

246 & 248 WALNUT STREET

A RESIDENTIAL SUBDIVISION
IN READING, MA

STORMWATER MANAGEMENT REPORT

VOLUME 2 OF 2

STORMWATER MANAGEMENT DESIGN

December 20, 2023

PREPARED FOR:

STELLA CONSTRUCTION
25 EVERETT STREET
WOBURN, MA 01810

PREPARED BY:

MEISNER BREM CORPORATION
142 LITTLETON ROAD, STE. 16
WESTFORD, MA 01886

MBC JOB NUMBER: 3110

NO.	DATE	REVISION	BY
1	2-8-24	NOAA 14 Rainfall & Cul-De-Sac Circle	IJA

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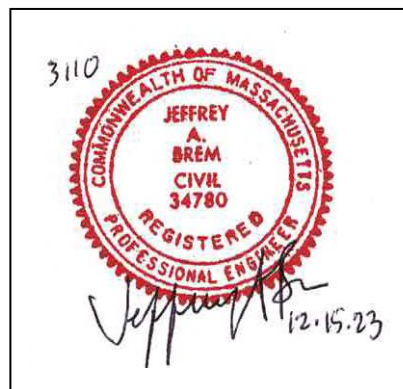
THE FOLLOWING REPORT HAS BEEN PREPARED UNDER THE SUPERVISION OF A REGISTERED PROFESSIONAL ENGINEER LICENSED IN THE COMMONWEALTH OF MASSACHUSETTS.

246 & 248 WALNUT STREET

*A RESIDENTIAL SUBDIVISION
IN READING, MA*

Volume 2

STORMWATER MANAGEMENT DESIGN



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246 & 248 WALNUT STREET STORMWATER MANAGEMENT REPORT – VOLUME 2 OF 2 A RESIDENTIAL SUBDIVISION IN READING, MA

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STORMWATER CHECKLIST

SEE FOLLOWING PAGES FOR MASS DEP STORMWATER CHECKLIST



Checklist for Stormwater Report

A. Introduction

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



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

The Stormwater Report must include:

- The Stormwater Checklist completed and stamped by a Registered Professional Engineer (see page 2) that certifies that the Stormwater Report contains all required submittals.¹ This Checklist is to be used as the cover for the completed Stormwater Report.
- Applicant/Project Name
- Project Address
- Name of Firm and Registered Professional Engineer that prepared the Report
- Long-Term Pollution Prevention Plan required by Standards 4-6
- Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan required by Standard 8²
- Operation and Maintenance Plan required by Standard 9

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

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

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

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

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



Checklist for Stormwater Report

B. Stormwater Checklist and Certification

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

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

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

Registered Professional Engineer's Certification

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

Registered Professional Engineer Block and Signature

Signature and Date

Checklist

Project Type: Is the application for new development, redevelopment, or a mix of new and redevelopment?

- New development
- Redevelopment
- Mix of New Development and Redevelopment



Checklist for Stormwater Report

Checklist (continued)

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

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

Standard 1: No New Untreated Discharges

- No new untreated discharges
- Outlets have been designed so there is no erosion or scour to wetlands and waters of the Commonwealth
- Supporting calculations specified in Volume 3 of the Massachusetts Stormwater Handbook included.



Checklist for Stormwater Report

Checklist (continued)

Standard 2: Peak Rate Attenuation

- Standard 2 waiver requested because the project is located in land subject to coastal storm flowage and stormwater discharge is to a wetland subject to coastal flooding.
- Evaluation provided to determine whether off-site flooding increases during the 100-year 24-hour storm.
- Calculations provided to show that post-development peak discharge rates do not exceed pre-development rates for the 2-year and 10-year 24-hour storms. If evaluation shows that off-site flooding increases during the 100-year 24-hour storm, calculations are also provided to show that post-development peak discharge rates do not exceed pre-development rates for the 100-year 24-hour storm.

Standard 3: Recharge

- Soil Analysis provided.
- Required Recharge Volume calculation provided.
- Required Recharge volume reduced through use of the LID site Design Credits.
- Sizing the infiltration, BMPs is based on the following method: Check the method used.
 - Static
 - Simple Dynamic
 - Dynamic Field¹
- Runoff from all impervious areas at the site discharging to the infiltration BMP.
- Runoff from all impervious areas at the site is *not* discharging to the infiltration BMP and calculations are provided showing that the drainage area contributing runoff to the infiltration BMPs is sufficient to generate the required recharge volume.
- Recharge BMPs have been sized to infiltrate the Required Recharge Volume.
- Recharge BMPs have been sized to infiltrate the Required Recharge Volume *only* to the maximum extent practicable for the following reason:
 - Site is comprised solely of C and D soils and/or bedrock at the land surface
 - M.G.L. c. 21E sites pursuant to 310 CMR 40.0000
 - Solid Waste Landfill pursuant to 310 CMR 19.000
 - Project is otherwise subject to Stormwater Management Standards only to the maximum extent practicable.
- Calculations showing that the infiltration BMPs will drain in 72 hours are provided.
- Property includes a M.G.L. c. 21E site or a solid waste landfill and a mounding analysis is included.

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



Checklist for Stormwater Report

Checklist (continued)

Standard 3: Recharge (continued)

- The infiltration BMP is used to attenuate peak flows during storms greater than or equal to the 10-year 24-hour storm and separation to seasonal high groundwater is less than 4 feet and a mounding analysis is provided.
- Documentation is provided showing that infiltration BMPs do not adversely impact nearby wetland resource areas.

Standard 4: Water Quality

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

- Good housekeeping practices;
 - Provisions for storing materials and waste products inside or under cover;
 - Vehicle washing controls;
 - Requirements for routine inspections and maintenance of stormwater BMPs;
 - Spill prevention and response plans;
 - Provisions for maintenance of lawns, gardens, and other landscaped areas;
 - Requirements for storage and use of fertilizers, herbicides, and pesticides;
 - Pet waste management provisions;
 - Provisions for operation and management of septic systems;
 - Provisions for solid waste management;
 - Snow disposal and plowing plans relative to Wetland Resource Areas;
 - Winter Road Salt and/or Sand Use and Storage restrictions;
 - Street sweeping schedules;
 - Provisions for prevention of illicit discharges to the stormwater management system;
 - Documentation that Stormwater BMPs are designed to provide for shutdown and containment in the event of a spill or discharges to or near critical areas or from LUHPPL;
 - Training for staff or personnel involved with implementing Long-Term Pollution Prevention Plan;
 - List of Emergency contacts for implementing Long-Term Pollution Prevention Plan.
- A Long-Term Pollution Prevention Plan is attached to Stormwater Report and is included as an attachment to the Wetlands Notice of Intent.
 - Treatment BMPs subject to the 44% TSS removal pretreatment requirement and the one inch rule for calculating the water quality volume are included, and discharge:
 - is within the Zone II or Interim Wellhead Protection Area
 - is near or to other critical areas
 - is within soils with a rapid infiltration rate (greater than 2.4 inches per hour)
 - involves runoff from land uses with higher potential pollutant loads.
 - The Required Water Quality Volume is reduced through use of the LID site Design Credits.
 - Calculations documenting that the treatment train meets the 80% TSS removal requirement and, if applicable, the 44% TSS removal pretreatment requirement, are provided.



Checklist for Stormwater Report

Checklist (continued)

Standard 4: Water Quality (continued)

- The BMP is sized (and calculations provided) based on:
 - The ½" or 1" Water Quality Volume or
 - The equivalent flow rate associated with the Water Quality Volume and documentation is provided showing that the BMP treats the required water quality volume.
- The applicant proposes to use proprietary BMPs, and documentation supporting use of proprietary BMP and proposed TSS removal rate is provided. This documentation may be in the form of the propriety BMP checklist found in Volume 2, Chapter 4 of the Massachusetts Stormwater Handbook and submitting copies of the TARP Report, STEP Report, and/or other third party studies verifying performance of the proprietary BMPs.
- A TMDL exists that indicates a need to reduce pollutants other than TSS and documentation showing that the BMPs selected are consistent with the TMDL is provided.

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

- The NPDES Multi-Sector General Permit covers the land use and the Stormwater Pollution Prevention Plan (SWPPP) has been included with the Stormwater Report.
- The NPDES Multi-Sector General Permit covers the land use and the SWPPP will be submitted **prior to** the discharge of stormwater to the post-construction stormwater BMPs.
- The NPDES Multi-Sector General Permit does **not** cover the land use.
- LUHPPLs are located at the site and industry specific source control and pollution prevention measures have been proposed to reduce or eliminate the exposure of LUHPPLs to rain, snow, snow melt and runoff, and been included in the long term Pollution Prevention Plan.
- All exposure has been eliminated.
- All exposure has **not** been eliminated and all BMPs selected are on MassDEP LUHPPL list.
- The LUHPPL has the potential to generate runoff with moderate to higher concentrations of oil and grease (e.g. all parking lots with >1000 vehicle trips per day) and the treatment train includes an oil grit separator, a filtering bioretention area, a sand filter or equivalent.

Standard 6: Critical Areas

- The discharge is near or to a critical area and the treatment train includes only BMPs that MassDEP has approved for stormwater discharges to or near that particular class of critical area.
- Critical areas and BMPs are identified in the Stormwater Report.



Checklist for Stormwater Report

Checklist (continued)

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

- The project is subject to the Stormwater Management Standards only to the maximum Extent Practicable as a:
 - Limited Project
 - Small Residential Projects: 5-9 single family houses or 5-9 units in a multi-family development provided there is no discharge that may potentially affect a critical area.
 - Small Residential Projects: 2-4 single family houses or 2-4 units in a multi-family development with a discharge to a critical area
 - Marina and/or boatyard provided the hull painting, service and maintenance areas are protected from exposure to rain, snow, snow melt and runoff
 - Bike Path and/or Foot Path
 - Redevelopment Project
 - Redevelopment portion of mix of new and redevelopment.
- Certain standards are not fully met (Standard No. 1, 8, 9, and 10 must always be fully met) and an explanation of why these standards are not met is contained in the Stormwater Report.
- The project involves redevelopment and a description of all measures that have been taken to improve existing conditions is provided in the Stormwater Report. The redevelopment checklist found in Volume 2 Chapter 3 of the Massachusetts Stormwater Handbook may be used to document that the proposed stormwater management system (a) complies with Standards 2, 3 and the pretreatment and structural BMP requirements of Standards 4-6 to the maximum extent practicable and (b) improves existing conditions.

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

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

- Narrative;
 - Construction Period Operation and Maintenance Plan;
 - Names of Persons or Entity Responsible for Plan Compliance;
 - Construction Period Pollution Prevention Measures;
 - Erosion and Sedimentation Control Plan Drawings;
 - Detail drawings and specifications for erosion control BMPs, including sizing calculations;
 - Vegetation Planning;
 - Site Development Plan;
 - Construction Sequencing Plan;
 - Sequencing of Erosion and Sedimentation Controls;
 - Operation and Maintenance of Erosion and Sedimentation Controls;
 - Inspection Schedule;
 - Maintenance Schedule;
 - Inspection and Maintenance Log Form.
- A Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan containing the information set forth above has been included in the Stormwater Report.



Checklist for Stormwater Report

Checklist (continued)

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

- The project is highly complex and information is included in the Stormwater Report that explains why it is not possible to submit the Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan with the application. A Construction Period Pollution Prevention and Erosion and Sedimentation Control has **not** been included in the Stormwater Report but will be submitted **before** land disturbance begins.
- The project is **not** covered by a NPDES Construction General Permit.
- The project is covered by a NPDES Construction General Permit and a copy of the SWPPP is in the Stormwater Report.
- The project is covered by a NPDES Construction General Permit but no SWPPP been submitted. The SWPPP will be submitted BEFORE land disturbance begins.

Standard 9: Operation and Maintenance Plan

- The Post Construction Operation and Maintenance Plan is included in the Stormwater Report and includes the following information:
 - Name of the stormwater management system owners;
 - Party responsible for operation and maintenance;
 - Schedule for implementation of routine and non-routine maintenance tasks;
 - Plan showing the location of all stormwater BMPs maintenance access areas;
 - Description and delineation of public safety features;
 - Estimated operation and maintenance budget; and
 - Operation and Maintenance Log Form.
- The responsible party is **not** the owner of the parcel where the BMP is located and the Stormwater Report includes the following submissions:
 - A copy of the legal instrument (deed, homeowner's association, utility trust or other legal entity) that establishes the terms of and legal responsibility for the operation and maintenance of the project site stormwater BMPs;
 - A plan and easement deed that allows site access for the legal entity to operate and maintain BMP functions.

Standard 10: Prohibition of Illicit Discharges

- The Long-Term Pollution Prevention Plan includes measures to prevent illicit discharges;
- An Illicit Discharge Compliance Statement is attached;
- NO Illicit Discharge Compliance Statement is attached but will be submitted **prior to** the discharge of any stormwater to post-construction BMPs.

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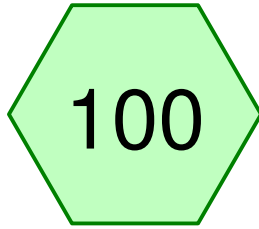
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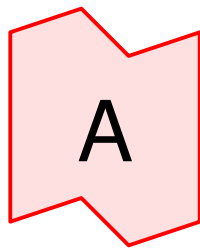
Pre Development

Storm Frequency: 2, 10, 25, 100 Year

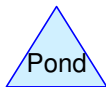
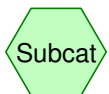
NOAA 14 Storm Events



On-Site and Off-Site
Flow to Wetland



Eastern Wetland



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Rainfall Events Listing

Event#	Event Name	Storm Type	Curve	Mode	Duration (hours)	B/B	Depth (inches)	AMC
1	2-Year	Type III 24-hr		Default	24.00	1	3.30	2
2	10-Year	Type III 24-hr		Default	24.00	1	5.21	2
3	25-Year	Type III 24-hr		Default	24.00	1	6.39	2
4	100-Year	Type III 24-hr		Default	24.00	1	8.22	2

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Area Listing (all nodes)

Area (sq-ft)	CN	Description (subcatchment-numbers)
39,382	39	>75% Grass cover, Good, HSG A (100)
7,000	98	Paved parking, HSG A (100)
47,768	30	Woods, Good, HSG A (100)
94,150	39	TOTAL AREA

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Soil Listing (all nodes)

Area (sq-ft)	Soil Group	Subcatchment Numbers
94,150	HSG A	100
0	HSG B	
0	HSG C	
0	HSG D	
0	Other	
94,150		TOTAL AREA

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Ground Covers (all nodes)

HSG-A (sq-ft)	HSG-B (sq-ft)	HSG-C (sq-ft)	HSG-D (sq-ft)	Other (sq-ft)	Total (sq-ft)	Ground Cover
39,382	0	0	0	0	39,382	>75% Grass cover, Good
7,000	0	0	0	0	7,000	Paved parking
47,768	0	0	0	0	47,768	Woods, Good
94,150	0	0	0	0	94,150	TOTAL AREA

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Type III 24-hr 2-Year Rainfall=3.30"

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Time span=0.00-36.00 hrs, dt=0.01 hrs, 3601 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 100: On-Site and Off-Site

Runoff Area=94,150 sf 7.43% Impervious Runoff Depth=0.00"
Flow Length=360' Tc=7.7 min CN=39 Runoff=0.00 cfs 15 cf

Link A: Eastern Wetland

Inflow=0.00 cfs 15 cf
Primary=0.00 cfs 15 cf

Total Runoff Area = 94,150 sf Runoff Volume = 15 cf Average Runoff Depth = 0.00"
92.57% Pervious = 87,150 sf 7.43% Impervious = 7,000 sf

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Type III 24-hr 2-Year Rainfall=3.30"

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Summary for Subcatchment 100: On-Site and Off-Site Flow to Wetland

Runoff = 0.00 cfs @ 24.00 hrs, Volume= 15 cf, Depth= 0.00"

Routed to Link A : Eastern Wetland

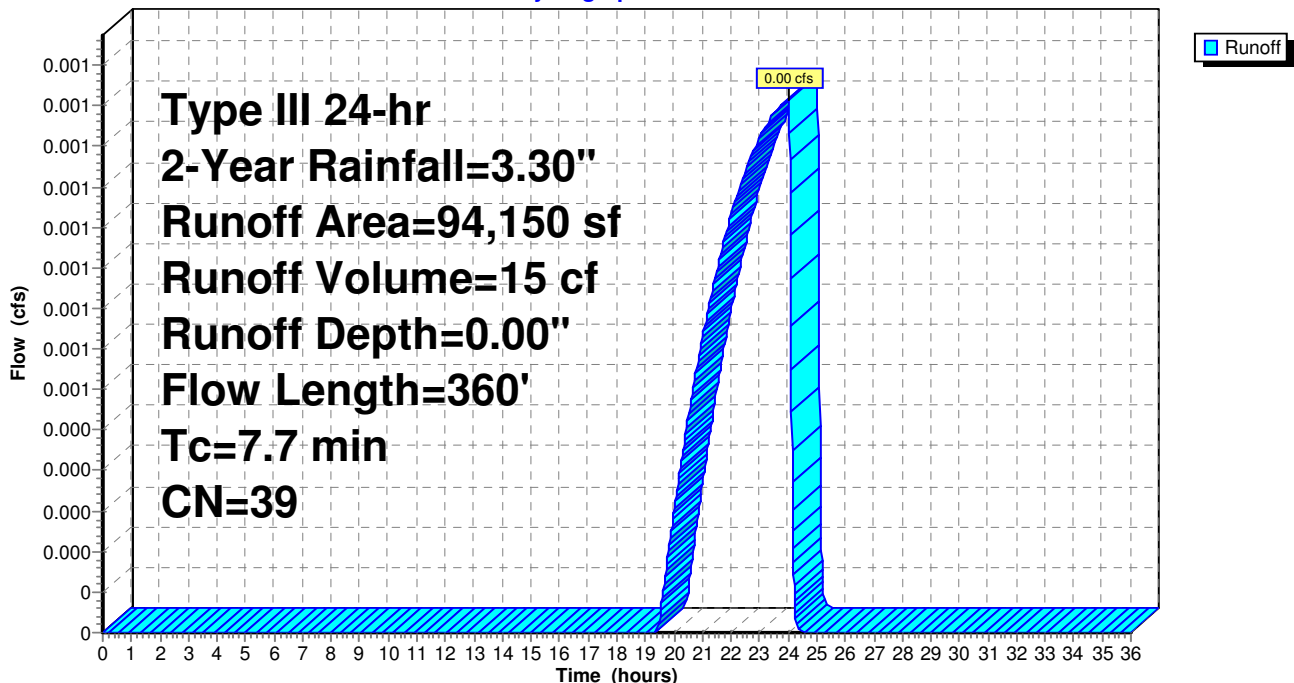
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-Year Rainfall=3.30"

Area (sf)	CN	Description
47,768	30	Woods, Good, HSG A
39,382	39	>75% Grass cover, Good, HSG A
7,000	98	Paved parking, HSG A
94,150	39	Weighted Average
87,150		92.57% Pervious Area
7,000		7.43% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.2	30	0.1000	0.12		Sheet Flow, Woods: Light underbrush n= 0.400 P2= 3.30"
2.0	190	0.0500	1.57		Shallow Concentrated Flow, Short Grass Pasture Kv= 7.0 fps
1.5	140	0.1000	1.58		Shallow Concentrated Flow, Woodland Kv= 5.0 fps
7.7	360	Total			

Subcatchment 100: On-Site and Off-Site Flow to Wetland

Hydrograph



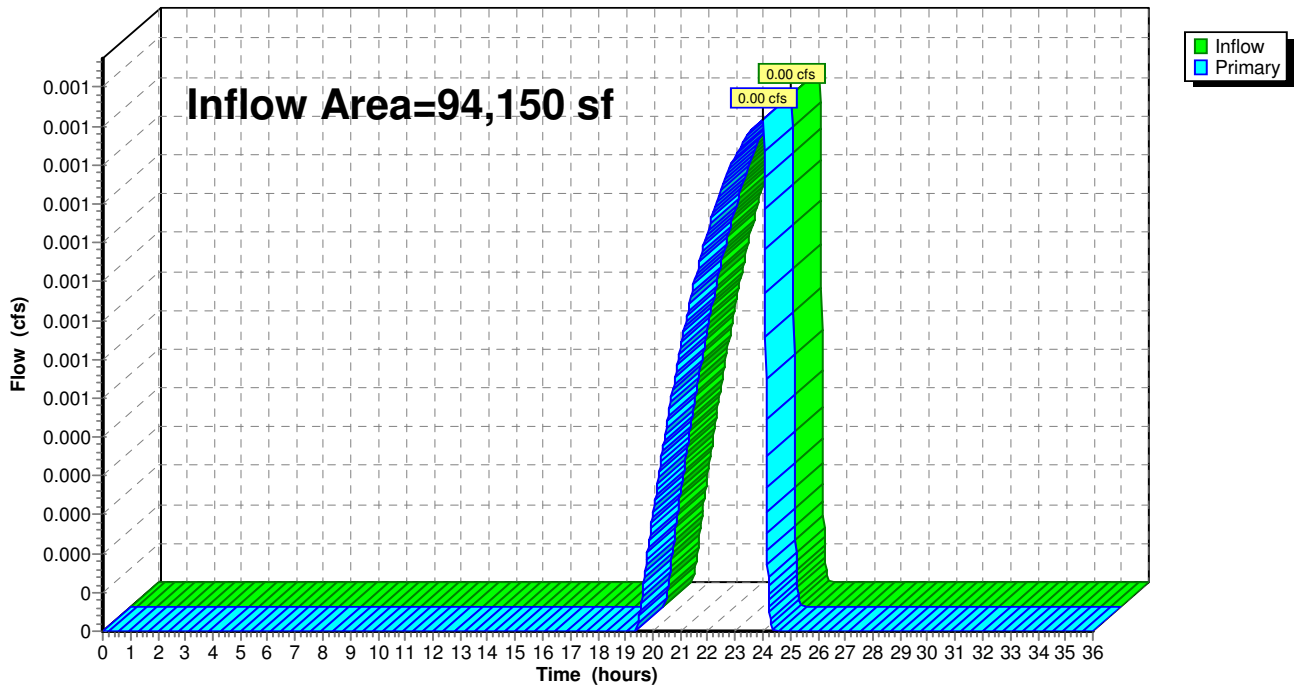
Summary for Link A: Eastern Wetland

Inflow Area = 94,150 sf, 7.43% Impervious, Inflow Depth = 0.00" for 2-Year event
Inflow = 0.00 cfs @ 24.00 hrs, Volume= 15 cf
Primary = 0.00 cfs @ 24.00 hrs, Volume= 15 cf, Atten= 0%, Lag= 0.0 min

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

Link A: Eastern Wetland

Hydrograph



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Type III 24-hr 10-Year Rainfall=5.21"

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Time span=0.00-36.00 hrs, dt=0.01 hrs, 3601 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 100: On-Site and Off-Site

Runoff Area=94,150 sf 7.43% Impervious Runoff Depth=0.24"
Flow Length=360' Tc=7.7 min CN=39 Runoff=0.13 cfs 1,919 cf

Link A: Eastern Wetland

Inflow=0.13 cfs 1,919 cf
Primary=0.13 cfs 1,919 cf

Total Runoff Area = 94,150 sf Runoff Volume = 1,919 cf Average Runoff Depth = 0.24"
92.57% Pervious = 87,150 sf 7.43% Impervious = 7,000 sf

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Type III 24-hr 10-Year Rainfall=5.21"

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Summary for Subcatchment 100: On-Site and Off-Site Flow to Wetland

Runoff = 0.13 cfs @ 12.47 hrs, Volume= 1,919 cf, Depth= 0.24"

Routed to Link A : Eastern Wetland

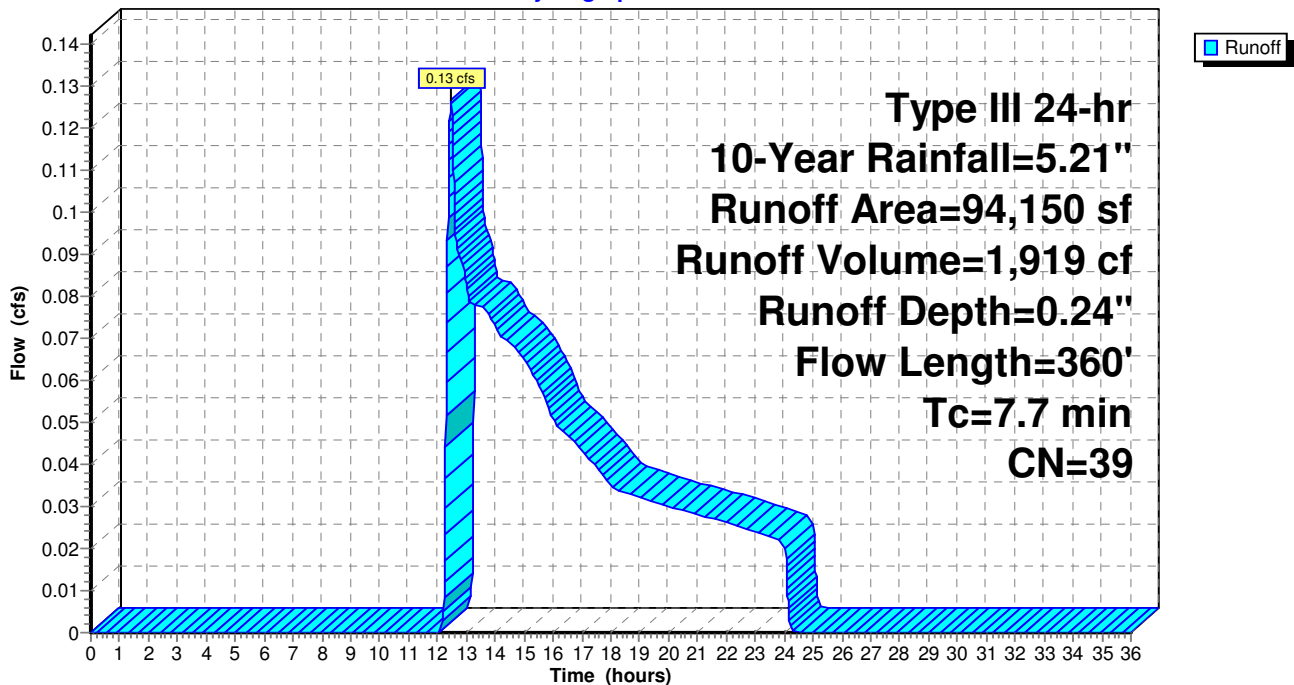
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
 Type III 24-hr 10-Year Rainfall=5.21"

