STORMWATER REPORT

Whale's Tooth Station

New Bedford,
Massachusetts

PREPARED FOR

massDOT

Massachusetts Department of Transportation
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Boston, Massachusetts

PREPARED BY

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May 2018

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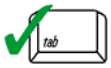
Checklist for Stormwater Report

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.

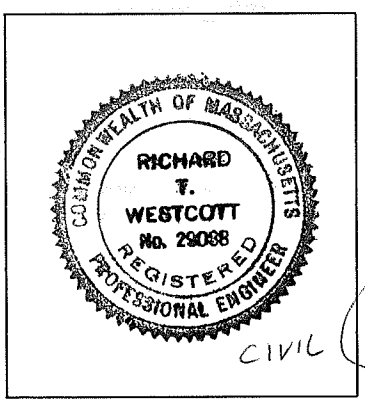
Note: Because stormwater requirements vary from project to project, it is possible that a complete Stormwater Report may not include information on some of the subjects specified in the Checklist. If it is determined that a specific item does not apply to the project under review, please note that the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



2018-05-31

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): _____

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.

Stormwater Report Narrative

This Stormwater Report has been prepared to demonstrate compliance with the Massachusetts Stormwater Management Standards in accordance with the Massachusetts Wetlands Protection Act Regulations (310 CMR 10.00) and Water Quality Certification Regulations (314 CMR 9.00).

Project Description

The Applicant, MassDOT, is proposing to construct a commuter rail station along the existing New Bedford Main Line (NBML) tracks in New Bedford, Massachusetts (the Project). The Project includes construction of a passenger platform with canopy, walkways and plaza, ancillary landscape improvements, parking lot restriping, bicycle parking facilities, and utility improvements to support this use. Project construction will disturb approximately 1.5 acres of land.

Site Description

The project development area (the Site) consists of approximately 1.5 acres of partially developed land (see Figures 1 and 2) located near the end of the NBML in in New Bedford, MA. It is located near the intersection of Acushnet Ave and Pearl Street, near the southern terminus of the NBML. The site is bounded by the NBML tracks to the east, existing freight rail yard to the north, Greater New Bedford Career Center to the west, and the existing Whale's Tooth Parking Lot to the west and south.

The nearby area consists of various commercial uses located along Acushnet Ave and parallel JFK Memorial Highway. To the west beyond the JFK Memorial Highway is Clasky Common Park and residential properties. There is a high-density residential development on Acushnet Avenue north of the site, past Wamsutta Street. New Bedford Harbor lies to the east, beyond the existing freight yard and Herman Melville Boulevard. See Figure 1, Site Locus Map and Figure 2, Site Aerial.

The former freight rail yard north of the Site was managed as a voluntary "Brownfields" redevelopment site. Elevated concentrations of polychlorinated biphenyls (PCB), arsenic, lead, and polycyclic aromatic hydrocarbons (PAHs) were found near the center of the freight yard with the perimeter soils having lower concentrations of these contaminants. An agreement was reached with the Massachusetts Department of Environmental Protection (MassDEP) and US

Environmental Protection Agency (EPA) based on the financial infeasibility of remediating contamination at the Site. The contamination was proposed to be left in place with proper engineering controls, including a soil geotextile composition cap and land use restrictions consisting of an Activity and Use Limitation (AUL) in the areas exhibiting the highest concentrations of contamination above the Upper Concentration Limits. Since contaminated soil was left in place, there are potential human health impacts related to exposure during future soil disturbance at the Site during construction related to the South Coast Rail Project.

There are no Wetland Resource Areas located on the Site. Hydrologic Soil Group (HSG) data is not available from National Resources Conservation Service (NRCS) for this site.

The project is not located within the 100-year flood plain as shown on the FEMA Flood Insurance Rate Map, City of New Bedford, Massachusetts Bristol County, Community Panel Number 0393G dated July 16, 2014. This map is included in Figure 2. The proposed station is located entirely within the coastal zone associated with New Bedford Inner Harbor but is not within the New Bedford/Fairhaven Designated Port Area (DPA).

Existing Drainage Conditions

Under existing conditions, the Site consists of partially developed land. A fence surrounds the MBTA property. The portion of the Site on MBTA property is covered in crushed stone. The portion of the Site on adjacent properties consists of meadow around Whale's Tooth Parking Lot and brush east of the New Bedford Career Center.

For existing conditions hydrologic analysis, the drainage area was divided into two drainage areas that contribute to two drainage design points, where peak discharge rates were evaluated. Drainage Area designations are numbered to coincide with the drainage analysis done for the Wamsutta Layover Facility, as noted below. Drainage from subcatchment area EX3 drains to the Pearl Street drainage network, which has the same outfall as the DP3 identified in the Wamsutta Layover Facility drainage report. Drainage from EX4 ponds up in the drainage swale between the Whale's Tooth Parking Lot and the track and is captured in a drainage network alongside the track, identified as DP4 in the Wamsutta Layover Facility drainage report as well. This network discharges to the water quality treatment structure within the parking lot, then diverts stormwater under the tracks. Both drainage areas ultimately discharge to the New Bedford Inner Harbor. The hydrologic analysis for existing conditions was performed using the National Oceanographic and Atmospheric Administration (NOAA) Atlas 14 Point Precipitation Frequency Estimates rainfall data.

Figure 3 illustrates the existing drainage patterns on the Site. Table 1 summarizes the key hydrologic parameters for each drainage area used in the existing conditions analysis.

Table 1
Existing Conditions Hydrologic Data

Drainage Area	*Discharge Location*	*Design Point*	*Area (acres)*	*Curve Number*	*Time of Concentration (min)*
EX3	Pearl Street Drainage Network	3	1.41	91	5.8
EX4	Stormwater Water Quality Unit	4	0.20	85	21.2

Proposed Drainage Conditions

Figure 4 illustrates the proposed "post construction" drainage conditions for the project. As shown, the Site will be divided into five drainage areas that discharge treated stormwater to the two existing Design Points. Existing drainage and grading patterns were maintained to the maximum extent possible. Integrated into the site design is a comprehensive stormwater management system that has been developed in accordance with the Massachusetts Stormwater Handbook. The proposed stormwater management system has been designed to treat the one inch Water Quality Volume per Standard 5. The drainage from the paved areas will be captured and treated in two proposed bioretention basins. The proposed basins are designed to decentralize stormwater management, reduce peak runoff rates, and treat stormwater for water quality. The hydrologic analysis for proposed conditions was performed using the National Oceanographic and Atmospheric Administration (NOAA) Atlas 14 Point Precipitation Frequency Estimates rainfall data.

The landscape area of subcatchment area PR3B will sheet flow over land until it reaches DP3, the Pearl Street drainage network. Within subcatchment area PR3A, runoff from the paved transition plaza and sidewalk will sheet flow over a 1-foot width gravel pea diaphragm and a minimum of 3 feet of grass for pretreatment before reaching the bioretention basin 1P. The sidewalk and platform area of PR3C will be collected in a vegetated and gravel swale between the sidewalk and the platform and directed to a sidewalk curb inlet that outlets into a sediment forebay for pretreatment before overflowing into the bioretention basin. Runoff from subcatchment area PR3D will be piped from the roof directly into the sediment forebay for pretreatment before overflowing into the bioretention basin.

Runoff from the sidewalk and platform of subcatchment area PR4 will sheet flow over a vegetated area to a sediment forebay before overflowing into bioretention basin 2P.

Table 2 below provides a summary of the proposed conditions hydrologic data.

Table 2
Proposed Conditions Hydrologic Data

Drainage Area	*Discharge Location*	*Design Point*	*Area (acres)*	*Curve Number*	*Time of Concentration (min)*
PR3A	Bioretention Basin 1	3	0.45	86	5.6
PR3B	Pearl Street Drainage Network	3	0.64	84	5.0
PR3C	Bioretention Basin 1	3	0.35	97	5.0
PR3D	Bioretention Basin 1	3	0.06	98	5.0
PR4	Bioretention Basin 2	4	0.11	92	5.0

Environmentally Sensitive and Low Impact Development (LID) Techniques

Low Impact Development (LID) techniques and stormwater Best Management Practices (BMPs) implemented into the site design include two bioretention basins with sediment forebays. The BMP treats stormwater runoff from the proposed impervious surfaces before discharging the stormwater to the existing design points.

Hydraulic Analysis

The closed drainage system was designed for the 10-year storm event, in accordance with the Massachusetts Bay Transportation Authority, Railroad Operations, Commuter Rail Design Standards Manual, Volume 1.

Drainage pipes were sized using Manning's Equation for full-flow capacity and the Rational Method. Pipe sizing calculations are included in Appendix A of this report.

Regulatory Compliance

Massachusetts Department of Environmental Protection (DEP) - Stormwater Management Standards

As demonstrated below, the proposed Project fully complies with the DEP Stormwater Management Standards.

Standard 1: No New Untreated Discharges or Erosion to Wetlands

The Project has been designed to comply with Standard 1.

The Best Management Practices (BMPs) included in the proposed stormwater management system have been designed in accordance with the Massachusetts Stormwater Handbook. Supporting information and computations demonstrating that no new untreated discharges will result from the Project are presented through compliance with Standards 4 through 6.

Standard 2: Peak Rate Attenuation

The Project has been designed to comply with Standard 2.

The rainfall-runoff responses of the Site under existing and proposed conditions were analyzed for storm events with recurrence intervals of 2, 10, and 100-years using the National Oceanographic and Atmospheric Administration (NOAA) Atlas 14 Point Precipitation Frequency Estimates. The results of the analysis, as summarized in Table 3 below, indicate that there is no increase in peak discharge rates between the existing and proposed conditions. Computations and supporting information regarding the hydrologic modeling are included in Appendix B.

Table 3
Peak Discharge Rates (cfs)

Design Point	*2-year*	*10-year*	*100-year*
Design Point 3:			
Pearl Street Drainage Network			
Existing	3.72	6.00	11.25
Proposed	1.45	2.55	8.69
Design Point 4:			
Parking Lot Drainage Network			
Existing	0.28	0.49	1.00
Proposed	0.28	0.46	0.88

Standard 3: Stormwater Recharge

Recharge is not proposed on site because the Site is designated a M.G.L. c. 21E site pursuant to 310 CMR 40.0000. As noted in the Existing Conditions section above, an existing geotextile cap isolates contaminated soils, and thus groundwater infiltration is not advisable. Furthermore, the post closure requirements necessitate on-going groundwater monitoring due to potential migration of residual contamination which could be exacerbated by infiltration associated with storm water. Contamination cap limits are shown on the site plans.

Standard 4: Water Quality

The Project has been designed to comply with Standard 4. The proposed stormwater management systems implement a treatment train of BMPs that has been designed to provide 80% TSS removal of stormwater runoff from all new impervious surfaces. The BMPs also treat a runoff volume equal to 0.5 inches times the total impervious area of the Project Site. Sediment forebay and gravel and grass strips provide pretreatment for the bioretention basins.

Computations and supporting information are included in Appendix C. Practices for source control and pollution prevention are provided in the Long-Term Pollution Prevention Plan included in Appendix F.

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

The Project is not considered a LUHPPL and therefore has been designed with suitable BMPs sized to treat the 0.5 inch Water Quality Volume per Standard 4. Computations and supporting information are included in Appendix D.

Standard 6: Critical Areas

The Project will not discharge stormwater near or to a critical area.

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

The Project Site is currently partially developed, therefore Standards 2 and 3 are required to be met only to the maximum extent practicable. Nevertheless, this Project has been design to be fully compliant with all the Standards.

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

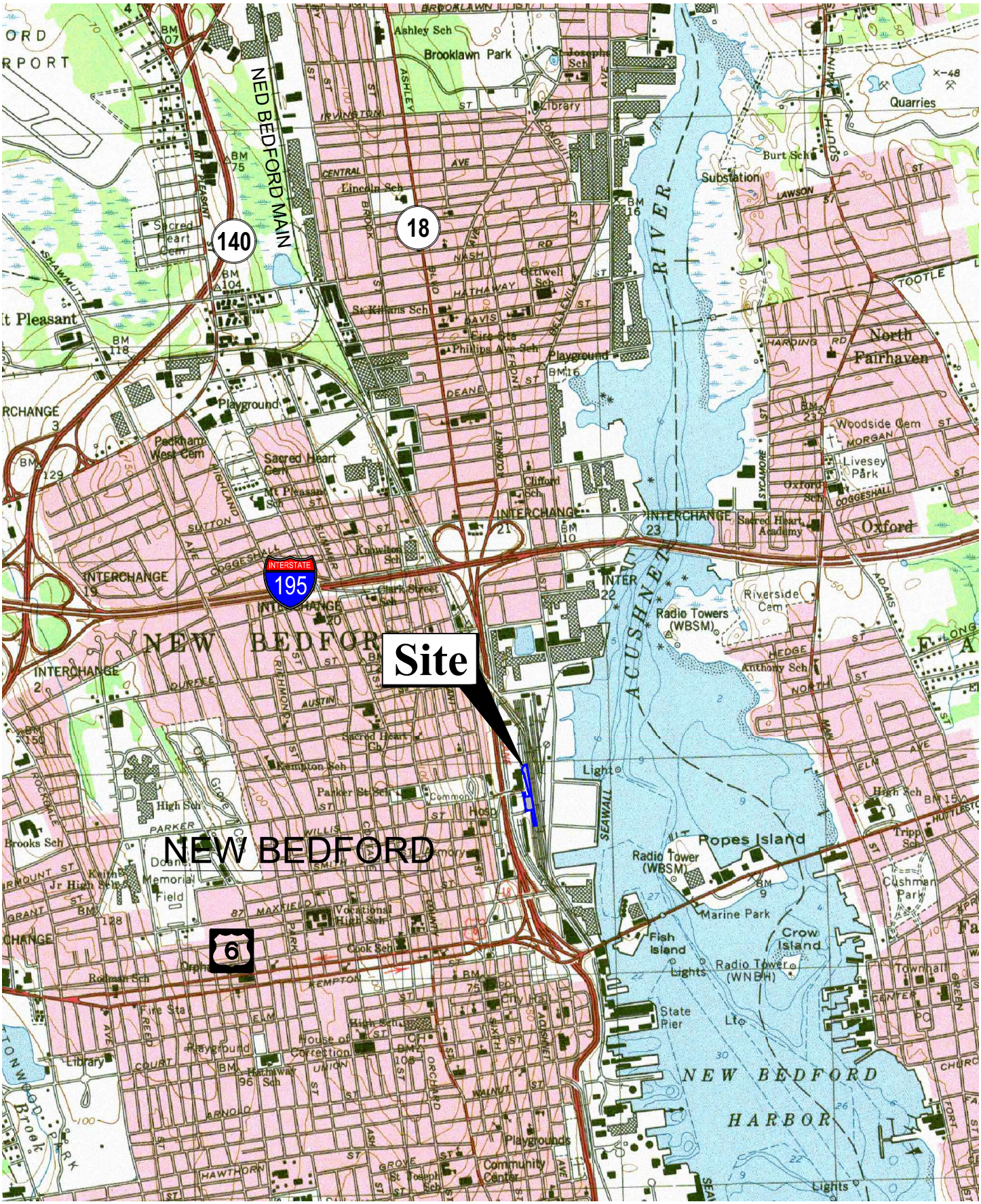
The Project will disturb approximately 1.5 acres of land. Since it is part of a larger common plan of development that includes the Wamsutta Railway Yard, the Project will be covered under the Environmental Protection Agency (EPA) National Pollutant Discharge Elimination System (NPDES) Construction General Permit provided for the Wamustta Railway Yard. As required under this permit, a Stormwater Pollution Prevention Plan (SWPPP) will be developed and submitted before land disturbance begins. Recommended construction period pollution prevention and erosion and sedimentation controls to be finalized in the SWPPP are included in Appendix E.

Standard 9: Operation and Maintenance Plan

In compliance with Standard 9, a Post Construction Stormwater Operation and Maintenance (O&M) Plan has been developed for the Project. The O&M Plan is included in Appendix F as part of the Long Term Pollution Prevention Plan.

Standard 10: Prohibition of Illicit Discharges

The site was previously partially developed and existing separate sanitary sewer and storm drainage infrastructure exists on the site. The design plans submitted with this report have been designed in full compliance with current standards. The Long-Term Pollution Prevention Plan includes measures to prevent illicit discharges.



Site Locus Map
Whale's Tooth Station
South Coast Rail
New Bedford, Massachusetts

Figure 1

May 2018

0 250 500 1000 Feet

Site Aerial Map
Whale's Tooth Station
South Coast Rail
New Bedford, Massachusetts

Figure 2

May 2018

\\vhb\proj\Boston\12815.00 SCR PM & CM\Engineering\Civil\Stations\Stormwater\NOI Reports\Whale's Tooth\Figures\Figure 3-Exist Drainage Area.dwg

Legend

SYMBOLS

DP-# — DESIGN POINT

EX# — DRAINAGE AREA DESIGNATION

LINETYPES

DRAINAGE AREA BOUNDARY

TIME OF CONCENTRATION FLOW LINE

LIMIT OF EXIST 1–FOOT CAP

LIMIT OF EXIST 3–FOOT CAP

SCS SOIL CLASSIFICATIONS

602 — URBAN LAND

0 30 60 Feet

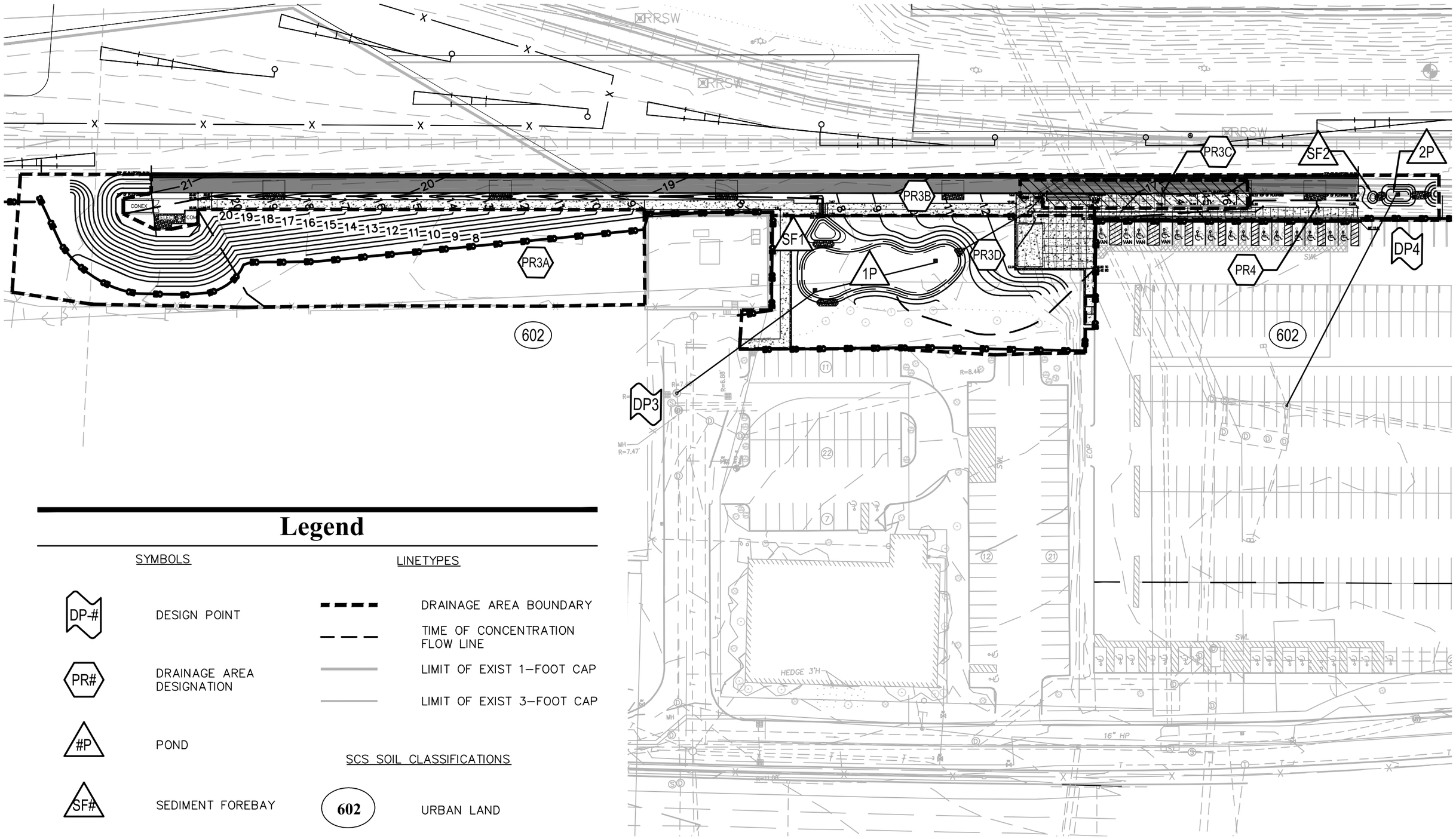
vhb

Existing Drainage Areas
Whale's Tooth Station
South Coast Rail
New Bedford, MA

Figure 3

May 2018

\\vhb\proj\Boston\12815.00 SCR PM & CM\Engineering\Civil\Stations\Stormwater\NOI Reports\Whale's Tooth\Figures\Figure 4-Proposed Drainage Area.dwg



Legend

SYMBOLS

DP-#	DESIGN POINT
PR#	DRAINAGE AREA DESIGNATION
#P	POND
SF#	SEDIMENT FOREBAY

LINETYPES

▬ ▬ ▬	DRAINAGE AREA BOUNDARY
– – –	TIME OF CONCENTRATION FLOW LINE
———	LIMIT OF EXIST 1–FOOT CAP
———	LIMIT OF EXIST 3–FOOT CAP

SCS SOIL CLASSIFICATIONS

602	URBAN LAND

0 30 60 Feet

vhb

Proposed Drainage Areas

Whale's Tooth Station
New Bedford, MA

Figure 4

May 2018

Appendix A
Standard 1 Computations and Supporting Information

Closed Drainage System Calculations

101 Walnut Street
Post Office Box 9151
Watertown, MA 02471
P 617.924.1770

Storm Drainage Computations

Name: Whale's Tooth Station
New Bedford, MA
Client: MassDOT

Proj. No.: **12815.00**
Date: **5/31/2018**
Computed by: **JHC**
Checked by: **RTW**

Design Parameters:
10 **Year Storm**
k_e= **0.5**

DESCRIPTION	LOCATION		FLOW TIME (MIN)		i*	DESIGN					CAPACITY		PROFILE				
	FROM	TO	PIPE	CONC TIME		Q cfs	V fps	n	PIPE SIZE	SLOPE	Q full ft^3/s	V full ft/s	LENGTH ft	FALL ft	RIM	INV UPPER	INV LOWER
	AD 1	AD 2	0.70	5.0	5.6	0.32	2.0	0.012	12	0.61%	3.0	3.8	82	0.30	6.1	2.9	2.4
	AD 2	EX DMH 1	0.72	5.0	5.6	0.86	2.6	0.012	15	0.62%	5.5	4.5	114	0.70	6.0	2.2	1.5
	AD 3	EX DMH 2	0.89	5.0	5.6	0.44	2.9	0.012	8	0.98%	1.3	3.7	153	1.50	10.0	5.0	3.5

Appendix B
Standard 2 Computations and Supporting Information

Rainfall volumes used for this analysis were based on the Natural Resources Conservation Service (NRCS) Type III, 24-hour storm event for Bristol County. Runoff coefficients for the existing and proposed conditions, as previously shown in Tables 1 and 2 respectively, were determined using NRCS Technical Release 55 (TR-55) methodology as provided in HydroCAD. The HydroCAD model is based on the NRCS Technical Release 20 (TR-20) Model for Project Formulation Hydrology.

FEMA Flood Maps

NOTES TO USERS

This map is for use in administering the National Flood Insurance Program. It does not necessarily identify all areas subject to flooding, particularly from local drainage sources of small size. The **community map repository** should be consulted for possible updated or additional flood hazard information.

To obtain more detailed information in areas where **Base Flood Elevations** (BFEs) and/or **floodways** have been determined, users are encouraged to consult the Flood Profiles and Floodway Data and/or Summary of Stillwater Elevations tables contained within the Flood Insurance Study (FIS) Report that accompanies this FIRM. Users should be aware that BFEs shown on the FIRM represent rounded whole-foot elevations. These BFEs are intended for flood insurance rating purposes only and should not be used as the sole source of flood elevation information. Accordingly, flood elevation data presented in the FIS Report should be utilized in conjunction with the FIRM for purposes of construction and/or floodplain management.

Coastal Base Flood Elevations shown on this map apply only landward of 0.0' North American Vertical Datum of 1988 (NAVD 88). Users of this FIRM should be aware that coastal flood elevations are also provided in the Summary of Stillwater Elevations table in the Flood Insurance Study Report for this jurisdiction. Elevations shown in the Summary of Stillwater Elevations table should be used for construction and/or floodplain management purposes when they are higher than the elevations shown on this FIRM.

Boundaries of the **floodways** were computed at cross sections and interpolated between cross sections. The floodways were based on hydraulic considerations with regard to requirements of the National Flood Insurance Program. Floodway widths and other pertinent floodway data are provided in the Flood Insurance Study Report for this jurisdiction.

Certain areas not in Special Flood Hazard Areas may be protected by **flood control structures**. Refer to Section 2.4 "Flood Protection Measures" of the Flood Insurance Study Report for information on flood control structures for this jurisdiction.

Accredited Levee Notes to Users: Check with your local community to obtain more information, such as the estimated level of protection provided (which may exceed the 1-percent-annual-chance level) and Emergency Action Plan, or the levee system(s) shown as providing protection for areas on this panel. To mitigate flood risk in residual risk areas, property owners and residents are encouraged to consider flood insurance and floodproofing or other protective measures. For more information on flood insurance, interested parties should visit the FEMA Website at http://www.fema.gov/businessandjobs/bj.shtm.

The **projection** used in the preparation of this map was Massachusetts State Plane Mainland Zone (FIPS zone 2001). The **horizontal datum** was NAD83, GRS 1980 spheroid. Differences in datum, spheroid, projection or UTM zones used in the production of FIRMs for adjacent jurisdictions may result in slight positional differences in map features across jurisdiction boundaries. These differences do not affect the accuracy of this FIRM.

Flood elevations on this map are referenced to the North American Vertical Datum of 1988. These flood elevations must be compared to structure and ground elevations referenced to the same **vertical datum**. For information regarding conversion between the National Geodetic Vertical Datum of 1929 and the North American Vertical Datum of 1988, visit the National Geodetic Survey website at http://www.ngs.noaa.gov or contact the National Geodetic Survey at the following address:

NGS Information Services
NOAA, NNGS12
National Geodetic Survey
SSMC-3, #9202
1315 East-West Highway
Silver Spring, Maryland 20910-3282
(301) 713-3242

To obtain current elevation, description, and/or location information for **bench marks** shown on this map, please contact the Information Services Branch of the National Geodetic Survey at **(301) 713-3242**, or visit its website at http://www.ngs.noaa.gov.

Base Map information shown on this FIRM was derived from digital orthophotography. Base map files were provided in digital form by Massachusetts Geographic Information System (MassGIS). Ortho imagery was produced at a scale of 1:5,000. Aerial photography is dated April 2005.

The **profile baselines** depicted on this map represent the hydraulic modeling baselines that match the flood profiles in the FIS report. As a result of improved topographic data, this **profile baseline**, in some cases, may deviate significantly from the channel centerline or appear outside the SFHA.

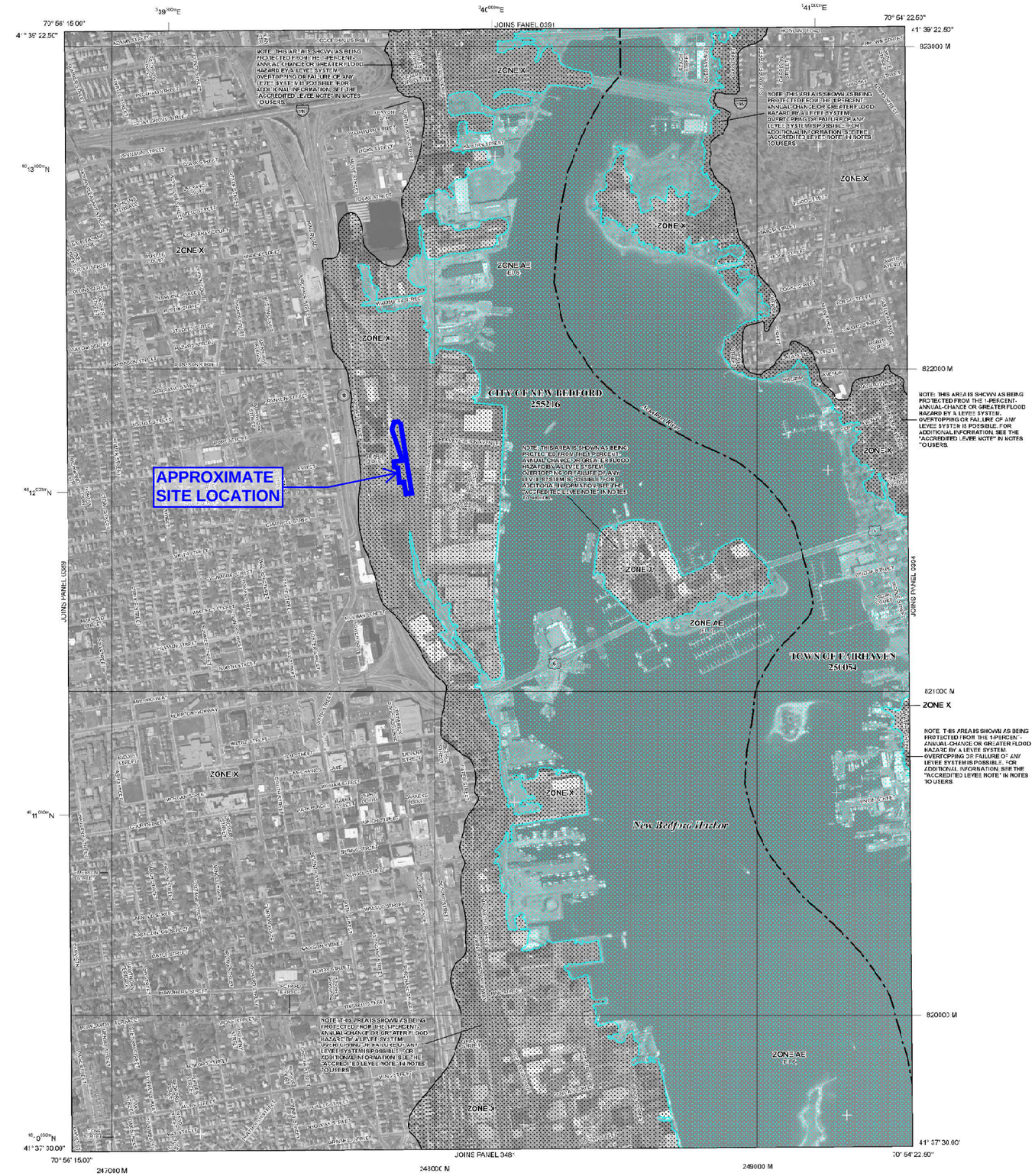
This map reflects more detailed and up-to-date **stream channel configurations** than those shown on the previous FIRM for this jurisdiction. The floodplains and floodways that were transferred from the previous FIRM may have been adjusted to conform to these new stream channel configurations. As a result, the Flood Profiles and Floodway Data tables for multiple streams in the Flood Insurance Study Report (which contains authoritative hydraulic data) may reflect stream channel distances that differ from what is shown on this map.

Corporate limits shown on this map are based on the best data available at the time of publication. Because changes due to annexations or de-annexations may have occurred after this map was published, map users should contact appropriate community officials to verify current corporate limit locations.

Please refer to the separately printed **Map Index** for an overview map of the county showing the layout of map panels; community map repository addresses; and a Listing of Communities table containing National Flood Insurance Program dates for each community as well as a listing of the panels on which each community is located.

For information on available products associated with this FIRM visit the **Map Service Center (MSC)** website at http://msc.fema.gov. Available products may include previously issued Letters of Map Change, a Flood Insurance Study Report, and/or digital versions of this map. Many of these products can be ordered or obtained directly from the MSC website.

If you have **questions about this map,** how to order products, or the National Flood Insurance Program in general, please call the **FEMA Map Information eXchange (FMIX)** at **1-877-FEMA-MAP** (1-877-336-2627) or visit the FEMA website at http://www.fema.gov/business/nfp.



LEGEND

SPECIAL FLOOD HAZARD AREAS (SFHAs) SUBJECT TO INUNDATION BY THE 1% ANNUAL CHANCE FLOOD

The 1% annual chance flood (100-year flood), also known as the base flood, is the flood that has a 1% chance of being equaled or exceeded in any given year. The Special Flood Hazard Area is the area subject to flooding by the 1% annual chance flood. Areas of Special Flood Hazard include Zones A, AE, AR, AO, AH, A99, V, and VE. The Base Flood Elevation is the water surface elevation of the 1% annual chance flood.

ZONE A	No Base Flood Elevations determined.
ZONE AE	Base Flood Elevations determined.
ZONE AH	Flood depths of 1 to 3 feet (usually areas of ponding); Base Flood Elevations determined.
ZONE AO	Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); average depths determined. For areas of alluvial fan flooding, velocities also determined.
ZONE AR	Special Flood Hazard Areas formerly protected from the 1% annual chance flood by a flood control system that was subsequently decertified. Zone AR indicates that the former flood control system is being restored to provide protection from the 1% annual chance or greater flood.
ZONE A99	Area to be protected from 1% annual chance flood by a federal flood protection system under construction; no Base Flood Elevations determined.
ZONE V	Coastal flood zone with velocity hazard (wave action); no Base Flood Elevations determined.
ZONE VE	Coastal flood zone with velocity hazard (wave action); Base Flood Elevations determined.

FLOODWAY AREAS IN ZONE AE

The floodway is the channel of a stream plus any adjacent floodplain areas that must be kept free of encroachment so that the 1% annual chance flood can be carried without substantial increases in flood heights.

OTHER FLOOD AREAS

ZONE X	Areas of 0.2% annual chance flood; areas of 1% annual chance flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 1% annual chance flood.

OTHER AREAS

ZONE X	Areas determined to be outside the 0.2% annual chance floodplain.
ZONE D	Areas in which flood hazards are undetermined, but possible.

