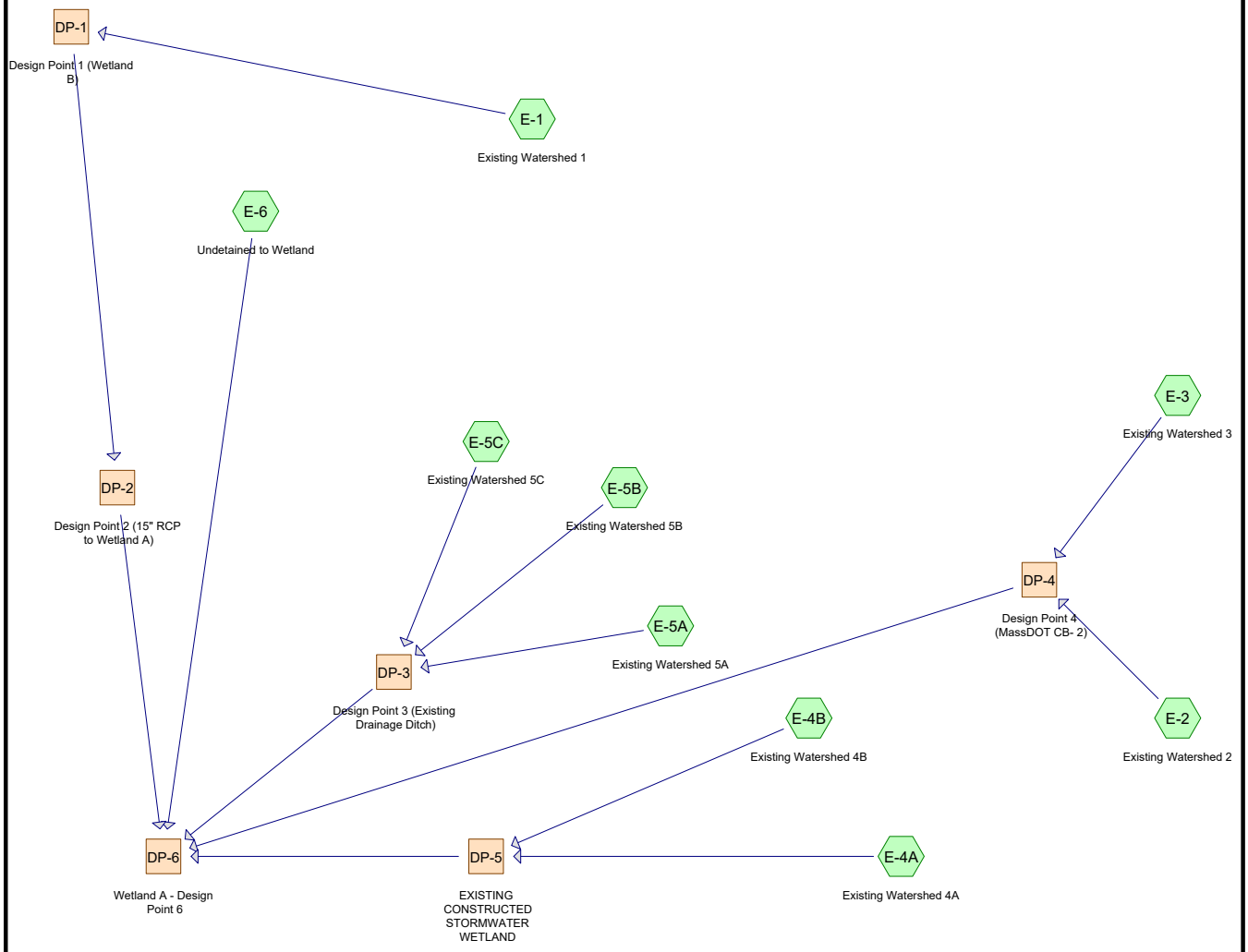
To the best of our knowledge and professional belief no illicit discharges to the stormwater system, surface waters, or wetland resource areas will remain on the site after construction. We will agree to implement a pollution prevention plan to prevent illicit discharges into the stormwater management system. The design of the site based on the plans entitled "Herb Chambers Mercedes of Sudbury" prepared by Crocker Design Group, 2 Sharp Street, Unit A, Hingham, Massachusetts show a separation and no direct connection between the stormwater management systems and the wastewater and/ or groundwater on the site. To the maximum extent practicable, the design prevents entry of illicit discharges into the stormwater management system.

Owner's Name: _____
(please print)

Owner's Signature: _____ Date: _____

Company: Herb Chambers, Mercedes of Sudbury

SECTION 3 – STORMATER HYDROLOGY MODEL



Subcat Reach Pond Link

Routing Diagram for 100-107 Existing Watershed

Prepared by {enter your company name here}, Printed 2/10/2022

HydroCAD® 10.00-26 s/n 01012 © 2020 HydroCAD Software Solutions LLC

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
0.007	79	50-75% Grass cover, Fair, HSG C (E-5C)
1.593	74	>75% Grass cover, Good, HSG C (E-1, E-2, E-3, E-4B, E-5A, E-6)
0.287	96	Gravel surface, HSG C (E-1, E-4B, E-5C)
0.040	74	Mulch (E-4B)
2.468	98	Paved parking, HSG C (E-1, E-2, E-4B, E-5B, E-5C, E-6)
1.199	98	Roofs, HSG C (E-4A)
0.270	70	Woods, Good, HSG C (E-1, E-4B, E-5A, E-5C, E-6)

Summary for Subcatchment E-1: Existing Watershed 1

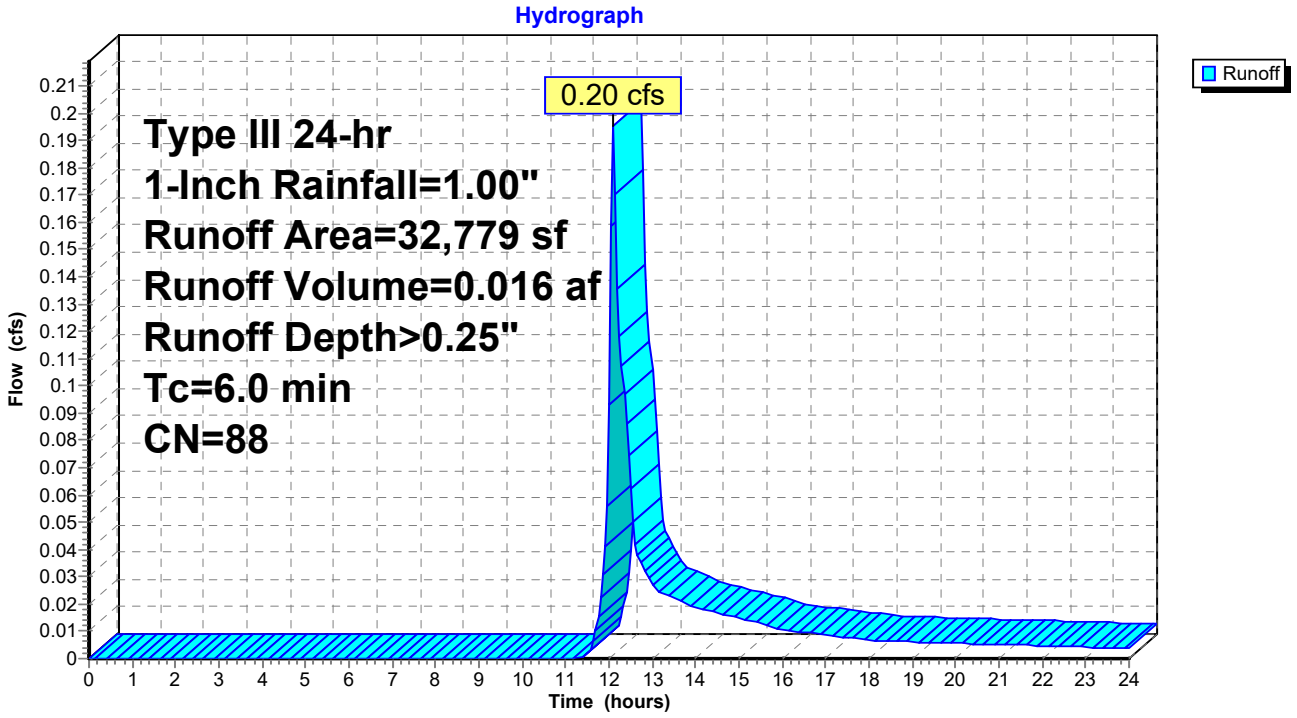
Runoff = 0.20 cfs @ 12.10 hrs, Volume= 0.016 af, Depth> 0.25"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 1-Inch Rainfall=1.00"

Area (sf)	CN	Description
11,618	98	Paved parking, HSG C
9,421	96	Gravel surface, HSG C
5,782	74	>75% Grass cover, Good, HSG C
3,103	70	Woods, Good, HSG C
561	70	Woods, Good, HSG C
2,294	74	>75% Grass cover, Good, HSG C
32,779	88	Weighted Average
21,161		64.56% Pervious Area
11,618		35.44% Impervious Area

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

Subcatchment E-1: Existing Watershed 1



Summary for Subcatchment E-2: Existing Watershed 2

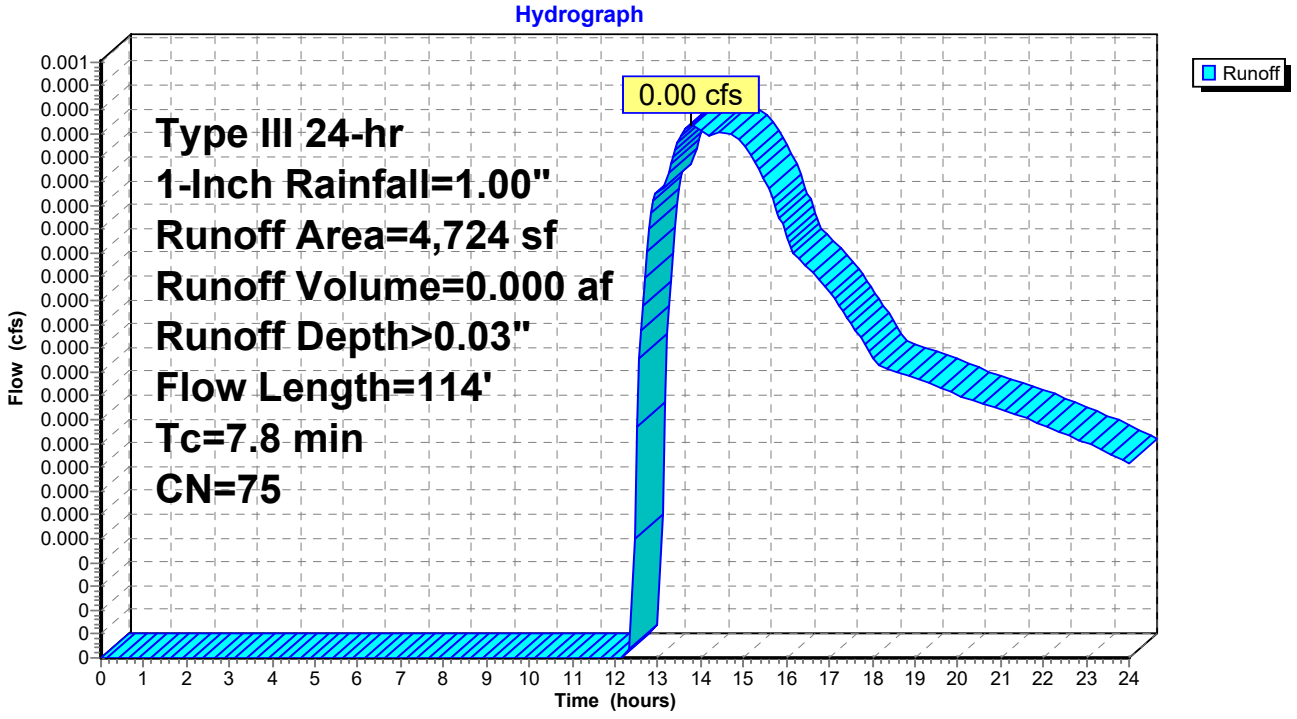
Runoff = 0.00 cfs @ 13.80 hrs, Volume= 0.000 af, Depth> 0.03"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 1-Inch Rainfall=1.00"

Area (sf)	CN	Description
4,621	74	>75% Grass cover, Good, HSG C
103	98	Paved parking, HSG C
4,724	75	Weighted Average
4,621		97.82% Pervious Area
103		2.18% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.4	50	0.0100	0.11		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.20"
0.4	64	0.0312	2.84		**Shallow Concentrated Flow, Shallow Concentrated Flow** Unpaved Kv= 16.1 fps
7.8	114	Total			

Subcatchment E-2: Existing Watershed 2



Summary for Subcatchment E-3: Existing Watershed 3

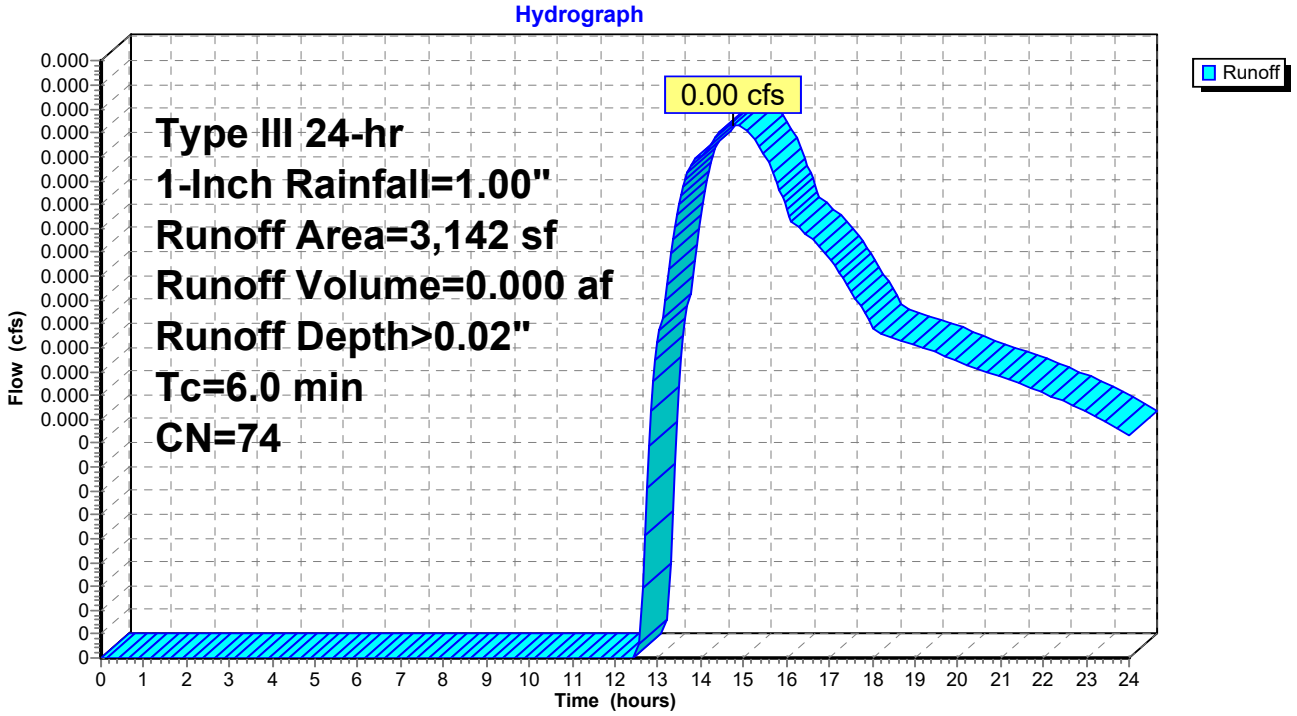
Runoff = 0.00 cfs @ 14.78 hrs, Volume= 0.000 af, Depth> 0.02"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 1-Inch Rainfall=1.00"

Area (sf)	CN	Description
3,142	74	>75% Grass cover, Good, HSG C
3,142		100.00% Pervious Area

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

Subcatchment E-3: Existing Watershed 3



Summary for Subcatchment E-4A: Existing Watershed 4A

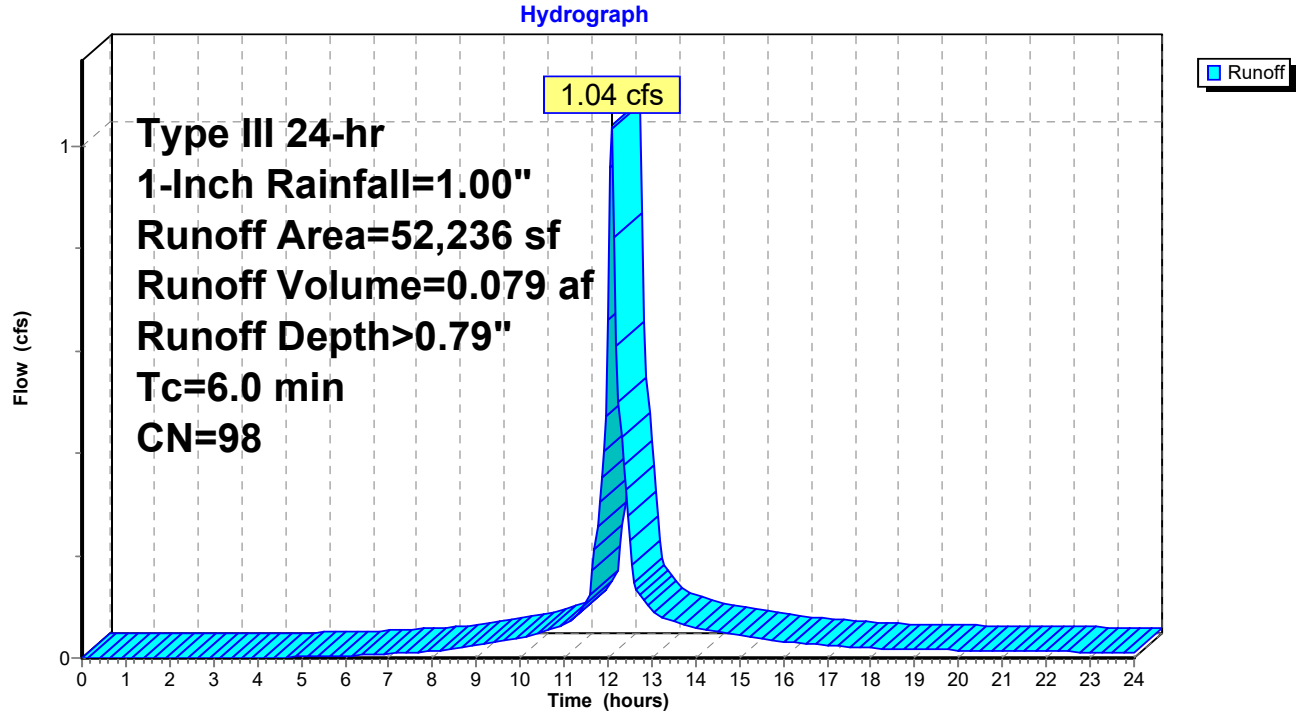
Runoff = 1.04 cfs @ 12.09 hrs, Volume= 0.079 af, Depth> 0.79"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 1-Inch Rainfall=1.00"

Area (sf)	CN	Description
52,236	98	Roofs, HSG C
52,236		100.00% Impervious Area

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

Subcatchment E-4A: Existing Watershed 4A



Summary for Subcatchment E-4B: Existing Watershed 4B

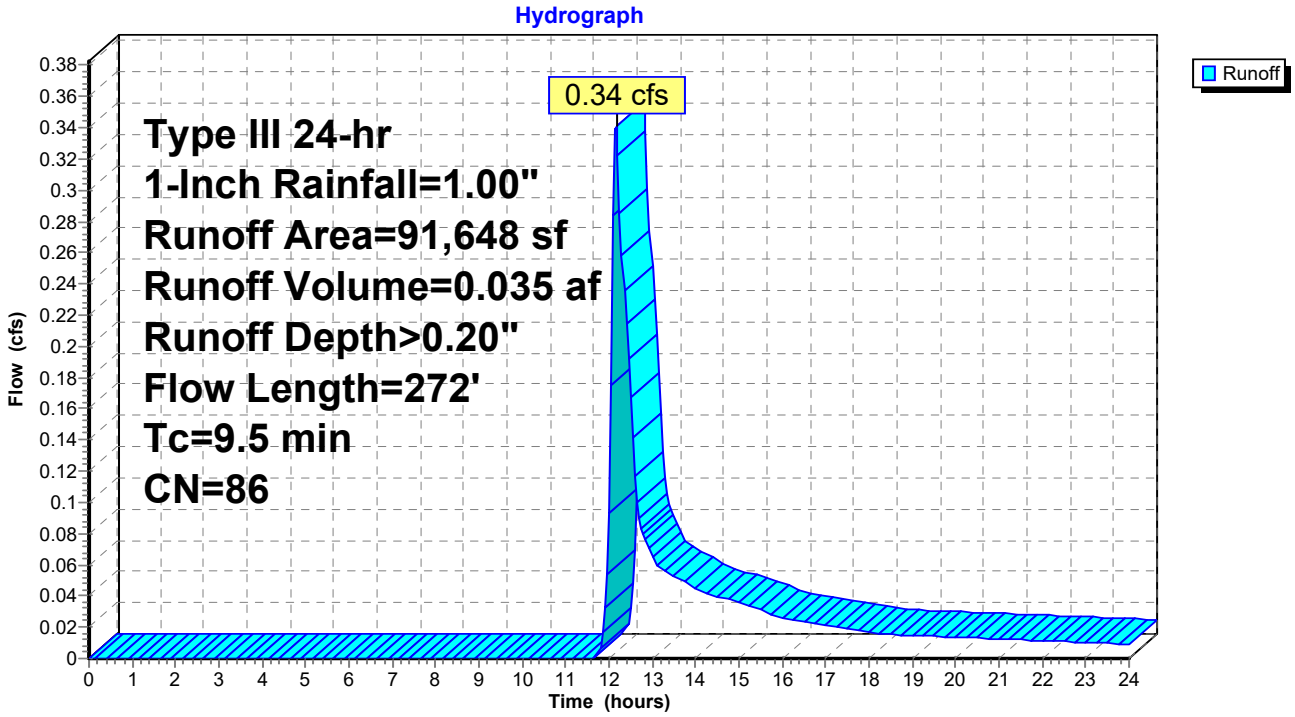
Runoff = 0.34 cfs @ 12.16 hrs, Volume= 0.035 af, Depth> 0.20"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 1-Inch Rainfall=1.00"

	Area (sf)	CN	Description
	43,351	98	Paved parking, HSG C
	1,304	96	Gravel surface, HSG C
	42,526	74	>75% Grass cover, Good, HSG C
	2,704	70	Woods, Good, HSG C
*	1,763	74	Mulch
	91,648	86	Weighted Average
	48,297		52.70% Pervious Area
	43,351		47.30% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.1	50	0.0080	0.10		**Sheet Flow, Sheet Flow** Grass: Short n= 0.150 P2= 3.20"
0.8	111	0.0216	2.37		**Shallow Concentrated Flow, Shallow Concentrated Flow** Unpaved Kv= 16.1 fps
0.1	40	0.1500	6.24		**Shallow Concentrated Flow, SHallow** Unpaved Kv= 16.1 fps
0.5	71	0.0150	2.49		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
9.5	272	Total			

Subcatchment E-4B: Existing Watershed 4B



Summary for Subcatchment E-5A: Existing Watershed 5A

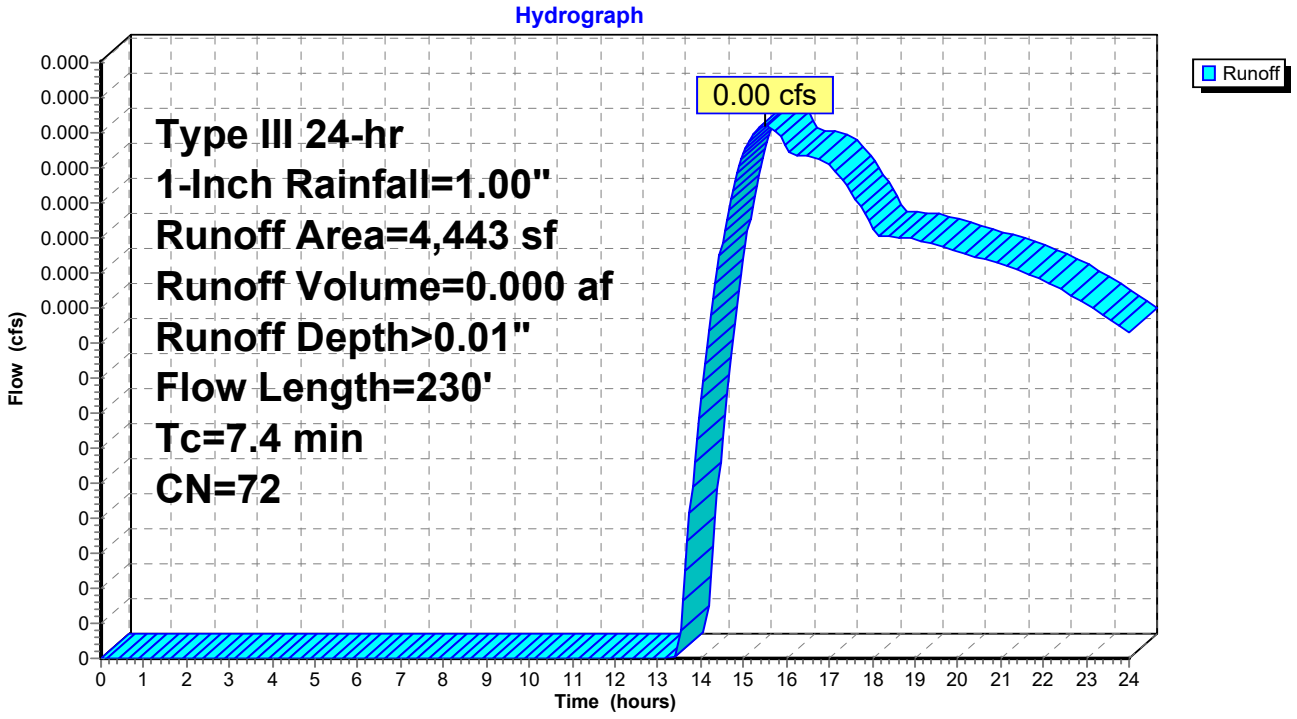
Runoff = 0.00 cfs @ 15.52 hrs, Volume= 0.000 af, Depth> 0.01"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 1-Inch Rainfall=1.00"

Area (sf)	CN	Description
1,742	74	>75% Grass cover, Good, HSG C
2,701	70	Woods, Good, HSG C
4,443	72	Weighted Average
4,443		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.2	50	0.0160	0.14		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.20"
1.2	180	0.0244	2.51		**Shallow Concentrated Flow, Shallow COncentrated Flow** Unpaved Kv= 16.1 fps
7.4	230	Total			

Subcatchment E-5A: Existing Watershed 5A



Summary for Subcatchment E-5B: Existing Watershed 5B

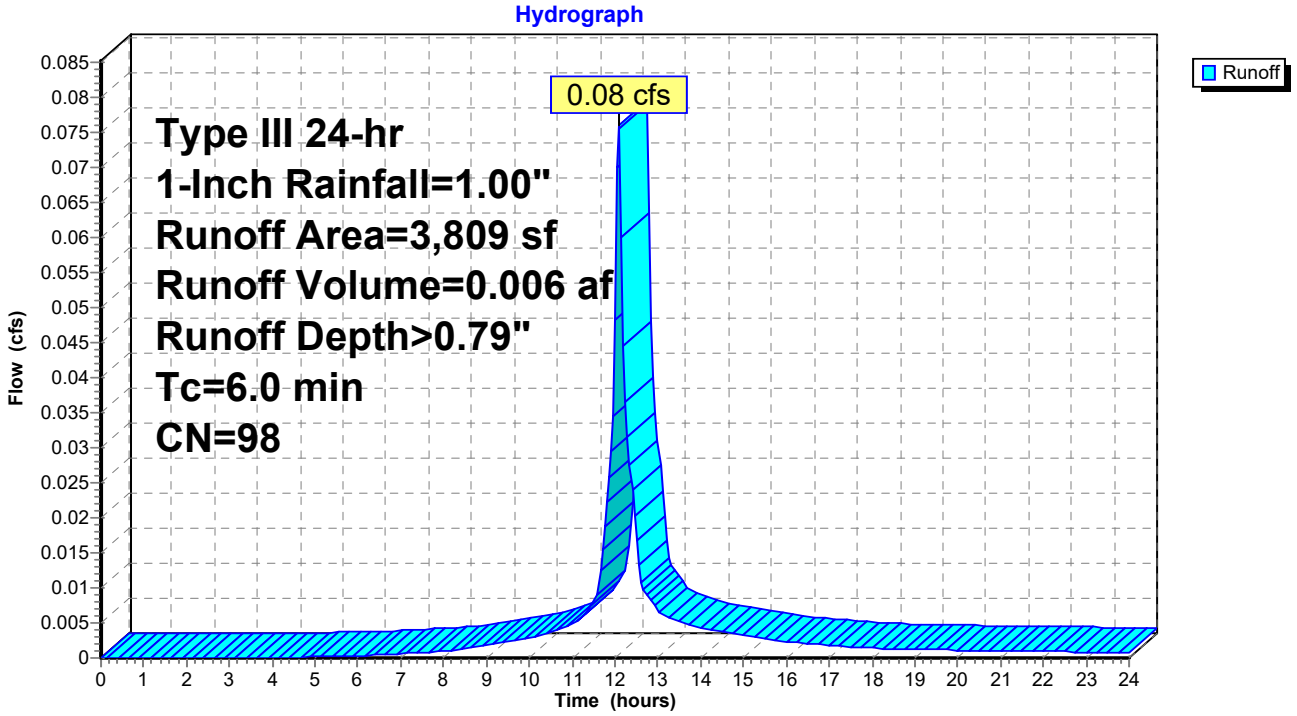
Runoff = 0.08 cfs @ 12.09 hrs, Volume= 0.006 af, Depth> 0.79"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 1-Inch Rainfall=1.00"

Area (sf)	CN	Description
3,809	98	Paved parking, HSG C
3,809		100.00% Impervious Area

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

Subcatchment E-5B: Existing Watershed 5B



Summary for Subcatchment E-5C: Existing Watershed 5C

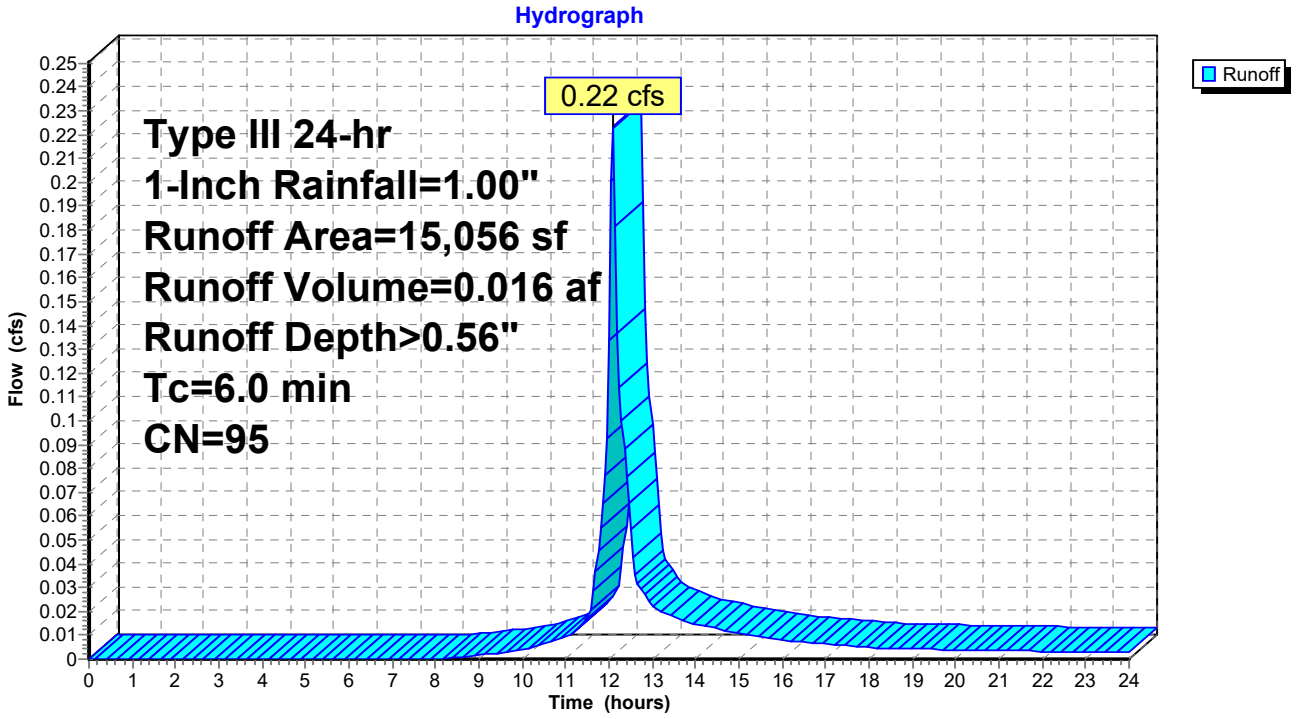
Runoff = 0.22 cfs @ 12.09 hrs, Volume= 0.016 af, Depth> 0.56"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 1-Inch Rainfall=1.00"

Area (sf)	CN	Description
11,709	98	Paved parking, HSG C
1,791	96	Gravel surface, HSG C
303	79	50-75% Grass cover, Fair, HSG C
678	70	Woods, Good, HSG C
575	70	Woods, Good, HSG C
15,056	95	Weighted Average
3,347		22.23% Pervious Area
11,709		77.77% Impervious Area

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

Subcatchment E-5C: Existing Watershed 5C



Summary for Subcatchment E-6: Undetained to Wetland

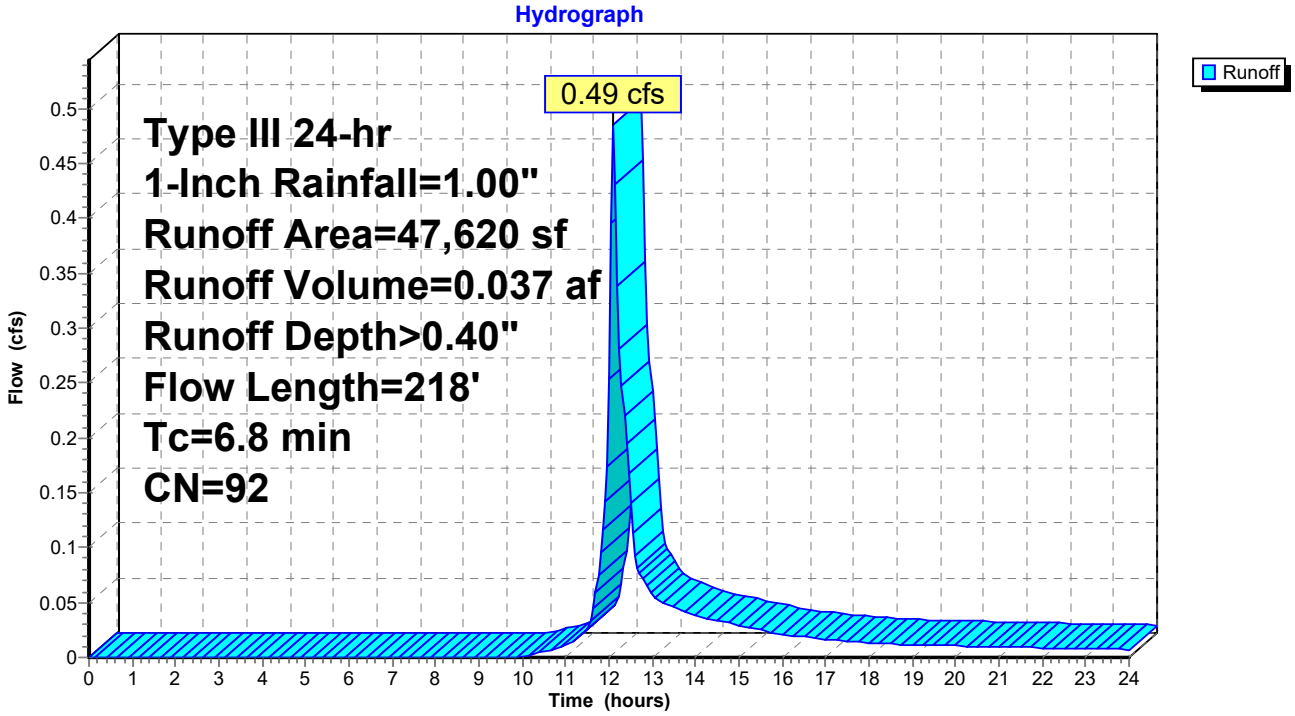
Runoff = 0.49 cfs @ 12.11 hrs, Volume= 0.037 af, Depth> 0.40"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 1-Inch Rainfall=1.00"

Area (sf)	CN	Description
36,924	98	Paved parking, HSG C
9,270	74	>75% Grass cover, Good, HSG C
1,426	70	Woods, Good, HSG C
47,620	92	Weighted Average
10,696		22.46% Pervious Area
36,924		77.54% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.6	50	0.0340	0.18		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.20"
2.2	168	0.0060	1.25		**Shallow Concentrated Flow, SHallow Concentrated Flow** Unpaved Kv= 16.1 fps
6.8	218	Total			

Subcatchment E-6: Undetained to Wetland

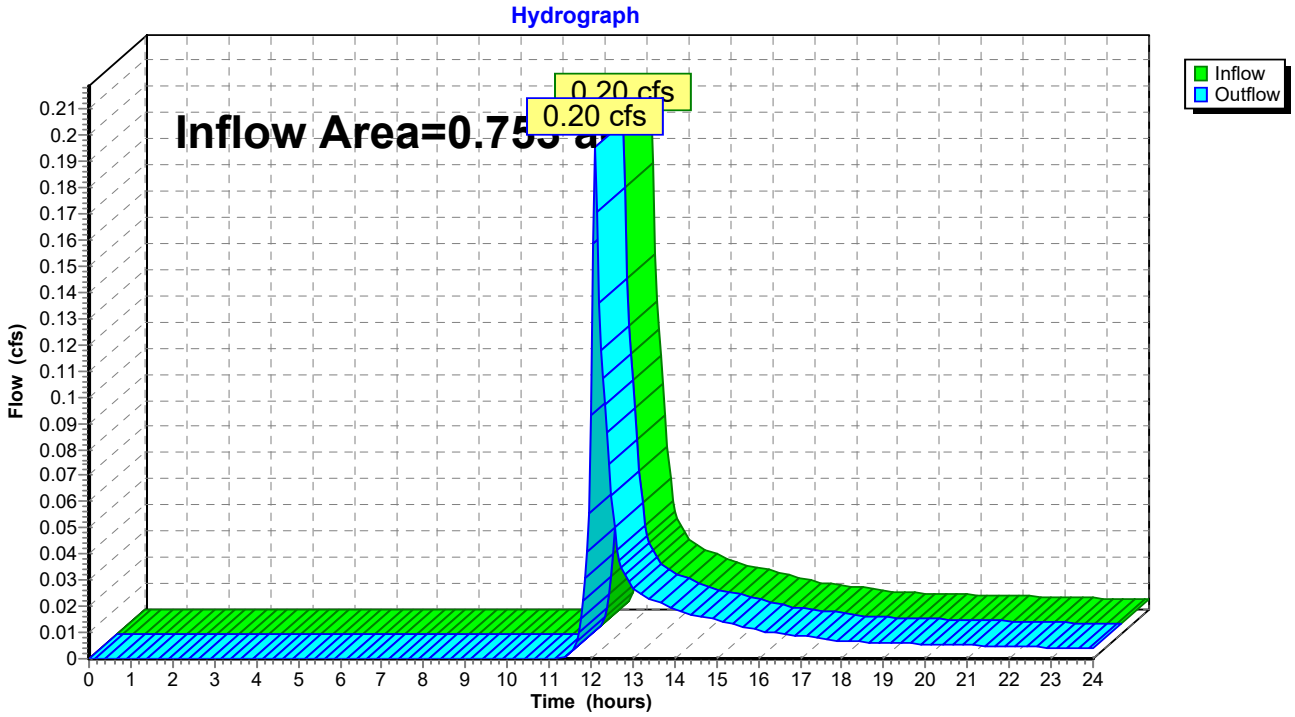


Summary for Reach DP-1: Design Point 1 (Wetland B)

Inflow Area = 0.753 ac, 35.44% Impervious, Inflow Depth > 0.25" for 1-Inch event
Inflow = 0.20 cfs @ 12.10 hrs, Volume= 0.016 af
Outflow = 0.20 cfs @ 12.10 hrs, Volume= 0.016 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

Reach DP-1: Design Point 1 (Wetland B)

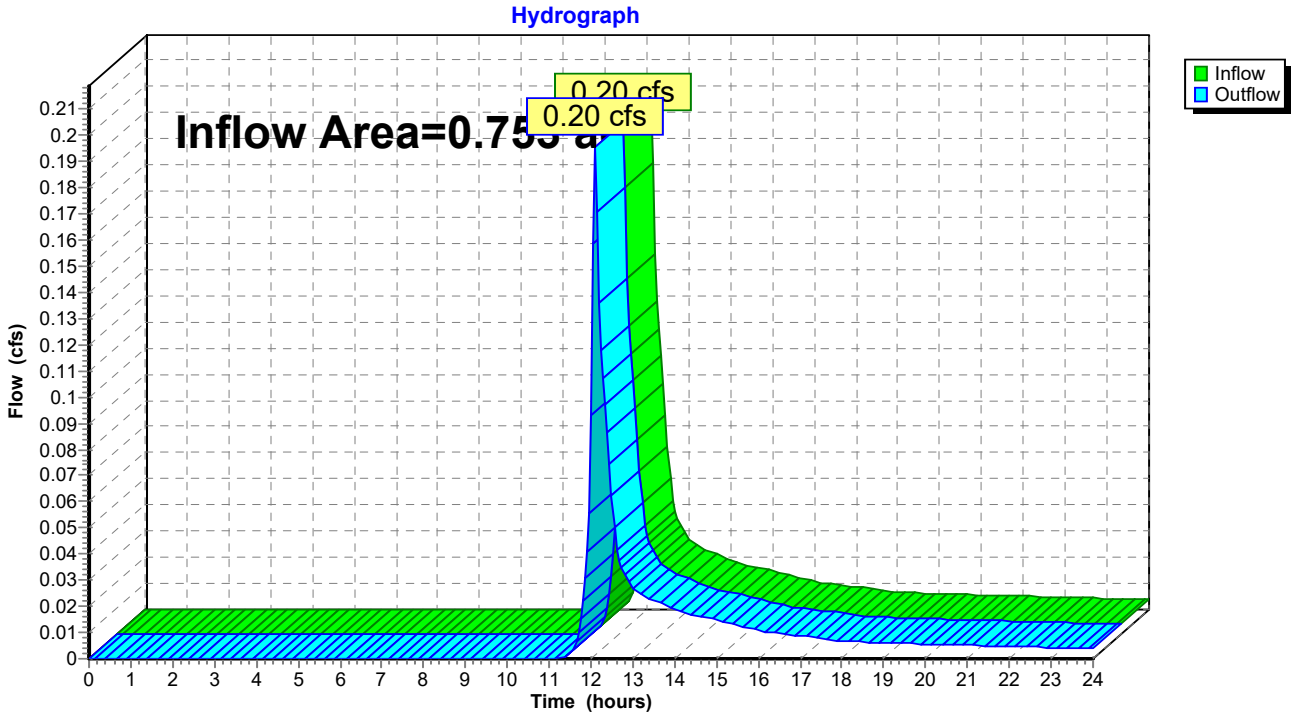


Summary for Reach DP-2: Design Point 2 (15" RCP to Wetland A)

Inflow Area = 0.753 ac, 35.44% Impervious, Inflow Depth > 0.25" for 1-Inch event
Inflow = 0.20 cfs @ 12.10 hrs, Volume= 0.016 af
Outflow = 0.20 cfs @ 12.10 hrs, Volume= 0.016 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

Reach DP-2: Design Point 2 (15" RCP to Wetland A)

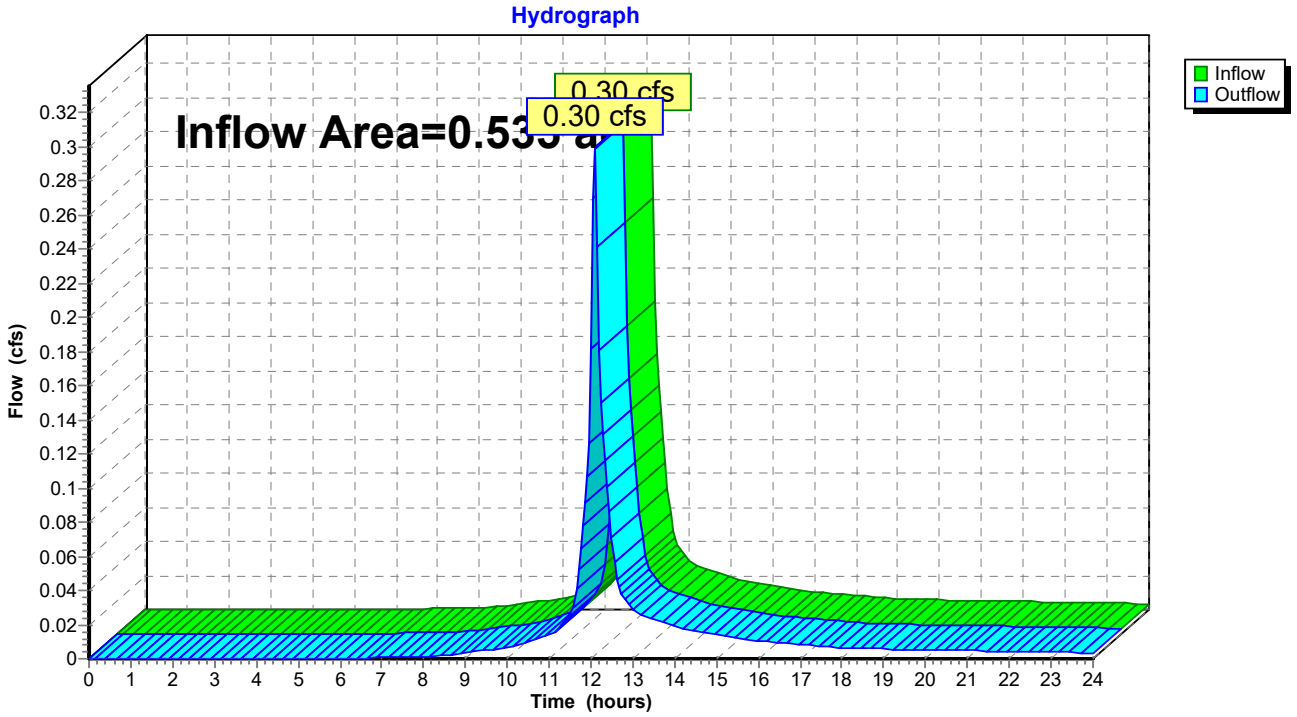


Summary for Reach DP-3: Design Point 3 (Existing Drainage Ditch)

Inflow Area = 0.535 ac, 66.58% Impervious, Inflow Depth > 0.50" for 1-Inch event
Inflow = 0.30 cfs @ 12.09 hrs, Volume= 0.022 af
Outflow = 0.30 cfs @ 12.09 hrs, Volume= 0.022 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

Reach DP-3: Design Point 3 (Existing Drainage Ditch)

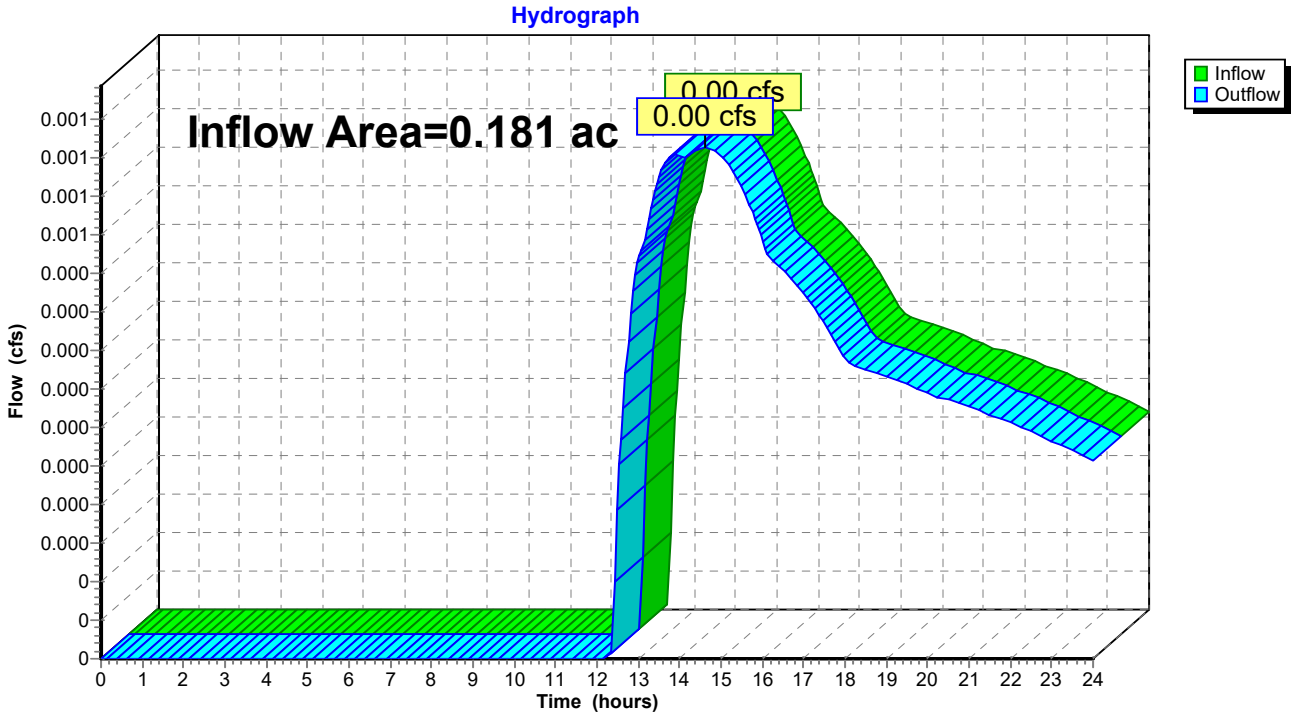


Summary for Reach DP-4: Design Point 4 (MassDOT CB- 2)

Inflow Area = 0.181 ac, 1.31% Impervious, Inflow Depth > 0.03" for 1-Inch event
Inflow = 0.00 cfs @ 14.60 hrs, Volume= 0.000 af
Outflow = 0.00 cfs @ 14.60 hrs, Volume= 0.000 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

Reach DP-4: Design Point 4 (MassDOT CB- 2)

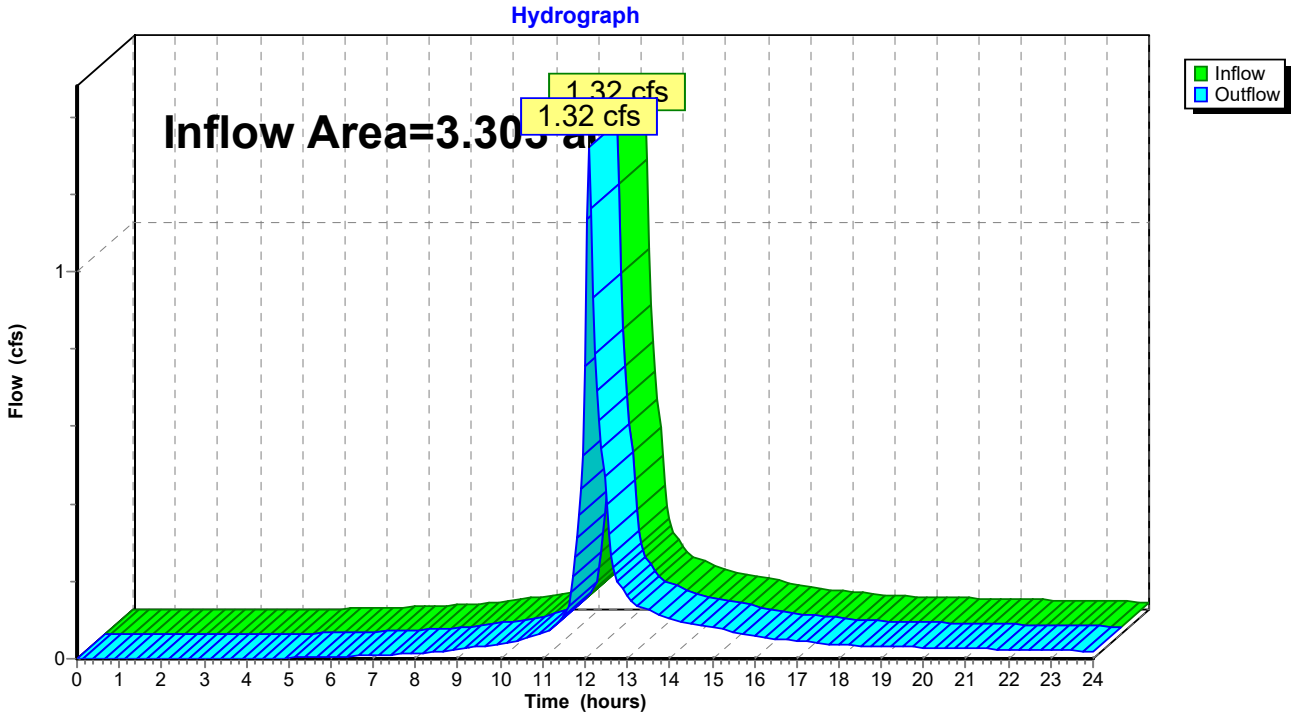


Summary for Reach DP-5: EXISTING CONSTRUCTED STORMWATER WETLAND

Inflow Area = 3.303 ac, 66.43% Impervious, Inflow Depth > 0.41" for 1-Inch event
Inflow = 1.32 cfs @ 12.10 hrs, Volume= 0.114 af
Outflow = 1.32 cfs @ 12.10 hrs, Volume= 0.114 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

Reach DP-5: EXISTING CONSTRUCTED STORMWATER WETLAND

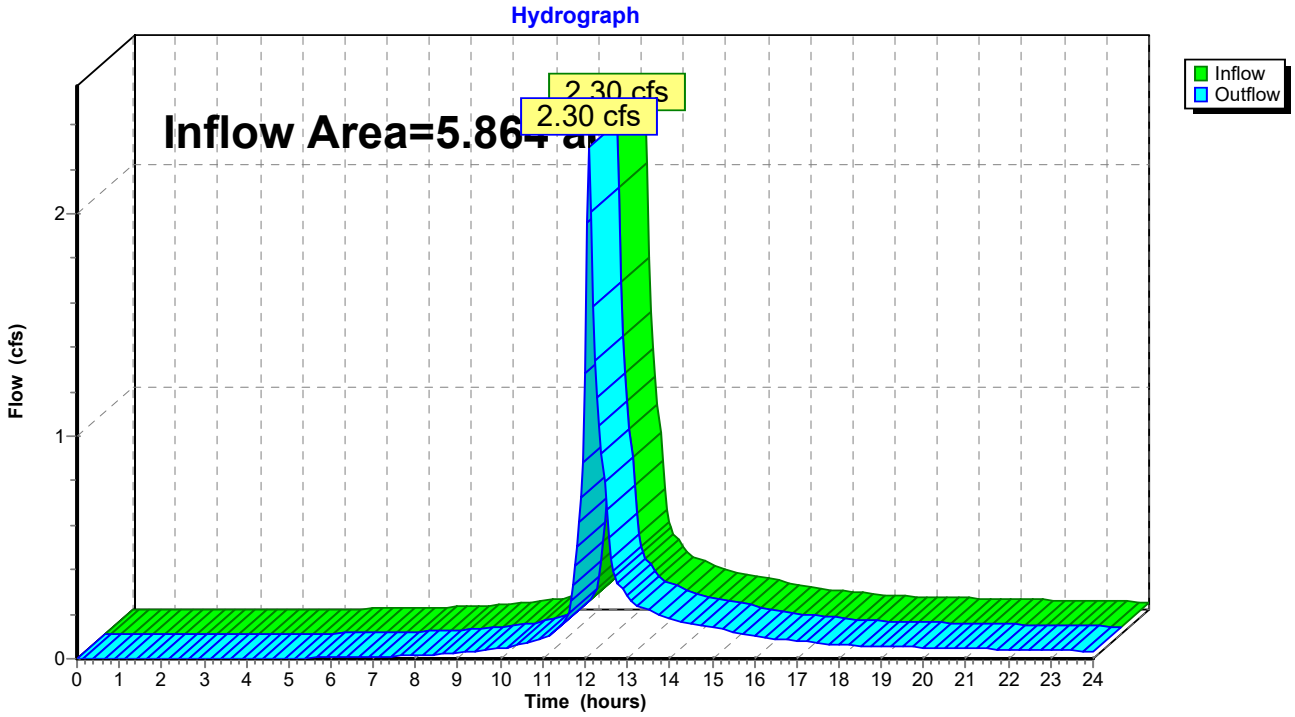


Summary for Reach DP-6: Wetland A - Design Point 6

Inflow Area = 5.864 ac, 62.53% Impervious, Inflow Depth > 0.39" for 1-Inch event
Inflow = 2.30 cfs @ 12.10 hrs, Volume= 0.188 af
Outflow = 2.30 cfs @ 12.10 hrs, Volume= 0.188 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

Reach DP-6: Wetland A - Design Point 6



Summary for Subcatchment E-1: Existing Watershed 1

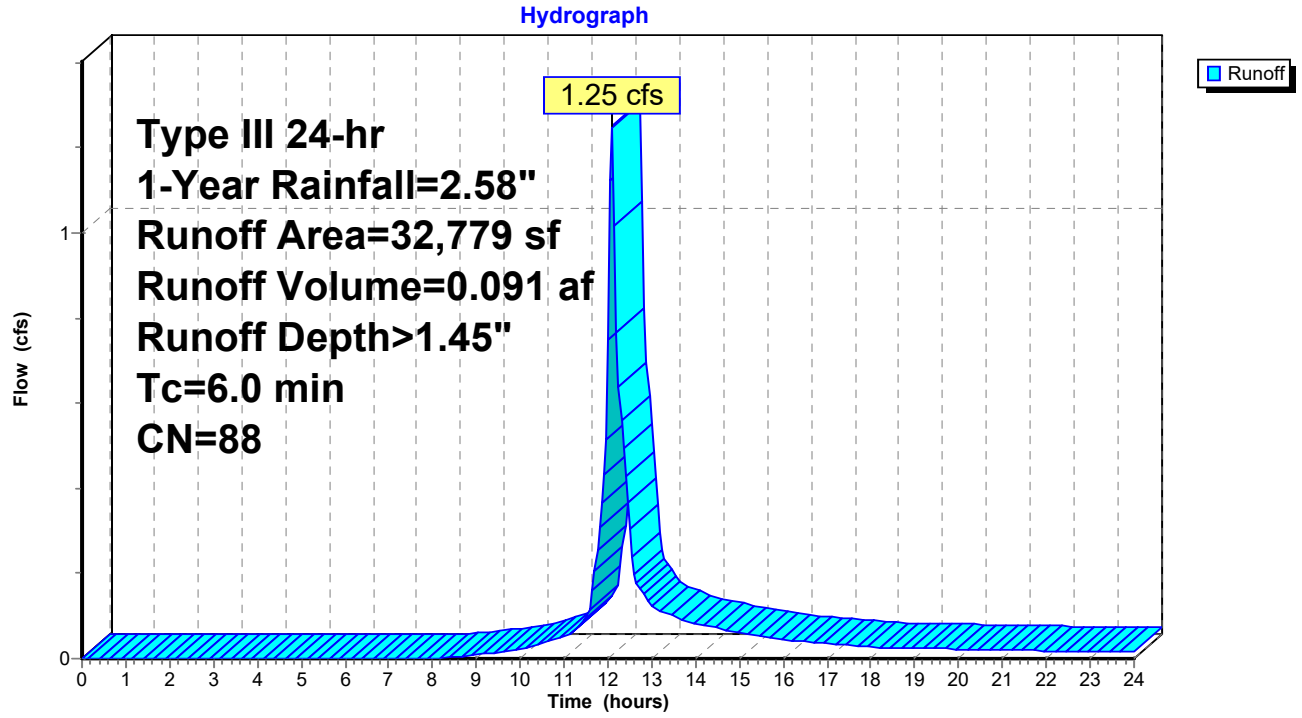
Runoff = 1.25 cfs @ 12.09 hrs, Volume= 0.091 af, Depth> 1.45"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 1-Year Rainfall=2.58"

Area (sf)	CN	Description
11,618	98	Paved parking, HSG C
9,421	96	Gravel surface, HSG C
5,782	74	>75% Grass cover, Good, HSG C
3,103	70	Woods, Good, HSG C
561	70	Woods, Good, HSG C
2,294	74	>75% Grass cover, Good, HSG C
32,779	88	Weighted Average
21,161		64.56% Pervious Area
11,618		35.44% Impervious Area

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

Subcatchment E-1: Existing Watershed 1



Summary for Subcatchment E-2: Existing Watershed 2

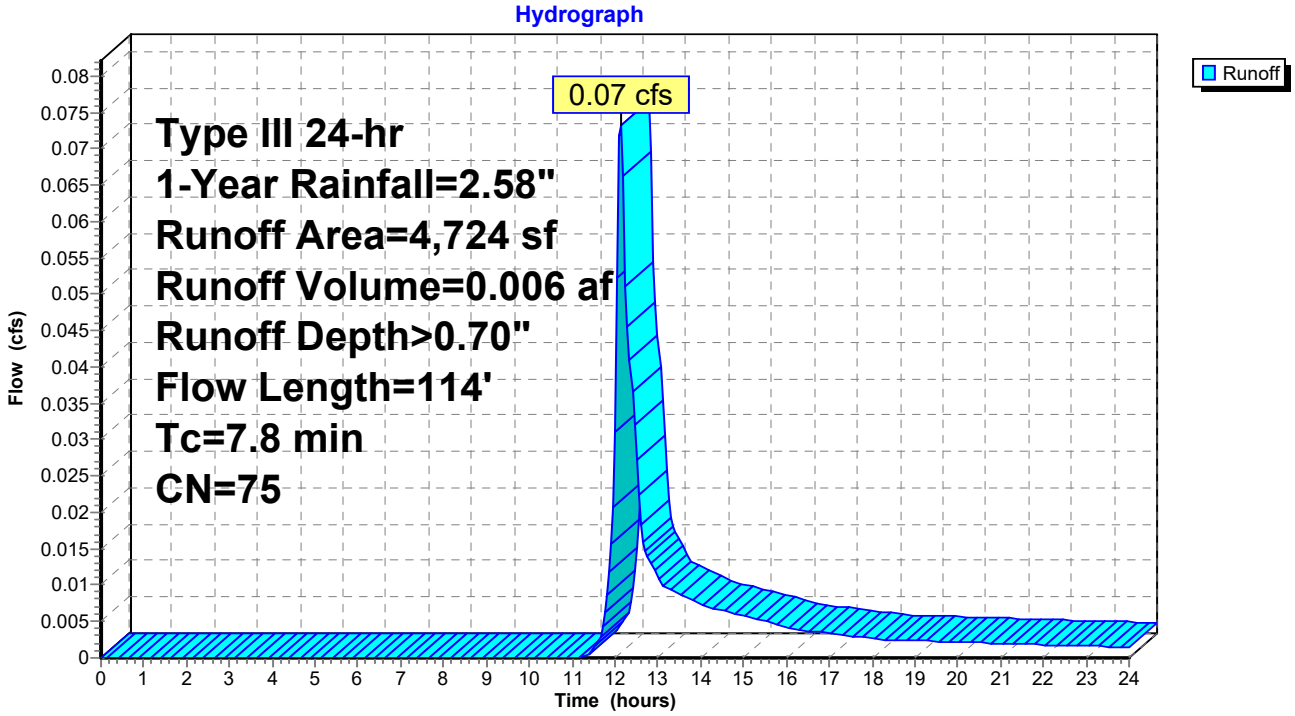
Runoff = 0.07 cfs @ 12.13 hrs, Volume= 0.006 af, Depth> 0.70"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 1-Year Rainfall=2.58"

Area (sf)	CN	Description
4,621	74	>75% Grass cover, Good, HSG C
103	98	Paved parking, HSG C
4,724	75	Weighted Average
4,621		97.82% Pervious Area
103		2.18% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.4	50	0.0100	0.11		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.20"
0.4	64	0.0312	2.84		**Shallow Concentrated Flow, Shallow Concentrated Flow** Unpaved Kv= 16.1 fps
7.8	114	Total			

Subcatchment E-2: Existing Watershed 2



Summary for Subcatchment E-3: Existing Watershed 3

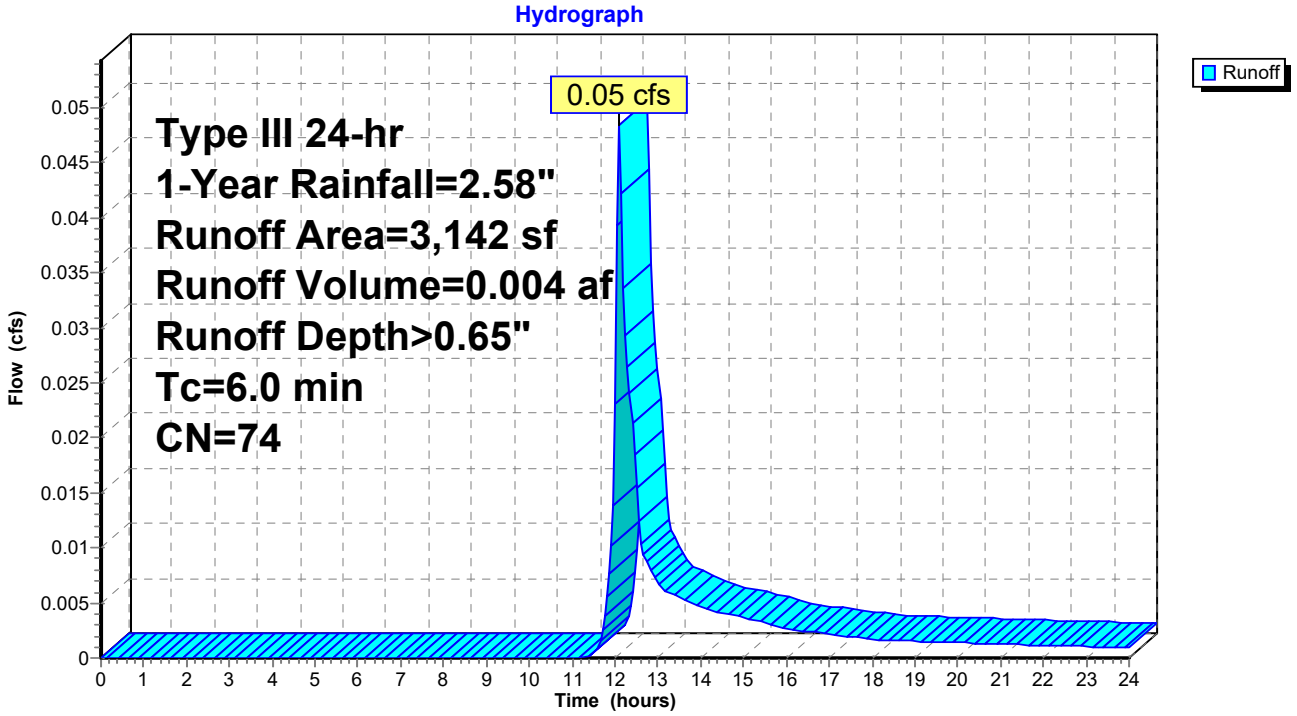
Runoff = 0.05 cfs @ 12.10 hrs, Volume= 0.004 af, Depth> 0.65"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 1-Year Rainfall=2.58"

Area (sf)	CN	Description
3,142	74	>75% Grass cover, Good, HSG C
3,142		100.00% Pervious Area

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

Subcatchment E-3: Existing Watershed 3



Summary for Subcatchment E-4A: Existing Watershed 4A

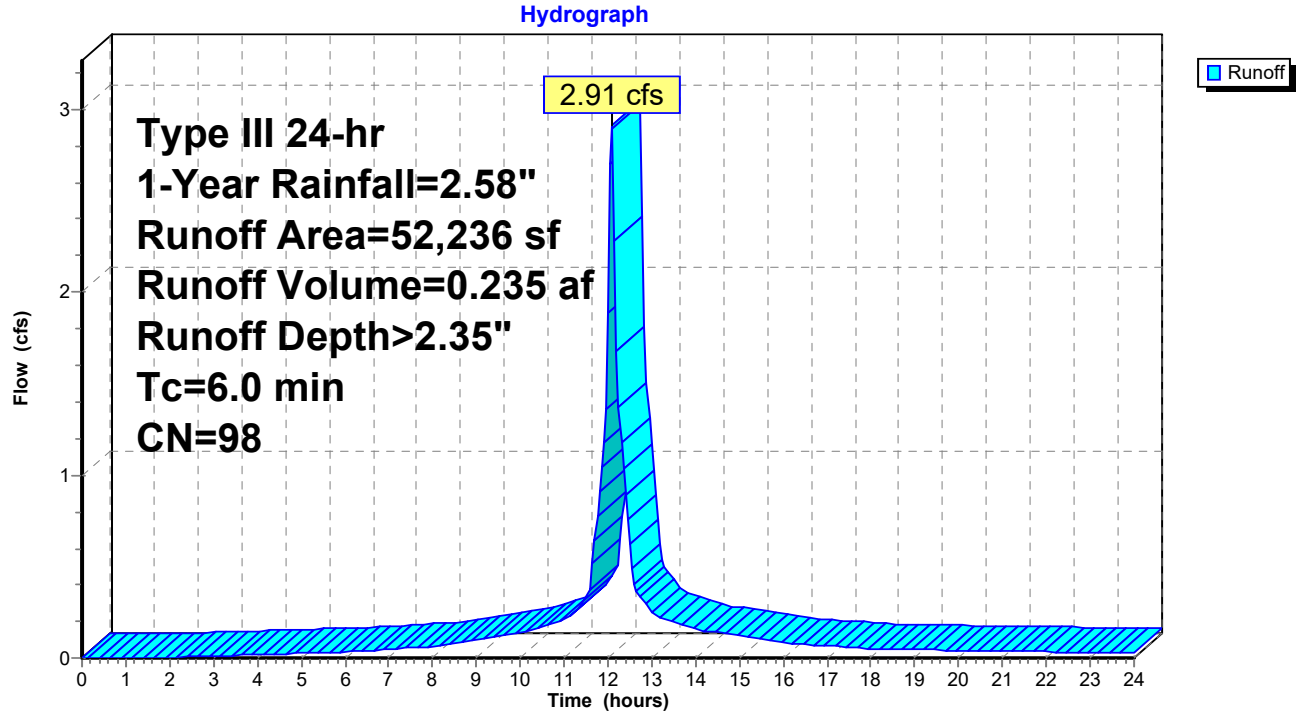
Runoff = 2.91 cfs @ 12.09 hrs, Volume= 0.235 af, Depth> 2.35"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 1-Year Rainfall=2.58"

Area (sf)	CN	Description
52,236	98	Roofs, HSG C
52,236		100.00% Impervious Area

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

Subcatchment E-4A: Existing Watershed 4A



Summary for Subcatchment E-4B: Existing Watershed 4B

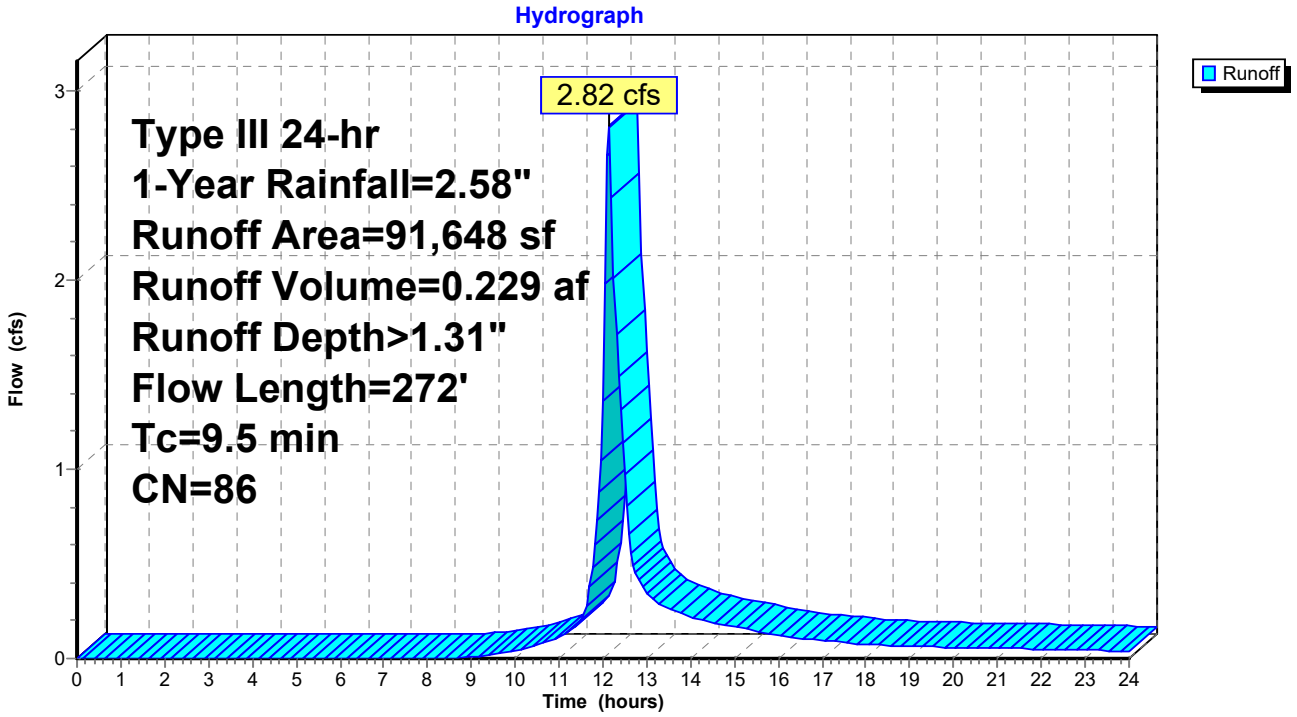
Runoff = 2.82 cfs @ 12.14 hrs, Volume= 0.229 af, Depth> 1.31"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 1-Year Rainfall=2.58"

	Area (sf)	CN	Description
	43,351	98	Paved parking, HSG C
	1,304	96	Gravel surface, HSG C
	42,526	74	>75% Grass cover, Good, HSG C
	2,704	70	Woods, Good, HSG C
*	1,763	74	Mulch
	91,648	86	Weighted Average
	48,297		52.70% Pervious Area
	43,351		47.30% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.1	50	0.0080	0.10		**Sheet Flow, Sheet Flow** Grass: Short n= 0.150 P2= 3.20"
0.8	111	0.0216	2.37		**Shallow Concentrated Flow, Shallow Concentrated Flow** Unpaved Kv= 16.1 fps
0.1	40	0.1500	6.24		**Shallow Concentrated Flow, SHallow** Unpaved Kv= 16.1 fps
0.5	71	0.0150	2.49		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
9.5	272	Total			

Subcatchment E-4B: Existing Watershed 4B



Summary for Subcatchment E-5A: Existing Watershed 5A

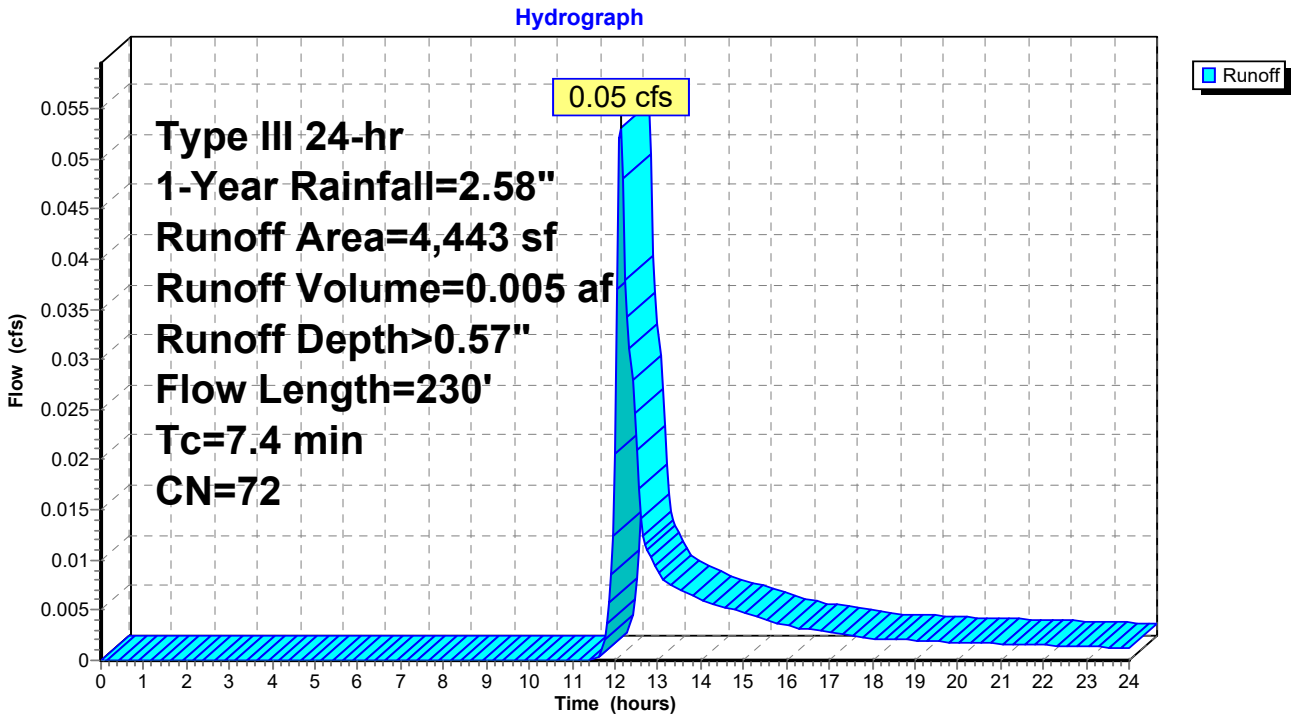
Runoff = 0.05 cfs @ 12.13 hrs, Volume= 0.005 af, Depth> 0.57"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 1-Year Rainfall=2.58"

Area (sf)	CN	Description
1,742	74	>75% Grass cover, Good, HSG C
2,701	70	Woods, Good, HSG C
4,443	72	Weighted Average
4,443		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.2	50	0.0160	0.14		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.20"
1.2	180	0.0244	2.51		**Shallow Concentrated Flow, Shallow COncentrated Flow** Unpaved Kv= 16.1 fps
7.4	230	Total			

Subcatchment E-5A: Existing Watershed 5A



Summary for Subcatchment E-5B: Existing Watershed 5B

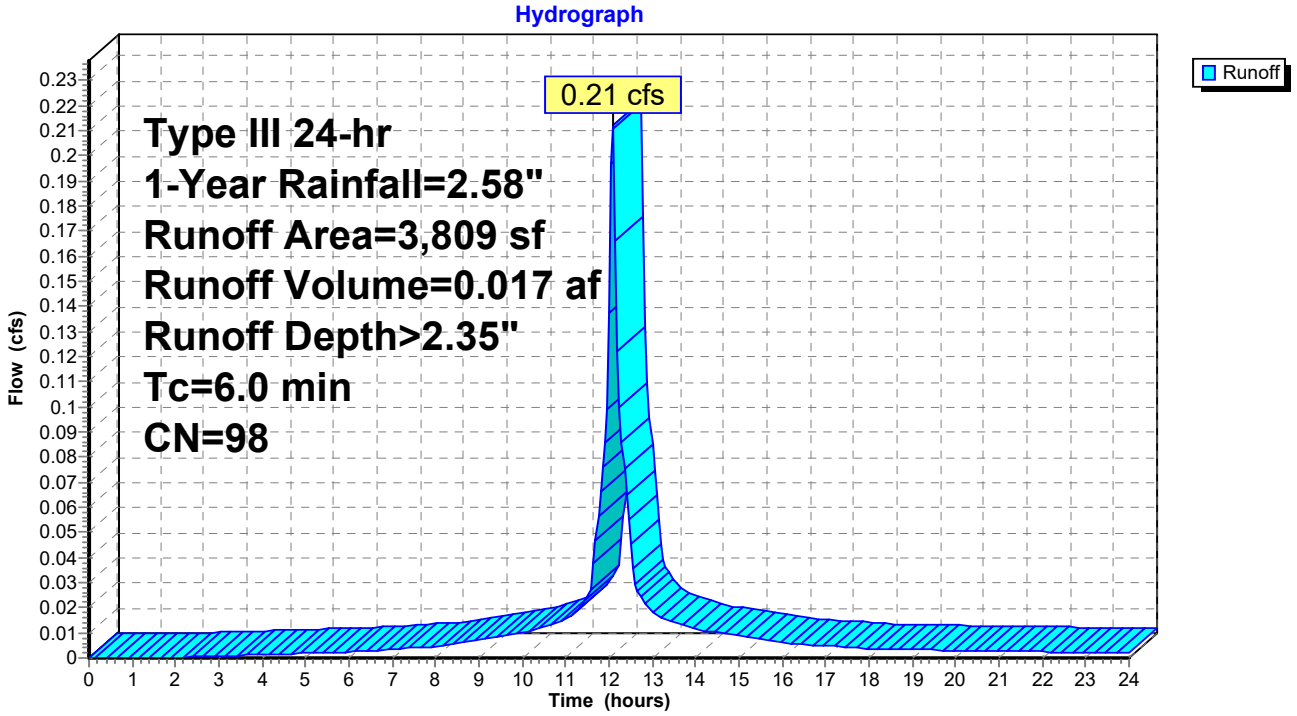
Runoff = 0.21 cfs @ 12.09 hrs, Volume= 0.017 af, Depth> 2.35"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 1-Year Rainfall=2.58"

Area (sf)	CN	Description
3,809	98	Paved parking, HSG C
3,809		100.00% Impervious Area

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

Subcatchment E-5B: Existing Watershed 5B



Summary for Subcatchment E-5C: Existing Watershed 5C

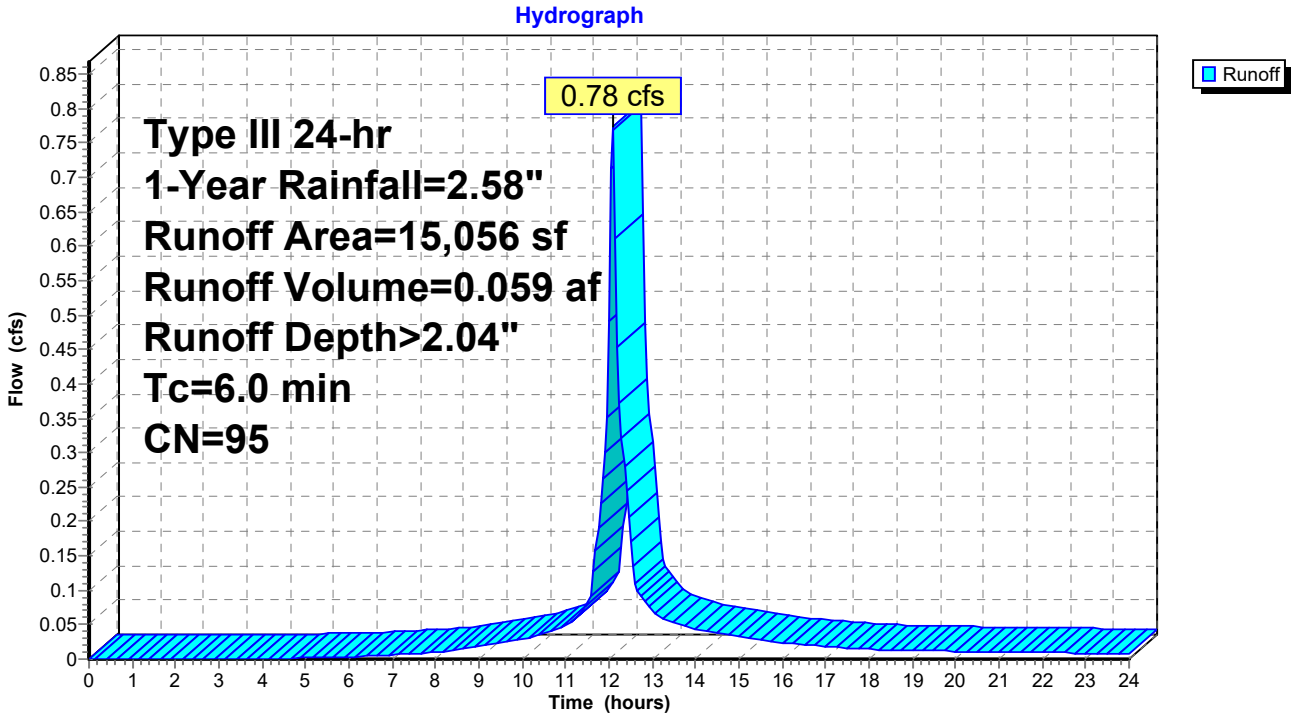
Runoff = 0.78 cfs @ 12.09 hrs, Volume= 0.059 af, Depth> 2.04"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 1-Year Rainfall=2.58"

Area (sf)	CN	Description
11,709	98	Paved parking, HSG C
1,791	96	Gravel surface, HSG C
303	79	50-75% Grass cover, Fair, HSG C
678	70	Woods, Good, HSG C
575	70	Woods, Good, HSG C
15,056	95	Weighted Average
3,347		22.23% Pervious Area
11,709		77.77% Impervious Area

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

Subcatchment E-5C: Existing Watershed 5C



Summary for Subcatchment E-6: Undetained to Wetland

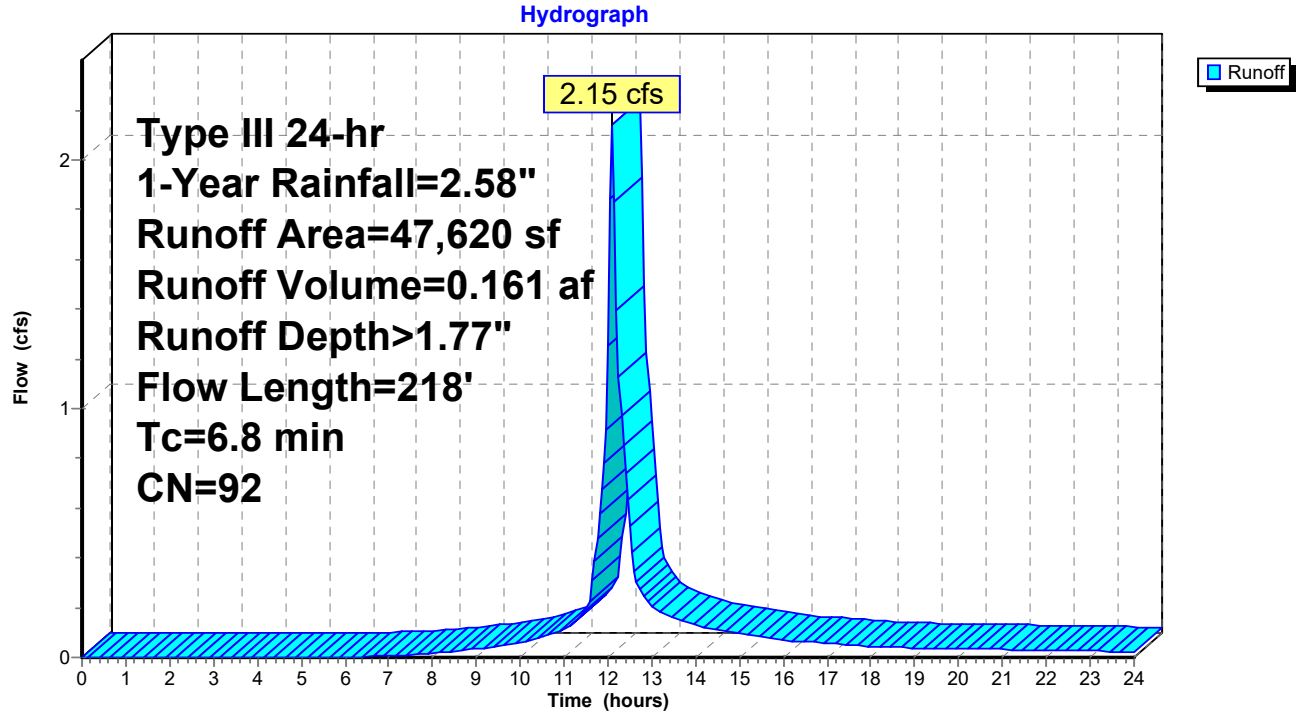
Runoff = 2.15 cfs @ 12.10 hrs, Volume= 0.161 af, Depth> 1.77"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 1-Year Rainfall=2.58"

Area (sf)	CN	Description
36,924	98	Paved parking, HSG C
9,270	74	>75% Grass cover, Good, HSG C
1,426	70	Woods, Good, HSG C
47,620	92	Weighted Average
10,696		22.46% Pervious Area
36,924		77.54% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.6	50	0.0340	0.18		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.20"
2.2	168	0.0060	1.25		**Shallow Concentrated Flow, SHallow Concentrated Flow** Unpaved Kv= 16.1 fps
6.8	218	Total			

Subcatchment E-6: Undetained to Wetland

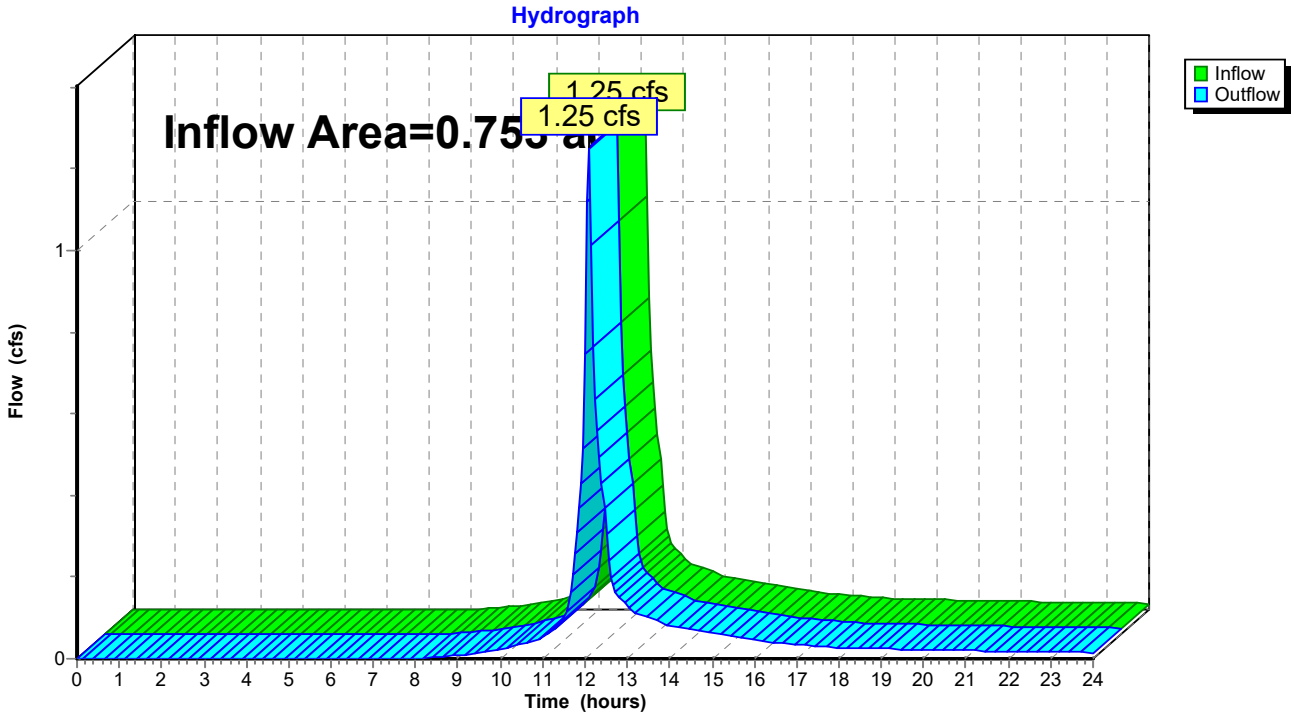


Summary for Reach DP-1: Design Point 1 (Wetland B)

Inflow Area = 0.753 ac, 35.44% Impervious, Inflow Depth > 1.45" for 1-Year event
Inflow = 1.25 cfs @ 12.09 hrs, Volume= 0.091 af
Outflow = 1.25 cfs @ 12.09 hrs, Volume= 0.091 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

Reach DP-1: Design Point 1 (Wetland B)

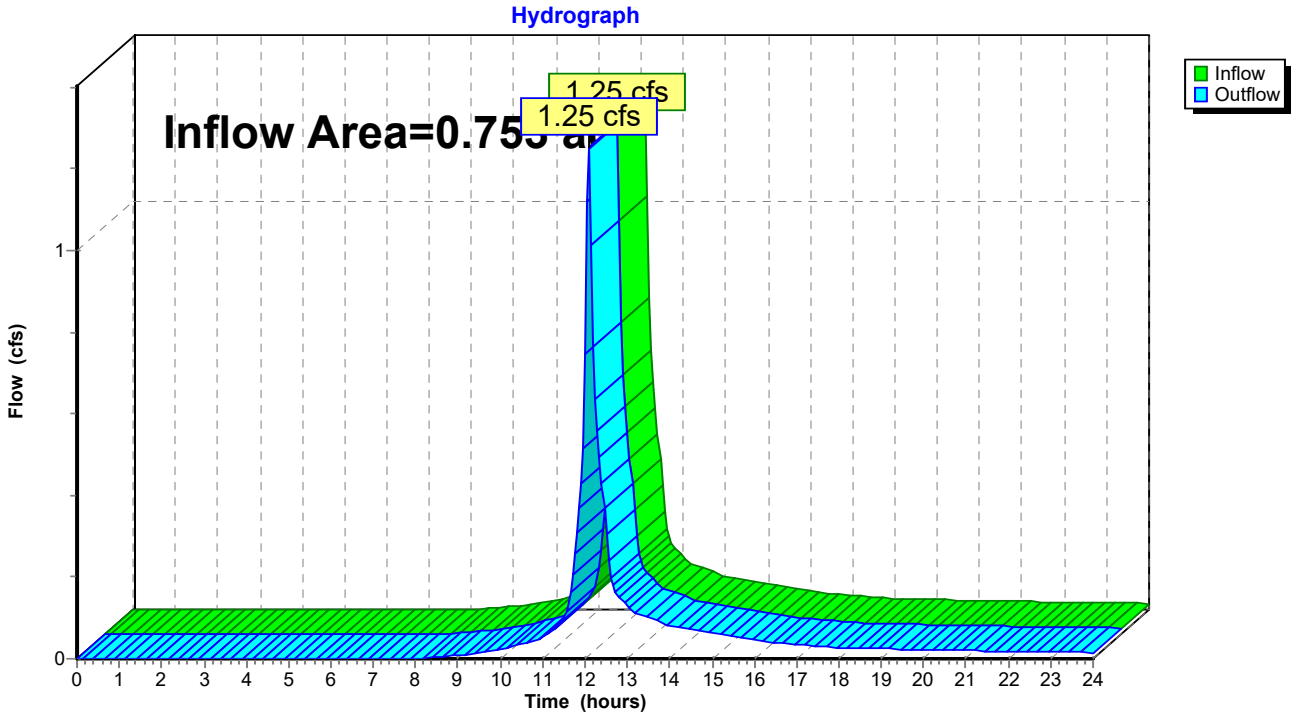


Summary for Reach DP-2: Design Point 2 (15" RCP to Wetland A)

Inflow Area = 0.753 ac, 35.44% Impervious, Inflow Depth > 1.45" for 1-Year event
Inflow = 1.25 cfs @ 12.09 hrs, Volume= 0.091 af
Outflow = 1.25 cfs @ 12.09 hrs, Volume= 0.091 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

Reach DP-2: Design Point 2 (15" RCP to Wetland A)

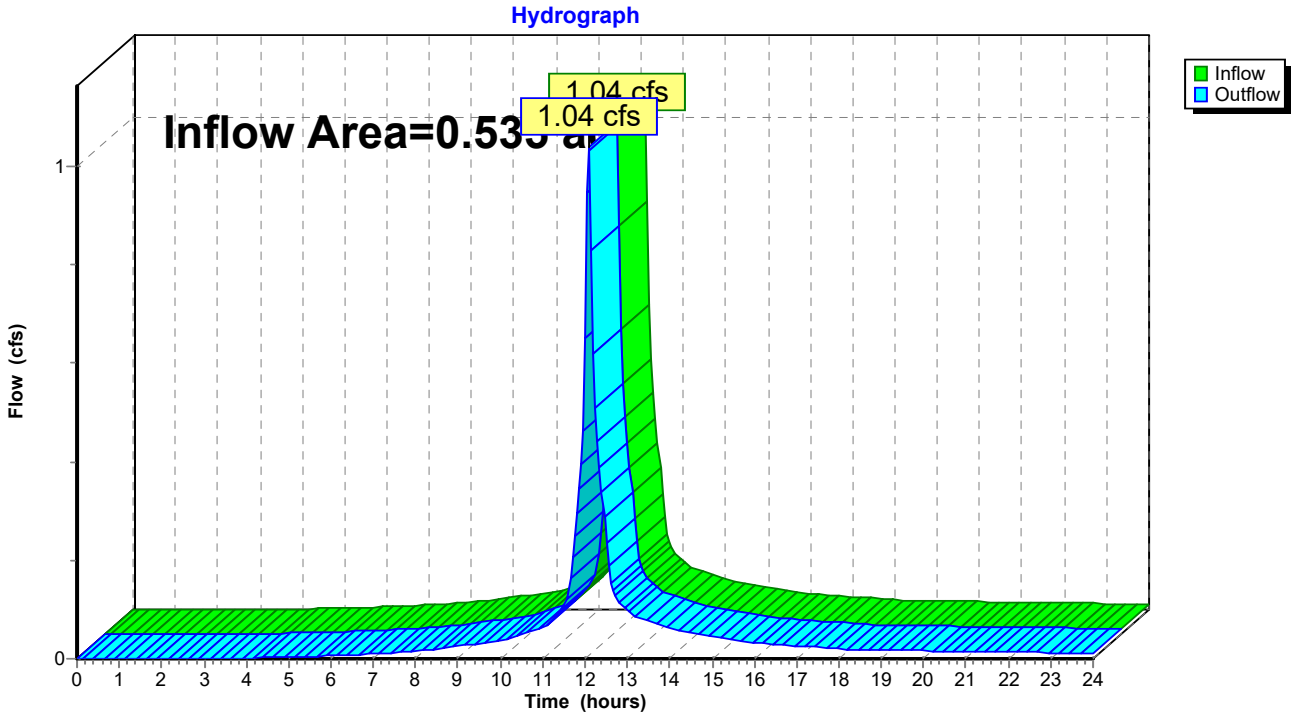


Summary for Reach DP-3: Design Point 3 (Existing Drainage Ditch)

Inflow Area = 0.535 ac, 66.58% Impervious, Inflow Depth > 1.81" for 1-Year event
Inflow = 1.04 cfs @ 12.09 hrs, Volume= 0.081 af
Outflow = 1.04 cfs @ 12.09 hrs, Volume= 0.081 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

Reach DP-3: Design Point 3 (Existing Drainage Ditch)

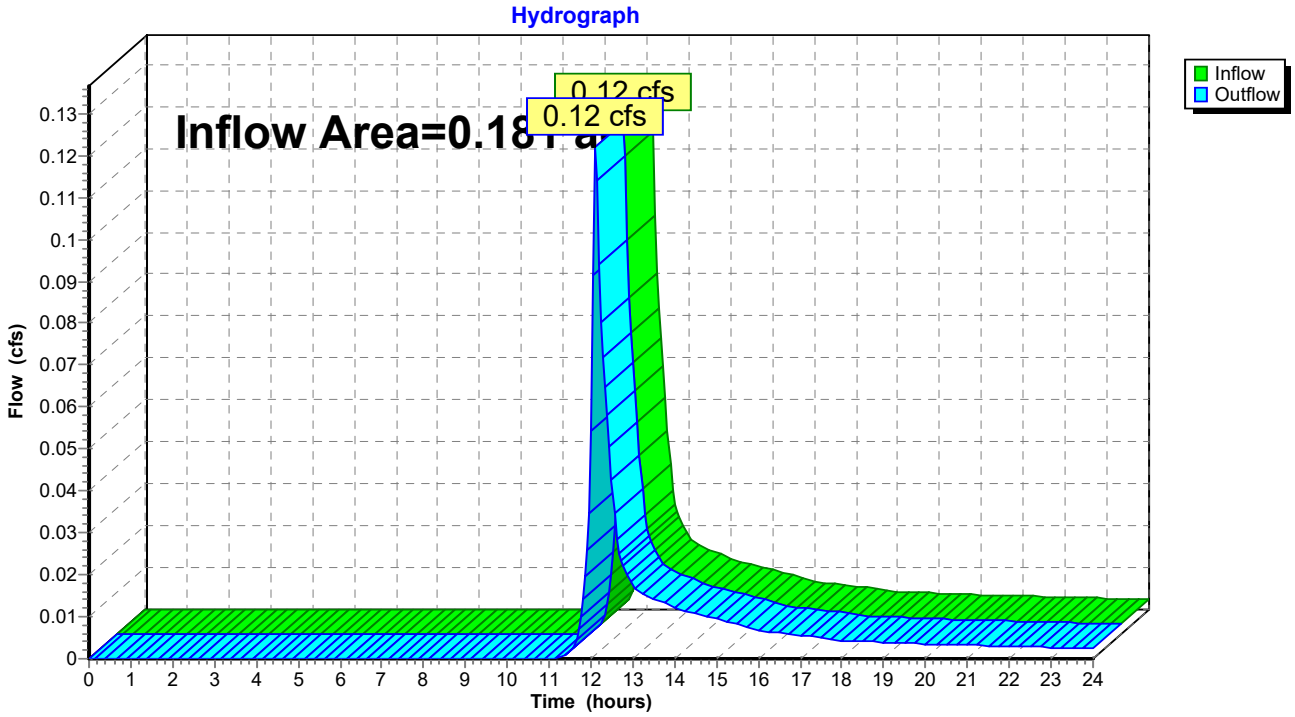


Summary for Reach DP-4: Design Point 4 (MassDOT CB- 2)

Inflow Area = 0.181 ac, 1.31% Impervious, Inflow Depth > 0.68" for 1-Year event
Inflow = 0.12 cfs @ 12.12 hrs, Volume= 0.010 af
Outflow = 0.12 cfs @ 12.12 hrs, Volume= 0.010 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

Reach DP-4: Design Point 4 (MassDOT CB- 2)

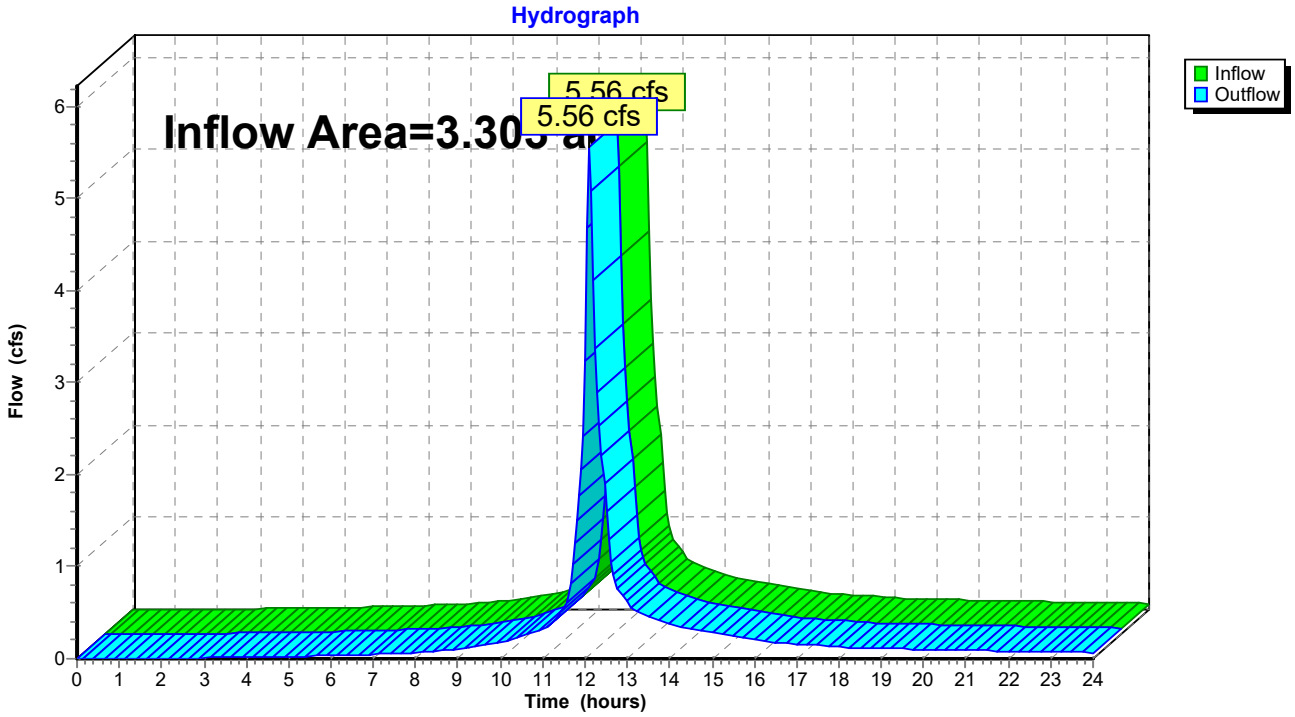


Summary for Reach DP-5: EXISTING CONSTRUCTED STORMWATER WETLAND

Inflow Area = 3.303 ac, 66.43% Impervious, Inflow Depth > 1.69" for 1-Year event
Inflow = 5.56 cfs @ 12.11 hrs, Volume= 0.464 af
Outflow = 5.56 cfs @ 12.11 hrs, Volume= 0.464 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

Reach DP-5: EXISTING CONSTRUCTED STORMWATER WETLAND

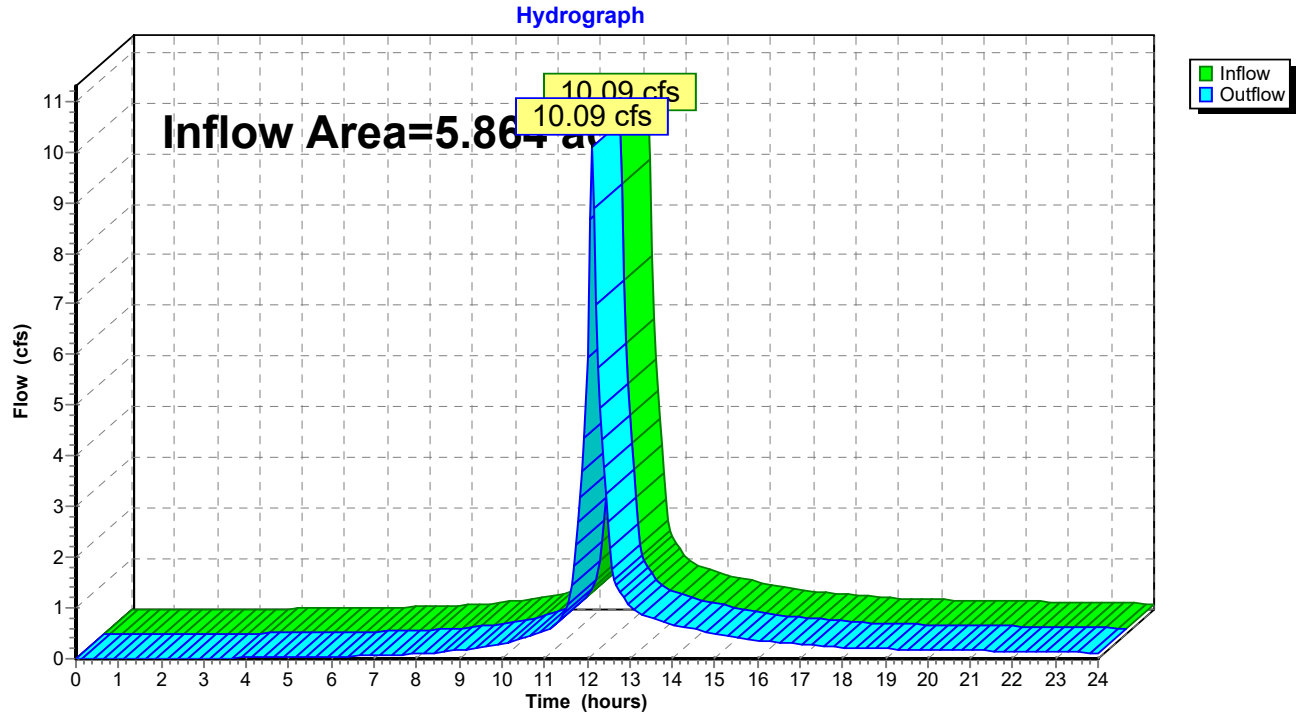


Summary for Reach DP-6: Wetland A - Design Point 6

Inflow Area = 5.864 ac, 62.53% Impervious, Inflow Depth > 1.65" for 1-Year event
Inflow = 10.09 cfs @ 12.10 hrs, Volume= 0.806 af
Outflow = 10.09 cfs @ 12.10 hrs, Volume= 0.806 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

Reach DP-6: Wetland A - Design Point 6



Summary for Subcatchment E-1: Existing Watershed 1

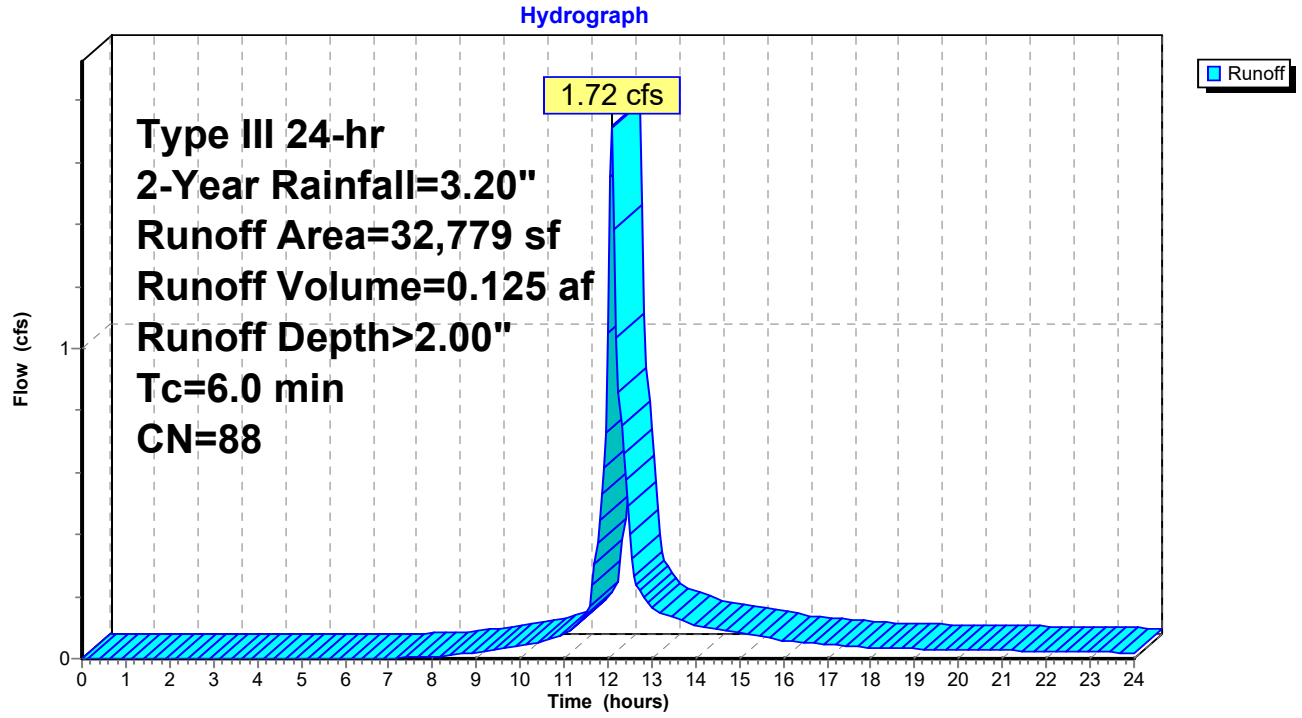
Runoff = 1.72 cfs @ 12.09 hrs, Volume= 0.125 af, Depth> 2.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.20"

Area (sf)	CN	Description
11,618	98	Paved parking, HSG C
9,421	96	Gravel surface, HSG C
5,782	74	>75% Grass cover, Good, HSG C
3,103	70	Woods, Good, HSG C
561	70	Woods, Good, HSG C
2,294	74	>75% Grass cover, Good, HSG C
32,779	88	Weighted Average
21,161		64.56% Pervious Area
11,618		35.44% Impervious Area

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

Subcatchment E-1: Existing Watershed 1



Summary for Subcatchment E-2: Existing Watershed 2

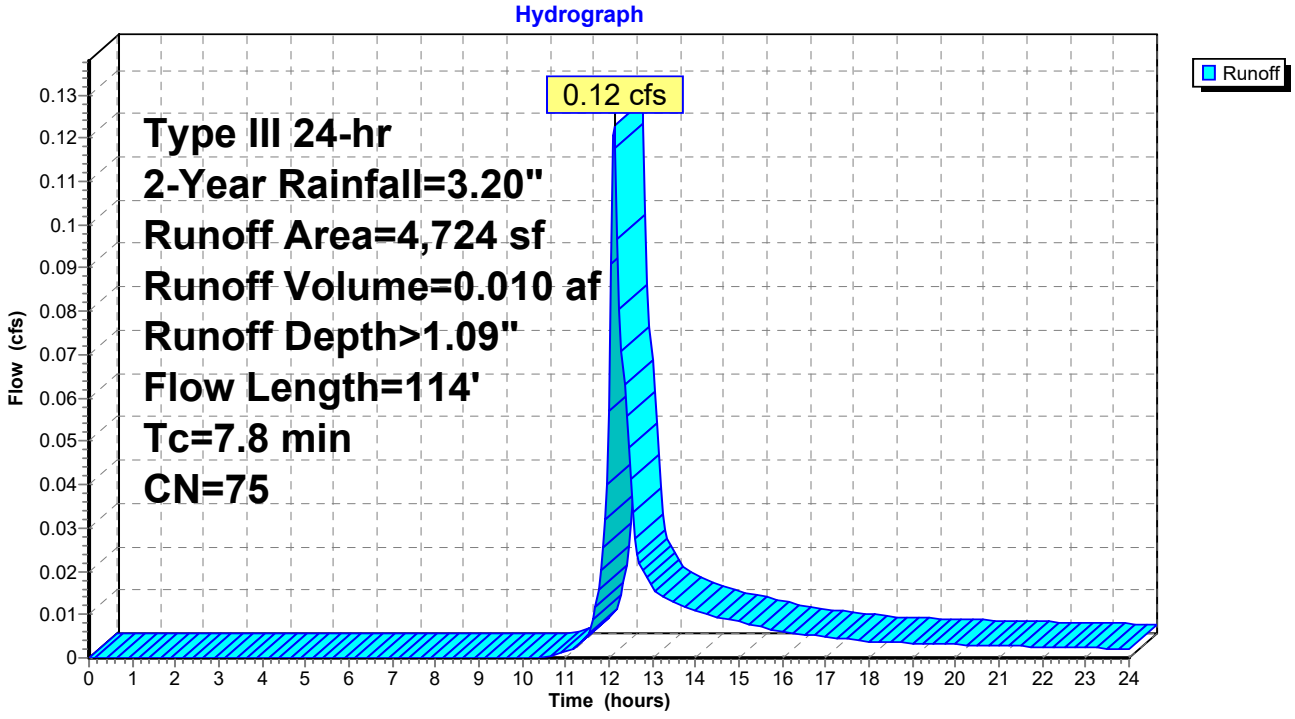
Runoff = 0.12 cfs @ 12.12 hrs, Volume= 0.010 af, Depth> 1.09"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.20"

Area (sf)	CN	Description
4,621	74	>75% Grass cover, Good, HSG C
103	98	Paved parking, HSG C
4,724	75	Weighted Average
4,621		97.82% Pervious Area
103		2.18% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.4	50	0.0100	0.11		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.20"
0.4	64	0.0312	2.84		**Shallow Concentrated Flow, Shallow Concentrated Flow** Unpaved Kv= 16.1 fps
7.8	114	Total			

Subcatchment E-2: Existing Watershed 2



Summary for Subcatchment E-3: Existing Watershed 3

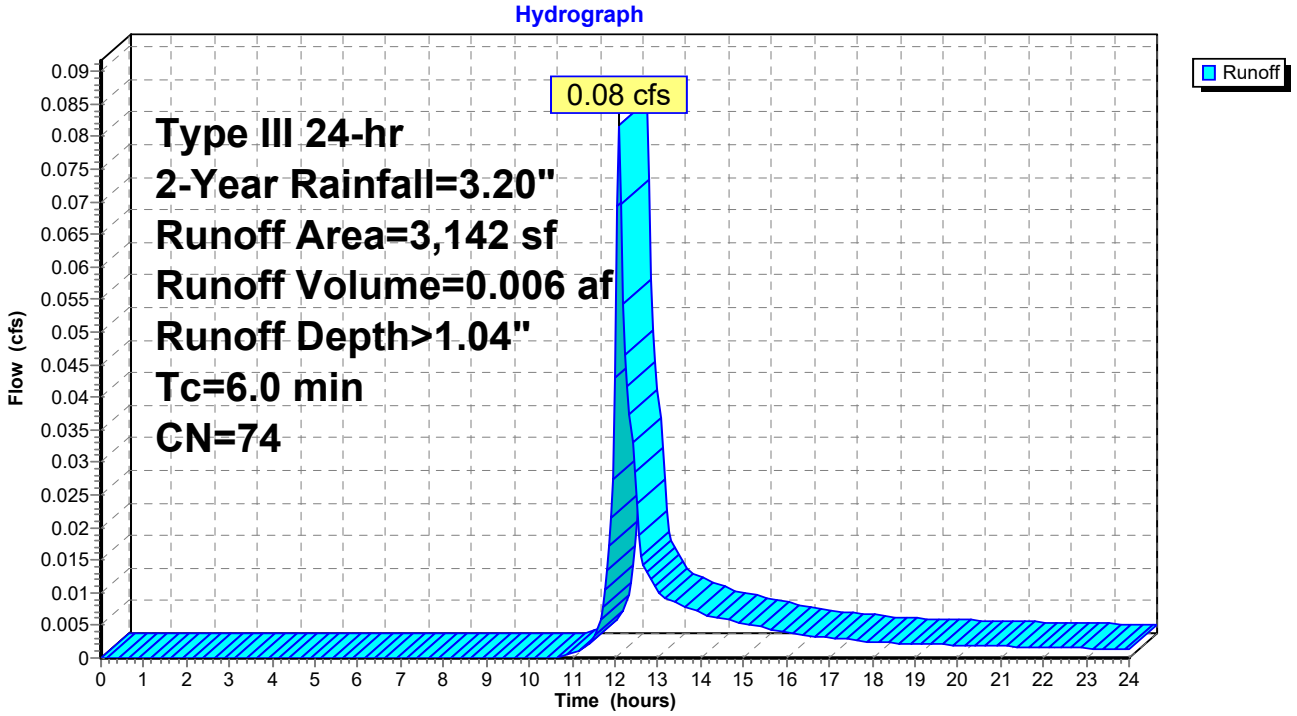
Runoff = 0.08 cfs @ 12.10 hrs, Volume= 0.006 af, Depth> 1.04"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.20"

Area (sf)	CN	Description
3,142	74	>75% Grass cover, Good, HSG C
3,142		100.00% Pervious Area

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

Subcatchment E-3: Existing Watershed 3



Summary for Subcatchment E-4A: Existing Watershed 4A

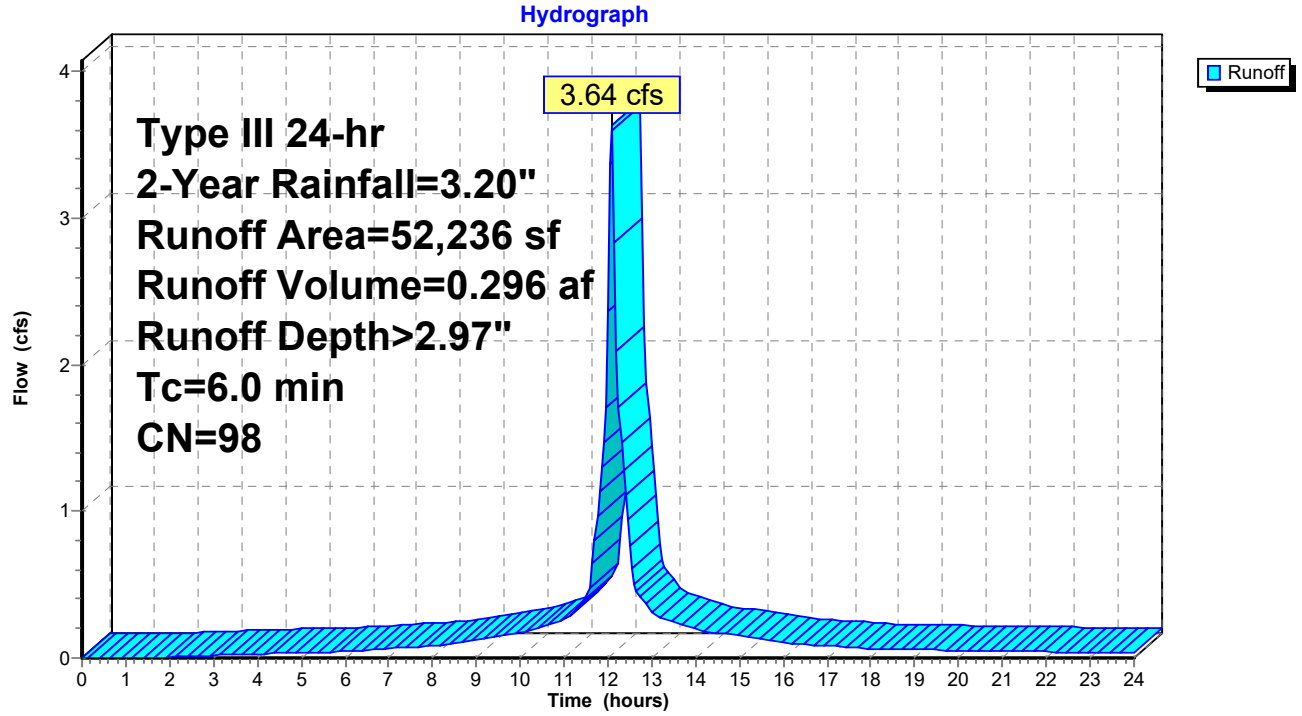
Runoff = 3.64 cfs @ 12.09 hrs, Volume= 0.296 af, Depth> 2.97"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.20"

Area (sf)	CN	Description
52,236	98	Roofs, HSG C
52,236		100.00% Impervious Area

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

Subcatchment E-4A: Existing Watershed 4A



Summary for Subcatchment E-4B: Existing Watershed 4B

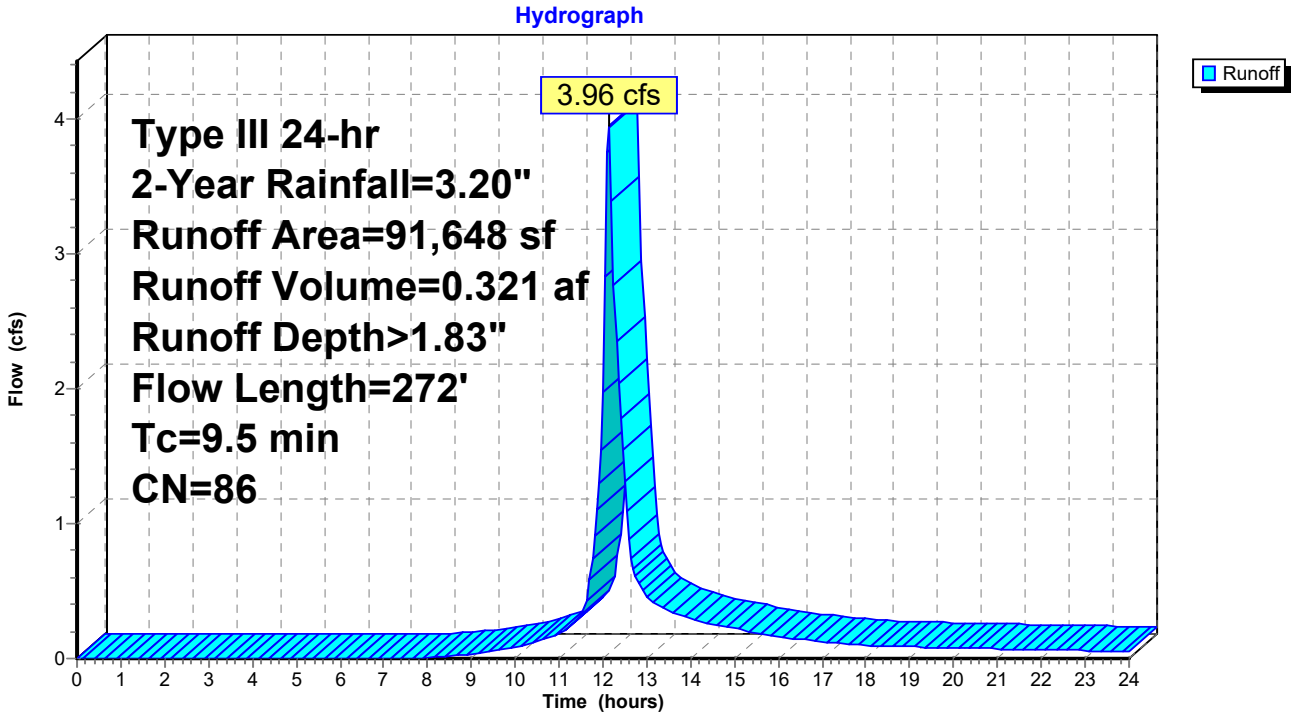
Runoff = 3.96 cfs @ 12.14 hrs, Volume= 0.321 af, Depth> 1.83"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.20"

	Area (sf)	CN	Description
	43,351	98	Paved parking, HSG C
	1,304	96	Gravel surface, HSG C
	42,526	74	>75% Grass cover, Good, HSG C
	2,704	70	Woods, Good, HSG C
*	1,763	74	Mulch
	91,648	86	Weighted Average
	48,297		52.70% Pervious Area
	43,351		47.30% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.1	50	0.0080	0.10		**Sheet Flow, Sheet Flow** Grass: Short n= 0.150 P2= 3.20"
0.8	111	0.0216	2.37		**Shallow Concentrated Flow, Shallow Concentrated Flow** Unpaved Kv= 16.1 fps
0.1	40	0.1500	6.24		**Shallow Concentrated Flow, SHallow** Unpaved Kv= 16.1 fps
0.5	71	0.0150	2.49		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
9.5	272	Total			

Subcatchment E-4B: Existing Watershed 4B



Summary for Subcatchment E-5A: Existing Watershed 5A

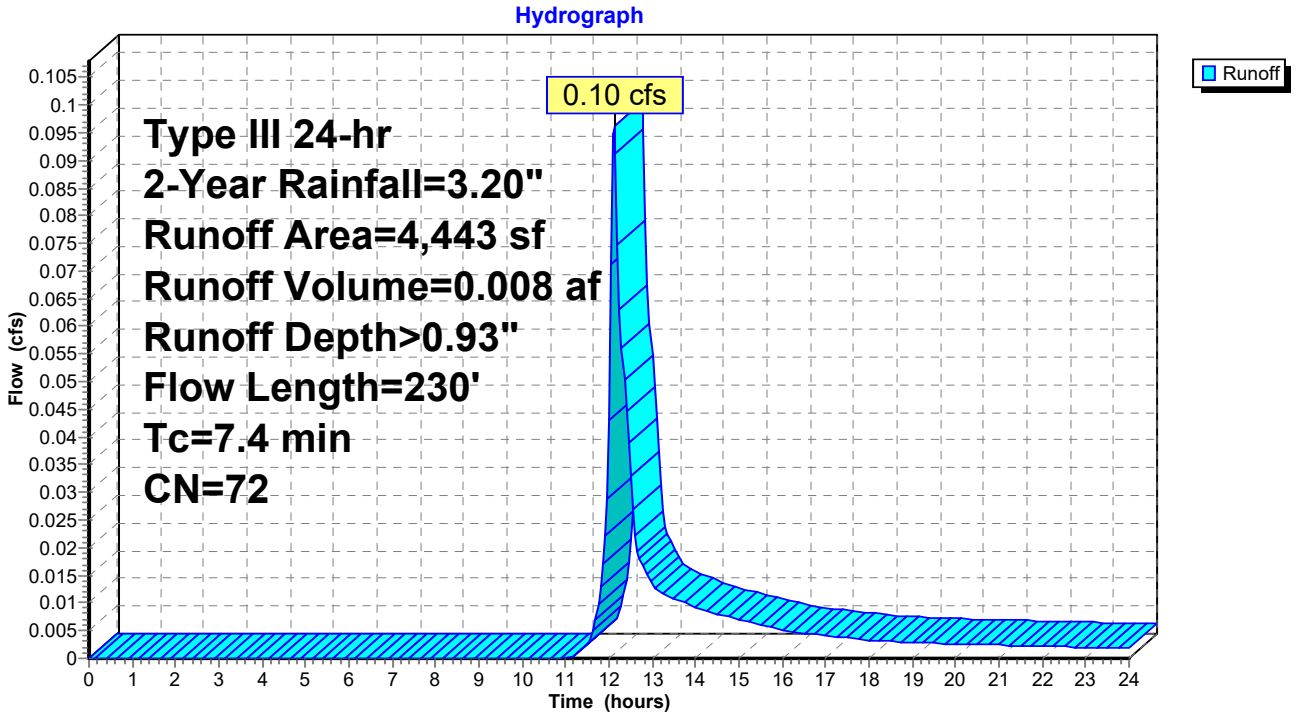
Runoff = 0.10 cfs @ 12.12 hrs, Volume= 0.008 af, Depth> 0.93"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.20"

Area (sf)	CN	Description
1,742	74	>75% Grass cover, Good, HSG C
2,701	70	Woods, Good, HSG C
4,443	72	Weighted Average
4,443		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.2	50	0.0160	0.14		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.20"
1.2	180	0.0244	2.51		**Shallow Concentrated Flow, Shallow COncentrated Flow** Unpaved Kv= 16.1 fps
7.4	230	Total			

Subcatchment E-5A: Existing Watershed 5A



Summary for Subcatchment E-5B: Existing Watershed 5B

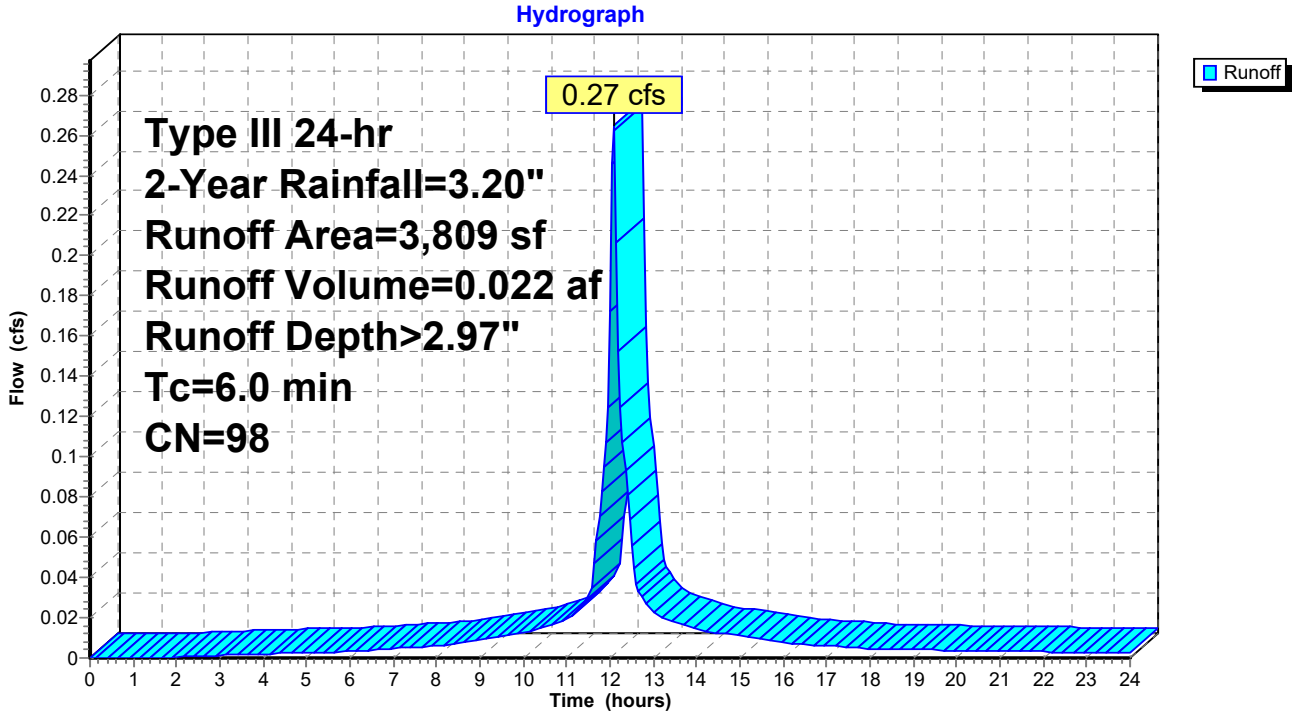
Runoff = 0.27 cfs @ 12.09 hrs, Volume= 0.022 af, Depth> 2.97"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.20"

Area (sf)	CN	Description
3,809	98	Paved parking, HSG C
3,809		100.00% Impervious Area

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

Subcatchment E-5B: Existing Watershed 5B



Summary for Subcatchment E-5C: Existing Watershed 5C

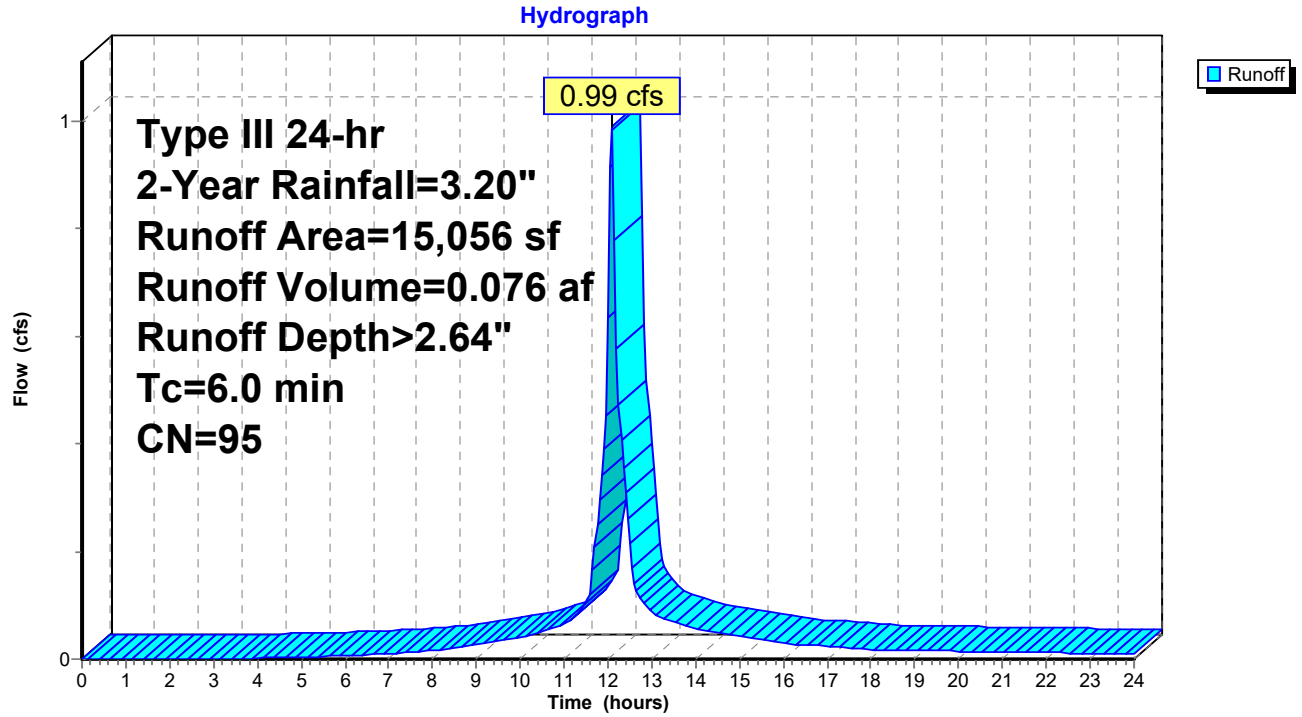
Runoff = 0.99 cfs @ 12.09 hrs, Volume= 0.076 af, Depth> 2.64"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.20"

Area (sf)	CN	Description
11,709	98	Paved parking, HSG C
1,791	96	Gravel surface, HSG C
303	79	50-75% Grass cover, Fair, HSG C
678	70	Woods, Good, HSG C
575	70	Woods, Good, HSG C
15,056	95	Weighted Average
3,347		22.23% Pervious Area
11,709		77.77% Impervious Area

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

Subcatchment E-5C: Existing Watershed 5C



Summary for Subcatchment E-6: Undetained to Wetland

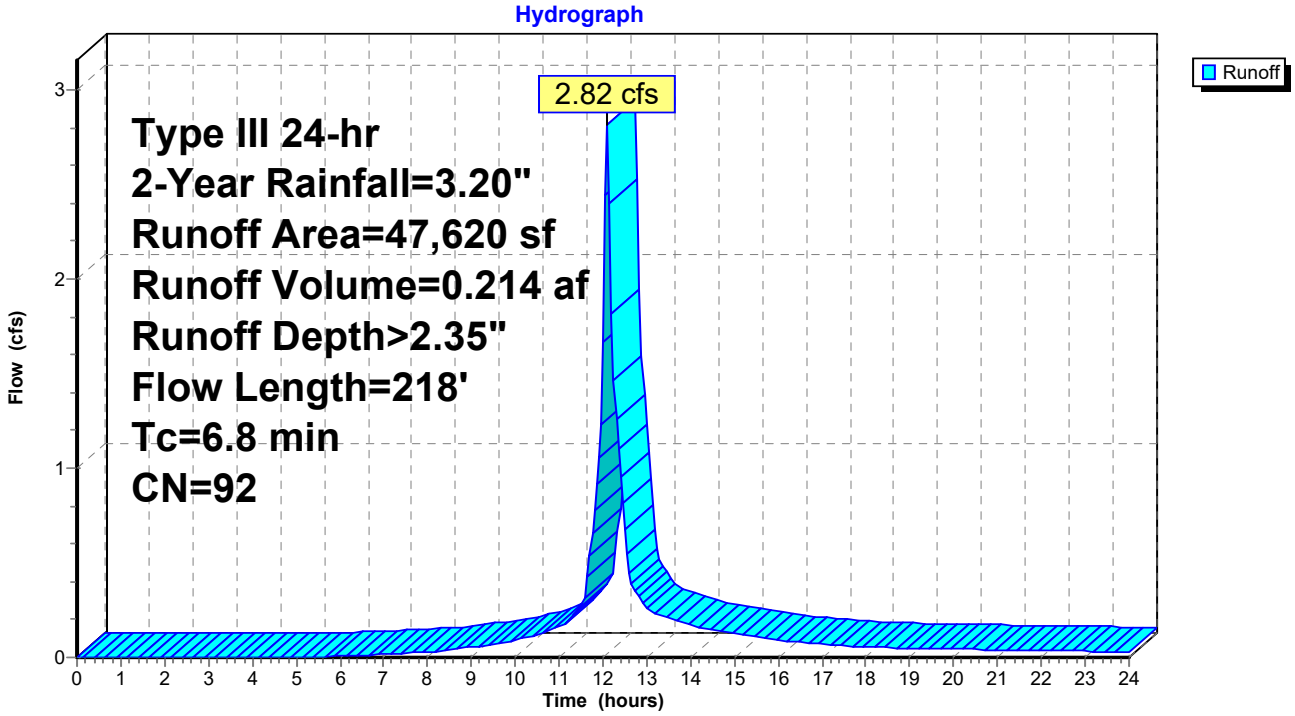
Runoff = 2.82 cfs @ 12.10 hrs, Volume= 0.214 af, Depth> 2.35"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.20"

Area (sf)	CN	Description
36,924	98	Paved parking, HSG C
9,270	74	>75% Grass cover, Good, HSG C
1,426	70	Woods, Good, HSG C
47,620	92	Weighted Average
10,696		22.46% Pervious Area
36,924		77.54% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.6	50	0.0340	0.18		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.20"
2.2	168	0.0060	1.25		**Shallow Concentrated Flow, SHallow Concentrated Flow** Unpaved Kv= 16.1 fps
6.8	218	Total			

Subcatchment E-6: Undetained to Wetland

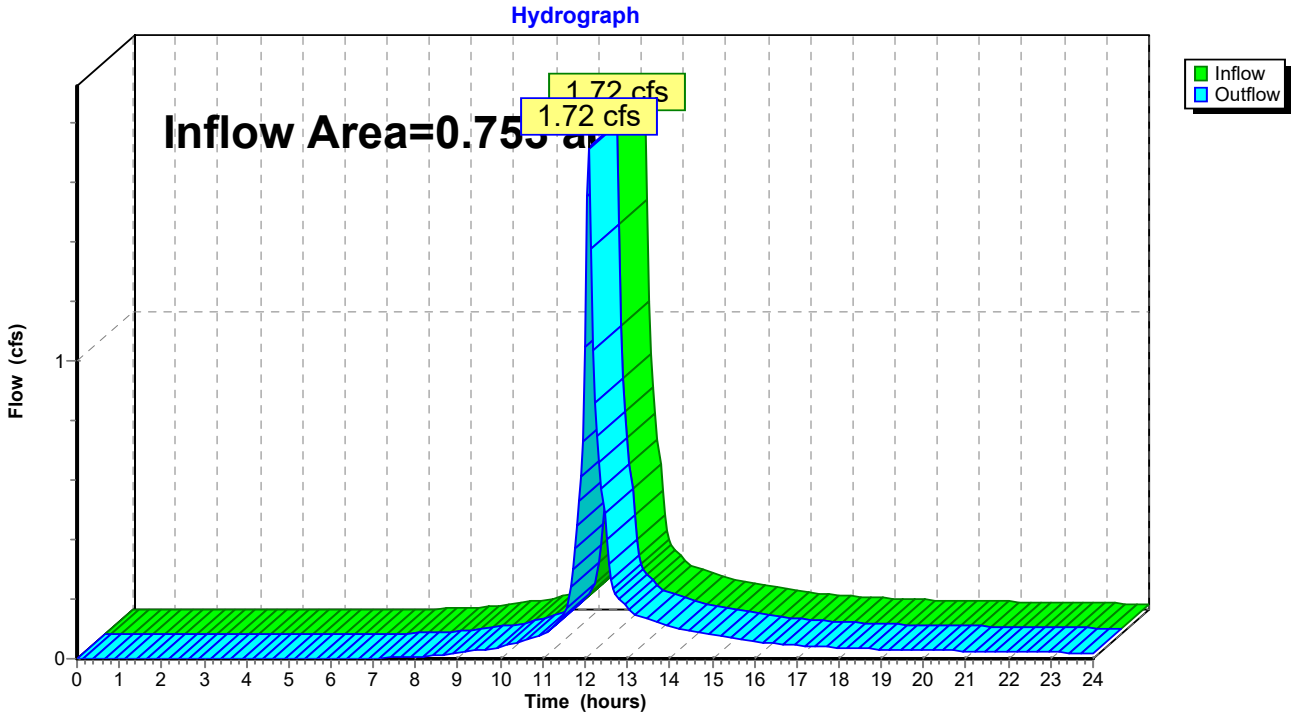


Summary for Reach DP-1: Design Point 1 (Wetland B)

Inflow Area = 0.753 ac, 35.44% Impervious, Inflow Depth > 2.00" for 2-Year event
Inflow = 1.72 cfs @ 12.09 hrs, Volume= 0.125 af
Outflow = 1.72 cfs @ 12.09 hrs, Volume= 0.125 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

Reach DP-1: Design Point 1 (Wetland B)

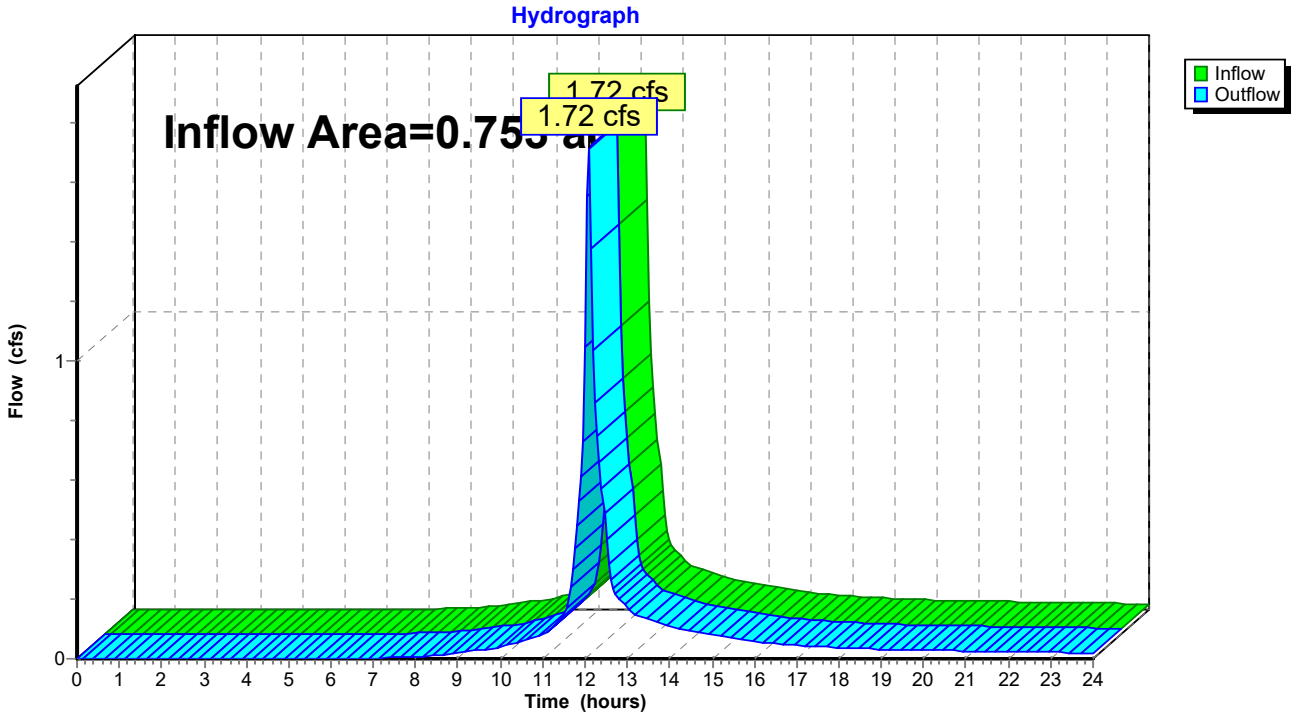


Summary for Reach DP-2: Design Point 2 (15" RCP to Wetland A)

Inflow Area = 0.753 ac, 35.44% Impervious, Inflow Depth > 2.00" for 2-Year event
Inflow = 1.72 cfs @ 12.09 hrs, Volume= 0.125 af
Outflow = 1.72 cfs @ 12.09 hrs, Volume= 0.125 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

Reach DP-2: Design Point 2 (15" RCP to Wetland A)

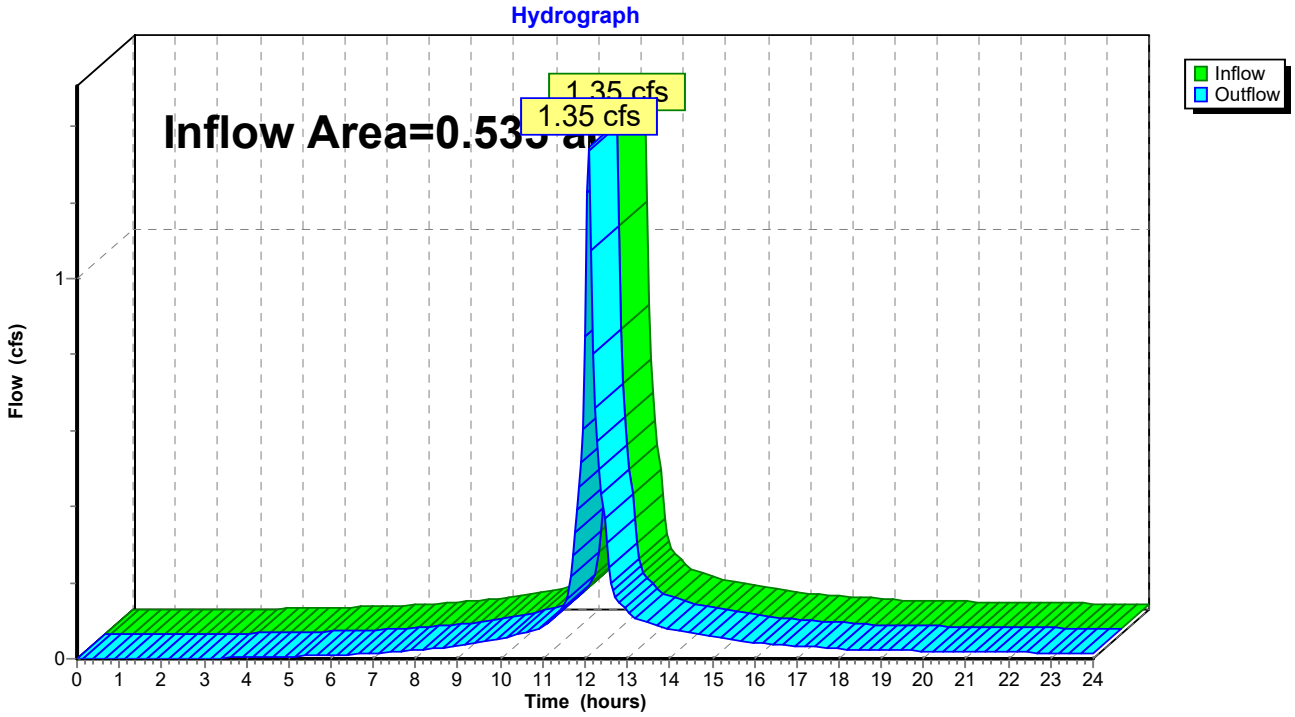


Summary for Reach DP-3: Design Point 3 (Existing Drainage Ditch)

Inflow Area = 0.535 ac, 66.58% Impervious, Inflow Depth > 2.37" for 2-Year event
Inflow = 1.35 cfs @ 12.09 hrs, Volume= 0.106 af
Outflow = 1.35 cfs @ 12.09 hrs, Volume= 0.106 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

Reach DP-3: Design Point 3 (Existing Drainage Ditch)

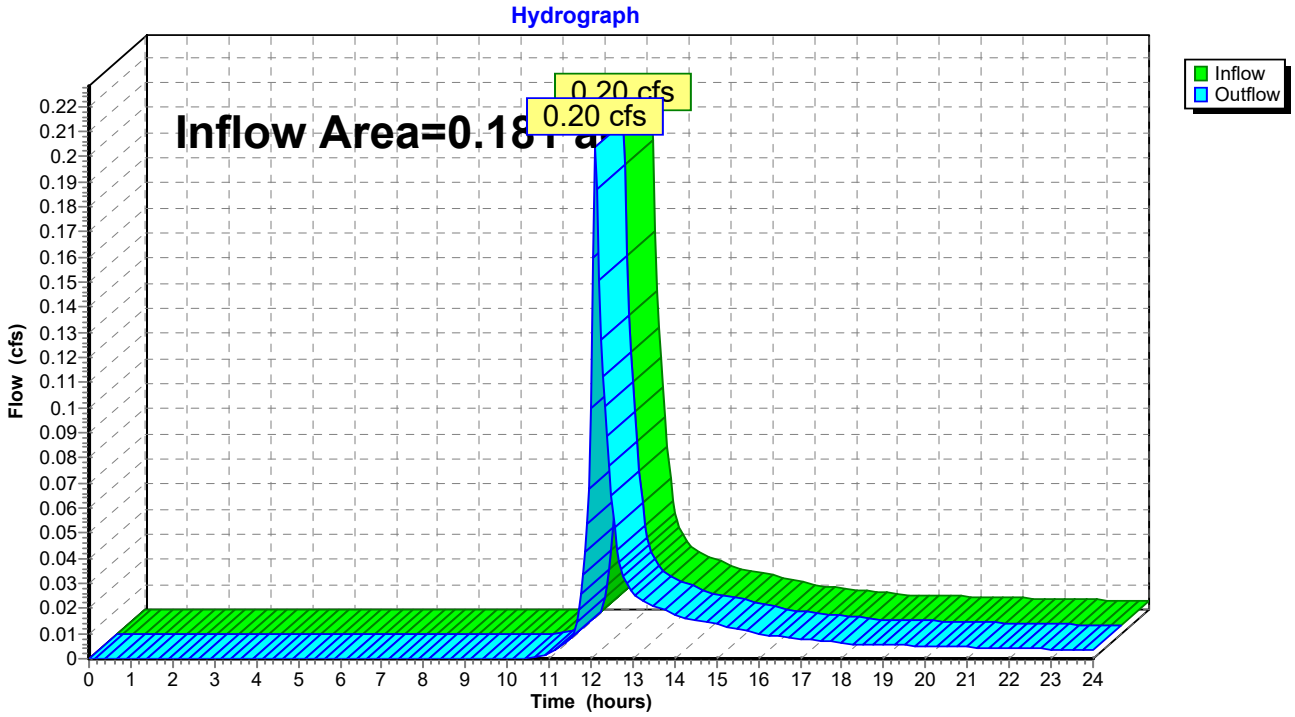


Summary for Reach DP-4: Design Point 4 (MassDOT CB- 2)

Inflow Area = 0.181 ac, 1.31% Impervious, Inflow Depth > 1.07" for 2-Year event
Inflow = 0.20 cfs @ 12.11 hrs, Volume= 0.016 af
Outflow = 0.20 cfs @ 12.11 hrs, Volume= 0.016 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

Reach DP-4: Design Point 4 (MassDOT CB- 2)

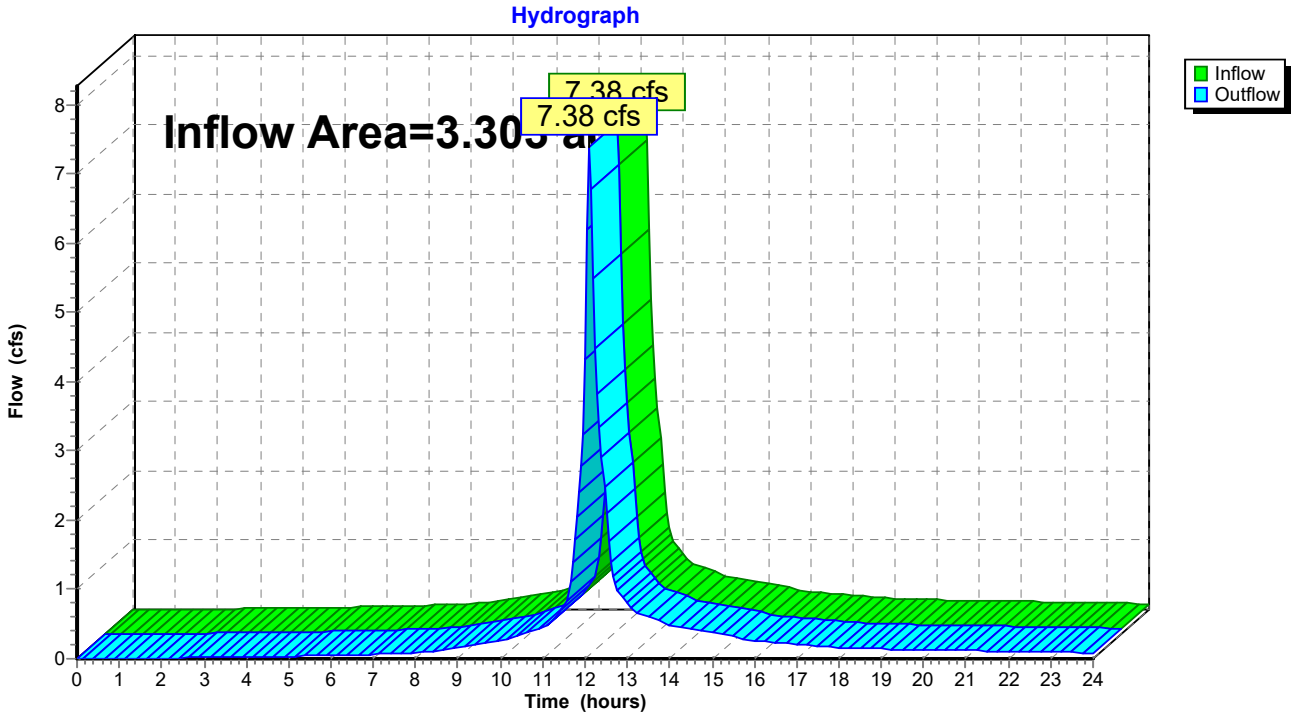


Summary for Reach DP-5: EXISTING CONSTRUCTED STORMWATER WETLAND

Inflow Area = 3.303 ac, 66.43% Impervious, Inflow Depth > 2.24" for 2-Year event
Inflow = 7.38 cfs @ 12.11 hrs, Volume= 0.618 af
Outflow = 7.38 cfs @ 12.11 hrs, Volume= 0.618 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

Reach DP-5: EXISTING CONSTRUCTED STORMWATER WETLAND

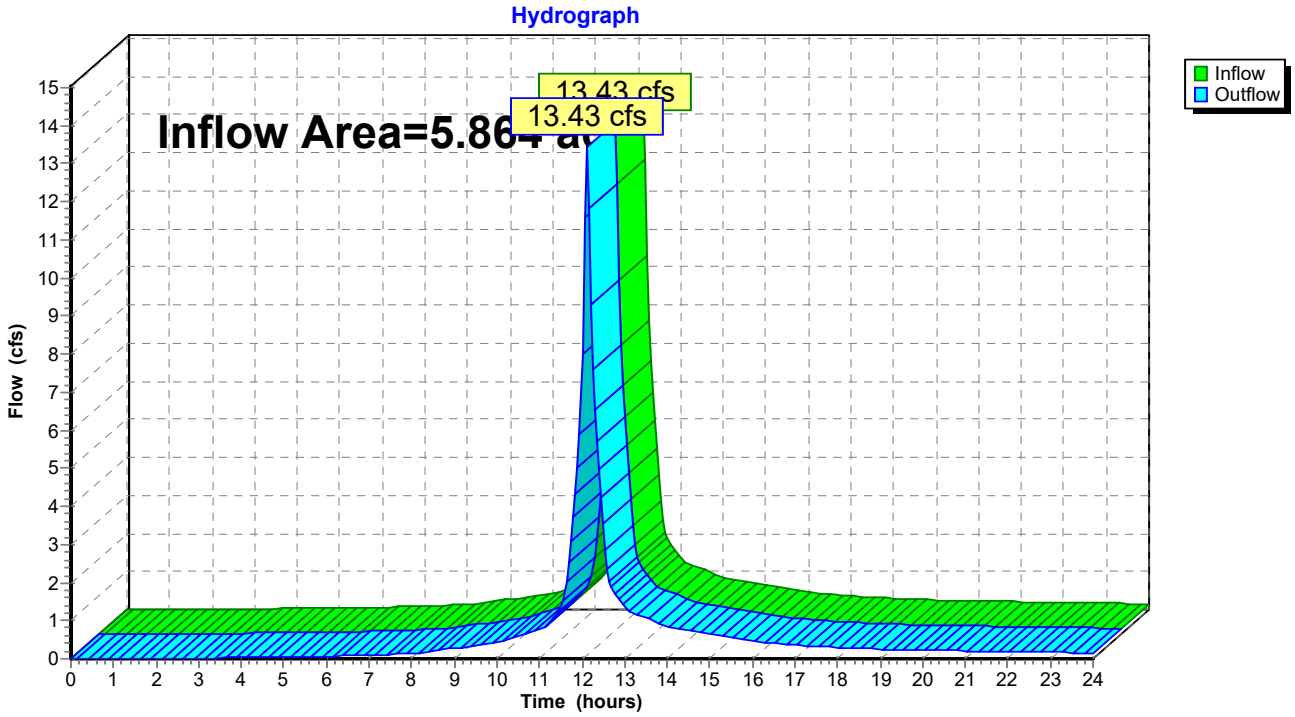


Summary for Reach DP-6: Wetland A - Design Point 6

Inflow Area = 5.864 ac, 62.53% Impervious, Inflow Depth > 2.21" for 2-Year event
Inflow = 13.43 cfs @ 12.10 hrs, Volume= 1.078 af
Outflow = 13.43 cfs @ 12.10 hrs, Volume= 1.078 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

Reach DP-6: Wetland A - Design Point 6



Summary for Subcatchment E-1: Existing Watershed 1

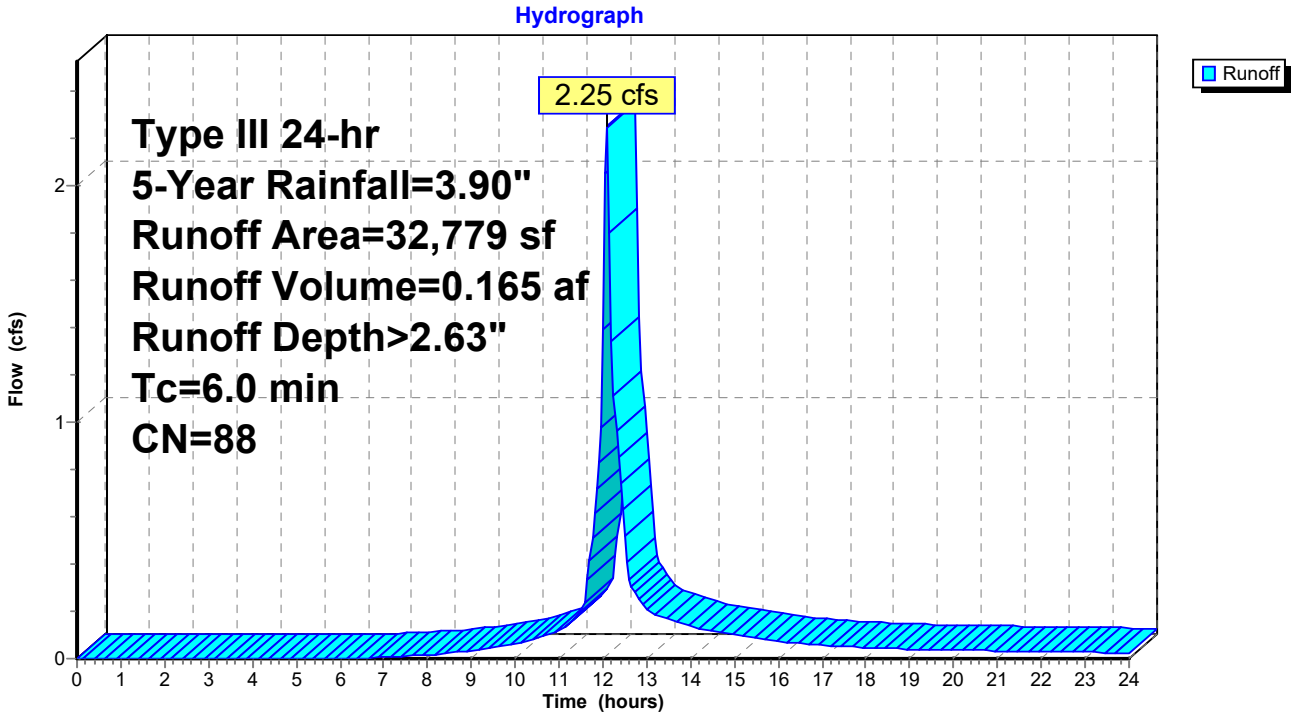
Runoff = 2.25 cfs @ 12.09 hrs, Volume= 0.165 af, Depth> 2.63"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 5-Year Rainfall=3.90"

Area (sf)	CN	Description
11,618	98	Paved parking, HSG C
9,421	96	Gravel surface, HSG C
5,782	74	>75% Grass cover, Good, HSG C
3,103	70	Woods, Good, HSG C
561	70	Woods, Good, HSG C
2,294	74	>75% Grass cover, Good, HSG C
32,779	88	Weighted Average
21,161		64.56% Pervious Area
11,618		35.44% Impervious Area

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

Subcatchment E-1: Existing Watershed 1



Summary for Subcatchment E-2: Existing Watershed 2

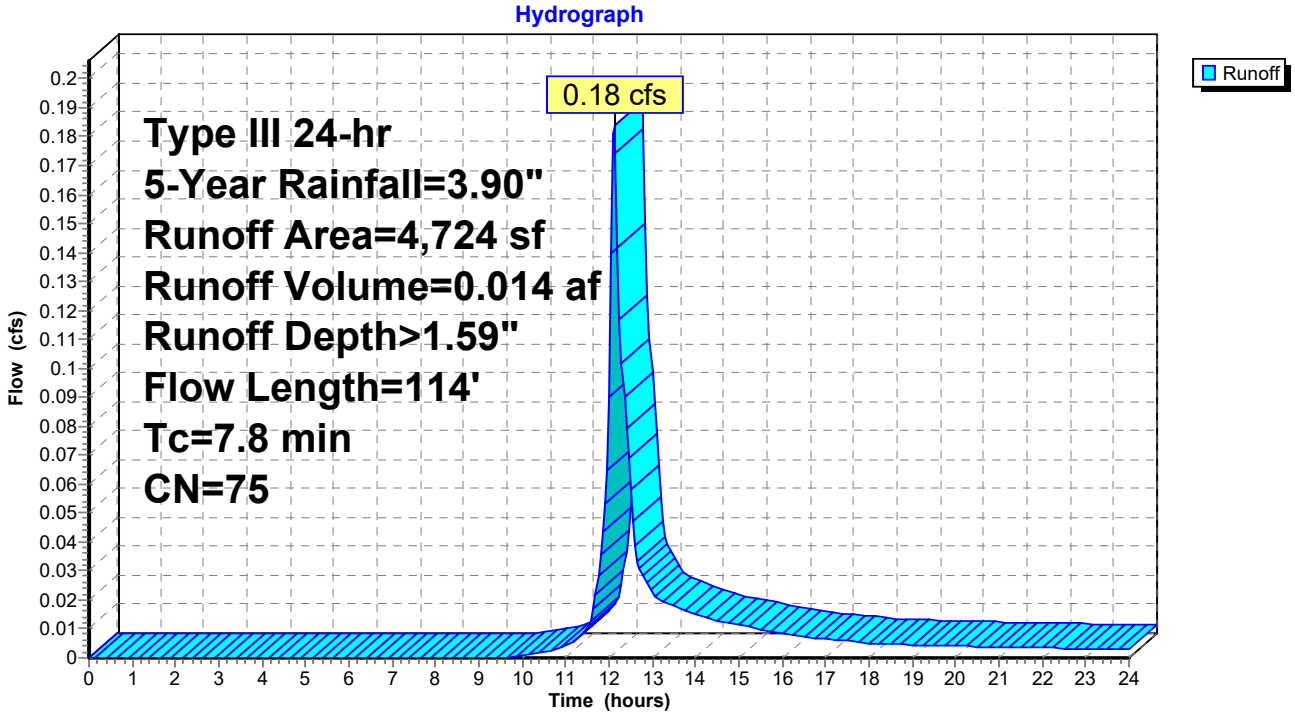
Runoff = 0.18 cfs @ 12.12 hrs, Volume= 0.014 af, Depth> 1.59"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 5-Year Rainfall=3.90"

Area (sf)	CN	Description
4,621	74	>75% Grass cover, Good, HSG C
103	98	Paved parking, HSG C
4,724	75	Weighted Average
4,621		97.82% Pervious Area
103		2.18% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.4	50	0.0100	0.11		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.20"
0.4	64	0.0312	2.84		**Shallow Concentrated Flow, Shallow Concentrated Flow** Unpaved Kv= 16.1 fps
7.8	114	Total			

Subcatchment E-2: Existing Watershed 2



Summary for Subcatchment E-3: Existing Watershed 3

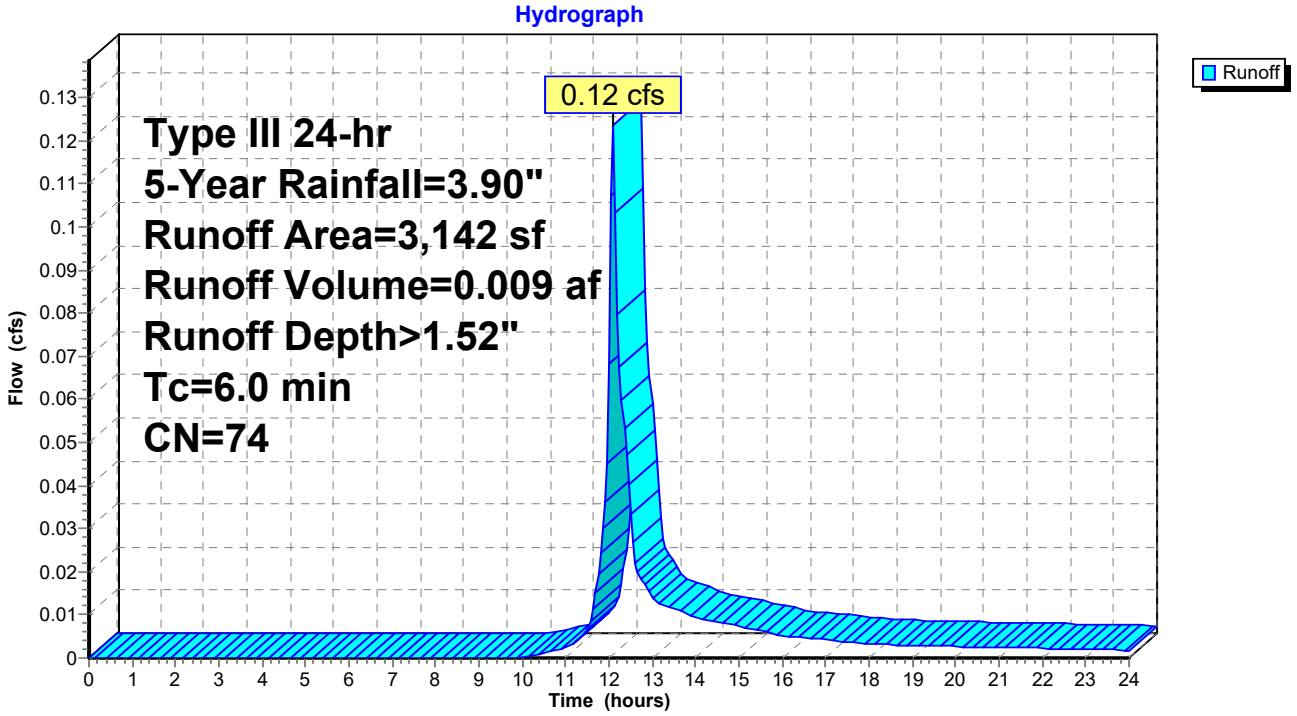
Runoff = 0.12 cfs @ 12.10 hrs, Volume= 0.009 af, Depth> 1.52"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 5-Year Rainfall=3.90"

Area (sf)	CN	Description
3,142	74	>75% Grass cover, Good, HSG C
3,142		100.00% Pervious Area

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

Subcatchment E-3: Existing Watershed 3



Summary for Subcatchment E-4A: Existing Watershed 4A

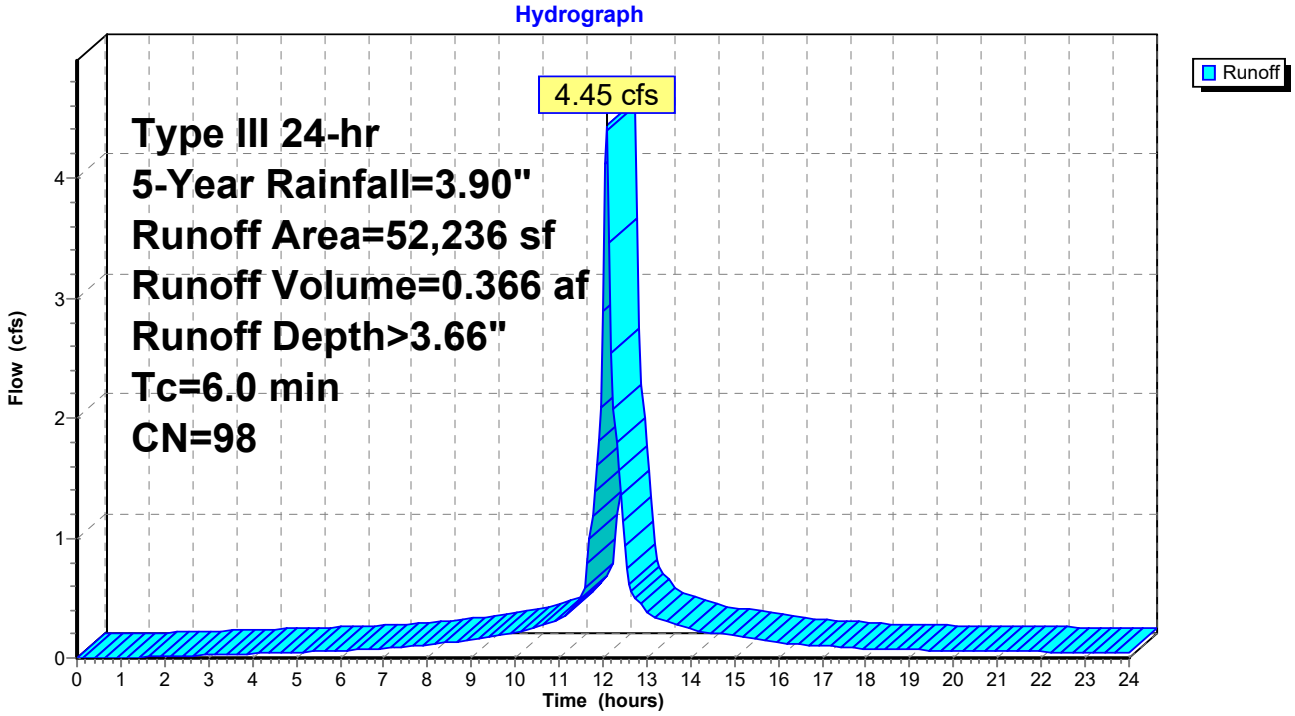
Runoff = 4.45 cfs @ 12.09 hrs, Volume= 0.366 af, Depth> 3.66"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 5-Year Rainfall=3.90"