Area (sf)	CN	Description
47,768	30	Woods, Good, HSG A
39,382	39	>75% Grass cover, Good, HSG A
7,000	98	Paved parking, HSG A
94,150	39	Weighted Average
87,150		92.57% Pervious Area
7,000		7.43% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.2	30	0.1000	0.12		Sheet Flow, Woods: Light underbrush n= 0.400 P2= 3.30"
2.0	190	0.0500	1.57		Shallow Concentrated Flow, Short Grass Pasture Kv= 7.0 fps
1.5	140	0.1000	1.58		Shallow Concentrated Flow, Woodland Kv= 5.0 fps
7.7	360	Total			

Subcatchment 100: On-Site and Off-Site Flow to Wetland

Hydrograph



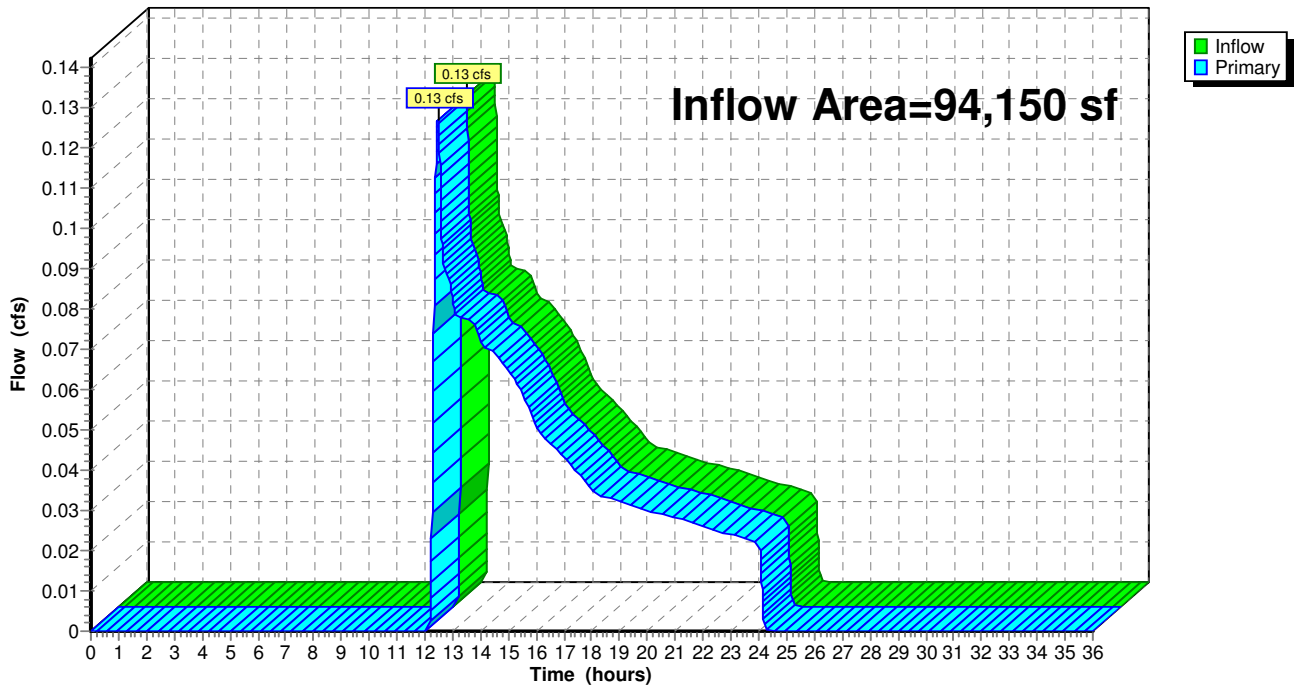
Summary for Link A: Eastern Wetland

Inflow Area = 94,150 sf, 7.43% Impervious, Inflow Depth = 0.24" for 10-Year event
Inflow = 0.13 cfs @ 12.47 hrs, Volume= 1,919 cf
Primary = 0.13 cfs @ 12.47 hrs, Volume= 1,919 cf, Atten= 0%, Lag= 0.0 min

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

Link A: Eastern Wetland

Hydrograph



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Type III 24-hr 25-Year Rainfall=6.39"

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Time span=0.00-36.00 hrs, dt=0.01 hrs, 3601 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 100: On-Site and Off-Site Runoff Area=94,150 sf 7.43% Impervious Runoff Depth=0.56"
Flow Length=360' Tc=7.7 min CN=39 Runoff=0.54 cfs 4,416 cf

Link A: Eastern Wetland

Inflow=0.54 cfs 4,416 cf
Primary=0.54 cfs 4,416 cf

Total Runoff Area = 94,150 sf Runoff Volume = 4,416 cf Average Runoff Depth = 0.56"
92.57% Pervious = 87,150 sf 7.43% Impervious = 7,000 sf

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Type III 24-hr 25-Year Rainfall=6.39"

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Summary for Subcatchment 100: On-Site and Off-Site Flow to Wetland

Runoff = 0.54 cfs @ 12.33 hrs, Volume= 4,416 cf, Depth= 0.56"

Routed to Link A : Eastern Wetland

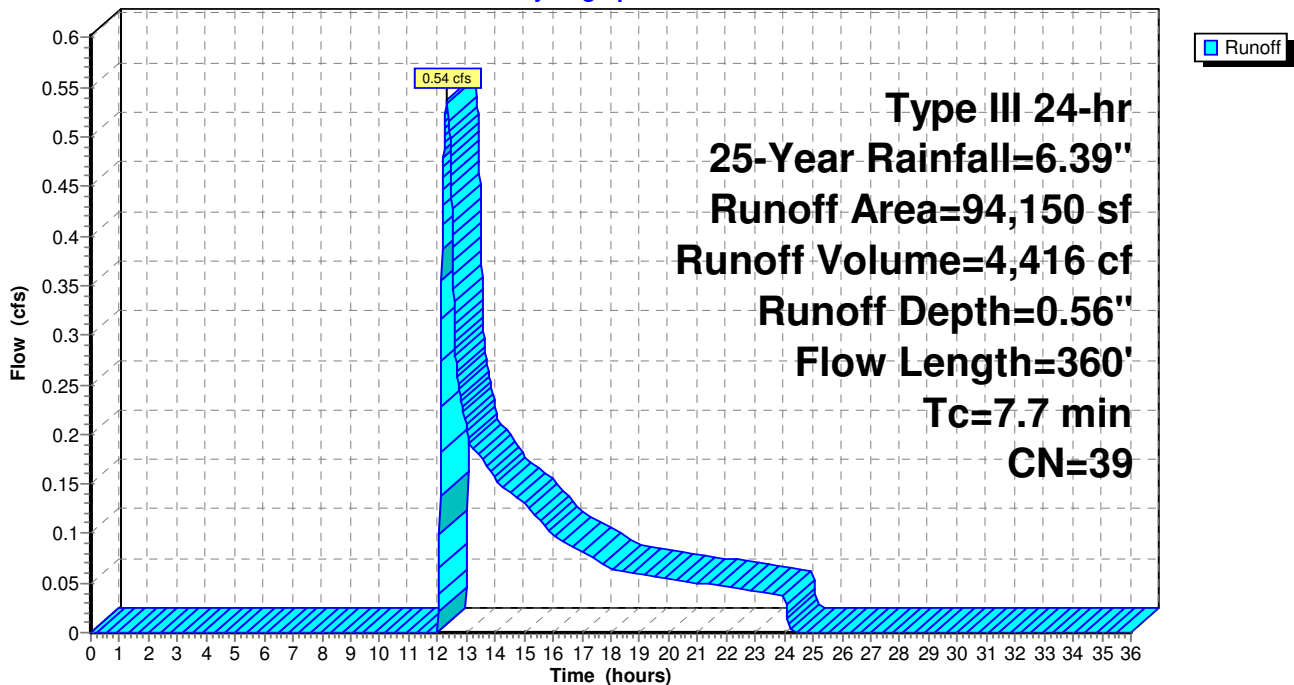
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Year Rainfall=6.39"

Area (sf)	CN	Description
47,768	30	Woods, Good, HSG A
39,382	39	>75% Grass cover, Good, HSG A
7,000	98	Paved parking, HSG A
94,150	39	Weighted Average
87,150		92.57% Pervious Area
7,000		7.43% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.2	30	0.1000	0.12		Sheet Flow, Woods: Light underbrush n= 0.400 P2= 3.30"
2.0	190	0.0500	1.57		Shallow Concentrated Flow, Short Grass Pasture Kv= 7.0 fps
1.5	140	0.1000	1.58		Shallow Concentrated Flow, Woodland Kv= 5.0 fps
7.7	360	Total			

Subcatchment 100: On-Site and Off-Site Flow to Wetland

Hydrograph



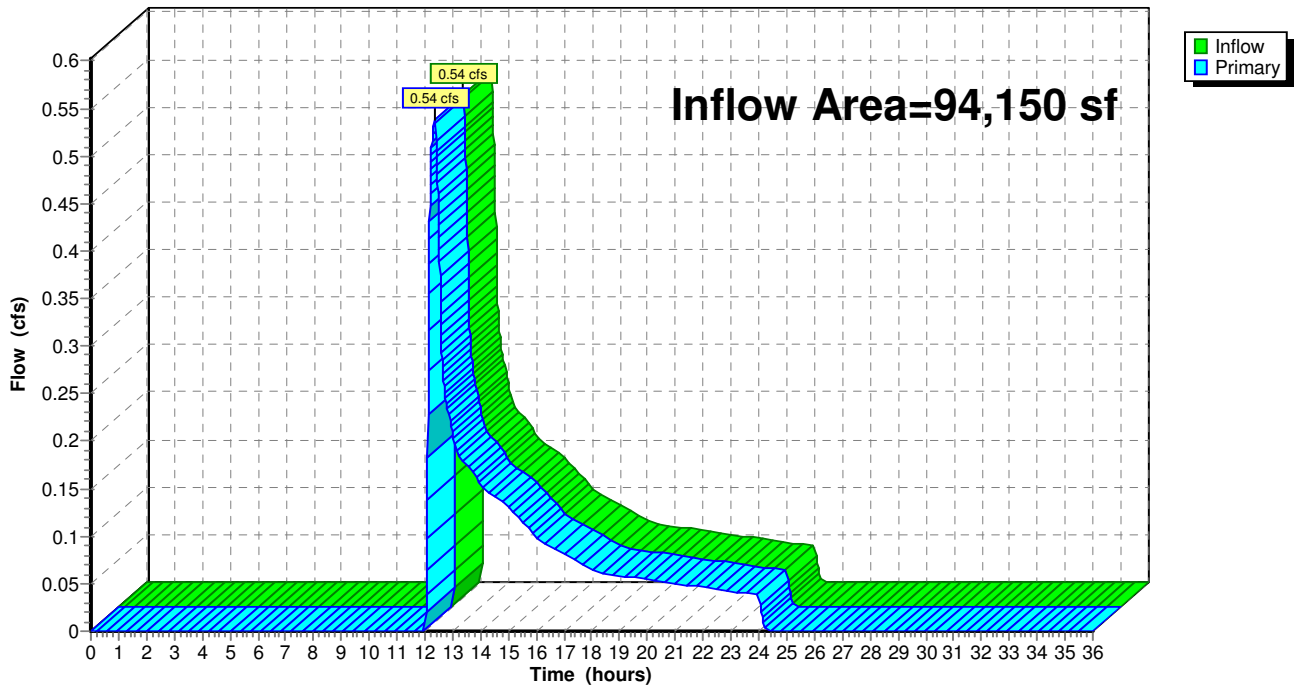
Summary for Link A: Eastern Wetland

Inflow Area = 94,150 sf, 7.43% Impervious, Inflow Depth = 0.56" for 25-Year event
Inflow = 0.54 cfs @ 12.33 hrs, Volume= 4,416 cf
Primary = 0.54 cfs @ 12.33 hrs, Volume= 4,416 cf, Atten= 0%, Lag= 0.0 min

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

Link A: Eastern Wetland

Hydrograph



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Type III 24-hr 100-Year Rainfall=8.22"

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Time span=0.00-36.00 hrs, dt=0.01 hrs, 3601 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 100: On-Site and Off-Site

Runoff Area=94,150 sf 7.43% Impervious Runoff Depth=1.25"
Flow Length=360' Tc=7.7 min CN=39 Runoff=2.01 cfs 9,811 cf

Link A: Eastern Wetland

Inflow=2.01 cfs 9,811 cf
Primary=2.01 cfs 9,811 cf

Total Runoff Area = 94,150 sf Runoff Volume = 9,811 cf Average Runoff Depth = 1.25"
92.57% Pervious = 87,150 sf 7.43% Impervious = 7,000 sf

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Type III 24-hr 100-Year Rainfall=8.22"

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Summary for Subcatchment 100: On-Site and Off-Site Flow to Wetland

Runoff = 2.01 cfs @ 12.14 hrs, Volume= 9,811 cf, Depth= 1.25"

Routed to Link A : Eastern Wetland

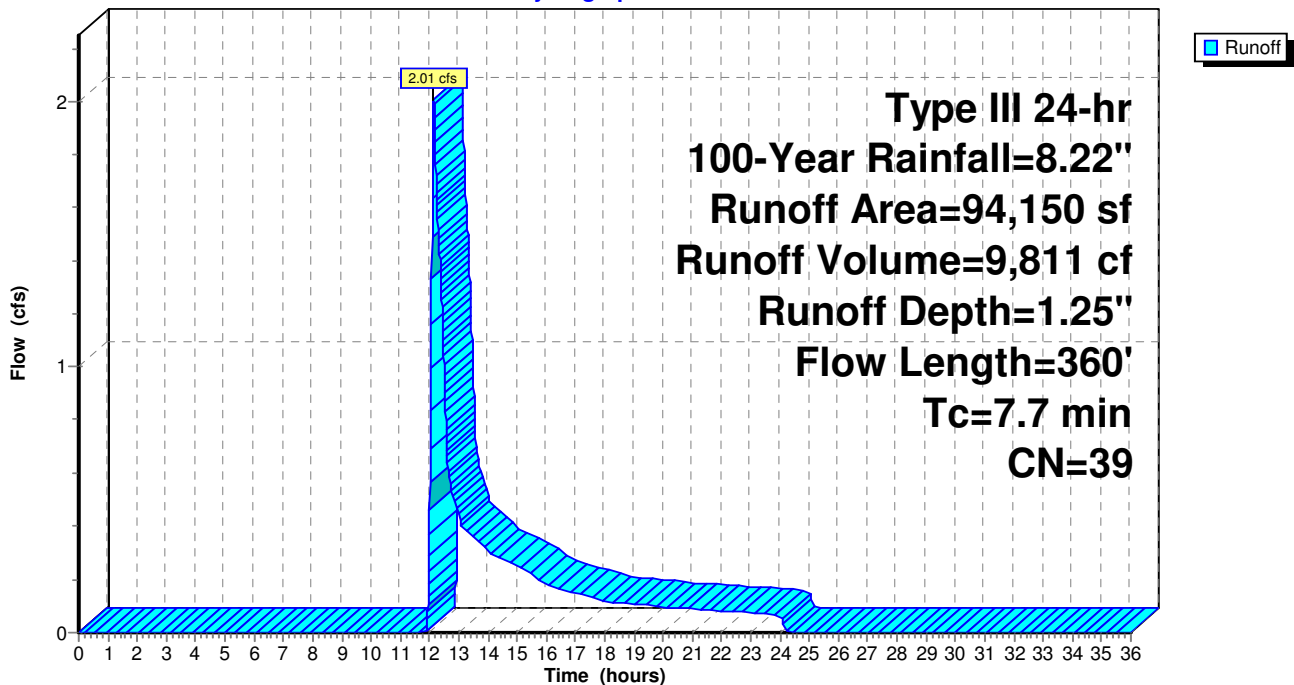
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
 Type III 24-hr 100-Year Rainfall=8.22"

Area (sf)	CN	Description
47,768	30	Woods, Good, HSG A
39,382	39	>75% Grass cover, Good, HSG A
7,000	98	Paved parking, HSG A
94,150	39	Weighted Average
87,150		92.57% Pervious Area
7,000		7.43% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.2	30	0.1000	0.12		Sheet Flow, Woods: Light underbrush n= 0.400 P2= 3.30"
2.0	190	0.0500	1.57		Shallow Concentrated Flow, Short Grass Pasture Kv= 7.0 fps
1.5	140	0.1000	1.58		Shallow Concentrated Flow, Woodland Kv= 5.0 fps
7.7	360	Total			

Subcatchment 100: On-Site and Off-Site Flow to Wetland

Hydrograph



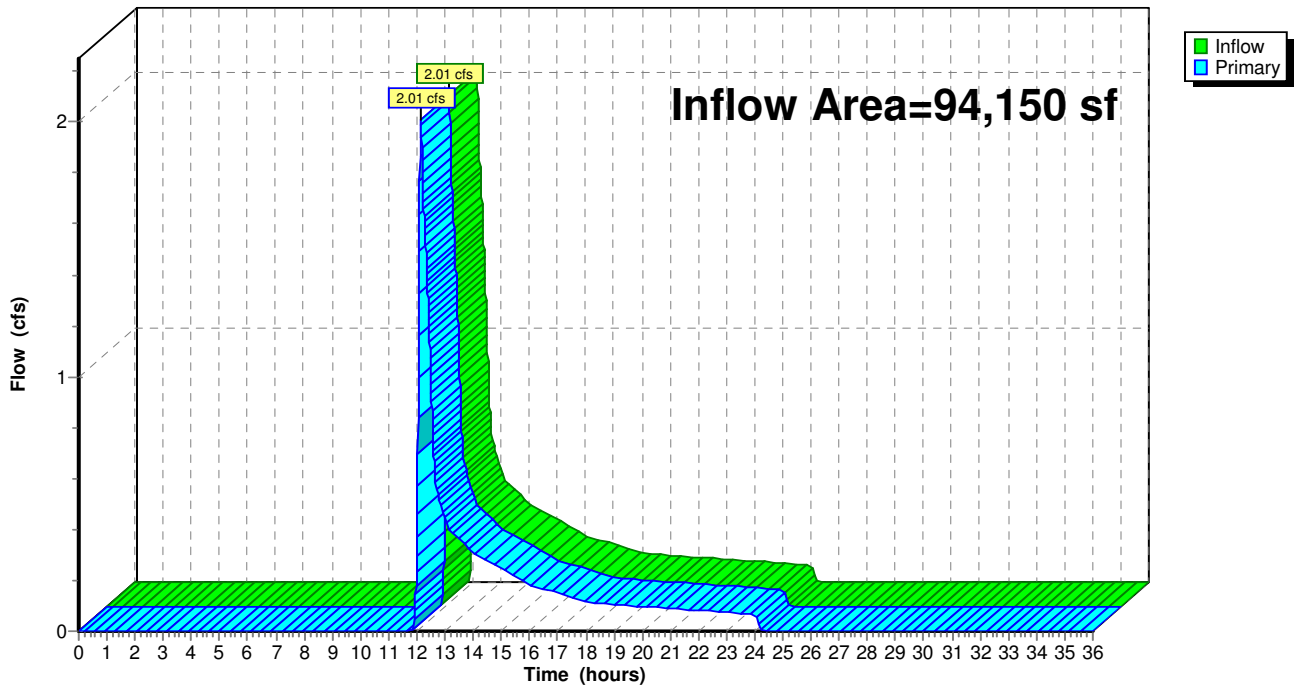
Summary for Link A: Eastern Wetland

Inflow Area = 94,150 sf, 7.43% Impervious, Inflow Depth = 1.25" for 100-Year event
Inflow = 2.01 cfs @ 12.14 hrs, Volume= 9,811 cf
Primary = 2.01 cfs @ 12.14 hrs, Volume= 9,811 cf, Atten= 0%, Lag= 0.0 min

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

Link A: Eastern Wetland

Hydrograph



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246 & 248 WALNUT STREET

STORMWATER MANAGEMENT REPORT – VOLUME 2 OF 2

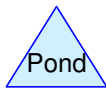
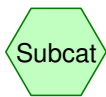
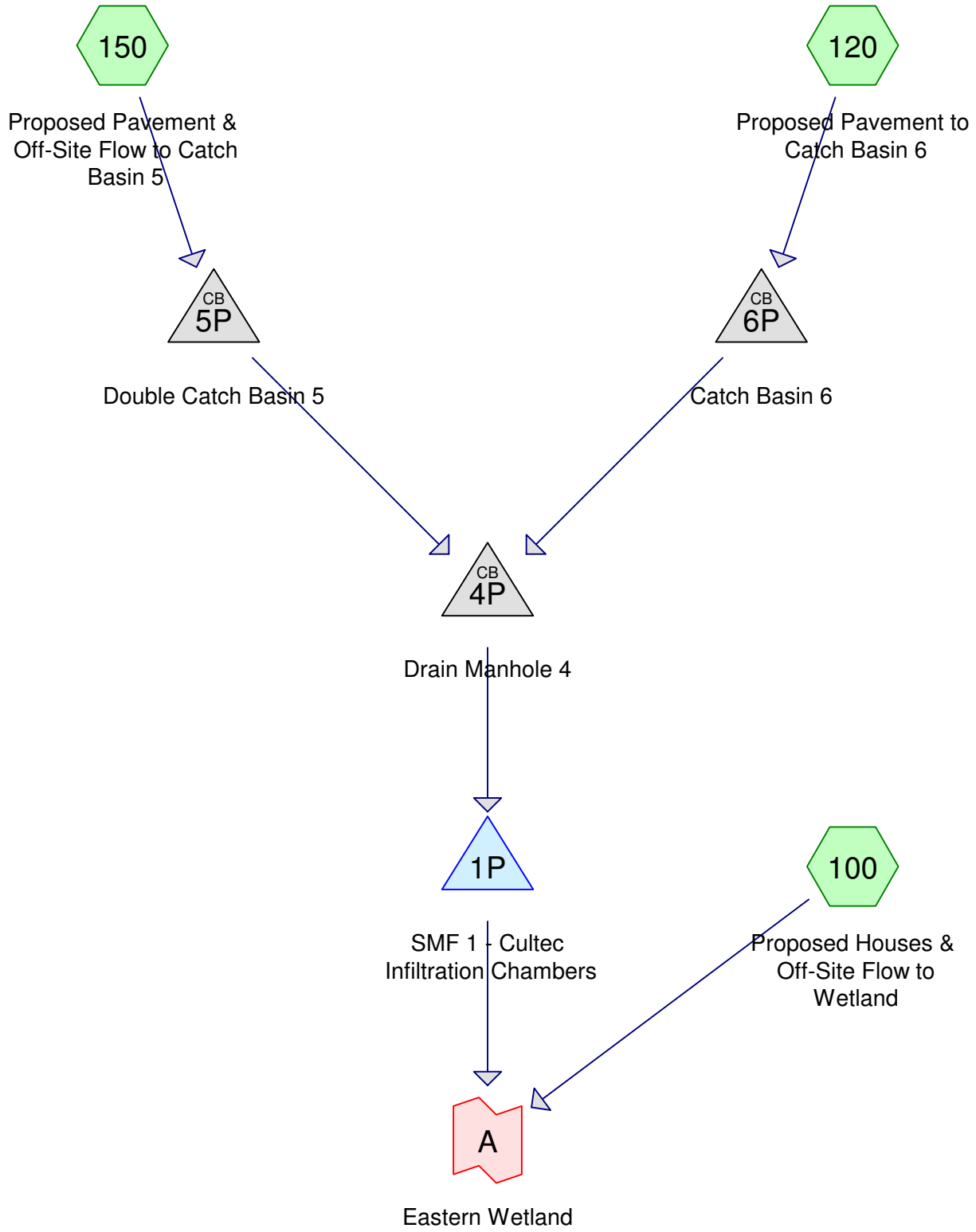
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HydroCAD Printouts

Post Development

Storm Frequency: 2, 10, 25, 100 Year

NOAA 14 Storm Events



Routing Diagram for 3110 - Post Development 1
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Rainfall Events Listing

Event#	Event Name	Storm Type	Curve	Mode	Duration (hours)	B/B	Depth (inches)	AMC
1	2-Year	Type III 24-hr		Default	24.00	1	3.30	2
2	10-Year	Type III 24-hr		Default	24.00	1	5.21	2
3	25-Year	Type III 24-hr		Default	24.00	1	6.39	2
4	100-Year	Type III 24-hr		Default	24.00	1	8.22	2

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Area Listing (all nodes)

Area (sq-ft)	CN	Description (subcatchment-numbers)
24,090	39	>75% Grass cover, Good, HSG A (100, 120, 150)
22,527	98	Paved parking, HSG A (100, 120, 150)
47,533	30	Woods, Good, HSG A (100, 150)
94,150	49	TOTAL AREA

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Soil Listing (all nodes)

Area (sq-ft)	Soil Group	Subcatchment Numbers
94,150	HSG A	100, 120, 150
0	HSG B	
0	HSG C	
0	HSG D	
0	Other	
94,150		TOTAL AREA

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Ground Covers (all nodes)

HSG-A (sq-ft)	HSG-B (sq-ft)	HSG-C (sq-ft)	HSG-D (sq-ft)	Other (sq-ft)	Total (sq-ft)	Ground Cover
24,090	0	0	0	0	24,090	>75% Grass cover, Good
22,527	0	0	0	0	22,527	Paved parking
47,533	0	0	0	0	47,533	Woods, Good
94,150	0	0	0	0	94,150	TOTAL AREA

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Pipe Listing (all nodes)

