Stormwater Report

Greenmont Commons
Dracut, MA

Prepared for

Riverbank Properties
908 Lawrence Street
Lowell, MA 01852

May 18, 2023

REVISED April 10, 2024

Cornerstone Land Associates, LLC
Civil & Structural Engineering • Permitting
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Forward

This Stormwater Report is required by the Massachusetts Wetland Protection Act (MGL Ch. 131, Sect. 40); provisions of the Mass DEP Stormwater Management Standards per 310 CMR 10.05(6)(k)-(q); and the Town of Dracut General By Laws Chapter 24 and Town of Dracut Stormwater Management Rules and Regulations.

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SECTION 1: SITE & CONTACT DATA

1.1 Project & Site Information

Project/Site Name: Greenmont Commons
Project Street/Location: 135 Greenmont Avenue
City: Dracut State: MA ZIP Code: 01826
County or Similar Subdivision:
Applicant Name: Riverbank Properties
Applicant Address: 908 Lawrence Street City: Lowell State: MA ZIP Code: 01852

1.2 Applicant Information

Name: Riverbank Properties
Address: 908 Lawrence Street City: Lowell State: MA ZIP Code: 01852
Contact: Branco Perego Phone: (978) 771-3205

1.3 Preparer Information

Name: Kenneth M. Lania, E.I.T., Cornerstone Land Associates, LLC.
Address: 25 Dean Avenue City: Dracut State: MA ZIP Code: 01826
Registered P.E.: John A. Visniewski, P.E. Email: kmconsultants@comcast.net
Phone: (978) 835-0102 Fax:

1.4 Project Type

Scope of Work: Development of an existing vacant lot including retaining walls, drainage, utilities, and parking lot.
Function: ☒ Residential ☐ Commercial ☐ Industrial ☐ Other:
☒ New ☐ Redevelopment ☐ Industrial ☐ Mix of New & Redevelopment
Estimated Start Date.: Upon Approvals Estimated Completion Date: September 2024

1.5 Drainage Narrative

The proposed project has been revised to construct 26 Townhouse Rental Units on the 2.45 Acre parcel utilizing the State's Comprehensive Permit Statute (M.G.L. c. 40B, Sections 20-23 enacted as Chapter 774 of the Acts of 1969) known as "Chapter 40B". The property is rectangle in shape with 240 LF of frontage along Greenmont Avenue and a depth of approximately 430 LF from the road. The property contains one single family dwelling located approximately 85 ft from Greenmont Avenue with associated driveway, rear deck and patio, as well as an in-ground

pool with concrete apron. The remainder of the property is a well established lawn with Bordering Vegetated Wetlands (BVW) in the southwestern corner of the property. The BVW was established on the property with flagging and is shown as WF-1 to WF-7. The majority of the property, approximately 2.22 acres, drains from north to south to the existing BVW area with the remainder 0.23 acres draining to Greenmont Avenue.

The proposed conditions utilize a Closed Drainage System with both underground and above ground techniques to mimic the existing drainage patterns. Four proposed Deep Sump Hooded Catch Basins are utilized to collect all of the impervious stormwater flow on site. The stormwater is then directed to an alternative technology sediment removal Barracuda Hydrodynamic Separator's to achieve the required 80% Total Suspended Solids removal. The stormwater then enters the underground 24" ADS Detention Area for storage and mitigation of the Peak Flow and Peak Volume. Stormwater then exits this system and enters into an above ground basin system. First, stormwater is passed into a Sedimentation Forebay for additional removal of pollutants that may pass through the underground system. The Sedimentation Forebay overflows into a Wet Basin that completes the cleaning of the stormwater and allows the clean stormwater to enter into the wetlands at the rear of the parcel with a reduction of Peak Flow and Peak Volume.

The proposed drainage system mitigates for the Peak Flow and Peak Volume for each storm event, 2 year to 100 year. There is no increase in Post-Development runoff from Pre-Development runoff for both Peak Flow and Peak Volume.

SECTION 2: STORMWATER CHECKLIST

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.

SECTION 3: LOW IMPACT DEVELOPMENT (LID)

Credits for LID have not been taken since the site does not comply with certain aspects of each credit item required. However, small portions of LID practices have been incorporated into the overall design. These practices are small in nature and include the utilization of Sheet Flow and a combination of multiple Best Management Practices for stormwater treatment of the entire proposed impervious surface up to and including the 100 Year Storm event to promote the use of Rain Gardens and Underground Chamber Systems for infiltration to groundwater and pollutant removal.

SECTION 4: STORMWATER STANDARDS

4.1 Standard 1: No New Untreated Discharges

New stormwater conveyances (e.g. outfalls) will not discharge untreated stormwater directly to or cause erosion in wetlands or waters of the Commonwealth.

Rip Rap Sizing at Spillways

Stormwater calculations utilizing a closed drainage system for Stormwater collection throughout the development areas attenuates the Peak Flow and Peak Volume for all storm events 2 yr to 100 yr.

The design utilizes a Sedimentation Basin with an overflow to a Wet Basin to promote as much infiltration of runoff back into the ground as possible. Proposed flow in large storm events travels to the Underground ADS Pipe Detention Basin then into an outlet Sedimentation & Wet Basin system that utilizes stone lined spillways for outlet protection of flow leaving the property.

4.2 Standard 2: Peak Rate Attenuation

Stormwater management systems have been designed so that the post-development peak discharge rates do not exceed pre-development peak discharge rates.

Soils Evaluation

Soils on the site are classified on the USDA Natural Resources Conservation Service (NRCS) Soil Map that is shown below as an overlay on the MASS GIS Aerial Photography with NRCS Soils Overlay Layer. These soil classifications have been further assigned to Hydraulic Soil Groups (HSG) by the NRCS as shown on the map. Hydraulic soil groups range from A, sandy soils, to D, clayey soils.

Hydrologic Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
71B	Ridgebury fine sandy loam, 3 to 8 percent slopes, extremely stony	D	3.5	26.3%
305B	Paxton fine sandy loam, 3 to 8 percent slopes	C	0.5	3.9%
310A	Woodbridge fine sandy loam, 0 to 3 percent slopes	C/D	9.2	69.8%
Totals for Area of Interest			**13.2**	**100.0%**

Soils have also been evaluated in the field as shown in the following table; and soil logs are also shown on the Grading & Drainage Plan. The table shows the textural classification in each location according to direct field observation. The Estimated Seasonal High Groundwater (ESHGW) depth was determined by field observation of redoximorphic features (mottles) within the soil profile. The Rawls Rate assigned to various Hydraulic Soil Groups and textural types is used for calculations relative to exfiltration of stormwater into subsurface soils within stormwater storage facilities. In addition, soil samples were taken and sent to a soils laboratory for analysis of particle size and permeability.

Soil Evaluation

ON-SITE SOILS EVALUATION

Deep Hole Number [1.]	Textural Classification [2.]	HSG [3.]	Depth to Refusal (ft)	ESHGW [4.] (in)	Rawls Rate (in/hr) [5.]	Laboratory Results (in/hr) [6.]
TP#1	SL	D	n/a	34	0.09	0.44
TP#2	SL	D	n/a	32	0.09	0.11
TP#3	SL	C/D	n/a	36	0.27	1.08
TP#4	SL	C/D	n/a	38	0.27	

[1.] See Site Plan for deep hole locations

[2.] Laboratory soil analysis; otherwise field observation

[3.] Hydraulic Soil Group; USDA NRCS

[4.] Estimated seasonal high groundwater depth

[5.] DEP Stormwater Handbook, Table 2.3.3.

[6.] Laboratory permeability analysis per DEP Stormwater Handbook Vol. 3 Chap. 1

USDA Soils Description

Map Unit #	Soil Name	HSG
71B	Ridgebury fine sandy loam	D
310A	Woodbridge fine sandy loam	C/D

The following Table shows land areas associated with the hydraulic soil group for each type of ground coverage within each drainage area. Hydraulic Soil Group designations are shown as provided by the NRCS for the soil types found on this site. Curve Number (CN) values have been assigned based on the ground cover type and condition, and HSG. The curve number values are weighted according to NRCS criteria and used in the calculations for peak rate attenuation provided in Appendix C. The Pre-Development and Post-Development Drainage Maps provided in Appendix C show the relationship between the drainage areas and surface cover types.

Drainage Areas & Curve Numbers

PRE-DEVELOPMENT

Drainage Area 1S - DP#1-GREENMONT

	Hydraulic Soils Group (HSG) Area (sf) & Curve Number (CN)							
Surface Description	A	CN	B	CN	C	CN	D	CN
Roofs							981	98
Paved Parking							2,843	98
Grass > 75% Cover Good					2,107	74	4,478	80
Subtotal Area					*2,107*		*8,302*	
Total Area							***10,409***	***85***

Drainage Area 2S - DP#2-REAR WETLANDS

	Hydraulic Soils Group (HSG) Area (sf) & Curve Number (CN)							
Surface Description	A	CN	B	CN	C	CN	D	CN
Roofs							1,008	98
Paved Parking							4,356	98
Wooded					10,179	70	2,063	77
Grass >75% Cover Good					45,595	74	33,120	80
Subtotal Area					*55,774*		*96,321*	
Total Area							***96,321***	***77***

TOTAL PRE-DEVELOPMENT AREA = 106,730 SF

POST-DEVELOPMENT

Drainage Areas & Curve Numbers

PRE-DEVELOPMENT

Drainage Area 1S - DP#1-GREENMONT

	Hydraulic Soils Group (HSG) Area (sf) & Curve Number (CN)							
Surface Description	A	CN	B	CN	C	CN	D	CN
Roofs							981	98
Paved Parking							2,843	98
Grass > 75% Cover Good					2,107	74	4,478	80

Subtotal Area				*2,107*		*8,302*	
Total Area						***10,409***	***85***

Drainage Area 2S - DP#2-REAR WETLANDS

Hydraulic Soils Group (HSG) Area (sf) & Curve Number (CN)

Surface Description	A	CN	B	CN	C	CN	D	CN
Roofs							1,008	98
Paved Parking							4,356	98
Wooded					10,179	70	2,063	77
Grass >75% Cover Good					45,595	74	33,120	80
Subtotal Area					*55,774*		*96,321*	
Total Area							***96,321***	***77***

POST-DEVELOPMENT

Drainage Area - DP#1-GREENMONT

Hydraulic Soils Group (HSG) Area (sf) & Curve Number (CN)

Surface Description	A	CN	B	CN	C	CN	D	CN
Grass >75% Cover Good							7,914	80
Subtotal Area							*7,914*	
Total Area							***7,914***	***80***

Drainage Area 1S - DP#2-REAR WETLANDS

Hydraulic Soils Group (HSG) Area (sf) & Curve Number (CN)

Surface Description	A	CN	B	CN	C	CN	D	CN
Paved Parking, HSG D							4,612	98
Grass > 75% Cover Good							3,479	80
Subtotal Area					-		*8,091*	
Total Area							***8,091***	***90***

Drainage Area 3S - DP#2-REAR WETLANDS

Hydraulic Soils Group (HSG) Area (sf) & Curve Number (CN)

Surface Description	A	C	B	CN	C	CN	D	CN

	N				
Paved Parking, HSG D				4,612	98
Grass >75% Cover Good				3,479	80
Subtotal Area			-	*8,091*	
Total Area				***8,091***	***90***

Drainage Area 7S - DP#2-REAR WETLANDS

Hydraulic Soils Group (HSG) Area (sf) & Curve Number (CN)

Surface Description	A	C N	B	CN	C	CN	D	CN
Paved Parking, HSG D							5,831	98
Grass >75% Cover Good							11,784	80
Subtotal Area							*17,615*	
Total Area							***17,615***	***86***

Drainage Area 8S - DP#2-REAR WETLANDS

Hydraulic Soils Group (HSG) Area (sf) & Curve Number (CN)

Surface Description	A	C N	B	CN	C	CN	D	CN
Paved Parking, HSG D							5,812	98
Grass >75% Cover Good							11,779	80
Subtotal Area							*17,591*	
Total Area							***17,591***	***86***

Drainage Area 4S - DP#2-REAR WETLANDS

Hydraulic Soils Group (HSG) Area (sf) & Curve Number (CN)

Surface Description	A	C N	B	CN	C	CN	D	CN
Roofs							20,980	98
Subtotal Area							*20,980*	
Total Area							***20,980***	***98***

Drainage Area 5S - DP#2-REAR WETLANDS

Hydraulic Soils Group (HSG) Area (sf) & Curve Number (CN)

Surface Description	A	CN	B	CN	C	CN	D	CN
Grass >75% Cover Good							22,509	80
Subtotal Area							*22,509*	
Total Area							***22,509***	***80***

Drainage Area 6S - DP#2-REAR WETLANDS

Hydraulic Soils Group (HSG) Area (sf) & Curve Number (CN)

Surface Description	A	CN	B	CN	C	CN	D	CN
Grass >75% Cover Good							3,941	80
Subtotal Area					-		*3,941*	
Total Area							***3,941***	***80***

TOTAL POST-DEVELOPMENT AREA = 106,730 SF

Peak Flow Rate Attenuation

Once the soils and drainage areas were analyzed and classified, a detailed hydrologic analysis was performed in accordance with the NRCS Technical Release 55 (TR-55) by using the HydroCAD® Stormwater Modeling System. The following tables represent a summary and comparison of the flow and volume between the pre-development and the post-development conditions. The comparison shows that there will be a net decrease in the flow and volume of stormwater runoff from the site after the project is completed. The detailed HydroCAD analysis is provided in Appendix C.

Summary of Pre- and Post-Development Peak Flow Rates

PRE-DEVELOPMENT (Existing Conditions)

Type III Storm Event:	**100-yr**	**25-yr**	**10-yr**	**2-yr**
Rainfall (in/24 hr):	6.4	5.3	4.5	3.2
FLOW TO GREENMONT AVENUE				
Flow Rate (cfs):	1.47	1.16	0.93	0.57
Volume (acre-ft):	0.088	0.068	0.054	0.033

PRE-DEVELOPMENT (Existing Conditions)

Type III Storm Event:	**100-yr**	**25-yr**	**10-yr**	**2-yr**
Rainfall (in/24 hr):	6.4	5.3	4.5	3.2
FLOW TO REAR WETLAND AREA				
Flow Rate (cfs):	12.54	9.66	7.59	4.35
Volume (acre-ft):	0.737	0.562	0.439	0.251

POST-DEVELOPMENT (Proposed Conditions)

Type III Storm Event:	**100-yr**	**25-yr**	**10-yr**	**2-yr**
Rainfall (in/24 hr):	6.4	5.3	4.5	3.2
FLOW TO GREENMONT AVENUE				
Flow Rate (cfs):	1.01	0.77	0.60	0.34
Volume (acre-ft):	0.063	0.048	0.037	0.021

POST-DEVELOPMENT (Proposed Conditions)

Type III Storm Event:	**100-yr**	**25-yr**	**10-yr**	**2-yr**
Rainfall (in/24 hr):	6.4	5.3	4.5	3.2
FLOW TO REAR WETLANDS				
Flow Rate (cfs):	6.14	4.48	3.45	0.80
Volume (acre-ft):	0.737	0.558	0.464	0.241

PRE & POST DEVELOPMENT COMPARISON

Type III Storm Event:	**100-yr**	**25-yr**	**10-yr**	**2-yr**
Rainfall (in/24 hr):	6.4	5.3	4.5	3.2
TOTAL FLOW TO GREENMONT AVENUE				
Flow Rate (cfs):	-0.46	-0.39	-0.33	-0.23
Volume (acre-ft):	-0.025	-0.020	-0.017	-0.012

PRE & POST DEVELOPMENT COMPARISON

Type III Storm Event:	**100-yr**	**25-yr**	**10-yr**	**2-yr**
Rainfall (in/24 hr):	6.4	5.3	4.5	3.2
TOTAL FLOW TO REAR WETLANDS				
Flow Rate (cfs):	-6.40	-5.18	-4.14	-3.55
Volume (acre-ft):	0.000	-0.004	0.025	-0.010

4.3 Standard 3: Recharge

Loss of annual recharge to groundwater has been eliminated or minimized by recharging runoff.

Recharge Volume

RECHARGE VOLUME REQUIRED

Due to the existing soil types and analysis on site, it has been determined that recharge is not required per the Massachusetts Stormwater Handbook regulations.

Total Suspended Solids (TSS)

TSS TO BE REMOVED

Stormwater management systems have been designed to remove 80% of the average annual post-construction load of Total Suspended Solids (TSS) as shown in the Treatment Train Forms Attached.

4.5 Standard 5: Higher Potential Pollutant Loads

Land Uses with Higher Potential Pollution Loads (LUHPPL) will include source controls and pollution prevention Proprietary Best Management Practices (BMPS) to ensure that the discharge of stormwater runoff from the impervious areas are treated to meet the Standard prior to conveyance to Infiltration BMPS. The project does not classify as a LUHPPL.

4.6 Standard 6: Critical Areas

Stormwater discharges to critical areas will utilize source controls, pollution prevention measures and approved Best Management Practices (BMP's). There are no stormwater discharges within the Zone II, Interim Wellhead Protection Areas of a public water supply or near an Outstanding Resource Water (ORW) or cold water fishery

4.7 Standard 7: Redevelopment

The project is proposed as new development due to the separation of the lots. An overall decrease in impervious area is proposed within the developed portion of the two lots.

4.8 Standard 8: Construction Period Controls

A plan to control construction-related impacts including erosion, sedimentation and other pollutant sources during construction has been developed.

Erosion Control Plan

An Erosion Control Plan has been provided within the Site Plan Set

Stormwater Pollution Prevention Plan

A National Pollution Discharge Elimination System (NPDES) Construction General Permit (CGP) is required for this project. CGP applications are required to be developed and submitted by the Owner/Applicant/Contractor seven (30) days prior to the commencement of construction. Due to the complex nature of this project, the Owner/Applicant will coordinate with this office and the selected contractor for the project to complete the application filing. The application, when filed, will contain a Stormwater Pollution Prevention Plan that will be kept on site and reviewed and updated weekly. The application shall be completed and submitted to the Town of Dracut Zoning Board of Appeals and Conservation Commission thirty (45-60) days prior to the commencement of construction for review.

4.9 Standard 9: Operation & Maintenance

A long term operation and maintenance plan has been developed to insure that the stormwater management systems function as designed.

Operation & Maintenance Manual

An Operation and Maintenance Manual has been provided under separate cover.

4.10 Standard 10: Illicit Discharges

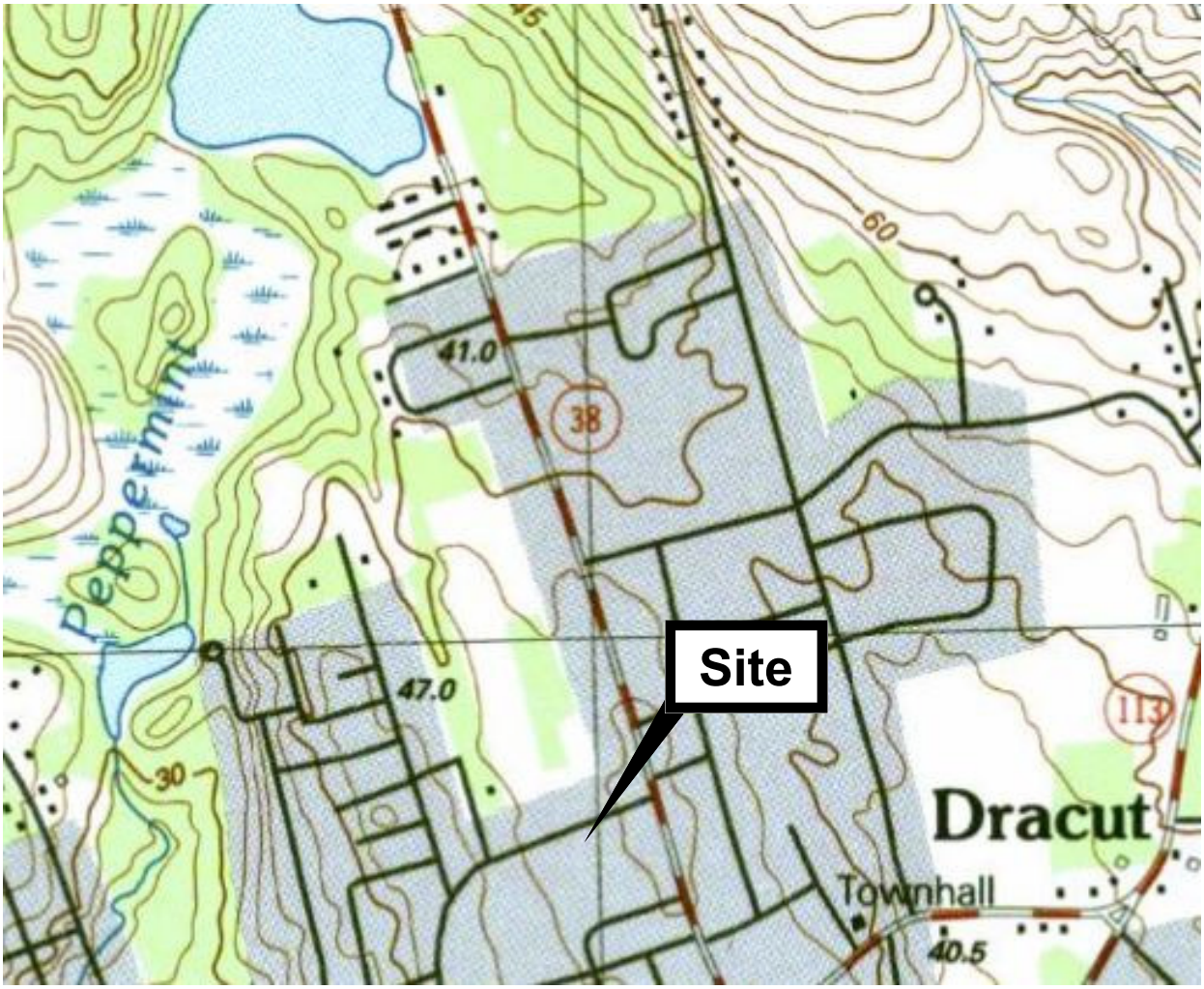
There are no known current illicit discharges of wastewater, stormwater contaminated with process wastes, raw materials, toxic pollutants, hazardous substances, oil or grease from the site. The discharge of any of these illicit materials is prohibited from the proposed stormwater management system.

APPENDICES

Appendix A: Background Data

USGS Locus Map

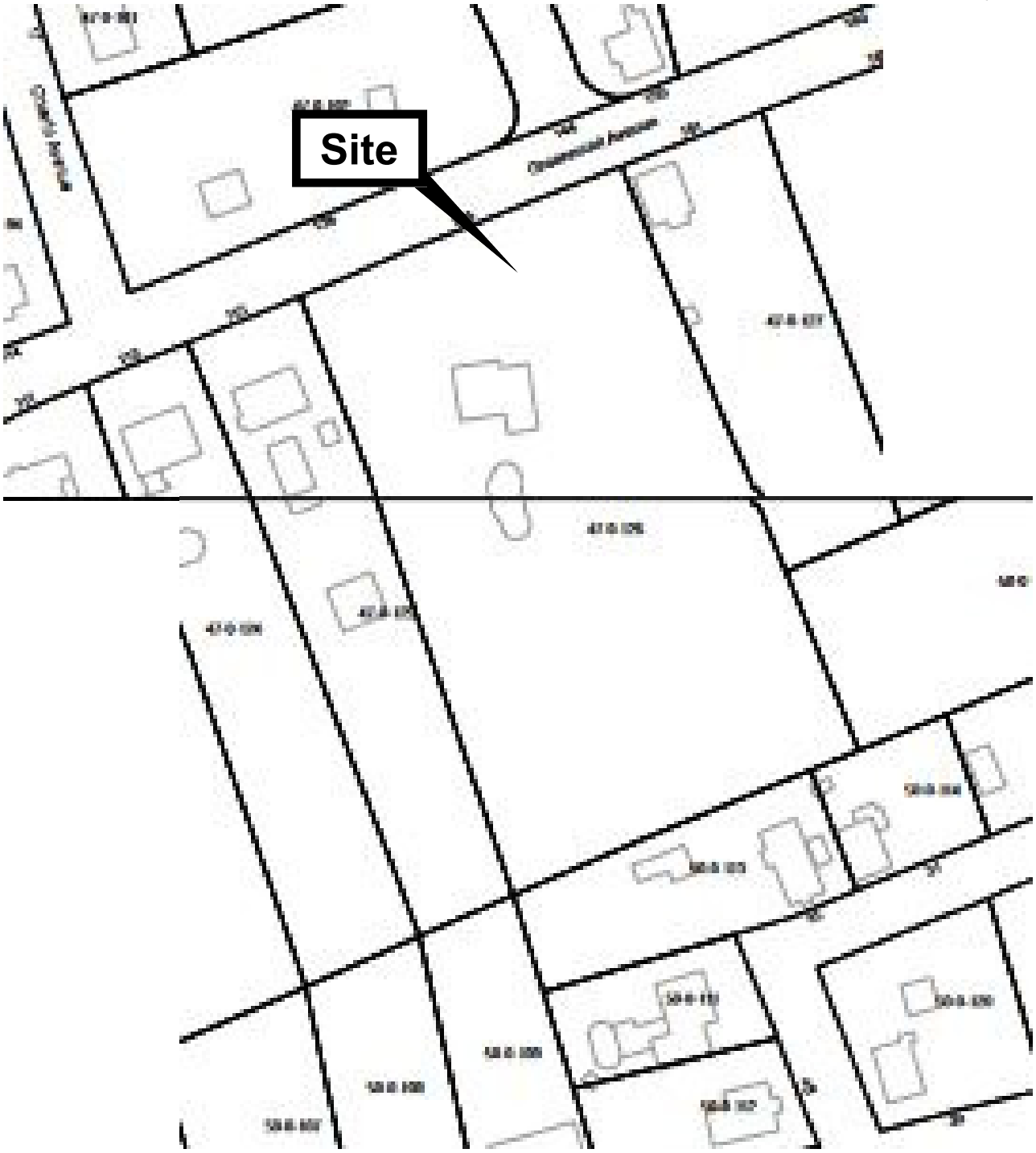
REF.: MassGIS Website



SCALE: Not to Scale

Assessor's Map

REF.: Tyngsborough Official Website



MAP 47 LOT 126

SCALE: 1" = 50 FT

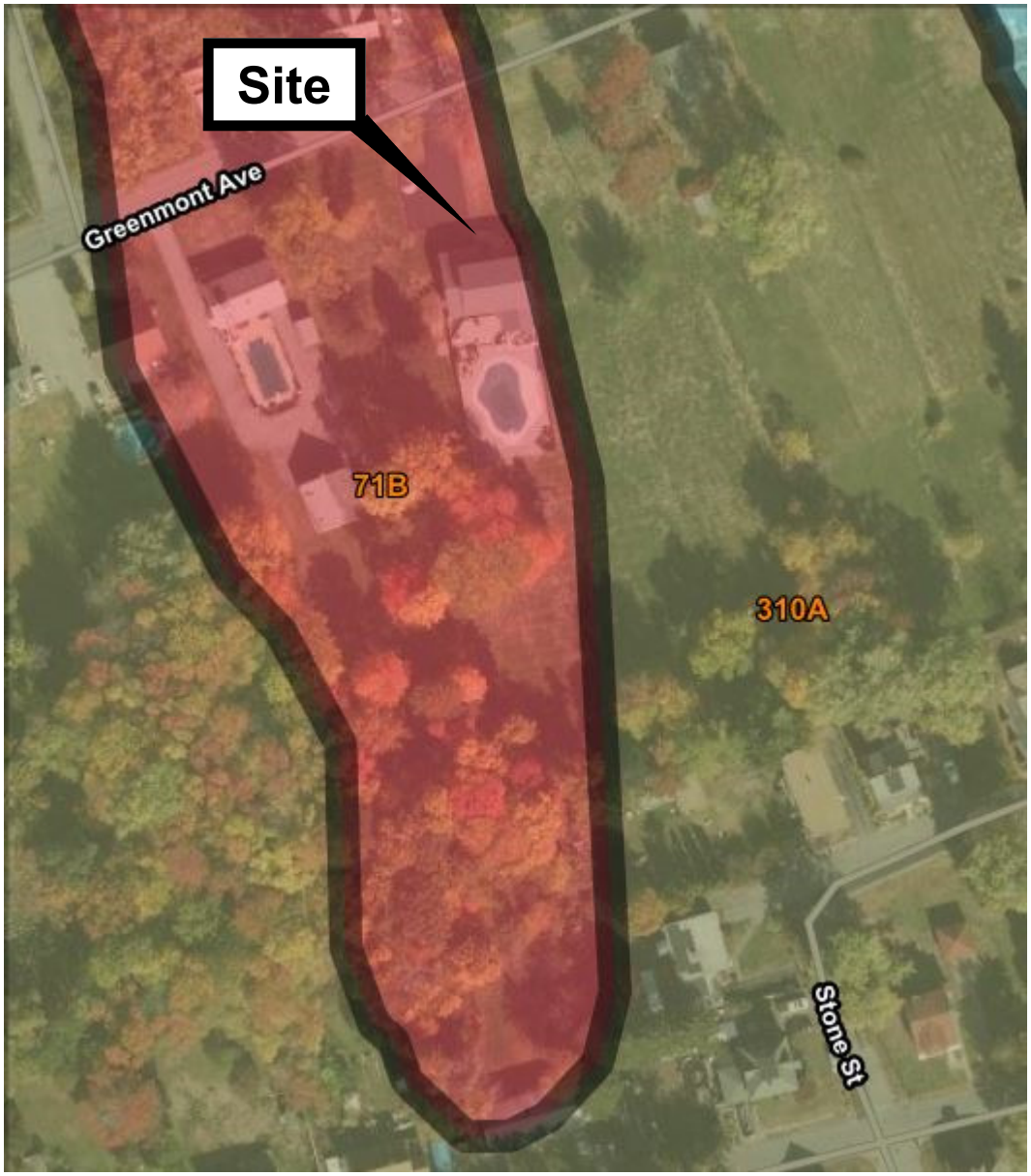
Aerial Photography

REF.: MassGIS Website

SCALE: 1” = 100 FT

NRCS Soil Map

REF.: NRCS Website



Hydrologic Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
71B	Ridgebury fine sandy loam, 3 to 8 percent slopes, extremely stony	D	3.5	26.3%
305B	Paxton fine sandy loam, 3 to 8 percent slopes	C	0.5	3.9%
310A	Woodbridge fine sandy loam, 0 to 3 percent slopes	C/D	9.2	69.8%
Totals for Area of Interest			13.2	100.0%

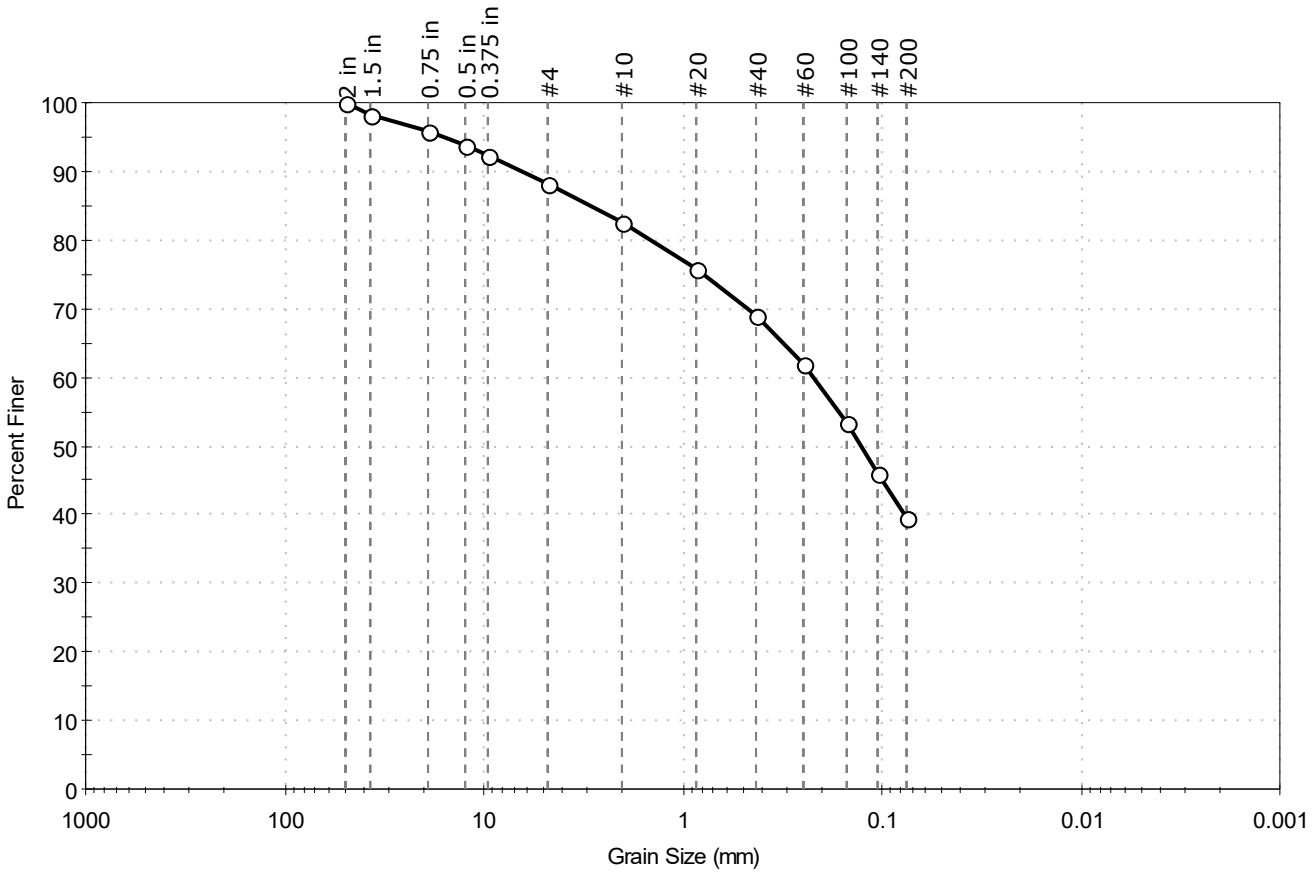
SCALE: Not to Scale

GeoTesting EXPRESS

Client:	Cornerstone Land Consultants				
Project:	Greenmont Commons				
Location:	Dracut, MA			Project No:	GTX-316104
Boring ID:	TP #1	Sample Type:	bucket	Tested By:	ckg
Sample ID:	---	Test Date:	09/26/22	Checked By:	jsc
Depth :	---	Test Id:	686183		

Test Comment: ---
Visual Description: Moist, light yellowish brown silty sand
Sample Comment: ---

Particle Size Analysis - ASTM D6913



% Cobble	% Gravel	% Sand	% Silt & Clay Size
--	11.8	48.7	39.5

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
2 in	50.00	100		
1.5 in	37.50	98		
0.75 in	19.00	96		
0.5 in	12.50	94		
0.375 in	9.50	92		
#4	4.75	88		
#10	2.00	83		
#20	0.85	76		
#40	0.42	69		
#60	0.25	62		
#100	0.15	53		
#140	0.11	46		
#200	0.075	40		

Coefficients

D_{85} = 2.8746 mm D_{30} = N/A
D_{60} = 0.2220 mm D_{15} = N/A
D_{50} = 0.1274 mm D_{10} = N/A
C_u = N/A C_c = N/A

Classification

ASTM N/A

AASHTO Silty Soils (A-4 (0))