COASTAL BARRIER RESOURCES SYSTEM (CBRS) AREAS

OTHERWISE PROTECTED AREAS (OPAs)

CBRS areas and OPAs are normally located within or adjacent to Special Flood Hazard Areas.

	1% Annual Chance Floodplain Boundary
	0.2% Annual Chance Floodplain Boundary
	Floodway boundary
	Zone D boundary
	CBRS and OPA boundary
	Boundary dividing Special Flood Hazard Area Zones and boundary dividing Special Flood Hazard Areas of different Base Flood Elevations, flood depths, or flood velocities.
513	Base Flood Elevation line and value; elevation in feet*
(EL 987)	Base Flood Elevation value where uniform within zone; elevation in feet*

*Referenced to the North American Vertical Datum of 1988

A ---- A	Cross section line
23 ---- 23	Transect line
65° 02' 08" 58° 02' 12"	Geographic coordinates referenced to the North American Datum of 1983 (NAD 83) Western Hemisphere
4189000 M	1000-meter ticks: Massachusetts State Plane Mainland Zone (FIPS Zone 2001), Transverse Mercator projection
4639000mN	1000-meter Universal Transverse Mercator grid values, zone 19
DX5510	Bench mark (see explanation in Notes to Users section of this FIRM panel)
M1.5	River Mile

MAP REPOSITORIES
Refer to Map Repositories list on Map Index

EFFECTIVE DATE OF COUNTYWIDE FLOOD INSURANCE RATE MAP
July 7, 2009

EFFECTIVE DATE(S) OF REVISION(S) TO THIS PANEL
July 16, 2014 - to reflect the accreditation of formerly provisionally accredited levees.

For community map revision history prior to countywide mapping, refer to the Community Map History table located in the Flood Insurance Study report for this jurisdiction.

To determine if flood insurance is available in this community, contact your insurance agent or call the National Flood Insurance Program at 1-800-638-6620.

MAP SCALE 1" = 500'

250 0 500 1000 FEET
150 0 150 300 METERS

PANEL 0393G

FIRM

FLOOD INSURANCE RATE MAP

BRISTOL COUNTY, MASSACHUSETTS (ALL JURISDICTIONS)

PANEL 393 OF 550
(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

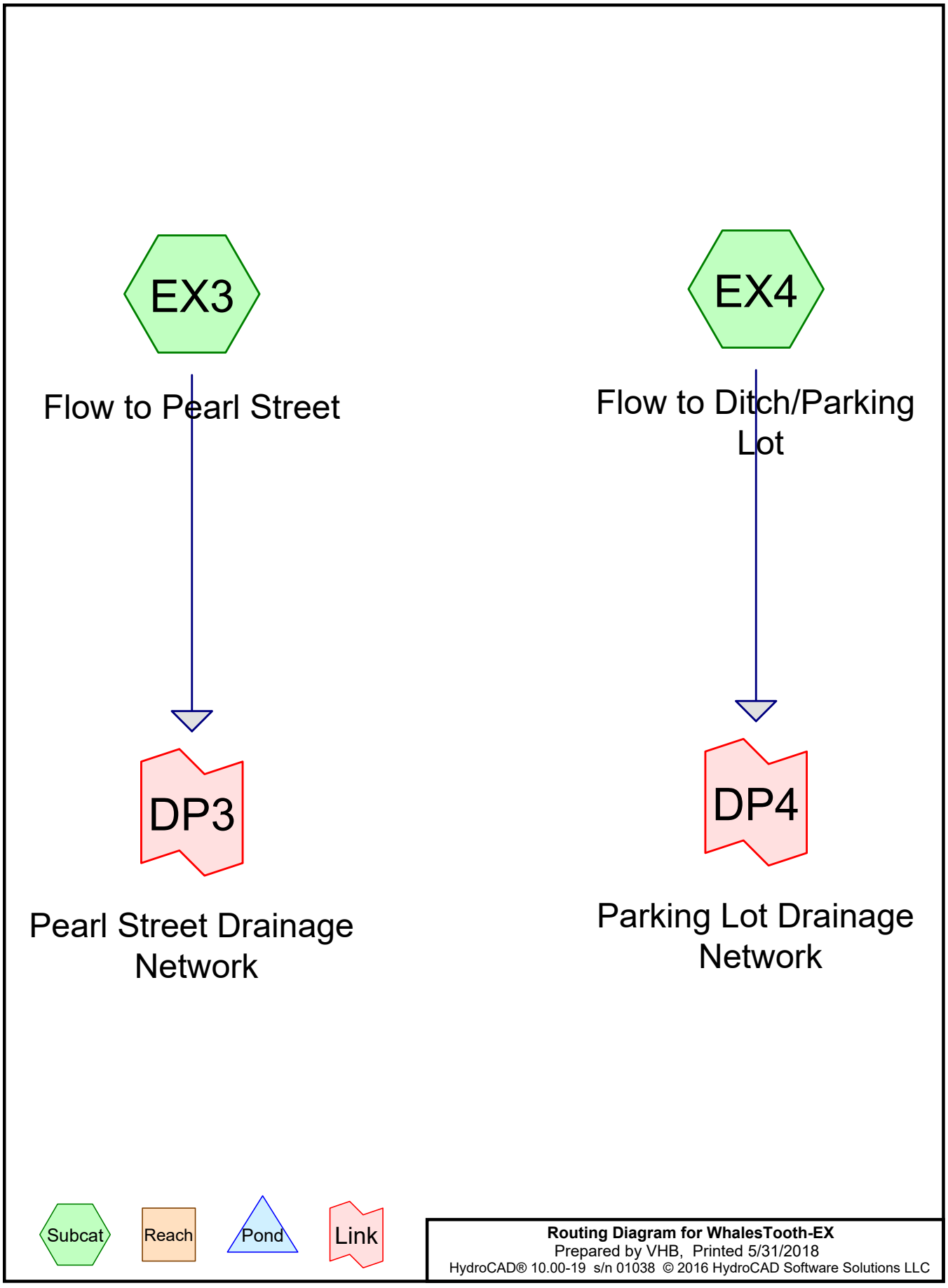
COMMUNITY	NUMBER	PANEL	SUFFIX
FAIRHAVEN, TOWN OF	250054	0393	G
NEW BEDFORD, CITY OF	250216	0393	G

Notice to User: The **Map Number** shown below should be used when placing map orders; the **Community Number** shown above should be used on insurance applications for the subject community.

MAP NUMBER
25005C0393G
MAP REVISED
JULY 16, 2014

Federal Emergency Management Agency

HydroCAD Analysis: Existing Conditions


EX3
Flow to Pearl Street
EX4
Flow to Ditch/Parking Lot
DP3
DP4
Pearl Street Drainage Network
Parking Lot Drainage Network
Subcat
Reach
Pond
Link
Routing Diagram for WhalesTooth-EX
Prepared by VHB, Printed 5/31/2018
HydroCAD® 10.00-19 s/n 01038 © 2016 HydroCAD Software Solutions LLC

Area Listing (all nodes)

Area (sq-ft)	CN	Description (subcatchment-numbers)
12,472	77	Brush, Fair, HSG D (EX3)
45,771	96	Gravel surface, HSG D (EX3, EX4)
7,068	78	Meadow, non-grazed, HSG D (EX3, EX4)
302	98	Unconnected pavement, HSG D (EX3, EX4)
4,637	82	Woods/grass comb., Fair, HSG D (EX3)
70,251	**90**	**TOTAL AREA**

2-Year Storm Event – Existing

Summary for Subcatchment EX3: Flow to Pearl Street

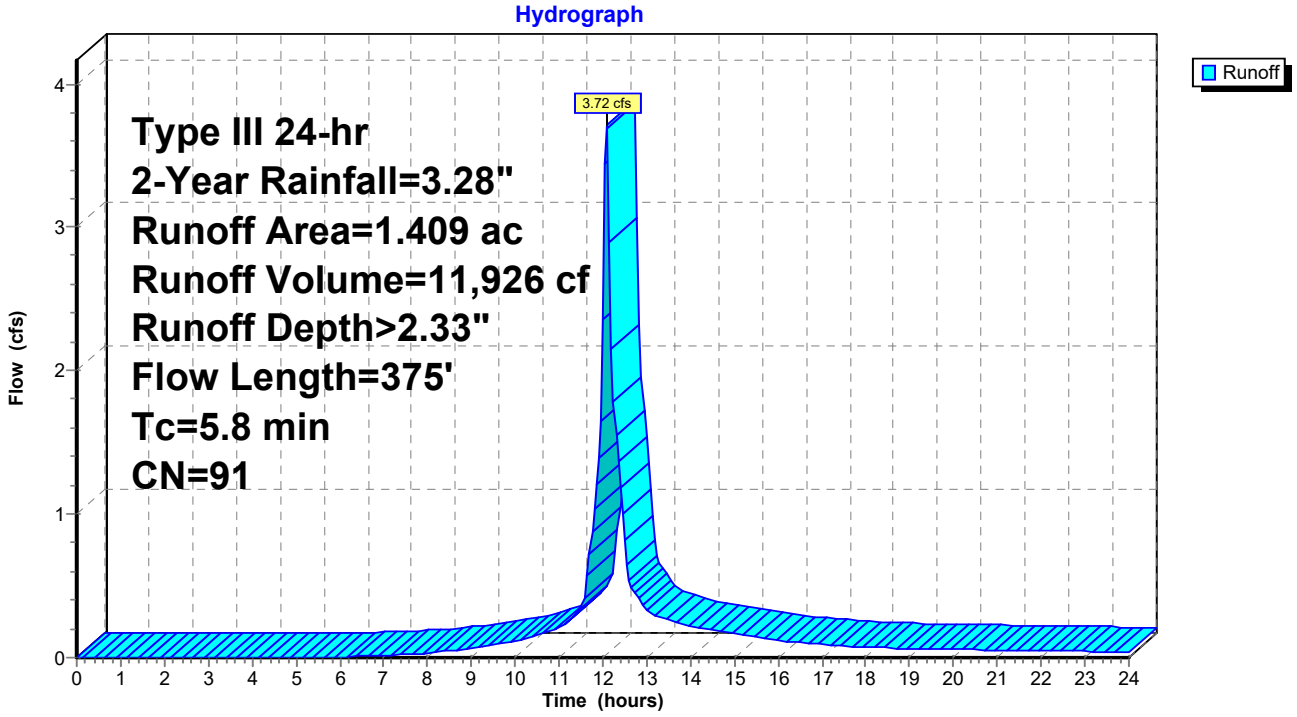
Runoff = 3.72 cfs @ 12.09 hrs, Volume= 11,926 cf, Depth> 2.33"

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 2-Year Rainfall=3.28"

Area (ac)	CN	Description
0.286	77	Brush, Fair, HSG D
0.974	96	Gravel surface, HSG D
0.037	78	Meadow, non-grazed, HSG D
0.005	98	Unconnected pavement, HSG D
0.106	82	Woods/grass comb., Fair, HSG D
1.409	91	Weighted Average
1.404		99.63% Pervious Area
0.005		0.37% Impervious Area
0.005		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.3	50	0.0200	0.37		**Sheet Flow, Fallow** Fallow n= 0.050 P2= 3.40"
3.5	325	0.0093	1.55		**Shallow Concentrated Flow, Fallow** Unpaved Kv= 16.1 fps
5.8	375	Total			

Subcatchment EX3: Flow to Pearl Street



Summary for Subcatchment EX4: Flow to Ditch/Parking Lot

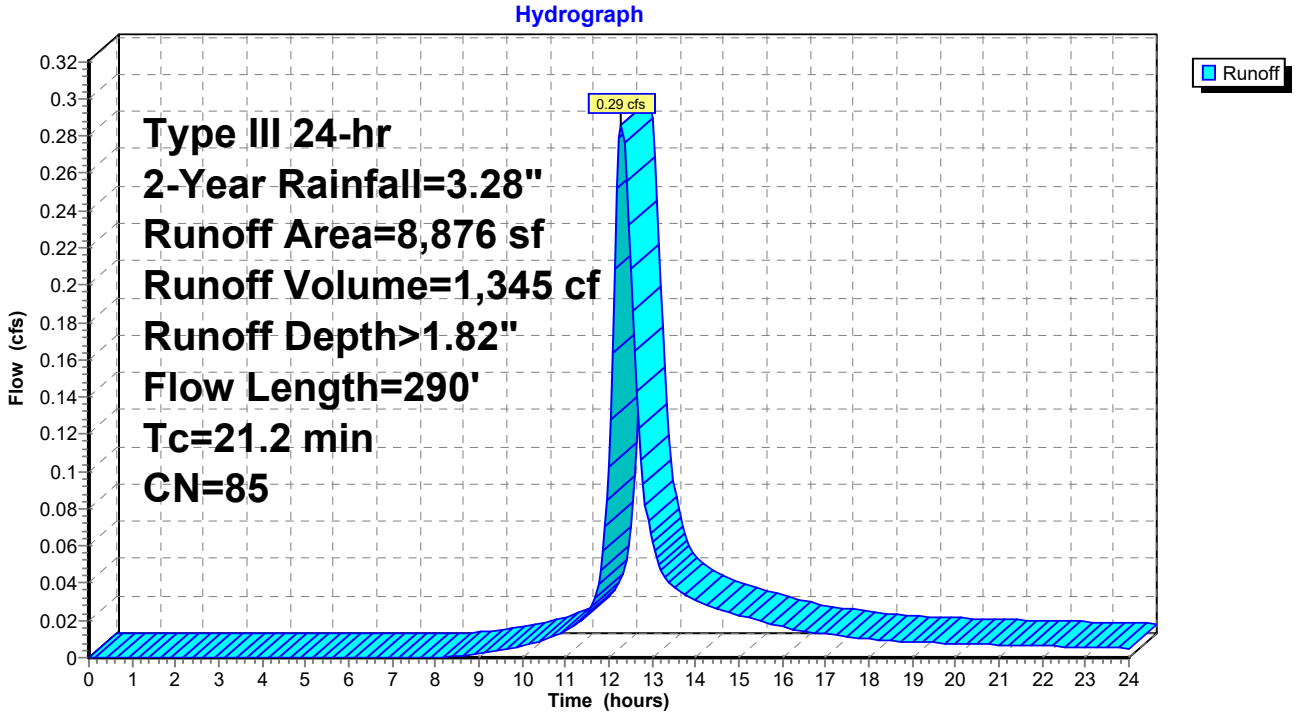
Runoff = 0.29 cfs @ 12.30 hrs, Volume= 1,345 cf, Depth> 1.82"

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=3.28"

Area (sf)	CN	Description
3,333	96	Gravel surface, HSG D
5,467	78	Meadow, non-grazed, HSG D
77	98	Unconnected pavement, HSG D
8,876	85	Weighted Average
8,799		99.13% Pervious Area
77		0.87% Impervious Area
77		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.3	40	0.0500	0.51		**Sheet Flow, Fallow** Fallow n= 0.050 P2= 3.40"
19.9	250	0.0022	0.21		**Sheet Flow, Ditch** Fallow n= 0.050 P2= 3.40"
21.2	290	Total			

Subcatchment EX4: Flow to Ditch/Parking Lot

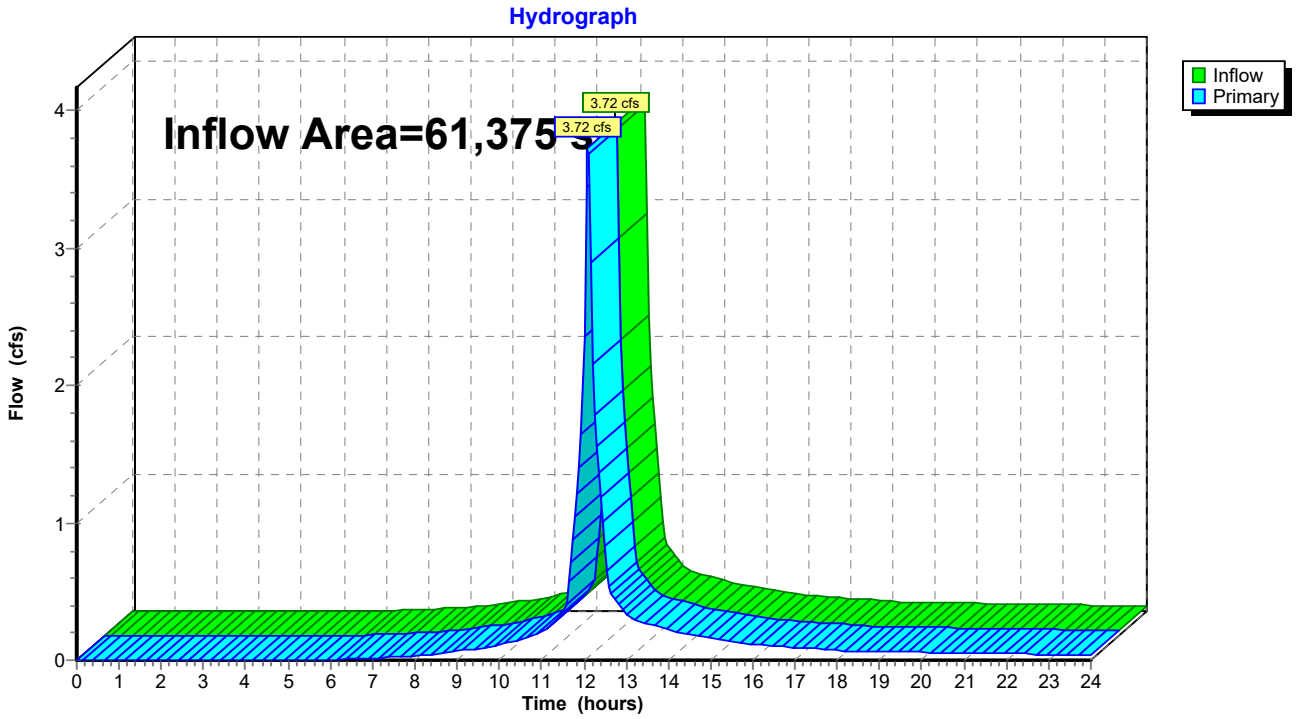


Summary for Link DP3: Pearl Street Drainage Network

Inflow Area = 61,375 sf, 0.37% Impervious, Inflow Depth > 2.33" for 2-Year event
Inflow = 3.72 cfs @ 12.09 hrs, Volume= 11,926 cf
Primary = 3.72 cfs @ 12.09 hrs, Volume= 11,926 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

Link DP3: Pearl Street Drainage Network

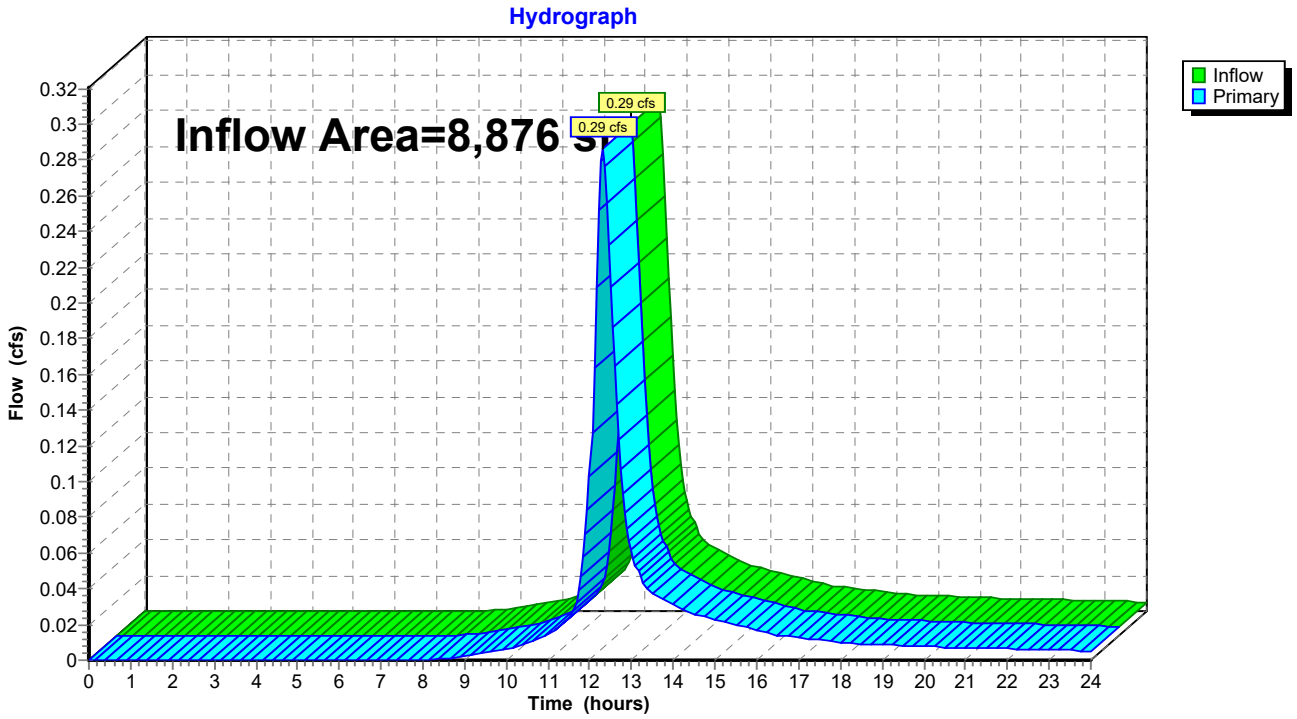


Summary for Link DP4: Parking Lot Drainage Network

Inflow Area = 8,876 sf, 0.87% Impervious, Inflow Depth > 1.82" for 2-Year event
Inflow = 0.29 cfs @ 12.30 hrs, Volume= 1,345 cf
Primary = 0.29 cfs @ 12.30 hrs, Volume= 1,345 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

Link DP4: Parking Lot Drainage Network



10-Year Storm Event – Existing

Summary for Subcatchment EX3: Flow to Pearl Street

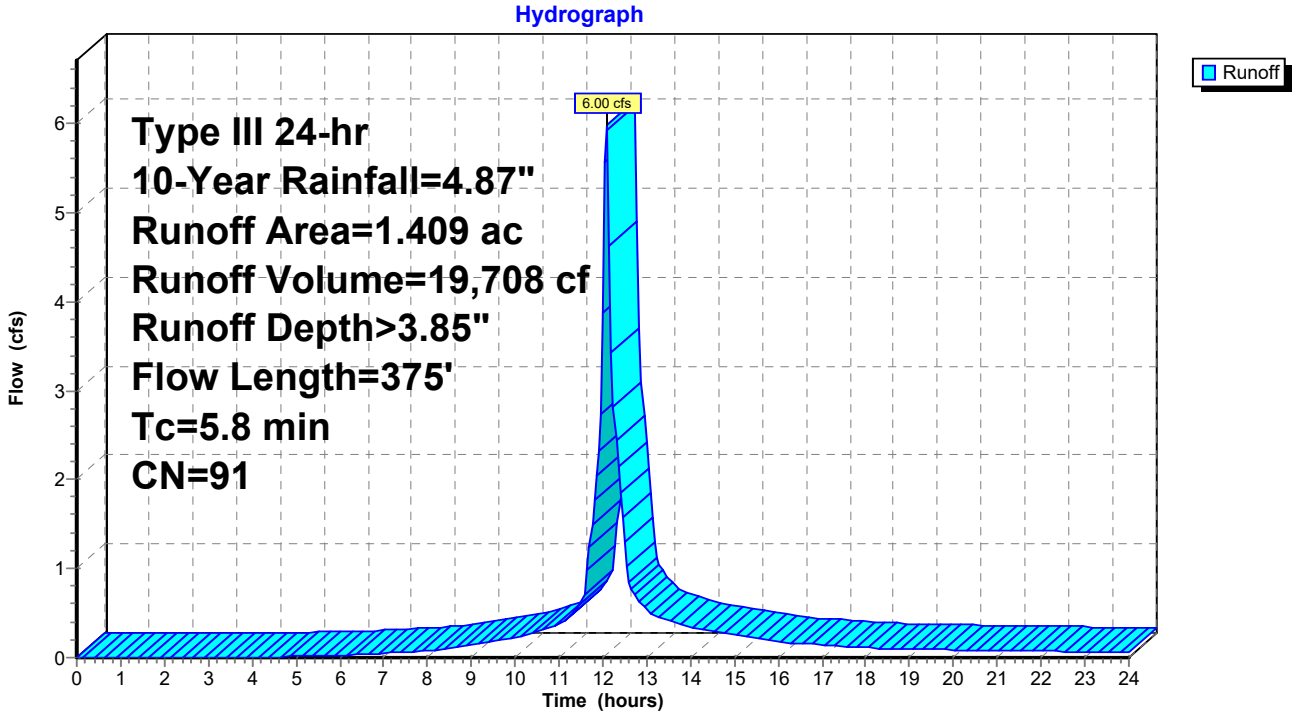
Runoff = 6.00 cfs @ 12.09 hrs, Volume= 19,708 cf, Depth> 3.85"

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=4.87"

Area (ac)	CN	Description
0.286	77	Brush, Fair, HSG D
0.974	96	Gravel surface, HSG D
0.037	78	Meadow, non-grazed, HSG D
0.005	98	Unconnected pavement, HSG D
0.106	82	Woods/grass comb., Fair, HSG D
1.409	91	Weighted Average
1.404		99.63% Pervious Area
0.005		0.37% Impervious Area
0.005		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.3	50	0.0200	0.37		**Sheet Flow, Fallow** Fallow n= 0.050 P2= 3.40"
3.5	325	0.0093	1.55		**Shallow Concentrated Flow, Fallow** Unpaved Kv= 16.1 fps
5.8	375	Total			

Subcatchment EX3: Flow to Pearl Street



Summary for Subcatchment EX4: Flow to Ditch/Parking Lot

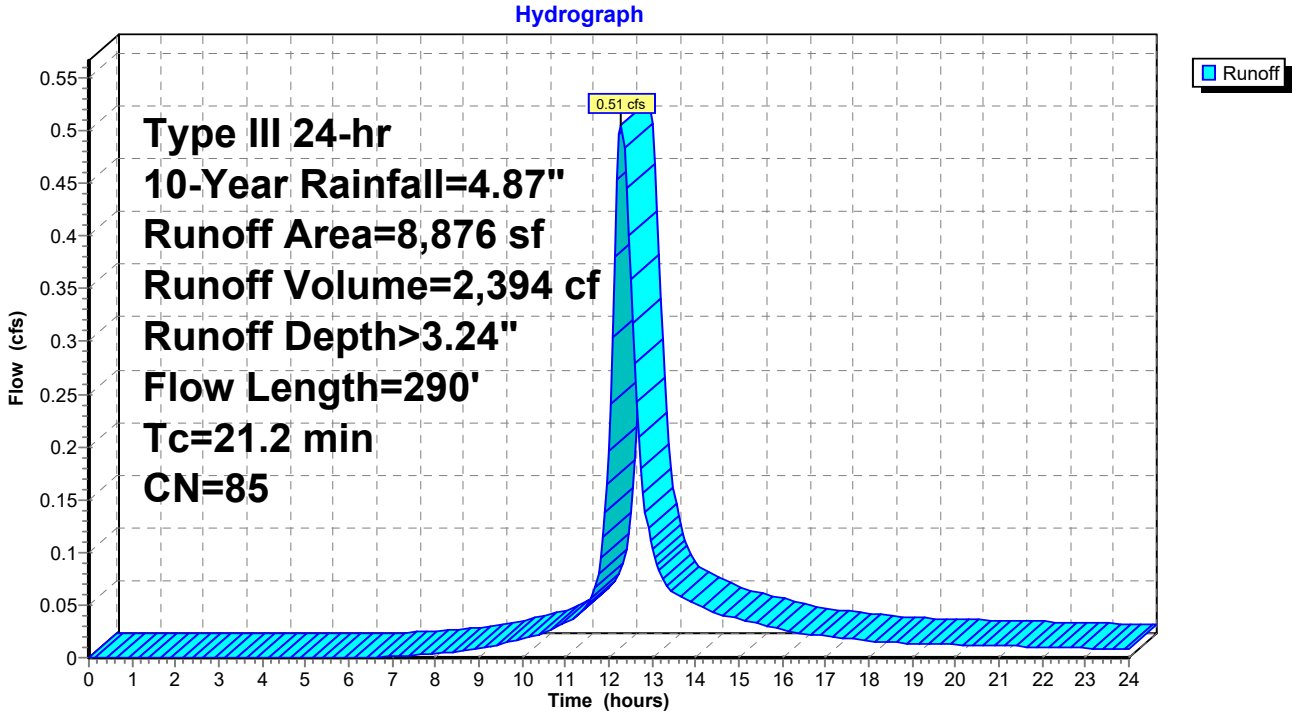
Runoff = 0.51 cfs @ 12.29 hrs, Volume= 2,394 cf, Depth> 3.24"

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=4.87"

Area (sf)	CN	Description
3,333	96	Gravel surface, HSG D
5,467	78	Meadow, non-grazed, HSG D
77	98	Unconnected pavement, HSG D
8,876	85	Weighted Average
8,799		99.13% Pervious Area
77		0.87% Impervious Area
77		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.3	40	0.0500	0.51		**Sheet Flow, Fallow** Fallow n= 0.050 P2= 3.40"
19.9	250	0.0022	0.21		**Sheet Flow, Ditch** Fallow n= 0.050 P2= 3.40"
21.2	290	Total			

Subcatchment EX4: Flow to Ditch/Parking Lot

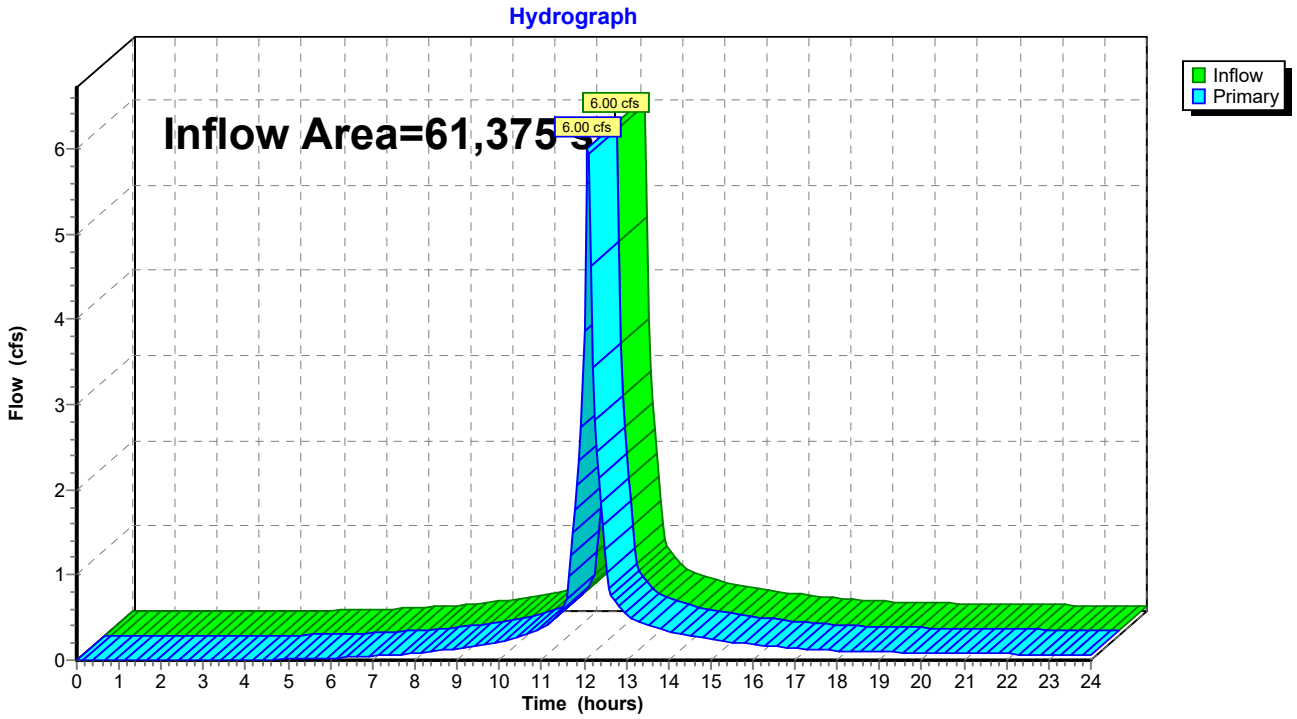


Summary for Link DP3: Pearl Street Drainage Network

Inflow Area = 61,375 sf, 0.37% Impervious, Inflow Depth > 3.85" for 10-Year event
Inflow = 6.00 cfs @ 12.09 hrs, Volume= 19,708 cf
Primary = 6.00 cfs @ 12.09 hrs, Volume= 19,708 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

Link DP3: Pearl Street Drainage Network

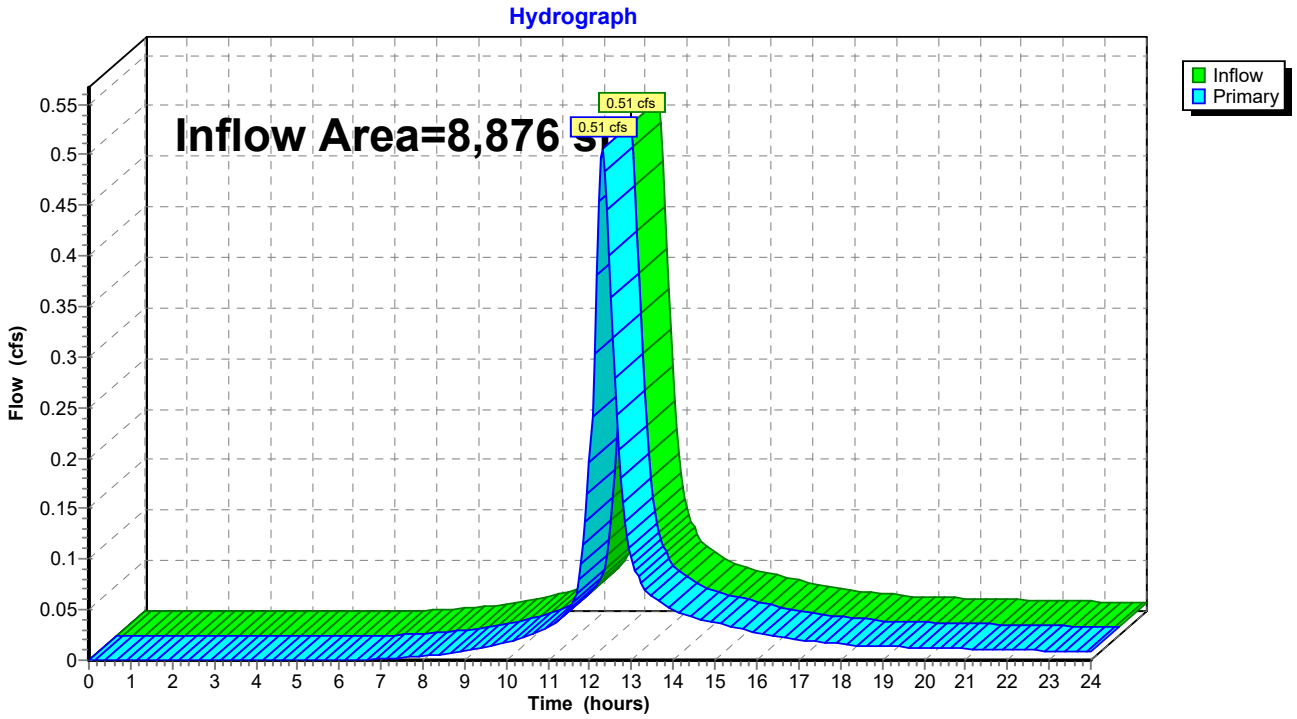


Summary for Link DP4: Parking Lot Drainage Network

Inflow Area = 8,876 sf, 0.87% Impervious, Inflow Depth > 3.24" for 10-Year event
Inflow = 0.51 cfs @ 12.29 hrs, Volume= 2,394 cf
Primary = 0.51 cfs @ 12.29 hrs, Volume= 2,394 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

