

**PROJECT NARRATIVE
and
STORMWATER
MANAGEMENT
REPORT**

For

20 Goddard Drive Warehouse

**20 Goddard Drive
Cranston, Rhode Island
Assessor's Plat 13, Lot 39**

prepared for:

**Churchill & Banks, LLC
10 Greene Street
Providence, Rhode Island 02903**

prepared by:



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**May, 2022
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PN 7287-00



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I. PROJECT SUMMARY

Garofalo and Associates, Inc. has prepared this Project Narrative and Stormwater Management Report to outline drainage requirements for a proposed development at an existing industrial property along Goddard Drive, and outline the calculations and methodology used to design a proposed stormwater management system to comply with the current edition of the *RI Stormwater Design and Installations Standards Manual* (RISDISM).

The 16.84-acre property is contained within a single watershed and is situated at 20 Goddard Drive. The property is identified as the City of Cranston Tax Assessor’s Plat 13, Lot 39. Goddard Drive abuts the site to the west, Kenney Drive abuts the site to the east, and existing industrial properties abut the site to the north and south. Route 95 lies east of Kenney Drive, with the Pawtuxet River running between.

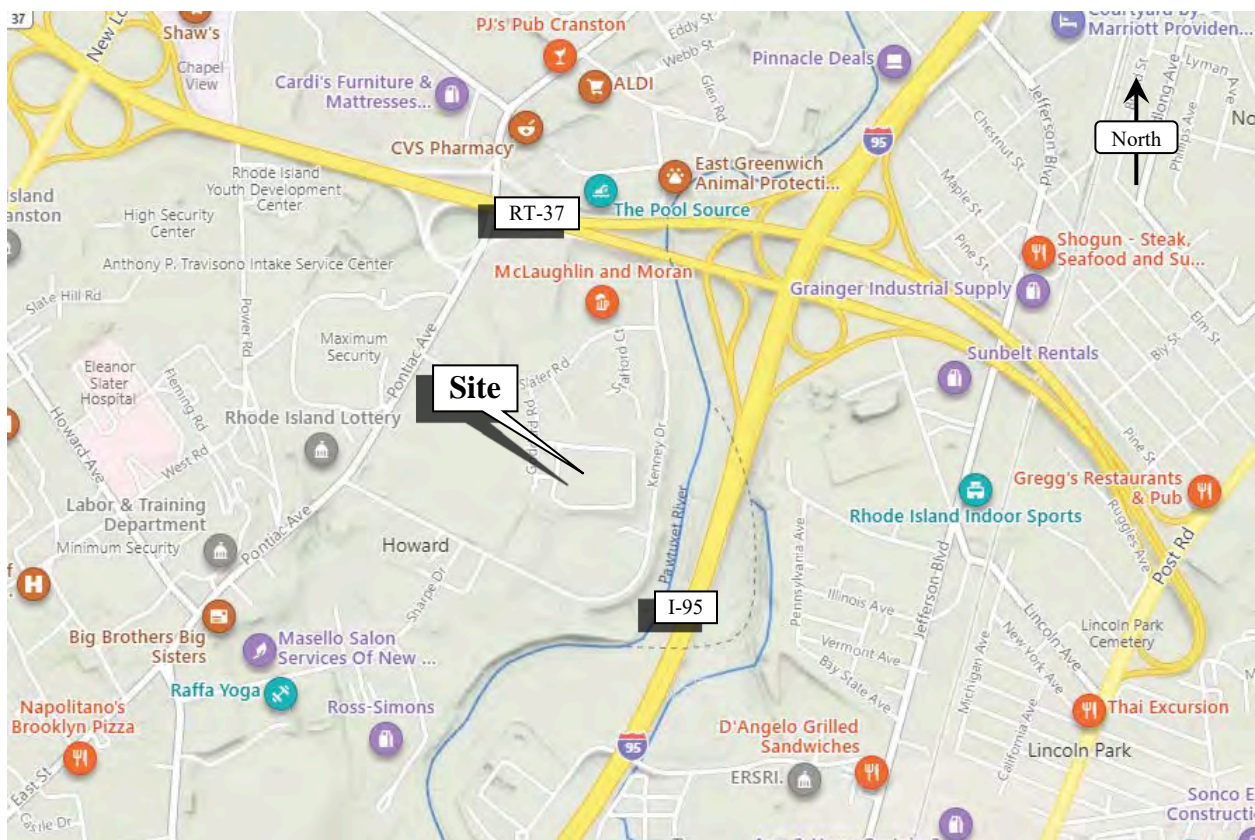


Figure 1. Locus Map

The proposed development primarily involves the construction of an industrial warehouse on the site of the (former) Department of Corrections Medium Security Facility. The warehouse will be located within the



same general footprint of the existing correctional facility, with parking fields located to the north and storage/loading areas to the south. The warehouse is estimated to have a 210,000 GSF footprint with loading and storage truck bays and 295 employee parking spaces. Access will continue to be provided through entrances along the eastern side of Goddard Drive.

Stormwater treatment and runoff control facilities are proposed on the eastern portions of the lot. The permanent stormwater management measures proposed will fully mitigate the impacts to stormwater runoff from the proposed project, and will comply with the City of Cranston Stormwater Ordinances and the Stormwater Management Standard and Performance Criteria of the RI Stormwater Design and Installation Standards Manual (RISDISM).

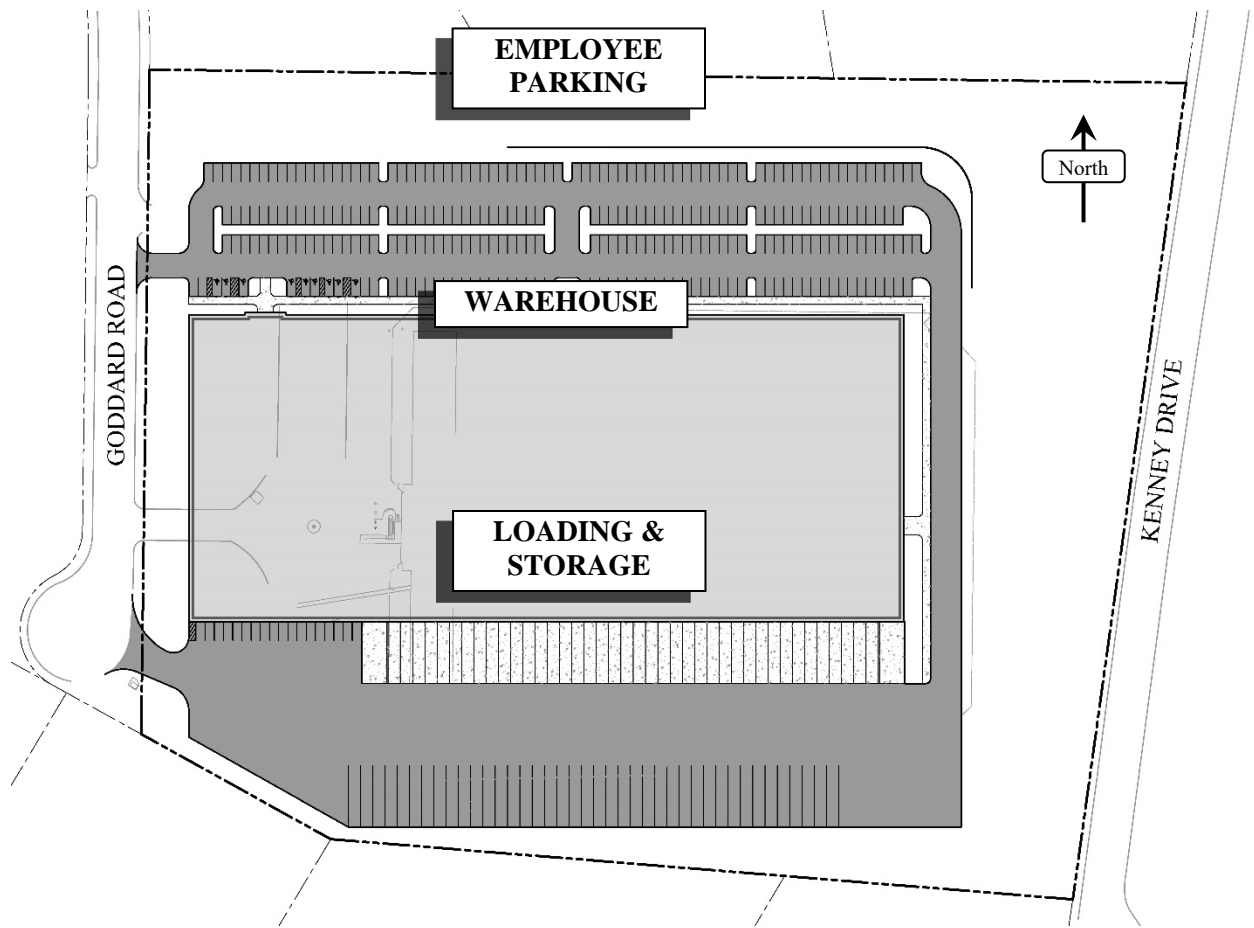


Figure 2. Development Schematic



I. SITE CONDITIONS

2.1 Site Characteristics

The site is located along the southern portion of Goddard Drive within an industrial district of Cranston, RI. The site is developed by the former Donald Price Correctional Facility, and includes approximately 4.17-acres of impervious cover throughout the developed areas. Approximately 5.84-acres of developed/altered grassed and wooded areas are also present within northern, eastern and southern site perimeters. These wooded areas generally slope steeply down and away from the existing patrol road that encompasses the correctional facility and exercise yard. These steep slopes reach as high as thirty-percent within northern and eastern site areas.



Figure 3. Aerial Image



2.2 Soils

The *Soil Survey of Rhode Island* prepared by the US Department of Agriculture, Soil Conservation Service depicts the underlying soils of the site to be well-draining and favorable for development. The site is almost entirely comprised of Udorthents-Urban land complex, with a small area of Pootatuck fine sandy loam within the northeastern corner of the property. The Hydrologic Soil Group classifications for Udorthents-Urban land complex and Pootatuck fine sandy loam are ‘A’ and ‘B’, respectively. Soil evaluations performed on-site are provided in Appendix E.

Map Unit Symbol	Map Unit Name	Hydrologic Soil Group
UD	Udorthents-Urban land complex	A
Pp	Pootatuck fine sandy loam	B

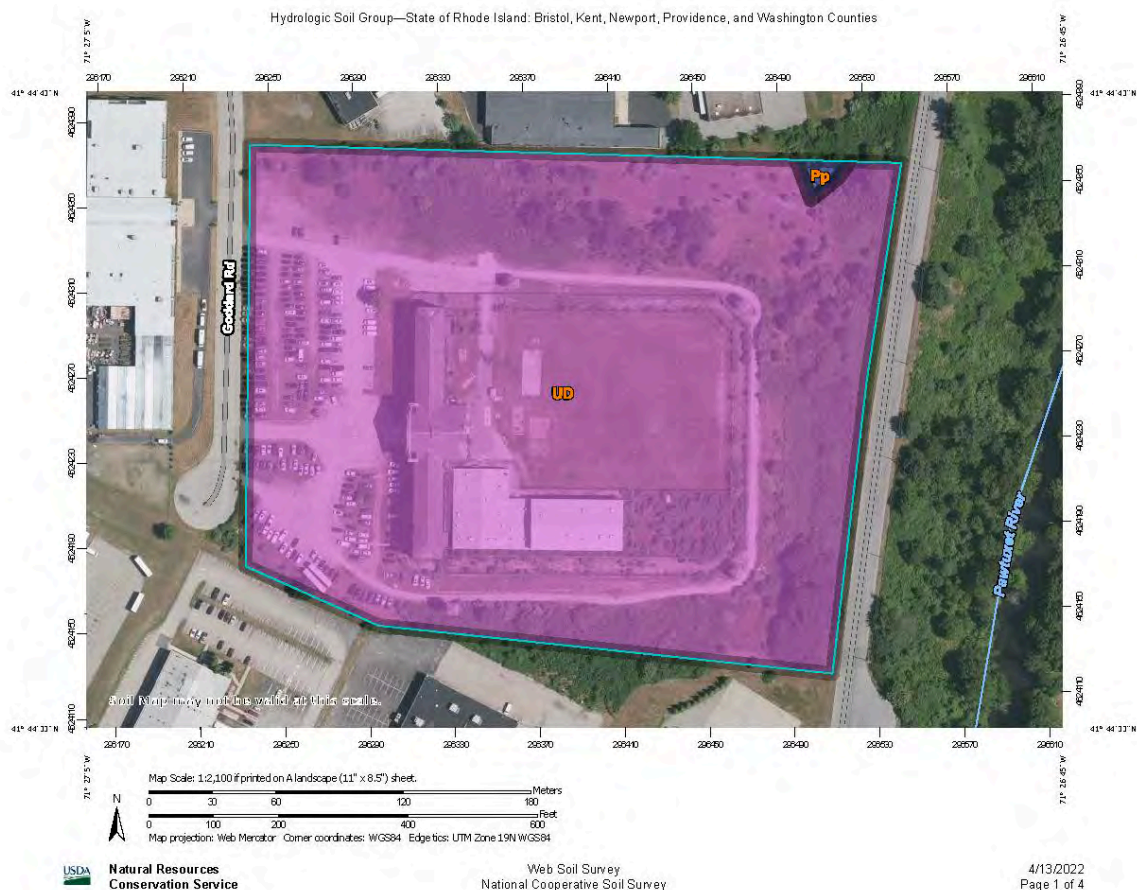


Figure 4. NRCS Soils Map



2.3 FEMA

The project area is located within Zone "X" (areas outside the 0.2% annual floodplain) as shown on F.E.M.A. Flood Insurance Rate Map for the City of Cranston, Providence County, Rhode Island, Community Panel No. 44007C0427H having an effective date of October 2, 2015.

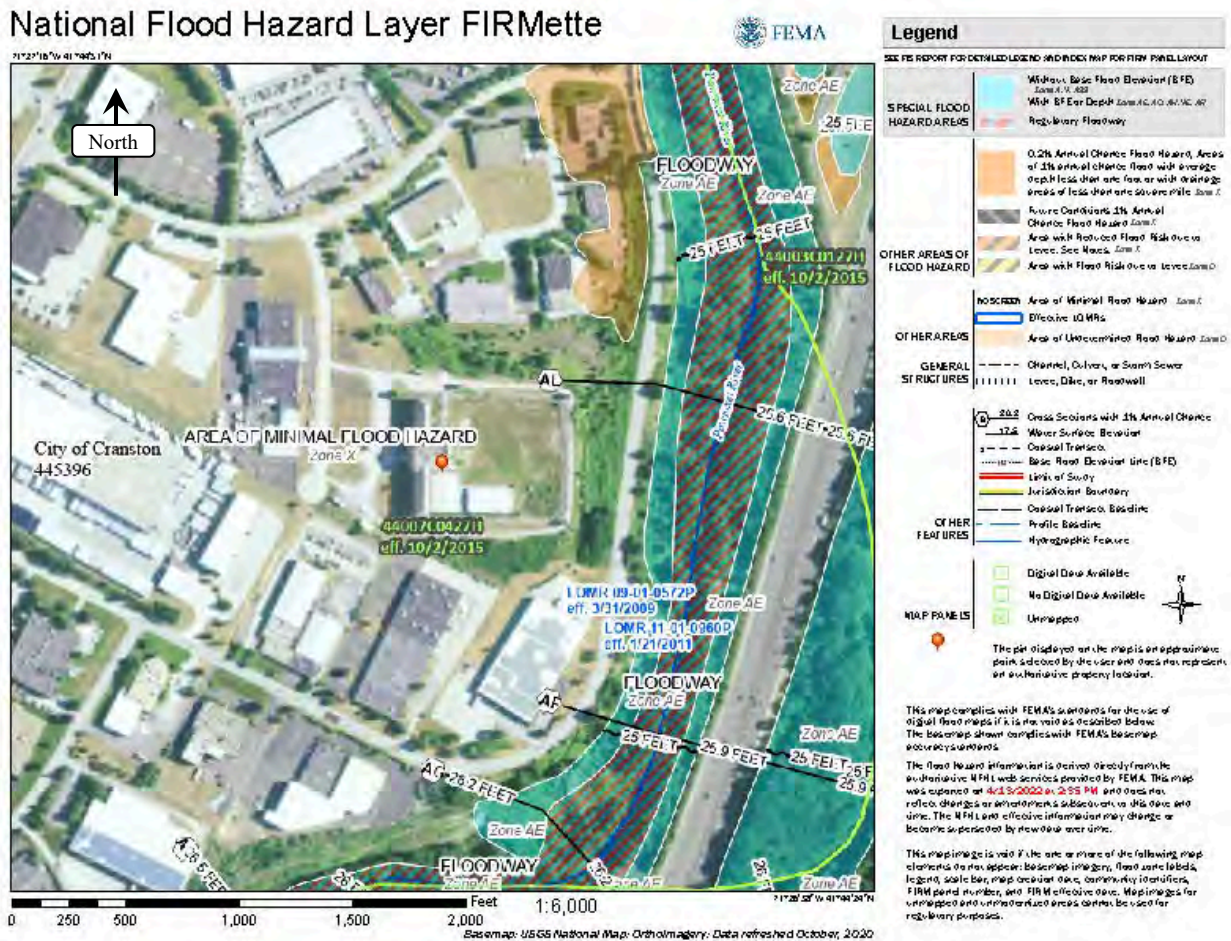


Figure 5. FEMA Flood Map

2.4 Natural Resource Inventory

The project site is not documented by the Rhode Island Natural Heritage Survey or the Rhode Island Department of Environmental Management (RIDEM) Geographic Information System (GIS) Mapping as being within a natural heritage area.



2.5 Wetland Resources

Wetland resource areas are not present within project limits. Forested wetland areas exist farther north of the site, but do not fall within jurisdictional limits.



III. DRAINAGE ANALYSIS

3.1 Methodology

The project's stormwater management system has been designed to mitigate the impacts of stormwater runoff generated by the proposed site and comply with the development standards and performance criteria of the City of Cranston and the RISDISM using low-impact development (LID) techniques and best management practices (BMP's). The runoff from the proposed development has been reviewed for impact using two design points. An existing forested drainage channel located immediately north of the property along the western side of Kenney Drive has been selected as the first design point. The closed drainage system within Goddard Drive serves as the second design point. A comparative pre-development vs. post-development hydrologic analysis was performed for the 1-, 10-, and 100-year storm events utilizing HydroCAD software.

3.2 Existing Conditions

The existing conditions analysis for the project includes two (2) sub-watershed areas to account for all stormwater flow generated by the existing site.

EWS-1: This existing sub-watershed includes the majority of the correctional facility rooftop, the exercise yard and surrounding access roadway, southern parking field and all wooded areas to the north, east and south. This sub-watershed is 22-percent impervious. Stormwater generally flows north and east across the site over initially mild grades, until reaching very steeply sloped wooded areas surrounding the exercise yard. Stormwater flows are then conveyed into a moderately well-defined forested drainage channel running north along the western side of Kenney Drive, which continues north of the property to serve industrial developments to the north. This channel eventually discharges to the Pawtuxet River Main Stem through a 42" concrete culvert beneath Kenney Drive.

EWS-2: This existing sub-watershed area includes the remainder of the property, and includes the central and northern parking fields, western lawn areas and a portion of the correctional facility rooftop. This area is approximately 46-percent impervious. Stormwater generally flows west over mild grades into Goddard Drive where it is collected by a closed drainage system within the roadway.



3.3 Proposed Conditions

The project will maintain existing drainage patterns while addressing the requirements of the RISDISM. Specifically, the developed site will address water quality treatment and peak flow attenuation by directing stormwater flow into a series of surface BMPs. The proposed site conditions have been analyzed using five (5) sub-watersheds for a complete accounting of stormwater flow leaving the proposed development.

PWS-1: This sub-watershed includes the proposed warehouse rooftop, northern parking field area and access roadway along the eastern side of the warehouse. This sub-watershed contains approximately 68-percent impervious surface coverage under proposed conditions. The proposed closed drainage system within the northern parking fields and access roadway along with the warehouse roof drain system will collect and convey stormwater in an easterly direction until discharging into a proposed infiltration/detention system (BMP-2).

PWS-1L: This proposed sub-watershed area includes the proposed loading and storage (LUHPPL) areas to the south of the proposed warehouse. This area is 100-percent impervious. Stormwater flows over mild grades within these paved areas and is collected within a closed drainage system, ultimately discharging water quality flows offline to an impermeably lined surface sand filter (BMP-1). Larger flows are bypassed through a flow-splitter structure and directed toward BMP-2.

PWS-B1: This sub-watershed generally includes grassed and wooded areas along the northern portion of the property, and does not contain impervious surface coverage. Stormwater is conveyed over steep grades in a northern and eastern direction over this subwatershed, ultimately reaching Design Point 1 as it does under existing conditions.

PWS-B2: This sub-watershed generally includes grassed and wooded areas south of the proposed loading and storage areas, and does not contain impervious surface coverage. Stormwater is conveyed over steep grades in a south and westerly direction over this subwatershed, ultimately reaching Design Point 1 as it does under existing conditions.

PWS-2: This sub-watershed includes a small area immediately west of the proposed warehouse, and does not contain impervious surface coverage. Stormwater from this area sheet flows west over mild grades and into the Goddard Drive closed drainage system.



3.4 Runoff Summary

The following is a comparison summary of the peak discharge rates and total discharge volumes for the existing and proposed site. Runoff rates from the property toward the existing infiltration facility (Design Point 1), and Goddard Drive (Design Point 2), have been reduced during the 1-, 10- and 100-year storm events. See *Appendix A Checklist: Table 5-1 'Hydraulic Analysis Summary'* (Appendix D).

		Peak Discharge Rate (cfs)		
		1 yr	10 yr	100 yr
Design Point 1				
	Existing Runoff	0.18	7.49	36.83
	Proposed Runoff	0.00	2.42	33.10
	ΔQ	-0.18	-5.07	-3.73
		Total Discharge Volume (ac-ft)		
		1 yr	10 yr	100 yr
Design Point 1				
	Existing Runoff	0.109	1.015	3.782
	Proposed Runoff	0.000	0.986	4.637
	ΔQ	-0.109	-0.029	+0.855

		Peak Discharge Rate (cfs)		
		1 yr	10 yr	100 yr
Design Point 2				
	Existing Runoff	0.80	3.23	8.37
	Proposed Runoff	0.00	0.01	0.38
	ΔQ	-0.80	-3.22	-7.99
		Total Discharge Volume (ac-ft)		
		1 yr	10 yr	100 yr
Design Point 2				
	Existing Runoff	0.094	0.323	0.822
	Proposed Runoff	0.000	0.005	0.038
	ΔQ	-0.094	-0.318	-0.784

Table 1. Watershed Runoff Summary

3.5 Water Quality

The design proposes an impermeably lined surface sand filter along with an infiltration/detention basin (BMP-1 and BMP-2) to meet the water quality treatment requirements of the development standard.



Loading and storage facilities south of the warehouse that are classified as LUHPPL areas are directed to the lined surface sand filter (BMP-1). A flow splitter structure ensures that the water quality volume from these LUHPPL areas is directed off-line to BMP-1, while bypassing flows from larger storm events toward the infiltration/detention facility (BMP-2). BMP-2 has been designed to receive all additional stormwater flow generated by the remaining areas of the development, which include the warehouse roof, northern parking field and access roadway immediately east of the warehouse.

Further, the proposed infiltration/detention basin (BMP-2) provides the required pollutant removal capabilities necessary to address the impairments of The Pawtuxet River Main Stem, which is documented on the 303(d) list as being impaired for Mercury in Fish Tissue, Non-Native Aquatic Plants, Lead and Enterococcus.

See Appendix C for HydroCAD analysis and Appendix E for the RIDEM Water Quality Volume Calculation Worksheet and BMP Sizing Spreadsheet.

3.6 Pre-treatment

Pre-treatment for the lined surface sand filter is provided within a sediment forebay (BMP-1A).

<u>Proposed Subwatershed</u>	<u>Pre-Treatment Required</u>	<u>Pre-Treatment Provided</u>
PWS-1L	2,995 CF	3,361 CF

Pre-treatment for the surface infiltration/detention basin is provided within a sediment forebay (BMP-2A).

<u>Proposed Subwatershed</u>	<u>Pre-Treatment Required</u>	<u>Pre-Treatment Provided</u>
PWS-1	6,534 CF	7,889 CF



IV. STORMWATER STANDARDS:

The proposed development has been designed to meet all of the minimum standards identified in the RISDISM through utilization of filtration and infiltration/detention practices with maintenance planning.

4.1 Standard 1: LID Planning and Design Strategies

LID site planning and design strategies must be used to the maximum extent practicable.

Standard Met – LID site planning and strategies have been employed to the maximum extent possible.

4.2 Standard 2: Groundwater Recharge

Stormwater must be recharged within the same sub-watershed to maintain base flow at pre-development recharge levels to the maximum extent practicable.

Standard Met – Recharge will be provided on-site through the proposed infiltration/detention system (BMP-2). The project has a soil recharge factor of 0.60 (Hydrologic Soil Group ‘A’)

Design Point 1

Total Impervious Site Coverage:	457,380 SF
Required Recharge Volume:	$(457,380 \text{ SF} \times 0.60 / 12 \text{ in./ft}) = 22,869 \text{ CF}$
Provided Recharge Volume (BMP-1)	0 CF (Lined for LUHHPL)
Provided Recharge Volume (BMP-2)	<u>27,925 CF +</u>
TOTAL	27,925 CF > 22,869 CF

4.3 Standard 3: Water Quality

Stormwater runoff must be treated prior to discharge.

Standard Met – Water quality treatment will be provided on-site through a surface sand filter and a surface infiltration/detention basin (BMP-1 and BMP-2).

Design Point 1

Total Impervious Site Coverage:	457,380 SF
Required Water Quality Treatment Volume:	$(457,380 \text{ SF} / 12 \text{ in./ft}) = 38,115 \text{ CF}$



Provided Water Quality Treatment Volume (BMP-1)	13,463 CF
Provided Water Quality Treatment Volume (BMP-2)	<u>27,925 CF</u> +
TOTAL	41,388 CF > 38,115 CF

(See Appendix C for water quality storage volumes provided within BMP-1 and BMP-2, and Appendix E for *RIDEM Water Quality Volume Calculation Worksheet*)

4.4 Standard 4: Conveyance and Natural Channel Protection

This standard is designed to prevent erosive flow within natural channels and drainage ways.

Standard Met – This standard has been met for sub-watersheds PWS-1L and PWS-1 by capturing 65-percent of the total runoff volume for the 1-year, Type III storm event and releasing it over a 24-hour period. CP_v is not required for PWS-2, PWS-B1 or PWS-B2 as their runoff rates during the 1-year Type III storm event do not exceed 2 cfs. Below is a summary of the required CP_v, provided CP_v, and CP_v orifice sizing at the proposed outlet control structure located within BMP-2. Note that the discharge orifice has been sized to release the difference in CP_v and WQ.

1-Year Type III storm inflow to BMP-2 = 0.910 ac-ft (39,640 ft³)

Required CP_v = (0.65) (39,640 ft³) = 25, 766 ft³

Difference between provided CP_v and WQ_v = 6,644 ft³

Desired CP_v runoff rate = 6,644 ft³ / (24 hours) (3,600 sec/hour) = 0.08 cfs

Average Head difference (h_{avg}) between CP_v and WQ_v = 0.075 ft

$$Q = (C)(A)(2f \cdot h_{avg})^{1/2}$$

$$0.08 \text{ cfs} = (0.62)(A)[(2)(32.2 \text{ ft/s}^2)(0.075)]^{1/2}$$

$$A = 0.06 \text{ ft}^2$$

$$A = \pi D^2/4$$

$$0.06 \text{ ft}^2 = \pi D^2/4$$

$$D = 0.28 \text{ ft} = 3.36 \text{ in (use 3.5-inch diameter orifice)}$$

4.5 Standard 5: Overbank Flood Protection

Downstream overbank flood protection must be provided by attenuating the post-development peak discharge rate to the pre-development levels for the 10-year and 100-year, Type III design storm events



Standard Met – Post-development peak discharge rates have been mitigated within the proposed surface infiltration/detention basin (BMP-2) and brought below pre-development levels during the 10-year and 100-year Type III storm events (see Table-1 Watershed Runoff Summary).

Downstream Analysis

An existing drainage channel will convey stormwater discharges from the property under proposed conditions to the north along the western side of Kenney Drive (as it does under existing conditions). This channel then discharges through an existing 42” concrete culvert beneath Kenney Drive to the Pawtuxet River Main Stem, which is classified by RIDEM as a 5th-order stream (meeting the downstream analysis exemption criteria for discharge to a large river). This 42” culvert was designed to accommodate the developed industrial park and was inspected on May 26, 2022 and observed to be in excellent condition without any significant deficiencies noted. As noted above, discharges from the proposed development have been mitigated below existing rates during the 10-year and 100-year Type III storm events and the outfall was designed to accommodate the industrial park buildout. The proposed area of disturbance and impervious cover percentage meet the criteria for a downstream analysis (RISDISM Table 3-7). However, after consideration is given to the design conditions of downstream reaches, peak flow attenuation provided by the project, and discharge to a 5th-order stream classification water body (Pawtuxet River Main Stem), further evaluation of the downstream reach is not thought to be warranted for the project.

4.6 Standard 6: Redevelopment and Infill Projects

For redevelopment sites with 40% or more existing impervious surface coverage and infill sites, only Standards 2, 3, and 7-11 must be addressed.

Standard Not Met – Total existing impervious surface coverage is < 40% of the total site size.

(See Appendix E)

4.7 Standard 7: Pollution Prevention

All development sites require the use of source control and pollution prevention measures to minimize the impact that the land use may have on stormwater runoff quality.

Standard Met – A Soil Erosion and Sediment Control (SESC) Plan has been prepared for the project and stormwater measures are proposed that comply with the Standard.



4.8 Standard 8: Land Uses with Higher Potential Pollutant Loads

Stormwater discharges from land uses with higher potential pollutant loads (LUHPPLs) require the use of specific source control and pollution prevention measures and the specific stormwater BMPs approved for such use.

Standard Met – Loading and storage areas south of the proposed warehouse meet the criteria for land uses with higher potential pollutant loads (LUHPPLs). A closed drainage system is proposed to collect stormwater within these areas and convey flows offline to an impermeably lined sand filter (BMP-1) for water quality treatment. This system is an acceptable BMP for use at LUHPPLs (RISDISM Table 3-3) and does not infiltrate to groundwater, and therefore meets the recharge prohibition requirement of the LUHPPL standard.

4.9 Standard 9: Illicit Discharges

All illicit discharges to stormwater management systems are prohibited, including discharges from OWTS, sub-drains and French drains near any OWTS that does not meet the State’s OWTS Rules.

Standard Met – There are no known illicit discharges at the site and none are proposed as part of this project.

4.10 Standard 10: Construction and Erosion Sedimentation Control

Erosion and sedimentation control practices must be utilized during the construction phase as well as during any land disturbing activities

Standard Met - Soil Erosion and Sediment Control Practices will be employed to avoid and minimize impacts to the existing stormwater systems. Detailed notes are included in the plans as well as within an Erosion and Sediment Control Report to ensure effective implementation of erosion and sedimentation controls.

4.11 Standard 11: Stormwater Management System Operation and Maintenance

The stormwater management system, including all structural stormwater controls and conveyances, must have an operation and maintenance plan to ensure that it continues to function as designed.

Standard Met - A long-term Stormwater Operation and Maintenance Plan has been prepared for the development in accordance with the Manual, and is provided as a separate document.



V. CONCLUSION

This project has been designed to mitigate the water quality impacts and runoff control from the proposed development. Water quality treatment for all proposed development areas is provided in accordance with the development standards of the *State of Rhode Island Stormwater Design and Installation Standards Manual*. Water quality treatment for loading and storage areas classified as LUHPPLs is provided within an impermeably lined sand filter (BMP-1) selected from the acceptable LUHPPL BMP list. Additionally, the proposed infiltration/detention basin (BMP-2) provides the required pollutant removal capabilities necessary to address the impairments of The Pawtuxet River Main Stem. Best Management Practices will be employed to control temporary discharges associated with construction activities in accordance with the standards outlined in the *Rhode Island Soil and Erosion Sediment Control Handbook*.

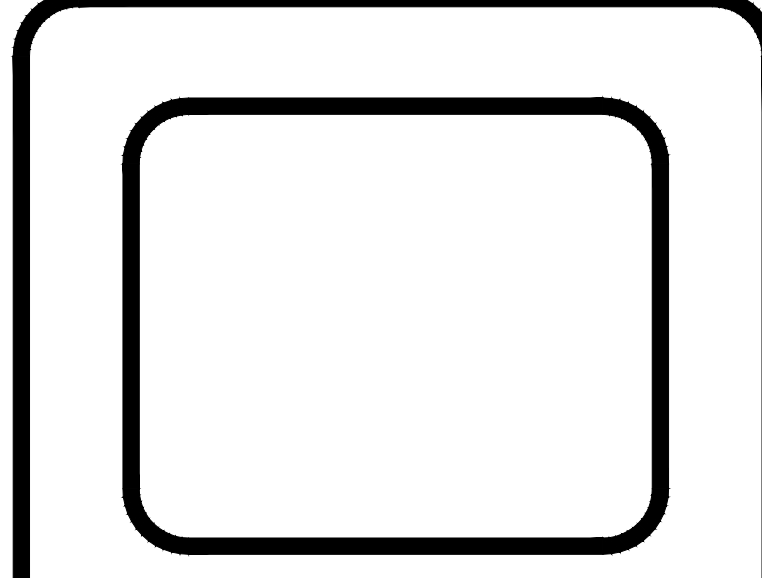


Appendix A
Watershed Maps



EXISTING WATERSHED MAP
 FOR
 A.P. 13, LOT 39
 SITUATED ON
 20 GODDARD ROAD
 CRANSTON, RHODE ISLAND
 PREPARED FOR
 CHURCHILL & BANKS LLC

NO.	REVISION	BY	DATE



GAROFALO
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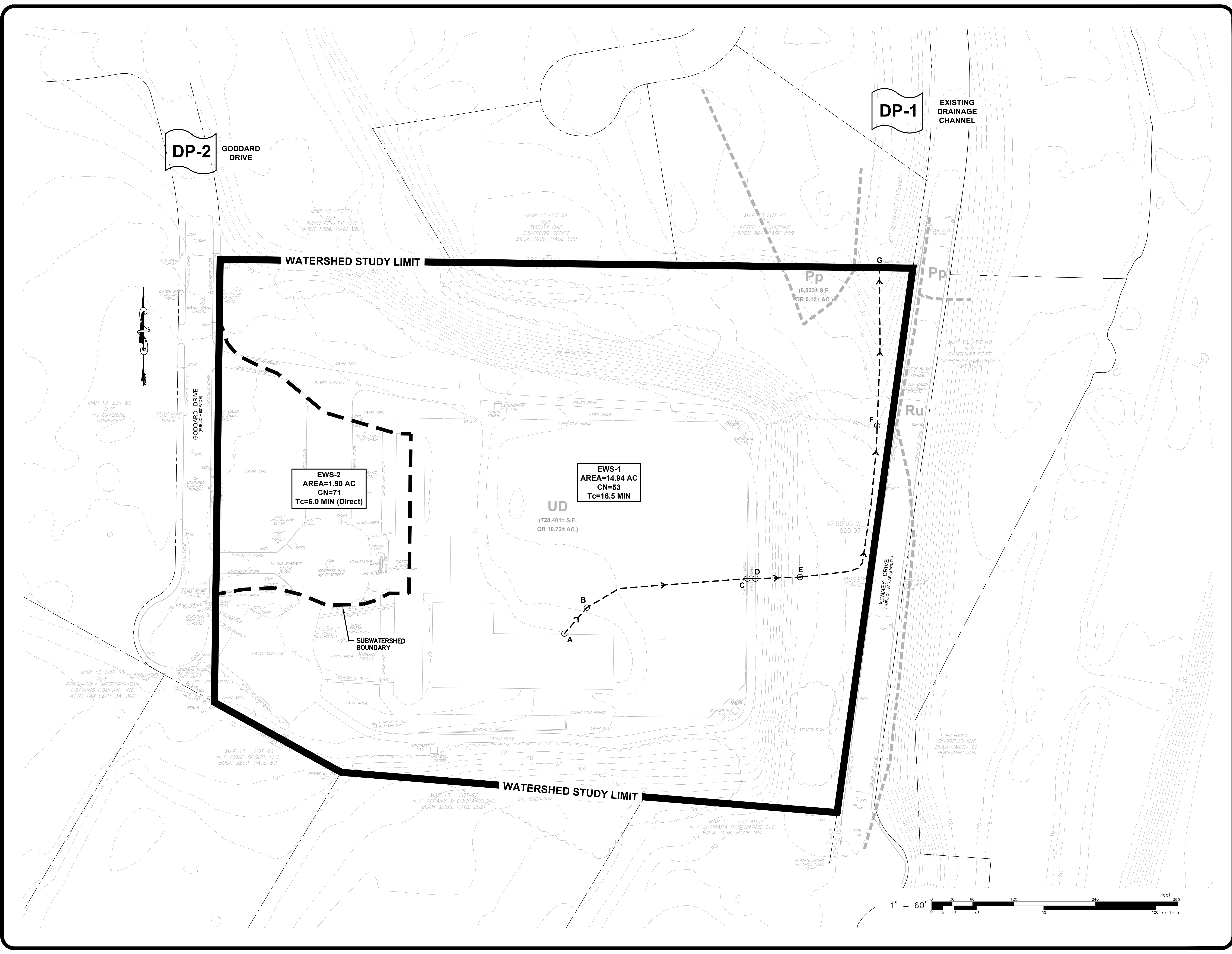
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DWG. NO. 7287-00-EWS.dwg	CHECK BY SSH
SCALE: 1"=60'	APPROVED SBG
	DATE: APRIL, 2022

SHEET

EWS

1 OF 2 SHEETS



DP-2
GODDARD DRIVE

DP-1
EXISTING DRAINAGE CHANNEL

PWS-B1
AREA=1.92 AC
CN=37
Tc=11.3 MIN

PWS-1
AREA=10.62 AC
CN=79
Tc=6.0 MIN
(Direct)

PWS-2
AREA=0.31 AC
CN=39
Tc=6.0 MIN (Direct)

PWS-1L
AREA=3.30 AC
CN=98
Tc=6.0 MIN
(Direct)

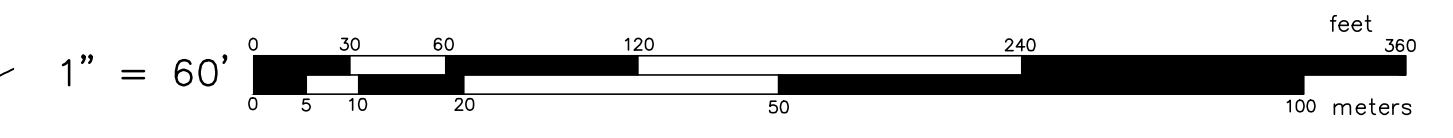
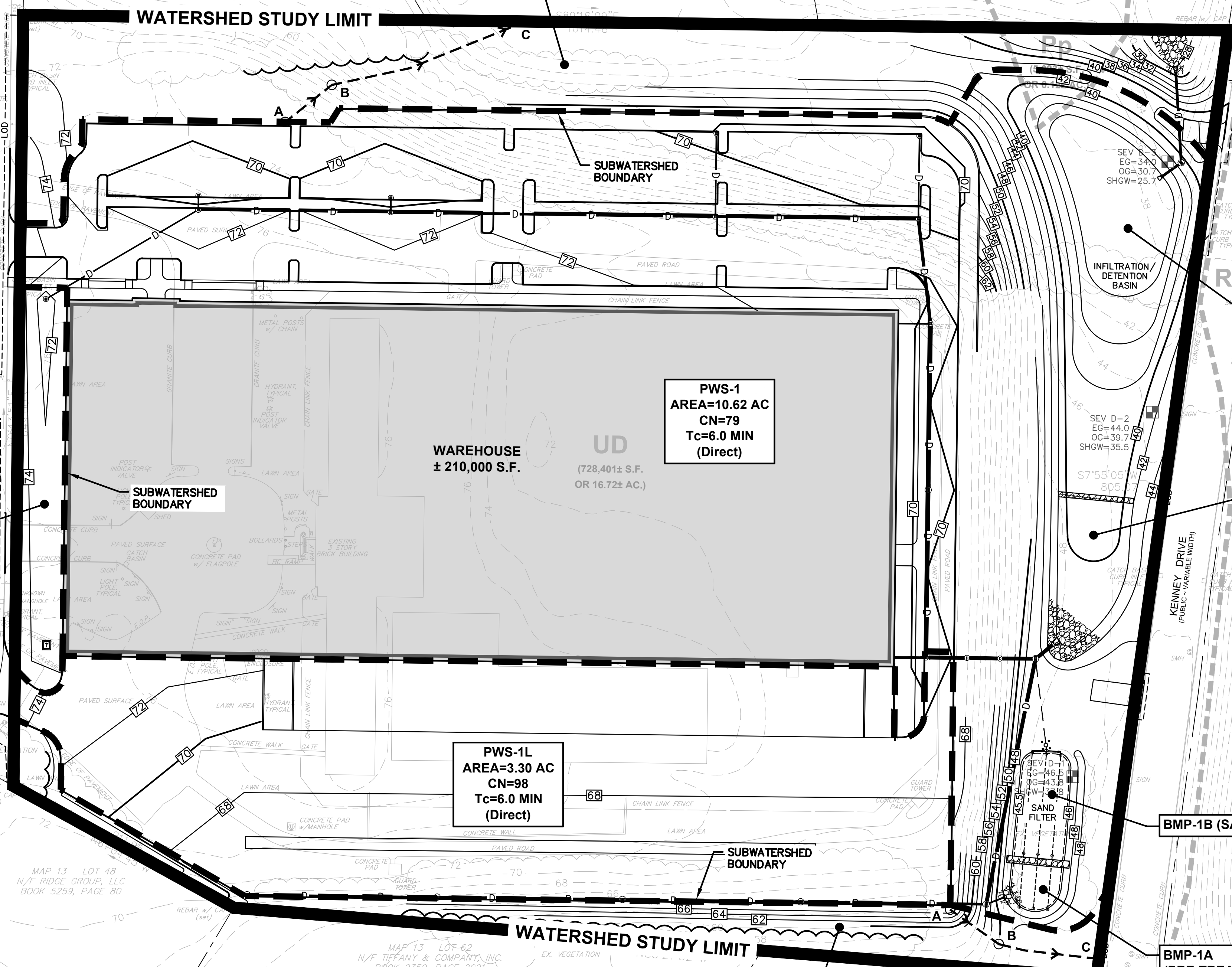
PWS-B2
AREA=0.69 AC
CN=33
Tc=9.1 MIN

BMP-2B
(INFILTRATION / DETENTION BASIN)

BMP-2A
(PRE-TREATMENT FOREBAY)

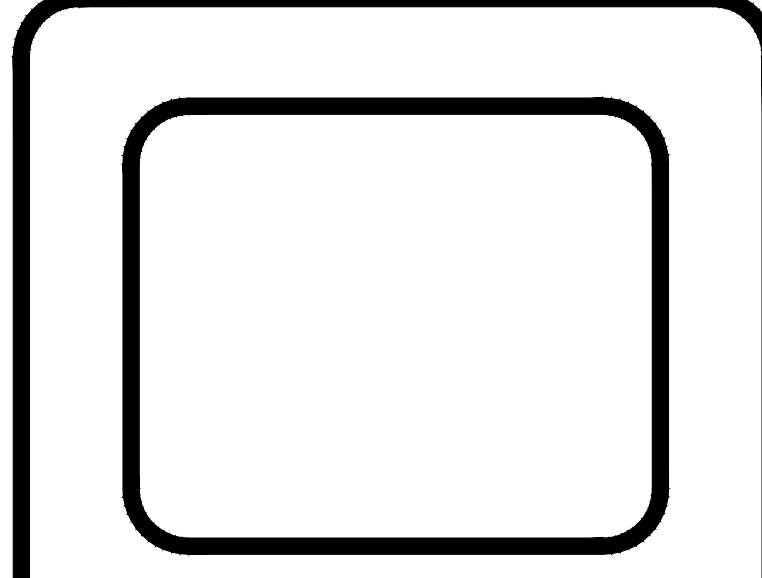
BMP-1B (SAND FILTER)

BMP-1A
(PRE-TREATMENT FOREBAY)



PROPOSED WATERSHED MAP
FOR
A.P. 13, LOT 39
SITUATED ON
20 GODDARD ROAD
CRANSTON, RHODE ISLAND
PREPARED FOR
CHURCHILL & BANKS LLC

NO.	REVISION	BY	DATE



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JOB NO. 7287-00	DRAWN BY RAS
DWG. NO. 7287-00-PWS.dwg	CHECK BY SSH
SCALE: 1"=60'	APPROVED SBG
	DATE: APRIL, 2022

SHEET
PWS
2 OF 2 SHEETS

Appendix B
Stormwater Analysis
Existing Conditions





14.94 AC



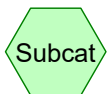
1.90 AC



Existing Drainage Channel



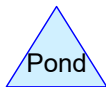
Goddard Drive



Subcat



Reach



Pond



Link

Routing Diagram for 7287-00 HydroCAD Analysis
Prepared by {enter your company name here}, Printed 5/27/2022
HydroCAD® 10.10-7a s/n 05506 © 2021 HydroCAD Software Solutions LLC

7287-00 HydroCAD Analysis

Type III 24-hr 1.2-Inch Rainfall=1.20"

Prepared by {enter your company name here}

Printed 5/27/2022

HydroCAD® 10.10-7a s/n 05506 © 2021 HydroCAD Software Solutions LLC

Page 2

Summary for Subcatchment EWS-1: 14.94 AC

Runoff = 2.65 cfs @ 12.22 hrs, Volume= 0.271 af, Depth= 0.22"

Routed to Link EX-DP-1 : Existing Drainage Channel

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 1.2-Inch Rainfall=1.20"

Area (ac)	CN	Description
2.370	98	Paved parking, HSG A
0.930	98	Roofs, HSG A
5.970	49	50-75% Grass cover, Fair, HSG A
2.500	30	Woods, Good, HSG A
0.120	48	Brush, Good, HSG B
3.050	30	Brush, Good, HSG A
14.940	53	Weighted Average
11.640	40	77.91% Pervious Area
3.300	98	22.09% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.2	50	0.0400	0.20		Sheet Flow, A-B Grass: Short n= 0.150 P2= 3.30"
4.6	243	0.0160	0.89		Shallow Concentrated Flow, B-C Short Grass Pasture Kv= 7.0 fps
0.1	12	0.0160	2.57		Shallow Concentrated Flow, C-D Paved Kv= 20.3 fps
0.4	65	0.3080	2.77		Shallow Concentrated Flow, D-E Woodland Kv= 5.0 fps
5.5	299	0.0330	0.91		Shallow Concentrated Flow, E-F Woodland Kv= 5.0 fps
1.7	232	0.0600	2.31	407.41	Channel Flow, F-G Area= 176.0 sf Perim= 485.0' r= 0.36' n= 0.080 Earth, long dense weeds
16.5	901	Total			

7287-00 HydroCAD Analysis

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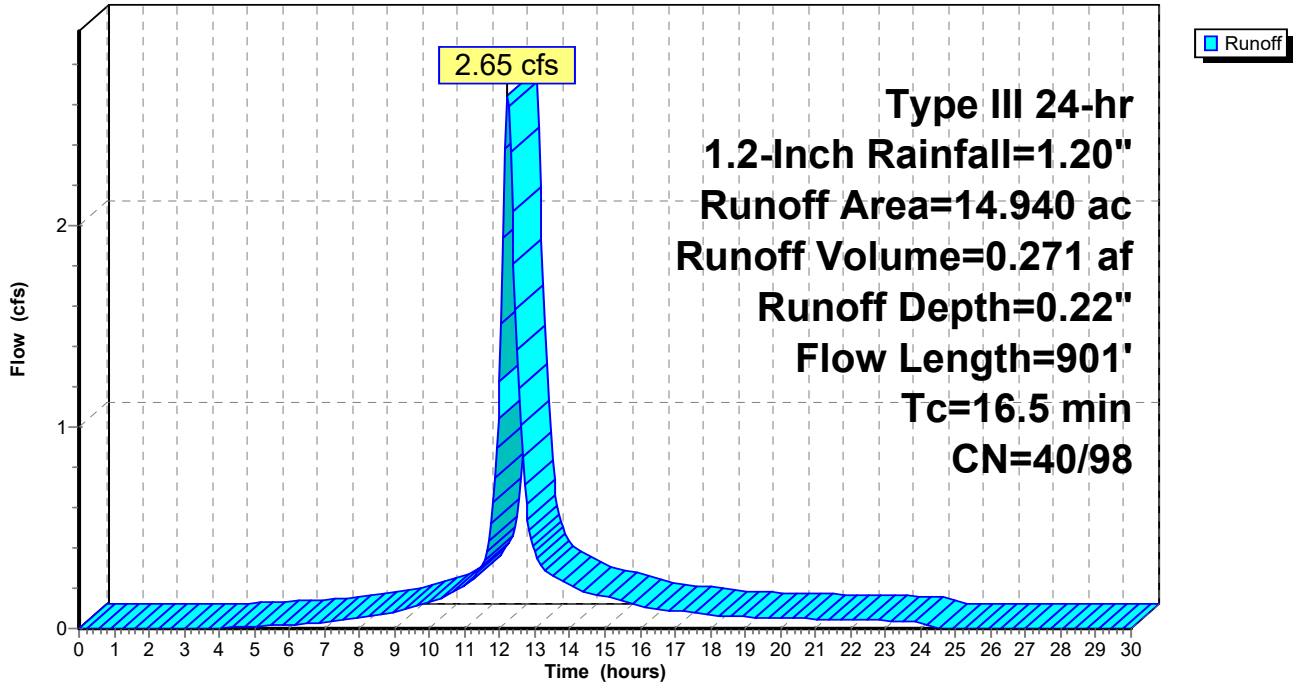
Type III 24-hr 1.2-Inch Rainfall=1.20"

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Page 3

Subcatchment EWS-1: 14.94 AC

Hydrograph



7287-00 HydroCAD Analysis

Type III 24-hr 1.2-Inch Rainfall=1.20"

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Summary for Subcatchment EWS-2: 1.90 AC

Runoff = 0.70 cfs @ 12.22 hrs, Volume= 0.071 af, Depth= 0.45"
 Routed to Link EX-DP-2 : Goddard Drive

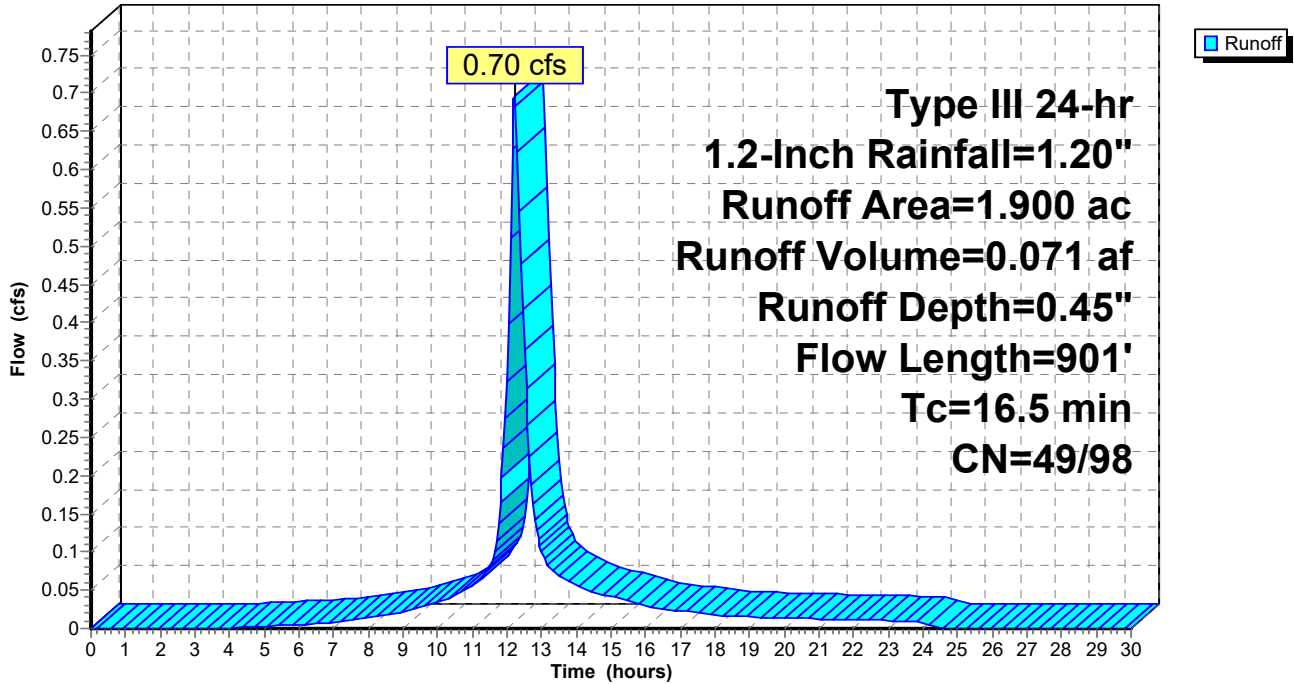
Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
 Type III 24-hr 1.2-Inch Rainfall=1.20"

Area (ac)	CN	Description
0.740	98	Paved parking, HSG A
0.130	98	Roofs, HSG A
1.030	49	50-75% Grass cover, Fair, HSG A
1.900	71	Weighted Average
1.030	49	54.21% Pervious Area
0.870	98	45.79% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.2	50	0.0400	0.20		Sheet Flow, A-B Grass: Short n= 0.150 P2= 3.30"
4.6	243	0.0160	0.89		Shallow Concentrated Flow, B-C Short Grass Pasture Kv= 7.0 fps
0.1	12	0.0160	2.57		Shallow Concentrated Flow, C-D Paved Kv= 20.3 fps
0.4	65	0.3080	2.77		Shallow Concentrated Flow, D-E Woodland Kv= 5.0 fps
5.5	299	0.0330	0.91		Shallow Concentrated Flow, E-F Woodland Kv= 5.0 fps
1.7	232	0.0600	2.31	407.41	Channel Flow, F-G Area= 176.0 sf Perim= 485.0' r= 0.36' n= 0.080 Earth, long dense weeds
16.5	901	Total			

