

# STORMWATER REPORT

FOR

## *WILLIAM WALLACE VILLAGE*

274 VILLAGE STREET

MEDWAY MA, 02053

### *PROPOSED RESIDENTIAL DEVELOPMENT*

JUNE 25, 2019

REVISED SEPTEMBER 4, 2019

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VOLUME 1 OF 1

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# INTRODUCTION

This report presents a description along with supporting calculations for the stormwater runoff treatment and mitigation systems proposed for the residential development as presented on a plan set entitled "William Wallace Village Medway, MA Site Plan" prepared by Legacy Engineering, LLC with an original date of June 25, 2019. The development consists of 4 two-family dwellings, 1 three-family dwelling, and 1 four family dwelling, for a total of 15 dwelling units.

## EXISTING SITE

The proposed development lies on the northerly side of Village Street in Medway, totaling approximately 3.63 acres. The site is developed with a single-family dwelling to the rear of the property, and a building used as a gym toward the front of the property. Wetlands lie in the northeast corner of the site. Multiple concrete pads can be found across the site, which are surrounded by woodlands.

## SOILS

A series of test pits have been conducted across the site, which have generally confirmed the soils conditions described in the soils conservation service on-line soils website maps (see Attachment H). The soils conservation service maps indicate that the site is comprised of various soils types as follows:

Easterly Portions:

- Sudbury (260B): A class B soil.

Westerly Portions:

- Scio (223B): A class B/D soil.

Southeasterly Portions:

- Merrimac (254B): A class A soil.

## GROUNDWATER CONDITIONS

On-site testing concluded that the groundwater table slopes from northwest to southeast and ranges from 184.0 in the northwest to 179.2 in the southeast, with the central portions in the vicinity of elevation 183.

## SOIL PERMEABILITY

For the purposes of this report and based on the soils present at the proposed stormwater infiltration facilities, a Rawls rate for loamy sand (2.41 inches per hour) is used for infiltration related calculations.

## **FLOOD PLAIN**

No portion of this site lies within a flood plain.

## **WETLAND PROTECTION ACT**

The northeasterly portions of the site include bordering vegetated wetlands along an unnamed tributary of the Charles River. A Notice of Intent will be filed for proposed work within wetland jurisdictional areas.

## **PROPOSED DEVELOPMENT**

The proposed construction consists of 7 two-family dwellings for a total of 14 new dwelling units. The existing house and gym will be demolished to accommodate the new dwellings. Construction also includes all appurtenant driveways, utilities, landscaping, and stormwater management systems.

## **MASSACHUSETTS STORMWATER MANAGEMENT STANDARDS**

The stormwater management system is designed in accordance with the provisions of the DEP Stormwater Management Standards and Handbook, which are summarized below.

### **STANDARD 1 - New Stormwater Conveyances**

*No New Stormwater Conveyances (e.g. outfalls) May Discharge Untreated Stormwater Directly to or Cause Erosion in Wetlands or Waters of the Commonwealth.* The proposed development complies with this standard.

The development includes four primary stormwater discharge points. Note the following:

- Design Point #1: Flow to 280 Village Street: Stormwater basin #1 overflows via level spreader to the adjacent property with a 100-year flow rate of only 1 cfs. This flow will not erode the surrounding soils.
- Design Point #2: Flow to 278 Village Street: There are no new point source discharges to this design point.
- Design Point #3a: Flow to Village Street: The proposed stormwater infiltration field overflows via the trench drain towards the street in a manner similar to the exiting condition and will therefore not cause erosion.
- Design Point #3B: Flow to Eastern Abutter: There are no new point source discharges to this design point.

- Design Point #4: Flow to Wetlands: Stormwater basin #4 overflows to the adjacent wetlands via level spreader. Given the 100-year peak flow rates of only 2.6 cfs, erosion will not occur at this outfall point.

**STANDARD 2 – Peak Discharge Rates**

*Stormwater Management Systems shall be designed so that the Post-Development Peak Discharge Rates do not Exceed Pre-Development Peak Discharge Rates.* The proposed development complies with this standard.

In order to model pre and post peak discharges, a program called Hydrocad was used, which employs the TR-20 modeling system. The DEP Stormwater Management regulations require that the 2 and 10 year storms should be considered for peak rates and the 100-year storm for flooding considerations. Medway Conservation regulations require that the 25-year storm be analyzed for storm drains and basins, and the 50-year storm for culverts. The following five theoretical storm events were used to model the site before and after the proposed activities occur<sup>1</sup>:

<u>Design Storm</u>	<u>Rainfall</u>
2-Year	3.2 inches
10-Year	4.7 inches
25-Year	5.5 inches
50-Year	6.1 inches
100-Year	6.7 inches

**DESIGN POINT #1: Flow to 280 Village Street**

*Description of Existing Conditions:* In the existing condition, Watershed E1 represents uncontrolled overland flow to the adjacent property and consists of woods, lawn, and roof runoff.

*Description of Proposed Conditions:* In the proposed condition, Watersheds P1a and P1b represent flow to Stormwater Basin #1 and consist of roof and lawn runoff. Watershed P1c represents the uncontrolled runoff to the adjacent property consisting of lawn areas.

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<sup>1</sup> Rainfall depths are as specified by MassDEP in Appendix F-1 of the Hydrology Handbook for Conservation Commissioners dated March 2002.

Summary of Peak Flow Rates to Design Point:

Design Storm (Year)	Peak Runoff Rate (cfs)		Volume of Runoff (ac-ft)	
	Existing	Proposed	Existing	Proposed
2	0.12	0.07	0.024	0.007
10	0.62	0.39	0.072	0.028
25	0.98	0.78	0.105	0.048
50	1.29	1.15	0.132	0.064
100	1.61	1.57	0.161	0.081

**DESIGN POINT #2: Flow to 278 Village Street**

Description of Existing Conditions: In the existing condition, Watersheds E2a and E2b represent uncontrolled overland flow to the abutter. Watershed E2a is mostly woods, and Watershed E2b is mostly pavement and roof runoff.

Description of Proposed Conditions: In the proposed condition, Watershed P2 represents the narrow strip of land that sheds lawn runoff to the adjacent property. Rates are significantly reduced as a result of the large reduction in watershed area.

Summary of Peak Flow Rates to Design Point:

Design Storm (Year)	Peak Runoff Rate (cfs)		Volume of Runoff (ac-ft)	
	Existing	Existing	Proposed	Proposed
2	0.51	0.03	0.041	0.004
10	0.90	0.13	0.073	0.010
25	1.13	0.19	0.092	0.014
50	1.31	0.24	0.106	0.018
100	1.49	0.29	0.121	0.021

**DESIGN POINT #3a: Flow to Village Street**

Description of Existing Conditions: In the existing condition, Watershed E3a represents the runoff to Village Street. The watershed consists of roof, pavement, gravel, and lawn areas.

Description of Proposed Conditions: In the proposed condition, Watershed P3a sheds to the trench drain, which is routed to the underground infiltration field. Watershed P3b is directly routed to the infiltration field. Watershed P3d sheds uncontrolled to Village Street and is vegetated.

Summary of Peak Flow Rates to Design Point:

Design Storm (Year)	Peak Runoff Rate (cfs)		Volume of Runoff (ac-ft)	
	Proposed	Proposed	Existing	Proposed
2	0.45	0.01	0.035	0.003
10	0.86	0.09	0.067	0.010
25	1.10	0.16	0.085	0.014
50	1.28	0.21	0.099	0.018
100	1.46	1.41	0.113	0.031

**DESIGN POINT #3b: Flow to Eastern Abutters**

Description of Existing Conditions: In the existing condition, Watershed E3a represents the runoff to the eastern abutter. The watershed consists of roof, pavement, gravel, woods, and lawn areas.

Description of Proposed Conditions: In the proposed condition, Watershed P3c sheds via overland flow to the eastern abutters' stormwater management system (which was designed to accommodate this off-site flow).

Summary of Peak Flow Rates to Design Point:

Design Storm (Year)	Peak Runoff Rate (cfs)		Volume of Runoff (ac-ft)	
	Existing	Proposed	Existing	Proposed
2	0.07	0.04	0.009	0.005
10	0.26	0.24	0.023	0.034
25	0.37	0.34	0.032	0.054
50	0.47	0.41	0.040	0.070
100	0.57	0.49	0.048	0.079

**DESIGN POINT #4: Flow to Wetlands**

Description of Existing Conditions: In the existing condition, Watershed E4 represents the runoff to the on-site wetlands and consists of roof, pavement, gravel driveway, concrete slabs, woods, and lawn areas.

Description of Proposed Conditions: In the proposed condition, Watershed P4a represents the runoff from the areas that sheds towards Stormwater Basin #2. Watershed P4b represents the roof runoff from units 4-7 and 15 that is routed to Stormwater Basin #2. The stormwater that sheds to Stormwater Basin #3 is represented by Watershed P4c. Watershed P4d and P4e represent the landscape and roof runoff that is directed to Stormwater Basin #4. The uncontrolled runoff to the wetlands is represented by Watershed P4e.

*Summary of Peak Flow Rates to Design Point:*

Design Storm (Year)	Peak Runoff Rate (cfs)		Volume of Runoff (ac-ft)	
	Existing	Proposed	Existing	Proposed
2	0.63	0.45	0.078	0.048
10	1.96	1.71	0.195	0.177
25	2.80	2.57	0.268	0.260
50	3.48	3.28	0.328	0.328
100	4.18	4.15	0.389	0.399

**STANDARD 3 - Loss of Annual Recharge**

*Loss of Annual Recharge to Groundwater shall be Eliminated or Minimized through the use of Environmentally Sensitive Site Design, Low Impact Development Techniques, Stormwater Best Management Practices, and Good Operation and Maintenance.*

**RECHARGE CALCULATIONS AND METHODS**

The DEP Stormwater Management Standards requires that a minimum volume of runoff (Required Recharge Volume, Rv) be recharged on the site based on soils conditions in accordance with the following table:

	Class A Soils	Class B Soils	Class C Soils	Class D Soils
Runoff Depth (d) to be Recharged	d = 0.60 inches	d = 0.35 inches	d = 0.25 inches	d = 0.10 inches

The Required Recharge Volume is calculated by multiplying the runoff depth to be recharged (d) for each soils class by the amount of impervious coverage (on the site) under the proposed condition.

**STORMWATER INFILTRATION BASIN #1**

Recharge required (Rv)=(Impervious coverage)\*(depth to be recharged)

	Class A Soils	Class B Soils	Class C Soils	Class D Soils
On-Site Impervious Area	0 s.f.	9,310 s.f.	0 s.f.	0 s.f.
Required Recharge Volume (Rv)	0 c.f.	272 c.f.	0 c.f.	0 c.f.
Total Rv	272 c.f.			

Standard 3 requires that infiltration facilities be provided and sized in accordance with three acceptable methods; 1) the Static Method, 2) The Simple Dynamic Method, and 3) the Dynamic Field Method. Each method is summarized below.

Static Method: The Static Method simply requires that the proposed recharge facility contain a total raw volume (adjusted for void space if stone is used within the storage volume) equal to or greater than the Required Recharge Volume.

Simple Dynamic Method: The Simple Dynamic method allows for a very conservative inclusion of some of the recharge which occurs within the infiltration facility during the design storm in accordance with the following formula:

$$A' = Rv \div (D + kT)$$

$$V' = A \times D$$

Where

*A' is the minimum required bottom area*

*V' is the minimum required storage volume of the infiltration facility*

*Rv is the Required Recharge Volume*

*D is the depth of the infiltration facility (adjusted by the void space factor if the leaching facility is filled with stone)*

*K is the saturated hydraulic conductivity determined by the Rawls Rate (Table 2.3.3 of Volume 3, Chapter 1 of the Stormwater Handbook)*

*T is the allowable drawdown during the peak of the storm = 2 hours for this method*

This method allows the designer to include two hours of ongoing recharge during the design storm using a permeability rate (saturated hydraulic conductivity) selected based on the classification of the soil under the infiltration facility.

Dynamic Field Method: The Dynamic Field Method uses a more aggressive inclusion of on-going recharge from an infiltration facility during the design storm. This method is calculated using rainfall routing software (Hydrocad) and a truncated hydrograph which assumes that the Required Recharge Volume is loaded to the infiltration facility during a 12 hour period. For this method the design permeability rate must be based on in-situ permeability testing with a safety factor of 50% applied to the actual rate found.

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For this infiltration facility, the Static Method has been utilized. The Static Method simply requires that the infiltration facility's raw storage volume be at least equal to Rv. The proposed Infiltration Basin has a raw storage volume of approximately

1,150 cubic feet below the lowest outlet, which exceeds the required recharge volume and thus satisfies this requirement.

A secondary check is required to ensure that the Rv will recharge within at least 72 hours. The required WQV exceeds the Rv and is used for this calculation. A K value of 2.41 is used for drawdown design purposes since soils testing found loamy sand soils at this location. Using the following formula, the drawdown time is calculated:

$$\text{Time}_{\text{drawdown}} = [Rv / (K \times \text{Bottom Area})]$$

Where:

$$WQV = 388 \text{ c.f.}$$

$$K = 2.41 \text{ inches per hour} = 0.20 \text{ feet per hour}$$

$$\text{Bottom Area} = 1,345 \text{ s.f.}$$

It is concluded that the drawdown time for the infiltrated volume is 1.4 hours, which satisfies this requirement.

Mounding Analysis:

A mounding analysis has been conducted and can be found in attachment L. The bottom of Stormwater Basin #1 is at elevation 186.0, with a seasonal high groundwater elevation below the basin at 184.0. The mound s 0.54 feet and will not impact the basin bottom.

**STORMWATER INFILTRATION FIELD**

Recharge required (Rv)=(Impervious coverage)\*(depth to be recharged)

	Class A Soils	Class B Soils	Class C Soils	Class D Soils
On-Site Impervious Area	0 s.f.	15,023 s.f.	0 s.f.	0 s.f.
Required Recharge Volume (Rv)	0 c.f.	438 c.f.	0 c.f.	0 c.f.
Total Rv	438 c.f.			

Capture Area Adjustment: All new impervious surfaces are routed through infiltration BMPs except for a small portion of sidewalk at the front of the development. A capture area adjustment is provided as follows:

➤ Treated Impervious:	63,681 s.f.
➤ Untreated Impervious:	1,871 s.f.
➤ Percent to Infiltration BMP:	98.3%
➤ Ratio:	1.02
➤ <u>Capture Area Adjusted Rv:</u>	<u>446 c.f.</u>

For this infiltration facility, the Static Method has been utilized. The Static Method simply requires that the infiltration facility's raw storage volume be at least equal to Rv. The proposed Infiltration Field has a raw storage volume of approximately 825 cubic feet below the lowest outlet, which exceeds the required recharge volume and thus satisfies this requirement.

A secondary check is required to ensure that the Rv will recharge within at least 72 hours. The required WQV exceeds the Rv and is used for this calculation. A K value of 2.41 is used for drawdown design purposes since soils testing found loamy sand soils at this location. Using the following formula, the drawdown time is calculated:

$$\text{Time}_{\text{drawdown}} = [Rv / (K \times \text{Bottom Area})]$$

Where:

$$WQV = 637 \text{ c.f.}$$

$$K = 2.41 \text{ inches per hour} = 0.20 \text{ feet per hour}$$

$$\text{Bottom Area} = 2,364 \text{ s.f.} \times 40\% \text{ Voids} = 946 \text{ s.f.}$$

It is concluded that the drawdown time for the infiltrated volume is 3.4 hours, which satisfies this requirement.

#### Mounding Analysis:

A mounding analysis has been conducted and can be found in attachment L. The bottom of the field is at elevation 181.2, with a seasonal high groundwater elevation below the basin at 179.2. The mound is 0.85 feet and will not impact the field bottom.

## STORMWATER INFILTRATION BASINS #2-4

Recharge required (Rv)=(Impervious coverage)\*(depth to be recharged)

	Class A Soils	Class B Soils	Class C Soils	Class D Soils
On-Site Impervious Area	0 s.f.	37,712 s.f.	0 s.f.	0 s.f.
Required Recharge Volume (Rv)	0 c.f.	1,100 c.f.	0 c.f.	0 c.f.
Total Rv	1,100 c.f.			

For this infiltration facility, the Static Method has been utilized. The Static Method simply requires that the infiltration facility's raw storage volume be at least equal to Rv. The proposed Infiltration Basins have a cumulative raw storage volume of approximately 1,740 cubic feet below the lowest outlet, which exceeds the required recharge volume and thus satisfies this requirement.

A secondary check is required to ensure that the Rv will recharge within at least 72 hours. The required WQV exceeds the Rv and is used for this calculation. A K value of 2.41 is used for drawdown design purposes since soils testing found loamy sand soils at this location. Using the following formula, the drawdown time is calculated:

$$\text{Time}_{\text{drawdown}} = [Rv / (K \times \text{Bottom Area})]$$

Where:

$$WQV = 1,571 \text{ c.f.}$$

$$K = 2.41 \text{ inches per hour} = 0.20 \text{ feet per hour}$$

$$\text{Bottom Area} = 4,286 \text{ s.f.}$$

It is concluded that the drawdown time for the infiltrated volume is 1.8 hours, which satisfies this requirement.

### Mounding Analysis:

A mounding analysis has been conducted for each basin separately and can be found in attachment L. The bottom of Stormwater Basins #2-4 are each 2 feet or more above groundwater at their locations. The mounds are 0.52, 0.72, and 0.44 feet and will not impact the bottom of the basins.

## **STANDARD 4 - TSS Removal**

*Stormwater Management Systems shall be Designed to Remove 80% of Average Annual Post-Construction Load of Total Suspended Solids (TSS).* This standard is met when:

- a) A long-term pollution prevention plan is provided and implemented as required (refer to Attachment A),
- b) Structural stormwater BMP's are provided as required, and
- c) Pretreatment is provided as required.

The proposed stormwater management system has been designed to provide a series of Best Management Practices in accordance with the Stormwater Management Policy to remove the pollutants found in runoff as described below for each drainage sub-system.

### **WATER QUALITY VOLUME (WQV)**

The Water Quality Volume represents the volume of water which must receive TSS removal treatment in order to comply with Standard 4. The water quality volume is calculated based on either 0.5 inches of runoff or 1.0 inches of runoff from all impervious surfaces on the site. 0.5 inches is used except in sensitive locations as described in the Stormwater Handbook. Since this site does not discharge to a critical area, the WQV is based on 0.5 inches of runoff. The total WQV for the site is split amongst the various BMP treatment trains as described below (or may not apply if the specific BMP's utilized do not use it as a sizing criteria). Using the following formula, the WQV is calculated:

$$\begin{aligned} \text{WQV} &= (\text{Impervious Area}) * (0.5 \text{ in.}) \\ \text{WQV} &= (62,303 \text{ sq. ft.}) * (0.5 \text{ in.}) / (12 \text{ in./ft}) = 2,596 \text{ c.f.} \end{aligned}$$

Each basin was designed to treat the WQV attributed to it as shown in Standard 3 of this report.

### **PROPOSED BMP DESIGN**

#### **Deep Sump Catch basin**

All proposed deep sump catch basins have 4' sumps with hoods designed in accordance with the DEP Stormwater Handbook. Each structure represents one of the pretreatment BMP's in each treatment train and provides a 25% TSS removal credit.

### Sediment Forebay

In accordance with the DEP Handbook, a forebay is sized to hold 0.1" of runoff from its tributary impervious area.

For Stormwater Infiltration Basins #1 and #4, there is no non-rooftop impervious runoff, and therefore requires no pretreatment.

For Stormwater Infiltration Basin #2, the tributary (non-roof) impervious area is 7,817 s.f. and the minimum forebay volume is 66 cubic feet. With water trapped behind the 6" high checkdams, the designed forebays will contain 33 cubic feet each for a total of 66 cubic feet meeting the requirement.

For Stormwater Infiltration Basin #3, the tributary (non-roof) impervious area is 16,861 s.f. and the minimum forebay volume is 141 cubic feet. Runoff is directed to four locations in the basin, and the treatment volume has been split evenly between the four sediment forebays. With water trapped behind the 6" high checkdams, the designed forebays will each contain 36 cubic feet for a total of 144 cubic feet, meeting the requirement.

### Stormwater Infiltration Basin:

Stormwater pre-treatment is achieved by sediment forebays where needed (see Attachment E for TSS calculations). These pre-treatment facilities remove the required 25% TSS before water is discharged to the infiltration basin.

Infiltration Basin #1 and Infiltration Basins #2-4 have been designed with a simple concrete outlet headwall with a notch designed to control design storm conditions. The weir wall itself acts as the higher emergency overflow, which discharges towards the wetland via a level spreader.

### Underground Infiltration Field:

Stormwater pretreatment is handled by a deep catch basin, which removes the required 25% TSS before treatment.

The infiltration field consists of 84 Cultec C-100HD units, overflow from which is piped to a level spreader.

## **TSS REMOVAL CALCULATIONS**

In accordance with the DEP Stormwater Management Handbook, each of the drainage treatment trains has been analyzed for TSS removal. The required TSS

removal calculation sheets are included in Attachment E and the following sections provide a narrative discussion of each.

Infiltration Basin:

With the sediment forebay, the total pretreatment TSS removal prior to the infiltration basin is 25%. The infiltration basin provides 80% TSS removal when including one pretreatment device, for a total of 80% TSS removal.

Roof Runoff Infiltration Systems:

With the deep sump structure, the total pretreatment TSS removal prior to the infiltration basin is 25%. The infiltration field provides 80% TSS removal when including one pretreatment device, for a total of 80% TSS removal.

**STANDARD 5 - Land Uses with Higher Potential Pollutant Loads**

*For land uses with higher potential pollutant loads, source control and pollution prevention shall be implemented in accordance with the Massachusetts Stormwater Handbook to eliminate or reduce the discharge of stormwater runoff from such land uses to the maximum extent practicable. If, through source control and/or pollution prevention, all land uses with higher potential pollutant load cannot be completely protected from exposure to rain, snow, snow melt and stormwater runoff, the proponent shall use the specific structural stormwater BMP's determined by the Department to be suitable for such uses as provided in the Massachusetts Stormwater Handbook. Stormwater discharges from land uses with higher potential pollutant loads shall also comply with the requirements of the Massachusetts Clean Waters Act, M.G.L. c. 21, §§ 26-53 and the regulations promulgated thereunder at 314 CMR 3.00, 314 CMR 4.00 and 314 CMR 5.00.*

This development is not a Land Use with Higher Potential Pollutant Loads.

**STANDARD 6 – Critical Areas**

*Stormwater discharges within the Zone II or Interim Wellhead Protection Area of a public water supply and stormwater discharge near or to any other critical area requires the use of the specific source control and pollution prevention measures and the specific structural stormwater best management practices determined by the Department to be suitable for managing discharges to such area, as provided in the Massachusetts Stormwater Handbook. A discharge is near a critical area if there is a strong likelihood of a significant impact occurring to said area, taking into account site-specific factors. Stormwater discharges to Outstanding Resource Waters and Special Resource Waters shall be removed and set back from the receiving water or wetland and receive the highest and best practical method of treatment. A*

*“stormwater discharge” as defined in 314 CMR 3.04(2)(a)1 or (b) to an Outstanding Resource Water or Special Resource Water shall comply with 314 CMR 3.00 and 314 CMR 4.00. Stormwater discharges to a Zone 1 or Zone A are prohibited unless essential to the operation of the public water supply.*

This site does not lie within a Critical Area.

### **STANDARD 7 - Redevelopment**

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

The site is a partial redevelopment and therefore is required to meet these standards to the maximum extent practicable, however all standards are met anyway.

### **STANDARD 8 – Erosion Control**

*A plan to control construction-related impacts, including erosion, sedimentation, and other pollutant sources during construction and land disturbance activities (construction period erosion, sedimentation, and pollution prevention plan) shall be developed and implemented.*

A construction activity NPDES Stormwater Pollution Prevention Plan has been prepared and included as Attachment D.

### **STANDARD 9 – Long-Term Operations and Maintenance Plan**

*A Long-Term Operations and Maintenance (O&M) Plan shall be developed and implemented to ensure that stormwater management systems function as designed.*

A Drainage System Operations and Maintenance Plan has been prepared and included as Attachment A.

### **STANDARD 10 – Illicit Discharge Compliance**

*All illicit discharges to the stormwater management system are prohibited.*

See Attachment C for the Illicit Discharge Compliance Statement.

# **ATTACHMENT A: OPERATIONS AND MAINTENANCE PLAN**

# OPERATIONS & MAINTENANCE PLAN

FOR

## WILLIAM WALLACE VILLAGE

274 VILLAGE STREET

MEDWAY MA, 02053

### *PROPOSED RESIDENTIAL DEVELOPMENT*

JUNE 25, 2019

REVISED SEPTEMBER 4, 2019

REVISED OCTOBER 7, 2019

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# INTRODUCTION

This Operations and Maintenance Plan (hereinafter referred to "O&M Plan") is provided to ensure the long-term monitoring and maintenance of various components of the development's infrastructure. This O&M Plan includes the following provisions:

1. Stormwater System Operations and Maintenance
2. Integrated Pest Management Plan
3. Miscellaneous Provisions
4. Accidental Spill and Emergency Response Plan

The "Development" and the various components which are referenced in this O&M Plan are described on the site plan referenced below.

## Project Name

William Wallace Village

## Project Location

274 Village Street  
Medway MA, 02053

## Operator Name and Address

DTRT LLC  
P.O. Box 95  
Truro, MA 02666

## References

This O&M Plan references other documents as follows:

Site Plan - Plans entitled "William Wallace Village, Medway, MA Site Plan" with an original date of June 25, 2019 (as may be amended), and prepared by Legacy Engineering LLC, hereinafter referred to as the "Site Plan".

Stormwater Report - Report entitled "Stormwater Report for William Wallace Village, 274 Village Street, Medway, MA 02053" prepared by Legacy Engineering LLC with an original date of June 25, 2019 (as may be amended).

## Site Description

The site consists of seven proposed two-family residential buildings located on 3.63 acres of land on Village Street in Medway and includes all appurtenant driveways, utility systems, landscape areas, and stormwater management systems. Those land areas are collectively referred to herein as the "Development."

## Site Usage and Activities

Multi-family residential buildings and associated appurtenances.

# **PART 1: STORMWATER SYSTEM OPERATIONS AND MAINTENANCE**

In order to maximize the continued effectiveness of the Stormwater Management BMP's for the development, the following Operation and Maintenance requirements apply to all stormwater facilities within the extents of the Development. The stormwater facilities are depicted on the Site Plan and are hereinafter referred to as the "Stormwater Facilities."

## **Operations and Maintenance Responsibilities**

The Operator or its designee shall be responsible for implementing all Operations and Maintenance (O&M) responsibilities.

## **Commencement of Operations and Maintenance Responsibilities**

Operations and Maintenance tasks shall be commenced once each respective Stormwater Facility is fully constructed and is receiving runoff from the Development.

## **Operations and Maintenance Tasks**

### *Deep Sump Catch Basins:*

1. Deep sump catch basins shall be inspected daily during construction activities and all sediments and debris shall be removed four times per year unless the owner can determine through recorded observations that sediment accumulation does not warrant such frequent cleanings. If deep sump structure cleaning occurs less than four times per year, cleaning shall occur when two feet of sediments have accumulated in the sump and at least once per year.
2. Silt sacks shall be installed on all catch basins in and around the development throughout the time of construction.
3. All sediments and hydrocarbons shall be disposed of off-site in accordance with all applicable local, state, and federal regulations.

### *Sediment Forebays:*

1. Sediment forebays shall be inspected at least four times per year to insure proper operation (during a storm event).
2. Sediment forebays should be mowed and all clippings and debris removed at least twice per year. Debris shall be removed at more frequent intervals if warranted by extreme weather events.
3. Sediment should be removed when 3-inches of sediment accumulates anywhere in the forebay.
4. Remove woody vegetation, leaves, and other materials that would affect the life of the system or its operations.

Stormwater Infiltration Basin:

1. Stormwater basins shall be inspected at least twice per year to insure proper operation (during a storm event).
2. Inspections shall include ensuring that inlet, outlet, and splash pad rip-rap aprons are in good condition and that that interior wall systems are in good condition. Deficiencies shall be remedied immediately.
3. Inspections shall include an observation of the accumulation of sediment in the basin. Pretreatment BMPs are intended to capture and contain coarse sediments. Should indication of significant accumulation of sediments in the infiltration basin be observed, increased frequency of cleaning of the preceding sediment forebay and catch basins shall be implemented.
4. Inspections shall include ensuring that outlet structures are unobstructed and free-flowing per the Site Plan design specifications.
5. Inspections shall include ensuring that all berms are fully stabilized, structurally sound and not eroded. Deficiencies shall be remedied immediately.
6. Stormwater basins should be mowed and all clippings and debris removed at least twice per year. Debris shall be removed at more frequent intervals if warranted by extreme weather events. If wetland vegetation grows at the bottom of the stormwater basin, it shall only be mowed once per year at the beginning of the winter season.
7. Sediment should be removed at least once every 5 years or when 2-inches of sediment accumulates anywhere in the basin and disposed of off-site in accordance with all applicable local, state, and federal regulations. Two sedimentation markers shall be installed in the basin by a Registered Land Surveyors with a clear marking of the 2-inch accumulation line. It is recommended that stone bounds be installed with chiseled marks indicating the limit of accumulation, although other similarly permanent marking methods may be utilized.

Underground Infiltration Field:

1. Perform all pretreatment BMP maintenance, structural and non-structural, as required herein.
2. Inspect the infiltration field at least twice per year, approximately 2-4 days after a rainfall event to ensure that water is not still in the field (as it should have infiltrated into underlying soils by then). Should the infiltration field fail to infiltrate water sufficiently, the field system shall be excavated and replaced in accordance with the original design.

Stormwater Pipes, Inlets and Outfalls:

1. All stormwater inlets and outfalls shall be inspected twice per year.
2. Trash, leaves, debris and sediment shall be removed from inlets and outfalls as needed to keep them free flowing.
3. If inspections indicate that stormwater pipelines have become partially obstructed with trash, leaves, debris or sediment, the pipelines shall be cleaned by water jet truck and the obstructions removed and disposed of.

The various operations and maintenance schedule requirements listed above may be reduced in frequency by approval from the Town. Should such permission be desired,

the Operator shall provide documentation of actual on-site maintenance observations by a qualified source (engineer or other qualified person meeting the approval of the Town) demonstrating that the particular Stormwater BMP in question does not warrant the specified frequency of inspection or maintenance activities.

## **Reporting Requirements**

The following documentation shall be submitted no later than December 31<sup>st</sup> of each calendar year to the Town:

1. A statement, signed by an authorized representative of the Operator indicating that the requirements of this O&M Plan were performed during the previous calendar year. Where requirements were not met, a schedule for their completion shall be provided and a follow-up statement submitted when complete.
2. A list of the maintenance activities performed along with the approximate date of the work.
3. A list of the inspections performed along with a statement by each inspector summarizing the results of the inspections performed in accordance with this O&M plan.
4. Copies of appurtenant documentation supporting the completion of the O&M responsibilities such as copies of contracts and/or receipts with parties engaged to perform maintenance and inspection services.
5. A notation regarding whether there has been any change in the name and or contact information for the Operator.

## **Public Safety Features**

The stormwater system has been designed to safely collect surface runoff from developed areas (as described on the Site Plan and Stormwater Report) by providing collections systems at regular intervals to prevent surface flooding and to treat that runoff in accordance with the provisions of the Massachusetts Stormwater Management Standards and Handbook.

## **PART 2: INTEGRATED PEST MANAGEMENT PLAN**

### **Applicability**

The Development shall adhere to this IPM in perpetuity, unless the conservation Commission releases the Operator from this obligation in writing.

### **Lawn Preparation and Installation**

The following methods shall be employed for all lawn installation and replacements.

- Topsoil installed in lawn areas shall be installed to a minimum thickness of 4-inches. Installation shall be in a manner that minimizes compaction of the topsoil. Topsoil should include a minimum organic content of 18% in the top 4-inches. In areas where existing topsoil is limited or non-existent due to bedrock or hardpan, 6-24 inches of sandy loam topsoil should be spread with a minimum 18% organic content in the top 6-inches.
- Topsoil shall be tested for pH, organic content and mineral content including calcium, magnesium, potassium and sodium at the time of installation and supplements shall be added as recommended. Lime shall be added at the rates recommended by the soil test lab to bring topsoil pH within recommended levels.
- Seeding shall include at least three of the following turf types: Fine Fescue, Kentucky Bluegrass, Perennial Rye Grass, and Tall Fescue.
- Fertilizer application at the time of seeding shall not exceed 0.5 pounds per 1,000 square feet and shall be either organic or mineral. Fertilizer shall be slow release, organic, and low in phosphorous in the 100' wetland buffer.
- During the period of turf establishment (1-2 seasons after seeding), up to two broadleaf weed control applications per year may be applied to the entire lawn area to encourage the establishment of the turf and prevent weed infestations.

### **Mechanical Lawn Care Standards**

The following maintenance guidelines shall be generally applied to lawn care, although specific adherence to every standard is not necessary. Adherence to these mechanical lawn care standards will encourage the development of a thick, dense, and healthy turf system which will ultimately result in fewer Lawn Care Treatment requirements.

- Lawn cutting height should be adjusted according to the season using the following as guidance:
  - May – June: 2.5" Cut Height
  - July – August: 3-3.5" Cut Height
  - September: 2.5-3" Cut Height
  - October – November: 2" Cut Height
- Lawn mowing should be at sufficient frequency such that not more than 1/3 of the leaf blade height is cut off.
- Aerate the lawn generally once per year in the mid-summer to mid-fall period. A second aeration in the spring may be appropriate for compact soils conditions.
- Dethatching is generally not necessary unless the thatch layer exceed ¾".

## Core Lawn Care Treatment Program

Each lawn shall adhere to the following lawn care practices and restrictions:

- A soil test shall be conducted at least once every two years to evaluate topsoil pH level and the necessary application of lime will be made to bring soil pH within recommended levels. Recommended topsoil pH levels are between 6.5 and 6.8. Soils testing shall also include organic content, mineral content, including calcium, magnesium, potassium and sodium, total cation exchange capacity, and hydrogen. Ideal base saturation percentages for these parameters are as follows:
  - Calcium: 68-70%
  - Magnesium: 15-20%
  - Potassium: 4.5-6%
  - Sodium: <3%
  - Other Bases: 4-8%
  - Hydrogen: 5-10%
- Fertilizer application shall be as-needed based on the results of the latest soils test, plant health, rooting characteristics, growth rate desired, and season. Fertilizer application shall not exceed five times per calendar year and the total quantity of fertilizer applied in any given year shall not result in the application of more than three pounds of nitrogen per 1,000 square feet with not more than one pound of nitrogen applied per 1,000 square feet in any single application. Nitrogen, in the form of fertilizer, should generally be applied in small increments to avoid nitrate leachate and runoff, undesired sprits in growth, and increase in pest population. Granular organic and/or organic/synthetic slow release fertilizers shall be used. The optimal use of fertilizers is to create an organic foundation for soil health and development which provides sufficient nutrients for controlled plant growth and avoiding subsurface and surface nutrient loss to groundwater or stormwater runoff. Fertilizer shall be slow release, organic, and low in phosphorous in the 100' wetland buffer.
- Except as noted below, only one application of crab-grass prevention product is permitted per year during March or April, and only in portions of the lawn in full sun which are prone to such infestations. The use of corn gluton (organic crab-grass control method) is permitted twice per year.
- At the time of fertilizer application, any accidental spillage onto impervious surfaces such as driveways, walkways, patios, and streets shall be swept up and either applied to the lawn or removed from the site.

## Optional Maintenance Practices to be Applied as Needed

- Where topsoil testing demonstrates a deficiency, mineral or organic micro-nutrients may be added to achieve recommended levels.
- Generally, chemical pesticides should be used as a final option and the minimum amount necessary to achieve the desired result should be used. Non chemical means of pest control should be tried first. In the event of suspected pest problem, a visual inspection shall first be made by qualified personnel to confirm the presence of stressed vegetation, wildlife activity, pathogens, and other similar indicators. Should a pest problem be identified, the condition shall be monitored periodically such that if the problem subsides, treatment methods can stop as soon as possible thereafter.
- Root bio-stimulants from organic sources (examples include Roots, Organica, or PHC type products, which are brand names and which may change depending on market conditions) may be used as needed.

- Compost topdressing (1/8" – 1/4" depth) may be applied as needed.
- Spot treatment of weeds and Crabgrass may be implemented at any time as needed, but only on a spot-treatment basis and only to those areas affected.
- Spot treatment for turf disease may be implemented at any time as needed, but only on a spot-treatment basis and only to those areas affected.
- Grub control products and similar products may be applied to localized areas only where grub activity is evident. Grub control may be applied when grub populations reach an average of 8 -10 grubs per square foot or if the plant/lawns are showing signs of stress from grub activity.
- One application of Imidacloprid (Merit) or similar products per year is permitted during June and July in areas where grub activity has historically occurred.
- Pesticides which are classified for Restricted Use pursuant to 333 CMR may only be applied by properly licensed or certified personnel or by individuals under the direct on-site supervision of properly licensed or certified personnel in accordance with 333 CMR.

## **PART 3: MISCELLANEOUS PROVISIONS**

### **Good Housekeeping Controls**

The following good housekeeping measures will be implemented in the day-to-day operation of the Development:

1. The site will be maintained in a neat and orderly manner.
2. Fertilizers and pesticide application on the lots shall be in accordance with this plan.
3. All hydrants and gate valves on site will be exercised at least once per year.

### **Management of Deicing Chemicals and Snow**

Management of on-site snow will be as follows:

1. The site shall be plowed as needed to maintain safe driving conditions. Snow will be stored in windrows along pavement edges and shall be piled in landscape strips as needed.
2. Snow will not be plowed into piles which block or obstruct stormwater management facilities.
3. Snow will not be plowed into piles at roadway intersections such that it would obstruct visibility for entering or exiting vehicles.
4. Deicing chemicals application will be as little as possible while provide a safe environment for vehicular operation and function.
5. Deicing chemicals in shall be limited to sand, sodium chloride or calcium chloride.
6. Snow is not to be stored where runoff will flow directly to the wetlands.

### **Operator Training**

The Operator is responsible for providing training for the staff that will be responsible for the implementation of this O&M Plan. Such training shall occur at least once annually.

### **Illicit Discharges**

The Operator shall not allow non-stormwater discharges into the development's stormwater system. Any discovered non-stormwater discharges into the development's stormwater system shall be immediately disconnected.

### **Estimated Operations and Maintenance Budget**

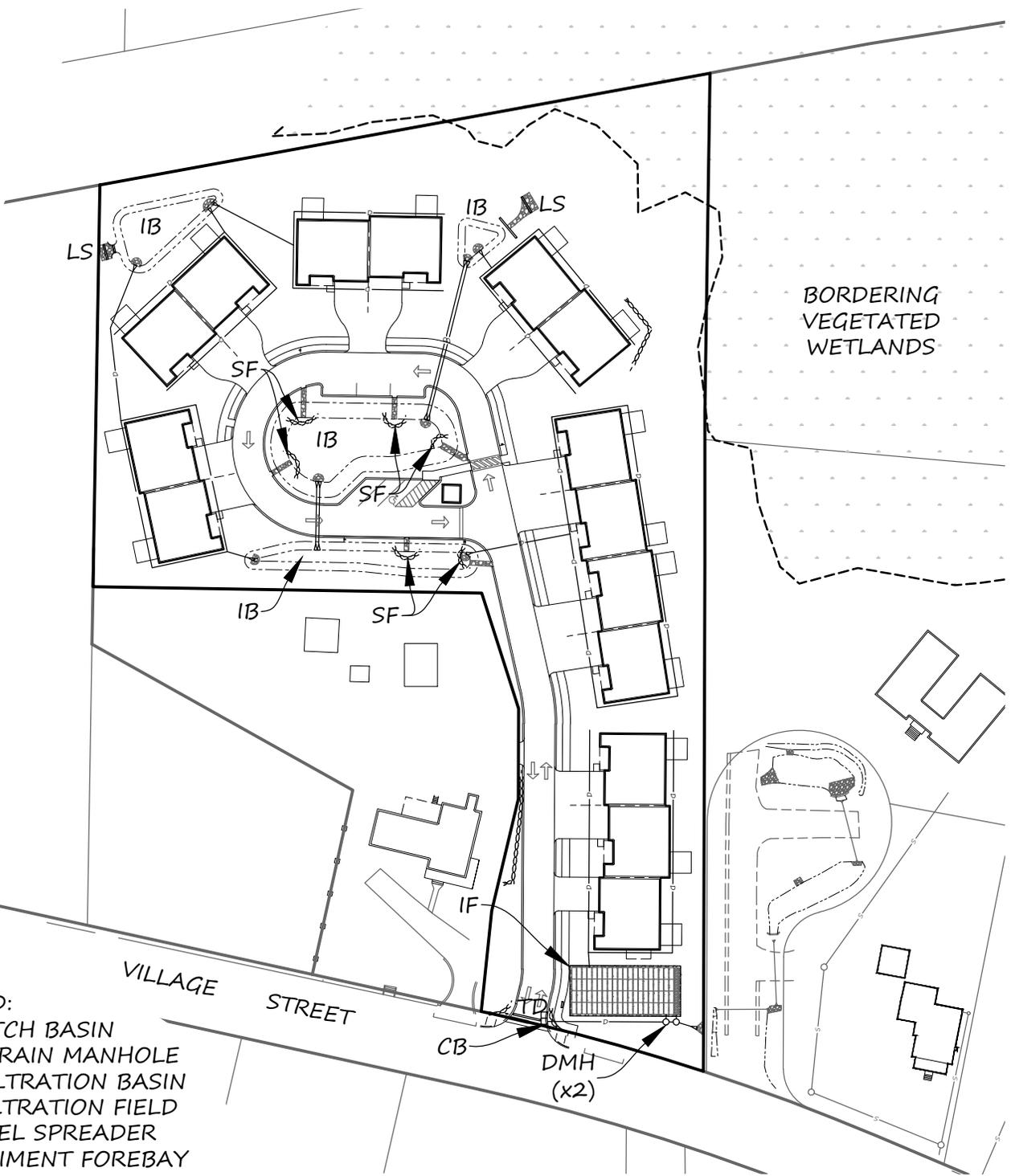
It is estimated that the regular annual maintenance tasks described herein will cost \$1,000 per year (2019 value).

## **PART 4: ACCIDENTAL SPILL AND EMERGENCY RESPONSE PLAN**

In the event of an accident within the boundaries of the Site, where significant gasoline or other petroleum products or other hazardous materials are released, the following procedure shall be followed in the order noted.

1. As quickly as possible, attempt to block the nearest stormwater catch basins if on a roadway, or if in proximity to wetlands, create a berm of soil downslope of the spill.
2. Immediately, and while the containment measures are implemented as described above, notify the following governmental entities and inform them of the type of spill that occurred:
  - Medway Fire Department at 911,
  - Medway Board of Health at 508-533-3206,
  - Medway Conservation Commission at 508-533-3292,
  - Mass. Department of Environmental Protection (DEP) Central Region at (508) 792-7650 (address is 8 New Bond Street, Worcester, MA 01606), and
  - National Response Center (NRC) at (800) 424-8802 (for spills that require such notification pursuant to 40 CFR Part 110, 40 CFR Part 117, and 40 CR Part 302).
3. Once the various emergency response teams have arrived at the site and if the spill occurs on a lot, the owner shall follow the instructions of the various governmental entities, which may include the following:
  - A clean up firm may need to be immediately contacted.
  - If the hazardous materials have entered the stormwater system, portions of it may need to be cleaned and restored per the DEP. All such activities shall be as specified by the DEP.

# **EXHIBIT 1 STORMWATER FACILITIES SITE PLAN**



**LEGEND:**  
 CB=CATCH BASIN  
 DMH=DRAIN MANHOLE  
 IB=INFILTRATION BASIN  
 IF=INFILTRATION FIELD  
 LS=LEVEL SPREADER  
 SF=SEDIMENT FOREBAY  
 TD=TRENCH DRAIN

730 MAIN STREET  
 SUITE 2C  
 MILLIS, MA 02054  
 508-376-8883(o)

SHEET 1 OF 1



**LEGACY**  
 ENGINEERING

WILLIAM WALLACE  
 VILLAGE  
 O&M  
 PLAN OF LAND  
 IN MEDWAY, MA

PLAN DATE: 6/25/19

PLAN SCALE: 1"=100'

REVISION	DATE
REV. TOWN COMMENTS	9/4/19
REV. TOWN COMMENTS	10/7/19

**EXHIBIT 2** STORMWATER  
SYSTEM OPERATIONS AND  
MAINTENANCE LOG FORM

# Stormwater System Operations and Maintenance Log

Year \_\_\_\_\_

General Information	
Project Name	274 Village Street
Site Location	274 Village Street, Medway Ma, 02053
Inspector's Name	
Inspector's Title	
Inspector's Phone	
Signature of Operator at end of Year, Certifying that Work was Completed as Noted. Date:	

## O&M Task Checklist

	O&M Activity	Date Completed	Notes/Comments
Deep Sump Catch Basins			
	1 <sup>st</sup> Quarter Cleanout		
	2 <sup>nd</sup> Quarter Cleanout		
	3 <sup>rd</sup> Quarter Cleanout		
	4 <sup>th</sup> Quarter Cleanout		
Sediment Forebay			
	1 <sup>st</sup> Annual Inspection		
	2 <sup>nd</sup> Annual Inspection		
	3 <sup>rd</sup> Annual Inspection		
	4 <sup>th</sup> Annual Inspection		
	1 <sup>st</sup> Annual Mowing		
	2 <sup>nd</sup> Annual Mowing		
	Sediment Rem. Req'd?		
Stormwater Infiltration Basin			
	1 <sup>st</sup> Annual Inspection		
	2 <sup>nd</sup> Annual Inspection		
	1 <sup>st</sup> Annual Mowing		

	O&M Activity	Date Completed	Notes/Comments
	2 <sup>nd</sup> Annual Mowing		
	Sediment Rem. Req'd?		
Infiltration Field			
	1 <sup>st</sup> Annual Inspection		
	2 <sup>nd</sup> Annual inspection		
	System Repl. Req'd?		
Stormwater Pipes, Inlets and Outlets			
	1 <sup>st</sup> Annual Inspection		
	2 <sup>nd</sup> Annual inspection		

## **ATTACHMENT B: USGS MAP**



**ATTACHMENT C: ILLICIT DISCHARGE  
COMPLIANCE STATEMENT**

# ILLICIT DISCHARGE COMPLIANCE STATEMENT

**William Wallace Village  
274 Village Street  
Medway, MA**

This statement is provided in accordance with the provisions of the Massachusetts Stormwater Management Standard 10 and of the Massachusetts Stormwater Management Handbook.

Note the following:

- All stormwater management systems contain no connection to the site's wastewater sewer system or to any other non-stormwater collection system.
- Groundwater collection systems on the site are not connected to the site's wastewater sewer system or to any other non-stormwater collection system.
- The facility's Operations & Maintenance Plan is designed to prevent any discharge of non-stormwater to the drainage system.
- Any illicit discharges identified during or after construction will be immediately disconnected.

Date: June 25, 2019

**ATTACHMENT D: CONSTRUCTION  
ACTIVITY NPDES STORMWATER POLLUTION  
PREVENTION PLAN**

STORMWATER POLLUTION PREVENTION  
PLAN (SWPPP)

FOR A

*CONSTRUCTION ACTIVITY*

FOR

***WILLIAM WALLACE VILLAGE***

274 VILLAGE STREET

MEDWAY MA, 02053

*PROPOSED RESIDENTIAL DEVELOPMENT*

JUNE 25, 2019

REVISED SEPTEMBER 4, 2019

REVISED OCTOBER 7, 2019

PREPARED BY:

LEGACY ENGINEERING LLC

CONSULTING ENGINEERS

730 MAIN STREET, SUITE 2C

MILLIS, MA 02054

PREPARED FOR:

DTRT LLC

P.O. Box 95

TRURO, MA 02666

VOLUME 1 OF 1

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## 274 VILLAGE STREET SWPPP

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## 1.0 PROJECT DESCRIPTION AND ELIGIBILITY

This SWPPP is prepared in accordance with the requirements of the National Pollutant Discharge Elimination System (NPDES) 2017 Construction General Permit (CGP) for Discharges from Construction Activities, pursuant to the provisions of the Clean Water Act as amended by the Water Quality Act of 1987. The 2017 CGP became effective on February 16, 2017 and expires at midnight on February 16, 2022.

This SWPPP provides project-specific guidance and requirements for the proposed construction activity. Operators are, however, responsible to read, understand, and comply with all applicable requirements of the CGP, which is appended to this SWPPP.

### 1.1 Project Name

William Wallace Village

### 1.2 Project Location

274 Village Street  
Medway, MA 02053

### 1.3 Owner Name and Address

DTRT LLC  
P.O. Box 95  
Truro, MA 02666

### 1.4 General Contractor/Operator Name and Address

Owner Operator:

DTRT LLC  
P.O. Box 95  
Truro, MA 02666

The DTRC LLC has full control of plans and specifications. The site contractor, who will have day-to-day operational control and responsibility, will file a separate NPDES Notice of Intent.

Designation of Site Manager and Emergency Contact (person responsible for the day-to-day management of site operations): Larry Rucki (or other individual as may be appointed by the Operator).

General Contractor/Operator:

(to be determined)

\_\_\_\_\_ will have day-to-day operational control and responsibility of construction activities.

Designation of Site Manager (person responsible for the day-to-day management of site operations): (to be determined) or other individual as may be appointed by the Operator.

## 1.5 Stormwater Team

The stormwater team is identified in Appendix 10.5.

## 1.6 Associated Project Documents

This SWPPP references other documents as follows:

Site Plan - Plans entitled "274 Village Street Medway, MA Site Plan" with an original date of May 13, 2019 (as may be amended), and prepared by Legacy Engineering, LLC, hereinafter referred to as the "Site Plan".

Stormwater Report - Report entitled "Stormwater Report for 274 Village Street, Medway MA 02053" prepared by Legacy Engineering, LLC with an original date of May 13, 2019 (as may be amended).

## 1.7 SWPPP Site Plan and Relation to Other Permits

Attached to this document is a SWPPP Site Plan which summarizes the various structural construction erosion control measures to be implemented during construction. Refer to the Site Plan for additional details and requirements. In the event that provisions of this SWPPP conflict with the requirements of the other permits obtained for the project, the requirements of the other permits will prevail unless such conformance will violate the provisions of the CGP. When such conflict is discovered, this SWPPP will be revised to reflect conformance with said permit.

## 1.8 Nature of Construction Activities

1. The proposed construction consists of 4 two-family dwellings and two multi-family dwellings for a total of 15 new dwelling units. The existing house and gym will be demolished to make way for these new dwellings. Construction also includes all appurtenant driveways, utilities, and stormwater management systems.
2. The total lot area of the development is approximately 3.63 acres, with approximately 1.8 acres previously disturbed.
3. The site is developed with a single-family dwelling to the rear of the property, and a building used as a gym toward the front of the property. Multiple concrete pads can be found across the site and are surrounded by woodlands. The land in the northeasterly corner of the lot consists of wetlands along an unnamed tributary to the Charles River.
4. The proposed construction activities will disturb approximately 3.0 acres in a single phase.
5. The only on-site construction support activities consist of minor areas of materials storage, which will vary in nature and location depending on the stage of construction.
6. Refer to Section 1.10 and Appendix 7.12 for a discussion of construction sequencing and schedule.
7. Refer to Attachment 10.10 for a list of pollutant generating activities, including materials inventories.
8. Construction activities are expected to occur Mondays through Saturday, 7:00 am through 6:00 pm.
9. This SWPPP is not for a public emergency.

## 1.9 Overall Phasing

The project will be constructed in one phase, which is expected to commence in the fall of 2019 and to be completed by the fall of 2020.

## 1.10 Major Activity Construction Sequence

### 1.10.1 Construction Sequence

- ✓ Install construction entrance and perimeter erosion controls;
- ✓ Locate existing utilities on and around the construction area;
- ✓ Demolish the existing buildings and appurtenances;
- ✓ Clear and grub the development area;
- ✓ Install temporary stormwater basin;
- ✓ Grade the site;
- ✓ Construct the stormwater basins;
- ✓ Install utilities and begin road construction;
- ✓ Install building foundation(s) for all units except units 8 & 9 and begin building construction;
- ✓ Complete building construction and begin landscaping
- ✓ Construct units 8 & 9
- ✓ Finish landscaping and pavement top coat;
- ✓ Ensure that all stormwater facilities are cleaned out and operate as intended.

## 1.11 Anticipated Discharges

The following discharges as authorized in the CGP are expected from the proposed construction and associated activities:

- ✓ Stormwater discharges associated with the proposed construction activity.
- ✓ Stormwater discharges from supporting activities such as equipment staging yards, material storage areas, excavated materials disposal areas, etc... directly related to the above noted construction activity.
- ✓ The following non-stormwater discharges, which are directly associated with the proposed large construction activity:
  - Fire hydrant flushing,
  - Waters used to wash vehicles when detergents are not used,
  - Water used to control dust in accordance with Part 3.1.B of the CGP,
  - Potable water including uncontaminated water line flushings,
  - Routine external building wash down that does not use detergents,
  - Pavement wash waters where detergents, spills or leaks of toxic or hazardous materials have not occurred (unless all spilled material has been removed). Such wash waters may only be discharged to a surface water if it will first pass through a stormwater treatment BMP,
  - Uncontaminated air conditioning or compressor condensate,
  - Uncontaminated, non-turbid ground water or spring water,
  - Uncontaminated foundation or footing drains,
  - Treated dewatering water;
  - Landscape irrigation, and
  - Any other non-stormwater discharges otherwise allowed in the CGP

### 1.12 Anticipated Construction and Waste Materials

It is anticipated that the following materials will be present on the site during construction:

- ✓ Earthen materials such as dirt, gravel, crushed stone, loam, sand, fill, and other such substances.
- ✓ Asphalt and paving related materials.
- ✓ Utility piping, manholes, structures, and relative materials.
- ✓ Building materials typically involved in the construction of a residential building.
- ✓ Other typical construction materials.
- ✓ All such materials which are deemed potential pollutants shall be itemized in the log in Appendix 7.10. Potential pollutants include pesticides, fertilizers, plaster, cleaning solvents, glue/adhesives, curing compounds, wood preservatives, hydraulic oil/fluids, gasoline/diesel fuel, kerosene, antifreeze/coolant, sanitary facilities and other similar items.

Waste materials are expected to be limited to excess or discarded portions of the construction materials noted above.

### 1.13 Project Eligibility

The proposed construction activity is eligible to be permitted under the Construction General Permit for Massachusetts (CGP Permit No. MAR1200000) as the proposed activity will be completed in accordance with all requirements of the CGP.

The proposed construction activity is eligible to be permitted under the Construction General Permit for Massachusetts (CGP Permit No. MAR1200000) for the following reasons:

- ✓ The site will discharge construction-stage stormwater to be covered under the CGP.
- ✓ The parties listed are “operators” as defined in the CGP.
- ✓ The proposed work will disturb more than one acre of land.
- ✓ The EPA is the permitting authority for Massachusetts.
- ✓ As described in 1.9.1, the project meets one of the criteria related to the protection of species that are federally listed as endangered or threatened.
- ✓ The screening process related to the protection of historic properties has or will be completed.
- ✓ The site does not discharge to a Tier 2 water.
- ✓ No cationic treatment chemicals are proposed for use in sediment control.

#### 1.13.1 Endangered Species

The proposed work is not likely to adversely affect ESA-listed species and/or designated critical habitats. Per the most recent NHESP data found on MassGIS, the site does not lie within, nor will it affect an area containing endangered species. Information from the U.S. Fish & Wildlife Service IPaC website indicates that the site may potentially affect one endangered species, the northern long-eared bat. We have therefore conducted a review and concluded the following:

- Per IPaC data, the site does not lie within a critical habitat for said species.
- NHESP mapping data indicates that this site is not a habitat area for said species.

- Stormwater discharges will be managed in accordance with applicable requirements and will therefore not represent a hydrological or toxicity threat to the species of concern.

It is therefore concluded that the activity is not likely to adversely affect an ESA-listed species and/or designated critical habitat.

### 1.13.2 Historic Properties

The proposed activity involves excavation for the installation of various stormwater management BMPs. To the best of our knowledge the site is not considered to be historically significant. There are no site features that suggest historical significance and the site is not listed on the National Register of Historic Places. Consequently, the proposed construction activity meets Appendix E of the CGP.

### **1.14 Coverage Dates**

Coverage under the 2017 CGP terminates at the earliest of the following:

- ✓ The date a Notice of Termination is submitted to the EPA;
- ✓ Expiration of the 2017 CGP on February 16, 2022 (unless the CGP is temporarily extended or the subsequent replacement CGP automatically authorizes continuing coverage)
- ✓ In the event the construction activity extends beyond the termination date of the 2017 CGP, the Operator will be responsible for complying with the subsequent replacement CGP, including any applicability eligibility requirements.

### **1.15 Receiving Waters**

Stormwater Runoff from the entire site will discharge to an unnamed tributary to the Charles River.

#### 1.15.1 Impaired Waters

In accordance with Section 3.2 of the CGP, the following analysis is provided with respect to Impaired Waters:

- The unnamed tributary is not listed in the Massachusetts Year 2016 Integrated List of Waters.
- Section 3.2 of the CGP therefore does apply to this site. As such, inspection frequencies need not comply with section 4.3 of the CGP and stabilization completion deadlines comply with relevant portions of section 2.2.14 of the CGP.

#### 1.15.2 Tier 2, 2.5 and 3 Waters

In accordance with Section 3.2 of the CGP, the following analysis is provided with respect to Tier 2, Tier 2.5, and Tier 3 waters.

- Tier 2 waters in Massachusetts are those waters designated as "High Quality Waters" on 314 CMR 4's associated watershed tables.
- Tier 2.5 waters in Massachusetts are those waters designated as Outstanding Resource Waters on the aforementioned watershed tables.
- To the best of our knowledge, there are no separate Tier 3 waters in Massachusetts.

- The unnamed tributary is not identified as a High Quality Water on the tables appended to 314 CMR 4.

### 1.15.3 TMDL Compliance

As of the date of this report, a review of the EPA's TMDL website (<http://cfpub.epa.gov/npdes/stormwater/tmdl.cfm>) concludes that there are TMDL's that apply to the town where this project is located. A summary of each and its relationship to the proposed construction activity are discussed below.

#### *Northeast Regional Mercury Total Maximum Daily Load:*

This TMDL is not exclusive to Massachusetts but rather applies to all of New England. It provides for a reduction in mercury concentrations within surface water bodies. The primary sources of mercury are wastewater (sewer) and atmospheric deposition. Page 27 of the October 24, 2007 "Northeast Regional Mercury Total Maximum Daily Load" report states "Because the majority of mercury in stormwater originates from atmospheric deposition, reductions of mercury loading in stormwater will be addressed through controls on atmospheric deposition." It is therefore concluded that this project is not required to implement any specific measure to comply with this TMDL.

#### *Nutrient (Phosphorus) TMDL for the Upper/Middle Charles River:*

This TMDL provides for a reduction in phosphorus discharges into the Charles River to reduce warm-weather eutrophication that regularly occurs. A review of the MassDEP implementation plan is available for this TMDL concludes that there are no specific numeric limitations or requirements for individual construction or development projects. Rather, the focus of the proposed implementation plan is in requiring additional regulation by local communities to control and reduce phosphorus generation. The primary impact of a project of this nature relative to phosphorus generation is stormwater generation. The Final TMDL recommends that local communities adopt stormwater management regulations/bylaws to ensure adequate treatment of stormwater runoff, thus reducing phosphorus loadings. The Town has implemented such regulations and this project is designed to be consistent with the local stormwater regulations, the DEP Stormwater Management Handbook, and the NPDES Construction General Permit. The Final TMDL also highly recommends a few specific BMP's for phosphorus reduction. One such approach is the use of infiltration facilities, which are highly effective at removing phosphorus as the phosphorus is almost eliminated through vegetation and soils contact as the water infiltrates downward. Data within the TMDL indicates that infiltration facilities designed to hold 1.0 inches of runoff from impervious surfaces, will remove more than 80% of the total annual phosphorus load from the site. Runoff from the site's impervious areas are routed to infiltration facilities designed to accommodate a minimum of 1-inches of runoff. Another focus of the Final TMDL is the elimination of illicit discharges, of which there are none within this project. It is therefore concluded that the proposed site design is consistent with the Nutrient TMDL for the Upper Charles River.

### Nutrient (Phosphorus) TMDL for the Lower Charles River:

This TMDL is essentially the same as noted above for the Upper Charles River. For the same reasons as discussed above, it is therefore concluded that the proposed site design is consistent with the Nutrient TMDL for the Lower Charles River.

### Pathogen TMDL for the Charles River Watershed:

This TMDL provides for reduction in pathogen concentrations in the Charles River watershed's impaired waterbody segments. A review of the EPA TMDL approval dated May 22, 2007 finds a reference to the requirement that projects of this nature implement stormwater BMP's consistent with the NPDES and other applicable regulations. The DEP has issued an implementation guide for this TMDL entitled "Mitigation Measures to Address Pathogen Pollution in Surface Water: A TMDL Implementation Guidance Manual for Massachusetts," which is the basis for the TMDL compliance assessment for this project. Pathogen sources within the Charles River watershed are numerous but many have no specific relation to this project such as combined-sewer overflows (CSO's), agricultural sources, and septic systems. For this project, the only significant potential source of pathogens is stormwater runoff. Stormwater runoff itself is not a source of pathogens. Rather, increases in the peak rate and volume of runoff from a site contribute to a potential increase in the amount of animal waste and other pathogen sources that can be washed into a waterbody. The DEP implementation guides reference the need for local communities to adopt local bylaws and regulations regulating stormwater runoff from both construction activities and post-construction site conditions. The Town has these regulations and the project has been designed accordingly. The DEP implementation guide also notes that infiltration facilities are perhaps the most effective pathogen removal BMP as the pathogens are removed through vegetation contact and by movement through the soil matrix. It is therefore concluded that the project is consistent with the TMDL for pathogens.

### **1.16 Site Notice & SWPPP Accessibility**

A notice will be posted conspicuously near the main entrance of the site adjacent to a public road or right-of-way. It will denote the following:

1. That this site is permitted under the NPDES Construction General Permit No. MAR1200000 and shall include the NPDES Permit tracking number.
2. A contact name and phone number for obtaining additional site information.
3. A URL where the SWPPP is posted or the following statement "If you would like to obtain a copy of the Stormwater Pollution Prevention Plan (SWPPP) for this site, contact the EPA Regional Office at <https://www.epa.gov/aboutepa/epa-region-1-new-england>.
4. The following statement "If you observe indicators of stormwater pollutants in the discharge or in the receiving waterbody, contact the EPA through the following website: <https://www.epa.gov/enforcement/report-environmental-violations>.

The site notice must use fonts large enough to be readily viewed from the adjacent public right-of-way.

This Plan will be kept on-site at all times except where not practical. The Plan will be easily available to Approving Authority inspectors during normal working hours for the construction site.

## 2.0 STORMWATER CONTROLS

### 2.1 Project Limits and General Control Considerations

The site boundaries are shown on the Site Plan. Construction activities will be limited only to those areas necessary for site construction and no soil disturbance will occur downstream of the limits of erosion controls on the site. The proposed area of disturbance is 3.0 acres, which does not involve the disturbance of more than 10 acres of land that drain to a single point. Furthermore, the limit of work along downstream wetlands buffer areas span some 400 linear feet with no concentration points. As such, there is no requirement for a construction sedimentation basin. However, a 9 feet wide, 1 foot deep temporary basin will be constructed based on comments from the Town's Conservation Commission. Stormwater runoff shall not be directed to the proposed stormwater infiltration basin until the sideslopes and bottom of the basin are vegetated. Perimeter erosion controls are provided to prevent eroded materials from leaving the site. The construction sequence has been proposed in such a way as to minimize the amount of time that disturbed soils will be exposed to weather. The soils on the disturbed area of the site are Classes A and B, which will generate minimal amounts of runoff during construction. Additional temporary sediment basins will be implemented if needed during construction.

### 2.2 Natural Buffers or Equivalent Sediment Controls

The site is bounded to the northeast by bordering vegetated wetlands which flank an unnamed tributary. No work is proposed within 50 feet of a waterbody or waterway. Thus, a minimum 50' wide natural buffer will be maintained around the nearest of such features. Perimeter erosion controls will be provided as specified herein.

Site runoff through construction will be directed through vegetated buffer areas and perimeter erosion controls to maximize stormwater infiltration and filtering to reduce pollutant discharge.

### 2.3 Perimeter Erosion and Sediment Controls

Perimeter erosion and sediment control barriers will be provided, installed, and maintained downstream of all proposed construction activities in accordance with this Plan, the Site Plan, and all permits issued for the site development. Such controls must be installed before any earth-disturbing activities occur on the site in question. Erosion and sediment controls may be installed in phases so long as it precedes any earth-disturbing activities within the controls' upstream watershed.

The proposed single layer of perimeter erosion controls will provide adequate protection.

Sediment shall be removed along such controls on a regular basis. In no case, shall sediment be allowed to reach a depth equal to one half of the above ground height of the erosion control device.

### **2.4 Site Access Controls**

Construction vehicles will use designated entry points for each site. Crushed stone or rip-rap entry apron(s) will be installed and properly maintained during construction until the site is paved. All construction access will be via Main Street. In the vicinity of the site, Main Street will be kept clean and swept as needed to minimize the tracking of soils and dust from the site.

### **2.5 Stockpiled Soils**

Soil stockpiles to be left in place more than 24 hours shall be surrounded with a line of silt fence to prevent the piles from eroding into the site and to discourage on-site runoff from eroding the stockpiles. Soil stockpiles to be left in place more than 14 days shall be stabilized temporarily in accordance with this plan. Dust control measures shall be implemented to prevent wind erosion of the stockpiles.

### **2.6 Dust Control**

Dust control measures will be implemented regularly to prevent the off-site deposition of wind-eroded soils. The principal form of dust control will be water application.

### **2.7 Disturbance of Steep Slopes**

Contractors must pay careful attention to steep slopes and must implement additional temporary erosion and sediment control measures during work on steep slopes to prevent erosion.

### **2.8 Topsoil Preservation**

Topsoil generated from the site construction activities must either be stockpiled for reuse on site in accordance with the practices noted above, or shall be removed from the site for reuse on other sites. Topsoil may not be mixed with general fill.

### **2.9 Soil Compaction**

Areas designated for final vegetative surfaces or construction-stage or final stormwater infiltration practices shall be protected from excessive compaction by restricting vehicle access and the types of equipment that may be used in such areas. Prior to seeding/planting of such areas, exposed soil that has been compacted shall be loosened by tilling or other similar methods. Conditioning shall consist of deep tilling with a rotary tiller, disc harrowing, or manual loosening and re-grading with an excavator bucket. Conditioning shall extend to a depth of at least 12-inches.

### **2.10 Protection of Storm Drain Inlets**

All storm drain system inlets inside of perimeter controls shall be protected with sediment control measures (silt sacks for catch basins) designed to remove sediment from stormwater prior to entering the inlet. Catch basins along the street frontage shall also be protected.

Such measures shall be periodically maintained and replaced as needed to ensure their proper functionality. Sediment shall be removed daily where found.

Proposed infiltration fields, once installed, are to also be inspected periodically and cleaned when needed.

### **2.11 Protection of Channels and Discharge Points**

Areas of concentrated stormwater discharge points such as swales, channels, and pipe outfalls shall incorporate velocity mitigation controls. Channels and swales shall implement temporary check dams constructed of straw bales or crushed stone berms. Discharge points shall be protected with temporary rip-rap aprons to dissipate the energy and velocity of stormwater flows.

### **2.12 Construction Stage Sediment Traps/Basins**

Due to the size of this project and the decentralized nature of runoff patterns, sediment traps are not expected to be needed. Should construction conditions dictate otherwise, this SWPPP shall be updated to incorporate properly designed sediment trap(s).

### **2.13 Treatment Chemicals**

There is no planned use of polymers, flocculants, or other erosion and sediment-control related treatment chemicals at this site.

### **2.14 Temporary Stabilization**

Where construction activities have permanently ceased or where they have temporarily ceased for a period of more than 14 days, temporary soil stabilization measures will be employed in the affected areas in accordance with the following schedule:

- For disturbed areas less than 5 acres: as soon as practicable but no later than 14 calendar days after stabilization has been initiated.
- For disturbed areas larger than 5 acres and for site discharging to sediment- or nutrient-impaired waters: as soon as practicable but no later than 7 calendar days after stabilization has been initiated.

Such stabilization measures will consist of either erosion control mats or seeding. Where seeded for temporary erosion control purposes, a minimum of 6 pounds per 1,000 square feet of seed will be applied along with an appropriate fertilizer (based on the time of year applied) or as necessary to obtain a 70% vegetative cover. Additional seeding will be completed if needed and periodic watering will also be employed if necessary. Where stabilization by the 14<sup>th</sup> day is precluded by snow cover, frozen ground conditions, or other similar circumstances, stabilization measures will be initiated as soon as practicable.

Areas which are to ultimately be stabilized with pavement or other structural measures will be temporarily stabilized (when construction activities cease for more than 14 days), with crushed stone or a compacted gravel sub-base. Such temporary stabilization measures will be maintained in good condition.

### **2.15 Maintenance of Erosion & Sediment Control Measures**

Erosion and sediment control measures will be maintained in good condition for the duration of the construction activity and until such time as the upstream areas achieve final stabilization as described herein. Sediment will be removed along haybales, silt

fence, or filter socks when the depth exceeds four-inches. All control measures will be maintained in effective operating condition. If site inspections identify control measures that are not operating effectively or finds other problems, the Operator must:

- ✓ Initiate work to correct the problem immediately upon discovery and complete the work by the close of the next work day if the problem can be corrected through routine maintenance;
- ✓ For more significant repairs or where inspections determine that additional erosion and sediment controls are needed, such work must be completed and operation no later than 7 calendar days after discovery of the problem.

## 2.16 Pollution Prevention (Good Housekeeping Practices)

### 2.16.1 Construction Staging Areas

Construction staging areas will be limited in quantity and will be maintained in a neat and orderly fashion. Refer to the Site Plan for staging area location(s).

### 2.16.2 Vehicle Storage, Fueling and Maintenance Area

The Operator will designate a specific area of the site for fueling and overnight storage of vehicles on the site. Such area shall be located as far from wetlands areas and stormwater inlets as practicable and outside of the 100' buffer zone. Refer to the Site Plan for vehicle storage area location(s).

All equipment stored on-site will be monitored for leaks and will receive regular preventative maintenance to reduce the chance of leakage. Where vehicle leaks are identified, drip pans and absorbent pads shall be employed until the leak can be repaired, which shall be completed as soon as practicable. The Operator will maintain a bag of chemical sorbent, absorbent pads and an emergency spill kit on the site at all times within one of the designated Staging Areas. A sign shall be posted at the entrance to each Staging Area noting the location of the emergency spill kit. Spill kits shall include the following at a minimum.

- Universal chemical sorbent capable of absorbing up to 15 gallons of liquid.
- Gloves and safety glasses,
- Four chemical socks,
- Four chemical pads,
- Four chemical pillows, and
- Four plastic disposal bags.

### 2.16.3 Equipment Washing

Vehicle or equipment washing is not allowed on-site.

### 2.16.4 Building Products, Materials and Wastes

- ✓ The site will be maintained in a neat and orderly manner, with debris regularly disposed of.
- ✓ All products and materials stored on-site will be stored in a neat and orderly manner in appropriate containers. Building materials must be stored under cover (i.e. under a roof or under plastic sheeting) to prevent contact with rainwater.
- ✓ Manufacturer recommendations relative to the proper storage, use, and disposal of products and materials will be followed.

- ✓ An effort will be made to minimize the on-site storage of excess construction materials. In all cases, materials will be removed from the site if unused for more than three months.
- ✓ When use of products and materials have been completed, any excess products and materials will be promptly removed from the site and/or properly disposed of in accordance with all applicable state and federal regulations.
- ✓ All equipment to be stored on-site will be stored in a neat and orderly manner and such equipment will only be stored in the designated equipment Staging Areas on the site.

### 2.16.5 Fertilizer, Pesticide, Herbicide, or Insecticide Storage

Such materials may not be stored on-site and shall only be brought on-site in the quantities needed for application. Application shall be in accordance with manufacturer recommendation. Disposal of excess products shall follow local, state and federal law.

### 2.16.7 Petroleum and Other Chemical Products Storage

- ✓ Petroleum products may only be stored on-site in the limited quantities necessary for the ongoing work.
- ✓ All petroleum products will be stored in tightly sealed containers in one of the designated Staging Areas on the site and must be covered to prevent contact with rainwater.
- ✓ All paint and other hazardous materials containers will be stored in a tightly sealed container whenever not in use and stored under cover. Any waste and/or excess for these products will be disposed of off-site in accordance with all applicable state and federal regulations.

### 2.16.8 Hazardous Products and Hazardous Waste

- ✓ The use of hazardous products during construction will be in accordance with manufacturer recommendations and established construction practices.
- ✓ Hazardous materials must be stored in a separately designated area, under cover, and within secondary storage containers designed to hold at least 110% of the volume of the substance in question.
- ✓ Hazardous products will be kept in their original containers until they are used, and the container labels will be kept on-site within a designated Staging Area until use of the product is no longer needed.
- ✓ Unused quantities of hazardous products will be removed from the site in accordance with all applicable state and federal regulations.
- ✓ Hazardous waste materials generated by the construction (if any) will be disposed of off-site in accordance with all applicable state and federal regulations pertaining to such disposal. The Site Manager will be informed of these requirements and will ensure that this provision is adhered to.
- ✓ Any spills of hazardous materials found on the site will be cleaned up immediately using dry-cleanup procedures and reported in accordance with procedures established by local, state, and federal regulations. Washdowns of spill areas is prohibited.
- ✓ The Site Manager will be properly trained in hazardous materials spill prevention and clean-up.

#### 2.16.9 Construction and Domestic Waste

- ✓ All waste materials from the site will be collected in dumpsters and disposed of off-site in accordance with all applicable state and federal regulations. The dumpster will be emptied as needed and the Operator will ensure that trash collection does not accumulate outside the dumpster. Trash and debris will be collected at least once per working day.
- ✓ The Operator will keep a portable toilet on the site for the use of work personnel and shall dispose of the waste materials in accordance with local, state, and federal regulations.

#### 2.16.10 Materials/Tools Washing

- ✓ Any such wash water shall be directed into a leak-proof container and disposed of off-site in accordance with local, state and federal regulations.
- ✓ Concrete trucks will only wash out or dump surplus concrete within areas designated by the Operator on the site in designated depressions to prevent uncontrolled migration of such materials. All such surplus concrete will be cleaned-up by crushing the concrete and either re-using it in the construction activities or by removing it from the site.
- ✓ Wash waters from concrete or stucco applications, or from paint brushes or other similar activities must be directed into a leak-proof container or pit designed to prevent overflows due to precipitation. Accumulated wastewater must be disposed of in accordance with all local, state, and federal regulations to the extent it is deemed hazardous. Washwater generating activities must be conducted as far away from wetlands areas and storm drain inlets as possible.

#### 2.16.11 Fertilizer Application

- ✓ Fertilizer shall be applied in accordance with the rates specified herein and in no case more than stipulated in the manufacturer's specifications.
- ✓ To the extent practicable, apply fertilizers in optimal seasons to maximize vegetation uptake and growth.
- ✓ Avoid applying fertilizers before heavy rains are expected and never apply to frozen ground or during winter conditions.
- ✓ Fertilizer may not be used in stormwater BMPs unless the BMP discharges to upland areas and unless the BMP is an infiltration practice.
- ✓ Fertilizers are not to be applied within buffer zones or within the Zone II for drinking water.
- ✓ Within the 100' wetland buffer zone, fertilizer shall be slow release, organic, and low in phosphorous.

#### 2.16.12 Spill Prevention and Response

(This portion of the document is written as if giving instructions to parties working on the property and/or the owner of the property)

In the event of an accident where significant gasoline or other petroleum products are released, the following procedure shall be followed in the order noted.

- ✓ Seek to contain the spill by constructing a berm of earthen or other materials around the spill site until the appropriate emergency response personnel has arrived. Seek to seal off any downstream stormwater facilities by earthen berms or the emergency spill kit materials.
- ✓ Immediately notify the following governmental entities and inform them of the type of spill that occurred:

- Medway Fire Department at 911,
  - Medway Board of Health at 508-533-3206,
  - Medway Conservation Commission at 508-533-3292,
  - Mass. Department of Environmental Protection (DEP) Central Region at (508) 792-7650 (address is 8 New Bond Street, Worcester, MA 01606), and
  - National Response Center (NRC) at (800) 424-8802 (for spills that require such notification pursuant to 40 CFR Part 110, 40 CFR Part 117, and 40 CR Part 302).
- ✓ Once the various emergency response teams have arrived at the site, the owner shall follow the instructions of the various governmental entities, which may include the following:
- A clean up firm may need to be immediately contacted.
  - If the materials have remained trapped in the catch basins or proprietary stormwater treatment units, then these structures may be pumped out. All materials shall be removed by qualified personnel and disposed of in accordance with all applicable local, state, and federal regulations.

### 2.17 Dewatering Practices

This site is not expected to encounter significant quantities of groundwater during construction activities but if it does, the following practices will be implemented:

- ✓ Do not discharge any floating solids or foam;
- ✓ If dewatering water is found to contain oil, grease, etc... it must be filtered or passed through an oil/water separator prior to discharge;
- ✓ Wherever possible, discharge dewatering water to vegetated upland areas for infiltration. Where this is not possible, discharge dewatering water into a filtering pit consisting of a perimeter of double rows of haybales lined with three layers of filter fabric. Do not direct dewatering water into wetlands without prior treatment;
- ✓ Velocity dissipation measures must be included at all discharge points (rip-rap or crushed stone apron).

### 2.18 Infiltration Systems

The proposed construction-stage stormwater controls do not include any underground stormwater infiltration BMPs.

## 3.0 INSPECTIONS

### 3.1 Inspection Frequency

The Operator will designate an inspector or inspectors, who shall be a “qualified person” as defined in the CGP and will familiarize himself/herself with the design plans, with the CGP, and with the specifications of this SWPPP. The inspector will inspect the site for compliance with this Plan at least once every seven calendar days and within 24 hours of the occurrence of a storm event of 0.5 inches or greater for the entire duration of construction, except as otherwise noted herein. The site does not discharge to a sediment or nutrient impaired water. Refer to CGP for additional inspection requirements.

Inspections may be reduced to twice per month in the first month, and thereafter once per month, in areas that have been temporarily stabilized or to areas that have

achieved final stabilization. Wherever work within temporarily stabilized areas resumes, inspections shall be at the normal frequency specified above.

Should construction span a winter season, inspection may cease so long as the ground is frozen, all disturbed areas have been stabilized and construction is not continuing during the frozen conditions. In such case, inspections will resume one month before expected thaw of soil on the site. In areas where work will proceed through frozen ground conditions, inspections may be monthly until the area thaws or until rainfall is expected, whichever occurs earlier.

Once specific areas have received final stabilization, no further inspections are necessary for that area.

### 3.2 Inspection Areas

The Inspector will inspect all areas that have been cleared, graded, or excavated and which have not yet been stabilized; all stormwater controls including erosion and sediment controls; all equipment, materials, or waste storage areas; all areas where stormwater typically flows on the site; all areas where stormwater discharges from the site; and all areas where stabilization measures have been implemented.

### 3.2 Scope of Inspection

The inspection will review the following, at a minimum:

- ✓ Ensure that all snow fence lines (to be orange color) are vertical and strung securely between stakes;
- ✓ Ensure that all silt fence lines are vertical and strung securely between stakes and have no tears;
- ✓ Ensure that straw bales are not buried;
- ✓ Ensure that filter socks are not buried;
- ✓ Ensure that sediment accumulation along erosion controls does not exceed amounts specified above;
- ✓ Ensure that sediment accumulation within existing catch basins are not excessive and that sediment is removed when the depth of accumulation exceeds two feet or 50% of the sump depth, whichever is less;
- ✓ Ensure that un-stabilized areas during active construction activities are not eroding unduly;
- ✓ Ensure that slopes on the construction site are not eroding unduly;
- ✓ Ensure that drainage swales and drainage basins (once constructed) are functioning properly during construction;
- ✓ Ensure that areas where construction activities cease for more than 7 days are temporarily stabilized as specified herein;
- ✓ Ensure that temporary and permanent stabilization measures are thorough and complete and that there are no unprotected or deficient areas;
- ✓ Ensure that the point of vehicular entry into the site is not resulting in soils being tracked into the adjacent street;
- ✓ Care will be taken to determine if pollutants are leaving the site via either overland runoff or entrance into the municipal stormwater system;
- ✓ Determine if pollutants are passing erosion prevention measures and determine whether such issue will result in adverse downstream impacts, in which case additional measures shall be installed as required herein;
- ✓ Identify any areas where new or modified stormwater, sediment and erosion controls are needed;

- ✓ Check for the presence of conditions that could lead to leaks, spills or other accumulations of pollutants on the site;
- ✓ Identify and document all instances of non-compliance; and
- ✓ If a discharge from the property is identified: specify the location, document the visual quality of the discharge including color, odor, floating, settled, or suspended solids, foam, oil sheen or other obvious indicators of stormwater pollutants; and documents the effectiveness and any needed improvements to stormwater controls on the site.

All deficiencies will be remedied immediately and no later than seven days after discovery of the deficiency, and if possible, prior to the next anticipated rainfall event, if that event is anticipated to occur sooner than seven days. In addition, this Plan will be updated if needed, upon the documentation of a deficiency. The inspector will complete an inspection report after each site inspection and will provide a copy of this report to the Operator, who will keep the reports on-file. The inspection reports will at a minimum, contain the following information:

- ✓ The inspection date,
- ✓ Name, title, and qualifications of personnel conducting the inspection,
- ✓ Weather information for the period since the last inspection, including an estimate of the beginning time, duration, and rainfall quantity for any rainfall events since the last inspection,
- ✓ Weather information for the time of the inspection,
- ✓ Location of discharges of sediment or pollution from the site, if any are discovered during the inspection,
- ✓ Location of Controls (identified below) that need to be maintained,
- ✓ Location of Controls (identified below) that have failed to perform adequately, and which need redesign or improvement, and
- ✓ Location where additional Controls (not originally designed) need to be provided (if any).
- ✓ The report must identify any discovered incidents of non-compliance, and if none are found, a certification that the site is in compliance with this Plan. The report must be signed by the Inspector and the Operator as identified above.

### 4.0 CORRECTIVE ACTIONS

Any corrective actions (spills, repairs of stormwater controls, replacement of stormwater controls, installation of new stormwater controls, etc...) must be completed within seven calendar days of the first deficiency observation. A log report must be prepared for each corrective action in accordance with the requirements of the CGP and appended to this SWPPP.

## **5.0 PERSONNEL TRAINING AND RECORDING KEEPING**

### **5.1 Personnel Training**

Inspectors and personnel who are responsible for taking corrective action or for designing, installing, maintaining or repairing stormwater controls, must be trained. Each such person must receive sufficient training such that they understand the requirements of the SWPPP and CGP and the scope of their responsibilities pursuant to these documents. Training will include a thorough description of the location of stormwater controls, the design function of stormwater controls, requirements for inspections and corrective action, and proper procedures to follow when implementing the requirements of the CGP and SWPPP.

### **5.2 Records**

In addition to the inspection reports required herein, the Operator shall keep a record of:

- ✓ Dates when grading occurred,
- ✓ Dates when construction activities temporarily or permanently cease on any portion of the site, and
- ✓ Dates when stabilization measures are installed.

Inspection reports shall be copied to the Town's Conservation Agent.

### **5.3 Retention of Records**

This SWPPP along with the NOI, acknowledgement letter from the EPA, all correspondence, inspection reports, records, and supporting data for this Notice of Intent will be kept for at least three years from the date of termination of coverage under the CGP.

### **5.4 Updating This SWPPP**

This SWPPP will be updated as needed during the construction process to reflect changes in design, construction methodology, operation, maintenance, or other factors that may affect the discharge of stormwater and/or pollutants off the site during construction.

**6.0 CERTIFICATIONS**

I certify under the penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gathered and evaluated the information contained therein. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I have no personal knowledge that the information submitted is other than true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Signed: \_\_\_\_\_  
(Signature)

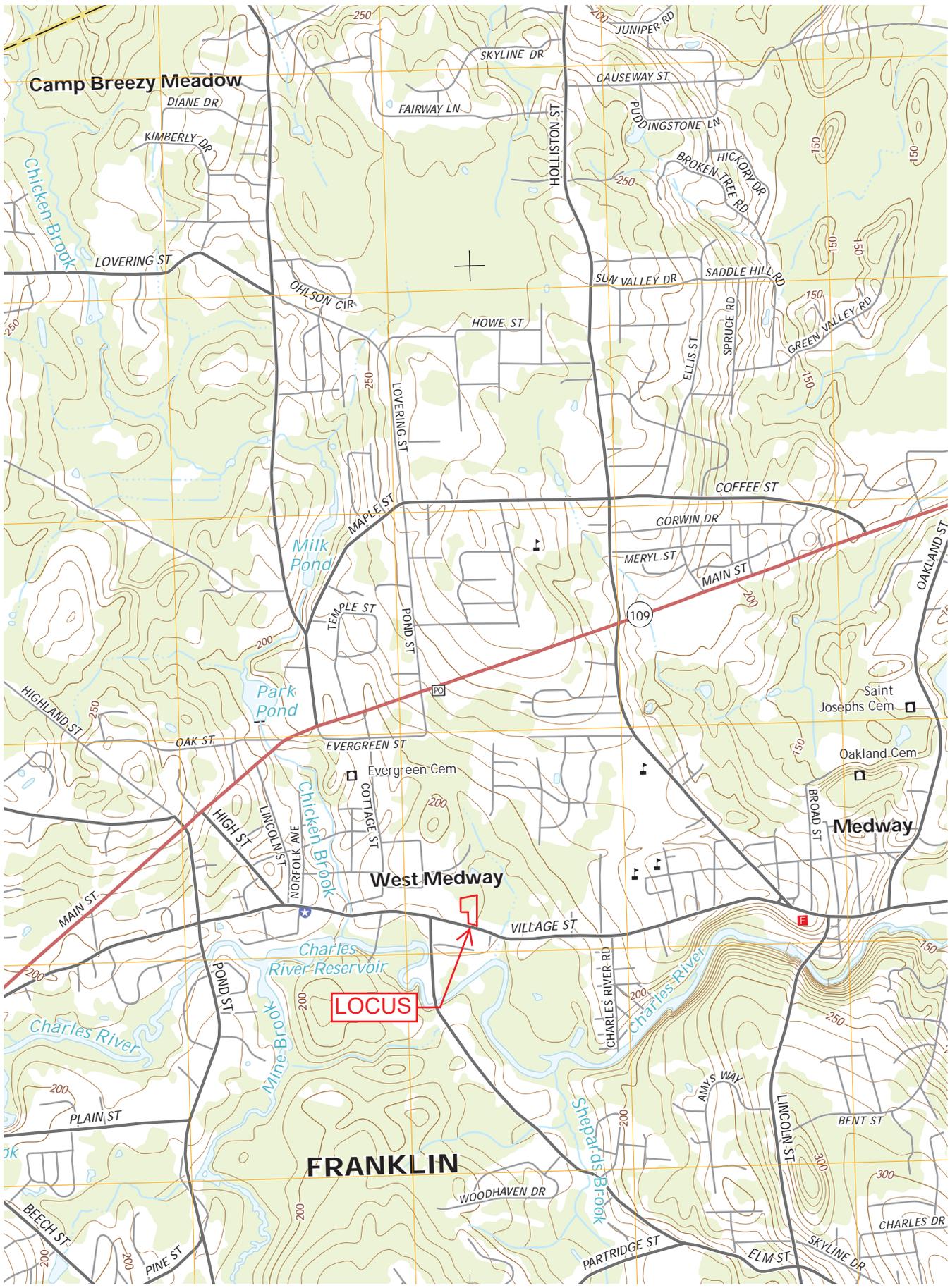
Date: \_\_\_\_\_

Signed: \_\_\_\_\_  
(Signature)

Date: \_\_\_\_\_

# 7.0 APPENDICES

# APPENDIX 7.1 USGS MAP



Camp Breezy Meadow

West Medway

Medway

FRANKLIN

LOCUS

109

Chicken Brook

Milk Pond

Park Pond

Chicken Brook

Charles River Reservoir

Charles River

Shepard's Brook

Saint Josephs Cem

Oakland Cem

Highland St

Lovering St

Howe St

Causeway St

Broken Tree Rd

SUV Valley Dr

Ellis St

Spruce Rd

Coffee St

Gorwin Dr

Meryl St

Main St

Oakland St

Diane Dr

Kimberly Dr

Fairway Ln

Skyline Dr

Causeway St

Puddingstone Ln

Holliston St

Olson Cir

Maple St

Temple St

Lovering St

Pond St

Evergreen St

Cottage St

Oak St

High St

Norfolk Ave

Lincoln St

West Medway

Village St

Charles River Rd

Charles River

Plain St

Beech St

Pine St

Woodhaven Dr

Partridge St

Elm St

Lincoln St

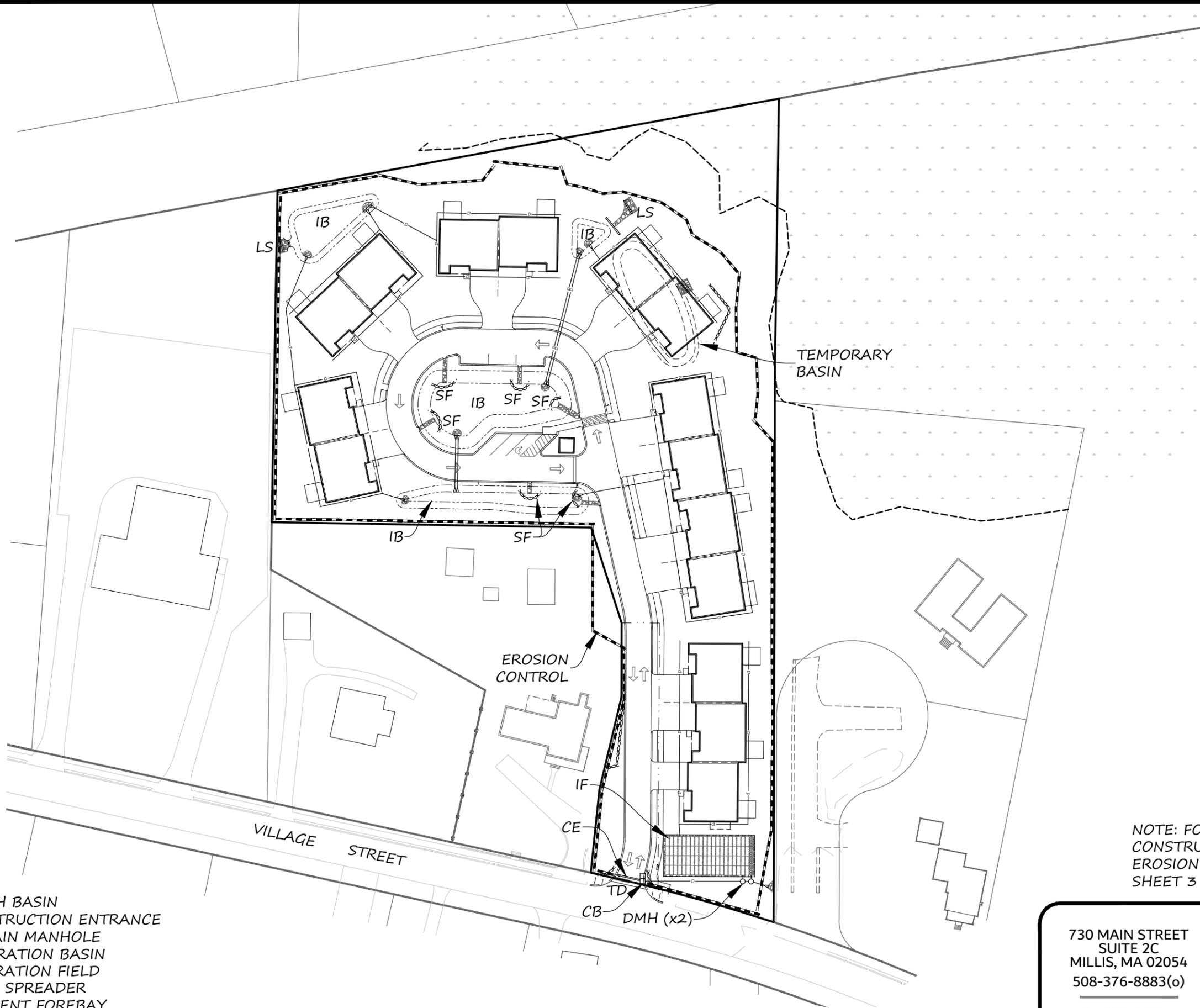
Bent St

Charles Dr

Skyline Dr

Amys Way

# APPENDIX 7.2 SWPPP SITE PLAN



**LEGEND:**  
 CB=CATCH BASIN  
 CE=CONSTRUCTION ENTRANCE  
 DMH=DRAIN MANHOLE  
 IB=INFILTRATION BASIN  
 IF=INFILTRATION FIELD  
 LS=LEVEL SPREADER  
 SF=SEDIMENT FOREBAY  
 TD=TRENCH DRAIN

PLAN SCALE: 1"=80'



PLAN DATE: JUNE 25, 2019

REVISION	DATE	BY
REVISIONS PER TOWN COMMENTS	9/4/19	DJM
REVISIONS PER TOWN COMMENTS	10/7/19	DJM

**WILLIAM WALLACE**  
**SWPPP**  
**PLAN OF LAND**  
**IN**  
**MEDWAY, MA**

NOTE: FOR A MORE DETAILED  
 CONSTRUCTION STAGE  
 EROSION CONTROL PLAN, SEE  
 SHEET 3 OF THE SITE PLAN.