Sample/Test Description

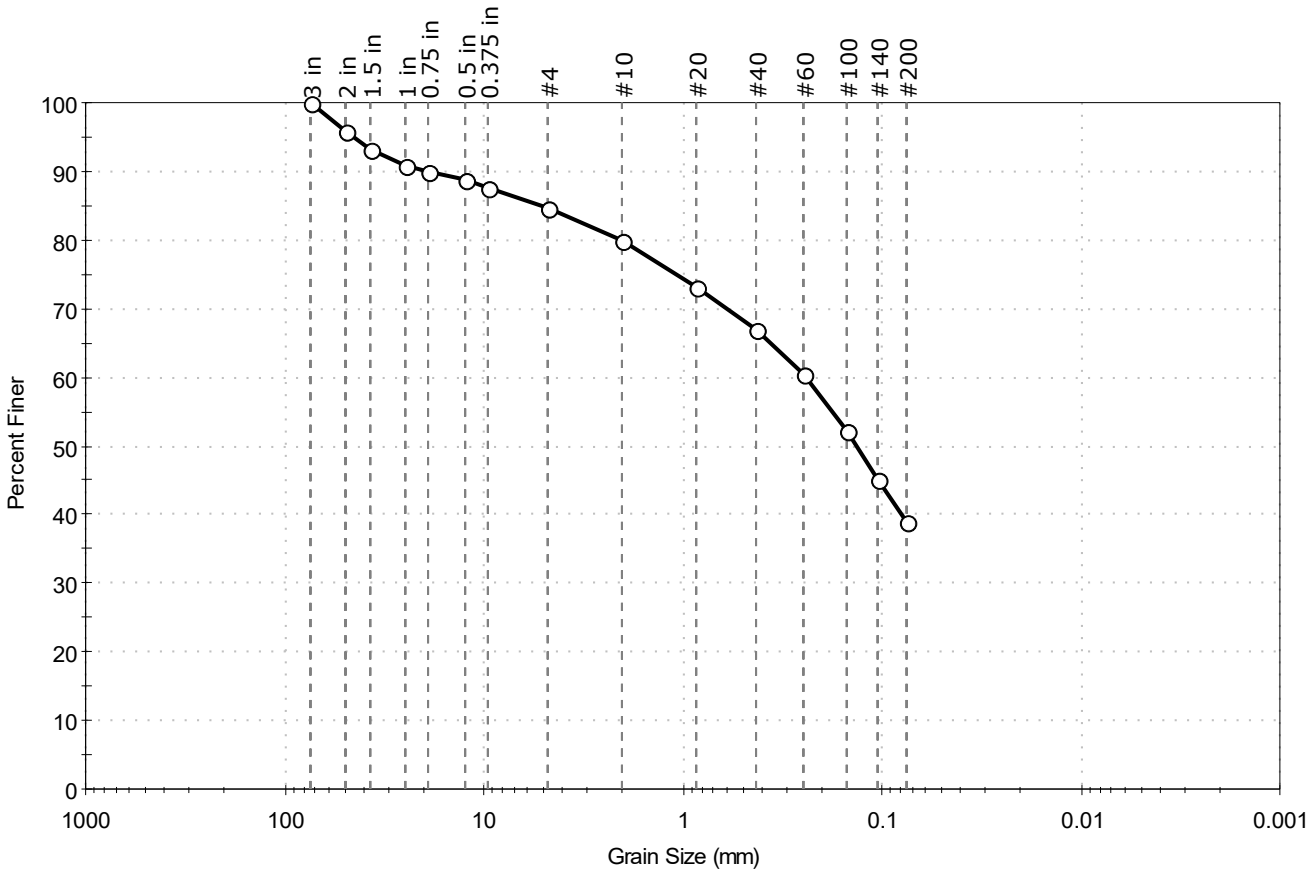
Sand/Gravel Particle Shape : ANGULAR
Sand/Gravel Hardness : HARD

GeoTesting EXPRESS

Client:	Cornerstone Land Consultants				
Project:	Greenmont Commons				
Location:	Dracut, MA			Project No:	GTX-316104
Boring ID:	TP #2	Sample Type:	bucket	Tested By:	ckg
Sample ID:	---	Test Date:	09/28/22	Checked By:	jsc
Depth :	---	Test Id:	686184		

Test Comment: ---
Visual Description: Moist, light olive brown silty sand with gravel
Sample Comment: ---

Particle Size Analysis - ASTM D6913



% Cobble	% Gravel	% Sand	% Silt & Clay Size
—	15.4	45.6	39.0

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
3 in	75.00	100		
2 in	50.00	96		
1.5 in	37.50	93		
1 in	25.00	91		
0.75 in	19.00	90		
0.5 in	12.50	89		
0.375 in	9.50	88		
#4	4.75	85		
#10	2.00	80		
#20	0.85	73		
#40	0.42	67		
#60	0.25	60		
#100	0.15	52		
#140	0.11	45		
#200	0.075	39		

Coefficients

D_{85} = 5.2042 mm D_{30} = N/A
D_{60} = 0.2449 mm D_{15} = N/A
D_{50} = 0.1347 mm D_{10} = N/A
C_u = N/A C_c = N/A

Classification

ASTM N/A

AASHTO Silty Soils (A-4 (0))

Sample/Test Description

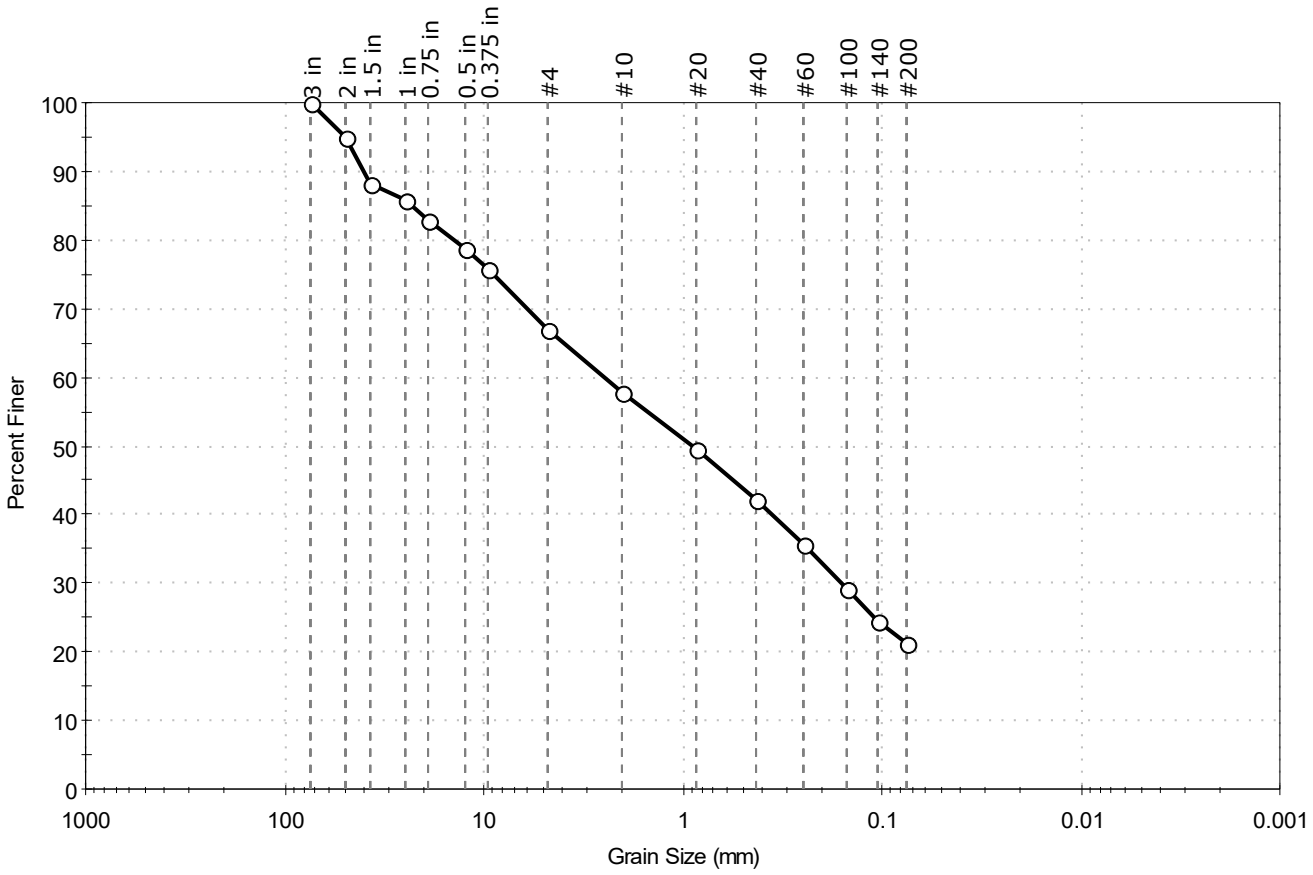
Sand/Gravel Particle Shape : ANGULAR
Sand/Gravel Hardness : HARD

GeoTesting EXPRESS

Client:	Cornerstone Land Consultants				
Project:	Greenmont Commons				
Location:	Dracut, MA			Project No:	GTX-316104
Boring ID:	TP #3	Sample Type:	bucket	Tested By:	ckg
Sample ID:	---	Test Date:	09/27/22	Checked By:	jsc
Depth :	---	Test Id:	686185		

Test Comment: ---
Visual Description: Moist, dark yellowish brown silty sand with gravel
Sample Comment: ---

Particle Size Analysis - ASTM D6913



% Cobble	% Gravel	% Sand	% Silt & Clay Size
—	32.9	45.8	21.3

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
3 in	75.00	100		
2 in	50.00	95		
1.5 in	37.50	88		
1 in	25.00	86		
0.75 in	19.00	83		
0.5 in	12.50	79		
0.375 in	9.50	76		
#4	4.75	67		
#10	2.00	58		
#20	0.85	50		
#40	0.42	42		
#60	0.25	36		
#100	0.15	29		
#140	0.11	24		
#200	0.075	21		

Coefficients

D_{85} = 23.0906 mm D_{30} = 0.1587 mm
D_{60} = 2.4279 mm D_{15} = N/A
D_{50} = 0.8828 mm D_{10} = N/A
C_u = N/A C_c = N/A

Classification

ASTM N/A

AASHTO Stone Fragments, Gravel and Sand (A-1-b (0))

Sample/Test Description

Sand/Gravel Particle Shape : ANGULAR

Sand/Gravel Hardness : HARD

printed 10/7/2022 2:53:00 PM

Client:	Cornerstone Land Consultants		
Project Name:	Greenmont Commons		
Project Location:	Dracut, MA		
GTX #:	316104		
Start Date:	09/30/22	Tested By:	awp
End Date:	10/04/22	Checked By:	jsc
Boring #:	TP-1		
Sample #:	---		
Depth:	---		
Visual Description:	Moist, light yellowish brown silty sand		

Permeability of Granular Soils (Constant Head) by ASTM D2434

Sample Type: Remolded

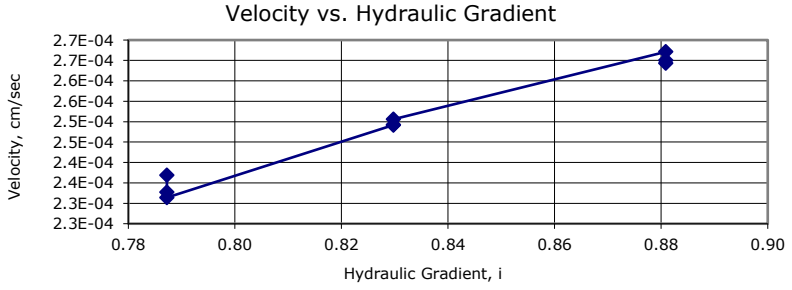
Sample Information:

Maximum Dry Density:	--- pcf
Optimum Moisture Content:	--- %
Compaction Test Method:	---
Classification (ASTM D2487):	---
Assumed Specific Gravity:	2.65

Sample Preparation / Test Setup: Test specimen compacted with moderate effort at air-dried moisture content. Material >3/4-inch removed from sample prior to testing (4.1% of sample).

Parameter	Initial	Final
Height, in	12.00	11.75
Diameter, in	9.50	9.50
Area, in^2	70.9	70.9
Volume, in^3	850.6	832.9
Mass, g	23931	---
Bulk Density, pcf	107	---
Moisture Content, %	1.2	---
Dry Density, pcf	106	---
Degree of Saturation, %	---	---
Void Ratio, e	---	---

Date	Reading #	Volume of Flow, cc	Time of Flow, sec	Flow Rate, cc/sec	Gradient	Permeability, cm/sec	Temp., °C	Correction Factor	Permeability @ 20 °C, cm/sec
10/4	1	3.3	31	0.11	0.79	3.0E-04	18.4	1.041	3.1E-04
10/4	2	3.2	30	0.11	0.79	3.0E-04	18.4	1.041	3.1E-04
10/4	3	3.2	30	0.11	0.79	2.9E-04	18.4	1.041	3.1E-04
10/4	4	3.5	31	0.11	0.83	3.0E-04	18.4	1.041	3.1E-04
10/4	5	3.5	31	0.11	0.83	3.0E-04	18.4	1.041	3.1E-04
10/4	6	3.5	31	0.11	0.83	3.0E-04	18.4	1.041	3.1E-04
10/4	7	3.7	31	0.12	0.88	3.0E-04	18.5	1.038	3.1E-04
10/4	8	3.7	30	0.12	0.88	3.0E-04	18.5	1.038	3.1E-04
10/4	9	3.7	30	0.12	0.88	3.0E-04	18.5	1.038	3.1E-04



PERMEABILITY @ 20 °C = 3.1×10^{-4} cm/sec

PERMEABILITY @ 20 °C = 3.1×10^{-6} m/sec

Client:	Cornerstone Land consultants		
Project Name:	Greenmont Commons		
Project Location:	Dracut, MA		
GTX #:	316104		
Start Date:	09/30/22	Tested By:	awp
End Date:	10/06/22	Checked By:	jsc
Boring #:	TP-2		
Sample #:	---		
Depth:	---		
Visual Description:	Moist, light olive brown silty sand with gravel		

Permeability of Granular Soils (Constant Head) by ASTM D2434

Sample Type: Remolded

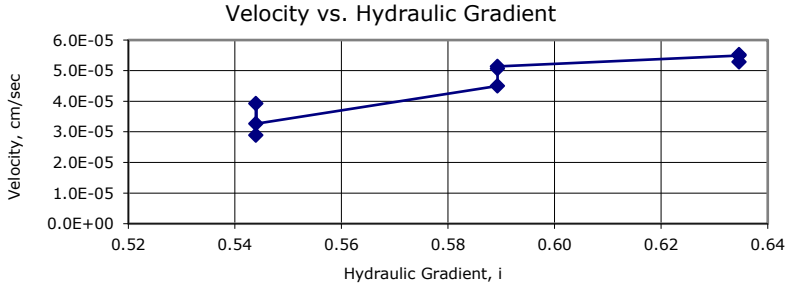
Sample Information:

Maximum Dry Density:	--- pcf
Optimum Moisture Content:	--- %
Compaction Test Method:	---
Classification (ASTM D2487):	---
Assumed Specific Gravity:	2.65

Sample Preparation / Test Setup: Test specimen compacted with moderate effort at air-dried moisture content. Material >3/8-inch removed from sample prior to testing (7% of sample).

Parameter	Initial	Final
Height, in	10.65	11.03
Diameter, in	9.50	9.50
Area, in^2	70.9	70.9
Volume, in^3	754.9	781.8
Mass, g	20807	---
Bulk Density, pcf	105	---
Moisture Content, %	0.0	---
Dry Density, pcf	105	---
Degree of Saturation, %	---	---
Void Ratio, e	---	---

Date	Reading #	Volume of Flow, cc	Time of Flow, sec	Flow Rate, cc/sec	Gradient	Permeability, cm/sec	Temp., °C	Correction Factor	Permeability @ 20 °C, cm/sec
10/5	1	4.0	300	0.01	0.54	5.3E-05	19.8	1.005	5.3E-05
10/5	2	5.4	300	0.02	0.54	7.2E-05	19.8	1.005	7.2E-05
10/5	3	4.5	300	0.01	0.54	6.0E-05	19.8	1.005	6.0E-05
10/5	4	6.2	300	0.02	0.59	7.6E-05	19.5	1.013	7.7E-05
10/5	5	6.9	300	0.02	0.59	8.6E-05	19.5	1.013	8.7E-05
10/5	6	7.0	300	0.02	0.59	8.7E-05	19.5	1.013	8.8E-05
10/5	7	7.5	300	0.03	0.63	8.7E-05	19.4	1.015	8.8E-05
10/5	8	7.6	300	0.03	0.63	8.7E-05	19.4	1.015	8.8E-05
10/5	9	7.3	300	0.02	0.63	8.3E-05	19.4	1.015	8.5E-05



PERMEABILITY @ 20 °C = 7.8×10^{-5} cm/sec

PERMEABILITY @ 20 °C = 7.8×10^{-7} m/sec

Client:	Conerstone Land Consultants		
Project Name:	Greenmont Commons		
Project Location:	Dracut, MA		
GTX #:	316104		
Start Date:	09/30/22	Tested By:	awp
End Date:	10/06/22	Checked By:	jsc
Boring #:	TP-3		
Sample #:	---		
Depth:	---		
Visual Description:	Moist, dark yellowish brown sand with gravel		

Permeability of Granular Soils (Constant Head) by ASTM D2434

Sample Type: Remolded

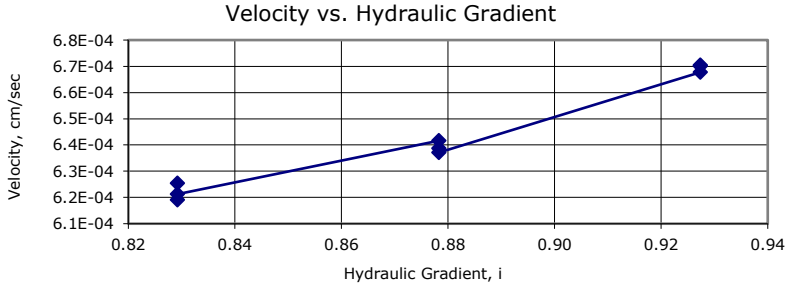
Sample Information:

Maximum Dry Density:	--- pcf
Optimum Moisture Content:	--- %
Compaction Test Method:	---
Classification (ASTM D2487):	---
Assumed Specific Gravity:	2.65

Sample Preparation / Test Setup: Test specimen compacted with moderate effort at air-dried moisture content. Material >3/4-inch removed from sample prior to testing (17.2% of sample).

Parameter	Initial	Final
Height, in	10.04	10.19
Diameter, in	9.50	9.50
Area, in^2	70.9	70.9
Volume, in^3	711.7	722.3
Mass, g	20380	---
Bulk Density, pcf	109	---
Moisture Content, %	2.9	---
Dry Density, pcf	106	---
Degree of Saturation, %	---	---
Void Ratio, e	---	---

Date	Reading #	Volume of Flow, cc	Time of Flow, sec	Flow Rate, cc/sec	Gradient	Permeability, cm/sec	Temp., °C	Correction Factor	Permeability @ 20 °C, cm/sec
10/6	1	34.3	120	0.29	0.83	7.5E-04	18.6	1.036	7.8E-04
10/6	2	34.5	122	0.28	0.83	7.5E-04	18.6	1.036	7.7E-04
10/6	3	38.0	134	0.28	0.83	7.5E-04	18.6	1.036	7.8E-04
10/6	4	35.6	121	0.29	0.88	7.3E-04	18.6	1.036	7.6E-04
10/6	5	35.2	121	0.29	0.88	7.3E-04	18.6	1.036	7.5E-04
10/6	6	41.5	142	0.29	0.88	7.3E-04	18.6	1.036	7.5E-04
10/6	7	39.8	130	0.31	0.93	7.2E-04	18.4	1.041	7.5E-04
10/6	8	38.2	125	0.31	0.93	7.2E-04	18.4	1.041	7.5E-04
10/6	9	41.2	134	0.31	0.93	7.2E-04	18.4	1.041	7.5E-04



PERMEABILITY @ 20 °C = 7.6×10^{-4} cm/sec

PERMEABILITY @ 20 °C = 7.6×10^{-6} m/sec

Appendix B: BMP Designs

ADS® Barracuda™ Max

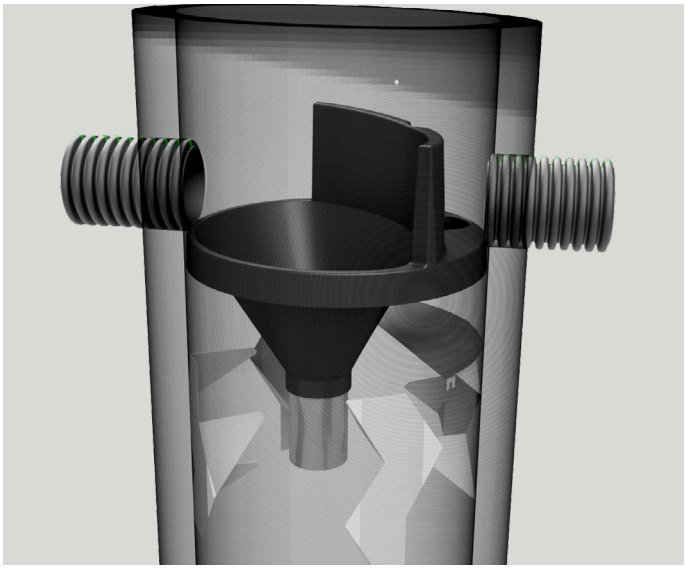
The Barracuda Max is market-changing stormwater quality technology. This high-performance vortex hydrodynamic separator is designed to remove total suspended solids in order to protect our precious receiving waters. The Barracuda Max is also an outstanding value that offers multiple pipe configurations, and quick installation. The “Max” version of the Barracuda is built on the base platform of the original ADS Barracuda with improved removal efficiencies and installation components.

Features

- Single manhole design
- No elevation loss between the inlet and outlet
- Variable inlet/outlet angle configurations (not just 180 degree orientation)
- Internal bypass for inline installation (where applicable)
- Revolutionary, patent-pending “teeth” mitigate turbulence in the sump area to prevent re-suspension of captured contaminants and an added deflector plate and bowl extension enhance the unit’s removal capabilities

Benefits

- Internal components are in stock for quick delivery
- The S3, S4, S6, and S8 can be installed in a standard 36” (900 mm), 48” (1200 m), 72” (1800 m), and 96” (2400 m) precast manhole, respectively
- The S3 & S4 can be provided factory installed within a 36” (900 mm) and 48” (1200 mm) ADS HP manhole and delivered to the jobsite
- The Barracuda Max “teeth” and deflector plate apparatus are fabricated and designed for quick and easy field assembly
- Designed for easy maintenance using a vacuum truck or similar equipment.
- Inspection and maintenance are performed from the surface with no confined space entry



ADS™

Barrucuda Specification

Materials and Design

- Concrete Structures: Designed for H-20 traffic loading and applicable soil loads or as otherwise determined by a Licensed Professional Engineer. The materials and structural design of the devices shall be per ASTM C857 and ASTM C858.
- 36” (900 mm) and 48” (1200 mm) HP Manhole Structures: Made from an impact modified copolymer polypropylene meeting the material requirements of ASTM F2764. The eccentric cone reducer shall be manufactured from polyethylene material meeting ASTM D3350 cell class 213320C. Gaskets shall be made of material meeting the requirements of ASTM F477.
- Separator internals shall be substantially constructed of stainless steel, polyethylene or other thermoplastic material approved by the manufacturer.

Performance

- The stormwater treatment unit shall be an inline unit capable of conveying 100% of the design peak flow. If peak flow rates exceed maximum hydraulic rate, the unit shall be installed offline.
- The Barracuda Max unit shall be designed to remove at least 80% of the suspended solids on an annual aggregate removal basis. Said removal shall be based on full-scale third party testing using OK-110 media gradation or equivalent and 300 mg/L influent concentration. Said full scale testing shall have included sediment capture based on actual total mass collected by the stormwater treatment unit.

  - OR -

  The Barracuda Max unit shall be designed to remove at least 50% of TSS using a media mix with d_{50}=75 micron and 200 mg/L influent concentration.

  - OR -

  The Barracuda Max unit shall be designed to remove at least 50% of TSS per current NJDEP/NJCAT HDS protocol.
- The stormwater treatment unit internals shall consist of (1) separator cone assembly, and (1) sump assembly, which includes the “teeth”.

Barracuda Max Model	Manhole Diameter	NJDEP (50% removal)	OK-110 (80% removal)
S3	36” (900 mm)	0.85 CFS (24.1 L/s)	0.86 CFS (24.1 L/s)
S4	48” (1200 mm)	1.52 CFS (43.0 L/s)	1.52 CFS (43.0 L/s)
S6	72” (1800 mm)	3.40 CFS (96.3 L/s)	3.42 CFS (96.8 L/s)
S8	96” (2400 mm)	6.08 CFS (172.2 L/s)	6.08 CFS (172.2 L/s)

* Peak bypass flows are dependent on final design

Installation

Installation of the stormwater treatment unit(s) shall be performed per manufacturer’s installation instructions. Such instructions can be obtained by calling Advanced Drainage Systems at 800-821-6710 or by logging on to www.adspipe.com.

adspipe.com
800-821-6710

B.3: Total Suspended Solids

Location: Greenmont Commons

TSS Removal Calculation Worksheet

B BMP[1]	C TSS Removal Rate[1]	D Starting TSS Load*	E Amount Removed (C*D)	F Remaining Load (D-E)
Deep Sump and Hooded Catch Basin	0.25	1.00	0.25	0.75
Barracuda Hydrodynamic Separator	0.80	0.75	0.60	0.15
Sediment Forebay	0.25	0.15	0.04	0.11
Wet Basin	0.80	0.11	0.09	0.02
	0.00	0.02	0.00	0.02

Total TSS Removal = 98%

Separate Form Needs to be Completed for Each Outlet or BMP Train

Project: Greenmont Commons

Prepared By: Cornerstone Land Associates, LLC

Date: 10-Apr-24

*Equals remaining load from previous BMP (E) which enters the BMP

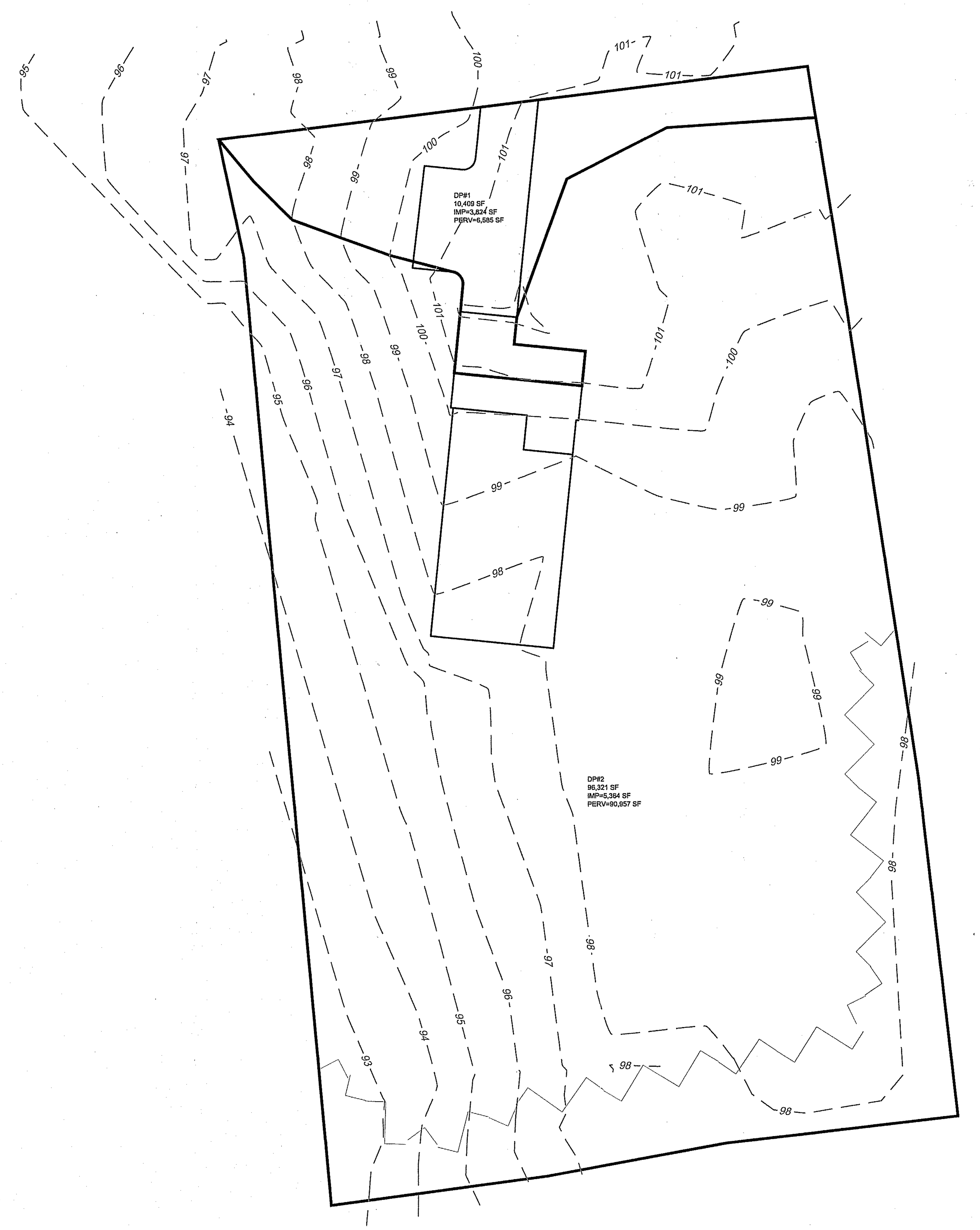
Non-automated TSS Calculation Sheet must be used if Proprietary BMP Proposed

1. From MassDEP Stormwater Handbook Vol. 1

Appendix C: Hydrologic Analysis

C.1: Pre-Development Analysis

[Existing Watershed Plan & HydroCAD calculations]



APPROVED DRACUT ZONING BOARD OF APPEALS

SIGNATURE	DATE

For Registry Use Only

"I certify that this plan conforms to the Rules and Regulations of the Registers of Deeds of the Commonwealth of Massachusetts."

Signature ______________________ Date __________

Notice of Appeals

I, ______________________, being the Town Clerk of the Town of Dracut, hereby certify that notice of this plan has been received and recorded at this office on __________, and no appeal of such has been received during the twenty days next.

Town Clerk ______________________ Date__________

Site Plan

SCALE: 1 in. = 30 ft.