Subcatchment EWS-2: 1.90 AC

Hydrograph

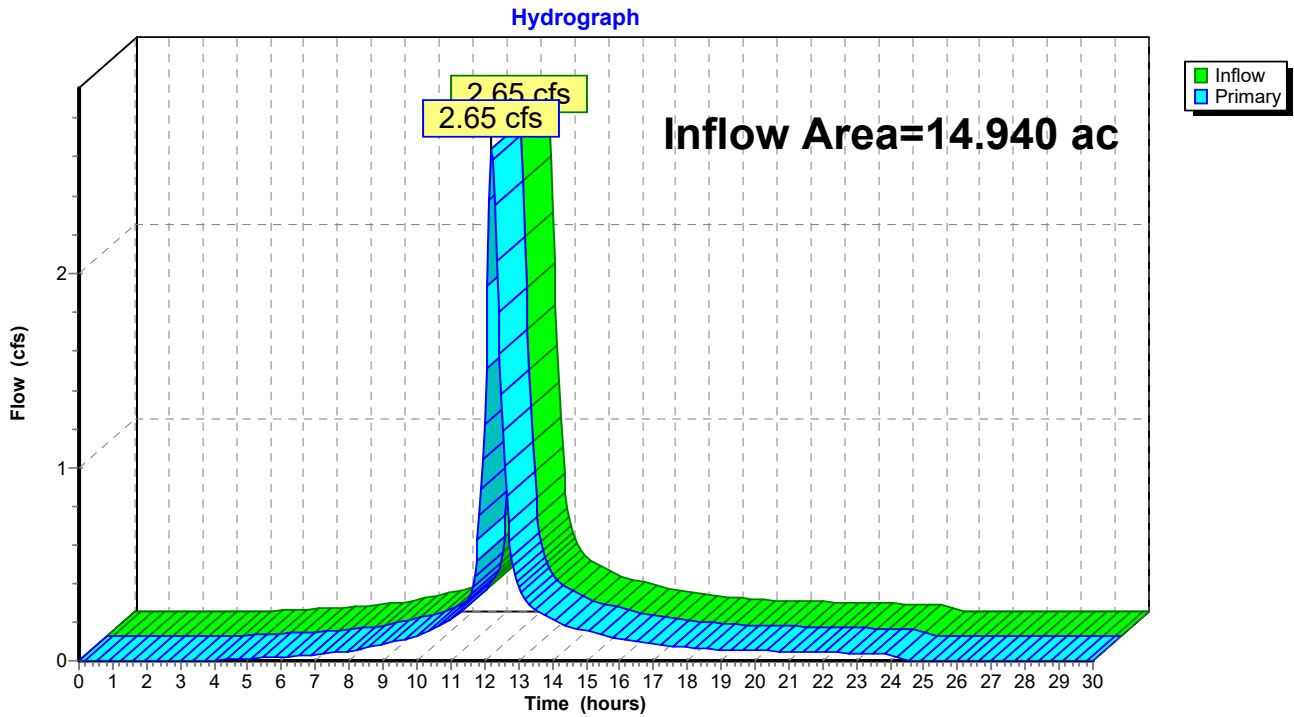


Summary for Link EX-DP-1: Existing Drainage Channel

Inflow Area = 14.940 ac, 22.09% Impervious, Inflow Depth = 0.22" for 1.2-Inch event
Inflow = 2.65 cfs @ 12.22 hrs, Volume= 0.271 af
Primary = 2.65 cfs @ 12.22 hrs, Volume= 0.271 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs

Link EX-DP-1: Existing Drainage Channel

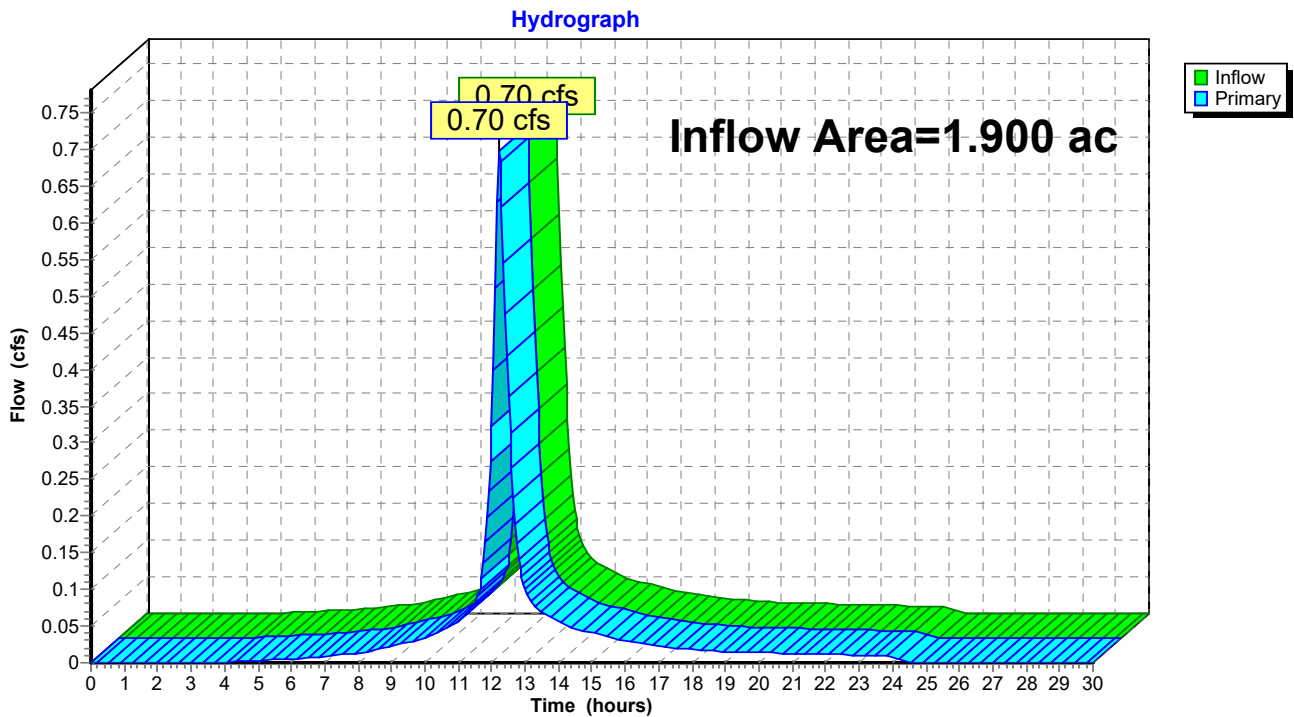


Summary for Link EX-DP-2: Goddard Drive

Inflow Area = 1.900 ac, 45.79% Impervious, Inflow Depth = 0.45" for 1.2-Inch event
Inflow = 0.70 cfs @ 12.22 hrs, Volume= 0.071 af
Primary = 0.70 cfs @ 12.22 hrs, Volume= 0.071 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs

Link EX-DP-2: Goddard Drive





14.94 AC



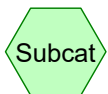
1.90 AC



Existing Drainage Channel



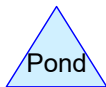
Goddard Drive



Subcat



Reach



Pond



Link

Routing Diagram for 7287-00 HydroCAD Analysis
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7287-00 HydroCAD Analysis

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Page 2

Rainfall Events Listing (selected events)

Event#	Event Name	Storm Type	Curve	Mode	Duration (hours)	B/B	Depth (inches)	AMC
1	1-Year	Type III 24-hr		Default	24.00	1	2.70	2
2	10-Year	Type III 24-hr		Default	24.00	1	4.90	2
3	100-Year	Type III 24-hr		Default	24.00	1	8.70	2

7287-00 HydroCAD Analysis

Type III 24-hr 1-Year Rainfall=2.70"

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Page 3

Summary for Subcatchment EWS-1: 14.94 AC

Runoff = 0.18 cfs @ 13.88 hrs, Volume= 0.109 af, Depth= 0.09"

Routed to Link EX-DP-1 : Existing Drainage Channel

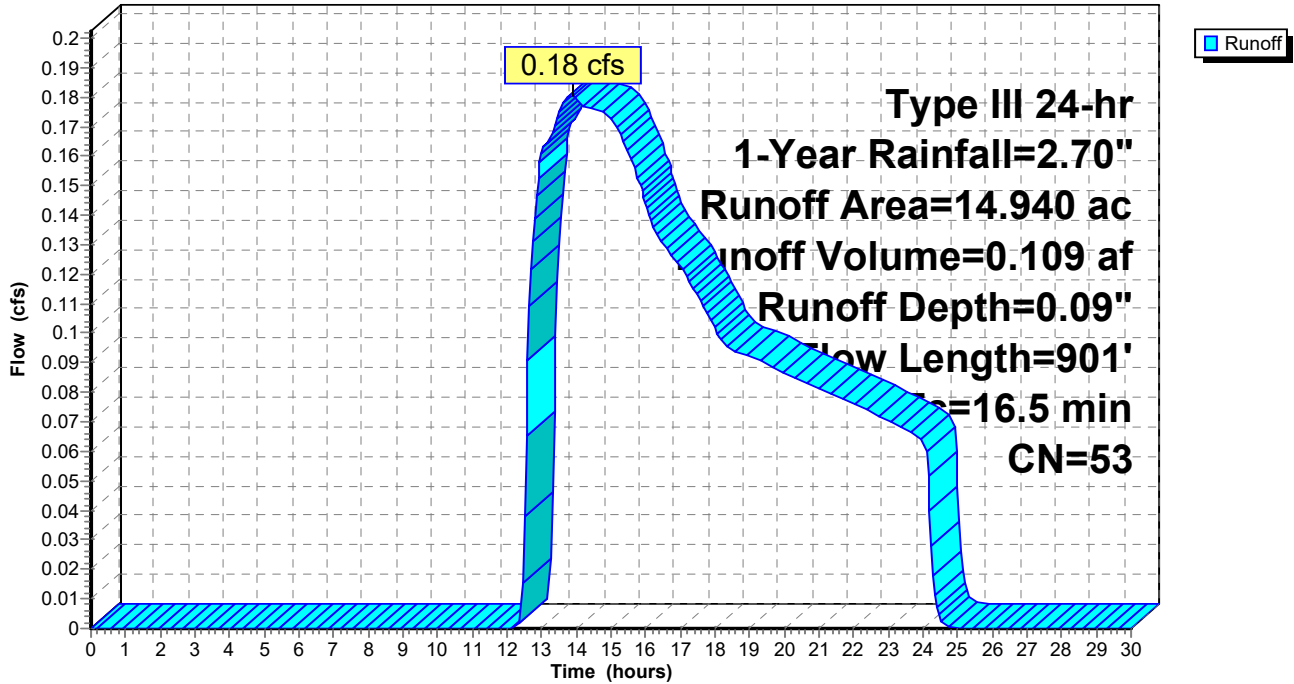
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 1-Year Rainfall=2.70"

Area (ac)	CN	Description
2.370	98	Paved parking, HSG A
0.930	98	Roofs, HSG A
5.970	49	50-75% Grass cover, Fair, HSG A
2.500	30	Woods, Good, HSG A
0.120	48	Brush, Good, HSG B
3.050	30	Brush, Good, HSG A
14.940	53	Weighted Average
11.640	40	77.91% Pervious Area
3.300	98	22.09% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.2	50	0.0400	0.20		Sheet Flow, A-B Grass: Short n= 0.150 P2= 3.30"
4.6	243	0.0160	0.89		Shallow Concentrated Flow, B-C Short Grass Pasture Kv= 7.0 fps
0.1	12	0.0160	2.57		Shallow Concentrated Flow, C-D Paved Kv= 20.3 fps
0.4	65	0.3080	2.77		Shallow Concentrated Flow, D-E Woodland Kv= 5.0 fps
5.5	299	0.0330	0.91		Shallow Concentrated Flow, E-F Woodland Kv= 5.0 fps
1.7	232	0.0600	2.31	407.41	Channel Flow, F-G Area= 176.0 sf Perim= 485.0' r= 0.36' n= 0.080 Earth, long dense weeds
16.5	901	Total			

Subcatchment EWS-1: 14.94 AC

Hydrograph



7287-00 HydroCAD Analysis

Type III 24-hr 1-Year Rainfall=2.70"

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Summary for Subcatchment EWS-2: 1.90 AC

Runoff = 0.80 cfs @ 12.27 hrs, Volume= 0.094 af, Depth= 0.59"
 Routed to Link EX-DP-2 : Goddard Drive

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
 Type III 24-hr 1-Year Rainfall=2.70"

Area (ac)	CN	Description
0.740	98	Paved parking, HSG A
0.130	98	Roofs, HSG A
1.030	49	50-75% Grass cover, Fair, HSG A
1.900	71	Weighted Average
1.030	49	54.21% Pervious Area
0.870	98	45.79% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.2	50	0.0400	0.20		Sheet Flow, A-B Grass: Short n= 0.150 P2= 3.30"
4.6	243	0.0160	0.89		Shallow Concentrated Flow, B-C Short Grass Pasture Kv= 7.0 fps
0.1	12	0.0160	2.57		Shallow Concentrated Flow, C-D Paved Kv= 20.3 fps
0.4	65	0.3080	2.77		Shallow Concentrated Flow, D-E Woodland Kv= 5.0 fps
5.5	299	0.0330	0.91		Shallow Concentrated Flow, E-F Woodland Kv= 5.0 fps
1.7	232	0.0600	2.31	407.41	Channel Flow, F-G Area= 176.0 sf Perim= 485.0' r= 0.36' n= 0.080 Earth, long dense weeds
16.5	901	Total			

7287-00 HydroCAD Analysis

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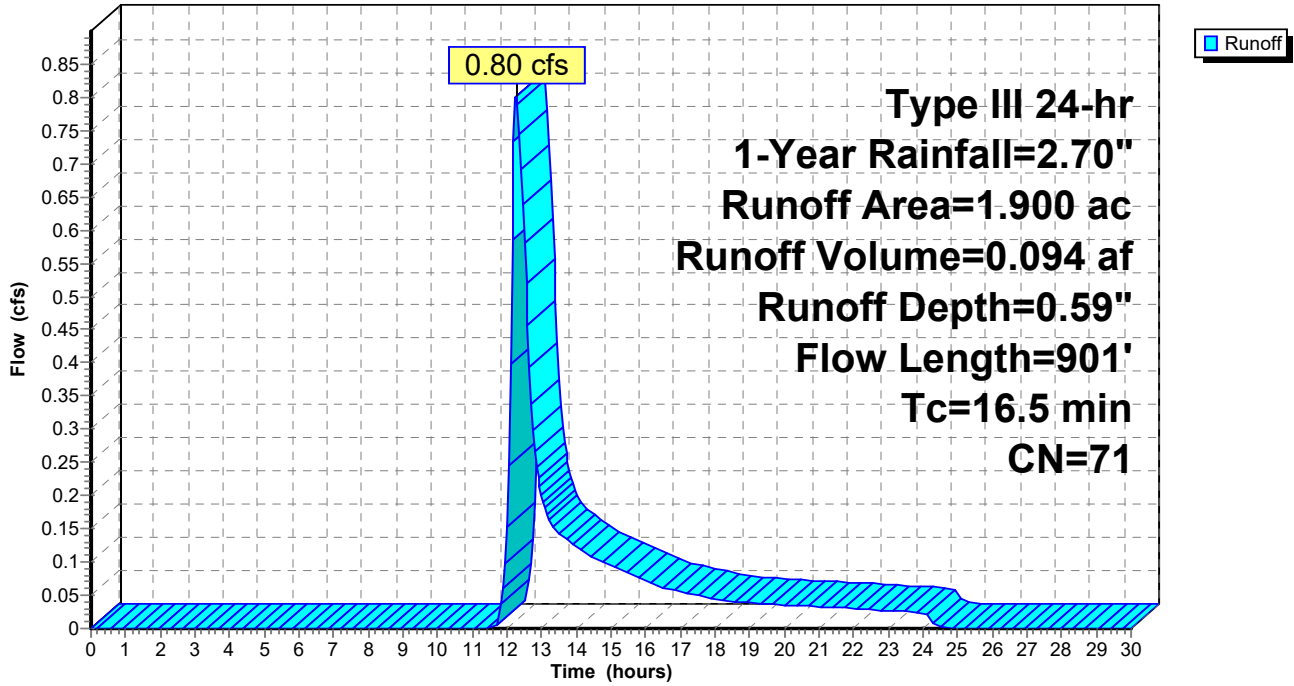
Type III 24-hr 1-Year Rainfall=2.70"

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Subcatchment EWS-2: 1.90 AC

Hydrograph

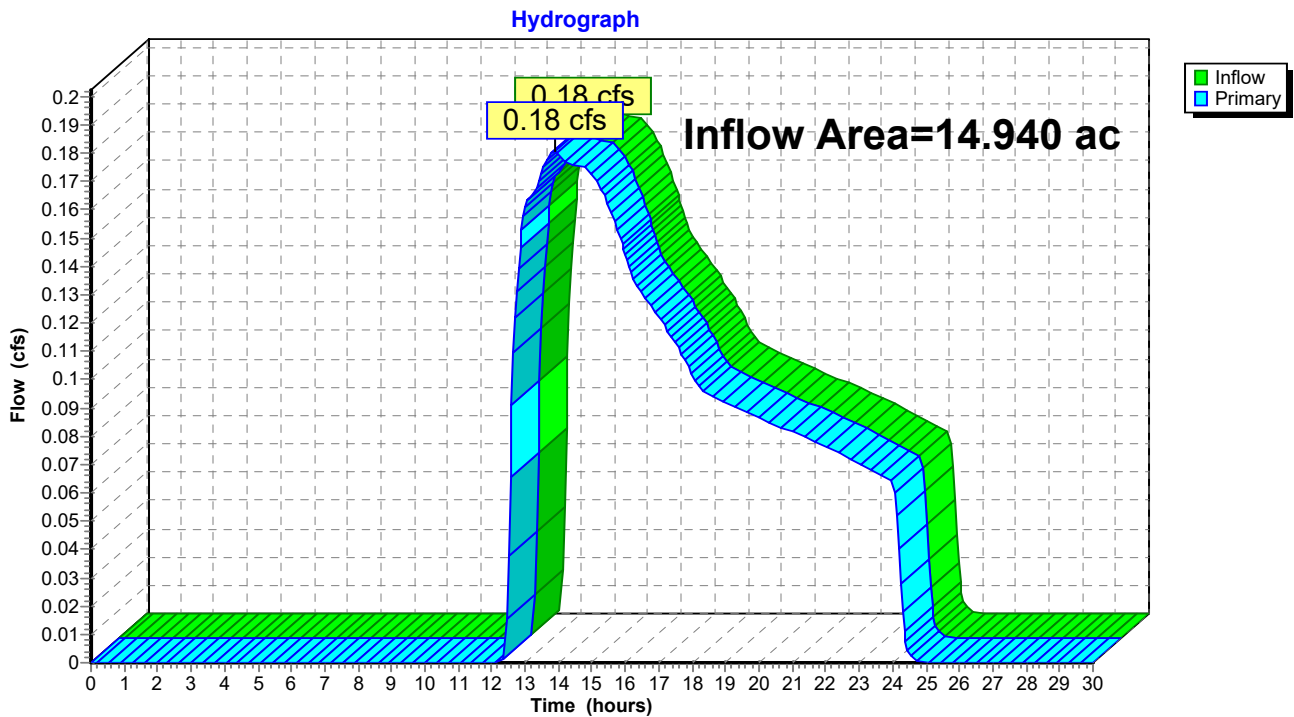


Summary for Link EX-DP-1: Existing Drainage Channel

Inflow Area = 14.940 ac, 22.09% Impervious, Inflow Depth = 0.09" for 1-Year event
Inflow = 0.18 cfs @ 13.88 hrs, Volume= 0.109 af
Primary = 0.18 cfs @ 13.88 hrs, Volume= 0.109 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs

Link EX-DP-1: Existing Drainage Channel



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Type III 24-hr 1-Year Rainfall=2.70"

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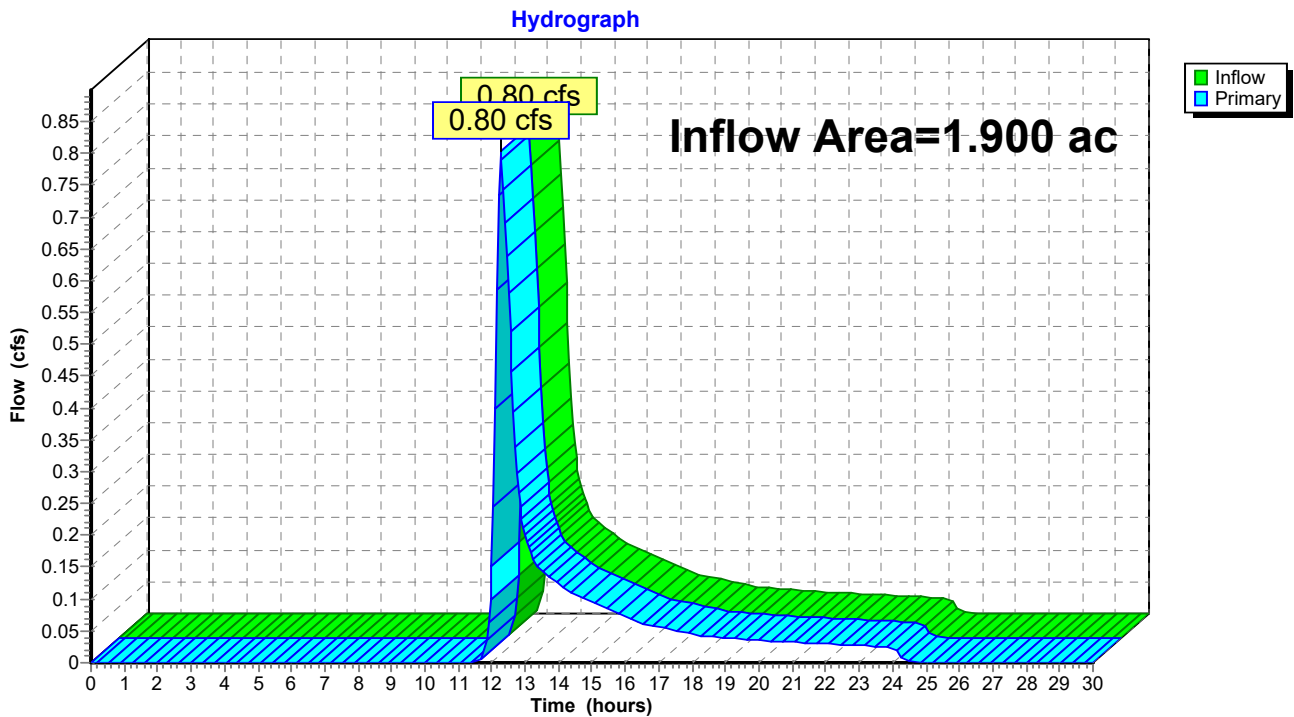
Page 8

Summary for Link EX-DP-2: Goddard Drive

Inflow Area = 1.900 ac, 45.79% Impervious, Inflow Depth = 0.59" for 1-Year event
Inflow = 0.80 cfs @ 12.27 hrs, Volume= 0.094 af
Primary = 0.80 cfs @ 12.27 hrs, Volume= 0.094 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs

Link EX-DP-2: Goddard Drive



7287-00 HydroCAD Analysis

Type III 24-hr 10-Year Rainfall=4.90"

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Summary for Subcatchment EWS-1: 14.94 AC

Runoff = 7.49 cfs @ 12.30 hrs, Volume= 1.015 af, Depth= 0.81"

Routed to Link EX-DP-1 : Existing Drainage Channel

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.90"

Area (ac)	CN	Description
2.370	98	Paved parking, HSG A
0.930	98	Roofs, HSG A
5.970	49	50-75% Grass cover, Fair, HSG A
2.500	30	Woods, Good, HSG A
0.120	48	Brush, Good, HSG B
3.050	30	Brush, Good, HSG A
14.940	53	Weighted Average
11.640	40	77.91% Pervious Area
3.300	98	22.09% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.2	50	0.0400	0.20		Sheet Flow, A-B Grass: Short n= 0.150 P2= 3.30"
4.6	243	0.0160	0.89		Shallow Concentrated Flow, B-C Short Grass Pasture Kv= 7.0 fps
0.1	12	0.0160	2.57		Shallow Concentrated Flow, C-D Paved Kv= 20.3 fps
0.4	65	0.3080	2.77		Shallow Concentrated Flow, D-E Woodland Kv= 5.0 fps
5.5	299	0.0330	0.91		Shallow Concentrated Flow, E-F Woodland Kv= 5.0 fps
1.7	232	0.0600	2.31	407.41	Channel Flow, F-G Area= 176.0 sf Perim= 485.0' r= 0.36' n= 0.080 Earth, long dense weeds
16.5	901	Total			

7287-00 HydroCAD Analysis

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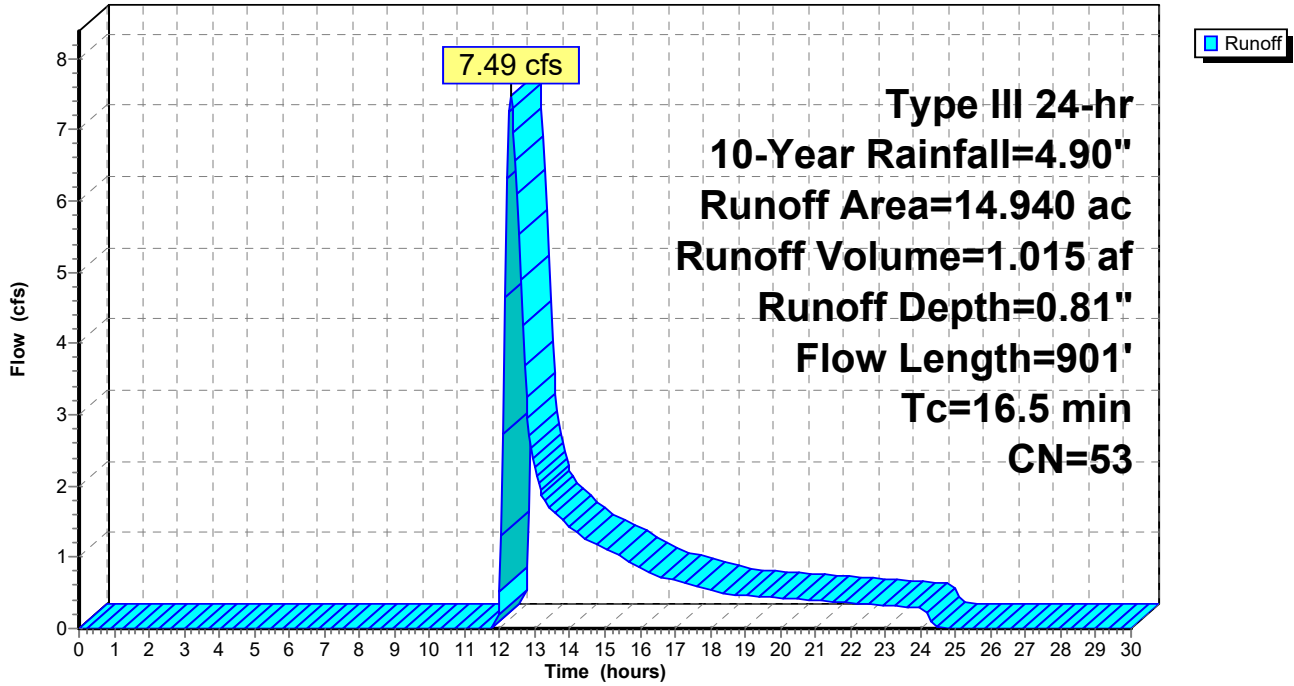
Type III 24-hr 10-Year Rainfall=4.90"

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Subcatchment EWS-1: 14.94 AC

Hydrograph



7287-00 HydroCAD Analysis

Type III 24-hr 10-Year Rainfall=4.90"

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Summary for Subcatchment EWS-2: 1.90 AC

Runoff = 3.23 cfs @ 12.24 hrs, Volume= 0.323 af, Depth= 2.04"
 Routed to Link EX-DP-2 : Goddard Drive

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
 Type III 24-hr 10-Year Rainfall=4.90"

Area (ac)	CN	Description
0.740	98	Paved parking, HSG A
0.130	98	Roofs, HSG A
1.030	49	50-75% Grass cover, Fair, HSG A
1.900	71	Weighted Average
1.030	49	54.21% Pervious Area
0.870	98	45.79% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.2	50	0.0400	0.20		Sheet Flow, A-B Grass: Short n= 0.150 P2= 3.30"
4.6	243	0.0160	0.89		Shallow Concentrated Flow, B-C Short Grass Pasture Kv= 7.0 fps
0.1	12	0.0160	2.57		Shallow Concentrated Flow, C-D Paved Kv= 20.3 fps
0.4	65	0.3080	2.77		Shallow Concentrated Flow, D-E Woodland Kv= 5.0 fps
5.5	299	0.0330	0.91		Shallow Concentrated Flow, E-F Woodland Kv= 5.0 fps
1.7	232	0.0600	2.31	407.41	Channel Flow, F-G Area= 176.0 sf Perim= 485.0' r= 0.36' n= 0.080 Earth, long dense weeds
16.5	901	Total			

7287-00 HydroCAD Analysis

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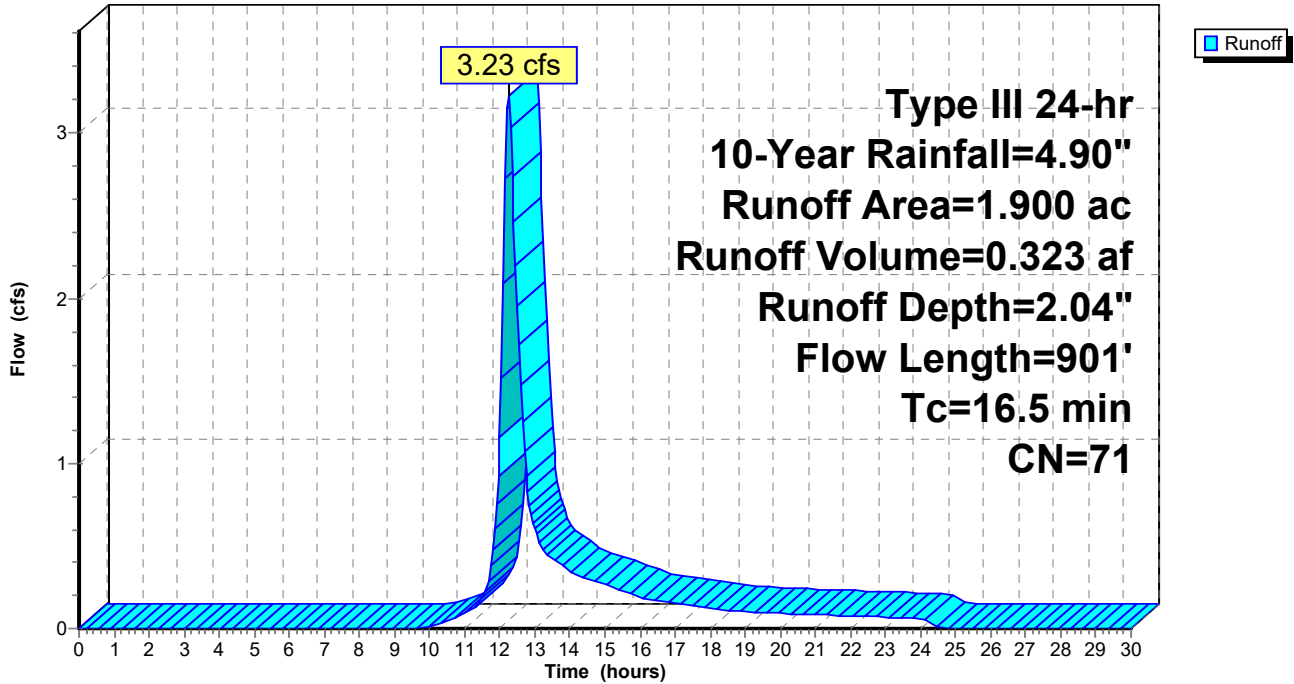
Type III 24-hr 10-Year Rainfall=4.90"

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Page 12

Subcatchment EWS-2: 1.90 AC

Hydrograph

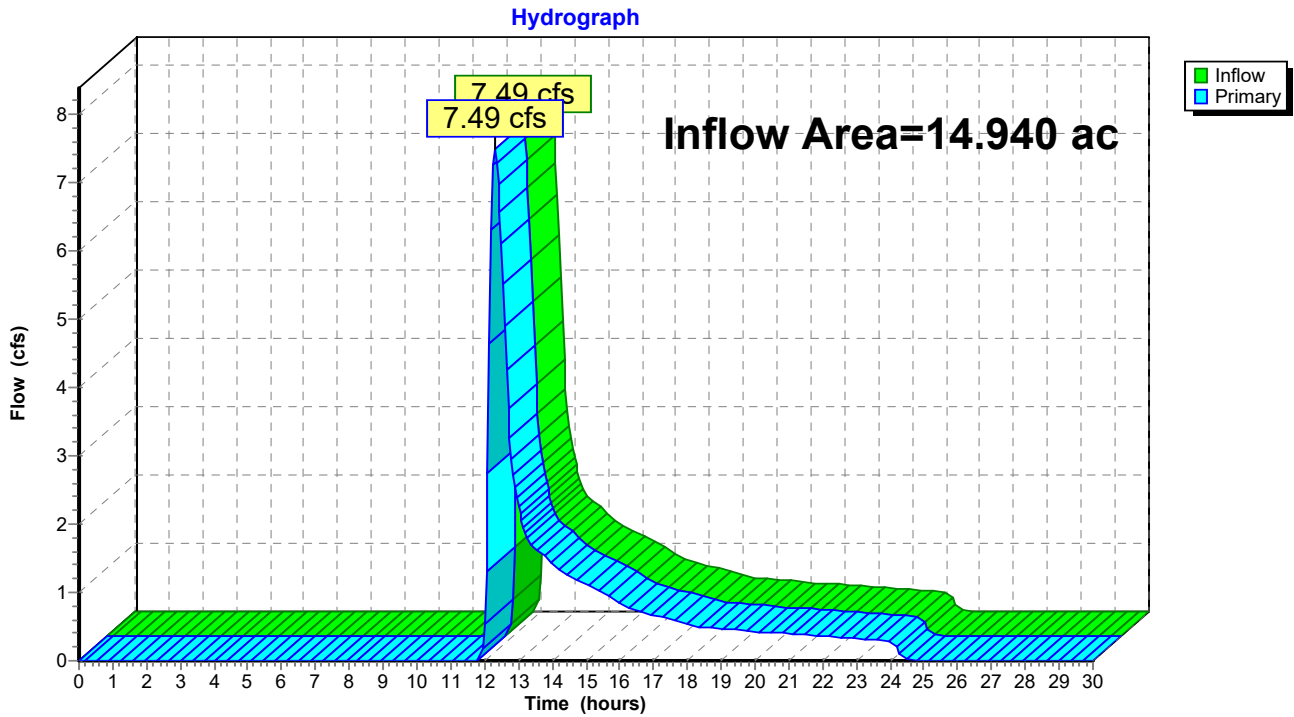


Summary for Link EX-DP-1: Existing Drainage Channel

Inflow Area = 14.940 ac, 22.09% Impervious, Inflow Depth = 0.81" for 10-Year event
Inflow = 7.49 cfs @ 12.30 hrs, Volume= 1.015 af
Primary = 7.49 cfs @ 12.30 hrs, Volume= 1.015 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs

Link EX-DP-1: Existing Drainage Channel



7287-00 HydroCAD Analysis

Type III 24-hr 10-Year Rainfall=4.90"

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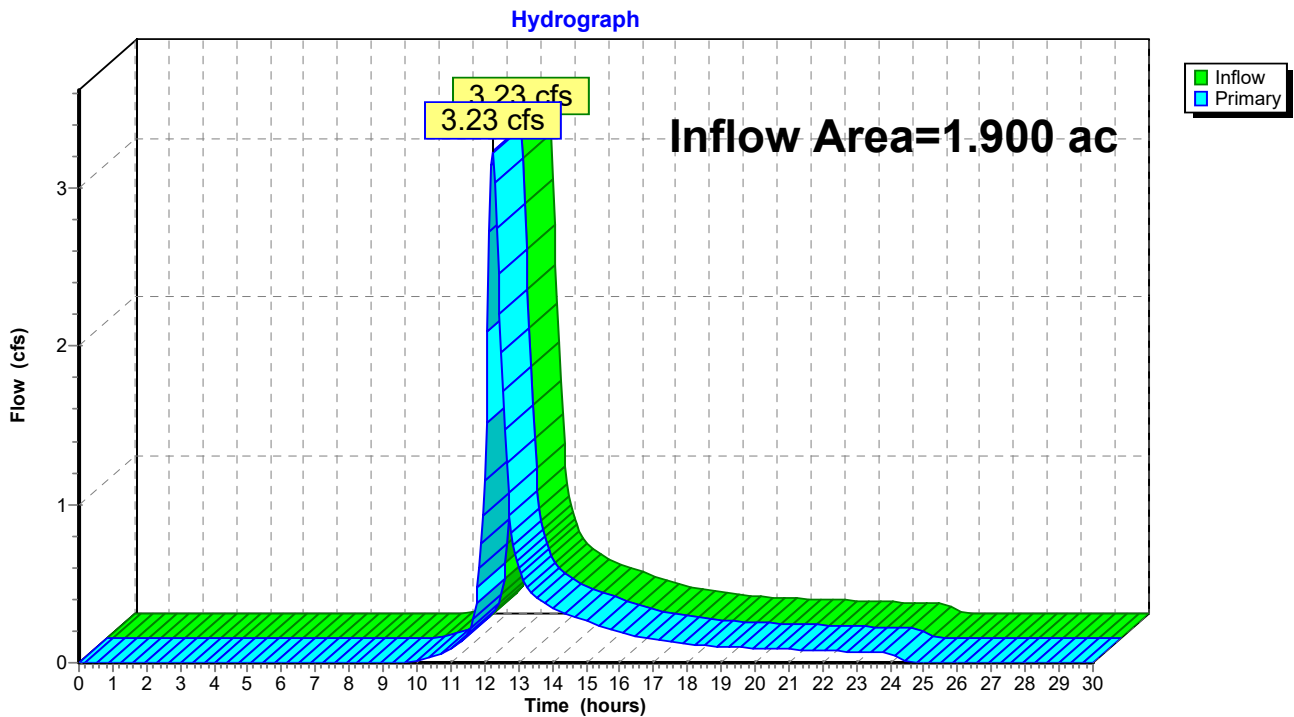
Page 14

Summary for Link EX-DP-2: Goddard Drive

Inflow Area = 1.900 ac, 45.79% Impervious, Inflow Depth = 2.04" for 10-Year event
Inflow = 3.23 cfs @ 12.24 hrs, Volume= 0.323 af
Primary = 3.23 cfs @ 12.24 hrs, Volume= 0.323 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs

Link EX-DP-2: Goddard Drive



7287-00 HydroCAD Analysis

Type III 24-hr 100-Year Rainfall=8.70"

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Summary for Subcatchment EWS-1: 14.94 AC

Runoff = 36.83 cfs @ 12.25 hrs, Volume= 3.782 af, Depth= 3.04"

Routed to Link EX-DP-1 : Existing Drainage Channel

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=8.70"

Area (ac)	CN	Description
2.370	98	Paved parking, HSG A
0.930	98	Roofs, HSG A
5.970	49	50-75% Grass cover, Fair, HSG A
2.500	30	Woods, Good, HSG A
0.120	48	Brush, Good, HSG B
3.050	30	Brush, Good, HSG A
14.940	53	Weighted Average
11.640	40	77.91% Pervious Area
3.300	98	22.09% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.2	50	0.0400	0.20		Sheet Flow, A-B Grass: Short n= 0.150 P2= 3.30"
4.6	243	0.0160	0.89		Shallow Concentrated Flow, B-C Short Grass Pasture Kv= 7.0 fps
0.1	12	0.0160	2.57		Shallow Concentrated Flow, C-D Paved Kv= 20.3 fps
0.4	65	0.3080	2.77		Shallow Concentrated Flow, D-E Woodland Kv= 5.0 fps
5.5	299	0.0330	0.91		Shallow Concentrated Flow, E-F Woodland Kv= 5.0 fps
1.7	232	0.0600	2.31	407.41	Channel Flow, F-G Area= 176.0 sf Perim= 485.0' r= 0.36' n= 0.080 Earth, long dense weeds
16.5	901	Total			

7287-00 HydroCAD Analysis

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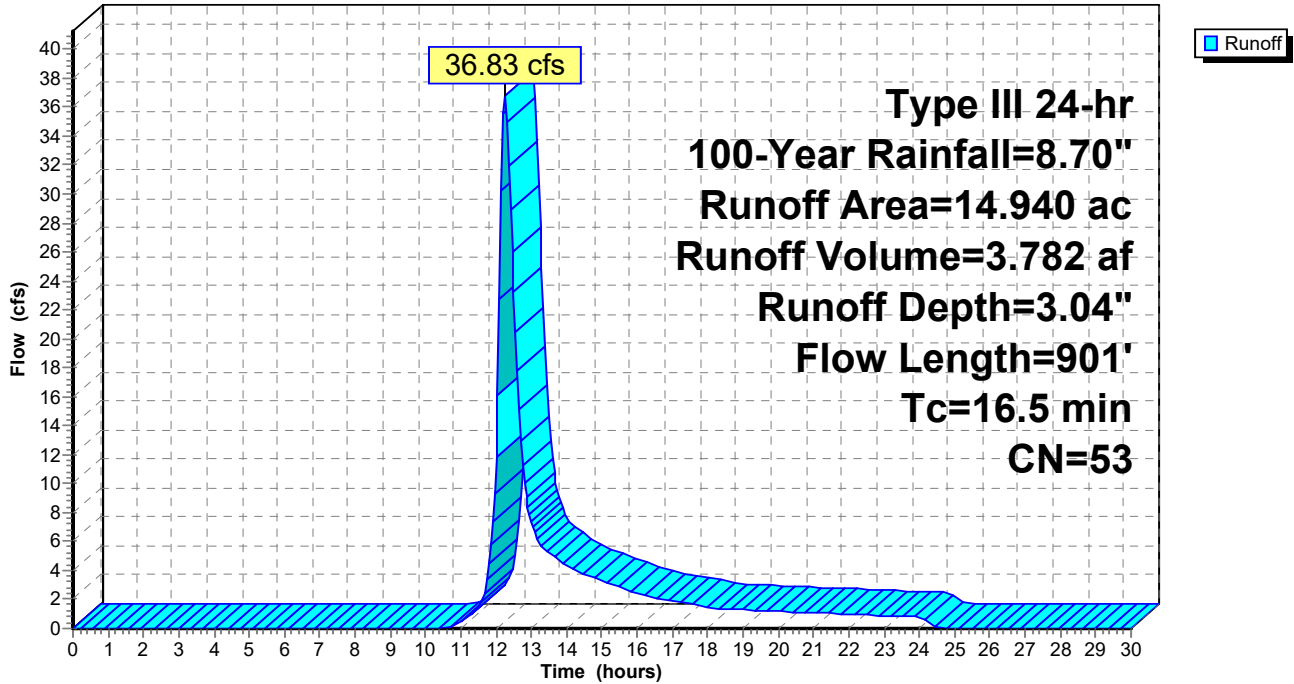
Type III 24-hr 100-Year Rainfall=8.70"

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Subcatchment EWS-1: 14.94 AC

Hydrograph



7287-00 HydroCAD Analysis

Type III 24-hr 100-Year Rainfall=8.70"

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Summary for Subcatchment EWS-2: 1.90 AC

Runoff = 8.37 cfs @ 12.23 hrs, Volume= 0.822 af, Depth= 5.19"
 Routed to Link EX-DP-2 : Goddard Drive

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
 Type III 24-hr 100-Year Rainfall=8.70"

Area (ac)	CN	Description
0.740	98	Paved parking, HSG A
0.130	98	Roofs, HSG A
1.030	49	50-75% Grass cover, Fair, HSG A
1.900	71	Weighted Average
1.030	49	54.21% Pervious Area
0.870	98	45.79% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.2	50	0.0400	0.20		Sheet Flow, A-B Grass: Short n= 0.150 P2= 3.30"
4.6	243	0.0160	0.89		Shallow Concentrated Flow, B-C Short Grass Pasture Kv= 7.0 fps
0.1	12	0.0160	2.57		Shallow Concentrated Flow, C-D Paved Kv= 20.3 fps
0.4	65	0.3080	2.77		Shallow Concentrated Flow, D-E Woodland Kv= 5.0 fps
5.5	299	0.0330	0.91		Shallow Concentrated Flow, E-F Woodland Kv= 5.0 fps
1.7	232	0.0600	2.31	407.41	Channel Flow, F-G Area= 176.0 sf Perim= 485.0' r= 0.36' n= 0.080 Earth, long dense weeds
16.5	901	Total			

7287-00 HydroCAD Analysis

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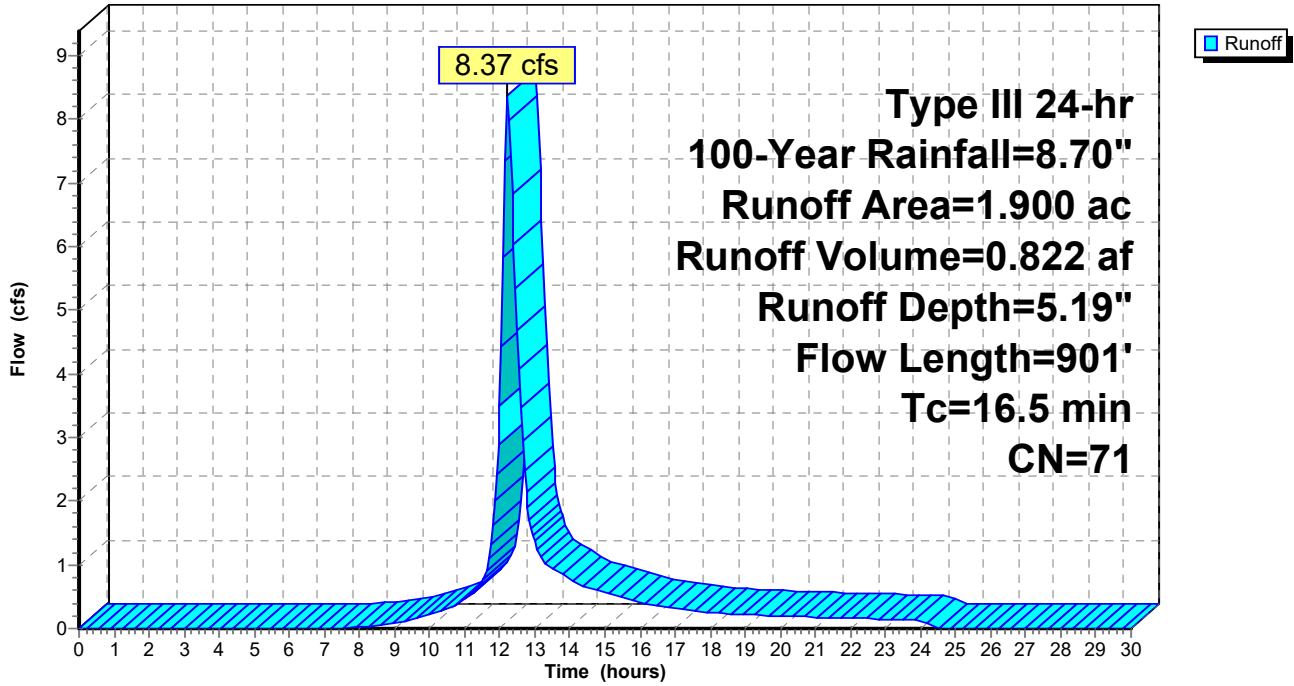
Type III 24-hr 100-Year Rainfall=8.70"

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Subcatchment EWS-2: 1.90 AC

Hydrograph



7287-00 HydroCAD Analysis

Type III 24-hr 100-Year Rainfall=8.70"

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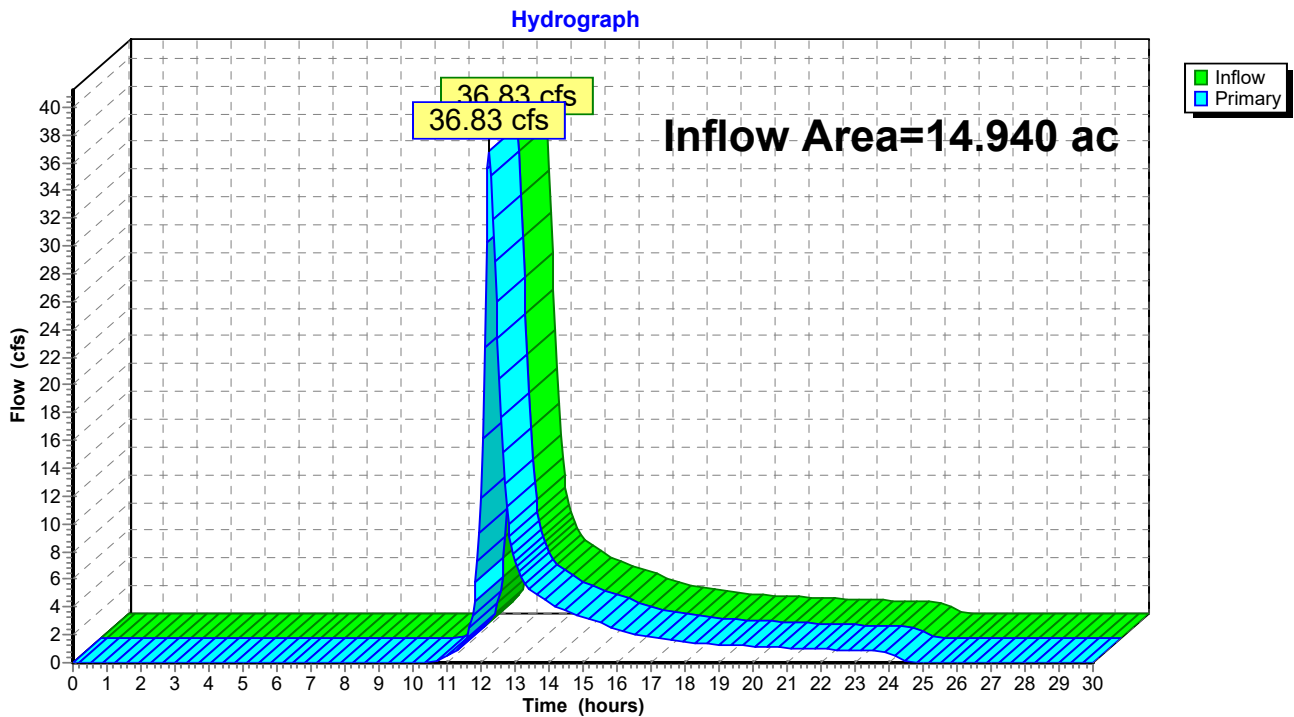
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Summary for Link EX-DP-1: Existing Drainage Channel

Inflow Area = 14.940 ac, 22.09% Impervious, Inflow Depth = 3.04" for 100-Year event
Inflow = 36.83 cfs @ 12.25 hrs, Volume= 3.782 af
Primary = 36.83 cfs @ 12.25 hrs, Volume= 3.782 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs

Link EX-DP-1: Existing Drainage Channel



7287-00 HydroCAD Analysis

Type III 24-hr 100-Year Rainfall=8.70"

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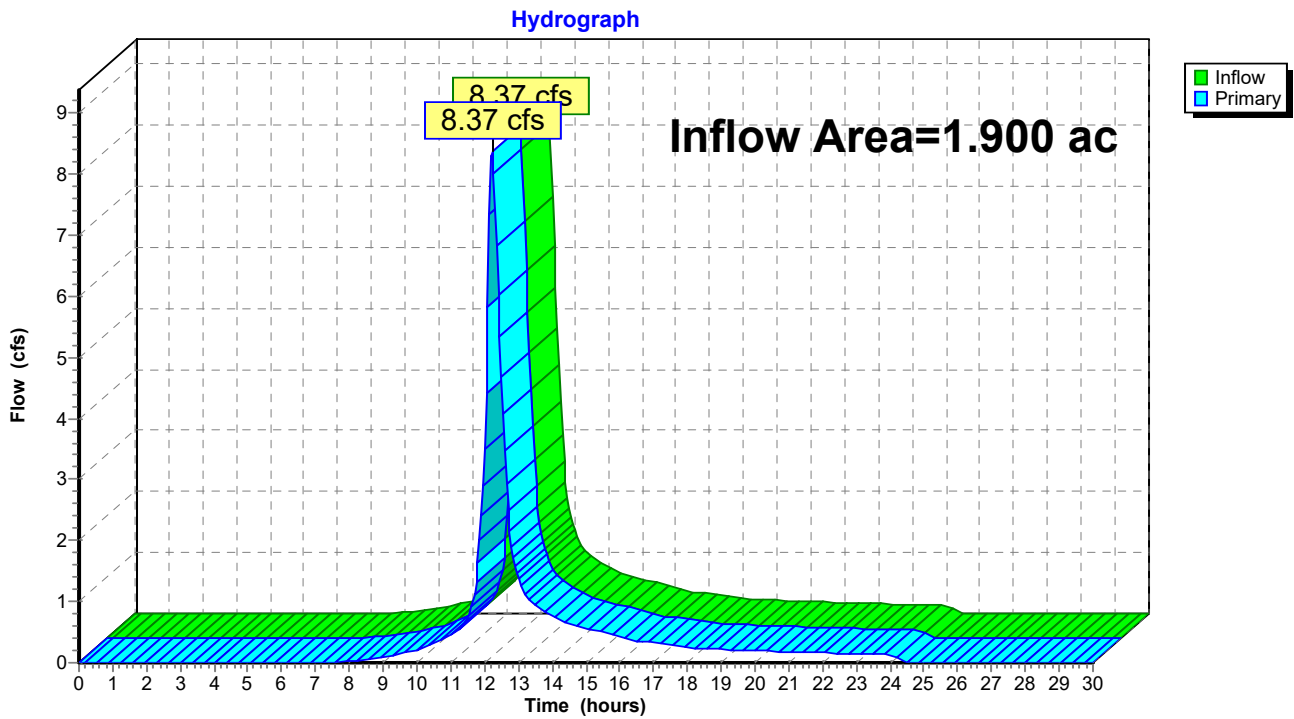
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Summary for Link EX-DP-2: Goddard Drive