730 MAIN STREET  
 SUITE 2C  
 MILLIS, MA 02054  
 508-376-8883(o)



**LEGACY**  
**ENGINEERING**

**APPENDIX 7.3**  
**CONSTRUCTION GENERAL**  
**PERMIT (CGP)**  
(TO BE ADDED AT TIME OF CONSTRUCTION)

**APPENDIX 7.4**  
**NOTICE OF INTENT**  
(TO BE ADDED AT TIME OF CONSTRUCTION)

**APPENDIX 7.5**  
**STORMWATER TEAM**  
(TO BE FINALIZED AT TIME OF CONSTRUCTION)

# STORMWATER TEAM

## Operator #1 Stormwater Team

Owner/Operator Name: DTRT LLC

### Stormwater Team

	Team Member	Responsibility
1	SWPPP Preparer: Legacy Engineering LLC	Preparing and modifying SWPPP
2	SWPPP Compliance & Oversight: Larry Rucki	General oversight of compliance with SWPPP & CGP
3	Qualified Inspector: Operator 2 to perform Inspections: T.B.D.	Performing Site Inspections
4	Construction Manager: Operator 2 to provide construction management: T.B.D.	Overseeing the installation & maintenance of all stormwater and erosion controls throughout construction. Day-to-day responsibility for compliance with the SWPPP and CGP

## Operator #2 Stormwater Team

Construction Operator Name:

### Stormwater Team

	Team Member	Responsibility
1	SWPPP Preparer: Legacy Engineering LLC	Preparing and modifying SWPPP
2	SWPPP Compliance & Oversight: T.B.D.	General oversight of compliance with SWPPP & CGP
3	Qualified Inspector: T.B.D.	Performing Site Inspections
4	Construction Manager: T.B.D.	Overseeing the installation & maintenance of all stormwater and erosion controls throughout construction. Day-to-day responsibility for compliance with the SWPPP and CGP

**APPENDIX 7.6**  
**INSPECTION REPORTS**  
(TO BE ADDED AS THEY ARE GENERATED)

## STORMWATER CONSTRUCTION SITE INSPECTION REPORT

General Information			
Project Name	274 Village Street		
NPDES Tracking No.	MAR_____	Location	274 Village Street, Medway MA, 02053
Date of Site Inspection		Start/End Time	
Inspector's Name(s) and Qualifications			
Inspector's Title(s)			
Inspector's Contact Information			
Describe present phase of construction			
Type of Inspection ("Storm" = any rainfall event of 0.5 inches or more)			
<input type="checkbox"/> Regular 7-day Inspection <input type="checkbox"/> Pre-storm event <input type="checkbox"/> During storm event <input type="checkbox"/> Post-storm event			
Weather Information			
Has it rained since the last inspection?			
<input type="checkbox"/> Yes <input type="checkbox"/> No If yes, provide: Storm Start Date & Time:                      Storm Duration (hrs):                      Approximate Rainfall (in):			
Weather at time of this inspection?			
Do you suspect that discharges may have occurred since the last inspection?			
<input type="checkbox"/> Yes <input type="checkbox"/> No			
Is it safe to perform the required inspection? If no, indicate why and where these limitations apply			
<input type="checkbox"/> Yes <input type="checkbox"/> No			

**Site-specific BMPs Inspection Checklist**

	BMP Description	BMP Installed and Operating Properly?	Corrective Action Needed	Date for corrective action/responsible person
1	Entrance Aprons	<input type="checkbox"/> Yes <input type="checkbox"/> No		
2	Erosion Barriers along perimeter of work area	<input type="checkbox"/> Yes <input type="checkbox"/> No		
3	Catch Basin Inlet protection	<input type="checkbox"/> Yes <input type="checkbox"/> No		
4	Other-	<input type="checkbox"/> Yes <input type="checkbox"/> No		
5	Other-	<input type="checkbox"/> Yes <input type="checkbox"/> No		

## 274 VILLAGE STREET SWPPP

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### Overall Site Issues

	BMP/activity	Implemented?	Maintained?	Corrective Action	Date for corrective action/responsible person
1	Are all slopes and disturbed areas not actively being worked properly stabilized?	<input type="checkbox"/> Yes <input type="checkbox"/> No	n/a		
2	Are perimeter controls and sediment barriers adequately installed and maintained?	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No		
3	Are stormwater discharges free of sediment deposits?	<input type="checkbox"/> Yes <input type="checkbox"/> No	n/a		
4	Are storm drain inlets properly protected?	<input type="checkbox"/> Yes <input type="checkbox"/> No	n/a		
5	Is there evidence of sediment being tracked into the street?	<input type="checkbox"/> Yes <input type="checkbox"/> No	n/a		
6	Do silt sacs require cleaning or replacement?	<input type="checkbox"/> Yes <input type="checkbox"/> No			
7	Do installed proprietary separators have sediment accumulation?	<input type="checkbox"/> Yes <input type="checkbox"/> No			
8	Do the installed infiltration BMPs have evidence of sediment accumulation?	<input type="checkbox"/> Yes <input type="checkbox"/> No			
9	Is trash/litter from work areas collected and placed in covered dumpsters?	<input type="checkbox"/> Yes <input type="checkbox"/> No	n/a		

274 VILLAGE STREET SWPPP

	BMP/activity	Implemented?	Maintained?	Corrective Action	Date for corrective action/responsible person
10	Are vehicle and equipment fueling, cleaning, and maintenance areas free of spills, leaks, or any other deleterious material?	<input type="checkbox"/> Yes <input type="checkbox"/> No	n/a		
11	Are non-stormwater discharges (e.g., wash water, dewatering) properly controlled?	<input type="checkbox"/> Yes <input type="checkbox"/> No	n/a		
12	Are new or additional stormwater controls necessary to ensure compliance with the CGP?	<input type="checkbox"/> Yes <input type="checkbox"/> No	n/a		
13	Do material storage areas present risk of spillage or leakage of potentially hazardous materials ?	<input type="checkbox"/> Yes <input type="checkbox"/> No	n/a		
14	Other-	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No		

## 274 VILLAGE STREET SWPPP

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**Non-Compliance:** Record any incidents of non-compliance with the Construction General Permit or the SWPPP since the last inspection in the table below.

Have any incidents of non-compliance occurred since the last inspection?

Yes No

	Incident Description	Corrective Action Needed & Date of Initiation
1		
2		
3		
4		
5		

**Discharges:** Record any incidents of the discharge of sediment or eroded materials from the site

Have any discharges from the site occurred since the last inspection?

Yes No

	Location of Discharge & Description of Water Quality (color, odor, floating, settled, or suspected solids, foam, sheen, etc...)	Corrective Action Needed & Date of Initiation (i.e. correction of existing stormwater controls or installation of new stormwater controls)
1		
2		
3		
4		
5		

**Certification statement:**

"I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gathered and evaluated the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations."

Print name:

\_\_\_\_\_

Signature:

\_\_\_\_\_

Date: \_\_\_\_\_

**APPENDIX 7.7  
LOG OF CORRECTIVE  
ACTIONS**

(TO BE ADDED AS INCIDENTS OCCUR)

# LOG OF CORRECTIVE ACTION

	Condition Type & Description	Date & Time Condition was Identified	Is SWPPP Modification Required?	Description of Corrective Action Taken (attach additional sheets as needed to describe). Specify type of materials disposed and the disposal location.
1			<input type="checkbox"/> Yes <input type="checkbox"/> No	
2			<input type="checkbox"/> Yes <input type="checkbox"/> No	
3			<input type="checkbox"/> Yes <input type="checkbox"/> No	
4			<input type="checkbox"/> Yes <input type="checkbox"/> No	
5			<input type="checkbox"/> Yes <input type="checkbox"/> No	
6			<input type="checkbox"/> Yes <input type="checkbox"/> No	
7			<input type="checkbox"/> Yes <input type="checkbox"/> No	
8			<input type="checkbox"/> Yes <input type="checkbox"/> No	
9			<input type="checkbox"/> Yes <input type="checkbox"/> No	

## 274 VILLAGE STREET SWPPP

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10			<input type="checkbox"/> Yes <input type="checkbox"/> No	
----	--	--	--	--

Corrective Action: "Any action taken to (1) repair, modify, or replace any stormwater control used at the site; (2) clean up and dispose of spills, releases, or other deposits found on the site; and (3) remedy a permit violation."

**APPENDIX 7.8**  
**LOG OF REDUCED**  
**INSPECTIONS**  
(TO BE ADDED AS INCIDENTS OCCUR)

## LOG OF REDUCED INSPECTIONS

Log of reduced inspections permissible pursuant to section 4.4 of the Construction General Permit.

	Reason for Reduced Inspection	Portion of Site Applicable To	Beginning of Reduced Inspection Period	Conclusion of Reduced Inspection Period
1	<input type="checkbox"/> Stabilized Area (reduced to monthly) <input type="checkbox"/> Frozen Conditions			
2	<input type="checkbox"/> Stabilized Area (reduced to monthly) <input type="checkbox"/> Frozen Conditions			
3	<input type="checkbox"/> Stabilized Area (reduced to monthly) <input type="checkbox"/> Frozen Conditions			
4	<input type="checkbox"/> Stabilized Area (reduced to monthly) <input type="checkbox"/> Frozen Conditions			
5	<input type="checkbox"/> Stabilized Area (reduced to monthly) <input type="checkbox"/> Frozen Conditions			
6	<input type="checkbox"/> Stabilized Area (reduced to monthly) <input type="checkbox"/> Frozen Conditions			
7	<input type="checkbox"/> Stabilized Area (reduced to monthly) <input type="checkbox"/> Frozen Conditions			
8	<input type="checkbox"/> Stabilized Area (reduced to monthly) <input type="checkbox"/> Frozen Conditions			
9	<input type="checkbox"/> Stabilized Area (reduced to monthly) <input type="checkbox"/> Frozen Conditions			
10	<input type="checkbox"/> Stabilized Area (reduced to monthly) <input type="checkbox"/> Frozen Conditions			

**APPENDIX 7.9**  
**LOG OF SWPPP**  
**MODIFICATIONS**  
(TO BE ADDED AS MODIFICATIONS OCCUR)

## LOG OF SWPPP MODIFICATIONS

	Date of Modification	Person Authorizing Modification	General Description of Modification
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			
11			
12			
13			
14			

# APPENDIX 7.10 LOG OF POTENTIAL POLLUTANTS

LIST OF CONSTRUCTION MATERIALS WHICH MAY BE  
CONSIDERED A POTENTIAL POLLUTANT  
(TO BE ADDED AS SUCH INFORMATION IS DETERMINED)

# CONSTRUCTION MATERIALS POLLUTANT LIST

No. \_\_\_\_\_

DESCRIPTION OF CONSTRUCTION ACTIVITY:

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	Construction Material	Solid/Liquid?	General Description of Storage and Use
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			



## APPENDIX 7.1 1 SUB-CONTRACTOR LOG

LIST ALL SUB-CONTRACTORS AND APPEND A  
CERTIFICATION STATEMENT FOR EACH INDICATING THEIR  
KNOWLEDGE OF AND COMPLIANCE WITH THIS SWPPP

(TO BE ADDED AS SUCH INFORMATION IS DETERMINED)





# APPENDIX 7.12 ESTIMATED SCHEDULE

(TO BE ADDED AS SUCH INFORMATION IS DETERMINED)

## ESTIMATED SCHEDULE

Task	Estimated Start Date	Estimated Duration
Earth Disturbing Activities		
Clearing and Grubbing		
Mass Grading (major cuts and fills)		
Final Grading		
Soil Stockpile Creation		
Removal of Temporary Stormwater Conveyances (if applicable)		
Removal of Other Temporary Stormwater Control Measures		
Removal of Construction Equipment and Vehicles		
Cessation of Any Pollutant-Generating Activities		

**ATTACHMENT E: TSS REMOVAL  
CALCULATION SHEETS**

**INSTRUCTIONS:**

*Non-automated: Mar. 4, 2008*

1. Sheet is nonautomated. Print sheet and complete using hand calculations. Column A and B: See MassDEP Structural BMP Table
2. The calculations must be completed using the Column Headings specified in Chart and Not the Excel Column Headings
3. To complete Chart Column D, multiple Column B value within Row x Column C value within Row
4. To complete Chart Column E value, subtract Column D value within Row from Column C within Row
5. Total TSS Removal = Sum All Values in Column D

**Location: Infiltration Basin**

TSS Removal Calculation Worksheet

A	B	C	D	E
BMP1	TSS Removal Rate1	Starting TSS Load*	Amount Removed (B*C)	Remaining Load (C-D)
Infiltration Basin w/ Sediment Forebay	80%	1.00	80%	20%

**Total TSS Removal =**

80%

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

Project: 274 Village Street  
 Prepared By: Legacy Engineering LLC  
 Date: September 4, 2019

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

**INSTRUCTIONS:**

*Non-automated: Mar. 4, 2008*

1. Sheet is nonautomated. Print sheet and complete using hand calculations. Column A and B: See MassDEP Structural BMP Table
2. The calculations must be completed using the Column Headings specified in Chart and Not the Excel Column Headings
3. To complete Chart Column D, multiple Column B value within Row x Column C value within Row
4. To complete Chart Column E value, subtract Column D value within Row from Column C within Row
5. Total TSS Removal = Sum All Values in Column D

**Location: Infiltration Field**

TSS Removal Calculation Worksheet

A	B	C	D	E
BMP1	TSS Removal Rate1	Starting TSS Load*	Amount Removed (B*C)	Remaining Load (C-D)
Infiltration Field w/ Deep Sump Catch Basin	80%	1.00	80%	20%

**Total TSS Removal =**

80%

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

Project: 274 Village Street  
 Prepared By: Legacy Engineering LLC  
 Date: September 4, 2019

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

# **ATTACHMENT F: STORMWATER MANAGEMENT HANDBOOK 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.<sup>1</sup> This Checklist is to be used as the cover for the completed Stormwater Report.
- Applicant/Project Name
- Project Address
- Name of Firm and Registered Professional Engineer that prepared the Report
- Long-Term Pollution Prevention Plan required by Standards 4-6
- Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan required by Standard 8<sup>2</sup>
- 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.

<sup>1</sup> 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.

<sup>2</sup> 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

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## 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.

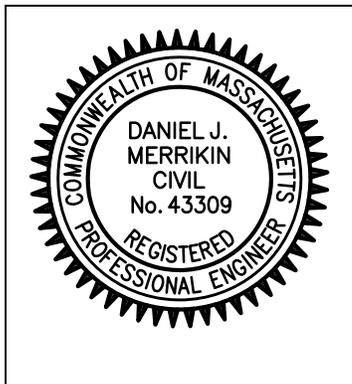
A complete checklist must include the Certification set forth below signed by the Registered Professional Engineer who prepared the Stormwater Report.

---

### 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

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## Checklist (continued)

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

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

### Standard 1: No New Untreated Discharges

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



# Checklist for Stormwater Report

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## Checklist (continued)

### Standard 2: Peak Rate Attenuation

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

### Standard 3: Recharge

- Soil Analysis provided.
- Required Recharge Volume calculation provided.
- Required Recharge volume reduced through use of the LID site Design Credits.
- Sizing the infiltration, BMPs is based on the following method: Check the method used.
  - Static
  - Simple Dynamic
  - Dynamic Field<sup>1</sup>
- 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.

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



# Checklist for Stormwater Report

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## 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

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## 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

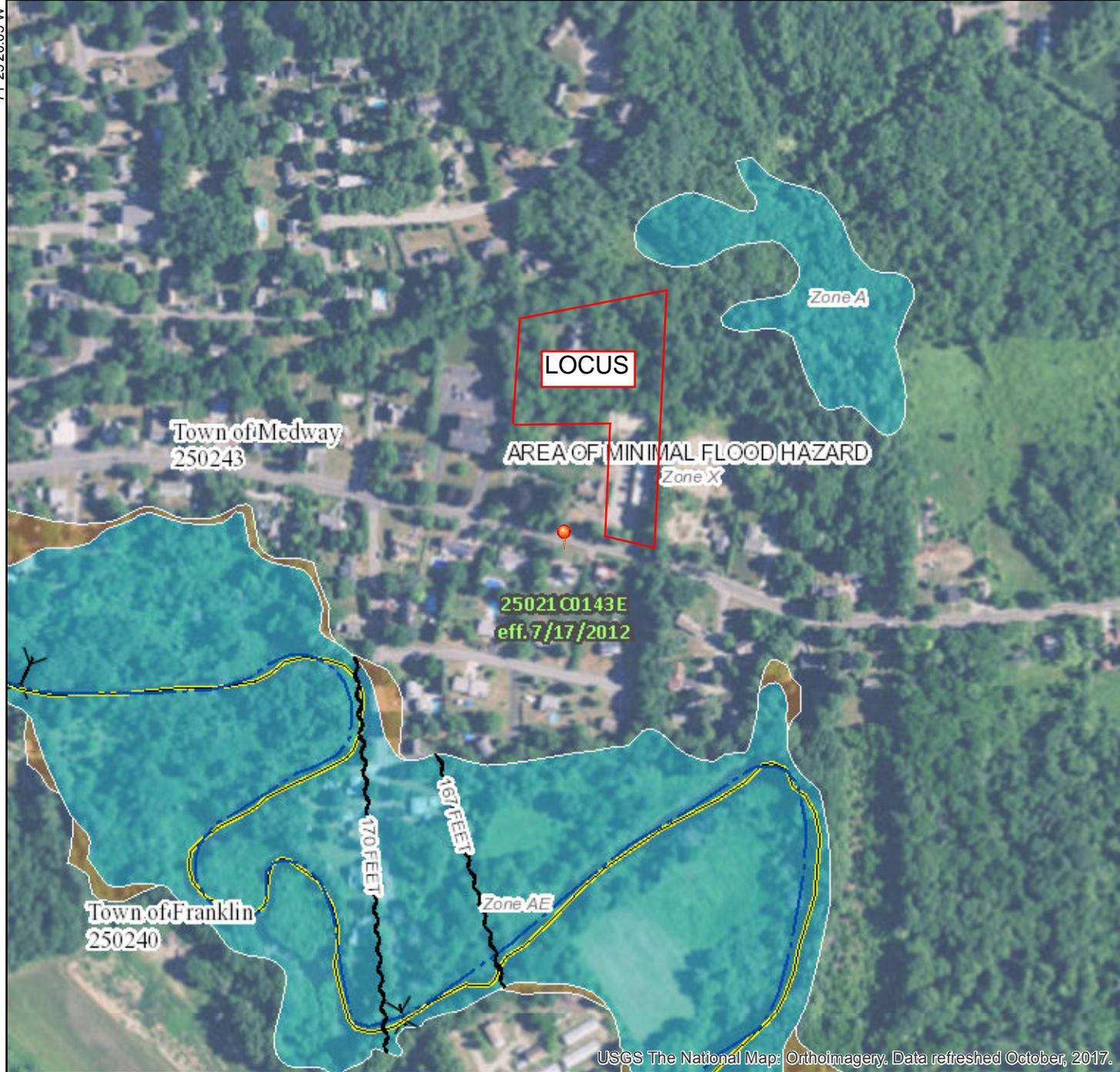
- The Long-Term Pollution Prevention Plan includes measures to prevent illicit discharges;
- An Illicit Discharge Compliance Statement is attached;
- NO Illicit Discharge Compliance Statement is attached but will be submitted **prior to** the discharge of any stormwater to post-construction BMPs.

# ATTACHMENT G: FEMA FIRMETTE

# National Flood Hazard Layer FIRMette



42°8'36.72"N



## Legend

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

SPECIAL FLOOD HAZARD AREAS		Without Base Flood Elevation (BFE) Zone A, V, A99
		With BFE or Depth Zone AE, AO, AH, VE, AR
		Regulatory Floodway
OTHER AREAS OF FLOOD HAZARD		0.2% Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile Zone X
		Future Conditions 1% Annual Chance Flood Hazard Zone X
		Area with Reduced Flood Risk due to Levee. See Notes. Zone X
		Area with Flood Risk due to Levee Zone D
OTHER AREAS		NO SCREEN Area of Minimal Flood Hazard Zone X
		Effective LOMRs
GENERAL STRUCTURES		Area of Undetermined Flood Hazard Zone D
		Channel, Culvert, or Storm Sewer
OTHER FEATURES		Levee, Dike, or Floodwall
		20.2 Cross Sections with 1% Annual Chance Water Surface Elevation
MAP PANELS		17.5 Coastal Transect
		Base Flood Elevation Line (BFE)
OTHER FEATURES		Limit of Study
		Jurisdiction Boundary
OTHER FEATURES		Coastal Transect Baseline
		Profile Baseline
OTHER FEATURES		Hydrographic Feature
		Digital Data Available
MAP PANELS		No Digital Data Available
		Unmapped



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

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

The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on **1/28/2019 at 11:17:24 AM** and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time.

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

USGS The National Map: Orthoimagery. Data refreshed October, 2017.

0 250 500 1,000 1,500 2,000 Feet

1:6,000

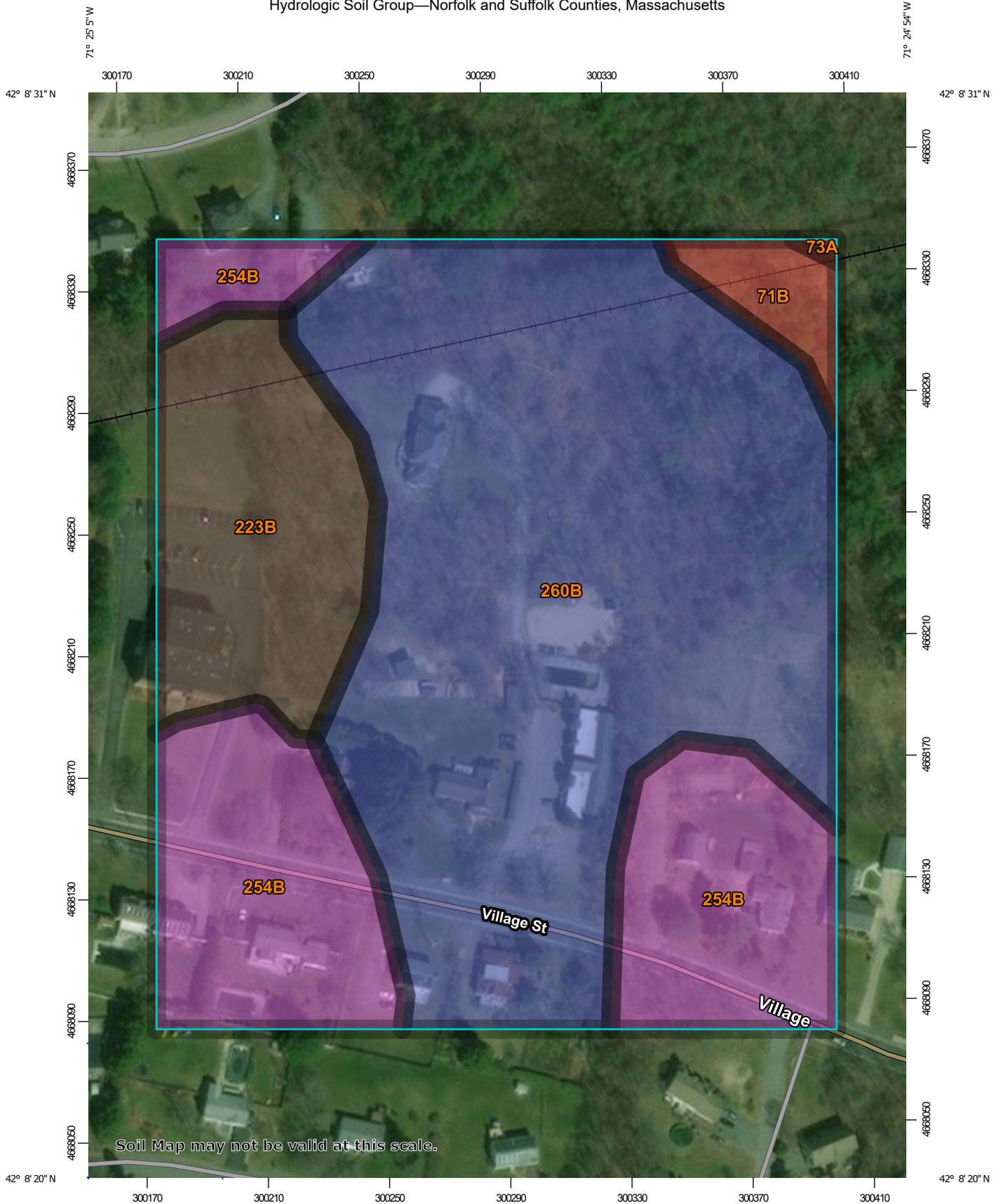
42°8'10.04"N

71°24'42.60"W



# **ATTACHMENT H: SOILS DATA**

Hydrologic Soil Group—Norfolk and Suffolk Counties, Massachusetts



Map Scale: 1:1,740 if printed on A portrait (8.5" x 11") sheet.



Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 19N WGS84



## MAP LEGEND

### Area of Interest (AOI)

 Area of Interest (AOI)

### Soils

#### Soil Rating Polygons

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

#### Soil Rating Lines

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

#### Soil Rating Points

 A  
 A/D  
 B  
 B/D

 C  
 C/D  
 D  
 Not rated or not available

### Water Features

 Streams and Canals

### Transportation

 Rails  
 Interstate Highways  
 US Routes  
 Major Roads  
 Local Roads

### Background

 Aerial Photography

## MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:25,000.

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

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

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

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

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

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

Soil Survey Area: Norfolk and Suffolk Counties, Massachusetts  
 Survey Area Data: Version 14, Sep 12, 2018

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

Date(s) aerial images were photographed: May 14, 2010—Apr 1, 2017

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

## Hydrologic Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
71B	Ridgebury fine sandy loam, 3 to 8 percent slopes, extremely stony	D	0.4	2.7%
73A	Whitman fine sandy loam, 0 to 3 percent slopes, extremely stony	D	0.0	0.1%
223B	Scio very fine sandy loam, 2 to 5 percent slopes	B/D	2.1	14.4%
254B	Merrimac fine sandy loam, 3 to 8 percent slopes	A	3.7	25.4%
260B	Sudbury fine sandy loam, 2 to 8 percent slopes	B	8.3	57.4%
<b>Totals for Area of Interest</b>			<b>14.5</b>	<b>100.0%</b>

## Description

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

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

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

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

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

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

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

## Rating Options

*Aggregation Method:* Dominant Condition

*Component Percent Cutoff:* None Specified

*Tie-break Rule:* Higher

## DEEP OBSERVATION TEST HOLE SOIL LOG

### 274 Village Street Medway, MA 02053

Deep Observation Hole: OTH 1

Date of Test Hole: May 1, 2019

Soil Evaluation By: Daniel J. Merrikin, P.E.  
(Mass. Approved Soil Evaluator)

Depth (In.)	Soil Horizon/ Layer	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features (mottles)			Soil Texture (USDA)	Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color	Percent		Gravel	Cobbles & Stones			
28"	Fill										
48"	Bw	10YR6/8				Loamy Sand	1%	<1%	V. Friable	Massive	
108"	C	2.5Y6/2	84"	7.5Y6/8	5%	Loamy Sand	<1%	<1%	V. Friable	Massive	

Additional Notes: Ground Elev.=186.2

Groundwater Indicators Observed at Time of Testing:

- Depth observed standing water in observation hole: None
- Depth weeping from side of observation hole: 89" (Elev.=178.8)

- Depth to soil redoximorphic features (mottles): 84" (Elev.=179.2)

**DEEP OBSERVATION TEST HOLE SOIL LOG**  
**274 Village Street Medway, MA 02053**

Deep Observation Hole: OTH 2

Date of Test Hole: May 1, 2019

Soil Evaluation By: Daniel J. Merrikin, P.E.  
(Mass. Approved Soil Evaluator)

Depth (In.)	Soil Horizon/ Layer	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features (mottles)			Soil Texture (USDA)	Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color	Percent		Gravel	Cobbles & Stones			
32"	Fill & Ab										
50"	Bw	10YR6/8				Loamy Sand	<1%	<1%	V. Friable	Massive	
61"	C1	2.5Y6/4	55"	7.5Y6/8	5%	Med. Sand	<1%	<1%	Single Grain	Loose	
108"	C2	2.5Y6/2				Sandy Loam	<1%	<1%	V. Friable	Massive	

Additional Notes: Ground Elev.=186.1

Groundwater Indicators Observed at Time of Testing:

- Depth observed standing water in observation hole: 75" (Elev.=179.9)
- Depth to soil redoximorphic features (mottles): 55" (Elev.=181.5)
- Depth weeping from side of observation hole: 61" (Elev.=181.0)

## DEEP OBSERVATION TEST HOLE SOIL LOG

### 274 Village Street Medway, MA 02053

Deep Observation Hole: OTH 3

Date of Test Hole: May 1, 2019

Soil Evaluation By: Daniel J. Merrikin, P.E.  
(Mass. Approved Soil Evaluator)

Depth (In.)	Soil Horizon/ Layer	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features (mottles)			Soil Texture (USDA)	Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color	Percent		Gravel	Cobbles & Stones			
24"	Fill										
41"	Bw	10YR6/8				Loamy Sand	<1%	<1%	V. Friable	Massive	
81"	C1	2.5Y6/4	53"	7.5Y6/8	5%	Med S/LS	<1%	<1%	V. Friable	Massive	
108"	C2	2.5Y6/2				Sandy Loam	<1%	<1%	V. Friable	Massive	

Additional Notes: Ground Elev.=187.5

Groundwater Indicators Observed at Time of Testing:

- Depth observed standing water in observation hole: 72" (Elev.=181.5)
- Depth to soil redoximorphic features (mottles): 53" (Elev.=183.1)
- Depth weeping from side of observation hole: None

**DEEP OBSERVATION TEST HOLE SOIL LOG**  
**274 Village Street Medway, MA 02053**

Deep Observation Hole: OTH 4

Date of Test Hole: May 1, 2019

Soil Evaluation By: Daniel J. Merrikin, P.E.  
(Mass. Approved Soil Evaluator)

Depth (In.)	Soil Horizon/ Layer	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features (mottles)			Soil Texture (USDA)	Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color	Percent		Gravel	Cobbles & Stones			
15"	Fill/Af										
27"	Bw	10YR6/8				Loamy Sand	<1%	<1%	V. Friable	Massive	
72"	C1	2.5Y6/4	53"	7.5Y6/8	5%	Med S/LS	<1%	<1%	Single Grain	Loose	
108"	C2	2.5Y6/2				Sandy Loam	<1%	<1%	V. Friable	Massive	

Additional Notes: Ground Elev.=187.3

Groundwater Indicators Observed at Time of Testing:

- Depth observed standing water in observation hole: 68" (Elev.=181.6)
- Depth to soil redoximorphic features (mottles): 53" (Elev.=182.9)
- Depth weeping from side of observation hole: None

**DEEP OBSERVATION TEST HOLE SOIL LOG**  
**274 Village Street Medway, MA 02053**

Deep Observation Hole: OTH 5

Date of Test Hole: May 1, 2019

Soil Evaluation By: Daniel J. Merrikin, P.E.  
(Mass. Approved Soil Evaluator)

Depth (In.)	Soil Horizon/ Layer	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features (mottles)			Soil Texture (USDA)	Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color	Percent		Gravel	Cobbles & Stones			
14"	Ap	10YR4/3				Sandy Loam	1%	<1%	V. Friable	Massive	
30"	Bw	10YR6/8				Loamy Sand	1%	<1%	V. Friable	Massive	
63"	C1	2.5Y6/4	36"	7.5Y6/8	5%	Med S/LS	<1%	<1%	V. Friable	Massive	
108"	C2	2.5Y6/2				Sandy Loam	<1%	<1%	V. Friable	Massive	

Additional Notes: Ground Elev.=187.0

Groundwater Indicators Observed at Time of Testing:

- Depth observed standing water in observation hole: 60" (Elev.=182.0)
- Depth to soil redoximorphic features (mottles): 36" (Elev.=184.0)
- Depth weeping from side of observation hole: None

**DEEP OBSERVATION TEST HOLE SOIL LOG**  
**274 Village Street Medway, MA 02053**

Deep Observation Hole: OTH 6

Date of Test Hole: May 1, 2019

Soil Evaluation By: Daniel J. Merrikin, P.E.  
(Mass. Approved Soil Evaluator)

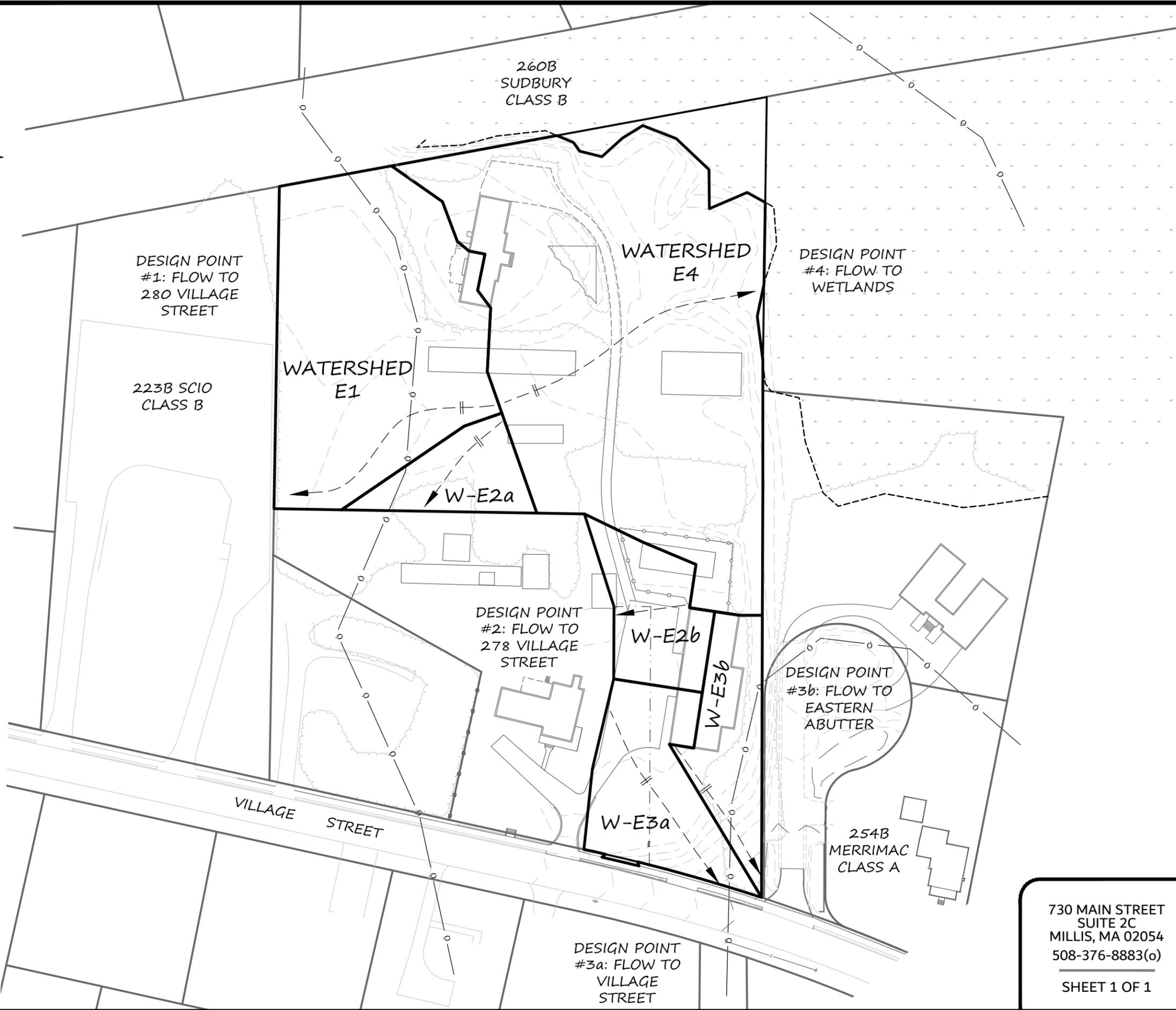
Depth (In.)	Soil Horizon/ Layer	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features (mottles)			Soil Texture (USDA)	Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color	Percent		Gravel	Cobbles & Stones			
8"	Ap	10YR4/3				Loamy Sand	1%	<1%	V. Friable	Massive	
16"	Bw	10YR6/7				Loamy Sand	1%	<1%	V. Friable	Massive	
60"	C1	2.5Y6/4	60"	7.5Y6/8	5%	Med. Sand	<1%	<1%	Single Grain	Loose	
108"	C2	2.5Y6/2				Sandy Loam	<1%	<1%	V. Friable	Massive	

Additional Notes: Ground Elev.=187.3

Groundwater Indicators Observed at Time of Testing:

- Depth observed standing water in observation hole: None
- Depth to soil redoximorphic features (mottles): 60" (Elev.=182.3)
- Depth weeping from side of observation hole: 60" (Elev.=182.3)

**ATTACHMENT I: EXISTING WATERSHED  
PLAN**



PLAN SCALE: 1"=80'



PLAN DATE: JUNE 25, 2019

REVISION	DATE	BY
REVISED PER TOWN COMMENTS	9/4/19	DJM

WILLIAM WALLACE  
EXISTING WATERSHED  
PLAN OF LAND  
IN  
MEDWAY, MA

730 MAIN STREET  
SUITE 2C  
MILLIS, MA 02054  
508-376-8883(o)

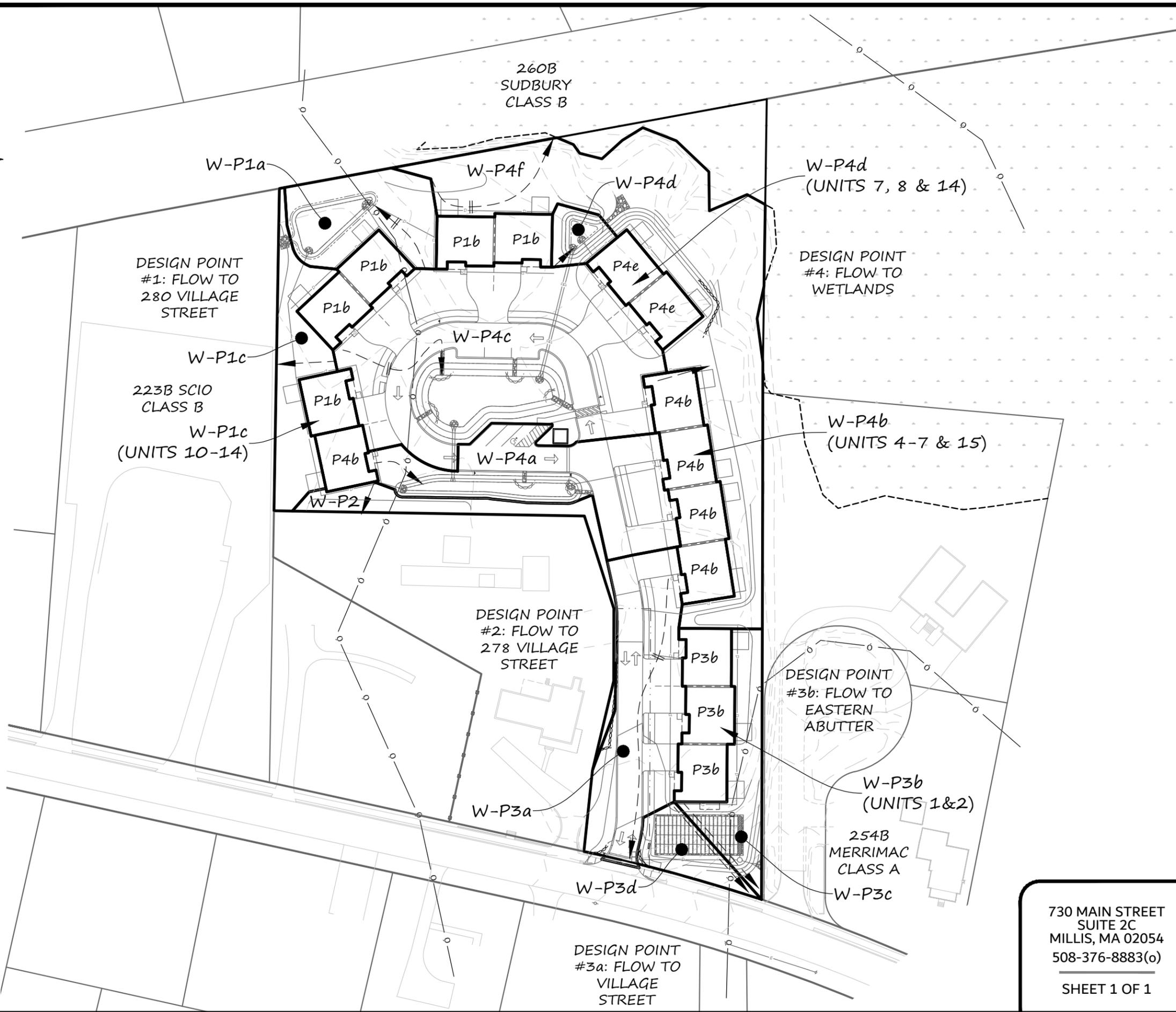


**LEGACY**  
ENGINEERING

SHEET 1 OF 1

DESIGN POINT  
#3a: FLOW TO  
VILLAGE  
STREET

**ATTACHMENT J: PROPOSED WATERSHED  
PLAN**



DESIGN POINT #1: FLOW TO 280 VILLAGE STREET

223B SCIO CLASS B  
W-P1c (UNITS 10-14)

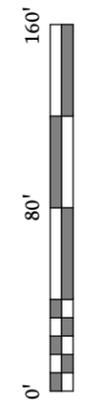
DESIGN POINT #2: FLOW TO 278 VILLAGE STREET

DESIGN POINT #4: FLOW TO WETLANDS

DESIGN POINT #3b: FLOW TO EASTERN ABUTTER

DESIGN POINT #3a: FLOW TO VILLAGE STREET

PLAN SCALE: 1"=80'



PLAN DATE: JUNE 25, 2019

REVISION	DATE	BY
REVISED PER TOWN COMMENTS	9/4/19	DJM
REVISED PER TOWN COMMENTS	10/7/19	DJM

WILLIAM WALLACE  
PROPOSED WATERSHED  
PLAN OF LAND  
IN  
MEDWAY, MA

730 MAIN STREET  
SUITE 2C  
MILLIS, MA 02054  
508-376-8883(o)

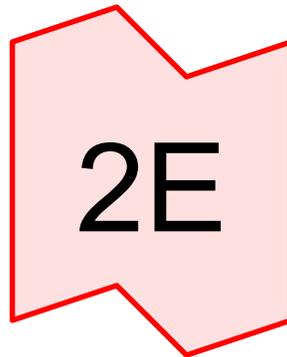
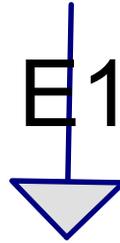
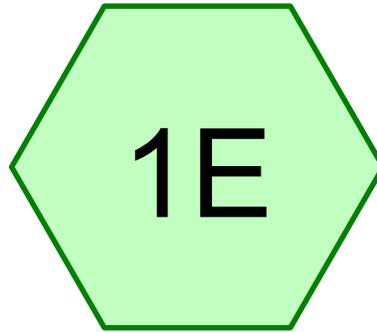


**LEGACY**  
ENGINEERING

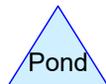
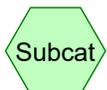
SHEET 1 OF 1

# ATTACHMENT K: HYDROCAD HYDROLOGY CALCULATIONS

**DESIGN POINT #1: FLOW TO 280**  
**VILLAGE STREET EXISTING**  
**CONDITIONS**



## Design Point #1: Flow to 280 Village Street



### Routing Diagram for HydroCAD2

Prepared by {enter your company name here}, Printed 6/29/2019  
HydroCAD® 10.00-24 s/n 05266 © 2018 HydroCAD Software Solutions LLC

## HydroCAD2

Prepared by {enter your company name here}

HydroCAD® 10.00-24 s/n 05266 © 2018 HydroCAD Software Solutions LLC

Printed 6/29/2019

Page 2

### Area Listing (selected nodes)

Area (acres)	CN	Description (subcatchment-numbers)
0.112	61	>75% Grass cover, Good, HSG B (1E)
0.023	98	Conc Pads, HSG B (1E)
0.015	98	Roofs, HSG B (1E)
0.763	55	Woods, Good, HSG B (1E)
<b>0.913</b>	<b>57</b>	<b>TOTAL AREA</b>

## HydroCAD2

Prepared by {enter your company name here}

HydroCAD® 10.00-24 s/n 05266 © 2018 HydroCAD Software Solutions LLC

Printed 6/29/2019

Page 3

### Soil Listing (selected nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.000	HSG A	
0.913	HSG B	1E
0.000	HSG C	
0.000	HSG D	
0.000	Other	
<b>0.913</b>		<b>TOTAL AREA</b>

## HydroCAD2

Prepared by {enter your company name here}

HydroCAD® 10.00-24 s/n 05266 © 2018 HydroCAD Software Solutions LLC

Type III 24-hr 2-YR Rainfall=3.20"

Printed 6/29/2019

Page 4

Time span=0.00-30.00 hrs, dt=0.01 hrs, 3001 points  
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN  
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

### Subcatchment 1E: E1

Runoff Area=39,750 sf 4.08% Impervious Runoff Depth=0.31"  
Flow Length=194' Tc=14.8 min CN=57 Runoff=0.12 cfs 0.024 af

### Link 2E: Design Point #1: Flow to 280 Village Street

Inflow=0.12 cfs 0.024 af  
Primary=0.12 cfs 0.024 af

**Total Runoff Area = 0.913 ac Runoff Volume = 0.024 af Average Runoff Depth = 0.31"**  
**95.92% Pervious = 0.875 ac 4.08% Impervious = 0.037 ac**

**Summary for Subcatchment 1E: E1**

Runoff = 0.12 cfs @ 12.42 hrs, Volume= 0.024 af, Depth= 0.31"

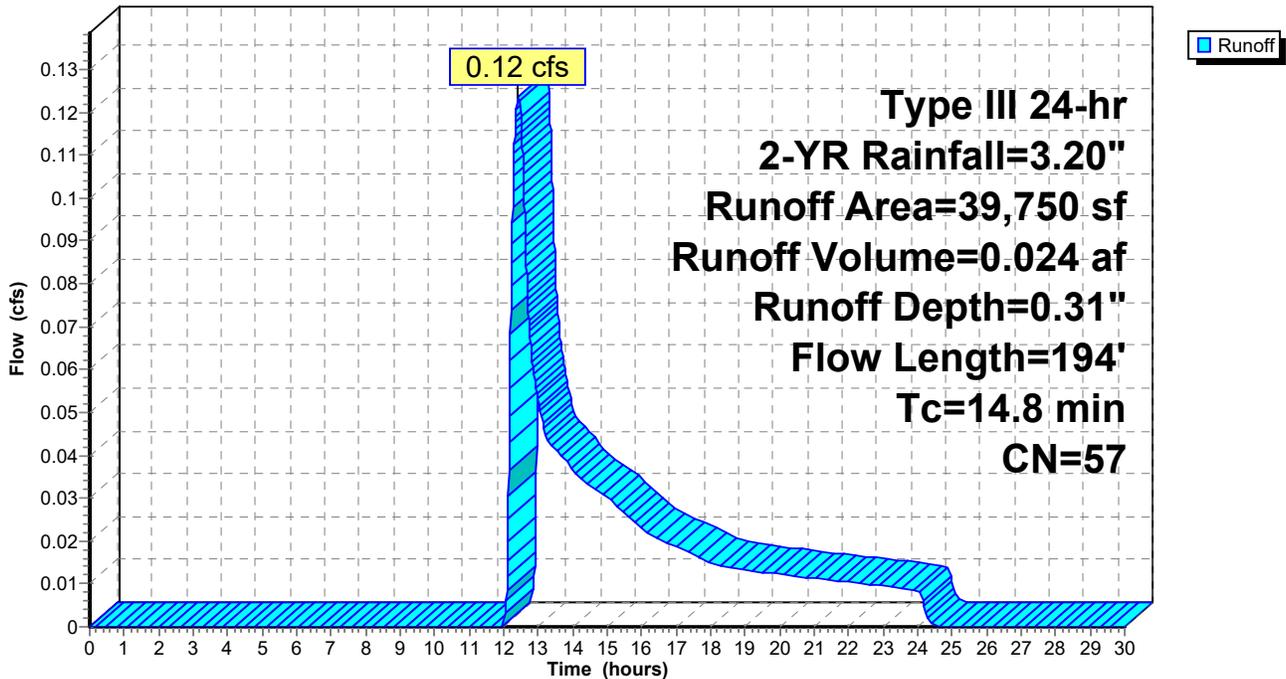
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
Type III 24-hr 2-YR Rainfall=3.20"

Area (sf)	CN	Description
* 987	98	Conc Pads, HSG B
636	98	Roofs, HSG B
4,896	61	>75% Grass cover, Good, HSG B
33,231	55	Woods, Good, HSG B
39,750	57	Weighted Average
38,127		95.92% Pervious Area
1,623		4.08% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.2	27	0.0120	0.05		<b>Sheet Flow,</b> Woods: Light underbrush n= 0.400 P2= 3.20"
5.6	167	0.0100	0.50		<b>Shallow Concentrated Flow,</b> Woodland Kv= 5.0 fps
14.8	194	Total			

**Subcatchment 1E: E1**

Hydrograph



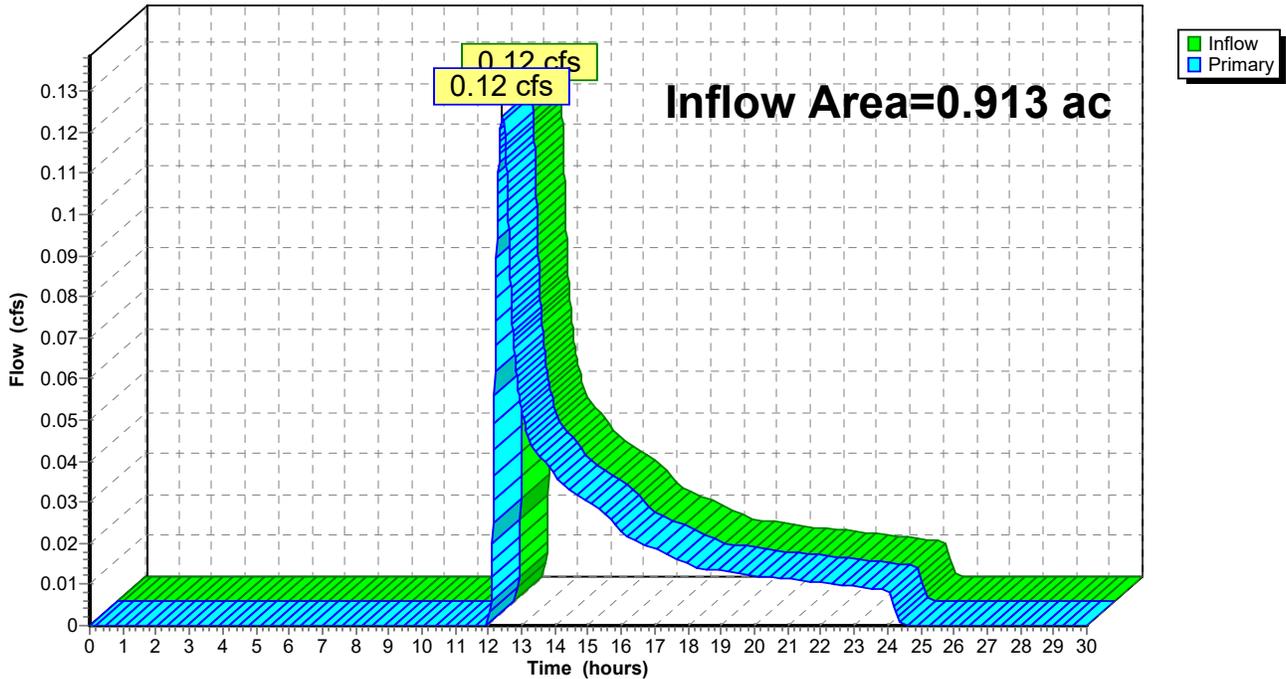
### Summary for Link 2E: Design Point #1: Flow to 280 Village Street

Inflow Area = 0.913 ac, 4.08% Impervious, Inflow Depth = 0.31" for 2-YR event  
Inflow = 0.12 cfs @ 12.42 hrs, Volume= 0.024 af  
Primary = 0.12 cfs @ 12.42 hrs, Volume= 0.024 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs

### Link 2E: Design Point #1: Flow to 280 Village Street

Hydrograph



## HydroCAD2

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Type III 24-hr 10-YR Rainfall=4.70"

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Time span=0.00-30.00 hrs, dt=0.01 hrs, 3001 points  
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN  
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

### Subcatchment 1E: E1

Runoff Area=39,750 sf 4.08% Impervious Runoff Depth=0.95"  
Flow Length=194' Tc=14.8 min CN=57 Runoff=0.62 cfs 0.072 af

### Link 2E: Design Point #1: Flow to 280 Village Street

Inflow=0.62 cfs 0.072 af  
Primary=0.62 cfs 0.072 af

**Total Runoff Area = 0.913 ac Runoff Volume = 0.072 af Average Runoff Depth = 0.95"**  
**95.92% Pervious = 0.875 ac 4.08% Impervious = 0.037 ac**

**Summary for Subcatchment 1E: E1**

Runoff = 0.62 cfs @ 12.25 hrs, Volume= 0.072 af, Depth= 0.95"

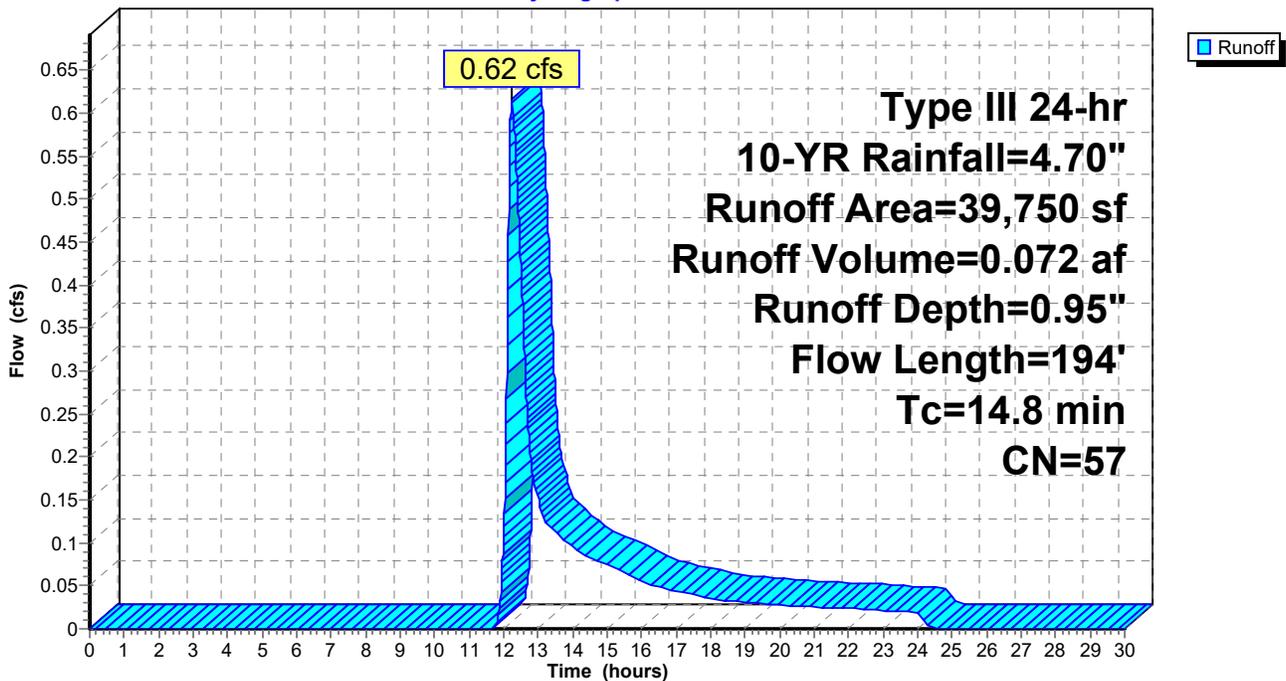
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
Type III 24-hr 10-YR Rainfall=4.70"

Area (sf)	CN	Description
* 987	98	Conc Pads, HSG B
636	98	Roofs, HSG B
4,896	61	>75% Grass cover, Good, HSG B
33,231	55	Woods, Good, HSG B
39,750	57	Weighted Average
38,127		95.92% Pervious Area
1,623		4.08% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.2	27	0.0120	0.05		<b>Sheet Flow,</b> Woods: Light underbrush n= 0.400 P2= 3.20"
5.6	167	0.0100	0.50		<b>Shallow Concentrated Flow,</b> Woodland Kv= 5.0 fps
14.8	194	Total			

**Subcatchment 1E: E1**

Hydrograph



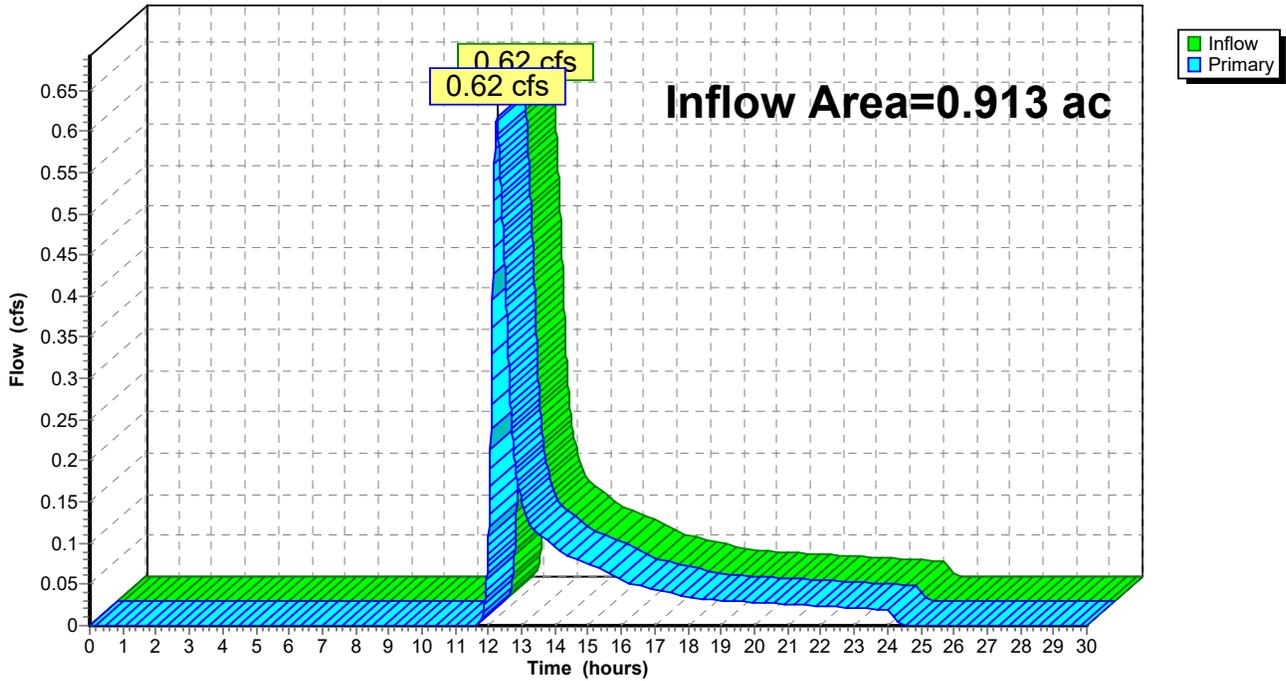
### Summary for Link 2E: Design Point #1: Flow to 280 Village Street

Inflow Area = 0.913 ac, 4.08% Impervious, Inflow Depth = 0.95" for 10-YR event  
Inflow = 0.62 cfs @ 12.25 hrs, Volume= 0.072 af  
Primary = 0.62 cfs @ 12.25 hrs, Volume= 0.072 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs

### Link 2E: Design Point #1: Flow to 280 Village Street

Hydrograph



## HydroCAD2

Type III 24-hr 25-YR Rainfall=5.50"

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Time span=0.00-30.00 hrs, dt=0.01 hrs, 3001 points  
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN  
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

### Subcatchment 1E: E1

Runoff Area=39,750 sf 4.08% Impervious Runoff Depth=1.38"  
Flow Length=194' Tc=14.8 min CN=57 Runoff=0.98 cfs 0.105 af

### Link 2E: Design Point #1: Flow to 280 Village Street

Inflow=0.98 cfs 0.105 af  
Primary=0.98 cfs 0.105 af

**Total Runoff Area = 0.913 ac Runoff Volume = 0.105 af Average Runoff Depth = 1.38"**  
**95.92% Pervious = 0.875 ac 4.08% Impervious = 0.037 ac**

**Summary for Subcatchment 1E: E1**

Runoff = 0.98 cfs @ 12.22 hrs, Volume= 0.105 af, Depth= 1.38"

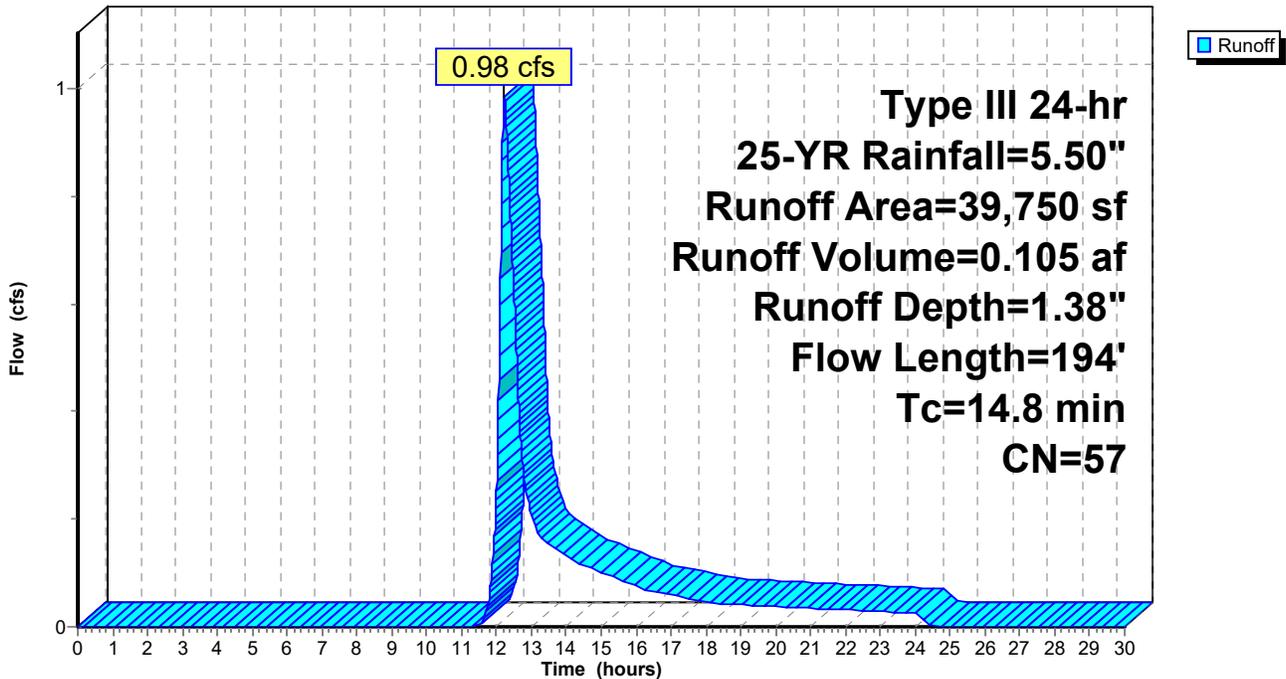
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
Type III 24-hr 25-YR Rainfall=5.50"

Area (sf)	CN	Description
* 987	98	Conc Pads, HSG B
636	98	Roofs, HSG B
4,896	61	>75% Grass cover, Good, HSG B
33,231	55	Woods, Good, HSG B
39,750	57	Weighted Average
38,127		95.92% Pervious Area
1,623		4.08% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.2	27	0.0120	0.05		<b>Sheet Flow,</b> Woods: Light underbrush n= 0.400 P2= 3.20"
5.6	167	0.0100	0.50		<b>Shallow Concentrated Flow,</b> Woodland Kv= 5.0 fps
14.8	194	Total			

**Subcatchment 1E: E1**

Hydrograph

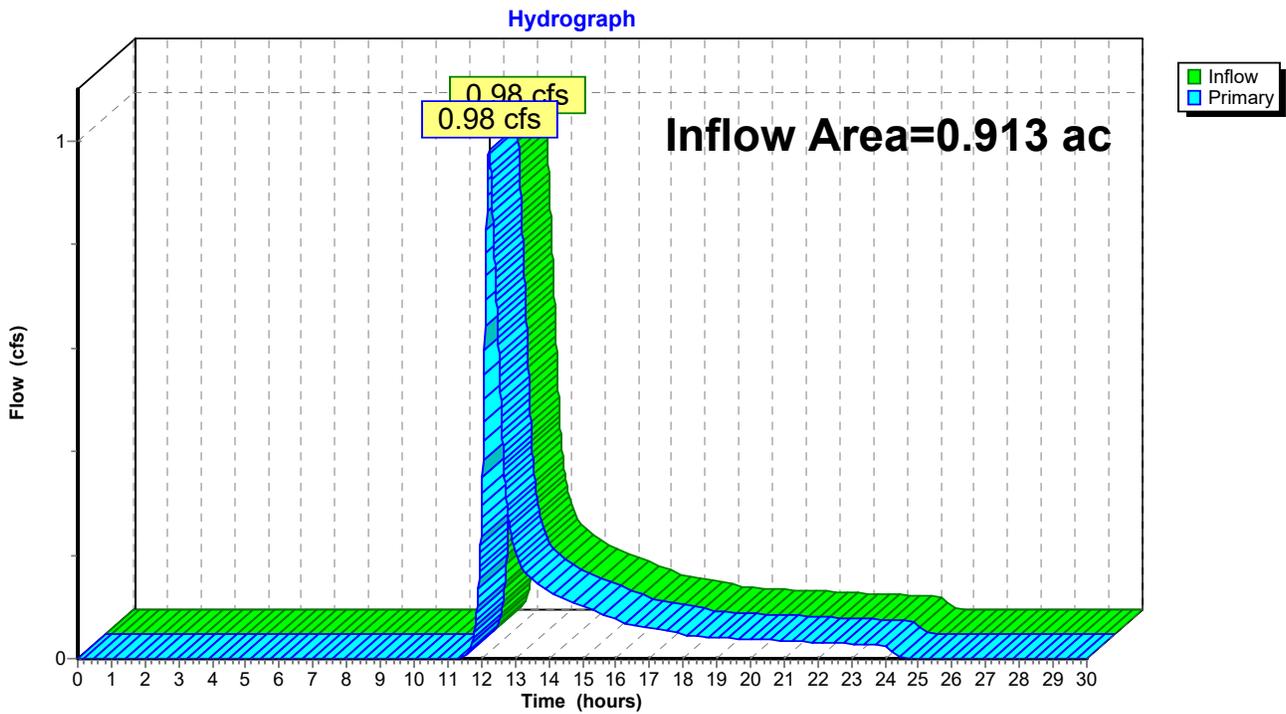


### Summary for Link 2E: Design Point #1: Flow to 280 Village Street

Inflow Area = 0.913 ac, 4.08% Impervious, Inflow Depth = 1.38" for 25-YR event  
Inflow = 0.98 cfs @ 12.22 hrs, Volume= 0.105 af  
Primary = 0.98 cfs @ 12.22 hrs, Volume= 0.105 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs

### Link 2E: Design Point #1: Flow to 280 Village Street



## HydroCAD2

Type III 24-hr 50-YR Rainfall=6.10"

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Time span=0.00-30.00 hrs, dt=0.01 hrs, 3001 points  
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN  
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

### Subcatchment 1E: E1

Runoff Area=39,750 sf 4.08% Impervious Runoff Depth=1.74"  
Flow Length=194' Tc=14.8 min CN=57 Runoff=1.29 cfs 0.132 af

### Link 2E: Design Point #1: Flow to 280 Village Street

Inflow=1.29 cfs 0.132 af  
Primary=1.29 cfs 0.132 af

**Total Runoff Area = 0.913 ac Runoff Volume = 0.132 af Average Runoff Depth = 1.74"**  
**95.92% Pervious = 0.875 ac 4.08% Impervious = 0.037 ac**

**Summary for Subcatchment 1E: E1**

Runoff = 1.29 cfs @ 12.22 hrs, Volume= 0.132 af, Depth= 1.74"

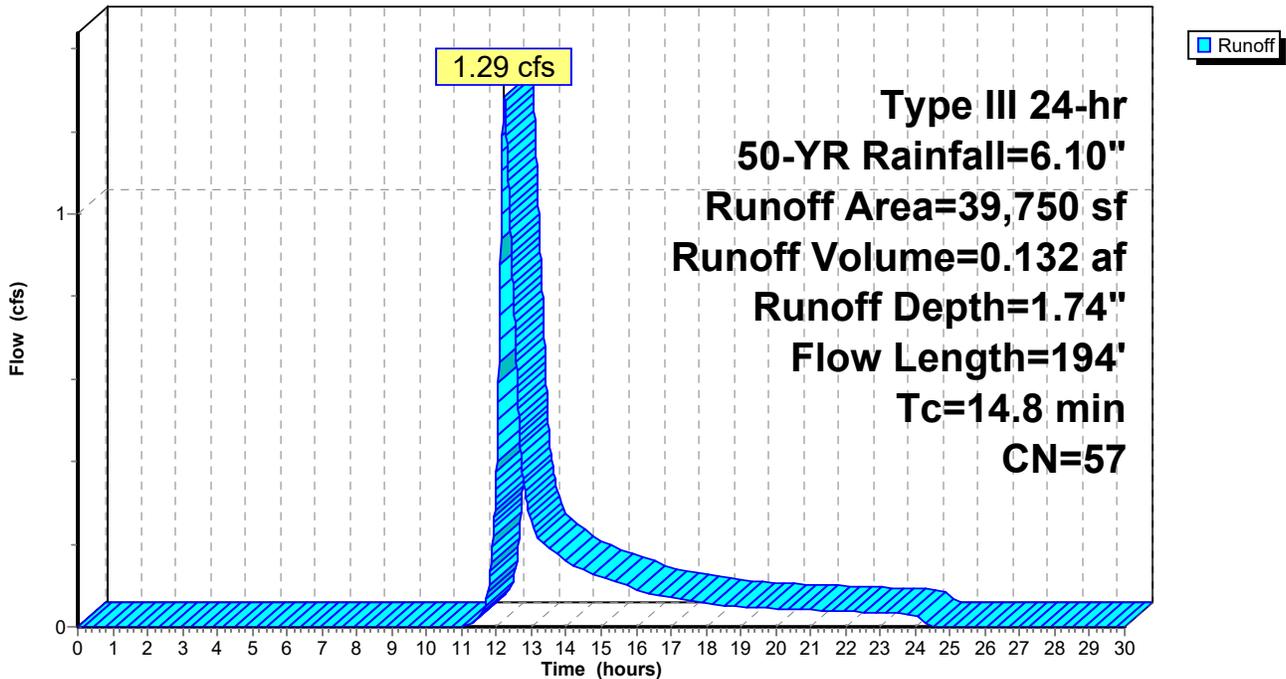
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
Type III 24-hr 50-YR Rainfall=6.10"

Area (sf)	CN	Description
* 987	98	Conc Pads, HSG B
636	98	Roofs, HSG B
4,896	61	>75% Grass cover, Good, HSG B
33,231	55	Woods, Good, HSG B
39,750	57	Weighted Average
38,127		95.92% Pervious Area
1,623		4.08% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.2	27	0.0120	0.05		<b>Sheet Flow,</b> Woods: Light underbrush n= 0.400 P2= 3.20"
5.6	167	0.0100	0.50		<b>Shallow Concentrated Flow,</b> Woodland Kv= 5.0 fps
14.8	194	Total			

**Subcatchment 1E: E1**

Hydrograph

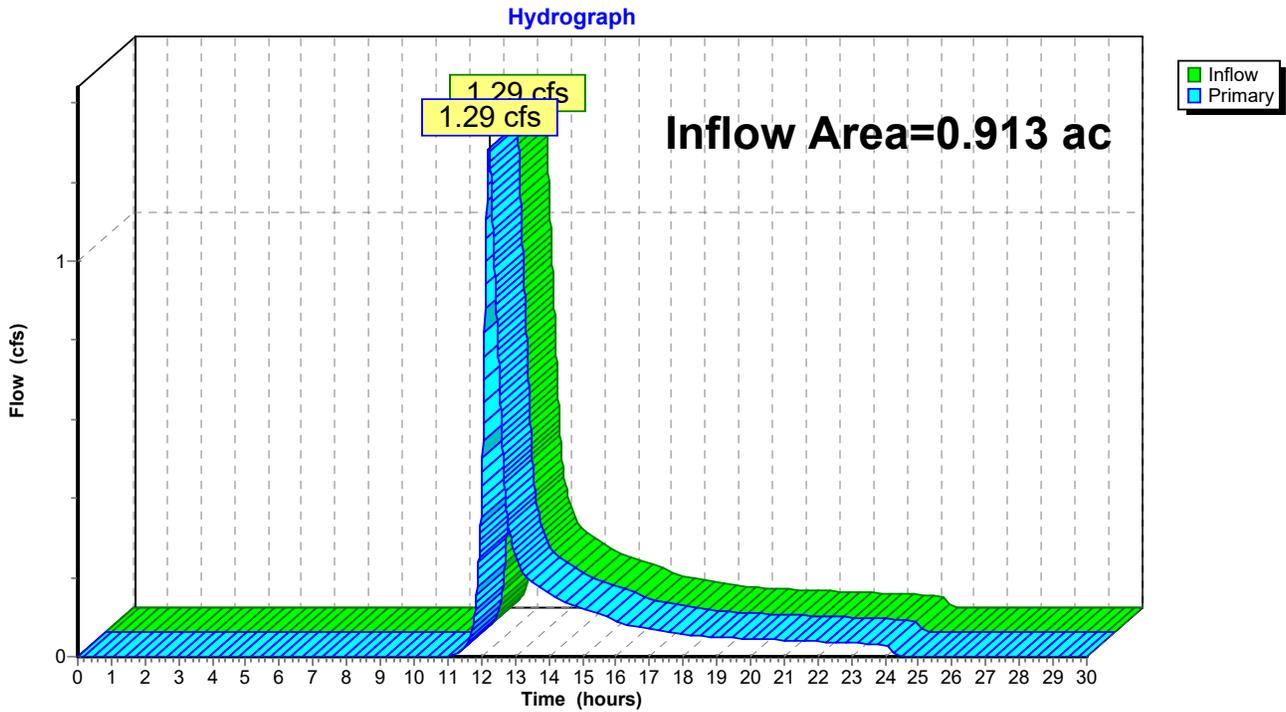


### Summary for Link 2E: Design Point #1: Flow to 280 Village Street

Inflow Area = 0.913 ac, 4.08% Impervious, Inflow Depth = 1.74" for 50-YR event  
Inflow = 1.29 cfs @ 12.22 hrs, Volume= 0.132 af  
Primary = 1.29 cfs @ 12.22 hrs, Volume= 0.132 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs

### Link 2E: Design Point #1: Flow to 280 Village Street



## HydroCAD2

Type III 24-hr 100-YR Rainfall=6.70"

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Time span=0.00-30.00 hrs, dt=0.01 hrs, 3001 points  
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN  
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

### Subcatchment 1E: E1

Runoff Area=39,750 sf 4.08% Impervious Runoff Depth=2.12"  
Flow Length=194' Tc=14.8 min CN=57 Runoff=1.61 cfs 0.161 af

### Link 2E: Design Point #1: Flow to 280 Village Street

Inflow=1.61 cfs 0.161 af  
Primary=1.61 cfs 0.161 af

**Total Runoff Area = 0.913 ac Runoff Volume = 0.161 af Average Runoff Depth = 2.12"**  
**95.92% Pervious = 0.875 ac 4.08% Impervious = 0.037 ac**

**Summary for Subcatchment 1E: E1**

Runoff = 1.61 cfs @ 12.22 hrs, Volume= 0.161 af, Depth= 2.12"

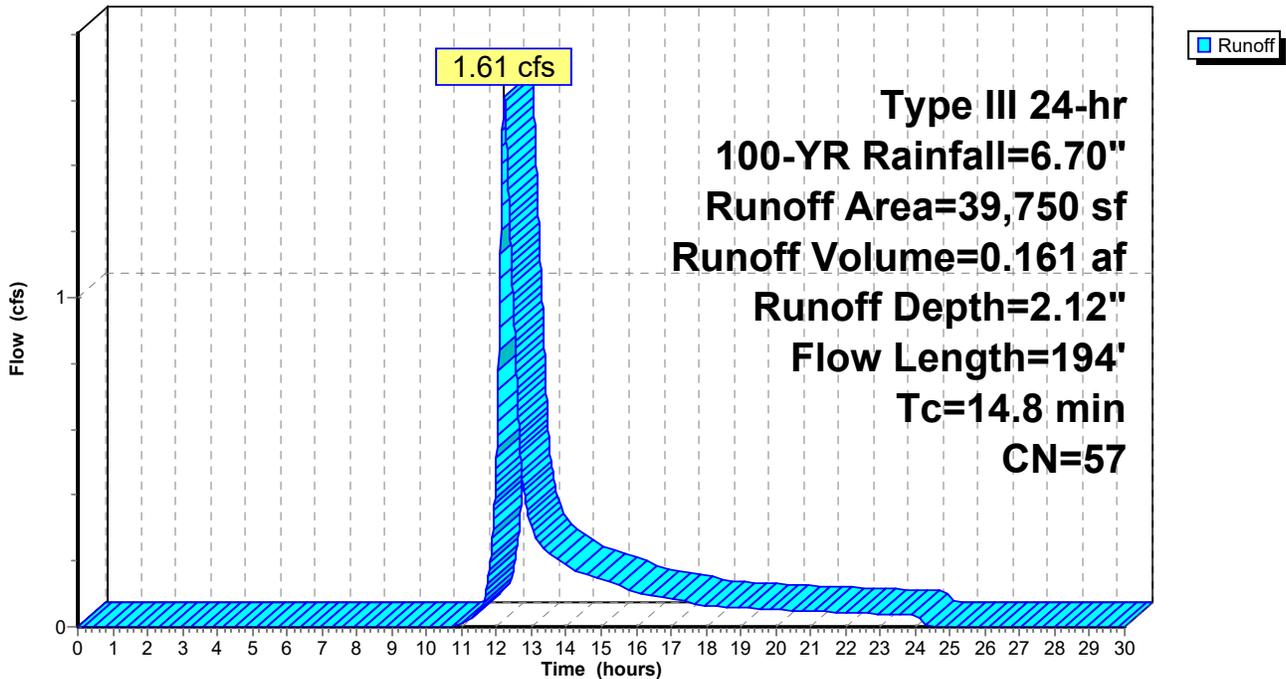
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
Type III 24-hr 100-YR Rainfall=6.70"

Area (sf)	CN	Description
* 987	98	Conc Pads, HSG B
636	98	Roofs, HSG B
4,896	61	>75% Grass cover, Good, HSG B
33,231	55	Woods, Good, HSG B
39,750	57	Weighted Average
38,127		95.92% Pervious Area
1,623		4.08% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.2	27	0.0120	0.05		<b>Sheet Flow,</b> Woods: Light underbrush n= 0.400 P2= 3.20"
5.6	167	0.0100	0.50		<b>Shallow Concentrated Flow,</b> Woodland Kv= 5.0 fps
14.8	194	Total			

**Subcatchment 1E: E1**

Hydrograph

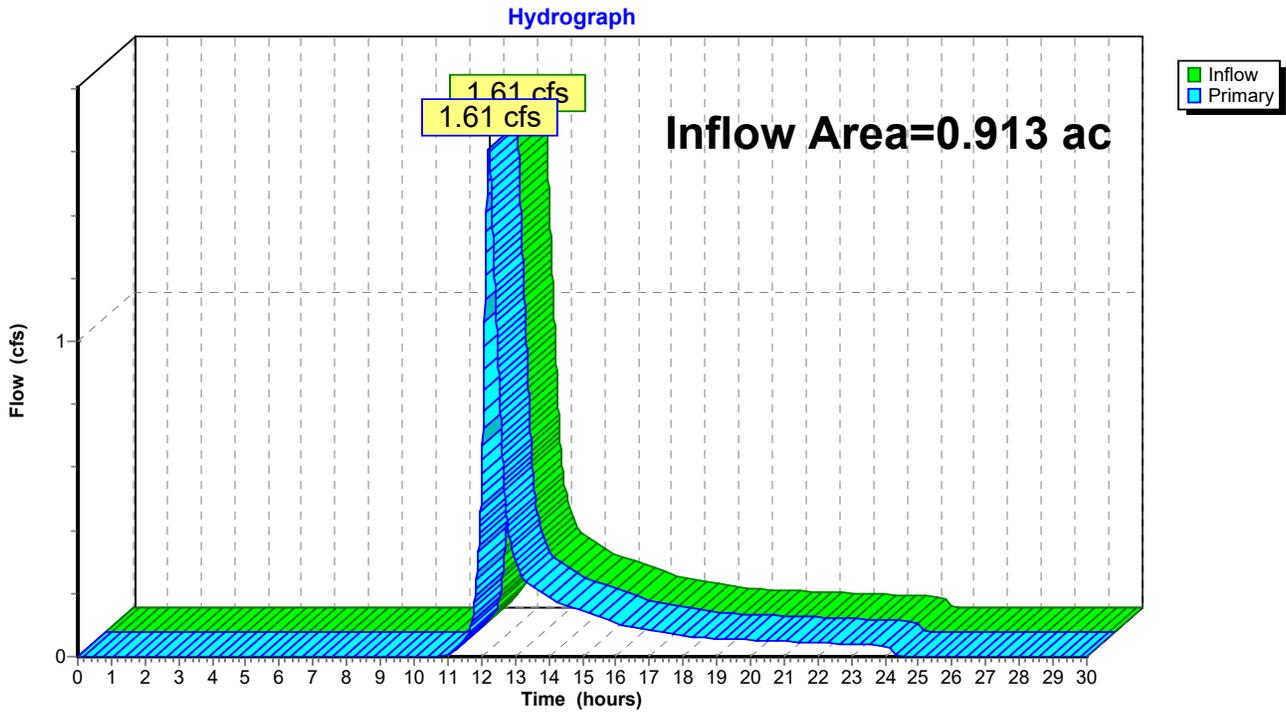


### Summary for Link 2E: Design Point #1: Flow to 280 Village Street

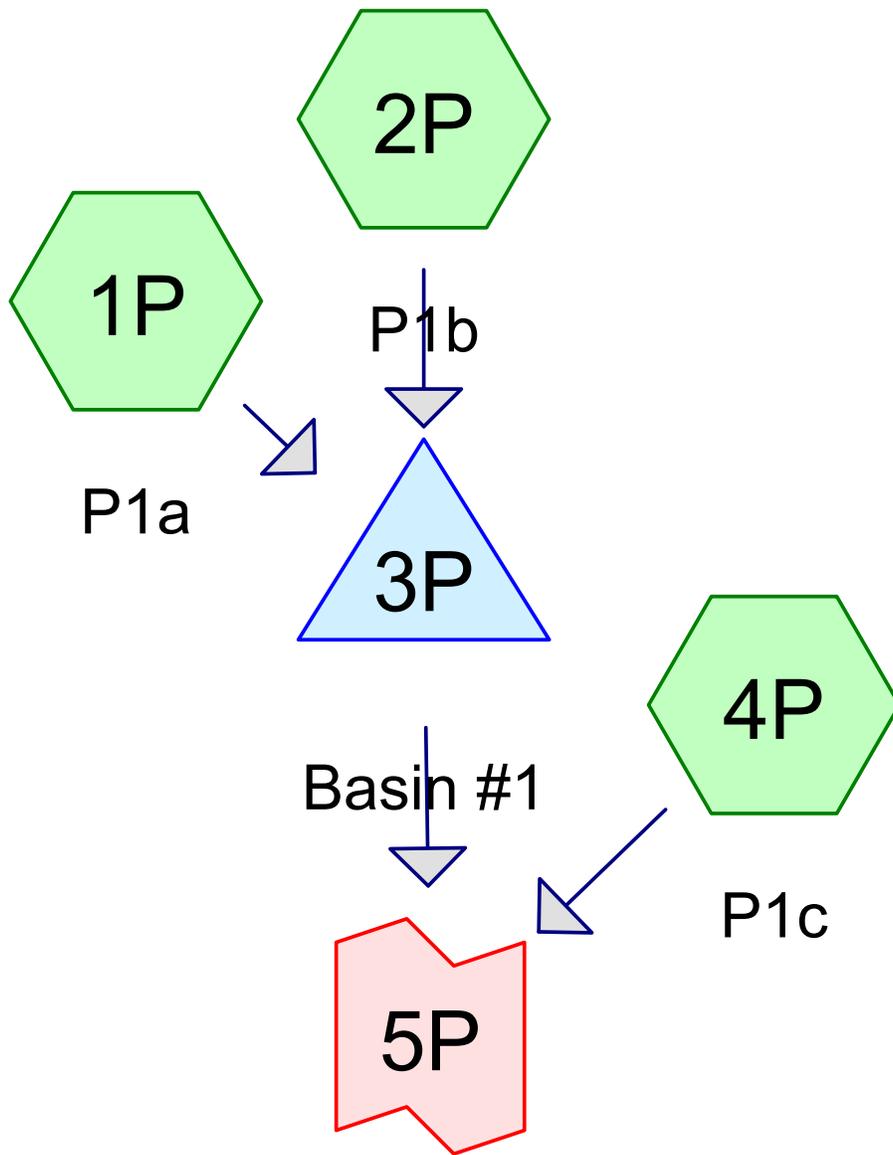
Inflow Area = 0.913 ac, 4.08% Impervious, Inflow Depth = 2.12" for 100-YR event  
Inflow = 1.61 cfs @ 12.22 hrs, Volume= 0.161 af  
Primary = 1.61 cfs @ 12.22 hrs, Volume= 0.161 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs

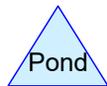
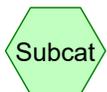
### Link 2E: Design Point #1: Flow to 280 Village Street



**DESIGN POINT #1: FLOW TO 280**  
**VILLAGE STREET PROPOSED**  
**CONDITIONS**



Design Point #1: Flow to  
280 Village Street



**Routing Diagram for HydroCAD4**

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# HydroCAD4

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## Area Listing (selected nodes)

Area (acres)	CN	Description (subcatchment-numbers)
0.323	61	>75% Grass cover, Good, HSG B (1P, 4P)
0.013	98	Patios, HSG B (4P)
0.004	90	Pavers, HSG B (1P)
0.214	98	Roofs, HSG B (2P)
<b>0.555</b>	<b>76</b>	<b>TOTAL AREA</b>

**HydroCAD4**

Type III 24-hr 2-YR Rainfall=3.20"

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Page 3

Time span=0.00-30.00 hrs, dt=0.01 hrs, 3001 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 1P: P1a**

Runoff Area=7,863 sf 0.00% Impervious Runoff Depth=0.48"  
Flow Length=68' Tc=9.6 min CN=62 Runoff=0.06 cfs 0.007 af

**Subcatchment 2P: P1b**

Runoff Area=9,310 sf 100.00% Impervious Runoff Depth=2.97"  
Tc=2.0 min CN=98 Runoff=0.77 cfs 0.053 af

**Pond 3P: Basin #1**

Peak Elev=186.53' Storage=782 cf Inflow=0.78 cfs 0.060 af  
Discarded=0.09 cfs 0.060 af Primary=0.00 cfs 0.000 af Outflow=0.09 cfs 0.060 af

**Subcatchment 4P: P1c**

Runoff Area=6,988 sf 8.41% Impervious Runoff Depth=0.56"  
Flow Length=47' Slope=0.0200 '/ Tc=7.8 min CN=64 Runoff=0.07 cfs 0.007 af