Area (sf)	CN	Description
52,236	98	Roofs, HSG C
52,236		100.00% Impervious Area

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

Subcatchment E-4A: Existing Watershed 4A



Summary for Subcatchment E-4B: Existing Watershed 4B

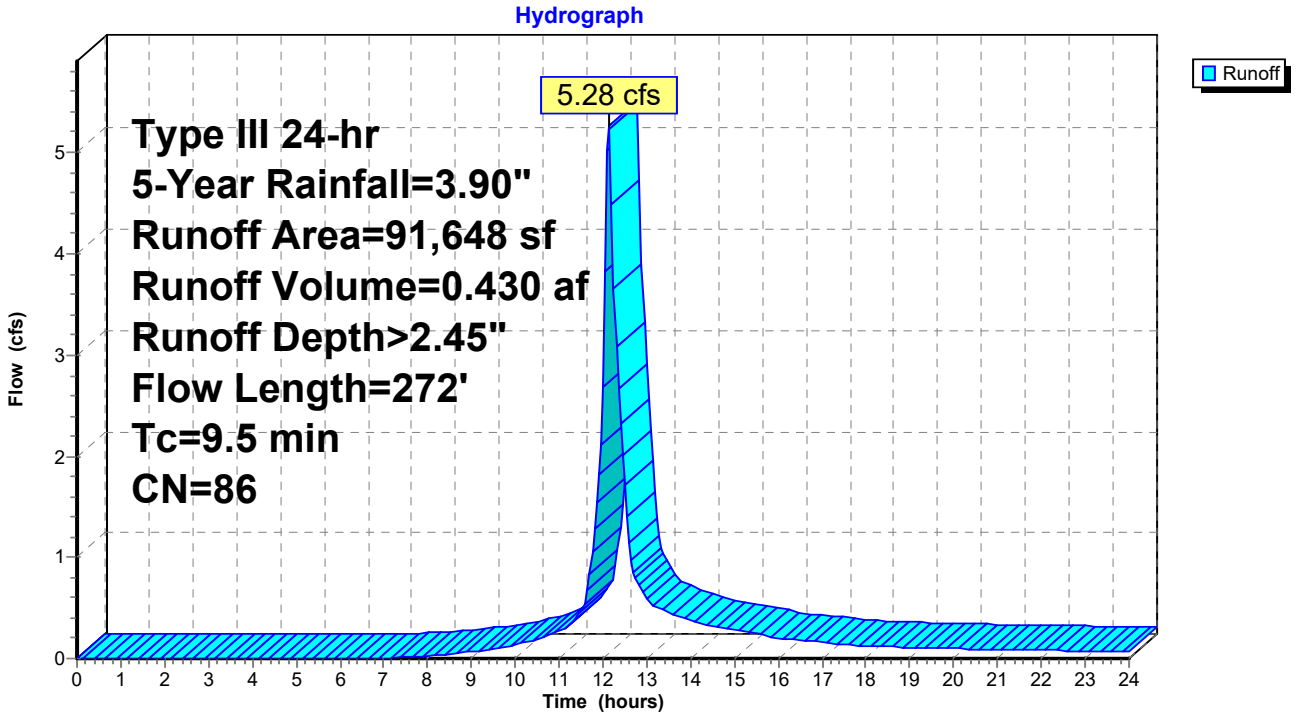
Runoff = 5.28 cfs @ 12.14 hrs, Volume= 0.430 af, Depth> 2.45"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 5-Year Rainfall=3.90"

	Area (sf)	CN	Description
	43,351	98	Paved parking, HSG C
	1,304	96	Gravel surface, HSG C
	42,526	74	>75% Grass cover, Good, HSG C
	2,704	70	Woods, Good, HSG C
*	1,763	74	Mulch
	91,648	86	Weighted Average
	48,297		52.70% Pervious Area
	43,351		47.30% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.1	50	0.0080	0.10		**Sheet Flow, Sheet Flow** Grass: Short n= 0.150 P2= 3.20"
0.8	111	0.0216	2.37		**Shallow Concentrated Flow, Shallow Concentrated Flow** Unpaved Kv= 16.1 fps
0.1	40	0.1500	6.24		**Shallow Concentrated Flow, SHallow** Unpaved Kv= 16.1 fps
0.5	71	0.0150	2.49		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
9.5	272	Total			

Subcatchment E-4B: Existing Watershed 4B



Summary for Subcatchment E-5A: Existing Watershed 5A

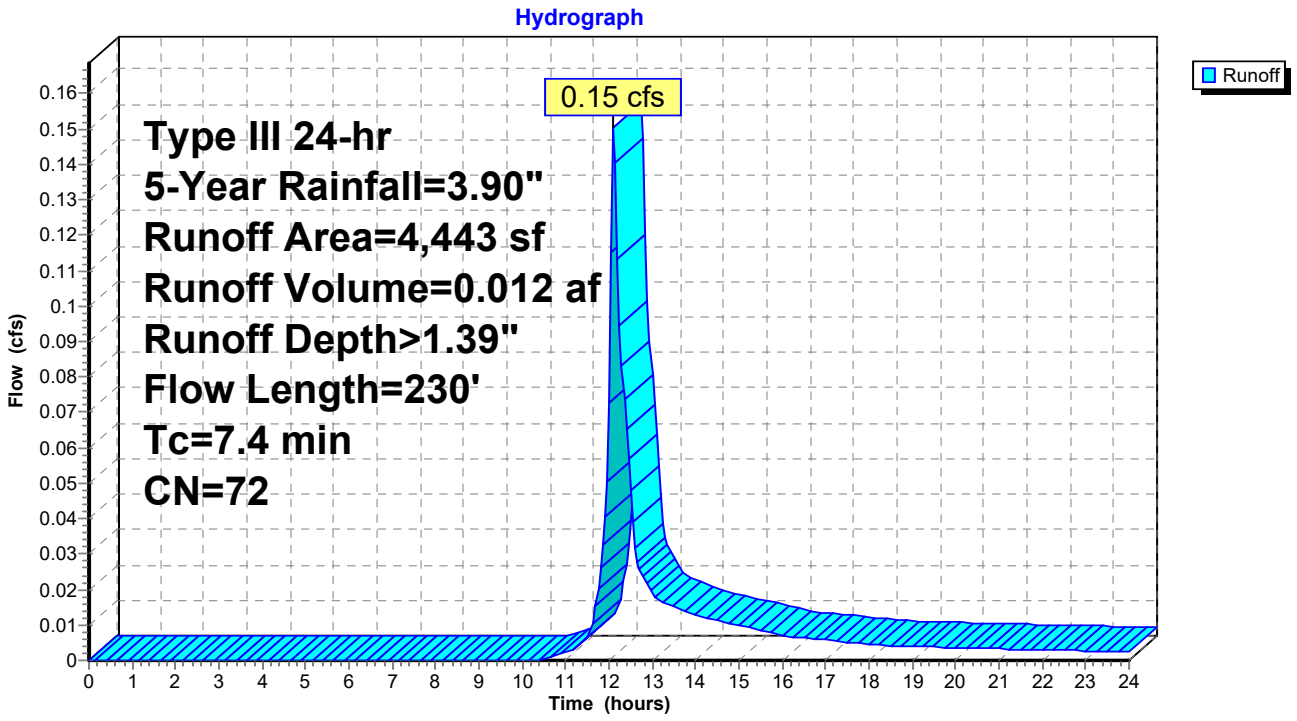
Runoff = 0.15 cfs @ 12.11 hrs, Volume= 0.012 af, Depth> 1.39"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 5-Year Rainfall=3.90"

Area (sf)	CN	Description
1,742	74	>75% Grass cover, Good, HSG C
2,701	70	Woods, Good, HSG C
4,443	72	Weighted Average
4,443		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.2	50	0.0160	0.14		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.20"
1.2	180	0.0244	2.51		**Shallow Concentrated Flow, Shallow COncentrated Flow** Unpaved Kv= 16.1 fps
7.4	230	Total			

Subcatchment E-5A: Existing Watershed 5A



Summary for Subcatchment E-5B: Existing Watershed 5B

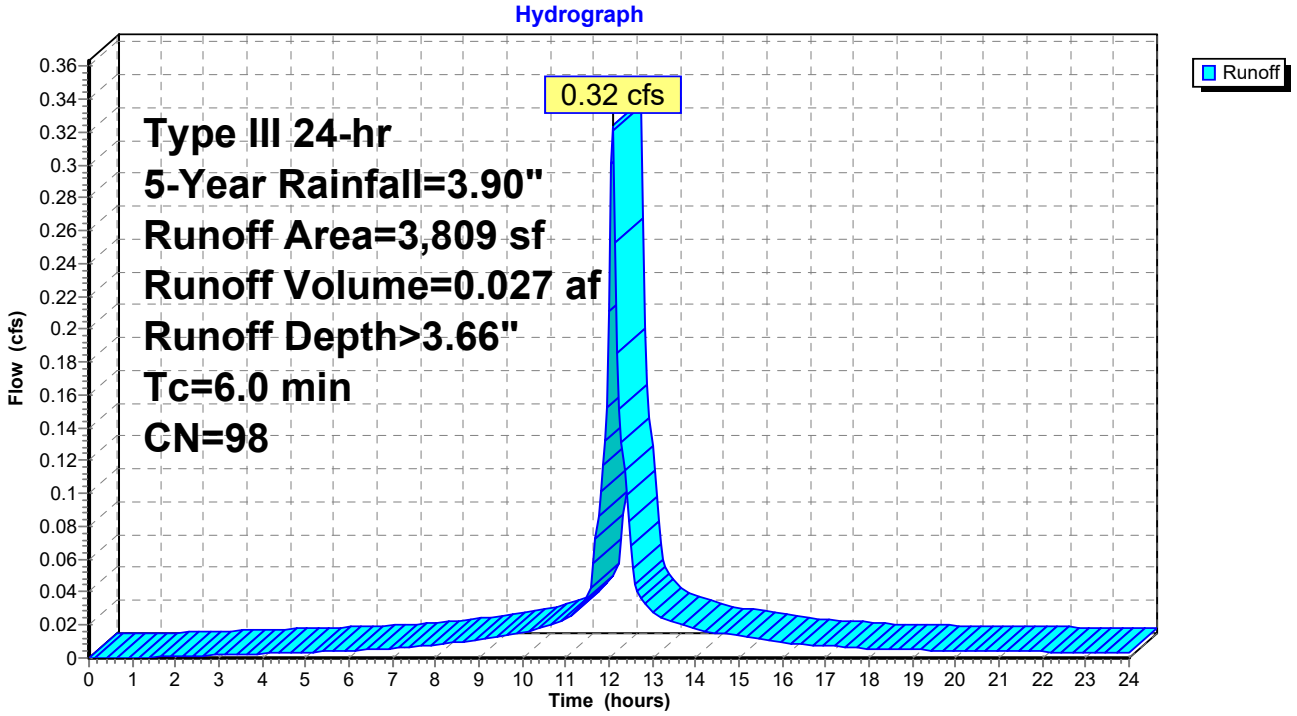
Runoff = 0.32 cfs @ 12.09 hrs, Volume= 0.027 af, Depth> 3.66"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 5-Year Rainfall=3.90"

Area (sf)	CN	Description
3,809	98	Paved parking, HSG C
3,809		100.00% Impervious Area

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

Subcatchment E-5B: Existing Watershed 5B



Summary for Subcatchment E-5C: Existing Watershed 5C

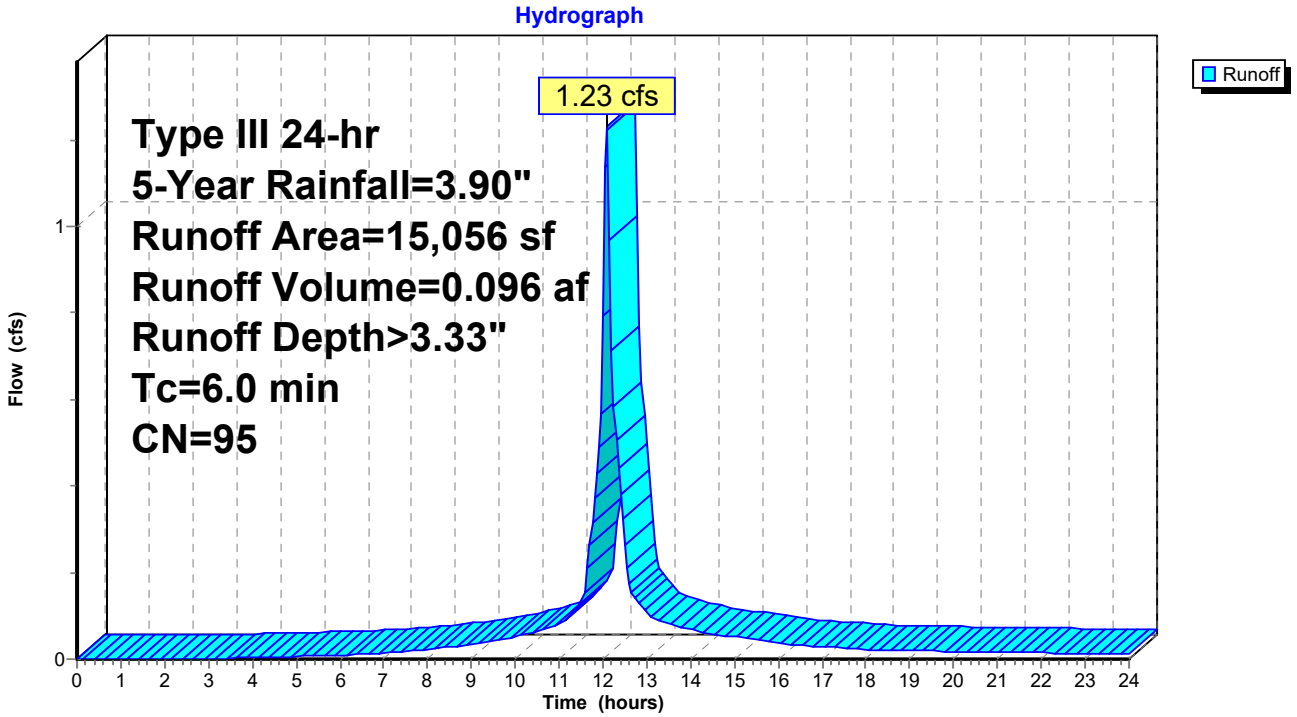
Runoff = 1.23 cfs @ 12.09 hrs, Volume= 0.096 af, Depth> 3.33"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 5-Year Rainfall=3.90"

Area (sf)	CN	Description
11,709	98	Paved parking, HSG C
1,791	96	Gravel surface, HSG C
303	79	50-75% Grass cover, Fair, HSG C
678	70	Woods, Good, HSG C
575	70	Woods, Good, HSG C
15,056	95	Weighted Average
3,347		22.23% Pervious Area
11,709		77.77% Impervious Area

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

Subcatchment E-5C: Existing Watershed 5C



Summary for Subcatchment E-6: Undetained to Wetland

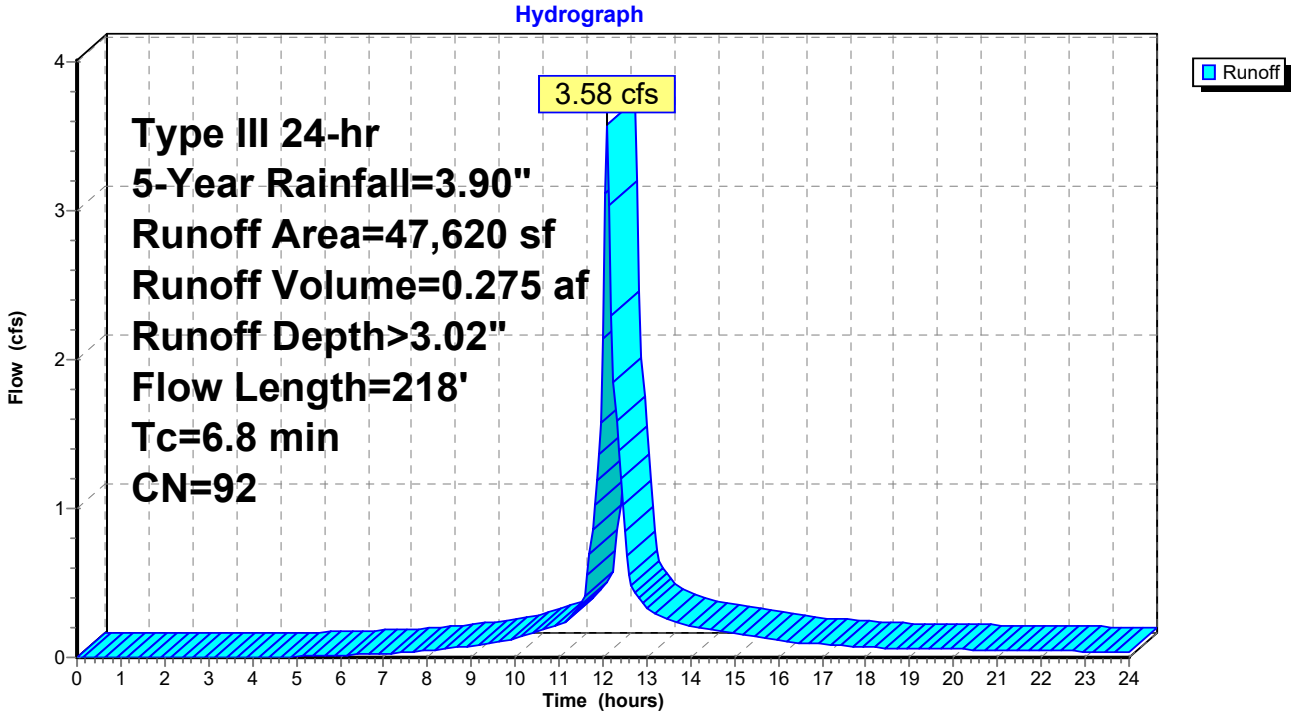
Runoff = 3.58 cfs @ 12.10 hrs, Volume= 0.275 af, Depth> 3.02"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 5-Year Rainfall=3.90"

Area (sf)	CN	Description
36,924	98	Paved parking, HSG C
9,270	74	>75% Grass cover, Good, HSG C
1,426	70	Woods, Good, HSG C
47,620	92	Weighted Average
10,696		22.46% Pervious Area
36,924		77.54% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.6	50	0.0340	0.18		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.20"
2.2	168	0.0060	1.25		**Shallow Concentrated Flow, SHallow Concentrated Flow** Unpaved Kv= 16.1 fps
6.8	218	Total			

Subcatchment E-6: Undetained to Wetland

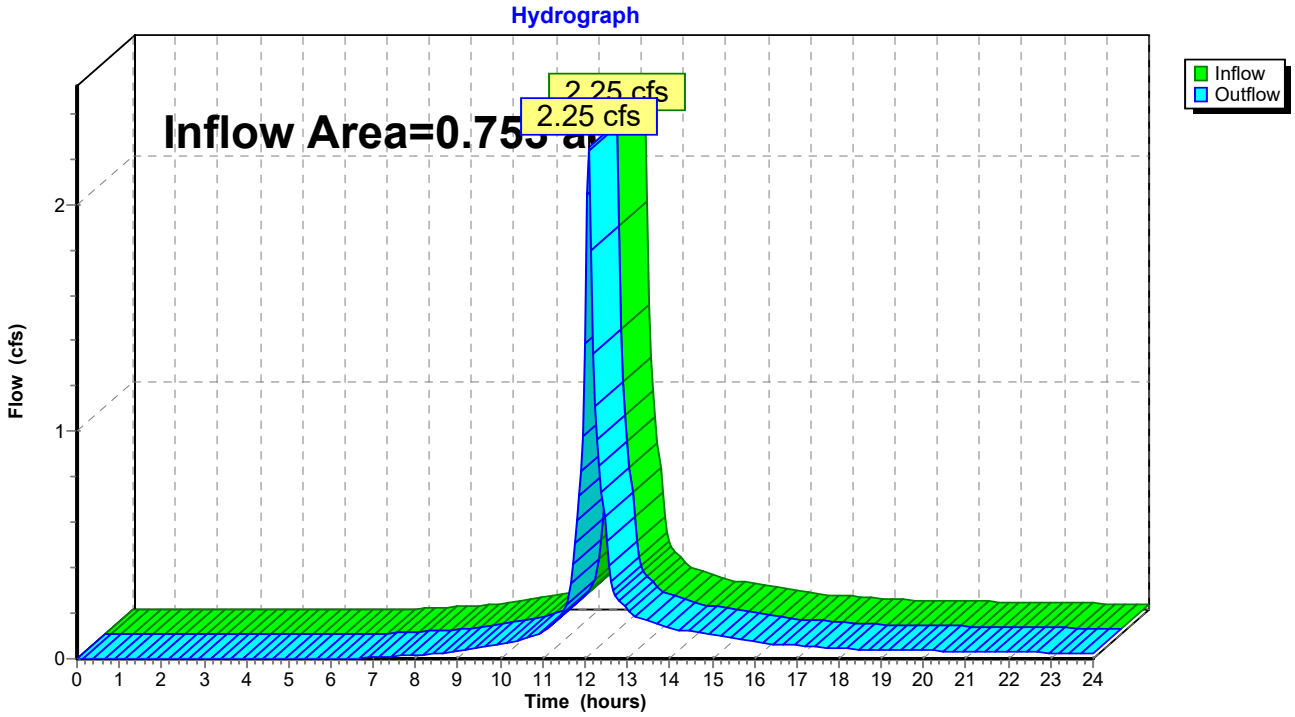


Summary for Reach DP-1: Design Point 1 (Wetland B)

Inflow Area = 0.753 ac, 35.44% Impervious, Inflow Depth > 2.63" for 5-Year event
Inflow = 2.25 cfs @ 12.09 hrs, Volume= 0.165 af
Outflow = 2.25 cfs @ 12.09 hrs, Volume= 0.165 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

Reach DP-1: Design Point 1 (Wetland B)

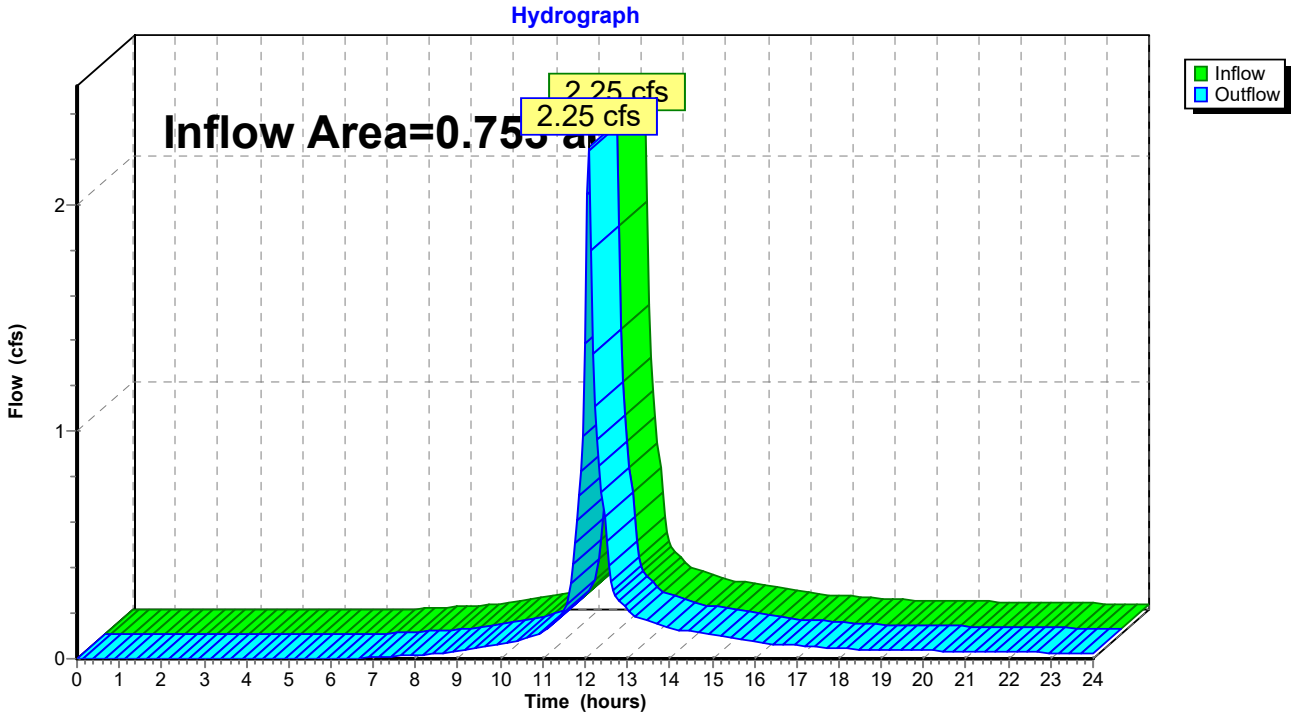


Summary for Reach DP-2: Design Point 2 (15" RCP to Wetland A)

Inflow Area = 0.753 ac, 35.44% Impervious, Inflow Depth > 2.63" for 5-Year event
Inflow = 2.25 cfs @ 12.09 hrs, Volume= 0.165 af
Outflow = 2.25 cfs @ 12.09 hrs, Volume= 0.165 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

Reach DP-2: Design Point 2 (15" RCP to Wetland A)

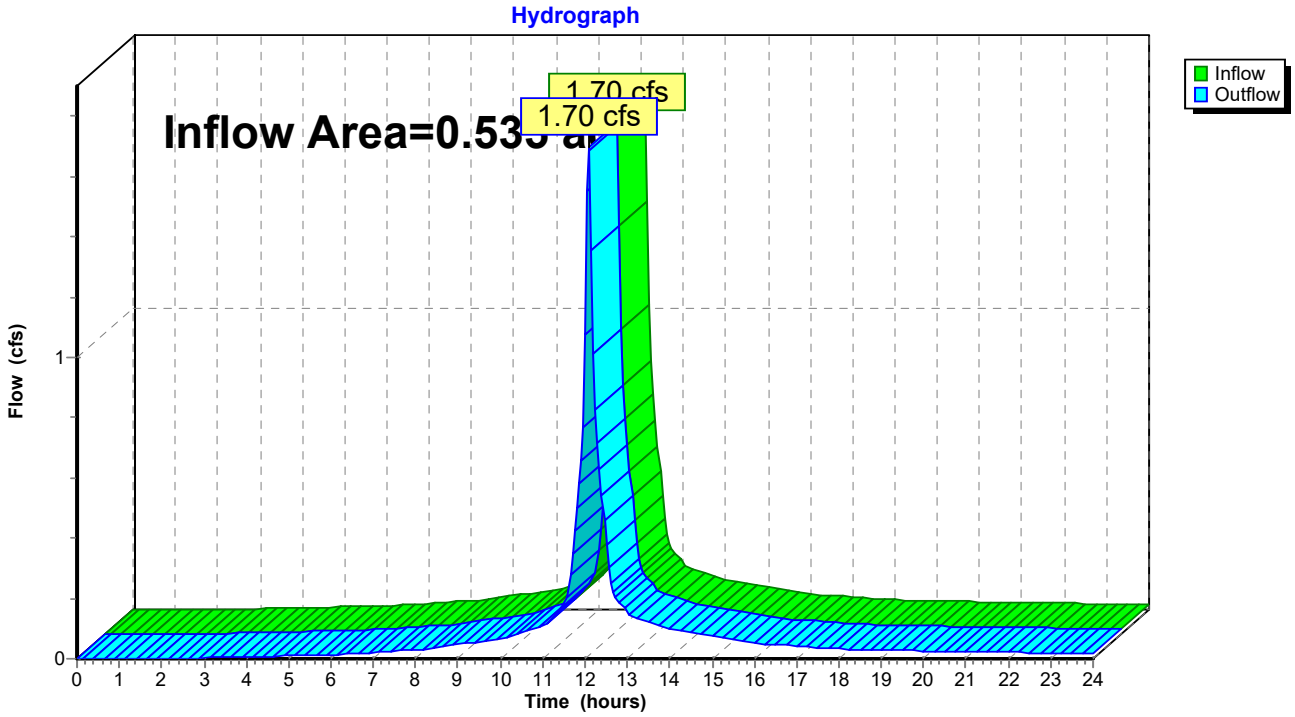


Summary for Reach DP-3: Design Point 3 (Existing Drainage Ditch)

Inflow Area = 0.535 ac, 66.58% Impervious, Inflow Depth > 3.01" for 5-Year event
Inflow = 1.70 cfs @ 12.09 hrs, Volume= 0.134 af
Outflow = 1.70 cfs @ 12.09 hrs, Volume= 0.134 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

Reach DP-3: Design Point 3 (Existing Drainage Ditch)

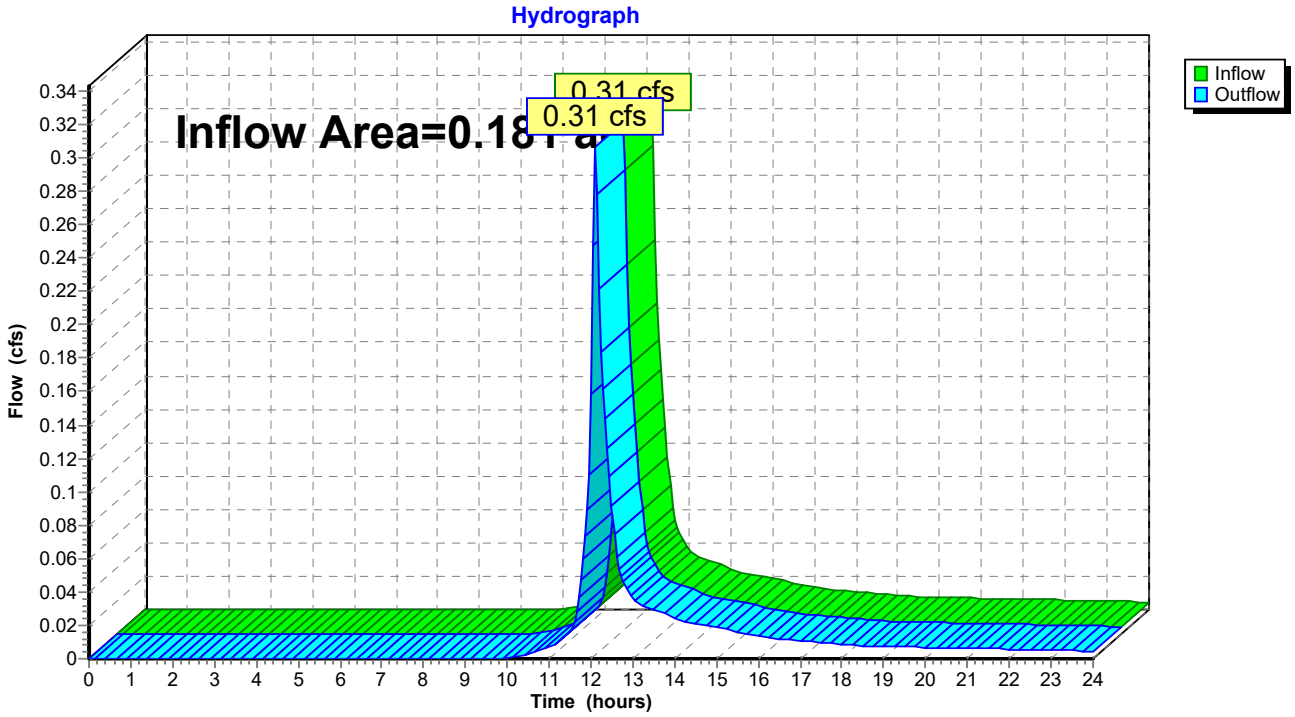


Summary for Reach DP-4: Design Point 4 (MassDOT CB- 2)

Inflow Area = 0.181 ac, 1.31% Impervious, Inflow Depth > 1.56" for 5-Year event
Inflow = 0.31 cfs @ 12.11 hrs, Volume= 0.024 af
Outflow = 0.31 cfs @ 12.11 hrs, Volume= 0.024 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

Reach DP-4: Design Point 4 (MassDOT CB- 2)

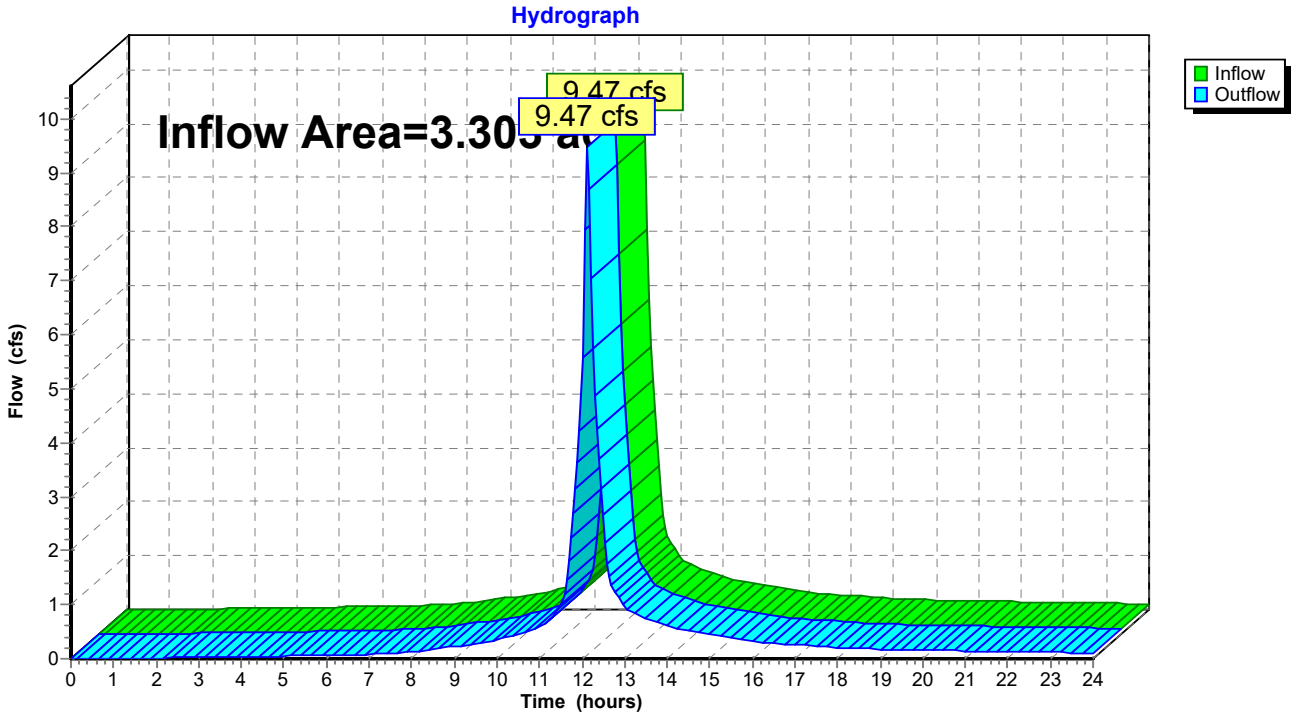


Summary for Reach DP-5: EXISTING CONSTRUCTED STORMWATER WETLAND

Inflow Area = 3.303 ac, 66.43% Impervious, Inflow Depth > 2.89" for 5-Year event
Inflow = 9.47 cfs @ 12.11 hrs, Volume= 0.796 af
Outflow = 9.47 cfs @ 12.11 hrs, Volume= 0.796 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

Reach DP-5: EXISTING CONSTRUCTED STORMWATER WETLAND

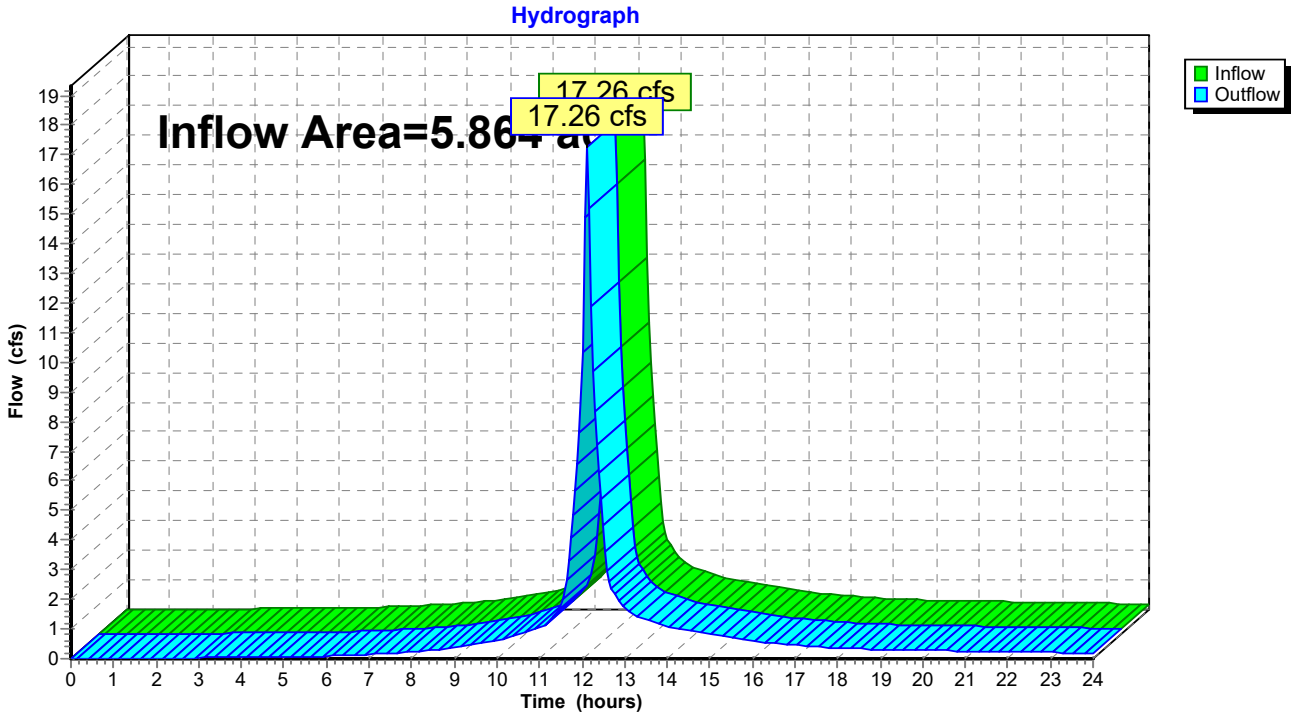


Summary for Reach DP-6: Wetland A - Design Point 6

Inflow Area = 5.864 ac, 62.53% Impervious, Inflow Depth > 2.85" for 5-Year event
Inflow = 17.26 cfs @ 12.10 hrs, Volume= 1.394 af
Outflow = 17.26 cfs @ 12.10 hrs, Volume= 1.394 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

Reach DP-6: Wetland A - Design Point 6



Summary for Subcatchment E-1: Existing Watershed 1

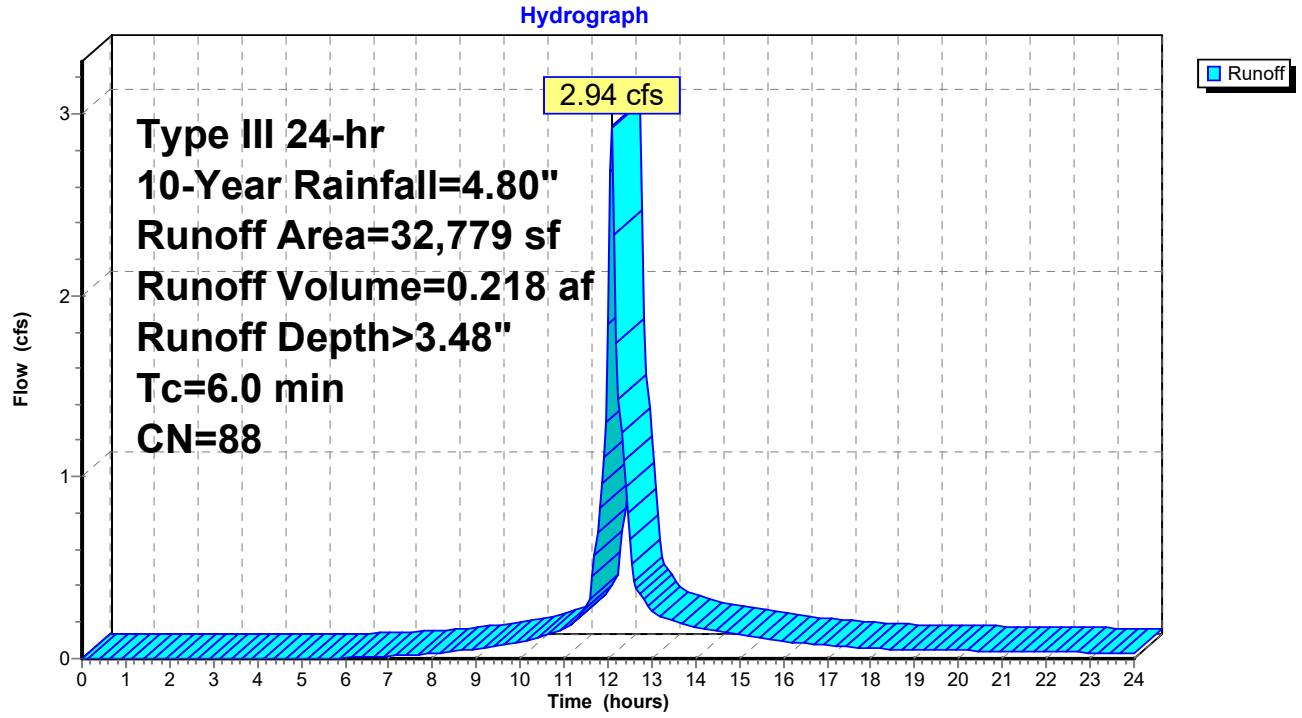
Runoff = 2.94 cfs @ 12.09 hrs, Volume= 0.218 af, Depth> 3.48"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.80"

Area (sf)	CN	Description
11,618	98	Paved parking, HSG C
9,421	96	Gravel surface, HSG C
5,782	74	>75% Grass cover, Good, HSG C
3,103	70	Woods, Good, HSG C
561	70	Woods, Good, HSG C
2,294	74	>75% Grass cover, Good, HSG C
32,779	88	Weighted Average
21,161		64.56% Pervious Area
11,618		35.44% Impervious Area

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

Subcatchment E-1: Existing Watershed 1



Summary for Subcatchment E-2: Existing Watershed 2

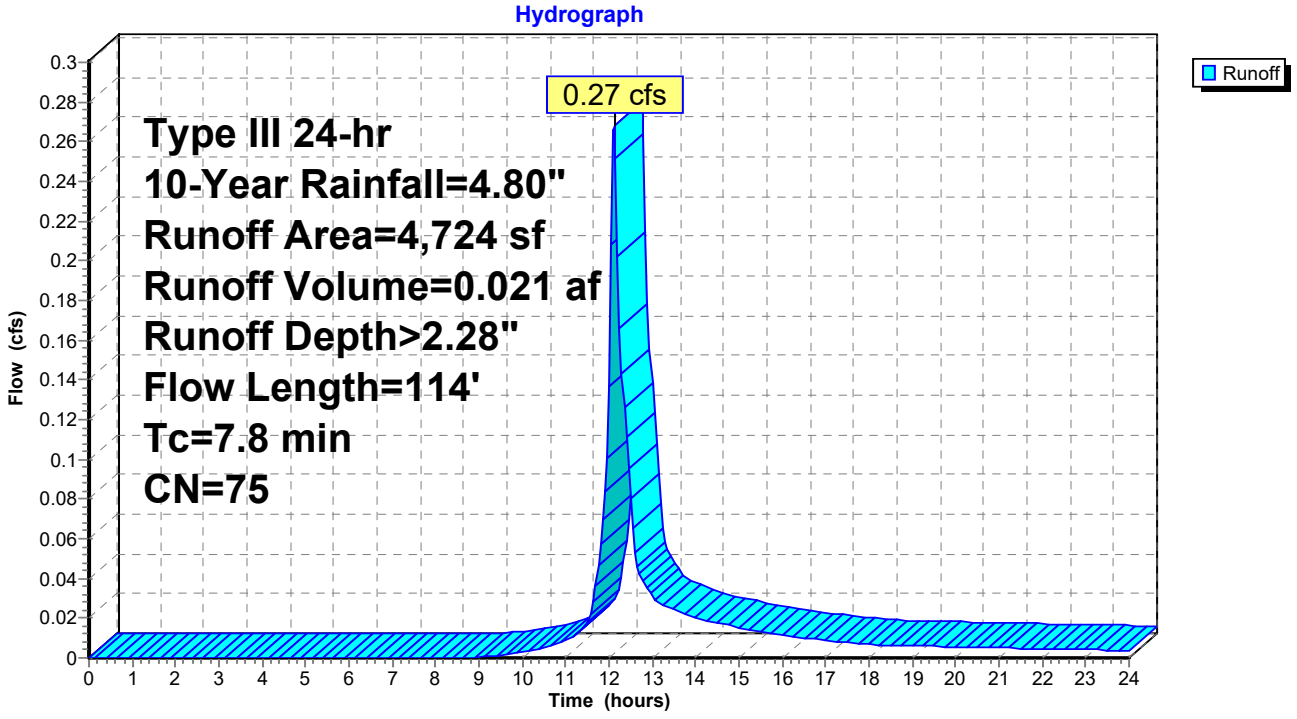
Runoff = 0.27 cfs @ 12.12 hrs, Volume= 0.021 af, Depth> 2.28"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.80"

Area (sf)	CN	Description
4,621	74	>75% Grass cover, Good, HSG C
103	98	Paved parking, HSG C
4,724	75	Weighted Average
4,621		97.82% Pervious Area
103		2.18% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.4	50	0.0100	0.11		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.20"
0.4	64	0.0312	2.84		**Shallow Concentrated Flow, Shallow Concentrated Flow** Unpaved Kv= 16.1 fps
7.8	114	Total			

Subcatchment E-2: Existing Watershed 2



Summary for Subcatchment E-3: Existing Watershed 3

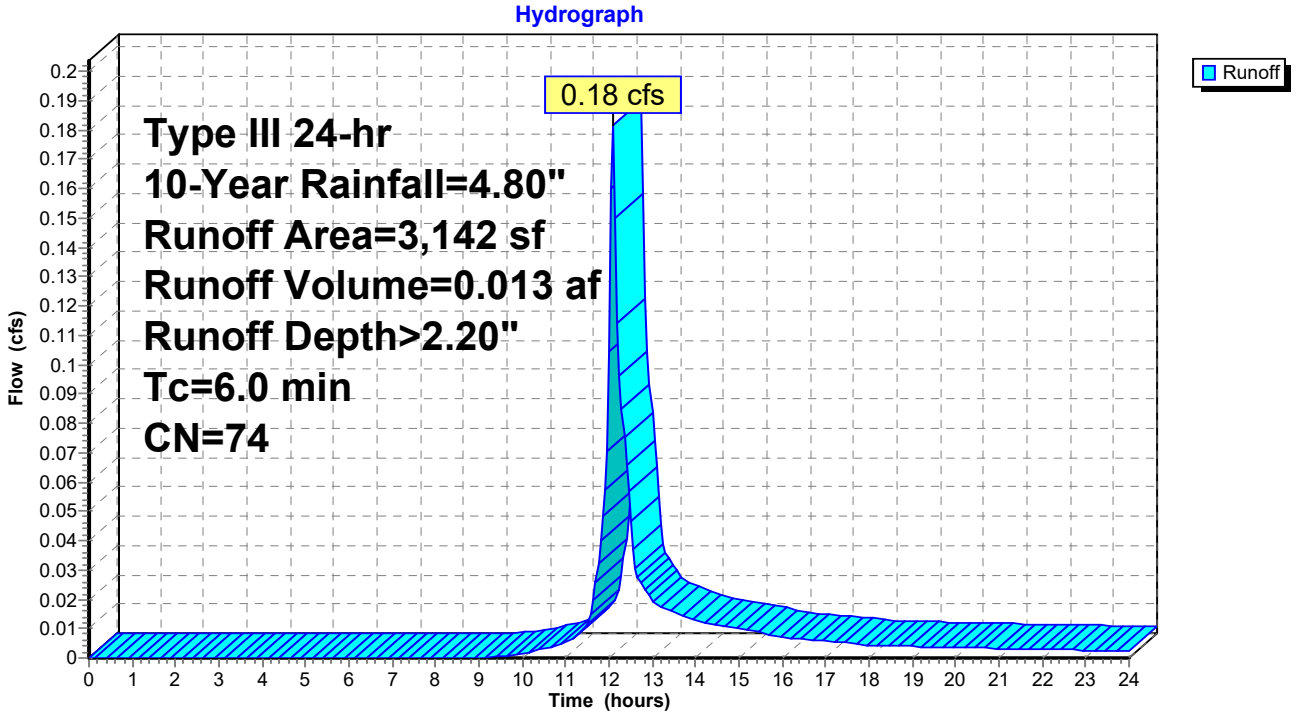
Runoff = 0.18 cfs @ 12.10 hrs, Volume= 0.013 af, Depth> 2.20"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.80"

Area (sf)	CN	Description
3,142	74	>75% Grass cover, Good, HSG C
3,142		100.00% Pervious Area

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

Subcatchment E-3: Existing Watershed 3



Summary for Subcatchment E-4A: Existing Watershed 4A

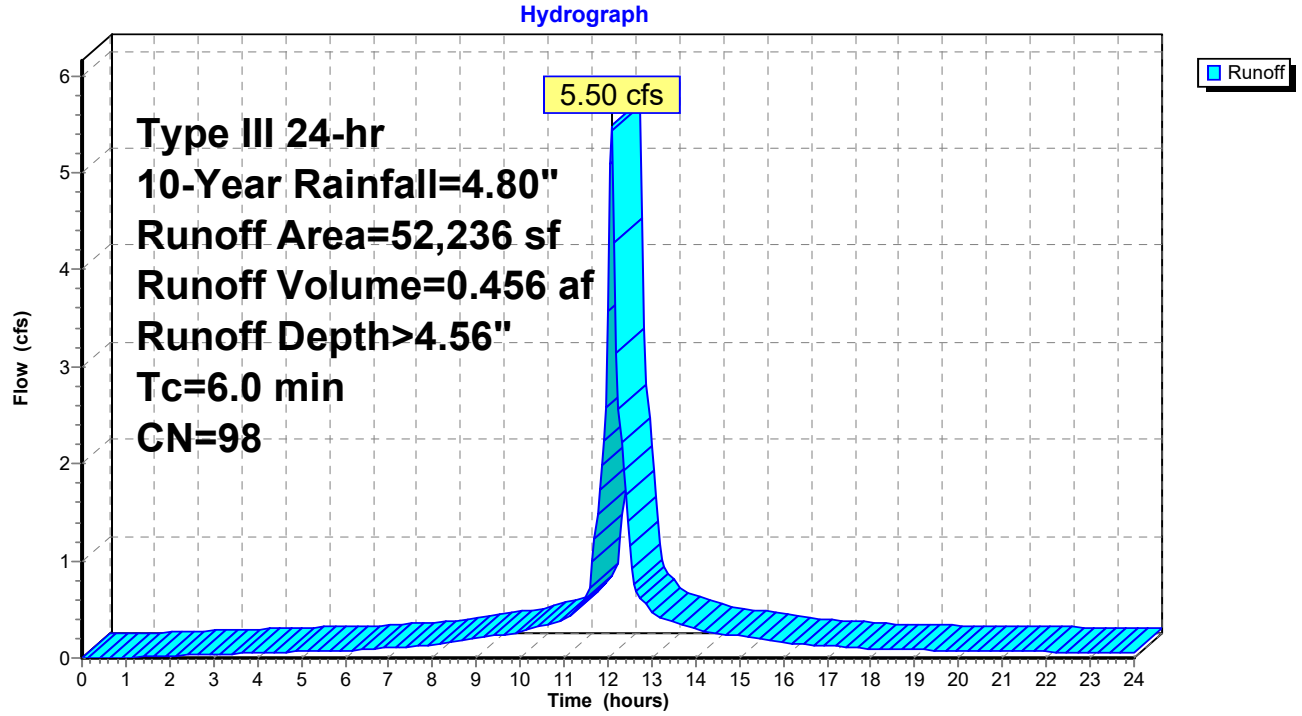
Runoff = 5.50 cfs @ 12.09 hrs, Volume= 0.456 af, Depth> 4.56"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.80"

Area (sf)	CN	Description
52,236	98	Roofs, HSG C
52,236		100.00% Impervious Area

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

Subcatchment E-4A: Existing Watershed 4A



Summary for Subcatchment E-4B: Existing Watershed 4B

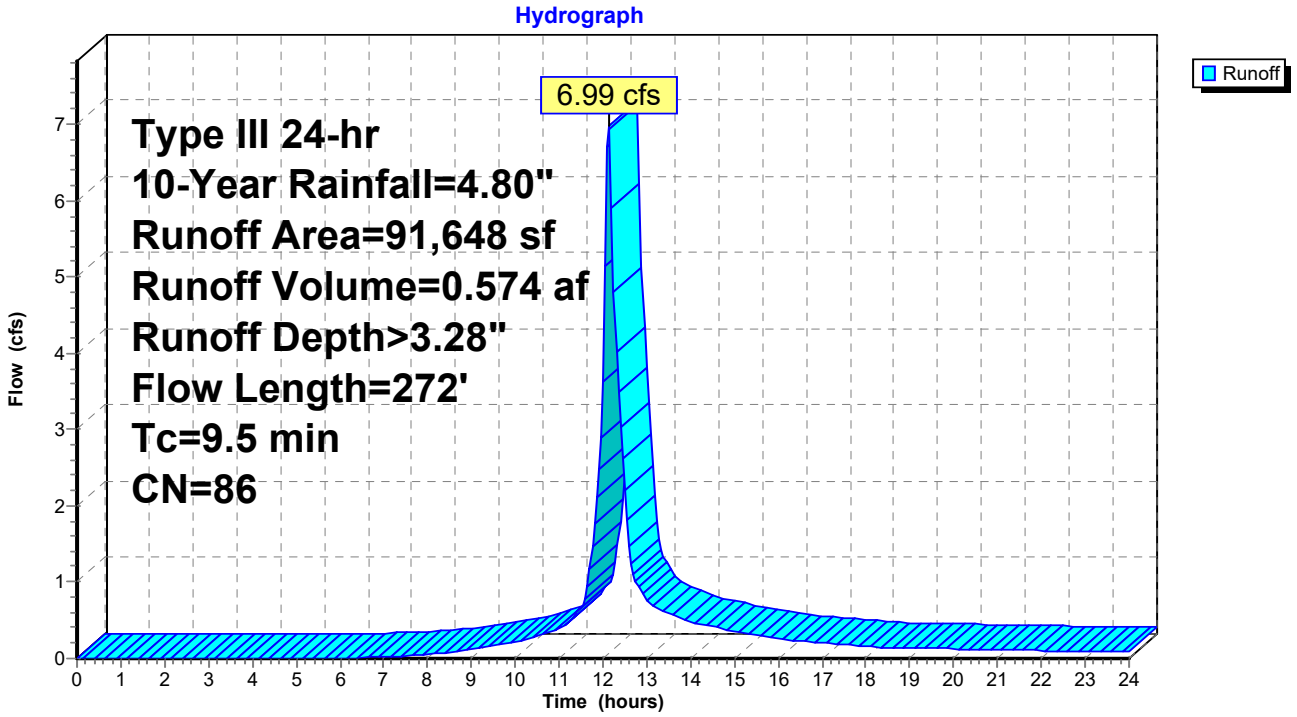
Runoff = 6.99 cfs @ 12.13 hrs, Volume= 0.574 af, Depth> 3.28"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.80"

	Area (sf)	CN	Description
	43,351	98	Paved parking, HSG C
	1,304	96	Gravel surface, HSG C
	42,526	74	>75% Grass cover, Good, HSG C
	2,704	70	Woods, Good, HSG C
*	1,763	74	Mulch
	91,648	86	Weighted Average
	48,297		52.70% Pervious Area
	43,351		47.30% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.1	50	0.0080	0.10		**Sheet Flow, Sheet Flow** Grass: Short n= 0.150 P2= 3.20"
0.8	111	0.0216	2.37		**Shallow Concentrated Flow, Shallow Concentrated Flow** Unpaved Kv= 16.1 fps
0.1	40	0.1500	6.24		**Shallow Concentrated Flow, SHallow** Unpaved Kv= 16.1 fps
0.5	71	0.0150	2.49		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
9.5	272	Total			

Subcatchment E-4B: Existing Watershed 4B



Summary for Subcatchment E-5A: Existing Watershed 5A

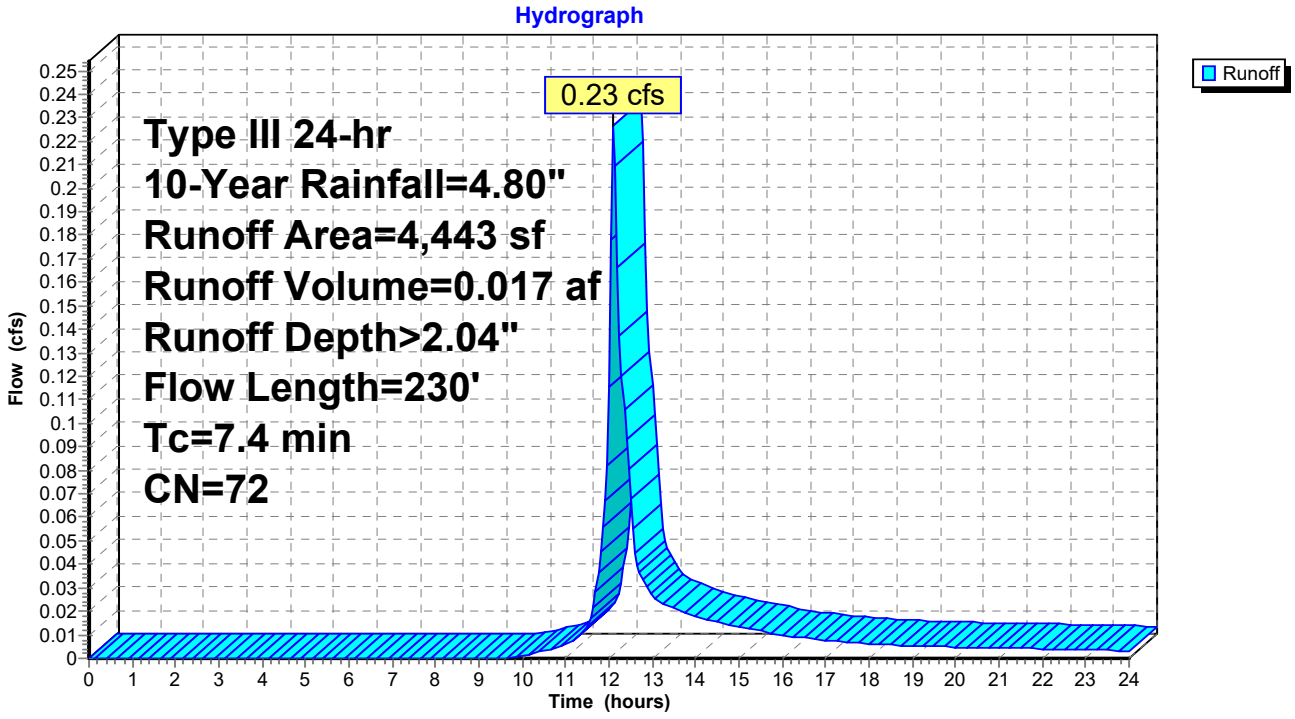
Runoff = 0.23 cfs @ 12.11 hrs, Volume= 0.017 af, Depth> 2.04"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.80"

Area (sf)	CN	Description
1,742	74	>75% Grass cover, Good, HSG C
2,701	70	Woods, Good, HSG C
4,443	72	Weighted Average
4,443		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.2	50	0.0160	0.14		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.20"
1.2	180	0.0244	2.51		**Shallow Concentrated Flow, Shallow COncentrated Flow** Unpaved Kv= 16.1 fps
7.4	230	Total			

Subcatchment E-5A: Existing Watershed 5A



Summary for Subcatchment E-5B: Existing Watershed 5B

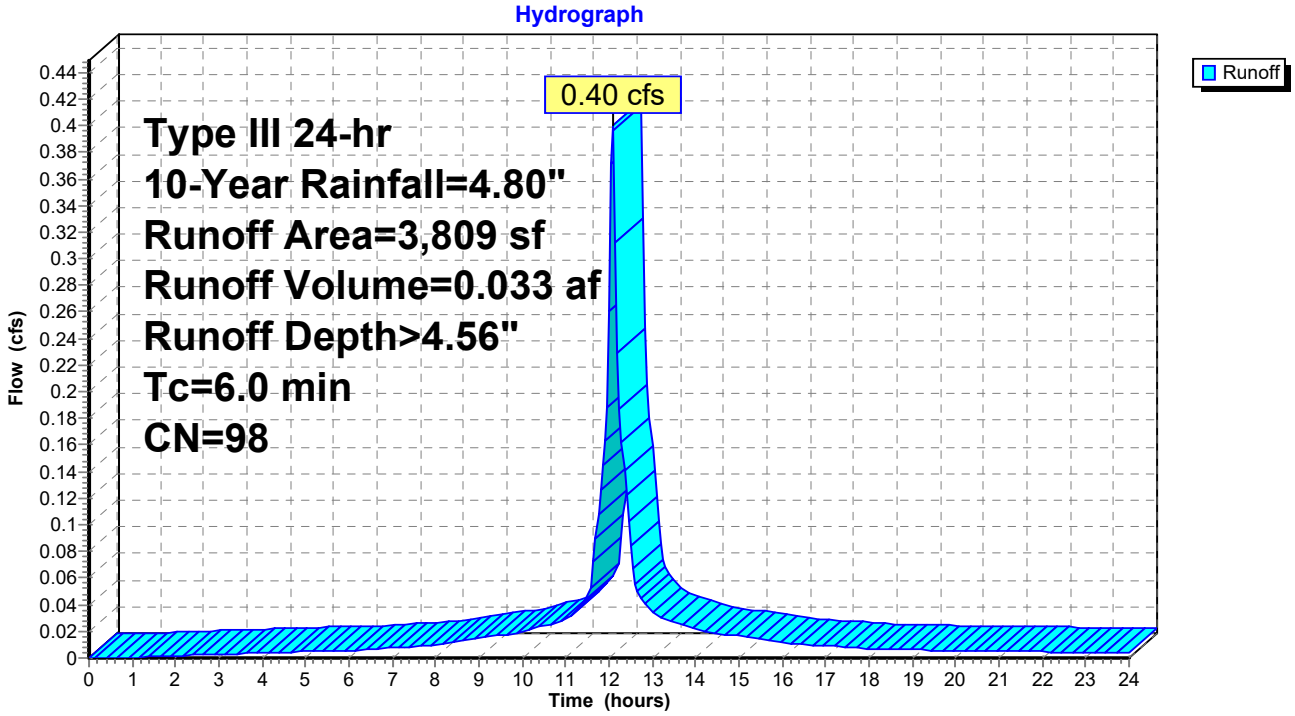
Runoff = 0.40 cfs @ 12.09 hrs, Volume= 0.033 af, Depth> 4.56"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.80"

Area (sf)	CN	Description
3,809	98	Paved parking, HSG C
3,809		100.00% Impervious Area

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

Subcatchment E-5B: Existing Watershed 5B



Summary for Subcatchment E-5C: Existing Watershed 5C

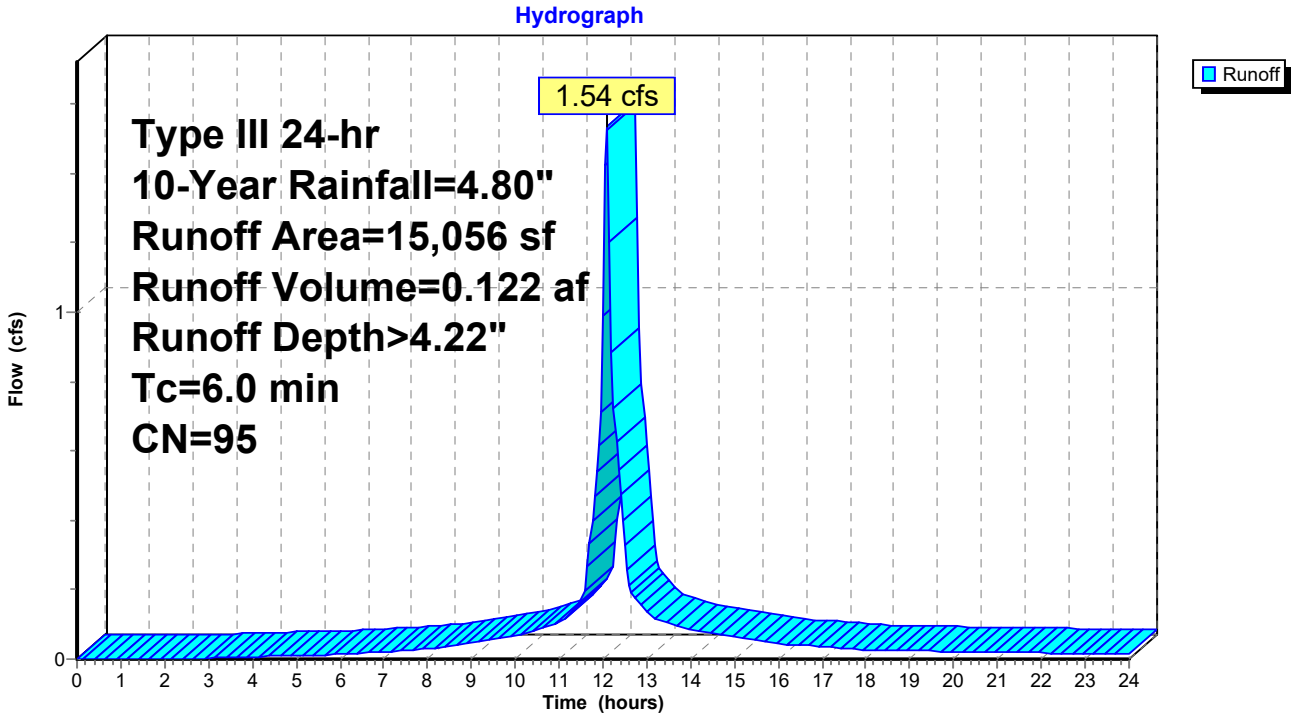
Runoff = 1.54 cfs @ 12.09 hrs, Volume= 0.122 af, Depth> 4.22"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.80"

Area (sf)	CN	Description
11,709	98	Paved parking, HSG C
1,791	96	Gravel surface, HSG C
303	79	50-75% Grass cover, Fair, HSG C
678	70	Woods, Good, HSG C
575	70	Woods, Good, HSG C
15,056	95	Weighted Average
3,347		22.23% Pervious Area
11,709		77.77% Impervious Area

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

Subcatchment E-5C: Existing Watershed 5C



Summary for Subcatchment E-6: Undetained to Wetland

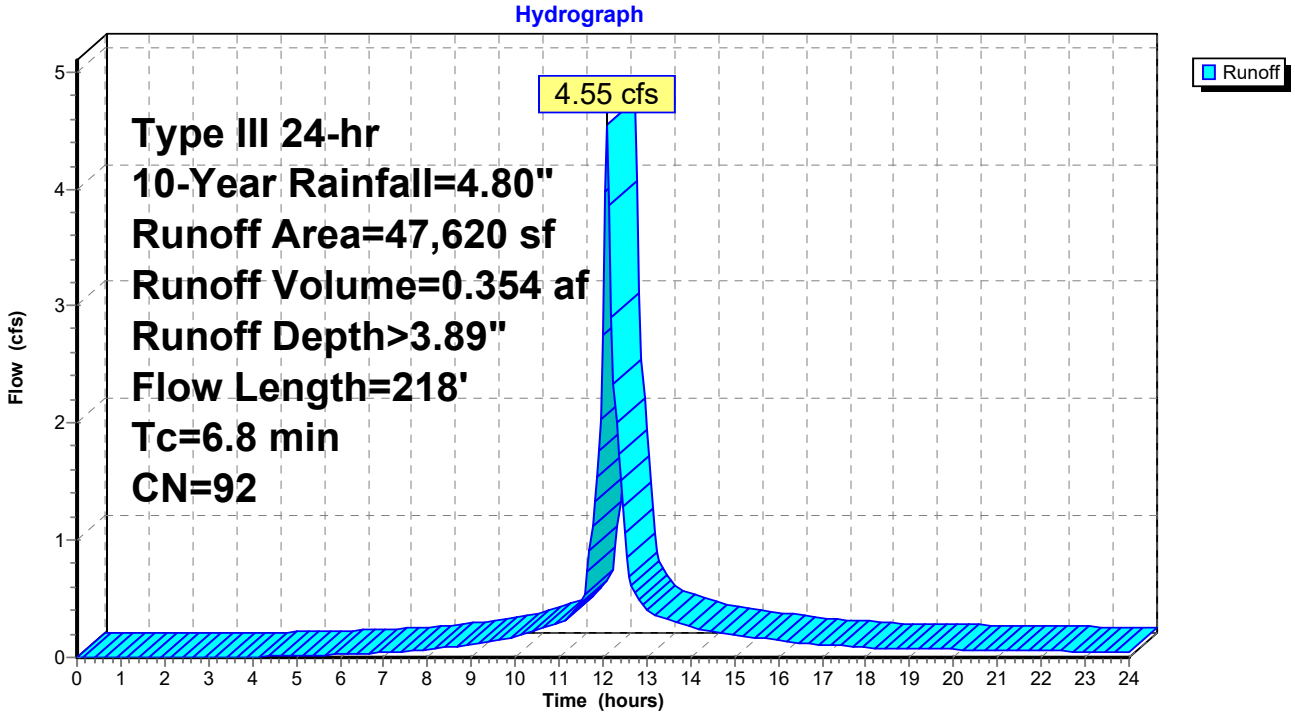
Runoff = 4.55 cfs @ 12.10 hrs, Volume= 0.354 af, Depth> 3.89"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.80"

Area (sf)	CN	Description
36,924	98	Paved parking, HSG C
9,270	74	>75% Grass cover, Good, HSG C
1,426	70	Woods, Good, HSG C
47,620	92	Weighted Average
10,696		22.46% Pervious Area
36,924		77.54% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.6	50	0.0340	0.18		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.20"
2.2	168	0.0060	1.25		**Shallow Concentrated Flow, SHallow Concentrated Flow** Unpaved Kv= 16.1 fps
6.8	218	Total			

Subcatchment E-6: Undetained to Wetland

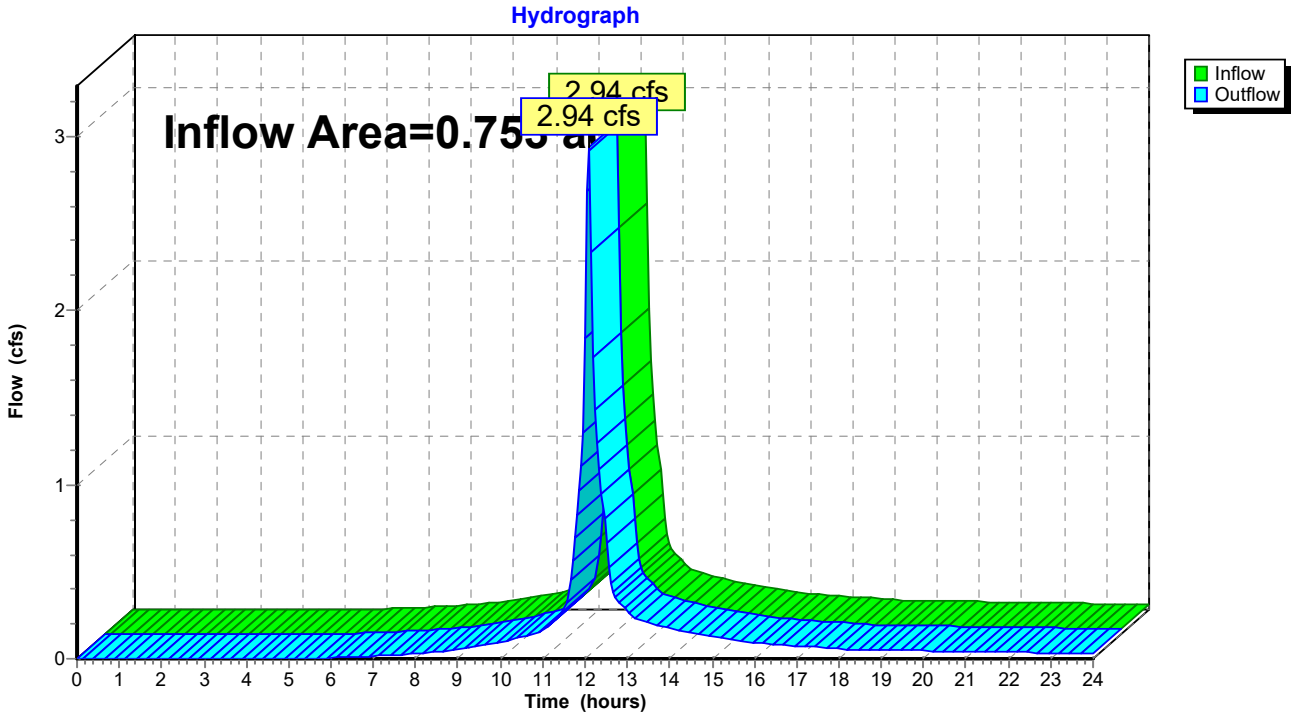


Summary for Reach DP-1: Design Point 1 (Wetland B)

Inflow Area = 0.753 ac, 35.44% Impervious, Inflow Depth > 3.48" for 10-Year event
Inflow = 2.94 cfs @ 12.09 hrs, Volume= 0.218 af
Outflow = 2.94 cfs @ 12.09 hrs, Volume= 0.218 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

Reach DP-1: Design Point 1 (Wetland B)

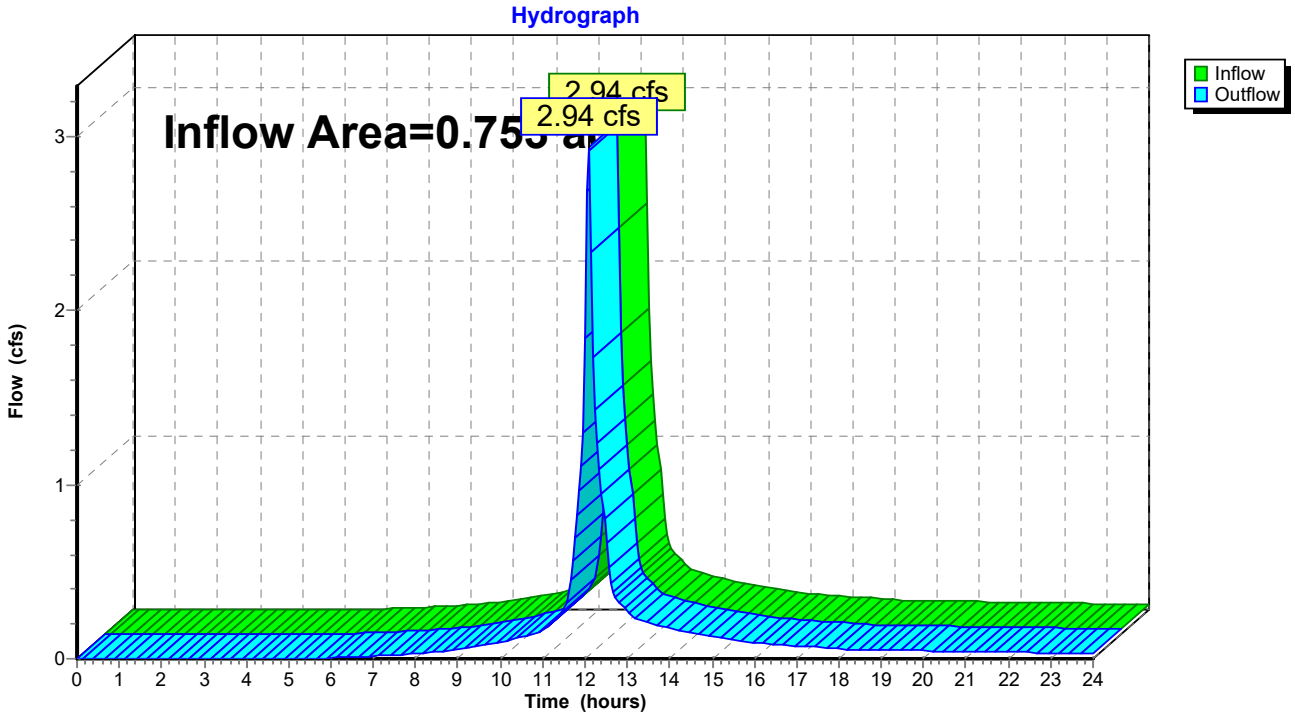


Summary for Reach DP-2: Design Point 2 (15" RCP to Wetland A)

Inflow Area = 0.753 ac, 35.44% Impervious, Inflow Depth > 3.48" for 10-Year event
Inflow = 2.94 cfs @ 12.09 hrs, Volume= 0.218 af
Outflow = 2.94 cfs @ 12.09 hrs, Volume= 0.218 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

Reach DP-2: Design Point 2 (15" RCP to Wetland A)

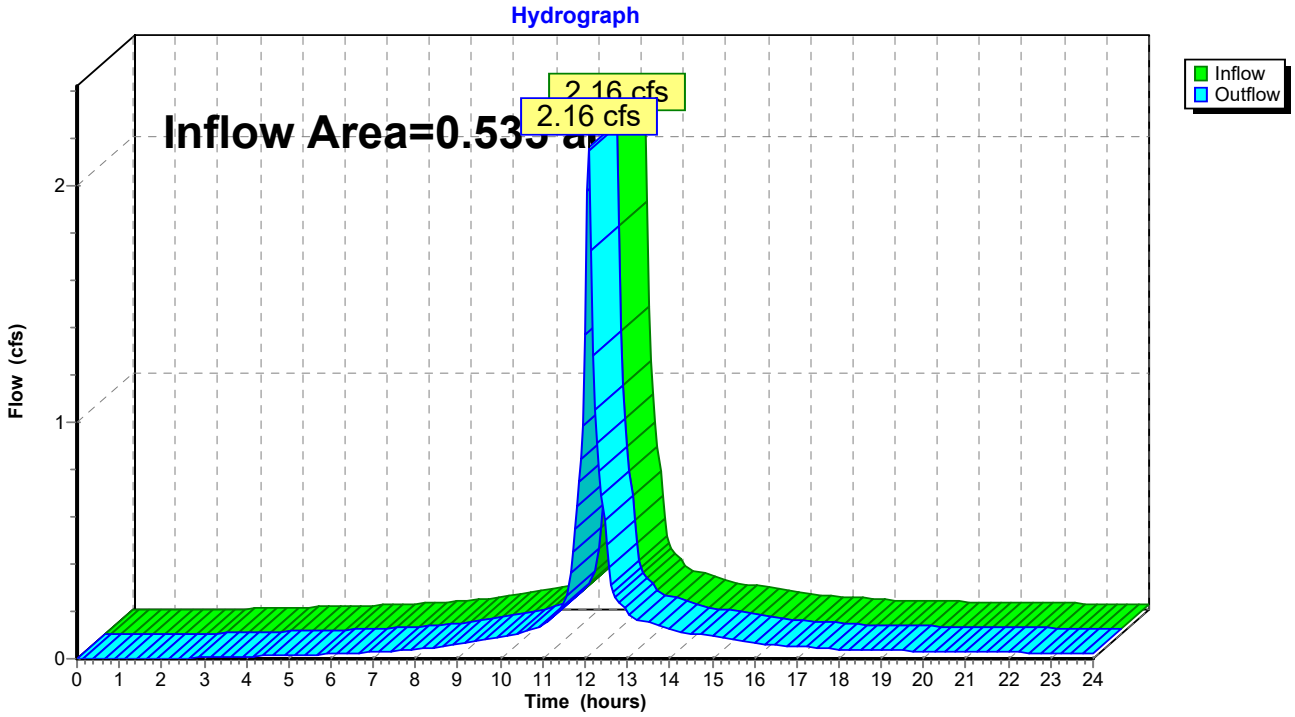


Summary for Reach DP-3: Design Point 3 (Existing Drainage Ditch)

Inflow Area = 0.535 ac, 66.58% Impervious, Inflow Depth > 3.86" for 10-Year event
Inflow = 2.16 cfs @ 12.09 hrs, Volume= 0.172 af
Outflow = 2.16 cfs @ 12.09 hrs, Volume= 0.172 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

Reach DP-3: Design Point 3 (Existing Drainage Ditch)

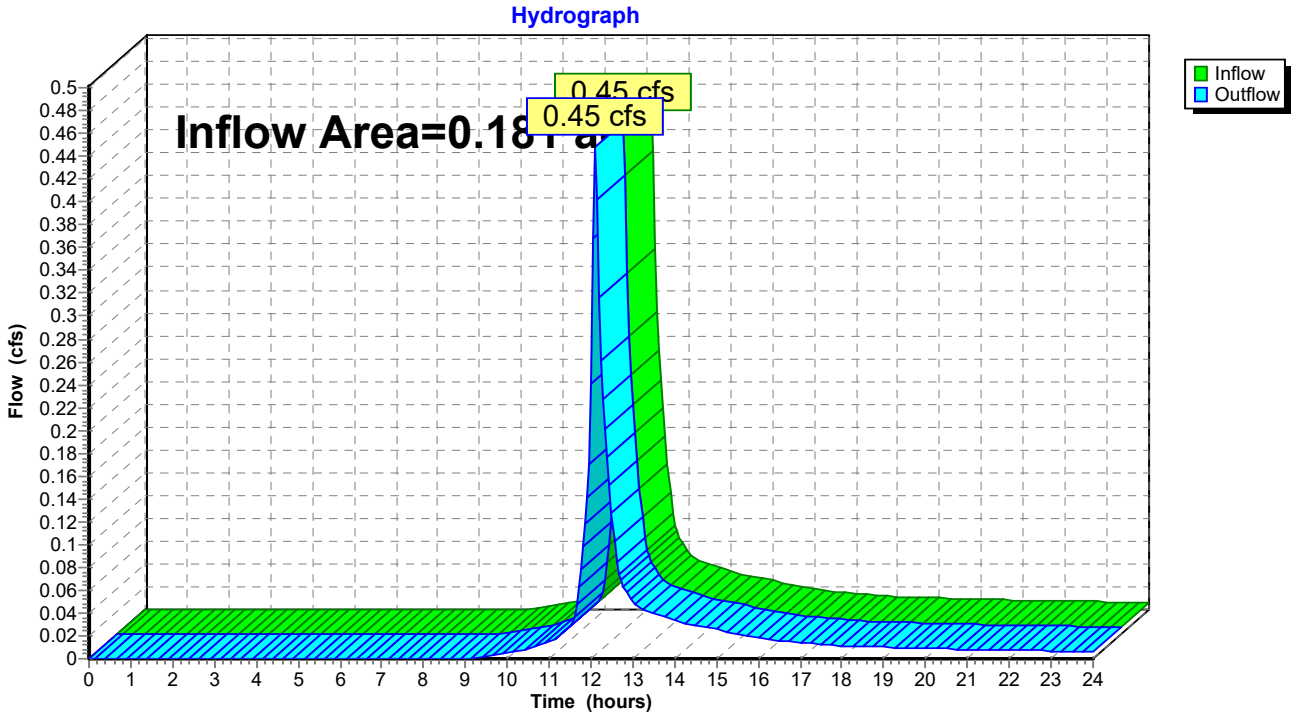


Summary for Reach DP-4: Design Point 4 (MassDOT CB- 2)

Inflow Area = 0.181 ac, 1.31% Impervious, Inflow Depth > 2.25" for 10-Year event
Inflow = 0.45 cfs @ 12.11 hrs, Volume= 0.034 af
Outflow = 0.45 cfs @ 12.11 hrs, Volume= 0.034 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

Reach DP-4: Design Point 4 (MassDOT CB- 2)

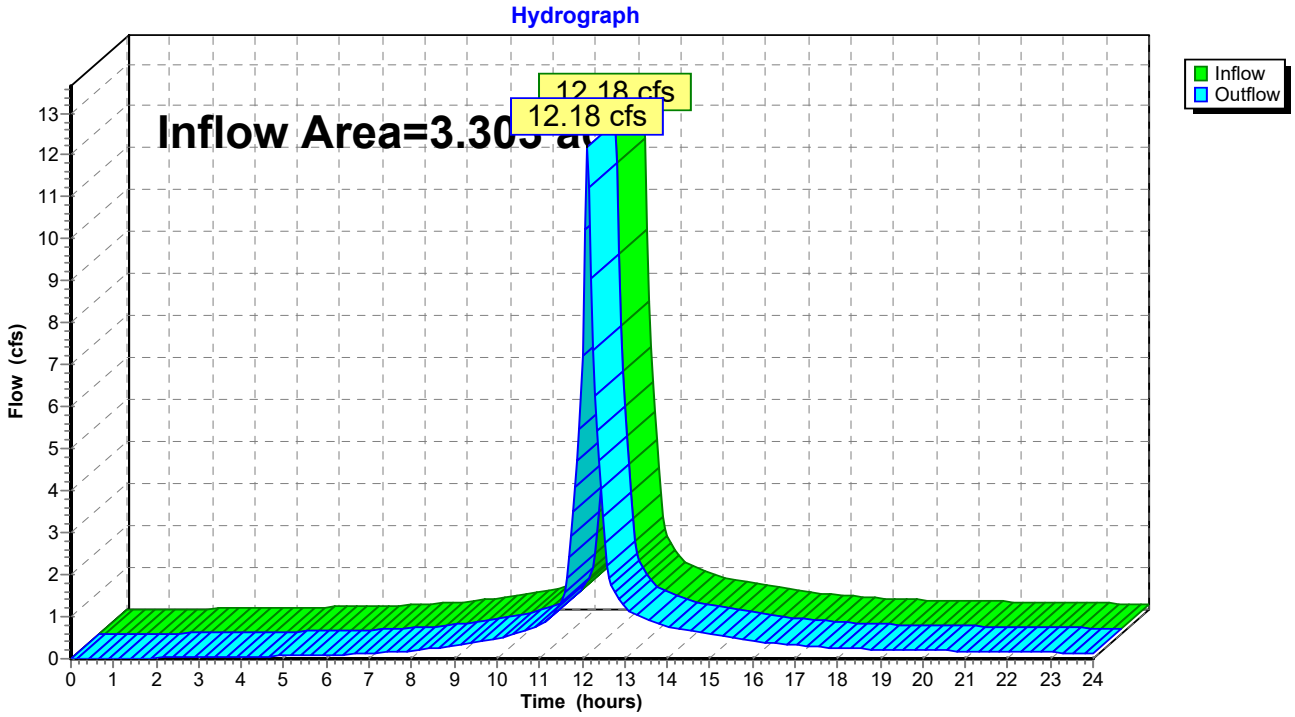


Summary for Reach DP-5: EXISTING CONSTRUCTED STORMWATER WETLAND

Inflow Area = 3.303 ac, 66.43% Impervious, Inflow Depth > 3.74" for 10-Year event
Inflow = 12.18 cfs @ 12.11 hrs, Volume= 1.030 af
Outflow = 12.18 cfs @ 12.11 hrs, Volume= 1.030 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

Reach DP-5: EXISTING CONSTRUCTED STORMWATER WETLAND

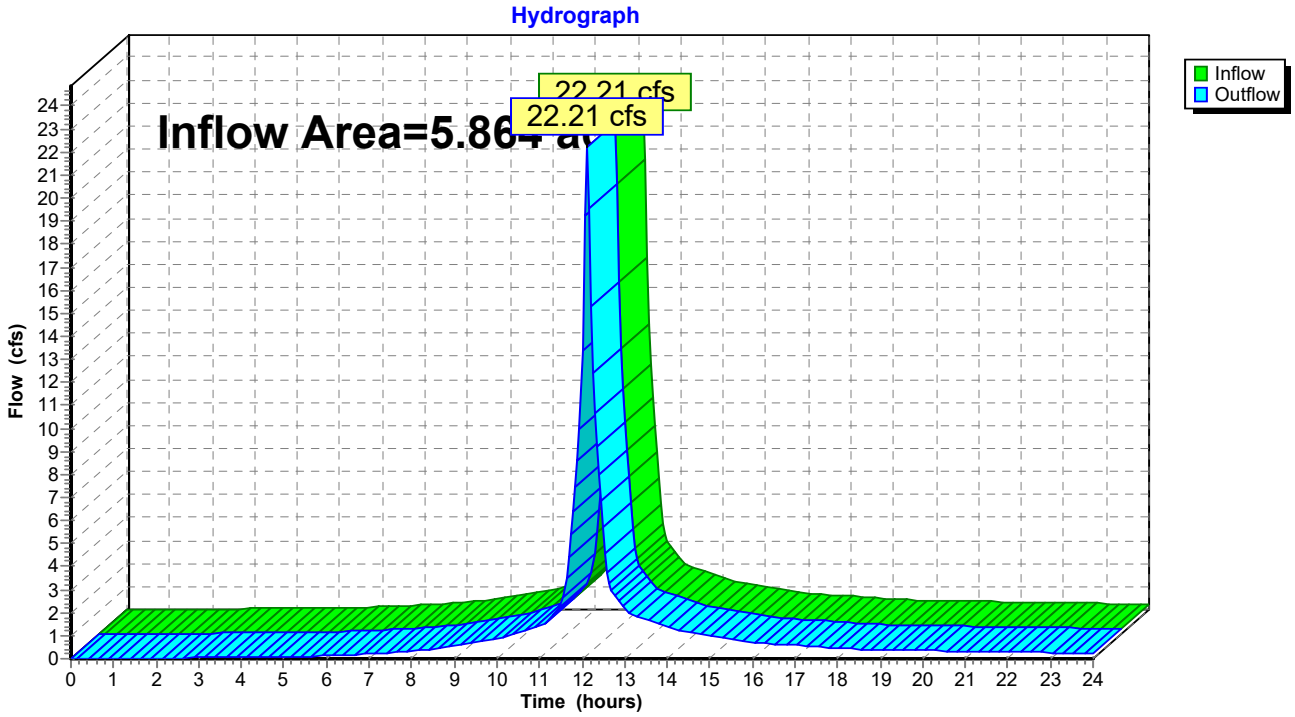


Summary for Reach DP-6: Wetland A - Design Point 6

Inflow Area = 5.864 ac, 62.53% Impervious, Inflow Depth > 3.70" for 10-Year event
Inflow = 22.21 cfs @ 12.10 hrs, Volume= 1.809 af
Outflow = 22.21 cfs @ 12.10 hrs, Volume= 1.809 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

Reach DP-6: Wetland A - Design Point 6



Summary for Subcatchment E-1: Existing Watershed 1

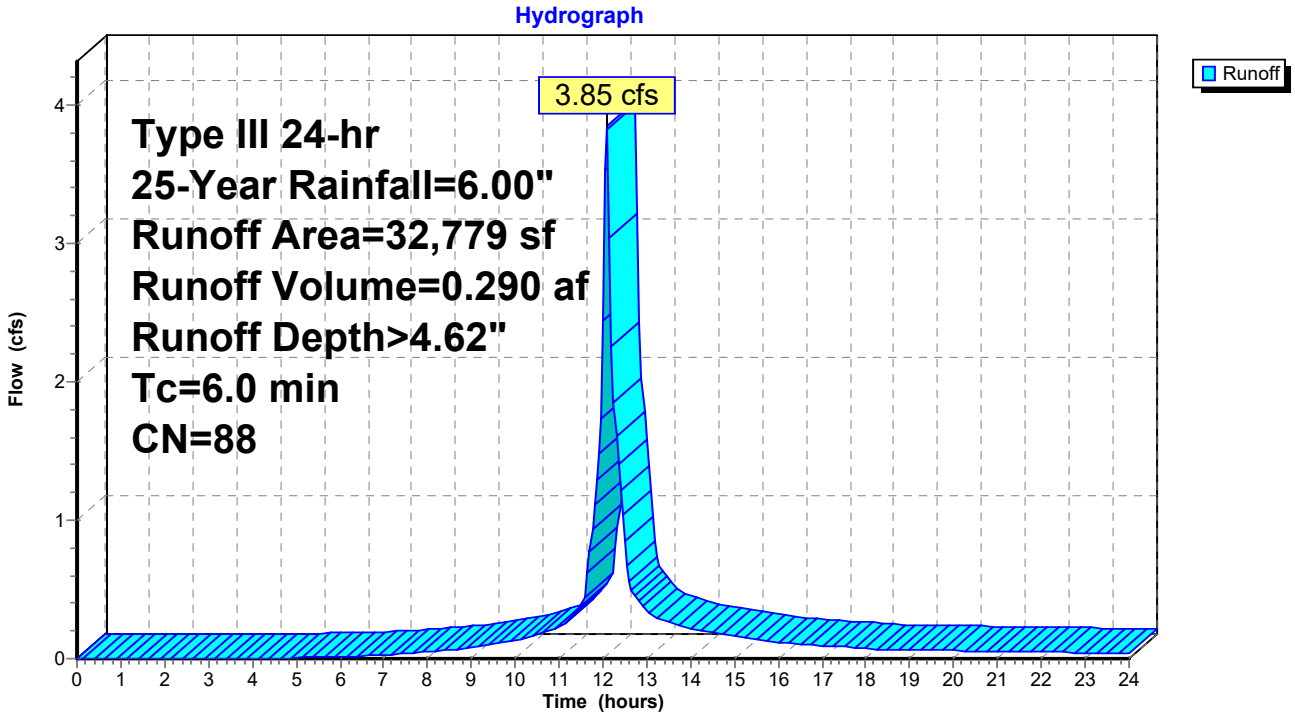
Runoff = 3.85 cfs @ 12.09 hrs, Volume= 0.290 af, Depth> 4.62"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=6.00"

Area (sf)	CN	Description
11,618	98	Paved parking, HSG C
9,421	96	Gravel surface, HSG C
5,782	74	>75% Grass cover, Good, HSG C
3,103	70	Woods, Good, HSG C
561	70	Woods, Good, HSG C
2,294	74	>75% Grass cover, Good, HSG C
32,779	88	Weighted Average
21,161		64.56% Pervious Area
11,618		35.44% Impervious Area

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

Subcatchment E-1: Existing Watershed 1



Summary for Subcatchment E-2: Existing Watershed 2

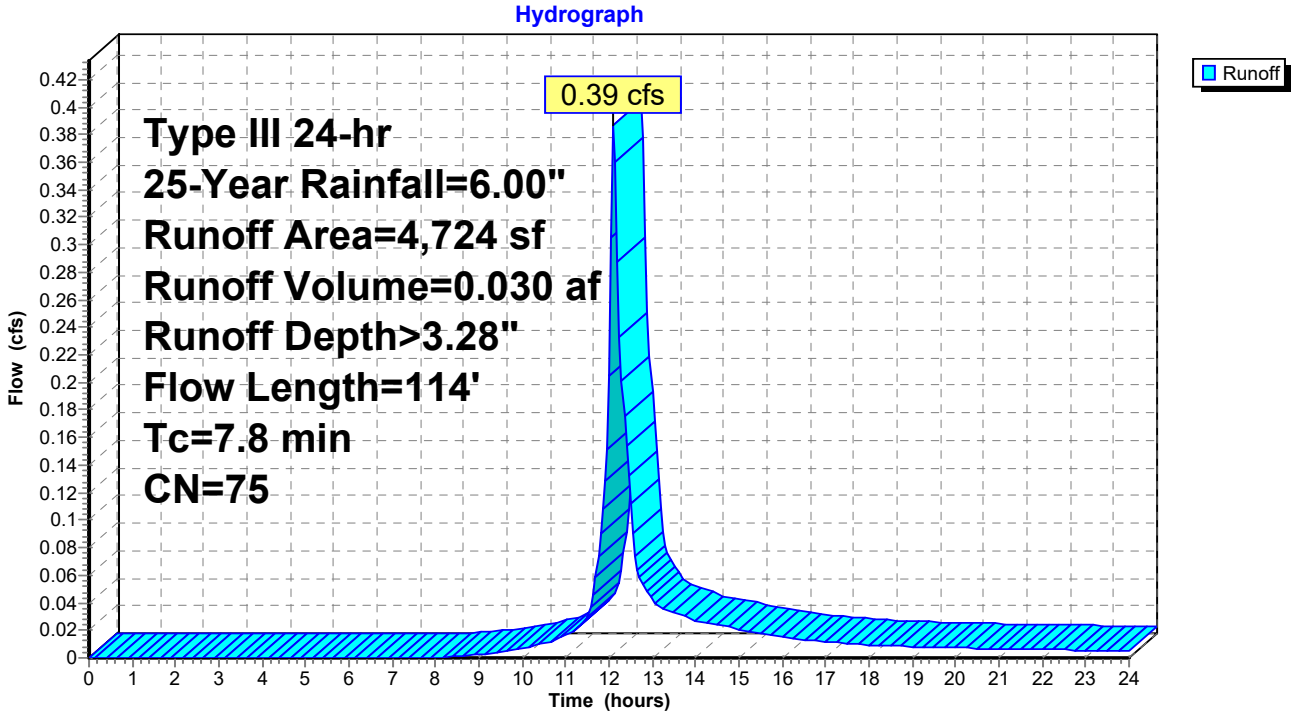
Runoff = 0.39 cfs @ 12.11 hrs, Volume= 0.030 af, Depth> 3.28"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=6.00"

Area (sf)	CN	Description
4,621	74	>75% Grass cover, Good, HSG C
103	98	Paved parking, HSG C
4,724	75	Weighted Average
4,621		97.82% Pervious Area
103		2.18% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.4	50	0.0100	0.11		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.20"
0.4	64	0.0312	2.84		**Shallow Concentrated Flow, Shallow Concentrated Flow** Unpaved Kv= 16.1 fps
7.8	114	Total			

Subcatchment E-2: Existing Watershed 2



Summary for Subcatchment E-3: Existing Watershed 3

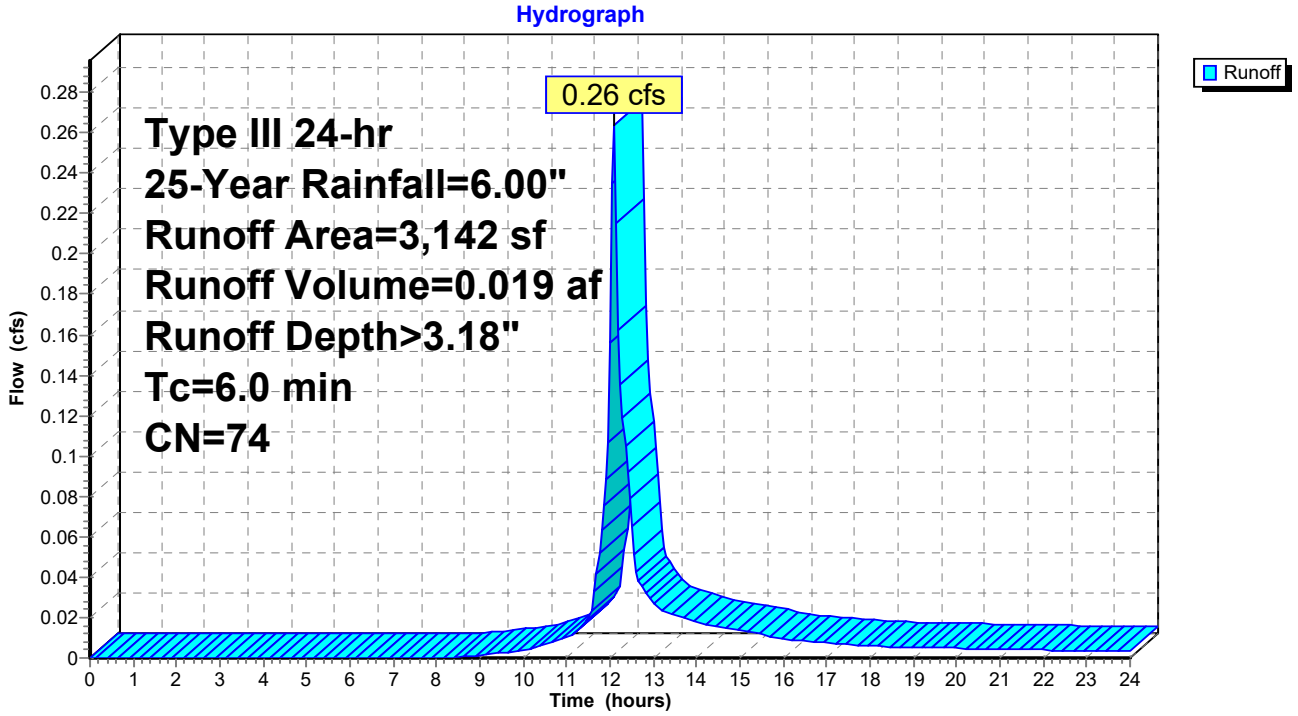
Runoff = 0.26 cfs @ 12.09 hrs, Volume= 0.019 af, Depth> 3.18"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=6.00"

Area (sf)	CN	Description
3,142	74	>75% Grass cover, Good, HSG C
3,142		100.00% Pervious Area

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

Subcatchment E-3: Existing Watershed 3



Summary for Subcatchment E-4A: Existing Watershed 4A

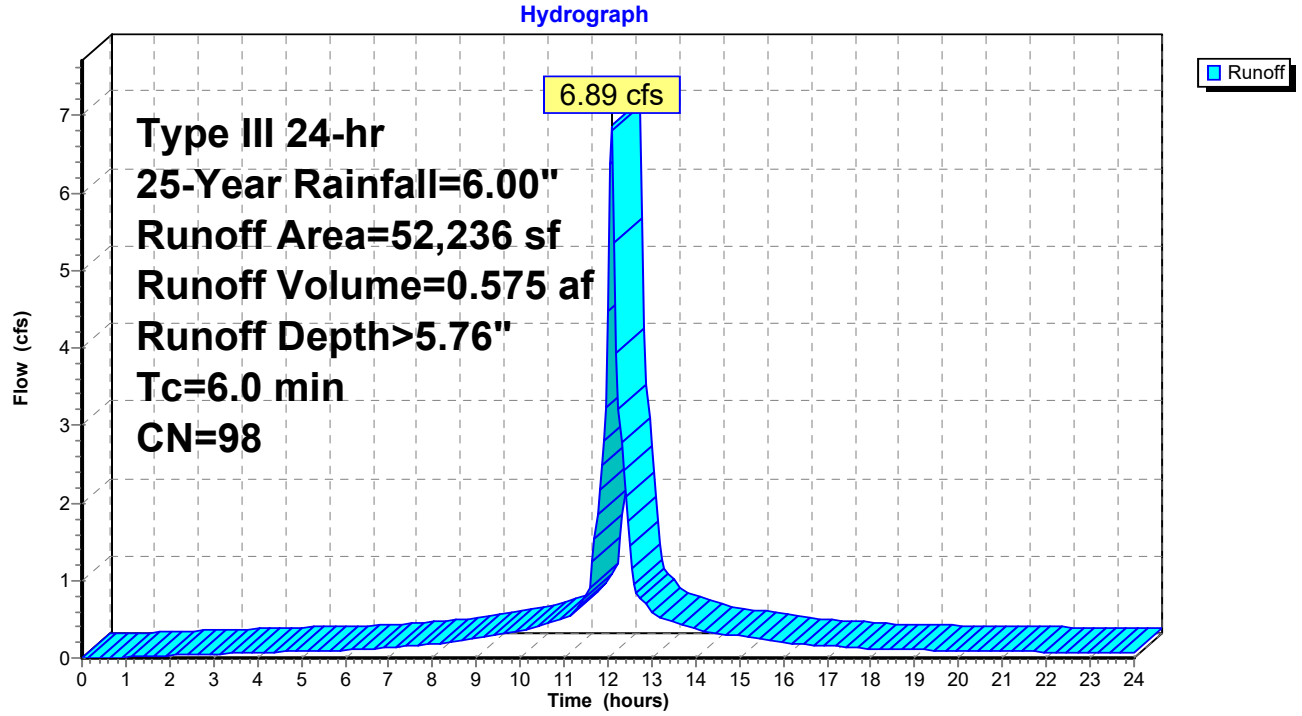
Runoff = 6.89 cfs @ 12.09 hrs, Volume= 0.575 af, Depth> 5.76"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=6.00"

Area (sf)	CN	Description
52,236	98	Roofs, HSG C
52,236		100.00% Impervious Area

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

Subcatchment E-4A: Existing Watershed 4A



Summary for Subcatchment E-4B: Existing Watershed 4B

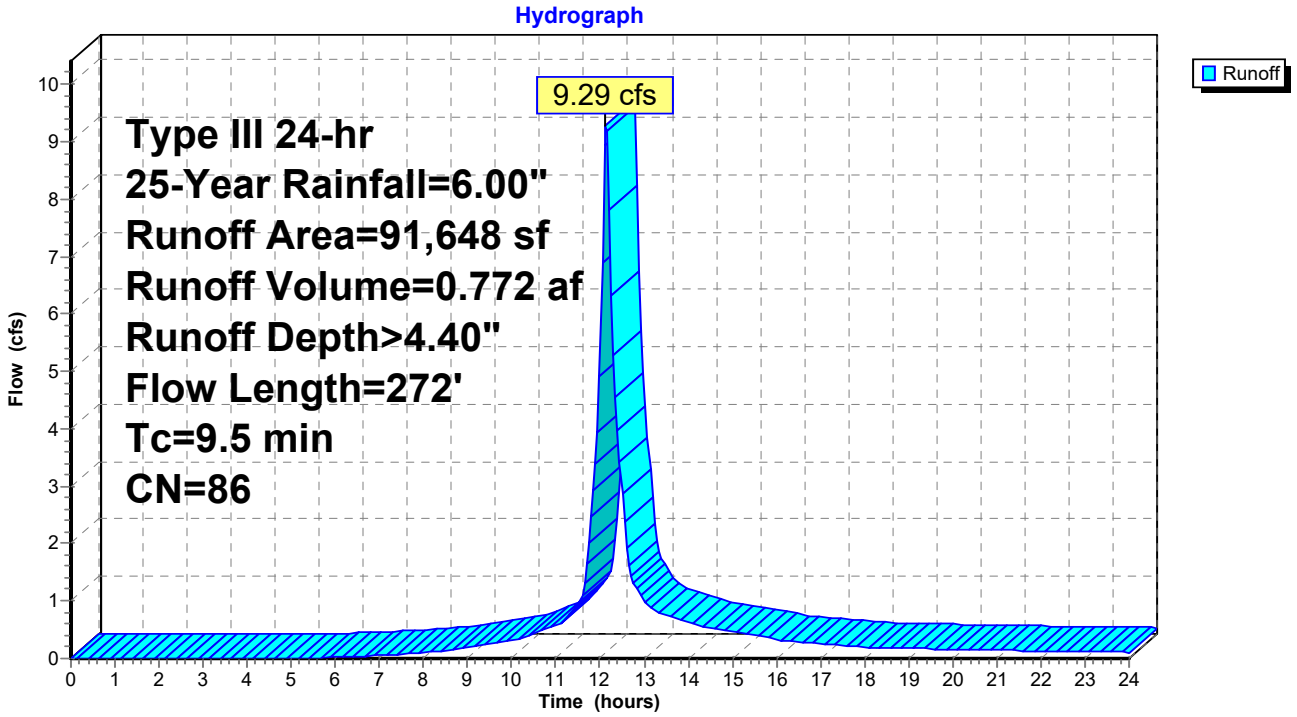
Runoff = 9.29 cfs @ 12.13 hrs, Volume= 0.772 af, Depth> 4.40"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=6.00"

	Area (sf)	CN	Description
	43,351	98	Paved parking, HSG C
	1,304	96	Gravel surface, HSG C
	42,526	74	>75% Grass cover, Good, HSG C
	2,704	70	Woods, Good, HSG C
*	1,763	74	Mulch
	91,648	86	Weighted Average
	48,297		52.70% Pervious Area
	43,351		47.30% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.1	50	0.0080	0.10		**Sheet Flow, Sheet Flow** Grass: Short n= 0.150 P2= 3.20"
0.8	111	0.0216	2.37		**Shallow Concentrated Flow, Shallow Concentrated Flow** Unpaved Kv= 16.1 fps
0.1	40	0.1500	6.24		**Shallow Concentrated Flow, SHallow** Unpaved Kv= 16.1 fps
0.5	71	0.0150	2.49		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
9.5	272	Total			

Subcatchment E-4B: Existing Watershed 4B



Summary for Subcatchment E-5A: Existing Watershed 5A

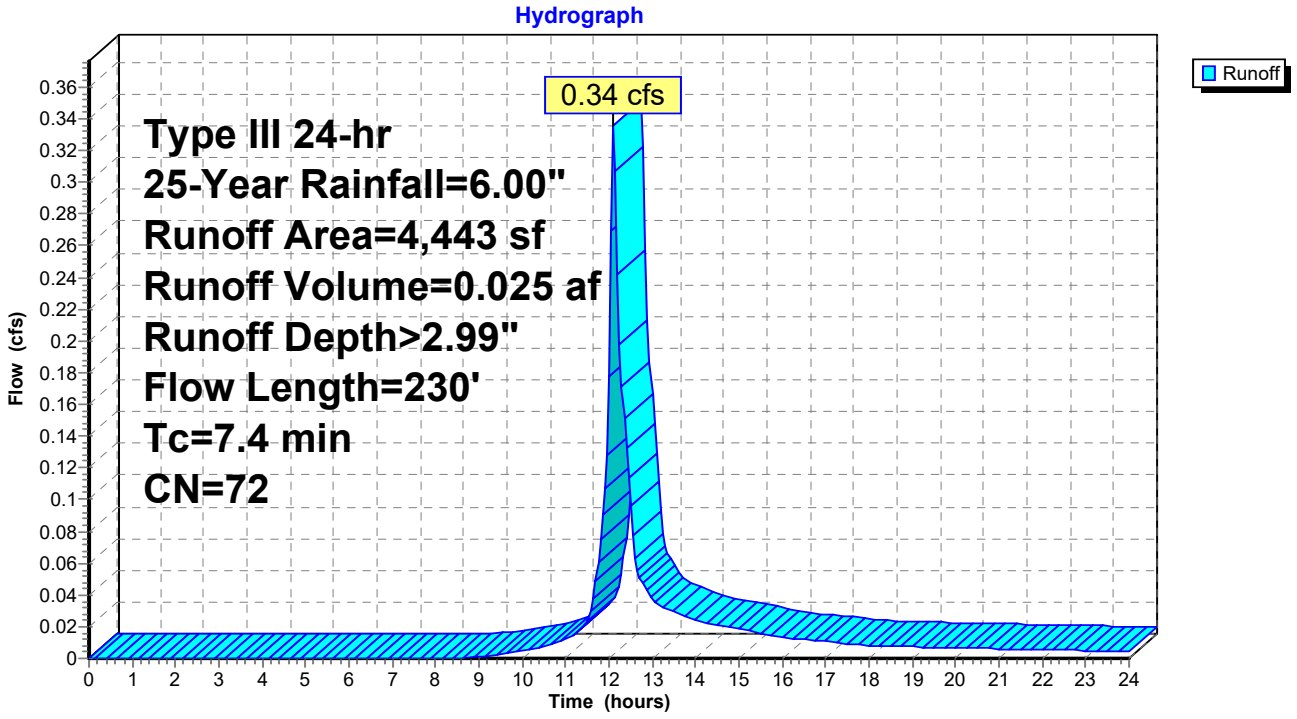
Runoff = 0.34 cfs @ 12.11 hrs, Volume= 0.025 af, Depth> 2.99"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=6.00"

Area (sf)	CN	Description
1,742	74	>75% Grass cover, Good, HSG C
2,701	70	Woods, Good, HSG C
4,443	72	Weighted Average
4,443		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.2	50	0.0160	0.14		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.20"
1.2	180	0.0244	2.51		**Shallow Concentrated Flow, Shallow COncentrated Flow** Unpaved Kv= 16.1 fps
7.4	230	Total			

Subcatchment E-5A: Existing Watershed 5A



Summary for Subcatchment E-5B: Existing Watershed 5B

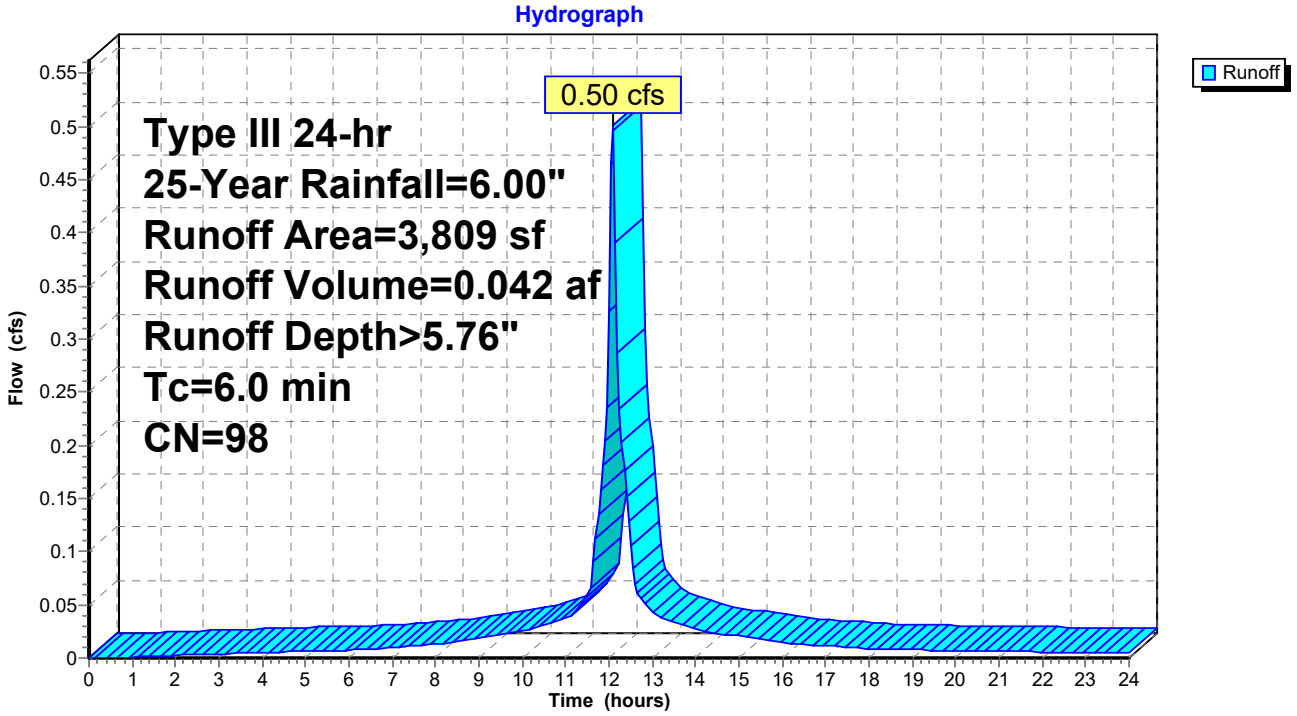
Runoff = 0.50 cfs @ 12.09 hrs, Volume= 0.042 af, Depth> 5.76"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=6.00"

Area (sf)	CN	Description
3,809	98	Paved parking, HSG C
3,809		100.00% Impervious Area

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

Subcatchment E-5B: Existing Watershed 5B



Summary for Subcatchment E-5C: Existing Watershed 5C

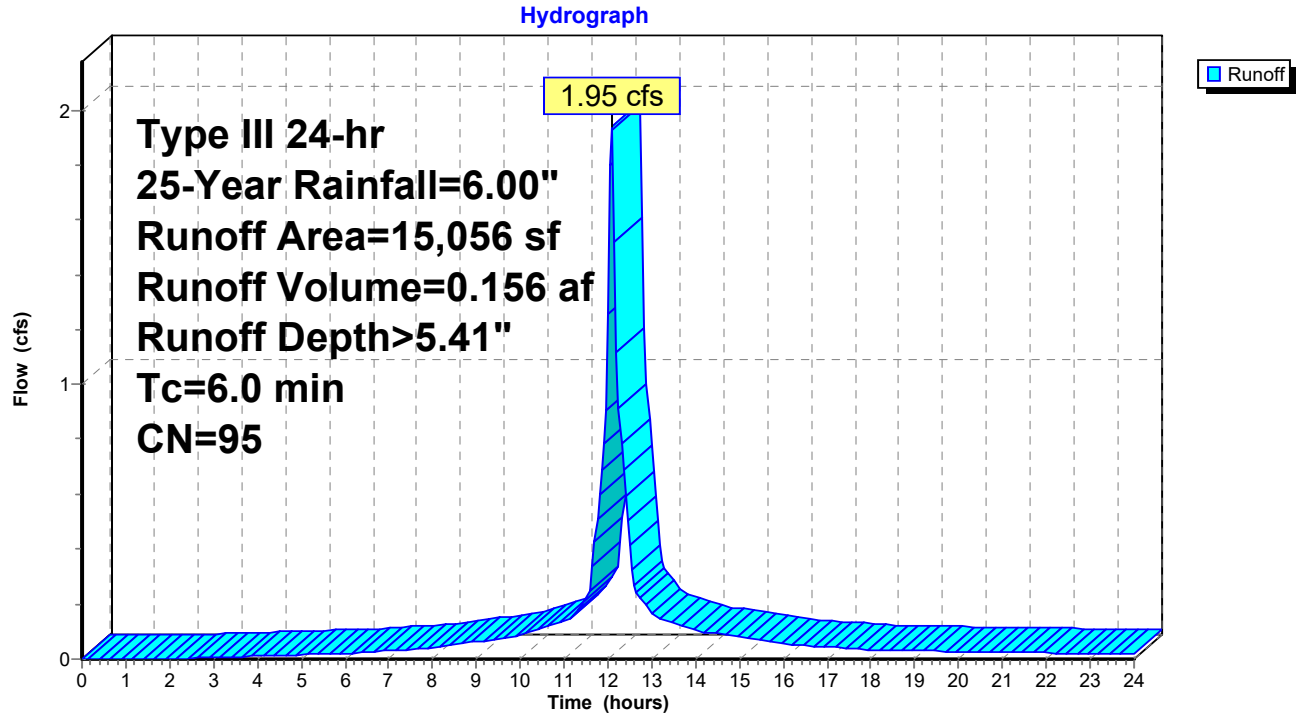
Runoff = 1.95 cfs @ 12.09 hrs, Volume= 0.156 af, Depth> 5.41"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=6.00"

Area (sf)	CN	Description
11,709	98	Paved parking, HSG C
1,791	96	Gravel surface, HSG C
303	79	50-75% Grass cover, Fair, HSG C
678	70	Woods, Good, HSG C
575	70	Woods, Good, HSG C
15,056	95	Weighted Average
3,347		22.23% Pervious Area
11,709		77.77% Impervious Area

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

Subcatchment E-5C: Existing Watershed 5C



Summary for Subcatchment E-6: Undetained to Wetland

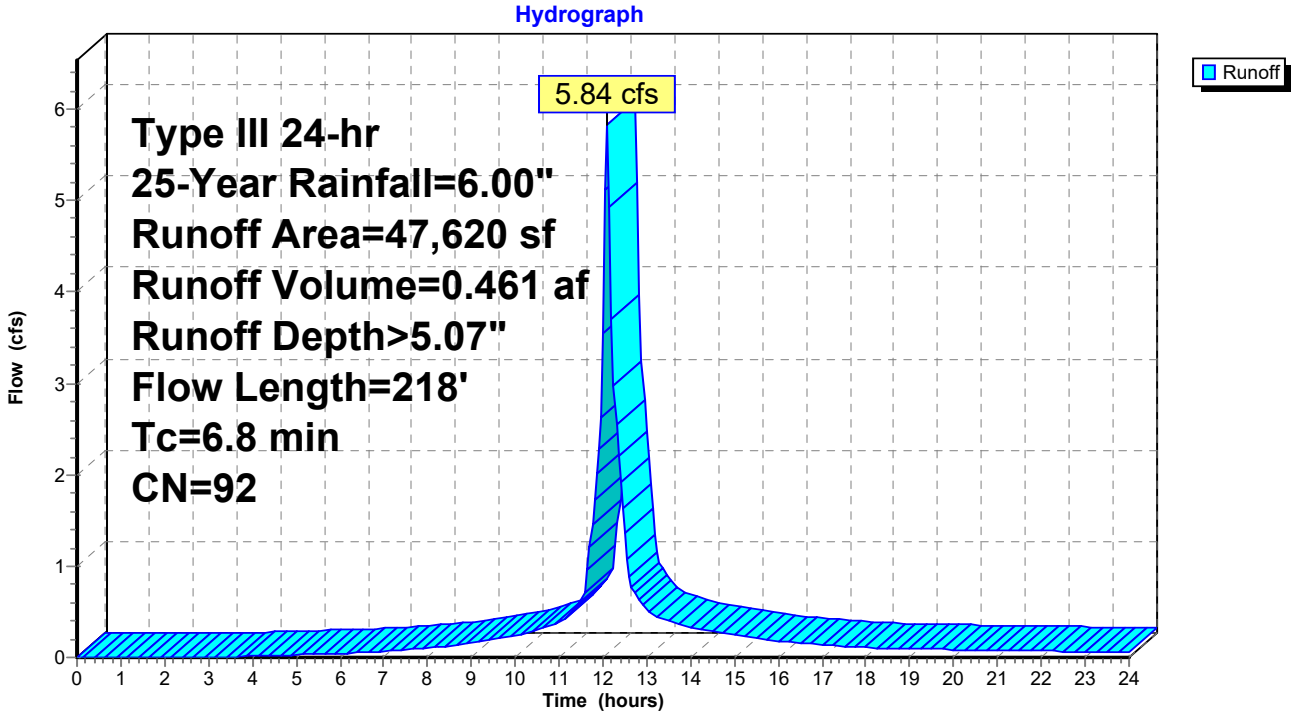
Runoff = 5.84 cfs @ 12.10 hrs, Volume= 0.461 af, Depth> 5.07"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=6.00"

Area (sf)	CN	Description
36,924	98	Paved parking, HSG C
9,270	74	>75% Grass cover, Good, HSG C
1,426	70	Woods, Good, HSG C
47,620	92	Weighted Average
10,696		22.46% Pervious Area
36,924		77.54% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.6	50	0.0340	0.18		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.20"
2.2	168	0.0060	1.25		**Shallow Concentrated Flow, SHallow Concentrated Flow** Unpaved Kv= 16.1 fps
6.8	218	Total			

Subcatchment E-6: Undetained to Wetland

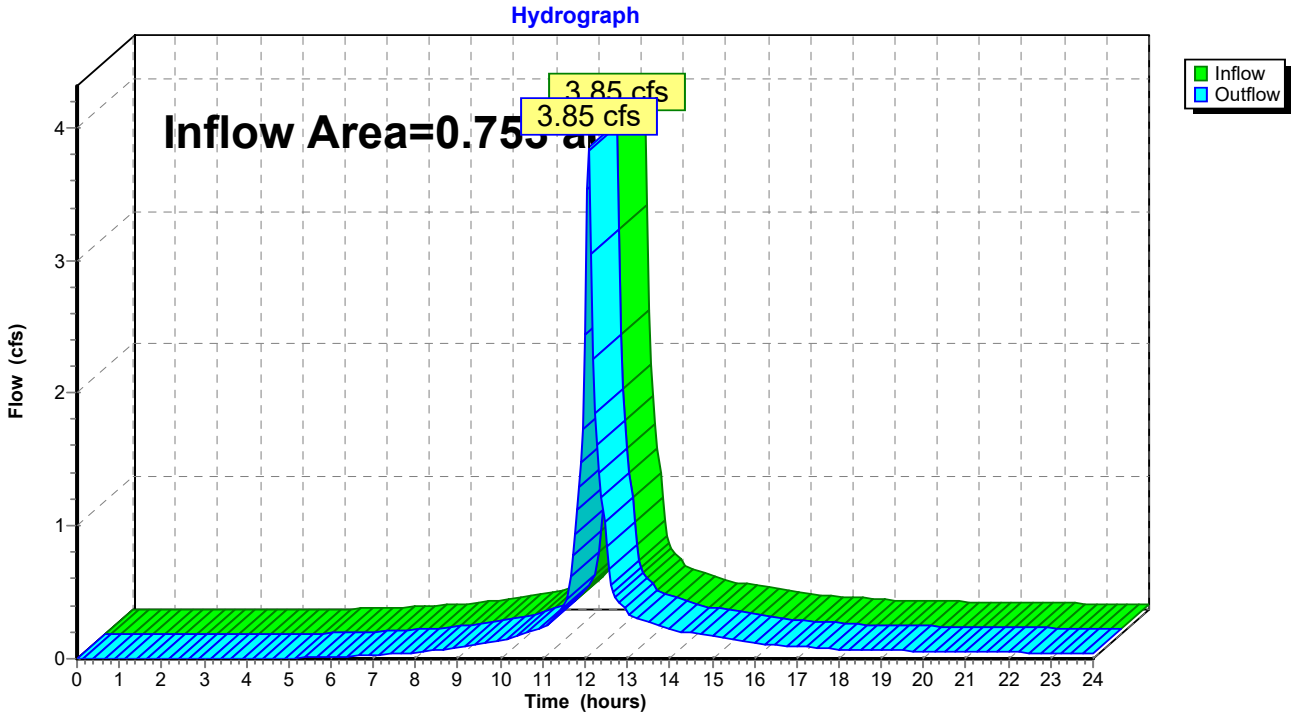


Summary for Reach DP-1: Design Point 1 (Wetland B)

Inflow Area = 0.753 ac, 35.44% Impervious, Inflow Depth > 4.62" for 25-Year event
Inflow = 3.85 cfs @ 12.09 hrs, Volume= 0.290 af
Outflow = 3.85 cfs @ 12.09 hrs, Volume= 0.290 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

Reach DP-1: Design Point 1 (Wetland B)

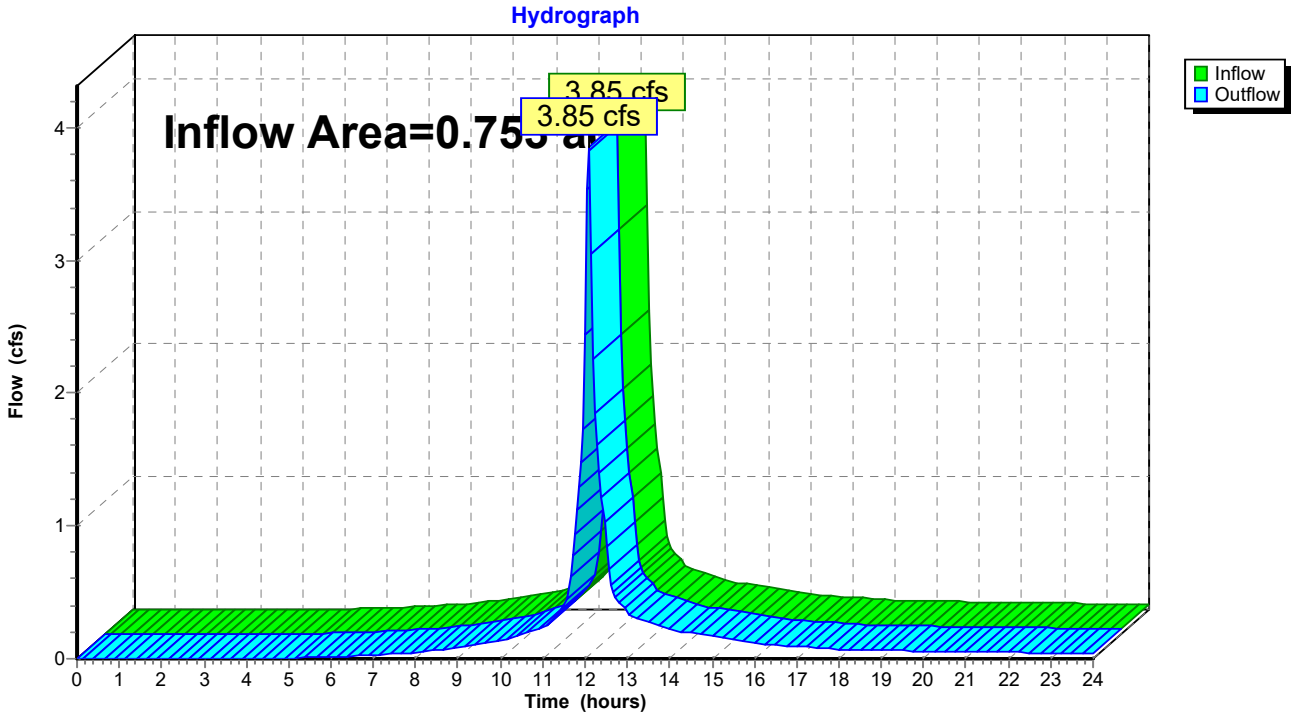


Summary for Reach DP-2: Design Point 2 (15" RCP to Wetland A)

Inflow Area = 0.753 ac, 35.44% Impervious, Inflow Depth > 4.62" for 25-Year event
Inflow = 3.85 cfs @ 12.09 hrs, Volume= 0.290 af
Outflow = 3.85 cfs @ 12.09 hrs, Volume= 0.290 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

Reach DP-2: Design Point 2 (15" RCP to Wetland A)

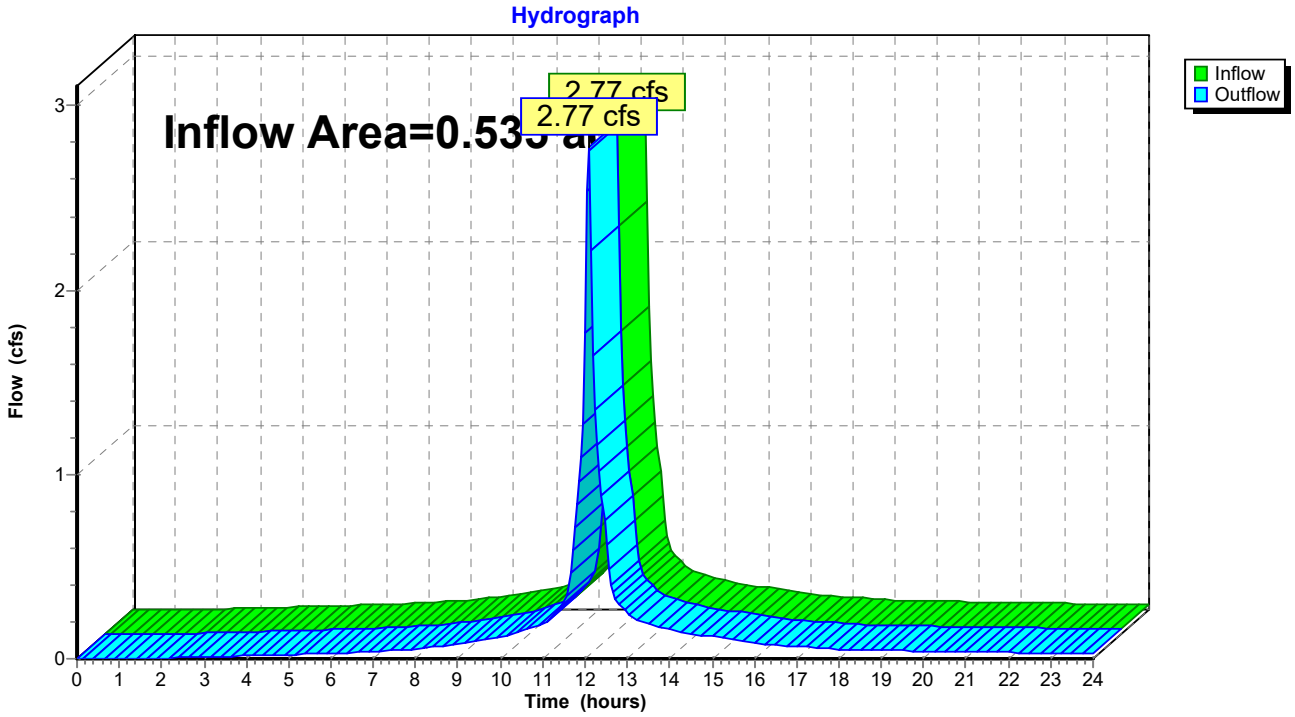


Summary for Reach DP-3: Design Point 3 (Existing Drainage Ditch)

Inflow Area = 0.535 ac, 66.58% Impervious, Inflow Depth > 5.00" for 25-Year event
Inflow = 2.77 cfs @ 12.09 hrs, Volume= 0.223 af
Outflow = 2.77 cfs @ 12.09 hrs, Volume= 0.223 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

Reach DP-3: Design Point 3 (Existing Drainage Ditch)

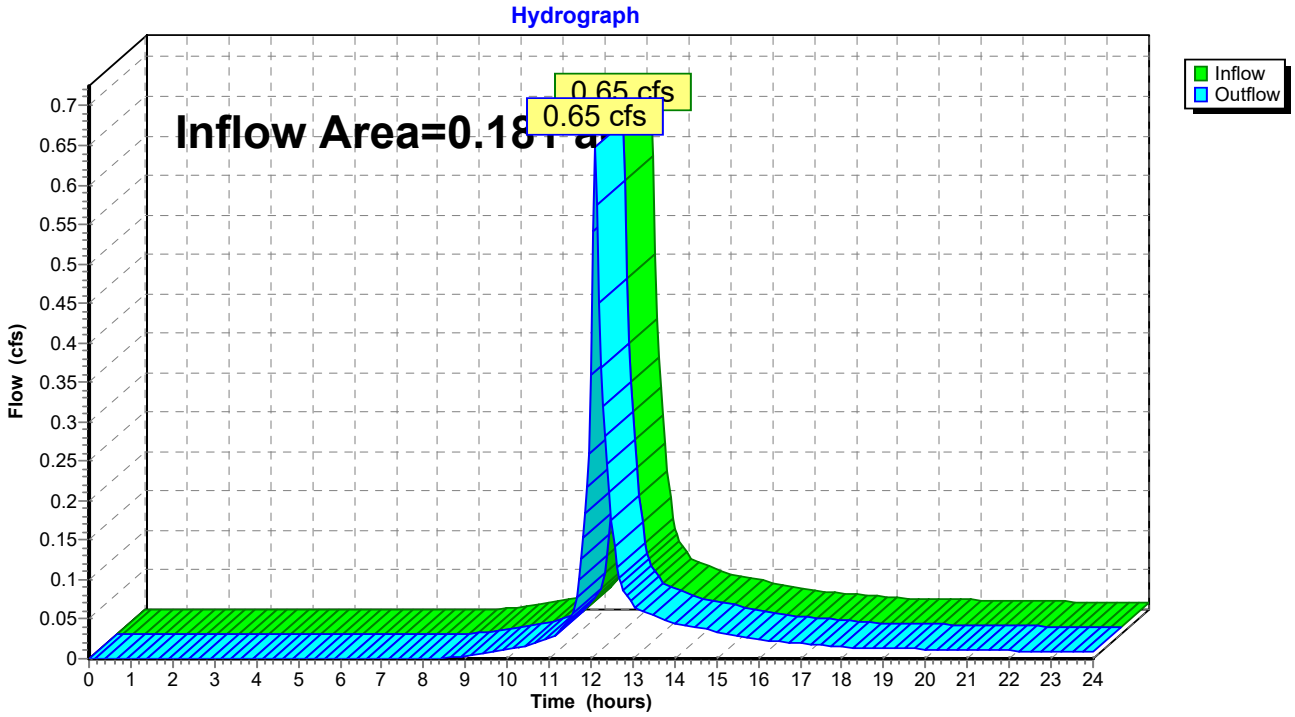


Summary for Reach DP-4: Design Point 4 (MassDOT CB- 2)

Inflow Area = 0.181 ac, 1.31% Impervious, Inflow Depth > 3.24" for 25-Year event
Inflow = 0.65 cfs @ 12.10 hrs, Volume= 0.049 af
Outflow = 0.65 cfs @ 12.10 hrs, Volume= 0.049 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

Reach DP-4: Design Point 4 (MassDOT CB- 2)

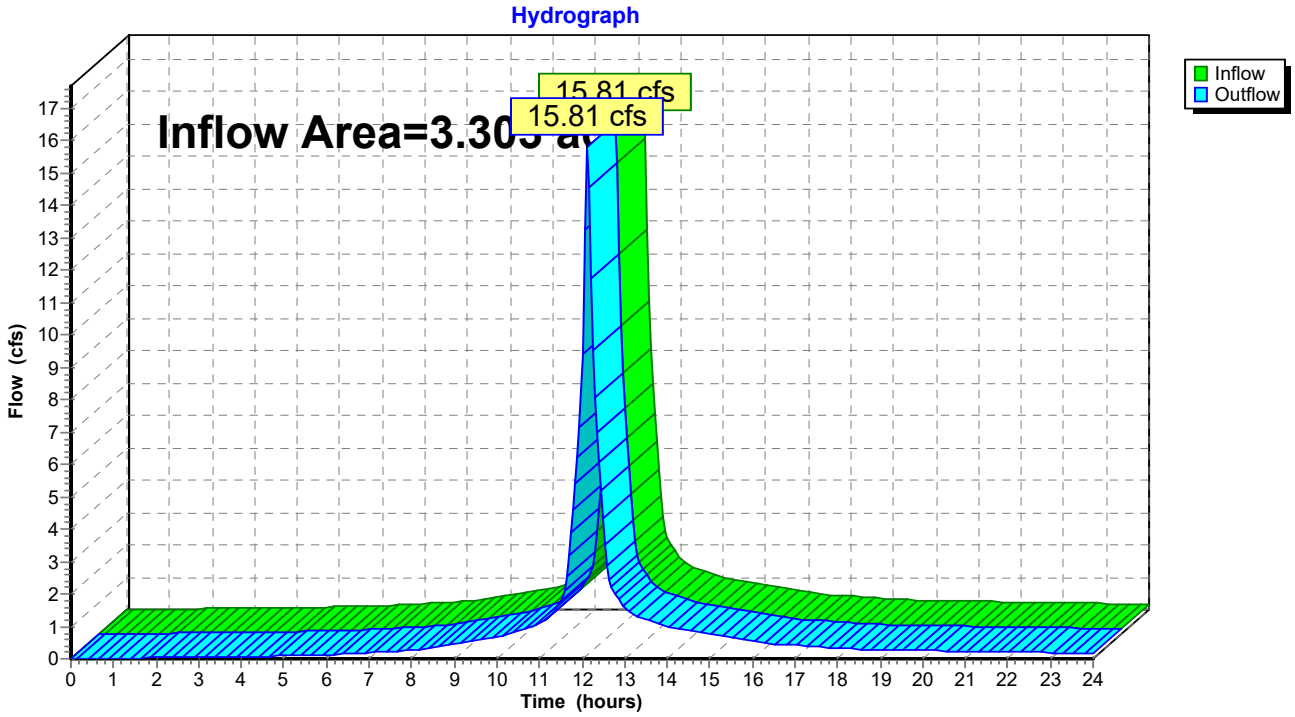


Summary for Reach DP-5: EXISTING CONSTRUCTED STORMWATER WETLAND

Inflow Area = 3.303 ac, 66.43% Impervious, Inflow Depth > 4.90" for 25-Year event
Inflow = 15.81 cfs @ 12.11 hrs, Volume= 1.347 af
Outflow = 15.81 cfs @ 12.11 hrs, Volume= 1.347 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

Reach DP-5: EXISTING CONSTRUCTED STORMWATER WETLAND

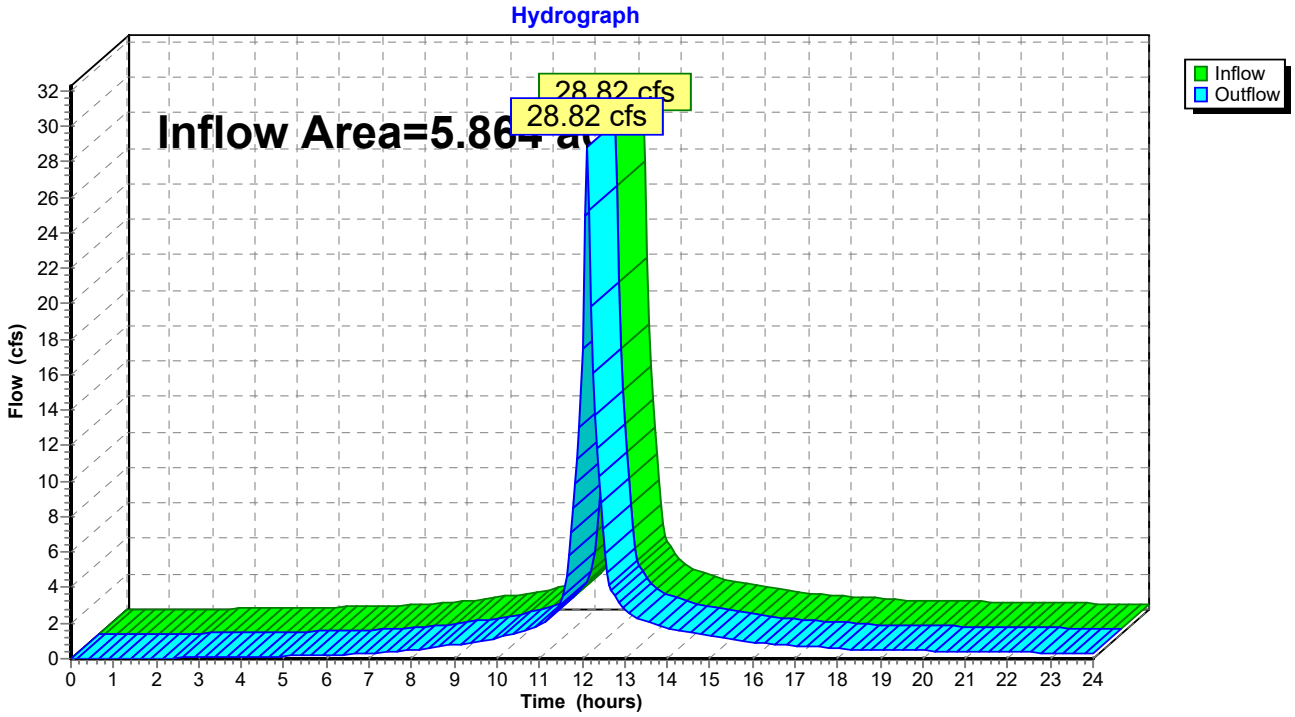


Summary for Reach DP-6: Wetland A - Design Point 6

Inflow Area = 5.864 ac, 62.53% Impervious, Inflow Depth > 4.85" for 25-Year event
Inflow = 28.82 cfs @ 12.10 hrs, Volume= 2.371 af
Outflow = 28.82 cfs @ 12.10 hrs, Volume= 2.371 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

Reach DP-6: Wetland A - Design Point 6



Summary for Subcatchment E-1: Existing Watershed 1

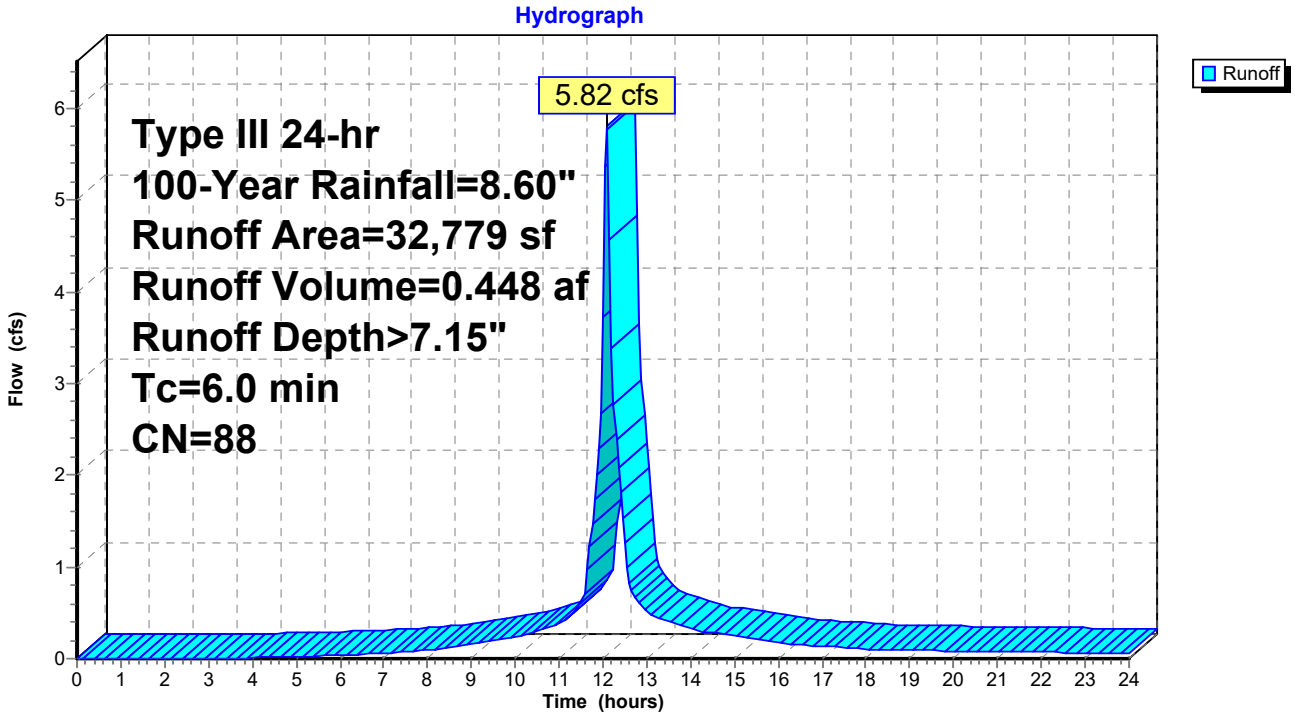
Runoff = 5.82 cfs @ 12.09 hrs, Volume= 0.448 af, Depth> 7.15"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=8.60"

Area (sf)	CN	Description
11,618	98	Paved parking, HSG C
9,421	96	Gravel surface, HSG C
5,782	74	>75% Grass cover, Good, HSG C
3,103	70	Woods, Good, HSG C
561	70	Woods, Good, HSG C
2,294	74	>75% Grass cover, Good, HSG C
32,779	88	Weighted Average
21,161		64.56% Pervious Area
11,618		35.44% Impervious Area

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

Subcatchment E-1: Existing Watershed 1



Summary for Subcatchment E-2: Existing Watershed 2

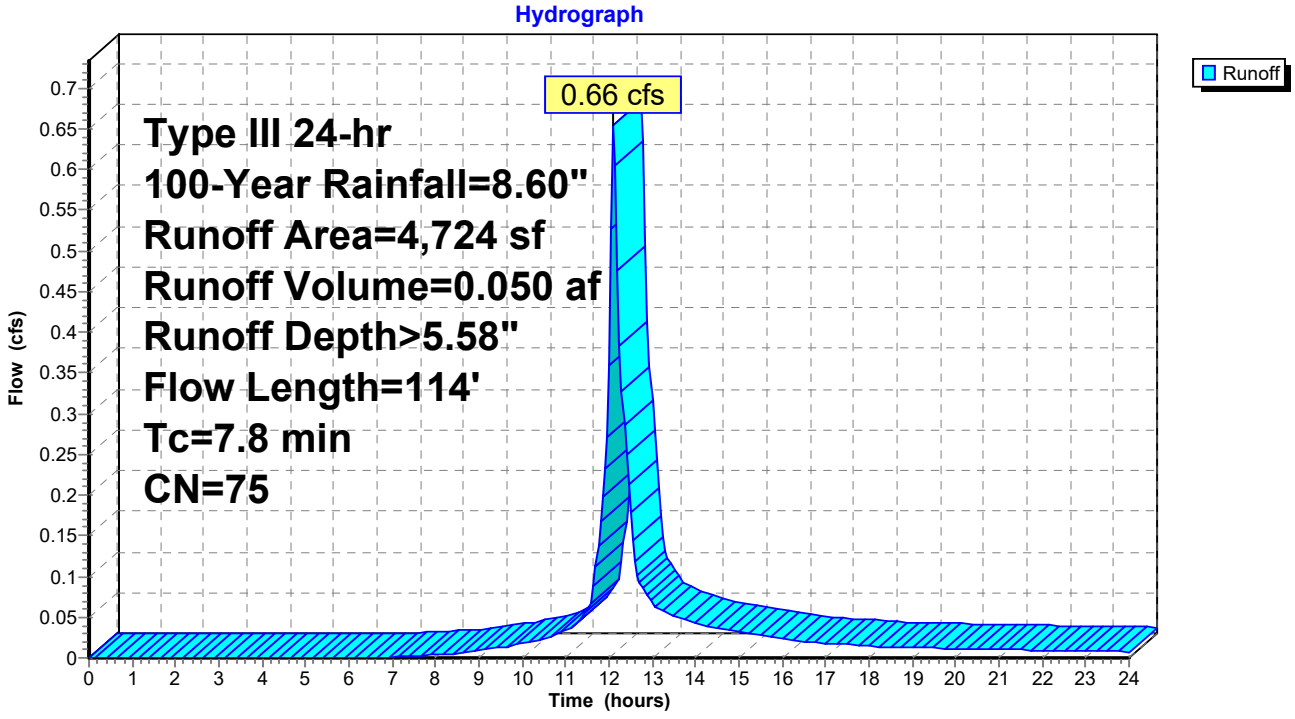
Runoff = 0.66 cfs @ 12.11 hrs, Volume= 0.050 af, Depth> 5.58"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=8.60"

Area (sf)	CN	Description
4,621	74	>75% Grass cover, Good, HSG C
103	98	Paved parking, HSG C
4,724	75	Weighted Average
4,621		97.82% Pervious Area
103		2.18% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.4	50	0.0100	0.11		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.20"
0.4	64	0.0312	2.84		**Shallow Concentrated Flow, Shallow Concentrated Flow** Unpaved Kv= 16.1 fps
7.8	114	Total			

Subcatchment E-2: Existing Watershed 2



Summary for Subcatchment E-3: Existing Watershed 3

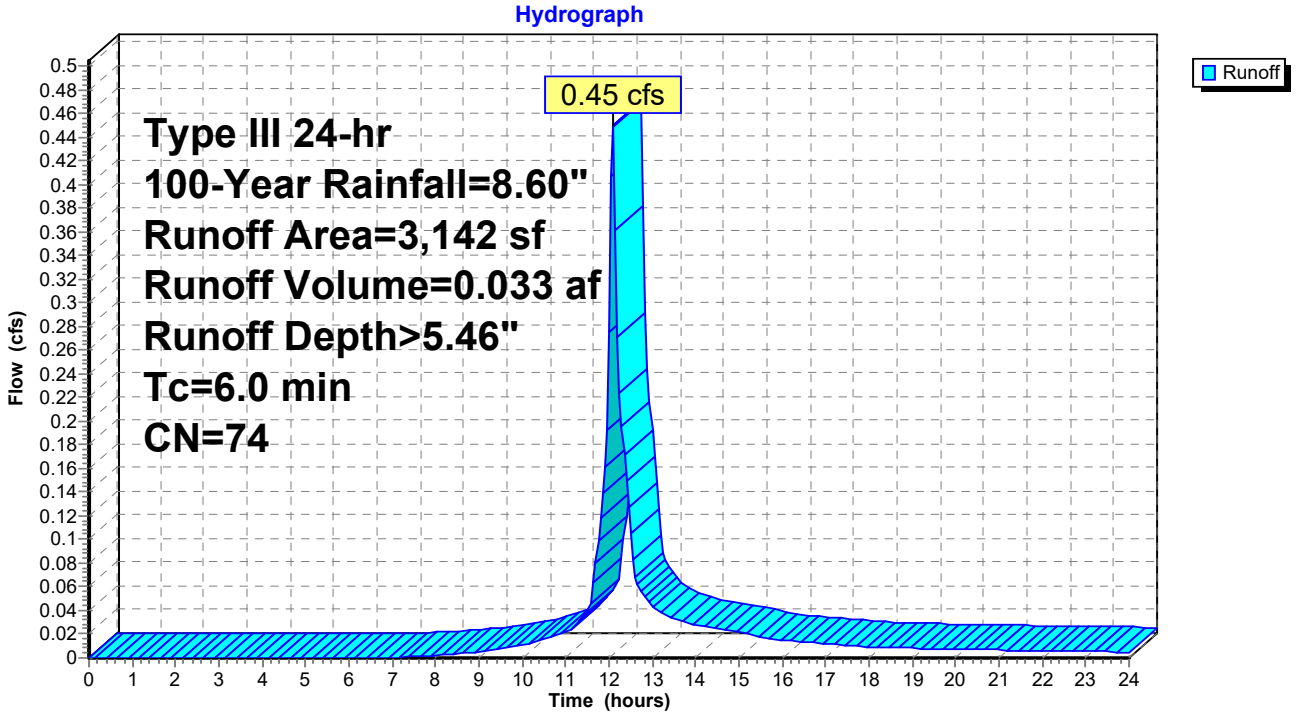
Runoff = 0.45 cfs @ 12.09 hrs, Volume= 0.033 af, Depth> 5.46"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=8.60"

Area (sf)	CN	Description
3,142	74	>75% Grass cover, Good, HSG C
3,142		100.00% Pervious Area

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

Subcatchment E-3: Existing Watershed 3



Summary for Subcatchment E-4A: Existing Watershed 4A

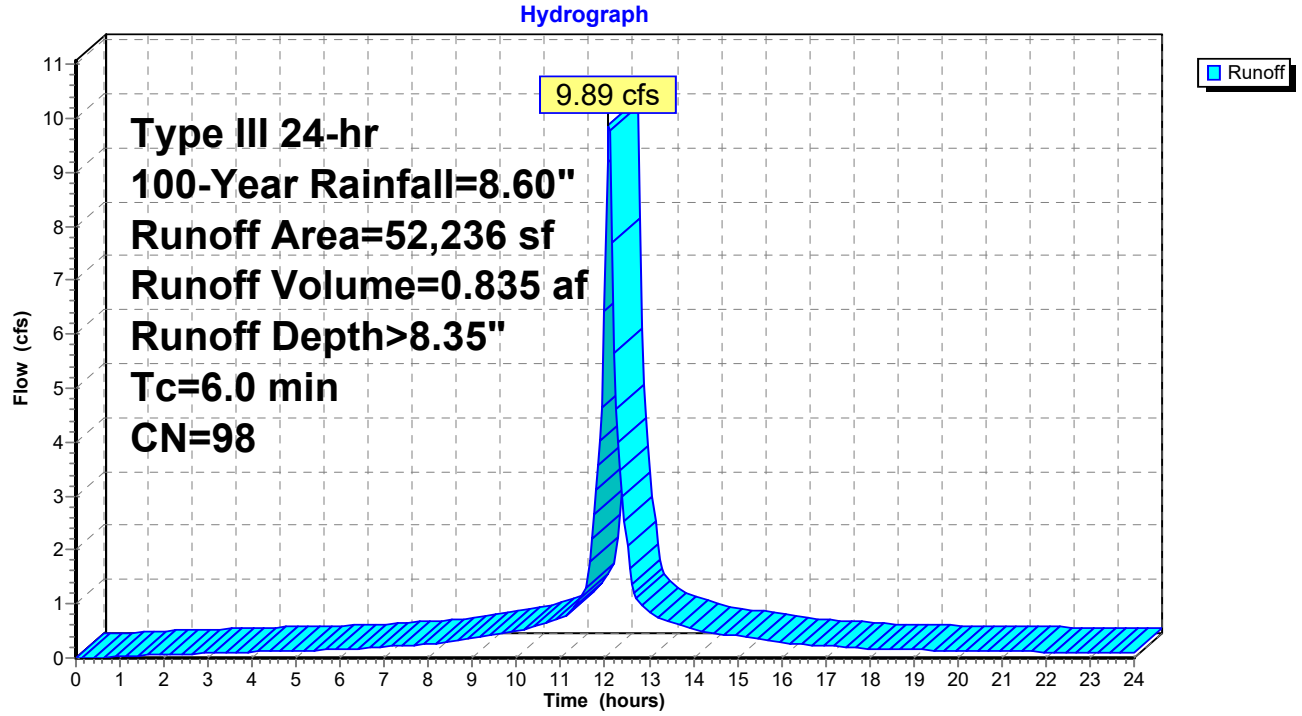
Runoff = 9.89 cfs @ 12.09 hrs, Volume= 0.835 af, Depth> 8.35"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=8.60"

Area (sf)	CN	Description
52,236	98	Roofs, HSG C
52,236		100.00% Impervious Area

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

Subcatchment E-4A: Existing Watershed 4A



Summary for Subcatchment E-4B: Existing Watershed 4B

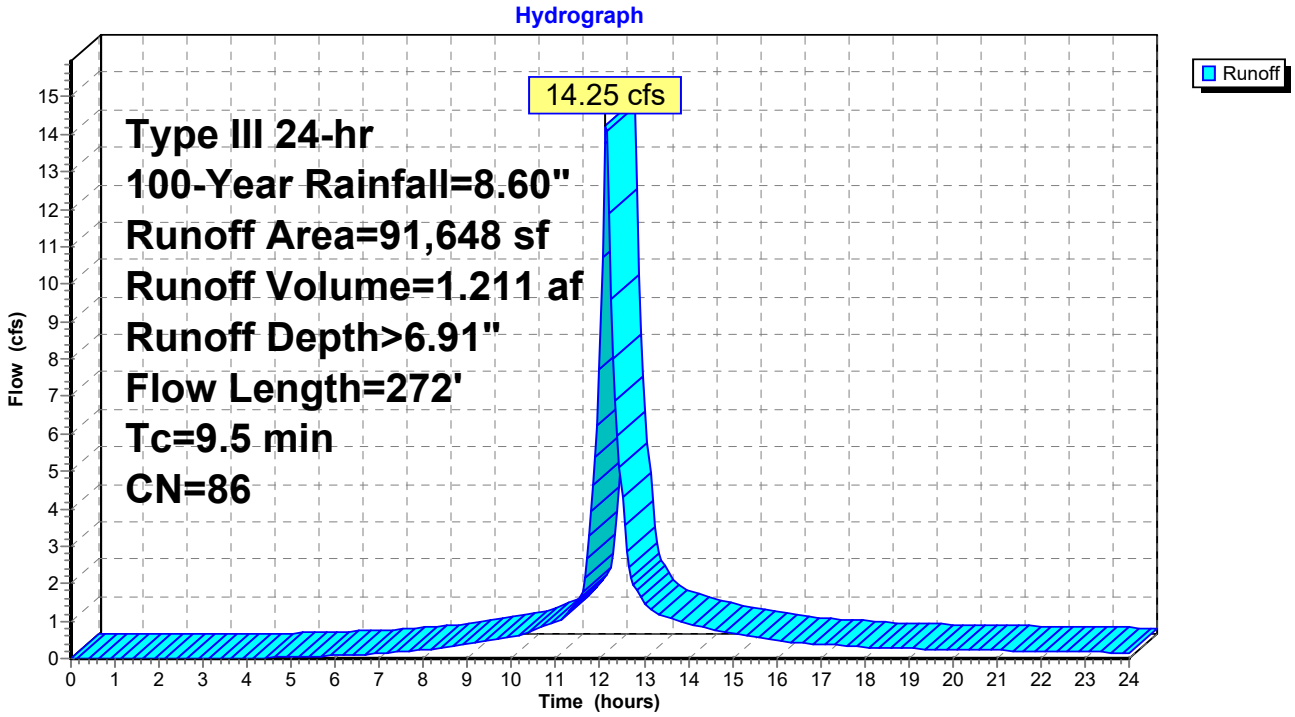
Runoff = 14.25 cfs @ 12.13 hrs, Volume= 1.211 af, Depth> 6.91"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=8.60"

	Area (sf)	CN	Description
	43,351	98	Paved parking, HSG C
	1,304	96	Gravel surface, HSG C
	42,526	74	>75% Grass cover, Good, HSG C
	2,704	70	Woods, Good, HSG C
*	1,763	74	Mulch
	91,648	86	Weighted Average
	48,297		52.70% Pervious Area
	43,351		47.30% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.1	50	0.0080	0.10		**Sheet Flow, Sheet Flow** Grass: Short n= 0.150 P2= 3.20"
0.8	111	0.0216	2.37		**Shallow Concentrated Flow, Shallow Concentrated Flow** Unpaved Kv= 16.1 fps
0.1	40	0.1500	6.24		**Shallow Concentrated Flow, SHallow** Unpaved Kv= 16.1 fps
0.5	71	0.0150	2.49		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
9.5	272	Total			

Subcatchment E-4B: Existing Watershed 4B



Summary for Subcatchment E-5A: Existing Watershed 5A

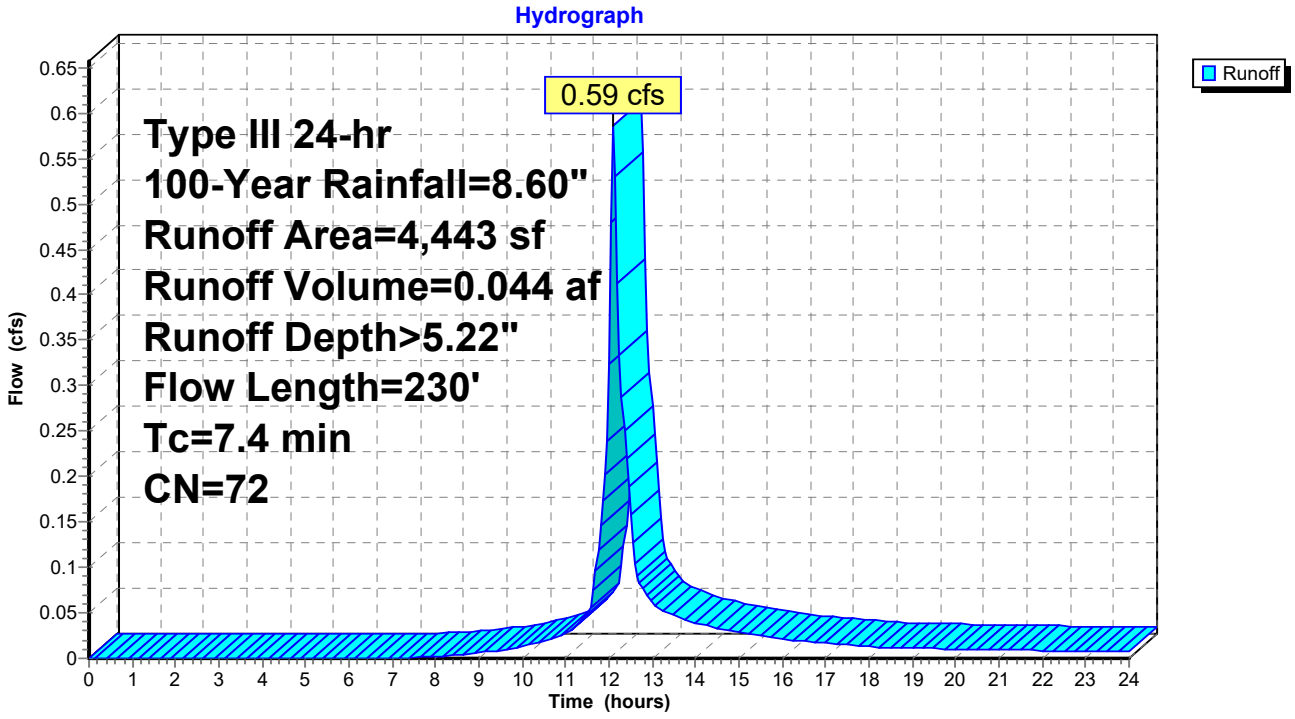
Runoff = 0.59 cfs @ 12.11 hrs, Volume= 0.044 af, Depth> 5.22"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=8.60"

Area (sf)	CN	Description
1,742	74	>75% Grass cover, Good, HSG C
2,701	70	Woods, Good, HSG C
4,443	72	Weighted Average
4,443		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.2	50	0.0160	0.14		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.20"
1.2	180	0.0244	2.51		**Shallow Concentrated Flow, Shallow COncentrated Flow** Unpaved Kv= 16.1 fps
7.4	230	Total			

Subcatchment E-5A: Existing Watershed 5A



Summary for Subcatchment E-5B: Existing Watershed 5B

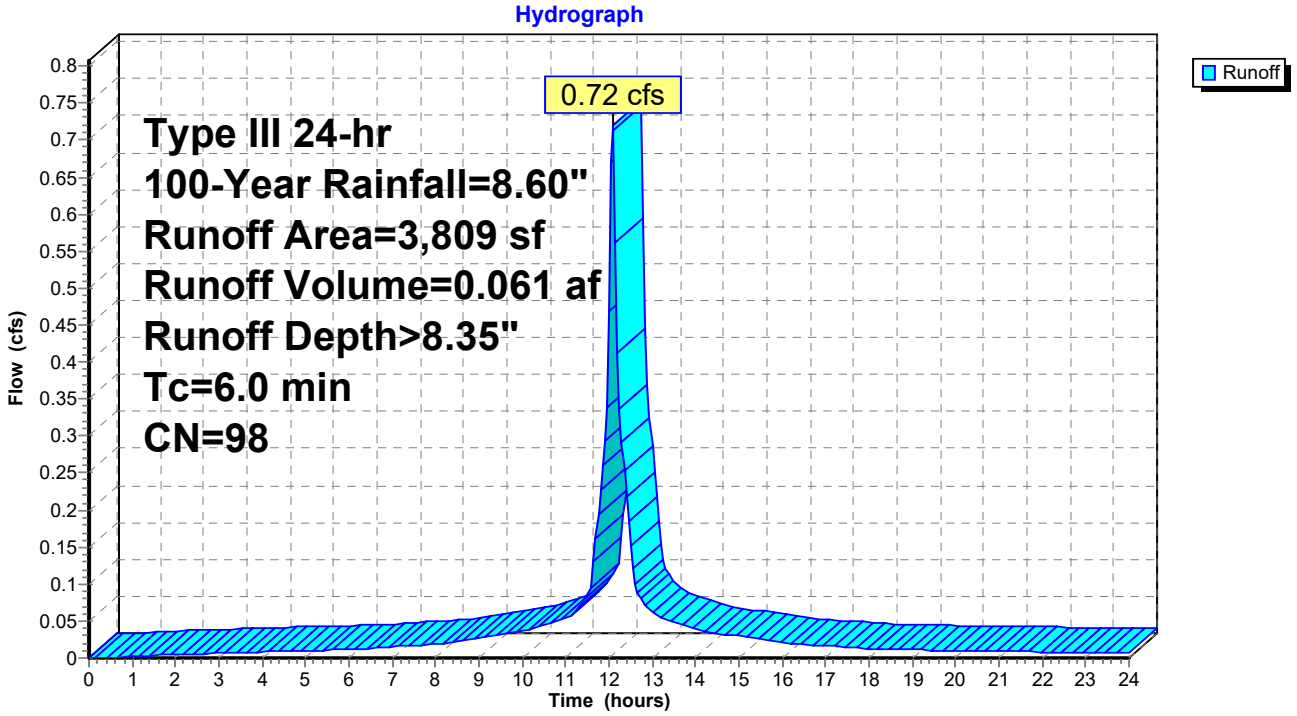
Runoff = 0.72 cfs @ 12.09 hrs, Volume= 0.061 af, Depth> 8.35"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=8.60"

Area (sf)	CN	Description
3,809	98	Paved parking, HSG C
3,809		100.00% Impervious Area

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

Subcatchment E-5B: Existing Watershed 5B



Summary for Subcatchment E-5C: Existing Watershed 5C

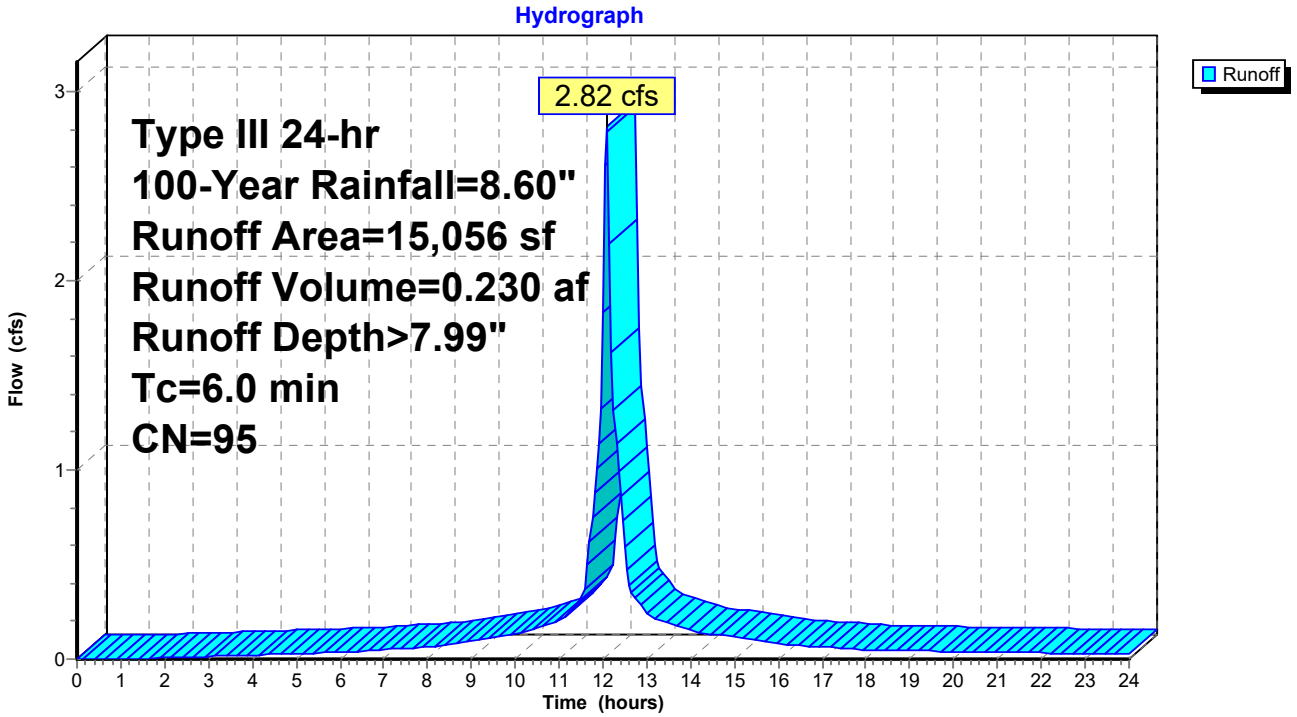
Runoff = 2.82 cfs @ 12.09 hrs, Volume= 0.230 af, Depth> 7.99"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=8.60"

Area (sf)	CN	Description
11,709	98	Paved parking, HSG C
1,791	96	Gravel surface, HSG C
303	79	50-75% Grass cover, Fair, HSG C
678	70	Woods, Good, HSG C
575	70	Woods, Good, HSG C
15,056	95	Weighted Average
3,347		22.23% Pervious Area
11,709		77.77% Impervious Area

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

Subcatchment E-5C: Existing Watershed 5C



Summary for Subcatchment E-6: Undetained to Wetland

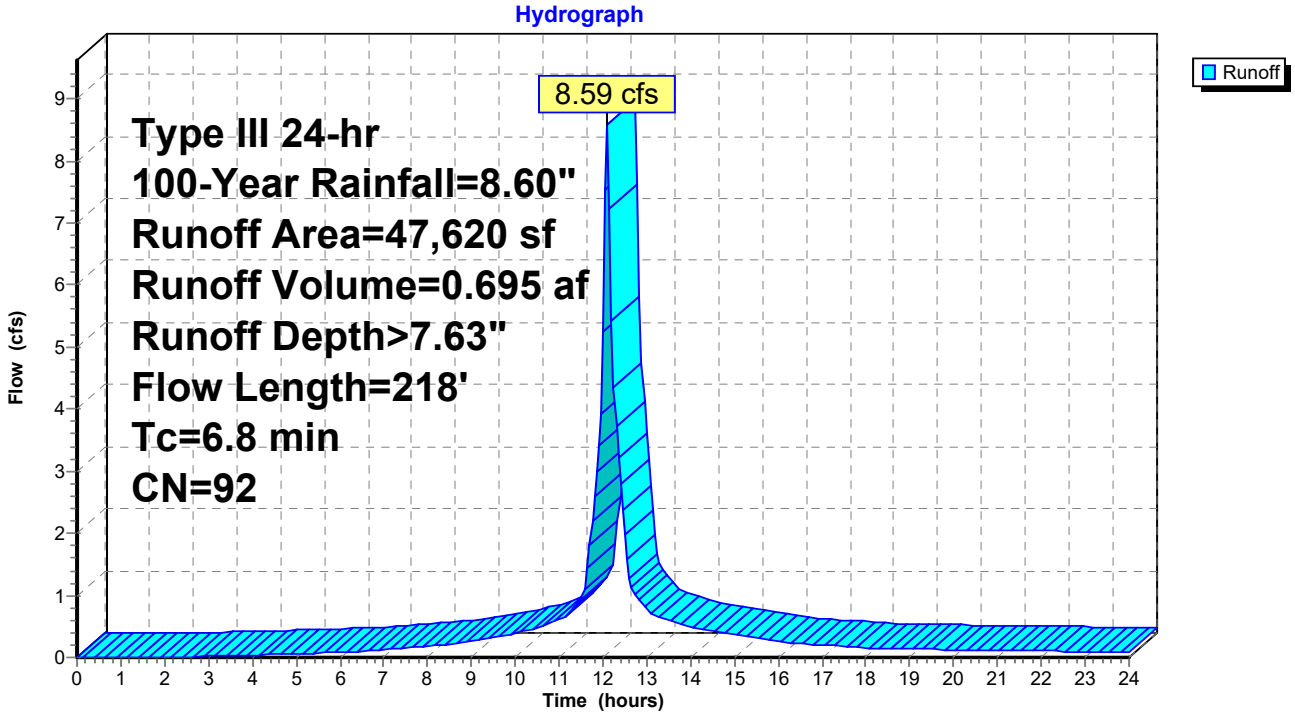
Runoff = 8.59 cfs @ 12.10 hrs, Volume= 0.695 af, Depth> 7.63"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=8.60"

Area (sf)	CN	Description
36,924	98	Paved parking, HSG C
9,270	74	>75% Grass cover, Good, HSG C
1,426	70	Woods, Good, HSG C
47,620	92	Weighted Average
10,696		22.46% Pervious Area
36,924		77.54% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.6	50	0.0340	0.18		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.20"
2.2	168	0.0060	1.25		**Shallow Concentrated Flow, SHallow Concentrated Flow** Unpaved Kv= 16.1 fps
6.8	218	Total			

Subcatchment E-6: Undetained to Wetland

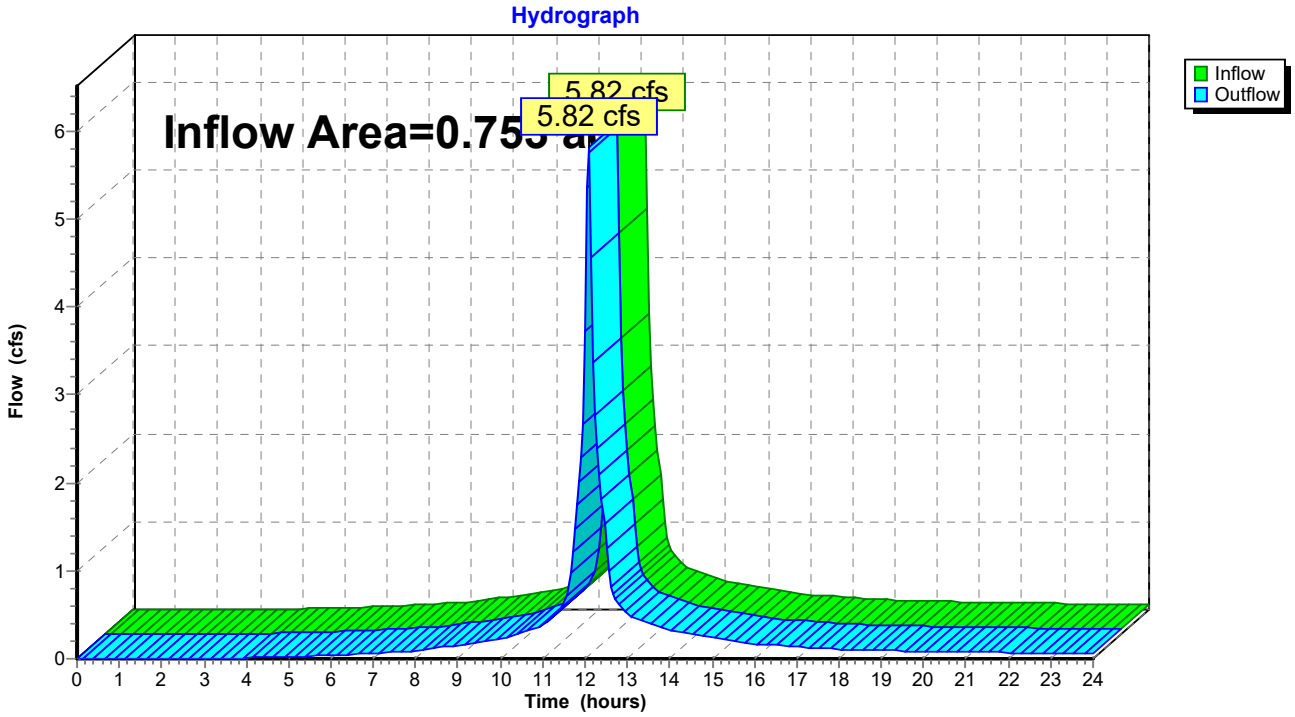


Summary for Reach DP-1: Design Point 1 (Wetland B)

Inflow Area = 0.753 ac, 35.44% Impervious, Inflow Depth > 7.15" for 100-Year event
Inflow = 5.82 cfs @ 12.09 hrs, Volume= 0.448 af
Outflow = 5.82 cfs @ 12.09 hrs, Volume= 0.448 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

Reach DP-1: Design Point 1 (Wetland B)

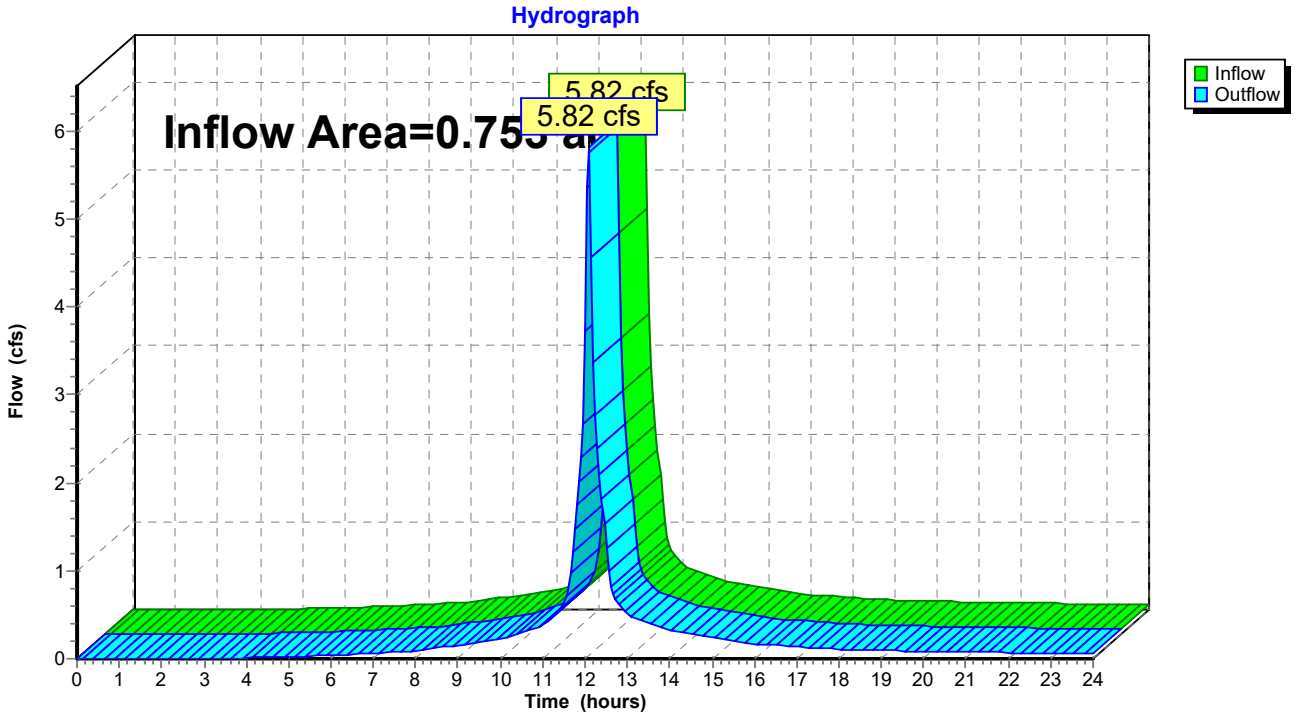


Summary for Reach DP-2: Design Point 2 (15" RCP to Wetland A)

Inflow Area = 0.753 ac, 35.44% Impervious, Inflow Depth > 7.15" for 100-Year event
Inflow = 5.82 cfs @ 12.09 hrs, Volume= 0.448 af
Outflow = 5.82 cfs @ 12.09 hrs, Volume= 0.448 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

Reach DP-2: Design Point 2 (15" RCP to Wetland A)

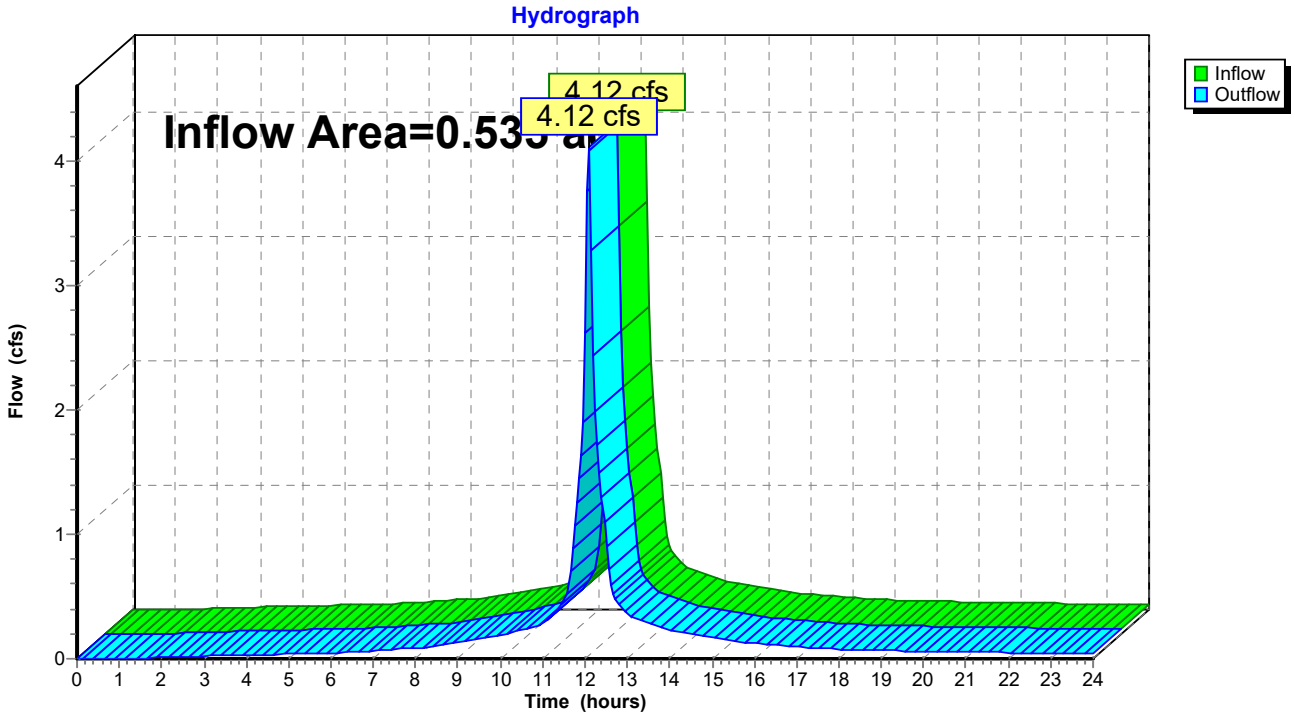


Summary for Reach DP-3: Design Point 3 (Existing Drainage Ditch)

Inflow Area = 0.535 ac, 66.58% Impervious, Inflow Depth > 7.52" for 100-Year event
Inflow = 4.12 cfs @ 12.09 hrs, Volume= 0.335 af
Outflow = 4.12 cfs @ 12.09 hrs, Volume= 0.335 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

Reach DP-3: Design Point 3 (Existing Drainage Ditch)

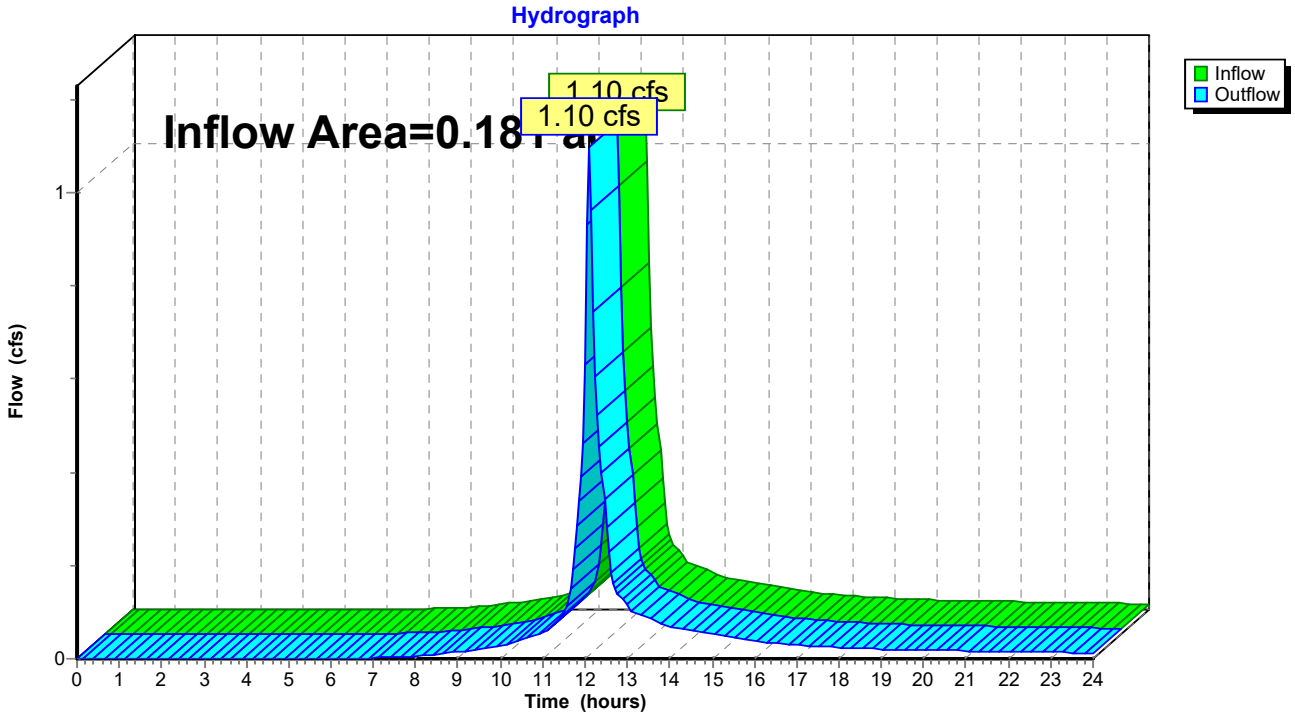


Summary for Reach DP-4: Design Point 4 (MassDOT CB- 2)

Inflow Area = 0.181 ac, 1.31% Impervious, Inflow Depth > 5.53" for 100-Year event
Inflow = 1.10 cfs @ 12.10 hrs, Volume= 0.083 af
Outflow = 1.10 cfs @ 12.10 hrs, Volume= 0.083 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

Reach DP-4: Design Point 4 (MassDOT CB- 2)

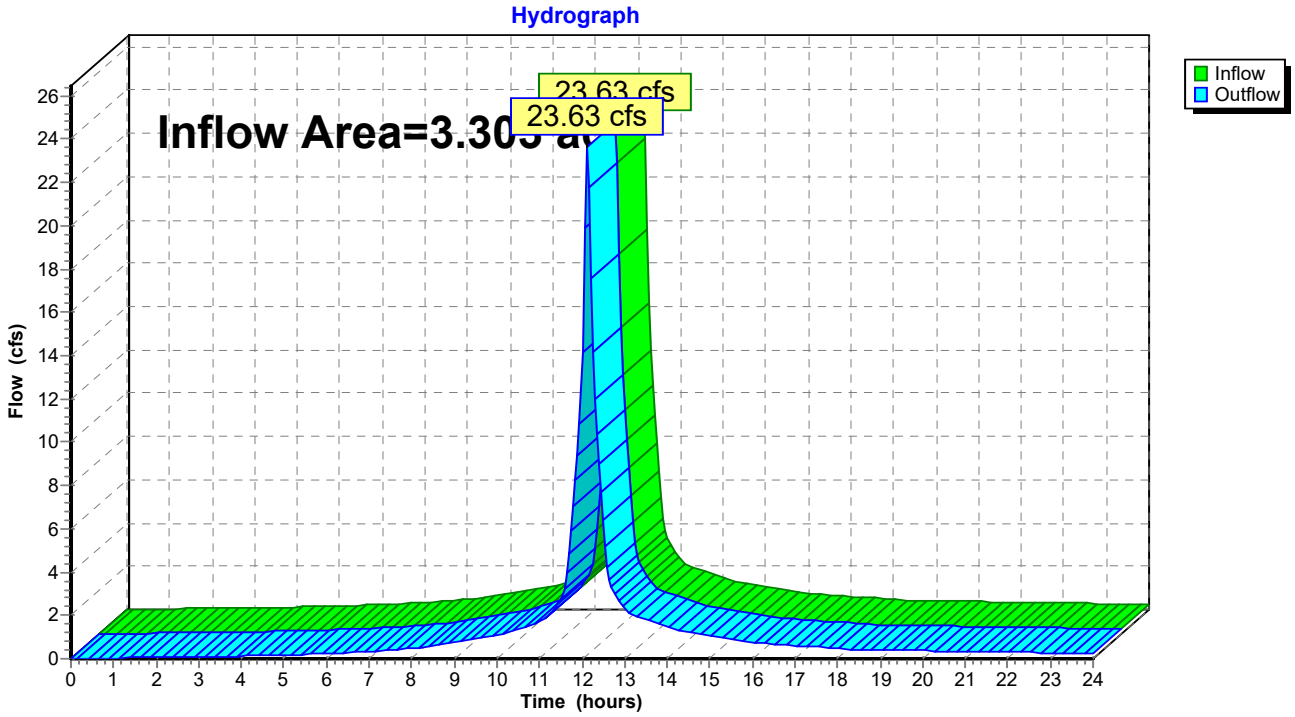


Summary for Reach DP-5: EXISTING CONSTRUCTED STORMWATER WETLAND

Inflow Area = 3.303 ac, 66.43% Impervious, Inflow Depth > 7.43" for 100-Year event
Inflow = 23.63 cfs @ 12.11 hrs, Volume= 2.046 af
Outflow = 23.63 cfs @ 12.11 hrs, Volume= 2.046 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

Reach DP-5: EXISTING CONSTRUCTED STORMWATER WETLAND

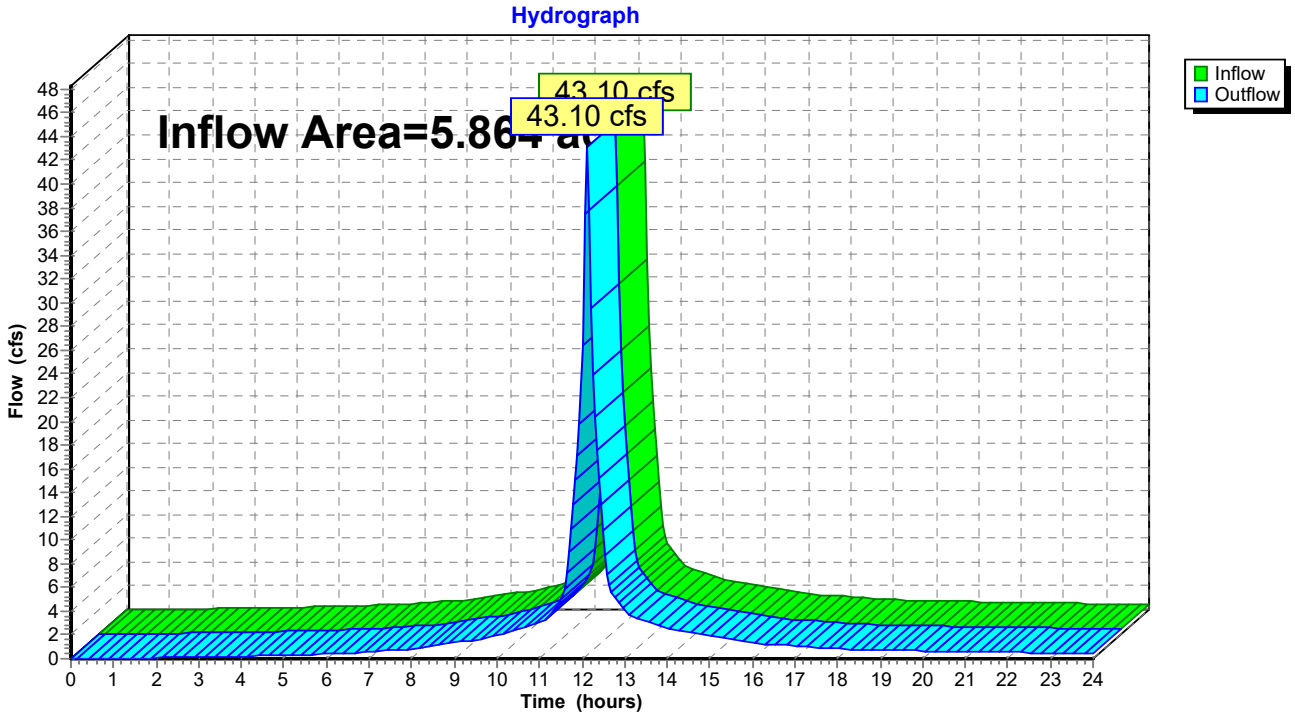


Summary for Reach DP-6: Wetland A - Design Point 6

Inflow Area = 5.864 ac, 62.53% Impervious, Inflow Depth > 7.38" for 100-Year event
Inflow = 43.10 cfs @ 12.10 hrs, Volume= 3.608 af
Outflow = 43.10 cfs @ 12.10 hrs, Volume= 3.608 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

Reach DP-6: Wetland A - Design Point 6



POINT OF DISCHARGE 1

PEAK DISCHARGE SUMMARY
1–INCH STORM = 0.26 CFS
1–YEAR STORM = 1.39 CFS
2–YEAR STORM = 1.86 CFS
5–YEAR STORM = 2.40 CFS
10–YEAR STORM = 3.09 CFS
25–YEAR STORM = 4.01 CFS
100–YEAR STORM = 5.97 CFS

POINT OF DISCHARGE 2

PEAK DISCHARGE SUMMARY
1–INCH STORM = 0.22 CFS
1–YEAR STORM = 1.19 CFS
2–YEAR STORM = 1.60 CFS
5–YEAR STORM = 2.06 CFS
10–YEAR STORM = 2.66 CFS
25–YEAR STORM = 3.45 CFS
100–YEAR STORM = 5.14 CFS

POINT OF DISCHARGE 3

PEAK DISCHARGE SUMMARY
1–INCH STORM = 0.30 CFS
1–YEAR STORM = 1.06 CFS
2–YEAR STORM = 1.38 CFS
5–YEAR STORM = 1.73 CFS
10–YEAR STORM = 2.20 CFS
25–YEAR STORM = 2.82 CFS
100–YEAR STORM = 4.17 CFS

T OF DISCHARGE 6

PEAK DISCHARGE SUMMARY
1–INCH STORM = 2.44 CFS
1–YEAR STORM = 10.36 CFS
2–YEAR STORM = 13.73 CFS
5–YEAR STORM = 17.57 CFS
10–YEAR STORM = 22.54 CFS
25–YEAR STORM = 29.16 CFS
100–YEAR STORM = 43.67 CFS

POINT OF DISCHARGE 4

PEAK DISCHARGE SUMMARY
1–INCH STORM = 0.00 CFS
1–YEAR STORM = 0.12 CFS
2–YEAR STORM = 0.20 CFS
5–YEAR STORM = 0.31 CFS
10–YEAR STORM = 0.42 CFS
25–YEAR STORM = 0.65 CFS
100–YEAR STORM = 1.10 CFS

POINT OF DISCHARGE 5

PEAK DISCHARGE SUMMARY
1–INCH STORM = 1.32 CFS
1–YEAR STORM = 5.56 CFS
2–YEAR STORM = 7.38 CFS
5–YEAR STORM = 9.47 CFS
10–YEAR STORM = 12.18 CFS
25–YEAR STORM = 15.81 CFS
100–YEAR STORM = 26.63 CFS

VOLUME TABLE						
	DP1 (ACFT)	DP2 (ACFT)	DP3 (ACFT)	DP4 (ACFT)	DP5 (ACFT)	DP6 (ACFT)
1 INCH	0.020	0.020	0.022	0.000	0.114	0.198
1 YEAR	0.101	0.101	0.082	0.010	0.464	0.828
2 YEAR	0.137	0.137	0.108	0.016	0.618	1.103
5 YEAR	0.178	0.178	0.137	0.024	0.796	1.422
10 YEAR	0.232	0.232	0.175	0.034	1.030	1.840
25 YEAR	0.306	0.306	0.226	0.049	1.347	2.406
100 YEAR	0.467	0.467	0.340	0.083	2.046	3.650

ON-SITE SOIL NOTE:

1. THE SITE IS MAPPED AS 656: UDORTHENTS-URBAN LAND COMPLEX, 52A: FREETOWN MUCK, AND 32B: WAREHAM LOAMY FINE SAND WHICH DO NOT HAVE A HYDRAULIC SOIL RATING. USING TABLE 2.3.3, 1982 RAWLS RATE, FROM VOLUME 3, CHAPTER 1 OF THE MASSACHUSETTS STORMWATER HANDBOOK, THE TEST PITS PERFORMED ON SITE, IT WAS DETERMINED THAT THE NRCS HYDROLOGIC SOIL GROUP (HSG) FOR THE SITE IS HSG-C.