Inflow Area = 1.900 ac, 45.79% Impervious, Inflow Depth = 5.19" for 100-Year event
Inflow = 8.37 cfs @ 12.23 hrs, Volume= 0.822 af
Primary = 8.37 cfs @ 12.23 hrs, Volume= 0.822 af, Atten= 0%, Lag= 0.0 min

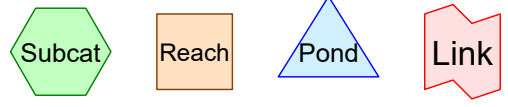
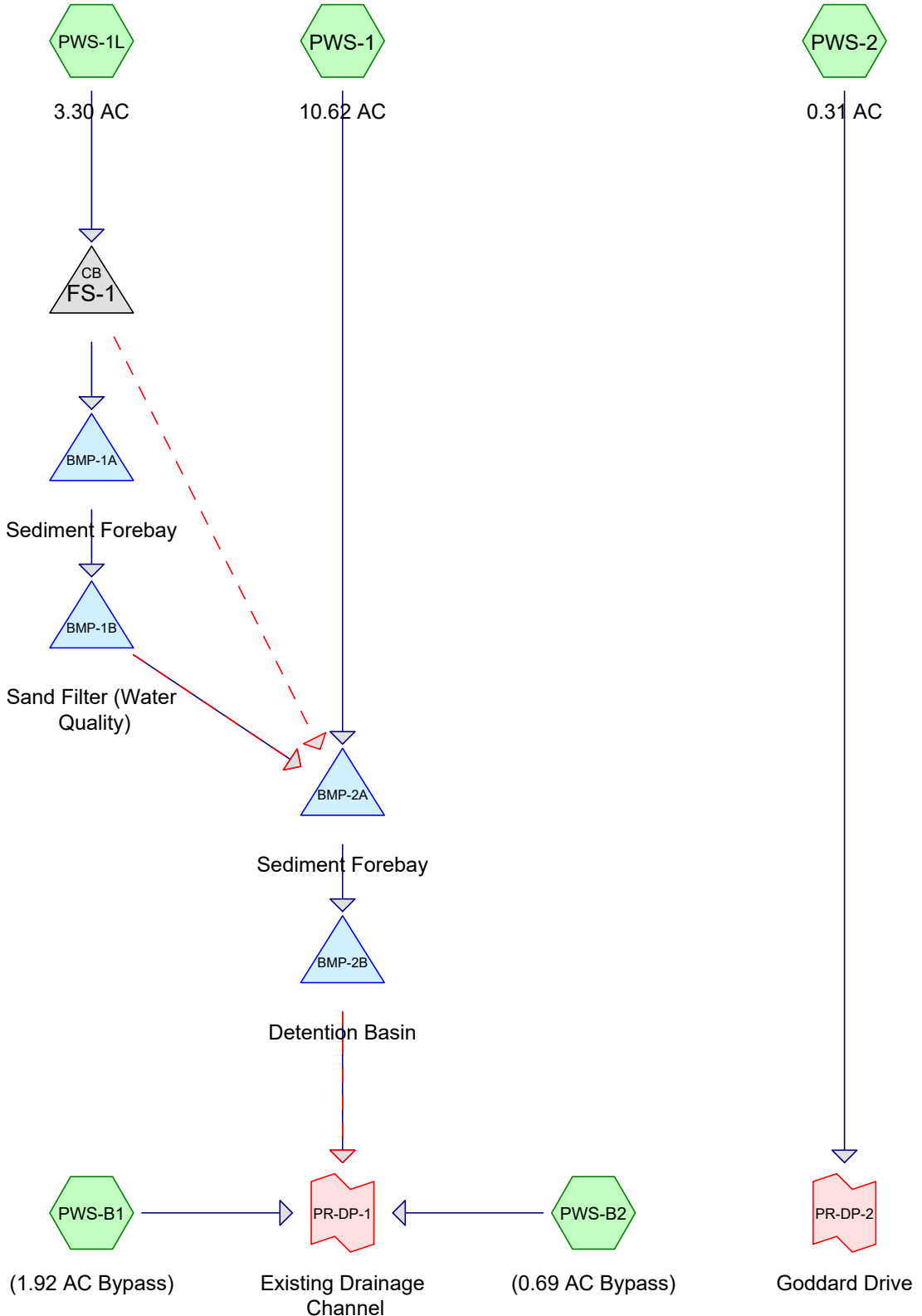
Primary outflow = Inflow, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs

Link EX-DP-2: Goddard Drive



Appendix C
Stormwater Analysis
Proposed Conditions





Routing Diagram for 7287-00 HydroCAD Analysis
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7287-00 HydroCAD Analysis

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Rainfall Events Listing (selected events)

Event#	Event Name	Storm Type	Curve	Mode	Duration (hours)	B/B	Depth (inches)	AMC
1	1-Year	Type III 24-hr		Default	24.00	1	2.70	2
2	10-Year	Type III 24-hr		Default	24.00	1	4.90	2
3	100-Year	Type III 24-hr		Default	24.00	1	8.70	2

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Type III 24-hr 1-Year Rainfall=2.70"

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Summary for Subcatchment PWS-1: 10.62 AC

Runoff = 11.52 cfs @ 12.10 hrs, Volume= 0.862 af, Depth= 0.97"

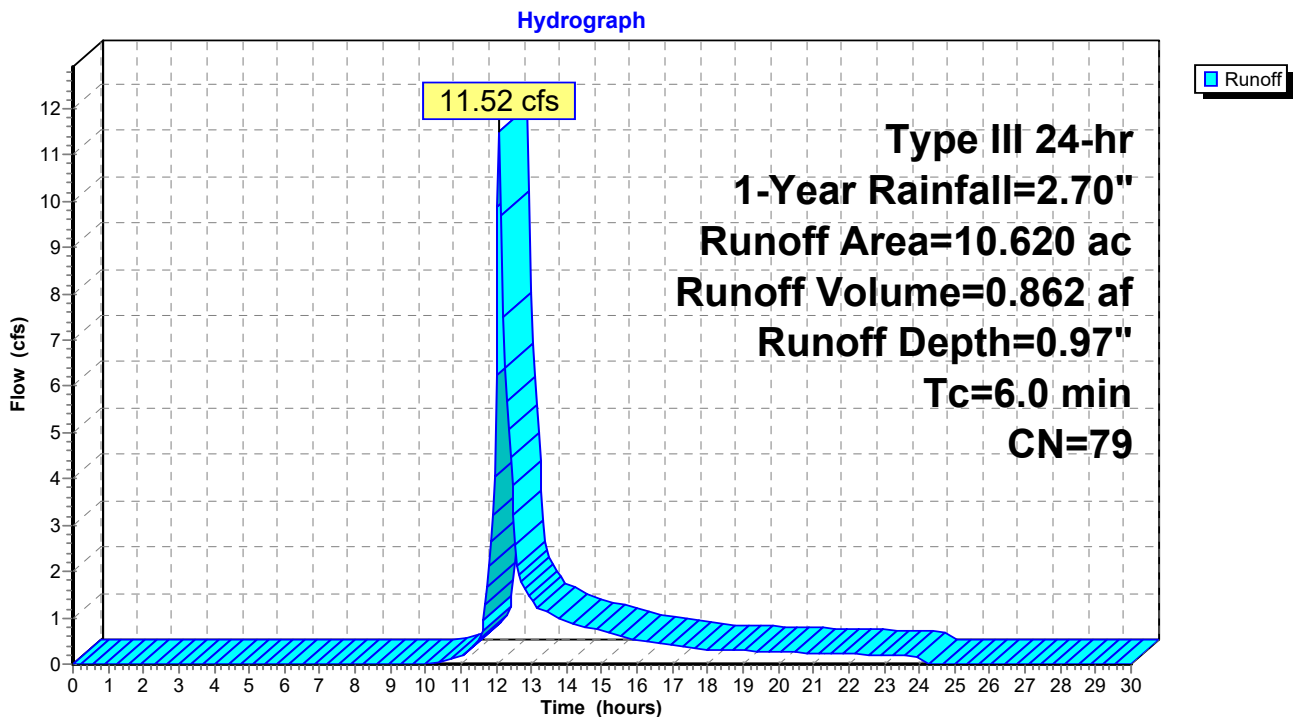
Routed to Pond BMP-2A : Sediment Forebay

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 1-Year Rainfall=2.70"

Area (ac)	CN	Description
2.420	98	Paved parking, HSG A
4.820	98	Roofs, HSG A
0.470	30	Brush, Good, HSG A
2.910	39	>75% Grass cover, Good, HSG A
10.620	79	Weighted Average
3.380	38	31.83% Pervious Area
7.240	98	68.17% Impervious Area

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

Subcatchment PWS-1: 10.62 AC



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Type III 24-hr 1-Year Rainfall=2.70"

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Summary for Subcatchment PWS-1L: 3.30 AC

Runoff = 8.40 cfs @ 12.09 hrs, Volume= 0.679 af, Depth= 2.47"

Routed to Pond FS-1 :

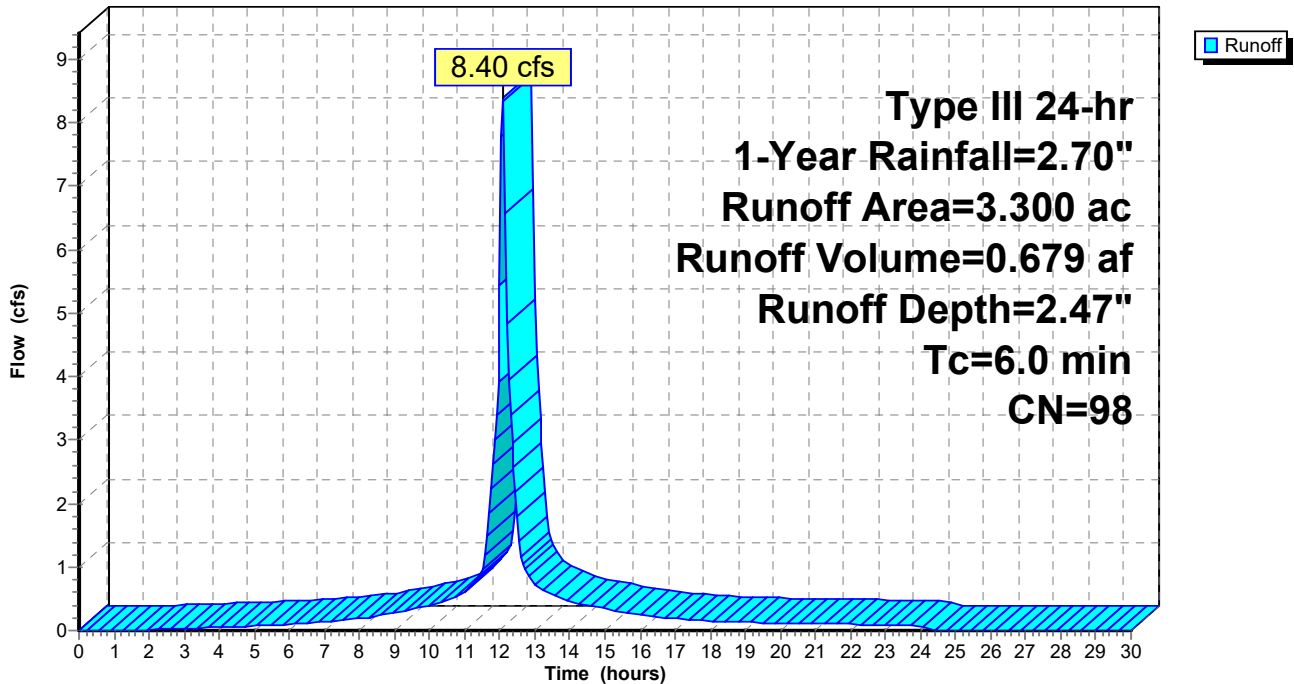
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 1-Year Rainfall=2.70"

Area (ac)	CN	Description
3.300	98	Paved parking, HSG A
3.300	98	100.00% Impervious Area

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

Subcatchment PWS-1L: 3.30 AC

Hydrograph



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Type III 24-hr 1-Year Rainfall=2.70"

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Summary for Subcatchment PWS-2: 0.31 AC

[45] Hint: Runoff=Zero

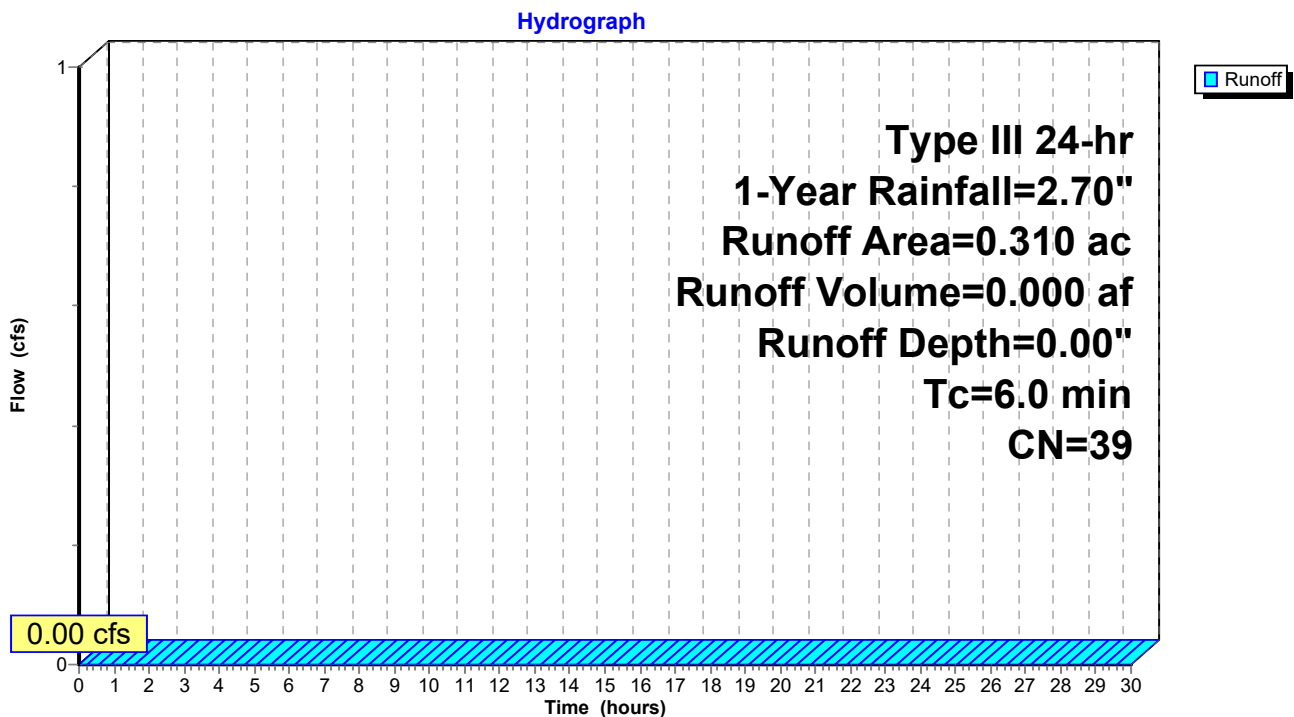
Runoff = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Depth= 0.00"
Routed to Link PR-DP-2 : Goddard Drive

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 1-Year Rainfall=2.70"

Area (ac)	CN	Description
0.310	39	>75% Grass cover, Good, HSG A
0.310	39	100.00% Pervious Area

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

Subcatchment PWS-2: 0.31 AC



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Type III 24-hr 1-Year Rainfall=2.70"

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Summary for Subcatchment PWS-B1: (1.92 AC Bypass)

[45] Hint: Runoff=Zero

Runoff = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Depth= 0.00"
 Routed to Link PR-DP-1 : Existing Drainage Channel

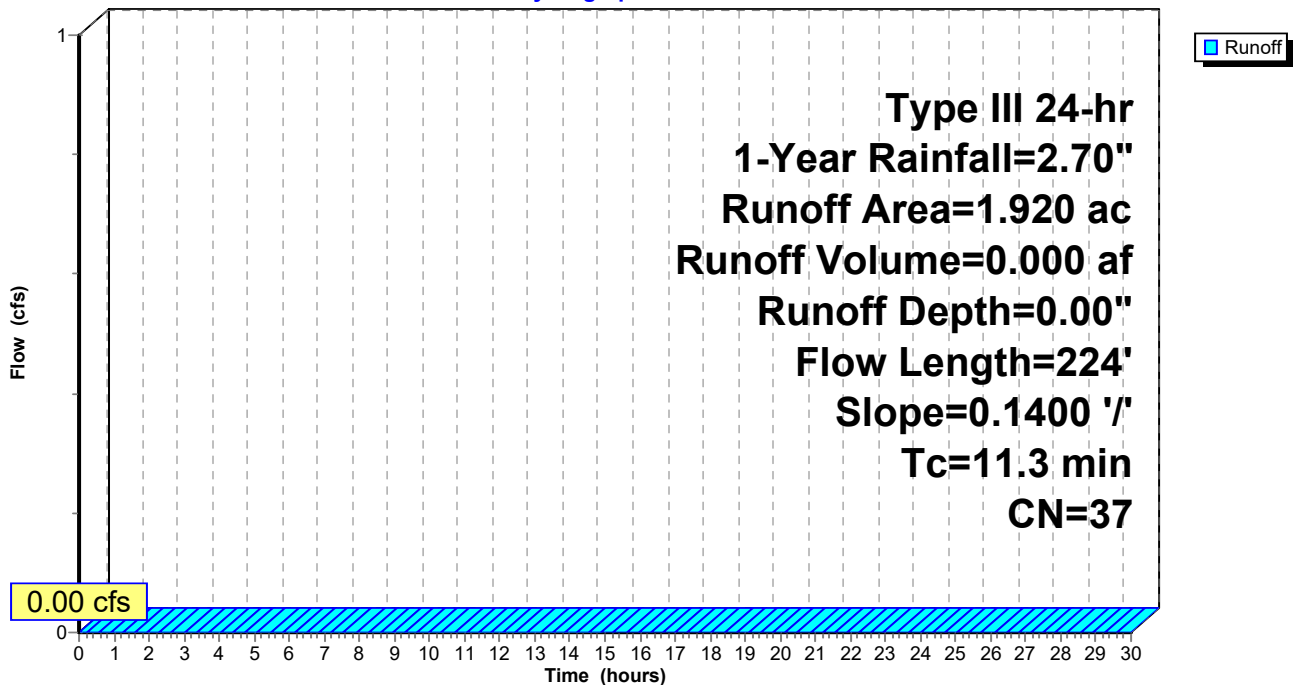
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
 Type III 24-hr 1-Year Rainfall=2.70"

Area (ac)	CN	Description
1.150	39	>75% Grass cover, Good, HSG A
0.080	61	>75% Grass cover, Good, HSG B
0.690	30	Woods, Good, HSG A
1.920	37	Weighted Average
1.920	37	100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.7	50	0.1400	0.09		Sheet Flow, A-B Woods: Dense underbrush n= 0.800 P2= 3.30"
1.6	174	0.1400	1.87		Shallow Concentrated Flow, B-C Woodland Kv= 5.0 fps
11.3	224	Total			

Subcatchment PWS-B1: (1.92 AC Bypass)

Hydrograph



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Type III 24-hr 1-Year Rainfall=2.70"

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Summary for Subcatchment PWS-B2: (0.69 AC Bypass)

[45] Hint: Runoff=Zero

Runoff = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Depth= 0.00"
 Routed to Link PR-DP-1 : Existing Drainage Channel

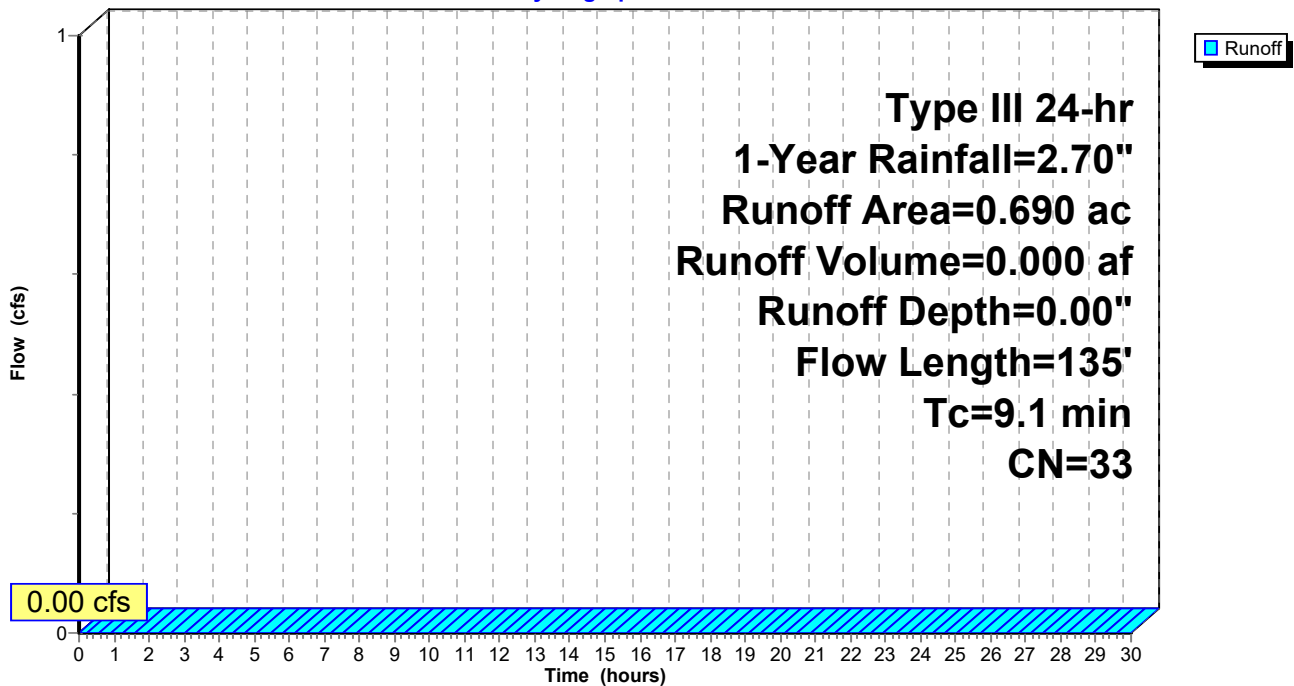
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
 Type III 24-hr 1-Year Rainfall=2.70"

Area (ac)	CN	Description
0.220	39	>75% Grass cover, Good, HSG A
0.470	30	Woods, Good, HSG A
0.690	33	Weighted Average
0.690	33	100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.8	50	0.2400	0.11		Sheet Flow, A-B Woods: Dense underbrush n= 0.800 P2= 3.30"
1.3	85	0.0500	1.12		Shallow Concentrated Flow, B-C Woodland Kv= 5.0 fps
9.1	135	Total			

Subcatchment PWS-B2: (0.69 AC Bypass)

Hydrograph



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Type III 24-hr 1-Year Rainfall=2.70"

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Summary for Pond BMP-1A: Sediment Forebay

Inflow Area = 3.300 ac, 100.00% Impervious, Inflow Depth = 2.36" for 1-Year event
 Inflow = 5.60 cfs @ 12.09 hrs, Volume= 0.649 af
 Outflow = 5.56 cfs @ 12.09 hrs, Volume= 0.549 af, Atten= 1%, Lag= 0.4 min
 Primary = 5.56 cfs @ 12.09 hrs, Volume= 0.549 af
 Routed to Pond BMP-1B : Sand Filter (Water Quality)

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs / 2
 Peak Elev= 47.60' @ 12.09 hrs Surf.Area= 4,748 sf Storage= 4,553 cf

Plug-Flow detention time= 117.7 min calculated for 0.549 af (85% of inflow)
 Center-of-Mass det. time= 52.1 min (813.8 - 761.7)

Volume	Invert	Avail.Storage	Storage Description
#1	45.50'	4,389 cf	Custom Stage Data (Prismatic) Listed below (Recalc)
#2	44.00'	670 cf	Custom Stage Data (Prismatic) Listed below (Recalc)
			2,031 cf Overall x 33.0% Voids
#3	43.25'	332 cf	Custom Stage Data (Prismatic) Listed below (Recalc)
			1,016 cf Overall - 10 cf Embedded = 1,005 cf x 33.0% Voids
#4	43.40'	10 cf	4.0" Round Pipe Storage x 3 Inside #3 L= 40.0'
		5,402 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
45.50	1,354	0	0
46.00	1,500	714	714
47.50	2,007	2,630	3,344
48.00	2,175	1,046	4,389

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
44.00	1,354	0	0
45.50	1,354	2,031	2,031

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
43.25	1,354	0	0
44.00	1,354	1,016	1,016

Device	Routing	Invert	Outlet Devices
#1	Primary	47.50'	55.0' long Sharp-Crested Rectangular Weir 2 End Contraction(s)

Primary OutFlow Max=5.41 cfs @ 12.09 hrs HW=47.60' (Free Discharge)
 ↑1=Sharp-Crested Rectangular Weir (Weir Controls 5.41 cfs @ 1.02 fps)

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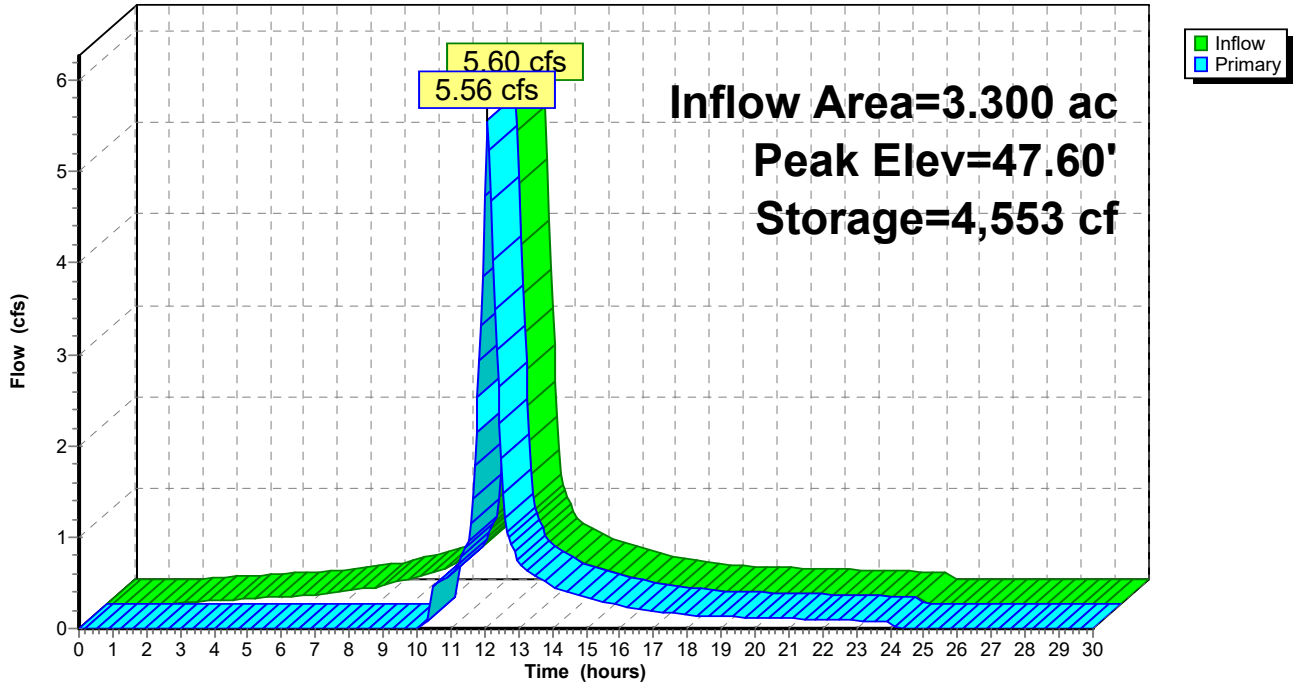
Type III 24-hr 1-Year Rainfall=2.70"

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Pond BMP-1A: Sediment Forebay

Hydrograph



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Stage-Area-Storage for Pond BMP-1A: Sediment Forebay

Elevation (feet)	Storage (cubic-feet)	Elevation (feet)	Storage (cubic-feet)
43.25	0	45.90	1,577
43.30	22	45.95	1,651
43.35	45	46.00	1,726
43.40	67	46.05	1,801
43.45	90	46.10	1,878
43.50	113	46.15	1,955
43.55	137	46.20	2,033
43.60	161	46.25	2,111
43.65	184	46.30	2,191
43.70	208	46.35	2,272
43.75	230	46.40	2,353
43.80	253	46.45	2,435
43.85	275	46.50	2,518
43.90	297	46.55	2,602
43.95	320	46.60	2,687
44.00	342	46.65	2,772
44.05	364	46.70	2,859
44.10	387	46.75	2,946
44.15	409	46.80	3,034
44.20	431	46.85	3,123
44.25	454	46.90	3,213
44.30	476	46.95	3,303
44.35	499	47.00	3,395
44.40	521	47.05	3,487
44.45	543	47.10	3,580
44.50	566	47.15	3,674
44.55	588	47.20	3,769
44.60	610	47.25	3,865
44.65	633	47.30	3,961
44.70	655	47.35	4,059
44.75	677	47.40	4,157
44.80	700	47.45	4,256
44.85	722	47.50	4,356
44.90	744	47.55	4,457
44.95	767	47.60	4,558
45.00	789	47.65	4,661
45.05	811	47.70	4,764
45.10	834	47.75	4,868
45.15	856	47.80	4,973
45.20	878	47.85	5,079
45.25	901	47.90	5,186
45.30	923	47.95	5,293
45.35	945	48.00	5,402
45.40	968		
45.45	990		
45.50	1,012		
45.55	1,080		
45.60	1,149		
45.65	1,219		
45.70	1,289		
45.75	1,360		
45.80	1,432		
45.85	1,504		

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Type III 24-hr 1-Year Rainfall=2.70"

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Summary for Pond BMP-1B: Sand Filter (Water Quality)

[79] Warning: Submerged Pond BMP-1A Primary device # 1 by 0.03'

Inflow Area = 3.300 ac, 100.00% Impervious, Inflow Depth = 2.00" for 1-Year event
 Inflow = 5.56 cfs @ 12.09 hrs, Volume= 0.549 af
 Outflow = 1.31 cfs @ 12.59 hrs, Volume= 0.545 af, Atten= 77%, Lag= 29.9 min
 Primary = 0.62 cfs @ 12.59 hrs, Volume= 0.527 af
 Routed to Pond BMP-2A : Sediment Forebay
 Secondary = 0.68 cfs @ 12.59 hrs, Volume= 0.018 af
 Routed to Pond BMP-2A : Sediment Forebay

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs / 2
 Peak Elev= 47.53' @ 12.59 hrs Surf.Area= 11,921 sf Storage= 11,145 cf

Plug-Flow detention time= 186.4 min calculated for 0.545 af (99% of inflow)
 Center-of-Mass det. time= 181.2 min (995.0 - 813.8)

Volume	Invert	Avail.Storage	Storage Description
#1	45.50'	10,815 cf	Custom Stage Data (Prismatic) Listed below (Recalc)
#2	44.00'	1,762 cf	Custom Stage Data (Prismatic) Listed below (Recalc)
			5,340 cf Overall x 33.0% Voids
#3	43.25'	873 cf	Custom Stage Data (Prismatic) Listed below (Recalc)
			2,670 cf Overall - 24 cf Embedded = 2,646 cf x 33.0% Voids
#4	43.40'	24 cf	4.0" Round Pipe Storage x 3 Inside #3 L= 90.0'
		13,474 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
45.50	3,560	0	0
46.00	3,865	1,856	1,856
47.50	4,780	6,484	8,340
48.00	5,120	2,475	10,815

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
44.00	3,560	0	0
45.50	3,560	5,340	5,340

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
43.25	3,560	0	0
44.00	3,560	2,670	2,670

Device	Routing	Invert	Outlet Devices
#1	Primary	43.40'	4.0" Round Culvert L= 55.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 43.40' / 42.50' S= 0.0164 ' / ' Cc= 0.900 n= 0.010 PVC, smooth interior, Flow Area= 0.09 sf
#2	Secondary	47.50'	50.0' long x 6.0' breadth Broad-Crested Rectangular Weir

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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
	2.65	2.66	2.66	2.67	2.69	2.72	2.76	2.83		

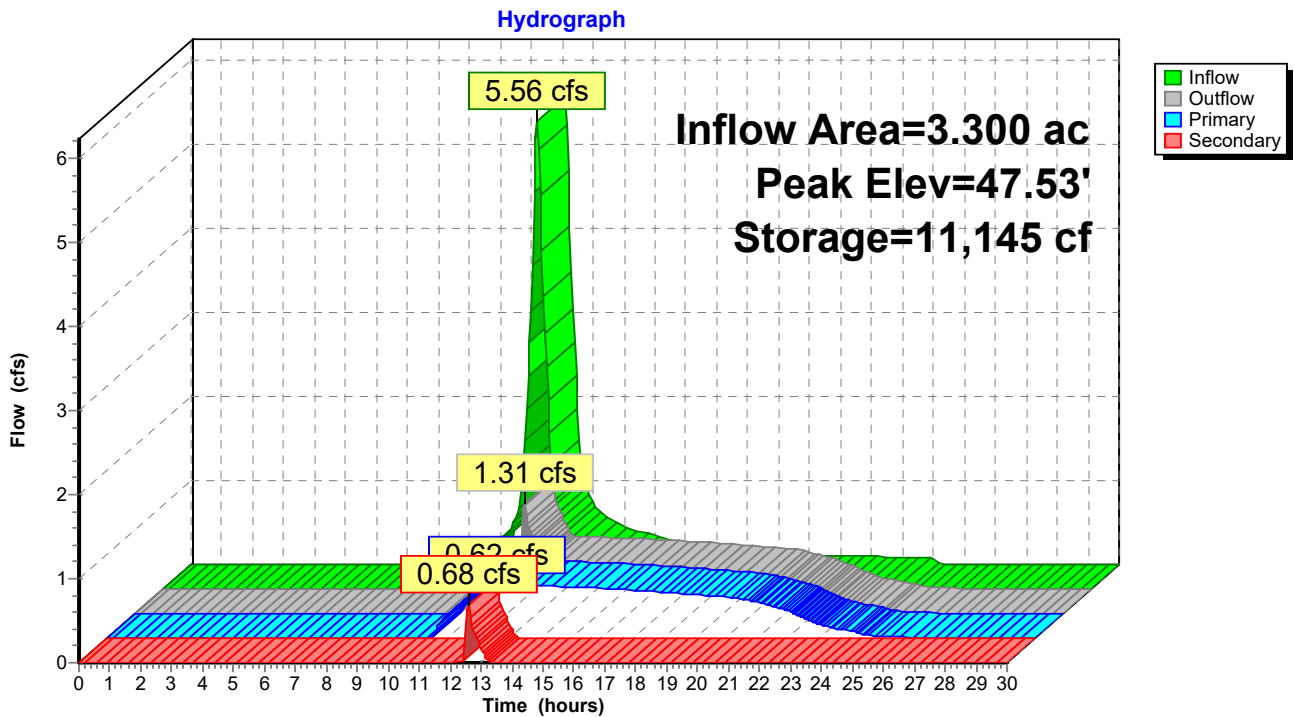
Primary OutFlow Max=0.62 cfs @ 12.59 hrs HW=47.53' (Free Discharge)

↳ **1=Culvert** (Barrel Controls 0.62 cfs @ 7.15 fps)

Secondary OutFlow Max=0.62 cfs @ 12.59 hrs HW=47.53' (Free Discharge)

↳ **2=Broad-Crested Rectangular Weir** (Weir Controls 0.62 cfs @ 0.41 fps)

Pond BMP-1B: Sand Filter (Water Quality)



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Stage-Area-Storage for Pond BMP-1B: Sand Filter (Water Quality)

Elevation (feet)	Storage (cubic-feet)	Elevation (feet)	Storage (cubic-feet)
43.25	0	45.90	4,132
43.30	59	45.95	4,323
43.35	117	46.00	4,515
43.40	176	46.05	4,709
43.45	236	46.10	4,905
43.50	298	46.15	5,102
43.55	359	46.20	5,301
43.60	421	46.25	5,501
43.65	483	46.30	5,702
43.70	544	46.35	5,905
43.75	603	46.40	6,110
43.80	662	46.45	6,316
43.85	721	46.50	6,524
43.90	779	46.55	6,733
43.95	838	46.60	6,944
44.00	897	46.65	7,156
44.05	956	46.70	7,370
44.10	1,014	46.75	7,586
44.15	1,073	46.80	7,803
44.20	1,132	46.85	8,021
44.25	1,191	46.90	8,241
44.30	1,249	46.95	8,462
44.35	1,308	47.00	8,685
44.40	1,367	47.05	8,910
44.45	1,426	47.10	9,136
44.50	1,484	47.15	9,363
44.55	1,543	47.20	9,593
44.60	1,602	47.25	9,823
44.65	1,661	47.30	10,055
44.70	1,719	47.35	10,289
44.75	1,778	47.40	10,524
44.80	1,837	47.45	10,761
44.85	1,895	47.50	10,999
44.90	1,954	47.55	11,239
44.95	2,013	47.60	11,480
45.00	2,072	47.65	11,724
45.05	2,130	47.70	11,969
45.10	2,189	47.75	12,215
45.15	2,248	47.80	12,464
45.20	2,307	47.85	12,714
45.25	2,365	47.90	12,965
45.30	2,424	47.95	13,219
45.35	2,483	48.00	13,474
45.40	2,542		
45.45	2,600		
45.50	2,659		
45.55	2,838		
45.60	3,018		
45.65	3,200		
45.70	3,383		
45.75	3,568		
45.80	3,755		
45.85	3,942		

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Type III 24-hr 1-Year Rainfall=2.70"

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Summary for Pond BMP-2A: Sediment Forebay

Inflow Area = 13.920 ac, 75.72% Impervious, Inflow Depth > 1.24" for 1-Year event
 Inflow = 14.85 cfs @ 12.09 hrs, Volume= 1.437 af
 Outflow = 14.02 cfs @ 12.12 hrs, Volume= 1.389 af, Atten= 6%, Lag= 1.8 min
 Discarded = 0.35 cfs @ 12.10 hrs, Volume= 0.487 af
 Primary = 13.67 cfs @ 12.12 hrs, Volume= 0.902 af
 Routed to Pond BMP-2B : Detention Basin

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs / 3
 Peak Elev= 42.15' @ 12.10 hrs Surf.Area= 6,205 sf Storage= 8,793 cf

Plug-Flow detention time= 109.6 min calculated for 1.389 af (97% of inflow)
 Center-of-Mass det. time= 92.1 min (997.7 - 905.7)

Volume	Invert	Avail.Storage	Storage Description
#1	40.00'	22,436 cf	Custom Stage Data (Prismatic) Listed below (Recalc)
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
40.00	1,869	0	0
42.00	6,020	7,889	7,889
44.00	8,527	14,547	22,436

Device	Routing	Invert	Outlet Devices
#1	Discarded	40.00'	2.410 in/hr Exfiltration over Surface area
#2	Primary	42.00'	65.0' long Sharp-Crested Rectangular Weir 2 End Contraction(s)

Discarded OutFlow Max=0.35 cfs @ 12.10 hrs HW=42.15' (Free Discharge)
 ↑1=Exfiltration (Exfiltration Controls 0.35 cfs)

Primary OutFlow Max=12.08 cfs @ 12.12 hrs HW=42.15' (Free Discharge)
 ↑2=Sharp-Crested Rectangular Weir (Weir Controls 12.08 cfs @ 1.26 fps)

7287-00 HydroCAD Analysis

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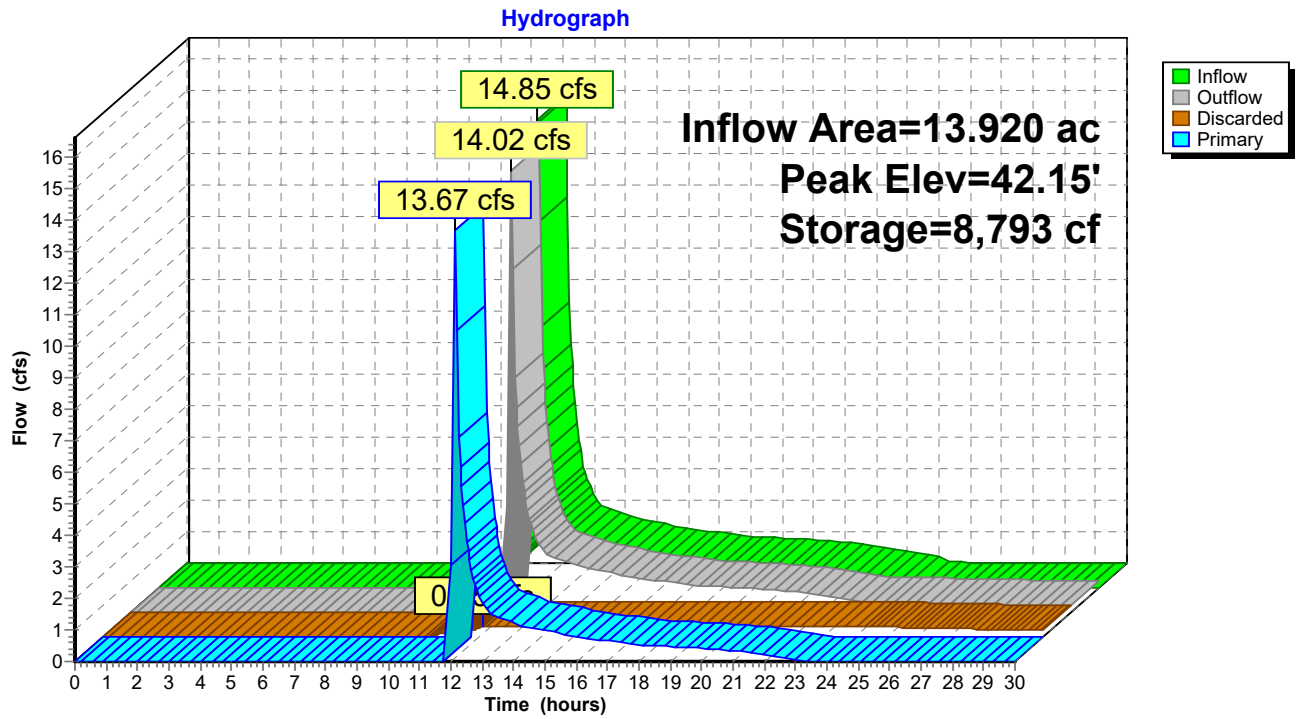
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Type III 24-hr 1-Year Rainfall=2.70"

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Pond BMP-2A: Sediment Forebay



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Stage-Area-Storage for Pond BMP-2A: Sediment Forebay

Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)	Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)
40.00	1,869	0	42.65	6,835	12,067
40.05	1,973	96	42.70	6,897	12,410
40.10	2,077	197	42.75	6,960	12,757
40.15	2,180	304	42.80	7,023	13,106
40.20	2,284	415	42.85	7,085	13,459
40.25	2,388	532	42.90	7,148	13,815
40.30	2,492	654	42.95	7,211	14,174
40.35	2,595	781	43.00	7,274	14,536
40.40	2,699	914	43.05	7,336	14,901
40.45	2,803	1,051	43.10	7,399	15,269
40.50	2,907	1,194	43.15	7,462	15,641
40.55	3,011	1,342	43.20	7,524	16,016
40.60	3,114	1,495	43.25	7,587	16,393
40.65	3,218	1,653	43.30	7,650	16,774
40.70	3,322	1,817	43.35	7,712	17,158
40.75	3,426	1,985	43.40	7,775	17,545
40.80	3,529	2,159	43.45	7,838	17,936
40.85	3,633	2,338	43.50	7,900	18,329
40.90	3,737	2,523	43.55	7,963	18,726
40.95	3,841	2,712	43.60	8,026	19,125
41.00	3,945	2,907	43.65	8,088	19,528
41.05	4,048	3,107	43.70	8,151	19,934
41.10	4,152	3,312	43.75	8,214	20,343
41.15	4,256	3,522	43.80	8,276	20,756
41.20	4,360	3,737	43.85	8,339	21,171
41.25	4,463	3,958	43.90	8,402	21,590
41.30	4,567	4,183	43.95	8,464	22,011
41.35	4,671	4,414	44.00	8,527	22,436
41.40	4,775	4,651			
41.45	4,878	4,892			
41.50	4,982	5,138			
41.55	5,086	5,390			
41.60	5,190	5,647			
41.65	5,294	5,909			
41.70	5,397	6,176			
41.75	5,501	6,449			
41.80	5,605	6,727			
41.85	5,709	7,009			
41.90	5,812	7,297			
41.95	5,916	7,591			
42.00	6,020	7,889			
42.05	6,083	8,192			
42.10	6,145	8,497			
42.15	6,208	8,806			
42.20	6,271	9,118			
42.25	6,333	9,433			
42.30	6,396	9,751			
42.35	6,459	10,073			
42.40	6,521	10,397			
42.45	6,584	10,725			
42.50	6,647	11,056			
42.55	6,709	11,390			
42.60	6,772	11,727			

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Summary for Pond BMP-2B: Detention Basin

Inflow Area = 13.920 ac, 75.72% Impervious, Inflow Depth = 0.78" for 1-Year event
 Inflow = 13.67 cfs @ 12.12 hrs, Volume= 0.902 af
 Outflow = 0.78 cfs @ 15.95 hrs, Volume= 0.902 af, Atten= 94%, Lag= 229.6 min
 Discarded = 0.78 cfs @ 15.95 hrs, Volume= 0.902 af
 Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
 Routed to Link PR-DP-1 : Existing Drainage Channel
 Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
 Routed to Link PR-DP-1 : Existing Drainage Channel

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs / 3
 Peak Elev= 35.47' @ 15.95 hrs Surf.Area= 14,069 sf Storage= 17,777 cf

Plug-Flow detention time= 278.9 min calculated for 0.901 af (100% of inflow)
 Center-of-Mass det. time= 279.1 min (1,162.6 - 883.5)

Volume	Invert	Avail.Storage	Storage Description
#1	34.00'	186,688 cf	Custom Stage Data (Prismatic) Listed below (Recalc)
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
34.00	10,145	0	0
36.00	15,490	25,635	25,635
38.00	21,685	37,175	62,810
40.00	31,870	53,555	116,365
42.00	38,453	70,323	186,688

Device	Routing	Invert	Outlet Devices
#1	Discarded	34.00'	2.410 in/hr Exfiltration over Surface area
#2	Primary	30.00'	24.0" Round Culvert L= 100.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 30.00' / 28.00' S= 0.0200 1/ S Cc= 0.900 n= 0.012, Flow Area= 3.14 sf
#3	Device 2	35.70'	3.5" Vert. Orifice/Grate C= 0.600 Limited to weir flow at low heads
#4	Device 2	37.50'	12.0" W x 10.0" H Vert. Orifice/Grate C= 0.600 Limited to weir flow at low heads
#5	Device 2	39.00'	5.0' long Sharp-Crested Rectangular Weir 2 End Contraction(s)
#6	Secondary	40.50'	50.0' long + 10.0 1/ SideZ x 8.0' 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) 2.43 2.54 2.70 2.69 2.68 2.68 2.66 2.64 2.64 2.64 2.65 2.65 2.66 2.66 2.68 2.70 2.74

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Type III 24-hr 1-Year Rainfall=2.70"

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Discarded OutFlow Max=0.78 cfs @ 15.95 hrs HW=35.47' (Free Discharge)

↳ **1=Exfiltration** (Exfiltration Controls 0.78 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=34.00' (Free Discharge)

↳ **2=Culvert** (Passes 0.00 cfs of 26.20 cfs potential flow)

↳ **3=Orifice/Grate** (Controls 0.00 cfs)

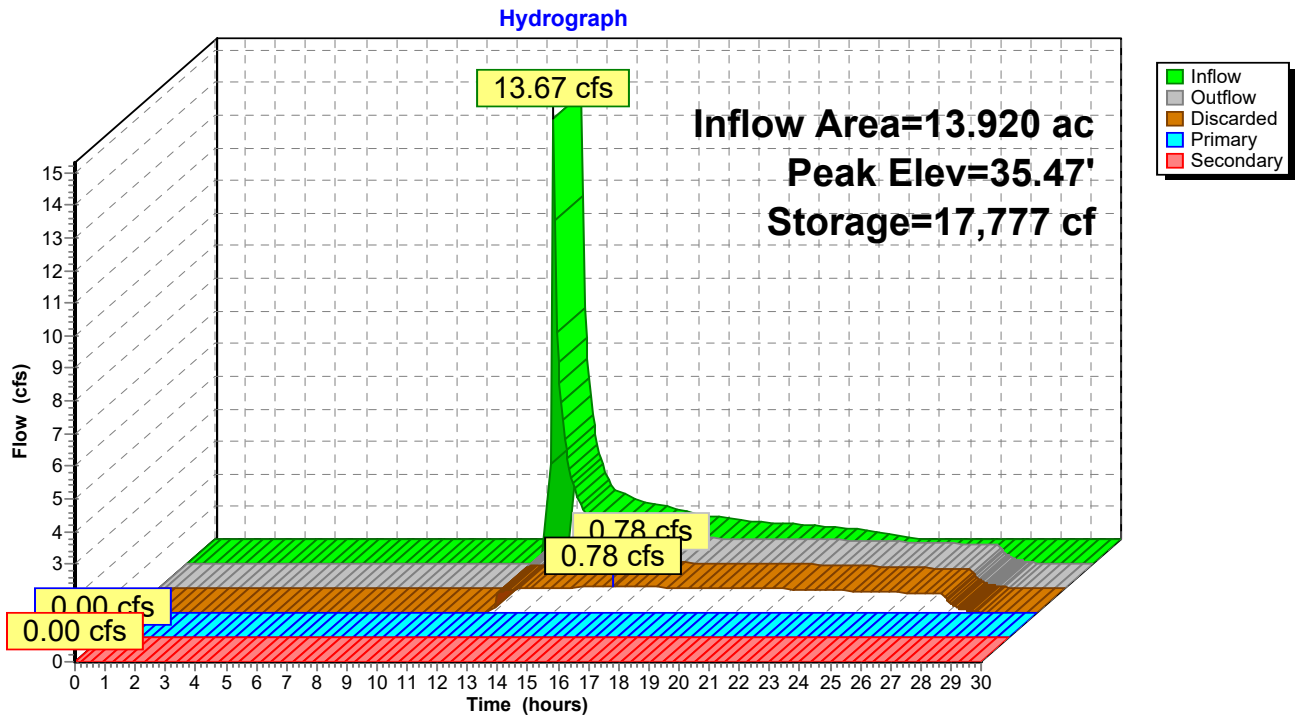
↳ **4=Orifice/Grate** (Controls 0.00 cfs)

↳ **5=Sharp-Crested Rectangular Weir** (Controls 0.00 cfs)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=34.00' (Free Discharge)

↳ **6=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond BMP-2B: Detention Basin



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Stage-Area-Storage for Pond BMP-2B: Detention Basin

Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)	Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)
34.00	10,145	0	39.30	28,305	95,304
34.10	10,412	1,028	39.40	28,814	98,160
34.20	10,680	2,082	39.50	29,324	101,067
34.30	10,947	3,164	39.60	29,833	104,024
34.40	11,214	4,272	39.70	30,342	107,033
34.50	11,481	5,407	39.80	30,851	110,093
34.60	11,749	6,568	39.90	31,361	113,203
34.70	12,016	7,756	40.00	31,870	116,365
34.80	12,283	8,971	40.10	32,199	119,568
34.90	12,550	10,213	40.20	32,528	122,805
35.00	12,818	11,481	40.30	32,857	126,074
35.10	13,085	12,776	40.40	33,187	129,376
35.20	13,352	14,098	40.50	33,516	132,711
35.30	13,619	15,447	40.60	33,845	136,079
35.40	13,886	16,822	40.70	34,174	139,480
35.50	14,154	18,224	40.80	34,503	142,914
35.60	14,421	19,653	40.90	34,832	146,381
35.70	14,688	21,108	41.00	35,162	149,881
35.80	14,955	22,590	41.10	35,491	153,413
35.90	15,223	24,099	41.20	35,820	156,979
36.00	15,490	25,635	41.30	36,149	160,577
36.10	15,800	27,199	41.40	36,478	164,209
36.20	16,110	28,795	41.50	36,807	167,873
36.30	16,419	30,421	41.60	37,136	171,570
36.40	16,729	32,079	41.70	37,466	175,300
36.50	17,039	33,767	41.80	37,795	179,063
36.60	17,349	35,487	41.90	38,124	182,859
36.70	17,658	37,237	42.00	38,453	186,688
36.80	17,968	39,018			
36.90	18,278	40,830			
37.00	18,588	42,674			
37.10	18,897	44,548			
37.20	19,207	46,453			
37.30	19,517	48,389			
37.40	19,826	50,357			
37.50	20,136	52,355			
37.60	20,446	54,384			
37.70	20,756	56,444			
37.80	21,065	58,535			
37.90	21,375	60,657			
38.00	21,685	62,810			
38.10	22,194	65,004			
38.20	22,704	67,249			
38.30	23,213	69,545			
38.40	23,722	71,891			
38.50	24,231	74,289			
38.60	24,741	76,738			
38.70	25,250	79,237			
38.80	25,759	81,788			
38.90	26,268	84,389			
39.00	26,778	87,041			
39.10	27,287	89,744			
39.20	27,796	92,499			