**Link 5P: Design Point #1: Flow to 280 Village Street**

Inflow=0.07 cfs 0.007 af  
Primary=0.07 cfs 0.007 af

**Total Runoff Area = 0.555 ac Runoff Volume = 0.068 af Average Runoff Depth = 1.46"**  
**59.03% Pervious = 0.327 ac 40.97% Impervious = 0.227 ac**

**Summary for Subcatchment 1P: P1a**

Runoff = 0.06 cfs @ 12.17 hrs, Volume= 0.007 af, Depth= 0.48"

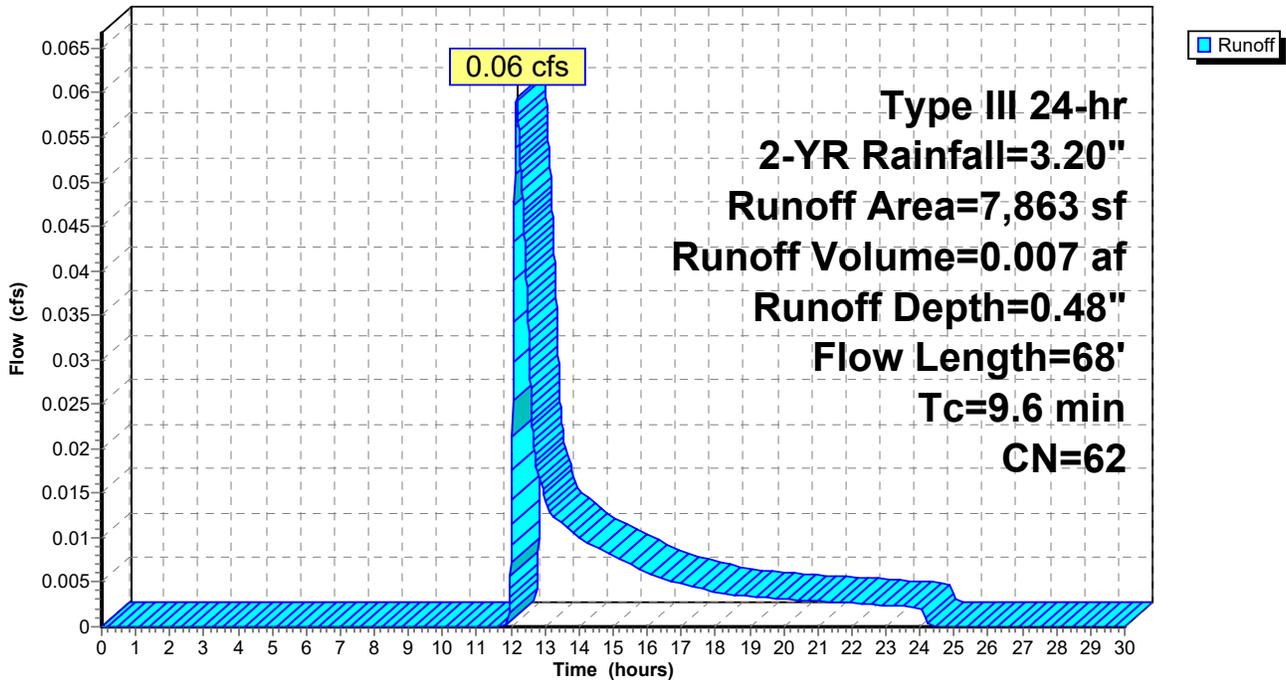
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
Type III 24-hr 2-YR Rainfall=3.20"

Area (sf)	CN	Description
* 196	90	Pavers, HSG B
7,667	61	>75% Grass cover, Good, HSG B
7,863	62	Weighted Average
7,863		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.4	46	0.0120	0.08		Sheet Flow, Grass: Dense n= 0.240 P2= 3.20"
0.2	22	0.0500	1.57		Shallow Concentrated Flow, Short Grass Pasture Kv= 7.0 fps
9.6	68	Total			

**Subcatchment 1P: P1a**

Hydrograph



**Summary for Subcatchment 2P: P1b**

Runoff = 0.77 cfs @ 12.03 hrs, Volume= 0.053 af, Depth= 2.97"

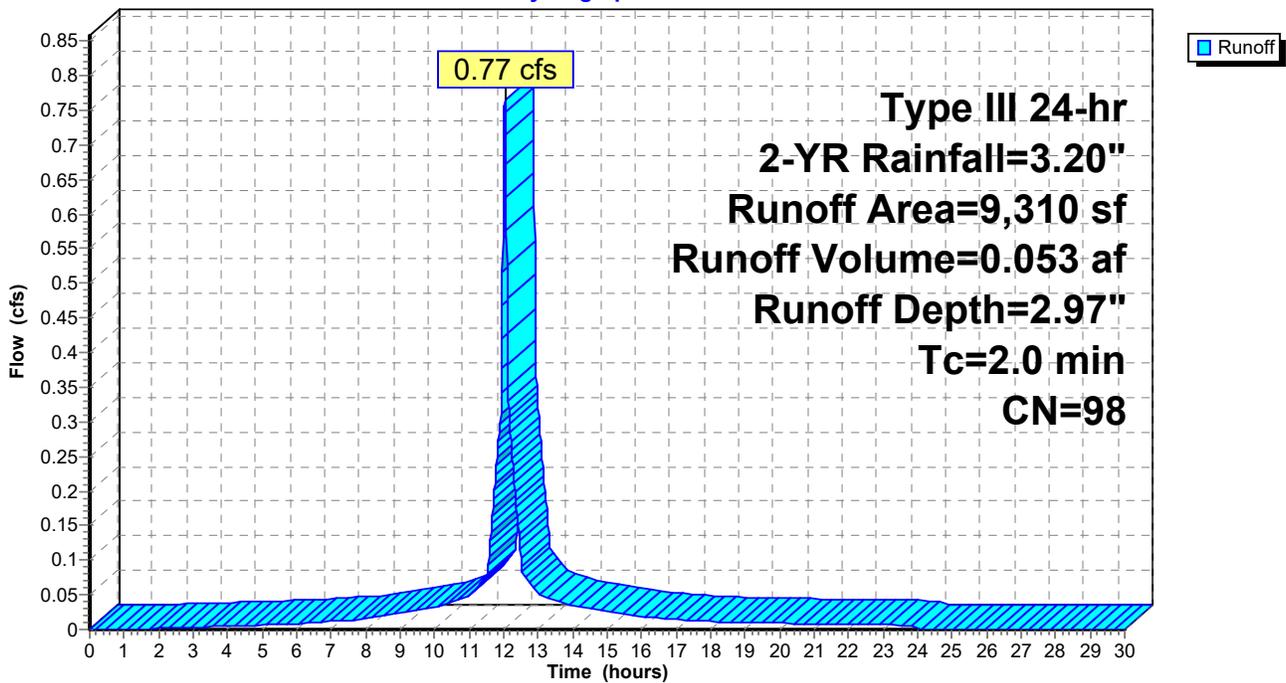
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
 Type III 24-hr 2-YR Rainfall=3.20"

Area (sf)	CN	Description
9,310	98	Roofs, HSG B
9,310		100.00% Impervious Area

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

**Subcatchment 2P: P1b**

Hydrograph



**Summary for Pond 3P: Basin #1**

Inflow Area = 0.394 ac, 54.21% Impervious, Inflow Depth = 1.83" for 2-YR event  
 Inflow = 0.78 cfs @ 12.03 hrs, Volume= 0.060 af  
 Outflow = 0.09 cfs @ 12.70 hrs, Volume= 0.060 af, Atten= 88%, Lag= 40.3 min  
 Discarded = 0.09 cfs @ 12.70 hrs, Volume= 0.060 af  
 Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
 Peak Elev= 186.53' @ 12.70 hrs Surf.Area= 1,612 sf Storage= 782 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)  
 Center-of-Mass det. time= 59.5 min ( 831.4 - 772.0 )

Volume	Invert	Avail.Storage	Storage Description			
#1	186.00'	2,608 cf	<b>Custom Stage Data (Irregular)</b> Listed below (Recalc)			
Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)	
186.00	1,345	167.0	0	0	1,345	
187.50	2,165	196.0	2,608	2,608	2,226	

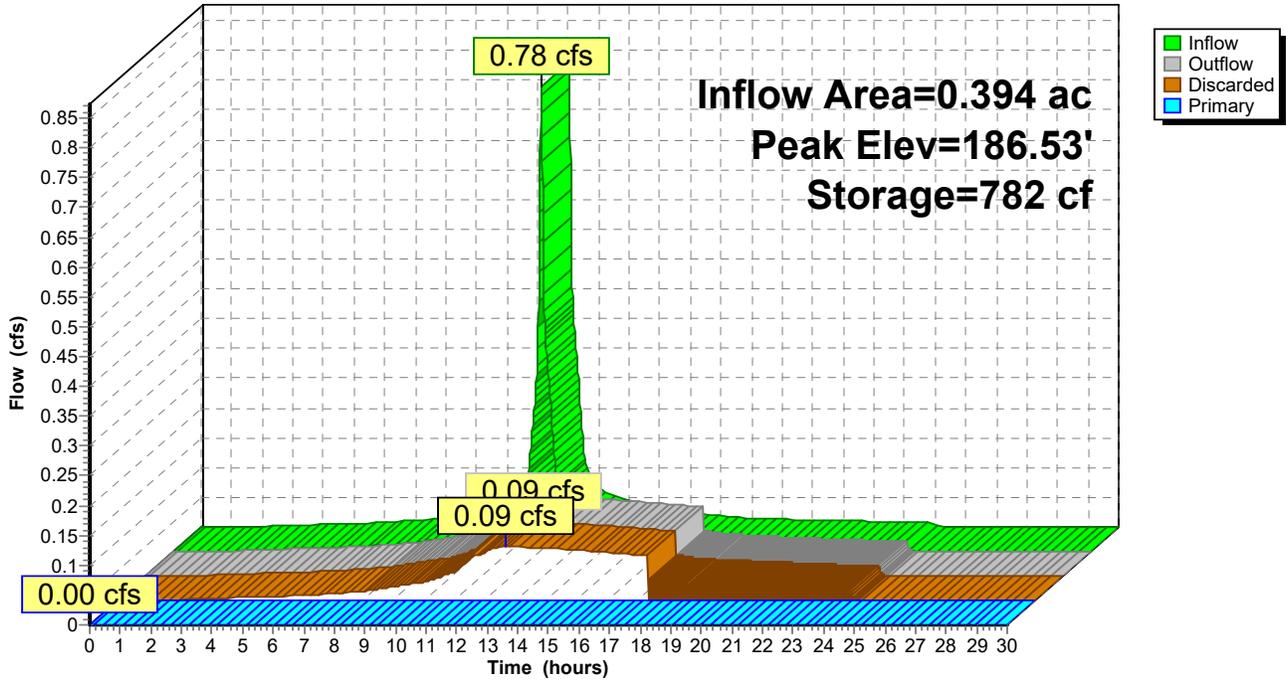
Device	Routing	Invert	Outlet Devices
#1	Discarded	186.00'	<b>2.410 in/hr Exfiltration over Surface area</b>
#2	Device 3	186.75'	<b>Custom Weir/Orifice, Cv= 2.62 (C= 3.28)</b> Elev. (feet) 186.75 187.00 Width (feet) 4.00 4.00
#3	Primary	186.60'	<b>Custom Weir/Orifice, Cv= 2.62 (C= 3.28)</b> Elev. (feet) 186.60 187.00 Width (feet) 10.00 10.00

**Discarded OutFlow** Max=0.09 cfs @ 12.70 hrs HW=186.53' (Free Discharge)  
 ↑1=Exfiltration (Exfiltration Controls 0.09 cfs)

**Primary OutFlow** Max=0.00 cfs @ 0.00 hrs HW=186.00' TW=0.00' (Dynamic Tailwater)  
 ↑3=Custom Weir/Orifice ( Controls 0.00 cfs)  
 ↑2=Custom Weir/Orifice ( Controls 0.00 cfs)

### Pond 3P: Basin #1

Hydrograph



**Summary for Subcatchment 4P: P1c**

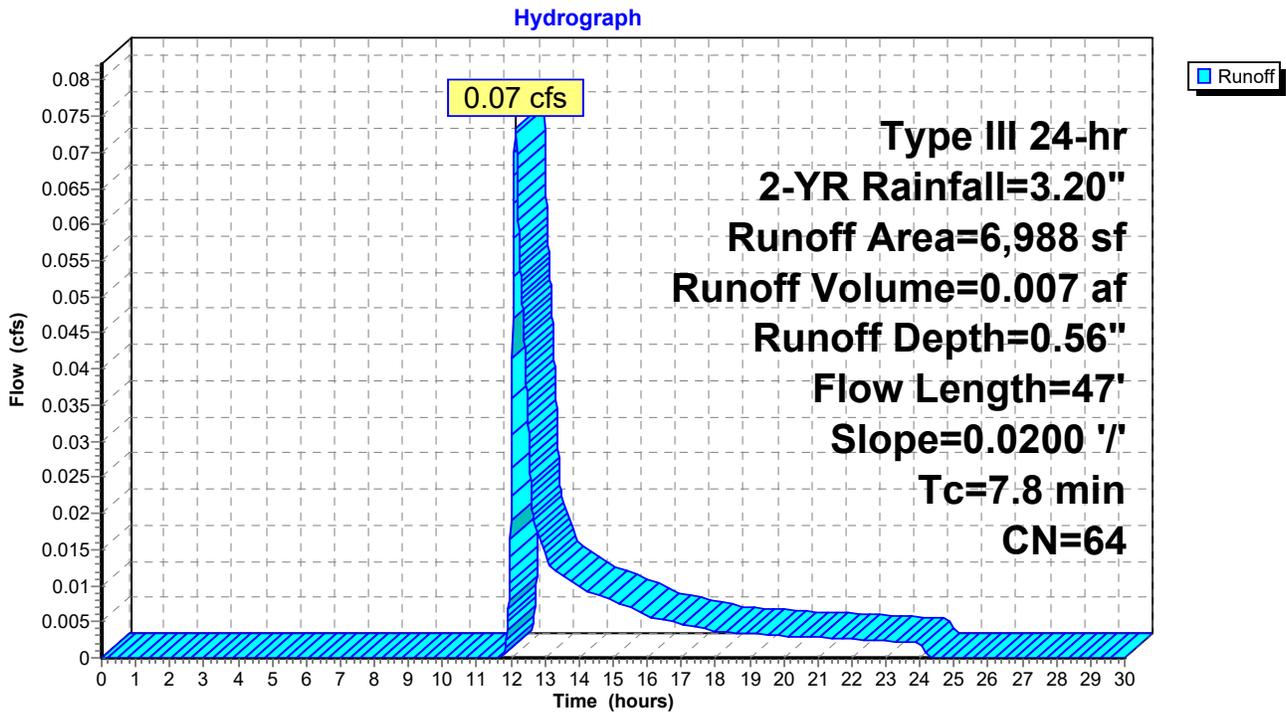
Runoff = 0.07 cfs @ 12.14 hrs, Volume= 0.007 af, Depth= 0.56"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
Type III 24-hr 2-YR Rainfall=3.20"

Area (sf)	CN	Description
* 588	98	Patios, HSG B
6,400	61	>75% Grass cover, Good, HSG B
6,988	64	Weighted Average
6,400		91.59% Pervious Area
588		8.41% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.8	47	0.0200	0.10		Sheet Flow, Grass: Dense n= 0.240 P2= 3.20"

**Subcatchment 4P: P1c**



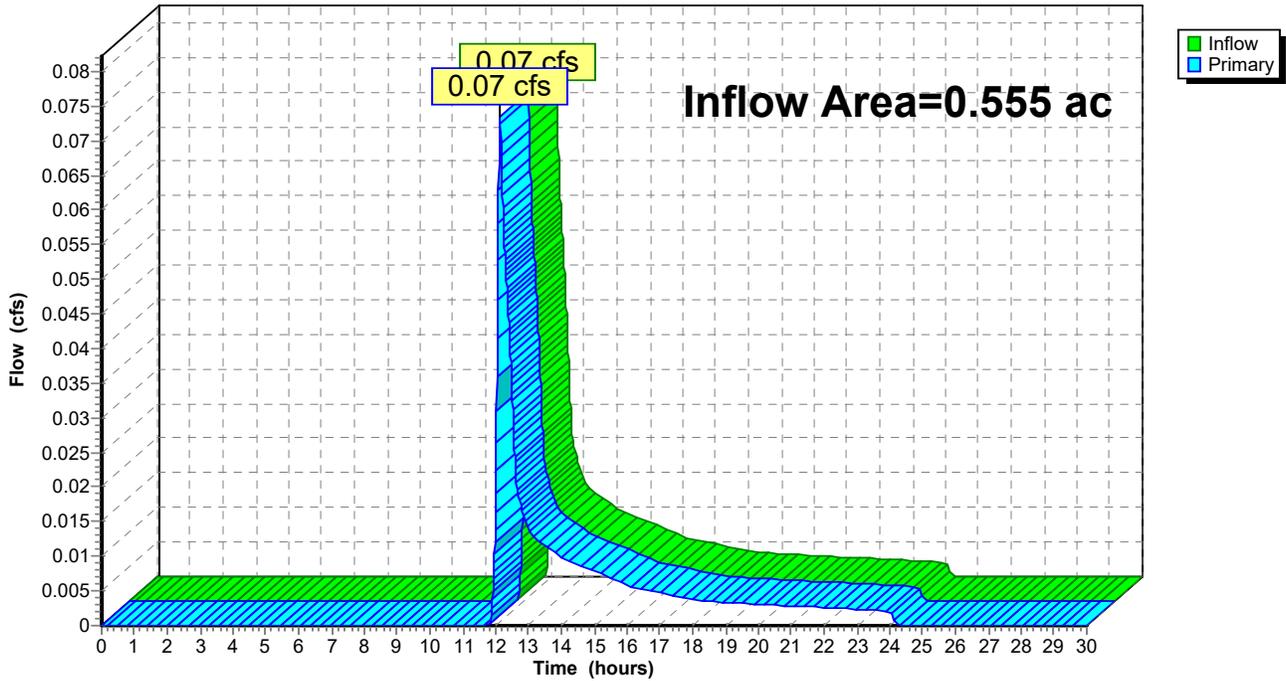
### Summary for Link 5P: Design Point #1: Flow to 280 Village Street

Inflow Area = 0.555 ac, 40.97% Impervious, Inflow Depth = 0.16" for 2-YR event  
Inflow = 0.07 cfs @ 12.14 hrs, Volume= 0.007 af  
Primary = 0.07 cfs @ 12.14 hrs, Volume= 0.007 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs

### Link 5P: Design Point #1: Flow to 280 Village Street

Hydrograph



**HydroCAD4**

Type III 24-hr 10-YR Rainfall=4.70"

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Time span=0.00-30.00 hrs, dt=0.01 hrs, 3001 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 1P: P1a**

Runoff Area=7,863 sf 0.00% Impervious Runoff Depth=1.26"  
Flow Length=68' Tc=9.6 min CN=62 Runoff=0.21 cfs 0.019 af

**Subcatchment 2P: P1b**

Runoff Area=9,310 sf 100.00% Impervious Runoff Depth=4.46"  
Tc=2.0 min CN=98 Runoff=1.13 cfs 0.080 af

**Pond 3P: Basin #1**

Peak Elev=186.83' Storage=1,283 cf Inflow=1.23 cfs 0.098 af  
Discarded=0.10 cfs 0.089 af Primary=0.27 cfs 0.010 af Outflow=0.37 cfs 0.098 af

**Subcatchment 4P: P1c**

Runoff Area=6,988 sf 8.41% Impervious Runoff Depth=1.39"  
Flow Length=47' Slope=0.0200 '/ Tc=7.8 min CN=64 Runoff=0.23 cfs 0.019 af

**Link 5P: Design Point #1: Flow to 280 Village Street**

Inflow=0.39 cfs 0.028 af  
Primary=0.39 cfs 0.028 af

**Total Runoff Area = 0.555 ac Runoff Volume = 0.117 af Average Runoff Depth = 2.53"**  
**59.03% Pervious = 0.327 ac 40.97% Impervious = 0.227 ac**

**Summary for Subcatchment 1P: P1a**

Runoff = 0.21 cfs @ 12.15 hrs, Volume= 0.019 af, Depth= 1.26"

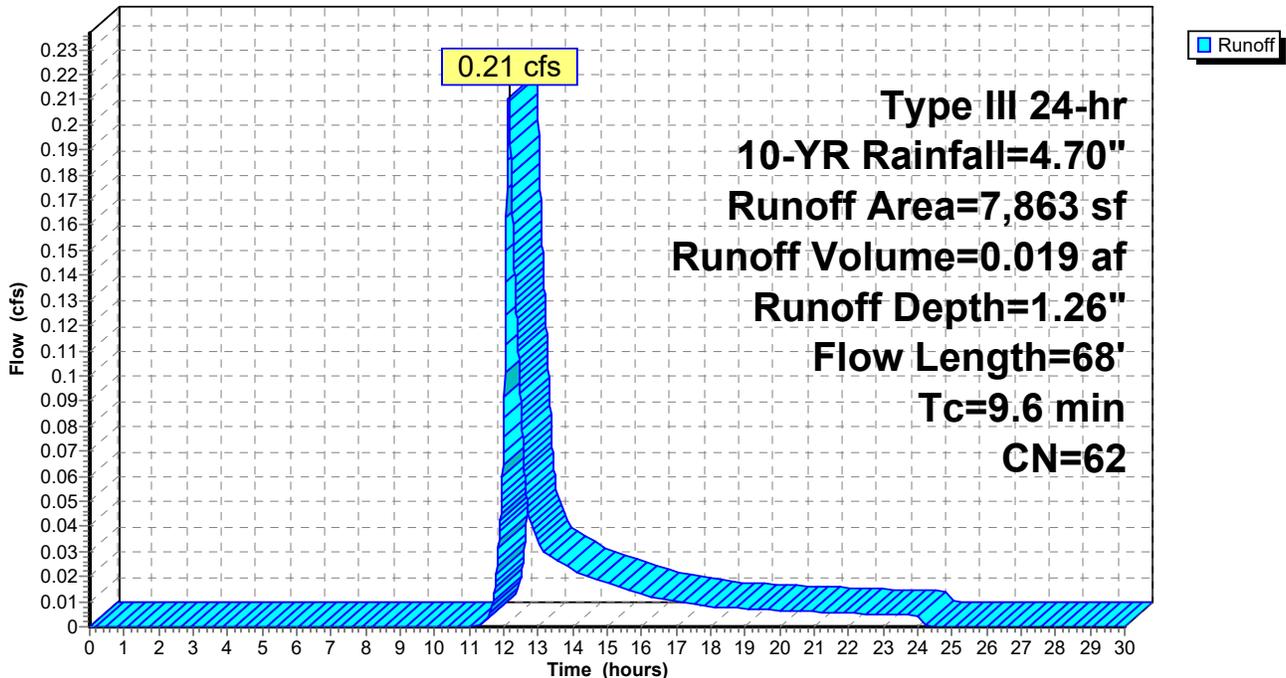
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
 Type III 24-hr 10-YR Rainfall=4.70"

Area (sf)	CN	Description
* 196	90	Pavers, HSG B
7,667	61	>75% Grass cover, Good, HSG B
7,863	62	Weighted Average
7,863		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.4	46	0.0120	0.08		Sheet Flow, Grass: Dense n= 0.240 P2= 3.20"
0.2	22	0.0500	1.57		Shallow Concentrated Flow, Short Grass Pasture Kv= 7.0 fps
9.6	68	Total			

**Subcatchment 1P: P1a**

Hydrograph



**Summary for Subcatchment 2P: P1b**

Runoff = 1.13 cfs @ 12.03 hrs, Volume= 0.080 af, Depth= 4.46"

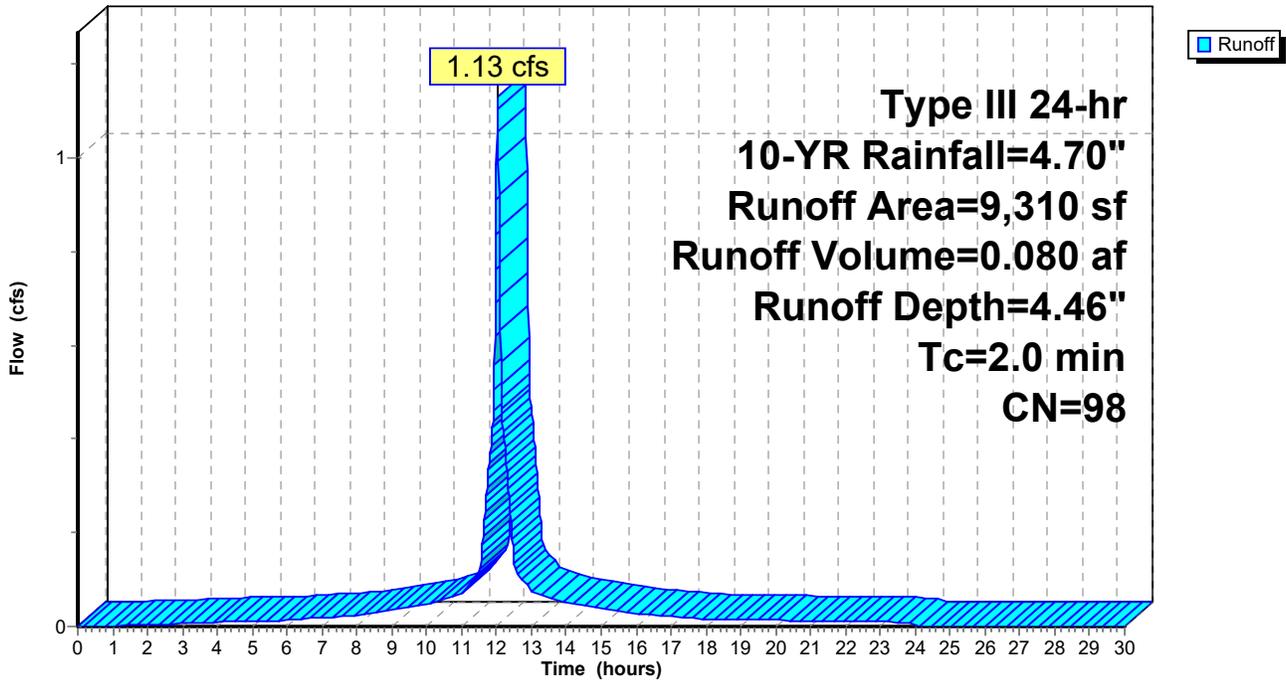
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
 Type III 24-hr 10-YR Rainfall=4.70"

Area (sf)	CN	Description
9,310	98	Roofs, HSG B
9,310		100.00% Impervious Area

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

**Subcatchment 2P: P1b**

Hydrograph



**Summary for Pond 3P: Basin #1**

Inflow Area = 0.394 ac, 54.21% Impervious, Inflow Depth = 3.00" for 10-YR event  
 Inflow = 1.23 cfs @ 12.03 hrs, Volume= 0.098 af  
 Outflow = 0.37 cfs @ 12.38 hrs, Volume= 0.098 af, Atten= 70%, Lag= 21.2 min  
 Discarded = 0.10 cfs @ 12.38 hrs, Volume= 0.089 af  
 Primary = 0.27 cfs @ 12.38 hrs, Volume= 0.010 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
 Peak Elev= 186.83' @ 12.38 hrs Surf.Area= 1,772 sf Storage= 1,283 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)  
 Center-of-Mass det. time= 87.3 min ( 858.0 - 770.7 )

Volume	Invert	Avail.Storage	Storage Description			
#1	186.00'	2,608 cf	<b>Custom Stage Data (Irregular)</b> Listed below (Recalc)			
Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)	
186.00	1,345	167.0	0	0	1,345	
187.50	2,165	196.0	2,608	2,608	2,226	

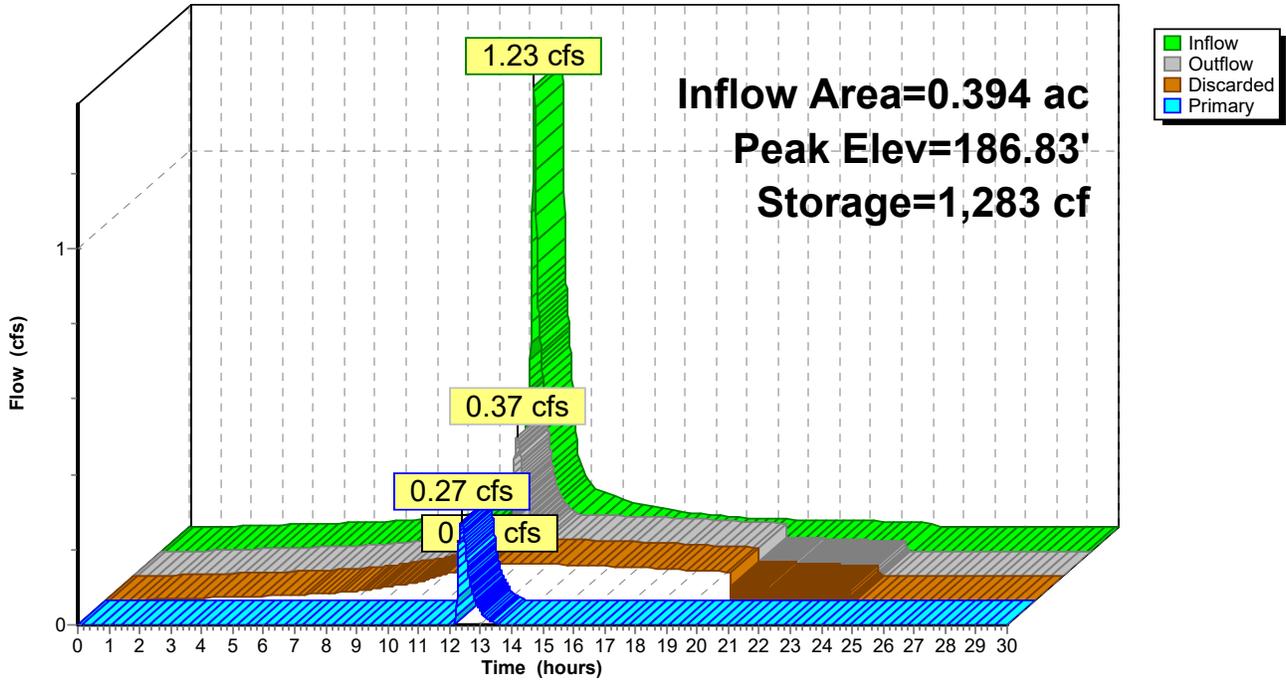
Device	Routing	Invert	Outlet Devices
#1	Discarded	186.00'	<b>2.410 in/hr Exfiltration over Surface area</b>
#2	Device 3	186.75'	<b>Custom Weir/Orifice, Cv= 2.62 (C= 3.28)</b> Elev. (feet) 186.75 187.00 Width (feet) 4.00 4.00
#3	Primary	186.60'	<b>Custom Weir/Orifice, Cv= 2.62 (C= 3.28)</b> Elev. (feet) 186.60 187.00 Width (feet) 10.00 10.00

**Discarded OutFlow** Max=0.10 cfs @ 12.38 hrs HW=186.83' (Free Discharge)  
 ↑1=Exfiltration (Exfiltration Controls 0.10 cfs)

**Primary OutFlow** Max=0.27 cfs @ 12.38 hrs HW=186.83' TW=0.00' (Dynamic Tailwater)  
 ↑3=Custom Weir/Orifice (Passes 0.27 cfs of 3.51 cfs potential flow)  
 ↑2=Custom Weir/Orifice (Weir Controls 0.27 cfs @ 0.90 fps)

Pond 3P: Basin #1

Hydrograph



**Summary for Subcatchment 4P: P1c**

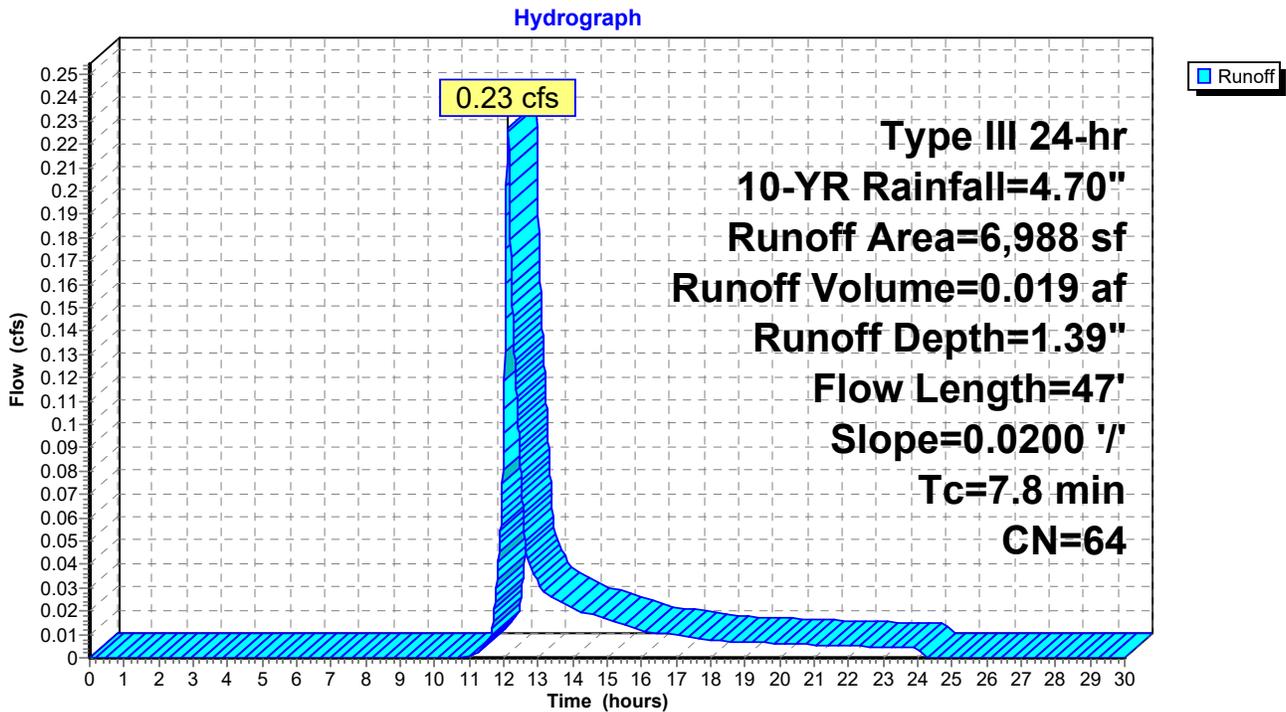
Runoff = 0.23 cfs @ 12.12 hrs, Volume= 0.019 af, Depth= 1.39"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
Type III 24-hr 10-YR Rainfall=4.70"

Area (sf)	CN	Description
588	98	Patios, HSG B
6,400	61	>75% Grass cover, Good, HSG B
6,988	64	Weighted Average
6,400		91.59% Pervious Area
588		8.41% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.8	47	0.0200	0.10		Sheet Flow, Grass: Dense n= 0.240 P2= 3.20"

**Subcatchment 4P: P1c**

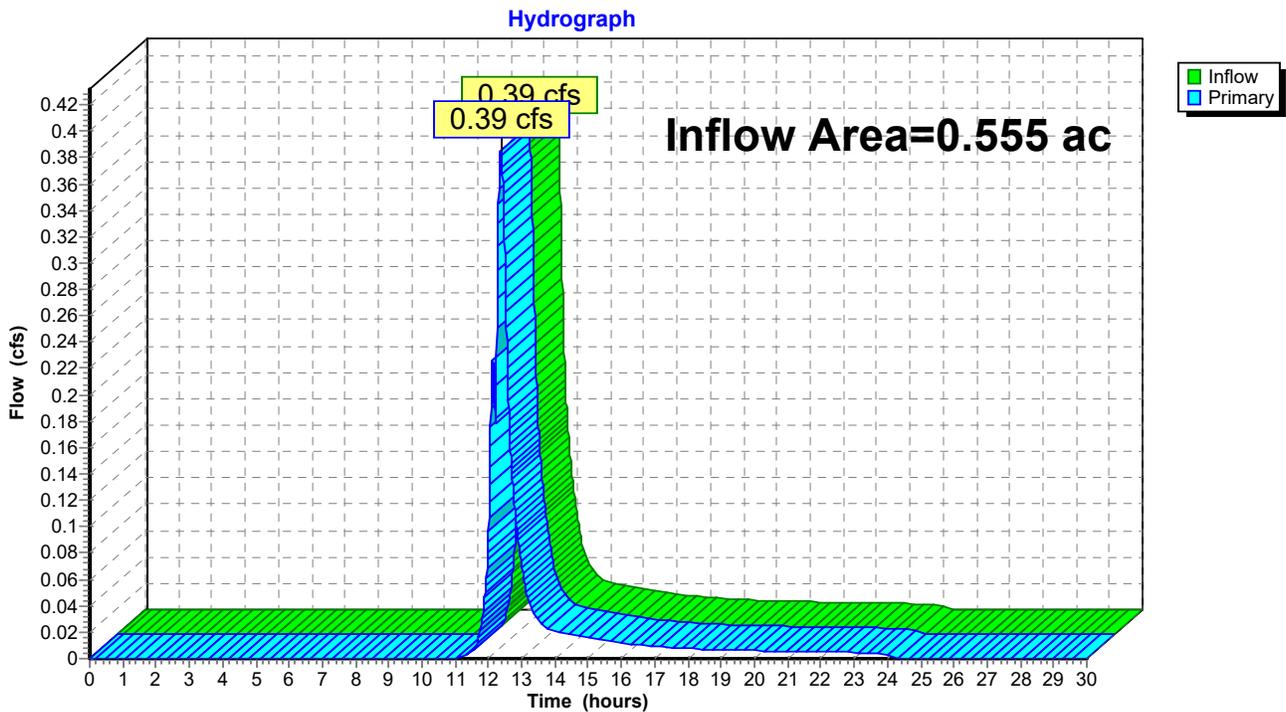


### Summary for Link 5P: Design Point #1: Flow to 280 Village Street

Inflow Area = 0.555 ac, 40.97% Impervious, Inflow Depth = 0.61" for 10-YR event  
Inflow = 0.39 cfs @ 12.37 hrs, Volume= 0.028 af  
Primary = 0.39 cfs @ 12.37 hrs, Volume= 0.028 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs

### Link 5P: Design Point #1: Flow to 280 Village Street



**HydroCAD4**

Type III 24-hr 25-YR Rainfall=5.50"

Prepared by {enter your company name here}

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Time span=0.00-30.00 hrs, dt=0.01 hrs, 3001 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 1P: P1a**

Runoff Area=7,863 sf 0.00% Impervious Runoff Depth=1.76"  
Flow Length=68' Tc=9.6 min CN=62 Runoff=0.31 cfs 0.026 af

**Subcatchment 2P: P1b**

Runoff Area=9,310 sf 100.00% Impervious Runoff Depth=5.26"  
Tc=2.0 min CN=98 Runoff=1.33 cfs 0.094 af

**Pond 3P: Basin #1**

Peak Elev=186.87' Storage=1,366 cf Inflow=1.49 cfs 0.120 af  
Discarded=0.10 cfs 0.098 af Primary=0.56 cfs 0.022 af Outflow=0.66 cfs 0.120 af

**Subcatchment 4P: P1c**

Runoff Area=6,988 sf 8.41% Impervious Runoff Depth=1.91"  
Flow Length=47' Slope=0.0200 '/ Tc=7.8 min CN=64 Runoff=0.32 cfs 0.026 af

**Link 5P: Design Point #1: Flow to 280 Village Street**

Inflow=0.78 cfs 0.048 af  
Primary=0.78 cfs 0.048 af

**Total Runoff Area = 0.555 ac Runoff Volume = 0.146 af Average Runoff Depth = 3.15"**  
**59.03% Pervious = 0.327 ac 40.97% Impervious = 0.227 ac**

**Summary for Subcatchment 1P: P1a**

Runoff = 0.31 cfs @ 12.15 hrs, Volume= 0.026 af, Depth= 1.76"

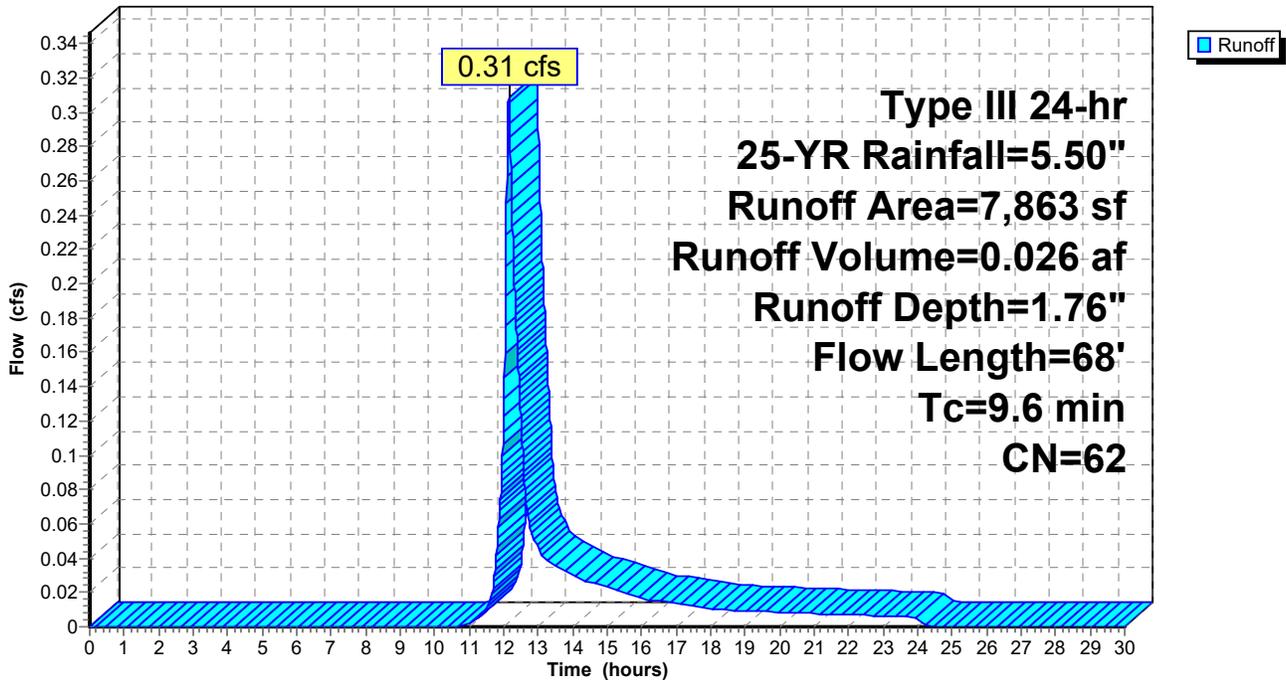
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
 Type III 24-hr 25-YR Rainfall=5.50"

Area (sf)	CN	Description
* 196	90	Pavers, HSG B
7,667	61	>75% Grass cover, Good, HSG B
7,863	62	Weighted Average
7,863		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.4	46	0.0120	0.08		Sheet Flow, Grass: Dense n= 0.240 P2= 3.20"
0.2	22	0.0500	1.57		Shallow Concentrated Flow, Short Grass Pasture Kv= 7.0 fps
9.6	68	Total			

**Subcatchment 1P: P1a**

Hydrograph



**Summary for Subcatchment 2P: P1b**

Runoff = 1.33 cfs @ 12.03 hrs, Volume= 0.094 af, Depth= 5.26"

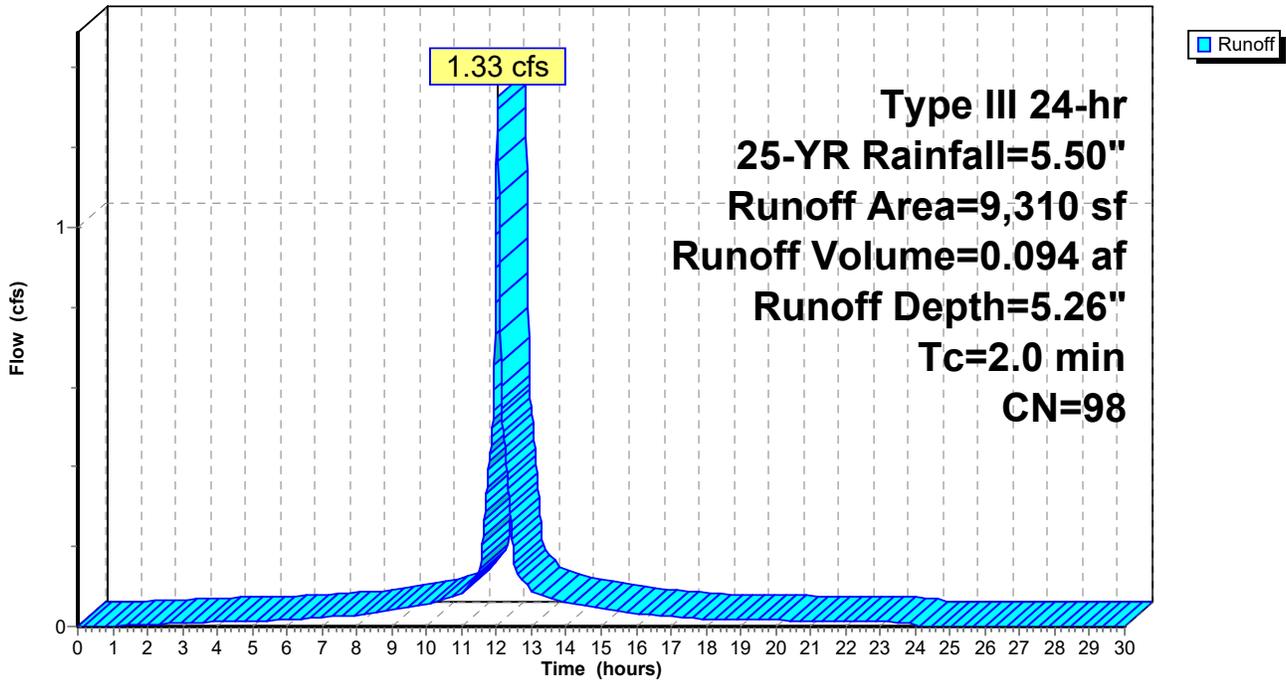
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
 Type III 24-hr 25-YR Rainfall=5.50"

Area (sf)	CN	Description
9,310	98	Roofs, HSG B
9,310		100.00% Impervious Area

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

**Subcatchment 2P: P1b**

Hydrograph



**Summary for Pond 3P: Basin #1**

Inflow Area = 0.394 ac, 54.21% Impervious, Inflow Depth = 3.66" for 25-YR event  
 Inflow = 1.49 cfs @ 12.03 hrs, Volume= 0.120 af  
 Outflow = 0.66 cfs @ 12.25 hrs, Volume= 0.120 af, Atten= 56%, Lag= 13.3 min  
 Discarded = 0.10 cfs @ 12.25 hrs, Volume= 0.098 af  
 Primary = 0.56 cfs @ 12.25 hrs, Volume= 0.022 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
 Peak Elev= 186.87' @ 12.25 hrs Surf.Area= 1,798 sf Storage= 1,366 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)  
 Center-of-Mass det. time= 82.1 min ( 852.1 - 769.9 )

Volume	Invert	Avail.Storage	Storage Description		
#1	186.00'	2,608 cf	<b>Custom Stage Data (Irregular)</b> Listed below (Recalc)		
Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
186.00	1,345	167.0	0	0	1,345
187.50	2,165	196.0	2,608	2,608	2,226

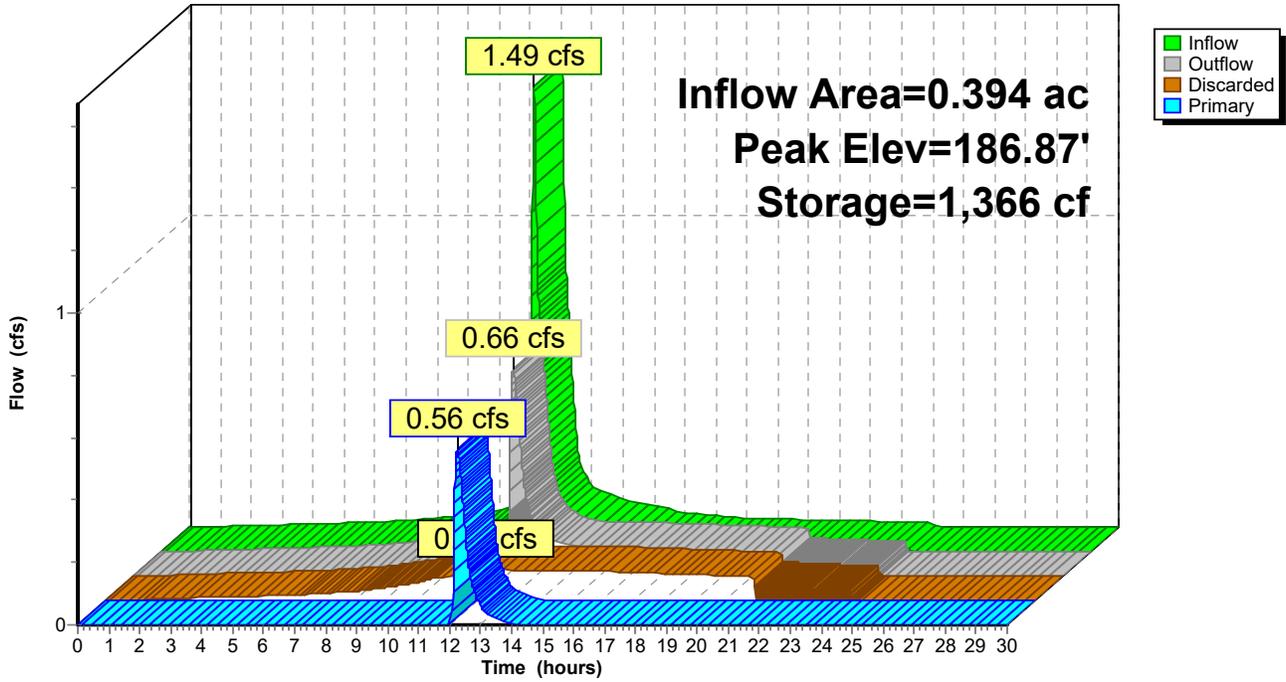
Device	Routing	Invert	Outlet Devices
#1	Discarded	186.00'	<b>2.410 in/hr Exfiltration over Surface area</b>
#2	Device 3	186.75'	<b>Custom Weir/Orifice, Cv= 2.62 (C= 3.28)</b> Elev. (feet) 186.75 187.00 Width (feet) 4.00 4.00
#3	Primary	186.60'	<b>Custom Weir/Orifice, Cv= 2.62 (C= 3.28)</b> Elev. (feet) 186.60 187.00 Width (feet) 10.00 10.00

**Discarded OutFlow** Max=0.10 cfs @ 12.25 hrs HW=186.87' (Free Discharge)  
 ↑1=Exfiltration (Exfiltration Controls 0.10 cfs)

**Primary OutFlow** Max=0.56 cfs @ 12.25 hrs HW=186.87' TW=0.00' (Dynamic Tailwater)  
 ↑3=Custom Weir/Orifice (Passes 0.56 cfs of 4.65 cfs potential flow)  
 ↑2=Custom Weir/Orifice (Weir Controls 0.56 cfs @ 1.15 fps)

Pond 3P: Basin #1

Hydrograph



**Summary for Subcatchment 4P: P1c**

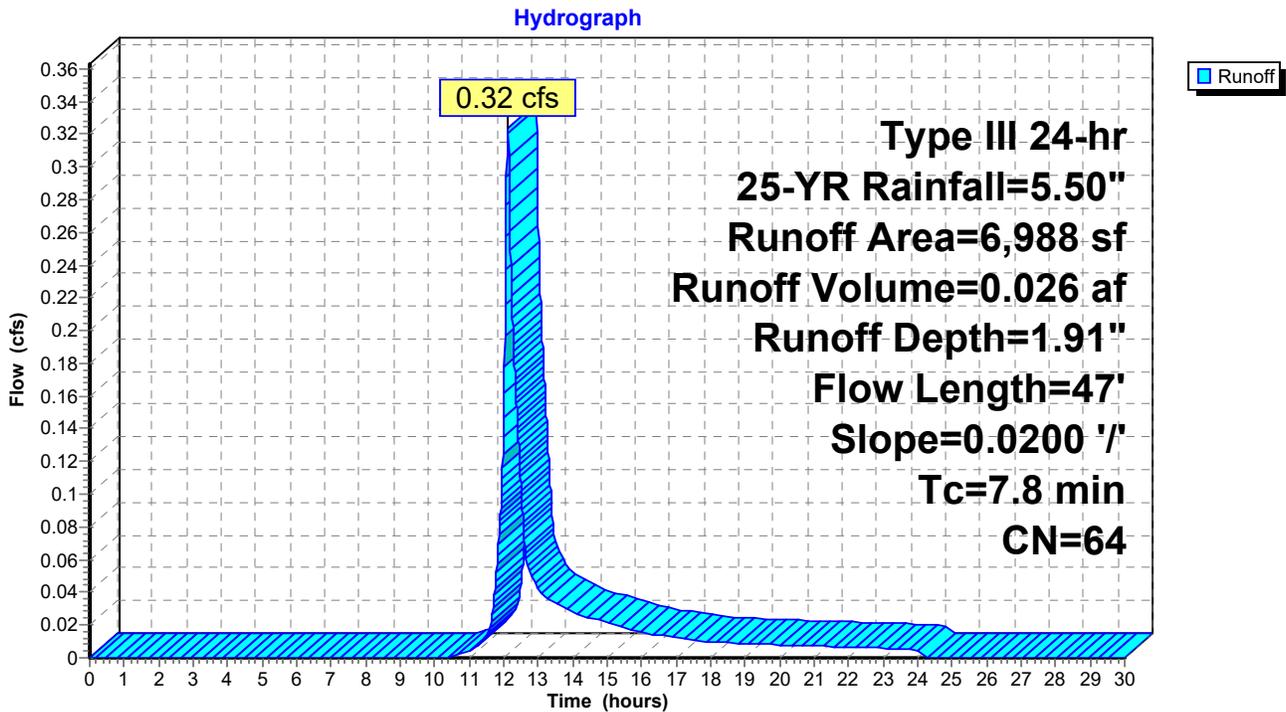
Runoff = 0.32 cfs @ 12.12 hrs, Volume= 0.026 af, Depth= 1.91"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
Type III 24-hr 25-YR Rainfall=5.50"

Area (sf)	CN	Description
* 588	98	Patios, HSG B
6,400	61	>75% Grass cover, Good, HSG B
6,988	64	Weighted Average
6,400		91.59% Pervious Area
588		8.41% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.8	47	0.0200	0.10		Sheet Flow, Grass: Dense n= 0.240 P2= 3.20"

**Subcatchment 4P: P1c**



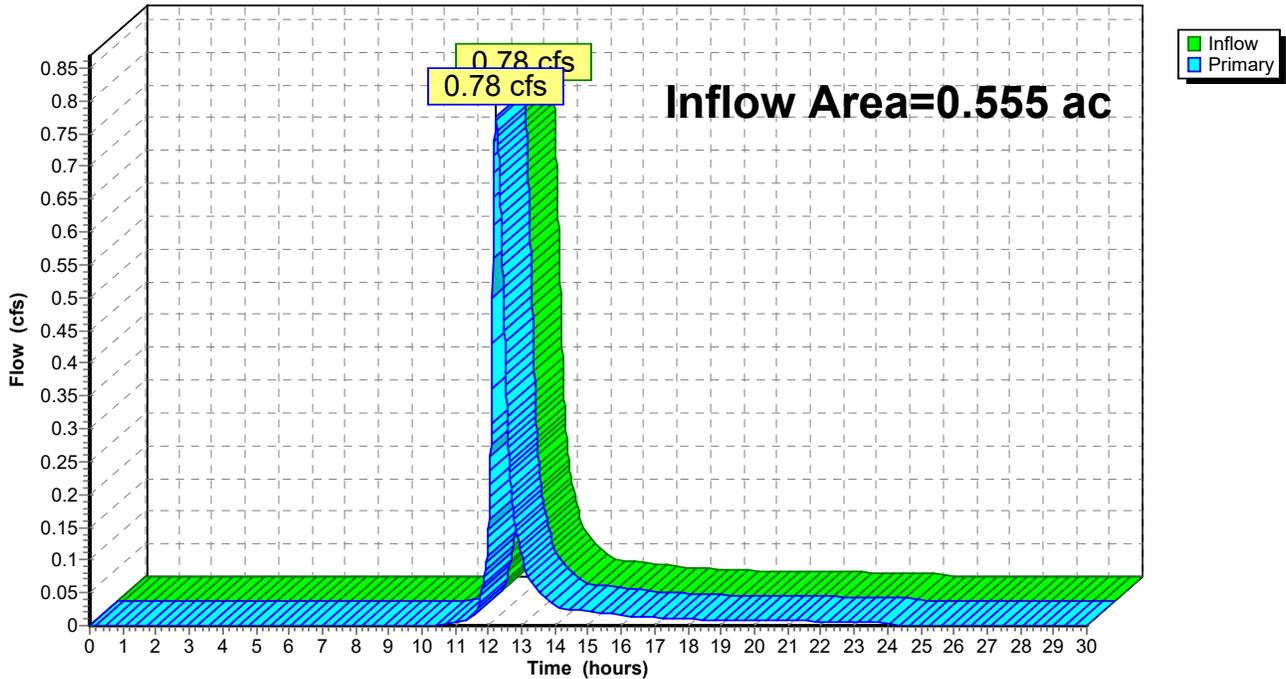
### Summary for Link 5P: Design Point #1: Flow to 280 Village Street

Inflow Area = 0.555 ac, 40.97% Impervious, Inflow Depth = 1.03" for 25-YR event  
Inflow = 0.78 cfs @ 12.23 hrs, Volume= 0.048 af  
Primary = 0.78 cfs @ 12.23 hrs, Volume= 0.048 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs

### Link 5P: Design Point #1: Flow to 280 Village Street

Hydrograph



**HydroCAD4**

Type III 24-hr 50-YR Rainfall=6.10"

Prepared by {enter your company name here}

Printed 9/5/2019

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Time span=0.00-30.00 hrs, dt=0.01 hrs, 3001 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 1P: P1a**

Runoff Area=7,863 sf 0.00% Impervious Runoff Depth=2.16"  
Flow Length=68' Tc=9.6 min CN=62 Runoff=0.39 cfs 0.032 af

**Subcatchment 2P: P1b**

Runoff Area=9,310 sf 100.00% Impervious Runoff Depth=5.86"  
Tc=2.0 min CN=98 Runoff=1.47 cfs 0.104 af

**Pond 3P: Basin #1**

Peak Elev=186.91' Storage=1,426 cf Inflow=1.68 cfs 0.137 af  
Discarded=0.10 cfs 0.104 af Primary=0.80 cfs 0.033 af Outflow=0.91 cfs 0.137 af

**Subcatchment 4P: P1c**

Runoff Area=6,988 sf 8.41% Impervious Runoff Depth=2.33"  
Flow Length=47' Slope=0.0200 '/ Tc=7.8 min CN=64 Runoff=0.40 cfs 0.031 af

**Link 5P: Design Point #1: Flow to 280 Village Street**

Inflow=1.15 cfs 0.064 af  
Primary=1.15 cfs 0.064 af

**Total Runoff Area = 0.555 ac Runoff Volume = 0.168 af Average Runoff Depth = 3.64"**  
**59.03% Pervious = 0.327 ac 40.97% Impervious = 0.227 ac**

### Summary for Subcatchment 1P: P1a

Runoff = 0.39 cfs @ 12.14 hrs, Volume= 0.032 af, Depth= 2.16"

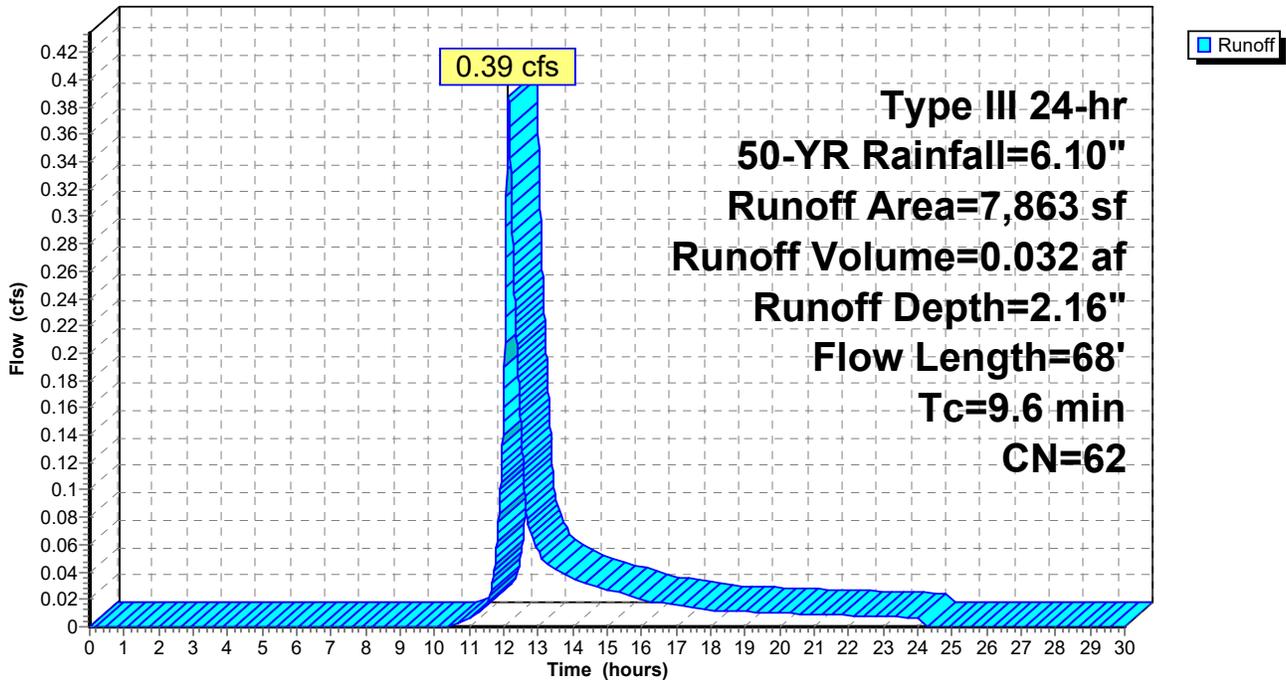
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
 Type III 24-hr 50-YR Rainfall=6.10"

Area (sf)	CN	Description
* 196	90	Pavers, HSG B
7,667	61	>75% Grass cover, Good, HSG B
7,863	62	Weighted Average
7,863		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.4	46	0.0120	0.08		Sheet Flow, Grass: Dense n= 0.240 P2= 3.20"
0.2	22	0.0500	1.57		Shallow Concentrated Flow, Short Grass Pasture Kv= 7.0 fps
9.6	68	Total			

### Subcatchment 1P: P1a

Hydrograph



**Summary for Subcatchment 2P: P1b**

Runoff = 1.47 cfs @ 12.03 hrs, Volume= 0.104 af, Depth= 5.86"

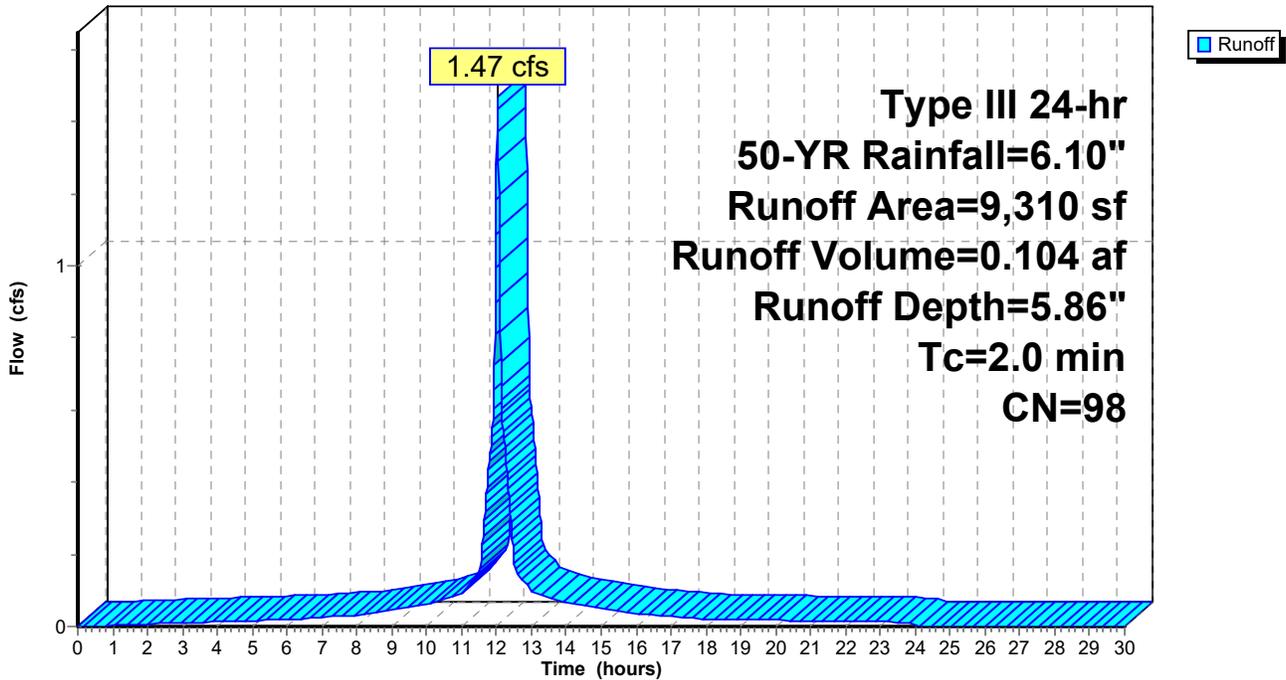
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
 Type III 24-hr 50-YR Rainfall=6.10"

Area (sf)	CN	Description
9,310	98	Roofs, HSG B
9,310		100.00% Impervious Area

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

**Subcatchment 2P: P1b**

Hydrograph



**Summary for Pond 3P: Basin #1**

Inflow Area = 0.394 ac, 54.21% Impervious, Inflow Depth = 4.17" for 50-YR event  
 Inflow = 1.68 cfs @ 12.03 hrs, Volume= 0.137 af  
 Outflow = 0.91 cfs @ 12.19 hrs, Volume= 0.137 af, Atten= 46%, Lag= 9.5 min  
 Discarded = 0.10 cfs @ 12.19 hrs, Volume= 0.104 af  
 Primary = 0.80 cfs @ 12.19 hrs, Volume= 0.033 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
 Peak Elev= 186.91' @ 12.19 hrs Surf.Area= 1,817 sf Storage= 1,426 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)  
 Center-of-Mass det. time= 78.8 min ( 848.1 - 769.4 )

Volume	Invert	Avail.Storage	Storage Description		
#1	186.00'	2,608 cf	<b>Custom Stage Data (Irregular)</b> Listed below (Recalc)		
Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
186.00	1,345	167.0	0	0	1,345
187.50	2,165	196.0	2,608	2,608	2,226

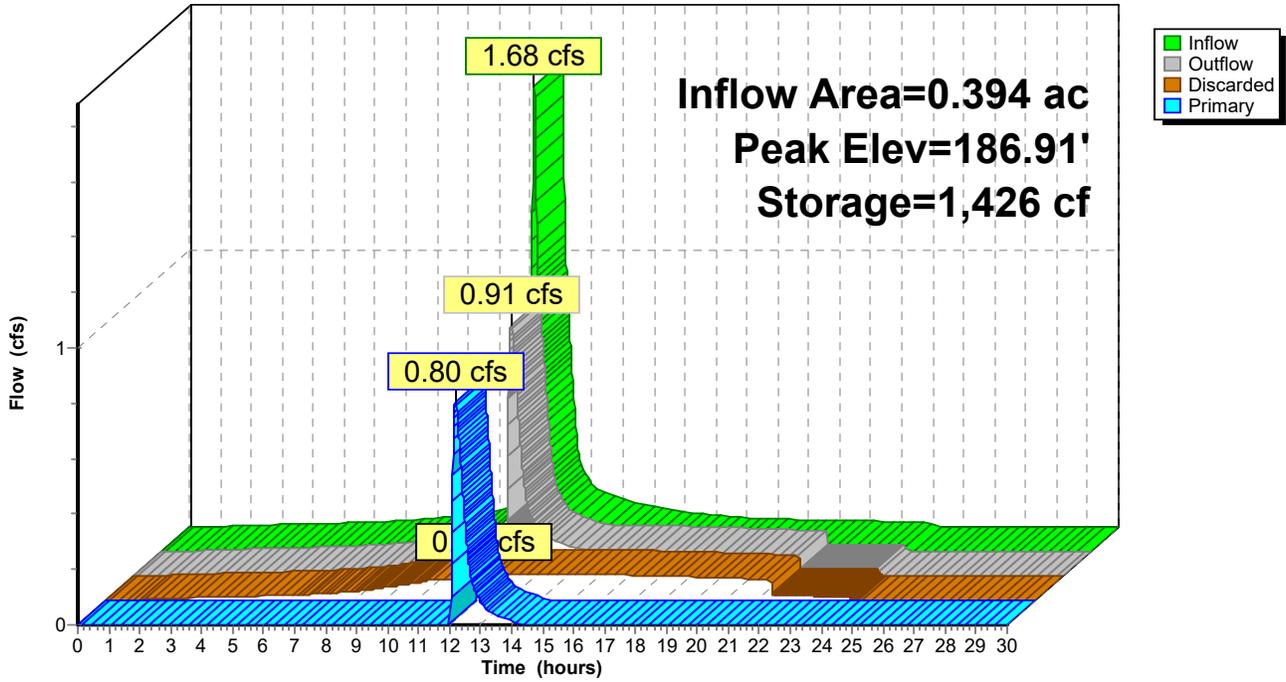
Device	Routing	Invert	Outlet Devices
#1	Discarded	186.00'	<b>2.410 in/hr Exfiltration over Surface area</b>
#2	Device 3	186.75'	<b>Custom Weir/Orifice, Cv= 2.62 (C= 3.28)</b> Elev. (feet) 186.75 187.00 Width (feet) 4.00 4.00
#3	Primary	186.60'	<b>Custom Weir/Orifice, Cv= 2.62 (C= 3.28)</b> Elev. (feet) 186.60 187.00 Width (feet) 10.00 10.00

**Discarded OutFlow** Max=0.10 cfs @ 12.19 hrs HW=186.91' (Free Discharge)  
 ↑1=Exfiltration (Exfiltration Controls 0.10 cfs)

**Primary OutFlow** Max=0.80 cfs @ 12.19 hrs HW=186.91' TW=0.00' (Dynamic Tailwater)  
 ↑3=Custom Weir/Orifice (Passes 0.80 cfs of 5.53 cfs potential flow)  
 ↑2=Custom Weir/Orifice (Weir Controls 0.80 cfs @ 1.29 fps)

### Pond 3P: Basin #1

Hydrograph



**Summary for Subcatchment 4P: P1c**

Runoff = 0.40 cfs @ 12.12 hrs, Volume= 0.031 af, Depth= 2.33"

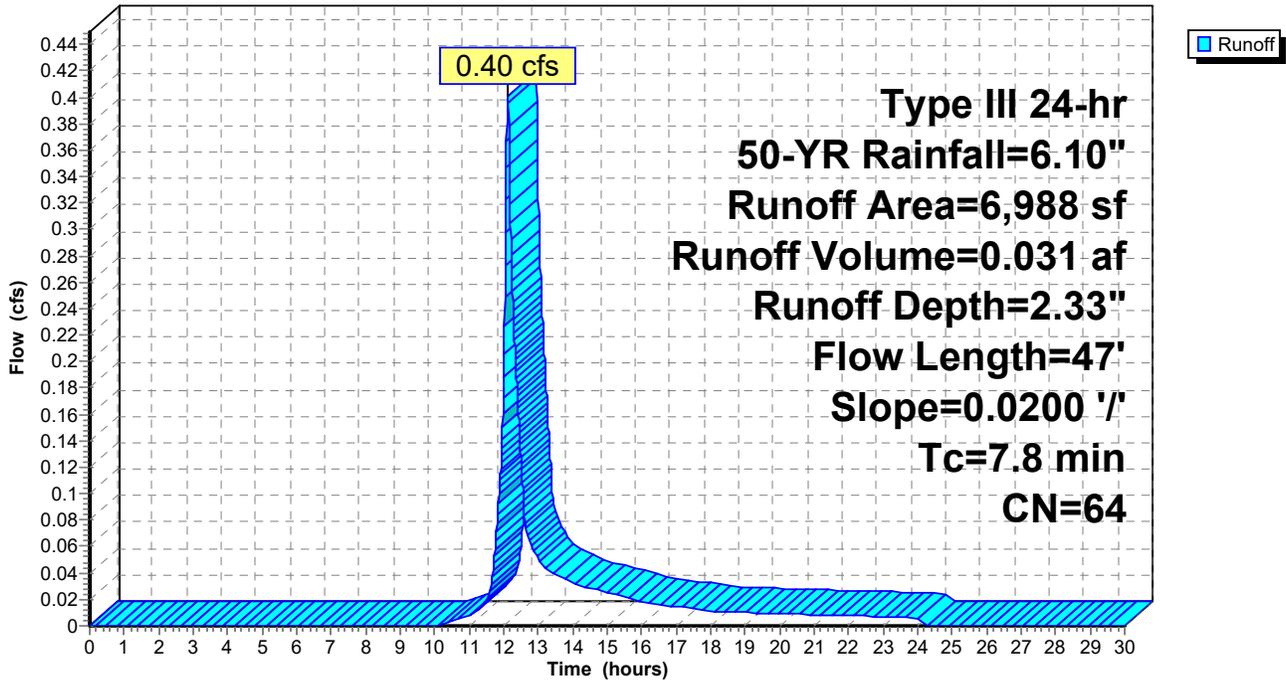
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
 Type III 24-hr 50-YR Rainfall=6.10"

Area (sf)	CN	Description
588	98	Patios, HSG B
6,400	61	>75% Grass cover, Good, HSG B
6,988	64	Weighted Average
6,400		91.59% Pervious Area
588		8.41% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.8	47	0.0200	0.10		Sheet Flow, Grass: Dense n= 0.240 P2= 3.20"

**Subcatchment 4P: P1c**

Hydrograph

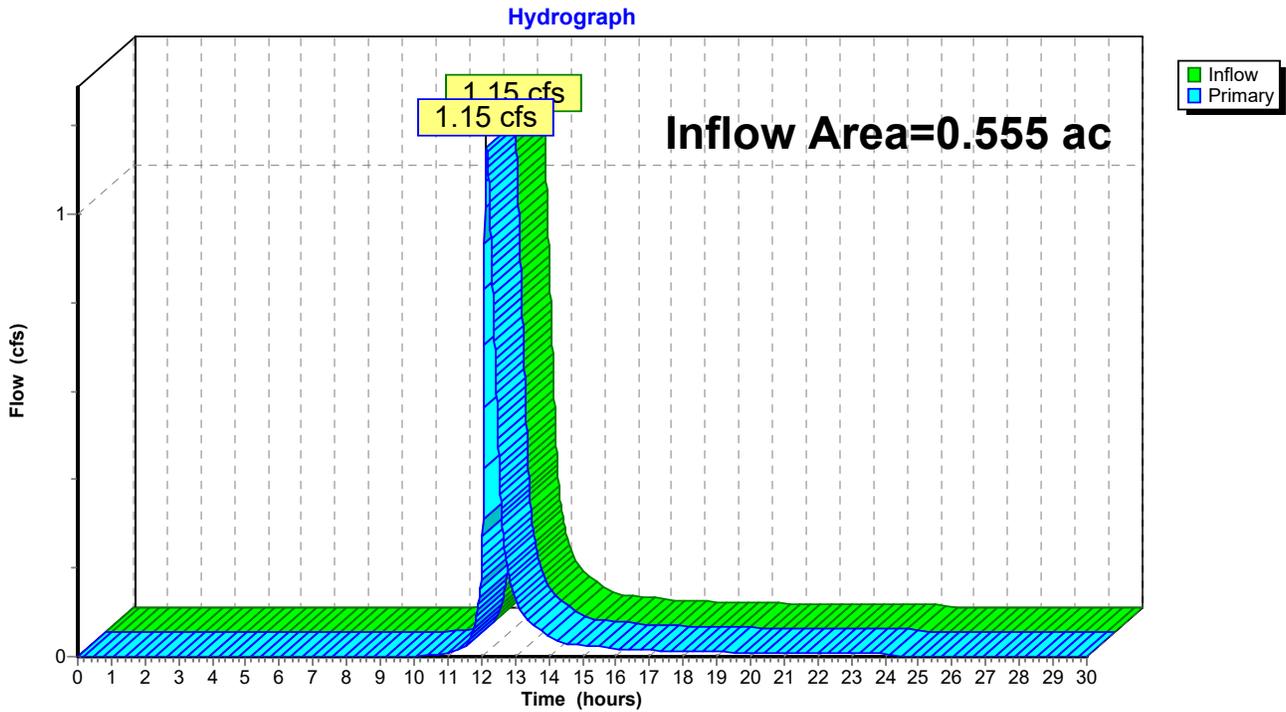


### Summary for Link 5P: Design Point #1: Flow to 280 Village Street

Inflow Area = 0.555 ac, 40.97% Impervious, Inflow Depth = 1.38" for 50-YR event  
Inflow = 1.15 cfs @ 12.16 hrs, Volume= 0.064 af  
Primary = 1.15 cfs @ 12.16 hrs, Volume= 0.064 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs

### Link 5P: Design Point #1: Flow to 280 Village Street



**HydroCAD4**

Type III 24-hr 100-YR Rainfall=6.70"

Prepared by {enter your company name here}

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Time span=0.00-30.00 hrs, dt=0.01 hrs, 3001 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 1P: P1a**

Runoff Area=7,863 sf 0.00% Impervious Runoff Depth=2.58"  
Flow Length=68' Tc=9.6 min CN=62 Runoff=0.47 cfs 0.039 af

**Subcatchment 2P: P1b**

Runoff Area=9,310 sf 100.00% Impervious Runoff Depth=6.46"  
Tc=2.0 min CN=98 Runoff=1.62 cfs 0.115 af

**Pond 3P: Basin #1**

Peak Elev=186.94' Storage=1,491 cf Inflow=1.88 cfs 0.154 af  
Discarded=0.10 cfs 0.110 af Primary=1.09 cfs 0.044 af Outflow=1.20 cfs 0.154 af

**Subcatchment 4P: P1c**

Runoff Area=6,988 sf 8.41% Impervious Runoff Depth=2.78"  
Flow Length=47' Slope=0.0200 '/ Tc=7.8 min CN=64 Runoff=0.48 cfs 0.037 af

**Link 5P: Design Point #1: Flow to 280 Village Street**

Inflow=1.57 cfs 0.081 af  
Primary=1.57 cfs 0.081 af

**Total Runoff Area = 0.555 ac Runoff Volume = 0.191 af Average Runoff Depth = 4.13"**  
**59.03% Pervious = 0.327 ac 40.97% Impervious = 0.227 ac**

**Summary for Subcatchment 1P: P1a**

Runoff = 0.47 cfs @ 12.14 hrs, Volume= 0.039 af, Depth= 2.58"

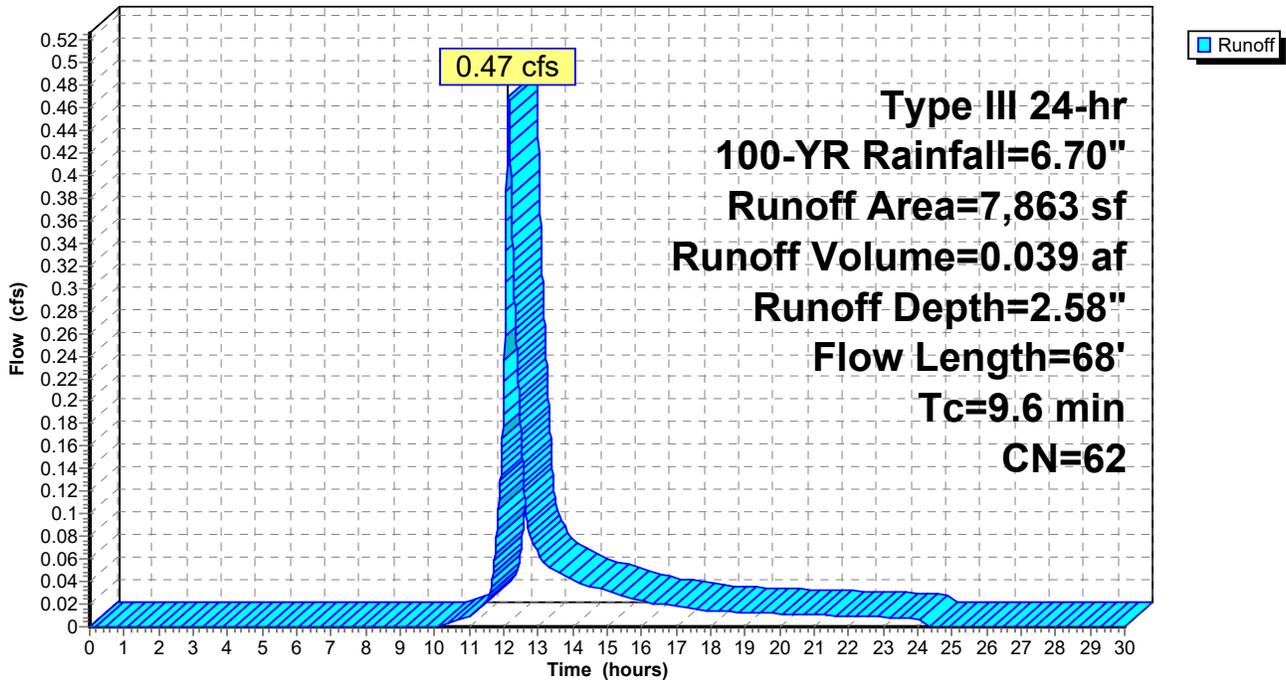
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
 Type III 24-hr 100-YR Rainfall=6.70"

Area (sf)	CN	Description
* 196	90	Pavers, HSG B
7,667	61	>75% Grass cover, Good, HSG B
7,863	62	Weighted Average
7,863		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.4	46	0.0120	0.08		Sheet Flow, Grass: Dense n= 0.240 P2= 3.20"
0.2	22	0.0500	1.57		Shallow Concentrated Flow, Short Grass Pasture Kv= 7.0 fps
9.6	68	Total			

**Subcatchment 1P: P1a**

Hydrograph



**Summary for Subcatchment 2P: P1b**

Runoff = 1.62 cfs @ 12.03 hrs, Volume= 0.115 af, Depth= 6.46"

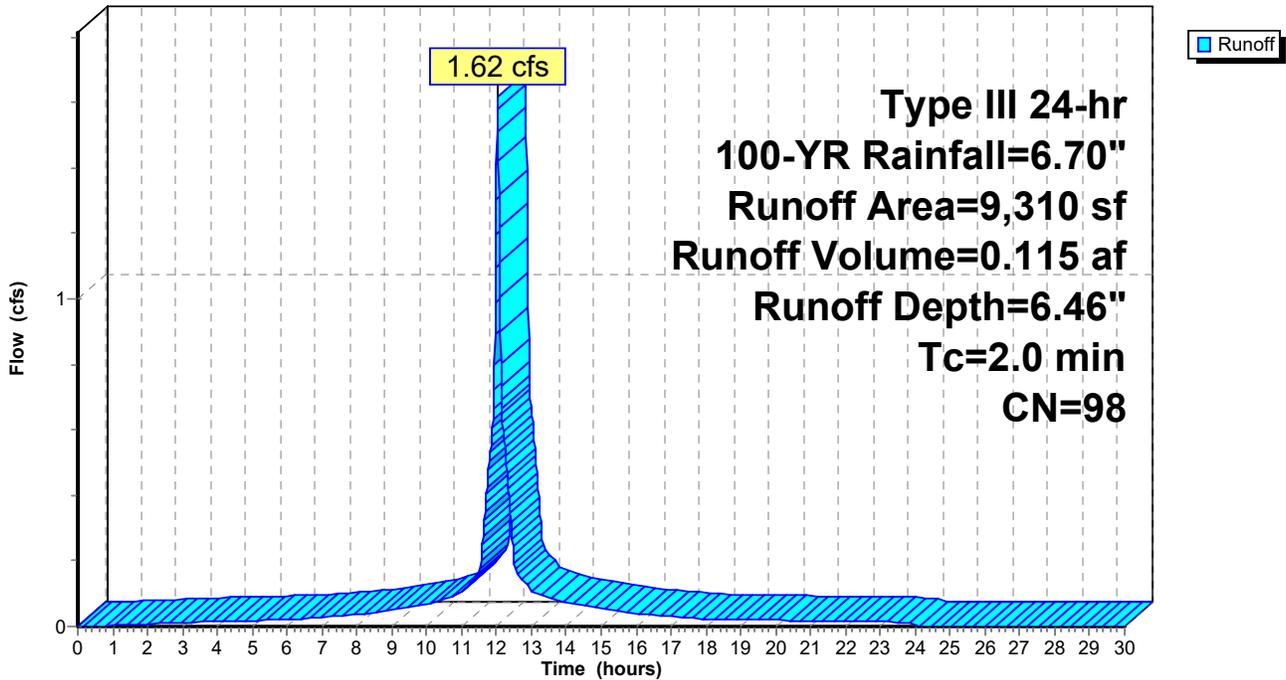
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
 Type III 24-hr 100-YR Rainfall=6.70"

Area (sf)	CN	Description
9,310	98	Roofs, HSG B
9,310		100.00% Impervious Area

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

**Subcatchment 2P: P1b**

Hydrograph



**Summary for Pond 3P: Basin #1**

Inflow Area = 0.394 ac, 54.21% Impervious, Inflow Depth = 4.69" for 100-YR event  
 Inflow = 1.88 cfs @ 12.03 hrs, Volume= 0.154 af  
 Outflow = 1.20 cfs @ 12.13 hrs, Volume= 0.154 af, Atten= 36%, Lag= 6.0 min  
 Discarded = 0.10 cfs @ 12.13 hrs, Volume= 0.110 af  
 Primary = 1.09 cfs @ 12.13 hrs, Volume= 0.044 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
 Peak Elev= 186.94' @ 12.13 hrs Surf.Area= 1,837 sf Storage= 1,491 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)  
 Center-of-Mass det. time= 75.8 min ( 844.6 - 768.8 )

Volume	Invert	Avail.Storage	Storage Description			
#1	186.00'	2,608 cf	<b>Custom Stage Data (Irregular)</b> Listed below (Recalc)			
Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)	
186.00	1,345	167.0	0	0	1,345	
187.50	2,165	196.0	2,608	2,608	2,226	

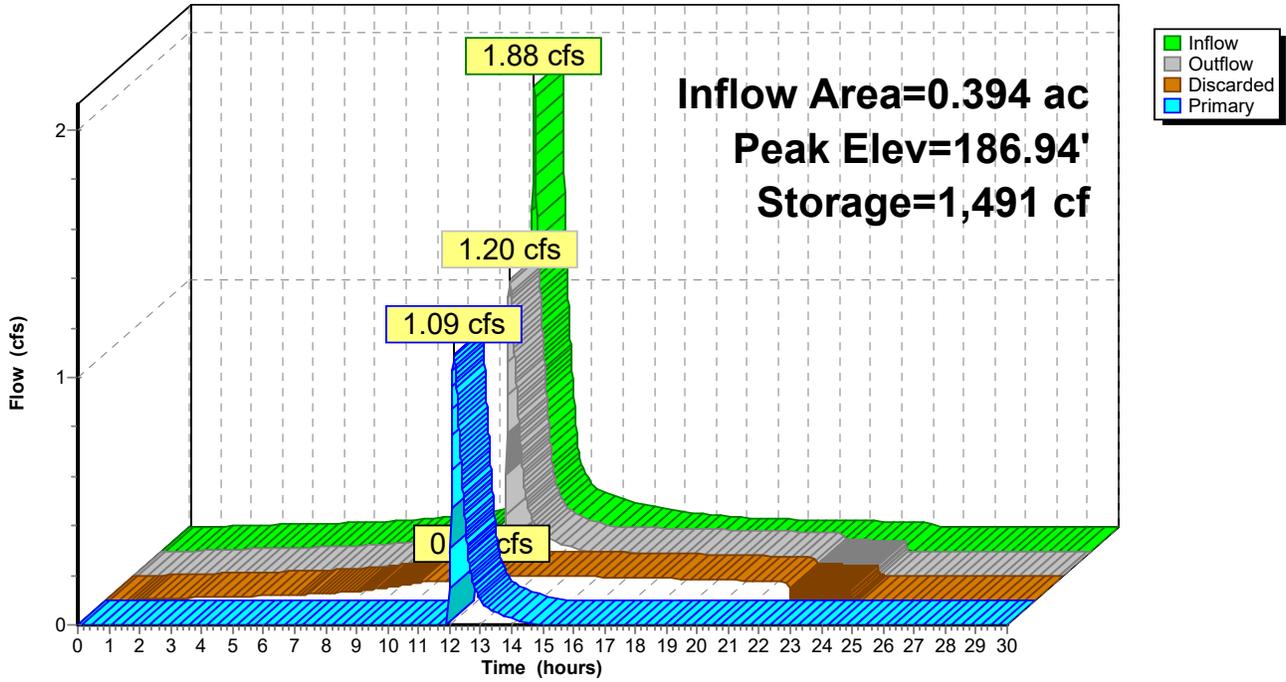
Device	Routing	Invert	Outlet Devices
#1	Discarded	186.00'	<b>2.410 in/hr Exfiltration over Surface area</b>
#2	Device 3	186.75'	<b>Custom Weir/Orifice, Cv= 2.62 (C= 3.28)</b> Elev. (feet) 186.75 187.00 Width (feet) 4.00 4.00
#3	Primary	186.60'	<b>Custom Weir/Orifice, Cv= 2.62 (C= 3.28)</b> Elev. (feet) 186.60 187.00 Width (feet) 10.00 10.00

**Discarded OutFlow** Max=0.10 cfs @ 12.13 hrs HW=186.94' (Free Discharge)  
 ↑1=Exfiltration (Exfiltration Controls 0.10 cfs)

**Primary OutFlow** Max=1.09 cfs @ 12.13 hrs HW=186.94' TW=0.00' (Dynamic Tailwater)  
 ↑3=Custom Weir/Orifice (Passes 1.09 cfs of 6.52 cfs potential flow)  
 ↑2=Custom Weir/Orifice (Weir Controls 1.09 cfs @ 1.43 fps)