Line#	Node Number	In-Invert (feet)	Out-Invert (feet)	Length (feet)	Slope (ft/ft)	n	Width (inches)	Diam/Height (inches)	Inside-Fill (inches)	Node Name
1	1P	111.38	110.96	21.0	0.0200	0.011	0.0	6.0	0.0	
2	4P	109.43	109.33	5.0	0.0200	0.013	0.0	12.0	0.0	
3	5P	110.01	109.53	24.0	0.0200	0.013	0.0	12.0	0.0	
4	6P	109.73	109.53	10.0	0.0200	0.013	0.0	12.0	0.0	

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Type III 24-hr 2-Year Rainfall=3.30"

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Time span=0.00-36.00 hrs, dt=0.01 hrs, 3601 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 100: Proposed Houses & Runoff Area=58,891 sf 9.20% Impervious Runoff Depth=0.00"
Flow Length=200' Slope=0.1000 '/' Tc=8.0 min CN=38 Runoff=0.00 cfs 0 cf

Subcatchment 120: Proposed Pavement to Runoff Area=3,976 sf 69.22% Impervious Runoff Depth=1.48"
Flow Length=110' Tc=3.8 min CN=80 Runoff=0.17 cfs 490 cf

Subcatchment 150: Proposed Pavement & Runoff Area=31,283 sf 45.89% Impervious Runoff Depth=0.65"
Flow Length=220' Tc=5.5 min CN=65 Runoff=0.45 cfs 1,693 cf

Pond 1P: SMF 1 - Cultec Infiltration Chambers Peak Elev=109.37' Storage=493 cf Inflow=0.60 cfs 2,184 cf
Discarded=0.12 cfs 2,184 cf Primary=0.00 cfs 0 cf Outflow=0.12 cfs 2,184 cf

Pond 4P: Drain Manhole 4 Peak Elev=109.86' Inflow=0.60 cfs 2,184 cf
12.0" Round Culvert n=0.013 L=5.0' S=0.0200 '/' Outflow=0.60 cfs 2,184 cf

Pond 5P: Double Catch Basin 5 Peak Elev=110.34' Inflow=0.45 cfs 1,693 cf
12.0" Round Culvert n=0.013 L=24.0' S=0.0200 '/' Outflow=0.45 cfs 1,693 cf

Pond 6P: Catch Basin 6 Peak Elev=109.97' Inflow=0.17 cfs 490 cf
12.0" Round Culvert n=0.013 L=10.0' S=0.0200 '/' Outflow=0.17 cfs 490 cf

Link A: Eastern Wetland Inflow=0.00 cfs 0 cf
Primary=0.00 cfs 0 cf

Total Runoff Area = 94,150 sf Runoff Volume = 2,184 cf Average Runoff Depth = 0.28"
76.07% Pervious = 71,623 sf 23.93% Impervious = 22,527 sf

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Type III 24-hr 2-Year Rainfall=3.30"

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Summary for Subcatchment 120: Proposed Pavement to Catch Basin 6

Runoff = 0.17 cfs @ 12.06 hrs, Volume= 490 cf, Depth= 1.48"
 Routed to Pond 6P : Catch Basin 6

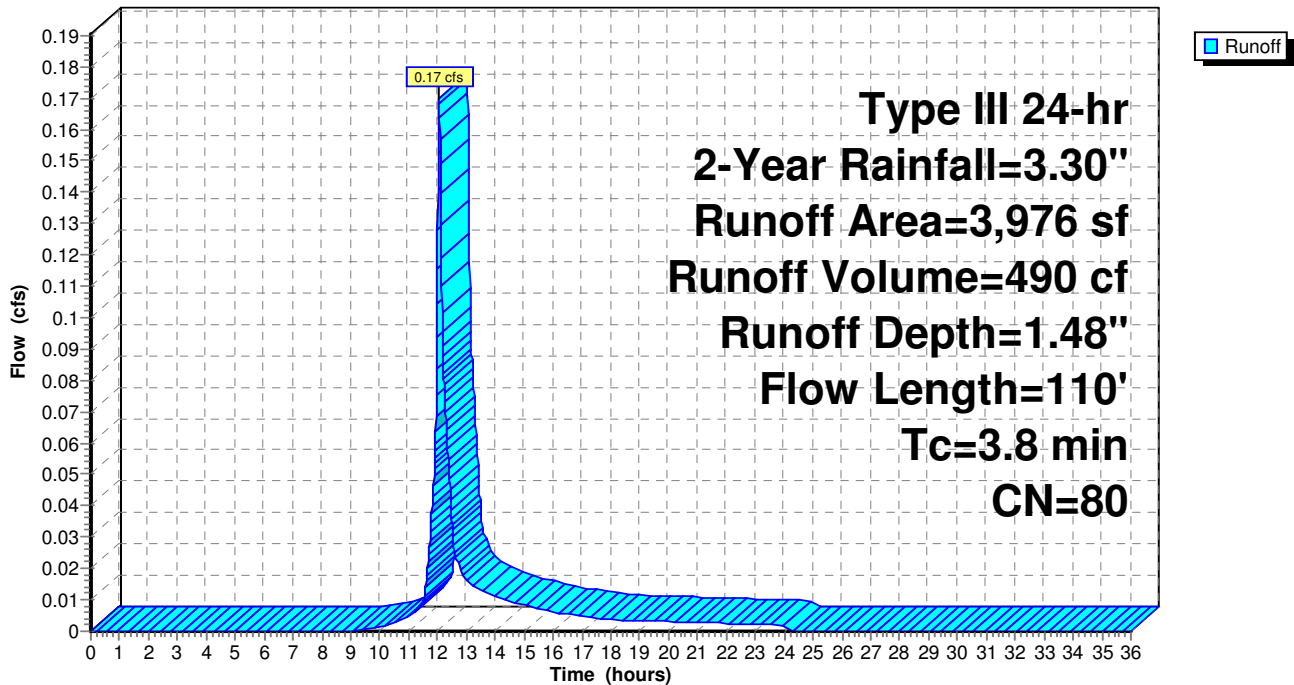
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
 Type III 24-hr 2-Year Rainfall=3.30"

Area (sf)	CN	Description
1,224	39	>75% Grass cover, Good, HSG A
2,752	98	Paved parking, HSG A
3,976	80	Weighted Average
1,224		30.78% Pervious Area
2,752		69.22% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.5	35	0.0300	0.16		Sheet Flow, Grass: Short n= 0.150 P2= 3.30"
0.3	75	0.0340	3.74		Shallow Concentrated Flow, Paved Kv= 20.3 fps
3.8	110	Total			

Subcatchment 120: Proposed Pavement to Catch Basin 6

Hydrograph



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Type III 24-hr 2-Year Rainfall=3.30"

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Summary for Subcatchment 150: Proposed Pavement & Off-Site Flow to Catch Basin 5

Runoff = 0.45 cfs @ 12.10 hrs, Volume= 1,693 cf, Depth= 0.65"
 Routed to Pond 5P : Double Catch Basin 5

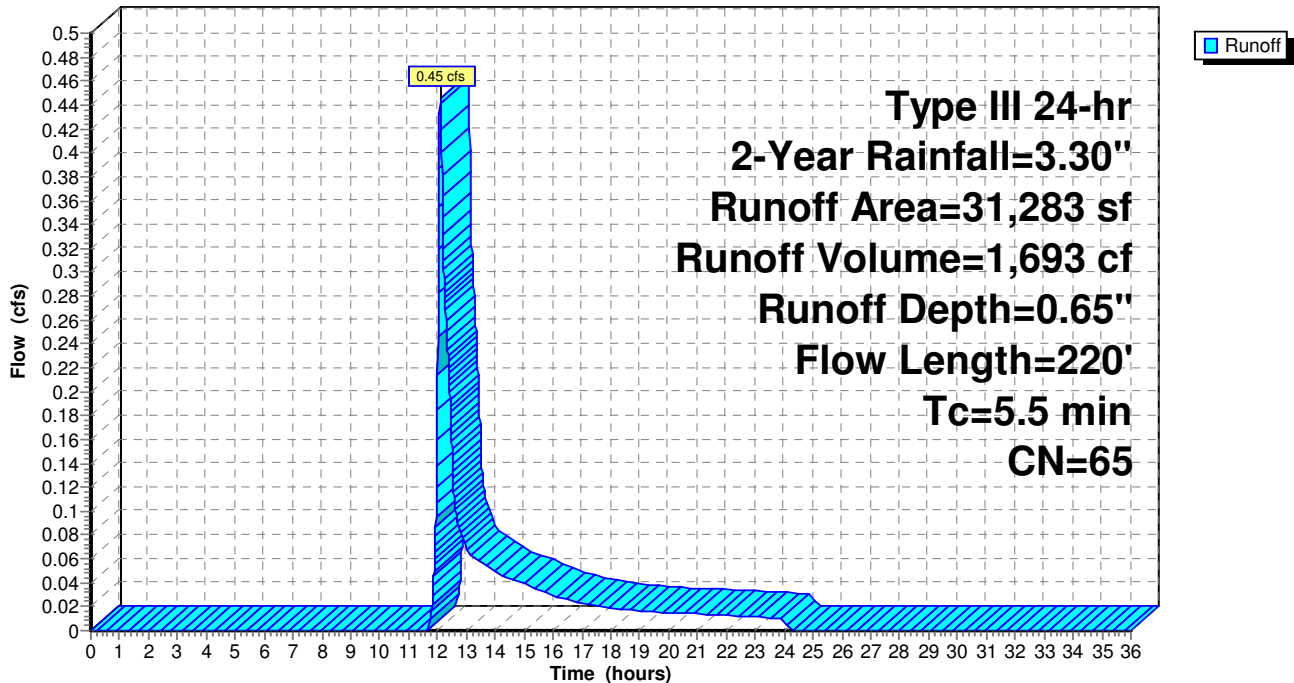
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
 Type III 24-hr 2-Year Rainfall=3.30"

Area (sf)	CN	Description
3,591	30	Woods, Good, HSG A
13,337	39	>75% Grass cover, Good, HSG A
14,355	98	Paved parking, HSG A
31,283	65	Weighted Average
16,928		54.11% Pervious Area
14,355		45.89% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.2	30	0.1000	0.12		Sheet Flow, Woods: Light underbrush n= 0.400 P2= 3.30"
0.6	50	0.0400	1.40		Shallow Concentrated Flow, Short Grass Pasture Kv= 7.0 fps
0.7	140	0.0300	3.52		Shallow Concentrated Flow, Paved Kv= 20.3 fps
5.5	220	Total			

Subcatchment 150: Proposed Pavement & Off-Site Flow to Catch Basin 5

Hydrograph



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Type III 24-hr 2-Year Rainfall=3.30"

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Summary for Pond 1P: SMF 1 - Cultec Infiltration Chambers

[87] Warning: Oscillations may require smaller dt or Finer Routing (severity=441)

Inflow Area = 35,259 sf, 48.52% Impervious, Inflow Depth = 0.74" for 2-Year event
 Inflow = 0.60 cfs @ 12.09 hrs, Volume= 2,184 cf
 Outflow = 0.12 cfs @ 12.02 hrs, Volume= 2,184 cf, Atten= 80%, Lag= 0.0 min
 Discarded = 0.12 cfs @ 12.02 hrs, Volume= 2,184 cf
 Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf
 Routed to Link A : Eastern Wetland

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
 Peak Elev= 109.37' @ 12.65 hrs Surf.Area= 2,102 sf Storage= 493 cf
 Flood Elev= 113.38' Surf.Area= 2,102 sf Storage= 4,778 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
 Center-of-Mass det. time= 27.7 min (907.7 - 880.1)

Volume	Invert	Avail.Storage	Storage Description
#1A	108.83'	1,779 cf	35.33'W x 59.50'L x 3.54'H Field A 7,446 cf Overall - 2,999 cf Embedded = 4,447 cf x 40.0% Voids
#2A	109.33'	2,999 cf	Cultec R-330XLHD x 56 Inside #1 Effective Size= 47.8"W x 30.0"H => 7.45 sf x 7.00'L = 52.2 cf Overall Size= 52.0"W x 30.5"H x 8.50'L with 1.50' Overlap Row Length Adjustment= +1.50' x 7.45 sf x 7 rows
		4,778 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	108.83'	2.410 in/hr Exfiltration over Surface area
#2	Primary	111.38'	6.0" Round Culvert L= 21.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 111.38' / 110.96' S= 0.0200 '/' Cc= 0.900 n= 0.011 PVC, smooth interior, Flow Area= 0.20 sf

Discarded OutFlow Max=0.12 cfs @ 12.02 hrs HW=108.88' (Free Discharge)
 ↑1=Exfiltration (Exfiltration Controls 0.12 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=108.83' TW=0.00' (Dynamic Tailwater)
 ↑2=Culvert (Controls 0.00 cfs)

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Type III 24-hr 2-Year Rainfall=3.30"

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Pond 1P: SMF 1 - Cultec Infiltration Chambers - Chamber Wizard Field A

Chamber Model = Cultec R-330XLHD (Cultec Recharger® 330XLHD)

Effective Size= 47.8"W x 30.0"H => 7.45 sf x 7.00'L = 52.2 cf

Overall Size= 52.0"W x 30.5"H x 8.50'L with 1.50' Overlap

Row Length Adjustment= +1.50' x 7.45 sf x 7 rows

52.0" Wide + 6.0" Spacing = 58.0" C-C Row Spacing

8 Chambers/Row x 7.00' Long +1.50' Row Adjustment = 57.50' Row Length +12.0" End Stone x 2 = 59.50' Base Length

7 Rows x 52.0" Wide + 6.0" Spacing x 6 + 12.0" Side Stone x 2 = 35.33' Base Width

6.0" Stone Base + 30.5" Chamber Height + 6.0" Stone Cover = 3.54' Field Height

56 Chambers x 52.2 cf +1.50' Row Adjustment x 7.45 sf x 7 Rows = 2,999.0 cf Chamber Storage

7,445.8 cf Field - 2,999.0 cf Chambers = 4,446.7 cf Stone x 40.0% Voids = 1,778.7 cf Stone Storage

Chamber Storage + Stone Storage = 4,777.7 cf = 0.110 af

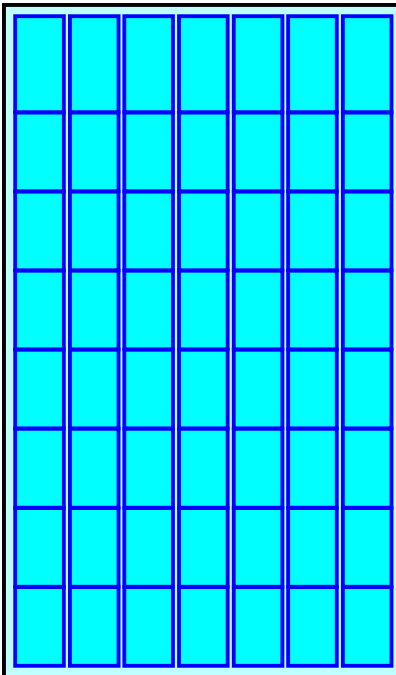
Overall Storage Efficiency = 64.2%

Overall System Size = 59.50' x 35.33' x 3.54'

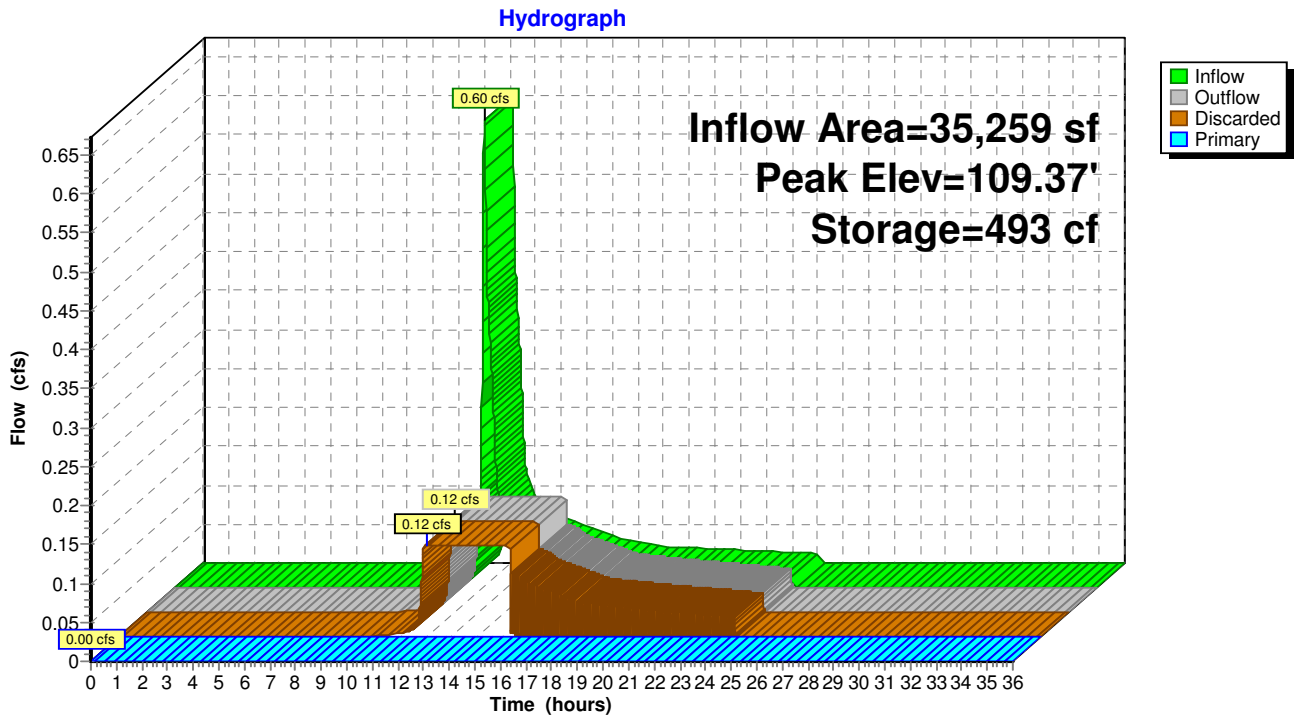
56 Chambers

275.8 cy Field

164.7 cy Stone



Pond 1P: SMF 1 - Cultec Infiltration Chambers



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Type III 24-hr 2-Year Rainfall=3.30"

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Summary for Pond 4P: Drain Manhole 4

Inflow Area = 35,259 sf, 48.52% Impervious, Inflow Depth = 0.74" for 2-Year event
 Inflow = 0.60 cfs @ 12.09 hrs, Volume= 2,184 cf
 Outflow = 0.60 cfs @ 12.09 hrs, Volume= 2,184 cf, Atten= 0%, Lag= 0.0 min
 Primary = 0.60 cfs @ 12.09 hrs, Volume= 2,184 cf
 Routed to Pond 1P : SMF 1 - Cultec Infiltration Chambers

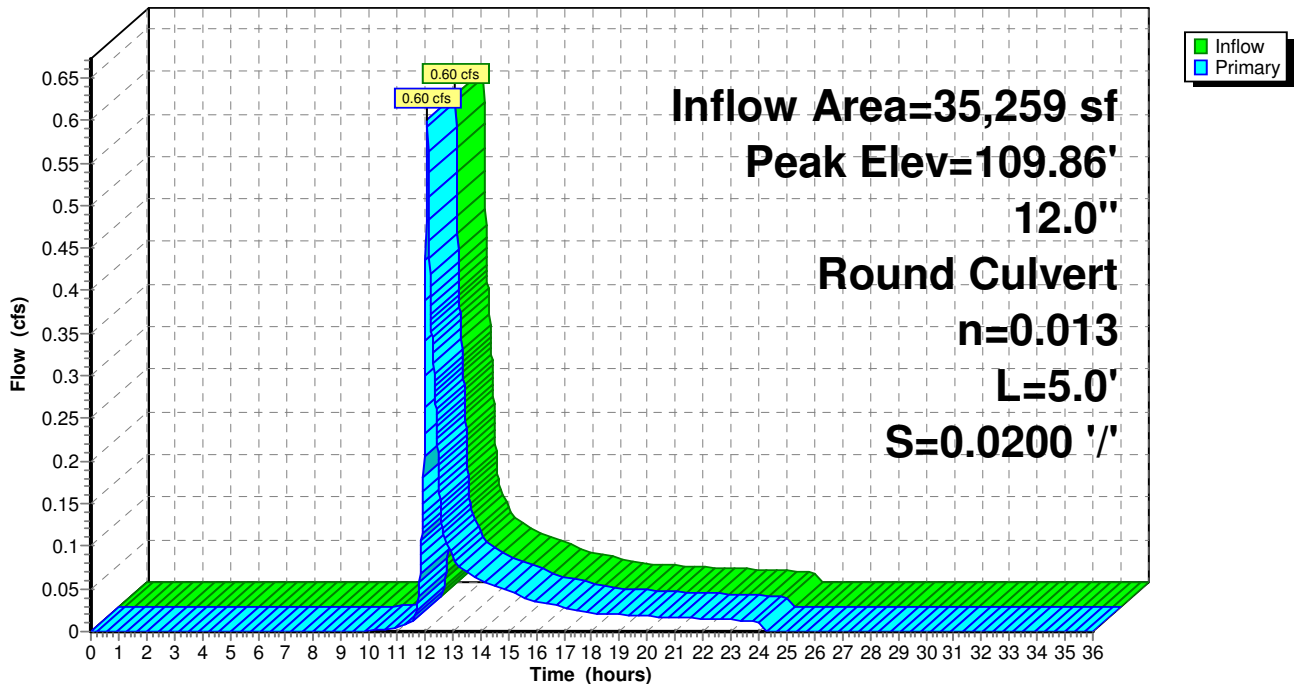
Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
 Peak Elev= 109.86' @ 12.09 hrs
 Flood Elev= 114.40'

Device #	Routing	Invert	Outlet Devices
1	Primary	109.43'	12.0" Round Culvert L= 5.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 109.43' / 109.33' S= 0.0200 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=0.60 cfs @ 12.09 hrs HW=109.86' TW=109.00' (Dynamic Tailwater)
 ↑1=Culvert (Barrel Controls 0.60 cfs @ 2.76 fps)

Pond 4P: Drain Manhole 4

Hydrograph



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Type III 24-hr 2-Year Rainfall=3.30"

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Summary for Pond 5P: Double Catch Basin 5

Inflow Area = 31,283 sf, 45.89% Impervious, Inflow Depth = 0.65" for 2-Year event
 Inflow = 0.45 cfs @ 12.10 hrs, Volume= 1,693 cf
 Outflow = 0.45 cfs @ 12.10 hrs, Volume= 1,693 cf, Atten= 0%, Lag= 0.0 min
 Primary = 0.45 cfs @ 12.10 hrs, Volume= 1,693 cf
 Routed to Pond 4P : Drain Manhole 4

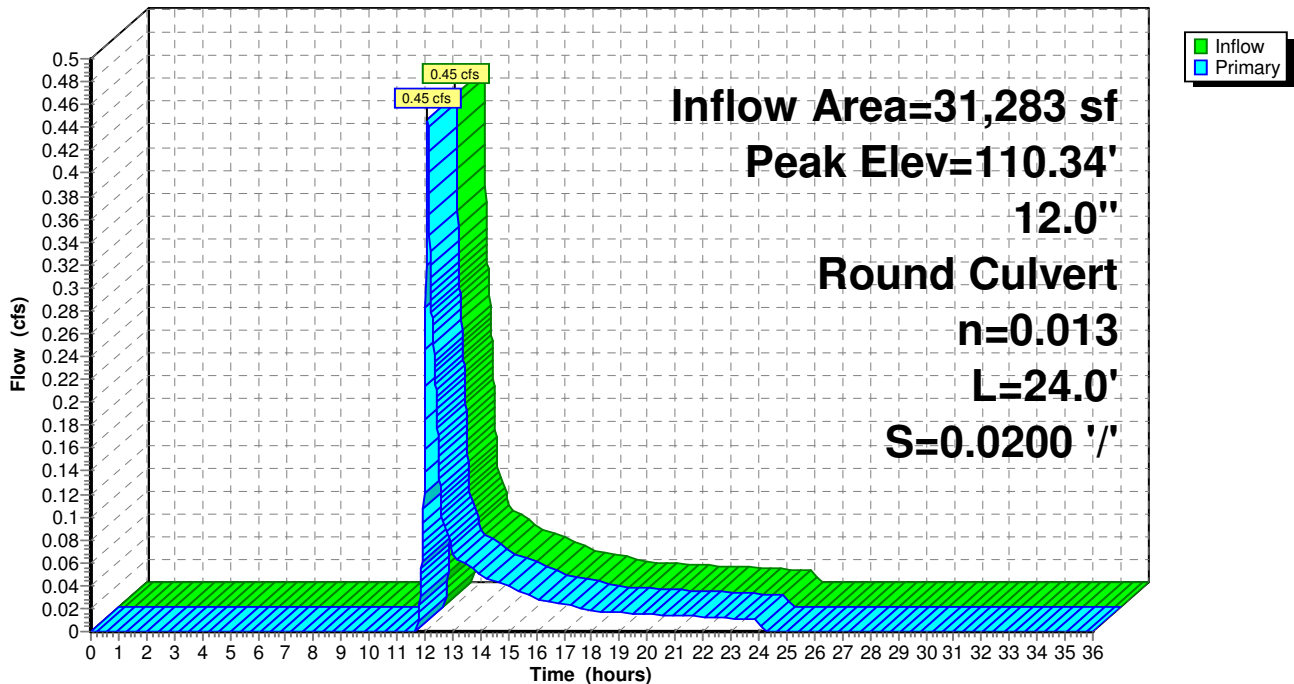
Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
 Peak Elev= 110.34' @ 12.10 hrs
 Flood Elev= 113.50'

Device #	Routing	Invert	Outlet Devices
1	Primary	110.01'	12.0" Round Culvert L= 24.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 110.01' / 109.53' S= 0.0200 '/ Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=0.45 cfs @ 12.10 hrs HW=110.34' TW=109.86' (Dynamic Tailwater)
 ↳ **1=Culvert** (Inlet Controls 0.45 cfs @ 1.96 fps)

Pond 5P: Double Catch Basin 5

Hydrograph



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Type III 24-hr 2-Year Rainfall=3.30"

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Summary for Pond 6P: Catch Basin 6