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Summary for Pond FS-1:

[57] Hint: Peaked at 50.31' (Flood elevation advised)

Inflow Area = 3.300 ac, 100.00% Impervious, Inflow Depth = 2.47" for 1-Year event
Inflow = 8.40 cfs @ 12.09 hrs, Volume= 0.679 af
Outflow = 8.40 cfs @ 12.09 hrs, Volume= 0.679 af, Atten= 0%, Lag= 0.0 min
Primary = 5.60 cfs @ 12.09 hrs, Volume= 0.649 af
Routed to Pond BMP-1A : Sediment Forebay
Secondary = 2.81 cfs @ 12.09 hrs, Volume= 0.030 af
Routed to Pond BMP-2A : Sediment Forebay

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs / 2
Peak Elev= 50.31' @ 12.09 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	48.75'	15.0" Round Culvert L= 20.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 48.75' / 48.50' S= 0.0125 '/ Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.23 sf
#2	Secondary	46.50'	36.0" Round Culvert L= 200.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 46.50' / 44.00' S= 0.0125 '/ Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 7.07 sf
#3	Device 2	50.00'	5.0' long Sharp-Crested Rectangular Weir 2 End Contraction(s)

Primary OutFlow Max=5.55 cfs @ 12.09 hrs HW=50.30' (Free Discharge)

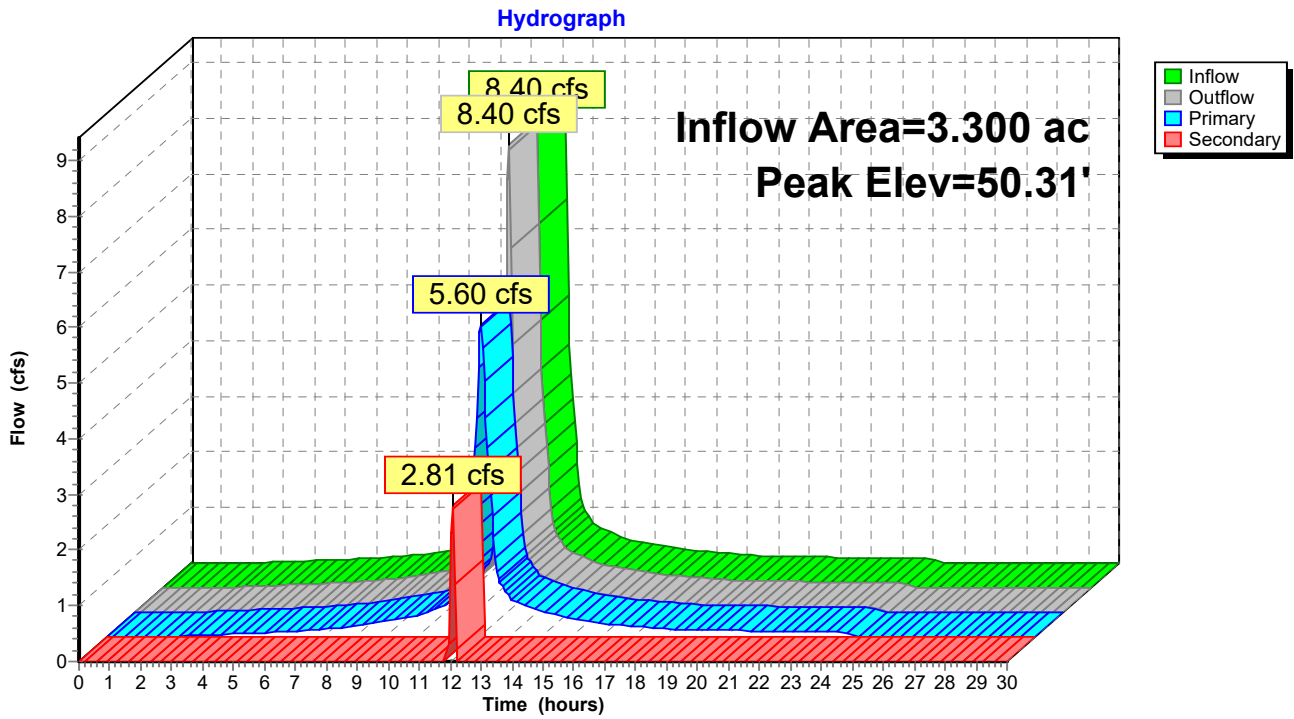
↑**1=Culvert** (Barrel Controls 5.55 cfs @ 4.67 fps)

Secondary OutFlow Max=2.63 cfs @ 12.09 hrs HW=50.30' (Free Discharge)

↑**2=Culvert** (Passes 2.63 cfs of 51.59 cfs potential flow)

↑**3=Sharp-Crested Rectangular Weir** (Weir Controls 2.63 cfs @ 1.79 fps)

Pond FS-1:



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Stage-Area-Storage for Pond FS-1:

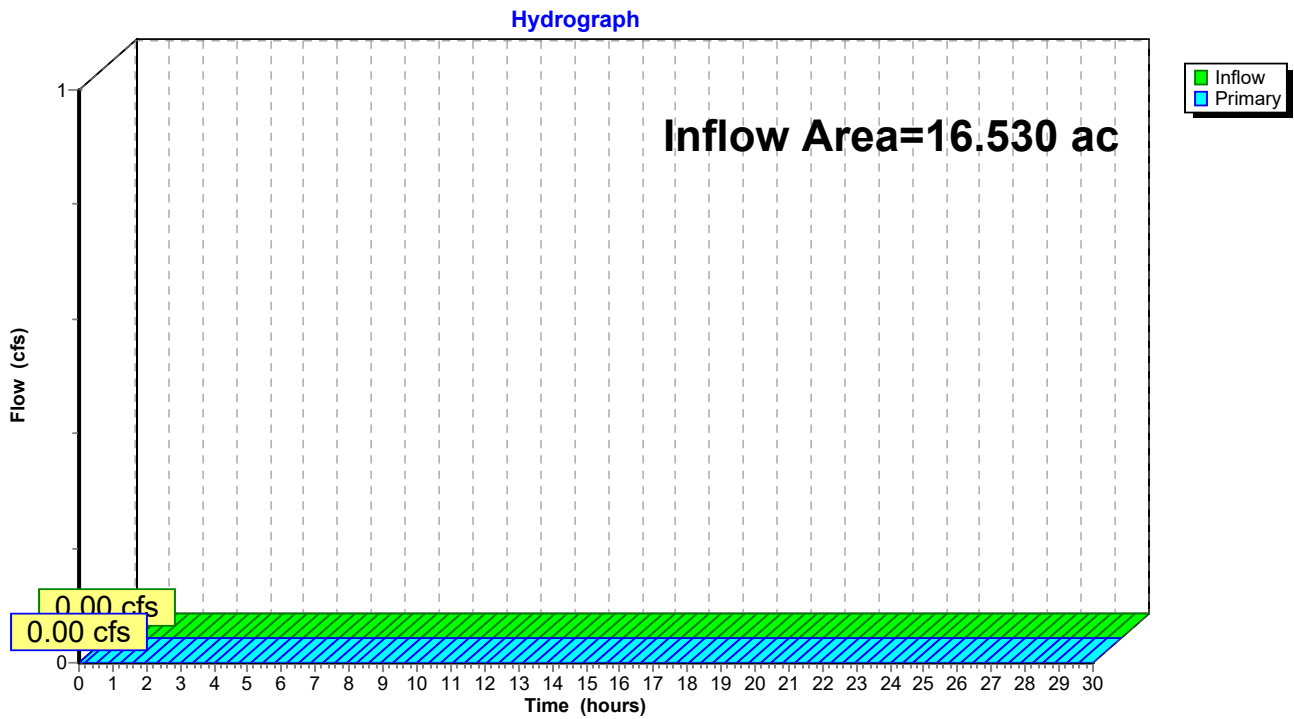
<u>Elevation</u> <u>(feet)</u>	<u>Storage</u> <u>(acre-feet)</u>	<u>Elevation</u> <u>(feet)</u>	<u>Storage</u> <u>(acre-feet)</u>
46.50	0.000	49.15	0.000
46.55	0.000	49.20	0.000
46.60	0.000	49.25	0.000
46.65	0.000	49.30	0.000
46.70	0.000	49.35	0.000
46.75	0.000	49.40	0.000
46.80	0.000	49.45	0.000
46.85	0.000	49.50	0.000
46.90	0.000	49.55	0.000
46.95	0.000	49.60	0.000
47.00	0.000	49.65	0.000
47.05	0.000	49.70	0.000
47.10	0.000	49.75	0.000
47.15	0.000	49.80	0.000
47.20	0.000	49.85	0.000
47.25	0.000	49.90	0.000
47.30	0.000	49.95	0.000
47.35	0.000	50.00	0.000
47.40	0.000	50.05	0.000
47.45	0.000	50.10	0.000
47.50	0.000	50.15	0.000
47.55	0.000	50.20	0.000
47.60	0.000	50.25	0.000
47.65	0.000	50.30	0.000
47.70	0.000		
47.75	0.000		
47.80	0.000		
47.85	0.000		
47.90	0.000		
47.95	0.000		
48.00	0.000		
48.05	0.000		
48.10	0.000		
48.15	0.000		
48.20	0.000		
48.25	0.000		
48.30	0.000		
48.35	0.000		
48.40	0.000		
48.45	0.000		
48.50	0.000		
48.55	0.000		
48.60	0.000		
48.65	0.000		
48.70	0.000		
48.75	0.000		
48.80	0.000		
48.85	0.000		
48.90	0.000		
48.95	0.000		
49.00	0.000		
49.05	0.000		
49.10	0.000		

Summary for Link PR-DP-1: Existing Drainage Channel

Inflow Area = 16.530 ac, 63.76% Impervious, Inflow Depth = 0.00" for 1-Year event
Inflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs

Link PR-DP-1: Existing Drainage Channel



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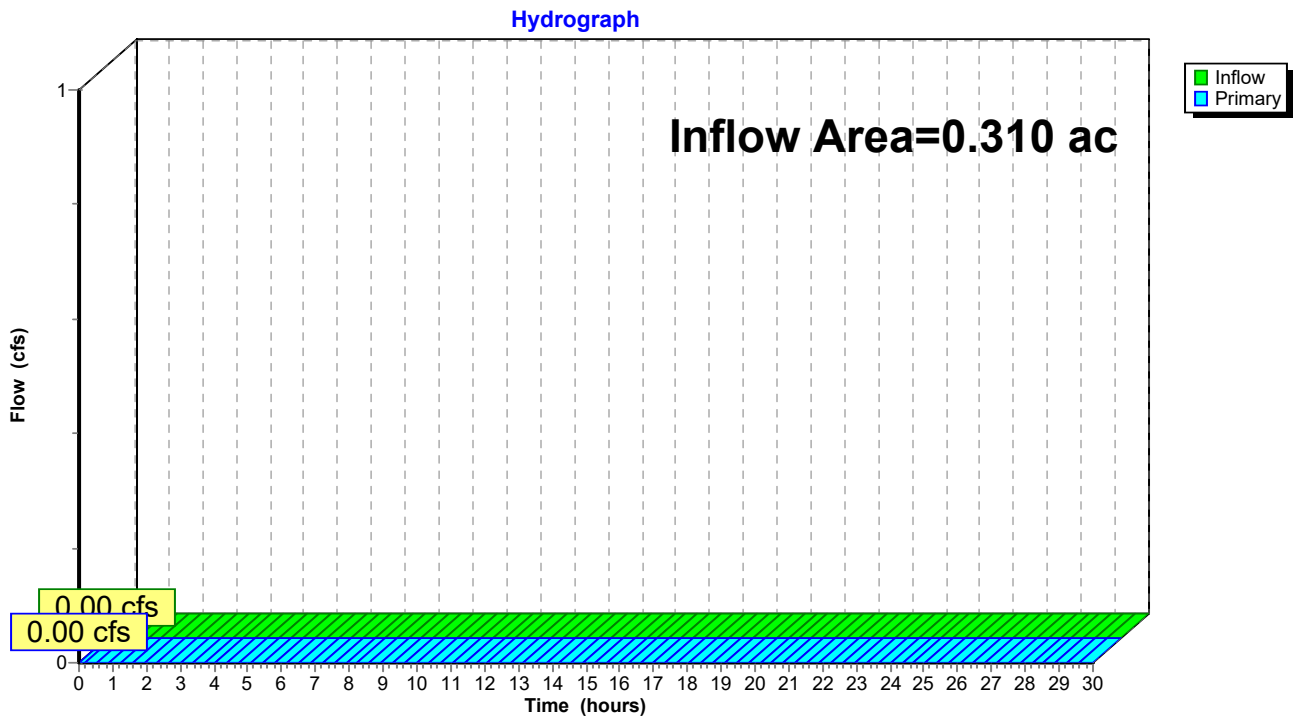
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Summary for Link PR-DP-2: Goddard Drive

Inflow Area = 0.310 ac, 0.00% Impervious, Inflow Depth = 0.00" for 1-Year event
Inflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs

Link PR-DP-2: Goddard Drive



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Type III 24-hr 10-Year Rainfall=4.90"

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Summary for Subcatchment PWS-1: 10.62 AC

Runoff = 33.15 cfs @ 12.09 hrs, Volume= 2.403 af, Depth= 2.72"

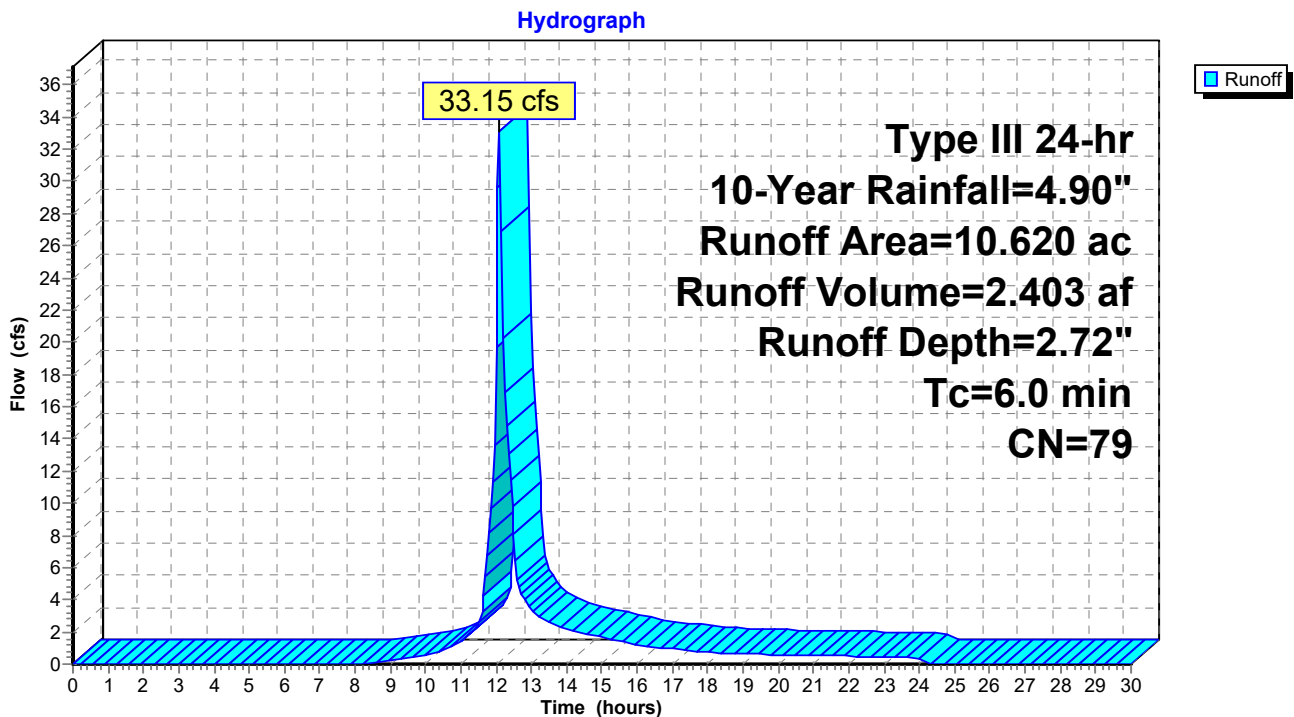
Routed to Pond BMP-2A : Sediment Forebay

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.90"

Area (ac)	CN	Description
2.420	98	Paved parking, HSG A
4.820	98	Roofs, HSG A
0.470	30	Brush, Good, HSG A
2.910	39	>75% Grass cover, Good, HSG A
10.620	79	Weighted Average
3.380	38	31.83% Pervious Area
7.240	98	68.17% Impervious Area

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

Subcatchment PWS-1: 10.62 AC



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Type III 24-hr 10-Year Rainfall=4.90"

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Summary for Subcatchment PWS-1L: 3.30 AC

Runoff = 15.44 cfs @ 12.09 hrs, Volume= 1.282 af, Depth= 4.66"
Routed to Pond FS-1 :

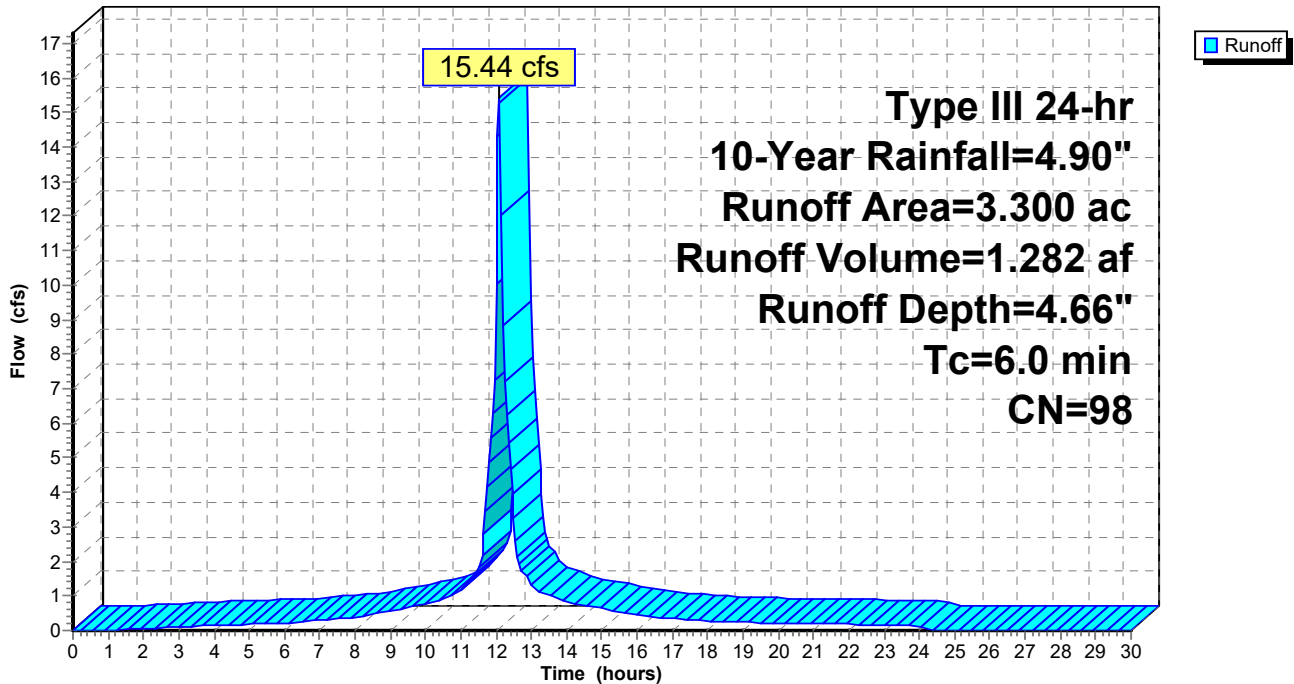
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.90"

Area (ac)	CN	Description
3.300	98	Paved parking, HSG A
3.300	98	100.00% Impervious Area

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

Subcatchment PWS-1L: 3.30 AC

Hydrograph



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Type III 24-hr 10-Year Rainfall=4.90"

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Summary for Subcatchment PWS-2: 0.31 AC

Runoff = 0.01 cfs @ 12.50 hrs, Volume= 0.005 af, Depth= 0.18"
 Routed to Link PR-DP-2 : Goddard Drive

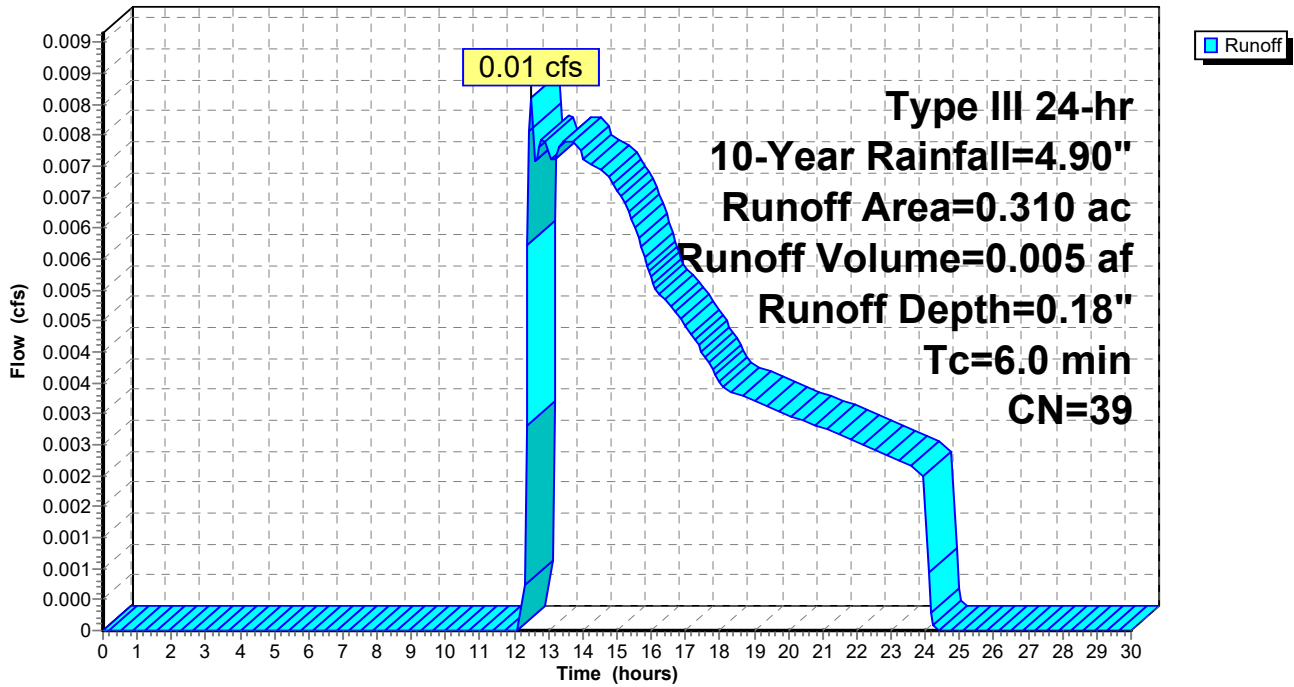
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
 Type III 24-hr 10-Year Rainfall=4.90"

Area (ac)	CN	Description
0.310	39	>75% Grass cover, Good, HSG A
0.310	39	100.00% Pervious Area

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

Subcatchment PWS-2: 0.31 AC

Hydrograph



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Type III 24-hr 10-Year Rainfall=4.90"

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Summary for Subcatchment PWS-B1: (1.92 AC Bypass)

Runoff = 0.03 cfs @ 14.79 hrs, Volume= 0.019 af, Depth= 0.12"

Routed to Link PR-DP-1 : Existing Drainage Channel

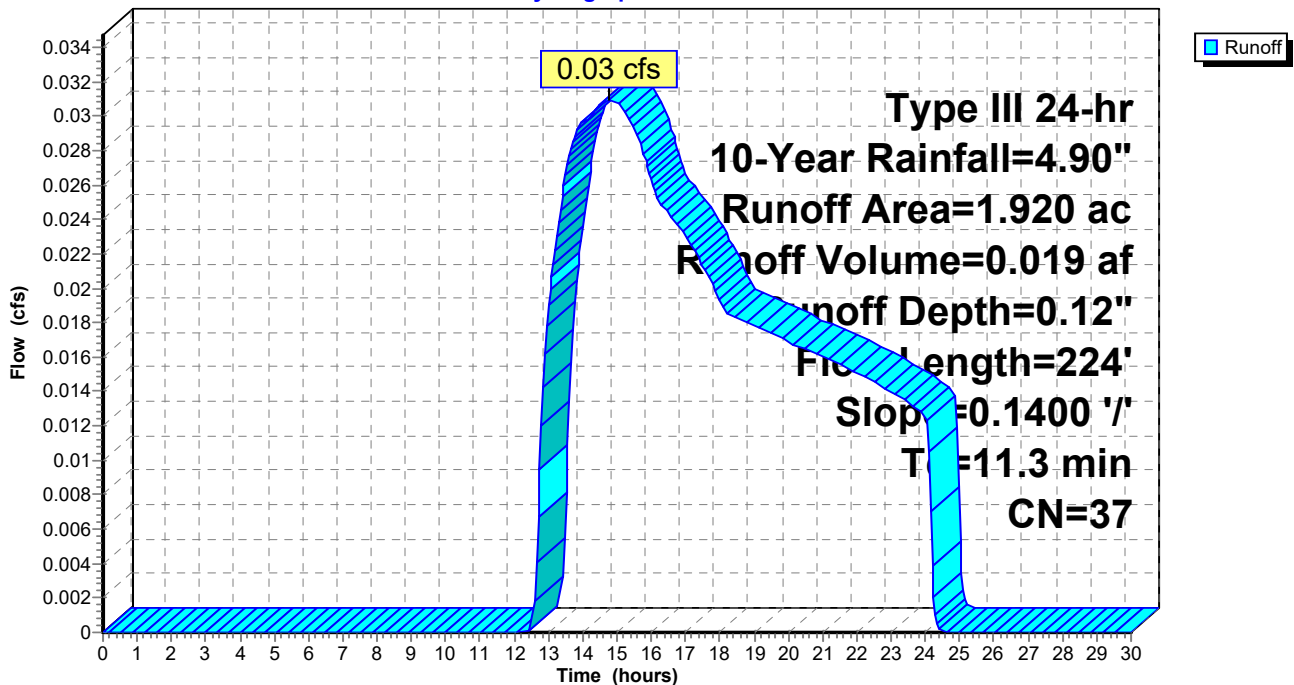
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.90"

Area (ac)	CN	Description
1.150	39	>75% Grass cover, Good, HSG A
0.080	61	>75% Grass cover, Good, HSG B
0.690	30	Woods, Good, HSG A
1.920	37	Weighted Average
1.920	37	100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.7	50	0.1400	0.09		Sheet Flow, A-B Woods: Dense underbrush n= 0.800 P2= 3.30"
1.6	174	0.1400	1.87		Shallow Concentrated Flow, B-C Woodland Kv= 5.0 fps
11.3	224	Total			

Subcatchment PWS-B1: (1.92 AC Bypass)

Hydrograph



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Type III 24-hr 10-Year Rainfall=4.90"

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Summary for Subcatchment PWS-B2: (0.69 AC Bypass)

Runoff = 0.00 cfs @ 17.21 hrs, Volume= 0.002 af, Depth= 0.03"

Routed to Link PR-DP-1 : Existing Drainage Channel

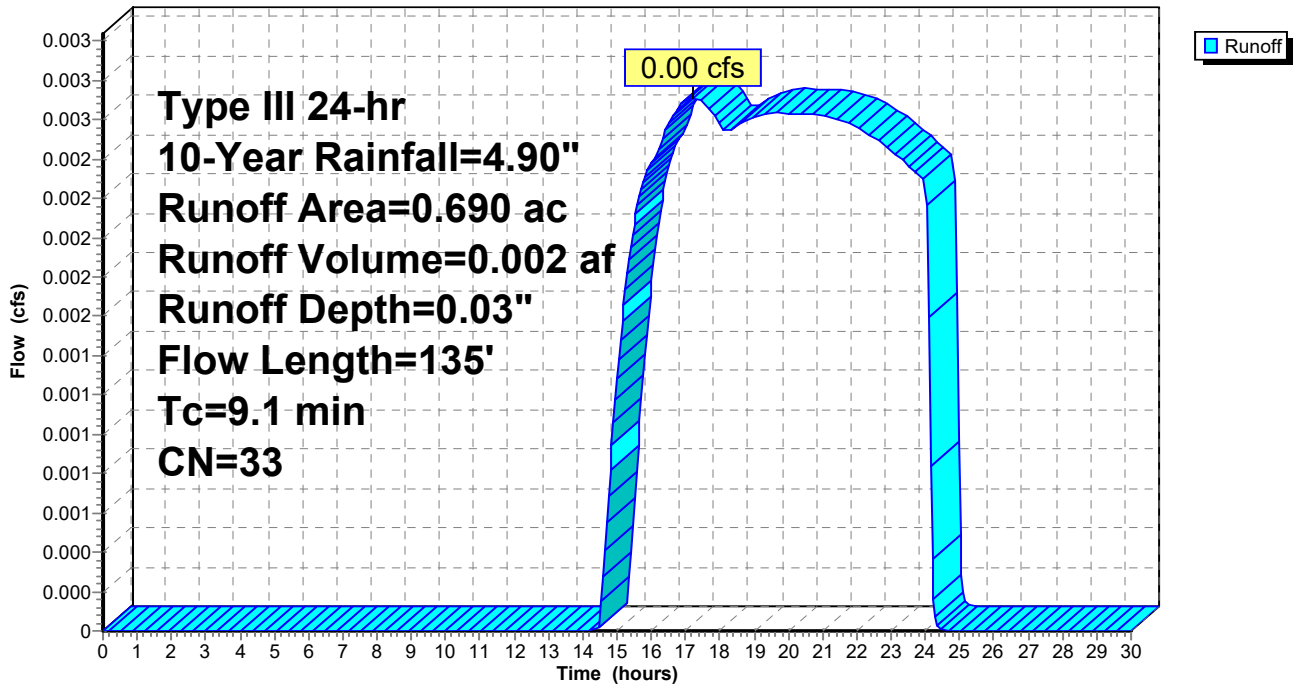
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.90"

Area (ac)	CN	Description
0.220	39	>75% Grass cover, Good, HSG A
0.470	30	Woods, Good, HSG A
0.690	33	Weighted Average
0.690	33	100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.8	50	0.2400	0.11		Sheet Flow, A-B Woods: Dense underbrush n= 0.800 P2= 3.30"
1.3	85	0.0500	1.12		Shallow Concentrated Flow, B-C Woodland Kv= 5.0 fps
9.1	135	Total			

Subcatchment PWS-B2: (0.69 AC Bypass)

Hydrograph



7287-00 HydroCAD Analysis

Type III 24-hr 10-Year Rainfall=4.90"

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Summary for Pond BMP-1A: Sediment Forebay

Inflow Area = 3.300 ac, 100.00% Impervious, Inflow Depth = 4.10" for 10-Year event
 Inflow = 6.73 cfs @ 12.09 hrs, Volume= 1.128 af
 Outflow = 6.68 cfs @ 12.09 hrs, Volume= 1.028 af, Atten= 1%, Lag= 0.3 min
 Primary = 6.68 cfs @ 12.09 hrs, Volume= 1.028 af
 Routed to Pond BMP-1B : Sand Filter (Water Quality)

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs / 2
 Peak Elev= 47.61' @ 12.09 hrs Surf.Area= 4,752 sf Storage= 4,580 cf

Plug-Flow detention time= 88.3 min calculated for 1.028 af (91% of inflow)
 Center-of-Mass det. time= 41.0 min (792.4 - 751.5)

Volume	Invert	Avail.Storage	Storage Description
#1	45.50'	4,389 cf	Custom Stage Data (Prismatic) Listed below (Recalc)
#2	44.00'	670 cf	Custom Stage Data (Prismatic) Listed below (Recalc)
			2,031 cf Overall x 33.0% Voids
#3	43.25'	332 cf	Custom Stage Data (Prismatic) Listed below (Recalc)
			1,016 cf Overall - 10 cf Embedded = 1,005 cf x 33.0% Voids
#4	43.40'	10 cf	4.0" Round Pipe Storage x 3 Inside #3 L= 40.0'
		5,402 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
45.50	1,354	0	0
46.00	1,500	714	714
47.50	2,007	2,630	3,344
48.00	2,175	1,046	4,389

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
44.00	1,354	0	0
45.50	1,354	2,031	2,031

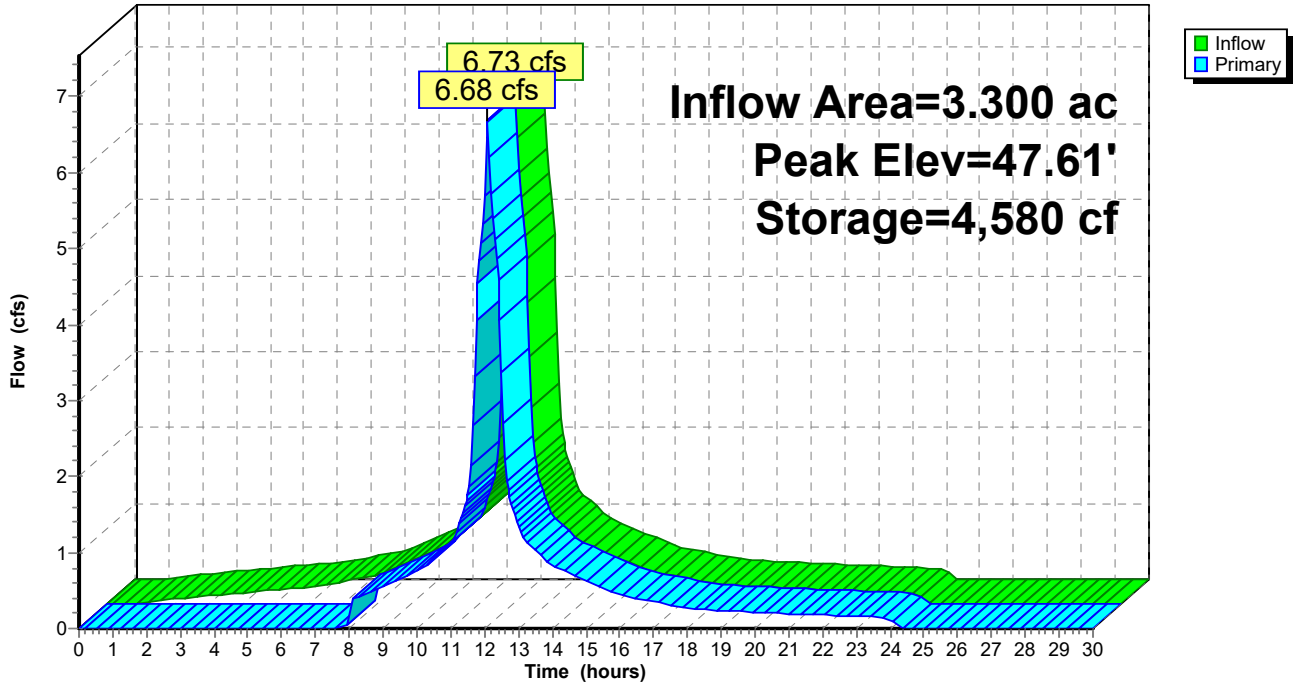
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
43.25	1,354	0	0
44.00	1,354	1,016	1,016

Device	Routing	Invert	Outlet Devices
#1	Primary	47.50'	55.0' long Sharp-Crested Rectangular Weir 2 End Contraction(s)

Primary OutFlow Max=6.55 cfs @ 12.09 hrs HW=47.61' (Free Discharge)
 ↑1=Sharp-Crested Rectangular Weir (Weir Controls 6.55 cfs @ 1.08 fps)

Pond BMP-1A: Sediment Forebay

Hydrograph



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Stage-Area-Storage for Pond BMP-1A: Sediment Forebay

Elevation (feet)	Storage (cubic-feet)	Elevation (feet)	Storage (cubic-feet)
43.25	0	45.90	1,577
43.30	22	45.95	1,651
43.35	45	46.00	1,726
43.40	67	46.05	1,801
43.45	90	46.10	1,878
43.50	113	46.15	1,955
43.55	137	46.20	2,033
43.60	161	46.25	2,111
43.65	184	46.30	2,191
43.70	208	46.35	2,272
43.75	230	46.40	2,353
43.80	253	46.45	2,435
43.85	275	46.50	2,518
43.90	297	46.55	2,602
43.95	320	46.60	2,687
44.00	342	46.65	2,772
44.05	364	46.70	2,859
44.10	387	46.75	2,946
44.15	409	46.80	3,034
44.20	431	46.85	3,123
44.25	454	46.90	3,213
44.30	476	46.95	3,303
44.35	499	47.00	3,395
44.40	521	47.05	3,487
44.45	543	47.10	3,580
44.50	566	47.15	3,674
44.55	588	47.20	3,769
44.60	610	47.25	3,865
44.65	633	47.30	3,961
44.70	655	47.35	4,059
44.75	677	47.40	4,157
44.80	700	47.45	4,256
44.85	722	47.50	4,356
44.90	744	47.55	4,457
44.95	767	47.60	4,558
45.00	789	47.65	4,661
45.05	811	47.70	4,764
45.10	834	47.75	4,868
45.15	856	47.80	4,973
45.20	878	47.85	5,079
45.25	901	47.90	5,186
45.30	923	47.95	5,293
45.35	945	48.00	5,402
45.40	968		
45.45	990		
45.50	1,012		
45.55	1,080		
45.60	1,149		
45.65	1,219		
45.70	1,289		
45.75	1,360		
45.80	1,432		
45.85	1,504		

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Summary for Pond BMP-1B: Sand Filter (Water Quality)

[81] Warning: Exceeded Pond BMP-1A by 0.03' @ 12.15 hrs

Inflow Area = 3.300 ac, 100.00% Impervious, Inflow Depth = 3.74" for 10-Year event
 Inflow = 6.68 cfs @ 12.09 hrs, Volume= 1.028 af
 Outflow = 6.62 cfs @ 12.12 hrs, Volume= 1.022 af, Atten= 1%, Lag= 1.7 min
 Primary = 0.63 cfs @ 12.12 hrs, Volume= 0.731 af
 Routed to Pond BMP-2A : Sediment Forebay
 Secondary = 5.99 cfs @ 12.12 hrs, Volume= 0.291 af
 Routed to Pond BMP-2A : Sediment Forebay

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs / 2
 Peak Elev= 47.64' @ 12.12 hrs Surf.Area= 11,992 sf Storage= 11,655 cf

Plug-Flow detention time= 146.6 min calculated for 1.020 af (99% of inflow)
 Center-of-Mass det. time= 143.1 min (935.5 - 792.4)

Volume	Invert	Avail.Storage	Storage Description
#1	45.50'	10,815 cf	Custom Stage Data (Prismatic) Listed below (Recalc)
#2	44.00'	1,762 cf	Custom Stage Data (Prismatic) Listed below (Recalc)
			5,340 cf Overall x 33.0% Voids
#3	43.25'	873 cf	Custom Stage Data (Prismatic) Listed below (Recalc)
			2,670 cf Overall - 24 cf Embedded = 2,646 cf x 33.0% Voids
#4	43.40'	24 cf	4.0" Round Pipe Storage x 3 Inside #3 L= 90.0'
		13,474 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
45.50	3,560	0	0
46.00	3,865	1,856	1,856
47.50	4,780	6,484	8,340
48.00	5,120	2,475	10,815

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
44.00	3,560	0	0
45.50	3,560	5,340	5,340

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
43.25	3,560	0	0
44.00	3,560	2,670	2,670

Device	Routing	Invert	Outlet Devices
#1	Primary	43.40'	4.0" Round Culvert L= 55.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 43.40' / 42.50' S= 0.0164 ' / ' Cc= 0.900 n= 0.010 PVC, smooth interior, Flow Area= 0.09 sf
#2	Secondary	47.50'	50.0' long x 6.0' breadth Broad-Crested Rectangular Weir

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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
	2.65	2.66	2.66	2.67	2.69	2.72	2.76	2.83		

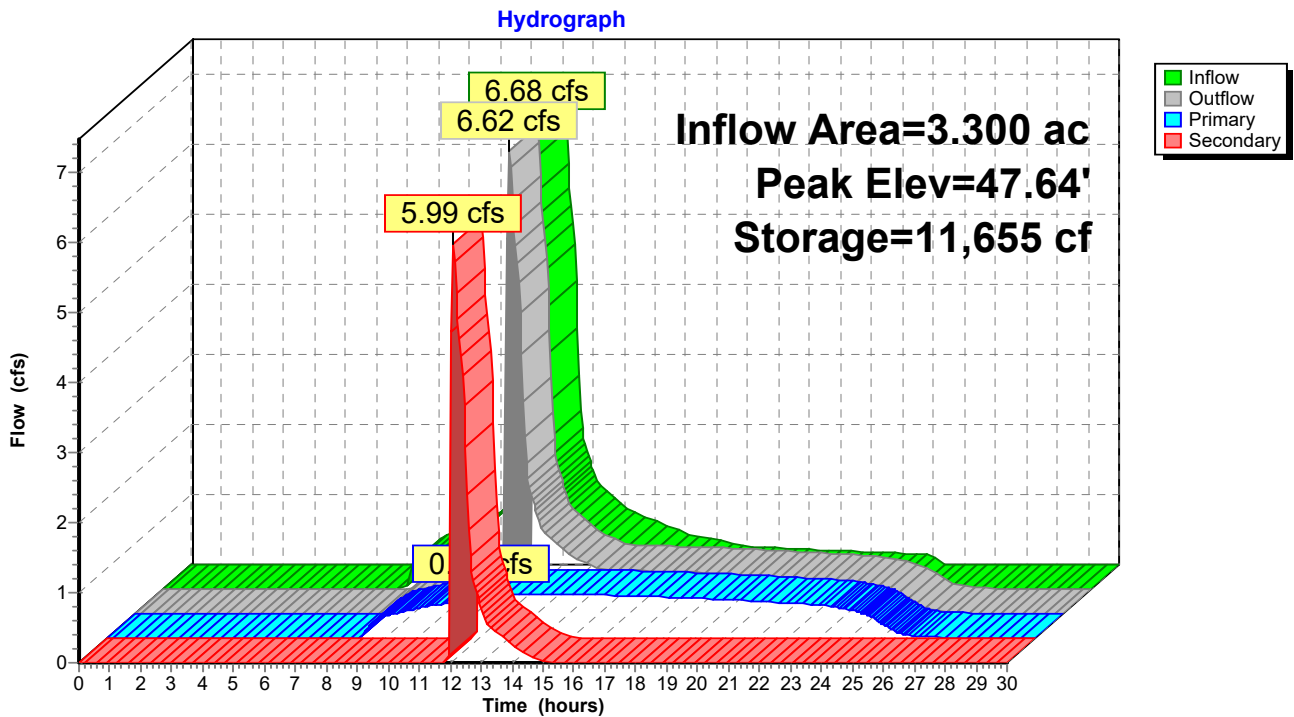
Primary OutFlow Max=0.63 cfs @ 12.12 hrs HW=47.63' (Free Discharge)

↑1=Culvert (Barrel Controls 0.63 cfs @ 7.23 fps)

Secondary OutFlow Max=5.78 cfs @ 12.12 hrs HW=47.63' (Free Discharge)

↑2=Broad-Crested Rectangular Weir (Weir Controls 5.78 cfs @ 0.87 fps)

Pond BMP-1B: Sand Filter (Water Quality)



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Stage-Area-Storage for Pond BMP-1B: Sand Filter (Water Quality)

Elevation (feet)	Storage (cubic-feet)	Elevation (feet)	Storage (cubic-feet)
43.25	0	45.90	4,132
43.30	59	45.95	4,323
43.35	117	46.00	4,515
43.40	176	46.05	4,709
43.45	236	46.10	4,905
43.50	298	46.15	5,102
43.55	359	46.20	5,301
43.60	421	46.25	5,501
43.65	483	46.30	5,702
43.70	544	46.35	5,905
43.75	603	46.40	6,110
43.80	662	46.45	6,316
43.85	721	46.50	6,524
43.90	779	46.55	6,733
43.95	838	46.60	6,944
44.00	897	46.65	7,156
44.05	956	46.70	7,370
44.10	1,014	46.75	7,586
44.15	1,073	46.80	7,803
44.20	1,132	46.85	8,021
44.25	1,191	46.90	8,241
44.30	1,249	46.95	8,462
44.35	1,308	47.00	8,685
44.40	1,367	47.05	8,910
44.45	1,426	47.10	9,136
44.50	1,484	47.15	9,363
44.55	1,543	47.20	9,593
44.60	1,602	47.25	9,823
44.65	1,661	47.30	10,055
44.70	1,719	47.35	10,289
44.75	1,778	47.40	10,524
44.80	1,837	47.45	10,761
44.85	1,895	47.50	10,999
44.90	1,954	47.55	11,239
44.95	2,013	47.60	11,480
45.00	2,072	47.65	11,724
45.05	2,130	47.70	11,969
45.10	2,189	47.75	12,215
45.15	2,248	47.80	12,464
45.20	2,307	47.85	12,714
45.25	2,365	47.90	12,965
45.30	2,424	47.95	13,219
45.35	2,483	48.00	13,474
45.40	2,542		
45.45	2,600		
45.50	2,659		
45.55	2,838		
45.60	3,018		
45.65	3,200		
45.70	3,383		
45.75	3,568		
45.80	3,755		
45.85	3,942		

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Summary for Pond BMP-2A: Sediment Forebay

Inflow Area = 13.920 ac, 75.72% Impervious, Inflow Depth = 3.09" for 10-Year event
 Inflow = 48.27 cfs @ 12.09 hrs, Volume= 3.580 af
 Outflow = 47.17 cfs @ 12.10 hrs, Volume= 3.508 af, Atten= 2%, Lag= 0.6 min
 Discarded = 0.36 cfs @ 12.10 hrs, Volume= 0.553 af
 Primary = 46.81 cfs @ 12.10 hrs, Volume= 2.955 af
 Routed to Pond BMP-2B : Detention Basin

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs / 3
 Peak Elev= 42.36' @ 12.10 hrs Surf.Area= 6,477 sf Storage= 10,169 cf

Plug-Flow detention time= 50.7 min calculated for 3.508 af (98% of inflow)
 Center-of-Mass det. time= 38.2 min (890.7 - 852.5)

Volume	Invert	Avail.Storage	Storage Description
#1	40.00'	22,436 cf	Custom Stage Data (Prismatic) Listed below (Recalc)
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
40.00	1,869	0	0
42.00	6,020	7,889	7,889
44.00	8,527	14,547	22,436

Device	Routing	Invert	Outlet Devices
#1	Discarded	40.00'	2.410 in/hr Exfiltration over Surface area
#2	Primary	42.00'	65.0' long Sharp-Crested Rectangular Weir 2 End Contraction(s)

Discarded OutFlow Max=0.36 cfs @ 12.10 hrs HW=42.36' (Free Discharge)
 ↑1=Exfiltration (Exfiltration Controls 0.36 cfs)

Primary OutFlow Max=46.37 cfs @ 12.10 hrs HW=42.36' (Free Discharge)
 ↑2=Sharp-Crested Rectangular Weir (Weir Controls 46.37 cfs @ 1.97 fps)

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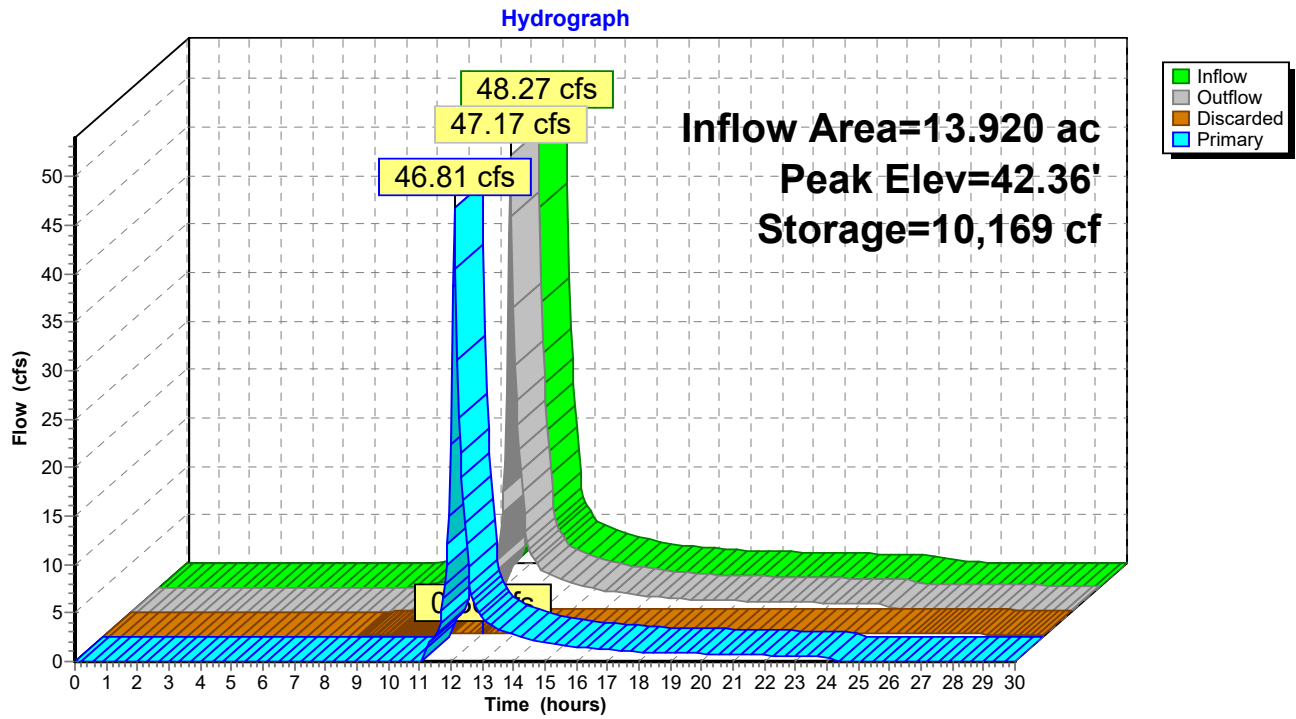
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Pond BMP-2A: Sediment Forebay



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Stage-Area-Storage for Pond BMP-2A: Sediment Forebay

Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)	Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)
40.00	1,869	0	42.65	6,835	12,067
40.05	1,973	96	42.70	6,897	12,410
40.10	2,077	197	42.75	6,960	12,757
40.15	2,180	304	42.80	7,023	13,106
40.20	2,284	415	42.85	7,085	13,459
40.25	2,388	532	42.90	7,148	13,815
40.30	2,492	654	42.95	7,211	14,174
40.35	2,595	781	43.00	7,274	14,536
40.40	2,699	914	43.05	7,336	14,901
40.45	2,803	1,051	43.10	7,399	15,269
40.50	2,907	1,194	43.15	7,462	15,641
40.55	3,011	1,342	43.20	7,524	16,016
40.60	3,114	1,495	43.25	7,587	16,393
40.65	3,218	1,653	43.30	7,650	16,774
40.70	3,322	1,817	43.35	7,712	17,158
40.75	3,426	1,985	43.40	7,775	17,545
40.80	3,529	2,159	43.45	7,838	17,936
40.85	3,633	2,338	43.50	7,900	18,329
40.90	3,737	2,523	43.55	7,963	18,726
40.95	3,841	2,712	43.60	8,026	19,125
41.00	3,945	2,907	43.65	8,088	19,528
41.05	4,048	3,107	43.70	8,151	19,934
41.10	4,152	3,312	43.75	8,214	20,343
41.15	4,256	3,522	43.80	8,276	20,756
41.20	4,360	3,737	43.85	8,339	21,171
41.25	4,463	3,958	43.90	8,402	21,590
41.30	4,567	4,183	43.95	8,464	22,011
41.35	4,671	4,414	44.00	8,527	22,436
41.40	4,775	4,651			
41.45	4,878	4,892			
41.50	4,982	5,138			
41.55	5,086	5,390			
41.60	5,190	5,647			
41.65	5,294	5,909			
41.70	5,397	6,176			
41.75	5,501	6,449			
41.80	5,605	6,727			
41.85	5,709	7,009			
41.90	5,812	7,297			
41.95	5,916	7,591			
42.00	6,020	7,889			
42.05	6,083	8,192			
42.10	6,145	8,497			
42.15	6,208	8,806			
42.20	6,271	9,118			
42.25	6,333	9,433			
42.30	6,396	9,751			
42.35	6,459	10,073			
42.40	6,521	10,397			
42.45	6,584	10,725			
42.50	6,647	11,056			
42.55	6,709	11,390			
42.60	6,772	11,727			

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Summary for Pond BMP-2B: Detention Basin

Inflow Area = 13.920 ac, 75.72% Impervious, Inflow Depth = 2.55" for 10-Year event
 Inflow = 46.81 cfs @ 12.10 hrs, Volume= 2.955 af
 Outflow = 3.66 cfs @ 13.29 hrs, Volume= 2.564 af, Atten= 92%, Lag= 71.5 min
 Discarded = 1.27 cfs @ 13.29 hrs, Volume= 1.600 af
 Primary = 2.39 cfs @ 13.29 hrs, Volume= 0.965 af
 Routed to Link PR-DP-1 : Existing Drainage Channel
 Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
 Routed to Link PR-DP-1 : Existing Drainage Channel

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs / 3
 Peak Elev= 38.20' @ 13.29 hrs Surf.Area= 22,724 sf Storage= 67,339 cf

Plug-Flow detention time= 347.2 min calculated for 2.560 af (87% of inflow)
 Center-of-Mass det. time= 287.9 min (1,128.0 - 840.2)

Volume	Invert	Avail.Storage	Storage Description
#1	34.00'	186,688 cf	Custom Stage Data (Prismatic) Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
34.00	10,145	0	0
36.00	15,490	25,635	25,635
38.00	21,685	37,175	62,810
40.00	31,870	53,555	116,365
42.00	38,453	70,323	186,688