Link DP4: Parking Lot Drainage Network



100-Year Storm Event – Existing

Summary for Subcatchment EX3: Flow to Pearl Street

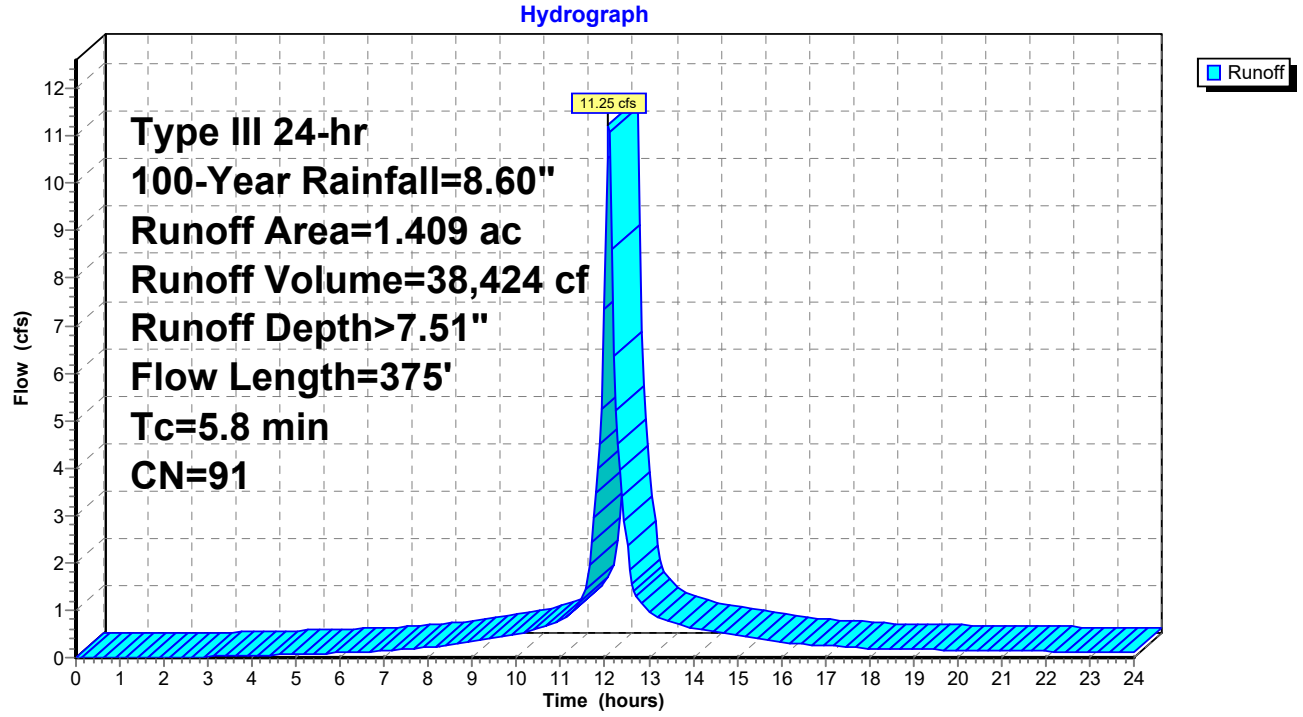
Runoff = 11.25 cfs @ 12.08 hrs, Volume= 38,424 cf, Depth> 7.51"

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 (ac)	CN	Description
0.286	77	Brush, Fair, HSG D
0.974	96	Gravel surface, HSG D
0.037	78	Meadow, non-grazed, HSG D
0.005	98	Unconnected pavement, HSG D
0.106	82	Woods/grass comb., Fair, HSG D
1.409	91	Weighted Average
1.404		99.63% Pervious Area
0.005		0.37% Impervious Area
0.005		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.3	50	0.0200	0.37		**Sheet Flow, Fallow** Fallow n= 0.050 P2= 3.40"
3.5	325	0.0093	1.55		**Shallow Concentrated Flow, Fallow** Unpaved Kv= 16.1 fps
5.8	375	Total			

Subcatchment EX3: Flow to Pearl Street



Summary for Subcatchment EX4: Flow to Ditch/Parking Lot

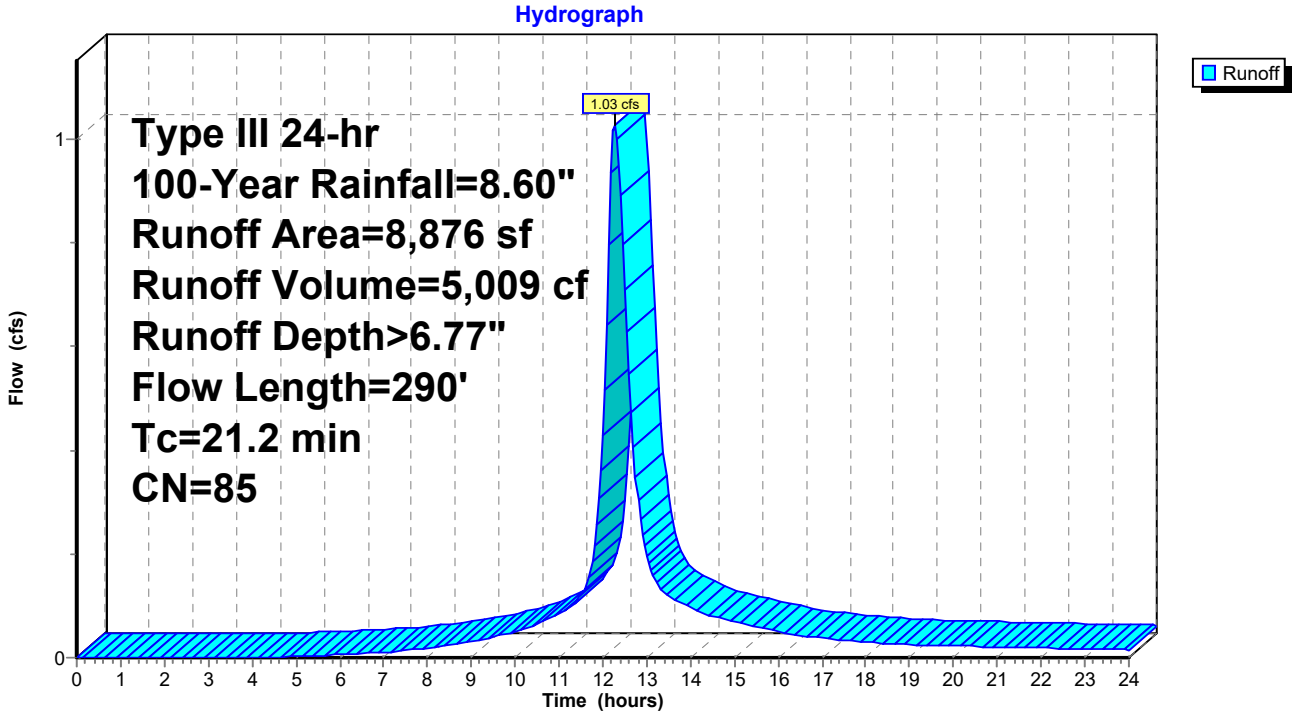
Runoff = 1.03 cfs @ 12.28 hrs, Volume= 5,009 cf, Depth> 6.77"

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 100-Year Rainfall=8.60"

Area (sf)	CN	Description
3,333	96	Gravel surface, HSG D
5,467	78	Meadow, non-grazed, HSG D
77	98	Unconnected pavement, HSG D
8,876	85	Weighted Average
8,799		99.13% Pervious Area
77		0.87% Impervious Area
77		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.3	40	0.0500	0.51		**Sheet Flow, Fallow** Fallow n= 0.050 P2= 3.40"
19.9	250	0.0022	0.21		**Sheet Flow, Ditch** Fallow n= 0.050 P2= 3.40"
21.2	290	Total			

Subcatchment EX4: Flow to Ditch/Parking Lot

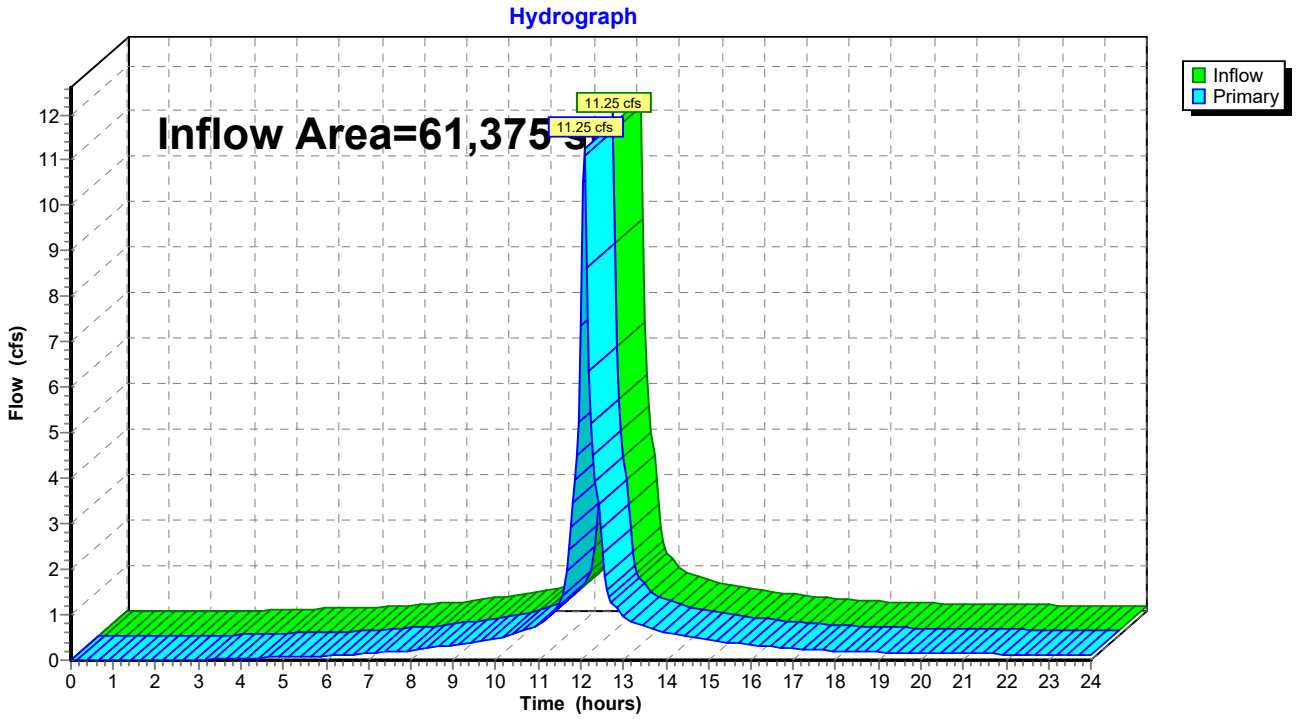


Summary for Link DP3: Pearl Street Drainage Network

Inflow Area = 61,375 sf, 0.37% Impervious, Inflow Depth > 7.51" for 100-Year event
Inflow = 11.25 cfs @ 12.08 hrs, Volume= 38,424 cf
Primary = 11.25 cfs @ 12.08 hrs, Volume= 38,424 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

Link DP3: Pearl Street Drainage Network

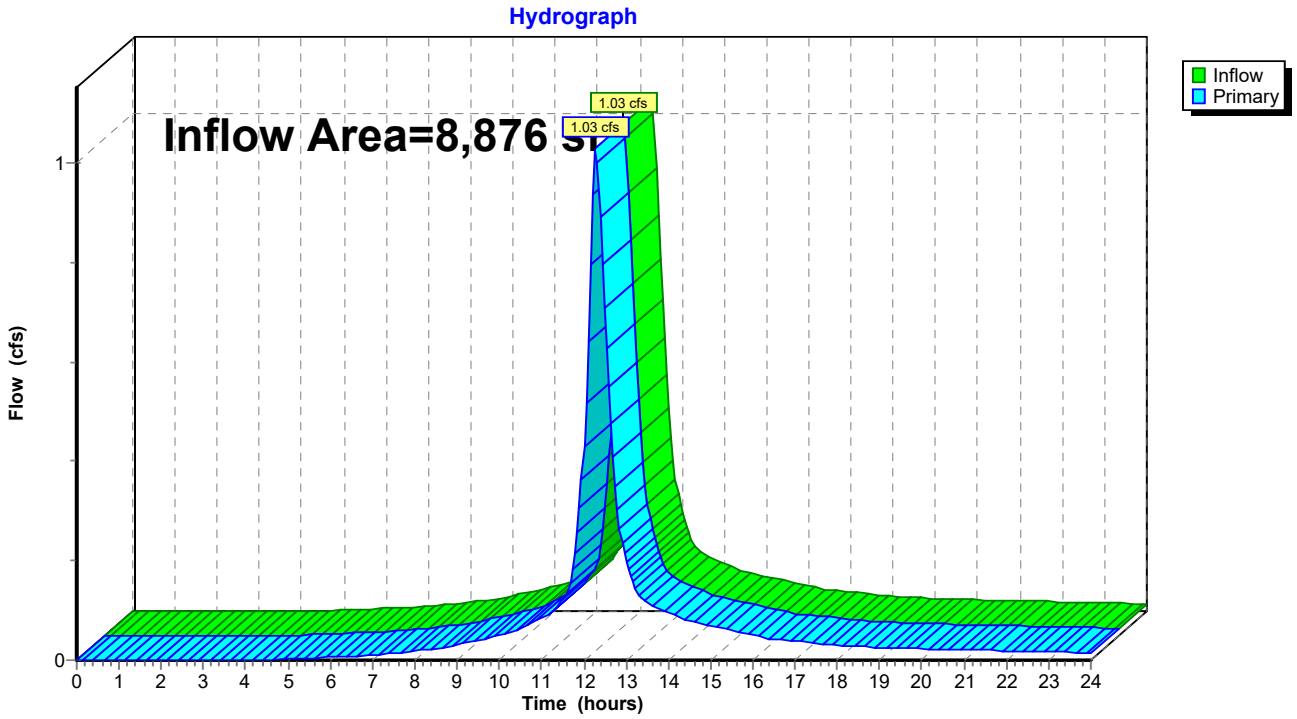


Summary for Link DP4: Parking Lot Drainage Network

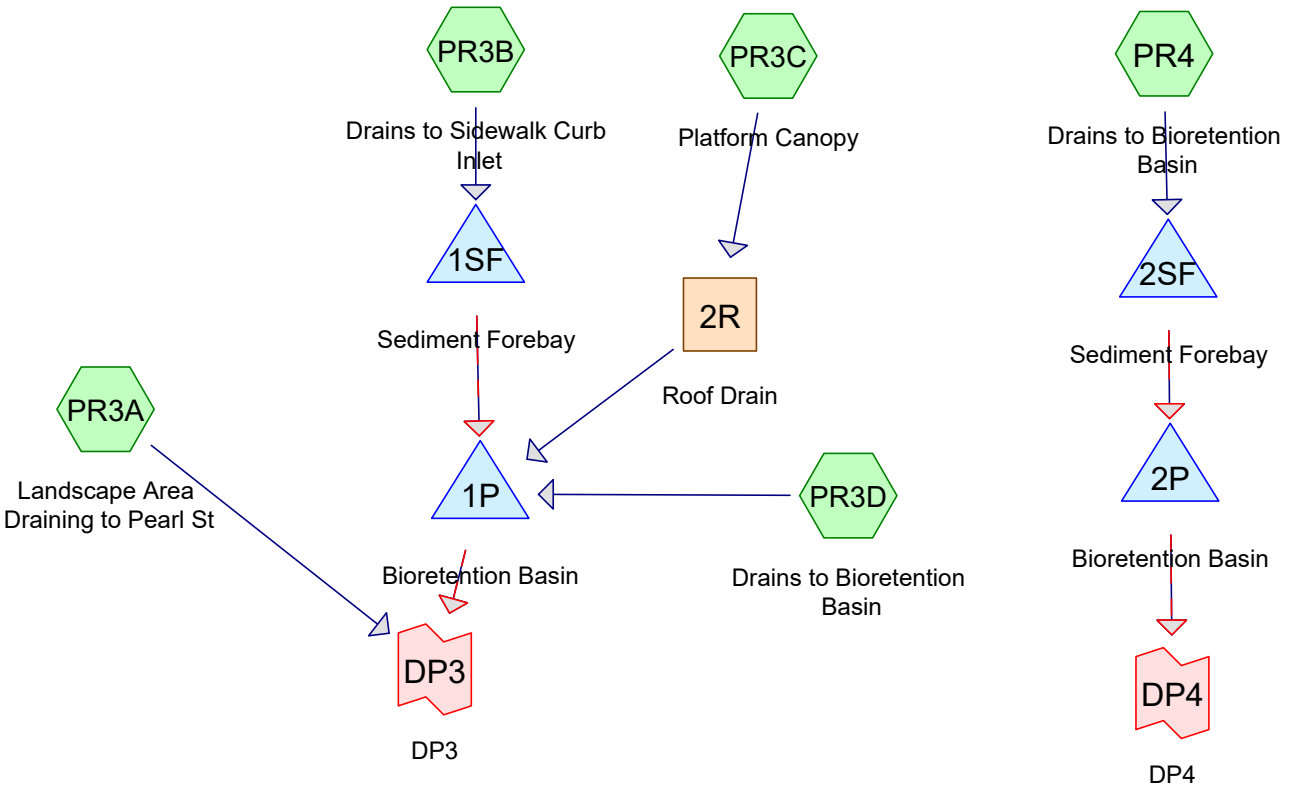
Inflow Area = 8,876 sf, 0.87% Impervious, Inflow Depth > 6.77" for 100-Year event
Inflow = 1.03 cfs @ 12.28 hrs, Volume= 5,009 cf
Primary = 1.03 cfs @ 12.28 hrs, Volume= 5,009 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

Link DP4: Parking Lot Drainage Network



HydroCAD Analysis: Proposed Conditions



Subcat Reach Pond Link

Routing Diagram for WhalesTooth-PR
Prepared by VHB, Printed 5/31/2018

Area Listing (all nodes)

Area (sq-ft)	CN	Description (subcatchment-numbers)
42,443	84	50-75% Grass cover, Fair, HSG D (PR3A, PR3B, PR3D, PR4)
2,477	80	>75% Grass cover, Good, HSG D (PR3B)
1,916	96	Gravel surface, HSG D (PR3B, PR3D, PR4)
14,843	98	Unconnected pavement, HSG D (PR3B, PR3D, PR4)
4,032	98	Unconnected roofs, HSG D (PR3B, PR3C, PR3D, PR4)
4,539	82	Woods/grass comb., Fair, HSG D (PR3D)
70,252	**88**	**TOTAL AREA**

2-Year Storm Event – Proposed

Summary for Subcatchment PR3A: Landscape Area Draining to Pearl St

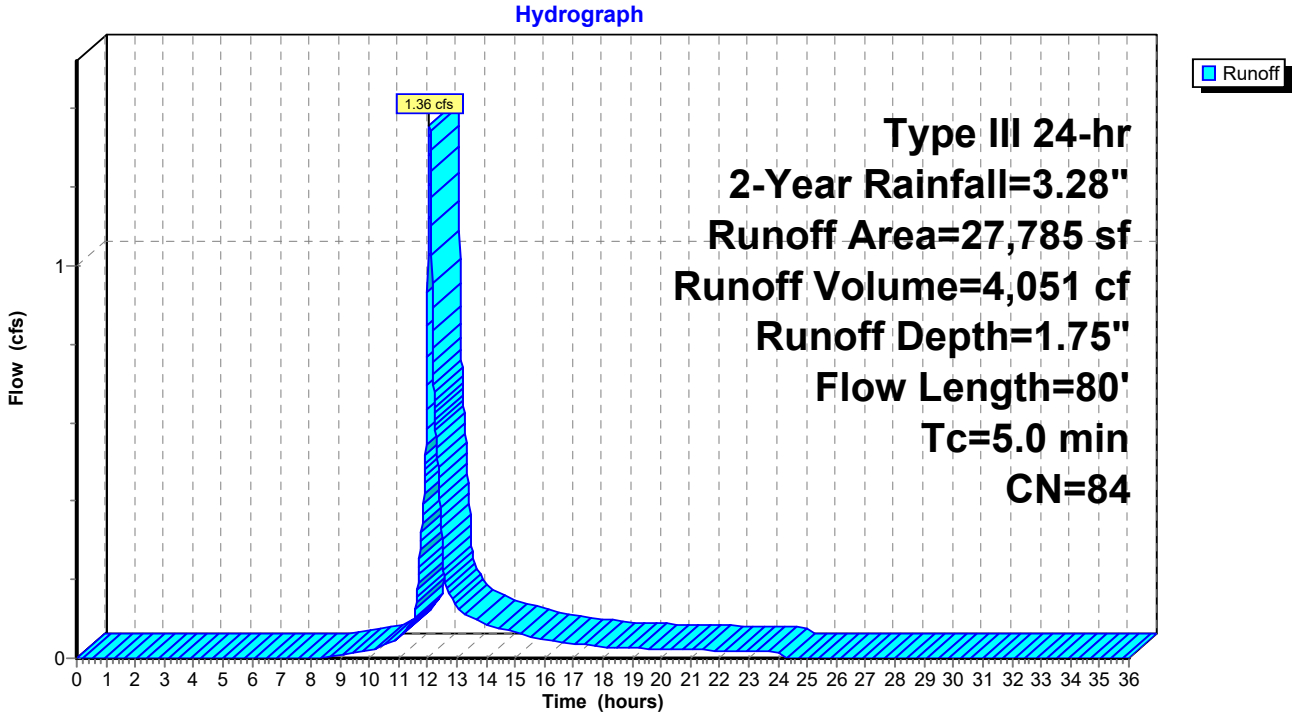
Runoff = 1.36 cfs @ 12.08 hrs, Volume= 4,051 cf, Depth= 1.75"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-Year Rainfall=3.28"

Area (sf)	CN	Description
27,785	84	50-75% Grass cover, Fair, HSG D
27,785		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.4	5	0.0150	0.21		**Sheet Flow, Top of Hill - Utility Pad** Fallow n= 0.050 P2= 3.40"
2.4	45	0.3300	0.31		**Sheet Flow, Hill** Grass: Dense n= 0.240 P2= 3.40"
0.4	30	0.0350	1.31		**Shallow Concentrated Flow, Lawn** Short Grass Pasture Kv= 7.0 fps
3.2	80	Total, Increased to minimum Tc = 5.0 min			

Subcatchment PR3A: Landscape Area Draining to Pearl St



Summary for Subcatchment PR3B: Drains to Sidewalk Curb Inlet

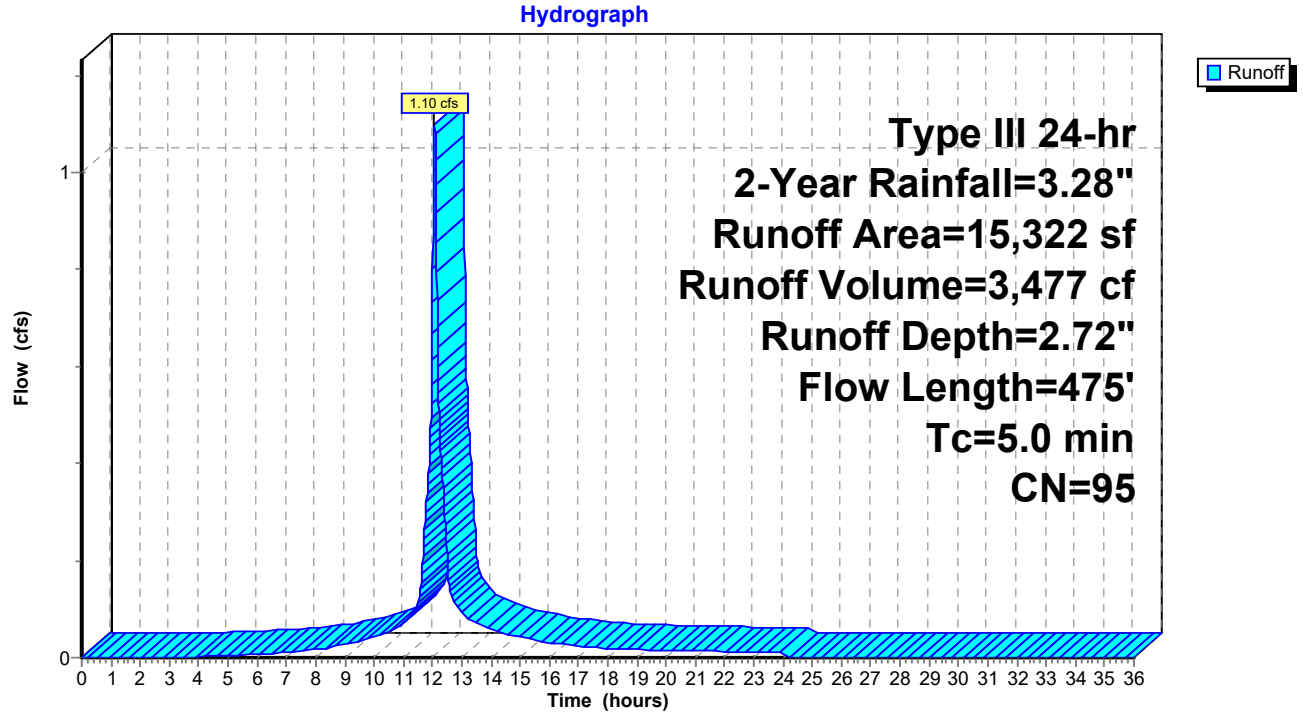
Runoff = 1.10 cfs @ 12.07 hrs, Volume= 3,477 cf, Depth= 2.72"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-Year Rainfall=3.28"

Area (sf)	CN	Description
461	84	50-75% Grass cover, Fair, HSG D
2,477	80	>75% Grass cover, Good, HSG D
407	96	Gravel surface, HSG D
11,383	98	Unconnected pavement, HSG D
594	98	Unconnected roofs, HSG D
15,322	95	Weighted Average
3,345		21.83% Pervious Area
11,977		78.17% Impervious Area
11,977		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.8	50	0.0150	1.10		**Sheet Flow, Pavement** Smooth surfaces n= 0.011 P2= 3.40"
2.2	425	0.0450	3.18		**Shallow Concentrated Flow, Grassed Swale** Grassed Waterway Kv= 15.0 fps
3.0	475	Total, Increased to minimum Tc = 5.0 min			

Subcatchment PR3B: Drains to Sidewalk Curb Inlet



Summary for Subcatchment PR3C: Platform Canopy

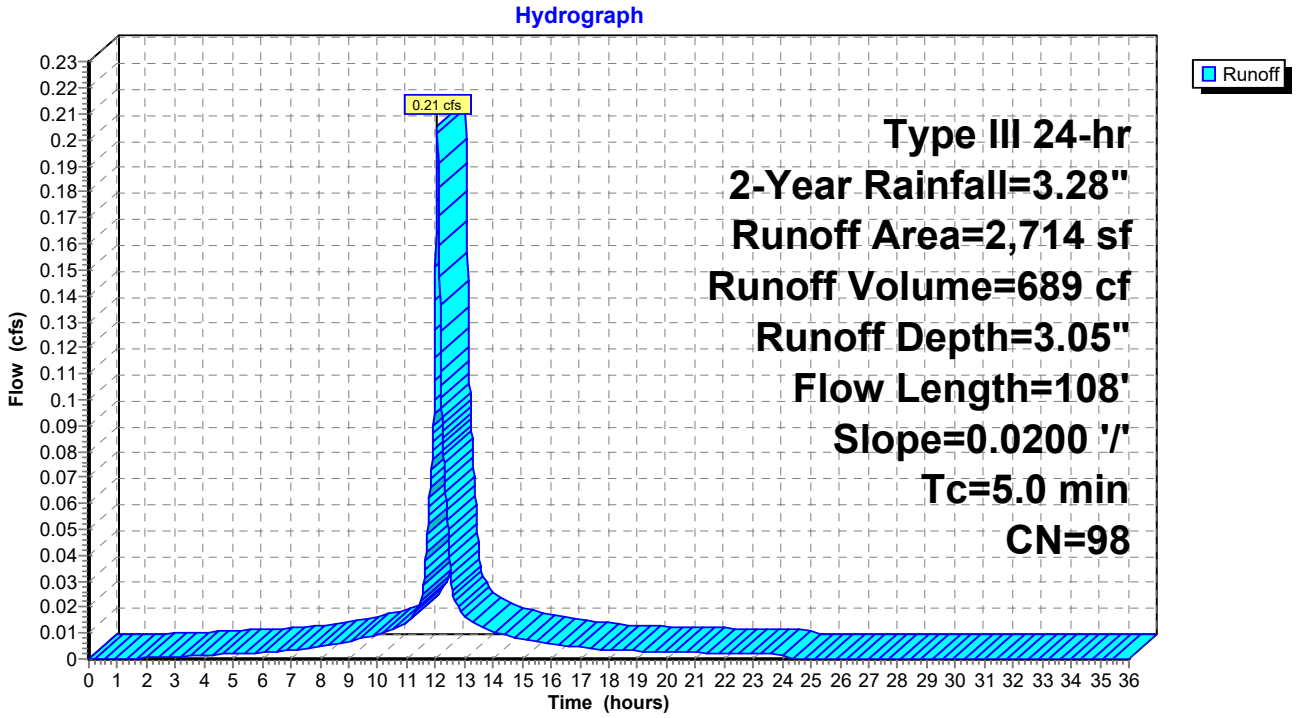
Runoff = 0.21 cfs @ 12.07 hrs, Volume= 689 cf, Depth= 3.05"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-Year Rainfall=3.28"

Area (sf)	CN	Description
2,714	98	Unconnected roofs, HSG D
2,714		100.00% Impervious Area
2,714		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.7	50	0.0200	1.23		**Sheet Flow, Roof** Smooth surfaces n= 0.011 P2= 3.40"
0.3	58	0.0200	2.87		**Shallow Concentrated Flow, Roof** Paved Kv= 20.3 fps
1.0	108	Total, Increased to minimum Tc = 5.0 min			

Subcatchment PR3C: Platform Canopy



Summary for Subcatchment PR3D: Drains to Bioretention Basin

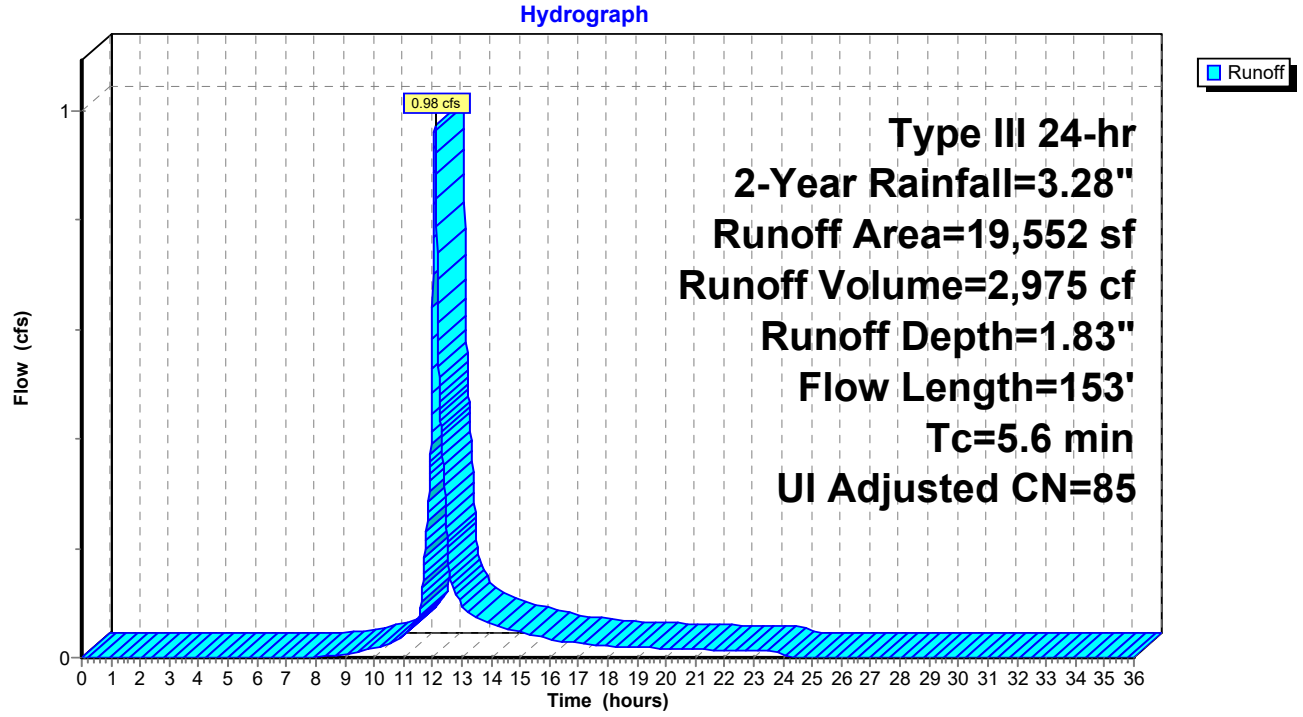
Runoff = 0.98 cfs @ 12.08 hrs, Volume= 2,975 cf, Depth= 1.83"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-Year Rainfall=3.28"