GRAPHIC SCALE (ft)

0 30

LEGEND

EXISTING	PROPOSED	
100	100	GRADE CONTOUR
WF-1		BORDERING VEGETATIVE WETLAND FLAGGING
o		STONE WALL DRILL HOLE
		CONCRETE BOUND MARKER
TEXT, Text	TEXT, Text	GENERAL TEXT
		50 FT NO BUILD ZONE
		100 FT BVW BUFFER ZONE

Commonwealth of Massachusetts — John A. Visniewski, Civil, No. 29775, Registered Professional Engineer

Certification not valid without ORIGINAL stamp and/or signature

		BY	
11/29/23	REVS PER ZONING BOARD OF APPEALS MEETING AND ZBA PEER REVIEW COMMENTS	KML	Design by KML
			Survey by KML/TAJ
			Draft by KML
			Check by JAV/TAJ

Cornerstone Land Associates, LLC
Civil & Structural Engineering
Land Surveying · Land Development
25 Dean Avenue • Dracut, MA 01826 • (978) 835-0102
kmconsultants@comcast.net

SCALE: As Shown
DATE: May 18, 2023

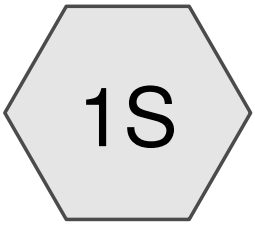
PREPARED FOR:
Riverbank Properties
908 Lawrence Street
Lowell, MA 01852

EXISTING WATERSHED PLAN

Comprehensive Permit Application
135 GREENMONT AVENUE
DRACUT, MASSACHUSETTS

JOB NO.: 2021-235
SHEET: 1 of 1

DRAWING NO.
EX-WS



DP#1-GREENMONT

DP#2-REAR WETLANDS

Subcat Reach Pond Link

Routing Diagram for Ex-Conditions

Prepared by Cornerstone Land Consultants LLC, Printed 4/19/2024

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
0.048	74	>75% Grass cover, Good, HSG C (1S)
1.910	80	>75% Grass cover, Good, HSG D (1S, 2S)
0.165	98	Paved parking, HSG D (1S, 2S)
0.046	98	Roofs, HSG D (1S, 2S)
0.281	77	Woods, Good, HSG D (2S)
2.450	**81**	**TOTAL AREA**

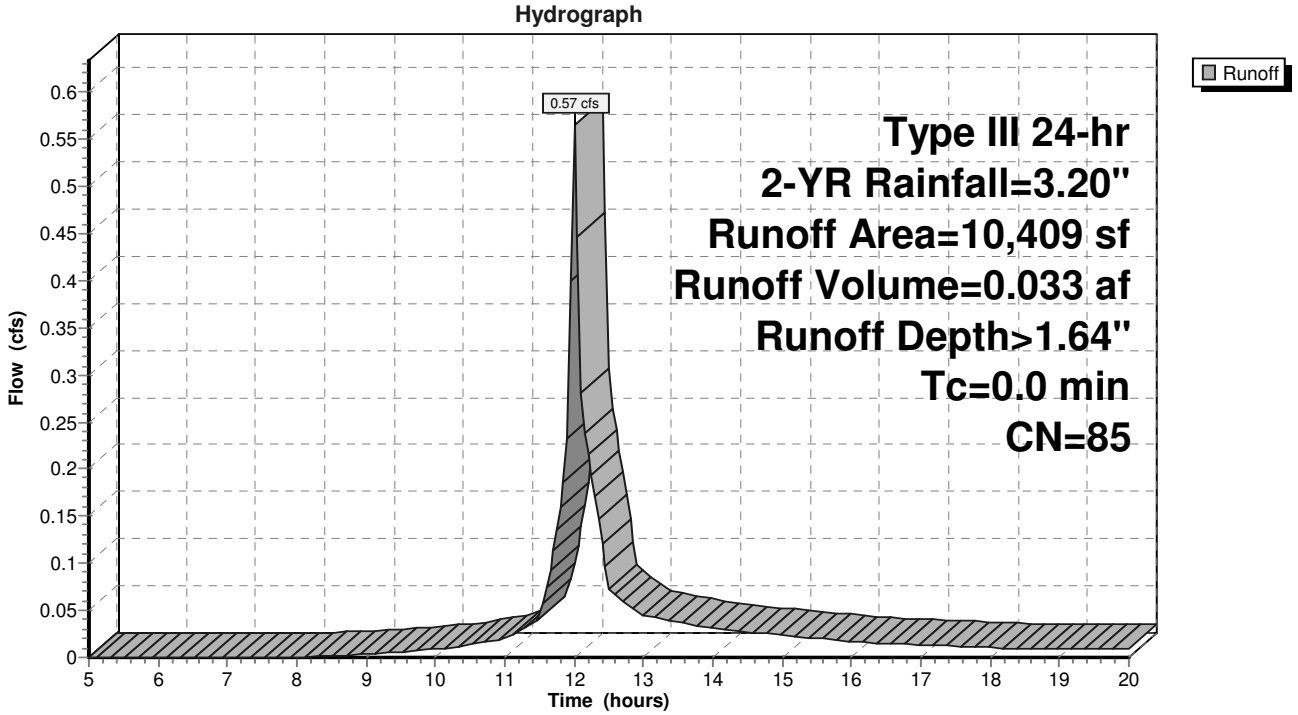
Summary for Subcatchment 1S: DP#1-GREENMONT

Runoff = 0.57 cfs @ 12.00 hrs, Volume= 0.033 af, Depth> 1.64"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-YR Rainfall=3.20"

Area (sf)	CN	Description
981	98	Roofs, HSG D
2,843	98	Paved parking, HSG D
4,478	80	>75% Grass cover, Good, HSG D
2,107	74	>75% Grass cover, Good, HSG C
10,409	85	Weighted Average
6,585		63.26% Pervious Area
3,824		36.74% Impervious Area

Subcatchment 1S: DP#1-GREENMONT



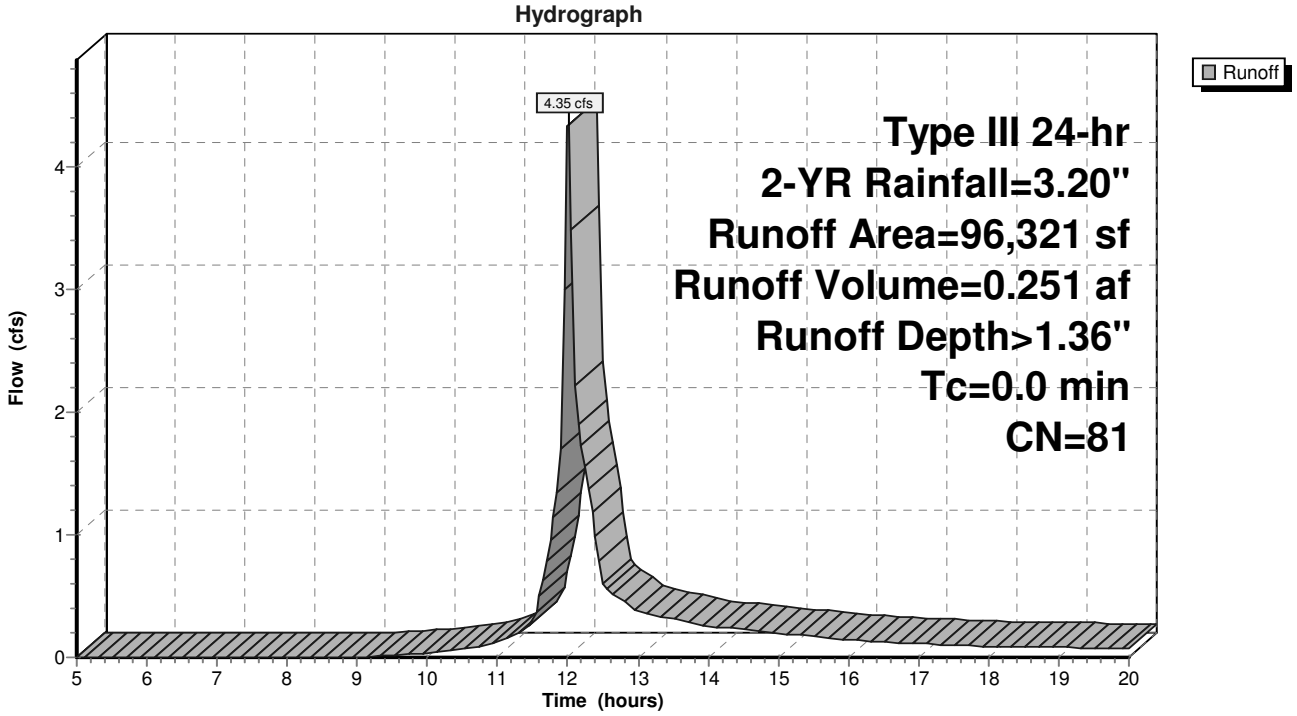
Summary for Subcatchment 2S: DP#2-REAR WETLANDS

Runoff = 4.35 cfs @ 12.01 hrs, Volume= 0.251 af, Depth> 1.36"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-YR Rainfall=3.20"

Area (sf)	CN	Description
1,008	98	Roofs, HSG D
4,356	98	Paved parking, HSG D
33,120	80	>75% Grass cover, Good, HSG D
2,063	77	Woods, Good, HSG D
10,179	77	Woods, Good, HSG D
45,595	80	>75% Grass cover, Good, HSG D
96,321	81	Weighted Average
90,957		94.43% Pervious Area
5,364		5.57% Impervious Area

Subcatchment 2S: DP#2-REAR WETLANDS



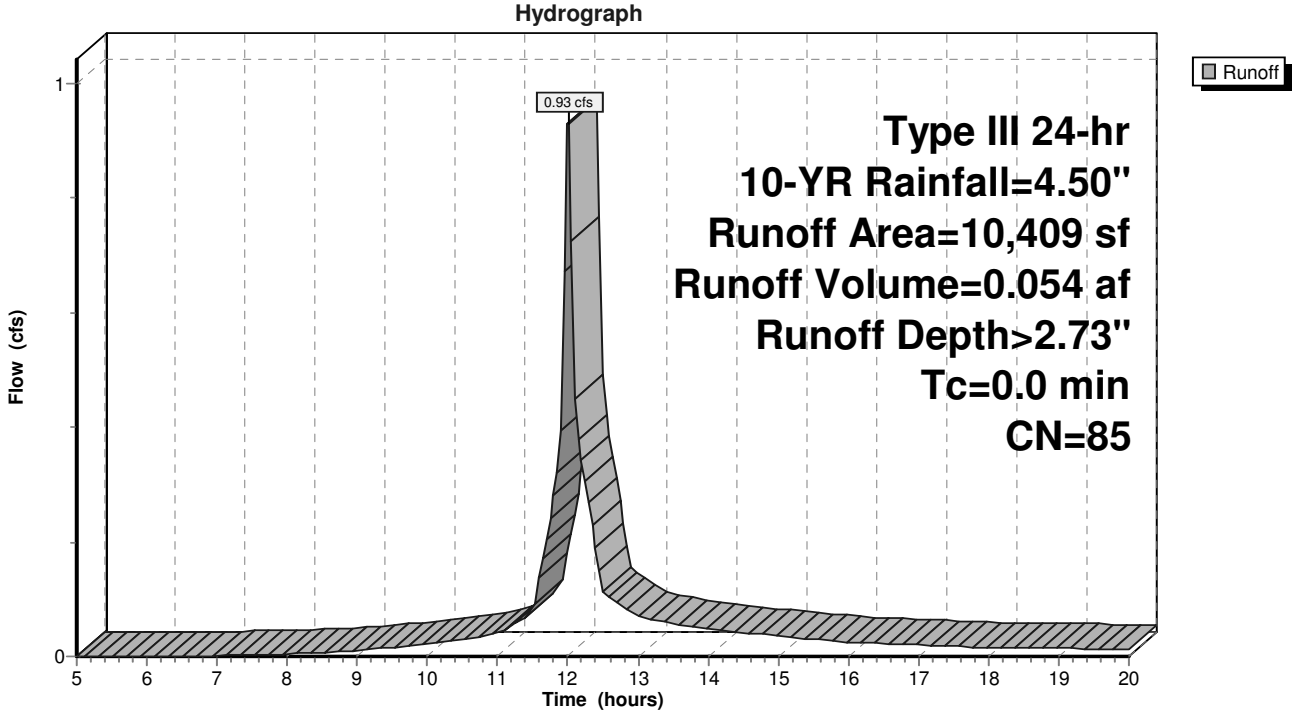
Summary for Subcatchment 1S: DP#1-GREENMONT

Runoff = 0.93 cfs @ 12.00 hrs, Volume= 0.054 af, Depth> 2.73"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-YR Rainfall=4.50"

Area (sf)	CN	Description
981	98	Roofs, HSG D
2,843	98	Paved parking, HSG D
4,478	80	>75% Grass cover, Good, HSG D
2,107	74	>75% Grass cover, Good, HSG C
10,409	85	Weighted Average
6,585		63.26% Pervious Area
3,824		36.74% Impervious Area

Subcatchment 1S: DP#1-GREENMONT



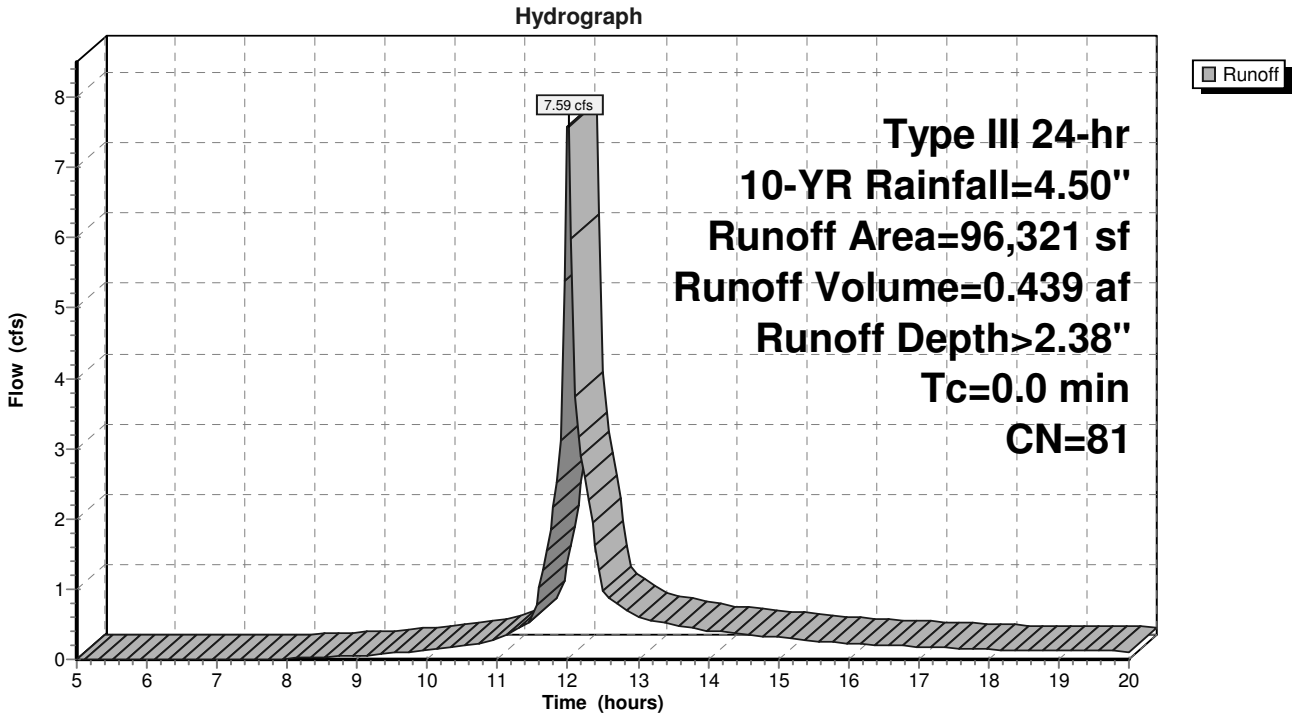
Summary for Subcatchment 2S: DP#2-REAR WETLANDS

Runoff = 7.59 cfs @ 12.00 hrs, Volume= 0.439 af, Depth> 2.38"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-YR Rainfall=4.50"

Area (sf)	CN	Description
1,008	98	Roofs, HSG D
4,356	98	Paved parking, HSG D
33,120	80	>75% Grass cover, Good, HSG D
2,063	77	Woods, Good, HSG D
10,179	77	Woods, Good, HSG D
45,595	80	>75% Grass cover, Good, HSG D
96,321	81	Weighted Average
90,957		94.43% Pervious Area
5,364		5.57% Impervious Area

Subcatchment 2S: DP#2-REAR WETLANDS



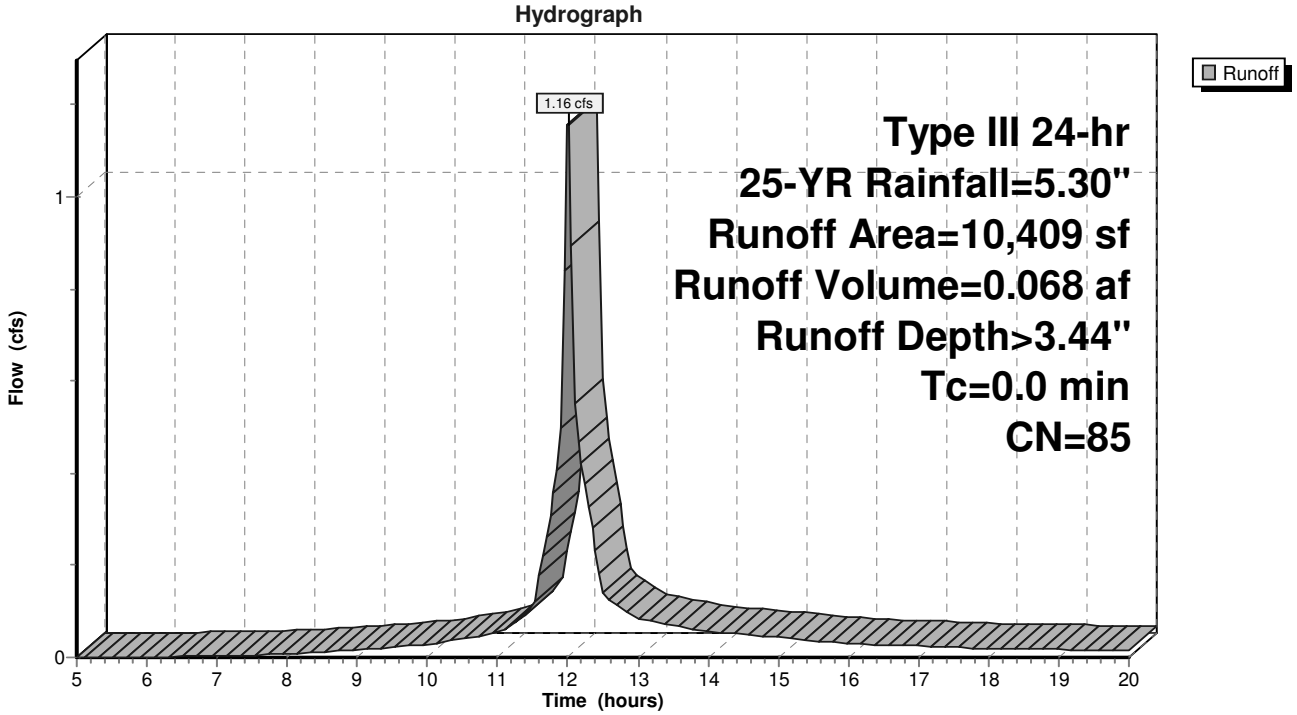
Summary for Subcatchment 1S: DP#1-GREENMONT

Runoff = 1.16 cfs @ 12.00 hrs, Volume= 0.068 af, Depth> 3.44"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-YR Rainfall=5.30"

Area (sf)	CN	Description
981	98	Roofs, HSG D
2,843	98	Paved parking, HSG D
4,478	80	>75% Grass cover, Good, HSG D
2,107	74	>75% Grass cover, Good, HSG C
10,409	85	Weighted Average
6,585		63.26% Pervious Area
3,824		36.74% Impervious Area

Subcatchment 1S: DP#1-GREENMONT



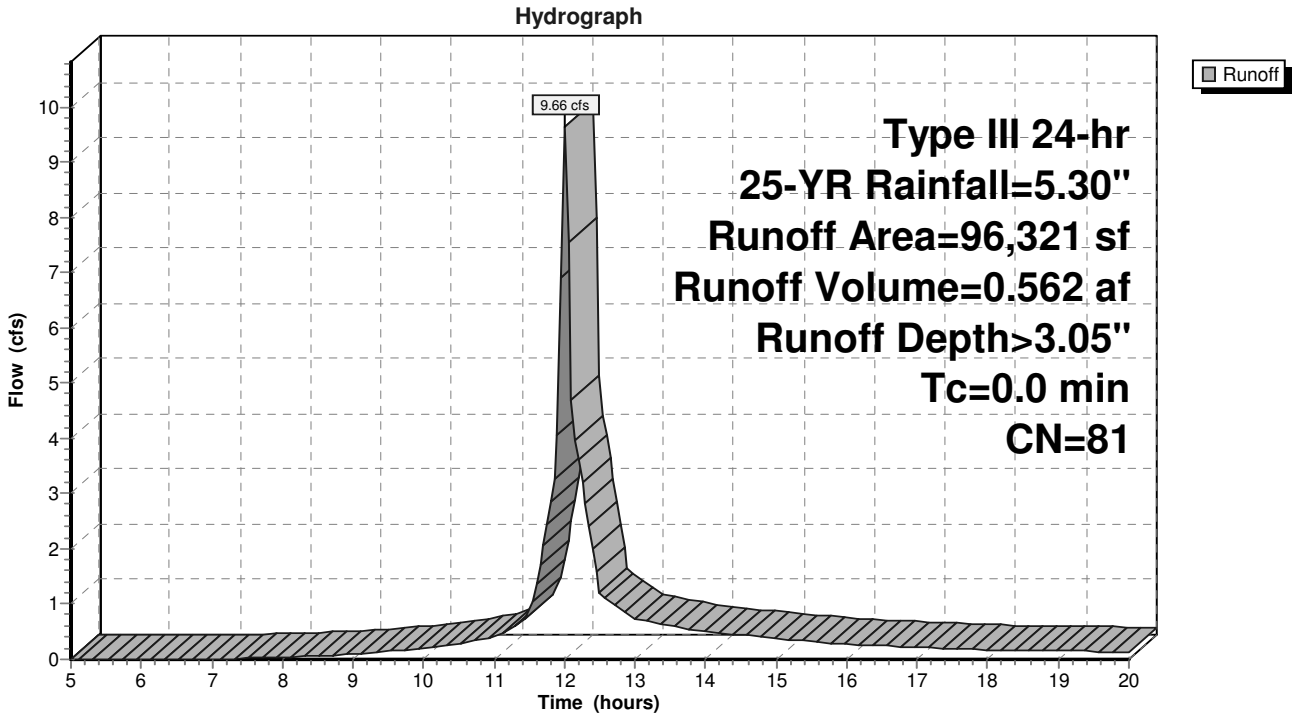
Summary for Subcatchment 2S: DP#2-REAR WETLANDS

Runoff = 9.66 cfs @ 12.00 hrs, Volume= 0.562 af, Depth> 3.05"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-YR Rainfall=5.30"

Area (sf)	CN	Description
1,008	98	Roofs, HSG D
4,356	98	Paved parking, HSG D
33,120	80	>75% Grass cover, Good, HSG D
2,063	77	Woods, Good, HSG D
10,179	77	Woods, Good, HSG D
45,595	80	>75% Grass cover, Good, HSG D
96,321	81	Weighted Average
90,957		94.43% Pervious Area
5,364		5.57% Impervious Area

Subcatchment 2S: DP#2-REAR WETLANDS



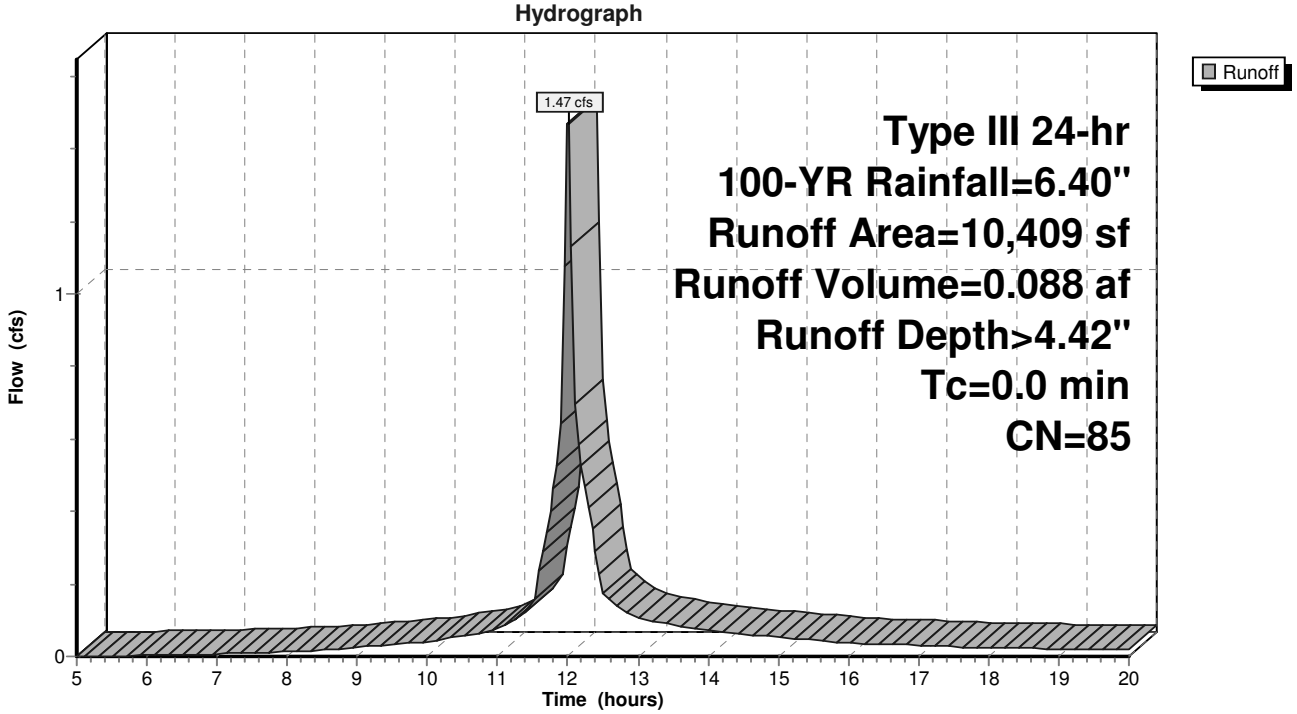
Summary for Subcatchment 1S: DP#1-GREENMONT

Runoff = 1.47 cfs @ 12.00 hrs, Volume= 0.088 af, Depth> 4.42"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-YR Rainfall=6.40"

Area (sf)	CN	Description
981	98	Roofs, HSG D
2,843	98	Paved parking, HSG D
4,478	80	>75% Grass cover, Good, HSG D
2,107	74	>75% Grass cover, Good, HSG C
10,409	85	Weighted Average
6,585		63.26% Pervious Area
3,824		36.74% Impervious Area

Subcatchment 1S: DP#1-GREENMONT



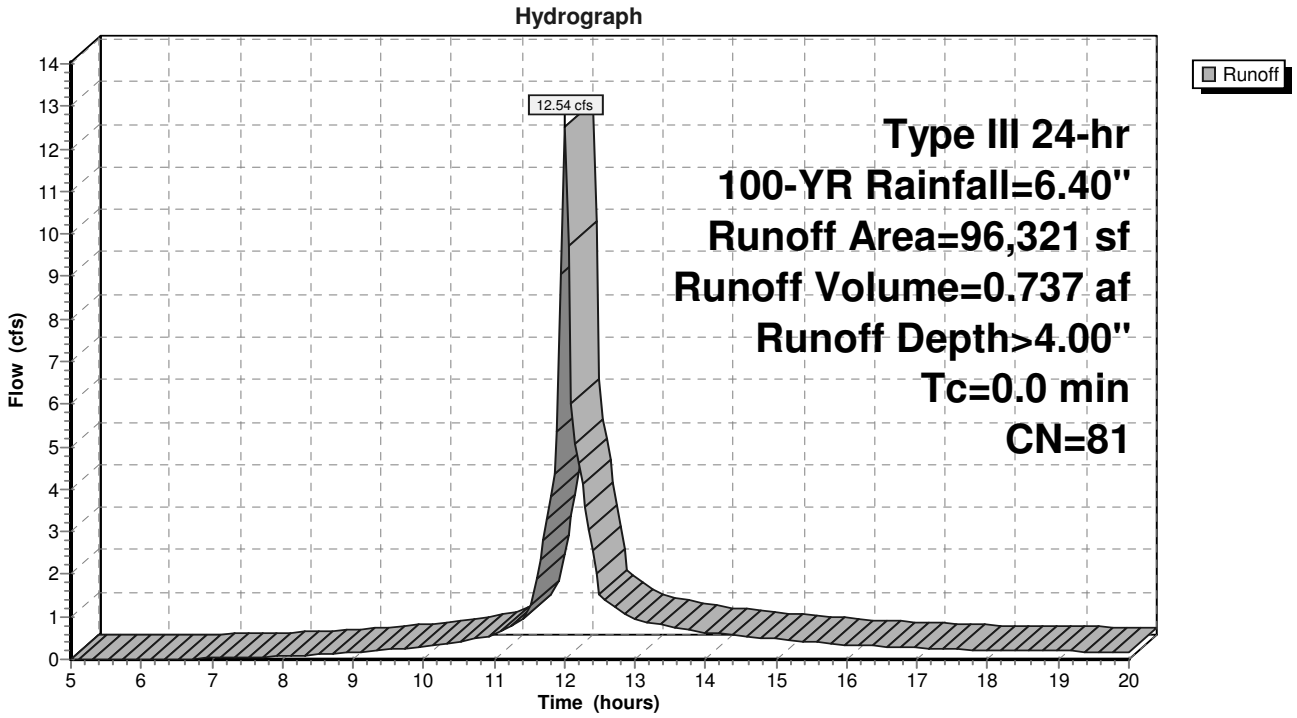
Summary for Subcatchment 2S: DP#2-REAR WETLANDS

Runoff = 12.54 cfs @ 12.00 hrs, Volume= 0.737 af, Depth> 4.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-YR Rainfall=6.40"

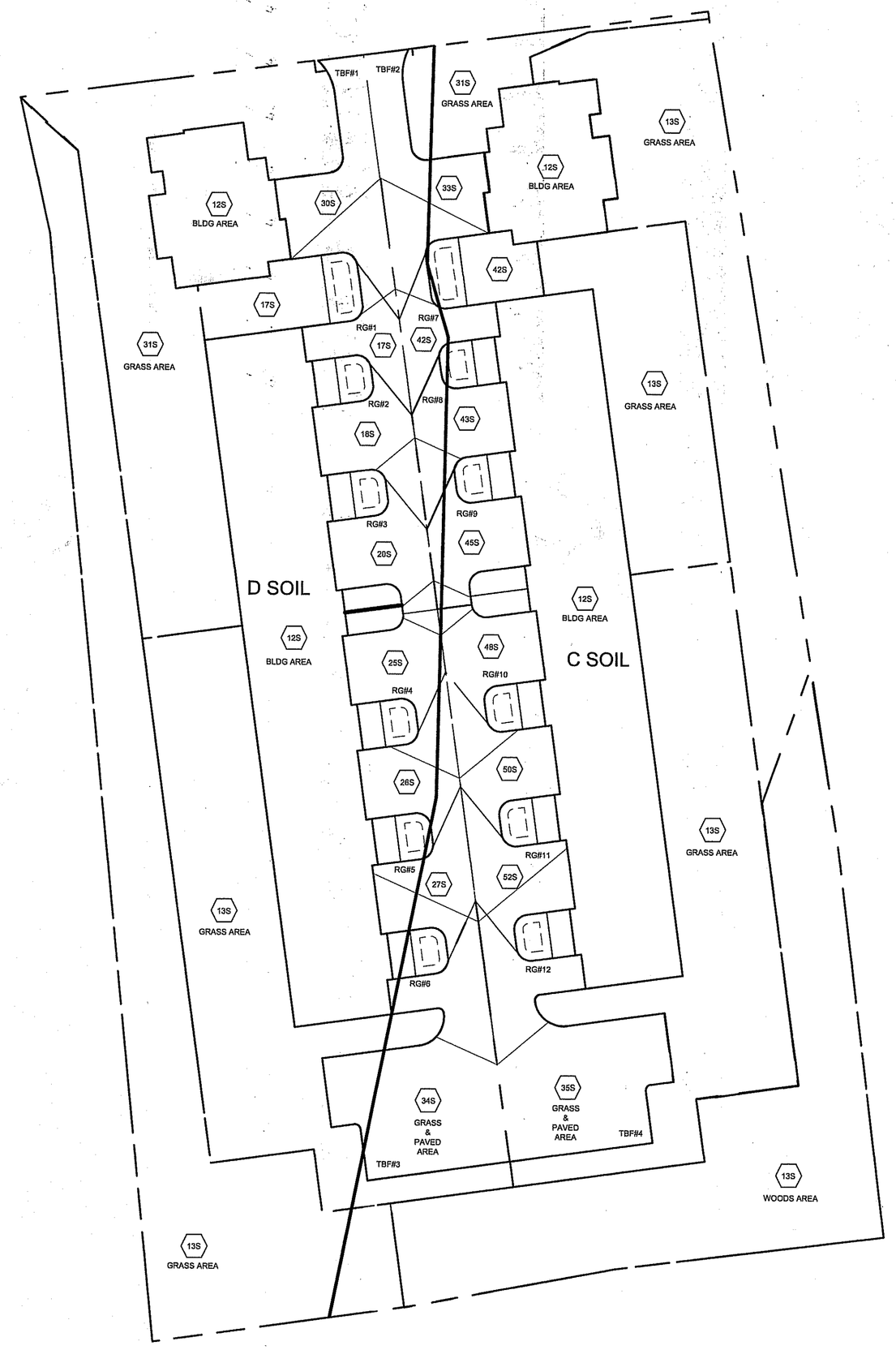
Area (sf)	CN	Description
1,008	98	Roofs, HSG D
4,356	98	Paved parking, HSG D
33,120	80	>75% Grass cover, Good, HSG D
2,063	77	Woods, Good, HSG D
10,179	77	Woods, Good, HSG D
45,595	80	>75% Grass cover, Good, HSG D
96,321	81	Weighted Average
90,957		94.43% Pervious Area
5,364		5.57% Impervious Area

Subcatchment 2S: DP#2-REAR WETLANDS



C.2: Post-Development Analysis

[Proposed Watershed Plan & HydroCAD calculations]



APPROVED DRACUT ZONING BOARD OF APPEALS

SIGNATURE DATE

For Registry Use Only

"I certify that this plan conforms to the Rules and Regulations of the Registers of Deeds of the Commonwealth of Massachusetts."

Signature Date

Notice of Appeals

I, _____, being the Town Clerk of the Town of Dracut, hereby certify that notice of this plan has been received and recorded at this office on _____, and no appeal of such has been received during the twenty days next.

Town Clerk _____ Date_____

Site Plan

SCALE: 1 in. = 30 ft.

GRAPHIC SCALE (ft)

0 30

LEGEND

EXISTING	PROPOSED	
100	100	GRADE CONTOUR
WF-1		BORDERING VEGETATIVE WETLAND FLAGGING
		STONE WALL DRILL HOLE
		CONCRETE BOUND MARKER
TEXT, Text	TEXT, Text	GENERAL TEXT
		50 FT NO BUILD ZONE
		100 FT BVW BUFFER ZONE

JOHN VISNEWSKI No. 37775 REGISTERED PROFESSIONAL ENGINEER COMMONWEALTH OF MASSACHUSETTS

Certification not valid without ORIGINAL stamp and/or signature

BY	Design by KML	Survey by KML/TAJ	Draft by KML	Check by JAV/TAJ
KML				

11/29/23	REVS PER ZONING BOARD OF APPEALS MEETING AND ZBA PEER REVIEW COMMENTS

Cornerstone Land Associates, LLC
Civil & Structural Engineering
Land Surveying - Land Development
25 Dean Avenue - Tyngsboro, MA 01879 - (978) 835-5102
tmcorsi@comcast.net

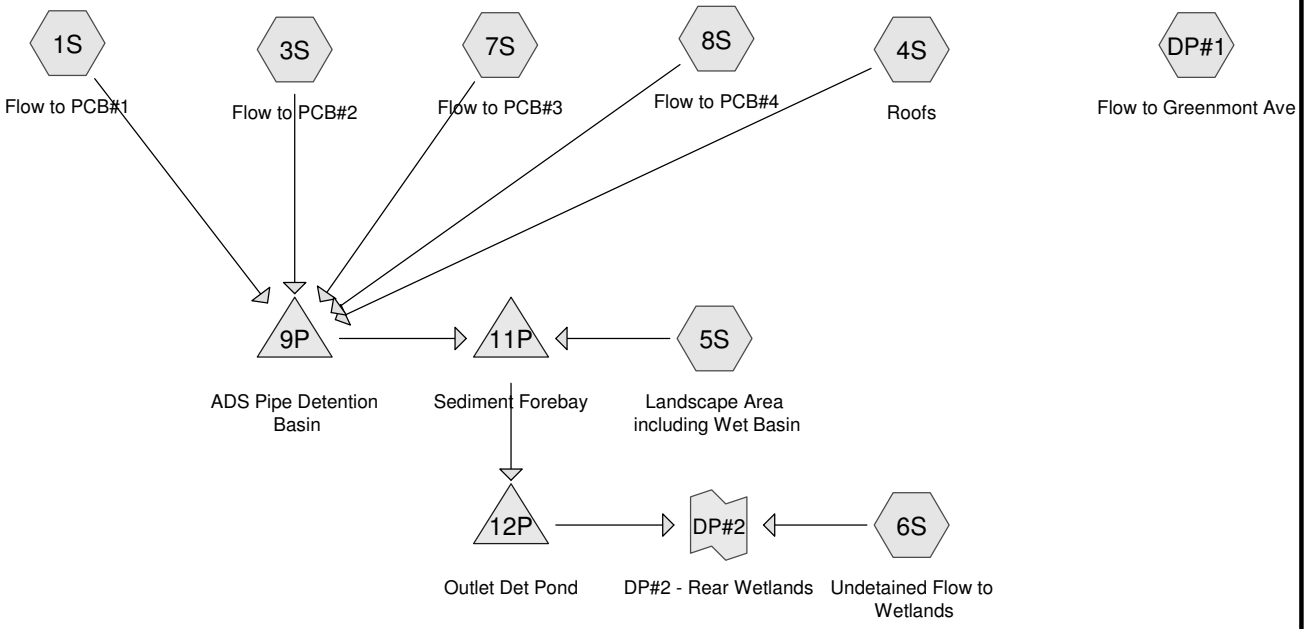
SCALE: As Shown
DATE: May 18, 2023

PREPARED FOR:
Riverbank Properties
908 Lawrence Street
Lowell, MA 01852

PROPOSED WATERSHED PLAN
Comprehensive Permit Application
135 GREENMONT AVENUE
DRACUT, MASSACHUSETTS

JOB NO.: 2021-235
SHEET: 1 of 1

DRAWING NO.
Prop-WS



Subcat Reach Pond Link

Routing Diagram for Prop-Conditions REVISED 041024

Prepared by Cornerstone Land Consultants LLC, Printed 4/19/2024

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
1.490	80	>75% Grass cover, Good, HSG D (1S, 3S, 5S, 6S, 7S, 8S, DP#1)
0.479	98	Paved parking, HSG D (1S, 3S, 7S, 8S)
0.482	98	Roofs, HSG D (4S)
2.450	**87**	**TOTAL AREA**