Inflow Area = 3,976 sf, 69.22% Impervious, Inflow Depth = 1.48" for 2-Year event
 Inflow = 0.17 cfs @ 12.06 hrs, Volume= 490 cf
 Outflow = 0.17 cfs @ 12.06 hrs, Volume= 490 cf, Atten= 0%, Lag= 0.0 min
 Primary = 0.17 cfs @ 12.06 hrs, Volume= 490 cf
 Routed to Pond 4P : Drain Manhole 4

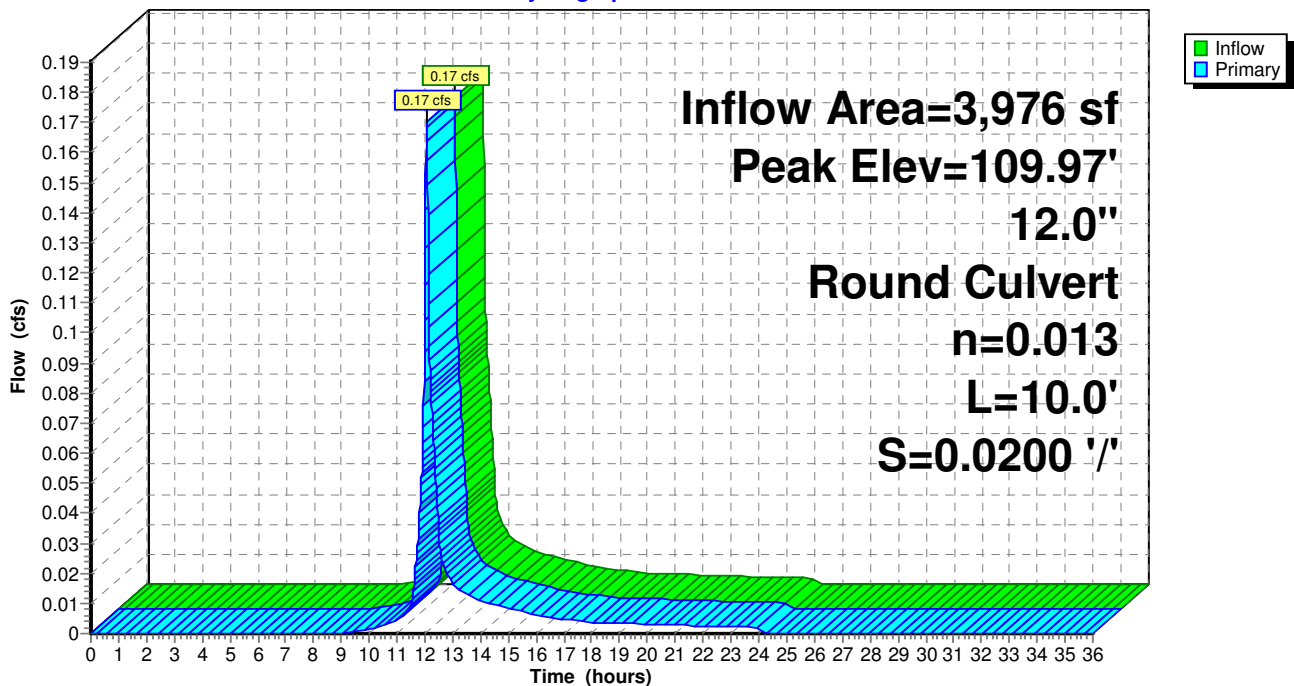
Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
 Peak Elev= 109.97' @ 12.08 hrs
 Flood Elev= 114.20'

Device #	Routing	Invert	Outlet Devices
1	Primary	109.73'	12.0" Round Culvert L= 10.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 109.73' / 109.53' S= 0.0200 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=0.16 cfs @ 12.06 hrs HW=109.96' TW=109.84' (Dynamic Tailwater)
 ↑1=Culvert (Outlet Controls 0.16 cfs @ 1.77 fps)

Pond 6P: Catch Basin 6

Hydrograph



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Type III 24-hr 2-Year Rainfall=3.30"

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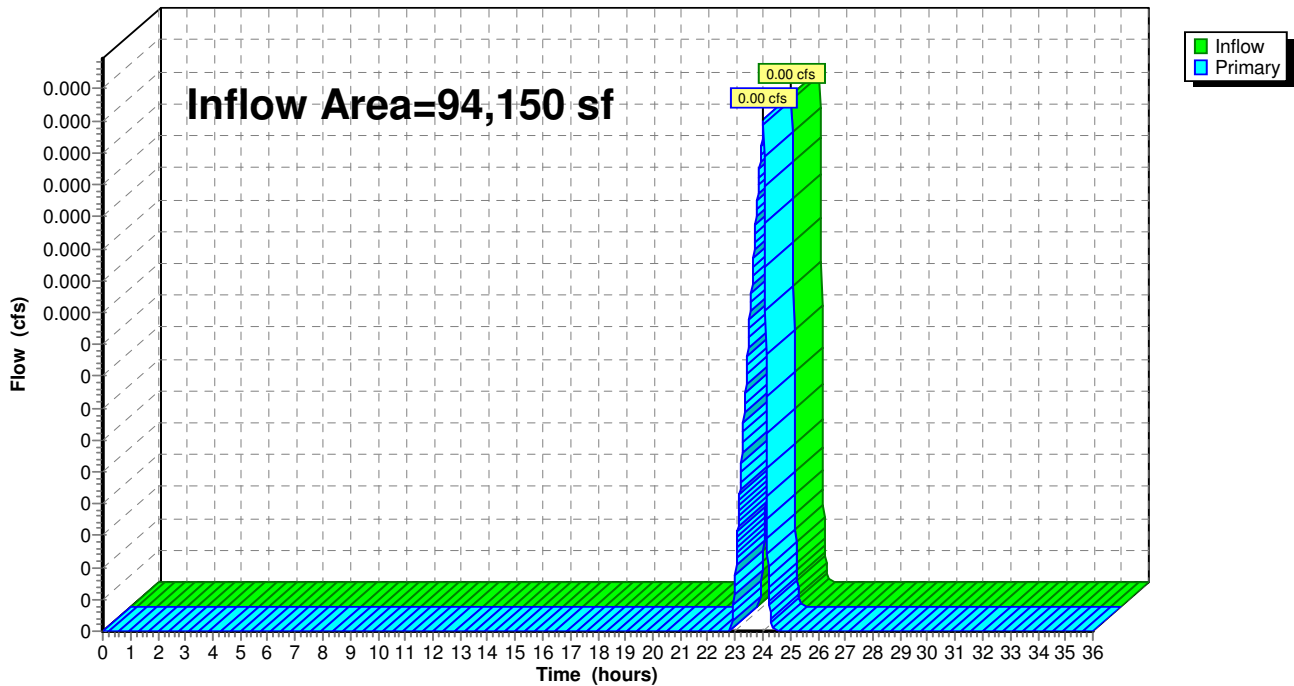
Summary for Link A: Eastern Wetland

Inflow Area = 94,150 sf, 23.93% Impervious, Inflow Depth = 0.00" for 2-Year event
Inflow = 0.00 cfs @ 24.02 hrs, Volume= 0 cf
Primary = 0.00 cfs @ 24.02 hrs, Volume= 0 cf, Atten= 0%, Lag= 0.0 min

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

Link A: Eastern Wetland

Hydrograph



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Type III 24-hr 10-Year Rainfall=5.21"

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Time span=0.00-36.00 hrs, dt=0.01 hrs, 3601 points
 Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
 Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 100: Proposed Houses & Runoff Area=58,891 sf 9.20% Impervious Runoff Depth=0.21"
 Flow Length=200' Slope=0.1000 '/' Tc=8.0 min CN=38 Runoff=0.05 cfs 1,019 cf

Subcatchment 120: Proposed Pavement to Runoff Area=3,976 sf 69.22% Impervious Runoff Depth=3.08"
 Flow Length=110' Tc=3.8 min CN=80 Runoff=0.36 cfs 1,019 cf

Subcatchment 150: Proposed Pavement & Runoff Area=31,283 sf 45.89% Impervious Runoff Depth=1.79"
 Flow Length=220' Tc=5.5 min CN=65 Runoff=1.48 cfs 4,679 cf

Pond 1P: SMF 1 - Cultec Infiltration Peak Elev=110.53' Storage=2,518 cf Inflow=1.81 cfs 5,698 cf
 Discarded=0.12 cfs 5,700 cf Primary=0.00 cfs 0 cf Outflow=0.12 cfs 5,700 cf

Pond 4P: Drain Manhole 4 Peak Elev=110.53' Inflow=1.81 cfs 5,698 cf
 12.0" Round Culvert n=0.013 L=5.0' S=0.0200 '/' Outflow=1.81 cfs 5,698 cf

Pond 5P: Double Catch Basin 5 Peak Elev=110.70' Inflow=1.48 cfs 4,679 cf
 12.0" Round Culvert n=0.013 L=24.0' S=0.0200 '/' Outflow=1.48 cfs 4,679 cf

Pond 6P: Catch Basin 6 Peak Elev=110.53' Inflow=0.36 cfs 1,019 cf
 12.0" Round Culvert n=0.013 L=10.0' S=0.0200 '/' Outflow=0.36 cfs 1,019 cf

Link A: Eastern Wetland Inflow=0.05 cfs 1,019 cf
 Primary=0.05 cfs 1,019 cf

Total Runoff Area = 94,150 sf Runoff Volume = 6,717 cf Average Runoff Depth = 0.86"
76.07% Pervious = 71,623 sf 23.93% Impervious = 22,527 sf

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Type III 24-hr 10-Year Rainfall=5.21"

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Summary for Subcatchment 100: Proposed Houses & Off-Site Flow to Wetland

Runoff = 0.05 cfs @ 12.51 hrs, Volume= 1,019 cf, Depth= 0.21"

Routed to Link A : Eastern Wetland

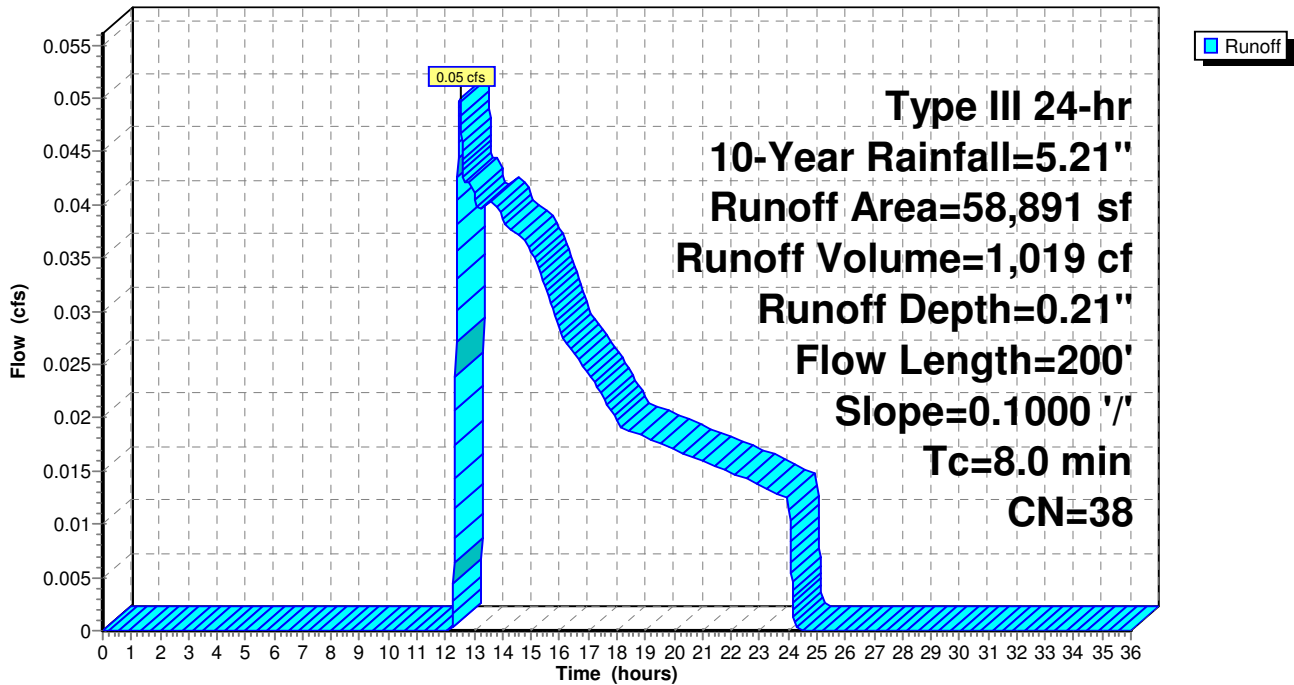
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Rainfall=5.21"

Area (sf)	CN	Description
43,942	30	Woods, Good, HSG A
9,529	39	>75% Grass cover, Good, HSG A
5,420	98	Paved parking, HSG A
58,891	38	Weighted Average
53,471		90.80% Pervious Area
5,420		9.20% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.4	50	0.1000	0.13		Sheet Flow, Woods: Light underbrush n= 0.400 P2= 3.30"
1.6	150	0.1000	1.58		Shallow Concentrated Flow, Woodland Kv= 5.0 fps
8.0	200	Total			

Subcatchment 100: Proposed Houses & Off-Site Flow to Wetland

Hydrograph



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Type III 24-hr 10-Year Rainfall=5.21"

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Summary for Subcatchment 120: Proposed Pavement to Catch Basin 6

Runoff = 0.36 cfs @ 12.06 hrs, Volume= 1,019 cf, Depth= 3.08"
 Routed to Pond 6P : Catch Basin 6

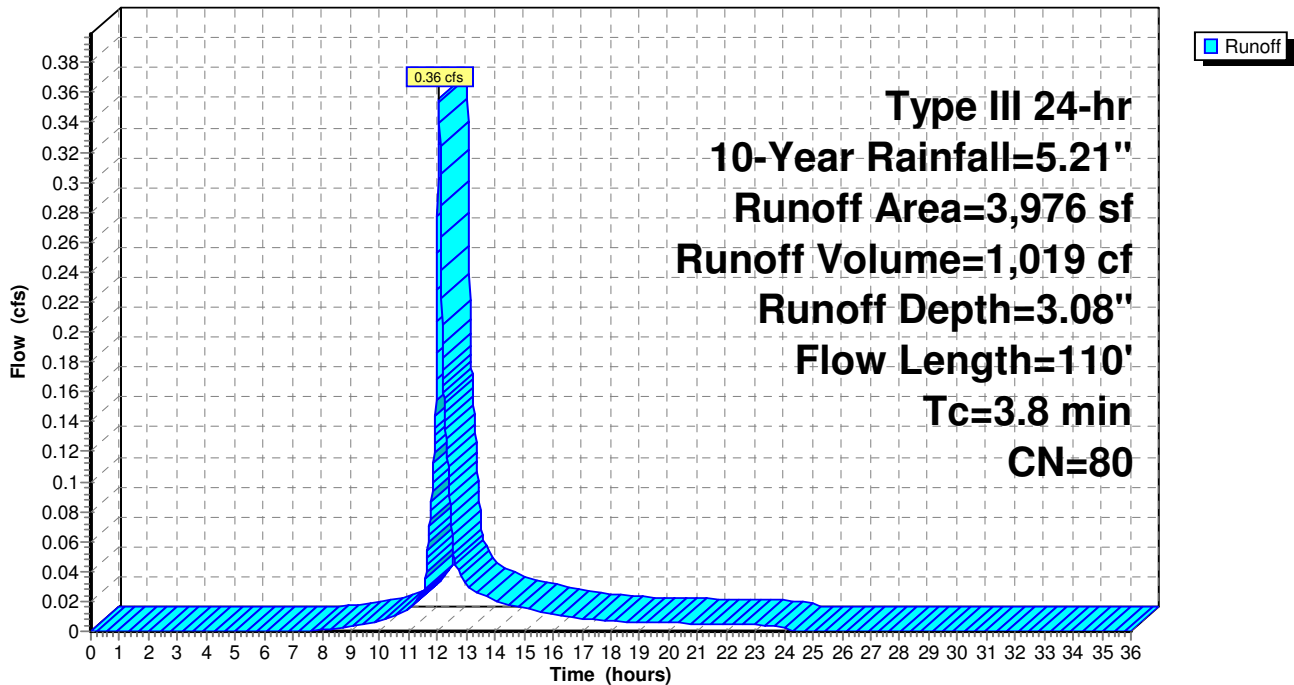
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
 Type III 24-hr 10-Year Rainfall=5.21"

Area (sf)	CN	Description
1,224	39	>75% Grass cover, Good, HSG A
2,752	98	Paved parking, HSG A
3,976	80	Weighted Average
1,224		30.78% Pervious Area
2,752		69.22% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.5	35	0.0300	0.16		Sheet Flow, Grass: Short n= 0.150 P2= 3.30"
0.3	75	0.0340	3.74		Shallow Concentrated Flow, Paved Kv= 20.3 fps
3.8	110	Total			

Subcatchment 120: Proposed Pavement to Catch Basin 6

Hydrograph



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Type III 24-hr 10-Year Rainfall=5.21"

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Summary for Subcatchment 150: Proposed Pavement & Off-Site Flow to Catch Basin 5

Runoff = 1.48 cfs @ 12.09 hrs, Volume= 4,679 cf, Depth= 1.79"
 Routed to Pond 5P : Double Catch Basin 5

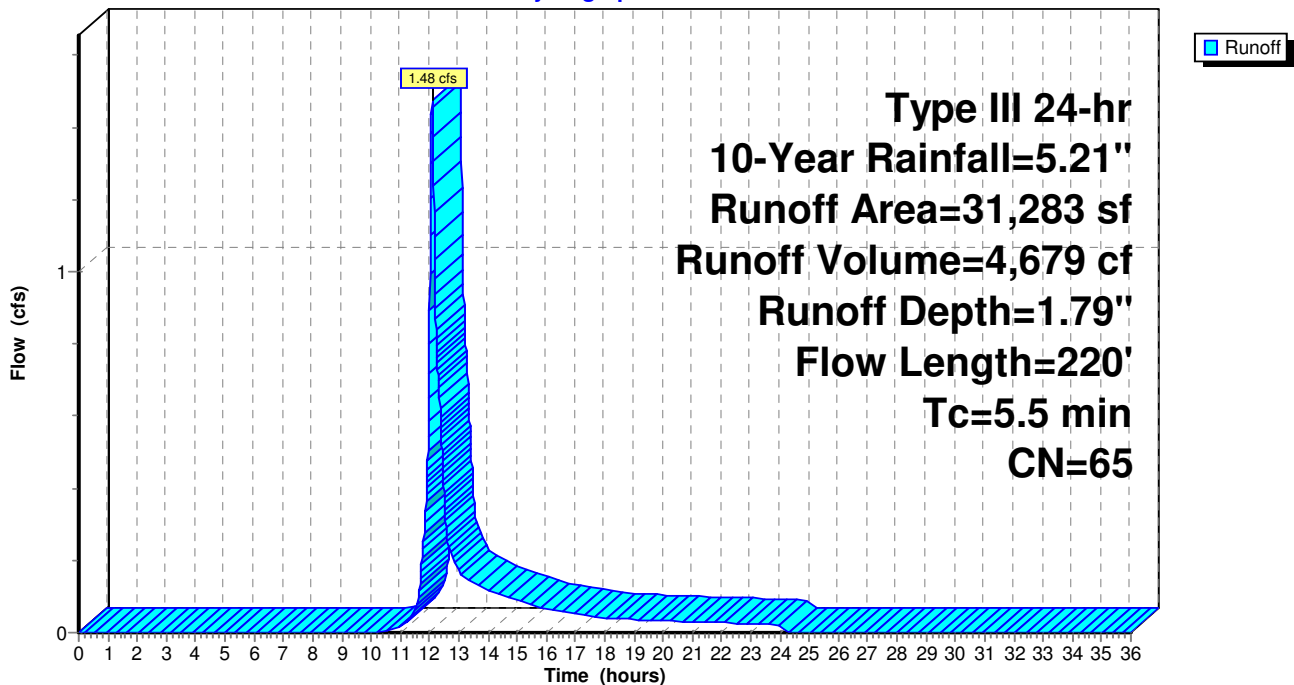
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
 Type III 24-hr 10-Year Rainfall=5.21"

Area (sf)	CN	Description
3,591	30	Woods, Good, HSG A
13,337	39	>75% Grass cover, Good, HSG A
14,355	98	Paved parking, HSG A
31,283	65	Weighted Average
16,928		54.11% Pervious Area
14,355		45.89% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.2	30	0.1000	0.12		Sheet Flow, Woods: Light underbrush n= 0.400 P2= 3.30"
0.6	50	0.0400	1.40		Shallow Concentrated Flow, Short Grass Pasture Kv= 7.0 fps
0.7	140	0.0300	3.52		Shallow Concentrated Flow, Paved Kv= 20.3 fps
5.5	220	Total			

Subcatchment 150: Proposed Pavement & Off-Site Flow to Catch Basin 5

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Type III 24-hr 10-Year Rainfall=5.21"

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Summary for Pond 1P: SMF 1 - Cultec Infiltration Chambers

Inflow Area = 35,259 sf, 48.52% Impervious, Inflow Depth = 1.94" for 10-Year event
Inflow = 1.81 cfs @ 12.08 hrs, Volume= 5,698 cf
Outflow = 0.12 cfs @ 11.75 hrs, Volume= 5,700 cf, Atten= 94%, Lag= 0.0 min
Discarded = 0.12 cfs @ 11.75 hrs, Volume= 5,700 cf
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf
Routed to Link A : Eastern Wetland

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Peak Elev= 110.53' @ 14.59 hrs Surf.Area= 2,102 sf Storage= 2,518 cf
Flood Elev= 113.38' Surf.Area= 2,102 sf Storage= 4,778 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 218.9 min (1,069.6 - 850.7)

Volume	Invert	Avail.Storage	Storage Description
#1A	108.83'	1,779 cf	35.33'W x 59.50'L x 3.54'H Field A 7,446 cf Overall - 2,999 cf Embedded = 4,447 cf x 40.0% Voids
#2A	109.33'	2,999 cf	Cultec R-330XLHD x 56 Inside #1 Effective Size= 47.8"W x 30.0"H => 7.45 sf x 7.00'L = 52.2 cf Overall Size= 52.0"W x 30.5"H x 8.50'L with 1.50' Overlap Row Length Adjustment= +1.50' x 7.45 sf x 7 rows
		4,778 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	108.83'	2.410 in/hr Exfiltration over Surface area
#2	Primary	111.38'	6.0" Round Culvert L= 21.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 111.38' / 110.96' S= 0.0200 '/' Cc= 0.900 n= 0.011 PVC, smooth interior, Flow Area= 0.20 sf

Discarded OutFlow Max=0.12 cfs @ 11.75 hrs HW=108.88' (Free Discharge)

↑1=Exfiltration (Exfiltration Controls 0.12 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=108.83' TW=0.00' (Dynamic Tailwater)

↑2=Culvert (Controls 0.00 cfs)

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Pond 1P: SMF 1 - Cultec Infiltration Chambers - Chamber Wizard Field A

Chamber Model = Cultec R-330XLHD (Cultec Recharger® 330XLHD)

Effective Size= 47.8"W x 30.0"H => 7.45 sf x 7.00'L = 52.2 cf

Overall Size= 52.0"W x 30.5"H x 8.50'L with 1.50' Overlap

Row Length Adjustment= +1.50' x 7.45 sf x 7 rows

52.0" Wide + 6.0" Spacing = 58.0" C-C Row Spacing

8 Chambers/Row x 7.00' Long +1.50' Row Adjustment = 57.50' Row Length +12.0" End Stone x 2 = 59.50' Base Length

7 Rows x 52.0" Wide + 6.0" Spacing x 6 + 12.0" Side Stone x 2 = 35.33' Base Width

6.0" Stone Base + 30.5" Chamber Height + 6.0" Stone Cover = 3.54' Field Height

56 Chambers x 52.2 cf +1.50' Row Adjustment x 7.45 sf x 7 Rows = 2,999.0 cf Chamber Storage

7,445.8 cf Field - 2,999.0 cf Chambers = 4,446.7 cf Stone x 40.0% Voids = 1,778.7 cf Stone Storage

Chamber Storage + Stone Storage = 4,777.7 cf = 0.110 af

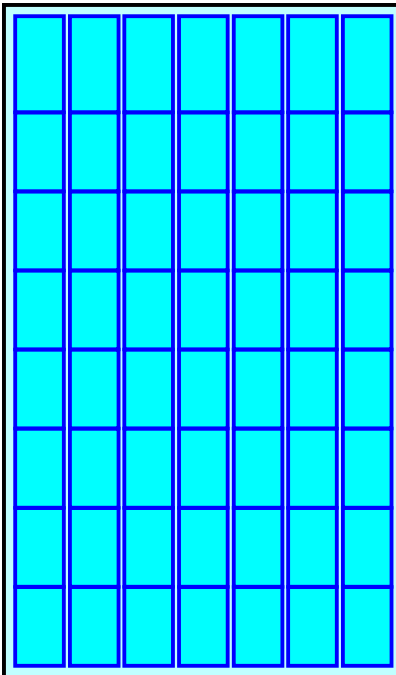
Overall Storage Efficiency = 64.2%

Overall System Size = 59.50' x 35.33' x 3.54'