Device	Routing	Invert	Outlet Devices
#1	Discarded	34.00'	2.410 in/hr Exfiltration over Surface area
#2	Primary	30.00'	24.0" Round Culvert L= 100.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 30.00' / 28.00' S= 0.0200 '/ Cc= 0.900 n= 0.012, Flow Area= 3.14 sf
#3	Device 2	35.70'	3.5" Vert. Orifice/Grate C= 0.600 Limited to weir flow at low heads
#4	Device 2	37.50'	12.0" W x 10.0" H Vert. Orifice/Grate C= 0.600 Limited to weir flow at low heads
#5	Device 2	39.00'	5.0' long Sharp-Crested Rectangular Weir 2 End Contraction(s)
#6	Secondary	40.50'	50.0' long + 10.0' SideZ x 8.0' 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) 2.43 2.54 2.70 2.69 2.68 2.68 2.66 2.66 2.64 2.64 2.64 2.65 2.65 2.66 2.66 2.68 2.70 2.74

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Discarded OutFlow Max=1.27 cfs @ 13.29 hrs HW=38.20' (Free Discharge)

↳ **1=Exfiltration** (Exfiltration Controls 1.27 cfs)

Primary OutFlow Max=2.39 cfs @ 13.29 hrs HW=38.20' (Free Discharge)

↳ **2=Culvert** (Passes 2.39 cfs of 40.60 cfs potential flow)

↳ **3=Orifice/Grate** (Orifice Controls 0.49 cfs @ 7.39 fps)

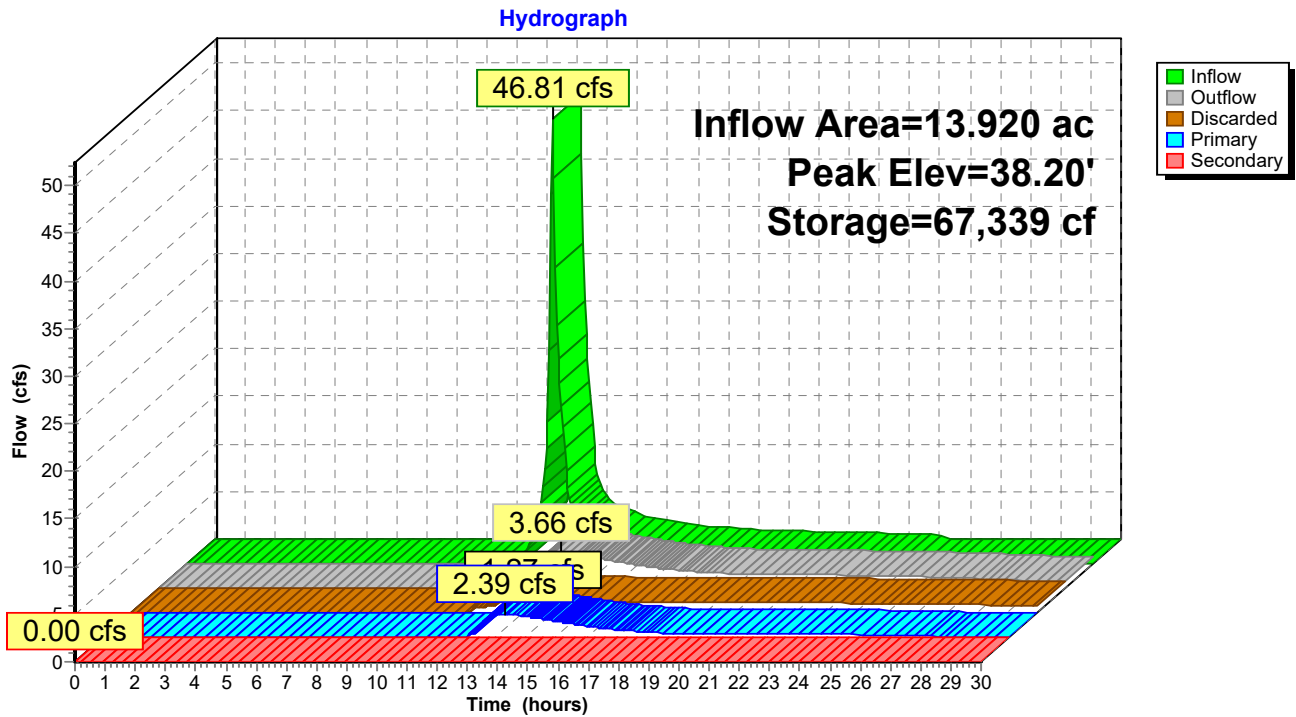
↳ **4=Orifice/Grate** (Orifice Controls 1.90 cfs @ 2.69 fps)

↳ **5=Sharp-Crested Rectangular Weir** (Controls 0.00 cfs)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=34.00' (Free Discharge)

↳ **6=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond BMP-2B: Detention Basin



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Stage-Area-Storage for Pond BMP-2B: Detention Basin

Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)	Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)
34.00	10,145	0	39.30	28,305	95,304
34.10	10,412	1,028	39.40	28,814	98,160
34.20	10,680	2,082	39.50	29,324	101,067
34.30	10,947	3,164	39.60	29,833	104,024
34.40	11,214	4,272	39.70	30,342	107,033
34.50	11,481	5,407	39.80	30,851	110,093
34.60	11,749	6,568	39.90	31,361	113,203
34.70	12,016	7,756	40.00	31,870	116,365
34.80	12,283	8,971	40.10	32,199	119,568
34.90	12,550	10,213	40.20	32,528	122,805
35.00	12,818	11,481	40.30	32,857	126,074
35.10	13,085	12,776	40.40	33,187	129,376
35.20	13,352	14,098	40.50	33,516	132,711
35.30	13,619	15,447	40.60	33,845	136,079
35.40	13,886	16,822	40.70	34,174	139,480
35.50	14,154	18,224	40.80	34,503	142,914
35.60	14,421	19,653	40.90	34,832	146,381
35.70	14,688	21,108	41.00	35,162	149,881
35.80	14,955	22,590	41.10	35,491	153,413
35.90	15,223	24,099	41.20	35,820	156,979
36.00	15,490	25,635	41.30	36,149	160,577
36.10	15,800	27,199	41.40	36,478	164,209
36.20	16,110	28,795	41.50	36,807	167,873
36.30	16,419	30,421	41.60	37,136	171,570
36.40	16,729	32,079	41.70	37,466	175,300
36.50	17,039	33,767	41.80	37,795	179,063
36.60	17,349	35,487	41.90	38,124	182,859
36.70	17,658	37,237	42.00	38,453	186,688
36.80	17,968	39,018			
36.90	18,278	40,830			
37.00	18,588	42,674			
37.10	18,897	44,548			
37.20	19,207	46,453			
37.30	19,517	48,389			
37.40	19,826	50,357			
37.50	20,136	52,355			
37.60	20,446	54,384			
37.70	20,756	56,444			
37.80	21,065	58,535			
37.90	21,375	60,657			
38.00	21,685	62,810			
38.10	22,194	65,004			
38.20	22,704	67,249			
38.30	23,213	69,545			
38.40	23,722	71,891			
38.50	24,231	74,289			
38.60	24,741	76,738			
38.70	25,250	79,237			
38.80	25,759	81,788			
38.90	26,268	84,389			
39.00	26,778	87,041			
39.10	27,287	89,744			
39.20	27,796	92,499			

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Type III 24-hr 10-Year Rainfall=4.90"

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Summary for Pond FS-1:

[57] Hint: Peaked at 50.67' (Flood elevation advised)

Inflow Area = 3.300 ac, 100.00% Impervious, Inflow Depth = 4.66" for 10-Year event
 Inflow = 15.44 cfs @ 12.09 hrs, Volume= 1.282 af
 Outflow = 15.44 cfs @ 12.09 hrs, Volume= 1.282 af, Atten= 0%, Lag= 0.0 min
 Primary = 6.73 cfs @ 12.09 hrs, Volume= 1.128 af
 Routed to Pond BMP-1A : Sediment Forebay
 Secondary = 8.71 cfs @ 12.09 hrs, Volume= 0.155 af
 Routed to Pond BMP-2A : Sediment Forebay

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs / 2
 Peak Elev= 50.67' @ 12.09 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	48.75'	15.0" Round Culvert L= 20.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 48.75' / 48.50' S= 0.0125 '/ Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.23 sf
#2	Secondary	46.50'	36.0" Round Culvert L= 200.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 46.50' / 44.00' S= 0.0125 '/ Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 7.07 sf
#3	Device 2	50.00'	5.0' long Sharp-Crested Rectangular Weir 2 End Contraction(s)

Primary OutFlow Max=6.66 cfs @ 12.09 hrs HW=50.65' (Free Discharge)
 ↑1=Culvert (Barrel Controls 6.66 cfs @ 5.43 fps)

Secondary OutFlow Max=8.36 cfs @ 12.09 hrs HW=50.65' (Free Discharge)
 ↑2=Culvert (Passes 8.36 cfs of 55.42 cfs potential flow)
 ↑3=Sharp-Crested Rectangular Weir (Weir Controls 8.36 cfs @ 2.64 fps)

7287-00 HydroCAD Analysis

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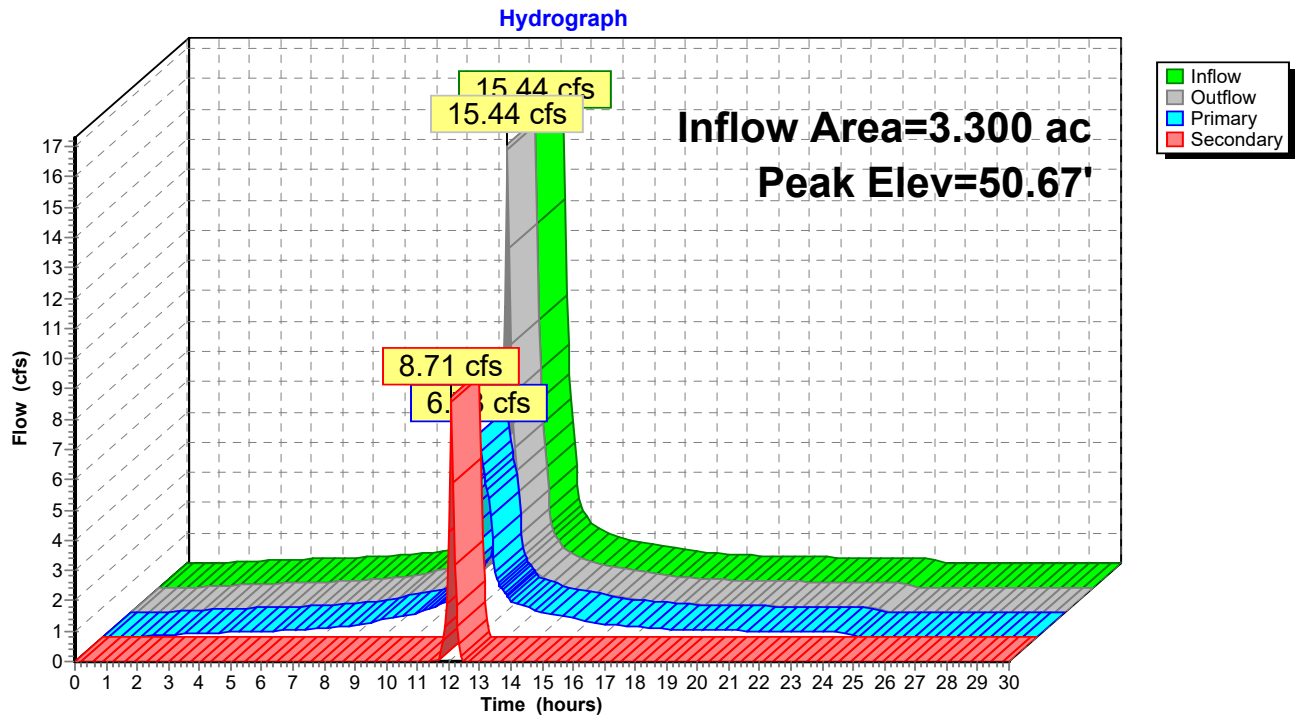
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Type III 24-hr 10-Year Rainfall=4.90"

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Pond FS-1:



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Type III 24-hr 10-Year Rainfall=4.90"

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Stage-Area-Storage for Pond FS-1:

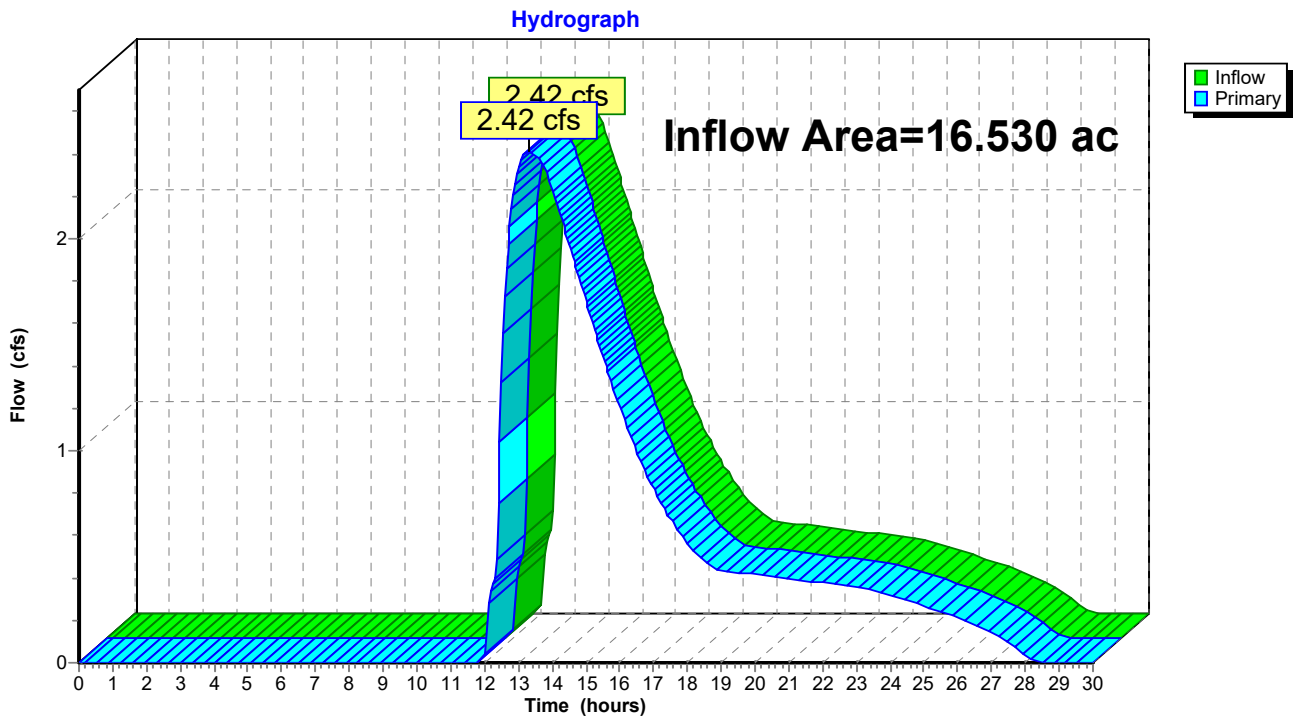
Elevation (feet)	Storage (acre-feet)	Elevation (feet)	Storage (acre-feet)
46.50	0.000	49.15	0.000
46.55	0.000	49.20	0.000
46.60	0.000	49.25	0.000
46.65	0.000	49.30	0.000
46.70	0.000	49.35	0.000
46.75	0.000	49.40	0.000
46.80	0.000	49.45	0.000
46.85	0.000	49.50	0.000
46.90	0.000	49.55	0.000
46.95	0.000	49.60	0.000
47.00	0.000	49.65	0.000
47.05	0.000	49.70	0.000
47.10	0.000	49.75	0.000
47.15	0.000	49.80	0.000
47.20	0.000	49.85	0.000
47.25	0.000	49.90	0.000
47.30	0.000	49.95	0.000
47.35	0.000	50.00	0.000
47.40	0.000	50.05	0.000
47.45	0.000	50.10	0.000
47.50	0.000	50.15	0.000
47.55	0.000	50.20	0.000
47.60	0.000	50.25	0.000
47.65	0.000	50.30	0.000
47.70	0.000	50.35	0.000
47.75	0.000	50.40	0.000
47.80	0.000	50.45	0.000
47.85	0.000	50.50	0.000
47.90	0.000	50.55	0.000
47.95	0.000	50.60	0.000
48.00	0.000	50.65	0.000
48.05	0.000		
48.10	0.000		
48.15	0.000		
48.20	0.000		
48.25	0.000		
48.30	0.000		
48.35	0.000		
48.40	0.000		
48.45	0.000		
48.50	0.000		
48.55	0.000		
48.60	0.000		
48.65	0.000		
48.70	0.000		
48.75	0.000		
48.80	0.000		
48.85	0.000		
48.90	0.000		
48.95	0.000		
49.00	0.000		
49.05	0.000		
49.10	0.000		

Summary for Link PR-DP-1: Existing Drainage Channel

Inflow Area = 16.530 ac, 63.76% Impervious, Inflow Depth = 0.72" for 10-Year event
Inflow = 2.42 cfs @ 13.31 hrs, Volume= 0.986 af
Primary = 2.42 cfs @ 13.31 hrs, Volume= 0.986 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs

Link PR-DP-1: Existing Drainage Channel



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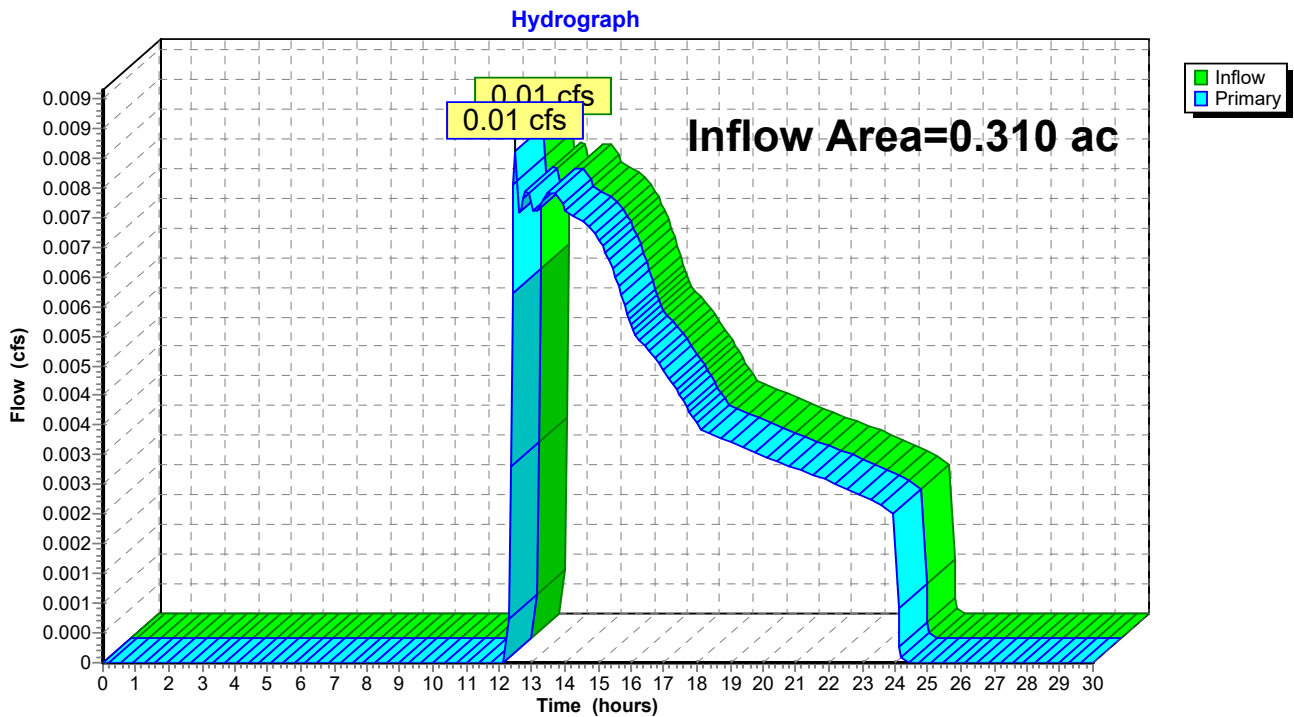
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Summary for Link PR-DP-2: Goddard Drive

Inflow Area = 0.310 ac, 0.00% Impervious, Inflow Depth = 0.18" for 10-Year event
Inflow = 0.01 cfs @ 12.50 hrs, Volume= 0.005 af
Primary = 0.01 cfs @ 12.50 hrs, Volume= 0.005 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs

Link PR-DP-2: Goddard Drive



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Type III 24-hr 100-Year Rainfall=8.70"

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Summary for Subcatchment PWS-1: 10.62 AC

Runoff = 73.78 cfs @ 12.09 hrs, Volume= 5.454 af, Depth= 6.16"

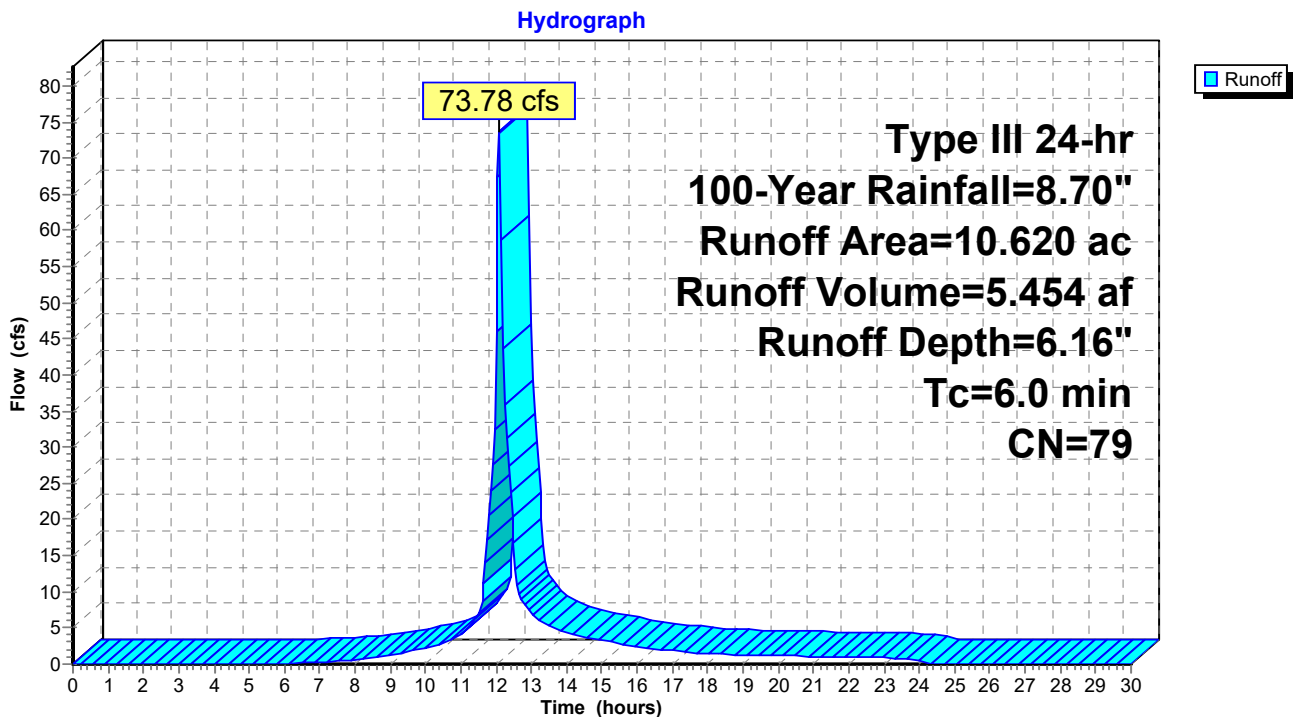
Routed to Pond BMP-2A : Sediment Forebay

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=8.70"

Area (ac)	CN	Description
2.420	98	Paved parking, HSG A
4.820	98	Roofs, HSG A
0.470	30	Brush, Good, HSG A
2.910	39	>75% Grass cover, Good, HSG A
10.620	79	Weighted Average
3.380	38	31.83% Pervious Area
7.240	98	68.17% Impervious Area

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

Subcatchment PWS-1: 10.62 AC



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Summary for Subcatchment PWS-1L: 3.30 AC

Runoff = 27.53 cfs @ 12.09 hrs, Volume= 2.326 af, Depth= 8.46"
Routed to Pond FS-1 :

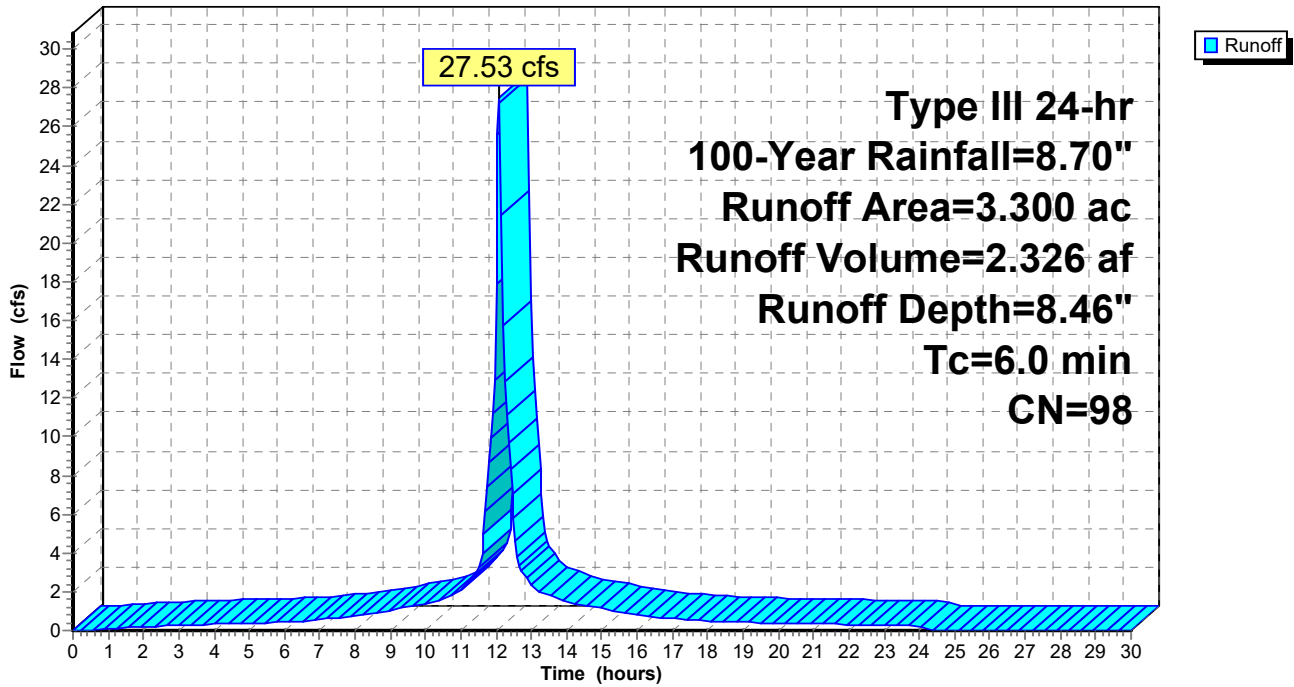
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=8.70"

Area (ac)	CN	Description
3.300	98	Paved parking, HSG A
3.300	98	100.00% Impervious Area

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

Subcatchment PWS-1L: 3.30 AC

Hydrograph



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Type III 24-hr 100-Year Rainfall=8.70"

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Summary for Subcatchment PWS-2: 0.31 AC

Runoff = 0.38 cfs @ 12.12 hrs, Volume= 0.038 af, Depth= 1.46"
Routed to Link PR-DP-2 : Goddard Drive

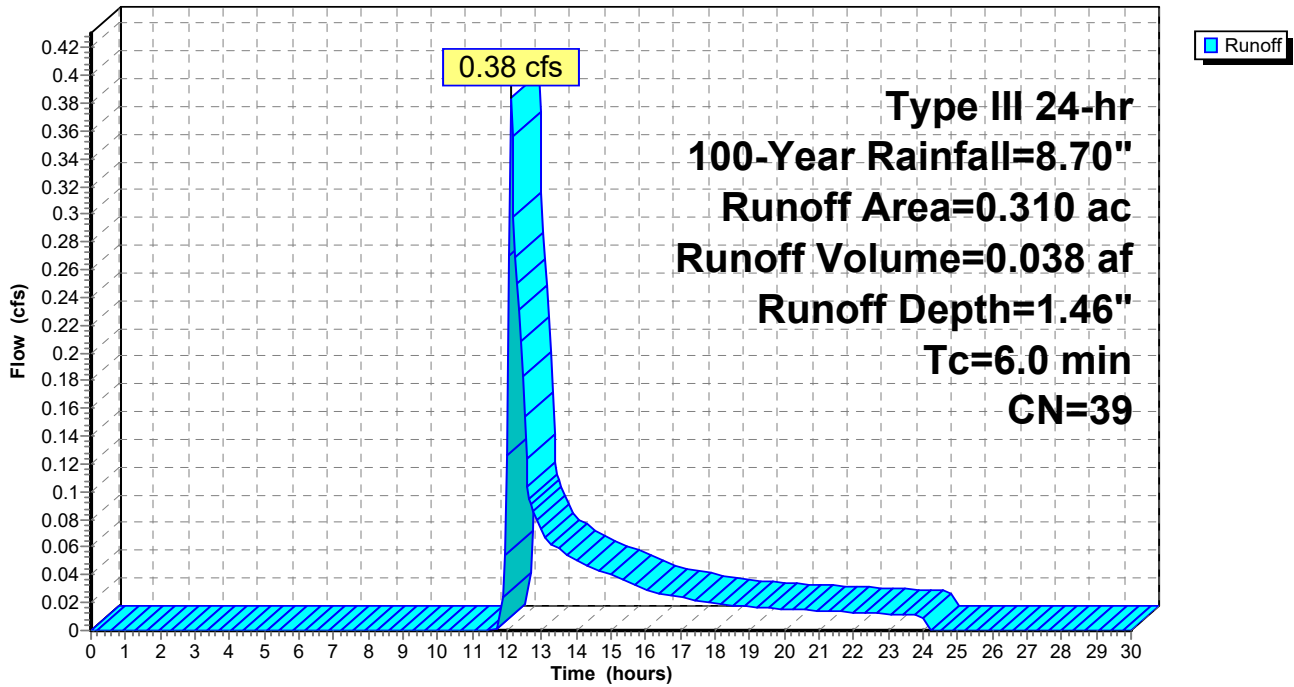
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=8.70"

Area (ac)	CN	Description
0.310	39	>75% Grass cover, Good, HSG A
0.310	39	100.00% Pervious Area

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

Subcatchment PWS-2: 0.31 AC

Hydrograph



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Type III 24-hr 100-Year Rainfall=8.70"

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Summary for Subcatchment PWS-B1: (1.92 AC Bypass)

Runoff = 1.52 cfs @ 12.22 hrs, Volume= 0.201 af, Depth= 1.26"

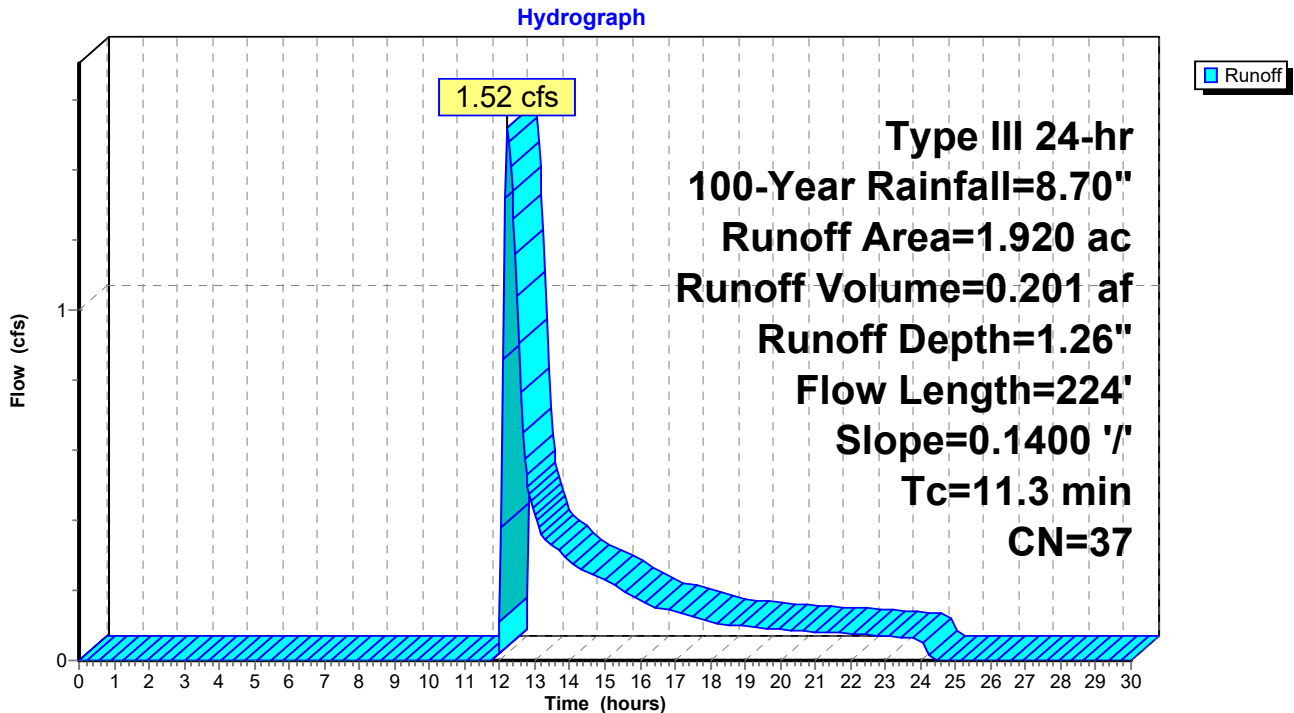
Routed to Link PR-DP-1 : Existing Drainage Channel

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=8.70"

Area (ac)	CN	Description
1.150	39	>75% Grass cover, Good, HSG A
0.080	61	>75% Grass cover, Good, HSG B
0.690	30	Woods, Good, HSG A
1.920	37	Weighted Average
1.920	37	100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.7	50	0.1400	0.09		Sheet Flow, A-B Woods: Dense underbrush n= 0.800 P2= 3.30"
1.6	174	0.1400	1.87		Shallow Concentrated Flow, B-C Woodland Kv= 5.0 fps
11.3	224	Total			

Subcatchment PWS-B1: (1.92 AC Bypass)



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Type III 24-hr 100-Year Rainfall=8.70"

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Summary for Subcatchment PWS-B2: (0.69 AC Bypass)

Runoff = 0.28 cfs @ 12.32 hrs, Volume= 0.050 af, Depth= 0.86"

Routed to Link PR-DP-1 : Existing Drainage Channel

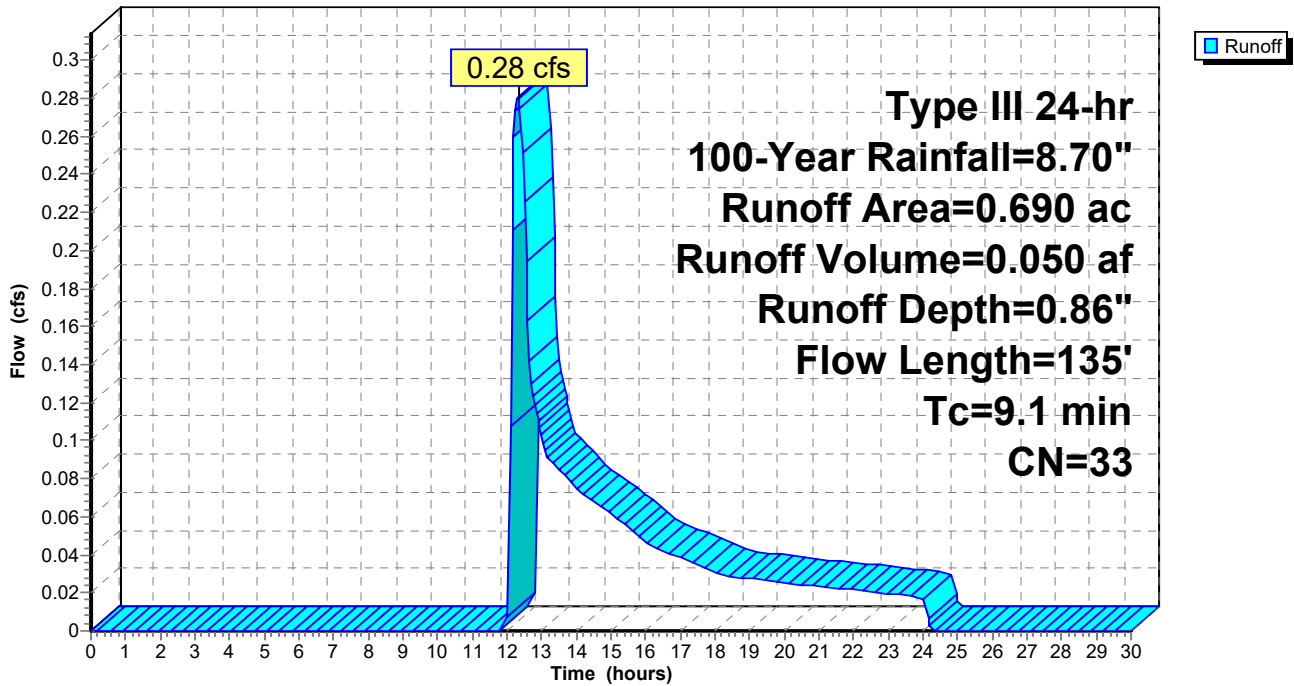
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=8.70"

Area (ac)	CN	Description
0.220	39	>75% Grass cover, Good, HSG A
0.470	30	Woods, Good, HSG A
0.690	33	Weighted Average
0.690	33	100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.8	50	0.2400	0.11		Sheet Flow, A-B Woods: Dense underbrush n= 0.800 P2= 3.30"
1.3	85	0.0500	1.12		Shallow Concentrated Flow, B-C Woodland Kv= 5.0 fps
9.1	135	Total			

Subcatchment PWS-B2: (0.69 AC Bypass)

Hydrograph



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Type III 24-hr 100-Year Rainfall=8.70"

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Summary for Pond BMP-1A: Sediment Forebay

Inflow Area = 3.300 ac, 100.00% Impervious, Inflow Depth = 6.73" for 100-Year event
 Inflow = 7.91 cfs @ 12.09 hrs, Volume= 1.852 af
 Outflow = 7.87 cfs @ 12.09 hrs, Volume= 1.752 af, Atten= 1%, Lag= 0.3 min
 Primary = 7.87 cfs @ 12.09 hrs, Volume= 1.752 af
 Routed to Pond BMP-1B : Sand Filter (Water Quality)

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs / 2
 Peak Elev= 47.62' @ 12.09 hrs Surf.Area= 4,757 sf Storage= 4,607 cf

Plug-Flow detention time= 63.4 min calculated for 1.752 af (95% of inflow)
 Center-of-Mass det. time= 30.8 min (774.7 - 744.0)

Volume	Invert	Avail.Storage	Storage Description
#1	45.50'	4,389 cf	Custom Stage Data (Prismatic) Listed below (Recalc)
#2	44.00'	670 cf	Custom Stage Data (Prismatic) Listed below (Recalc)
			2,031 cf Overall x 33.0% Voids
#3	43.25'	332 cf	Custom Stage Data (Prismatic) Listed below (Recalc)
			1,016 cf Overall - 10 cf Embedded = 1,005 cf x 33.0% Voids
#4	43.40'	10 cf	4.0" Round Pipe Storage x 3 Inside #3 L= 40.0'
		5,402 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
45.50	1,354	0	0
46.00	1,500	714	714
47.50	2,007	2,630	3,344
48.00	2,175	1,046	4,389

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
44.00	1,354	0	0
45.50	1,354	2,031	2,031

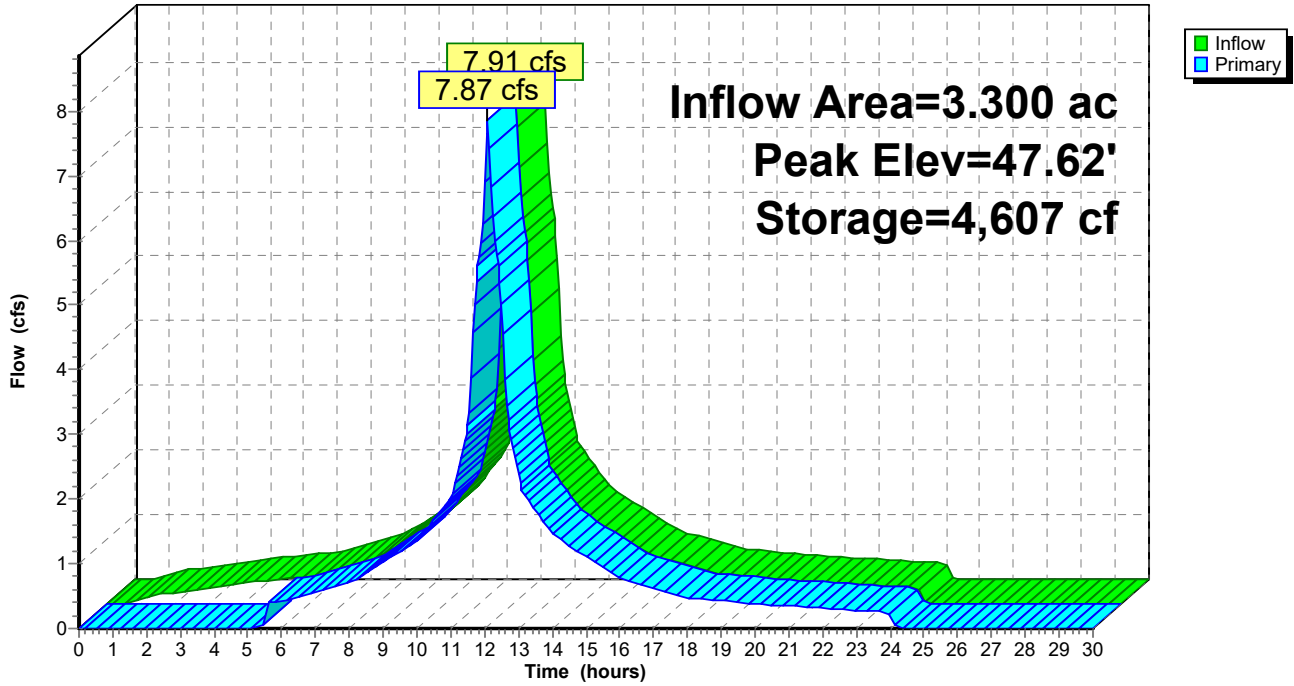
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
43.25	1,354	0	0
44.00	1,354	1,016	1,016

Device	Routing	Invert	Outlet Devices
#1	Primary	47.50'	55.0' long Sharp-Crested Rectangular Weir 2 End Contraction(s)

Primary OutFlow Max=7.79 cfs @ 12.09 hrs HW=47.62' (Free Discharge)
 ↑1=Sharp-Crested Rectangular Weir (Weir Controls 7.79 cfs @ 1.15 fps)

Pond BMP-1A: Sediment Forebay

Hydrograph



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Stage-Area-Storage for Pond BMP-1A: Sediment Forebay

Elevation (feet)	Storage (cubic-feet)	Elevation (feet)	Storage (cubic-feet)
43.25	0	45.90	1,577
43.30	22	45.95	1,651
43.35	45	46.00	1,726
43.40	67	46.05	1,801
43.45	90	46.10	1,878
43.50	113	46.15	1,955
43.55	137	46.20	2,033
43.60	161	46.25	2,111
43.65	184	46.30	2,191
43.70	208	46.35	2,272
43.75	230	46.40	2,353
43.80	253	46.45	2,435
43.85	275	46.50	2,518
43.90	297	46.55	2,602
43.95	320	46.60	2,687
44.00	342	46.65	2,772
44.05	364	46.70	2,859
44.10	387	46.75	2,946
44.15	409	46.80	3,034
44.20	431	46.85	3,123
44.25	454	46.90	3,213
44.30	476	46.95	3,303
44.35	499	47.00	3,395
44.40	521	47.05	3,487
44.45	543	47.10	3,580
44.50	566	47.15	3,674
44.55	588	47.20	3,769
44.60	610	47.25	3,865
44.65	633	47.30	3,961
44.70	655	47.35	4,059
44.75	677	47.40	4,157
44.80	700	47.45	4,256
44.85	722	47.50	4,356
44.90	744	47.55	4,457
44.95	767	47.60	4,558
45.00	789	47.65	4,661
45.05	811	47.70	4,764
45.10	834	47.75	4,868
45.15	856	47.80	4,973
45.20	878	47.85	5,079
45.25	901	47.90	5,186
45.30	923	47.95	5,293
45.35	945	48.00	5,402
45.40	968		
45.45	990		
45.50	1,012		
45.55	1,080		
45.60	1,149		
45.65	1,219		
45.70	1,289		
45.75	1,360		
45.80	1,432		
45.85	1,504		

Summary for Pond BMP-1B: Sand Filter (Water Quality)

[81] Warning: Exceeded Pond BMP-1A by 0.03' @ 12.15 hrs

Inflow Area = 3.300 ac, 100.00% Impervious, Inflow Depth = 6.37" for 100-Year event
 Inflow = 7.87 cfs @ 12.09 hrs, Volume= 1.752 af
 Outflow = 7.77 cfs @ 12.11 hrs, Volume= 1.747 af, Atten= 1%, Lag= 1.1 min
 Primary = 0.63 cfs @ 12.11 hrs, Volume= 0.966 af
 Routed to Pond BMP-2A : Sediment Forebay
 Secondary = 7.14 cfs @ 12.11 hrs, Volume= 0.781 af
 Routed to Pond BMP-2A : Sediment Forebay

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs / 2
 Peak Elev= 47.65' @ 12.11 hrs Surf.Area= 12,004 sf Storage= 11,738 cf

Plug-Flow detention time= 123.5 min calculated for 1.747 af (100% of inflow)
 Center-of-Mass det. time= 121.5 min (896.2 - 774.7)

Volume	Invert	Avail.Storage	Storage Description
#1	45.50'	10,815 cf	Custom Stage Data (Prismatic) Listed below (Recalc)
#2	44.00'	1,762 cf	Custom Stage Data (Prismatic) Listed below (Recalc)
			5,340 cf Overall x 33.0% Voids
#3	43.25'	873 cf	Custom Stage Data (Prismatic) Listed below (Recalc)
			2,670 cf Overall - 24 cf Embedded = 2,646 cf x 33.0% Voids
#4	43.40'	24 cf	4.0" Round Pipe Storage x 3 Inside #3 L= 90.0'
		13,474 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
45.50	3,560	0	0
46.00	3,865	1,856	1,856
47.50	4,780	6,484	8,340
48.00	5,120	2,475	10,815

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
44.00	3,560	0	0
45.50	3,560	5,340	5,340

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
43.25	3,560	0	0
44.00	3,560	2,670	2,670

Device	Routing	Invert	Outlet Devices
#1	Primary	43.40'	4.0" Round Culvert L= 55.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 43.40' / 42.50' S= 0.0164 ' / ' Cc= 0.900 n= 0.010 PVC, smooth interior, Flow Area= 0.09 sf
#2	Secondary	47.50'	50.0' long x 6.0' breadth Broad-Crested Rectangular Weir

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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
	2.65	2.66	2.66	2.67	2.69	2.72	2.76	2.83		

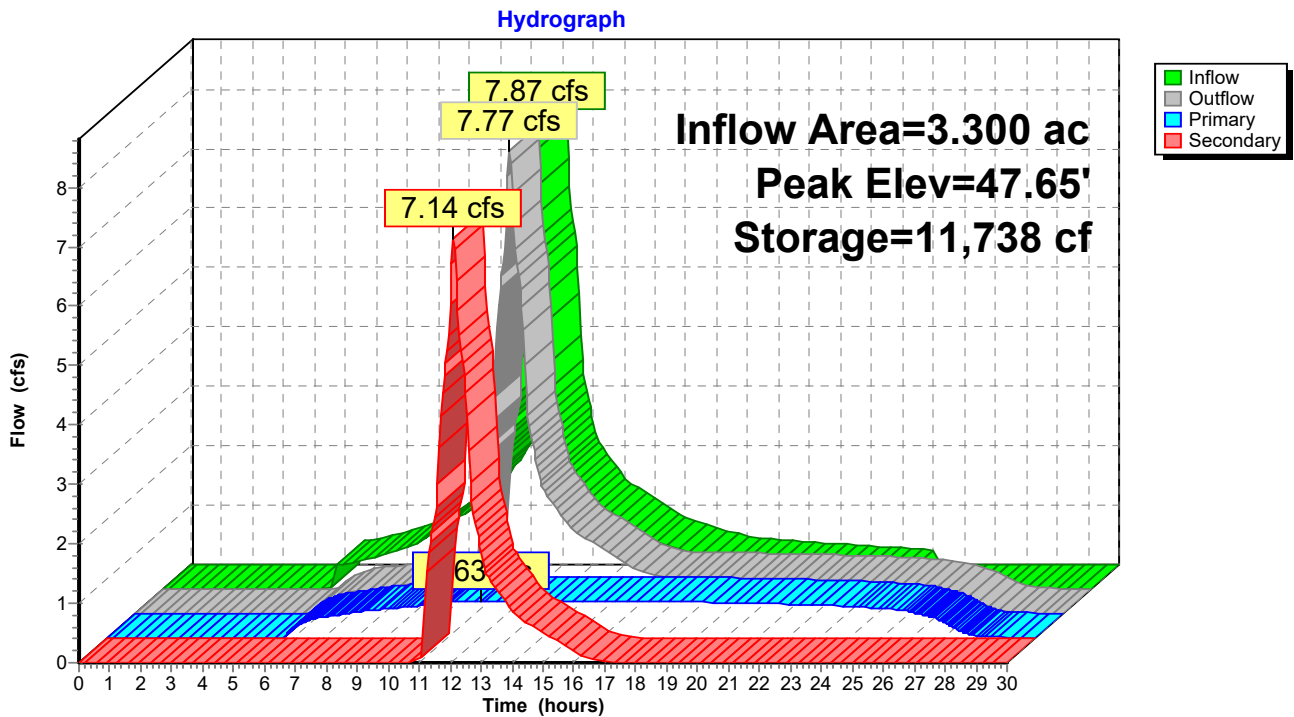
Primary OutFlow Max=0.63 cfs @ 12.11 hrs HW=47.65' (Free Discharge)

↑1=Culvert (Barrel Controls 0.63 cfs @ 7.24 fps)

Secondary OutFlow Max=7.04 cfs @ 12.11 hrs HW=47.65' (Free Discharge)

↑2=Broad-Crested Rectangular Weir (Weir Controls 7.04 cfs @ 0.92 fps)

Pond BMP-1B: Sand Filter (Water Quality)



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Stage-Area-Storage for Pond BMP-1B: Sand Filter (Water Quality)

Elevation (feet)	Storage (cubic-feet)	Elevation (feet)	Storage (cubic-feet)
43.25	0	45.90	4,132
43.30	59	45.95	4,323
43.35	117	46.00	4,515
43.40	176	46.05	4,709
43.45	236	46.10	4,905
43.50	298	46.15	5,102
43.55	359	46.20	5,301
43.60	421	46.25	5,501
43.65	483	46.30	5,702
43.70	544	46.35	5,905
43.75	603	46.40	6,110
43.80	662	46.45	6,316
43.85	721	46.50	6,524
43.90	779	46.55	6,733
43.95	838	46.60	6,944
44.00	897	46.65	7,156
44.05	956	46.70	7,370
44.10	1,014	46.75	7,586
44.15	1,073	46.80	7,803
44.20	1,132	46.85	8,021
44.25	1,191	46.90	8,241
44.30	1,249	46.95	8,462
44.35	1,308	47.00	8,685
44.40	1,367	47.05	8,910
44.45	1,426	47.10	9,136
44.50	1,484	47.15	9,363
44.55	1,543	47.20	9,593
44.60	1,602	47.25	9,823
44.65	1,661	47.30	10,055
44.70	1,719	47.35	10,289
44.75	1,778	47.40	10,524
44.80	1,837	47.45	10,761
44.85	1,895	47.50	10,999
44.90	1,954	47.55	11,239
44.95	2,013	47.60	11,480
45.00	2,072	47.65	11,724
45.05	2,130	47.70	11,969
45.10	2,189	47.75	12,215
45.15	2,248	47.80	12,464
45.20	2,307	47.85	12,714
45.25	2,365	47.90	12,965
45.30	2,424	47.95	13,219
45.35	2,483	48.00	13,474
45.40	2,542		
45.45	2,600		
45.50	2,659		
45.55	2,838		
45.60	3,018		
45.65	3,200		
45.70	3,383		
45.75	3,568		
45.80	3,755		
45.85	3,942		

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Summary for Pond BMP-2A: Sediment Forebay

[79] Warning: Submerged Pond BMP-1B Primary device # 1 OUTLET by 0.10'

Inflow Area = 13.920 ac, 75.72% Impervious, Inflow Depth = 6.62" for 100-Year event
 Inflow = 101.12 cfs @ 12.09 hrs, Volume= 7.676 af
 Outflow = 99.31 cfs @ 12.10 hrs, Volume= 7.558 af, Atten= 2%, Lag= 0.4 min
 Discarded = 0.38 cfs @ 12.10 hrs, Volume= 0.637 af
 Primary = 98.93 cfs @ 12.10 hrs, Volume= 6.921 af
 Routed to Pond BMP-2B : Detention Basin

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs / 3
 Peak Elev= 42.60' @ 12.10 hrs Surf.Area= 6,774 sf Storage= 11,736 cf

Plug-Flow detention time= 28.2 min calculated for 7.558 af (98% of inflow)
 Center-of-Mass det. time= 16.9 min (835.6 - 818.7)