30 15 0 30 60

02/14/22	P.B. AND CON.–COM. RESUBMITTAL	3.
01/31/22	ZBA RESUBMITTAL	2.
11/15/21	PLANNING BOARD SUBMITTAL	1.
Date	Description	No.
Revisions		

GABRIEL R. CROCKER
CIVIL
No. 47917
REGISTERED PROFESSIONAL ENGINEER
COMMONWEALTH OF MASSACHUSETTS
2-14-2022
GABRIEL R. CROCKER
PROFESSIONAL ENGINEER, MA REGISTRATION #47917

Crocker Design Group
2 SHARP STREET, UNIT A
HINGHAM, MA 02043
P: 781–919–0808

Project
MERCEDES OF SUDBURY
141 BOSTON POST ROAD, SUDBURY, MA

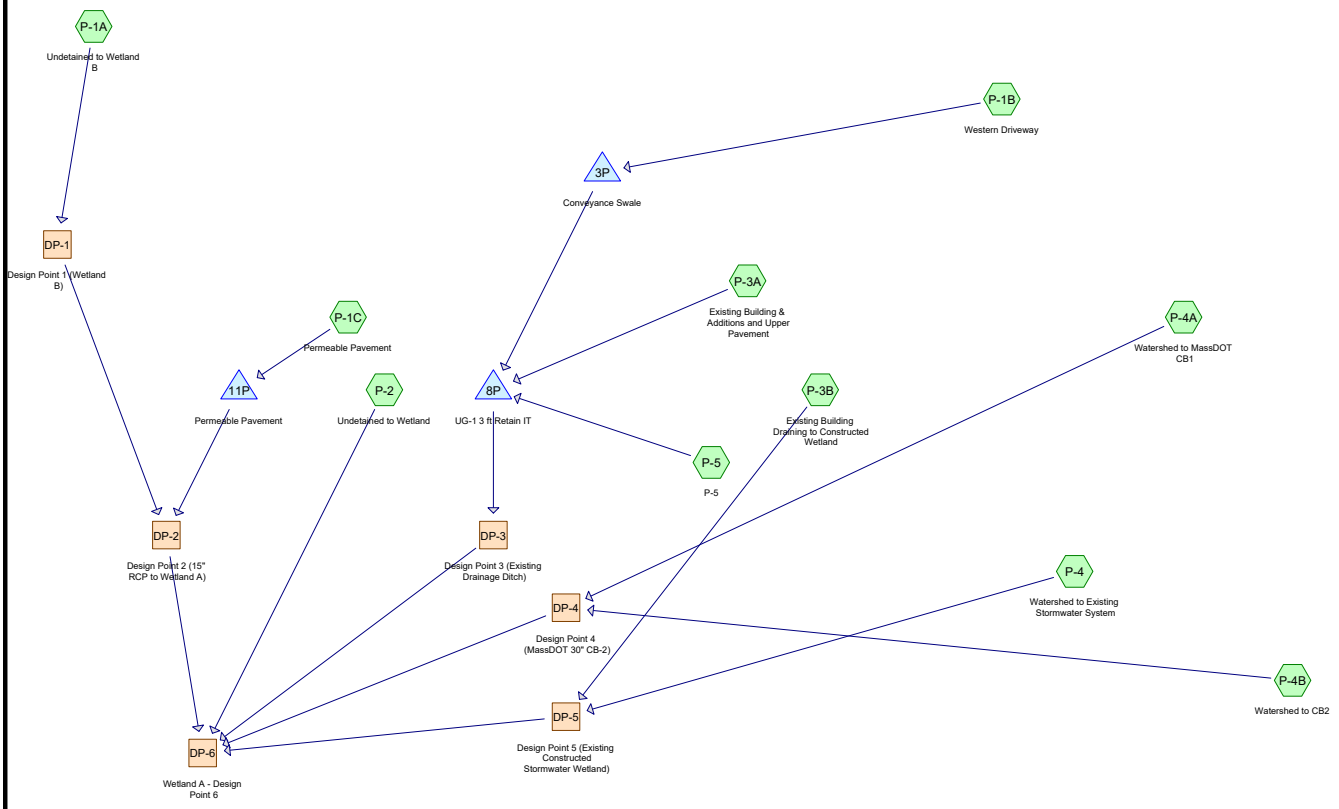
Prepared for
HERB CHAMBERS 43 BRAINTREE STREET, LLC
#259 McGRATH HIGHWAY - ROUTE 28 SOMERVILLE, MA 02143

Drawing Title
EXISTING CONDITION WATERSHED MAP

Project No.	100-107
Date	11/10/2021
Scale	1"=30'
Drawn By	DJN / JPM
Approved By	GC

Drawing No.
EW-1

C:\CDG\Crocker Design Group, LLC\Gabriel Crocker - Projects\100-107 Sudbury - Mercedes\dwg\Plot Sheets\Site Plan Application_ 10\EXISTING WATERSHED MAP_revised.dwg, EW-1 ex watershed, Feb 14, 2022 12:38



Subcat Reach Pond Link

Routing Diagram for 100-107 Proposed Watershed

Prepared by {enter your company name here}, Printed 2/10/2022

HydroCAD® 10.00-26 s/n 01012 © 2020 HydroCAD Software Solutions LLC

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
1.189	74	>75% Grass cover, Good, HSG C (P-1C, P-2, P-3A, P-4, P-4A, P-4B, P-5)
2.887	98	Paved parking, HSG C (P-1B, P-1C, P-3A, P-4, P-5)
1.326	98	Roofs, HSG C (P-3A, P-3B)
0.094	70	Woods, Good, HSG C (P-2, P-4)
0.369	72	Woods/grass comb., Good, HSG C (P-1A, P-1B)

Summary for Subcatchment P-1A: Undetained to Wetland B

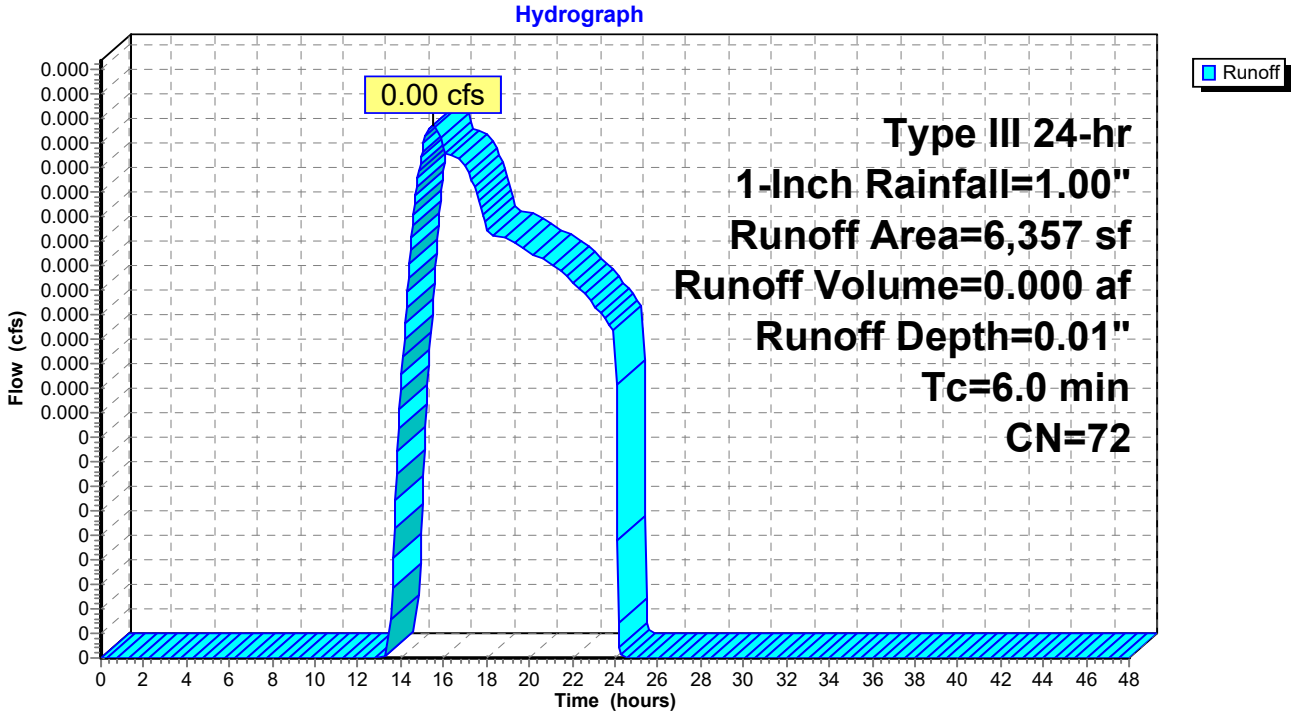
Runoff = 0.00 cfs @ 15.50 hrs, Volume= 0.000 af, Depth= 0.01"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 1-Inch Rainfall=1.00"

Area (sf)	CN	Description
6,357	72	Woods/grass comb., Good, HSG C
6,357		100.00% Pervious Area

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

Subcatchment P-1A: Undetained to Wetland B



Summary for Subcatchment P-1B: Western Driveway

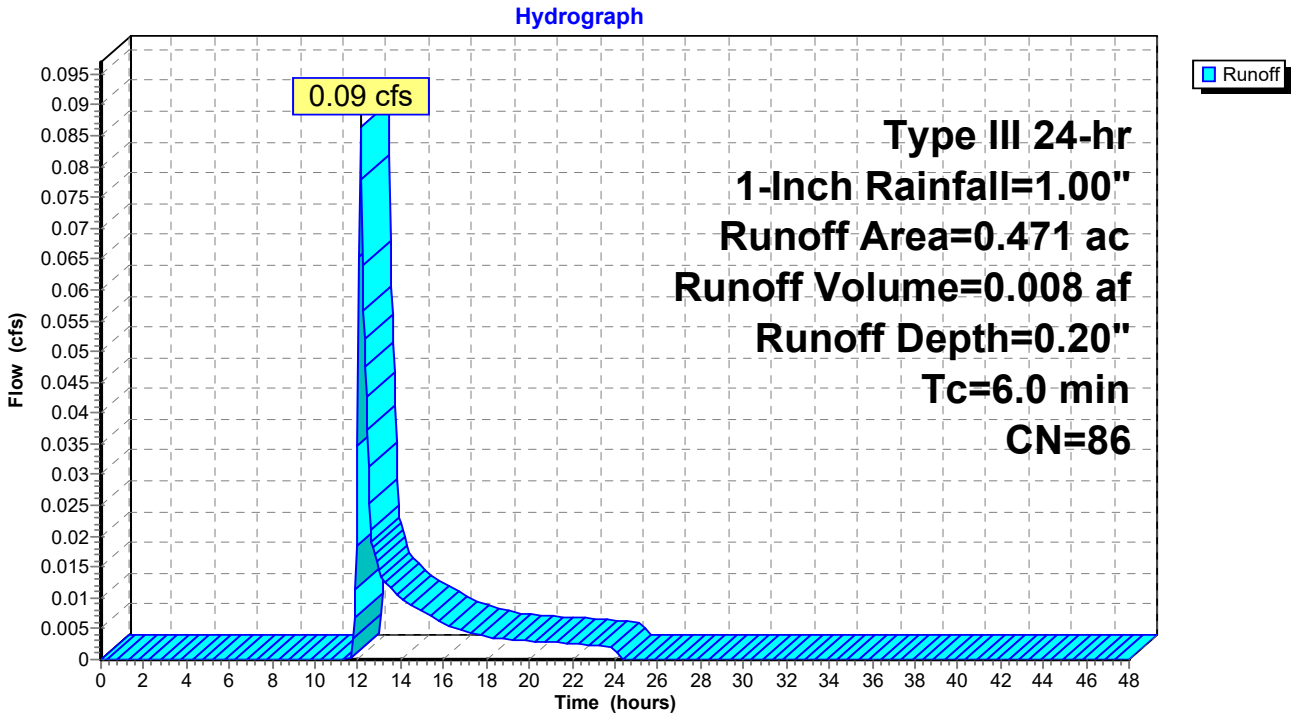
Runoff = 0.09 cfs @ 12.11 hrs, Volume= 0.008 af, Depth= 0.20"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 1-Inch Rainfall=1.00"

Area (ac)	CN	Description
0.248	98	Paved parking, HSG C
0.223	72	Woods/grass comb., Good, HSG C
0.471	86	Weighted Average
0.223		47.35% Pervious Area
0.248		52.65% Impervious Area

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

Subcatchment P-1B: Western Driveway



Summary for Subcatchment P-1C: Permeable Pavement

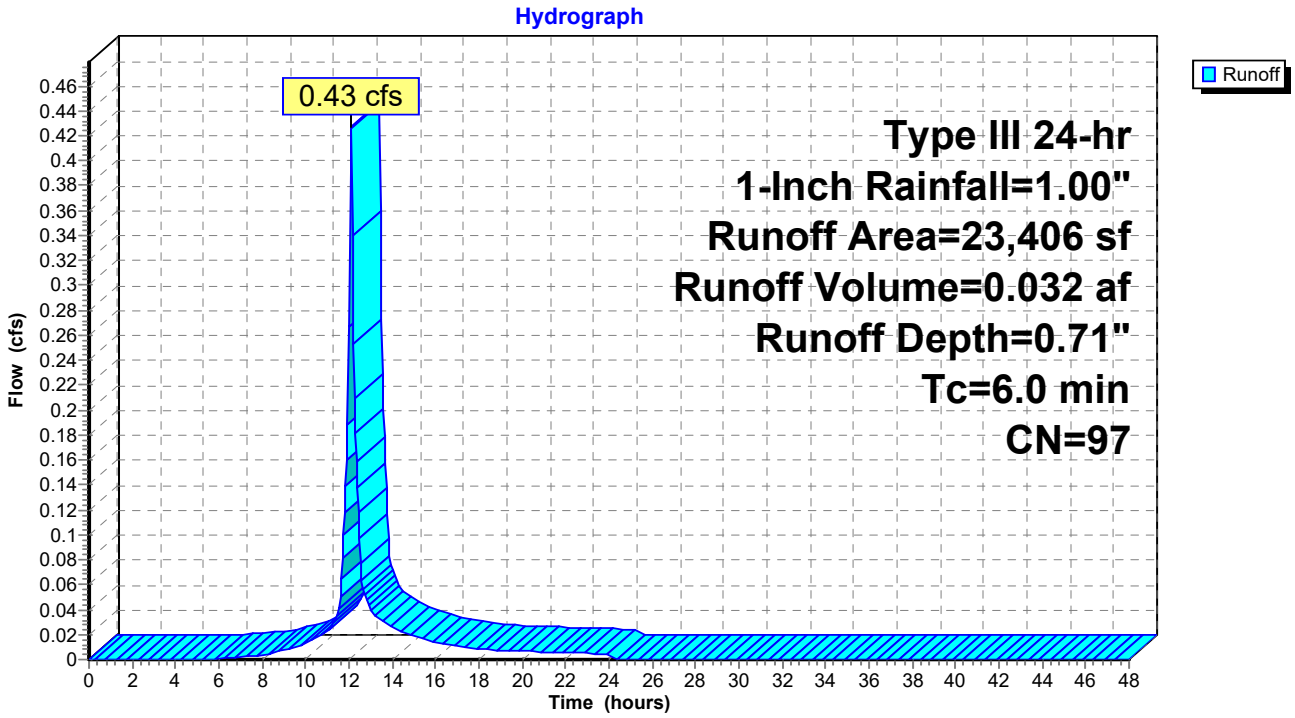
Runoff = 0.43 cfs @ 12.09 hrs, Volume= 0.032 af, Depth= 0.71"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 1-Inch Rainfall=1.00"

Area (sf)	CN	Description
22,160	98	Paved parking, HSG C
1,246	74	>75% Grass cover, Good, HSG C
23,406	97	Weighted Average
1,246		5.32% Pervious Area
22,160		94.68% Impervious Area

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

Subcatchment P-1C: Permeable Pavement



Summary for Subcatchment P-2: Undetained to Wetland

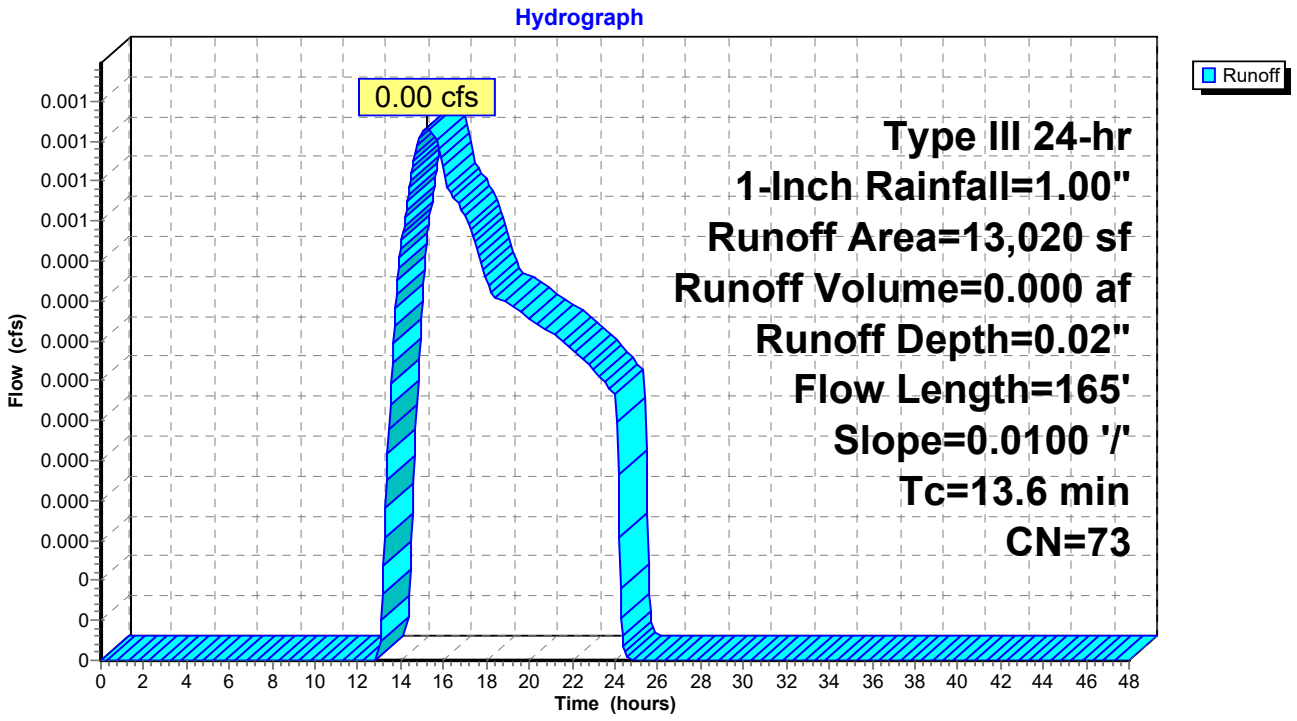
Runoff = 0.00 cfs @ 15.22 hrs, Volume= 0.000 af, Depth= 0.02"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 1-Inch Rainfall=1.00"

Area (sf)	CN	Description
10,967	74	>75% Grass cover, Good, HSG C
2,053	70	Woods, Good, HSG C
13,020	73	Weighted Average
13,020		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.9	100	0.0100	0.13		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.20"
0.7	65	0.0100	1.61		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
13.6	165	Total			

Subcatchment P-2: Undetained to Wetland



Summary for Subcatchment P-3A: Existing Building & Additions and Upper Pavement

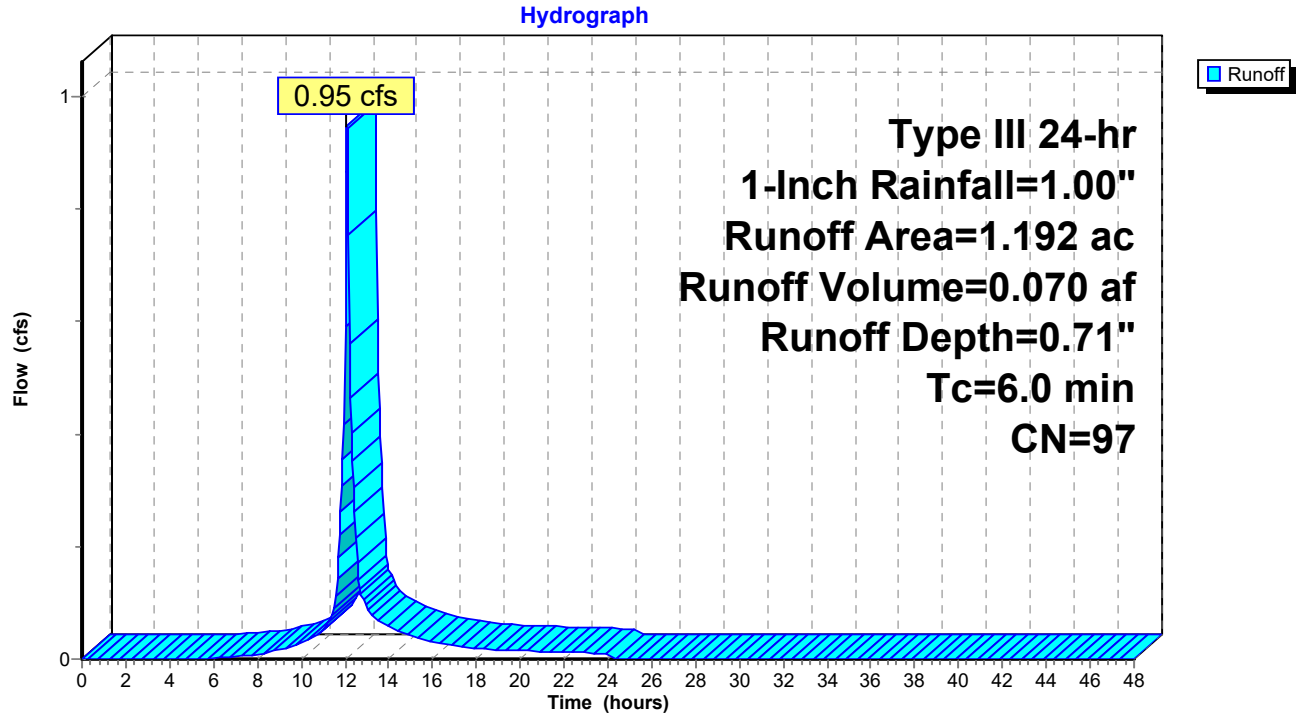
Runoff = 0.95 cfs @ 12.09 hrs, Volume= 0.070 af, Depth= 0.71"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 1-Inch Rainfall=1.00"

Area (ac)	CN	Description
0.701	98	Paved parking, HSG C
0.461	98	Roofs, HSG C
0.030	74	>75% Grass cover, Good, HSG C
1.192	97	Weighted Average
0.030		2.52% Pervious Area
1.162		97.48% Impervious Area

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

Subcatchment P-3A: Existing Building & Additions and Upper Pavement



Summary for Subcatchment P-3B: Existing Building Draining to Constructed Wetland

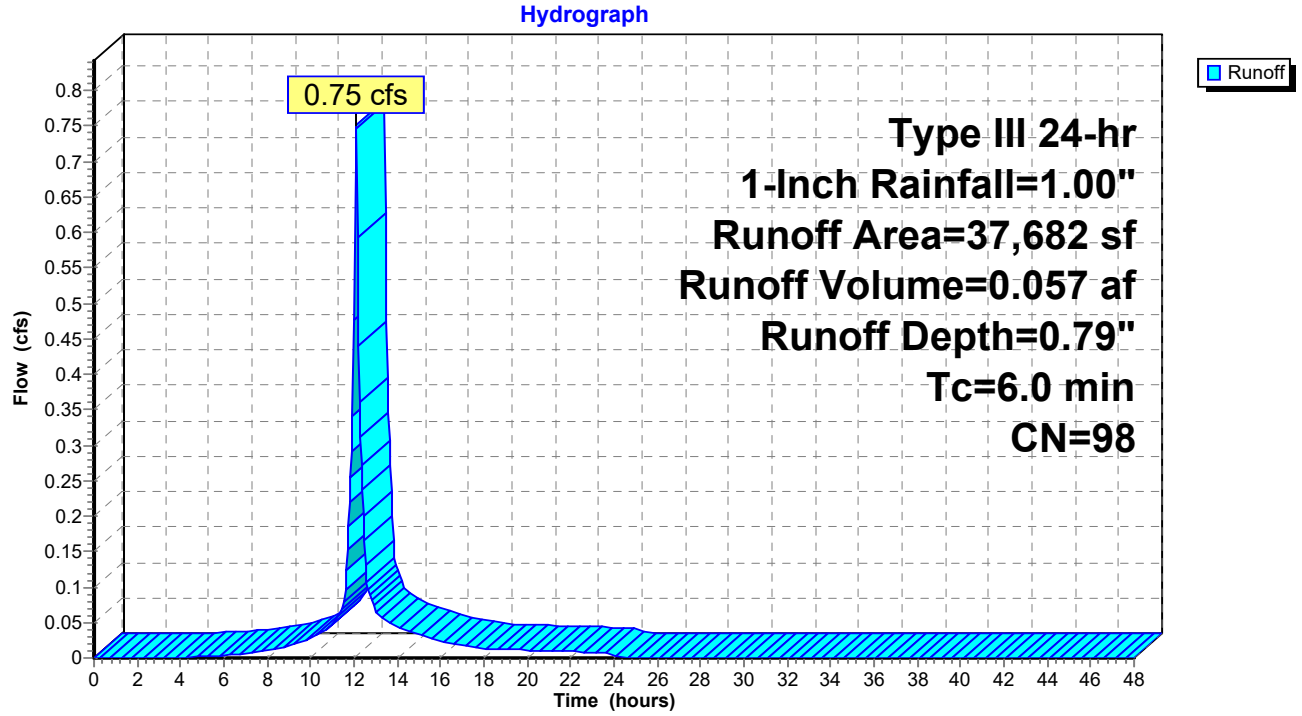
Runoff = 0.75 cfs @ 12.09 hrs, Volume= 0.057 af, Depth= 0.79"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 1-Inch Rainfall=1.00"

Area (sf)	CN	Description
37,682	98	Roofs, HSG C
37,682		100.00% Impervious Area

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

Subcatchment P-3B: Existing Building Draining to Constructed Wetland



Summary for Subcatchment P-4: Watershed to Existing Stormwater System

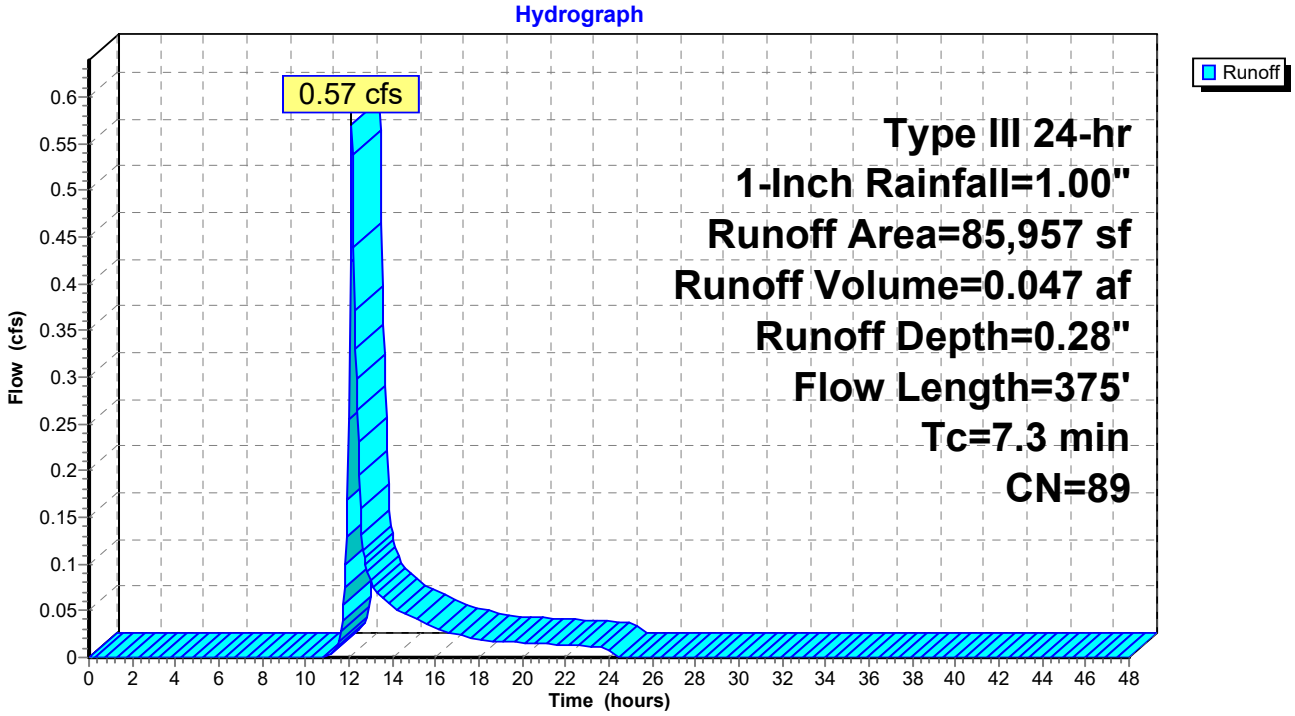
Runoff = 0.57 cfs @ 12.12 hrs, Volume= 0.047 af, Depth= 0.28"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 1-Inch Rainfall=1.00"

Area (sf)	CN	Description
54,671	98	Paved parking, HSG C
29,238	74	>75% Grass cover, Good, HSG C
2,048	70	Woods, Good, HSG C
85,957	89	Weighted Average
31,286		36.40% Pervious Area
54,671		63.60% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.2	50	0.0240	0.16		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.20"
1.7	245	0.0220	2.39		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
0.4	80	0.0287	3.44		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
7.3	375	Total			

Subcatchment P-4: Watershed to Existing Stormwater System



Summary for Subcatchment P-4A: Watershed to MassDOT CB1

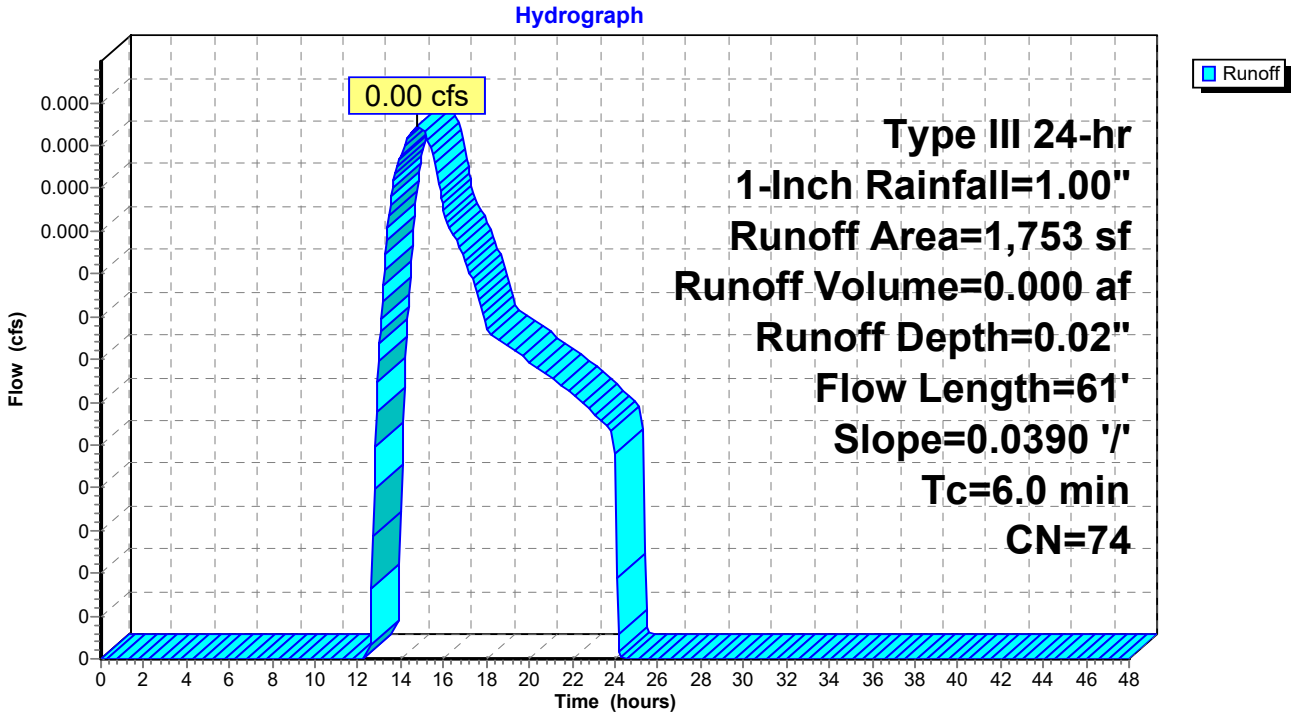
Runoff = 0.00 cfs @ 14.78 hrs, Volume= 0.000 af, Depth= 0.02"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 1-Inch Rainfall=1.00"

Area (sf)	CN	Description
1,753	74	>75% Grass cover, Good, HSG C
1,753		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.1	61	0.0390	0.20		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.20"
0.9					**Direct Entry,**
6.0	61	Total			

Subcatchment P-4A: Watershed to MassDOT CB1



Summary for Subcatchment P-4B: Watershed to CB2

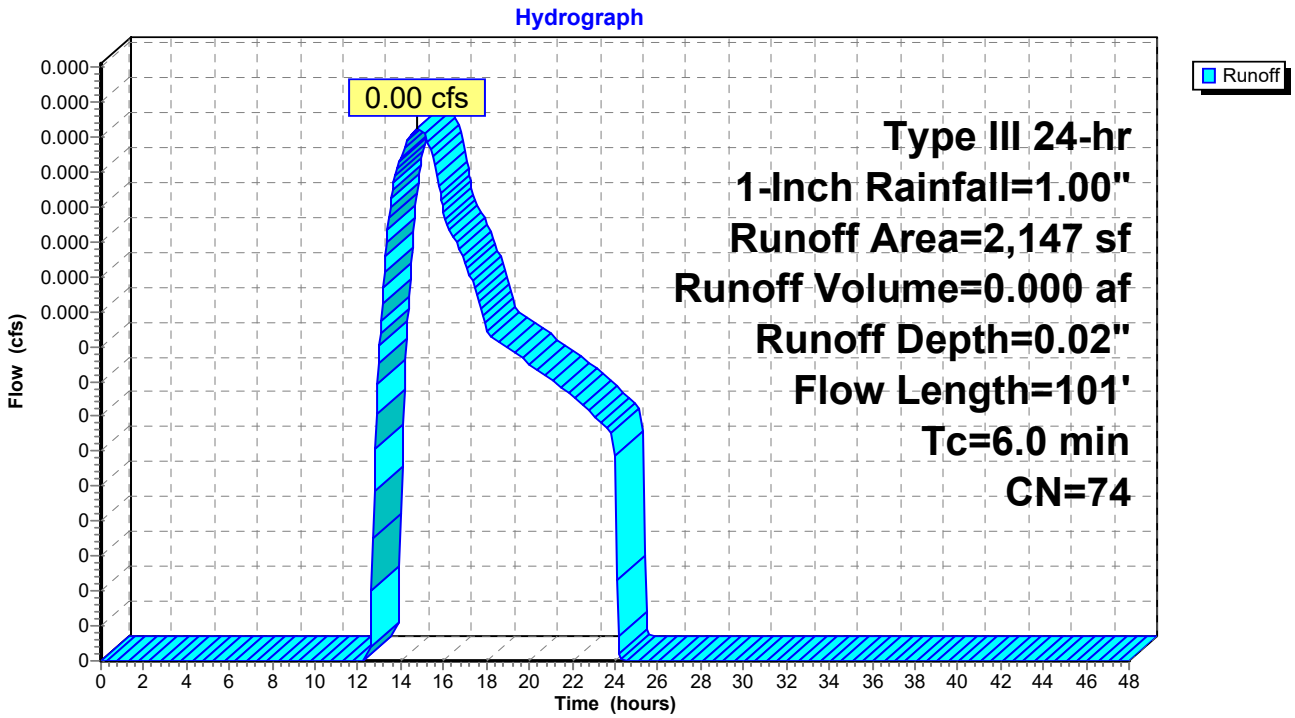
Runoff = 0.00 cfs @ 14.78 hrs, Volume= 0.000 af, Depth= 0.02"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 1-Inch Rainfall=1.00"

Area (sf)	CN	Description
2,147	74	>75% Grass cover, Good, HSG C
2,147		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.6	50	0.0200	0.15		**Sheet Flow, SHeet Flow** Grass: Short n= 0.150 P2= 3.20"
0.3	51	0.0390	3.18		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
0.1					**Direct Entry, Miniumum**
6.0	101	Total			

Subcatchment P-4B: Watershed to CB2



Summary for Subcatchment P-5: P-5

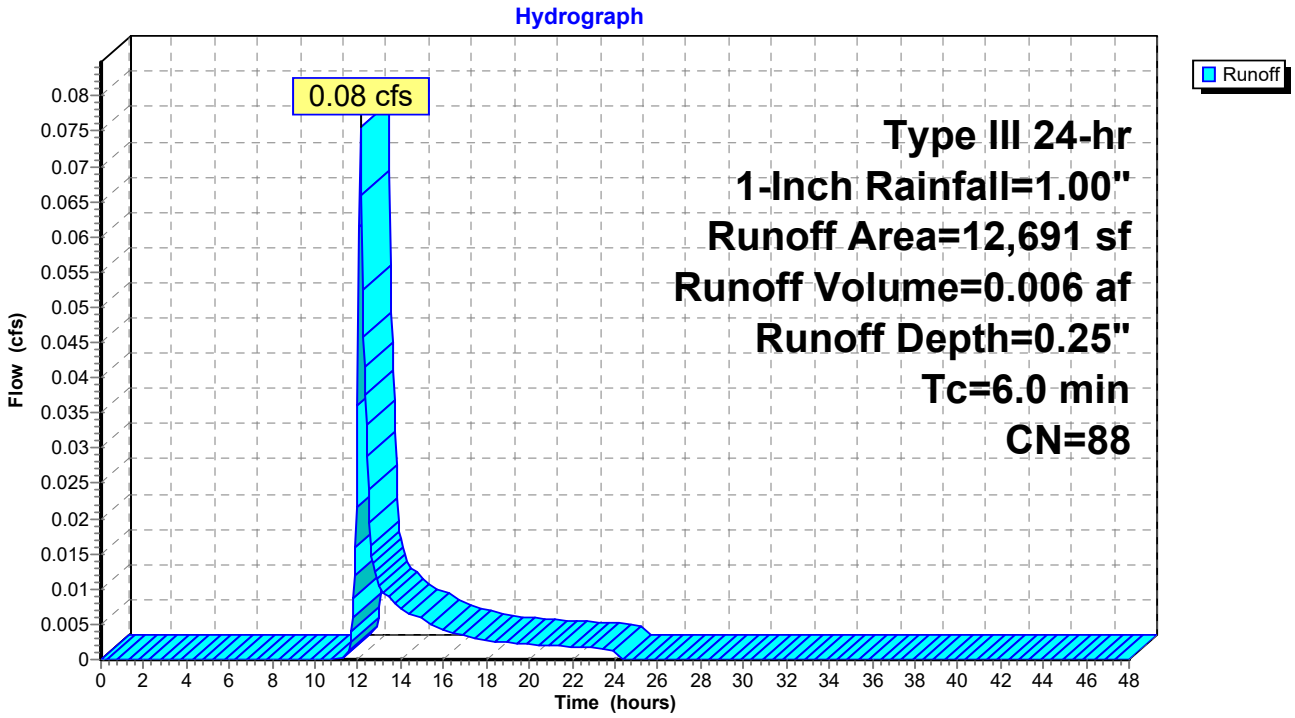
Runoff = 0.08 cfs @ 12.10 hrs, Volume= 0.006 af, Depth= 0.25"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 1-Inch Rainfall=1.00"

Area (sf)	CN	Description
5,116	74	>75% Grass cover, Good, HSG C
7,575	98	Paved parking, HSG C
12,691	88	Weighted Average
5,116		40.31% Pervious Area
7,575		59.69% Impervious Area

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

Subcatchment P-5: P-5

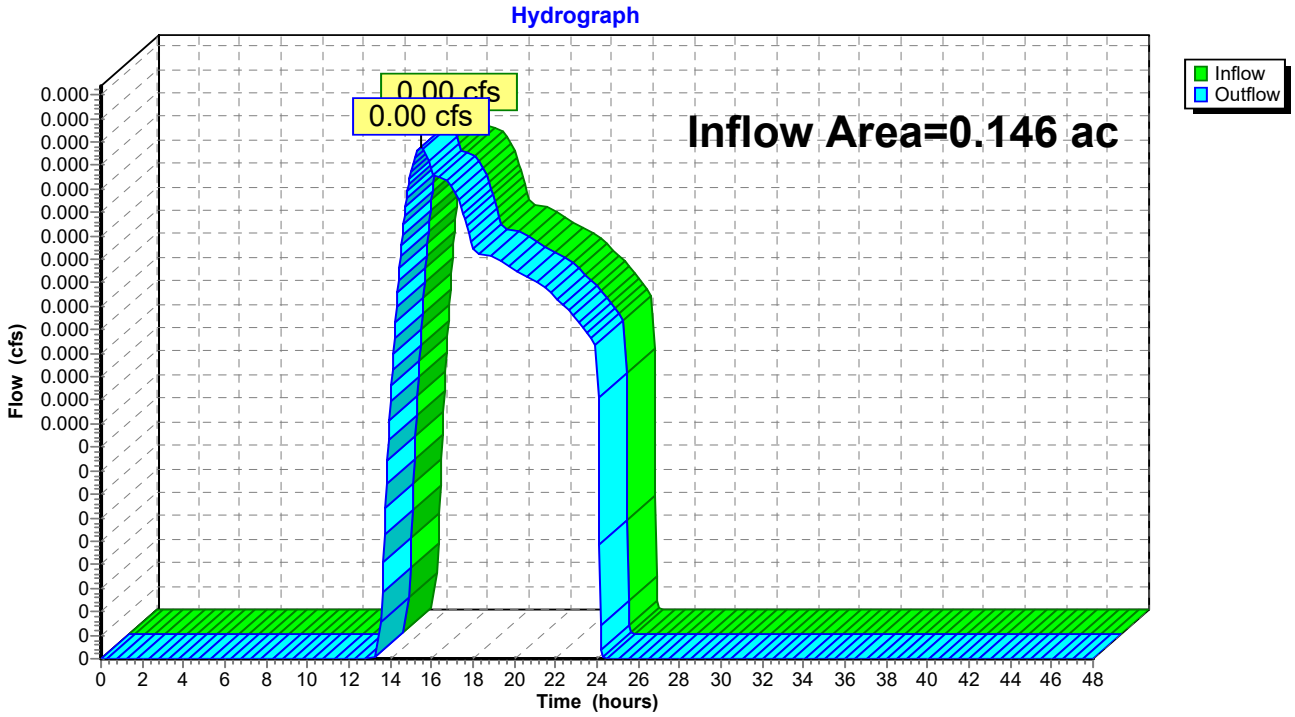


Summary for Reach DP-1: Design Point 1 (Wetland B)

Inflow Area = 0.146 ac, 0.00% Impervious, Inflow Depth = 0.01" for 1-Inch event
Inflow = 0.00 cfs @ 15.50 hrs, Volume= 0.000 af
Outflow = 0.00 cfs @ 15.50 hrs, Volume= 0.000 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Reach DP-1: Design Point 1 (Wetland B)

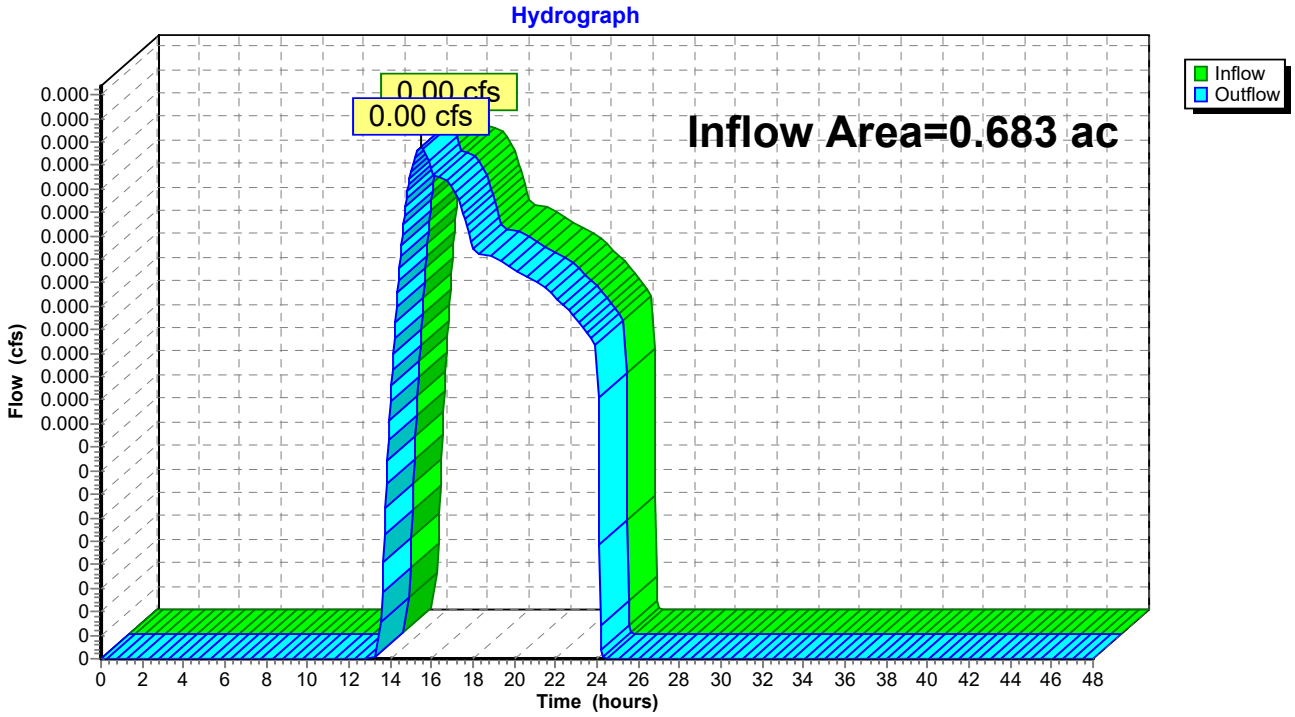


Summary for Reach DP-2: Design Point 2 (15" RCP to Wetland A)

Inflow Area = 0.683 ac, 74.45% Impervious, Inflow Depth = 0.00" for 1-Inch event
Inflow = 0.00 cfs @ 15.50 hrs, Volume= 0.000 af
Outflow = 0.00 cfs @ 15.50 hrs, Volume= 0.000 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Reach DP-2: Design Point 2 (15" RCP to Wetland A)

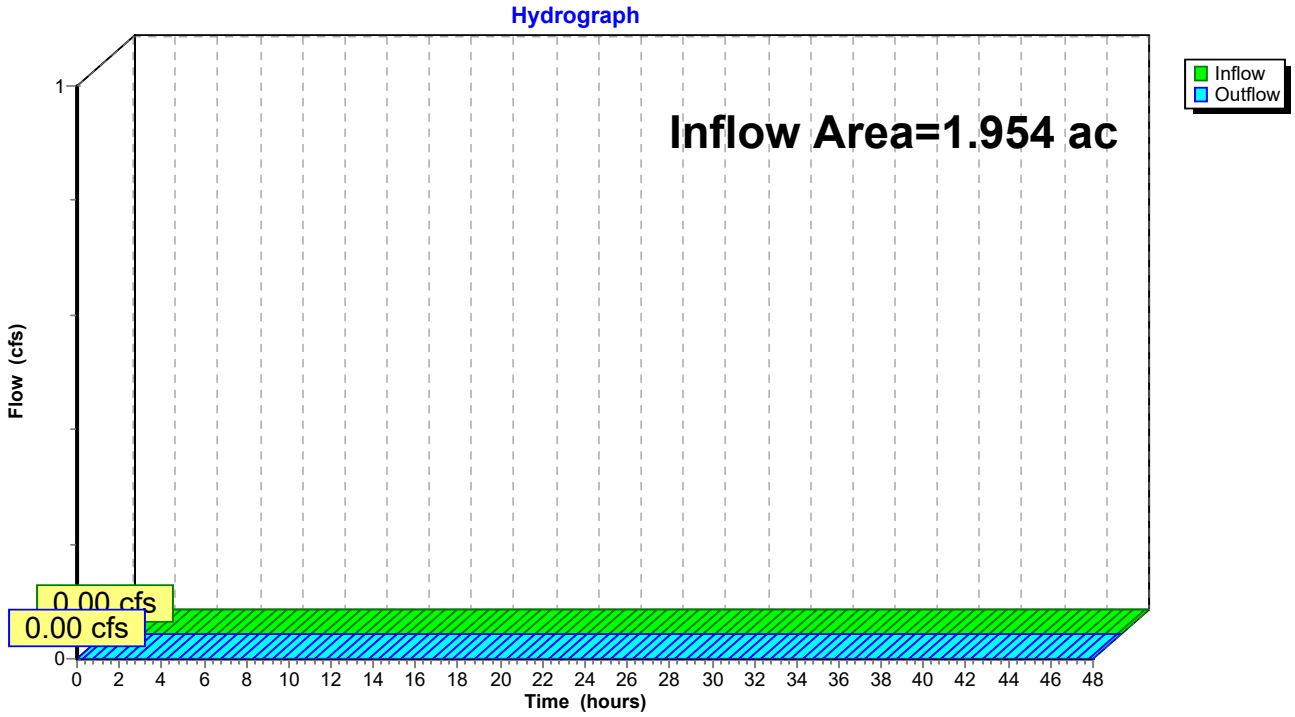


Summary for Reach DP-3: Design Point 3 (Existing Drainage Ditch)

Inflow Area = 1.954 ac, 81.04% Impervious, Inflow Depth = 0.00" for 1-Inch event
Inflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Reach DP-3: Design Point 3 (Existing Drainage Ditch)

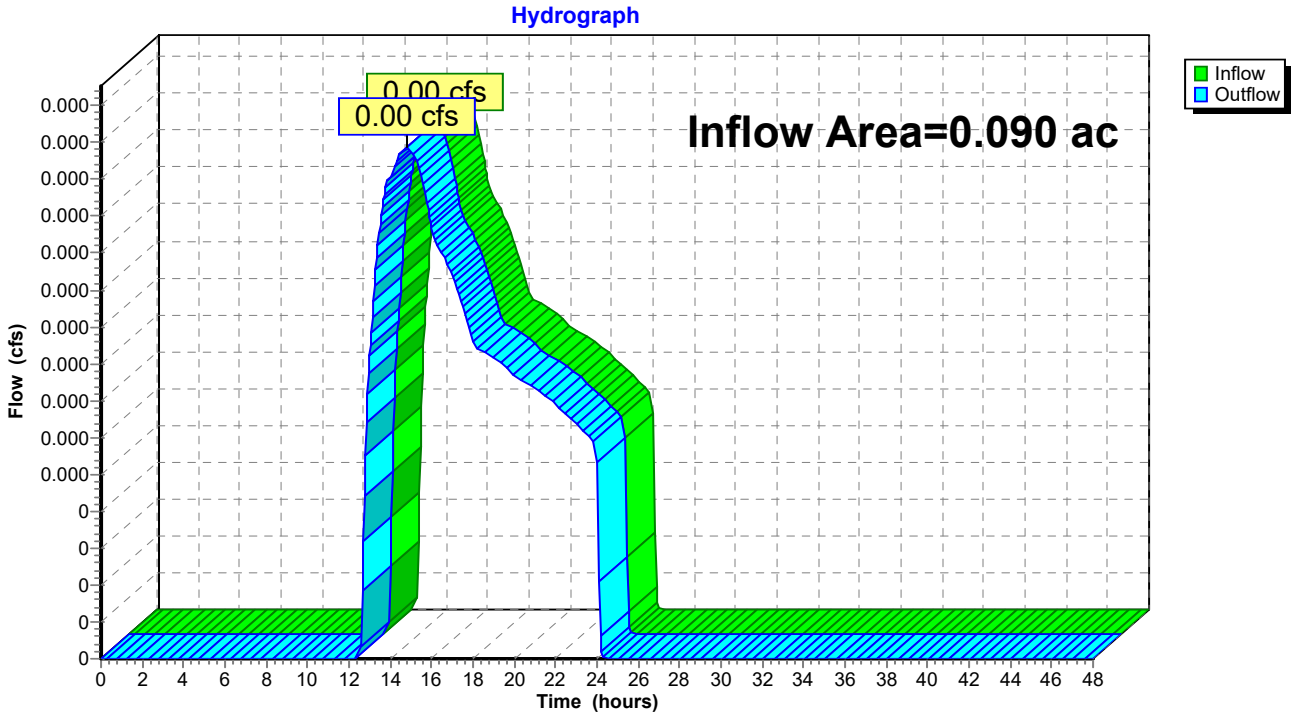


Summary for Reach DP-4: Design Point 4 (MassDOT 30" CB-2)

Inflow Area = 0.090 ac, 0.00% Impervious, Inflow Depth = 0.02" for 1-Inch event
Inflow = 0.00 cfs @ 14.78 hrs, Volume= 0.000 af
Outflow = 0.00 cfs @ 14.78 hrs, Volume= 0.000 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Reach DP-4: Design Point 4 (MassDOT 30" CB-2)

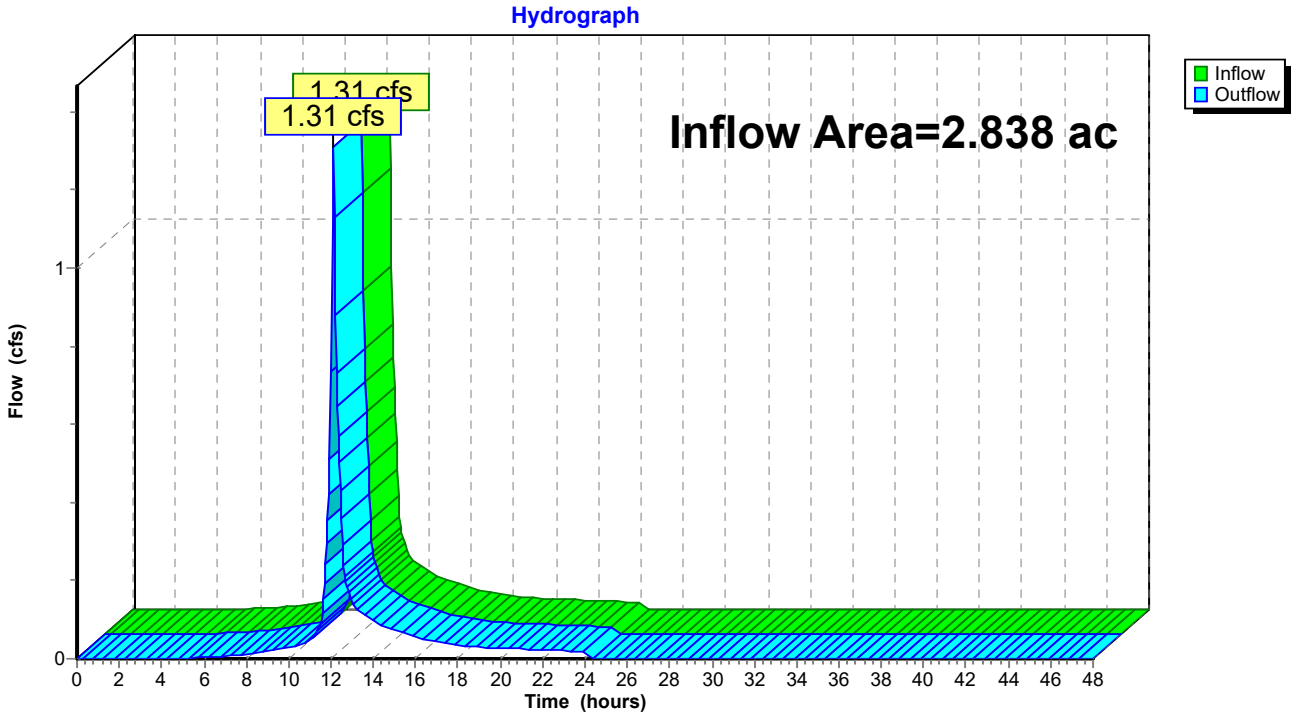


Summary for Reach DP-5: Design Point 5 (Existing Constructed Stormwater Wetland)

Inflow Area = 2.838 ac, 74.70% Impervious, Inflow Depth = 0.44" for 1-Inch event
Inflow = 1.31 cfs @ 12.10 hrs, Volume= 0.104 af
Outflow = 1.31 cfs @ 12.10 hrs, Volume= 0.104 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Reach DP-5: Design Point 5 (Existing Constructed Stormwater Wetland)

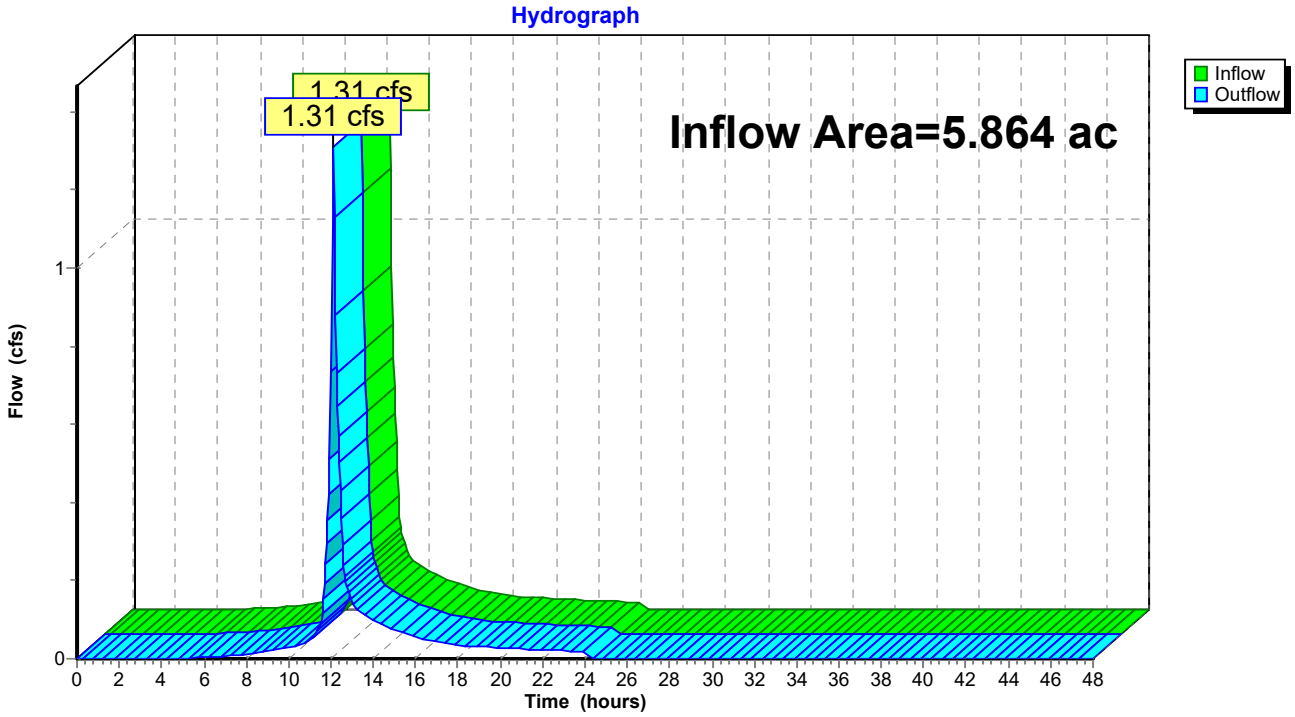


Summary for Reach DP-6: Wetland A - Design Point 6

Inflow Area = 5.864 ac, 71.84% Impervious, Inflow Depth = 0.21" for 1-Inch event
Inflow = 1.31 cfs @ 12.10 hrs, Volume= 0.105 af
Outflow = 1.31 cfs @ 12.10 hrs, Volume= 0.105 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Reach DP-6: Wetland A - Design Point 6



Summary for Pond 3P: Conveyance Swale

Inflow Area = 0.471 ac, 52.65% Impervious, Inflow Depth = 0.20" for 1-Inch event
Inflow = 0.09 cfs @ 12.11 hrs, Volume= 0.008 af
Outflow = 0.05 cfs @ 12.29 hrs, Volume= 0.008 af, Atten= 39%, Lag= 11.0 min
Primary = 0.05 cfs @ 12.29 hrs, Volume= 0.008 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs / 2
Peak Elev= 125.10' @ 12.29 hrs Surf.Area= 477 sf Storage= 45 cf

Plug-Flow detention time= 32.8 min calculated for 0.008 af (100% of inflow)
Center-of-Mass det. time= 33.3 min (925.4 - 892.2)

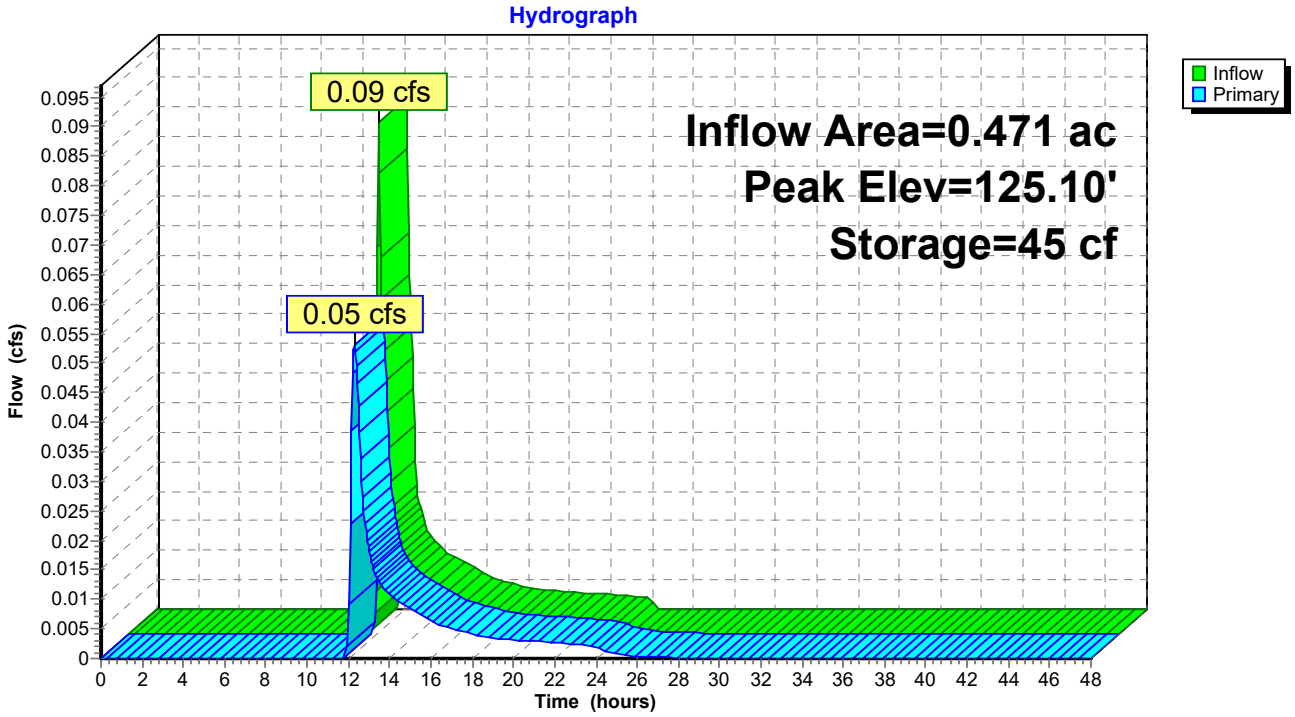
Volume	Invert	Avail.Storage	Storage Description
#1	125.00'	1,147 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
125.00	436	0	0
126.00	848	642	642
126.50	1,170	505	1,147

Device	Routing	Invert	Outlet Devices
#1	Primary	124.18'	**12.0" Round Culvert** L= 10.0' Ke= 0.500 Inlet / Outlet Invert= 124.18' / 124.13' S= 0.0050 '/' Cc= 0.900 n= 0.011 Concrete pipe, straight & clean, Flow Area= 0.79 sf
#2	Device 1	125.00'	**18.0" Vert. Orifice/Grate** C= 0.600

Primary OutFlow Max=0.05 cfs @ 12.29 hrs HW=125.10' (Free Discharge)
↑**1=Culvert** (Passes 0.05 cfs of 1.89 cfs potential flow)
↑**2=Orifice/Grate** (Orifice Controls 0.05 cfs @ 1.07 fps)

Pond 3P: Conveyance Swale



Summary for Pond 8P: UG-1 3 ft Retain IT

Inflow Area = 1.954 ac, 81.04% Impervious, Inflow Depth = 0.52" for 1-Inch event
Inflow = 1.04 cfs @ 12.09 hrs, Volume= 0.084 af
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 100%, Lag= 0.0 min
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs / 2
Peak Elev= 122.30' @ 48.00 hrs Surf.Area= 15,300 sf Storage= 3,658 cf

Plug-Flow detention time= (not calculated: initial storage exceeds outflow)
Center-of-Mass det. time= (not calculated: no outflow)

Volume	Invert	Avail.Storage	Storage Description
#1A	121.75'	3,817 cf	**90.00'W x 170.00'L x 4.17'H Field A** 63,750 cf Overall - 54,208 cf Embedded = 9,542 cf x 40.0% Voids
#2A	122.25'	39,109 cf	**retain_it retain_it 3.0'** x 231 Inside #1 Inside= 84.0"W x 36.0"H => 21.33 sf x 8.00'L = 170.6 cf Outside= 96.0"W x 44.0"H => 29.33 sf x 8.00'L = 234.7 cf 11 Rows adjusted for 302.1 cf perimeter wall
		42,926 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	124.25'	**12.0" Round HDPE_Round 12"** L= 12.5' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 124.25' / 124.18' S= 0.0056 '/' Cc= 0.900 n= 0.011 Concrete pipe, straight & clean, Flow Area= 0.79 sf
#2	Device 1	124.40'	**4.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=121.75' (Free Discharge)
↑—**1=HDPE_Round 12"** (Controls 0.00 cfs)
↑—**2=Sharp-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 8P: UG-1 3 ft Retain IT - Chamber Wizard Field A

Chamber Model = retain_it retain_it 3.0' (retain-it®)
Inside= 84.0"W x 36.0"H => 21.33 sf x 8.00'L = 170.6 cf
Outside= 96.0"W x 44.0"H => 29.33 sf x 8.00'L = 234.7 cf
11 Rows adjusted for 302.1 cf perimeter wall

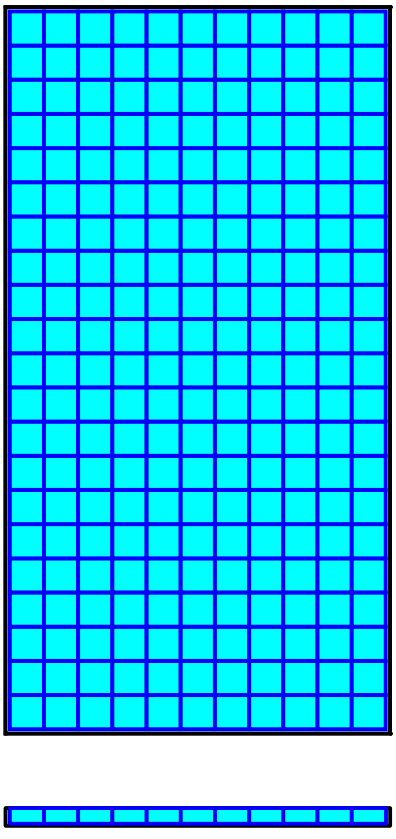
21 Chambers/Row x 8.00' Long = 168.00' Row Length +12.0" End Stone x 2 = 170.00' Base Length
11 Rows x 96.0" Wide + 12.0" Side Stone x 2 = 90.00' Base Width
6.0" Base + 44.0" Chamber Height = 4.17' Field Height

4.7 cf Sidewall x 21 x 2 + 4.7 cf Endwall x 11 x 2 = 302.1 cf Perimeter Wall
231 Chambers x 170.6 cf - 302.1 cf Perimeter wall = 39,108.9 cf Chamber Storage
231 Chambers x 234.7 cf = 54,208.0 cf Displacement

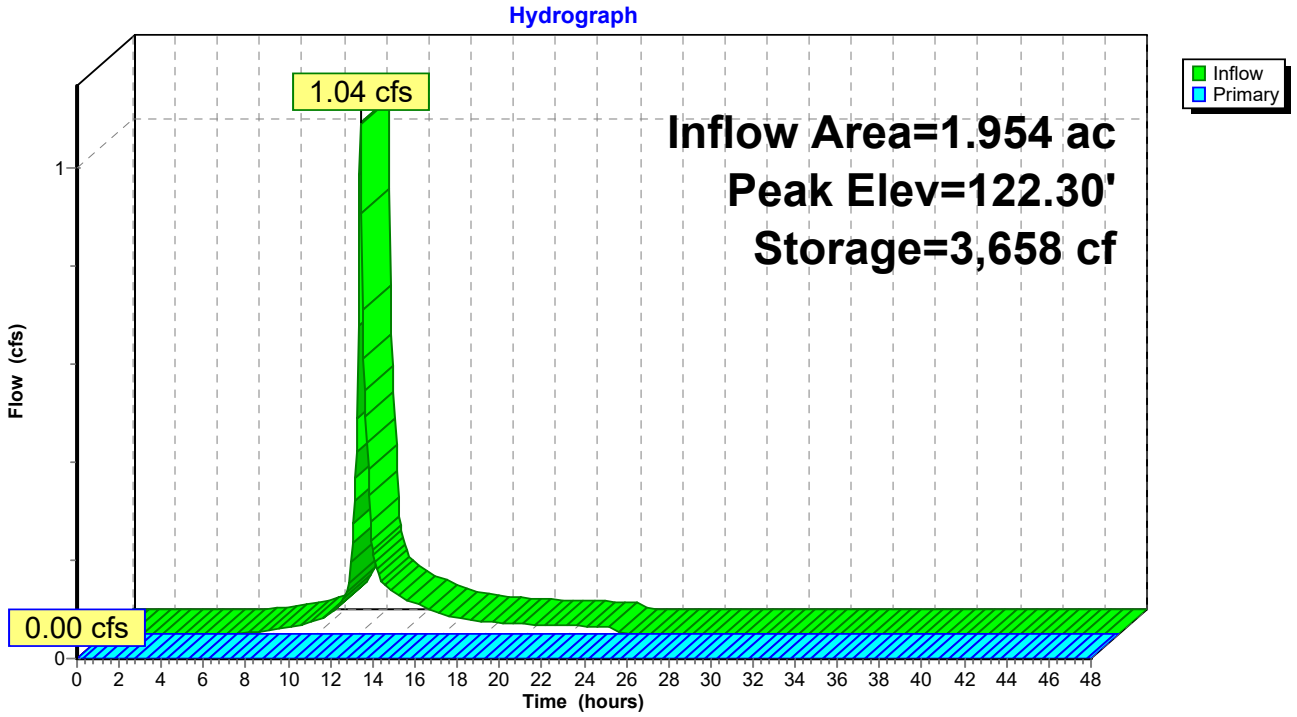
63,750.0 cf Field - 54,208.0 cf Chambers = 9,542.0 cf Stone x 40.0% Voids = 3,816.8 cf Stone Storage

Chamber Storage + Stone Storage = 42,925.7 cf = 0.985 af
Overall Storage Efficiency = 67.3%
Overall System Size = 170.00' x 90.00' x 4.17'

231 Chambers
2,361.1 cy Field
353.4 cy Stone



Pond 8P: UG-1 3 ft Retain IT



Summary for Pond 11P: Permeable Pavement

Inflow Area = 0.537 ac, 94.68% Impervious, Inflow Depth = 0.71" for 1-Inch event
Inflow = 0.43 cfs @ 12.09 hrs, Volume= 0.032 af
Outflow = 0.14 cfs @ 12.00 hrs, Volume= 0.032 af, Atten= 68%, Lag= 0.0 min
Discarded = 0.14 cfs @ 12.00 hrs, Volume= 0.032 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Peak Elev= 122.78' @ 12.40 hrs Surf.Area= 22,160 sf Storage= 286 cf

Plug-Flow detention time= 17.1 min calculated for 0.032 af (100% of inflow)
Center-of-Mass det. time= 17.0 min (819.5 - 802.5)

Volume	Invert	Avail.Storage	Storage Description
#1	122.75'	7,512 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

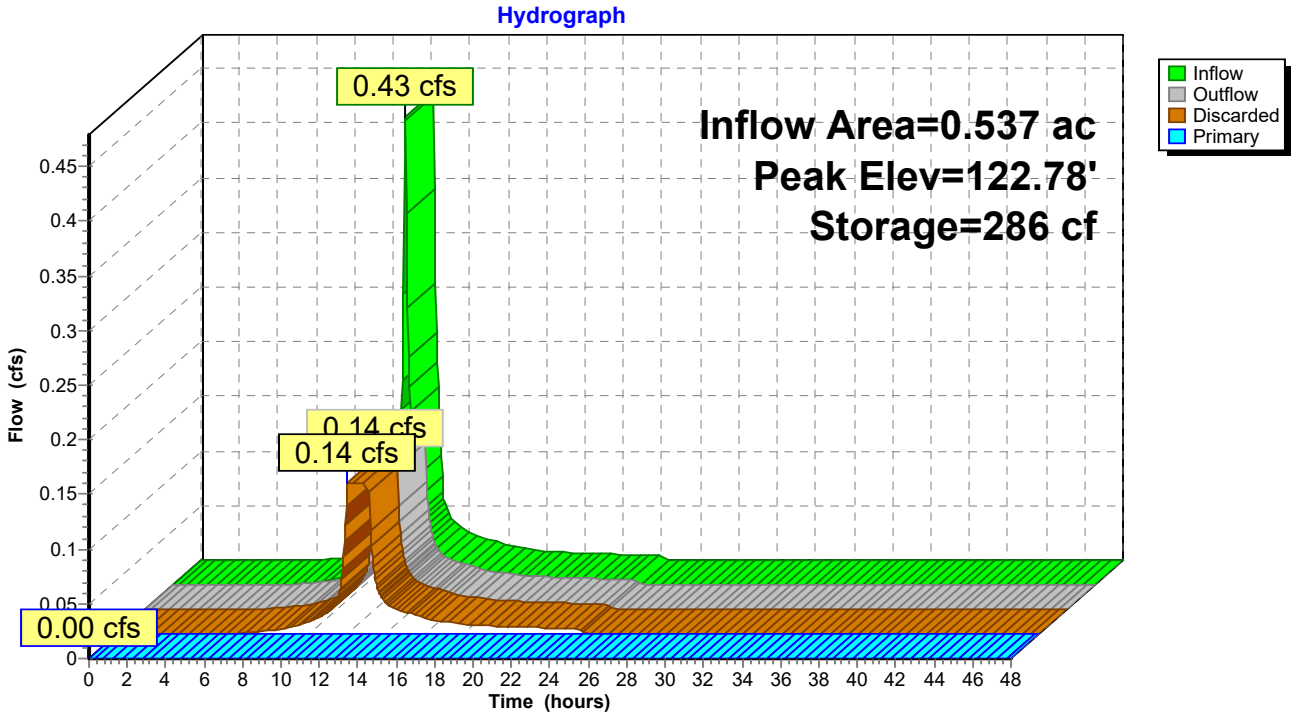
Elevation (feet)	Surf.Area (sq-ft)	Voids (%)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
122.75	22,160	0.0	0	0
123.41	22,160	40.0	5,850	5,850
123.66	22,160	30.0	1,662	7,512

Device	Routing	Invert	Outlet Devices
#1	Discarded	122.75'	**0.270 in/hr Exfiltration over Surface area**
#2	Primary	123.30'	**6.0" Round Culvert** L= 10.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 123.30' / 119.00' S= 0.4300 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 0.20 sf

Discarded OutFlow Max=0.14 cfs @ 12.00 hrs HW=122.76' (Free Discharge)
1=Exfiltration (Exfiltration Controls 0.14 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=122.75' (Free Discharge)
2=Culvert (Controls 0.00 cfs)

Pond 11P: Permeable Pavement



Summary for Subcatchment P-1A: Undetained to Wetland B

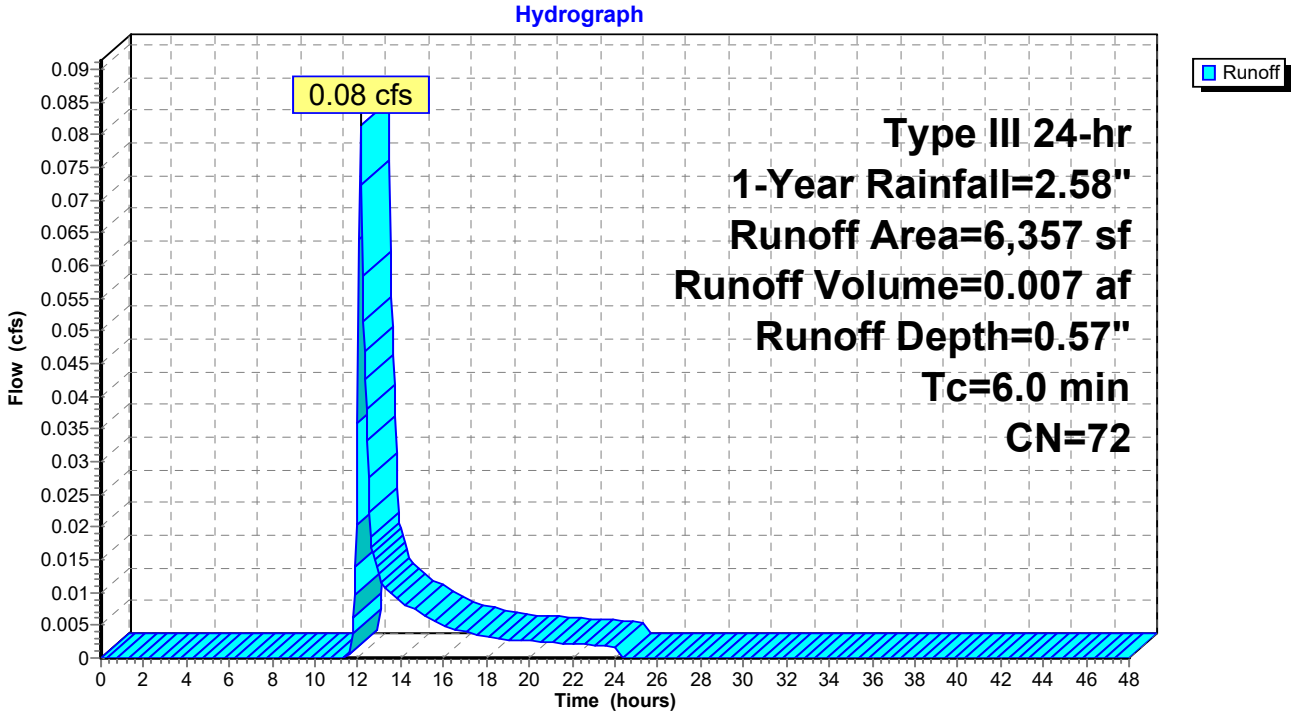
Runoff = 0.08 cfs @ 12.11 hrs, Volume= 0.007 af, Depth= 0.57"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 1-Year Rainfall=2.58"

Area (sf)	CN	Description
6,357	72	Woods/grass comb., Good, HSG C
6,357		100.00% Pervious Area

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

Subcatchment P-1A: Undetained to Wetland B



Summary for Subcatchment P-1B: Western Driveway

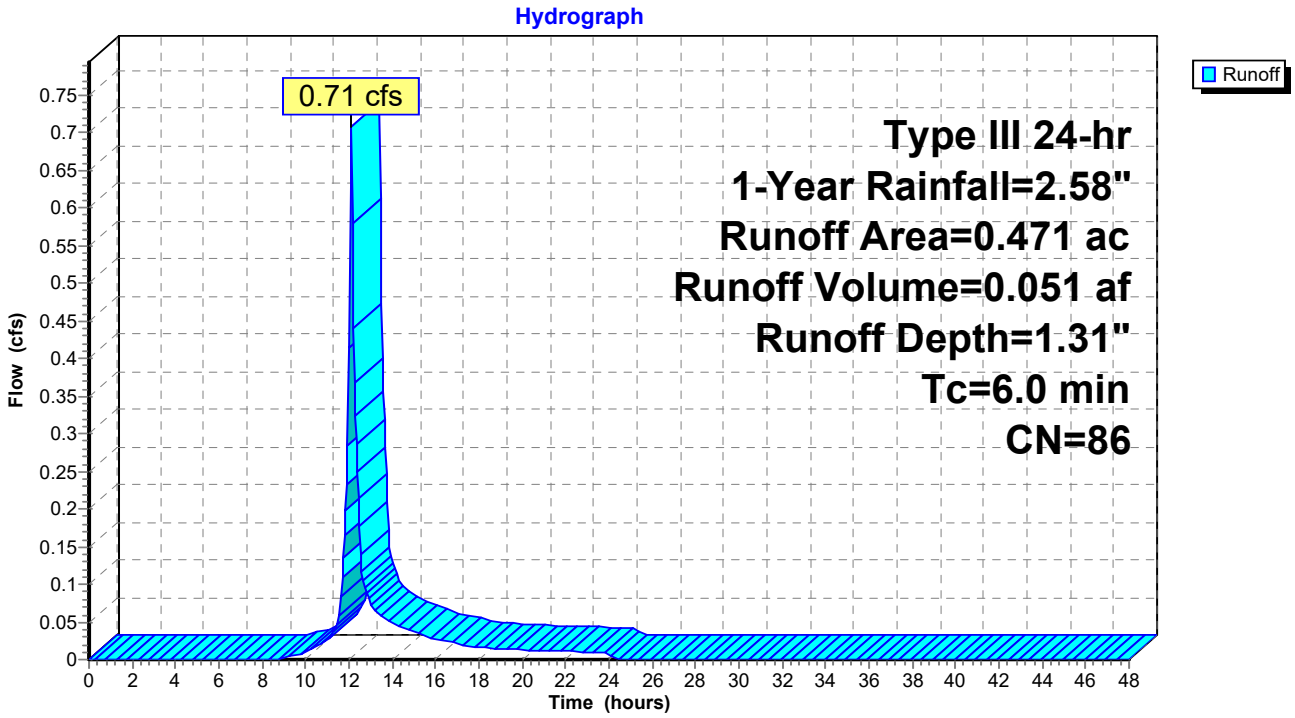
Runoff = 0.71 cfs @ 12.09 hrs, Volume= 0.051 af, Depth= 1.31"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 1-Year Rainfall=2.58"

Area (ac)	CN	Description
0.248	98	Paved parking, HSG C
0.223	72	Woods/grass comb., Good, HSG C
0.471	86	Weighted Average
0.223		47.35% Pervious Area
0.248		52.65% Impervious Area

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

Subcatchment P-1B: Western Driveway



Summary for Subcatchment P-1C: Permeable Pavement

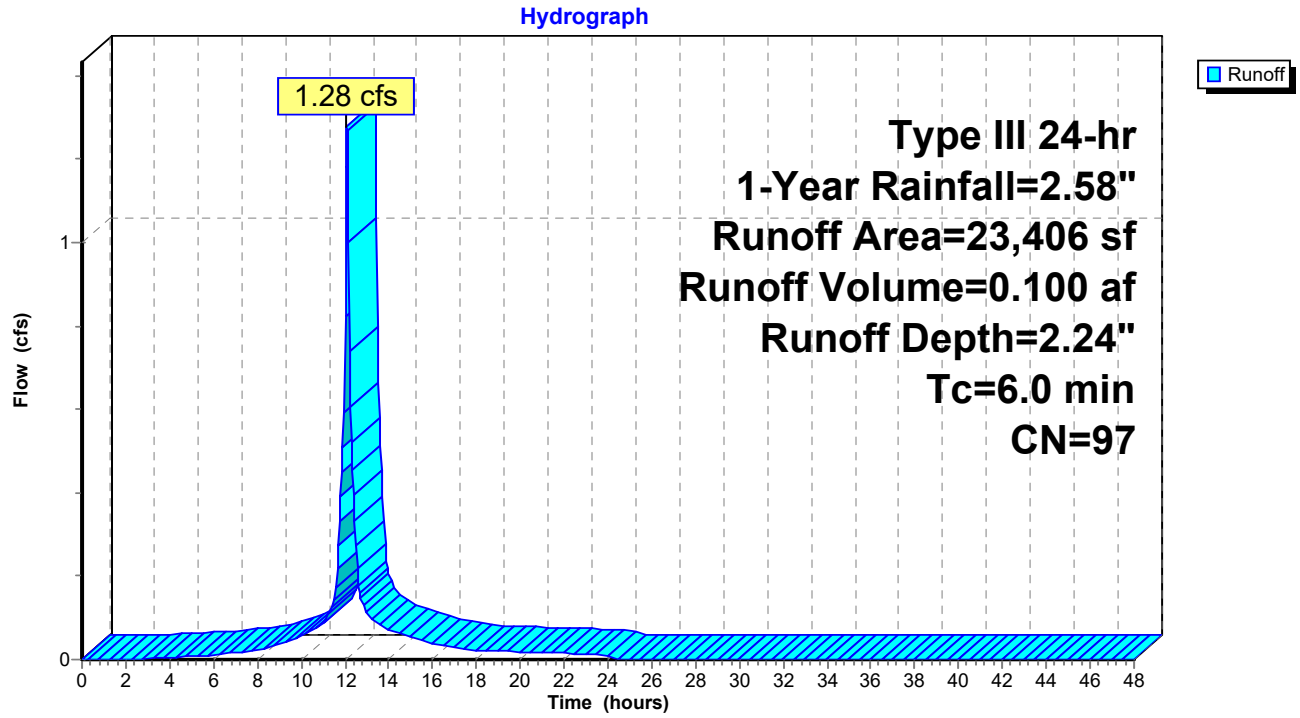
Runoff = 1.28 cfs @ 12.09 hrs, Volume= 0.100 af, Depth= 2.24"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 1-Year Rainfall=2.58"

Area (sf)	CN	Description
22,160	98	Paved parking, HSG C
1,246	74	>75% Grass cover, Good, HSG C
23,406	97	Weighted Average
1,246		5.32% Pervious Area
22,160		94.68% Impervious Area

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

Subcatchment P-1C: Permeable Pavement



Summary for Subcatchment P-2: Undetained to Wetland

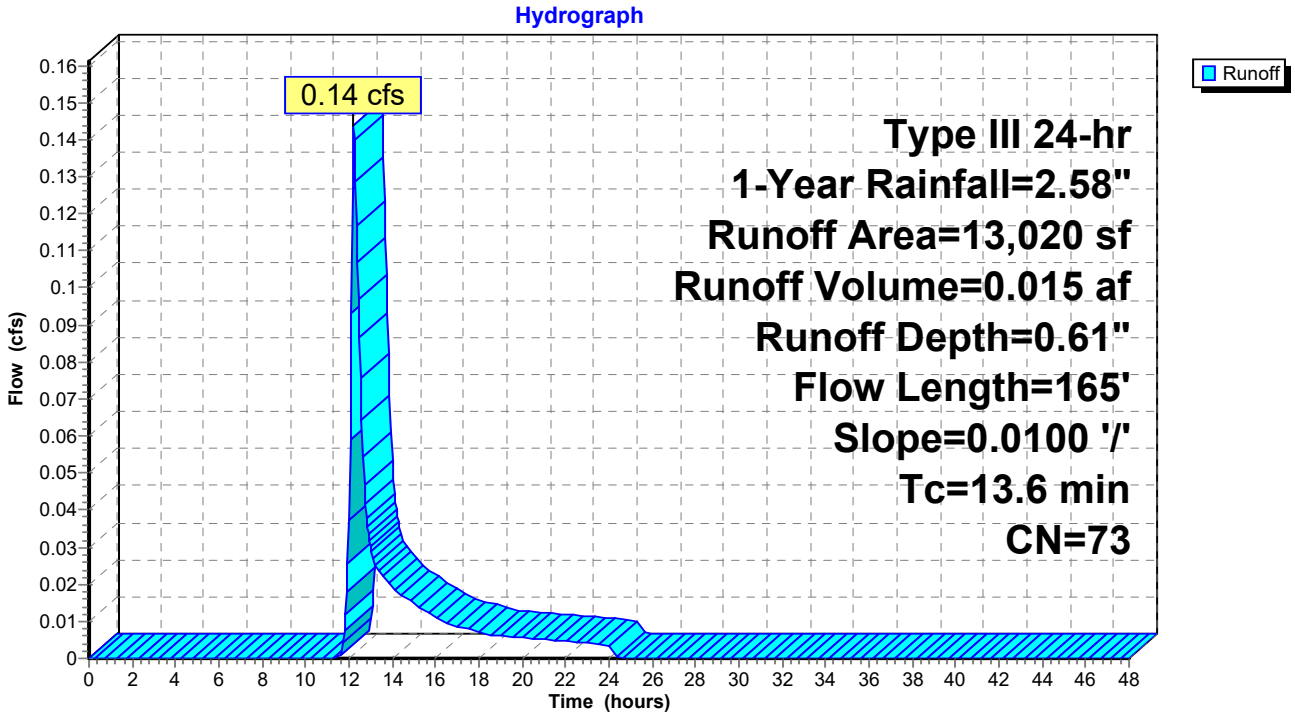
Runoff = 0.14 cfs @ 12.22 hrs, Volume= 0.015 af, Depth= 0.61"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 1-Year Rainfall=2.58"

Area (sf)	CN	Description
10,967	74	>75% Grass cover, Good, HSG C
2,053	70	Woods, Good, HSG C
13,020	73	Weighted Average
13,020		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.9	100	0.0100	0.13		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.20"
0.7	65	0.0100	1.61		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
13.6	165	Total			

Subcatchment P-2: Undetained to Wetland



Summary for Subcatchment P-3A: Existing Building & Additions and Upper Pavement

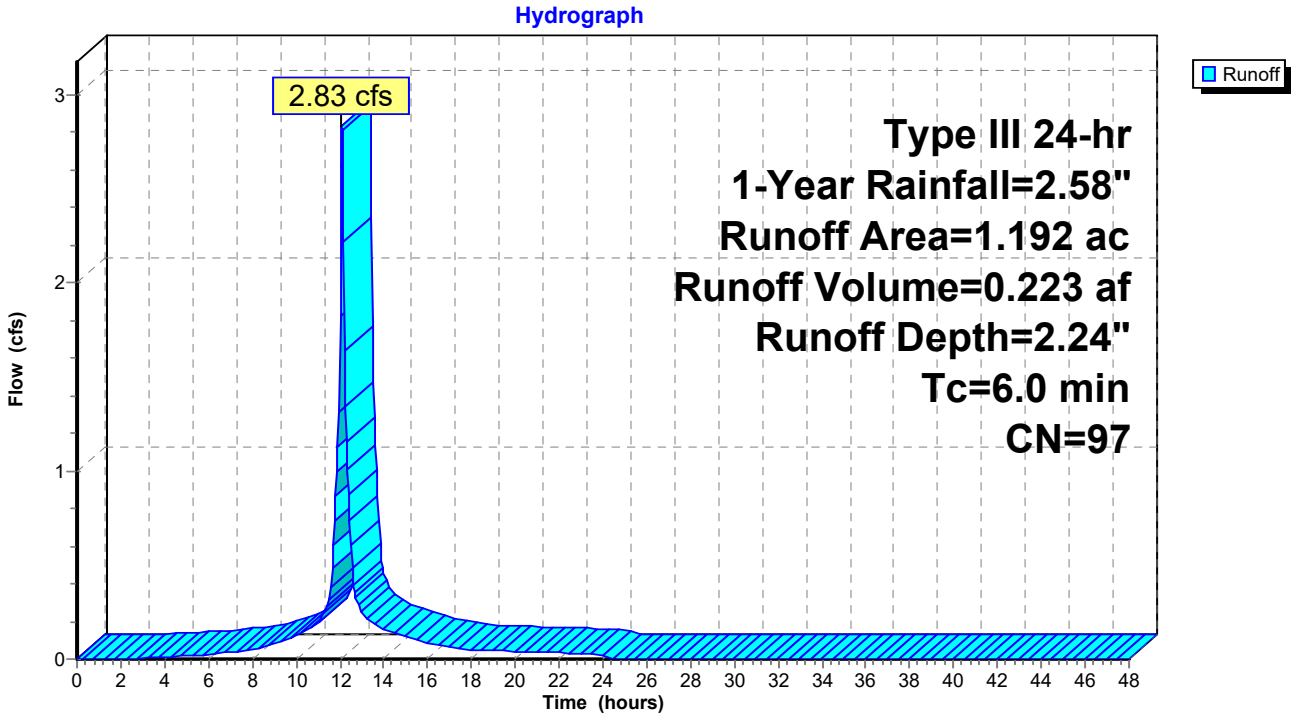
Runoff = 2.83 cfs @ 12.09 hrs, Volume= 0.223 af, Depth= 2.24"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 1-Year Rainfall=2.58"

Area (ac)	CN	Description
0.701	98	Paved parking, HSG C
0.461	98	Roofs, HSG C
0.030	74	>75% Grass cover, Good, HSG C
1.192	97	Weighted Average
0.030		2.52% Pervious Area
1.162		97.48% Impervious Area

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

Subcatchment P-3A: Existing Building & Additions and Upper Pavement



Summary for Subcatchment P-3B: Existing Building Draining to Constructed Wetland

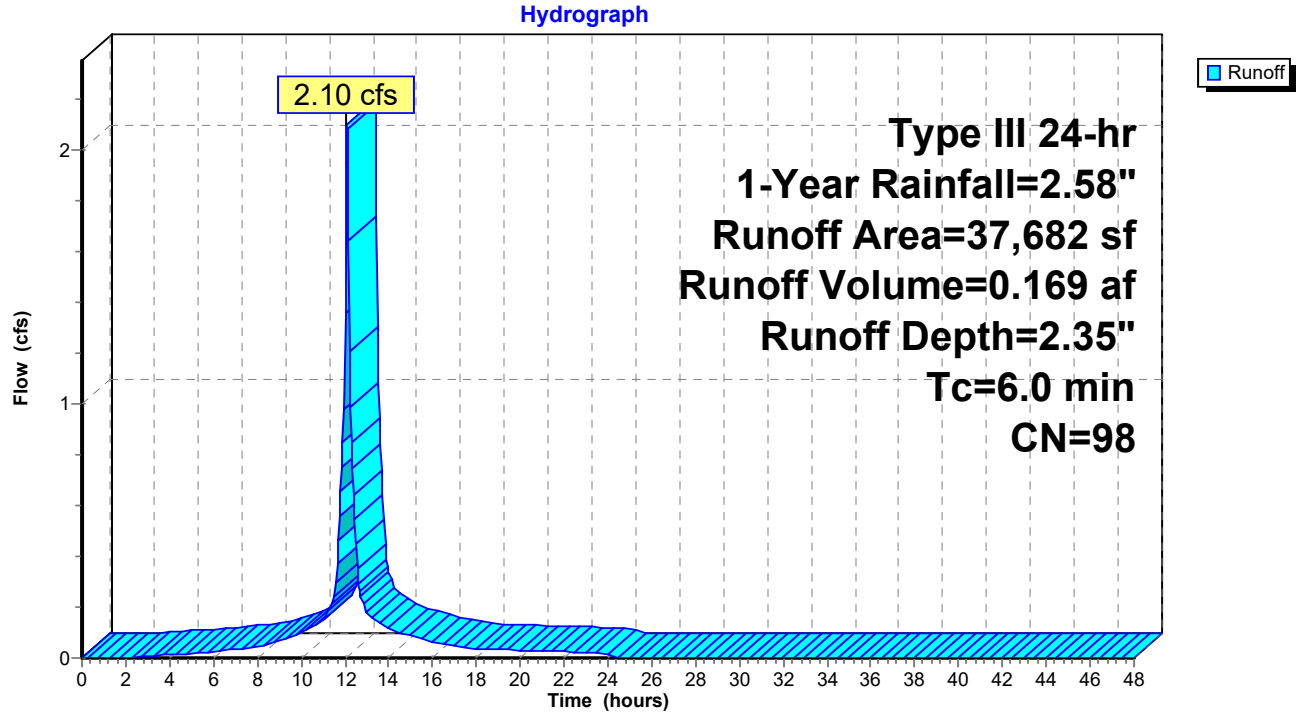
Runoff = 2.10 cfs @ 12.09 hrs, Volume= 0.169 af, Depth= 2.35"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 1-Year Rainfall=2.58"

Area (sf)	CN	Description
37,682	98	Roofs, HSG C
37,682		100.00% Impervious Area

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

Subcatchment P-3B: Existing Building Draining to Constructed Wetland



Summary for Subcatchment P-4: Watershed to Existing Stormwater System

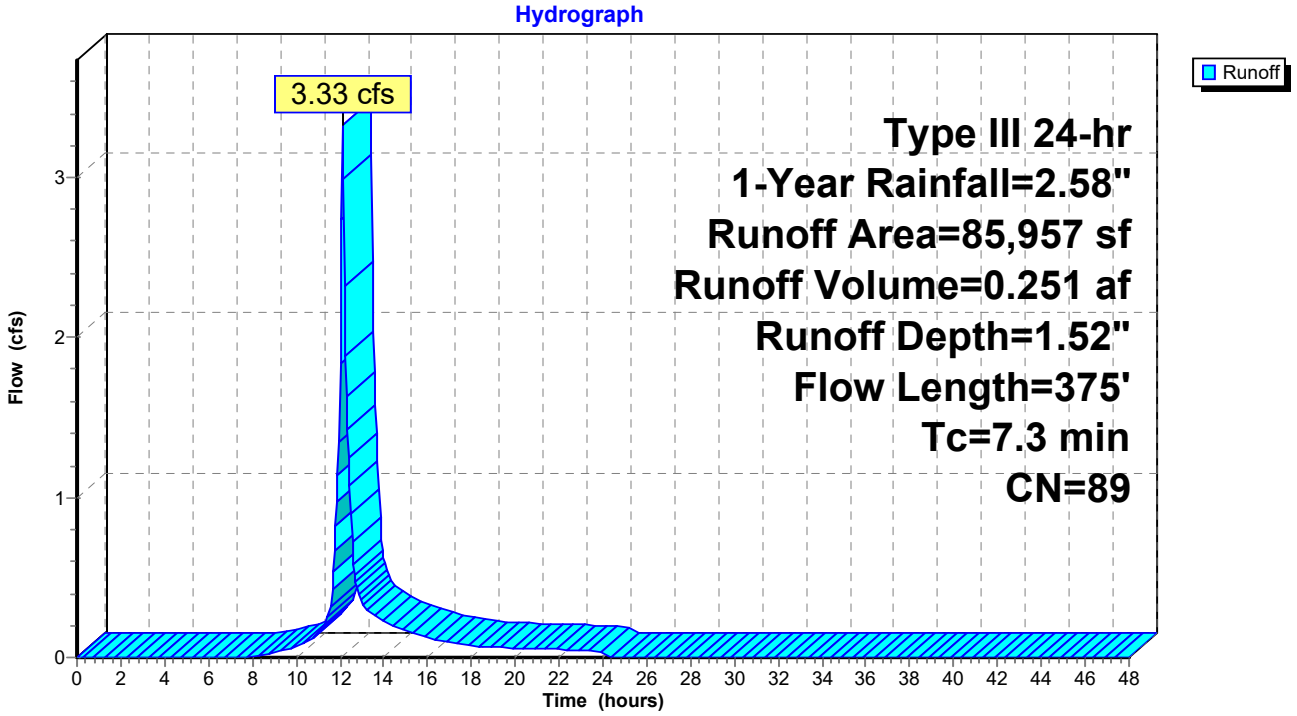
Runoff = 3.33 cfs @ 12.11 hrs, Volume= 0.251 af, Depth= 1.52"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 1-Year Rainfall=2.58"

Area (sf)	CN	Description
54,671	98	Paved parking, HSG C
29,238	74	>75% Grass cover, Good, HSG C
2,048	70	Woods, Good, HSG C
85,957	89	Weighted Average
31,286		36.40% Pervious Area
54,671		63.60% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.2	50	0.0240	0.16		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.20"
1.7	245	0.0220	2.39		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
0.4	80	0.0287	3.44		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
7.3	375	Total			

Subcatchment P-4: Watershed to Existing Stormwater System



Summary for Subcatchment P-4A: Watershed to MassDOT CB1

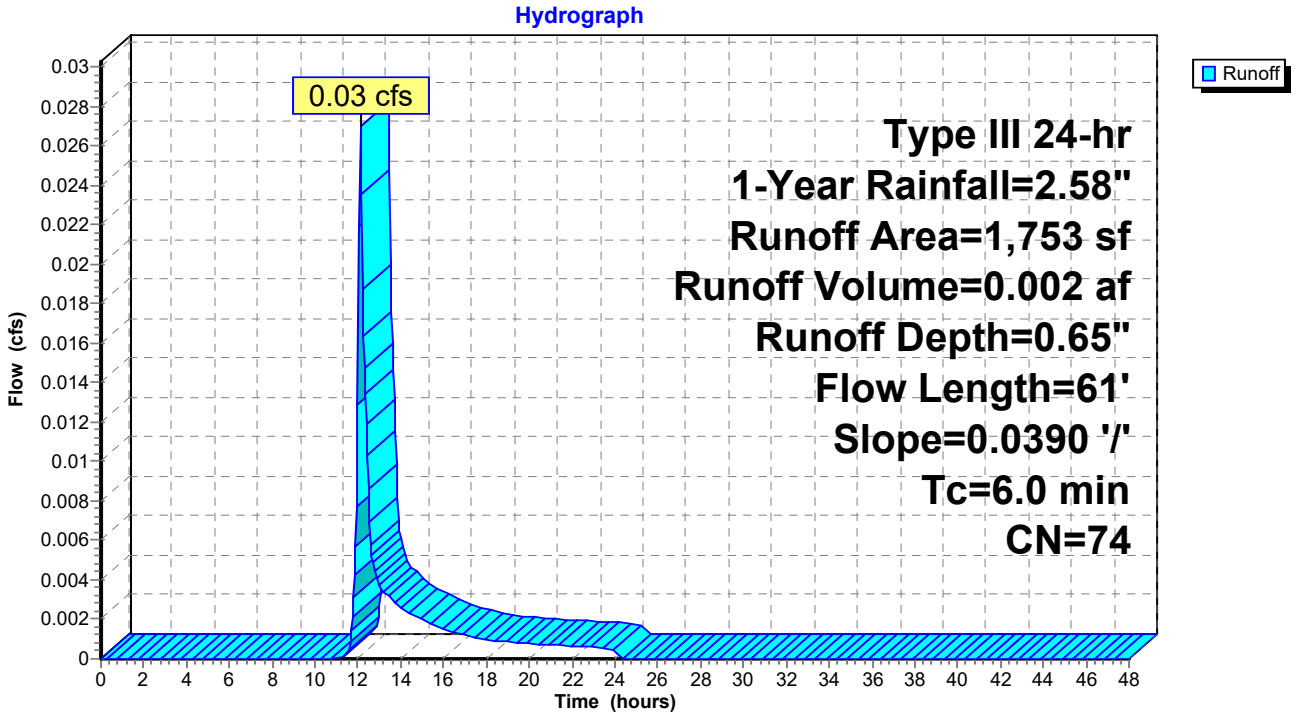
Runoff = 0.03 cfs @ 12.10 hrs, Volume= 0.002 af, Depth= 0.65"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 1-Year Rainfall=2.58"

Area (sf)	CN	Description
1,753	74	>75% Grass cover, Good, HSG C
1,753		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.1	61	0.0390	0.20		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.20"
0.9					**Direct Entry,**
6.0	61	Total			

Subcatchment P-4A: Watershed to MassDOT CB1



Summary for Subcatchment P-4B: Watershed to CB2

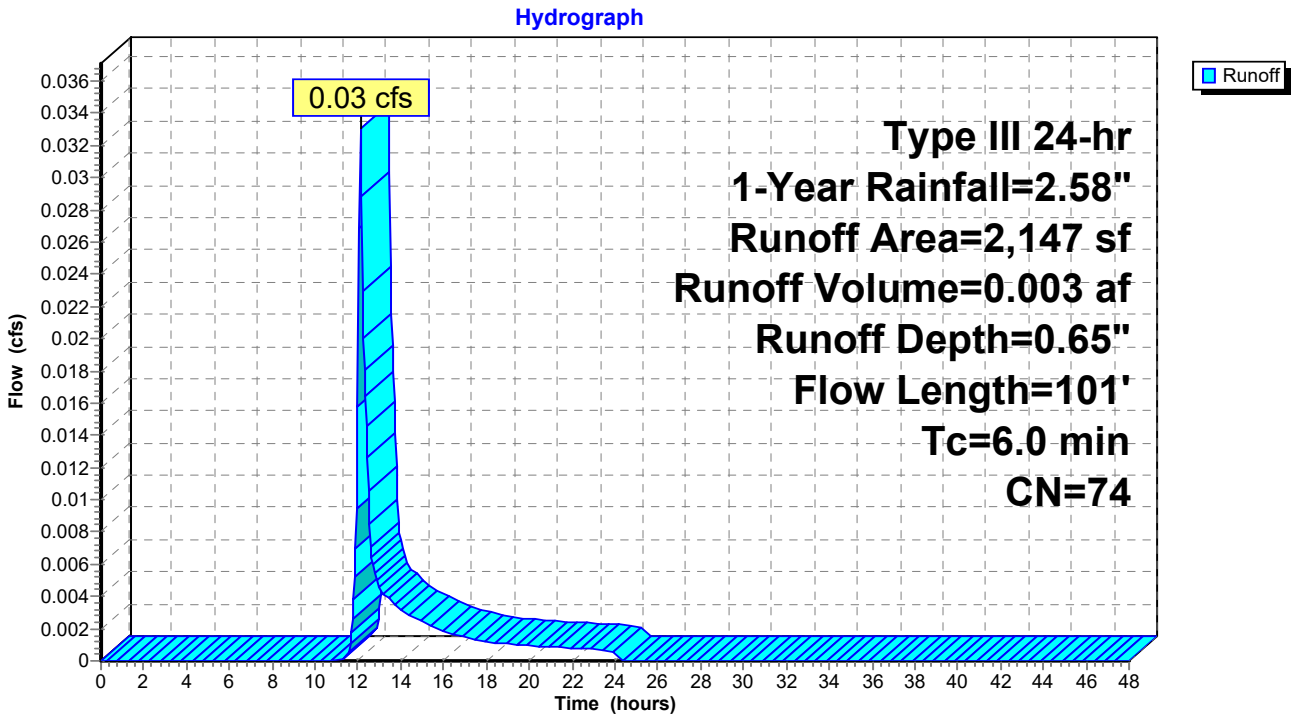
Runoff = 0.03 cfs @ 12.10 hrs, Volume= 0.003 af, Depth= 0.65"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 1-Year Rainfall=2.58"

Area (sf)	CN	Description
2,147	74	>75% Grass cover, Good, HSG C
2,147		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.6	50	0.0200	0.15		**Sheet Flow, SHeet Flow** Grass: Short n= 0.150 P2= 3.20"
0.3	51	0.0390	3.18		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
0.1					**Direct Entry, Miniumum**
6.0	101	Total			

Subcatchment P-4B: Watershed to CB2



Summary for Subcatchment P-5: P-5

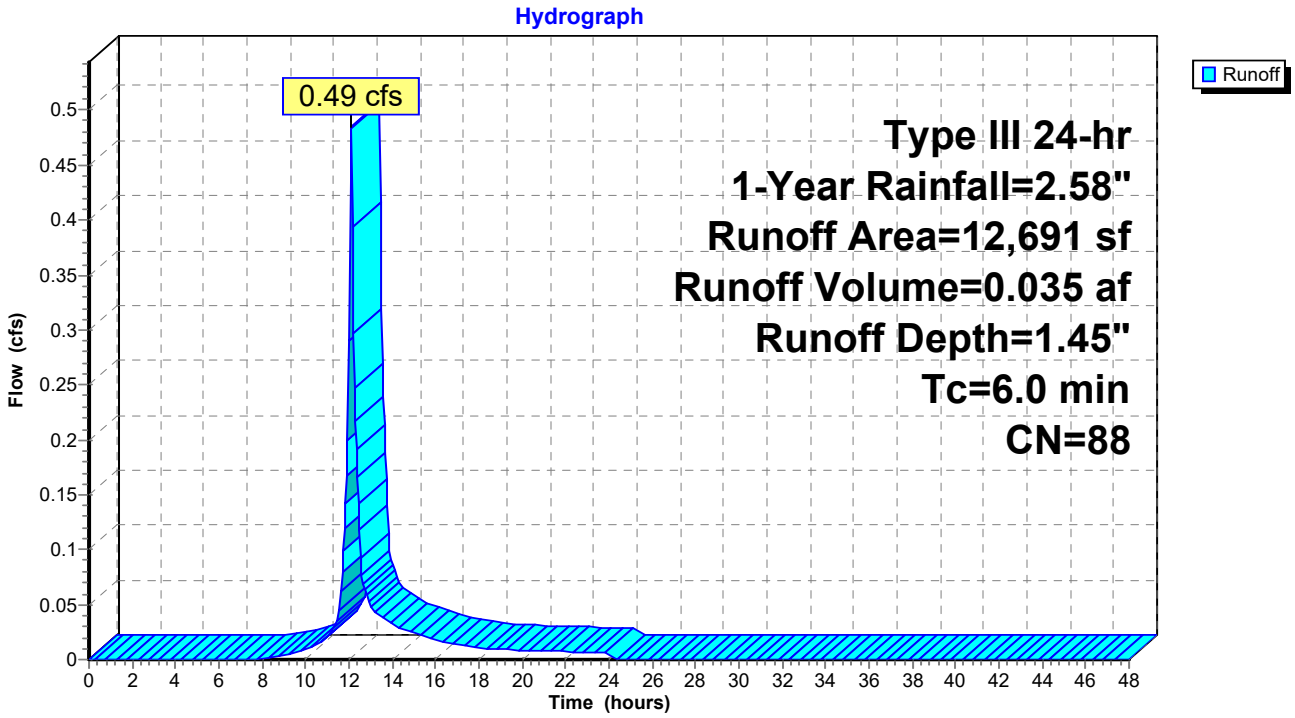
Runoff = 0.49 cfs @ 12.09 hrs, Volume= 0.035 af, Depth= 1.45"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 1-Year Rainfall=2.58"

Area (sf)	CN	Description
5,116	74	>75% Grass cover, Good, HSG C
7,575	98	Paved parking, HSG C
12,691	88	Weighted Average
5,116		40.31% Pervious Area
7,575		59.69% Impervious Area

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

Subcatchment P-5: P-5

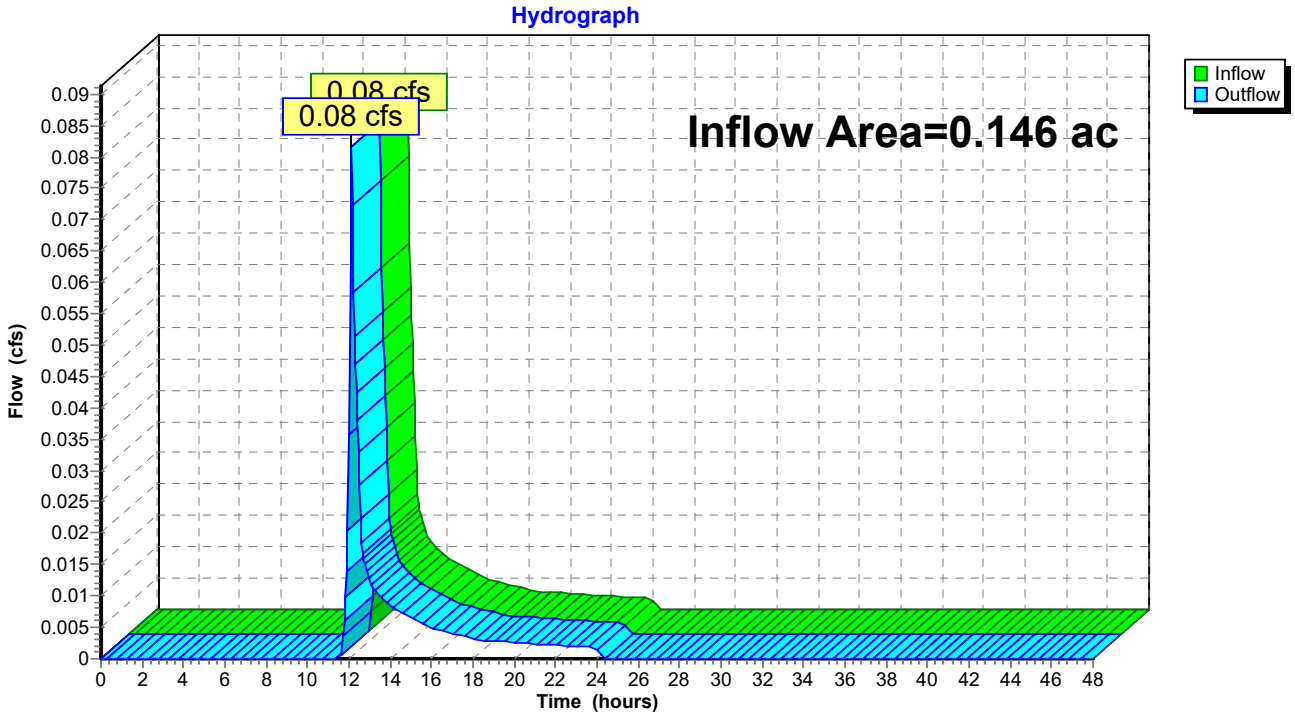


Summary for Reach DP-1: Design Point 1 (Wetland B)

Inflow Area = 0.146 ac, 0.00% Impervious, Inflow Depth = 0.57" for 1-Year event
Inflow = 0.08 cfs @ 12.11 hrs, Volume= 0.007 af
Outflow = 0.08 cfs @ 12.11 hrs, Volume= 0.007 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Reach DP-1: Design Point 1 (Wetland B)

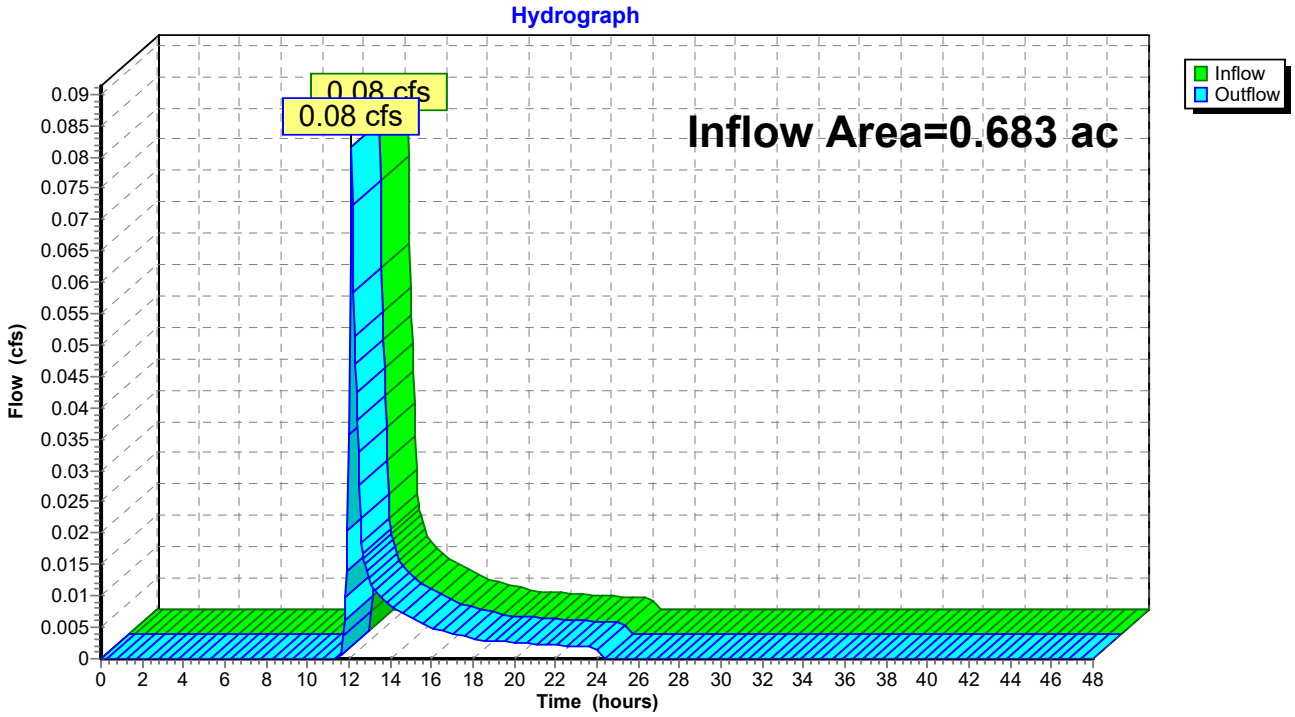


Summary for Reach DP-2: Design Point 2 (15" RCP to Wetland A)

Inflow Area = 0.683 ac, 74.45% Impervious, Inflow Depth = 0.12" for 1-Year event
Inflow = 0.08 cfs @ 12.11 hrs, Volume= 0.007 af
Outflow = 0.08 cfs @ 12.11 hrs, Volume= 0.007 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Reach DP-2: Design Point 2 (15" RCP to Wetland A)

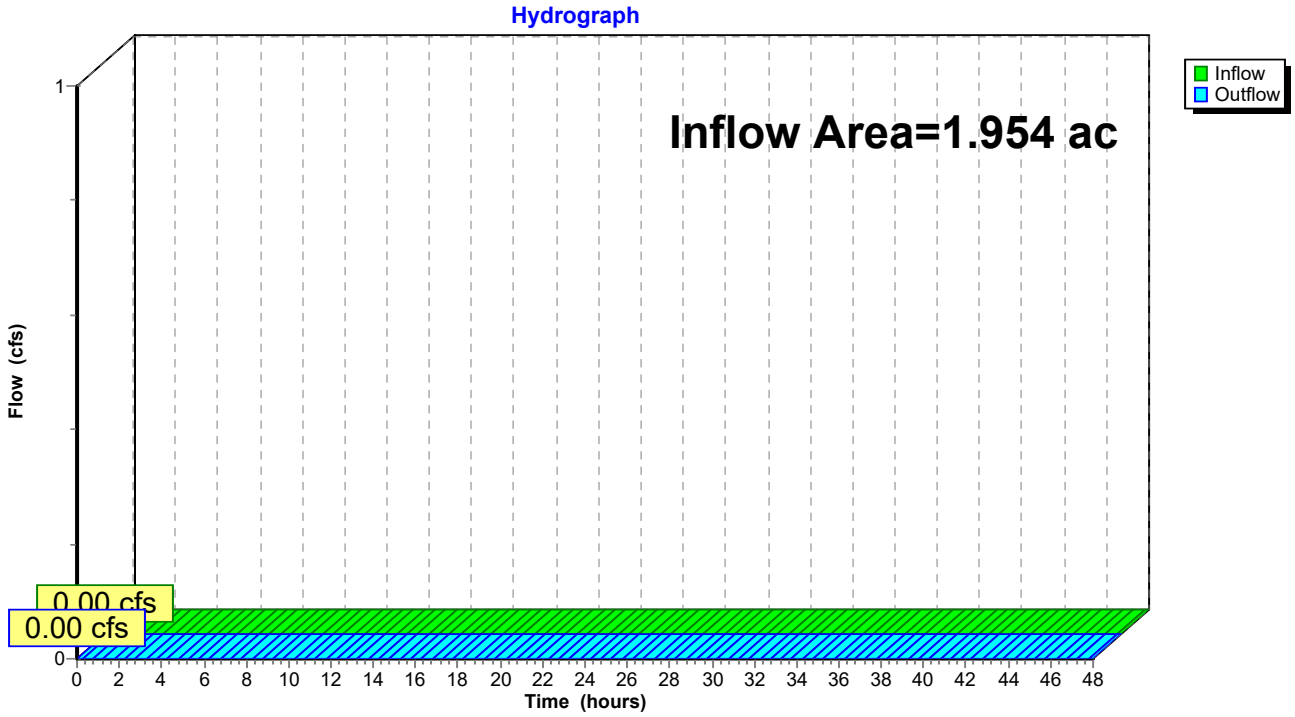


Summary for Reach DP-3: Design Point 3 (Existing Drainage Ditch)

Inflow Area = 1.954 ac, 81.04% Impervious, Inflow Depth = 0.00" for 1-Year event
Inflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Reach DP-3: Design Point 3 (Existing Drainage Ditch)

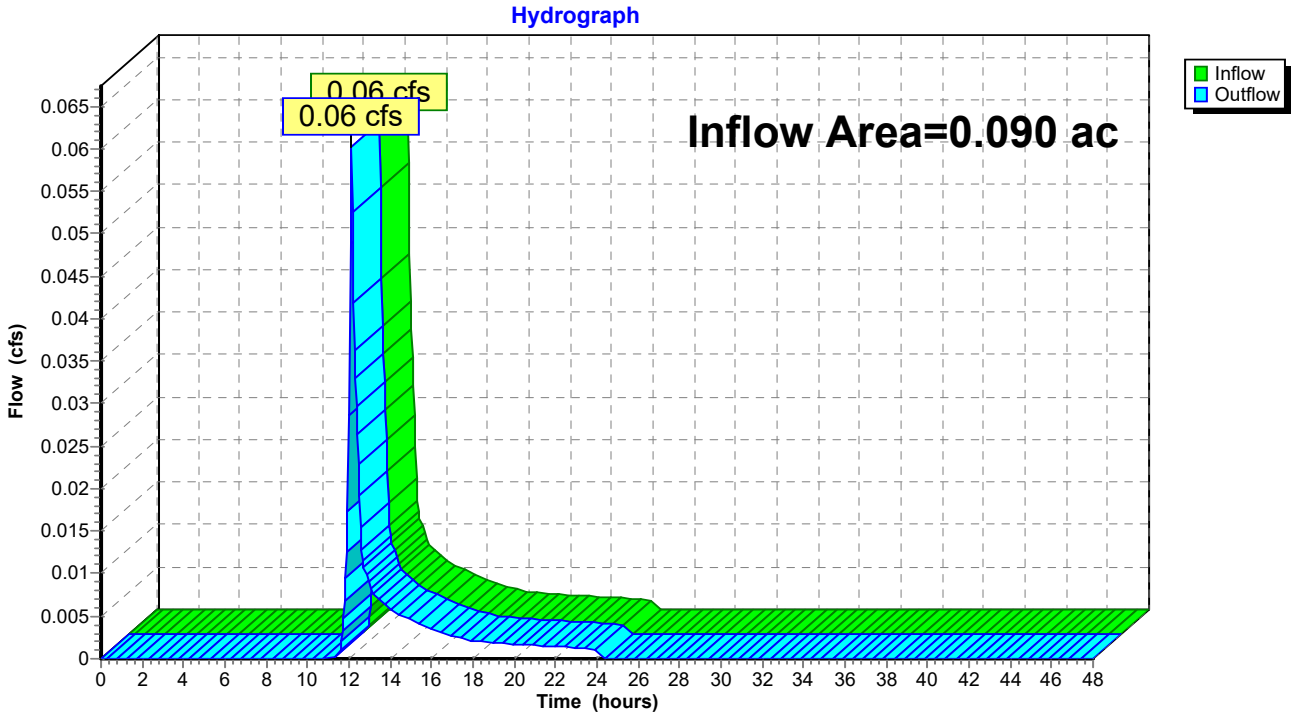


Summary for Reach DP-4: Design Point 4 (MassDOT 30" CB-2)

Inflow Area = 0.090 ac, 0.00% Impervious, Inflow Depth = 0.65" for 1-Year event
Inflow = 0.06 cfs @ 12.10 hrs, Volume= 0.005 af
Outflow = 0.06 cfs @ 12.10 hrs, Volume= 0.005 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Reach DP-4: Design Point 4 (MassDOT 30" CB-2)

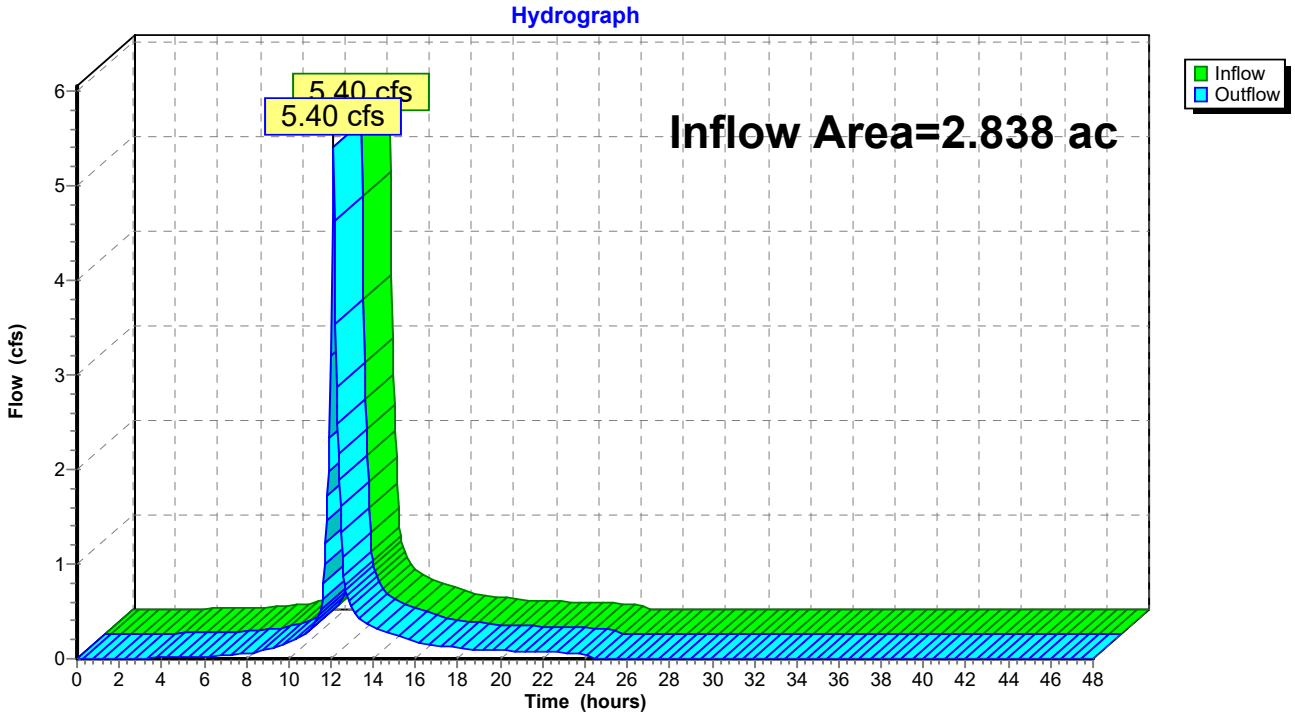


Summary for Reach DP-5: Design Point 5 (Existing Constructed Stormwater Wetland)

Inflow Area = 2.838 ac, 74.70% Impervious, Inflow Depth = 1.78" for 1-Year event
Inflow = 5.40 cfs @ 12.10 hrs, Volume= 0.420 af
Outflow = 5.40 cfs @ 12.10 hrs, Volume= 0.420 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Reach DP-5: Design Point 5 (Existing Constructed Stormwater Wetland)

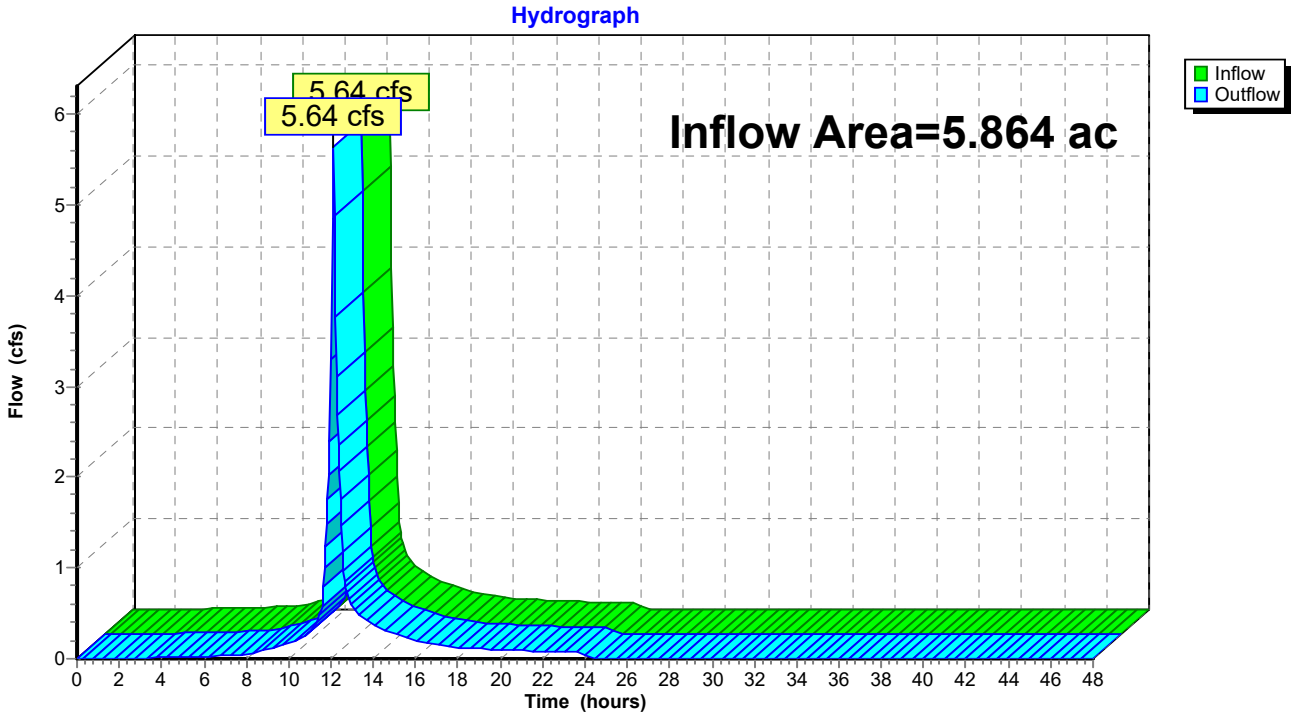


Summary for Reach DP-6: Wetland A - Design Point 6

Inflow Area = 5.864 ac, 71.84% Impervious, Inflow Depth = 0.92" for 1-Year event
Inflow = 5.64 cfs @ 12.10 hrs, Volume= 0.447 af
Outflow = 5.64 cfs @ 12.10 hrs, Volume= 0.447 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Reach DP-6: Wetland A - Design Point 6



Summary for Pond 3P: Conveyance Swale

Inflow Area = 0.471 ac, 52.65% Impervious, Inflow Depth = 1.31" for 1-Year event
Inflow = 0.71 cfs @ 12.09 hrs, Volume= 0.051 af
Outflow = 0.62 cfs @ 12.14 hrs, Volume= 0.051 af, Atten= 12%, Lag= 2.7 min
Primary = 0.62 cfs @ 12.14 hrs, Volume= 0.051 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs / 2
Peak Elev= 125.35' @ 12.14 hrs Surf.Area= 579 sf Storage= 176 cf

Plug-Flow detention time= 13.4 min calculated for 0.051 af (100% of inflow)
Center-of-Mass det. time= 13.6 min (845.9 - 832.3)

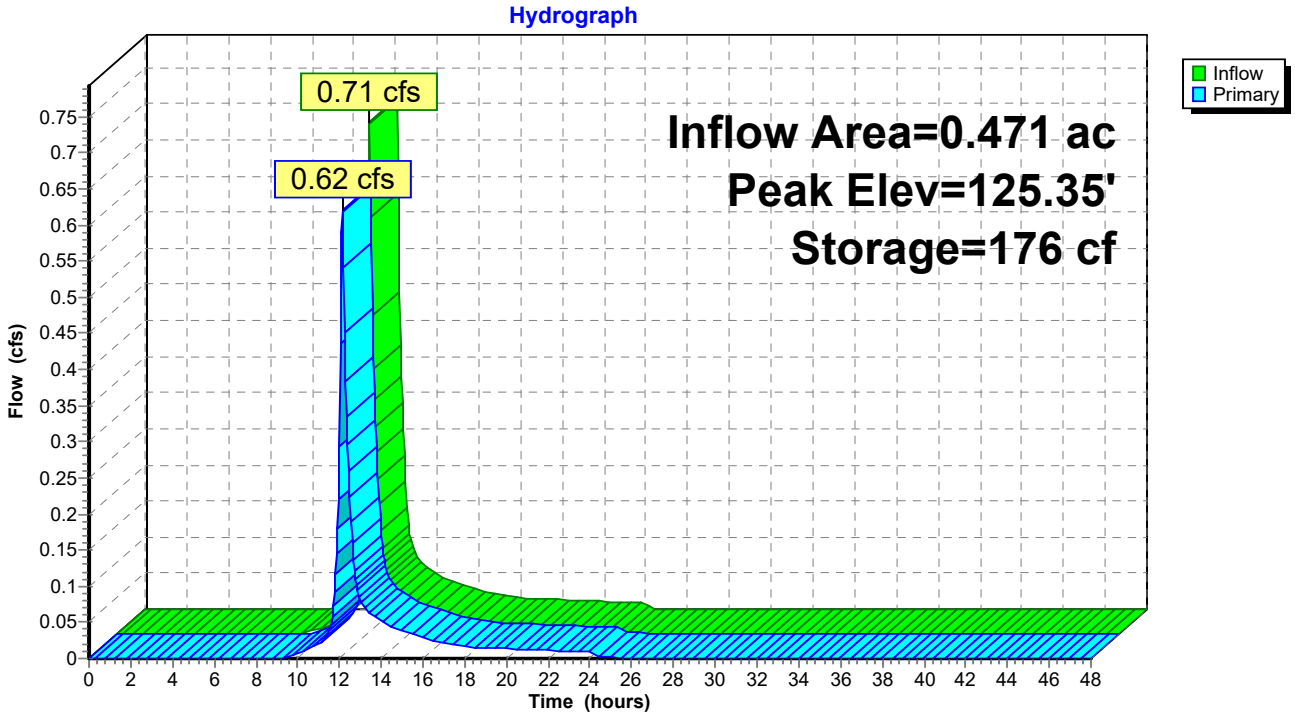
Volume	Invert	Avail.Storage	Storage Description
#1	125.00'	1,147 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
125.00	436	0	0
126.00	848	642	642
126.50	1,170	505	1,147

Device	Routing	Invert	Outlet Devices
#1	Primary	124.18'	**12.0" Round Culvert** L= 10.0' Ke= 0.500 Inlet / Outlet Invert= 124.18' / 124.13' S= 0.0050 '/' Cc= 0.900 n= 0.011 Concrete pipe, straight & clean, Flow Area= 0.79 sf
#2	Device 1	125.00'	**18.0" Vert. Orifice/Grate** C= 0.600

Primary OutFlow Max=0.61 cfs @ 12.14 hrs HW=125.34' (Free Discharge)
↑**1=Culvert** (Passes 0.61 cfs of 2.63 cfs potential flow)
↑**2=Orifice/Grate** (Orifice Controls 0.61 cfs @ 2.00 fps)

Pond 3P: Conveyance Swale



Summary for Pond 8P: UG-1 3 ft Retain IT

Inflow Area = 1.954 ac, 81.04% Impervious, Inflow Depth = 1.90" for 1-Year event
Inflow = 3.89 cfs @ 12.09 hrs, Volume= 0.309 af
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 100%, Lag= 0.0 min
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs / 2
Peak Elev= 123.04' @ 48.00 hrs Surf.Area= 15,300 sf Storage= 13,476 cf

Plug-Flow detention time= (not calculated: initial storage exceeds outflow)
Center-of-Mass det. time= (not calculated: no outflow)

Volume	Invert	Avail.Storage	Storage Description
#1A	121.75'	3,817 cf	**90.00'W x 170.00'L x 4.17'H Field A** 63,750 cf Overall - 54,208 cf Embedded = 9,542 cf x 40.0% Voids
#2A	122.25'	39,109 cf	**retain_it retain_it 3.0'** x 231 Inside #1 Inside= 84.0"W x 36.0"H => 21.33 sf x 8.00'L = 170.6 cf Outside= 96.0"W x 44.0"H => 29.33 sf x 8.00'L = 234.7 cf 11 Rows adjusted for 302.1 cf perimeter wall
		42,926 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	124.25'	**12.0" Round HDPE_Round 12"** L= 12.5' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 124.25' / 124.18' S= 0.0056 '/' Cc= 0.900 n= 0.011 Concrete pipe, straight & clean, Flow Area= 0.79 sf
#2	Device 1	124.40'	**4.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=121.75' (Free Discharge)
↑**1=HDPE_Round 12"** (Controls 0.00 cfs)
↑**2=Sharp-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 8P: UG-1 3 ft Retain IT - Chamber Wizard Field A

Chamber Model = retain_it retain_it 3.0' (retain-it®)
Inside= 84.0"W x 36.0"H => 21.33 sf x 8.00'L = 170.6 cf
Outside= 96.0"W x 44.0"H => 29.33 sf x 8.00'L = 234.7 cf
11 Rows adjusted for 302.1 cf perimeter wall

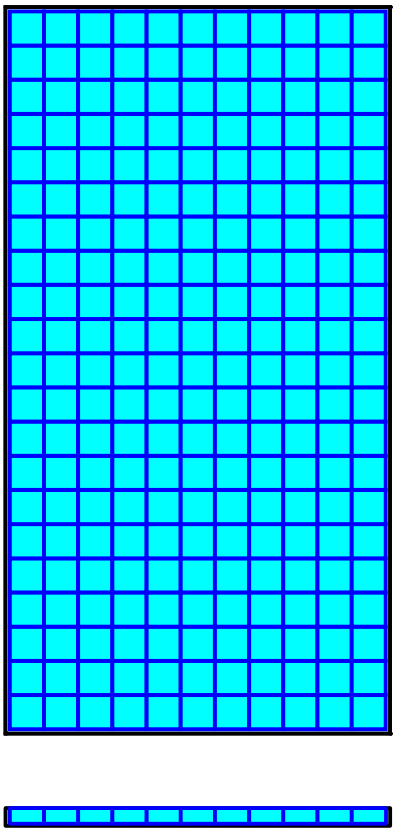
21 Chambers/Row x 8.00' Long = 168.00' Row Length +12.0" End Stone x 2 = 170.00' Base Length
11 Rows x 96.0" Wide + 12.0" Side Stone x 2 = 90.00' Base Width
6.0" Base + 44.0" Chamber Height = 4.17' Field Height

4.7 cf Sidewall x 21 x 2 + 4.7 cf Endwall x 11 x 2 = 302.1 cf Perimeter Wall
231 Chambers x 170.6 cf - 302.1 cf Perimeter wall = 39,108.9 cf Chamber Storage
231 Chambers x 234.7 cf = 54,208.0 cf Displacement

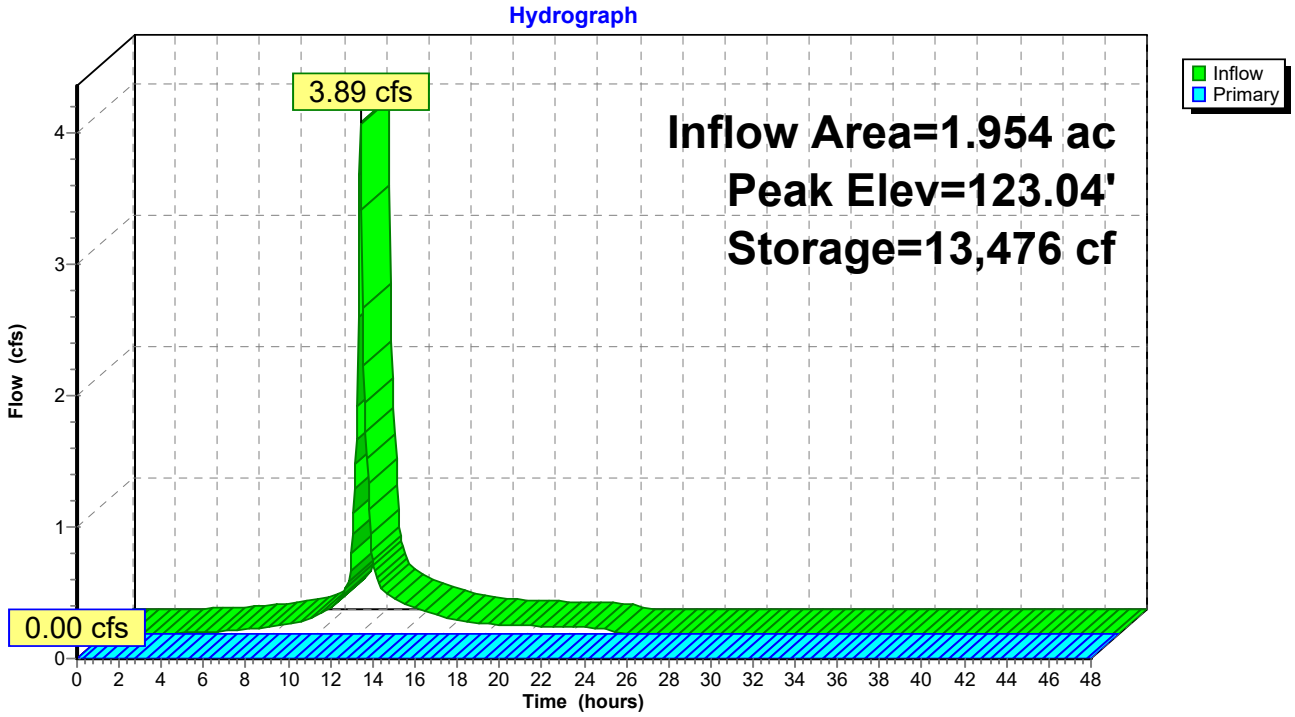
63,750.0 cf Field - 54,208.0 cf Chambers = 9,542.0 cf Stone x 40.0% Voids = 3,816.8 cf Stone Storage

Chamber Storage + Stone Storage = 42,925.7 cf = 0.985 af
Overall Storage Efficiency = 67.3%
Overall System Size = 170.00' x 90.00' x 4.17'

231 Chambers
2,361.1 cy Field
353.4 cy Stone



Pond 8P: UG-1 3 ft Retain IT



Summary for Pond 11P: Permeable Pavement

Inflow Area = 0.537 ac, 94.68% Impervious, Inflow Depth = 2.24" for 1-Year event
Inflow = 1.28 cfs @ 12.09 hrs, Volume= 0.100 af
Outflow = 0.14 cfs @ 11.65 hrs, Volume= 0.100 af, Atten= 89%, Lag= 0.0 min
Discarded = 0.14 cfs @ 11.65 hrs, Volume= 0.100 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Peak Elev= 122.92' @ 12.79 hrs Surf.Area= 22,160 sf Storage= 1,536 cf

Plug-Flow detention time= 81.1 min calculated for 0.100 af (100% of inflow)
Center-of-Mass det. time= 81.0 min (852.7 - 771.7)

Volume	Invert	Avail.Storage	Storage Description
#1	122.75'	7,512 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

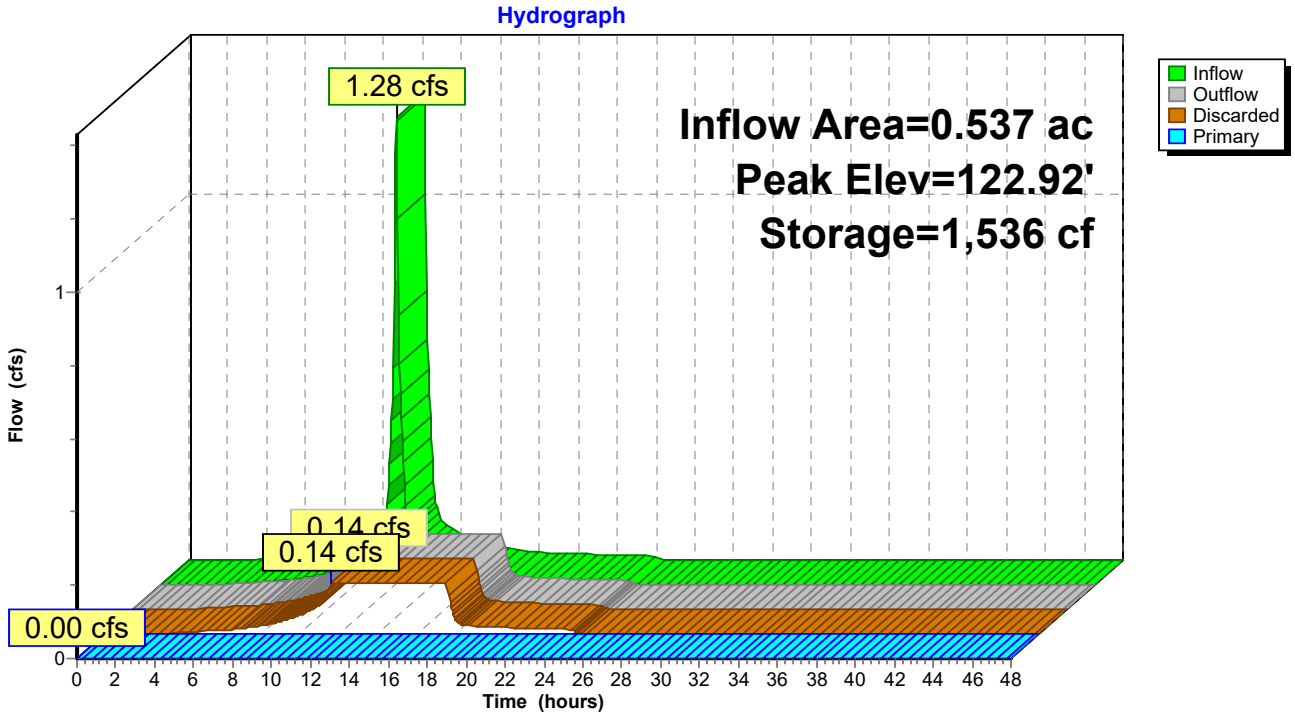
Elevation (feet)	Surf.Area (sq-ft)	Voids (%)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
122.75	22,160	0.0	0	0
123.41	22,160	40.0	5,850	5,850
123.66	22,160	30.0	1,662	7,512

Device	Routing	Invert	Outlet Devices
#1	Discarded	122.75'	**0.270 in/hr Exfiltration over Surface area**
#2	Primary	123.30'	**6.0" Round Culvert** L= 10.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 123.30' / 119.00' S= 0.4300 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 0.20 sf

Discarded OutFlow Max=0.14 cfs @ 11.65 hrs HW=122.76' (Free Discharge)
1=Exfiltration (Exfiltration Controls 0.14 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=122.75' (Free Discharge)
2=Culvert (Controls 0.00 cfs)

Pond 11P: Permeable Pavement



Summary for Subcatchment P-1A: Undetained to Wetland B

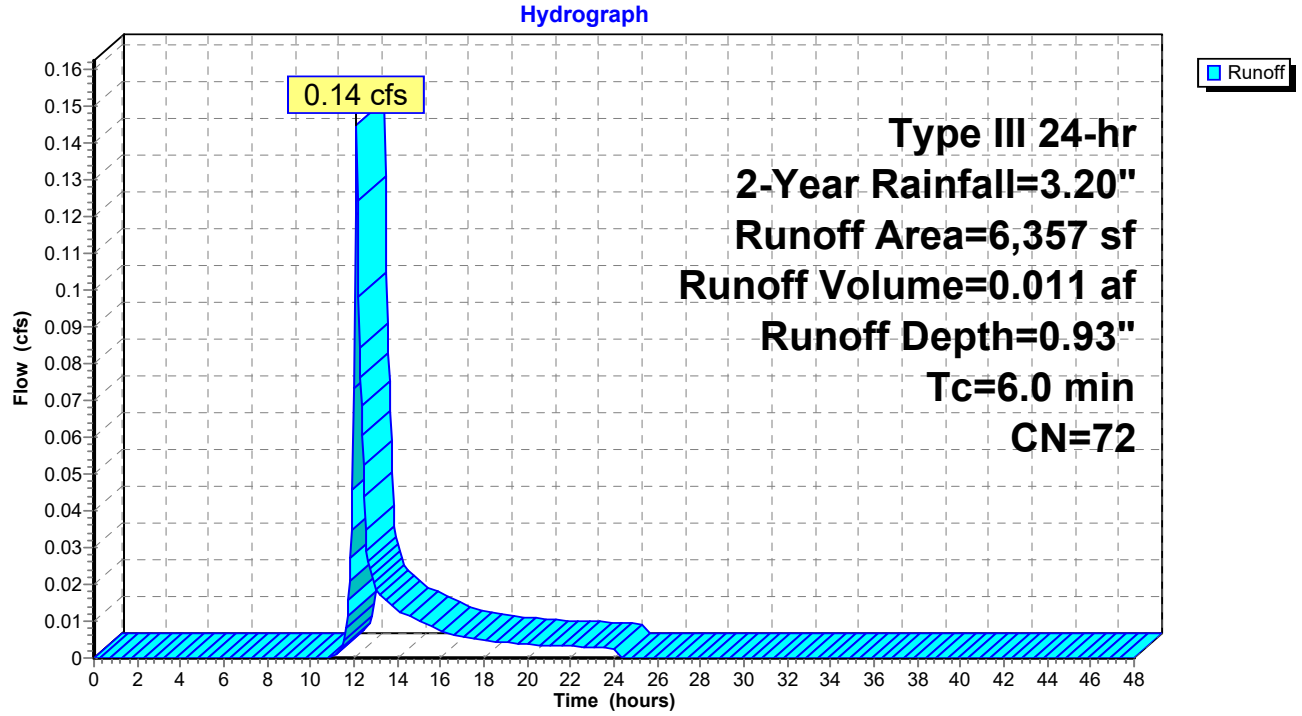
Runoff = 0.14 cfs @ 12.10 hrs, Volume= 0.011 af, Depth= 0.93"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.20"

Area (sf)	CN	Description
6,357	72	Woods/grass comb., Good, HSG C
6,357		100.00% Pervious Area

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

Subcatchment P-1A: Undetained to Wetland B



Summary for Subcatchment P-1B: Western Driveway

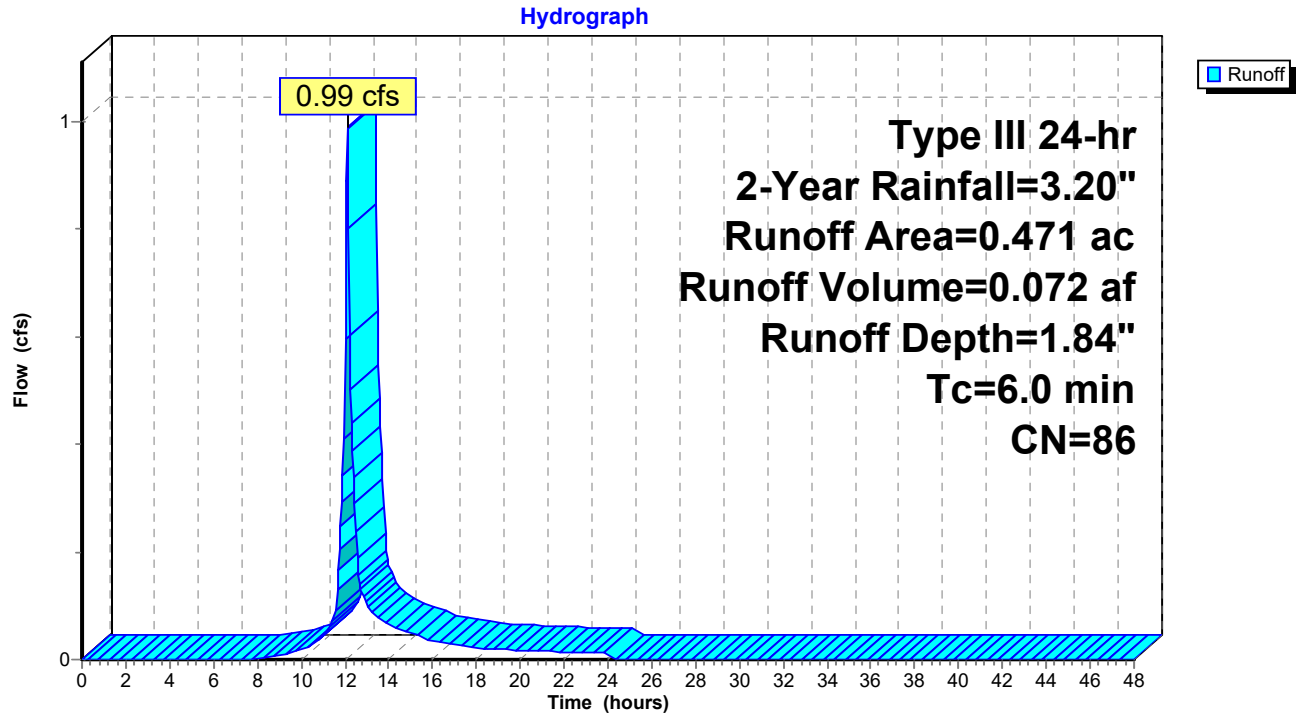
Runoff = 0.99 cfs @ 12.09 hrs, Volume= 0.072 af, Depth= 1.84"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.20"

Area (ac)	CN	Description
0.248	98	Paved parking, HSG C
0.223	72	Woods/grass comb., Good, HSG C
0.471	86	Weighted Average
0.223		47.35% Pervious Area
0.248		52.65% Impervious Area