56 Chambers

275.8 cy Field

164.7 cy Stone



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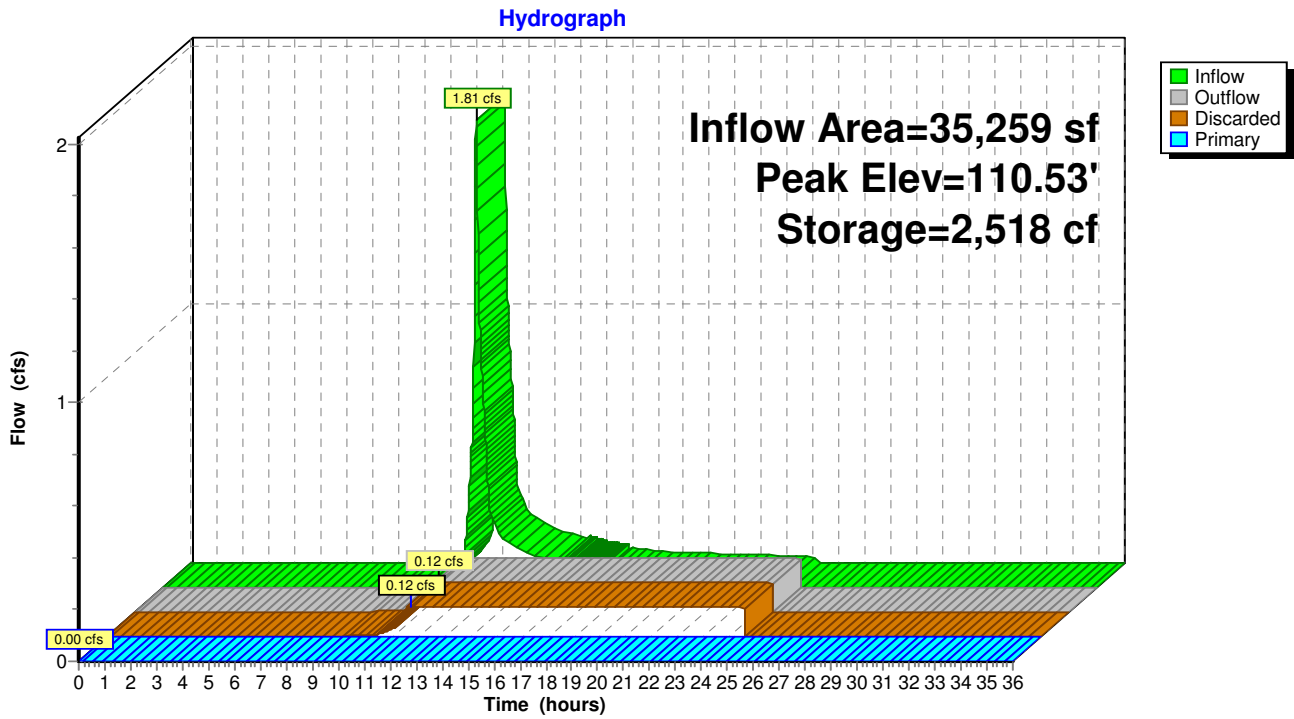
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Pond 1P: SMF 1 - Cultec Infiltration Chambers



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Summary for Pond 4P: Drain Manhole 4

[80] Warning: Exceeded Pond 6P by 0.77' @ 15.62 hrs (1.76 cfs 8,646 cf)

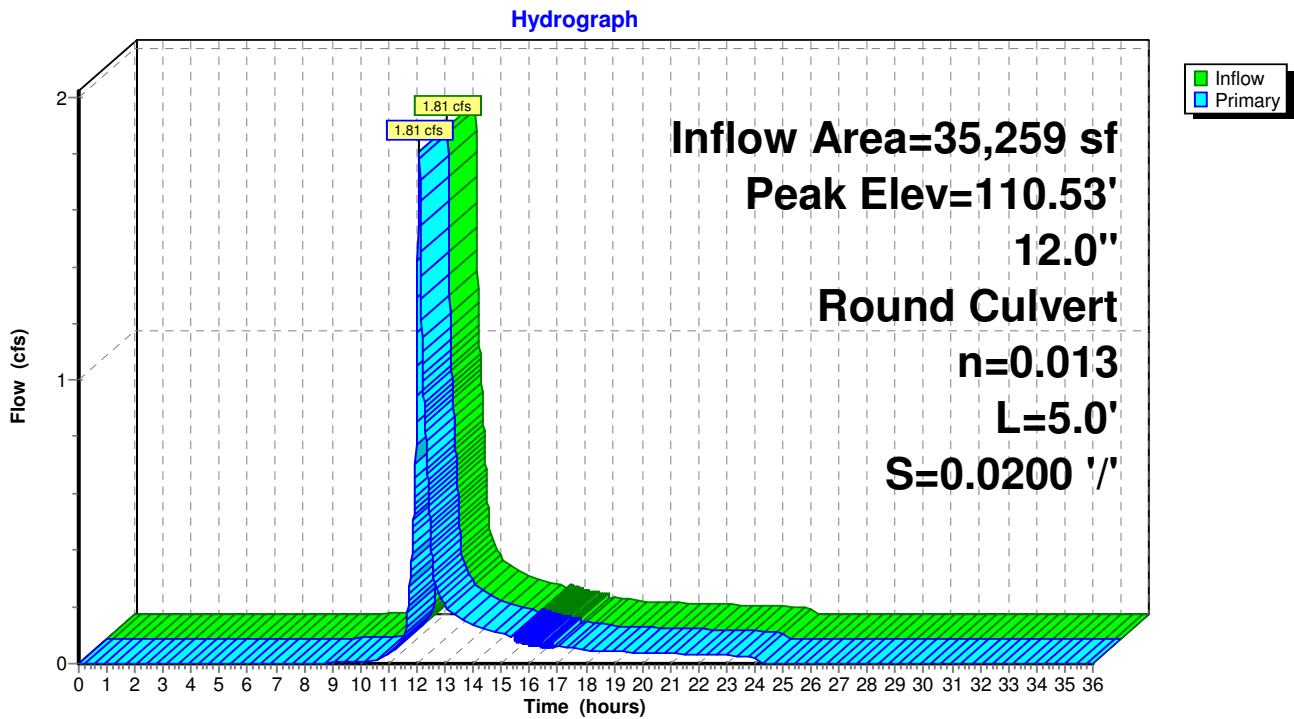
Inflow Area = 35,259 sf, 48.52% Impervious, Inflow Depth = 1.94" for 10-Year event
Inflow = 1.81 cfs @ 12.08 hrs, Volume= 5,698 cf
Outflow = 1.81 cfs @ 12.08 hrs, Volume= 5,698 cf, Atten= 0%, Lag= 0.0 min
Primary = 1.81 cfs @ 12.08 hrs, Volume= 5,698 cf
Routed to Pond 1P : SMF 1 - Cultec Infiltration Chambers

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Peak Elev= 110.53' @ 14.60 hrs
Flood Elev= 114.40'

Device	Routing	Invert	Outlet Devices
#1	Primary	109.43'	12.0" Round Culvert L= 5.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 109.43' / 109.33' S= 0.0200 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=1.81 cfs @ 12.08 hrs HW=110.26' TW=109.55' (Dynamic Tailwater)
↑1=Culvert (Barrel Controls 1.81 cfs @ 3.49 fps)

Pond 4P: Drain Manhole 4



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Summary for Pond 5P: Double Catch Basin 5

Inflow Area = 31,283 sf, 45.89% Impervious, Inflow Depth = 1.79" for 10-Year event
Inflow = 1.48 cfs @ 12.09 hrs, Volume= 4,679 cf
Outflow = 1.48 cfs @ 12.09 hrs, Volume= 4,679 cf, Atten= 0%, Lag= 0.0 min
Primary = 1.48 cfs @ 12.09 hrs, Volume= 4,679 cf
Routed to Pond 4P : Drain Manhole 4

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

Peak Elev= 110.70' @ 12.09 hrs

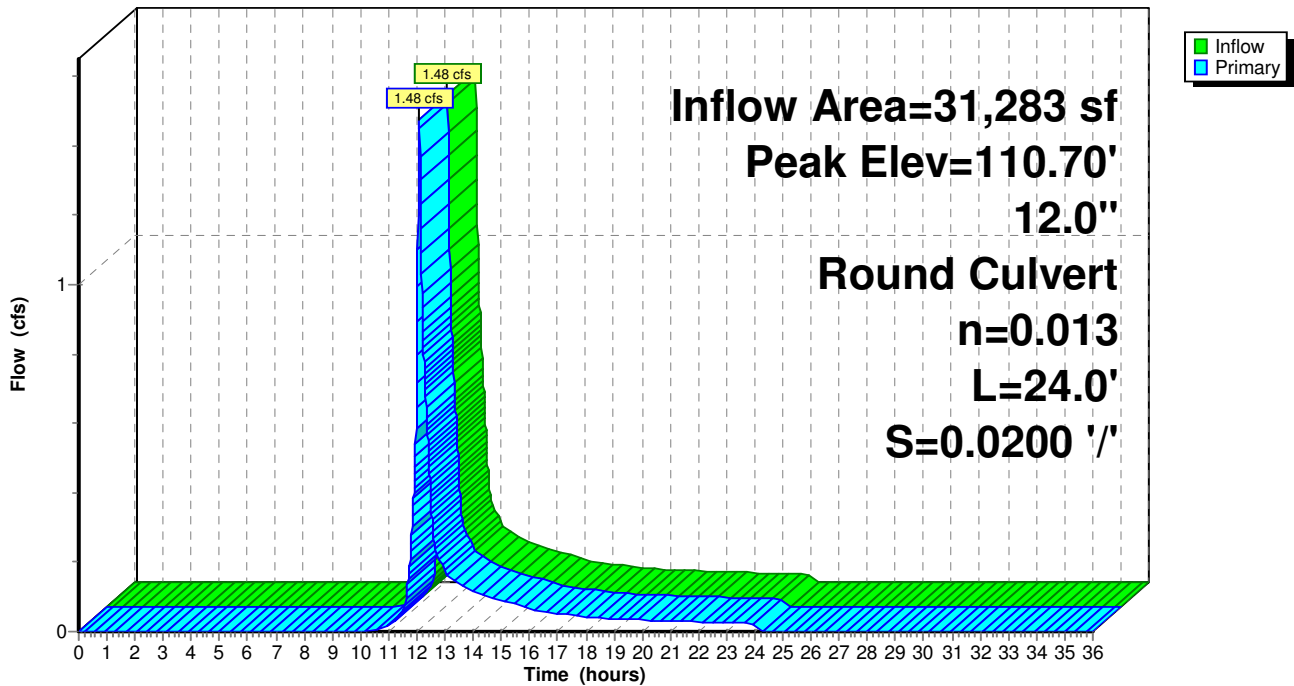
Flood Elev= 113.50'

Device #	Routing	Invert	Outlet Devices
1	Primary	110.01'	12.0" Round Culvert L= 24.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 110.01' / 109.53' S= 0.0200 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=1.47 cfs @ 12.09 hrs HW=110.70' TW=110.26' (Dynamic Tailwater)
↑1=Culvert (Outlet Controls 1.47 cfs @ 3.57 fps)

Pond 5P: Double Catch Basin 5

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Type III 24-hr 10-Year Rainfall=5.21"

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Summary for Pond 6P: Catch Basin 6

[87] Warning: Oscillations may require smaller dt or Finer Routing (severity=467)

Inflow Area = 3,976 sf, 69.22% Impervious, Inflow Depth = 3.08" for 10-Year event
Inflow = 0.36 cfs @ 12.06 hrs, Volume= 1,019 cf
Outflow = 0.36 cfs @ 12.06 hrs, Volume= 1,019 cf, Atten= 0%, Lag= 0.0 min
Primary = 0.36 cfs @ 12.06 hrs, Volume= 1,019 cf
Routed to Pond 4P : Drain Manhole 4

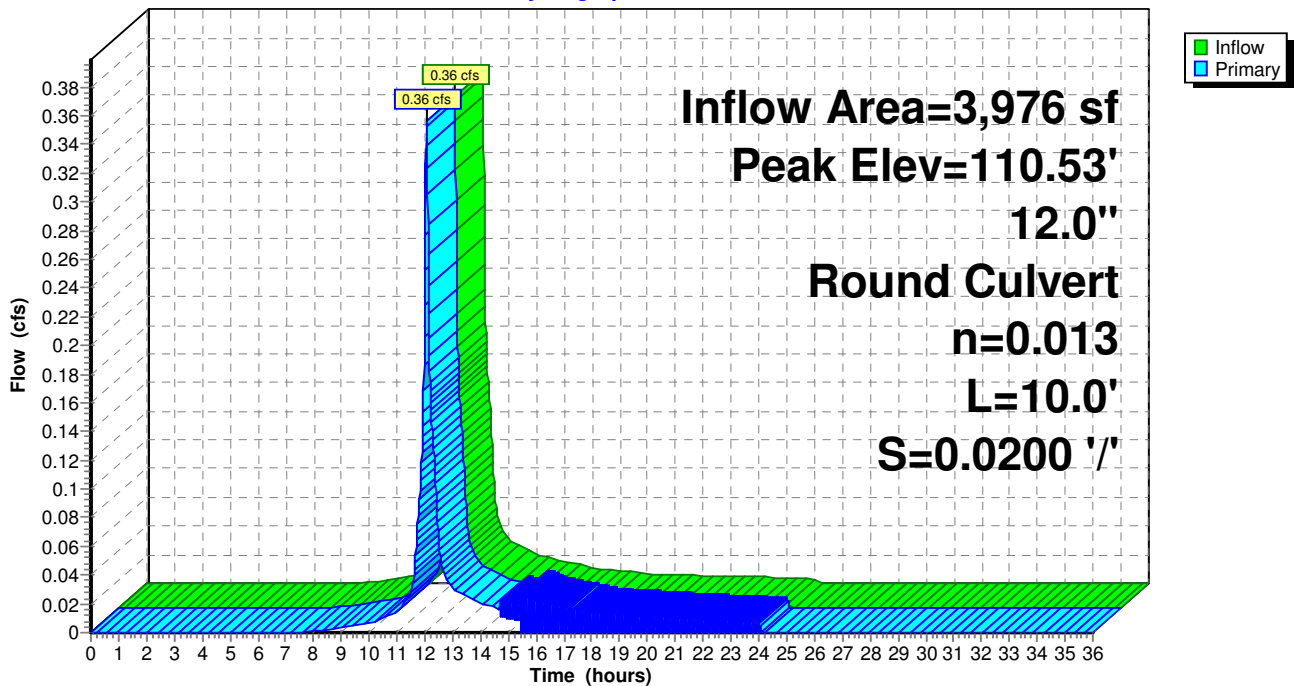
Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Peak Elev= 110.53' @ 14.61 hrs
Flood Elev= 114.20'

Device	Routing	Invert	Outlet Devices
#1	Primary	109.73'	12.0" Round Culvert L= 10.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 109.73' / 109.53' S= 0.0200 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=0.23 cfs @ 12.06 hrs HW=110.26' TW=110.24' (Dynamic Tailwater)
↑**1=Culvert** (Outlet Controls 0.23 cfs @ 0.79 fps)

Pond 6P: Catch Basin 6

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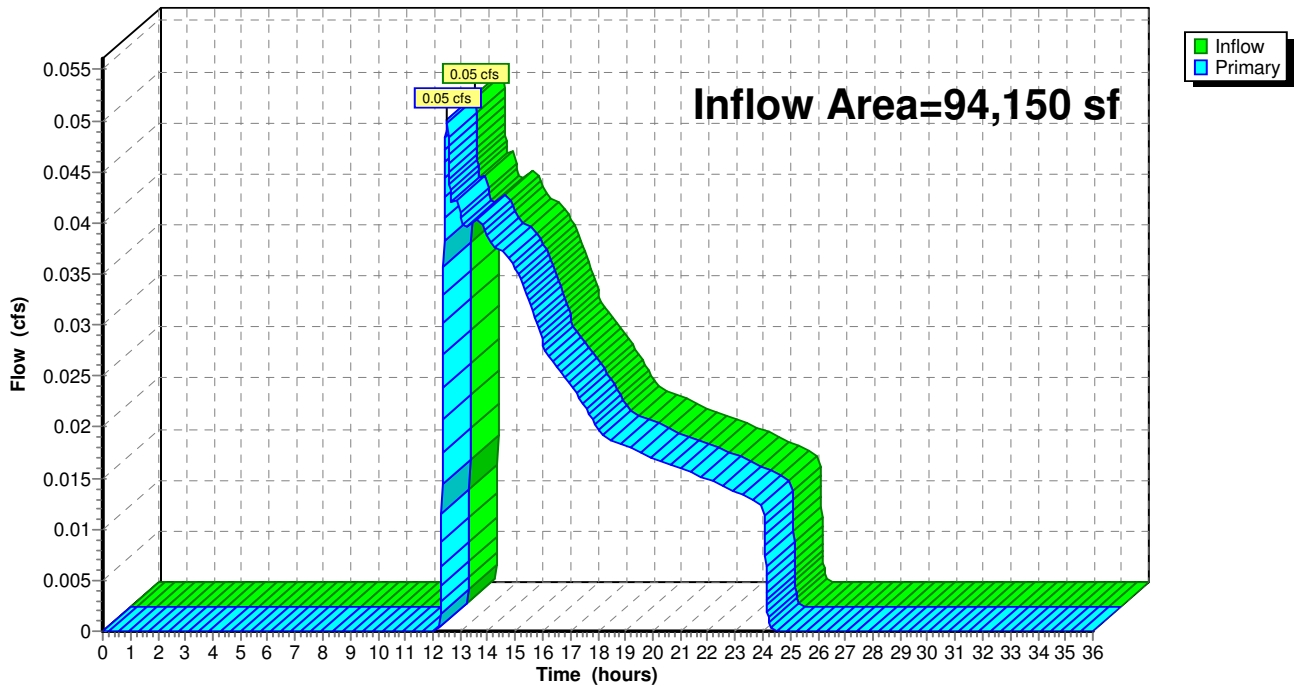
Summary for Link A: Eastern Wetland

Inflow Area = 94,150 sf, 23.93% Impervious, Inflow Depth = 0.13" for 10-Year event
Inflow = 0.05 cfs @ 12.51 hrs, Volume= 1,019 cf
Primary = 0.05 cfs @ 12.51 hrs, Volume= 1,019 cf, Atten= 0%, Lag= 0.0 min

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

Link A: Eastern Wetland

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Type III 24-hr 25-Year Rainfall=6.39"

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Time span=0.00-36.00 hrs, dt=0.01 hrs, 3601 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 100: Proposed Houses & Runoff Area=58,891 sf 9.20% Impervious Runoff Depth=0.50"
Flow Length=200' Slope=0.1000 '/' Tc=8.0 min CN=38 Runoff=0.28 cfs 2,468 cf

Subcatchment 120: Proposed Pavement to Runoff Area=3,976 sf 69.22% Impervious Runoff Depth=4.13"
Flow Length=110' Tc=3.8 min CN=80 Runoff=0.48 cfs 1,370 cf

Subcatchment 150: Proposed Pavement & Runoff Area=31,283 sf 45.89% Impervious Runoff Depth=2.64"
Flow Length=220' Tc=5.5 min CN=65 Runoff=2.23 cfs 6,879 cf

Pond 1P: SMF 1 - Cultec Infiltration Peak Elev=111.53' Storage=4,020 cf Inflow=2.67 cfs 8,246 cf
Discarded=0.12 cfs 7,814 cf Primary=0.07 cfs 432 cf Outflow=0.19 cfs 8,247 cf

Pond 4P: Drain Manhole 4 Peak Elev=111.54' Inflow=2.67 cfs 8,246 cf
12.0" Round Culvert n=0.013 L=5.0' S=0.0200 '/' Outflow=2.67 cfs 8,246 cf

Pond 5P: Double Catch Basin 5 Peak Elev=111.54' Inflow=2.23 cfs 6,879 cf
12.0" Round Culvert n=0.013 L=24.0' S=0.0200 '/' Outflow=2.23 cfs 6,879 cf

Pond 6P: Catch Basin 6 Peak Elev=111.54' Inflow=0.48 cfs 1,370 cf
12.0" Round Culvert n=0.013 L=10.0' S=0.0200 '/' Outflow=0.48 cfs 1,367 cf

Link A: Eastern Wetland Inflow=0.28 cfs 2,900 cf
Primary=0.28 cfs 2,900 cf

Total Runoff Area = 94,150 sf Runoff Volume = 10,717 cf Average Runoff Depth = 1.37"
76.07% Pervious = 71,623 sf 23.93% Impervious = 22,527 sf

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Type III 24-hr 25-Year Rainfall=6.39"

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Summary for Subcatchment 100: Proposed Houses & Off-Site Flow to Wetland

Runoff = 0.28 cfs @ 12.36 hrs, Volume= 2,468 cf, Depth= 0.50"

Routed to Link A : Eastern Wetland

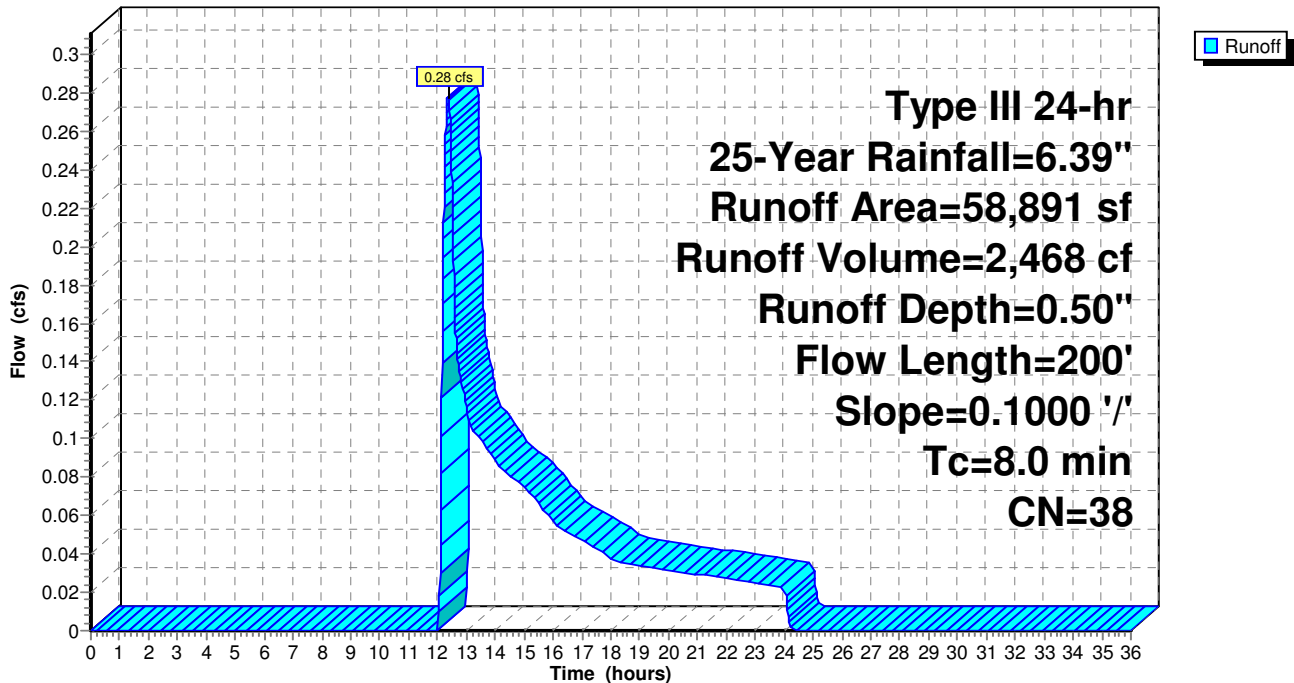
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
 Type III 24-hr 25-Year Rainfall=6.39"

Area (sf)	CN	Description
43,942	30	Woods, Good, HSG A
9,529	39	>75% Grass cover, Good, HSG A
5,420	98	Paved parking, HSG A
58,891	38	Weighted Average
53,471		90.80% Pervious Area
5,420		9.20% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.4	50	0.1000	0.13		Sheet Flow, Woods: Light underbrush n= 0.400 P2= 3.30"
1.6	150	0.1000	1.58		Shallow Concentrated Flow, Woodland Kv= 5.0 fps
8.0	200	Total			

Subcatchment 100: Proposed Houses & Off-Site Flow to Wetland

Hydrograph



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Type III 24-hr 25-Year Rainfall=6.39"

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Summary for Subcatchment 120: Proposed Pavement to Catch Basin 6

Runoff = 0.48 cfs @ 12.06 hrs, Volume= 1,370 cf, Depth= 4.13"
 Routed to Pond 6P : Catch Basin 6

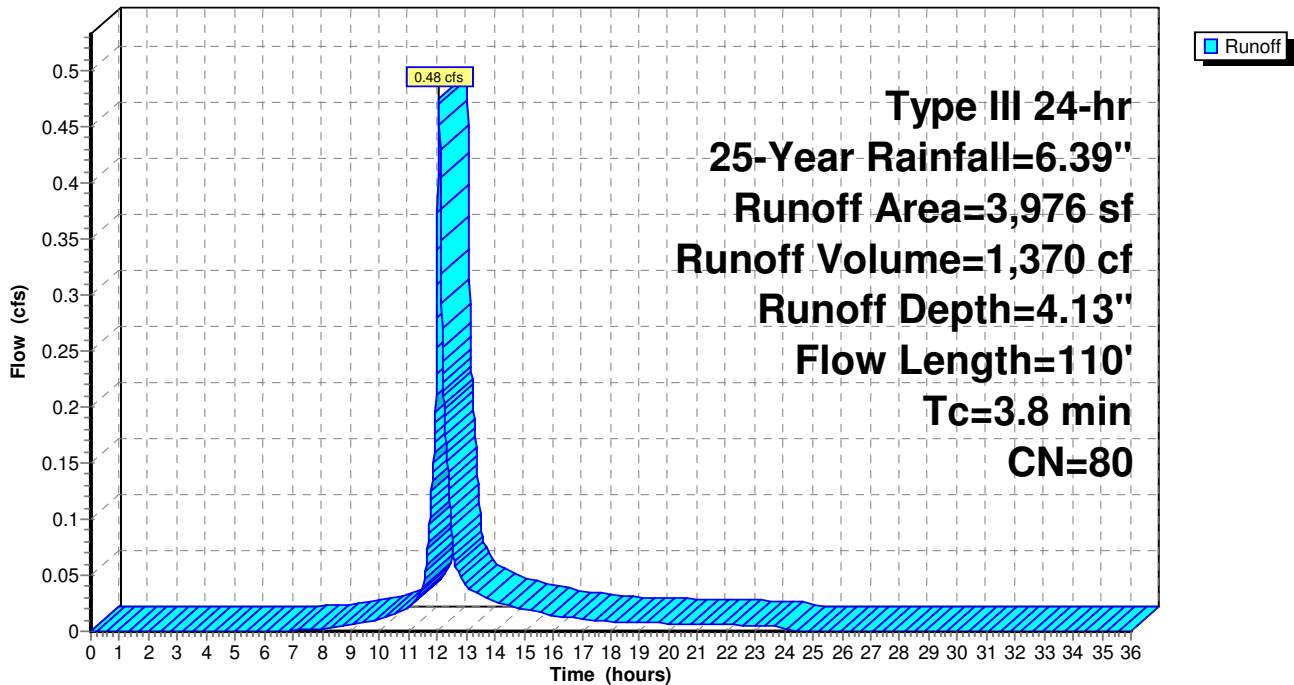
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
 Type III 24-hr 25-Year Rainfall=6.39"