Area (sf)	CN	Adj	Description
11,983	84		50-75% Grass cover, Fair, HSG D
354	96		Gravel surface, HSG D
2,099	98		Unconnected pavement, HSG D
576	98		Unconnected roofs, HSG D
4,539	82		Woods/grass comb., Fair, HSG D
19,552	86	85	Weighted Average, UI Adjusted
16,877			86.32% Pervious Area
2,675			13.68% Impervious Area
2,675			100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.9	40	0.1625	0.23		**Sheet Flow, Slope** Grass: Dense n= 0.240 P2= 3.40"
2.7	113	0.0100	0.70		**Shallow Concentrated Flow, Trees** Short Grass Pasture Kv= 7.0 fps
5.6	153	Total			

Subcatchment PR3D: Drains to Bioretention Basin



Summary for Subcatchment PR4: Drains to Bioretention Basin

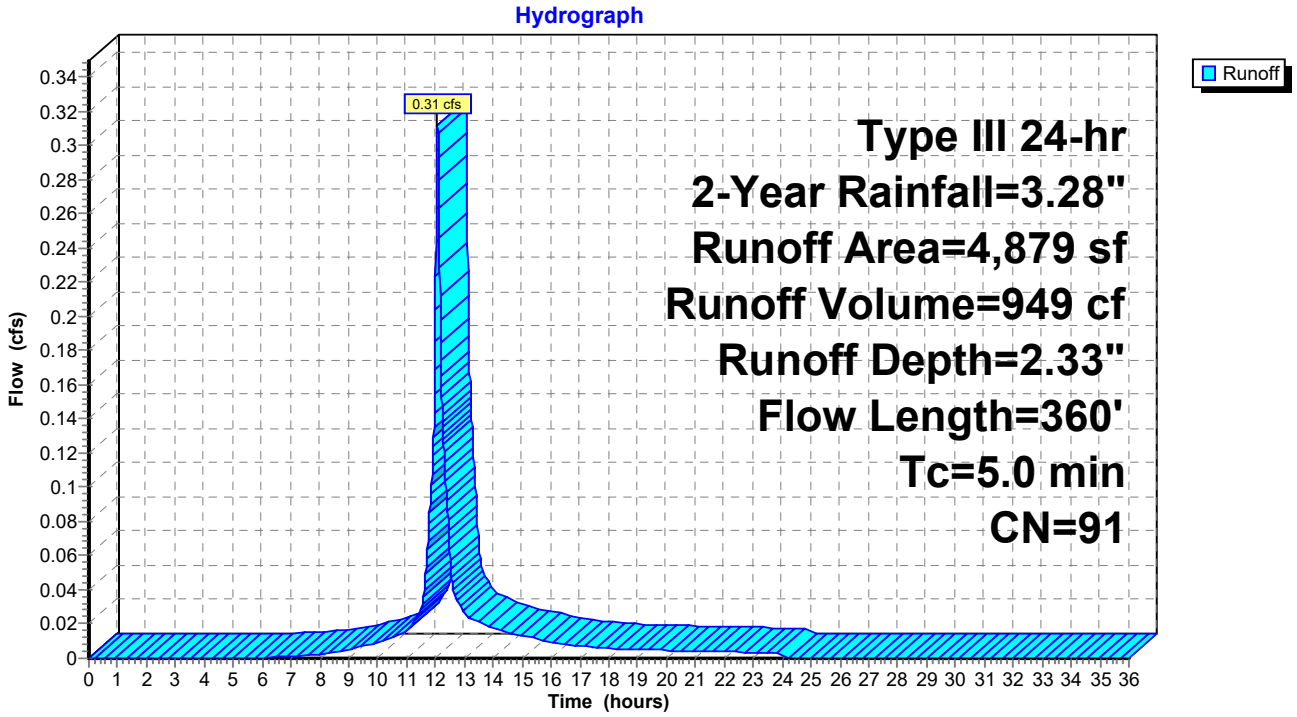
Runoff = 0.31 cfs @ 12.07 hrs, Volume= 949 cf, Depth= 2.33"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-Year Rainfall=3.28"

Area (sf)	CN	Description
2,214	84	50-75% Grass cover, Fair, HSG D
1,156	96	Gravel surface, HSG D
1,361	98	Unconnected pavement, HSG D
148	98	Unconnected roofs, HSG D
4,879	91	Weighted Average
3,370		69.07% Pervious Area
1,509		30.93% Impervious Area
1,509		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.0	50	0.0070	0.81		**Sheet Flow, Pavement** Smooth surfaces n= 0.011 P2= 3.40"
0.5	50	0.0070	1.70		**Shallow Concentrated Flow, Pavement** Paved Kv= 20.3 fps
0.0	6	0.5000	10.61		**Shallow Concentrated Flow, Slope** Grassed Waterway Kv= 15.0 fps
3.4	254	0.0070	1.25		**Shallow Concentrated Flow, Grass** Grassed Waterway Kv= 15.0 fps
4.9	360	Total, Increased to minimum Tc = 5.0 min			

Subcatchment PR4: Drains to Bioretention Basin



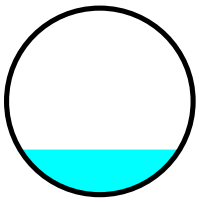
Summary for Reach 2R: Roof Drain

Inflow Area = 2,714 sf,100.00% Impervious, Inflow Depth = 3.05" for 2-Year event
Inflow = 0.21 cfs @ 12.07 hrs, Volume= 689 cf
Outflow = 0.21 cfs @ 12.08 hrs, Volume= 689 cf, Atten= 0%, Lag= 0.4 min

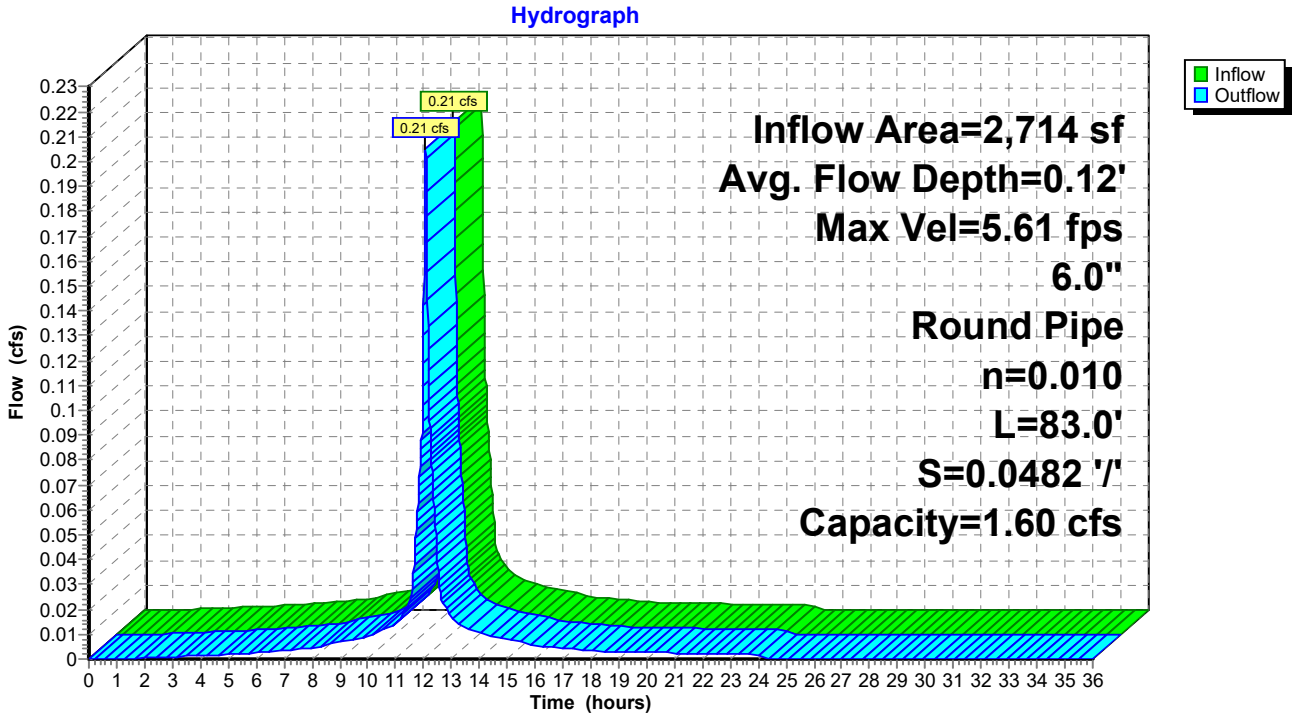
Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Max. Velocity= 5.61 fps, Min. Travel Time= 0.2 min
Avg. Velocity = 1.82 fps, Avg. Travel Time= 0.8 min

Peak Storage= 3 cf @ 12.07 hrs
Average Depth at Peak Storage= 0.12'
Bank-Full Depth= 0.50' Flow Area= 0.2 sf, Capacity= 1.60 cfs

6.0" Round Pipe
n= 0.010 PVC, smooth interior
Length= 83.0' Slope= 0.0482 '/'
Inlet Invert= 11.00', Outlet Invert= 7.00'



Reach 2R: Roof Drain



Summary for Pond 1P: Bioretention Basin

Inflow Area = 37,588 sf, 46.20% Impervious, Inflow Depth = 2.22" for 2-Year event
Inflow = 2.27 cfs @ 12.08 hrs, Volume= 6,952 cf
Outflow = 0.13 cfs @ 14.03 hrs, Volume= 6,952 cf, Atten= 94%, Lag= 117.1 min
Primary = 0.13 cfs @ 14.03 hrs, Volume= 6,952 cf
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Peak Elev= 5.81' @ 14.03 hrs Surf.Area= 2,744 sf Storage= 3,583 cf

Plug-Flow detention time= 312.1 min calculated for 6,950 cf (100% of inflow)
Center-of-Mass det. time= 312.1 min (1,117.9 - 805.8)

Volume	Invert	Avail.Storage	Storage Description
#1	2.50'	7,392 cf	**Bioretention Basin (Conic)** Listed below (Recalc)

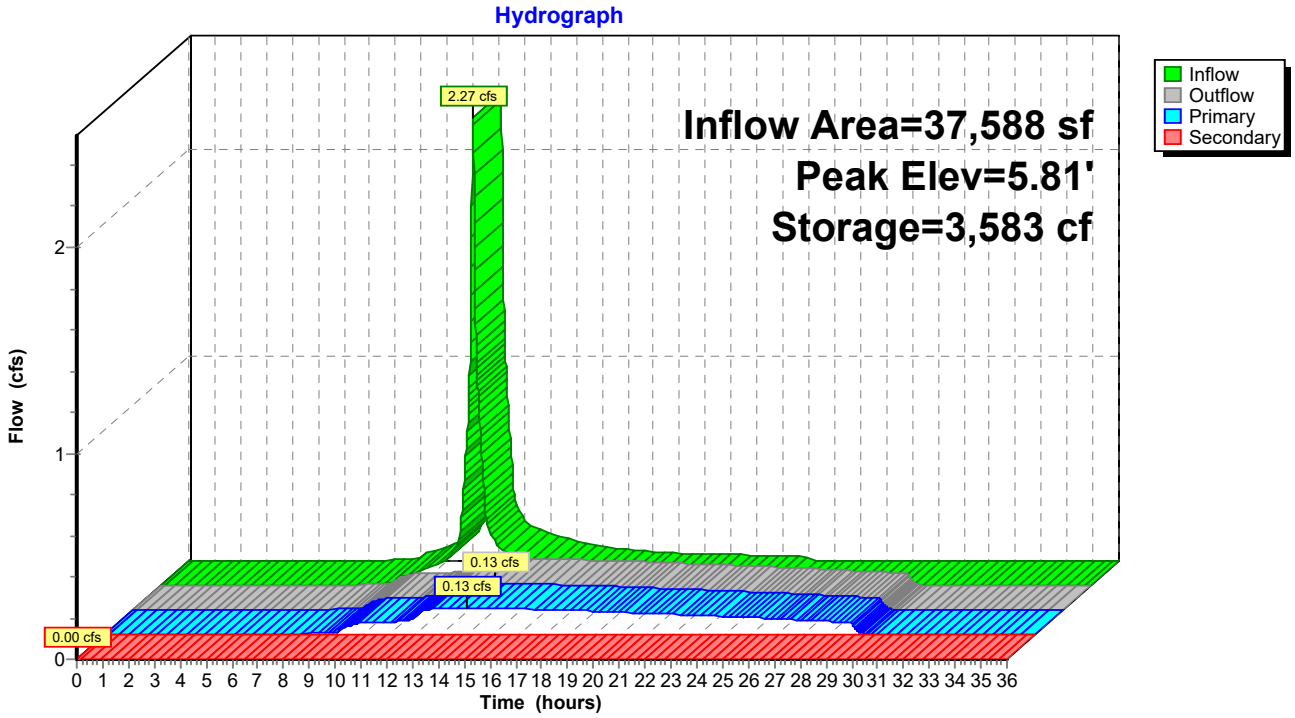
Elevation (feet)	Surf.Area (sq-ft)	Voids (%)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
2.50	2,513	0.0	0	0	2,513
3.50	2,513	30.0	754	754	2,691
5.50	2,513	40.0	2,010	2,764	3,046
6.00	2,888	100.0	1,349	4,113	3,432
6.50	3,277	100.0	1,540	5,654	3,833
7.00	3,680	100.0	1,738	7,392	4,250

Device	Routing	Invert	Outlet Devices
#1	Primary	2.20'	**15.0" Round Culvert** L= 113.6' RCP, mitered to conform to fill, Ke= 0.700 Inlet / Outlet Invert= 2.20' / 1.60' S= 0.0053 '/' Cc= 0.900 n= 0.012, Flow Area= 1.23 sf
#2	Device 1	2.90'	**15.0" Round Culvert** L= 82.2' RCP, mitered to conform to fill, Ke= 0.700 Inlet / Outlet Invert= 2.90' / 2.40' S= 0.0061 '/' Cc= 0.900 n= 0.012, Flow Area= 1.23 sf
#3	Device 1	2.50'	**1.000 in/hr Exfiltration over Surface area** Conductivity to Groundwater Elevation = -0.50'
#4	Secondary	6.80'	**Stone Overflow, Cv= 2.62 (C= 3.28)** Head (feet) 0.00 0.50 1.00 Width (feet) 4.00 6.00 8.00
#5	Device 1	6.00'	**Nyloplast 12" Dome Grate** Head (feet) 0.00 0.10 0.20 0.40 0.75 1.10 Disch. (cfs) 0.000 0.300 0.850 1.400 2.100 2.400
#6	Device 2	6.10'	**Nyloplast 12" Dome Grate** Head (feet) 0.00 0.10 0.20 0.40 0.75 1.10 Disch. (cfs) 0.000 0.300 0.850 1.400 2.100 2.400

Primary OutFlow Max=0.13 cfs @ 14.03 hrs HW=5.81' (Free Discharge)
└─**1=Culvert** (Passes 0.13 cfs of 8.52 cfs potential flow)
  └─**2=Culvert** (Passes 0.00 cfs of 7.88 cfs potential flow)
    └─**6=Nyloplast 12" Dome Grate** (Controls 0.00 cfs)
  └─**3=Exfiltration** (Controls 0.13 cfs)
  └─**5=Nyloplast 12" Dome Grate** (Controls 0.00 cfs)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=2.50' (Free Discharge)
└─**4=Stone Overflow** (Controls 0.00 cfs)

Pond 1P: Bioretention Basin



Summary for Pond 1SF: Sediment Forebay

Inflow Area = 15,322 sf, 78.17% Impervious, Inflow Depth = 2.72" for 2-Year event
Inflow = 1.10 cfs @ 12.07 hrs, Volume= 3,477 cf
Outflow = 1.10 cfs @ 12.07 hrs, Volume= 3,288 cf, Atten= 0%, Lag= 0.2 min
Primary = 1.10 cfs @ 12.07 hrs, Volume= 3,288 cf

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Peak Elev= 6.58' @ 12.07 hrs Surf.Area= 310 sf Storage= 212 cf

Plug-Flow detention time= 50.3 min calculated for 3,287 cf (95% of inflow)
Center-of-Mass det. time= 19.9 min (799.2 - 779.3)

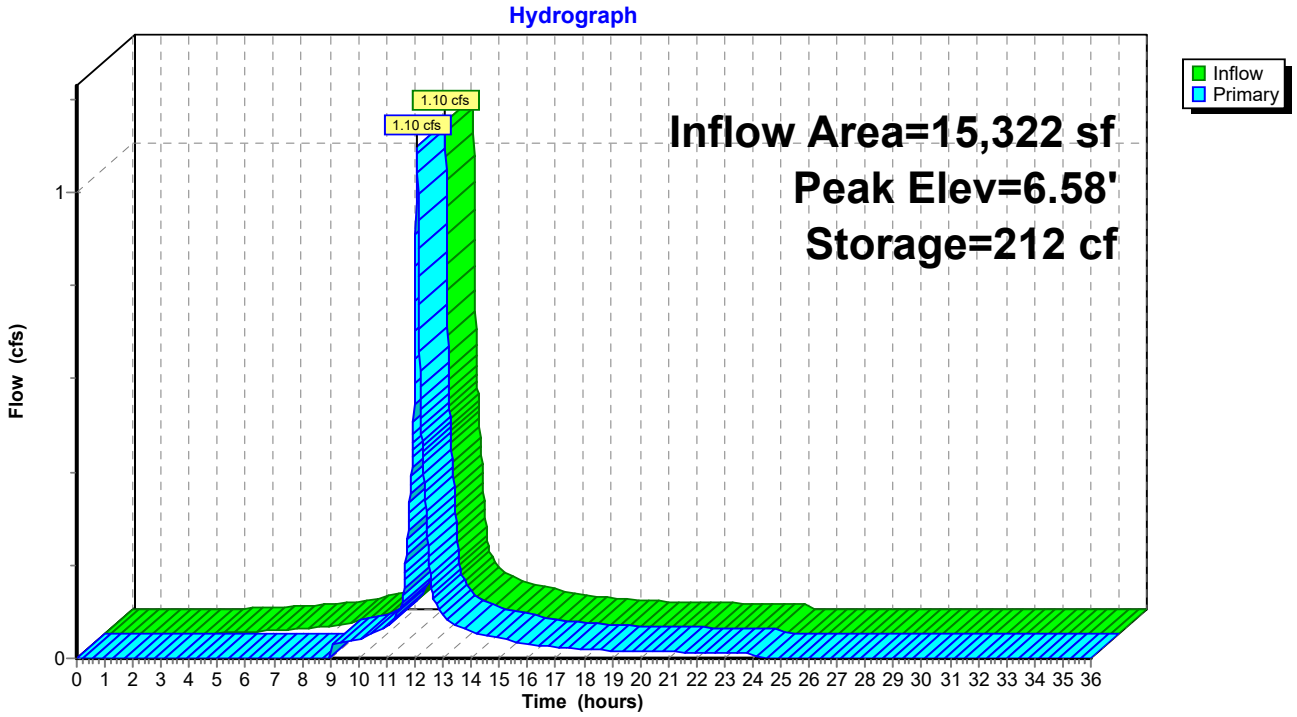
Volume	Invert	Avail.Storage	Storage Description
#1	5.50'	599 cf	**Sediment Forebay (Conic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
5.50	99	0	0	99
6.00	186	70	70	188
6.50	295	119	189	301
7.00	400	173	362	411
7.50	550	237	599	566

Device	Routing	Invert	Outlet Devices
#1	Primary	6.50'	**Stone Overflow, Cv= 2.62 (C= 3.28)** Head (feet) 0.00 0.50 1.00 Width (feet) 16.00 18.00 20.00

Primary OutFlow Max=1.09 cfs @ 12.07 hrs HW=6.58' (Free Discharge)
↑**1=Stone Overflow** (Weir Controls 1.09 cfs @ 0.90 fps)

Pond 1SF: Sediment Forebay



Summary for Pond 2P: Bioretention Basin

Inflow Area = 4,879 sf, 30.93% Impervious, Inflow Depth = 2.33" for 2-Year event
Inflow = 0.31 cfs @ 12.07 hrs, Volume= 949 cf
Outflow = 0.29 cfs @ 12.10 hrs, Volume= 949 cf, Atten= 7%, Lag= 1.8 min
Primary = 0.29 cfs @ 12.10 hrs, Volume= 949 cf
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Peak Elev= 9.62' @ 12.10 hrs Surf.Area= 223 sf Storage= 220 cf

Plug-Flow detention time= 99.7 min calculated for 948 cf (100% of inflow)
Center-of-Mass det. time= 99.7 min (900.3 - 800.7)

Volume	Invert	Avail.Storage	Storage Description
#1	5.50'	317 cf	**Bioretention Swale and Basin (Prismatic)** Listed below (Recalc)

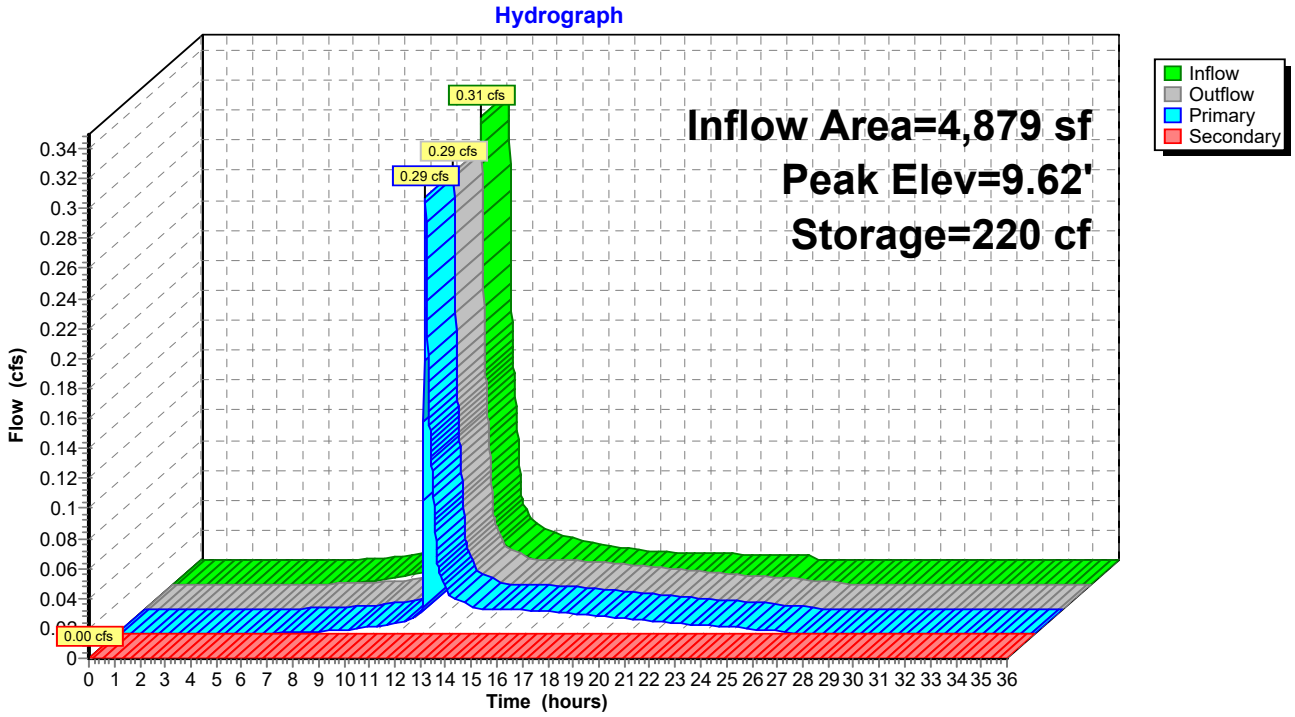
Elevation (feet)	Surf.Area (sq-ft)	Voids (%)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
5.50	62	0.0	0	0
6.50	62	30.0	19	19
8.50	62	40.0	50	68
9.00	120	100.0	46	114
9.50	201	100.0	80	194
10.00	290	100.0	123	317

Device	Routing	Invert	Outlet Devices
#1	Primary	5.00'	**8.0" Round Culvert** L= 150.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 5.00' / 3.50' S= 0.0100 '/' Cc= 0.900 n= 0.010 PVC, smooth interior, Flow Area= 0.35 sf
#2	Device 1	5.50'	**1.000 in/hr Exfiltration over Surface area** Conductivity to Groundwater Elevation = 5.00'
#3	Device 1	9.50'	**Nyloplast 8" Dome Grate** Head (feet) 0.00 0.10 0.20 0.40 0.75 1.10 Disch. (cfs) 0.000 0.220 0.450 0.630 0.840 1.050
#4	Secondary	9.80'	**Stone Overflow, Cv= 2.62 (C= 3.28)** Head (feet) 0.00 0.50 1.00 Width (feet) 4.00 6.00 8.00

Primary OutFlow Max=0.29 cfs @ 12.10 hrs HW=9.62' (Free Discharge)
└**1=Culvert** (Passes 0.29 cfs of 2.61 cfs potential flow)
  ├**2=Exfiltration** (Controls 0.02 cfs)
  └**3=Nyloplast 8" Dome Grate** (Custom Controls 0.27 cfs)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=5.50' (Free Discharge)
└**4=Stone Overflow** (Controls 0.00 cfs)

Pond 2P: Bioretention Basin



Summary for Pond 2SF: Sediment Forebay

Inflow Area = 4,879 sf, 30.93% Impervious, Inflow Depth = 2.33" for 2-Year event
Inflow = 0.31 cfs @ 12.07 hrs, Volume= 949 cf
Outflow = 0.31 cfs @ 12.07 hrs, Volume= 949 cf, Atten= 0%, Lag= 0.0 min
Primary = 0.31 cfs @ 12.07 hrs, Volume= 949 cf

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Peak Elev= 9.53' @ 12.07 hrs Surf.Area= 15 sf Storage= 0 cf

Plug-Flow detention time= 0.0 min calculated for 948 cf (100% of inflow)
Center-of-Mass det. time= 0.0 min (800.7 - 800.6)

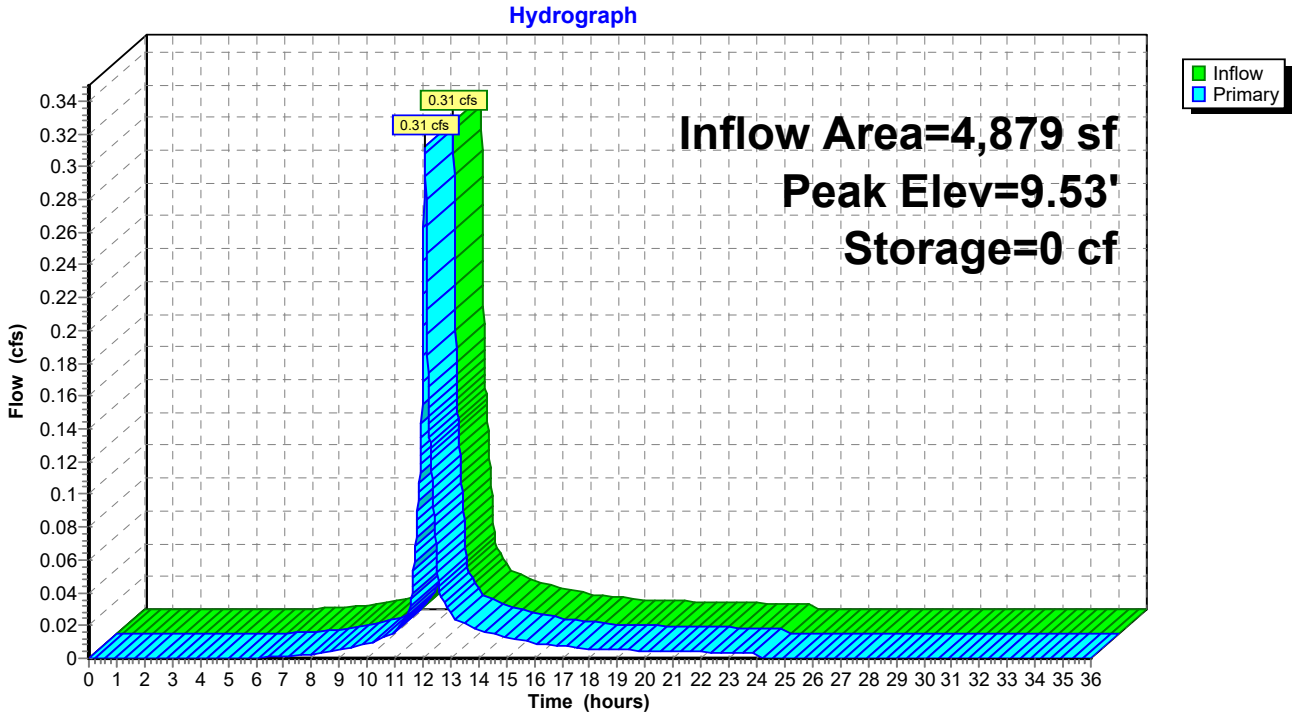
Volume	Invert	Avail.Storage	Storage Description
#1	9.50'	13 cf	**Sediment Forebay (Conic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
9.50	14	0	0	14
10.00	42	13	13	43

Device	Routing	Invert	Outlet Devices
#1	Primary	9.50'	**Stone Overflow, Cv= 2.62 (C= 3.28)** Head (feet) 0.00 0.50 1.00 Width (feet) 16.00 18.00 20.00

Primary OutFlow Max=0.31 cfs @ 12.07 hrs HW=9.53' (Free Discharge)
↑—**1=Stone Overflow** (Weir Controls 0.31 cfs @ 0.59 fps)

Pond 2SF: Sediment Forebay

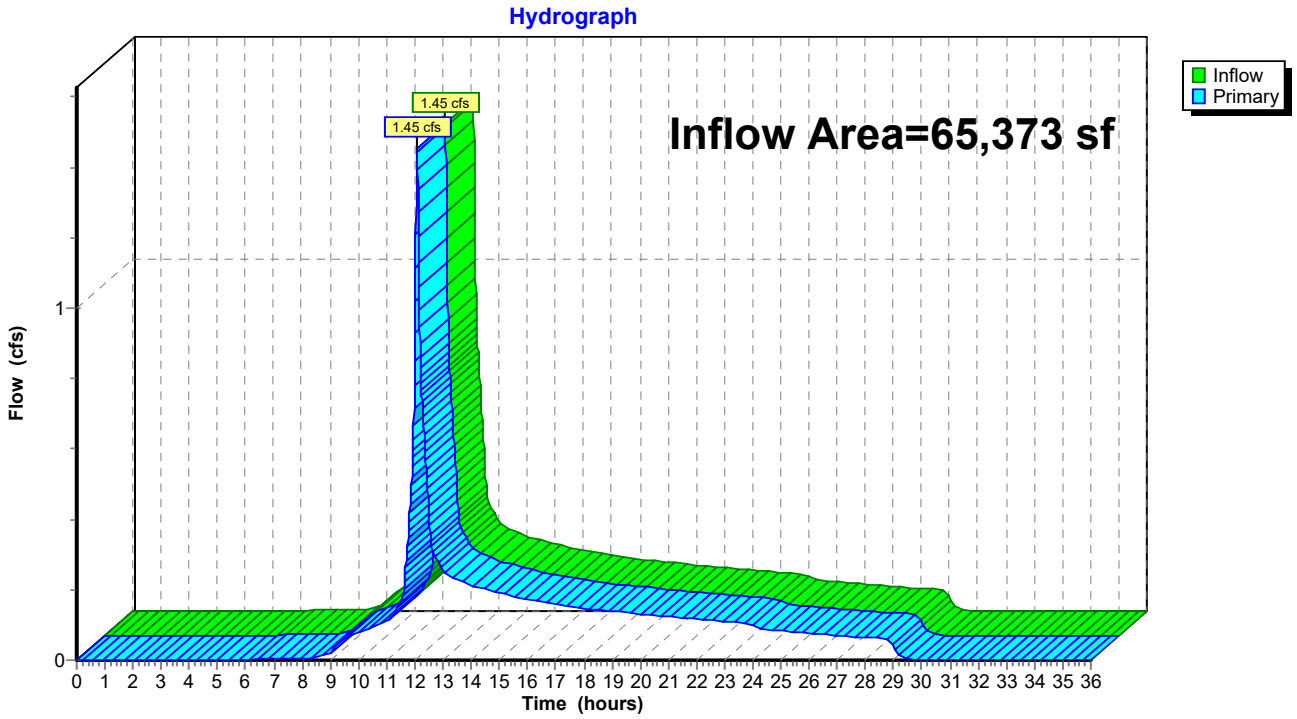


Summary for Link DP3: DP3

Inflow Area = 65,373 sf, 26.56% Impervious, Inflow Depth = 2.02" for 2-Year event
Inflow = 1.45 cfs @ 12.08 hrs, Volume= 11,003 cf
Primary = 1.45 cfs @ 12.08 hrs, Volume= 11,003 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