Pond 3P: Basin #1

Hydrograph



**Summary for Subcatchment 4P: P1c**

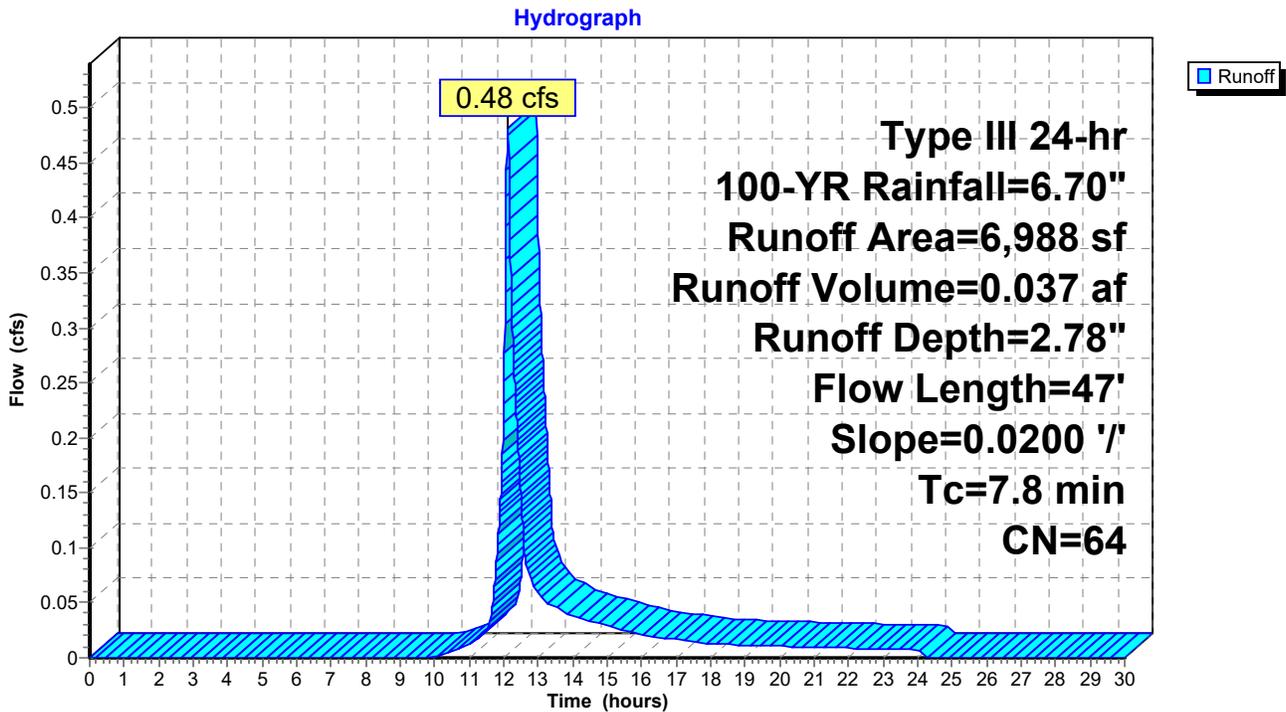
Runoff = 0.48 cfs @ 12.12 hrs, Volume= 0.037 af, Depth= 2.78"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
 Type III 24-hr 100-YR Rainfall=6.70"

Area (sf)	CN	Description
* 588	98	Patios, HSG B
6,400	61	>75% Grass cover, Good, HSG B
6,988	64	Weighted Average
6,400		91.59% Pervious Area
588		8.41% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.8	47	0.0200	0.10		Sheet Flow, Grass: Dense n= 0.240 P2= 3.20"

**Subcatchment 4P: P1c**

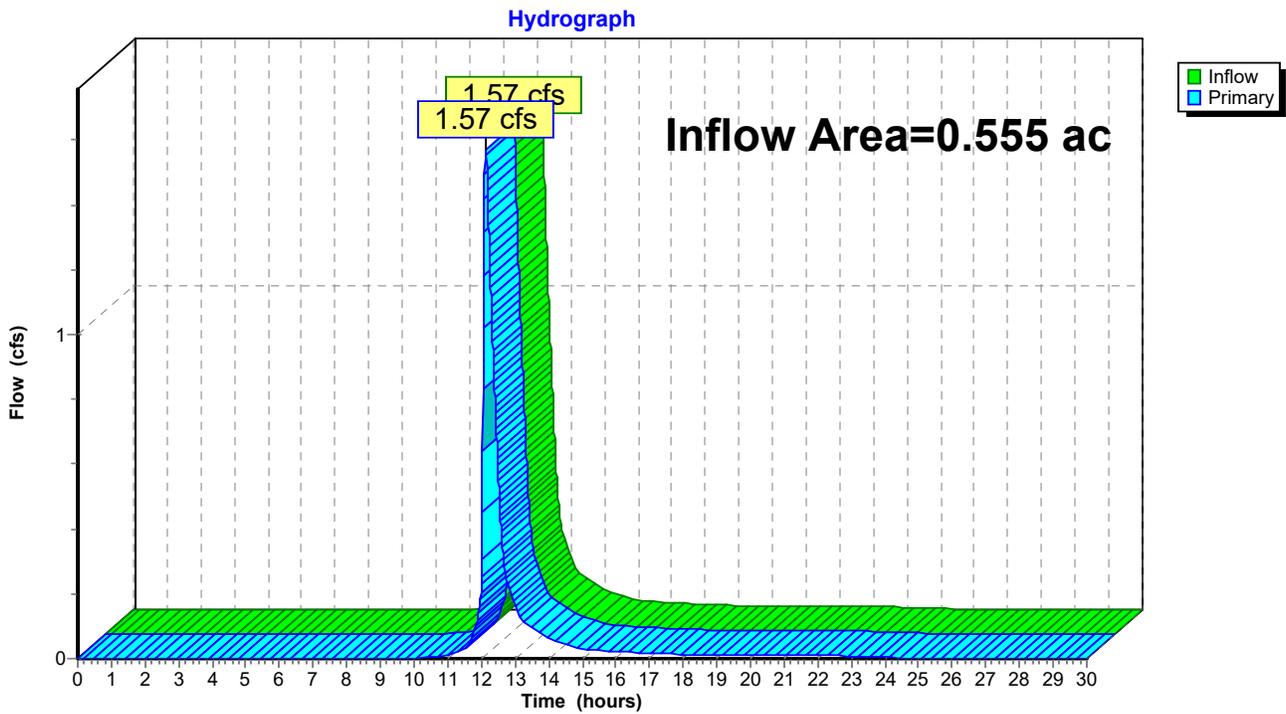


### Summary for Link 5P: Design Point #1: Flow to 280 Village Street

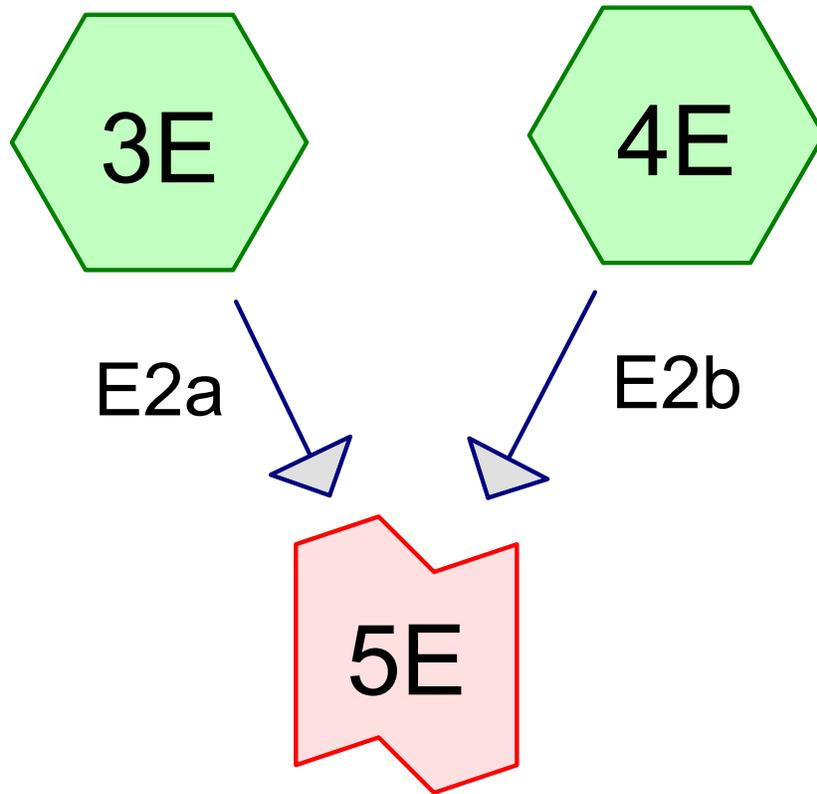
Inflow Area = 0.555 ac, 40.97% Impervious, Inflow Depth = 1.75" for 100-YR event  
Inflow = 1.57 cfs @ 12.13 hrs, Volume= 0.081 af  
Primary = 1.57 cfs @ 12.13 hrs, Volume= 0.081 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs

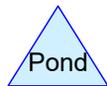
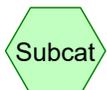
### Link 5P: Design Point #1: Flow to 280 Village Street



**DESIGN POINT #2: FLOW TO 278**  
**VILLAGE STREET EXISTING**  
**CONDITIONS**



Design Point #2: Flow to  
278 Village Street



**Routing Diagram for HydroCAD2**

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## HydroCAD2

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Page 2

### Area Listing (selected nodes)

Area (acres)	CN	Description (subcatchment-numbers)
0.076	61	>75% Grass cover, Good, HSG B (3E, 4E)
0.000	98	Concrete Pad, HSG B (3E)
0.012	90	Gravel (4E)
0.113	98	Paved parking, HSG B (4E)
0.035	98	Roofs, HSG B (4E)
0.127	55	Woods, Good, HSG B (3E)
<b>0.364</b>	<b>75</b>	<b>TOTAL AREA</b>

## HydroCAD2

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### Soil Listing (selected nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.000	HSG A	
0.352	HSG B	3E, 4E
0.000	HSG C	
0.000	HSG D	
0.012	Other	4E
<b>0.364</b>		<b>TOTAL AREA</b>

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Type III 24-hr 2-YR Rainfall=3.20"

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Time span=0.00-30.00 hrs, dt=0.01 hrs, 3001 points  
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN  
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

### Subcatchment3E: E2a

Runoff Area=6,946 sf 0.26% Impervious Runoff Depth=0.28"  
Flow Length=69' Slope=0.0100 '/' Tc=10.3 min CN=56 Runoff=0.02 cfs 0.004 af

### Subcatchment4E: E2b

Runoff Area=8,889 sf 72.75% Impervious Runoff Depth=2.17"  
Flow Length=60' Tc=6.3 min CN=90 Runoff=0.51 cfs 0.037 af

### Link 5E: Design Point #2: Flow to 278 Village Street

Inflow=0.51 cfs 0.041 af  
Primary=0.51 cfs 0.041 af

**Total Runoff Area = 0.364 ac Runoff Volume = 0.041 af Average Runoff Depth = 1.34"**  
**59.05% Pervious = 0.215 ac 40.95% Impervious = 0.149 ac**

**Summary for Subcatchment 3E: E2a**

Runoff = 0.02 cfs @ 12.37 hrs, Volume= 0.004 af, Depth= 0.28"

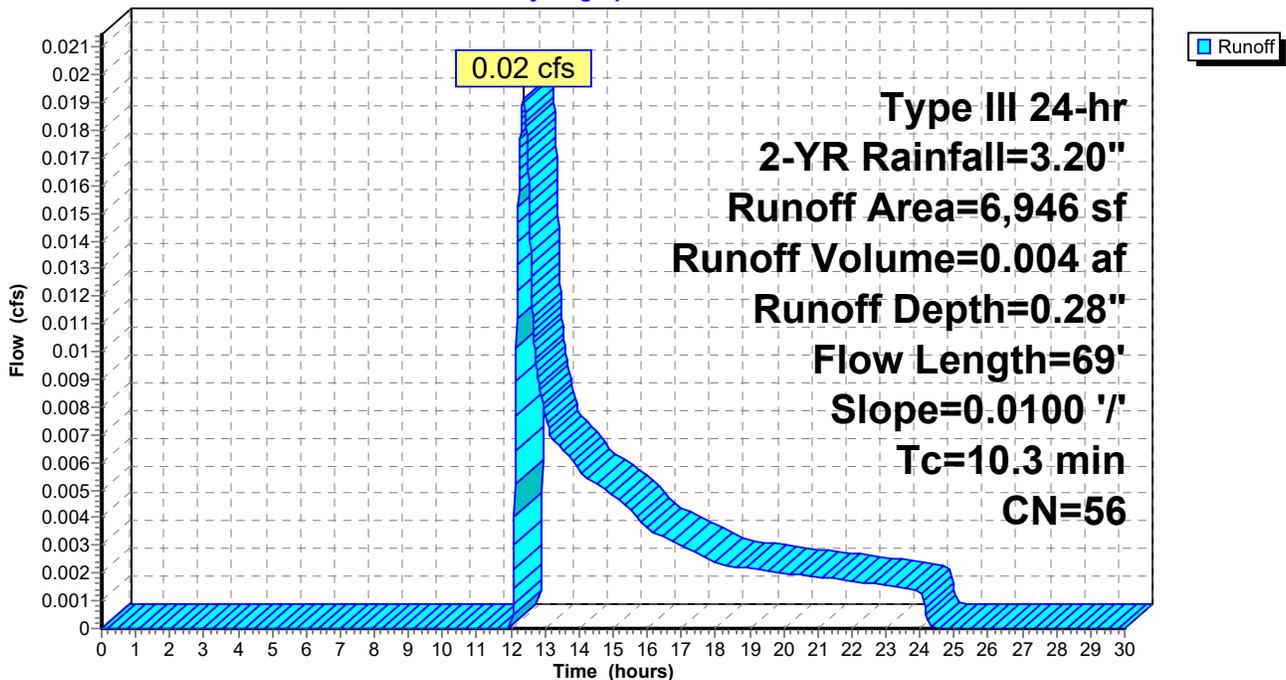
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
Type III 24-hr 2-YR Rainfall=3.20"

Area (sf)	CN	Description
* 18	98	Concrete Pad, HSG B
1,404	61	>75% Grass cover, Good, HSG B
5,524	55	Woods, Good, HSG B
6,946	56	Weighted Average
6,928		99.74% Pervious Area
18		0.26% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.3	25	0.0100	0.04		<b>Sheet Flow,</b> Woods: Light underbrush n= 0.400 P2= 3.20"
1.0	44	0.0100	0.70		<b>Shallow Concentrated Flow,</b> Short Grass Pasture Kv= 7.0 fps
10.3	69	Total			

**Subcatchment 3E: E2a**

Hydrograph



**Summary for Subcatchment 4E: E2b**

Runoff = 0.51 cfs @ 12.09 hrs, Volume= 0.037 af, Depth= 2.17"

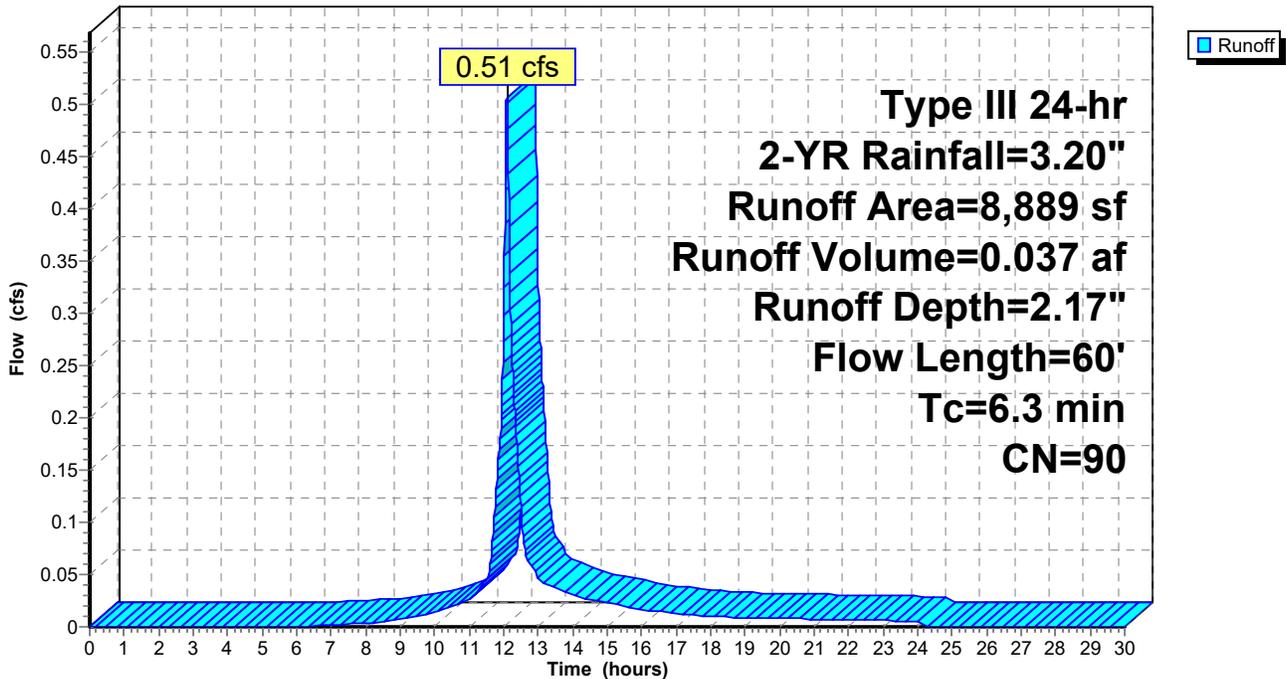
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
Type III 24-hr 2-YR Rainfall=3.20"

Area (sf)	CN	Description
4,930	98	Paved parking, HSG B
1,537	98	Roofs, HSG B
* 513	90	Gravel
1,909	61	>75% Grass cover, Good, HSG B
8,889	90	Weighted Average
2,422		27.25% Pervious Area
6,467		72.75% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.6	24	0.0120	0.07		Sheet Flow, Grass: Dense n= 0.240 P2= 3.20"
0.7	36	0.0100	0.85		Sheet Flow, Smooth surfaces n= 0.011 P2= 3.20"
6.3	60	Total			

**Subcatchment 4E: E2b**

Hydrograph



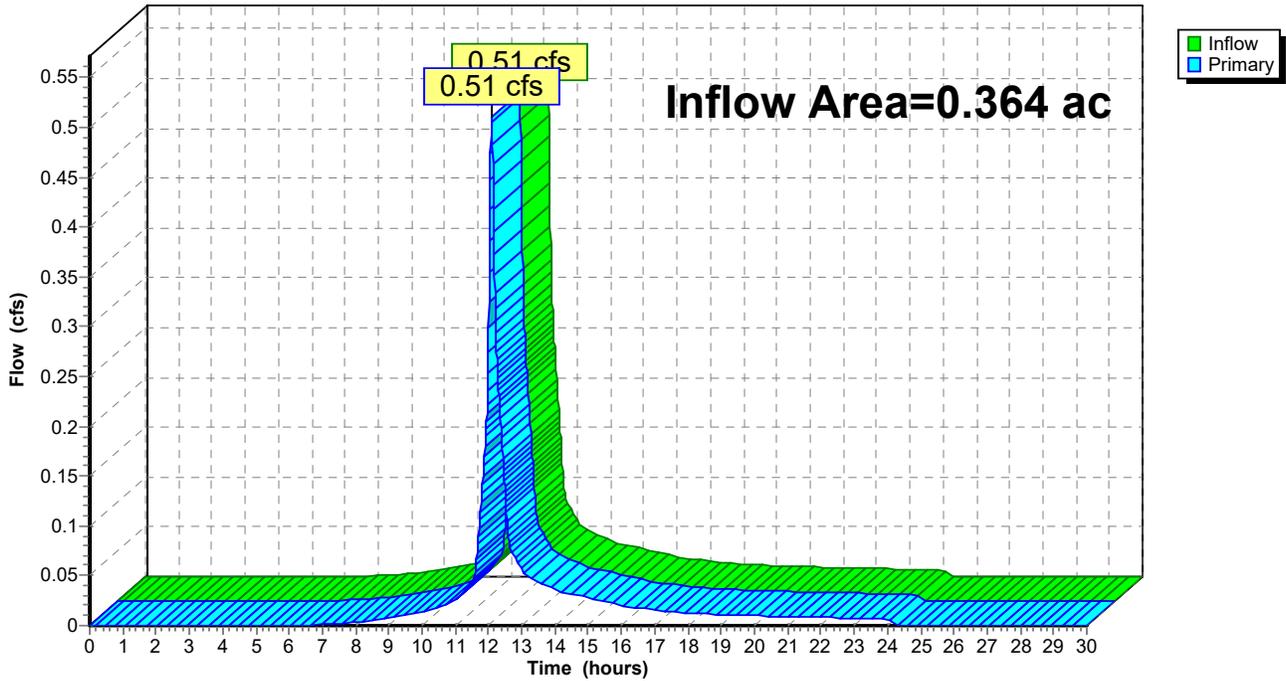
### Summary for Link 5E: Design Point #2: Flow to 278 Village Street

Inflow Area = 0.364 ac, 40.95% Impervious, Inflow Depth = 1.34" for 2-YR event  
Inflow = 0.51 cfs @ 12.09 hrs, Volume= 0.041 af  
Primary = 0.51 cfs @ 12.09 hrs, Volume= 0.041 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs

### Link 5E: Design Point #2: Flow to 278 Village Street

Hydrograph



## HydroCAD2

Type III 24-hr 10-YR Rainfall=4.70"

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Time span=0.00-30.00 hrs, dt=0.01 hrs, 3001 points  
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN  
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

### Subcatchment3E: E2a

Runoff Area=6,946 sf 0.26% Impervious Runoff Depth=0.89"  
Flow Length=69' Slope=0.0100 '/' Tc=10.3 min CN=56 Runoff=0.11 cfs 0.012 af

### Subcatchment4E: E2b

Runoff Area=8,889 sf 72.75% Impervious Runoff Depth=3.59"  
Flow Length=60' Tc=6.3 min CN=90 Runoff=0.82 cfs 0.061 af

### Link 5E: Design Point #2: Flow to 278 Village Street

Inflow=0.90 cfs 0.073 af  
Primary=0.90 cfs 0.073 af

**Total Runoff Area = 0.364 ac Runoff Volume = 0.073 af Average Runoff Depth = 2.40"**  
**59.05% Pervious = 0.215 ac 40.95% Impervious = 0.149 ac**

**Summary for Subcatchment 3E: E2a**

Runoff = 0.11 cfs @ 12.17 hrs, Volume= 0.012 af, Depth= 0.89"

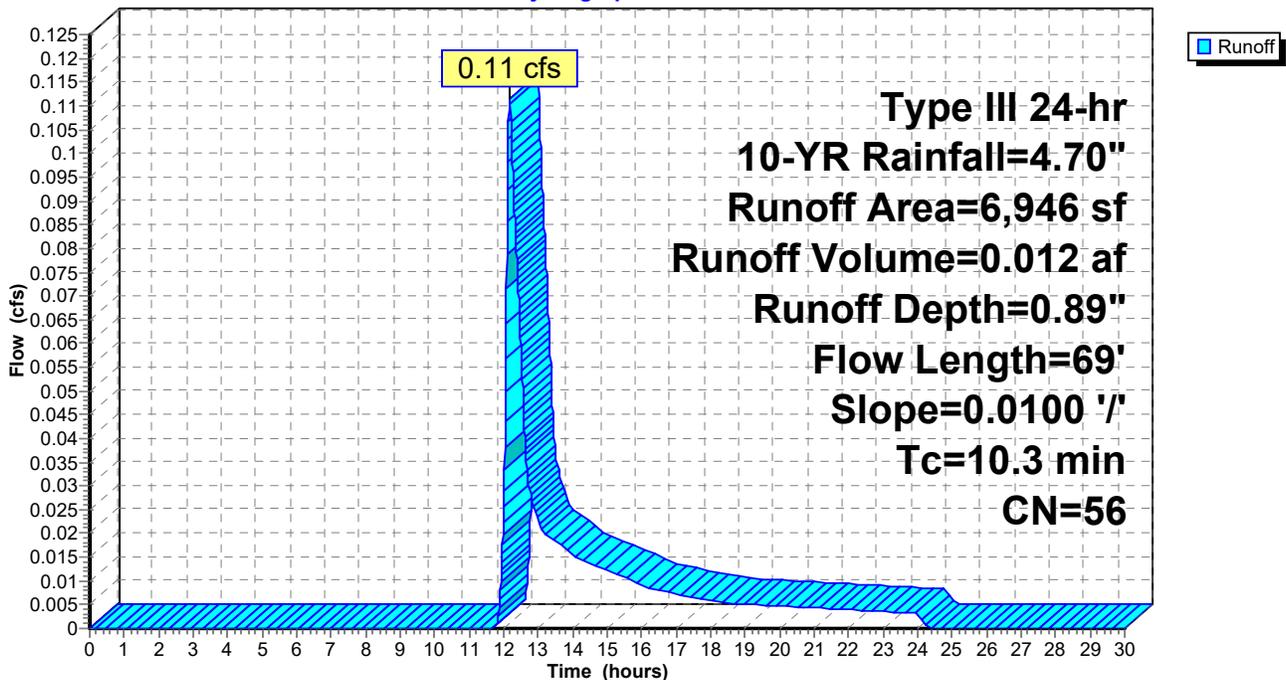
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
Type III 24-hr 10-YR Rainfall=4.70"

Area (sf)	CN	Description
* 18	98	Concrete Pad, HSG B
1,404	61	>75% Grass cover, Good, HSG B
5,524	55	Woods, Good, HSG B
6,946	56	Weighted Average
6,928		99.74% Pervious Area
18		0.26% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.3	25	0.0100	0.04		<b>Sheet Flow,</b> Woods: Light underbrush n= 0.400 P2= 3.20"
1.0	44	0.0100	0.70		<b>Shallow Concentrated Flow,</b> Short Grass Pasture Kv= 7.0 fps
10.3	69	Total			

**Subcatchment 3E: E2a**

Hydrograph



**Summary for Subcatchment 4E: E2b**

Runoff = 0.82 cfs @ 12.09 hrs, Volume= 0.061 af, Depth= 3.59"

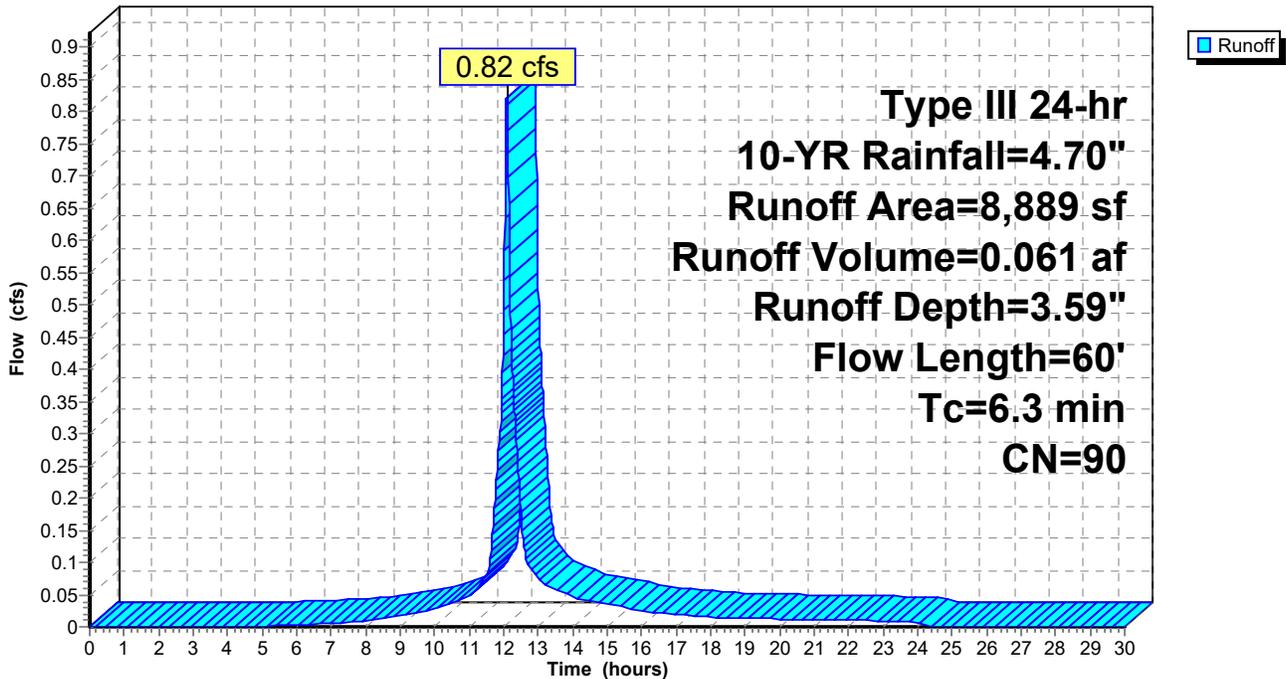
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
Type III 24-hr 10-YR Rainfall=4.70"

Area (sf)	CN	Description
4,930	98	Paved parking, HSG B
1,537	98	Roofs, HSG B
* 513	90	Gravel
1,909	61	>75% Grass cover, Good, HSG B
8,889	90	Weighted Average
2,422		27.25% Pervious Area
6,467		72.75% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.6	24	0.0120	0.07		Sheet Flow, Grass: Dense n= 0.240 P2= 3.20"
0.7	36	0.0100	0.85		Sheet Flow, Smooth surfaces n= 0.011 P2= 3.20"
6.3	60	Total			

**Subcatchment 4E: E2b**

Hydrograph

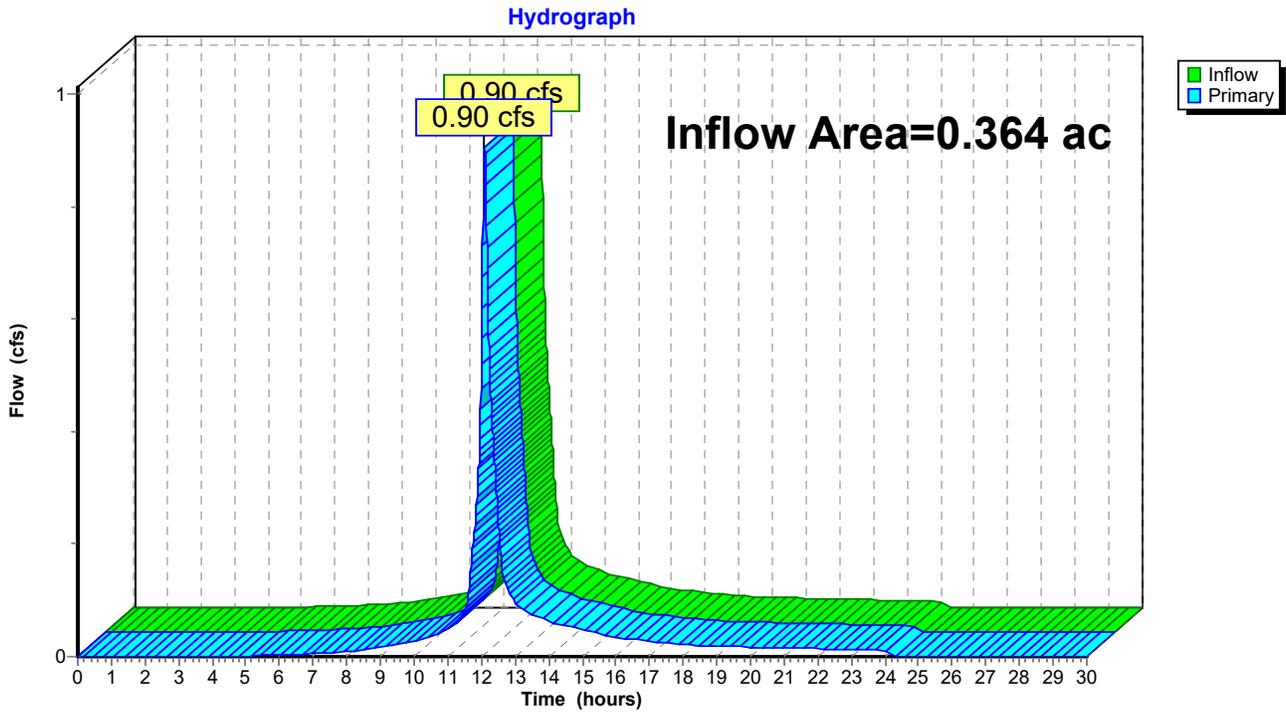


**Summary for Link 5E: Design Point #2: Flow to 278 Village Street**

Inflow Area = 0.364 ac, 40.95% Impervious, Inflow Depth = 2.40" for 10-YR event  
Inflow = 0.90 cfs @ 12.09 hrs, Volume= 0.073 af  
Primary = 0.90 cfs @ 12.09 hrs, Volume= 0.073 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs

**Link 5E: Design Point #2: Flow to 278 Village Street**



**HydroCAD2**

Type III 24-hr 25-YR Rainfall=5.50"

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Time span=0.00-30.00 hrs, dt=0.01 hrs, 3001 points  
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN  
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

**Subcatchment3E: E2a**

Runoff Area=6,946 sf 0.26% Impervious Runoff Depth=1.31"  
Flow Length=69' Slope=0.0100 '/' Tc=10.3 min CN=56 Runoff=0.18 cfs 0.017 af

**Subcatchment4E: E2b**

Runoff Area=8,889 sf 72.75% Impervious Runoff Depth=4.36"  
Flow Length=60' Tc=6.3 min CN=90 Runoff=0.99 cfs 0.074 af

**Link 5E: Design Point #2: Flow to 278 Village Street**

Inflow=1.13 cfs 0.092 af  
Primary=1.13 cfs 0.092 af

**Total Runoff Area = 0.364 ac Runoff Volume = 0.092 af Average Runoff Depth = 3.02"**  
**59.05% Pervious = 0.215 ac 40.95% Impervious = 0.149 ac**

**Summary for Subcatchment 3E: E2a**

Runoff = 0.18 cfs @ 12.16 hrs, Volume= 0.017 af, Depth= 1.31"

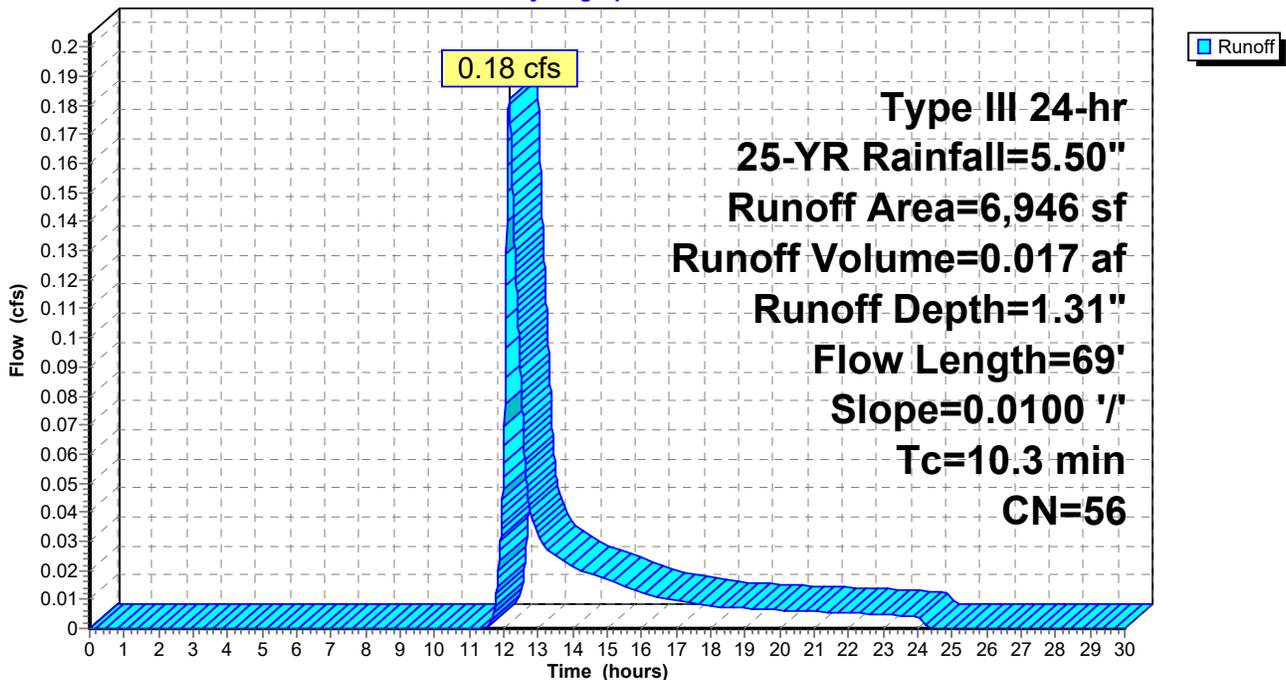
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
 Type III 24-hr 25-YR Rainfall=5.50"

Area (sf)	CN	Description
* 18	98	Concrete Pad, HSG B
1,404	61	>75% Grass cover, Good, HSG B
5,524	55	Woods, Good, HSG B
6,946	56	Weighted Average
6,928		99.74% Pervious Area
18		0.26% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.3	25	0.0100	0.04		<b>Sheet Flow,</b> Woods: Light underbrush n= 0.400 P2= 3.20"
1.0	44	0.0100	0.70		<b>Shallow Concentrated Flow,</b> Short Grass Pasture Kv= 7.0 fps
10.3	69	Total			

**Subcatchment 3E: E2a**

Hydrograph



**Summary for Subcatchment 4E: E2b**

Runoff = 0.99 cfs @ 12.09 hrs, Volume= 0.074 af, Depth= 4.36"

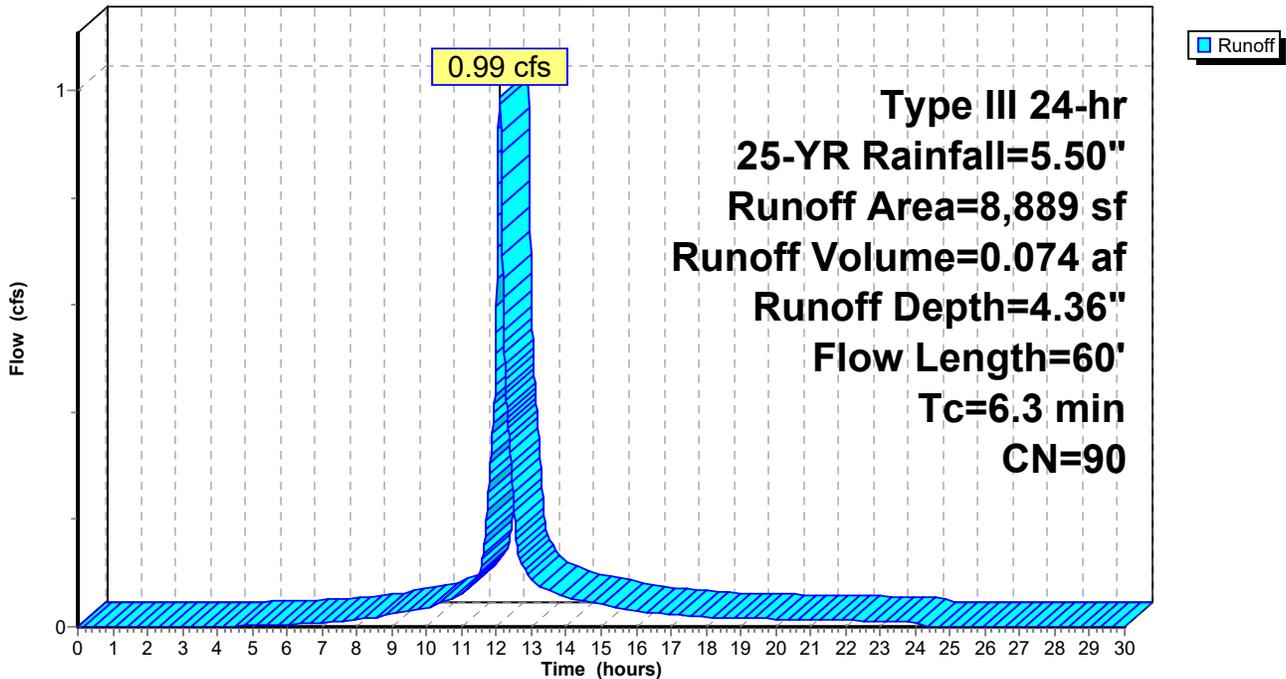
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
Type III 24-hr 25-YR Rainfall=5.50"

Area (sf)	CN	Description
4,930	98	Paved parking, HSG B
1,537	98	Roofs, HSG B
* 513	90	Gravel
1,909	61	>75% Grass cover, Good, HSG B
8,889	90	Weighted Average
2,422		27.25% Pervious Area
6,467		72.75% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.6	24	0.0120	0.07		<b>Sheet Flow,</b> Grass: Dense n= 0.240 P2= 3.20"
0.7	36	0.0100	0.85		<b>Sheet Flow,</b> Smooth surfaces n= 0.011 P2= 3.20"
6.3	60	Total			

**Subcatchment 4E: E2b**

Hydrograph

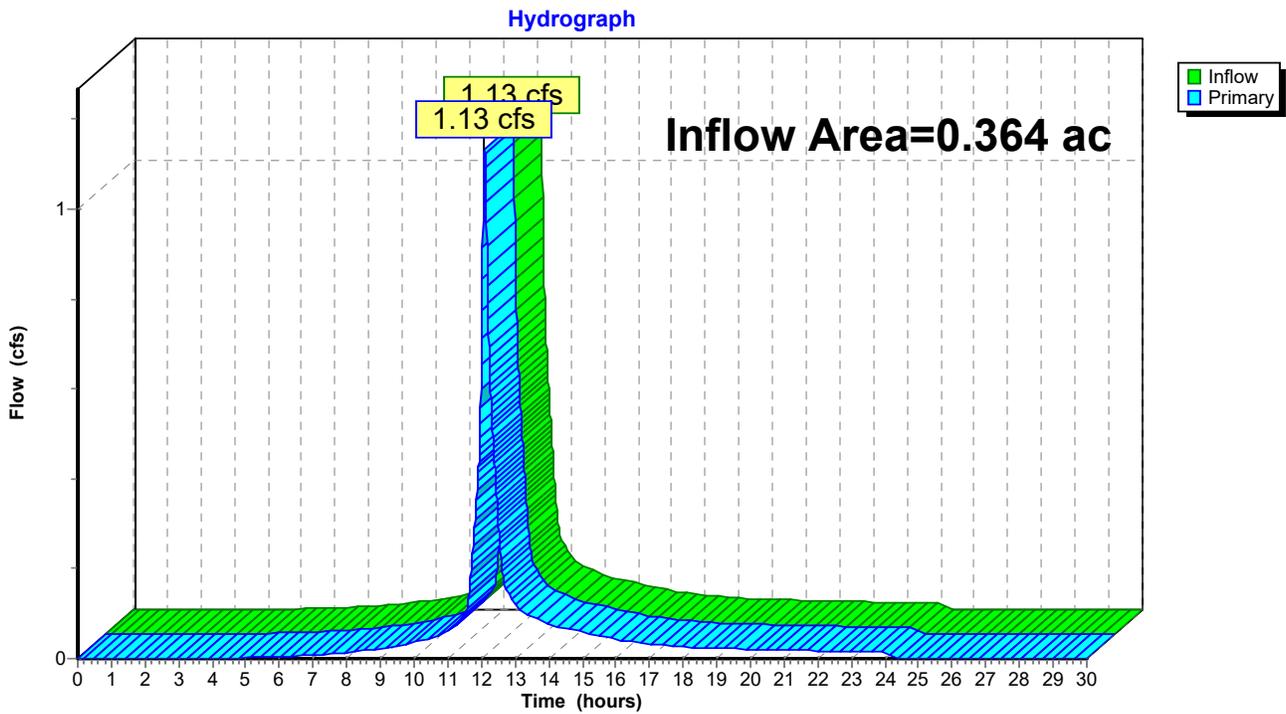


### Summary for Link 5E: Design Point #2: Flow to 278 Village Street

Inflow Area = 0.364 ac, 40.95% Impervious, Inflow Depth = 3.02" for 25-YR event  
Inflow = 1.13 cfs @ 12.10 hrs, Volume= 0.092 af  
Primary = 1.13 cfs @ 12.10 hrs, Volume= 0.092 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs

### Link 5E: Design Point #2: Flow to 278 Village Street



## HydroCAD2

Type III 24-hr 50-YR Rainfall=6.10"

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Time span=0.00-30.00 hrs, dt=0.01 hrs, 3001 points  
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN  
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

### Subcatchment3E: E2a

Runoff Area=6,946 sf 0.26% Impervious Runoff Depth=1.66"  
Flow Length=69' Slope=0.0100 '/' Tc=10.3 min CN=56 Runoff=0.24 cfs 0.022 af

### Subcatchment4E: E2b

Runoff Area=8,889 sf 72.75% Impervious Runoff Depth=4.94"  
Flow Length=60' Tc=6.3 min CN=90 Runoff=1.11 cfs 0.084 af

### Link 5E: Design Point #2: Flow to 278 Village Street

Inflow=1.31 cfs 0.106 af  
Primary=1.31 cfs 0.106 af

**Total Runoff Area = 0.364 ac Runoff Volume = 0.106 af Average Runoff Depth = 3.50"**  
**59.05% Pervious = 0.215 ac 40.95% Impervious = 0.149 ac**

**Summary for Subcatchment 3E: E2a**

Runoff = 0.24 cfs @ 12.16 hrs, Volume= 0.022 af, Depth= 1.66"

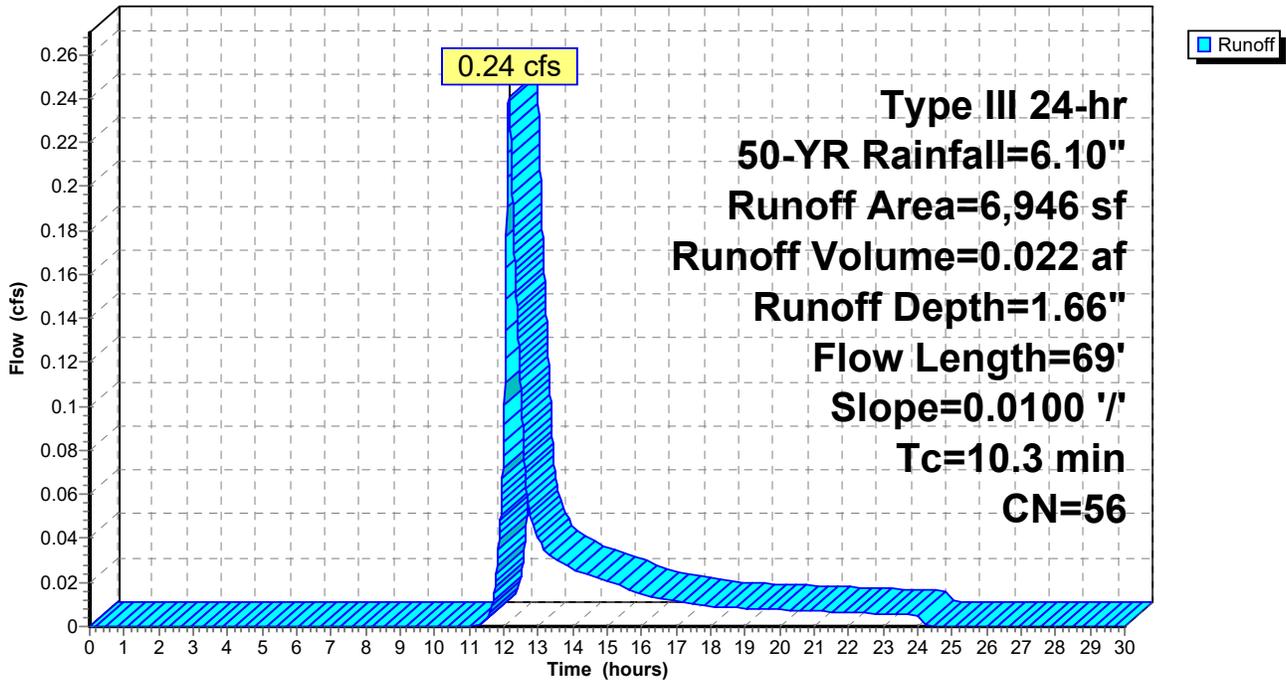
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
Type III 24-hr 50-YR Rainfall=6.10"

Area (sf)	CN	Description
* 18	98	Concrete Pad, HSG B
1,404	61	>75% Grass cover, Good, HSG B
5,524	55	Woods, Good, HSG B
6,946	56	Weighted Average
6,928		99.74% Pervious Area
18		0.26% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.3	25	0.0100	0.04		<b>Sheet Flow,</b> Woods: Light underbrush n= 0.400 P2= 3.20"
1.0	44	0.0100	0.70		<b>Shallow Concentrated Flow,</b> Short Grass Pasture Kv= 7.0 fps
10.3	69	Total			

**Subcatchment 3E: E2a**

Hydrograph



**Summary for Subcatchment 4E: E2b**

Runoff = 1.11 cfs @ 12.09 hrs, Volume= 0.084 af, Depth= 4.94"

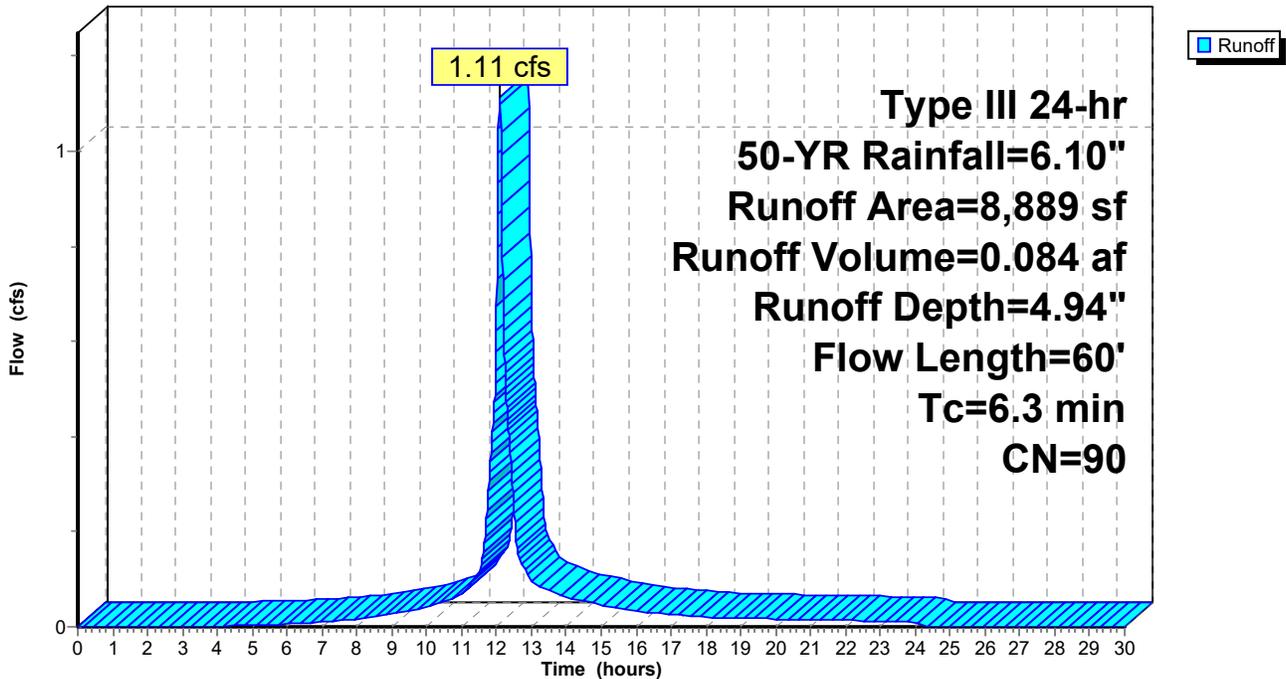
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
Type III 24-hr 50-YR Rainfall=6.10"

Area (sf)	CN	Description
4,930	98	Paved parking, HSG B
1,537	98	Roofs, HSG B
* 513	90	Gravel
1,909	61	>75% Grass cover, Good, HSG B
8,889	90	Weighted Average
2,422		27.25% Pervious Area
6,467		72.75% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.6	24	0.0120	0.07		Sheet Flow, Grass: Dense n= 0.240 P2= 3.20"
0.7	36	0.0100	0.85		Sheet Flow, Smooth surfaces n= 0.011 P2= 3.20"
6.3	60	Total			

**Subcatchment 4E: E2b**

Hydrograph

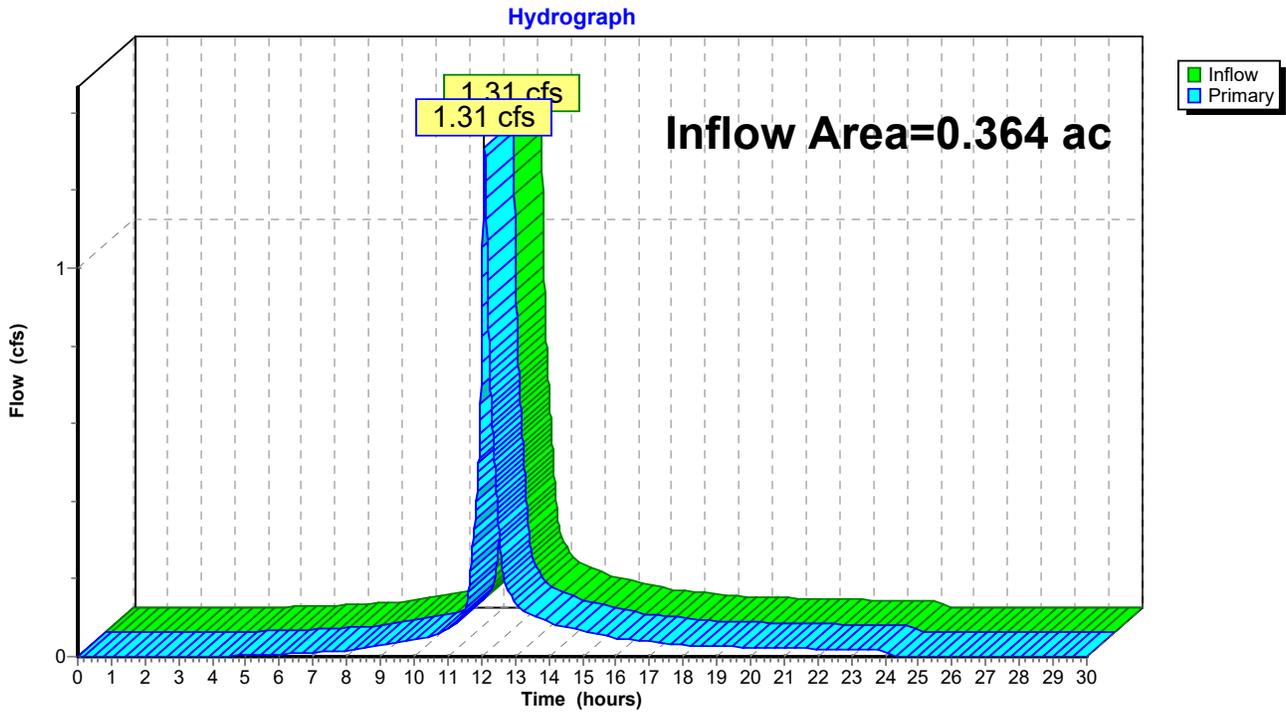


### Summary for Link 5E: Design Point #2: Flow to 278 Village Street

Inflow Area = 0.364 ac, 40.95% Impervious, Inflow Depth = 3.50" for 50-YR event  
Inflow = 1.31 cfs @ 12.10 hrs, Volume= 0.106 af  
Primary = 1.31 cfs @ 12.10 hrs, Volume= 0.106 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs

### Link 5E: Design Point #2: Flow to 278 Village Street



## HydroCAD2

Type III 24-hr 100-YR Rainfall=6.70"

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Time span=0.00-30.00 hrs, dt=0.01 hrs, 3001 points  
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN  
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

### Subcatchment3E: E2a

Runoff Area=6,946 sf 0.26% Impervious Runoff Depth=2.03"  
Flow Length=69' Slope=0.0100 '/' Tc=10.3 min CN=56 Runoff=0.30 cfs 0.027 af

### Subcatchment4E: E2b

Runoff Area=8,889 sf 72.75% Impervious Runoff Depth=5.53"  
Flow Length=60' Tc=6.3 min CN=90 Runoff=1.24 cfs 0.094 af

### Link 5E: Design Point #2: Flow to 278 Village Street

Inflow=1.49 cfs 0.121 af  
Primary=1.49 cfs 0.121 af

**Total Runoff Area = 0.364 ac Runoff Volume = 0.121 af Average Runoff Depth = 3.99"**  
**59.05% Pervious = 0.215 ac 40.95% Impervious = 0.149 ac**

**Summary for Subcatchment 3E: E2a**

Runoff = 0.30 cfs @ 12.16 hrs, Volume= 0.027 af, Depth= 2.03"

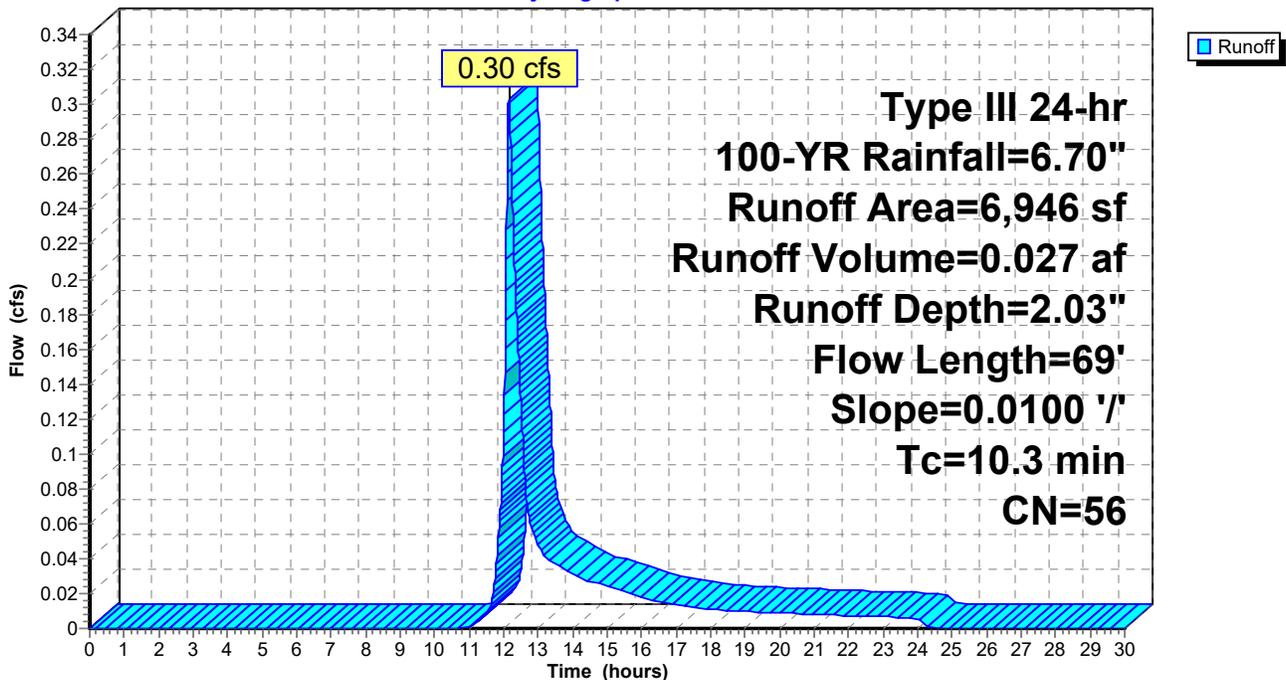
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
 Type III 24-hr 100-YR Rainfall=6.70"

Area (sf)	CN	Description
* 18	98	Concrete Pad, HSG B
1,404	61	>75% Grass cover, Good, HSG B
5,524	55	Woods, Good, HSG B
6,946	56	Weighted Average
6,928		99.74% Pervious Area
18		0.26% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.3	25	0.0100	0.04		<b>Sheet Flow,</b> Woods: Light underbrush n= 0.400 P2= 3.20"
1.0	44	0.0100	0.70		<b>Shallow Concentrated Flow,</b> Short Grass Pasture Kv= 7.0 fps
10.3	69	Total			

**Subcatchment 3E: E2a**

Hydrograph



**Summary for Subcatchment 4E: E2b**

Runoff = 1.24 cfs @ 12.09 hrs, Volume= 0.094 af, Depth= 5.53"

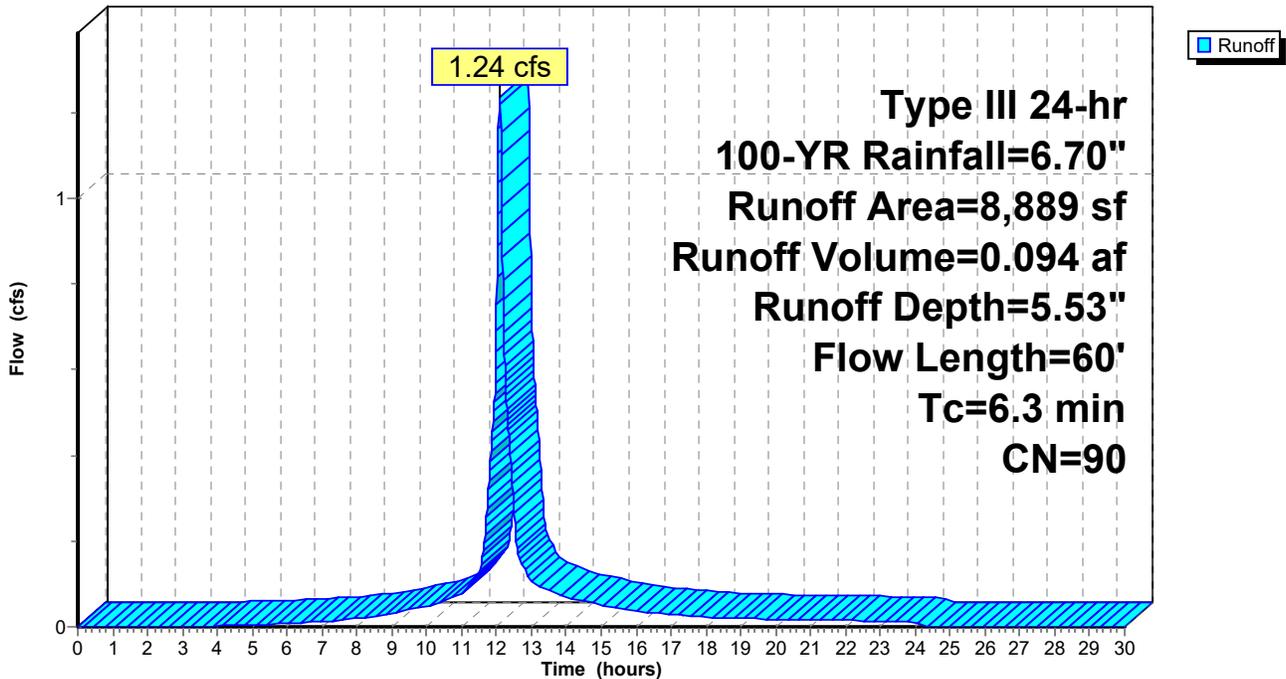
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
 Type III 24-hr 100-YR Rainfall=6.70"

Area (sf)	CN	Description
4,930	98	Paved parking, HSG B
1,537	98	Roofs, HSG B
* 513	90	Gravel
1,909	61	>75% Grass cover, Good, HSG B
8,889	90	Weighted Average
2,422		27.25% Pervious Area
6,467		72.75% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.6	24	0.0120	0.07		Sheet Flow, Grass: Dense n= 0.240 P2= 3.20"
0.7	36	0.0100	0.85		Sheet Flow, Smooth surfaces n= 0.011 P2= 3.20"
6.3	60	Total			

**Subcatchment 4E: E2b**

Hydrograph

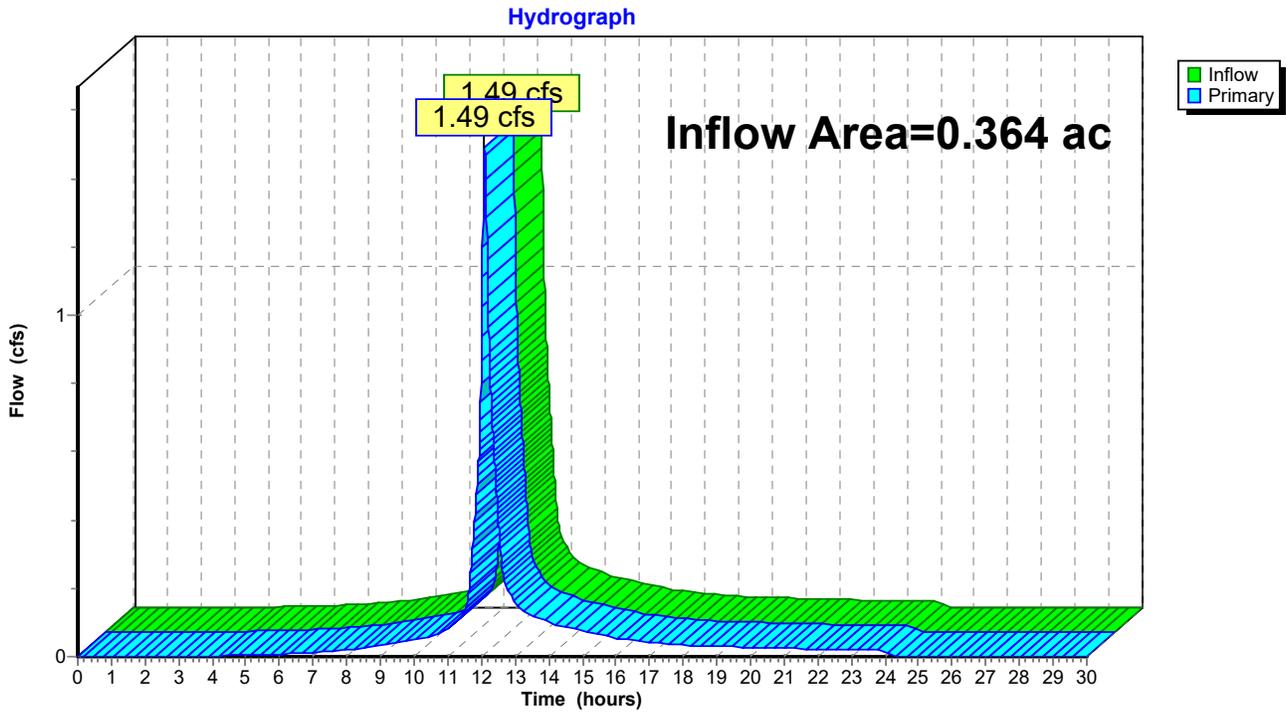


### Summary for Link 5E: Design Point #2: Flow to 278 Village Street

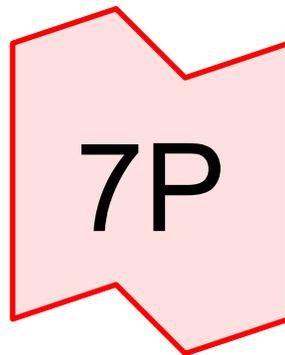
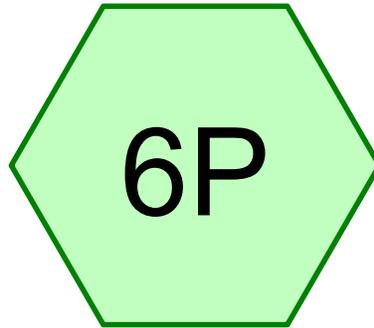
Inflow Area = 0.364 ac, 40.95% Impervious, Inflow Depth = 3.99" for 100-YR event  
Inflow = 1.49 cfs @ 12.10 hrs, Volume= 0.121 af  
Primary = 1.49 cfs @ 12.10 hrs, Volume= 0.121 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs

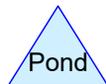
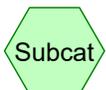
### Link 5E: Design Point #2: Flow to 278 Village Street



**DESIGN POINT #2: FLOW TO 278**  
**VILLAGE STREET PROPOSED**  
**CONDITIONS**



## Design Point #2: Flow to 278 Village Street



### Routing Diagram for HydroCAD4

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# HydroCAD4

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## Area Listing (selected nodes)

Area (acres)	CN	Description (subcatchment-numbers)
0.101	61	>75% Grass cover, Good, HSG B (6P)
<b>0.101</b>	<b>61</b>	<b>TOTAL AREA</b>

# HydroCAD4

Type III 24-hr 2-YR Rainfall=3.20"

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Time span=0.00-30.00 hrs, dt=0.01 hrs, 3001 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 6P: P2

Runoff Area=4,419 sf 0.00% Impervious Runoff Depth=0.44"  
Flow Length=30' Slope=0.0200 '/' Tc=5.4 min CN=61 Runoff=0.03 cfs 0.004 af

## Link 7P: Design Point #2: Flow to 278 Village Street

Inflow=0.03 cfs 0.004 af  
Primary=0.03 cfs 0.004 af

**Total Runoff Area = 0.101 ac Runoff Volume = 0.004 af Average Runoff Depth = 0.44"**  
**100.00% Pervious = 0.101 ac 0.00% Impervious = 0.000 ac**

**Summary for Subcatchment 6P: P2**

Runoff = 0.03 cfs @ 12.11 hrs, Volume= 0.004 af, Depth= 0.44"

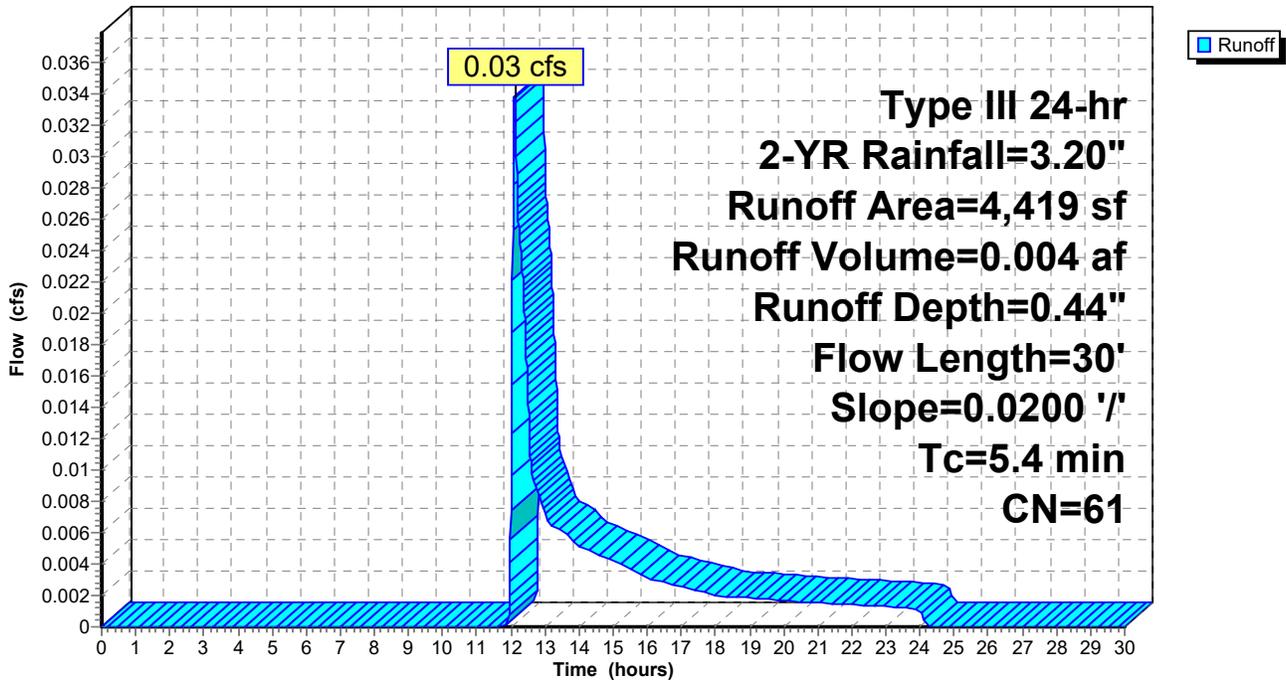
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
 Type III 24-hr 2-YR Rainfall=3.20"

Area (sf)	CN	Description
4,419	61	>75% Grass cover, Good, HSG B
4,419		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.4	30	0.0200	0.09		Sheet Flow, Grass: Dense n= 0.240 P2= 3.20"

**Subcatchment 6P: P2**

Hydrograph

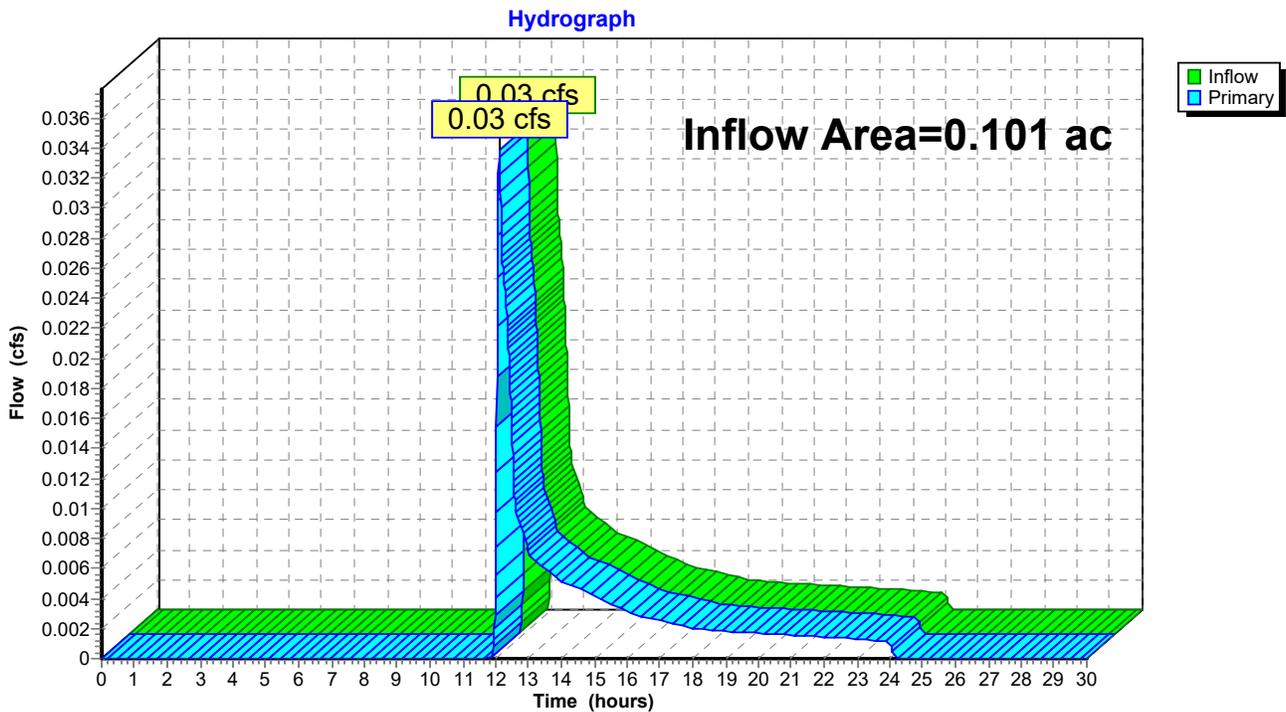


### Summary for Link 7P: Design Point #2: Flow to 278 Village Street

Inflow Area = 0.101 ac, 0.00% Impervious, Inflow Depth = 0.44" for 2-YR event  
Inflow = 0.03 cfs @ 12.11 hrs, Volume= 0.004 af  
Primary = 0.03 cfs @ 12.11 hrs, Volume= 0.004 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs

### Link 7P: Design Point #2: Flow to 278 Village Street



# HydroCAD4

Type III 24-hr 10-YR Rainfall=4.70"

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Time span=0.00-30.00 hrs, dt=0.01 hrs, 3001 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 6P: P2

Runoff Area=4,419 sf 0.00% Impervious Runoff Depth=1.19"  
Flow Length=30' Slope=0.0200 '/' Tc=5.4 min CN=61 Runoff=0.13 cfs 0.010 af

## Link 7P: Design Point #2: Flow to 278 Village Street

Inflow=0.13 cfs 0.010 af  
Primary=0.13 cfs 0.010 af

**Total Runoff Area = 0.101 ac Runoff Volume = 0.010 af Average Runoff Depth = 1.19"**  
**100.00% Pervious = 0.101 ac 0.00% Impervious = 0.000 ac**

**Summary for Subcatchment 6P: P2**

Runoff = 0.13 cfs @ 12.09 hrs, Volume= 0.010 af, Depth= 1.19"

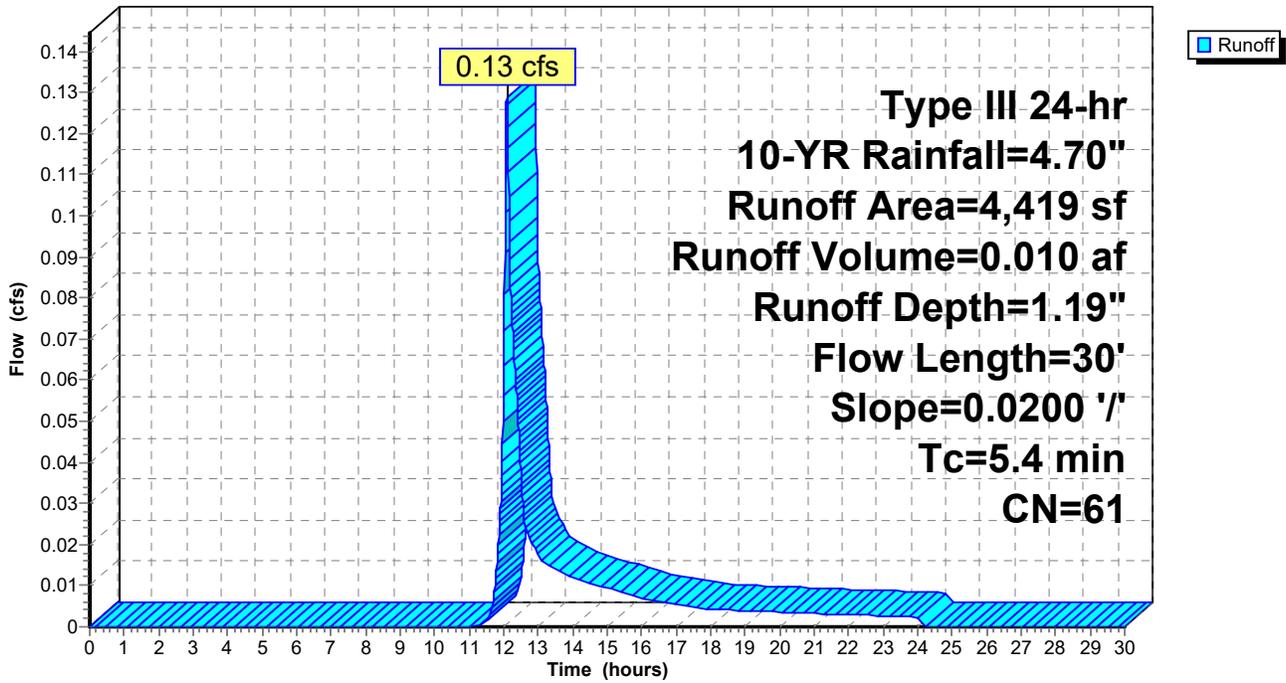
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
 Type III 24-hr 10-YR Rainfall=4.70"

Area (sf)	CN	Description
4,419	61	>75% Grass cover, Good, HSG B
4,419		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.4	30	0.0200	0.09		Sheet Flow, Grass: Dense n= 0.240 P2= 3.20"

**Subcatchment 6P: P2**

Hydrograph

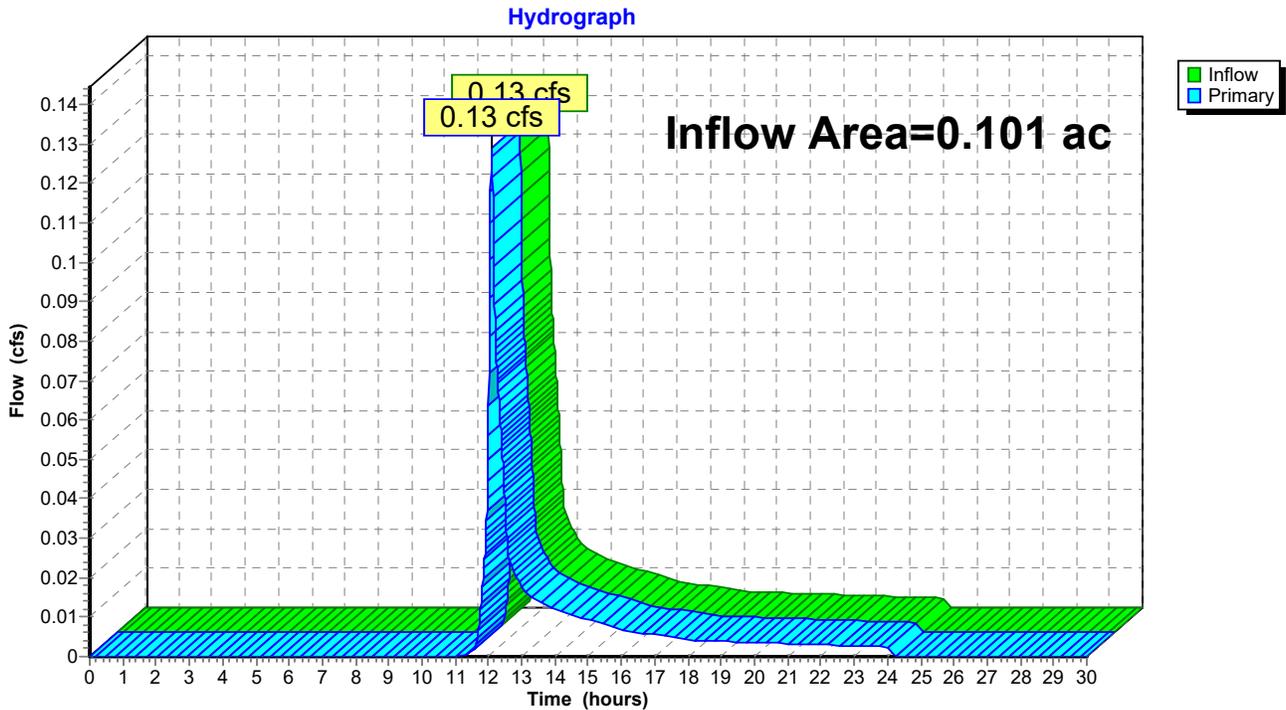


### Summary for Link 7P: Design Point #2: Flow to 278 Village Street

Inflow Area = 0.101 ac, 0.00% Impervious, Inflow Depth = 1.19" for 10-YR event  
Inflow = 0.13 cfs @ 12.09 hrs, Volume= 0.010 af  
Primary = 0.13 cfs @ 12.09 hrs, Volume= 0.010 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs

### Link 7P: Design Point #2: Flow to 278 Village Street



**HydroCAD4**

Type III 24-hr 25-YR Rainfall=5.50"

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Time span=0.00-30.00 hrs, dt=0.01 hrs, 3001 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 6P: P2**

Runoff Area=4,419 sf 0.00% Impervious Runoff Depth=1.68"  
Flow Length=30' Slope=0.0200 '/' Tc=5.4 min CN=61 Runoff=0.19 cfs 0.014 af

**Link 7P: Design Point #2: Flow to 278 Village Street**

Inflow=0.19 cfs 0.014 af  
Primary=0.19 cfs 0.014 af

**Total Runoff Area = 0.101 ac Runoff Volume = 0.014 af Average Runoff Depth = 1.68"**  
**100.00% Pervious = 0.101 ac 0.00% Impervious = 0.000 ac**

**Summary for Subcatchment 6P: P2**

Runoff = 0.19 cfs @ 12.09 hrs, Volume= 0.014 af, Depth= 1.68"

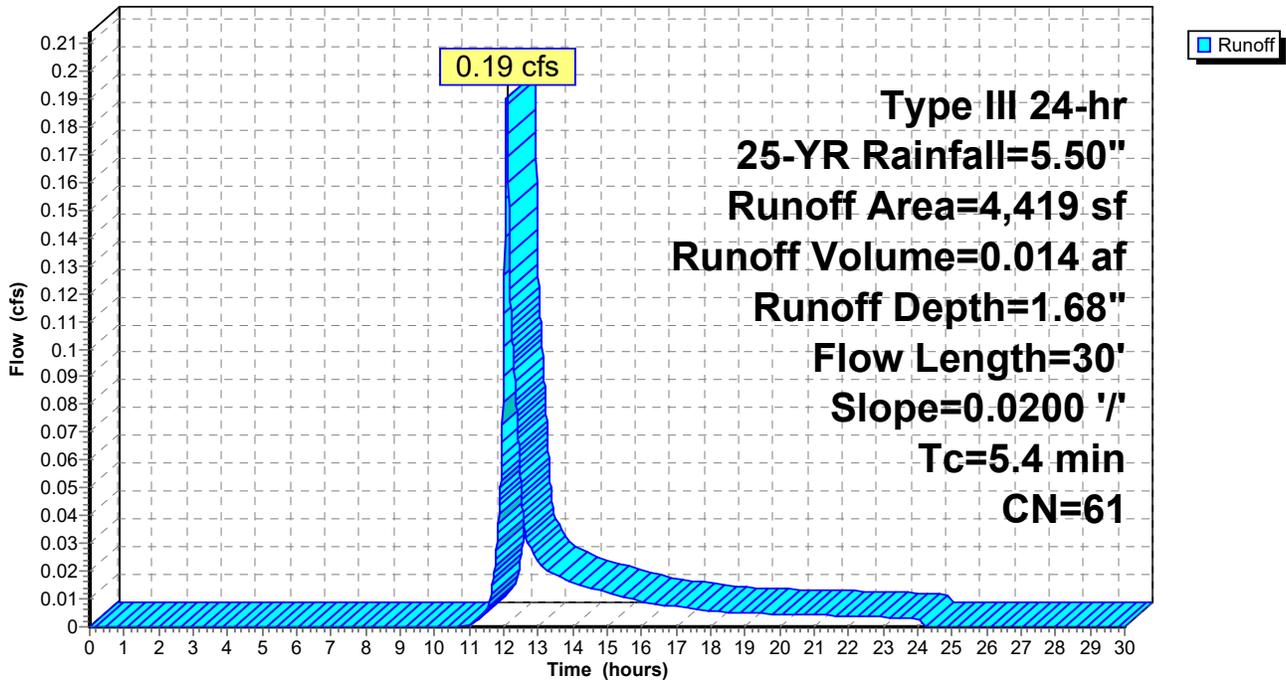
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
Type III 24-hr 25-YR Rainfall=5.50"

Area (sf)	CN	Description
4,419	61	>75% Grass cover, Good, HSG B
4,419		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.4	30	0.0200	0.09		Sheet Flow, Grass: Dense n= 0.240 P2= 3.20"

**Subcatchment 6P: P2**

Hydrograph

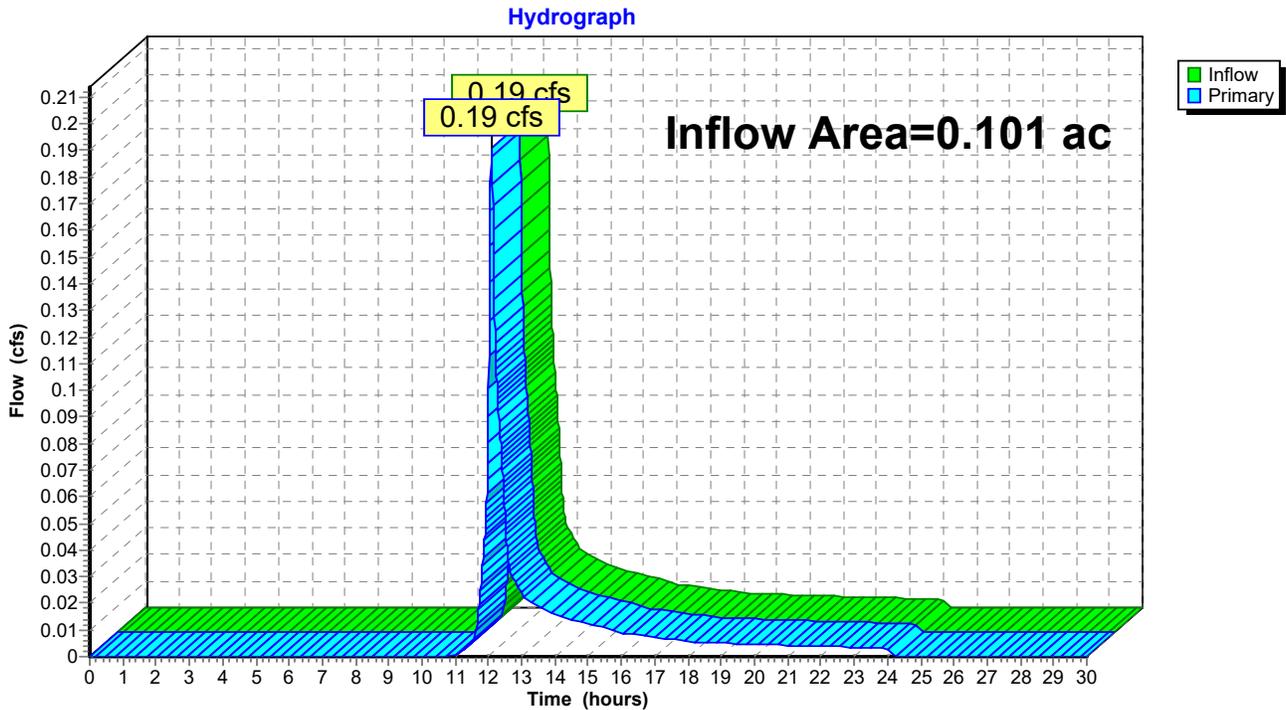


### Summary for Link 7P: Design Point #2: Flow to 278 Village Street

Inflow Area = 0.101 ac, 0.00% Impervious, Inflow Depth = 1.68" for 25-YR event  
Inflow = 0.19 cfs @ 12.09 hrs, Volume= 0.014 af  
Primary = 0.19 cfs @ 12.09 hrs, Volume= 0.014 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs

### Link 7P: Design Point #2: Flow to 278 Village Street



# HydroCAD4

Type III 24-hr 50-YR Rainfall=6.10"

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Time span=0.00-30.00 hrs, dt=0.01 hrs, 3001 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 6P: P2

Runoff Area=4,419 sf 0.00% Impervious Runoff Depth=2.07"  
Flow Length=30' Slope=0.0200 '/ Tc=5.4 min CN=61 Runoff=0.24 cfs 0.018 af

## Link 7P: Design Point #2: Flow to 278 Village Street

Inflow=0.24 cfs 0.018 af  
Primary=0.24 cfs 0.018 af

**Total Runoff Area = 0.101 ac Runoff Volume = 0.018 af Average Runoff Depth = 2.07"**  
**100.00% Pervious = 0.101 ac 0.00% Impervious = 0.000 ac**