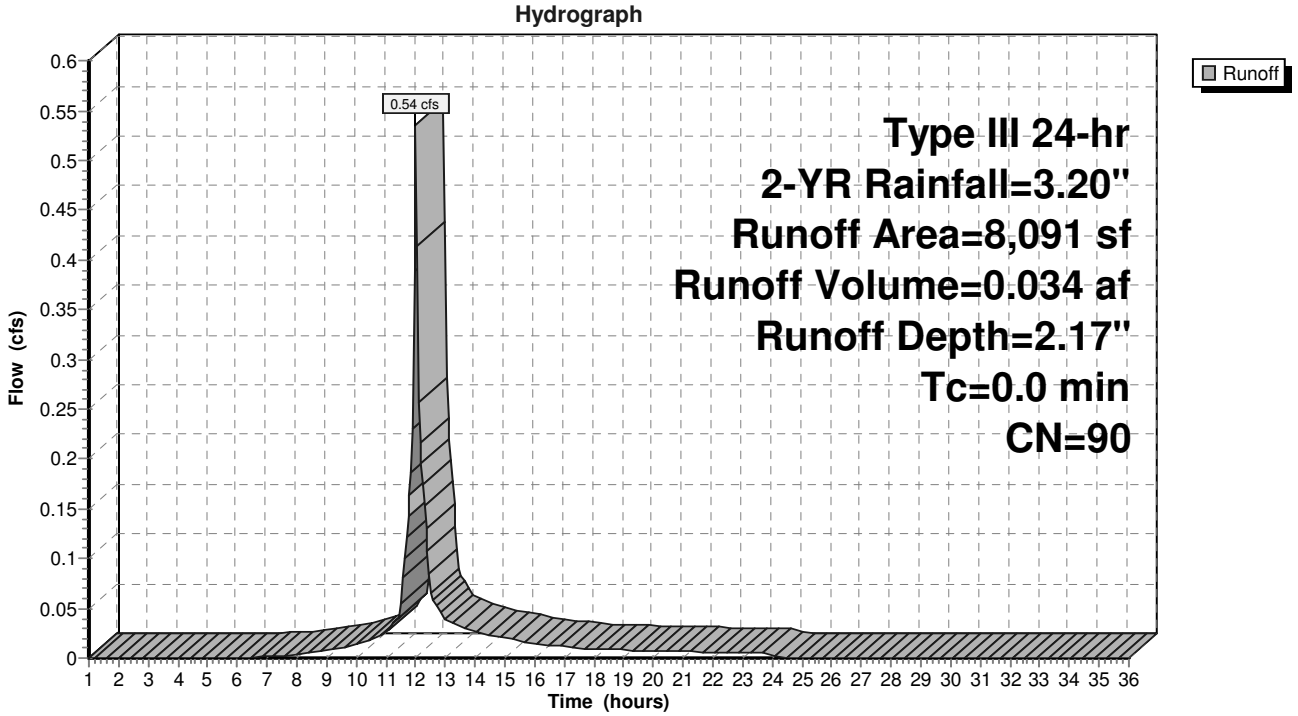
Summary for Subcatchment 1S: Flow to PCB#1

Runoff = 0.54 cfs @ 12.00 hrs, Volume= 0.034 af, Depth= 2.17"
Routed to Pond 9P : ADS Pipe Detention Basin

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-YR Rainfall=3.20"

Area (sf)	CN	Description
4,612	98	Paved parking, HSG D
3,479	80	>75% Grass cover, Good, HSG D
8,091	90	Weighted Average
3,479		43.00% Pervious Area
4,612		57.00% Impervious Area

Subcatchment 1S: Flow to PCB#1



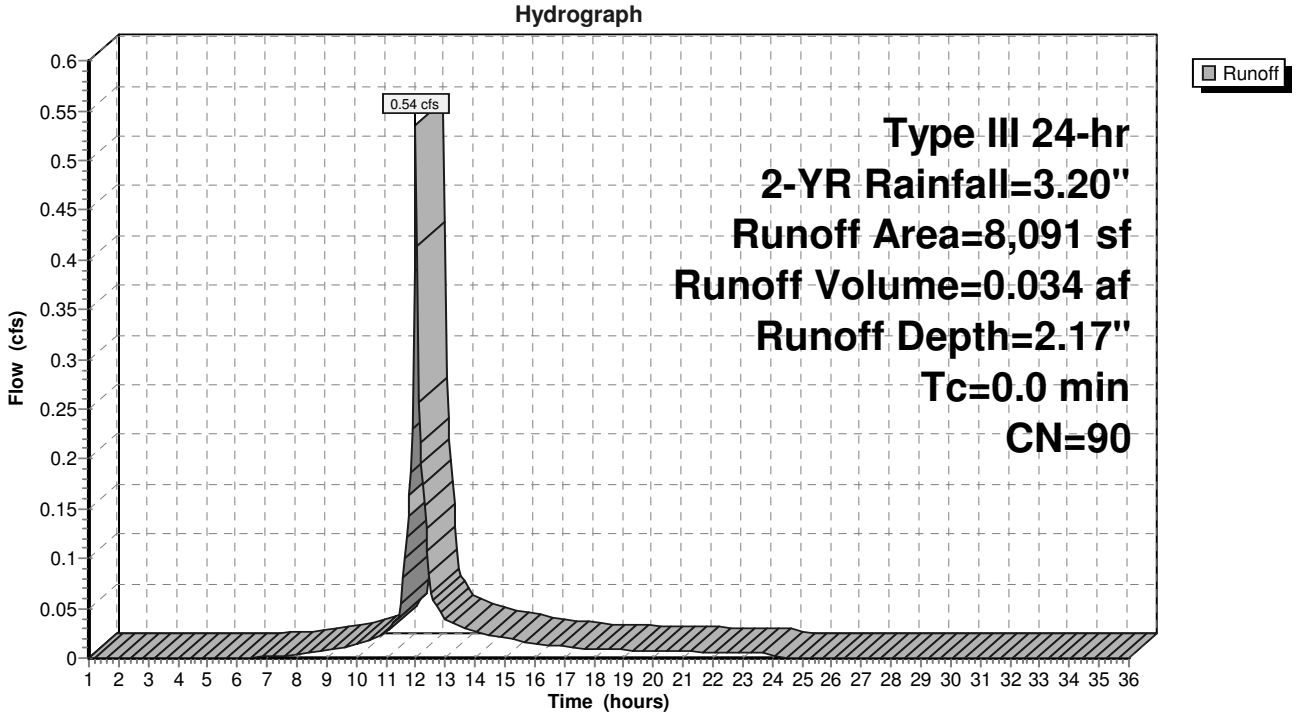
Summary for Subcatchment 3S: Flow to PCB#2

Runoff = 0.54 cfs @ 12.00 hrs, Volume= 0.034 af, Depth= 2.17"
Routed to Pond 9P : ADS Pipe Detention Basin

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-YR Rainfall=3.20"

Area (sf)	CN	Description
4,612	98	Paved parking, HSG D
3,479	80	>75% Grass cover, Good, HSG D
8,091	90	Weighted Average
3,479		43.00% Pervious Area
4,612		57.00% Impervious Area

Subcatchment 3S: Flow to PCB#2



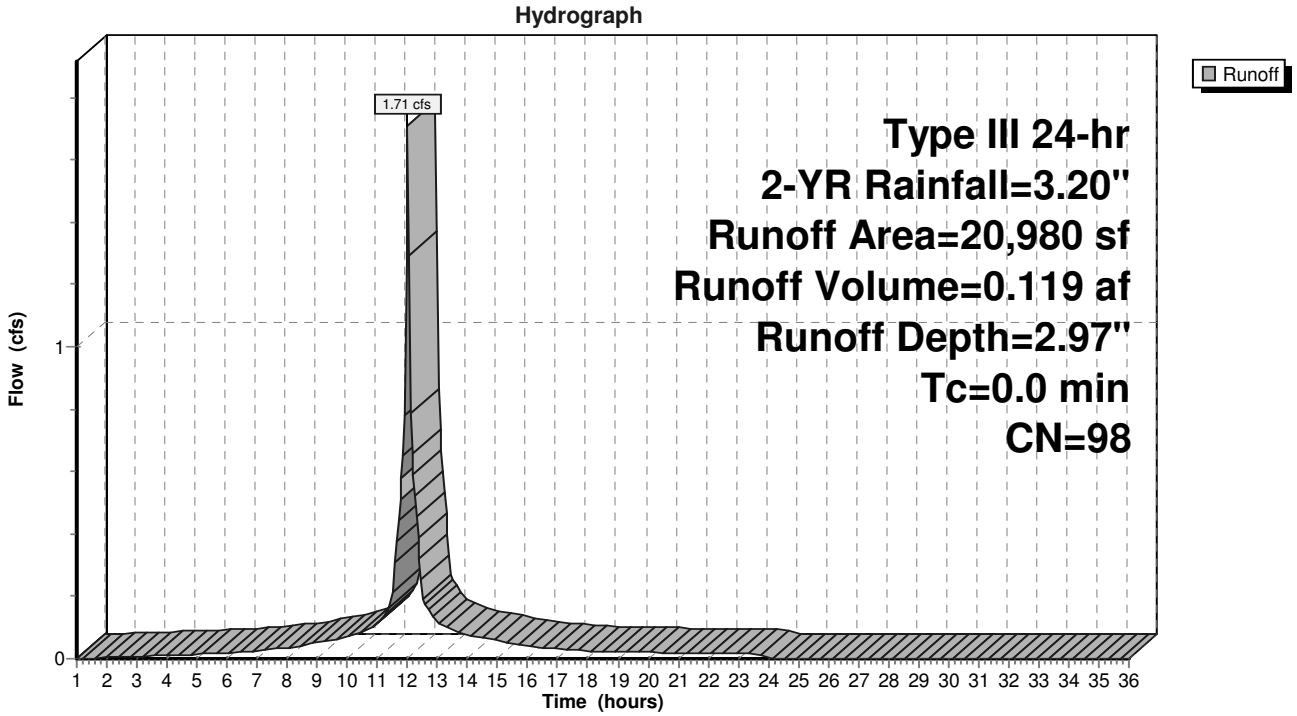
Summary for Subcatchment 4S: Roofs

Runoff = 1.71 cfs @ 12.00 hrs, Volume= 0.119 af, Depth= 2.97"
Routed to Pond 9P : ADS Pipe Detention Basin

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-YR Rainfall=3.20"

Area (sf)	CN	Description
20,980	98	Roofs, HSG D
20,980		100.00% Impervious Area

Subcatchment 4S: Roofs



Summary for Subcatchment 5S: Landscape Area including Wet Basin

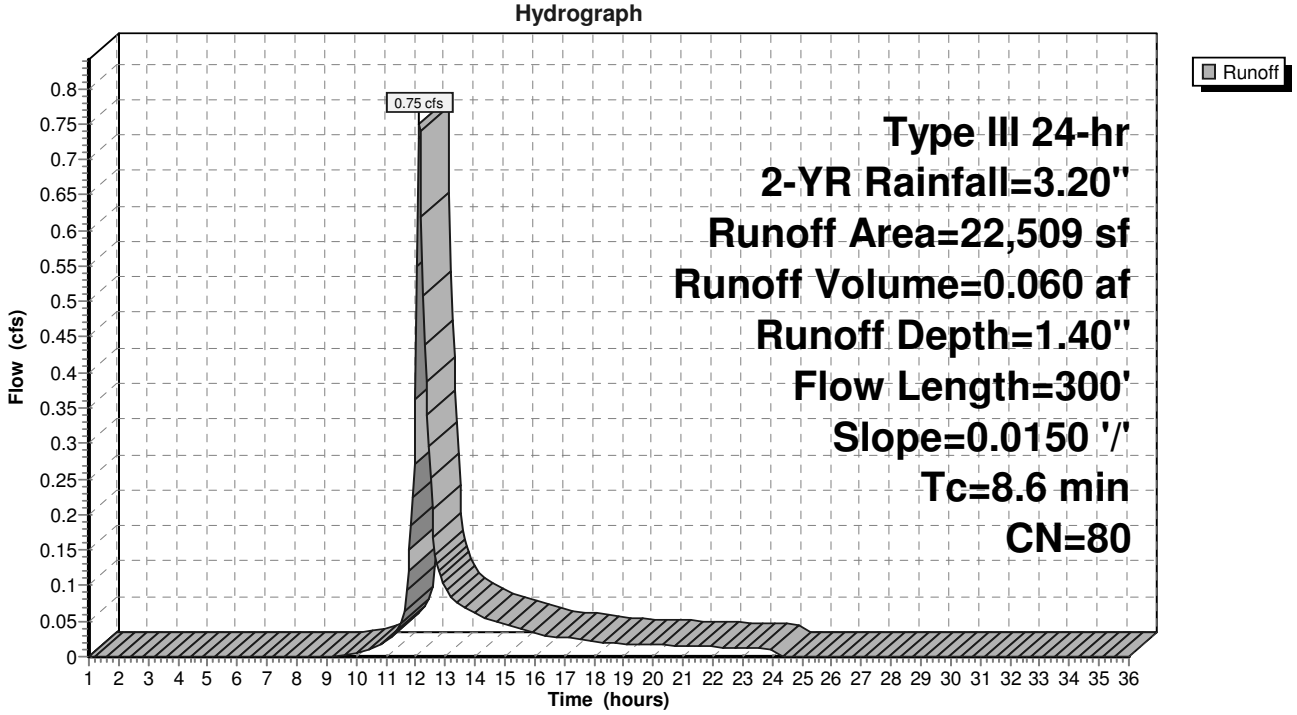
Runoff = 0.75 cfs @ 12.13 hrs, Volume= 0.060 af, Depth= 1.40"
Routed to Pond 11P : Sediment Forebay

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-YR Rainfall=3.20"

Area (sf)	CN	Description
16,611	80	>75% Grass cover, Good, HSG D
5,898	80	>75% Grass cover, Good, HSG D
22,509	80	Weighted Average
22,509		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.3	50	0.0150	0.13		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.20"
2.3	250	0.0150	1.84		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
8.6	300	Total			

Subcatchment 5S: Landscape Area including Wet Basin



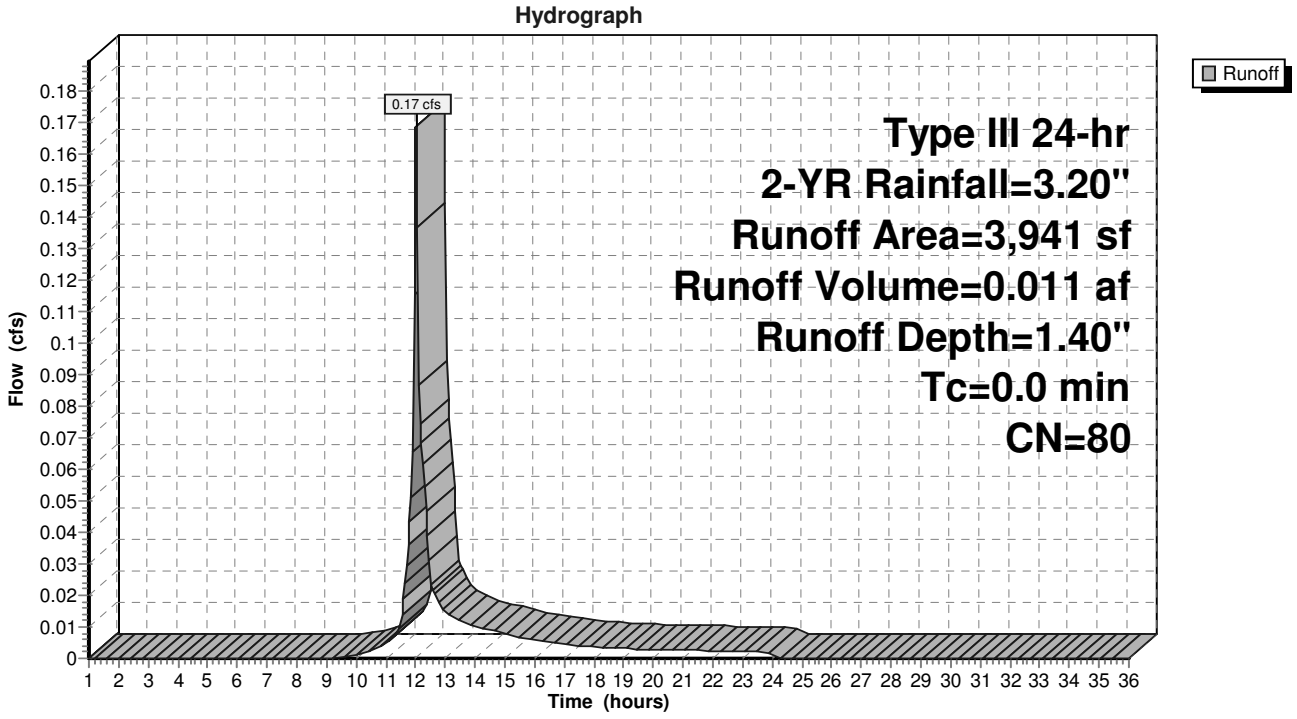
Summary for Subcatchment 6S: Undetained Flow to Wetlands

Runoff = 0.17 cfs @ 12.01 hrs, Volume= 0.011 af, Depth= 1.40"
Routed to Link DP#2 : DP#2 - Rear Wetlands

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-YR Rainfall=3.20"

Area (sf)	CN	Description
2,032	80	>75% Grass cover, Good, HSG D
1,909	80	>75% Grass cover, Good, HSG D
3,941	80	Weighted Average
3,941		100.00% Pervious Area

Subcatchment 6S: Undetained Flow to Wetlands



Summary for Subcatchment 7S: Flow to PCB#3

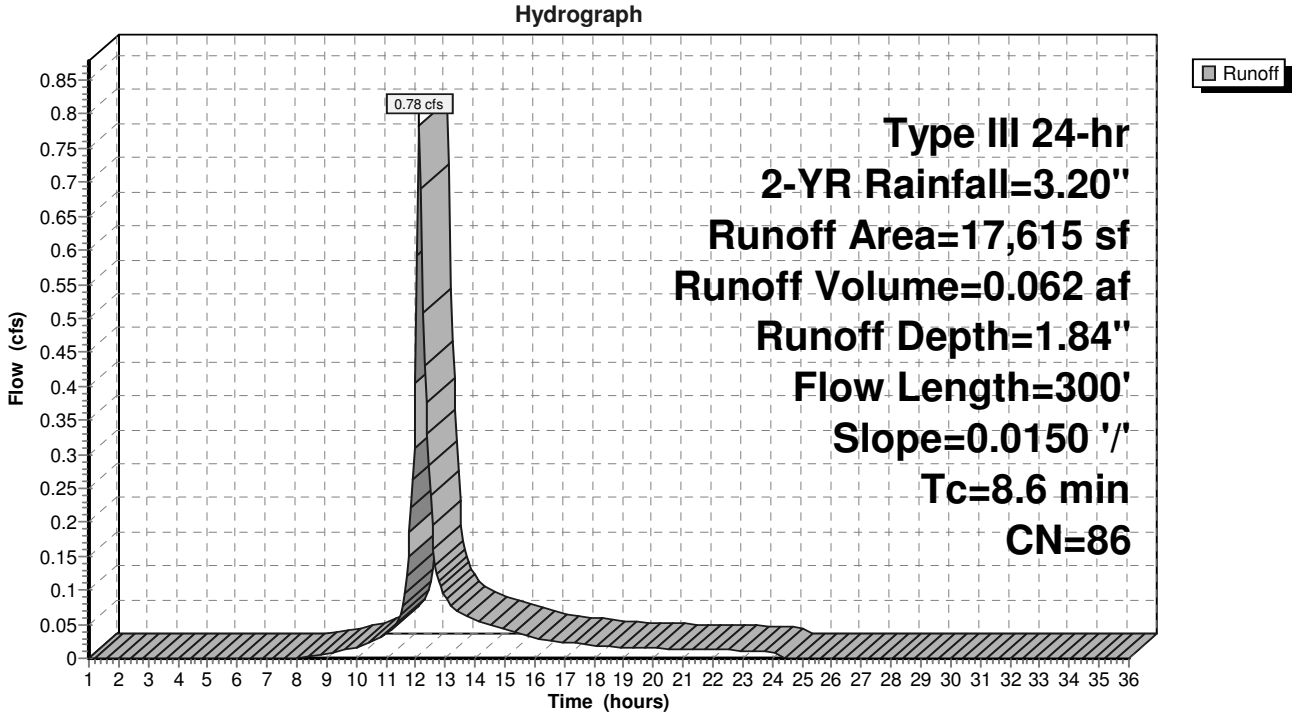
Runoff = 0.78 cfs @ 12.12 hrs, Volume= 0.062 af, Depth= 1.84"
Routed to Pond 9P : ADS Pipe Detention Basin

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-YR Rainfall=3.20"

Area (sf)	CN	Description
11,784	80	>75% Grass cover, Good, HSG D
5,831	98	Paved parking, HSG D
17,615	86	Weighted Average
11,784		66.90% Pervious Area
5,831		33.10% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.3	50	0.0150	0.13		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.20"
2.3	250	0.0150	1.84		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
8.6	300	Total			

Subcatchment 7S: Flow to PCB#3



Summary for Subcatchment 8S: Flow to PCB#4

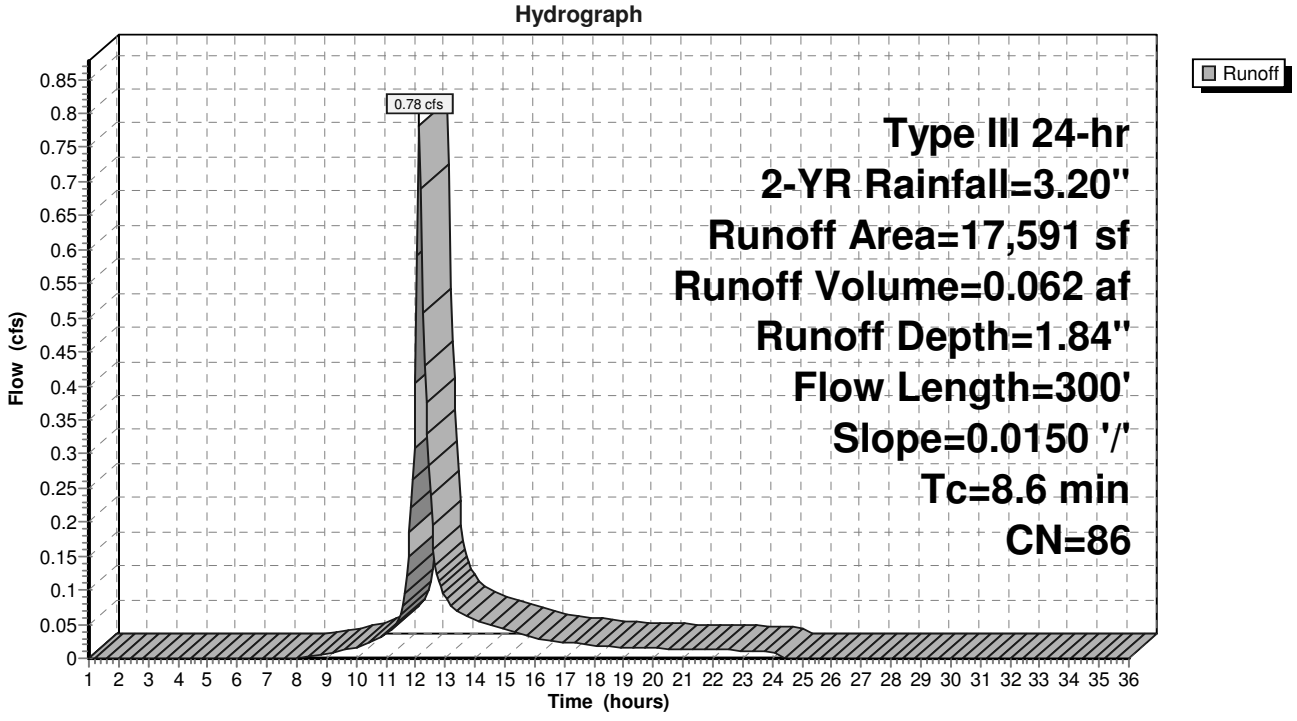
Runoff = 0.78 cfs @ 12.12 hrs, Volume= 0.062 af, Depth= 1.84"
Routed to Pond 9P : ADS Pipe Detention Basin

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-YR Rainfall=3.20"

Area (sf)	CN	Description
11,779	80	>75% Grass cover, Good, HSG D
5,812	98	Paved parking, HSG D
17,591	86	Weighted Average
11,779		66.96% Pervious Area
5,812		33.04% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.3	50	0.0150	0.13		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.20"
2.3	250	0.0150	1.84		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
8.6	300	Total			

Subcatchment 8S: Flow to PCB#4



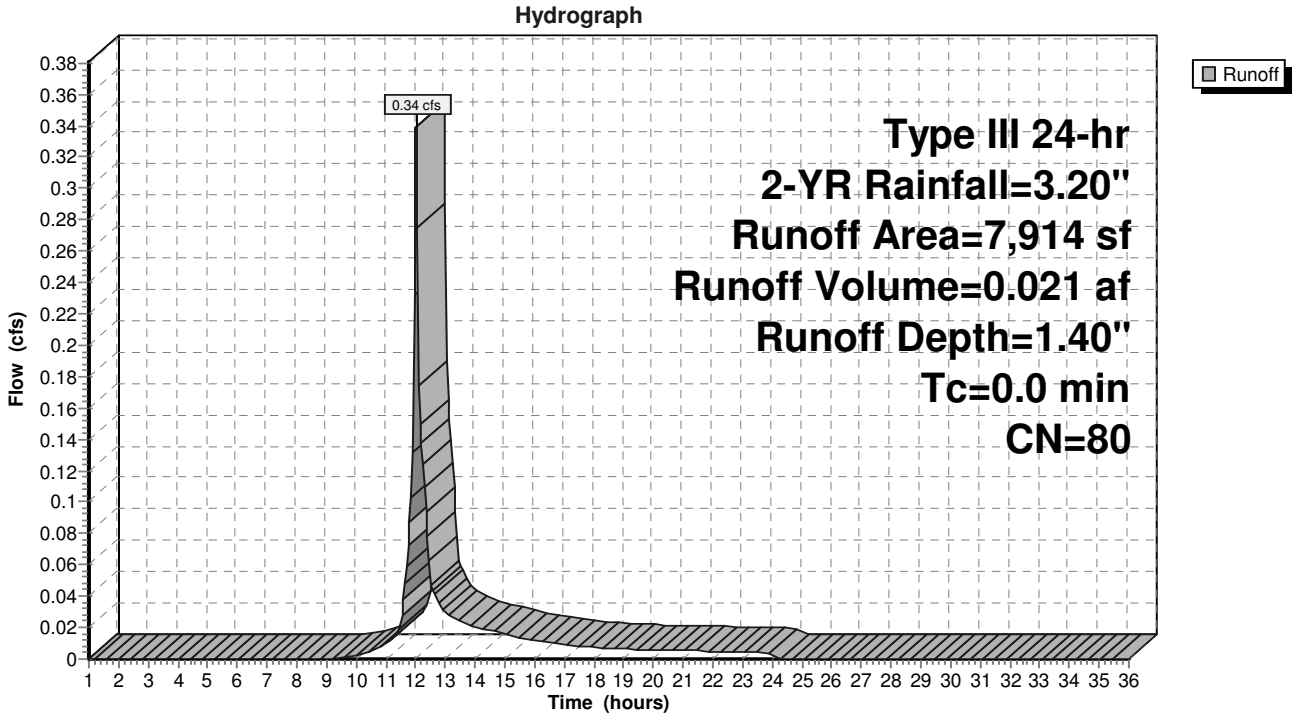
Summary for Subcatchment DP#1: Flow to Greenmont Ave

Runoff = 0.34 cfs @ 12.01 hrs, Volume= 0.021 af, Depth= 1.40"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-YR Rainfall=3.20"

Area (sf)	CN	Description
6,641	80	>75% Grass cover, Good, HSG D
1,273	80	>75% Grass cover, Good, HSG D
7,914	80	Weighted Average
7,914		100.00% Pervious Area

Subcatchment DP#1: Flow to Greenmont Ave



Summary for Pond 9P: ADS Pipe Detention Basin

Inflow Area = 1.661 ac, 57.83% Impervious, Inflow Depth = 2.24" for 2-YR event
Inflow = 3.63 cfs @ 12.01 hrs, Volume= 0.310 af
Outflow = 1.85 cfs @ 12.26 hrs, Volume= 0.289 af, Atten= 49%, Lag= 15.0 min
Primary = 1.85 cfs @ 12.26 hrs, Volume= 0.289 af
Routed to Pond 11P : Sediment Forebay

Routing by Stor-Ind method, Time Span= 1.00-36.00 hrs, dt= 0.05 hrs
Peak Elev= 158.25' @ 12.26 hrs Surf.Area= 4,466 sf Storage= 4,903 cf

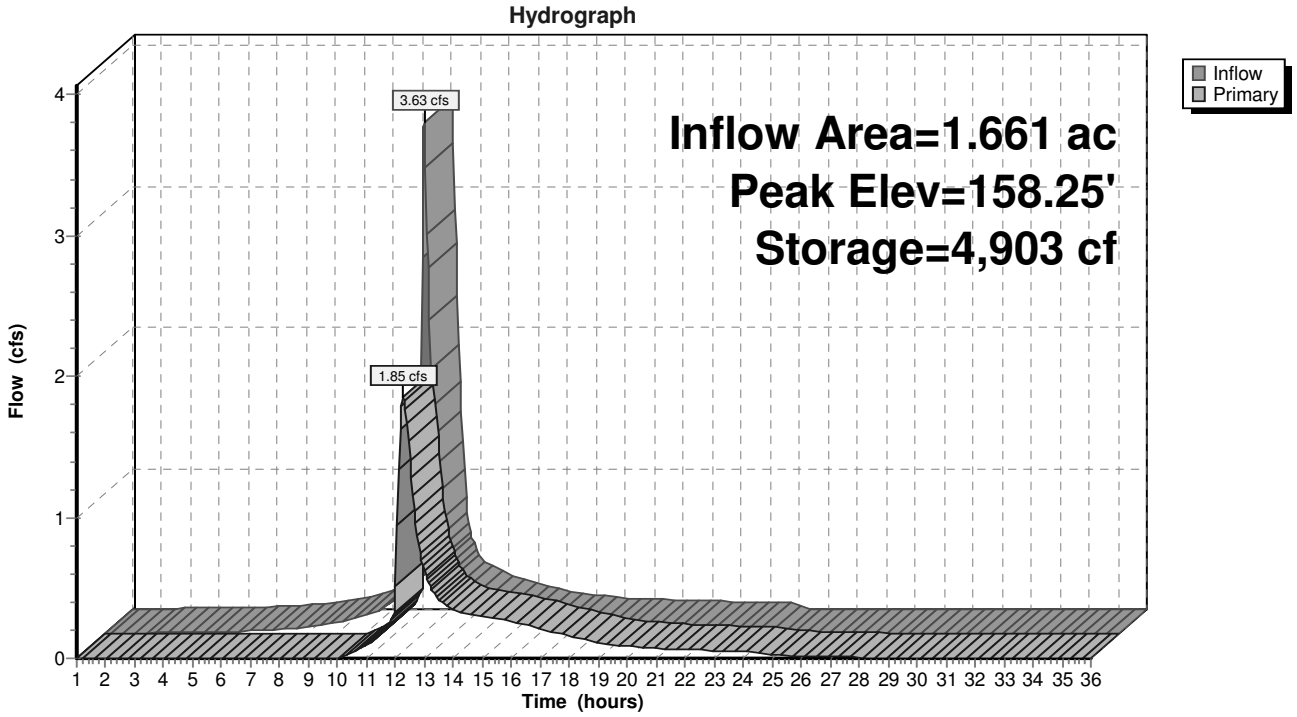
Plug-Flow detention time= 142.0 min calculated for 0.289 af (93% of inflow)
Center-of-Mass det. time= 105.6 min (896.9 - 791.3)

Volume	Invert	Avail.Storage	Storage Description
#1	156.50'	3,550 cf	**22.00'W x 203.00'L x 3.00'H Prismatoid** 13,398 cf Overall - 4,524 cf Embedded = 8,874 cf x 40.0% Voids
#2	157.00'	4,524 cf	**24.0" Round Pipe Storage** x 6 Inside #1 L= 240.0'
		8,074 cf	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Primary	157.75'	**12.0" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#2	Primary	157.00'	**4.0" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Primary	157.75'	**6.0" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=1.84 cfs @ 12.26 hrs HW=158.25' (Free Discharge)
- **1=Orifice/Grate** (Orifice Controls 0.93 cfs @ 2.40 fps)
- **2=Orifice/Grate** (Orifice Controls 0.44 cfs @ 5.00 fps)
- **3=Orifice/Grate** (Orifice Controls 0.47 cfs @ 2.40 fps)

Pond 9P: ADS Pipe Detention Basin



Summary for Pond 11P: Sediment Forebay

Inflow Area = 2.178 ac, 44.11% Impervious, Inflow Depth > 1.92" for 2-YR event
Inflow = 2.41 cfs @ 12.20 hrs, Volume= 0.349 af
Outflow = 2.41 cfs @ 12.21 hrs, Volume= 0.342 af, Atten= 0%, Lag= 1.0 min
Primary = 2.41 cfs @ 12.21 hrs, Volume= 0.342 af
Routed to Pond 12P : Outlet Det Pond

Routing by Stor-Ind method, Time Span= 1.00-36.00 hrs, dt= 0.05 hrs
Peak Elev= 156.80' @ 12.21 hrs Surf.Area= 761 sf Storage= 512 cf

Plug-Flow detention time= 21.8 min calculated for 0.342 af (98% of inflow)
Center-of-Mass det. time= 7.4 min (895.3 - 888.0)

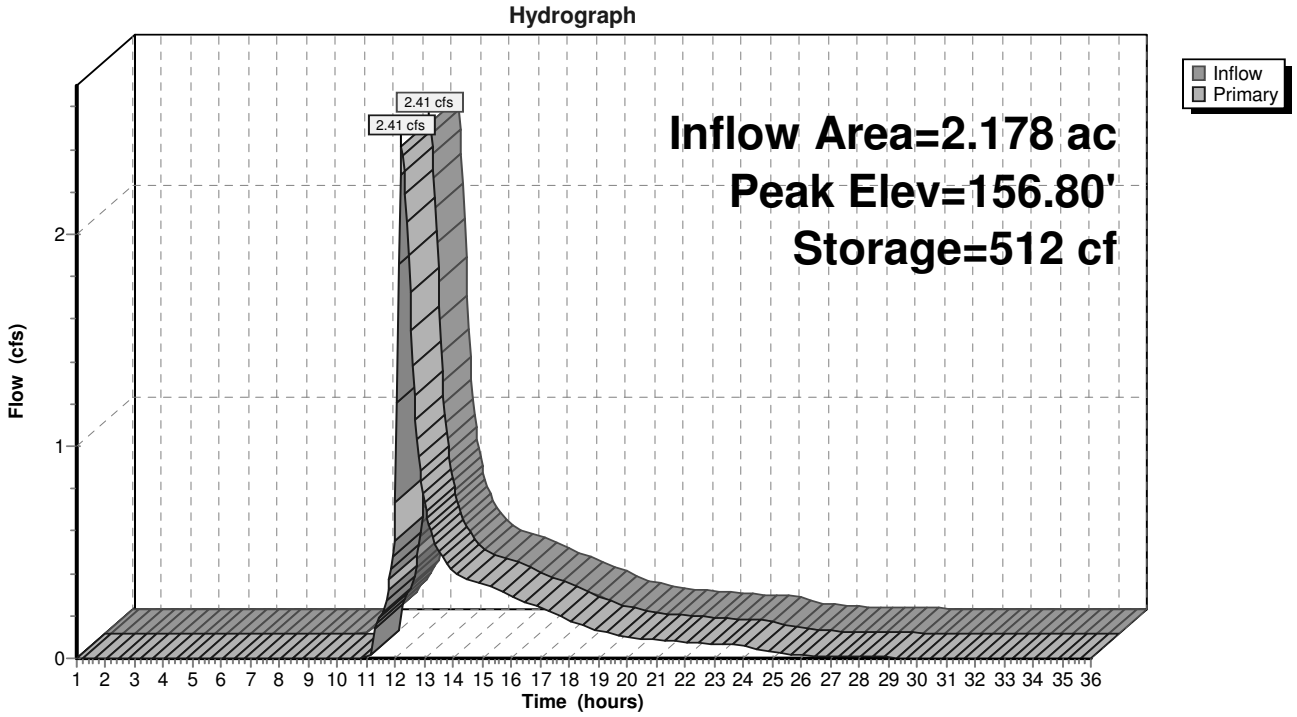
Volume	Invert	Avail.Storage	Storage Description
#1	156.00'	1,698 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
156.00	532	89.0	0	0	532
157.00	827	108.0	674	674	846
158.00	1,235	137.0	1,024	1,698	1,424