Link DP3: DP3

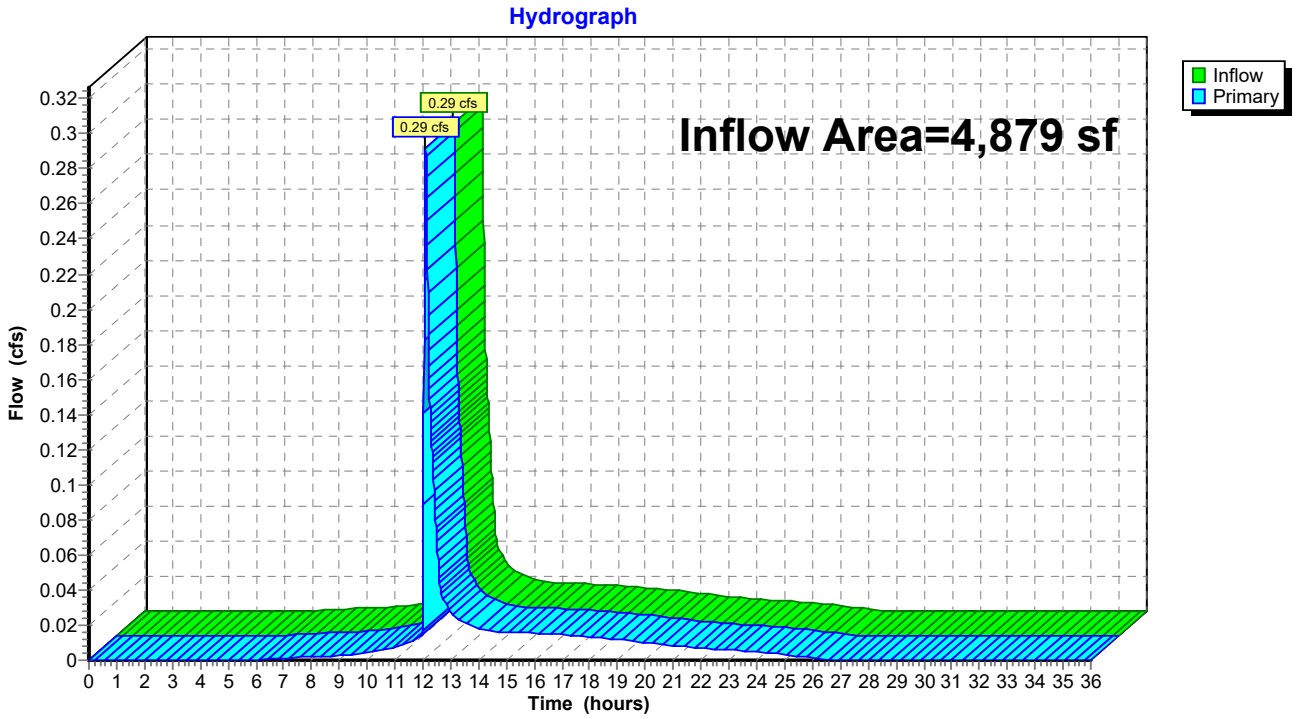


Summary for Link DP4: DP4

Inflow Area = 4,879 sf, 30.93% Impervious, Inflow Depth = 2.33" for 2-Year event
Inflow = 0.29 cfs @ 12.10 hrs, Volume= 949 cf
Primary = 0.29 cfs @ 12.10 hrs, Volume= 949 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

Link DP4: DP4



10-Year Storm Event- Proposed

Summary for Subcatchment PR3A: Landscape Area Draining to Pearl St

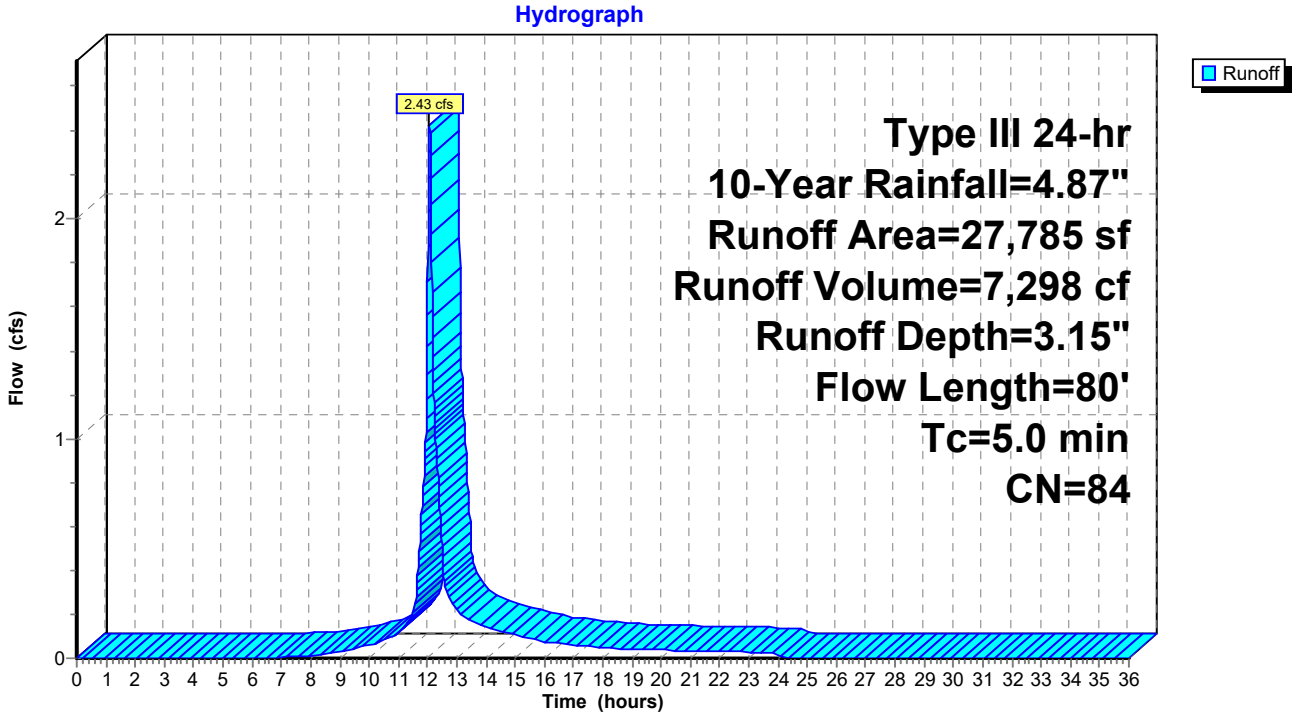
Runoff = 2.43 cfs @ 12.07 hrs, Volume= 7,298 cf, Depth= 3.15"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Rainfall=4.87"

Area (sf)	CN	Description
27,785	84	50-75% Grass cover, Fair, HSG D
27,785		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.4	5	0.0150	0.21		**Sheet Flow, Top of Hill - Utility Pad** Fallow n= 0.050 P2= 3.40"
2.4	45	0.3300	0.31		**Sheet Flow, Hill** Grass: Dense n= 0.240 P2= 3.40"
0.4	30	0.0350	1.31		**Shallow Concentrated Flow, Lawn** Short Grass Pasture Kv= 7.0 fps
3.2	80	Total, Increased to minimum Tc = 5.0 min			

Subcatchment PR3A: Landscape Area Draining to Pearl St



Summary for Subcatchment PR3B: Drains to Sidewalk Curb Inlet

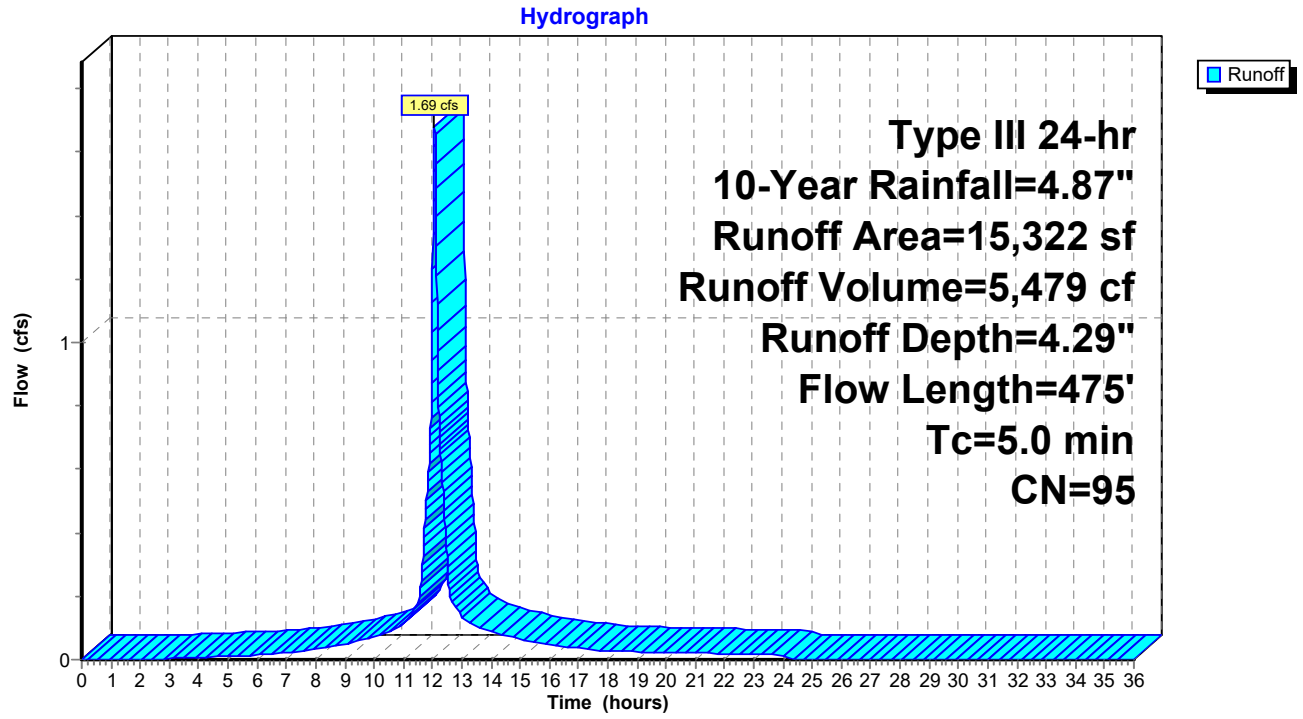
Runoff = 1.69 cfs @ 12.07 hrs, Volume= 5,479 cf, Depth= 4.29"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Rainfall=4.87"

Area (sf)	CN	Description
461	84	50-75% Grass cover, Fair, HSG D
2,477	80	>75% Grass cover, Good, HSG D
407	96	Gravel surface, HSG D
11,383	98	Unconnected pavement, HSG D
594	98	Unconnected roofs, HSG D
15,322	95	Weighted Average
3,345		21.83% Pervious Area
11,977		78.17% Impervious Area
11,977		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.8	50	0.0150	1.10		**Sheet Flow, Pavement** Smooth surfaces n= 0.011 P2= 3.40"
2.2	425	0.0450	3.18		**Shallow Concentrated Flow, Grassed Swale** Grassed Waterway Kv= 15.0 fps
3.0	475	Total, Increased to minimum Tc = 5.0 min			

Subcatchment PR3B: Drains to Sidewalk Curb Inlet



Summary for Subcatchment PR3C: Platform Canopy

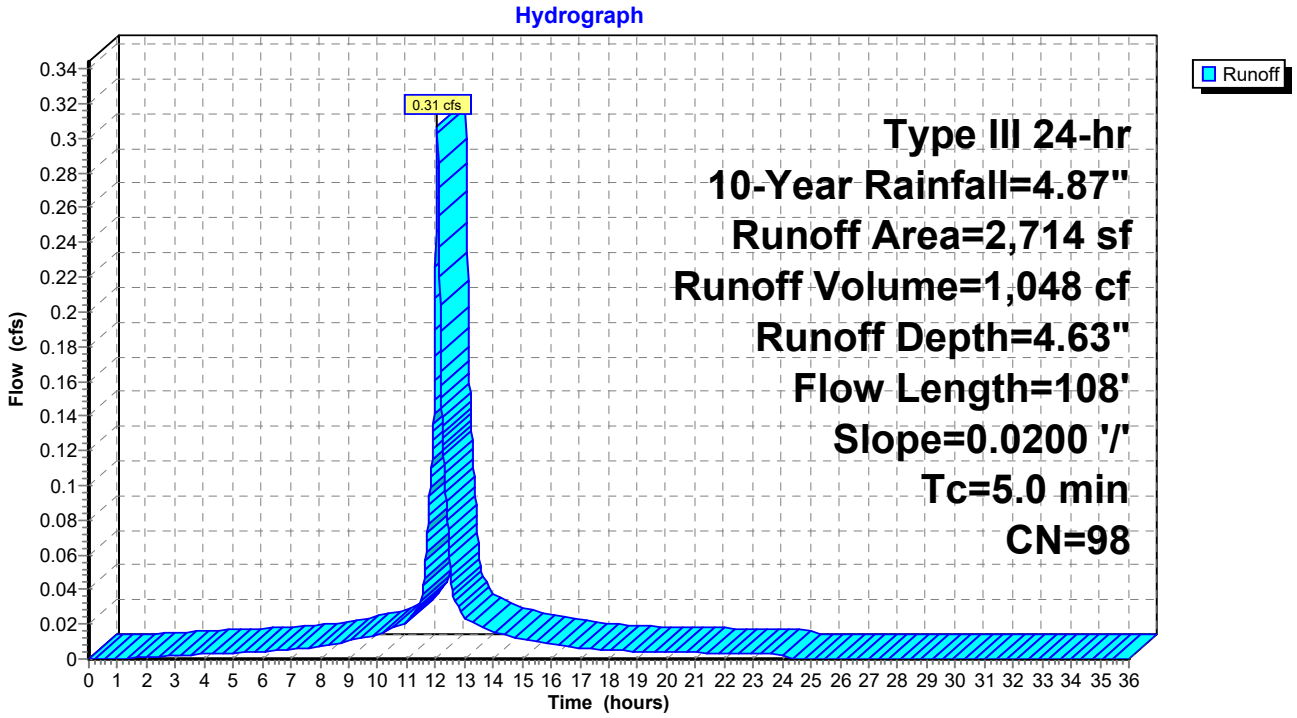
Runoff = 0.31 cfs @ 12.07 hrs, Volume= 1,048 cf, Depth= 4.63"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Rainfall=4.87"

Area (sf)	CN	Description
2,714	98	Unconnected roofs, HSG D
2,714		100.00% Impervious Area
2,714		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.7	50	0.0200	1.23		**Sheet Flow, Roof** Smooth surfaces n= 0.011 P2= 3.40"
0.3	58	0.0200	2.87		**Shallow Concentrated Flow, Roof** Paved Kv= 20.3 fps
1.0	108	Total, Increased to minimum Tc = 5.0 min			

Subcatchment PR3C: Platform Canopy



Summary for Subcatchment PR3D: Drains to Bioretention Basin

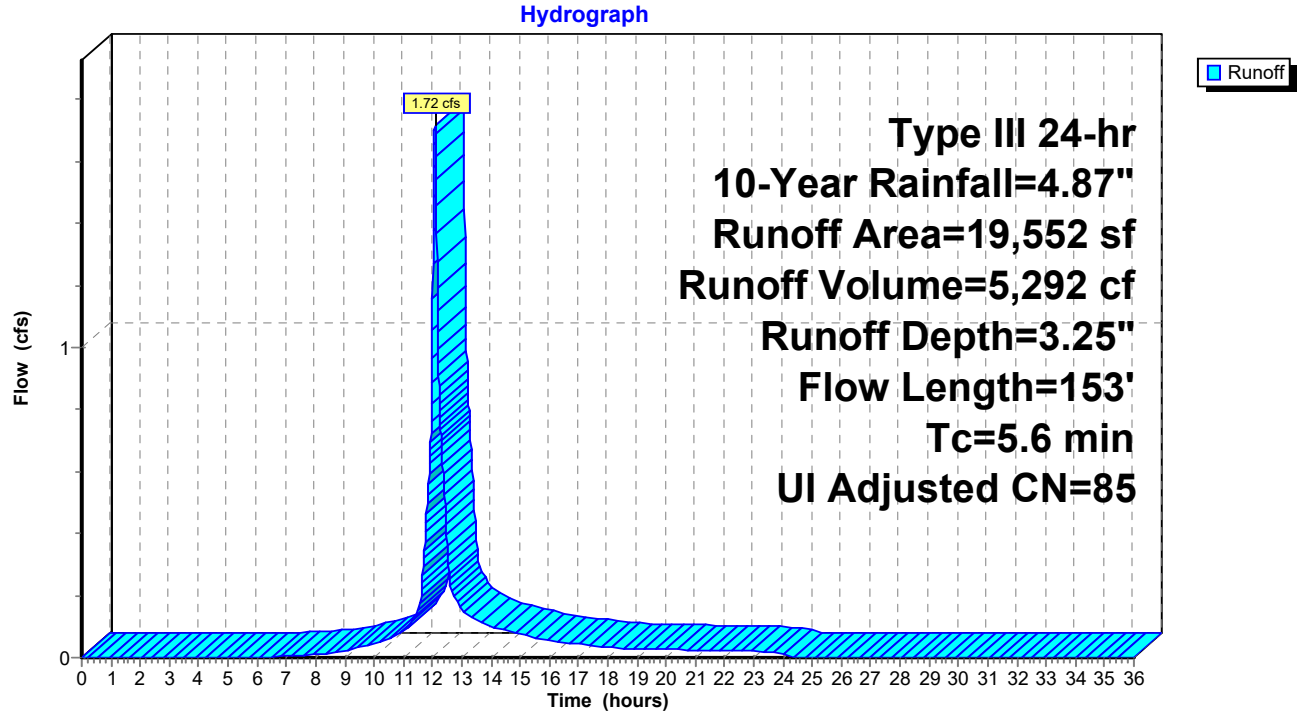
Runoff = 1.72 cfs @ 12.08 hrs, Volume= 5,292 cf, Depth= 3.25"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Rainfall=4.87"

Area (sf)	CN	Adj	Description
11,983	84		50-75% Grass cover, Fair, HSG D
354	96		Gravel surface, HSG D
2,099	98		Unconnected pavement, HSG D
576	98		Unconnected roofs, HSG D
4,539	82		Woods/grass comb., Fair, HSG D
19,552	86	85	Weighted Average, UI Adjusted
16,877			86.32% Pervious Area
2,675			13.68% Impervious Area
2,675			100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.9	40	0.1625	0.23		**Sheet Flow, Slope** Grass: Dense n= 0.240 P2= 3.40"
2.7	113	0.0100	0.70		**Shallow Concentrated Flow, Trees** Short Grass Pasture Kv= 7.0 fps
5.6	153	Total			

Subcatchment PR3D: Drains to Bioretention Basin



Summary for Subcatchment PR4: Drains to Bioretention Basin

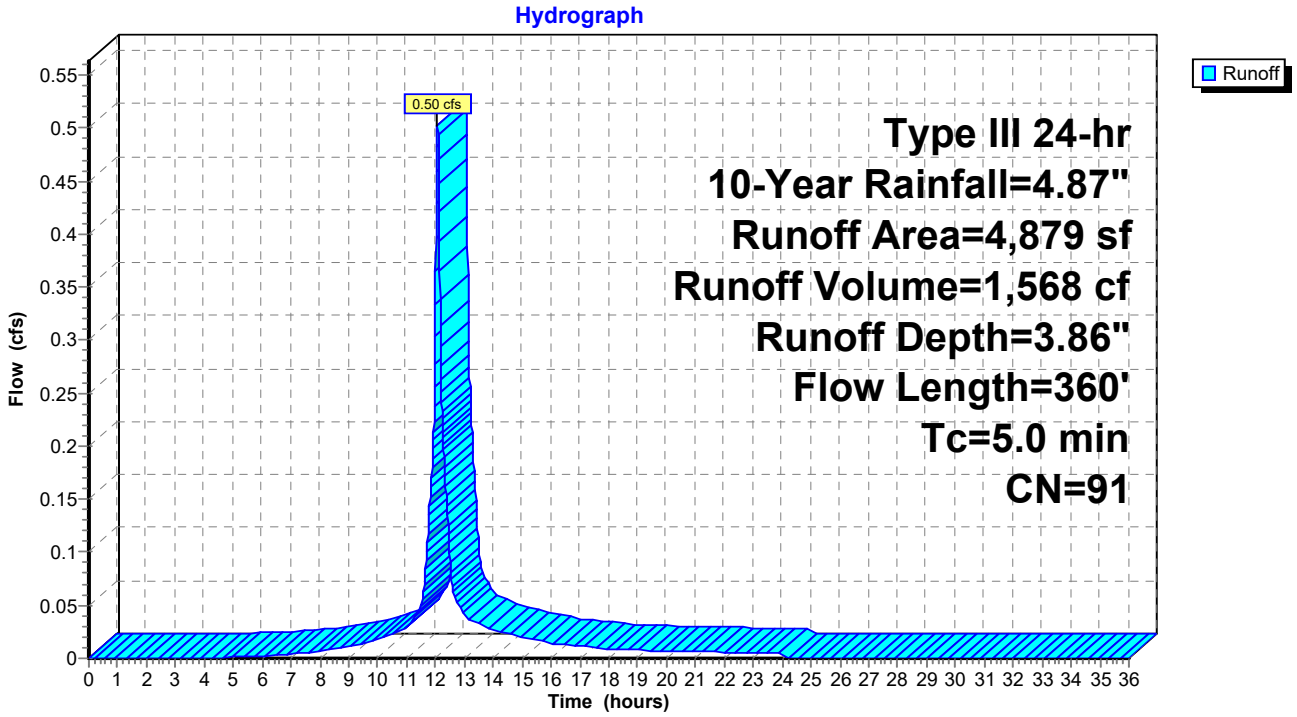
Runoff = 0.50 cfs @ 12.07 hrs, Volume= 1,568 cf, Depth= 3.86"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Rainfall=4.87"

Area (sf)	CN	Description
2,214	84	50-75% Grass cover, Fair, HSG D
1,156	96	Gravel surface, HSG D
1,361	98	Unconnected pavement, HSG D
148	98	Unconnected roofs, HSG D
4,879	91	Weighted Average
3,370		69.07% Pervious Area
1,509		30.93% Impervious Area
1,509		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.0	50	0.0070	0.81		**Sheet Flow, Pavement** Smooth surfaces n= 0.011 P2= 3.40"
0.5	50	0.0070	1.70		**Shallow Concentrated Flow, Pavement** Paved Kv= 20.3 fps
0.0	6	0.5000	10.61		**Shallow Concentrated Flow, Slope** Grassed Waterway Kv= 15.0 fps
3.4	254	0.0070	1.25		**Shallow Concentrated Flow, Grass** Grassed Waterway Kv= 15.0 fps
4.9	360	Total, Increased to minimum Tc = 5.0 min			

Subcatchment PR4: Drains to Bioretention Basin



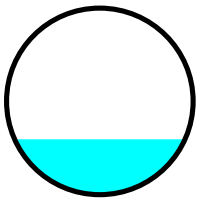
Summary for Reach 2R: Roof Drain

Inflow Area = 2,714 sf,100.00% Impervious, Inflow Depth = 4.63" for 10-Year event
Inflow = 0.31 cfs @ 12.07 hrs, Volume= 1,048 cf
Outflow = 0.31 cfs @ 12.08 hrs, Volume= 1,048 cf, Atten= 0%, Lag= 0.4 min

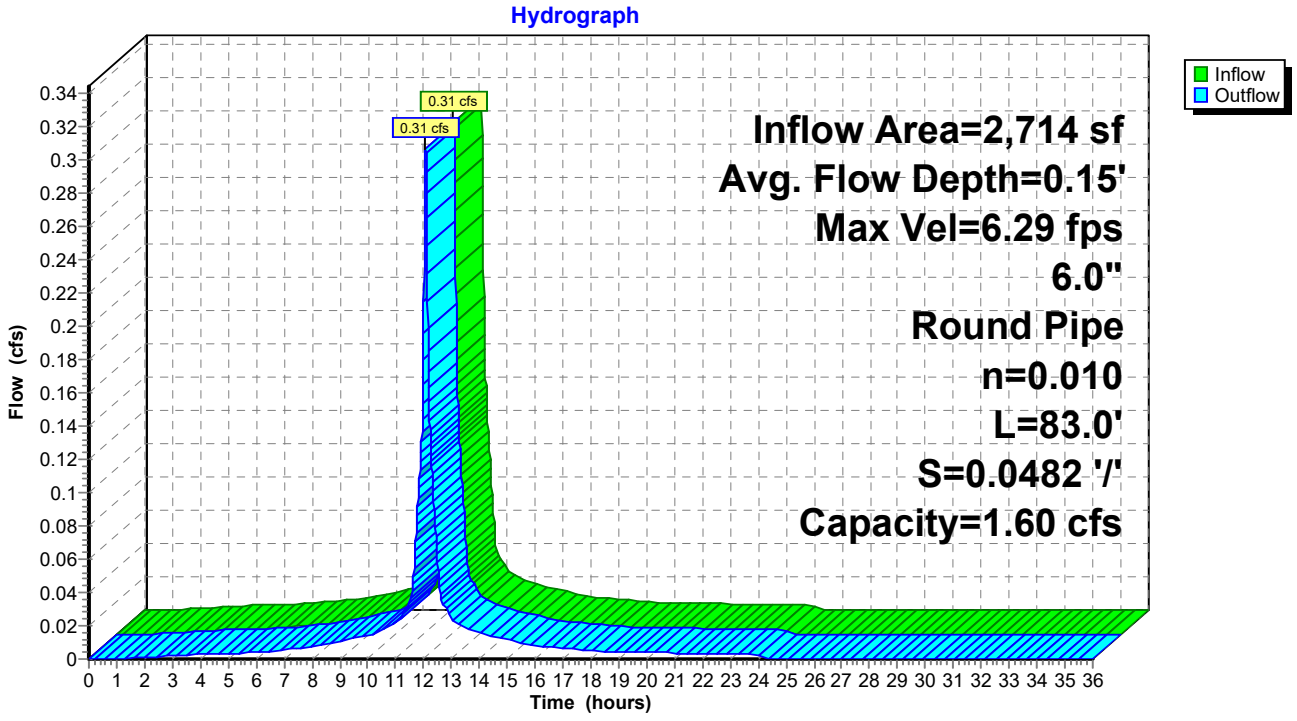
Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Max. Velocity= 6.29 fps, Min. Travel Time= 0.2 min
Avg. Velocity = 2.06 fps, Avg. Travel Time= 0.7 min

Peak Storage= 4 cf @ 12.07 hrs
Average Depth at Peak Storage= 0.15'
Bank-Full Depth= 0.50' Flow Area= 0.2 sf, Capacity= 1.60 cfs

6.0" Round Pipe
n= 0.010 PVC, smooth interior
Length= 83.0' Slope= 0.0482 '/'
Inlet Invert= 11.00', Outlet Invert= 7.00'



Reach 2R: Roof Drain



Summary for Pond 1P: Bioretention Basin

Inflow Area = 37,588 sf, 46.20% Impervious, Inflow Depth = 3.71" for 10-Year event
Inflow = 3.71 cfs @ 12.08 hrs, Volume= 11,629 cf
Outflow = 1.32 cfs @ 12.33 hrs, Volume= 11,629 cf, Atten= 64%, Lag= 15.4 min
Primary = 1.32 cfs @ 12.33 hrs, Volume= 11,629 cf
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Peak Elev= 6.20' @ 12.33 hrs Surf.Area= 3,043 sf Storage= 4,715 cf

Plug-Flow detention time= 269.7 min calculated for 11,629 cf (100% of inflow)
Center-of-Mass det. time= 269.7 min (1,061.3 - 791.6)

Volume	Invert	Avail.Storage	Storage Description
#1	2.50'	7,392 cf	**Bioretention Basin (Conic)** Listed below (Recalc)

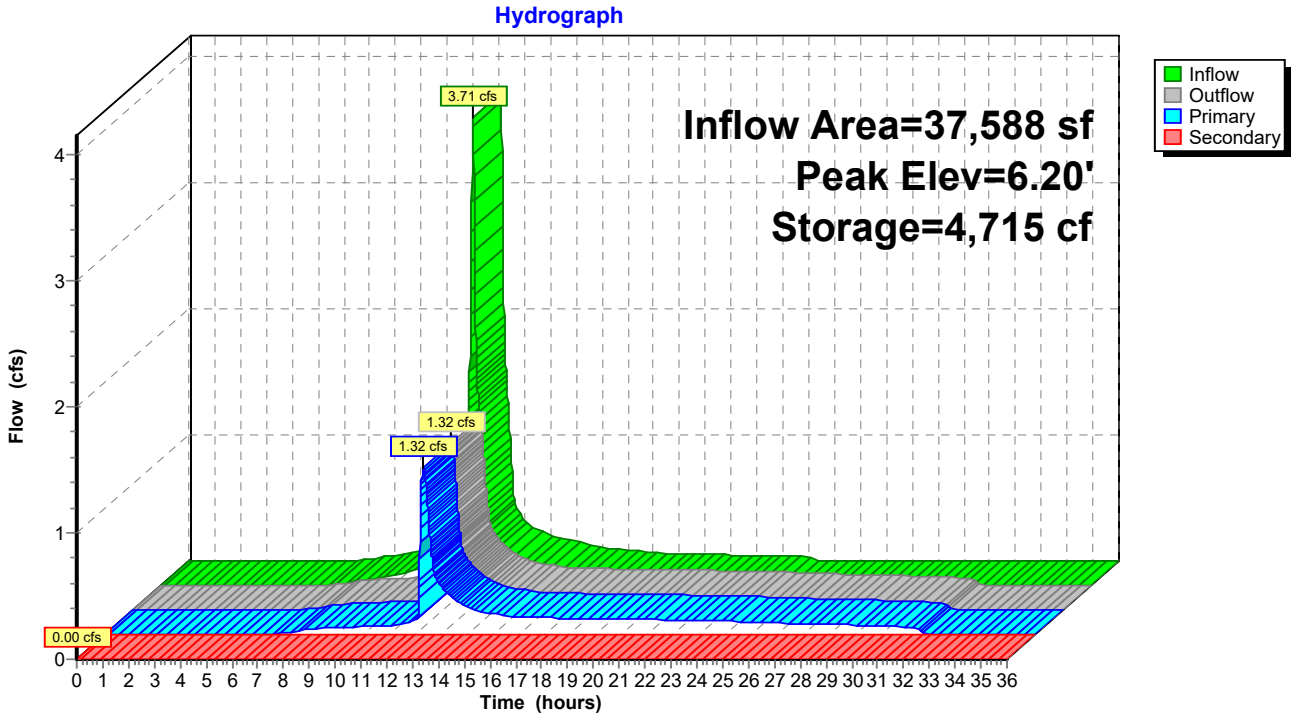
Elevation (feet)	Surf.Area (sq-ft)	Voids (%)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
2.50	2,513	0.0	0	0	2,513
3.50	2,513	30.0	754	754	2,691
5.50	2,513	40.0	2,010	2,764	3,046
6.00	2,888	100.0	1,349	4,113	3,432
6.50	3,277	100.0	1,540	5,654	3,833
7.00	3,680	100.0	1,738	7,392	4,250

Device	Routing	Invert	Outlet Devices
#1	Primary	2.20'	**15.0" Round Culvert** L= 113.6' RCP, mitered to conform to fill, Ke= 0.700 Inlet / Outlet Invert= 2.20' / 1.60' S= 0.0053 '/' Cc= 0.900 n= 0.012, Flow Area= 1.23 sf
#2	Device 1	2.90'	**15.0" Round Culvert** L= 82.2' RCP, mitered to conform to fill, Ke= 0.700 Inlet / Outlet Invert= 2.90' / 2.40' S= 0.0061 '/' Cc= 0.900 n= 0.012, Flow Area= 1.23 sf
#3	Device 1	2.50'	**1.000 in/hr Exfiltration over Surface area** Conductivity to Groundwater Elevation = -0.50'
#4	Secondary	6.80'	**Stone Overflow, Cv= 2.62 (C= 3.28)** Head (feet) 0.00 0.50 1.00 Width (feet) 4.00 6.00 8.00
#5	Device 1	6.00'	**Nyloplast 12" Dome Grate** Head (feet) 0.00 0.10 0.20 0.40 0.75 1.10 Disch. (cfs) 0.000 0.300 0.850 1.400 2.100 2.400
#6	Device 2	6.10'	**Nyloplast 12" Dome Grate** Head (feet) 0.00 0.10 0.20 0.40 0.75 1.10 Disch. (cfs) 0.000 0.300 0.850 1.400 2.100 2.400

Primary OutFlow Max=1.32 cfs @ 12.33 hrs HW=6.20' (Free Discharge)
└─**1=Culvert** (Passes 1.32 cfs of 9.07 cfs potential flow)
  └─**2=Culvert** (Passes 0.32 cfs of 8.53 cfs potential flow)
    └─**6=Nyloplast 12" Dome Grate** (Custom Controls 0.32 cfs)
  └─**3=Exfiltration** (Controls 0.14 cfs)
  └─**5=Nyloplast 12" Dome Grate** (Custom Controls 0.86 cfs)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=2.50' (Free Discharge)
└─**4=Stone Overflow** (Controls 0.00 cfs)

Pond 1P: Bioretention Basin



Summary for Pond 1SF: Sediment Forebay

Inflow Area = 15,322 sf, 78.17% Impervious, Inflow Depth = 4.29" for 10-Year event
Inflow = 1.69 cfs @ 12.07 hrs, Volume= 5,479 cf
Outflow = 1.68 cfs @ 12.07 hrs, Volume= 5,289 cf, Atten= 0%, Lag= 0.2 min
Primary = 1.68 cfs @ 12.07 hrs, Volume= 5,289 cf

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Peak Elev= 6.60' @ 12.07 hrs Surf.Area= 315 sf Storage= 220 cf

Plug-Flow detention time= 36.4 min calculated for 5,288 cf (97% of inflow)
Center-of-Mass det. time= 15.7 min (783.7 - 768.0)

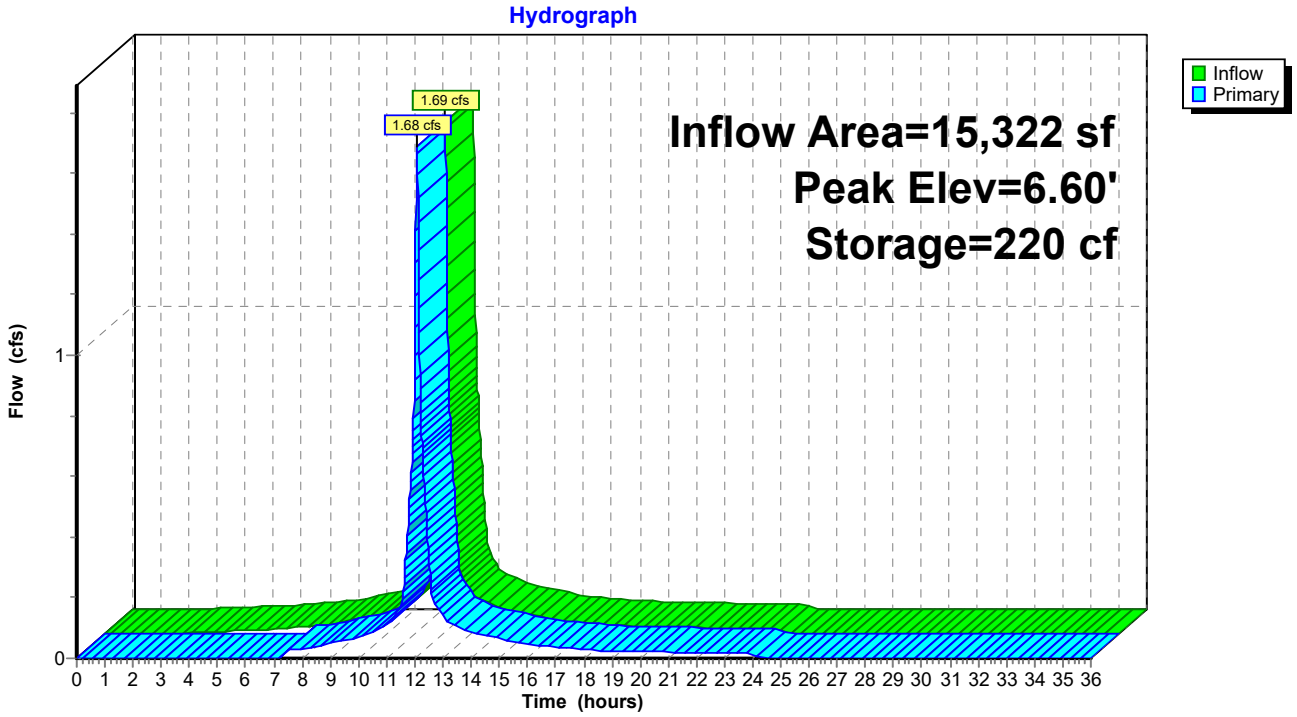
Volume	Invert	Avail.Storage	Storage Description
#1	5.50'	599 cf	**Sediment Forebay (Conic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
5.50	99	0	0	99
6.00	186	70	70	188
6.50	295	119	189	301
7.00	400	173	362	411
7.50	550	237	599	566