**Summary for Subcatchment 6P: P2**

Runoff = 0.24 cfs @ 12.09 hrs, Volume= 0.018 af, Depth= 2.07"

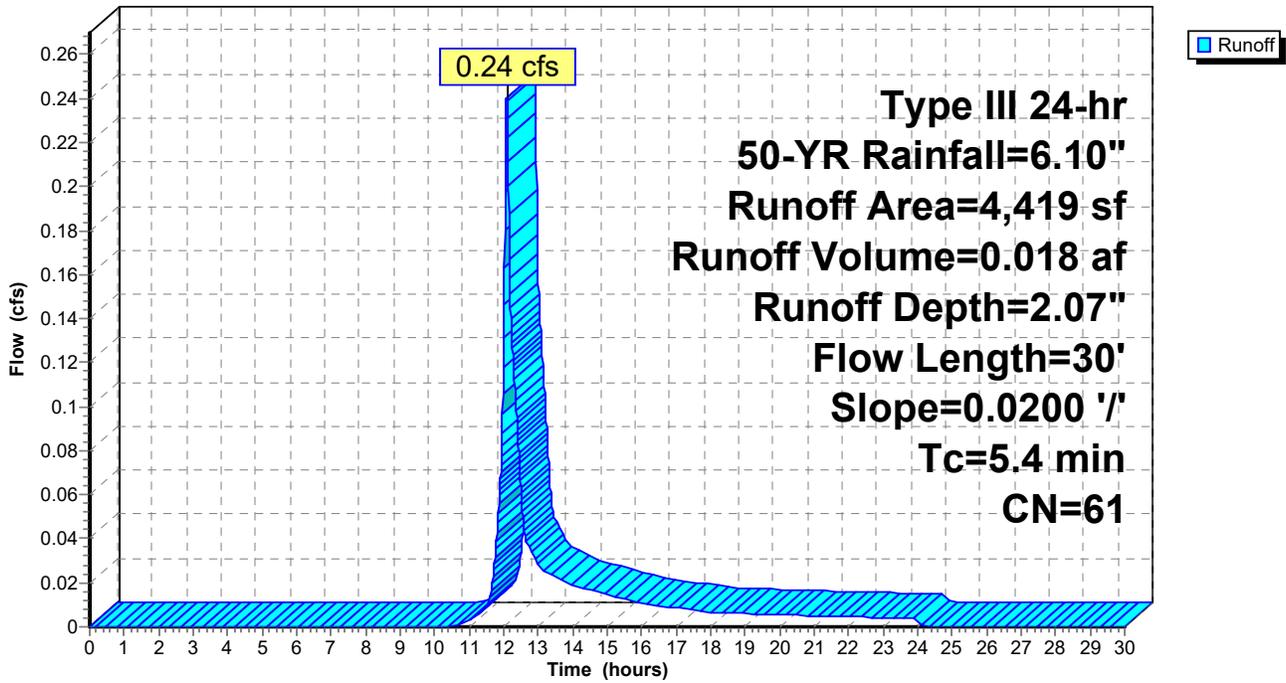
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
 Type III 24-hr 50-YR Rainfall=6.10"

Area (sf)	CN	Description
4,419	61	>75% Grass cover, Good, HSG B
4,419		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.4	30	0.0200	0.09		Sheet Flow, Grass: Dense n= 0.240 P2= 3.20"

**Subcatchment 6P: P2**

Hydrograph

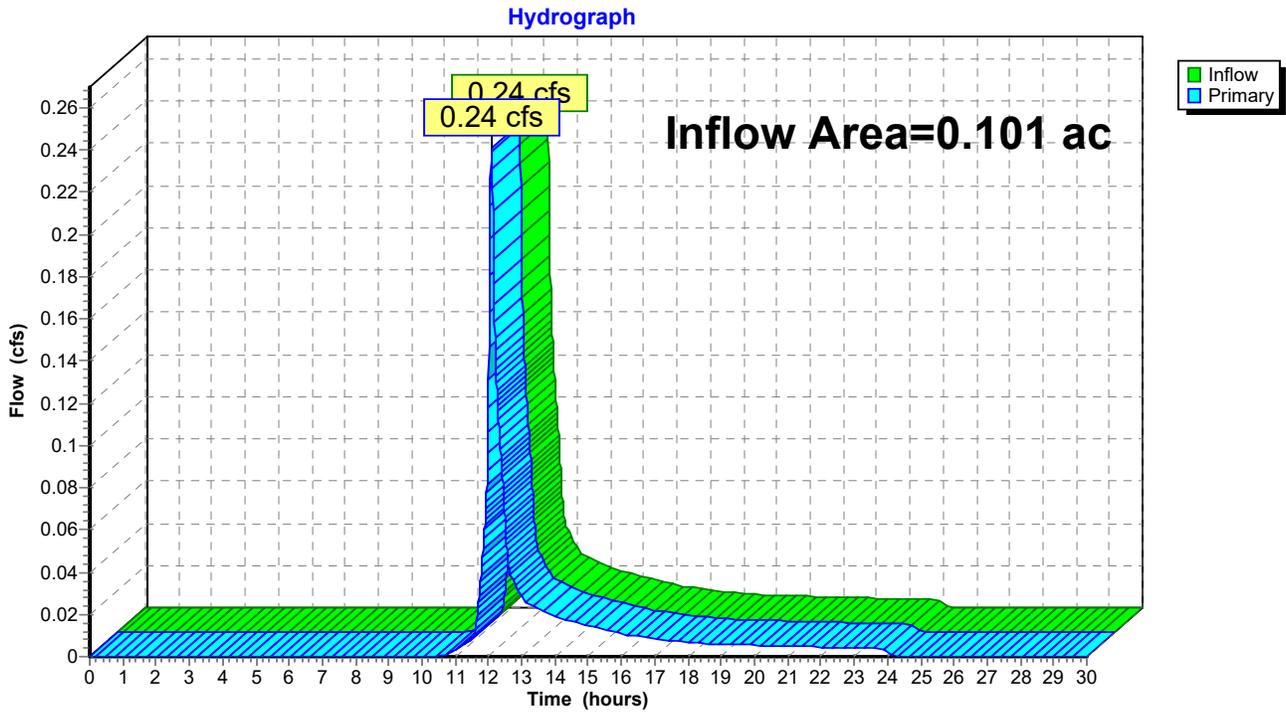


### Summary for Link 7P: Design Point #2: Flow to 278 Village Street

Inflow Area = 0.101 ac, 0.00% Impervious, Inflow Depth = 2.07" for 50-YR event  
Inflow = 0.24 cfs @ 12.09 hrs, Volume= 0.018 af  
Primary = 0.24 cfs @ 12.09 hrs, Volume= 0.018 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs

### Link 7P: Design Point #2: Flow to 278 Village Street



**HydroCAD4**

Type III 24-hr 100-YR Rainfall=6.70"

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Time span=0.00-30.00 hrs, dt=0.01 hrs, 3001 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 6P: P2**

Runoff Area=4,419 sf 0.00% Impervious Runoff Depth=2.49"  
Flow Length=30' Slope=0.0200 '/' Tc=5.4 min CN=61 Runoff=0.29 cfs 0.021 af

**Link 7P: Design Point #2: Flow to 278 Village Street**

Inflow=0.29 cfs 0.021 af  
Primary=0.29 cfs 0.021 af

**Total Runoff Area = 0.101 ac Runoff Volume = 0.021 af Average Runoff Depth = 2.49"**  
**100.00% Pervious = 0.101 ac 0.00% Impervious = 0.000 ac**

**Summary for Subcatchment 6P: P2**

Runoff = 0.29 cfs @ 12.09 hrs, Volume= 0.021 af, Depth= 2.49"

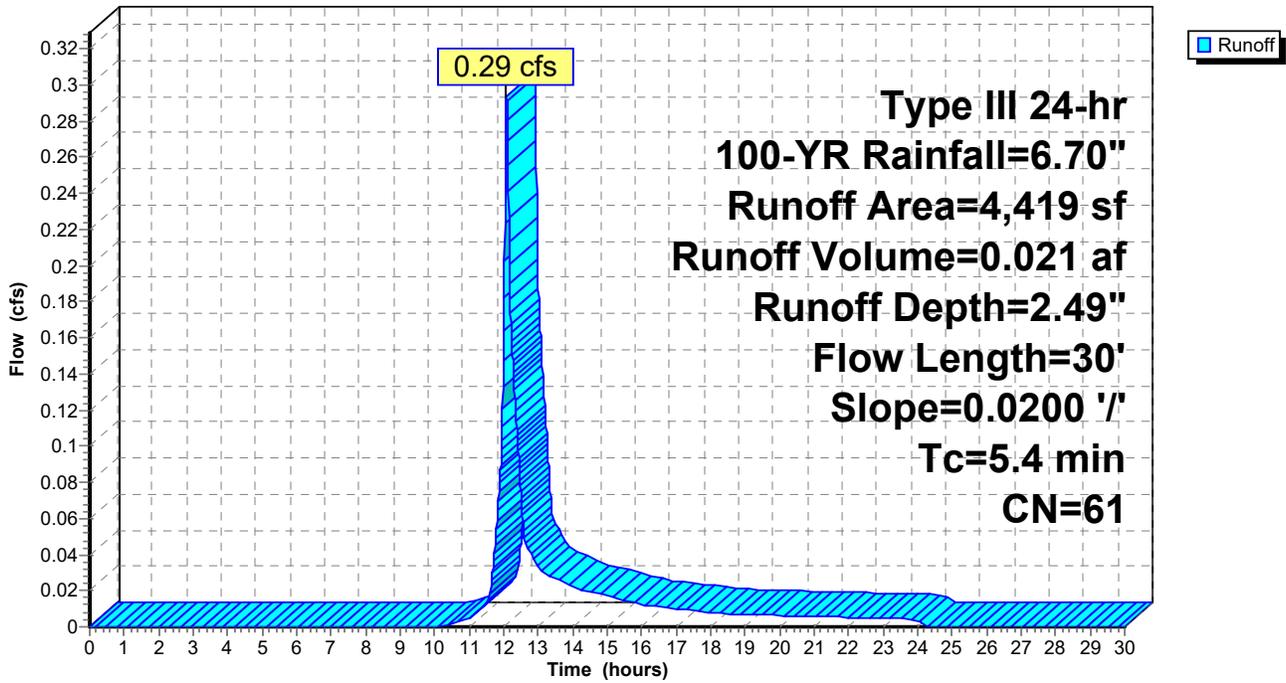
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
 Type III 24-hr 100-YR Rainfall=6.70"

Area (sf)	CN	Description
4,419	61	>75% Grass cover, Good, HSG B
4,419		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.4	30	0.0200	0.09		Sheet Flow, Grass: Dense n= 0.240 P2= 3.20"

**Subcatchment 6P: P2**

Hydrograph

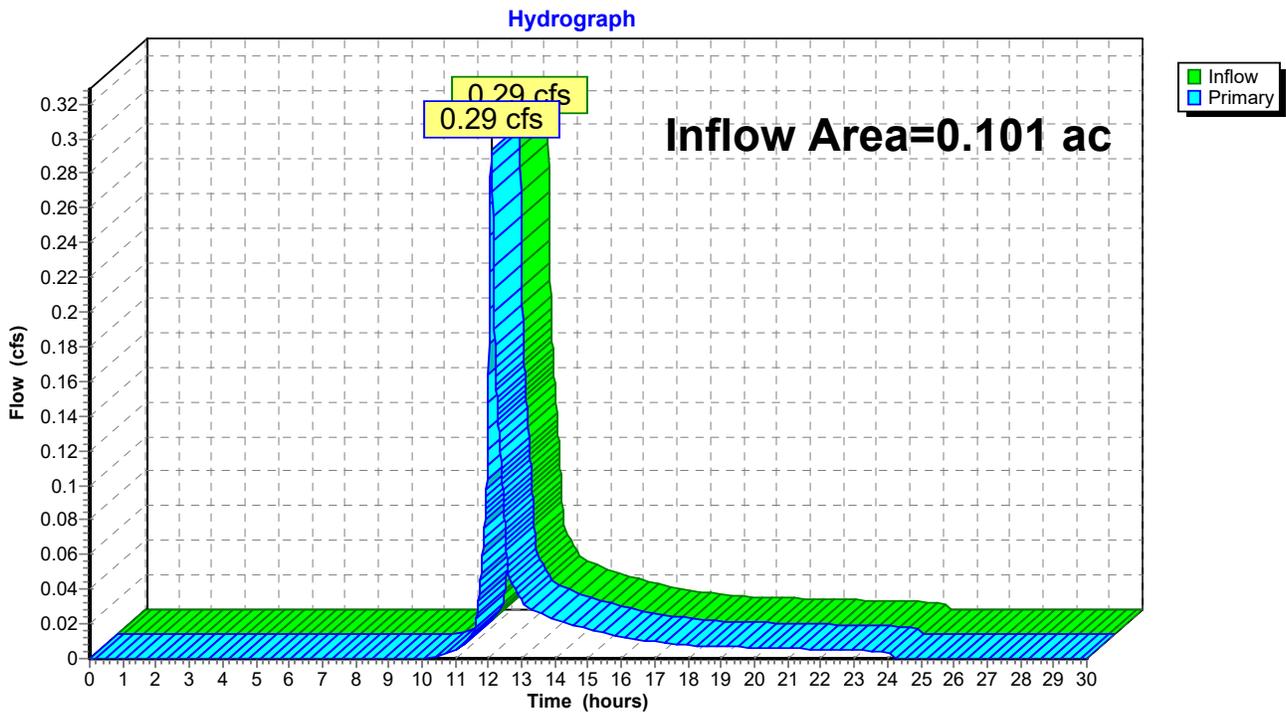


### Summary for Link 7P: Design Point #2: Flow to 278 Village Street

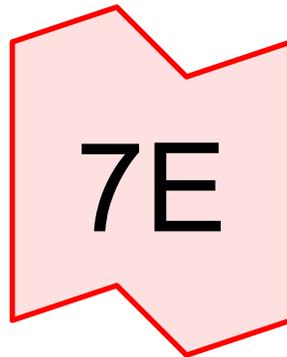
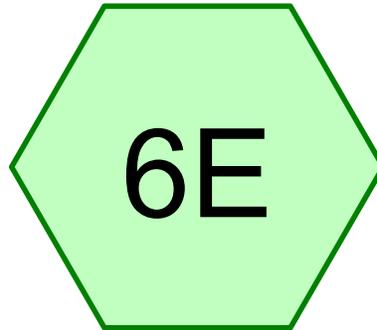
Inflow Area = 0.101 ac, 0.00% Impervious, Inflow Depth = 2.49" for 100-YR event  
Inflow = 0.29 cfs @ 12.09 hrs, Volume= 0.021 af  
Primary = 0.29 cfs @ 12.09 hrs, Volume= 0.021 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs

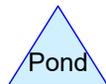
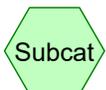
### Link 7P: Design Point #2: Flow to 278 Village Street



**DESIGN POINT #3a: FLOW TO VILLAGE**  
**STREET EXISTING CONDITIONS**



## Design Point #3a: Flow to Village Street



### Routing Diagram for HydroCAD2

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## HydroCAD2

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### Area Listing (selected nodes)

Area (acres)	CN	Description (subcatchment-numbers)
0.117	61	>75% Grass cover, Good, HSG B (6E)
0.090	90	Gravel (6E)
0.072	98	Paved parking, HSG B (6E)
0.021	98	Roofs, HSG B (6E)
0.010	30	Woods, Good, HSG A (6E)
0.003	55	Woods, Good, HSG B (6E)
<b>0.314</b>	<b>79</b>	<b>TOTAL AREA</b>

## HydroCAD2

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### Soil Listing (selected nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.010	HSG A	6E
0.214	HSG B	6E
0.000	HSG C	
0.000	HSG D	
0.090	Other	6E
<b>0.314</b>		<b>TOTAL AREA</b>

## HydroCAD2

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Type III 24-hr 2-YR Rainfall=3.20"

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Time span=0.00-30.00 hrs, dt=0.01 hrs, 3001 points  
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN  
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

### Subcatchment 6E: E3a

Runoff Area=13,673 sf 29.88% Impervious Runoff Depth=1.34"  
Flow Length=164' Tc=8.3 min CN=79 Runoff=0.45 cfs 0.035 af

### Link 7E: Design Point #3a: Flow to Village Street

Inflow=0.45 cfs 0.035 af  
Primary=0.45 cfs 0.035 af

**Total Runoff Area = 0.314 ac Runoff Volume = 0.035 af Average Runoff Depth = 1.34"**  
**70.12% Pervious = 0.220 ac 29.88% Impervious = 0.094 ac**

**Summary for Subcatchment 6E: E3a**

Runoff = 0.45 cfs @ 12.12 hrs, Volume= 0.035 af, Depth= 1.34"

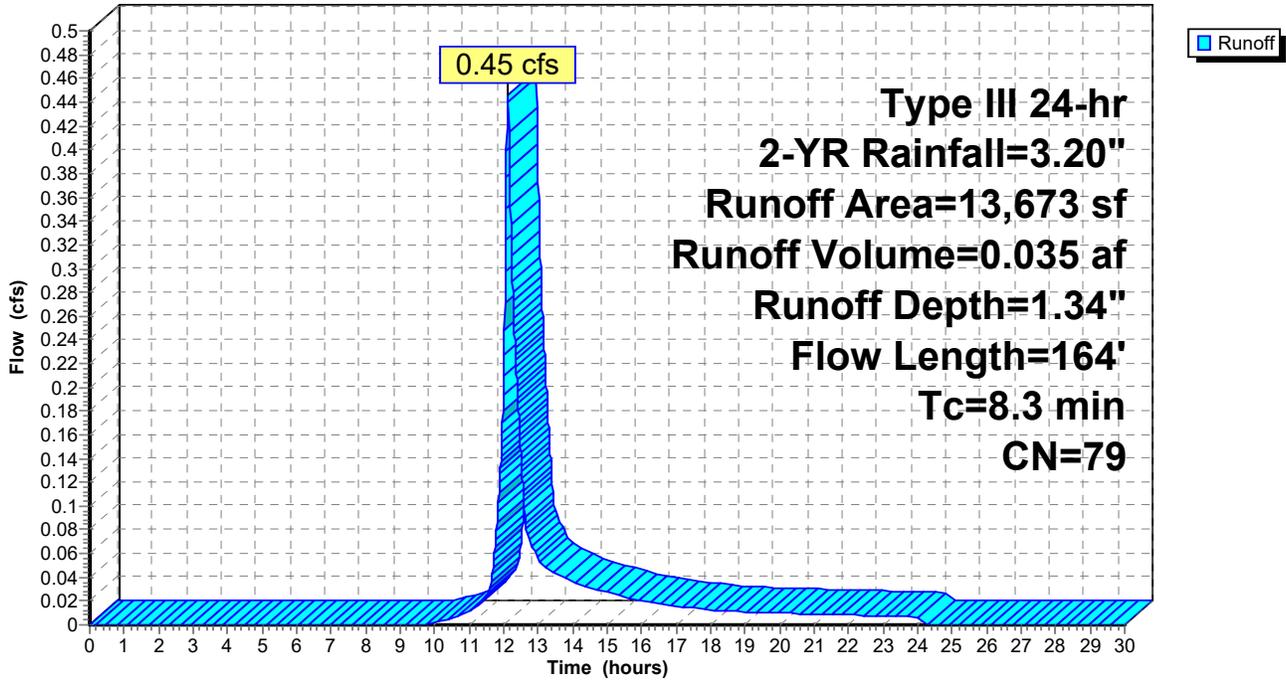
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
Type III 24-hr 2-YR Rainfall=3.20"

Area (sf)	CN	Description
3,157	98	Paved parking, HSG B
928	98	Roofs, HSG B
* 3,909	90	Gravel
5,111	61	>75% Grass cover, Good, HSG B
451	30	Woods, Good, HSG A
117	55	Woods, Good, HSG B
13,673	79	Weighted Average
9,588		70.12% Pervious Area
4,085		29.88% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.7	36	0.0100	0.85		<b>Sheet Flow,</b> Smooth surfaces n= 0.011 P2= 3.20"
6.6	27	0.0100	0.07		<b>Sheet Flow,</b> Grass: Dense n= 0.240 P2= 3.20"
1.0	101	0.0600	1.71		<b>Shallow Concentrated Flow,</b> Short Grass Pasture Kv= 7.0 fps
8.3	164	Total			

Subcatchment 6E: E3a

Hydrograph

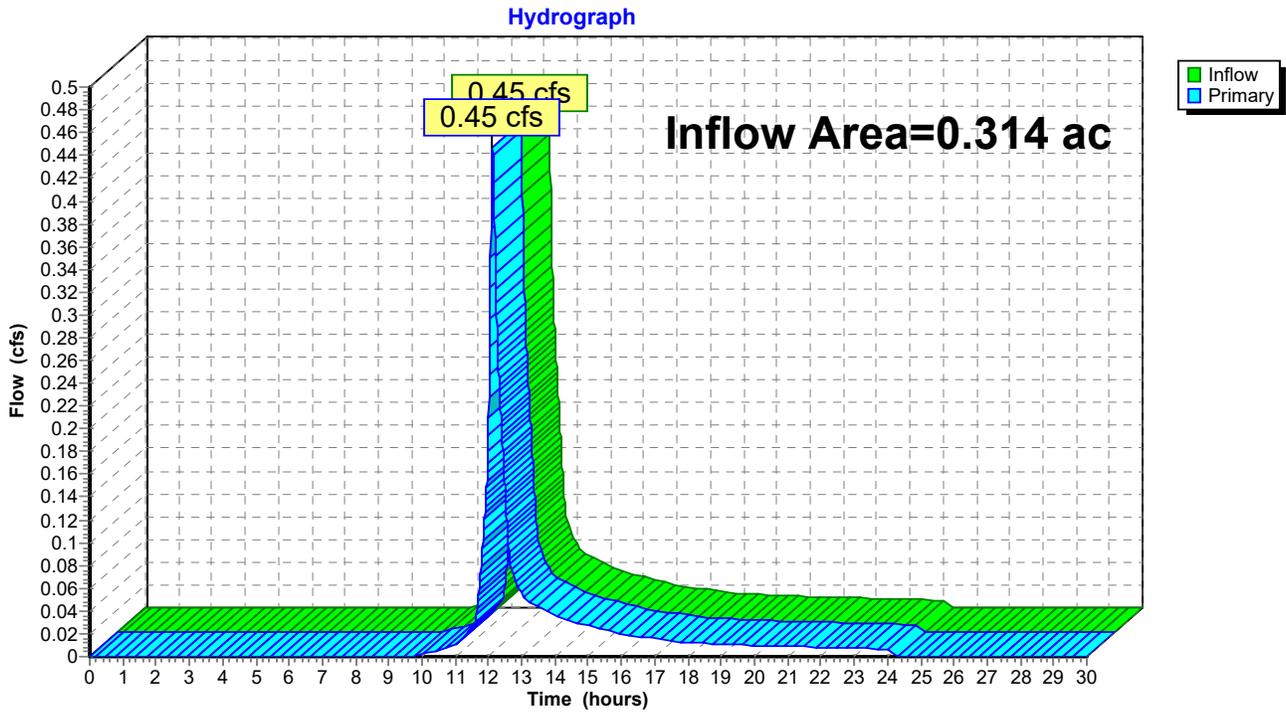


### Summary for Link 7E: Design Point #3a: Flow to Village Street

Inflow Area = 0.314 ac, 29.88% Impervious, Inflow Depth = 1.34" for 2-YR event  
Inflow = 0.45 cfs @ 12.12 hrs, Volume= 0.035 af  
Primary = 0.45 cfs @ 12.12 hrs, Volume= 0.035 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs

### Link 7E: Design Point #3a: Flow to Village Street



## HydroCAD2

Type III 24-hr 10-YR Rainfall=4.70"

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Time span=0.00-30.00 hrs, dt=0.01 hrs, 3001 points  
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN  
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

### Subcatchment 6E: E3a

Runoff Area=13,673 sf 29.88% Impervious Runoff Depth=2.55"  
Flow Length=164' Tc=8.3 min CN=79 Runoff=0.86 cfs 0.067 af

### Link 7E: Design Point #3a: Flow to Village Street

Inflow=0.86 cfs 0.067 af  
Primary=0.86 cfs 0.067 af

**Total Runoff Area = 0.314 ac Runoff Volume = 0.067 af Average Runoff Depth = 2.55"**  
**70.12% Pervious = 0.220 ac 29.88% Impervious = 0.094 ac**

**Summary for Subcatchment 6E: E3a**

Runoff = 0.86 cfs @ 12.12 hrs, Volume= 0.067 af, Depth= 2.55"

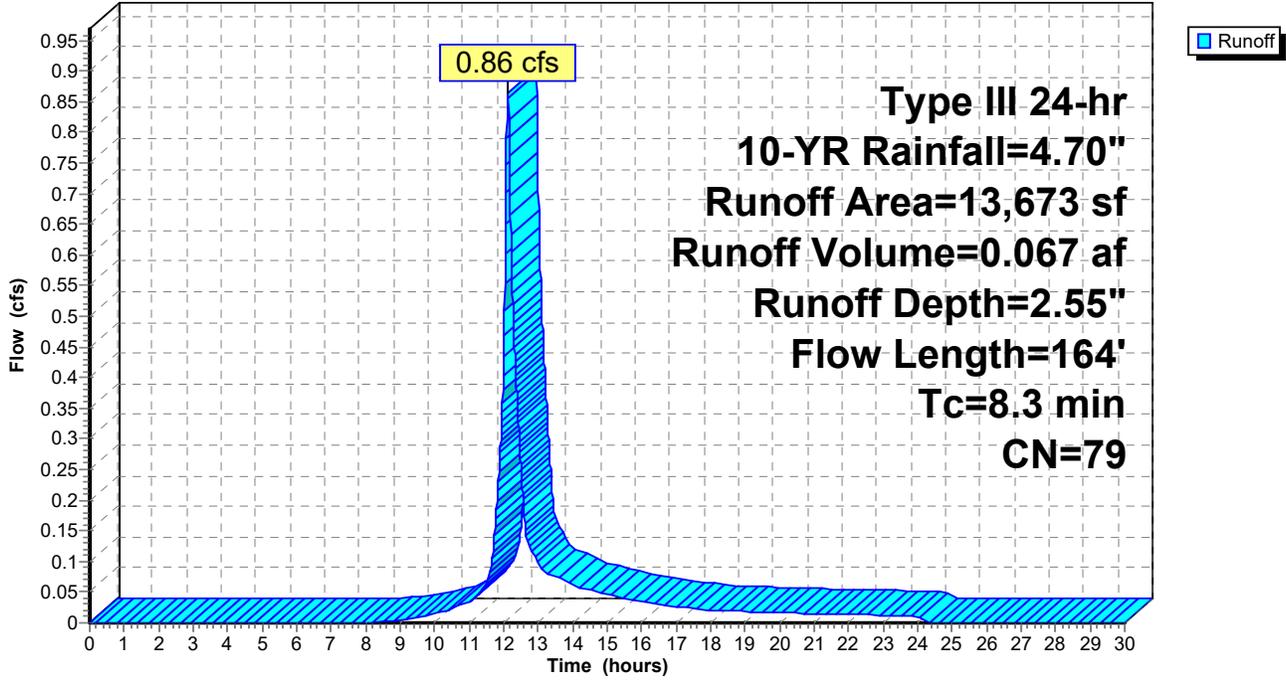
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
Type III 24-hr 10-YR Rainfall=4.70"

Area (sf)	CN	Description
3,157	98	Paved parking, HSG B
928	98	Roofs, HSG B
* 3,909	90	Gravel
5,111	61	>75% Grass cover, Good, HSG B
451	30	Woods, Good, HSG A
117	55	Woods, Good, HSG B
13,673	79	Weighted Average
9,588		70.12% Pervious Area
4,085		29.88% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.7	36	0.0100	0.85		<b>Sheet Flow,</b> Smooth surfaces n= 0.011 P2= 3.20"
6.6	27	0.0100	0.07		<b>Sheet Flow,</b> Grass: Dense n= 0.240 P2= 3.20"
1.0	101	0.0600	1.71		<b>Shallow Concentrated Flow,</b> Short Grass Pasture Kv= 7.0 fps
8.3	164	Total			

Subcatchment 6E: E3a

Hydrograph

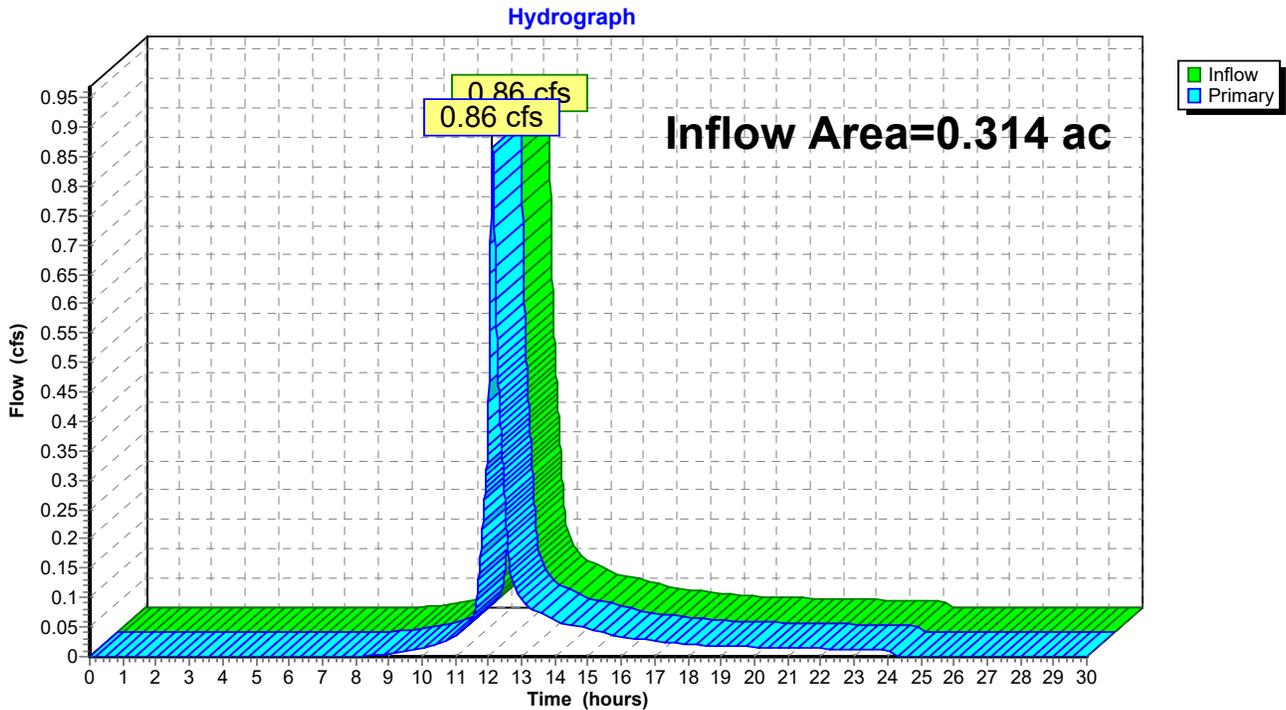


### Summary for Link 7E: Design Point #3a: Flow to Village Street

Inflow Area = 0.314 ac, 29.88% Impervious, Inflow Depth = 2.55" for 10-YR event  
Inflow = 0.86 cfs @ 12.12 hrs, Volume= 0.067 af  
Primary = 0.86 cfs @ 12.12 hrs, Volume= 0.067 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs

### Link 7E: Design Point #3a: Flow to Village Street



## HydroCAD2

Type III 24-hr 25-YR Rainfall=5.50"

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Time span=0.00-30.00 hrs, dt=0.01 hrs, 3001 points  
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN  
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

### Subcatchment 6E: E3a

Runoff Area=13,673 sf 29.88% Impervious Runoff Depth=3.24"  
Flow Length=164' Tc=8.3 min CN=79 Runoff=1.10 cfs 0.085 af

### Link 7E: Design Point #3a: Flow to Village Street

Inflow=1.10 cfs 0.085 af  
Primary=1.10 cfs 0.085 af

**Total Runoff Area = 0.314 ac Runoff Volume = 0.085 af Average Runoff Depth = 3.24"**  
**70.12% Pervious = 0.220 ac 29.88% Impervious = 0.094 ac**

**Summary for Subcatchment 6E: E3a**

Runoff = 1.10 cfs @ 12.12 hrs, Volume= 0.085 af, Depth= 3.24"

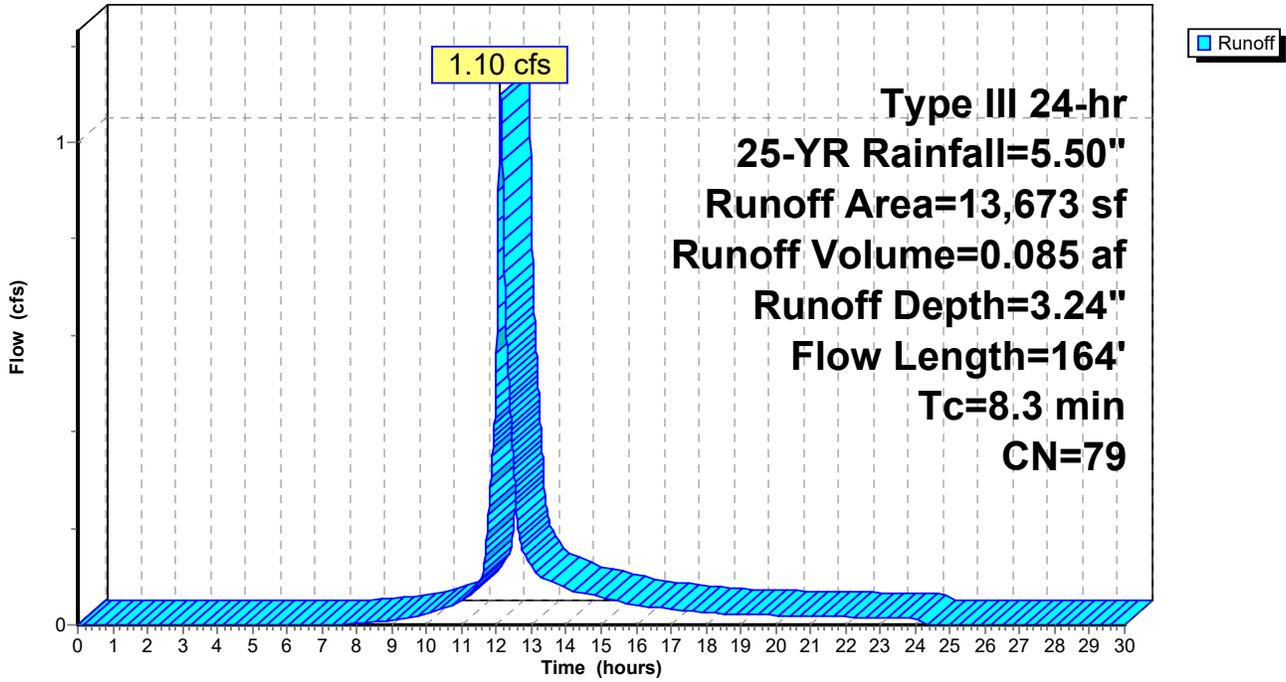
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
 Type III 24-hr 25-YR Rainfall=5.50"

Area (sf)	CN	Description
3,157	98	Paved parking, HSG B
928	98	Roofs, HSG B
* 3,909	90	Gravel
5,111	61	>75% Grass cover, Good, HSG B
451	30	Woods, Good, HSG A
117	55	Woods, Good, HSG B
13,673	79	Weighted Average
9,588		70.12% Pervious Area
4,085		29.88% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.7	36	0.0100	0.85		<b>Sheet Flow,</b> Smooth surfaces n= 0.011 P2= 3.20"
6.6	27	0.0100	0.07		<b>Sheet Flow,</b> Grass: Dense n= 0.240 P2= 3.20"
1.0	101	0.0600	1.71		<b>Shallow Concentrated Flow,</b> Short Grass Pasture Kv= 7.0 fps
8.3	164	Total			

Subcatchment 6E: E3a

Hydrograph

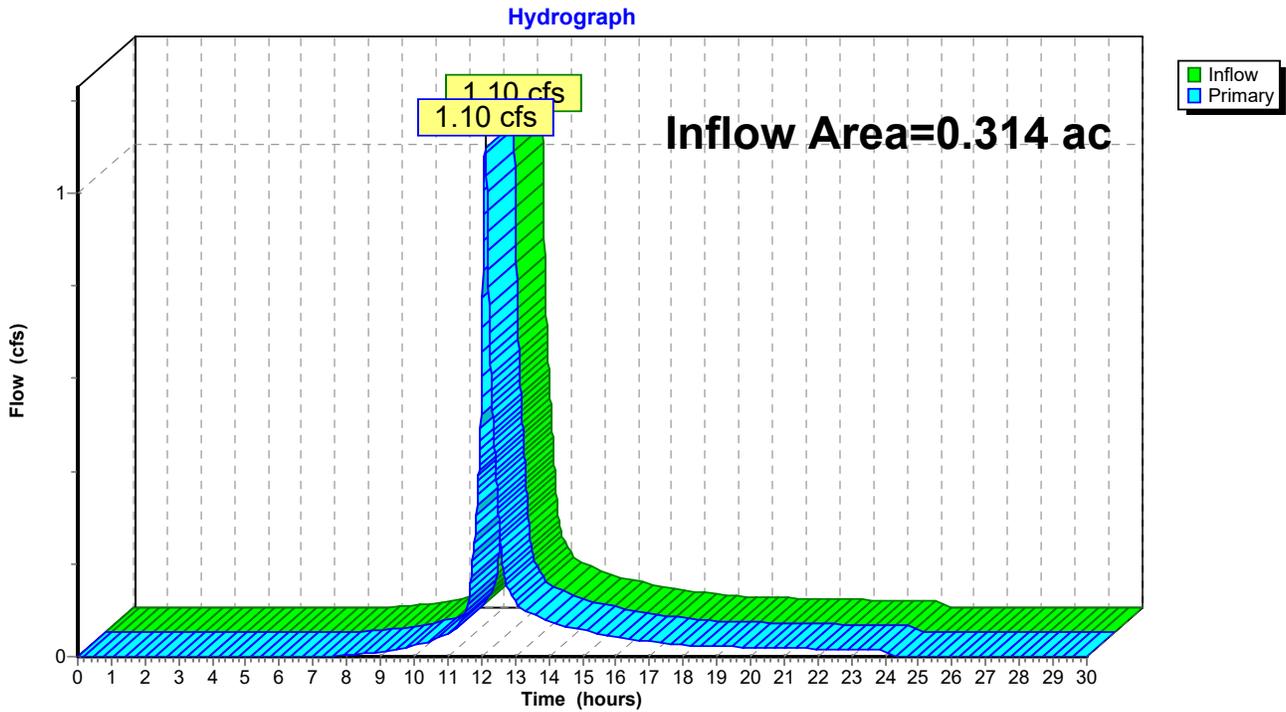


### Summary for Link 7E: Design Point #3a: Flow to Village Street

Inflow Area = 0.314 ac, 29.88% Impervious, Inflow Depth = 3.24" for 25-YR event  
Inflow = 1.10 cfs @ 12.12 hrs, Volume= 0.085 af  
Primary = 1.10 cfs @ 12.12 hrs, Volume= 0.085 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs

### Link 7E: Design Point #3a: Flow to Village Street



## HydroCAD2

Type III 24-hr 50-YR Rainfall=6.10"

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Time span=0.00-30.00 hrs, dt=0.01 hrs, 3001 points  
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN  
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

### Subcatchment 6E: E3a

Runoff Area=13,673 sf 29.88% Impervious Runoff Depth=3.77"  
Flow Length=164' Tc=8.3 min CN=79 Runoff=1.28 cfs 0.099 af

### Link 7E: Design Point #3a: Flow to Village Street

Inflow=1.28 cfs 0.099 af  
Primary=1.28 cfs 0.099 af

**Total Runoff Area = 0.314 ac Runoff Volume = 0.099 af Average Runoff Depth = 3.77"**  
**70.12% Pervious = 0.220 ac 29.88% Impervious = 0.094 ac**

**Summary for Subcatchment 6E: E3a**

Runoff = 1.28 cfs @ 12.12 hrs, Volume= 0.099 af, Depth= 3.77"

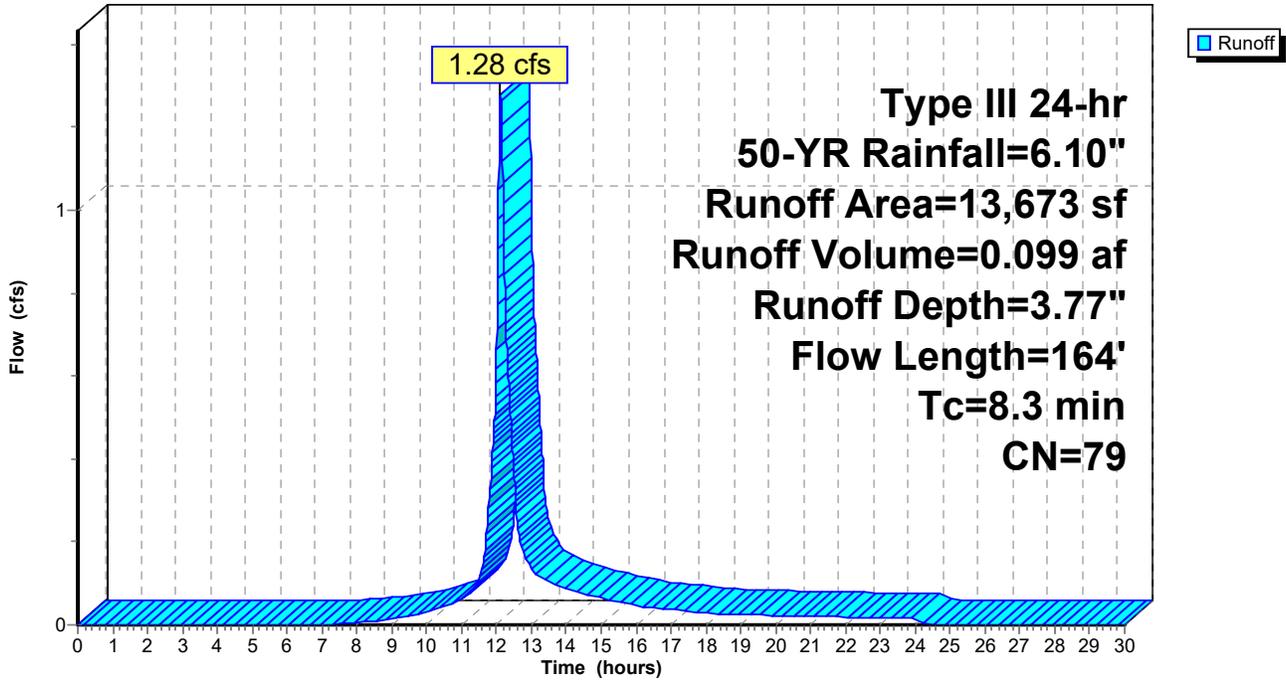
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
 Type III 24-hr 50-YR Rainfall=6.10"

Area (sf)	CN	Description
3,157	98	Paved parking, HSG B
928	98	Roofs, HSG B
* 3,909	90	Gravel
5,111	61	>75% Grass cover, Good, HSG B
451	30	Woods, Good, HSG A
117	55	Woods, Good, HSG B
13,673	79	Weighted Average
9,588		70.12% Pervious Area
4,085		29.88% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.7	36	0.0100	0.85		<b>Sheet Flow,</b> Smooth surfaces n= 0.011 P2= 3.20"
6.6	27	0.0100	0.07		<b>Sheet Flow,</b> Grass: Dense n= 0.240 P2= 3.20"
1.0	101	0.0600	1.71		<b>Shallow Concentrated Flow,</b> Short Grass Pasture Kv= 7.0 fps
8.3	164	Total			

Subcatchment 6E: E3a

Hydrograph

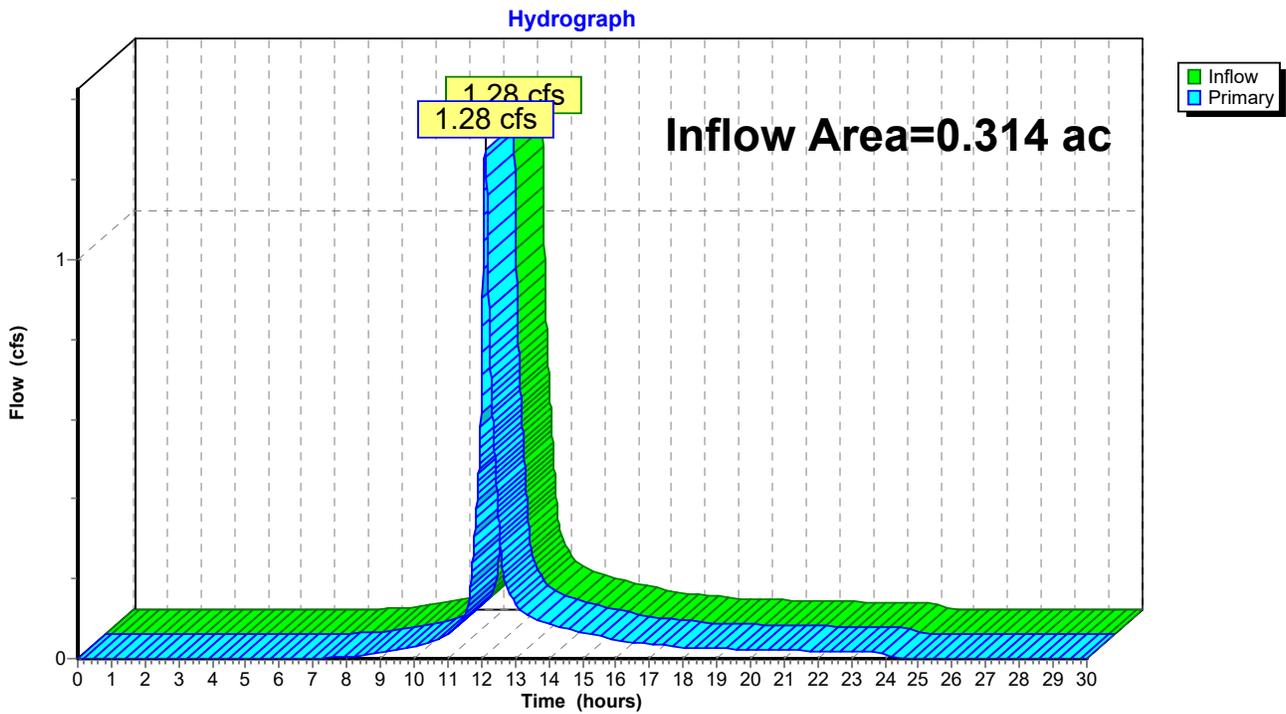


### Summary for Link 7E: Design Point #3a: Flow to Village Street

Inflow Area = 0.314 ac, 29.88% Impervious, Inflow Depth = 3.77" for 50-YR event  
Inflow = 1.28 cfs @ 12.12 hrs, Volume= 0.099 af  
Primary = 1.28 cfs @ 12.12 hrs, Volume= 0.099 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs

### Link 7E: Design Point #3a: Flow to Village Street



## HydroCAD2

Type III 24-hr 100-YR Rainfall=6.70"

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Time span=0.00-30.00 hrs, dt=0.01 hrs, 3001 points  
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN  
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

### Subcatchment 6E: E3a

Runoff Area=13,673 sf 29.88% Impervious Runoff Depth=4.31"  
Flow Length=164' Tc=8.3 min CN=79 Runoff=1.46 cfs 0.113 af

### Link 7E: Design Point #3a: Flow to Village Street

Inflow=1.46 cfs 0.113 af  
Primary=1.46 cfs 0.113 af

**Total Runoff Area = 0.314 ac Runoff Volume = 0.113 af Average Runoff Depth = 4.31"**  
**70.12% Pervious = 0.220 ac 29.88% Impervious = 0.094 ac**

**Summary for Subcatchment 6E: E3a**

Runoff = 1.46 cfs @ 12.12 hrs, Volume= 0.113 af, Depth= 4.31"

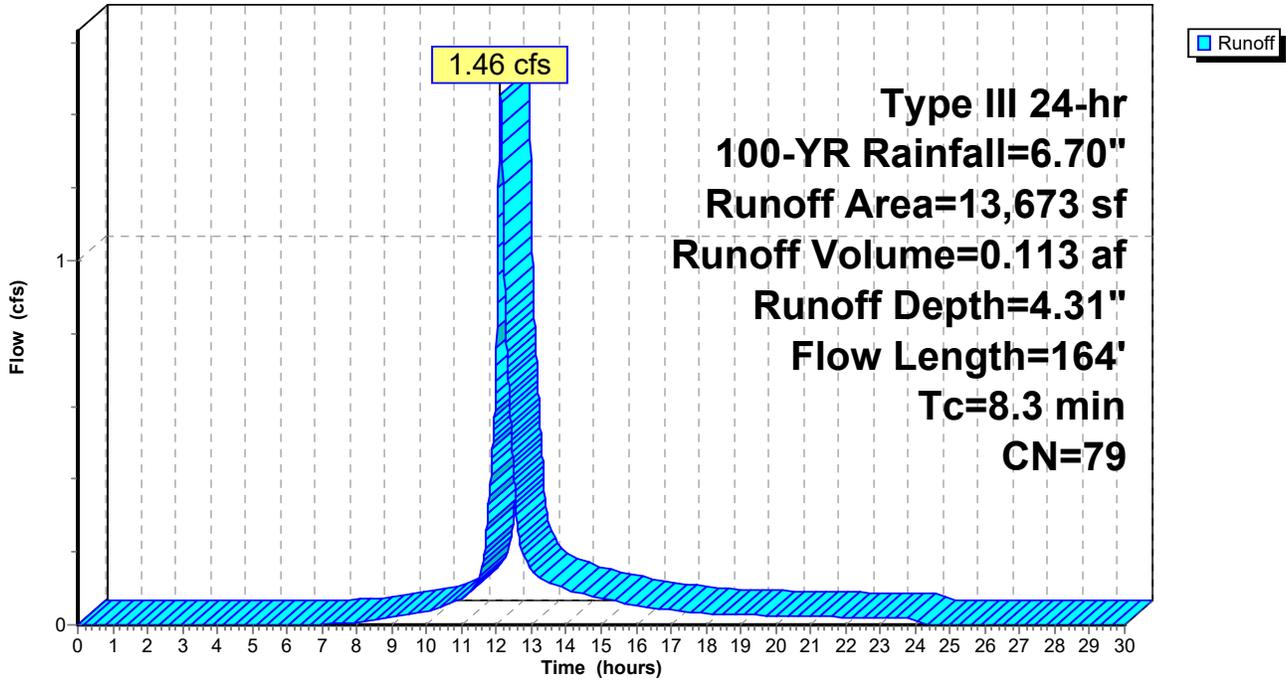
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
 Type III 24-hr 100-YR Rainfall=6.70"

Area (sf)	CN	Description
3,157	98	Paved parking, HSG B
928	98	Roofs, HSG B
* 3,909	90	Gravel
5,111	61	>75% Grass cover, Good, HSG B
451	30	Woods, Good, HSG A
117	55	Woods, Good, HSG B
13,673	79	Weighted Average
9,588		70.12% Pervious Area
4,085		29.88% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.7	36	0.0100	0.85		<b>Sheet Flow,</b> Smooth surfaces n= 0.011 P2= 3.20"
6.6	27	0.0100	0.07		<b>Sheet Flow,</b> Grass: Dense n= 0.240 P2= 3.20"
1.0	101	0.0600	1.71		<b>Shallow Concentrated Flow,</b> Short Grass Pasture Kv= 7.0 fps
8.3	164	Total			

Subcatchment 6E: E3a

Hydrograph

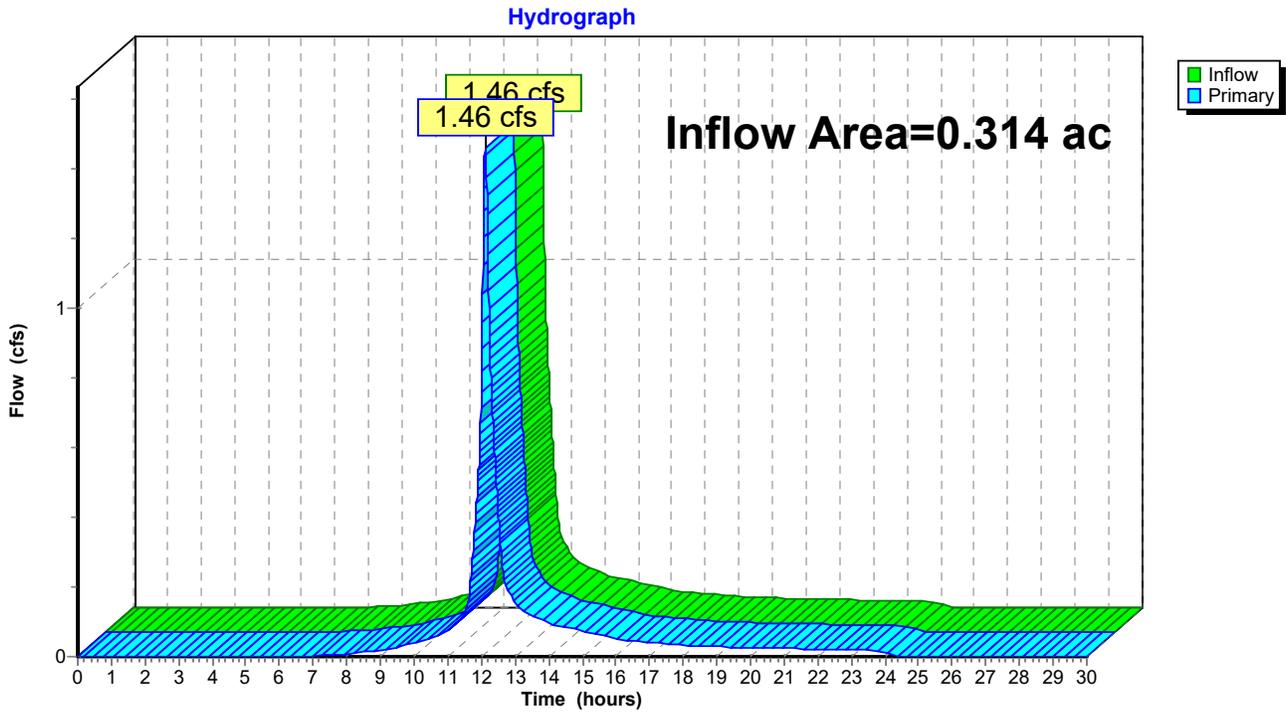


### Summary for Link 7E: Design Point #3a: Flow to Village Street

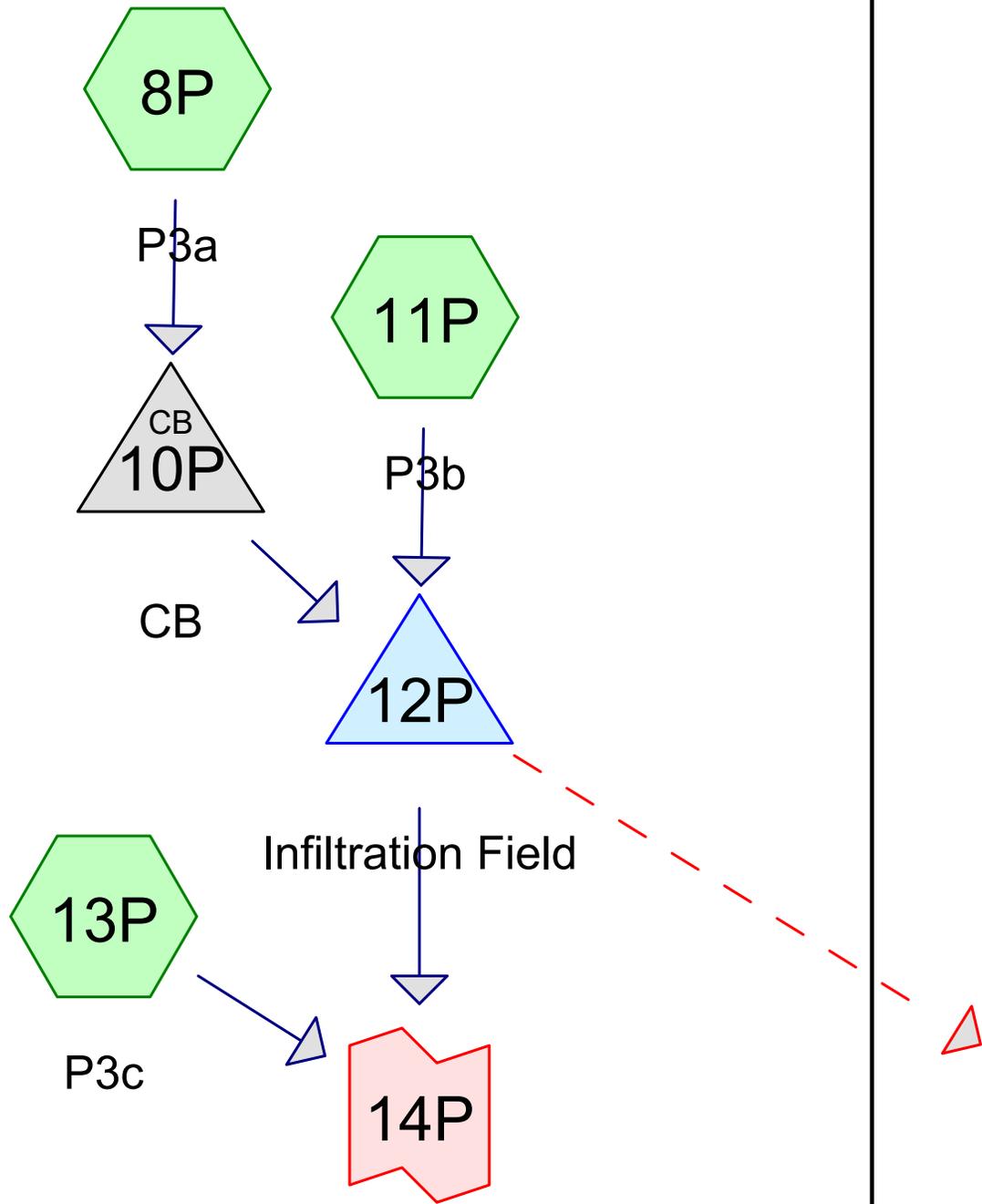
Inflow Area = 0.314 ac, 29.88% Impervious, Inflow Depth = 4.31" for 100-YR event  
Inflow = 1.46 cfs @ 12.12 hrs, Volume= 0.113 af  
Primary = 1.46 cfs @ 12.12 hrs, Volume= 0.113 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs

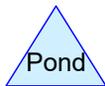
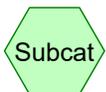
### Link 7E: Design Point #3a: Flow to Village Street



**DESIGN POINT #3b: FLOW TO VILLAGE**  
**STREET PROPOSED CONDITIONS**



Design Point #3a: Flow to Village Street



## HydroCAD Revised2

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### Area Listing (selected nodes)

Area (acres)	CN	Description (subcatchment-numbers)
0.063	39	>75% Grass cover, Good, HSG A (13P)
0.183	61	>75% Grass cover, Good, HSG B (8P, 13P)
0.217	98	Paved parking, HSG B (8P)
0.003	88	Pavers, HSG A (13P)
0.010	90	Pavers, HSG B (13P)
0.128	98	Roofs, HSG B (11P)
<b>0.604</b>	<b>80</b>	<b>TOTAL AREA</b>

**HydroCAD Revised2**

Type III 24-hr 2-YR Rainfall=3.20"

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Time span=0.00-30.00 hrs, dt=0.01 hrs, 3001 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 8P: P3a**

Runoff Area=14,343 sf 65.80% Impervious Runoff Depth=1.76"  
Flow Length=229' Tc=10.0 min CN=85 Runoff=0.59 cfs 0.048 af

**Pond 10P: CB**

Peak Elev=182.01' Inflow=0.59 cfs 0.048 af  
12.0" Round Culvert n=0.011 L=75.0' S=0.0000 '/ Outflow=0.59 cfs 0.048 af

**Subcatchment 11P: P3b**

Runoff Area=5,586 sf 100.00% Impervious Runoff Depth=2.97"  
Tc=2.0 min CN=98 Runoff=0.46 cfs 0.032 af

**Pond 12P: Infiltration Field**

Peak Elev=182.01' Storage=1,065 cf Inflow=0.84 cfs 0.080 af  
Discarded=0.13 cfs 0.078 af Primary=0.00 cfs 0.000 af Secondary=0.03 cfs 0.002 af Outflow=0.16 cfs 0.080 af

**Subcatchment 13P: P3c**

Runoff Area=6,382 sf 0.00% Impervious Runoff Depth=0.22"  
Flow Length=97' Slope=0.0900 '/ Tc=7.6 min CN=54 Runoff=0.01 cfs 0.003 af

**Link 14P: Design Point #3a: Flow to Village Street**

Inflow=0.01 cfs 0.003 af  
Primary=0.01 cfs 0.003 af

**Total Runoff Area = 0.604 ac Runoff Volume = 0.083 af Average Runoff Depth = 1.64"**  
**42.90% Pervious = 0.259 ac 57.10% Impervious = 0.345 ac**

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Type III 24-hr 2-YR Rainfall=3.20"

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## Summary for Subcatchment 8P: P3a

Runoff = 0.59 cfs @ 12.14 hrs, Volume= 0.048 af, Depth= 1.76"

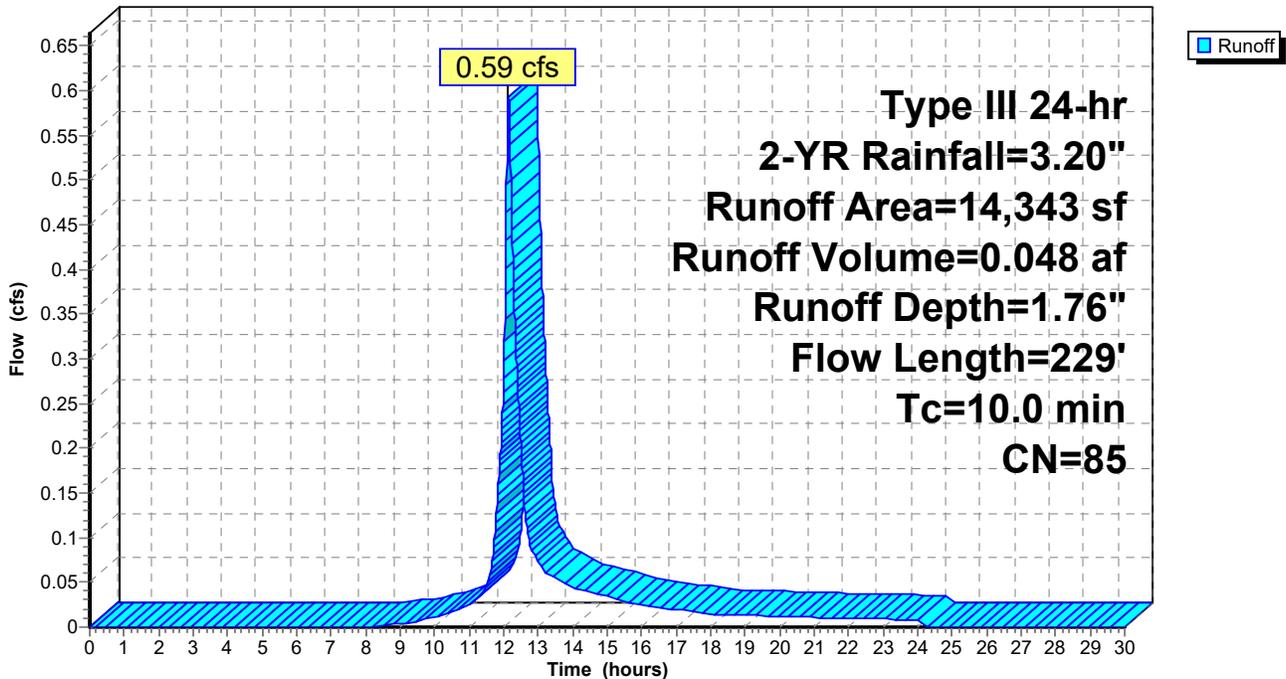
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
Type III 24-hr 2-YR Rainfall=3.20"

Area (sf)	CN	Description
9,437	98	Paved parking, HSG B
4,906	61	>75% Grass cover, Good, HSG B
14,343	85	Weighted Average
4,906		34.20% Pervious Area
9,437		65.80% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.6	63	0.0280	0.12		Sheet Flow, Grass: Dense n= 0.240 P2= 3.20"
1.4	166	0.0100	2.03		Shallow Concentrated Flow, Paved Kv= 20.3 fps
10.0	229	Total			

## Subcatchment 8P: P3a

Hydrograph



**Summary for Pond 10P: CB**

Inflow Area = 0.329 ac, 65.80% Impervious, Inflow Depth = 1.76" for 2-YR event  
 Inflow = 0.59 cfs @ 12.14 hrs, Volume= 0.048 af  
 Outflow = 0.59 cfs @ 12.14 hrs, Volume= 0.048 af, Atten= 0%, Lag= 0.0 min  
 Primary = 0.59 cfs @ 12.14 hrs, Volume= 0.048 af

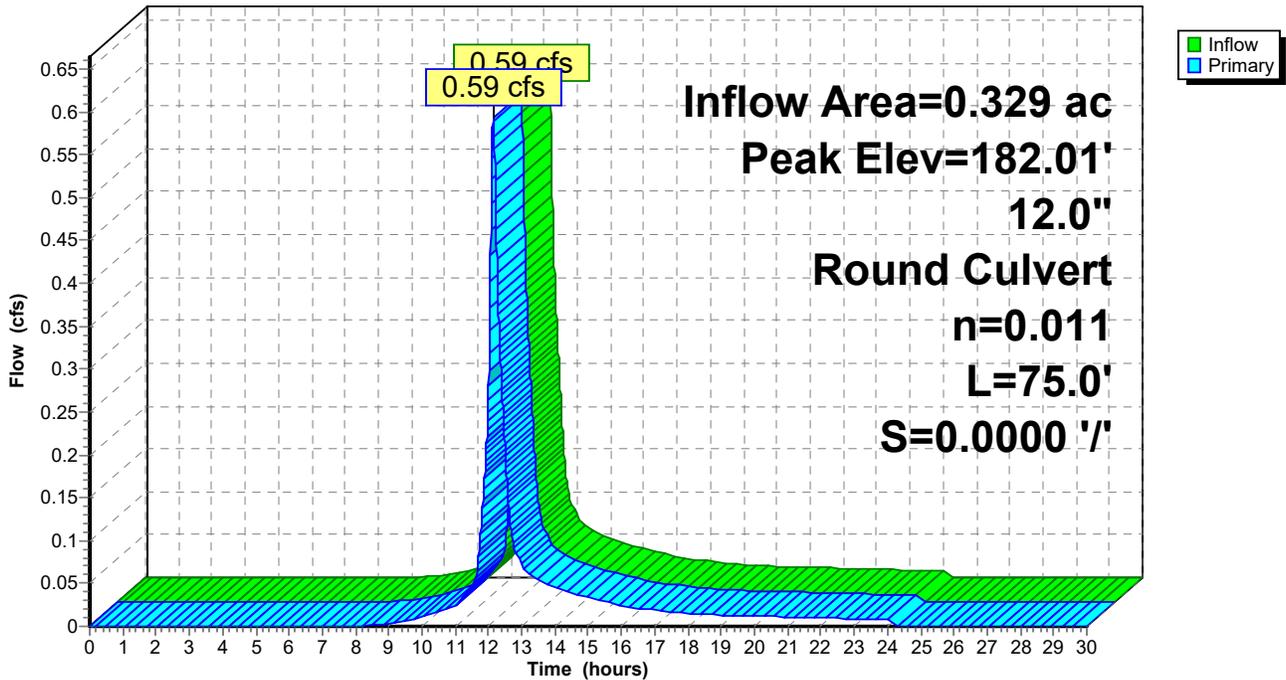
Routing by Dyn-Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
 Peak Elev= 182.01' @ 12.65 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	180.60'	<b>12.0" Round Culvert</b> L= 75.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 180.60' / 180.60' S= 0.0000 '/ Cc= 0.900 n= 0.011, Flow Area= 0.79 sf

**Primary OutFlow** Max=0.45 cfs @ 12.14 hrs HW=181.77' TW=181.75' (Dynamic Tailwater)  
 ↳ **1=Culvert** (Outlet Controls 0.45 cfs @ 0.62 fps)

**Pond 10P: CB**

Hydrograph



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Type III 24-hr 2-YR Rainfall=3.20"

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## Summary for Subcatchment 11P: P3b

Runoff = 0.46 cfs @ 12.03 hrs, Volume= 0.032 af, Depth= 2.97"

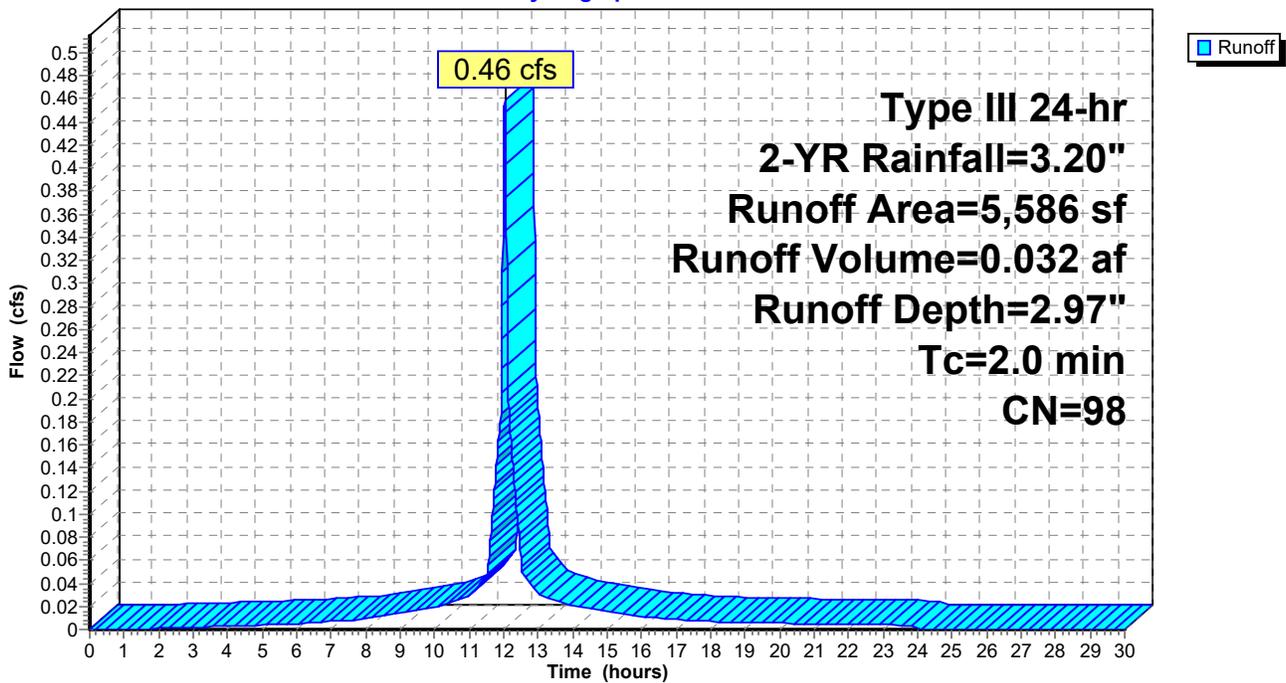
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
Type III 24-hr 2-YR Rainfall=3.20"

Area (sf)	CN	Description
5,586	98	Roofs, HSG B
5,586		100.00% Impervious Area

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

## Subcatchment 11P: P3b

Hydrograph



**Summary for Pond 12P: Infiltration Field**

Inflow Area = 0.458 ac, 75.38% Impervious, Inflow Depth = 2.10" for 2-YR event  
 Inflow = 0.84 cfs @ 12.08 hrs, Volume= 0.080 af  
 Outflow = 0.16 cfs @ 12.65 hrs, Volume= 0.080 af, Atten= 81%, Lag= 34.0 min  
 Discarded = 0.13 cfs @ 11.97 hrs, Volume= 0.078 af  
 Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af  
 Secondary = 0.03 cfs @ 12.65 hrs, Volume= 0.002 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
 Peak Elev= 182.01' @ 12.65 hrs Surf.Area= 2,377 sf Storage= 1,065 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)  
 Center-of-Mass det. time= 51.3 min ( 850.6 - 799.2 )

Volume	Invert	Avail.Storage	Storage Description
#1A	181.20'	1,454 cf	<b>72.00'W x 32.83'L x 2.04'H Field A</b> 4,826 cf Overall - 1,192 cf Embedded = 3,634 cf x 40.0% Voids
#2A	181.70'	1,192 cf	<b>Cultec C-100HD</b> x 84 Inside #1 Effective Size= 32.1"W x 12.0"H => 1.86 sf x 7.50'L = 14.0 cf Overall Size= 36.0"W x 12.5"H x 8.00'L with 0.50' Overlap Row Length Adjustment= +0.50' x 1.86 sf x 21 rows
#3	181.40'	38 cf	<b>4.00'D x 3.00'H Vertical Cone/Cylinder</b>
		2,684 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	181.20'	<b>2.410 in/hr Exfiltration over Surface area</b>
#2	Secondary	181.88'	<b>4.0" Round Culvert</b> L= 7.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 181.88' / 181.00' S= 0.1257 '/' Cc= 0.900 n= 0.011, Flow Area= 0.09 sf
#3	Primary	183.30'	<b>Trench Drain, Cv= 2.62 (C= 3.28)</b> Elev. (feet) 183.30 183.40 Width (feet) 20.00 20.00

**Discarded OutFlow** Max=0.13 cfs @ 11.97 hrs HW=181.40' (Free Discharge)

↑1=Exfiltration (Exfiltration Controls 0.13 cfs)

**Primary OutFlow** Max=0.00 cfs @ 0.00 hrs HW=181.20' TW=0.00' (Dynamic Tailwater)

↑3=Trench Drain ( Controls 0.00 cfs)

**Secondary OutFlow** Max=0.03 cfs @ 12.65 hrs HW=182.01' TW=0.00' (Dynamic Tailwater)

↑2=Culvert (Inlet Controls 0.03 cfs @ 0.96 fps)

**Pond 12P: Infiltration Field - Chamber Wizard Field A**

**Chamber Model = Cultec C-100HD (Cultec Contactor® 100HD)**

Effective Size= 32.1"W x 12.0"H => 1.86 sf x 7.50'L = 14.0 cf

Overall Size= 36.0"W x 12.5"H x 8.00'L with 0.50' Overlap

Row Length Adjustment= +0.50' x 1.86 sf x 21 rows

36.0" Wide + 4.0" Spacing = 40.0" C-C Row Spacing

4 Chambers/Row x 7.50' Long +0.50' Row Adjustment = 30.50' Row Length +14.0" End Stone x 2 = 32.83' Base Length

21 Rows x 36.0" Wide + 4.0" Spacing x 20 + 14.0" Side Stone x 2 = 72.00' Base Width

6.0" Base + 12.5" Chamber Height + 6.0" Cover = 2.04' Field Height

84 Chambers x 14.0 cf +0.50' Row Adjustment x 1.86 sf x 21 Rows = 1,192.3 cf Chamber Storage

4,826.5 cf Field - 1,192.3 cf Chambers = 3,634.2 cf Stone x 40.0% Voids = 1,453.7 cf Stone Storage

Chamber Storage + Stone Storage = 2,646.0 cf = 0.061 af

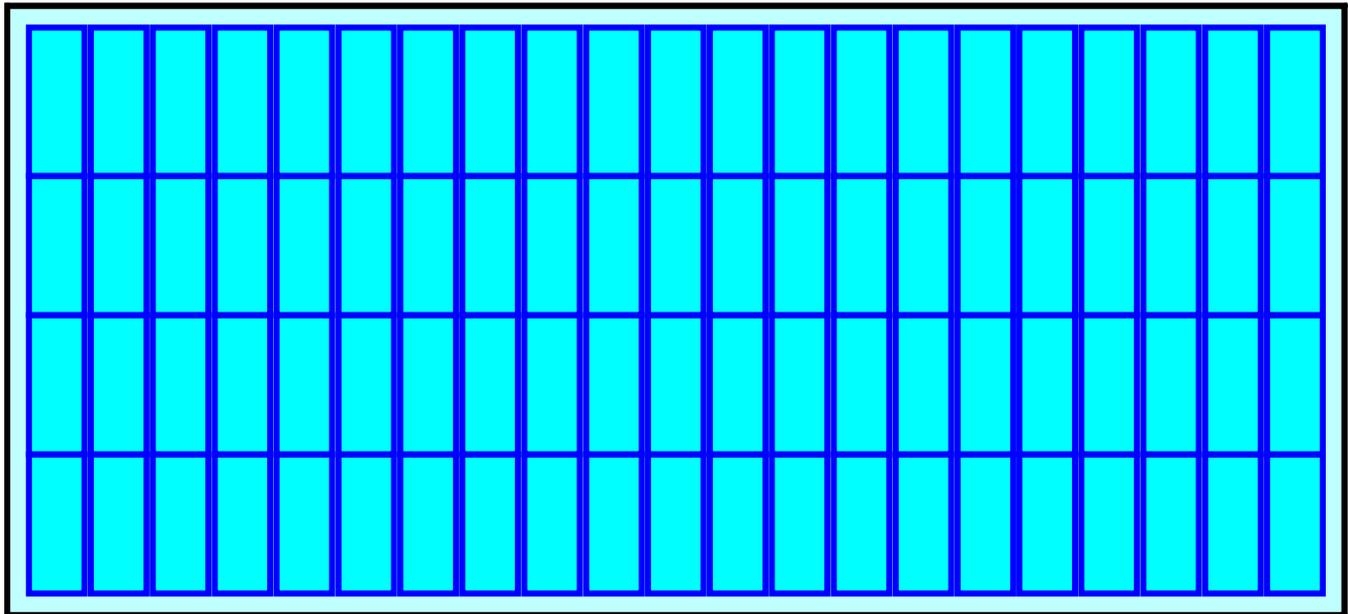
Overall Storage Efficiency = 54.8%

Overall System Size = 32.83' x 72.00' x 2.04'

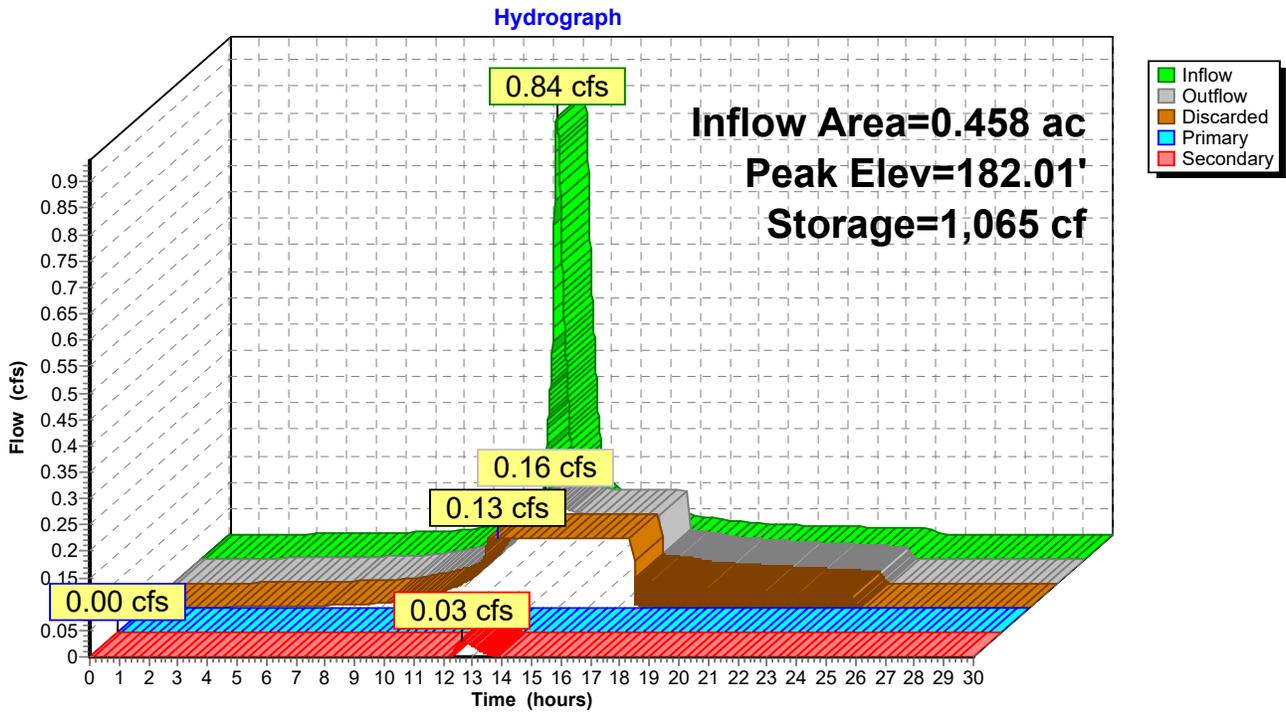
84 Chambers

178.8 cy Field

134.6 cy Stone



### Pond 12P: Infiltration Field



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Type III 24-hr 2-YR Rainfall=3.20"

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**Summary for Subcatchment 13P: P3c**

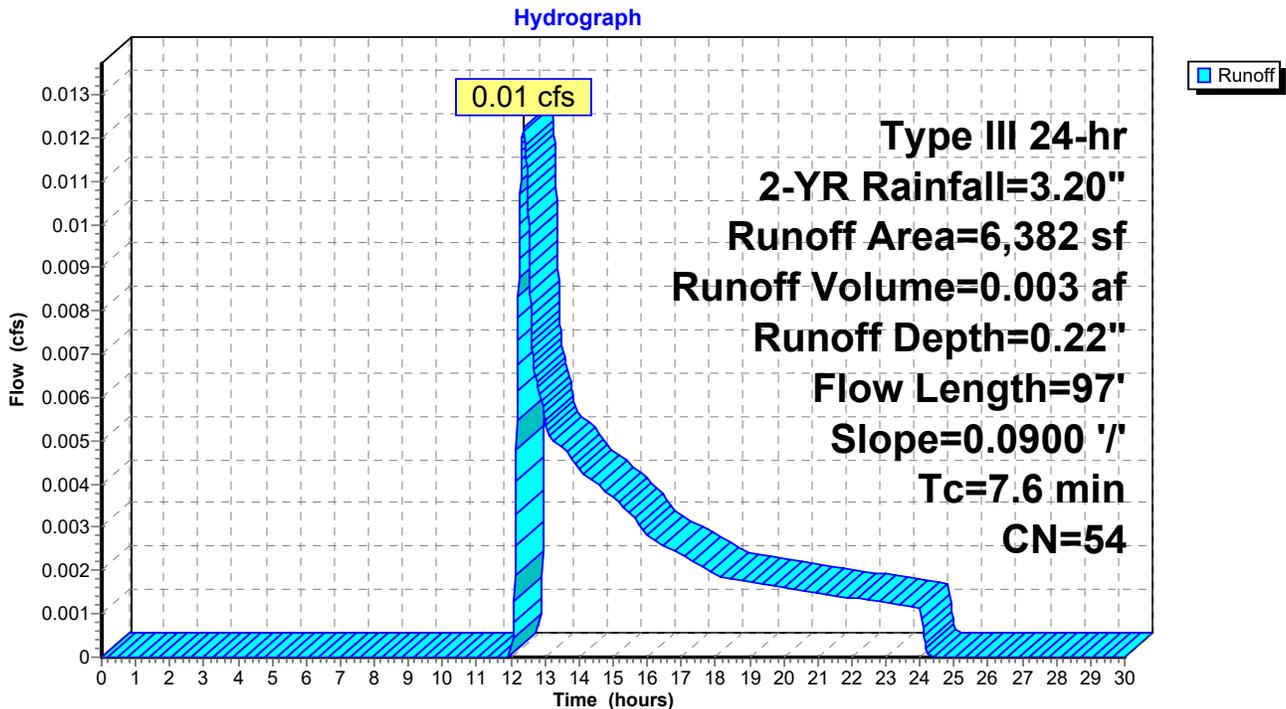
Runoff = 0.01 cfs @ 12.38 hrs, Volume= 0.003 af, Depth= 0.22"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
Type III 24-hr 2-YR Rainfall=3.20"

Area (sf)	CN	Description
* 454	90	Pavers, HSG B
* 134	88	Pavers, HSG A
2,741	39	>75% Grass cover, Good, HSG A
3,053	61	>75% Grass cover, Good, HSG B
6,382	54	Weighted Average
6,382		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.6	97	0.0900	0.21		Sheet Flow, Grass: Dense n= 0.240 P2= 3.20"

**Subcatchment 13P: P3c**

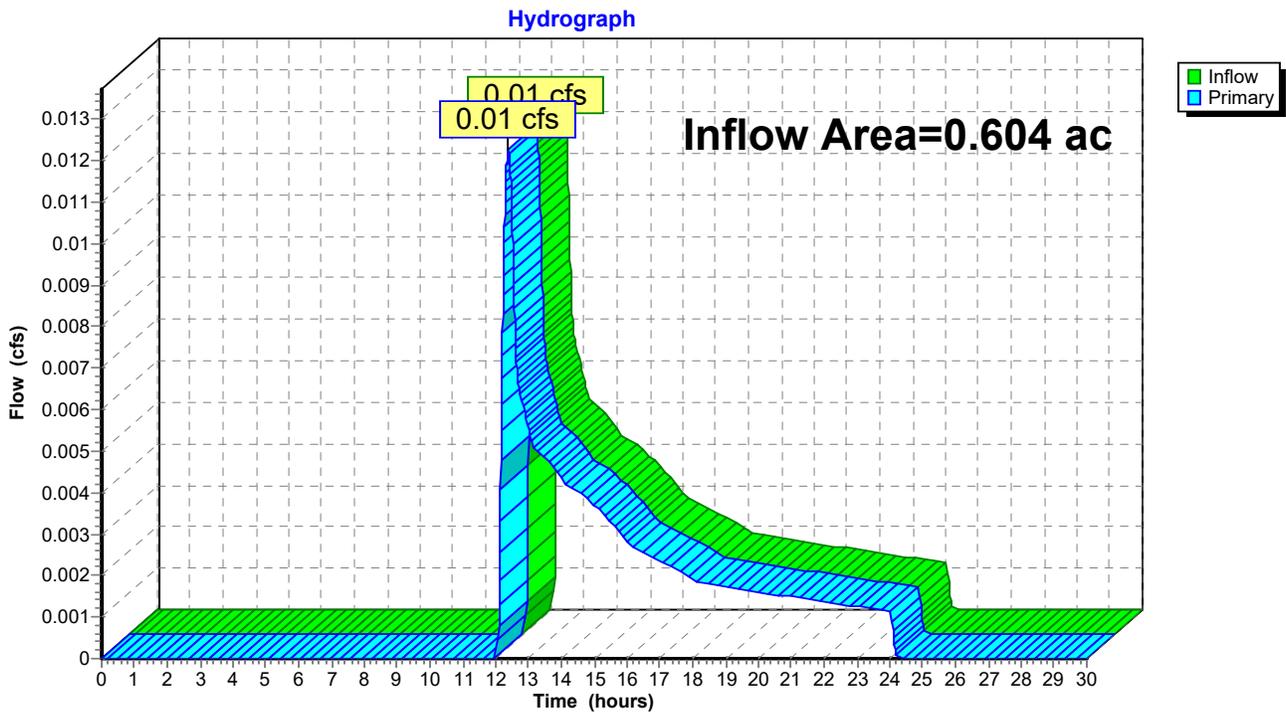


### Summary for Link 14P: Design Point #3a: Flow to Village Street

Inflow Area = 0.604 ac, 57.10% Impervious, Inflow Depth = 0.05" for 2-YR event  
Inflow = 0.01 cfs @ 12.38 hrs, Volume= 0.003 af  
Primary = 0.01 cfs @ 12.38 hrs, Volume= 0.003 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs

### Link 14P: Design Point #3a: Flow to Village Street



**HydroCAD Revised2**

Type III 24-hr 10-YR Rainfall=4.70"

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Time span=0.00-30.00 hrs, dt=0.01 hrs, 3001 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 8P: P3a**

Runoff Area=14,343 sf 65.80% Impervious Runoff Depth=3.09"  
Flow Length=229' Tc=10.0 min CN=85 Runoff=1.04 cfs 0.085 af

**Pond 10P: CB**

Peak Elev=182.46' Inflow=1.04 cfs 0.085 af  
12.0" Round Culvert n=0.011 L=75.0' S=0.0000 '/ Outflow=1.04 cfs 0.085 af

**Subcatchment 11P: P3b**

Runoff Area=5,586 sf 100.00% Impervious Runoff Depth=4.46"  
Tc=2.0 min CN=98 Runoff=0.68 cfs 0.048 af

**Pond 12P: Infiltration Field**

Peak Elev=182.45' Storage=1,841 cf Inflow=1.39 cfs 0.133 af  
Discarded=0.13 cfs 0.106 af Primary=0.00 cfs 0.000 af Secondary=0.21 cfs 0.026 af Outflow=0.34 cfs 0.133 af

**Subcatchment 13P: P3c**

Runoff Area=6,382 sf 0.00% Impervious Runoff Depth=0.78"  
Flow Length=97' Slope=0.0900 '/ Tc=7.6 min CN=54 Runoff=0.09 cfs 0.010 af

**Link 14P: Design Point #3a: Flow to Village Street**

Inflow=0.09 cfs 0.010 af  
Primary=0.09 cfs 0.010 af

**Total Runoff Area = 0.604 ac Runoff Volume = 0.142 af Average Runoff Depth = 2.82"**  
**42.90% Pervious = 0.259 ac 57.10% Impervious = 0.345 ac**

# HydroCAD Revised2

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Type III 24-hr 10-YR Rainfall=4.70"

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## Summary for Subcatchment 8P: P3a

Runoff = 1.04 cfs @ 12.14 hrs, Volume= 0.085 af, Depth= 3.09"