Area (sf)	CN	Description
1,224	39	>75% Grass cover, Good, HSG A
2,752	98	Paved parking, HSG A
3,976	80	Weighted Average
1,224		30.78% Pervious Area
2,752		69.22% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.5	35	0.0300	0.16		Sheet Flow, Grass: Short n= 0.150 P2= 3.30"
0.3	75	0.0340	3.74		Shallow Concentrated Flow, Paved Kv= 20.3 fps
3.8	110	Total			

Subcatchment 120: Proposed Pavement to Catch Basin 6

Hydrograph



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Type III 24-hr 25-Year Rainfall=6.39"

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Summary for Subcatchment 150: Proposed Pavement & Off-Site Flow to Catch Basin 5

Runoff = 2.23 cfs @ 12.09 hrs, Volume= 6,879 cf, Depth= 2.64"
 Routed to Pond 5P : Double Catch Basin 5

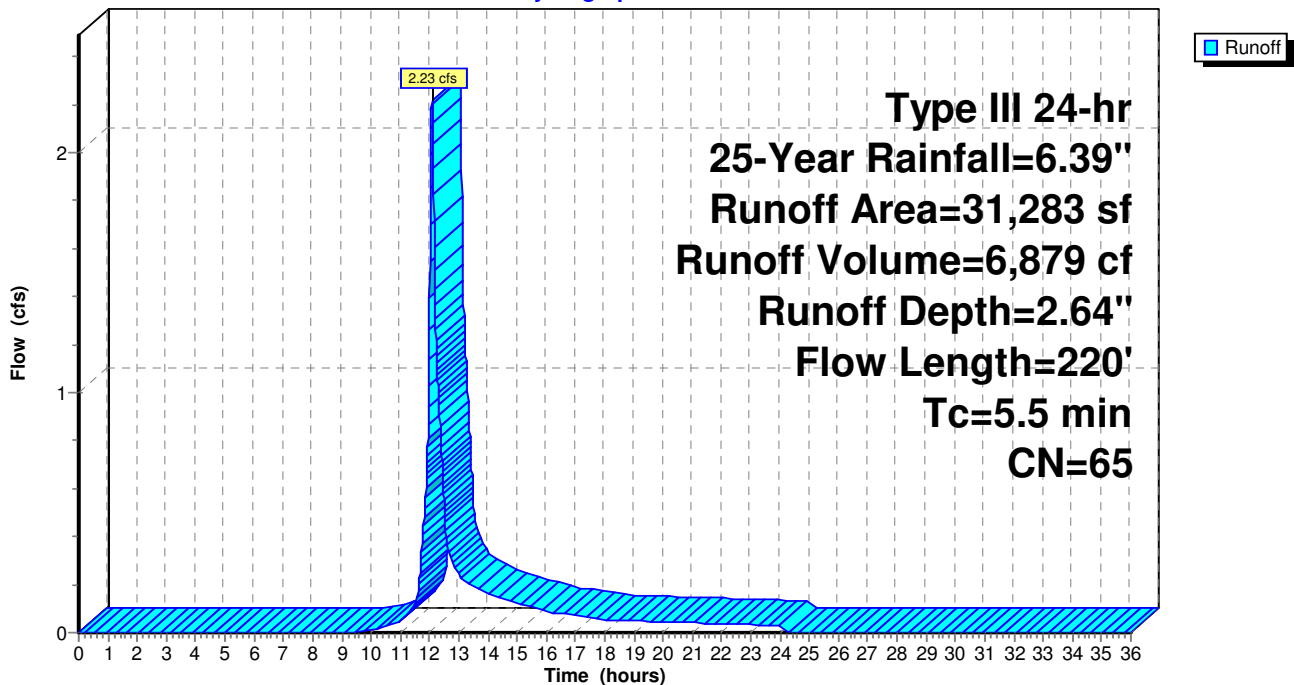
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
 Type III 24-hr 25-Year Rainfall=6.39"

Area (sf)	CN	Description
3,591	30	Woods, Good, HSG A
13,337	39	>75% Grass cover, Good, HSG A
14,355	98	Paved parking, HSG A
31,283	65	Weighted Average
16,928		54.11% Pervious Area
14,355		45.89% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.2	30	0.1000	0.12		Sheet Flow, Woods: Light underbrush n= 0.400 P2= 3.30"
0.6	50	0.0400	1.40		Shallow Concentrated Flow, Short Grass Pasture Kv= 7.0 fps
0.7	140	0.0300	3.52		Shallow Concentrated Flow, Paved Kv= 20.3 fps
5.5	220	Total			

Subcatchment 150: Proposed Pavement & Off-Site Flow to Catch Basin 5

Hydrograph



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Type III 24-hr 25-Year Rainfall=6.39"

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Summary for Pond 1P: SMF 1 - Cultec Infiltration Chambers

[80] Warning: Exceeded Pond 4P by 0.81' @ 24.29 hrs (1.72 cfs 3,092 cf)

Inflow Area = 35,259 sf, 48.52% Impervious, Inflow Depth = 2.81" for 25-Year event
 Inflow = 2.67 cfs @ 12.08 hrs, Volume= 8,246 cf
 Outflow = 0.19 cfs @ 14.00 hrs, Volume= 8,247 cf, Atten= 93%, Lag= 115.5 min
 Discarded = 0.12 cfs @ 11.61 hrs, Volume= 7,814 cf
 Primary = 0.07 cfs @ 14.00 hrs, Volume= 432 cf
 Routed to Link A : Eastern Wetland

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
 Peak Elev= 111.53' @ 14.00 hrs Surf.Area= 2,102 sf Storage= 4,020 cf
 Flood Elev= 113.38' Surf.Area= 2,102 sf Storage= 4,778 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
 Center-of-Mass det. time= 331.7 min (1,171.7 - 840.1)

Volume	Invert	Avail.Storage	Storage Description
#1A	108.83'	1,779 cf	35.33'W x 59.50'L x 3.54'H Field A 7,446 cf Overall - 2,999 cf Embedded = 4,447 cf x 40.0% Voids
#2A	109.33'	2,999 cf	Cultec R-330XLHD x 56 Inside #1 Effective Size= 47.8"W x 30.0"H => 7.45 sf x 7.00'L = 52.2 cf Overall Size= 52.0"W x 30.5"H x 8.50'L with 1.50' Overlap Row Length Adjustment= +1.50' x 7.45 sf x 7 rows
		4,778 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	108.83'	2.410 in/hr Exfiltration over Surface area
#2	Primary	111.38'	6.0" Round Culvert L= 21.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 111.38' / 110.96' S= 0.0200 '/' Cc= 0.900 n= 0.011 PVC, smooth interior, Flow Area= 0.20 sf

Discarded OutFlow Max=0.12 cfs @ 11.61 hrs HW=108.88' (Free Discharge)
 ↑1=Exfiltration (Exfiltration Controls 0.12 cfs)

Primary OutFlow Max=0.07 cfs @ 14.00 hrs HW=111.53' TW=0.00' (Dynamic Tailwater)
 ↑2=Culvert (Inlet Controls 0.07 cfs @ 1.33 fps)

3110 - Post Development 1

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Type III 24-hr 25-Year Rainfall=6.39"

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Pond 1P: SMF 1 - Cultec Infiltration Chambers - Chamber Wizard Field A

Chamber Model = Cultec R-330XLHD (Cultec Recharger® 330XLHD)

Effective Size= 47.8"W x 30.0"H => 7.45 sf x 7.00'L = 52.2 cf

Overall Size= 52.0"W x 30.5"H x 8.50'L with 1.50' Overlap

Row Length Adjustment= +1.50' x 7.45 sf x 7 rows

52.0" Wide + 6.0" Spacing = 58.0" C-C Row Spacing

8 Chambers/Row x 7.00' Long +1.50' Row Adjustment = 57.50' Row Length +12.0" End Stone x 2 = 59.50' Base Length

7 Rows x 52.0" Wide + 6.0" Spacing x 6 + 12.0" Side Stone x 2 = 35.33' Base Width

6.0" Stone Base + 30.5" Chamber Height + 6.0" Stone Cover = 3.54' Field Height

56 Chambers x 52.2 cf +1.50' Row Adjustment x 7.45 sf x 7 Rows = 2,999.0 cf Chamber Storage

7,445.8 cf Field - 2,999.0 cf Chambers = 4,446.7 cf Stone x 40.0% Voids = 1,778.7 cf Stone Storage

Chamber Storage + Stone Storage = 4,777.7 cf = 0.110 af

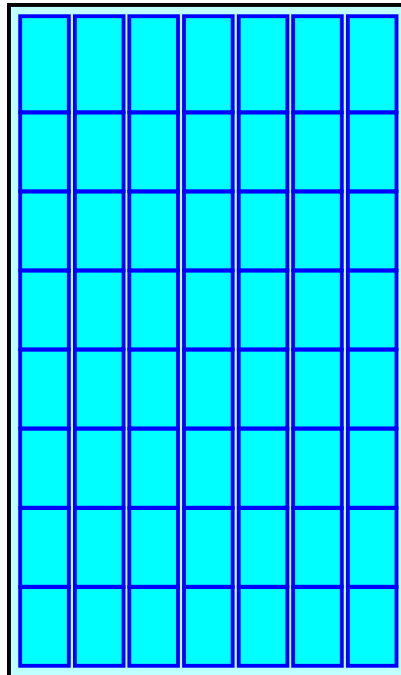
Overall Storage Efficiency = 64.2%

Overall System Size = 59.50' x 35.33' x 3.54'

56 Chambers

275.8 cy Field

164.7 cy Stone



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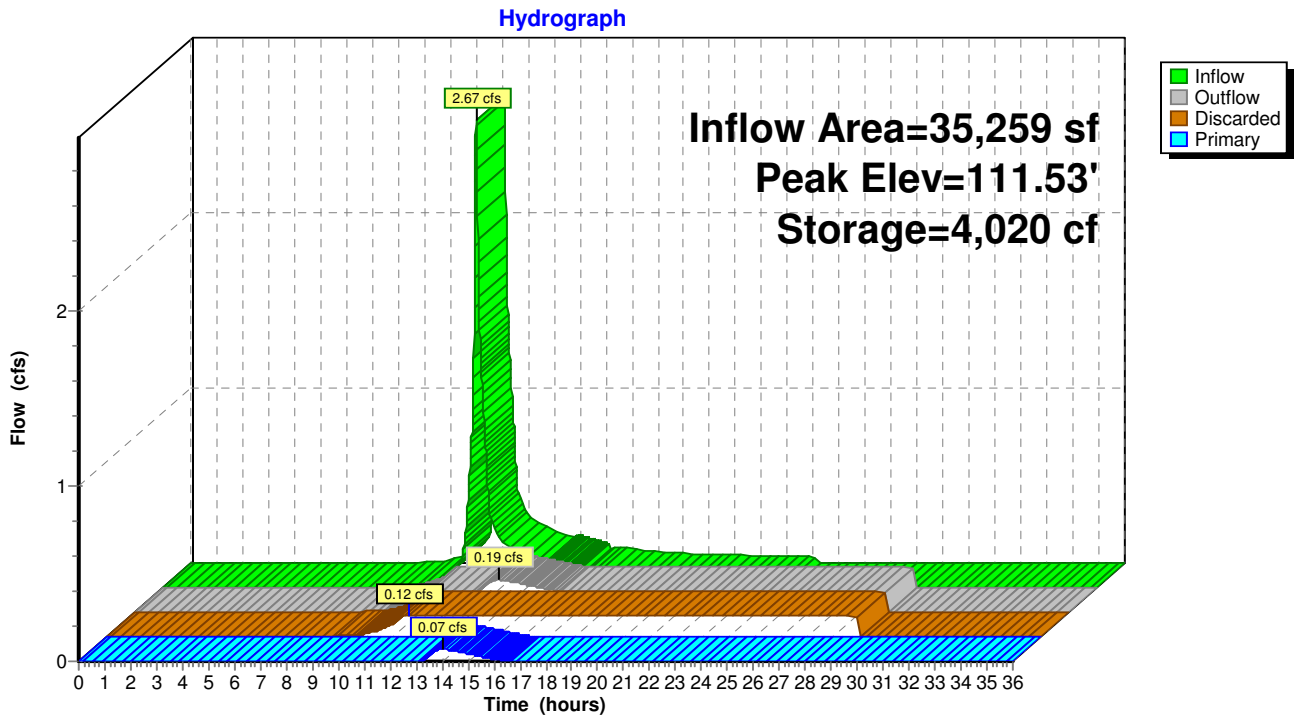
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Type III 24-hr 25-Year Rainfall=6.39"

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Pond 1P: SMF 1 - Cultec Infiltration Chambers



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Type III 24-hr 25-Year Rainfall=6.39"

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Summary for Pond 4P: Drain Manhole 4

[80] Warning: Exceeded Pond 5P by 0.22' @ 24.18 hrs (0.15 cfs 171 cf)

[80] Warning: Exceeded Pond 6P by 1.74' @ 15.51 hrs (4.22 cfs 24,768 cf)

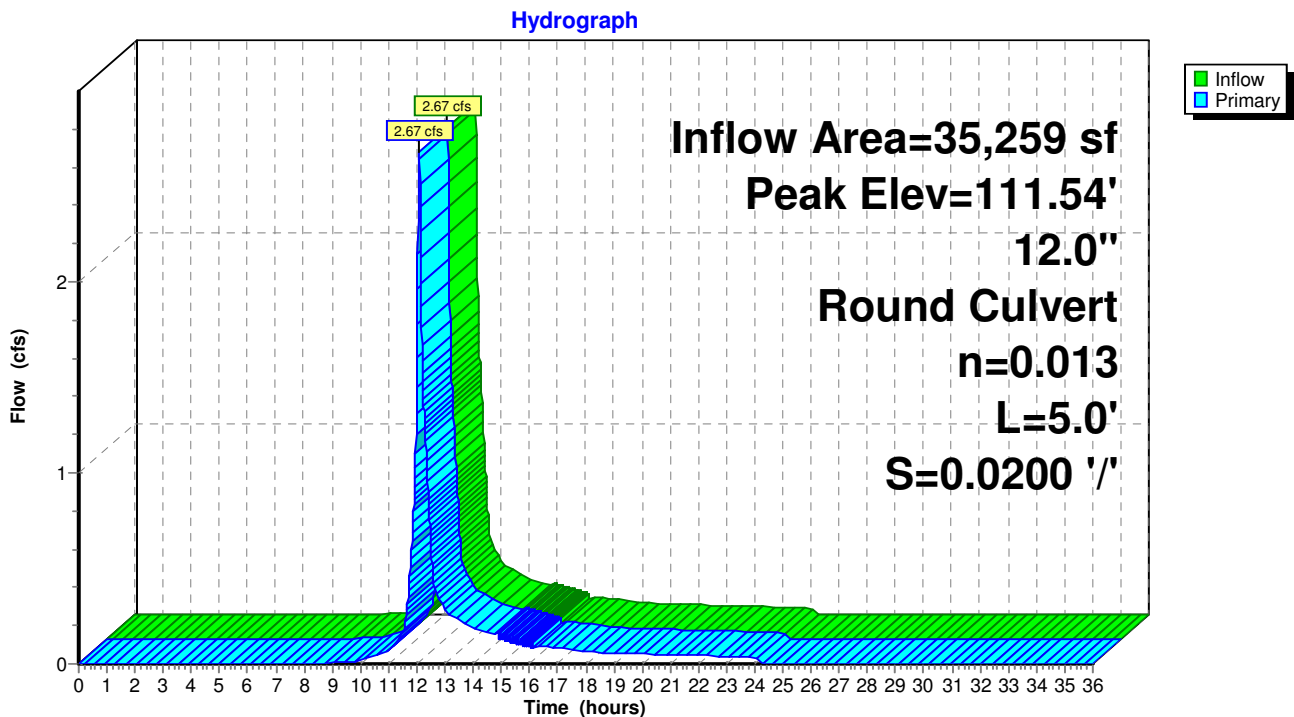
Inflow Area = 35,259 sf, 48.52% Impervious, Inflow Depth = 2.81" for 25-Year event
Inflow = 2.67 cfs @ 12.08 hrs, Volume= 8,246 cf
Outflow = 2.67 cfs @ 12.08 hrs, Volume= 8,246 cf, Atten= 0%, Lag= 0.0 min
Primary = 2.67 cfs @ 12.08 hrs, Volume= 8,246 cf
Routed to Pond 1P : SMF 1 - Cultec Infiltration Chambers

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Peak Elev= 111.54' @ 14.01 hrs
Flood Elev= 114.40'

Device	Routing	Invert	Outlet Devices
#1	Primary	109.43'	12.0" Round Culvert L= 5.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 109.43' / 109.33' S= 0.0200 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=2.67 cfs @ 12.08 hrs HW=110.53' TW=109.88' (Dynamic Tailwater)
↑1=Culvert (Barrel Controls 2.67 cfs @ 3.86 fps)

Pond 4P: Drain Manhole 4



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Type III 24-hr 25-Year Rainfall=6.39"

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Summary for Pond 5P: Double Catch Basin 5

Inflow Area = 31,283 sf, 45.89% Impervious, Inflow Depth = 2.64" for 25-Year event
Inflow = 2.23 cfs @ 12.09 hrs, Volume= 6,879 cf
Outflow = 2.23 cfs @ 12.09 hrs, Volume= 6,879 cf, Atten= 0%, Lag= 0.0 min
Primary = 2.23 cfs @ 12.09 hrs, Volume= 6,879 cf
Routed to Pond 4P : Drain Manhole 4

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

Peak Elev= 111.54' @ 14.01 hrs

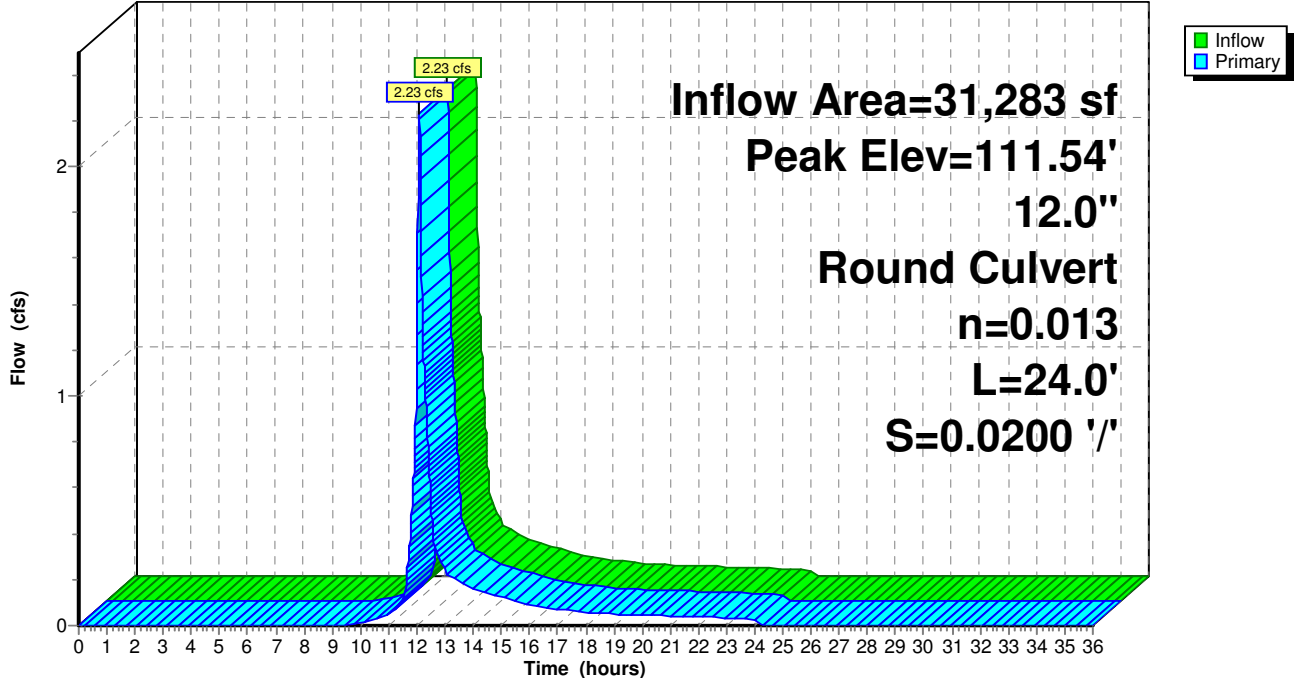
Flood Elev= 113.50'

Device #	Routing	Invert	Outlet Devices
1	Primary	110.01'	12.0" Round Culvert L= 24.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 110.01' / 109.53' S= 0.0200 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=2.22 cfs @ 12.09 hrs HW=110.97' TW=110.53' (Dynamic Tailwater)
↑1=Culvert (Outlet Controls 2.22 cfs @ 3.68 fps)

Pond 5P: Double Catch Basin 5

Hydrograph



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Type III 24-hr 25-Year Rainfall=6.39"

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Summary for Pond 6P: Catch Basin 6

[87] Warning: Oscillations may require smaller dt or Finer Routing (severity=367)

Inflow Area = 3,976 sf, 69.22% Impervious, Inflow Depth = 4.13" for 25-Year event
 Inflow = 0.48 cfs @ 12.06 hrs, Volume= 1,370 cf
 Outflow = 0.48 cfs @ 12.06 hrs, Volume= 1,367 cf, Atten= 0%, Lag= 0.0 min
 Primary = 0.48 cfs @ 12.06 hrs, Volume= 1,367 cf
 Routed to Pond 4P : Drain Manhole 4

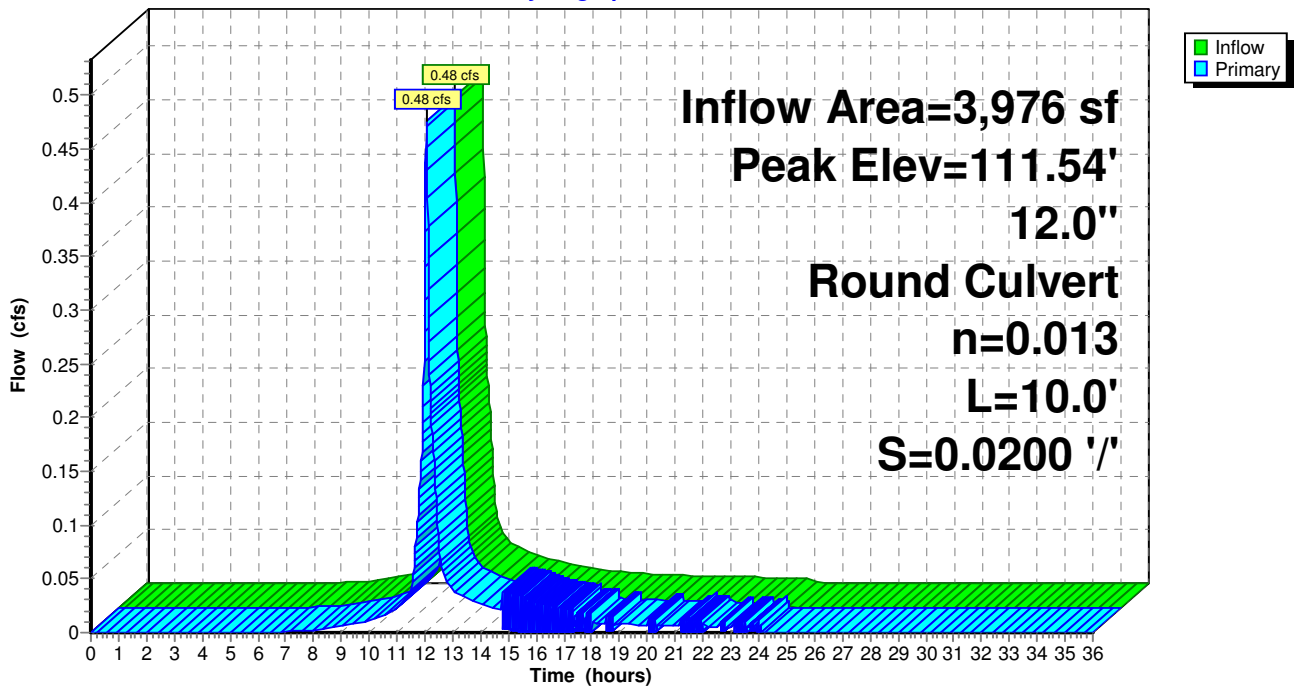
Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
 Peak Elev= 111.54' @ 14.02 hrs
 Flood Elev= 114.20'

Device #	Routing	Invert	Outlet Devices
#1	Primary	109.73'	12.0" Round Culvert L= 10.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 109.73' / 109.53' S= 0.0200 '/ Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=0.00 cfs @ 12.06 hrs HW=110.48' TW=110.49' (Dynamic Tailwater)
 ↑1=Culvert (Controls 0.00 cfs)

Pond 6P: Catch Basin 6

Hydrograph



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Type III 24-hr 25-Year Rainfall=6.39"