Device	Routing	Invert	Outlet Devices
#1	Primary	6.50'	**Stone Overflow, Cv= 2.62 (C= 3.28)** Head (feet) 0.00 0.50 1.00 Width (feet) 16.00 18.00 20.00

Primary OutFlow Max=1.68 cfs @ 12.07 hrs HW=6.60' (Free Discharge)
↑**1=Stone Overflow** (Weir Controls 1.68 cfs @ 1.03 fps)

Pond 1SF: Sediment Forebay



Summary for Pond 2P: Bioretention Basin

Inflow Area = 4,879 sf, 30.93% Impervious, Inflow Depth = 3.86" for 10-Year event
Inflow = 0.50 cfs @ 12.07 hrs, Volume= 1,568 cf
Outflow = 0.47 cfs @ 12.10 hrs, Volume= 1,568 cf, Atten= 6%, Lag= 1.6 min
Primary = 0.47 cfs @ 12.10 hrs, Volume= 1,568 cf
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Peak Elev= 9.70' @ 12.10 hrs Surf.Area= 237 sf Storage= 239 cf

Plug-Flow detention time= 80.1 min calculated for 1,567 cf (100% of inflow)
Center-of-Mass det. time= 80.1 min (866.9 - 786.8)

Volume	Invert	Avail.Storage	Storage Description
#1	5.50'	317 cf	**Bioretention Swale and Basin (Prismatic)** Listed below (Recalc)

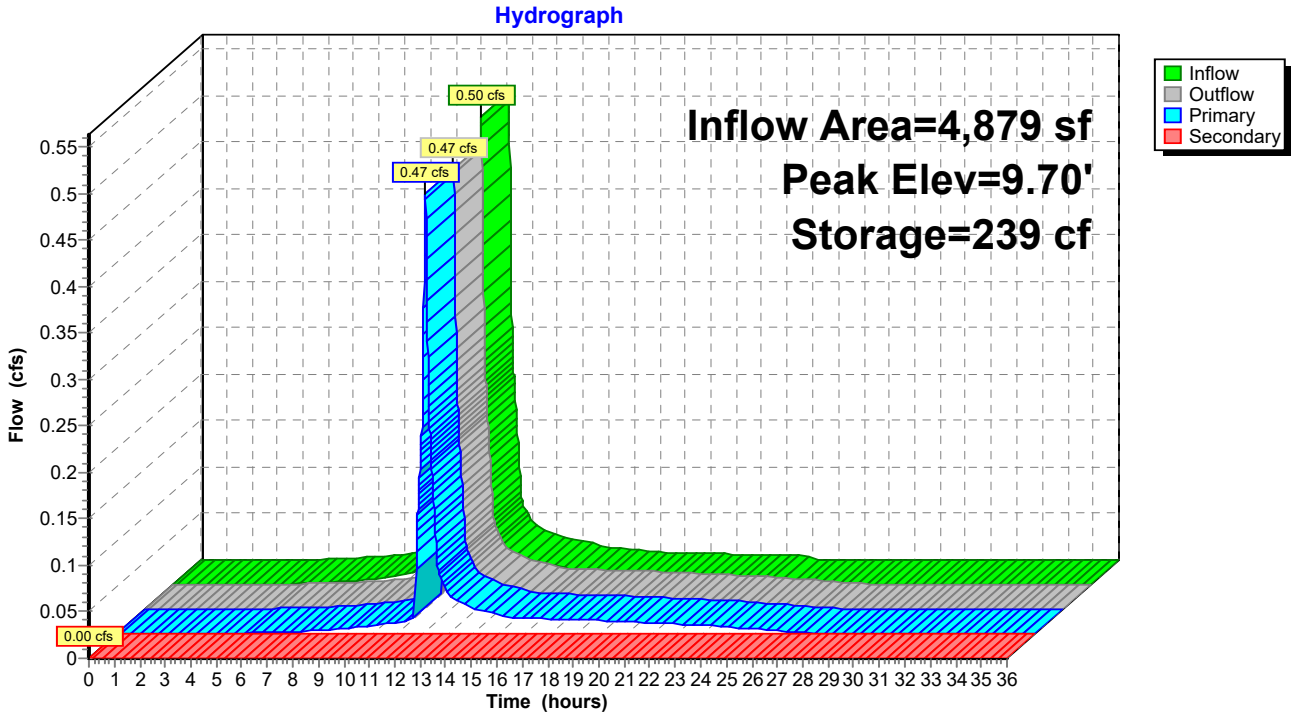
Elevation (feet)	Surf.Area (sq-ft)	Voids (%)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
5.50	62	0.0	0	0
6.50	62	30.0	19	19
8.50	62	40.0	50	68
9.00	120	100.0	46	114
9.50	201	100.0	80	194
10.00	290	100.0	123	317

Device	Routing	Invert	Outlet Devices
#1	Primary	5.00'	**8.0" Round Culvert** L= 150.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 5.00' / 3.50' S= 0.0100 '/' Cc= 0.900 n= 0.010 PVC, smooth interior, Flow Area= 0.35 sf
#2	Device 1	5.50'	**1.000 in/hr Exfiltration over Surface area** Conductivity to Groundwater Elevation = 5.00'
#3	Device 1	9.50'	**Nyloplast 8" Dome Grate** Head (feet) 0.00 0.10 0.20 0.40 0.75 1.10 Disch. (cfs) 0.000 0.220 0.450 0.630 0.840 1.050
#4	Secondary	9.80'	**Stone Overflow, Cv= 2.62 (C= 3.28)** Head (feet) 0.00 0.50 1.00 Width (feet) 4.00 6.00 8.00

Primary OutFlow Max=0.47 cfs @ 12.10 hrs HW=9.70' (Free Discharge)
└**1=Culvert** (Passes 0.47 cfs of 2.63 cfs potential flow)
  ├**2=Exfiltration** (Controls 0.02 cfs)
  └**3=Nyloplast 8" Dome Grate** (Custom Controls 0.45 cfs)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=5.50' (Free Discharge)
└**4=Stone Overflow** (Controls 0.00 cfs)

Pond 2P: Bioretention Basin



Summary for Pond 2SF: Sediment Forebay

Inflow Area = 4,879 sf, 30.93% Impervious, Inflow Depth = 3.86" for 10-Year event
Inflow = 0.50 cfs @ 12.07 hrs, Volume= 1,568 cf
Outflow = 0.50 cfs @ 12.07 hrs, Volume= 1,568 cf, Atten= 0%, Lag= 0.0 min
Primary = 0.50 cfs @ 12.07 hrs, Volume= 1,568 cf

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Peak Elev= 9.54' @ 12.07 hrs Surf.Area= 16 sf Storage= 1 cf

Plug-Flow detention time= 0.0 min calculated for 1,567 cf (100% of inflow)
Center-of-Mass det. time= 0.0 min (786.8 - 786.8)

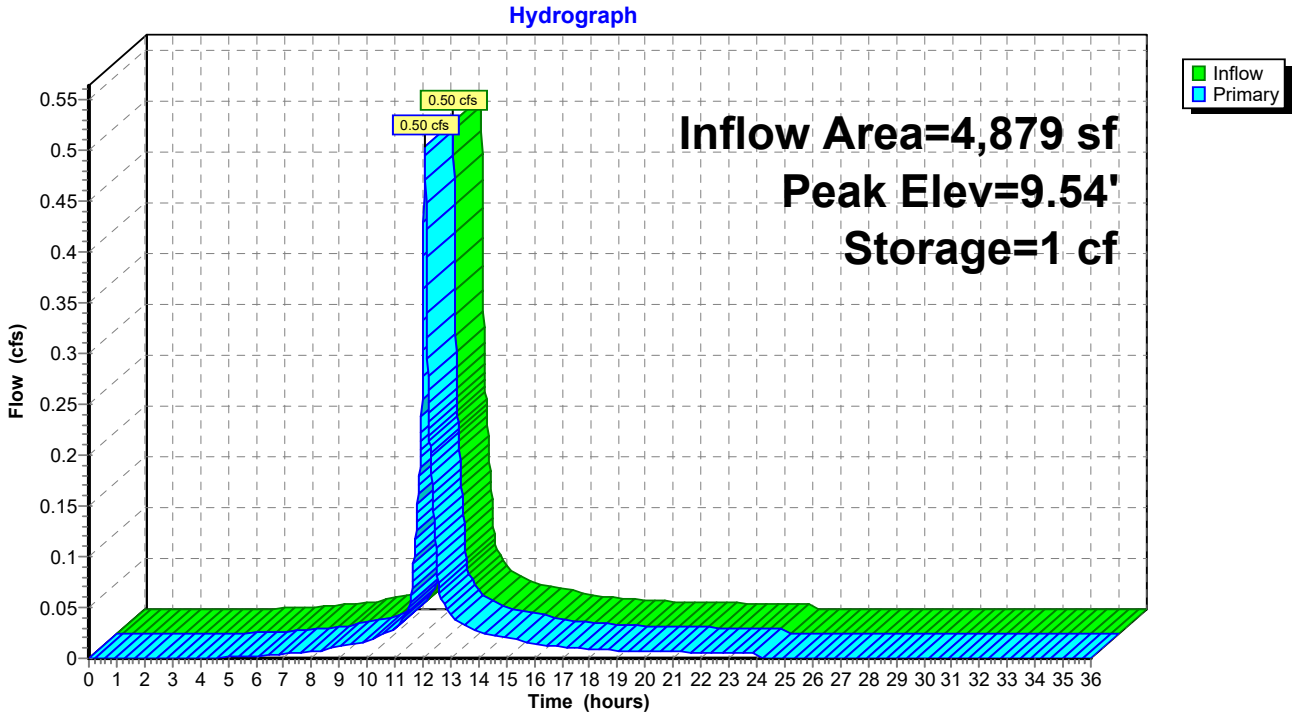
Volume	Invert	Avail.Storage	Storage Description
#1	9.50'	13 cf	**Sediment Forebay (Conic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
9.50	14	0	0	14
10.00	42	13	13	43

Device	Routing	Invert	Outlet Devices
#1	Primary	9.50'	**Stone Overflow, Cv= 2.62 (C= 3.28)** Head (feet) 0.00 0.50 1.00 Width (feet) 16.00 18.00 20.00

Primary OutFlow Max=0.50 cfs @ 12.07 hrs HW=9.54' (Free Discharge)
↑—**1=Stone Overflow** (Weir Controls 0.50 cfs @ 0.69 fps)

Pond 2SF: Sediment Forebay

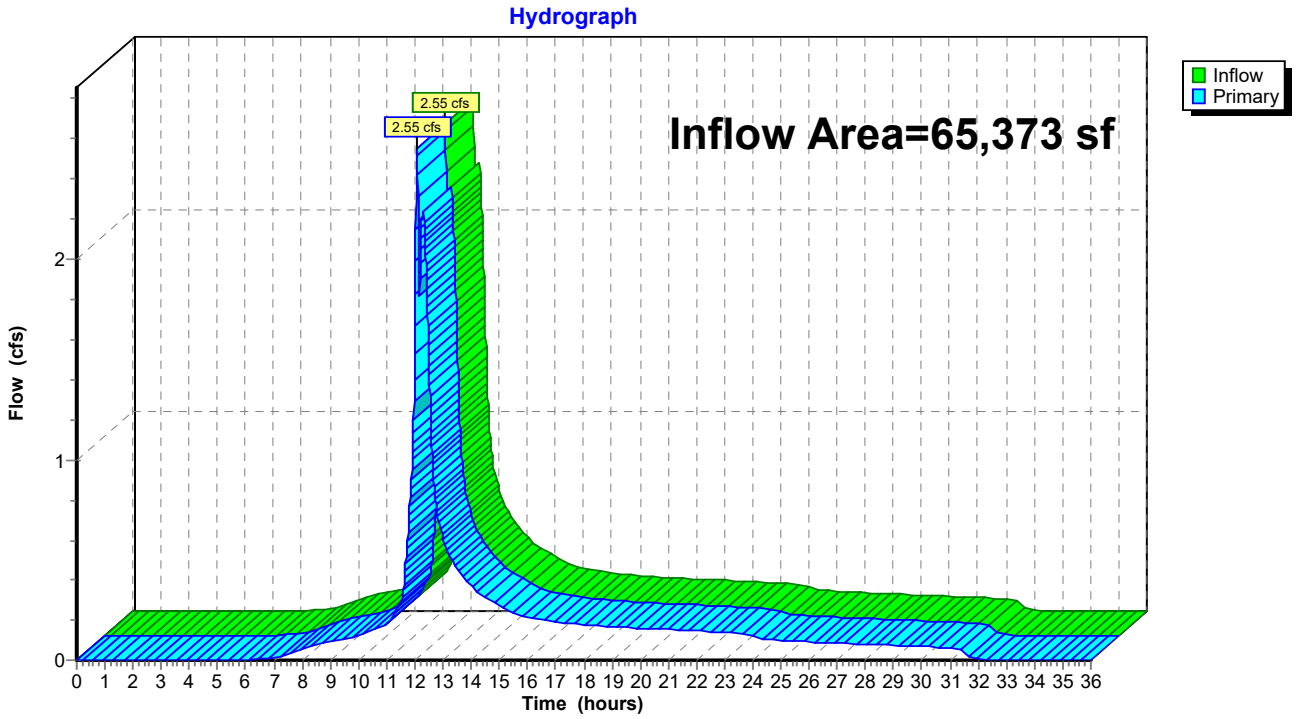


Summary for Link DP3: DP3

Inflow Area = 65,373 sf, 26.56% Impervious, Inflow Depth = 3.47" for 10-Year event
Inflow = 2.55 cfs @ 12.07 hrs, Volume= 18,927 cf
Primary = 2.55 cfs @ 12.07 hrs, Volume= 18,927 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

Link DP3: DP3

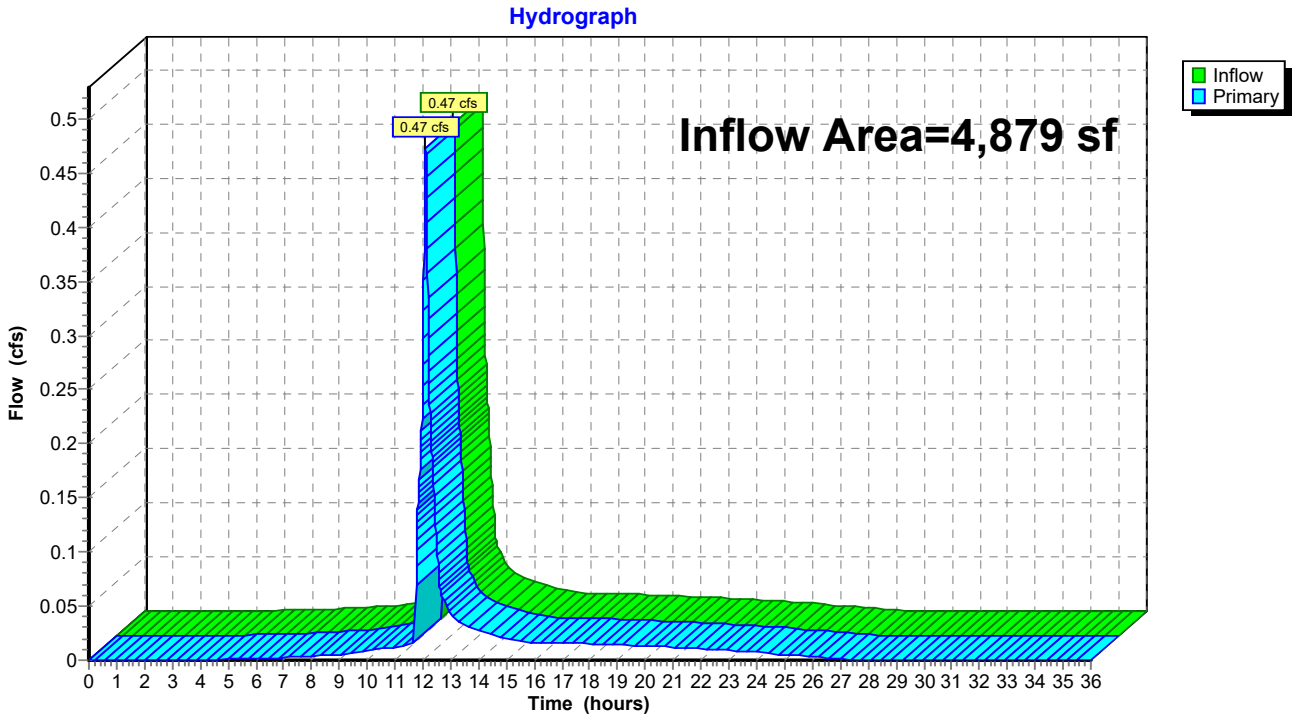


Summary for Link DP4: DP4

Inflow Area = 4,879 sf, 30.93% Impervious, Inflow Depth = 3.86" for 10-Year event
Inflow = 0.47 cfs @ 12.10 hrs, Volume= 1,568 cf
Primary = 0.47 cfs @ 12.10 hrs, Volume= 1,568 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

Link DP4: DP4



100-Year Storm Event – Proposed

Summary for Subcatchment PR3A: Landscape Area Draining to Pearl St

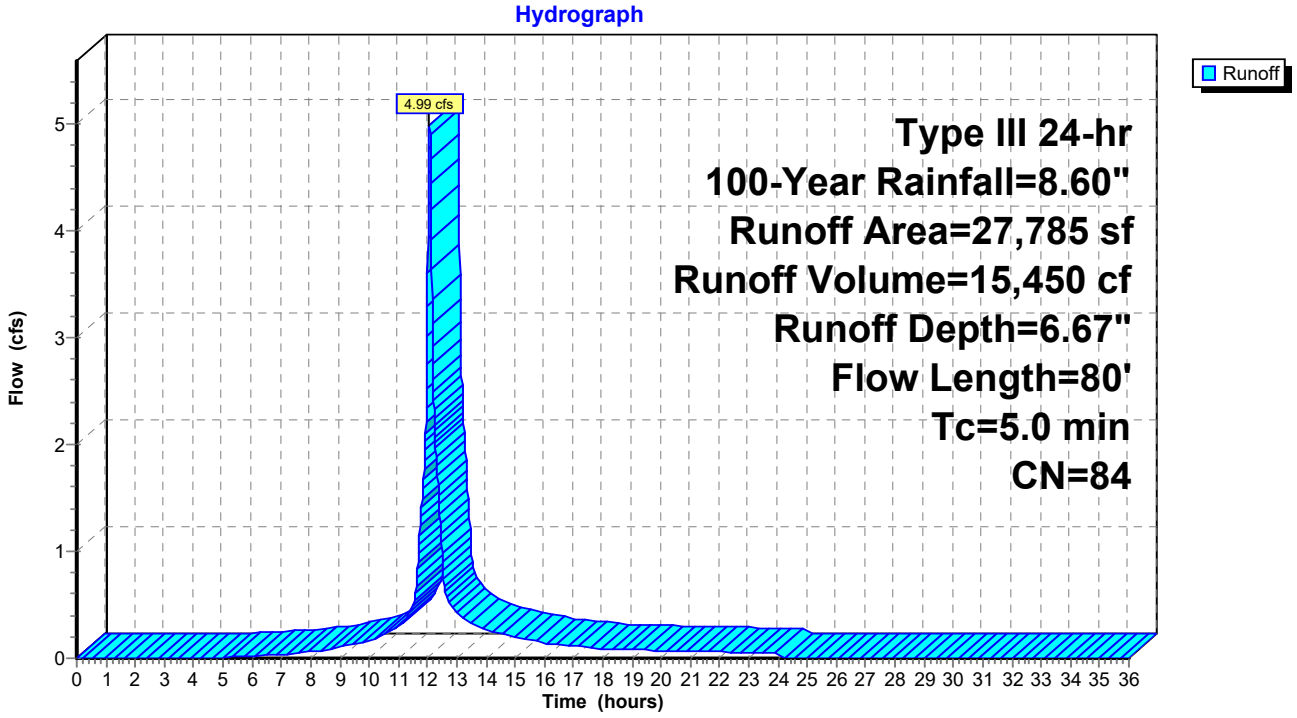
Runoff = 4.99 cfs @ 12.07 hrs, Volume= 15,450 cf, Depth= 6.67"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Rainfall=8.60"

Area (sf)	CN	Description
27,785	84	50-75% Grass cover, Fair, HSG D
27,785		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.4	5	0.0150	0.21		**Sheet Flow, Top of Hill - Utility Pad** Fallow n= 0.050 P2= 3.40"
2.4	45	0.3300	0.31		**Sheet Flow, Hill** Grass: Dense n= 0.240 P2= 3.40"
0.4	30	0.0350	1.31		**Shallow Concentrated Flow, Lawn** Short Grass Pasture Kv= 7.0 fps
3.2	80	Total, Increased to minimum Tc = 5.0 min			

Subcatchment PR3A: Landscape Area Draining to Pearl St



Summary for Subcatchment PR3B: Drains to Sidewalk Curb Inlet

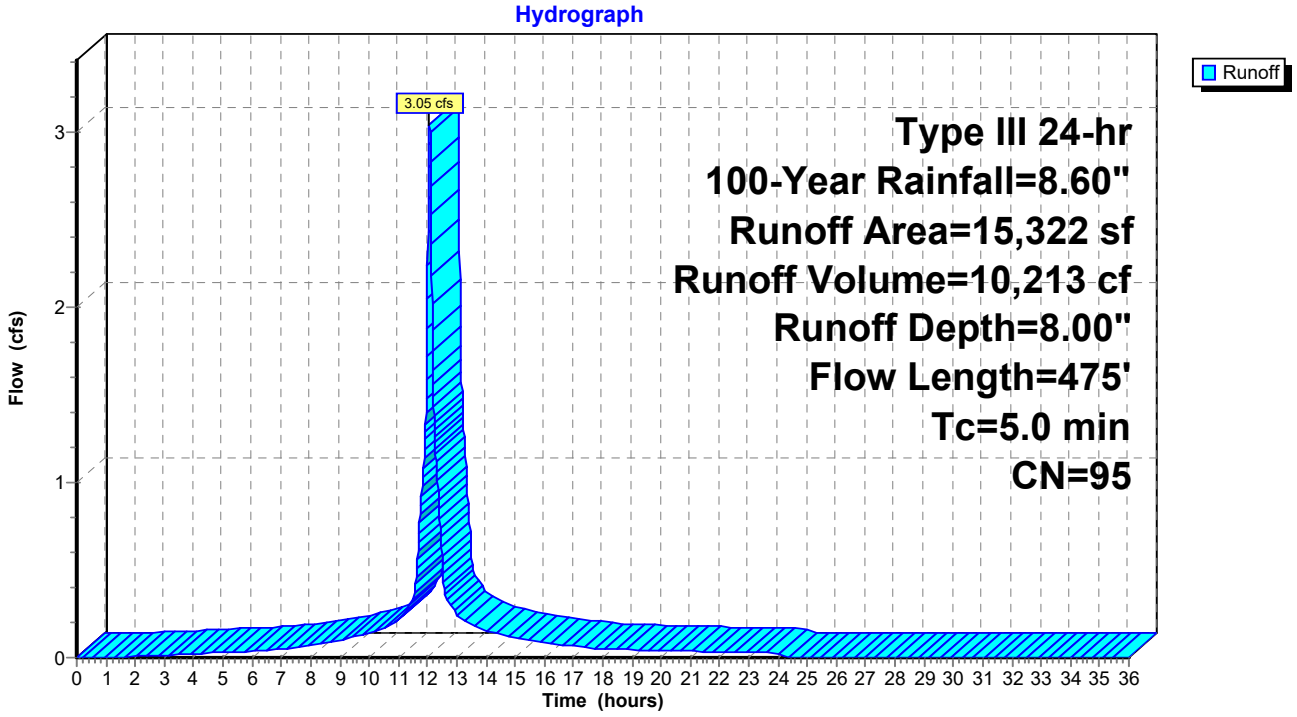
Runoff = 3.05 cfs @ 12.07 hrs, Volume= 10,213 cf, Depth= 8.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Rainfall=8.60"

Area (sf)	CN	Description
461	84	50-75% Grass cover, Fair, HSG D
2,477	80	>75% Grass cover, Good, HSG D
407	96	Gravel surface, HSG D
11,383	98	Unconnected pavement, HSG D
594	98	Unconnected roofs, HSG D
15,322	95	Weighted Average
3,345		21.83% Pervious Area
11,977		78.17% Impervious Area
11,977		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.8	50	0.0150	1.10		**Sheet Flow, Pavement** Smooth surfaces n= 0.011 P2= 3.40"
2.2	425	0.0450	3.18		**Shallow Concentrated Flow, Grassed Swale** Grassed Waterway Kv= 15.0 fps
3.0	475	Total, Increased to minimum Tc = 5.0 min			

Subcatchment PR3B: Drains to Sidewalk Curb Inlet



Summary for Subcatchment PR3C: Platform Canopy

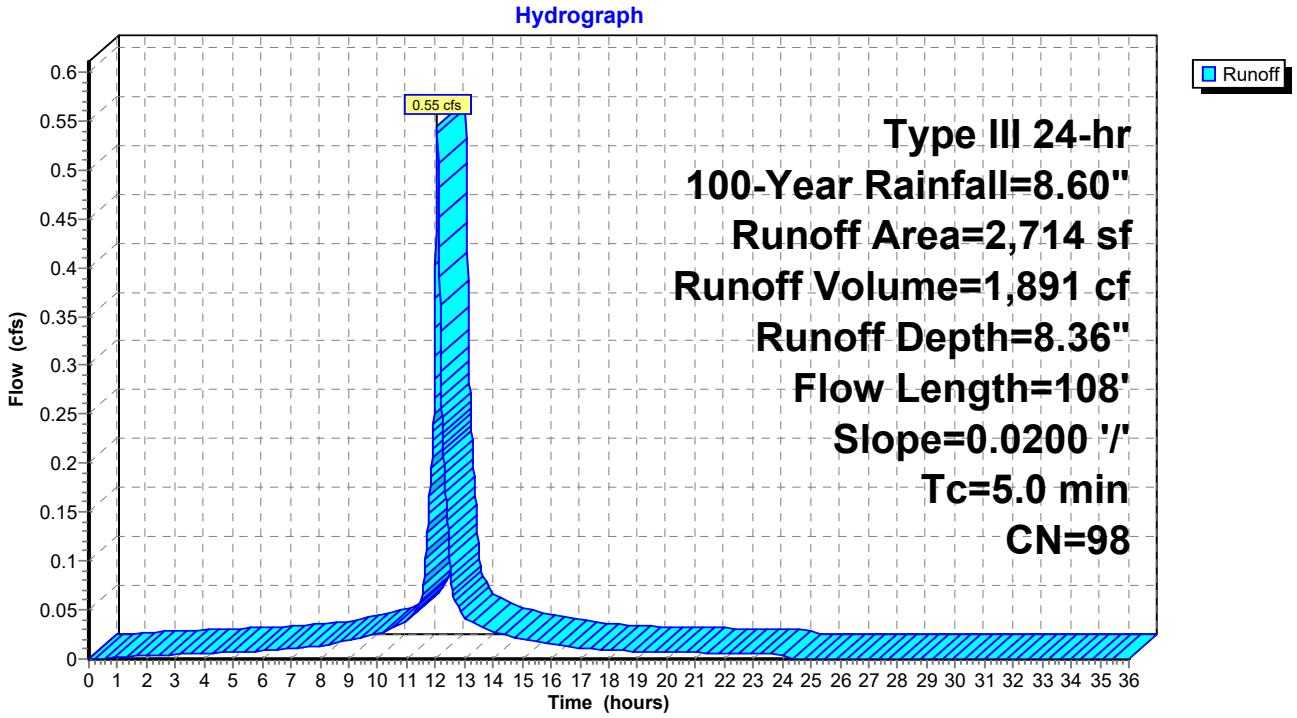
Runoff = 0.55 cfs @ 12.07 hrs, Volume= 1,891 cf, Depth= 8.36"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Rainfall=8.60"

Area (sf)	CN	Description
2,714	98	Unconnected roofs, HSG D
2,714		100.00% Impervious Area
2,714		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.7	50	0.0200	1.23		**Sheet Flow, Roof** Smooth surfaces n= 0.011 P2= 3.40"
0.3	58	0.0200	2.87		**Shallow Concentrated Flow, Roof** Paved Kv= 20.3 fps
1.0	108	Total, Increased to minimum Tc = 5.0 min			

Subcatchment PR3C: Platform Canopy



Summary for Subcatchment PR3D: Drains to Bioretention Basin

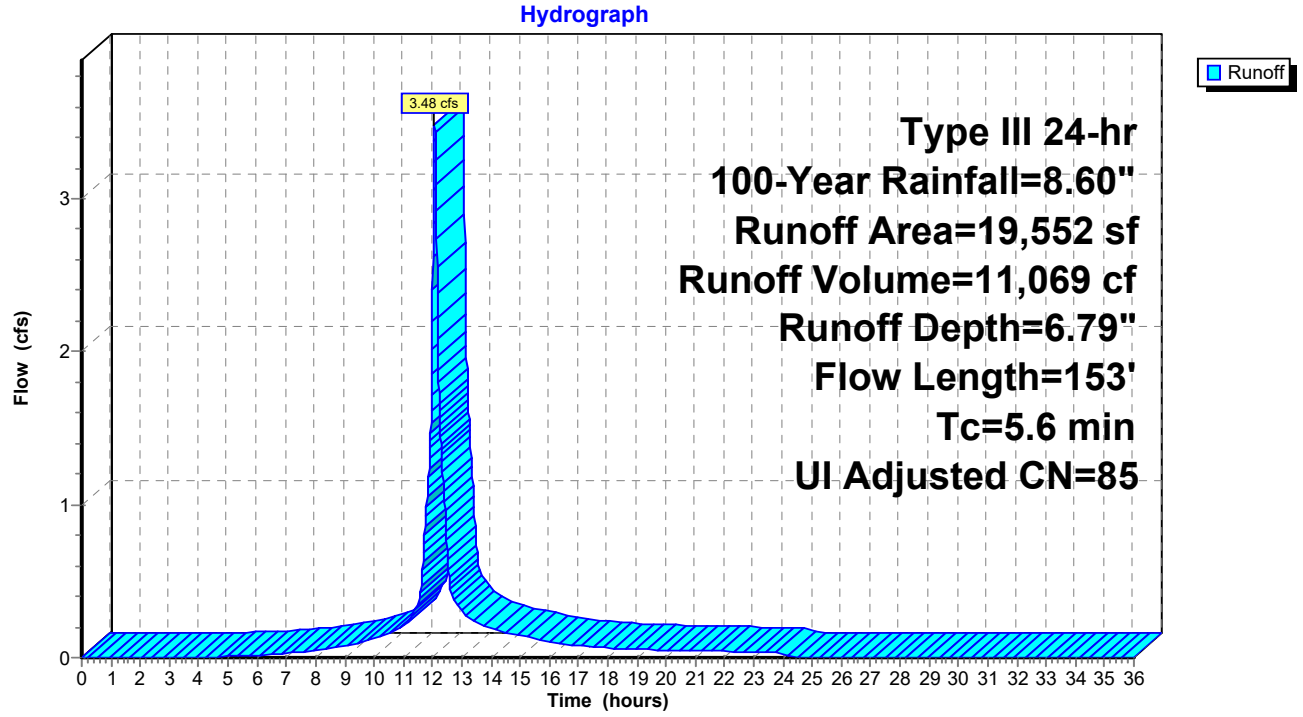
Runoff = 3.48 cfs @ 12.08 hrs, Volume= 11,069 cf, Depth= 6.79"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Rainfall=8.60"

Area (sf)	CN	Adj	Description
11,983	84		50-75% Grass cover, Fair, HSG D
354	96		Gravel surface, HSG D
2,099	98		Unconnected pavement, HSG D
576	98		Unconnected roofs, HSG D
4,539	82		Woods/grass comb., Fair, HSG D
19,552	86	85	Weighted Average, UI Adjusted
16,877			86.32% Pervious Area
2,675			13.68% Impervious Area
2,675			100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.9	40	0.1625	0.23		**Sheet Flow, Slope** Grass: Dense n= 0.240 P2= 3.40"
2.7	113	0.0100	0.70		**Shallow Concentrated Flow, Trees** Short Grass Pasture Kv= 7.0 fps
5.6	153	Total			