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

Subcatchment P-1B: Western Driveway



Summary for Subcatchment P-1C: Permeable Pavement

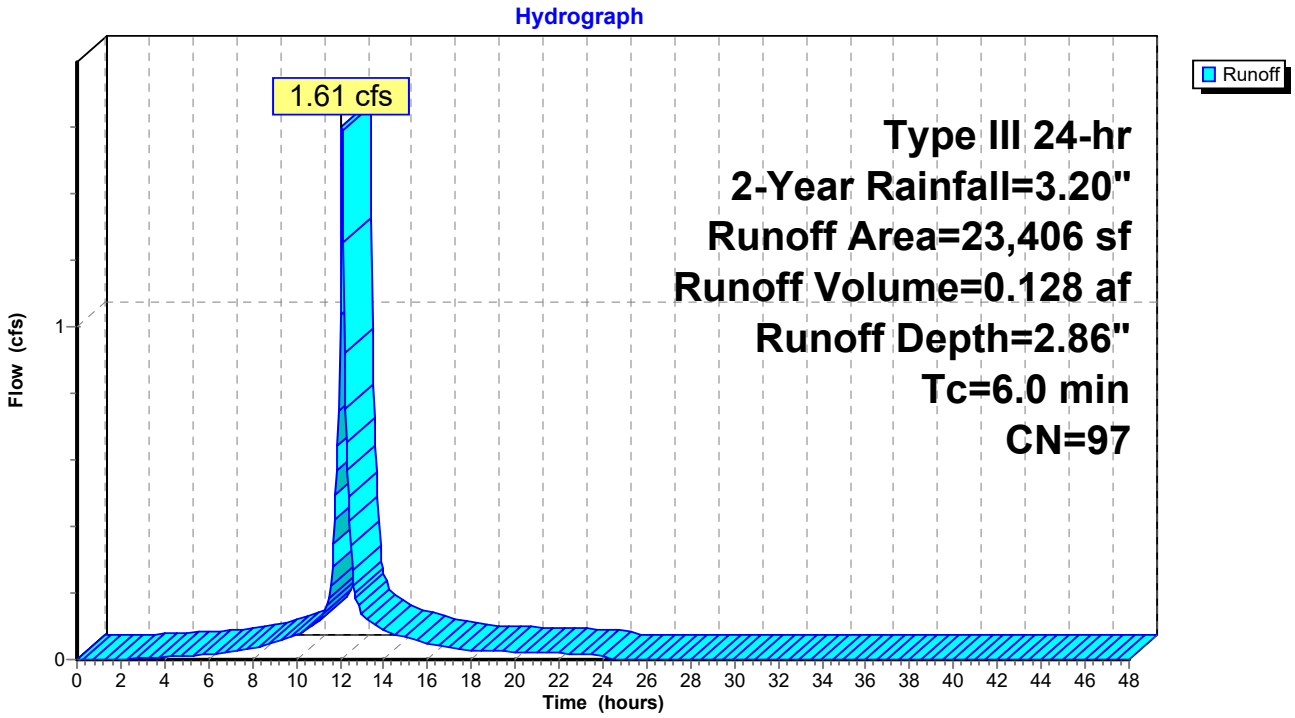
Runoff = 1.61 cfs @ 12.09 hrs, Volume= 0.128 af, Depth= 2.86"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.20"

Area (sf)	CN	Description
22,160	98	Paved parking, HSG C
1,246	74	>75% Grass cover, Good, HSG C
23,406	97	Weighted Average
1,246		5.32% Pervious Area
22,160		94.68% Impervious Area

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

Subcatchment P-1C: Permeable Pavement



Summary for Subcatchment P-2: Undetained to Wetland

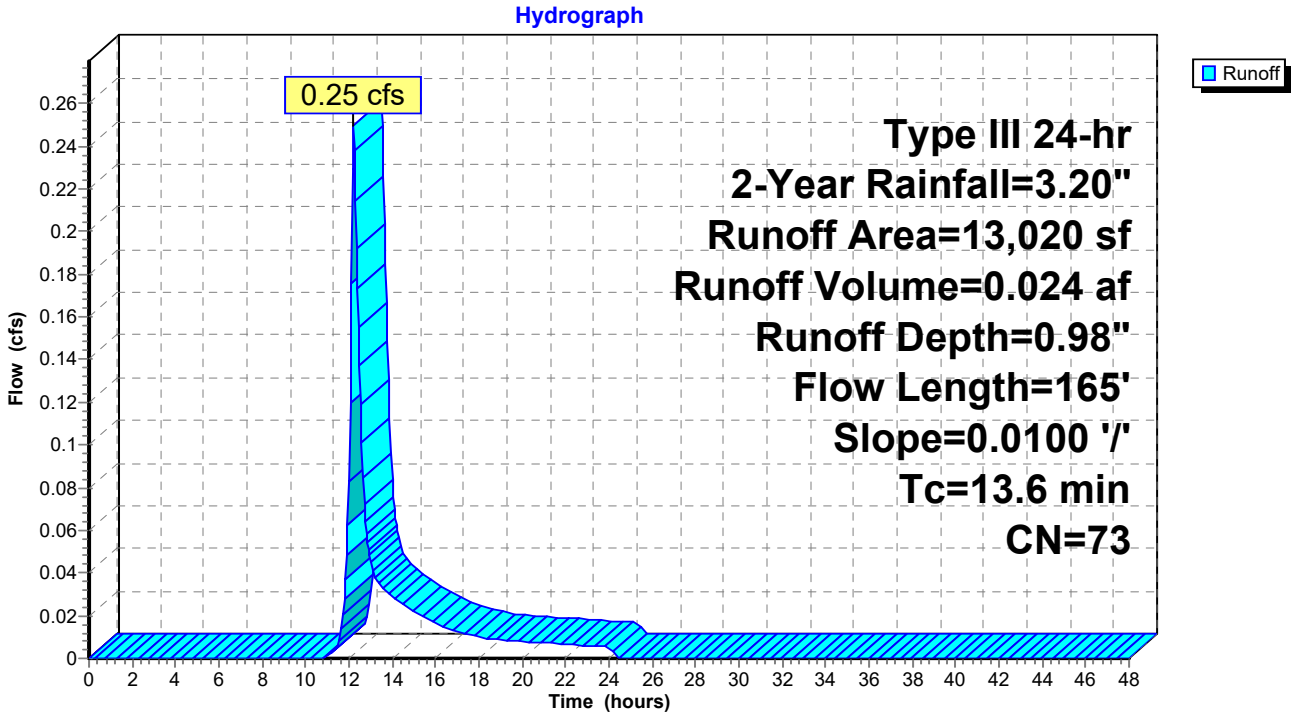
Runoff = 0.25 cfs @ 12.21 hrs, Volume= 0.024 af, Depth= 0.98"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.20"

Area (sf)	CN	Description
10,967	74	>75% Grass cover, Good, HSG C
2,053	70	Woods, Good, HSG C
13,020	73	Weighted Average
13,020		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.9	100	0.0100	0.13		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.20"
0.7	65	0.0100	1.61		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
13.6	165	Total			

Subcatchment P-2: Undetained to Wetland



Summary for Subcatchment P-3A: Existing Building & Additions and Upper Pavement

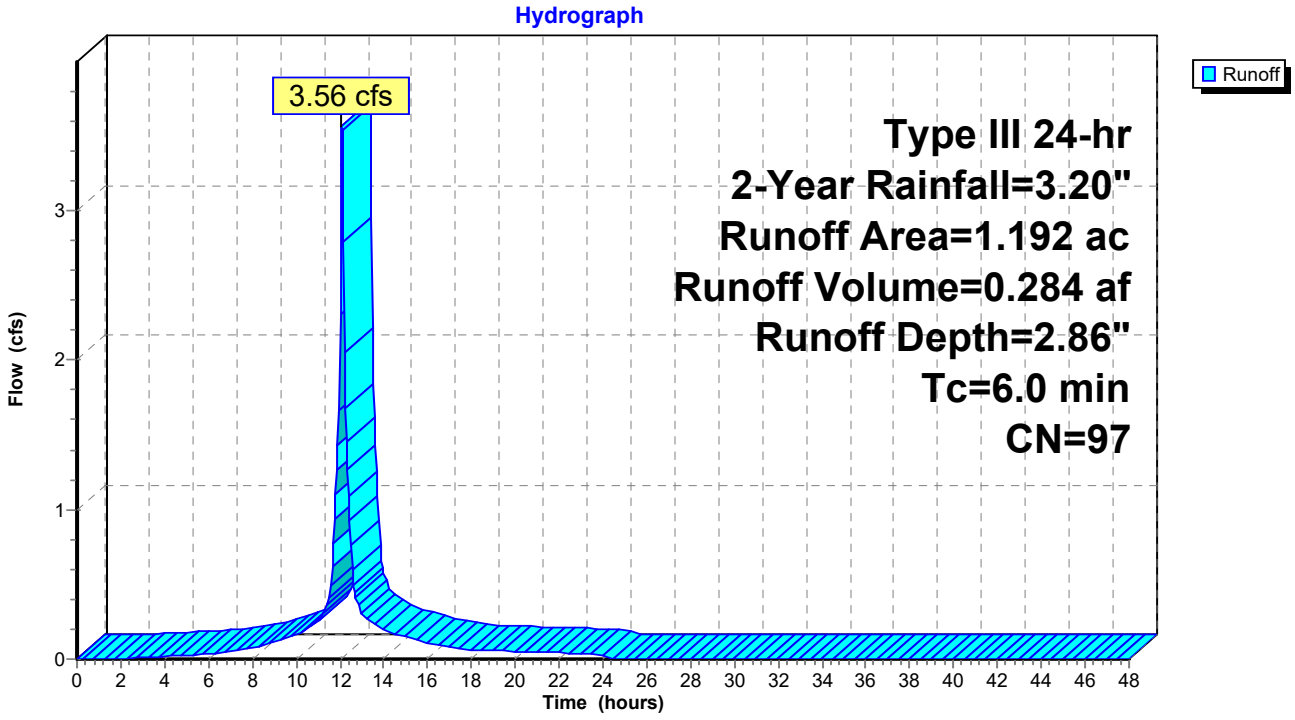
Runoff = 3.56 cfs @ 12.09 hrs, Volume= 0.284 af, Depth= 2.86"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.20"

Area (ac)	CN	Description
0.701	98	Paved parking, HSG C
0.461	98	Roofs, HSG C
0.030	74	>75% Grass cover, Good, HSG C
1.192	97	Weighted Average
0.030		2.52% Pervious Area
1.162		97.48% Impervious Area

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

Subcatchment P-3A: Existing Building & Additions and Upper Pavement



Summary for Subcatchment P-3B: Existing Building Draining to Constructed Wetland

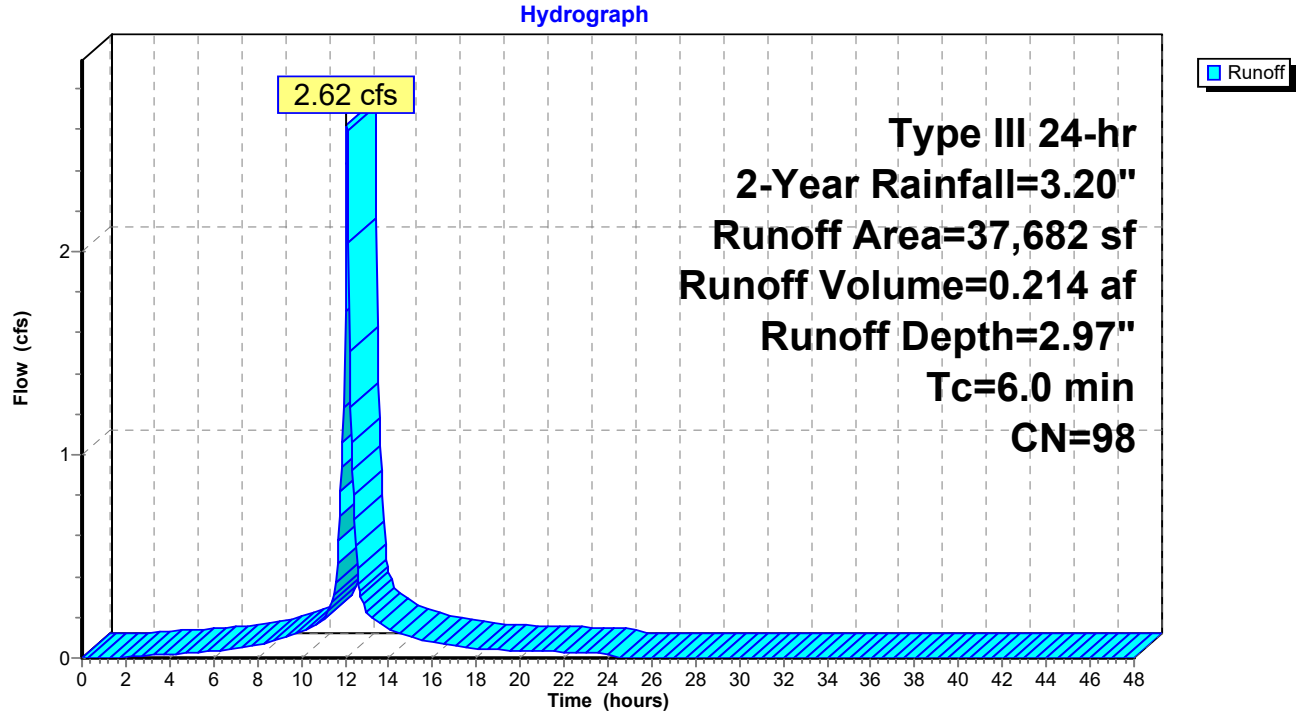
Runoff = 2.62 cfs @ 12.09 hrs, Volume= 0.214 af, Depth= 2.97"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.20"

Area (sf)	CN	Description
37,682	98	Roofs, HSG C
37,682		100.00% Impervious Area

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

Subcatchment P-3B: Existing Building Draining to Constructed Wetland



Summary for Subcatchment P-4: Watershed to Existing Stormwater System

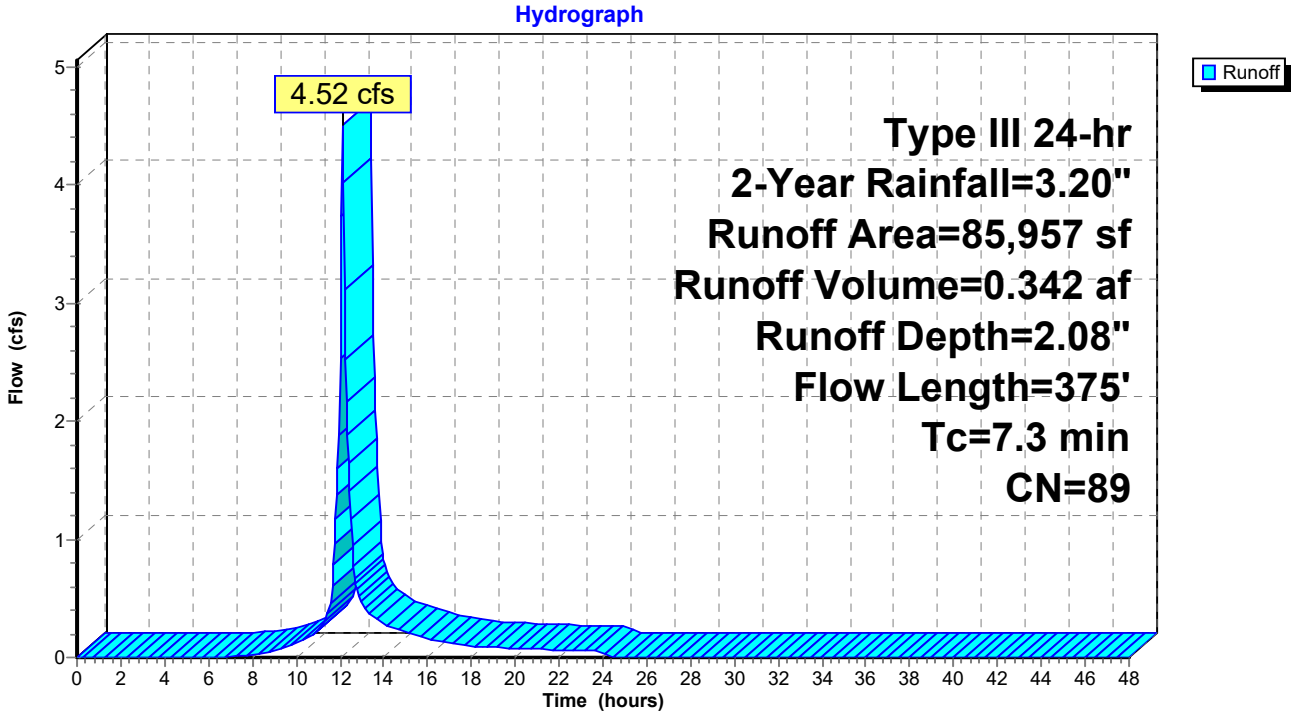
Runoff = 4.52 cfs @ 12.11 hrs, Volume= 0.342 af, Depth= 2.08"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.20"

Area (sf)	CN	Description
54,671	98	Paved parking, HSG C
29,238	74	>75% Grass cover, Good, HSG C
2,048	70	Woods, Good, HSG C
85,957	89	Weighted Average
31,286		36.40% Pervious Area
54,671		63.60% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.2	50	0.0240	0.16		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.20"
1.7	245	0.0220	2.39		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
0.4	80	0.0287	3.44		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
7.3	375	Total			

Subcatchment P-4: Watershed to Existing Stormwater System



Summary for Subcatchment P-4A: Watershed to MassDOT CB1

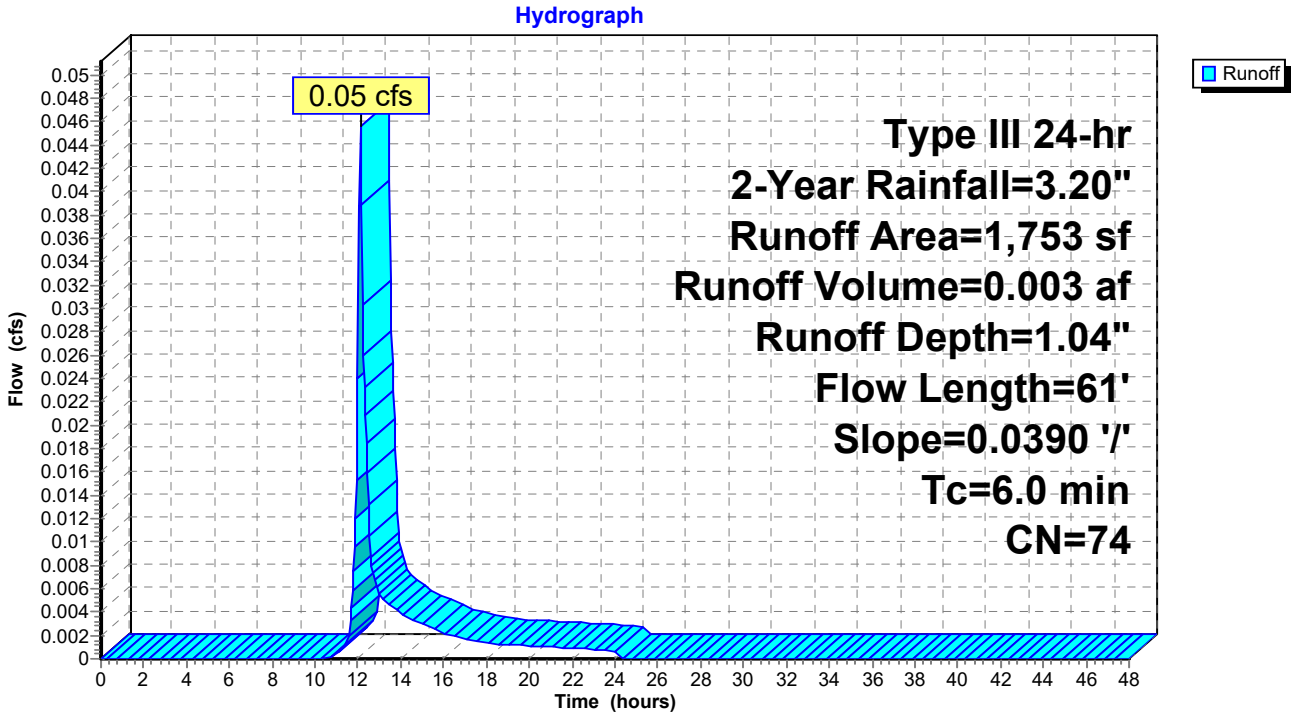
Runoff = 0.05 cfs @ 12.10 hrs, Volume= 0.003 af, Depth= 1.04"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.20"

Area (sf)	CN	Description
1,753	74	>75% Grass cover, Good, HSG C
1,753		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.1	61	0.0390	0.20		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.20"
0.9					**Direct Entry,**
6.0	61	Total			

Subcatchment P-4A: Watershed to MassDOT CB1



Summary for Subcatchment P-4B: Watershed to CB2

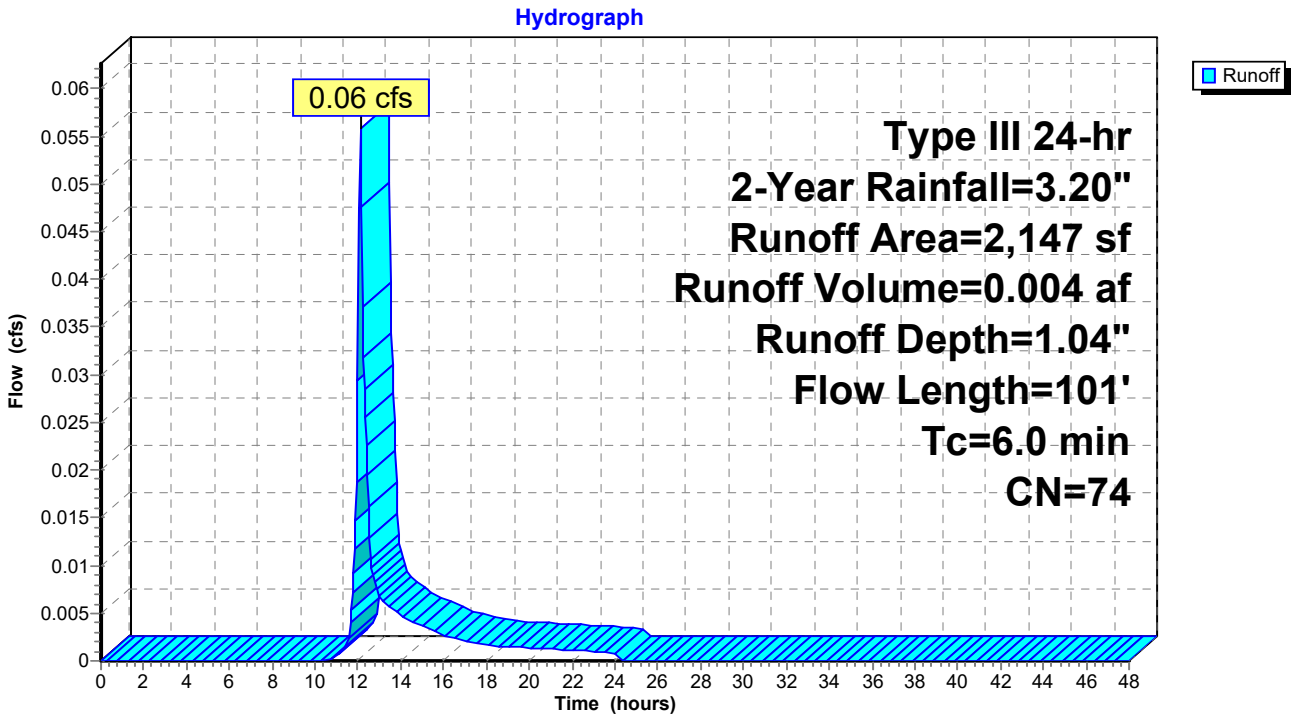
Runoff = 0.06 cfs @ 12.10 hrs, Volume= 0.004 af, Depth= 1.04"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.20"

Area (sf)	CN	Description
2,147	74	>75% Grass cover, Good, HSG C
2,147		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.6	50	0.0200	0.15		**Sheet Flow, SHeet Flow** Grass: Short n= 0.150 P2= 3.20"
0.3	51	0.0390	3.18		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
0.1					**Direct Entry, Miniumum**
6.0	101	Total			

Subcatchment P-4B: Watershed to CB2



Summary for Subcatchment P-5: P-5

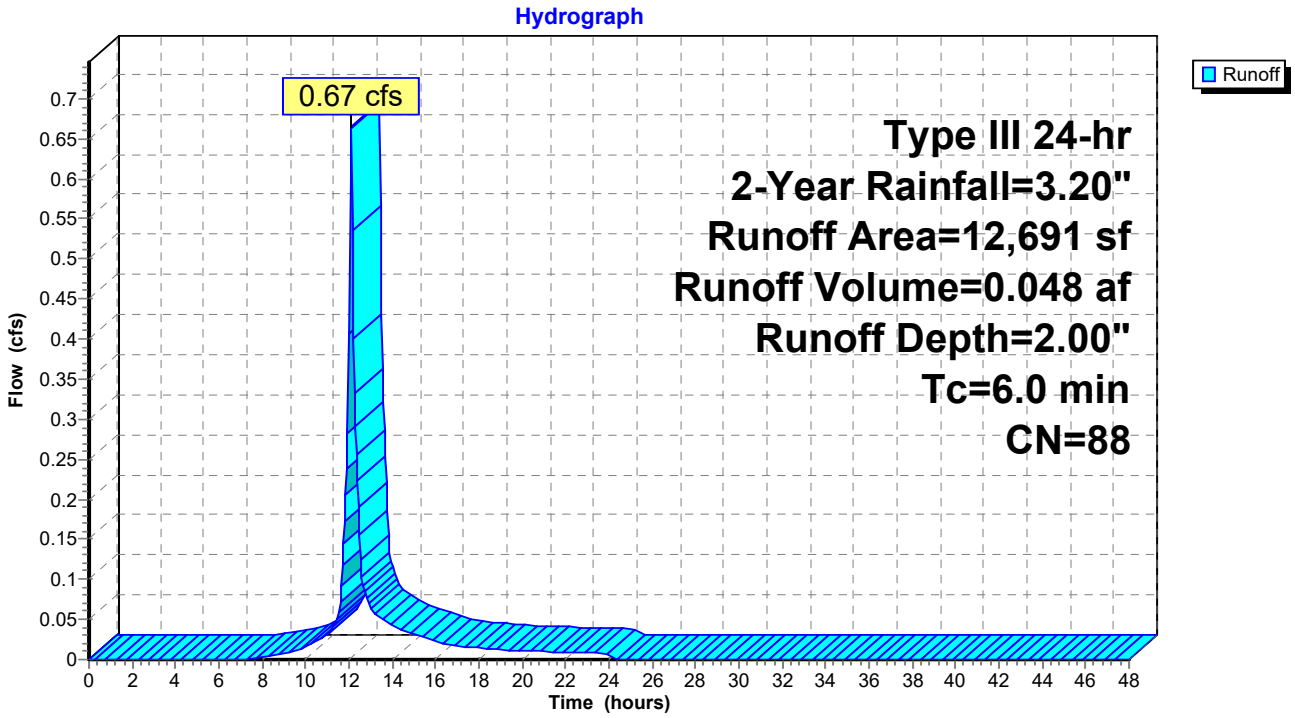
Runoff = 0.67 cfs @ 12.09 hrs, Volume= 0.048 af, Depth= 2.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.20"

Area (sf)	CN	Description
5,116	74	>75% Grass cover, Good, HSG C
7,575	98	Paved parking, HSG C
12,691	88	Weighted Average
5,116		40.31% Pervious Area
7,575		59.69% Impervious Area

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

Subcatchment P-5: P-5

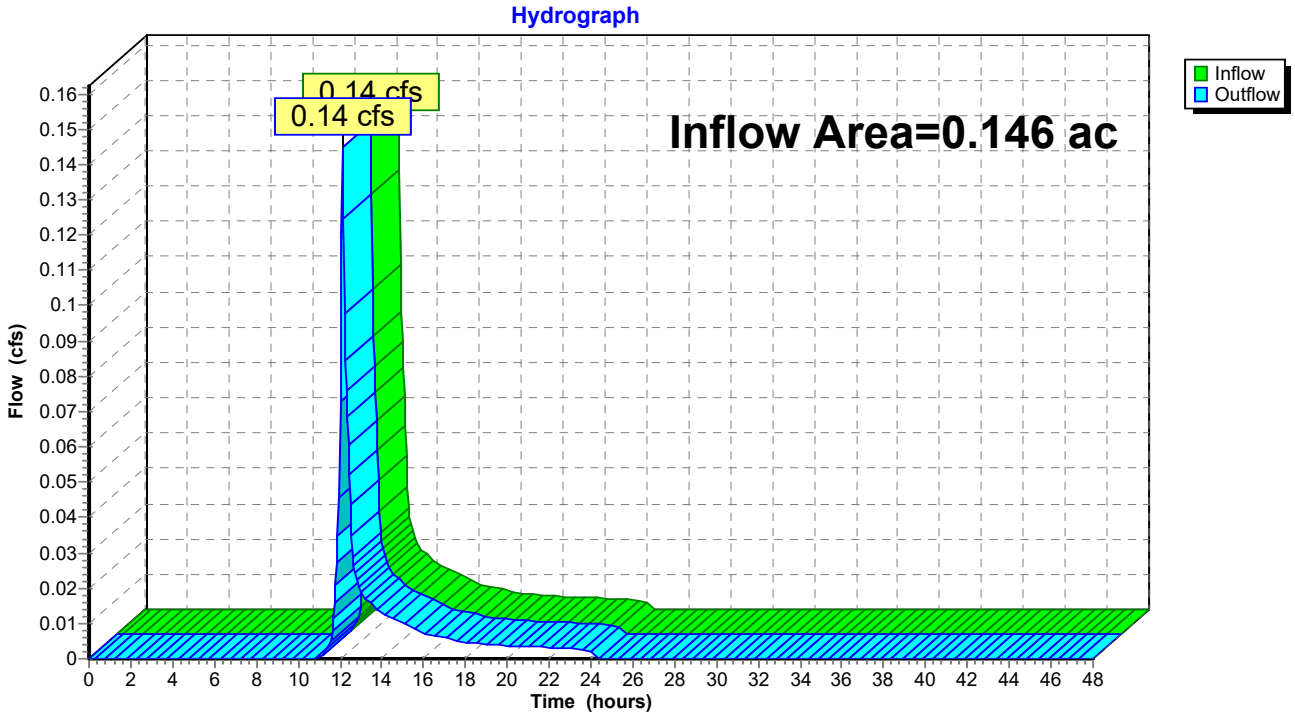


Summary for Reach DP-1: Design Point 1 (Wetland B)

Inflow Area = 0.146 ac, 0.00% Impervious, Inflow Depth = 0.93" for 2-Year event
Inflow = 0.14 cfs @ 12.10 hrs, Volume= 0.011 af
Outflow = 0.14 cfs @ 12.10 hrs, Volume= 0.011 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Reach DP-1: Design Point 1 (Wetland B)

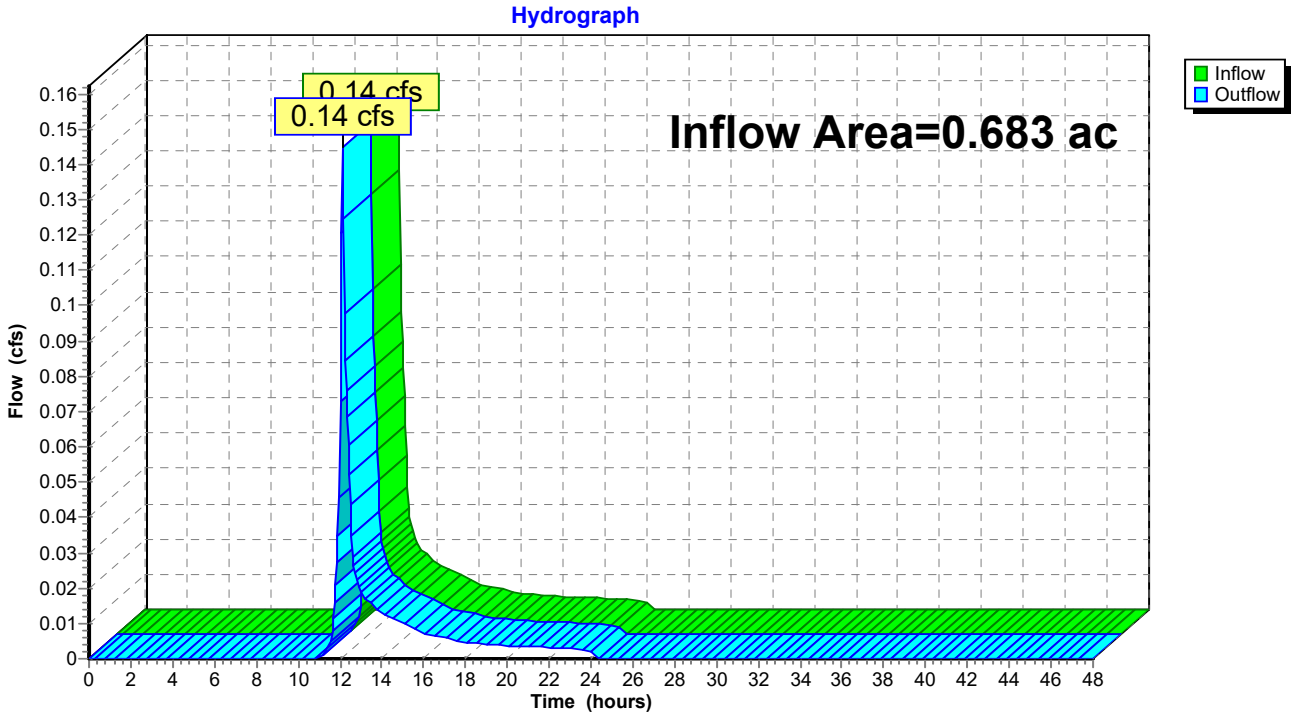


Summary for Reach DP-2: Design Point 2 (15" RCP to Wetland A)

Inflow Area = 0.683 ac, 74.45% Impervious, Inflow Depth = 0.20" for 2-Year event
Inflow = 0.14 cfs @ 12.10 hrs, Volume= 0.011 af
Outflow = 0.14 cfs @ 12.10 hrs, Volume= 0.011 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Reach DP-2: Design Point 2 (15" RCP to Wetland A)

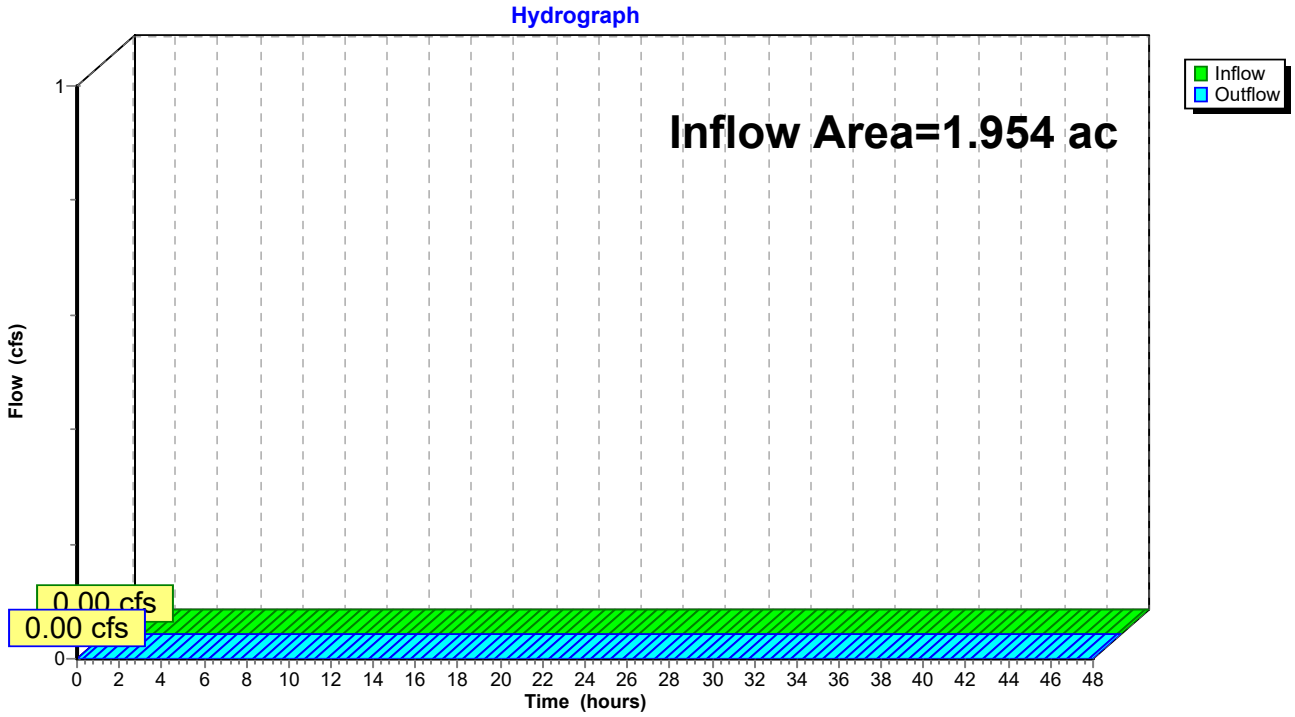


Summary for Reach DP-3: Design Point 3 (Existing Drainage Ditch)

Inflow Area = 1.954 ac, 81.04% Impervious, Inflow Depth = 0.00" for 2-Year event
Inflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Reach DP-3: Design Point 3 (Existing Drainage Ditch)

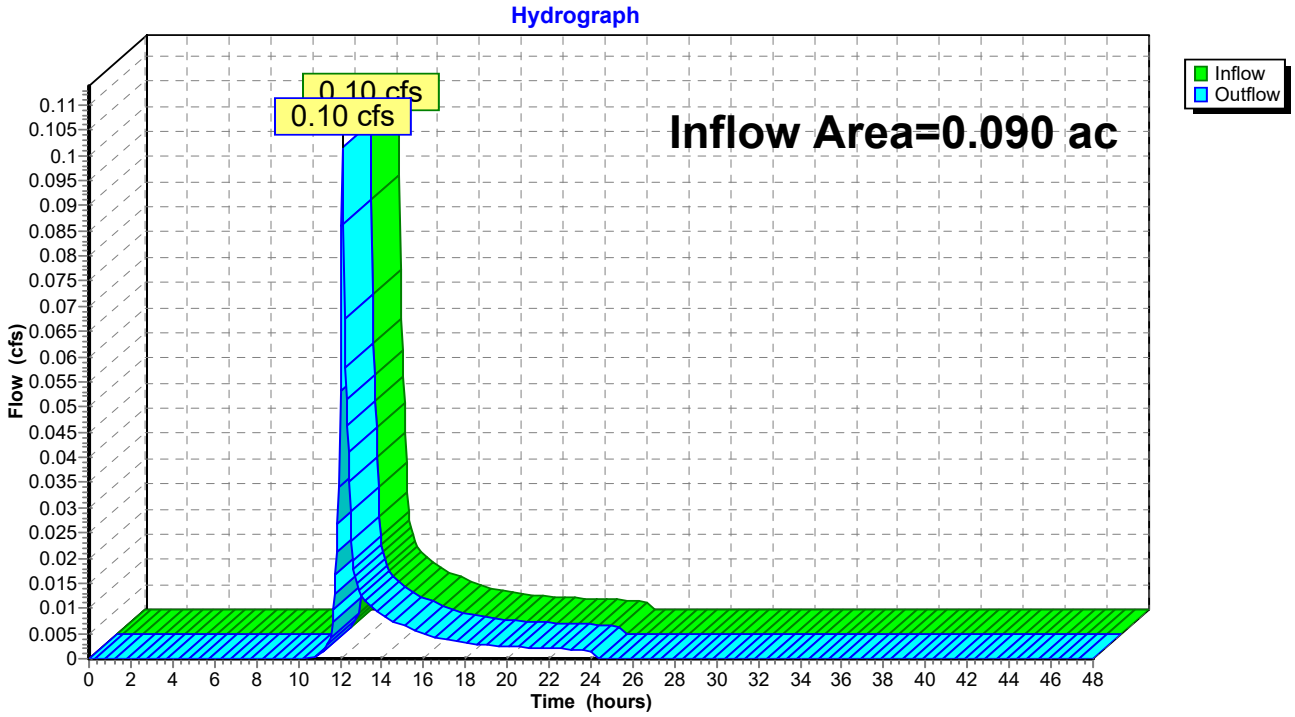


Summary for Reach DP-4: Design Point 4 (MassDOT 30" CB-2)

Inflow Area = 0.090 ac, 0.00% Impervious, Inflow Depth = 1.04" for 2-Year event
Inflow = 0.10 cfs @ 12.10 hrs, Volume= 0.008 af
Outflow = 0.10 cfs @ 12.10 hrs, Volume= 0.008 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Reach DP-4: Design Point 4 (MassDOT 30" CB-2)

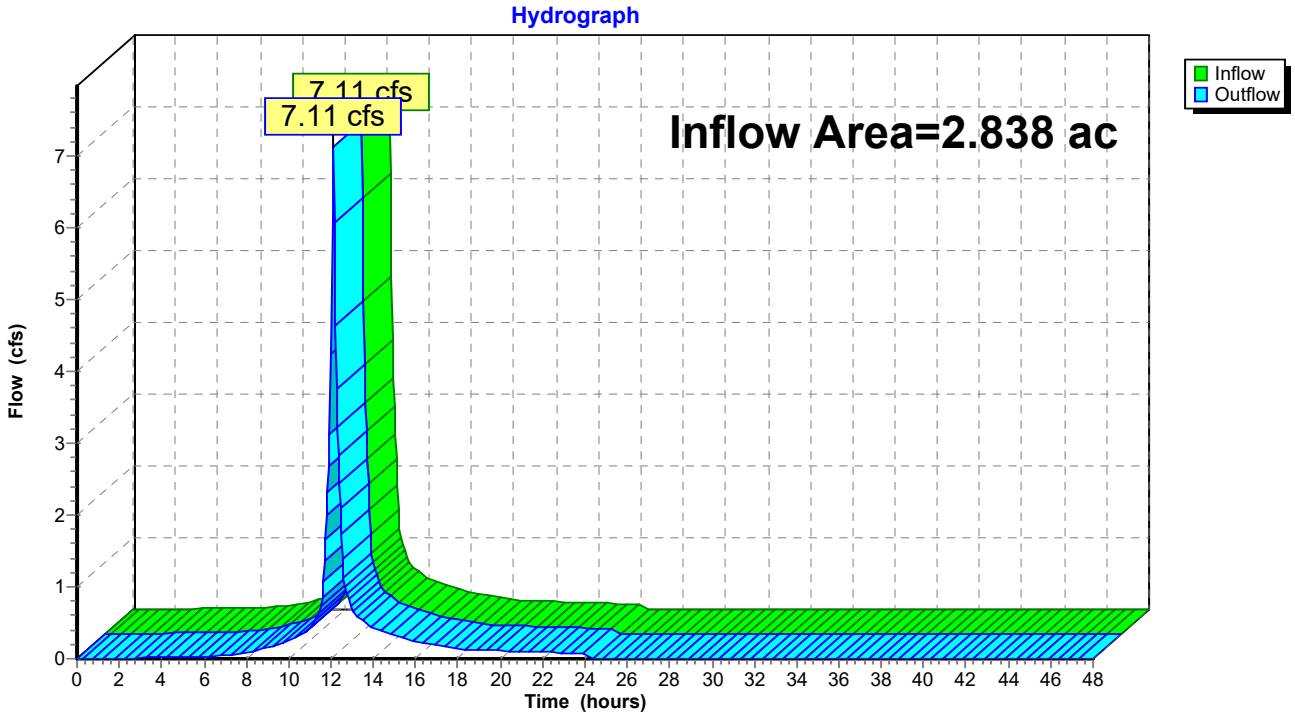


Summary for Reach DP-5: Design Point 5 (Existing Constructed Stormwater Wetland)

Inflow Area = 2.838 ac, 74.70% Impervious, Inflow Depth = 2.35" for 2-Year event
Inflow = 7.11 cfs @ 12.10 hrs, Volume= 0.556 af
Outflow = 7.11 cfs @ 12.10 hrs, Volume= 0.556 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Reach DP-5: Design Point 5 (Existing Constructed Stormwater Wetland)

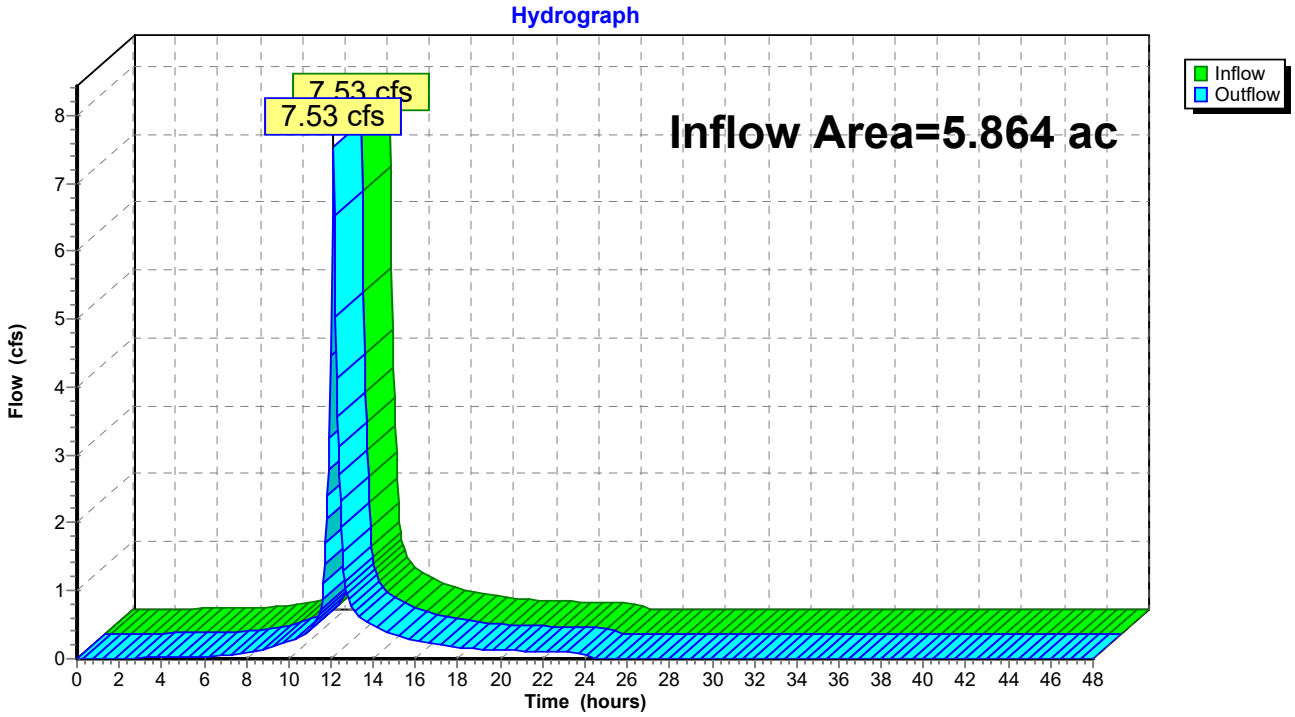


Summary for Reach DP-6: Wetland A - Design Point 6

Inflow Area = 5.864 ac, 71.84% Impervious, Inflow Depth = 1.23" for 2-Year event
Inflow = 7.53 cfs @ 12.10 hrs, Volume= 0.600 af
Outflow = 7.53 cfs @ 12.10 hrs, Volume= 0.600 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Reach DP-6: Wetland A - Design Point 6



Summary for Pond 3P: Conveyance Swale

Inflow Area = 0.471 ac, 52.65% Impervious, Inflow Depth = 1.84" for 2-Year event
Inflow = 0.99 cfs @ 12.09 hrs, Volume= 0.072 af
Outflow = 0.88 cfs @ 12.13 hrs, Volume= 0.072 af, Atten= 11%, Lag= 2.3 min
Primary = 0.88 cfs @ 12.13 hrs, Volume= 0.072 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs / 2
Peak Elev= 125.42' @ 12.13 hrs Surf.Area= 608 sf Storage= 218 cf

Plug-Flow detention time= 11.6 min calculated for 0.072 af (100% of inflow)
Center-of-Mass det. time= 11.8 min (834.4 - 822.5)

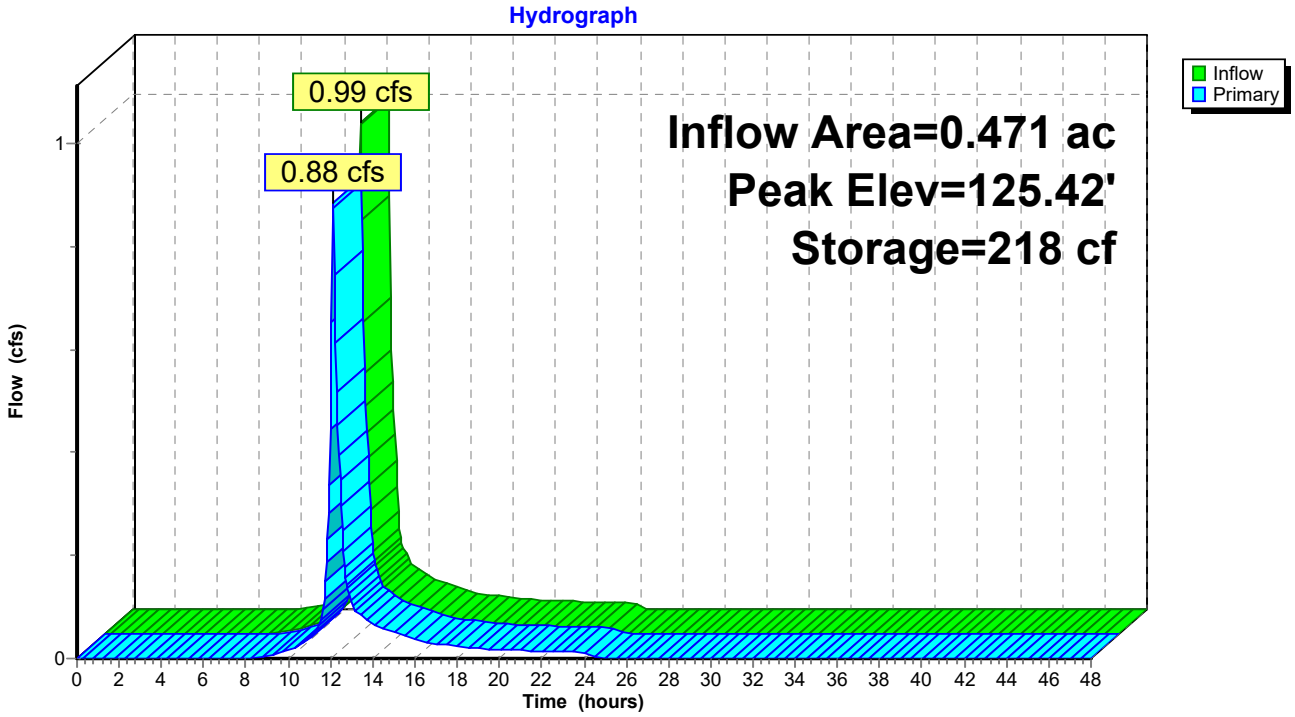
Volume	Invert	Avail.Storage	Storage Description
#1	125.00'	1,147 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
125.00	436	0	0
126.00	848	642	642
126.50	1,170	505	1,147

Device	Routing	Invert	Outlet Devices
#1	Primary	124.18'	**12.0" Round Culvert** L= 10.0' Ke= 0.500 Inlet / Outlet Invert= 124.18' / 124.13' S= 0.0050 '/' Cc= 0.900 n= 0.011 Concrete pipe, straight & clean, Flow Area= 0.79 sf
#2	Device 1	125.00'	**18.0" Vert. Orifice/Grate** C= 0.600

Primary OutFlow Max=0.87 cfs @ 12.13 hrs HW=125.41' (Free Discharge)
└**1=Culvert** (Passes 0.87 cfs of 2.81 cfs potential flow)
└**2=Orifice/Grate** (Orifice Controls 0.87 cfs @ 2.19 fps)

Pond 3P: Conveyance Swale



Summary for Pond 8P: UG-1 3 ft Retain IT

Inflow Area = 1.954 ac, 81.04% Impervious, Inflow Depth = 2.48" for 2-Year event
Inflow = 5.06 cfs @ 12.09 hrs, Volume= 0.404 af
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 100%, Lag= 0.0 min
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs / 2
Peak Elev= 123.35' @ 48.00 hrs Surf.Area= 15,300 sf Storage= 17,610 cf

Plug-Flow detention time= (not calculated: initial storage exceeds outflow)
Center-of-Mass det. time= (not calculated: no outflow)

Volume	Invert	Avail.Storage	Storage Description
#1A	121.75'	3,817 cf	**90.00'W x 170.00'L x 4.17'H Field A** 63,750 cf Overall - 54,208 cf Embedded = 9,542 cf x 40.0% Voids
#2A	122.25'	39,109 cf	**retain_it retain_it 3.0'** x 231 Inside #1 Inside= 84.0"W x 36.0"H => 21.33 sf x 8.00'L = 170.6 cf Outside= 96.0"W x 44.0"H => 29.33 sf x 8.00'L = 234.7 cf 11 Rows adjusted for 302.1 cf perimeter wall
		42,926 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	124.25'	**12.0" Round HDPE_Round 12"** L= 12.5' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 124.25' / 124.18' S= 0.0056 '/' Cc= 0.900 n= 0.011 Concrete pipe, straight & clean, Flow Area= 0.79 sf
#2	Device 1	124.40'	**4.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=121.75' (Free Discharge)
└**1=HDPE_Round 12"** (Controls 0.00 cfs)
└**2=Sharp-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 8P: UG-1 3 ft Retain IT - Chamber Wizard Field A

Chamber Model = retain_it retain_it 3.0' (retain-it®)
Inside= 84.0"W x 36.0"H => 21.33 sf x 8.00'L = 170.6 cf
Outside= 96.0"W x 44.0"H => 29.33 sf x 8.00'L = 234.7 cf
11 Rows adjusted for 302.1 cf perimeter wall

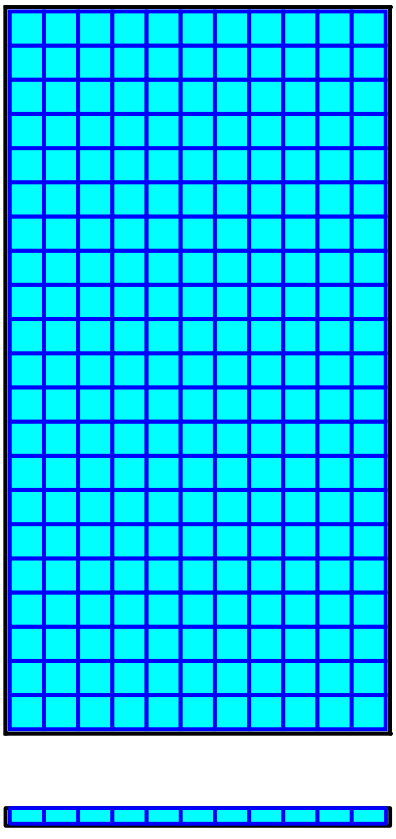
21 Chambers/Row x 8.00' Long = 168.00' Row Length +12.0" End Stone x 2 = 170.00' Base Length
11 Rows x 96.0" Wide + 12.0" Side Stone x 2 = 90.00' Base Width
6.0" Base + 44.0" Chamber Height = 4.17' Field Height

4.7 cf Sidewall x 21 x 2 + 4.7 cf Endwall x 11 x 2 = 302.1 cf Perimeter Wall
231 Chambers x 170.6 cf - 302.1 cf Perimeter wall = 39,108.9 cf Chamber Storage
231 Chambers x 234.7 cf = 54,208.0 cf Displacement

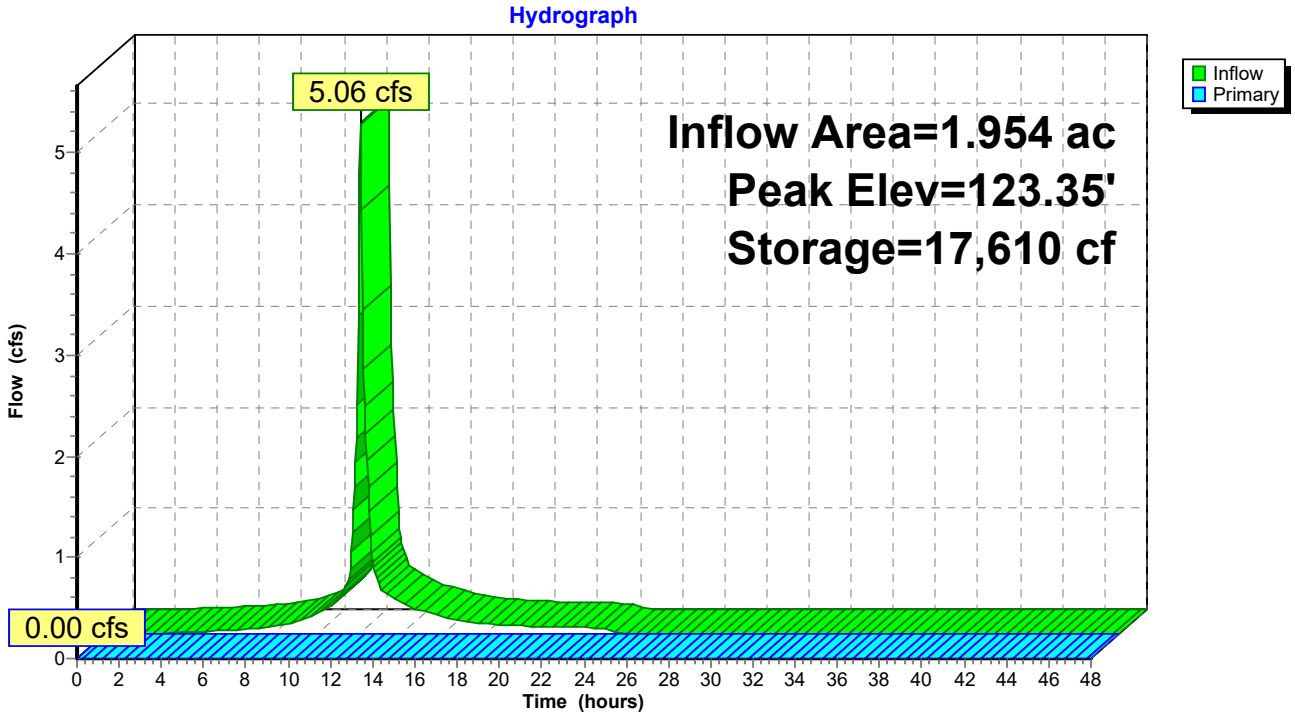
63,750.0 cf Field - 54,208.0 cf Chambers = 9,542.0 cf Stone x 40.0% Voids = 3,816.8 cf Stone Storage

Chamber Storage + Stone Storage = 42,925.7 cf = 0.985 af
Overall Storage Efficiency = 67.3%
Overall System Size = 170.00' x 90.00' x 4.17'

231 Chambers
2,361.1 cy Field
353.4 cy Stone



Pond 8P: UG-1 3 ft Retain IT



Summary for Pond 11P: Permeable Pavement

Inflow Area = 0.537 ac, 94.68% Impervious, Inflow Depth = 2.86" for 2-Year event
Inflow = 1.61 cfs @ 12.09 hrs, Volume= 0.128 af
Outflow = 0.14 cfs @ 11.45 hrs, Volume= 0.128 af, Atten= 91%, Lag= 0.0 min
Discarded = 0.14 cfs @ 11.45 hrs, Volume= 0.128 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Peak Elev= 122.99' @ 13.01 hrs Surf.Area= 22,160 sf Storage= 2,109 cf

Plug-Flow detention time= 116.1 min calculated for 0.128 af (100% of inflow)
Center-of-Mass det. time= 116.0 min (882.0 - 766.0)

Volume	Invert	Avail.Storage	Storage Description
#1	122.75'	7,512 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

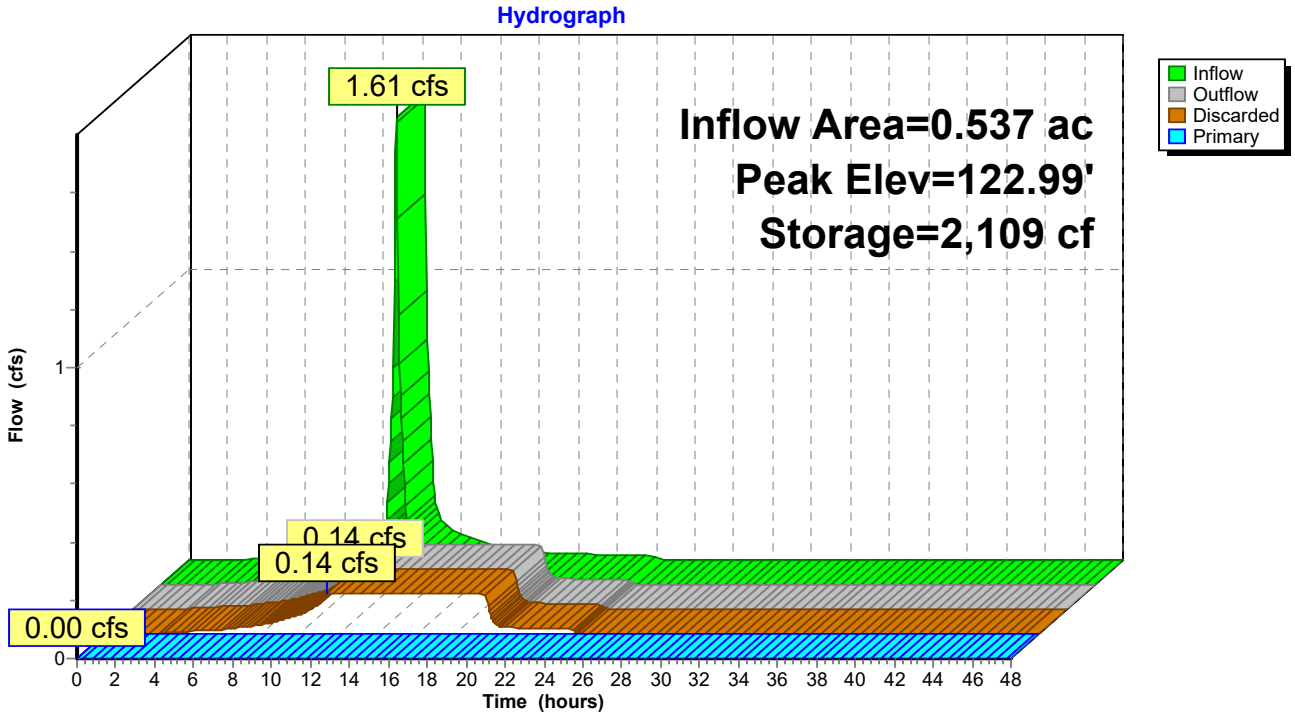
Elevation (feet)	Surf.Area (sq-ft)	Voids (%)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
122.75	22,160	0.0	0	0
123.41	22,160	40.0	5,850	5,850
123.66	22,160	30.0	1,662	7,512

Device	Routing	Invert	Outlet Devices
#1	Discarded	122.75'	**0.270 in/hr Exfiltration over Surface area**
#2	Primary	123.30'	**6.0" Round Culvert** L= 10.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 123.30' / 119.00' S= 0.4300 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 0.20 sf

Discarded OutFlow Max=0.14 cfs @ 11.45 hrs HW=122.76' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.14 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=122.75' (Free Discharge)
↑—**2=Culvert** (Controls 0.00 cfs)

Pond 11P: Permeable Pavement



Summary for Subcatchment P-1A: Undetained to Wetland B

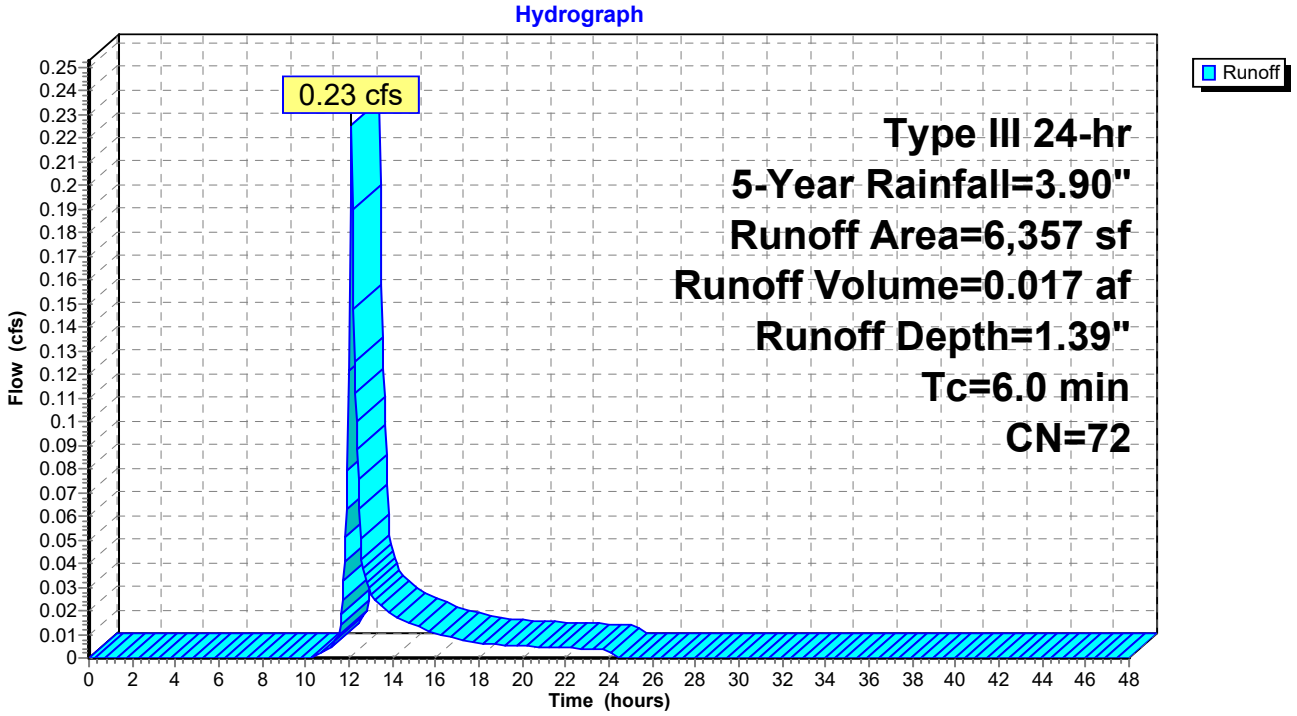
Runoff = 0.23 cfs @ 12.10 hrs, Volume= 0.017 af, Depth= 1.39"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 5-Year Rainfall=3.90"

Area (sf)	CN	Description
6,357	72	Woods/grass comb., Good, HSG C
6,357		100.00% Pervious Area

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

Subcatchment P-1A: Undetained to Wetland B



Summary for Subcatchment P-1B: Western Driveway

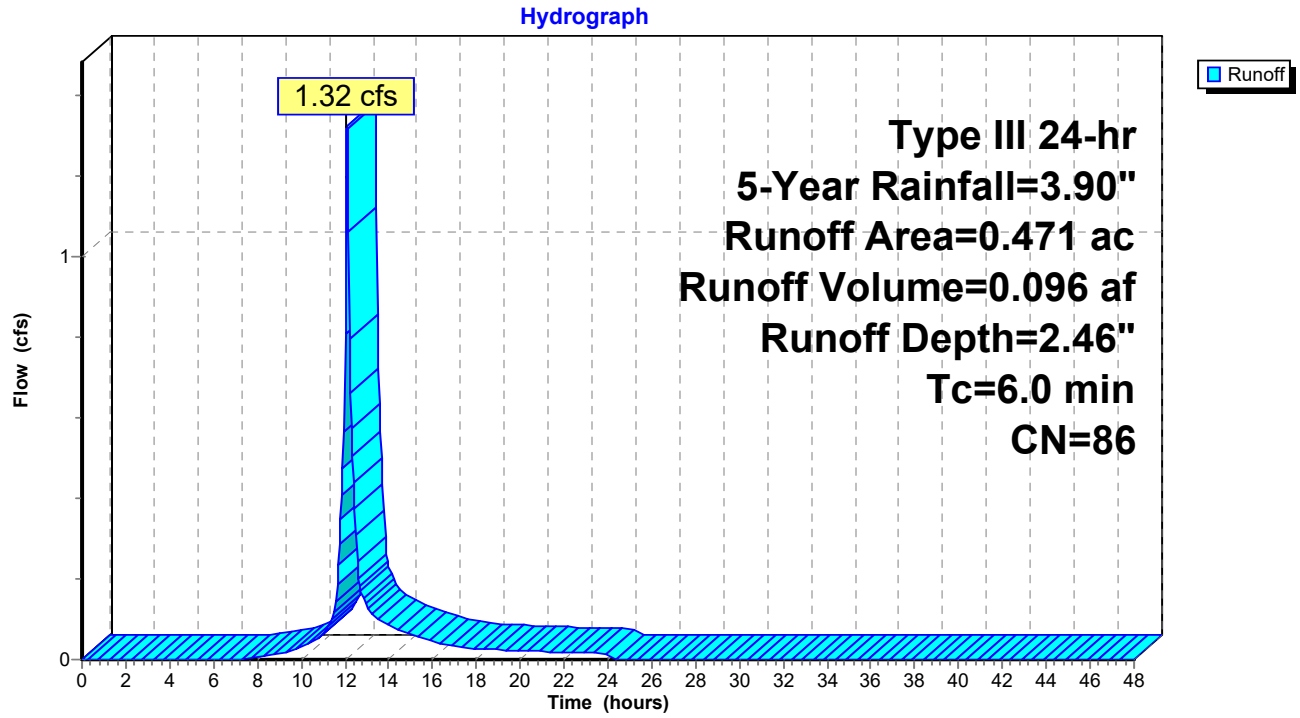
Runoff = 1.32 cfs @ 12.09 hrs, Volume= 0.096 af, Depth= 2.46"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 5-Year Rainfall=3.90"

Area (ac)	CN	Description
0.248	98	Paved parking, HSG C
0.223	72	Woods/grass comb., Good, HSG C
0.471	86	Weighted Average
0.223		47.35% Pervious Area
0.248		52.65% Impervious Area

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

Subcatchment P-1B: Western Driveway



Summary for Subcatchment P-1C: Permeable Pavement

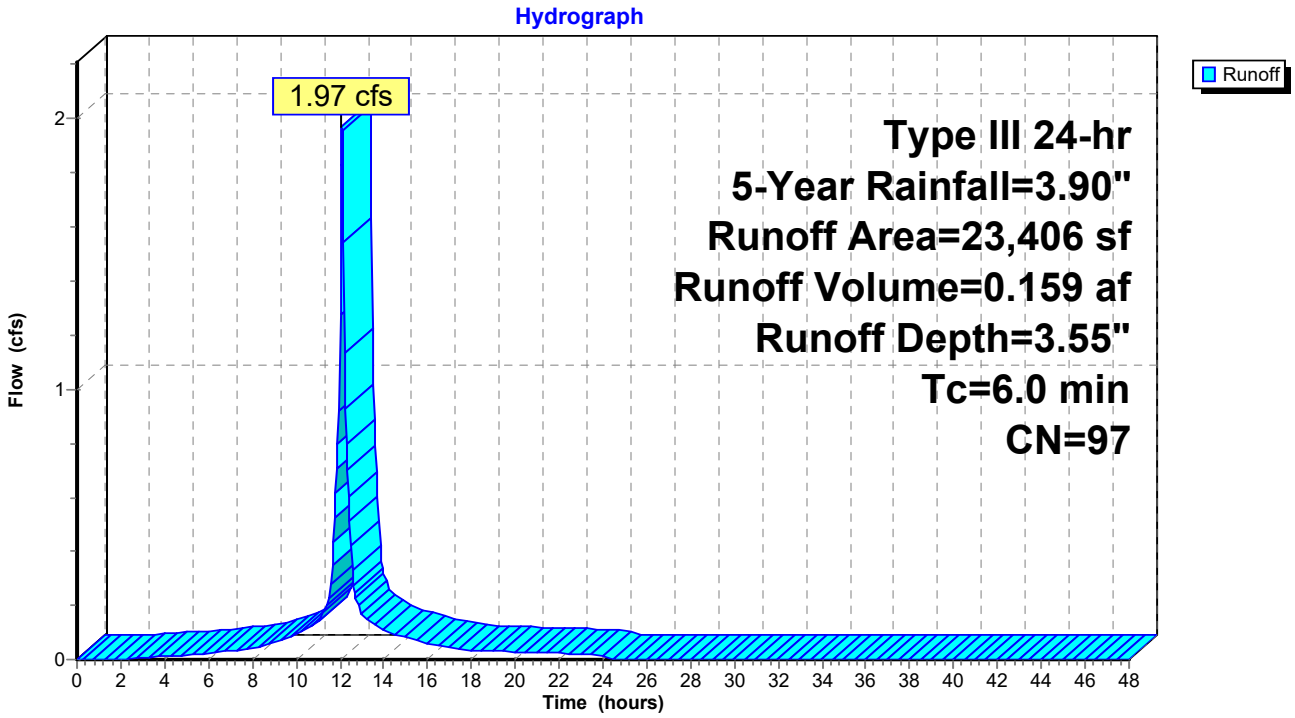
Runoff = 1.97 cfs @ 12.09 hrs, Volume= 0.159 af, Depth= 3.55"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 5-Year Rainfall=3.90"

Area (sf)	CN	Description
22,160	98	Paved parking, HSG C
1,246	74	>75% Grass cover, Good, HSG C
23,406	97	Weighted Average
1,246		5.32% Pervious Area
22,160		94.68% Impervious Area

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

Subcatchment P-1C: Permeable Pavement



Summary for Subcatchment P-2: Undetained to Wetland

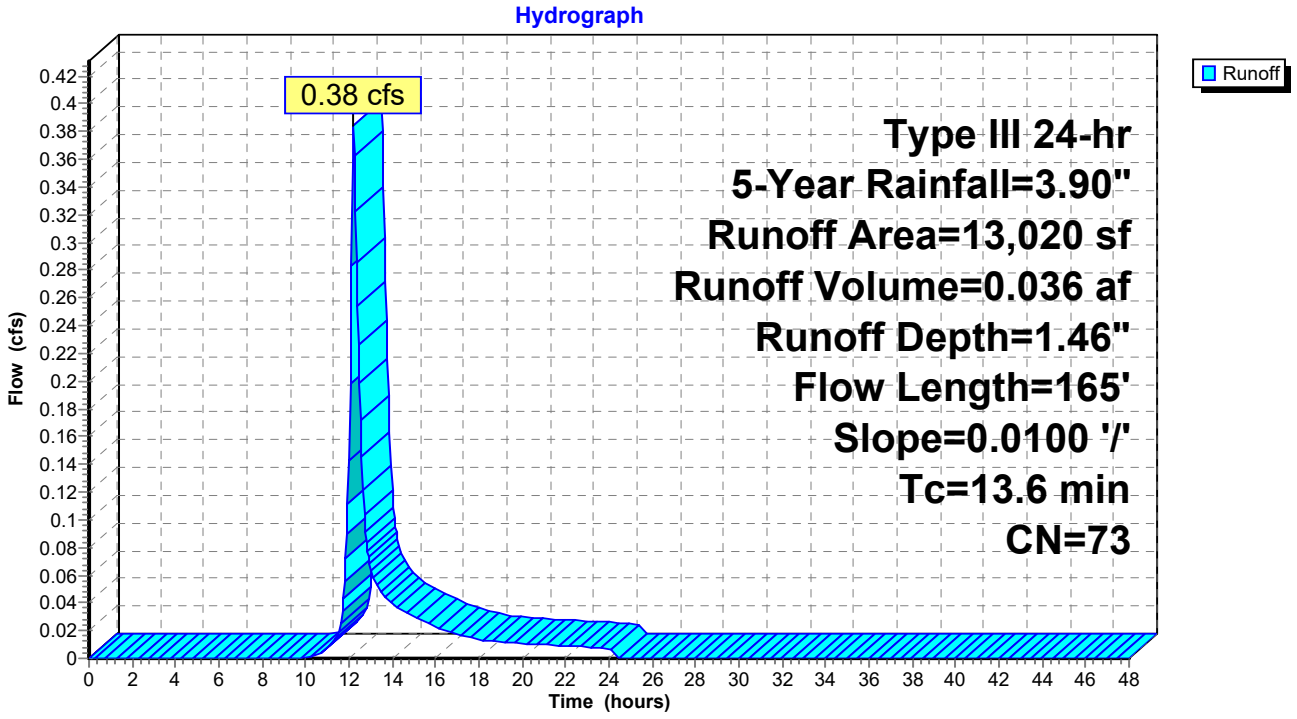
Runoff = 0.38 cfs @ 12.20 hrs, Volume= 0.036 af, Depth= 1.46"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 5-Year Rainfall=3.90"

Area (sf)	CN	Description
10,967	74	>75% Grass cover, Good, HSG C
2,053	70	Woods, Good, HSG C
13,020	73	Weighted Average
13,020		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.9	100	0.0100	0.13		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.20"
0.7	65	0.0100	1.61		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
13.6	165	Total			

Subcatchment P-2: Undetained to Wetland



Summary for Subcatchment P-3A: Existing Building & Additions and Upper Pavement

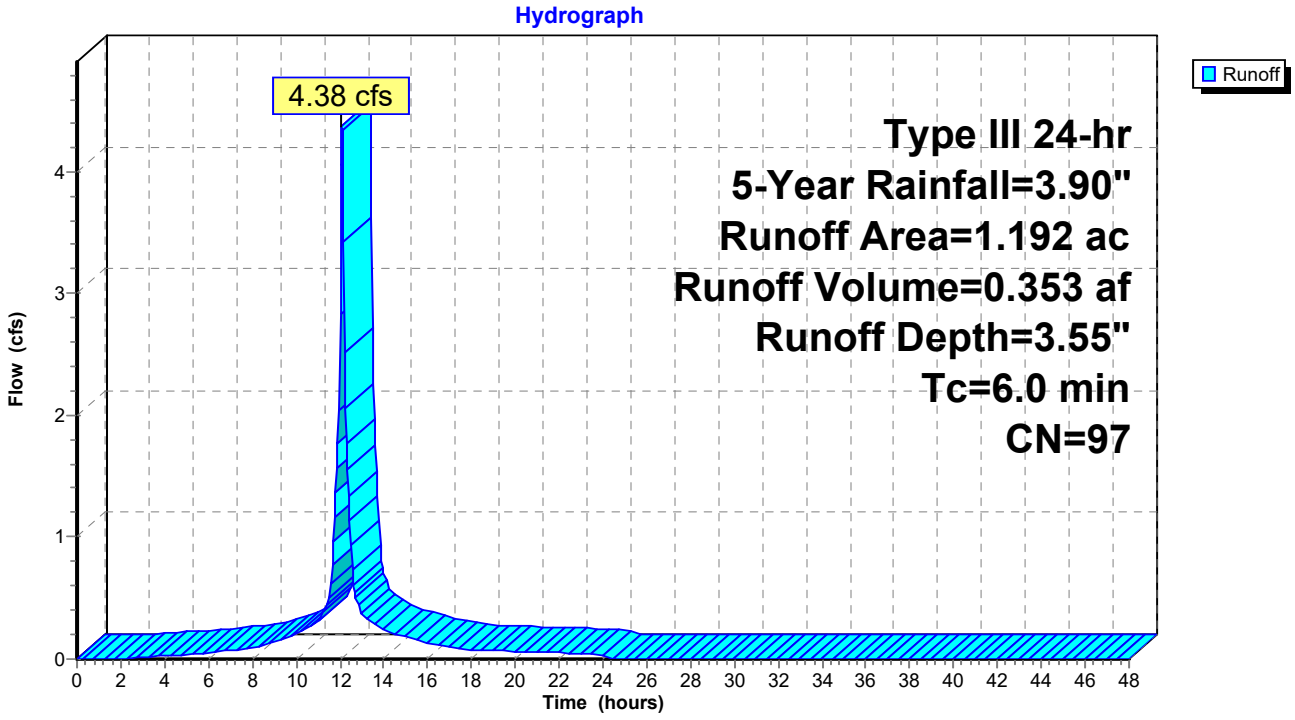
Runoff = 4.38 cfs @ 12.09 hrs, Volume= 0.353 af, Depth= 3.55"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 5-Year Rainfall=3.90"

Area (ac)	CN	Description
0.701	98	Paved parking, HSG C
0.461	98	Roofs, HSG C
0.030	74	>75% Grass cover, Good, HSG C
1.192	97	Weighted Average
0.030		2.52% Pervious Area
1.162		97.48% Impervious Area

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

Subcatchment P-3A: Existing Building & Additions and Upper Pavement



Summary for Subcatchment P-3B: Existing Building Draining to Constructed Wetland

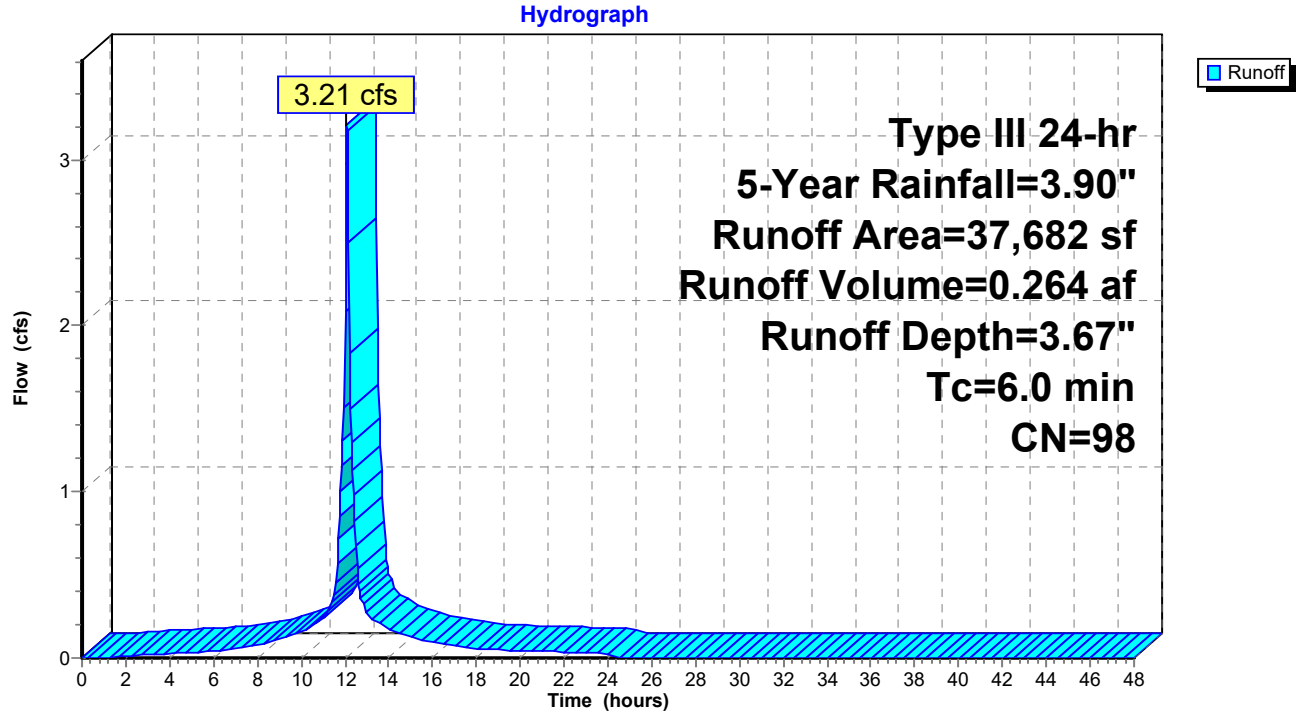
Runoff = 3.21 cfs @ 12.09 hrs, Volume= 0.264 af, Depth= 3.67"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 5-Year Rainfall=3.90"

Area (sf)	CN	Description
37,682	98	Roofs, HSG C
37,682		100.00% Impervious Area

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

Subcatchment P-3B: Existing Building Draining to Constructed Wetland



Summary for Subcatchment P-4: Watershed to Existing Stormwater System

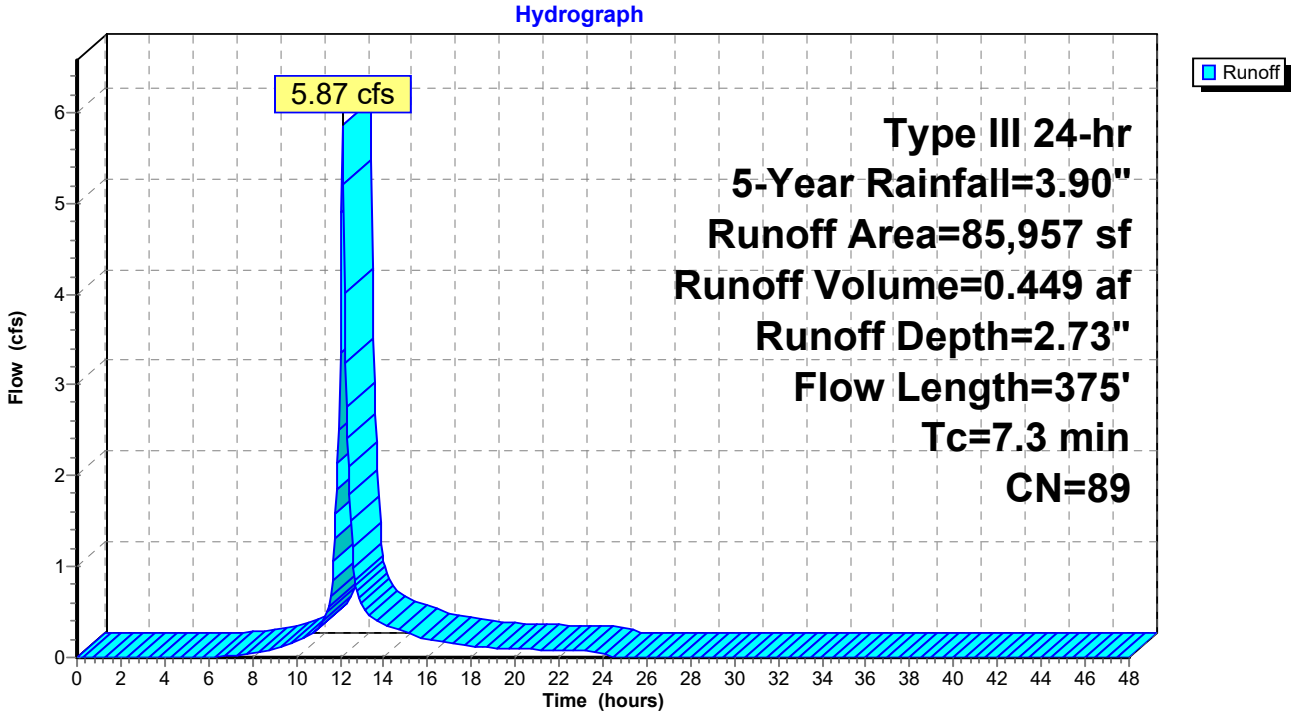
Runoff = 5.87 cfs @ 12.10 hrs, Volume= 0.449 af, Depth= 2.73"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 5-Year Rainfall=3.90"

Area (sf)	CN	Description
54,671	98	Paved parking, HSG C
29,238	74	>75% Grass cover, Good, HSG C
2,048	70	Woods, Good, HSG C
85,957	89	Weighted Average
31,286		36.40% Pervious Area
54,671		63.60% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.2	50	0.0240	0.16		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.20"
1.7	245	0.0220	2.39		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
0.4	80	0.0287	3.44		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
7.3	375	Total			

Subcatchment P-4: Watershed to Existing Stormwater System



Summary for Subcatchment P-4A: Watershed to MassDOT CB1

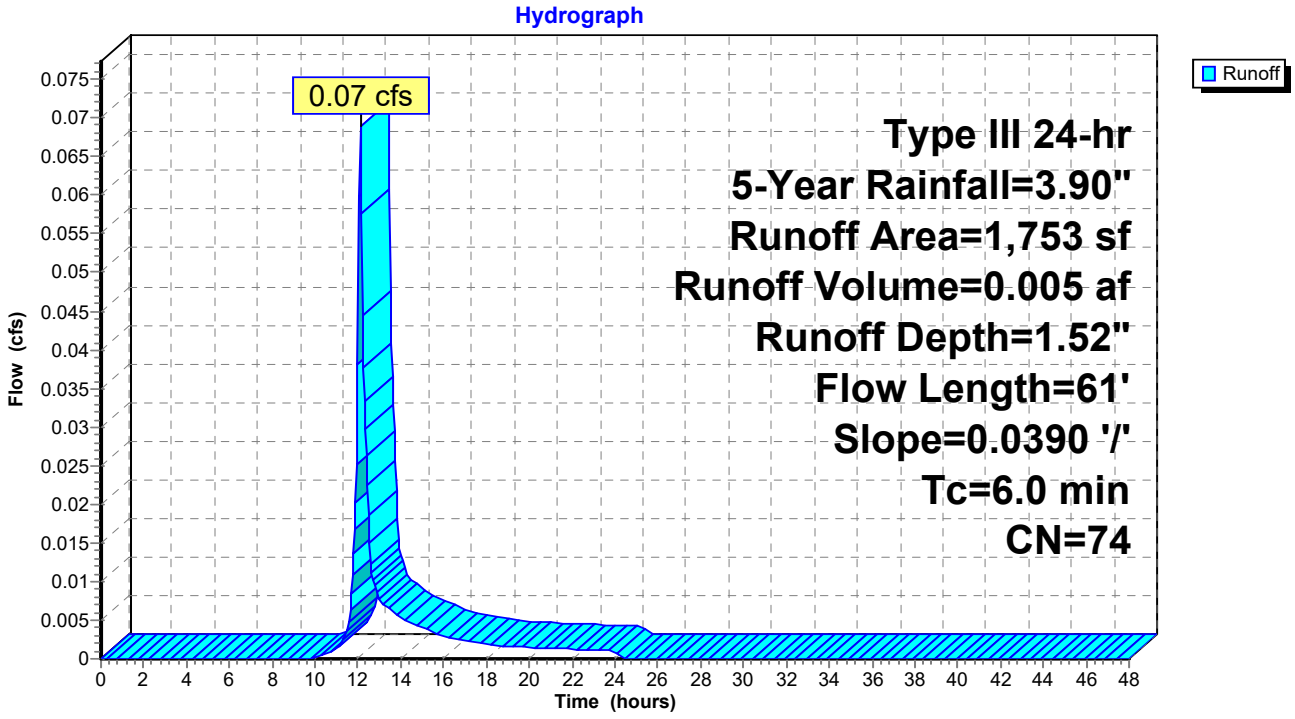
Runoff = 0.07 cfs @ 12.10 hrs, Volume= 0.005 af, Depth= 1.52"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 5-Year Rainfall=3.90"

Area (sf)	CN	Description
1,753	74	>75% Grass cover, Good, HSG C
1,753		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.1	61	0.0390	0.20		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.20"
0.9					**Direct Entry,**
6.0	61	Total			

Subcatchment P-4A: Watershed to MassDOT CB1



Summary for Subcatchment P-4B: Watershed to CB2

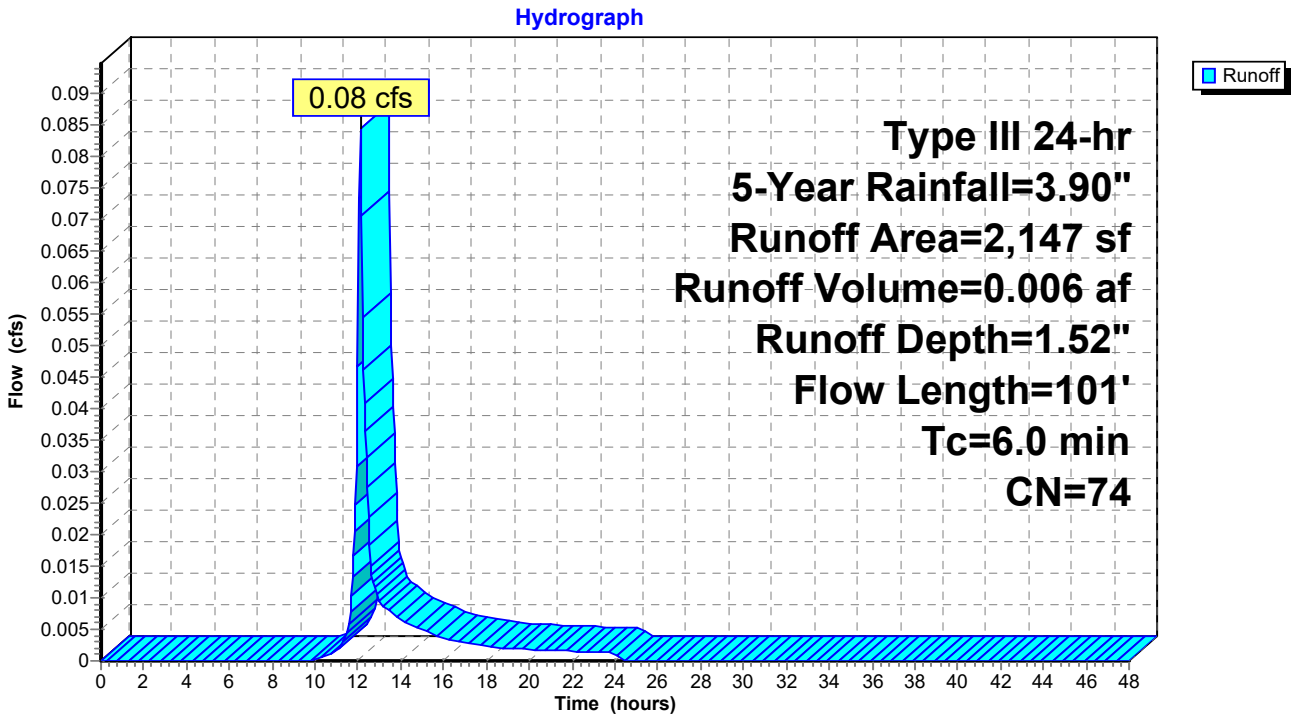
Runoff = 0.08 cfs @ 12.10 hrs, Volume= 0.006 af, Depth= 1.52"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 5-Year Rainfall=3.90"

Area (sf)	CN	Description
2,147	74	>75% Grass cover, Good, HSG C
2,147		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.6	50	0.0200	0.15		**Sheet Flow, SHeet Flow** Grass: Short n= 0.150 P2= 3.20"
0.3	51	0.0390	3.18		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
0.1					**Direct Entry, Miniumum**
6.0	101	Total			

Subcatchment P-4B: Watershed to CB2



Summary for Subcatchment P-5: P-5

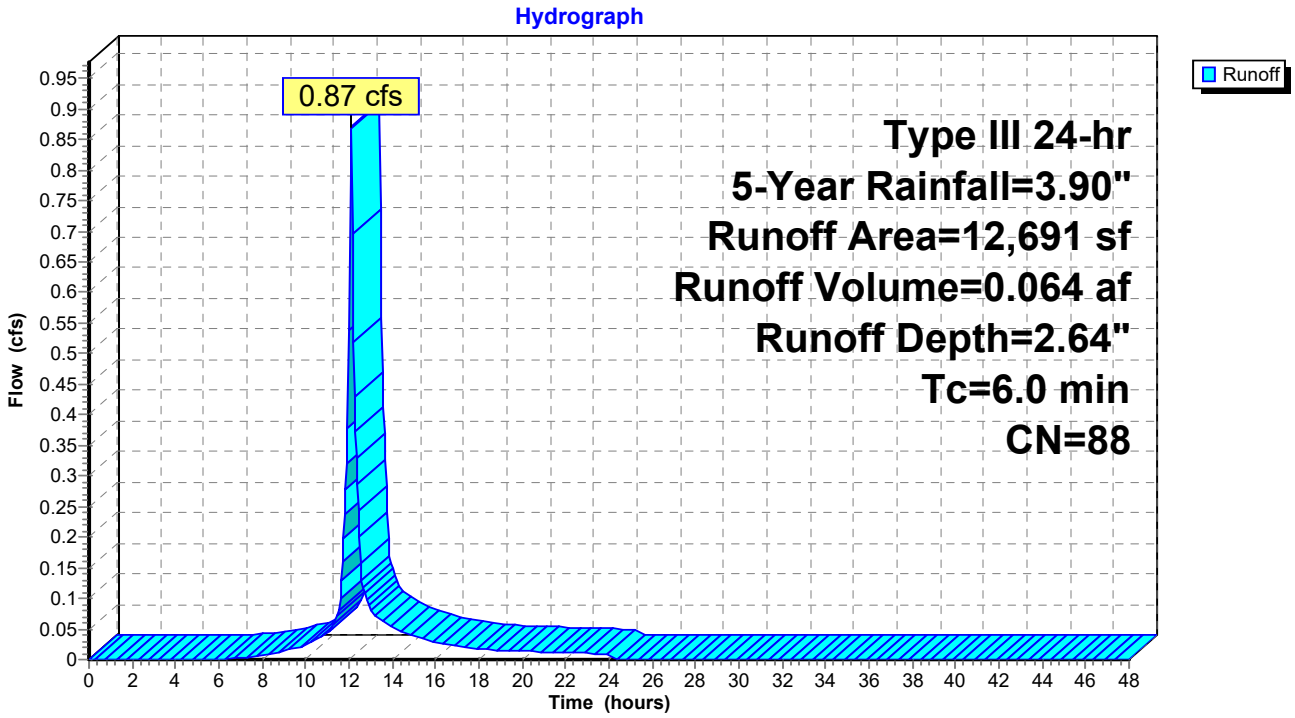
Runoff = 0.87 cfs @ 12.09 hrs, Volume= 0.064 af, Depth= 2.64"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 5-Year Rainfall=3.90"

Area (sf)	CN	Description
5,116	74	>75% Grass cover, Good, HSG C
7,575	98	Paved parking, HSG C
12,691	88	Weighted Average
5,116		40.31% Pervious Area
7,575		59.69% Impervious Area

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

Subcatchment P-5: P-5

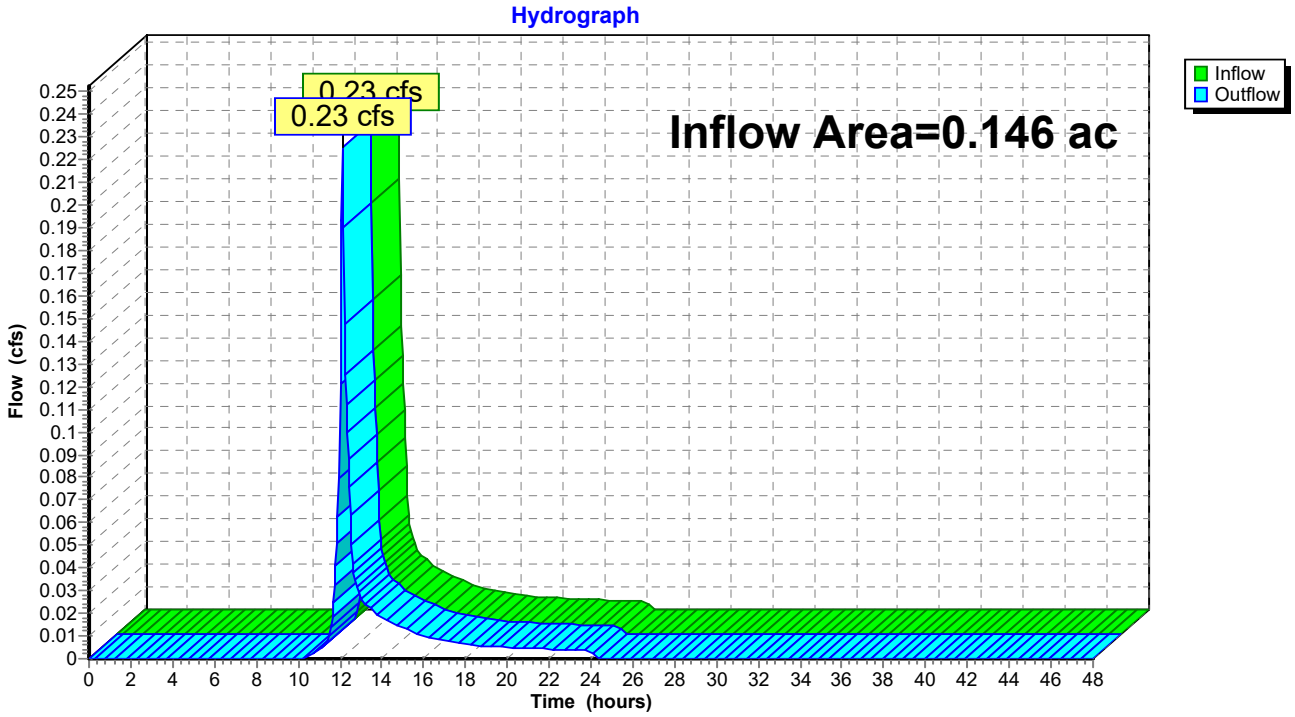


Summary for Reach DP-1: Design Point 1 (Wetland B)

Inflow Area = 0.146 ac, 0.00% Impervious, Inflow Depth = 1.39" for 5-Year event
Inflow = 0.23 cfs @ 12.10 hrs, Volume= 0.017 af
Outflow = 0.23 cfs @ 12.10 hrs, Volume= 0.017 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Reach DP-1: Design Point 1 (Wetland B)

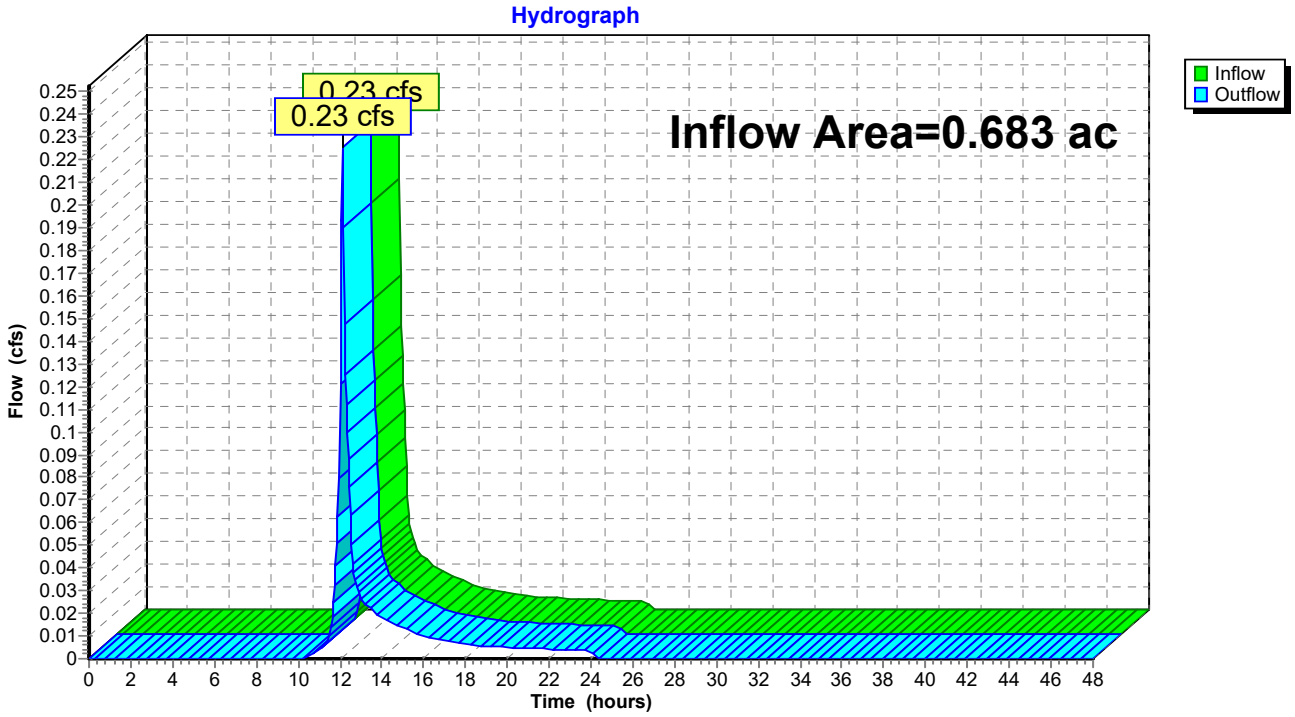


Summary for Reach DP-2: Design Point 2 (15" RCP to Wetland A)

Inflow Area = 0.683 ac, 74.45% Impervious, Inflow Depth = 0.30" for 5-Year event
Inflow = 0.23 cfs @ 12.10 hrs, Volume= 0.017 af
Outflow = 0.23 cfs @ 12.10 hrs, Volume= 0.017 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Reach DP-2: Design Point 2 (15" RCP to Wetland A)

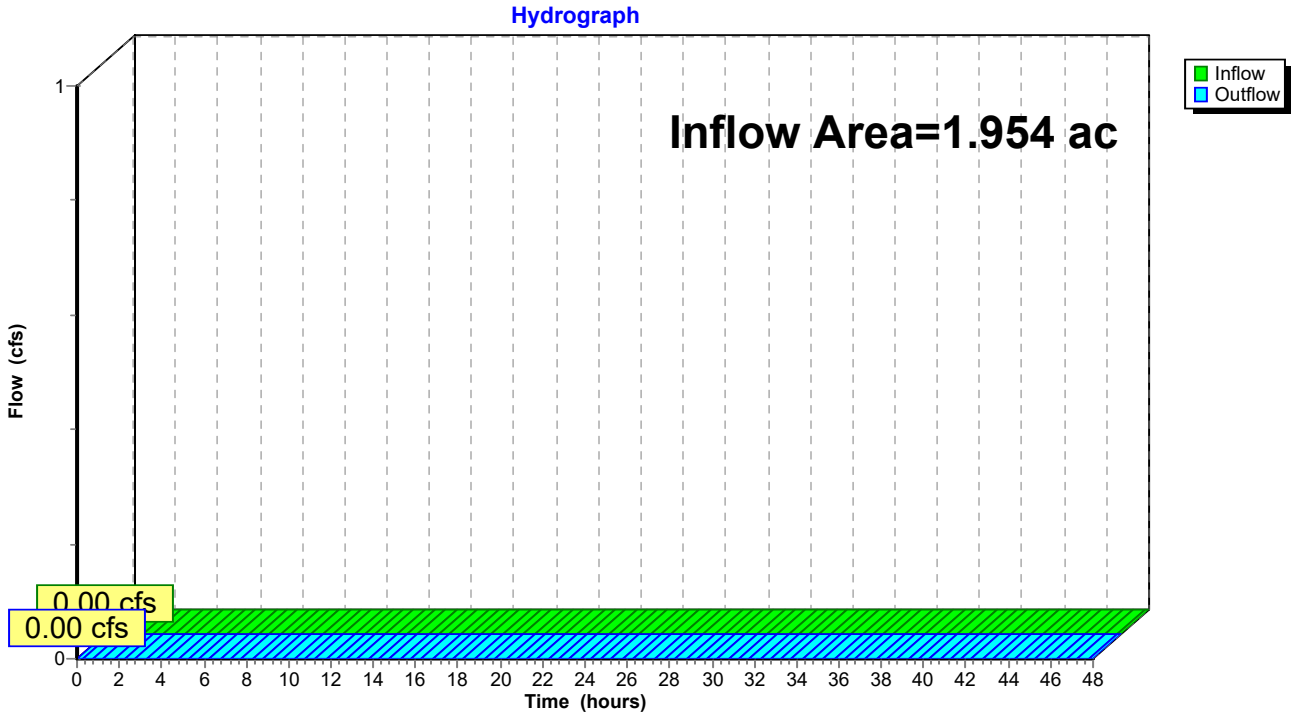


Summary for Reach DP-3: Design Point 3 (Existing Drainage Ditch)

Inflow Area = 1.954 ac, 81.04% Impervious, Inflow Depth = 0.00" for 5-Year event
Inflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Reach DP-3: Design Point 3 (Existing Drainage Ditch)

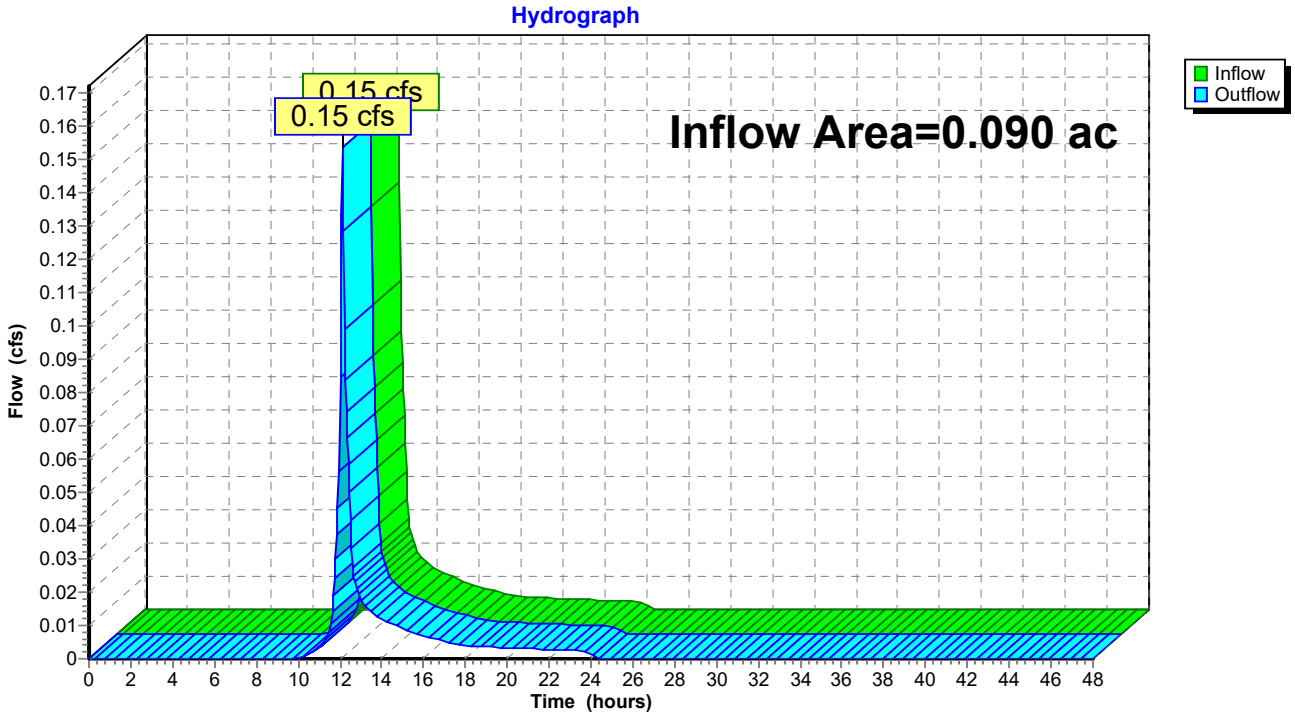


Summary for Reach DP-4: Design Point 4 (MassDOT 30" CB-2)

Inflow Area = 0.090 ac, 0.00% Impervious, Inflow Depth = 1.52" for 5-Year event
Inflow = 0.15 cfs @ 12.10 hrs, Volume= 0.011 af
Outflow = 0.15 cfs @ 12.10 hrs, Volume= 0.011 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Reach DP-4: Design Point 4 (MassDOT 30" CB-2)

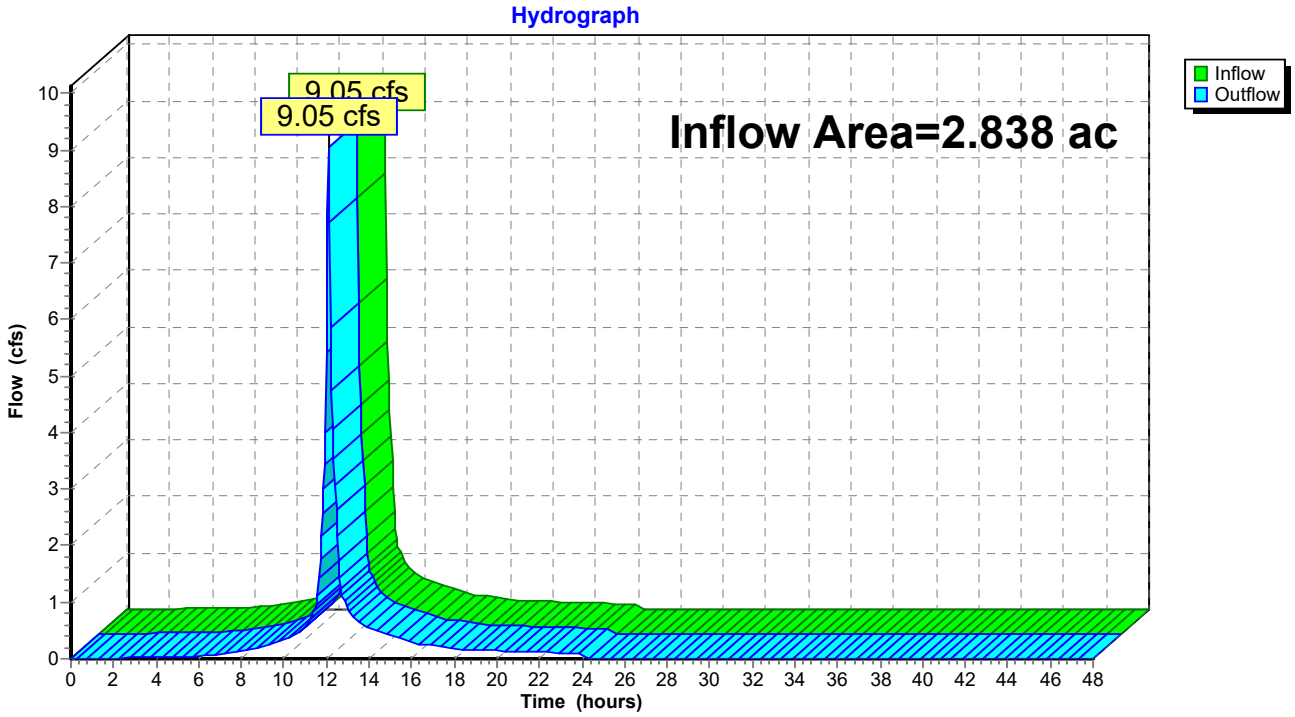


Summary for Reach DP-5: Design Point 5 (Existing Constructed Stormwater Wetland)

Inflow Area = 2.838 ac, 74.70% Impervious, Inflow Depth = 3.01" for 5-Year event
Inflow = 9.05 cfs @ 12.10 hrs, Volume= 0.713 af
Outflow = 9.05 cfs @ 12.10 hrs, Volume= 0.713 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Reach DP-5: Design Point 5 (Existing Constructed Stormwater Wetland)

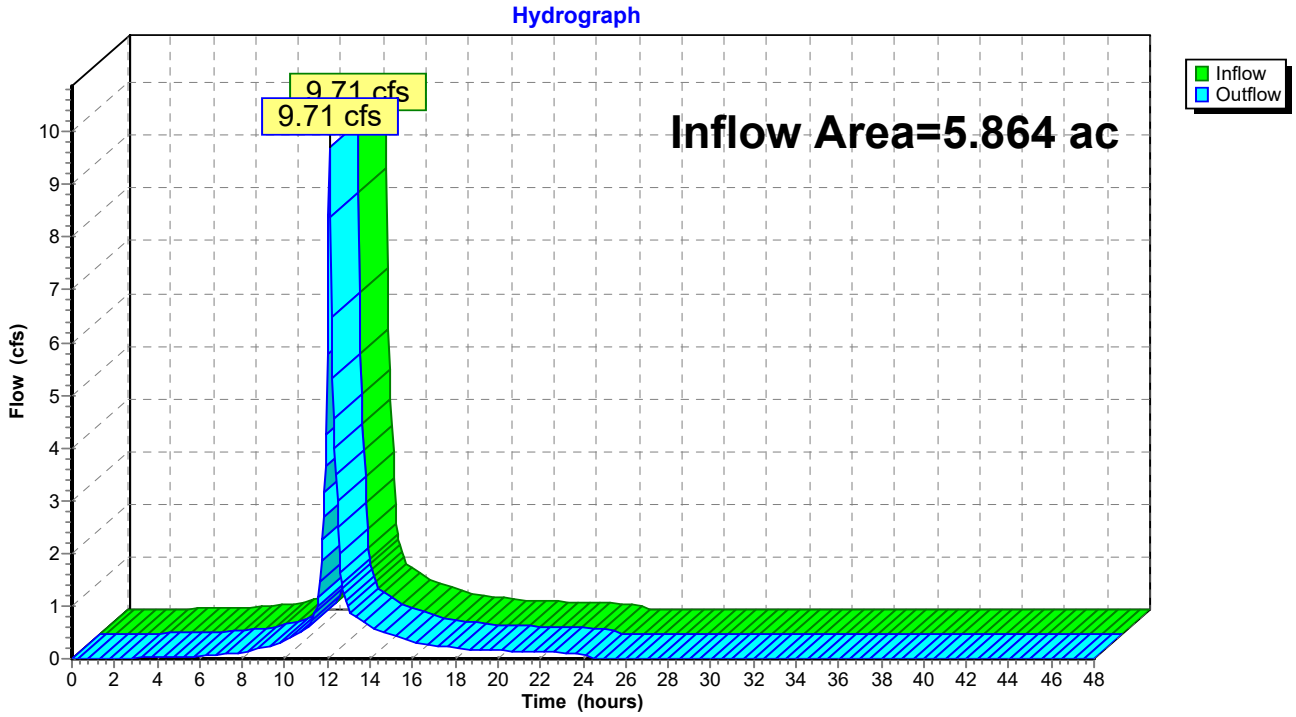


Summary for Reach DP-6: Wetland A - Design Point 6

Inflow Area = 5.864 ac, 71.84% Impervious, Inflow Depth = 1.59" for 5-Year event
Inflow = 9.71 cfs @ 12.10 hrs, Volume= 0.778 af
Outflow = 9.71 cfs @ 12.10 hrs, Volume= 0.778 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Reach DP-6: Wetland A - Design Point 6



Summary for Pond 3P: Conveyance Swale

Inflow Area = 0.471 ac, 52.65% Impervious, Inflow Depth = 2.46" for 5-Year event
Inflow = 1.32 cfs @ 12.09 hrs, Volume= 0.096 af
Outflow = 1.19 cfs @ 12.13 hrs, Volume= 0.096 af, Atten= 10%, Lag= 2.1 min
Primary = 1.19 cfs @ 12.13 hrs, Volume= 0.096 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs / 2
Peak Elev= 125.49' @ 12.13 hrs Surf.Area= 638 sf Storage= 263 cf

Plug-Flow detention time= 11.1 min calculated for 0.096 af (100% of inflow)
Center-of-Mass det. time= 10.5 min (824.7 - 814.2)

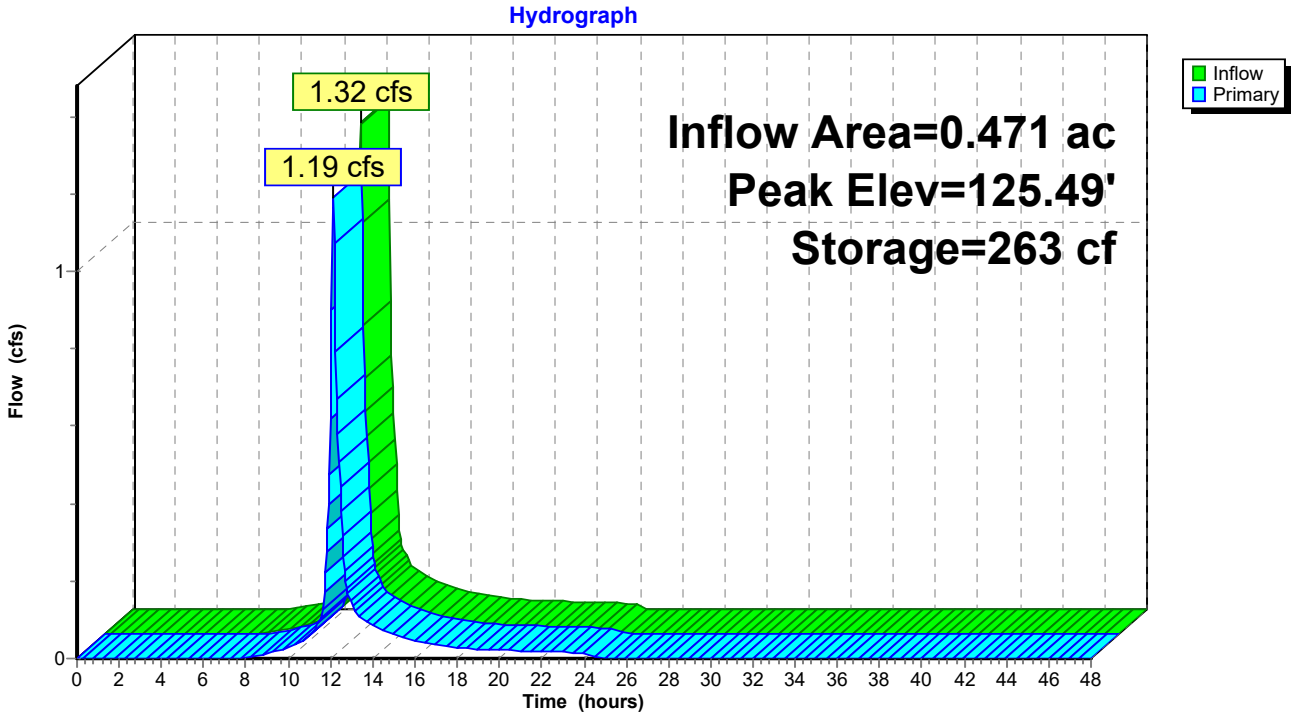
Volume	Invert	Avail.Storage	Storage Description
#1	125.00'	1,147 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
125.00	436	0	0
126.00	848	642	642
126.50	1,170	505	1,147

Device	Routing	Invert	Outlet Devices
#1	Primary	124.18'	**12.0" Round Culvert** L= 10.0' Ke= 0.500 Inlet / Outlet Invert= 124.18' / 124.13' S= 0.0050 '/' Cc= 0.900 n= 0.011 Concrete pipe, straight & clean, Flow Area= 0.79 sf
#2	Device 1	125.00'	**18.0" Vert. Orifice/Grate** C= 0.600

Primary OutFlow Max=1.17 cfs @ 12.13 hrs HW=125.48' (Free Discharge)
↑**1=Culvert** (Passes 1.17 cfs of 2.95 cfs potential flow)
↑**2=Orifice/Grate** (Orifice Controls 1.17 cfs @ 2.37 fps)

Pond 3P: Conveyance Swale



Summary for Pond 8P: UG-1 3 ft Retain IT

Inflow Area = 1.954 ac, 81.04% Impervious, Inflow Depth = 3.15" for 5-Year event
Inflow = 6.38 cfs @ 12.09 hrs, Volume= 0.513 af
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 100%, Lag= 0.0 min
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs / 2
Peak Elev= 123.71' @ 48.00 hrs Surf.Area= 15,300 sf Storage= 22,356 cf

Plug-Flow detention time= (not calculated: initial storage exceeds outflow)
Center-of-Mass det. time= (not calculated: no outflow)

Volume	Invert	Avail.Storage	Storage Description
#1A	121.75'	3,817 cf	**90.00'W x 170.00'L x 4.17'H Field A** 63,750 cf Overall - 54,208 cf Embedded = 9,542 cf x 40.0% Voids
#2A	122.25'	39,109 cf	**retain_it retain_it 3.0'** x 231 Inside #1 Inside= 84.0"W x 36.0"H => 21.33 sf x 8.00'L = 170.6 cf Outside= 96.0"W x 44.0"H => 29.33 sf x 8.00'L = 234.7 cf 11 Rows adjusted for 302.1 cf perimeter wall
		42,926 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	124.25'	**12.0" Round HDPE_Round 12"** L= 12.5' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 124.25' / 124.18' S= 0.0056 '/' Cc= 0.900 n= 0.011 Concrete pipe, straight & clean, Flow Area= 0.79 sf
#2	Device 1	124.40'	**4.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=121.75' (Free Discharge)
↑—**1=HDPE_Round 12"** (Controls 0.00 cfs)
↑—**2=Sharp-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 8P: UG-1 3 ft Retain IT - Chamber Wizard Field A

Chamber Model = retain_it retain_it 3.0' (retain-it®)
Inside= 84.0"W x 36.0"H => 21.33 sf x 8.00'L = 170.6 cf
Outside= 96.0"W x 44.0"H => 29.33 sf x 8.00'L = 234.7 cf
11 Rows adjusted for 302.1 cf perimeter wall

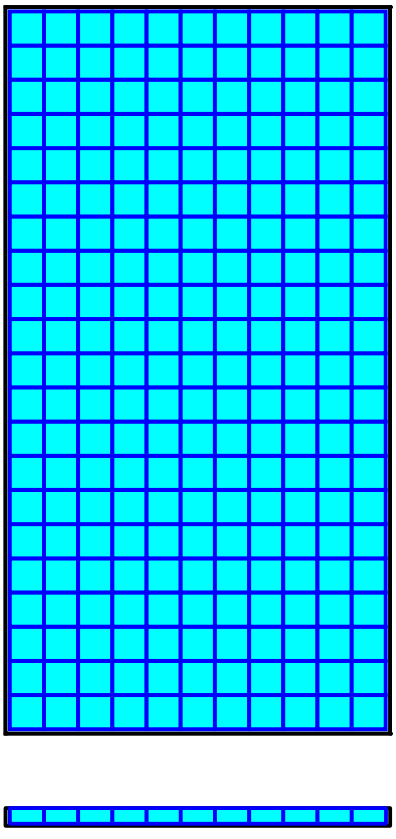
21 Chambers/Row x 8.00' Long = 168.00' Row Length +12.0" End Stone x 2 = 170.00' Base Length
11 Rows x 96.0" Wide + 12.0" Side Stone x 2 = 90.00' Base Width
6.0" Base + 44.0" Chamber Height = 4.17' Field Height

4.7 cf Sidewall x 21 x 2 + 4.7 cf Endwall x 11 x 2 = 302.1 cf Perimeter Wall
231 Chambers x 170.6 cf - 302.1 cf Perimeter wall = 39,108.9 cf Chamber Storage
231 Chambers x 234.7 cf = 54,208.0 cf Displacement

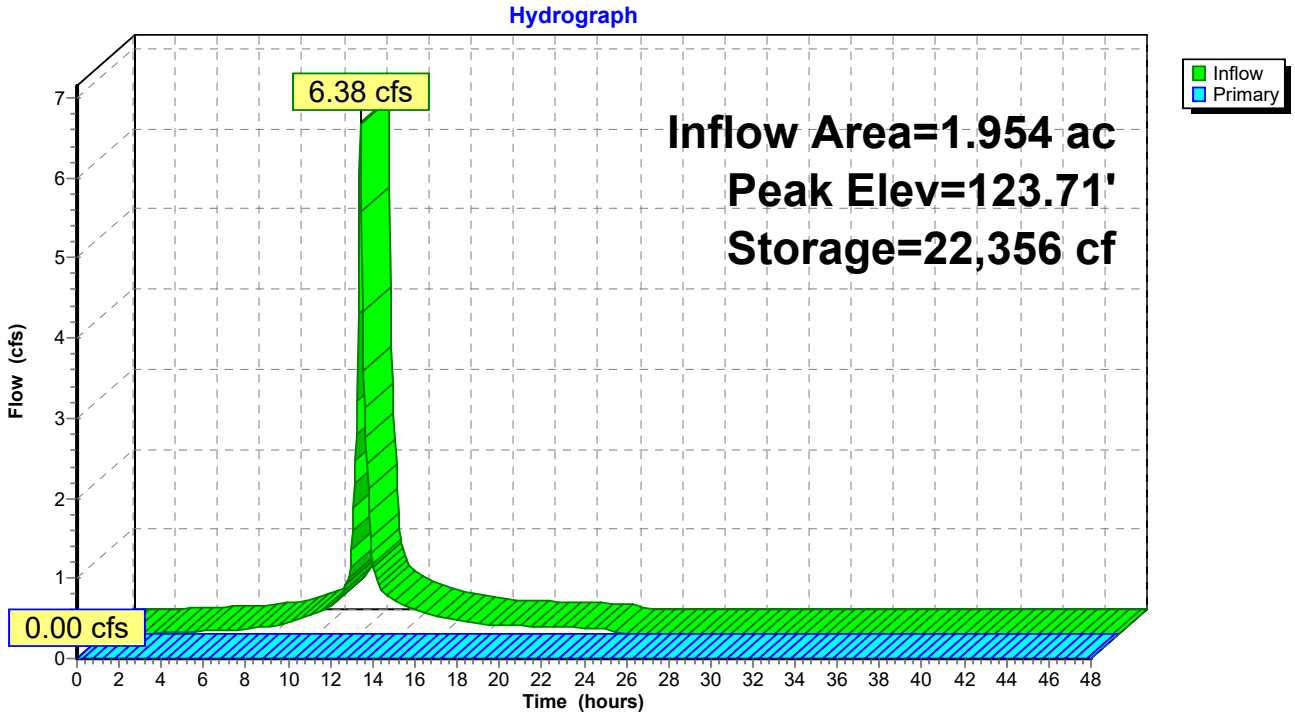
63,750.0 cf Field - 54,208.0 cf Chambers = 9,542.0 cf Stone x 40.0% Voids = 3,816.8 cf Stone Storage

Chamber Storage + Stone Storage = 42,925.7 cf = 0.985 af
Overall Storage Efficiency = 67.3%
Overall System Size = 170.00' x 90.00' x 4.17'

231 Chambers
2,361.1 cy Field
353.4 cy Stone



Pond 8P: UG-1 3 ft Retain IT



Summary for Pond 11P: Permeable Pavement

Inflow Area = 0.537 ac, 94.68% Impervious, Inflow Depth = 3.55" for 5-Year event
Inflow = 1.97 cfs @ 12.09 hrs, Volume= 0.159 af
Outflow = 0.14 cfs @ 11.15 hrs, Volume= 0.159 af, Atten= 93%, Lag= 0.0 min
Discarded = 0.14 cfs @ 11.15 hrs, Volume= 0.159 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Peak Elev= 123.07' @ 13.38 hrs Surf.Area= 22,160 sf Storage= 2,810 cf

Plug-Flow detention time= 161.1 min calculated for 0.159 af (100% of inflow)
Center-of-Mass det. time= 161.0 min (922.2 - 761.2)

Volume	Invert	Avail.Storage	Storage Description
#1	122.75'	7,512 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

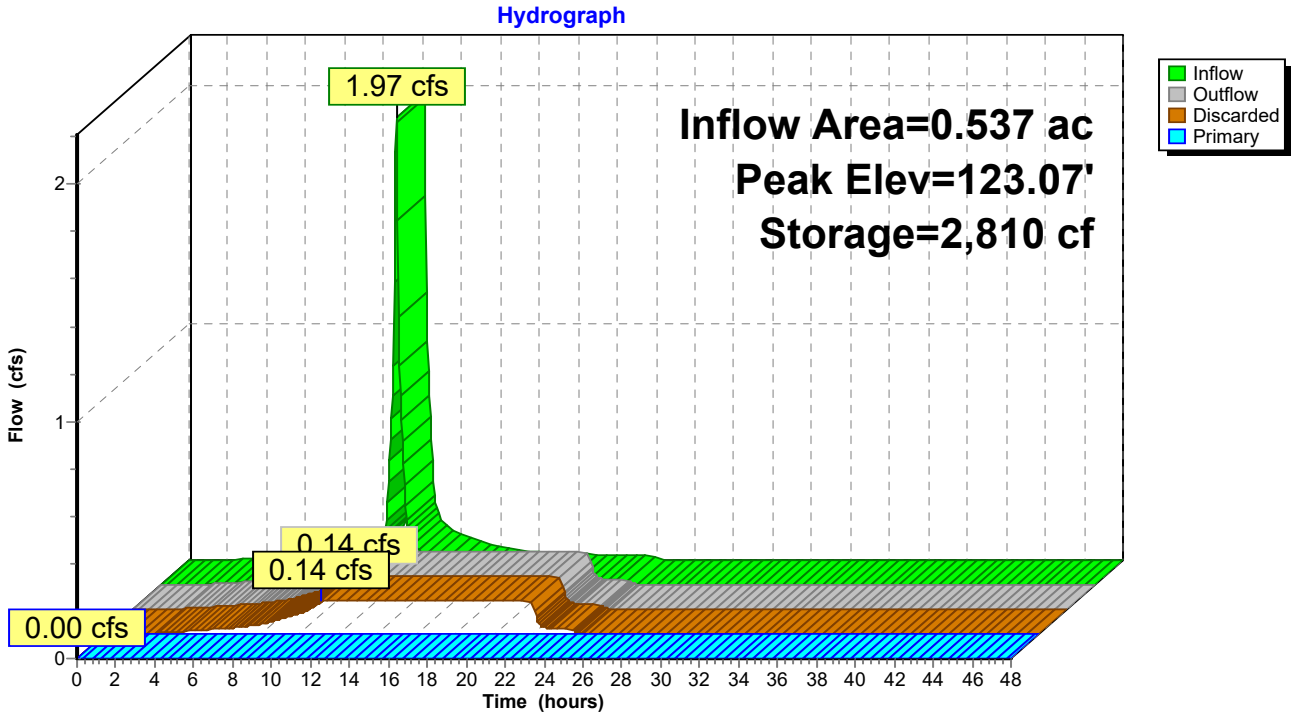
Elevation (feet)	Surf.Area (sq-ft)	Voids (%)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
122.75	22,160	0.0	0	0
123.41	22,160	40.0	5,850	5,850
123.66	22,160	30.0	1,662	7,512

Device	Routing	Invert	Outlet Devices
#1	Discarded	122.75'	**0.270 in/hr Exfiltration over Surface area**
#2	Primary	123.30'	**6.0" Round Culvert** L= 10.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 123.30' / 119.00' S= 0.4300 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 0.20 sf

Discarded OutFlow Max=0.14 cfs @ 11.15 hrs HW=122.76' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.14 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=122.75' (Free Discharge)
↑—**2=Culvert** (Controls 0.00 cfs)

Pond 11P: Permeable Pavement



Summary for Subcatchment P-1A: Undetained to Wetland B

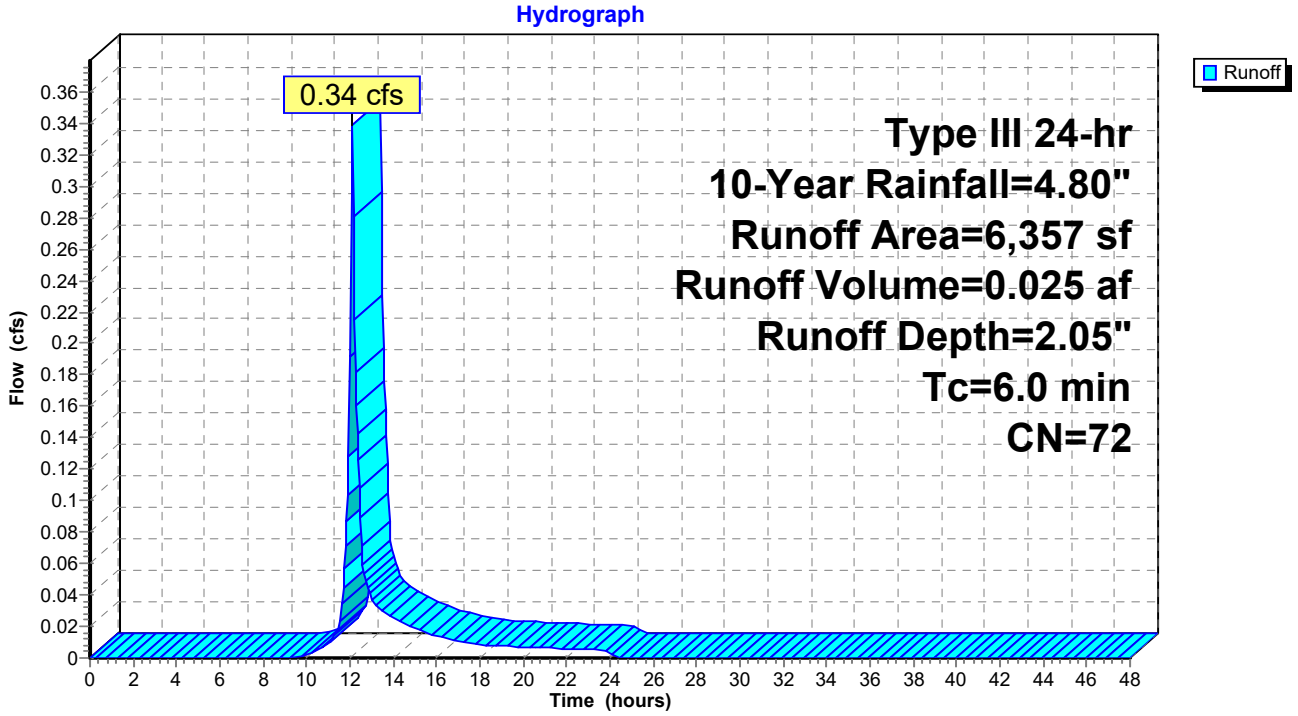
Runoff = 0.34 cfs @ 12.10 hrs, Volume= 0.025 af, Depth= 2.05"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.80"

Area (sf)	CN	Description
6,357	72	Woods/grass comb., Good, HSG C
6,357		100.00% Pervious Area

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

Subcatchment P-1A: Undetained to Wetland B



Summary for Subcatchment P-1B: Western Driveway

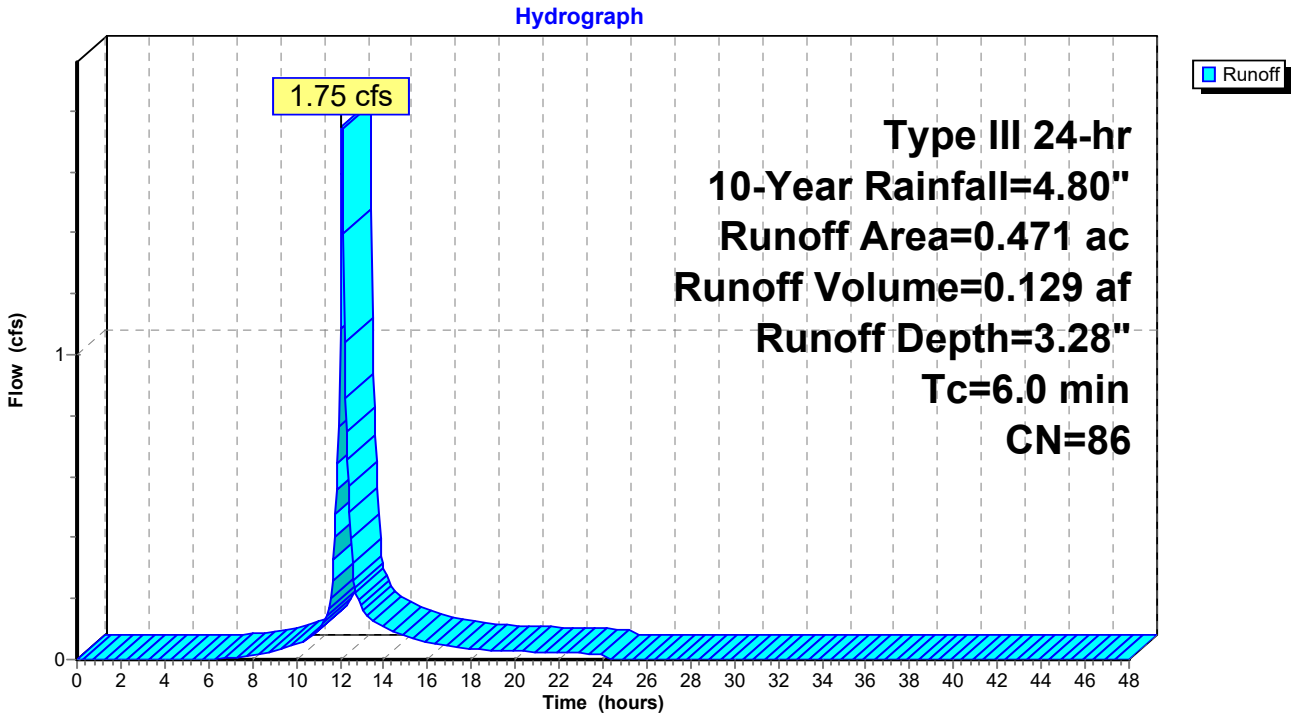
Runoff = 1.75 cfs @ 12.09 hrs, Volume= 0.129 af, Depth= 3.28"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.80"

Area (ac)	CN	Description
0.248	98	Paved parking, HSG C
0.223	72	Woods/grass comb., Good, HSG C
0.471	86	Weighted Average
0.223		47.35% Pervious Area
0.248		52.65% Impervious Area

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

Subcatchment P-1B: Western Driveway



Summary for Subcatchment P-1C: Permeable Pavement

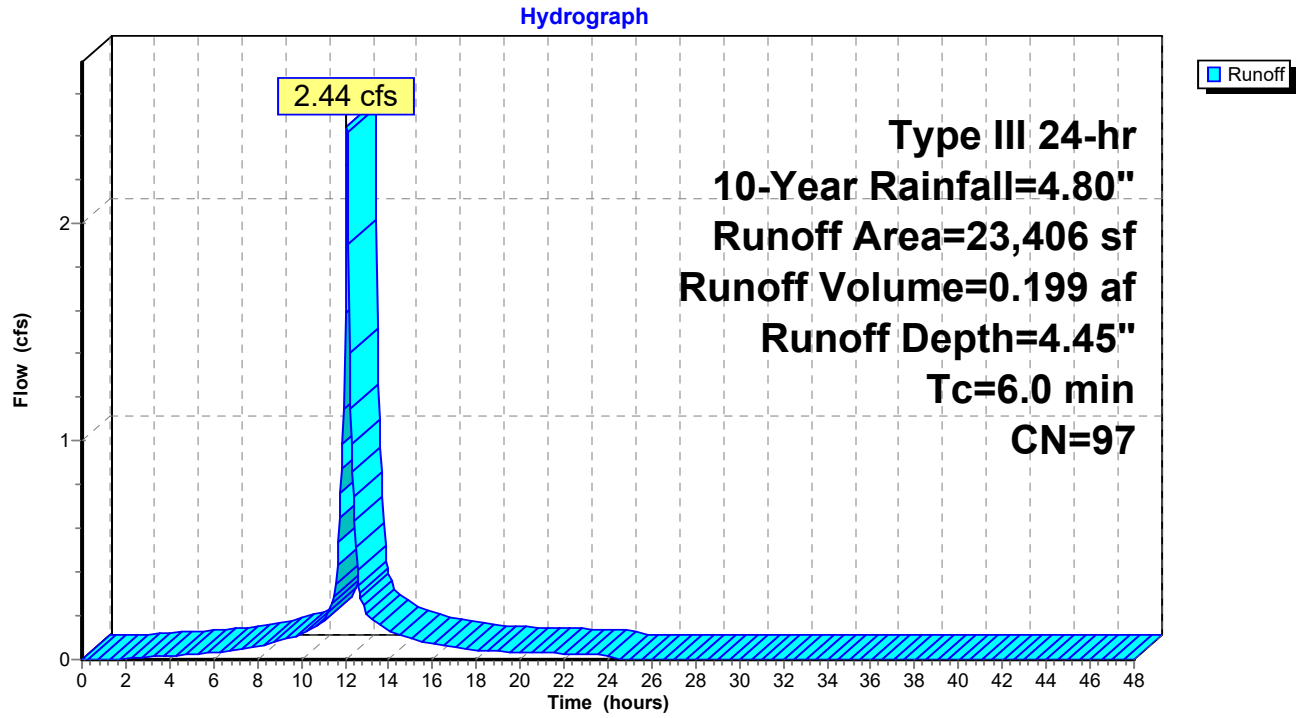
Runoff = 2.44 cfs @ 12.09 hrs, Volume= 0.199 af, Depth= 4.45"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.80"

Area (sf)	CN	Description
22,160	98	Paved parking, HSG C
1,246	74	>75% Grass cover, Good, HSG C
23,406	97	Weighted Average
1,246		5.32% Pervious Area
22,160		94.68% Impervious Area

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

Subcatchment P-1C: Permeable Pavement



Summary for Subcatchment P-2: Undetained to Wetland

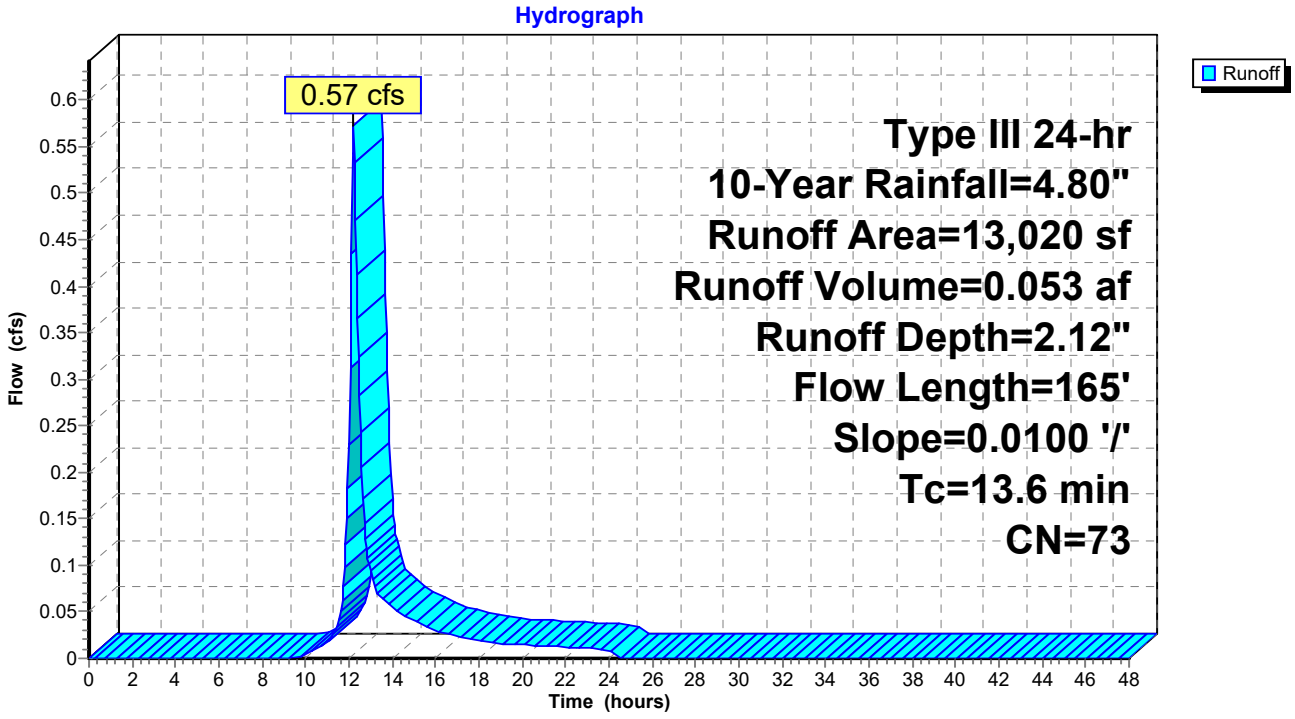
Runoff = 0.57 cfs @ 12.20 hrs, Volume= 0.053 af, Depth= 2.12"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.80"

Area (sf)	CN	Description
10,967	74	>75% Grass cover, Good, HSG C
2,053	70	Woods, Good, HSG C
13,020	73	Weighted Average
13,020		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.9	100	0.0100	0.13		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.20"
0.7	65	0.0100	1.61		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
13.6	165	Total			

Subcatchment P-2: Undetained to Wetland



Summary for Subcatchment P-3A: Existing Building & Additions and Upper Pavement

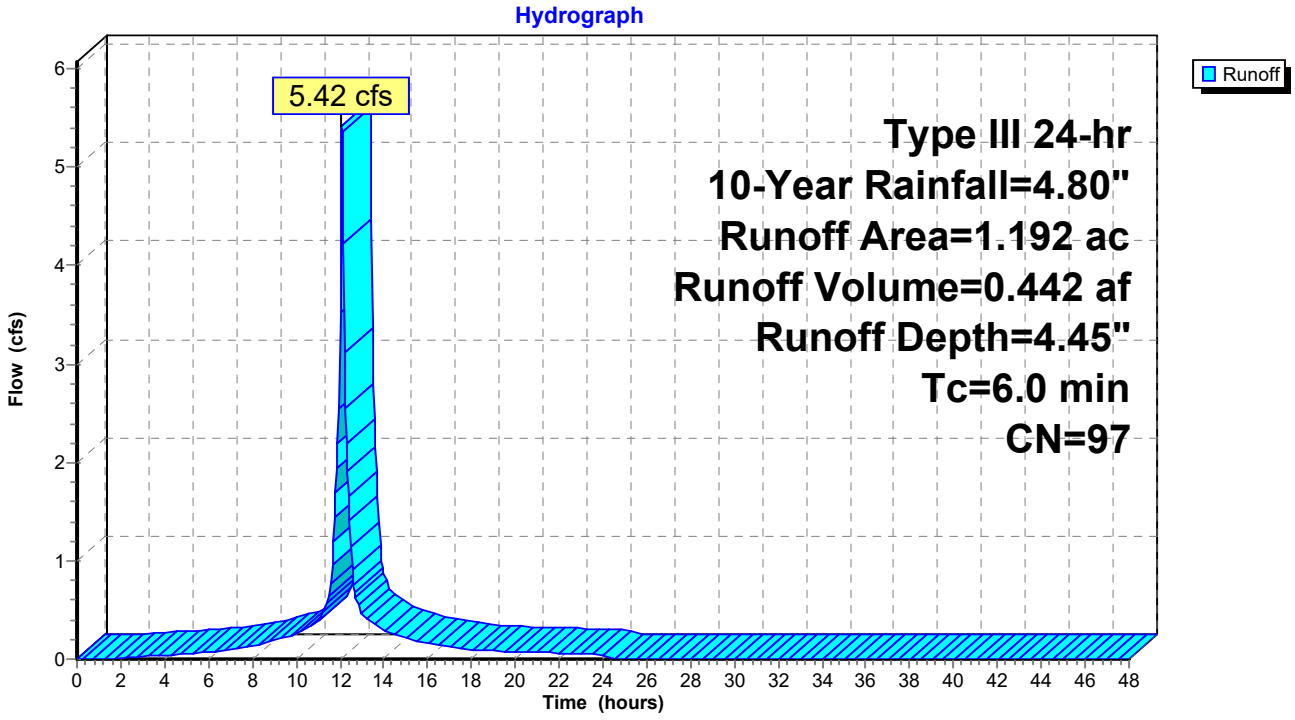
Runoff = 5.42 cfs @ 12.09 hrs, Volume= 0.442 af, Depth= 4.45"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.80"

Area (ac)	CN	Description
0.701	98	Paved parking, HSG C
0.461	98	Roofs, HSG C
0.030	74	>75% Grass cover, Good, HSG C
1.192	97	Weighted Average
0.030		2.52% Pervious Area
1.162		97.48% Impervious Area

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

Subcatchment P-3A: Existing Building & Additions and Upper Pavement



Summary for Subcatchment P-3B: Existing Building Draining to Constructed Wetland

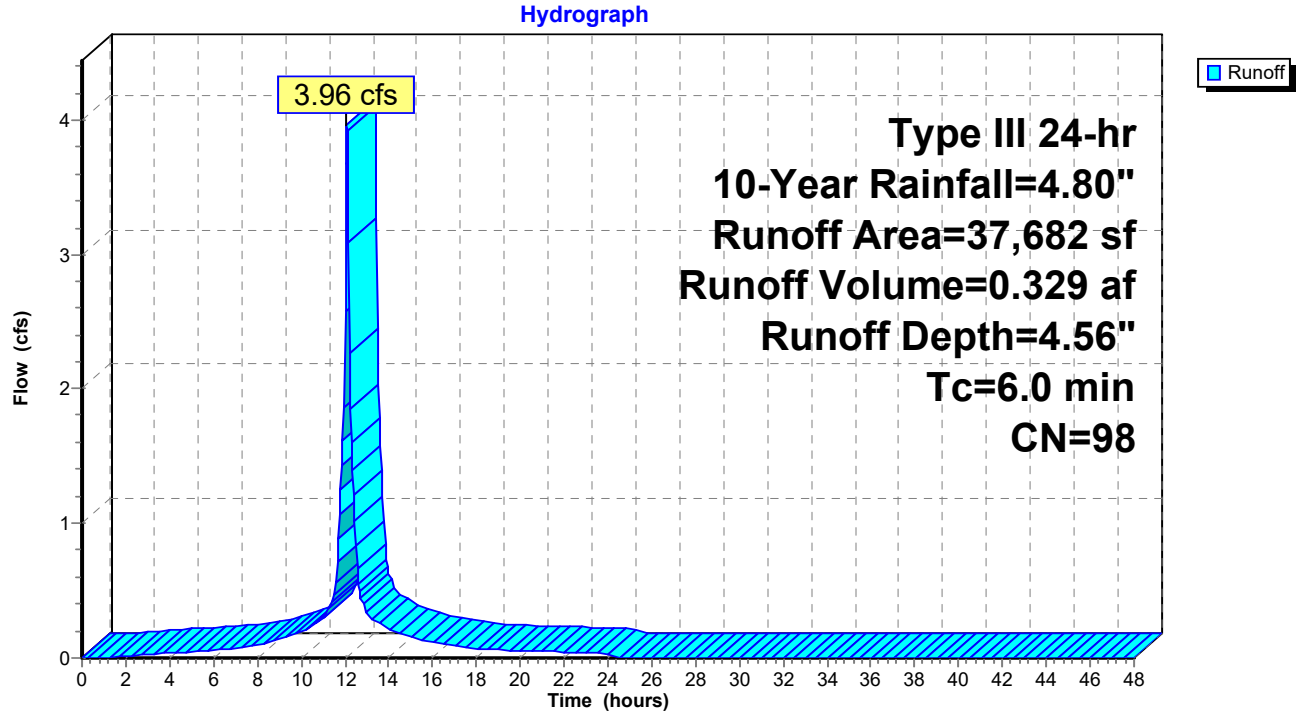
Runoff = 3.96 cfs @ 12.09 hrs, Volume= 0.329 af, Depth= 4.56"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.80"

Area (sf)	CN	Description
37,682	98	Roofs, HSG C
37,682		100.00% Impervious Area

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

Subcatchment P-3B: Existing Building Draining to Constructed Wetland



Summary for Subcatchment P-4: Watershed to Existing Stormwater System

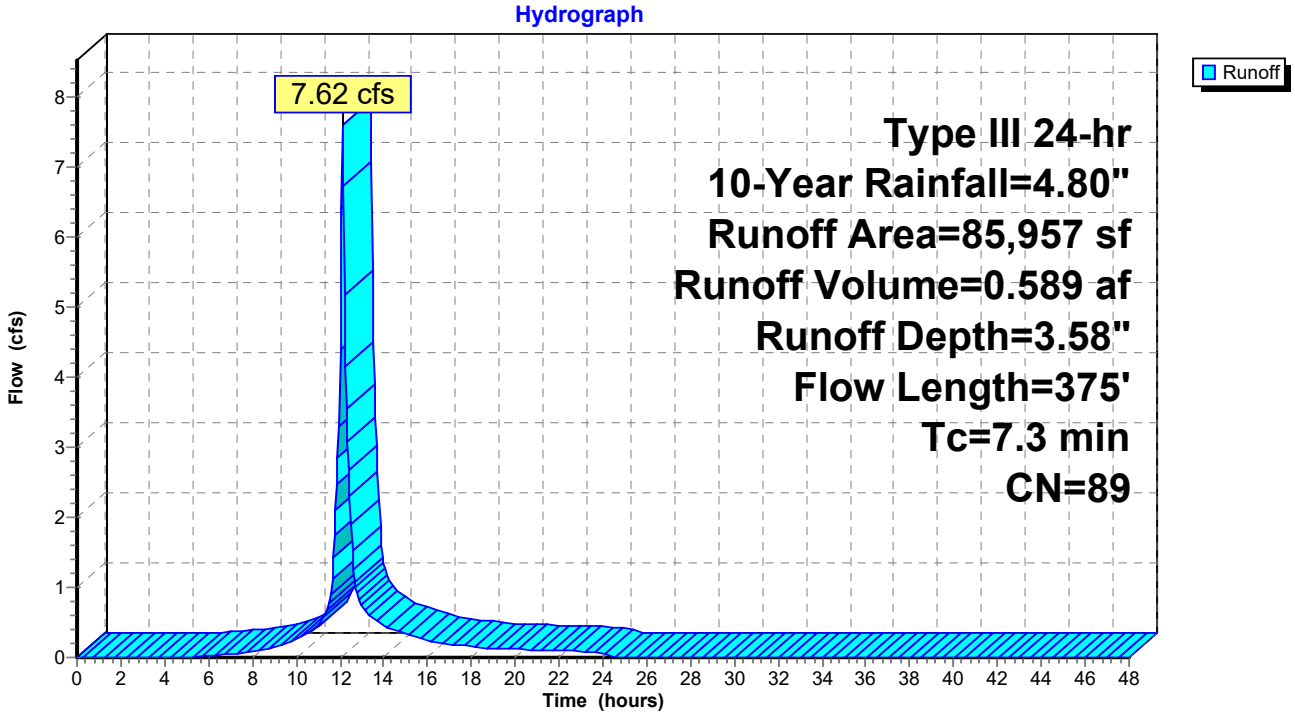
Runoff = 7.62 cfs @ 12.10 hrs, Volume= 0.589 af, Depth= 3.58"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.80"

Area (sf)	CN	Description
54,671	98	Paved parking, HSG C
29,238	74	>75% Grass cover, Good, HSG C
2,048	70	Woods, Good, HSG C
85,957	89	Weighted Average
31,286		36.40% Pervious Area
54,671		63.60% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.2	50	0.0240	0.16		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.20"
1.7	245	0.0220	2.39		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
0.4	80	0.0287	3.44		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
7.3	375	Total			

Subcatchment P-4: Watershed to Existing Stormwater System



Summary for Subcatchment P-4A: Watershed to MassDOT CB1

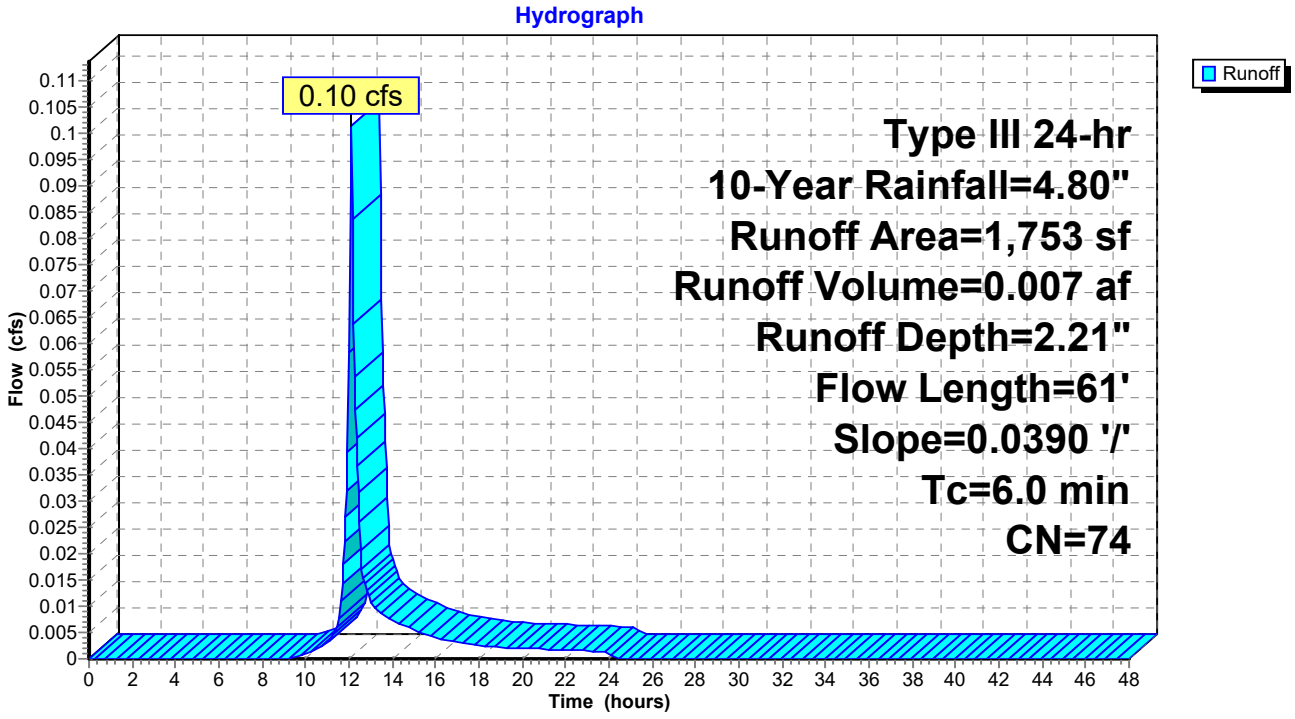
Runoff = 0.10 cfs @ 12.10 hrs, Volume= 0.007 af, Depth= 2.21"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.80"

Area (sf)	CN	Description
1,753	74	>75% Grass cover, Good, HSG C
1,753		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.1	61	0.0390	0.20		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.20"
0.9					**Direct Entry,**
6.0	61	Total			

Subcatchment P-4A: Watershed to MassDOT CB1



Summary for Subcatchment P-4B: Watershed to CB2

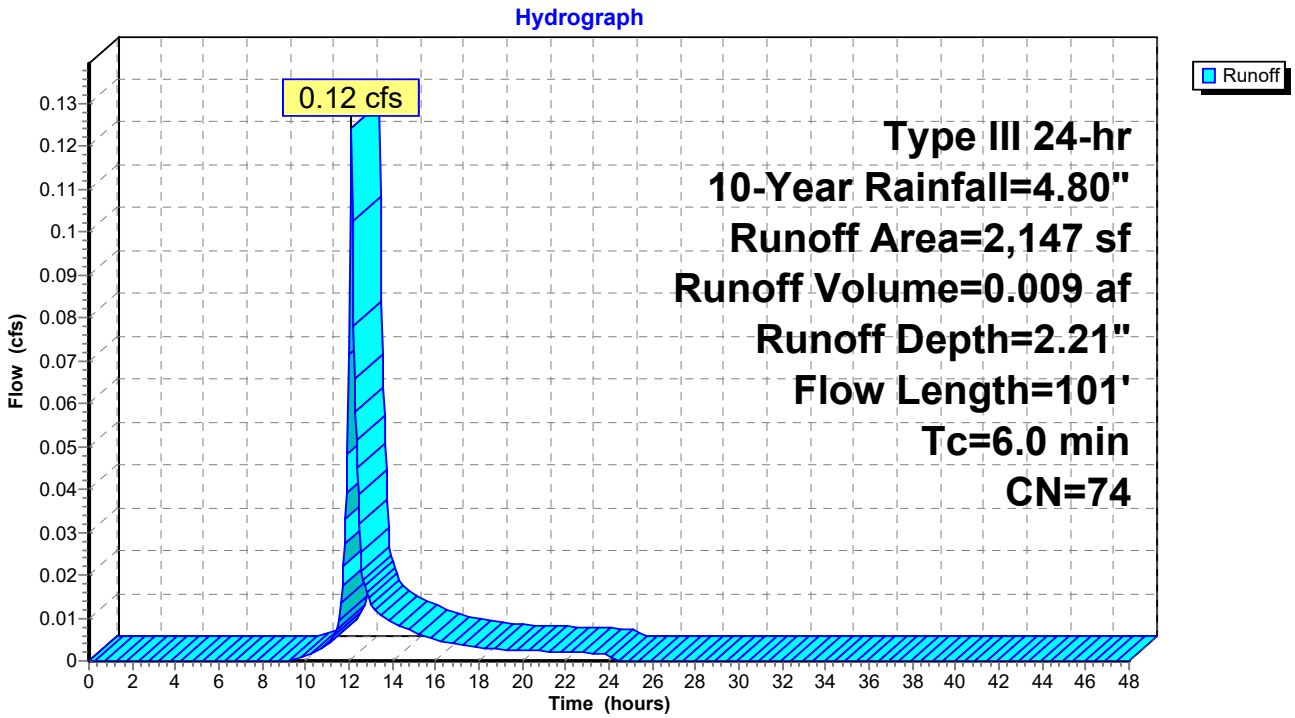
Runoff = 0.12 cfs @ 12.10 hrs, Volume= 0.009 af, Depth= 2.21"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.80"

Area (sf)	CN	Description
2,147	74	>75% Grass cover, Good, HSG C
2,147		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.6	50	0.0200	0.15		**Sheet Flow, SHeet Flow** Grass: Short n= 0.150 P2= 3.20"
0.3	51	0.0390	3.18		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
0.1					**Direct Entry, Miniumum**
6.0	101	Total			

Subcatchment P-4B: Watershed to CB2



Summary for Subcatchment P-5: P-5

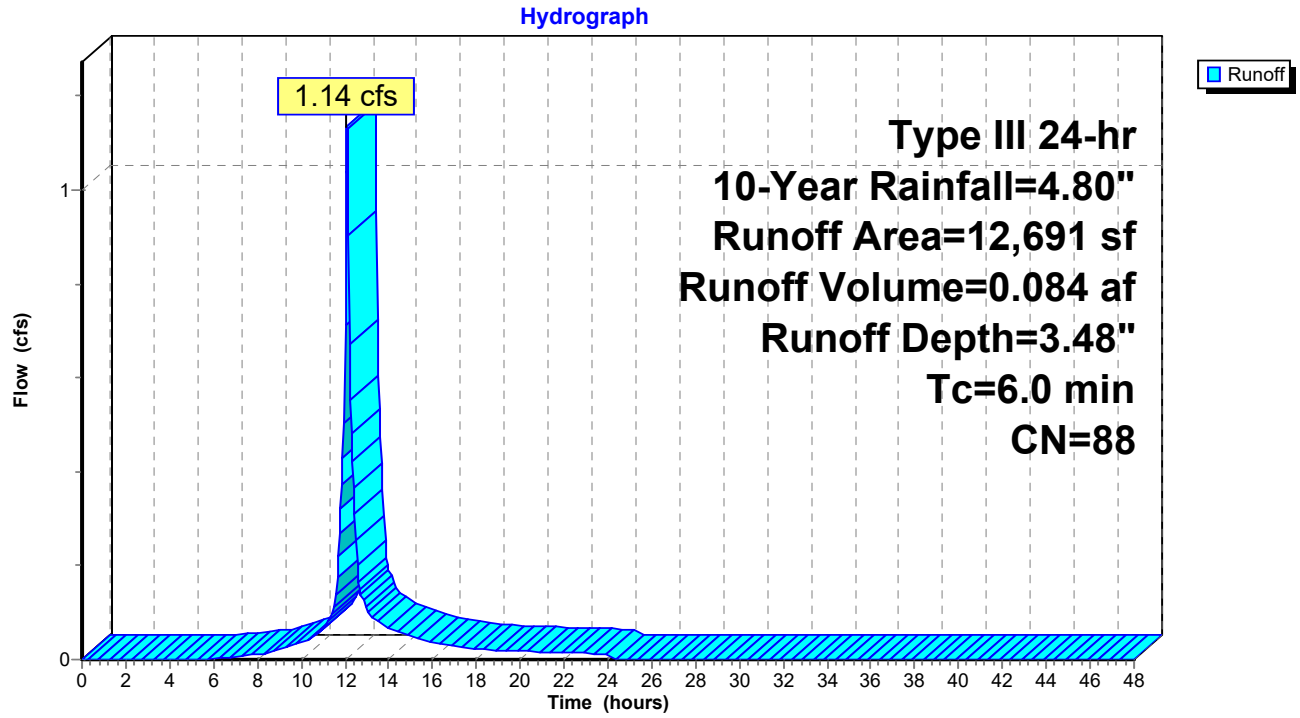
Runoff = 1.14 cfs @ 12.09 hrs, Volume= 0.084 af, Depth= 3.48"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.80"

Area (sf)	CN	Description
5,116	74	>75% Grass cover, Good, HSG C
7,575	98	Paved parking, HSG C
12,691	88	Weighted Average
5,116		40.31% Pervious Area
7,575		59.69% Impervious Area

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

Subcatchment P-5: P-5

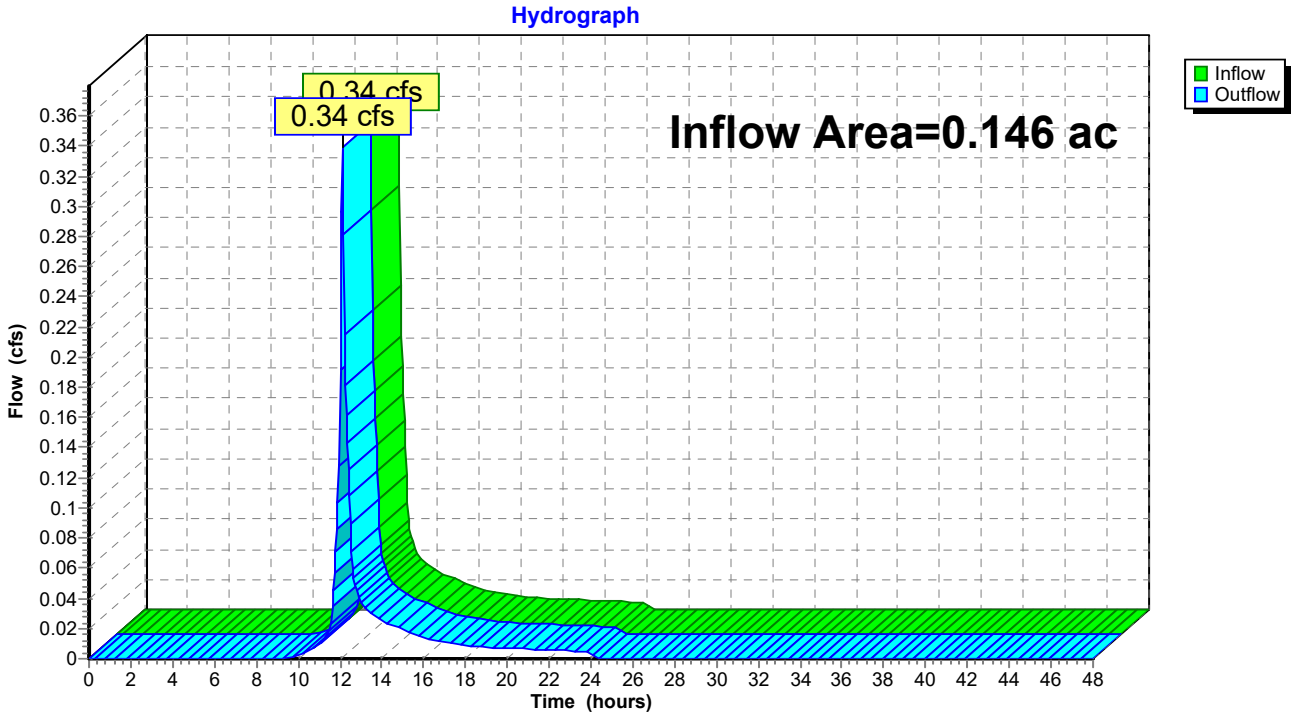


Summary for Reach DP-1: Design Point 1 (Wetland B)

Inflow Area = 0.146 ac, 0.00% Impervious, Inflow Depth = 2.05" for 10-Year event
Inflow = 0.34 cfs @ 12.10 hrs, Volume= 0.025 af
Outflow = 0.34 cfs @ 12.10 hrs, Volume= 0.025 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Reach DP-1: Design Point 1 (Wetland B)

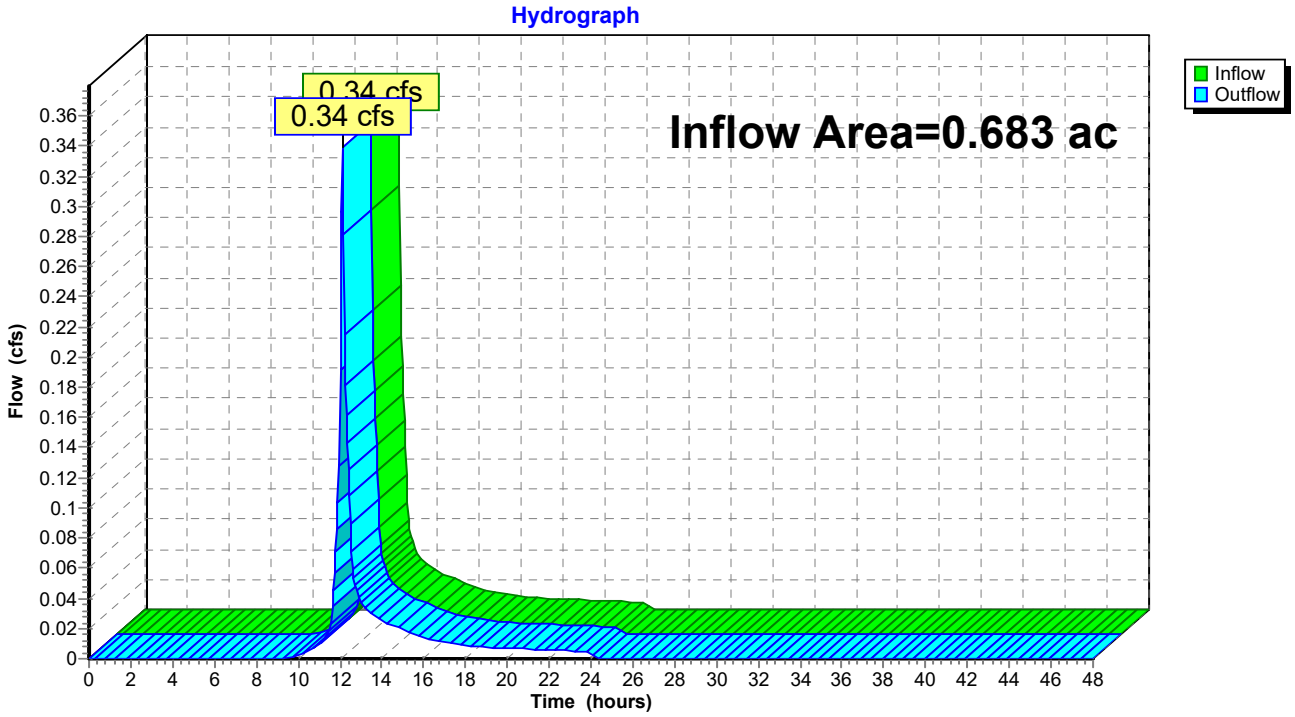


Summary for Reach DP-2: Design Point 2 (15" RCP to Wetland A)

Inflow Area = 0.683 ac, 74.45% Impervious, Inflow Depth = 0.44" for 10-Year event
Inflow = 0.34 cfs @ 12.10 hrs, Volume= 0.025 af
Outflow = 0.34 cfs @ 12.10 hrs, Volume= 0.025 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Reach DP-2: Design Point 2 (15" RCP to Wetland A)