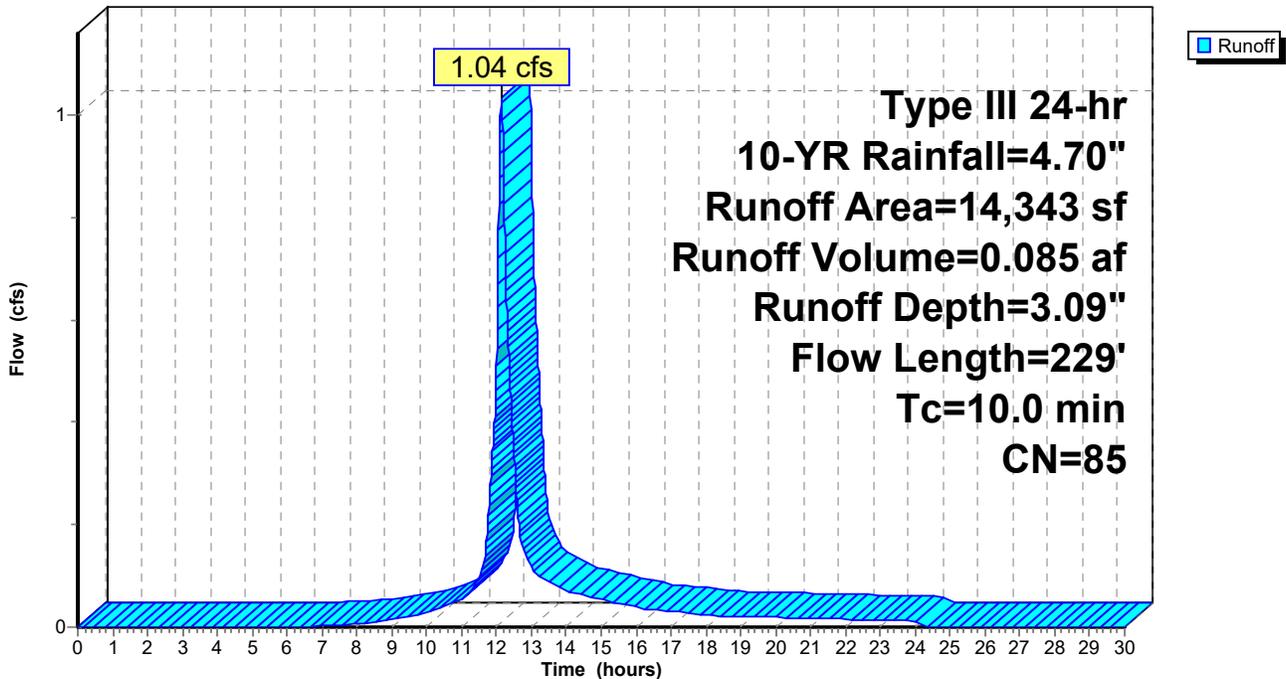
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
Type III 24-hr 10-YR Rainfall=4.70"

Area (sf)	CN	Description
9,437	98	Paved parking, HSG B
4,906	61	>75% Grass cover, Good, HSG B
14,343	85	Weighted Average
4,906		34.20% Pervious Area
9,437		65.80% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.6	63	0.0280	0.12		Sheet Flow, Grass: Dense n= 0.240 P2= 3.20"
1.4	166	0.0100	2.03		Shallow Concentrated Flow, Paved Kv= 20.3 fps
10.0	229	Total			

### Subcatchment 8P: P3a

Hydrograph



**Summary for Pond 10P: CB**

Inflow Area = 0.329 ac, 65.80% Impervious, Inflow Depth = 3.09" for 10-YR event  
 Inflow = 1.04 cfs @ 12.14 hrs, Volume= 0.085 af  
 Outflow = 1.04 cfs @ 12.14 hrs, Volume= 0.085 af, Atten= 0%, Lag= 0.0 min  
 Primary = 1.04 cfs @ 12.14 hrs, Volume= 0.085 af

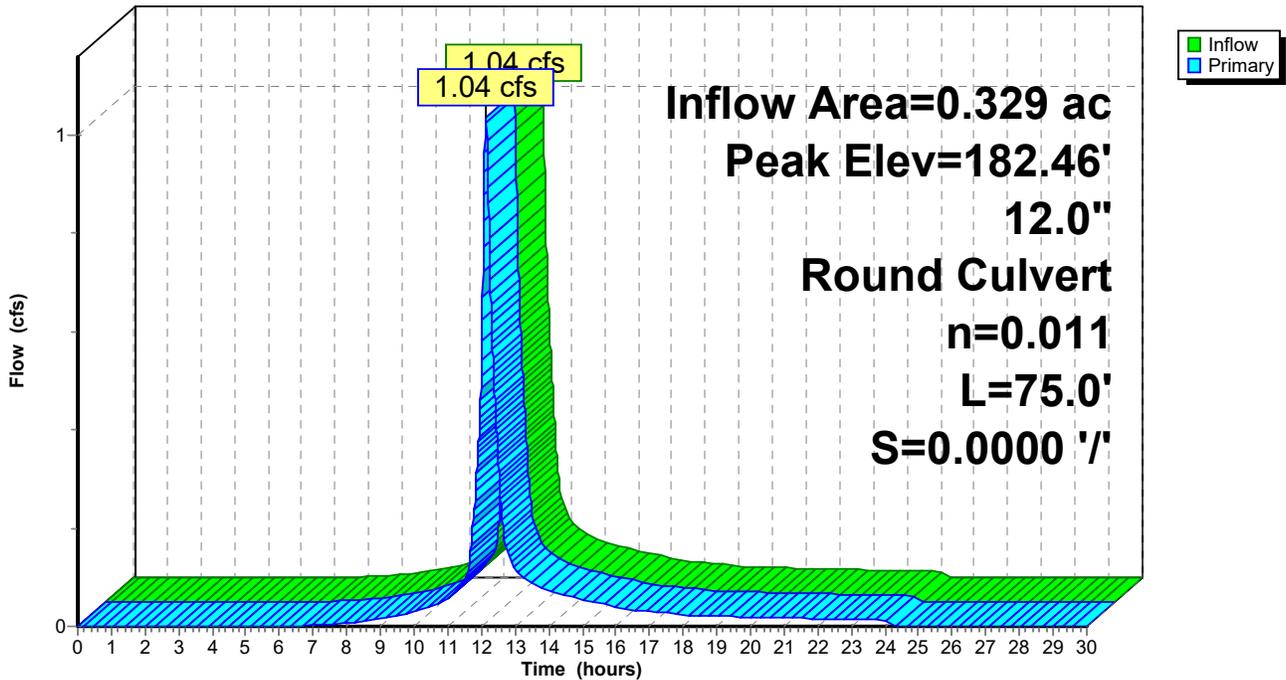
Routing by Dyn-Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
 Peak Elev= 182.46' @ 12.55 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	180.60'	<b>12.0" Round Culvert</b> L= 75.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 180.60' / 180.60' S= 0.0000 '/ Cc= 0.900 n= 0.011, Flow Area= 0.79 sf

**Primary OutFlow** Max=0.89 cfs @ 12.14 hrs HW=182.12' TW=182.06' (Dynamic Tailwater)  
 ←1=Culvert (Outlet Controls 0.89 cfs @ 1.13 fps)

**Pond 10P: CB**

Hydrograph



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Type III 24-hr 10-YR Rainfall=4.70"

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## Summary for Subcatchment 11P: P3b

Runoff = 0.68 cfs @ 12.03 hrs, Volume= 0.048 af, Depth= 4.46"

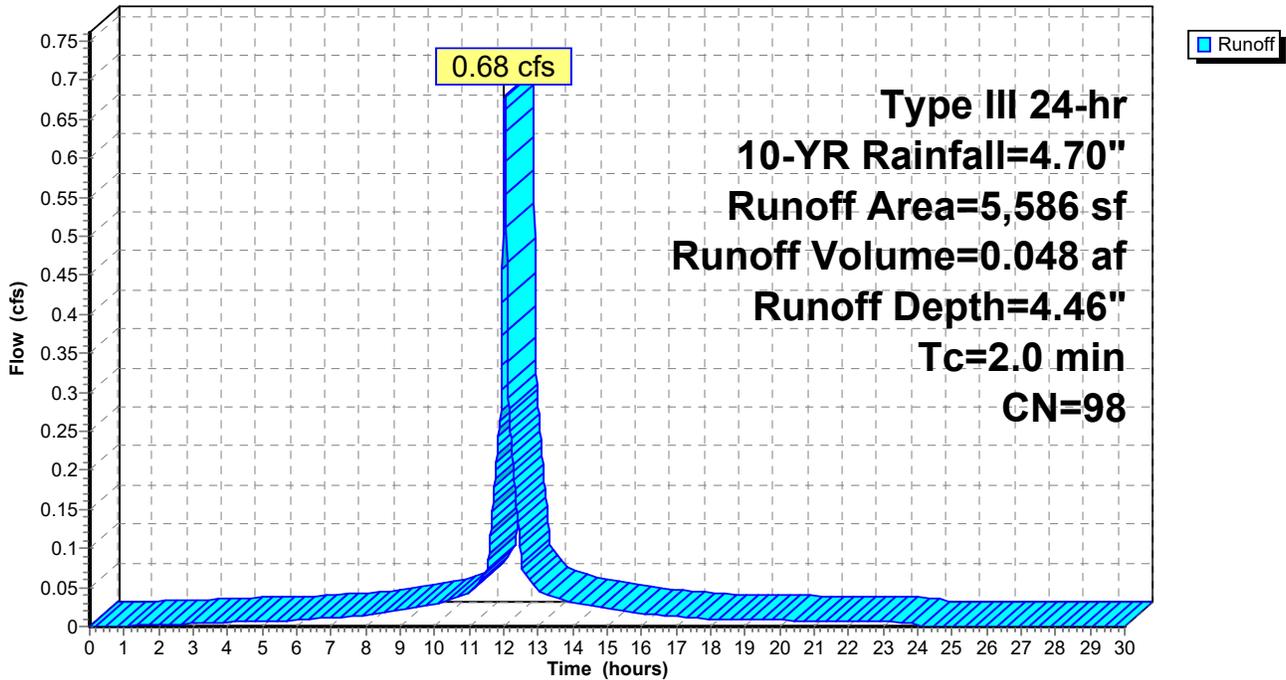
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
Type III 24-hr 10-YR Rainfall=4.70"

Area (sf)	CN	Description
5,586	98	Roofs, HSG B
5,586		100.00% Impervious Area

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

## Subcatchment 11P: P3b

Hydrograph



**Summary for Pond 12P: Infiltration Field**

Inflow Area = 0.458 ac, 75.38% Impervious, Inflow Depth = 3.48" for 10-YR event  
 Inflow = 1.39 cfs @ 12.09 hrs, Volume= 0.133 af  
 Outflow = 0.34 cfs @ 12.56 hrs, Volume= 0.133 af, Atten= 75%, Lag= 28.1 min  
 Discarded = 0.13 cfs @ 11.82 hrs, Volume= 0.106 af  
 Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af  
 Secondary = 0.21 cfs @ 12.56 hrs, Volume= 0.026 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
 Peak Elev= 182.45' @ 12.56 hrs Surf.Area= 2,377 sf Storage= 1,841 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)  
 Center-of-Mass det. time= 59.8 min ( 848.8 - 789.1 )

Volume	Invert	Avail.Storage	Storage Description
#1A	181.20'	1,454 cf	<b>72.00'W x 32.83'L x 2.04'H Field A</b> 4,826 cf Overall - 1,192 cf Embedded = 3,634 cf x 40.0% Voids
#2A	181.70'	1,192 cf	<b>Cultec C-100HD</b> x 84 Inside #1 Effective Size= 32.1"W x 12.0"H => 1.86 sf x 7.50'L = 14.0 cf Overall Size= 36.0"W x 12.5"H x 8.00'L with 0.50' Overlap Row Length Adjustment= +0.50' x 1.86 sf x 21 rows
#3	181.40'	38 cf	<b>4.00'D x 3.00'H Vertical Cone/Cylinder</b>
		2,684 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	181.20'	<b>2.410 in/hr Exfiltration over Surface area</b>
#2	Secondary	181.88'	<b>4.0" Round Culvert</b> L= 7.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 181.88' / 181.00' S= 0.1257 '/' Cc= 0.900 n= 0.011, Flow Area= 0.09 sf
#3	Primary	183.30'	<b>Trench Drain, Cv= 2.62 (C= 3.28)</b> Elev. (feet) 183.30 183.40 Width (feet) 20.00 20.00

**Discarded OutFlow** Max=0.13 cfs @ 11.82 hrs HW=181.41' (Free Discharge)

↑1=Exfiltration (Exfiltration Controls 0.13 cfs)

**Primary OutFlow** Max=0.00 cfs @ 0.00 hrs HW=181.20' TW=0.00' (Dynamic Tailwater)

↑3=Trench Drain ( Controls 0.00 cfs)

**Secondary OutFlow** Max=0.21 cfs @ 12.56 hrs HW=182.45' TW=0.00' (Dynamic Tailwater)

↑2=Culvert (Inlet Controls 0.21 cfs @ 2.42 fps)

**Pond 12P: Infiltration Field - Chamber Wizard Field A**

**Chamber Model = Cultec C-100HD (Cultec Contactor® 100HD)**

Effective Size= 32.1"W x 12.0"H => 1.86 sf x 7.50'L = 14.0 cf

Overall Size= 36.0"W x 12.5"H x 8.00'L with 0.50' Overlap

Row Length Adjustment= +0.50' x 1.86 sf x 21 rows

36.0" Wide + 4.0" Spacing = 40.0" C-C Row Spacing

4 Chambers/Row x 7.50' Long +0.50' Row Adjustment = 30.50' Row Length +14.0" End Stone x 2 = 32.83' Base Length

21 Rows x 36.0" Wide + 4.0" Spacing x 20 + 14.0" Side Stone x 2 = 72.00' Base Width

6.0" Base + 12.5" Chamber Height + 6.0" Cover = 2.04' Field Height

84 Chambers x 14.0 cf +0.50' Row Adjustment x 1.86 sf x 21 Rows = 1,192.3 cf Chamber Storage

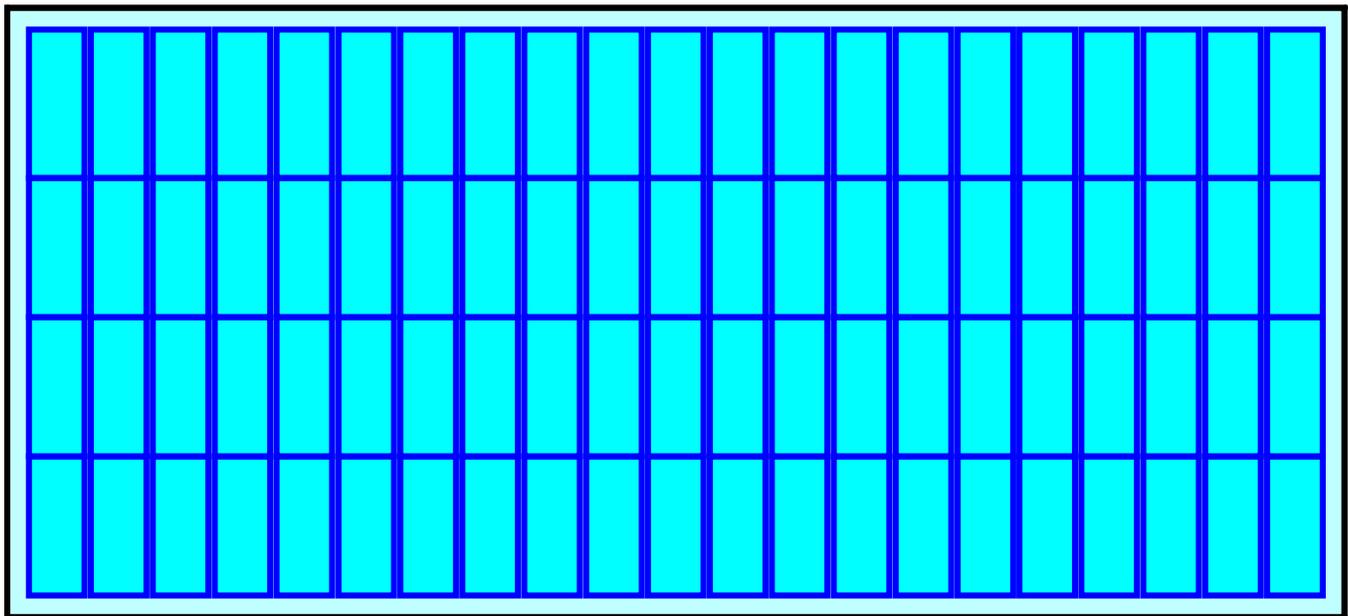
4,826.5 cf Field - 1,192.3 cf Chambers = 3,634.2 cf Stone x 40.0% Voids = 1,453.7 cf Stone Storage

Chamber Storage + Stone Storage = 2,646.0 cf = 0.061 af

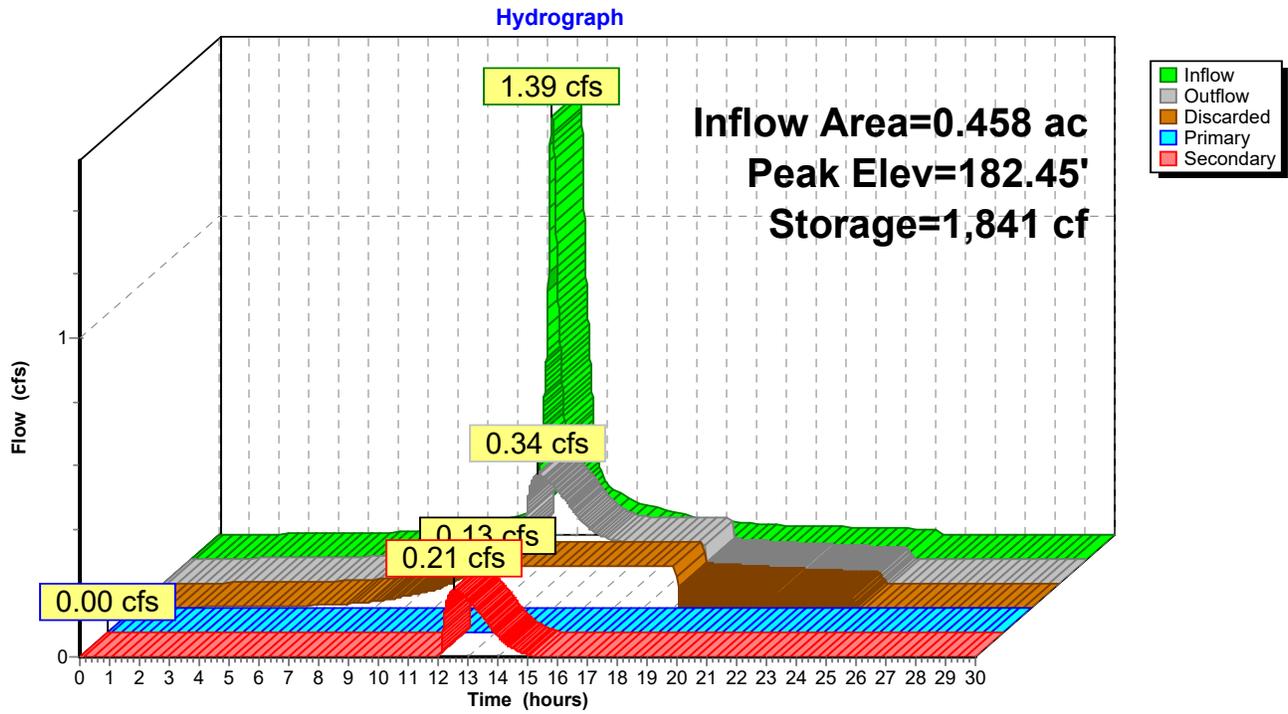
Overall Storage Efficiency = 54.8%

Overall System Size = 32.83' x 72.00' x 2.04'

84 Chambers  
178.8 cy Field  
134.6 cy Stone



### Pond 12P: Infiltration Field



**HydroCAD Revised2**

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Type III 24-hr 10-YR Rainfall=4.70"

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**Summary for Subcatchment 13P: P3c**

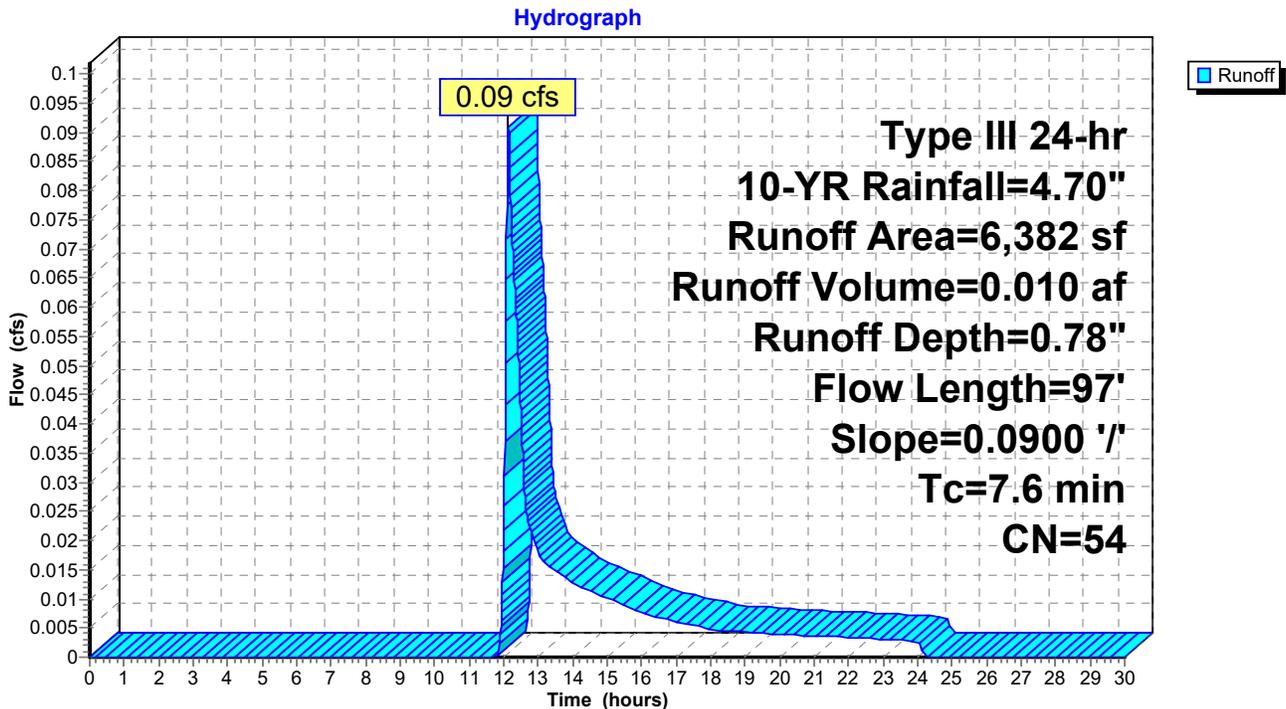
Runoff = 0.09 cfs @ 12.14 hrs, Volume= 0.010 af, Depth= 0.78"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
Type III 24-hr 10-YR Rainfall=4.70"

	Area (sf)	CN	Description
*	454	90	Pavers, HSG B
*	134	88	Pavers, HSG A
	2,741	39	>75% Grass cover, Good, HSG A
	3,053	61	>75% Grass cover, Good, HSG B
	6,382	54	Weighted Average
	6,382		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.6	97	0.0900	0.21		Sheet Flow, Grass: Dense n= 0.240 P2= 3.20"

**Subcatchment 13P: P3c**

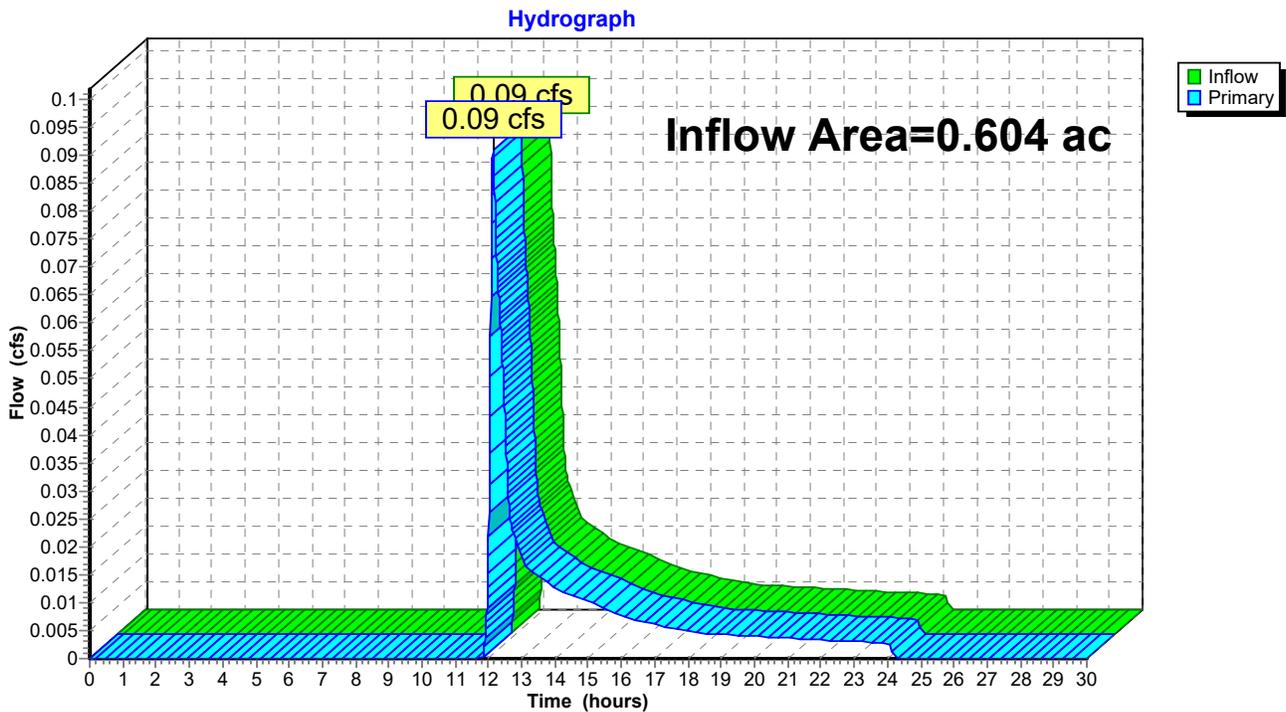


### Summary for Link 14P: Design Point #3a: Flow to Village Street

Inflow Area = 0.604 ac, 57.10% Impervious, Inflow Depth = 0.19" for 10-YR event  
Inflow = 0.09 cfs @ 12.14 hrs, Volume= 0.010 af  
Primary = 0.09 cfs @ 12.14 hrs, Volume= 0.010 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs

### Link 14P: Design Point #3a: Flow to Village Street



## HydroCAD Revised2

Type III 24-hr 25-YR Rainfall=5.50"

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Time span=0.00-30.00 hrs, dt=0.01 hrs, 3001 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 8P: P3a

Runoff Area=14,343 sf 65.80% Impervious Runoff Depth=3.83"  
Flow Length=229' Tc=10.0 min CN=85 Runoff=1.28 cfs 0.105 af

### Pond 10P: CB

Peak Elev=182.86' Inflow=1.28 cfs 0.105 af  
12.0" Round Culvert n=0.011 L=75.0' S=0.0000 '/ Outflow=1.28 cfs 0.105 af

### Subcatchment 11P: P3b

Runoff Area=5,586 sf 100.00% Impervious Runoff Depth=5.26"  
Tc=2.0 min CN=98 Runoff=0.80 cfs 0.056 af

### Pond 12P: Infiltration Field

Peak Elev=182.85' Storage=2,293 cf Inflow=1.69 cfs 0.161 af  
Discarded=0.13 cfs 0.119 af Primary=0.00 cfs 0.000 af Secondary=0.30 cfs 0.043 af Outflow=0.43 cfs 0.161 af

### Subcatchment 13P: P3c

Runoff Area=6,382 sf 0.00% Impervious Runoff Depth=1.17"  
Flow Length=97' Slope=0.0900 '/ Tc=7.6 min CN=54 Runoff=0.16 cfs 0.014 af

### Link 14P: Design Point #3a: Flow to Village Street

Inflow=0.16 cfs 0.014 af  
Primary=0.16 cfs 0.014 af

**Total Runoff Area = 0.604 ac Runoff Volume = 0.176 af Average Runoff Depth = 3.49"**  
**42.90% Pervious = 0.259 ac 57.10% Impervious = 0.345 ac**

**HydroCAD Revised2**

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Type III 24-hr 25-YR Rainfall=5.50"

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**Summary for Subcatchment 8P: P3a**

Runoff = 1.28 cfs @ 12.14 hrs, Volume= 0.105 af, Depth= 3.83"

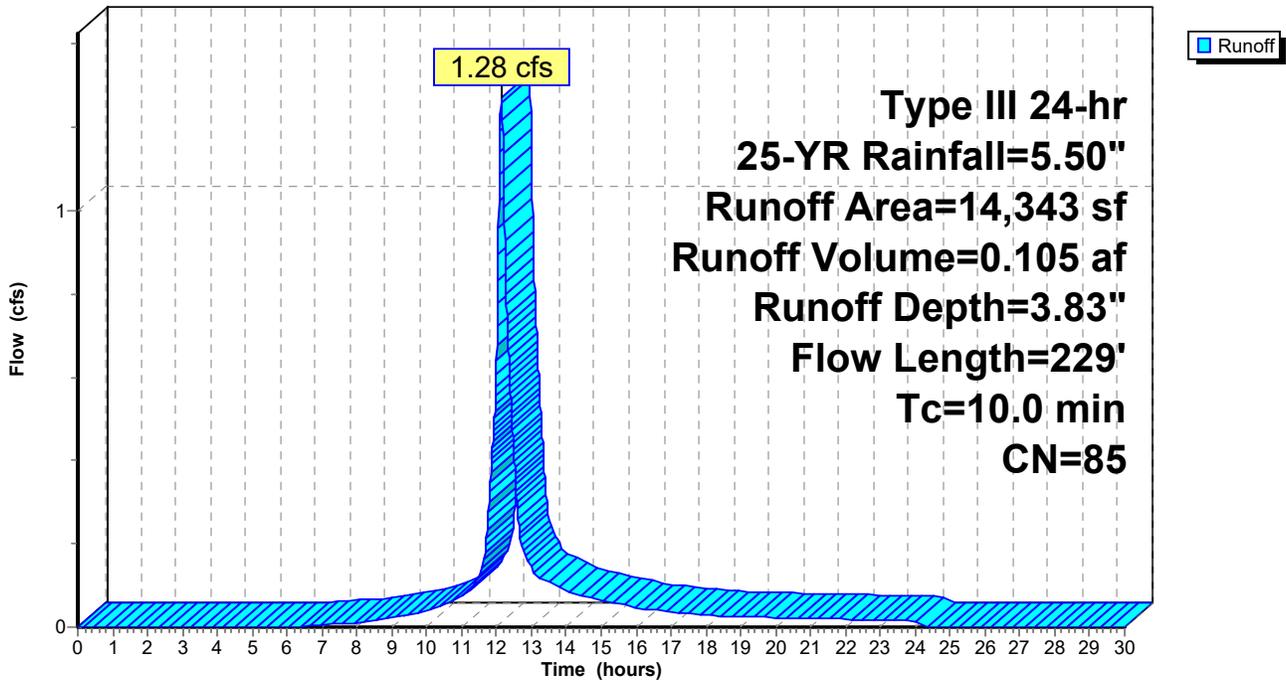
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
Type III 24-hr 25-YR Rainfall=5.50"

Area (sf)	CN	Description
9,437	98	Paved parking, HSG B
4,906	61	>75% Grass cover, Good, HSG B
14,343	85	Weighted Average
4,906		34.20% Pervious Area
9,437		65.80% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.6	63	0.0280	0.12		Sheet Flow, Grass: Dense n= 0.240 P2= 3.20"
1.4	166	0.0100	2.03		Shallow Concentrated Flow, Paved Kv= 20.3 fps
10.0	229	Total			

**Subcatchment 8P: P3a**

Hydrograph



**Summary for Pond 10P: CB**

Inflow Area = 0.329 ac, 65.80% Impervious, Inflow Depth = 3.83" for 25-YR event  
 Inflow = 1.28 cfs @ 12.14 hrs, Volume= 0.105 af  
 Outflow = 1.28 cfs @ 12.14 hrs, Volume= 0.105 af, Atten= 0%, Lag= 0.0 min  
 Primary = 1.28 cfs @ 12.14 hrs, Volume= 0.105 af

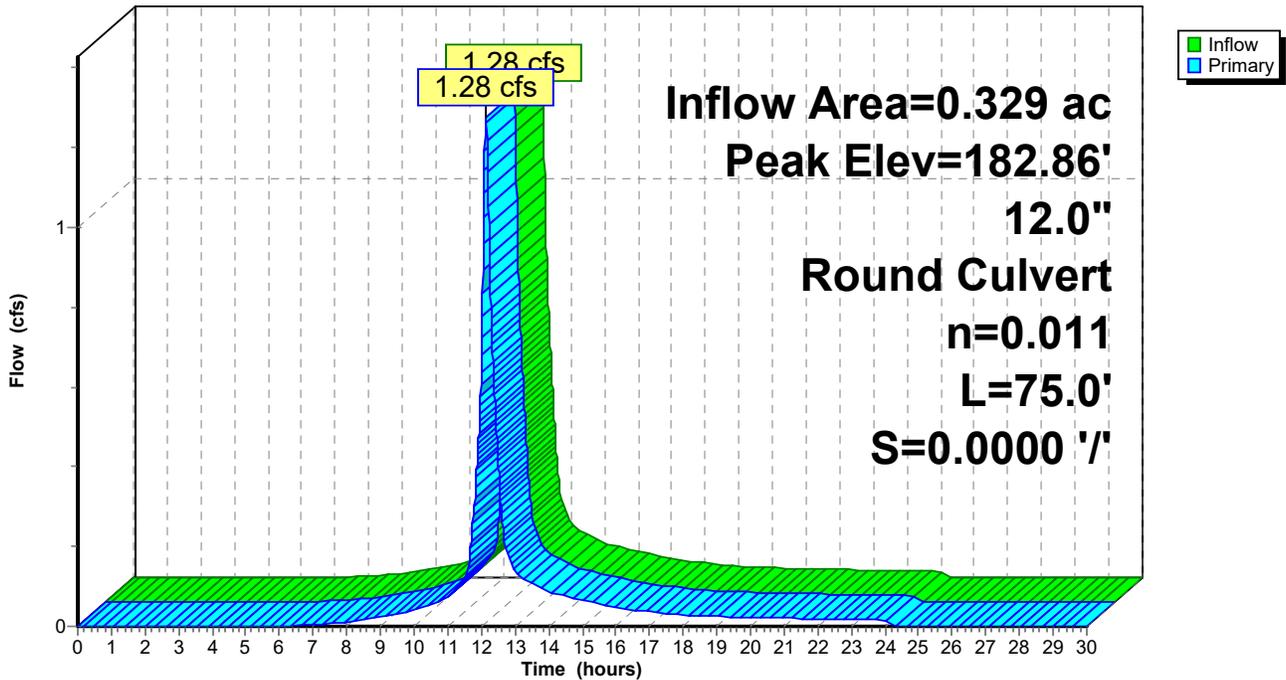
Routing by Dyn-Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
 Peak Elev= 182.86' @ 12.54 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	180.60'	<b>12.0" Round Culvert</b> L= 75.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 180.60' / 180.60' S= 0.0000 '/ Cc= 0.900 n= 0.011, Flow Area= 0.79 sf

**Primary OutFlow** Max=1.13 cfs @ 12.14 hrs HW=182.34' TW=182.24' (Dynamic Tailwater)  
 ↳ **1=Culvert** (Outlet Controls 1.13 cfs @ 1.44 fps)

**Pond 10P: CB**

Hydrograph



**Summary for Subcatchment 11P: P3b**

Runoff = 0.80 cfs @ 12.03 hrs, Volume= 0.056 af, Depth= 5.26"

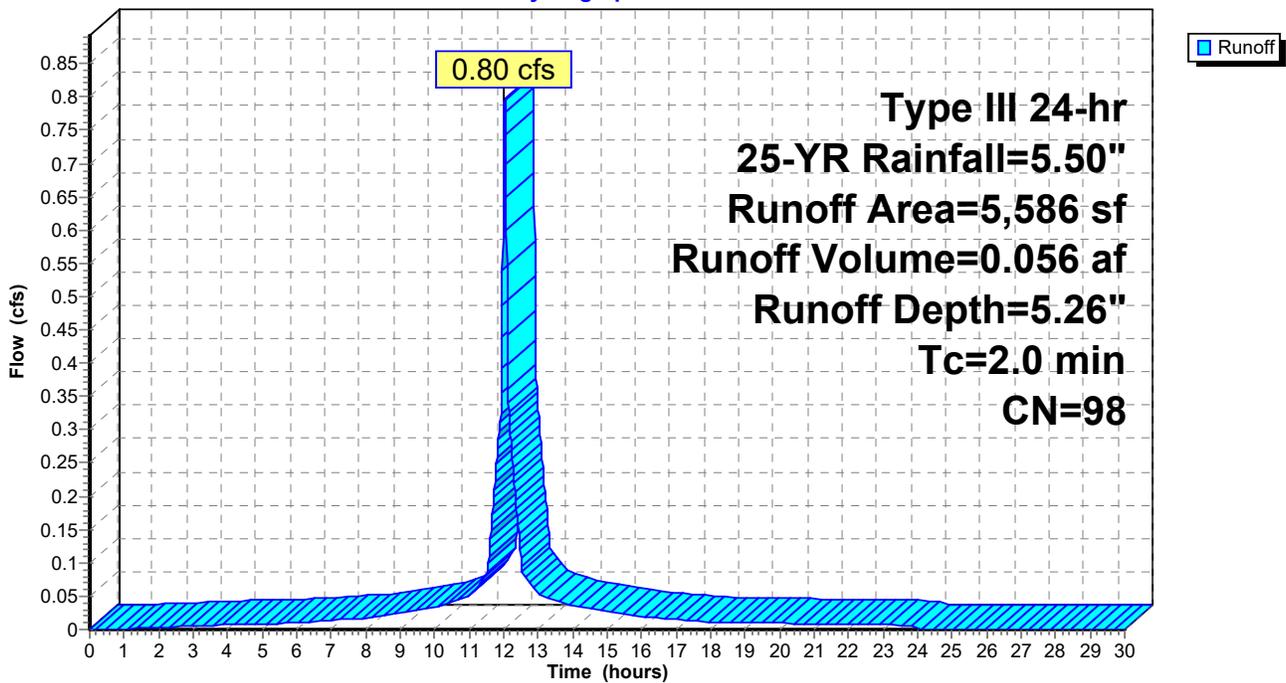
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
 Type III 24-hr 25-YR Rainfall=5.50"

Area (sf)	CN	Description
5,586	98	Roofs, HSG B
5,586		100.00% Impervious Area

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

**Subcatchment 11P: P3b**

Hydrograph



**Summary for Pond 12P: Infiltration Field**

Inflow Area = 0.458 ac, 75.38% Impervious, Inflow Depth = 4.23" for 25-YR event  
 Inflow = 1.69 cfs @ 12.09 hrs, Volume= 0.161 af  
 Outflow = 0.43 cfs @ 12.55 hrs, Volume= 0.161 af, Atten= 75%, Lag= 27.3 min  
 Discarded = 0.13 cfs @ 11.74 hrs, Volume= 0.119 af  
 Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af  
 Secondary = 0.30 cfs @ 12.55 hrs, Volume= 0.043 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
 Peak Elev= 182.85' @ 12.55 hrs Surf.Area= 2,377 sf Storage= 2,293 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)  
 Center-of-Mass det. time= 62.2 min ( 847.2 - 785.0 )

Volume	Invert	Avail.Storage	Storage Description
#1A	181.20'	1,454 cf	<b>72.00'W x 32.83'L x 2.04'H Field A</b> 4,826 cf Overall - 1,192 cf Embedded = 3,634 cf x 40.0% Voids
#2A	181.70'	1,192 cf	<b>Cultec C-100HD</b> x 84 Inside #1 Effective Size= 32.1"W x 12.0"H => 1.86 sf x 7.50'L = 14.0 cf Overall Size= 36.0"W x 12.5"H x 8.00'L with 0.50' Overlap Row Length Adjustment= +0.50' x 1.86 sf x 21 rows
#3	181.40'	38 cf	<b>4.00'D x 3.00'H Vertical Cone/Cylinder</b>
		2,684 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	181.20'	<b>2.410 in/hr Exfiltration over Surface area</b>
#2	Secondary	181.88'	<b>4.0" Round Culvert</b> L= 7.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 181.88' / 181.00' S= 0.1257 '/' Cc= 0.900 n= 0.011, Flow Area= 0.09 sf
#3	Primary	183.30'	<b>Trench Drain, Cv= 2.62 (C= 3.28)</b> Elev. (feet) 183.30 183.40 Width (feet) 20.00 20.00

**Discarded OutFlow** Max=0.13 cfs @ 11.74 hrs HW=181.41' (Free Discharge)

↑1=Exfiltration (Exfiltration Controls 0.13 cfs)

**Primary OutFlow** Max=0.00 cfs @ 0.00 hrs HW=181.20' TW=0.00' (Dynamic Tailwater)

↑3=Trench Drain ( Controls 0.00 cfs)

**Secondary OutFlow** Max=0.30 cfs @ 12.55 hrs HW=182.85' TW=0.00' (Dynamic Tailwater)

↑2=Culvert (Inlet Controls 0.30 cfs @ 3.40 fps)

**Pond 12P: Infiltration Field - Chamber Wizard Field A**

**Chamber Model = Cultec C-100HD (Cultec Contactor® 100HD)**

Effective Size= 32.1"W x 12.0"H => 1.86 sf x 7.50'L = 14.0 cf

Overall Size= 36.0"W x 12.5"H x 8.00'L with 0.50' Overlap

Row Length Adjustment= +0.50' x 1.86 sf x 21 rows

36.0" Wide + 4.0" Spacing = 40.0" C-C Row Spacing

4 Chambers/Row x 7.50' Long +0.50' Row Adjustment = 30.50' Row Length +14.0" End Stone x 2 = 32.83' Base Length

21 Rows x 36.0" Wide + 4.0" Spacing x 20 + 14.0" Side Stone x 2 = 72.00' Base Width

6.0" Base + 12.5" Chamber Height + 6.0" Cover = 2.04' Field Height

84 Chambers x 14.0 cf +0.50' Row Adjustment x 1.86 sf x 21 Rows = 1,192.3 cf Chamber Storage

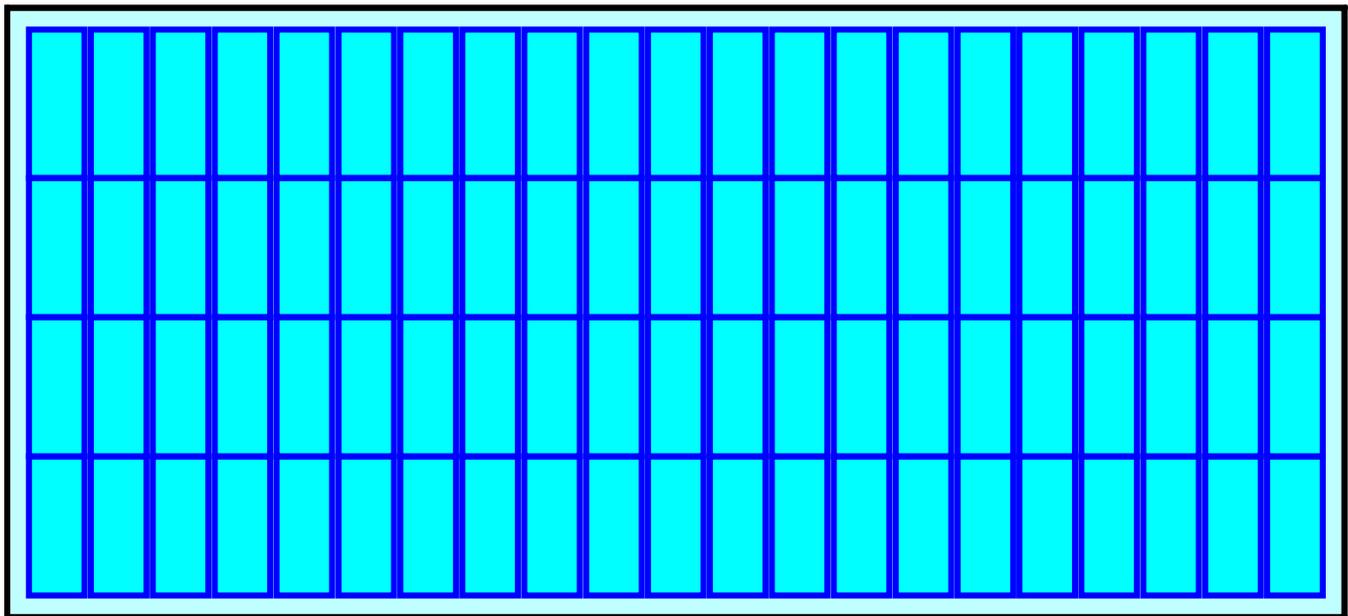
4,826.5 cf Field - 1,192.3 cf Chambers = 3,634.2 cf Stone x 40.0% Voids = 1,453.7 cf Stone Storage

Chamber Storage + Stone Storage = 2,646.0 cf = 0.061 af

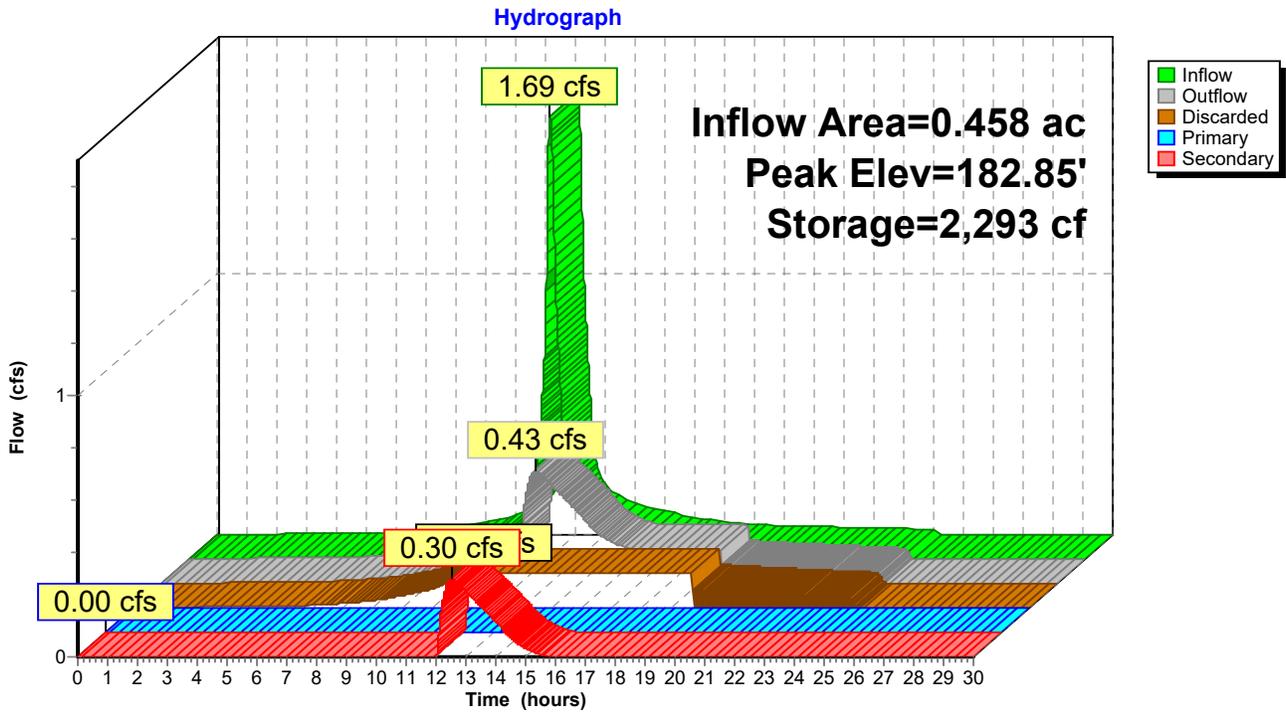
Overall Storage Efficiency = 54.8%

Overall System Size = 32.83' x 72.00' x 2.04'

84 Chambers  
178.8 cy Field  
134.6 cy Stone



### Pond 12P: Infiltration Field



**HydroCAD Revised2**

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Type III 24-hr 25-YR Rainfall=5.50"

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**Summary for Subcatchment 13P: P3c**

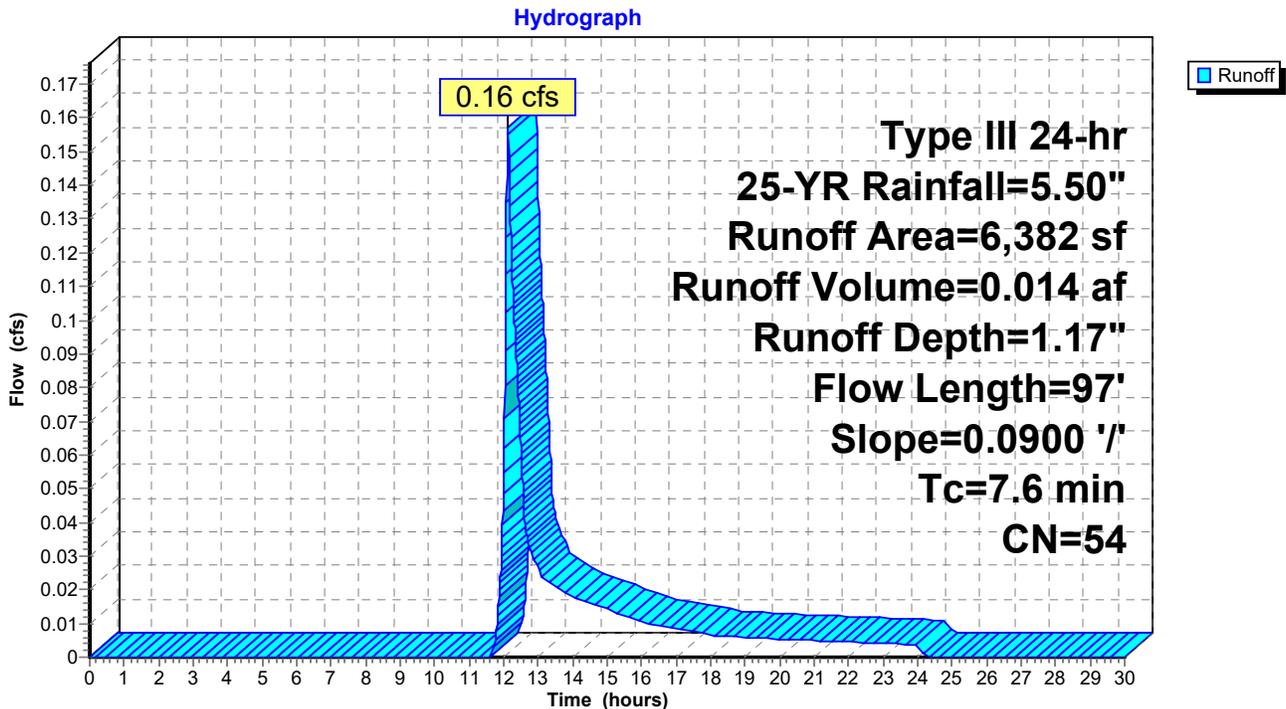
Runoff = 0.16 cfs @ 12.13 hrs, Volume= 0.014 af, Depth= 1.17"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
Type III 24-hr 25-YR Rainfall=5.50"

	Area (sf)	CN	Description
*	454	90	Pavers, HSG B
*	134	88	Pavers, HSG A
	2,741	39	>75% Grass cover, Good, HSG A
	3,053	61	>75% Grass cover, Good, HSG B
	6,382	54	Weighted Average
	6,382		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.6	97	0.0900	0.21		Sheet Flow, Grass: Dense n= 0.240 P2= 3.20"

**Subcatchment 13P: P3c**



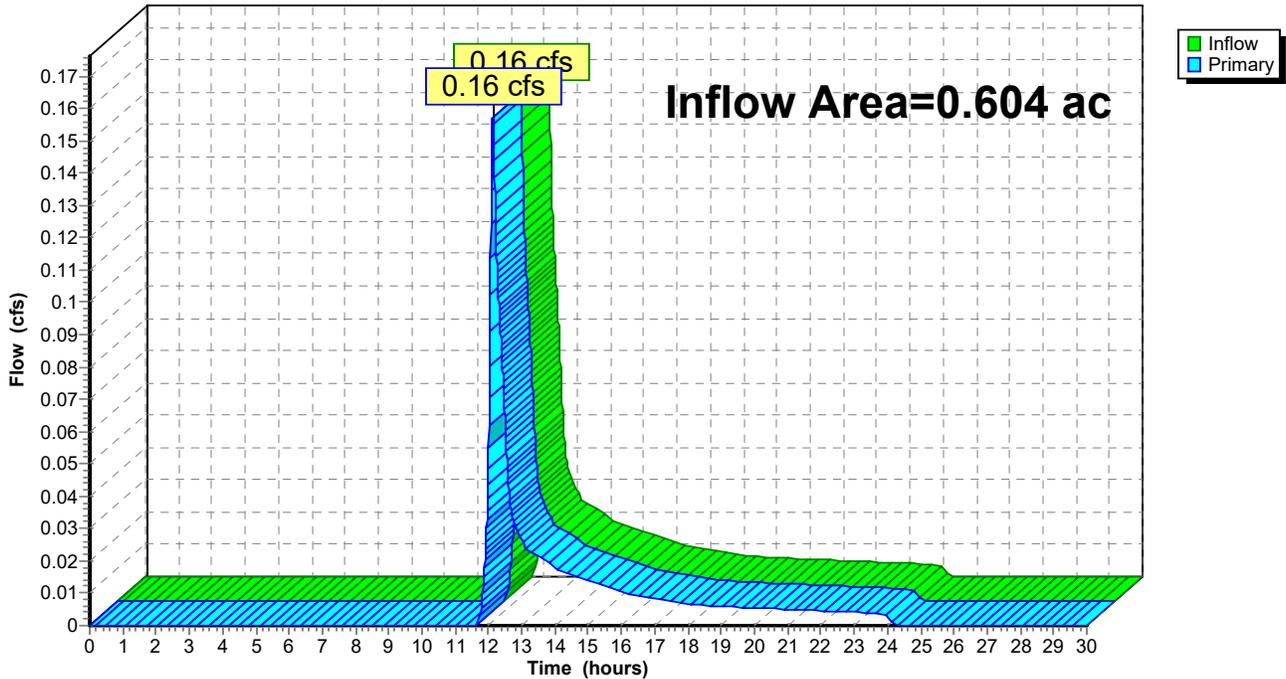
### Summary for Link 14P: Design Point #3a: Flow to Village Street

Inflow Area = 0.604 ac, 57.10% Impervious, Inflow Depth = 0.28" for 25-YR event  
Inflow = 0.16 cfs @ 12.13 hrs, Volume= 0.014 af  
Primary = 0.16 cfs @ 12.13 hrs, Volume= 0.014 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs

### Link 14P: Design Point #3a: Flow to Village Street

Hydrograph



**HydroCAD Revised2**

Type III 24-hr 50-YR Rainfall=6.10"

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Time span=0.00-30.00 hrs, dt=0.01 hrs, 3001 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 8P: P3a**

Runoff Area=14,343 sf 65.80% Impervious Runoff Depth=4.40"  
Flow Length=229' Tc=10.0 min CN=85 Runoff=1.46 cfs 0.121 af

**Pond 10P: CB**

Peak Elev=183.23' Inflow=1.46 cfs 0.121 af  
12.0" Round Culvert n=0.011 L=75.0' S=0.0000 '/ Outflow=1.46 cfs 0.121 af

**Subcatchment 11P: P3b**

Runoff Area=5,586 sf 100.00% Impervious Runoff Depth=5.86"  
Tc=2.0 min CN=98 Runoff=0.88 cfs 0.063 af

**Pond 12P: Infiltration Field**

Peak Elev=183.21' Storage=2,642 cf Inflow=1.92 cfs 0.183 af  
Discarded=0.13 cfs 0.127 af Primary=0.00 cfs 0.000 af Secondary=0.36 cfs 0.056 af Outflow=0.49 cfs 0.183 af

**Subcatchment 13P: P3c**

Runoff Area=6,382 sf 0.00% Impervious Runoff Depth=1.50"  
Flow Length=97' Slope=0.0900 '/ Tc=7.6 min CN=54 Runoff=0.21 cfs 0.018 af

**Link 14P: Design Point #3a: Flow to Village Street**

Inflow=0.21 cfs 0.018 af  
Primary=0.21 cfs 0.018 af

**Total Runoff Area = 0.604 ac Runoff Volume = 0.202 af Average Runoff Depth = 4.00"**  
**42.90% Pervious = 0.259 ac 57.10% Impervious = 0.345 ac**

**HydroCAD Revised2**

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Type III 24-hr 50-YR Rainfall=6.10"

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**Summary for Subcatchment 8P: P3a**

Runoff = 1.46 cfs @ 12.14 hrs, Volume= 0.121 af, Depth= 4.40"

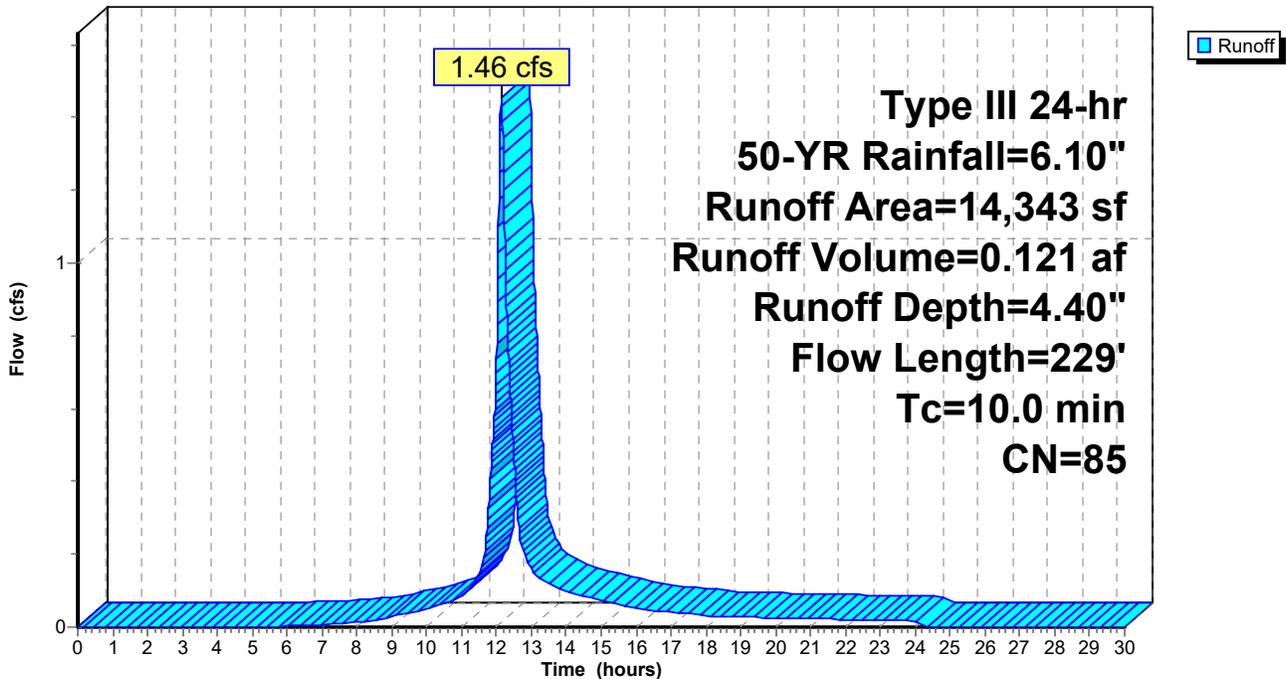
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
Type III 24-hr 50-YR Rainfall=6.10"

Area (sf)	CN	Description
9,437	98	Paved parking, HSG B
4,906	61	>75% Grass cover, Good, HSG B
14,343	85	Weighted Average
4,906		34.20% Pervious Area
9,437		65.80% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.6	63	0.0280	0.12		Sheet Flow, Grass: Dense n= 0.240 P2= 3.20"
1.4	166	0.0100	2.03		Shallow Concentrated Flow, Paved Kv= 20.3 fps
10.0	229	Total			

**Subcatchment 8P: P3a**

Hydrograph



**Summary for Pond 10P: CB**

Inflow Area = 0.329 ac, 65.80% Impervious, Inflow Depth = 4.40" for 50-YR event  
 Inflow = 1.46 cfs @ 12.14 hrs, Volume= 0.121 af  
 Outflow = 1.46 cfs @ 12.14 hrs, Volume= 0.121 af, Atten= 0%, Lag= 0.0 min  
 Primary = 1.46 cfs @ 12.14 hrs, Volume= 0.121 af

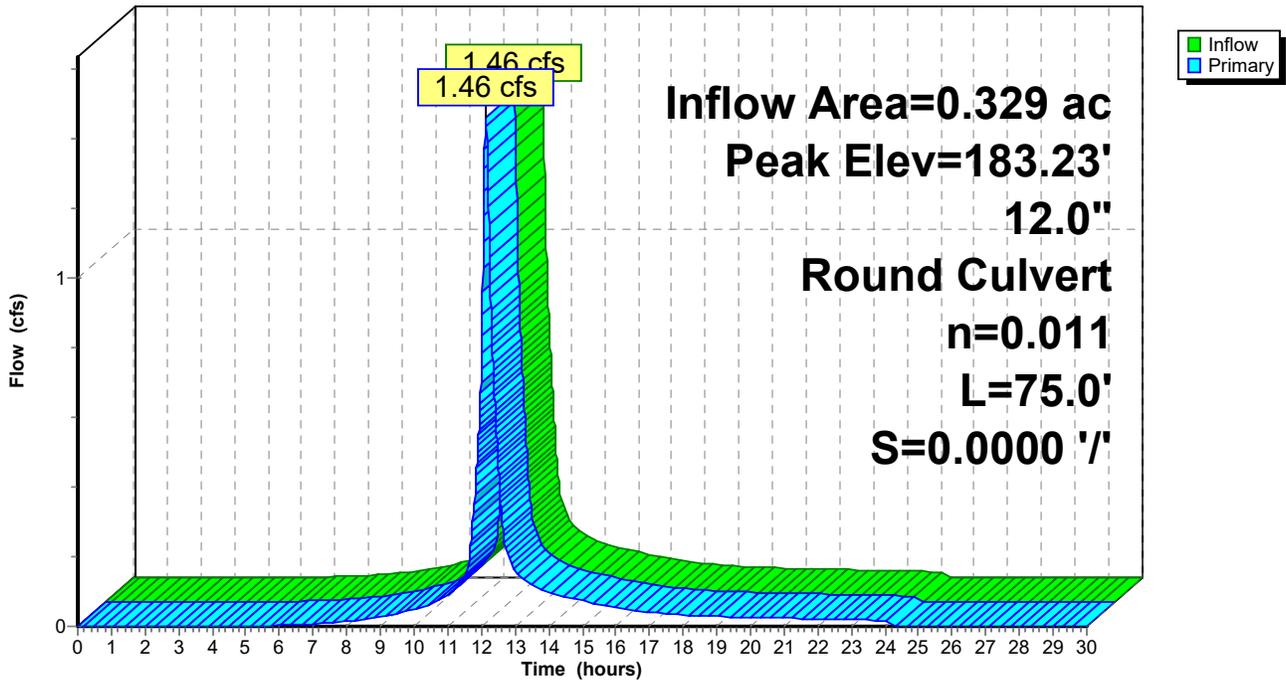
Routing by Dyn-Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
 Peak Elev= 183.23' @ 12.54 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	180.60'	<b>12.0" Round Culvert</b> L= 75.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 180.60' / 180.60' S= 0.0000 '/ Cc= 0.900 n= 0.011, Flow Area= 0.79 sf

**Primary OutFlow** Max=1.30 cfs @ 12.14 hrs HW=182.53' TW=182.39' (Dynamic Tailwater)  
 ↳ **1=Culvert** (Outlet Controls 1.30 cfs @ 1.66 fps)

**Pond 10P: CB**

Hydrograph



**Summary for Subcatchment 11P: P3b**

Runoff = 0.88 cfs @ 12.03 hrs, Volume= 0.063 af, Depth= 5.86"

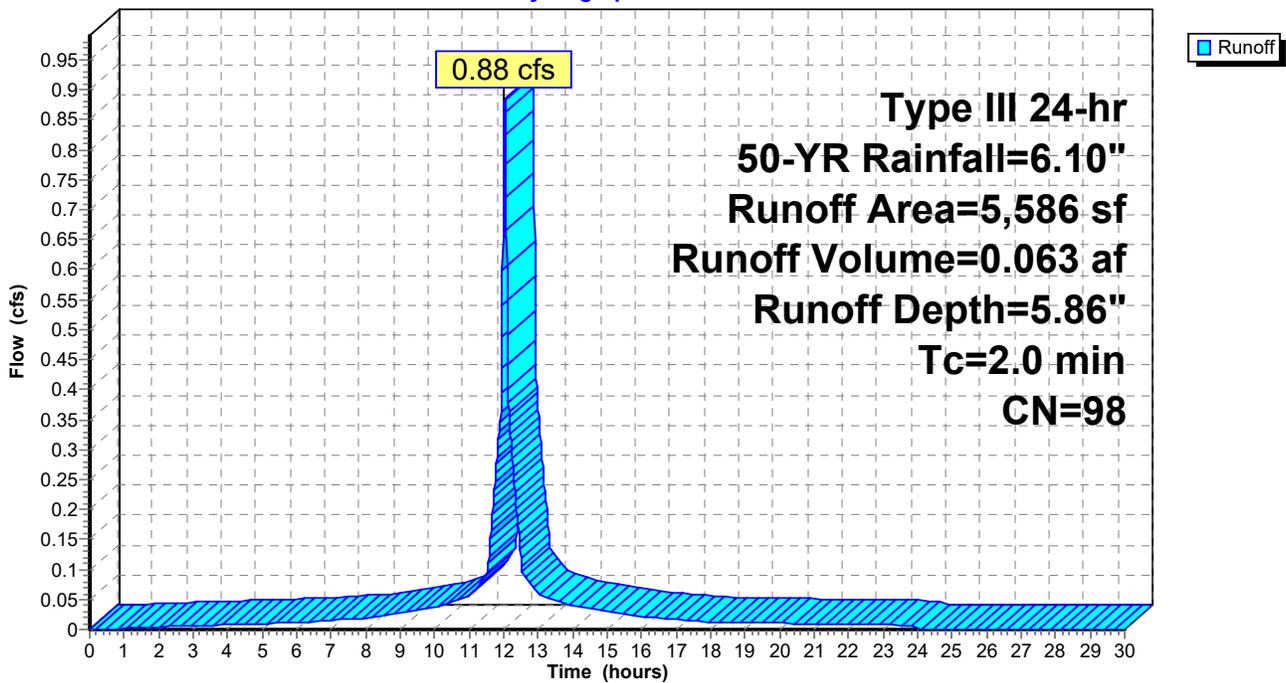
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
 Type III 24-hr 50-YR Rainfall=6.10"

Area (sf)	CN	Description
5,586	98	Roofs, HSG B
5,586		100.00% Impervious Area

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

**Subcatchment 11P: P3b**

Hydrograph



**Summary for Pond 12P: Infiltration Field**

Inflow Area = 0.458 ac, 75.38% Impervious, Inflow Depth = 4.81" for 50-YR event  
 Inflow = 1.92 cfs @ 12.09 hrs, Volume= 0.183 af  
 Outflow = 0.49 cfs @ 12.54 hrs, Volume= 0.183 af, Atten= 74%, Lag= 27.0 min  
 Discarded = 0.13 cfs @ 11.66 hrs, Volume= 0.127 af  
 Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af  
 Secondary = 0.36 cfs @ 12.54 hrs, Volume= 0.056 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
 Peak Elev= 183.21' @ 12.54 hrs Surf.Area= 2,377 sf Storage= 2,642 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)  
 Center-of-Mass det. time= 63.8 min ( 846.1 - 782.4 )

Volume	Invert	Avail.Storage	Storage Description
#1A	181.20'	1,454 cf	<b>72.00'W x 32.83'L x 2.04'H Field A</b> 4,826 cf Overall - 1,192 cf Embedded = 3,634 cf x 40.0% Voids
#2A	181.70'	1,192 cf	<b>Cultec C-100HD</b> x 84 Inside #1 Effective Size= 32.1"W x 12.0"H => 1.86 sf x 7.50'L = 14.0 cf Overall Size= 36.0"W x 12.5"H x 8.00'L with 0.50' Overlap Row Length Adjustment= +0.50' x 1.86 sf x 21 rows
#3	181.40'	38 cf	<b>4.00'D x 3.00'H Vertical Cone/Cylinder</b>
		2,684 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	181.20'	<b>2.410 in/hr Exfiltration over Surface area</b>
#2	Secondary	181.88'	<b>4.0" Round Culvert</b> L= 7.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 181.88' / 181.00' S= 0.1257 '/' Cc= 0.900 n= 0.011, Flow Area= 0.09 sf
#3	Primary	183.30'	<b>Trench Drain, Cv= 2.62 (C= 3.28)</b> Elev. (feet) 183.30 183.40 Width (feet) 20.00 20.00

**Discarded OutFlow** Max=0.13 cfs @ 11.66 hrs HW=181.40' (Free Discharge)

↑1=Exfiltration (Exfiltration Controls 0.13 cfs)

**Primary OutFlow** Max=0.00 cfs @ 0.00 hrs HW=181.20' TW=0.00' (Dynamic Tailwater)

↑3=Trench Drain ( Controls 0.00 cfs)

**Secondary OutFlow** Max=0.36 cfs @ 12.54 hrs HW=183.21' TW=0.00' (Dynamic Tailwater)

↑2=Culvert (Inlet Controls 0.36 cfs @ 4.11 fps)

**Pond 12P: Infiltration Field - Chamber Wizard Field A**

**Chamber Model = Cultec C-100HD (Cultec Contactor® 100HD)**

Effective Size= 32.1"W x 12.0"H => 1.86 sf x 7.50'L = 14.0 cf

Overall Size= 36.0"W x 12.5"H x 8.00'L with 0.50' Overlap

Row Length Adjustment= +0.50' x 1.86 sf x 21 rows

36.0" Wide + 4.0" Spacing = 40.0" C-C Row Spacing

4 Chambers/Row x 7.50' Long +0.50' Row Adjustment = 30.50' Row Length +14.0" End Stone x 2 = 32.83' Base Length

21 Rows x 36.0" Wide + 4.0" Spacing x 20 + 14.0" Side Stone x 2 = 72.00' Base Width

6.0" Base + 12.5" Chamber Height + 6.0" Cover = 2.04' Field Height

84 Chambers x 14.0 cf +0.50' Row Adjustment x 1.86 sf x 21 Rows = 1,192.3 cf Chamber Storage

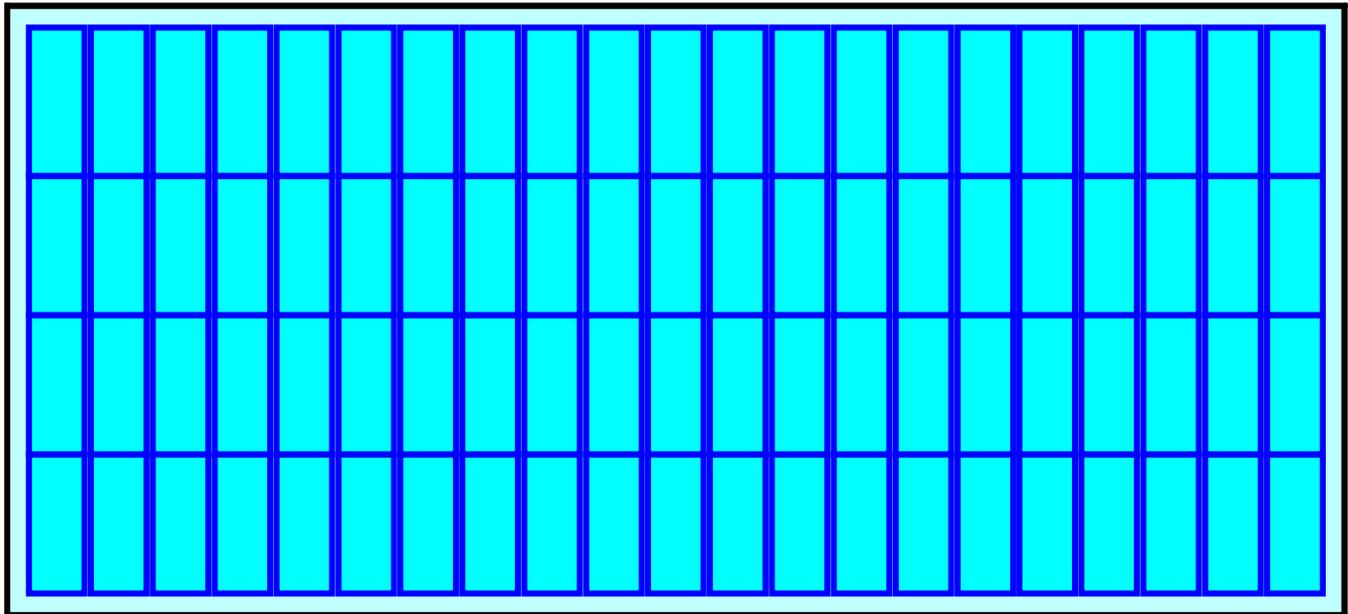
4,826.5 cf Field - 1,192.3 cf Chambers = 3,634.2 cf Stone x 40.0% Voids = 1,453.7 cf Stone Storage

Chamber Storage + Stone Storage = 2,646.0 cf = 0.061 af

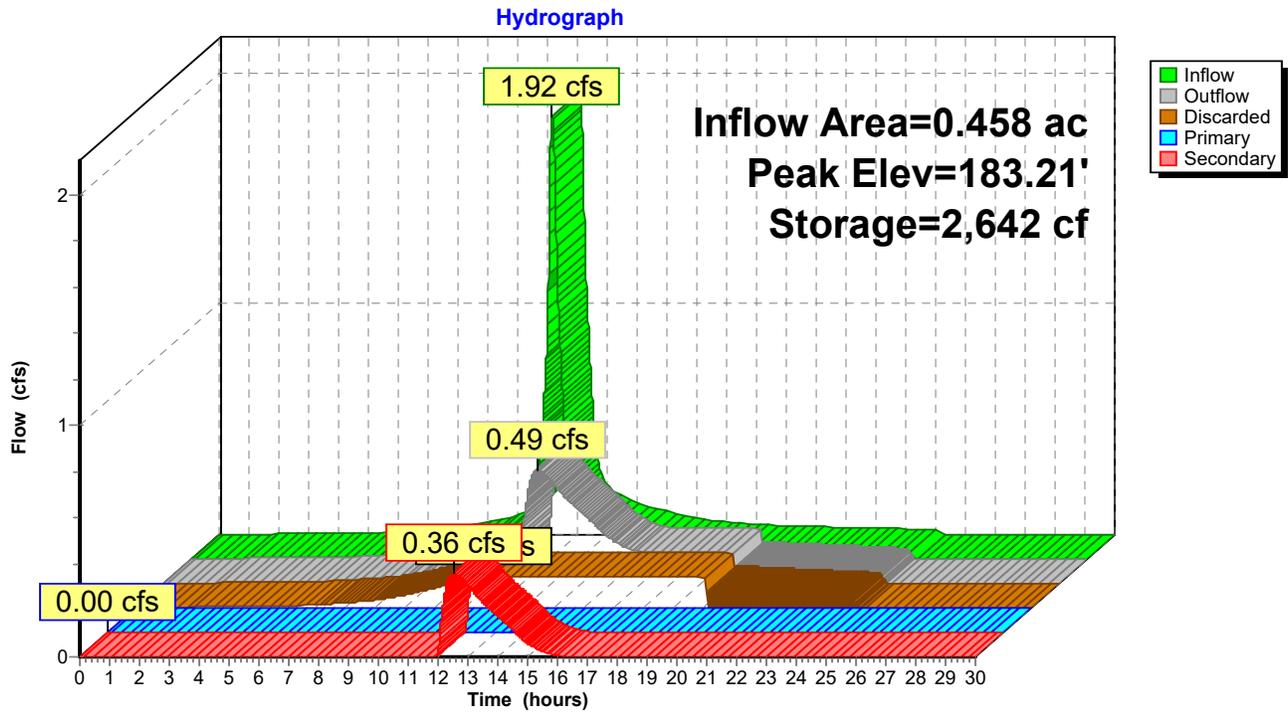
Overall Storage Efficiency = 54.8%

Overall System Size = 32.83' x 72.00' x 2.04'

84 Chambers  
178.8 cy Field  
134.6 cy Stone



### Pond 12P: Infiltration Field



**Summary for Subcatchment 13P: P3c**

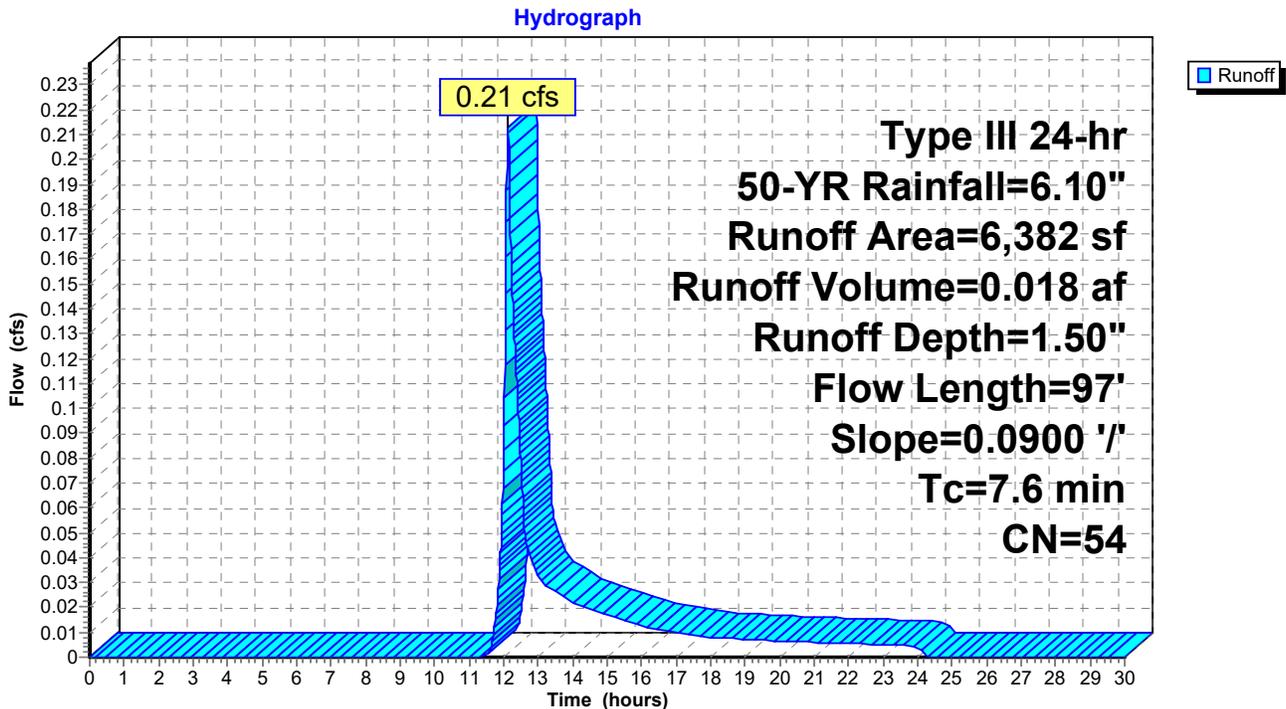
Runoff = 0.21 cfs @ 12.12 hrs, Volume= 0.018 af, Depth= 1.50"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
Type III 24-hr 50-YR Rainfall=6.10"

	Area (sf)	CN	Description
*	454	90	Pavers, HSG B
*	134	88	Pavers, HSG A
	2,741	39	>75% Grass cover, Good, HSG A
	3,053	61	>75% Grass cover, Good, HSG B
	6,382	54	Weighted Average
	6,382		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.6	97	0.0900	0.21		Sheet Flow, Grass: Dense n= 0.240 P2= 3.20"

**Subcatchment 13P: P3c**



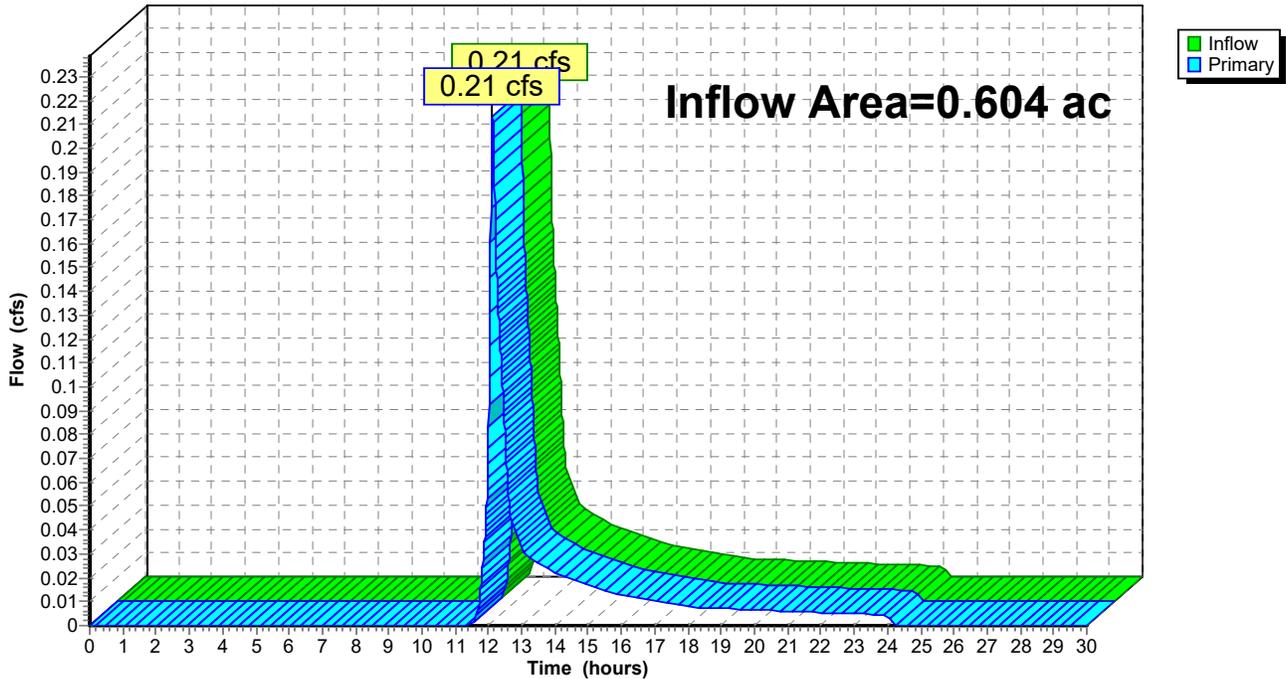
### Summary for Link 14P: Design Point #3a: Flow to Village Street

Inflow Area = 0.604 ac, 57.10% Impervious, Inflow Depth = 0.36" for 50-YR event  
Inflow = 0.21 cfs @ 12.12 hrs, Volume= 0.018 af  
Primary = 0.21 cfs @ 12.12 hrs, Volume= 0.018 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs

### Link 14P: Design Point #3a: Flow to Village Street

Hydrograph



**HydroCAD Revised2**

Type III 24-hr 100-YR Rainfall=6.70"

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Time span=0.00-30.00 hrs, dt=0.01 hrs, 3001 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 8P: P3a**

Runoff Area=14,343 sf 65.80% Impervious Runoff Depth=4.97"  
Flow Length=229' Tc=10.0 min CN=85 Runoff=1.64 cfs 0.136 af

**Pond 10P: CB**

Peak Elev=183.45' Inflow=1.64 cfs 0.136 af  
12.0" Round Culvert n=0.011 L=75.0' S=0.0000 '/ Outflow=1.64 cfs 0.136 af

**Subcatchment 11P: P3b**

Runoff Area=5,586 sf 100.00% Impervious Runoff Depth=6.46"  
Tc=2.0 min CN=98 Runoff=0.97 cfs 0.069 af

**Pond 12P: Infiltration Field**

Peak Elev=183.37' Storage=2,671 cf Inflow=2.14 cfs 0.205 af  
Discarded=0.13 cfs 0.135 af Primary=1.25 cfs 0.008 af Secondary=0.38 cfs 0.062 af Outflow=1.76 cfs 0.205 af

**Subcatchment 13P: P3c**

Runoff Area=6,382 sf 0.00% Impervious Runoff Depth=1.85"  
Flow Length=97' Slope=0.0900 '/ Tc=7.6 min CN=54 Runoff=0.27 cfs 0.023 af

**Link 14P: Design Point #3a: Flow to Village Street**

Inflow=1.41 cfs 0.031 af  
Primary=1.41 cfs 0.031 af

**Total Runoff Area = 0.604 ac Runoff Volume = 0.228 af Average Runoff Depth = 4.53"**  
**42.90% Pervious = 0.259 ac 57.10% Impervious = 0.345 ac**

**HydroCAD Revised2**

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Type III 24-hr 100-YR Rainfall=6.70"

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**Summary for Subcatchment 8P: P3a**

Runoff = 1.64 cfs @ 12.14 hrs, Volume= 0.136 af, Depth= 4.97"

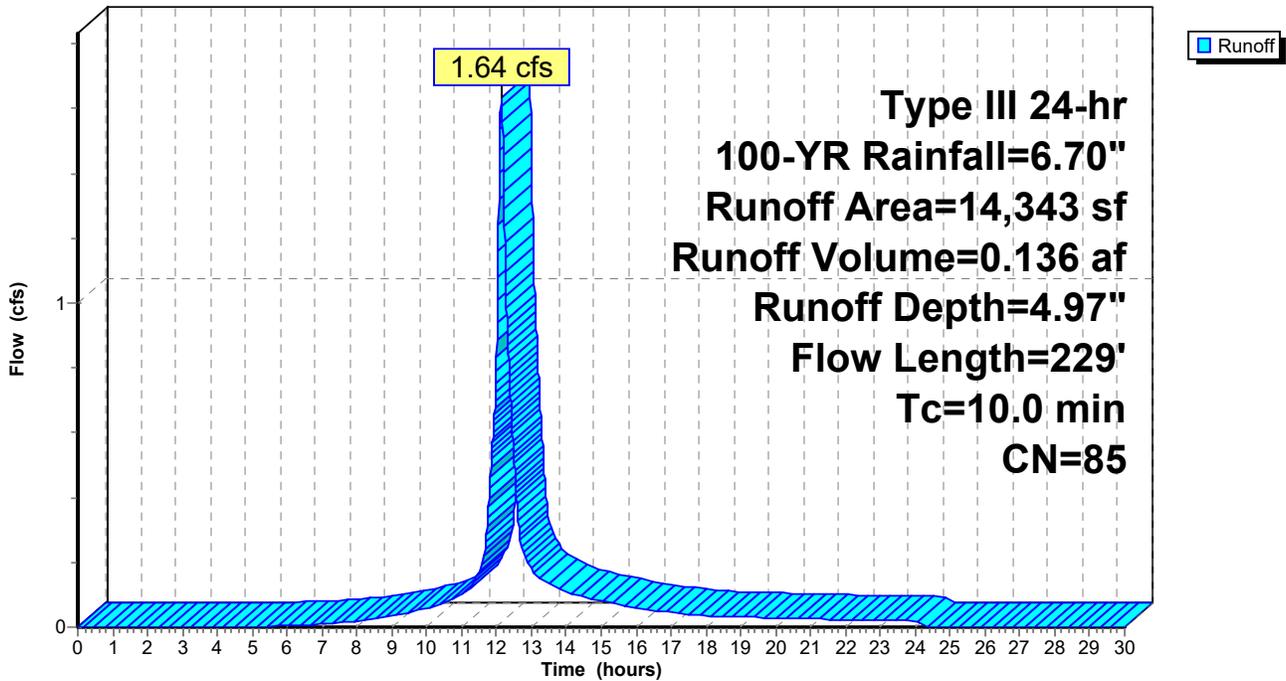
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
Type III 24-hr 100-YR Rainfall=6.70"

Area (sf)	CN	Description
9,437	98	Paved parking, HSG B
4,906	61	>75% Grass cover, Good, HSG B
14,343	85	Weighted Average
4,906		34.20% Pervious Area
9,437		65.80% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.6	63	0.0280	0.12		Sheet Flow, Grass: Dense n= 0.240 P2= 3.20"
1.4	166	0.0100	2.03		Shallow Concentrated Flow, Paved Kv= 20.3 fps
10.0	229	Total			

**Subcatchment 8P: P3a**

Hydrograph



**Summary for Pond 10P: CB**

Inflow Area = 0.329 ac, 65.80% Impervious, Inflow Depth = 4.97" for 100-YR event  
 Inflow = 1.64 cfs @ 12.14 hrs, Volume= 0.136 af  
 Outflow = 1.64 cfs @ 12.14 hrs, Volume= 0.136 af, Atten= 0%, Lag= 0.0 min  
 Primary = 1.64 cfs @ 12.14 hrs, Volume= 0.136 af

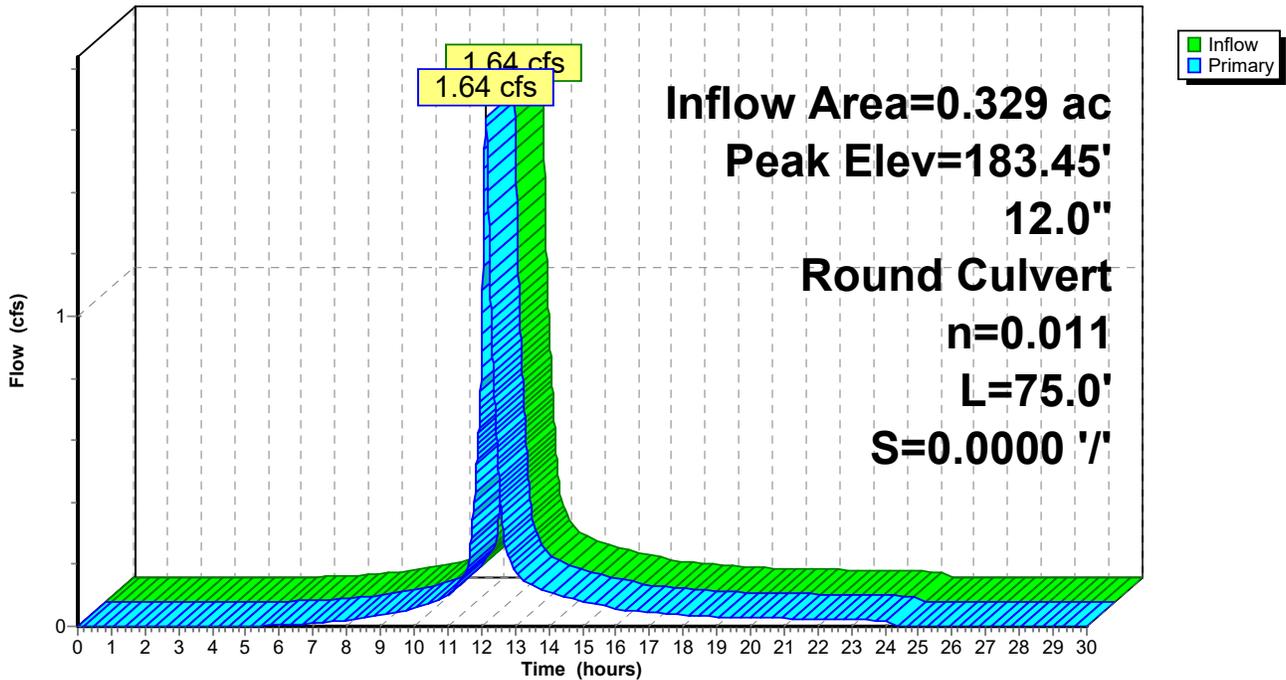
Routing by Dyn-Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
 Peak Elev= 183.45' @ 12.30 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	180.60'	<b>12.0" Round Culvert</b> L= 75.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 180.60' / 180.60' S= 0.0000 '/ Cc= 0.900 n= 0.011, Flow Area= 0.79 sf