Volume	Invert	Avail.Storage	Storage Description
#1	40.00'	22,436 cf	Custom Stage Data (Prismatic) Listed below (Recalc)
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
40.00	1,869	0	0
42.00	6,020	7,889	7,889
44.00	8,527	14,547	22,436

Device	Routing	Invert	Outlet Devices
#1	Discarded	40.00'	2.410 in/hr Exfiltration over Surface area
#2	Primary	42.00'	65.0' long Sharp-Crested Rectangular Weir 2 End Contraction(s)

Discarded OutFlow Max=0.38 cfs @ 12.10 hrs HW=42.60' (Free Discharge)
 ↑1=Exfiltration (Exfiltration Controls 0.38 cfs)

Primary OutFlow Max=97.92 cfs @ 12.10 hrs HW=42.60' (Free Discharge)
 ↑2=Sharp-Crested Rectangular Weir (Weir Controls 97.92 cfs @ 2.53 fps)

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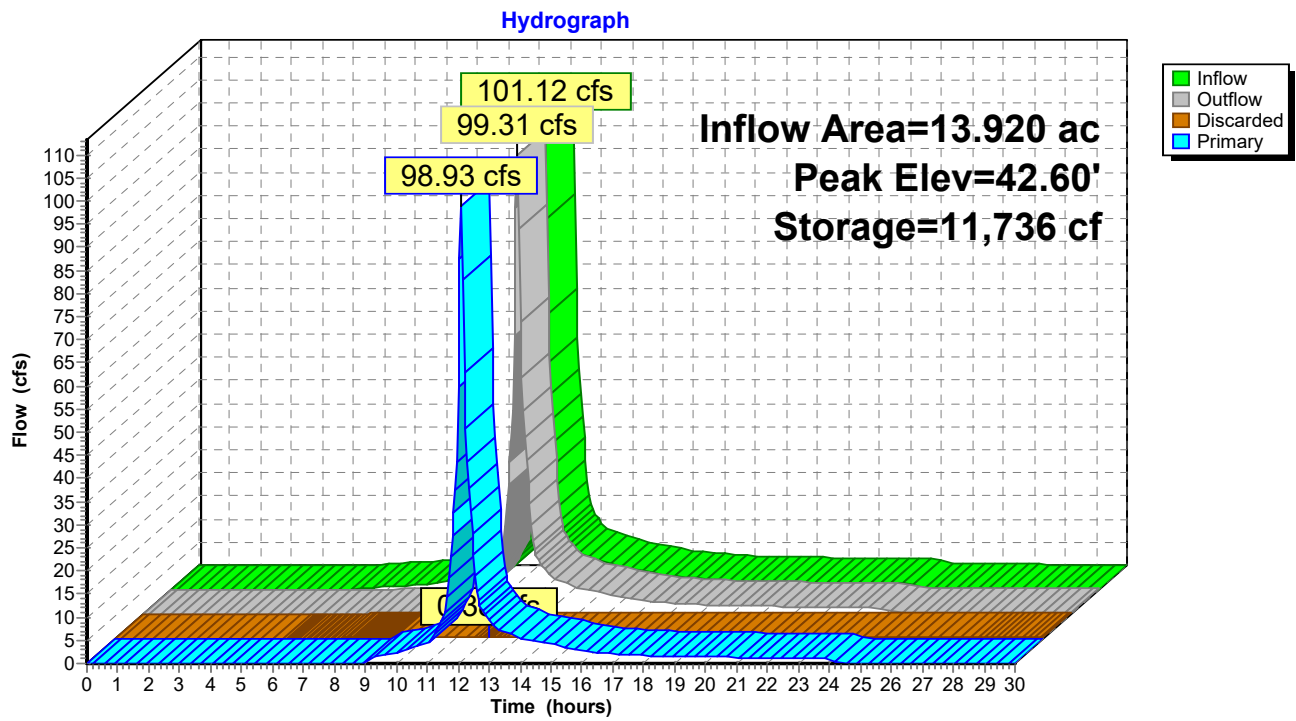
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Pond BMP-2A: Sediment Forebay



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Stage-Area-Storage for Pond BMP-2A: Sediment Forebay

Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)	Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)
40.00	1,869	0	42.65	6,835	12,067
40.05	1,973	96	42.70	6,897	12,410
40.10	2,077	197	42.75	6,960	12,757
40.15	2,180	304	42.80	7,023	13,106
40.20	2,284	415	42.85	7,085	13,459
40.25	2,388	532	42.90	7,148	13,815
40.30	2,492	654	42.95	7,211	14,174
40.35	2,595	781	43.00	7,274	14,536
40.40	2,699	914	43.05	7,336	14,901
40.45	2,803	1,051	43.10	7,399	15,269
40.50	2,907	1,194	43.15	7,462	15,641
40.55	3,011	1,342	43.20	7,524	16,016
40.60	3,114	1,495	43.25	7,587	16,393
40.65	3,218	1,653	43.30	7,650	16,774
40.70	3,322	1,817	43.35	7,712	17,158
40.75	3,426	1,985	43.40	7,775	17,545
40.80	3,529	2,159	43.45	7,838	17,936
40.85	3,633	2,338	43.50	7,900	18,329
40.90	3,737	2,523	43.55	7,963	18,726
40.95	3,841	2,712	43.60	8,026	19,125
41.00	3,945	2,907	43.65	8,088	19,528
41.05	4,048	3,107	43.70	8,151	19,934
41.10	4,152	3,312	43.75	8,214	20,343
41.15	4,256	3,522	43.80	8,276	20,756
41.20	4,360	3,737	43.85	8,339	21,171
41.25	4,463	3,958	43.90	8,402	21,590
41.30	4,567	4,183	43.95	8,464	22,011
41.35	4,671	4,414	44.00	8,527	22,436
41.40	4,775	4,651			
41.45	4,878	4,892			
41.50	4,982	5,138			
41.55	5,086	5,390			
41.60	5,190	5,647			
41.65	5,294	5,909			
41.70	5,397	6,176			
41.75	5,501	6,449			
41.80	5,605	6,727			
41.85	5,709	7,009			
41.90	5,812	7,297			
41.95	5,916	7,591			
42.00	6,020	7,889			
42.05	6,083	8,192			
42.10	6,145	8,497			
42.15	6,208	8,806			
42.20	6,271	9,118			
42.25	6,333	9,433			
42.30	6,396	9,751			
42.35	6,459	10,073			
42.40	6,521	10,397			
42.45	6,584	10,725			
42.50	6,647	11,056			
42.55	6,709	11,390			
42.60	6,772	11,727			

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Summary for Pond BMP-2B: Detention Basin

Inflow Area = 13.920 ac, 75.72% Impervious, Inflow Depth = 5.97" for 100-Year event
 Inflow = 98.93 cfs @ 12.10 hrs, Volume= 6.921 af
 Outflow = 33.40 cfs @ 12.40 hrs, Volume= 6.353 af, Atten= 66%, Lag= 18.1 min
 Discarded = 1.84 cfs @ 12.40 hrs, Volume= 1.966 af
 Primary = 31.56 cfs @ 12.40 hrs, Volume= 4.387 af
 Routed to Link PR-DP-1 : Existing Drainage Channel
 Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
 Routed to Link PR-DP-1 : Existing Drainage Channel

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs / 3
 Peak Elev= 40.36' @ 12.40 hrs Surf.Area= 33,065 sf Storage= 128,152 cf

Plug-Flow detention time= 197.3 min calculated for 6.353 af (92% of inflow)
 Center-of-Mass det. time= 154.5 min (965.6 - 811.0)

Volume	Invert	Avail.Storage	Storage Description
#1	34.00'	186,688 cf	Custom Stage Data (Prismatic) Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
34.00	10,145	0	0
36.00	15,490	25,635	25,635
38.00	21,685	37,175	62,810
40.00	31,870	53,555	116,365
42.00	38,453	70,323	186,688

Device	Routing	Invert	Outlet Devices
#1	Discarded	34.00'	2.410 in/hr Exfiltration over Surface area
#2	Primary	30.00'	24.0" Round Culvert L= 100.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 30.00' / 28.00' S= 0.0200 '/ Cc= 0.900 n= 0.012, Flow Area= 3.14 sf
#3	Device 2	35.70'	3.5" Vert. Orifice/Grate C= 0.600 Limited to weir flow at low heads
#4	Device 2	37.50'	12.0" W x 10.0" H Vert. Orifice/Grate C= 0.600 Limited to weir flow at low heads
#5	Device 2	39.00'	5.0' long Sharp-Crested Rectangular Weir 2 End Contraction(s)
#6	Secondary	40.50'	50.0' long + 10.0' /' SideZ x 8.0' 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) 2.43 2.54 2.70 2.69 2.68 2.68 2.66 2.64 2.64 2.64 2.65 2.65 2.66 2.66 2.68 2.70 2.74

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Discarded OutFlow Max=1.84 cfs @ 12.40 hrs HW=40.36' (Free Discharge)

↳ **1=Exfiltration** (Exfiltration Controls 1.84 cfs)

Primary OutFlow Max=31.53 cfs @ 12.40 hrs HW=40.36' (Free Discharge)

↳ **2=Culvert** (Passes 31.53 cfs of 46.28 cfs potential flow)

↳ **3=Orifice/Grate** (Orifice Controls 0.68 cfs @ 10.23 fps)

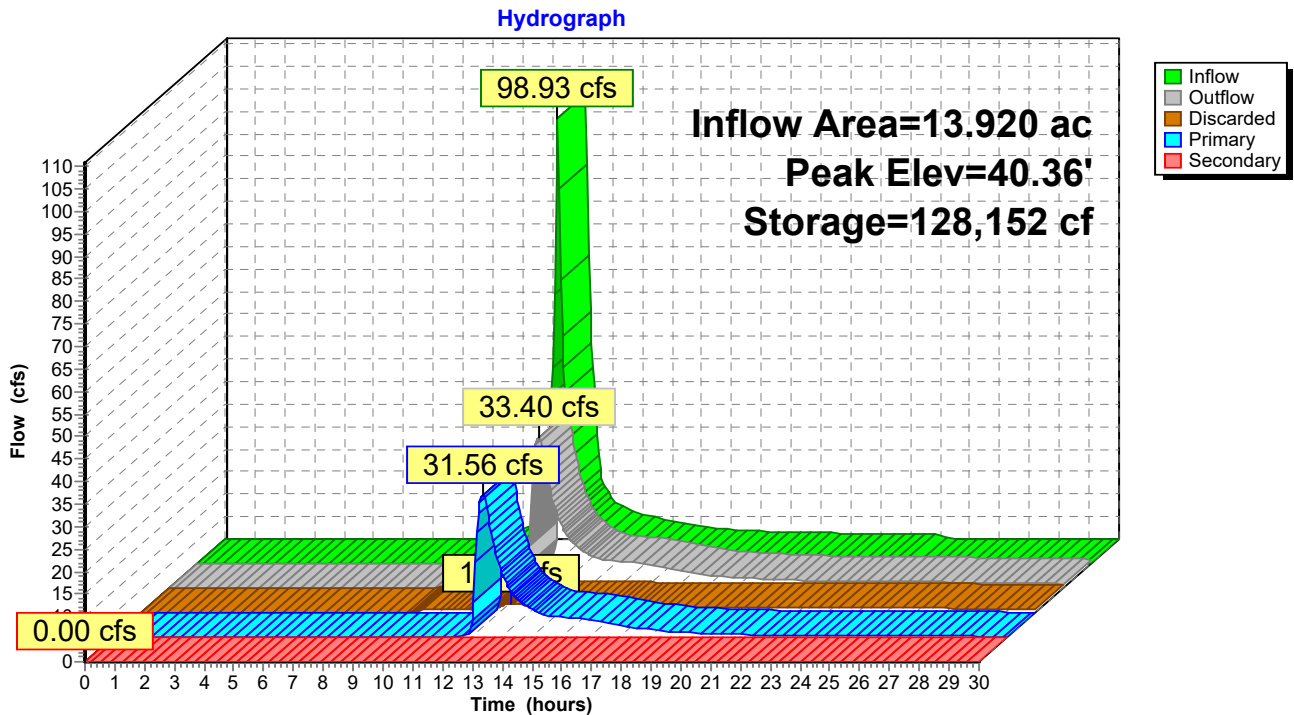
↳ **4=Orifice/Grate** (Orifice Controls 6.27 cfs @ 7.52 fps)

↳ **5=Sharp-Crested Rectangular Weir** (Weir Controls 24.58 cfs @ 3.82 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=34.00' (Free Discharge)

↳ **6=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond BMP-2B: Detention Basin



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Stage-Area-Storage for Pond BMP-2B: Detention Basin

Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)	Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)
34.00	10,145	0	39.30	28,305	95,304
34.10	10,412	1,028	39.40	28,814	98,160
34.20	10,680	2,082	39.50	29,324	101,067
34.30	10,947	3,164	39.60	29,833	104,024
34.40	11,214	4,272	39.70	30,342	107,033
34.50	11,481	5,407	39.80	30,851	110,093
34.60	11,749	6,568	39.90	31,361	113,203
34.70	12,016	7,756	40.00	31,870	116,365
34.80	12,283	8,971	40.10	32,199	119,568
34.90	12,550	10,213	40.20	32,528	122,805
35.00	12,818	11,481	40.30	32,857	126,074
35.10	13,085	12,776	40.40	33,187	129,376
35.20	13,352	14,098	40.50	33,516	132,711
35.30	13,619	15,447	40.60	33,845	136,079
35.40	13,886	16,822	40.70	34,174	139,480
35.50	14,154	18,224	40.80	34,503	142,914
35.60	14,421	19,653	40.90	34,832	146,381
35.70	14,688	21,108	41.00	35,162	149,881
35.80	14,955	22,590	41.10	35,491	153,413
35.90	15,223	24,099	41.20	35,820	156,979
36.00	15,490	25,635	41.30	36,149	160,577
36.10	15,800	27,199	41.40	36,478	164,209
36.20	16,110	28,795	41.50	36,807	167,873
36.30	16,419	30,421	41.60	37,136	171,570
36.40	16,729	32,079	41.70	37,466	175,300
36.50	17,039	33,767	41.80	37,795	179,063
36.60	17,349	35,487	41.90	38,124	182,859
36.70	17,658	37,237	42.00	38,453	186,688
36.80	17,968	39,018			
36.90	18,278	40,830			
37.00	18,588	42,674			
37.10	18,897	44,548			
37.20	19,207	46,453			
37.30	19,517	48,389			
37.40	19,826	50,357			
37.50	20,136	52,355			
37.60	20,446	54,384			
37.70	20,756	56,444			
37.80	21,065	58,535			
37.90	21,375	60,657			
38.00	21,685	62,810			
38.10	22,194	65,004			
38.20	22,704	67,249			
38.30	23,213	69,545			
38.40	23,722	71,891			
38.50	24,231	74,289			
38.60	24,741	76,738			
38.70	25,250	79,237			
38.80	25,759	81,788			
38.90	26,268	84,389			
39.00	26,778	87,041			
39.10	27,287	89,744			
39.20	27,796	92,499			

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Summary for Pond FS-1:

[57] Hint: Peaked at 51.17' (Flood elevation advised)

Inflow Area = 3.300 ac, 100.00% Impervious, Inflow Depth = 8.46" for 100-Year event
 Inflow = 27.53 cfs @ 12.09 hrs, Volume= 2.326 af
 Outflow = 27.53 cfs @ 12.09 hrs, Volume= 2.326 af, Atten= 0%, Lag= 0.0 min
 Primary = 7.91 cfs @ 12.09 hrs, Volume= 1.852 af
 Routed to Pond BMP-1A : Sediment Forebay
 Secondary = 19.62 cfs @ 12.09 hrs, Volume= 0.474 af
 Routed to Pond BMP-2A : Sediment Forebay

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs / 2
 Peak Elev= 51.17' @ 12.09 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	48.75'	15.0" Round Culvert L= 20.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 48.75' / 48.50' S= 0.0125 '/ Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.23 sf
#2	Secondary	46.50'	36.0" Round Culvert L= 200.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 46.50' / 44.00' S= 0.0125 '/ Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 7.07 sf
#3	Device 2	50.00'	5.0' long Sharp-Crested Rectangular Weir 2 End Contraction(s)

Primary OutFlow Max=7.84 cfs @ 12.09 hrs HW=51.14' (Free Discharge)

↑1=Culvert (Inlet Controls 7.84 cfs @ 6.39 fps)

Secondary OutFlow Max=18.94 cfs @ 12.09 hrs HW=51.14' (Free Discharge)

↑2=Culvert (Passes 18.94 cfs of 60.29 cfs potential flow)

↑3=Sharp-Crested Rectangular Weir (Weir Controls 18.94 cfs @ 3.49 fps)

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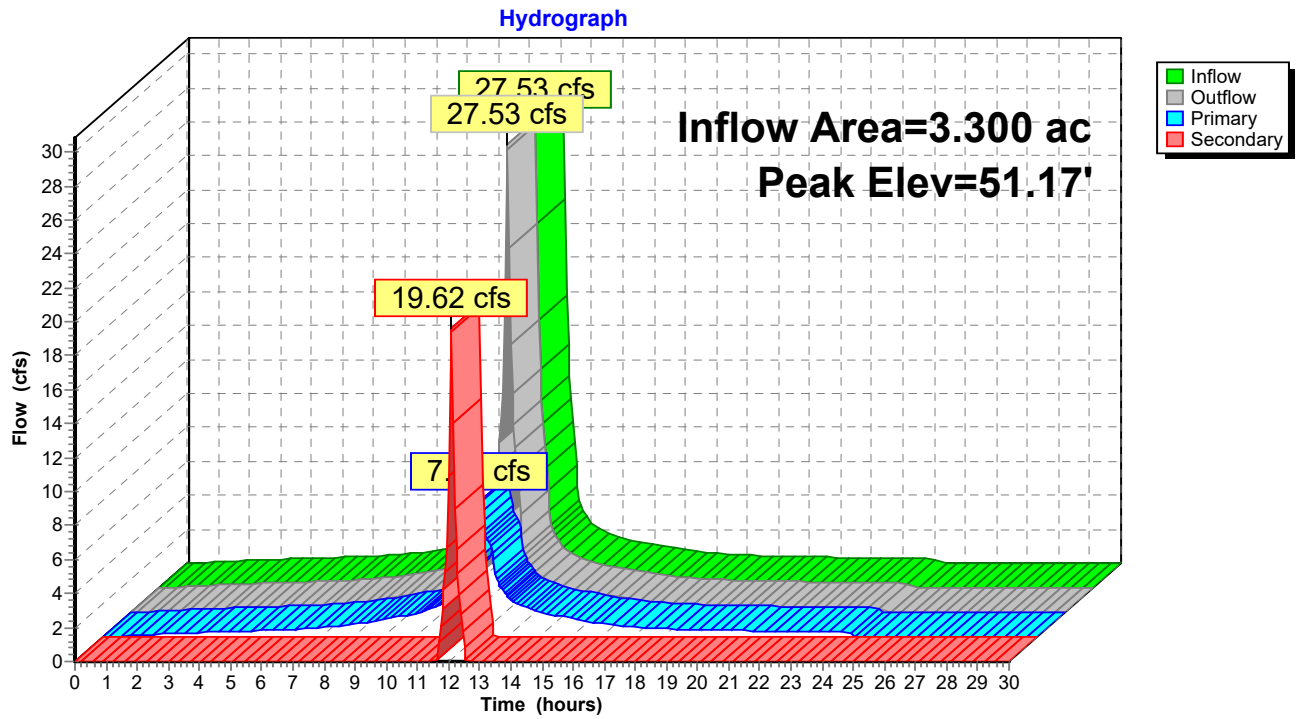
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Pond FS-1:



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Stage-Area-Storage for Pond FS-1:

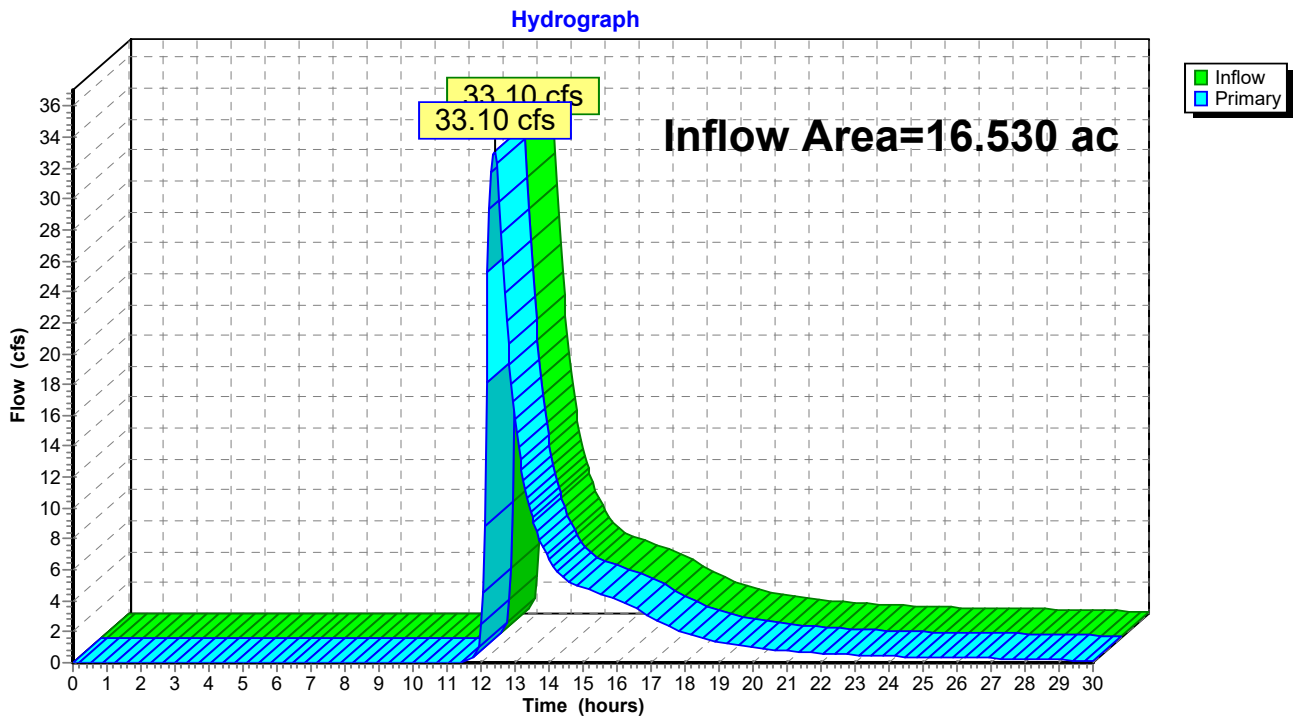
Elevation (feet)	Storage (acre-feet)	Elevation (feet)	Storage (acre-feet)
46.50	0.000	49.15	0.000
46.55	0.000	49.20	0.000
46.60	0.000	49.25	0.000
46.65	0.000	49.30	0.000
46.70	0.000	49.35	0.000
46.75	0.000	49.40	0.000
46.80	0.000	49.45	0.000
46.85	0.000	49.50	0.000
46.90	0.000	49.55	0.000
46.95	0.000	49.60	0.000
47.00	0.000	49.65	0.000
47.05	0.000	49.70	0.000
47.10	0.000	49.75	0.000
47.15	0.000	49.80	0.000
47.20	0.000	49.85	0.000
47.25	0.000	49.90	0.000
47.30	0.000	49.95	0.000
47.35	0.000	50.00	0.000
47.40	0.000	50.05	0.000
47.45	0.000	50.10	0.000
47.50	0.000	50.15	0.000
47.55	0.000	50.20	0.000
47.60	0.000	50.25	0.000
47.65	0.000	50.30	0.000
47.70	0.000	50.35	0.000
47.75	0.000	50.40	0.000
47.80	0.000	50.45	0.000
47.85	0.000	50.50	0.000
47.90	0.000	50.55	0.000
47.95	0.000	50.60	0.000
48.00	0.000	50.65	0.000
48.05	0.000	50.70	0.000
48.10	0.000	50.75	0.000
48.15	0.000	50.80	0.000
48.20	0.000	50.85	0.000
48.25	0.000	50.90	0.000
48.30	0.000	50.95	0.000
48.35	0.000	51.00	0.000
48.40	0.000	51.05	0.000
48.45	0.000	51.10	0.000
48.50	0.000	51.15	0.000
48.55	0.000		
48.60	0.000		
48.65	0.000		
48.70	0.000		
48.75	0.000		
48.80	0.000		
48.85	0.000		
48.90	0.000		
48.95	0.000		
49.00	0.000		
49.05	0.000		
49.10	0.000		

Summary for Link PR-DP-1: Existing Drainage Channel

Inflow Area = 16.530 ac, 63.76% Impervious, Inflow Depth > 3.37" for 100-Year event
Inflow = 33.10 cfs @ 12.39 hrs, Volume= 4.637 af
Primary = 33.10 cfs @ 12.39 hrs, Volume= 4.637 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs

Link PR-DP-1: Existing Drainage Channel



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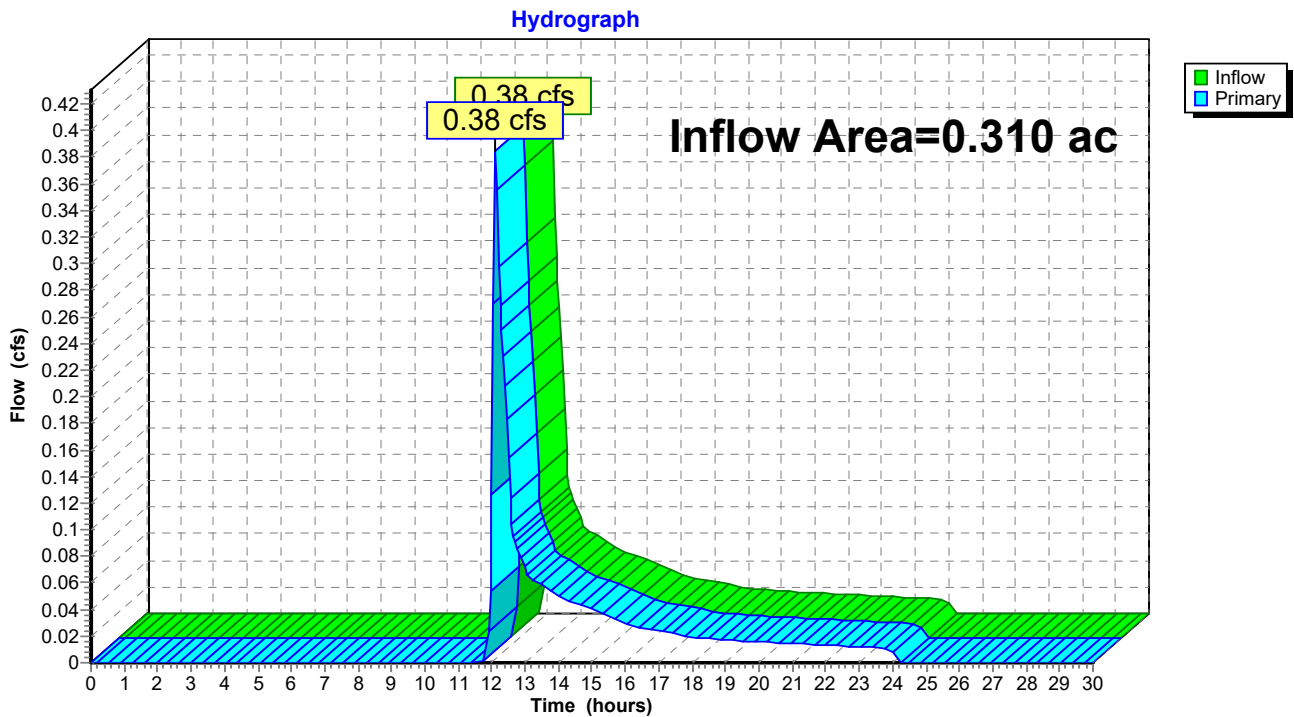
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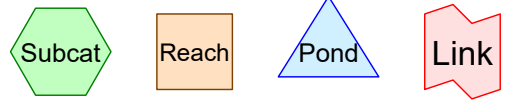
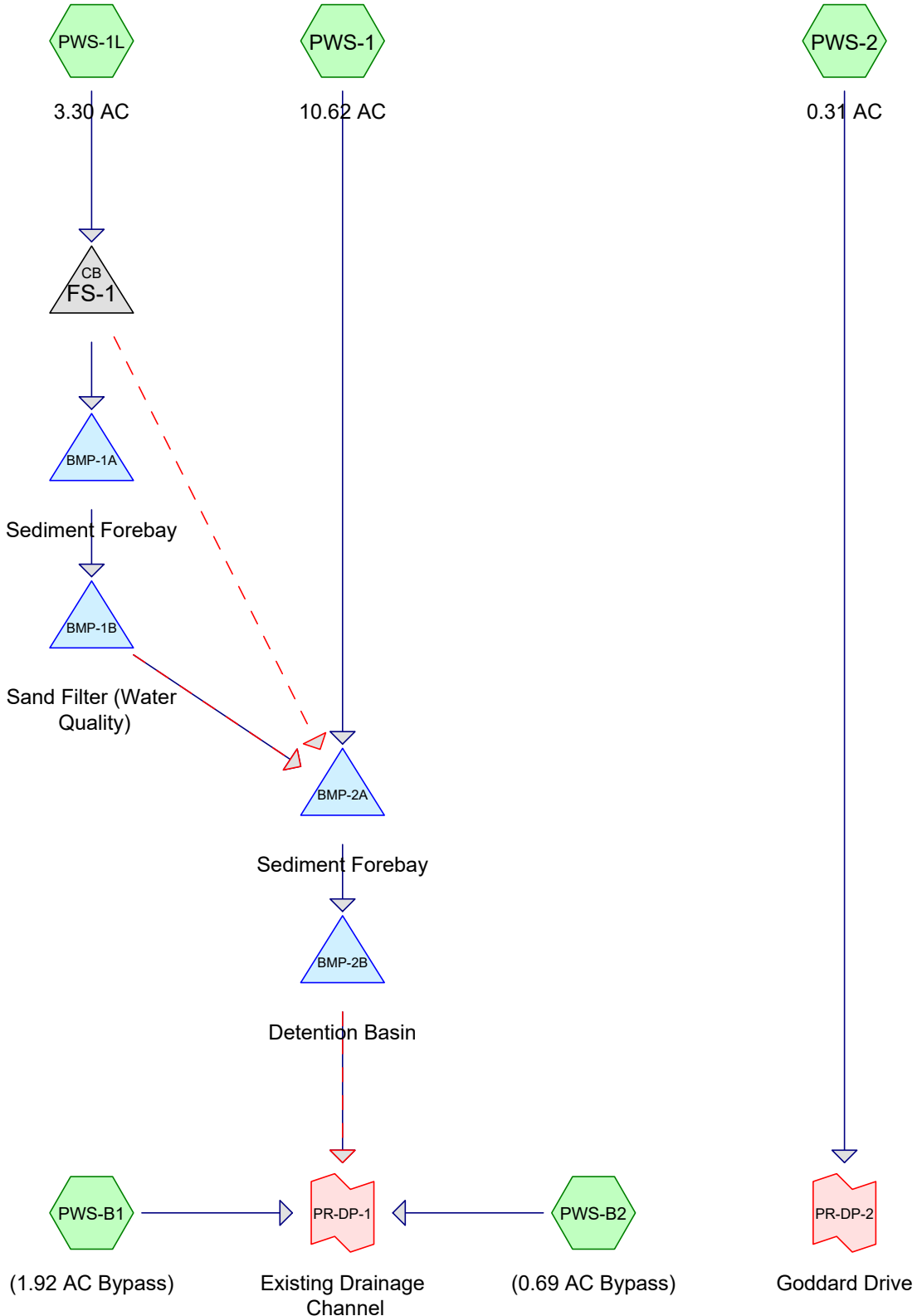
Summary for Link PR-DP-2: Goddard Drive

Inflow Area = 0.310 ac, 0.00% Impervious, Inflow Depth = 1.46" for 100-Year event
Inflow = 0.38 cfs @ 12.12 hrs, Volume= 0.038 af
Primary = 0.38 cfs @ 12.12 hrs, Volume= 0.038 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs

Link PR-DP-2: Goddard Drive





Routing Diagram for 7287-00 HydroCAD Analysis
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7287-00 HydroCAD Analysis

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Type III 24-hr 1.2-Inch Rainfall=1.20"

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Summary for Subcatchment PWS-1: 10.62 AC

Runoff = 7.75 cfs @ 12.09 hrs, Volume= 0.595 af, Depth= 0.67"

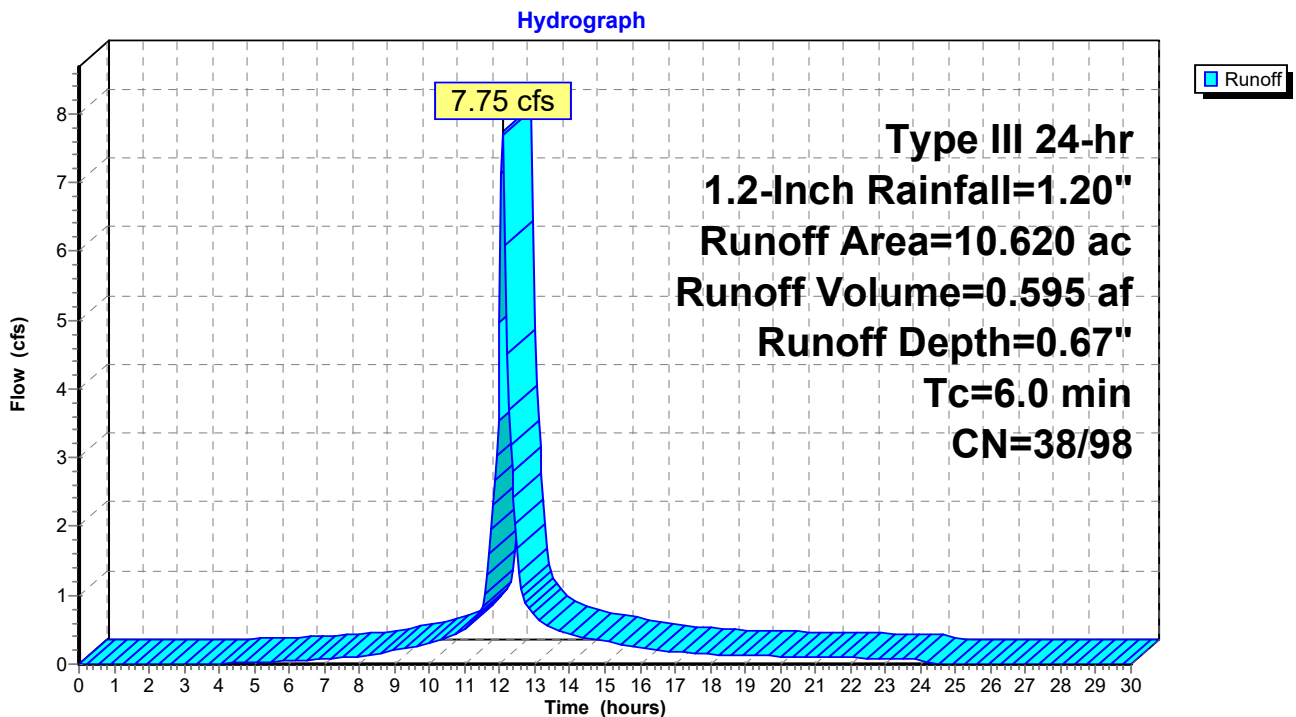
Routed to Pond BMP-2A : Sediment Forebay

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 1.2-Inch Rainfall=1.20"

Area (ac)	CN	Description
2.420	98	Paved parking, HSG A
4.820	98	Roofs, HSG A
0.470	30	Brush, Good, HSG A
2.910	39	>75% Grass cover, Good, HSG A
10.620	79	Weighted Average
3.380	38	31.83% Pervious Area
7.240	98	68.17% Impervious Area

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

Subcatchment PWS-1: 10.62 AC



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Type III 24-hr 1.2-Inch Rainfall=1.20"

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Summary for Subcatchment PWS-1L: 3.30 AC

Runoff = 3.53 cfs @ 12.09 hrs, Volume= 0.271 af, Depth= 0.99"

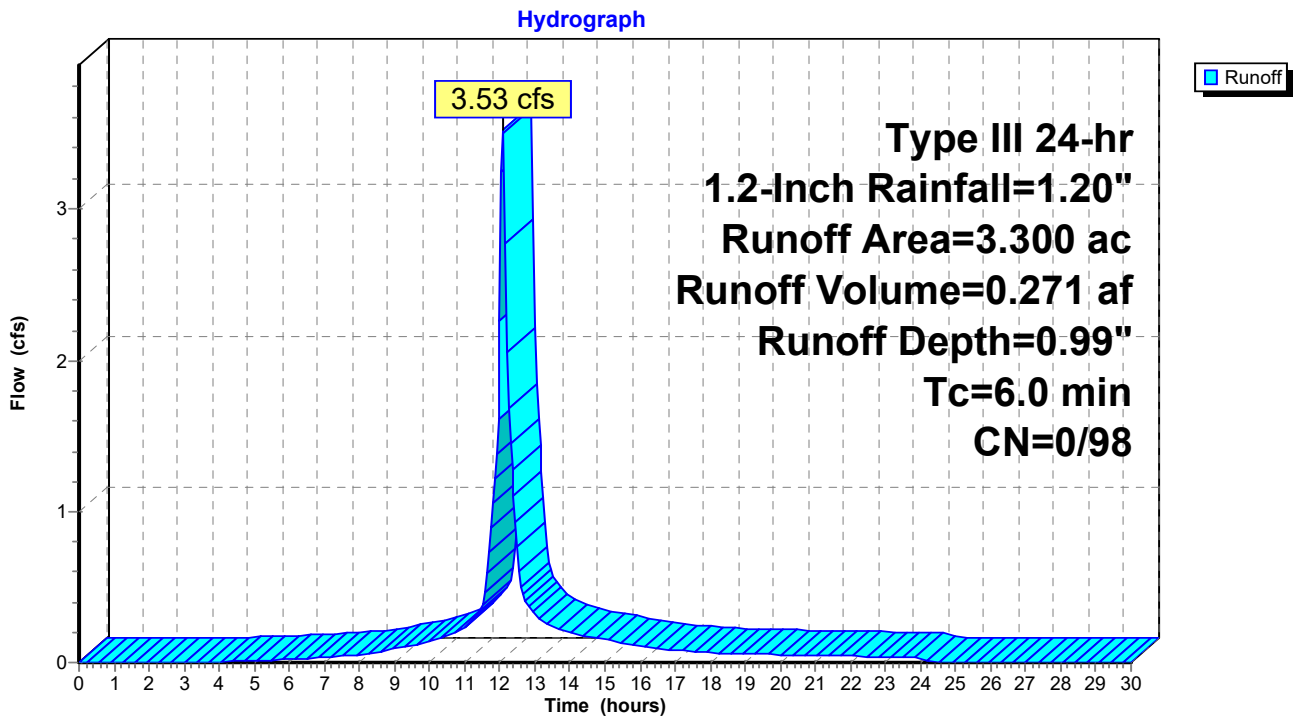
Routed to Pond FS-1 :

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 1.2-Inch Rainfall=1.20"

Area (ac)	CN	Description
3.300	98	Paved parking, HSG A
3.300	98	100.00% Impervious Area

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

Subcatchment PWS-1L: 3.30 AC



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Summary for Subcatchment PWS-2: 0.31 AC

[45] Hint: Runoff=Zero

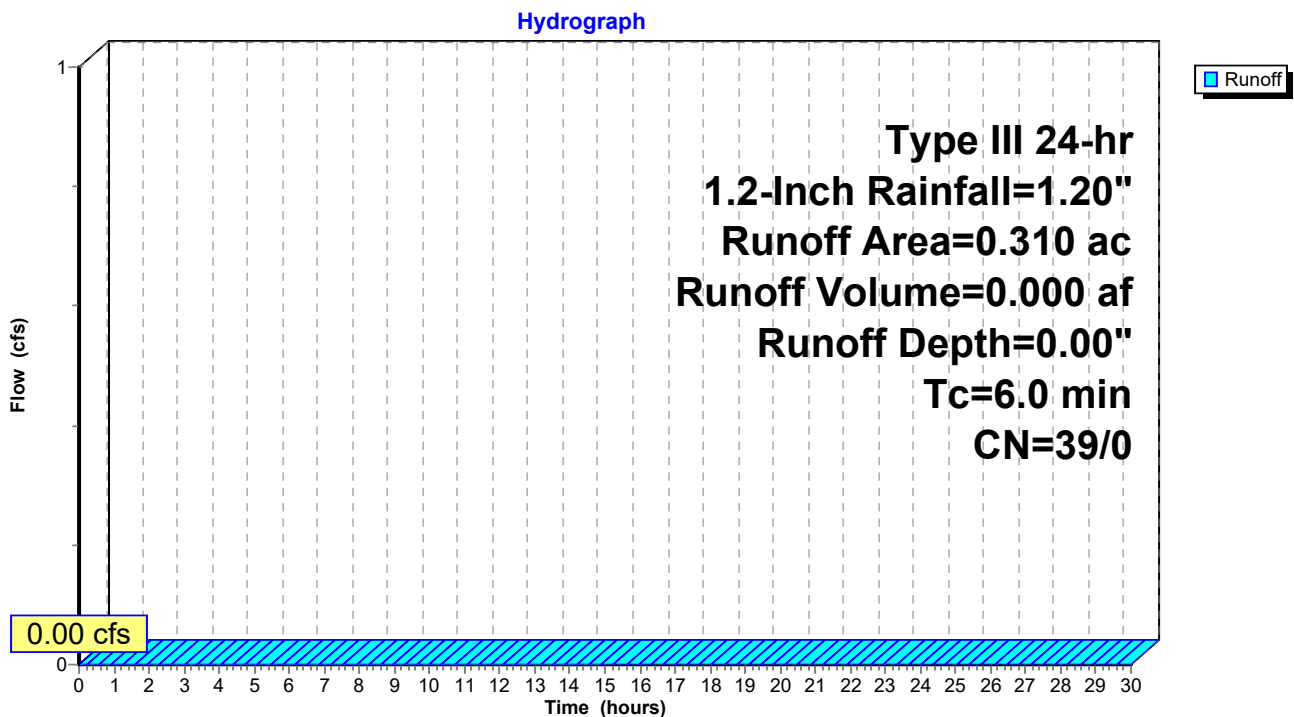
Runoff = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Depth= 0.00"
Routed to Link PR-DP-2 : Goddard Drive

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 1.2-Inch Rainfall=1.20"

Area (ac)	CN	Description
0.310	39	>75% Grass cover, Good, HSG A
0.310	39	100.00% Pervious Area

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

Subcatchment PWS-2: 0.31 AC



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Type III 24-hr 1.2-Inch Rainfall=1.20"

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Summary for Subcatchment PWS-B1: (1.92 AC Bypass)

[45] Hint: Runoff=Zero

Runoff = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Depth= 0.00"
 Routed to Link PR-DP-1 : Existing Drainage Channel

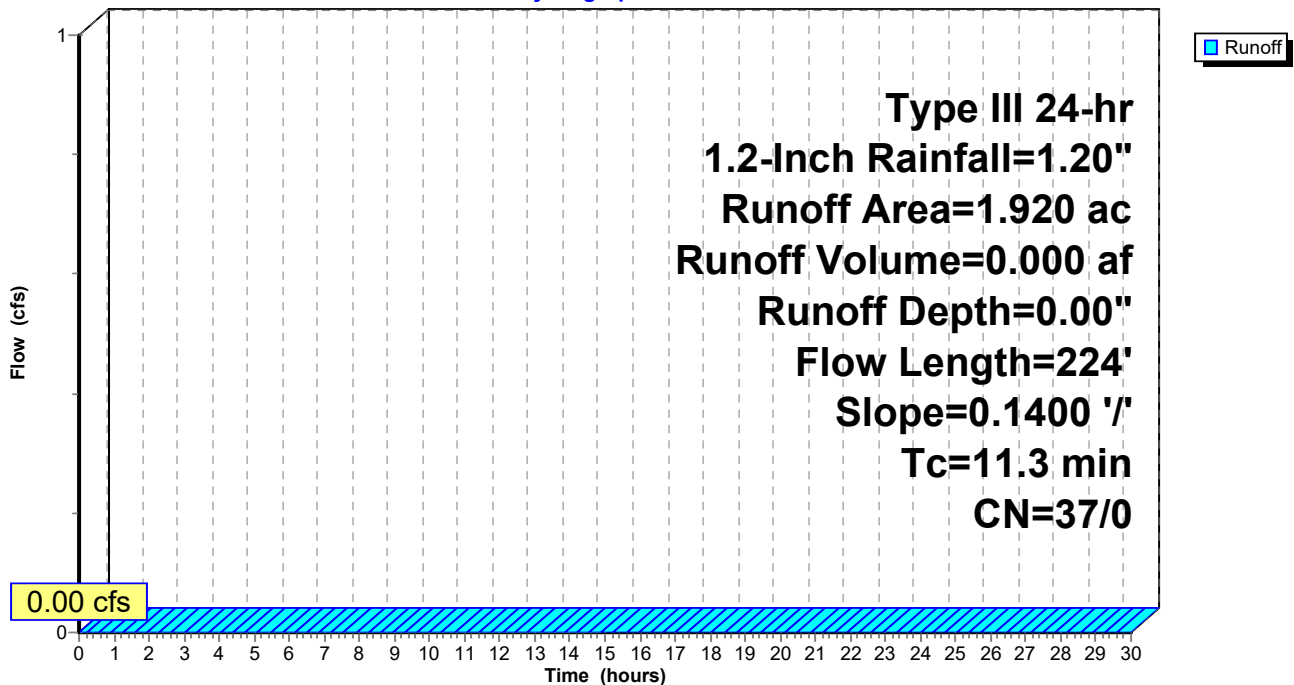
Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
 Type III 24-hr 1.2-Inch Rainfall=1.20"

Area (ac)	CN	Description
1.150	39	>75% Grass cover, Good, HSG A
0.080	61	>75% Grass cover, Good, HSG B
0.690	30	Woods, Good, HSG A
1.920	37	Weighted Average
1.920	37	100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.7	50	0.1400	0.09		Sheet Flow, A-B Woods: Dense underbrush n= 0.800 P2= 3.30"
1.6	174	0.1400	1.87		Shallow Concentrated Flow, B-C Woodland Kv= 5.0 fps
11.3	224	Total			

Subcatchment PWS-B1: (1.92 AC Bypass)

Hydrograph



7287-00 HydroCAD Analysis

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Type III 24-hr 1.2-Inch Rainfall=1.20"

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Summary for Subcatchment PWS-B2: (0.69 AC Bypass)

[45] Hint: Runoff=Zero

Runoff = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Depth= 0.00"
 Routed to Link PR-DP-1 : Existing Drainage Channel

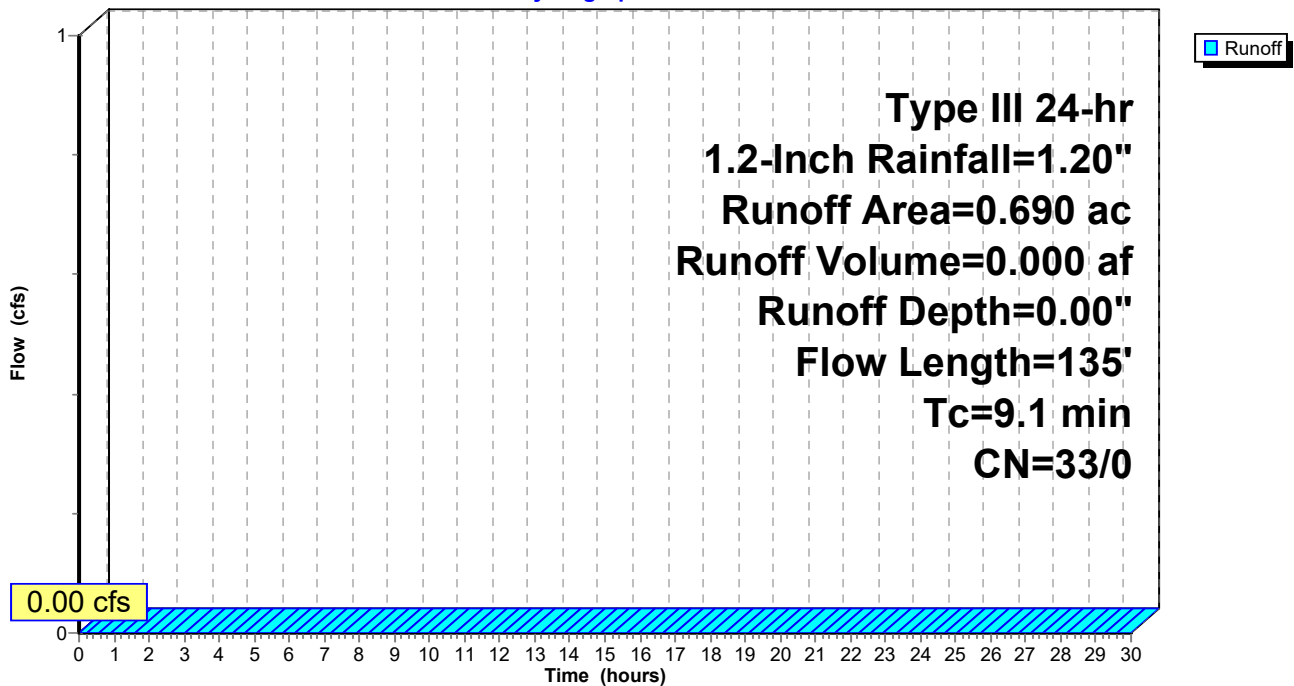
Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
 Type III 24-hr 1.2-Inch Rainfall=1.20"

Area (ac)	CN	Description
0.220	39	>75% Grass cover, Good, HSG A
0.470	30	Woods, Good, HSG A
0.690	33	Weighted Average
0.690	33	100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.8	50	0.2400	0.11		Sheet Flow, A-B Woods: Dense underbrush n= 0.800 P2= 3.30"
1.3	85	0.0500	1.12		Shallow Concentrated Flow, B-C Woodland Kv= 5.0 fps
9.1	135	Total			

Subcatchment PWS-B2: (0.69 AC Bypass)

Hydrograph



7287-00 HydroCAD Analysis

Type III 24-hr 1.2-Inch Rainfall=1.20"

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Summary for Pond BMP-1A: Sediment Forebay

[88] Warning: Qout>Qin may require smaller dt or Finer Routing

Inflow Area = 3.300 ac, 100.00% Impervious, Inflow Depth = 0.99" for 1.2-Inch event
 Inflow = 3.53 cfs @ 12.09 hrs, Volume= 0.271 af
 Outflow = 3.62 cfs @ 12.12 hrs, Volume= 0.168 af, Atten= 0%, Lag= 1.8 min
 Primary = 3.62 cfs @ 12.12 hrs, Volume= 0.168 af
 Routed to Pond BMP-1B : Sand Filter (Water Quality)

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs / 2
 Peak Elev= 47.57' @ 12.12 hrs Surf.Area= 4,740 sf Storage= 4,507 cf

Plug-Flow detention time= 184.1 min calculated for 0.168 af (62% of inflow)
 Center-of-Mass det. time= 83.2 min (865.2 - 782.0)

Volume	Invert	Avail.Storage	Storage Description
#1	45.50'	4,389 cf	Custom Stage Data (Prismatic) Listed below (Recalc)
#2	44.00'	670 cf	Custom Stage Data (Prismatic) Listed below (Recalc)
			2,031 cf Overall x 33.0% Voids
#3	43.25'	332 cf	Custom Stage Data (Prismatic) Listed below (Recalc)
			1,016 cf Overall - 10 cf Embedded = 1,005 cf x 33.0% Voids
#4	43.40'	10 cf	4.0" Round Pipe Storage x 3 Inside #3 L= 40.0'
		5,402 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
45.50	1,354	0	0
46.00	1,500	714	714
47.50	2,007	2,630	3,344
48.00	2,175	1,046	4,389

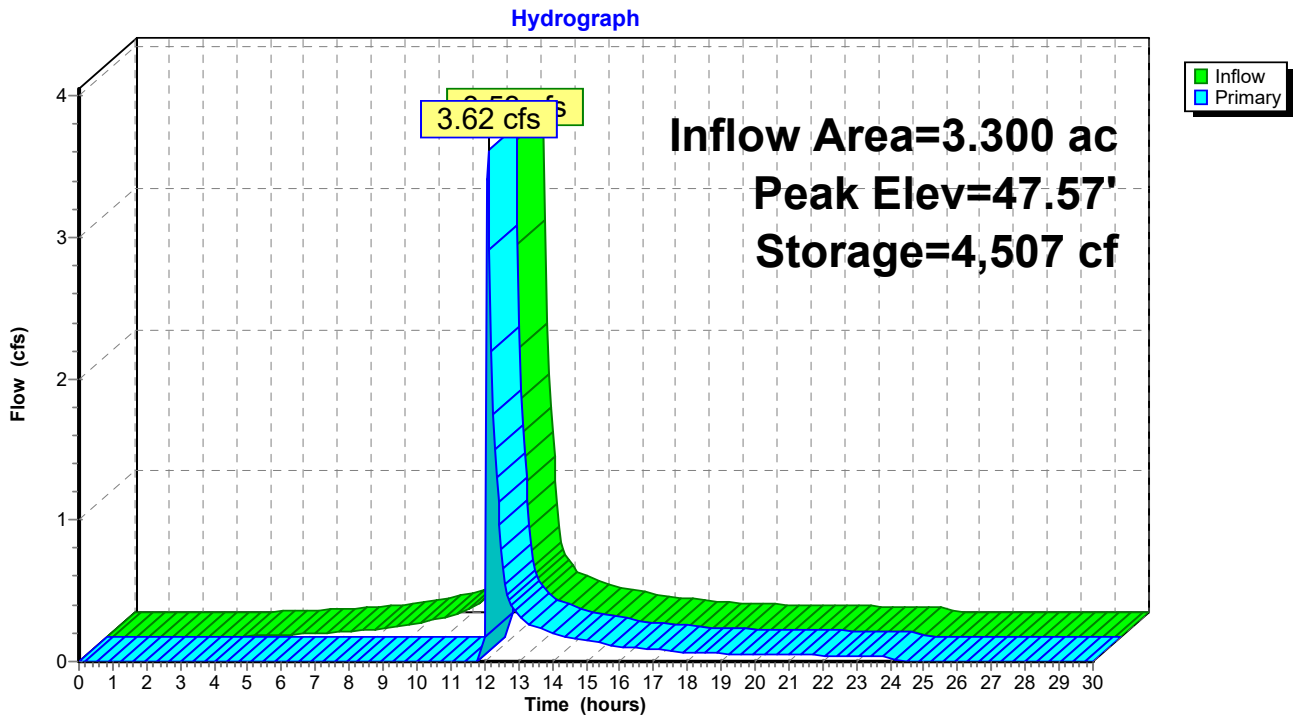
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
44.00	1,354	0	0
45.50	1,354	2,031	2,031