Device	Routing	Invert	Outlet Devices
#1	Primary	156.50'	**6.0' long x 3.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 Coef. (English) 2.44 2.58 2.68 2.67 2.65 2.64 2.64 2.68 2.68 2.72 2.81 2.92 2.97 3.07 3.32

Primary OutFlow Max=2.40 cfs @ 12.21 hrs HW=156.79' (Free Discharge)
1=Broad-Crested Rectangular Weir (Weir Controls 2.40 cfs @ 1.36 fps)

Pond 11P: Sediment Forebay



Summary for Pond 12P: Outlet Det Pond

Inflow Area = 2.178 ac, 44.11% Impervious, Inflow Depth > 1.88" for 2-YR event
Inflow = 2.41 cfs @ 12.21 hrs, Volume= 0.342 af
Outflow = 0.78 cfs @ 12.95 hrs, Volume= 0.231 af, Atten= 68%, Lag= 44.3 min
Primary = 0.78 cfs @ 12.95 hrs, Volume= 0.231 af
Routed to Link DP#2 : DP#2 - Rear Wetlands

Routing by Stor-Ind method, Time Span= 1.00-36.00 hrs, dt= 0.05 hrs / 2
Peak Elev= 155.64' @ 12.95 hrs Surf.Area= 4,776 sf Storage= 5,519 cf

Plug-Flow detention time= 215.0 min calculated for 0.231 af (67% of inflow)
Center-of-Mass det. time= 99.2 min (994.6 - 895.3)

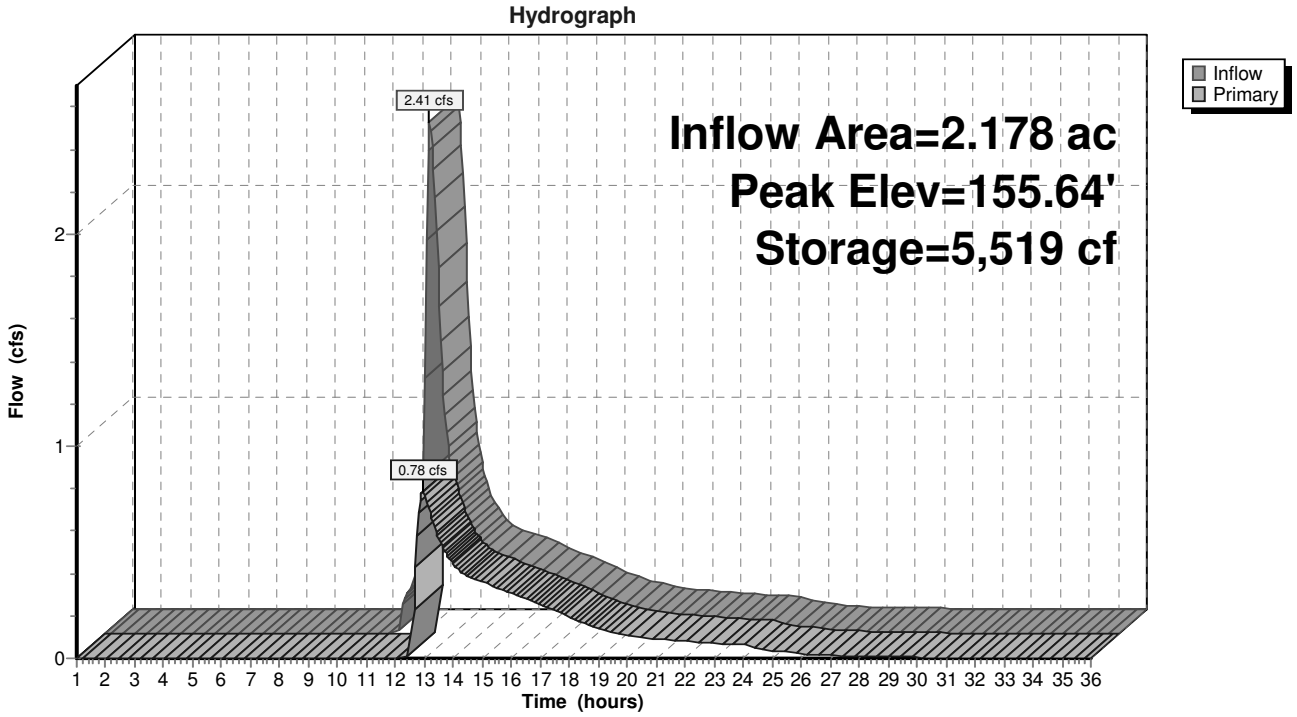
Volume	Invert	Avail.Storage	Storage Description
#1	154.00'	7,288 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
154.00	1,475	145.0	0	0	1,475
155.00	4,078	631.0	2,669	2,669	31,489
156.00	5,184	677.0	4,620	7,288	36,322

Device	Routing	Invert	Outlet Devices
#1	Primary	155.50'	**6.0' long x 6.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.37 2.51 2.70 2.68 2.68 2.67 2.65 2.65 2.65 2.65 2.66 2.66 2.67 2.69 2.72 2.76 2.83

Primary OutFlow Max=0.78 cfs @ 12.95 hrs HW=155.64' (Free Discharge)
1=Broad-Crested Rectangular Weir (Weir Controls 0.78 cfs @ 0.90 fps)

Pond 12P: Outlet Det Pond

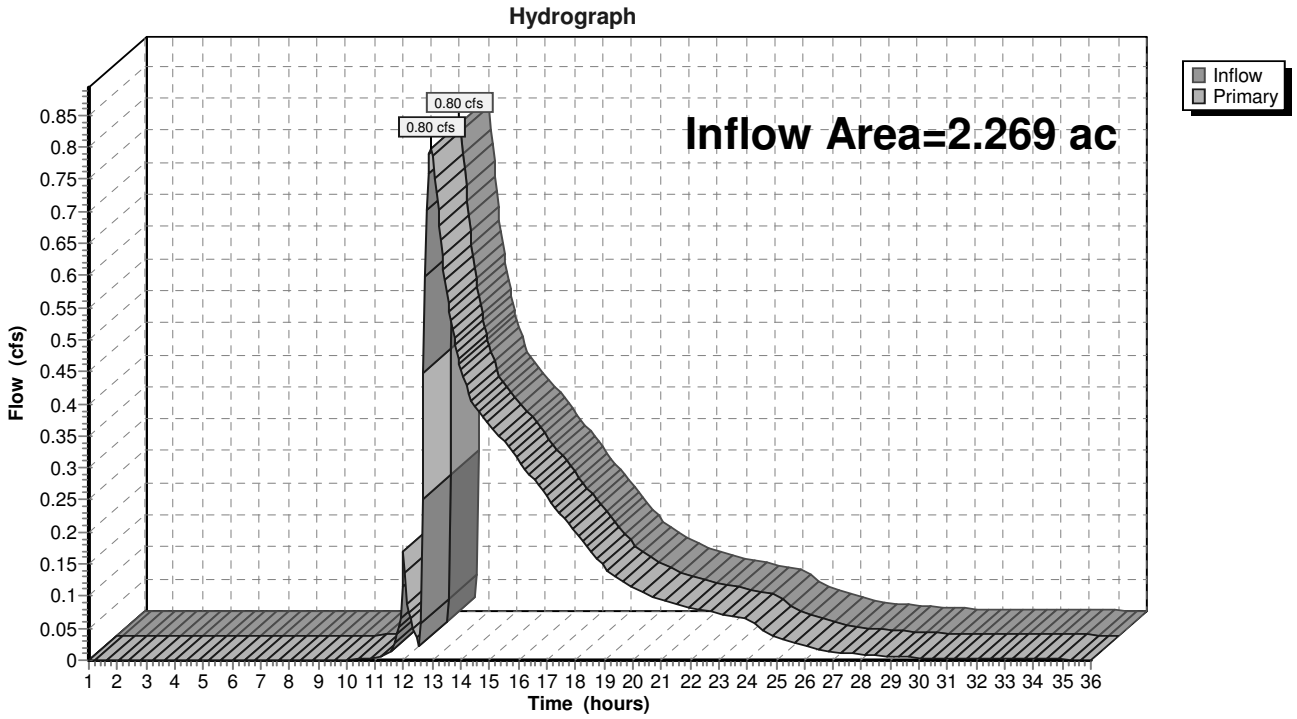


Summary for Link DP#2: DP#2 - Rear Wetlands

Inflow Area = 2.269 ac, 42.35% Impervious, Inflow Depth > 1.28" for 2-YR event
Inflow = 0.80 cfs @ 12.95 hrs, Volume= 0.241 af
Primary = 0.80 cfs @ 12.95 hrs, Volume= 0.241 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 1.00-36.00 hrs, dt= 0.05 hrs

Link DP#2: DP#2 - Rear Wetlands



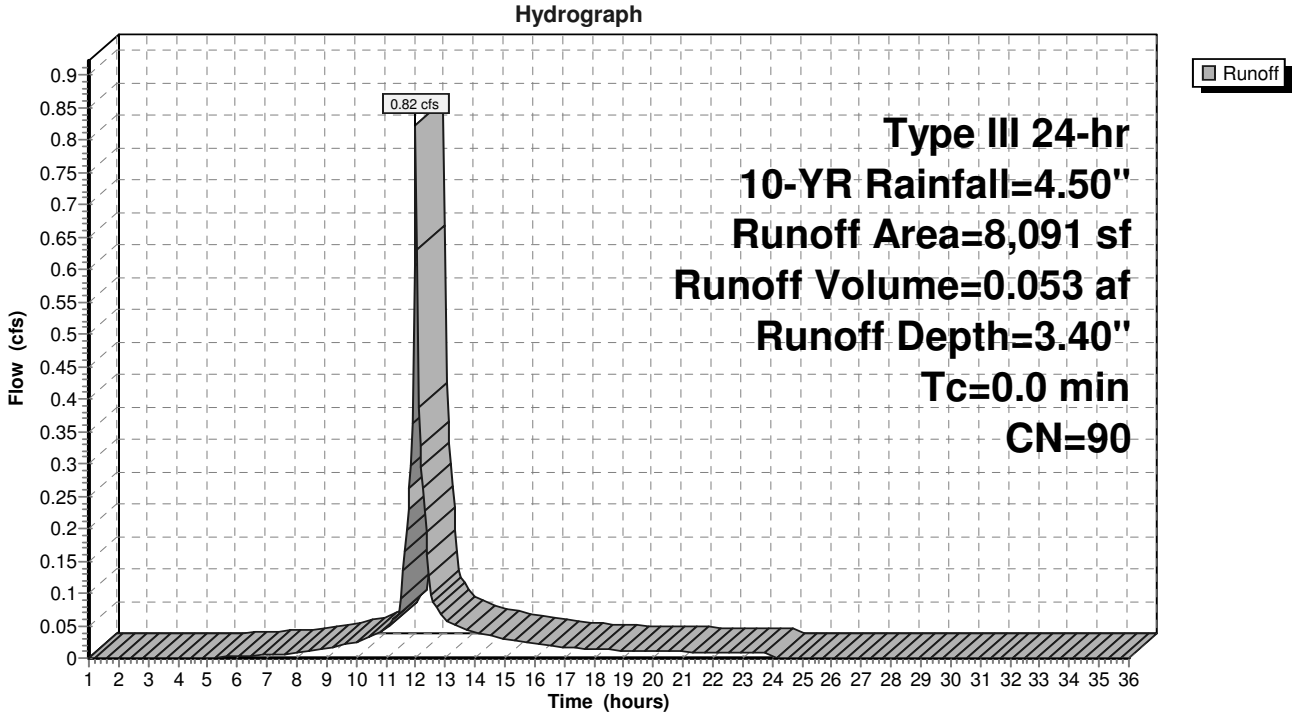
Summary for Subcatchment 1S: Flow to PCB#1

Runoff = 0.82 cfs @ 12.00 hrs, Volume= 0.053 af, Depth= 3.40"
Routed to Pond 9P : ADS Pipe Detention Basin

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-YR Rainfall=4.50"

Area (sf)	CN	Description
4,612	98	Paved parking, HSG D
3,479	80	>75% Grass cover, Good, HSG D
8,091	90	Weighted Average
3,479		43.00% Pervious Area
4,612		57.00% Impervious Area

Subcatchment 1S: Flow to PCB#1



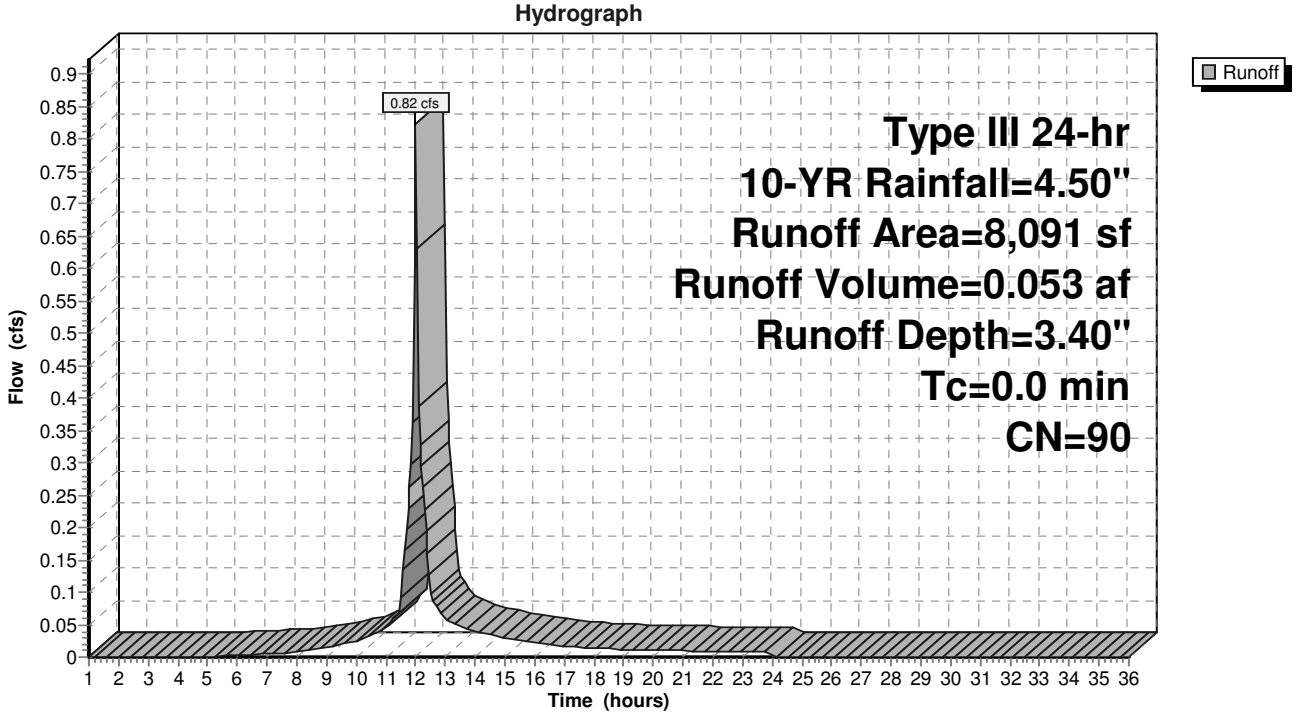
Summary for Subcatchment 3S: Flow to PCB#2

Runoff = 0.82 cfs @ 12.00 hrs, Volume= 0.053 af, Depth= 3.40"
Routed to Pond 9P : ADS Pipe Detention Basin

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-YR Rainfall=4.50"

Area (sf)	CN	Description
4,612	98	Paved parking, HSG D
3,479	80	>75% Grass cover, Good, HSG D
8,091	90	Weighted Average
3,479		43.00% Pervious Area
4,612		57.00% Impervious Area

Subcatchment 3S: Flow to PCB#2



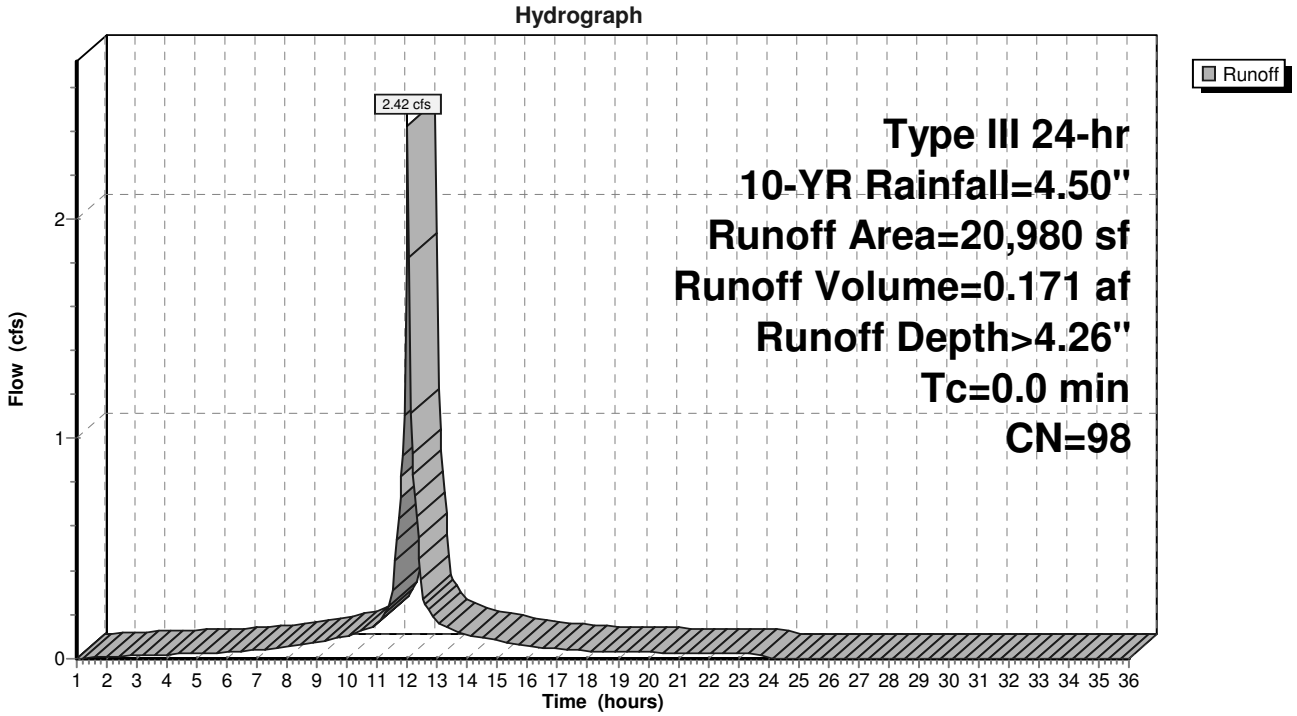
Summary for Subcatchment 4S: Roofs

Runoff = 2.42 cfs @ 12.00 hrs, Volume= 0.171 af, Depth> 4.26"
Routed to Pond 9P : ADS Pipe Detention Basin

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-YR Rainfall=4.50"

Area (sf)	CN	Description
20,980	98	Roofs, HSG D
20,980		100.00% Impervious Area

Subcatchment 4S: Roofs



Summary for Subcatchment 5S: Landscape Area including Wet Basin

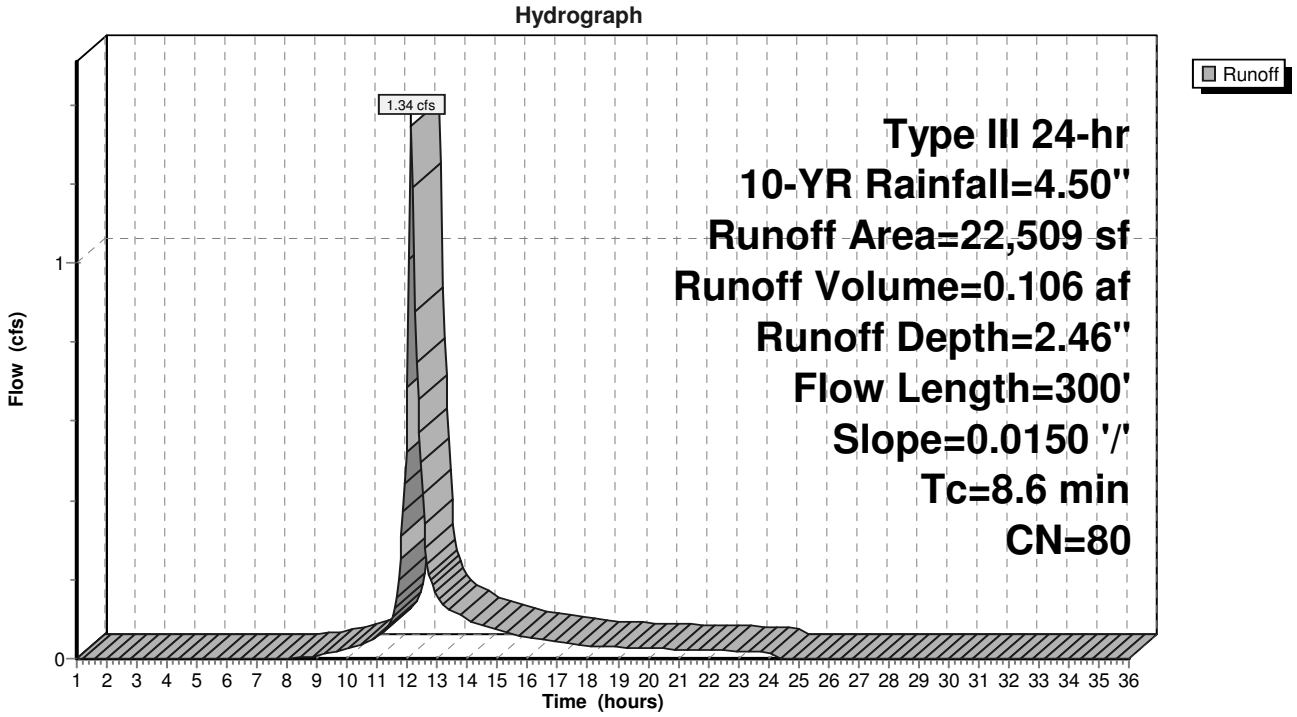
Runoff = 1.34 cfs @ 12.12 hrs, Volume= 0.106 af, Depth= 2.46"
Routed to Pond 11P : Sediment Forebay

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-YR Rainfall=4.50"

Area (sf)	CN	Description
16,611	80	>75% Grass cover, Good, HSG D
5,898	80	>75% Grass cover, Good, HSG D
22,509	80	Weighted Average
22,509		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.3	50	0.0150	0.13		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.20"
2.3	250	0.0150	1.84		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
8.6	300	Total			

Subcatchment 5S: Landscape Area including Wet Basin



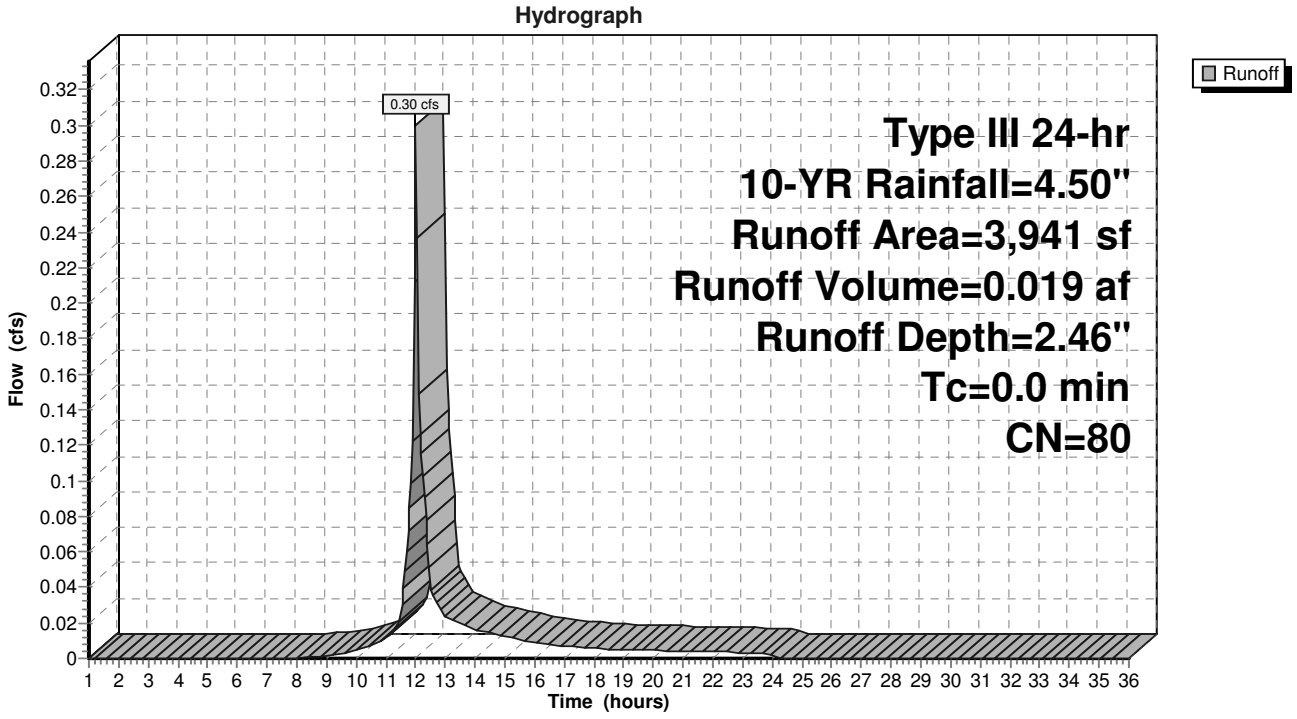
Summary for Subcatchment 6S: Undetained Flow to Wetlands

Runoff = 0.30 cfs @ 12.00 hrs, Volume= 0.019 af, Depth= 2.46"
Routed to Link DP#2 : DP#2 - Rear Wetlands

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-YR Rainfall=4.50"

Area (sf)	CN	Description
2,032	80	>75% Grass cover, Good, HSG D
1,909	80	>75% Grass cover, Good, HSG D
3,941	80	Weighted Average
3,941		100.00% Pervious Area

Subcatchment 6S: Undetained Flow to Wetlands



Summary for Subcatchment 7S: Flow to PCB#3

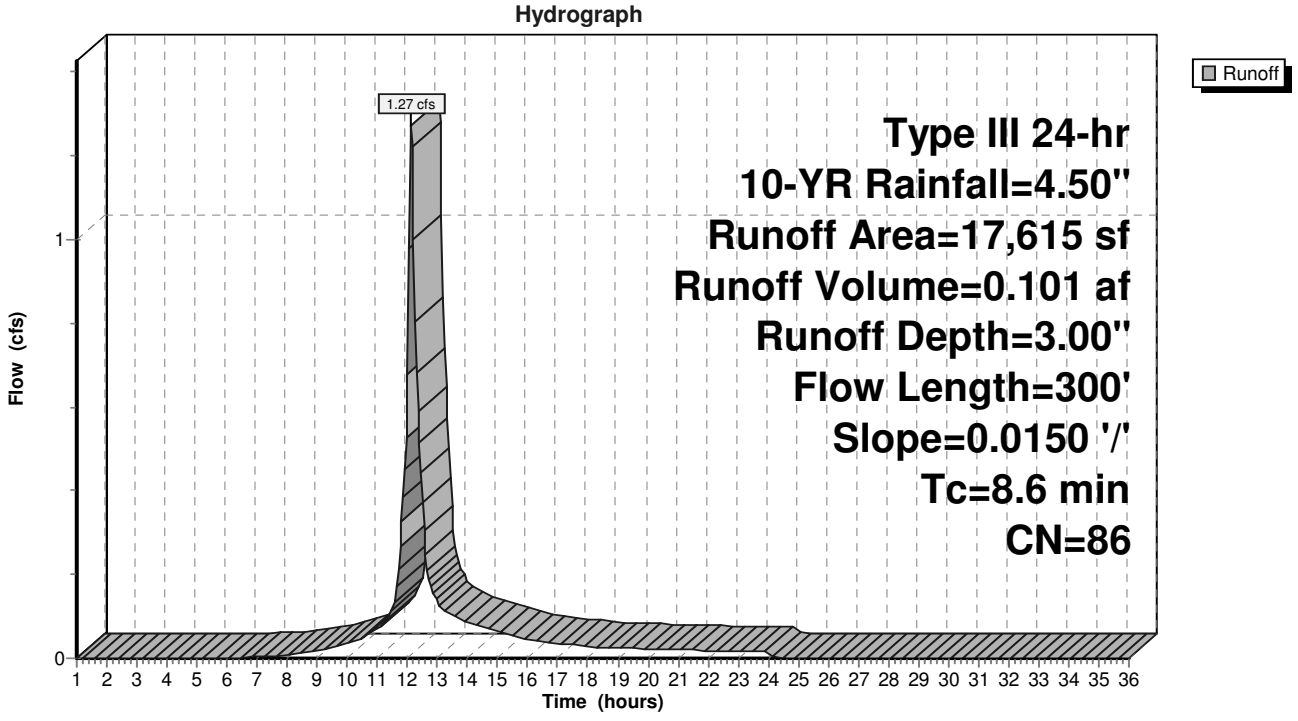
Runoff = 1.27 cfs @ 12.12 hrs, Volume= 0.101 af, Depth= 3.00"
Routed to Pond 9P : ADS Pipe Detention Basin

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-YR Rainfall=4.50"

Area (sf)	CN	Description
11,784	80	>75% Grass cover, Good, HSG D
5,831	98	Paved parking, HSG D
17,615	86	Weighted Average
11,784		66.90% Pervious Area
5,831		33.10% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.3	50	0.0150	0.13		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.20"
2.3	250	0.0150	1.84		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
8.6	300	Total			

Subcatchment 7S: Flow to PCB#3



Summary for Subcatchment 8S: Flow to PCB#4

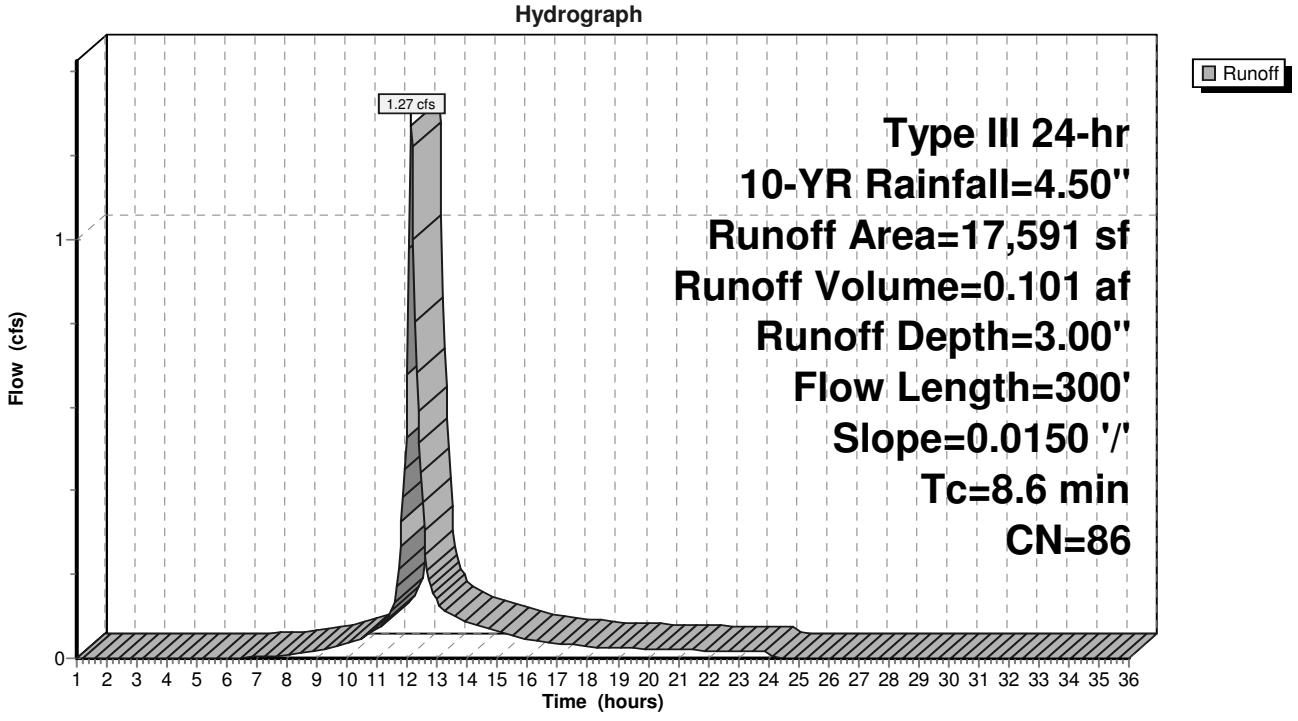
Runoff = 1.27 cfs @ 12.12 hrs, Volume= 0.101 af, Depth= 3.00"
Routed to Pond 9P : ADS Pipe Detention Basin

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-YR Rainfall=4.50"

Area (sf)	CN	Description
11,779	80	>75% Grass cover, Good, HSG D
5,812	98	Paved parking, HSG D
17,591	86	Weighted Average
11,779		66.96% Pervious Area
5,812		33.04% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.3	50	0.0150	0.13		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.20"
2.3	250	0.0150	1.84		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
8.6	300	Total			

Subcatchment 8S: Flow to PCB#4



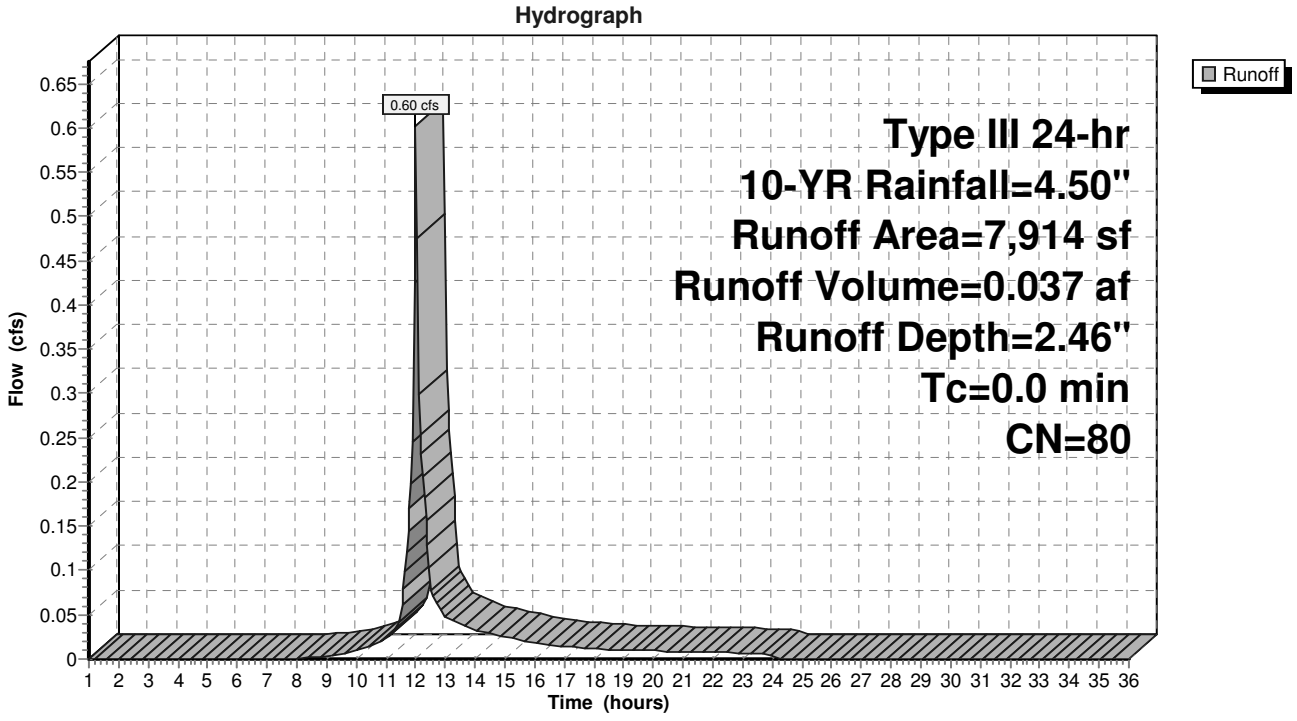
Summary for Subcatchment DP#1: Flow to Greenmont Ave