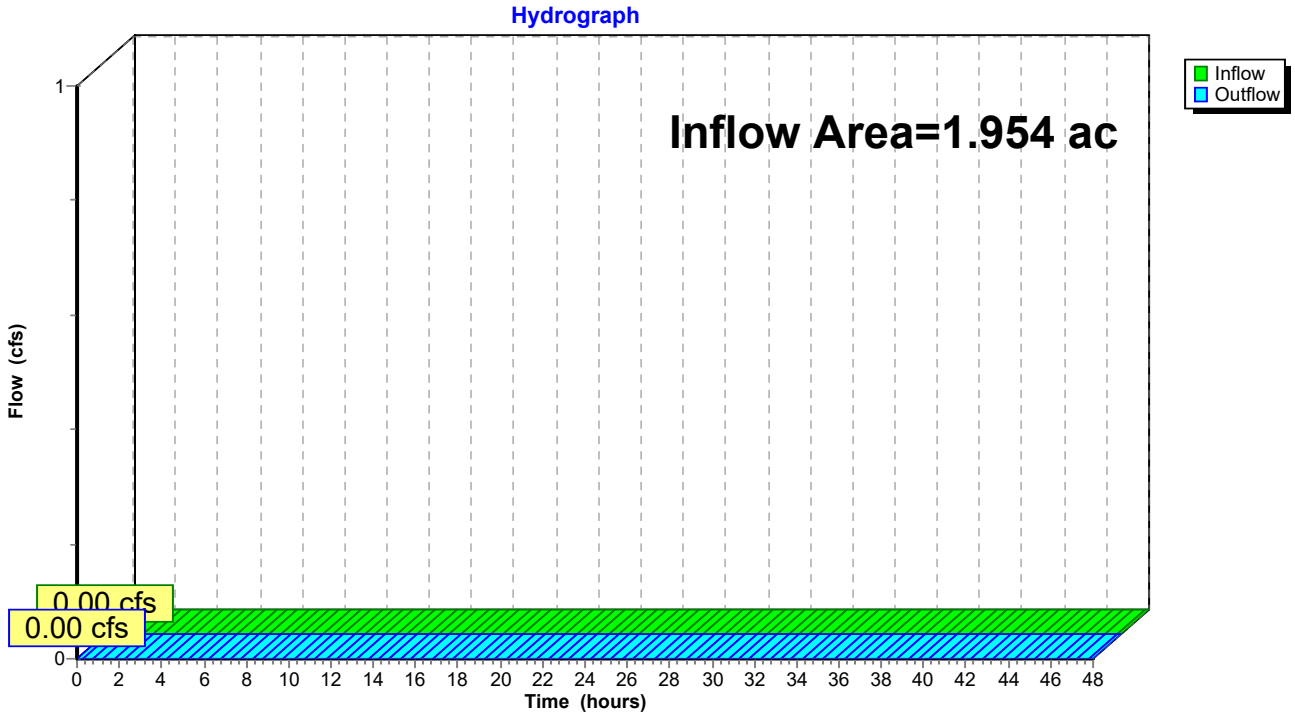


Summary for Reach DP-3: Design Point 3 (Existing Drainage Ditch)

Inflow Area = 1.954 ac, 81.04% Impervious, Inflow Depth = 0.00" for 10-Year event
Inflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Reach DP-3: Design Point 3 (Existing Drainage Ditch)

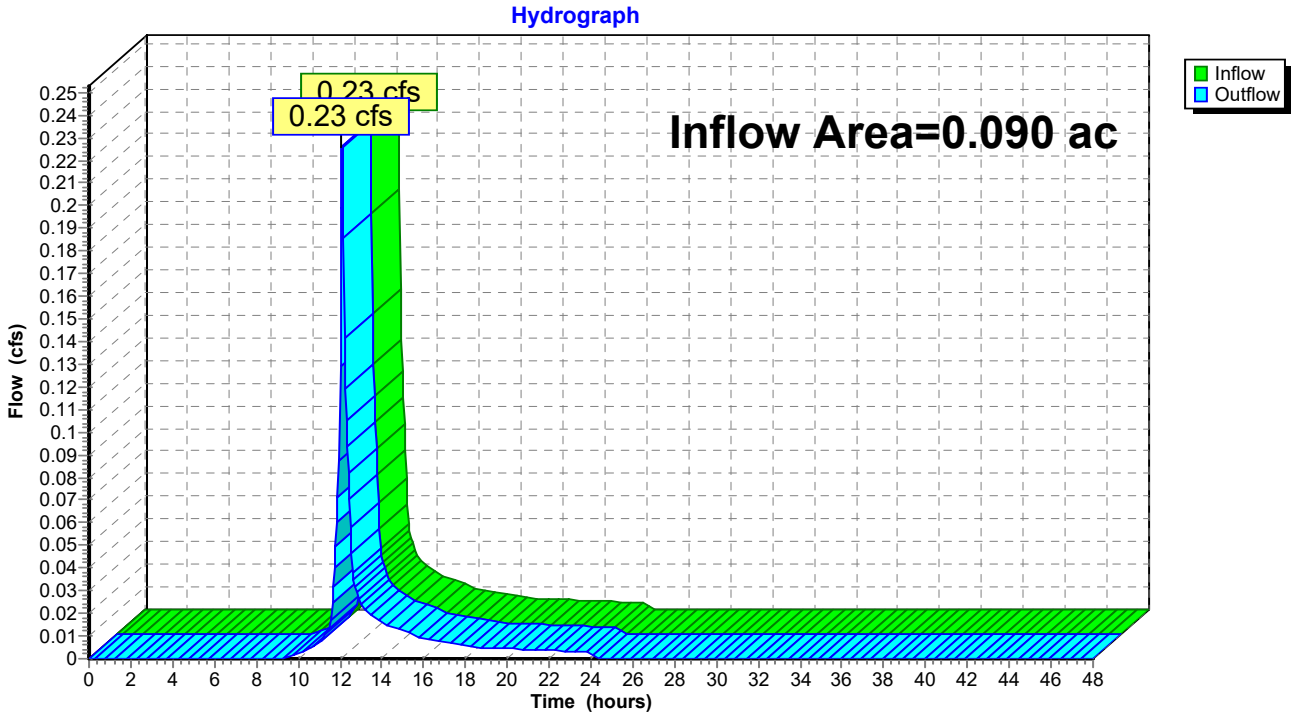


Summary for Reach DP-4: Design Point 4 (MassDOT 30" CB-2)

Inflow Area = 0.090 ac, 0.00% Impervious, Inflow Depth = 2.21" for 10-Year event
Inflow = 0.23 cfs @ 12.10 hrs, Volume= 0.016 af
Outflow = 0.23 cfs @ 12.10 hrs, Volume= 0.016 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Reach DP-4: Design Point 4 (MassDOT 30" CB-2)

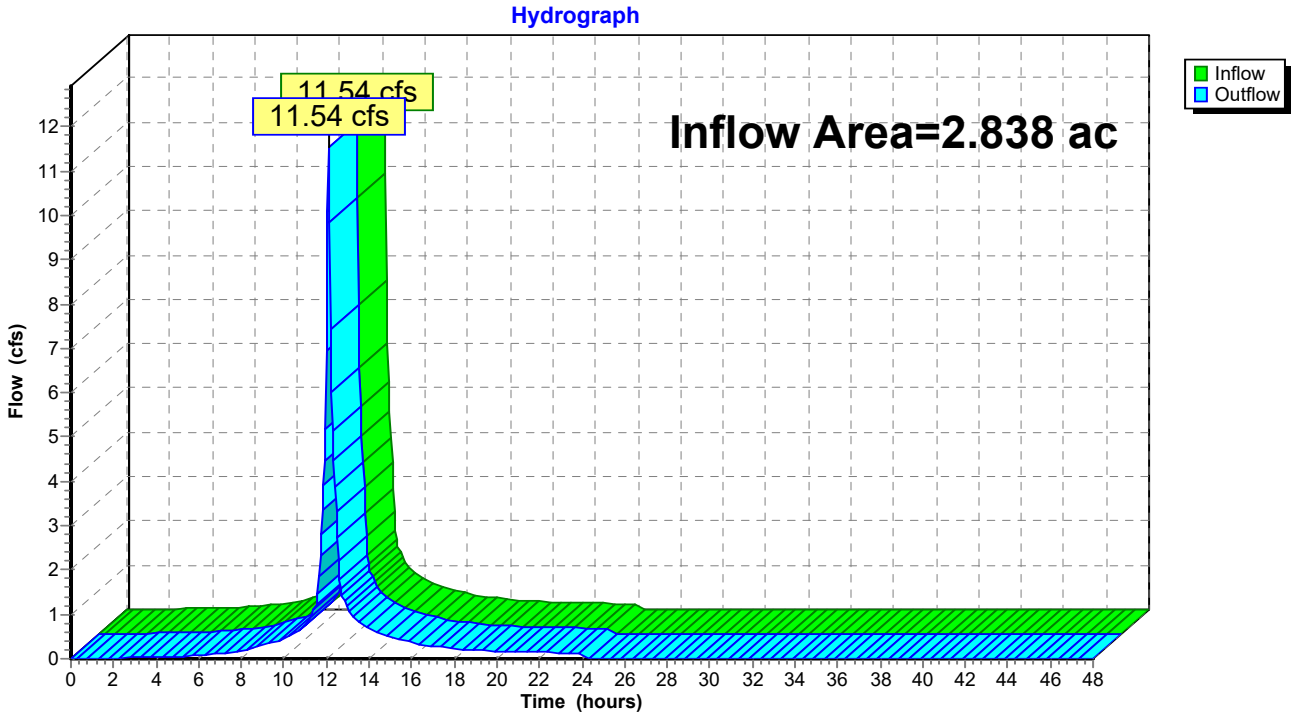


Summary for Reach DP-5: Design Point 5 (Existing Constructed Stormwater Wetland)

Inflow Area = 2.838 ac, 74.70% Impervious, Inflow Depth = 3.88" for 10-Year event
Inflow = 11.54 cfs @ 12.10 hrs, Volume= 0.918 af
Outflow = 11.54 cfs @ 12.10 hrs, Volume= 0.918 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Reach DP-5: Design Point 5 (Existing Constructed Stormwater Wetland)

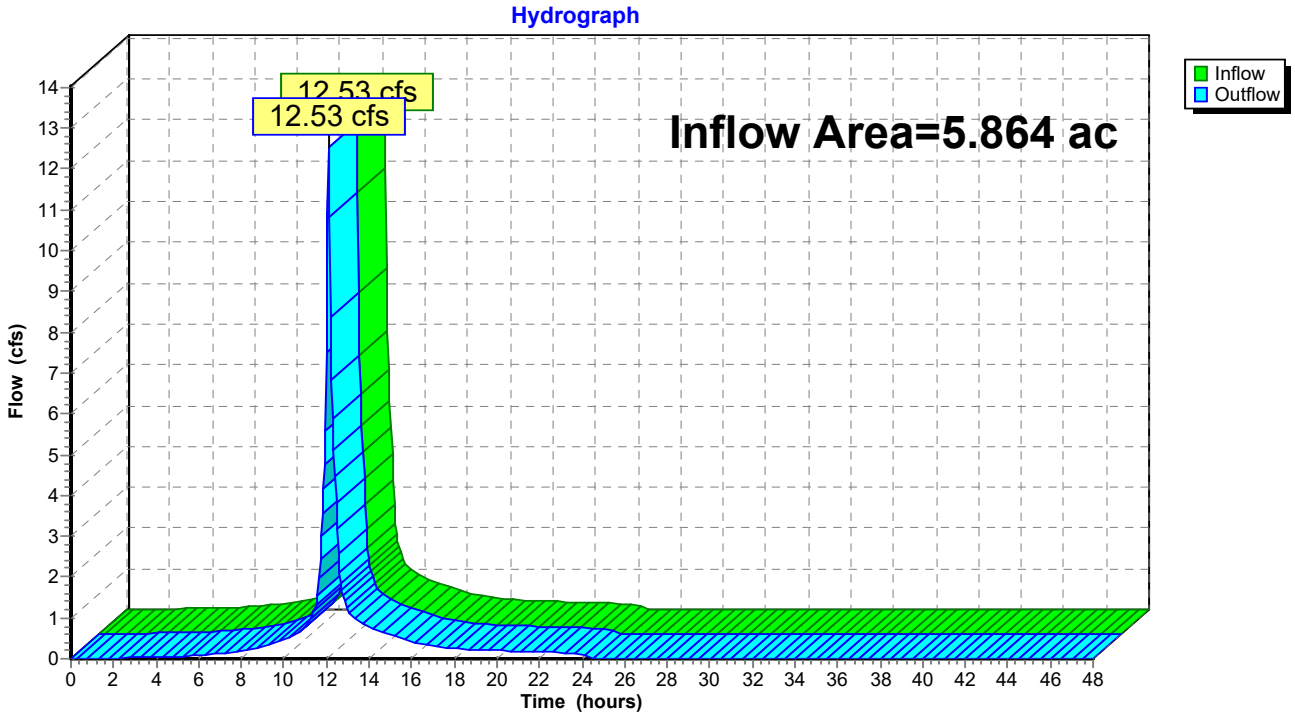


Summary for Reach DP-6: Wetland A - Design Point 6

Inflow Area = 5.864 ac, 71.84% Impervious, Inflow Depth = 2.07" for 10-Year event
Inflow = 12.53 cfs @ 12.10 hrs, Volume= 1.012 af
Outflow = 12.53 cfs @ 12.10 hrs, Volume= 1.012 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Reach DP-6: Wetland A - Design Point 6



Summary for Pond 3P: Conveyance Swale

Inflow Area = 0.471 ac, 52.65% Impervious, Inflow Depth = 3.28" for 10-Year event
Inflow = 1.75 cfs @ 12.09 hrs, Volume= 0.129 af
Outflow = 1.60 cfs @ 12.12 hrs, Volume= 0.129 af, Atten= 8%, Lag= 1.9 min
Primary = 1.60 cfs @ 12.12 hrs, Volume= 0.129 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs / 2
Peak Elev= 125.57' @ 12.12 hrs Surf.Area= 673 sf Storage= 318 cf

Plug-Flow detention time= 9.9 min calculated for 0.129 af (100% of inflow)
Center-of-Mass det. time= 9.3 min (815.3 - 806.0)

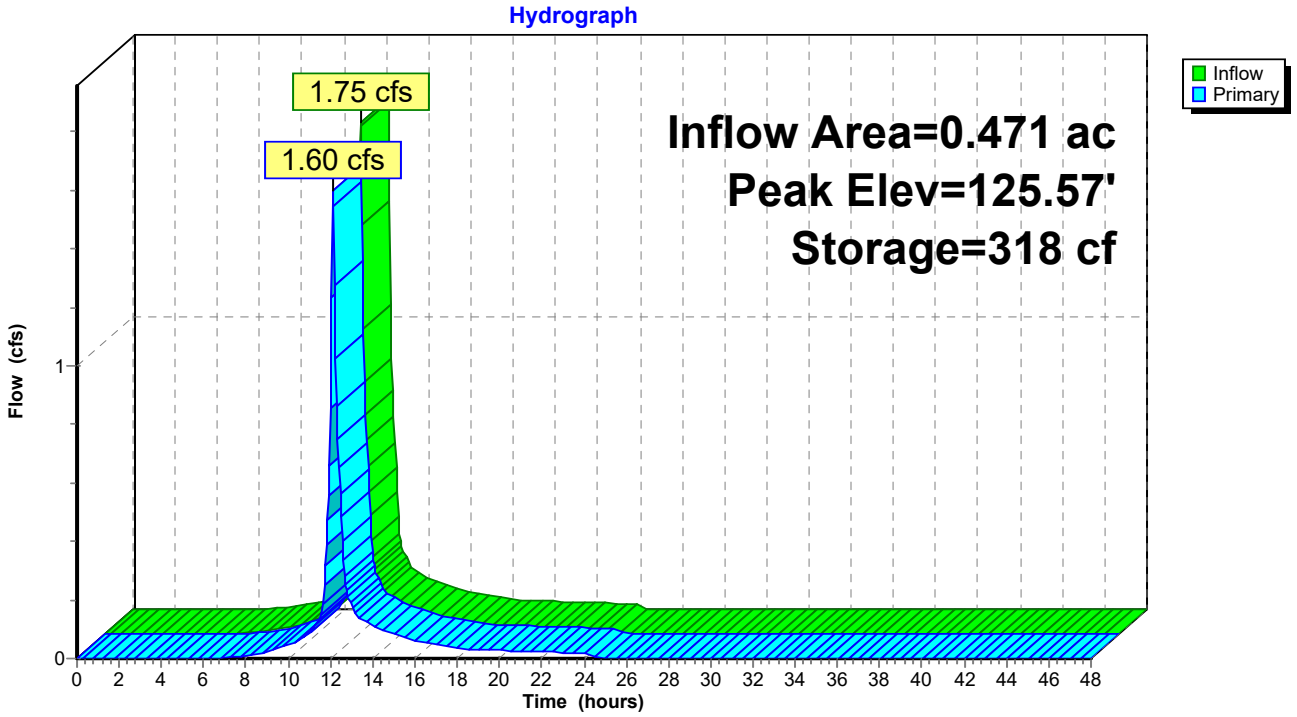
Volume	Invert	Avail.Storage	Storage Description
#1	125.00'	1,147 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
125.00	436	0	0
126.00	848	642	642
126.50	1,170	505	1,147

Device	Routing	Invert	Outlet Devices
#1	Primary	124.18'	**12.0" Round Culvert** L= 10.0' Ke= 0.500 Inlet / Outlet Invert= 124.18' / 124.13' S= 0.0050 '/' Cc= 0.900 n= 0.011 Concrete pipe, straight & clean, Flow Area= 0.79 sf
#2	Device 1	125.00'	**18.0" Vert. Orifice/Grate** C= 0.600

Primary OutFlow Max=1.56 cfs @ 12.12 hrs HW=125.57' (Free Discharge)
↑**1=Culvert** (Passes 1.56 cfs of 3.17 cfs potential flow)
↑**2=Orifice/Grate** (Orifice Controls 1.56 cfs @ 2.56 fps)

Pond 3P: Conveyance Swale



Summary for Pond 8P: UG-1 3 ft Retain IT

Inflow Area = 1.954 ac, 81.04% Impervious, Inflow Depth = 4.02" for 10-Year event
Inflow = 8.09 cfs @ 12.09 hrs, Volume= 0.655 af
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 100%, Lag= 0.0 min
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs / 2
Peak Elev= 124.17' @ 48.00 hrs Surf.Area= 15,300 sf Storage= 28,534 cf

Plug-Flow detention time= (not calculated: initial storage exceeds outflow)
Center-of-Mass det. time= (not calculated: no outflow)

Volume	Invert	Avail.Storage	Storage Description
#1A	121.75'	3,817 cf	**90.00'W x 170.00'L x 4.17'H Field A** 63,750 cf Overall - 54,208 cf Embedded = 9,542 cf x 40.0% Voids
#2A	122.25'	39,109 cf	**retain_it retain_it 3.0'** x 231 Inside #1 Inside= 84.0"W x 36.0"H => 21.33 sf x 8.00'L = 170.6 cf Outside= 96.0"W x 44.0"H => 29.33 sf x 8.00'L = 234.7 cf 11 Rows adjusted for 302.1 cf perimeter wall
		42,926 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	124.25'	**12.0" Round HDPE_Round 12"** L= 12.5' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 124.25' / 124.18' S= 0.0056 '/' Cc= 0.900 n= 0.011 Concrete pipe, straight & clean, Flow Area= 0.79 sf
#2	Device 1	124.40'	**4.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=121.75' (Free Discharge)
↑—**1=HDPE_Round 12"** (Controls 0.00 cfs)
↑—**2=Sharp-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 8P: UG-1 3 ft Retain IT - Chamber Wizard Field A

Chamber Model = retain_it retain_it 3.0' (retain-it®)
Inside= 84.0"W x 36.0"H => 21.33 sf x 8.00'L = 170.6 cf
Outside= 96.0"W x 44.0"H => 29.33 sf x 8.00'L = 234.7 cf
11 Rows adjusted for 302.1 cf perimeter wall

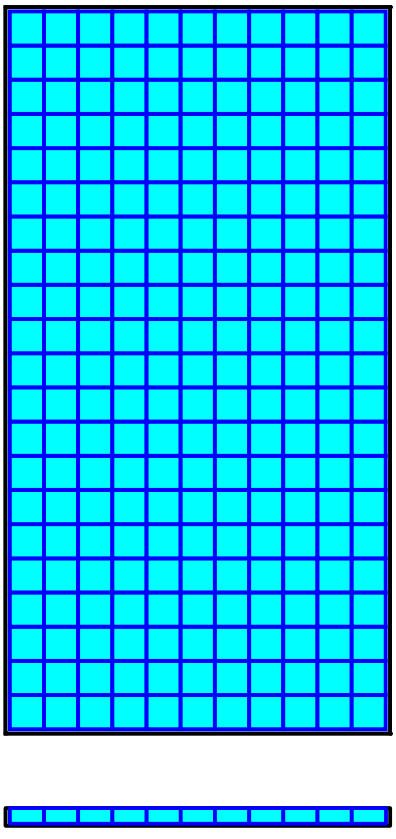
21 Chambers/Row x 8.00' Long = 168.00' Row Length +12.0" End Stone x 2 = 170.00' Base Length
11 Rows x 96.0" Wide + 12.0" Side Stone x 2 = 90.00' Base Width
6.0" Base + 44.0" Chamber Height = 4.17' Field Height

4.7 cf Sidewall x 21 x 2 + 4.7 cf Endwall x 11 x 2 = 302.1 cf Perimeter Wall
231 Chambers x 170.6 cf - 302.1 cf Perimeter wall = 39,108.9 cf Chamber Storage
231 Chambers x 234.7 cf = 54,208.0 cf Displacement

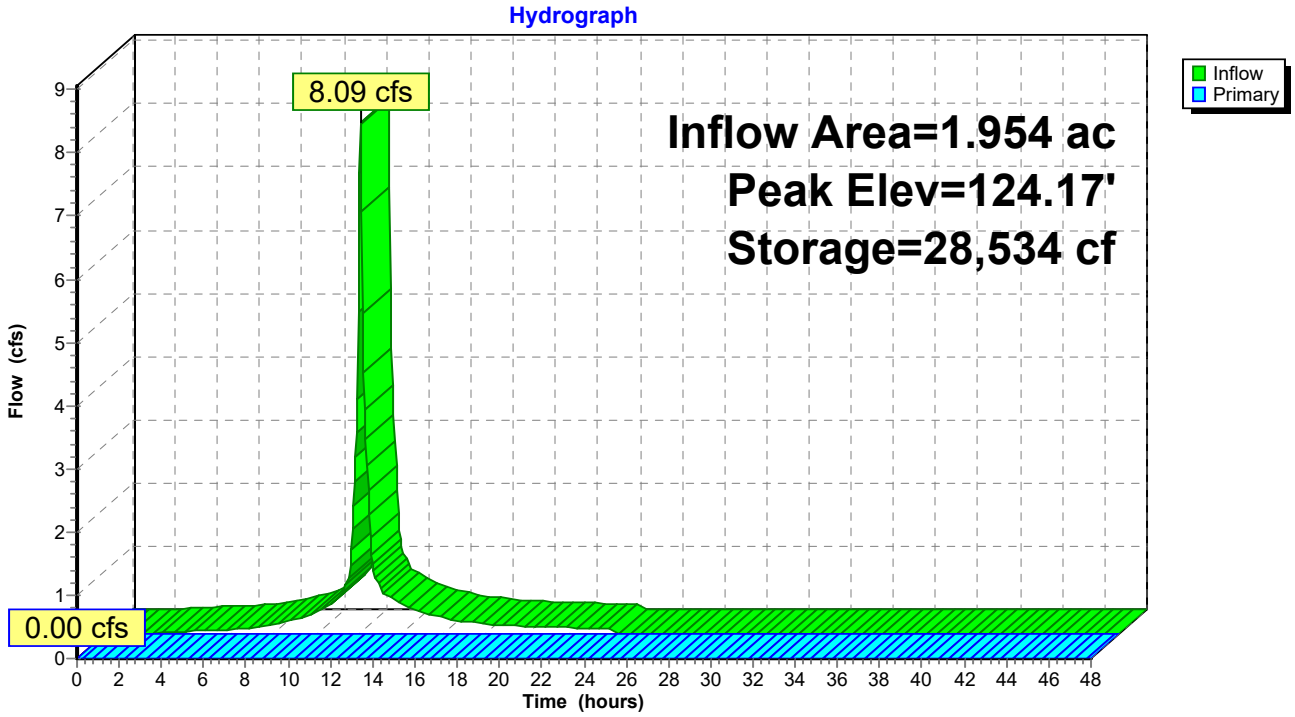
63,750.0 cf Field - 54,208.0 cf Chambers = 9,542.0 cf Stone x 40.0% Voids = 3,816.8 cf Stone Storage

Chamber Storage + Stone Storage = 42,925.7 cf = 0.985 af
Overall Storage Efficiency = 67.3%
Overall System Size = 170.00' x 90.00' x 4.17'

231 Chambers
2,361.1 cy Field
353.4 cy Stone



Pond 8P: UG-1 3 ft Retain IT



Summary for Pond 11P: Permeable Pavement

Inflow Area = 0.537 ac, 94.68% Impervious, Inflow Depth = 4.45" for 10-Year event
Inflow = 2.44 cfs @ 12.09 hrs, Volume= 0.199 af
Outflow = 0.14 cfs @ 10.60 hrs, Volume= 0.199 af, Atten= 94%, Lag= 0.0 min
Discarded = 0.14 cfs @ 10.60 hrs, Volume= 0.199 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Peak Elev= 123.18' @ 13.90 hrs Surf.Area= 22,160 sf Storage= 3,817 cf

Plug-Flow detention time= 227.6 min calculated for 0.199 af (100% of inflow)
Center-of-Mass det. time= 227.4 min (984.0 - 756.6)

Volume	Invert	Avail.Storage	Storage Description
#1	122.75'	7,512 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

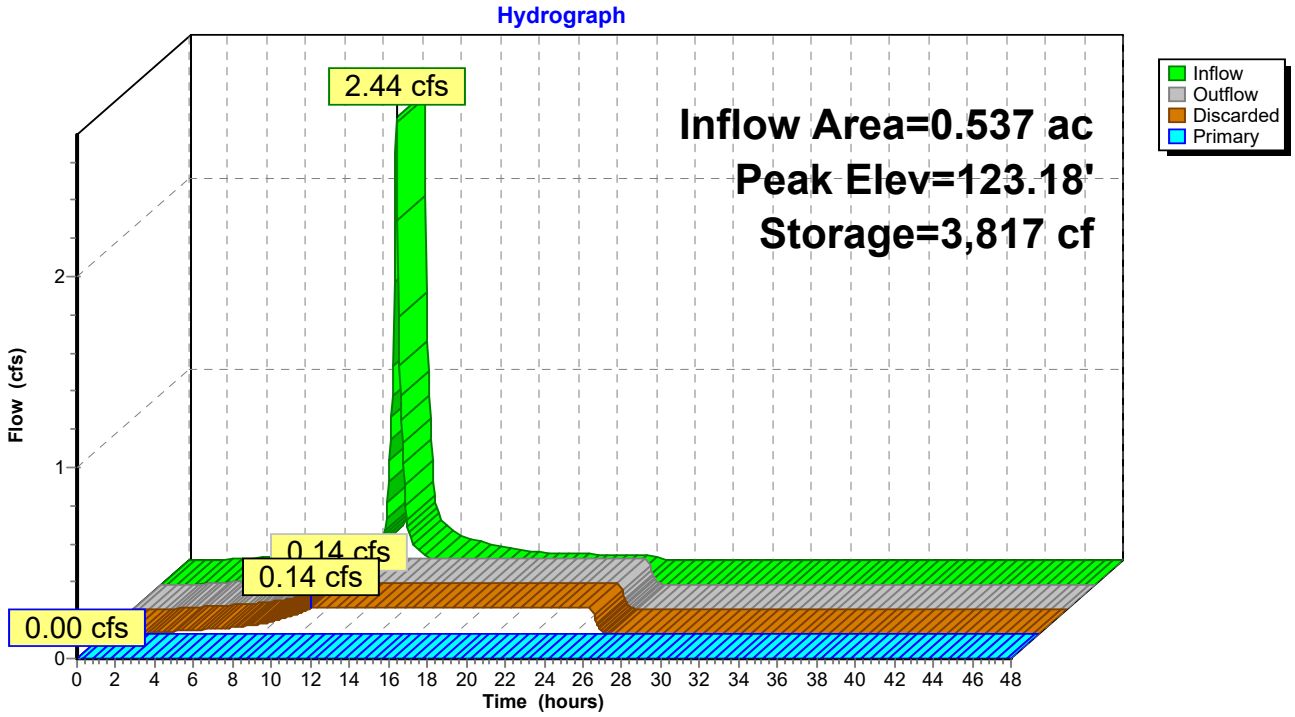
Elevation (feet)	Surf.Area (sq-ft)	Voids (%)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
122.75	22,160	0.0	0	0
123.41	22,160	40.0	5,850	5,850
123.66	22,160	30.0	1,662	7,512

Device	Routing	Invert	Outlet Devices
#1	Discarded	122.75'	**0.270 in/hr Exfiltration over Surface area**
#2	Primary	123.30'	**6.0" Round Culvert** L= 10.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 123.30' / 119.00' S= 0.4300 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 0.20 sf

Discarded OutFlow Max=0.14 cfs @ 10.60 hrs HW=122.76' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.14 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=122.75' (Free Discharge)
↑—**2=Culvert** (Controls 0.00 cfs)

Pond 11P: Permeable Pavement



Summary for Subcatchment P-1A: Undetained to Wetland B

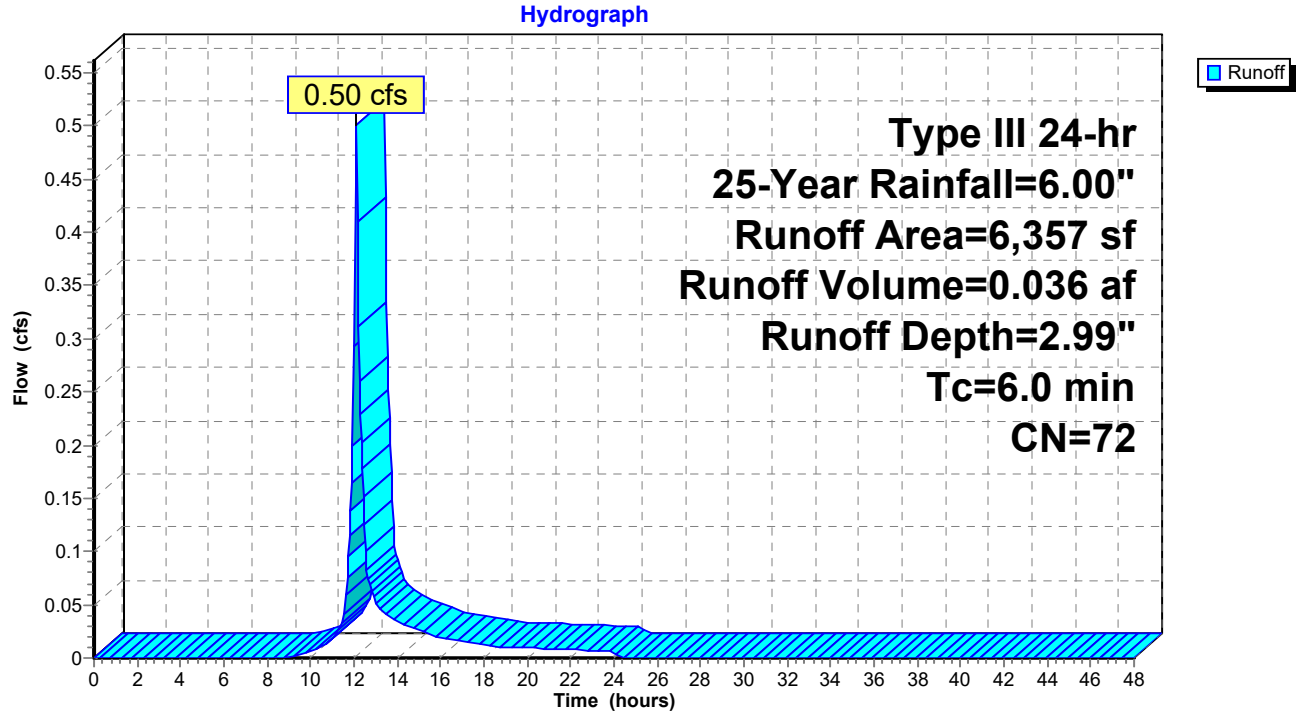
Runoff = 0.50 cfs @ 12.09 hrs, Volume= 0.036 af, Depth= 2.99"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=6.00"

Area (sf)	CN	Description
6,357	72	Woods/grass comb., Good, HSG C
6,357		100.00% Pervious Area

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

Subcatchment P-1A: Undetained to Wetland B



Summary for Subcatchment P-1B: Western Driveway

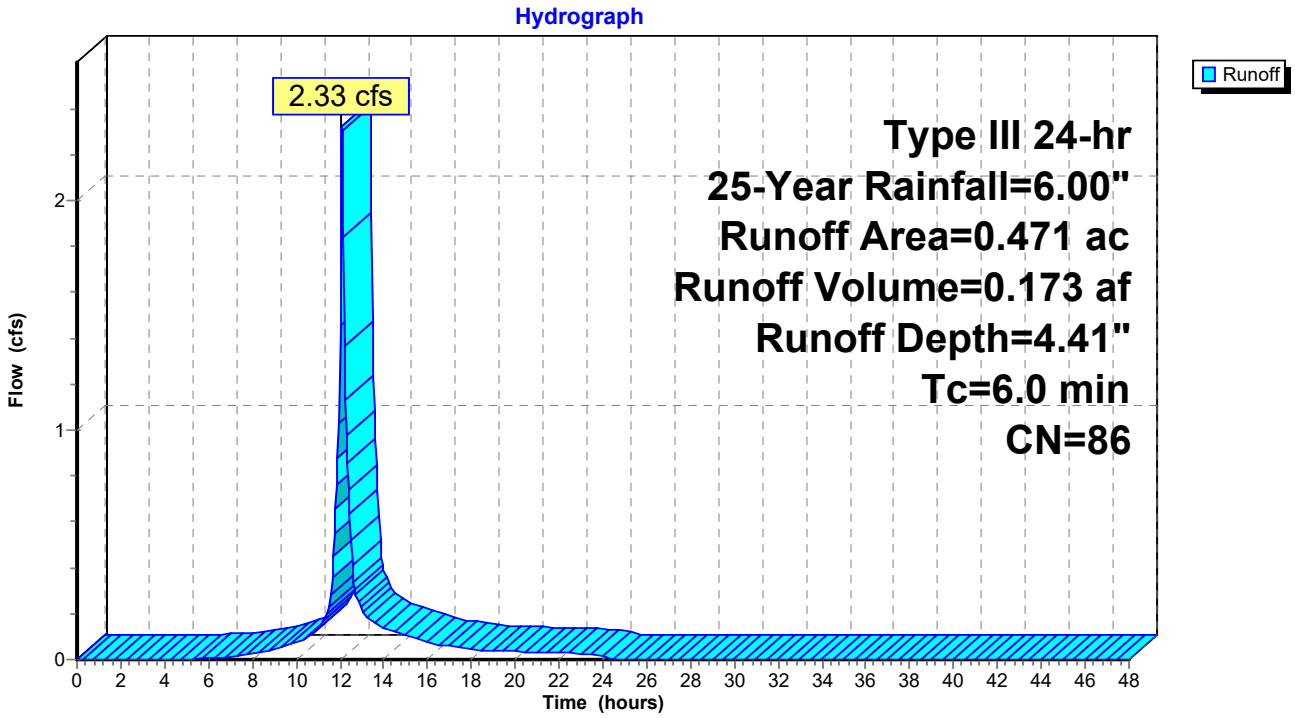
Runoff = 2.33 cfs @ 12.09 hrs, Volume= 0.173 af, Depth= 4.41"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=6.00"

Area (ac)	CN	Description
0.248	98	Paved parking, HSG C
0.223	72	Woods/grass comb., Good, HSG C
0.471	86	Weighted Average
0.223		47.35% Pervious Area
0.248		52.65% Impervious Area

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

Subcatchment P-1B: Western Driveway



Summary for Subcatchment P-1C: Permeable Pavement

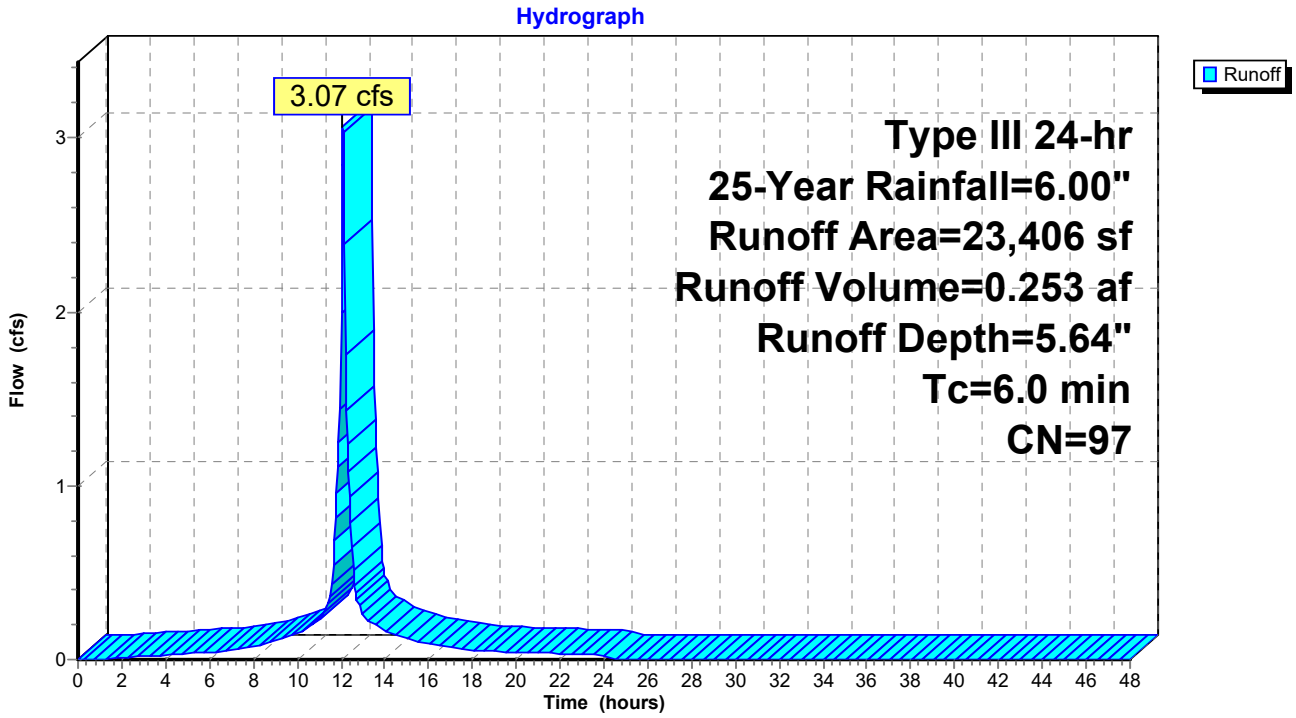
Runoff = 3.07 cfs @ 12.09 hrs, Volume= 0.253 af, Depth= 5.64"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=6.00"

Area (sf)	CN	Description
22,160	98	Paved parking, HSG C
1,246	74	>75% Grass cover, Good, HSG C
23,406	97	Weighted Average
1,246		5.32% Pervious Area
22,160		94.68% Impervious Area

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

Subcatchment P-1C: Permeable Pavement



Summary for Subcatchment P-2: Undetained to Wetland

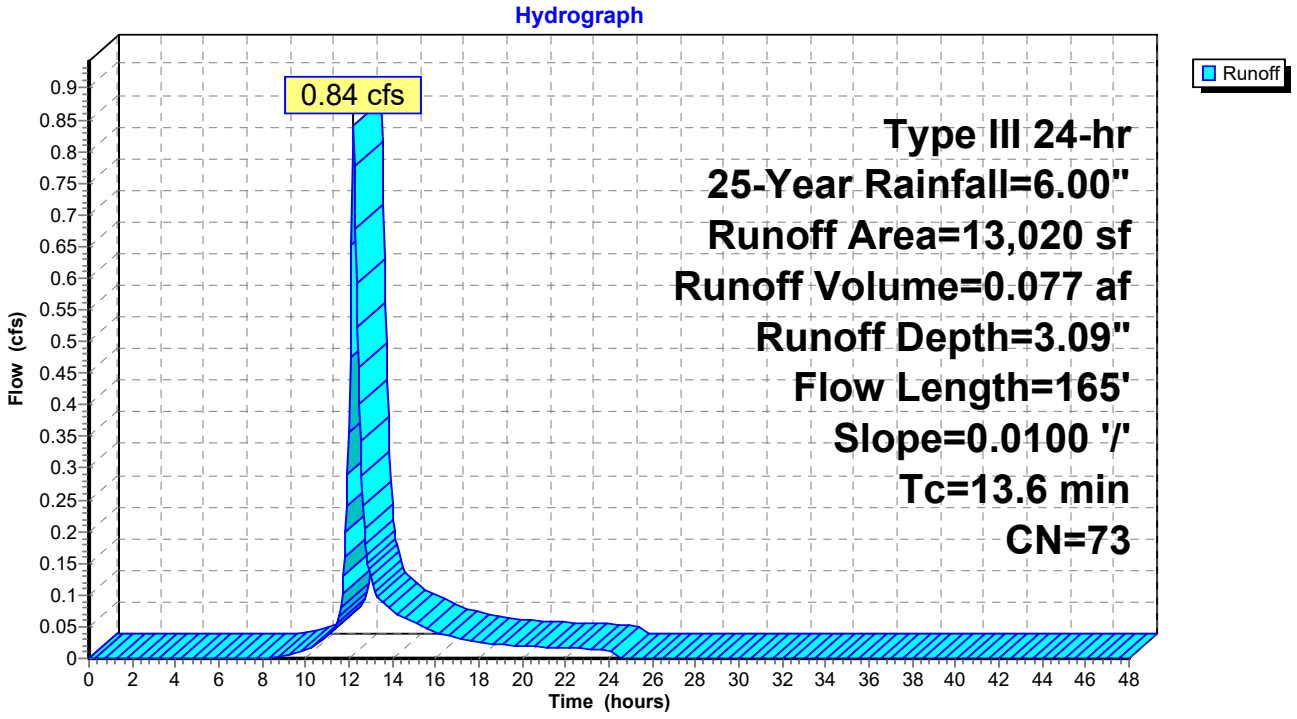
Runoff = 0.84 cfs @ 12.19 hrs, Volume= 0.077 af, Depth= 3.09"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=6.00"

Area (sf)	CN	Description
10,967	74	>75% Grass cover, Good, HSG C
2,053	70	Woods, Good, HSG C
13,020	73	Weighted Average
13,020		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.9	100	0.0100	0.13		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.20"
0.7	65	0.0100	1.61		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
13.6	165	Total			

Subcatchment P-2: Undetained to Wetland



Summary for Subcatchment P-3A: Existing Building & Additions and Upper Pavement

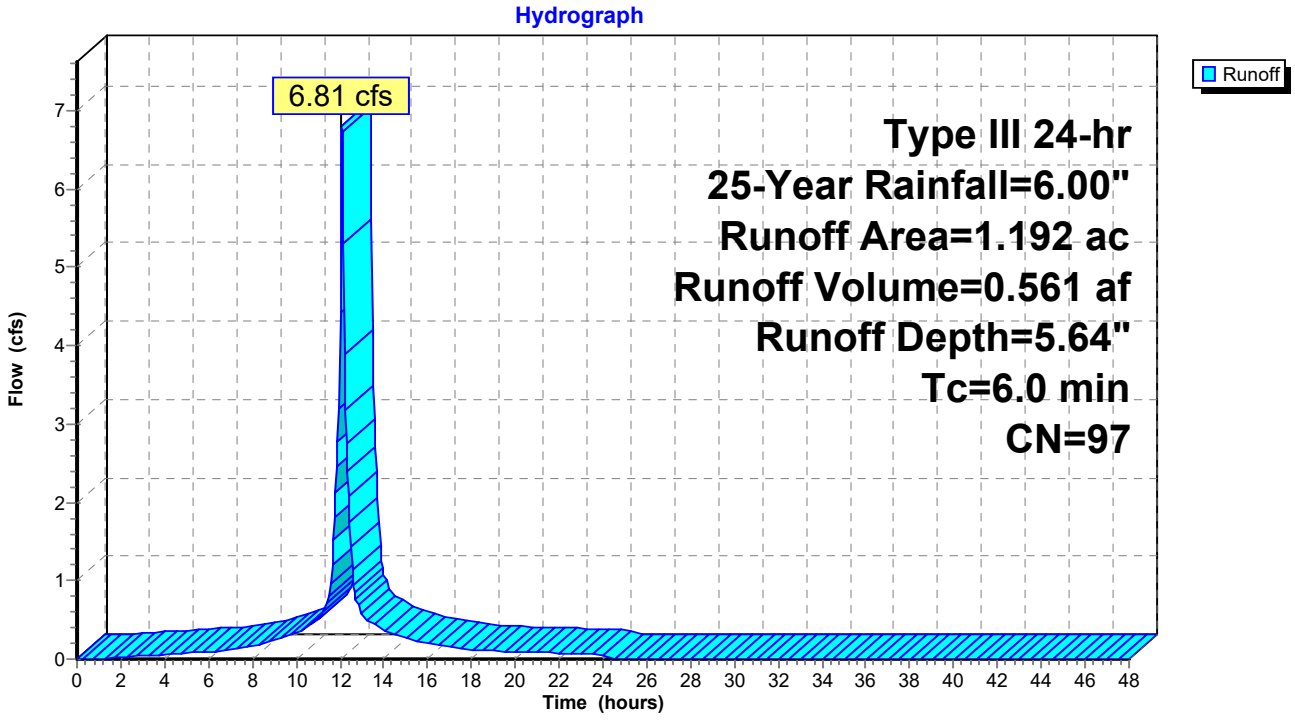
Runoff = 6.81 cfs @ 12.09 hrs, Volume= 0.561 af, Depth= 5.64"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=6.00"

Area (ac)	CN	Description
0.701	98	Paved parking, HSG C
0.461	98	Roofs, HSG C
0.030	74	>75% Grass cover, Good, HSG C
1.192	97	Weighted Average
0.030		2.52% Pervious Area
1.162		97.48% Impervious Area

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

Subcatchment P-3A: Existing Building & Additions and Upper Pavement



Summary for Subcatchment P-3B: Existing Building Draining to Constructed Wetland

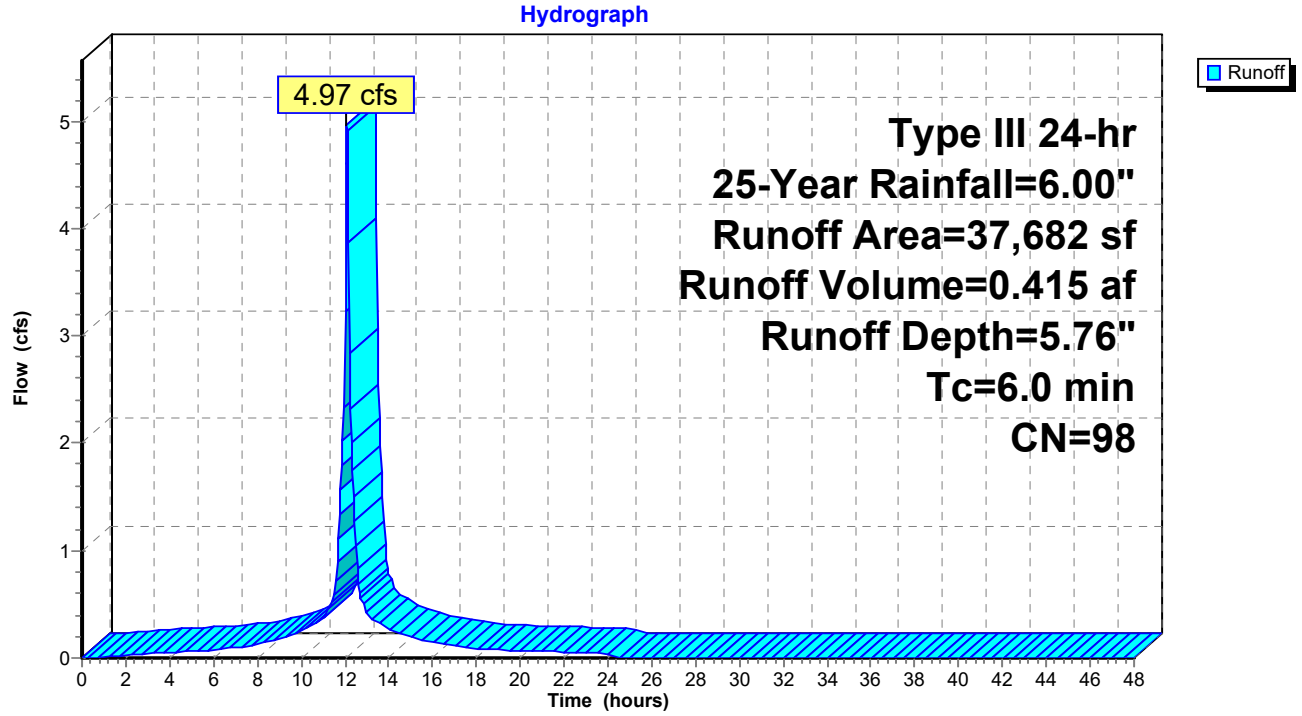
Runoff = 4.97 cfs @ 12.09 hrs, Volume= 0.415 af, Depth= 5.76"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=6.00"

Area (sf)	CN	Description
37,682	98	Roofs, HSG C
37,682		100.00% Impervious Area

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

Subcatchment P-3B: Existing Building Draining to Constructed Wetland



Summary for Subcatchment P-4: Watershed to Existing Stormwater System

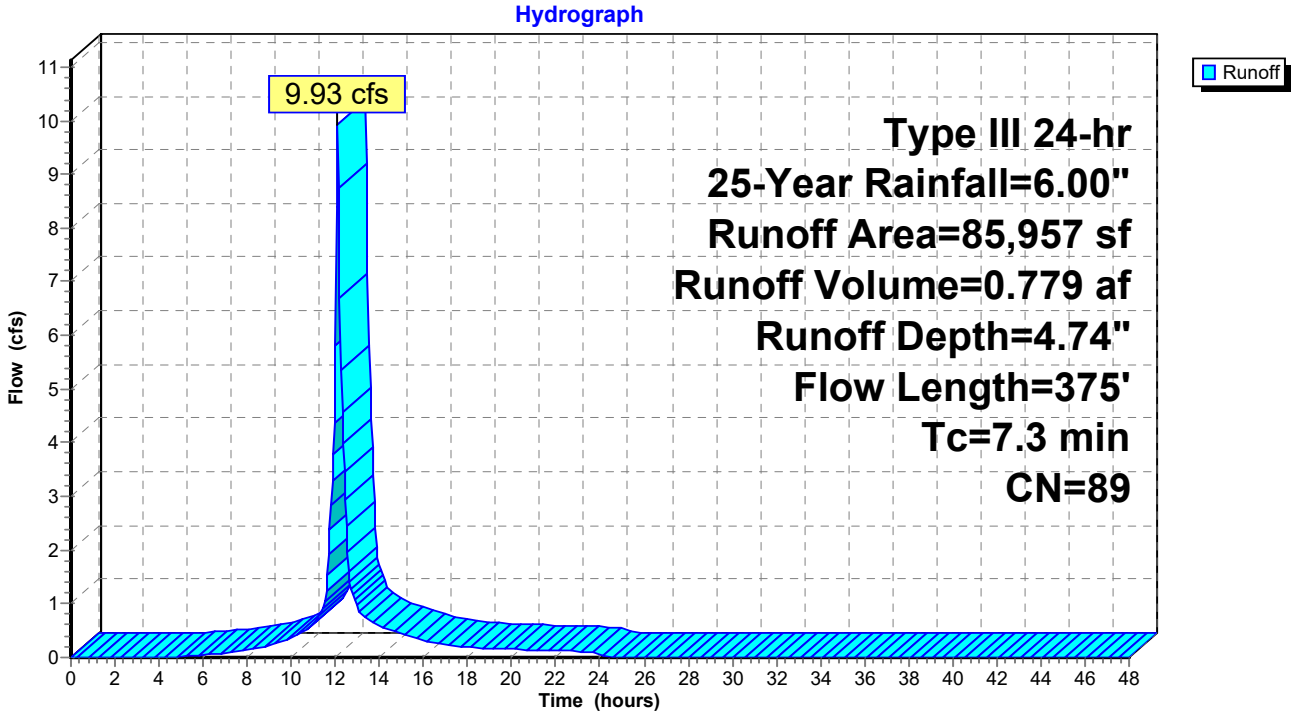
Runoff = 9.93 cfs @ 12.10 hrs, Volume= 0.779 af, Depth= 4.74"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=6.00"

Area (sf)	CN	Description
54,671	98	Paved parking, HSG C
29,238	74	>75% Grass cover, Good, HSG C
2,048	70	Woods, Good, HSG C
85,957	89	Weighted Average
31,286		36.40% Pervious Area
54,671		63.60% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.2	50	0.0240	0.16		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.20"
1.7	245	0.0220	2.39		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
0.4	80	0.0287	3.44		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
7.3	375	Total			

Subcatchment P-4: Watershed to Existing Stormwater System



Summary for Subcatchment P-4A: Watershed to MassDOT CB1

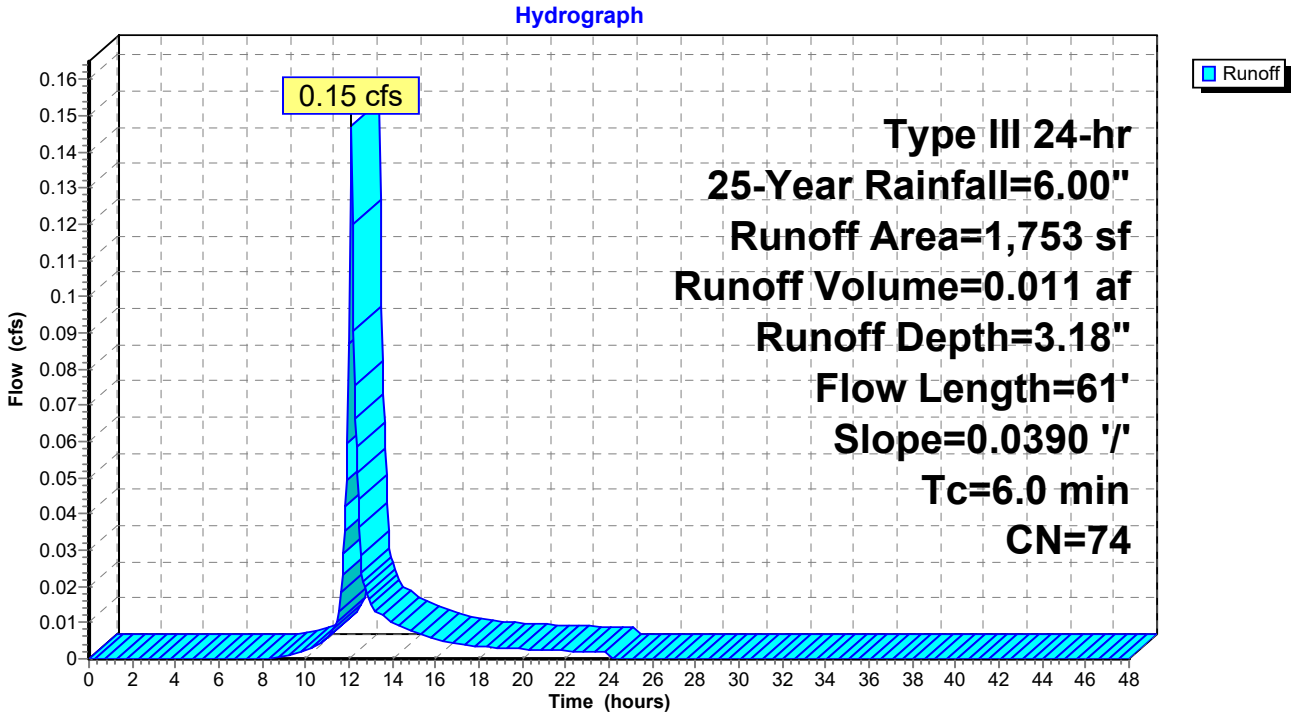
Runoff = 0.15 cfs @ 12.09 hrs, Volume= 0.011 af, Depth= 3.18"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=6.00"

Area (sf)	CN	Description
1,753	74	>75% Grass cover, Good, HSG C
1,753		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.1	61	0.0390	0.20		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.20"
0.9					**Direct Entry,**
6.0	61	Total			

Subcatchment P-4A: Watershed to MassDOT CB1



Summary for Subcatchment P-4B: Watershed to CB2

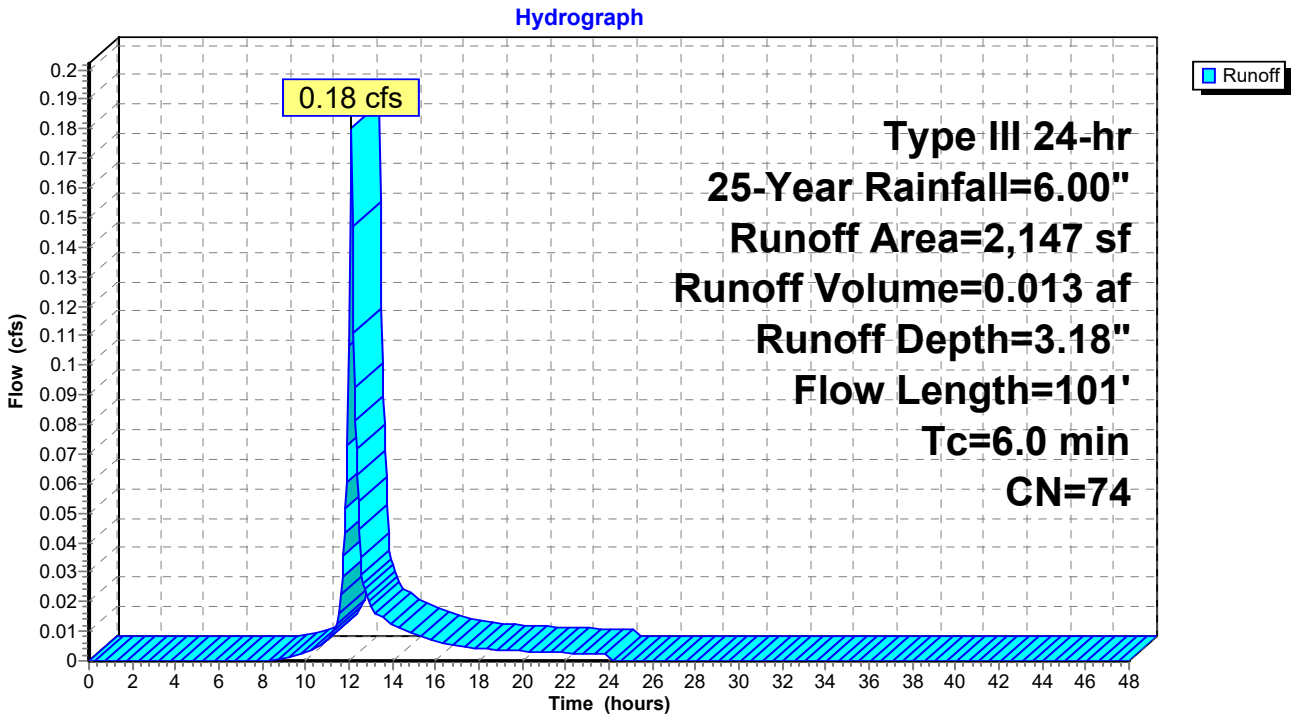
Runoff = 0.18 cfs @ 12.09 hrs, Volume= 0.013 af, Depth= 3.18"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=6.00"

Area (sf)	CN	Description
2,147	74	>75% Grass cover, Good, HSG C
2,147		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.6	50	0.0200	0.15		**Sheet Flow, SHeet Flow** Grass: Short n= 0.150 P2= 3.20"
0.3	51	0.0390	3.18		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
0.1					**Direct Entry, Miniumum**
6.0	101	Total			

Subcatchment P-4B: Watershed to CB2



Summary for Subcatchment P-5: P-5

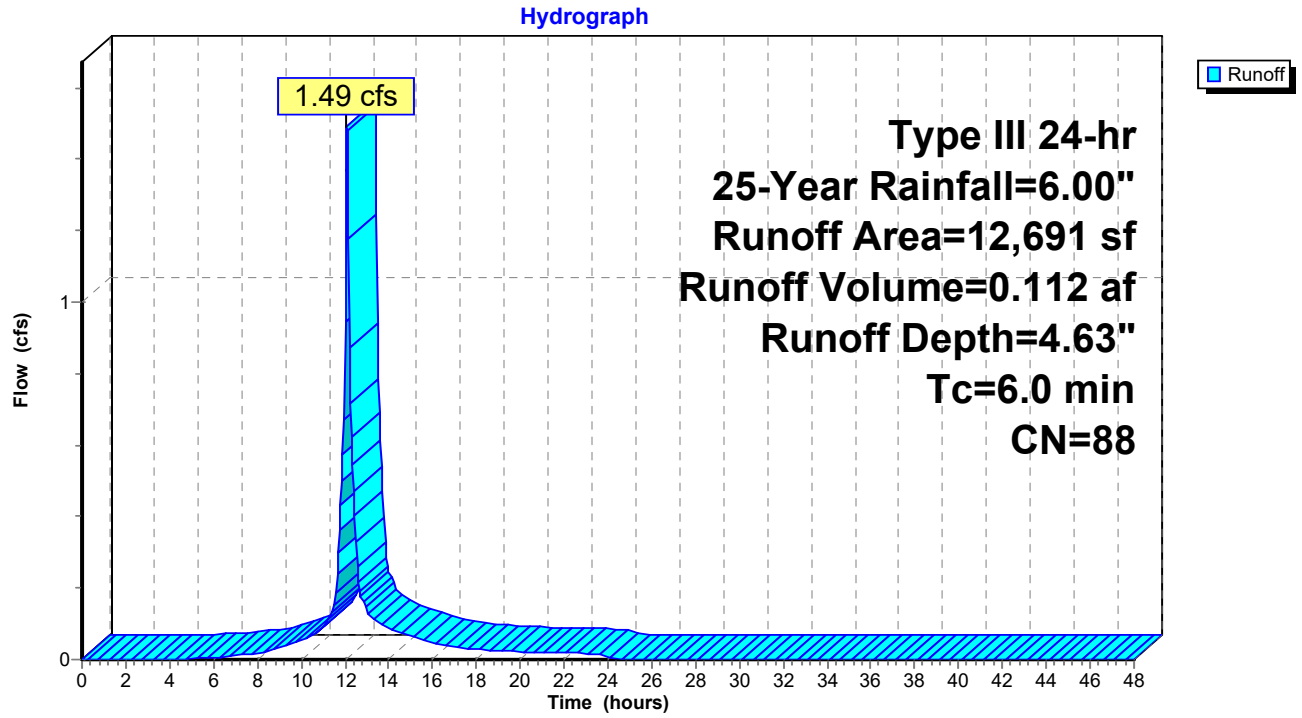
Runoff = 1.49 cfs @ 12.09 hrs, Volume= 0.112 af, Depth= 4.63"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=6.00"

Area (sf)	CN	Description
5,116	74	>75% Grass cover, Good, HSG C
7,575	98	Paved parking, HSG C
12,691	88	Weighted Average
5,116		40.31% Pervious Area
7,575		59.69% Impervious Area

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

Subcatchment P-5: P-5

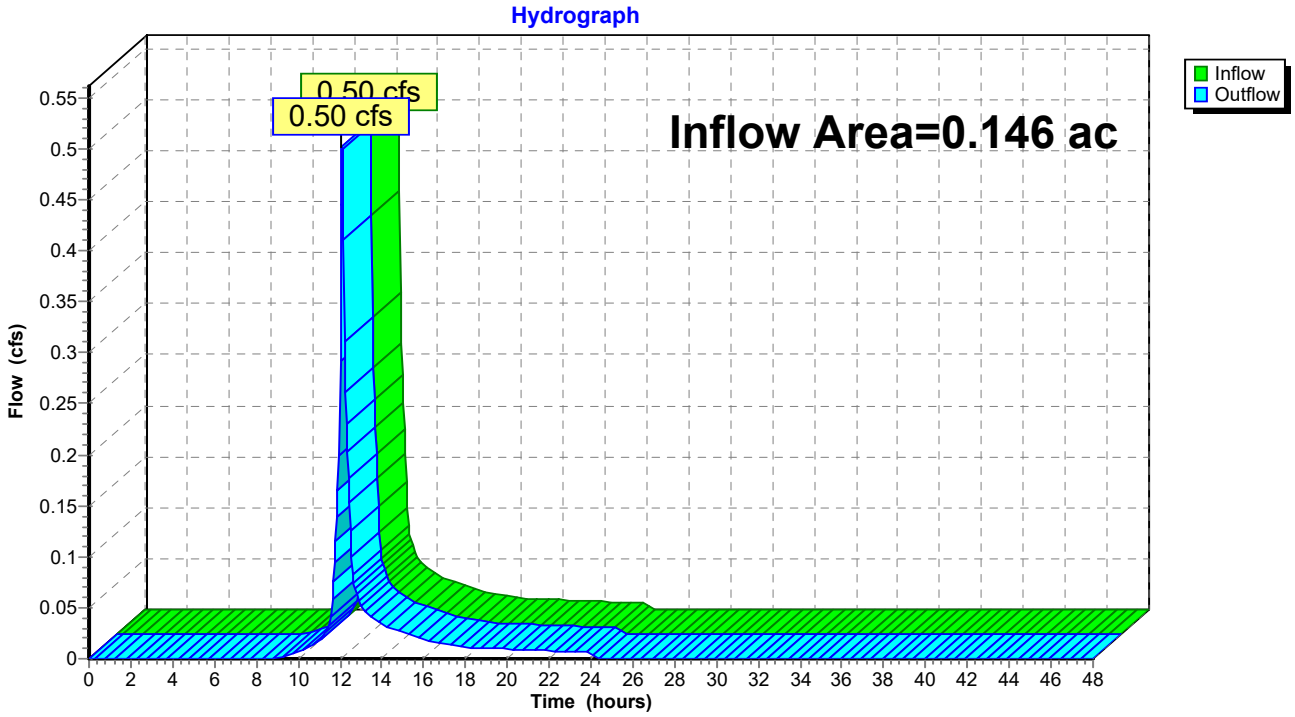


Summary for Reach DP-1: Design Point 1 (Wetland B)

Inflow Area = 0.146 ac, 0.00% Impervious, Inflow Depth = 2.99" for 25-Year event
Inflow = 0.50 cfs @ 12.09 hrs, Volume= 0.036 af
Outflow = 0.50 cfs @ 12.09 hrs, Volume= 0.036 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Reach DP-1: Design Point 1 (Wetland B)

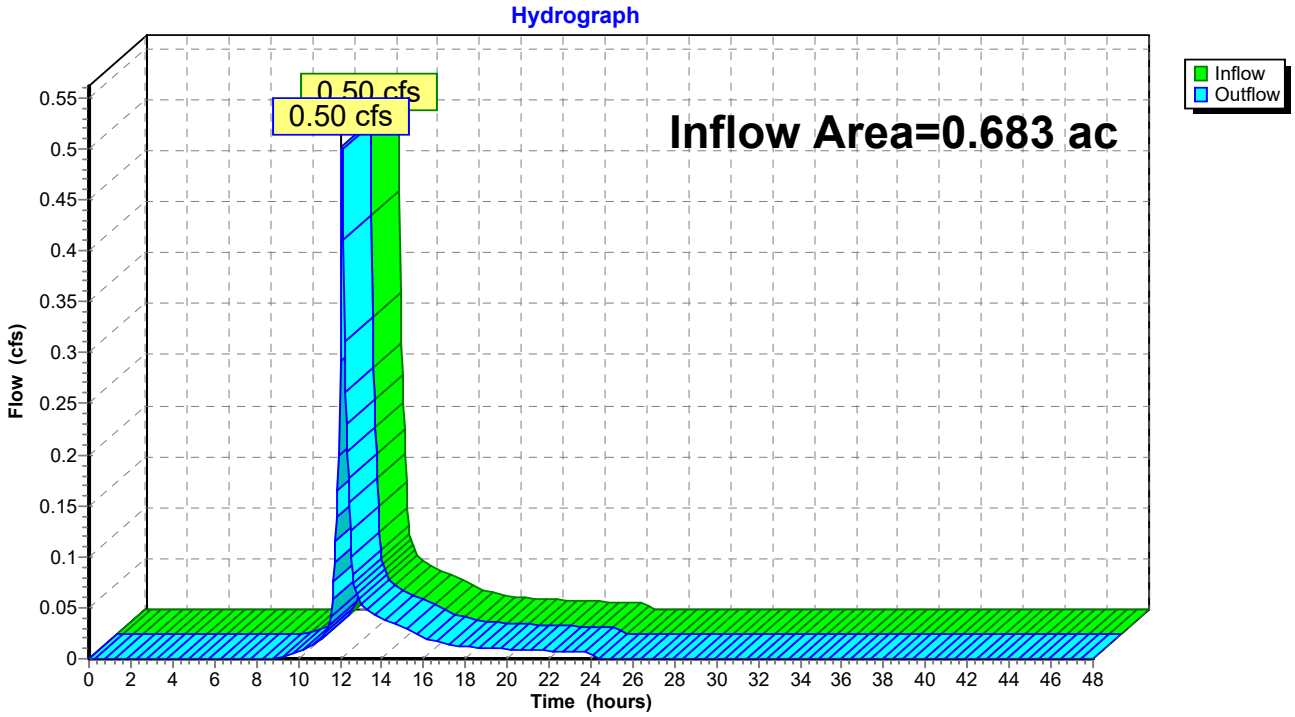


Summary for Reach DP-2: Design Point 2 (15" RCP to Wetland A)

Inflow Area = 0.683 ac, 74.45% Impervious, Inflow Depth = 0.66" for 25-Year event
Inflow = 0.50 cfs @ 12.09 hrs, Volume= 0.037 af
Outflow = 0.50 cfs @ 12.09 hrs, Volume= 0.037 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Reach DP-2: Design Point 2 (15" RCP to Wetland A)

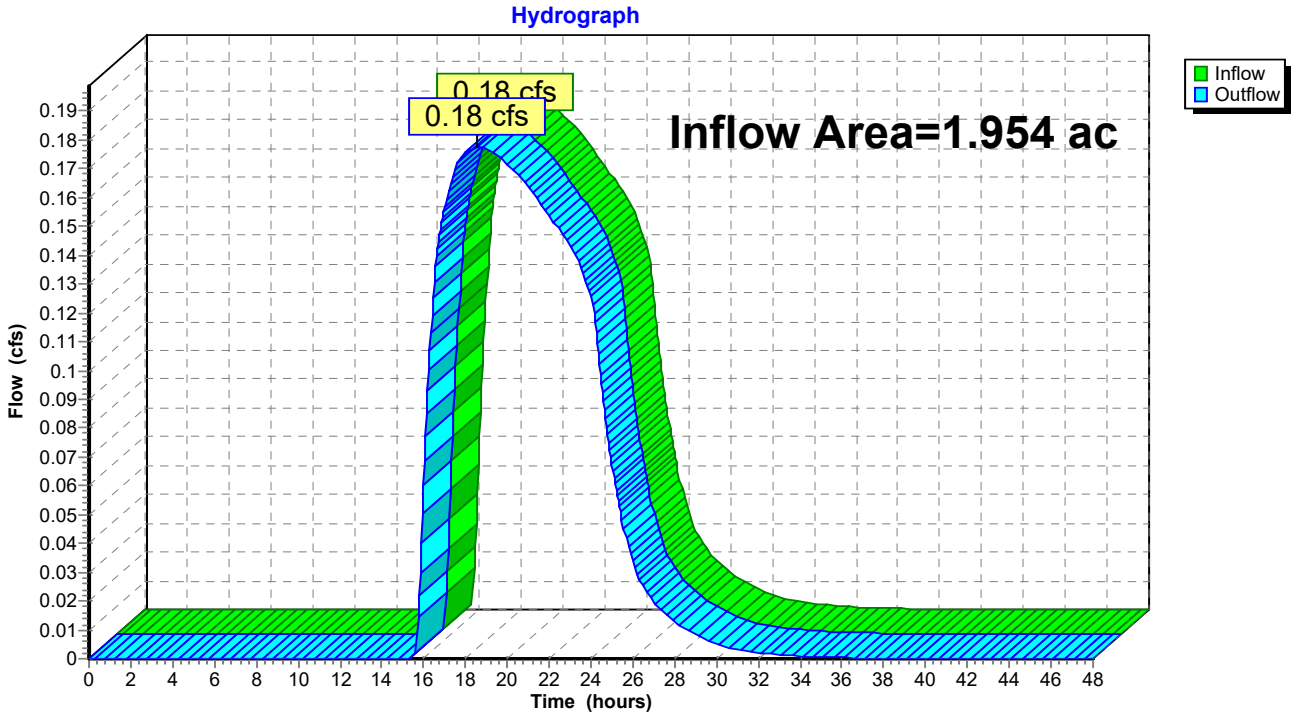


Summary for Reach DP-3: Design Point 3 (Existing Drainage Ditch)

Inflow Area = 1.954 ac, 81.04% Impervious, Inflow Depth = 0.75" for 25-Year event
Inflow = 0.18 cfs @ 18.57 hrs, Volume= 0.122 af
Outflow = 0.18 cfs @ 18.57 hrs, Volume= 0.122 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Reach DP-3: Design Point 3 (Existing Drainage Ditch)

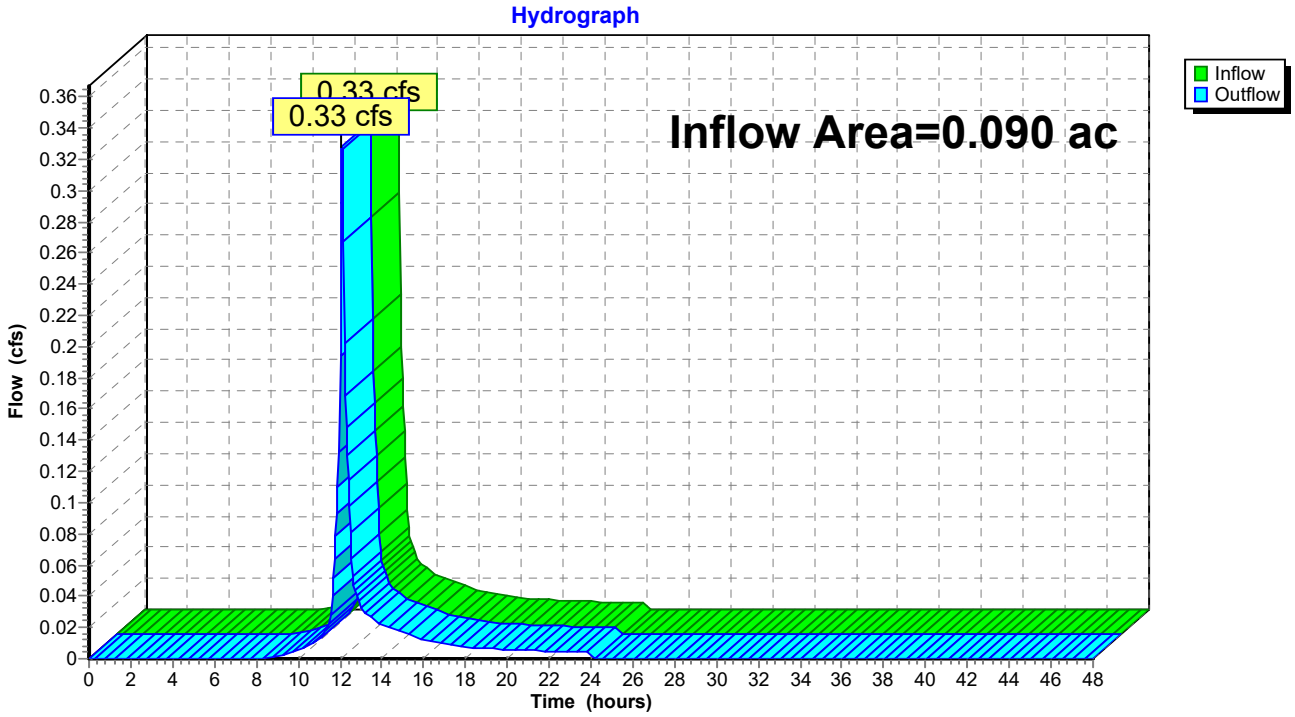


Summary for Reach DP-4: Design Point 4 (MassDOT 30" CB-2)

Inflow Area = 0.090 ac, 0.00% Impervious, Inflow Depth = 3.18" for 25-Year event
Inflow = 0.33 cfs @ 12.09 hrs, Volume= 0.024 af
Outflow = 0.33 cfs @ 12.09 hrs, Volume= 0.024 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Reach DP-4: Design Point 4 (MassDOT 30" CB-2)

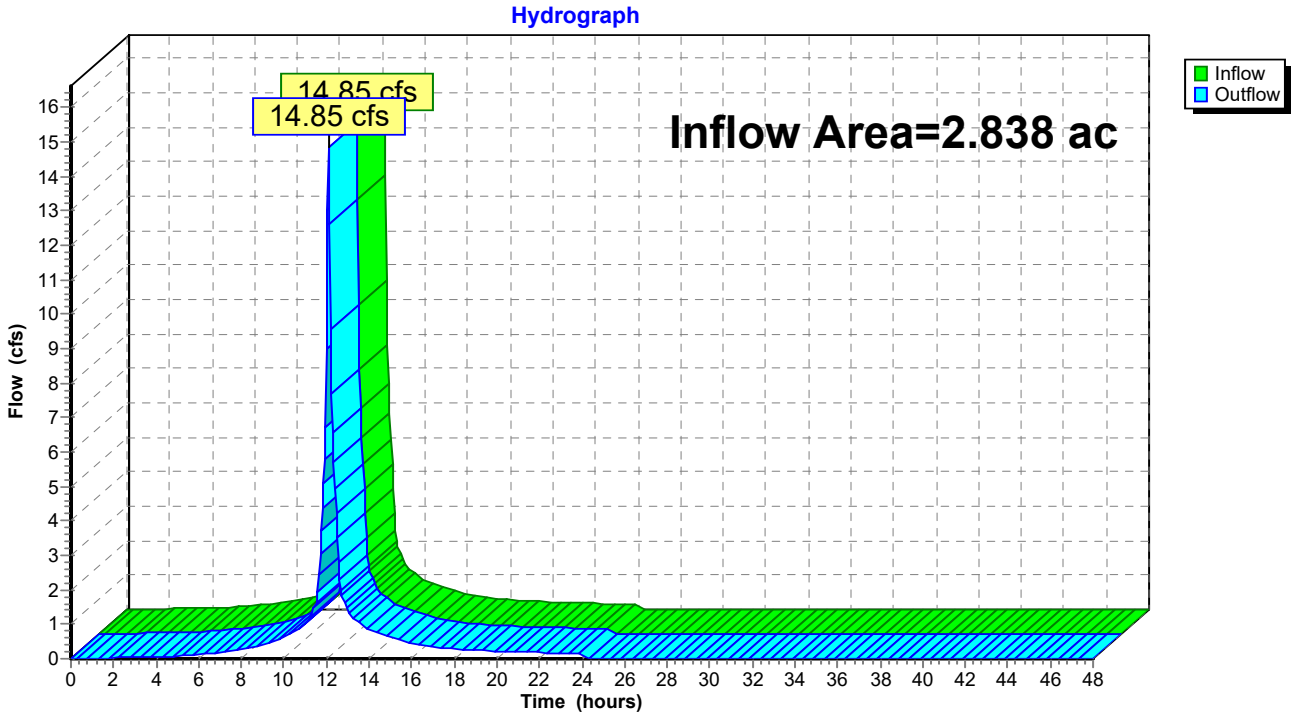


Summary for Reach DP-5: Design Point 5 (Existing Constructed Stormwater Wetland)

Inflow Area = 2.838 ac, 74.70% Impervious, Inflow Depth = 5.05" for 25-Year event
Inflow = 14.85 cfs @ 12.10 hrs, Volume= 1.194 af
Outflow = 14.85 cfs @ 12.10 hrs, Volume= 1.194 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Reach DP-5: Design Point 5 (Existing Constructed Stormwater Wetland)

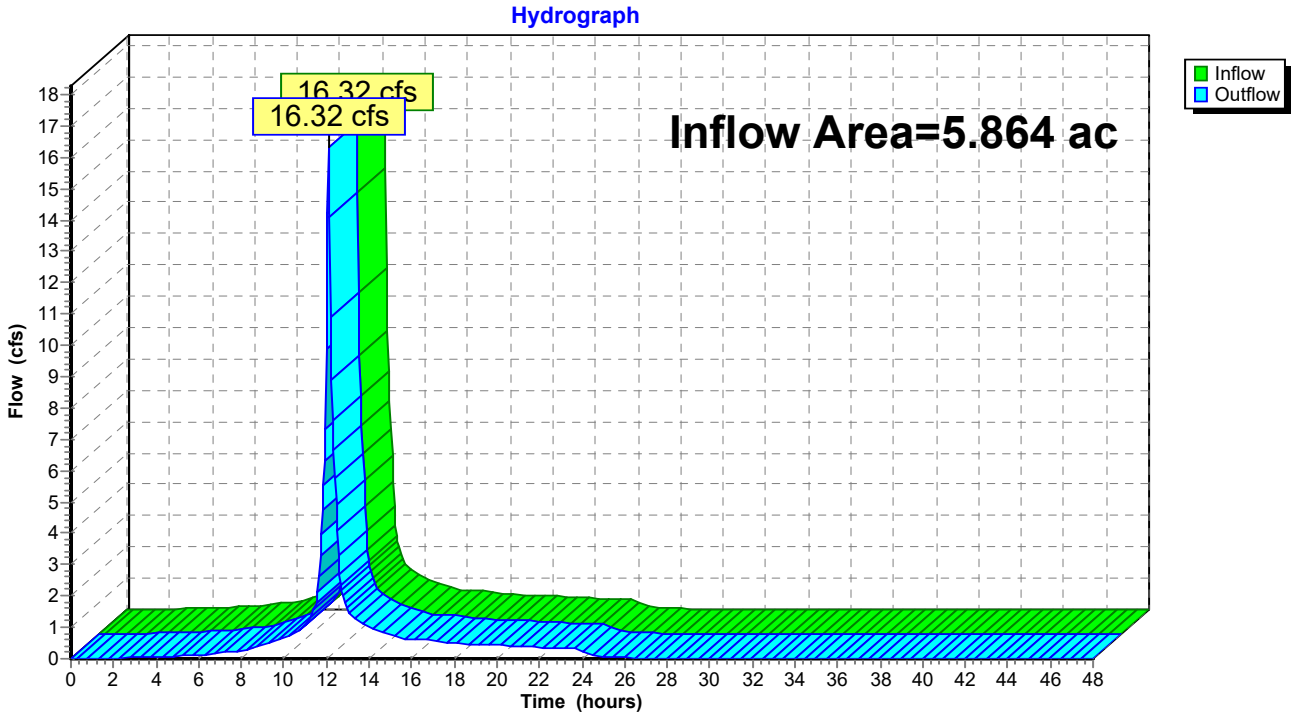


Summary for Reach DP-6: Wetland A - Design Point 6

Inflow Area = 5.864 ac, 71.84% Impervious, Inflow Depth = 2.98" for 25-Year event
Inflow = 16.32 cfs @ 12.10 hrs, Volume= 1.454 af
Outflow = 16.32 cfs @ 12.10 hrs, Volume= 1.454 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Reach DP-6: Wetland A - Design Point 6



Summary for Pond 3P: Conveyance Swale

Inflow Area = 0.471 ac, 52.65% Impervious, Inflow Depth = 4.41" for 25-Year event
Inflow = 2.33 cfs @ 12.09 hrs, Volume= 0.173 af
Outflow = 2.15 cfs @ 12.12 hrs, Volume= 0.173 af, Atten= 8%, Lag= 1.8 min
Primary = 2.15 cfs @ 12.12 hrs, Volume= 0.173 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs / 2
Peak Elev= 125.67' @ 12.12 hrs Surf.Area= 713 sf Storage= 387 cf

Plug-Flow detention time= 8.2 min calculated for 0.173 af (100% of inflow)
Center-of-Mass det. time= 8.3 min (806.0 - 797.7)

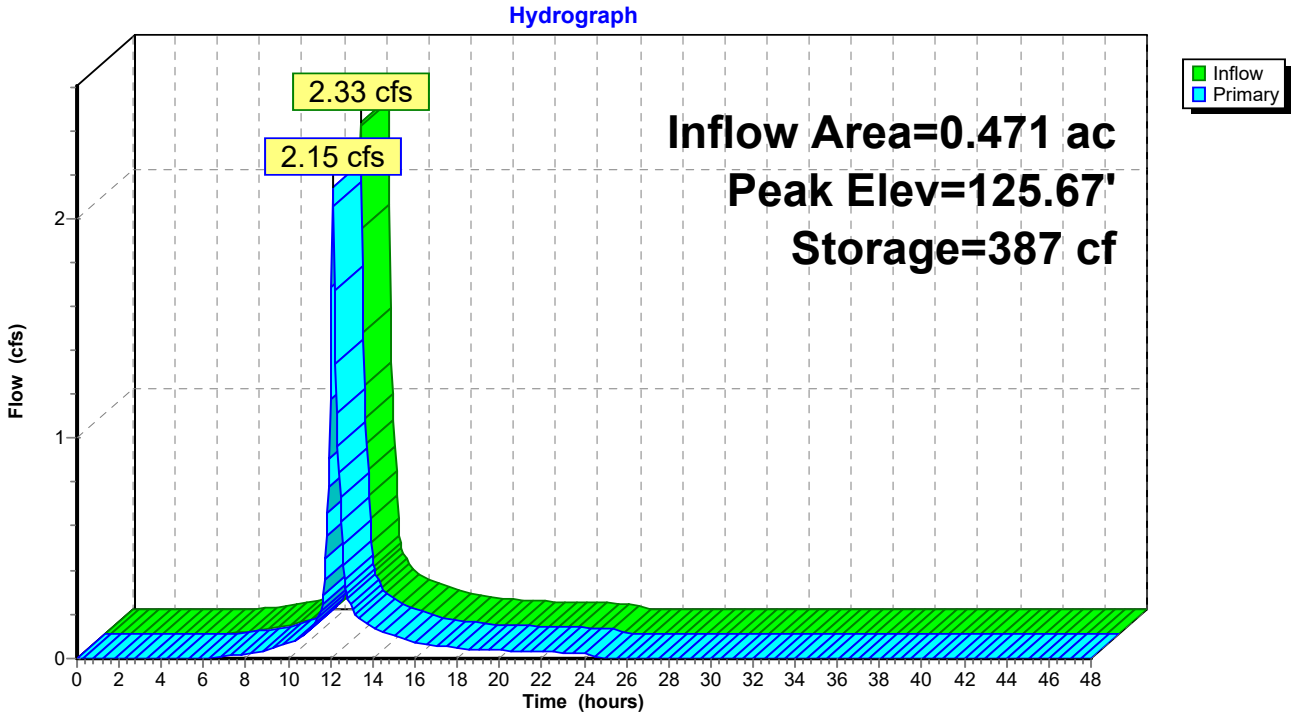
Volume	Invert	Avail.Storage	Storage Description
#1	125.00'	1,147 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
125.00	436	0	0
126.00	848	642	642
126.50	1,170	505	1,147

Device	Routing	Invert	Outlet Devices
#1	Primary	124.18'	**12.0" Round Culvert** L= 10.0' Ke= 0.500 Inlet / Outlet Invert= 124.18' / 124.13' S= 0.0050 '/' Cc= 0.900 n= 0.011 Concrete pipe, straight & clean, Flow Area= 0.79 sf
#2	Device 1	125.00'	**18.0" Vert. Orifice/Grate** C= 0.600

Primary OutFlow Max=2.09 cfs @ 12.12 hrs HW=125.66' (Free Discharge)
↑**1=Culvert** (Passes 2.09 cfs of 3.50 cfs potential flow)
↑**2=Orifice/Grate** (Orifice Controls 2.09 cfs @ 2.77 fps)

Pond 3P: Conveyance Swale



Summary for Pond 8P: UG-1 3 ft Retain IT

Inflow Area = 1.954 ac, 81.04% Impervious, Inflow Depth = 5.19" for 25-Year event
Inflow = 10.37 cfs @ 12.09 hrs, Volume= 0.846 af
Outflow = 0.18 cfs @ 18.57 hrs, Volume= 0.122 af, Atten= 98%, Lag= 388.7 min
Primary = 0.18 cfs @ 18.57 hrs, Volume= 0.122 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs / 2
Peak Elev= 124.49' @ 18.57 hrs Surf.Area= 15,300 sf Storage= 32,675 cf

Plug-Flow detention time= 754.7 min calculated for 0.122 af (14% of inflow)
Center-of-Mass det. time= 480.0 min (1,248.4 - 768.4)

Volume	Invert	Avail.Storage	Storage Description
#1A	121.75'	3,817 cf	**90.00'W x 170.00'L x 4.17'H Field A** 63,750 cf Overall - 54,208 cf Embedded = 9,542 cf x 40.0% Voids
#2A	122.25'	39,109 cf	**retain_it retain_it 3.0'** x 231 Inside #1 Inside= 84.0"W x 36.0"H => 21.33 sf x 8.00'L = 170.6 cf Outside= 96.0"W x 44.0"H => 29.33 sf x 8.00'L = 234.7 cf 11 Rows adjusted for 302.1 cf perimeter wall
		42,926 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	124.25'	**12.0" Round HDPE_Round 12"** L= 12.5' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 124.25' / 124.18' S= 0.0056 '/' Cc= 0.900 n= 0.011 Concrete pipe, straight & clean, Flow Area= 0.79 sf
#2	Device 1	124.40'	**4.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)

Primary OutFlow Max=0.18 cfs @ 18.57 hrs HW=124.49' (Free Discharge)
↑—**1=HDPE_Round 12"** (Barrel Controls 0.18 cfs @ 1.88 fps)
↑—**2=Sharp-Crested Rectangular Weir** (Passes 0.18 cfs of 0.33 cfs potential flow)

Pond 8P: UG-1 3 ft Retain IT - Chamber Wizard Field A

Chamber Model = retain_it retain_it 3.0' (retain-it®)
Inside= 84.0"W x 36.0"H => 21.33 sf x 8.00'L = 170.6 cf
Outside= 96.0"W x 44.0"H => 29.33 sf x 8.00'L = 234.7 cf
11 Rows adjusted for 302.1 cf perimeter wall

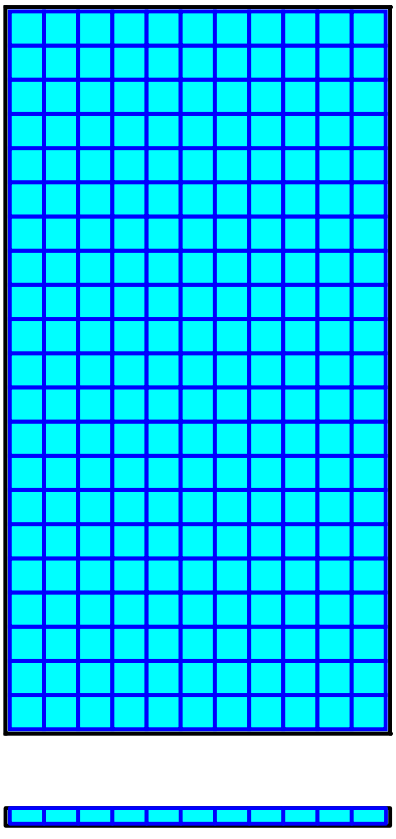
21 Chambers/Row x 8.00' Long = 168.00' Row Length +12.0" End Stone x 2 = 170.00' Base Length
11 Rows x 96.0" Wide + 12.0" Side Stone x 2 = 90.00' Base Width
6.0" Base + 44.0" Chamber Height = 4.17' Field Height

4.7 cf Sidewall x 21 x 2 + 4.7 cf Endwall x 11 x 2 = 302.1 cf Perimeter Wall
231 Chambers x 170.6 cf - 302.1 cf Perimeter wall = 39,108.9 cf Chamber Storage
231 Chambers x 234.7 cf = 54,208.0 cf Displacement

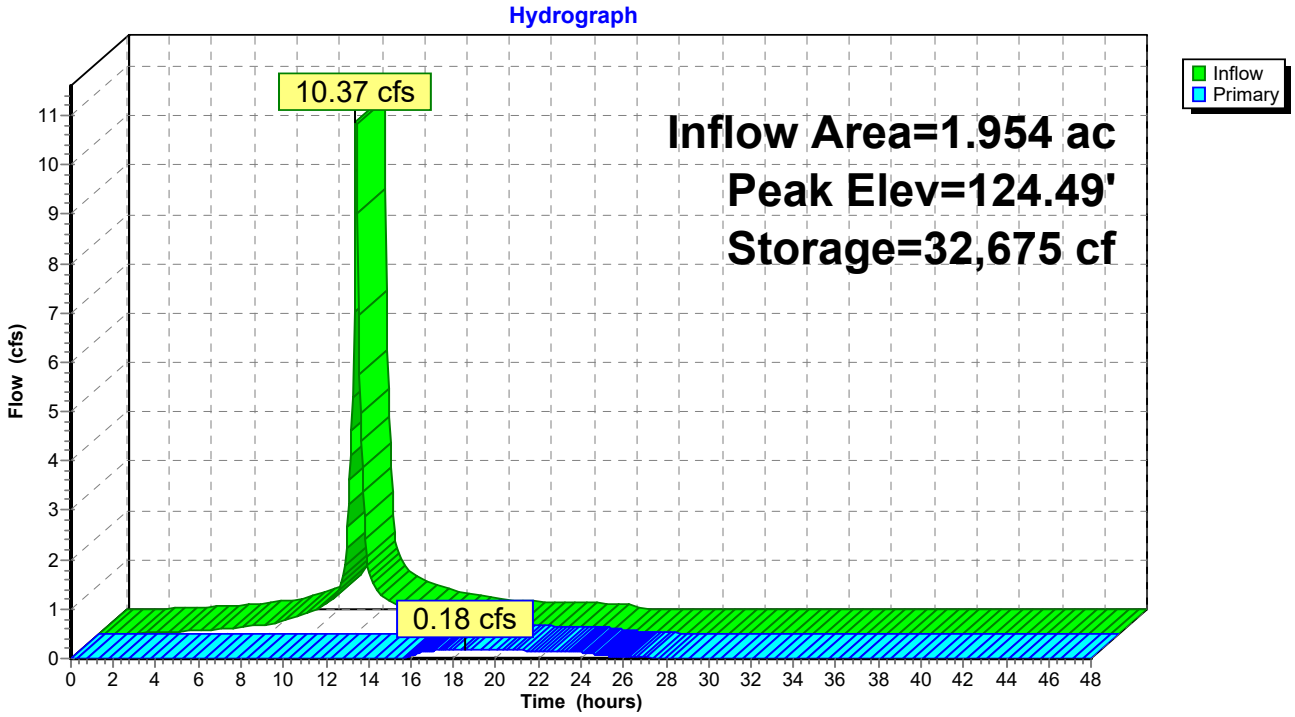
63,750.0 cf Field - 54,208.0 cf Chambers = 9,542.0 cf Stone x 40.0% Voids = 3,816.8 cf Stone Storage

Chamber Storage + Stone Storage = 42,925.7 cf = 0.985 af
Overall Storage Efficiency = 67.3%
Overall System Size = 170.00' x 90.00' x 4.17'

231 Chambers
2,361.1 cy Field
353.4 cy Stone



Pond 8P: UG-1 3 ft Retain IT



Summary for Pond 11P: Permeable Pavement

Inflow Area = 0.537 ac, 94.68% Impervious, Inflow Depth = 5.64" for 25-Year event
Inflow = 3.07 cfs @ 12.09 hrs, Volume= 0.253 af
Outflow = 0.14 cfs @ 14.50 hrs, Volume= 0.253 af, Atten= 95%, Lag= 144.5 min
Discarded = 0.14 cfs @ 9.95 hrs, Volume= 0.252 af
Primary = 0.01 cfs @ 14.50 hrs, Volume= 0.001 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Peak Elev= 123.35' @ 14.50 hrs Surf.Area= 22,160 sf Storage= 5,282 cf

Plug-Flow detention time= 320.2 min calculated for 0.252 af (100% of inflow)
Center-of-Mass det. time= 320.2 min (1,072.3 - 752.2)

Volume	Invert	Avail.Storage	Storage Description
#1	122.75'	7,512 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

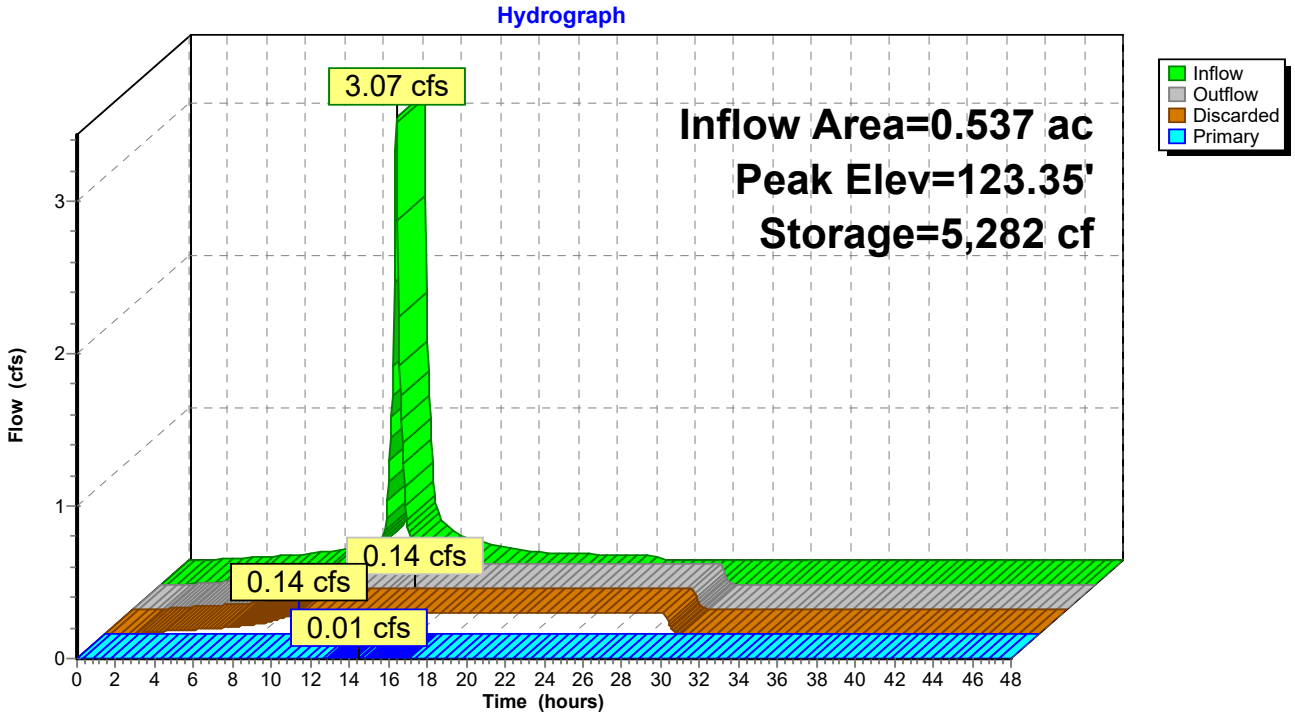
Elevation (feet)	Surf.Area (sq-ft)	Voids (%)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
122.75	22,160	0.0	0	0
123.41	22,160	40.0	5,850	5,850
123.66	22,160	30.0	1,662	7,512

Device	Routing	Invert	Outlet Devices
#1	Discarded	122.75'	**0.270 in/hr Exfiltration over Surface area**
#2	Primary	123.30'	**6.0" Round Culvert** L= 10.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 123.30' / 119.00' S= 0.4300 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 0.20 sf

Discarded OutFlow Max=0.14 cfs @ 9.95 hrs HW=122.76' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.14 cfs)

Primary OutFlow Max=0.01 cfs @ 14.50 hrs HW=123.35' (Free Discharge)
↑—**2=Culvert** (Inlet Controls 0.01 cfs @ 0.58 fps)

Pond 11P: Permeable Pavement



Summary for Subcatchment P-1A: Undetained to Wetland B

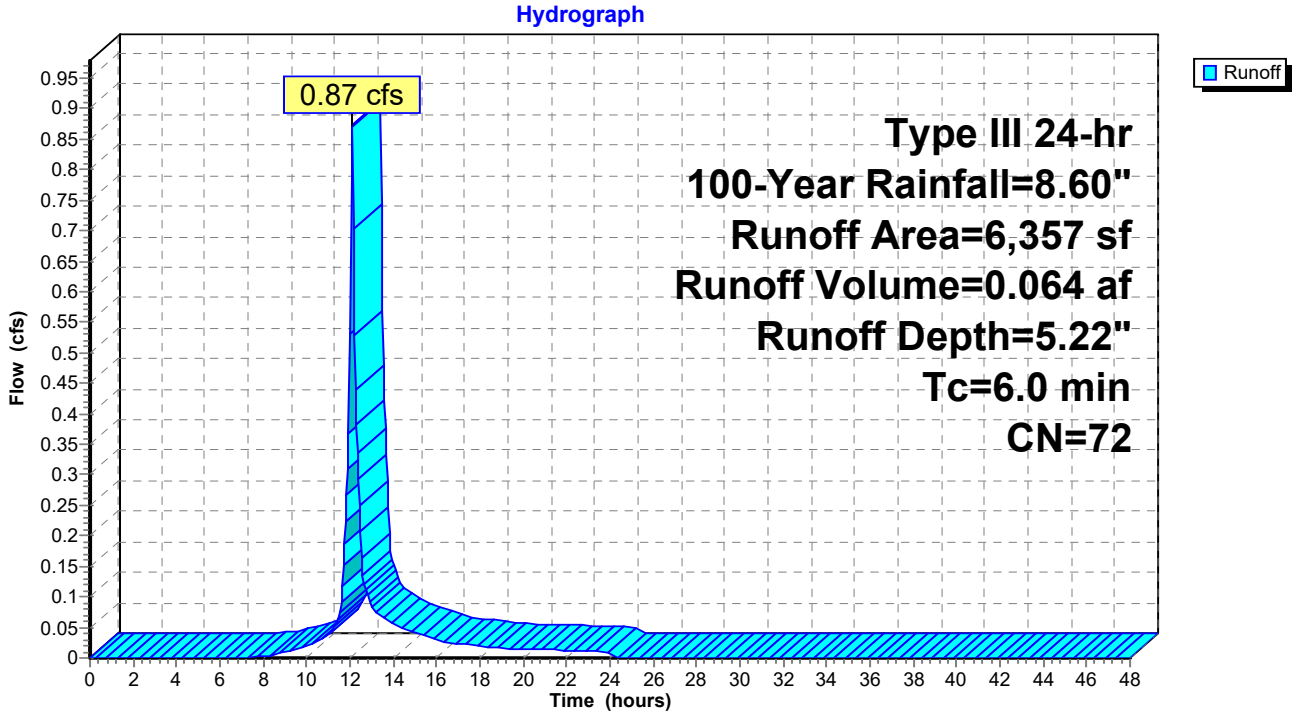
Runoff = 0.87 cfs @ 12.09 hrs, Volume= 0.064 af, Depth= 5.22"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=8.60"

Area (sf)	CN	Description
6,357	72	Woods/grass comb., Good, HSG C
6,357		100.00% Pervious Area

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

Subcatchment P-1A: Undetained to Wetland B



Summary for Subcatchment P-1B: Western Driveway

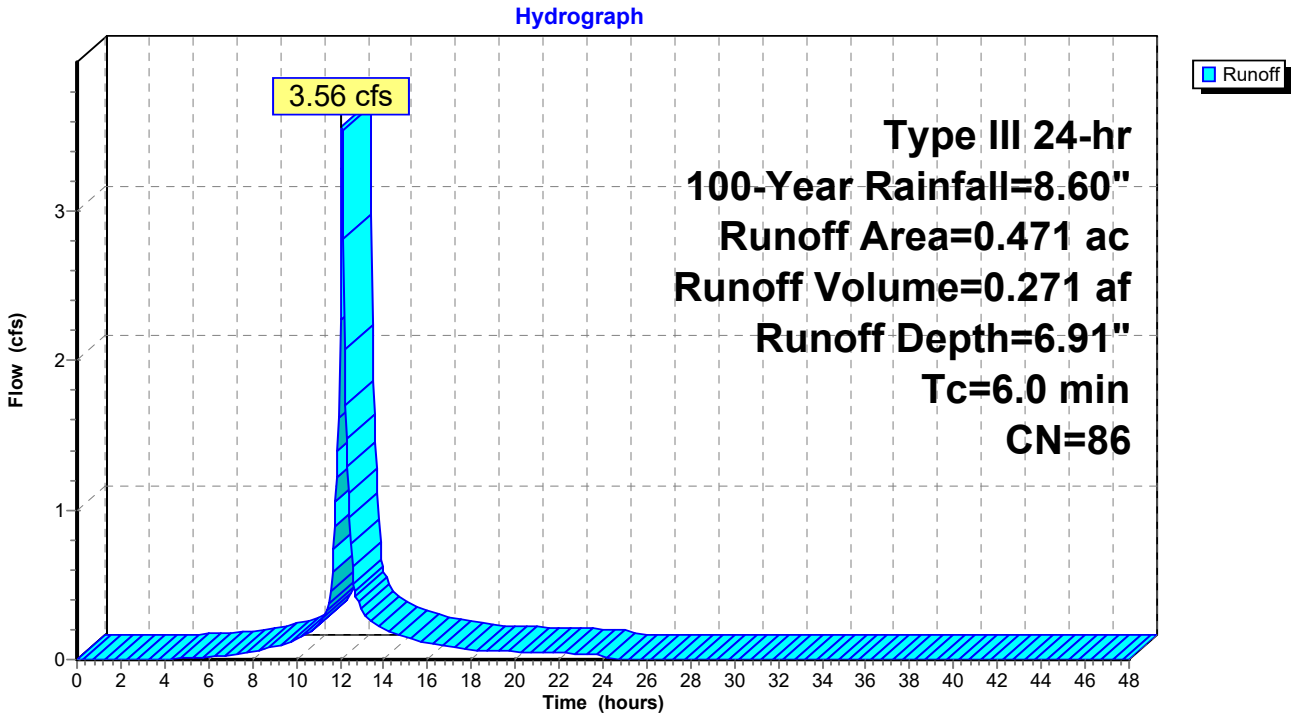
Runoff = 3.56 cfs @ 12.09 hrs, Volume= 0.271 af, Depth= 6.91"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=8.60"

Area (ac)	CN	Description
0.248	98	Paved parking, HSG C
0.223	72	Woods/grass comb., Good, HSG C
0.471	86	Weighted Average
0.223		47.35% Pervious Area
0.248		52.65% Impervious Area

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

Subcatchment P-1B: Western Driveway



Summary for Subcatchment P-1C: Permeable Pavement

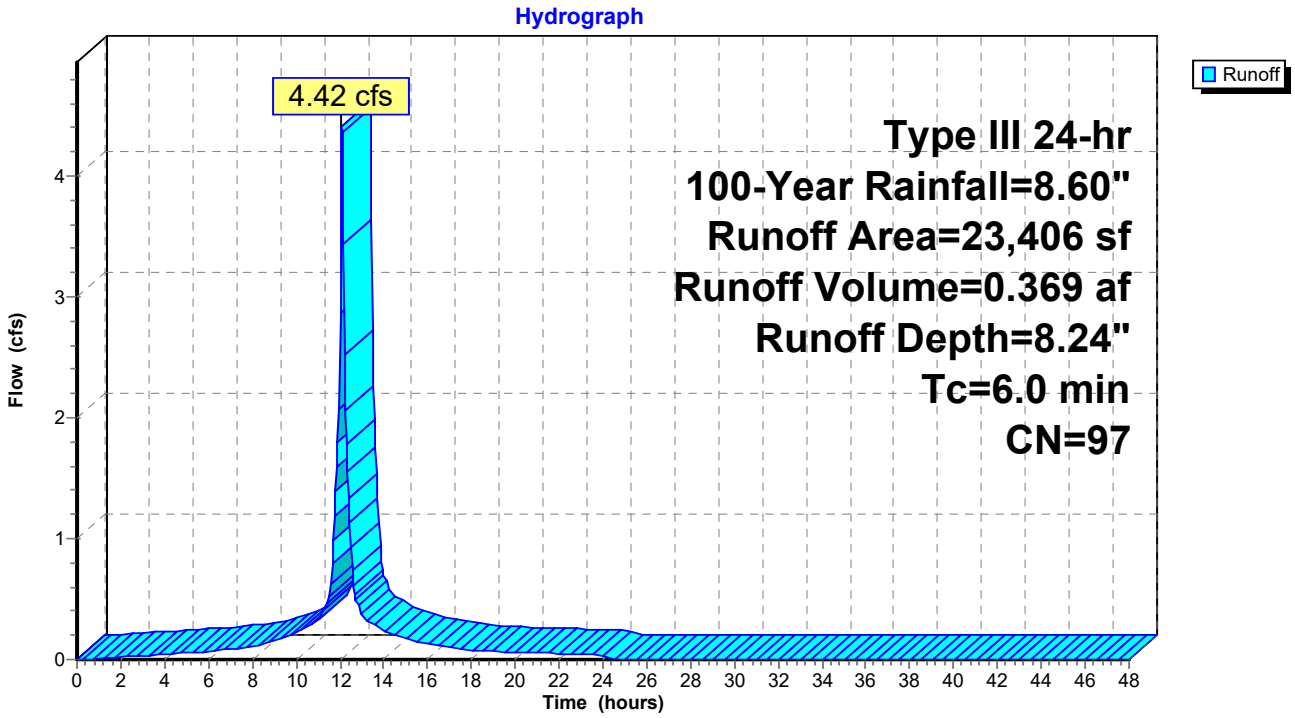
Runoff = 4.42 cfs @ 12.09 hrs, Volume= 0.369 af, Depth= 8.24"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=8.60"

Area (sf)	CN	Description
22,160	98	Paved parking, HSG C
1,246	74	>75% Grass cover, Good, HSG C
23,406	97	Weighted Average
1,246		5.32% Pervious Area
22,160		94.68% Impervious Area

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

Subcatchment P-1C: Permeable Pavement



Summary for Subcatchment P-2: Undetained to Wetland

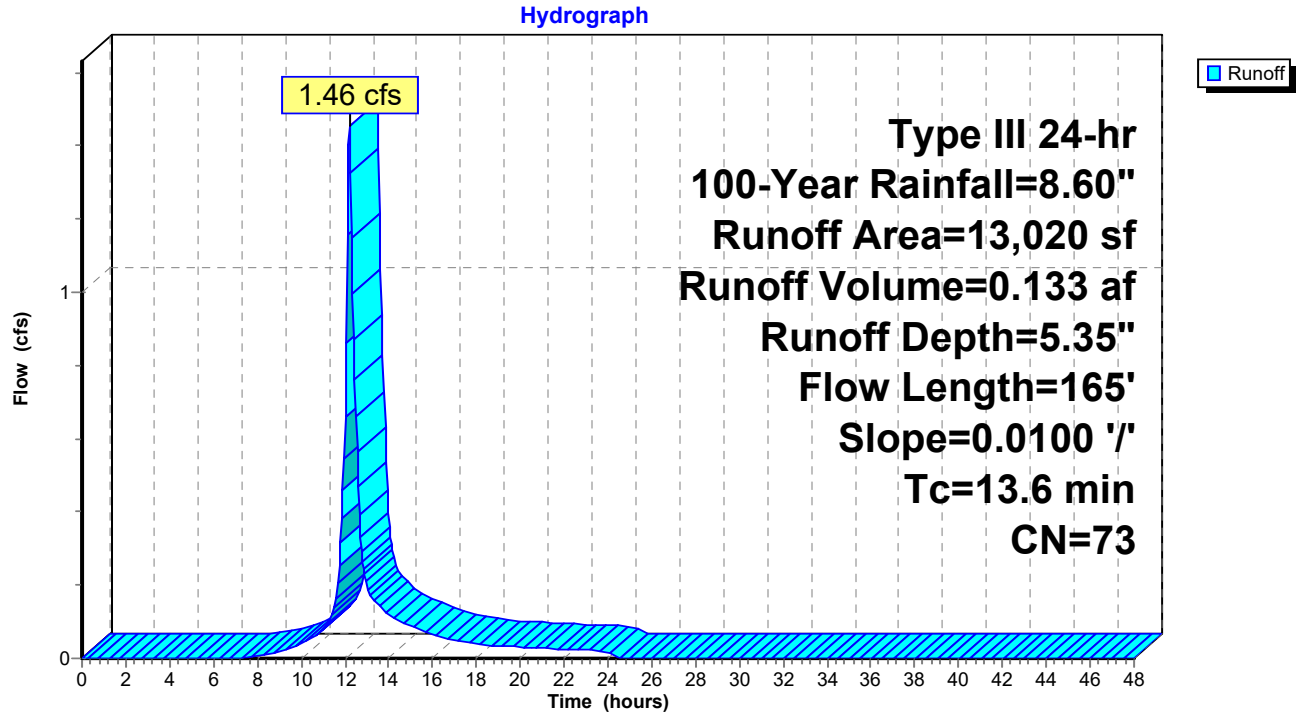
Runoff = 1.46 cfs @ 12.19 hrs, Volume= 0.133 af, Depth= 5.35"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=8.60"

Area (sf)	CN	Description
10,967	74	>75% Grass cover, Good, HSG C
2,053	70	Woods, Good, HSG C
13,020	73	Weighted Average
13,020		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.9	100	0.0100	0.13		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.20"
0.7	65	0.0100	1.61		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
13.6	165	Total			

Subcatchment P-2: Undetained to Wetland



Summary for Subcatchment P-3A: Existing Building & Additions and Upper Pavement

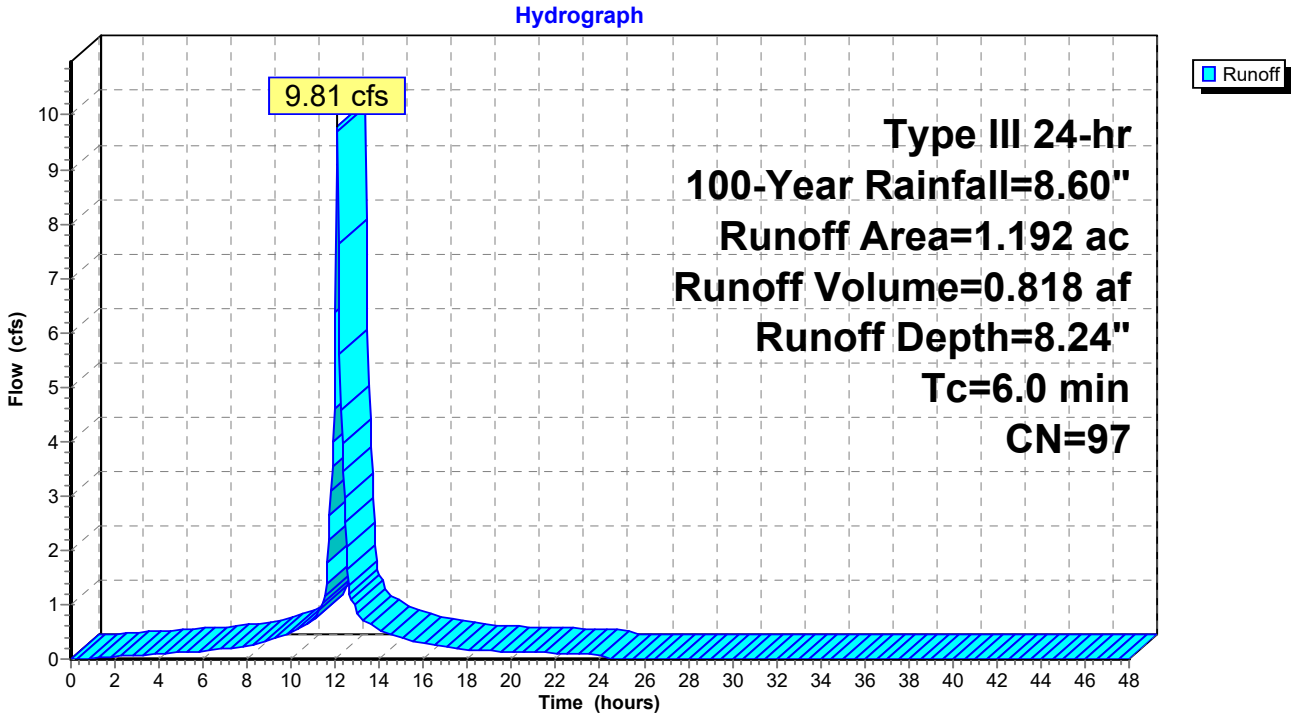
Runoff = 9.81 cfs @ 12.09 hrs, Volume= 0.818 af, Depth= 8.24"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=8.60"

Area (ac)	CN	Description
0.701	98	Paved parking, HSG C
0.461	98	Roofs, HSG C
0.030	74	>75% Grass cover, Good, HSG C
1.192	97	Weighted Average
0.030		2.52% Pervious Area
1.162		97.48% Impervious Area

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

Subcatchment P-3A: Existing Building & Additions and Upper Pavement



Summary for Subcatchment P-3B: Existing Building Draining to Constructed Wetland

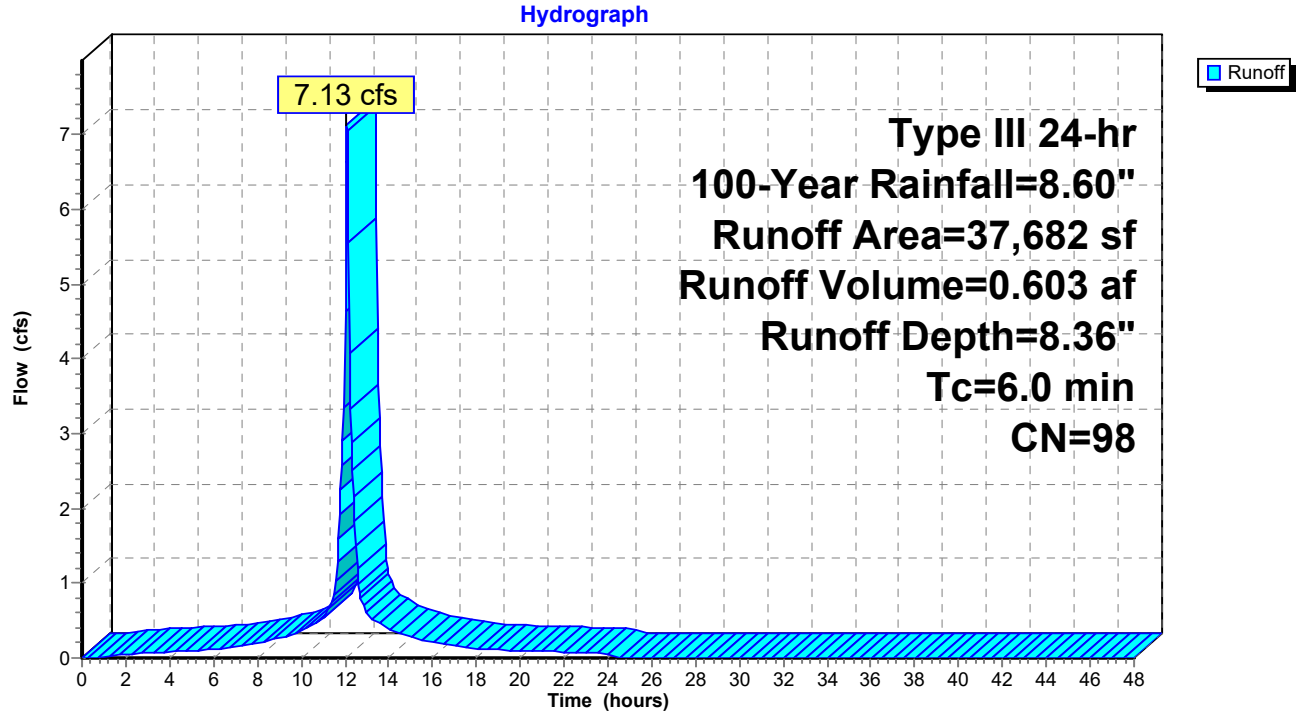
Runoff = 7.13 cfs @ 12.09 hrs, Volume= 0.603 af, Depth= 8.36"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=8.60"

Area (sf)	CN	Description
37,682	98	Roofs, HSG C
37,682		100.00% Impervious Area

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

Subcatchment P-3B: Existing Building Draining to Constructed Wetland



Summary for Subcatchment P-4: Watershed to Existing Stormwater System

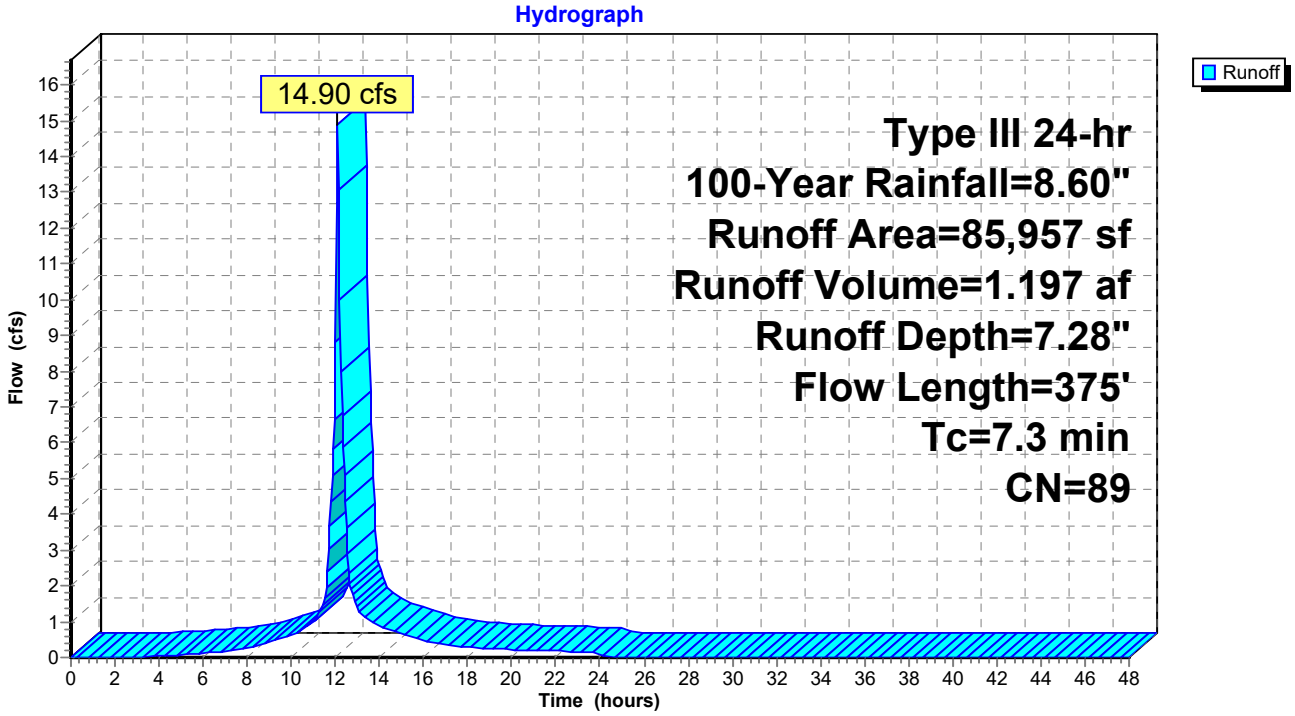
Runoff = 14.90 cfs @ 12.10 hrs, Volume= 1.197 af, Depth= 7.28"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=8.60"

Area (sf)	CN	Description
54,671	98	Paved parking, HSG C
29,238	74	>75% Grass cover, Good, HSG C
2,048	70	Woods, Good, HSG C
85,957	89	Weighted Average
31,286		36.40% Pervious Area
54,671		63.60% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.2	50	0.0240	0.16		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.20"
1.7	245	0.0220	2.39		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
0.4	80	0.0287	3.44		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
7.3	375	Total			

Subcatchment P-4: Watershed to Existing Stormwater System



Summary for Subcatchment P-4A: Watershed to MassDOT CB1

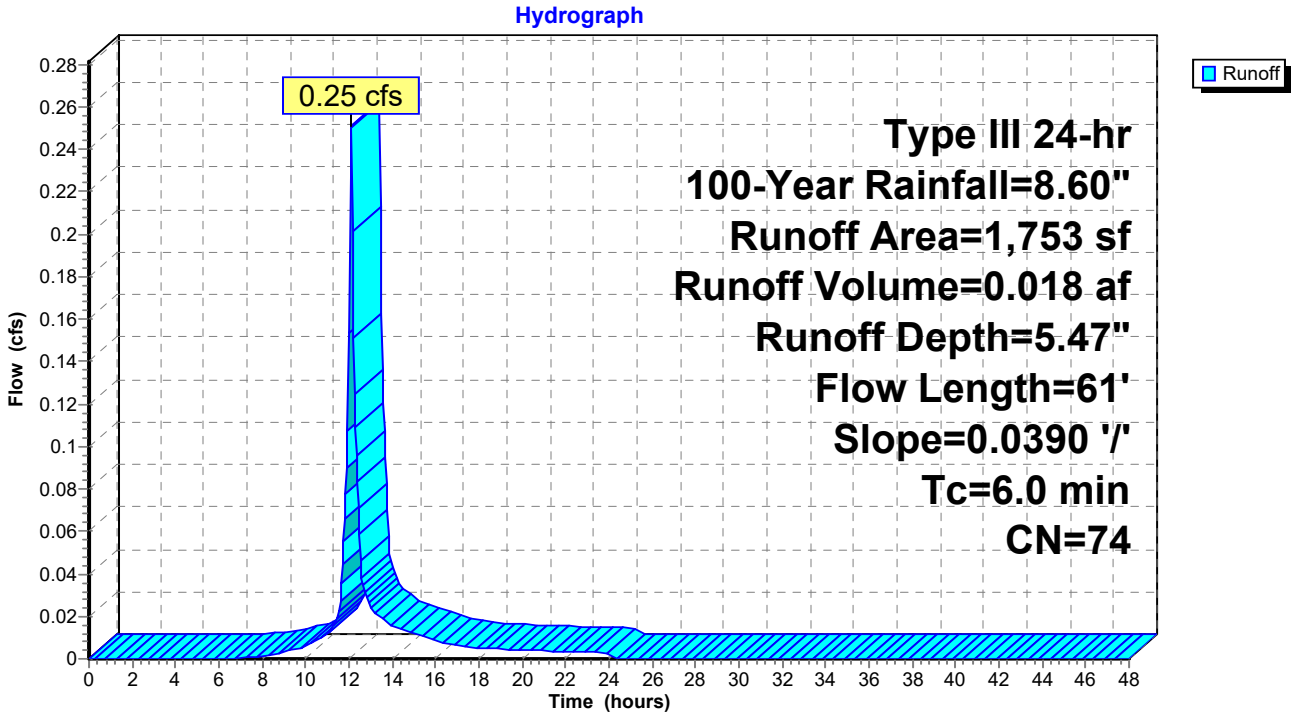
Runoff = 0.25 cfs @ 12.09 hrs, Volume= 0.018 af, Depth= 5.47"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=8.60"

Area (sf)	CN	Description
1,753	74	>75% Grass cover, Good, HSG C
1,753		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.1	61	0.0390	0.20		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.20"
0.9					**Direct Entry,**
6.0	61	Total			

Subcatchment P-4A: Watershed to MassDOT CB1



Summary for Subcatchment P-4B: Watershed to CB2

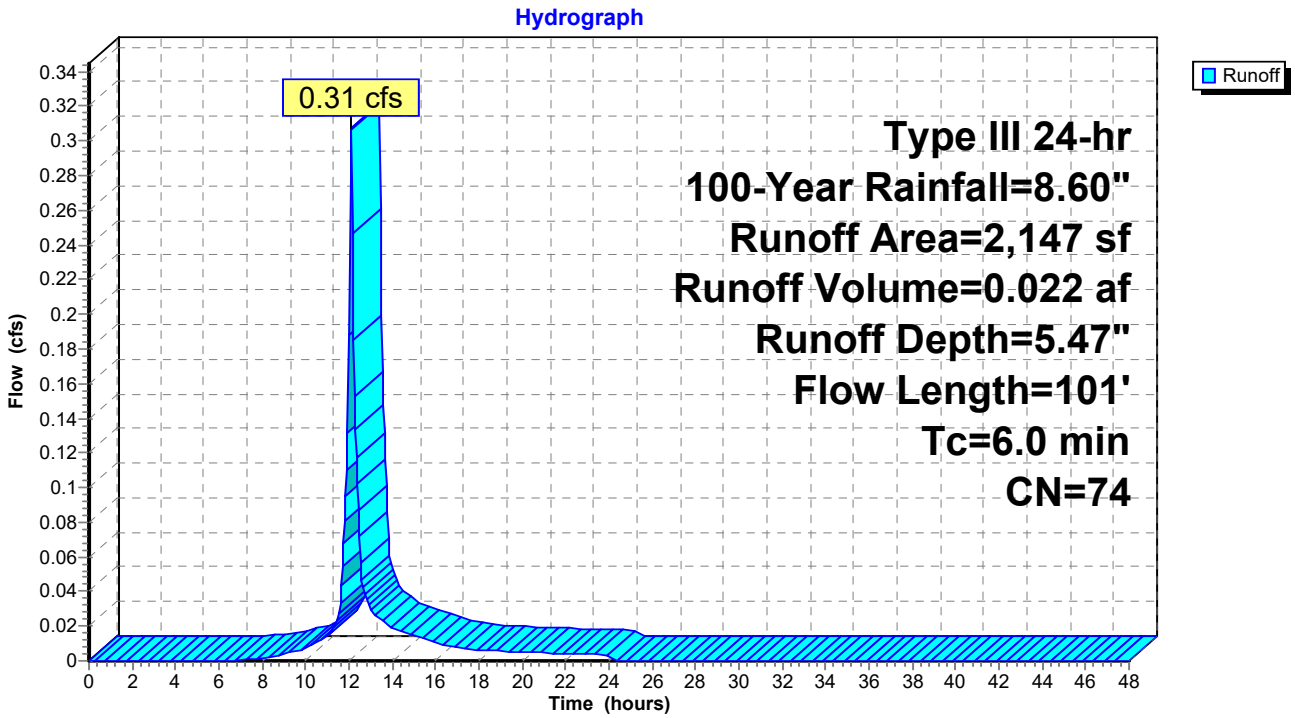
Runoff = 0.31 cfs @ 12.09 hrs, Volume= 0.022 af, Depth= 5.47"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=8.60"

Area (sf)	CN	Description
2,147	74	>75% Grass cover, Good, HSG C
2,147		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.6	50	0.0200	0.15		**Sheet Flow, SHeet Flow** Grass: Short n= 0.150 P2= 3.20"
0.3	51	0.0390	3.18		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
0.1					**Direct Entry, Miniumum**
6.0	101	Total			

Subcatchment P-4B: Watershed to CB2



Summary for Subcatchment P-5: P-5

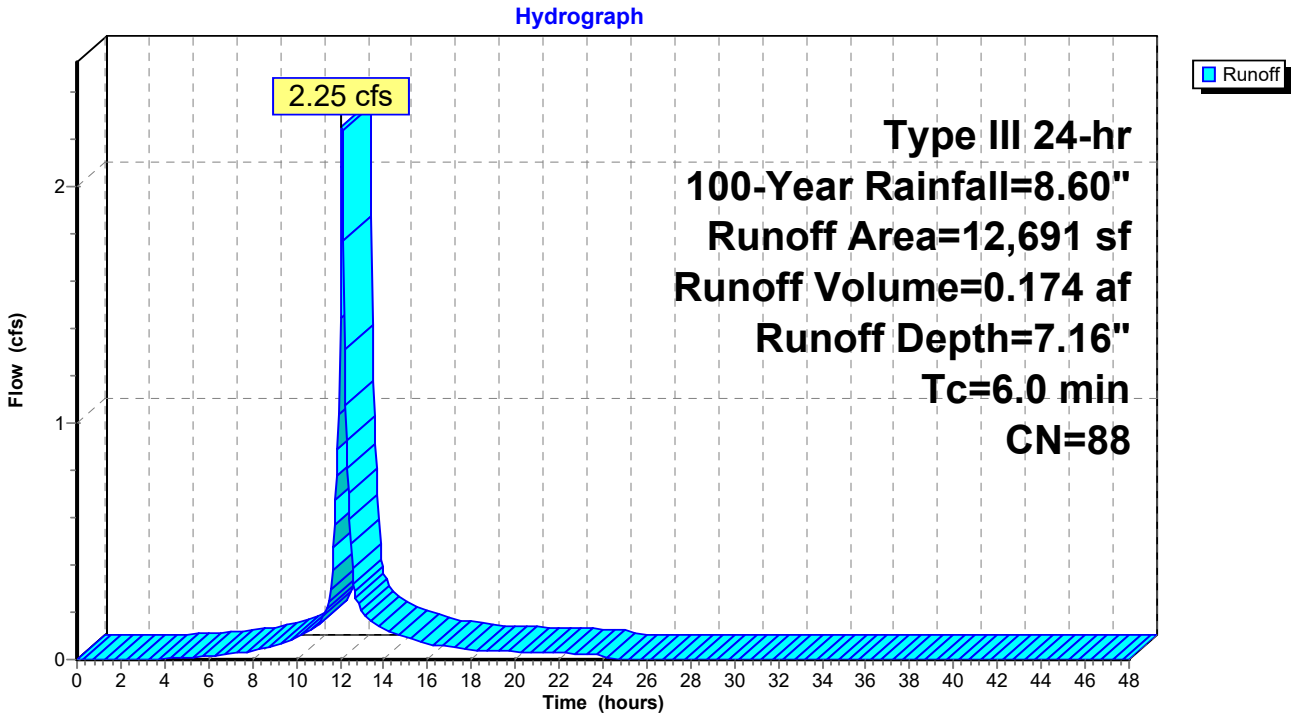
Runoff = 2.25 cfs @ 12.09 hrs, Volume= 0.174 af, Depth= 7.16"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=8.60"

Area (sf)	CN	Description
5,116	74	>75% Grass cover, Good, HSG C
7,575	98	Paved parking, HSG C
12,691	88	Weighted Average
5,116		40.31% Pervious Area
7,575		59.69% Impervious Area

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

Subcatchment P-5: P-5

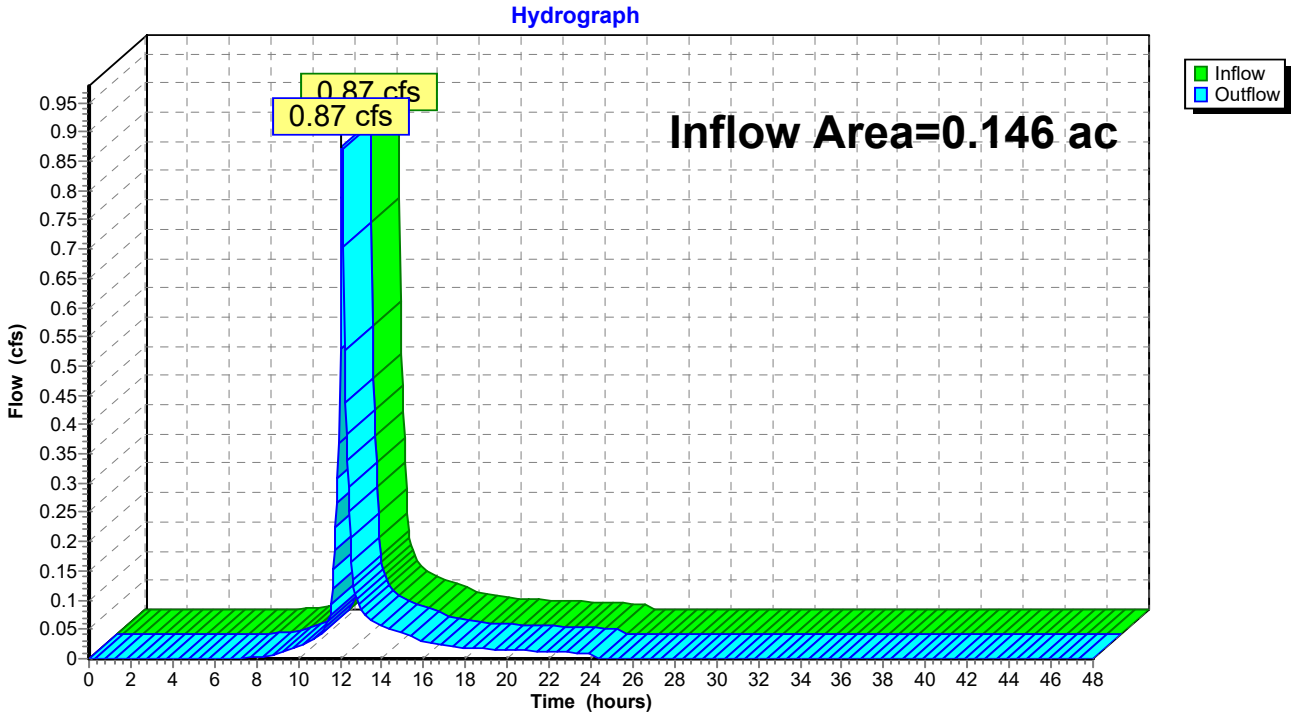


Summary for Reach DP-1: Design Point 1 (Wetland B)

Inflow Area = 0.146 ac, 0.00% Impervious, Inflow Depth = 5.22" for 100-Year event
Inflow = 0.87 cfs @ 12.09 hrs, Volume= 0.064 af
Outflow = 0.87 cfs @ 12.09 hrs, Volume= 0.064 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Reach DP-1: Design Point 1 (Wetland B)

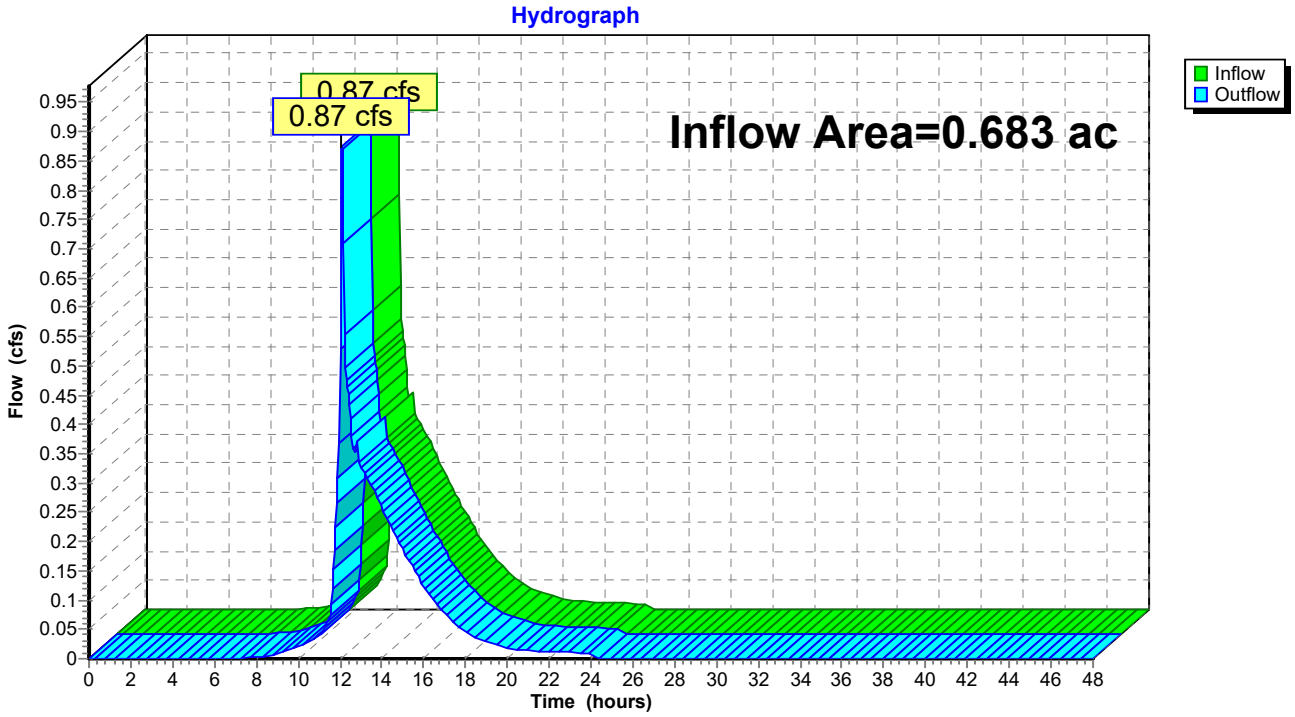


Summary for Reach DP-2: Design Point 2 (15" RCP to Wetland A)

Inflow Area = 0.683 ac, 74.45% Impervious, Inflow Depth = 2.31" for 100-Year event
Inflow = 0.87 cfs @ 12.09 hrs, Volume= 0.131 af
Outflow = 0.87 cfs @ 12.09 hrs, Volume= 0.131 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Reach DP-2: Design Point 2 (15" RCP to Wetland A)

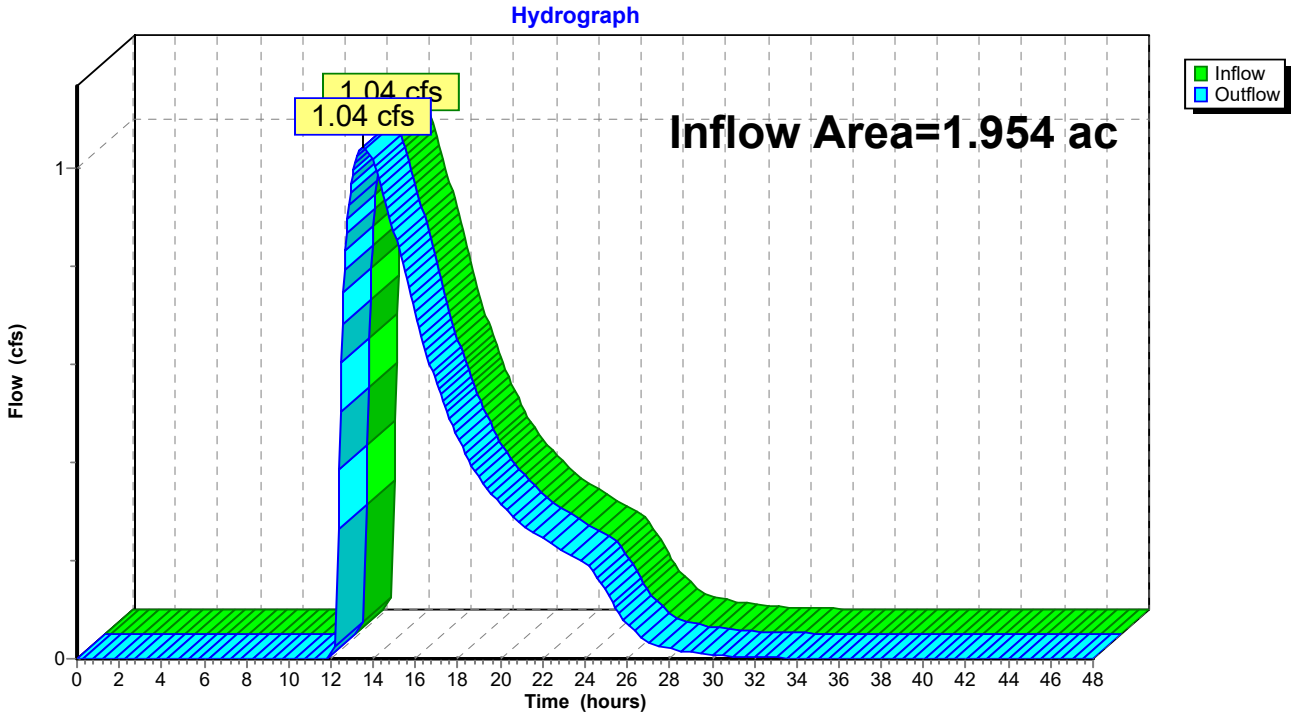


Summary for Reach DP-3: Design Point 3 (Existing Drainage Ditch)

Inflow Area = 1.954 ac, 81.04% Impervious, Inflow Depth = 3.31" for 100-Year event
Inflow = 1.04 cfs @ 13.54 hrs, Volume= 0.540 af
Outflow = 1.04 cfs @ 13.54 hrs, Volume= 0.540 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Reach DP-3: Design Point 3 (Existing Drainage Ditch)

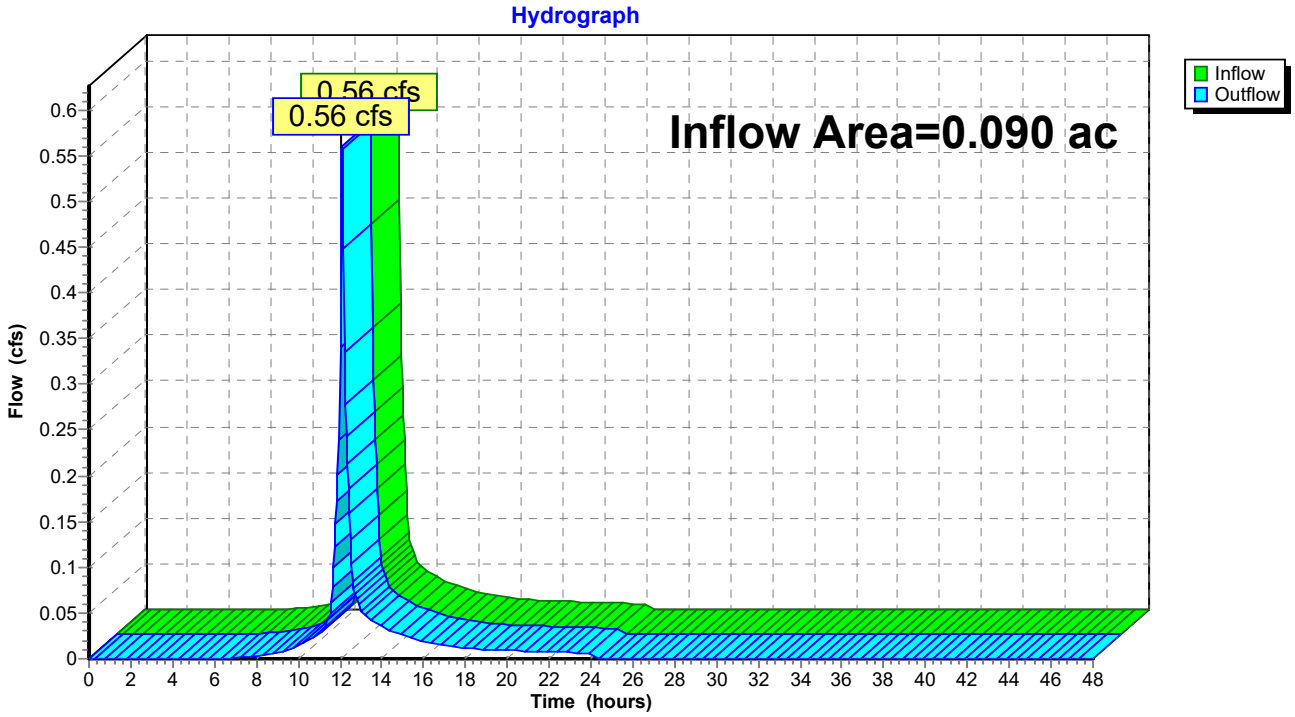


Summary for Reach DP-4: Design Point 4 (MassDOT 30" CB-2)

Inflow Area = 0.090 ac, 0.00% Impervious, Inflow Depth = 5.47" for 100-Year event
Inflow = 0.56 cfs @ 12.09 hrs, Volume= 0.041 af
Outflow = 0.56 cfs @ 12.09 hrs, Volume= 0.041 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Reach DP-4: Design Point 4 (MassDOT 30" CB-2)

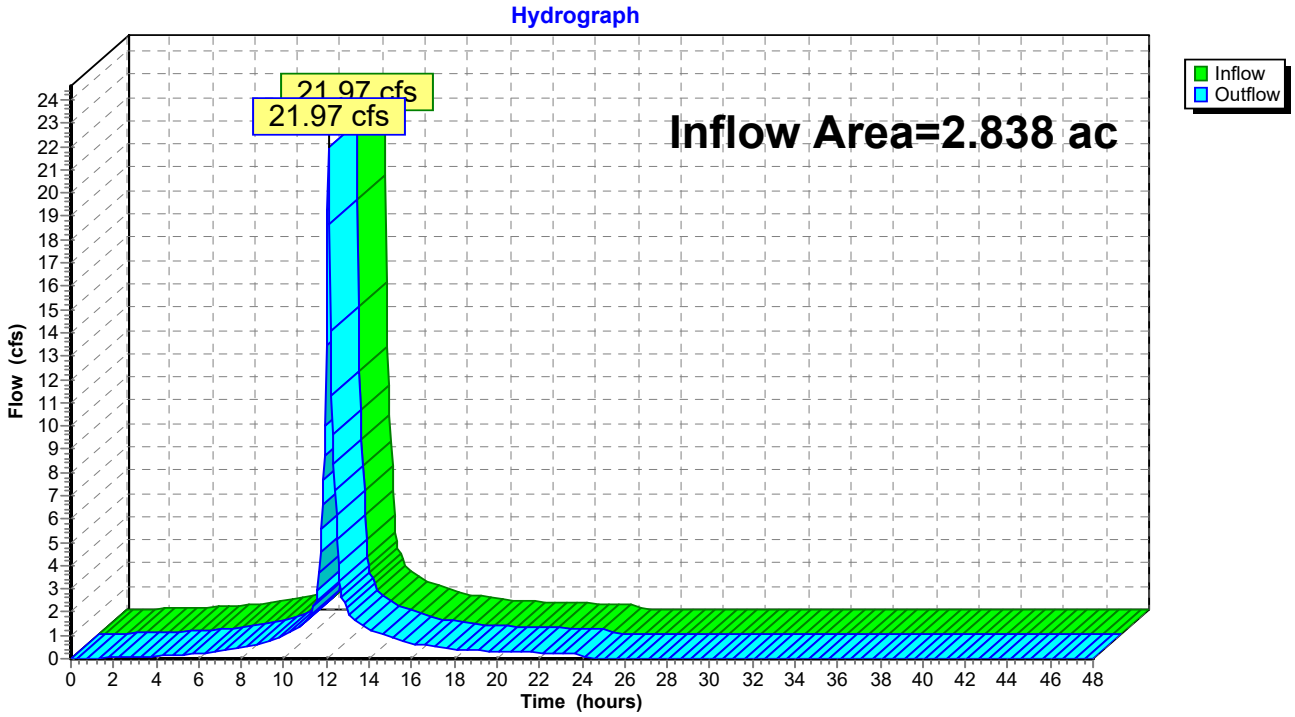


Summary for Reach DP-5: Design Point 5 (Existing Constructed Stormwater Wetland)

Inflow Area = 2.838 ac, 74.70% Impervious, Inflow Depth = 7.61" for 100-Year event
Inflow = 21.97 cfs @ 12.10 hrs, Volume= 1.799 af
Outflow = 21.97 cfs @ 12.10 hrs, Volume= 1.799 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Reach DP-5: Design Point 5 (Existing Constructed Stormwater Wetland)

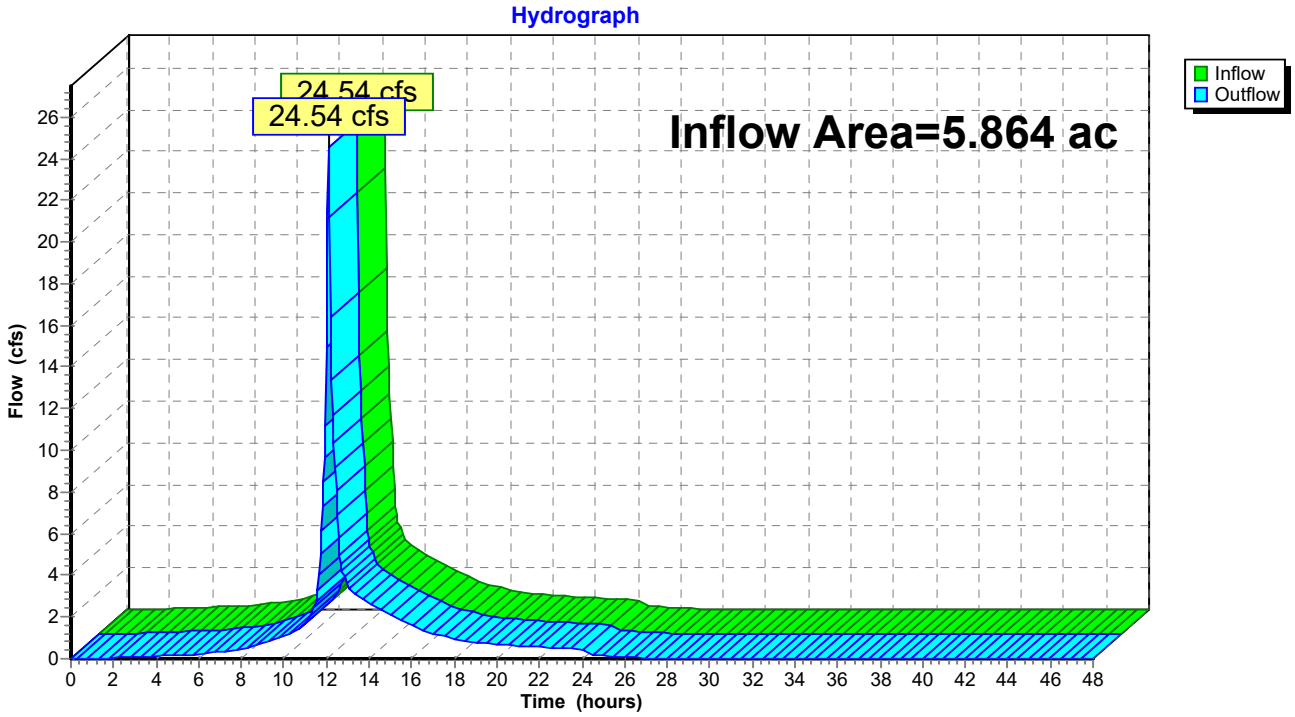


Summary for Reach DP-6: Wetland A - Design Point 6

Inflow Area = 5.864 ac, 71.84% Impervious, Inflow Depth = 5.41" for 100-Year event
Inflow = 24.54 cfs @ 12.10 hrs, Volume= 2.644 af
Outflow = 24.54 cfs @ 12.10 hrs, Volume= 2.644 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Reach DP-6: Wetland A - Design Point 6



Summary for Pond 3P: Conveyance Swale

Inflow Area = 0.471 ac, 52.65% Impervious, Inflow Depth = 6.91" for 100-Year event
Inflow = 3.56 cfs @ 12.09 hrs, Volume= 0.271 af
Outflow = 3.31 cfs @ 12.12 hrs, Volume= 0.271 af, Atten= 7%, Lag= 1.7 min
Primary = 3.31 cfs @ 12.12 hrs, Volume= 0.271 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs / 2
Peak Elev= 125.86' @ 12.12 hrs Surf.Area= 790 sf Storage= 527 cf

Plug-Flow detention time= 6.9 min calculated for 0.271 af (100% of inflow)
Center-of-Mass det. time= 7.0 min (792.4 - 785.4)

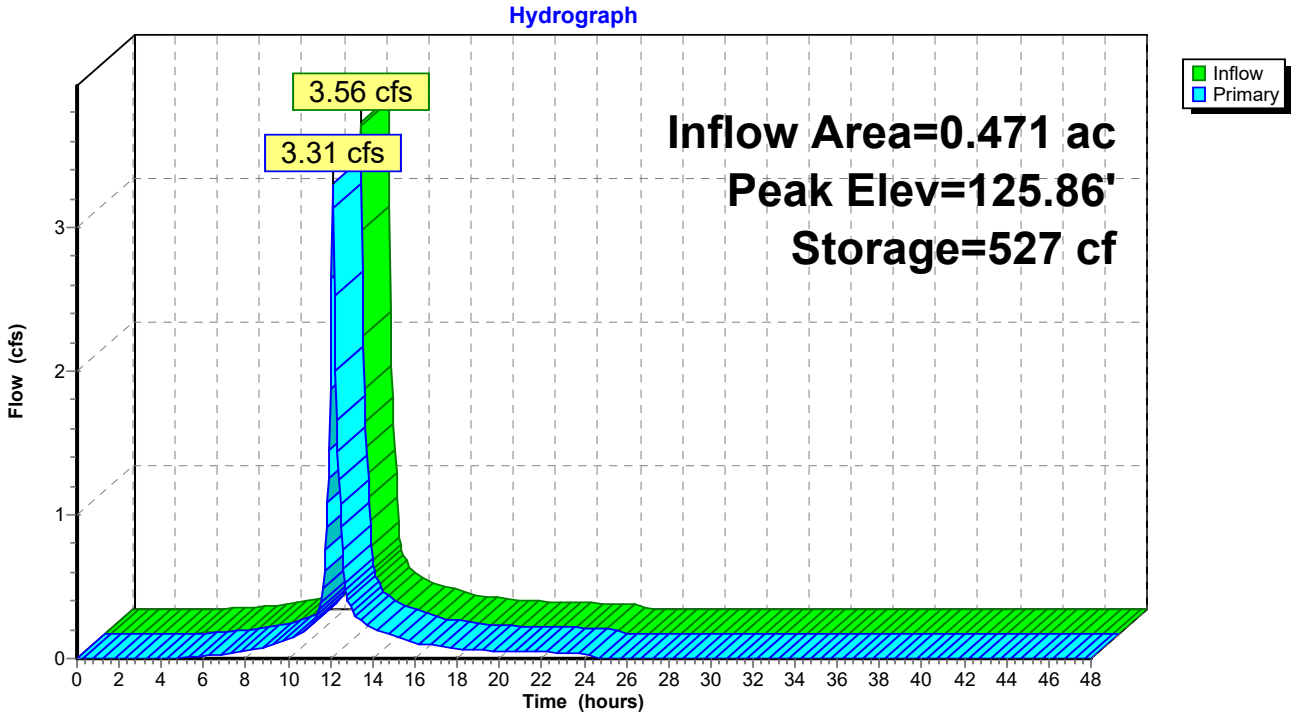
Volume	Invert	Avail.Storage	Storage Description
#1	125.00'	1,147 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
125.00	436	0	0
126.00	848	642	642
126.50	1,170	505	1,147

Device	Routing	Invert	Outlet Devices
#1	Primary	124.18'	**12.0" Round Culvert** L= 10.0' Ke= 0.500 Inlet / Outlet Invert= 124.18' / 124.13' S= 0.0050 '/' Cc= 0.900 n= 0.011 Concrete pipe, straight & clean, Flow Area= 0.79 sf
#2	Device 1	125.00'	**18.0" Vert. Orifice/Grate** C= 0.600

Primary OutFlow Max=3.23 cfs @ 12.12 hrs HW=125.85' (Free Discharge)
↑**1=Culvert** (Passes 3.23 cfs of 4.06 cfs potential flow)
↑**2=Orifice/Grate** (Orifice Controls 3.23 cfs @ 3.13 fps)

Pond 3P: Conveyance Swale



Summary for Pond 8P: UG-1 3 ft Retain IT

Inflow Area = 1.954 ac, 81.04% Impervious, Inflow Depth = 7.76" for 100-Year event
Inflow = 15.26 cfs @ 12.09 hrs, Volume= 1.264 af
Outflow = 1.04 cfs @ 13.54 hrs, Volume= 0.540 af, Atten= 93%, Lag= 86.9 min
Primary = 1.04 cfs @ 13.54 hrs, Volume= 0.540 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs / 2
Peak Elev= 124.88' @ 13.54 hrs Surf.Area= 15,300 sf Storage= 37,892 cf

Plug-Flow detention time= 403.7 min calculated for 0.540 af (43% of inflow)
Center-of-Mass det. time= 262.3 min (1,023.0 - 760.6)

Volume	Invert	Avail.Storage	Storage Description
#1A	121.75'	3,817 cf	**90.00'W x 170.00'L x 4.17'H Field A** 63,750 cf Overall - 54,208 cf Embedded = 9,542 cf x 40.0% Voids
#2A	122.25'	39,109 cf	**retain_it retain_it 3.0'** x 231 Inside #1 Inside= 84.0"W x 36.0"H => 21.33 sf x 8.00'L = 170.6 cf Outside= 96.0"W x 44.0"H => 29.33 sf x 8.00'L = 234.7 cf 11 Rows adjusted for 302.1 cf perimeter wall
		42,926 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	124.25'	**12.0" Round HDPE_Round 12"** L= 12.5' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 124.25' / 124.18' S= 0.0056 '/' Cc= 0.900 n= 0.011 Concrete pipe, straight & clean, Flow Area= 0.79 sf
#2	Device 1	124.40'	**4.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)

Primary OutFlow Max=1.04 cfs @ 13.54 hrs HW=124.88' (Free Discharge)
↑—**1=HDPE_Round 12"** (Barrel Controls 1.04 cfs @ 2.86 fps)
↑—**2=Sharp-Crested Rectangular Weir** (Passes 1.04 cfs of 4.25 cfs potential flow)

Pond 8P: UG-1 3 ft Retain IT - Chamber Wizard Field A

Chamber Model = retain_it retain_it 3.0' (retain-it®)
Inside= 84.0"W x 36.0"H => 21.33 sf x 8.00'L = 170.6 cf
Outside= 96.0"W x 44.0"H => 29.33 sf x 8.00'L = 234.7 cf
11 Rows adjusted for 302.1 cf perimeter wall

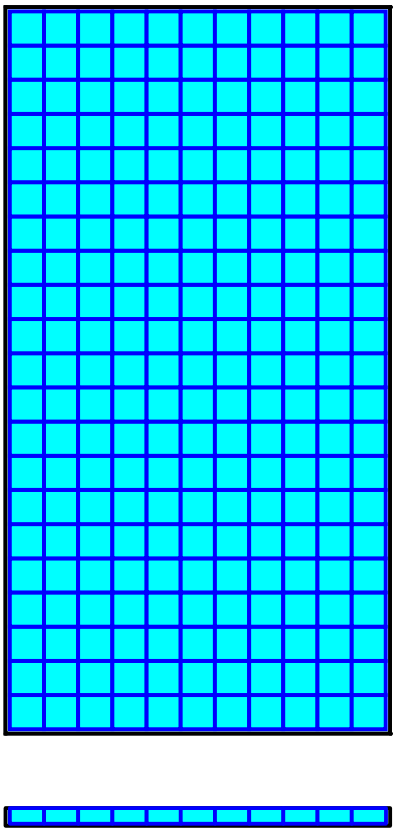
21 Chambers/Row x 8.00' Long = 168.00' Row Length +12.0" End Stone x 2 = 170.00' Base Length
11 Rows x 96.0" Wide + 12.0" Side Stone x 2 = 90.00' Base Width
6.0" Base + 44.0" Chamber Height = 4.17' Field Height

4.7 cf Sidewall x 21 x 2 + 4.7 cf Endwall x 11 x 2 = 302.1 cf Perimeter Wall
231 Chambers x 170.6 cf - 302.1 cf Perimeter wall = 39,108.9 cf Chamber Storage
231 Chambers x 234.7 cf = 54,208.0 cf Displacement

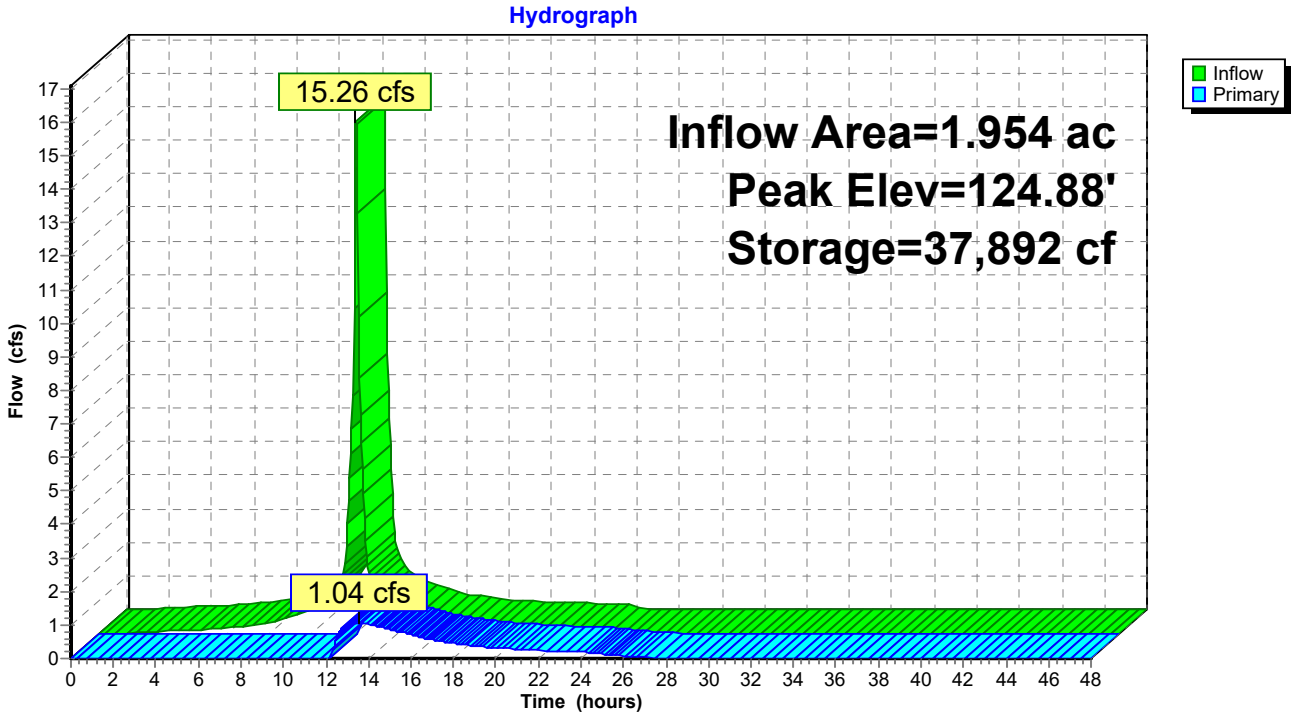
63,750.0 cf Field - 54,208.0 cf Chambers = 9,542.0 cf Stone x 40.0% Voids = 3,816.8 cf Stone Storage

Chamber Storage + Stone Storage = 42,925.7 cf = 0.985 af
Overall Storage Efficiency = 67.3%
Overall System Size = 170.00' x 90.00' x 4.17'

231 Chambers
2,361.1 cy Field
353.4 cy Stone



Pond 8P: UG-1 3 ft Retain IT



Summary for Pond 11P: Permeable Pavement

Inflow Area = 0.537 ac, 94.68% Impervious, Inflow Depth = 8.24" for 100-Year event
Inflow = 4.42 cfs @ 12.09 hrs, Volume= 0.369 af
Outflow = 0.47 cfs @ 12.90 hrs, Volume= 0.369 af, Atten= 89%, Lag= 48.7 min
Discarded = 0.14 cfs @ 8.75 hrs, Volume= 0.301 af
Primary = 0.33 cfs @ 12.90 hrs, Volume= 0.068 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Peak Elev= 123.75' @ 12.90 hrs Surf.Area= 22,160 sf Storage= 7,512 cf

Plug-Flow detention time= 327.4 min calculated for 0.369 af (100% of inflow)
Center-of-Mass det. time= 327.3 min (1,073.3 - 746.0)

Volume	Invert	Avail.Storage	Storage Description
#1	122.75'	7,512 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

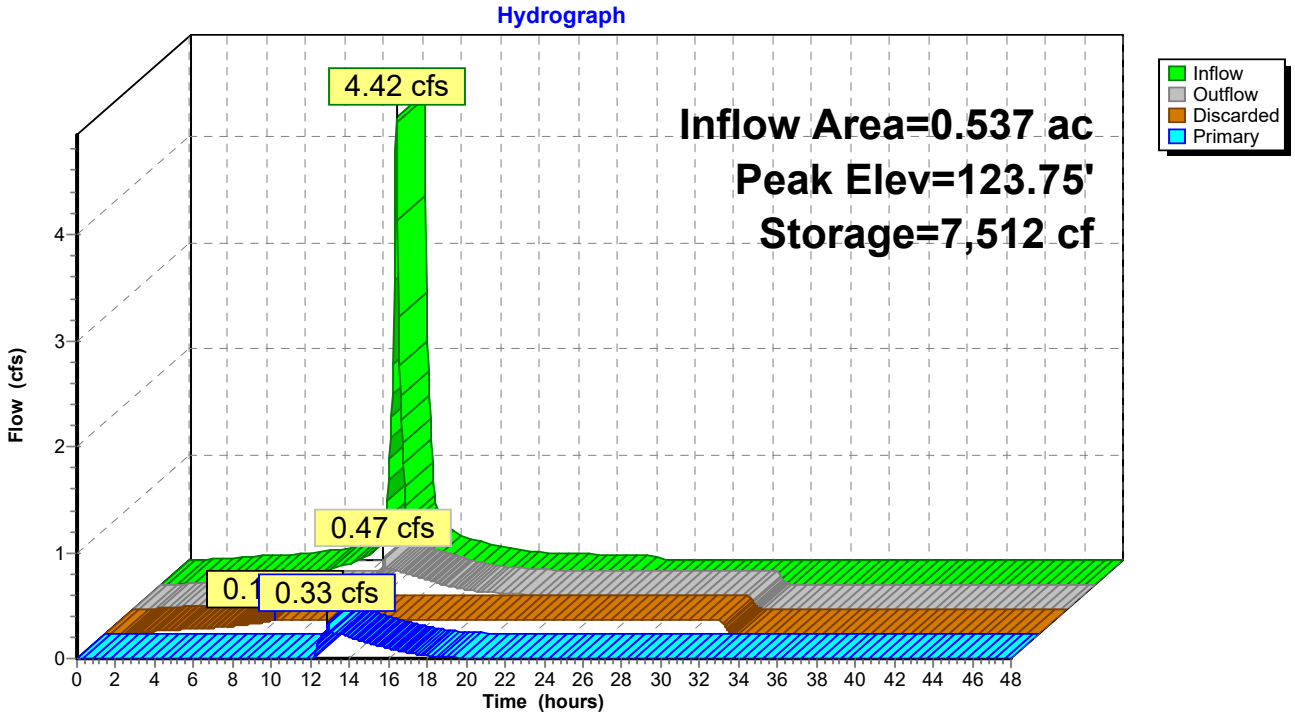
Elevation (feet)	Surf.Area (sq-ft)	Voids (%)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
122.75	22,160	0.0	0	0
123.41	22,160	40.0	5,850	5,850
123.66	22,160	30.0	1,662	7,512

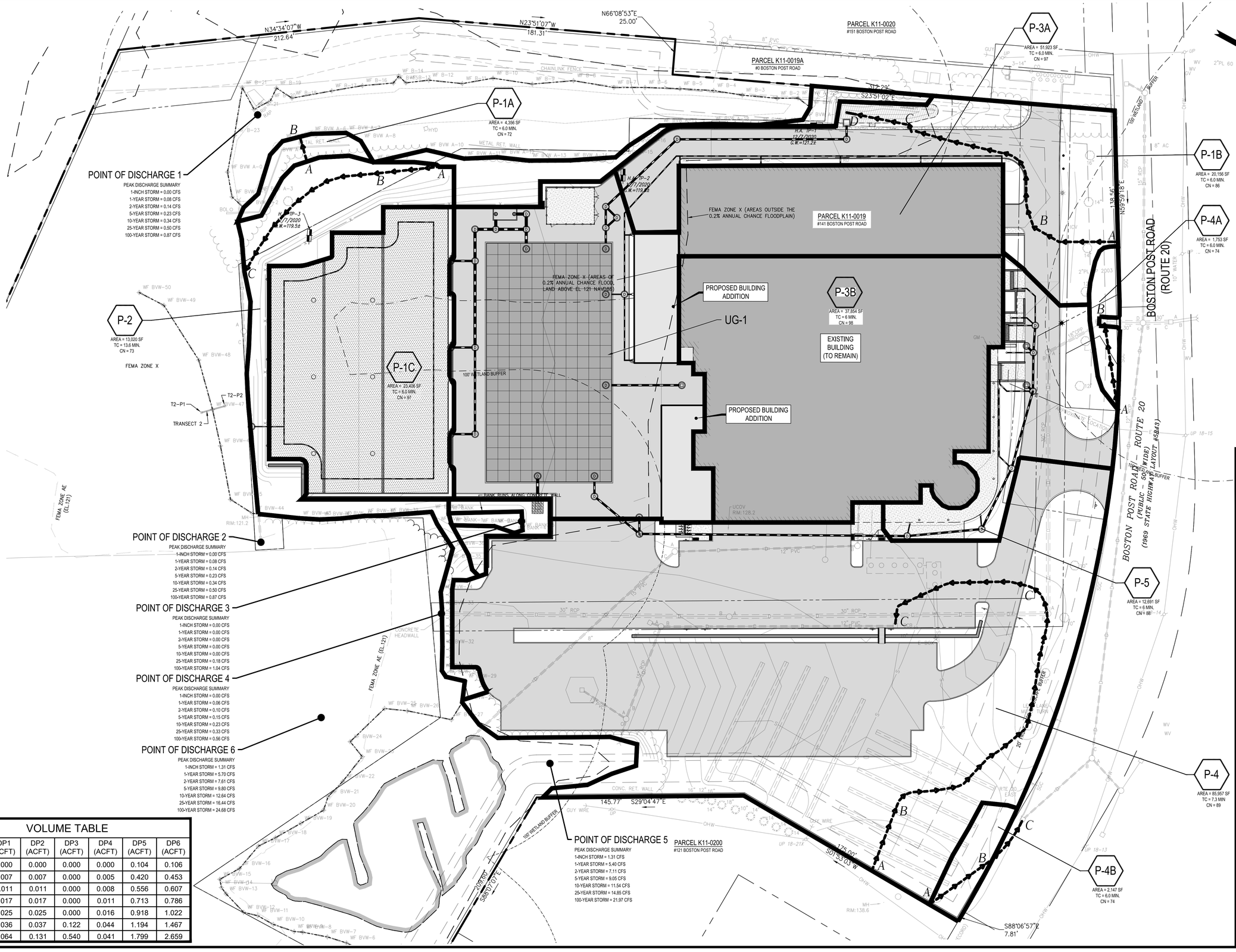
Device	Routing	Invert	Outlet Devices
#1	Discarded	122.75'	**0.270 in/hr Exfiltration over Surface area**
#2	Primary	123.30'	**6.0" Round Culvert** L= 10.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 123.30' / 119.00' S= 0.4300 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 0.20 sf

Discarded OutFlow Max=0.14 cfs @ 8.75 hrs HW=122.76' (Free Discharge)
↑**1=Exfiltration** (Exfiltration Controls 0.14 cfs)

Primary OutFlow Max=0.33 cfs @ 12.90 hrs HW=123.75' (Free Discharge)
↑**2=Culvert** (Inlet Controls 0.33 cfs @ 1.79 fps)

Pond 11P: Permeable Pavement





VOLUME TABLE						
	DP1 (ACFT)	DP2 (ACFT)	DP3 (ACFT)	DP4 (ACFT)	DP5 (ACFT)	DP6 (ACFT)
1 INCH	0.000	0.000	0.000	0.000	0.104	0.106
1 YEAR	0.007	0.007	0.000	0.005	0.420	0.453
2 YEAR	0.011	0.011	0.000	0.008	0.556	0.607
5 YEAR	0.017	0.017	0.000	0.011	0.713	0.786
10 YEAR	0.025	0.025	0.000	0.016	0.918	1.022
25 YEAR	0.036	0.037	0.122	0.044	1.194	1.467
100 YEAR	0.064	0.131	0.540	0.041	1.799	2.659

Date	Description	No.
	Revisions	
02/14/22	P.B. AND CON.–COM. RESUBMITTAL	3.
01/31/22	ZBA RESUBMITTAL	2.
11/15/21	PLANNING BOARD SUBMITTAL	1.