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
43.25	1,354	0	0
44.00	1,354	1,016	1,016

Device	Routing	Invert	Outlet Devices
#1	Primary	47.50'	55.0' long Sharp-Crested Rectangular Weir 2 End Contraction(s)

Primary OutFlow Max=3.17 cfs @ 12.12 hrs HW=47.57' (Free Discharge)
 ↑#1=Sharp-Crested Rectangular Weir (Weir Controls 3.17 cfs @ 0.85 fps)

Pond BMP-1A: Sediment Forebay



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Type III 24-hr 1.2-Inch Rainfall=1.20"

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Stage-Area-Storage for Pond BMP-1A: Sediment Forebay

Elevation (feet)	Storage (cubic-feet)	Elevation (feet)	Storage (cubic-feet)
43.25	0	45.90	1,577
43.30	22	45.95	1,651
43.35	45	46.00	1,726
43.40	67	46.05	1,801
43.45	90	46.10	1,878
43.50	113	46.15	1,955
43.55	137	46.20	2,033
43.60	161	46.25	2,111
43.65	184	46.30	2,191
43.70	208	46.35	2,272
43.75	230	46.40	2,353
43.80	253	46.45	2,435
43.85	275	46.50	2,518
43.90	297	46.55	2,602
43.95	320	46.60	2,687
44.00	342	46.65	2,772
44.05	364	46.70	2,859
44.10	387	46.75	2,946
44.15	409	46.80	3,034
44.20	431	46.85	3,123
44.25	454	46.90	3,213
44.30	476	46.95	3,303
44.35	499	47.00	3,395
44.40	521	47.05	3,487
44.45	543	47.10	3,580
44.50	566	47.15	3,674
44.55	588	47.20	3,769
44.60	610	47.25	3,865
44.65	633	47.30	3,961
44.70	655	47.35	4,059
44.75	677	47.40	4,157
44.80	700	47.45	4,256
44.85	722	47.50	4,356
44.90	744	47.55	4,457
44.95	767	47.60	4,558
45.00	789	47.65	4,661
45.05	811	47.70	4,764
45.10	834	47.75	4,868
45.15	856	47.80	4,973
45.20	878	47.85	5,079
45.25	901	47.90	5,186
45.30	923	47.95	5,293
45.35	945	48.00	5,402
45.40	968		
45.45	990		
45.50	1,012		
45.55	1,080		
45.60	1,149		
45.65	1,219		
45.70	1,289		
45.75	1,360		
45.80	1,432		
45.85	1,504		

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Type III 24-hr 1.2-Inch Rainfall=1.20"

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Summary for Pond BMP-1B: Sand Filter (Water Quality)

Inflow Area = 3.300 ac, 100.00% Impervious, Inflow Depth = 0.61" for 1.2-Inch event
 Inflow = 3.62 cfs @ 12.12 hrs, Volume= 0.168 af
 Outflow = 0.45 cfs @ 12.67 hrs, Volume= 0.164 af, Atten= 87%, Lag= 33.3 min
 Primary = 0.45 cfs @ 12.67 hrs, Volume= 0.164 af
 Routed to Pond BMP-2A : Sediment Forebay
 Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
 Routed to Pond BMP-2A : Sediment Forebay

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs / 2
 Peak Elev= 45.31' @ 12.67 hrs Surf.Area= 7,120 sf Storage= 2,435 cf

Plug-Flow detention time= 78.6 min calculated for 0.164 af (97% of inflow)
 Center-of-Mass det. time= 64.1 min (929.3 - 865.2)

Volume	Invert	Avail.Storage	Storage Description
#1	45.50'	10,815 cf	Custom Stage Data (Prismatic) Listed below (Recalc)
#2	44.00'	1,762 cf	Custom Stage Data (Prismatic) Listed below (Recalc)
			5,340 cf Overall x 33.0% Voids
#3	43.25'	873 cf	Custom Stage Data (Prismatic) Listed below (Recalc)
			2,670 cf Overall - 24 cf Embedded = 2,646 cf x 33.0% Voids
#4	43.40'	24 cf	4.0" Round Pipe Storage x 3 Inside #3 L= 90.0'
		13,474 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
45.50	3,560	0	0
46.00	3,865	1,856	1,856
47.50	4,780	6,484	8,340
48.00	5,120	2,475	10,815

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
44.00	3,560	0	0
45.50	3,560	5,340	5,340

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
43.25	3,560	0	0
44.00	3,560	2,670	2,670

Device	Routing	Invert	Outlet Devices
#1	Primary	43.40'	4.0" Round Culvert L= 55.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 43.40' / 42.50' S= 0.0164 ' / ' Cc= 0.900 n= 0.010 PVC, smooth interior, Flow Area= 0.09 sf
#2	Secondary	47.50'	50.0' 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

7287-00 HydroCAD Analysis

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Type III 24-hr 1.2-Inch Rainfall=1.20"

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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

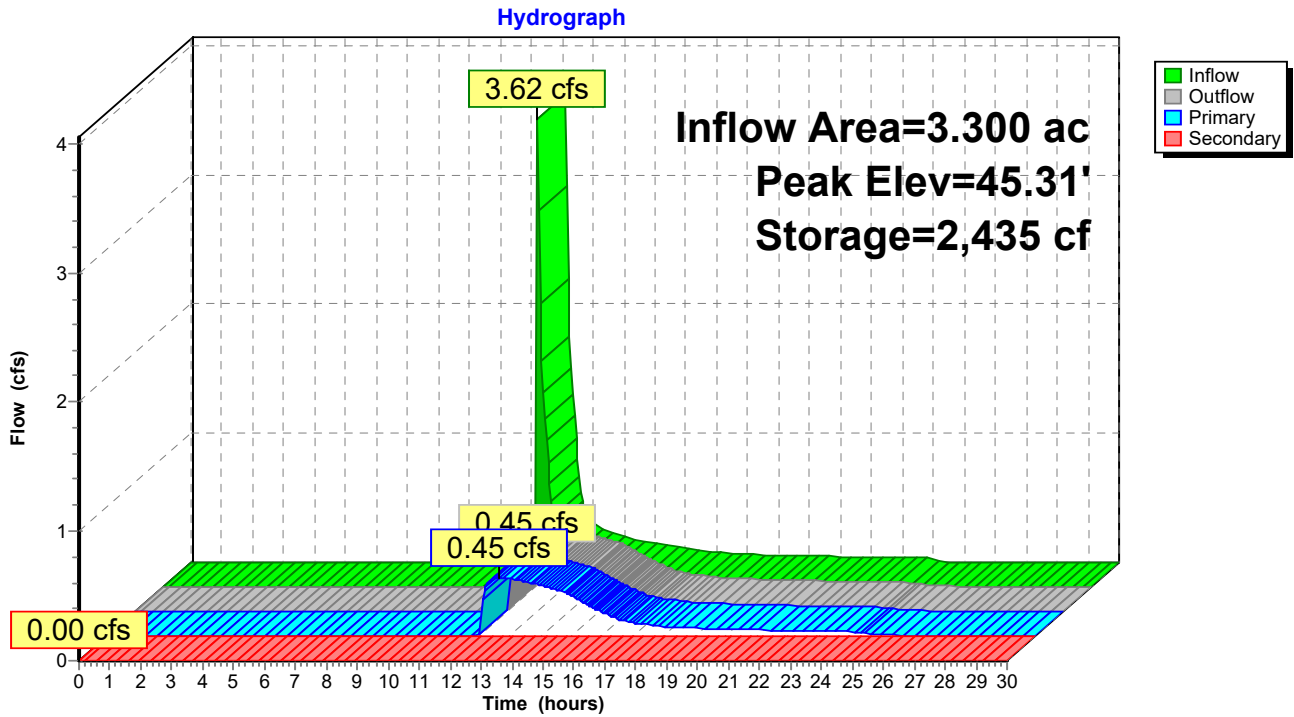
Primary OutFlow Max=0.45 cfs @ 12.67 hrs HW=45.31' (Free Discharge)

↑1=Culvert (Barrel Controls 0.45 cfs @ 5.19 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=43.25' (Free Discharge)

↑2=Broad-Crested Rectangular Weir (Controls 0.00 cfs)

Pond BMP-1B: Sand Filter (Water Quality)



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Type III 24-hr 1.2-Inch Rainfall=1.20"

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Stage-Area-Storage for Pond BMP-1B: Sand Filter (Water Quality)

Elevation (feet)	Storage (cubic-feet)	Elevation (feet)	Storage (cubic-feet)
43.25	0	45.90	4,132
43.30	59	45.95	4,323
43.35	117	46.00	4,515
43.40	176	46.05	4,709
43.45	236	46.10	4,905
43.50	298	46.15	5,102
43.55	359	46.20	5,301
43.60	421	46.25	5,501
43.65	483	46.30	5,702
43.70	544	46.35	5,905
43.75	603	46.40	6,110
43.80	662	46.45	6,316
43.85	721	46.50	6,524
43.90	779	46.55	6,733
43.95	838	46.60	6,944
44.00	897	46.65	7,156
44.05	956	46.70	7,370
44.10	1,014	46.75	7,586
44.15	1,073	46.80	7,803
44.20	1,132	46.85	8,021
44.25	1,191	46.90	8,241
44.30	1,249	46.95	8,462
44.35	1,308	47.00	8,685
44.40	1,367	47.05	8,910
44.45	1,426	47.10	9,136
44.50	1,484	47.15	9,363
44.55	1,543	47.20	9,593
44.60	1,602	47.25	9,823
44.65	1,661	47.30	10,055
44.70	1,719	47.35	10,289
44.75	1,778	47.40	10,524
44.80	1,837	47.45	10,761
44.85	1,895	47.50	10,999
44.90	1,954	47.55	11,239
44.95	2,013	47.60	11,480
45.00	2,072	47.65	11,724
45.05	2,130	47.70	11,969
45.10	2,189	47.75	12,215
45.15	2,248	47.80	12,464
45.20	2,307	47.85	12,714
45.25	2,365	47.90	12,965
45.30	2,424	47.95	13,219
45.35	2,483	48.00	13,474
45.40	2,542		
45.45	2,600		
45.50	2,659		
45.55	2,838		
45.60	3,018		
45.65	3,200		
45.70	3,383		
45.75	3,568		
45.80	3,755		
45.85	3,942		

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Summary for Pond BMP-2A: Sediment Forebay

Inflow Area = 13.920 ac, 75.72% Impervious, Inflow Depth > 0.65" for 1.2-Inch event
 Inflow = 7.79 cfs @ 12.09 hrs, Volume= 0.758 af
 Outflow = 6.71 cfs @ 12.17 hrs, Volume= 0.747 af, Atten= 14%, Lag= 4.6 min
 Discarded = 0.34 cfs @ 12.17 hrs, Volume= 0.477 af
 Primary = 6.37 cfs @ 12.17 hrs, Volume= 0.269 af
 Routed to Pond BMP-2B : Detention Basin

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs / 3
 Peak Elev= 42.10' @ 12.17 hrs Surf.Area= 6,143 sf Storage= 8,484 cf

Plug-Flow detention time= 185.1 min calculated for 0.746 af (98% of inflow)
 Center-of-Mass det. time= 175.8 min (989.5 - 813.8)

Volume	Invert	Avail.Storage	Storage Description
#1	40.00'	22,436 cf	Custom Stage Data (Prismatic) Listed below (Recalc)
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
40.00	1,869	0	0
42.00	6,020	7,889	7,889
44.00	8,527	14,547	22,436

Device	Routing	Invert	Outlet Devices
#1	Discarded	40.00'	2.410 in/hr Exfiltration over Surface area
#2	Primary	42.00'	65.0' long Sharp-Crested Rectangular Weir 2 End Contraction(s)

Discarded OutFlow Max=0.34 cfs @ 12.17 hrs HW=42.09' (Free Discharge)
 ↑1=Exfiltration (Exfiltration Controls 0.34 cfs)

Primary OutFlow Max=5.61 cfs @ 12.17 hrs HW=42.09' (Free Discharge)
 ↑2=Sharp-Crested Rectangular Weir (Weir Controls 5.61 cfs @ 0.97 fps)

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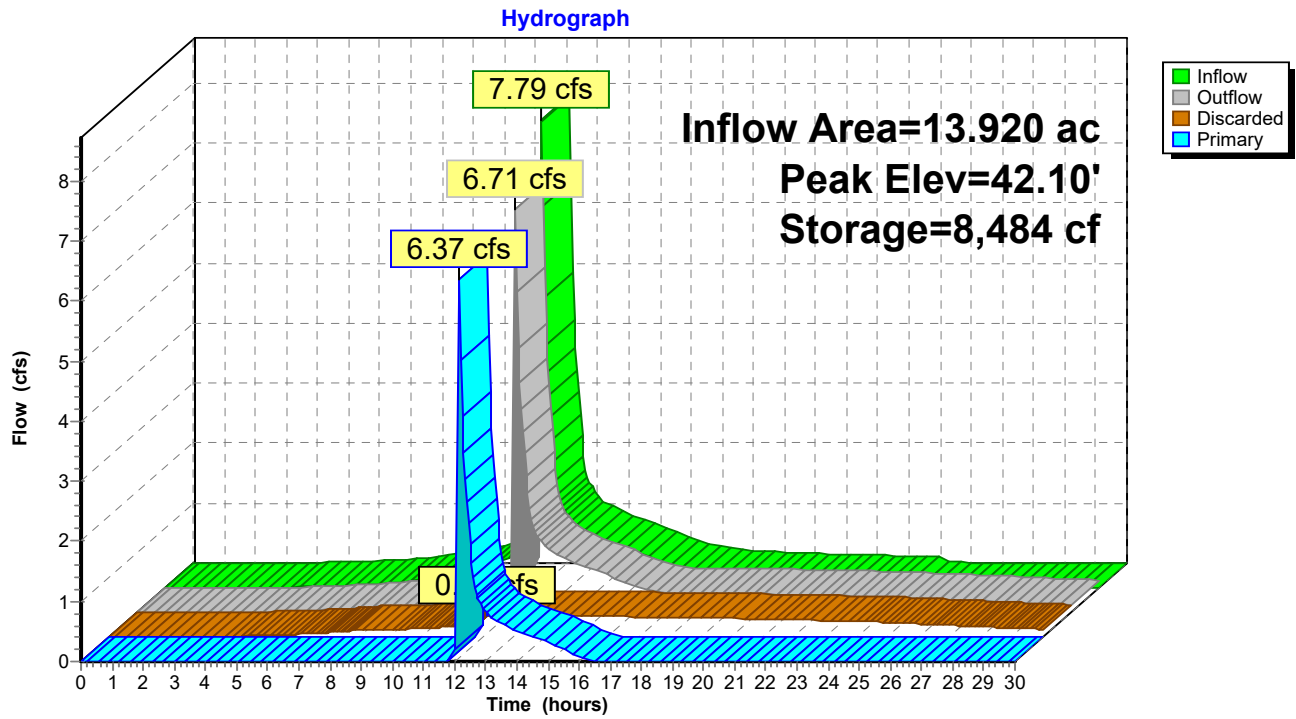
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Type III 24-hr 1.2-Inch Rainfall=1.20"

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Pond BMP-2A: Sediment Forebay



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Type III 24-hr 1.2-Inch Rainfall=1.20"

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Stage-Area-Storage for Pond BMP-2A: Sediment Forebay

Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)	Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)
40.00	1,869	0	42.65	6,835	12,067
40.05	1,973	96	42.70	6,897	12,410
40.10	2,077	197	42.75	6,960	12,757
40.15	2,180	304	42.80	7,023	13,106
40.20	2,284	415	42.85	7,085	13,459
40.25	2,388	532	42.90	7,148	13,815
40.30	2,492	654	42.95	7,211	14,174
40.35	2,595	781	43.00	7,274	14,536
40.40	2,699	914	43.05	7,336	14,901
40.45	2,803	1,051	43.10	7,399	15,269
40.50	2,907	1,194	43.15	7,462	15,641
40.55	3,011	1,342	43.20	7,524	16,016
40.60	3,114	1,495	43.25	7,587	16,393
40.65	3,218	1,653	43.30	7,650	16,774
40.70	3,322	1,817	43.35	7,712	17,158
40.75	3,426	1,985	43.40	7,775	17,545
40.80	3,529	2,159	43.45	7,838	17,936
40.85	3,633	2,338	43.50	7,900	18,329
40.90	3,737	2,523	43.55	7,963	18,726
40.95	3,841	2,712	43.60	8,026	19,125
41.00	3,945	2,907	43.65	8,088	19,528
41.05	4,048	3,107	43.70	8,151	19,934
41.10	4,152	3,312	43.75	8,214	20,343
41.15	4,256	3,522	43.80	8,276	20,756
41.20	4,360	3,737	43.85	8,339	21,171
41.25	4,463	3,958	43.90	8,402	21,590
41.30	4,567	4,183	43.95	8,464	22,011
41.35	4,671	4,414	44.00	8,527	22,436
41.40	4,775	4,651			
41.45	4,878	4,892			
41.50	4,982	5,138			
41.55	5,086	5,390			
41.60	5,190	5,647			
41.65	5,294	5,909			
41.70	5,397	6,176			
41.75	5,501	6,449			
41.80	5,605	6,727			
41.85	5,709	7,009			
41.90	5,812	7,297			
41.95	5,916	7,591			
42.00	6,020	7,889			
42.05	6,083	8,192			
42.10	6,145	8,497			
42.15	6,208	8,806			
42.20	6,271	9,118			
42.25	6,333	9,433			
42.30	6,396	9,751			
42.35	6,459	10,073			
42.40	6,521	10,397			
42.45	6,584	10,725			
42.50	6,647	11,056			
42.55	6,709	11,390			
42.60	6,772	11,727			

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Type III 24-hr 1.2-Inch Rainfall=1.20"

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Summary for Pond BMP-2B: Detention Basin

Inflow Area = 13.920 ac, 75.72% Impervious, Inflow Depth = 0.23" for 1.2-Inch event
 Inflow = 6.37 cfs @ 12.17 hrs, Volume= 0.269 af
 Outflow = 0.64 cfs @ 13.46 hrs, Volume= 0.270 af, Atten= 90%, Lag= 77.7 min
 Discarded = 0.64 cfs @ 13.46 hrs, Volume= 0.270 af
 Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
 Routed to Link PR-DP-1 : Existing Drainage Channel
 Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
 Routed to Link PR-DP-1 : Existing Drainage Channel

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs / 3
 Peak Elev= 34.50' @ 13.46 hrs Surf.Area= 11,469 sf Storage= 5,353 cf

Plug-Flow detention time= 100.1 min calculated for 0.269 af (100% of inflow)
 Center-of-Mass det. time= 100.2 min (884.8 - 784.5)

Volume	Invert	Avail.Storage	Storage Description
#1	34.00'	186,688 cf	Custom Stage Data (Prismatic) Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
34.00	10,145	0	0
36.00	15,490	25,635	25,635
38.00	21,685	37,175	62,810
40.00	31,870	53,555	116,365
42.00	38,453	70,323	186,688

Device	Routing	Invert	Outlet Devices
#1	Discarded	34.00'	2.410 in/hr Exfiltration over Surface area
#2	Primary	30.00'	24.0" Round Culvert L= 100.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 30.00' / 28.00' S= 0.0200 '/ Cc= 0.900 n= 0.012, Flow Area= 3.14 sf
#3	Device 2	35.70'	3.5" Vert. Orifice/Grate C= 0.600 Limited to weir flow at low heads
#4	Device 2	37.50'	12.0" W x 10.0" H Vert. Orifice/Grate C= 0.600 Limited to weir flow at low heads
#5	Device 2	39.00'	5.0' long Sharp-Crested Rectangular Weir 2 End Contraction(s)
#6	Secondary	40.50'	50.0' long + 10.0' SideZ x 8.0' 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) 2.43 2.54 2.70 2.69 2.68 2.68 2.66 2.64 2.64 2.64 2.65 2.65 2.66 2.66 2.68 2.70 2.74

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Type III 24-hr 1.2-Inch Rainfall=1.20"

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Discarded OutFlow Max=0.64 cfs @ 13.46 hrs HW=34.50' (Free Discharge)

↳ **1=Exfiltration** (Exfiltration Controls 0.64 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=34.00' (Free Discharge)

↳ **2=Culvert** (Passes 0.00 cfs of 26.20 cfs potential flow)

↳ **3=Orifice/Grate** (Controls 0.00 cfs)

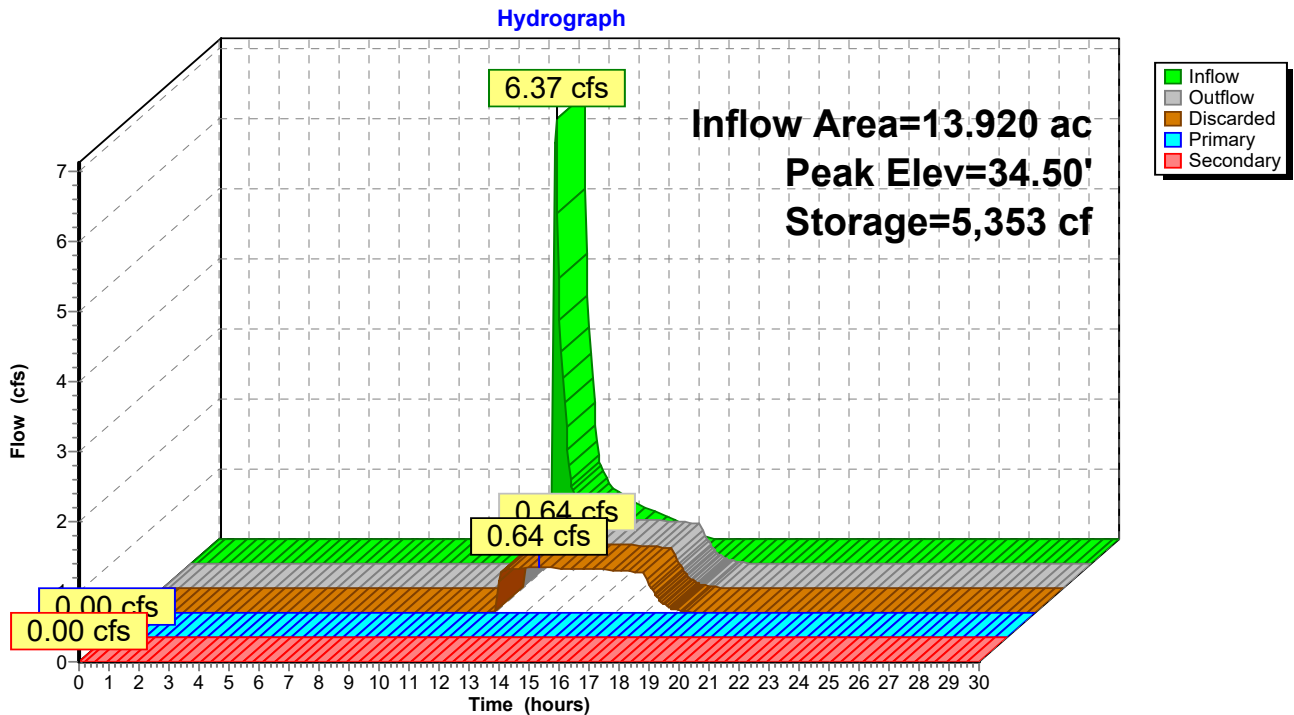
↳ **4=Orifice/Grate** (Controls 0.00 cfs)

↳ **5=Sharp-Crested Rectangular Weir** (Controls 0.00 cfs)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=34.00' (Free Discharge)

↳ **6=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond BMP-2B: Detention Basin



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Type III 24-hr 1.2-Inch Rainfall=1.20"

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Stage-Area-Storage for Pond BMP-2B: Detention Basin

Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)	Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)
34.00	10,145	0	39.30	28,305	95,304
34.10	10,412	1,028	39.40	28,814	98,160
34.20	10,680	2,082	39.50	29,324	101,067
34.30	10,947	3,164	39.60	29,833	104,024
34.40	11,214	4,272	39.70	30,342	107,033
34.50	11,481	5,407	39.80	30,851	110,093
34.60	11,749	6,568	39.90	31,361	113,203
34.70	12,016	7,756	40.00	31,870	116,365
34.80	12,283	8,971	40.10	32,199	119,568
34.90	12,550	10,213	40.20	32,528	122,805
35.00	12,818	11,481	40.30	32,857	126,074
35.10	13,085	12,776	40.40	33,187	129,376
35.20	13,352	14,098	40.50	33,516	132,711
35.30	13,619	15,447	40.60	33,845	136,079
35.40	13,886	16,822	40.70	34,174	139,480
35.50	14,154	18,224	40.80	34,503	142,914
35.60	14,421	19,653	40.90	34,832	146,381
35.70	14,688	21,108	41.00	35,162	149,881
35.80	14,955	22,590	41.10	35,491	153,413
35.90	15,223	24,099	41.20	35,820	156,979
36.00	15,490	25,635	41.30	36,149	160,577
36.10	15,800	27,199	41.40	36,478	164,209
36.20	16,110	28,795	41.50	36,807	167,873
36.30	16,419	30,421	41.60	37,136	171,570
36.40	16,729	32,079	41.70	37,466	175,300
36.50	17,039	33,767	41.80	37,795	179,063
36.60	17,349	35,487	41.90	38,124	182,859
36.70	17,658	37,237	42.00	38,453	186,688
36.80	17,968	39,018			
36.90	18,278	40,830			
37.00	18,588	42,674			
37.10	18,897	44,548			
37.20	19,207	46,453			
37.30	19,517	48,389			
37.40	19,826	50,357			
37.50	20,136	52,355			
37.60	20,446	54,384			
37.70	20,756	56,444			
37.80	21,065	58,535			
37.90	21,375	60,657			
38.00	21,685	62,810			
38.10	22,194	65,004			
38.20	22,704	67,249			
38.30	23,213	69,545			
38.40	23,722	71,891			
38.50	24,231	74,289			
38.60	24,741	76,738			
38.70	25,250	79,237			
38.80	25,759	81,788			
38.90	26,268	84,389			
39.00	26,778	87,041			
39.10	27,287	89,744			
39.20	27,796	92,499			

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Type III 24-hr 1.2-Inch Rainfall=1.20"

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Summary for Pond FS-1:

[57] Hint: Peaked at 49.83' (Flood elevation advised)

Inflow Area = 3.300 ac, 100.00% Impervious, Inflow Depth = 0.99" for 1.2-Inch event
Inflow = 3.53 cfs @ 12.09 hrs, Volume= 0.271 af
Outflow = 3.53 cfs @ 12.09 hrs, Volume= 0.271 af, Atten= 0%, Lag= 0.0 min
Primary = 3.53 cfs @ 12.09 hrs, Volume= 0.271 af
Routed to Pond BMP-1A : Sediment Forebay
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Routed to Pond BMP-2A : Sediment Forebay

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs / 2
Peak Elev= 49.83' @ 12.09 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	48.75'	15.0" Round Culvert L= 20.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 48.75' / 48.50' S= 0.0125 '/ Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.23 sf
#2	Secondary	46.50'	36.0" Round Culvert L= 200.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 46.50' / 44.00' S= 0.0125 '/ Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 7.07 sf
#3	Device 2	50.00'	5.0' long Sharp-Crested Rectangular Weir 2 End Contraction(s)

Primary OutFlow Max=3.44 cfs @ 12.09 hrs HW=49.81' (Free Discharge)

↑1=Culvert (Barrel Controls 3.44 cfs @ 4.19 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=46.50' (Free Discharge)

↑2=Culvert (Controls 0.00 cfs)

↑3=Sharp-Crested Rectangular Weir (Controls 0.00 cfs)

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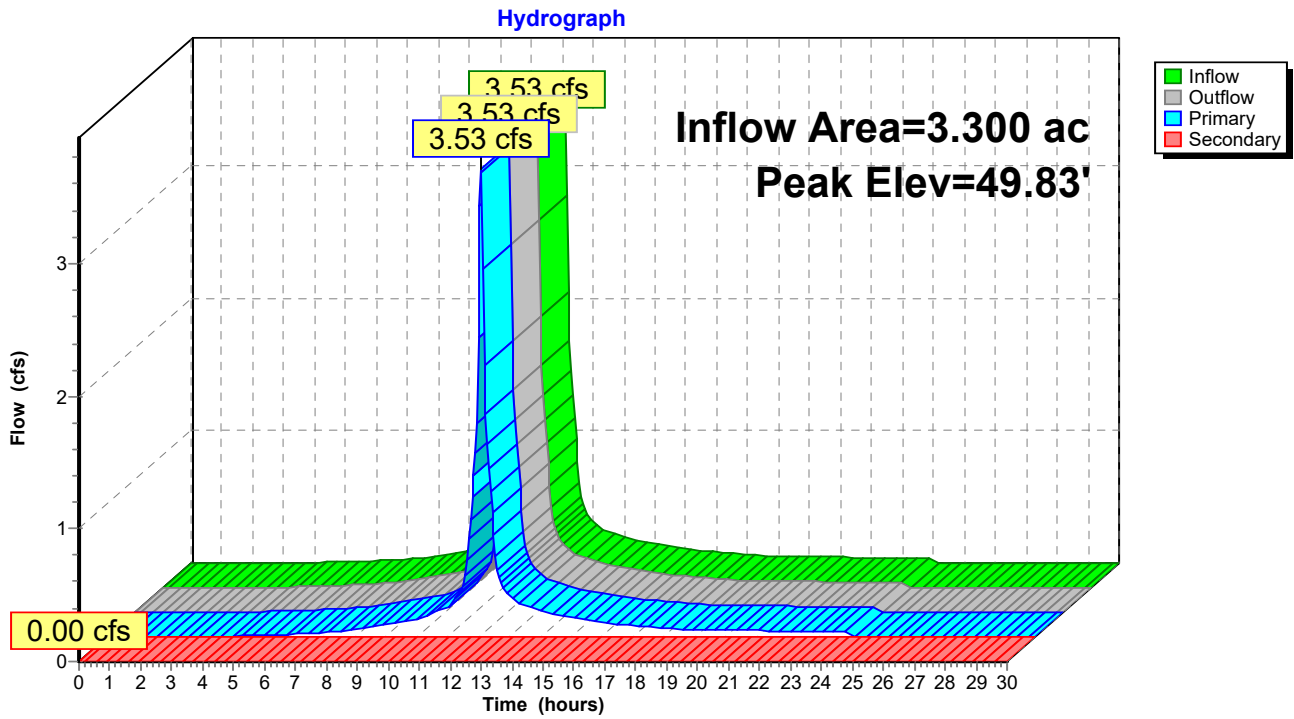
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Pond FS-1:



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Type III 24-hr 1.2-Inch Rainfall=1.20"

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Stage-Area-Storage for Pond FS-1:

Elevation (feet)	Storage (acre-feet)	Elevation (feet)	Storage (acre-feet)
46.50	0.000	49.15	0.000
46.55	0.000	49.20	0.000
46.60	0.000	49.25	0.000
46.65	0.000	49.30	0.000
46.70	0.000	49.35	0.000
46.75	0.000	49.40	0.000
46.80	0.000	49.45	0.000
46.85	0.000	49.50	0.000
46.90	0.000	49.55	0.000
46.95	0.000	49.60	0.000
47.00	0.000	49.65	0.000
47.05	0.000	49.70	0.000
47.10	0.000	49.75	0.000
47.15	0.000	49.80	0.000
47.20	0.000	49.85	0.000
47.25	0.000	49.90	0.000
47.30	0.000	49.95	0.000
47.35	0.000	50.00	0.000
47.40	0.000		
47.45	0.000		
47.50	0.000		
47.55	0.000		
47.60	0.000		
47.65	0.000		
47.70	0.000		
47.75	0.000		
47.80	0.000		
47.85	0.000		
47.90	0.000		
47.95	0.000		
48.00	0.000		
48.05	0.000		
48.10	0.000		
48.15	0.000		
48.20	0.000		
48.25	0.000		
48.30	0.000		
48.35	0.000		
48.40	0.000		
48.45	0.000		
48.50	0.000		
48.55	0.000		
48.60	0.000		
48.65	0.000		
48.70	0.000		
48.75	0.000		
48.80	0.000		
48.85	0.000		
48.90	0.000		
48.95	0.000		
49.00	0.000		
49.05	0.000		
49.10	0.000		

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Type III 24-hr 1.2-Inch Rainfall=1.20"

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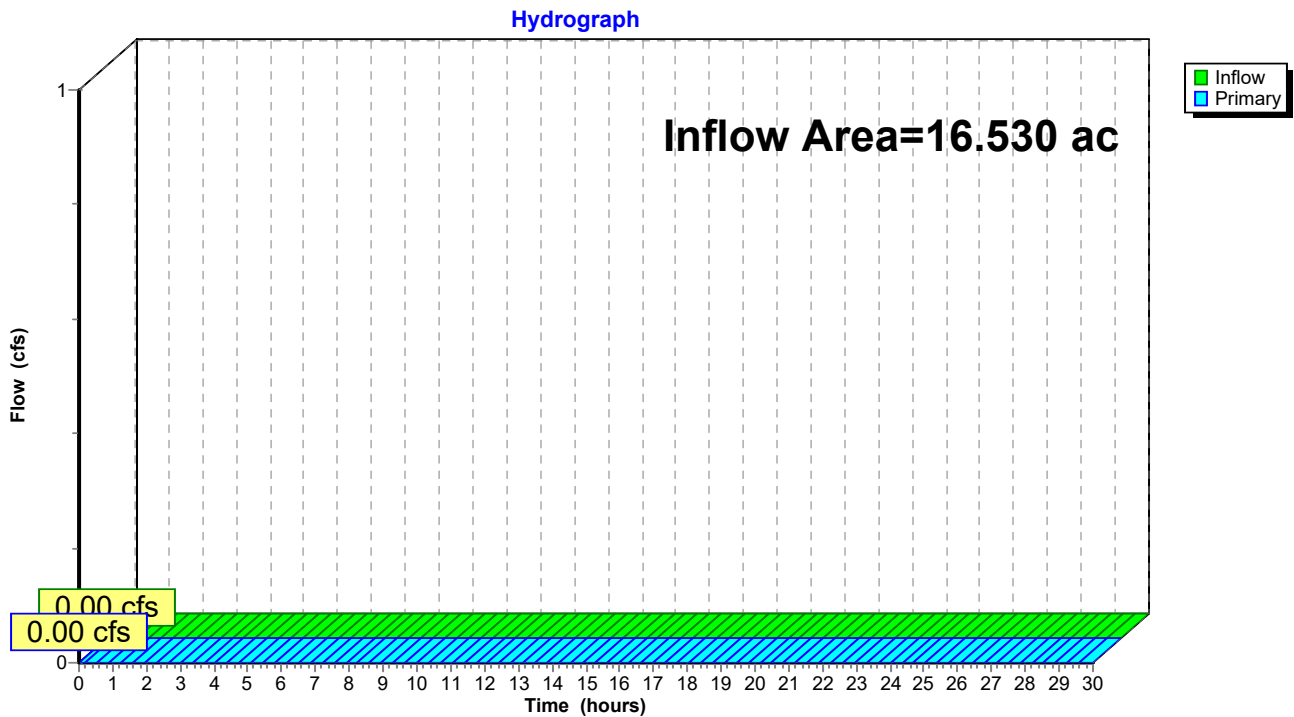
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Summary for Link PR-DP-1: Existing Drainage Channel

Inflow Area = 16.530 ac, 63.76% Impervious, Inflow Depth = 0.00" for 1.2-Inch event
Inflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs

Link PR-DP-1: Existing Drainage Channel



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Type III 24-hr 1.2-Inch Rainfall=1.20"

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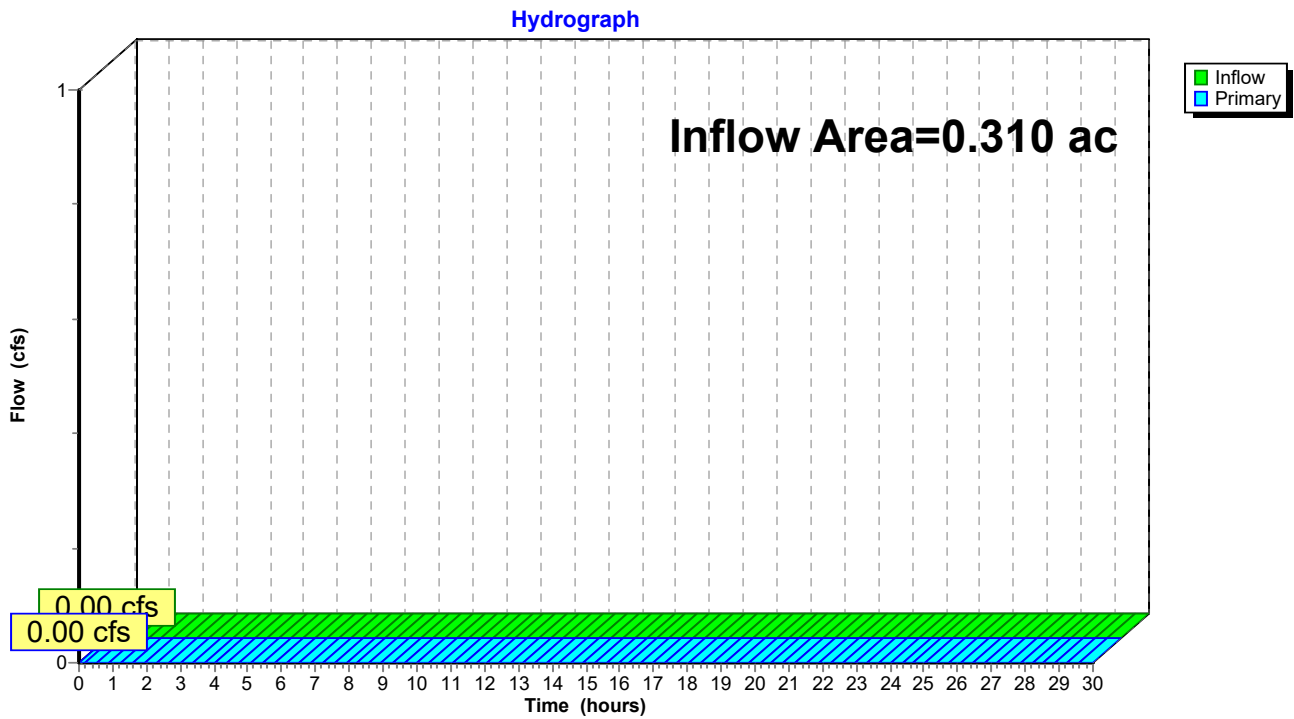
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Summary for Link PR-DP-2: Goddard Drive

Inflow Area = 0.310 ac, 0.00% Impervious, Inflow Depth = 0.00" for 1.2-Inch event
Inflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs

Link PR-DP-2: Goddard Drive



**Appendix D
RIDEM Stormwater
Management Checklist**



APPENDIX A: STORMWATER MANAGEMENT PLAN CHECKLIST AND LID PLANNING REPORT – STORMWATER DESIGN SUMMARY

PROJECT NAME 20 Goddard Drive Warehouse	(RIDEM USE ONLY)
TOWN Cranston	STW/WQC File #:
BRIEF PROJECT DESCRIPTION: The proposed development improvements primarily involve the construction of an industrial warehouse. The central site access will be removed, and the northern and southern site entrances will each be reconstructed in close proximity to their existing locations. An employee parking field will be located along the northern side of the warehouse, and truck loading and storage facilities along with an additional row of parking spaces will be located along the southern side of the building. Circulation between the northern parking field and southern loading/storage area will be provided along the eastern face of the warehouse. The development will provide landscaping improvements, and will include associated pedestrian features, walkways, lighting and other amenities.	Date Received:

Stormwater Management Plan (SMP) Elements – Minimum Standards

When submitting a SMP,¹ submit **four separately bound** documents: Appendix A Checklist; Stormwater Site Planning, Analysis and Design Report with Plan Set/Drawings; Soil Erosion and Sediment Control (SESC) Plan, and Post Construction Operations and Maintenance (O&M) Plan. Please refer to [Suggestions to Promote Brevity](#).

Note: All stormwater construction projects **must create** a Stormwater Management Plan (SMP). However, not every element listed below is required per the [RIDEM Stormwater Rules](#) and the [RIPDES Construction General Permit \(CGP\)](#). This checklist will help identify the required elements to be submitted with an Application for Stormwater Construction Permit & Water Quality Certification.

PART 1. PROJECT AND SITE INFORMATION

PROJECT TYPE (Check all that apply)

<input type="checkbox"/> Residential	<input type="checkbox"/> Commercial	<input type="checkbox"/> Federal	<input type="checkbox"/> Retrofit	<input type="checkbox"/> Restoration
<input type="checkbox"/> Road	<input type="checkbox"/> Utility	<input type="checkbox"/> Fill	<input type="checkbox"/> Dredge	<input type="checkbox"/> Mine
<input checked="" type="checkbox"/> Other (specify): Industrial Warehouse				

SITE INFORMATION

Vicinity Map

INITIAL DISCHARGE LOCATION(S): The WQv discharges to: (You may choose more than one answer if several discharge points are associated with the project.)

<input checked="" type="checkbox"/> Groundwater	<input type="checkbox"/> Surface Water	<input type="checkbox"/> MS4
<input type="checkbox"/> GAA	<input type="checkbox"/> Isolated Wetland	<input type="checkbox"/> RIDOT
<input type="checkbox"/> GA	<input type="checkbox"/> Named Waterbody	<input type="checkbox"/> RIDOT Alteration Permit is Approved
<input checked="" type="checkbox"/> GB	<input type="checkbox"/> Unnamed Waterbody Connected to Named Waterbody	<input type="checkbox"/> Town
		<input type="checkbox"/> Other (specify):

¹ Applications for a Construction General Permit that do not require any other permits from RIDEM and will disturb less than 5 acres over the entire course of the project do not need to submit a SMP. The Appendix A checklist must still be submitted.

Stormwater Management, Design, and Installation Rules (250-RICR-150-10-8)

ULTIMATE RECEIVING WATERBODY LOCATION(S): Include pertinent information that applies to both WQ _v and flow from larger storm events including overflows. Choose all that apply, and repeat table for each waterbody.			
<input type="checkbox"/> Groundwater or Disconnected Wetland	<input checked="" type="checkbox"/> SRWP		
<input checked="" type="checkbox"/> Waterbody Name: Pawtuxet River Main Stem	<input type="checkbox"/> Coldwater	<input checked="" type="checkbox"/> Warmwater	<input type="checkbox"/> Unassessed
<input checked="" type="checkbox"/> Waterbody ID: RI0006017R-03	<input type="checkbox"/> 4 th order stream of pond 50 acres or more		
<input type="checkbox"/> TMDL for:	<input type="checkbox"/> Watershed of flood prone river (e.g., Pocasset River)		
<input type="checkbox"/> Contributes to a priority outfall listed in the TMDL	<input type="checkbox"/> Contributes stormwater to a public beach		
<input checked="" type="checkbox"/> 303(d) list – Impairment(s) for: Mercury in fish tissue; Non-native aquatic plants; Lead; Enterococcus	<input type="checkbox"/> Contributes to shellfishing grounds		

PROJECT HISTORY		
<input type="checkbox"/> RIDEM Pre- Application Meeting	Meeting Date:	<input type="checkbox"/> Minutes Attached
<input type="checkbox"/> Municipal Master Plan Approval	Approval Date:	<input type="checkbox"/> Minutes Attached
<input type="checkbox"/> Subdivision Suitability Required	Approval #:	
<input type="checkbox"/> Previous Enforcement Action has been taken on the property	Enforcement #:	

FLOODPLAIN & FLOODWAY See Guidance Pertaining to Floodplain and Floodways	
<input type="checkbox"/> Riverine 100-year floodplain: FEMA FLOODPLAIN FIRMETTE has been reviewed and the 100-year floodplain is on site	
<input checked="" type="checkbox"/> Delineated from FEMA Maps	
NOTE: Per Rule 250-RICR-150-10-8-1.1(B)(5)(d)(3), provide volumetric floodplain compensation calculations for cut and fill/displacement calculated by qualified professional	
<input type="checkbox"/> Calculated by Professional Engineer	
<input type="checkbox"/> Calculations are provided for cut vs. fill/displacement volumes proposed within the 100-year floodplain	Amount of Fill (CY):
	Amount of Cut (CY):
<input type="checkbox"/> Restrictions or modifications are proposed to the flow path or velocities in a floodway	
<input type="checkbox"/> Floodplain storage capacity is impacted	
<input checked="" type="checkbox"/> Project area is not within 100-year floodplain as defined by RIDEM	

CRMC JURISDICTION	
<input type="checkbox"/> CRMC Assent required	
<input type="checkbox"/> Property subject to a Special Area Management Plan (SAMP). If so, specify which SAMP:	
<input type="checkbox"/> Sea level rise mitigation has been designed into this project	

LUHPPL IDENTIFICATION - MINIMUM STANDARD 8:

1. OFFICE OF Land Revitalization and Sustainable Materials Management (OLRSMM)		
<input type="checkbox"/> Known or suspected releases of HAZARDOUS MATERIAL are present at the site (Hazardous Material is defined in Rule 1.4(A)(33) of 250-140-30-1 of the RIDEM Rules and Regulations for Investigation and Remediation of Hazardous Materials (the Remediation Regulations))		RIDEM CONTACT:
<input type="checkbox"/> Known or suspected releases of PETROLEUM PRODUCT are present at the site (Petroleum Product as defined in Rule 1.5(A)(84) of 250-140-25-1 of the RIDEM Rules and Regulations for Underground Storage Facilities Used for Regulated Substances and Hazardous Materials)		
<input type="checkbox"/> This site is identified on the RIDEM Environmental Resources Map as one of the following regulated facilities		SITE ID#:
<input type="checkbox"/> CERCLIS/Superfund (NPL)		
<input type="checkbox"/> State Hazardous Waste Site (SHWS)		
<input type="checkbox"/> Environmental Land Usage Restriction (ELUR)		
<input type="checkbox"/> Leaking Underground Storage Tank (LUST)		
<input type="checkbox"/> Closed Landfill		

Note: If any boxes in 1 above are checked, the applicant must contact the RIDEM OLRSM Project Manager associated with the Site to determine if subsurface infiltration of stormwater is allowable for the project. Indicate if the infiltration corresponds

Stormwater Management, Design, and Installation Rules (250-RICR-150-10-8)

to “Red,” “Yellow” or “Green” as described in Section 3.2.8 of the RISDISM Guidance (Subsurface Contamination Guidance). Also, note and reference approval in PART 3, Minimum Standard 2: Groundwater Recharge/Infiltration.		
2. PER MINIMUM STANDARD 8 of RICR 8.14.C.1-6 “LUHPPLS,” THE SITE IS/HAS:		
	<input type="checkbox"/> Industrial Site with RIPDES MSGP, except where No Exposure Certification exists. http://www.dem.ri.gov/programs/water/permits/ripdes/stormwater/status.php	
	<input type="checkbox"/> Auto Fueling Facility (e.g., gas station)	
	<input type="checkbox"/> Exterior Vehicles Service, Maintenance, or Equipment Cleaning Area	
	<input type="checkbox"/> Road Salt Storage and Loading Areas (exposed to rainwater)	
	<input checked="" type="checkbox"/> Outdoor Storage and Loading/Unloading of Hazardous Substances	
3. STORMWATER INDUSTRIAL PERMITTING		
	<input checked="" type="checkbox"/> The site is associated with existing or proposed activities that are considered Land Uses with Higher Potential Pollutant Loads (LUHPPLS) (see RICR 8.14.C)	Activities: Warehouse loading & storage operations Sector:
	<input type="checkbox"/> Construction is proposed on a site that is subject to THE MULTI-SECTOR GENERAL PERMIT (MSGP) UNDER RULE 31(B)15 OF THE RIPDES REGULATIONS.	MSGP permit #
	<input type="checkbox"/> Additional stormwater treatment is required by the MSGP Explain:	
REDEVELOPMENT STANDARD – MINIMUM STANDARD 6		
<input checked="" type="checkbox"/> Pre-Construction Impervious Area		
4.17	<input checked="" type="checkbox"/> Total Pre-Construction Impervious Area (TIA)	
16.84	<input checked="" type="checkbox"/> Total Site Area (TSA)	
	<input type="checkbox"/> Jurisdictional Wetlands (JW)	
	<input type="checkbox"/> Conservation Land (CL)	
<input checked="" type="checkbox"/> Calculate the Site Size (defined as contiguous properties under same ownership)		
16.84	<input checked="" type="checkbox"/> Site Size (SS) = (TSA) – (JW) – (CL)	
0.25	<input checked="" type="checkbox"/> (TIA) / (SS) =	<input type="checkbox"/> (TIA) / (SS) >0.4?
<input type="checkbox"/> YES, Redevelopment		

PART 2. LOW IMPACT DEVELOPMENT ASSESSMENT – MINIMUM STANDARD 1
(NOT REQUIRED FOR REDEVELOPMENT OR RETROFITS)
This section may be deleted if not required.

Note: A written description must be provided specifying why each method is not being used or is not applicable at the Site. Appropriate answers may include:

- Town requires ... (state the specific local requirement)
- Meets Town’s dimensional requirement of ...
- Not practical for site because ...
- Applying for waiver/variance to achieve this (pending/approved/denied)
- Applying for wavier/variance to seek relief from this (pending/approved/denied)

Stormwater Management, Design, and Installation Rules (250-RICR-150-10-8)

<p>A) PRESERVATION OF UNDISTURBED AREAS, BUFFERS, AND FLOODPLAINS</p> <ul style="list-style-type: none"> <input checked="" type="checkbox"/> Sensitive resource areas and site constraints are identified (required) <input checked="" type="checkbox"/> Local development regulations have been reviewed (required) <input type="checkbox"/> All vegetated buffers and coastal and freshwater wetlands will be protected during and after construction <input type="checkbox"/> Conservation Development or another site design technique has been incorporated to protect open space and pre-development hydrology. Note: If Conservation Development has been used, check box and skip to Subpart C <input checked="" type="checkbox"/> As much natural vegetation and pre-development hydrology as possible has been maintained 	<p>IF NOT IMPLEMENTED, EXPLAIN HERE</p>
<p>B) LOCATE DEVELOPMENT IN LESS SENSITIVE AREAS AND WORK WITH THE NATURAL LANDSCAPE CONDITIONS, HYDROLOGY, AND SOILS</p> <ul style="list-style-type: none"> <input type="checkbox"/> Development sites and building envelopes have been appropriately distanced from wetlands and waterbodies <input checked="" type="checkbox"/> Development and stormwater systems have been located in areas with greatest infiltration capacity (e.g., soil groups A and B) <input type="checkbox"/> Plans show measures to prevent soil compaction in areas designated as Qualified Pervious Areas (QPA's) <input type="checkbox"/> Development sites and building envelopes have been positioned outside of floodplains <input type="checkbox"/> Site design positions buildings, roadways and parking areas in a manner that avoids impacts to surface water features <input checked="" type="checkbox"/> Development sites and building envelopes have been located to minimize impacts to steep slopes ($\geq 15\%$) <input type="checkbox"/> Other (describe): 	
<p>C) MINIMIZE CLEARING AND GRADING</p> <ul style="list-style-type: none"> <input checked="" type="checkbox"/> Site clearing has been restricted to <u>minimum area needed</u> for building footprints, development activities, construction access, and safety. <input checked="" type="checkbox"/> Site has been designed to position buildings, roadways, and parking areas in a manner that minimizes grading (cut and fill quantities) <input checked="" type="checkbox"/> Protection for stands of trees and individual trees and their root zones to be preserved has been specified, and such protection extends at least to the tree canopy drip line(s) <input type="checkbox"/> Plan notes specify that public trees removed or damaged during construction shall be replaced with equivalent 	
<p>D) REDUCE IMPERVIOUS COVER</p> <ul style="list-style-type: none"> <input type="checkbox"/> Reduced roadway widths (≤ 22 feet for ADT ≤ 400; ≤ 26 feet for ADT 400 - 2,000) <input type="checkbox"/> Reduced driveway areas (length minimized via reduced ROW width (≤ 45 ft.) and/or reduced (or absolute minimum) front yard setback; width minimized to ≤ 9 ft. wide one lane; ≤ 18 ft. wide two lanes; shared driveways; pervious surface) <input type="checkbox"/> Reduced building footprint: Explain approach: <input type="checkbox"/> Reduced sidewalk area (≤ 4 ft. wide; one side of the street; unpaved path; pervious surface) <input type="checkbox"/> Reduced cul-de-sacs (radius < 45 ft; vegetated island; alternative turn-around) <input type="checkbox"/> Reduced parking lot area: Explain approach <input type="checkbox"/> Use of pervious surfaces for driveways, sidewalks, parking areas/overflow parking areas, etc. <input type="checkbox"/> Minimized impervious surfaces (project meets or is less than maximum specified by Zoning Ordinance) <input checked="" type="checkbox"/> Other (describe): 	<p>Impervious cover has not been proposed beyond the minimum amount necessary to achieve the project purpose.</p>

Stormwater Management, Design, and Installation Rules (250-RICR-150-10-8)

<p>E) DISCONNECT IMPERVIOUS AREA</p> <p><input type="checkbox"/> Impervious surfaces have been disconnected, and runoff has been diverted to QPAs to the maximum extent possible</p> <p><input type="checkbox"/> Residential street edges allow side-of-the-road drainage into vegetated open swales</p> <p><input checked="" type="checkbox"/> Parking lot landscaping breaks up impervious expanse AND accepts runoff</p> <p><input type="checkbox"/> Other (describe):</p>	
<p>F) MITIGATE RUNOFF AT THE POINT OF GENERATION</p> <p><input checked="" type="checkbox"/> Small-scale BMPs have been designated to treat runoff as close as possible to the source</p>	
<p>G) PROVIDE LOW-MAINTENANCE NATIVE VEGETATION</p> <p><input checked="" type="checkbox"/> Low-maintenance landscaping has been proposed using native species and cultivars</p> <p><input checked="" type="checkbox"/> Plantings of native trees and shrubs in areas previously cleared of native vegetation are shown on site plan</p> <p><input type="checkbox"/> Lawn areas have been limited/minimized, and yards have been kept undisturbed to the maximum extent practicable on residential lots</p>	
<p>H) RESTORE STREAMS/WETLANDS</p> <p><input checked="" type="checkbox"/> Historic drainage patterns have been restored by removing closed drainage systems, daylighting buried streams, and/or restoring degraded stream channels and/or wetlands</p> <p><input type="checkbox"/> Removal of invasive species</p> <p><input type="checkbox"/> Other</p>	

PART 3. SUMMARY OF REMAINING STANDARDS

GROUNDWATER RECHARGE – MINIMUM STANDARD 2

YES	NO	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	The project has been designed to meet the groundwater recharge standard.
<input type="checkbox"/>	<input type="checkbox"/>	If “No,” the justification for groundwater recharge criterion waiver has been explained in the Narrative (e.g., threat of groundwater contamination or physical limitation), if applicable (see RICR 8.8.D);
<input type="checkbox"/>	<input type="checkbox"/>	Your waiver request has been explained in the Narrative, if applicable.
<input checked="" type="checkbox"/>	<input type="checkbox"/>	Is this site identified as a Regulated Facility in Part 1, Minimum Standard 8: LUHPPL Identification?
<input type="checkbox"/>	<input checked="" type="checkbox"/>	If “Yes,” has approval for infiltration by the OLRSM Site Project Manager, per Part 1, Minimum Standard 8, been requested? REQUEST THIS IN STM NARRATIVE??