Runoff = 0.60 cfs @ 12.00 hrs, Volume= 0.037 af, Depth= 2.46"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-YR Rainfall=4.50"

Area (sf)	CN	Description
6,641	80	>75% Grass cover, Good, HSG D
1,273	80	>75% Grass cover, Good, HSG D
7,914	80	Weighted Average
7,914		100.00% Pervious Area

Subcatchment DP#1: Flow to Greenmont Ave



Summary for Pond 9P: ADS Pipe Detention Basin

Inflow Area = 1.661 ac, 57.83% Impervious, Inflow Depth > 3.46" for 10-YR event
Inflow = 5.49 cfs @ 12.01 hrs, Volume= 0.479 af
Outflow = 3.50 cfs @ 12.20 hrs, Volume= 0.457 af, Atten= 36%, Lag= 11.0 min
Primary = 3.50 cfs @ 12.20 hrs, Volume= 0.457 af
Routed to Pond 11P : Sediment Forebay

Routing by Stor-Ind method, Time Span= 1.00-36.00 hrs, dt= 0.05 hrs
Peak Elev= 158.61' @ 12.20 hrs Surf.Area= 4,466 sf Storage= 6,100 cf

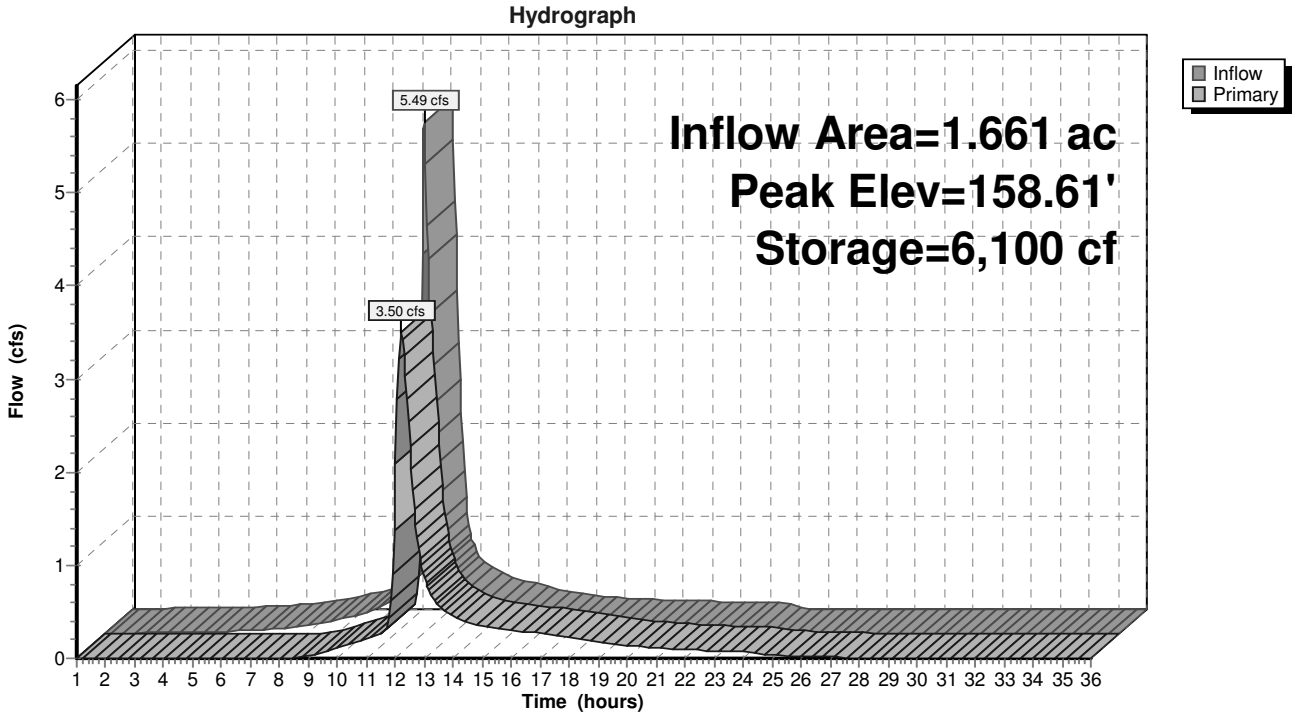
Plug-Flow detention time= 113.3 min calculated for 0.457 af (96% of inflow)
Center-of-Mass det. time= 87.6 min (869.8 - 782.2)

Volume	Invert	Avail.Storage	Storage Description
#1	156.50'	3,550 cf	**22.00'W x 203.00'L x 3.00'H Prismatoid** 13,398 cf Overall - 4,524 cf Embedded = 8,874 cf x 40.0% Voids
#2	157.00'	4,524 cf	**24.0" Round Pipe Storage** x 6 Inside #1 L= 240.0'
		8,074 cf	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Primary	157.75'	**12.0" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#2	Primary	157.00'	**4.0" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Primary	157.75'	**6.0" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=3.49 cfs @ 12.20 hrs HW=158.61' (Free Discharge)
- **1=Orifice/Grate** (Orifice Controls 2.25 cfs @ 3.15 fps)
- **2=Orifice/Grate** (Orifice Controls 0.50 cfs @ 5.78 fps)
- **3=Orifice/Grate** (Orifice Controls 0.74 cfs @ 3.75 fps)

Pond 9P: ADS Pipe Detention Basin



Summary for Pond 11P: Sediment Forebay

Inflow Area = 2.178 ac, 44.11% Impervious, Inflow Depth > 3.10" for 10-YR event
Inflow = 4.74 cfs @ 12.15 hrs, Volume= 0.563 af
Outflow = 4.74 cfs @ 12.17 hrs, Volume= 0.556 af, Atten= 0%, Lag= 0.8 min
Primary = 4.74 cfs @ 12.17 hrs, Volume= 0.556 af
Routed to Pond 12P : Outlet Det Pond

Routing by Stor-Ind method, Time Span= 1.00-36.00 hrs, dt= 0.05 hrs
Peak Elev= 156.95' @ 12.17 hrs Surf.Area= 811 sf Storage= 634 cf

Plug-Flow detention time= 14.6 min calculated for 0.556 af (99% of inflow)
Center-of-Mass det. time= 5.8 min (867.9 - 862.1)

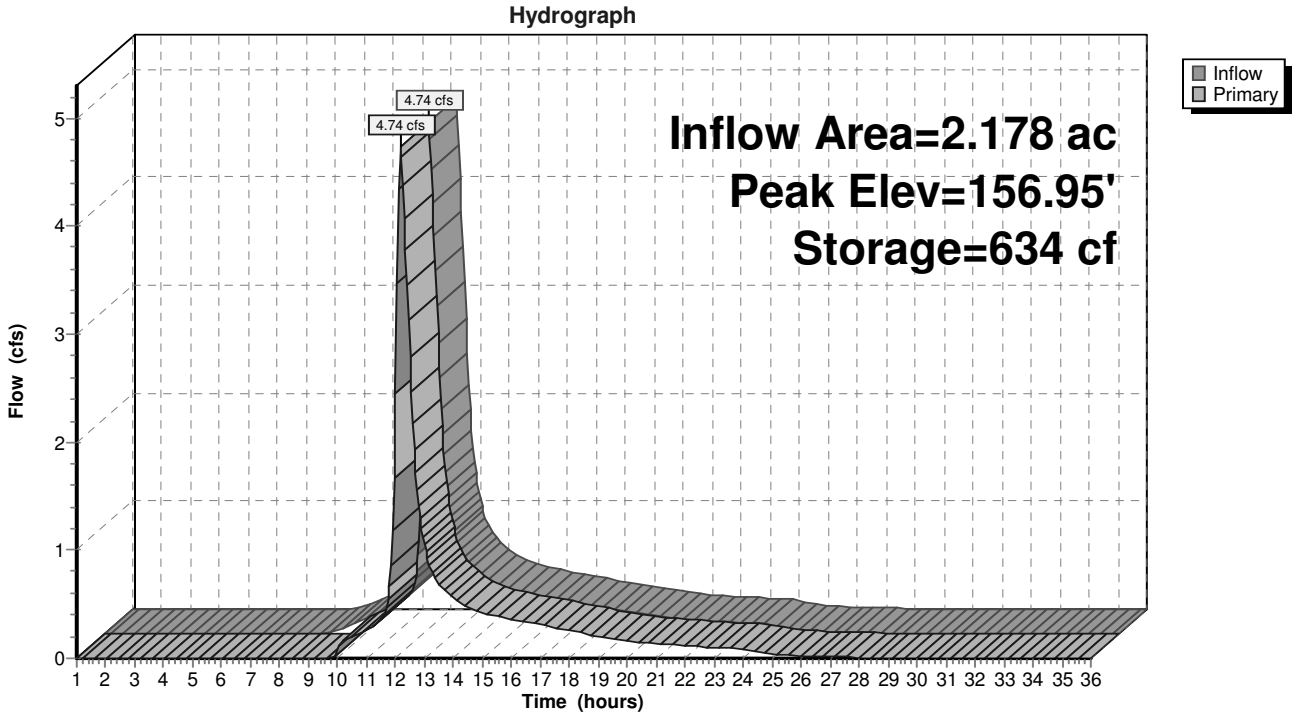
Volume	Invert	Avail.Storage	Storage Description
#1	156.00'	1,698 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
156.00	532	89.0	0	0	532
157.00	827	108.0	674	674	846
158.00	1,235	137.0	1,024	1,698	1,424

Device	Routing	Invert	Outlet Devices
#1	Primary	156.50'	**6.0' long x 3.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 Coef. (English) 2.44 2.58 2.68 2.67 2.65 2.64 2.64 2.68 2.68 2.72 2.81 2.92 2.97 3.07 3.32

Primary OutFlow Max=4.69 cfs @ 12.17 hrs HW=156.95' (Free Discharge)
1=Broad-Crested Rectangular Weir (Weir Controls 4.69 cfs @ 1.74 fps)

Pond 11P: Sediment Forebay



Summary for Pond 12P: Outlet Det Pond

Inflow Area = 2.178 ac, 44.11% Impervious, Inflow Depth > 3.07" for 10-YR event
Inflow = 4.74 cfs @ 12.17 hrs, Volume= 0.556 af
Outflow = 3.39 cfs @ 12.41 hrs, Volume= 0.445 af, Atten= 28%, Lag= 14.9 min
Primary = 3.39 cfs @ 12.41 hrs, Volume= 0.445 af
Routed to Link DP#2 : DP#2 - Rear Wetlands

Routing by Stor-Ind method, Time Span= 1.00-36.00 hrs, dt= 0.05 hrs / 2
Peak Elev= 155.87' @ 12.41 hrs Surf.Area= 5,035 sf Storage= 6,633 cf

Plug-Flow detention time= 143.0 min calculated for 0.445 af (80% of inflow)
Center-of-Mass det. time= 57.4 min (925.3 - 867.9)

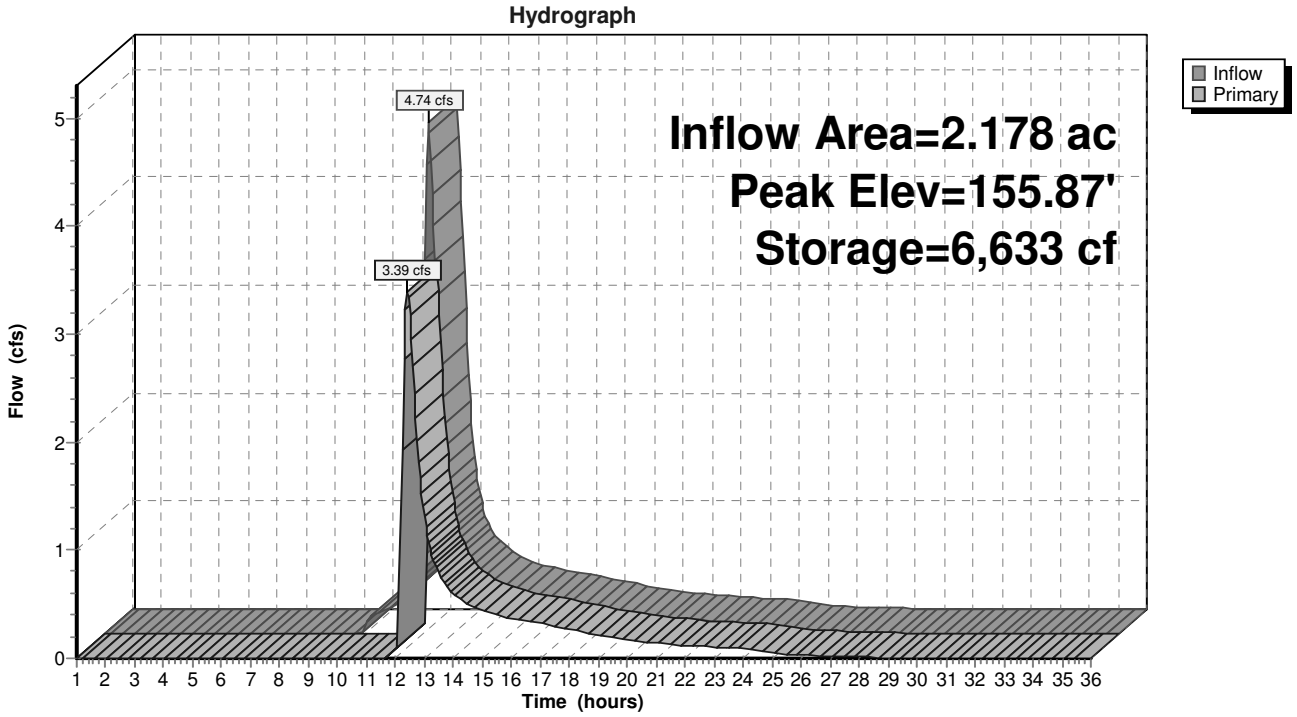
Volume	Invert	Avail.Storage	Storage Description
#1	154.00'	7,288 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
154.00	1,475	145.0	0	0	1,475
155.00	4,078	631.0	2,669	2,669	31,489
156.00	5,184	677.0	4,620	7,288	36,322

Device	Routing	Invert	Outlet Devices
#1	Primary	155.50'	**6.0' long x 6.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.37 2.51 2.70 2.68 2.68 2.67 2.65 2.65 2.65 2.65 2.66 2.66 2.67 2.69 2.72 2.76 2.83

Primary OutFlow Max=3.37 cfs @ 12.41 hrs HW=155.87' (Free Discharge)
1=Broad-Crested Rectangular Weir (Weir Controls 3.37 cfs @ 1.51 fps)

Pond 12P: Outlet Det Pond

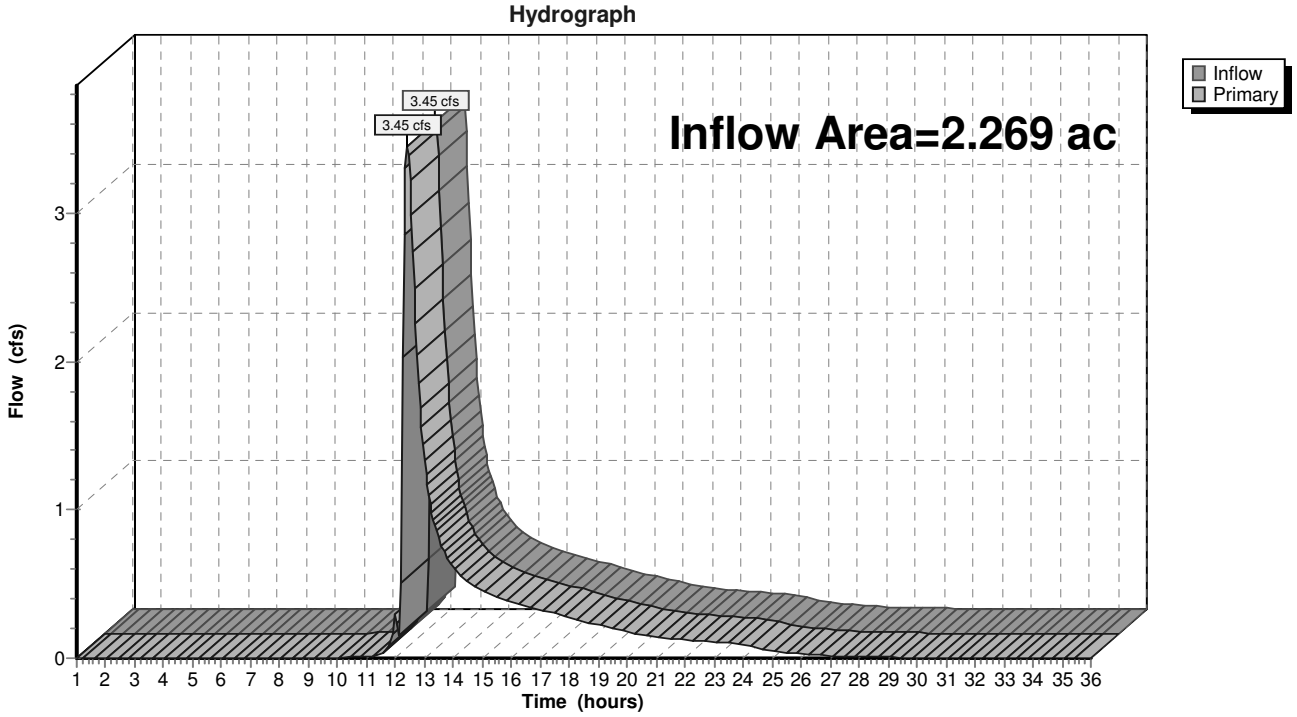


Summary for Link DP#2: DP#2 - Rear Wetlands

Inflow Area = 2.269 ac, 42.35% Impervious, Inflow Depth > 2.45" for 10-YR event
Inflow = 3.45 cfs @ 12.41 hrs, Volume= 0.464 af
Primary = 3.45 cfs @ 12.41 hrs, Volume= 0.464 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 1.00-36.00 hrs, dt= 0.05 hrs

Link DP#2: DP#2 - Rear Wetlands



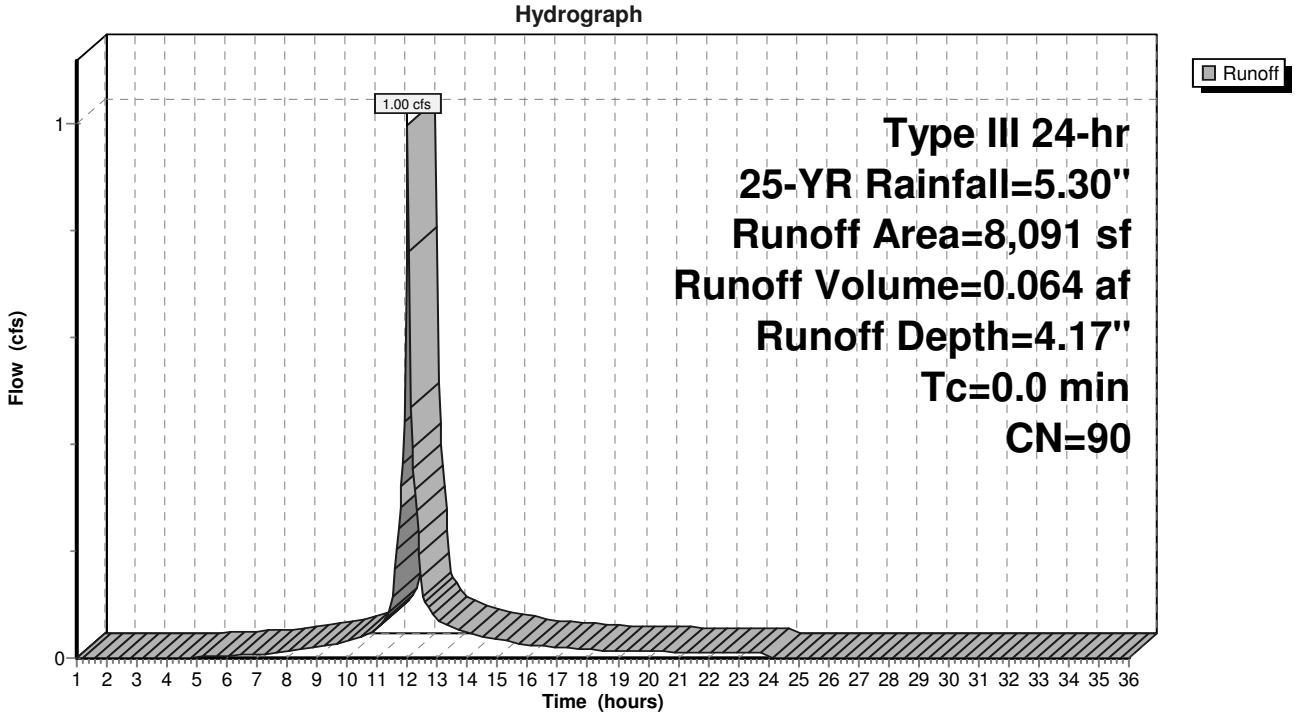
Summary for Subcatchment 1S: Flow to PCB#1

Runoff = 1.00 cfs @ 12.00 hrs, Volume= 0.064 af, Depth= 4.17"
Routed to Pond 9P : ADS Pipe Detention Basin

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-YR Rainfall=5.30"

Area (sf)	CN	Description
4,612	98	Paved parking, HSG D
3,479	80	>75% Grass cover, Good, HSG D
8,091	90	Weighted Average
3,479		43.00% Pervious Area
4,612		57.00% Impervious Area

Subcatchment 1S: Flow to PCB#1



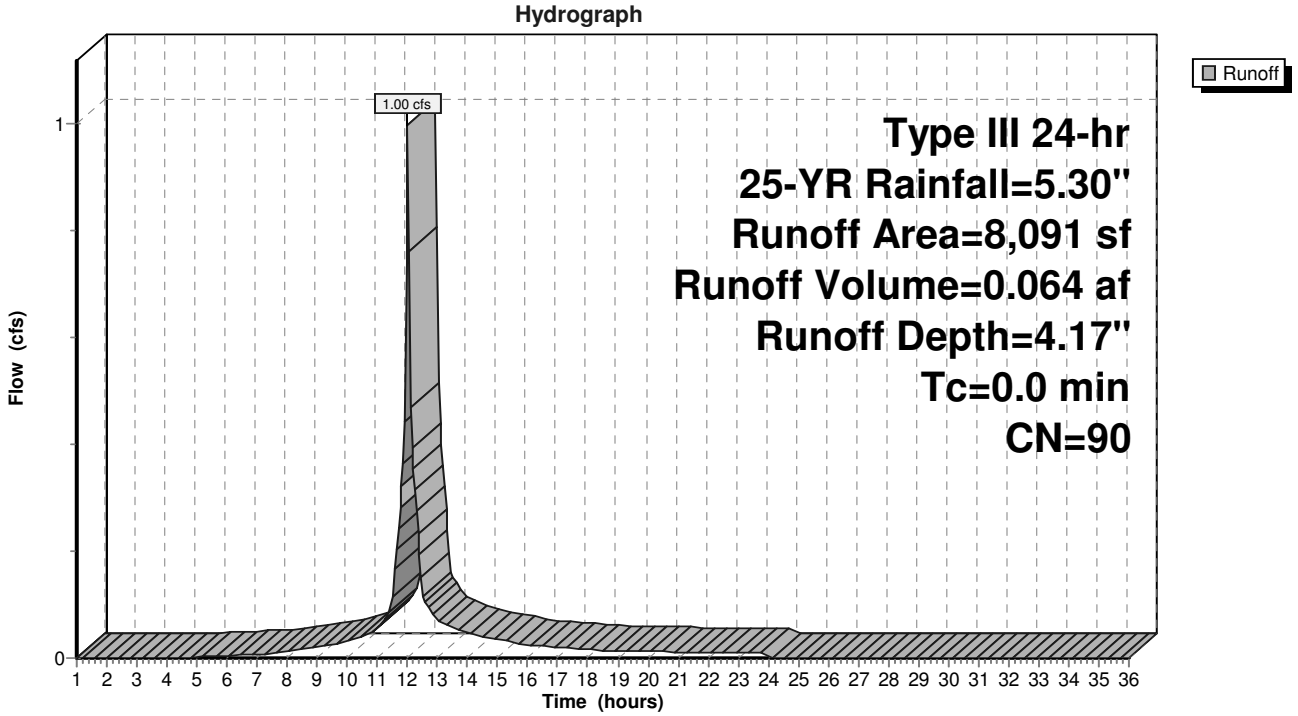
Summary for Subcatchment 3S: Flow to PCB#2

Runoff = 1.00 cfs @ 12.00 hrs, Volume= 0.064 af, Depth= 4.17"
Routed to Pond 9P : ADS Pipe Detention Basin

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-YR Rainfall=5.30"

Area (sf)	CN	Description
4,612	98	Paved parking, HSG D
3,479	80	>75% Grass cover, Good, HSG D
8,091	90	Weighted Average
3,479		43.00% Pervious Area
4,612		57.00% Impervious Area

Subcatchment 3S: Flow to PCB#2



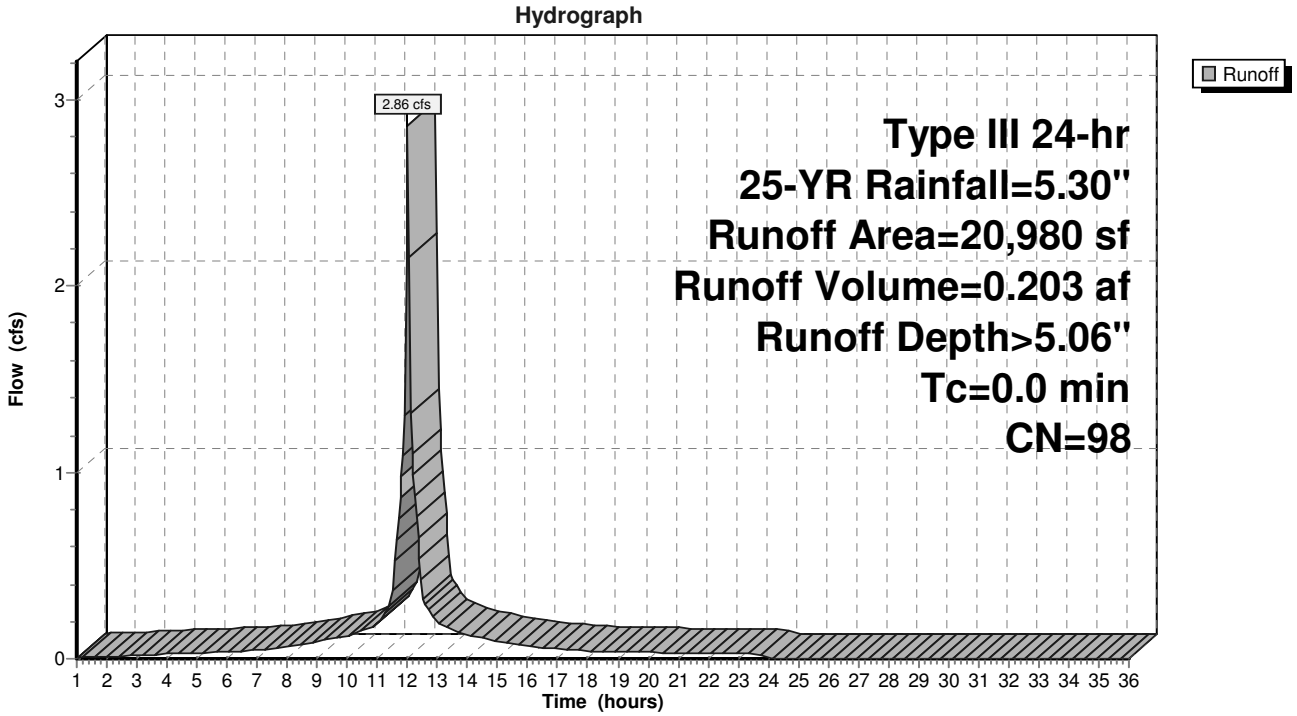
Summary for Subcatchment 4S: Roofs

Runoff = 2.86 cfs @ 12.00 hrs, Volume= 0.203 af, Depth> 5.06"
Routed to Pond 9P : ADS Pipe Detention Basin

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-YR Rainfall=5.30"

Area (sf)	CN	Description
20,980	98	Roofs, HSG D
20,980		100.00% Impervious Area

Subcatchment 4S: Roofs



Summary for Subcatchment 5S: Landscape Area including Wet Basin

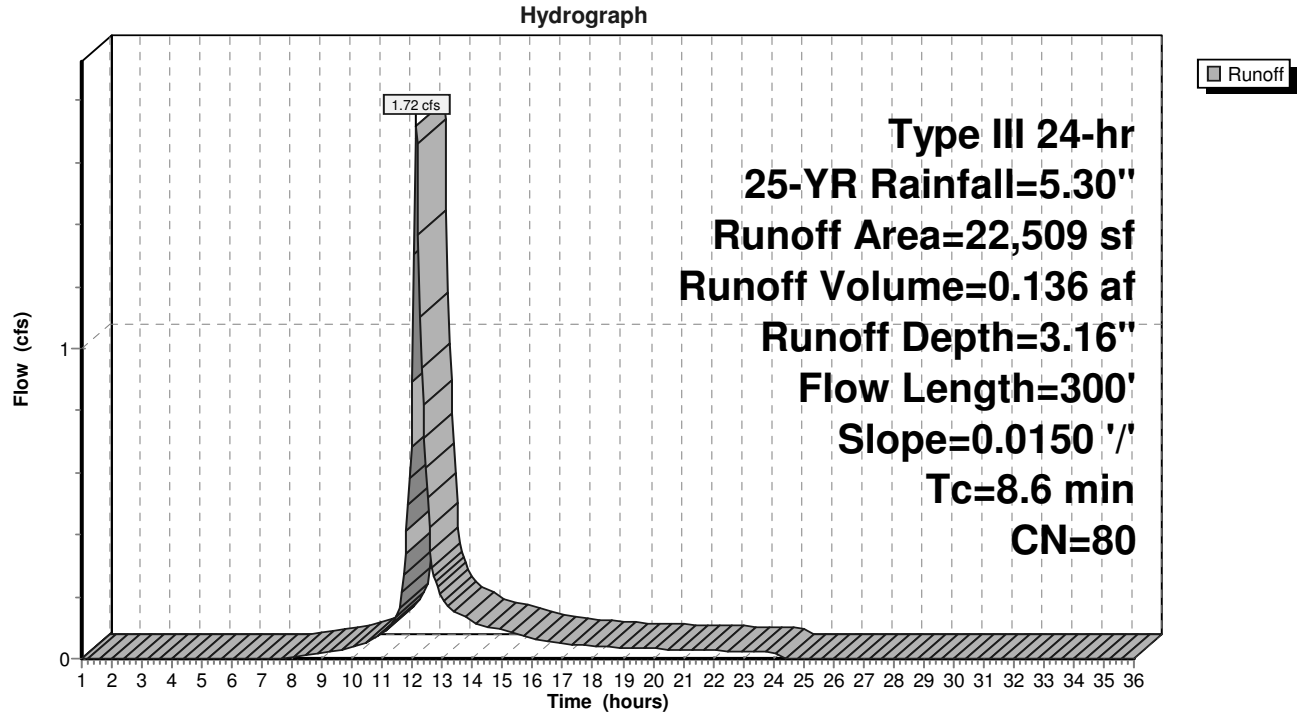
Runoff = 1.72 cfs @ 12.12 hrs, Volume= 0.136 af, Depth= 3.16"
Routed to Pond 11P : Sediment Forebay

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-YR Rainfall=5.30"

Area (sf)	CN	Description
16,611	80	>75% Grass cover, Good, HSG D
5,898	80	>75% Grass cover, Good, HSG D
22,509	80	Weighted Average
22,509		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.3	50	0.0150	0.13		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.20"
2.3	250	0.0150	1.84		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
8.6	300	Total			

Subcatchment 5S: Landscape Area including Wet Basin



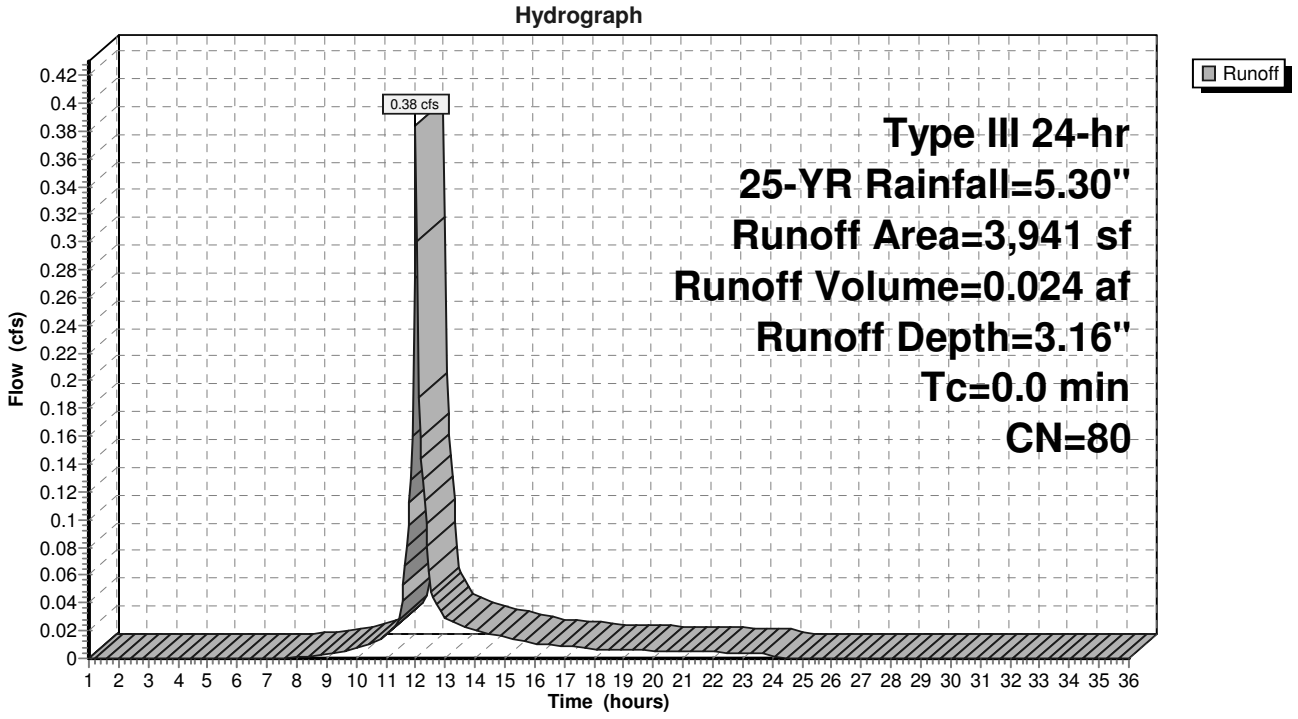
Summary for Subcatchment 6S: Undetained Flow to Wetlands