COMMONWEALTH OF MASSACHUSETTS
GABRIEL R. CROCKER
CIVIL
No. 47917
REGISTERED PROFESSIONAL ENGINEER

2-14-2022

GABRIEL R. CROCKER
PROFESSIONAL ENGINEER, MA REGISTRATION #47917

Crocker Design Group
2 SHARP STREET, UNIT A
HINGHAM, MA 02043
P: 781-919-0808

Project
MERCEDES OF SUDBURY
141 BOSTON POST ROAD, SUDBURY, MA

Prepared for
HERB CHAMBERS 43 BRAINTREE STREET, LLC
#259 McGRATH HIGHWAY - ROUTE 28 SOMERVILLE, MA 02143

Drawing Title
PROPOSED CONDITIONS WATERSHED PLAN

Project No.	100-107
Date	11/10/2021
Scale	1" = 30'
Drawn By	DJN / JPM
Approved By	GC

Drawing No.
PH-1

C:\2020\Crocker Design Group, LLC\Gabriel Crocker - Projects\100-107 Sudbury - Mercedes\Land\Plot Sheets\Site Plan Application_ DJ PROP WATERSHED MAP Feb 14, 2022 12:19

SECTION 4 – STORMWATER MANAGEMENT CALCS

4.1 STANDARD 3: RECHARGE CALCULATIONS

The Required Recharge Volume is computed using the equation provided in the 2008 Massachusetts Stormwater Handbook. The volume is computed as an equivalent depth of rainfall over the proposed impervious areas in accordance with a Target Depth Factor based on the soil classifications. The Calculations is as follows:

Rv = (F) X (Impervious Area)
(Equation 1) Volume 3, Ch 1, page 15

- Rv = Required Recharge Volume, expressed in cubic feet, cubic yards, or acre-feet
- F = Target Depth Factor associated with each Hydrologic Soil Group (HSG)
- Impervious Area = new pavement and new rooftop area
- The Target Depth Factor "F" per Table 2.3.2, Volume 3, Chapter 1 for each soil classification is as follows:
    - A soils = 0.60 inches
    - B soils = 0.35 inches
    - C soils = 0.25 inches
    - D soils = 0.10 inches

The existing impervious area within limit of work is 159,734 SF (pavement, buildings, compacted gravel parking) and the total proposed impervious area within limit of work is 183,518 SF (pavement, buildings and including permeable pavement, which per the MA Stormwater Standards and Sudbury Stormwater Bylaw must be considered impervious for this calculation). Therefore, there is an increase in impervious area of 23,783 SF.

There are two (2) infiltration BMP's for the site: Permeable pavement and subsurface infiltration chambers. Based on the test pits performed, groundwater was assumed to be at elevation 119.5± in both locations of the infiltration BMP's. Both infiltration BMP's have the minimum 2-feet of separation between the bottom of the recharge structure and seasonal high groundwater. The permeable pavement has approximately 4 feet of separation, and therefore we were able to account for exfiltration in the HydroCAD model, and we could consider this BMP for recharge. For the underground infiltration structures, we did not take credit for exfiltration in the HydroCAD model or for Standard 3: Recharge.

Based on the above formula, the minimum required recharge volume for the site is as follows:

Per Section 1.3, the onsite soils are considered "C" soils:

- F (C soils) = 0.25 inches
- Impervious Area (New Impervious) =23,783 SF

Rv = (F) X (Impervious Area)
Rv= (0.25 inches) x (1in/12 ft) x 23,783 SF = 493 CF

TOTAL RECHARGE VOLUME REQUIRED = 493 CF

Capture Area Adjustment:

Capture Area Adjustment = Surface Area of Inf. BMP/0.65
Capture Area Adjustment = 22,160 SF/0.65
Capture Area Adjustment = 34,092 SF

Adjusted Recharge Volume = Capture Area Adjustment * Depth of BMP * Voids
Adjusted Recharge Volume = 34,092 SF * (8in/12in)FT * 0.40
Adjusted Recharge Volume = 9,091 CF

Recharge Volume BMP Table

Infiltration BMP	Infiltration Rate (in/hr) k	Storage (Recharge) Volume (CF) Rv
Permeable Pavement	0.27	9,091
Totals		**9,091**
k = saturated hydraulic conductivity (in/hr) *Rv = storage volume (CF)* *Volume 3, Chapter 1 of the MA Stormwater Handbook*		

TOTAL RECHARGE VOLUME PROVIDED = 9,091 CF

Conclusion:
The porous pavement can be credited for the 22,160 SF of increased impervious area. This amounts to the majority of the increased proposed site impervious. Due to groundwater depth restricting infiltration BMPs elsewhere on the site, we feel that this design recharges to the maximum extent practicable.

4.2 DRAWDOWN TIME

Below are the drawdown time calculations for the infiltration systems proposed on the site. The calculation uses estimated hydraulic conductivity values "*K*" in accordance with the Rawls Rates table. The formula below utilized the recommended formula per the MA Stormwater Handbook as follows:

Drawdown Time = Rv / [(K*Bottom Area)*(1FT/12IN)]

- Rv = Storage Volume (CF)
- K = Saturated Hydraulic Conductivity per Rawls Rate Table
- Bottom Area = Area of Bottom of Proposed Recharge Structure

Below is a summary table of the drawdown calculations:

BASIN DRAWDOWN CALCULATIONS				
Infiltration BMP	**Infiltration Rate (IN/HR) k**	**Storage (Recharge) Volume Provided (CF) Rv**	**Bottom Area (SF)**	**Draw Down Time (HR)**
Permeable Pavement	0.27	9,091	22,160	18.31
Totals		**9,091**		
k = saturated hydraulic conductivity (IN/HR) *Rv = storage volume (CF)* *Bottom Area (SF)* *Volume 3, Chapter 1 of the MA Stormwater Handbook*				

Conclusion:
The calculations show that the infiltration BMP draws down in less than 72 hours, as required.

4.3 STANDARD 4: WATER QUALITY

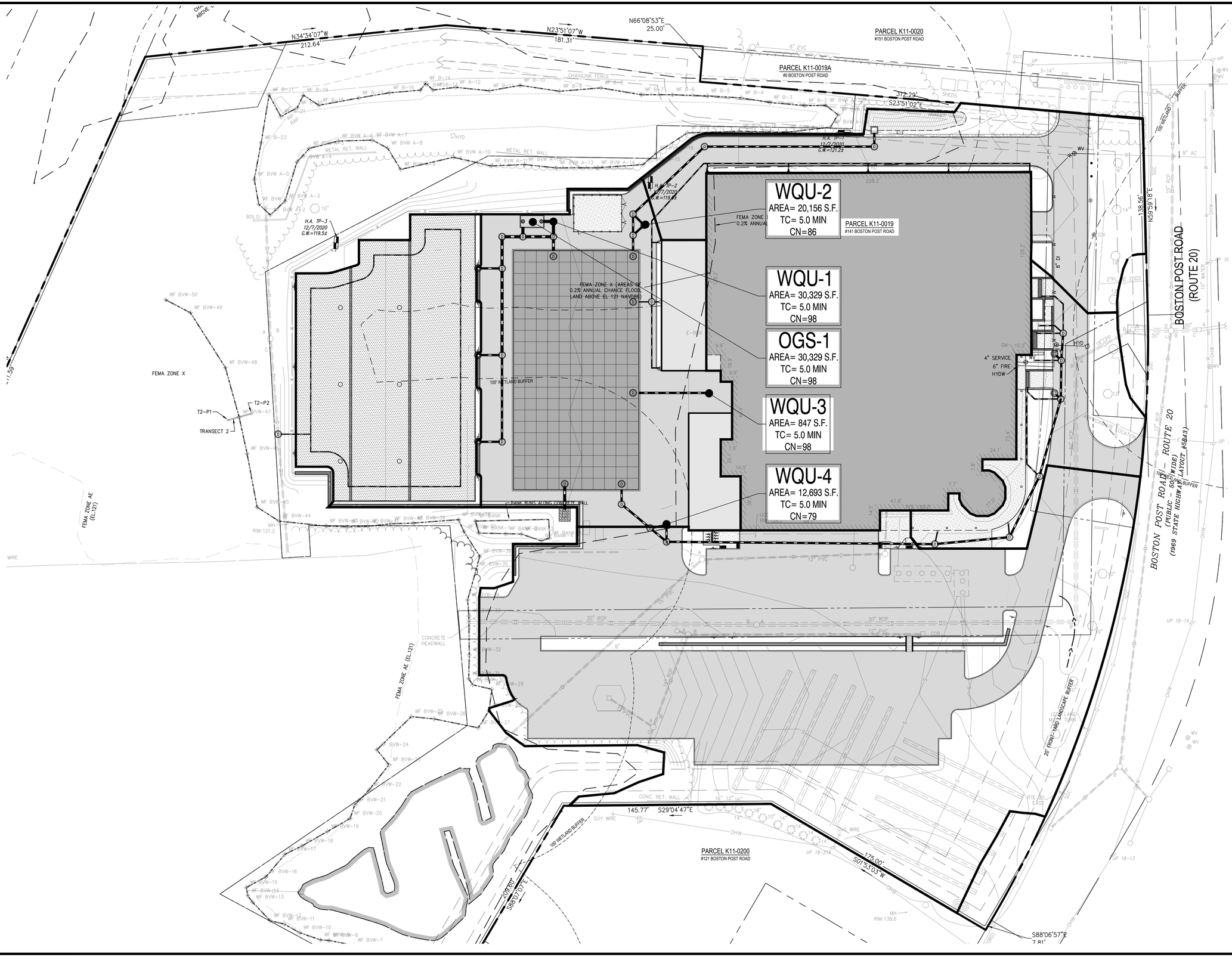
Although the site is not considered a critical area, BMP's have been designed to treat 1" of water quality volume (WQV). A table has been provided below that provides the sizing of the proprietary water quality units selected. All of the proprietary BMP's have been sized to treat 1" WQV of the contributing tributary area.

Water Quality Unit Sizing Using Equivalent Flow from 1" Rainfall Depth											REQUIRED VOLUME FOR OGS IN FIRST CHAMBER	PROPOSED OIL/GRIT UNIT SIZE
Basin / WQ structure	Tributary Area (acres)	Tributary Area (sq miles)	Pervious (sf)	Impervious %	CN Value (Estimated)	WQV (In)	Tc (min)	qu (csm/in)	WQF = qu A Q (cfs)	Unit	400 cf / AC of imperv (GAL)	(GAL)
OSG-1	0.70	0.0011	308	99%	98	1.00	5	795	0.86		2062.2	3,000
WQU #1	0.70	0.0011	308	99%	98	1.00	5	795	0.86	SC-6		
WQU #2	0.29	0.0005	5,118	60%	83	1.00	5	795	0.22	SC-4		
WQU #3	0.02	0.0000	-	100%	98	1.00	5	795	0.02	SC-4		
WQU #4	0.47	0.0007	9,668	53%	81	1.00	5	795	0.31	SC-4		
*Based on MASS DEP: The pool storage in the first chamber of the Oil/Grit has to accommodate 400 cubic feet per acre of impervious surface. First chamber is considered, at minimum, half of storage volume of the entire structure formula used is : IMPERVIOUS (AC) X 400 (CF) X 7.48 to get the minimum storage volume in the FIRST CHAMBER of Oil/Grit structure												

There is an existing channel that receives overland flow from the site. In the proposed condition, the applicant is planning to have an overflow from the retain-it system into the channel. The outlet is proposed to be a 12-inch HDPE pipe protruding from the retaining wall and discharging to a properly sized riprap plunge pool. Before discharging from the pipe, stormwater from the impervious areas will be collected by deep sump catch basins, and then entering an offline treatment system that includes various combinations of an oil/grit separator, a diversion manhole, a proprietary treatment unit and an underground infiltration chamber system. In the HydroCAD model, infiltration is not modeled for the Retain-it system due to the separation from seasonal high groundwater, however, the system will not have an impermeable liner and it will infiltrate to the maximum extent possible. All inlets to the Retain-It system meet the required 44% TSS removal pretreatment.

The diversion manholes have a weir elevation that will direct the water quality flow into the water quality unit. The larger flows will pass over the weir. The elevation of the weir is calculated using the Manning's equation. Please see the following spread sheet for the calculation. A flow of 0.70 CFS in an 12" HDPE pipe with a slope of 0.5% will develop a water depth in the pipe of approximate 3.8 inches. The weir elevation is proposed to be 3.8 inches higher than the invert in to ensure that the 1" WQV is treated in the Oil/Grit Separator and the proprietary treatment unit. The water quality calculated flow was used to size the unit. The SciClone, model SC-4, by BioClean is the proposed proprietary treatment device.

The SciClone Hydrodynamic Separator by BioClean Environmental Services, Inc. applied for and was granted a 50% TSS removal rate which has been verified by the New Jersey Corporation for Advanced Technology (NJCAT) and certified by the New Jersey Department of Environmental Protection (NJDEP). In fact, the testing report, which is enclosed in this section, provides a removal efficiency of 65%. NJDEP only certifies for 50% and 80%; however, the testing completed by NJCAT resulted in a removal efficiency of 65%. Please refer to page 22 of the NJCAT Certification, enclosed in this section of the report. Based on the results of the NJCAT testing, 65% was used in the TSS Treatment Calculations enclosed in Section 4.5. The units were sized per NJDEP design criteria, which is enclosed.



Date	Description	No.
02/14/22	P.B. AND CON.–COM. RESUBMITTAL	3.
01/31/22	ZBA RESUBMITTAL	2.
11/15/21	PLANNING BOARD SUBMITTAL	1.

Revisions

COMMONWEALTH OF MASSACHUSETTS
GABRIEL R. CROCKER
CIVIL
No. 47917
REGISTERED PROFESSIONAL ENGINEER

2-14-2022

GABRIEL R. CROCKER
PROFESSIONAL ENGINEER, MA REGISTRATION #47917

Crocker Design Group
2 SHARP STREET, UNIT A
HINGHAM, MA 02043
P: 781-919-0808

Project

MERCEDES OF SUDBURY

141 BOSTON POST ROAD,
SUDBURY, MA

Prepared for

HERB CHAMBERS 43 BRAINTREE STREET, LLC

#259 McGRATH HIGHWAY - ROUTE 28
SOMERVILLE, MA 02143

Drawing Title

PROPOSED WATER QUALITY CATCHMENT MAP

Project No.	100-107
Date	11/10/2021
Scale	1" = 30'
Drawn By	DJN / JPM
Approved By	GC

Drawing No.

PH-3

C:\CDG\Crocker Design Group, LLC\Gabriel Crocker - Projects\100-107 Sudbury - Mercedes\dwg\Plot Sheets\Site Plan Application_ 01 PROP WATERSHED MAP.dwg, CDG WDU, Feb 14, 2022 12:20

MANNING'S EQUATION FOR PIPE FLOW - 18" PIPE MINIMUM SLOPE CALC FOR DVM OGS1

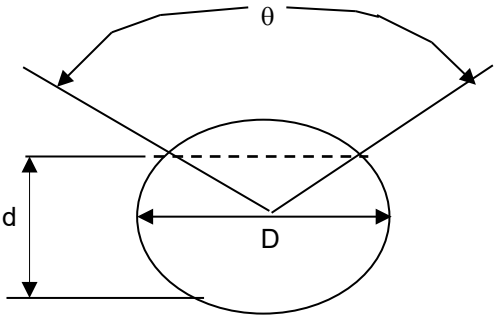
Project: HERB CHAMB. MERCEDES OF SL Location: 141 BOSTON POST RD- SUDBURY

By: MJL Date: 10/28/2021

Chk. By: GRC Date: 10/28/2021

mdo version 12.8.00

Clear Data Entry Cells



INPUT

D=	18	inches
d=	5.5	inches
n=	0.013	mannings coeff
θ=	134.2	degrees
S=	0.005	slope in/in

Mannings Formula

$Q=(1.486/n)AR_h^{2/3}S^{1/2}$

R=A/P

A=cross sectional area

P=wetted perimeter

S=slope of channel

n=Manning's roughness coefficient

$V=(1.49/n)R_h^{2/3}S^{1/2}$

Q=V x A

Solution to Mannings Equation

Area,ft^2	Wetted Perimeter, ft	Hydraulic Radius, ft	velocity ft/s	flow, cfs
0.46	1.76	0.26	3.30	1.51

Manning's n-values

PVC	0.01
PE (<9"dia)	0.015
PE (>12"dia)	0.02
PE(9-12"dia)	0.017
CMP	0.025
ADS N12	0.012
HCMP	0.023
Conc	0.013

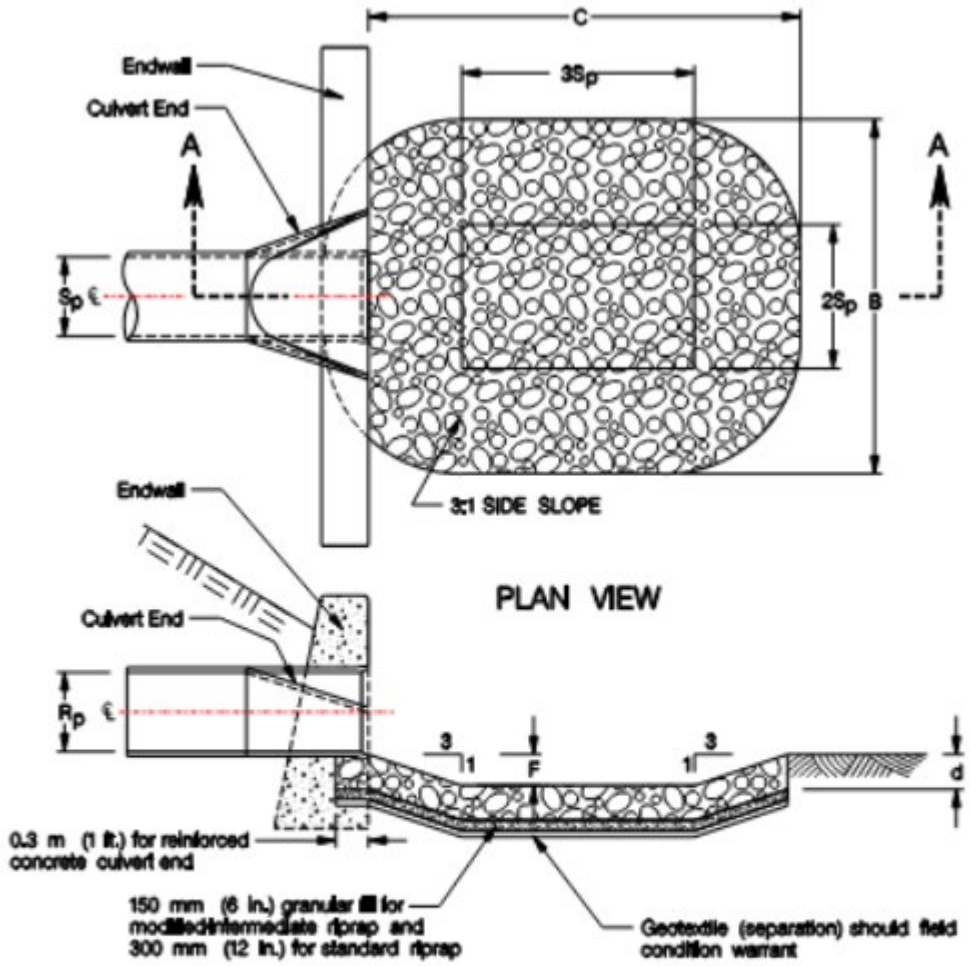
4.4 RIP RAP SPLASH PAD

Rip rap splash pads are designed to dissipate energy, prevent scour at the stormwater outlet, and minimize the potential for downstream erosion. A LEVEL SPREADER / PLUNGE POOLE was sized for each of the outlets of the drainage system. The calculations below are in accordance with the methodology of the "2002 Connecticut Guidelines for Soil Erosion and Sediment Control" produced by The Connecticut Council on Soil and Water Conservation.

Preformed Scour Hole Calculations										
	Q (25Y)	Do	TW	Depression	C	3Sp	B	2Sp	d50	
	(cfs)	(ft.)	(ft.)	(ft.)	(ft.)	(ft.)	(ft.)	(ft.)	(ft.)	(in.)
12" HDPE Pipe	0.18	1.0	0.30	0.50	6.00	3.00	5.00	2.00	0.00	0.05

Conclusion:

As identified above, the discharge points have been designed to accommodate and exceed the required minimum rip-rap stone sizing



PLAN VIEW

SECTION A–A

LEGEND

S_p = { Max. inside pipe span (non-circular sections) / Inside pipe diameter (circular sections) }

R_p = { Max. inside pipe rise (non-circular sections) / Inside pipe diameter (circular sections) }

d = { 300 mm (12 in.) Modified Riprap / 450 mm (18 in.) Intermediate Riprap / 900 mm (36 in.) Standard Riprap }

Type 1 $F = 0.5\ R_p$

Type 2 $F = R_p$

$C = 3S_p + 6F$

$B = 2S_p + 6F$

4.5 TSS REMOVAL

The project has been designed to comply with the required 80% TSS (minimum) removal per the Massachusetts Stormwater Regulations. Various combinations of stormwater BMPs including deep sump hooded catch basins, oil/grit separators, proprietary water quality units and subsurface infiltration chambers are utilized.

Please refer to the attached TSS calculation sheets that follow:

INSTRUCTIONS:

Non-automated: Mar. 4, 2008

1. Sheet is nonautomated. Print sheet and complete using hand calculations. Column A and B: See MassDEP Structural BMP Table
2. The calculations must be completed using the Column Headings specified in Chart and Not the Excel Column Headings
3. To complete Chart Column D, multiple Column B value within Row x Column C value within Row
4. To complete Chart Column E value, subtract Column D value within Row from Column C within Row
5. Total TSS Removal = Sum All Values in Column D

Location: **UNDERGROUND INFILTRATION BASIN UG-1 (via CB, OGS, SciClone)**

TSS Removal Calculation Worksheet

A BMP[1]	B TSS Removal Rate[1]	C Starting TSS Load*	D Amount Removed (B*C)	E Remaining Load (C-D)
Deep Sump and Hooded Catch Basin	**0.25**	**1.00**	**0.25**	**0.75**
OGS-1	**0.25**	**0.75**	**0.19**	**0.56**
SciClone	**0.65**	**0.56**	**0.37**	**0.20**
INFILTRATION BASIN UG-1 (Retain-It System)	**0.80**	**0.20**	**0.16**	**0.04**
		0.00	**0.00**	**0.04**

Total TSS Removal = **96%**

Separate Form Needs to be Completed for Each Outlet or BMP Train

Project: **141 BP Rd, Sudbury**

Prepared By: **MJL**

Date: **2/14/2021**

*Equals remaining load from previous BMP (E) which enters the BMP

INSTRUCTIONS:

Non-automated: Mar. 4, 2008

1. Sheet is nonautomated. Print sheet and complete using hand calculations. Column A and B: See MassDEP Structural BMP Table
2. The calculations must be completed using the Column Headings specified in Chart and Not the Excel Column Headings
3. To complete Chart Column D, multiple Column B value within Row x Column C value within Row
4. To complete Chart Column E value, subtract Column D value within Row from Column C within Row
5. Total TSS Removal = Sum All Values in Column D

Location: **UNDERGROUND INFILTRATION BASIN UG-1 (via CB, SciClone)**

TSS Removal Calculation Worksheet

A BMP[1]	B TSS Removal Rate[1]	C Starting TSS Load*	D Amount Removed (B*C)	E Remaining Load (C-D)
Deep Sump and Hooded Catch Basin	**0.25**	**1.00**	**0.25**	**0.75**
SciClone	**0.65**	**0.75**	**0.49**	**0.26**
INFILTRATION BASIN UG-1 (Retain-It System)	**0.80**	**0.26**	**0.21**	**0.05**
	0.00	**0.00**	**0.00**	**0.00**
	0.00	**0.00**	**0.00**	**0.00**

Total TSS Removal = **95%**

Separate Form Needs to be Completed for Each Outlet or BMP Train

Project: **141 BP Rd, Sudbury**

Prepared By: **MJL**

Date: **2/14/2022**

*Equals remaining load from previous BMP (E) which enters the BMP

INSTRUCTIONS:

Non-automated: Mar. 4, 2008

1. Sheet is nonautomated. Print sheet and complete using hand calculations. Column A and B: See MassDEP Structural BMP Table
2. The calculations must be completed using the Column Headings specified in Chart and Not the Excel Column Headings
3. To complete Chart Column D, multiple Column B value within Row x Column C value within Row
4. To complete Chart Column E value, subtract Column D value within Row from Column C within Row
5. Total TSS Removal = Sum All Values in Column D

Location: **Permeable Pavement**

TSS Removal Calculation Worksheet

A BMP[1]	B TSS Removal Rate[1]	C Starting TSS Load*	D Amount Removed (B*C)	E Remaining Load (C-D)
Permeable Pavement	**0.80**	**1.00**	**0.80**	**0.20**
	0.00	**0.00**	**0.00**	**0.00**
	0.00	**0.00**	**0.00**	**0.00**
	0.00	**0.00**	**0.00**	**0.00**
	0.00	**0.00**	**0.00**	**0.00**

Total TSS Removal = **80%**

Separate Form Needs to be Completed for Each Outlet or BMP Train

Project: **141 BP, Sudbury**

Prepared By: **MJL**

Date: **10/19/2021**

*Equals remaining load from previous BMP (E) which enters the BMP

KIM GUADAGNO

CHRIS CHRISTIE
Governor

Lt. Governor

State of New Jersey

DEPARTMENT OF ENVIRONMENTAL PROTECTION
Bureau of Nonpoint Pollution Control
Division of Water Quality
401-02B
Post Office Box 420
Trenton, New Jersey 08625-0420
609-633-7021 Fax: 609-777-0432
http://www.state.nj.us/dep/dwq/bnpc_home.htm

BOB MARTIN
Commissioner

December 21, 2017

Zachariha J. Kent
Director of Research & Development
BioClean Environmental Services, Inc.
P O Box 869
Oceanside, CA 92049

Re: MTD Lab Certification
SciClone™ Hydrodynamic Separator by BioClean Environmental Services, Inc.
On-line Installation

TSS Removal Rate 50%

Dear Mr. Kent:

The Stormwater Management rules under N.J.A.C. 7:8-5.5(b) and 5.7 (c) allow the use of manufactured treatment devices (MTDs) for compliance with the design and performance standards at N.J.A.C. 7:8-5 if the pollutant removal rates have been verified by the New Jersey Corporation for Advanced Technology (NJCAT) and have been certified by the New Jersey Department of Environmental Protection (NJDEP). BioClean Environmental Services, Inc. has requested an MTD Laboratory Certification for the SciClone™ Hydrodynamic Separator (SciClone).

The project falls under the "Procedure for Obtaining Verification of a Stormwater Manufactured Treatment Device from New Jersey Corporation for Advance Technology" dated January 25, 2013. The applicable protocol is the "New Jersey Laboratory Testing Protocol to Assess Total Suspended Solids Removal by a Hydrodynamic Sedimentation Manufactured Treatment Device" dated January 25, 2013.

NJCAT verification documents submitted to the NJDEP indicate that the requirements of the aforementioned protocol have been met or exceeded. The NJCAT letter also included a recommended certification TSS removal rate and the required maintenance plan. The NJCAT Verification Report with the Verification Appendix (dated December 2017) for this device is published online at http://www.njcat.org/verification-process/technology-verification-database.html.

New Jersey is an Equal Opportunity Employer
Printed on Recycled Paper and Recyclable

The NJDEP certifies the use of the SciClone by BioClean Environmental Services, Inc. at a TSS removal rate of 50% when designed, operated, and maintained in accordance with the information provided in the Verification Appendix and the following conditions:

1. The maximum treatment flow rate (MTFR) for the manufactured treatment device (MTD) is calculated using the New Jersey Water Quality Design Storm (1.25 inches in 2 hrs) in N.J.A.C. 7:8-5.5.

2. The SciClone shall be installed using the same configuration reviewed by NJCAT and shall be sized in accordance with the criteria specified in item 6 below.

3. This SciClone cannot be used in series with another MTD or a media filter (such as a sand filter) to achieve an enhanced removal rate for total suspended solids (TSS) removal under N.J.A.C. 7:8-5.5.

4. Additional design criteria for MTDs can be found in Chapter 9.6 of the New Jersey Stormwater Best Management Practices (NJ Stormwater BMP) Manual, which can be found online at www.njstormwater.org.

5. The maintenance plan for a site using this device shall incorporate, at a minimum, the maintenance requirements for the SciClone. A copy of the maintenance plan is attached to this certification. However, it is recommended to review the maintenance website at http://www.biocleanenvironmental.com/wp-content/uploads/2017/07/Operations-Maintenance-SciClone-1.pdf for any changes to the maintenance requirements.

6. Sizing Requirement:

   The example below demonstrates the sizing procedure for the SciClone:

   Example: A 0.25-acre impervious site is to be treated to 50% TSS removal using a SciClone. The impervious site runoff (Q) based on the New Jersey Water Quality Design Storm was determined to be 0.79 cfs.

   Maximum Treatment Flow Rate (MTFR) Evaluation:

   The site runoff (Q) was based on the following:
   time of concentration = 10 minutes
   i = 3.2 in/hr (page 5-8, Fig. 5-3 of the NJ Stormwater BMP Manual)
   c = 0.99 (runoff coefficient for impervious)
   Q = ciA = 0.99 x 3.2 x 0.25 = 0.79 cfs

   Given the site runoff is 0.79 cfs and based on Table 1 below, the SciClone Model SC-5 with a MTFR of 1.09 cfs could be used for this site to remove 50% of the TSS from the impervious area without exceeding the MTFR.

   The sizing table corresponding to the available system models is noted below. Additional specifications regarding each model can be found in the Verification Appendix under Tables A-1 and A-2.

Table 1 SciClone Sizing Information

SciClone Model	Maximum Treatment Flow Rate (cfs)	Treatment Area (ft^2)	Hydraulic Loading Rate (gpm/ft^2)	50% Maximum Sediment Storage (ft^3)
SC-3	0.39	7.1	25	5.3
SC-4	0.70	12.6	25	9.4
SC-5	1.09	19.6	25	14.7
SC-6	1.57	28.3	25	21.2
SC-7	2.14	38.5	25	28.9
SC-8	2.80	50.2	25	37.7
SC-9	3.54	63.6	25	47.7
SC-10	4.37	78.5	25	58.9
SC-11	5.29	95.0	25	71.2
SC-12	6.30	113.0	25	84.8
SC-13	7.39	132.7	25	99.5
SC-14	8.57	153.9	25	115.4

A detailed maintenance plan is mandatory for any project with a Stormwater BMP subject to the Stormwater Management Rules, N.J.A.C. 7:8. The plan must include all of the items identified in the Stormwater Management Rules, N.J.A.C. 7:8-5.8. Such items include, but are not limited to, the list of inspection and maintenance equipment and tools, specific corrective and preventative maintenance tasks, indication of problems in the system, and training of maintenance personnel. Additional information can be found in Chapter 8: Maintenance and Retrofit of Stormwater Management Measures.

If you have any questions regarding the above information, please contact Mr. Shashi Nayak of my office at (609) 633-7021.

Sincerely,

James J. Murphy, Chief
Bureau of Nonpoint Pollution Control

Attachment: Maintenance Plan

cc: Chron File
Richard Magee, NJCAT
Vince Mazzei, NJDEP - DLUR
Ravi Patraju, NJDEP - BES
Gabriel Mahon, NJDEP - BNPC
Shashi Nayak, NJDEP - BNPC

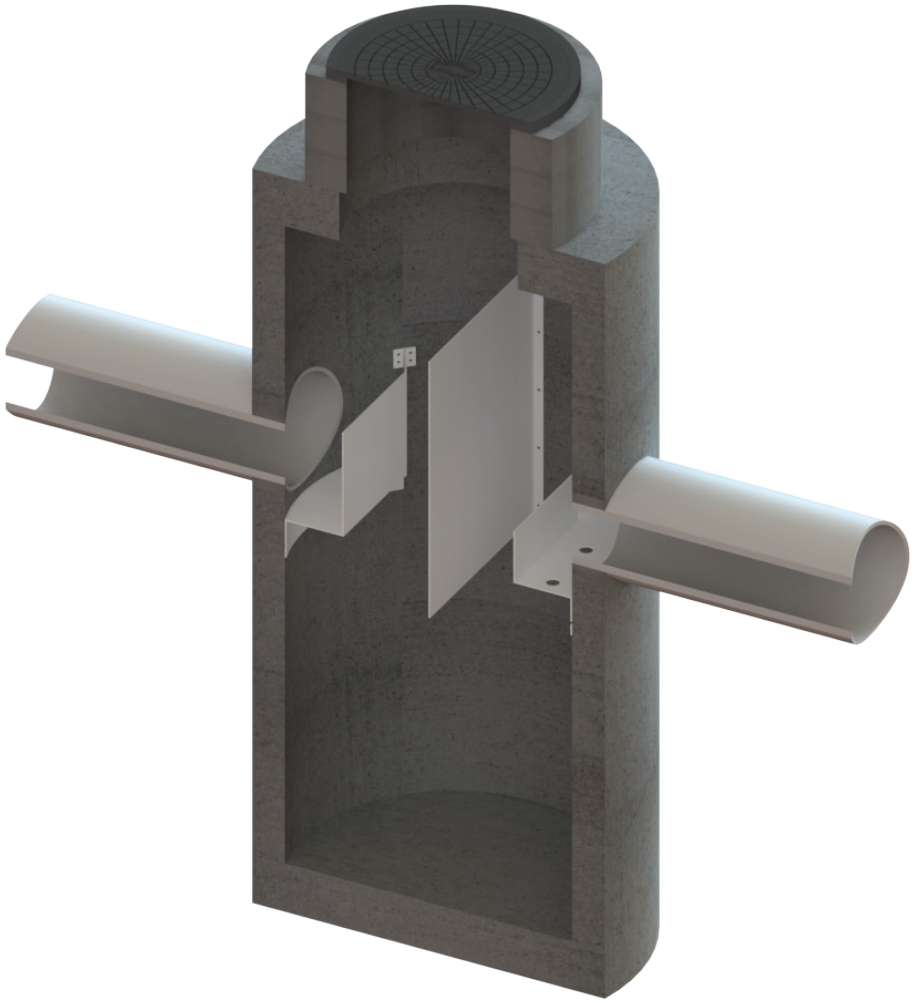
SciCLONE™

Hydrodynamic Separation

Bio Clean

A Forterra Company

OPERATION & MAINTENANCE



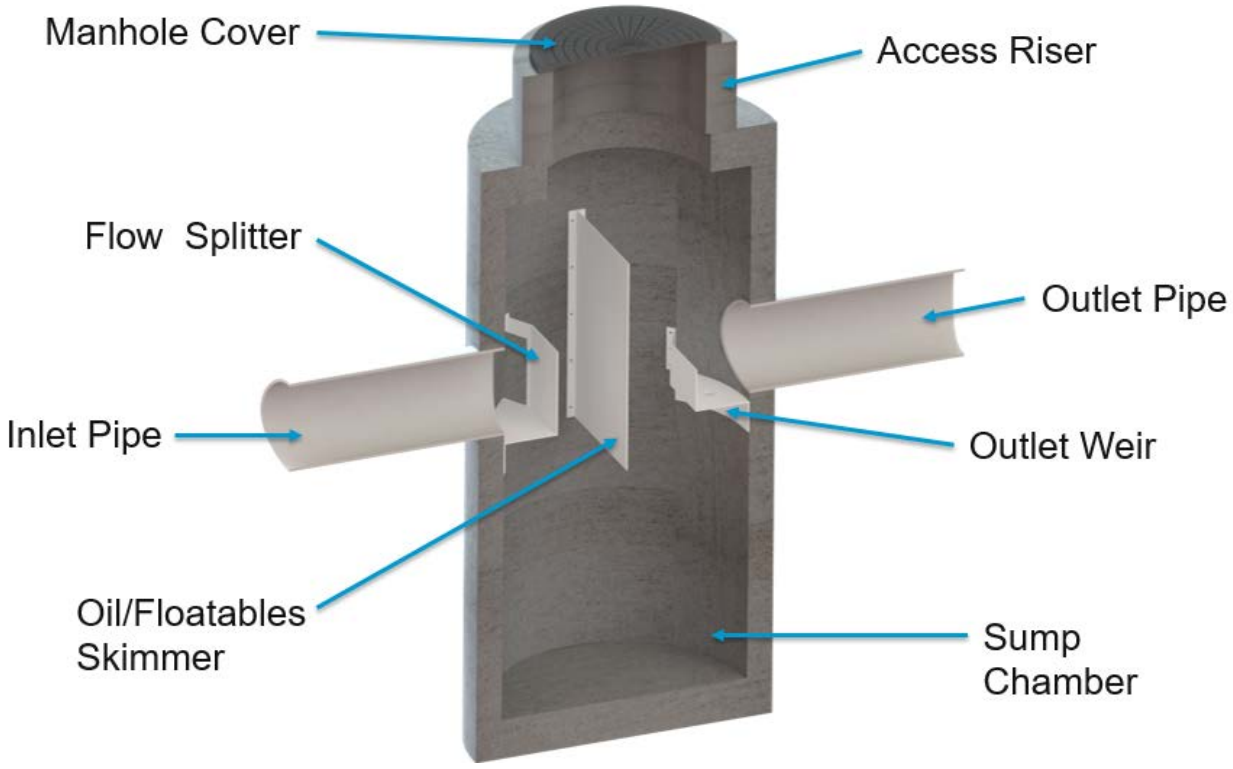
Bio Clean Environmental Services, Inc.
398 Via El Centro
Oceanside, CA 92058

www.BioCleanEnvironmental.com
p: 760.433.7640
f: 760.433.3176

OPERATION & MAINTENANCE

The SciCLONE™ Hydrodynamic Separator is designed to remove high levels of trash, debris, sediments and hydrocarbons. Its efficient design and construction maximize longevity and minimize maintenance requirements. The simple design of the system allows for unimpeded access for quick and easy maintenance. The SciCLONE™ is able to effectively capture and store sediment with no maintenance or loss of treatment capacity for a several years based on annual average loading in most regions.

Yet, as with all stormwater BMPs inspection and maintenance on the SciCLONE™ Hydrodynamic Separator is necessary. Stormwater regulations require that all BMPs be inspected and maintained to ensure they are operating as designed to allow for effective pollutant removal and provide protection to receiving water bodies. It is recommended that inspections be performed multiple times during the first year to assess site-specific loading conditions. This is recommended because pollutant loading can vary greatly from site to site. Variables such as nearby soil erosion or construction sites, winter sanding of roads, amount of daily traffic and land use can increase pollutant loading on the system. The first year of inspections can be used to set inspection and maintenance intervals for subsequent years. Without appropriate maintenance a BMP can exceed its storage capacity which can negatively affect its continued performance in removing and retaining captured pollutants.



System Diagram:

Inspection Equipment

Following is a list of equipment to allow for simple and effective inspection of the SciCLONE™ Separator:

- Bio Clean Environmental Inspection Form (contained within this manual).
- Flashlight.
- Manhole hook or appropriate tools to remove access hatches and covers.
- Appropriate traffic control signage and procedures.
- Measuring pole and/or tape measure.
- Protective clothing and eye protection.
- Note: entering a confined space requires appropriate safety and certification. It is generally not required for routine inspections or maintenance of the system.



Inspection Steps

The core to any successful stormwater BMP maintenance program is routine inspections. The inspection steps required on the SciCLONE™ Separator are quick and easy. As mentioned above the first year should be seen as the maintenance interval establishment phase. During the first year more frequent inspections should occur in order to gather loading data and maintenance requirements for that specific site. This information can be used to establish a base for long-term inspection and maintenance interval requirements.

The SciCLONE™ Separator can be inspected though visual observation without entry into the system. All necessary pre-inspection steps must be carried out before inspection occurs, especially traffic control and other safety measures to protect the inspector and near-by pedestrians from any dangers associated with an open access hatch or manhole. Once these access covers have been safely opened the inspection process can proceed:

- Prepare the inspection form by writing in the necessary information including project name, location, date & time, unit number and other info (see inspection form).
- Observe the inside of the system through the access hatches. If minimal light is available and vision into the unit is impaired utilize a flashlight to see inside the system.
- Look for any out of the ordinary obstructions in the inflow pipe, sump chamber, or outflow pipe. Write down any observations on the inspection form.
- Through observation and/or digital photographs estimate the amount of floatable debris accumulated on the influent side of the oil/floatables skimmer. Record this information on the inspection form. Next utilizing a tape measure or measuring stick estimate the amount of sediment accumulated in the sump. Record this depth on the inspection form.

- Finalize inspection report for analysis by the maintenance manager to determine if maintenance is required.

Maintenance Indicators

Based upon observations made during inspection, maintenance of the system may be required based on the following indicators:

- Missing or damaged internal components.
- Obstructions in the system or its inlet or outlet.
- Excessive accumulation of floatable in the sump chambers in which the length and width of the chambers behind oil/floatables skimmer is fully impacted extending down more than 9".
- Excessive accumulation of sediment in the sump chamber of more than 18" in depth.

Maintenance Equipment

It is recommended that a vacuum truck be utilized to minimize the time required to maintain the SciCLONE™ Separator:

- Bio Clean Environmental Maintenance Form (contained in O&M Manual).
- Flashlight.
- Manhole hook or appropriate tools to access hatches and covers.
- Appropriate traffic control signage and procedures.
- Protective clothing and eye protection.
- Note: entering a confined space requires appropriate safety and certification. It is generally not required for routine maintenance of the system.
- Vacuum truck (with pressure washer attachment preferred).

Maintenance Procedures

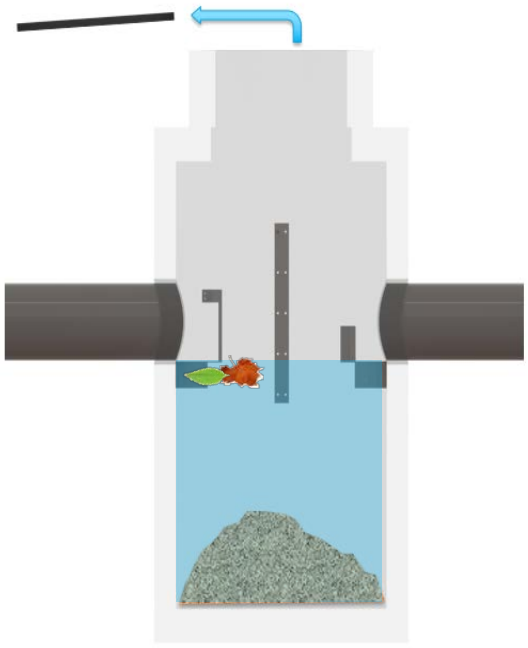
It is recommended that maintenance occurs at least three days after the most recent rain event to allow for drain down of any associated upstream detention systems. Maintaining the system while flows are still entering it will increase the time and complexity required for maintenance. Cleaning of the sump chamber can be performed from finish surface without entry into the vault utilizing a vacuum truck. Once all safety measures have been set up cleaning of the sump chamber can proceed as followed:

- Remove all access hatches (requires traffic control and safety measures to be completed prior).
- Using an extension on a vacuum truck position the hose over the opened access hatch and lower into the center of the sump chamber on the inlet side of the oil/floatables skimmer.

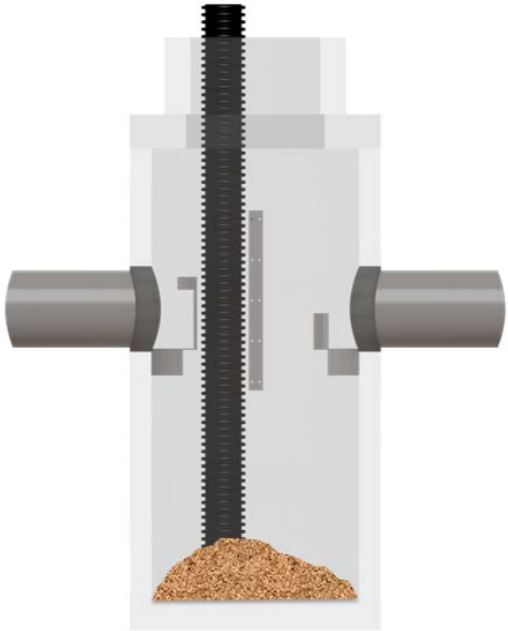
Remove all floating debris, standing water and sediment from the sump chamber. Access to the bottom of the sump chamber is unimpeded. The vac hose can be moved from side-to-side to fully remove sediments at the corners. A power washer can be used to assist if sediments have become hardened and stuck to the walls or the floor of the chamber. Repeat the same procedure on the effluent side of the oil/floatables skimmer to remove any remaining sediment. This completes the maintenance procedure required on the sump chamber and the SciCLONE™ Separator.

- The last step is to close up and replace all access hatches and remove all traffic control.
- All removed debris and pollutants shall be disposed of following local and state requirements.
- Disposal requirements for recovered pollutants may vary depending on local guidelines. In most areas the sediment, once dewatered, can be disposed of in a sanitary landfill. It is not anticipated that the sediment would be classified as hazardous waste.
- In the case of damaged components, replacement parts can be ordered by the manufacture.

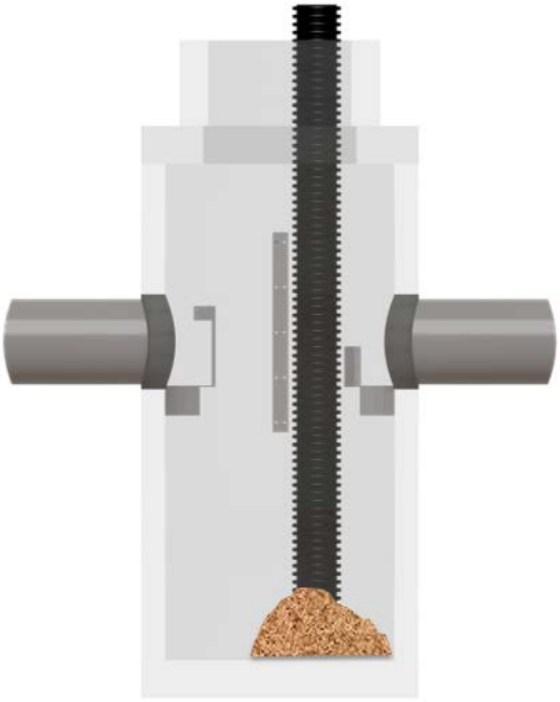
Maintenance Sequence



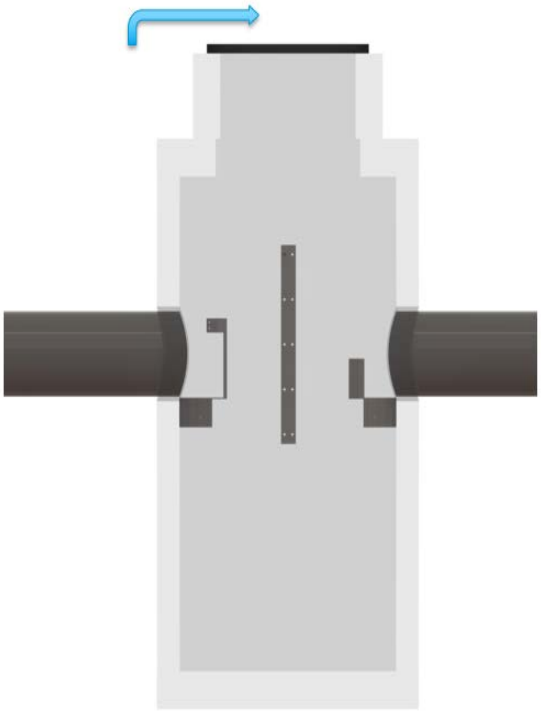
Remove Access Hatches Set Up Vacuum Truck to Clean the Sump Chamber.



Insert Vacuum Hose On the Inlet Side of the Oil/Floatables Skimmer and Vacuum Out All Trash, Sediment and Standing Water.



Insert Vacuum Hose On the Outlet Side of the Oil/Floatables Skimmer and Vacuum Out Any Remaining Sediment.



Replace Access Hatches and Remove Traffic Control and Safety Equipment.

For Maintenance Services or Information Please Contact Us At:
760-433-7640
Or Email: info@biocleanenvironmental.com

Inspection and Maintenance Report
Bio Clean SciCLONE™ Separator

Project Name _____

Project Address _____
(city) (Zip Code)

Owner / Management Company _____

Contact _____ Phone ( ) –

Inspector Name _____ Date ____ / ____ / _____ Time _____ AM / PM

Type of Inspection ☐ Routine ☐ Follow Up ☐ Complaint ☐ Stor Storm Event in Last 72-hours? ☐ No ☐ Yes

Weather Condition _____ Additional Notes _____

For Office Use Only
(Reviewed By)
(Date)
Office personnel to complete section to the left.

Site Map #	GPS Coordinates of Vault	Model #	Oils and Floatables Accumilation on Inlet Side of Oil/Floatables Skimmers (lbs)	Sediment Accumulation In Sump Chamber (lbs) & Depth (inches)	Structural Notes	Operational Per Manufactures' Specifications (If not, why?)
	Lat: Long:					
	Lat: Long:					
	Lat: Long:					

Comments:

NJCAT TECHNOLOGY VERIFICATION

SciClone™ Hydrodynamic Separator

Performance Verification of Sediment Capture and Light Liquid Retention

Bio Clean Environmental Services Inc.

September 2017

TABLE OF CONTENTS

Page

List of Tables ii

List of Figures iv

1. Introduction 1

2. Description of Technology 1

3. Laboratory Testing 4
   - 3.1 Test Setup 4
   - 3.2 Test Sediment 7
   - 3.3 Removal Efficiency Testing 10
   - 3.4 Scour Testing 10
   - 3.5 Light Liquid Re-Entrainment Simulation Test 10

4. Performance Claims 11

5. Supporting Documentation 12
   - 5.1 Removal Efficiency 12
   - 5.2 Scour 25
   - 5.3 Light Liquid Re-Entrainment 27

6. Maintenance Plans 30

7. Scaling 32

8. Statements 33

9. References 40

List of Tables **Page**

Table 1 SciClone™ Model SC-4 Dimensions 4

Table 2 Particle Size Distribution of #110 Test Sediment 8

Table 3 Particle Size Distribution of Scour Test Sediment 9

Table 4 LDPE Bead Specifications 11

Table 5 Sampling Schedule - 25% MTFR 13

Table 6 Water Flow and Temperature - 25% MTFR 14

Table 7 Sediment Feed Rate Summary – 25% MTFR 15

Table 8 SSC and Removal Efficiency - 25% MTFR 15

Table 9 Sampling Schedule - 50% MTFR 16

Table 10 Water Flow and Temperature - 50% MTFR 16

Table 11 Sediment Feed Rate Summary – 50% MTFR 17

Table 12 SSC and Removal Efficiency - 50% MTFR 18

Table 13 Sampling Schedule - 75% MTFR 18

Table 14 Water Flow and Temperature - 75% MTFR 19

Table 15 Sediment Feed Rate Summary – 75% MTFR 19

Table 16 SSC and Removal Efficiency - 75% MTFR 20

Table 17 Sampling Schedule - 100% MTFR 20

Table 18 Water Flow and Temperature - 100% MTFR 21

Table 19 Sediment Feed Rate Summary – 100% MTFR 21

Table 20 SSC and Removal Efficiency - 100% MTFR 22

Table 21 Sampling Schedule - 125% MTFR 22

Table 22 Water Flow and Temperature - 125% MTFR 23

Table 23 Sediment Feed Rate Summary – 125% MTFR 24

Table 24 SSC and Removal Efficiency - 125% MTFR 24

Table 25 Annualized Weighted Removal Efficiency for SciClone™ Model SC-4 25

Table 26 Scour Test Sampling Frequency 25

Table 27 Water Flow and Temperature - Scour Test 26

Table 28 Suspended Sediment Concentrations for Scour Test 27

Table 29 Light Liquid Re-Entrainment Testing Water Flow Rates 29

Table 30 Amount of Scoured Beads Based on Flow Rate 29

Table 31 Scaling of SciClone™ Models 32

List of Figures **Page**

Figure 1 Cut-Away View 2

Figure 2 Operational Diagram 2

Figure 3 Effective Treatment Area and Flow Path Diagram 3

Figure 4 View During Treatment and Bypass Flows 4

Figure 5 Test Flow Apparatus 5

Figure 6 Background Sampling Point 6

Figure 7 Effluent Sampling Point 6

Figure 8 Sediment Addition Point 7

Figure 9 Particle Size Distribution of Test Sediment 8

Figure 10 Particle Size Distribution of Scour Test Sediment 9

Figure 11 Water Flow and Temperature - 25% MTFR 14

Figure 12 Water Flow and Temperature - 50% MTFR 17

Figure 13 Water Flow and Temperature - 75% MTFR 19

Figure 14 Water Flow and Temperature - 100% MTFR 21

Figure 15 Water Flow and Temperature - 125% MTFR 23

Figure 16 Water Flow and Temperature – Scour Test 26

Figure 17 SciClone™ Inlet Loaded with LDPE Beads 28

Figure 18 Screening of Scoured LDPE Beads 28

1. Introduction

The SciClone™ is a manufactured treatment device (MTD) designed by Bio Clean Environmental Services Inc., a Forterra Company. The SciClone is designed to remove pollutants from stormwater runoff using a series of flow splitters, weirs and baffles. The device traps suspended particulates by promoting gravity separation, as well as being able to capture and retain floatables and light liquids, such as oil.

The test program was conducted by Good Harbour Laboratories (GHL), an independent water technology testing lab based in Ontario, Canada. The study results were submitted to the New Jersey Corporation for Advanced Technology (NJCAT) for verification. NJCAT is a private/public partnership that provides independent technology verification, education and information on emerging environmental and energy technology fields.

This testing program was based primarily on the *New Jersey Department of Environmental Protection Laboratory Protocol to Assess Total Suspended Solids Removal by a Hydrodynamic Sedimentation Manufactured Treatment Device (January 25, 2013)*. However, the particle size distribution (PSD) of the test sediment used is larger than what is required for NJDEP approval. This larger PSD is common in many regions throughout the nation and thus is more applicable in these areas.

In addition to sediment capture, the testing program incorporated an assessment for the retention of light liquids. This portion of the study was based on the Canada Environmental Technologies Verification (ETV) procedure: *Procedure for Laboratory Testing of Oil-Grit Separators (Version 3.0)*. The performance test results have been submitted to NJCAT for verification only.

2. Description of Technology

The SciClone™ system captures the following pollutants: total suspended solids, particulate bound nutrients and metals, debris, floatables and free-floating oil from contaminated runoff.

The SciClone™ is designed to maximize the flow path of entering stormwater thus optimizing its ability to capture suspended solids efficiently with minimal surface area. The system has no moving parts and operates utilizing the principles of gravity separation and flow path maximization to increase settling of finer particulates. It is composed of three components as shown in **Figure 1**.

Runoff is directed into the system via the inflow pipe and enters the flow splitter deck, as illustrated in **Figure 2**. From the flow splitter, water is channeled along the chamber wall on both sides of the inlet pipe. This splitting of the flow reduces inlet velocity into the system and channels flow along the walls of the chamber. As the split flow encounters the oil/floatables skimmer wall, it is directed along the skimmer wall toward the center of the chamber. At the center of the chamber the flow paths from both sides meet one another. As this occurs the flow path from both directions circles back toward the inlet pipe. This configuration directs the flow back toward the inlet and underneath the flow splitter deck thus maximizing the flow path. Finer sediments are directed into the sump chamber below the flow splitter to the chamber wall under the inlet as shown in **Figure 3**.

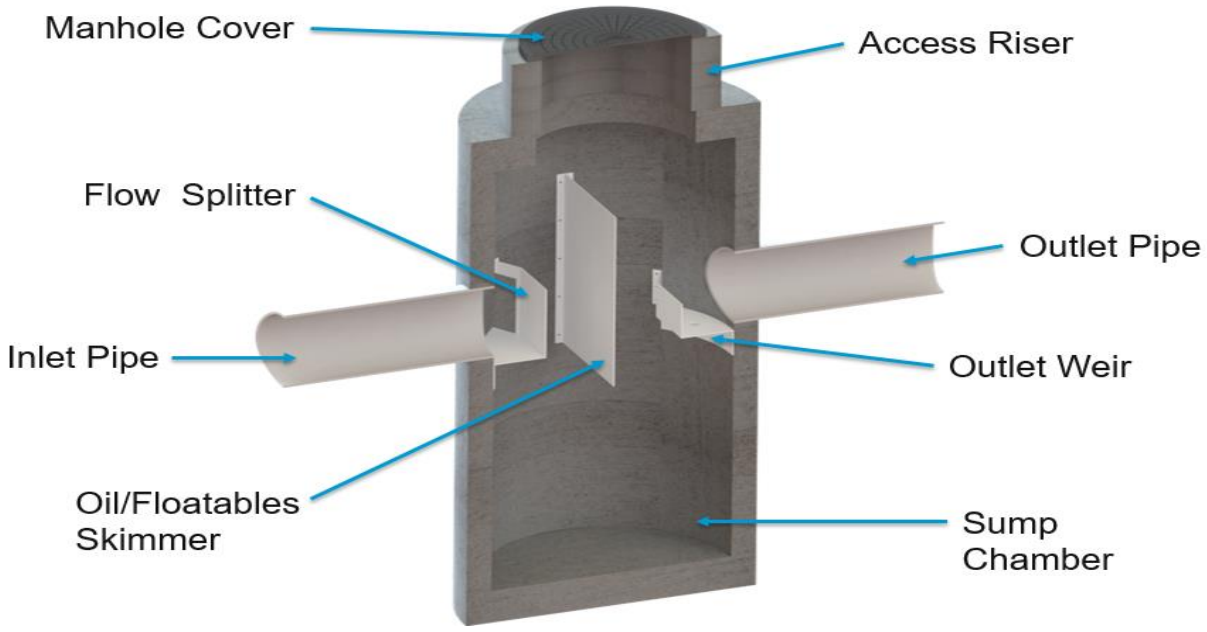


Figure 1 Cut-Away View

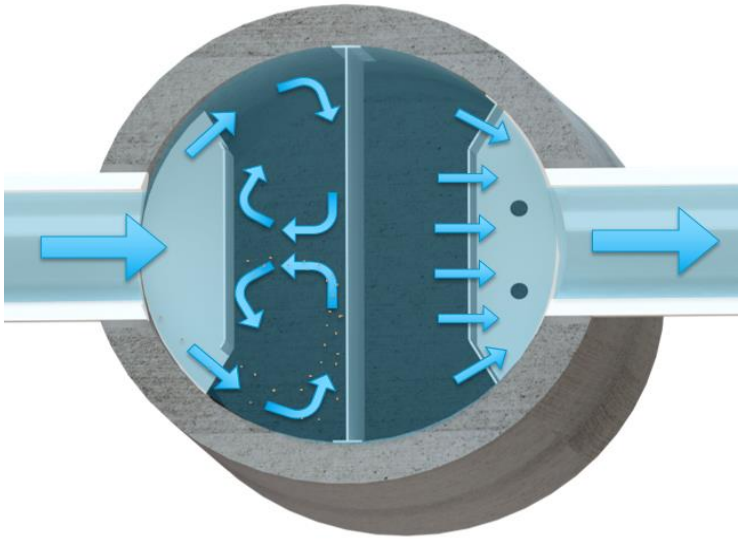


Figure 2 Operational Diagram

The oil/floatables skimmer is installed in the middle of the chamber and extends downward and upward to isolate free-floating oils and floatable trash and debris. Flows are forced to travel under the skimmer in the center of the system where the system is the widest thus creating a laminar flow under the weir and minimizing velocity. As water passes under the oil/floatables skimmer it rises back up and toward the outlet weir. The outlet weir extends across the width of the outlet pipe and protrudes up slightly above the outlet pipe invert. The outlet weir is much wider than the pipe and creates a laminar flow from the system into the outlet pipe to reduce entrance velocity back into the pipe in order to prevent channeling of flow as shown in **Figure 3**.

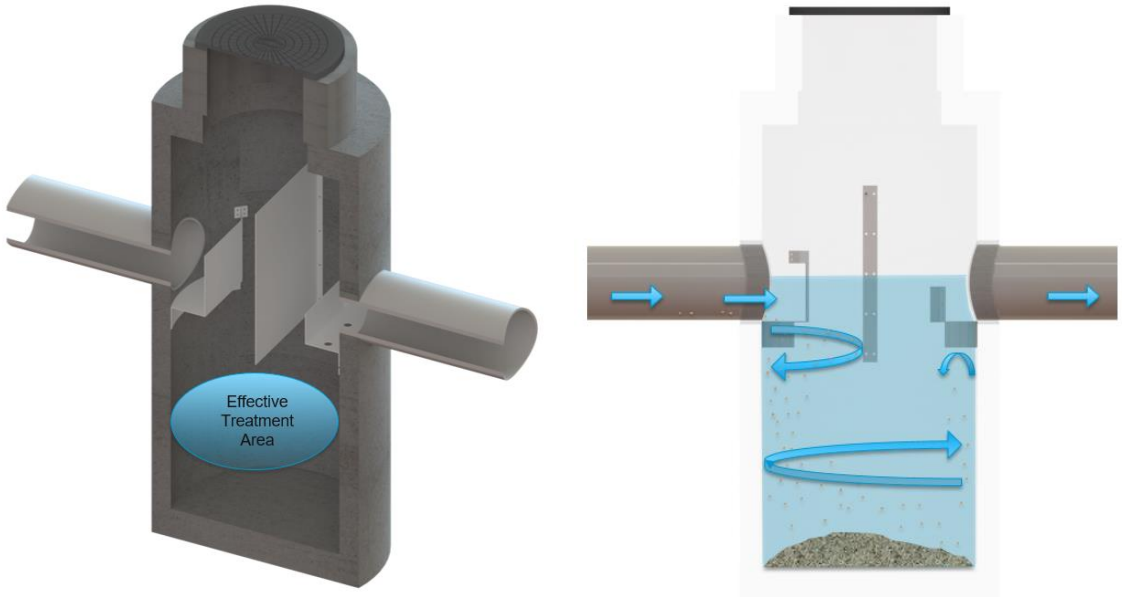


Figure 3 Effective Treatment Area and Flow Path Diagram

The unique design of the SciClone™, with a flow splitter, oil/floatables skimmer, and outlet weir maximizes the flow path and minimizes velocity for maximum performance. The system is designed to be installed online and process high flows internally. Higher flows are able to pass over the top of the flow splitter without impedance, under the oil/floatables skimmer and to the outlet. The outlet weir creates less turbulent conditions into the pipe and thus reduces head-loss during peak flow conditions as shown in **Figure 4**.

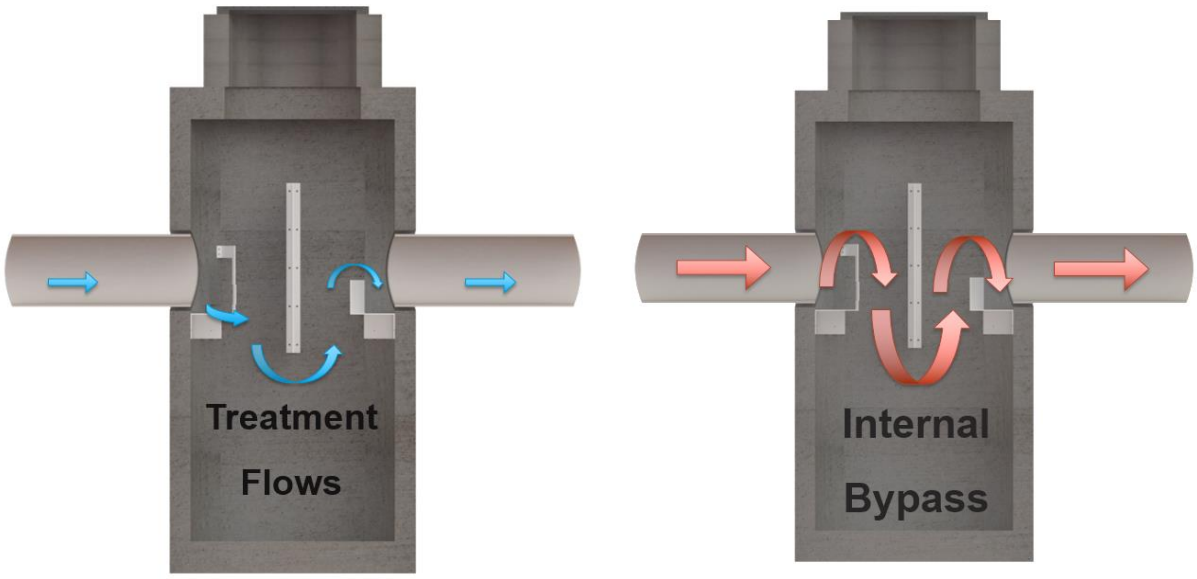


Figure 4 View During Treatment and Bypass Flows

3. Laboratory Testing

The device tested was a four-foot diameter SciClone™ unit (Model SC-4) consisting of internal components housed in a metal manhole. In commercial systems, the internal components are typically housed in a concrete manhole. The metal manhole of the test unit was equivalent to commercial concrete manholes in all key dimensions. The use of a metal manhole was proposed due to the difficulties associated with transporting and physically supporting the weight of a concrete vessel. Using a metal manhole in lieu of concrete did not impact system performance.

3.1 Test Setup

The specifications of the tested SciClone™ Hydrodynamic Separator (HDS) (Model SC-4) are provided in **Table 1**. The test unit had a total sedimentation area of 12.6 ft^2 and a maximum treatment flow rate (MTFR) of 0.70 cfs (315 gpm).

Table 1 SciClone™ Model SC-4 Dimensions

MTFR (cfs)	Diameter (ft)	50% of Sediment Storage Volume (ft^3)	Oil Capacity (Gal)	Effective Treatment Area (ft^2)
0.701	4	9.4	15.4	12.6

The laboratory test set-up was a water flow loop, capable of moving water at a rate of up to 2.2 cfs. The test loop, illustrated in **Figure 5**, was comprised of water storage tanks, pumps, sediment filter, receiving tank and flow meters.

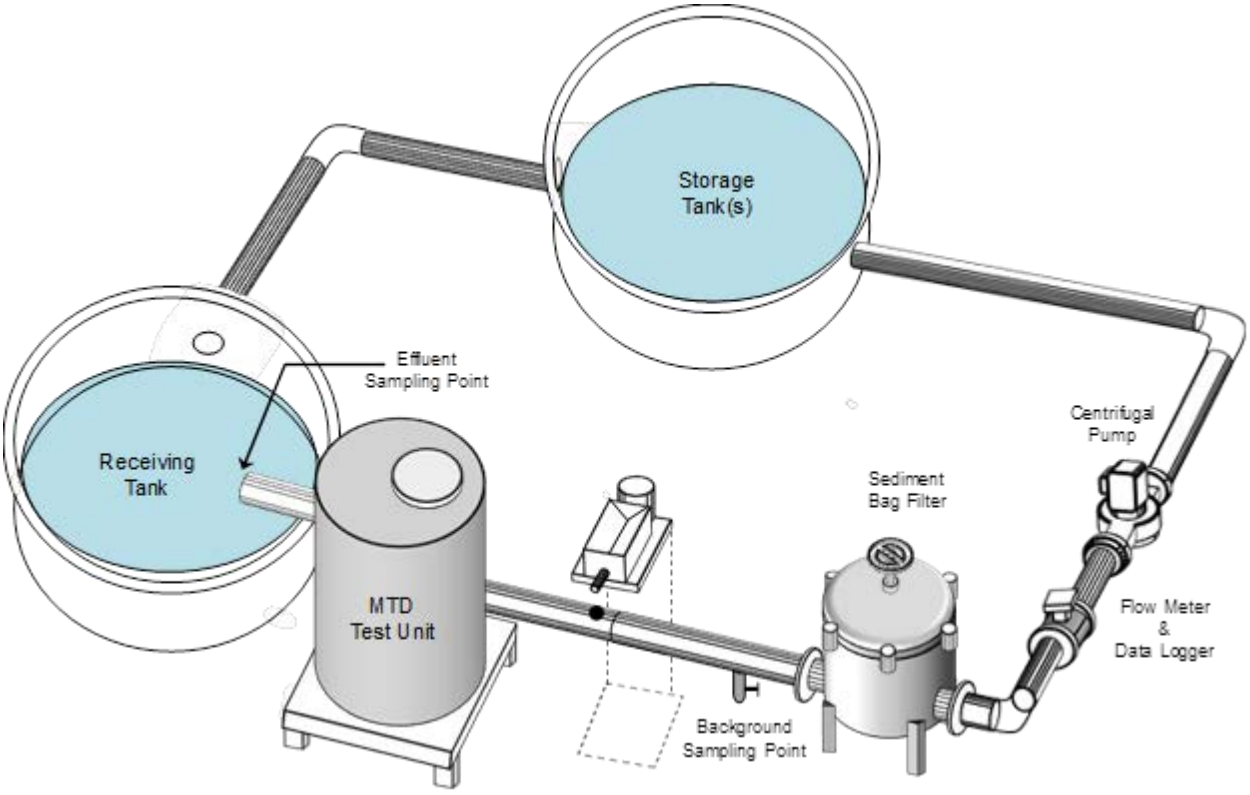


Figure 5 Test Flow Apparatus

Water Flow and Measurement

From the water supply tanks, water was pumped using either a WEG Model FC00312 (1 – 200 gpm) or an Armstrong Model 8X8X10 4380 (200 – 1000 gpm) centrifugal pump. Flow measurement was done using either a 3" Toshiba Model GF630 electromagnetic type flow meter with an accuracy of ± 0.5% of reading (1 – 200 gpm) or a MJK Magflux Type 7200 flow meter Model 297237 with an accuracy of ± 0.25% of reading (100 – 1000 gpm). The data logger used was a MadgeTech Process 101A data logger, configured to record a flow measurement once every minute.

The water in the flow loop was circulated through a filter housing containing high-efficiency pleated bag filters with a 0.5 µm absolute rating. The influent pipe was 24 inches in diameter and 132 inches long. Sediment addition was done through a port at the crown of the influent pipe, 118 inches upstream of the SciClone™. The sediment feeder was an Auger Feeders Model VF-1 volumetric screw feeder with vibratory hopper. The feeder had a 10-gallon hopper above the auger screw to provide a constant supply of sediment.

Water flow exited the SciClone™ and terminated with a free-fall into the receiving tank to complete the flow loop.

Sample Collection

Background water samples were collected in a 1 L jar from a sampling port located upstream of the auger feeder. The sampling port was controlled manually by a ball valve (**Figure 6**) that was opened approximately 5 seconds prior to sampling.

Effluent samples were also grabbed by hand. The effluent pipe drained freely into the receiving tank and the effluent sample was taken at that point (**Figure 7**). The sampling technique was to take the grab sample by sweeping a 1 L jar through the stream of effluent flow such that the jar was full after a single pass.



Figure 6 Background Sampling Point



Figure 7 Effluent Sampling Point

Duplicate samples were taken for both background and effluent. The primary set was analysed and reported while the second set was held under refrigerated conditions in case there was a need for an investigation following an aberrant result.

Other Instrumentation and Measurement

Effluent water temperature was taken as it exited the effluent pipe stub, using a Kangaroo digital, thermometer, Model 21800-068.

Run and sampling times were measured using a NIST traceable stopwatch, Control Company Model 62379-460.

The sediment feed samples that were taken during the run were collected in 500 mL jars and weighed on an analytical balance (Mettler Toledo, AB204-S).

3.2 Test Sediment

The test sediment was fed through an opening in the crown of the influent pipe, 118" upstream of the SciClone™. A funnel was used to direct the sediment into the pipe (**Figure 8**). The test sediment used for the removal efficiency study was commercially available silica sediment supplied by AGSCO Corporation, generally referred to as #110 but labeled #140-200. This particular batch was lot # 03311724648. Three samples of sediment were sent out for particle size analysis using the methodology of ASTM method D422-63 (reapproved 2007). The samples were composite samples created by taking a sediment sample from the hopper before the start of each of the five runs. The testing lab was Maxxam Analytics, an independent test lab also located in Ontario, Canada. The PSD results are summarized in **Table 2** and shown graphically in **Figure 9.**



Figure 8 Sediment Addition Point

Table 2 Particle Size Distribution of #110 Test Sediment

Particle Size (µm)	Test Sediment Particle size (%passing)			
	Sample 1	Sample 2	Sample 3	Average
1000	100.0	100.0	100.0	100.0
500	99.8	99.7	99.6	99.7
250	96.1	95.7	95.1	95.6
150	79.5	78.4	76.5	78.1
100	42.9	39.7	39.4	40.7
75	21.2	20.0	21.2	20.8
50	3.3	2.0	2.1	2.5
20	0	0	0	0
8	0	0	0	0
5	0	0	0	0
2	0	0	0	0
d_{50} (µm)	109	113	114	112

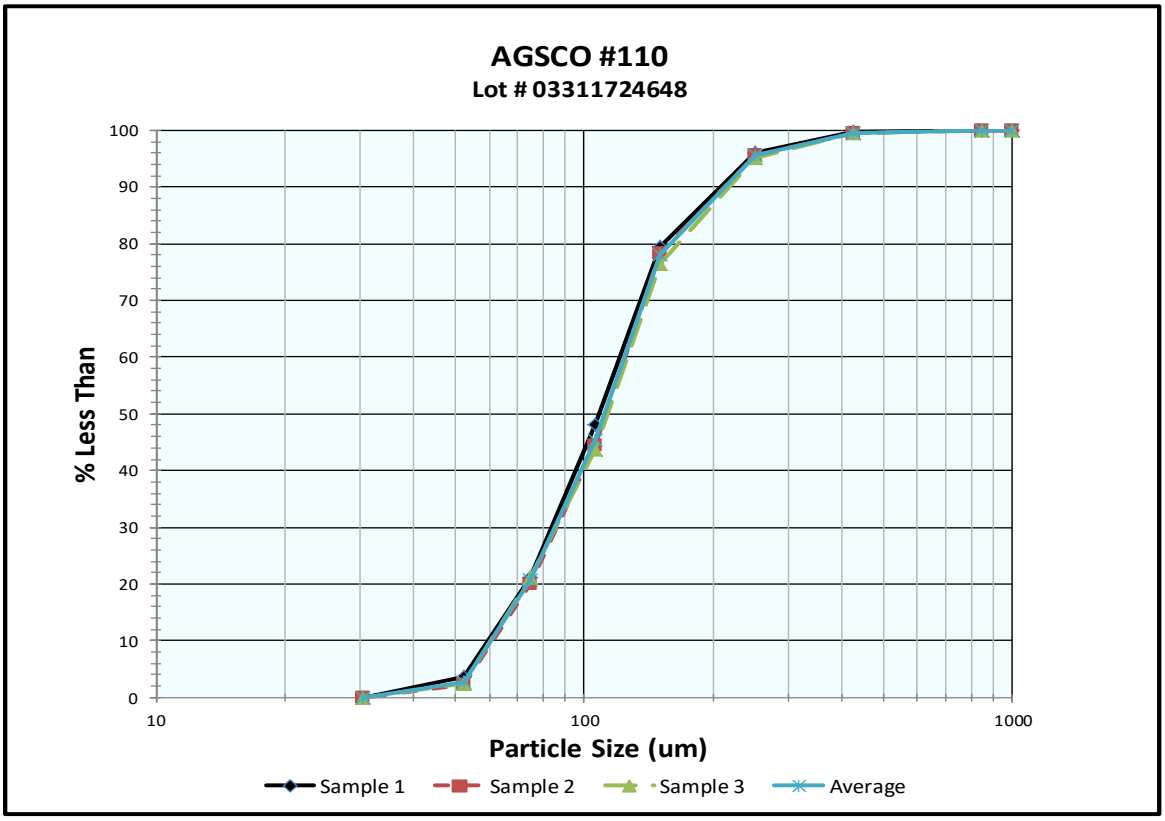


Figure 9 Particle Size Distribution of Test Sediment

For the scour test, the NJDEP specified scour test sediment was used. The sediment was blended by GHL using commercially available silica sands and the PSD of the sediment meet the specifications for the scour test sediment specified in the NJDEP laboratory test protocol. The scour test sediment PSD results are summarized in **Table 3** and shown graphically in **Figure 10**.

Table 3 Particle Size Distribution of Scour Test Sediment

Particle Size (µm)	Test Sediment Particle Size (% Less Than)				NJDEP Specification (Minimum % Less Than)
	Sample 1	Sample 2	Sample 3	Average	
1000	100	99	100	100	100
500	95	92	94	94	90
250	63	58	61	61	55
150	52	43	46	47	40
100	33	20	23	25	25
75	22	10	13	15	10
50	14	4	6	8	0

.

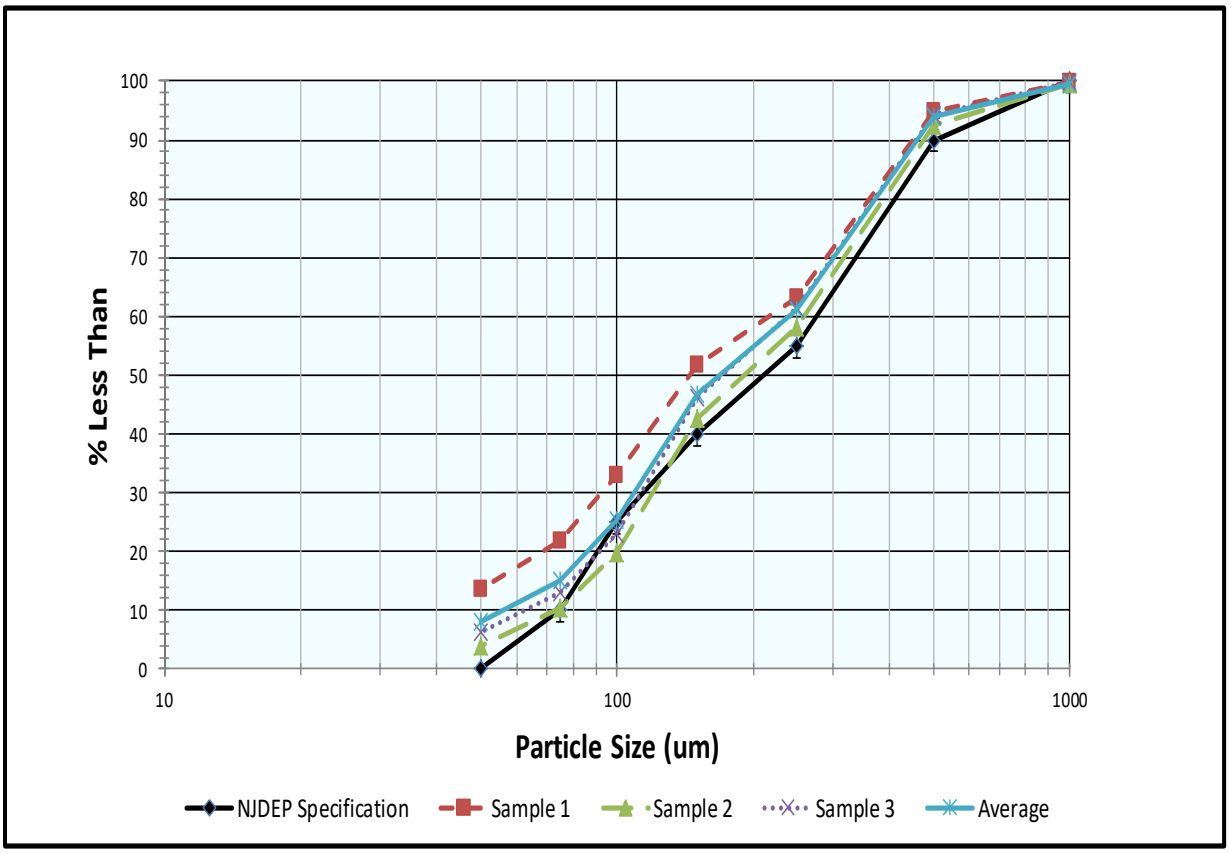


Figure 10 Particle Size Distribution of Scour Test Sediment

3.3 Removal Efficiency Testing

Removal efficiency testing was conducted on a clean unit with a false floor installed at 50% of the sump sediment storage depth, 9 inches above the device floor. Removal Efficiency Testing was based on Section 5 of the NJDEP Laboratory Protocol for Hydrodynamic Sedimentation MTDs.

The test sediment was sampled six times per run to confirm the sediment feed rate. Each sediment feed rate sample was collected in a 500-mL jar over an interval timed to the nearest second and was a minimum 0.1 liter or the collection interval did not exceed one minute, whichever came first.

Effluent grab sampling began following three MTD detention times after the initial sediment feed sample. The time interval between sequential samples was 1 minute, however, if the test sediment feed was interrupted for measurement, the next effluent sample was collected following three MTD detention times from the time the sediment feed was re-established. A total of 15 effluent samples were taken during each run.

Background water samples were taken with the odd-numbered effluent samples.

3.4 Scour Testing

Prior to the start of testing, sediment was loaded onto a 5-inch false floor of the sump of the SciClone™ and leveled at a depth of 4 inches. The final height of the sediment was at an elevation equivalent to 50% of the maximum sediment storage capacity of the MTD. After loading of the sediment, the unit was gradually filled with clear water, so as not to disturb the sediment, to the invert of the inlet pipe. The filled unit was allowed to sit for 89 hours.

The scour test was conducted at a flow rate of 630 gpm (1.4 cfs), two times the MTFR.

During the scour test, the water flow rate and temperature were recorded once every minute using a MadgeTech Process 101 data logger and a MicroTemp data logger. Testing commenced by gradually increasing the water flow into the system until the target flow rate was achieved (within five minutes of commencing the test). Background and effluent sampling began five minutes after adding water to the system. Sampling of background and effluent was completed as per the removal efficiency test. An effluent grab sample was taken once every two minutes, starting after achieving the target flow rate, until a total of 15 effluent samples were taken. A total of eight background water samples were collected at evenly spaced intervals throughout the scour test.

3.5 Light Liquid Re-Entrainment Simulation Test

The objective of this test was to assess whether light liquids captured in the SciClone™ are effectively retained at design flow rates. The test used low density polyethylene (LDPE) plastic beads as a surrogate for light liquids. The specifications of the LDPE beads are provided in **Table 4**. Since the density of the beads is similar to that of motor oil, the beads mimic the behaviour of light liquids trapped in a hydrodynamic separator.

Table 4 LDPE Bead Specifications

Manufacturer	Dow Chemical
Product Name	DOWLEX™ 2517 Polyethylene Resin
Batch Number	D204F5D01E
Density	0.9166 g/cm^3
Bulk Density	0.56074 g/cm^3

This test was run with clean water and with the false floor set at 50% of the maximum recommended sediment storage depth to ensure that the hydrodynamics of the SciClone™ were representative of an average condition. For the test, the SciClone™ was pre-loaded to its maximum recommended oil storage capacity, 15.4 gallons, with LDPE beads.

The potential for oil re-entrainment and washout was determined at five flow rates, ranging from 25% to 125% MTFR, increased in 5-minute intervals. Flow rates were recorded once every 30 seconds over the duration of the test and maintained within ±10% of the target flow rate with a COV of less than 0.03. The time to increase the flow initially, and from one rate to the next, did not exceed 1 minute.

All effluent during the test was screened for the entire duration of the test. The screen mesh size used ensured that all plastic beads washed out of the SciClone™ were retained on the screens while allowing water to pass through. The way the LDPE beads were collected and quantified ensured that they were associated with the flow rate interval in which they were washed out. Beads that washed out during a transition flow were associated with the higher target flow rate.

The volume, mass, and percentage of plastic beads washed out of the SciClone™ were determined for each flow rate.

4. Performance Claims

The following are the performance claims made by Bio Clean Environmental Services and/or established via the laboratory testing conducted for the SciClone™ Hydrodynamic Separator.

Total Suspended Solids (TSS) Removal Rate

The TSS removal rate of the SciClone™ using sediment with a median particle size (d_{50}) of 112 µm was determined using the weighted method specified by the NJDEP HDS MTD protocol. Based on a MTFR of 0.70 cfs, the SciClone™ achieved a weighted TSS removal rate, reported as Suspended Sediment Concentration (SSC) per the NJDEP protocol, of at least 80%.

Maximum Treatment Flow Rate (MTFR).

The SciClone™ unit had a total sedimentation area of 12.6 ft^2 and a maximum treatment flow rate (MTFR) of 0.70 cfs (315 gpm), which corresponds to a surface loading rate of 25 gpm/ft^2 of sedimentation area.

Maximum Sediment Storage Depth and Volume

The maximum sediment storage depth is 18" which equates to 18.8 ft^3 of sediment storage volume. A sediment storage depth of 9" corresponds to 50% full storage capacity (9.4 ft^3).

Effective Treatment/Sedimentation Area

The effective treatment area is 12.6 ft^2.

Detention Time and Wet Volume

The wet volume for the SciClone™ is 470 gallons. The detention time of the SciClone™ is dependent upon flow rate. The minimum design detention time, calculated by dividing the treatment volume by the MTFR of 315 gpm, is 89.5 seconds.

Light Liquid Retention

Based on the laboratory testing using polyethylene beads as a surrogate for light liquids, the SciClone™ can retain a minimum of 98.7% (on a mass basis) of trapped light liquids up to a flow rate of 100% MTFR and 89.1% at 125% MTFR.

5. Supporting Documentation

To support the performance claims, copies of the laboratory test reports, including all collected and measured data; all data from performance evaluation test runs; spreadsheets containing original data from all performance test runs; all pertinent calculations; etc. were made available to NJCAT for review. It was agreed that as long as such documentation could be made available upon request that it would not be prudent or necessary to include all this information in this verification report. All supporting documentation will be retained securely by GHL and has been provided to NJCAT.

5.1 Removal Efficiency

A total of 5 removal efficiency testing runs were completed in accordance with the NJDEP HDS protocol. The target flow rate ranged from 25 – 125% MTFR and the target influent sediment concentration was 200 mg/L. The results from all 5 runs were used to calculate an annualized weighted removal efficiency for the SciClone™.

The total water volume and average flow rate per run were calculated from the data collected by the flow data logger, one reading every minute. The average influent sediment concentration for each test flow was determined by mass balance. The amount of sediment fed into the auger feeder during dosing, and the amount remaining at the end of a run, was used to determine the amount of sediment fed during a run. The sediment mass was corrected for the mass of the six feed rate samples taken during the run. The mass of the sediment fed was divided by the volume of water that flowed through the SciClone™ during dosing to determine the average influent sediment concentration for each run.

Six feed rate samples were collected at evenly spaced intervals during the run to ensure the rate was stable. The COV of the samples had to be < 0.10 per the NJDEP protocol. The feed rate samples were also used to calculate an influent concentration in order to double check the concentration calculated by mass balance.

The average effluent sediment concentration was adjusted for the background sediment concentration. In cases where the reported background sediment concentration was less than 2.3 mg/L (the method quantitation limit), 2 mg/L was used in calculating the adjusted effluent concentration.

Removal efficiency for each test run was computed as follows:

$$Removal\ Efficiency\ (\%) = \left(\frac{Average\ Influent\ Concentration - Adjusted\ Average\ Effluent\ Concentration}{Average\ Influent\ Concentration} \right) \times 100\%$$

The data collected for each removal efficiency run is presented below.

25% MTFR

Table 5 Sampling Schedule - 25% MTFR

Runtime (min)	Sampling Schedule		
	Sediment Feed	Background	Effluent
0	1		
18.91		1	1
19.91			2
20.91	2	2	3
39.81			4
40.81		3	5
41.81	3		6
60.72		4	7
61.72			8
62.72	4	5	9
81.62			10
82.62		6	11
83.62	5		12
102.53		7	13
103.53			14
104.53	6	8	15
105.53	End of Testing		
MTD Detention Time = 5.968 minutes Target Sediment Sampling Time = 60 seconds			

Table 6 Water Flow and Temperature - 25% MTFR

Run Parameters	Water Flow Rate (GPM)				Maximum Water Temperature (°F)
	Target	Actual	Difference	COV	
	78.8	78.9	0.13%	0.006	64.2
QA/QC Limit	-	-	±10% PASS	0.03 PASS	80 PASS

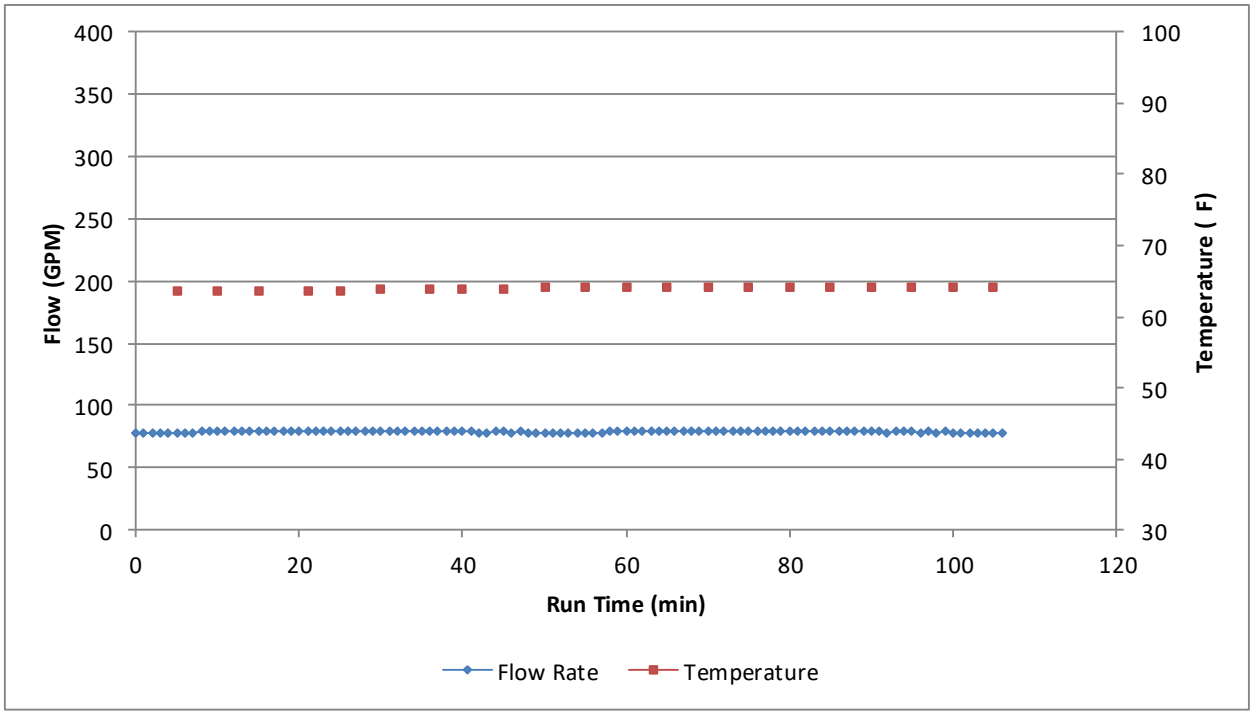


Figure 11 Water Flow and Temperature - 25% MTFR

Table 7 Sediment Feed Rate Summary – 25% MTFR

Sediment Feed Rate (g/min)		Sediment Mass Balance	
1	59.404	Starting Weight of Sediment (lbs.)	58.081
2	60.125		
3	61.024	Recovered Weight of Sediment (lbs.)	43.850
4	62.398		
5	60.995	Mass of Sediment Used (lbs.)	14.231
6	62.439	Volume of Water Through MTD During Dosing (gal)	7,860
Average	61.064		
COV	0.020	Average Influent Sediment Concentration (mg/L)	204.7*
QA/QC Limit	0.10 PASS	QA/QC Limit	180 – 220 mg/L PASS

*Corrected for sediment feed rate samples

Table 8 SSC and Removal Efficiency - 25% MTFR

	Suspended Sediment Concentration (mg/L)														
Sample #	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**
Effluent	6.9	7.4	6.5	6.9	7.4	6.6	6.9	7.5	6.7	7.3	7.5	7.9	6.7	6.8	7.3
Background	2		2		2		2		2		2		2		2
Adjusted Effluent	4.9	5.4	4.5	4.9	5.4	4.6	4.9	5.5	4.7	5.3	5.5	5.9	4.7	4.8	5.3

Average Adjusted Effluent Concentration	5.1 mg/L	Removal Efficiency	97.5%

50% MTFR

Table 9 Sampling Schedule - 50% MTFR

Runtime (min)	Sampling Schedule		
	Sediment Feed	Background	Effluent
0	1		
9.95		1	1
10.95			2
11.95	2	2	3
21.91			4
22.91		3	5
23.91	3		6
33.86		4	7
34.86			8
35.86	4	5	9
45.81			10
46.81		6	11
47.81	5		12
57.76		7	13
58.76			14
59.76	6	8	15
60.76	End of Testing		
MTD Detention Time = 2.984 minutes Target Sediment Sampling Time = 60 seconds			

Table 10 Water Flow and Temperature - 50% MTFR

Run Parameters	Water Flow Rate (GPM)				Maximum Water Temperature (°F)
	Target	Actual	Difference	COV	
	157.5	157.0	- 0.32%	0.010	64.4
QA/QC Limit	-	-	±10% PASS	0.03 PASS	80 PASS

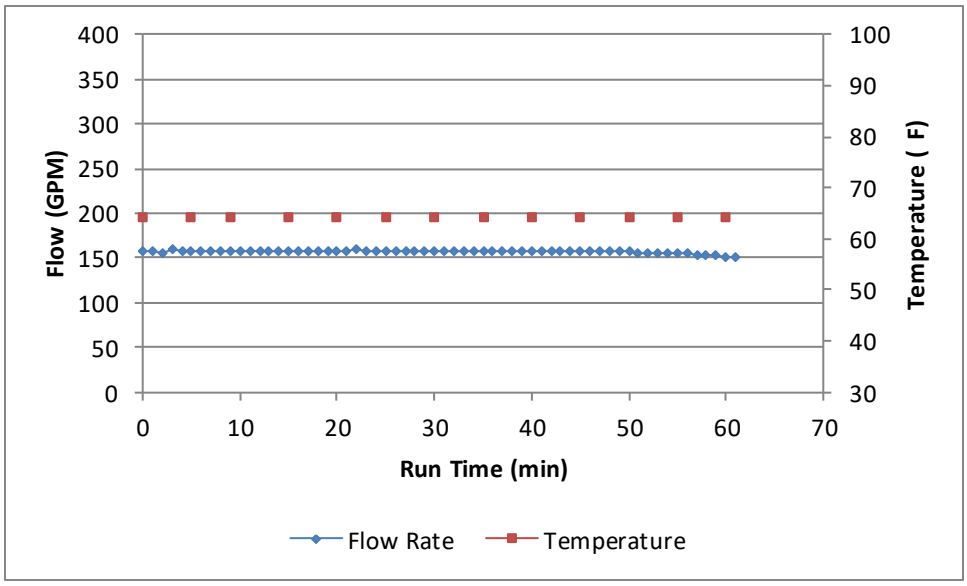


Figure 12 Water Flow and Temperature - 50% MTFR

Table 11 Sediment Feed Rate Summary – 50% MTFR

Sediment Feed Rate (g/min)		Sediment Mass Balance	
1	120.296	Starting Weight of Sediment (lbs.)	62.26
2	119.098		
3	122.968	Recovered Weight of Sediment (lbs.)	45.91
4	123.317		
5	122.352	Mass of Sediment Used (lbs.)	16.35
6	124.900	Volume of Water Through MTD During Dosing (gal)	8,607
Average	122.155		
COV	0.017	Average Influent Sediment Concentration (mg/L)	205.3*
QA/QC Limit	0.10 PASS	QA/QC Limit	180 – 220 mg/L PASS

*Corrected for sediment feed rate samples

Table 12 SSC and Removal Efficiency - 50% MTFR

	Suspended Sediment Concentration (mg/L)														
Sample #	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**
Effluent	28.8	28.1	28.4	29.0	29.4	31.4	28.8	28.9	26.4	28.5	27.9	30.2	33.2	30.9	31.8
Background	2		2		2		2		2		2		2		2
Adjusted Effluent	26.8	26.1	26.4	27.0	27.4	29.4	26.8	26.9	24.4	26.5	25.9	28.2	31.2	28.9	29.8
Average Adjusted Effluent Concentration					27.4			Removal Efficiency					86.6%		

75% MTFR

Table 13 Sampling Schedule - 75% MTFR

Runtime (min)	**Sampling Schedule**		
	Sediment Feed	**Background**	**Effluent**
0	1		
6.89		1	1
7.89			2
8.89	2	2	3
15.77			4
16.77		3	5
17.77	3		6
24.66		4	7
25.66			8
26.66	4	5	9
33.54			10
34.54		6	11
35.54	5		12
42.43		7	13
43.43			14
44.43	6	8	15
45.34	End of Testing		
MTD Detention Time = 1.989 minutes Target Sediment Sampling Time = 55 seconds			

Table 14 Water Flow and Temperature - 75% MTFR

Run Parameters	Water Flow Rate (GPM)				Maximum Water Temperature (°F)
	Target	Actual	Difference	COV	
	236.6	234.7	-0.80%	0.009	64.8
QA/QC Limit	-	-	±10% PASS	0.03 PASS	80 PASS

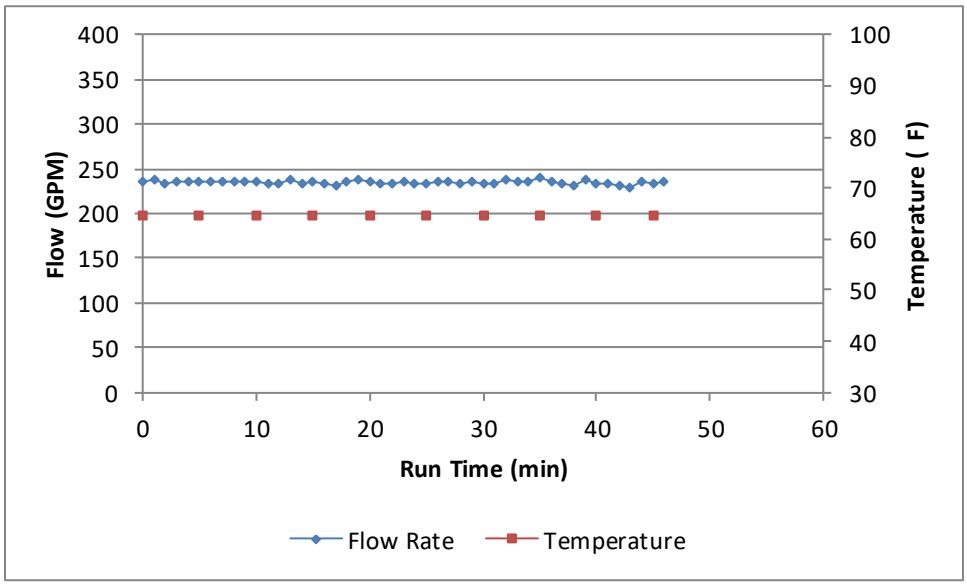


Figure 13 Water Flow and Temperature - 75% MTFR

Table 15 Sediment Feed Rate Summary – 75% MTFR

Sediment Feed Rate (g/min)		Sediment Mass Balance	
1	170.186	Starting Weight of Sediment (lbs.)	72.95
2	169.005		
3	170.214	Recovered Weight of Sediment (lbs.)	55.96
4	169.504		
5	171.289	Mass of Sediment Used (lbs.)	16.99
6	169.844	Volume of Water Through MTD During Dosing (gal)	9,355
Average	170.007		
COV	0.005	Average Influent Sediment Concentration (mg/L)	191.3*
QA/QC Limit	0.10 PASS	QA/QC Limit	180 – 220 mg/L PASS

*Corrected for sediment feed rate samples

Table 16 SSC and Removal Efficiency - 75% MTFR

	Suspended Sediment Concentration (mg/L)														
Sample #	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**
Effluent	46.0	47.4	46.2	44.8	52.0	51.7	55.2	48.4	51.5	57.1	54.2	53.2	51.7	49.6	51.0
Background	2		2		2		2		2		2		2		2
Adjusted Effluent	44.0	45.4	44.2	42.8	50.0	49.7	53.2	46.4	49.5	55.1	52.2	51.2	49.7	47.6	49.0
Average Adjusted Effluent Concentration					48.7 mg/L			Removal Efficiency					74.6%		

100% MTFR

Table 17 Sampling Schedule - 100% MTFR

Runtime (min)	**Sampling Schedule**		
	Sediment Feed	**Background**	**Effluent**
0	1		
5.14		1	1
6.14			2
7.14	2	2	3
12.29			4
13.29		3	5
14.29	3		6
19.43		4	7
20.43			8
21.43	4	5	9
26.57			10
27.57		6	11
28.57	5		12
33.72		7	13
34.72			14
35.72	6	8	15
36.38	End of Testing		
MTD Detention Time = 1.492 minutes Target Sediment Sampling Time = 40 seconds			

Table 18 Water Flow and Temperature - 100% MTFR

Run Parameters	Water Flow Rate (GPM)				Maximum Water Temperature (°F)
	Target	Actual	Difference	COV	
	315.0	310.6	-1.40	0.008	64.9
QA/QC Limit	-	-	±10% PASS	0.03 PASS	80 PASS

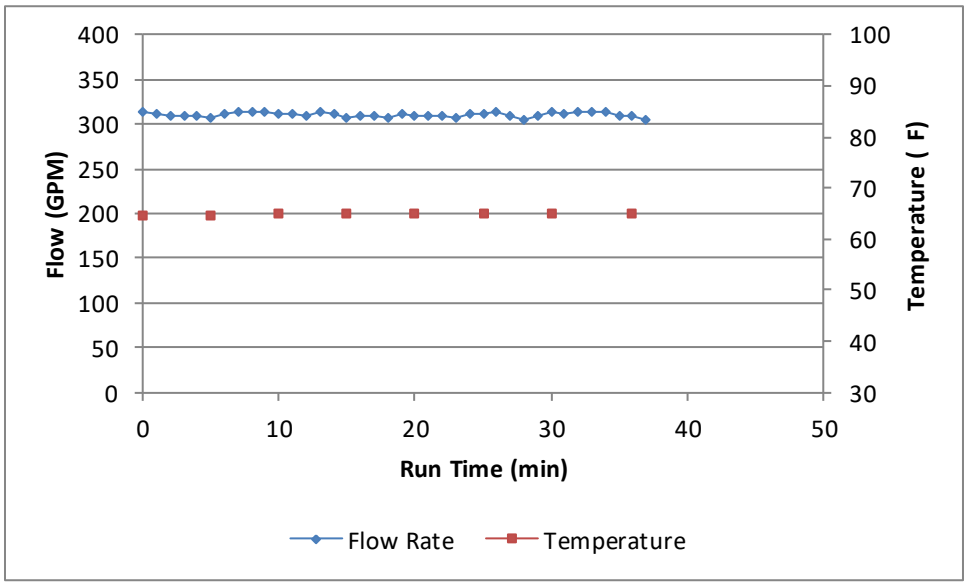


Figure 14 Water Flow and Temperature - 100% MTFR

Table 19 Sediment Feed Rate Summary – 100% MTFR

Sediment Feed Rate (g/min)		Sediment Mass Balance	
1	238.018	Starting Weight of Sediment (lbs.)	63.43
2	235.121		
3	240.393	Recovered Weight of Sediment (lbs.)	44.26
4	237.182		
5	236.349	Mass of Sediment Used (lbs.)	19.17
6	239.425	Volume of Water Through MTD During Dosing (gal)	10,056
Average	237.748		
COV	0.008	Average Influent Sediment Concentration (mg/L)	203.4*
QA/QC Limit	0.10 PASS	QA/QC Limit	180 – 220 mg/L PASS

*Corrected for sediment feed rate samples

Table 20 SSC and Removal Efficiency - 100% MTFR

	Suspended Sediment Concentration (mg/L)														
Sample #	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**
Effluent	68.9	66.7	59.6	75.0	69.2	70.0	73.3	74.1	71.6	72.9	71.3	75.1	73.4	78.8	72.6
Background	2		2		2		2		2		2		2		2
Adjusted Effluent	66.9	64.7	57.6	73.0	67.2	68.0	71.3	72.1	69.6	70.9	69.3	73.1	71.4	76.8	70.6
Average Adjusted Effluent Concentration				69.5 mg/L			Removal Efficiency						65.8%		

125% MTFR

Table 21 Sampling Schedule - 125% MTFR

Runtime (min)	**Sampling Schedule**		
	Sediment Feed	**Background**	**Effluent**
0	1		
4.08		1	1
5.08			2
6.08	2	2	3
10.16			4
11.16		3	5
12.16	3		6
16.24		4	7
17.24			8
18.24	4	5	9
22.32			10
23.32		6	11
24.32	5		12
28.41		7	13
29.41			14
30.41	6	8	15
30.91	End of Testing		
MTD Detention Time = 1.194 minutes Target Sediment Sampling Time = 30 seconds			

Table 22 Water Flow and Temperature - 125% MTFR

Run Parameters	Water Flow Rate (GPM)				Maximum Water Temperature (°F)
	Target	Actual	Difference	COV	
	393.8	388.6	-1.32%	0.009	65.1
QA/QC Limit	-	-	±10% PASS	0.03 PASS	80 PASS

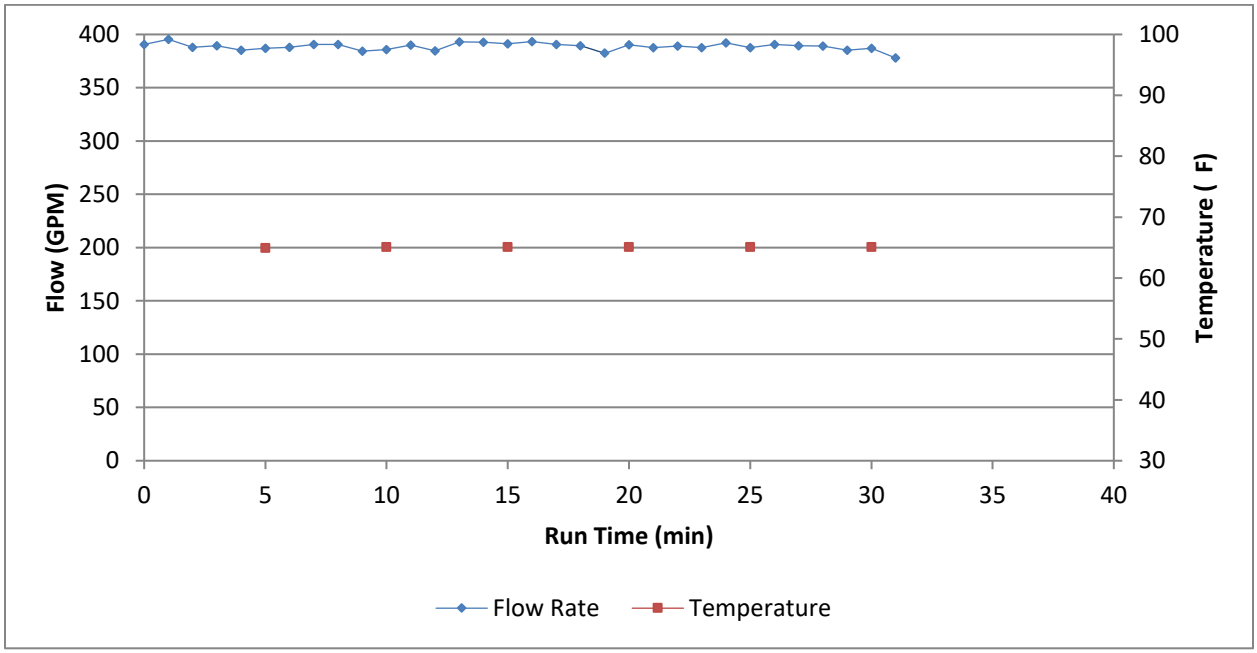


Figure 15 Water Flow and Temperature - 125% MTFR

Table 23 Sediment Feed Rate Summary – 125% MTFR

Sediment Feed Rate (g/min)		Sediment Mass Balance	
1	295.648	Starting Weight of Sediment (lbs.)	63.63
2	295.912		
3	293.050	Recovered Weight of Sediment (lbs.)	43.30
4	300.450		
5	297.978	Mass of Sediment Used (lbs.)	20.33
6	297.430	Volume of Water Through MTD During Dosing (gal)	10,841
Average	296.745		
COV	0.008	Average Influent Sediment Concentration (mg/L)	203.0*
QA/QC Limit	0.10 PASS	QA/QC Limit	180 – 220 mg/L PASS

*Corrected for sediment feed rate samples

Table 24 SSC and Removal Efficiency - 125% MTFR

	Suspended Sediment Concentration (mg/L)														
Sample #	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**
Effluent	84.2	83.2	94.6	96.6	89.4	89.2	99.7	92.5	95.2	99.0	98.8	95.2	100	94.0	98.4
Background	2		2		2		2		2		2		2		2
Adjusted Effluent	82.2	81.2	92.6	94.6	87.4	87.2	97.7	90.5	93.2	97.0	96.8	93.2	98.0	92.0	96.4
Average Adjusted Effluent Concentration				92.0			Removal Efficiency						54.7%		

Annualized Weighted Removal Efficiency

The annualized weighted removal efficiency for sediment in stormwater has been calculated using the rainfall weighting factors provided in the NJDEP laboratory test protocol. The SciClone™ Hydrodynamic Separator annual weighted removal for a MTFR of 315 gpm is 80.6%, as shown in **Table 25.**

Table 25 Annualized Weighted Removal Efficiency for SciClone™ Model SC-4

%MTFR	Removal Efficiency (%)	Annual Weighting Fact	Weighted Removal Efficiency (%)
25	97.5	0.25	24.4
50	86.6	0.30	26.0
75	74.6	0.20	14.9
100	65.8	0.15	9.87
125	54.7	0.10	5.47
Annualized Weighted Removal Efficiency			**80.6%**

5.2 Scour

Scour testing was conducted in accordance with Section 4 of the NJDEP Laboratory Protocol to Assess Total Suspended Solids Removal by a Hydrodynamic Sedimentation MTD. Testing was conducted at a target flow rate of 630 gpm, 200% of the maximum treatment flow rate (MTFR).

In preparation for the scour test, the sump of the SciClone™ was cleaned out to remove all of the accumulated sediment from the previous removal efficiency testing. A false floor was installed 4 inches below the depth of the 50% maximum sediment storage height. The sump was then loaded with scour test sediment so that when levelled, the sediment formed a layer at least 4 inches thick, confirmed by measuring the sediment thickness with a yard stick. After sediment loading, the sump was filled with water and allowed to sit for 89 hours.

Scour testing began by gradually increasing the flow rate to the target flow within a 5-minute period. Effluent and background samples were taken from the same locations as for the removal efficiency testing, starting 5 minutes after flow was initiated. The sampling frequency is summarized in Table **26**.

Table 26 Scour Test Sampling Frequency

Sample/ Measurement Taken	Run Time (min.)															
	0	**2**	**4**	**6**	**8**	**10**	**12**	**14**	**16**	**18**	**20**	**22**	**24**	**26**	**28**	**30**
Effluent		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Background	X		X		X		X		X		X		X		X	

Note: The Run Time of 0 minutes was the time that the 1st background sample was taken, just after achieving the target flow.

Water flow rate and water temperature measured during the scour testing are shown in **Table 27** and on **Figure 16**.

Table 27 Water Flow and Temperature - Scour Test

Run Parameters	Water Flow Rate (GPM)				Maximum Water Temperature (°F)
	Target	Actual	Difference	COV	
	630	630.2	0.0032 %	0.005	72
QA/QC Limit	-	-	±10% PASS	0.03 PASS	80 PASS

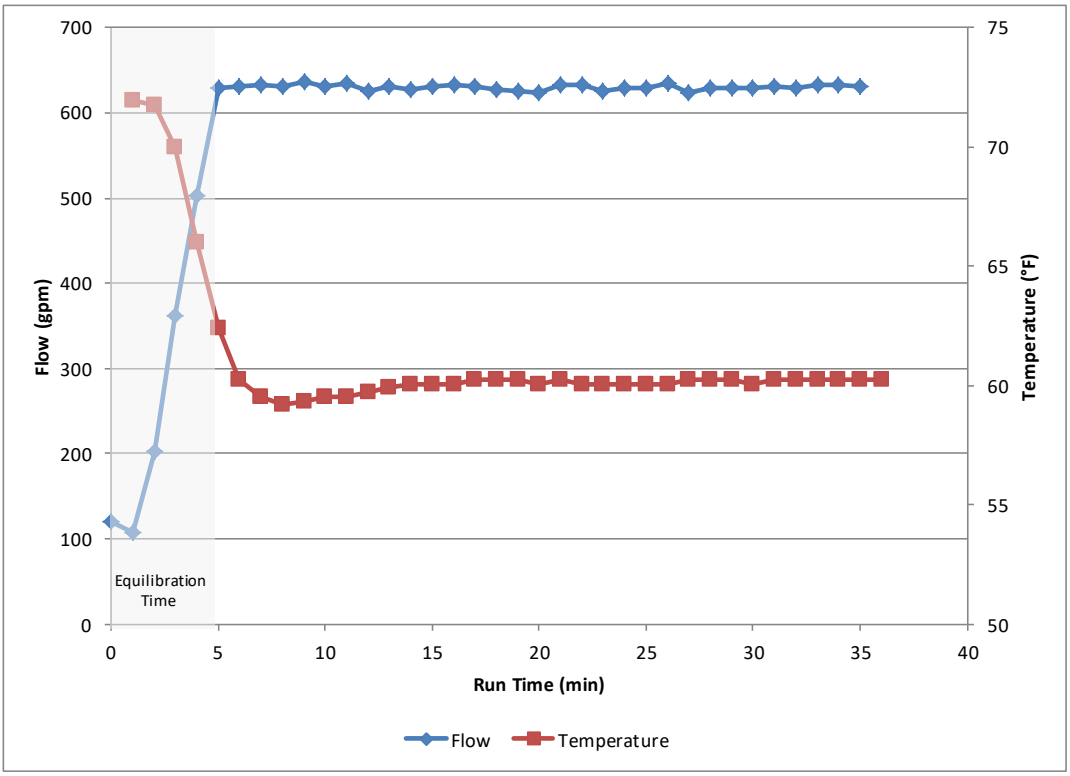


Figure 16 Water Flow and Temperature - Scour Test

The effluent and background SSC results are reported in **Table 28**. The adjusted effluent concentration was calculated as:

$$Adjusted\ Effluent\ Concentration\ \left(\frac{mg}{L}\right) = Initial\ Concentration - Background\ Concentration$$

The SSC method reporting limit was 2.3 mg/L. Any results below this value were reported as 2 mg/L for calculation purposes. For effluent samples that did not have a corresponding background sample, the background value was interpolated from the previous and subsequent samples. The

average adjusted effluent concentration was 0.2 mg/L; therefore, when operated at 200% of the MTFR, the SciClone™ meets the criteria for online use.

Table 28 Suspended Sediment Concentrations for Scour Test

	Scour Suspended Sediment Concentration (mg/L)															
Sample #		**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**
Effluent		2	2	2	2	2	2.3	2	2	2.4	2.6	2.3	2	2.6	2.9	2.5
Background	2		2		2		2		2		2		2.6		2	
Adjusted Effluent		0	0	0	0	0	0.3	0	0	0.4	0.6	0	0	0.3	0.9	0.5
Average Adjusted Effluent Concentration							0.2 mg/L									

5.3 Light Liquid Re-Entrainment

For the test, the SciClone™ had a false floor in place, set to represent 50% of the maximum recommended sediment storage depth, and the unit was pre-filled with clean water. The volume of beads added was 15.4 gallons, equivalent to 32.7 kg (72.1 lbs). The material was weighed into buckets and poured into the SciClone™ on the influent side of the Oil/Floatables Skimmer. To prevent the beads from traveling up the inlet pipe, a piece of acrylic sheet was placed over the mouth of the inlet and wedged in place. The acrylic sheet was pulled at the start of the test, immediately after the pump was started. The loaded SciClone™ is illustrated in **Figure 17**.

During the test, the effluent was screened through a mesh that captured any of the scoured beads (**Figure 18**). The captured beads were separated according to the scoured flow rate.

Following the test, the beads were dried in non-ferrous containers in an oven set at 103 °C until a constant weight was achieved. The mass, volume (calculated based on bulk density) and percentage of the pre-loaded beads scoured was determined for each flow rate.



Figure 17 SciClone™ Inlet Loaded with LDPE Beads

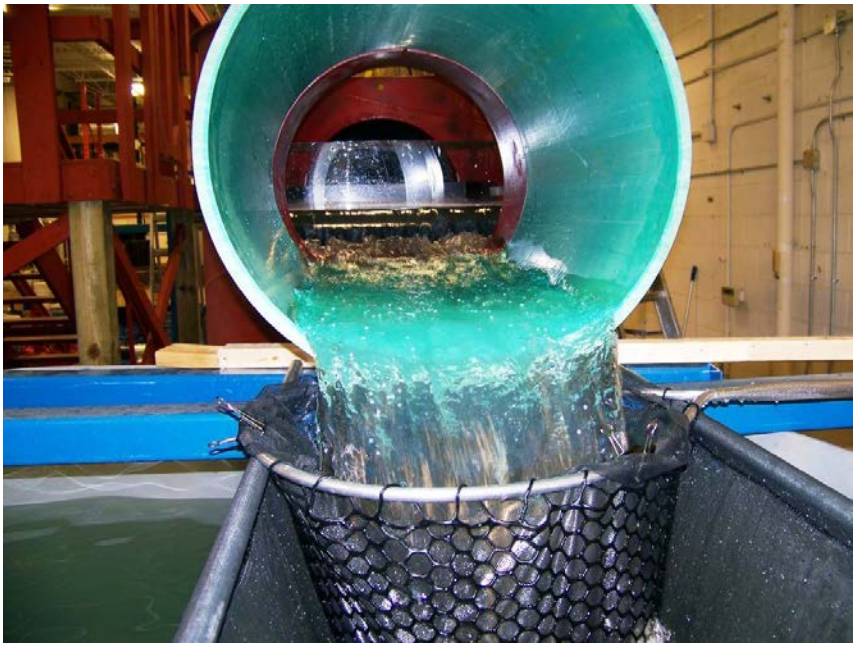


Figure 18 Screening of Scoured LDPE Beads

The flow rates for all five runs were recorded using a data logger, recording at 30 second intervals; the flow data is summarized in **Table 29**. The water temperature for the duration of the test was 74 °F.

Table 29 Light Liquid Re-Entrainment Testing Water Flow Rates

Target Flow Rate gpm	Actual Flow (gpm)			COV	QA/QC Compliance (COV < 0.03 and avg. ± 10% of target)
	Min	Max	Average		
78.8	77.3	83.8	80.1	0.022	Pass
157.5	153.8	158.3	155.9	0.010	Pass
236.7	236.5	239.6	237.9	0.004	Pass
315.0	313.9	318.7	316.0	0.004	Pass
393.8	390.2	396.1	392.5	0.005	Pass

The recovered scoured beads were dried to constant weight. **Table 30** summarizes the amount of beads scoured and captured at each flow rate. For flow rates up to the designed MTFR (315 gpm), the SciClone™ had retained 98.7% of the added LDPE beads. At 125% of the MTFR, the SciClone™ retained 89.1% of the LDPE beads.

Table 30 Amount of Scoured Beads Based on Flow Rate

Target Flow Rate (GPM)	Amount of Scoured Beads					
	Mass		Volume *		% of Total Beads Scoured	Cumulative %
	g	lbs	L	gal		
78.8	0.44	0.0010	0.0008	0.0002	0.001	0.001
157.5	0.23	0.0005	0.0004	0.0001	0.001	0.002
236.7	131.86	0.2907	0.2352	0.0621	0.403	0.405
315.0	300.38	0.6622	0.5357	0.1415	0.918	1.323
393.8	3144.62	6.9327	5.6080	1.4815	9.608	10.930
Total	3577.53	7.8871	6.3880	1.6854	10.930	

* Determined from bead bulk density

6. Maintenance Plans

As with all stormwater BMPs inspection and maintenance on the SciClone™ Hydrodynamic Separator is necessary. Stormwater regulations require that all BMPs be inspected and maintained to ensure they are operating as designed to allow for effective pollutant removal and provide protection to receiving water bodies. It is recommended that inspections be performed multiple times during the first year to assess site specific loading conditions. This is recommended because pollutant loading can vary greatly from site to site. Variables such as nearby soil erosion or construction sites, winter sanding of roads, amount of daily traffic and land use can increase pollutant loading on the system. The first year of inspections can be used to set inspection and maintenance intervals for subsequent years. Without appropriate maintenance, a BMP can exceed its storage capacity which can negatively affect its continued performance in removing and retaining captured pollutants. The SciClone™ Operation & Maintenance Manual is available at: http://www.biocleanenvironmental.com

Inspection Equipment

Following is a list of equipment to allow for simple and effective inspection of the SciClone™ Hydrodynamic Separator:

- Bio Clean Environmental Inspection Form (contained in O&M Manual).
- Flashlight.
- Manhole hook or appropriate tools to access hatches and covers.
- Appropriate traffic control signage and procedures.
- Measuring pole and/or tape measure.
- Protective clothing and eye protection.
- Note: entering a confined space requires appropriate safety and certification. It is generally not required for routine inspections of the system.

Inspection Steps

The core to any successful stormwater BMP maintenance program is routine inspections. The inspection steps required on the SciClone™ Hydrodynamic Separator are quick and easy. As mentioned above, the first year should be seen as the maintenance interval establishment phase. During the first year more frequent inspections should occur in order to gather loading data and maintenance requirements for that specific site. This information can be used to establish a base for long-term inspection and maintenance interval requirements.

The SciClone™ Separator can be inspected though visual observation without entry into the system. All necessary pre-inspection steps must be carried out before inspection occurs, especially traffic control and other safety measures to protect the inspector and near-by pedestrians from any dangers associated with an open access hatch or manhole. Once these access covers have been safely opened the inspection process can proceed:

- Prepare the inspection form by writing in the necessary information including project name, location, date & time, unit number and other info (see inspection form).

- Observe the inside of the system through the access hatches. If minimal light is available and vision into the unit is impaired utilize a flashlight to see inside the system.
- Look for any out of the ordinary obstructions in the inflow pipe, sump chamber, or outflow pipe. Write down any observations on the inspection form.
- Through observation and/or digital photographs estimate the amount of floatable debris accumulated on the influent side of the oil/floatables skimmer. Record this information on the inspection form. Next utilizing a tape measure or measuring stick estimate the amount of sediment accumulated in the sump. Record this depth on the inspection form.
- Finalize inspection report for analysis by the maintenance manager to determine if maintenance is required.

Maintenance Indicators

Based upon observations made during inspection, maintenance of the system may be required based on the following indicators:

- Missing or damaged internal components.
- Obstructions in the system or its inlet or outlet.
- Excessive accumulation of floatable in the sump chambers in which the length and width of the chambers behind oil/floatables skimmer is fully impacted extending down more than 9".
- Excessive accumulation of sediment in the sump chamber of more than 18" in depth.

Maintenance Equipment

It is recommended that a vacuum truck be utilized to minimize the time required to maintain the SciClone™ Separator:

- Bio Clean Environmental Maintenance Form (contained in O&M Manual).
- Flashlight.
- Manhole hook or appropriate tools to access hatches and covers.
- Appropriate traffic control signage and procedures.
- Protective clothing and eye protection.
- Note: entering a confined space requires appropriate safety and certification. It is generally not required for routine maintenance of the system.
- Vacuum truck (with pressure washer attachment preferred).

Maintenance Procedures

It is recommended that maintenance occurs at least three days after the most recent rain event to allow for drain down of any associated upstream detention systems. Maintaining the system while flows are still entering it will increase the time and complexity required for maintenance. Cleaning of the sump chamber can be performed from the finish surface without entry into the vault utilizing a vacuum truck. Once all safety measures have been set up cleaning of the sump chamber can proceed as follows:

- Using an extension on a vacuum truck position the hose over the opened access hatch and lower into the center of the sump chamber on the inlet side of the oil/floatables

skimmer. Remove all floating debris, standing water and sediment from the sump chamber. Access to the bottom of the sump chamber is unimpeded. The vac hose can be moved from side-to-side to fully remove sediments at the corners. A power washer can be used to assist if sediments have become hardened and stuck to the walls or the floor of the chamber. Repeat the same procedure on the effluent side of the oil/floatables skimmer to remove any remaining sediment. This completes the maintenance procedure required on the sump chamber and the SciClone™ Separator.

- The last step is to close and replace all access hatches and remove all traffic control.
- All removed debris and pollutants shall be disposed of following local and state requirements.
- Disposal requirements for recovered pollutants and spent cartridges may vary depending on local guidelines. In most areas the sediment, once dewatered, can be disposed of in a sanitary landfill. It is not anticipated that the sediment would be classified as hazardous waste.
- In the case of damaged components, replacement parts can be ordered by the manufacturer.

7. Scaling

Based on the test results of the SciClone™ Hydrodynamic Separator (model SC-4), the capacity of other model sizes has been determined based on a standard ratio of MTFR to effective treatment area.

Table 31 Scaling of SciClone™ Models

Model #	Diameter (ft)	Maximum Treatment Flow Rate[1] (cfs)	Surface Area (sq ft)	Storage Capacity (cu ft)
SC-3	3	0.39	7.1	11
SC-4	4	0.70	12.6	19
SC-5	5	1.09	19.6	29
SC-6	6	1.57	28.3	42
SC-7	7	2.14	38.5	58
SC-8	8	2.80	50.2	75
SC-9	9	3.54	63.6	95
SC-10	10	4.37	78.5	118
SC-11	11	5.29	95.0	142
SC-12	12	6.30	113.0	170
SC-13	13	7.39	132.7	199
SC-14	14	8.57	153.9	231

[1]Based on a verified loading rate of 25 gpm/ft^2 for sediment with a mean particle size of 112 µm and an annualized weighted TSS removal of at least 80% using the method specified in the current NJDEP HDS protocol.

8. Statements

The following attached pages are signed statements from the manufacturer (Bio Clean Environmental), the independent testing lab (Good Harbour Labs), and NJCAT. These statements are included to document that the requirements of the New Jersey Department of Environmental Protection Laboratory Protocol to Assess Total Suspended Solids Removal by a Hydrodynamic Sedimentation Manufactured Treatment Device (January 25, 2013) were followed with the exceptions as noted.

Bio Clean

A Forterra Company

Date: 7/7/2017

To Whom It May Concern,

We are providing this letter as our statement certifying that the protocol titled “New Jersey Department of Environmental Protection Laboratory Protocol to Assess Total Suspended Solids Removal by a Hydrodynamic Sedimentation Manufactured Treatment Device” (NJDEP HDS Protocol, January 2013) has been strictly followed with these exceptions. A larger particle size distribution (PSD) was used having a mean of 112 microns (d50) which replicates an OK110 PSD. A light liquid retention test was added to test the system’s ability to retain hydrocarbons

With exception of the above deviations, we certify that all requirements and criteria were met and/or exceeded during testing of the SciClone™ Hydrodynamic Separator.

If you have any questions please contact us at your convenience.

Sincerely,

Zachariha J. Kent
Director of Research & Development
Bio Clean, a Forterra Company.

Signature: Zack Kent Date: 7/7/2017

July 7, 2017

Dr. Greg Williams, Managing Director
Good Harbour Laboratories Ltd.
2596 Dunwin Dr., Mississauga, ON

Dr. Richard Magee
Executive Director,
New Jersey Corporation for Advancement of Technology

RE: Third party testing of the SciClone using Agsco 110

Dear Dr. Magee,

This purpose of this letter is to confirm that all of the testing described in the report **SciClone™ Hydrodynamic Separator - Performance Verification of Sediment Capture and Light Liquid Retention** (July 2017) was conducted at the Good Harbour Laboratories (GHL) facility in Mississauga, Ontario, in May and June of 2017.

The sediment and plastic beads used were delivered directly to GHL and were under our control at all times. Prior to testing we confirmed that the instrumentation being used was calibrated and in good working order. Testing was done and log books were maintained as required by our ISO 9001:2008 certification. GHL staff verified all sample bottle labels and confirmed the chains of custody for all samples sent to Maxxam.

After the testing was completed GHL wrote the test report, except for the sections not related to performance testing, and separately reviewed all of the data, calculations and conclusions contained in the report. I can confirm that the report accurately represents what we observed. Furthermore, we have retained copies of the background data, analytical reports and calibration certificates, as well as the calculations, in an independent and secure location on the GHL server. This supporting information is available to you upon request.

Sincerely,

Greg Williams

Greg Williams, Ph.D., P.Eng.

CC: Zach Kent, Bio Clean Environmental Services Inc.

Good Harbour Laboratories
T: 905.696.7276 | F: 905.696.7279
A: 2596 Dunwin Drive, Mississauga, ON L5L 1J5
www.goodharbourlabs.com

July 7, 2017

Dr. Richard Magee, ScD., P.E., BCEE
Executive Director
New Jersey Corporation for Advanced Technology (NJCAT)

Re: Performance Verification of the Bio Clean Environmental Services SciCLone HDS using Agsco 110

Dear Dr. Magee,

Good Harbour Laboratories was contracted by Bio Clean Environmental Servicers to test the performance of their SciClone using a coarser material than that specified by the New Jersey Department of Environmental Protection (NJDEP) Laboratory Protocol to Assess Total Suspended Solids Removal by a Hydrodynamic Sedimentation Manufactured Treatment Device (January, 2013). While the testing was not intended for submission to NJDEP the intent was to follow best practices for independent verification of the results.

Good Harbour Laboratories (GHL), a wholly owned subsidiary of Monteco Ltd., is an independent hydraulic test facility located in Mississauga, Ontario, Canada. GHL provides testing and verification services for numerous water treatment technologies including stormwater treatment devices. GHL has had several different stormwater equipment manufacturers as clients and we have accumulated considerable experience in testing these devices. In order to be able to make this experience available to as many potential clients as possible, GHL is careful to maintain its position as an independent service provider.

With the above in mind I, the undersigned, on behalf of GHL and Monteco, confirm:

-that I do not have any conflict of interest in connection to the contracted testing. Potential conflict of interest may arise in particular as a result of economic interests, political or national affinities, family or emotional ties, or any other relevant connection or shared interest;

-that I will inform NJCAT, without delay, of any situation constituting a conflict of interest or potentially giving rise to a conflict of interest;

Good Harbour Laboratories
T: 905.696.7276 | F: 905.696.7279
A: 2596 Dunwin Drive, Mississauga, ON L5L 1J5
www.goodharbourlabs.com

-that I have not granted, sought, attempted to obtain or accepted and will not grant, seek, attempt to obtain, or accept any advantage, financial or in kind, to or from any party whatsoever, constituting an illegal or corrupt practice, either directly or indirectly, as an incentive or reward relating to the award of the contract.

Sincerely,

Date

Greg Williams

July 7/17

Dr. Greg Williams, P.Eng.
Managing Director
Good Harbour Laboratories

CC: Zach Kent, Bio Clean Environmental Services

Good Harbour Laboratories
T: 905.696.7276 | F: 905.696.7279
A: 2596 Dunwin Drive, Mississauga, ON L5L 1J5
www.goodharbourlabs.com

Center for Environmental Systems
Stevens Institute of Technology
One Castle Point
Hoboken, NJ 07030-0000

August 20, 2017

Mr. Zach J. Kent
VP of Product Development & Regulatory Compliance
Bio Clean Environmental Services Inc.
398 Via El Centro
Oceanside, CA 92058

Dear Mr. Kent,

Based on my review, evaluation and assessment of the testing on the SciClone™ Hydrodynamic Separator (Model SC-4) conducted by Good Harbour Laboratories, Ltd., Mississauga, Ontario, Canada, the test protocol requirements contained in the *"New Jersey Laboratory Testing Protocol to Assess Total Suspended Solids Removal by a Hydrodynamic Sedimentation Manufactured Treatment Device"* (NJDEP HDS Protocol) were met with two exceptions. The deviations from the protocol were: 1) the use of a coarser test sediment, and 2) the addition of a light liquid entrainment test.

Test Sediment Feed -The mean PSD of the test sediment utilized for removal efficiency testing was significantly coarser than the PSD criteria established by the NJDEP HDS protocol (112 µm vs 75 µm).

Removal Efficiency Testing – The New Jersey annualized weighted TSS removal efficiency was calculated to be 80.6% at an MTFR of 0.70 cfs for the coarser sediment.

Scour Testing – Scour testing was conducted with the NJDEP scour test sediment PSD requirement met, at a flow rate meeting the 200% MTFR requirement. The results qualified the SciClone™ Hydrodynamic Separator for online installation.

All other criteria and requirements of the NJDEP protocol were met. These include: flow rate measurements COV <0.03; test sediment influent concentration COV <0.10; test sediment influent

concentration within 10% of the targeted value of 200 mg/L; influent background concentrations <20 mg/L; water temperature <80 ^{o}F; and adjusted scour effluent concentration <20 mg/L.

An additional test, based on the Canadian Environmental Technology Verification (CETV) *Procedure for Laboratory Testing of Oil-Grit Separators, June 6, 2014 – Version 3.0*, was conducted to demonstrate the light liquid retention capability of the SciClone™ Hydrodynamic Separator.

Sincerely,



Richard S. Magee, Sc.D., P.E., BCEE
Executive Director

9. References

1. NJDEP 2013. New Jersey Department of Environmental Protection Procedure for Obtaining Verification of a Stormwater Manufactured Treatment Device from New Jersey Corporation for Advanced Technology. January 25, 2013.

2. NJDEP 2013. New Jersey Department of Environmental Protection Laboratory Protocol to Assess Total Suspended Solids Removal by a Hydrodynamic Sedimentation Manufactured Treatment Device. January 25, 2013.

3. Canadian Environmental Technology Verification Program (CETV) Procedure for Laboratory Testing of Oil-Grit Separators, June 6, 2014 – Version 3.0.

4. GHL Laboratory Notebook: A016, pp. 59 – 125.

SECTION 5 – LONG TERM OPERATION & MAINTENANCE

LONG-TERM STORMWATER OPERATION & MAINTENANCE PLAN

HERB CHAMBERS OF SUDBURY, INC.

141 BOSTON POST ROAD
SUDBURY, MA 01776

November 15, 2021
Revised February 14, 2022

PROJECT OVERVIEW:

The proposed project consists of the construction of a new Mercedes of Sudbury dealership at 141 Boston Post Road in Sudbury, MA. The proposed scope includes renovating and converting the existing two-story health club facility (formerly Bosse Sports) into a new automobile dealership for the sales and display of new vehicles as well as vehicle service. Site renovations include reconfigured parking for employees, customers and vehicle inventory storage, as well as upgrades to stormwater management systems, utilities and landscaping. The project has been designed to comply with the Massachusetts Stormwater Management Regulations as well as the Town of Sudbury Stormwater Management Bylaws.

Appended to this document is a sample maintenance form and a chart describing the anticipated frequency of tasks.

OWNER AND RESPONSIBLE PARTY:

Current Land Owners:
Herb Chambers 43 Braintree Street, LLC.
259 McGrath Highway
Somerville, MA 02145

Proposed Site Contractor:
TBD

For any service beyond the service ability of staff on site for Herb Chambers, there will be subcontracting to the appropriate vendors such as street sweeping, catch basin and water quality unit cleaning, etc.

CONSTRUCTION MANAGEMENT:

A construction manager with adequate knowledge and experience on projects of similar size and scope shall be employed to oversee all site work related construction. The contractor shall incorporate the appropriate techniques to control sediment and erosion pollution during

construction in accordance with the *Massachusetts Erosion and Sediment Control Guidelines for Urban and Suburban Areas* and any conditions of approval from the local conservation commission.

Care should be taken when constructing stormwater control structures. Light earth-moving equipment shall be used to excavate in the vicinity of the infiltration areas. Use of heavy equipment causes excessive compaction of the soils beneath the basin resulting in reduced infiltration capacity. At no time shall temporary infiltration areas or settling basins be constructed in the vicinity of the proposed infiltration basins in order to prevent the soils from becoming clogged with sediment.

ON-GOING MAINTENANCE CONTRACT

The non-structural and structural approaches recommended below, as well as the required BMP maintenance, will be completed by the selected contractor. Adequate personnel with appropriate training and access to proper equipment will be available to complete the tasks. Future responsible parties must be notified of their responsibility to operate and maintain the system in perpetuity.

MAINTENANCE LOG

The Responsible Party shall develop and maintain a log of inspections, maintenance, repairs, and disposal (including location of disposal) during the life of the project. Records will be maintained for at least 3 years and be made available to the Massachusetts Department of Environmental Protection or the Town of Sudbury in accordance with the provisions of the Massachusetts Stormwater Handbook. A sample of such a maintenance log is provided.

STORMWATER BMP MAINTENANCE

The proposed stormwater management system has been designed with appropriate BMPs aimed at reducing the pollutants discharge based upon the intended use of the property. All BMPs require regular maintenance to function as intended. Some management measures have simple maintenance requirements; others are more involved. The Responsible Party must have all BMPs regularly inspected to ensure they are operating properly on an as needed basis, including during runoff events exceeding 0.5 inches of rainfall.

A description of the non-structural and structural approaches to be incorporated is indicated below. The following best management practices are proposed to be incorporated into the stormwater management design to reduce source runoff and improve stormwater runoff discharge quality. The Responsible Party will regularly inspect all BMPs to ensure they are operating properly. If any deficiencies are identified during these inspections, action to resolve it will be initiated and documented on the maintenance log.

STRUCTURAL BMPs

Deep Sump Hooded Catch Basins and Area/Yard Drains

On a regular basis the inlet pipe and outlet pipe shall be checked for debris and removed as necessary to ensure unobstructed flow of water. Inspections shall occur at least four times per year, and at the end of the foliage and snow removal seasons. Inspections shall verify the tees are secure and free flowing. Sediments must also be removed 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. Basins shall be cleaned using a vacuum pump. All liquid shall be pumped from the sump of each basin at least once per year. All sediments and hydrocarbons should be properly handled and disposed of in accordance with local, state and federal guidelines and regulations.

Oil/Grit Separators

At a minimum, oil grit separators should be inspected monthly and sediment, trash and pollutants shall be cleaned out at least twice per year. In areas of high sediment loading, inspect and clean inlets and outlets after every major storm. Basins shall be cleaned using a vacuum pump. All sediments and hydrocarbons should be properly handled and disposed of in accordance with local, state and federal guidelines and regulations.

Subsurface Infiltration System

The subsurface system (retain-it, 3.0' tall) has been designed with an access manhole to aid in the removal of sediment and debris. Preventative maintenance shall be performed in accordance with manufacturer's instructions, which is enclosed in this section. Retain-it suggests periodic inspections with a greater number occurring during the systems start-up to identify any issues of concern as they may arise. Cleaning will take place at the completion of construction and as deemed necessary based on the inspections. Retain-it recommends use of a vacuum truck to suction the accumulated sediment, oils and greases, and trash and debris from the system. Oils and greases may additionally be handled by on-site staff utilizing absorbent products to soak up the oils. Refer to the enclosed "retain-it Owners Maintenance Manual."

Proprietary Water Quality Units

Hydrodynamic Separators shall be maintained in accordance with the manufacturer's recommendations. Refer to the enclosed "SciClone Operation & Maintenance" guide. Typically, a vacuum truck removes accumulated sediment and oil most efficiently. See maintenance documentation from the manufacturer. Inspection should occur at least twice annually, once in the fall and then in the spring after the snow melts. Ideally the unit should be checked frequently throughout the first year, and that will dictate the

schedule going forward. All sediment and hydrocarbons should be properly handled and disposed of in accordance with local, state and federal guidelines and regulations. Cleaning will take place at the completion of construction and as deemed necessary based on the inspections and manufacturer's requirements.

NON-STRUCTURAL BMPs

Porous Pavement

Porous pavement sections on site shall be monitored annually and following any storms to ensure proper drainage and note any deterioration. Maintenance of the porous asphalt is performed four (4) times per year using a regenerative air vacuum truck that picks up large particles such as leaves and debris, as well as smaller particles such as sand and sediments. Exfiltration capability shall be assessed minimum once a year and as needed if capacity is found to decline. If ponding water is observed during precipitation cleaning is recommended. Signage will be installed to clearly demarcate the limits of the porous surface. Snow removal protocols for the porous surface is discussed in more detail, below.

Constructed Stormwater Wetland

The existing stormwater wetland (detention basin) should be inspected at least once per year to ensure that the basin is operating as intended. Inspections conducted at intervals during and after the storm will help to determine if the basin is meeting the expected detention times. The outlet structure should be inspected for evidence of clogging or outflow release velocities that are greater than the 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. Any necessary repairs should be made immediately. During inspections, changes to the detention basin or the contributing watershed should be noted, as these may effect basin performance.

- The upper-stage, side slopes, embankment, and emergency spillway should be mowed at least twice per year. Trash and debris should also be removed at this time.
- Sediment should be removed from the basin as necessary, and at least once every 5 years.

Grass Conveyance Swale

Inspect grass swale the first few months after construction to make sure that there is no rilling or gullying, and that vegetation in the swale is adequate. Thereafter, inspect twice a year for slope integrity, soil moisture, vegetative health, soil stability, soil compaction, soil erosion, ponding, and sediment accumulation. Regular maintenance tasks include

mowing, fertilizing, liming, watering, pruning, weeding and pest control. Mow the swale at least once per year. Do not cut the grass shorter than three to four inches. Keep grass height under 6 inches to maintain the design depth necessary to serve as conveyance. Do not mow excessively, because it may increase the design flow velocity. Remove sediment and debris manually at least once per year. Re seed periodically to maintain the dense growth of grass vegetation. Take care to protect grass swale from snow removal procedures and off-street parking.

Stone Trench

Inspect stone trench after the first several rainfall events, after all major storms and on regularly scheduled dates every 6 months. Inspect the trench 24 hours or several days after a rain event to look for ponded water. If there is ponded water at the surface of the trench, it is likely that the trench is clogged. To address surface clogging, remove and replace the topsoil or first layer of stone aggregate and the filter fabric. If the water is ponded inside the trench, it may indicate that the bottom of the trench has failed. To rehabilitate a failed trench, all accumulated sediment must be stripped from the bottom., the bottom of the trench must be scarified and tilled to induce infiltration, and all of the stone aggregate and filter fabric or media must be removed and replaced.

Pavement Sweeping

As street sweeping is a BMP under DEP guidelines, this non-structural BMP is an effective removal of Total Suspended Solids (TSS) in a comprehensive stormwater management program. Litter and debris are to be regularly picked up and removed from the pavement and porous pavers. Paved areas are to be swept a minimum of quarterly per year.

Pervious Areas and Slopes

Runoff from pervious areas and slopes shall be directed over vegetated areas to promote settlement of suspended solids before entering a wetland or resource area. Steep pervious slopes will be permanently vegetated to dissipate energy and reduce potential erosion. No constructed vegetated slopes should exceed 2H:1V. Slopes exceeding 2:1 shall be stabilized with rip-rap, jute netting or other similar measures to minimize the potential for future erosion.

Drainage Control Structures, Flared End Sections, Trash Racks, Riprap Pads, Swales, and Level Spreader Splash Pads

Basin control structures and flared end sections shall be inspected and any debris or growth surrounding or within these structures shall be removed. Any/all debris or vegetation encroaching on the control structures our outfall components shall be removed or appropriately trimmed back to maintain the designed control elevation and flow patterns/cross section without impediment. Inspection should occur twice

annually, once in the fall and then in the spring after the snow melts. Cleaning will take place at the completion of construction and as deemed necessary based on the inspections and manufacturer's requirements.

Pest and Insect Control

- As a first-line defense against pests/insects and weeds (the "First-Line Defense"), the party responsible for maintenance shall avoid the use of non-organic pesticides, herbicides, fungicides and insecticides unless spot treatment is required for a specific control application. The owner shall not be required to undertake extraordinary measures or incur unreasonable cost to locate, purchase or apply non-organic products.

- If the First-Line Defense fails, as determined by the owner or party responsible for maintenance, in its sole but reasonable discretion, non-organic approaches to pest/insect control may be used, the same to be applied by a professional licensed in the Commonwealth of Massachusetts, where required. But in no event shall such non-organic approaches be used within the 100ft. buffer zone to the wetlands, unless approved by the Sudbury Conservation Commission.

Waste Management

Solid waste and recycling will be contained in dumpsters for routine and regular trash pickup. The maintenance staff is directed to place their trash and recyclables in the appropriate bins at the trash/recycling facility provided on site.

Snow Removal

Snow removal is handled by Herb Chambers own in-house facility maintenance personnel. The drive aisles are plowed to maintain access through the site and around the building. The Chambers team will tightly arrange the vehicles together in one part of the lot, then plow the open section of the lot toward the islands, then move the cars back into their spaces and plow the remainder. The Chambers team anticipates they can typically handle between 1 to 1.5 feet of snow accumulation before having to switch to hauling off site. The chambers team will contract to have the snow hauled from the site.

Snow on porous asphalt can be plowed the same as standard pavement, however, sunshine acts quickly to melt snow and ice sooner than on frozen standard pavement, and the melting snow infiltrates from the surface directly through the open graded porous asphalt to the stone subbase, which significantly reduces the potential for black ice. UNH (the region's experts on permeable pavement specifications and maintenance) advises to use an anti-icing treatment on the permeable pavement surface (typically a brine solution which reduces the freezing point of water) prior to storms. Salt brine is typically a 23% salt/water mixture that can be applied to the surface which prevents

snow and ice from bonding, and accumulated snow can be easily removed down to the pavement. Sand application is not recommended and should be avoided if possible because it will increase the need for vacuuming and reduce the efficiency of the pavement due to clogging.

The On-Site Property Manager, who will be responsible for implementing the Stormwater Management Operations and Maintenance Plan and posted signage, will ensure that snowplow operators on this property apply the proper anti-icing treatment and do not apply sand as part of the winter maintenance. The on-site snow removal will be performed by employees of Herb Chambers and the same team members will oversee and perform snow removal from storm-to-storm, ensuring a consistent treatment of the porous pavement using anti-icing techniques. No outside contractors will be used to plow or perform anti-icing on site. The only outside contractors during a snow removal event will be those hired to conduct the snow hauling in large storm events. The snow will be loaded on to all hauling trucks by The Chambers Team. This site will use consistent anti-icing techniques throughout the site to ensure no salt or sand will be applied on this site or within the proximity of the porous pavement.

Hazardous Waste and Spill Control Containment

In the event of a discharge or spill of oil or another hazardous material, outlets to stormwater management facilities immediately downstream of the spill shall be plugged so that hazardous materials do not enter the system. In the event of a discharge of oil or other hazardous material, responsible facility personnel shall notify the appropriate state agencies, the Town of Sudbury DPW and the EPA National Response Center 1-800-424-8802 shall be notified. All hazardous waste materials will be disposed of in a manner specified by local, state and/or federal regulations and by the manufacturer of such products.

Activities Prohibited on Site

The use of sand and de-icing chemicals for this site is prohibited. Any exterior/outdoor vehicle servicing, equipment cleaning, or vehicle washing of any kind on the subject property is prohibited. Also refer to the Order of Conditions by the Conservation Commission and Planning Board Decision(s), as all general and special conditions post-construction must be followed in perpetuity, once issued.

Stormwater BMP Inspection and Maintenance Log

Facility Name	
Address	
Begin Date	End Date

Date	BMP ID#	BMP Description	Inspected by:	Cause for Inspection	Exceptions Noted	Comments and Actions Taken

Instructions: Record all inspections and maintenance for all treatment BMPs on this form. Use additional log sheets and/or attach extended comments or documentation as necessary. Submit a copy of the completed log with the annual independent inspectors' report to the municipality and start a new log at that time.

BMP ID# — Always use ID# from the Operation and Maintenance Manual.

Inspected by — Note all inspections and maintenance on this form, including the required independent annual inspection.

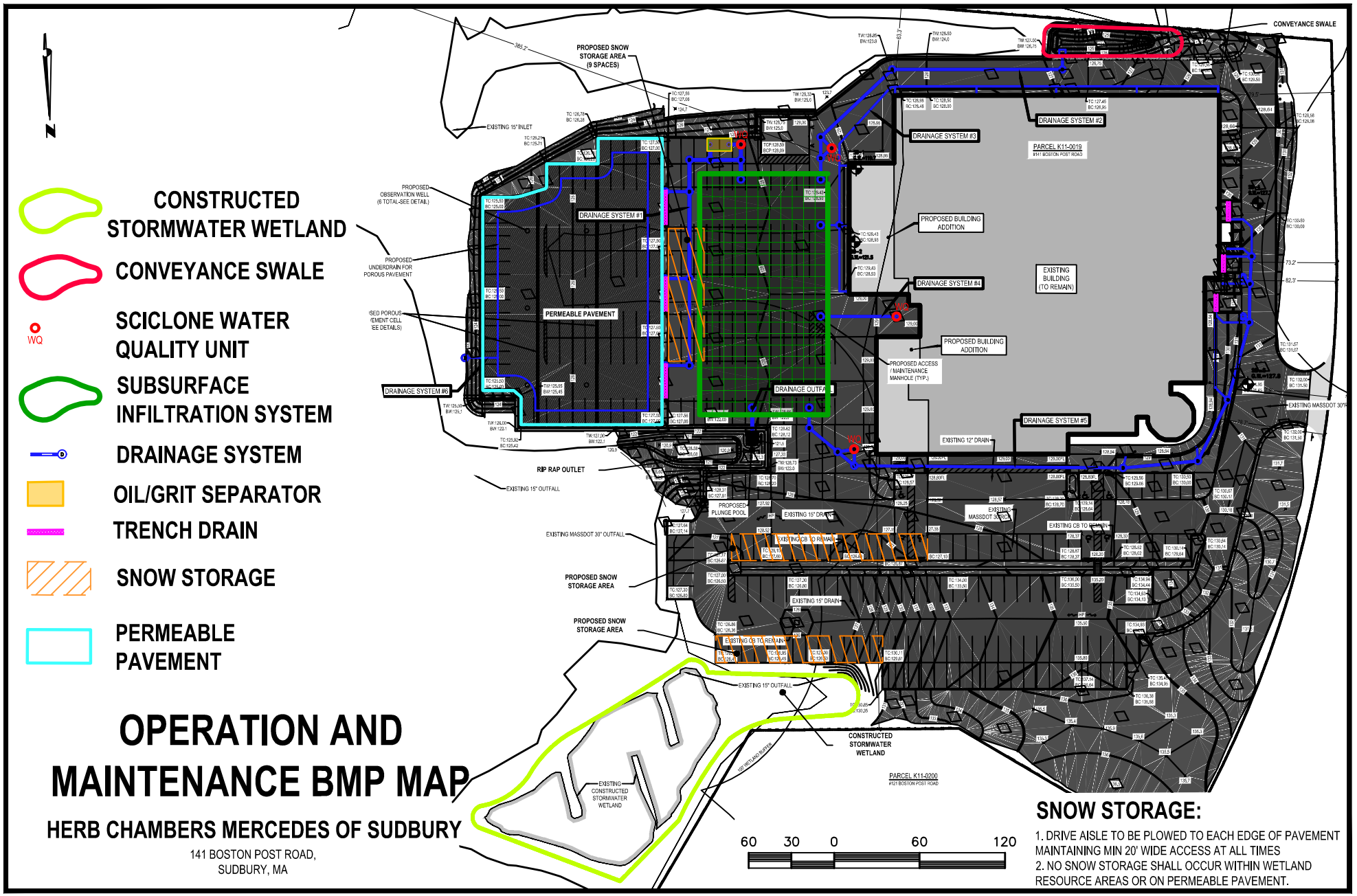
Cause for inspection — Note if the inspection is routine, pre-rainy-season, post-storm, annual, or in response to a noted problem or complaint.

Exceptions noted — Note any condition that requires correction or indicates a need for maintenance.

Comments and actions taken — Describe any maintenance done and need for follow-up.

Stormwater BMP Inspection Matrix

Conventional & LID Best Management Practices	**Inspection & Maint. Frequency**	**Erosion& Scour**	**Obstructions**	**Trash & Debris**	**Sediment Build-Up Removal**	**Vegetation Cover**	**Remove/Reset Filter Fabric & Stone As Required**	**Vac Truck Sediment & Contaminants**	**Remove/Reset Riprap as Required**
Catch Basins/Area & Yard Drains	Four times per year								
Pavement Sweeping	Four times per year								
Oil Grit Separators	Monthly								
Proprietary Water Quality Units	Twice-Annually (Spring and Fall)								
Subsurface Detention Structure	Annually								
Outlets (FES, Rip Rap Pad, Level Spreaders) Permeable Pavement Vacuuming Grass Swale Constructed Stormwater Wetland Stone Trench	Twice-Annually (Spring and Fall) Four times per year Twice Annually (Spring and Fall) Annually Twice Annually (Spring and Fall)								



OPERATION AND MAINTENANCE BMP MAP

HERB CHAMBERS MERCEDES OF SUDBURY

141 BOSTON POST ROAD,
SUDBURY, MA

SNOW STORAGE:

1. DRIVE AISLE TO BE PLOWED TO EACH EDGE OF PAVEMENT MAINTAINING MIN 20' WIDE ACCESS AT ALL TIMES
2. NO SNOW STORAGE SHALL OCCUR WITHIN WETLAND RESOURCE AREAS OR ON PERMEABLE PAVEMENT.

C:\CDC\Crocker Design Group, LLC\Gabriel Crocker - Projects\100-107 Sudbury - Mercedes\Permitting\Stormwater Report\5- Long-Term Pollution Prevention Plan\Archive\, O&M-MAP.dwg, C-3 LAYOUT OVERALL, Feb 14, 2022 11:45

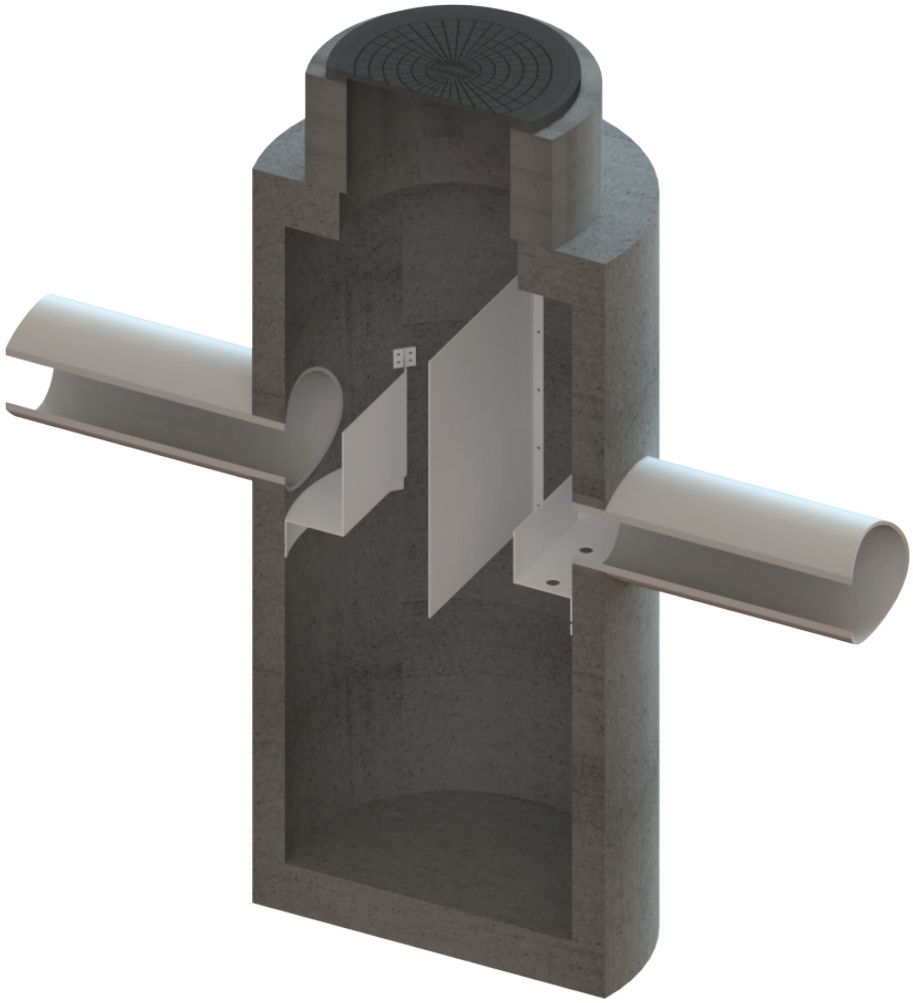
SciCLONE™

Hydrodynamic Separation

Bio Clean

A Forterra Company

OPERATION & MAINTENANCE



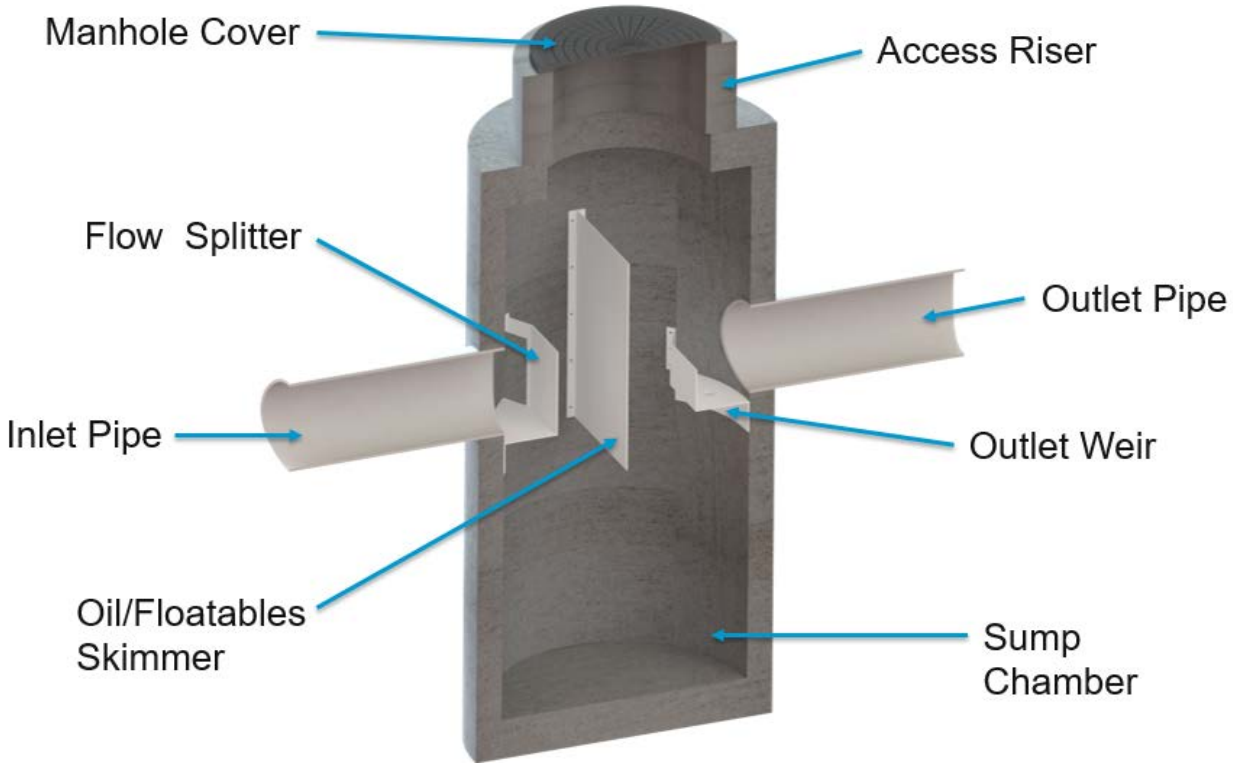
Bio Clean Environmental Services, Inc.
398 Via El Centro
Oceanside, CA 92058

www.BioCleanEnvironmental.com
p: 760.433.7640
f: 760.433.3176

OPERATION & MAINTENANCE

The SciCLONE™ Hydrodynamic Separator is designed to remove high levels of trash, debris, sediments and hydrocarbons. Its efficient design and construction maximize longevity and minimize maintenance requirements. The simple design of the system allows for unimpeded access for quick and easy maintenance. The SciCLONE™ is able to effectively capture and store sediment with no maintenance or loss of treatment capacity for a several years based on annual average loading in most regions.

Yet, as with all stormwater BMPs inspection and maintenance on the SciCLONE™ Hydrodynamic Separator is necessary. Stormwater regulations require that all BMPs be inspected and maintained to ensure they are operating as designed to allow for effective pollutant removal and provide protection to receiving water bodies. It is recommended that inspections be performed multiple times during the first year to assess site-specific loading conditions. This is recommended because pollutant loading can vary greatly from site to site. Variables such as nearby soil erosion or construction sites, winter sanding of roads, amount of daily traffic and land use can increase pollutant loading on the system. The first year of inspections can be used to set inspection and maintenance intervals for subsequent years. Without appropriate maintenance a BMP can exceed its storage capacity which can negatively affect its continued performance in removing and retaining captured pollutants.



System Diagram:

Inspection Equipment

Following is a list of equipment to allow for simple and effective inspection of the SciCLONE™ Separator:

- Bio Clean Environmental Inspection Form (contained within this manual).
- Flashlight.
- Manhole hook or appropriate tools to remove access hatches and covers.
- Appropriate traffic control signage and procedures.
- Measuring pole and/or tape measure.
- Protective clothing and eye protection.
- Note: entering a confined space requires appropriate safety and certification. It is generally not required for routine inspections or maintenance of the system.



Inspection Steps

The core to any successful stormwater BMP maintenance program is routine inspections. The inspection steps required on the SciCLONE™ Separator are quick and easy. As mentioned above the first year should be seen as the maintenance interval establishment phase. During the first year more frequent inspections should occur in order to gather loading data and maintenance requirements for that specific site. This information can be used to establish a base for long-term inspection and maintenance interval requirements.

The SciCLONE™ Separator can be inspected though visual observation without entry into the system. All necessary pre-inspection steps must be carried out before inspection occurs, especially traffic control and other safety measures to protect the inspector and near-by pedestrians from any dangers associated with an open access hatch or manhole. Once these access covers have been safely opened the inspection process can proceed:

- Prepare the inspection form by writing in the necessary information including project name, location, date & time, unit number and other info (see inspection form).
- Observe the inside of the system through the access hatches. If minimal light is available and vision into the unit is impaired utilize a flashlight to see inside the system.
- Look for any out of the ordinary obstructions in the inflow pipe, sump chamber, or outflow pipe. Write down any observations on the inspection form.
- Through observation and/or digital photographs estimate the amount of floatable debris accumulated on the influent side of the oil/floatables skimmer. Record this information on the inspection form. Next utilizing a tape measure or measuring stick estimate the amount of sediment accumulated in the sump. Record this depth on the inspection form.

- Finalize inspection report for analysis by the maintenance manager to determine if maintenance is required.

Maintenance Indicators

Based upon observations made during inspection, maintenance of the system may be required based on the following indicators:

- Missing or damaged internal components.
- Obstructions in the system or its inlet or outlet.
- Excessive accumulation of floatable in the sump chambers in which the length and width of the chambers behind oil/floatables skimmer is fully impacted extending down more than 9".
- Excessive accumulation of sediment in the sump chamber of more than 18" in depth.

Maintenance Equipment

It is recommended that a vacuum truck be utilized to minimize the time required to maintain the SciCLONE™ Separator:

- Bio Clean Environmental Maintenance Form (contained in O&M Manual).
- Flashlight.
- Manhole hook or appropriate tools to access hatches and covers.
- Appropriate traffic control signage and procedures.
- Protective clothing and eye protection.
- Note: entering a confined space requires appropriate safety and certification. It is generally not required for routine maintenance of the system.
- Vacuum truck (with pressure washer attachment preferred).

Maintenance Procedures

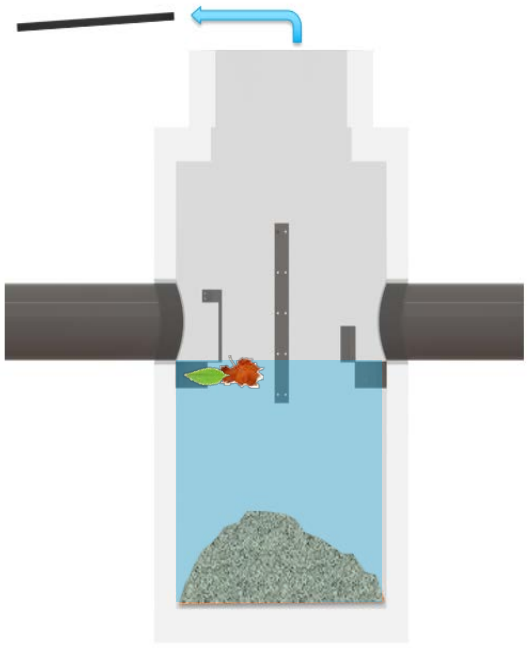
It is recommended that maintenance occurs at least three days after the most recent rain event to allow for drain down of any associated upstream detention systems. Maintaining the system while flows are still entering it will increase the time and complexity required for maintenance. Cleaning of the sump chamber can be performed from finish surface without entry into the vault utilizing a vacuum truck. Once all safety measures have been set up cleaning of the sump chamber can proceed as followed:

- Remove all access hatches (requires traffic control and safety measures to be completed prior).
- Using an extension on a vacuum truck position the hose over the opened access hatch and lower into the center of the sump chamber on the inlet side of the oil/floatables skimmer.

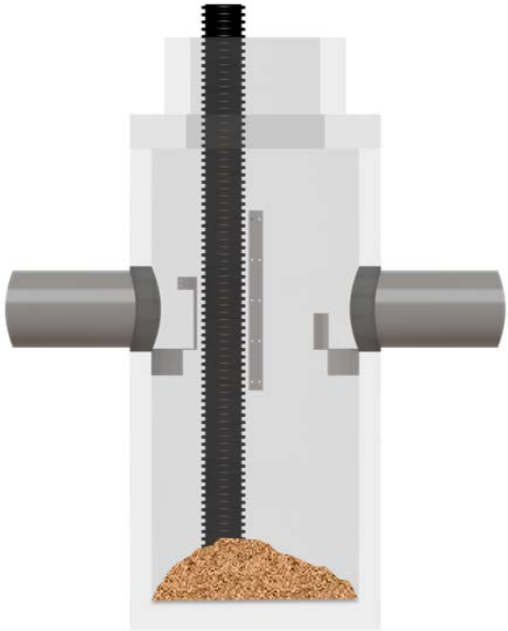
Remove all floating debris, standing water and sediment from the sump chamber. Access to the bottom of the sump chamber is unimpeded. The vac hose can be moved from side-to-side to fully remove sediments at the corners. A power washer can be used to assist if sediments have become hardened and stuck to the walls or the floor of the chamber. Repeat the same procedure on the effluent side of the oil/floatables skimmer to remove any remaining sediment. This completes the maintenance procedure required on the sump chamber and the SciCLONE™ Separator.

- The last step is to close up and replace all access hatches and remove all traffic control.
- All removed debris and pollutants shall be disposed of following local and state requirements.
- Disposal requirements for recovered pollutants may vary depending on local guidelines. In most areas the sediment, once dewatered, can be disposed of in a sanitary landfill. It is not anticipated that the sediment would be classified as hazardous waste.
- In the case of damaged components, replacement parts can be ordered by the manufacture.

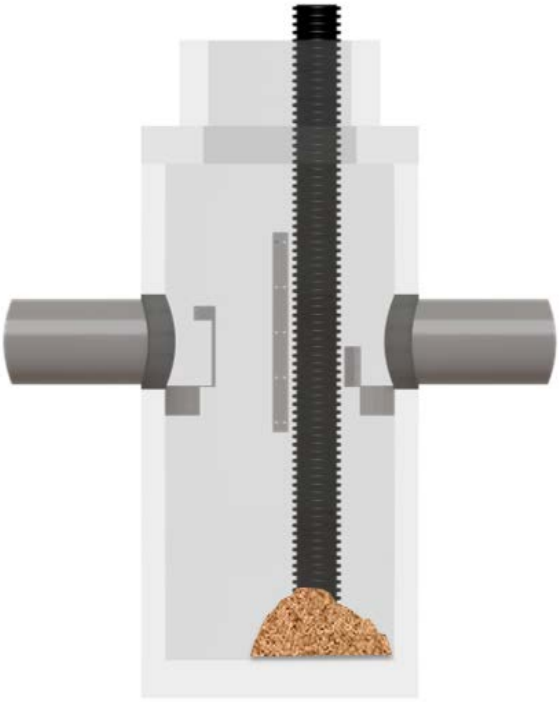
Maintenance Sequence



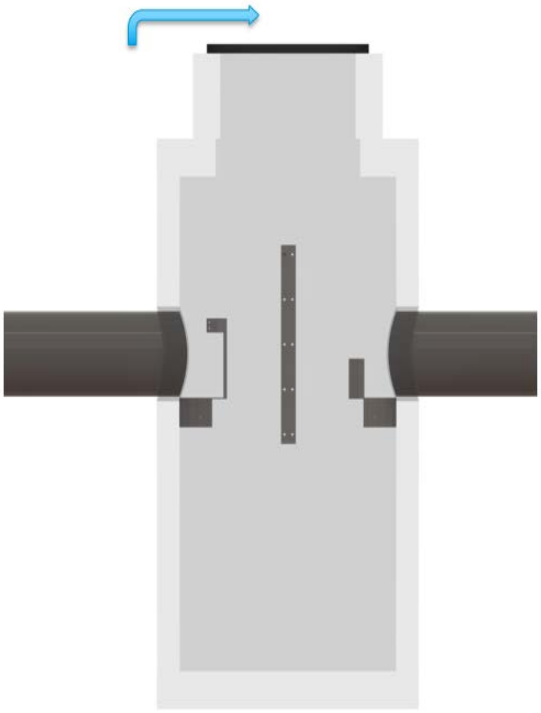
Remove Access Hatches Set Up Vacuum Truck to Clean the Sump Chamber.



Insert Vacuum Hose On the Inlet Side of the Oil/Floatables Skimmer and Vacuum Out All Trash, Sediment and Standing Water.



Insert Vacuum Hose On the Outlet Side of the Oil/Floatables Skimmer and Vacuum Out Any Remaining Sediment.



Replace Access Hatches and Remove Traffic Control and Safety Equipment.

For Maintenance Services or Information Please Contact Us At:
760-433-7640
Or Email: info@biocleanenvironmental.com

Inspection and Maintenance Report
Bio Clean SciCLONE™ Separator

Project Name _____

Project Address _____
(city) (Zip Code)

Owner / Management Company _____

Contact _____ Phone ( ) –

Inspector Name _____ Date ____ / ____ / _____ Time _____ AM / PM

Type of Inspection ☐ Routine ☐ Follow Up ☐ Complaint ☐ Stor Storm Event in Last 72-hours? ☐ No ☐ Yes

Weather Condition _____ Additional Notes _____

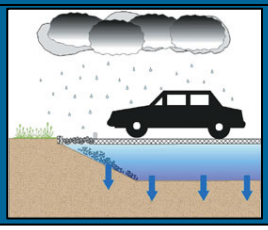
For Office Use Only
(Reviewed By)
(Date)
Office personnel to complete section to the left.

Site Map #	GPS Coordinates of Vault	Model #	Oils and Floatables Accumilation on Inlet Side of Oil/Floatables Skimmers (lbs)	Sediment Accumulation In Sump Chamber (lbs) & Depth (inches)	Structural Notes	Operational Per Manufactures' Specifications (If not, why?)
	Lat: Long:					
	Lat: Long:					
	Lat: Long:					

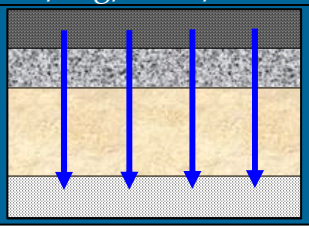
Comments:

Porous Asphalt Pavement for Stormwater Management

The UNH Stormwater Center Web: www.unh.edu/erg/cstev/







Benefits and Uses

Porous Asphalt can be used in replace of traditional stormwater management measures given the proper conditions. Porous Asphalt's primary advantages are:

1. Quantity and Flood Control
2. Water Quality Treatment
3. Recharges Groundwater to Underlying Aquifers
4. Allows for Reduction of Stormwater Infrastructure (Piping, Catch-Basins, Retention Ponds, Curbing, etc.)
5. Suitable for Cold-Climate Applications, Maintains Recharge Capacity When Frozen
6. Allows for Reduced Salt and Sand Usage Due to Low/No Black Ice Development
7. Maintains Traction While Wet
8. Reduced Spray from Traveling Vehicles, Reduced Roadway Noise
9. Extended Pavement Life Due to Well Drained Base and Reduced Freeze-Thaw

Disadvantages

- Requires Routine (Quarterly) Vacuum Sweeping (Vac-Assisted Dry Sweeper Only)
- Proper Construction Stabilization and Erosion Control are Required to Prevent Clogging
- Quality Control for Material Production and Installation are Essential for Success
- Accidental Seal-Coating or Similar Surface Treatment Will Cause Failure

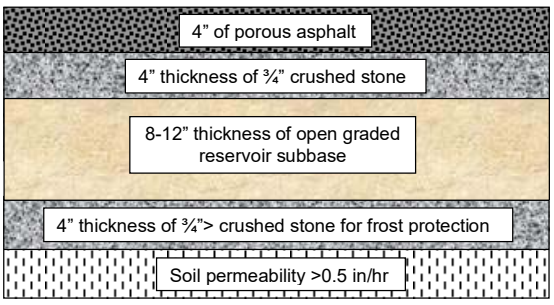
Cost & Maintenance

- Total Project Cost is Comparable for Porous Asphalt with Reduced Stormwater Infrastructure VS. Standard Pavement Applications where Stormwater Infrastructure is Required
- Materials Cost is ~20-25% More Than Traditional Asphalt
- Long-term Maintenance is Required by Routine Quarterly Vacuum Sweeping
- Sweeping Cost May Be Off-set by Reduced Deicing Costs
- Repairs Can be Made with Standard Asphalt Not to Exceed 10% of Surface Area

Design Criteria

- Soil Permeability is Recommended Between 0.25-3.0 Inches Per Hour
- Recommended Drainage Time of 24-48 Hours
- Sub-Drains Should be Used Where Proper Drainage May be an Issue to Minimize Frost Damage
- Most Appropriate for use with Low-Use Roadways and Parking Lots—Without a Modified Asphalt Binder
- 3-5 Feet of Vertical Separation is Needed from Seasonal High Groundwater

TYPICAL POROUS ASPHALT CROSS-SECTION



Additional Resources

- The UNH Stormwater Center, Porous Asphalt Specs - General Porous Bituminous Paving and Groundwater Infiltration Beds, http://www.unh.edu/erg/cstev/
- Federal Highway Administration (2006) Porous Pavement Fact Sheet http://www.fhwa.dot.gov/environment/ultraurb/3fs15.htm
- Ferguson, B. (2005), Porous Pavements, CRC Press.
- Porous Asphalt Pavements (2004) Information Series 131. The National Asphalt Pavement Association, Lanham, MD.

Winter Maintenance Guidelines for Porous Pavements







Maintenance Guidelines

- Road surfaces, porous and non-porous, are commonly not treated and plowed until 2 or more inches of snow accumulation.
- Plow after every storm. If possible plow with a slightly raised blade, while not necessary, this will help prevent pavement scarring.
- Up to ~75% salt reduction for porous asphalt can be achieved. Salt reduction amounts are site specific and are affected by degree of shading.

  USE SALT REDUCTION NUMBERS WITH CAUTION!!!
- Pervious concrete salt reduction will vary and is heavily dependent upon shading. For shaded areas, pervious concrete may not achieve salt reduction.
- Apply anti-icing treatments prior to storms. Anti-icing has the potential to provide the benefit of increased traffic safety at the lowest cost and with less environmental impact.
- Deicing is NOT required for black ice development. Meltwater readily drains through porous surfaces thereby preventing black ice.
- Apply deicing treatments during, and after storms as necessary to control compact snow and ice not removed by plowing.
- Sand application should be limited since its use will increase the need for vacuuming
- Vacuum porous areas a minimum of 2-4 times per year, especially after winter and fall seasons when debris accumulation and deposition is greatest.
- If ponding water is observed during precipitation cleaning is recommended.

Winter Maintenance Challenges

- Mixed precipitation and compact snow or ice is problematic for all paved surfaces, but is particularly problematic for porous surfaces. This is corrected by application of excess deicing chemicals.
- De-icing chemicals work by lowering the freezing point of water. Generally, the longer a de-icing chemical has to react, the greater the amount of melting. Meltwater readily drains through porous surfaces thereby reducing chemical contact time. This is corrected by excess salt application.
- Excess salt application in these instances is offset by the overall reduced salt during routine winter maintenance and salt reduction.