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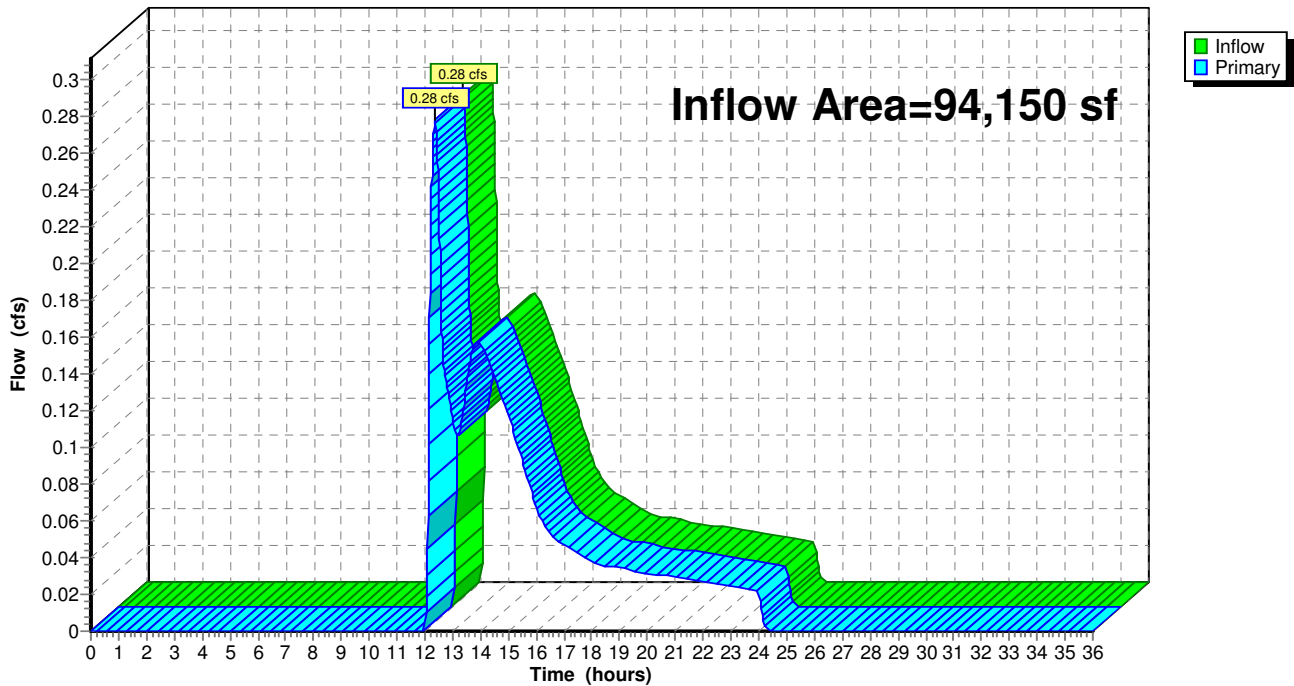
Summary for Link A: Eastern Wetland

Inflow Area = 94,150 sf, 23.93% Impervious, Inflow Depth = 0.37" for 25-Year event
Inflow = 0.28 cfs @ 12.36 hrs, Volume= 2,900 cf
Primary = 0.28 cfs @ 12.36 hrs, Volume= 2,900 cf, Atten= 0%, Lag= 0.0 min

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

Link A: Eastern Wetland

Hydrograph



3110 - Post Development 1

Type III 24-hr 100-Year Rainfall=8.22"

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Time span=0.00-36.00 hrs, dt=0.01 hrs, 3601 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 100: Proposed Houses & Runoff Area=58,891 sf 9.20% Impervious Runoff Depth=1.16"
Flow Length=200' Slope=0.1000 '/' Tc=8.0 min CN=38 Runoff=1.07 cfs 5,668 cf

Subcatchment 120: Proposed Pavement to Runoff Area=3,976 sf 69.22% Impervious Runoff Depth=5.83"
Flow Length=110' Tc=3.8 min CN=80 Runoff=0.66 cfs 1,932 cf

Subcatchment 150: Proposed Pavement & Runoff Area=31,283 sf 45.89% Impervious Runoff Depth=4.07"
Flow Length=220' Tc=5.5 min CN=65 Runoff=3.49 cfs 10,618 cf

Pond 1P: SMF 1 - Cultec Infiltration Peak Elev=113.04' Storage=4,778 cf Inflow=4.11 cfs 12,546 cf
Discarded=0.12 cfs 8,778 cf Primary=1.12 cfs 3,768 cf Outflow=1.24 cfs 12,546 cf

Pond 4P: Drain Manhole 4 Peak Elev=113.13' Inflow=4.11 cfs 12,546 cf
12.0" Round Culvert n=0.013 L=5.0' S=0.0200 '/' Outflow=4.11 cfs 12,546 cf

Pond 5P: Double Catch Basin 5 Peak Elev=113.20' Inflow=3.49 cfs 10,618 cf
12.0" Round Culvert n=0.013 L=24.0' S=0.0200 '/' Outflow=3.49 cfs 10,618 cf

Pond 6P: Catch Basin 6 Peak Elev=113.13' Inflow=0.66 cfs 1,932 cf
12.0" Round Culvert n=0.013 L=10.0' S=0.0200 '/' Outflow=0.66 cfs 1,928 cf

Link A: Eastern Wetland Inflow=1.82 cfs 9,437 cf
Primary=1.82 cfs 9,437 cf

Total Runoff Area = 94,150 sf Runoff Volume = 18,218 cf Average Runoff Depth = 2.32"
76.07% Pervious = 71,623 sf 23.93% Impervious = 22,527 sf

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Type III 24-hr 100-Year Rainfall=8.22"

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Summary for Subcatchment 100: Proposed Houses & Off-Site Flow to Wetland

Runoff = 1.07 cfs @ 12.15 hrs, Volume= 5,668 cf, Depth= 1.16"

Routed to Link A : Eastern Wetland

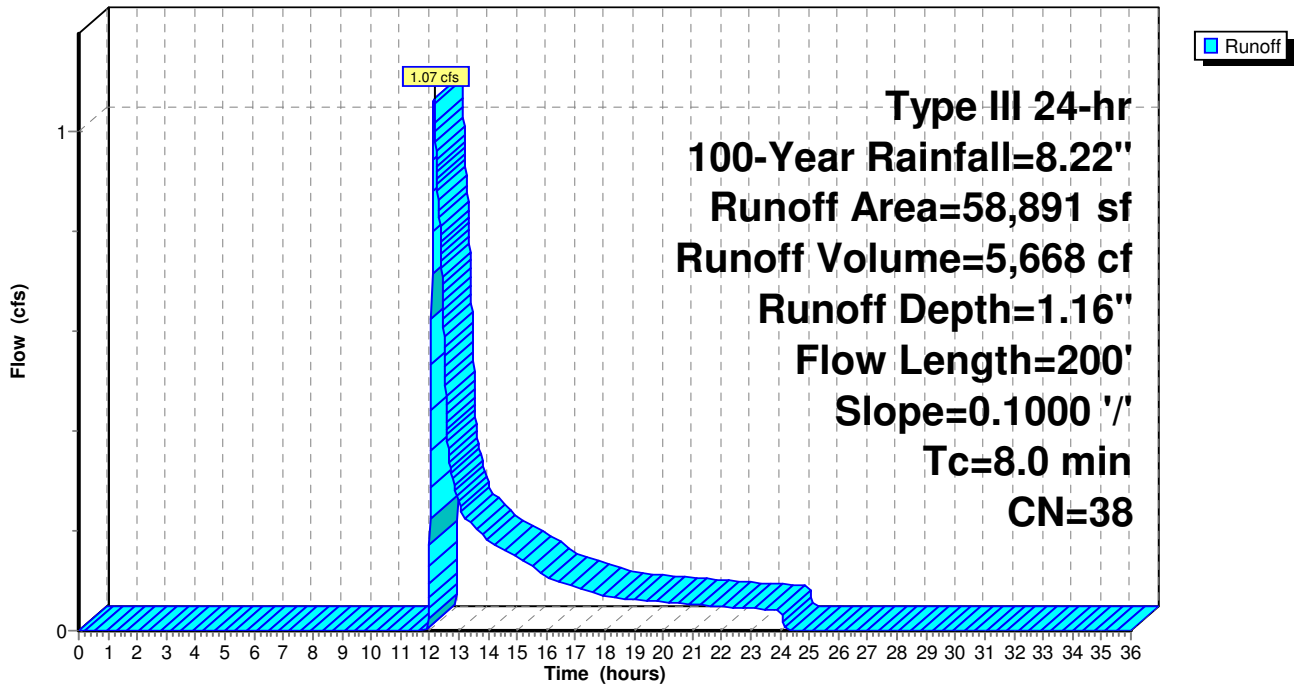
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
 Type III 24-hr 100-Year Rainfall=8.22"

Area (sf)	CN	Description
43,942	30	Woods, Good, HSG A
9,529	39	>75% Grass cover, Good, HSG A
5,420	98	Paved parking, HSG A
58,891	38	Weighted Average
53,471		90.80% Pervious Area
5,420		9.20% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.4	50	0.1000	0.13		Sheet Flow, Woods: Light underbrush n= 0.400 P2= 3.30"
1.6	150	0.1000	1.58		Shallow Concentrated Flow, Woodland Kv= 5.0 fps
8.0	200	Total			

Subcatchment 100: Proposed Houses & Off-Site Flow to Wetland

Hydrograph



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Type III 24-hr 100-Year Rainfall=8.22"

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Summary for Subcatchment 120: Proposed Pavement to Catch Basin 6

Runoff = 0.66 cfs @ 12.06 hrs, Volume= 1,932 cf, Depth= 5.83"
 Routed to Pond 6P : Catch Basin 6

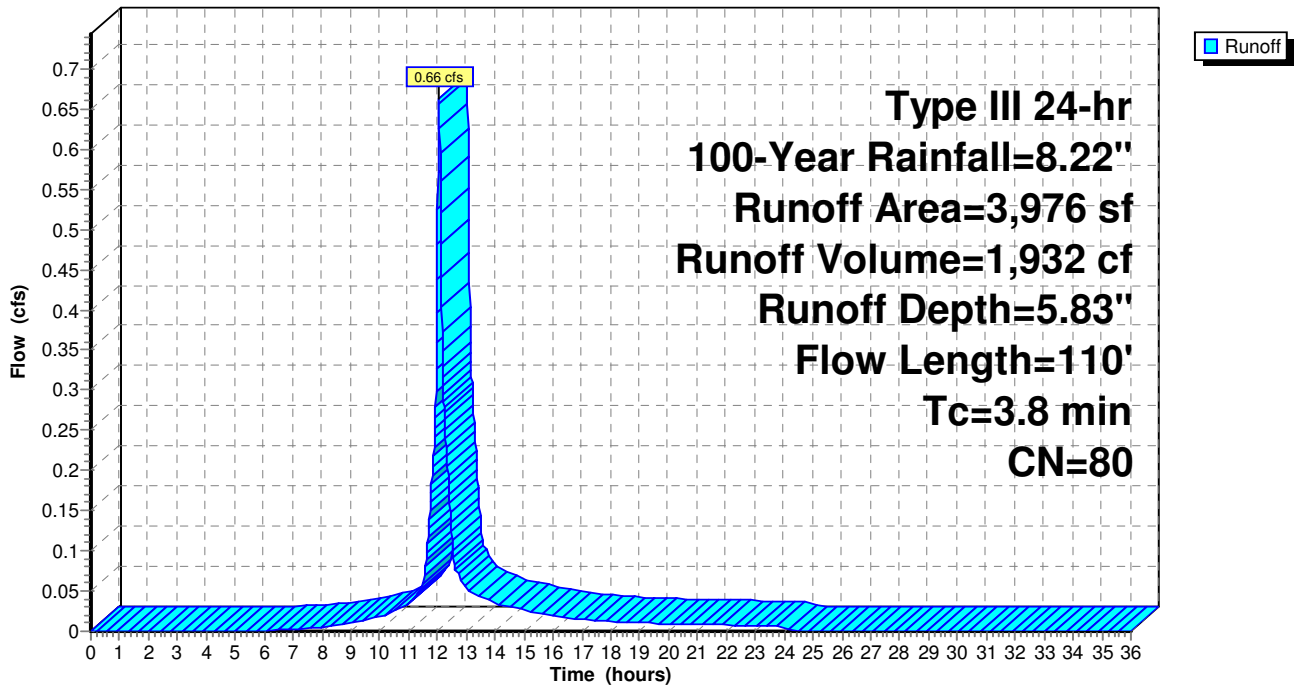
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
 Type III 24-hr 100-Year Rainfall=8.22"

Area (sf)	CN	Description
1,224	39	>75% Grass cover, Good, HSG A
2,752	98	Paved parking, HSG A
3,976	80	Weighted Average
1,224		30.78% Pervious Area
2,752		69.22% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.5	35	0.0300	0.16		Sheet Flow, Grass: Short n= 0.150 P2= 3.30"
0.3	75	0.0340	3.74		Shallow Concentrated Flow, Paved Kv= 20.3 fps
3.8	110	Total			

Subcatchment 120: Proposed Pavement to Catch Basin 6

Hydrograph



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Type III 24-hr 100-Year Rainfall=8.22"

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Summary for Subcatchment 150: Proposed Pavement & Off-Site Flow to Catch Basin 5

Runoff = 3.49 cfs @ 12.08 hrs, Volume= 10,618 cf, Depth= 4.07"
 Routed to Pond 5P : Double Catch Basin 5

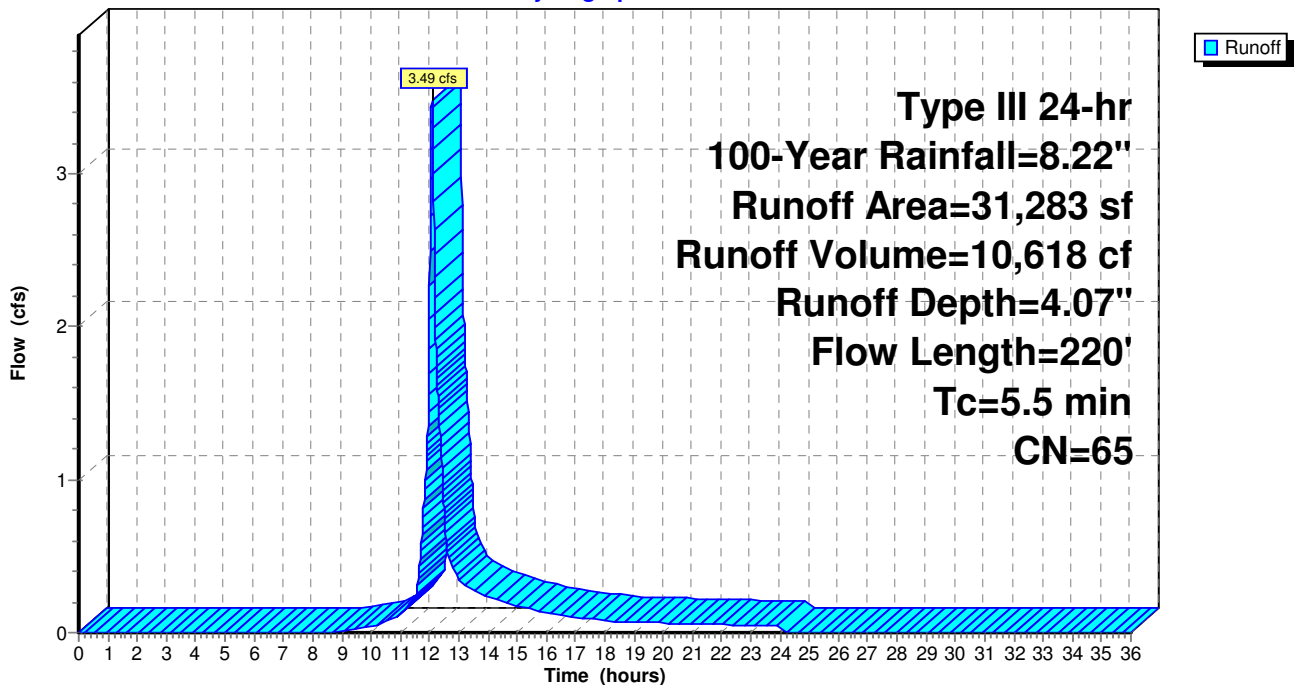
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
 Type III 24-hr 100-Year Rainfall=8.22"

Area (sf)	CN	Description
3,591	30	Woods, Good, HSG A
13,337	39	>75% Grass cover, Good, HSG A
14,355	98	Paved parking, HSG A
31,283	65	Weighted Average
16,928		54.11% Pervious Area
14,355		45.89% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.2	30	0.1000	0.12		Sheet Flow, Woods: Light underbrush n= 0.400 P2= 3.30"
0.6	50	0.0400	1.40		Shallow Concentrated Flow, Short Grass Pasture Kv= 7.0 fps
0.7	140	0.0300	3.52		Shallow Concentrated Flow, Paved Kv= 20.3 fps
5.5	220	Total			

Subcatchment 150: Proposed Pavement & Off-Site Flow to Catch Basin 5

Hydrograph



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Type III 24-hr 100-Year Rainfall=8.22"

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Summary for Pond 1P: SMF 1 - Cultec Infiltration Chambers

[93] Warning: Storage range exceeded by 0.67'

[80] Warning: Exceeded Pond 4P by 1.16' @ 24.31 hrs (2.87 cfs 6,873 cf)

Inflow Area = 35,259 sf, 48.52% Impervious, Inflow Depth = 4.27" for 100-Year event
 Inflow = 4.11 cfs @ 12.08 hrs, Volume= 12,546 cf
 Outflow = 1.24 cfs @ 12.44 hrs, Volume= 12,546 cf, Atten= 70%, Lag= 21.6 min
 Discarded = 0.12 cfs @ 11.15 hrs, Volume= 8,778 cf
 Primary = 1.12 cfs @ 12.44 hrs, Volume= 3,768 cf
 Routed to Link A : Eastern Wetland

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
 Peak Elev= 113.04' @ 12.44 hrs Surf.Area= 2,102 sf Storage= 4,778 cf
 Flood Elev= 113.38' Surf.Area= 2,102 sf Storage= 4,778 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
 Center-of-Mass det. time= 258.1 min (1,086.3 - 828.3)

Volume	Invert	Avail.Storage	Storage Description
#1A	108.83'	1,779 cf	35.33'W x 59.50'L x 3.54'H Field A 7,446 cf Overall - 2,999 cf Embedded = 4,447 cf x 40.0% Voids
#2A	109.33'	2,999 cf	Cultec R-330XLHD x 56 Inside #1 Effective Size= 47.8"W x 30.0"H => 7.45 sf x 7.00'L = 52.2 cf Overall Size= 52.0"W x 30.5"H x 8.50'L with 1.50' Overlap Row Length Adjustment= +1.50' x 7.45 sf x 7 rows
		4,778 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	108.83'	2.410 in/hr Exfiltration over Surface area
#2	Primary	111.38'	6.0" Round Culvert L= 21.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 111.38' / 110.96' S= 0.0200 '/' Cc= 0.900 n= 0.011 PVC, smooth interior, Flow Area= 0.20 sf

Discarded OutFlow Max=0.12 cfs @ 11.15 hrs HW=108.88' (Free Discharge)

↑1=Exfiltration (Exfiltration Controls 0.12 cfs)

Primary OutFlow Max=1.11 cfs @ 12.44 hrs HW=113.00' TW=0.00' (Dynamic Tailwater)

↑2=Culvert (Inlet Controls 1.11 cfs @ 5.64 fps)

3110 - Post Development 1

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Type III 24-hr 100-Year Rainfall=8.22"

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Pond 1P: SMF 1 - Cultec Infiltration Chambers - Chamber Wizard Field A

Chamber Model = Cultec R-330XLHD (Cultec Recharger® 330XLHD)

Effective Size= 47.8"W x 30.0"H => 7.45 sf x 7.00'L = 52.2 cf

Overall Size= 52.0"W x 30.5"H x 8.50'L with 1.50' Overlap

Row Length Adjustment= +1.50' x 7.45 sf x 7 rows

52.0" Wide + 6.0" Spacing = 58.0" C-C Row Spacing

8 Chambers/Row x 7.00' Long +1.50' Row Adjustment = 57.50' Row Length +12.0" End Stone x 2 = 59.50' Base Length

7 Rows x 52.0" Wide + 6.0" Spacing x 6 + 12.0" Side Stone x 2 = 35.33' Base Width

6.0" Stone Base + 30.5" Chamber Height + 6.0" Stone Cover = 3.54' Field Height

56 Chambers x 52.2 cf +1.50' Row Adjustment x 7.45 sf x 7 Rows = 2,999.0 cf Chamber Storage

7,445.8 cf Field - 2,999.0 cf Chambers = 4,446.7 cf Stone x 40.0% Voids = 1,778.7 cf Stone Storage

Chamber Storage + Stone Storage = 4,777.7 cf = 0.110 af

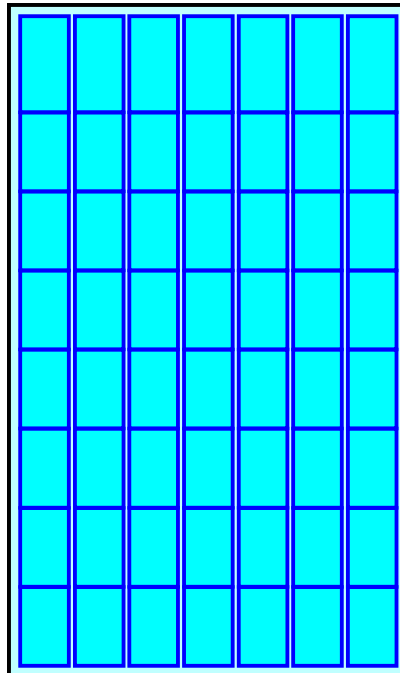
Overall Storage Efficiency = 64.2%

Overall System Size = 59.50' x 35.33' x 3.54'

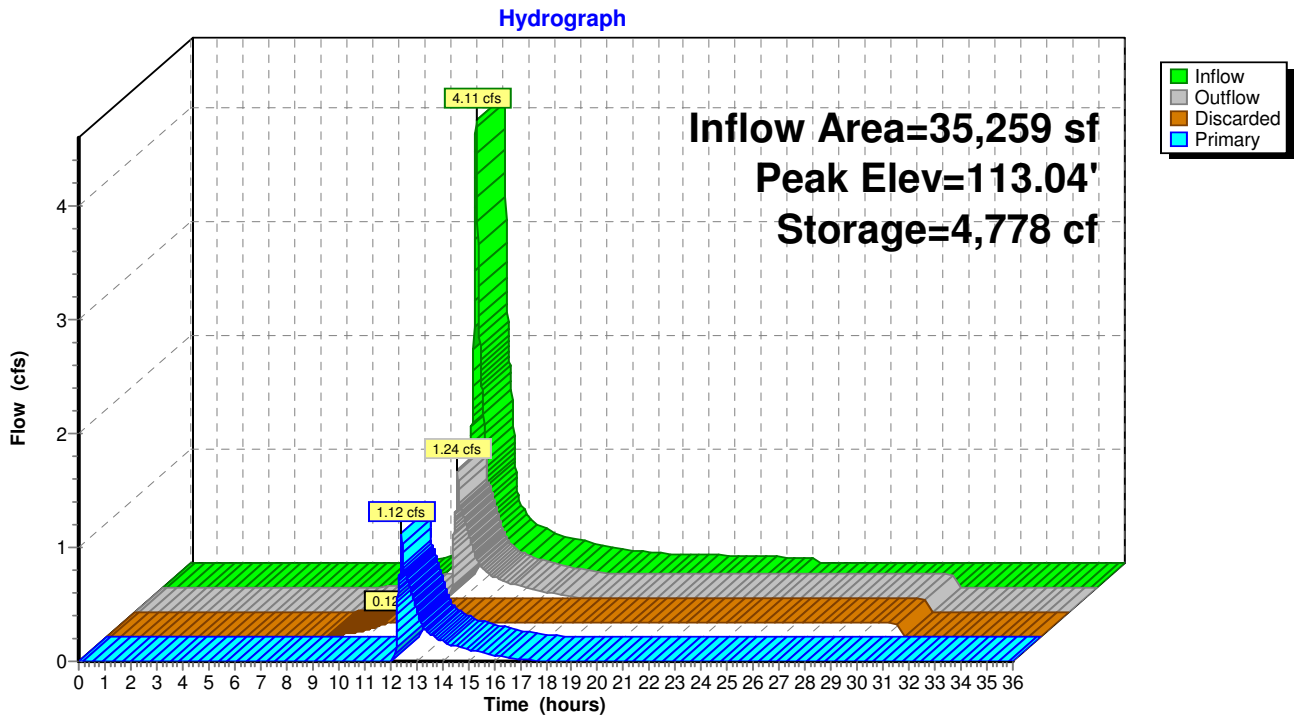
56 Chambers

275.8 cy Field

164.7 cy Stone



Pond 1P: SMF 1 - Cultec Infiltration Chambers



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Summary for Pond 4P: Drain Manhole 4

[80] Warning: Exceeded Pond 5P by 0.56' @ 24.32 hrs (1.16 cfs 897 cf)

[80] Warning: Exceeded Pond 6P by 1.73' @ 16.92 hrs (4.19 cfs 25,188 cf)