Runoff = 0.38 cfs @ 12.00 hrs, Volume= 0.024 af, Depth= 3.16"
Routed to Link DP#2 : DP#2 - Rear Wetlands

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-YR Rainfall=5.30"

Area (sf)	CN	Description
2,032	80	>75% Grass cover, Good, HSG D
1,909	80	>75% Grass cover, Good, HSG D
3,941	80	Weighted Average
3,941		100.00% Pervious Area

Subcatchment 6S: Undetained Flow to Wetlands



Summary for Subcatchment 7S: Flow to PCB#3

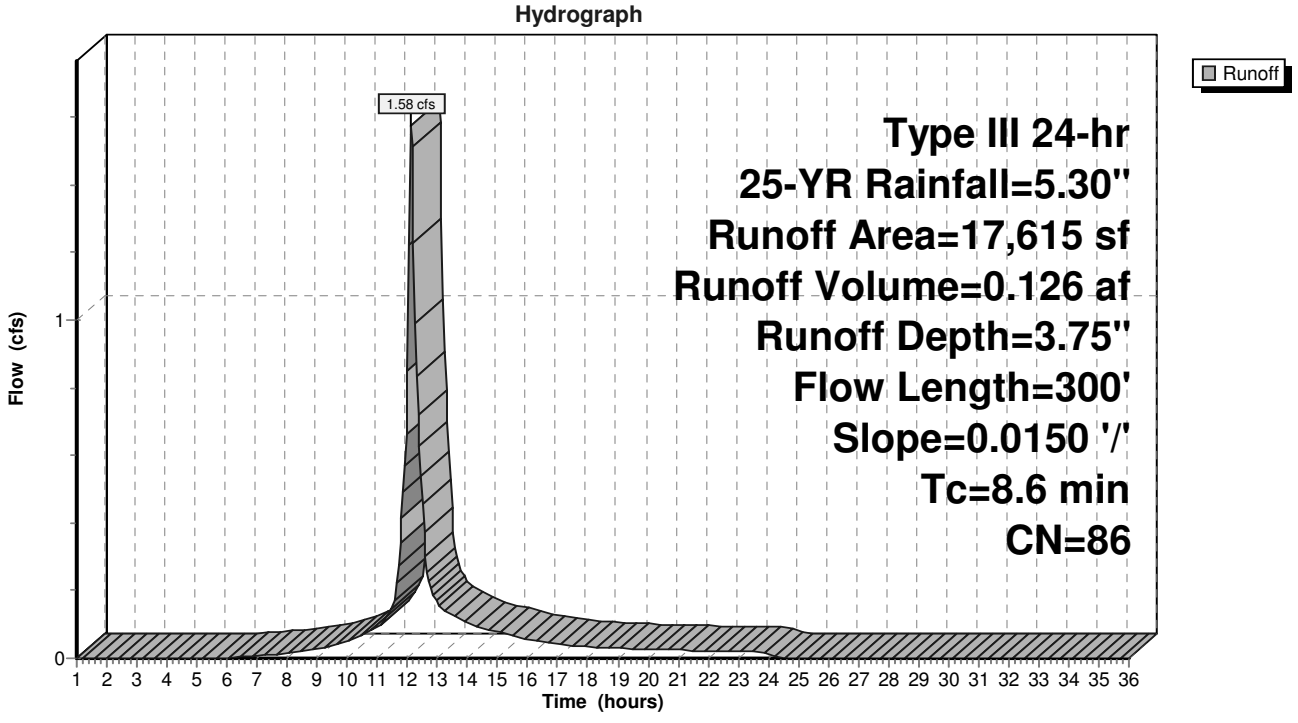
Runoff = 1.58 cfs @ 12.12 hrs, Volume= 0.126 af, Depth= 3.75"
Routed to Pond 9P : ADS Pipe Detention Basin

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-YR Rainfall=5.30"

Area (sf)	CN	Description
11,784	80	>75% Grass cover, Good, HSG D
5,831	98	Paved parking, HSG D
17,615	86	Weighted Average
11,784		66.90% Pervious Area
5,831		33.10% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.3	50	0.0150	0.13		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.20"
2.3	250	0.0150	1.84		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
8.6	300	Total			

Subcatchment 7S: Flow to PCB#3



Summary for Subcatchment 8S: Flow to PCB#4

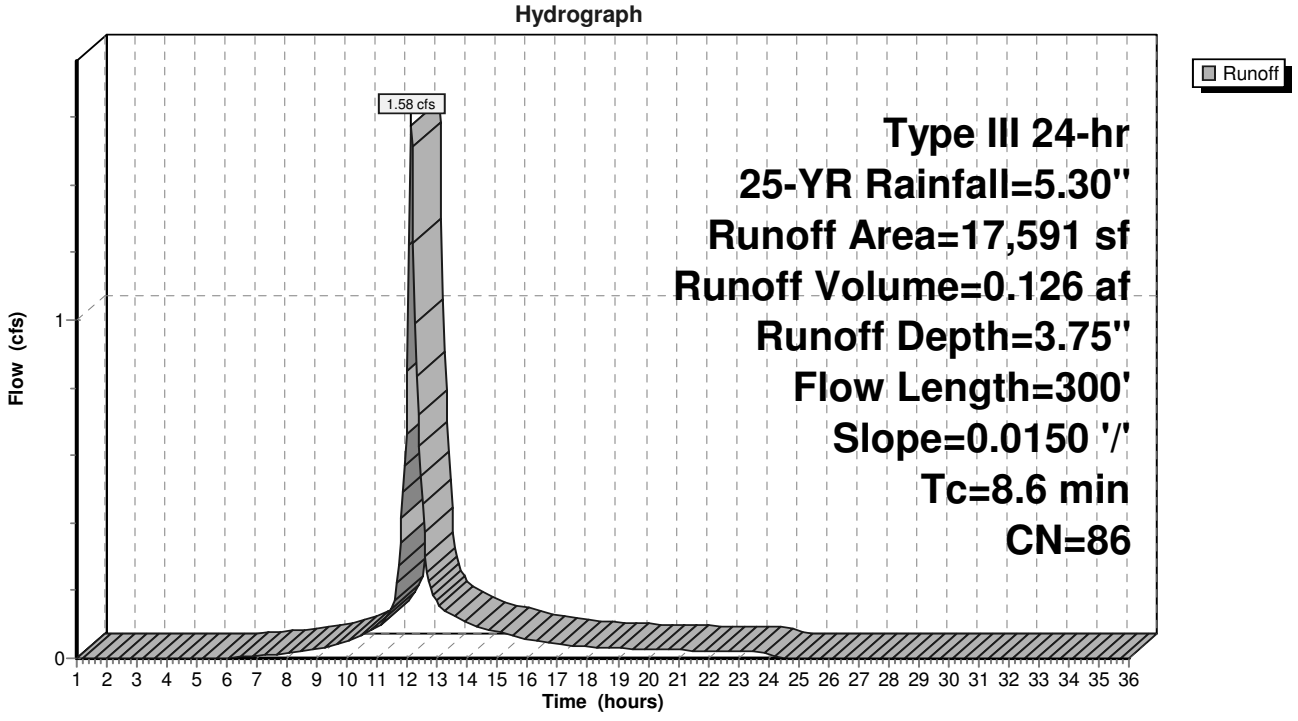
Runoff = 1.58 cfs @ 12.12 hrs, Volume= 0.126 af, Depth= 3.75"
Routed to Pond 9P : ADS Pipe Detention Basin

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-YR Rainfall=5.30"

Area (sf)	CN	Description
11,779	80	>75% Grass cover, Good, HSG D
5,812	98	Paved parking, HSG D
17,591	86	Weighted Average
11,779		66.96% Pervious Area
5,812		33.04% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.3	50	0.0150	0.13		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.20"
2.3	250	0.0150	1.84		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
8.6	300	Total			

Subcatchment 8S: Flow to PCB#4



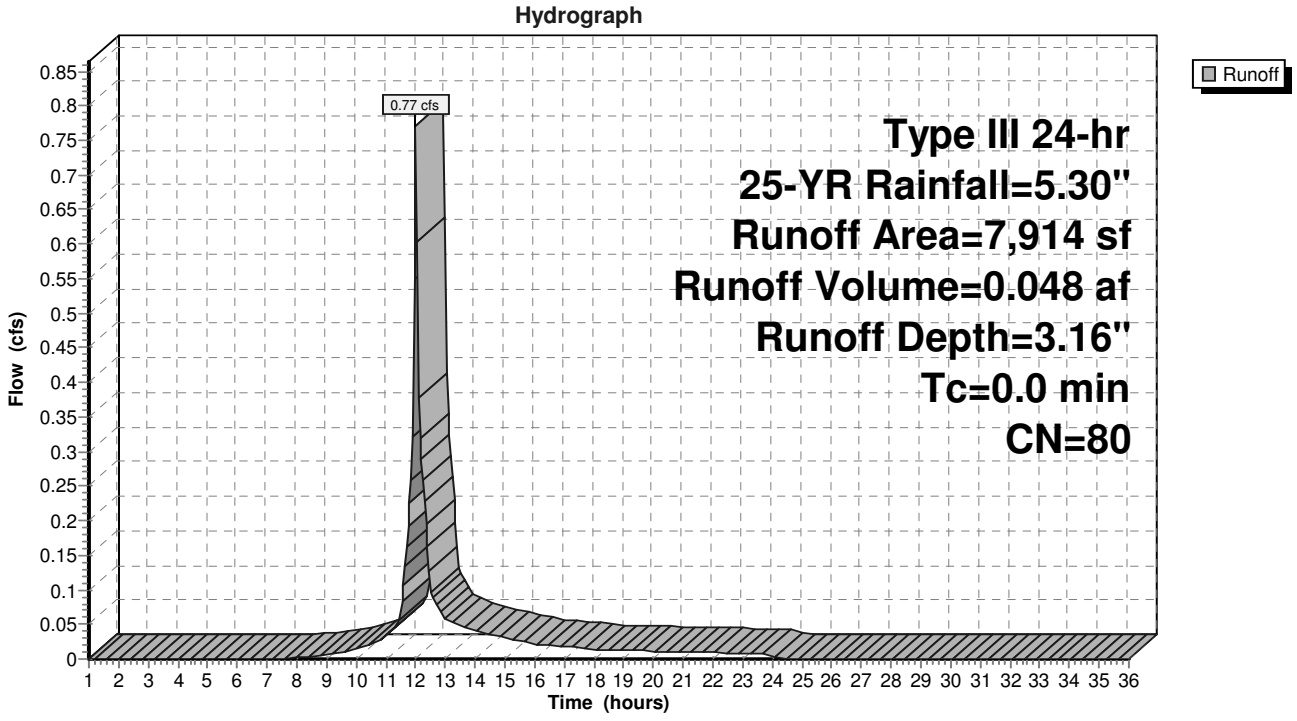
Summary for Subcatchment DP#1: Flow to Greenmont Ave

Runoff = 0.77 cfs @ 12.00 hrs, Volume= 0.048 af, Depth= 3.16"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-YR Rainfall=5.30"

Area (sf)	CN	Description
6,641	80	>75% Grass cover, Good, HSG D
1,273	80	>75% Grass cover, Good, HSG D
7,914	80	Weighted Average
7,914		100.00% Pervious Area

Subcatchment DP#1: Flow to Greenmont Ave



Summary for Pond 9P: ADS Pipe Detention Basin

Inflow Area = 1.661 ac, 57.83% Impervious, Inflow Depth > 4.22" for 25-YR event
Inflow = 6.64 cfs @ 12.01 hrs, Volume= 0.585 af
Outflow = 4.32 cfs @ 12.19 hrs, Volume= 0.563 af, Atten= 35%, Lag= 10.6 min
Primary = 4.32 cfs @ 12.19 hrs, Volume= 0.563 af
Routed to Pond 11P : Sediment Forebay

Routing by Stor-Ind method, Time Span= 1.00-36.00 hrs, dt= 0.05 hrs
Peak Elev= 158.84' @ 12.19 hrs Surf.Area= 4,466 sf Storage= 6,799 cf

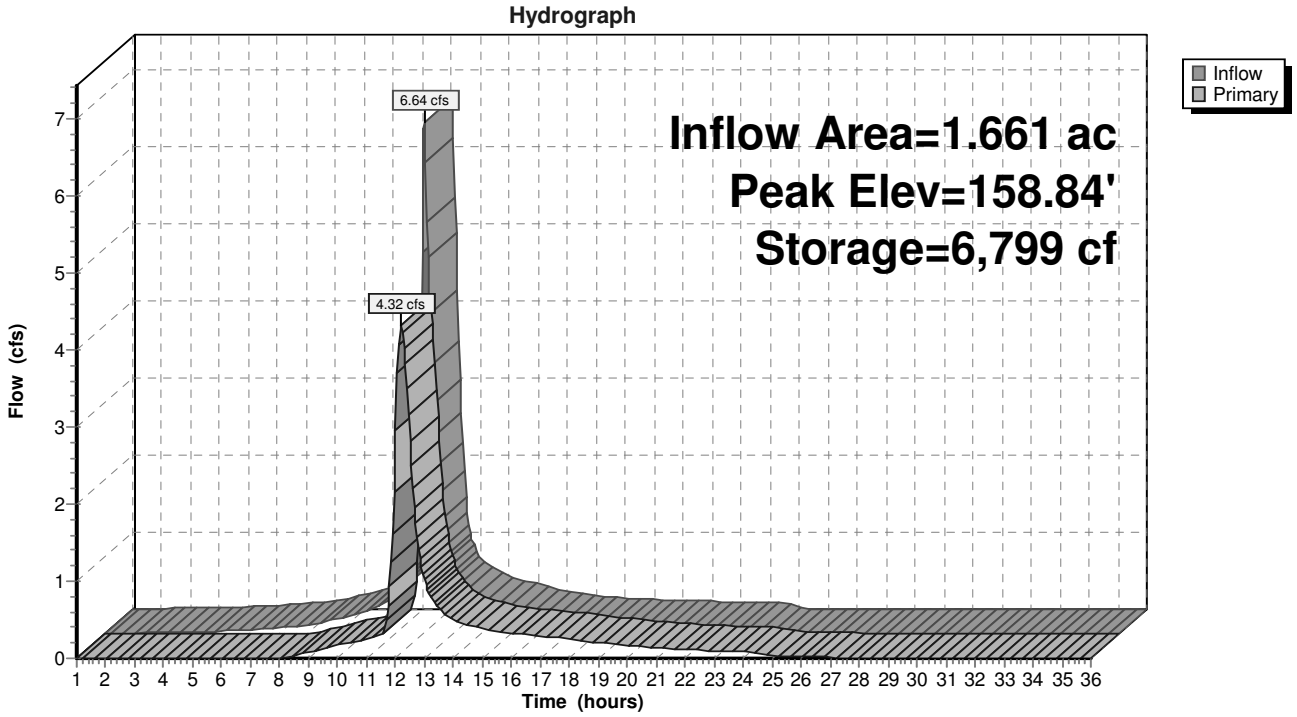
Plug-Flow detention time= 101.6 min calculated for 0.563 af (96% of inflow)
Center-of-Mass det. time= 80.8 min (858.8 - 778.0)

Volume	Invert	Avail.Storage	Storage Description
#1	156.50'	3,550 cf	**22.00'W x 203.00'L x 3.00'H Prismatoid** 13,398 cf Overall - 4,524 cf Embedded = 8,874 cf x 40.0% Voids
#2	157.00'	4,524 cf	**24.0" Round Pipe Storage** x 6 Inside #1 L= 240.0'
		8,074 cf	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Primary	157.75'	**12.0" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#2	Primary	157.00'	**4.0" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Primary	157.75'	**6.0" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=4.31 cfs @ 12.19 hrs HW=158.84' (Free Discharge)
- **1=Orifice/Grate** (Orifice Controls 2.90 cfs @ 3.70 fps)
- **2=Orifice/Grate** (Orifice Controls 0.54 cfs @ 6.23 fps)
- **3=Orifice/Grate** (Orifice Controls 0.87 cfs @ 4.41 fps)

Pond 9P: ADS Pipe Detention Basin



Summary for Pond 11P: Sediment Forebay

Inflow Area = 2.178 ac, 44.11% Impervious, Inflow Depth > 3.85" for 25-YR event
Inflow = 5.94 cfs @ 12.15 hrs, Volume= 0.699 af
Outflow = 5.93 cfs @ 12.16 hrs, Volume= 0.692 af, Atten= 0%, Lag= 0.8 min
Primary = 5.93 cfs @ 12.16 hrs, Volume= 0.692 af
Routed to Pond 12P : Outlet Det Pond

Routing by Stor-Ind method, Time Span= 1.00-36.00 hrs, dt= 0.05 hrs
Peak Elev= 157.02' @ 12.16 hrs Surf.Area= 834 sf Storage= 690 cf

Plug-Flow detention time= 12.4 min calculated for 0.691 af (99% of inflow)
Center-of-Mass det. time= 5.2 min (856.8 - 851.6)

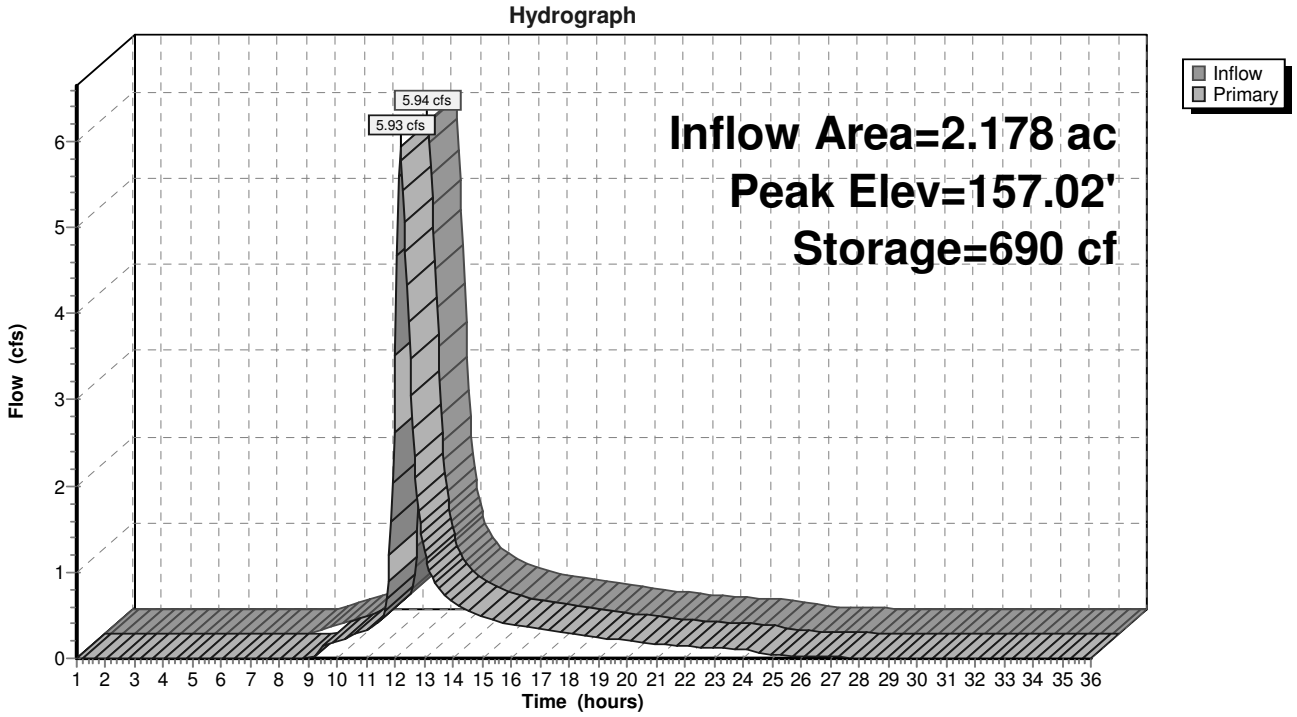
Volume	Invert	Avail.Storage	Storage Description
#1	156.00'	1,698 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
156.00	532	89.0	0	0	532
157.00	827	108.0	674	674	846
158.00	1,235	137.0	1,024	1,698	1,424

Device	Routing	Invert	Outlet Devices
#1	Primary	156.50'	**6.0' long x 3.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 Coef. (English) 2.44 2.58 2.68 2.67 2.65 2.64 2.64 2.68 2.68 2.72 2.81 2.92 2.97 3.07 3.32

Primary OutFlow Max=5.90 cfs @ 12.16 hrs HW=157.02' (Free Discharge)
1=Broad-Crested Rectangular Weir (Weir Controls 5.90 cfs @ 1.90 fps)

Pond 11P: Sediment Forebay



Summary for Pond 12P: Outlet Det Pond

Inflow Area = 2.178 ac, 44.11% Impervious, Inflow Depth > 3.81" for 25-YR event
Inflow = 5.93 cfs @ 12.16 hrs, Volume= 0.692 af
Outflow = 5.00 cfs @ 12.32 hrs, Volume= 0.581 af, Atten= 16%, Lag= 9.4 min
Primary = 5.00 cfs @ 12.32 hrs, Volume= 0.581 af
Routed to Link DP#2 : DP#2 - Rear Wetlands

Routing by Stor-Ind method, Time Span= 1.00-36.00 hrs, dt= 0.05 hrs / 2
Peak Elev= 155.97' @ 12.32 hrs Surf.Area= 5,150 sf Storage= 7,139 cf

Plug-Flow detention time= 123.3 min calculated for 0.581 af (84% of inflow)
Center-of-Mass det. time= 47.9 min (904.7 - 856.8)

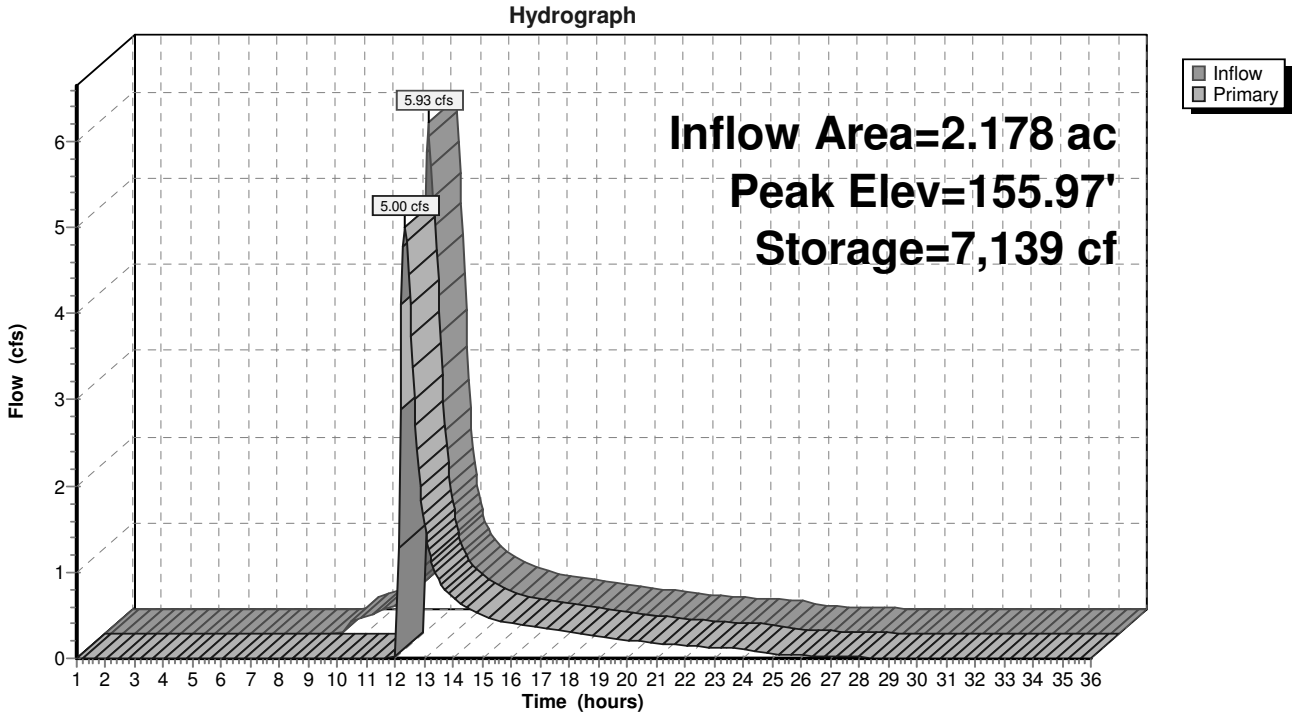
Volume	Invert	Avail.Storage	Storage Description
#1	154.00'	7,288 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
154.00	1,475	145.0	0	0	1,475
155.00	4,078	631.0	2,669	2,669	31,489
156.00	5,184	677.0	4,620	7,288	36,322

Device	Routing	Invert	Outlet Devices
#1	Primary	155.50'	**6.0' long x 6.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.37 2.51 2.70 2.68 2.68 2.67 2.65 2.65 2.65 2.65 2.66 2.66 2.67 2.69 2.72 2.76 2.83

Primary OutFlow Max=4.97 cfs @ 12.32 hrs HW=155.97' (Free Discharge)
↑—**1=Broad-Crested Rectangular Weir** (Weir Controls 4.97 cfs @ 1.76 fps)

Pond 12P: Outlet Det Pond

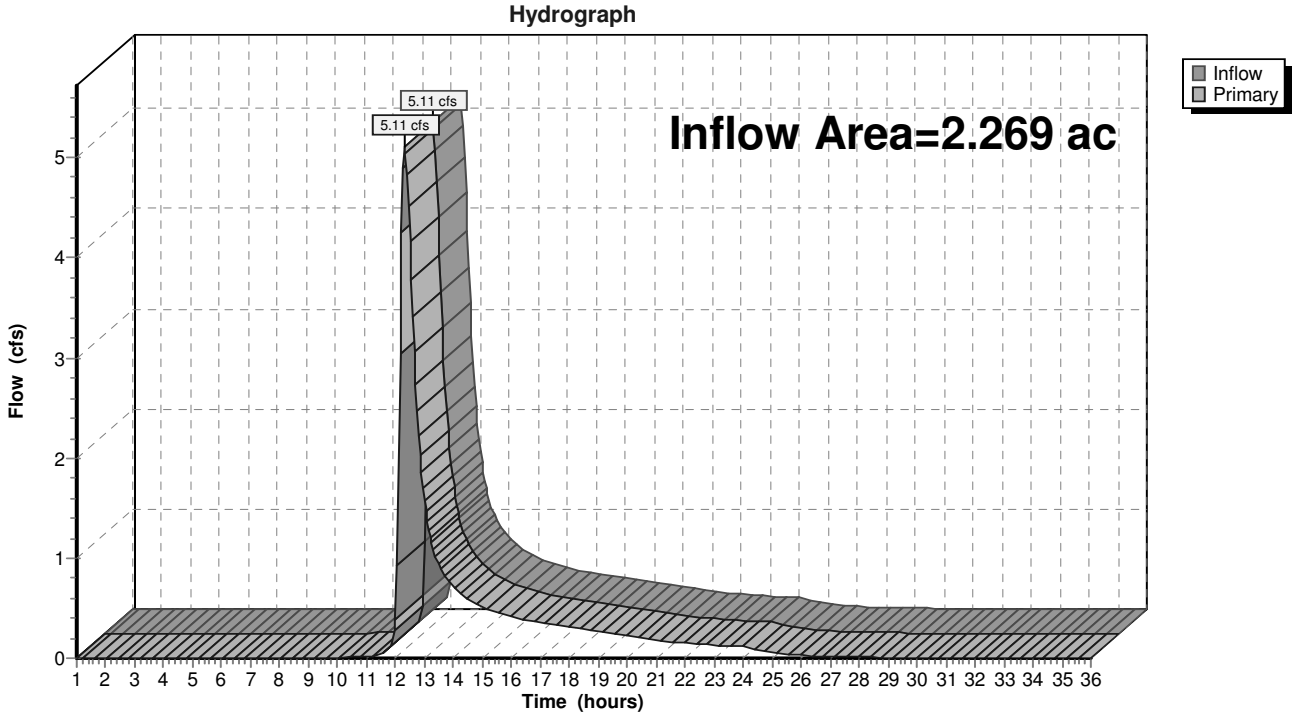


Summary for Link DP#2: DP#2 - Rear Wetlands

Inflow Area = 2.269 ac, 42.35% Impervious, Inflow Depth > 3.20" for 25-YR event
Inflow = 5.11 cfs @ 12.31 hrs, Volume= 0.605 af
Primary = 5.11 cfs @ 12.31 hrs, Volume= 0.605 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 1.00-36.00 hrs, dt= 0.05 hrs

Link DP#2: DP#2 - Rear Wetlands



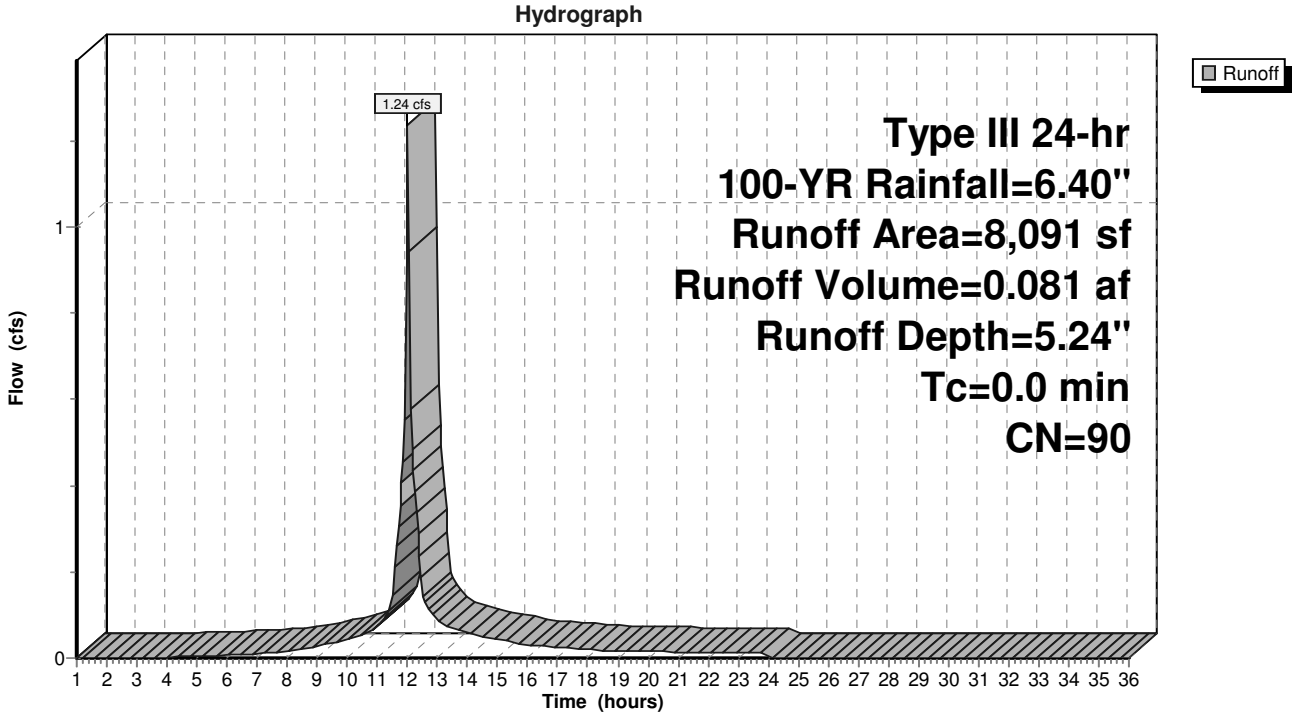
Summary for Subcatchment 1S: Flow to PCB#1

Runoff = 1.24 cfs @ 12.00 hrs, Volume= 0.081 af, Depth= 5.24"
Routed to Pond 9P : ADS Pipe Detention Basin

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-YR Rainfall=6.40"

Area (sf)	CN	Description
4,612	98	Paved parking, HSG D
3,479	80	>75% Grass cover, Good, HSG D
8,091	90	Weighted Average
3,479		43.00% Pervious Area
4,612		57.00% Impervious Area

Subcatchment 1S: Flow to PCB#1



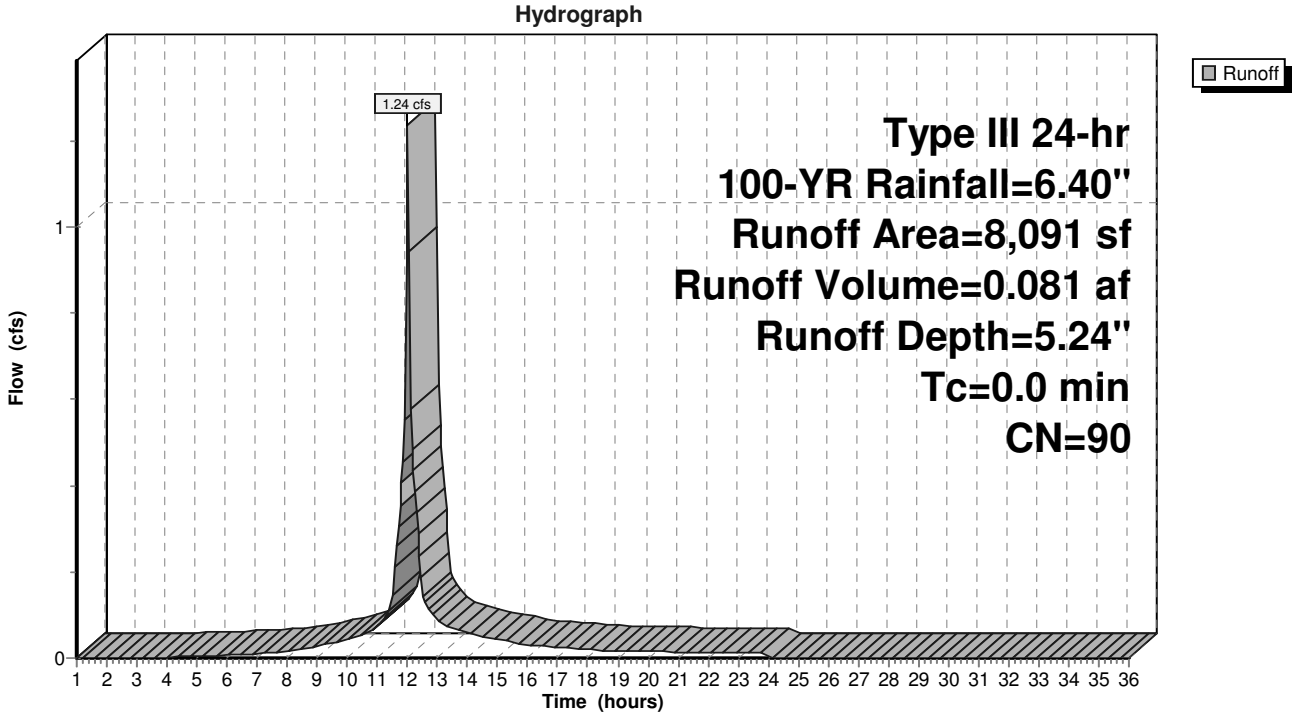
Summary for Subcatchment 3S: Flow to PCB#2

Runoff = 1.24 cfs @ 12.00 hrs, Volume= 0.081 af, Depth= 5.24"
Routed to Pond 9P : ADS Pipe Detention Basin

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-YR Rainfall=6.40"

Area (sf)	CN	Description
4,612	98	Paved parking, HSG D
3,479	80	>75% Grass cover, Good, HSG D
8,091	90	Weighted Average
3,479		43.00% Pervious Area
4,612		57.00% Impervious Area