Additional Resources

- The UNH Stormwater Center: http://www.unh.edu/erg/cstev/
- Pennsylvania Asphalt Pavement Association (PAPA) Porous Asphalt Pavements Guide: http://www.pahotmix.org/PDF/porous1.pdf
- National Asphalt Pavement Association (NAPA) Porous Asphalt Pavements for Stormwater Management Revised 11/2008, Information Series 131

retain-it®
Stormwater Management Systems

OWNERS MAINTENANCE MANUAL

retain-it, LLC
560 Salmon Brook Street
Granby, CT 06035
(860) 413-3050

retain-it ®

Owners Maintenance Manual

Table of Contents

Description

Engineering Design Specifications

Daily Operation and Long Term Maintenance
- System Operation
- Periodic Inspection
- Visual Inspection Guide
  - Internal Flow Evaluation
    - Low, Medium and High Flow
  - Pollution Storage Capacities
    - Oil and Grease
    - Sediments
    - Trash and Debris
- Standard Maintenance
- Emergency Spill Conditions

Sample Maintenance Log

Description

retain-it ® is a subsurface Storm Water Management system constructed of precast concrete structures. They are installed in a side by side configuration creating a continuous internal flow channel integrated throughout the system. Systems are constructed with designated inlet and outlet modules, some with multiple inlets and outlets depending on the site storm water system layout. Infiltration systems typically have an inlet and sidewalls/ base constructed on a stone infiltration blanket with geofabric installed at the native soil interface. Other systems incorporate outlet flow control devices. Detention systems are typically lined with a watertight membrane and have inlet and outlet control devices.

The retain-it ® system can consist of multiple varying layouts, with no two the same. Given this, it should be noted that the operation and maintenance requirements are very similar regardless of the intended layout. It is important that the end user know the specific elements of each system so as to understand how best to optimize it's operation.

Installation per Design: Operation is simple to follow where the installation was performed in accordance with the design specifications, drawings and calculations. Specifics shall be identified in the design drawings. As-built drawings will benefit the locating of specific design modules where the system has been buried below a parking lot area. Optional access manholes or removable grates may be installed above every inlet/outlet pipe and at critical design elements designated by the design.

Daily Operation and Long Term Maintenance: In general, daily usage of the system is self sufficient and will operate without requiring any outside assistance, except for periodic inspection to verify optimal performance and maintenance for removal of collected pollutants. A longer term maintenance program should incorporate a more thorough inspection of the all elements of the system to verify proper operating condition. This is more important with the infiltration type of systems where the soil infiltration surface may become restricted due to fine particle build up. Long term maintenance should include provisions for cleaning and removal of collected solids, oils and debris from the system.

System Operation: The system operational function is initiated according to rainfall runoff flows entering the structure. Internally, the runoff flows in a set pattern or sequence throughout the module layout in accordance with the hydraulic design conditions. The flows primarily operate on system head derived from the changes in

elevation from the internal water surface and the outlet invert elevation. Some designs incorporate internal flow controls to satisfy hydraulic conditions that enhance water quality treatment or other intended purposes. Modified systems may incorporate a pump, but in general there are no mechanical apparatus required.

End user operations primarily consist of inspection and maintenance of the system over time.

Periodic Inspection: Important note - All storm water management systems react differently depending on the conditions that are characteristic to the contributing water shed. Variables such as storm intensity, runoff flow rates, site geology, surface stabilization and pollution load will affect the system operation. As does the inspection and maintenance frequency to ensure optimum effectiveness.

Inspections should be done periodically, with a greater number scheduled during the system start up and less frequently as the operator becomes familiar with the system performance characteristics. It is recommended that the end user keep records of the performance using the inspection log record sheet found in the back of this manual. These records shall identify the cycle of maintenance “system calibration” required for the specific applications based on the contributing water shed variables operating under “normal” conditions.

Please note that immediate maintenance may be required during “non-normal” events such as during adverse weather conditions or emergency fuel spills. See information on emergency spills in this manual.

Visual inspection of all assessable components shall be performed throughout the lifetime of the system. Access has been supplied at critical points to monitor hydraulic performance and removed pollutants buildup.

Standard Maintenance:

After construction has been completed and all disturbed surfaces have been stabilized by means of vegetation, asphalt or concrete surfaces, and all drainage system components have been constructed and are free of construction debris and sediments; then the storm water management system can be considered in an operational status.

Periodic visual inspections will help to identify issues of concern.The usual indicators are signs of slow flows, backed up water, visible oil, trash and debris or an excessive amount of sediment in the storage area.

Normal operational flows can be observed to flow freely at the predicted design elevations, from the inlet to the outlet module, following a serpintine path thru the storage and attenuation modules. Note that some modules are designed to permanently

retain water where others may hold water and slowly release it over a typical 24 hour period. During a storm water event, the flows and water surface elevations will fluctuate from a low flow to a high flow/ storage status. The storage modules should fill during the event and drain down within a 24 hour period after the event has stopped. All pipes, orifices, weirs and standpipes should pass flows freely and at optimum capacity.

Standard maintenance is performed using a vacuum truck to suction the accumulated sediments, oils and greases and trash and debris from the system. Whereas an on-site maintenance staff can remove these items by hand, it is preferred that the vacuum truck be used as dictated by specific system conditions. When a specialized module designed to have a permanent water level is used, the vacuum truck should pump the liquid level down to inspect the below water elevation structures and sump storage areas.

Oils and greases can be handled by on-site staff by utilizing absorbent products that soak up the oils (and not) converting the oils from a liquid into a manageable solid form. These oil soaked absorbent materials should be disposed of in an approved manner.

Sediments, trash and debris shall be removed and disposed of in an approved manner.

Any indications of hazardous material, determined by visual inspection, testing, smell or abnormality, should be reported and handled per appropriate regulations.

Flow Conditions

System operators should familiarize themselves with proper hydraulic flow condition indicators, acceptable depths of sedimentation, debris and trash build up, and concentrations of oils and greases.

Hydraulic flow conditions are those that are established by the design as either a flow/storage or as a water quality treatment function. Both have performance characteristics that can be visually identified so as to determine the effective and efficient operation of the system.

The engineering design drawings should note the various expected water surface level elevations that are achieved during different design storms within the various modules. Since it is difficult for a visual inspection to coincide with the exact time given water elevations are predicted, the following guidelines are given for evaluation.

Visual Inspection Guide:

<u>Internal Flow Evaluation</u>

Low flow: water should flow freely from the inlet to the outlet, travelling the intended attenuation path thru the system with the water surface elevation below the structure

beam height (12” deep), the system should drain completely 24 hours after a storm event,

Medium flow: the system should hold and maintain a water level during the 24 hour storm event and yet continually fill as the storm increases or drain downward as the event recedes. Flow within the system should occur freely from inlet to outlet only being restricted when a flow control structure has been integrally designed in place. Flow control devices may result in a water level backing up either temporarily or permanently; noting devices such as water quality modules may require a permanent water level to operate properly (see water quality treatment). Other system applications should drain completely 24 hours after a storm event.

High flow: the system should fill to the maximum design storm water level elevation (hydraulic grade line) per design. In most cases, that is the highest storage elevation available in the system, at the underside of the module top slab, or the invert of the overflow pipe. As the storm event recedes, the water level should begin to drain down via flow thru the system and discharge. The system should drain completely within 24 hours after a storm event.

Pollutant Storage Capacities

<u>Oil and Grease</u>

Oil and Grease Collection (with optional Oil water separator module specified) - Oil and grease accumulation is generally a function related to vehicle parking lot and drive areas, oil generating land uses or emergency spill conditions. It is important to maintain the system from accumulating excessive volumes of oils in that they may wash over into other sections of the system potentially clogging and reducing the infiltration capacity, blocking control devices and contaminating the overall system. The following standards apply.

Oil should not accumulate more than a visible sheen on the water surface in the oil water separation module only. A sheen is described as a fine, thin oil layer on the water surface identified by the glossy rainbow colors. A dipstick (dry wooden stick) can be used as a probe to determine the thickness of oil on the surface.

Accumulated oils could be associated with insufficient maintenance or a potential large volume oil resource. Any accumulation of oil should be promptly maintained by an experienced waste handler. Emergency spills such as those generated by an accidental spill shall be contained and removed immediately before the next storm event. Spills shall be handled in accordance with local environmental regulations. See spill and accumulated oil maintenance procedures.

Sediments

Sediments (with optional primary grit module or sedimentation modules specified) - Sediments shall be periodically removed from the system as they accumulate within the designated storage modules. The inlet modules are generally equipped with a sediment storage sump located in the base of the inlet structure. Inspection should be performed after major storm events or a minimum of annually, unless a different inspection cycle has been determined to be sufficient. Inspection shall consist of using a probe to determine the presence of and depth of the accumulated solids. Access is via the 24" manhole.

Note that excessive volumes of sediments will reduce the performance and efficiency of the system. Regional accumulations of solids such as those associated with ice and snow, may result in large springtime volumes of sand and gravels used for traction and ice control.

Trash and Debris

Trash and Debris (with optional trash and debris module specified) - Trash and debris accumulates in the inlet module in three forms; floating debris, neutrally buoyant, and heavy material. The floating debris is visible from the access manhole floating on the water surface in the form of but not limited to wood, paper, plastic, foam, bottles and cans. The neutrally buoyant material resides below the surface and combines with the natural flow regime of the system. It is hard to detect and can only be recognized when at a high concentration appears as a thickening of the water viscosity. Heavier material will simply settle to the sump base and combine with the sediments.

Note that trash and debris typically cause the most problems when they become lodged in a flow control device such as an outlet elbow, riser pipe, and orifice or weir structure. This can be detected visibly when the system is pumped down during maintenance. It can also be evaluated as a condition when flow is impeded and the water level backs up higher than the design elevations.

Emergency Spill Conditions (with optional emergency spill control module specified):

Emergency spill conditions are defined as an excessive accumulation of hydrocarbons such as oil, gasoline, diesel fuel, transmission oil or antifreeze usually resulting from an accidental discharge. Excessive accumulation is described as any amount larger than a thin "sheen" visible on the water surface.

Care should be given in handling these types of fluids. The incident should be reported to the appropriate authorities and should be mitigated by a hazardous waste consultant approved for such matters.

retain-it ®

Maintenance Log

Storm Water Management System

Location: ID #:

Date	Inspection Notes	Inspector

Note the following conditions:

Inlet Module

Outlet Module

Water Quality Module

Oil Elbow

Oil Accumulation

Sedimentation Accumulation

Trash and Debris Quantity

Flow Conditions

Flow Control Outlet Structure

Overflow Pipe

SECTION 6 – SOILS TESTING DATA

APPENDIX B

Test Pit Logs and Photographs

HALEY ALDRICH

TEST PIT LOG

Test Pit No. TP-1

Project	HERB CHAMBERS MERCEDES OF SUDBURY	**File No.**	135627-002
Location	141 BOSTON POST ROAD, SUDBURY, MA	**H&A Rep**	S. Shay
Client	THE HERB CHAMBERS COMPANIES	**Date**	4 Dec 2020
Contractor	EARTHWORK INDUSTRIES, INC.	**Weather**	Bright sun, 50s
Equipment Used	Doosan Dx50 Small Excavator		

Ground El.: 125.0 (est.) **El. Datum:** NGVD 29 | **Location:** See Plan | **Groundwater depths/entry rates (in./min.):** 3.0 rapidly

Depth (ft)	Sample ID	Stratum Change Elev./ Depth (ft)	USCS Symbol	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (Color GROUP NAME & SYMBOL, % oversized, maximum particle size, structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Tests Dilatancy	Toughness	Plasticity	Strength
0				3/4 in. minus gravel layer for roadway		100								
		124.6 0.4		Gray poorly graded SAND with gravel (SP), 10% oversized, mps 1.5 ft, no structure, no odor, moist, trace fill items: concrete, crumpled metal, wood	10	15	10	10	50	5				
1			SP	-FILL-										
2		123.0 2.0		Gray brown silty SAND with gravel (SM), 8-10% oversized, mps 1.2 ft, no structure, no odor, moist										
				6-in. diameter perforated drain pipe. Crown of pipe at 2.3 ft. Geofabric wrap in gravel bedding. Exposed sidewall.	10	10	10	15	35	20				
3		122.0 3.0		-FILL-										
4			GP	Gray poorly graded GRAVEL (GP), 1.5 in. minus, no oversized, mps 1.5 in., strong petroleum odor, wet	100									
5		120.0 5.0	ML	Gray SILT with sand (ML), no oversized, mps 0.1 in., no structure, no odor, moist					20	80				
		119.5 5.5		-GLACIOLACUSTRINE DEPOSITS-										
				BOTTOM OF EXPLORATION 5.5 FT										

Obstructions: None

Remarks: Unable to observe bottom of pit due to rapid inflow of water.

Field Tests

Dilatancy R - Rapid S - Slow N - None
Toughness L - Low M - Medium H - High
Plasticity N - Nonplastic L - Low M - Medium H - High
Dry Strength N - None L - Low M - Medium H - High V - Very High

Standing Water in Completed Pit

at depth 3.5 ft
measured after 0.1 hours elapsed

Boulders

Diameter (in.)	Number	Approx. Vol. (cu.ft)
12 to 24	4.0	= 7.5
over 24	0	= -

Test Pit Dimensions (ft)

Pit Length x Width (ft) 12.0x5.0
Pit Depth (ft) 5.5

NOTE: Soil identification based on visual-manual methods of the USCS system as practiced by Haley & Aldrich, Inc.

HA TESTPIT-09 PLOG-HA-LIB09-BOS STANDARD ONLY.GLB HA-TP07-1.GDT \\HALEYALDRICH.COM\SHARE\CF\PROJECTS\135627\GINT\135627-002-TP.GPJ Feb 9, 21



Photo 1: Excavation at TP-1



Photo 2: Excavated material generated from TP-1



Photo 3: Excavated material generated from TP-1

HALEY ALDRICH

TEST PIT LOG

Test Pit No. TP-2

Project	HERB CHAMBERS MERCEDES OF SUDBURY
Location	141 BOSTON POST ROAD, SUDBURY, MA
Client	THE HERB CHAMBERS COMPANIES
Contractor	EARTHWORK INDUSTRIES, INC.
Equipment Used	Doosan Dx50 Small Excavator
File No.	135627-002
H&A Rep	S. Shay
Date	4 Dec 2020
Weather	Mostly sun, 50s

Ground El.: 124.5 (est.) **El. Datum:** NGVD 29 | **Location:** See Plan | **Groundwater depths/entry rates (in./min.):** 4.4 slowly

Depth (ft)	Sample ID	Stratum Change Elev./ Depth (ft)	USCS Symbol	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (Color GROUP NAME & SYMBOL, % oversized, maximum particle size, structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Tests: Dilatancy	Toughness	Plasticity	Strength
0		124.3	GP	Gray poorly graded GRAVEL (GP), no oversized, mps 3/4 in., no structure, no odor, dry		90	5	5						
		0.2												
1				Brown silty SAND with gravel (SM), 4-5% oversized, mps 6.0 in., no structure, no odor, moist	5	10	10	10	40	25				
2			SM	-FILL-										
		121.7												
		2.8												
3				Gray silty SAND with gravel (SM), 15% oversized, mostly as rubble, mps 1.5 (concrete), no structure, no odor, moist to wet, trace amounts of wood, wires, rebar pieces, concrete, asphalt	10	10	10	15	35	20				
			SM											
4				Concrete block from 4.0 to 4.4 ft										
		120.1												
		4.4		Gray SILT (ML), no oversized, mps 1/4 in., no structure, no odor, moist					10	90				
		119.8	ML											
		4.7												
5				Olive brown SILT with sand (ML), no oversized, mps 1/2 in., no structure, no odor, moist			5	5	5	85				
			ML											
6				-GLACIOLACUSTRINE DEPOSITS-										
		118.0												
		6.5		BOTTOM OF EXPLORATION 6.5 FT										

Obstructions: None

Remarks: Standard test pit backfill

Field Tests

Dilatancy R - Rapid S - Slow N - None
Toughness L - Low M - Medium H - High
Plasticity N - Nonplastic L - Low M - Medium H - High
Dry Strength N - None L - Low M - Medium H - High V - Very High

Standing Water in Completed Pit

at depth 6.3 ft
measured after 0.5 hours elapsed

Boulders

Diameter (in.)	Number	Approx. Vol. (cu.ft)
12 to 24	0	= 0
over 24	0	= 0

Test Pit Dimensions (ft)

Pit Length x Width (ft) 9.0x3.0
Pit Depth (ft) 6.5

NOTE: Soil identification based on visual-manual methods of the USCS system as practiced by Haley & Aldrich, Inc.

HA TESTPIT-09 PLOG-HA-LIB09-BOS STANDARD ONLY.GLB HA-TP07-1.GDT \\HALEYALDRICH.COM\SHARE\CF\PROJECTS\135627\GINT\135627-002-TP.GPJ Feb 9, 21



Photo 4: Excavation of TP-2



Photo 5: Excavated materials generated from TP-2

HALEY ALDRICH

TEST PIT LOG

Test Pit No. TP-3

Project	HERB CHAMBERS MERCEDES OF SUDBURY
Location	141 BOSTON POST ROAD, SUDBURY, MA
Client	THE HERB CHAMBERS COMPANIES
Contractor	EARTHWORK INDUSTRIES, INC.
Equipment Used	Doosan Dx50 Small Excavator
File No.	135627-002
H&A Rep	S. Shay
Date	4 Dec 2020
Weather	Partly cloudy, 40s

Ground El.: 124.0 (est.) **El. Datum:** NGVD 29 | **Location:** See Plan | **Groundwater depths/entry rates (in./min.):** Water entering pit at 3.8 ft.

Depth (ft)	Sample ID	Stratum Change Elev./ Depth (ft)	USCS Symbol	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (Color GROUP NAME & SYMBOL, % oversized, maximum particle size, structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Tests Dilatancy	Toughness	Plasticity	Strength
0		123.5	SM	Brown silty SAND (SM), no oversized, mps 2.0 in., no structure except heavy root mat, no odor, moist			10	10	40	40				
1		0.5 / 122.7	SC	Yellow brown clayey SAND with gravel (SC), 10% oversized, mps 9.0 in., no structure, no odor, moist, appears to be disturbed -FILL-	5	10	10	15	25	35				
2		1.3 / 121.5	SM	Brown silty SAND (SM), 5% oversized, mps 6.0 in., no structure, no odor, moist	5	5	15	20	35	20				
3		2.5 / 120.2	SM	Gray silty SAND (SM), no oversized, mps 2.4 in., no structure, except excavates blocky, no odor, moist, trace fill items - fabric, metal -FILL-	5	5	5	10	30	45				
4		3.8 / 119.5	SP	Olive brown poorly graded SAND (SP), no oversized, mps 0.02 in., single grain structure, no odor, wet, dark brown variable coloring at 4.0 ft -ALLUVIAL DEPOSITS-					30	70				
5		4.5	ML	Bright orange brown SILT (ML), no oversized, mps 0.01 in., thin stratification, no odor, moist, well defined, irregular mottling 4.5-6.0 ft -GLACIOLACUSTRINE DEPOSITS-						100	N	L	N	N
6			ML	Note: Abrupt color change to gray at 6.0 ft. Gray SILT (ML), no oversize, mps 0.01 in., stratified, no odor, moist										
7		117.0 / 7.0		BOTTOM OF EXPLORATION 7.0 FT										

Obstructions: None

Remarks: Standard test pit backfill

Field Tests

Dilatancy R - Rapid S - Slow N - None
Toughness L - Low M - Medium H - High
Plasticity N - Nonplastic L - Low M - Medium H - High
Dry Strength N - None L - Low M - Medium H - High V - Very High

Standing Water in Completed Pit

at depth 3.8 ft
measured after 0.1 hours elapsed

Boulders

Diameter (in.)	Number	Approx. Vol. (cu.ft)
12 to 24	0	= 0
over 24	0	= 0

Test Pit Dimensions (ft)

Pit Length x Width (ft) 9.0x2.5
Pit Depth (ft) 7.0

NOTE: Soil identification based on visual-manual methods of the USCS system as practiced by Haley & Aldrich, Inc.

HA TESTPIT-09 PLOG-HA-LIB09-BOS STANDARD ONLY.GLB HA-TP07-1.GDT \\HALEYALDRICH.COM\SHARE\CF\PROJECTS\135627\GINT\135627-002-TP.GPJ Feb 9, 21



Photo 6: Excavation of TP-3



Photo 7: Excavation of TP-3



Photo 8: Excavation of TP-3



Photo 9: Excavated materials generated from TP-3



Photo 10: Excavated materials generated from TP-3



Photo 11: Excavated materials generated from TP-3

T2-P2 Page 2

Section II. Indicators of Hydrology

Hydric Soil Interpretation

1. Soil Survey

Is there a published soil survey for this site? Yes X No

title/date: NRCS Web Soil Survey Middlesex County Update 2012

map number:

soil type mapped: Udorthents Urban Land Complex and Freetoown Muck

hydric soil inclusions: Yes

Are field observations consistent with soil survey? Yes X no

Remarks:

This aresa was part of a flood storage replication area constructed in 2003 as part of the Bosse Sports project. It is in the upper edge of that area. The Latest FEMA Mapping shows that the 100 year flood elevation is lower than previously indicated. So this area is a relatively dry field at this location.

2. Soil Description

Horizon	Depth	Matrix Color	Mottles Color
A–SL top	0–6"	10 YR 4/2	None
Bw – LS	6 – 17"	2.5 YR 5/3	10 YR 4/6 few At 9".
C – FSL	17 – 20"	10 YR 5/1	2.5 Y 5/7 Many.
			10 YR 4/6 Many. 2.5 Y 7/1 Some

Remarks: B horizon is too bright to be hydric.

SEASONAL GROUNDWATER @ 17"

3. Other:

Conclusion: Is soil hydric? Yes No X

Other Indicators of Hydrology: (check all that apply and describe)

- ☐ Site inundated: _____
- ☐ Depth to free water in observation hole: _____
- ☐ Depth to soil saturation in observation hole: _____
- ☐ Water marks: _____
- ☐ Drift lines: _____
- ☐ Sediment deposits: _____
- ☐ Drainage patterns in BVW: _____
- ☐ Oxidized rhizospheres: _____
- ☐ Water-stained leaves: _____
- ☐ Recorded data (stream, lake, or tidal gauge; aerial photo; other): _____
- ☐ Other: _____

Vegetation and Hydrology Conclusion

	Yes	No
Number of wetland indicator plants ≥ number of non-wetland indicator plants	X	
Wetland hydrology present: hydric soil present		X
other indicators of hydrology Present		X
Sample location is in a BVW?		X

Submit this form with the Request for Determination of Applicability or Notice of Intent.

Appendix G



Map Scale: 1:1,730 if printed on A portrait (8.5" x 11") sheet.

N

Meters: 0 25 50 100 150

Feet: 0 50 100 200 300

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 21, Sep 2, 2021

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

Date(s) aerial images were photographed: Aug 31, 2020—Oct 22, 2020

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

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
32B	Wareham loamy fine sand, 0 to 5 percent slopes	0.3	3.5%
52A	Freetown muck, 0 to 1 percent slopes	0.8	9.7%
656	Udorthents-Urban land complex	7.1	86.8%
Totals for Area of Interest		**8.2**	**100.0%**

Middlesex County, Massachusetts

52A—Freetown muck, 0 to 1 percent slopes

Map Unit Setting

National map unit symbol: 2t2q9
Elevation: 0 to 1,110 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

Freetown and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Freetown

Setting

Landform: Depressions, depressions, swamps, kettles, marshes, bogs
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Tread, dip
Down-slope shape: Concave
Across-slope shape: Concave
Parent material: Highly decomposed organic material

Typical profile

Oe - 0 to 2 inches: mucky peat
Oa - 2 to 79 inches: muck

Properties and qualities

Slope: 0 to 1 percent
Surface area covered with cobbles, stones or boulders: 0.0 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 low to high (0.14 to 14.17 in/hr)
Depth to water table: About 0 to 6 inches
Frequency of flooding: Rare
Frequency of ponding: Frequent
Available water supply, 0 to 60 inches: Very high (about 19.2 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 5w
Hydrologic Soil Group: B/D
Ecological site: F144AY043MA - Acidic Organic Wetlands

Hydric soil rating: Yes

Minor Components

Whitman

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

Swansea

Percent of map unit: 5 percent
Landform: Bogs, swamps, marshes, depressions, depressions, kettles
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Tread, dip
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

Scarboro

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

Data Source Information

Soil Survey Area: Middlesex County, Massachusetts
Survey Area Data: Version 21, Sep 2, 2021

Middlesex County, Massachusetts

656—Udorthents-Urban land complex

Map Unit Setting

National map unit symbol: 995k
Elevation: 0 to 3,000 feet
Mean annual precipitation: 32 to 54 inches
Mean annual air temperature: 43 to 54 degrees F
Frost-free period: 110 to 240 days
Farmland classification: Not prime farmland

Map Unit Composition

Udorthents and similar soils: 45 percent
Urban land: 35 percent
Minor components: 20 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Udorthents

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

Slope: 0 to 15 percent
Depth to restrictive feature: More than 80 inches
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None

Description of Urban Land

Setting

Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Base slope
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Excavated and filled land

Minor Components

Canton

Percent of map unit: 10 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

Merrimac

Percent of map unit: 5 percent
Landform: Terraces, plains
Landform position (two-dimensional): Shoulder
Landform position (three-dimensional): Tread, rise
Down-slope shape: Convex
Across-slope shape: Convex
Hydric soil rating: No

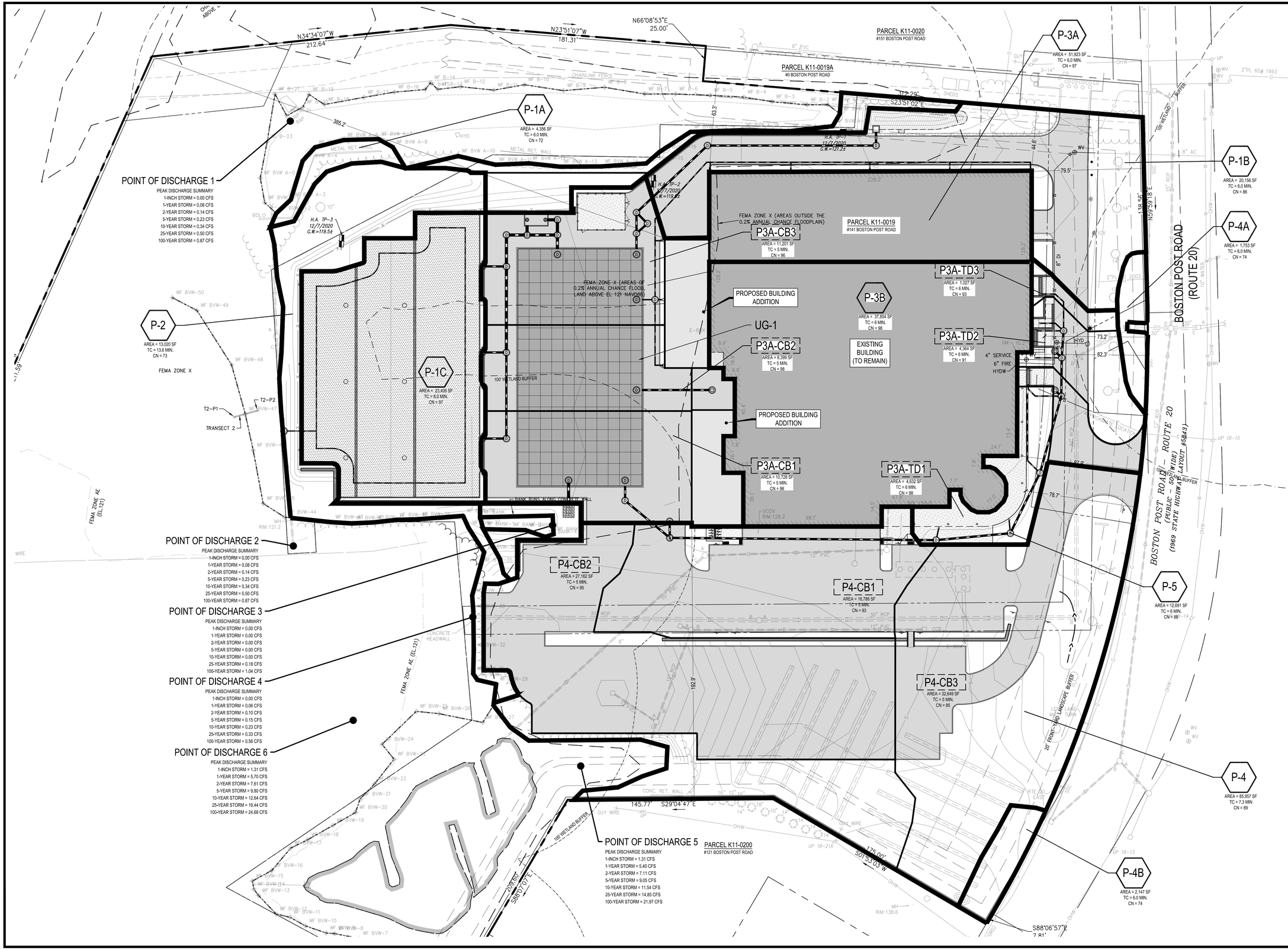
Paxton

Percent of map unit: 5 percent
Landform: Hillslopes
Landform position (two-dimensional): Backslope, summit
Landform position (three-dimensional): Head slope, side slope
Down-slope shape: Convex
Across-slope shape: Convex
Hydric soil rating: No

Data Source Information

Soil Survey Area: Middlesex County, Massachusetts
Survey Area Data: Version 21, Sep 2, 2021

SECTION 7 – HYDRAULIC PIPE SIZING



No.	Description	Date
	Revisions	
3.	P.B. AND CON.–COM. RESUBMITTAL	02/14/22
2.	ZBA RESUBMITTAL	01/31/22
1.	PLANNING BOARD SUBMITTAL	11/15/21

COMMONWEALTH OF MASSACHUSETTS
GABRIEL R. CROCKER
CIVIL
No. 47917
REGISTERED PROFESSIONAL ENGINEER

2-14-2022

GABRIEL R. CROCKER
PROFESSIONAL ENGINEER, MA REGISTRATION #47917

Crocker Design Group
2 SHARP STREET, UNIT A
HINGHAM, MA 02043
P: 781-919-0808

Project

MERCEDES OF SUDBURY

141 BOSTON POST ROAD,
SUDBURY, MA

Prepared for

HERB CHAMBERS 43 BRAINTREE STREET, LLC

#259 McGRATH HIGHWAY - ROUTE 28
SOMERVILLE, MA 02143

Drawing Title

PROPOSED CONDITIONS SUB-CATCHMENT MAP

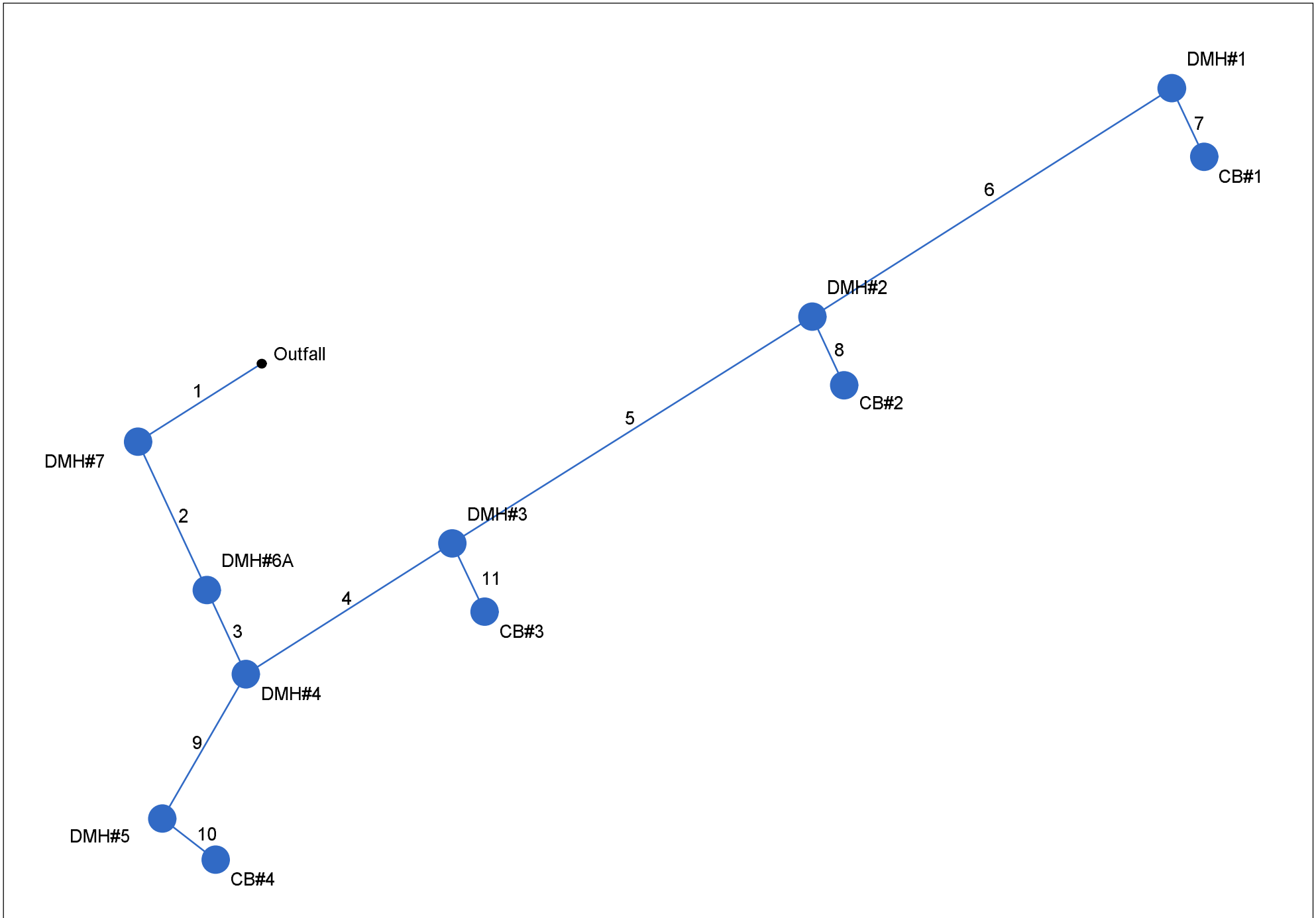
Project No.	100-107
Date	11/10/2021
Scale	1" = 30'
Drawn By	DJN / JPM
Approved By	GC

Drawing No.

PH-2

C:\2020\Crocker Design Group, LLC\Gabriel Crocker - Projects\100-107 Sudbury - Mercedes\Civil\Plot Sheets\Site Plan Application_ DV PROP WATERSHED MAP.dwg, DV PROP SUBCATCHMENT MAP, Feb 14, 2022 12:19

Hydraflow Storm Sewers Extension for Autodesk® Civil 3D® Plan



Project File: drain sys #1 test.stm	Number of lines: 11	Date: 11/11/2021

Storm Sewers v12.00

You created this PDF from an application that is not licensed to print to novaPDF printer (http://www.novapdf.com)

Storm Sewer Tabulation

Station		Len	Drng Area		Rnoff coeff	Area x C		Tc		Rain (I)	Total flow	Cap full	Vel	Pipe		Invert Elev		HGL Elev		Grnd / Rim Elev		Line ID
Line	To Line	(ft)	Incr (ac)	Total (ac)	(C)	Incr	Total	Inlet (min)	Syst (min)	(in/hr)	(cfs)	(cfs)	(ft/s)	Size (in)	Slope (%)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	
1	End	21.000	0.00	0.70	0.00	0.00	0.67	0.0	7.2	6.2	4.15	7.25	4.25	18	0.48	122.75	122.85	123.56	123.66	124.93	127.78	DMH7 to INLET1
2	1	21.473	0.00	0.70	0.00	0.00	0.67	0.0	7.0	6.2	4.19	7.52	3.18	18	0.51	122.85	122.96	123.94	123.96	127.78	127.47	DMH6A to DMH7
3	2	12.260	0.00	0.70	0.00	0.00	0.67	0.0	7.0	6.3	4.20	7.35	3.34	18	0.49	122.96	123.02	123.99	124.00	127.47	127.24	DMH4 to DMH6A
4	3	35.000	0.00	0.55	0.00	0.00	0.54	0.0	6.7	6.4	3.40	7.32	2.49	18	0.49	123.02	123.19	124.19	124.21	127.24	127.25	DMH3 to DMH4
5	4	61.000	0.00	0.38	0.00	0.00	0.37	0.0	6.4	6.5	2.43	7.49	2.74	18	0.51	123.19	123.50	124.32	124.09	127.25	127.18	DMH2 to DMH3
6	5	61.000	0.00	0.21	0.00	0.00	0.21	0.0	6.1	6.7	1.37	2.54	3.16	12	0.51	123.50	123.81	124.09	124.31	127.18	127.18	DMH1 to DMH2
7	6	10.000	0.21	0.21	0.98	0.21	0.21	6.0	6.0	6.7	1.38	4.36	2.97	12	1.50	123.81	123.96	124.50	124.46	127.18	127.00	CB1 to DMH1
8	5	10.000	0.17	0.17	0.98	0.17	0.17	6.0	6.0	6.7	1.12	4.36	2.82	12	1.50	123.50	123.65	124.09	124.09	127.18	127.00	CB2 to DMH2
9	3	22.255	0.00	0.15	0.00	0.00	0.14	0.0	6.1	6.7	0.91	3.54	1.17	12	0.99	123.02	123.24	124.19	124.20	127.24	127.20	DMH5 to DMH4
10	9	9.509	0.15	0.15	0.91	0.14	0.14	6.0	6.0	6.7	0.92	4.32	2.14	12	1.47	123.24	123.38	124.22	123.78	127.20	127.00	CB4 to DMH5
11	4	10.000	0.17	0.17	0.96	0.16	0.16	6.0	6.0	6.7	1.09	4.36	1.40	12	1.50	123.19	123.34	124.32	124.33	127.25	127.00	CB3 to DMH3

Project File: drain sys #1 test.stm

Number of lines: 11

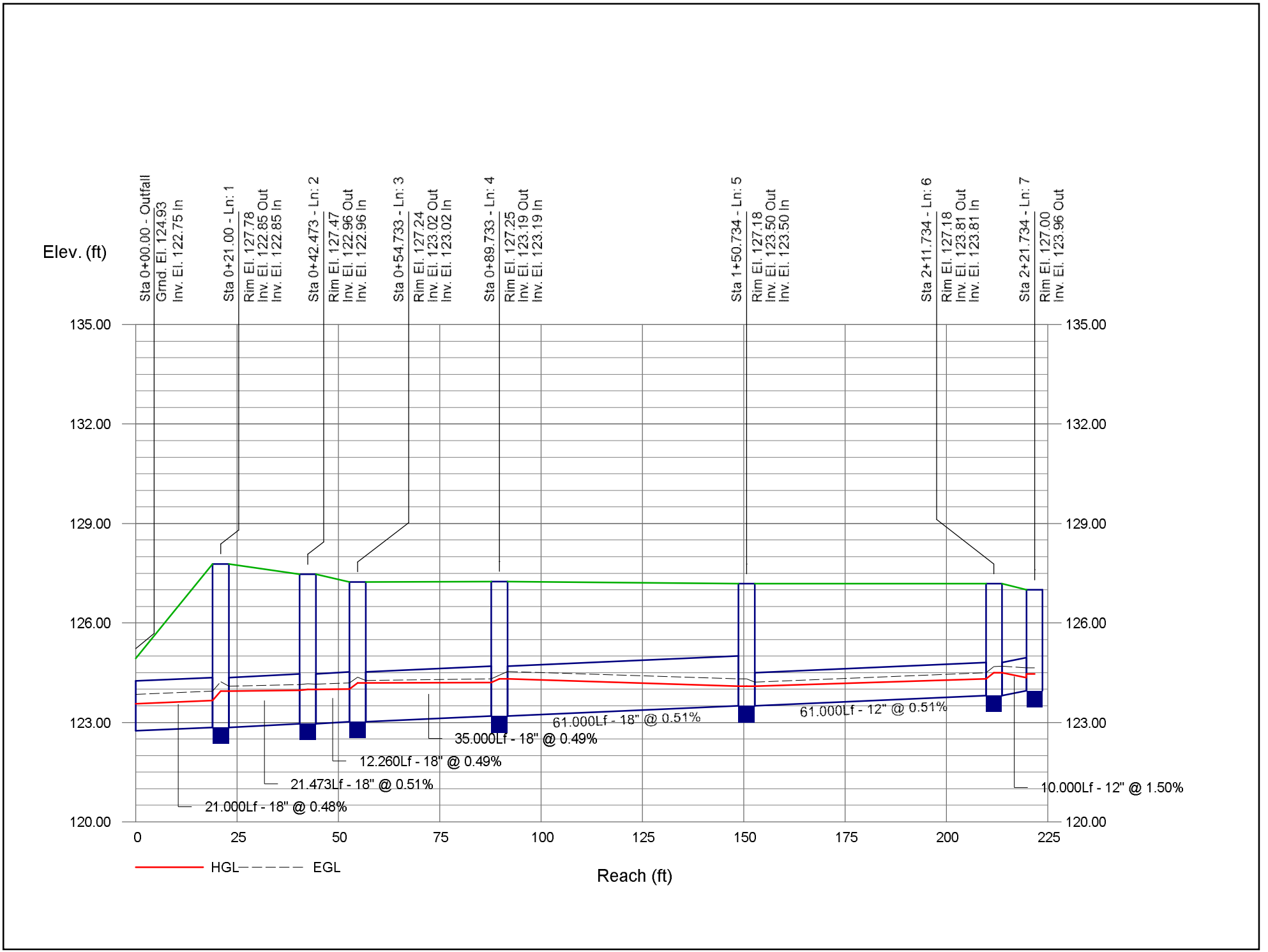
Run Date: 11/11/2021

NOTES:Intensity = 32.47 / (Inlet time + 3.40) ^ 0.70 ; Return period =Yrs. 10 ; c = cir e = ellip b = box

You created this PDF from an application that is not licensed to print to novaPDF printer (http://www.novapdf.com)

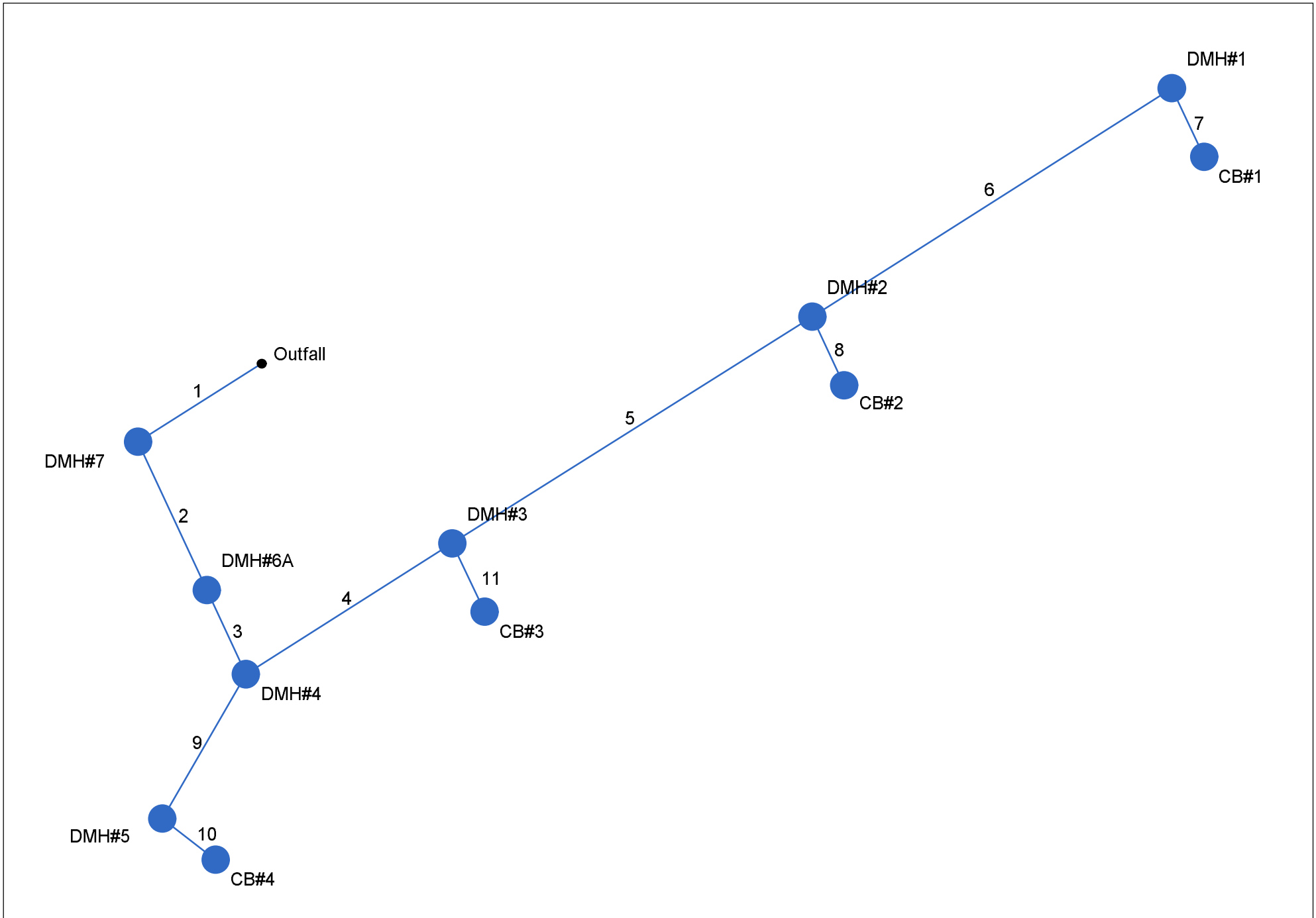
Storm Sewer Profile

Proj. file: drain sys #1 test.stm



You created this PDF from an application that is not licensed to print to novaPDF printer (http://www.novapdf.com)

Hydraflow Storm Sewers Extension for Autodesk® Civil 3D® Plan



Project File: drain sys #1 test.stm	Number of lines: 11	Date: 11/11/2021

Storm Sewers v12.00

You created this PDF from an application that is not licensed to print to novaPDF printer (http://www.novapdf.com)

Storm Sewer Tabulation

Station		Len	Drng Area		Rnoff coeff	Area x C		Tc		Rain (I)	Total flow	Cap full	Vel	Pipe		Invert Elev		HGL Elev		Grnd / Rim Elev		Line ID
Line	To Line	(ft)	Incr (ac)	Total (ac)	(C)	Incr	Total	Inlet (min)	Syst (min)	(in/hr)	(cfs)	(cfs)	(ft/s)	Size (in)	Slope (%)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	
1	End	21.000	0.00	0.70	0.00	0.00	0.67	0.0	7.3	9.3	6.26	7.25	3.54	18	0.48	122.75	122.85	124.86	124.93	124.93	127.78	DMH7 to INLET1
2	1	21.473	0.00	0.70	0.00	0.00	0.67	0.0	7.2	9.4	6.30	7.52	3.57	18	0.51	122.85	122.96	125.13	125.21	127.78	127.47	DMH6A to DMH7
3	2	12.260	0.00	0.70	0.00	0.00	0.67	0.0	7.1	9.4	6.33	7.35	3.58	18	0.49	122.96	123.02	125.24	125.28	127.47	127.24	DMH4 to DMH6A
4	3	35.000	0.00	0.55	0.00	0.00	0.54	0.0	6.9	9.5	5.11	7.32	2.89	18	0.49	123.02	123.19	125.48	125.56	127.24	127.25	DMH3 to DMH4
5	4	61.000	0.00	0.38	0.00	0.00	0.37	0.0	6.4	9.9	3.68	7.49	2.08	18	0.51	123.19	123.50	125.69	125.77	127.25	127.18	DMH2 to DMH3
6	5	61.000	0.00	0.21	0.00	0.00	0.21	0.0	6.1	10.2	2.09	2.54	2.66	12	0.51	123.50	123.81	125.84	126.05	127.18	127.18	DMH1 to DMH2
7	6	10.000	0.21	0.21	0.98	0.21	0.21	6.0	6.0	10.2	2.10	4.36	2.67	12	1.50	123.81	123.96	126.16	126.19	127.18	127.00	CB1 to DMH1
8	5	10.000	0.17	0.17	0.98	0.17	0.17	6.0	6.0	10.2	1.70	4.36	2.16	12	1.50	123.50	123.65	125.84	125.86	127.18	127.00	CB2 to DMH2
9	3	22.255	0.00	0.15	0.00	0.00	0.14	0.0	6.1	10.1	1.38	3.54	1.76	12	0.99	123.02	123.24	125.48	125.51	127.24	127.20	DMH5 to DMH4
10	9	9.509	0.15	0.15	0.91	0.14	0.14	6.0	6.0	10.2	1.39	4.32	1.77	12	1.47	123.24	123.38	125.56	125.58	127.20	127.00	CB4 to DMH5
11	4	10.000	0.17	0.17	0.96	0.16	0.16	6.0	6.0	10.2	1.67	4.36	2.12	12	1.50	123.19	123.34	125.69	125.72	127.25	127.00	CB3 to DMH3

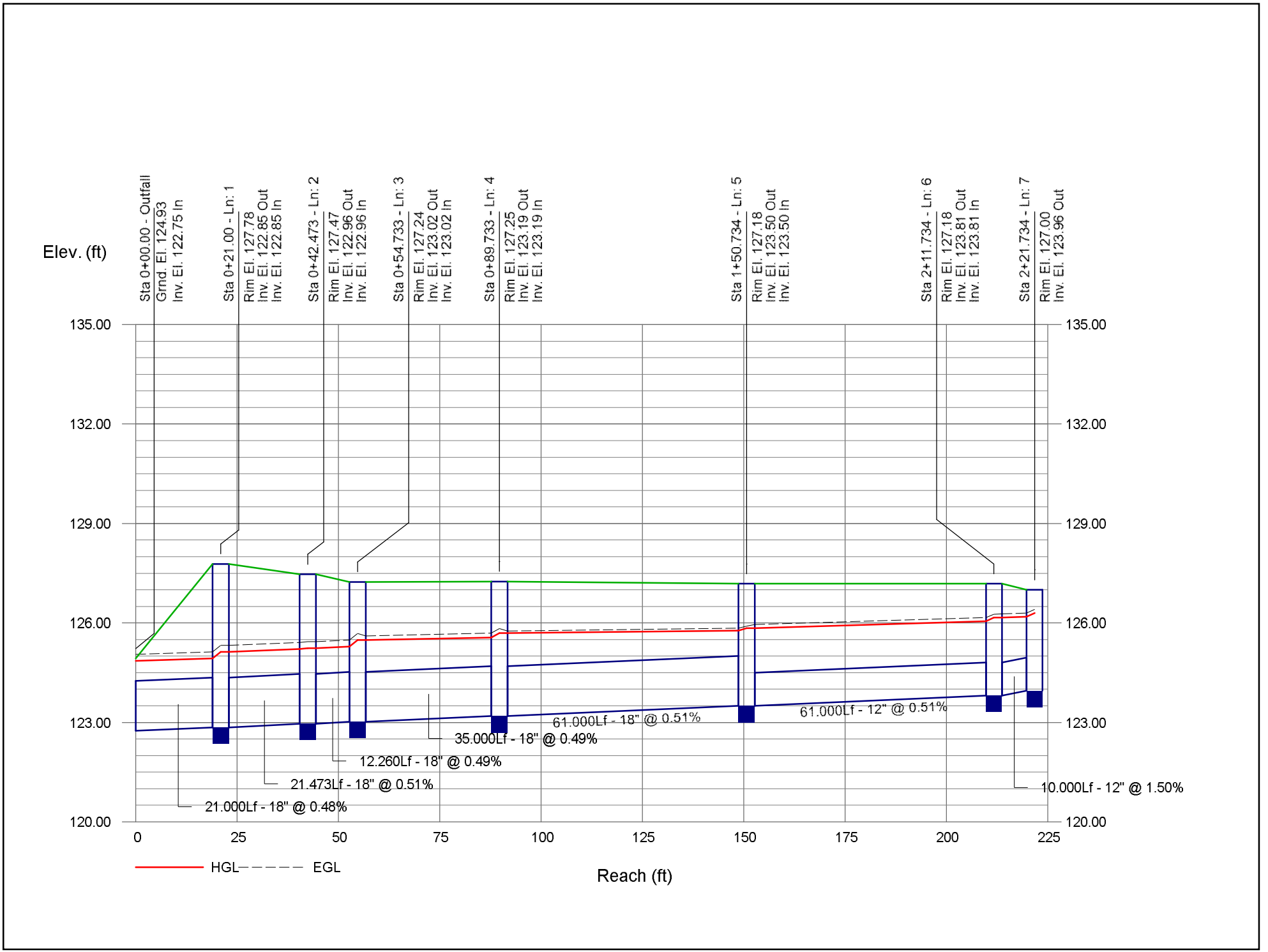
Project File: drain sys #1 test.stm | Number of lines: 11 | Run Date: 11/11/2021

NOTES:Intensity = 49.45 / (Inlet time + 3.40) ^ 0.70 ; Return period =Yrs. 100 ; c = cir e = ellip b = box

You created this PDF from an application that is not licensed to print to novaPDF printer (http://www.novapdf.com)

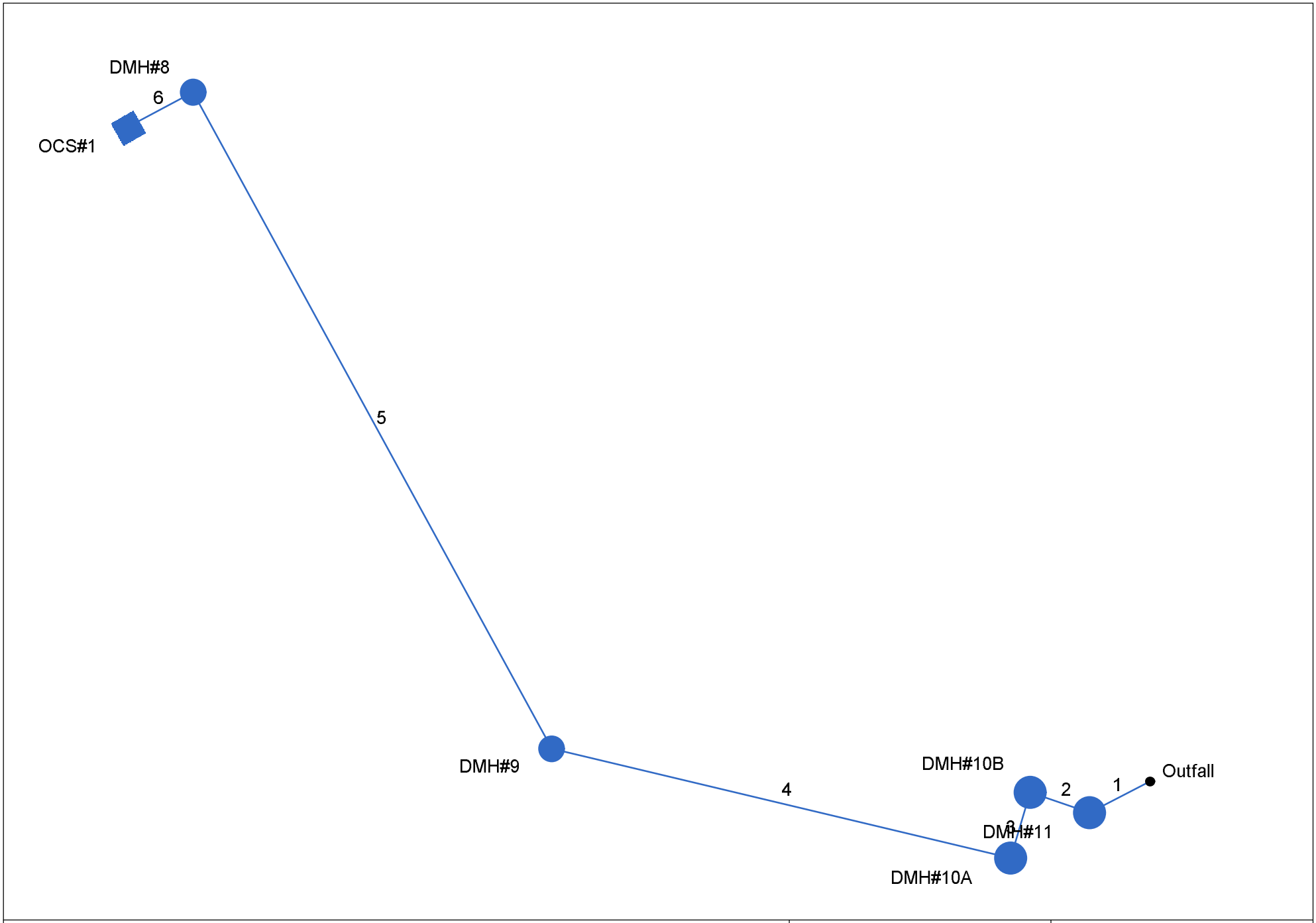
Storm Sewer Profile

Proj. file: drain sys #1 test.stm



You created this PDF from an application that is not licensed to print to novaPDF printer (http://www.novapdf.com)

Hydraflow Storm Sewers Extension for Autodesk® Civil 3D® Plan



Project File: drain sys #2.stm	Number of lines: 6	Date: 11/12/2021

Storm Sewers v12.00

You created this PDF from an application that is not licensed to print to novaPDF printer (http://www.novapdf.com)

Storm Sewer Tabulation

Station		Len	Drng Area		Rnoff coeff	Area x C		Tc		Rain (I)	Total flow	Cap full	Vel	Pipe		Invert Elev		HGL Elev		Grnd / Rim Elev		Line ID
Line	To Line	(ft)	Incr (ac)	Total (ac)	(C)	Incr	Total	Inlet (min)	Syst (min)	(in/hr)	(cfs)	(cfs)	(ft/s)	Size (in)	Slope (%)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	
1	End	10.937	0.00	0.45	0.00	0.00	0.39	0.0	7.1	6.2	2.40	7.10	2.02	18	0.46	122.75	122.80	123.73	123.74	123.86	128.66	DMH11 to INLET#
2	1	10.000	0.00	0.45	0.00	0.00	0.39	0.0	7.0	6.2	2.41	8.13	2.86	18	0.60	122.80	122.86	123.79	123.45	128.66	128.81	DMH11B to DMH
3	2	10.962	0.00	0.45	0.00	0.00	0.39	0.0	7.0	6.2	2.42	7.09	3.64	18	0.46	122.86	122.91	123.46	123.51	128.81	128.73	DMH10A to DMH
4	3	75.000	0.00	0.45	0.00	0.00	0.39	0.0	6.6	6.4	2.48	7.38	3.16	18	0.49	122.91	123.28	123.72	123.88	128.73	128.36	DMH9 to DMH10
5	4	119.365	0.00	0.45	0.00	0.00	0.39	0.0	6.1	6.7	2.58	2.52	3.66	12	0.50	123.28	123.88	124.12	124.72	128.36	126.84	DMH8 to DMH9
6	5	11.619	0.45	0.45	0.86	0.39	0.39	6.0	6.0	6.7	2.60	2.34	3.31	12	0.43	124.13	124.18	125.13	125.18	126.84	127.34	OCS1 to DMH8

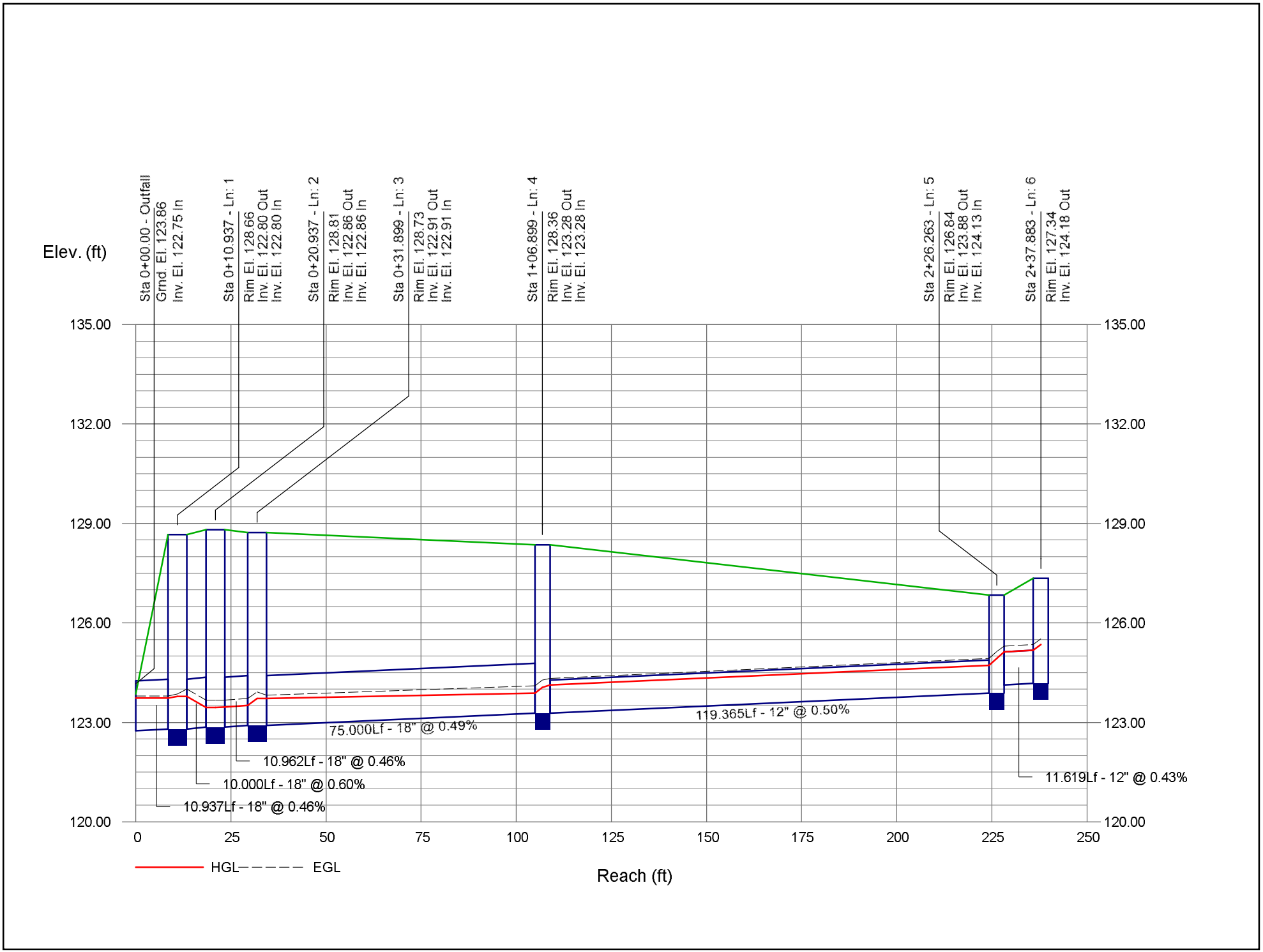
Project File: drain sys #2.stm | Number of lines: 6 | Run Date: 11/12/2021

NOTES:Intensity = 32.47 / (Inlet time + 3.40) ^ 0.70 ; Return period =Yrs. 10 ; c = cir e = ellip b = box

You created this PDF from an application that is not licensed to print to novaPDF printer (http://www.novapdf.com)

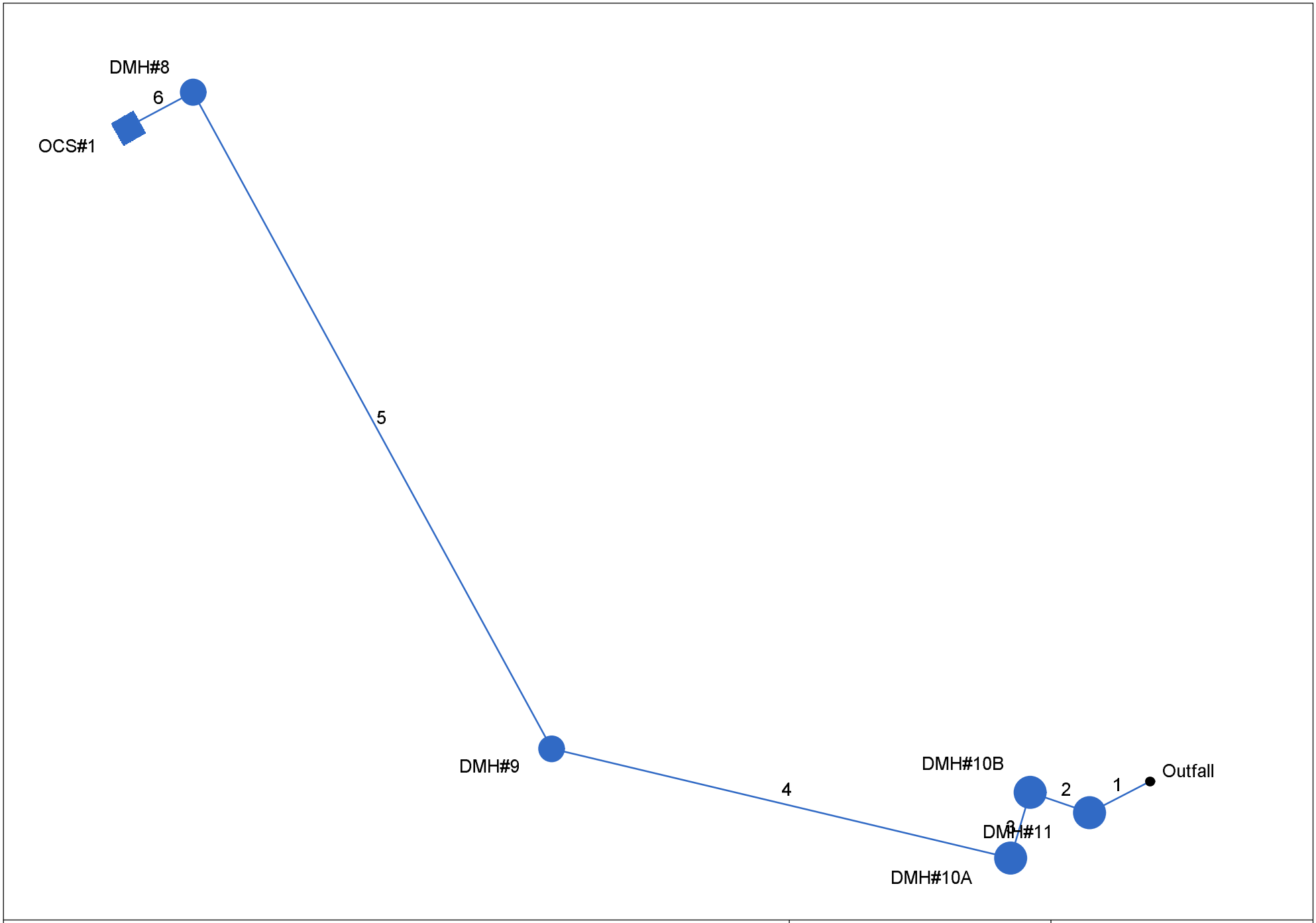
Storm Sewer Profile

Proj. file: drain sys #2.stm



You created this PDF from an application that is not licensed to print to novaPDF printer (http://www.novapdf.com)

Hydraflow Storm Sewers Extension for Autodesk® Civil 3D® Plan



Project File: drain sys #2.stm	Number of lines: 6	Date: 11/12/2021

Storm Sewers v12.00

You created this PDF from an application that is not licensed to print to novaPDF printer (http://www.novapdf.com)

Storm Sewer Tabulation

Station		Len	Drng Area		Rnoff coeff	Area x C		Tc		Rain (I)	Total flow	Cap full	Vel	Pipe		Invert Elev		HGL Elev		Grnd / Rim Elev		Line ID
Line	To Line	(ft)	Incr (ac)	Total (ac)	(C)	Incr	Total	Inlet (min)	Syst (min)	(in/hr)	(cfs)	(cfs)	(ft/s)	Size (in)	Slope (%)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	
1	End	10.937	0.00	0.45	0.00	0.00	0.39	0.0	7.2	9.4	3.63	7.10	2.06	18	0.46	122.75	122.80	124.48	124.49	123.86	128.66	DMH11 to INLET#
2	1	10.000	0.00	0.45	0.00	0.00	0.39	0.0	7.1	9.4	3.65	8.13	2.07	18	0.60	122.80	122.86	124.54	124.56	128.66	128.81	DMH11B to DMH
3	2	10.962	0.00	0.45	0.00	0.00	0.39	0.0	7.0	9.5	3.67	7.09	2.08	18	0.46	122.86	122.91	124.62	124.64	128.81	128.73	DMH10A to DMH
4	3	75.000	0.00	0.45	0.00	0.00	0.39	0.0	6.4	9.9	3.82	7.38	2.16	18	0.49	122.91	123.28	124.70	124.78	128.73	128.36	DMH9 to DMH10
5	4	119.365	0.00	0.45	0.00	0.00	0.39	0.0	6.0	10.2	3.94	2.52	5.01	12	0.50	123.28	123.88	124.84	126.30	128.36	126.84	DMH8 to DMH9
6	5	11.619	0.45	0.45	0.86	0.39	0.39	6.0	6.0	10.2	3.95	2.34	5.03	12	0.43	124.13	124.18	126.69	126.83	126.84	127.34	OCS1 to DMH8

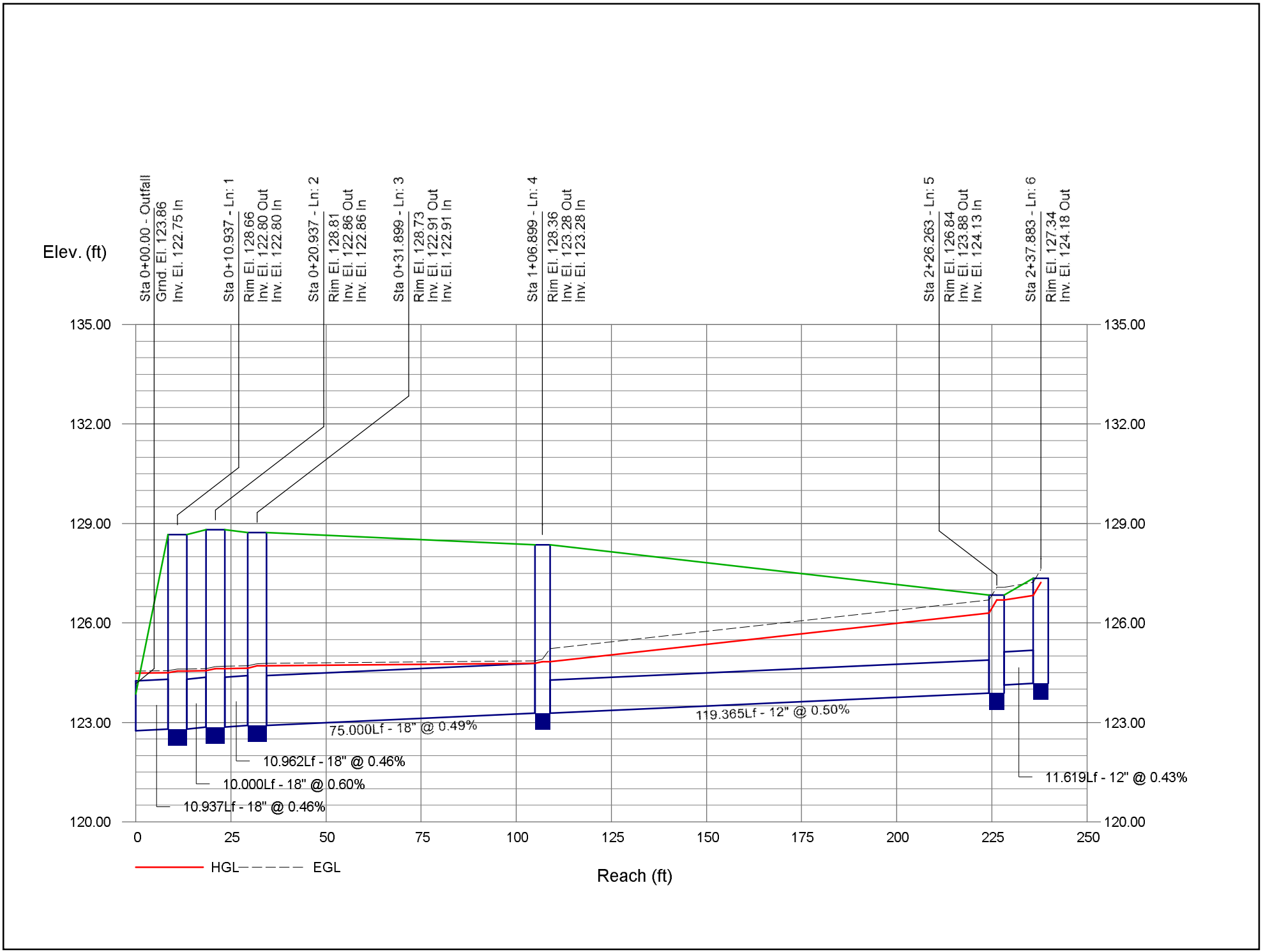
Project File: drain sys #2.stm | Number of lines: 6 | Run Date: 11/12/2021

NOTES:Intensity = 49.45 / (Inlet time + 3.40) ^ 0.70 ; Return period =Yrs. 100 ; c = cir e = ellip b = box

You created this PDF from an application that is not licensed to print to novaPDF printer (http://www.novapdf.com)

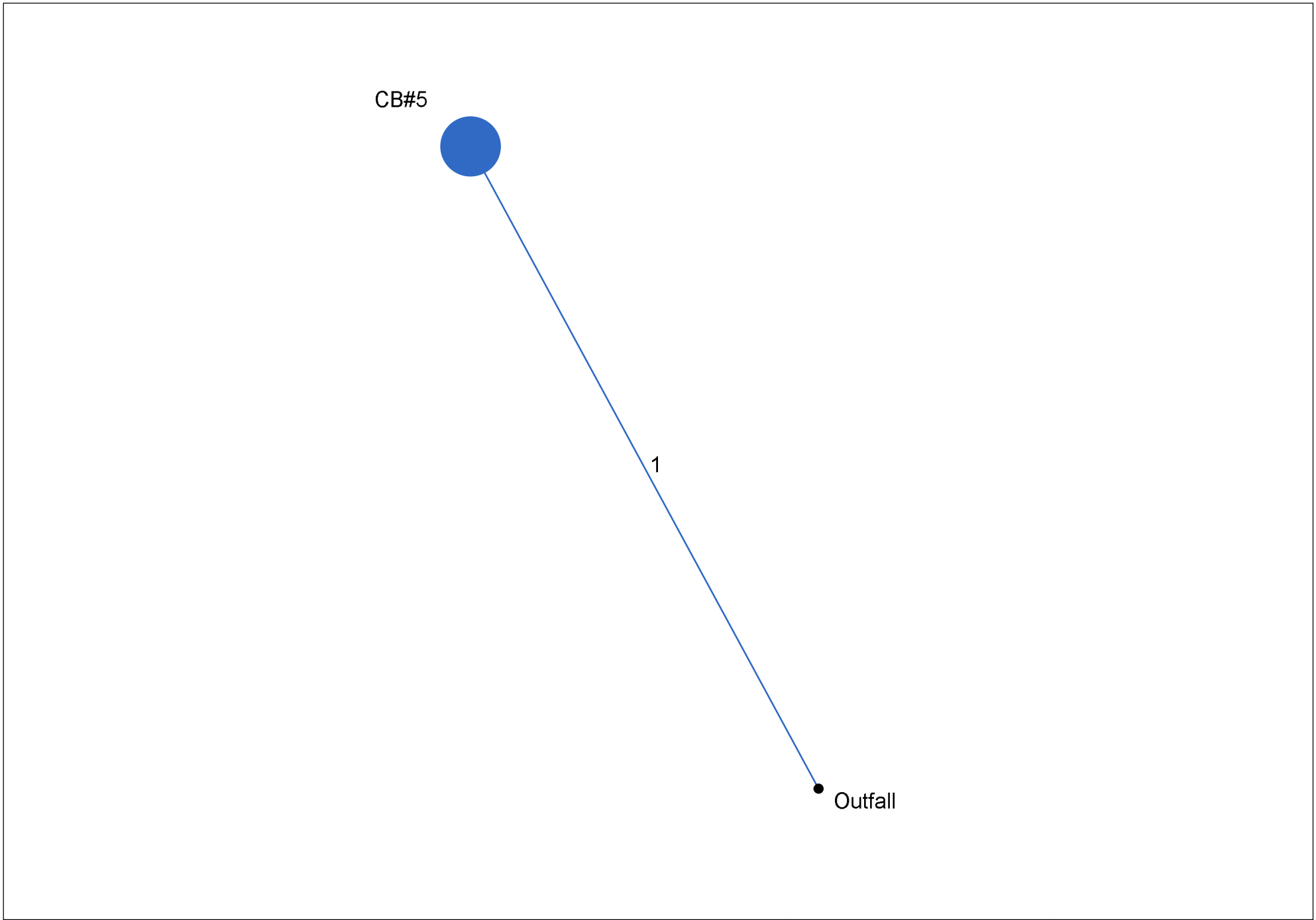
Storm Sewer Profile

Proj. file: drain sys #2.stm



You created this PDF from an application that is not licensed to print to novaPDF printer (http://www.novapdf.com)

Hydraflow Storm Sewers Extension for Autodesk® Civil 3D® Plan



Project File: drain sys #4.stm	Number of lines: 1	Date: 11/12/2021

Storm Sewers v12.00

You created this PDF from an application that is not licensed to print to novaPDF printer (http://www.novapdf.com)

Storm Sewer Tabulation

Station		Len	Drng Area		Rnoff coeff	Area x C		Tc		Rain (I)	Total flow	Cap full	Vel	Pipe		Invert Elev		HGL Elev		Grnd / Rim Elev		Line ID
Line	To Line	(ft)	Incr (ac)	Total (ac)	(C)	Incr	Total	Inlet (min)	Syst (min)	(in/hr)	(cfs)	(cfs)	(ft/s)	Size (in)	Slope (%)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	
1	End	49.501	0.02	0.02	0.98	0.02	0.02	6.0	6.0	6.7	0.13	5.04	0.99	12	2.00	122.75	123.74	123.73	123.89	123.86	128.80	CB5 to INLET4

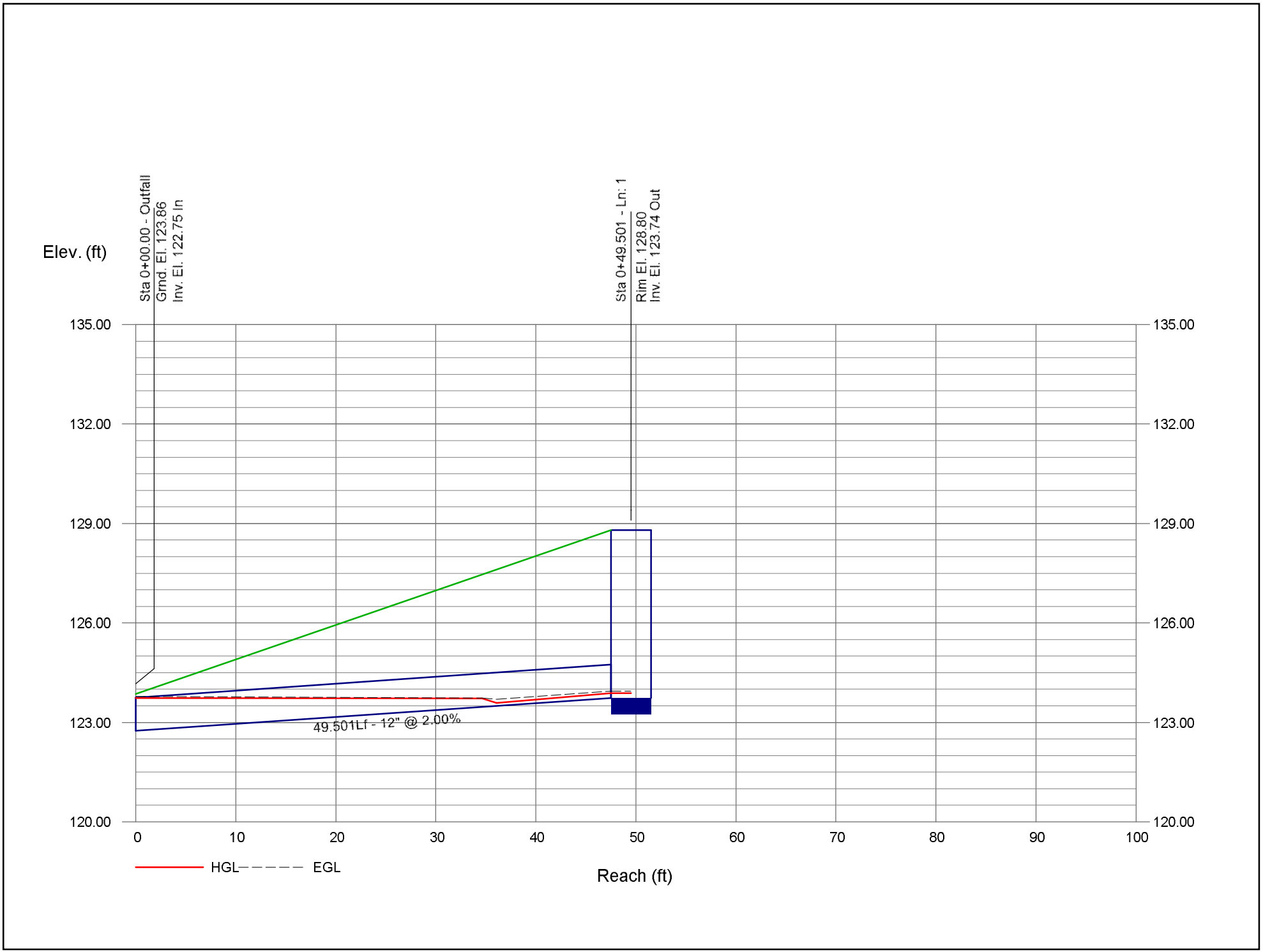
Project File: drain sys #4.stm | Number of lines: 1 | Run Date: 11/12/2021

NOTES:Intensity = 32.47 / (Inlet time + 3.40) ^ 0.70 ; Return period =Yrs. 10 ; c = cir e = ellip b = box

You created this PDF from an application that is not licensed to print to novaPDF printer (http://www.novapdf.com)

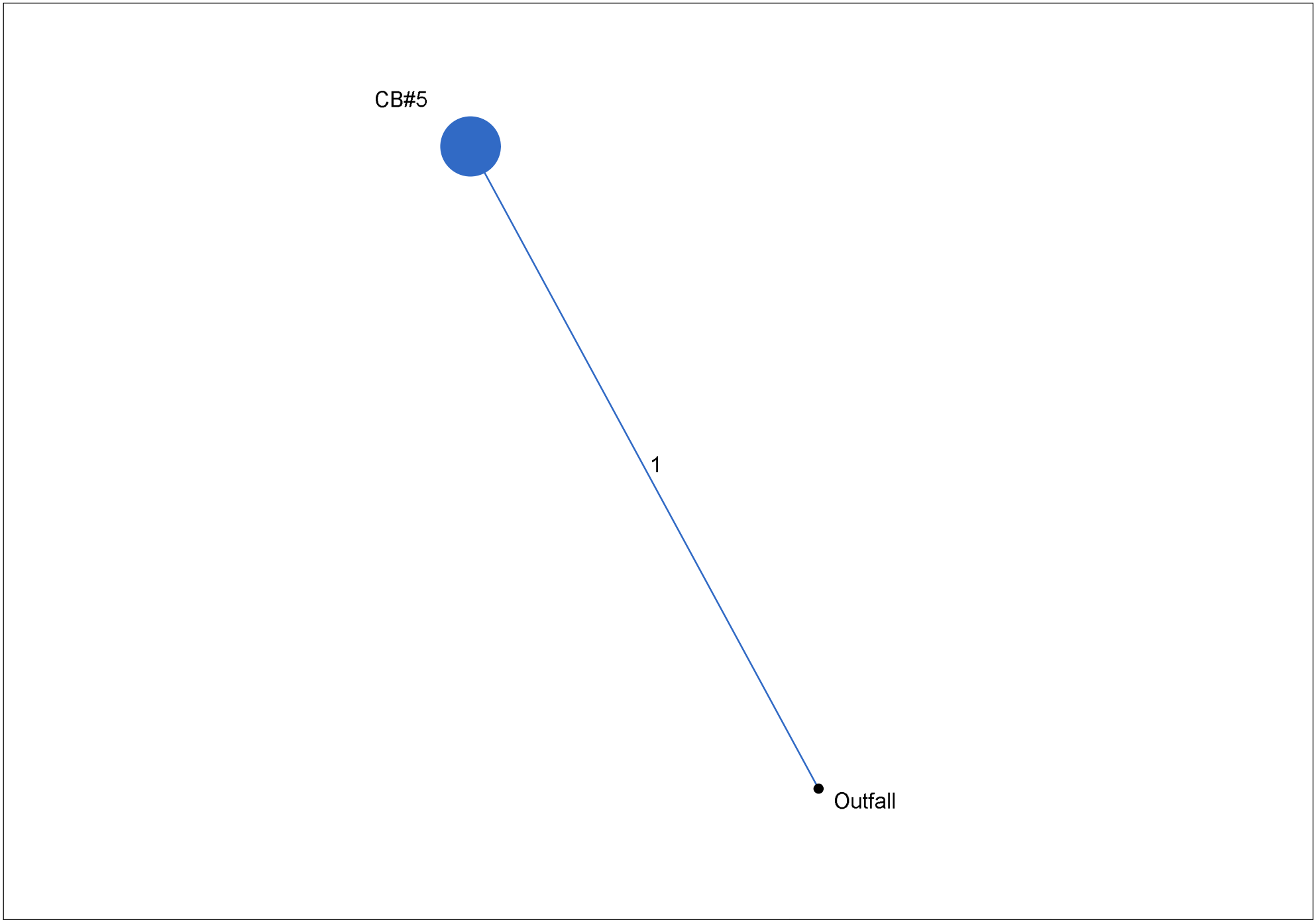
Storm Sewer Profile

Proj. file: drain sys #4.stm



You created this PDF from an application that is not licensed to print to novaPDF printer (http://www.novapdf.com)

Hydraflow Storm Sewers Extension for Autodesk® Civil 3D® Plan



Project File: drain sys #4.stm	Number of lines: 1	Date: 11/12/2021

Storm Sewers v12.00

You created this PDF from an application that is not licensed to print to novaPDF printer (http://www.novapdf.com)

Storm Sewer Tabulation

Station		Len	Drng Area		Rnoff coeff	Area x C		Tc		Rain (I)	Total flow	Cap full	Vel	Pipe		Invert Elev		HGL Elev		Grnd / Rim Elev		Line ID
Line	To Line	(ft)	Incr (ac)	Total (ac)	(C)	Incr	Total	Inlet (min)	Syst (min)	(in/hr)	(cfs)	(cfs)	(ft/s)	Size (in)	Slope (%)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	
1	End	49.501	0.02	0.02	0.98	0.02	0.02	6.0	6.0	10.2	0.20	5.04	0.29	12	2.00	122.75	123.74	124.48	124.48	123.86	128.80	CB5 to INLET4

Project File: drain sys #4.stm

Number of lines: 1

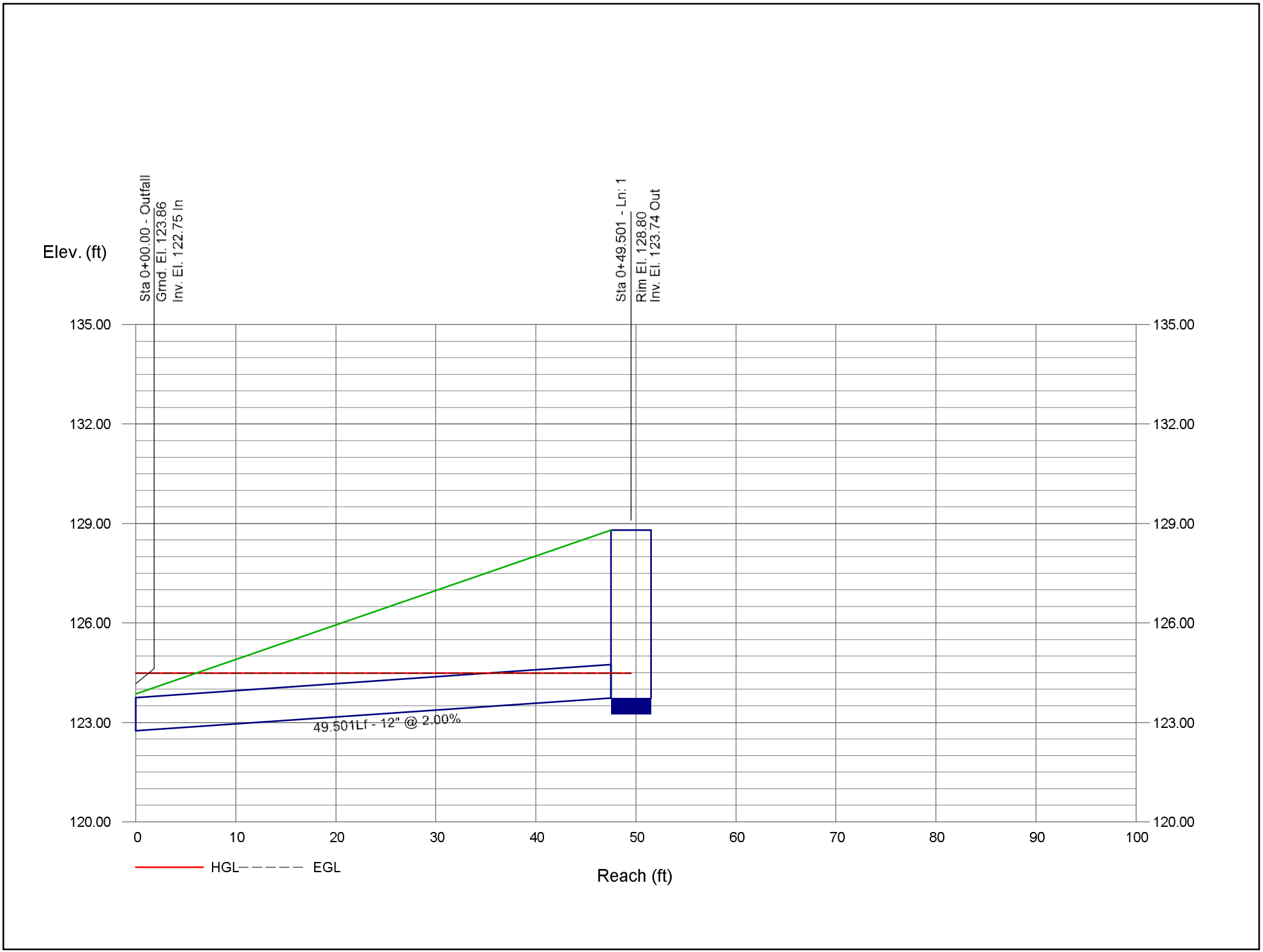
Run Date: 11/12/2021

NOTES:Intensity = 49.45 / (Inlet time + 3.40) ^ 0.70 ; Return period =Yrs. 100 ; c = cir e = ellip b = box

You created this PDF from an application that is not licensed to print to novaPDF printer (http://www.novapdf.com)

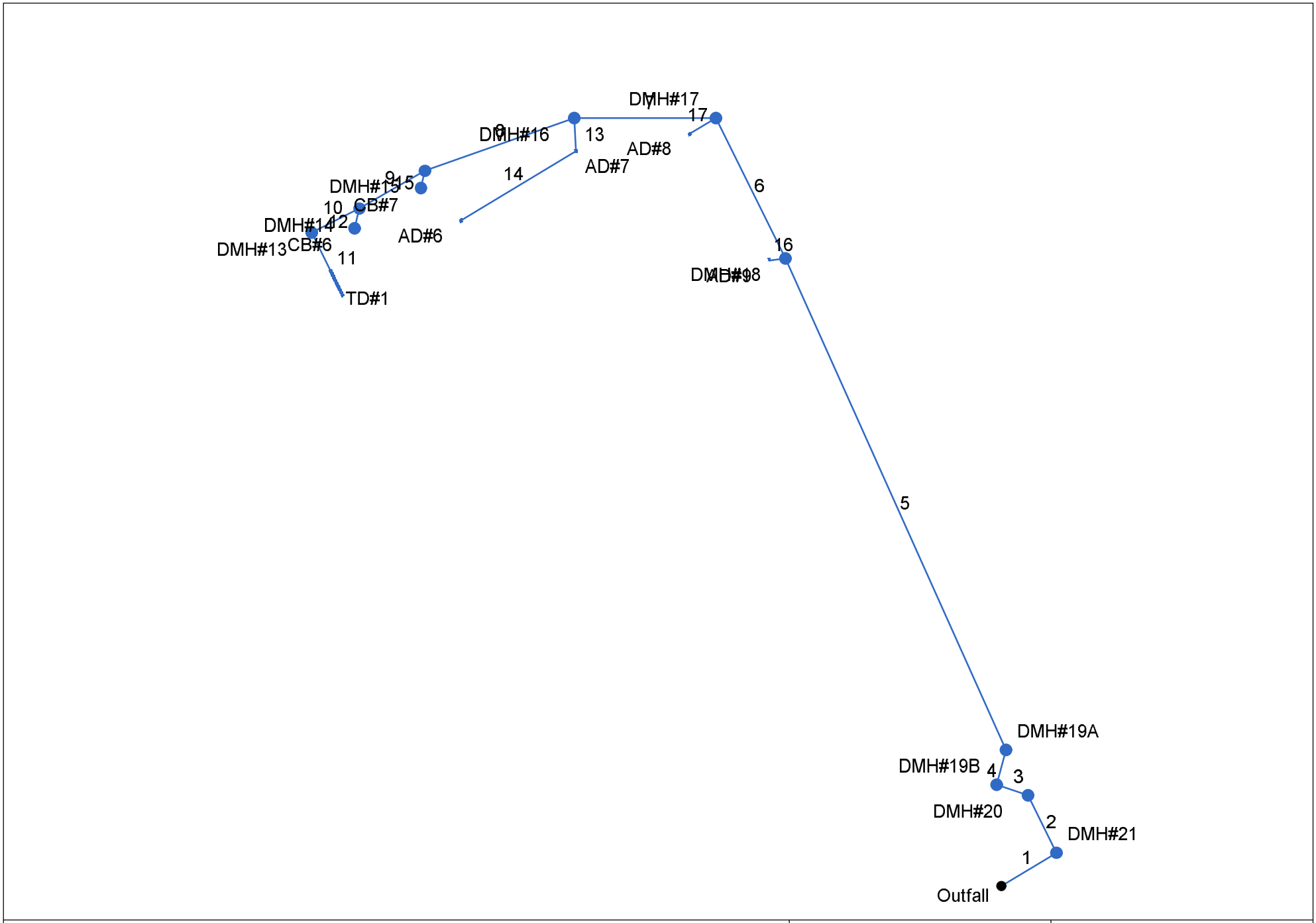
Storm Sewer Profile

Proj. file: drain sys #4.stm



You created this PDF from an application that is not licensed to print to novaPDF printer (http://www.novapdf.com)

Hydraflow Storm Sewers Extension for Autodesk® Civil 3D® Plan



Project File: drain sys #5.stm	Number of lines: 17	Date: 11/14/2021

Storm Sewers v12.00

You created this PDF from an application that is not licensed to print to novaPDF printer (http://www.novapdf.com)

Storm Sewer Tabulation

Station		Len	Drng Area		Rnoff coeff	Area x C		Tc		Rain (I)	Total flow	Cap full	Vel	Pipe		Invert Elev		HGL Elev		Grnd / Rim Elev		Line ID
Line	To Line	(ft)	Incr (ac)	Total (ac)	(C)	Incr	Total	Inlet (min)	Syst (min)	(in/hr)	(cfs)	(cfs)	(ft/s)	Size (in)	Slope (%)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	
1	End	23.000	0.00	0.29	0.00	0.00	0.24	0.0	9.1	5.5	1.32	2.97	2.59	12	0.70	122.75	122.91	123.74	123.40	123.86	128.56	DMH21 to INLET5
2	1	21.706	0.00	0.29	0.00	0.00	0.24	0.0	9.0	5.5	1.33	2.65	3.37	12	0.55	122.91	123.03	123.41	123.53	128.56	128.49	DMH20 to DMH21
3	2	12.033	0.00	0.29	0.00	0.00	0.24	0.0	9.0	5.5	1.34	3.08	3.02	12	0.75	123.03	123.12	123.66	123.61	128.49	128.79	DMH19B to DMH
4	3	12.033	0.00	0.29	0.00	0.00	0.24	0.0	8.9	5.6	1.34	2.90	3.51	12	0.66	123.12	123.20	123.61	123.69	128.79	128.75	DMH19A to DMH
5	4	181.636	0.00	0.29	0.00	0.00	0.24	0.0	7.9	5.9	1.42	2.26	3.04	12	0.40	123.20	123.93	123.78	124.51	128.75	129.30	DMH18 to DMH19
6	5	53.074	0.00	0.24	0.00	0.00	0.19	0.0	7.5	6.0	1.16	2.24	2.21	12	0.40	123.93	124.14	124.64	124.72	129.30	129.85	DMH17 to DMH18
7	6	51.749	0.00	0.20	0.00	0.00	0.17	0.0	7.1	6.2	1.06	2.27	2.19	12	0.41	124.14	124.35	124.81	124.88	129.85	130.69	DMH16 to DMH17
8	7	57.326	0.00	0.15	0.00	0.00	0.14	0.0	6.8	6.3	0.87	2.40	2.80	12	0.45	124.85	125.11	125.27	125.53	130.69	130.66	DMH15 to DMH16
9	8	27.142	0.00	0.12	0.00	0.00	0.11	0.0	6.5	6.5	0.69	2.37	1.92	12	0.44	125.11	125.23	125.63	125.66	130.66	130.26	DMH14 to DMH15
10	9	19.147	0.00	0.04	0.00	0.00	0.04	0.0	6.1	6.6	0.26	2.44	0.78	12	0.47	125.23	125.32	125.71	125.71	130.26	130.15	DMH13 to DMH14
11	10	18.977	0.04	0.04	0.96	0.04	0.04	6.0	6.0	6.7	0.26	1.21	2.55	8	1.00	125.68	125.87	125.89	126.10	130.15	126.44	TD1 to DMH13
12	9	6.721	0.08	0.08	0.86	0.07	0.07	6.0	6.0	6.7	0.46	4.95	2.21	12	1.93	125.36	125.49	125.71	125.77	130.26	130.10	CB6 to DMH4
13	7	10.863	0.02	0.05	0.86	0.02	0.03	6.0	6.5	6.5	0.22	1.72	2.81	8	2.03	125.21	125.43	125.37	125.64	130.69	128.87	AD7 to DMH16
14	13	48.000	0.03	0.03	0.55	0.02	0.02	6.0	6.0	6.7	0.11	1.71	1.50	8	2.00	125.43	126.39	125.64	126.54	128.87	128.88	AD6 to AD7
15	8	6.083	0.03	0.03	0.98	0.03	0.03	6.0	6.0	6.7	0.20	5.00	1.35	12	1.97	125.24	125.36	125.63	125.54	130.66	130.55	CB7 to DMH15
16	5	6.084	0.05	0.05	0.98	0.05	0.05	6.0	6.0	6.7	0.33	4.72	5.15	8	15.29	125.17	126.10	125.29	126.37	129.30	128.89	AD9 to DMH18
17	6	11.015	0.04	0.04	0.55	0.02	0.02	6.0	6.0	6.7	0.15	1.63	2.45	8	1.82	124.97	125.17	125.11	125.35	129.85	128.87	AD8 to DMH17

Project File: drain sys #5.stm

Number of lines: 17

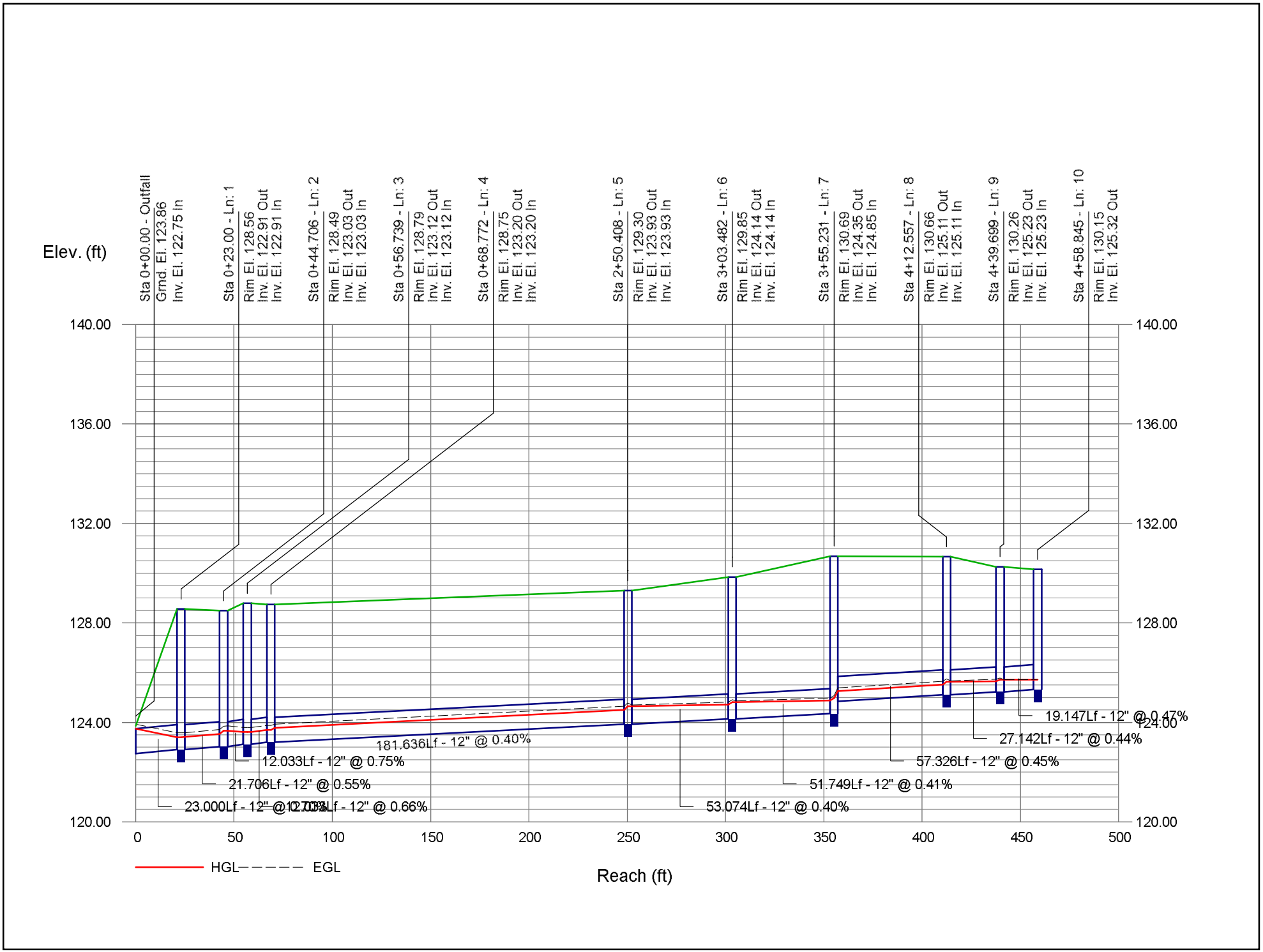
Run Date: 11/14/2021

NOTES:Intensity = 32.47 / (Inlet time + 3.40) ^ 0.70 ; Return period =Yrs. 10 ; c = cir e = ellip b = box

You created this PDF from an application that is not licensed to print to novaPDF printer (http://www.novapdf.com)

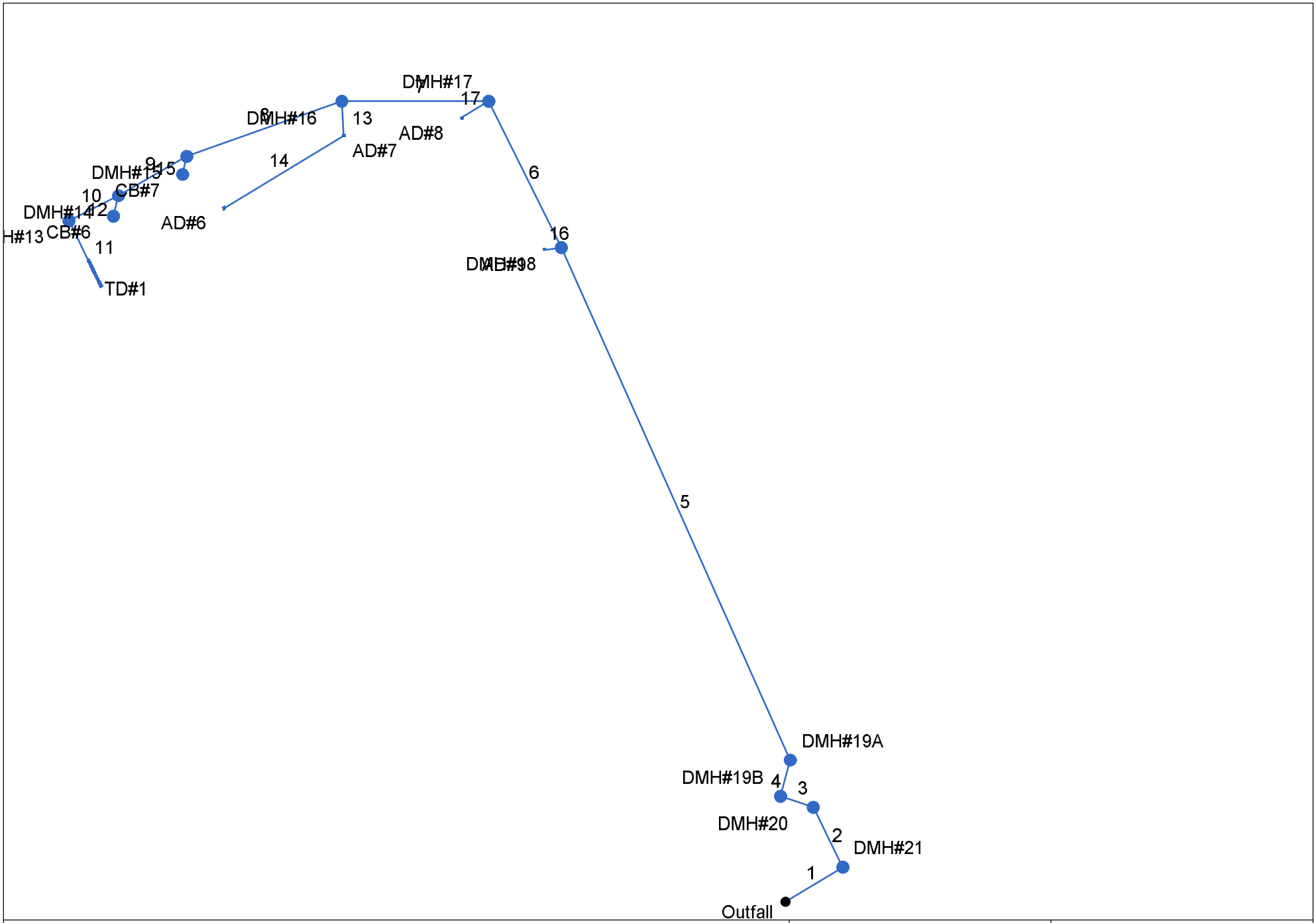
Storm Sewer Profile

Proj. file: drain sys #5.stm



You created this PDF from an application that is not licensed to print to novaPDF printer (http://www.novapdf.com)

Hydraflow Storm Sewers Extension for Autodesk® Civil 3D® Plan



Project File: drain sys #5.stm	Number of lines: 17	Date: 11/14/2021

Storm Sewers v12.00

You created this PDF from an application that is not licensed to print to novaPDF printer (http://www.novapdf.com)

Storm Sewer Tabulation

Station		Len	Drng Area		Rnoff coeff	Area x C		Tc		Rain (I)	Total flow	Cap full	Vel	Pipe		Invert Elev		HGL Elev		Grnd / Rim Elev		Line ID
Line	To Line	(ft)	Incr (ac)	Total (ac)	(C)	Incr	Total	Inlet (min)	Syst (min)	(in/hr)	(cfs)	(cfs)	(ft/s)	Size (in)	Slope (%)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	
1	End	23.000	0.00	0.29	0.00	0.00	0.24	0.0	10.0	7.9	1.92	2.97	2.44	12	0.70	122.75	122.91	124.48	124.55	123.86	128.56	DMH21 to INLET5
2	1	21.706	0.00	0.29	0.00	0.00	0.24	0.0	9.9	8.0	1.93	2.65	2.46	12	0.55	122.91	123.03	124.64	124.70	128.56	128.49	DMH20 to DMH21
3	2	12.033	0.00	0.29	0.00	0.00	0.24	0.0	9.8	8.0	1.94	3.08	2.47	12	0.75	123.03	123.12	124.77	124.81	128.49	128.79	DMH19B to DMH
4	3	12.033	0.00	0.29	0.00	0.00	0.24	0.0	9.7	8.1	1.95	2.90	2.48	12	0.66	123.12	123.20	124.90	124.94	128.79	128.75	DMH19A to DMH
5	4	181.636	0.00	0.29	0.00	0.00	0.24	0.0	8.6	8.6	2.08	2.26	2.65	12	0.40	123.20	123.93	125.01	125.63	128.75	129.30	DMH18 to DMH19
6	5	53.074	0.00	0.24	0.00	0.00	0.19	0.0	8.1	8.8	1.70	2.24	2.16	12	0.40	123.93	124.14	125.73	125.85	129.30	129.85	DMH17 to DMH18
7	6	51.749	0.00	0.20	0.00	0.00	0.17	0.0	7.7	9.1	1.54	2.27	1.97	12	0.41	124.14	124.35	125.92	126.02	129.85	130.69	DMH16 to DMH17
8	7	57.326	0.00	0.15	0.00	0.00	0.14	0.0	7.1	9.4	1.29	2.40	1.64	12	0.45	124.85	125.11	126.08	126.11	130.69	130.66	DMH15 to DMH16
9	8	27.142	0.00	0.12	0.00	0.00	0.11	0.0	6.8	9.6	1.03	2.37	1.34	12	0.44	125.11	125.23	126.15	126.17	130.66	130.26	DMH14 to DMH15
10	9	19.147	0.00	0.04	0.00	0.00	0.04	0.0	6.2	10.1	0.39	2.44	0.52	12	0.47	125.23	125.32	126.19	126.19	130.26	130.15	DMH13 to DMH14
11	10	18.977	0.04	0.04	0.96	0.04	0.04	6.0	6.0	10.2	0.39	1.21	2.02	8	1.00	125.68	125.87	126.19	126.16	130.15	126.44	TD1 to DMH13
12	9	6.721	0.08	0.08	0.86	0.07	0.07	6.0	6.0	10.2	0.70	4.95	1.94	12	1.93	125.36	125.49	126.19	125.84	130.26	130.10	CB6 to DMH4
13	7	10.863	0.02	0.05	0.86	0.02	0.03	6.0	6.6	9.8	0.33	1.72	0.94	8	2.03	125.21	125.43	126.08	126.09	130.69	128.87	AD7 to DMH16
14	13	48.000	0.03	0.03	0.55	0.02	0.02	6.0	6.0	10.2	0.17	1.71	1.28	8	2.00	125.43	126.39	126.11	126.58	128.87	128.88	AD6 to AD7
15	8	6.083	0.03	0.03	0.98	0.03	0.03	6.0	6.0	10.2	0.30	5.00	1.33	12	1.97	125.24	125.36	126.15	125.59	130.66	130.55	CB7 to DMH15
16	5	6.084	0.05	0.05	0.98	0.05	0.05	6.0	6.0	10.2	0.50	4.72	2.24	8	15.29	125.17	126.10	125.73	126.43	129.30	128.89	AD9 to DMH18
17	6	11.015	0.04	0.04	0.55	0.02	0.02	6.0	6.0	10.2	0.22	1.63	0.64	8	1.82	124.97	125.17	125.92	125.93	129.85	128.87	AD8 to DMH17

Project File: drain sys #5.stm

Number of lines: 17

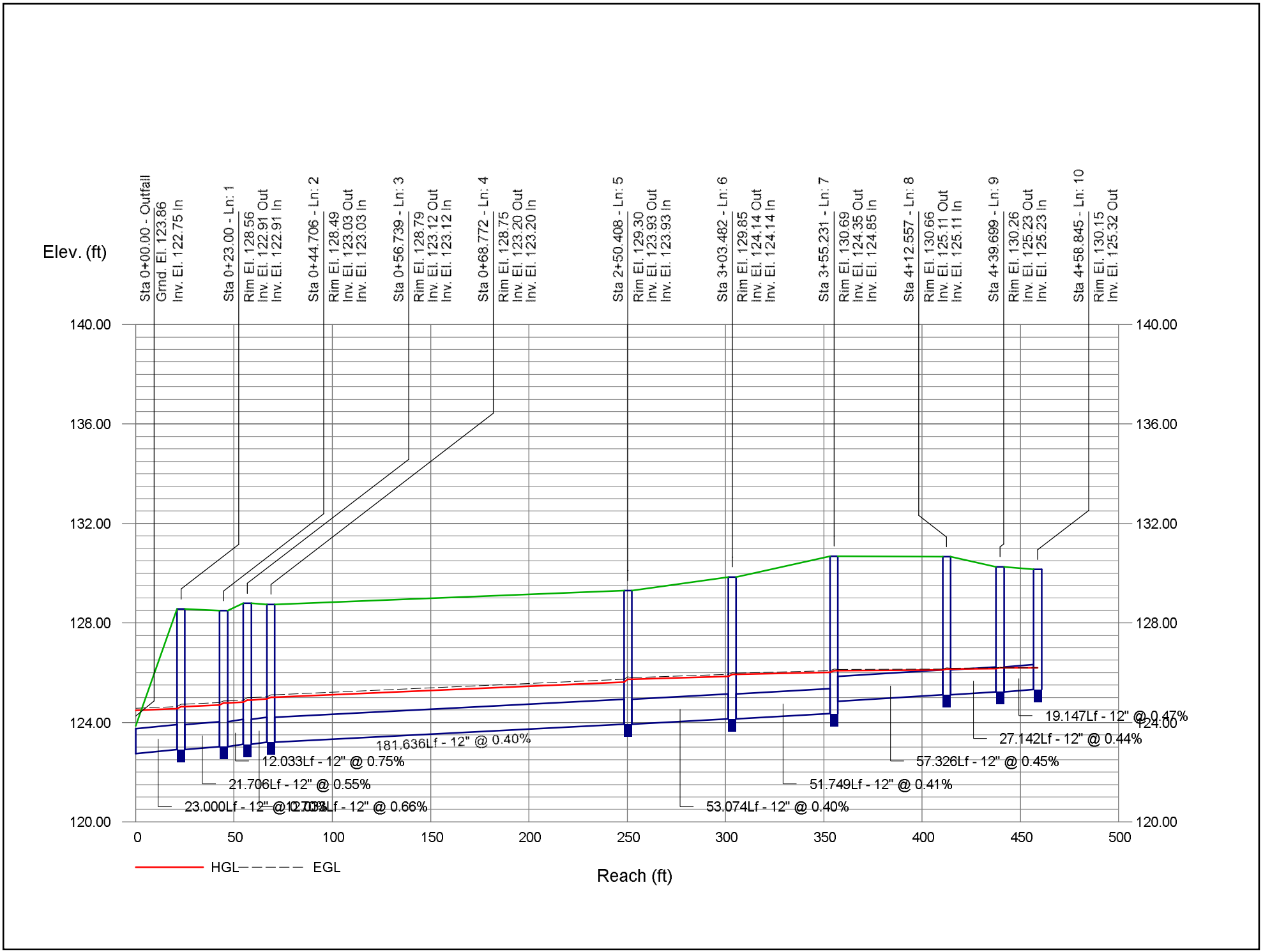
Run Date: 11/14/2021

NOTES:Intensity = 49.45 / (Inlet time + 3.40) ^ 0.70 ; Return period =Yrs. 100 ; c = cir e = ellip b = box

You created this PDF from an application that is not licensed to print to novaPDF printer (http://www.novapdf.com)

Storm Sewer Profile

Proj. file: drain sys #5.stm



You created this PDF from an application that is not licensed to print to novaPDF printer (http://www.novapdf.com)

SECTION 8 – DRAFT SWPPP

(INCLUDED UNDER SEPARATE COVER)

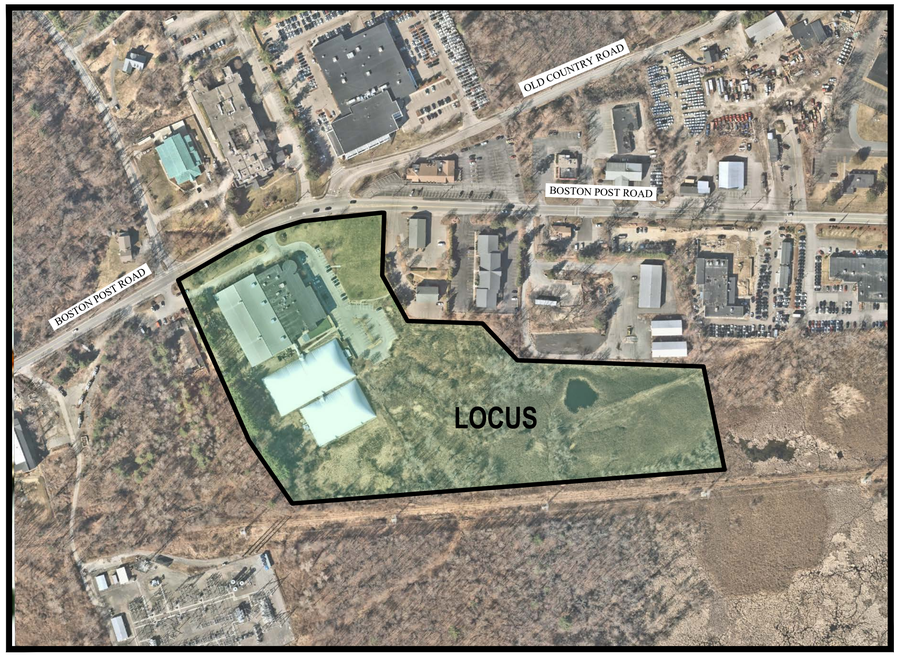
SECTION 9 – PROJECT PLANS
(Under Separate Cover)

PROPOSED SITE DEVELOPMENT PLANS

FOR

MERCEDES OF SUDBURY

141 BOSTON POST ROAD, SUDBURY, MA 01776

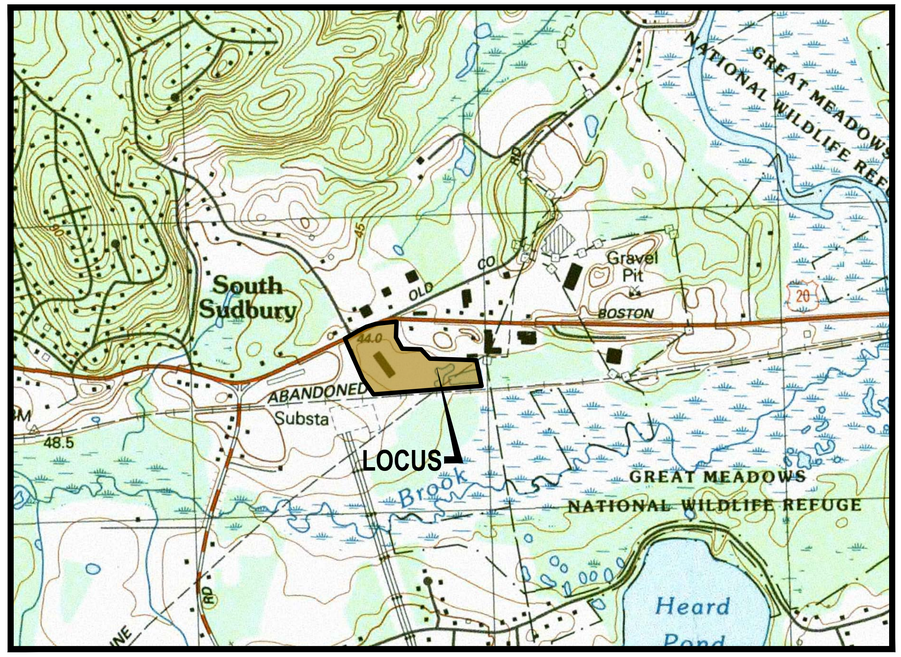


NORTH

AERIAL MAP

SCALE: 1" = 200'

200 100 0 200 4000



NORTH

USGS MAP

SCALE: 1" = 800'

800 400 0 800 1600

APPLICANT:

HERB CHAMBERS 43 BRAINTREE, LLC
83 BOSTON POST ROAD- ROUTE 20,
SUDBURY, MA 01776

SURVEYOR

CHA CONSULTING, INC.
141 LONGWATER DRIVE-SUITE 104
NORWELL, MA 02061

CONSULTING ENGINEER:

DGT ASSOCIATES
1071 WORCESTER ROAD
FRAMINGHAM, MA 01701

LANDSCAPE ARCHITECT:

RYAN ASSOCIATES
144 MOODY STREET, BUILDING 4
WALTHAM, MA 02453

ENGINEER/PERMITTING:

CROCKER DESIGN GROUP, LLC.
2 SHARP STREET, UNIT A,
HINGHAM, MA 02043

ARCHITECT:

THE CURTIS ARCHITECTURAL GROUP
36 BURRAGE ROAD
NEWTON CENTER, MA 02459

ATTORNEY:

ROLLINS, ROLLINS, AND FOX
36 GLEN AVENUE
NEWTON, MA 02459

DRAWING INDEX:

C-0	COVER SHEET
C-1	DEMOLITION PLAN
C-2	SOIL EROSION AND SEDIMENT CONTROL PLAN
C-3	SITE PLAN
C-4.1	GRADING AND DRAINAGE PLAN
C-4.2	GRADING AND DRAINAGE PLAN
C-5	UTILITIES PLAN
C-6.1	LANDSCAPE PLAN
C-6.2	LANDSCAPE PLAN
C-7	TEST PIT PLAN
C-8.1	DETAIL SHEET (1 OF 4)
C-8.2	DETAIL SHEET (2 OF 4)
C-8.3	DETAIL SHEET (3 OF 4)
C-8.4	DETAIL SHEET (4 OF 4)
C-9	LIGHTING PLAN

SUPPLEMENTAL PLANS:

EXISTING CONDITIONS PLAN

No.	Description	Date
3.	P.B. AND CON.–COM. RESUBMITTAL	02/14/22
2.	ZBA RESUBMITTAL	01/31/22
1.	PLANNING BOARD SUBMITTAL	11/15/21

Revisions

COMMONWEALTH OF MASSACHUSETTS
GABRIEL R. CROCKER
CIVIL
No. 47917
REGISTERED PROFESSIONAL ENGINEER

2-14-2022

GABRIEL R. CROCKER
PROFESSIONAL ENGINEER, MA REGISTRATION #47917

Crocker Design Group
2 SHARP STREET, UNIT A
HINGHAM, MA 02043
P: 781–919–0808

Project

MERCEDES OF SUDBURY

141 BOSTON POST ROAD, SUDBURY, MA

Prepared for

HERB CHAMBERS 43 BRAINTREE STREET, LLC

#259 McGRATH HIGHWAY - ROUTE 28 SOMERVILLE, MA 02143

Drawing Title

COVER SHEET

Project No.	100-107
Date	11/10/2021
Scale	AS NOTED
Drawn By	DJN / JPM
Approved By	GC

Drawing No. **C-0**

Feb 14, 2022, 13:57
C:\CDG\Crocker Design Group, LLC\Gabriel Crocker - Projects\100-107 Sudbury - Mercedes\dwg\Plot Sheets\Site Plan Application\ 01 COVER SHEET.dwg, C-0 COVER, Feb 14, 2022, 13:57

EXISTING PERVIOUS AREAS WITHIN LIMIT OF WORK TO BE STRIPPED AND EXCAVATED TO PROPOSED SUBGRADE (TYP.)

PROPOSED LIMIT OF WORK

PROPOSED 12" SILT SOCK AND SILT FENCE

EXISTING ROOF DRAIN COLLECTION PIPE TO BE REMOVED AND REPLACED.

EXISTING ROOF DRAINAGE SYSTEM TO BE REMOVED AND UPGRADED IN PLACE.

GRAVEL ROAD TO BE REMOVED AND STABILIZED.

PAVEMENT TO BE RECLAIMED. EXCAVATE AND GRADE TO SUBGRADE THROUGHOUT IN PREPARATION FOR PROPOSED CONDITIONS.

EXISTING 8" WATER SERVICE TO BE CUT, CAPPED, AND REMOVED YO ACCOMMODATE NEW WATER SERVICE AT LOWER DEPTH (SEE SHEET C-5)

LIMIT OF EXCAVATION FOR SUBSURFACE RETAIN IT SYSTEM

LIMIT OF EXCAVATION AND GROUND PREPARATION FOR BUILDING ADDITION

EXISTING BUILDING (TO REMAIN)

1-STORY AIR STRUCTURE TO BE REMOVED (TBR)

EXISTING WALKWAY TO BE REMOVED

EXISTING PRIMARY AND SECONDARY SERVICES, TRANSFORMER TO BE REMOVED TO ACCOMMODATE NEW ELECTRICAL SERVICE FROM NEW TRANSFORMER LOCATION

AREA TO BE STRIPPED OF GRASS AND TOPSOIL DOWN TO NATURAL MATERIAL AND STABILIZED.

PROPOSED TEMPORARY CONSTRUCTION ACCESS (SEE DETAIL)

EXISTING DRAINAGE PIPE TO BE REMOVED

EXISTING CONCRETE AND SPORT COURT AREA TO BE REMOVED

EXISTING DRAINAGE PIPES TO BE REMOVED

EXISTING PAVEMENT TO BE RECLAIMED THROUGHOUT

EXISTING RETAINING WALL SYSTEM TO BE REMOVED

EXISTING GAS SERVICE TO BE REMOVED AND RELOCATED TO ACCOMMODATE PROPOSED SITE IMPROVEMENTS. CONTRACTOR TO VERIFY EXISTING GAS SERVICE LOCATION PRIOR TO THE COMMENCEMENT OF ANY WORK. CONTRACTOR TO COORDINATE WITH GAS COMPANY AND CARRY COSTS FOR EXCAVATION AND BACKFILL WITH GAS COMPANY LAYING THE PIPE AND PERFORMING INSPECTIONS.

EXISTING PAVEMENT TO BE RECLAIMED (TYP. THROUGHOUT)

PROPOSED SILT SOCK AND SILT FENCE (TYP.)

END SILT FENCE CONTINUE 12" SILT SOCK

EXISTING WALKWAY TO BE REMOVED

APPROXIMATE LOCATION OF EXISTING SUBSURFACE SEWAGE DISPOSAL SYSTEM. CONTRACTOR TO VERIFY LOCATION AND FUNCTIONALITY OF SYSTEMS PER TITLE 5 RULES AND REGULATIONS PRIOR TO CONSTRUCTION. CONTRACTOR TO PROTECT SYSTEM DURING CONSTRUCTION. ANY ISSUES THAT ARISE BEFORE OR DURING CONSTRUCTION, THE CONTRACTOR IS INSTRUCTED TO CONTACT CROCKER DESIGN GROUP, LLC. AND OWNER OF PROPERTY IMMEDIATELY.

PROPOSED SILT SOCK

BEGIN 12" SILT SOCK AND SILT FENCE (TYP., SEE DETAIL)

BEGIN SINGLE SILT SOCK

CONTRACTOR TO MAINTAIN ACCESS TO/FOR ABUTTER THROUGHOUT THE DURATION OF CONSTRUCTION

EXISTING POSTS TO BE REMOVED

SEE LANDSCAPE SHEETS C-6.1 AND C-6.2 FOR PROTECTION AND MAINTENANCE OF EXISTING TREES TO REMAIN (TYP.)

PROPOSED SILT SOCK (SEE DETAIL)

EXISTING GAS SERVICE TO BE RELOCATED. COORDINATE WITH GAS COMPANY.

PROPOSED INLET PROTECTION (TYP)

SEE LANDSCAPE SHEET C-7 FOR PROTECTION AND MAINTENANCE OF EXISTING TREES TO REMAIN (TYP.)

EXISTING HYDRANT AND ASSOCIATED ASSEMBLY TO BE REMOVED AND TO ACCOMMODATE NEW LOCATION AND DEPTH OF WATER SERVICE (SEE SHEET C-5)

END SINGLE SILT SOCK

PROPOSED SAWCUT LINE

BEGIN 12" SILT SOCK

EXISTING BOSSE SPORTS SIGN TO BE REMOVED AND REPLACED WITH PROPOSED MERCEDES SIGN. REFER TO SEPARATE SIGN PACKAGE PREPARED BY ARCHITECT

EXISTING ELECTRICAL SERVICE TO BE REMOVED AND RELOCATED TO ACCOMMODATE PROPOSED SITE IMPROVEMENTS. CONTRACTOR TO VERIFY EXISTING ELECTRICAL SERVICE LOCATION PRIOR TO THE COMMENCEMENT OF ANY WORK. CONTRACTOR TO COORDINATE WITH ELECTRIC COMPANY AND CARRY COSTS FOR EXCAVATION AND BACKFILL WITH ELECTRIC COMPANY LAYING PERFORMING INSPECTIONS.

SEE LANDSCAPE SHEET C-7 FOR PROTECTION AND MAINTENANCE OF EXISTING TREES TO REMAIN (TYP.)

EXISTING PERVIOUS AREAS WITHIN LIMIT OF WORK TO BE STRIPPED AND EXCAVATED TO PROPOSED SUBGRADE (TYP.)

EXISTING ELECTRIC BOX FOR SEPTIC SYSTEM ALARM TO BE RELOCATED

PROPOSED LIMIT OF WORK

ABUTTER'S SIGN ON PROJECT'S PROPERTY. OWNER TO COORDINATE WITH ABUTTER ON WHETHER SIGN IS TO REMAIN OR BE REMOVED

TEMPORARY BENCHMARK DJB-1 CUT IN HYDRANT BONNET BOLT ELEV=133.79 (NAVD88)

BOSTON POST ROAD - ROUTE 20 (PUBLIC - 40' WIDE) (1969 STATE HIGHWAY LAYOUT #8345)

RTE 20 EAST

LEFT LANE MUST TURN

CONSERVATION RESTRICTION LINE (TYP.)

CONSERVATION RESTRICTION DOC. #1306088

LEGEND

	EXISTING TREE TO BE REMOVED
	EXISTING LIGHT TO BE REMOVED (SEE DEMO NOTE 1)
	PROPOSED CONSTRUCTION ENTRANCE
(TBR)	TO BE REMOVED
	CATCH BASIN INLET PROTECTION
	LIMIT OF WORK
	12" SILT SOCK
	WIRED BACKED SILT FENCE

GENERAL NOTES

1) PROTECTIONS

A.) PROVIDE PROTECTION NECESSARY TO PREVENT DAMAGE TO EXISTING IMPROVEMENTS, TREES OR VEGETATION.

B.) PROTECT IMPROVEMENTS ON ADJOINING PROPERTIES AND ON OWNER'S PROPERTY.

C.) RESTORE DAMAGED IMPROVEMENTS TO ORIGINAL CONDITION AS ACCEPTABLE TO PARTIES HAVING JURISDICTION.

D.) CONDUCT OPERATIONS TO ENSURE MINIMUM INTERFERENCE WITH OPERATIONS, STREETS, WALKS, AND OTHER ADJACENT FACILITIES. DO NOT CLOSE OR OBSTRUCT STREETS, WALKS, OR OTHER OCCUPIED OR USED FACILITIES WITHOUT PERMISSION FROM AUTHORITIES HAVING JURISDICTION. STREETS AND ROADWAYS SHALL BE THOROUGHLY CLEANED AND/OR SWEPT ON A DAILY BASIS OR MORE FREQUENTLY AS REQUIRED BY THE GOVERNING AUTHORITY.

2.) UNLESS SPECIFIED OTHERWISE ALL MATERIALS AND WORKMANSHIP SHALL BE IN ACCORDANCE WITH THE MASSACHUSETTS HIGHWAY DEPARTMENT SPECIFICATIONS FOR HIGHWAYS AND BRIDGES AND/OR THE APPROPRIATE LOCAL AUTHORITIES.

3.) ALL SLOPES, UNLESS OTHERWISE SPECIFIED, SHALL BE LOAMED AND SEEDED FOR STABILIZATION AS SOON AS POSSIBLE TO PREVENT EROSION INTO WETLAND RESOURCE AREAS, ABUTTING PROPERTIES, OR PUBLIC WAYS. EROSION CONTROL BLANKETS ARE REQUIRED FOR ALL 2H:1V SLOPES. SLOPES MAY NOT EXCEED 2H:1V. SEE "SEEDING" NOTE 3.

4.) ANY DEVIATIONS, I.E. "FIELD CHANGES" FROM THE DESIGN PLAN(S) MUST BE APPROVED BY THE DESIGN ENGINEER IN WRITING. CONTRACTOR SHOULD BE AWARE THAT LOCAL AND STATE AUTHORITIES HAVE JURISDICTION AND APPROVALS MUST BE OBTAINED FROM THE APPROPRIATE AUTHORITY PRIOR TO THE IMPLEMENTATION OF THE "FIELD CHANGE." CROCKER & COLANTONIO, INC. ASSUMES NO LIABILITY OR RESPONSIBILITY FOR WORK ASSOCIATED WITH FIELD CHANGES COMPLETED WITHOUT REGARD TO THE "FIELD CHANGE" PROCEDURE.

5.) RELOCATION OF ANY UTILITIES SHALL BE PERFORMED IN ACORDANCE WITH THE PROVISIONS OF THE APPROPRIATE UTILITY COMPANY AND/OR REGULATORY AGENCY.

6.) * * * DIG SAFE NOTE * * *
IN ACCORDANCE WITH MGL. CH. 82, SEC. 40 INCLUDING AMENDMENTS, ALL CONTRACTORS SHALL NOTIFY UTILITY COMPANIES AND GOVERNMENT AGENCIES, IN WRITING, OF THE INTENT TO EXCAVATE, BLAST, DEMOLISH, BORE, OR PERFORM OTHER EARTH MOVING OPERATIONS NO LESS THAN 72 HOURS AND NO MORE THAN 30 DAYS PRIOR TO THE COMMENCEMENT OF SUCH WORK (EXCLUSIVE OF SATURDAYS, SUNDAYS, AND LEGAL HOLIDAYS) OR CALL "DIG SAFE" AT 1-888-DIG-SAFE.

7.) LOCATION OF UNDERGROUND UTILITIES ON THIS PLAN ARE APPROXIMATE ONLY AND ARE BASED ON ACTUAL FIELD LOCATIONS OF VISIBLE STRUCTURES AND PLAN COMPILATIONS. EXISTING UTILITY LOCATIONS AND ELEVATIONS SHOWN SHALL BE VERIFIED BY CONTRACTOR PRIOR TO CONSTRUCTION. TEST PITS SHALL BE PERFORMED BY CONTRACTOR PRIOR TO CONSTRUCTION. THE CONTRACTOR SHALL INFORM THE DESIGN ENGINEER OF ANY DISCREPANCIES PRIOR TO THE START OF ANY CONSTRUCTION.

8.) USE OF EXPLOSIVES

A.) COMPLY WITH ALL LAWS, RULES AND REGULATIONS OF FEDERAL, STATE, AND LOCAL AUTHORITIES AND INSURERS WHICH GOVERN STORAGE, USE, MANUFACTURE, SALE, HANDLING, TRANSPORTATION, LICENSING, OR OTHER DISPOSITION OF EXPLOSIVES. UTILIZE SPECIAL PRECAUTIONS FOR PROPER USE OF EXPLOSIVES TO PREVENT HARM TO HUMAN LIFE AND DAMAGE TO SURFACE STRUCTURES, ALL UTILITY LINES OR OTHER SUBSURFACE STRUCTURES. DO NOT CONDUCT BLASTING OPERATIONS UNTIL PERSONS IN VICINITY HAVE HAD AMPLE NOTICE AND HAVE REACHED POSITIONS OF SAFETY.

B.) BLASTING OF ANY ROCK SHALL REQUIRE APPROPRIATE APPROVALS FROM THE LOCAL FIRE DEPARTMENT, PLANNING BOARD, BUILDING INSPECTOR AND OTHER PERTINENT AGENCIES, PRIOR TO COMMENCEMENT OF WORK. ALL BLASTED ROCK OR OTHER EXCESS MATERIALS MUST BE REMOVED FROM THE SITE AND DISPOSED OF AT THE EXPENSE OF THE CONTRACTOR.

9.) ADDITIONAL BENCHMARKS TO BE SET BY CONTRACTOR PRIOR TO CONSTRUCTION TO ENSURE QUALITY WORKMANSHIP.

30 15 0 30 60

Date	Description	No.
02/14/22	P.B. AND CON.-COM. RESUBMITTAL	3.
01/31/22	ZBA RESUBMITTAL	2.
11/15/21	PLANNING BOARD SUBMITTAL	1.

Revisions

COMMONWEALTH OF MASSACHUSETTS — GABRIEL R. CROCKER — CIVIL — No. 47917 — REGISTERED PROFESSIONAL ENGINEER

2-14-2022

GABRIEL R. CROCKER
PROFESSIONAL ENGINEER, MA REGISTRATION #47917

Crocker Design Group
2 SHARP STREET, UNIT A
HINGHAM, MA
02043
P: 781-919-0808

Project

MERCEDES OF SUDBURY

141 BOSTON POST ROAD,
SUDBURY, MA

Prepared for

HERB CHAMBERS 43 BRAINTREE STREET, LLC

#259 McGRATH HIGHWAY - ROUTE 28
SOMERVILLE, MA 02143

Drawing Title

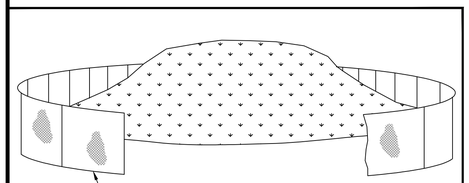
DEMOLITION PLAN

Project No.	100-107
Date	11/10/2021
Scale	1"=30'
Drawn By	DJN / JPM
Approved By	GC

Drawing No.

C-1

C:\CDG\Crocker Design Group, LLC\Gabriel Crocker - Projects\100-107 Sudbury - Mercedes\dwg\Plot Sheets\Site Plan Application_00 DEMO Feb 14, 2022 14:13

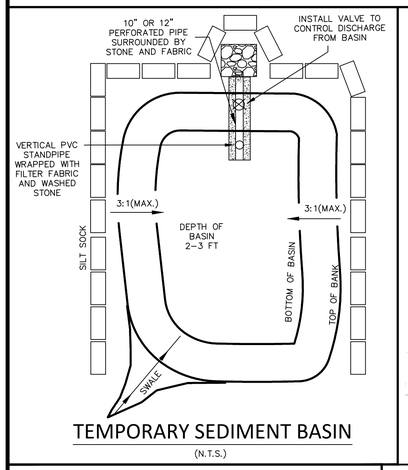


NOTE:

STABILIZE STOCKPILE WITH ANNUAL RYEGRASS, MULCH OR EROSION CONTROL BLANKETS.

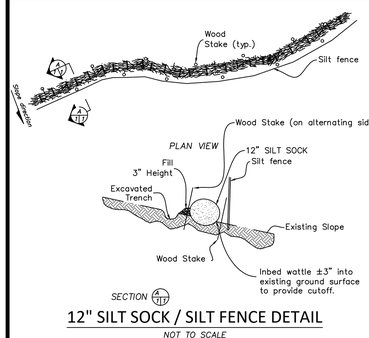
SOIL STOCKPILE

NOT TO SCALE



TEMPORARY SEDIMENT BASIN

(N.T.S.)

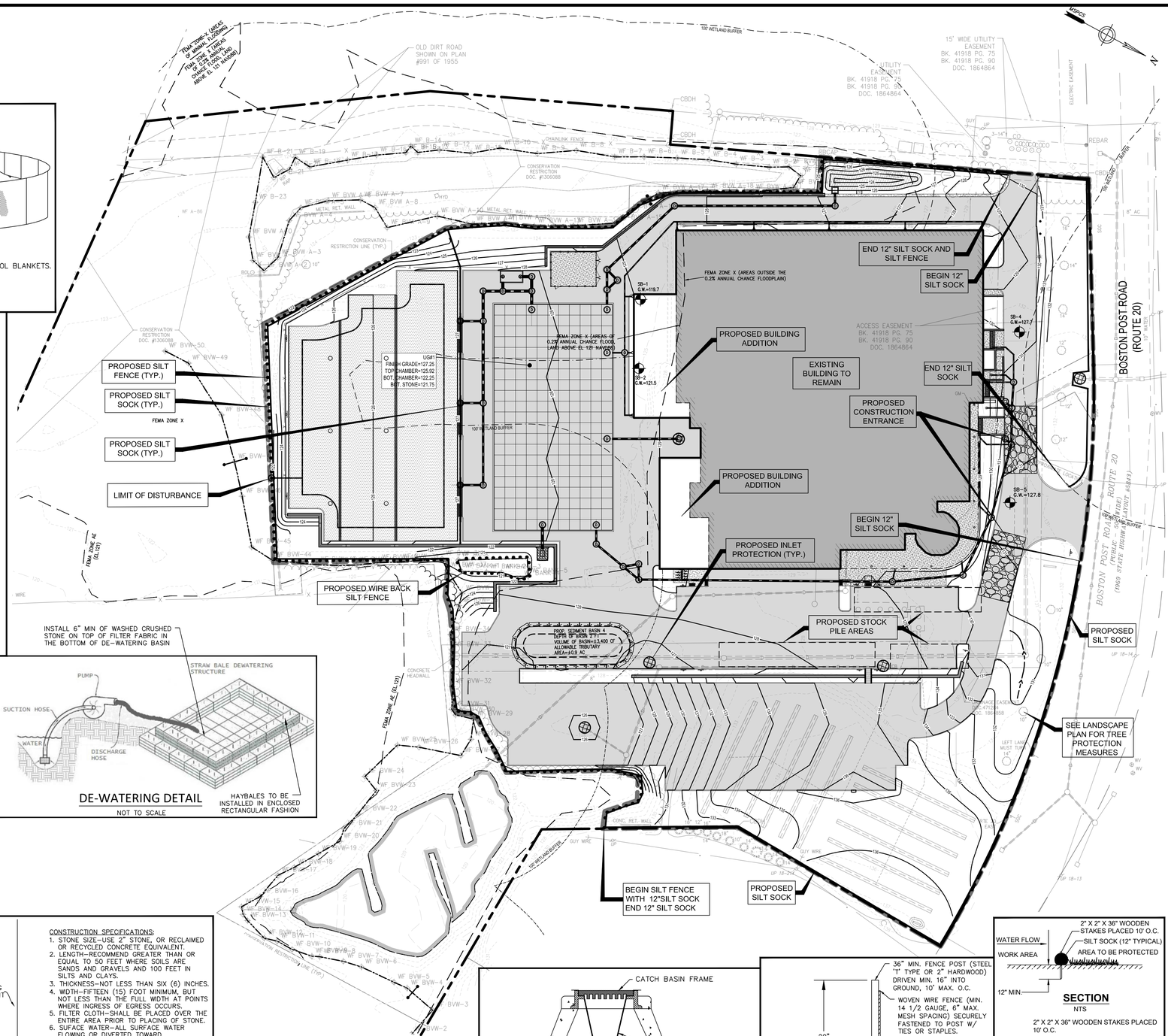


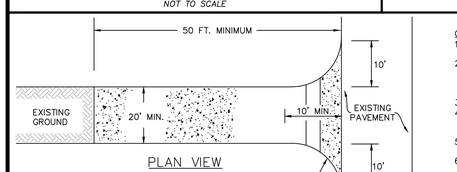
12" SILT SOCK / SILT FENCE DETAIL

NOT TO SCALE

DE-WATERING DETAIL

NOT TO SCALE





CONSTRUCTION ENTRANCE

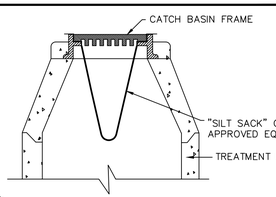
NOT TO SCALE

CONSTRUCTION SPECIFICATIONS:

1. STONE SIZE–USE 2" STONE, OR RECLAIMED OR RECYCLED CONCRETE EQUIVALENT.
2. LENGTH–RECOMMEND GREATER THAN OR EQUAL TO 50 FEET WHERE SOILS ARE SANDS AND GRAVELS AND 100 FEET IN SILTS AND CLAYS.
3. THICKNESS–NOT LESS THAN SIX (6) INCHES.
4. WIDTH–FIFTEEN (15) FOOT MINIMUM, BUT NOT LESS THAN THE FULL WIDTH AT POINTS WHERE INGRESS OF EGRESS OCCURS.
5. FILTER CLOTH–SHALL BE PLACED OVER THE ENTIRE AREA PRIOR TO PLACING OF STONE.
6. SUFACE WATER–ALL SURFACE WATER FLOWING OR DIVERTED TOWARD CONSTRUCTION ENTRANCES SHALL BE PIPED ACROSS THE ENTRANCE. IF PIPING IS IMPRACTICAL, A MOUNTABLE BERM SHALL BE INSTALLED.
7. MAINTENANCE– THE ENTRANCE SHALL BE MAINTAINED IN A CONDITION WHICH SHALL PREVENT TRACKING OF FLOWING OF SEDIMENT ONTO PUBLIC RIGHTS–OF–WAY. THIS MAY REQUIRE PERIODIC TOP DRESSING WITH ADDITIONAL STONE AS CONDITIONS DEMAND AND REPAIR OR CLEANOUT OF ANY MEASURES USED TO TRAP SEDIMENT. ALL SEDIMENT SPILLED, DROPPED, WASHED OR TRACKED ONTO PUBLIC RIGHTS–OF–WAY MUST BE REMOVED IMMEDIATELY.
8. PERIODIC INSPECTION AND NEEDED MAINTENCE SHALL BE PROVIDED.

LEGEND

- PROPOSED LIMIT OF DISTURBANCE
- PROPOSED SILT SOCK ROW
- PROPOSED SILT FENCE
- PROPOSED CONSTRUCTION ENTRANCE
- PROPOSED INLET PROTECTION
- PROPOSED STOCK PILE

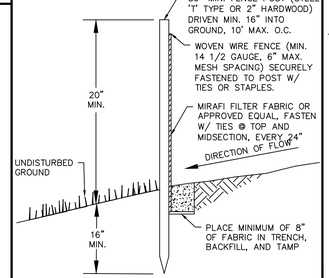


NOTES:

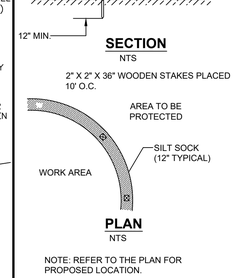
1. TO BE INSTALLED IN ALL GRATED TREATMENT UNITS AFTER INSTALLATION AND UNTIL COMPLETION OF CONSTRUCTION.
2. BOOT ADAPTER MAY BE TRIMMED TO SIZE.

"SILT SACK" FILTER BAG

(N.T.S.)



SILT FENCE



NOTE: REFER TO THE PLAN FOR PROPOSED LOCATION.

12" SILT SOCK DETAIL

NTS

GENERAL NOTES

1. CONTRACTOR TO ABIDE BY PROVISIONS OF EPA NOI NPDES STORMWATER POLLUTION PREVENTION PLAN (SWPPP) AND BY STORMWATER MANAGEMENT OPERATION AND MAINTENANCE PLAN AS PREPARED BY CROCKER DESIGN GROUP, LLC.

2. ALL TEMPORARY STOCKPILE AREAS SHALL HAVE EROSION CONTROLS (SILT SOCK AND SILT FENCE) AROUND THE PERIMETER.

3. UNDERGROUND UTILITIES MAY EXIST THAT ARE NOT SHOWN ON THIS PLAN. DIG SAFE MUST BE NOTIFIED (1-800-344-7233) AT LEAST 72 HOURS PRIOR TO ANY CONSTRUCTION.

4. ALL SEDIMENTATION AND EROSION CONTROL MEASURES SHALL BE MAINTAINED THROUGHOUT THE CONSTRUCTION PERIOD. SEDIMENTATION AND EROSION CONTROL MEASURES SHALL BE IN PLACE AND OBSERVED PRIOR TO ANY WORK STARTING ON THE PROJECT.

5. SITE ENTRY AND EXIT LOCATIONS SHALL BE MAINTAINED IN A CONDITION WHICH WILL PREVENT TRACKING OR FLOWING OF SEDIMENT ONTO PUBLIC ROADWAYS. ALL SEDIMENT SPILLED, DROPPED, WASHED OR TRACKED ON A PUBLIC ROADWAY MUST BE REMOVED IMMEDIATELY. WHEN WASHING IS REQUIRED TO REMOVE SEDIMENT PRIOR TO ENTRANCE TO A PUBLIC ROADWAY, IT SHALL BE DONE ON AN AREA STABILIZED WITH CRUSHED STONE WHICH DRAINS INTO AN APPROVED SEDIMENT BASIN. ALL FINES IMPOSED FOR TRACKING ONTO PUBLIC ROADS SHALL BE PAID BY THE CONTRACTOR.

6. TEMPORARY SEEDING OR OTHER METHOD OF STABILIZATION SHALL BE INITIATED WITHIN 14 DAYS OF THE LAST DISTURBANCE ON ANY AREA OF THE SITE, UNLESS ADDITIONAL CONSTRUCTION OF THE AREAS IS EXPECTED WITHIN 21 DAYS OF THE LAST DISTURBANCE.

7. UPON COMPLETION OF FINE GRADING, ALL AREAS NOT OTHERWISE PERMANENTLY STABILIZED SHALL BE SEEDED AND MAINTAINED UNTIL A UNIFORM COVERAGE OF 75%± MINIMUM DENSITY, AS DETERMINED BY THE OWNER'S REPRESENTATIVE, IS ACHIEVED.

8. MAINTENANCE - EROSION CONTROLS SHALL BE REPAIRED OR REPLACED AS INSPECTION DEEMS NECESSARY OR AS DIRECTED BY THE ENGINEER OR ARCHITECT. ACCUMULATED SILT AT ANY EROSION CONTROL DEVICE SHALL BE REMOVED WHEN IT REACHES A DEPTH OF 6", AND SHALL BE DISTRIBUTED ON-SITE IN A MANNER NOT CONTRIBUTING TO ADDITIONAL SILTATION.

9. ANY CONTRACTOR IS RESPONSIBLE FOR REESTABLISHING ANY EROSION CONTROL DEVICE

CONSTRUCTION PHASING

1. BELOW IS A GENERAL CONSTRUCTION PHASING. A MORE DETAILED SCHEDULE IS PRESENTED IN THE STORMWATER POLLUTION PREVENTION PLAN (SWPPP).

2. CENTERLINE OF ROAD AND EXTENTS OF CONSTRUCTION TO BE DELINEATED BY CONTRACTOR.

3. EROSION AND SEDIMENTATION CONTROL MEASURES INCLUDING SILT SOCK AND SILT FENCE (OR OPTIONAL FILTER SACK IN LIEU OF SILT SOCK AND SILT FENCE) WILL BE INSTALLED. CONTRACTOR SHALL INSPECT CONTROL MEASURES MONTHLY AND AFTER RAIN EVENTS OF 0.5" OR GREATER.

4. THE PROJECT AREA WILL BE CLEARED OF DEBRIS AND BOULDERS. MATERIAL REMOVED FROM THE SITE WILL BE TRANSPORTED TO AN APPROPRIATE FACILITY OR WILL BE DISPOSED OF ELSEWHERE ACCORDING TO FEDERAL, STATE, AND LOCAL GUIDELINES. INACTIVE STOCKPILES OR AREAS OF GRANULAR MATERIAL OR TOPSOIL SHALL BE TEMPORARILY SEEDED OR MULCHED IN ORDER TO CONTROL SEDIMENT LADEN RUNOFF.

5. CONTRACTOR IS RESPONSIBLE TO SET OUT UTILITIES AND ANY NECESSARY GRADES.

6. GRADING OF SITE INCLUDING BUILDING PADS, PARKING AREAS, AND DETENTION BASINS AND DIGGING OF UTILITY TRENCHES TO DEFINED INVERT LEVELS. MATERIAL TO BE STORED ON AN UNUSED SITE AREA FOR FILL OR PROPERLY REMOVED FROM THE JOB SITE. IF SUITABLE TOPSOIL IS FOUND, IT WILL BE REMOVED AND STOCKPILED IN AN UPLAND AREA AT LEAST 100' FROM WETLANDS TO BE REUSED AS TOPSOIL ON THE PROJECT.

7. PLACING OF FILL OR SUITABLE MATERIAL ON ALL ACCESS ROADS FOR EASY ACCESS, SETTING OUT OF FOUNDATIONS AND SURROUNDING ROADS.

8. LAYING OF ALL UTILITIES INCLUDING DRAINAGE PIPES AND STRUCTURES FOLLOWED BY BACK-FILL, TAKING CARE TO LEAVE ONLY TRENCHES BEING WORKED ON OPEN.

9. FINE GRADING FOR THE PARKING AREAS, ROADWAYS, AND DRAINAGE BASINS TO BE COMPLETED.

10. DRAINAGE BASIN VEGETATION TO BE ESTABLISHED PRIOR TO DISCHARGE FROM CONSTRUCTED DRAINAGE STRUCTURES.

11. ONCE THE DRAINAGE STRUCTURES ARE INSTALLED, PROVIDE PROTECTION AT ALL CATCH BASINS AND INLETS TO PREVENT SEDIMENT FROM ENTERING THE DRAINAGE SYSTEM.

12. INSTALL BINDER COURSE AND SPREAD TOPSOIL AS NEEDED.

13. LIGHT POLES, SIGNAGE, ETC. WILL BE INSTALLED.

14. INSTALL TOP COURSE OF PAVING AND SIDEWALK.

15. THE FINAL PHASE OF CONSTRUCTION IS RESTORATION AND STABILIZATION OF ALL EXPOSED SURFACES. DISTURBED AREAS SHALL BE LANDSCAPED OR SEEDED (SEE ADDITIONAL DISCUSSION IN SWPPP). IN THE EVENT THAT WEATHER CONDITIONS PREVENT FINAL STABILIZATION, TEMPORARY EROSION AND SEDIMENTATION MEASURES WILL BE EMPLOYED UNTIL THE TEMPERATURE AND WEATHER IS SUITABLE FOR GRASS GROWING. A FINAL INSPECTION WILL ENSURE THAT THE SITE IS CLEARED OF ALL PROJECT DEBRIS AND THAT EROSION AND SEDIMENTATION CONTROLS ARE FUNCTIONING PROPERLY. SILT SOCK AND SILT FENCE WILL REMAIN IN PLACE UNTIL THE SITE IS FULLY STABILIZED AND THE SITE HAS PASSED FINAL INSPECTION. VEGETATION IS TO BE OF A UNIFORM DENSITY OF AT LEAST 75% FOR ACCEPTANCE.

EROSION CONTROL NOTE:

EROSION CONTROL MEASURES ARE IDENTIFIED ON BOTH THE DEMOLITION PLAN AND THIS SHEET. THE EROSION CONTROLS ON THE DEMOLITION PLAN ADDRESS THOSE MEASURES REQUIRED TO BE IN PLACE TO PERFORM DEMOLITION OF EXISTING SITE FACILITIES. THE GOAL OF THIS PLAN IS TO IDENTIFY THE ADDITIONAL MINIMUM MEASURES EXPECTED TO BE REQUIRED AS THE PROPOSED SITE COMPONENTS TAKE SHAPE. ALSO REFER TO SWPPP REQUIREMENTS.

(CONTINUATION OF GENERAL NOTES)

WHICH HE DISTURBS. EACH CONTRACTOR SHALL NOTIFY THE ENGINEER/ARCHITECT OF ANY DEFICIENCIES IN THE ESTABLISHED EROSION CONTROL MEASURES WHICH MAY LEAD TO UNAUTHORIZED DISCHARGE OR STORM WATER POLLUTION, SEDIMENTATION OR OTHER POLLUTANTS. UNAUTHORIZED POLLUTANTS INCLUDE, BUT ARE NOT LIMITED TO, EXCESS CONCRETE DUMPING OR CONCRETE RESIDUE, PAINTS, SOLVENTS, GREASE, FUEL AND LUBE OIL, PESTICIDES, ANY SOLID WASTE MATERIALS.

9. ALL SIDE SLOPES SHALL BE SEEDED WITH GRASS OR INSTALL JUTE NETTING TO PREVENT EROSION.

10. INSPECTIONS: INSPECTIONS ARE TO BE PERFORMED BY QUALIFIED PERSONNEL. DISTURBED AREAS THAT HAVE NOT BEEN FINALLY STABILIZED, AREAS USED FOR STORAGE, STRUCTURAL CONTROL MEASURES, AND LOCATIONS WHERE VEHICLES ENTER OR EXIT THE SITE, MUST BE INSPECTED ONCE EVERY 7 DAYS AND WITHIN 24 HOURS OF A STORM EVEN OF 0.5 INCHES OR GREATER. STABILIZED AREAS ARE TO BE INSPECTED ONCE PER MONTH DISTURBED AREAS AND STORAGE AREAS EXPOSED TO PRECIPITATION SHALL BE INSPECTED FOR EVIDENCE OF OR POTENTIAL FOR POLLUTANTS ENTERING THE DRAINAGE SYSTEM. CONTROL MEASURES SHALL BE OBSERVED TO ENSURE THEY ARE WORKING PROPERLY. DISCHARGE LOCATIONS AND POINTS SHALL BE INSPECTED TO ASCERTAIN WHETHER CONTROLS ARE PREVENTING SIGNIFICANT IMPACT. BASED ON THE RESULTS OF THE ABOVE INSPECTIONS, ANY NECESSARY CHANGES TO THE PLAN WILL BE MADE WITHIN 7 DAYS OF THE INSPECTION AND SUBMITTED TO THE TOWN OF SUDBURY PLANNING BOARD. THE CHANGES MUST BE IMPLEMENTED IN THE FIELD BEFORE THE NEXT STORM EVEN IF PRACTICABLE, OTHERWISE AS SOON AS POSSIBLE.

11. INSTALL AND MAINTAIN CATCH BASIN INSERTS IN ALL PROPOSED AND EXISTING CATCH BASINS.

12. PROVIDE TEMPORARY SEDIMENTATION BASINS, SILT SOCK, ETC. AS NECESSARY.

13. STOCKPILES ARE TO BE AT LEAST 100 FEET FROM WETLAND AREAS. STOCKPILES NOT TO BE REUSED WITHIN 30 DAYS ARE TO BE STABILIZED WITH SEED OR MULCH.

14. POTENTIAL STOCK PILE AREA TO BE PROTECTED WITH EROSION CONTROL MEASURES.

15. THE CONTRACTOR SHALL HAVE A WATER TRUCK ON-SITE AT ALL TIMES AND SHALL PROVIDE TEMPORARY PLANTINGS OR OTHER COVERINGS, SUCH AS WOOD CHIPS, TO MINIMIZE THE AMOUNT OF DUST LEAVING THE PREMISES.

40 20 0 40 80

Date	Description	No.
02/14/22	P.B. AND CON.–COM. RESUBMITTAL	3.
01/31/22	ZBA RESUBMITTAL	2.
11/15/21	PLANNING BOARD SUBMITTAL	1.

Revisions

COMMONWEALTH OF MASSACHUSETTS
GABRIEL R. CROCKER
CIVIL
No. 47917
REGISTERED PROFESSIONAL ENGINEER

2-14-2022

GABRIEL R. CROCKER
PROFESSIONAL ENGINEER, MA REGISTRATION #47917

Crocker Design Group
2 SHARP STREET, UNIT A
HINGHAM, MA 02043
P: 781–919–0808

Project

MERCEDES OF SUDBURY

141 BOSTON POST ROAD, SUDBURY, MA

Prepared for

HERB CHAMBERS 43 BRAINTREE STREET, LLC

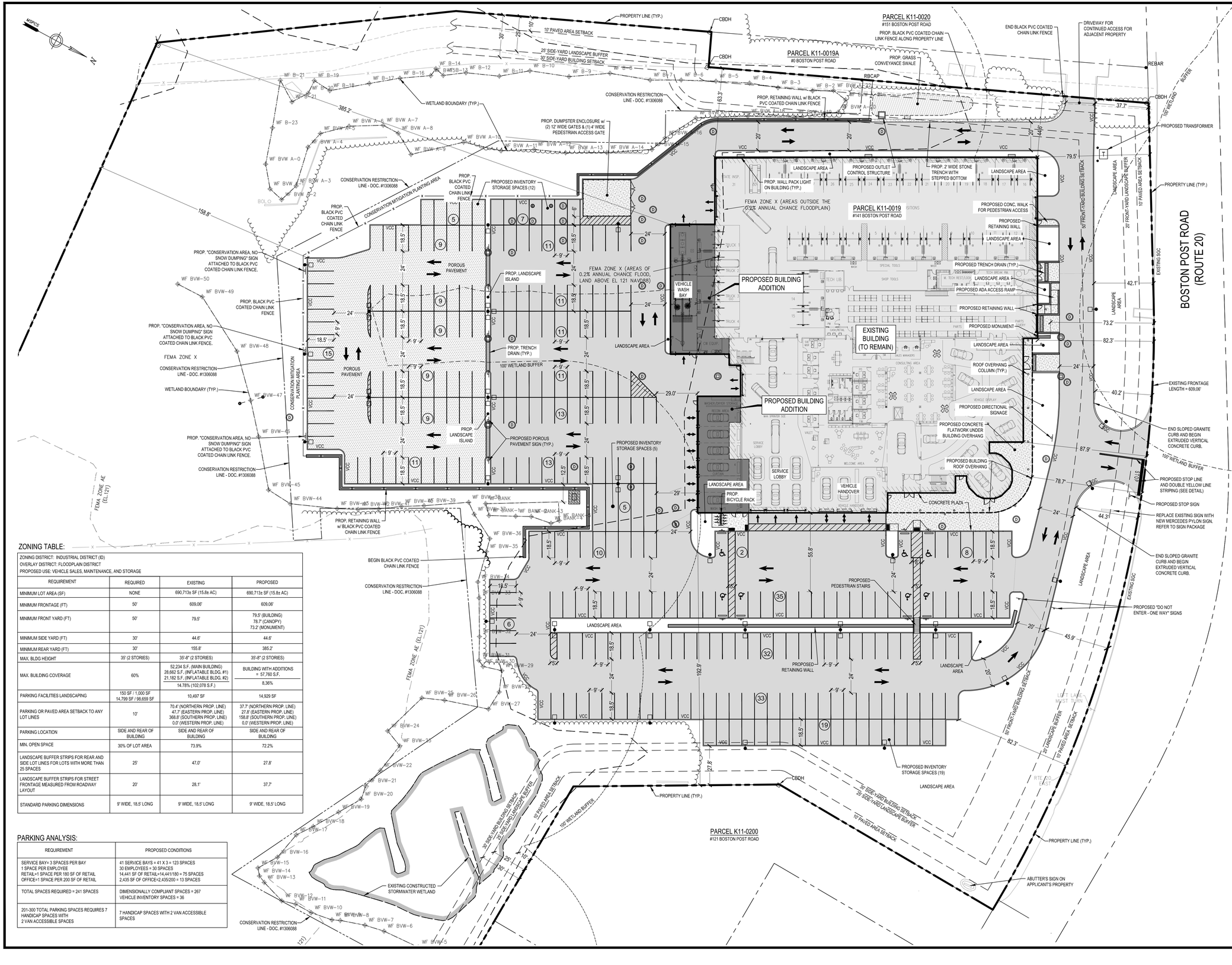
#259 McGRATH HIGHWAY - ROUTE 28 SOMERVILLE, MA 02143

Drawing Title

SOIL EROSION AND SEDIMENT CONTROL PLAN

Project No.	100-107	Drawing No.
Date	11/10/2021	C-2
Scale	1"=40'	
Drawn By	DJN / JPM	
Approved By	GC	

C:\2021\Crocker Design Group, LLC\Current Projects\100-107 Sudbury - Mercedes\Vinyl Plot Sheets\Site Plan Application_ DES\SEC PLAN.dwg, C-2 SESC, Feb 14, 2022 14:23



GENERAL NOTES:

1. THIS PLAN REFERENCES A SURVEY PLAN PREPARED BY CHA CONSULTING.
2. ACCESSIBLE CURB RAMPS SHALL BE PER THE MASSACHUSETTS ARCHITECTURAL ACCESS BOARD (AAB) AND THE AMERICANS WITH DISABILITIES ACT (ADA) ACCESSIBILITY GUIDELINES.
3. THE FOLLOWING LAYOUT CRITERIA SHALL CONTROL UNLESS OTHERWISE NOTED ON THE PLAN:
   DIMENSIONS ARE TO FACE OF CURB AT GUTTER LINE.
   DIMENSIONS ARE TO THE CENTER OF PAVEMENT MARKINGS.
   ALL TIES TO PROPERTY LINES ARE PERPENDICULAR TO THE PROPERTY LINE UNLESS OTHERWISE NOTED.
4. ALL LINES AND DIMENSIONS ARE PARALLEL OR PERPENDICULAR TO THE LINES FROM WHICH THEY ARE MEASURED UNLESS OTHERWISE INDICATED.
5. CONTRACTOR SHALL REPORT SIGNIFICANT CONFLICTS TO THE OWNER OR HIS REPRESENTATIVE FOR RESOLUTION.
6. THE CONTRACTOR SHALL FURNISH AND SET ALL LINES AND GRADES REQUIRED AND PROTECT ALL PERMANENT BENCHMARKS OR MONUMENTS. DAMAGED MONUMENTS SHALL BE REPLACED BY A LICENSED SURVEYOR AT NO COST TO THE OWNER.
7. ALL CONCRETE WORK SHALL COMPLY WITH ACI301, "SPECIFICATION FOR STRUCTURAL CONCRETE," AND ACI 316R, UNLESS MODIFIED BY THE CONTRACT DOCUMENTS. COMPLY WITH CRSI'S "MANUAL OF STANDARD PRACTICE" FOR FABRICATING, PLACING, AND SUPPORTING REINFORCEMENT. COMPLY WITH ACI 306.1 FOR COLD WEATHER PROTECTION, AND FOLLOW RECOMMENDATIONS IN ACI 350R FOR HOT WEATHER PROTECTION DURING CURING. COMPLY WITH ACI 304 "GUIDE FOR MEASURING, MIXING, TRANSPORTING, AND PLACING CONCRETE."
8. BITUMINOUS CONCRETE PAVEMENT: CLASS I, TYPE I-1 CONFORMING TO THE STANDARD SPECIFICATIONS, SECTIONS 460 THROUGH 460.02 FOR BINDER COURSE AND TOP COURSE JOB MIX FORMULAS. THE GENERAL CONTRACTOR SHALL SUPPLY THE ENGINEER WITH A CERTIFICATE OF COMPLIANCE SUPPLIED BY THE PAVING CONTRACTOR.
9. SAW-CUT EXISTING PAVEMENT WHERE NEW BITUMINOUS CONCRETE PAVEMENT IS TO COME IN CONTACT. PRIME COAT THE CUT EDGE PRIOR TO PLACEMENT.

30 15 0 30 60

ZONING TABLE:

ZONING DISTRICT: INDUSTRIAL DISTRICT (ID)
OVERLAY DISTRICT: FLOODPLAIN DISTRICT
PROPOSED USE: VEHICLE SALES, MAINTENANCE, AND STORAGE

REQUIREMENT	REQUIRED	EXISTING	PROPOSED
MINIMUM LOT AREA (SF)	NONE	690,713± SF (15.8± AC)	690,713± SF (15.8± AC)
MINIMUM FRONTAGE (FT)	50'	609.06'	609.06'
MINIMUM FRONT YARD (FT)	50'	79.5'	79.5' (BUILDING) 78.7' (CANOPY) 73.2' (MONUMENT)
MINIMUM SIDE YARD (FT)	30'	44.6'	44.6'
MINIMUM REAR YARD (FT)	30'	155.8'	385.2'
MAX. BLDG HEIGHT	35' (2 STORIES)	35'-6" (2 STORIES)	35'-8" (2 STORIES)
MAX. BUILDING COVERAGE	60%	52,234 S.F. (MAIN BUILDING) 28,662 S.F. (INFLATABLE BLDG. #1) 21,182 S.F. (INFLATABLE BLDG. #2) 14.78% (102,078 S.F.)	BUILDING WITH ADDITIONS = 57,760 S.F. 8.36%
PARKING FACILITIES LANDSCAPING	150 SF / 1,000 SF 14,799 SF / 98,659 SF	10,497 SF	14,929 SF
PARKING OR PAVED AREA SETBACK TO ANY LOT LINES	10'	70.4' (NORTHERN PROP. LINE) 47.7' (EASTERN PROP. LINE) 368.8' (SOUTHERN PROP. LINE) 0.0' (WESTERN PROP. LINE)	37.7' (NORTHERN PROP. LINE) 27.8' (EASTERN PROP. LINE) 158.8' (SOUTHERN PROP. LINE) 0.0' (WESTERN PROP. LINE)
PARKING LOCATION	SIDE AND REAR OF BUILDING	SIDE AND REAR OF BUILDING	SIDE AND REAR OF BUILDING
MIN. OPEN SPACE	30% OF LOT AREA	73.9%	72.2%
LANDSCAPE BUFFER STRIPS FOR REAR AND SIDE LOT LINES FOR LOTS WITH MORE THAN 25 SPACES	25'	47.0'	27.8'
LANDSCAPE BUFFER STRIPS FOR STREET FRONTAGE MEASURED FROM ROADWAY LAYOUT	20'	28.1'	37.7'
STANDARD PARKING DIMENSIONS	9' WIDE, 18.5' LONG	9' WIDE, 18.5' LONG	9' WIDE, 18.5' LONG

PARKING ANALYSIS:

REQUIREMENT	PROPOSED CONDITIONS
SERVICE BAY= 3 SPACES PER BAY 1 SPACE PER EMPLOYEE RETAIL=1 SPACE PER 180 SF OF RETAIL OFFICE=1 SPACE PER 200 SF OF RETAIL	41 SERVICE BAYS = 41 X 3 = 123 SPACES 30 EMPLOYEES = 30 SPACES 14,441 SF OF RETAIL=14,441/180 = 75 SPACES 2,435 SF OF OFFICE=2,435/200 = 13 SPACES
TOTAL SPACES REQUIRED = 241 SPACES	DIMENSIONALLY COMPLIANT SPACES = 267 VEHICLE INVENTORY SPACES = 36
201-300 TOTAL PARKING SPACES REQUIRES 7 HANDICAP SPACES WITH 2 VAN ACCESSIBLE SPACES	7 HANDICAP SPACES WITH 2 VAN ACCESSIBLE SPACES

Date	Description	No.
02/14/22	P.B. AND CON.–COM. RESUBMITTAL	3.
01/31/22	ZBA RESUBMITTAL	2.
11/15/21	PLANNING BOARD SUBMITTAL	1.