TABLE 2-1: Summary of Recharge (see RISDISM Section 3.3.2)

(Add or Subtract Rows as Necessary)

Design Point	Impervious Area Treated (Sq-ft)	Total Re _v Required (Cu-ft)	LID Stormwater Credits (see RISDISM Section 4.6.1)	Recharge Required by Remaining BMPs (cu ft)	Recharge Provided by BMPs (cu ft)
			Portion of Re _v directed to a QPA (cu ft)		
DP-1:	457,380	22,869	0	22,869	27,925
DP-2:	0	0	0	0	0
TOTALS:	457,380	22,869	0	22,869	27,925

Notes:

- Only BMPs listed in RISDISM Table 3-5 “List of BMPs Acceptable for Recharge” may be used to meet the recharge requirement.
- Recharge requirement must be satisfied for each waterbody ID.

Stormwater Management, Design, and Installation Rules (250-RICR-150-10-8)

Indicate where the pertinent calculations and/or information for the above items are provided (i.e., name of report/document, page numbers, appendices, etc.):

Project Narrative and Stormwater Management Report – Appendix C & E

WATER QUALITY – MINIMUM STANDARD 3

YES	NO	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	Does this project meet or exceed the required water quality volume WQv (see RICR 8.9.E-I)?
<input checked="" type="checkbox"/>	<input type="checkbox"/>	Is the proposed final impervious cover greater than 20% of the disturbed area (see RICR 8.9.E-I)?
<input checked="" type="checkbox"/>	<input type="checkbox"/>	If “Yes,” either the Modified Curve Number Method or the Split Pervious/Impervious method in Hydro-CAD was used to calculate WQv; or,
<input checked="" type="checkbox"/>	<input type="checkbox"/>	If “Yes,” either TR-55 or TR-20 was used to calculate WQv; and,
<input type="checkbox"/>	<input type="checkbox"/>	If “No,” the project meets the minimum WQv of 0.2 watershed inches over the entire disturbed area.
<input type="checkbox"/>	<input type="checkbox"/>	Not Applicable
<input checked="" type="checkbox"/>	<input type="checkbox"/>	Does this project meet or exceed the ability to treat required water quality flow WQf (see RICR 8.9.I.1-3)?
<input checked="" type="checkbox"/>	<input type="checkbox"/>	Does this project propose an increase of impervious cover to a receiving water body with impairments? If “Yes,” please indicate below the method that was used to address the water quality requirements of no further degradation to a low-quality water. Infiltration practices have been selected for this project that having pollutant removal capabilities specifically suited for the removal of the pollutants of concern (metals and pathogens).
<input type="checkbox"/>	<input checked="" type="checkbox"/>	RICR 8.36. A Pollutant Loading Analysis is needed and has been completed.
<input checked="" type="checkbox"/>	<input type="checkbox"/>	The Water Quality Guidance Document (Water Quality Goals and Pollutant Loading Analysis Guidance for Discharges to Impaired Waters) has been followed as applicable.
<input type="checkbox"/>	<input checked="" type="checkbox"/>	BMPs are proposed that are on the approved technology list . If “Yes,” please provide all required worksheets from the manufacturer.
<input type="checkbox"/>	<input checked="" type="checkbox"/>	Additional pollutant-specific requirements and/or pollutant removal efficiencies are applicable to the site as the result of a TMDL, SAMP, or other watershed-specific requirements. If “Yes,” please describe:

TABLE 3-1: Summary of Water Quality (see RICR 8.9)

Design Point and WB ID	Impervious area treated (sq ft)	Total WQv Required (cu ft)	LID Stormwater Credits (see RICR 8.18)	Water Quality Treatment Remaining (cu ft)	Water Quality Provided by BMPs (cu ft)
			WQv directed to a QPA (cu ft)		
DP-1:	457,380	38,115	0	38,115	41,388
DP-2:	0	0	0	0	0
TOTALS:	457,380	38,115	0	38,115	41,388

Notes:

- Only BMPs listed in RICR 8.20 and 8.25 or the Approved Technologies List of BMPs is Acceptable for Water Quality treatment.
- For each Design Point, the Water Quality Volume Standard must be met for each Waterbody ID.

YES This project has met the setback requirements for each BMP.

Stormwater Management, Design, and Installation Rules (250-RICR-150-10-8)

<input type="checkbox"/> NO	If "No," please explain:
<input checked="" type="checkbox"/> Indicate where the pertinent calculations and/or information for the above items are provided (i.e., name of report/document, page numbers, appendices, etc.): <p align="center"><i>Project Narrative and Stormwater Management Report – Appendix C & E</i></p>	

CONVEYANCE AND NATURAL CHANNEL PROTECTION (RICR 8.10) – MINIMUM STANDARD 4		
YES	NO	
<input type="checkbox"/>	<input checked="" type="checkbox"/>	Is this standard waived? If "Yes," please indicate one or more of the reasons below:
		<input type="checkbox"/> The project directs discharge to a large river (i.e., 4th-order stream or larger. See RISDISM Appendix I for State-wide list and map of stream orders), bodies of water >50.0 acres in surface area (i.e., lakes, ponds, reservoirs), or tidal waters. <input type="checkbox"/> The project is a small facility with impervious cover of less than or equal to 1 acre. <input type="checkbox"/> The project has a post-development peak discharge rate from the facility that is less than 2 cfs for the 1-year, 24-hour Type III design storm event (prior to any attenuation). (Note: LID design strategies can greatly reduce the peak discharge rate).
<input checked="" type="checkbox"/>	<input type="checkbox"/>	Conveyance and natural channel protection for the site have been met. If "No," explain why:

TABLE 4-1: Summary of Channel Protection Volumes (see RICR 8.10)					
Design Point	Receiving Water Body Name	Coldwater Fishery? (Y/N)	Total CPv Required (cu-ft)	Total CPv Provided (cu-ft)	Average Release Rate Modeled in the 1-yr storm (cfs)
DP-1:	Pawtuxet River Main Stem	N	25,766	26,680	0.08
TOTALS:	Pawtuxet River Main Stem	N	25,766	26,680	0.08

Note: The Channel Protection Volume Standard must be met in each waterbody ID.

<input checked="" type="checkbox"/> YES	The CPv is released at roughly a uniform rate over a 24-hour duration (see examples of sizing calculations in Appendix D of the RISDISM).
<input type="checkbox"/> NO	
<input type="checkbox"/> YES	Do additional design restrictions apply resulting from any discharge to cold-water fisheries; If "Yes," please indicate restrictions and solutions below.
<input checked="" type="checkbox"/> NO	
<input checked="" type="checkbox"/> Indicate below where the pertinent calculations and/or information for the above items are provided (i.e., name of report/document, page numbers, appendices, etc.). <p align="center"><i>Project Narrative and Stormwater Management Report – Appendix C</i></p>	

OVERBANK FLOOD PROTECTION (RICR 8.11) AND OTHER POTENTIAL HIGH FLOWS – MINIMUM STANDARD 5		
YES	NO	
<input type="checkbox"/>	<input checked="" type="checkbox"/>	Is this standard waived? If yes, please indicate one or more of the reasons below:

Stormwater Management, Design, and Installation Rules (250-RICR-150-10-8)

<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/> The project directs discharge to a large river (i.e., 4th-order stream or larger. See Appendix I for state-wide list and map of stream orders), bodies of water >50.0 acres in surface area (i.e., lakes, ponds, reservoirs), or tidal waters. <input type="checkbox"/> A Downstream Analysis (see RICR 8.11.D and E) indicates that peak discharge control would not be beneficial or would exacerbate peak flows in a downstream tributary of a particular site (e.g., through coincident peaks).
<input type="checkbox"/>	<input checked="" type="checkbox"/>	Does the project flow to an MS4 system or subject to other stormwater requirements? If "Yes," indicate as follows:
	<input type="checkbox"/>	RIDOT
	<input type="checkbox"/>	Other (specify):

Note: The project could be approved by RIDEM but not meet RIDOT or Town standards. RIDOT's regulations indicate that post-volumes must be **less** than pre-volumes for the 10-yr storm at the design point entering the RIDOT system. If you have not already received approval for the discharge to an MS4, please explain below your strategy to comply with RIDEM and the MS4.

		Indicate below which model was used for your analysis. <input type="checkbox"/> TR-55 <input checked="" type="checkbox"/> TR-20 <input checked="" type="checkbox"/> HydroCAD <input type="checkbox"/> Bentley/Haestad <input type="checkbox"/> Intellisolve <input type="checkbox"/> Other (Specify):
--	--	---

YES	NO	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	Does the drainage design demonstrate that flows from the 100-year storm event through a BMP will safely manage and convey the 100-year storm? If "No," please explain briefly below and reference where in the application further documentation can be found (i.e., name of report/document, page numbers, appendices, etc.):
<input type="checkbox"/>	<input checked="" type="checkbox"/>	Do off-site areas contribute to the sub-watersheds and design points? If "Yes,"
<input type="checkbox"/>	<input type="checkbox"/>	Are the areas modeled as "present condition" for both pre- and post-development analysis?
<input type="checkbox"/>	<input type="checkbox"/>	Are the off-site areas shown on the subwatershed maps?
<input checked="" type="checkbox"/>	<input type="checkbox"/>	Does the drainage design confirm safe passage of the 100-year flow through the site for off-site runoff?
<input checked="" type="checkbox"/>	<input type="checkbox"/>	Is a Downstream Analysis required (see RICR 8.11.E.1)? (<i>See Project Narrative and Stormwater Management Report Section 4.5</i>)
<input checked="" type="checkbox"/>	<input type="checkbox"/>	Calculate the following:
	<input checked="" type="checkbox"/>	Area of disturbance within the sub-watershed (areas)
	<input checked="" type="checkbox"/>	Impervious cover (%)
<input type="checkbox"/>	<input checked="" type="checkbox"/>	Is a dam breach analysis required (earthen embankments over six (6) feet in height, or a capacity of 15 acre-feet or more, and contributes to a significant or high hazard dam)?
<input checked="" type="checkbox"/>	<input type="checkbox"/>	Does this project meet the overbank flood protection standard?

Table 5-1 Hydraulic Analysis Summary

Subwatershed (Design Point)	1.2" Peak Flow (cfs) **		1-yr Peak Flow (cfs)		10-yr Peak Flow (cfs)		100-yr Peak Flow (cfs)	
	Pre (cfs)	Post (cfs)	Pre (cfs)	Post (cfs)	Pre (cfs)	Post (cfs)	Pre (cfs)	Post (cfs)
DP-1:	2.65	0.00	0.18	0.00	7.49	2.42	36.83	33.10
DP-2:	0.70	0.00	0.80	0.00	3.23	0.01	8.37	0.38
TOTALS:	3.35	0.00	0.98	0.00	10.72	2.43	45.20	33.48

** Utilize modified curve number method or split pervious /impervious method in HydroCAD.

Note: The hydraulic analysis must demonstrate no impact to each individual subwatershed DP unless each DP discharges to the same wetland or water resource.

Stormwater Management, Design, and Installation Rules (250-RICR-150-10-8)

Indicate as follows where the pertinent calculations and/or information for the items above are provided	Name of report/document, page numbers, appendices, etc.
Existing conditions analysis for each subwatershed, including curve numbers, times of concentration, runoff rates, volumes, and water surface elevations showing methodologies used and supporting calculations.	<i>Project Narrative and Stormwater Management Report – Appendix A, B</i>
Proposed conditions analysis for each subwatershed, including curve numbers, times of concentration, runoff rates, volumes, water surface elevations, and routing showing the methodologies used and supporting calculations.	<i>Project Narrative and Stormwater Management Report – Appendix A, C</i>
Final sizing calculations for structural stormwater BMPs, including contributing drainage area, storage, and outlet configuration.	<i>Project Narrative and Stormwater Management Report – Appendix C, E</i>
Stage-storage, inflow and outflow hydrographs for storage facilities (e.g., detention, retention, or infiltration facilities).	<i>Project Narrative and Stormwater Management Report – Appendix C</i>

Table 5-2 Summary of Best Management Practices											
BMP ID	DP #	BMP Type (e.g., bioretention, tree filter)	BMP Functions					Bypass Type External (E) Internal (I) or NA	Horizontal Setback Criteria are met per RICR 8.21.B.10, 8.22.D.11, and 8.35.B.4		
			Pre-Treatment (Y/N/N/A)	Re _v	WQ _v	CP _v (Y/N/NA)	Overbank Flood Reduction (Y/N/NA)		Yes/No	Technical Justification (Design Report page number)	Distance Provided
1	1	Lined Sand Filter	Y	N	Y	N/A	N/A	E	Y	N/A	N/A
2	1	Infiltration/ Detention Basin	Y	Y	Y	Y	Y	E	Y	N/A	50 Ft (upgradient from natural slopes >15%)

Table 5.3 Summary of Soils to Evaluate Each BMP										
DP #	BMP ID	BMP Type (e.g., bioretention, tree filter)	Soils Analysis for Each BMP							Exfiltration Rate Applied (in/hr)
			Test Pit ID# and Ground Elevation		SHWT Elevation (ft)	Bottom of Practice Elevation* (ft)	Separation Distance Provided (ft)	Hydrologic Soil Group (A, B, C, D)		
			Primary	Secondary						
1	1	Lined Sand Filter	SEV D-1		37.8	45.5	7.7	A	N/A	
1	2	Infiltration/ Detention Basin	SEV D-3		25.7	34.0	8.3	A	2.41	

* For underground infiltration systems (UICs) bottom equals bottom of stone, for surface infiltration basins bottom equals bottom of basin, for filters bottom equals interface of storage and top of filter layer

LAND USES WITH HIGHER POTENTIAL POLLUTANTS LOADS (LUHPPLs) – MINIMUM STANDARD 8			
YES	NO	N/A	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Describe any LUHPPLs identified in Part 1, Minimum Standard 8, Section 2. If not applicable, continue to Minimum Standard 9. <i>Loading and storage areas immediately south of the proposed warehouse.</i>

Stormwater Management, Design, and Installation Rules (250-RICR-150-10-8)

<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	Are these activities already covered under an MSGP? If “No,” please explain if you have applied for an MSGP or intend to do so?
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	List the specific BMPs that are proposed for this project that receive stormwater from LUHPPL drainage areas. These BMP types must be listed in RISDISM Table 3-3, “Acceptable BMPs for Use at LUHPPLs.” Please list BMPs: <i>Impermeably Lined Surface Sand Filter (BMP-1)</i>
<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Additional BMPs, or additional pretreatment BMP’s if any, that meet RIPDES MSGP requirements; Please list BMPs:
			Indicate below where the pertinent calculations and/or information for the above items are provided (i.e., name of report/document, page numbers, appendices, etc.). <i>Project Narrative and Stormwater Management Report Sections 3.5 & 4.3</i>

ILLICIT DISCHARGES – MINIMUM STANDARD 9

Illicit discharges are defined as unpermitted discharges to Waters of the State that do not consist entirely of stormwater or uncontaminated groundwater, except for certain discharges identified in the RIPDES Phase II Stormwater General Permit.

YES	NO	N/A	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Have you checked for illicit discharges?
<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Have any been found and/or corrected? If “Yes,” please identify.
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Does your report explain preventative measures that keep non-stormwater discharges out of the Waters of the State (during and after construction)?

SOIL EROSION AND SEDIMENT CONTROL (SESC) – MINIMUM STANDARD 10

YES	NO	N/A	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Have you included a Soil Erosion and Sediment Control Plan Set and/or Complete Construction Plan Set?
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Have you provided a separately-bound document based upon the SESC Template ? If yes, proceed to Minimum Standard 11 (the following items can be assumed to be addressed).
			If “No,” include a document with your submittal that addresses the following elements of an SESC Plan:
		<input type="checkbox"/>	Soil Erosion and Sediment Control Plan Project Narrative, including a description of how the fifteen (15) Performance Criteria have been met:
		<input type="checkbox"/>	Provide Natural Buffers and Maintain Existing Vegetation
		<input type="checkbox"/>	Minimize Area of Disturbance
		<input type="checkbox"/>	Minimize the Disturbance of Steep Slopes
		<input type="checkbox"/>	Preserve Topsoil
		<input type="checkbox"/>	Stabilize Soils
		<input type="checkbox"/>	Protect Storm Drain Inlets
		<input type="checkbox"/>	Protect Storm Drain Outlets
		<input type="checkbox"/>	Establish Temporary Controls for the Protection of Post-Construction Stormwater Control Measures
		<input type="checkbox"/>	Establish Perimeter Controls and Sediment Barriers
		<input type="checkbox"/>	Divert or Manage Run-On from Up-Gradient Areas
		<input type="checkbox"/>	Properly Design Constructed Stormwater Conveyance Channels
		<input type="checkbox"/>	Retain Sediment On-Site

Stormwater Management, Design, and Installation Rules (250-RICR-150-10-8)

<input type="checkbox"/>	Control Temporary Increases in Stormwater Velocity, Volume, and Peak Flows
<input type="checkbox"/>	Apply Construction Activity Pollution Prevention Control Measures
<input type="checkbox"/>	Install, Inspect, and Maintain Control Measures and Take Corrective Actions
<input type="checkbox"/>	Qualified SESC Plan Preparer's Information and Certification
<input type="checkbox"/>	Operator's Information and Certification; if not known at the time of application, the Operator must certify the SESC Plan upon selection and prior to initiating site activities
<input type="checkbox"/>	Description of Control Measures, such as Temporary Sediment Trapping and Conveyance Practices, including design calculations and supporting documentation, as required

STORMWATER MANAGEMENT SYSTEM OPERATION, MAINTENANCE, AND POLLUTION PREVENTION PLAN – MINIMUM STANDARDS 7 AND 9

Operation and Maintenance Section

YES	NO	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	Have you minimized all sources of pollutant contact with stormwater runoff, to the maximum extent practicable?
<input checked="" type="checkbox"/>	<input type="checkbox"/>	Have you provided a separately-bound Operation and Maintenance Plan for the site and for all of the BMPs, and does it address each element of RICR 8.17 and RISDISM Appendix C and E?
<input checked="" type="checkbox"/>	<input type="checkbox"/>	Lawn, Garden, and Landscape Management meet the requirements of RISDISM Section G.7? If "No," why not?
<input checked="" type="checkbox"/>	<input type="checkbox"/>	Is the property owner or homeowner's association responsible for the stormwater maintenance of all BMP's? If "No," you must provide a legally binding and enforceable maintenance agreement (see RISDISM Appendix E, page 26) that identifies the entity that will be responsible for maintenance of the stormwater. Indicate where this agreement can be found in your report (i.e., name of report/document, page numbers, appendices, etc.).
<input type="checkbox"/>	<input checked="" type="checkbox"/>	Do you anticipate that you will need legal agreements related to the stormwater structures? (e.g. off-site easements, deed restrictions, covenants, or ELUR per the Remediation Regulations). If "Yes," have you obtained them? Or please explain your plan to obtain them:
<input type="checkbox"/>	<input checked="" type="checkbox"/>	Is stormwater being directed from public areas to private property? If "Yes," note the following: <u>Note:</u> This is not allowed unless a funding mechanism is in place to provide the finances for the long-term maintenance of the BMP and drainage, or a funding mechanism is demonstrated that can guarantee the long-term maintenance of a stormwater BMP by an individual homeowner.

Pollution Prevention Section

<input checked="" type="checkbox"/>	<input type="checkbox"/>	Designated snow stockpile locations?
<input checked="" type="checkbox"/>	<input type="checkbox"/>	Trash racks to prevent floatables, trash, and debris from discharging to Waters of the State?
<input type="checkbox"/>	<input checked="" type="checkbox"/>	Asphalt-only based sealants?
<input type="checkbox"/>	<input checked="" type="checkbox"/>	Pet waste stations? (<u>Note:</u> If a receiving water has a bacterial impairment, and the project involves housing units, then this could be an important part of your pollution prevention plan).
<input checked="" type="checkbox"/>	<input type="checkbox"/>	Regular sweeping? Please describe:
<input checked="" type="checkbox"/>	<input type="checkbox"/>	De-icing specifications, in accordance with RISDISM Appendix G. (NOTE: If the groundwater is GAA, or this area contributes to a drinking water supply, then this could be an important part of your pollution prevention plan).
<input type="checkbox"/>	<input checked="" type="checkbox"/>	A prohibition of phosphate-based fertilizers? (<u>Note:</u> If the site discharges to a phosphorus impaired waterbody, then this could be an important part of your pollution prevention plan).

PART 4. SUBWATERSHED MAPPING AND SITE-PLAN DETAILS

Stormwater Management, Design, and Installation Rules (250-RICR-150-10-8)

Existing and Proposed Subwatershed Mapping (REQUIRED)		
YES	NO	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	Existing and proposed drainage area delineations
<input checked="" type="checkbox"/>	<input type="checkbox"/>	Locations of all streams and drainage swales
<input checked="" type="checkbox"/>	<input type="checkbox"/>	Drainage flow paths, mapped according to the DEM <i>Guidance for Preparation of Drainage Area Maps</i> (included in RISDISM Appendix K)
<input checked="" type="checkbox"/>	<input type="checkbox"/>	Complete drainage area boundaries; include off-site areas in both mapping and analyses, as applicable
<input checked="" type="checkbox"/>	<input type="checkbox"/>	Logs of borings and/or test pit investigations along with supporting soils/geotechnical report
<input checked="" type="checkbox"/>	<input type="checkbox"/>	Mapped seasonal high-water-table test pit locations
<input checked="" type="checkbox"/>	<input type="checkbox"/>	Mapped locations of the site-specific borings and/or test pits and soils information from the test pits at the locations of the BMPs
<input checked="" type="checkbox"/>	<input type="checkbox"/>	Mapped locations of the BMPs, with the BMPs consistently identified on the Site Construction Plans
<input type="checkbox"/>	<input type="checkbox"/>	Mapped bedrock outcrops adjacent to any infiltration BMP
<input checked="" type="checkbox"/>	<input type="checkbox"/>	Soils were logged by a:
	<input checked="" type="checkbox"/>	DEM-licensed Class IV soil evaluator Name: Kevin Fetzer (License No. D-4029)
	<input type="checkbox"/>	RI-registered P.E. Name:

Subwatershed and Impervious Area Summary				
Subwatershed (area to each design point)	First Receiving Water ID or MS4	Area Disturbed (Acres)	Existing Impervious (Acres)	Proposed Impervious (Acres)
DP-1: Existing Drainage Channel	RI0006017R-03	14.94	3.30	10.54
DP-2: Goddard Drive	Goddard Drive Drainage System	1.90	0.87	0.00
TOTALS:		16.84	4.17	10.54

Stormwater Management, Design, and Installation Rules (250-RICR-150-10-8)

Site Construction Plans (Indicate that the following applicable specifications are provided)		
YES	NO	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	Existing and proposed plans (scale not greater than 1" = 40') with North arrow
<input checked="" type="checkbox"/>	<input type="checkbox"/>	Existing and proposed site topography (with 1 or 2-foot contours); 10-foot contours accepted for off-site areas
<input checked="" type="checkbox"/>	<input type="checkbox"/>	Boundaries of existing predominant vegetation and proposed limits of clearing
<input checked="" type="checkbox"/>	<input type="checkbox"/>	Site Location clarification
<input type="checkbox"/>	<input type="checkbox"/>	Location and field-verified boundaries of resource protection areas such as: <ul style="list-style-type: none"> ▶ freshwater and coastal wetlands, including lakes and ponds ▶ coastal shoreline features Perennial and intermittent streams, in addition to Areas Subject to Storm Flowage (ASSFs)
<input checked="" type="checkbox"/>	<input type="checkbox"/>	All required setbacks (e.g., buffers, water-supply wells, septic systems)
<input checked="" type="checkbox"/>	<input type="checkbox"/>	Representative cross-section and profile drawings, and notes and details of structural stormwater management practices and conveyances (i.e., storm drains, open channels, swales, etc.), which include: <ul style="list-style-type: none"> ▶ Location and size of the stormwater treatment practices (type of practice, depth, area). Stormwater treatment practices (BMPs) must have labels that correspond to RISDISM Table 5-2; ▶ Design water surface elevations (applicable storms); ▶ Structural details of outlet structures, embankments, spillways, stilling basins, grade-control structures, conveyance channels, etc.; ▶ Existing and proposed structural elevations (e.g., inverts of pipes, manholes, etc.); ▶ Location of floodplain and, if applicable, floodway limits and relationship of site to upstream and downstream properties or drainage that could be affected by work in the floodplain; ▶ Planting plans for structural stormwater BMPs, including species, size, planting methods, and maintenance requirements of proposed planting
<input checked="" type="checkbox"/>	<input type="checkbox"/>	Logs of borings and/or test pit investigations along with supporting soils/geotechnical report and corresponding water tables
<input type="checkbox"/>	<input type="checkbox"/>	Mapping of any OLRSM-approv ed remedial actions/systems (including ELURs)
<input checked="" type="checkbox"/>	<input type="checkbox"/>	Location of existing and proposed roads, buildings, and other structures including limits of disturbance; <ul style="list-style-type: none"> ▶ Existing and proposed utilities (e.g., water, sewer, gas, electric) and easements; ▶ Location of existing and proposed conveyance systems, such as grass channels, swales, and storm drains, and location(s) of final discharge point(s) (wetland, waterbody, etc.); ▶ Cross sections of roadways, with edge details such as curbs and sidewalks; ▶ Location and dimensions of channel modifications, such as bridge or culvert crossings
<input type="checkbox"/>	<input type="checkbox"/>	Locations, cross sections, and profiles of all stream or wetland crossings and their method of stabilization

Appendix E
Supporting Documentation



Version: 4/2015

Project Name 20 Goddard Drive Warehouse

Date May 2022

Water Quality Volume Calculation WorkSheet

This worksheet is designed to assist the project engineer with a determination of the required water quality treatment area. The worksheet leads the designer through redevelopment applicability first and then receiving water requirements. This tool is intended to compliment to the Redevelopment Criteria Guidance and the Water Quality Guidance and assist both the designer and the permit application reviewer towards consistent results. Enter information into only the **YELLOW** Boxes.

[Redevelopment Criteria Guidance](#)

[Water Quality Goals "Stormwater Compensation Method"](#)

Step 1 - Determine which office in OWR you are applying to: [Application Guidance](#)

Step 2 - Site Information value/calculation units

Total Site Area (total area of project parcels)	TS	16.84	acres
Total Jurisdictional Wetlands and/or floodplain within the above TSA	JW1	0.00	acres
Existing impervious also within the Jurisdictional Wetlands	-JW2	0.00	acres
Conservation Land within the TSA	CL	0.00	acres
Site Size = (TSA)-(JW1-JW2)-CL	SS=	16.84	acres

Step 3 - Redevelopment Applicability

Total Impervious Area (pre-construction)	TIA=	4.17	acres
% Impervious (if ≥40% - redevelopment standard 3.2.6 applies)		0.25	

REPEAT IF NECESSARY Steps 4, 5 and 6 for EACH Waterbody ID (RIVER-ID as found in the GIS Map Server)

Step 4 - Receiving waterbody information

Waterbody ID or RIVER ID from GIS Map Server	
Waterbody Name from GIS Map Server	
Name the sub-watersheds (design-points) contributing to this Waterbody ID	
Is this Waterbody Impaired/TMDL for any Phosphorus, Metals or Bacteria?	YES
Is this Waterbody Impaired for Nitrogen?	NO

Step 5 - Pre-Post Construction Conditions to the Waterbody

Total Pre-Construction Impervious Surface to this Waterbody ID	4.17	acres
Total Disturbed Existing Impervious (DI)	4.17	acres
Total Post-Construction Impervious to this Waterbody ID	10.54	acres
Net Increased Impervious (NII)	6.37	acres

Step 6 - Infiltration and BMP information - Note: Increasing infiltration will likely decrease stormwater treatment area for Metals, Bacteria and Phosphorus

I am proposing to infiltrate this percentage WQv to this WBID	100%	%
I am proposing this number of BMP's	2	#

RESULTS - Select the Larger Number of the 2 numbers provided

Applicable Condition	Min Water Quality Treatment Area	Min Treatment w/o WQ consideration
No Impairment or TMDL - New Development		
No Impairment or TMDL - Redevelopment		
Only Phosphorus, Metals or Bacteria Impairment - New Development	6.37	10.54
Only Phosphorus, Metals or Bacteria Impairment - Redevelopment		
Nitrogen Impairment - New Development		
Nitrogen Impairment - Redevelopment		
REQUIRED STORMWATER TREATMENT AREA	10.5	acres

* Enter the name of the STP (both type and label) which has been designed to treat this particular Rev or Rea.

BMP-1-Sand Filter

This BMP has been sized in accordance with Section 5.5 of the Rhode Island Stormwater Design and Installation Standards Manual, dated March 2015

1) Calculate Impervious Area Directed to Sand Filter (A_{IMP})

Cover Description	Area (S.F.)
Total Impervious Area (A_{IMP})	143,748

2) Size on the larger of Water Quality Volume or Recharge Volume

a) Calculated Water Quality Volume (WQ_v) in accordance with Section 3.3.3

$$WQ_v = (1" * A_{IMP}) / 12 = \mathbf{11,979 \text{ cf}}$$

b) Calculated Recharge Volume (Re_v) in accordance with Section 3.3.2

$$Re_v = (1")(F)(A_{IMP})/12 = \mathbf{7,187 \text{ cf}}$$

A Hydrologic Soil Group from RI Soil Survey

0.60 F (Recharge Factor from Table 3-4 of the RISDISM)

143,748 sf A_{IMP} (Impervious Area)

c) Required Volume (V_{REQ})

Size Filter for Water Quality Volume

3) Size Sediment Forebay to Store 25% WQ_v in accordance with Section 5.5.3

a) Calculated 25% WQ_v 2995 cf

b) $Storage_{FOREBAY} = [(A_{BOTTOM} + A_{SPILL})/2] * D_{FOREBAY} = \mathbf{3361 \text{ cf}}$

1354 sf A_{BOTTOM} (surface area of bottom of forebay)

2007 sf A_{SPILL} (surface area at spillway elevation)

2 ft $D_{FOREBAY}$ (depth of forebay)

***Storage provided is greater than 25% WQ_v ; forebay is adequately sized**

4) Calculate Minimum Surface Area of Bottom of Forebay ($A_{MIN,FOREBAY}$) in accordance with Section 6.4.1

a) Surface area of bottom of forebay provided = 1,109 sf

b) $A_{\text{MIN,FOREBAY}} = 5,750 * [(0.25 * WQ_v) / 86,400 \text{ sec}] =$ **199 sf**
 2995 cf 25% WQ_v (Water Quality Volume)

***Surface area provided is greater than minimum surface area required; forebay is adequately sized**

5) Calculate Sand Filter WQ_v Storage in accordance with Section 5.5.4

a) Calculated Surface Area measured in Autocad

b) $\text{Storage}_{\text{BASIN}} = [((A_{\text{POND}} + A_{\text{FILTER}}) / 2) * D_{\text{POND}}] + (A_{\text{FILTER}} * df * p) =$ **10,102 cf**
 4,780 sf A_{POND} (surface area at ponding depth)
 2 ft D_{POND} (depth of ponding)
 3,560 sf A_{FILTER} (surface area of filter media)
 1.5 ft df (depth of filter bed)
 0.33 p (porosity of filter bed)

***Storage provided will be added to pretreatment storage to meet 75% WQ_v storage requirement**

6) Calculate Minimum Surface Area of Filter ($A_{\text{MIN,FILTER}}$) in accordance with Section 5.5.4

a) Surface area of filter media provided = 3,560 sf

b) $A_{\text{MIN,FILTER}} = (WQ_v * df) / (k * ((D_{\text{POND}} / 2) + df) * tf) =$ **790 sf**
 11,979 cf WQ_v (Water Quality Volume)
 1.5 feet df (depth of filter bed)
 3.5 ft/day k (coefficient of permeability of filter media)
 3.5 ft D_{POND} (depth of ponding)
 2 days tf (drain time)

***Surface area provided is greater than minimum surface area required; filter is adequately sized**

7) Calculate Total Storage Provided in accordance with Section 5.5.4

a) Calculated 75% WQ_v is 8984 cf

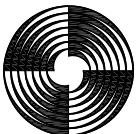
b) Storage_{TOTAL} = (Storage_{FOREBAY}) + (Storage_{BASIN}) = **13,463 cf**
 3361 Storage_{FOREBAY}
 10102 Storage_{BASIN}

***Storage provided is greater than 75% WQ_v therefore, practice is adequately sized**

8) Calculate Drawdown Time (tf_{ACTUAL})

tf_{ACTUAL} = (Storage_{FILTER}) / (k * A_{FILTER}) = **0.811 days**
 10102 cf Storage_{FILTER}
 3.5 ft/day k (coefficient of permeability)
 3560 sf A_{FILTER} (surface area of filter media)

***Actual drawdown time is less than 2 days; filter is adequately sized**



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 85 CORLISS STREET | P.O. BOX 6145
 PROVIDENCE, RHODE ISLAND 02940

DOWNSTREAM DRAINAGE CONVEYANCE

20 GODDARD DRIVE WAREHOUSE

20 GODDARD DRIVE

CRANSTON, RHODE ISLAND




Part B

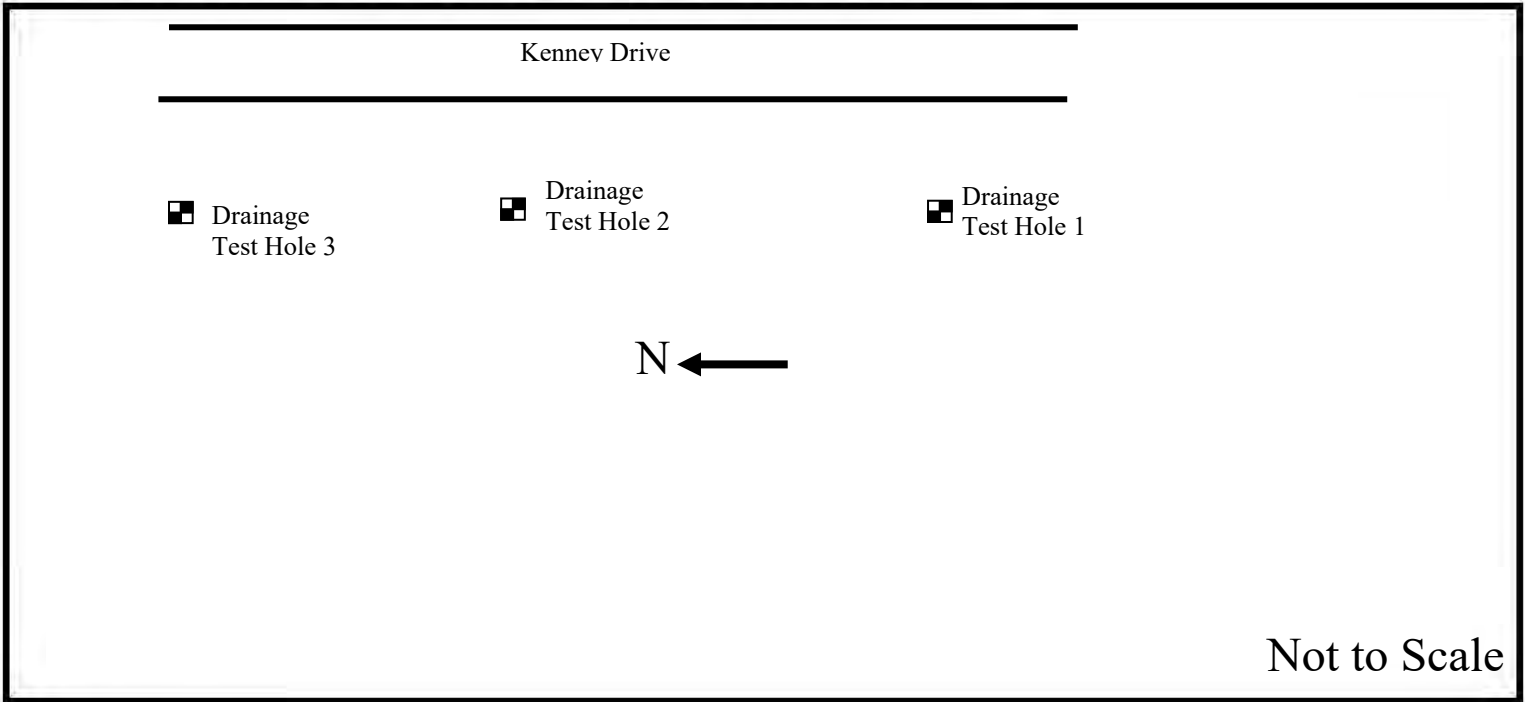
Site Evaluation - to be completed by Class II or III Designer or Soil Evaluator

Please use the area below to locate:

1. Test holes
2. Approximate direction of due north
3. Offsets from test holes to fixed points such as street, utility pole, or other permanent, marked object

Key:

	Approximate location of test holes
	Estimated gradient and direction of slope
	Approximate direction of due north




1. Relief and Slope: _____
2. Presence of any watercourse, wetlands or surface water bodies, within 200 feet of test holes: YES NO If yes, locate on above sketch.
3. Presence of existing or proposed private drinking water wells within 200 feet of test holes: YES NO If yes, locate on above sketch.
4. Public drinking water wells within 500 feet of test holes: YES NO If yes, locate on above sketch.
5. Is site within the watershed of a public drinking water reservoir or other critical area defined in SD 19.00? YES NO
6. Has soil been excavated from or fill deposited on site? YES NO If yes, locate on above sketch
7. Site's potential for flooding or ponding: NONE SLIGHT MODERATE SEVERE
8. Landscape position: _____
9. Vegetation: _____
10. Indicate approximate location of property lines and roadways: _____
11. Additional comments, site constraints or additional information regarding site: _____

Soil Evaluations for drainage design

The soil evaluation results will provide soil texture and the estimated depth to the Seasonal High Water Table (SHWT) based upon qualitative field assessment techniques. No lab analysis of soil material is proposed to verify qualitative estimates in the field. To definitively determine the actual depth to the SHWT, it is necessary to install monitoring wells/pipes and record water level fluctuations over a long time period. No long-term monitoring is proposed. Original soil texture and SHWT estimates may need to be revised based upon additional information from other soil evaluations, excavations, and/or bottom inspections prior to the OWTS installation or drainage structure installation. Soil evaluations for septic system design only, not for foundation elevation.

Certification

The undersigned hereby certifies that all information on this application and accompanying forms, submittals and sketches are true and accurate and that I have been authorized by the owner(s) to conduct these necessary field investigations and submit this request.

Part A prepared by:  License # D-4029

Part B prepared by: _____ Signature _____ License # _____

FOR OFFICE USE ONLY

Decision: Approved Disclaimed

Comments: _____

Signature Authorized Agent _____ Date _____



STATE OF RHODE ISLAND AND PROVIDENCE PLANTATIONS

Department of Environmental Management

Office of Water Resources



Site Evaluation Form
Part A - Soil Profile Description

Application Number DRAINAGE

Property Owner:

Property Location: 20 Goddard Drive, AP 13 Lot 39, Cranston

Date of Test Hole: June 17, 2022

Soil Evaluator: Kevin Fetzer License Number: D-4029

Weather: Sunny Shaded: Yes [X] No [] Time: 0900

Table with 12 columns: TH D-1 Horizon, Depth, Horizon Boundaries (Dist, Topo), Soil Colors (Matrix, Re-Dox Features), Re-Dox Description (Ab., S., Con.), Texture, Structure, Consistence, in/hr ft/min. Includes data for horizons ^C, C, C2, 2C and TH D-2 horizons ^C, ^2C, C.

Soil Class: HTM over Outwash

Total Depth of each Test Hole: 120" - 120"

Depth to Groundwater Seepage: None Encountered

Depth to Impervious or Limiting Layer: None Encountered

Estimated Seasonal High Water Table: 72" OG - 50" OG

Comments: EG = Existing Grade - OG = Original Grade



STATE OF RHODE ISLAND AND PROVIDENCE PLANTATIONS

Department of Environmental Management

Office of Water Resources



Site Evaluation Form
Part A - Soil Profile Description

Application Number DRAINAGE

Property Owner:

Property Location: 20 Goddard Drive, AP 13 Lot 39, Cranston

Date of Test Hole: June 17, 2022

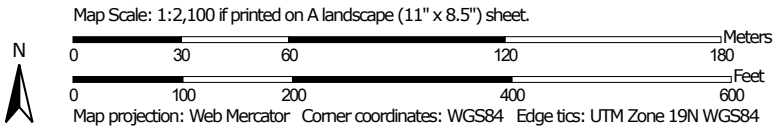
Soil Evaluator: Kevin Fetzer License Number: D-4029

Weather: Sunny Shaded: Yes [X] No [] Time: 0900

Table with columns: TH Horizon, Depth, Horizon Boundaries (Dist, Topo), Soil Colors (Matrix, Re-Dox Features), Re-Dox Description (Ab., S., Con.), Texture, Structure, Consistence, in/hr ft/min. Includes handwritten entries for horizons ^A, ^C, ^2C, C, and 2C.


Soil Class: HTM over Outwash over Lacustrine Total Depth of each Test Hole: 120"
Depth to Groundwater Seepage: None Encountered Depth to Impervious or Limiting Layer: None Encountered
Estimated Seasonal High Water Table: 60" OG Comments: EG = Existing Grade - OG = Original Grade

Hydrologic Soil Group—State of Rhode Island: Bristol, Kent, Newport, Providence, and Washington Counties



MAP LEGEND

Area of Interest (AOI)









 Area of Interest (AOI)

Soils

Soil Rating Polygons





 A
 A/D
 B
 B/D
 C
 C/D
 D
 Not rated or not available

Soil Rating Lines


 A
 A/D
 B
 B/D
 C
 C/D
 D
 Not rated or not available

Soil Rating Points




 A
 A/D
 B
 B/D

 C
 C/D
 D
 Not rated or not available


Water Features

 Streams and Canals

Transportation

 Rails
 Interstate Highways
 US Routes
 Major Roads
 Local Roads

Background

 Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:12,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
 Web Soil Survey URL:
 Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: State of Rhode Island: Bristol, Kent, Newport, Providence, and Washington Counties
 Survey Area Data: Version 21, Sep 3, 2021

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: May 24, 2020—Jul 18, 2020

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Hydrologic Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
Pp	Pootatuck fine sandy loam	B	0.1	0.4%
UD	Udorthents-Urban land complex	A	16.4	99.6%
Totals for Area of Interest			16.5	100.0%

Description

Hydrologic soil groups are based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms.

The soils in the United States are assigned to four groups (A, B, C, and D) and three dual classes (A/D, B/D, and C/D). The groups are defined as follows:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas. Only the soils that in their natural condition are in group D are assigned to dual classes.

Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

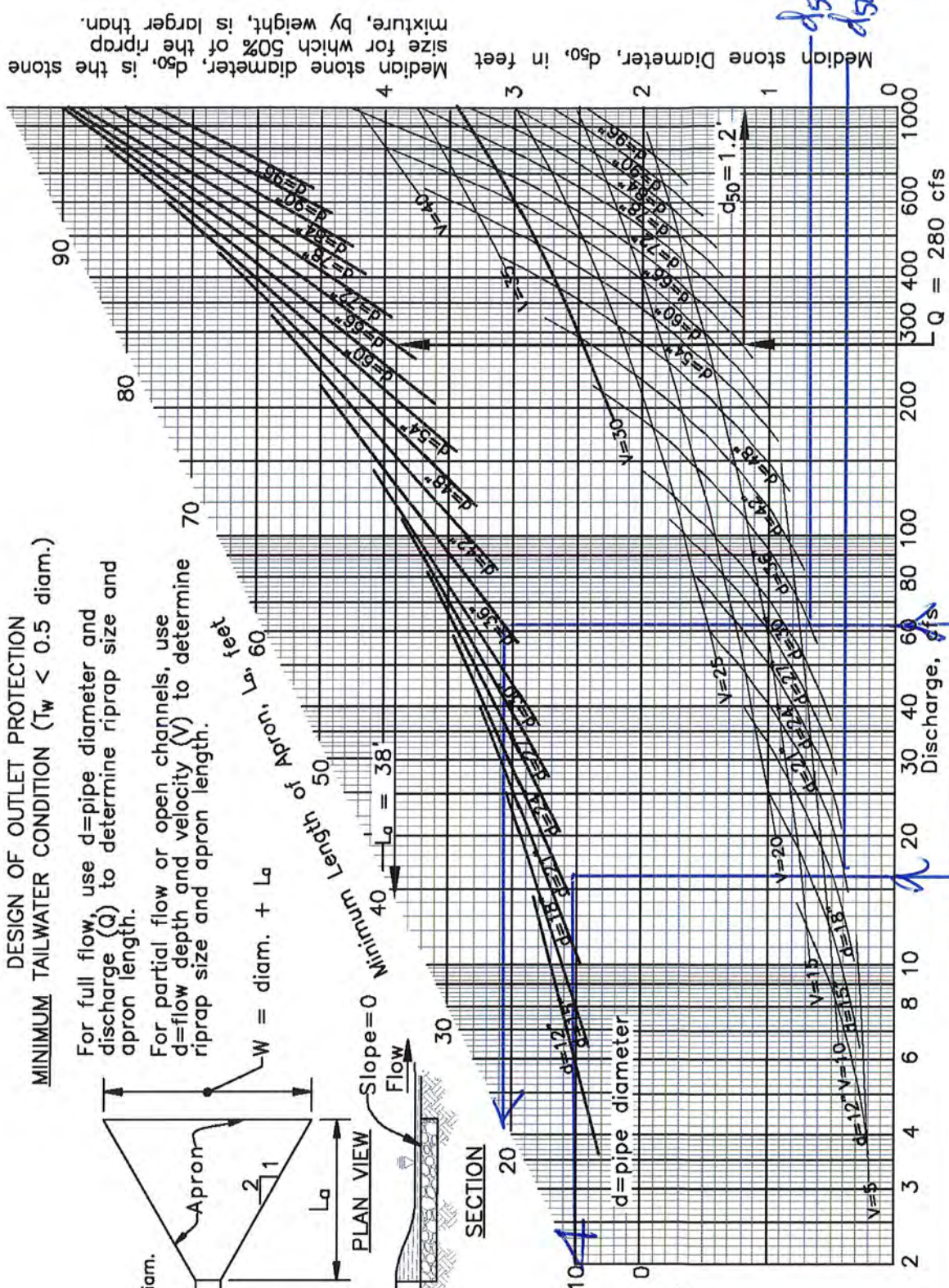
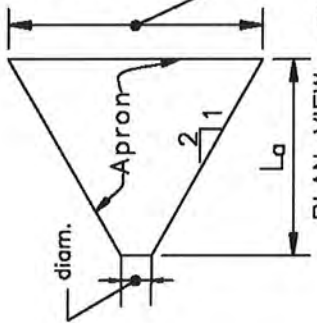
Tie-break Rule: Higher

DESIGN OF OUTLET PROTECTION
 MINIMUM TAILWATER CONDITION ($T_w < 0.5$ diam.)

For full flow, use d =pipe diameter and discharge (Q) to determine riprap size and apron length.

For partial flow or open channels, use d =flow depth and velocity (V) to determine riprap size and apron length.

$W = \text{diam.} + L_a$



NOTE: DO NOT
 EXTRAPOLATE
 LENGTH OF
 CURVES.

Figure D.2: Design of Outlet Protection - Minimum Tailwater Condition

Q_{15} Q_{15} Q_{15}
 D.18



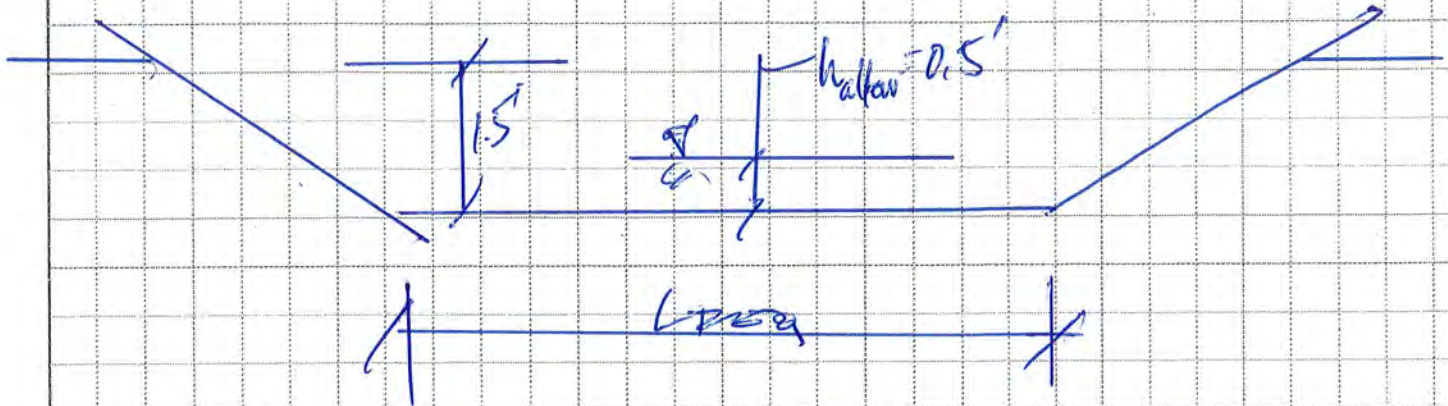
GAROFALO

GAROFALO & ASSOCIATES, INC.
ENGINEERS, LAND PLANNERS/SURVEYORS
85 CORLISS STREET * POST OFFICE BOX 6145
PROVIDENCE, RHODE ISLAND 02940
PHONE: (401) 273-6000 * FAX: (401) 273-1000

PROJECT : HOWARD AVE JOB NO. 7287
SUBJECT _____

BY: [Signature] DATE: _____ CHECKED: _____ DATE: _____
SHEET NO. _____ OF _____

EMERGENCY SPILLWAY



$$Q = 3.3 C U^{1.5} \quad L_{req} = \frac{Q_{100}}{3.3 h^{1.5}}$$

$$water = Q_{100} = 90 \text{ cfs}$$
$$h = 0.5'$$

$$L_{req} = 38'$$

National Flood Hazard Layer FIRMMette



71°27'16"W 41°44'51"N



Basemap: USGS National Map: Orthoimagery: Data refreshed October, 2020

Legend

SEE FIS REPORT FOR DETAILED LEGEND AND INDEX MAP FOR FIRM PANEL LAYOUT

SPECIAL FLOOD HAZARD AREAS		Without Base Flood Elevation (BFE) Zone A, V, A99
		With BFE or Depth Zone AE, AO, AH, VE, AR
		Regulatory Floodway

OTHER AREAS OF FLOOD HAZARD		0.2% Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile Zone X
		Future Conditions 1% Annual Chance Flood Hazard Zone X
		Area with Reduced Flood Risk due to Levee. See Notes. Zone X
		Area with Flood Risk due to Levee Zone D

OTHER AREAS		NO SCREEN Area of Minimal Flood Hazard Zone X
		Effective LOMRs

GENERAL STRUCTURES		Channel, Culvert, or Storm Sewer
		Levee, Dike, or Floodwall

OTHER FEATURES		20.2 Cross Sections with 1% Annual Chance
		17.5 Water Surface Elevation
		Coastal Transect
		Base Flood Elevation Line (BFE)
		Limit of Study
		Jurisdiction Boundary
		Profile Baseline

MAP PANELS		Digital Data Available
		No Digital Data Available
		Unmapped

The pin displayed on the map is an approximate point selected by the user and does not represent an authoritative property location.

This map complies with FEMA's standards for the use of digital flood maps if it is not void as described below. The basemap shown complies with FEMA's basemap accuracy standards

The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on 4/13/2022 at 2:35 PM and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time.

This map image is void if the one or more of the following map elements do not appear: basemap imagery, flood zone labels, legend, scale bar, map creation date, community identifiers, FIRM panel number, and FIRM effective date. Map images for unmapped and unmodernized areas cannot be used for regulatory purposes.