Subcatchment 3S: Flow to PCB#2



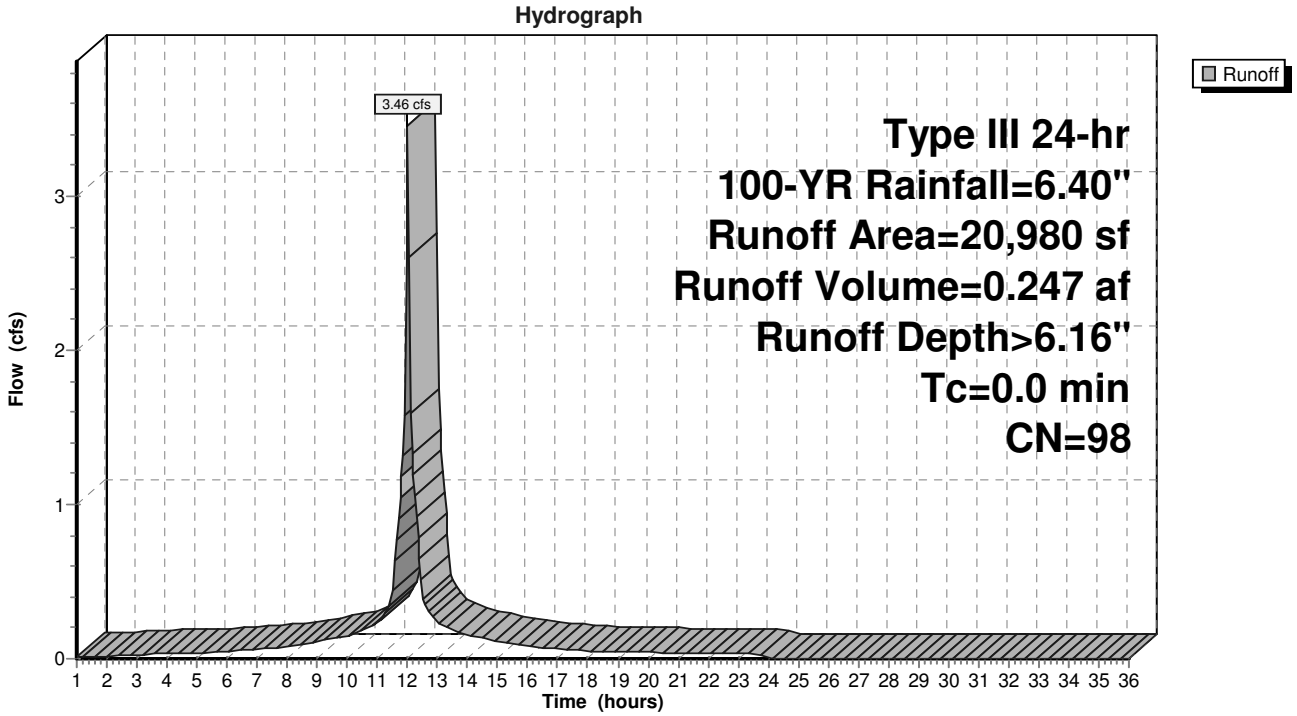
Summary for Subcatchment 4S: Roofs

Runoff = 3.46 cfs @ 12.00 hrs, Volume= 0.247 af, Depth> 6.16"
Routed to Pond 9P : ADS Pipe Detention Basin

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-YR Rainfall=6.40"

Area (sf)	CN	Description
20,980	98	Roofs, HSG D
20,980		100.00% Impervious Area

Subcatchment 4S: Roofs



Summary for Subcatchment 5S: Landscape Area including Wet Basin

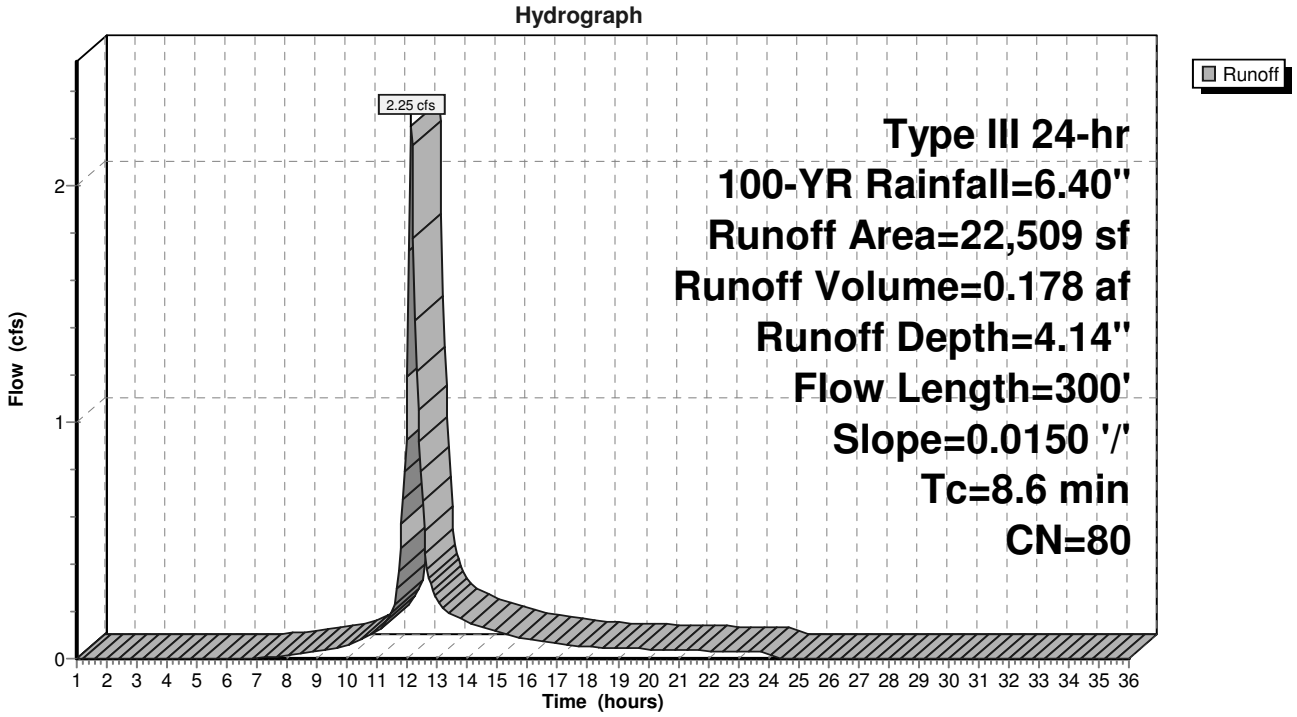
Runoff = 2.25 cfs @ 12.12 hrs, Volume= 0.178 af, Depth= 4.14"
Routed to Pond 11P : Sediment Forebay

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-YR Rainfall=6.40"

Area (sf)	CN	Description
16,611	80	>75% Grass cover, Good, HSG D
5,898	80	>75% Grass cover, Good, HSG D
22,509	80	Weighted Average
22,509		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.3	50	0.0150	0.13		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.20"
2.3	250	0.0150	1.84		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
8.6	300	Total			

Subcatchment 5S: Landscape Area including Wet Basin



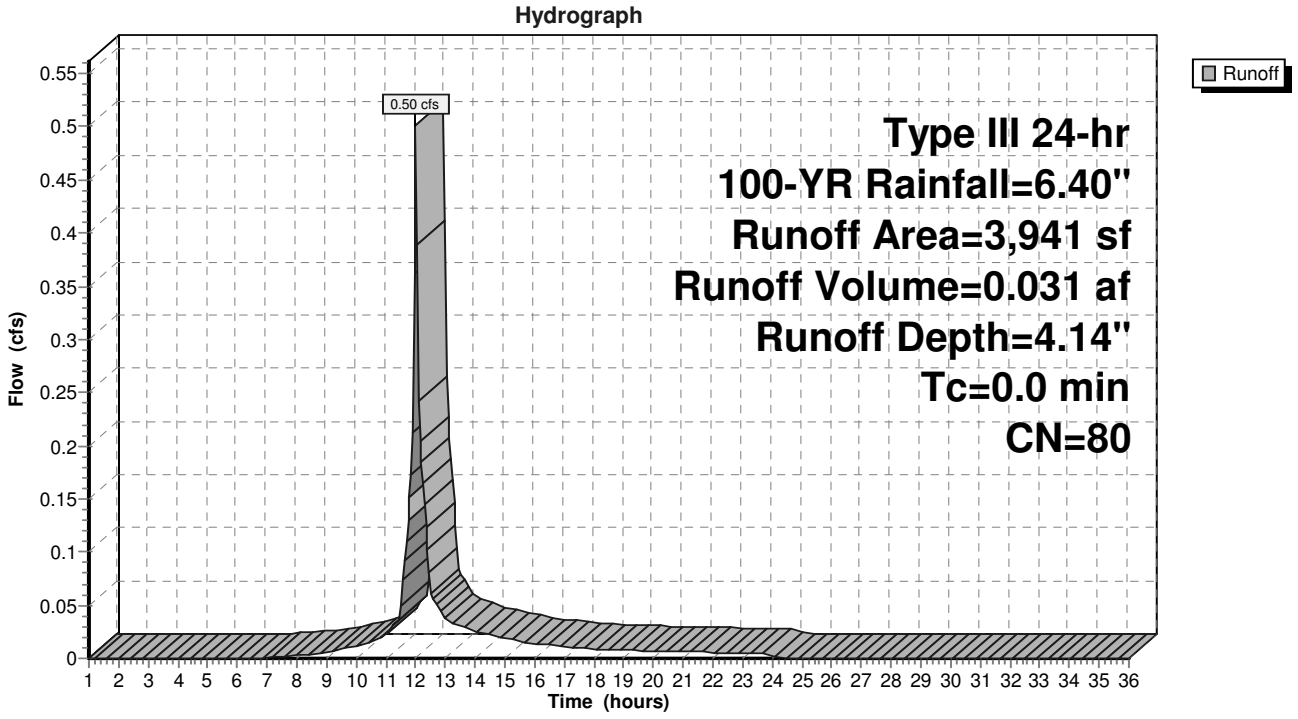
Summary for Subcatchment 6S: Undetained Flow to Wetlands

Runoff = 0.50 cfs @ 12.00 hrs, Volume= 0.031 af, Depth= 4.14"
Routed to Link DP#2 : DP#2 - Rear Wetlands

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-YR Rainfall=6.40"

Area (sf)	CN	Description
2,032	80	>75% Grass cover, Good, HSG D
1,909	80	>75% Grass cover, Good, HSG D
3,941	80	Weighted Average
3,941		100.00% Pervious Area

Subcatchment 6S: Undetained Flow to Wetlands



Summary for Subcatchment 7S: Flow to PCB#3

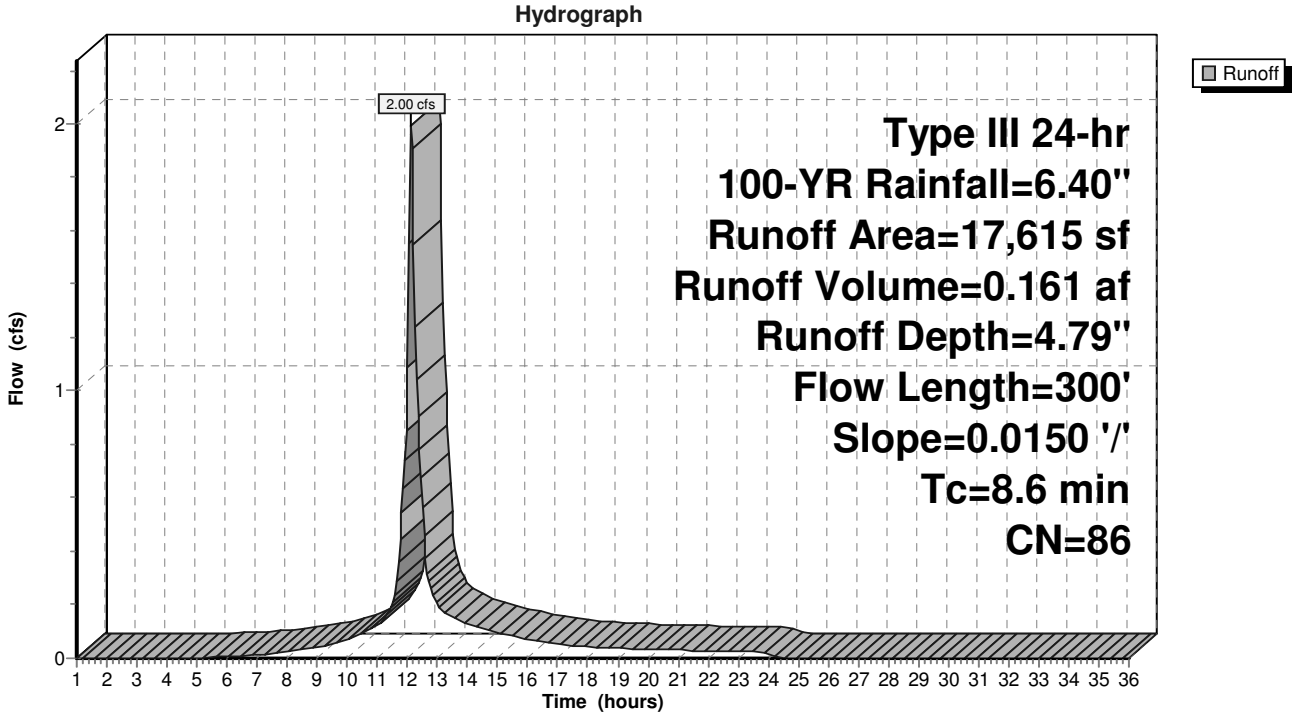
Runoff = 2.00 cfs @ 12.12 hrs, Volume= 0.161 af, Depth= 4.79"
Routed to Pond 9P : ADS Pipe Detention Basin

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-YR Rainfall=6.40"

Area (sf)	CN	Description
11,784	80	>75% Grass cover, Good, HSG D
5,831	98	Paved parking, HSG D
17,615	86	Weighted Average
11,784		66.90% Pervious Area
5,831		33.10% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.3	50	0.0150	0.13		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.20"
2.3	250	0.0150	1.84		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
8.6	300	Total			

Subcatchment 7S: Flow to PCB#3



Summary for Subcatchment 8S: Flow to PCB#4

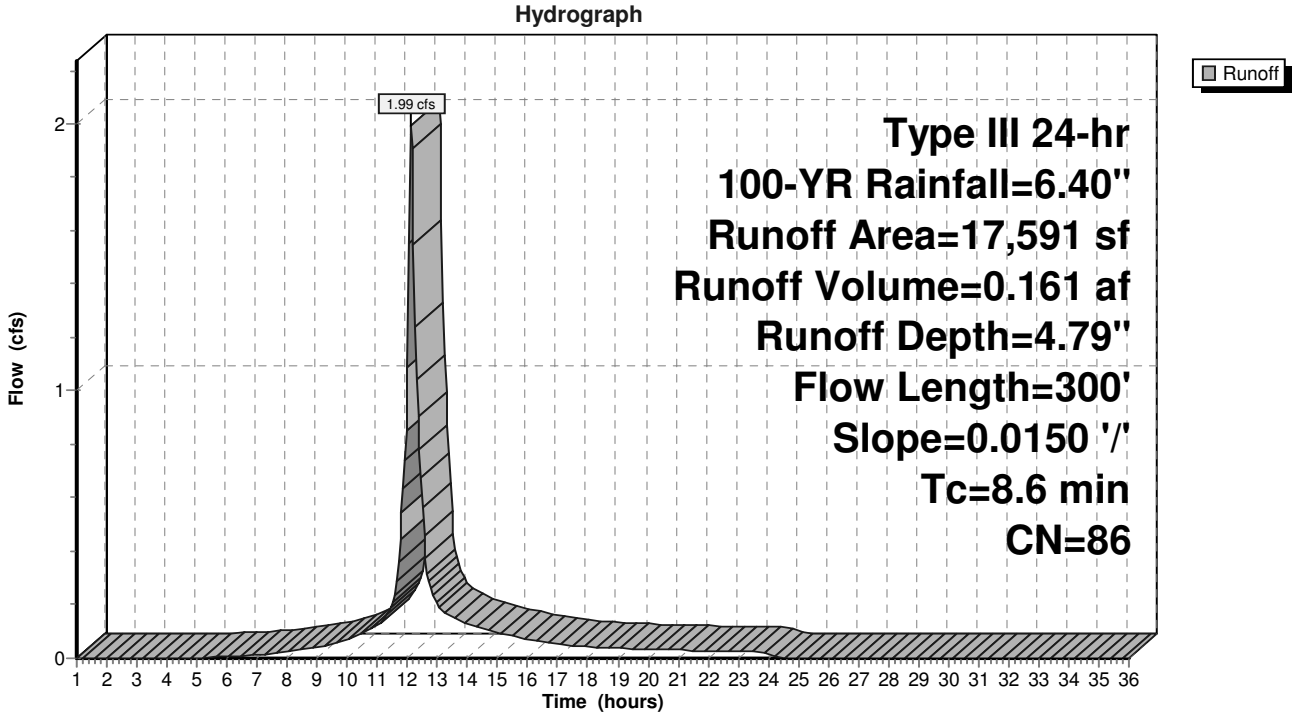
Runoff = 1.99 cfs @ 12.12 hrs, Volume= 0.161 af, Depth= 4.79"
Routed to Pond 9P : ADS Pipe Detention Basin

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-YR Rainfall=6.40"

Area (sf)	CN	Description
11,779	80	>75% Grass cover, Good, HSG D
5,812	98	Paved parking, HSG D
17,591	86	Weighted Average
11,779		66.96% Pervious Area
5,812		33.04% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.3	50	0.0150	0.13		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.20"
2.3	250	0.0150	1.84		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
8.6	300	Total			

Subcatchment 8S: Flow to PCB#4



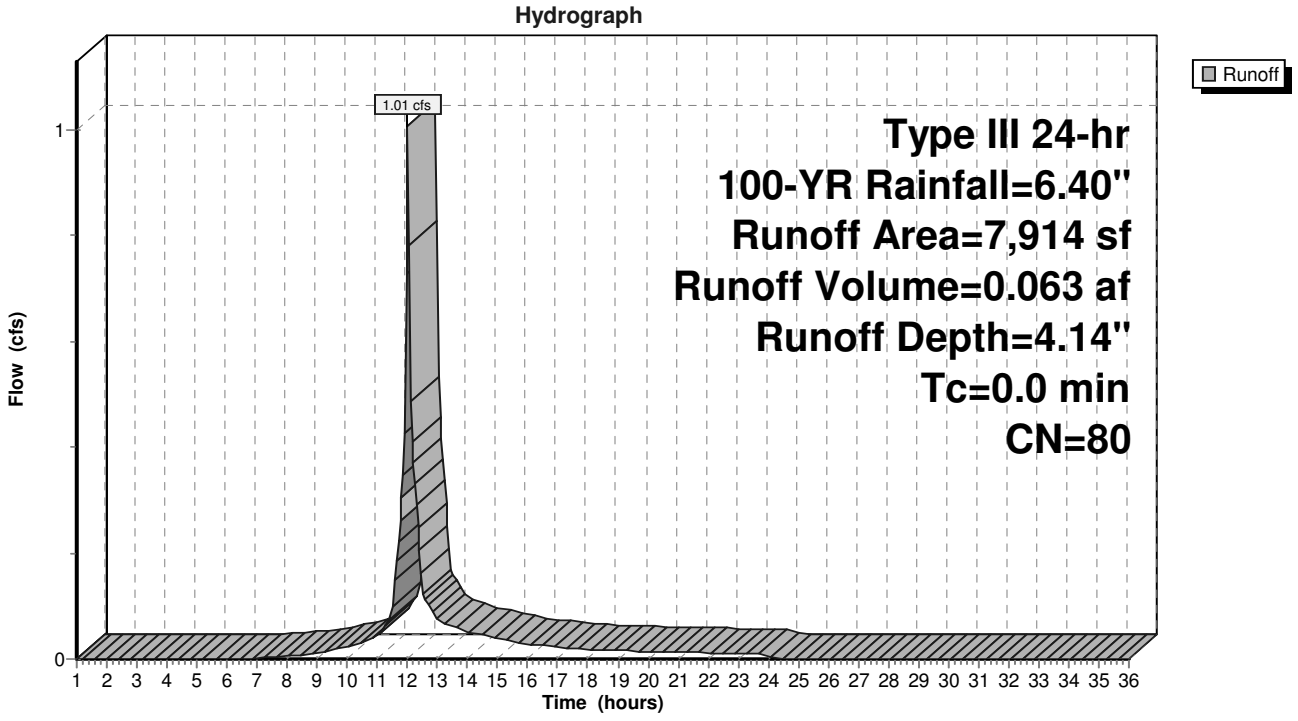
Summary for Subcatchment DP#1: Flow to Greenmont Ave

Runoff = 1.01 cfs @ 12.00 hrs, Volume= 0.063 af, Depth= 4.14"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-YR Rainfall=6.40"

Area (sf)	CN	Description
6,641	80	>75% Grass cover, Good, HSG D
1,273	80	>75% Grass cover, Good, HSG D
7,914	80	Weighted Average
7,914		100.00% Pervious Area

Subcatchment DP#1: Flow to Greenmont Ave



Summary for Pond 9P: ADS Pipe Detention Basin

Inflow Area = 1.661 ac, 57.83% Impervious, Inflow Depth > 5.29" for 100-YR event
Inflow = 8.22 cfs @ 12.01 hrs, Volume= 0.732 af
Outflow = 5.52 cfs @ 12.18 hrs, Volume= 0.711 af, Atten= 33%, Lag= 10.1 min
Primary = 5.52 cfs @ 12.18 hrs, Volume= 0.711 af
Routed to Pond 11P : Sediment Forebay

Routing by Stor-Ind method, Time Span= 1.00-36.00 hrs, dt= 0.05 hrs
Peak Elev= 159.28' @ 12.18 hrs Surf.Area= 4,466 sf Storage= 7,683 cf

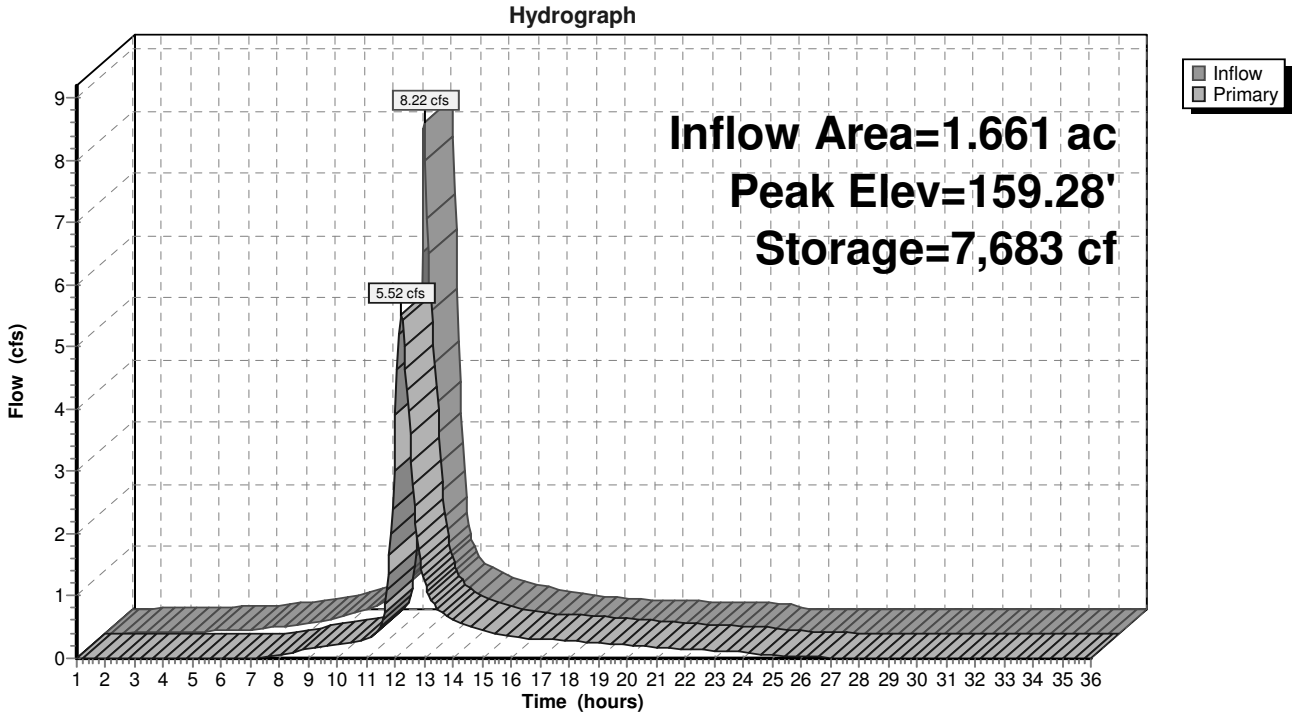
Plug-Flow detention time= 91.0 min calculated for 0.710 af (97% of inflow)
Center-of-Mass det. time= 74.1 min (847.4 - 773.3)

Volume	Invert	Avail.Storage	Storage Description
#1	156.50'	3,550 cf	**22.00'W x 203.00'L x 3.00'H Prismatoid** 13,398 cf Overall - 4,524 cf Embedded = 8,874 cf x 40.0% Voids
#2	157.00'	4,524 cf	**24.0" Round Pipe Storage** x 6 Inside #1 L= 240.0'
		8,074 cf	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Primary	157.75'	**12.0" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#2	Primary	157.00'	**4.0" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Primary	157.75'	**6.0" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=5.50 cfs @ 12.18 hrs HW=159.27' (Free Discharge)
- **1=Orifice/Grate** (Orifice Controls 3.82 cfs @ 4.87 fps)
- **2=Orifice/Grate** (Orifice Controls 0.61 cfs @ 6.99 fps)
- **3=Orifice/Grate** (Orifice Controls 1.07 cfs @ 5.43 fps)

Pond 9P: ADS Pipe Detention Basin



Summary for Pond 11P: Sediment Forebay

Inflow Area = 2.178 ac, 44.11% Impervious, Inflow Depth > 4.90" for 100-YR event
Inflow = 7.65 cfs @ 12.14 hrs, Volume= 0.889 af
Outflow = 7.66 cfs @ 12.16 hrs, Volume= 0.882 af, Atten= 0%, Lag= 0.8 min
Primary = 7.66 cfs @ 12.16 hrs, Volume= 0.882 af
Routed to Pond 12P : Outlet Det Pond

Routing by Stor-Ind method, Time Span= 1.00-36.00 hrs, dt= 0.05 hrs
Peak Elev= 157.11' @ 12.16 hrs Surf.Area= 868 sf Storage= 767 cf

Plug-Flow detention time= 11.1 min calculated for 0.882 af (99% of inflow)
Center-of-Mass det. time= 4.7 min (845.4 - 840.7)

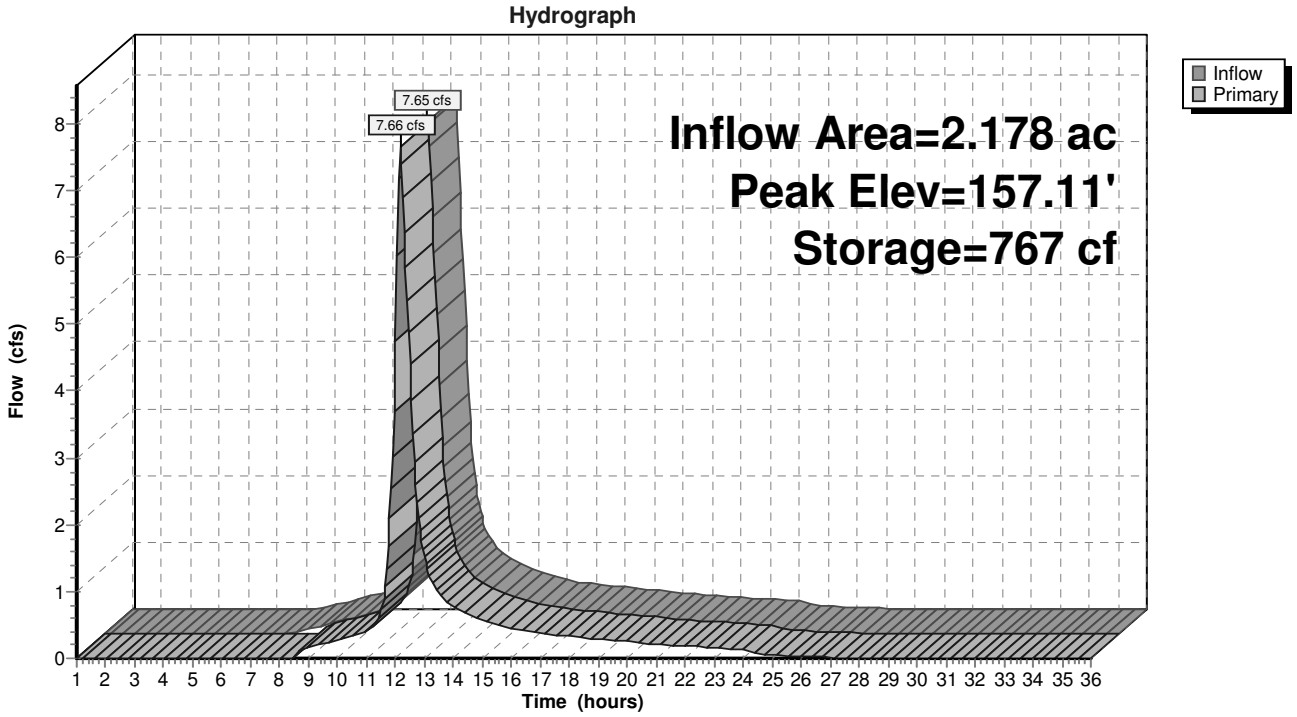
Volume	Invert	Avail.Storage	Storage Description
#1	156.00'	1,698 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
156.00	532	89.0	0	0	532
157.00	827	108.0	674	674	846
158.00	1,235	137.0	1,024	1,698	1,424

Device	Routing	Invert	Outlet Devices
#1	Primary	156.50'	**6.0' long x 3.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 Coef. (English) 2.44 2.58 2.68 2.67 2.65 2.64 2.64 2.68 2.68 2.72 2.81 2.92 2.97 3.07 3.32

Primary OutFlow Max=7.61 cfs @ 12.16 hrs HW=157.11' (Free Discharge)
1=Broad-Crested Rectangular Weir (Weir Controls 7.61 cfs @ 2.09 fps)

Pond 11P: Sediment Forebay



Summary for Pond 12P: Outlet Det Pond

Inflow Area = 2.178 ac, 44.11% Impervious, Inflow Depth > 4.86" for 100-YR event
Inflow = 7.66 cfs @ 12.16 hrs, Volume= 0.882 af
Outflow = 9.86 cfs @ 12.17 hrs, Volume= 0.796 af, Atten= 0%, Lag= 0.9 min
Primary = 9.86 cfs @ 12.17 hrs, Volume= 0.796 af
Routed to Link DP#2 : DP#2 - Rear Wetlands

Routing by Stor-Ind method, Time Span= 1.00-36.00 hrs, dt= 0.05 hrs / 2
Peak Elev= 156.22' @ 12.17 hrs Surf.Area= 5,184 sf Storage= 7,288 cf

Plug-Flow detention time= 88.4 min calculated for 0.796 af (90% of inflow)
Center-of-Mass det. time= 35.9 min (881.2 - 845.4)

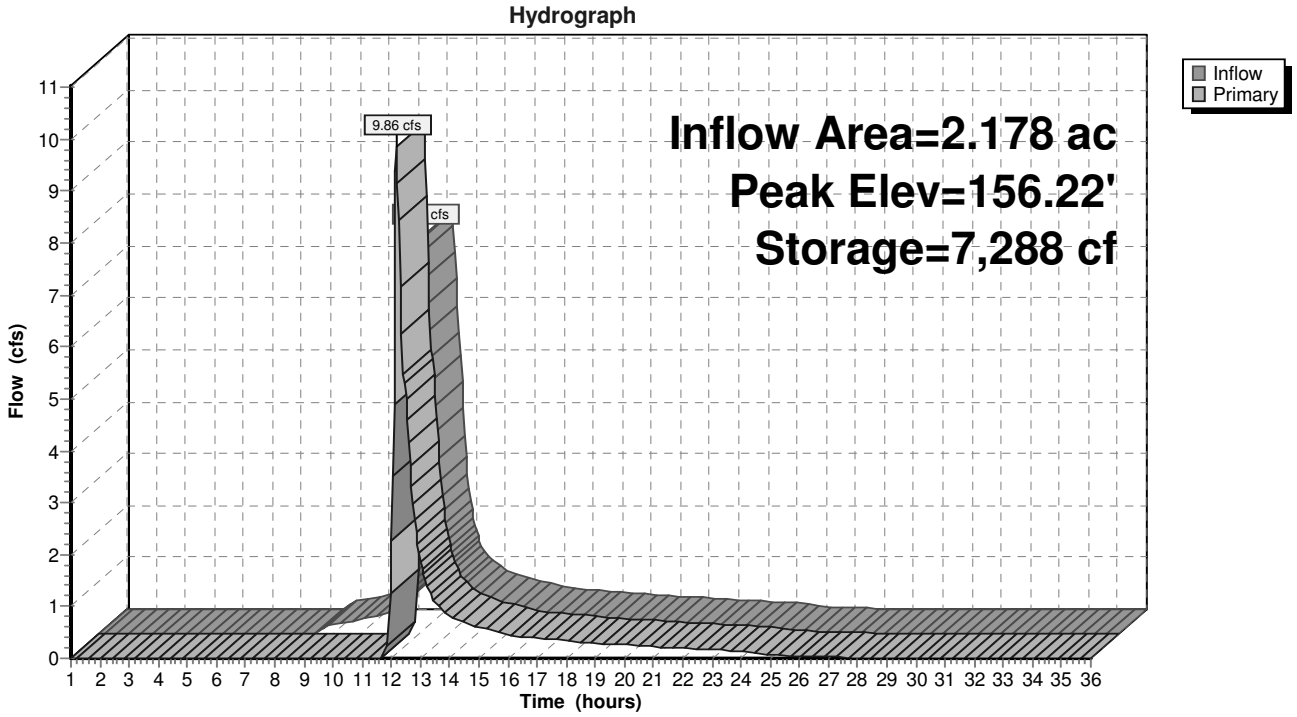
Volume	Invert	Avail.Storage	Storage Description
#1	154.00'	7,288 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
154.00	1,475	145.0	0	0	1,475
155.00	4,078	631.0	2,669	2,669	31,489
156.00	5,184	677.0	4,620	7,288	36,322

Device	Routing	Invert	Outlet Devices
#1	Primary	155.50'	**6.0' long x 6.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.37 2.51 2.70 2.68 2.68 2.67 2.65 2.65 2.65 2.65 2.66 2.66 2.67 2.69 2.72 2.76 2.83

Primary OutFlow Max=9.27 cfs @ 12.17 hrs HW=156.19' (Free Discharge)
↑—**1=Broad-Crested Rectangular Weir** (Weir Controls 9.27 cfs @ 2.24 fps)

Pond 12P: Outlet Det Pond



Summary for Link DP#2: DP#2 - Rear Wetlands

Inflow Area = 2.269 ac, 42.35% Impervious, Inflow Depth > 4.38" for 100-YR event
Inflow = 10.05 cfs @ 12.17 hrs, Volume= 0.828 af
Primary = 10.05 cfs @ 12.17 hrs, Volume= 0.828 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 1.00-36.00 hrs, dt= 0.05 hrs

Link DP#2: DP#2 - Rear Wetlands