**Primary OutFlow** Max=1.44 cfs @ 12.14 hrs HW=182.74' TW=182.58' (Dynamic Tailwater)  
 ↳ **1=Culvert** (Outlet Controls 1.44 cfs @ 1.84 fps)

**Pond 10P: CB**

Hydrograph



**Summary for Subcatchment 11P: P3b**

Runoff = 0.97 cfs @ 12.03 hrs, Volume= 0.069 af, Depth= 6.46"

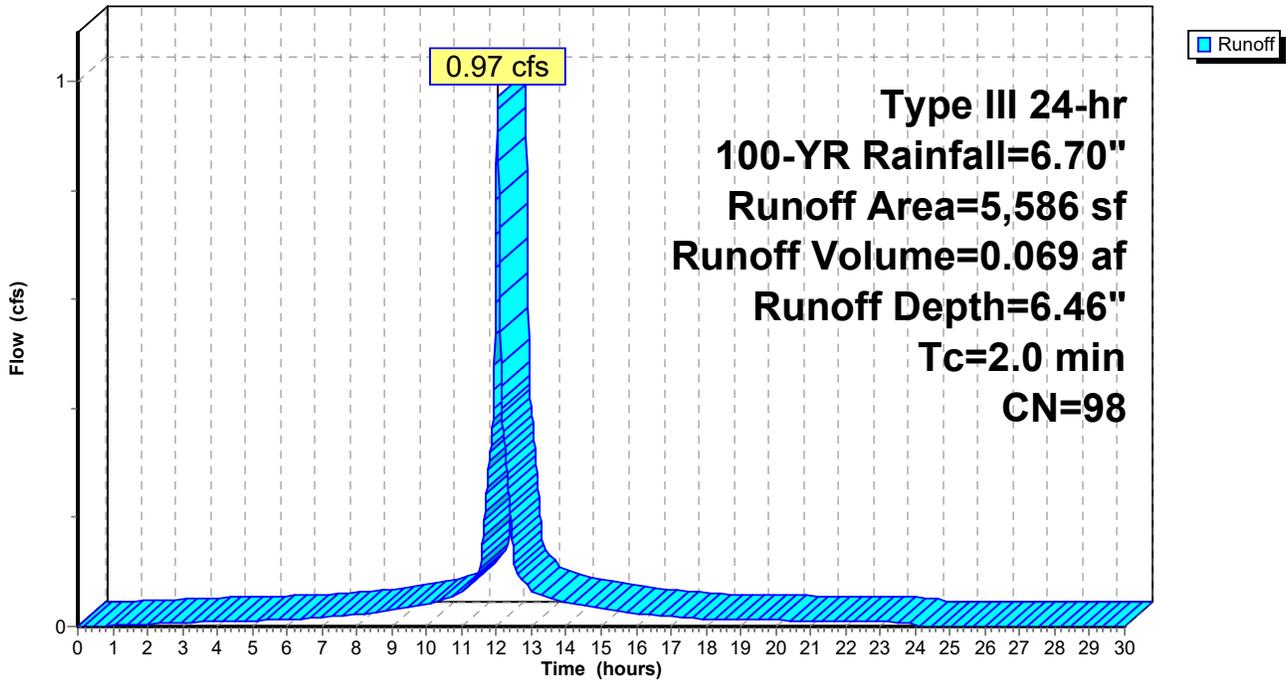
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
 Type III 24-hr 100-YR Rainfall=6.70"

Area (sf)	CN	Description
5,586	98	Roofs, HSG B
5,586		100.00% Impervious Area

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

**Subcatchment 11P: P3b**

Hydrograph



**Summary for Pond 12P: Infiltration Field**

Inflow Area = 0.458 ac, 75.38% Impervious, Inflow Depth = 5.39" for 100-YR event  
 Inflow = 2.14 cfs @ 12.09 hrs, Volume= 0.205 af  
 Outflow = 1.76 cfs @ 12.29 hrs, Volume= 0.205 af, Atten= 18%, Lag= 11.8 min  
 Discarded = 0.13 cfs @ 11.56 hrs, Volume= 0.135 af  
 Primary = 1.25 cfs @ 12.29 hrs, Volume= 0.008 af  
 Secondary = 0.38 cfs @ 12.29 hrs, Volume= 0.062 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
 Peak Elev= 183.37' @ 12.29 hrs Surf.Area= 2,377 sf Storage= 2,671 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)  
 Center-of-Mass det. time= 61.5 min ( 841.5 - 780.0 )

Volume	Invert	Avail.Storage	Storage Description
#1A	181.20'	1,454 cf	<b>72.00'W x 32.83'L x 2.04'H Field A</b> 4,826 cf Overall - 1,192 cf Embedded = 3,634 cf x 40.0% Voids
#2A	181.70'	1,192 cf	<b>Cultec C-100HD</b> x 84 Inside #1 Effective Size= 32.1"W x 12.0"H => 1.86 sf x 7.50'L = 14.0 cf Overall Size= 36.0"W x 12.5"H x 8.00'L with 0.50' Overlap Row Length Adjustment= +0.50' x 1.86 sf x 21 rows
#3	181.40'	38 cf	<b>4.00'D x 3.00'H Vertical Cone/Cylinder</b>
		2,684 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	181.20'	<b>2.410 in/hr Exfiltration over Surface area</b>
#2	Secondary	181.88'	<b>4.0" Round Culvert</b> L= 7.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 181.88' / 181.00' S= 0.1257 '/' Cc= 0.900 n= 0.011, Flow Area= 0.09 sf
#3	Primary	183.30'	<b>Trench Drain, Cv= 2.62 (C= 3.28)</b> Elev. (feet) 183.30 183.40 Width (feet) 20.00 20.00

**Discarded OutFlow** Max=0.13 cfs @ 11.56 hrs HW=181.40' (Free Discharge)

↑1=Exfiltration (Exfiltration Controls 0.13 cfs)

**Primary OutFlow** Max=1.17 cfs @ 12.29 hrs HW=183.37' TW=0.00' (Dynamic Tailwater)

↑3=Trench Drain (Weir Controls 1.17 cfs @ 0.86 fps)

**Secondary OutFlow** Max=0.38 cfs @ 12.29 hrs HW=183.37' TW=0.00' (Dynamic Tailwater)

↑2=Culvert (Inlet Controls 0.38 cfs @ 4.37 fps)

**Pond 12P: Infiltration Field - Chamber Wizard Field A**

**Chamber Model = Cultec C-100HD (Cultec Contactor® 100HD)**

Effective Size= 32.1"W x 12.0"H => 1.86 sf x 7.50'L = 14.0 cf

Overall Size= 36.0"W x 12.5"H x 8.00'L with 0.50' Overlap

Row Length Adjustment= +0.50' x 1.86 sf x 21 rows

36.0" Wide + 4.0" Spacing = 40.0" C-C Row Spacing

4 Chambers/Row x 7.50' Long +0.50' Row Adjustment = 30.50' Row Length +14.0" End Stone x 2 = 32.83' Base Length

21 Rows x 36.0" Wide + 4.0" Spacing x 20 + 14.0" Side Stone x 2 = 72.00' Base Width

6.0" Base + 12.5" Chamber Height + 6.0" Cover = 2.04' Field Height

84 Chambers x 14.0 cf +0.50' Row Adjustment x 1.86 sf x 21 Rows = 1,192.3 cf Chamber Storage

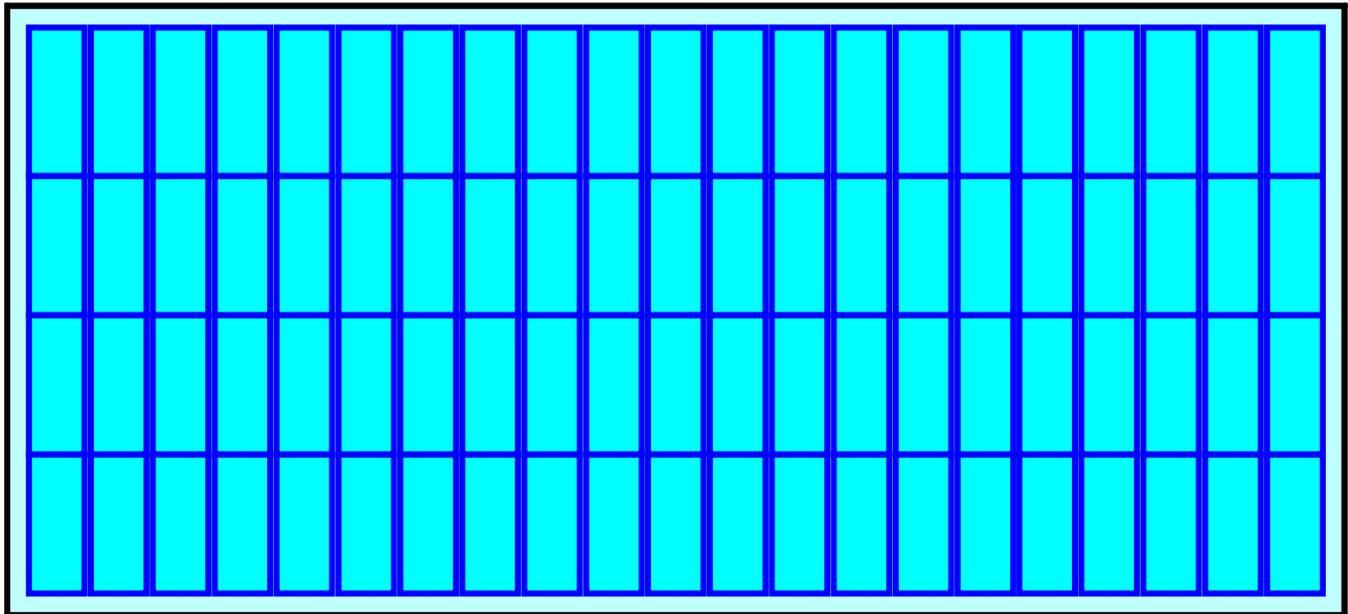
4,826.5 cf Field - 1,192.3 cf Chambers = 3,634.2 cf Stone x 40.0% Voids = 1,453.7 cf Stone Storage

Chamber Storage + Stone Storage = 2,646.0 cf = 0.061 af

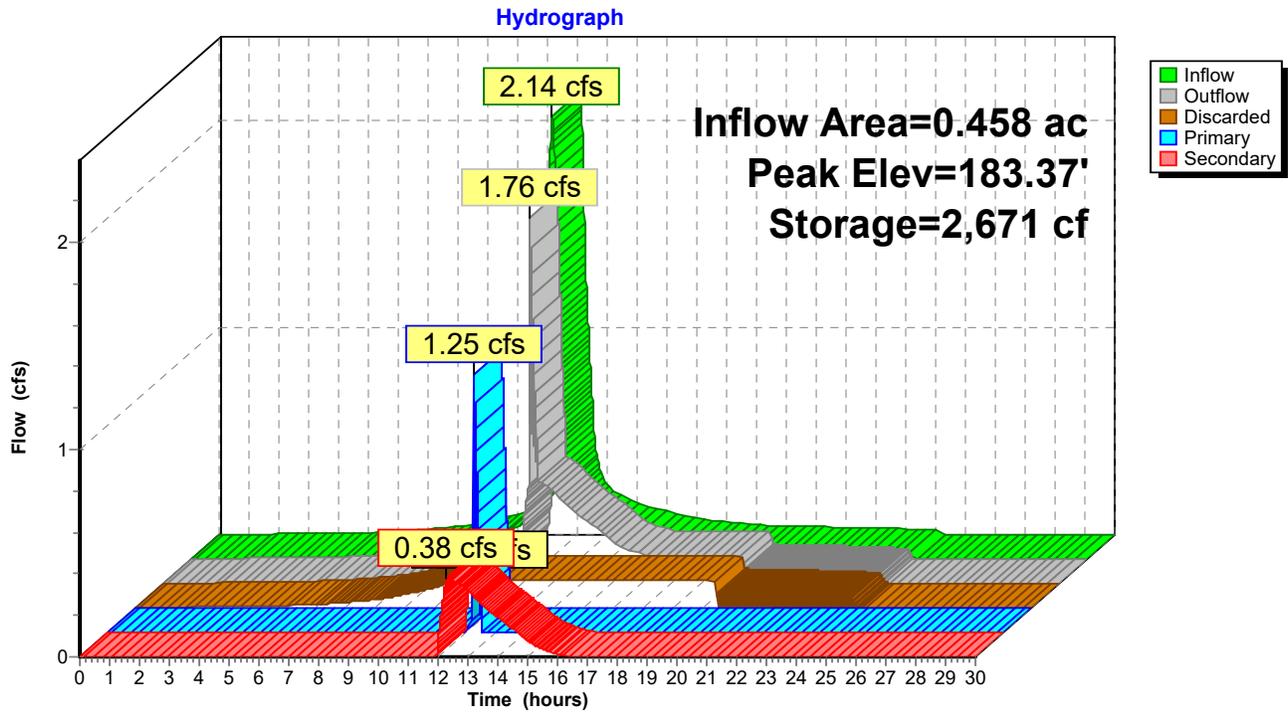
Overall Storage Efficiency = 54.8%

Overall System Size = 32.83' x 72.00' x 2.04'

84 Chambers  
178.8 cy Field  
134.6 cy Stone



### Pond 12P: Infiltration Field



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Type III 24-hr 100-YR Rainfall=6.70"

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**Summary for Subcatchment 13P: P3c**

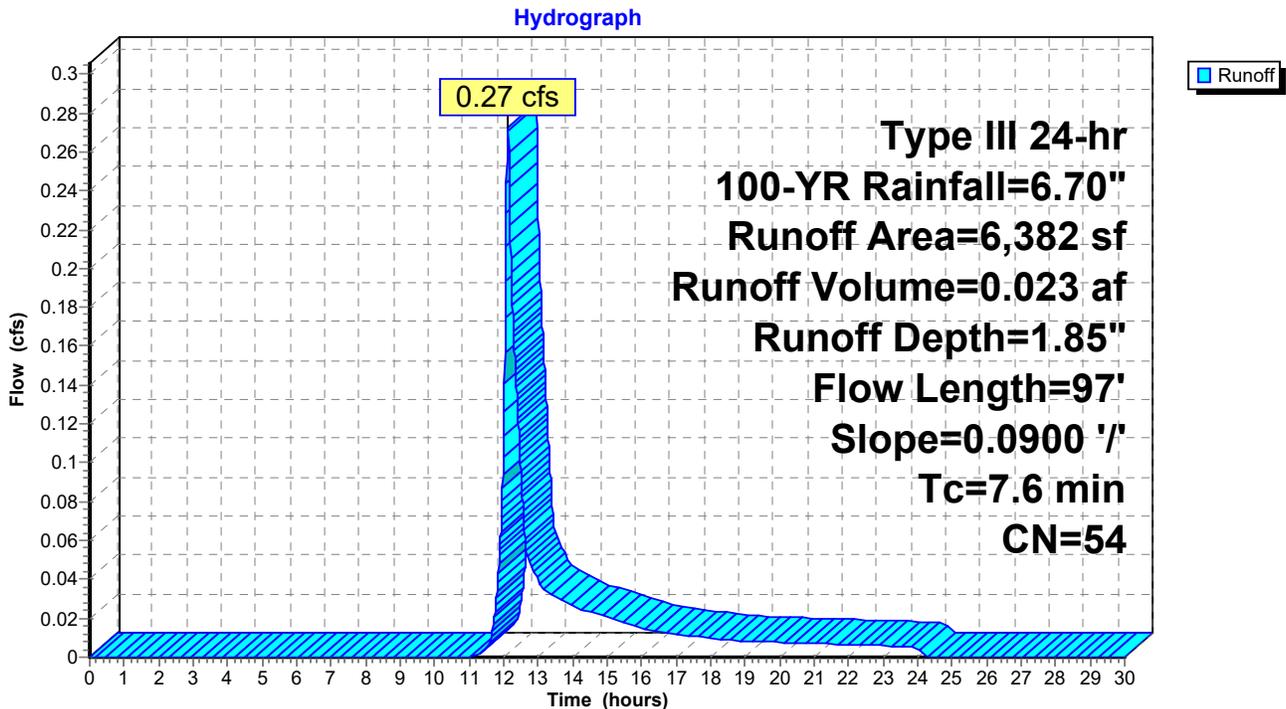
Runoff = 0.27 cfs @ 12.12 hrs, Volume= 0.023 af, Depth= 1.85"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
Type III 24-hr 100-YR Rainfall=6.70"

Area (sf)	CN	Description
* 454	90	Pavers, HSG B
* 134	88	Pavers, HSG A
2,741	39	>75% Grass cover, Good, HSG A
3,053	61	>75% Grass cover, Good, HSG B
6,382	54	Weighted Average
6,382		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.6	97	0.0900	0.21		Sheet Flow, Grass: Dense n= 0.240 P2= 3.20"

**Subcatchment 13P: P3c**

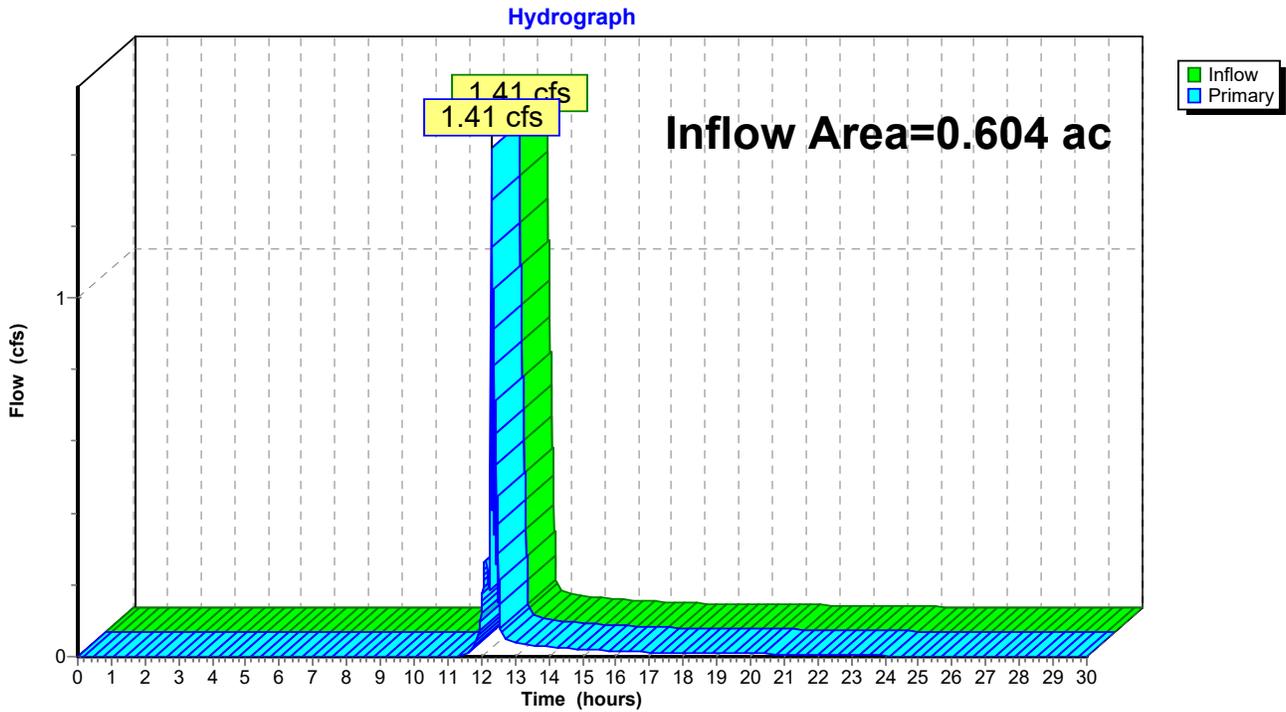


### Summary for Link 14P: Design Point #3a: Flow to Village Street

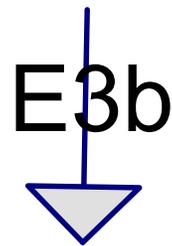
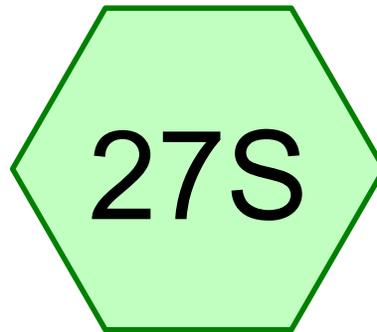
Inflow Area = 0.604 ac, 57.10% Impervious, Inflow Depth = 0.61" for 100-YR event  
Inflow = 1.41 cfs @ 12.29 hrs, Volume= 0.031 af  
Primary = 1.41 cfs @ 12.29 hrs, Volume= 0.031 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs

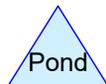
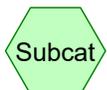
### Link 14P: Design Point #3a: Flow to Village Street



**DESIGN POINT #3b: FLOW TO EASTERN  
ABUTTER EXISTING CONDITIONS**



## Design Point #3b: Flow to Eastern Abutter



### Routing Diagram for HydroCAD2

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### Area Listing (selected nodes)

Area (acres)	CN	Description (subcatchment-numbers)
0.045	61	>75% Grass cover, Good, HSG B (27S)
0.003	90	Gravel, HSG B (27S)
0.064	98	Roofs, HSG B (27S)
0.062	30	Woods, Good, HSG A (27S)
0.047	55	Woods, Good, HSG B (27S)
<b>0.222</b>	<b>62</b>	<b>TOTAL AREA</b>

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### Soil Listing (selected nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.062	HSG A	27S
0.160	HSG B	27S
0.000	HSG C	
0.000	HSG D	
0.000	Other	
<b>0.222</b>		<b>TOTAL AREA</b>

## HydroCAD2

Type III 24-hr 2-YR Rainfall=3.20"

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Time span=0.00-30.00 hrs, dt=0.01 hrs, 3001 points  
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN  
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

### Subcatchment 27S: E3b

Runoff Area=9,663 sf 29.03% Impervious Runoff Depth=0.48"  
Flow Length=127' Tc=10.0 min CN=62 Runoff=0.07 cfs 0.009 af

### Link 28L: Design Point #3b: Flow to Eastern Abutter

Inflow=0.07 cfs 0.009 af  
Primary=0.07 cfs 0.009 af

**Total Runoff Area = 0.222 ac Runoff Volume = 0.009 af Average Runoff Depth = 0.48"**  
**70.97% Pervious = 0.157 ac 29.03% Impervious = 0.064 ac**

**Summary for Subcatchment 27S: E3b**

Runoff = 0.07 cfs @ 12.18 hrs, Volume= 0.009 af, Depth= 0.48"

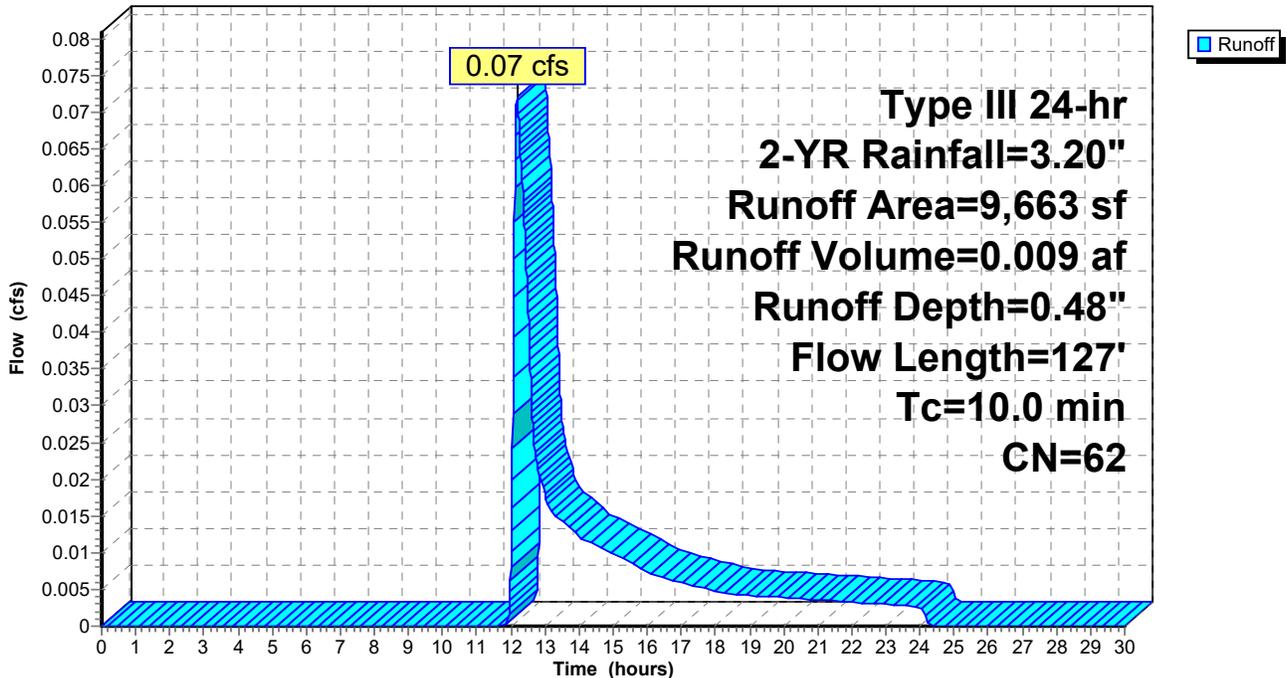
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
Type III 24-hr 2-YR Rainfall=3.20"

Area (sf)	CN	Description
2,805	98	Roofs, HSG B
* 151	90	Gravel, HSG B
1,940	61	>75% Grass cover, Good, HSG B
2,700	30	Woods, Good, HSG A
2,067	55	Woods, Good, HSG B
9,663	62	Weighted Average
6,858		70.97% Pervious Area
2,805		29.03% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.4	42	0.0100	0.07		<b>Sheet Flow,</b> Grass: Dense n= 0.240 P2= 3.20"
0.6	85	0.1300	2.52		<b>Shallow Concentrated Flow,</b> Short Grass Pasture Kv= 7.0 fps
10.0	127	Total			

**Subcatchment 27S: E3b**

Hydrograph

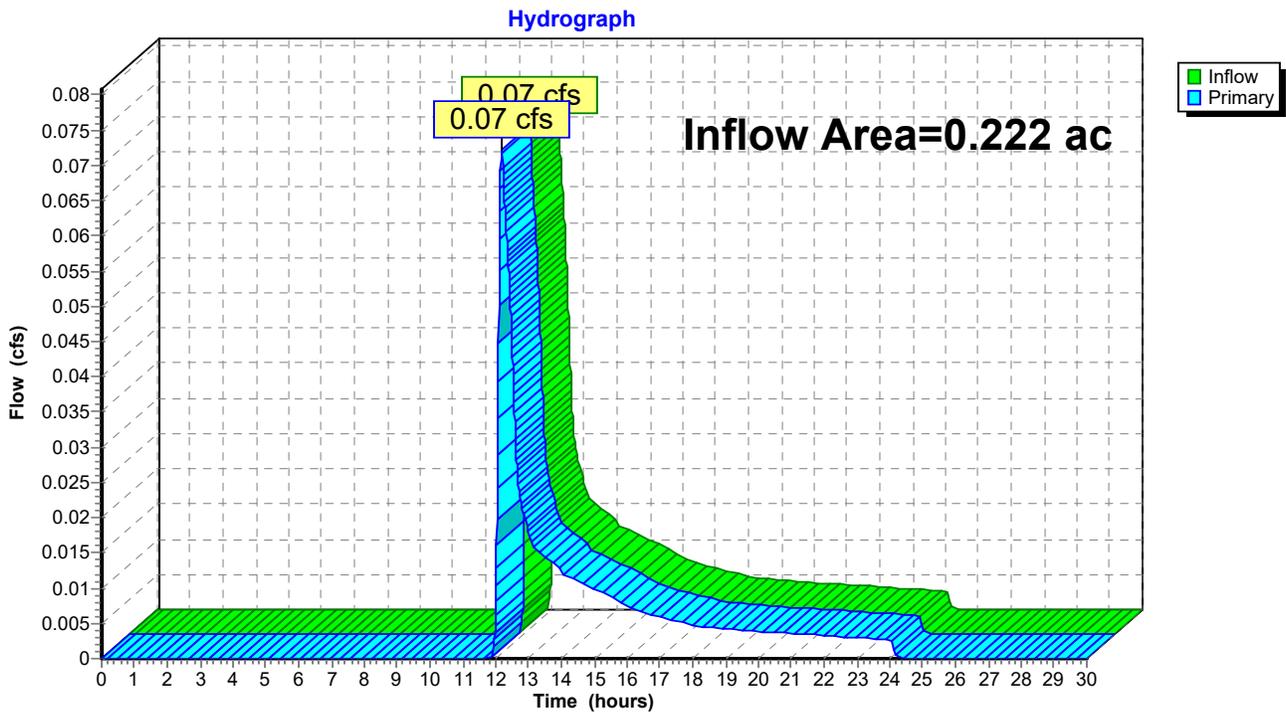


### Summary for Link 28L: Design Point #3b: Flow to Eastern Abutter

Inflow Area = 0.222 ac, 29.03% Impervious, Inflow Depth = 0.48" for 2-YR event  
Inflow = 0.07 cfs @ 12.18 hrs, Volume= 0.009 af  
Primary = 0.07 cfs @ 12.18 hrs, Volume= 0.009 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs

### Link 28L: Design Point #3b: Flow to Eastern Abutter



## HydroCAD2

Type III 24-hr 10-YR Rainfall=4.70"

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Time span=0.00-30.00 hrs, dt=0.01 hrs, 3001 points  
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN  
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

### Subcatchment 27S: E3b

Runoff Area=9,663 sf 29.03% Impervious Runoff Depth=1.26"  
Flow Length=127' Tc=10.0 min CN=62 Runoff=0.26 cfs 0.023 af

### Link 28L: Design Point #3b: Flow to Eastern Abutter

Inflow=0.26 cfs 0.023 af  
Primary=0.26 cfs 0.023 af

**Total Runoff Area = 0.222 ac Runoff Volume = 0.023 af Average Runoff Depth = 1.26"**  
**70.97% Pervious = 0.157 ac 29.03% Impervious = 0.064 ac**

**Summary for Subcatchment 27S: E3b**

Runoff = 0.26 cfs @ 12.15 hrs, Volume= 0.023 af, Depth= 1.26"

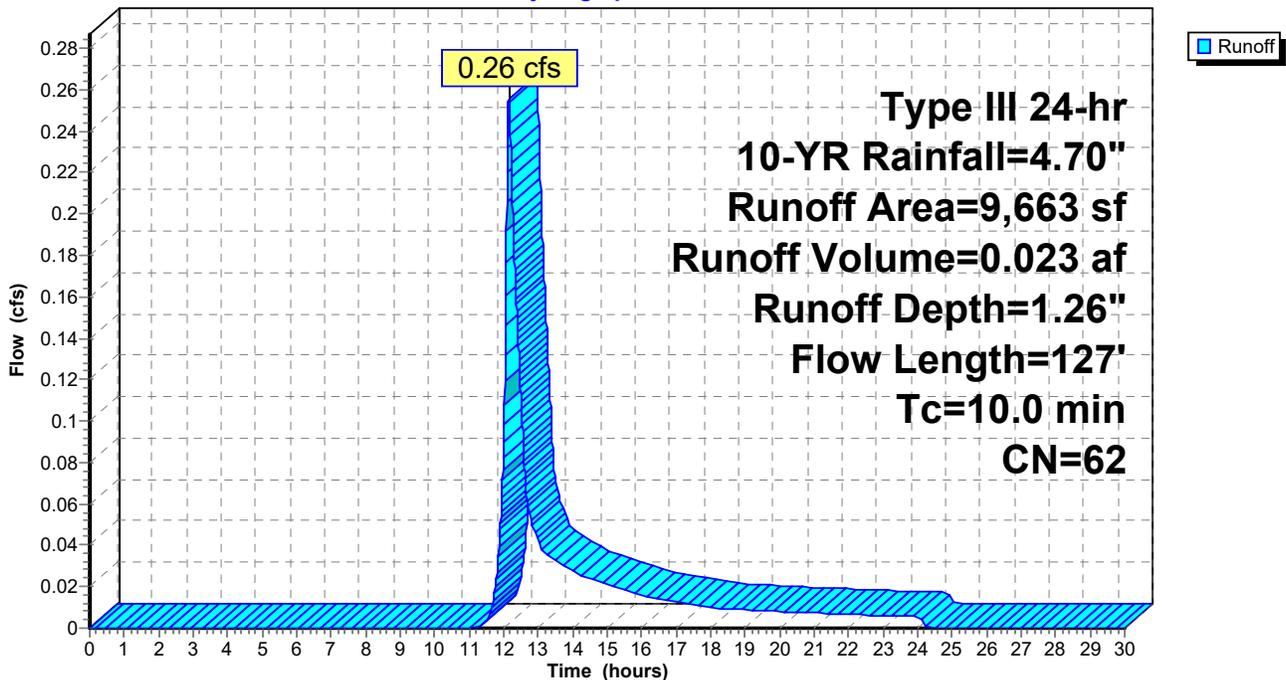
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
Type III 24-hr 10-YR Rainfall=4.70"

Area (sf)	CN	Description
2,805	98	Roofs, HSG B
* 151	90	Gravel, HSG B
1,940	61	>75% Grass cover, Good, HSG B
2,700	30	Woods, Good, HSG A
2,067	55	Woods, Good, HSG B
9,663	62	Weighted Average
6,858		70.97% Pervious Area
2,805		29.03% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.4	42	0.0100	0.07		<b>Sheet Flow,</b> Grass: Dense n= 0.240 P2= 3.20"
0.6	85	0.1300	2.52		<b>Shallow Concentrated Flow,</b> Short Grass Pasture Kv= 7.0 fps
10.0	127	Total			

**Subcatchment 27S: E3b**

Hydrograph

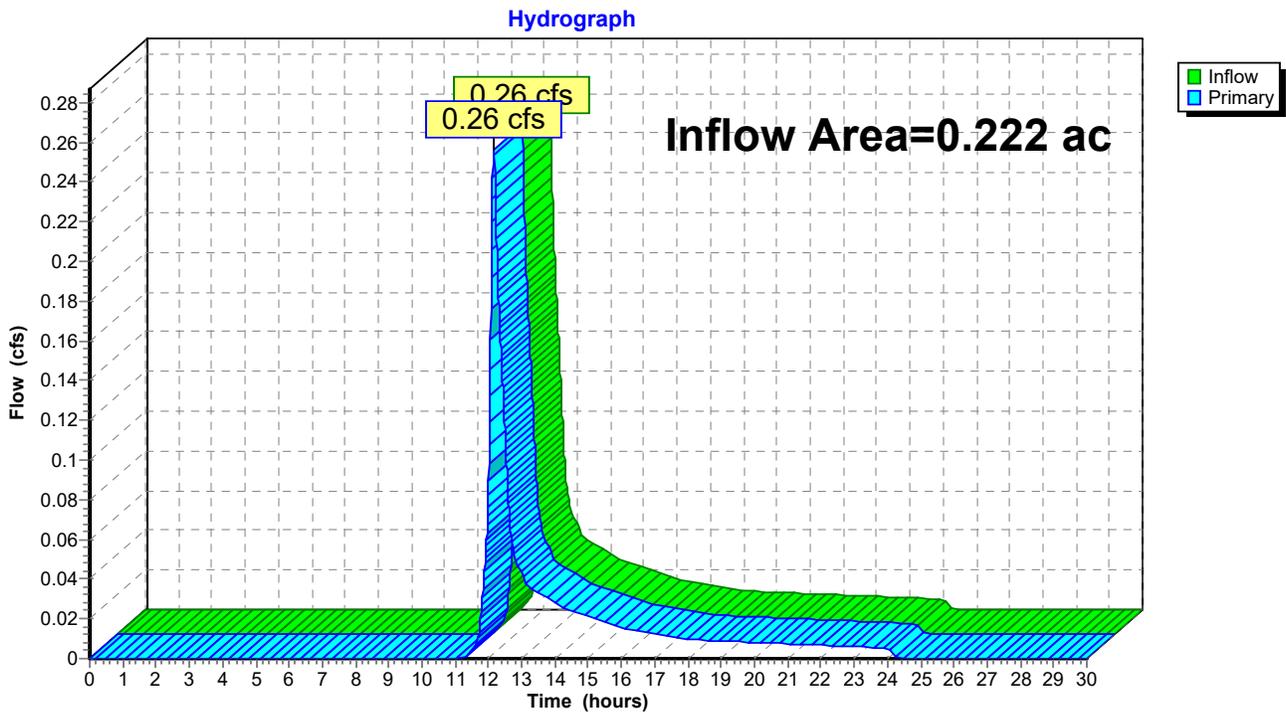


### Summary for Link 28L: Design Point #3b: Flow to Eastern Abutter

Inflow Area = 0.222 ac, 29.03% Impervious, Inflow Depth = 1.26" for 10-YR event  
Inflow = 0.26 cfs @ 12.15 hrs, Volume= 0.023 af  
Primary = 0.26 cfs @ 12.15 hrs, Volume= 0.023 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs

### Link 28L: Design Point #3b: Flow to Eastern Abutter



## HydroCAD2

Type III 24-hr 25-YR Rainfall=5.50"

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Time span=0.00-30.00 hrs, dt=0.01 hrs, 3001 points  
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN  
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

### Subcatchment27S: E3b

Runoff Area=9,663 sf 29.03% Impervious Runoff Depth=1.76"  
Flow Length=127' Tc=10.0 min CN=62 Runoff=0.37 cfs 0.032 af

### Link 28L: Design Point #3b: Flow to Eastern Abutter

Inflow=0.37 cfs 0.032 af  
Primary=0.37 cfs 0.032 af

**Total Runoff Area = 0.222 ac Runoff Volume = 0.032 af Average Runoff Depth = 1.76"**  
**70.97% Pervious = 0.157 ac 29.03% Impervious = 0.064 ac**

**Summary for Subcatchment 27S: E3b**

Runoff = 0.37 cfs @ 12.15 hrs, Volume= 0.032 af, Depth= 1.76"

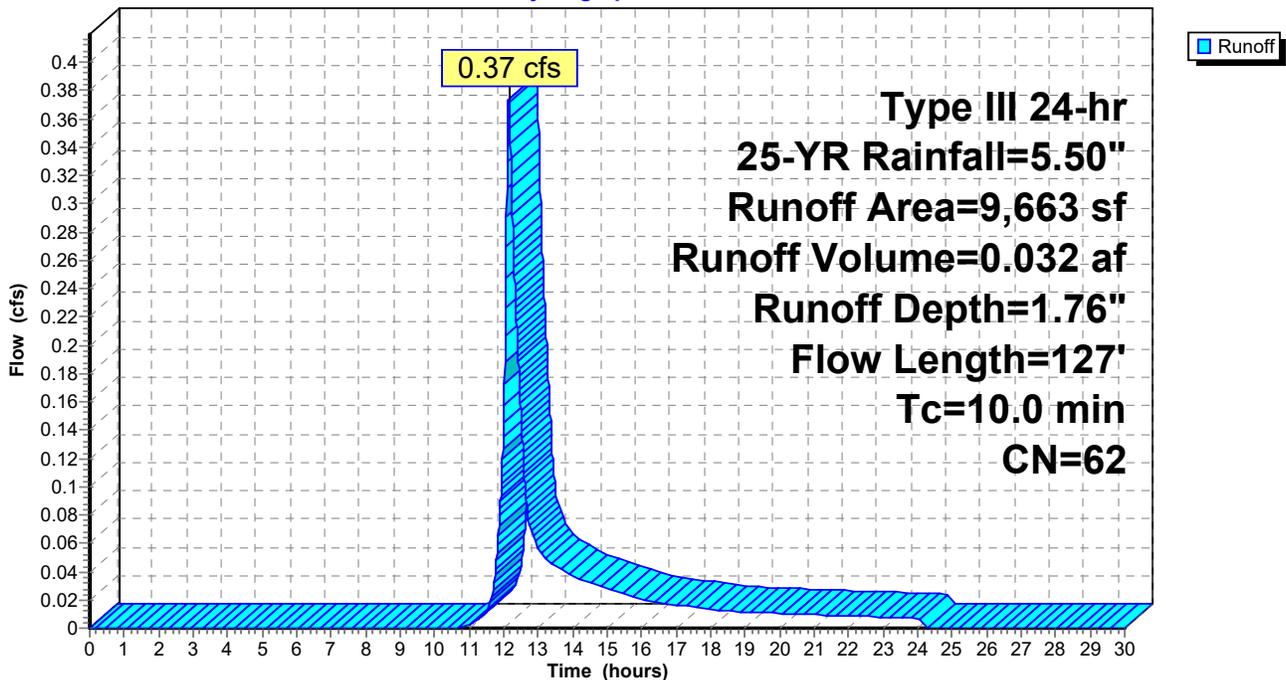
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
 Type III 24-hr 25-YR Rainfall=5.50"

Area (sf)	CN	Description
2,805	98	Roofs, HSG B
* 151	90	Gravel, HSG B
1,940	61	>75% Grass cover, Good, HSG B
2,700	30	Woods, Good, HSG A
2,067	55	Woods, Good, HSG B
9,663	62	Weighted Average
6,858		70.97% Pervious Area
2,805		29.03% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.4	42	0.0100	0.07		<b>Sheet Flow,</b> Grass: Dense n= 0.240 P2= 3.20"
0.6	85	0.1300	2.52		<b>Shallow Concentrated Flow,</b> Short Grass Pasture Kv= 7.0 fps
10.0	127	Total			

**Subcatchment 27S: E3b**

Hydrograph

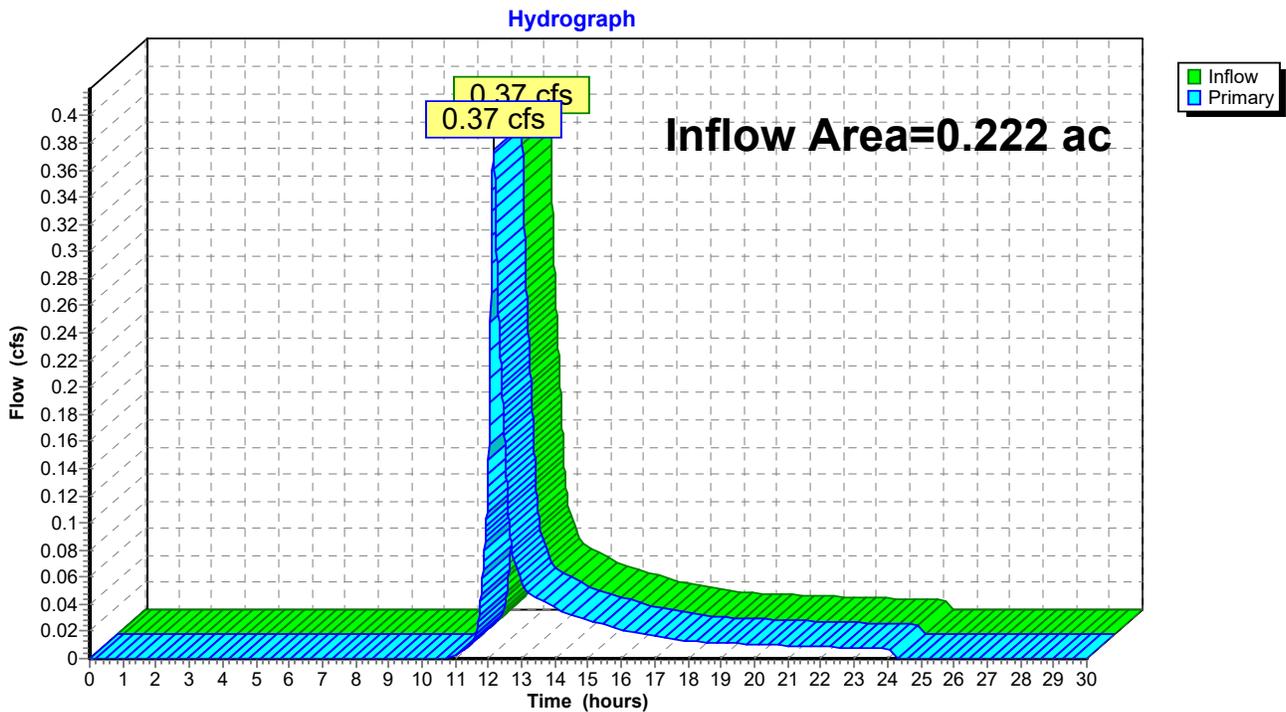


### Summary for Link 28L: Design Point #3b: Flow to Eastern Abutter

Inflow Area = 0.222 ac, 29.03% Impervious, Inflow Depth = 1.76" for 25-YR event  
Inflow = 0.37 cfs @ 12.15 hrs, Volume= 0.032 af  
Primary = 0.37 cfs @ 12.15 hrs, Volume= 0.032 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs

### Link 28L: Design Point #3b: Flow to Eastern Abutter



## HydroCAD2

Type III 24-hr 50-YR Rainfall=6.10"

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Time span=0.00-30.00 hrs, dt=0.01 hrs, 3001 points  
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN  
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

### Subcatchment 27S: E3b

Runoff Area=9,663 sf 29.03% Impervious Runoff Depth=2.16"  
Flow Length=127' Tc=10.0 min CN=62 Runoff=0.47 cfs 0.040 af

### Link 28L: Design Point #3b: Flow to Eastern Abutter

Inflow=0.47 cfs 0.040 af  
Primary=0.47 cfs 0.040 af

**Total Runoff Area = 0.222 ac Runoff Volume = 0.040 af Average Runoff Depth = 2.16"**  
**70.97% Pervious = 0.157 ac 29.03% Impervious = 0.064 ac**

**Summary for Subcatchment 27S: E3b**

Runoff = 0.47 cfs @ 12.15 hrs, Volume= 0.040 af, Depth= 2.16"

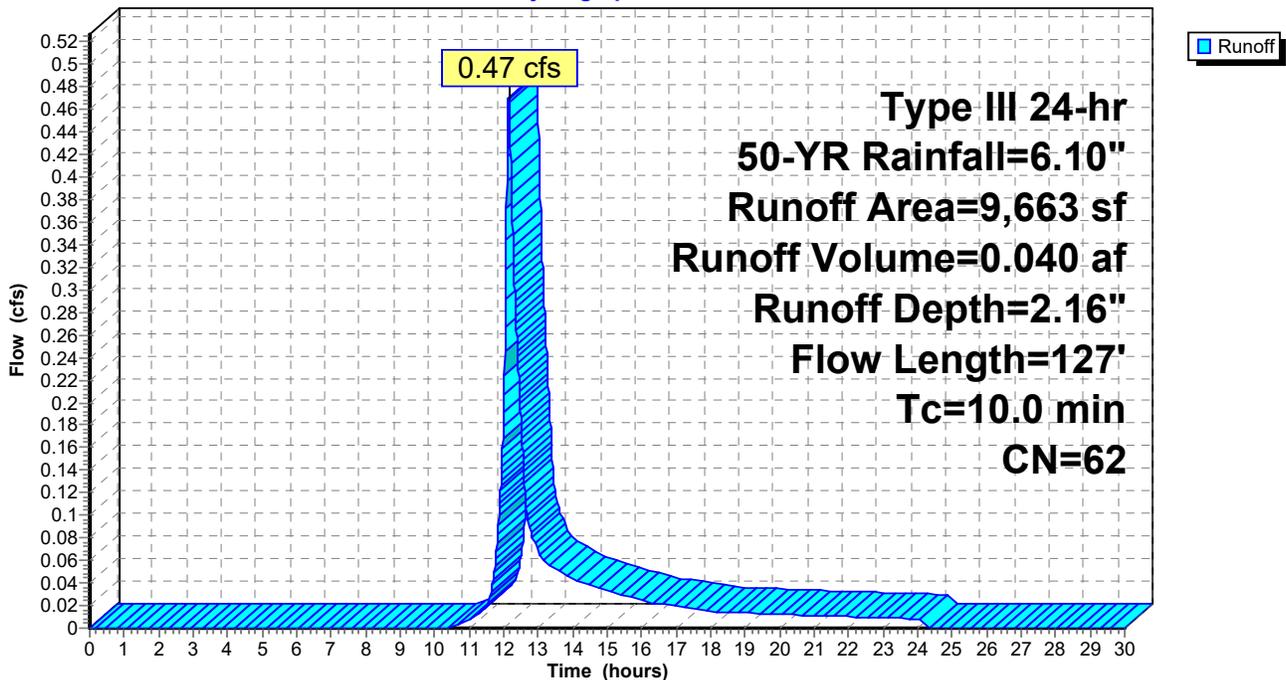
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
Type III 24-hr 50-YR Rainfall=6.10"

Area (sf)	CN	Description
2,805	98	Roofs, HSG B
* 151	90	Gravel, HSG B
1,940	61	>75% Grass cover, Good, HSG B
2,700	30	Woods, Good, HSG A
2,067	55	Woods, Good, HSG B
9,663	62	Weighted Average
6,858		70.97% Pervious Area
2,805		29.03% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.4	42	0.0100	0.07		Sheet Flow, Grass: Dense n= 0.240 P2= 3.20"
0.6	85	0.1300	2.52		Shallow Concentrated Flow, Short Grass Pasture Kv= 7.0 fps
10.0	127	Total			

**Subcatchment 27S: E3b**

Hydrograph

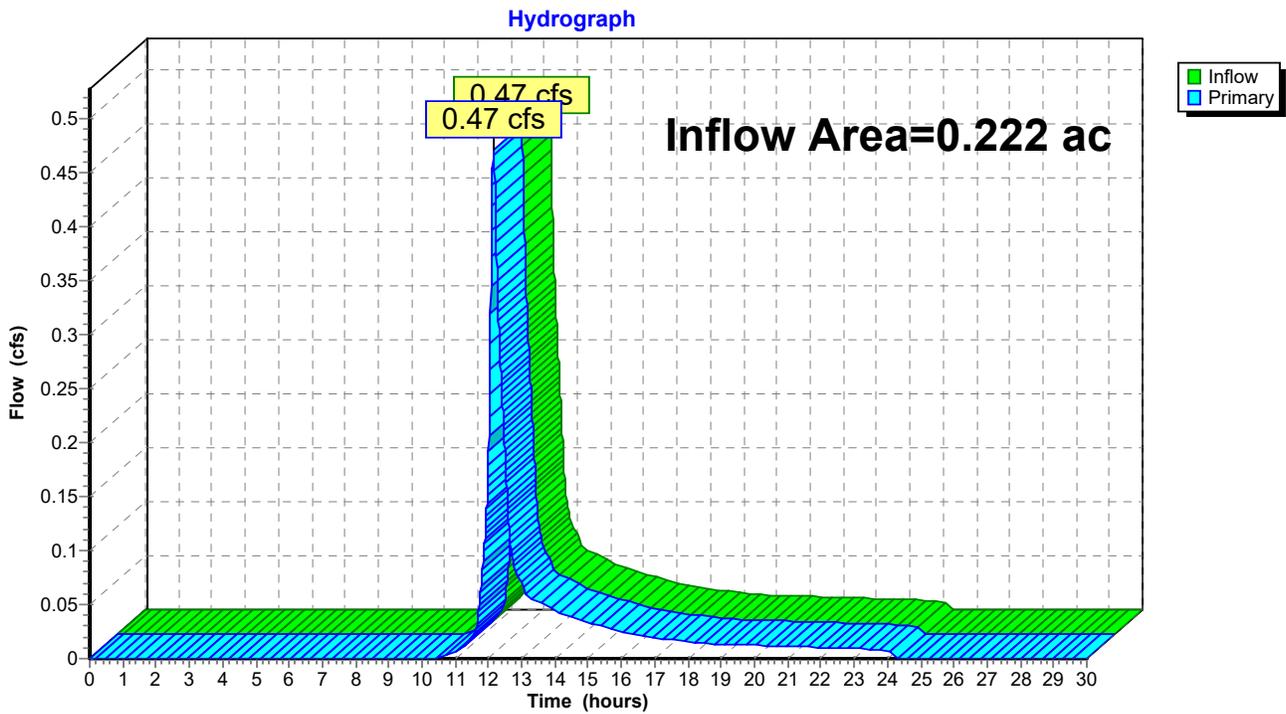


### Summary for Link 28L: Design Point #3b: Flow to Eastern Abutter

Inflow Area = 0.222 ac, 29.03% Impervious, Inflow Depth = 2.16" for 50-YR event  
Inflow = 0.47 cfs @ 12.15 hrs, Volume= 0.040 af  
Primary = 0.47 cfs @ 12.15 hrs, Volume= 0.040 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs

### Link 28L: Design Point #3b: Flow to Eastern Abutter



## HydroCAD2

Type III 24-hr 100-YR Rainfall=6.70"

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Time span=0.00-30.00 hrs, dt=0.01 hrs, 3001 points  
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN  
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

### Subcatchment 27S: E3b

Runoff Area=9,663 sf 29.03% Impervious Runoff Depth=2.58"  
Flow Length=127' Tc=10.0 min CN=62 Runoff=0.57 cfs 0.048 af

### Link 28L: Design Point #3b: Flow to Eastern Abutter

Inflow=0.57 cfs 0.048 af  
Primary=0.57 cfs 0.048 af

**Total Runoff Area = 0.222 ac Runoff Volume = 0.048 af Average Runoff Depth = 2.58"**  
**70.97% Pervious = 0.157 ac 29.03% Impervious = 0.064 ac**

**Summary for Subcatchment 27S: E3b**

Runoff = 0.57 cfs @ 12.15 hrs, Volume= 0.048 af, Depth= 2.58"

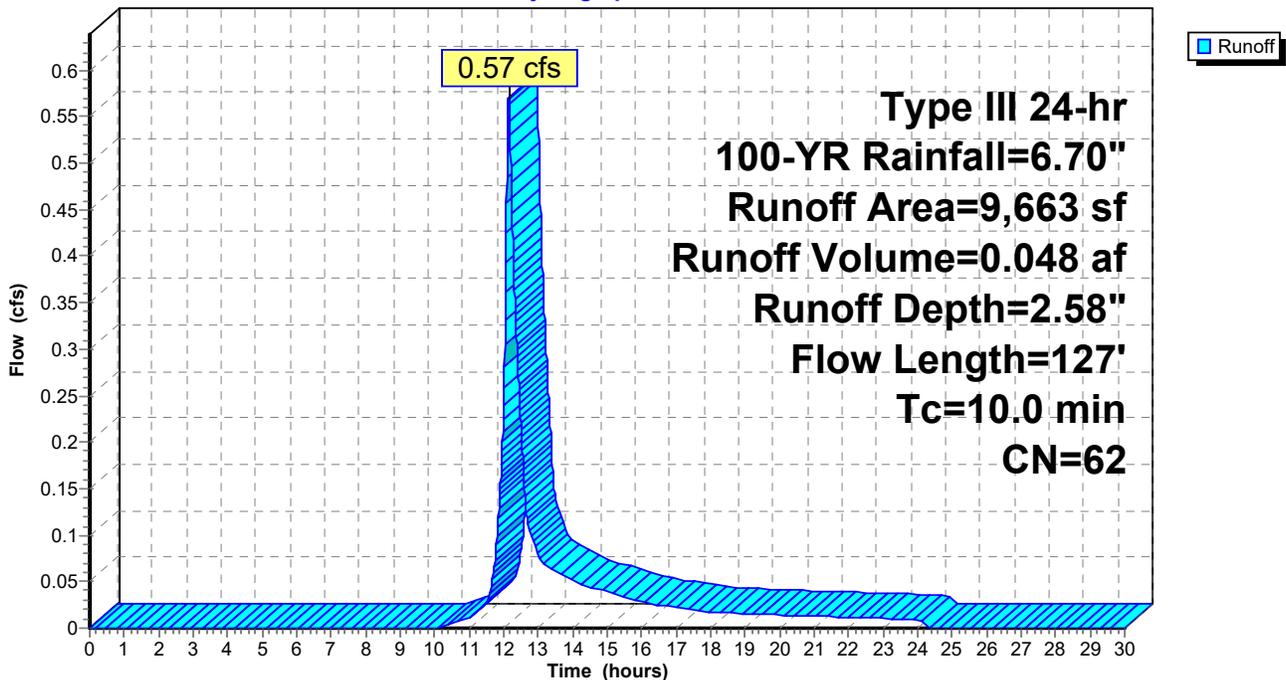
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
 Type III 24-hr 100-YR Rainfall=6.70"

Area (sf)	CN	Description
2,805	98	Roofs, HSG B
* 151	90	Gravel, HSG B
1,940	61	>75% Grass cover, Good, HSG B
2,700	30	Woods, Good, HSG A
2,067	55	Woods, Good, HSG B
9,663	62	Weighted Average
6,858		70.97% Pervious Area
2,805		29.03% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.4	42	0.0100	0.07		<b>Sheet Flow,</b> Grass: Dense n= 0.240 P2= 3.20"
0.6	85	0.1300	2.52		<b>Shallow Concentrated Flow,</b> Short Grass Pasture Kv= 7.0 fps
10.0	127	Total			

**Subcatchment 27S: E3b**

Hydrograph

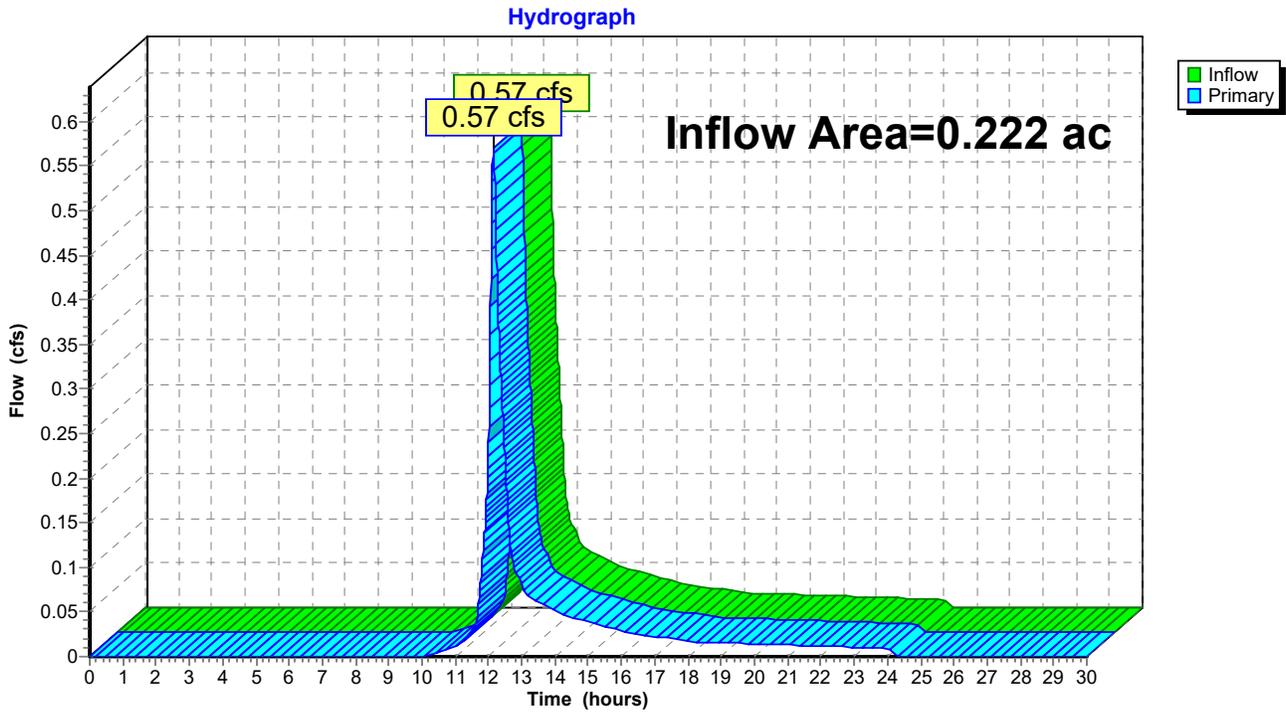


### Summary for Link 28L: Design Point #3b: Flow to Eastern Abutter

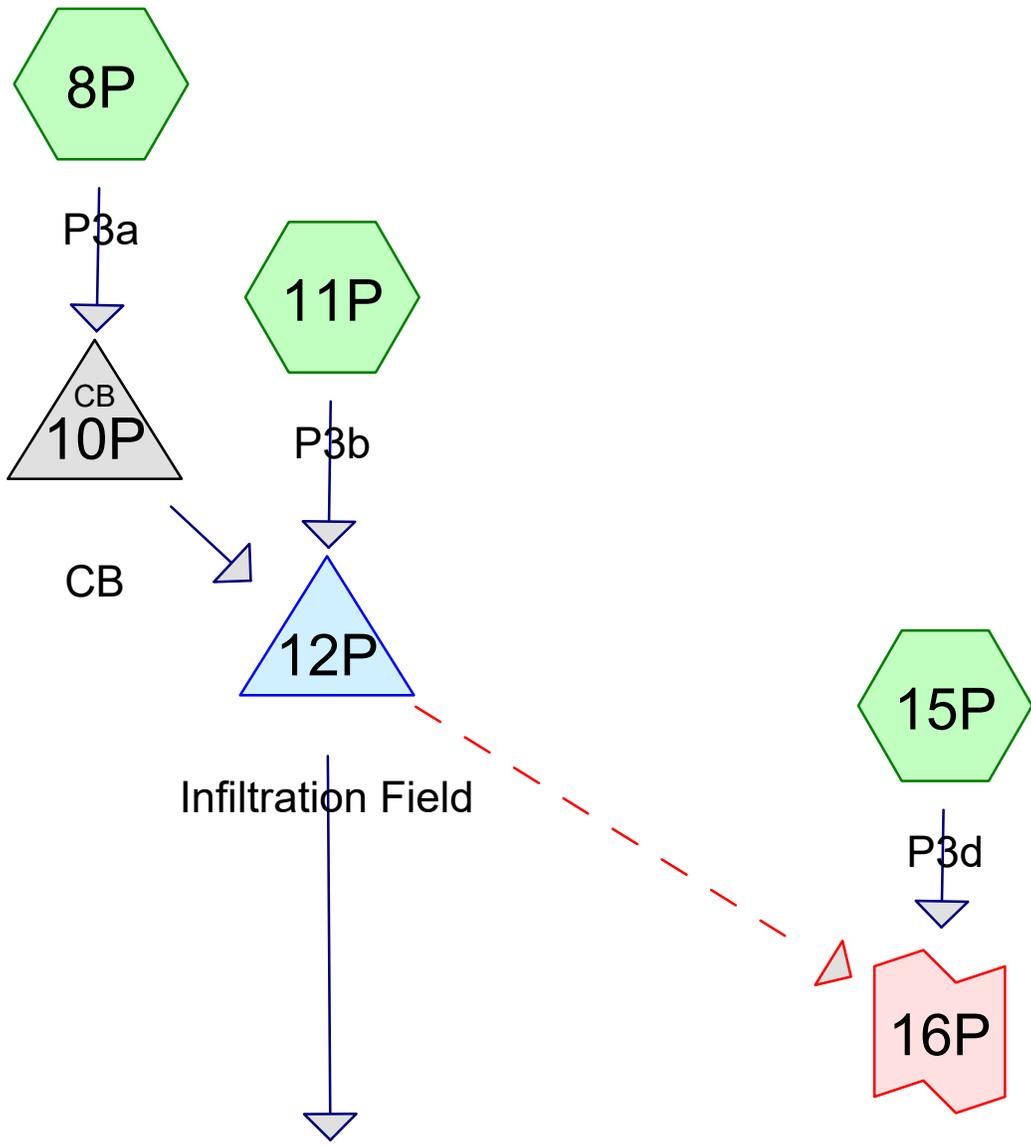
Inflow Area = 0.222 ac, 29.03% Impervious, Inflow Depth = 2.58" for 100-YR event  
Inflow = 0.57 cfs @ 12.15 hrs, Volume= 0.048 af  
Primary = 0.57 cfs @ 12.15 hrs, Volume= 0.048 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs

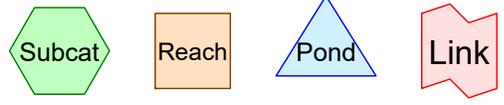
### Link 28L: Design Point #3b: Flow to Eastern Abutter



**DESIGN POINT #3b: FLOW TO EASTERN  
ABUTTER PROPOSED CONDITIONS**



Design Point #3b: Flow to Eastern Abutter



## HydroCAD Revised2

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### Area Listing (selected nodes)

Area (acres)	CN	Description (subcatchment-numbers)
0.006	39	>75% Grass cover, Good, HSG A (15P)
0.178	61	>75% Grass cover, Good, HSG B (8P, 15P)
0.223	98	Paved parking, HSG B (8P, 15P)
0.128	98	Roofs, HSG B (11P)
<b>0.535</b>	<b>85</b>	<b>TOTAL AREA</b>

## HydroCAD Revised2

Type III 24-hr 2-YR Rainfall=3.20"

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Time span=0.00-30.00 hrs, dt=0.01 hrs, 3001 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 8P: P3a

Runoff Area=14,343 sf 65.80% Impervious Runoff Depth=1.76"  
Flow Length=229' Tc=10.0 min CN=85 Runoff=0.59 cfs 0.048 af

### Pond 10P: CB

Peak Elev=182.01' Inflow=0.59 cfs 0.048 af  
12.0" Round Culvert n=0.011 L=75.0' S=0.0000 '/ Outflow=0.59 cfs 0.048 af

### Subcatchment 11P: P3b

Runoff Area=5,586 sf 100.00% Impervious Runoff Depth=2.97"  
Tc=2.0 min CN=98 Runoff=0.46 cfs 0.032 af

### Pond 12P: Infiltration Field

Peak Elev=182.01' Storage=1,065 cf Inflow=0.84 cfs 0.080 af  
Discarded=0.13 cfs 0.078 af Primary=0.00 cfs 0.000 af Secondary=0.03 cfs 0.002 af Outflow=0.16 cfs 0.080 af

### Subcatchment 15P: P3d

Runoff Area=3,373 sf 7.65% Impervious Runoff Depth=0.48"  
Flow Length=90' Slope=0.0900 '/ Tc=4.9 min CN=62 Runoff=0.03 cfs 0.003 af

### Link 16P: Design Point #3b: Flow to Eastern Abutter

Inflow=0.04 cfs 0.005 af  
Primary=0.04 cfs 0.005 af

**Total Runoff Area = 0.535 ac Runoff Volume = 0.083 af Average Runoff Depth = 1.86"**  
**34.42% Pervious = 0.184 ac 65.58% Impervious = 0.351 ac**

# HydroCAD Revised2

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Type III 24-hr 2-YR Rainfall=3.20"

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## Summary for Subcatchment 8P: P3a

Runoff = 0.59 cfs @ 12.14 hrs, Volume= 0.048 af, Depth= 1.76"

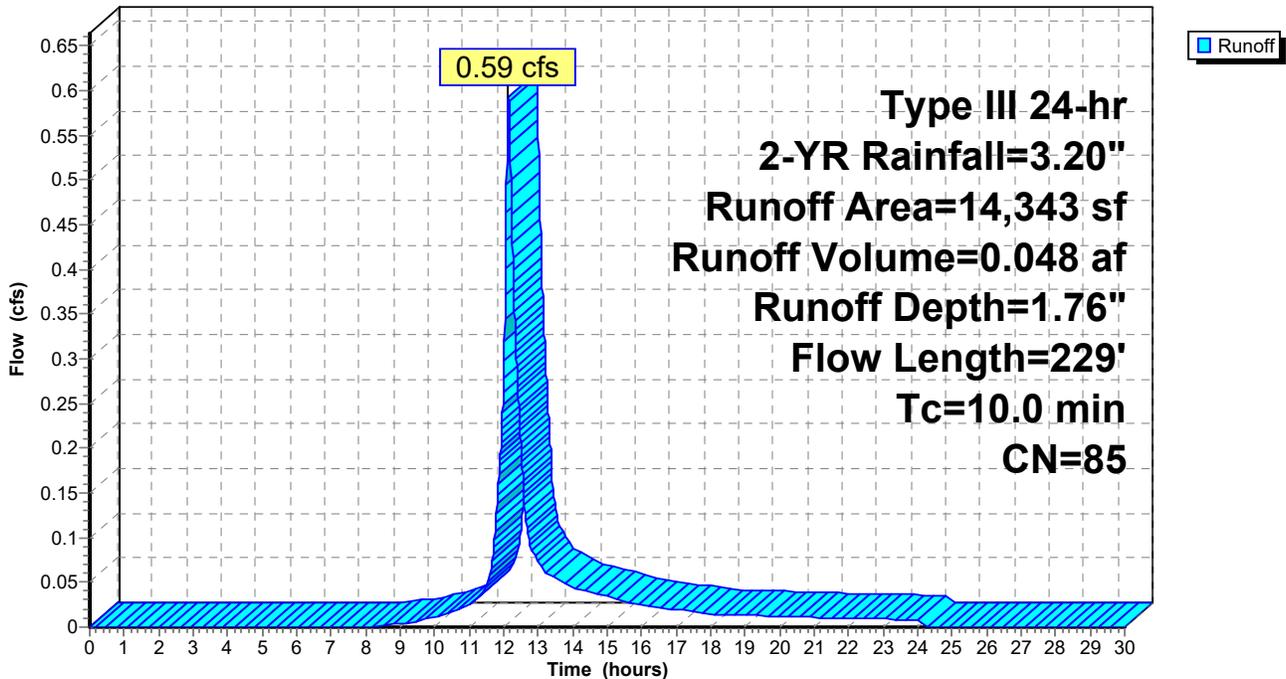
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
Type III 24-hr 2-YR Rainfall=3.20"

Area (sf)	CN	Description
9,437	98	Paved parking, HSG B
4,906	61	>75% Grass cover, Good, HSG B
14,343	85	Weighted Average
4,906		34.20% Pervious Area
9,437		65.80% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.6	63	0.0280	0.12		Sheet Flow, Grass: Dense n= 0.240 P2= 3.20"
1.4	166	0.0100	2.03		Shallow Concentrated Flow, Paved Kv= 20.3 fps
10.0	229	Total			

## Subcatchment 8P: P3a

Hydrograph



**Summary for Pond 10P: CB**

Inflow Area = 0.329 ac, 65.80% Impervious, Inflow Depth = 1.76" for 2-YR event  
 Inflow = 0.59 cfs @ 12.14 hrs, Volume= 0.048 af  
 Outflow = 0.59 cfs @ 12.14 hrs, Volume= 0.048 af, Atten= 0%, Lag= 0.0 min  
 Primary = 0.59 cfs @ 12.14 hrs, Volume= 0.048 af

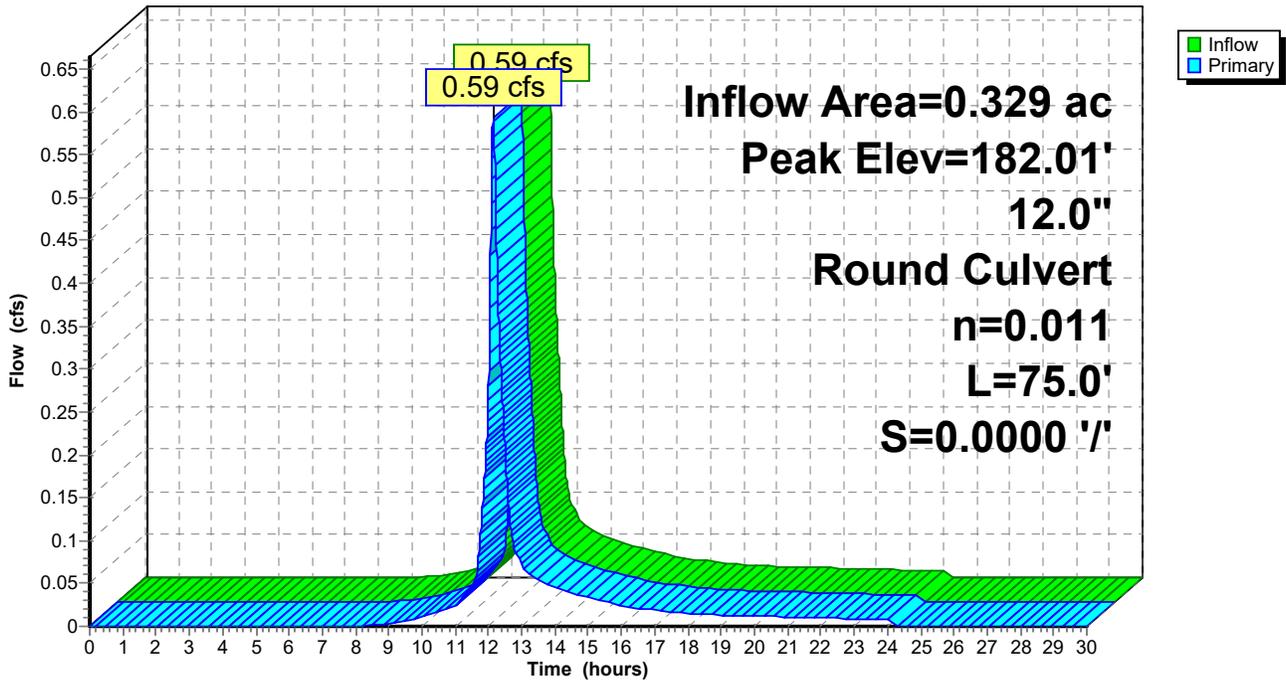
Routing by Dyn-Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
 Peak Elev= 182.01' @ 12.65 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	180.60'	<b>12.0" Round Culvert</b> L= 75.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 180.60' / 180.60' S= 0.0000 '/ Cc= 0.900 n= 0.011, Flow Area= 0.79 sf

**Primary OutFlow** Max=0.45 cfs @ 12.14 hrs HW=181.77' TW=181.75' (Dynamic Tailwater)  
 ↳ **1=Culvert** (Outlet Controls 0.45 cfs @ 0.62 fps)

**Pond 10P: CB**

Hydrograph



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Type III 24-hr 2-YR Rainfall=3.20"

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## Summary for Subcatchment 11P: P3b

Runoff = 0.46 cfs @ 12.03 hrs, Volume= 0.032 af, Depth= 2.97"

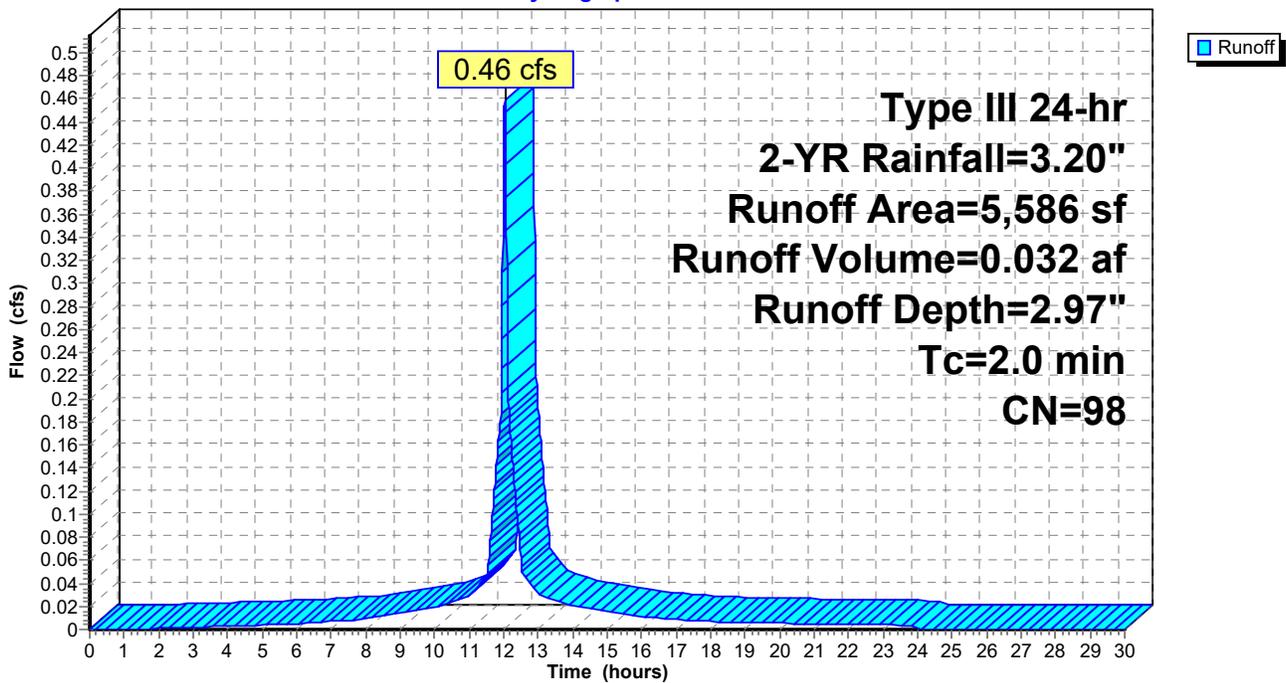
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
Type III 24-hr 2-YR Rainfall=3.20"

Area (sf)	CN	Description
5,586	98	Roofs, HSG B
5,586		100.00% Impervious Area

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

## Subcatchment 11P: P3b

Hydrograph



**Summary for Pond 12P: Infiltration Field**

Inflow Area = 0.458 ac, 75.38% Impervious, Inflow Depth = 2.10" for 2-YR event  
 Inflow = 0.84 cfs @ 12.08 hrs, Volume= 0.080 af  
 Outflow = 0.16 cfs @ 12.65 hrs, Volume= 0.080 af, Atten= 81%, Lag= 34.0 min  
 Discarded = 0.13 cfs @ 11.97 hrs, Volume= 0.078 af  
 Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af  
 Secondary = 0.03 cfs @ 12.65 hrs, Volume= 0.002 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
 Peak Elev= 182.01' @ 12.65 hrs Surf.Area= 2,377 sf Storage= 1,065 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)  
 Center-of-Mass det. time= 51.3 min ( 850.6 - 799.2 )

Volume	Invert	Avail.Storage	Storage Description
#1A	181.20'	1,454 cf	<b>72.00'W x 32.83'L x 2.04'H Field A</b> 4,826 cf Overall - 1,192 cf Embedded = 3,634 cf x 40.0% Voids
#2A	181.70'	1,192 cf	<b>Cultec C-100HD</b> x 84 Inside #1 Effective Size= 32.1"W x 12.0"H => 1.86 sf x 7.50'L = 14.0 cf Overall Size= 36.0"W x 12.5"H x 8.00'L with 0.50' Overlap Row Length Adjustment= +0.50' x 1.86 sf x 21 rows
#3	181.40'	38 cf	<b>4.00'D x 3.00'H Vertical Cone/Cylinder</b>
		2,684 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	181.20'	<b>2.410 in/hr Exfiltration over Surface area</b>
#2	Secondary	181.88'	<b>4.0" Round Culvert</b> L= 7.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 181.88' / 181.00' S= 0.1257 '/' Cc= 0.900 n= 0.011, Flow Area= 0.09 sf
#3	Primary	183.30'	<b>Trench Drain, Cv= 2.62 (C= 3.28)</b> Elev. (feet) 183.30 183.40 Width (feet) 20.00 20.00

**Discarded OutFlow** Max=0.13 cfs @ 11.97 hrs HW=181.40' (Free Discharge)

↑1=Exfiltration (Exfiltration Controls 0.13 cfs)

**Primary OutFlow** Max=0.00 cfs @ 0.00 hrs HW=181.20' TW=0.00' (Dynamic Tailwater)

↑3=Trench Drain ( Controls 0.00 cfs)

**Secondary OutFlow** Max=0.03 cfs @ 12.65 hrs HW=182.01' TW=0.00' (Dynamic Tailwater)

↑2=Culvert (Inlet Controls 0.03 cfs @ 0.96 fps)

**Pond 12P: Infiltration Field - Chamber Wizard Field A**

**Chamber Model = Cultec C-100HD (Cultec Contactor® 100HD)**

Effective Size= 32.1"W x 12.0"H => 1.86 sf x 7.50'L = 14.0 cf

Overall Size= 36.0"W x 12.5"H x 8.00'L with 0.50' Overlap

Row Length Adjustment= +0.50' x 1.86 sf x 21 rows

36.0" Wide + 4.0" Spacing = 40.0" C-C Row Spacing

4 Chambers/Row x 7.50' Long +0.50' Row Adjustment = 30.50' Row Length +14.0" End Stone x 2 = 32.83' Base Length

21 Rows x 36.0" Wide + 4.0" Spacing x 20 + 14.0" Side Stone x 2 = 72.00' Base Width

6.0" Base + 12.5" Chamber Height + 6.0" Cover = 2.04' Field Height

84 Chambers x 14.0 cf +0.50' Row Adjustment x 1.86 sf x 21 Rows = 1,192.3 cf Chamber Storage

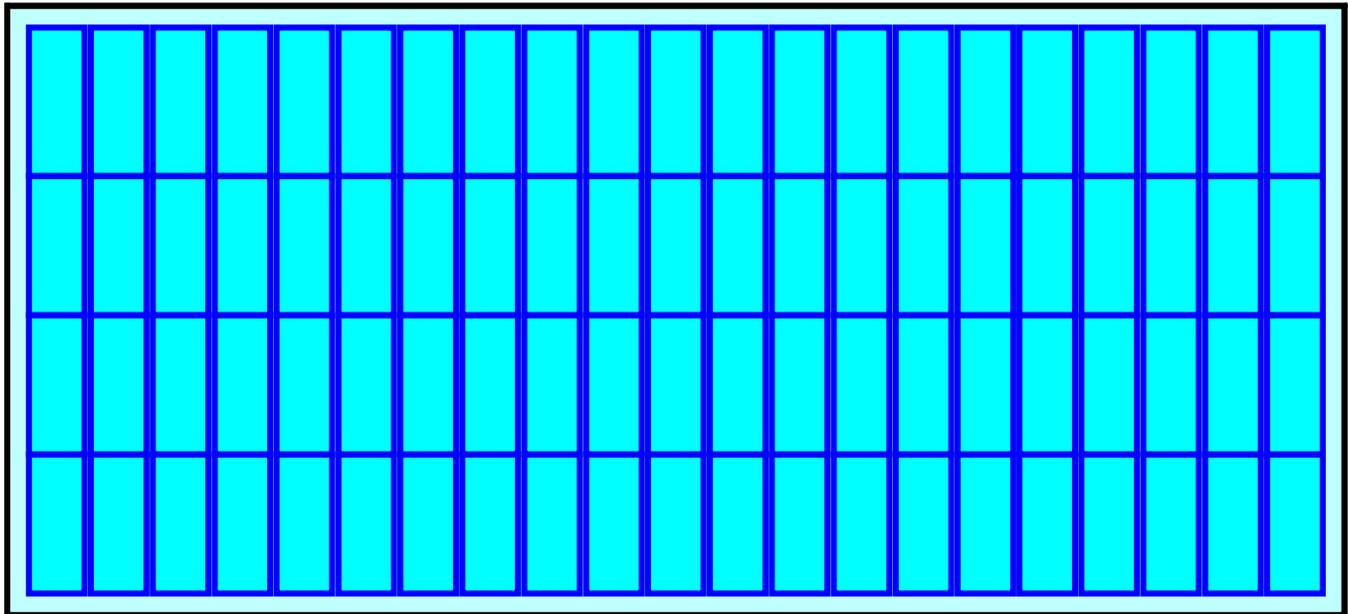
4,826.5 cf Field - 1,192.3 cf Chambers = 3,634.2 cf Stone x 40.0% Voids = 1,453.7 cf Stone Storage

Chamber Storage + Stone Storage = 2,646.0 cf = 0.061 af

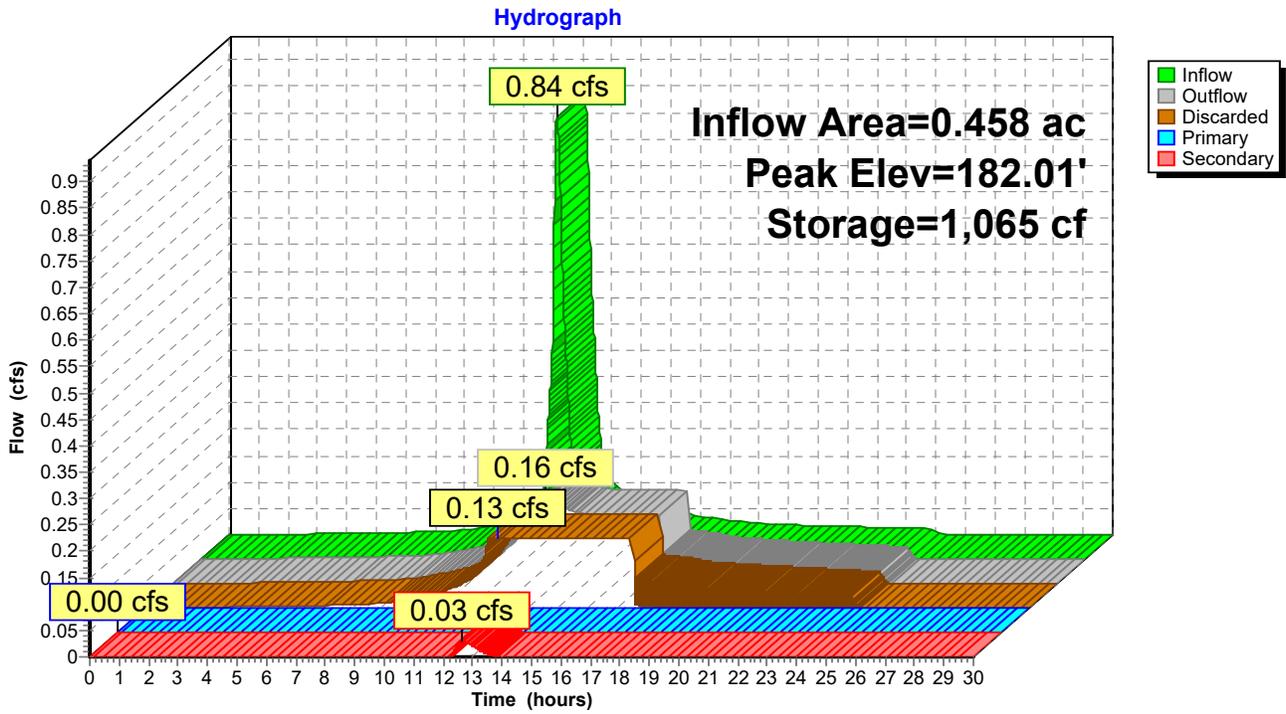
Overall Storage Efficiency = 54.8%

Overall System Size = 32.83' x 72.00' x 2.04'

84 Chambers  
178.8 cy Field  
134.6 cy Stone



### Pond 12P: Infiltration Field



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Type III 24-hr 2-YR Rainfall=3.20"

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**Summary for Subcatchment 15P: P3d**

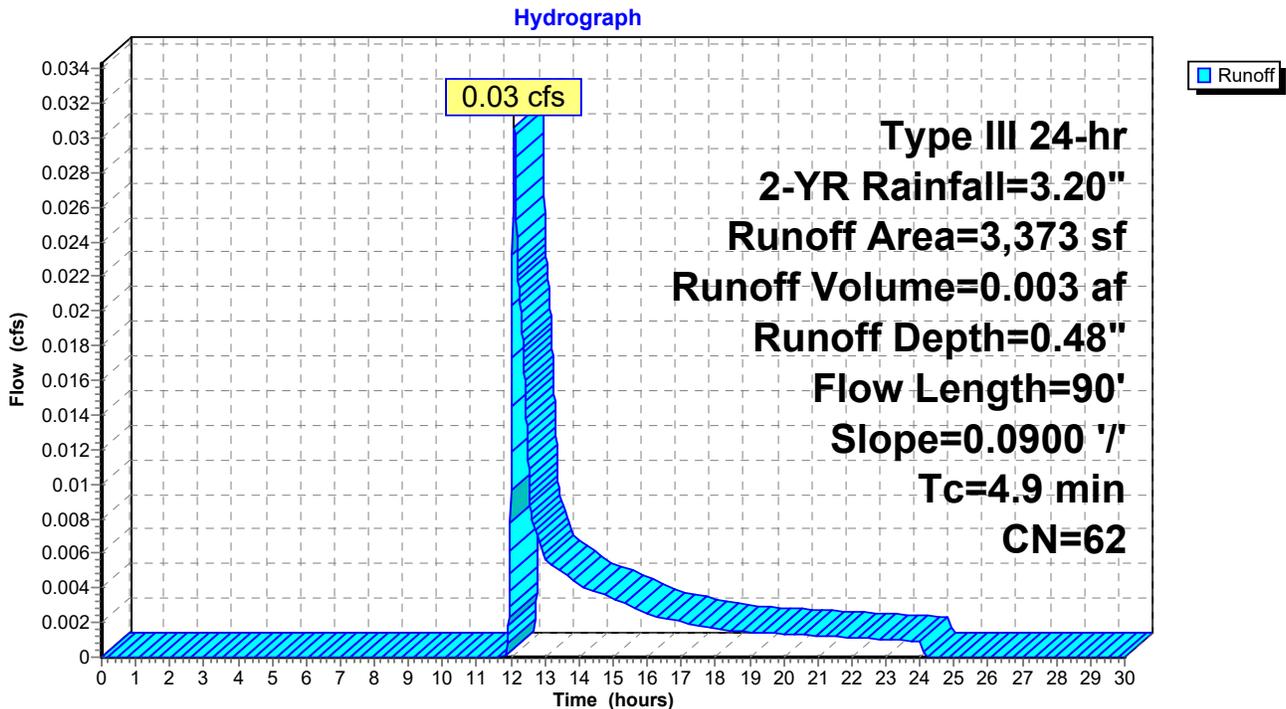
Runoff = 0.03 cfs @ 12.10 hrs, Volume= 0.003 af, Depth= 0.48"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
Type III 24-hr 2-YR Rainfall=3.20"

Area (sf)	CN	Description
258	98	Paved parking, HSG B
272	39	>75% Grass cover, Good, HSG A
2,843	61	>75% Grass cover, Good, HSG B
3,373	62	Weighted Average
3,115		92.35% Pervious Area
258		7.65% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.9	90	0.0900	0.30		Sheet Flow, Grass: Short n= 0.150 P2= 3.20"