Subcatchment PR3D: Drains to Bioretention Basin



Summary for Subcatchment PR4: Drains to Bioretention Basin

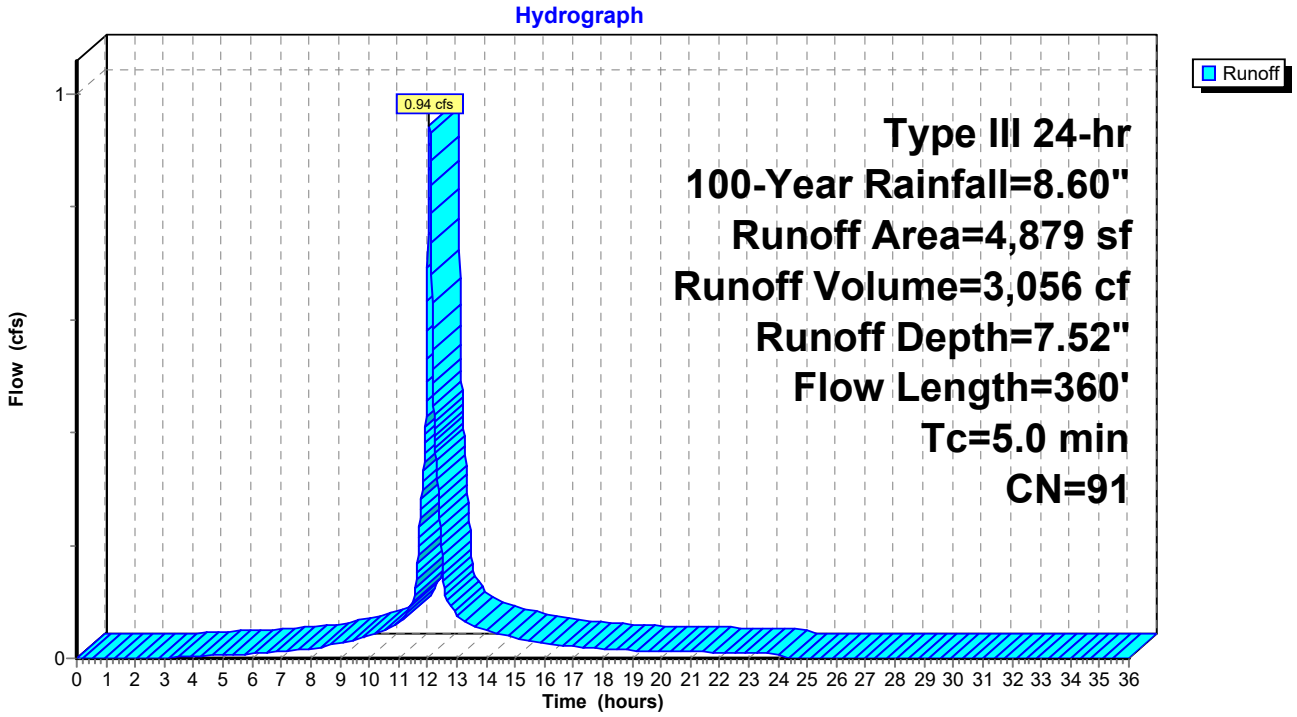
Runoff = 0.94 cfs @ 12.07 hrs, Volume= 3,056 cf, Depth= 7.52"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Rainfall=8.60"

Area (sf)	CN	Description
2,214	84	50-75% Grass cover, Fair, HSG D
1,156	96	Gravel surface, HSG D
1,361	98	Unconnected pavement, HSG D
148	98	Unconnected roofs, HSG D
4,879	91	Weighted Average
3,370		69.07% Pervious Area
1,509		30.93% Impervious Area
1,509		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.0	50	0.0070	0.81		**Sheet Flow, Pavement** Smooth surfaces n= 0.011 P2= 3.40"
0.5	50	0.0070	1.70		**Shallow Concentrated Flow, Pavement** Paved Kv= 20.3 fps
0.0	6	0.5000	10.61		**Shallow Concentrated Flow, Slope** Grassed Waterway Kv= 15.0 fps
3.4	254	0.0070	1.25		**Shallow Concentrated Flow, Grass** Grassed Waterway Kv= 15.0 fps
4.9	360	Total, Increased to minimum Tc = 5.0 min			

Subcatchment PR4: Drains to Bioretention Basin



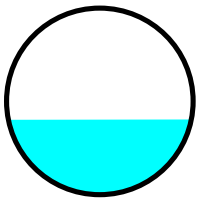
Summary for Reach 2R: Roof Drain

Inflow Area = 2,714 sf,100.00% Impervious, Inflow Depth = 8.36" for 100-Year event
Inflow = 0.55 cfs @ 12.07 hrs, Volume= 1,891 cf
Outflow = 0.54 cfs @ 12.08 hrs, Volume= 1,891 cf, Atten= 0%, Lag= 0.3 min

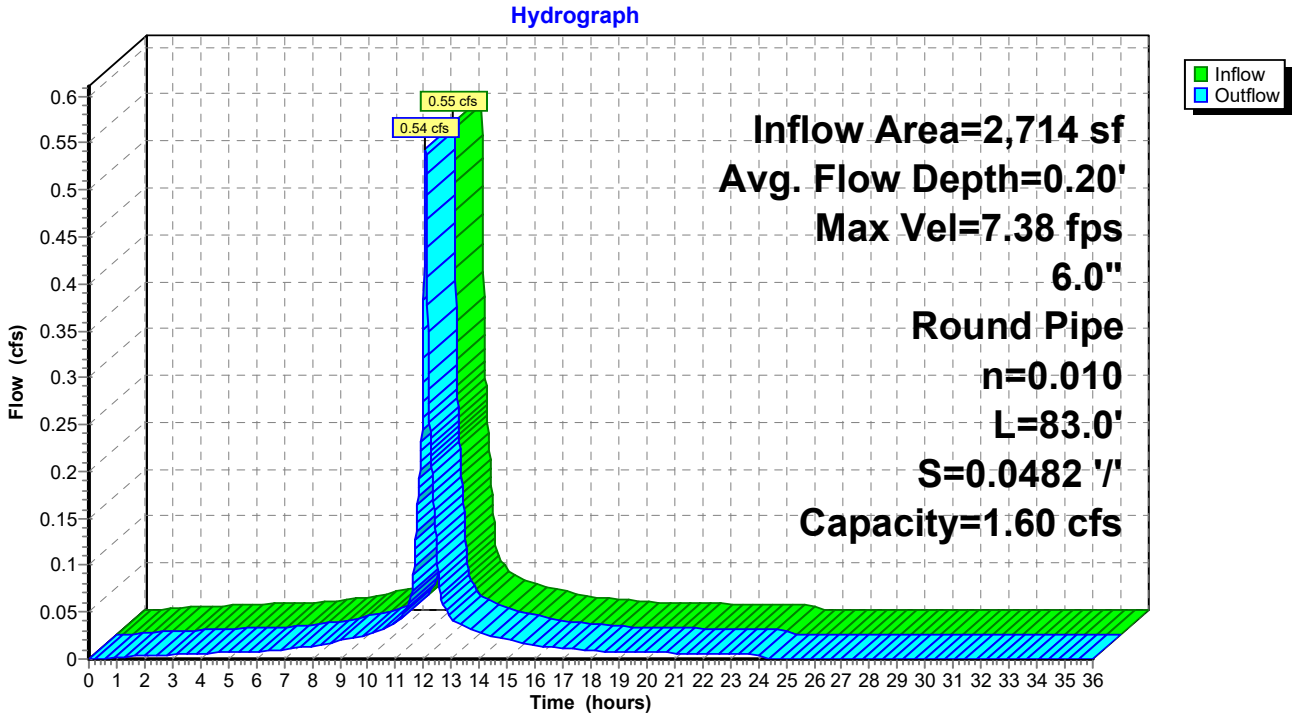
Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Max. Velocity= 7.38 fps, Min. Travel Time= 0.2 min
Avg. Velocity = 2.46 fps, Avg. Travel Time= 0.6 min

Peak Storage= 6 cf @ 12.07 hrs
Average Depth at Peak Storage= 0.20'
Bank-Full Depth= 0.50' Flow Area= 0.2 sf, Capacity= 1.60 cfs

6.0" Round Pipe
n= 0.010 PVC, smooth interior
Length= 83.0' Slope= 0.0482 '/'
Inlet Invert= 11.00', Outlet Invert= 7.00'



Reach 2R: Roof Drain



Summary for Pond 1P: Bioretention Basin

Inflow Area = 37,588 sf, 46.20% Impervious, Inflow Depth = 7.34" for 100-Year event
Inflow = 7.06 cfs @ 12.08 hrs, Volume= 22,983 cf
Outflow = 4.31 cfs @ 12.17 hrs, Volume= 22,983 cf, Atten= 39%, Lag= 5.7 min
Primary = 4.31 cfs @ 12.17 hrs, Volume= 22,983 cf
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Peak Elev= 6.80' @ 12.17 hrs Surf.Area= 3,516 sf Storage= 6,672 cf

Plug-Flow detention time= 182.0 min calculated for 22,983 cf (100% of inflow)
Center-of-Mass det. time= 182.0 min (955.9 - 773.9)

Volume	Invert	Avail.Storage	Storage Description
#1	2.50'	7,392 cf	**Bioretention Basin (Conic)** Listed below (Recalc)

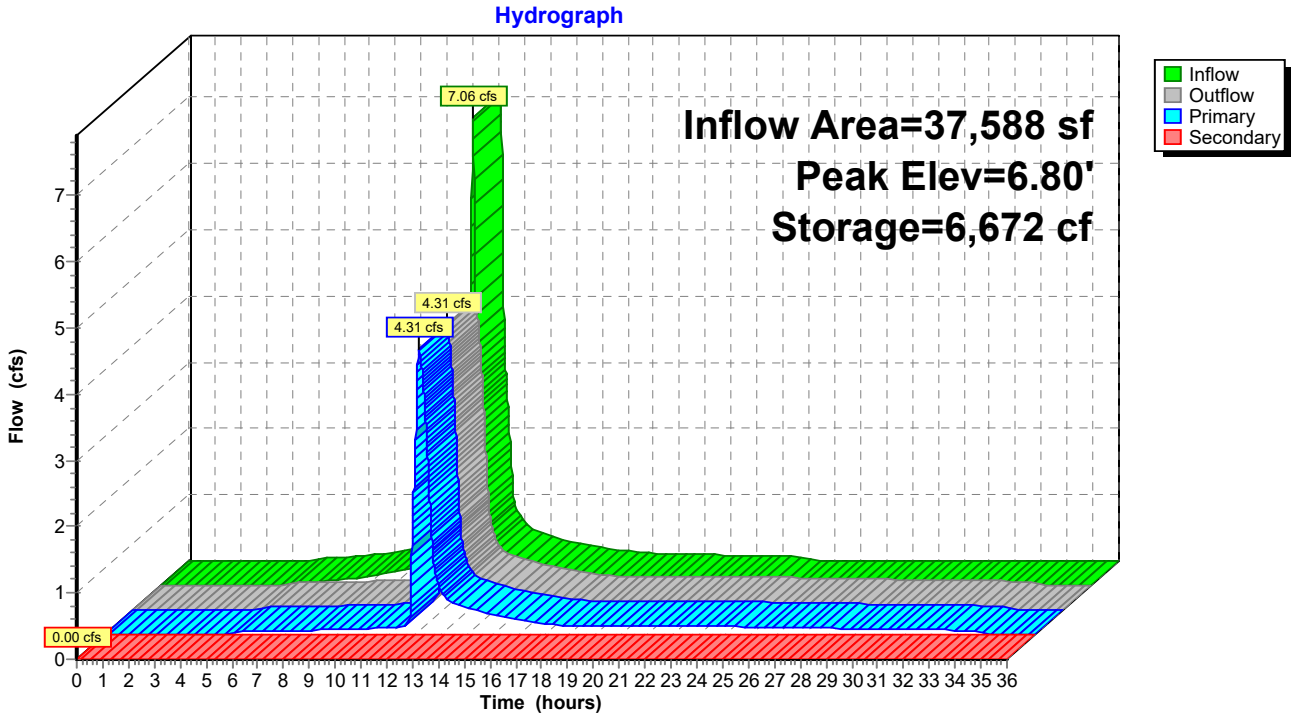
Elevation (feet)	Surf.Area (sq-ft)	Voids (%)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
2.50	2,513	0.0	0	0	2,513
3.50	2,513	30.0	754	754	2,691
5.50	2,513	40.0	2,010	2,764	3,046
6.00	2,888	100.0	1,349	4,113	3,432
6.50	3,277	100.0	1,540	5,654	3,833
7.00	3,680	100.0	1,738	7,392	4,250

Device	Routing	Invert	Outlet Devices
#1	Primary	2.20'	**15.0" Round Culvert** L= 113.6' RCP, mitered to conform to fill, Ke= 0.700 Inlet / Outlet Invert= 2.20' / 1.60' S= 0.0053 '/' Cc= 0.900 n= 0.012, Flow Area= 1.23 sf
#2	Device 1	2.90'	**15.0" Round Culvert** L= 82.2' RCP, mitered to conform to fill, Ke= 0.700 Inlet / Outlet Invert= 2.90' / 2.40' S= 0.0061 '/' Cc= 0.900 n= 0.012, Flow Area= 1.23 sf
#3	Device 1	2.50'	**1.000 in/hr Exfiltration over Surface area** Conductivity to Groundwater Elevation = -0.50'
#4	Secondary	6.80'	**Stone Overflow, Cv= 2.62 (C= 3.28)** Head (feet) 0.00 0.50 1.00 Width (feet) 4.00 6.00 8.00
#5	Device 1	6.00'	**Nyloplast 12" Dome Grate** Head (feet) 0.00 0.10 0.20 0.40 0.75 1.10 Disch. (cfs) 0.000 0.300 0.850 1.400 2.100 2.400
#6	Device 2	6.10'	**Nyloplast 12" Dome Grate** Head (feet) 0.00 0.10 0.20 0.40 0.75 1.10 Disch. (cfs) 0.000 0.300 0.850 1.400 2.100 2.400

Primary OutFlow Max=4.31 cfs @ 12.17 hrs HW=6.80' (Free Discharge)
└─**1=Culvert** (Passes 4.31 cfs of 9.84 cfs potential flow)
  └─**2=Culvert** (Passes 2.00 cfs of 9.43 cfs potential flow)
    └─**6=Nyloplast 12" Dome Grate** (Custom Controls 2.00 cfs)
  └─**3=Exfiltration** (Controls 0.17 cfs)
  └─**5=Nyloplast 12" Dome Grate** (Custom Controls 2.14 cfs)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=2.50' (Free Discharge)
└─**4=Stone Overflow** (Controls 0.00 cfs)

Pond 1P: Bioretention Basin



Summary for Pond 1SF: Sediment Forebay

Inflow Area = 15,322 sf, 78.17% Impervious, Inflow Depth = 8.00" for 100-Year event
Inflow = 3.05 cfs @ 12.07 hrs, Volume= 10,213 cf
Outflow = 3.04 cfs @ 12.07 hrs, Volume= 10,024 cf, Atten= 0%, Lag= 0.2 min
Primary = 3.04 cfs @ 12.07 hrs, Volume= 10,024 cf

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Peak Elev= 6.65' @ 12.07 hrs Surf.Area= 324 sf Storage= 235 cf

Plug-Flow detention time= 22.5 min calculated for 10,024 cf (98% of inflow)
Center-of-Mass det. time= 10.6 min (765.2 - 754.6)

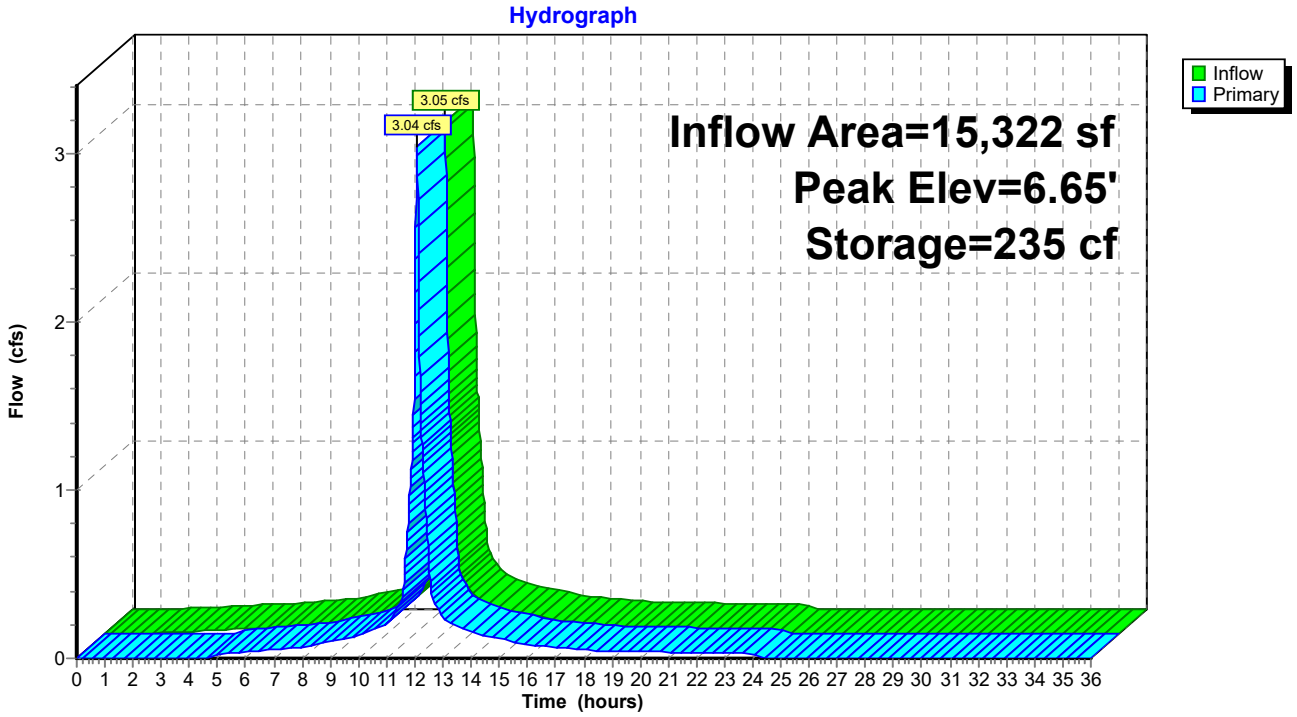
Volume	Invert	Avail.Storage	Storage Description
#1	5.50'	599 cf	**Sediment Forebay (Conic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
5.50	99	0	0	99
6.00	186	70	70	188
6.50	295	119	189	301
7.00	400	173	362	411
7.50	550	237	599	566

Device	Routing	Invert	Outlet Devices
#1	Primary	6.50'	**Stone Overflow, Cv= 2.62 (C= 3.28)** Head (feet) 0.00 0.50 1.00 Width (feet) 16.00 18.00 20.00

Primary OutFlow Max=3.03 cfs @ 12.07 hrs HW=6.65' (Free Discharge)
↑**1=Stone Overflow** (Weir Controls 3.03 cfs @ 1.26 fps)

Pond 1SF: Sediment Forebay



Summary for Pond 2P: Bioretention Basin

Inflow Area = 4,879 sf, 30.93% Impervious, Inflow Depth = 7.52" for 100-Year event
Inflow = 0.94 cfs @ 12.07 hrs, Volume= 3,056 cf
Outflow = 0.93 cfs @ 12.08 hrs, Volume= 3,056 cf, Atten= 1%, Lag= 0.8 min
Primary = 0.63 cfs @ 12.08 hrs, Volume= 2,956 cf
Secondary = 0.30 cfs @ 12.08 hrs, Volume= 100 cf

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Peak Elev= 9.88' @ 12.08 hrs Surf.Area= 268 sf Storage= 282 cf

Plug-Flow detention time= 60.6 min calculated for 3,056 cf (100% of inflow)
Center-of-Mass det. time= 60.6 min (830.3 - 769.7)

Volume	Invert	Avail.Storage	Storage Description
#1	5.50'	317 cf	**Bioretention Swale and Basin (Prismatic)** Listed below (Recalc)

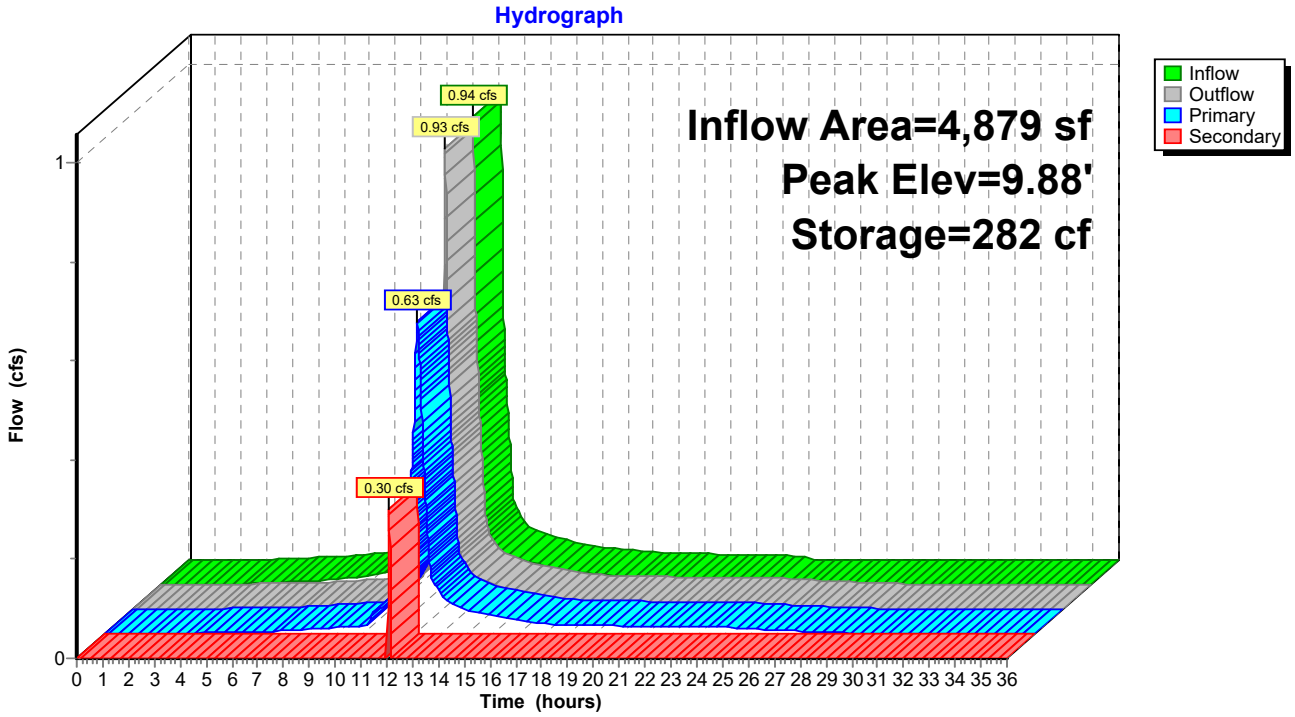
Elevation (feet)	Surf.Area (sq-ft)	Voids (%)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
5.50	62	0.0	0	0
6.50	62	30.0	19	19
8.50	62	40.0	50	68
9.00	120	100.0	46	114
9.50	201	100.0	80	194
10.00	290	100.0	123	317

Device	Routing	Invert	Outlet Devices
#1	Primary	5.00'	**8.0" Round Culvert** L= 150.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 5.00' / 3.50' S= 0.0100 '/' Cc= 0.900 n= 0.010 PVC, smooth interior, Flow Area= 0.35 sf
#2	Device 1	5.50'	**1.000 in/hr Exfiltration over Surface area** Conductivity to Groundwater Elevation = 5.00'
#3	Device 1	9.50'	**Nyloplast 8" Dome Grate** Head (feet) 0.00 0.10 0.20 0.40 0.75 1.10 Disch. (cfs) 0.000 0.220 0.450 0.630 0.840 1.050
#4	Secondary	9.80'	**Stone Overflow, Cv= 2.62 (C= 3.28)** Head (feet) 0.00 0.50 1.00 Width (feet) 4.00 6.00 8.00

Primary OutFlow Max=0.63 cfs @ 12.08 hrs HW=9.88' (Free Discharge)
└**1=Culvert** (Passes 0.63 cfs of 2.67 cfs potential flow)
  └**2=Exfiltration** (Controls 0.02 cfs)
  └**3=Nyloplast 8" Dome Grate** (Custom Controls 0.61 cfs)

Secondary OutFlow Max=0.29 cfs @ 12.08 hrs HW=9.88' (Free Discharge)
└**4=Stone Overflow** (Weir Controls 0.29 cfs @ 0.90 fps)

Pond 2P: Bioretention Basin



Summary for Pond 2SF: Sediment Forebay

Inflow Area = 4,879 sf, 30.93% Impervious, Inflow Depth = 7.52" for 100-Year event
Inflow = 0.94 cfs @ 12.07 hrs, Volume= 3,056 cf
Outflow = 0.94 cfs @ 12.07 hrs, Volume= 3,056 cf, Atten= 0%, Lag= 0.0 min
Primary = 0.94 cfs @ 12.07 hrs, Volume= 3,056 cf

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Peak Elev= 9.57' @ 12.07 hrs Surf.Area= 17 sf Storage= 1 cf

Plug-Flow detention time= 0.0 min calculated for 3,055 cf (100% of inflow)
Center-of-Mass det. time= 0.0 min (769.7 - 769.7)

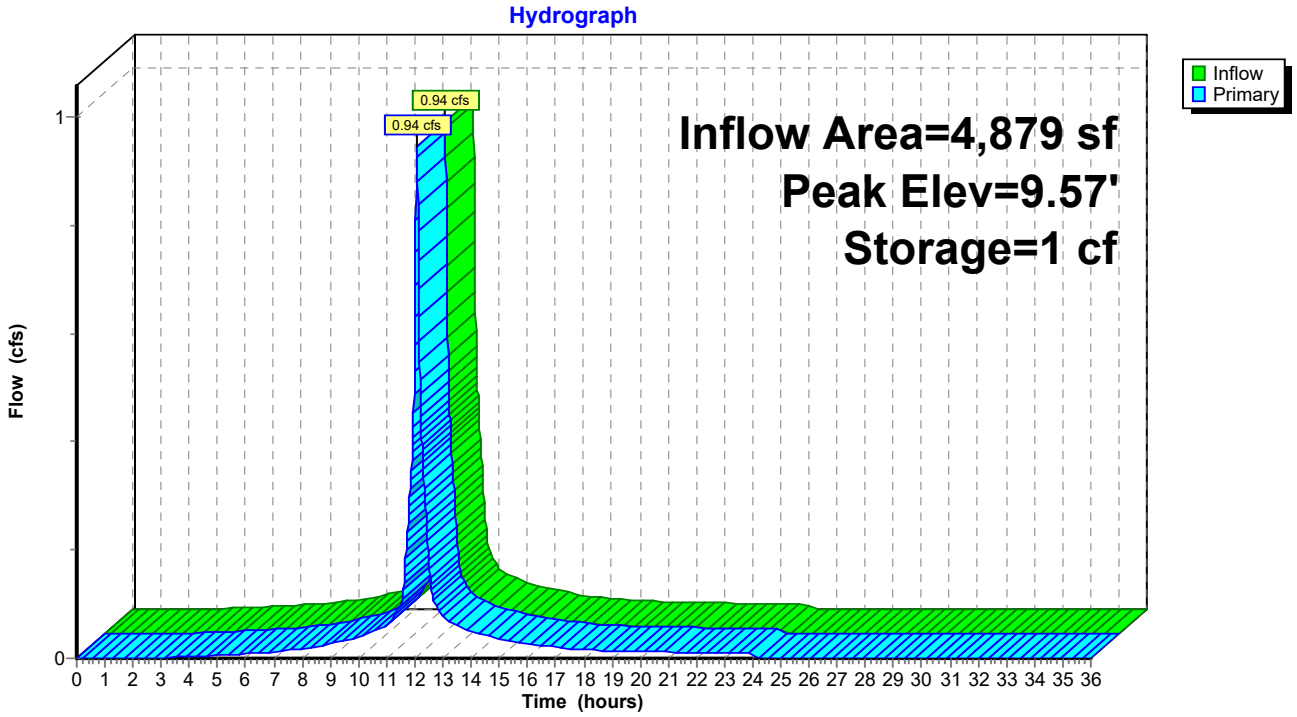
Volume	Invert	Avail.Storage	Storage Description
#1	9.50'	13 cf	**Sediment Forebay (Conic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
9.50	14	0	0	14
10.00	42	13	13	43

Device	Routing	Invert	Outlet Devices
#1	Primary	9.50'	**Stone Overflow, Cv= 2.62 (C= 3.28)** Head (feet) 0.00 0.50 1.00 Width (feet) 16.00 18.00 20.00

Primary OutFlow Max=0.94 cfs @ 12.07 hrs HW=9.57' (Free Discharge)
↑—**1=Stone Overflow** (Weir Controls 0.94 cfs @ 0.85 fps)

Pond 2SF: Sediment Forebay

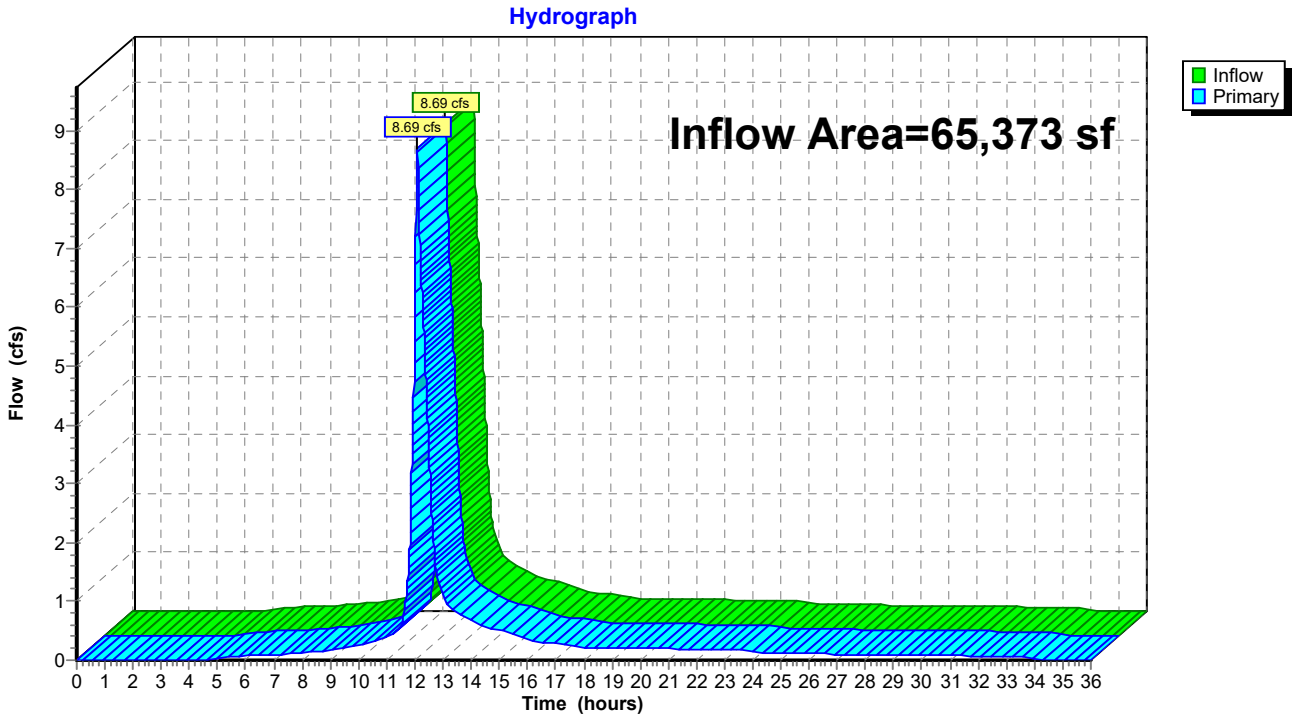


Summary for Link DP3: DP3

Inflow Area = 65,373 sf, 26.56% Impervious, Inflow Depth = 7.05" for 100-Year event
Inflow = 8.69 cfs @ 12.09 hrs, Volume= 38,434 cf
Primary = 8.69 cfs @ 12.09 hrs, Volume= 38,434 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

Link DP3: DP3

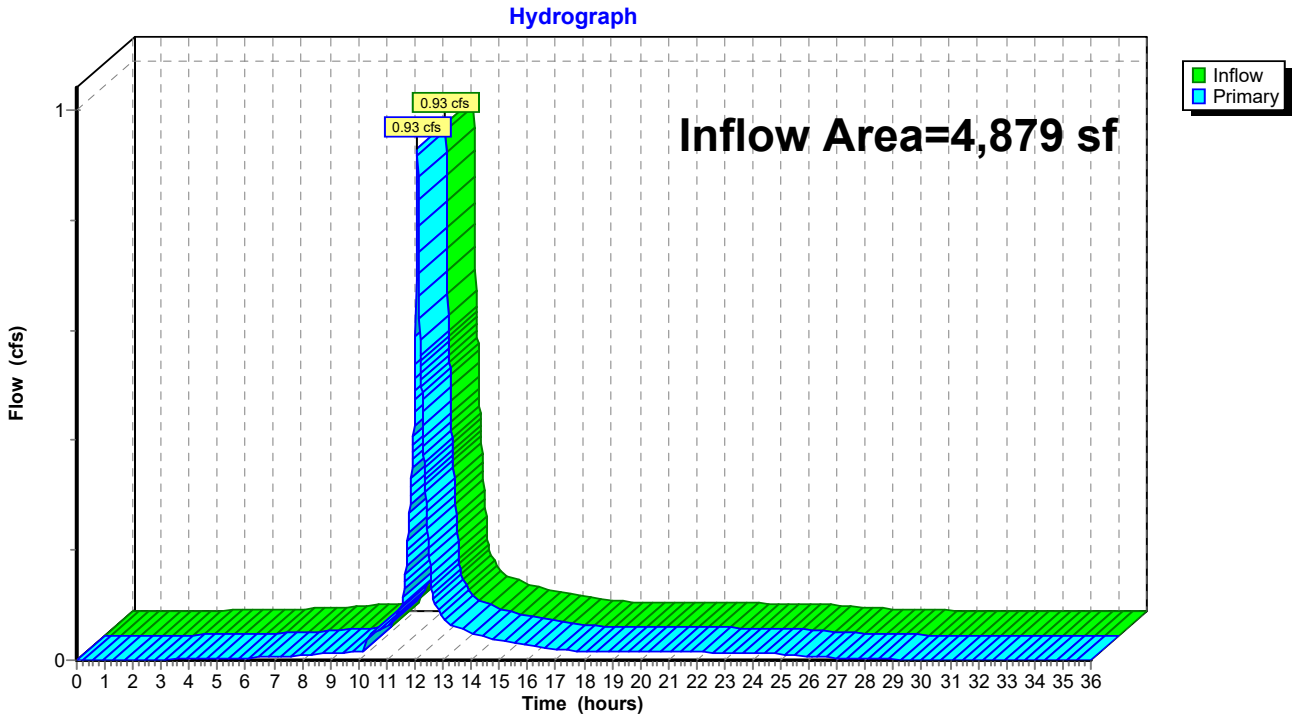


Summary for Link DP4: DP4

Inflow Area = 4,879 sf, 30.93% Impervious, Inflow Depth = 7.52" for 100-Year event
Inflow = 0.93 cfs @ 12.08 hrs, Volume= 3,056 cf
Primary = 0.93 cfs @ 12.08 hrs, Volume= 3,056 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

Link DP4: DP4



Appendix C
Standard 4 Computations and Supporting Information

TSS Removal Worksheets

TSS Removal Calculation Worksheet

VHB, Inc..
101 Walnut Street
Post Office Box 9151
Watertown, MA 02471
P 617.924.1770

Project Name:	**Whale's Tooth Station**	Sheet:	**1 of 1**
Project Number:	**12815.04**	Date:	**30-May-2018**
Location:	**New Bedford, MA**	Computed by:	**JHC**
Discharge Point:	**3**	Checked by:	**RTW**
Drainage Area(s):	**PR3B, PR3C, PR3D, PR4**		

A	B	C	D	E
BMP*	TSS Removal Rate*	Starting TSS Load**	Amount Removed (C*D)	Remaining Load (D-E)
Bioretention Area	**90%**	**1.00**	**0.90**	**0.10**
	0%	**0.10**	**0.00**	**0.10**
	0%	**0.10**	**0.00**	**0.10**
	0%	**0.10**	**0.00**	**0.10**
	0%	**0.10**	**0.00**	**0.10**

* BMP and TSS Removal Rate Values from the MassDEP Stormwater Handbook Vol. 1.