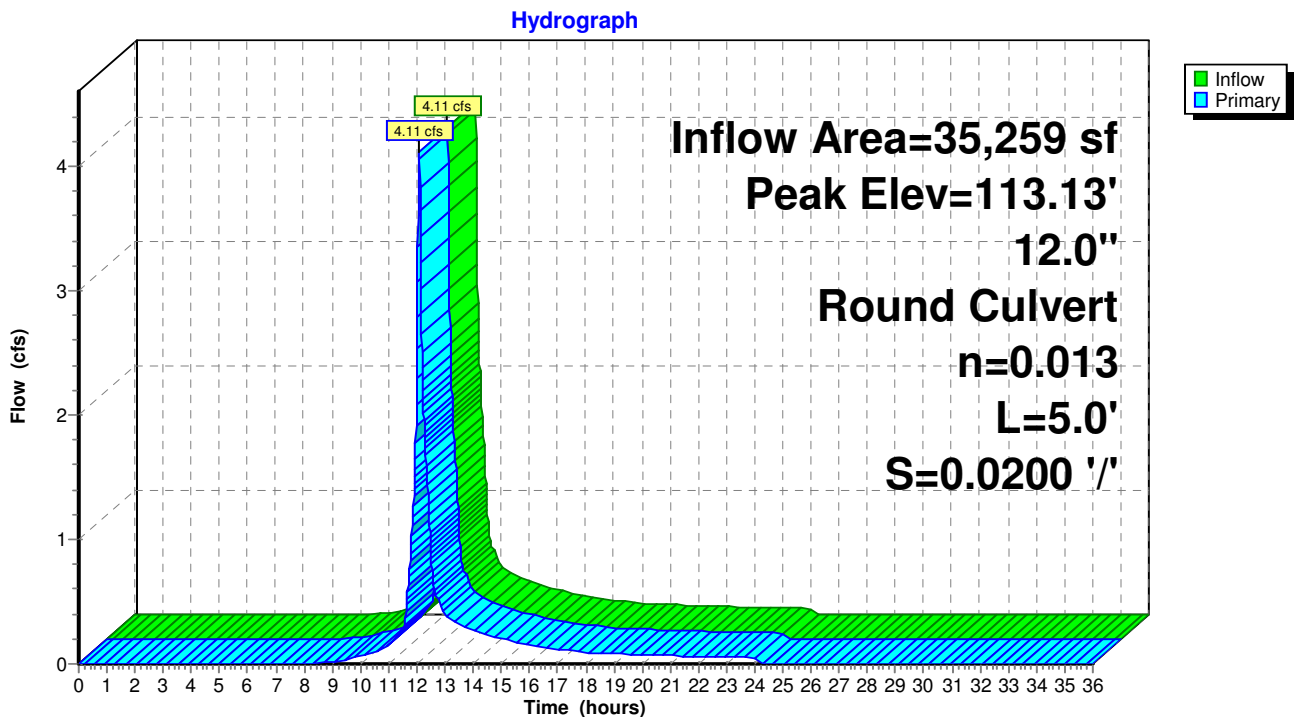
Inflow Area = 35,259 sf, 48.52% Impervious, Inflow Depth = 4.27" for 100-Year event
 Inflow = 4.11 cfs @ 12.08 hrs, Volume= 12,546 cf
 Outflow = 4.11 cfs @ 12.08 hrs, Volume= 12,546 cf, Atten= 0%, Lag= 0.0 min
 Primary = 4.11 cfs @ 12.08 hrs, Volume= 12,546 cf
 Routed to Pond 1P : SMF 1 - Cultec Infiltration Chambers

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
 Peak Elev= 113.13' @ 12.45 hrs
 Flood Elev= 114.40'

Device	Routing	Invert	Outlet Devices
#1	Primary	109.43'	12.0" Round Culvert L= 5.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 109.43' / 109.33' S= 0.0200 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=3.96 cfs @ 12.08 hrs HW=111.66' TW=110.56' (Dynamic Tailwater)
 ↳ **1=Culvert** (Inlet Controls 3.96 cfs @ 5.04 fps)

Pond 4P: Drain Manhole 4



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Summary for Pond 5P: Double Catch Basin 5

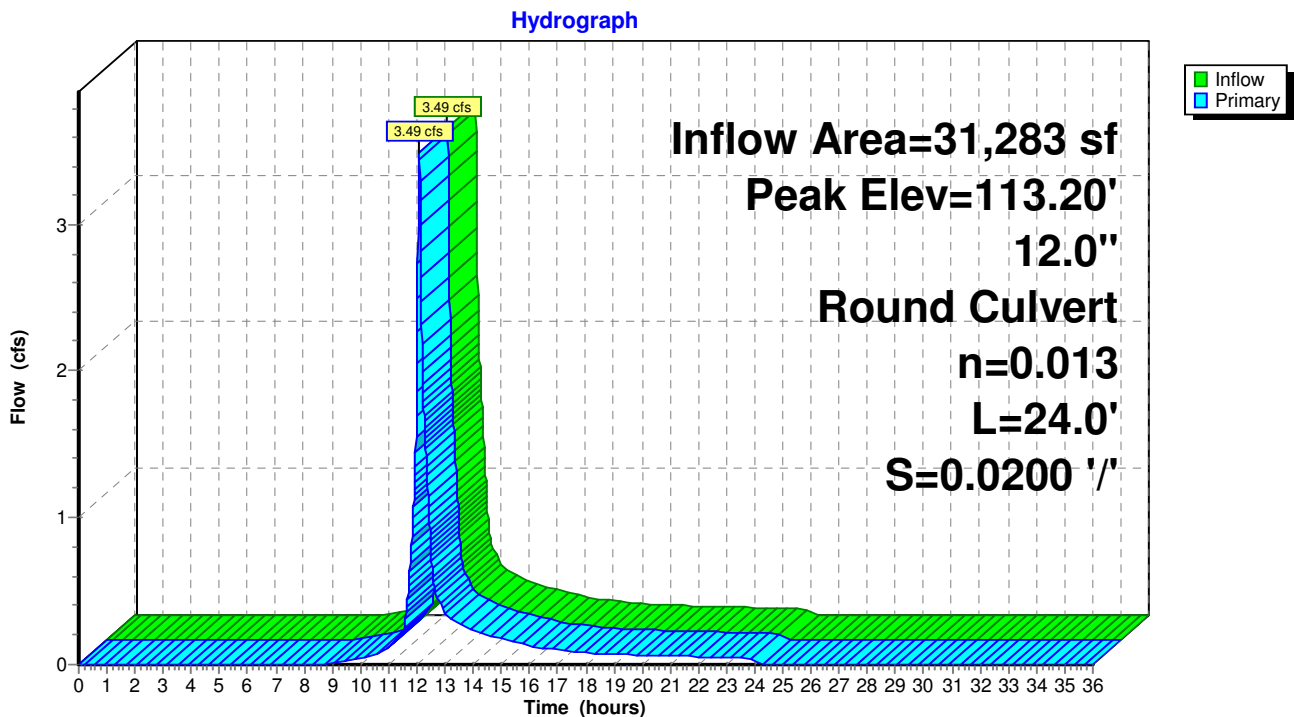
Inflow Area = 31,283 sf, 45.89% Impervious, Inflow Depth = 4.07" for 100-Year event
 Inflow = 3.49 cfs @ 12.08 hrs, Volume= 10,618 cf
 Outflow = 3.49 cfs @ 12.08 hrs, Volume= 10,618 cf, Atten= 0%, Lag= 0.0 min
 Primary = 3.49 cfs @ 12.08 hrs, Volume= 10,618 cf
 Routed to Pond 4P : Drain Manhole 4

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
 Peak Elev= 113.20' @ 12.46 hrs
 Flood Elev= 113.50'

Device #	Routing	Invert	Outlet Devices
#1	Primary	110.01'	12.0" Round Culvert L= 24.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 110.01' / 109.53' S= 0.0200 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=3.30 cfs @ 12.08 hrs HW=112.45' TW=111.69' (Dynamic Tailwater)
 ↳ **1=Culvert** (Inlet Controls 3.30 cfs @ 4.20 fps)

Pond 5P: Double Catch Basin 5



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Summary for Pond 6P: Catch Basin 6

[87] Warning: Oscillations may require smaller dt or Finer Routing (severity=373)

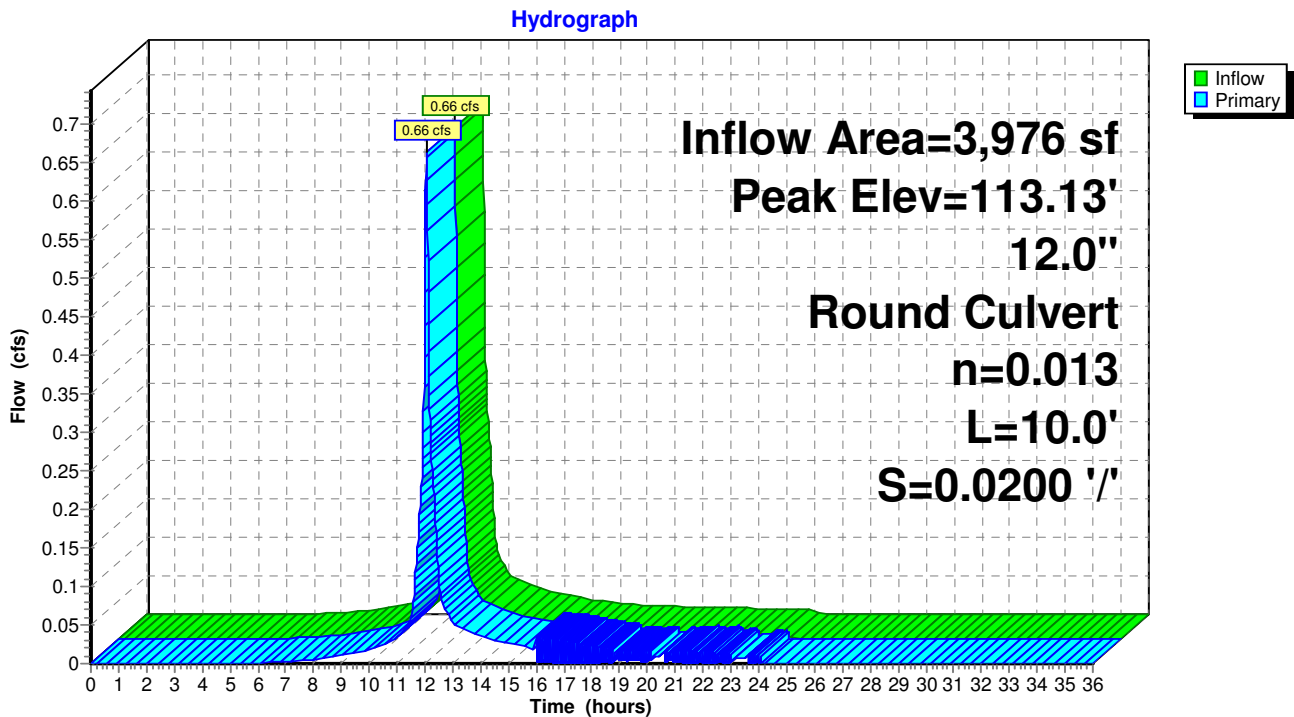
Inflow Area = 3,976 sf, 69.22% Impervious, Inflow Depth = 5.83" for 100-Year event
Inflow = 0.66 cfs @ 12.06 hrs, Volume= 1,932 cf
Outflow = 0.66 cfs @ 12.06 hrs, Volume= 1,928 cf, Atten= 0%, Lag= 0.0 min
Primary = 0.66 cfs @ 12.06 hrs, Volume= 1,928 cf
Routed to Pond 4P : Drain Manhole 4

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Peak Elev= 113.13' @ 12.46 hrs
Flood Elev= 114.20'

Device #	Routing	Invert	Outlet Devices
#1	Primary	109.73'	12.0" Round Culvert L= 10.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 109.73' / 109.53' S= 0.0200 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=0.00 cfs @ 12.06 hrs HW=111.23' TW=111.37' (Dynamic Tailwater)
↑1=Culvert (Controls 0.00 cfs)

Pond 6P: Catch Basin 6



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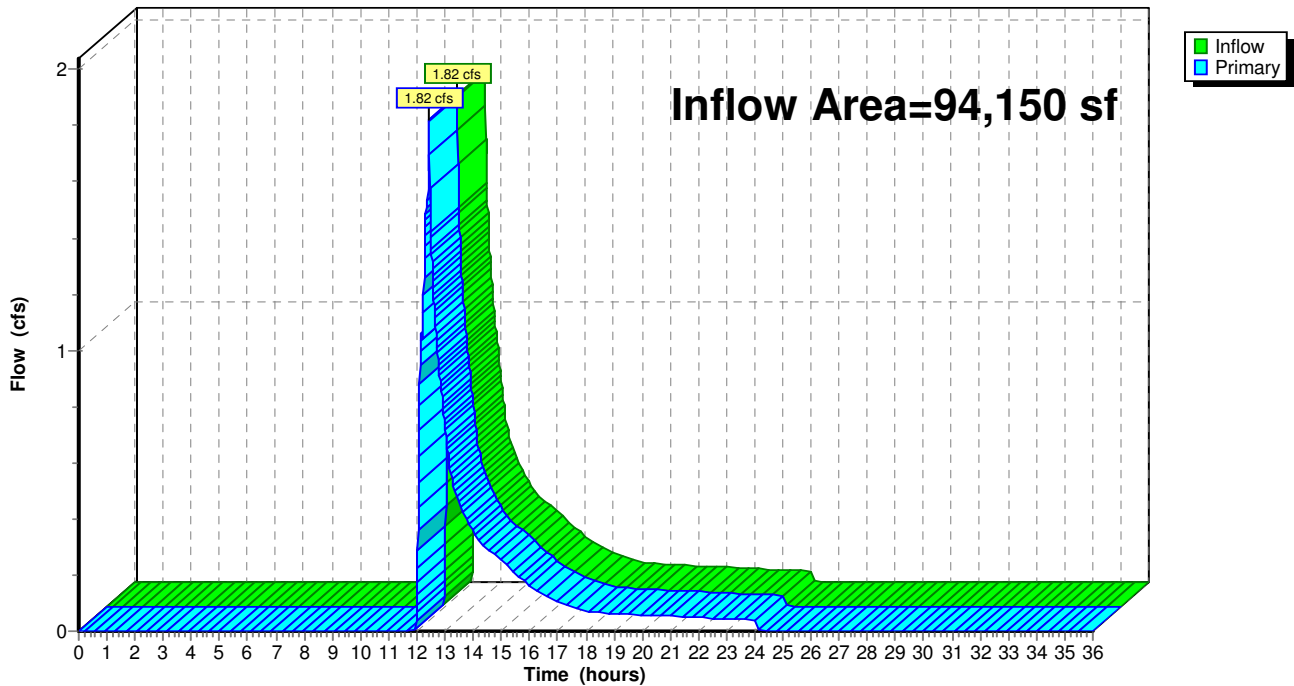
Summary for Link A: Eastern Wetland

Inflow Area = 94,150 sf, 23.93% Impervious, Inflow Depth = 1.20" for 100-Year event
Inflow = 1.82 cfs @ 12.44 hrs, Volume= 9,437 cf
Primary = 1.82 cfs @ 12.44 hrs, Volume= 9,437 cf, Atten= 0%, Lag= 0.0 min

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

Link A: Eastern Wetland

Hydrograph



MEISNER BREM CORPORATION

142 LITTLETON ROAD, STE. 16, WESTFORD, MA 01886

246 & 248 WALNUT STREET

STORMWATER MANAGEMENT REPORT – VOLUME 2 OF 2

A RESIDENTIAL SUBDIVISION IN READING, MA

NOAA Atlas 14 Rainfall Data



POINT PRECIPITATION FREQUENCY ESTIMATES

Sanja Perica, Sandra Pavlovic, Michael St. Laurent, Carl Trypaluk, Dale Unruh, Orlan Wilhite

NOAA, National Weather Service, Silver Spring, Maryland

[PF_tabular](#) | [PF_graphical](#) | [Maps & aerials](#)

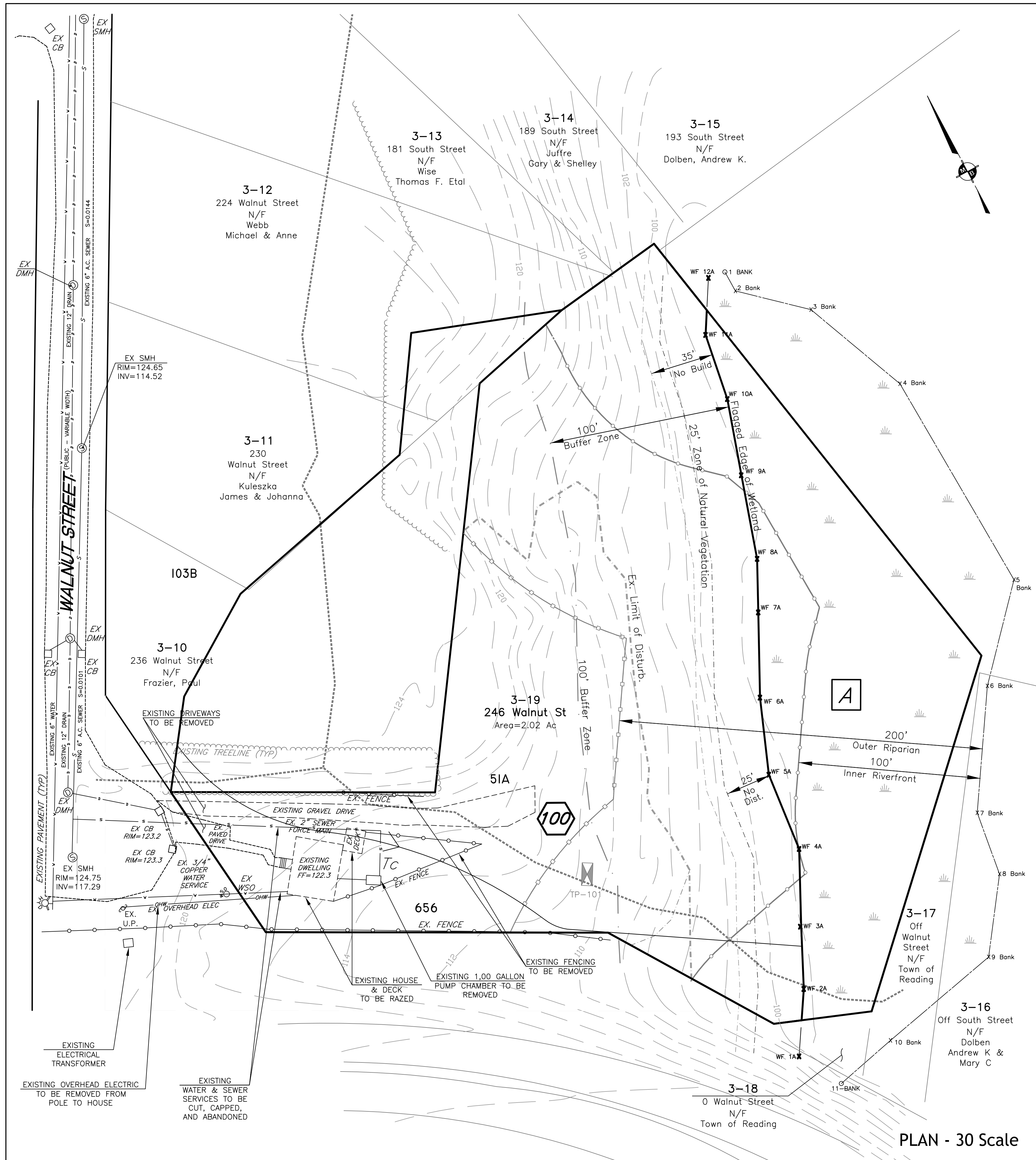
PF tabular

PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches)¹										
Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	0.308 (0.237-0.389)	0.373 (0.287-0.471)	0.479 (0.367-0.606)	0.567 (0.432-0.722)	0.687 (0.509-0.919)	0.776 (0.566-1.06)	0.872 (0.620-1.25)	0.985 (0.660-1.43)	1.15 (0.746-1.74)	1.29 (0.819-1.99)
10-min	0.437 (0.336-0.551)	0.528 (0.406-0.667)	0.678 (0.520-0.858)	0.802 (0.611-1.02)	0.973 (0.721-1.30)	1.10 (0.801-1.51)	1.24 (0.878-1.77)	1.40 (0.935-2.03)	1.63 (1.06-2.46)	1.83 (1.16-2.82)
15-min	0.514 (0.396-0.648)	0.622 (0.478-0.785)	0.798 (0.611-1.01)	0.943 (0.719-1.20)	1.14 (0.848-1.53)	1.29 (0.942-1.77)	1.45 (1.03-2.08)	1.64 (1.10-2.39)	1.92 (1.24-2.90)	2.16 (1.36-3.32)
30-min	0.707 (0.544-0.891)	0.855 (0.657-1.08)	1.10 (0.841-1.39)	1.30 (0.991-1.66)	1.58 (1.17-2.11)	1.78 (1.30-2.44)	2.00 (1.42-2.87)	2.26 (1.52-3.30)	2.66 (1.72-4.01)	2.99 (1.89-4.60)
60-min	0.899 (0.692-1.13)	1.09 (0.837-1.37)	1.40 (1.07-1.77)	1.66 (1.26-2.11)	2.01 (1.49-2.69)	2.27 (1.66-3.12)	2.56 (1.82-3.66)	2.89 (1.94-4.20)	3.39 (2.19-5.12)	3.82 (2.42-5.88)
2-hr	1.17 (0.903-1.46)	1.42 (1.10-1.78)	1.83 (1.41-2.31)	2.18 (1.67-2.76)	2.65 (1.98-3.54)	3.00 (2.20-4.10)	3.38 (2.43-4.84)	3.85 (2.59-5.57)	4.58 (2.97-6.86)	5.22 (3.31-7.97)
3-hr	1.36 (1.05-1.69)	1.65 (1.28-2.06)	2.14 (1.66-2.68)	2.55 (1.96-3.21)	3.10 (2.33-4.13)	3.51 (2.59-4.79)	3.96 (2.86-5.66)	4.52 (3.05-6.51)	5.41 (3.51-8.06)	6.18 (3.93-9.39)
6-hr	1.75 (1.37-2.17)	2.14 (1.67-2.65)	2.77 (2.16-3.45)	3.30 (2.56-4.13)	4.02 (3.04-5.31)	4.55 (3.38-6.16)	5.14 (3.73-7.28)	5.87 (3.97-8.37)	7.01 (4.57-10.4)	8.01 (5.11-12.1)
12-hr	2.23 (1.76-2.74)	2.72 (2.14-3.35)	3.53 (2.77-4.37)	4.20 (3.28-5.23)	5.13 (3.89-6.71)	5.81 (4.33-7.80)	6.55 (4.77-9.19)	7.47 (5.08-10.6)	8.89 (5.82-13.0)	10.1 (6.48-15.1)
24-hr	2.67 (2.12-3.26)	3.30 (2.62-4.04)	4.34 (3.43-5.34)	5.21 (4.09-6.43)	6.39 (4.88-8.32)	7.26 (5.45-9.70)	8.22 (6.03-11.5)	9.42 (6.43-13.2)	11.3 (7.42-16.4)	12.9 (8.30-19.2)
2-day	3.03 (2.42-3.67)	3.82 (3.05-4.65)	5.13 (4.08-6.25)	6.21 (4.91-7.61)	7.70 (5.92-9.98)	8.78 (6.65-11.7)	9.99 (7.41-14.0)	11.6 (7.91-16.1)	14.1 (9.27-20.3)	16.3 (10.5-24.0)
3-day	3.31 (2.66-4.00)	4.17 (3.34-5.04)	5.57 (4.45-6.77)	6.73 (5.35-8.22)	8.34 (6.44-10.8)	9.50 (7.22-12.6)	10.8 (8.04-15.0)	12.5 (8.58-17.4)	15.3 (10.1-21.9)	17.7 (11.4-25.9)
4-day	3.58 (2.88-4.32)	4.47 (3.59-5.39)	5.91 (4.74-7.16)	7.11 (5.66-8.66)	8.76 (6.79-11.3)	9.97 (7.59-13.2)	11.3 (8.44-15.7)	13.1 (8.99-18.1)	15.9 (10.5-22.8)	18.5 (11.9-26.9)
7-day	4.35 (3.52-5.22)	5.27 (4.26-6.33)	6.77 (5.46-8.16)	8.02 (6.42-9.71)	9.74 (7.58-12.4)	11.0 (8.40-14.4)	12.4 (9.25-17.0)	14.2 (9.80-19.5)	17.1 (11.3-24.3)	19.7 (12.7-28.5)
10-day	5.05 (4.10-6.04)	6.00 (4.87-7.17)	7.55 (6.10-9.05)	8.83 (7.09-10.7)	10.6 (8.26-13.4)	11.9 (9.09-15.5)	13.3 (9.93-18.1)	15.1 (10.5-20.7)	18.0 (12.0-25.4)	20.5 (13.3-29.5)
20-day	7.04 (5.76-8.35)	8.08 (6.60-9.59)	9.78 (7.96-11.7)	11.2 (9.05-13.4)	13.1 (10.3-16.4)	14.6 (11.1-18.6)	16.1 (11.9-21.4)	17.9 (12.5-24.2)	20.5 (13.7-28.7)	22.6 (14.7-32.3)
30-day	8.68 (7.14-10.3)	9.80 (8.04-11.6)	11.6 (9.50-13.8)	13.1 (10.7-15.7)	15.2 (11.9-18.8)	16.8 (12.8-21.2)	18.4 (13.6-24.0)	20.1 (14.1-27.1)	22.5 (15.1-31.3)	24.4 (15.9-34.7)
45-day	10.8 (8.89-12.7)	12.0 (9.86-14.1)	13.9 (11.4-16.4)	15.5 (12.7-18.5)	17.8 (13.9-21.8)	19.5 (14.9-24.4)	21.2 (15.6-27.3)	22.9 (16.1-30.5)	25.0 (16.8-34.6)	26.6 (17.4-37.6)
60-day	12.6 (10.4-14.8)	13.8 (11.4-16.2)	15.9 (13.1-18.7)	17.5 (14.3-20.8)	19.9 (15.6-24.3)	21.7 (16.6-27.0)	23.4 (17.2-30.0)	25.1 (17.7-33.4)	27.1 (18.3-37.4)	28.6 (18.7-40.2)

¹ Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS). Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values. Please refer to NOAA Atlas 14 document for more information.

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PF graphical



NRCS SOILS:
 51A - Swansea muck, 0 to 1% slopes
 103B - Charlton-Hollis-Rock Outcrop Complex, 3% to 8% slopes
 656 - Urdothents-Urban Land Complex

----- SOILS LINE

PLAN - 30 Scale

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PRE-DEVELOPMENT DRAINAGE MAP 246 & 248 WALNUT STREET READING, MASSACHUSETTS	
PREPARED FOR: STELLA CONSTRUCTION 25 Everett Street Woburn, MA 01810 857-251-5110	
DECEMBER 20, 2023	
 SCALE: 1"=30'	
 MEISNER BREM CORPORATION 142 LITTLETON ROAD, STE. 16, WESTFORD, MA 01886 · (978) 892-1313 202 MAIN STREET, SALEM, NH 03079 · (603) 883-3301	JOB NUMBER: 3110 ACAD FILE: 3110-Stella Const. Prelim
1 OF 2	

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