Revisions

GABRIEL R. CROCKER
CIVIL
No. 47917
REGISTERED PROFESSIONAL ENGINEER
COMMONWEALTH OF MASSACHUSETTS

2-14-2022

GABRIEL R. CROCKER
PROFESSIONAL ENGINEER, MA REGISTRATION #47917

Crocker Design Group
2 SHARP STREET, UNIT A
HINGHAM, MA 02043
P: 781–919–0808

Project
MERCEDES OF SUDBURY
141 BOSTON POST ROAD,
SUDBURY, MA

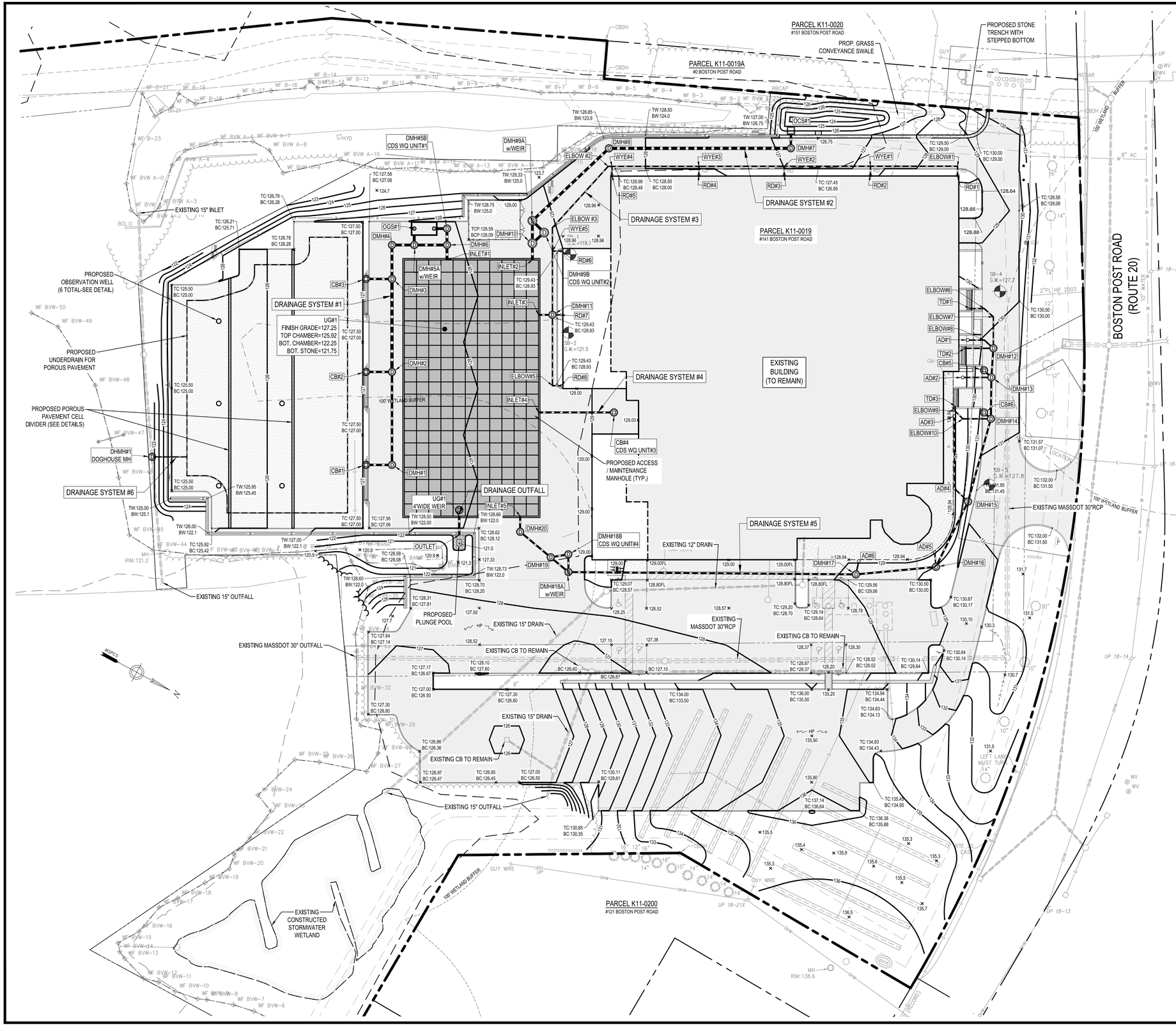
Prepared for
HERB CHAMBERS 43 BRAINTREE STREET, LLC
#259 McGRATH HIGHWAY - ROUTE 28
SOMERVILLE, MA 02143

Drawing Title
SITE PLAN

Project No.	100-107
Date	11/10/2021
Scale	1"=30'
Drawn By	DJN / JPM
Approved By	GC

Drawing No.
C-3

C:\CDG\Crocker Design Group, LLC\Gabriel Crocker - Projects\100-107 Sudbury - Mercedes\dwg\Plot Sheets\Site Plan Application_03 LAYOUT PLAN.dwg, C-2 LAYOUT, Feb 14, 2022 14:31



GRADING NOTES:

1. THE CONTRACTOR SHALL VERIFY EXISTING GRADES IN THE FIELD AND REPORT ANY DISCREPANCIES IMMEDIATELY TO THE OWNER OR HIS REPRESENTATIVE.
2. EXCAVATION REQUIRED WITHIN THE PROXIMITY OF EXISTING UTILITY LINES SHALL BE DONE BY HAND. CONTRACTOR SHALL REPAIR ANY DAMAGE TO EXISTING UTILITY LINES OR STRUCTURES INCURRED DURING CONSTRUCTION OPERATIONS AT NO COST TO THE OWNER.
3. PITCH EVENLY BETWEEN SPOT GRADES. GRADE ALL AREAS TO DRAIN. ALL PAVED AREAS MUST PITCH TO DRAIN AT A MINIMUM OF 1/8" PER FOOT UNLESS OTHERWISE SPECIFIED. ANY DISCREPANCIES NOT ALLOWING THIS MINIMUM PITCH SHALL BE REPORTED TO THE OWNER OR HIS REPRESENTATIVE PRIOR TO CONTINUING WORK.
4. ALL SITEWORK SHALL CONFORM TO THE CONTRACT DOCUMENTS AND SHALL COMPLY WITH APPLICABLE CODES AND REGULATIONS, AND THE STORMWATER POLLUTION PREVENTION PLAN (SWPPP) PREPARED FOR THE PROJECT.
5. DURING THE PROGRESS OF THE WORK, THE CONTRACTOR MAY BE REQUIRED TO EXCAVATE ADDITIONAL TEST PITS FOR THE PURPOSE OF LOCATING UNDERGROUND UTILITIES OR STRUCTURES AS AN AID IN ESTABLISHING THE PRECISE LOCATION OF NEW WORK. THIS WORK IS TO BE PERFORMED AT NO ADDITIONAL COST TO THE OWNER. TEST PITS SHALL BE BACKFILLED, AS SOON AS THE DESIRED INFORMATION HAS BEEN OBTAINED.
6. PROTECT STRUCTURES, UTILITIES, SIDEWALKS, PAVEMENTS AND OTHER FACILITIES FROM DAMAGE CAUSED BY SETTLEMENT, LATERAL MOVEMENT, UNDERMINING, WASHOUT AND OTHER HAZARDS CREATED BY CONTRACTOR OPERATIONS.
7. UNLESS DIRECTED OTHERWISE, ALL EXISTING TURF OR VEGETATED AREAS WITHIN THE PROPOSED LIMITS OF WORK FOR EXCAVATION, GRADING, OR IMPROVEMENT SHALL BE CLEARED AND GRUBBED. WITHIN THE CLEARING AND GRUBBING AREA, REMOVE ALL TREES, SHRUBS AND ROOTS UNLESS DESIGNATED OTHERWISE. CLEARING SHALL INCLUDE THE FELLING, CUTTING AND OFF-SITE DISPOSAL OF ALL TREES, SHRUBS, STUMPS AND VEGETATIVE DEBRIS PRODUCED THROUGH THE CLEARING OPERATIONS.
8. FILL DEPRESSIONS CAUSED BY TEST PITS AND CLEARING AND GRUBBING OPERATIONS WITH SATISFACTORY SOIL MATERIAL UNLESS FURTHER EXCAVATION OR EARTHWORK IS INDICATED.
9. THE CONTRACTOR SHALL PREVENT SURFACE WATER AND SUBSURFACE OR GROUNDWATER FROM FLOWING INTO EXCAVATIONS OR EARTHWORK AREAS WHICH WOULD CAUSE FLOODING OF THE PROJECT SITE AND SURROUNDING AREA, OR SOFTENING OR LOOSENING OF THE SOIL AT EXCAVATION OR EARTHWORK SUB-GRADES.
10. THE CONTRACTOR SHALL PROVIDE, INSTALL, OPERATE, MAINTAIN AND REMOVE ADEQUATE AND SATISFACTORY DEWATERING SYSTEMS AND DRAINAGE OF EXCAVATIONS TO PERMIT CONSTRUCTION TO PROCEED "IN THE DRY". THE CONTRACTOR SHALL ASSUME ALL RESPONSIBILITY FOR THE ADEQUACY OF THE METHODS, MATERIALS AND EQUIPMENT EMPLOYED. THE CONTRACTOR SHALL BEAR THE FULL COST OF PROVIDING ALL NECESSARY DEWATERING.
11. THE CONTRACTOR SHALL PROHIBIT SEEPAGE, GROUNDWATER FLOW OR SURFACE INFILTRATION AND RUNOFF FROM UNDERMINING OR OTHERWISE DAMAGING ADJACENT STRUCTURES AND UTILITIES.
12. ANY WATER PUMPED FROM EXCAVATIONS WILL BE CONVEYED BY HOSE TO AN UPLAND AREA AND DISCHARGED INTO HAYBALE CORRALS OR SEDIMENTATION BAGS.
13. PAVING, CONCRETE WORK AND BASE COURSE PREPARATION SHALL BE DONE ONLY AFTER EXCAVATION AND CONSTRUCTION WORK WHICH MIGHT INJURE THEM HAS BEEN COMPLETED. DAMAGE CAUSED DURING CONSTRUCTION SHALL BE REPAIRED BEFORE ACCEPTANCE.
14. PAVEMENT OR BASE MATERIALS SHALL NOT BE PLACED ON A MUDDY OR FROZEN SUBGRADE.
15. ESTABLISHMENT OF GRADES, GRADE CONTROL, AND CONFORMANCE TO REQUIRED GRADE TOLERANCES SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR.
16. PROTECT GRADED, FINISHED OR PAVED AREAS FROM DAMAGE AND KEEP THEM FREE OF TRASH AND DEBRIS RESULTING FROM CONSTRUCTION OPERATIONS. REPAIR AND RE-ESTABLISH GRADES IN SETTLED, ERODED AND RUTTED AREAS.
17. PAVEMENT EXCAVATED DURING UTILITY CONSTRUCTION, WHETHER ON THE SITE OR ADJACENT PROPERTIES, SHALL BE RESTORED AND MATCHED WITH EXACTLY THE SAME MATERIALS AND TO TOLERANCES AS PRIOR TO DISRUPTION, AT NO ADDITIONAL COST TO THE OWNER, OR ADJACENT PROPERTY OWNERS.
18. STONE USED FOR MACHINE PLACED RIP-RAP SHALL BE REASONABLY WELL GRADED, HARD, DURABLE, ANGULAR IN SHAPE, RESISTANT TO WEATHERING AND FREE FROM ORGANIC MATERIAL. ROUNDED STONES OR BOULDERS ARE NOT ACCEPTABLE. THE MINIMUM WEIGHT OF THE STONE SHALL BE 155 POUNDS PER CUBIC FOOT. STONE SHALL BE PLACED IN CONFORMANCE WITH THE LINES, GRADES AND THICKNESSES SHOWN ON THE DRAWINGS.
19. AT ALL LOCATIONS WHERE EXISTING CURBING OR PAVEMENT ABUTS NEW CONSTRUCTION, THE EDGE OF THE EXISTING CURB OR PAVEMENT SHALL BE SAW CUT TO A CLEAN, SMOOTH EDGE. BLEND NEW PAVEMENT, CURBS AND EARTHWORK SMOOTHLY INTO EXISTING BY MATCHING LINES, GRADES AND JOINTS.
20. ALL RIP RAP STONE SHALL BE HAND CHINKED AND SHALL CONFORM TO MASSACHUSETTS HIGHWAY DEPARTMENT STANDARDS.

DRAINAGE NOTES:

1. MANHOLES SHALL BE 48-INCH DIAMETER (UNLESS OTHERWISE SPECIFIED). CAST-IN-PLACE BASES SHALL BE USED WHERE MANHOLES ARE CONSTRUCTED OVER EXISTING PIPES.
2. THE CONTRACTOR SHALL FILL ALL PRE-CAST TANKS WITH WATER FOR LEAKAGE OBSERVATIONS BY THE ENGINEER OVER A PERIOD OF 24-HOURS. ANY LEAKS SHALL BE REPAIRED BY THE CONTRACTOR.
3. FOR SPECIFIC INFORMATION OF FRAMES AND COVER FOR DRAINAGE STRUCTURES SEE DETAIL SHEET
4. DRAINAGE STRUCTURE COVERS SHALL HAVE THE WORD "DRAIN" CENTERED ON THE COVER IN 3-INCH HIGH LETTERS.
5. FRAMES, GRATES AND COVERS SHALL BE SET FIRM AND TRUE TO GRADE, ADJUST FOR GRADE WITH BRICK MASONRY.
6. ALL ON-SITE DRAIN LINES SHALL BE SMOOTH INT. WALLED CPE PIPE UNLESS OTHERWISE NOTED.
7. FLARED END SECTIONS SHALL BE PIPE MANUFACTURER STANDARD CONSTRUCTED FROM THE SAME MATERIAL AS THE PIPE.
8. INSTALL PIPE AND FLARED ENDS IN STRICT ACCORDANCE WITH PIPE MANUFACTURER INSTRUCTIONS.
9. PROTECT PROPOSED INFILTRATION BASINS FROM SEDIMENTATION THROUGHOUT CONSTRUCTION OPERATIONS. INFILTRATION BASINS ARE NOT TO BE USED UNTIL DRAINAGE SYSTEM IS INSTALLED AN FUNCTIONAL.

30 15 0 30 60

Date	Description	No.
02/14/22	P.B. AND CON.–COM. RESUBMITTAL	3.
01/31/22	ZBA RESUBMITTAL	2.
11/15/21	PLANNING BOARD SUBMITTAL	1.

Revisions

COMMONWEALTH OF MASSACHUSETTS
GABRIEL R. CROCKER
CIVIL
No. 47917
REGISTERED PROFESSIONAL ENGINEER

2-14-2022

GABRIEL R. CROCKER
PROFESSIONAL ENGINEER, MA REGISTRATION #47917

Crocker Design Group
2 SHARP STREET, UNIT A
HINGHAM, MA 02043
P: 781-919-0808

Project

MERCEDES OF SUDBURY

141 BOSTON POST ROAD, SUDBURY, MA

Prepared for

HERB CHAMBERS 43 BRAINTREE STREET, LLC

#259 McGRATH HIGHWAY - ROUTE 28 SOMERVILLE, MA 02143

Drawing Title

GRADING AND DRAINAGE PLAN

Project No.	100-107
Date	11/10/2021
Scale	1"=30'
Drawn By	DJN / JPM
Approved By	GC

Drawing No.

C-4.1

STRUCTURE TABLE - DRAINAGE SYSTEM #1

STRUCTURE NAME:	DETAILS:	PIPES IN:	PIPES OUT
CB#1 w/ TRENCH	RIM = 127.00		CB1 to DMH1: 12" REINFORCED CONCRETE PIPE - INV OUT =124.20
CB#2 w/ TRENCH	RIM = 127.00		CB2 to DMH2: 12" REINFORCED CONCRETE PIPE - INV OUT =123.85
CB#3 w/ TRENCH	RIM = 127.00		CB3 to DMH3: 12" REINFORCED CONCRETE PIPE - INV OUT =123.50
DMH#1	RIM = 127.26	CB1 to DMH1: 12" REINFORCED CONCRETE PIPE - INV IN =124.10	DMH1 to DMH2: 12" REINFORCED CONCRETE PIPE - INV OUT =124.10
DMH#2	RIM = 127.26	DMH1 to DMH2: 12" REINFORCED CONCRETE PIPE - INV IN =123.75 CB2 to DMH2: 12" REINFORCED CONCRETE PIPE - INV IN =123.75	DMH2 to DMH3: 18" REINFORCED CONCRETE PIPE - INV OUT =123.75
DMH#3	RIM = 127.26	DMH2 to DMH3: 18" REINFORCED CONCRETE PIPE - INV IN =123.40 CB3 to DMH3: 12" REINFORCED CONCRETE PIPE - INV IN =123.40	DMH3 to DMH4: 18" HDPE - INV OUT =123.40
DMH#4	RIM = 127.65	DMH3 to DMH4: 18" HDPE - INV IN =123.25	DMH4 to DMH5A: 18" HDPE - INV OUT =123.20
DMH#5A w/WEIR	RIM = 127.55	DMH4 to DMH5A: 18" HDPE - INV IN =123.10	DMH5A to OGS1: 18" HDPE - INV OUT =123.00 DMH5A to DMH6: 18" HDPE - INV OUT =123.00
DMH#5B CDS WQ UNIT#1	RIM = 127.90	OGS1 to DMH5B: 18" HDPE - INV IN =122.87	DMH6B to DMH7: 18" HDPE - INV OUT =122.87
DMH#6	RIM = 127.86	DMH5A to DMH6: 18" HDPE - INV IN =122.80 DMH6B to DMH7: 18" HDPE - INV IN =122.80	DMH6 to INLET1: 18" HDPE - INV OUT =122.80
INLET#1	RIM = 124.39	DMH6 to INLET1: 18" HDPE - INV IN =122.75	
OGS1 in	RIM = 124.57	DMH5A to OGS1: 18" HDPE - INV IN =122.93	
OGS1 out	RIM = 124.58		OGS1 to DMH5B: 18" HDPE - INV OUT =122.93

PIPE TABLE - DRAINAGE SYSTEM #1

NAME	SIZE	LENGTH	SLOPE	MATERIAL
CB1 to DMH1	12"	14'	0.6%	Reinforced Concrete Pipe
CB2 to DMH2	12"	13'	0.6%	Reinforced Concrete Pipe
CB3 to DMH3	12"	13'	0.6%	Reinforced Concrete Pipe
DMH1 to DMH2	12"	58'	0.6%	Reinforced Concrete Pipe
DMH2 to DMH3	18"	57'	0.6%	Reinforced Concrete Pipe
DMH3 to DMH4	18"	19'	0.7%	HDPE
DMH4 to DMH5A	18"	11'	0.7%	HDPE
DMH5A to DMH6	18"	18'	0.9%	HDPE
DMH5A to OGS1	18"	5'	1.1%	HDPE
DMH6 to INLET1	18"	8'	0.5%	HDPE
DMH6B to DMH7	18"	7'	0.7%	HDPE
OGS1 to DMH5B	18"	5'	0.9%	HDPE

STRUCTURE TABLE - DRAINAGE SYSTEM #2

STRUCTURE NAME:	DETAILS:	PIPES IN:	PIPES OUT
DMH#7	RIM = 126.92	OCS1 to DMH7: 12" REINFORCED CONCRETE PIPE - INV IN =124.10	DMH7 to DMH8: 18" REINFORCED CONCRETE PIPE - INV OUT =124.00
DMH#8	RIM = 128.32	DMH7 to DMH8: 18" REINFORCED CONCRETE PIPE - INV IN =123.35	DMH8 to DMH9A: 18" HDPE - INV OUT =123.35
DMH#9A w/WEIR	RIM = 128.78	DMH8 to DMH9A: 18" HDPE - INV IN =123.00	DMH9A to DMH9B: 18" HDPE - INV OUT =123.00 DMH9A to DMH10: 18" HDPE - INV OUT =123.00
DMH#9B CDS WQ UNIT#2	RIM = 128.87	DMH9A to DMH9B: 18" HDPE - INV IN =122.90	DMH9B to DMH10: 18" HDPE - INV OUT =122.90
DMH#10	RIM = 128.71	DMH9B to DMH10: 18" HDPE - INV IN =122.80 DMH9A to DMH10: 18" HDPE - INV IN =122.80	DMH10 to INLET#2: 18" HDPE - INV OUT =122.80
INLET#2	RIM = 124.39	DMH10 to INLET#2: 18" HDPE - INV IN =122.75	
OCS#1 w/18" ORIFICE	RIM = 127.00		OCS1 to DMH7: 12" REINFORCED CONCRETE PIPE - INV OUT =124.18

PIPE TABLE - DRAINAGE SYSTEM #2

NAME	SIZE	LENGTH	SLOPE	MATERIAL
DMH7 to DMH8	18"	116'	0.5%	Reinforced Concrete Pipe
DMH8 to DMH9A	18"	65'	0.5%	HDPE
DMH9A to DMH9B	18"	6'	0.9%	HDPE
DMH9A to DMH10	18"	10'	1.4%	HDPE
DMH9B to DMH10	18"	6'	1.0%	HDPE
DMH10 to INLET#2	18"	9'	0.5%	HDPE
OCS1 to DMH7	12"	8'	0.7%	Reinforced Concrete Pipe

STRUCTURE TABLE - DRAINAGE SYSTEM #3

STRUCTURE NAME:	DETAILS:	PIPES IN:	PIPES OUT
DMH#11	RIM = 128.88	WYE5 to DMH12: 8" HDPE - INV IN =122.37 RD7 to DMH11: 8" HDPE - INV IN =123.07 ELBOW5 to DMH12: 8" HDPE - INV IN =123.07	DMH11 to INLET3: 12" HDPE - INV OUT =122.34
ELBOW #2 45 BEND	RIM = 124.21	WYE4 to ELBOW2: 8" HDPE - INV IN =123.46	ELBOW2 to ELBOW3: 8" HDPE - INV OUT =123.46
ELBOW #3 45 BEND	RIM = 123.67	ELBOW2 to ELBOW3: 8" HDPE - INV IN =122.92	ELBOW3 to WYE5: 8" HDPE - INV OUT =122.92
ELBOW#1 90 BEND	RIM = 126.51	RD1 to ELBOW1: 8" HDPE - INV IN =125.76	ELBOW1 to WYE1: 8" HDPE - INV OUT =125.76
ELBOW#5 90 BEND	RIM = 124.30	RD8 to ELBOW5: 8" HDPE - INV IN =123.55	ELBOW5 to DMH12: 8" HDPE - INV OUT =123.55
INLET#3	RIM = 123.36	DMH11 to INLET3: 12" HDPE - INV IN =122.25	
RD#1	RIM = 126.57		RD1 to ELBOW1: 8" HDPE - INV OUT =125.82
RD#2	RIM = 126.00		RD2 to WYE1: 8" HDPE - INV OUT =125.25
RD#3	RIM = 125.43		RD3 to WYE2: 8" HDPE - INV OUT =124.68
RD#4	RIM = 124.87		RD4 to WYE3: 8" HDPE - INV OUT =124.12
RD#5	RIM = 124.30		RD5 to WYE4: 8" HDPE - INV OUT =123.55
RD#6	RIM = 123.58		RD6 to WYE5: 8" HDPE - INV OUT =122.83
RD#7	RIM = 123.88		RD7 to DMH11: 8" HDPE - INV OUT =123.13
RD#8	RIM = 124.36		RD8 to ELBOW5: 8" HDPE - INV OUT =123.61
WYE#1 8"x8"x8"	RIM = 125.94	ELBOW1 to WYE1: 8" HDPE - INV IN =125.19 RD2 to WYE1: 8" HDPE - INV IN =125.19	WYE1 to WYE2: 8" HDPE - INV OUT =125.19
WYE#2 8"x8"x8"	RIM = 125.37	WYE1 to WYE2: 8" HDPE - INV IN =124.62 RD3 to WYE2: 8" HDPE - INV IN =124.62	WYE2 to WYE3: 8" HDPE - INV OUT =124.62
WYE#3 8"x8"x8"	RIM = 124.81	WYE2 to WYE3: 8" HDPE - INV IN =124.06 RD4 to WYE3: 8" HDPE - INV IN =124.06	WYE3 to WYE4: 8" HDPE - INV OUT =124.06
WYE#4 8"x8"x8"	RIM = 124.24	WYE3 to WYE4: 8" HDPE - INV IN =123.49 RD5 to WYE4: 8" HDPE - INV IN =123.49	WYE4 to ELBOW2: 8" HDPE - INV OUT =123.49
WYE#5 8"x8"x8"	RIM = 123.52	ELBOW3 to WYE5: 8" HDPE - INV IN =122.77 RD6 to WYE5: 8" HDPE - INV IN =122.77	WYE5 to DMH12: 8" HDPE - INV OUT =122.77

PIPE TABLE - DRAINAGE SYSTEM #3

NAME	SIZE	LENGTH	SLOPE	MATERIAL
DMH11 to INLET3	12"	8'	1.0%	HDPE
ELBOW1 to WYE1	8"	58'	1.0%	HDPE
ELBOW2 to ELBOW3	8"	55'	1.0%	HDPE
ELBOW3 to WYE5	8"	16'	1.0%	HDPE
ELBOW5 to DMH12	8"	45'	1.0%	HDPE
RD1 to ELBOW1	8"	7'	1.0%	HDPE
RD2 to WYE1	8"	6'	1.0%	HDPE
RD3 to WYE2	8"	6'	1.0%	HDPE
RD4 to WYE3	8"	6'	1.0%	HDPE
RD5 to WYE4	8"	6'	1.0%	HDPE
RD6 to WYE5	8"	7'	1.0%	HDPE
RD7 to DMH11	8"	3'	1.2%	HDPE
RD8 to ELBOW5	8"	6'	1.0%	HDPE
WYE1 to WYE2	8"	57'	1.0%	HDPE
WYE2 to WYE3	8"	56'	1.0%	HDPE
WYE3 to WYE4	8"	58'	1.0%	HDPE
WYE4 to ELBOW2	8"	3'	1.0%	HDPE
WYE5 to DMH12	8"	40'	1.0%	HDPE

STRUCTURE TABLE - DRAINAGE SYSTEM #4

STRUCTURE NAME:	DETAILS:	PIPES IN:	PIPES OUT
CB#4 CDS WQ UNIT#3	RIM = 128.80		CB4 to INLET4: 12" HDPE - INV OUT =123.74
INLET#4	RIM = 123.86	CB4 to INLET4: 12" HDPE - INV IN =122.75	

PIPE TABLE - DRAINAGE SYSTEM #4

NAME	SIZE	LENGTH	SLOPE	MATERIAL
CB4 to INLET4	12"	48'	2.0%	HDPE

STRUCTURE TABLE - DRAINAGE SYSTEM #5

STRUCTURE NAME:	DETAILS:	PIPES IN:	PIPES OUT
AD#1	RIM = 128.93		AD1 to ELBOW8: 8" HDPE - INV OUT =126.38
AD#2	RIM = 128.74		AD2 to DMH13: 8" HDPE - INV OUT =126.23
AD#3	RIM = 128.94		AD3 to AD4: 8" HDPE - INV OUT =126.39
AD#4	RIM = 128.94	AD3 to AD4: 8" HDPE - INV IN =125.43	AD4 to DMH15: 8" HDPE - INV OUT =125.43
AD#5	RIM = 128.94		AD5 to DMH16: 8" HDPE - INV OUT =125.17
AD#6	RIM = 128.94		AD6 to DMH17: 8" HDPE - INV OUT =126.10
CB#5	RIM = 130.29		CB5 to DMH13: 12" HDPE - INV OUT =125.95
CB#6	RIM = 130.64		CB6 to DMH14: 12" HDPE - INV OUT =125.70
DMH#12	RIM = 130.17	ELBOW8 to DMH12: 8" HDPE - INV IN =126.00 TD2 to DMH12: 8" HDPE - INV IN =126.00 ELBOW7 to DMH12: 8" HDPE - INV IN =126.00	DMH12 to DMH13: 12" HDPE - INV OUT =125.95
DMH#13	RIM = 130.39	DMH12 to DMH13: 12" HDPE - INV IN =125.85 AD2 to DMH13: 8" HDPE - INV IN =125.85 CB5 to DMH13: 12" HDPE - INV IN =125.85	DMH13 to DMH14: 12" HDPE - INV OUT =125.75
DMH#14	RIM = 130.73	DMH13 to DMH14: 12" HDPE - INV IN =125.60 ELBOW10 to DMH14: 8" HDPE - INV IN =125.60 CB6 to DMH14: 12" HDPE - INV IN =125.60	DMH14 to DMH15: 12" HDPE - INV OUT =125.50
DMH#15	RIM = 130.92	DMH14 to DMH15: 12" HDPE - INV IN =125.20 AD4 to DMH15: 8" HDPE - INV IN =125.20	DMH15 to DMH16: 12" HDPE - INV OUT =125.10
DMH#16	RIM = 130.03	DMH15 to DMH16: 12" HDPE - INV IN =124.85 AD5 to DMH16: 8" HDPE - INV IN =125.00	DMH16 to DMH17: 12" HDPE - INV OUT =124.75
DMH#17	RIM = 129.39	DMH16 to DMH17: 12" HDPE - INV IN =124.45 AD6 to DMH17: 8" HDPE - INV IN =125.30	DMH17 to DMH18A: 12" HDPE - INV OUT =124.35
DMH#18A w/WEIR	RIM = 128.60	DMH17 to DMH18A: 12" HDPE - INV IN =123.40	DMH18A to DMH19: 12" HDPE - INV OUT =123.30 DMH18A to DMH18B: 12" HDPE - INV OUT =123.30
DMH#18B CDS WQ UNIT#4	RIM = 128.84	DMH18A to DMH18B: 12" HDPE - INV IN =123.20	DMH18B to DMH19: 12" HDPE - INV OUT =123.20
DMH#19	RIM = 128.74	DMH18A to DMH19: 12" HDPE - INV IN =123.10 DMH18B to DMH19: 12" HDPE - INV IN =123.10	DMH19 to DMH20: 12" HDPE - INV OUT =123.10
DMH#20	RIM = 128.47	DMH19 to DMH20: 12" HDPE - INV IN =122.95	DMH20 to INLET5: 12" HDPE - INV OUT =122.85
ELBOW#6 45 BEND	RIM = 127.32	TD1 to ELBOW6: 8" HDPE - INV IN =126.57	ELBOW 6 to ELBOW7: 8" HDPE - INV OUT =126.57
ELBOW#7 45 BEND	RIM = 127.16	ELBOW 6 to ELBOW7: 8" HDPE - INV IN =126.41	ELBOW7 to DMH12: 8" HDPE - INV OUT =126.41
ELBOW#8 45 BEND	RIM = 126.91	AD1 to ELBOW8: 8" HDPE - INV IN =126.16	ELBOW8 to DMH12: 8" HDPE - INV OUT =126.16
ELBOW#9 45 BEND	RIM = 126.86	TD2 to ELBOW9: 8" HDPE - INV IN =126.11	ELBOW9 to ELBOW10: 8" HDPE - INV OUT =126.11
ELBOW#10 45 BEND	RIM = 126.72	ELBOW9 to ELBOW10: 8" HDPE - INV IN =125.97	ELBOW10 to DMH14: 8" HDPE - INV OUT =125.97
INLET#5	RIM = 123.86	DMH20 to INLET5: 12" HDPE - INV IN =122.75	
TD#1 Null Structure	RIM = 127.51		TD1 to ELBOW6: 8" HDPE - INV OUT =126.76
TD#2	RIM = 127.13		TD2 to DMH12: 8" HDPE - INV OUT =126.38
TD#3	RIM = 126.92		TD2 to ELBOW9: 8" HDPE - INV OUT =126.17

PIPE TABLE - DRAINAGE SYSTEM #5

NAME	SIZE	LENGTH	SLOPE	MATERIAL
AD1 to ELBOW8	8"	10'	2.0%	HDPE
AD2 to DMH13	8"	16'	2.0%	HDPE
AD3 to AD4	8"	46'	2.0%	HDPE
AD4 to DMH15	8"	9'	1.9%	HDPE
AD5 to DMH16	8"	7'	1.8%	HDPE
AD6 to DMH17	8"	6'	9.0%	HDPE
CB5 to DMH13	12"	3'	1.5%	HDPE
CB6 to DMH14	12"	3'	1.6%	HDPE
DMH12 to DMH13	12"	16'	0.5%	HDPE
DMH13 to DMH14	12"	24'	0.6%	HDPE
DMH14 to DMH15	12"	53'	0.5%	HDPE
DMH15 to DMH16	12"	44'	0.5%	HDPE
DMH16 to DMH17	12"	49'	0.6%	HDPE
DMH17 to DMH18A	12"	185'	0.5%	HDPE
DMH18A to DMH18B	12"	8'	0.9%	HDPE
DMH18A to DMH19	12"	12'	1.3%	HDPE
DMH18B to DMH19	12"	8'	0.9%	HDPE
DMH19 to DMH20	12"	23'	0.6%	HDPE
DMH20 to INLET5	12"	9'	1.0%	HDPE
ELBOW 6 to ELBOW7	8"	9'	2.0%	HDPE
ELBOW7 to DMH12	8"	19'	2.0%	HDPE
ELBOW8 to DMH12	8"	7'	2.0%	HDPE
ELBOW9 to ELBOW10	8"	8'	2.0%	HDPE
ELBOW10 to DMH14	8"	17'	2.0%	HDPE
TD1 to ELBOW6	8"	10'	2.0%	HDPE
TD2 to DMH12	8"	17'	2.0%	HDPE
TD2 to ELBOW9	8"	4'	2.0%	HDPE

STRUCTURE TABLE - DRAINAGE SYSTEM #6

STRUCTURE NAME:	DETAILS:	PIPES IN:	PIPES OUT
DHMH#1 DOGHOUSE MH	RIM = 121.54	UNDERDRAIN to DHMH1: 6" HDPE - INV IN =120.50	

PIPE TABLE - DRAINAGE SYSTEM #6

NAME	SIZE	LENGTH	SLOPE	MATERIAL
UNDERDRAIN to DHMH1	6"	22'	12.3%	HDPE

STRUCTURE TABLE - DRAINAGE OUTFALLS

STRUCTURE NAME:	DETAILS:	PIPES IN:	PIPES OUT
OUTLET	RIM = 125.41	UG1 to OUTLET: 12" REINFORCED CONCRETE PIPE - INV IN =124.18	
UG#1 4'WIDE WEIR	RIM = 125.48		UG1 to OUTLET: 12" REINFORCED CONCRETE PIPE - INV OUT =124.25

PIPE TABLE - DRAINAGE OUTFALLS

NAME	SIZE	LENGTH	SLOPE	MATERIAL
UG1 to OUTLET	12"	13'	0.6%	Reinforced Concrete Pipe

Date	Description	No.
02/14/22	P.B. AND CON.–COM. RESUBMITTAL	3.
01/31/22	ZBA RESUBMITTAL	2.
11/15/21	PLANNING BOARD SUBMITTAL	1.

Revisions

COMMONWEALTH OF MASSACHUSETTS
GABRIEL R. CROCKER
CIVIL
No. 47917
REGISTERED PROFESSIONAL ENGINEER

2-14-2022

GABRIEL R. CROCKER
PROFESSIONAL ENGINEER, MA REGISTRATION #47917

Crocker Design Group
2 SHARP STREET, UNIT A
HINGHAM, MA
02043
P: 781–919–0808

Project

MERCEDES OF SUDBURY

**141 BOSTON POST ROAD,
SUDBURY, MA**

Prepared for

**HERB CHAMBERS 43
BRAINTREE STREET, LLC**

**#259 McGRATH HIGHWAY - ROUTE 28
SOMERVILLE, MA 02143**

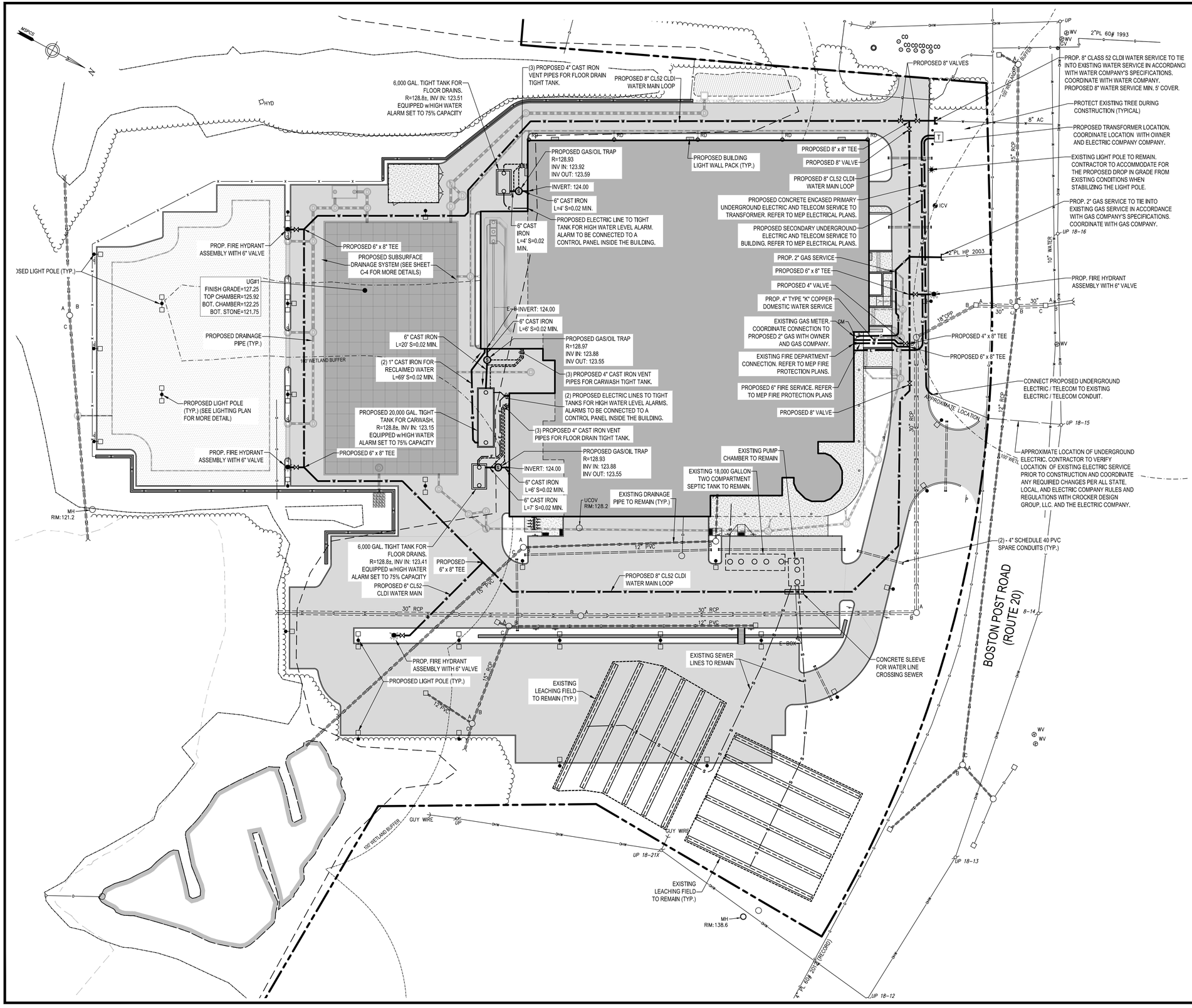
Drawing Title

**GRADING AND
DRAINAGE PLAN**

Project No.	100-107
Date	11/10/2021
Scale	1"=30'
Drawn By	DJN / JPM
Approved By	GC

Drawing No.

C-4.2



GENERAL NOTES

1. THE CONTRACTOR SHALL BE RESPONSIBLE FOR VERIFYING THAT THE PROPOSED IMPROVEMENTS SHOWN ON THE PLANS DO NOT CONFLICT WITH ANY KNOWN EXISTING OR OTHER PROPOSED IMPROVEMENTS. IF ANY CONFLICTS ARE DISCOVERED, THE CONTRACTOR SHALL NOTIFY THE OWNER AND THE ENGINEER PRIOR TO INSTALLATION OF ANY PORTION OF THE SITE WORK WHICH WOULD BE AFFECTED.

2. AT ALL LOCATIONS WHERE EXISTING CURBING OR PAVEMENT ABUTS NEW CONSTRUCTION, THE EDGE OF THE EXISTING CURB OR PAVEMENT SHALL BE SAW CUT TO A CLEAN, SMOOTH EDGE. BLEND NEW PAVEMENT, CURBS AND EARTHWORK SMOOTHLY INTO EXISTING BY MATCHING LINES, GRADES AND JOINTS.

3. THE CONTRACTOR SHALL MAKE ALL ARRANGEMENTS FOR THE ALTERATION AND ADJUSTMENT OF GAS, ELECTRIC, TELEPHONE AND ANY OTHER PRIVATE UTILITIES BY THE UTILITY COMPANIES, AS REQUIRED. WHERE AN EXISTING UTILITY IS FOUND TO CONFLICT WITH THE PROPOSED WORK, THE LOCATION, ELEVATION AND SIZE OF THE UTILITY SHALL BE ACCURATELY DETERMINED WITHOUT DELAY BY THE CONTRACTOR, AND THE INFORMATION FURNISHED TO THE OWNER AND ARCHITECT FOR RESOLUTION.

4. ALL UTILITY COVERS, GRATES, ETC. SHALL BE ADJUSTED TO BE FLUSH WITH THE PAVEMENT FINISH GRADE UNLESS OTHERWISE NOTED. RIM ELEVATIONS OF DRAINAGE STRUCTURES AND MANHOLES ARE APPROXIMATE.

5. CONTRACTOR SHALL MAINTAIN POSITIVE DRAINAGE AWAY FROM ALL BUILDING FOUNDATIONS, STRUCTURES AND PLANTING BEDS. PITCH EVENLY BETWEEN SPOT GRADES.

6. THE CONTRACTOR SHALL PRESERVE FROM DAMAGE ALL VEGETATION DESIGNATED TO REMAIN AS SHOWN ON THE DRAWINGS, FLAGGED IN THE FIELD OR AS DIRECTED BY THE LANDSCAPE ARCHITECT. THE LIMIT OF CLEARING SHALL BE IN ACCORDANCE WITH LIMIT OF WORK AS SHOWN ON THE DRAWINGS, UNLESS OTHERWISE SPECIFIED. NO TREES SHALL BE CUT, REMOVED, DESTROYED OR TRIMMED OUTSIDE THE LIMIT OF WORK WITHOUT APPROVAL OF THE OWNER AND THE TOWN OF SUDBURY PLANNING BOARD.

7. THE CONTRACTOR SHALL ALTER THE MASONRY OF THE TOP SECTION OF ALL EXISTING DRAINAGE STRUCTURES AS NECESSARY FOR CHANGES IN GRADE, AND RESET ALL WATER AND DRAINAGE FRAMES, GRATES AND BOXES TO THE PROPOSED FINISH SURFACE GRADE.

8. UNDERGROUND UTILITIES WERE COMPILED FROM AVAILABLE RECORD PLANS OF UTILITY COMPANIES AND PUBLIC AGENCIES AND ARE APPROXIMATE AND ASSUMED. BEFORE COMMENCING SITE WORK IN ANY AREA, CONTACT "DIG SAFE" AT 1-888-344-7233 TO ACCURATELY LOCATE UNDERGROUND UTILITIES. ANY DAMAGE TO EXISTING UTILITIES OR STRUCTURES SHALL BE THE CONTRACTOR'S RESPONSIBILITY. NO EXCAVATION SHALL BE DONE UNTIL UTILITY COMPANIES ARE PROPERLY NOTIFIED IN ADVANCE.

9. ALL SITEWORK SHALL CONFORM TO THE CONTRACT DOCUMENTS AND SHALL COMPLY WITH APPLICABLE CODES AND REGULATIONS, AND THE STORMWATER POLLUTION PREVENTION PLAN (SWPPP) PREPARED FOR THE PROJECT. THE CONTRACTOR SHALL MAKE ALL NOTIFICATIONS REQUIRED FOR INSPECTIONS AND TESTING ASSOCIATED WITH SUCH.

10. THE CONTRACTOR SHALL OBTAIN ALL NECESSARY PERMITS AND CONSTRUCTION SHALL COMPLY WITH ALL TOWN OF SUDBURY DEPARTMENT OF PUBLIC WORKS FOR PAVING, PAVEMENT CUTTING, EXCAVATION, UTILITY CONNECTIONS, BACKFILLING, AND PATCHING.

11. ALL RIP RAP STONE SHALL BE HAND CHINKED AND SHALL CONFORM TO MASSACHUSETTS HIGHWAY DEPARTMENT STANDARDS.

12. SIZES OF DOMESTIC AND FIRE WATER SERVICES TO BE DETERMINED BY PROJECT MEP ENGINEER AND FIRE PROTECTION ENGINEER.

13. CONTRACTOR IS CAUTIONED THAT NOT EVERY FITTING ON THE WATER AND FIRE SERVICE ARE LABELED. TYPICAL FITTINGS ARE LABELED FROM TIME TO TIME, HOWEVER THE INTENT OF THESE DRAWINGS IS THAT THE CONTRACTOR PROVIDE A COMPLETE WORKING SYSTEM, INCLUSIVE OF ALL COMPONENTS NECESSARY TO CONSTRUCT , OPERATE AND MAINTAIN BOTH THE FIRE AND WATER SYSTEMS.

14. LOCATION OF ELECTRICAL AND TELECOM SYSTEMS ARE APPROXIMATE. REFER TO FINAL ELECTRICAL SITE PLANS FOR DETAIL INFORMATION AND LOCATION OF ALL ELECTRIC, TELECOM, CABLE AND EQUIPMENTS.

TITLE 5 ANALYSIS

DESIGN FLOW REQUIRED:
RETAIL (50 GPD / 1,000 SF)
13,441 X [50 GPD / 1,000 SF] = 672.1 GPD

OFFICE BUILDING (75 GPD / 1,000 SF)
2,435 X [75 GPD/ 1,000 SF] = 182.6 GPD

SERVICE/PARTS (15 GPD / 1 PERSONS)
30 NON OFFICE/RETAIL EMPLOYEES X 15 GPD = 450 GPD

TOTAL FLOW REQUIRED = 1,305 GPD

SEPTIC TANK REQUIREMENTS:

COMPARTMENT 1
1,305 X 2 DAYS = 2,610 GPD

COMPARTMENT 2
1,305 X 1 DAYS = 1,305 GPD

TOTAL GALLONS REQUIRED FOR STORAGE = 3,915 GPD

SEPTIC TANK PROVIDED:
EXISTING 2 COMPARTMENT SEPTIC TANK

COMPARTMENT 1:
5,737 GPD * 2 DAYS = 11,474 GALLONS

COMPARTMENT 2:
5,737 GPD * 1 DAYS = 5,737 GALLONS

TOTAL GALLONS PROVIDED FOR STORAGE = 17,211 GPD

17,211 GPD > 13,398 GPD

LEACHING FIELD PROVIDED:
12 TRENCHES X 7' X 92.3' = 7,753.2 SF
7,753.2 SF X 0.74 GPD/SF = 5,737.4 GPD

5,737.4 GPD > 1,305 GPD

THE EXISTING SUB-SURFACE SEWAGE DISPOSAL SYSTEM HAS THE REQUIRED CAPACITY TO TREAT THE PROPOSED USE.

NOTES:

1. INTERIOR BUILDING FLOOR DRAINS SHALL DISCHARGE TO NEW INDUSTRIAL WASTE HOLDING TANKS, NOT TO THE EXISTING SEPTIC SYSTEM.
2. THE INTERIOR VEHICLE WASH SYSTEM SHALL DISCHARGE TO A NEW INDUSTRIAL WASTE HOLDING TANK, NOT TO THE EXISTING SEPTIC SYSTEM.

30 15 0 30 60

Date	Description	No.
02/14/22	P.B. AND CON.–COM. RESUBMITTAL	3.
01/31/22	ZBA RESUBMITTAL	2.
11/15/21	PLANNING BOARD SUBMITTAL	1.

Revisions

COMMONWEALTH OF MASSACHUSETTS
GABRIEL R. CROCKER
CIVIL
No. 47917
REGISTERED PROFESSIONAL ENGINEER

2-14-2022

GABRIEL R. CROCKER
PROFESSIONAL ENGINEER, MA REGISTRATION #47917

Crocker Design Group
2 SHARP STREET, UNIT A
HINGHAM, MA 02043
P: 781–919–0808

Project

MERCEDES OF SUDBURY

141 BOSTON POST ROAD, SUDBURY, MA

Prepared for

HERB CHAMBERS 43 BRAINTREE STREET, LLC

#259 McGRATH HIGHWAY - ROUTE 28 SOMERVILLE, MA 02143

Drawing Title

UTILITIES PLAN

Project No.	100-107
Date	11/10/2021
Scale	1"=30'
Drawn By	DJN / JPM
Approved By	GC

Drawing No.

C-5

C:\CDG\Crocker Design Group, LLC\Gabriel Crocker – Projects\100–107 Sudbury – Mercedes\dwg\Plot Sheets\Site Plan Application\ - DJJTL, PLAN.dwg, C–5 UTIL, Feb 14, 2022 15:20

REMOVE EXISTING INVASIVE PLANT SPECIES (MULTIFLORA ROSE, ASIAN BITTERSWEET, PHRAGMITES, BUCKTHORN, ET. AL. WHERE PRESENT) REMOVAL AND CONTROL WILL LIKELY BE ANNUAL, ONGOING. PLANTS SHALL BE CUT IN THE FALL/WINTER AND A CONCENTRATE SYSTEMATIC HERBICIDE SHALL BE APPLIED IMMEDIATELY TO THE ROOTED, CUT SURFACES. SPECIFIC HERBICIDE TO BE COORDINATED WITH THE SUDBURY CONSERVATION COMMISSION.

NEW ENGLAND CONSERVATION / WILDLIFE MIX FROM NEW ENGLAND WETLAND PLANTS, INC.

LOAM AND SEED (TURF GRASS MIX)

10' PAVED AREA SETBACK

25' FRONT-YARD LANDSCAPE BUFFER

10' PAVED AREA SETBACK

25' SIDE-YARD LANDSCAPE BUFFER

BOSTON POST ROAD (ROUTE 20)

100' WETLAND BUFFER

5 Hamamelis virginiana 5'-7' ht
9 Viburnum acerifolium 2.5' ht
7 Cornus racemosa 2.5' ht
7 Ilex glabra 2.5' ht
11 Rhododendron Maximum 2.5' ht.
5 Aronia arbutifolia 2.5' ht

6 Ilex glabra 2.5' ht
7 Cornus racemosa 2.5' ht
7 Rhododendron maximum 2.5' ht
18 Clethra alnifolia 2.5' ht
5 Ilex glabra 2.5' ht

LOAM & SEED

SEED WITH NEW ENGLAND CONSERVATION WILDLIFE MIX

4 Hamamelis virginiana 5'-7' ht

PROPOSED BUILDING ADDITION

LOAM & SEED

LOAM & SEED

100' WETLAND BUFFER

EXISTING BUILDING (TO REMAIN)

21 Clethra alnifolia 2.5' ht
21 Onoclea sensibilis 2 gal
8 Ilex glabra 2.5' ht

20 Dennstaedtia punctilobula 2 gal
13 Cimicifuga racemosa 2 gal
2 Betula nigra 14'-16'
8 Rhus aromatica 'Gro Low' 2.5' ht

2 Betula nigra 14'-16'
10 Rhus aromatica 'Gro Low' 2.5' ht

3 Thuja o. 'Emerald Green' 12' ht.

LOAM & SEED

LOAM & SEED

LOAM & SEED

68 Ilex glabra 'Shamrock' 2.5' ht.

6 Rhus aromatica 'Gro Low' 3 Gal.
104 Liriope spicata 1.5 o.c. Typical
EXISTING TREE (TYP)
15 Rhus aromatica 'Gro Low' 3 Gal.
109 Liriope spicata 1.5 o.c. Typical
10' PAVED AREA SETBACK
16 Rhus aromatica 'Gro Low' 3 Gal.
107 Liriope spicata 1.5 o.c. Typical
12 Rhus aromatica 'Gro Low' 3 Gal.
100 Liriope spicata 1.5 o.c. Typical
53 Rhus aromatica 'Gro Low' 3 Gal.
EXISTING TURF REPAIR AS NEEDED
93 Liriope spicata 1.5 o.c. Typical
160 Liriope spicata 1.5 o.c. Typical
8 Juniperus horiz. 'Blue Chip' 3 gal.
7 Rhus aromatica 'Gro Low' 3 Gal.
12 Schizachyrium scop. 'MinnblueA' 2 Gal.
10' PAVED AREA SETBACK
100' WETLAND BUFFER
20' FRONT-YARD LANDSCAPE BUFFER
10 Schizachyrium scop. 'MinnblueA' 2 Gal.
23 Juniperus horizontalis 'Blue Chip' 3 Gal.
84 Liriope spicata 1.5 o.c. Typical
12 Ilex glabra 'Shamrock' 2.5' ht
12 Rhus aromatica 'Gro Low' 3 Gal.
82 Ilex glabra 'Shamrock' 2.5' ht.
80 Liriope spicata 1.5' o.c. Typical
15 Rhus aromatica 'Gro Low' 3 Gal.
EXISTING TURF REPAIR AS NEEDED
49 Liriope spicata 1.5' o.c. Typical
13 Rhus aromatica 'Gro Low' 3 Gal.
49 Liriope spicata 1.5' o.c. Typical
12 Rhus aromatica 'Gro Low' 3 Gal.
44 Liriope spicata 1.5' o.c. Typical
3 Quercus palustris 3.5-4" cal
6 Rhus aromatica 'Gro Low' 3 Gal.
33 Liriope spicata 1.5' o.c. Typical
8 Rhus aromatica 'Gro Low' 5' ht
28 Liriope spicata 1.5' o.c. Typical

5 Ilex glabra 2.5' ht
9 Rhododendron max. 2.5' ht

3 Hamamelis virginiana 5'-7' ht

7 Myrica pensylvanica 2.5' ht
6 Ilex glabra 2.5' ht

8 Ilex glabra 2.5' ht
6 Rhus aromatica 3 gal.

SEED WITH NEW ENGLAND CONSERVATION WILDLIFE MIX FROM NEW ENGLAND WETLAND PLANTS, INC.

PROPOSED BUILDING ADDITION

3 Ilex Glabra 'Shamrock' 2.5' ht
3 Rhus aromatica 'Gro Low 3 Gal.

LOAM & SEED

6 Rhus aromatica 3 Gal.
4 Ilex glabra 2.5' ht

LOAM & SEED

1 Liquidambar s. 'Slender Silhouette' 3.5-4" cal

LOAM & SEED

RIVER STONE

50' FRONT-YARD BUILDING SETBACK

26 Ilex glabra 'Shamrock' 2.5' ht

1 Hamamelis virginiana 5'-7' ht

4 Liquidambar s. 'Slender Silh.' 3.5-4" cal

6 Ilex glabra 2.5' ht

LOAM & SEED

ROOT BARRIER

11 Aronia arbutifolia 2.5' ht
11 Clethra alnifolia 2.5' ht
7 Ilex glabra 2.5' ht
10 Myrica pensylvanica 2.5' ht

25' SIDE-YARD LANDSCAPE BUFFER

100' WETLAND BUFFER

10' PAVED AREA SETBACK

9 Ilex glabra 2.5' ht
16 Rhus aromatica 'Gro Low' 3 Gal.

BOSTON POST ROAD (ROUTE 20)

0 15 30 60 Feet

MERCEDES OF SUDBURY - PLANT LIST

	BOTANICAL NAME	COMMON NAME	SIZE – TYP
*Trees**			
4	*Betula nigra*	Heritage Birch	14'-16' ht.
13	*Hamamelis virginiana*	Witch Hazel	5'-7' ht.
5	*Liquidambar styraciflua 'Slender Silhouette'*	Sweetgum, Slender Silhouette	3.5-4" cal
3	*Thuja o. Emerald Green'*	Emerald Green Arborvitae	12' ht.
3	*Quercus palustris*	Pin Oak	3.5-4" cal
Shrubs			
16	*Aronia arbutifolia*	Chokeberry	2.5' ht.
50	*Clethera alnifolia*	Summersweet	2.5' ht.
14	*Cornus racemosa*	Gray Dogwood	2.5' ht.
71	*Ilex glabra*	Inkberry	2.5' ht.
29	*Ilex glabra 'Compacta'*	Compact Kinkberry	2.5' ht.
188	*Ilex glabra 'Shamrock'*	Shamrock Inkberry	2.5' ht.
31	*Juniperus horizontalis 'Blue Chip'*	Blue Chip Juniper	2.5' spread
17	*Myrica pensylvanica*	Northern Bayberry	2.5' ht.
27	*Rhododendron maximum*	Rosebay Rhododendron	2.5' ht.
12	*Rhus aromatica*	Fragrant Sumac	2.5' ht.
212	*Rhus aromatica 'Gro Low'*	Fragrant Sumac 'Gro Low'	3 Gal.
9	*Viburnum acerifolium*	Mapleleaf Viburnum	2.5' ht.
Perennials and Grasses			
13	*Cimicifuga racemosa*	Black Cohosh	*2 gal*
20	*Dennstaedtia puntilobula*	Hayscented Fern	2 gal
1040	*Liriope spicata*	Creeping Lilyturf	2 gal (1.5' O.C)
21	*Onoclea sensibilis*	Sensitive Fern	2 gal
22	Schizachyrium scoparium	Bluestem Grass	2 gal

Date	Description	No.
02/14/22	PLANNING BOARD RESUBMITTAL	
01/31/22	ZBA RESUBMITTAL	2.
11/15/21	PLANNING BOARD SUBMITTAL	1.

Revisions

THOMAS R. RYAN
LANDSCAPE ARCHITECT, MA REGISTRATION #590

RYAN ASSOCIATES
LANDSCAPE ARCHITECTURE AND PLANNING
144 Moody Street, Building 4
Waltham, MA 02453-5332
ph: 781 - 314 - 0401
www.ryan-assoc.com

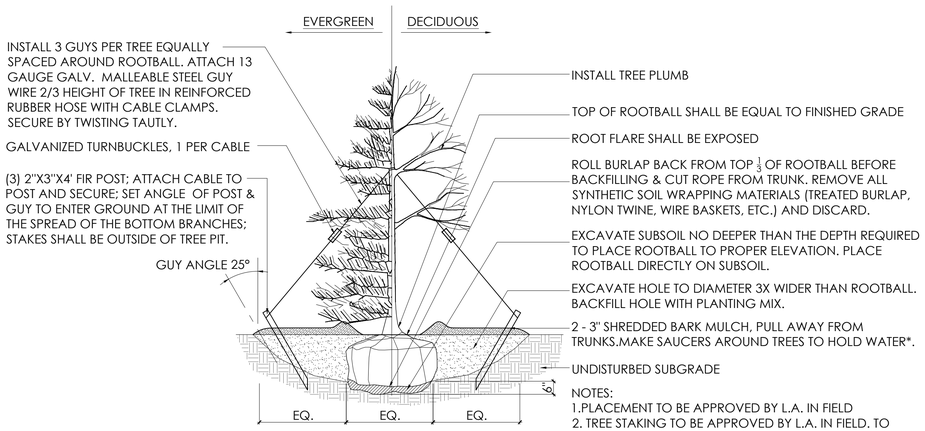
Project
HERB CHAMBERS MERCEDES OF SUDBURY
141 BOSTON POST ROAD, SUDBURY, MA

Prepared for
HERB CHAMBERS
#83 BOSTON POST ROAD - ROUTE 20 SUDBURY, MA 01776

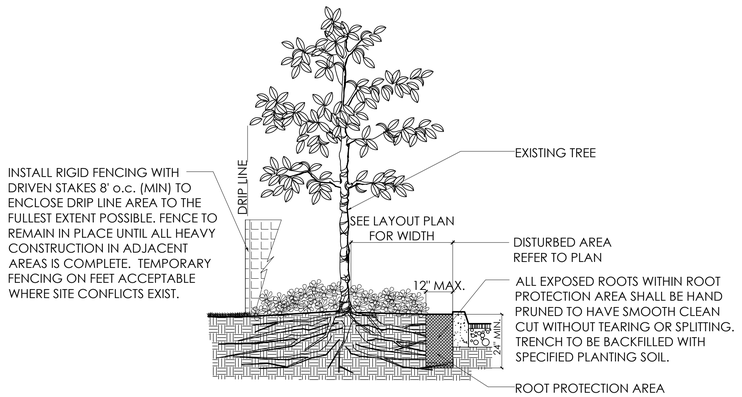
Drawing Title
LANDSCAPE PLAN

Date 2/14/2022
Scale 1"= 30'
Drawn By AA

Drawing No.
C-6.1

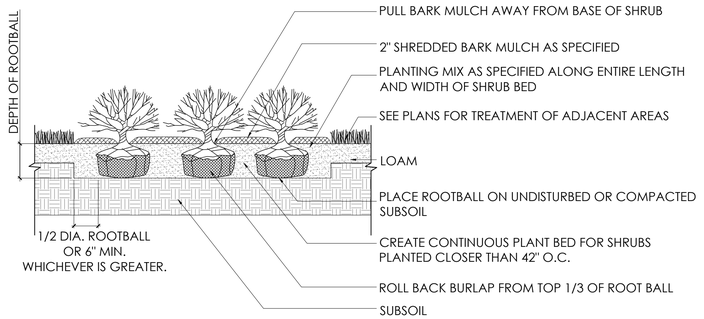


1 TREE
C-6.2 SCALE: 3/8" = 1'-0" SECTION



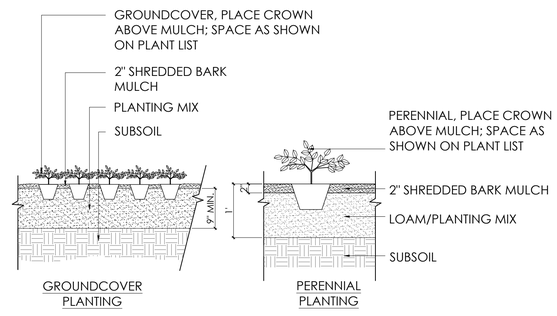
NOTE: NO MATERIAL OR VEHICLE STORAGE IS TO OCCUR WITHIN THE DRIP LINE AREAS OF EXISTING TREES.

2 CONSTRUCTION NEAR EXISTING TREE
C-6.2 SCALE: 3/8" = 1'-0" SECTION



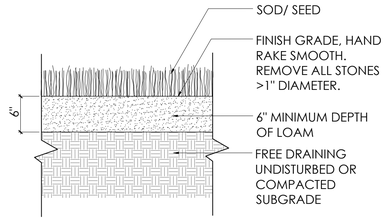
NOTE: SEE PLANTING PLAN FOR PLANT SPACING. PLANTS TO BEAR SAME RELATIONSHIP TO FINISHED GRADE AS TO PREVIOUS GRADE.

3 SHRUB
C-6.2 SCALE: 3/8" = 1'-0" SECTION



NOTE: SEE PLANTING PLAN FOR PLANT SPACING. PLANTS TO BEAR SAME RELATIONSHIP TO FINISHED GRADE AS TO PREVIOUS GRADE.

4 GROUNDCOVER AND PERENNIALS
C-6.2 SCALE: 3/4" = 1'-0" SECTION



5 SOD/ SEED
C-6.2 SCALE: 1" = 1'-0" SECTION

FINAL PLANTING AND FINAL STABILIZATION NOTES

1. ALL PLANT MATERIAL SHALL CONFORM TO THE MINIMUM GUIDELINES ESTABLISHED BY THE AMERICAN STANDARD FOR NURSERY STOCK PUBLISHED BY THE AMERICAN ASSOCIATION OF NURSERYMEN, INC.
2. ALL PLANTING BEDS TO BE MULCHED WITH AGED HARDWOOD BARK MULCH TO A DEPTH OF THREE (3) INCHES. PROVIDE FIVE (5) FOOT DIAMETER MULCH CIRCLE AROUND ALL INDIVIDUAL TREE PLANTINGS.
3. PLANT MATERIALS SHALL BEAR SAME RELATIONSHIP TO FINISH GRADE AS THEY BORE TO GRADE IN THE NURSERY.
4. SPACE PLANTS AT SCALED DISTANCES SHOWN ON DRAWINGS UNLESS OTHERWISE REQUIRED IN FIELD DUE TO UTILITY OR DRIVEWAY CONFLICTS. REVISED LOCATIONS SHALL BE APPROVED BY THE LANDSCAPE ARCHITECT.
5. ALL DECIDUOUS TREES SHALL BE FITTED WITH TREE-WATERING BAGS (TREEGATOR© OR EQUAL) FOLLOWING COMPLETION OF PLANTING.
6. ANY PROPOSED SUBSTITUTION OF PLANT MATERIAL SHALL ONLY BE MADE AFTER PRIOR APPROVAL OF LANDSCAPE ARCHITECT OR OWNER'S REPRESENTATIVE.
7. ALL PLANT MATERIALS SHALL BE GUARANTEED FOR TWO YEARS FOLLOWING DATE OF FINAL WRITTEN ACCEPTANCE FROM THE OWNER OR OWNER'S REPRESENTATIVE.
8. CONTRACTOR SHALL PROTECT ALL EXISTING VEGETATION AT THE SITE THAT IS NOT REQUIRED TO BE REMOVED TO MAKE WAY FOR NEW CONSTRUCTION.

SOIL NOTES

1. ALL AREAS DISTURBED BY CONSTRUCTION NOT DESIGNATED TO RECEIVE OTHER TREATMENT SHALL BE LOAMED A MINIMUM OF 6" AND SEEDED AS SPECIFIED BELOW. TOPSOIL FOR THIS PURPOSE SHALL BE TESTED BY AN APPROVED SOIL TESTING LABORATORY AND SHALL MEET THE FOLLOWING MINIMUM STANDARDS:
   - -- TEXTURE: FINE SANDY LOAM OR SANDY LOAM, AS DETERMINED BY MECHANICAL ANALYSIS AND BASED ON THE USDA STANDARD SOIL CLASSIFICATION SYSTEM.
   - -- ACIDITY: SOIL REACTION SHALL BE IN THE RANGE OF 5.5 TO 7.6, OR SHALL BE AMENDED TO MEET THIS RANGE.
   - -- ORGANIC MATTER: TOPSOIL SHALL HAVE A RANGE BETWEEN 5% AND 10% ORGANIC MATTER CONTENT BASED ON THE LOSS ON IGNITION OF OVEN-DRIED SAMPLES.
2. TREE/SHRUB PLANTING MIX: MIX THE SPECIFIED MATERIALS ON-SITE IN THE FOLLOWING PROPORTIONS:
   - -- 3 PARTS TOPSOIL AS SPECIFIED ABOVE, 1 PART PEAT MOSS, 1 PART SAND. IF PLANTS ARE INSTALLED IN SPRING, ADD 5 POUNDS OF SUPERPHOSPHATE/CUBIC YARD OF MIXTURE. ALL AMENDMENTS SHALL BE THOROUGHLY INCORPORATED INTO MIXTURE TO ASSURE UNIFORM DISTRIBUTION. PLANTING MIX SHALL BE USED TO BACKFILL ALL TREE PLANTING HOLES, AS INDICATED IN THE PLANTING DETAIL.

PERMANENT SEED MIX NOTES

SEED/SOD GRASS AREAS: SEED/SODSEED ALL SEED/SODGRASS LAWN AREAS WITH A DROUGHT TOLERANT, HIGH-FESCUE SEED/SODGRASS SEED MIX SUCH AS PEARL'S PREMIUM GRASS SEED BY PEARL'S PREMIUM, WAYLAND, MA; ENVIROSEED/SOD BY BLUESTEM NURSERY, LAURIER, WA; ECO-LAWN BY WILDFLOWER FARM, COLDWATER, ONT, CAN; OR APPROVED EQUAL, APPLIED AT SEED PRODUCER'S RECOMMENDED RATE. SEEDING SHALL BE DONE EITHER BETWEEN APRIL 1 AND JUNE 15, OR BETWEEN AUGUST 15 AND SEPTEMBER 30.

MEADOW MIX AREA: SEED OVER STORMWATER DETENTION AREA WITH "NEW ENGLAND NATIVE WARM SEASON GRASS MIX" BY NEW ENGLAND WETLAND PLANTS, AMHERST, MA, OR APPROVED EQUAL, PER MANUFACTURER'S RECOMMENDATIONS. WARM SEASON SEEDING PROGRAM WILL LIKELY TAKE 2-3 GROWING SEASONS UNTIL GOOD GROWTH IS ESTABLISHED.

MULCH ALL SEEDED AREAS WITH 500-700 LBS. OF SALTMARSH HAY OR WEED-FREE STRAW PER ACRE, SPREAD EVENLY. ALL SLOPES OF 3:1 OR GREATER, AFTER BEING LOAMED, SEEDED, AND MULCHED, SHALL BE COVERED WITH JUTE OR BIODEGRADABLE TOBACCO NETTING SECURELY ANCHORED TO THE SLOPE. OVERLAP A NETTING JOINTS A MINIMUM OF 4" AND SECURE WITH A DOUBLE ROW OF STAPLES.*

MAINTENANCE OF SEED AREAS SHALL CONSIST OF WATERING, WEEDING, CURING, REPAIR OF ALL EROSION, AND RESEEDING AS NECESSARY TO ESTABLISH A UNIFORM STAND OF GRASS. LAWNS SHALL BE WATERED IN A SATISFACTORY MANNER DURING AND IMMEDIATELY AFTER PLANTING, AND NOT LESS THAN TWICE PER WEEK UNTIL FINAL ACCEPTANCE. ALL AREAS WHICH FAIL TO SHOW A UNIFORM STAND OF GRASS FOR ANY REASON SHALL BE RESEEDED REPEATEDLY UNTIL A UNIFORM STAND IS ATTAINED.

HYDROSEEDING IS AN ACCEPTABLE ALTERNATE METHOD OF SEEDING, IF UNDERTAKEN IN ACCORDANCE WITH THE FOLLOWING SPECIFICATIONS:
- -- MATERIALS FOR HYDROSEEDING SHALL INCLUDE TACKIFIER, WOOD CELLULOSE FIBER MULCH, FERTILIZER, GROUND LIMESTONE AND WATER.
- -- PROVIDE JUTE MATTING OR BIODEGRADABLE TOBACCO NETTING ON ALL SLOPES EQUAL TO OR GREATER THAN 3:1. JUTE MATTING SHALL BE C-JUTE BY CONTECH CONSTRUCTION PRODUCTS, INC, GEOJUTE BY BELTON INDUSTRIES OR APPROVED EQUAL.*
- -- IF PROJECT SCHEDULE REQUIRES SEEDING TO BE PERFORMED AFTER OCTOBER 15 UNTIL MARCH 31, THE FOLLOWING IS REQUIRED: AFTER HYDROSEEDING/SEEDING, THOSE VEGETATED AREAS WHICH HAVE A SLOPE EQUAL TO OR STEEPER THAN 4:1 SHALL BE COVERED WITH JUTE MATTING AND STAPLED IN PLACE PER MANUFACTURERS REQUIREMENTS. PRECAUTIONS SHALL BE TAKEN TO MINIMIZE DISTURBANCE OF THE HYDROSEED/SEED WHEN INSTALLING THE JUTE.*

HYDROSEEDING/ SEEDING MIXTURE:
- -- TACKIFER: APPLY AT A RATE OF 60 GALLONS PER ACRE.
- -- WOOD CELLULOSE FIBER MULCH: APPLY AT A RATE OF 2,000 POUNDS PER ACRE.
- -- APPLY FERTILIZER AND LIMESTONE AT RATES DETERMINED BY SOIL ANALYSIS

*STRAW MULCH AND NETTING ON SLOPES 3:1 OR GREATER IS NOT REQUIRED ON HYDROSEEDING OPERATIONS IF SLOPES ARE SPRAYED WITH A BONDED FIBER MATRIX MULCH, SUCH AS FLEXTERRA BY PROFILE PRODUCTS, LLC, OR HYDROSTRAW BFM BY HYDROSTATION, INC., INSTALLED IN ACCORDANCE WITH MANUFACTURER'S SPECIFICATIONS.

Date	Description	No.
02/14/22	PLANNING BOARD RESUBMITTAL	
01/31/22	ZBA RESUBMITTAL	
11/15/21	PLANNING BOARD SUBMITTAL	

Revisions

THOMAS R. RYAN
LANDSCAPE ARCHITECT, MA REGISTRATION #590

RYAN ASSOCIATES
LANDSCAPE ARCHITECTURE AND PLANNING
144 Moody Street, Building 4
Waltham, MA 02453-5332
ph: 781 - 314 - 0401
www.ryan-assoc.com

Project
HERB CHAMBERS MERCEDES OF SUDBURY
141 BOSTON POST ROAD, SUDBURY, MA

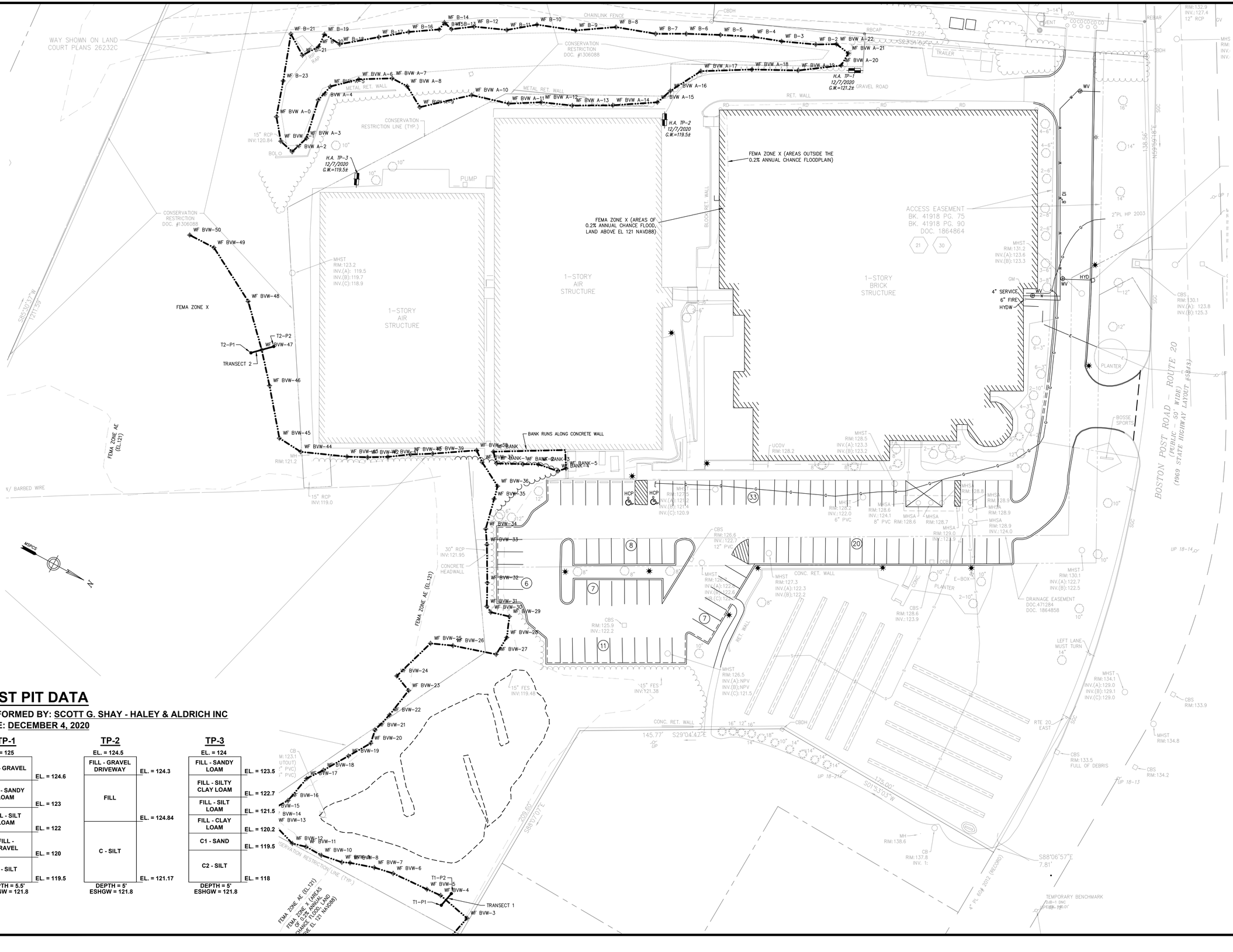
Prepared for
HERB CHAMBERS
#83 BOSTON POST ROAD - ROUTE 20 SUDBURY, MA 01776

Drawing Title
PLANTING DETAILS

Date 2/14/2022
Scale AS NOTED
Drawn By AA

Drawing No.
C-6.2

C:\Users\...\Desktop\...\C-6.2.dwg, 2/14/2022 12:45:...



TEST PIT DATA

PERFORMED BY: SCOTT G. SHAY - HALEY & ALDRICH INC

DATE: DECEMBER 4, 2020

TP-1

EL. = 125

FILL - GRAVEL	EL. = 124.6
FILL - SANDY LOAM	EL. = 123
FILL - SILT LOAM	EL. = 122
FILL - GRAVEL	EL. = 120
C - SILT	EL. = 119.5

DEPTH = 5.5'
ESHGW = 121.8

TP-2

EL. = 124.5

FILL - GRAVEL DRIVEWAY	EL. = 124.3
FILL	EL. = 124.84
C - SILT	EL. = 121.17

DEPTH = 5'
ESHGW = 121.8

TP-3

EL. = 124

FILL - SANDY LOAM	EL. = 123.5
FILL - SILTY CLAY LOAM	EL. = 122.7
FILL - SILT LOAM	EL. = 121.5
FILL - CLAY LOAM	EL. = 120.2
C1 - SAND	EL. = 119.5
C2 - SILT	EL. = 118

DEPTH = 5'
ESHGW = 121.8

30 15 0 30 60

No.	Revisions	Date
3.	P.B. AND CON.–COM. RESUBMITTAL	02/14/22
2.	ZBA RESUBMITTAL	01/31/22
1.	PLANNING BOARD SUBMITTAL	11/15/21

2-14-2022

GABRIEL R. CROCKER
PROFESSIONAL ENGINEER, MA REGISTRATION #47917

COMMONWEALTH OF MASSACHUSETTS
GABRIEL R. CROCKER
CIVIL
No. 47917
REGISTERED PROFESSIONAL ENGINEER

Crocker Design Group
2 SHARP STREET, UNIT A
HINGHAM, MA 02043
P: 781-919-0808

Project

MERCEDES OF SUDBURY

141 BOSTON POST ROAD, SUDBURY, MA

Prepared for

HERB CHAMBERS 43 BRAINTREE STREET, LLC

#259 McGRATH HIGHWAY - ROUTE 28 SOMERVILLE, MA 02143

Drawing Title

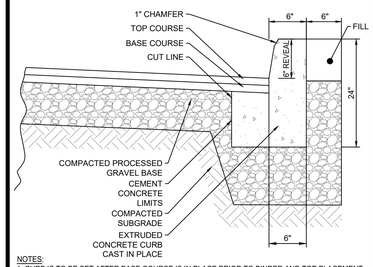
TEST PIT PLAN

Project No.	100-107
Date	11/10/2021
Scale	1"=30'
Drawn By	DJN / JPM
Approved By	GC

Drawing No.

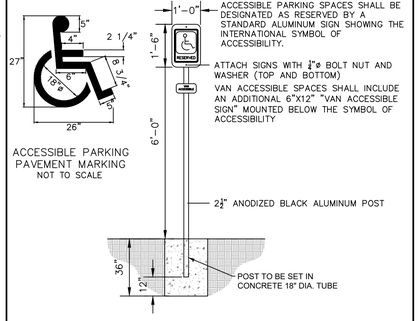
C-7

C:\2021\Crocker Design Group, LLC\Gabriel Crocker - Projects\100-107 Sudbury - Mercedes\dwg\Plot Sheets\Site Plan Application_ 11 TEST PIT PLAN.dwg, C-7 TEST PIT, Feb 14, 2022 15:24



NOTES:
1. CURB IS TO BE SET AFTER BASE COURSE IS IN PLACE PRIOR TO BINDER AND TOP PLACEMENT
2. CUT NEAT LINE 6" FROM CURB LINE AND REMOVE BASE GRAVEL WITH CEMENT CONCRETE.
3. ANY DESIGNATED CEMENT CONCRETE THAT IS ACCEPTABLE UNDER SECTION M4 OF THE "MASSACHUSETTS DEPARTMENT OF TRANSPORTATION - HIGHWAY DIVISION STANDARD SPECIFICATIONS FOR HIGHWAY AND BRIDGES" BE USED.
4. AS AN ALTERNATE, CONTRACTOR MAY FORM AND POUR SIDEWALK/CURB COMBO AREAS IN MONOLITHIC POUR.

VERTICAL CONCRETE CURB
NOT TO SCALE



ACCESSIBLE PARKING SPACES SHALL BE DESIGNATED AS RESERVED BY A STANDARD ALUMINUM SIGN SHOWING THE INTERNATIONAL SYMBOL OF ACCESSIBILITY.

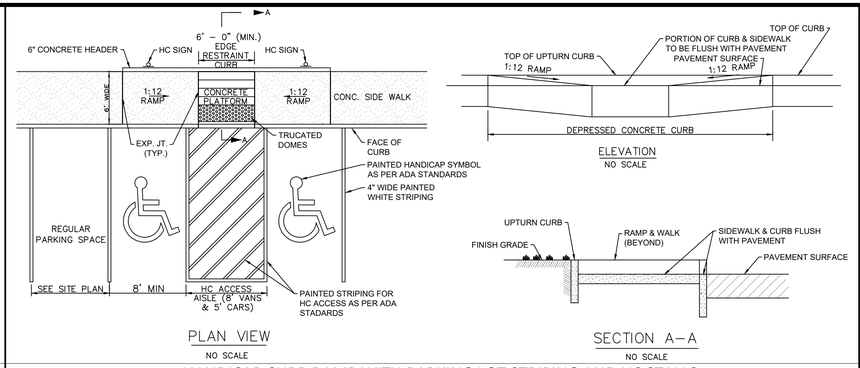
ATTACH SIGNS WITH ⅜" ø BOLT NUT AND WASHER (TOP AND BOTTOM)

VAN ACCESSIBLE SPACES SHALL INCLUDE AN ADDITIONAL 6"X12" "VAN ACCESSIBLE SIGN" MOUNTED BELOW THE SYMBOL OF ACCESSIBILITY

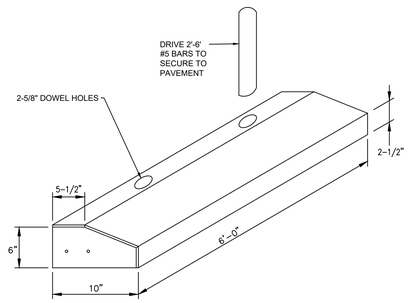
2½" ANODIZED BLACK ALUMINUM POST

POST TO BE SET IN CONCRETE 18" DIA. TUBE

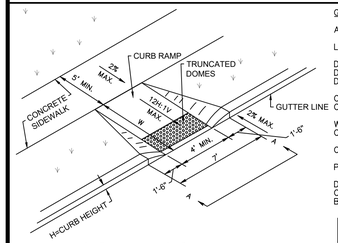
ACCESSIBLE PARKING SIGN
NOT TO SCALE



HANDICAP CURB RAMP WITH PARKING LOT STRIPING AND HC STALLS
NOT TO SCALE



CONCRETE WHEEL STOP FOR HANDICAP PARKING SPACES
NOT TO SCALE



GENERAL NOTES:

ALL CONCRETE SHALL BE CLASS "B" 3500 PSI, GREY.

LANDING AREA, APPROACH SIDEWALK TRANSITIONS, AND CURB RAMP SHALL BE KEPT CLEAR OF OBSTRUCTIONS.

DIMENSIONS SHOWN IN TABLES ARE FOR RELATIVELY FLAT SIDEWALK AREAS. CARE SHOULD BE TAKEN WHEN DETERMINING CURB RAMP SIZE BASED ON CURB HEIGHT (H) WHERE ELEVATION OF CURB AND SIDEWALK VARY DRASTICALLY IN AREA OF PROPOSED CURB RAMP.

CURB (DROPPED CURB) GUTTERLINE TO BE FLUSH WITH ROADWAY PAVEMENT A MINIMUM OF 4 FEET AT ALL CURB RAMPS, EXCEPT THAT CURB RAMP TYPE E SHALL BE A MINIMUM OF 5 FEET.

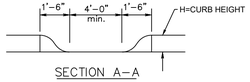
WHERE THE DISTANCE FROM THE GUTTER LINE TO THE OUTSIDE EDGE OF SIDEWALK IS 6 FEET OR LESS, CURB RAMP TYPE E SHOULD BE USED, INSTEAD OF CURB RAMP TYPE A THROUGH D.

CROSSWALKS AND STOP LINES MAY BE MARKED OR UNMARKED, SEE PLANS.

PREFERRED AND ALTERNATE TREATMENTS SHOULD NOT BE INTERMIXED WITHIN THE SAME INTERSECTION.

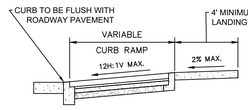
DIMENSIONS SHOWN IN TABLES ARE FOR 3 INCH TO 9 INCH CURB HEIGHTS. WHERE THE CURB HEIGHTS ARE OTHER THAN WHAT IS PROVIDED IN THE TABLES, THE DIMENSIONS OF THE RAMPS WILL HAVE TO BE CALCULATED BASED ON CROSS SLOPES SHOWN.

CURB RAMP	
H INCHES	W FEET
3	3
4	4
5	5
6	6
7	7
8	8
9	9



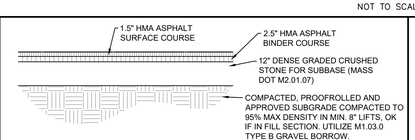
SECTION A–A

NOTE:
CURB RAMP OPENING TO BE FLUSH WITH ROADWAY PAVEMENT.

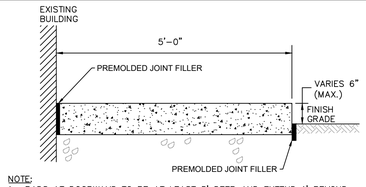


SECTION THROUGH CURB RAMPS

CONCRETE CURB RAMP
NOT TO SCALE

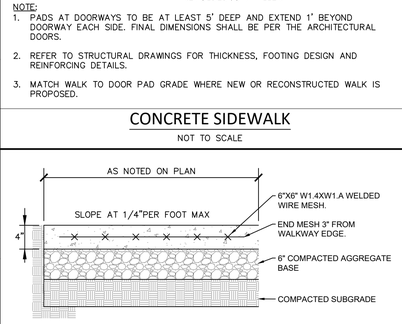


BITUMINOUS PAVEMENT
NOT TO SCALE

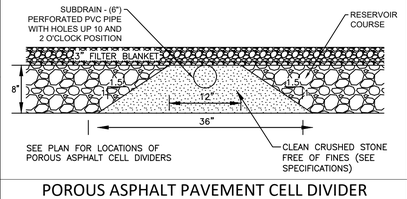


NOTE:
1. PADS AT DOORWAYS TO BE AT LEAST 5' DEEP AND EXTEND 1' BEYOND DOORWAY EACH SIDE. FINAL DIMENSIONS SHALL BE PER THE ARCHITECTURAL DOORS.
2. REFER TO STRUCTURAL DRAWINGS FOR THICKNESS, FOOTING DESIGN AND REINFORCING DETAILS.
3. MATCH WALK TO DOOR PAD GRADE WHERE NEW OR RECONSTRUCTED WALK IS PROPOSED.

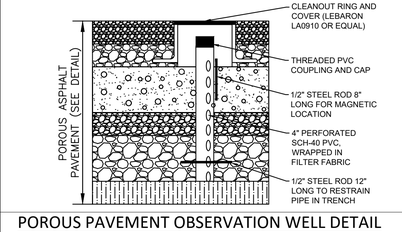
CONCRETE SIDEWALK
NOT TO SCALE



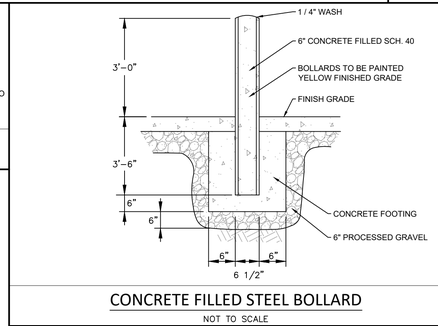
CONCRETE SIDEWALK
NOT TO SCALE



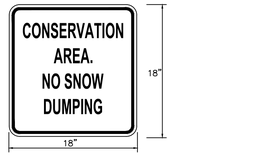
POROUS ASPHALT PAVEMENT CELL DIVIDER
NOT TO SCALE



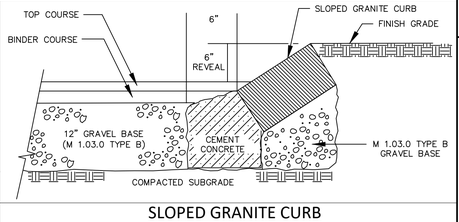
POROUS PAVEMENT OBSERVATION WELL DETAIL
NOT TO SCALE



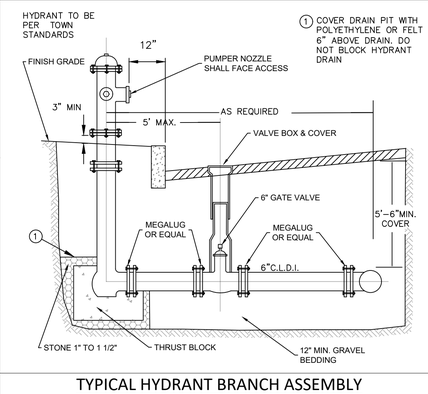
CONCRETE FILLED STEEL BOLLARD
NOT TO SCALE



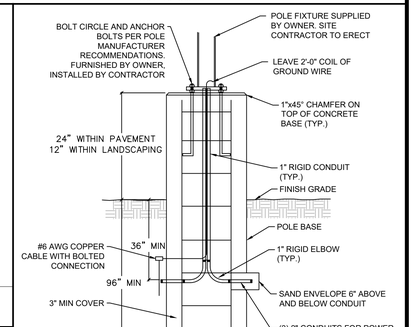
CONSERVATION SIGN DETAIL
NOT TO SCALE



SLOPED GRANITE CURB
NOT TO SCALE

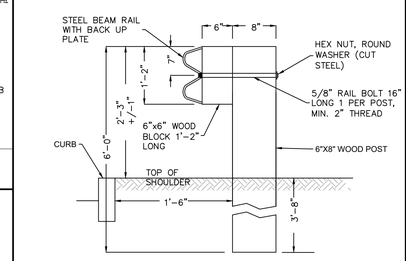


TYPICAL HYDRANT BRANCH ASSEMBLY
NOT TO SCALE



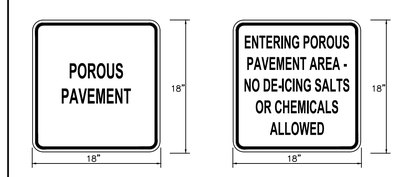
NOTES:
1. TOTAL MINIMUM LENGTH OF SONOTUBE (BURIED PORTION) IS A 3–1 RATIO WITH RESPECT TO THE TOTAL HEIGHT OF POLE INCLUDING EXTENSION ABOVE FINISHED GRADE.
2. LIGHTING NOTE: CONTRACTOR IS RESPONSIBLE FOR PLANNING/ORIENTATING THE BASE PLATE MOUNTING PATTERN TO FIT THE SELECTED POLE AND ACCOUNT FOR THE ORIENTATION OF THE FIXTURE HEADS. BOLT PATTERNS AND ANCHOR BOLTS TO BE PROVIDED BY OWNER'S LIGHTING REP.
3. CONTRACTOR TO SUBMIT SHOP DRAWINGS FOR APPROVAL PRIOR TO CONSTRUCTION

LIGHT POLE EXPOSED BASE DETAIL
NOT TO SCALE

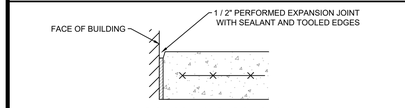


NOTES:
1. POSTS SPACED 6'–3" CENTER TO CENTER 2. PROVIDE TERMINAL SECTION AT ENDS

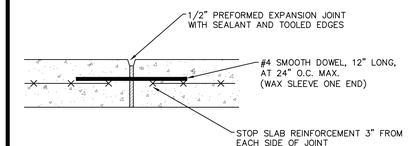
WOOD POST GUARD RAIL
NOT TO SCALE



POROUS PAVEMENT SIGN DETAILS
NOT TO SCALE



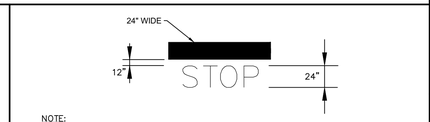
EXPANSION JOINT AT BUILDING



NOTE:
PROVIDE EXPANSION JOINTS AT ALL INTERFACES BETWEEN WALKWAY AND VERTICAL BUILDING SURFACES.

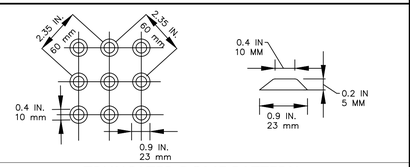
CONCRETE SIDEWALK EXPANSION JOINT

EXPANSION JOINT
NOT TO SCALE

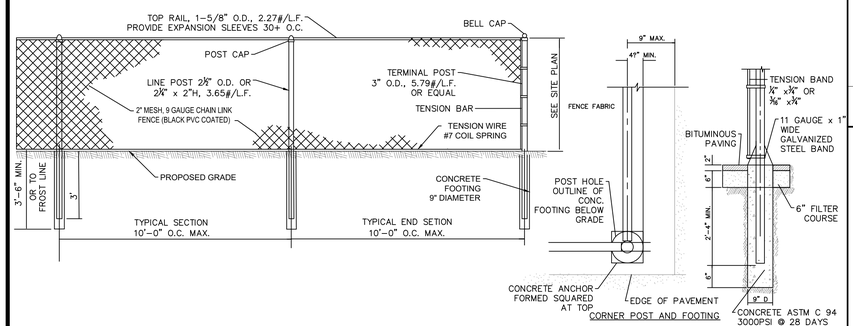


NOTE:
WORDS CAN BE ARRANGED IN OTHER COMBINATIONS THAN THOSE ILLUSTRATED HERE TO ACHIEVE DESIRED RESULT. ALL PAINT TO BE THERMOPLASTIC.

PAINTED MARKING DETAILS
NOT TO SCALE



TRUNCATED DOME PATTERN
NOT TO SCALE



ELEVATION OF TYPICAL CHAIN LINK FENCE
NOT TO SCALE

02/14/22	P.B. AND CON.–COM. RESUBMITTAL	3.
01/31/22	ZBA RESUBMITTAL	2.
11/15/21	PLANNING BOARD SUBMITTAL	1.
Date	Description	No.
	Revisions	

COMMONWEALTH OF MASSACHUSETTS
GABRIEL R. CROCKER
CIVIL
No.47917
REGISTERED PROFESSIONAL ENGINEER

2-14-2022

GABRIEL R. CROCKER
PROFESSIONAL ENGINEER, MA REGISTRATION #47917

Crocker Design Group
2 SHARP STREET, UNIT A
HINGHAM, MA 02043
P: 781–919–0808

Project

MERCEDES OF SUDBURY

141 BOSTON POST ROAD, SUDBURY, MA

Prepared for

HERB CHAMBERS 43 BRAINTREE STREET, LLC

#259 McGRATH HIGHWAY - ROUTE 28 SOMERVILLE, MA 02143

Drawing Title

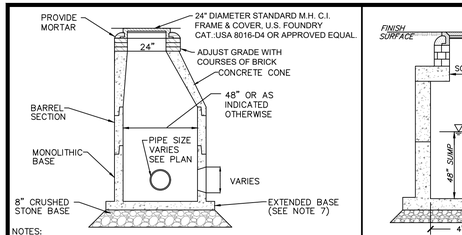
DETAIL SHEET

Project No.	100-107
Date	11/10/2021
Scale	AS NOTED
Drawn By	DJN / JPM
Approved By	GC

Drawing No.

C-8.1

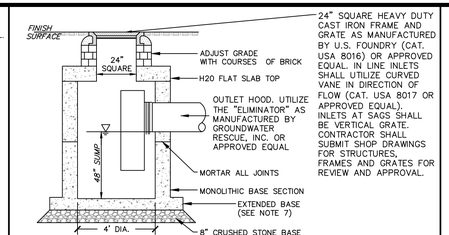
C:\CDG\Crocker Design Group, LLC\Gabriel Crocker - Projects\100-107 Sudbury - Mercedes\dwg\Plot Sheets\Site Plan Application_ 08 DETAIL SHEET.dwg, C-8.1 DETAIL, Feb 14, 2022, 15:12



NOTES:
1. MANHOLE DESIGN SHALL CONFORM TO LATEST ASTM C478.
2. REINFORCING STEEL SHALL CONFORM TO LATEST ASTM A 185.
3. CONCRETE COMPRESSIVE STRENGTH – 4,000 PSI @ 28 DAYS.
4. ONE POUR MONOLITHIC BASE.
5. BITUMASTIC BUTYL RUBBER FOR JOINTS SHALL CONFORM TO LATEST ASTM C443 AND FED SS–S–201A SPEC.
6. COVERS TO BE STAMPED "DRAIN"
7. CONTRACTOR TO PROVIDE BUOYANCY CALCULATIONS WITH THE PRECAST STRUCTURE SHOP DRAWING PACKAGE. ESTIMATE SEASONAL HIGH GROUNDWATER USING THE TEST PIT PLAN. USE FACTOR OF SAFETY OF 1.5 APPLIED TO UNIT FORCE. PROVIDE ANTI FLOTATION COLLAR WHERE CALCULATIONS REQUIRE TO MEET FACTOR OF SAFETY.

PRECAST CONCRETE DRAIN MANHOLE

NOT TO SCALE

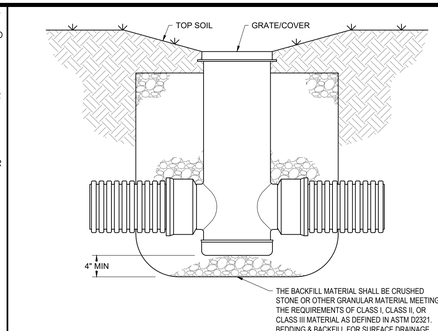


24" SQUARE HEAVY DUTY CAST IRON FRAME AND GRATE AS MANUFACTURED BY U.S. FOUNDRY (CAT. USA 8016) OR APPROVED EQUAL. IN LINE INLETS SHALL UTILIZE CURVED VANE IN DIRECTION OF FLOW (CAT. USA 8017 OR APPROVED EQUAL). INLETS AT SAGS SHALL BE VERTICAL GRATE. CONTRACTOR SHALL SUBMIT SHOP DRAWINGS FOR STRUCTURES, FRAMES AND GRATES FOR REVIEW AND APPROVAL.

NOTES:
1. STRUCTURE DESIGN TO LATEST ASTM C478.
2. REINFORCING STEEL CONFORMS TO LATEST ASTM A 185.
3. CONCRETE COMPRESSIVE STRENGTH – 4,000 PSI @ 28 DAYS.
4. LAT SLAB TOP AASHTO H–20
5. ONE POUR MONOLITHIC BASE.
6. UTILIZE CURVED VANE GRATES WHERE CATCH BASIN IS ON AN INLINE SLOPE CONDITION.
7. CONTRACTOR TO PROVIDE BUOYANCY CALCULATIONS WITH THE PRECAST STRUCTURE SHOP DRAWING PACKAGE. ESTIMATE SEASONAL HIGH GROUNDWATER USING THE TEST PIT PLAN. USE FACTOR OF SAFETY OF 1.5 APPLIED TO UNIT FORCE. PROVIDE ANTI FLOTATION COLLAR WHERE CALCULATIONS REQUIRE TO MEET FACTOR OF SAFETY.

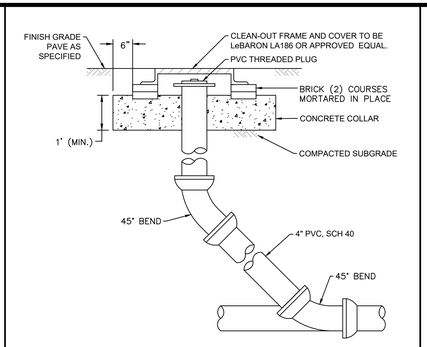
SINGLE GRATE CATCH BASIN

NOT TO SCALE



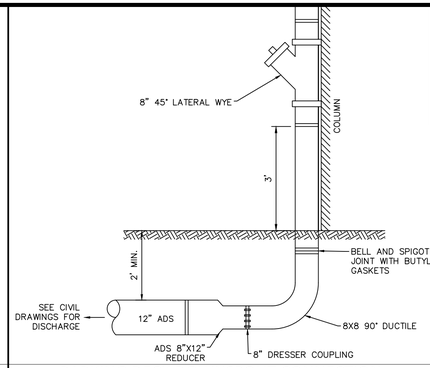
NYOPLAST YARD DRAIN

NOT TO SCALE



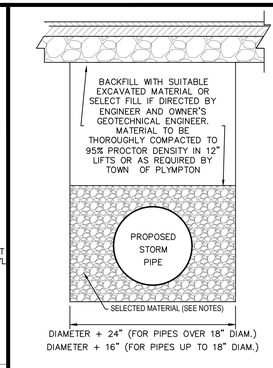
TYPICAL CLEAN-OUT DETAIL

NOT TO SCALE



PARKING DECK DOWNSPOUT CONNECTION

NOT TO SCALE



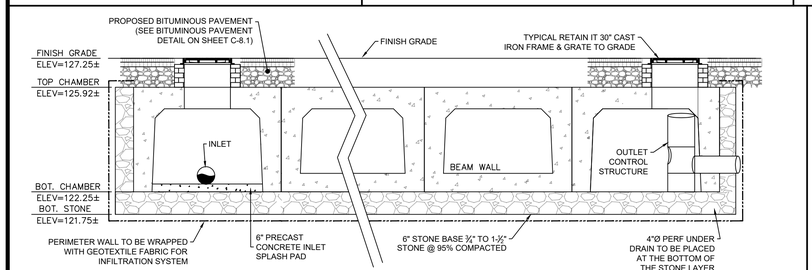
DIAMETER + 24" (FOR PIPES OVER 18" DIAM.)
DIAMETER + 16" (FOR PIPES UP TO 18" DIAM.)

BACKFILLING:

AFTER THE PIPE HAS BEEN LAID AND INSPECTED, THE TRENCH SHALL BE BACKFILLED. THE SPACE UNDER THE PIPE HAUNCHES SHALL BE CAREFULLY FILLED WITH SELECTED MATERIAL, FREE FROM STONES OR FROZEN EARTH, AND COMPACTED CAREFULLY TO PREVENT THE PIPE FROM MOVING. THE LAYER OF BACKFILL UP TO TWELVE (12) INCHES OVER THE TOP OF THE PIPE SHALL ALSO BE OF SELECTED MATERIAL FREE FROM STONES AND FROZEN EARTH, WELL COMPACTED. THE REMAINDER OF THE TRENCH SHALL BE BACKFILLED IN TWELVE (12) INCH LAYERS EXCEPT AS NOTED BELOW, AND EACH LAYER SHALL BE FULLY COMPACTED IN AN APPROVED MANNER. UNDER ROADS OR OTHER TRAFFIC AREAS THE TRENCH SHALL BE BACKFILLED IN SIX (6) INCH LAYERS WITH EACH LAYER COMPACTED TO THE DENSITY OF THE SURROUNDING SOIL. PAVEMENT AND BASE COURSE MATERIALS REMOVED DURING THE EXCAVATION PROCESS SHALL BE REPLACED WITH PAVEMENT AND BASE COURSE TO MATCH THOSE REMOVED. WHEN, IN THE OPINION OF THE PLANNING BOARD OR ITS AGENT, THE EXCAVATION IS DEEP ENOUGH TO WARRANT IT, TEMPORARY PAVEMENT SHALL BE PROVIDED AS DIRECTED. TRENCHES NOT IN PAVEMENT SHALL BE LEFT IN A MOUNDED CONDITION AS DIRECTED BY THE PLANNING BOARD OR ITS AGENT.

STORM PIPE TRENCH

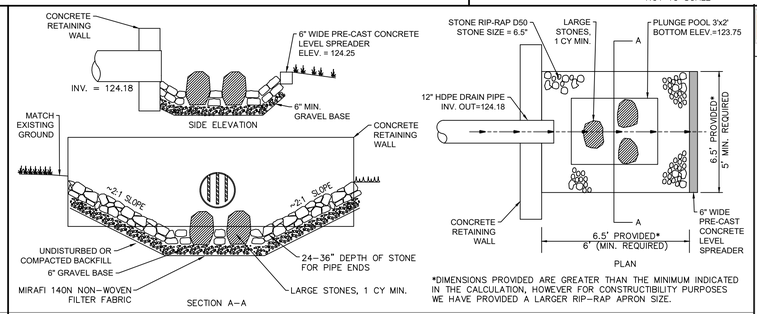
NOT TO SCALE



NOTE:
ELEVATIONS REFER TO A SPECIFIC LOCATION AND VARY THROUGHOUT THE CHAMBER SYSTEM. SEE GRADING AND DRAINAGE PLAN FOR FINISH GRADE ELEVATIONS AT SPECIFIC LOCATIONS.

UG#1: 3 FT RETAIN-IT INFILTRATION SYSTEM

NOT TO SCALE



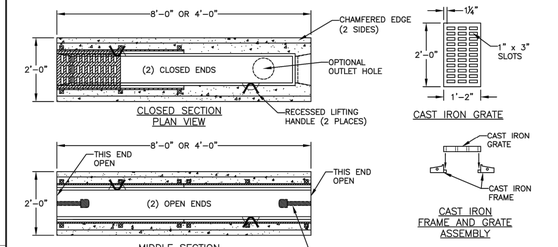
*DIMENSIONS PROVIDED ARE GREATER THAN THE MINIMUM INDICATED IN THE CALCULATION, HOWEVER FOR CONSTRUCTIBILITY PURPOSES WE HAVE PROVIDED A LARGER RIP-RAP APRON SIZE.

LEVEL SPREADER/PLUNGE POOL/ENERGY DISSIPATER

NOT TO SCALE

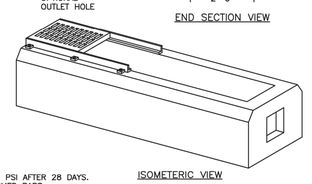
SHEA CONCRETE PRODUCTS
New England's Premier Precaster
800-696-7432 (SHEA)
www.sheaconcrete.com
BILLING ADDRESS: 87 HAVERHILL RD, AMESBURY MA 01913

12" X 18" TRENCH DRAIN



NOTES:
1. MINIMUM CONCRETE COMPRESSIVE STRENGTH: 4,000 PSI AFTER 28 DAYS.
2. REINFORCING STEEL: A615 GRAD 60 BLACK DEFORMED BARS
3. AVAILABLE IN 4' AND 8' SECTIONS.
4. AVAILABLE IN CENTER, END OR MIDDLE SECTIONS.
5. DESIGNED FOR AASHTO HS–20 LOADING.
6. GRATING TO BE ATTACHED BY CONTRACTOR.
7. END KNOCK OUTS SIZED FOR MAXIMUM #8" PIPE.
8. SLOPED FLOOR IF REQUIRED TO BE INSTALLED BY OTHERS AFTER INSTALLATION.

ISOMETERIC VIEW



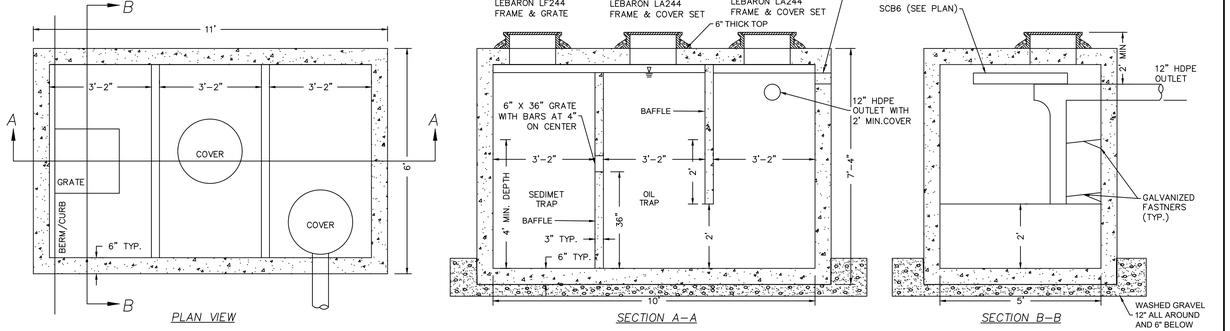
12" x 18" TRENCH DRAIN

ITEM CODE	SECTION TYPE	WEIGHT
TD–8	CLOSED	3,075#
TD–8	MIDDLE	3,000#
TD–8	END	3,350#
TD–4	CLOSED	1,575#
TD–4	MIDDLE	1,500#
TD–4	END	1,540#

SHEA PRODUCT ID: SEE TABLE	PREPARED FOR:	FILE NAME: trenchdrain12x18	NPCA CERTIFIED PLANT
WEIGHT (LBS): SEE TABLE	DRAWN BY: ARO	DATE: 06/01/18	PAGE: H6.2

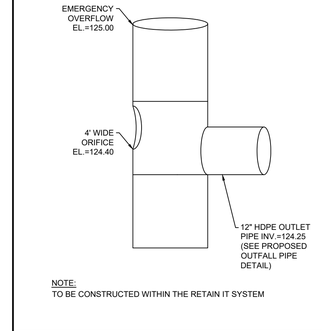
773 Salem Street–Wilmington, MA | 153 Cranberry Hwy–Rochester, MA | 87 Haverhill Road–Amesbury, MA | 160 Old Turnpike Rd–Nottingham, NH

Specifications subject to change without notice



CATCH BASIN/WATER QUALITY INLET H-20 LOADING

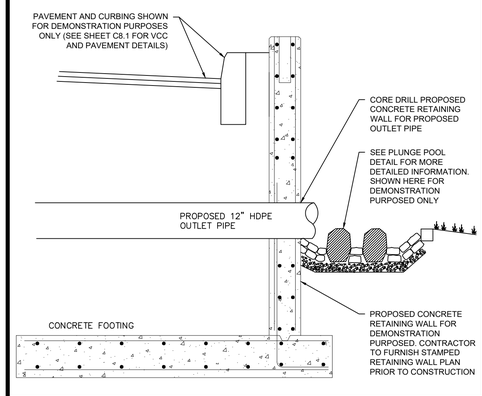
NOT TO SCALE



NOTE:
TO BE CONSTRUCTED WITHIN THE RETAIN IT SYSTEM

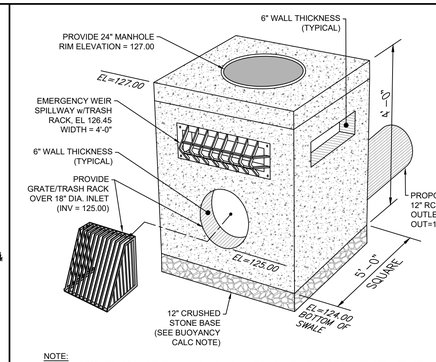
RETAIN IT OUTLET CONTROL STRUCTURE

NOT TO SCALE



PROPOSED OUTFALL PIPE

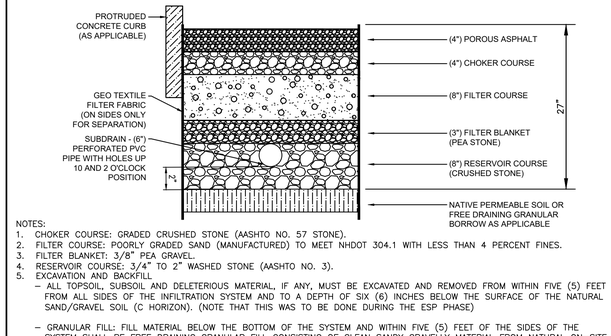
NOT TO SCALE



NOTE:
CONTRACTOR TO PROVIDE BUOYANCY CALCULATIONS WITH THE PRECAST STRUCTURE SHOP DRAWING PACKAGE. ESTIMATE SEASONAL HIGH GROUNDWATER USING THE TEST PIT PLAN. USE FACTOR OF SAFETY OF 1.5 APPLIED TO UNIT FORCE. PROVIDE ANTI FLOTATION COLLAR WHERE CALCULATIONS REQUIRE TO MEET FACTOR OF SAFETY.

PRECAST CONCRETE OUTLET STRUCTURE (OCS#1)

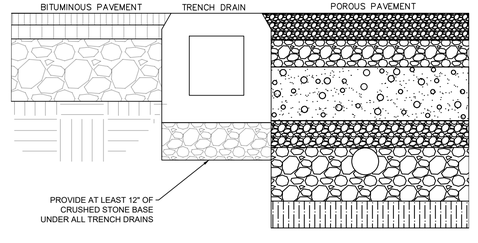
NOT TO SCALE



NOTES:
1. CHOKER COURSE: GRADED CRUSHED STONE (AASHTO NO. 57 STONE).
2. FILTER COURSE: POORLY GRADED SAND (MANUFACTURED) TO MEET NHDOT 304.1 WITH LESS THAN 4 PERCENT FINES.
3. FILTER BLANKET: 3/8" PEA GRAVEL.
4. RESERVOIR COURSE: 3/4" TO 2" WASHED STONE (AASHTO NO. 3).
5. EXCAVATION and BACKFILL
   - ALL TOPSOIL, SUBSOIL AND DELETERIOUS MATERIAL, IF ANY, MUST BE EXCAVATED AND REMOVED FROM WITHIN FIVE (5) FEET FROM ALL SIDES OF THE INFILTRATION SYSTEM AND TO A DEPTH OF SIX (6) INCHES BELOW THE SURFACE OF THE NATURAL SAND/GRAVEL SOIL (C HORIZON). (NOTE THAT THIS WAS TO BE DONE DURING THE ESP PHASE)
   - GRANULAR FILL: FILL MATERIAL BELOW THE BOTTOM OF THE SYSTEM AND WITHIN FIVE (5) FEET OF THE SIDES OF THE SYSTEM SHALL BE FREE DRAINING GRANULAR FILL CONSISTING OF CLEAN SANDY GRAVELLY MATERIAL FROM NATURAL ON–SITE SOIL, FREE FROM ORGANIC MATTER AND DELETERIOUS MATTER APPROVED BY THE ENGINEER OR IMPORTED SAND MATERIAL MEETING THE SPECIFICATIONS FOR FREE DRAINING GRANULAR FILL. FILL MATERIAL SHALL BE COMPACTED TO 90% DENSITY. NOTE THAT THIS IS TO BE DONE DURING THE ESP PHASE. THE CONTRACTOR SHALL REMOVE AND DELETERIOUS MATERIAL, AND/OR ANY COMPACTED SOIL, IF ANY, AND INSTALL FILL MATERIAL AS DESCRIBED ABOVE AND PER THIS DETAIL.

POROUS PAVEMENT DETAIL

NOT TO SCALE



TRENCH DRAIN

NOT TO SCALE

No.	Description	Date
3.	PLANNING BOARD SUBMITTAL	02/14/22
2.	ZBA RESUBMITTAL	01/31/22
1.	P.B. AND CON.–COM. RESUBMITTAL	11/15/21

Revisions

COMMONWEALTH OF MASSACHUSETTS — GABRIEL R. CROCKER — CIVIL — No.47917 — REGISTERED PROFESSIONAL ENGINEER

2-14-2022

GABRIEL R. CROCKER
PROFESSIONAL ENGINEER, MA REGISTRATION #47917

Crocker Design Group
2 SHARP STREET, UNIT A
HINGHAM, MA 02043
P: 781–919–0808

Project
MERCEDES OF SUDBURY
141 BOSTON POST ROAD, SUDBURY, MA

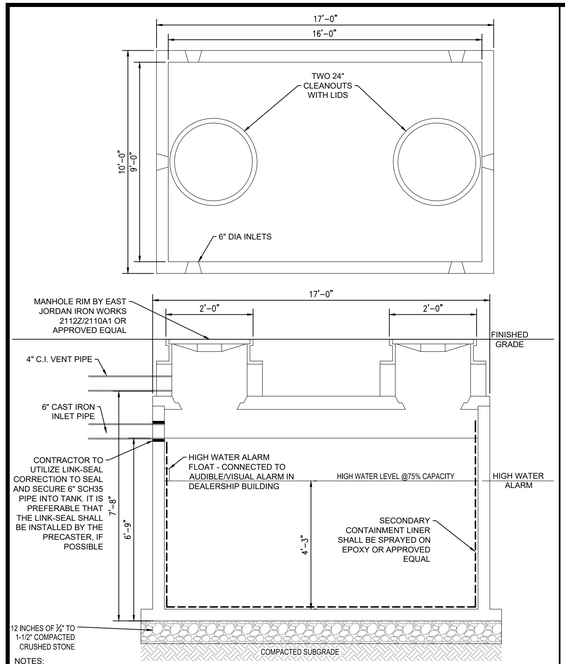
Prepared for
HERB CHAMBERS 43 BRAINTREE STREET, LLC
#259 McGRATH HIGHWAY - ROUTE 28 SOMERVILLE, MA 02143

Drawing Title
DETAIL SHEET

Project No.	100-107
Date	11/10/2021
Scale	AS NOTED
Drawn By	DJN / JPM
Approved By	GC

Drawing No.
C-8.2

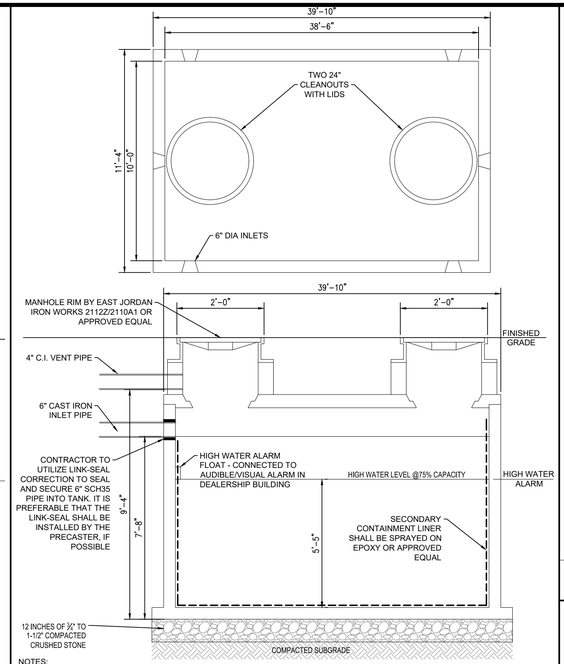
C:\CDG\Crocker Design Group, LLC\Gabriel Crocker - Projects\100-107 Sudbury - Mercedes\dwg\Plot Sheets\Site Plan Application_ 08 DETAIL SHEET.dwg, C-8.2 DETAIL, Feb 14, 2022 15:12



NOTES:
1. TIGHT TANK SHALL BE CONSTRUCTED OF PRECAST CONCRETE, FIBERGLASS, OR OTHER MASSDEP APPROVED TANK MATERIALS APPLICABLE FOR INDUSTRIAL WASTE HOLDING REQUIREMENTS.
2. CONCRETE: 4,000 PSI MIN. AFTER 28 DAYS.
3. CEMENT: PORTLAND TYPE I OR III. ASTM C150-81.
4. ADMIXTURES: ASTM C233-82.
5. REINFORCEMENT: ASTM A615.
6. TANK AND FRAMES/COVERS SHALL BE H20 LOADING RATED.
7. JOINTS SEALED WITH BUTYL RUBBER.
8. THE TANK SHALL HAVE A FLOAT SET AT 75% OF TANK CAPACITY (BELOW INVERT CAPACITY). TEH FLOAT WILL BE CONNECTED TO A CONTROL PANEL TO BE MOUNTED INSIDE THE BUILDING THAT WILL HAVE AUDIBLE AND VISUAL ALARM TO NOTIFY THE FACILITY THAT THE TAN K IS TO BE PUMPED.
9. OWNER SHALL ENTER INTO A PUMPING CONTRACT WITH A LOCAL HAULING COMPANY AND WILL NEED TO PROVIDE EVIDENCE OF THAT CONTRACT TO THE ENGINEER TO PROVIDE WITH THE TIGHT TANK CERTIFICATION SUBMISSION TO MASSDEP.
10. CONTRACTOR TO PROVIDE BUOYANCY CALCULATIONS WITH THE PRECAST STRUCTURE SHOP DRAWING PACKAGE. ASSUME ESTIMATED SEASONAL HIGH GROUNDWATER IS 2 FEET BELOW EXISTING GRADE. USE FACTOR OF SAFETY OF 1.5 APPLIED TO UNIT FORCE.

6,000 GALLON TIGHT TANK DETAIL

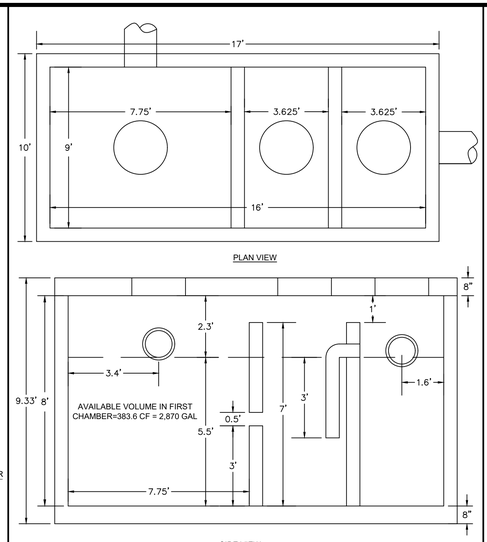
NOT TO SCALE



NOTES:
1. TIGHT TANK SHALL BE CONSTRUCTED OF PRECAST CONCRETE, FIBERGLASS, OR OTHER MASSDEP APPROVED TANK MATERIALS APPLICABLE FOR INDUSTRIAL WASTE HOLDING REQUIREMENTS.
2. CONCRETE: 4,000 PSI MIN. AFTER 28 DAYS.
3. CEMENT: PORTLAND TYPE I OR III. ASTM C150-81.
4. ADMIXTURES: ASTM C233-82.
5. REINFORCEMENT: ASTM A615.
6. TANK AND FRAMES/COVERS SHALL BE H20 LOADING RATED.
7. JOINTS SEALED WITH BUTYL RUBBER.
8. THE TANK SHALL HAVE A FLOAT SET AT 75% OF TANK CAPACITY (BELOW INVERT CAPACITY). TEH FLOAT WILL BE CONNECTED TO A CONTROL PANEL TO BE MOUNTED INSIDE THE BUILDING THAT WILL HAVE AUDIBLE AND VISUAL ALARM TO NOTIFY THE FACILITY THAT THE TAN K IS TO BE PUMPED.
9. OWNER SHALL ENTER INTO A PUMPING CONTRACT WITH A LOCAL HAULING COMPANY AND WILL NEED TO PROVIDE EVIDENCE OF THAT CONTRACT TO THE ENGINEER TO PROVIDE WITH THE TIGHT TANK CERTIFICATION SUBMISSION TO MASSDEP.
10. CONTRACTOR TO PROVIDE BUOYANCY CALCULATIONS WITH THE PRECAST STRUCTURE SHOP DRAWING PACKAGE. ASSUME ESTIMATED SEASONAL HIGH GROUNDWATER IS 2 FEET BELOW EXISTING GRADE. USE FACTOR OF SAFETY OF 1.5 APPLIED TO UNIT FORCE.

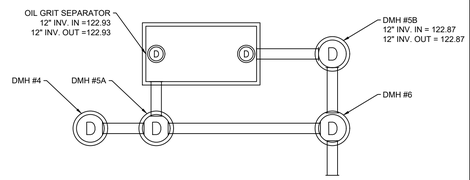
20,000 GALLON TIGHT TANK DETAIL

NOT TO SCALE



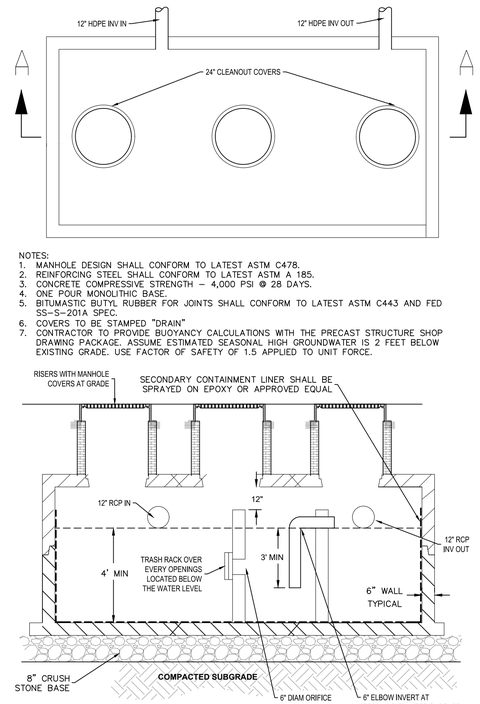
OGS#1 7,000 GAS OIL/GRIT SEPARATOR DETAIL

NOT TO SCALE



PLAN VIEW OGS#1

NOT TO SCALE

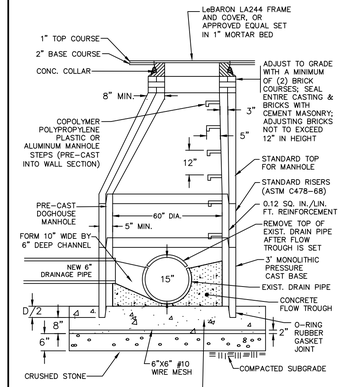


NOTES:
1. MANHOLE DESIGN SHALL CONFORM TO LATEST ASTM C478.
2. REINFORCING STEEL SHALL CONFORM TO LATEST ASTM A 185.
3. CONCRETE COMPRESSIVE STRENGTH – 4,000 PSI @ 28 DAYS.
4. ONE POUR MONOLITHIC BASE.
5. BITUMASTIC BUTYL RUBBER FOR JOINTS SHALL CONFORM TO LATEST ASTM C443 AND FED SS-S-201A SPEC.
6. COVERS TO BE STAMPED "DRAIN"
7. CONTRACTOR TO PROVIDE BUOYANCY CALCULATIONS WITH THE PRECAST STRUCTURE SHOP DRAWING PACKAGE. ASSUME ESTIMATED SEASONAL HIGH GROUNDWATER IS 2 FEET BELOW EXISTING GRADE. USE FACTOR OF SAFETY OF 1.5 APPLIED TO UNIT FORCE..

SECTION A-A

TYPICAL OIL/GRIT SEPARATOR

NOT TO SCALE



NOTES:
1. MANHOLE DESIGN SHALL CONFORM TO LATEST ASTM C478.
2. REINFORCING STEEL SHALL CONFORM TO LATEST ASTM A 185.
3. CONCRETE COMPRESSIVE STRENGTH – 4,000 PSI @ 28 DAYS.
4. ONE POUR MONOLITHIC BASE.
5. BITUMASTIC BUTYL RUBBER FOR JOINTS SHALL CONFORM TO LATEST ASTM C443 AND FED SS-S-201A SPEC.
6. COVERS TO BE STAMPED "DRAIN"
7. CONTRACTOR TO PROVIDE BUOYANCY CALCULATIONS WITH THE PRECAST STRUCTURE SHOP DRAWING PACKAGE. ASSUME ESTIMATED SEASONAL HIGH GROUNDWATER IS 2 FEET BELOW EXISTING GRADE. USE FACTOR OF SAFETY OF 1.5 APPLIED TO UNIT FORCE.

DOGHOUSE MANHOLE w/ CAST IN PLACE BASE (DMH#1)

NOT TO SCALE

SITE SPECIFIC DATA*	
PROJECT NUMBER	100-107
PROJECT NAME	MERCEDES OF SUDBURY
PROJECT LOCATION	141 BOSTON POST ROAD
STRUCTURE ID	N/A
WATER QUALITY FLOW RATE (CFS)	1.57
PEAK FLOW RATE (CFS)	
PEAK STORM DURATION (YEARS)	

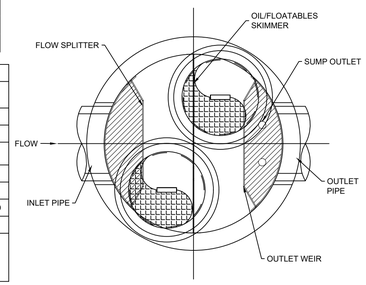
PIPE DATA	I.E. (#5B)	MATERIAL	DIAMETER
INLET PIPE 1	122.87	HDPE	12"
OUTLET PIPE 1	122.87	HDPE	12"
RIM ELEVATION	127.90		
SUMP ELEVATION	117.87		
SURFACE LOADING REQUIREMENT			HS-20
FRAME AND COVER			Ø30"
SKIMMER WALL HEIGHT			STANDARD
KNOWN GROUNDWATER ELEVATION			
NOTES: *PER ENGINEER OF RECORD			

PERFORMANCE DATA	
TREATMENT FLOW RATE PER LOCAL REQUIREMENTS	1.57
SETTLING AREA (SF)	28.2600
LOADING RATE (GPM/SF)	24.9350
SEDIMENT STORAGE CAPACITY (CF)	141.3000

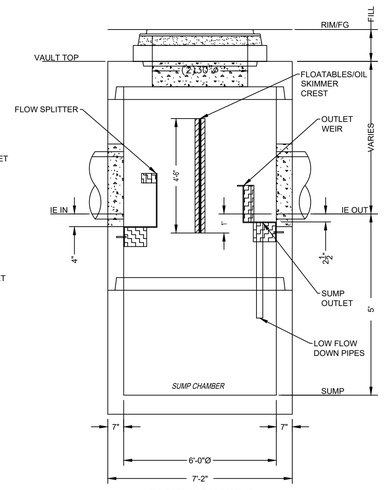
STORAGE CAPACITIES

SUMP CHAMBER CAPACITY

	DIAMETE R (FT)	AREA (SF)	HEIGHT (FT)	TOTAL (CF)
CHAMBER 1	6.00	28.2600	5.00	141.30



PLAN VIEW
NTS



ELEVATION VIEW

INSTALLATION NOTES

1. CONTRACTOR TO PROVIDE ALL LABOR, EQUIPMENT, MATERIALS, AND INCIDENTALS REQUIRED TO OFFLOAD AND INSTALL THE UNIT AND APPURTENANCES IN ACCORDANCE WITH THIS DRAWING AND THE MANUFACTURERS SPECIFICATIONS, UNLESS OTHERWISE STATED IN MANUFACTURERS CONTRACT.
2. MANUFACTURER RECOMMENDS A 6"-12" LEVEL ROCK BASE UNLESS SPECIFIED BY THE PROJECT ENGINEER. CONTRACTOR IS RESPONSIBLE TO VERIFY PROJECT ENGINEERS RECOMMENDED BASE SPECIFICATIONS.
3. ALL PIPES MUST BE FLUSH WITH INSIDE SURFACE OF CONCRETE. (PIPES CANNOT INTRUDE BEYOND FLUSH).
4. ALL GAPS AROUND PIPES SHALL BE SEALED WATER TIGHT WITH A NON-SHRINK GROUT PER MANUFACTURERS STANDARD CONNECTION DETAIL AND SHALL MEET OR EXCEED REGIONAL PIPE CONNECTION STANDARDS.
5. CONTRACTOR RESPONSIBLE FOR INSTALLATION OF ALL RISERS, MANHOLES, AND HATCHES. ALL COVERS SHALL BE SHIPPED LOOSE. CONTRACTOR TO GROUT ALL MANHOLES AND HATCHES TO MATCH FINISHED SURFACE UNLESS SPECIFIED OTHERWISE.
6. CONTRACTOR TO PROVIDE BUOYANCY CALCULATIONS WITH THE PRECAST STRUCTURE SHOP DRAWING PACKAGE. ASSUME ESTIMATED SEASONAL HIGH GROUNDWATER IS 2 FEET BELOW EXISTING GRADE. USE FACTOR OF SAFETY OF 1.5 APPLIED TO UNIT FORCE.

GENERAL NOTES

1. BIO CLEAN TO PROVIDE ALL MATERIALS UNLESS OTHERWISE NOTED.
2. ALL DIMENSIONS, ELEVATIONS, SPECIFICATIONS, AND CAPACITIES ARE SUBJECT TO CHANGE. FOR PROJECT SPECIFIC DRAWINGS DETAILING EXACT DIMENSIONS, WEIGHTS, AND ACCESSORIES PLEASE CONTACT BIO CLEAN.
3. ALTERNATIVE HATCHES OR MANHOLES AVAILABLE UPON REQUEST.

THE PRODUCT DESCRIBED MAY BE PROTECTED BY ONE OR MORE US PATENTS, RELATED FOREIGN PATENTS, OR OTHER PATENTS PENDING

PROPRIETARY AND CONFIDENTIAL:
THE INFORMATION CONTAINED IN THIS DRAWING IS THE SOLE PROPERTY OF BIO CLEAN ENVIRONMENTAL SERVICES, INC. ANY REPRODUCTION IN PART OR AS A WHOLE WITHOUT THE WRITTEN PERMISSION OF BIO CLEAN ENVIRONMENTAL SERVICES, INC. IS PROHIBITED.

Bio Clean™ A Forterra Company

SC-6 HYDRODYNAMIC SEPARATOR

SciCLONE SC-6 WATER QUALITY STRUCTURE DETAILS (DMH#5B)

NOT TO SCALE

SITE SPECIFIC DATA*	
PROJECT NUMBER	100-107
PROJECT NAME	MERCEDES OF SUDBURY
PROJECT LOCATION	141 BOSTON POST ROAD
STRUCTURE ID	N/A
WATER QUALITY FLOW RATE (CFS)	0.3900
PEAK FLOW RATE (CFS)	
PEAK STORM DURATION (YEARS)	

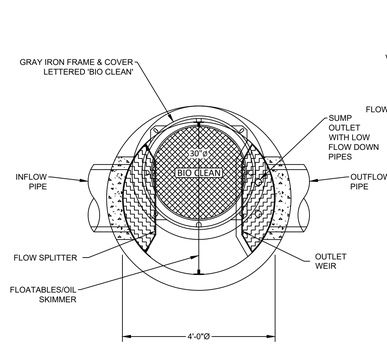
PIPE DATA	I.E. (#9B/#18B)	MATERIAL	DIAMETER
INLET PIPE 1	122.90/123.20	HDPE	12"
OUTLET PIPE 1	122.90/123.20	HDPE	12"
RIM ELEVATION	128.87/128.84		
SUMP ELEVATION	118.15/118.45		
SURFACE LOADING REQUIREMENT			HS-20
FRAME AND COVER			Ø30"
SKIMMER WALL HEIGHT			STANDARD
KNOWN GROUNDWATER ELEVATION			
NOTES: *PER ENGINEER OF RECORD			

PERFORMANCE DATA	
TREATMENT FLOW RATE PER LOCAL REQUIREMENTS	0.3900
SETTLING AREA (SF)	12.5600
LOADING RATE (GPM/SF)	13.9366
SEDIMENT STORAGE CAPACITY (CF)	59.6600

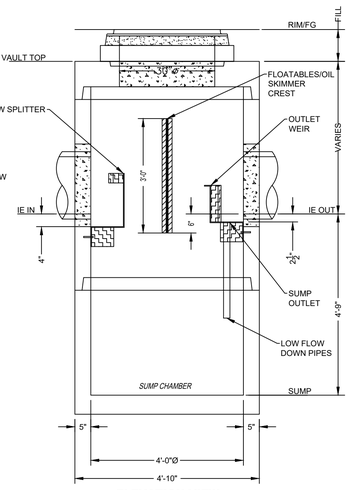
STORAGE CAPACITIES

SUMP CHAMBER CAPACITY

	DIAMETE R (FT)	AREA (SF)	HEIGHT (FT)	TOTAL (CF)
CHAMBER 1	4.00	12.5600	4.75	59.66



PLAN VIEW



ELEVATION VIEW

INSTALLATION NOTES

1. CONTRACTOR TO PROVIDE ALL LABOR, EQUIPMENT, MATERIALS, AND INCIDENTALS REQUIRED TO OFFLOAD AND INSTALL THE UNIT AND APPURTENANCES IN ACCORDANCE WITH THIS DRAWING AND THE MANUFACTURERS SPECIFICATIONS, UNLESS OTHERWISE STATED IN MANUFACTURERS CONTRACT.
2. MANUFACTURER RECOMMENDS A 6"-12" LEVEL ROCK BASE UNLESS SPECIFIED BY THE PROJECT ENGINEER. CONTRACTOR IS RESPONSIBLE TO VERIFY PROJECT ENGINEERS RECOMMENDED BASE SPECIFICATIONS.
3. ALL PIPES MUST BE FLUSH WITH INSIDE SURFACE OF CONCRETE. (PIPES CANNOT INTRUDE BEYOND FLUSH).
4. ALL GAPS AROUND PIPES SHALL BE SEALED WATER TIGHT WITH A NON-SHRINK GROUT PER MANUFACTURERS STANDARD CONNECTION DETAIL AND SHALL MEET OR EXCEED REGIONAL PIPE CONNECTION STANDARDS.
5. CONTRACTOR RESPONSIBLE FOR INSTALLATION OF ALL RISERS, MANHOLES, AND HATCHES. ALL COVERS SHALL BE SHIPPED LOOSE. CONTRACTOR TO GROUT ALL MANHOLES AND HATCHES TO MATCH FINISHED SURFACE UNLESS SPECIFIED OTHERWISE.
6. CONTRACTOR TO PROVIDE BUOYANCY CALCULATIONS WITH THE PRECAST STRUCTURE SHOP DRAWING PACKAGE. ASSUME ESTIMATED SEASONAL HIGH GROUNDWATER IS 2 FEET BELOW EXISTING GRADE. USE FACTOR OF SAFETY OF 1.5 APPLIED TO UNIT FORCE.

GENERAL NOTES

1. BIO CLEAN TO PROVIDE ALL MATERIALS UNLESS OTHERWISE NOTED.
2. ALL DIMENSIONS, ELEVATIONS, SPECIFICATIONS, AND CAPACITIES ARE SUBJECT TO CHANGE. FOR PROJECT SPECIFIC DRAWINGS DETAILING EXACT DIMENSIONS, WEIGHTS, AND ACCESSORIES PLEASE CONTACT BIO CLEAN.
3. ALTERNATIVE HATCHES OR MANHOLES AVAILABLE UPON REQUEST.

THE PRODUCT DESCRIBED MAY BE PROTECTED BY ONE OR MORE US PATENTS, RELATED FOREIGN PATENTS, OR OTHER PATENTS PENDING

PROPRIETARY AND CONFIDENTIAL:
THE INFORMATION CONTAINED IN THIS DRAWING IS THE SOLE PROPERTY OF BIO CLEAN ENVIRONMENTAL SERVICES, INC. ANY REPRODUCTION IN PART OR AS A WHOLE WITHOUT THE WRITTEN PERMISSION OF BIO CLEAN ENVIRONMENTAL SERVICES, INC. IS PROHIBITED.

Bio Clean™ A Forterra Company

SC-4 HYDRODYNAMIC SEPARATOR

SciCLONE SC-4 WATER QUALITY STRUCTURE DETAILS (DMH#9B & DMH#18B)

NOT TO SCALE

Date	Description	No.
02/14/22	P.B. AND CON.–COM. RESUBMITTAL	3.
01/31/22	ZBA RESUBMITTAL	2.
11/15/21	PLANNING BOARD SUBMITTAL	1.

Revisions

COMMONWEALTH OF MASSACHUSETTS — GABRIEL R. CROCKER — CIVIL — No. 47917 — REGISTERED PROFESSIONAL ENGINEER

2-14-2022

GABRIEL R. CROCKER
PROFESSIONAL ENGINEER, MA REGISTRATION #47917

Crocker Design Group
2 SHARP STREET, UNIT A
HINGHAM, MA 02043
P: 781–919–0808

Project

MERCEDES OF SUDBURY

141 BOSTON POST ROAD, SUDBURY, MA

Prepared for

HERB CHAMBERS 43 BRAINTREE STREET, LLC

#259 McGRATH HIGHWAY - ROUTE 28 SOMERVILLE, MA 02143

Drawing Title

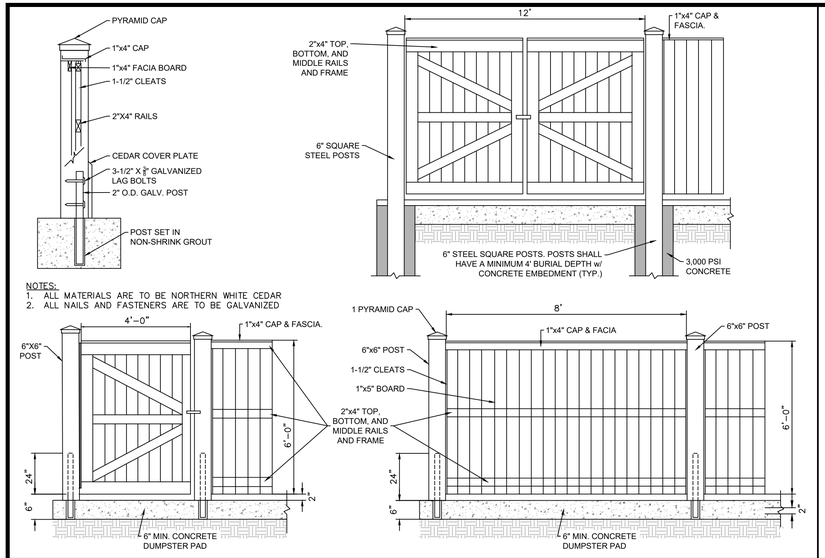
DETAIL SHEET

Project No.	100-107
Date	11/10/2021
Scale	AS NOTED
Drawn By	DJN / JPM
Approved By	GC

Drawing No.

C-8.3

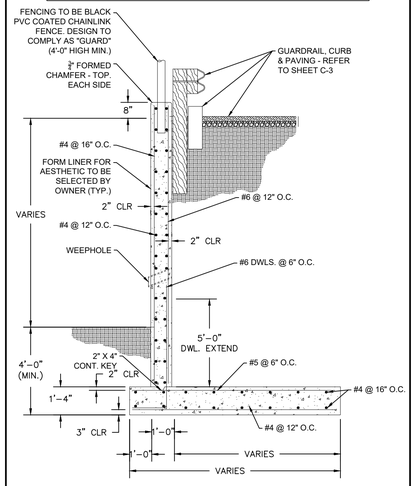
G:\CDG\Crocker Design Group, LLC\Gabriel Crocker - Projects\100-107 Sudbury – Mercedes\dwg\Plot Sheets\Site Plan Application_08_DETAIL SHEET.dwg, C-8.3 DETAIL, Feb 14, 2022 15:12



DUMPSTER ENCLOSURE DETAILS

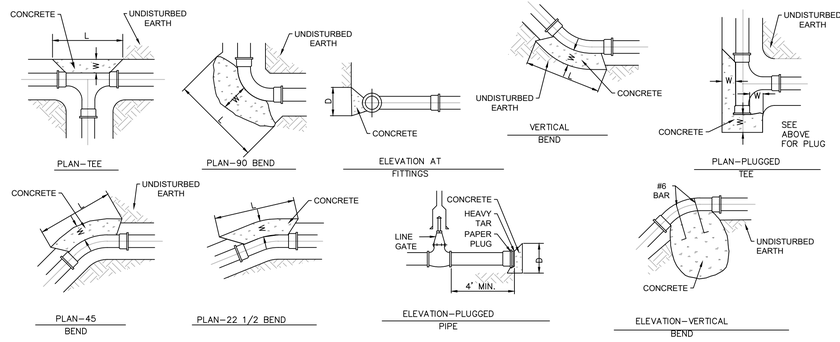
NOT TO SCALE

NOTE: SCHEMATIC CONCRETE WALL DESIGN SHOWN IS FOR PERMITTING PURPOSED ONLY. CONTRACTOR TO PROVIDE A WALL DESIGN STAMPED BY A MASSACHUSETTS REGISTERED PROFESSIONAL ENGINEER TO THE BUILDING DEPARTMENT PRIOR TO THE START OF CONSTRUCTION. CONTRACTOR TO FURNISH AND INSTALL A COMPLETE DESIGN-BUILD WALL SYSTEM.



RETAINING WALL DETAIL

NOT TO SCALE



PIPE SIZE	THRUST BLOCK SCHEDULE								
	TEE		22 1/2		45		90		W
	L	D	L	D	L	D	L	D	
6"	18"	15"	15"	12"	15"	12"	15"	15"	21"
8"	2'	18"	18"	12"	18"	12"	2'	18"	2'
12"	3'	2'	2'	12"	2'	12"	3'	2'	28"
16"	4'	2.5'	2'	12"	2.33'	15"	4'	2.5'	31"
20"	5.25'	3'	2'	18"	3'	2'	5.25'	3'	33"
24"	7.5'	3'	3'	18"	4'	2.5'	7.5'	3'	3'

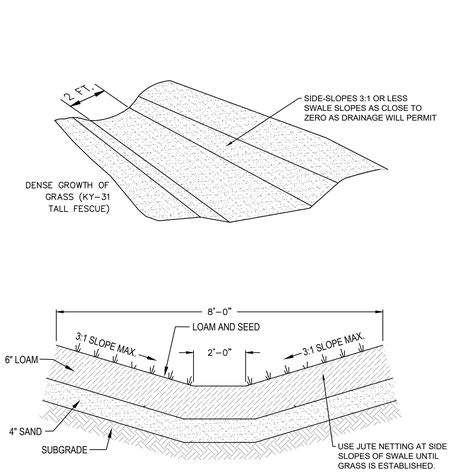
BASIS: 2,000 LB/SQ.FT. SOIL RESISTANCE 250 PSI WATER PRESSURE CORRECTION FACTORS FOR OTHER SOILS:

SOFT CLAY	4
SAND	2
SAND & GRAVEL	1.33
SHALE	0.4

NOTE:
1. IF SOFT MATERIALS ARE ENCOUNTERED, THE THRUST BLOCKS SIZES SHALL BE ADJUSTED ACCORDINGLY.
2. CONCRETE TO BE 3000 PSI.

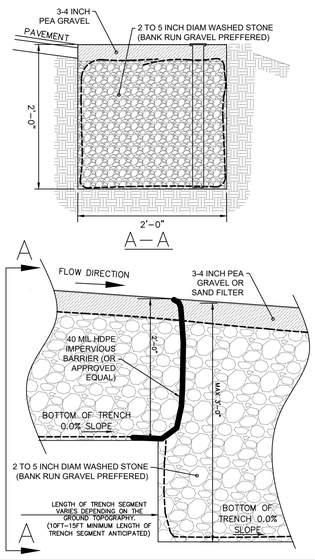
CONCRETE TRUST BLOCK

NOT TO SCALE



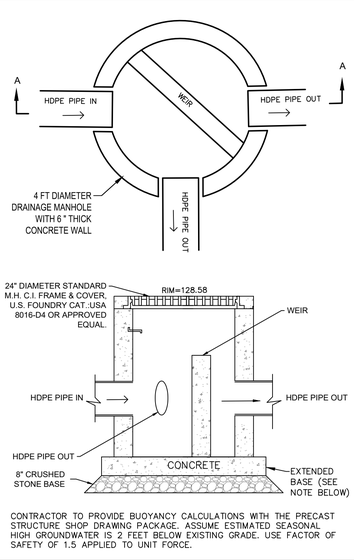
GRASSED SWALE

NOT TO SCALE



STONE TRENCH WITH STEPPED BOTTOM DETAIL

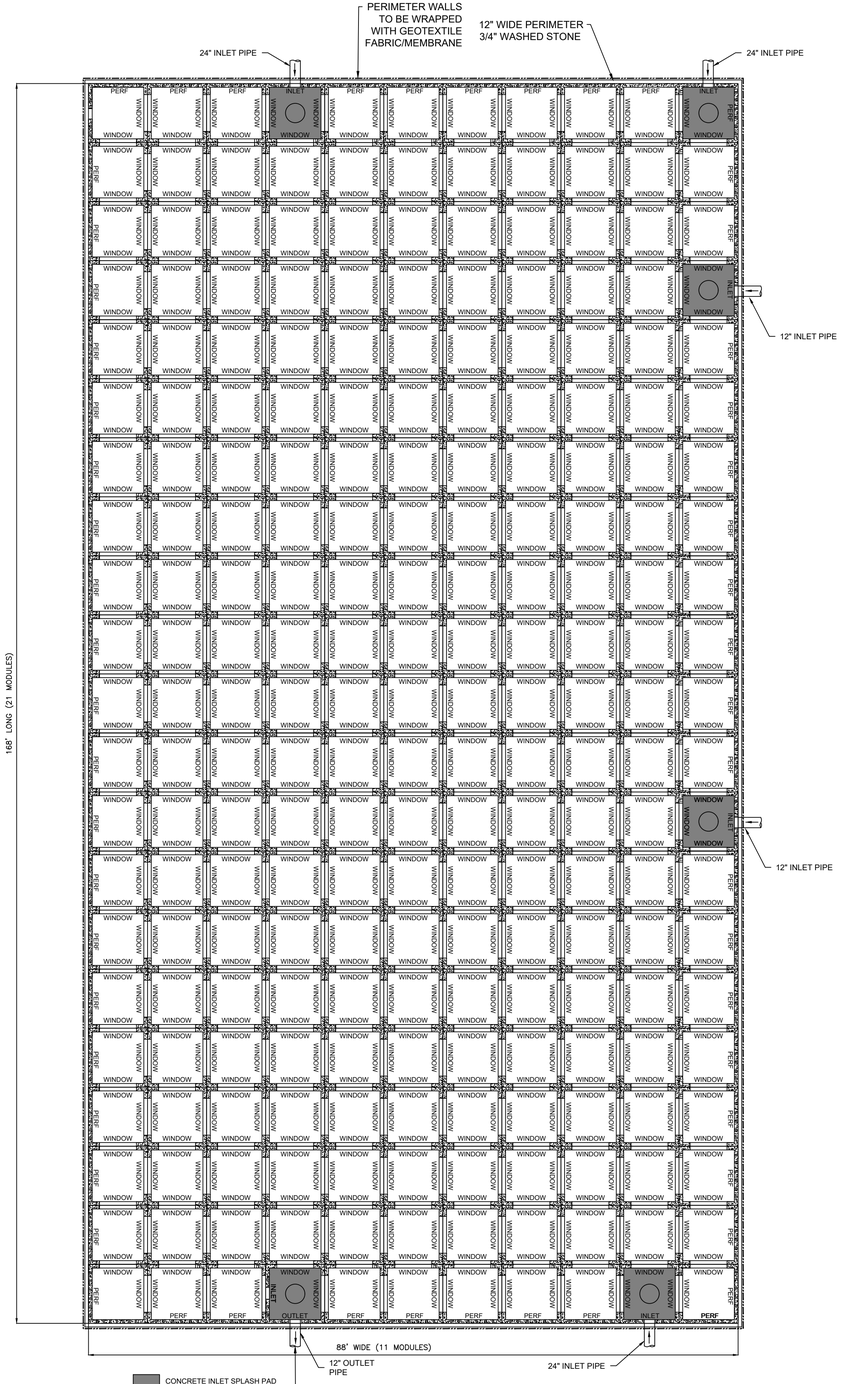
NOT TO SCALE



CONTRACTOR TO PROVIDE BUOYANCY CALCULATIONS WITH THE PRECAST STRUCTURE SHOP DRAWING PACKAGE. ASSUME ESTIMATED SEASONAL HIGH GROUNDWATER IS 2 FEET BELOW EXISTING GRADE. USE FACTOR OF SAFETY OF 1.5 APPLIED TO UNIT FORCE.

TYPICAL DIVERSION MANHOLE DETAIL

NOT TO SCALE



RETAIN-IT SYSTEM LAYOUT

NOT TO SCALE

Date	Description	No.
	Revisions	
02/14/22	P.B. AND CON.–COM. RESUBMITTAL	3.
01/31/22	ZBA RESUBMITTAL	2.
11/15/21	PLANNING BOARD SUBMITTAL	1.

COMMONWEALTH OF MASSACHUSETTS
GABRIEL R. CROCKER
CIVIL
No. 47917
REGISTERED PROFESSIONAL ENGINEER
2-14-2022
GABRIEL R. CROCKER
PROFESSIONAL ENGINEER, MA REGISTRATION #47917

Crocker Design Group
2 SHARP STREET, UNIT A
HINGHAM, MA 02043
P: 781-919-0808

Project
MERCEDES OF SUDBURY
141 BOSTON POST ROAD, SUDBURY, MA

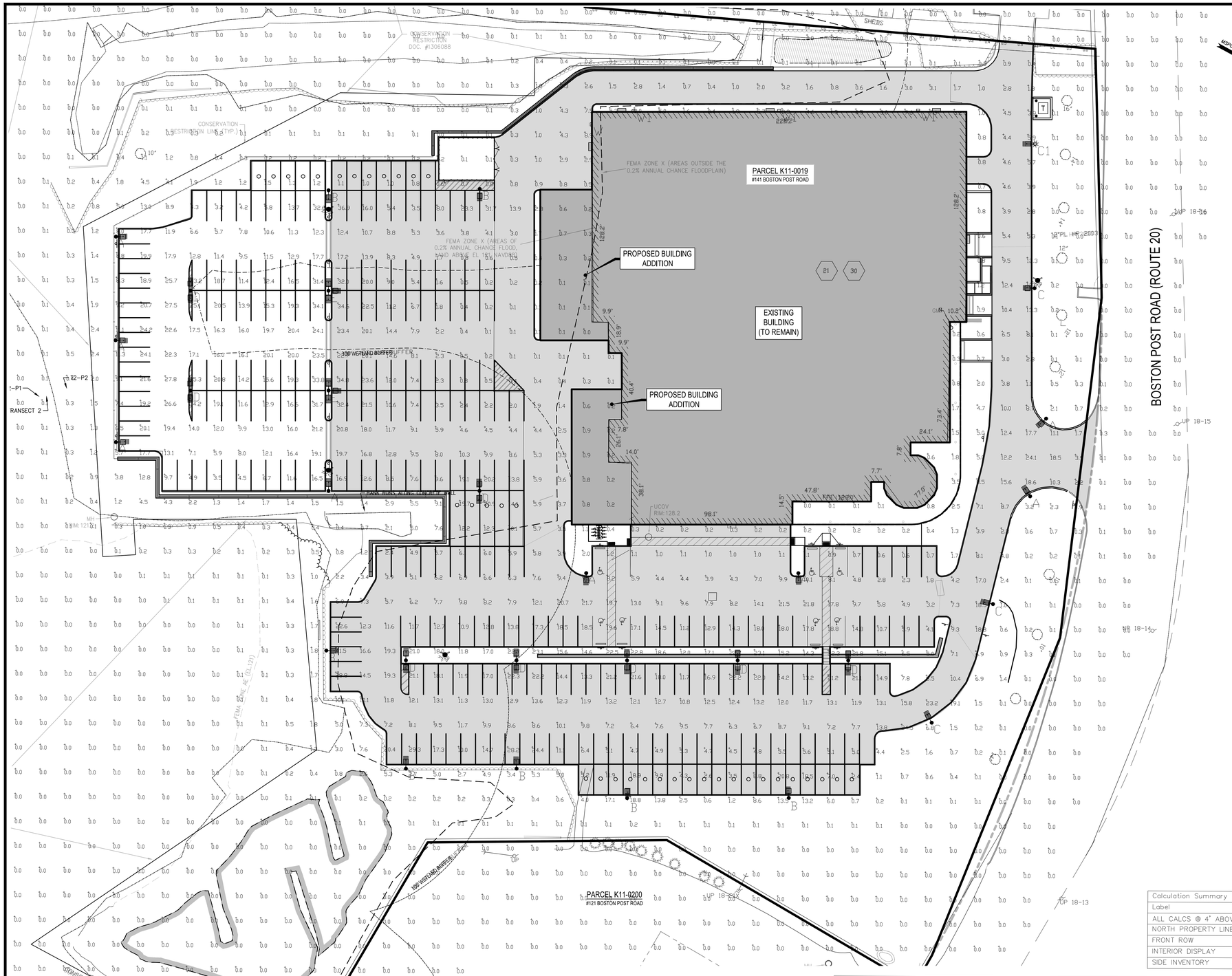
Prepared for
HERB CHAMBERS 43 BRAINTREE STREET, LLC
#259 McGRATH HIGHWAY - ROUTE 28 SOMERVILLE, MA 02143

Drawing Title
DETAIL SHEET

Project No.	100-107
Date	11/10/2021
Scale	AS NOTED
Drawn By	DJN / JPM
Approved By	GC

Drawing No.
C-8.4

G:\100\Crocker Design Group, LLC\Gabriel Crocker - Projects\100-107 Sudbury - Mercedes\dwg\Plot Sheets\Site Plan Application\ 08_DETAIL SHEET.dwg, C-8.4 DETAIL, Feb 14, 2022 15:13



PHOTOMETRIC EVALUATION
NOT FOR CONSTRUCTION

Based on the information provided, all dimensions and luminaire locations shown represent recommended positions. The engineer and/or architect must determine the applicability of the layout to existing or future field conditions.

This lighting plan represents illumination levels calculated from laboratory data taken under controlled conditions in accordance with The Illuminating Engineering Society (IES) approved methods. Actual performance of any manufacturer's luminaires may vary due to changes in electrical voltage, tolerance in lamps/LED's and other variable field conditions. Calculations do not include obstructions such as buildings, curbs, landscaping, or any other architectural elements unless noted. Fixture nomenclature noted does not include mounting hardware or poles. This drawing is for photometric evaluation purposes only and should not be used as a construction document or as a final document for ordering product.

GENERAL NOTES:

1. ALL LIGHT LEVELS ARE TO BE REDUCED TO 50% DURING NON-BUSINESS HOURS.
2. ALL LIGHTS ARE DARK SKY COMPLIANT

30 15 0 30 60





Calculation Summary							
Label	CalcType	Units	Avg	Max	Min	Avg/Min	Max/Min
ALL CALCS @ 4' ABOVE GRADE	Illuminance	Fc	2.91	41.5	0.0	N.A.	N.A.
NORTH PROPERTY LINE	Illuminance	Fc	0.06	0.5	0.0	N.A.	N.A.
FRONT ROW	Illuminance	Fc	12.07	41.5	2.4	5.03	17.29
INTERIOR DISPLAY	Illuminance	Fc	15.89	22.3	4.1	3.88	5.44
SIDE INVENTORY	Illuminance	Fc	13.29	36.9	0.1	132.90	369.00

Luminaire Schedule									
Symbol	Qty	Label	Arrangement	Description	LLD	LDD	LLF	Arr. Lum. Lumens	Arr. Watts
	8	A	SINGLE	SLM-LED-42L-SIL-FT-50-70CRI-IL-SINGLE-24' MH	1.000	1.000	1.000	27455	352
	7	B	SINGLE	SLM-LED-42L-SIL-FTA-50-70CRI-IL-SINGLE-24' MH	1.000	1.000	1.000	25294	352
	3	C	SINGLE	SLM-LED-42L-SIL-2-50-70CRI-IL-SINGLE-24' MH	1.000	1.000	1.000	25582	352
	1	C1	SINGLE	SLM-LED-18L-SIL-2-50-70CRI-IL	1.000	1.000	1.000	10926	135
	8	D	D180°	SLM-LED-42L-SIL-5W-50-70CRI-D180-24' MH	1.000	1.000	1.000	85598	704
	2	E	3 @ 90°	SLM-LED-42L-SIL-5W-50-70CRI-T90-24' MH	1.000	1.000	1.000	128397	1056
	1	W	SINGLE	XWM-FT-LED-12L-50-16' MH	1.000	1.000	1.000	11838	102.2
	3	W1	SINGLE	XWM-2-LED-08L-50-16' MH	1.000	1.000	1.000	7833	62

Date	Description	No.
02/14/22	P.B. AND CON.-COM. RESUBMITTAL	3.
01/31/22	ZBA RESUBMITTAL	2.
11/15/21	PLANNING BOARD SUBMITTAL	1.

Revisions

COMMONWEALTH OF MASSACHUSETTS
GABRIEL R. CROCKER
CIVIL
No. 47917
REGISTERED PROFESSIONAL ENGINEER

2-14-2022

GABRIEL R. CROCKER
PROFESSIONAL ENGINEER, MA REGISTRATION #47917

Crocker Design Group
2 SHARP STREET, UNIT A
HINGHAM, MA 02043
P: 781-919-0808

Project

MERCEDES OF SUDBURY

141 BOSTON POST ROAD,
SUDBURY, MA

Prepared for

HERB CHAMBERS 43 BRAINTREE STREET, LLC

#259 McGRATH HIGHWAY - ROUTE 28
SOMERVILLE, MA 02143

Drawing Title

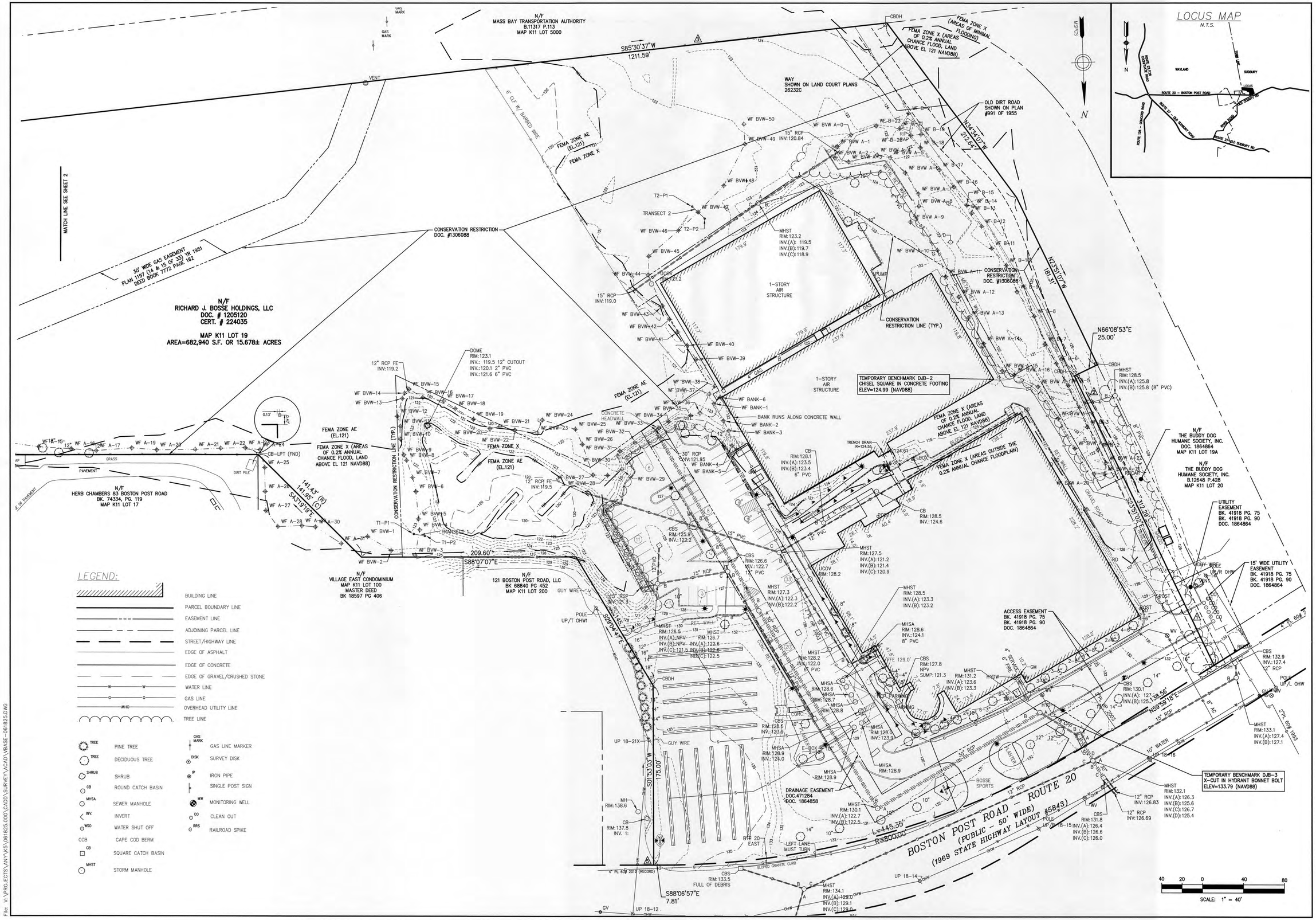
LIGHTING PLAN

Project No.	100-107
Date	11/10/2021
Scale	1"=30'
Drawn By	DJN / JPM
Approved By	GC

Drawing No.

C-9

C:\CDG\Crocker Design Group, LLC\Gabriel Crocker - Projects\100-107 Sudbury - Mercedes\dwg\Plot Sheets\Site Plan Application_13. LIGHTING PLAN.dwg, C-9 LIGHTING, Feb 14, 2022 11:25



LEGEND:

- BUILDING LINE
- PARCEL BOUNDARY LINE
- EASEMENT LINE
- ADJOINING PARCEL LINE
- STREET/HIGHWAY LINE
- EDGE OF ASPHALT
- EDGE OF CONCRETE
- EDGE OF GRAVEL/CRUSHED STONE
- WATER LINE
- GAS LINE
- OVERHEAD UTILITY LINE
- TREE LINE

- PINE TREE
- DECIDUOUS TREE
- SHRUB
- ROUND CATCH BASIN
- SEWER MANHOLE
- INVERT
- WATER SHUT OFF
- CCB CAPE COD BERM
- SQUARE CATCH BASIN
- STORM MANHOLE
- GAS LINE MARKER
- SURVEY DISK
- IRON PIPE
- SINGLE POST SIGN
- MONITORING WELL
- CLEAN OUT
- RAILROAD SPIKE

Drawing Copyright © 2017

CHA
101 Accord Park Drive
Norwell, MA 02061
Main: (781) 982-5400 • www.chacompanies.com

PREPARED FOR:

HERB CHAMBERS COMPANIES

259 MCGRATH HIGHWAY

SOMERVILLE, MA 02143

COMMONWEALTH OF MASSACHUSETTS
WILLIAM J. DORGAN
No. 49822
PROFESSIONAL LAND SURVEYOR

1/13/21

IT IS A VIOLATION OF LAW FOR ANY PERSON, UNLESS THEY ARE ACTING UNDER THE DIRECTION OF A LICENSED PROFESSIONAL ENGINEER, ARCHITECT, LANDSCAPE ARCHITECT OR LAND SURVEYOR, TO ALTER IN ANY WAY ANY DOCUMENT BEARING THE STAMP OF A LICENSED PROFESSIONAL ID ALTER THE ALTERING ENGINEER, ARCHITECT, LANDSCAPE ARCHITECT OR LAND SURVEYOR SHALL STAMP THE DOCUMENT AND INCLUDE THE NOTATION "ALTERED BY" FOLLOWED BY THEIR SIGNATURE, THE DATE OF SUCH ALTERATION, AND A SPECIFIC DESCRIPTION OF THE ALTERATION.

PROJECT LOCATION :

ASSESSORS'S MAP K11 LOT 19

141 BOSTON POST ROAD ROUTE 20

SUDBURY, MA 01778

No.	Submittal / Revision	App'd.	By	Date
0	Issued as Final	WJD	CHA	10/08/2020
1	Additional Detail	WJD	CHA	01/13/2021

EXISTING CONDITIONS PLAN

Designed By:	Drawn By:	Checked By:
	CHA	WJD
Issue Date:	Project No:	Scale:
10-08-2020	061825	1" = 40'

Drawing No.:

SHEET 1 OF 2

File: V:\PROJECTS\VANY\K9\061825.000\CADD\SURVEY\ACAD\VBASE--061825.DWG

GENERAL NOTES

1. THE EXISTING CONDITIONS INFORMATION SHOWN HEREON IS THE RESULT OF AN ON-THE-GROUND SURVEY PERFORMED BY CHA CONSULTING, INC. DURING MARCH OF 2020 AND JANUARY OF 2021.

2. ALL DEED AND MAP REFERENCES ARE TO MIDDLESEX COUNTY SOUTH REGISTRY OF DEEDS UNLESS OTHERWISE NOTED.

3. LOCUS OWNER OF RECORD:

RICHARD J. BOSSE HOLDINGS, LLC
LAND COURT BOOK 1250 PAGE 85
LAND COURT DOC. #1205120
LAND COURT CERT. # 224035
MAP K11 LOT 19

4. TOPOGRAPHY, CONTOURS AND BENCHMARKS ARE BASED ON THE NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD88) BASED ON GPS OBSERVATIONS. TEMPORARY BENCHMARKS, REFERENCED TO THE DATUM ARE INDICATED ON THE SURVEY.

IN THE EVENT THAT BENCHMARKS (TBM'S), ESTABLISHED FOR THIS PROJECT AND PUBLISHED ON THIS SURVEY ARE DESTROYED, NOT RECOVERABLE OR A DISCREPANCY IS FOUND, THE USER SHOULD NOTIFY THIS FIRM IN WRITING PRIOR TO COMMENCING OR CONTINUING ANY WORK.

5. THE PROJECT AREA LIES WITHIN FEMA ZONES (X & AE) AS SHOWN ON FLOOD INSURANCE RATE MAP FOR MIDDLESEX COUNTY, PANEL NUMBER 25017C0507F, DATED JULY 7, 2014. THE FEMA LINE DEPICTED IS BASED ON GRAPHIC INFORMATION WHERE NO FIELD TOPOGRAPHY WAS COLLECTED.

6. A PORTION OF THE LOCUS PARCEL IS LOCATED IN THE TOWN OF SUDBURY INDUSTRIAL DISTRICT AS DEFINED BY THE TOWN OF SUDBURY ZONING MAP.
MINIMUM SETBACK REQUIREMENTS ARE:

FRONT SETBACK:.....20'
SIDE SETBACK:.....30'
REAR SETBACK:.....30'

7. LOCATION OF SUBSURFACE UTILITIES SHOWN HEREON ARE APPROXIMATE AND ADDITIONAL UTILITIES MAY EXIST THAT ARE NOT SHOWN ON THIS PLAN. LOCATIONS ARE COMPILED FROM UTILITY PLANS OF RECORD AND DIG-SAFE FIELD MARKINGS. RIM AND INVERT INFORMATION HAS BEEN COMPILED AND FIELD VERIFIED WHERE POSSIBLE. THIS INFORMATION IS NOT TO BE USED FOR CONSTRUCTION. PRIOR TO ANY CONSTRUCTION, CONTACT DIG-SAFE (1-800-344-7233) TO FIELD VERIFY LOCATION OF ALL UTILITIES.

8. PLAN REFERENCES:

1. LAND COURT PLAN 26232A, 26232B, 26232C.
2. LAND COURT PLAN 29597B.
3. STATE HIGHWAY LAYOUT PLAN 644-1 DATED OCTOBER 3, 1901.
4. STATE HIGHWAY LAYOUT #5843 DATED NOVEMBER 5, 1969.
5. PLAN NUMBER 173 OF 1931.
6. PLAN NUMBER 961 OF 1949.
7. PLAN NUMBER 1197 (SHEET 15 OF 33) OF 1951.
8. PLAN NUMBER 991 OF 1955.
9. PLAN NUMBER 1681 OF 1955.
10. PLAN NUMBER 159 OF 1959.
11. PLAN NUMBER 63 OF 1960.
12. PLAN NUMBER 189 OF 1980.
13. PLAN NUMBER 799 OF 2000.
14. PLAN NUMBER 1111 OF 2017.

15. TOPOGRAPHIC PLAN OF LAND IN SUDBURY & WAYLAND MASSACHUSETTS PREPARED FOR: FOREIGN MOTORS WEST, AS PREPARED BY SCHOFIELD BROTHERS OF NEW ENGLAND, DATED SEPTEMBER 3, 2003 AND LAST REVISED DECEMBER 5, 2003.

16. AS-BUILT SITE PLAN IN WAYLAND, MASS PREPARED FOR R & S HATCH REALTY TRUST, AS PREPARED BY DRAKE ASSOCIATES, INC. DATED MARCH 2005.

17. AS-BUILT PLAN OF LAND IN SUDBURY, MA, PREPARED FOR BOSSE SPORTS & HEALTH CLUB LLC, PREPARED BY SCHOFIELD BROTHERS OF NEW ENGLAND, INC., DATED JANUARY 15, 2004.

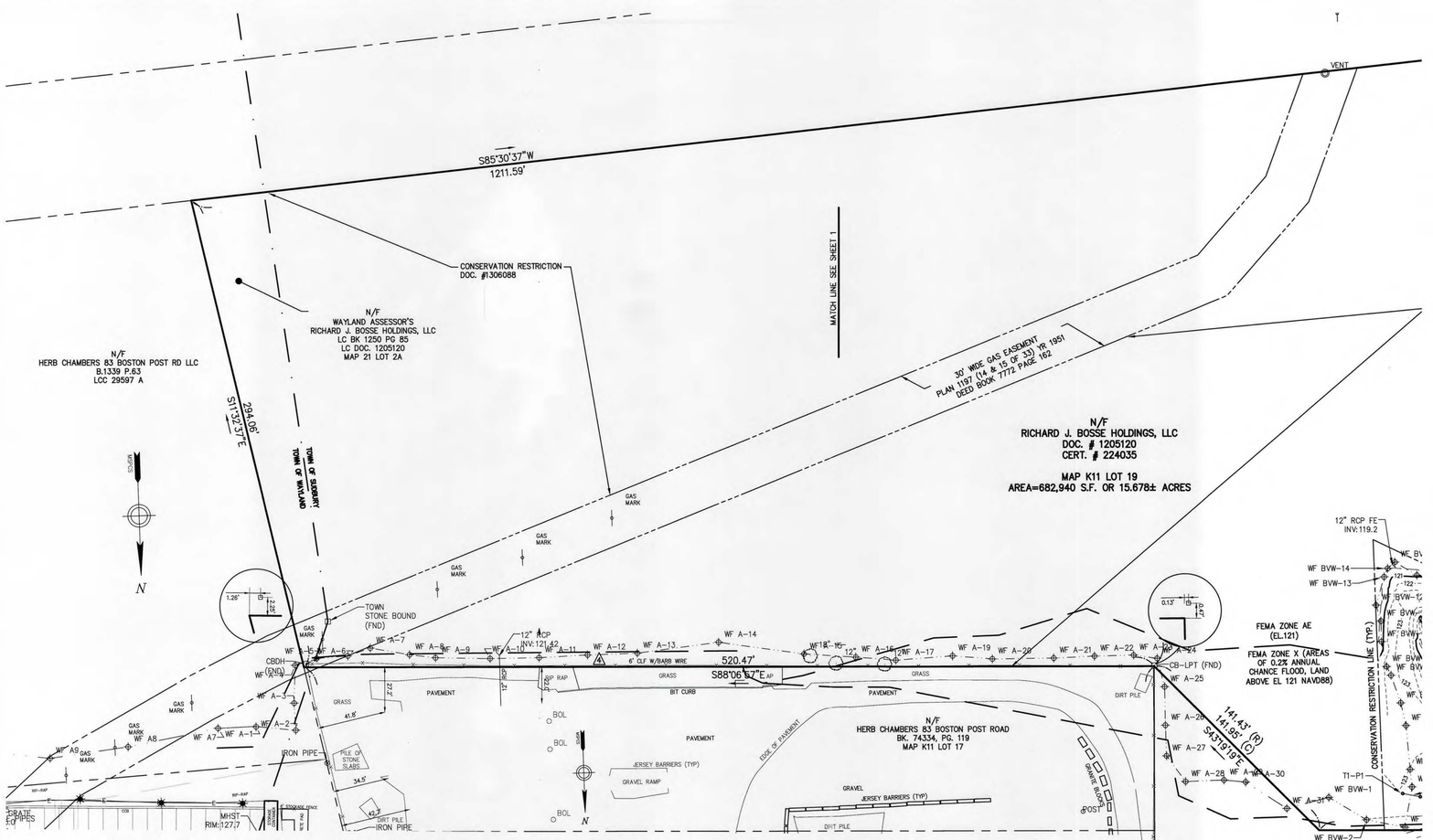
18. ALTA/ACSM LAND TITLE SURVEY IN SUDBURY & WAYLAND MASSACHUSETTS PREPARED FOR: HINKLEY, ALLEN AND SNYDER, LLP, AS PREPARED BY SCHOFIELD BROTHERS OF NEW ENGLAND, DATED MAY 10, 2006.

19. PLAN OF LAND IN SUDBURY & WAYLAND MA. PREPARED FOR RICHARD J. BOSSE HOLDINGS, LLC, PREPARED BY SCHOFIELD BROTHERS OF NEW ENGLAND, INC., DATED NOVEMBER 25, 2002.

9. THERE ARE 90 REGULAR PARKING SPACES AND 2 HANDICAP SPACES.

10. (a) WETLAND DELINEATION FLAGS BVW 1 TO BVW 50, BVW A-1 TO BVW A22, AND BANK 1 TO BANK 6 ARE BY DGT ASSOCIATES, INC. ON 9/25/2020.

(b) WETLAND DELINEATION FLAGS WF A-1 TO WF A-31 AND WF B-2 TO WF B-23 ARE BY CHA CONSULTING, INC. IN MARCH OF 2020.



LEGEND:

- BUILDING LINE
- PARCEL BOUNDARY LINE
- EASEMENT LINE
- ADJOINING PARCEL LINE
- STREET/HIGHWAY LINE
- EDGE OF ASPHALT
- EDGE OF CONCRETE
- EDGE OF GRAVEL/CRUSHED STONE
- WATER LINE
- GAS LINE
- OVERHEAD UTILITY LINE
- TREE LINE

- PINE TREE
- DECIDUOUS TREE
- SHRUB
- ROUND CATCH BASIN
- SEWER MANHOLE
- INVERT
- WATER SHUT OFF
- CAPE COD BERM
- SQUARE CATCH BASIN
- STORM MANHOLE
- GAS LINE MARKER
- SURVEY DISK
- IRON PIPE
- SINGLE POST SIGN
- MONITORING WELL
- CLEAN OUT
- RAILROAD SPIKE
- ENCROACHMENTS

ENCROACHMENTS

1. PAVEMENT CROSSES OVER PROPERTY LINE.
2. CHAIN-LINK FENCE CROSSES OVER PROPERTY LINE.
3. CHAIN-LINK FENCE CROSSES OVER PROPERTY LINE.
4. CHAIN-LINK FENCE CROSSES OVER PROPERTY LINE.
5. PAVEMENT CROSSES OVER PROPERTY LINE.

Drawing Copyright © 2017

CHA
101 Accord Park Drive
Norwell, MA 02061
Main: (781) 982-0400 • www.chacompanies.com

PREPARED FOR:

HERB CHAMBERS COMPANIES

259 MCGRATH HIGHWAY

SOMERVILLE, MA 02143

COMMONWEALTH OF MASSACHUSETTS
WILLIAM J. DORGAN
No. 49522
REGISTERED PROFESSIONAL LAND SURVEYOR
1/13/21

IT IS A VIOLATION OF LAW FOR ANY PERSON, UNLESS THEY ARE ACTING UNDER THE DIRECTION OF A LICENSED PROFESSIONAL ENGINEER, ARCHITECT, LANDSCAPE ARCHITECT OR LAND SURVEYOR, TO ALTER AN ITEM IN ANY WAY. IF AN ITEM BEARING THE STAMP OF A LICENSED PROFESSIONAL IS ALTERED, THE ALTERING ENGINEER, ARCHITECT, LANDSCAPE ARCHITECT OR LAND SURVEYOR SHALL STAMP THE DOCUMENT AND INCLUDE THE NOTATION "ALTERED BY" FOLLOWED BY THEIR SIGNATURE, THE DATE OF SUCH ALTERATION, AND A SPECIFIC DESCRIPTION OF THE ALTERATION.

PROJECT LOCATION :

ASSESSORS'S MAP K11 LOT 19

141 BOSTON POST ROAD ROUTE 20

SUDBURY, MA 01778

No.	Submittal / Revision	App'd.	By	Date
0	Issued as Final	WJD	CHA	10/08/2020
1	Additional Detail	WJD	CHA	01/13/2021

EXISTING CONDITIONS PLAN

Designed By:	Drawn By:	Checked By:
	CHA	WJD
Issue Date:	Project No:	Scale:
10-08-2020	061825	1" = 40'

Drawing No.:

SHEET 2 OF 2

File: V:\PROJECTS\VANY\X61\061825.000\CADD\SURVEY\ACAD\VBASE - 061825.DWG