** Equals remaining load from previous BMP (E)

Treatment Train TSS Removal = **90%**

Appendix D
Standard 5 Computations and Supporting Information

Water Quality Volume Calculations

Water Quality Volume Calculations

Project Name: **Whale's Tooth Station**
Project Location: **New Bedford, MA**
Proj. No.: 12815.04
Date: 5/31/2018
Calculated by: JHC
Checked by: RTW

DP3 Pearl Street

Total Impervious Area = 16,003 SF

Required:

	Runoff Depth to be Treated (in.)	Required Volume (c.f.)
Forebay Volume	0.1	133
Water Quality Volume	0.5	667

Provided:

Sediment Forebay	Elevation	Area (s.f.)	Cumulative Volume (c.f.)	
	5.5	99	0	
	6.0	186	71	
	6.5	295	191	OK

Bioretention Basin	Elevation	Area (s.f.)	Cumulative Volume (c.f.)	
	5.5	2,542	0	
	6.0	2,886	1,357	OK

DP4 Parking Lot

Total Impervious Area = 1,484 SF

Required:

	Runoff Depth to be Treated (in.)	Required Volume (c.f.)
Forebay Volume	0.1	12
Water Quality Volume	0.5	62

Provided:

Sediment Forebay	Elevation	Area (s.f.)	Cumulative Volume (c.f.)	
	9.5	14	0	
	10.0	41	14	OK

Bioretention Basin	Elevation	Area (s.f.)	Cumulative Volume (c.f.)	
	8.5	62	0	
	9.0	120	45	
	9.5	201	126	OK

Appendix E
Standard 8 Supporting Information

Recommended Construction Period Pollution Prevention and Erosion and Sedimentation Controls

Erosion and Sedimentation Control Measures

The following erosion and sedimentation controls are for use during the earthwork and construction phases of the project. The following controls are provided as recommendations for the site contractor and do not constitute or replace the final Stormwater Pollution Prevention Plan that must be fully implemented by the Contractor and owner in Compliance with EPA NPDES regulations.

General Erosion Control Measures

The most important aspects of controlling erosion and sedimentation are limiting the extent of disturbance, and limiting the size and length of the tributary drainage areas to the worksite and drainage structures. These fundamental principles shall be the key factors in the Contractor's control of erosion on-site. If necessary, the Contractor shall utilize temporary diversion swales, settling basins or settling tanks. Additional drainage or erosion control measures, if needed, shall be located in uplands, up-gradient from perimeter erosion control barriers.

The contractor shall maintain a stockpile of erosion control materials to supplement or repair on-site erosion control devices. These materials shall include, but are not limited to, straw bales, silt fence, erosion control matting and crushed stone.

Throughout the site, denuded areas shall be stabilized within 14 days of ceased or temporarily halted construction unless additional construction is intended to be initiated within 21 days.

The Contractor is responsible for regular inspections, maintenance and repair of all on-site erosion control devices. At no time shall silt-laden water be allowed to enter sensitive areas (wetlands, streams, and drainage systems). Any runoff from disturbed surfaces shall be directed through a sedimentation tank or other sediment removal BMP that will discharge by gravity to the existing on-site drainage system.

Erosion Control Barrier

Prior to any ground disturbance, erosion control barriers will be placed to trap sediment transported by runoff before it reaches the drainage system or leaves the construction site. As construction progresses, additional barriers will be installed around the base of stockpiles and other erosion prone areas. In areas where high runoff velocities or high sediment loads are expected, barriers will be backed up with silt fencing. This semi-permeable barrier made of a synthetic porous fabric will provide additional protection. The silt fences and erosion control barriers will be replaced as determined by periodic field inspections. If sediment has accumulated to depth which impairs proper functioning of the barrier, it will be removed by hand or

by machinery operating upslope of the barriers. This material will be either reused at the site or disposed of at a suitable offsite location. Any damaged sections of silt fence or barriers will be repaired or replaced immediately upon discovery.

Catch Basin Protection

Newly constructed and existing catch basins will be protected with hay bale barriers (where appropriate) or silt sacks throughout construction.

Gravel and Construction Entrance/Exit

A temporary crushed-stone construction entrance/exit will be constructed. A cross slope will be placed in the entrance to direct runoff to a protected catch basin inlet or settling area. If deemed necessary after construction begins, a wash pad may be included to wash off vehicle wheels before leaving the project site.

Diversion Channels

Diversion channels will be used to collect runoff from construction areas and discharge to either sedimentation basins or protected catch basin inlets.

Temporary Sediment Basins

Temporary sediment basins will be designed either as excavations or bermed stormwater detention structures (depending on grading) that will retain runoff for a sufficient period of time to allow suspended soil particles to settle out prior to discharge. These temporary basins will be located based on construction needs as determined by the contractor and outlet devices will be designed to control velocity and sediment. Points of discharge from sediment basins will be stabilized to minimize erosion.

Vegetative Slope Stabilization

Stabilization of open soil surfaces will be implemented within 14 days after grading or construction activities have temporarily or permanently ceased, unless there is sufficient snow cover to prohibit implementation. Vegetative slope stabilization will be used to minimize erosion on slopes of 3:1 or flatter. Annual grasses, such as annual rye, will be used to ensure rapid germination and production of root mass. Permanent stabilization will be completed with the planting of perennial grasses or legumes. Establishment of temporary and permanent vegetative cover may be established by hydro-seeding or sodding. A suitable topsoil, good seedbed preparation, and adequate lime, fertilizer and water will be provided for effective establishment of these vegetative stabilization methods. Mulch will also be used after

permanent seeding to protect soil from the impact of falling rain and to increase the capacity of the soil to absorb water.

Maintenance

- The contractor or subcontractor will be responsible for implementing each control shown on the Sedimentation and Erosion Control Plan. In accordance with EPA regulations, the contractor must sign a copy of a certification to verify that a plan has been prepared and that permit regulations are understood.

- The on-site contractor will inspect all sediment and erosion control structures periodically and after each rainfall event. Records of the inspections will be prepared and maintained on-site by the contractor.

- Silt shall be removed from behind barriers if greater than 6-inches deep or as needed.

- Damaged or deteriorated items will be repaired immediately after identification.

- The underside of hay bales should be kept in close contact with the earth and reset as necessary.

- Sediment that is collected in structures shall be disposed of properly and covered if stored on-site.

- Erosion control structures shall remain in place until all disturbed earth has been securely stabilized. After removal of structures, disturbed areas shall be regraded and stabilized as necessary.

Erosion Control Operation and Maintenance Log

Whale's Tooth Station, New Bedford, MA
Erosion Control Inspection and Maintenance Log Form

Best Management Practice	Inspection Frequency	Date Inspected	Inspector	Minimum Maintenance and Key Items to Check	Cleaning/Repair Needed ☐yes ☐no (List Items)	Date of Cleaning/Repair	Performed by:
Erosion Control Barrier	Weekly and after storm events				☐yes ☐no		
Gravel Construction Entrance	Weekly and after storm events				☐yes ☐no		
Catch Basin Protection	Weekly and after storm events				☐yes ☐no		
Temporary Sedimentation Basins	Weekly and after storm events				☐yes ☐no		
Vegetated Slope Stabilization	Weekly and after storm events				☐yes ☐no		
					☐yes ☐no		
					☐yes ☐no		

Stormwater Control Manager _____

Appendix F
Standard 9 Supporting Information

Long–Term Pollution Prevention Plan

Long-Term Pollution Prevention Plan

This Long-Term Pollution Prevention Plan has been developed to establish site management practices that improve the quality of stormwater discharges from the Project.

Pollutant Control Approach

Maintenance of Pavement Systems

Standard Asphalt Pavement

Regular maintenance of pavement surfaces will prevent pollutants such as oil and grease, trash, and sediments from entering the stormwater management system. The following practices should be performed:

- Sweep or vacuum asphalt pavement areas semi-annually with a commercial cleaning unit and dispose of removed material.
- Routinely pick up and remove litter from the parking areas, islands, and perimeter landscaping.

Maintenance of Vegetated Areas

Proper maintenance of vegetated areas can prevent the pollution of stormwater runoff by controlling the source of pollutants such as suspended sediments, excess nutrients, and chemicals from landscape care products. Practices that should be followed under the regular maintenance of the vegetated landscape include:

- Inspect planted areas on a semi-annual basis and remove any litter.
- Maintain planted areas adjacent to pavement to prevent soil washout.
- Immediately clean any soil deposited on pavement.
- Re-seed bare areas; install appropriate erosion control measures when native soil is exposed or erosion channels are forming.

- Plant alternative mixture of grass species in the event of unsuccessful establishment.
- The grass vegetation should be cut to a height between four inches.
- Pesticide/Herbicide Usage – No pesticides are to be used unless a single spot treatment is required for a specific control application.
- Fertilizer usage should be avoided. If deemed necessary, slow release fertilizer should be used. Fertilizer may be used to begin the establishment of vegetation in bare or damaged areas, but should not be applied on a regular basis unless necessary.
- Pet waste provision if applicable.

Management of Snow and Ice

Storage and Disposal

Snow shall be stockpiled on standard pavement surfaces so sand and salt may be swept in the spring or removed as snow melts and drains through the stormwater management system. Recommended locations for snow storage are shown on the attached Snow Storage Plan. Key practices for the safe storage and disposal of snow include:

- Under no circumstances shall snow be disposed or stored in wetland resource areas.
- Under no circumstances shall snow be disposed or stored in stormwater basins, ponds, rain gardens, swales, channels, or trenches.
- Do not stockpile snow on permeable pavement surfaces. Sand and grit in snow will clog pavement.
- Plow parking areas paved with permeable asphalt pavement carefully. Plow blades should be set approximately 1" higher than usual to avoid scarring the pavement and loosening material that could potentially clog surface pores.
- Do not apply abrasives such as sand or grit on or adjacent to permeable asphalt pavement.
- Monitor application rates of deicing materials on permeable pavement areas and reduce application rate accordingly. Permeable pavements tend to require less deicer per unit area because the water is not required to remain liquid over the entire parking surface area before discharge.
- Do not apply abrasives such as sand or grit on or adjacent to permeable pavers.
- Avoid plowing of areas with permeable pavers.

Salt and Deicing Chemicals

The amount of salt and deicing chemicals to be used on the site shall be reduced to the minimum amount needed to provide safe pedestrian and vehicle travel. The

following practices should be followed to control the amount of salt and deicing materials that come into contact with stormwater runoff:

- Devices used for spreading salt and deicing chemicals should be capable of varying the rate of application based on the site specific conditions.
- Specific environmentally sensitive areas [engineer to identify] should be designated as no and/or reduced salt areas.
- Alternate materials [list alternate materials] should be used in place of standard salt and deicing chemicals in specific environmentally sensitive areas [engineer to identify].
- Sand and salt should be stockpiled under covered storage facilities that prevent precipitation and adjacent runoff from coming in contact with the deicing materials

Spill Prevention and Response Plan

Spill prevention equipment and training will be provided by the property owner.

Initial Notification

In the event of a spill the facility and/or construction manager or supervisor will be notified immediately.

FACILITY MANAGER

Name: _____ Home Phone: _____

Phone: _____ E-mail: _____

CONSTRUCTION MANAGER

Name: _____ Home Phone: _____

Phone: _____ E-mail: _____

The supervisor will first contact the Fire Department and then notify the Police Department, the Public Health Commission and the Conservation Commission. The Fire Department is ultimately responsible for matters of public health and safety and should be notified immediately.

Further Notification

The Massachusetts Department of Environmental Protection (DEP) and the EPA may be notified depending upon the nature and severity of the spill. The Fire Chief will be responsible for determining the level of cleanup and notification required. The attached list of emergency phone numbers shall be posted in the main construction/facility office and readily accessible to all employees. A hazardous waste spill report shall be completed as necessary using the attached form.

Emergency Notification Phone Numbers

1. FACILITY MANAGER

Name: _____ Home Phone: _____

Phone: _____ E-mail: _____

ALTERENATE

Name: _____ Home Phone: _____

Phone: _____ E-mail: _____

2. FIRE DEPARTMENT

Emergency: **911**

Business: _____

POLICE DEPARTMENT

Emergency: **911**

Business: _____

3. CLEANUP CONTRACTOR:

Address: _____

Phone: _____

4. MASSACHUSETTS DEPARTMENT OF ENVIRONMENTAL PROTECTION

Emergency: _____

Southeast Region – Lakeville Office: _____

5. NATIONAL RESPONSE CENTER

Phone: (800) 424-8802

ALTERNATE: U.S. ENVIRONMENTAL PROTECTION AGENCY

Emergency: _____

Business: _____

6. CONSERVATION COMMISSION

Contact: _____

Phone: _____

BOARD OF HEALTH

Contact: _____

Phone: _____

Hazardous Waste / Oil Spill Report

Date _____ Time _____ AM / PM

Exact location (Transformer #) _____

Type of equipment _____ Make _____ Size _____

S / N _____ Weather Conditions _____

On or near Water ☐ Yes If Yes, name of body of Water _____

☐ No

Type of chemical/oil spilled _____

Amount of chemical/oil spilled _____

Cause of Spill _____

Measures taken to contain or clean up spill _____

Amount of chemical/oil recovered _____ Method _____

Material collected as a result of cleanup:

_____ Drums containing _____

_____ Drums containing _____

_____ Drums containing _____

Location and method of debris disposal

_____

Name and address of any person, firm, or corporation suffering damages:

_____

Procedures, method, and precautions instituted to prevent a similar occurrence from recurring:

_____

Spill reported to General Office by _____ Time _____ AM / PM

Spill reported to DEP / National Response Center by _____

DEP Date _____ Time _____ AM / PM Inspector _____

NRC Date _____ Time _____ AM / PM Inspector _____

Additional comments: _____

Assessment - Initial Containment

The supervisor or manager will assess the incident and initiate containment control measures with the appropriate spill containment equipment included in the spill kit kept on-site. A list of recommended spill equipment to be kept on site is included on the following page.

Fire / Police Department	911
Municipality Health Department	
Municipality Conservation Commission:	

Emergency Response Equipment

The following equipment and materials shall be maintained at all times and stored in a secure area for long-term emergency response need.

Supplies		Recommended Suppliers
SORBENT PILLOWS/"PIGS"	**2**	http://www.newpig.com Item # KIT276 — mobile container with two pigs, 26 feet of sock, 50 pads, and five pounds of absorbent (or equivalent) http://www.forestry-suppliers.com Item # 43210 — Manhole cover pick (or equivalent) Item # 33934 — Shovel (or equivalent) Item # 90926 — Gloves (or equivalent) Item # 23334 — Goggles (or equivalent)
SORBENT BOOM/SOCK	**25 FEET**	
SORBENT PADS	**50**	
LITE-DRI® ABSORBENT	**5 POUNDS**	
SHOVEL	**1**	
PRY BAR	**1**	
GOGGLES	**1 PAIR**	
GLOVES – HEAVY	**1 PAIR**	

Stormwater Operation and Maintenance Plan

Project Information

Site

Whale's Tooth Station
Located at 532 Acushnet Avenue
New Bedford, Massachusetts

Owner

Housing 70 Corp
131 William Street
New Bedford, Massachusetts

Site Supervisor

Site Manager Name
Site Manager Address
Site Manager City, State Zip
Site Manager Phone Number

Name: _____

Telephone: _____

Cell phone: _____

Email: _____

Description of Stormwater Maintenance Measures

The following Operation and Maintenance (O&M) program is proposed to ensure the continued effectiveness of the stormwater management system. Attached to this plan are a Construction Stormwater Best Management Practices (BMP) Checklist, Operation and Maintenance Log Form, and BMP Maintenance Figure for use during the long-term operation and maintenance of the stormwater management system.

Area Drains

- All area drains shall be inspected and cleaned a minimum of at least once per year.
- Sediment (if more than six inches deep) and/or floatable pollutants shall be pumped from the drain and disposed of at an approved offsite facility in accordance with all applicable regulations.
- Any structural damage or other indication of malfunction will be reported to the site manager and repaired as necessary
- During colder periods, the area drain grates must be kept free of snow and ice.
- During warmer periods, the area drain grates must be kept free of leaves, litter, sand, and debris.

Roof Drain Leaders

- Perform routine roof inspections quarterly.
- Keep roofs clean and free of debris.
- Keep roof drainage systems clear.
- Keep roof access limited to authorized personnel.
- Clean inlets draining to the subsurface bed twice per year as necessary.

Stormwater Outfalls and Sediment Forebays

The stormwater drainage system contains many outfall locations, where treated stormwater is discharged to surface wetlands or existing drainage pipes. Outfall locations are shown on Figure C-1 included herein.

- At a minimum, inspect outfalls annually.
- At a minimum, inspect sediment forebays quarterly and clean them out annually. When mowing grasses, keep the grass height no greater than 6-inches. Set mower blades no lower than 3 to 4 inches. Annual inspections should be supplemented after large storms, when washouts may occur.
- Maintain vegetation around outfalls to prevent blockages at the outfall.
- Maintain rip rap pad below each outfall and replace any washouts.
- Remove and dispose of any trash or debris at the outfall.

- Replace vegetation damaged during the clean-out by either reseeding or resodding. When reseeding, incorporate practices such as hydroseeding with a tackifier, blanket, or similar practice to ensure no scour occurs in the forebay, while the seeds germinate and develop roots

Bioretention Basins

Mulching is an important part of bioretention basin maintenance. Mulch keeps the soil moist, allowing for easy infiltration of rain water. Un-mulched surfaces may develop into a hardpan, a condition in which the soil surface becomes cemented together, forming a hard, impervious layer. Mulching also protects plants and reduces weed growth.

Initial Post-Construction Inspection

- During the initial period of vegetation establishment pruning and weeding are required twice in first year by contractor.
- Any dead vegetation found after the first year must be replaced.
- Proper mulching is mandatory and regular watering may be required initially to ensure proper establishment of new vegetation.

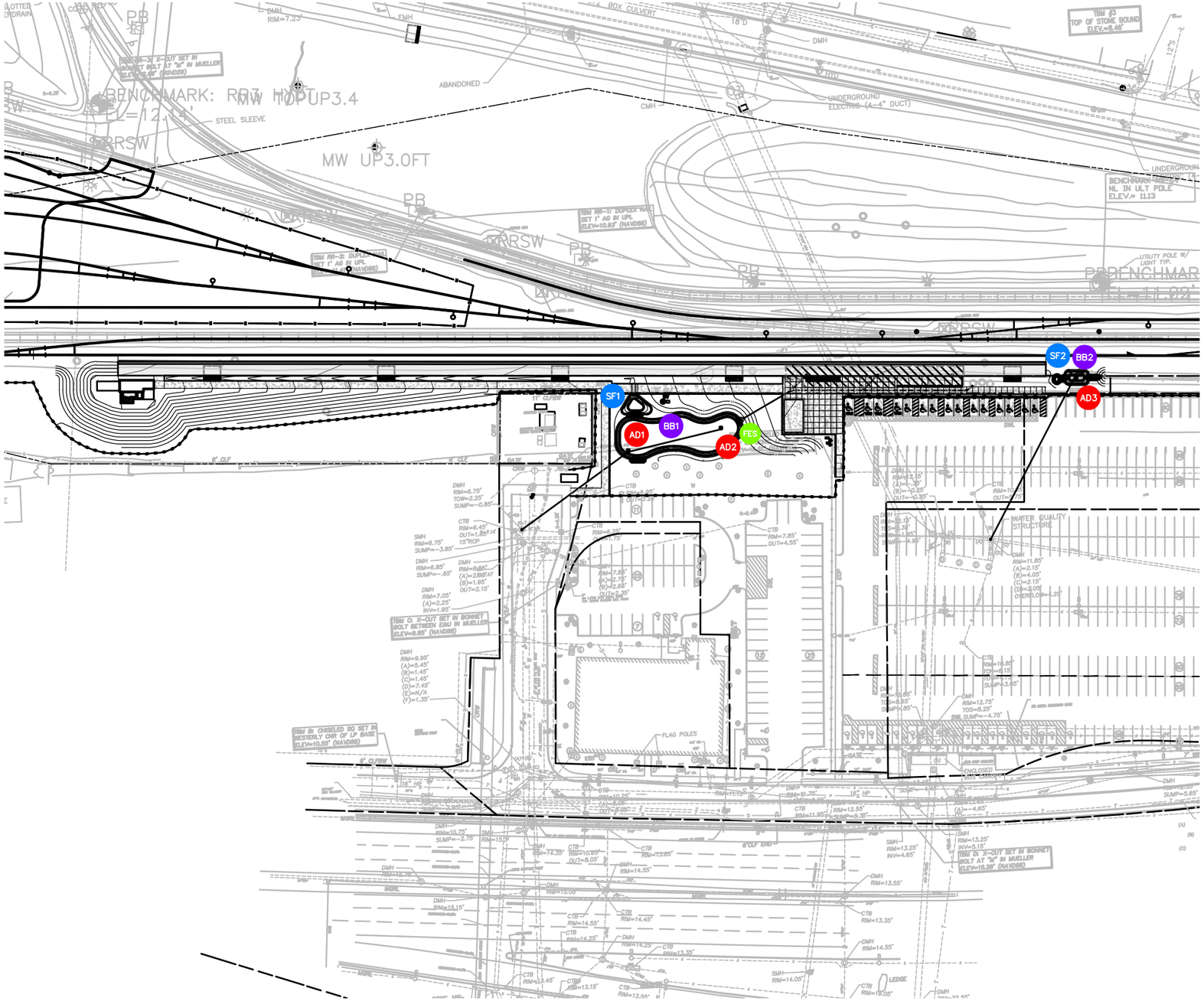
Long-Term Maintenance

- Weeds and invasive plant species shall be removed by hand.
- Leaf litter and other detritus shall be removed twice per year.
- If needed to maintain aesthetic appearance, perennial plantings may be trimmed at the end of the growing season.
- Trees and shrubs should be inspected twice per year to evaluate health and attended to as necessary.
- Re-mulch bioretention basins with hardwood mulch to a depth of 3 inches each spring or whenever erosion is evident. The entire area may require mulch replacement once every two to three years. Mulch depth shall not exceed 3 inches.

Inspections and Cleaning

- Bioretention basins shall be inspected twice during for the first year and annually thereafter for sediment buildup, erosion, vegetative conditions, etc. If sediment build-up is found, core aeration or cultivating of un-vegetated areas may be required to ensure adequate filtration.
- The inflow location should be inspected annually for clogging. Sediment build up is a common problem where runoff leaves an impervious surface and enters a vegetative or earthen surface. Any built-up sediment should be removed to prevent runoff from bypassing the facility.
- The overflow structure and underdrain standpipes should be inspected annually to ensure that they are functioning.

BMP Maintenance Figure



BIORETENTION BASINS MAINTENANCE REQUIREMENTS

INITIAL POST-CONSTRUCTION INSPECTION

BIORETENTION BASINS SHOULD BE INSPECTED AFTER EVERY MAJOR STORM FOR THE FIRST FEW MONTHS TO ENSURE PROPER STABILIZATION AND FUNCTION.

DURING THE INITIAL PERIOD OF VEGETATION ESTABLISHMENT, PRUNING AND WEEDING ARE REQUIRED TWICE IN FIRST YEAR BY CONTRACTOR.

ANY DEAD VEGETATION FOUND AFTER THE FIRST YEAR MUST BE REPLACED. PROPER MULCHING IS MANDATORY AND REGULAR WATERING MAY BE REQUIRED INITIALLY TO ENSURE PROPER ESTABLISHMENT OF NEW VEGETATION.

LONG-TERM MAINTENANCE

WEEDS AND INVASIVE PLANT SPECIES SHALL BE REMOVED BY HAND.

LEAF LITTER AND OTHER DETRITUS SHALL BE REMOVED TWICE PER YEAR.

IF NEEDED TO MAINTAIN AESTHETIC APPEARANCE, PERENNIAL PLANTINGS MAY BE TRIMMED AT THE END OF THE GROWING SEASON.

TREES AND SHRUBS SHOULD BE INSPECTED TWICE PER YEAR TO EVALUATE HEALTH AND ATTENDED TO AS NECESSARY.

RE-MULCH BIORETENTION BASINS WITH WELL-AGED HARDWOOD MULCH TO A DEPTH OF 3 INCHES EACH SPRING OR WHENEVER EROSION IS EVIDENT. THE ENTIRE AREA MAY REQUIRE MULCH REPLACEMENT ONCE EVERY TWO TO THREE YEARS. MULCH DEPTH SHALL NOT EXCEED 3 INCHES AND THE DEPTH OF THE DEPRESSION SHALL NOT BE COMPROMISED BY THE ACCUMULATION OF VEGETATION OR OLD MULCH.

SEEDED GROUND COVER OR GRASS AREAS SHALL NOT RECEIVE MULCHING.

FERTILIZERS SHOULD NOT BE USED IN THE BIORETENTION BASINS AS EXCESSIVE NUTRIENTS IN THE BIORETENTION BASINS MAY MIGRATE TO THE UNDERDRAIN AND BE DISCHARGED TO ADJACENT SURFACE WATERS.

TEST PH OF THE SOILS IN THE PLANTING BED ANNUALLY. IF THE PH IS BELOW 5.2, LIMESTONE SHOULD BE APPLIED TO INCREASE IT. IF THE PH IS ABOVE 8.0, IRON SULFATE PLUS SULFUR SHOULD BE ADDED TO REDUCE IT.

BIORETENTION BASINS MAY REQUIRE WATERING DURING PERIODS OF EXTENDED DROUGHT.

STORMWATER OUTFALL AND SEDIMENT FOREBAY MAINTENANCE REQUIREMENTS

INSPECT OUTFALL LOCATIONS MONTHLY FOR THE FIRST THREE MONTHS AFTER CONSTRUCTION TO ENSURE PROPER FUNCTIONING AND CORRECT ANY AREAS THAT HAVE SETTLED OR EXPERIENCED WASHOUTS.

INSPECT OUTFALLS ANNUALLY AFTER INITIAL THREE MONTH PERIOD.

ANNUAL INSPECTIONS SHOULD BE SUPPLEMENTED AFTER LARGE STORMS, WHEN WASHOUTS MAY OCCUR.

MAINTAIN VEGETATION AROUND OUTFALLS TO PREVENT BLOCKAGES AT THE OUTFALL.

MAINTAIN RIP RAP PAD WHERE APPLICABLE AND REPLACE ANY WASHOUTS.

REMOVE AND LEGALLY DISPOSE OF ANY TRASH OR DEBRIS AT THE OUTFALL.

AREA DRAIN MAINTENANCE REQUIREMENTS

ALL AREA DRAINS SHALL BE INSPECTED AT LEAST TWO TIMES PER YEAR AND CLEANED A MINIMUM OF AT LEAST ONCE PER YEAR.

SEDIMENT (IF MORE THAN SIX INCHES DEEP) AND/OR FLOATABLE POLLUTANTS SHALL BE PUMPED FROM THE DRAIN AND DISPOSED OF AT AN APPROVED OFFSITE FACILITY IN ACCORDANCE WITH ALL APPLICABLE REGULATIONS.

ANY STRUCTURAL DAMAGE OR OTHER INDICATION OF MALFUNCTION WILL BE REPORTED TO THE SITE MANAGER AND REPAIRED AS NECESSARY.

DURING COLDER PERIODS, THE AREA DRAIN GRATES MUST BE KEPT FREE OF SNOW AND ICE.

DURING WARMER PERIODS, THE AREA DRAIN GRATES MUST BE KEPT FREE OF LEAVES, LITTER, SAND, AND DEBRIS.

LEGEND

AD	AREA DRAIN
FES	STORMWATER OUTFALL
BB	BIORETENTION BASINS
SF	SEDIMENT FOREBAY

0 50 100 Feet

BMP Maintenance Figure
Whale's Tooth Station
South Coast Rail
New Bedford, MA

Figure F-1

May 2018

Operation and Maintenance Log Form with Inspection Schedule

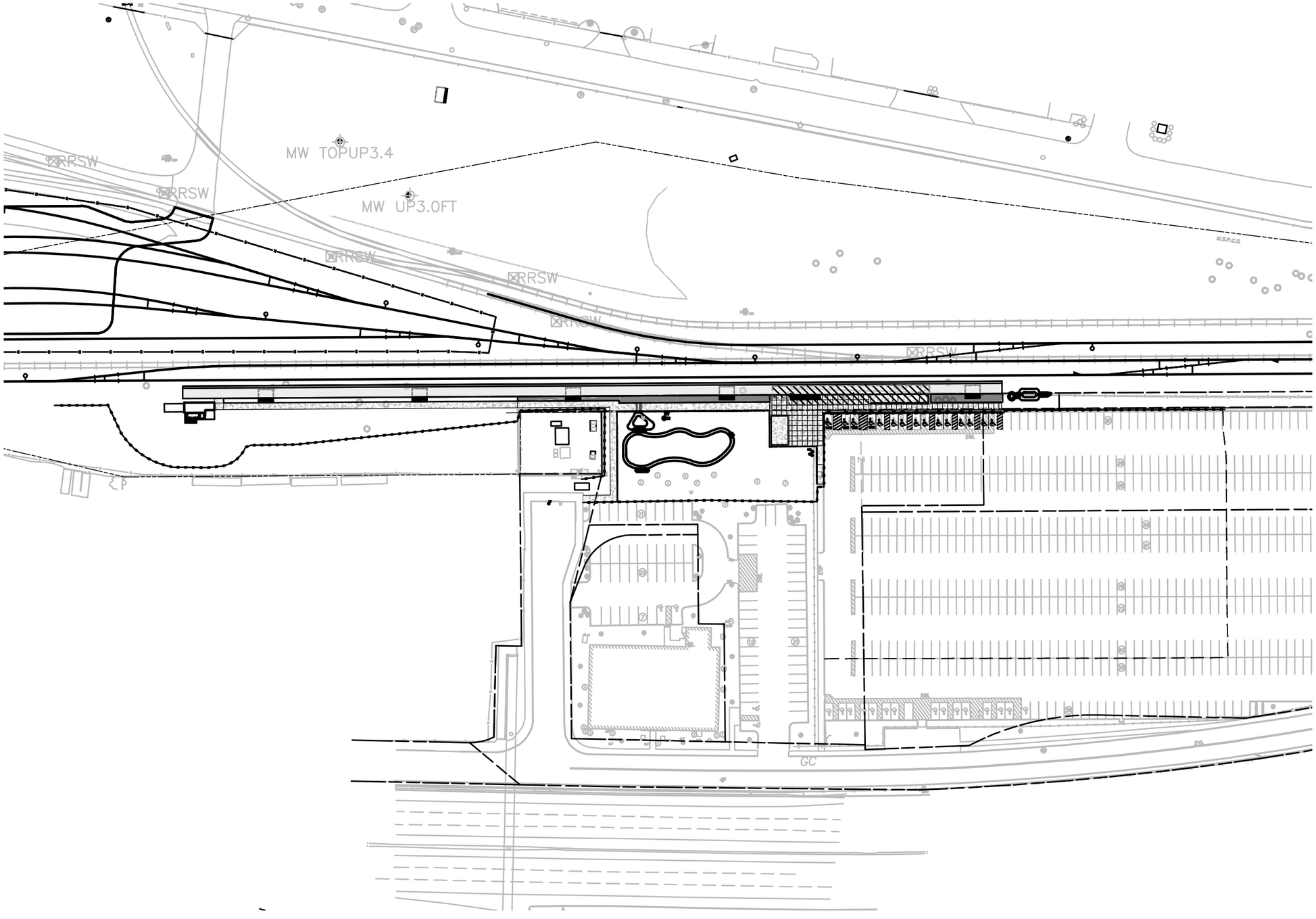
Whale's Tooth Station, New Bedford, MA

Long-Term Best Management Practices –Operation and Maintenance Log Form with Inspection Schedule

Best Management Practice	Inspection Frequency	Date Inspected	Inspector	Minimum Maintenance and Key Items to Check	Cleaning/Repair Needed ☐yes ☐no (List Items)	Date of Cleaning/Repair	Performed by
Bioretention Basin 1	Bi-annually				☐yes ☐no		
Sedimentation Forebay 1	Annually				☐yes ☐no		
Area Drain 1	Bi-annually				☐yes ☐no		
Area Drain 2	Bi-annually				☐yes ☐no		
Stormwater Outfall FES-1	Annually				☐yes ☐no		
Bioretention Basin 2	Bi-annually				☐yes ☐no		
Sedimentation Forebay 2	Annually				☐yes ☐no		
Area Drain 2	Bi-annually				☐yes ☐no		
					☐yes ☐no		
					☐yes ☐no		
					☐yes ☐no		
					☐yes ☐no		
					☐yes ☐no		

Stormwater Control Manager _____

Snow Storage Plan



Legend

Approximate Snow Storage Area

Notes

1. The Whale's Tooth Station area has approximately 0.4 acres of impervious area. The plan does not include snow storage for the roof or pervious areas.

2. The plan depicts approximately 2,000 SF of area available for snow storage within the station area. This area is estimated to accommodate an approximate 1' snowfall, assuming 5:1 compaction and an average snow pile height of 2.0'. Additional snow storage is available in pervious areas throughout the project area.

3. Under no circumstance shall snow be stored in any wetland resource area or proposed stormwater best management practice.

4. Snow storage will be implemented to avoid hydrants, fences, landscaping, and other permanent features.

0 50 100 Feet

Snow Storage Plan
Whale's Tooth Station
South Coast Rail
New Bedford, MA

Figure F-2

May 2018