**Subcatchment 15P: P3d**

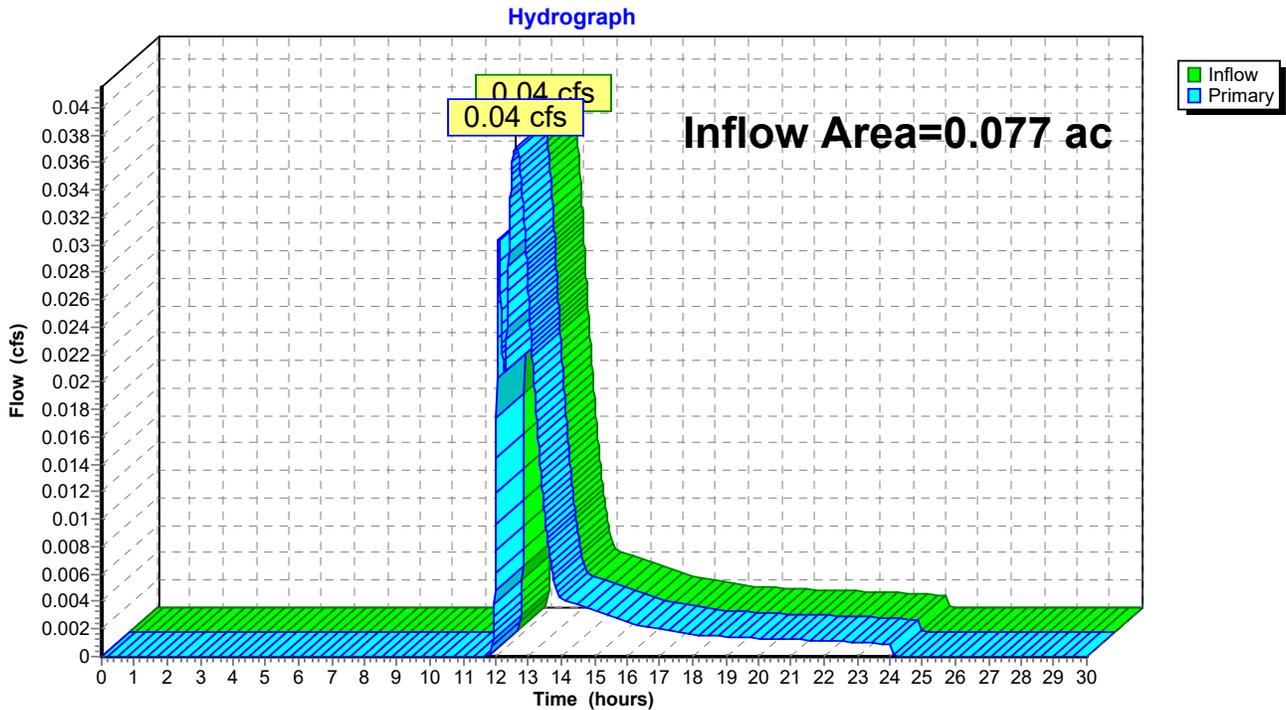


### Summary for Link 16P: Design Point #3b: Flow to Eastern Abutter

Inflow Area = 0.077 ac, 7.65% Impervious, Inflow Depth = 0.77" for 2-YR event  
Inflow = 0.04 cfs @ 12.62 hrs, Volume= 0.005 af  
Primary = 0.04 cfs @ 12.62 hrs, Volume= 0.005 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs

### Link 16P: Design Point #3b: Flow to Eastern Abutter



## HydroCAD Revised2

Type III 24-hr 10-YR Rainfall=4.70"

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Time span=0.00-30.00 hrs, dt=0.01 hrs, 3001 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 8P: P3a

Runoff Area=14,343 sf 65.80% Impervious Runoff Depth=3.09"  
Flow Length=229' Tc=10.0 min CN=85 Runoff=1.04 cfs 0.085 af

### Pond 10P: CB

Peak Elev=182.46' Inflow=1.04 cfs 0.085 af  
12.0" Round Culvert n=0.011 L=75.0' S=0.0000 '/ Outflow=1.04 cfs 0.085 af

### Subcatchment 11P: P3b

Runoff Area=5,586 sf 100.00% Impervious Runoff Depth=4.46"  
Tc=2.0 min CN=98 Runoff=0.68 cfs 0.048 af

### Pond 12P: Infiltration Field

Peak Elev=182.45' Storage=1,841 cf Inflow=1.39 cfs 0.133 af  
Discarded=0.13 cfs 0.106 af Primary=0.00 cfs 0.000 af Secondary=0.21 cfs 0.026 af Outflow=0.34 cfs 0.133 af

### Subcatchment 15P: P3d

Runoff Area=3,373 sf 7.65% Impervious Runoff Depth=1.26"  
Flow Length=90' Slope=0.0900 '/ Tc=4.9 min CN=62 Runoff=0.11 cfs 0.008 af

### Link 16P: Design Point #3b: Flow to Eastern Abutter

Inflow=0.24 cfs 0.034 af  
Primary=0.24 cfs 0.034 af

**Total Runoff Area = 0.535 ac Runoff Volume = 0.141 af Average Runoff Depth = 3.16"**  
**34.42% Pervious = 0.184 ac 65.58% Impervious = 0.351 ac**

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Type III 24-hr 10-YR Rainfall=4.70"

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## Summary for Subcatchment 8P: P3a

Runoff = 1.04 cfs @ 12.14 hrs, Volume= 0.085 af, Depth= 3.09"

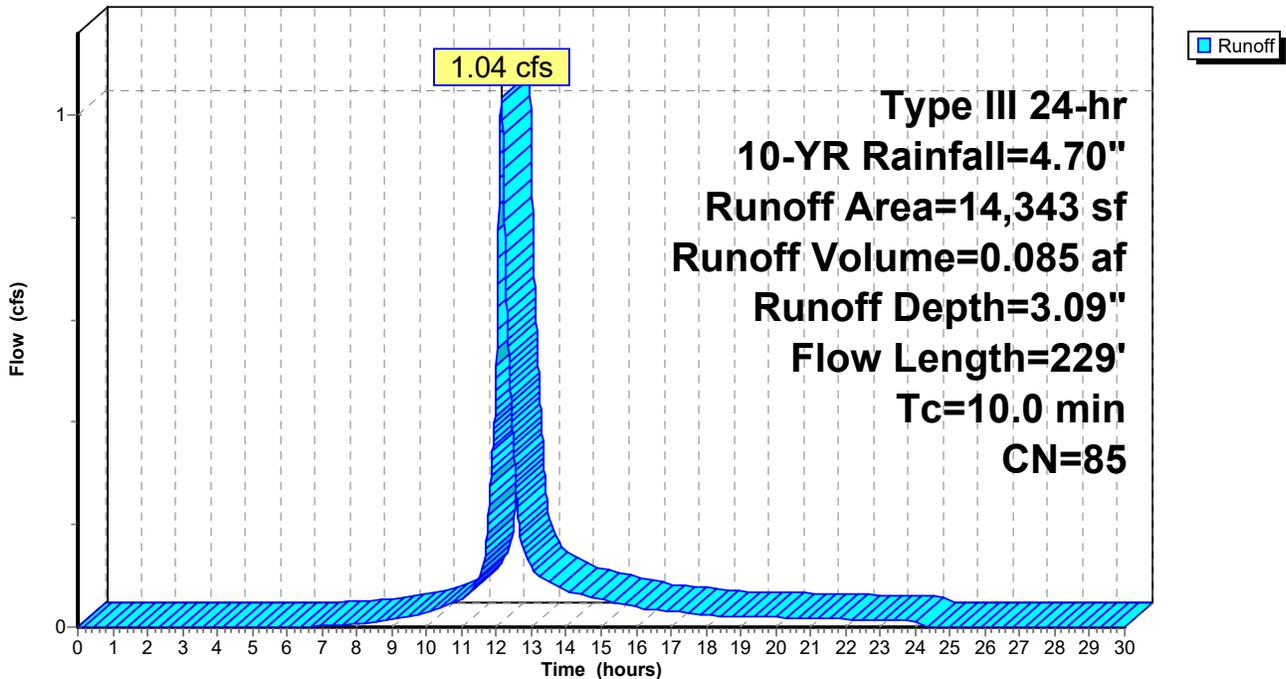
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
Type III 24-hr 10-YR Rainfall=4.70"

Area (sf)	CN	Description
9,437	98	Paved parking, HSG B
4,906	61	>75% Grass cover, Good, HSG B
14,343	85	Weighted Average
4,906		34.20% Pervious Area
9,437		65.80% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.6	63	0.0280	0.12		Sheet Flow, Grass: Dense n= 0.240 P2= 3.20"
1.4	166	0.0100	2.03		Shallow Concentrated Flow, Paved Kv= 20.3 fps
10.0	229	Total			

### Subcatchment 8P: P3a

Hydrograph



**Summary for Pond 10P: CB**

Inflow Area = 0.329 ac, 65.80% Impervious, Inflow Depth = 3.09" for 10-YR event  
 Inflow = 1.04 cfs @ 12.14 hrs, Volume= 0.085 af  
 Outflow = 1.04 cfs @ 12.14 hrs, Volume= 0.085 af, Atten= 0%, Lag= 0.0 min  
 Primary = 1.04 cfs @ 12.14 hrs, Volume= 0.085 af

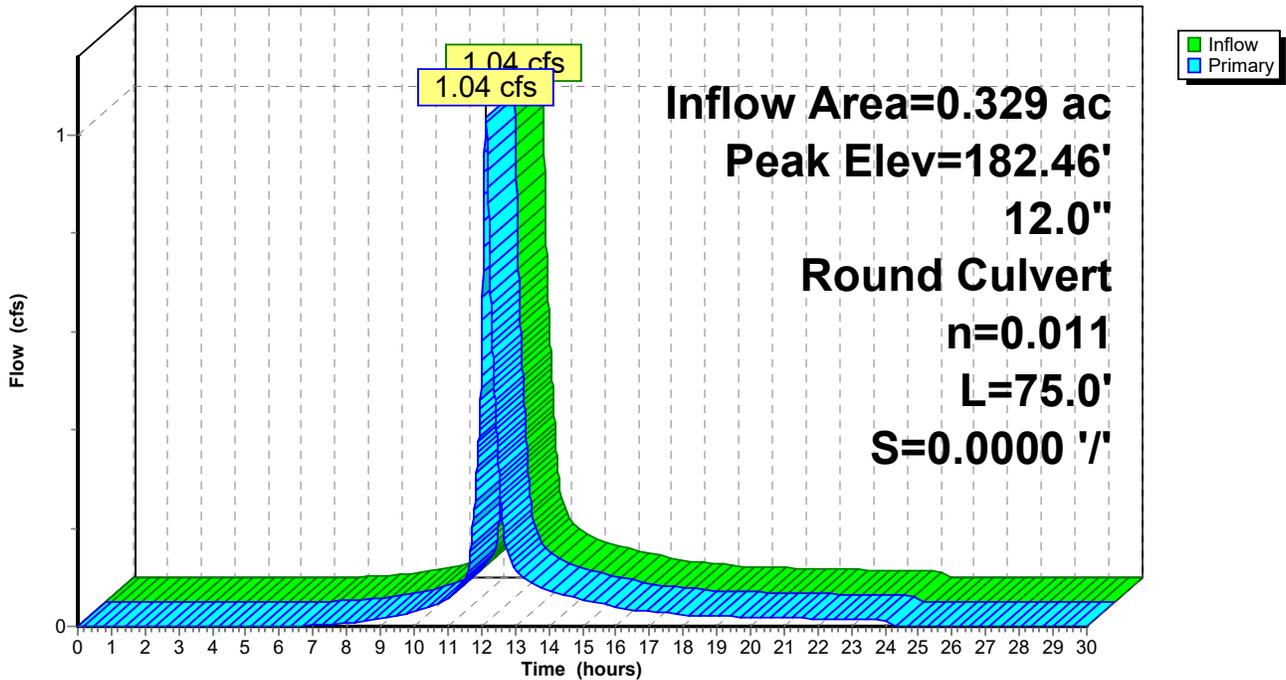
Routing by Dyn-Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
 Peak Elev= 182.46' @ 12.55 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	180.60'	<b>12.0" Round Culvert</b> L= 75.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 180.60' / 180.60' S= 0.0000 '/ Cc= 0.900 n= 0.011, Flow Area= 0.79 sf

**Primary OutFlow** Max=0.89 cfs @ 12.14 hrs HW=182.12' TW=182.06' (Dynamic Tailwater)  
 ←1=Culvert (Outlet Controls 0.89 cfs @ 1.13 fps)

**Pond 10P: CB**

Hydrograph



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Type III 24-hr 10-YR Rainfall=4.70"

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## Summary for Subcatchment 11P: P3b

Runoff = 0.68 cfs @ 12.03 hrs, Volume= 0.048 af, Depth= 4.46"

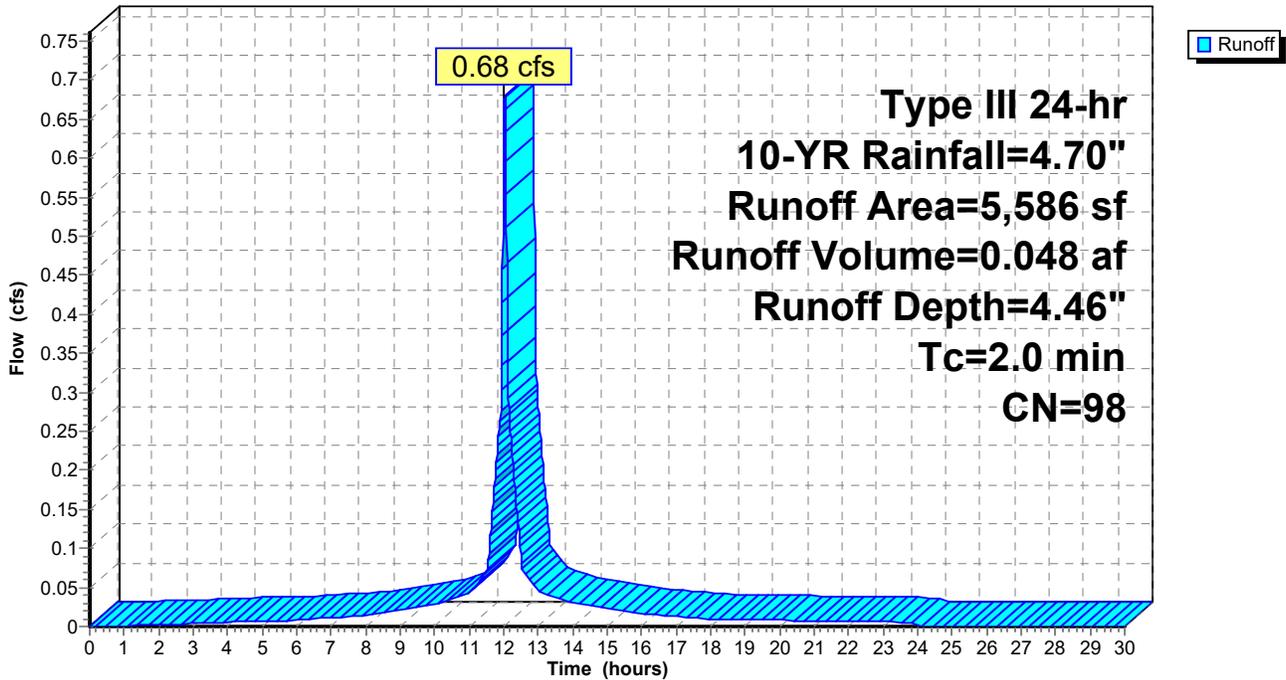
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
Type III 24-hr 10-YR Rainfall=4.70"

Area (sf)	CN	Description
5,586	98	Roofs, HSG B
5,586		100.00% Impervious Area

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

## Subcatchment 11P: P3b

Hydrograph



**Summary for Pond 12P: Infiltration Field**

Inflow Area = 0.458 ac, 75.38% Impervious, Inflow Depth = 3.48" for 10-YR event  
 Inflow = 1.39 cfs @ 12.09 hrs, Volume= 0.133 af  
 Outflow = 0.34 cfs @ 12.56 hrs, Volume= 0.133 af, Atten= 75%, Lag= 28.1 min  
 Discarded = 0.13 cfs @ 11.82 hrs, Volume= 0.106 af  
 Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af  
 Secondary = 0.21 cfs @ 12.56 hrs, Volume= 0.026 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
 Peak Elev= 182.45' @ 12.56 hrs Surf.Area= 2,377 sf Storage= 1,841 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)  
 Center-of-Mass det. time= 59.8 min ( 848.8 - 789.1 )

Volume	Invert	Avail.Storage	Storage Description
#1A	181.20'	1,454 cf	<b>72.00'W x 32.83'L x 2.04'H Field A</b> 4,826 cf Overall - 1,192 cf Embedded = 3,634 cf x 40.0% Voids
#2A	181.70'	1,192 cf	<b>Cultec C-100HD</b> x 84 Inside #1 Effective Size= 32.1"W x 12.0"H => 1.86 sf x 7.50'L = 14.0 cf Overall Size= 36.0"W x 12.5"H x 8.00'L with 0.50' Overlap Row Length Adjustment= +0.50' x 1.86 sf x 21 rows
#3	181.40'	38 cf	<b>4.00'D x 3.00'H Vertical Cone/Cylinder</b>
		2,684 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	181.20'	<b>2.410 in/hr Exfiltration over Surface area</b>
#2	Secondary	181.88'	<b>4.0" Round Culvert</b> L= 7.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 181.88' / 181.00' S= 0.1257 '/' Cc= 0.900 n= 0.011, Flow Area= 0.09 sf
#3	Primary	183.30'	<b>Trench Drain, Cv= 2.62 (C= 3.28)</b> Elev. (feet) 183.30 183.40 Width (feet) 20.00 20.00

**Discarded OutFlow** Max=0.13 cfs @ 11.82 hrs HW=181.41' (Free Discharge)

↑1=Exfiltration (Exfiltration Controls 0.13 cfs)

**Primary OutFlow** Max=0.00 cfs @ 0.00 hrs HW=181.20' TW=0.00' (Dynamic Tailwater)

↑3=Trench Drain ( Controls 0.00 cfs)

**Secondary OutFlow** Max=0.21 cfs @ 12.56 hrs HW=182.45' TW=0.00' (Dynamic Tailwater)

↑2=Culvert (Inlet Controls 0.21 cfs @ 2.42 fps)

**Pond 12P: Infiltration Field - Chamber Wizard Field A**

**Chamber Model = Cultec C-100HD (Cultec Contactor® 100HD)**

Effective Size= 32.1"W x 12.0"H => 1.86 sf x 7.50'L = 14.0 cf

Overall Size= 36.0"W x 12.5"H x 8.00'L with 0.50' Overlap

Row Length Adjustment= +0.50' x 1.86 sf x 21 rows

36.0" Wide + 4.0" Spacing = 40.0" C-C Row Spacing

4 Chambers/Row x 7.50' Long +0.50' Row Adjustment = 30.50' Row Length +14.0" End Stone x 2 = 32.83' Base Length

21 Rows x 36.0" Wide + 4.0" Spacing x 20 + 14.0" Side Stone x 2 = 72.00' Base Width

6.0" Base + 12.5" Chamber Height + 6.0" Cover = 2.04' Field Height

84 Chambers x 14.0 cf +0.50' Row Adjustment x 1.86 sf x 21 Rows = 1,192.3 cf Chamber Storage

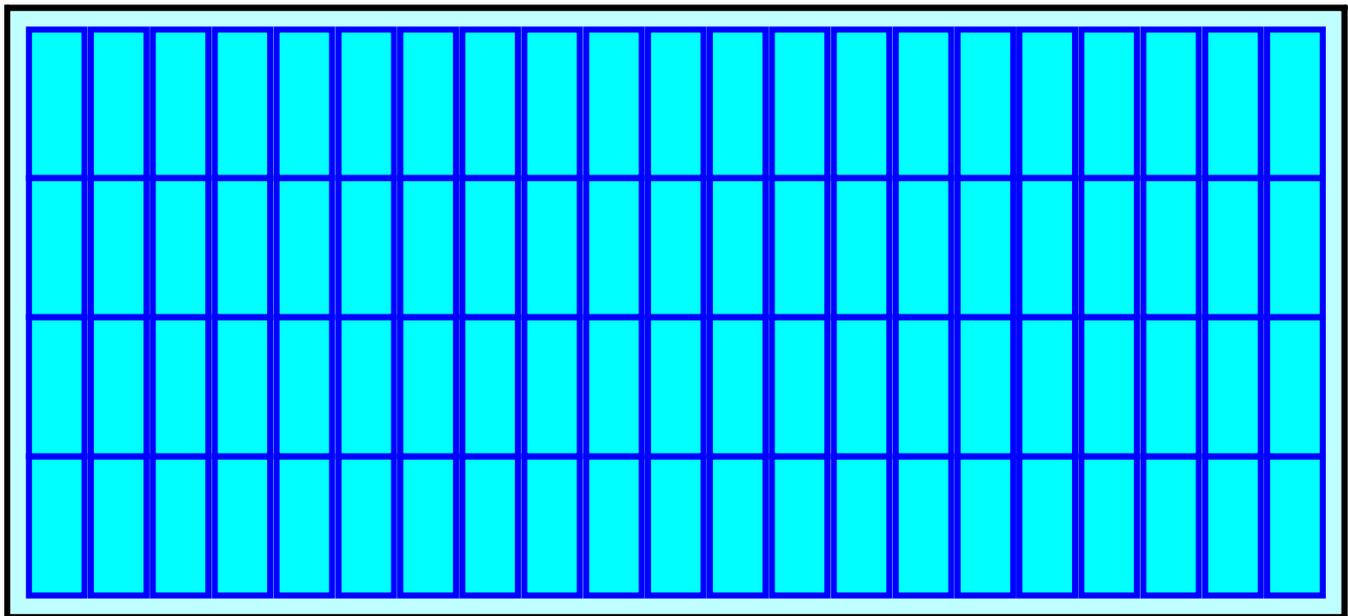
4,826.5 cf Field - 1,192.3 cf Chambers = 3,634.2 cf Stone x 40.0% Voids = 1,453.7 cf Stone Storage

Chamber Storage + Stone Storage = 2,646.0 cf = 0.061 af

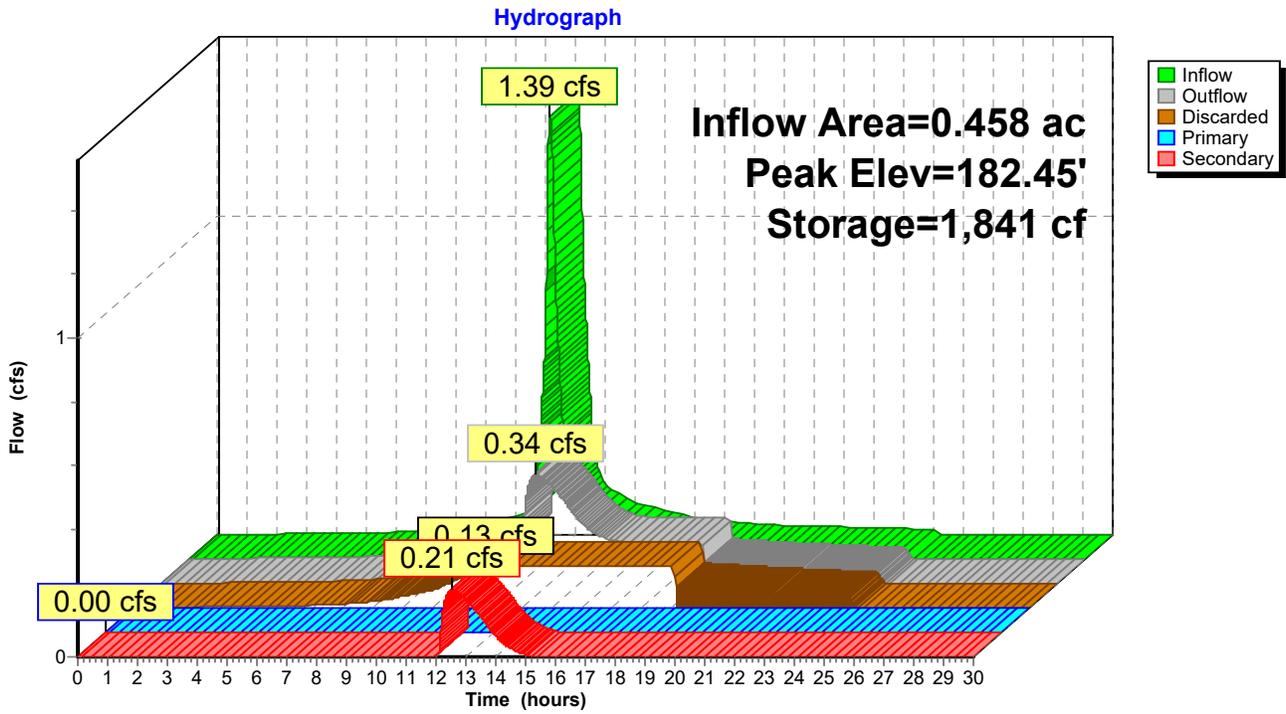
Overall Storage Efficiency = 54.8%

Overall System Size = 32.83' x 72.00' x 2.04'

84 Chambers  
178.8 cy Field  
134.6 cy Stone



### Pond 12P: Infiltration Field



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Type III 24-hr 10-YR Rainfall=4.70"

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**Summary for Subcatchment 15P: P3d**

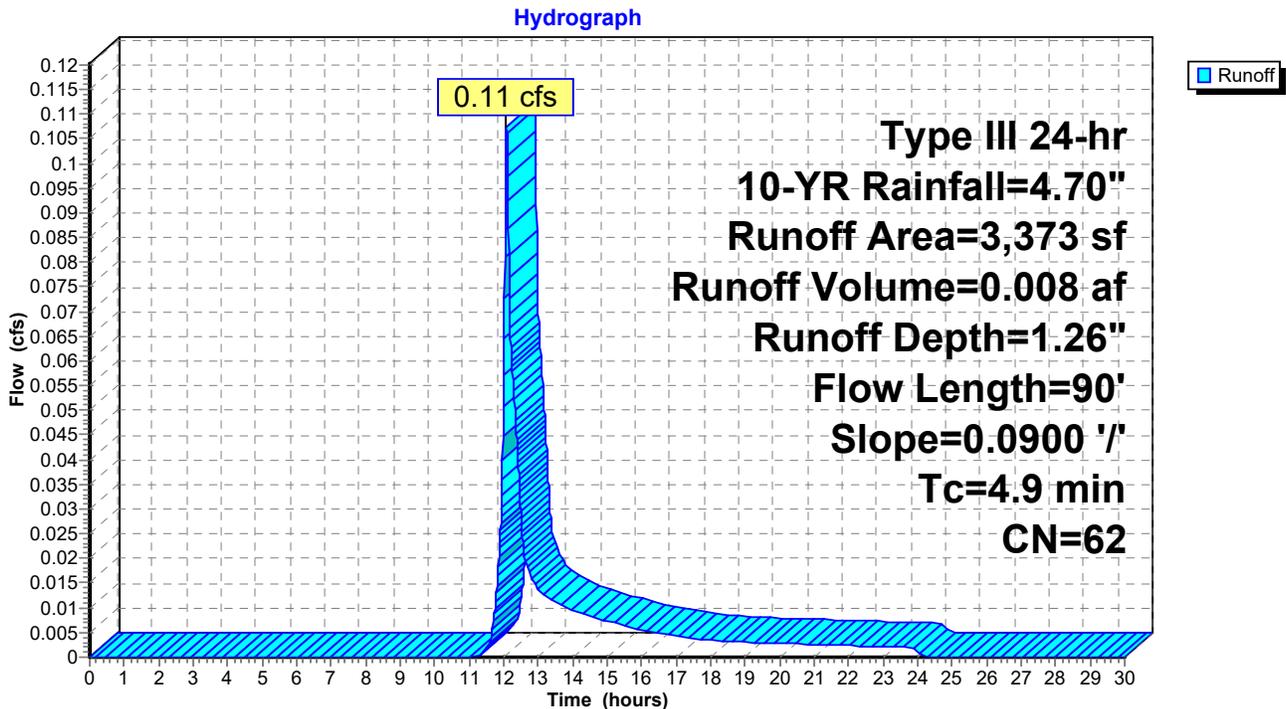
Runoff = 0.11 cfs @ 12.08 hrs, Volume= 0.008 af, Depth= 1.26"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
Type III 24-hr 10-YR Rainfall=4.70"

Area (sf)	CN	Description
258	98	Paved parking, HSG B
272	39	>75% Grass cover, Good, HSG A
2,843	61	>75% Grass cover, Good, HSG B
3,373	62	Weighted Average
3,115		92.35% Pervious Area
258		7.65% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.9	90	0.0900	0.30		Sheet Flow, Grass: Short n= 0.150 P2= 3.20"

**Subcatchment 15P: P3d**

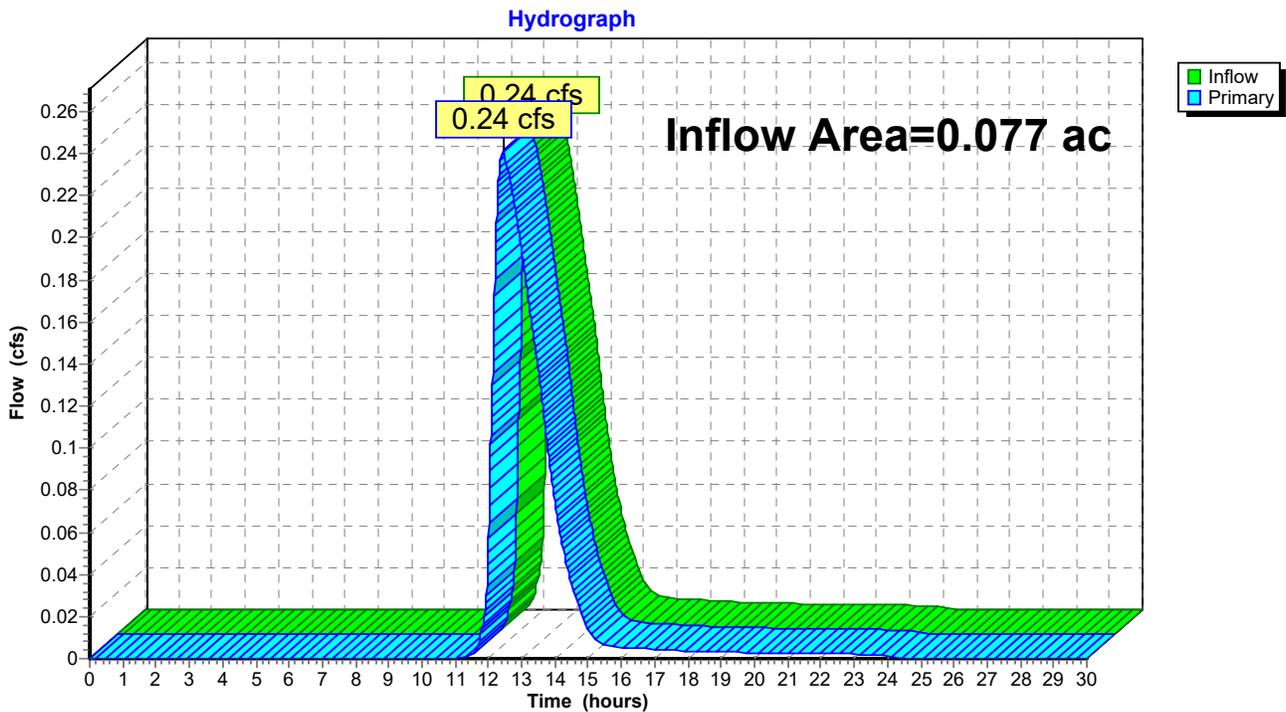


### Summary for Link 16P: Design Point #3b: Flow to Eastern Abutter

Inflow Area = 0.077 ac, 7.65% Impervious, Inflow Depth = 5.31" for 10-YR event  
Inflow = 0.24 cfs @ 12.44 hrs, Volume= 0.034 af  
Primary = 0.24 cfs @ 12.44 hrs, Volume= 0.034 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs

### Link 16P: Design Point #3b: Flow to Eastern Abutter



**HydroCAD Revised2**

Type III 24-hr 25-YR Rainfall=5.50"

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Time span=0.00-30.00 hrs, dt=0.01 hrs, 3001 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 8P: P3a**

Runoff Area=14,343 sf 65.80% Impervious Runoff Depth=3.83"  
Flow Length=229' Tc=10.0 min CN=85 Runoff=1.28 cfs 0.105 af

**Pond 10P: CB**

Peak Elev=182.86' Inflow=1.28 cfs 0.105 af  
12.0" Round Culvert n=0.011 L=75.0' S=0.0000 '/ Outflow=1.28 cfs 0.105 af

**Subcatchment 11P: P3b**

Runoff Area=5,586 sf 100.00% Impervious Runoff Depth=5.26"  
Tc=2.0 min CN=98 Runoff=0.80 cfs 0.056 af

**Pond 12P: Infiltration Field**

Peak Elev=182.85' Storage=2,293 cf Inflow=1.69 cfs 0.161 af  
Discarded=0.13 cfs 0.119 af Primary=0.00 cfs 0.000 af Secondary=0.30 cfs 0.043 af Outflow=0.43 cfs 0.161 af

**Subcatchment 15P: P3d**

Runoff Area=3,373 sf 7.65% Impervious Runoff Depth=1.76"  
Flow Length=90' Slope=0.0900 '/ Tc=4.9 min CN=62 Runoff=0.16 cfs 0.011 af

**Link 16P: Design Point #3b: Flow to Eastern Abutter**

Inflow=0.34 cfs 0.054 af  
Primary=0.34 cfs 0.054 af

**Total Runoff Area = 0.535 ac Runoff Volume = 0.173 af Average Runoff Depth = 3.87"**  
**34.42% Pervious = 0.184 ac 65.58% Impervious = 0.351 ac**

**HydroCAD Revised2**

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Type III 24-hr 25-YR Rainfall=5.50"

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**Summary for Subcatchment 8P: P3a**

Runoff = 1.28 cfs @ 12.14 hrs, Volume= 0.105 af, Depth= 3.83"

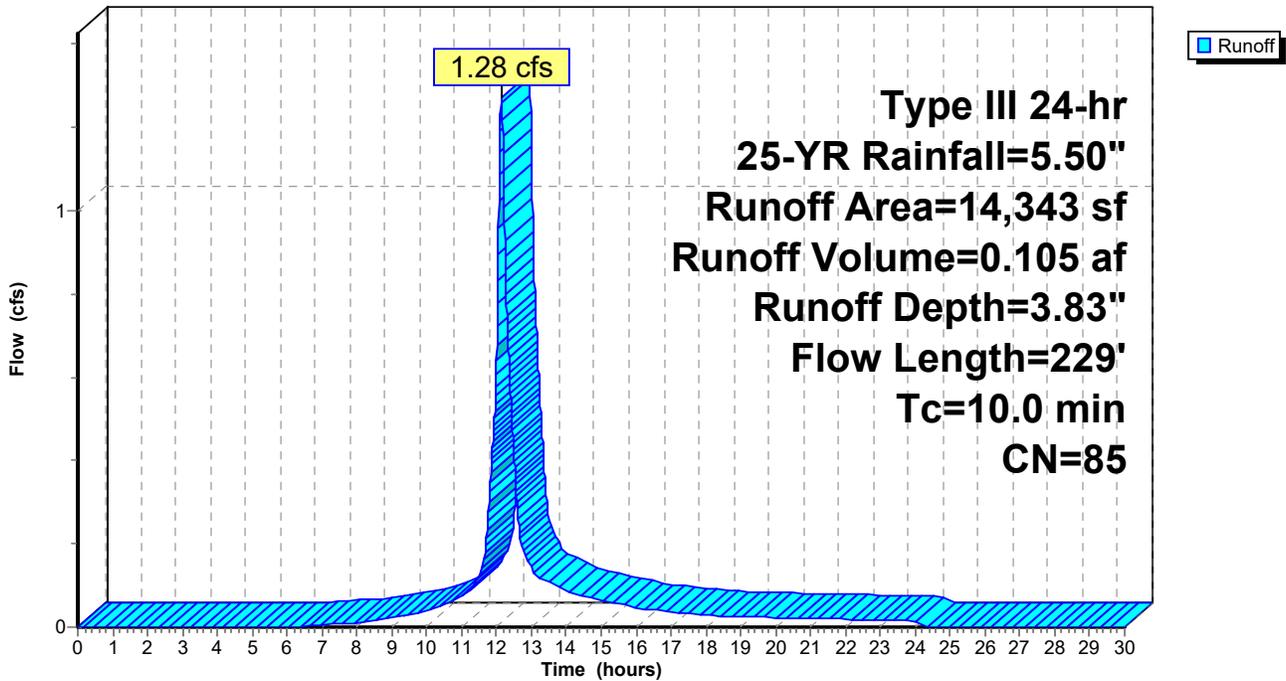
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
Type III 24-hr 25-YR Rainfall=5.50"

Area (sf)	CN	Description
9,437	98	Paved parking, HSG B
4,906	61	>75% Grass cover, Good, HSG B
14,343	85	Weighted Average
4,906		34.20% Pervious Area
9,437		65.80% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.6	63	0.0280	0.12		Sheet Flow, Grass: Dense n= 0.240 P2= 3.20"
1.4	166	0.0100	2.03		Shallow Concentrated Flow, Paved Kv= 20.3 fps
10.0	229	Total			

**Subcatchment 8P: P3a**

Hydrograph



**Summary for Pond 10P: CB**

Inflow Area = 0.329 ac, 65.80% Impervious, Inflow Depth = 3.83" for 25-YR event  
 Inflow = 1.28 cfs @ 12.14 hrs, Volume= 0.105 af  
 Outflow = 1.28 cfs @ 12.14 hrs, Volume= 0.105 af, Atten= 0%, Lag= 0.0 min  
 Primary = 1.28 cfs @ 12.14 hrs, Volume= 0.105 af

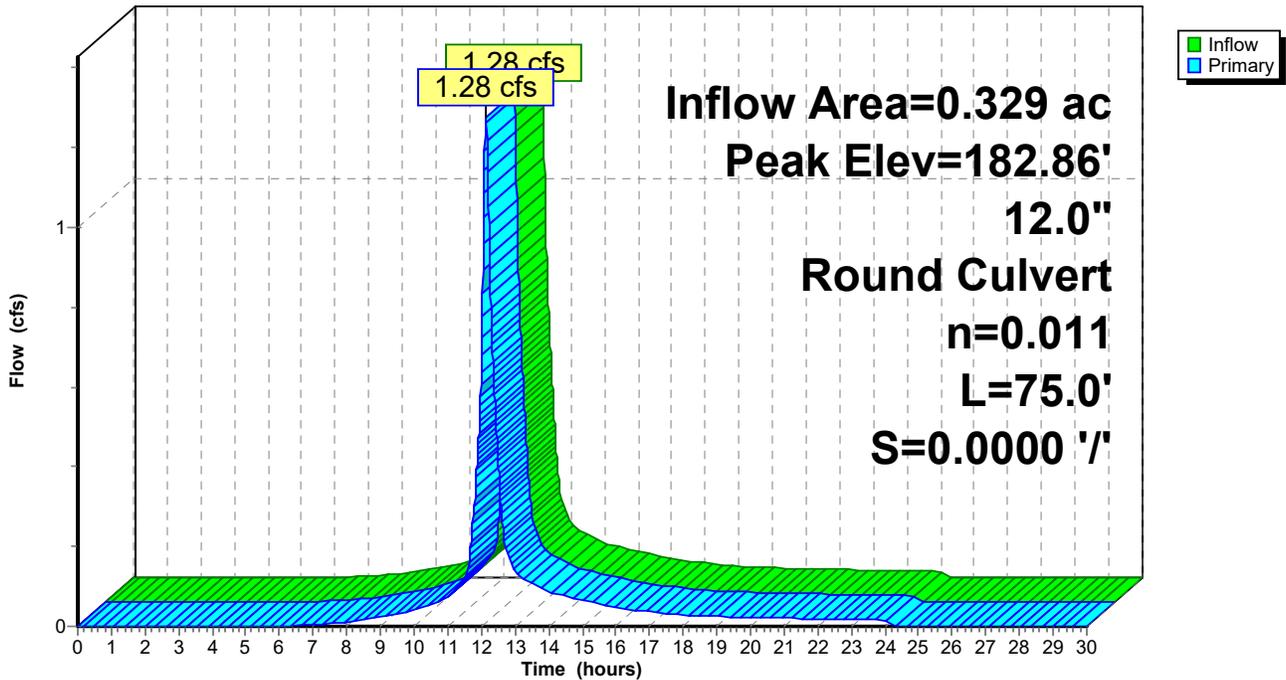
Routing by Dyn-Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
 Peak Elev= 182.86' @ 12.54 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	180.60'	<b>12.0" Round Culvert</b> L= 75.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 180.60' / 180.60' S= 0.0000 '/ Cc= 0.900 n= 0.011, Flow Area= 0.79 sf

**Primary OutFlow** Max=1.13 cfs @ 12.14 hrs HW=182.34' TW=182.24' (Dynamic Tailwater)  
 ↳ **1=Culvert** (Outlet Controls 1.13 cfs @ 1.44 fps)

**Pond 10P: CB**

Hydrograph



**Summary for Subcatchment 11P: P3b**

Runoff = 0.80 cfs @ 12.03 hrs, Volume= 0.056 af, Depth= 5.26"

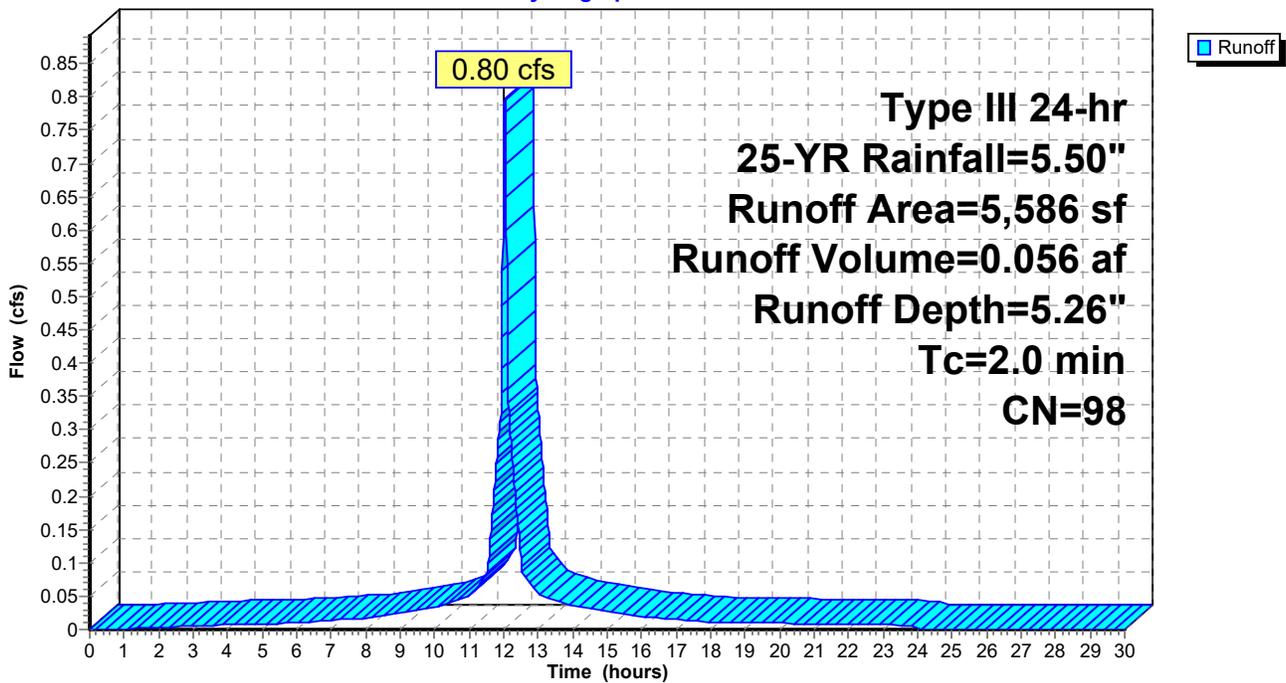
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
 Type III 24-hr 25-YR Rainfall=5.50"

Area (sf)	CN	Description
5,586	98	Roofs, HSG B
5,586		100.00% Impervious Area

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

**Subcatchment 11P: P3b**

Hydrograph



**Summary for Pond 12P: Infiltration Field**

Inflow Area = 0.458 ac, 75.38% Impervious, Inflow Depth = 4.23" for 25-YR event  
 Inflow = 1.69 cfs @ 12.09 hrs, Volume= 0.161 af  
 Outflow = 0.43 cfs @ 12.55 hrs, Volume= 0.161 af, Atten= 75%, Lag= 27.3 min  
 Discarded = 0.13 cfs @ 11.74 hrs, Volume= 0.119 af  
 Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af  
 Secondary = 0.30 cfs @ 12.55 hrs, Volume= 0.043 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
 Peak Elev= 182.85' @ 12.55 hrs Surf.Area= 2,377 sf Storage= 2,293 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)  
 Center-of-Mass det. time= 62.2 min ( 847.2 - 785.0 )

Volume	Invert	Avail.Storage	Storage Description
#1A	181.20'	1,454 cf	<b>72.00'W x 32.83'L x 2.04'H Field A</b> 4,826 cf Overall - 1,192 cf Embedded = 3,634 cf x 40.0% Voids
#2A	181.70'	1,192 cf	<b>Cultec C-100HD</b> x 84 Inside #1 Effective Size= 32.1"W x 12.0"H => 1.86 sf x 7.50'L = 14.0 cf Overall Size= 36.0"W x 12.5"H x 8.00'L with 0.50' Overlap Row Length Adjustment= +0.50' x 1.86 sf x 21 rows
#3	181.40'	38 cf	<b>4.00'D x 3.00'H Vertical Cone/Cylinder</b>
		2,684 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	181.20'	<b>2.410 in/hr Exfiltration over Surface area</b>
#2	Secondary	181.88'	<b>4.0" Round Culvert</b> L= 7.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 181.88' / 181.00' S= 0.1257 '/' Cc= 0.900 n= 0.011, Flow Area= 0.09 sf
#3	Primary	183.30'	<b>Trench Drain, Cv= 2.62 (C= 3.28)</b> Elev. (feet) 183.30 183.40 Width (feet) 20.00 20.00

**Discarded OutFlow** Max=0.13 cfs @ 11.74 hrs HW=181.41' (Free Discharge)

↑1=Exfiltration (Exfiltration Controls 0.13 cfs)

**Primary OutFlow** Max=0.00 cfs @ 0.00 hrs HW=181.20' TW=0.00' (Dynamic Tailwater)

↑3=Trench Drain ( Controls 0.00 cfs)

**Secondary OutFlow** Max=0.30 cfs @ 12.55 hrs HW=182.85' TW=0.00' (Dynamic Tailwater)

↑2=Culvert (Inlet Controls 0.30 cfs @ 3.40 fps)

**Pond 12P: Infiltration Field - Chamber Wizard Field A**

**Chamber Model = Cultec C-100HD (Cultec Contactor® 100HD)**

Effective Size= 32.1"W x 12.0"H => 1.86 sf x 7.50'L = 14.0 cf

Overall Size= 36.0"W x 12.5"H x 8.00'L with 0.50' Overlap

Row Length Adjustment= +0.50' x 1.86 sf x 21 rows

36.0" Wide + 4.0" Spacing = 40.0" C-C Row Spacing

4 Chambers/Row x 7.50' Long +0.50' Row Adjustment = 30.50' Row Length +14.0" End Stone x 2 = 32.83' Base Length

21 Rows x 36.0" Wide + 4.0" Spacing x 20 + 14.0" Side Stone x 2 = 72.00' Base Width

6.0" Base + 12.5" Chamber Height + 6.0" Cover = 2.04' Field Height

84 Chambers x 14.0 cf +0.50' Row Adjustment x 1.86 sf x 21 Rows = 1,192.3 cf Chamber Storage

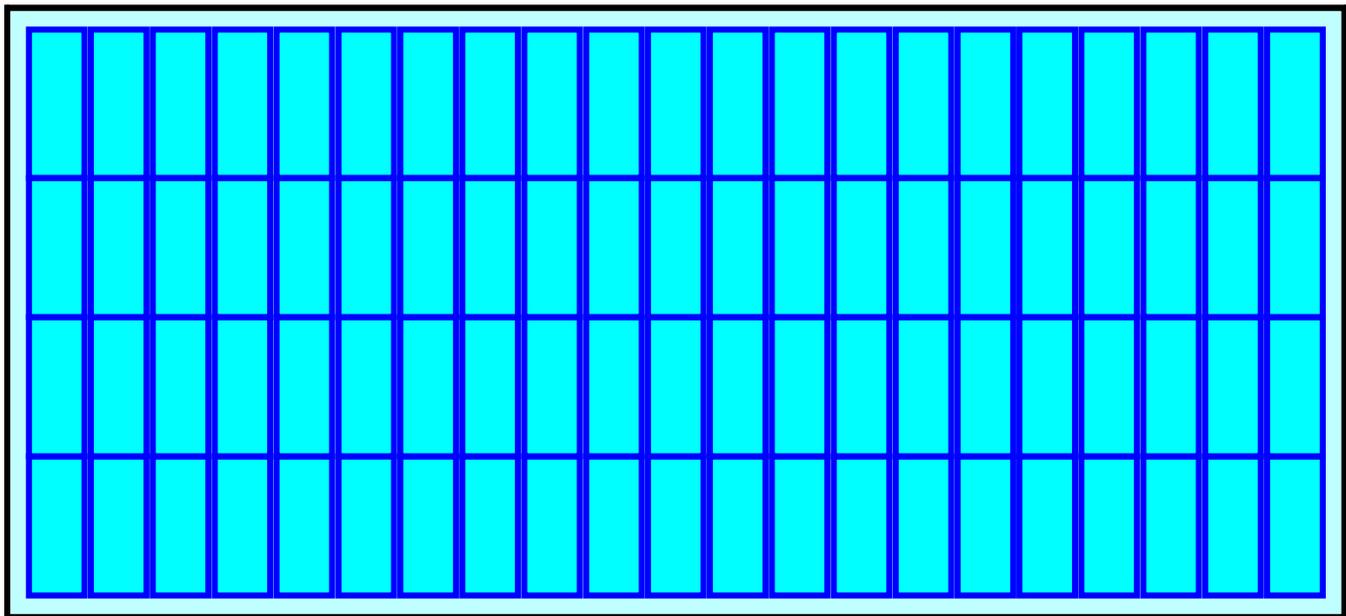
4,826.5 cf Field - 1,192.3 cf Chambers = 3,634.2 cf Stone x 40.0% Voids = 1,453.7 cf Stone Storage

Chamber Storage + Stone Storage = 2,646.0 cf = 0.061 af

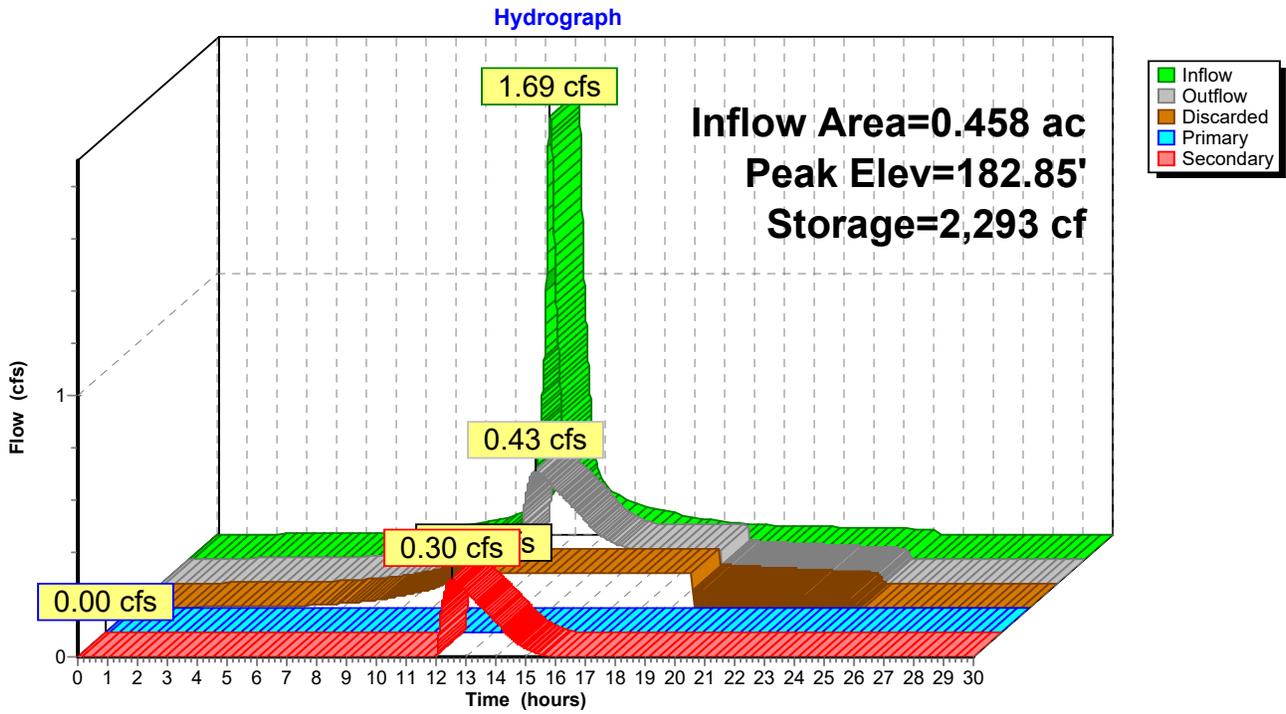
Overall Storage Efficiency = 54.8%

Overall System Size = 32.83' x 72.00' x 2.04'

84 Chambers  
178.8 cy Field  
134.6 cy Stone



### Pond 12P: Infiltration Field



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Type III 24-hr 25-YR Rainfall=5.50"

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**Summary for Subcatchment 15P: P3d**

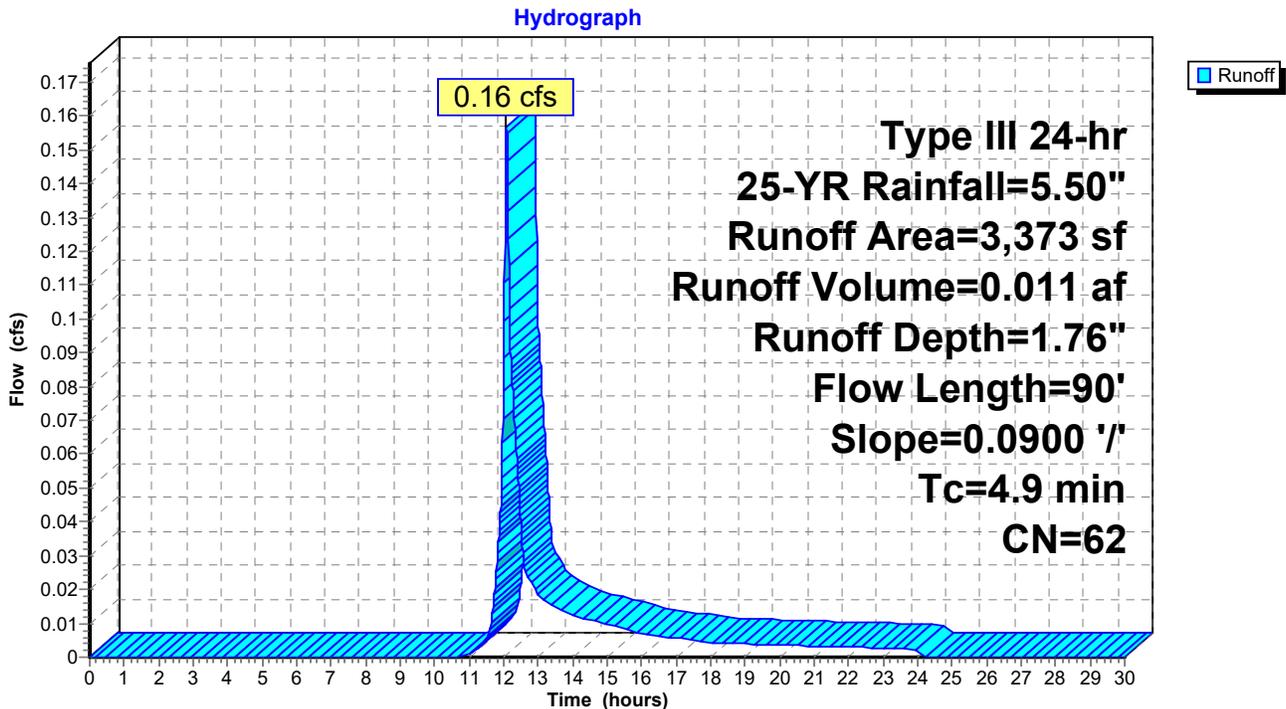
Runoff = 0.16 cfs @ 12.08 hrs, Volume= 0.011 af, Depth= 1.76"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
Type III 24-hr 25-YR Rainfall=5.50"

Area (sf)	CN	Description
258	98	Paved parking, HSG B
272	39	>75% Grass cover, Good, HSG A
2,843	61	>75% Grass cover, Good, HSG B
3,373	62	Weighted Average
3,115		92.35% Pervious Area
258		7.65% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.9	90	0.0900	0.30		Sheet Flow, Grass: Short n= 0.150 P2= 3.20"

**Subcatchment 15P: P3d**

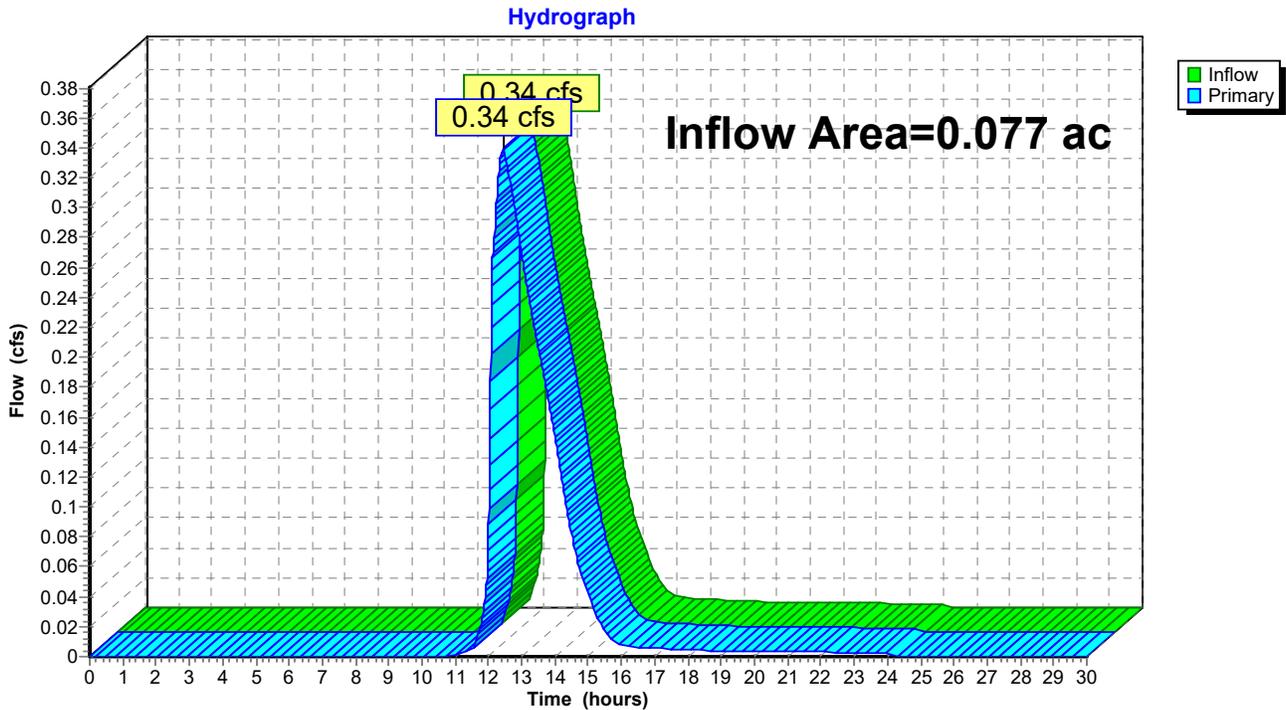


### Summary for Link 16P: Design Point #3b: Flow to Eastern Abutter

Inflow Area = 0.077 ac, 7.65% Impervious, Inflow Depth = 8.36" for 25-YR event  
Inflow = 0.34 cfs @ 12.43 hrs, Volume= 0.054 af  
Primary = 0.34 cfs @ 12.43 hrs, Volume= 0.054 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs

### Link 16P: Design Point #3b: Flow to Eastern Abutter



**HydroCAD Revised2**

Type III 24-hr 50-YR Rainfall=6.10"

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Time span=0.00-30.00 hrs, dt=0.01 hrs, 3001 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 8P: P3a**

Runoff Area=14,343 sf 65.80% Impervious Runoff Depth=4.40"  
Flow Length=229' Tc=10.0 min CN=85 Runoff=1.46 cfs 0.121 af

**Pond 10P: CB**

Peak Elev=183.23' Inflow=1.46 cfs 0.121 af  
12.0" Round Culvert n=0.011 L=75.0' S=0.0000 '/ Outflow=1.46 cfs 0.121 af

**Subcatchment 11P: P3b**

Runoff Area=5,586 sf 100.00% Impervious Runoff Depth=5.86"  
Tc=2.0 min CN=98 Runoff=0.88 cfs 0.063 af

**Pond 12P: Infiltration Field**

Peak Elev=183.21' Storage=2,642 cf Inflow=1.92 cfs 0.183 af  
Discarded=0.13 cfs 0.127 af Primary=0.00 cfs 0.000 af Secondary=0.36 cfs 0.056 af Outflow=0.49 cfs 0.183 af

**Subcatchment 15P: P3d**

Runoff Area=3,373 sf 7.65% Impervious Runoff Depth=2.16"  
Flow Length=90' Slope=0.0900 '/ Tc=4.9 min CN=62 Runoff=0.20 cfs 0.014 af

**Link 16P: Design Point #3b: Flow to Eastern Abutter**

Inflow=0.41 cfs 0.070 af  
Primary=0.41 cfs 0.070 af

**Total Runoff Area = 0.535 ac Runoff Volume = 0.197 af Average Runoff Depth = 4.42"**  
**34.42% Pervious = 0.184 ac 65.58% Impervious = 0.351 ac**

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Type III 24-hr 50-YR Rainfall=6.10"

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**Summary for Subcatchment 8P: P3a**

Runoff = 1.46 cfs @ 12.14 hrs, Volume= 0.121 af, Depth= 4.40"

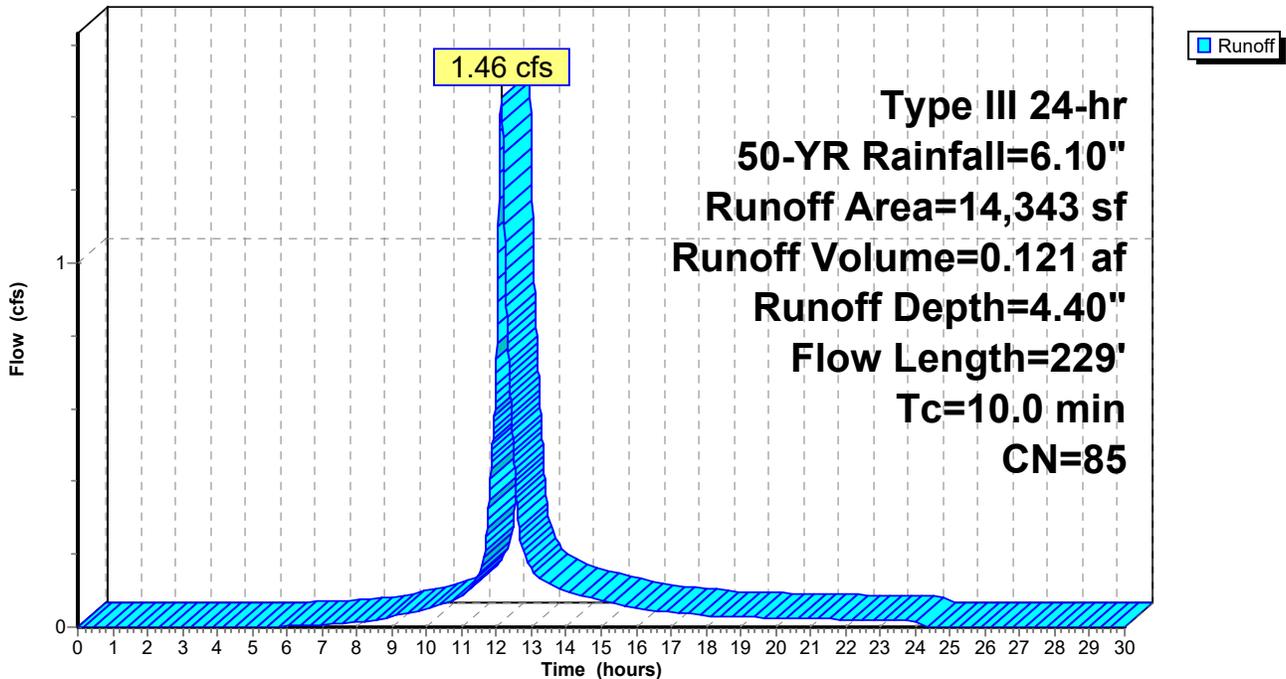
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
Type III 24-hr 50-YR Rainfall=6.10"

Area (sf)	CN	Description
9,437	98	Paved parking, HSG B
4,906	61	>75% Grass cover, Good, HSG B
14,343	85	Weighted Average
4,906		34.20% Pervious Area
9,437		65.80% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.6	63	0.0280	0.12		Sheet Flow, Grass: Dense n= 0.240 P2= 3.20"
1.4	166	0.0100	2.03		Shallow Concentrated Flow, Paved Kv= 20.3 fps
10.0	229	Total			

**Subcatchment 8P: P3a**

Hydrograph



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Type III 24-hr 50-YR Rainfall=6.10"

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## Summary for Pond 10P: CB

Inflow Area = 0.329 ac, 65.80% Impervious, Inflow Depth = 4.40" for 50-YR event  
Inflow = 1.46 cfs @ 12.14 hrs, Volume= 0.121 af  
Outflow = 1.46 cfs @ 12.14 hrs, Volume= 0.121 af, Atten= 0%, Lag= 0.0 min  
Primary = 1.46 cfs @ 12.14 hrs, Volume= 0.121 af

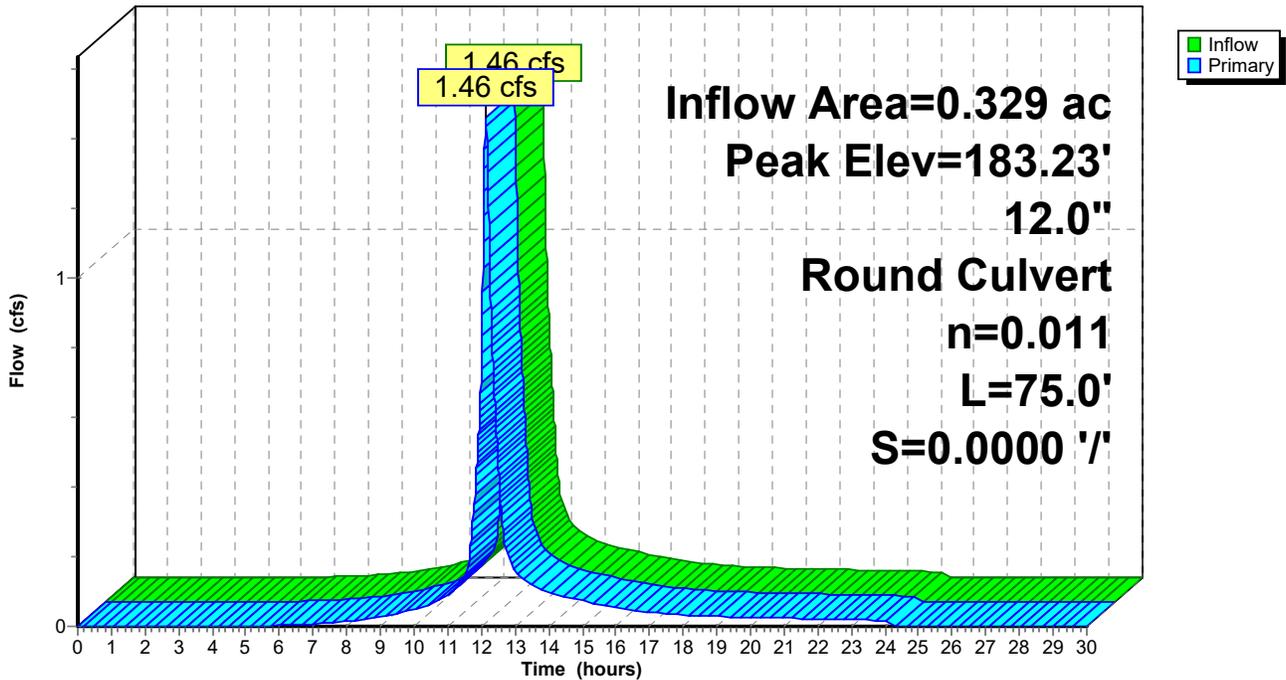
Routing by Dyn-Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
Peak Elev= 183.23' @ 12.54 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	180.60'	<b>12.0" Round Culvert</b> L= 75.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 180.60' / 180.60' S= 0.0000 '/ Cc= 0.900 n= 0.011, Flow Area= 0.79 sf

**Primary OutFlow** Max=1.30 cfs @ 12.14 hrs HW=182.53' TW=182.39' (Dynamic Tailwater)  
↑1=Culvert (Outlet Controls 1.30 cfs @ 1.66 fps)

## Pond 10P: CB

Hydrograph



**Summary for Subcatchment 11P: P3b**

Runoff = 0.88 cfs @ 12.03 hrs, Volume= 0.063 af, Depth= 5.86"

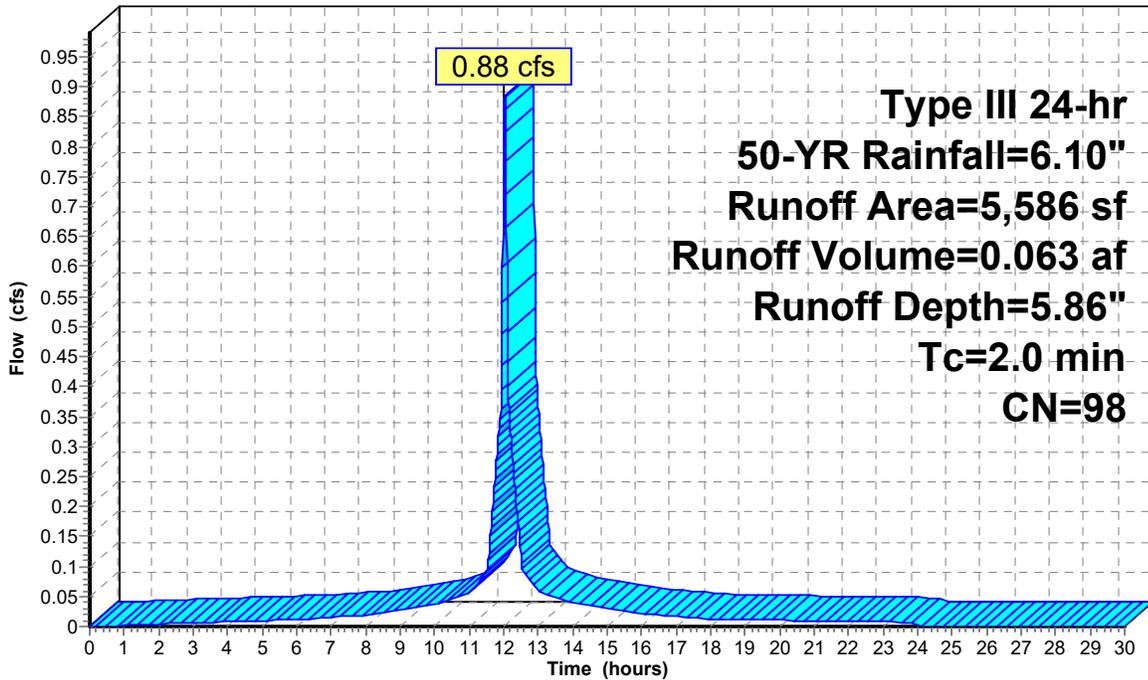
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
 Type III 24-hr 50-YR Rainfall=6.10"

Area (sf)	CN	Description
5,586	98	Roofs, HSG B
5,586		100.00% Impervious Area

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

**Subcatchment 11P: P3b**

Hydrograph



**Summary for Pond 12P: Infiltration Field**

Inflow Area = 0.458 ac, 75.38% Impervious, Inflow Depth = 4.81" for 50-YR event  
 Inflow = 1.92 cfs @ 12.09 hrs, Volume= 0.183 af  
 Outflow = 0.49 cfs @ 12.54 hrs, Volume= 0.183 af, Atten= 74%, Lag= 27.0 min  
 Discarded = 0.13 cfs @ 11.66 hrs, Volume= 0.127 af  
 Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af  
 Secondary = 0.36 cfs @ 12.54 hrs, Volume= 0.056 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
 Peak Elev= 183.21' @ 12.54 hrs Surf.Area= 2,377 sf Storage= 2,642 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)  
 Center-of-Mass det. time= 63.8 min ( 846.1 - 782.4 )

Volume	Invert	Avail.Storage	Storage Description
#1A	181.20'	1,454 cf	<b>72.00'W x 32.83'L x 2.04'H Field A</b> 4,826 cf Overall - 1,192 cf Embedded = 3,634 cf x 40.0% Voids
#2A	181.70'	1,192 cf	<b>Cultec C-100HD</b> x 84 Inside #1 Effective Size= 32.1"W x 12.0"H => 1.86 sf x 7.50'L = 14.0 cf Overall Size= 36.0"W x 12.5"H x 8.00'L with 0.50' Overlap Row Length Adjustment= +0.50' x 1.86 sf x 21 rows
#3	181.40'	38 cf	<b>4.00'D x 3.00'H Vertical Cone/Cylinder</b>
		2,684 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	181.20'	<b>2.410 in/hr Exfiltration over Surface area</b>
#2	Secondary	181.88'	<b>4.0" Round Culvert</b> L= 7.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 181.88' / 181.00' S= 0.1257 '/' Cc= 0.900 n= 0.011, Flow Area= 0.09 sf
#3	Primary	183.30'	<b>Trench Drain, Cv= 2.62 (C= 3.28)</b> Elev. (feet) 183.30 183.40 Width (feet) 20.00 20.00

**Discarded OutFlow** Max=0.13 cfs @ 11.66 hrs HW=181.40' (Free Discharge)

↑1=Exfiltration (Exfiltration Controls 0.13 cfs)

**Primary OutFlow** Max=0.00 cfs @ 0.00 hrs HW=181.20' TW=0.00' (Dynamic Tailwater)

↑3=Trench Drain ( Controls 0.00 cfs)

**Secondary OutFlow** Max=0.36 cfs @ 12.54 hrs HW=183.21' TW=0.00' (Dynamic Tailwater)

↑2=Culvert (Inlet Controls 0.36 cfs @ 4.11 fps)

**Pond 12P: Infiltration Field - Chamber Wizard Field A**

**Chamber Model = Cultec C-100HD (Cultec Contactor® 100HD)**

Effective Size= 32.1"W x 12.0"H => 1.86 sf x 7.50'L = 14.0 cf

Overall Size= 36.0"W x 12.5"H x 8.00'L with 0.50' Overlap

Row Length Adjustment= +0.50' x 1.86 sf x 21 rows

36.0" Wide + 4.0" Spacing = 40.0" C-C Row Spacing

4 Chambers/Row x 7.50' Long +0.50' Row Adjustment = 30.50' Row Length +14.0" End Stone x 2 = 32.83' Base Length

21 Rows x 36.0" Wide + 4.0" Spacing x 20 + 14.0" Side Stone x 2 = 72.00' Base Width

6.0" Base + 12.5" Chamber Height + 6.0" Cover = 2.04' Field Height

84 Chambers x 14.0 cf +0.50' Row Adjustment x 1.86 sf x 21 Rows = 1,192.3 cf Chamber Storage

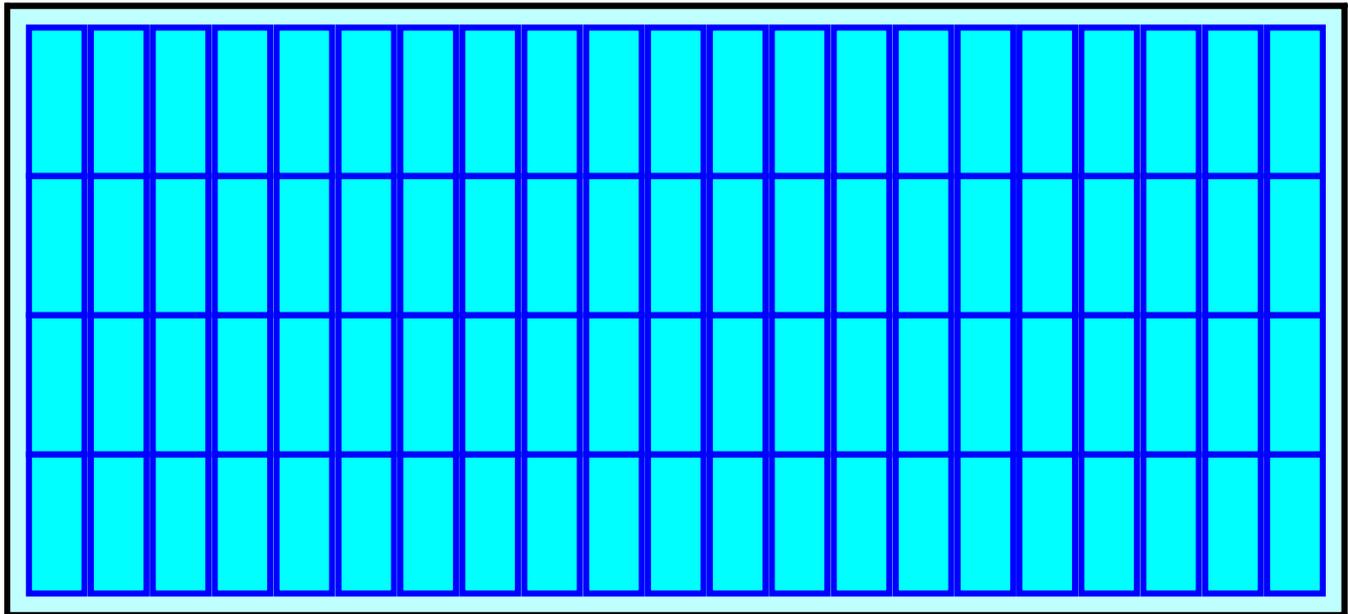
4,826.5 cf Field - 1,192.3 cf Chambers = 3,634.2 cf Stone x 40.0% Voids = 1,453.7 cf Stone Storage

Chamber Storage + Stone Storage = 2,646.0 cf = 0.061 af

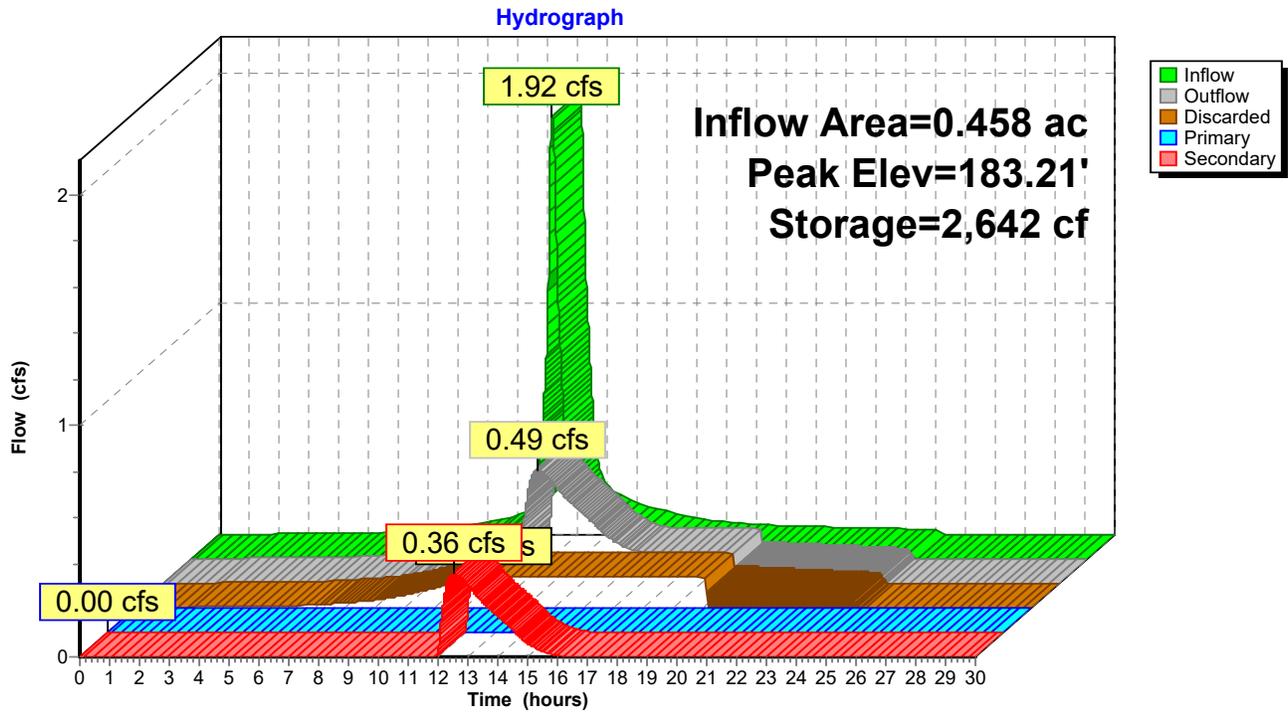
Overall Storage Efficiency = 54.8%

Overall System Size = 32.83' x 72.00' x 2.04'

84 Chambers  
178.8 cy Field  
134.6 cy Stone



### Pond 12P: Infiltration Field



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Type III 24-hr 50-YR Rainfall=6.10"

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**Summary for Subcatchment 15P: P3d**

Runoff = 0.20 cfs @ 12.08 hrs, Volume= 0.014 af, Depth= 2.16"

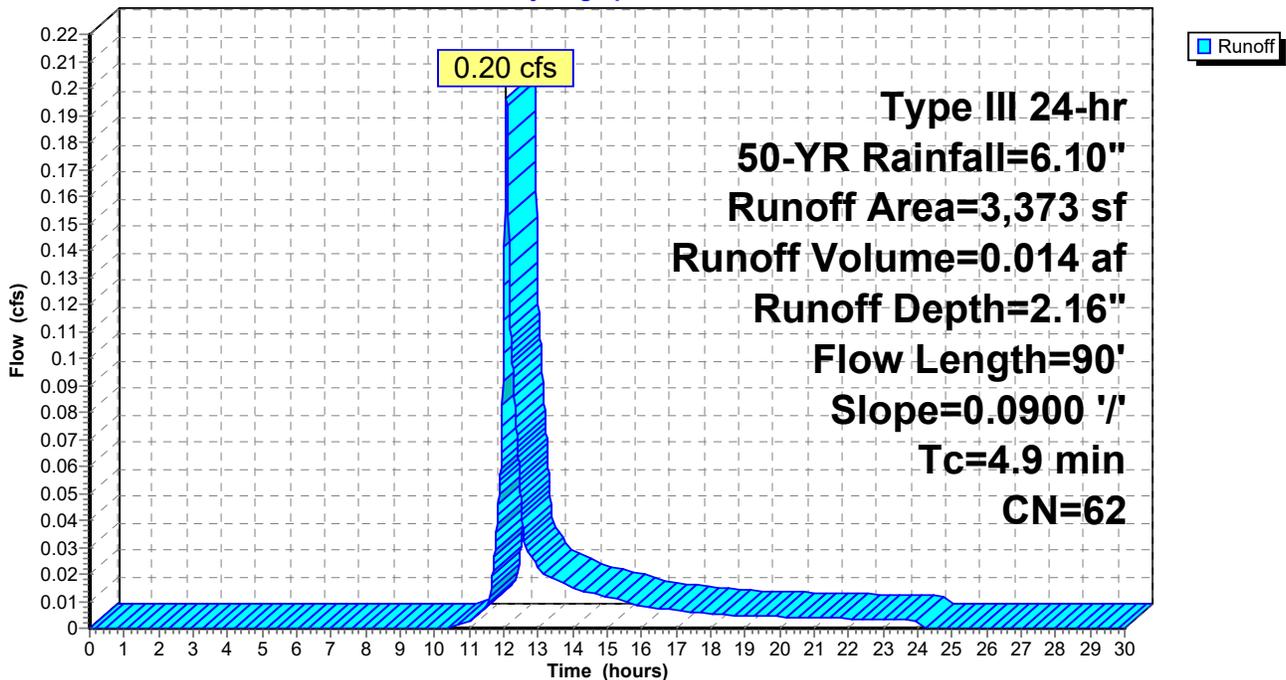
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
Type III 24-hr 50-YR Rainfall=6.10"

Area (sf)	CN	Description
258	98	Paved parking, HSG B
272	39	>75% Grass cover, Good, HSG A
2,843	61	>75% Grass cover, Good, HSG B
3,373	62	Weighted Average
3,115		92.35% Pervious Area
258		7.65% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.9	90	0.0900	0.30		Sheet Flow, Grass: Short n= 0.150 P2= 3.20"

**Subcatchment 15P: P3d**

Hydrograph



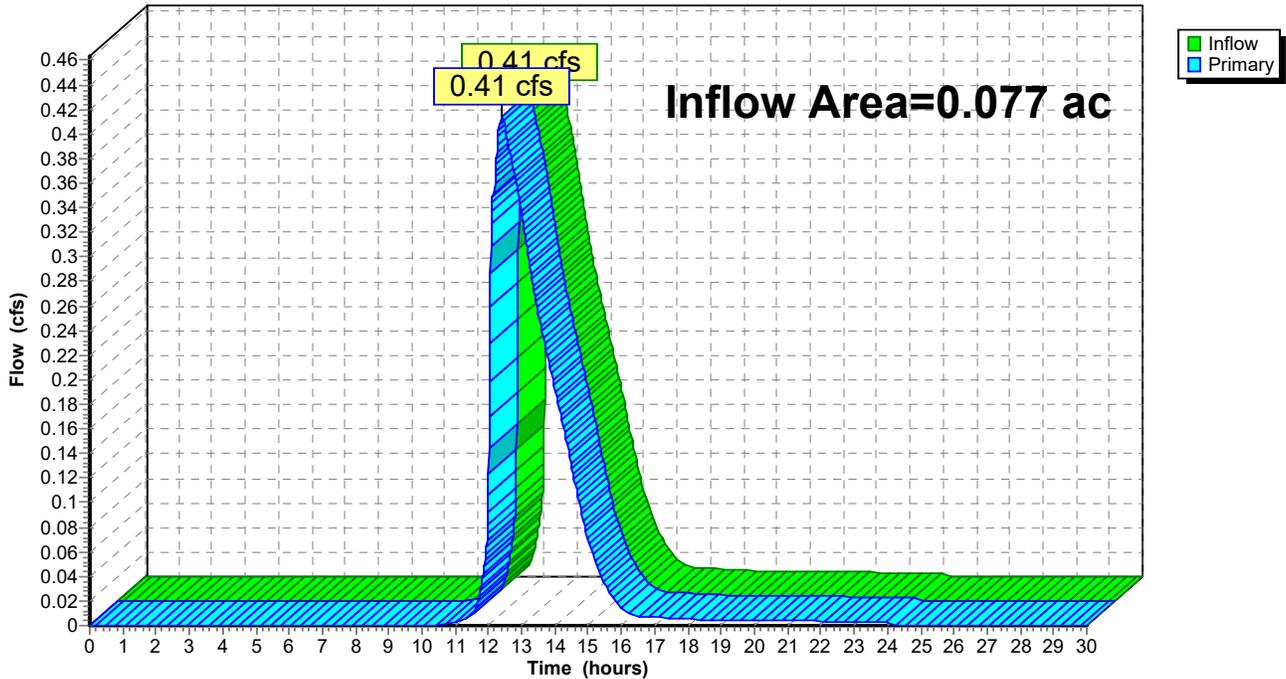
### Summary for Link 16P: Design Point #3b: Flow to Eastern Abutter

Inflow Area = 0.077 ac, 7.65% Impervious, Inflow Depth = 10.84" for 50-YR event  
Inflow = 0.41 cfs @ 12.40 hrs, Volume= 0.070 af  
Primary = 0.41 cfs @ 12.40 hrs, Volume= 0.070 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs

### Link 16P: Design Point #3b: Flow to Eastern Abutter

Hydrograph



**HydroCAD Revised2**

Type III 24-hr 100-YR Rainfall=6.70"

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Time span=0.00-30.00 hrs, dt=0.01 hrs, 3001 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 8P: P3a**

Runoff Area=14,343 sf 65.80% Impervious Runoff Depth=4.97"  
Flow Length=229' Tc=10.0 min CN=85 Runoff=1.64 cfs 0.136 af

**Pond 10P: CB**

Peak Elev=183.45' Inflow=1.64 cfs 0.136 af  
12.0" Round Culvert n=0.011 L=75.0' S=0.0000 '/ Outflow=1.64 cfs 0.136 af

**Subcatchment 11P: P3b**

Runoff Area=5,586 sf 100.00% Impervious Runoff Depth=6.46"  
Tc=2.0 min CN=98 Runoff=0.97 cfs 0.069 af

**Pond 12P: Infiltration Field**

Peak Elev=183.37' Storage=2,671 cf Inflow=2.14 cfs 0.205 af  
Discarded=0.13 cfs 0.135 af Primary=1.25 cfs 0.008 af Secondary=0.38 cfs 0.062 af Outflow=1.76 cfs 0.205 af

**Subcatchment 15P: P3d**

Runoff Area=3,373 sf 7.65% Impervious Runoff Depth=2.58"  
Flow Length=90' Slope=0.0900 '/ Tc=4.9 min CN=62 Runoff=0.24 cfs 0.017 af

**Link 16P: Design Point #3b: Flow to Eastern Abutter**

Inflow=0.49 cfs 0.079 af  
Primary=0.49 cfs 0.079 af

**Total Runoff Area = 0.535 ac Runoff Volume = 0.222 af Average Runoff Depth = 4.98"**  
**34.42% Pervious = 0.184 ac 65.58% Impervious = 0.351 ac**

**HydroCAD Revised2**

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Type III 24-hr 100-YR Rainfall=6.70"

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**Summary for Subcatchment 8P: P3a**

Runoff = 1.64 cfs @ 12.14 hrs, Volume= 0.136 af, Depth= 4.97"

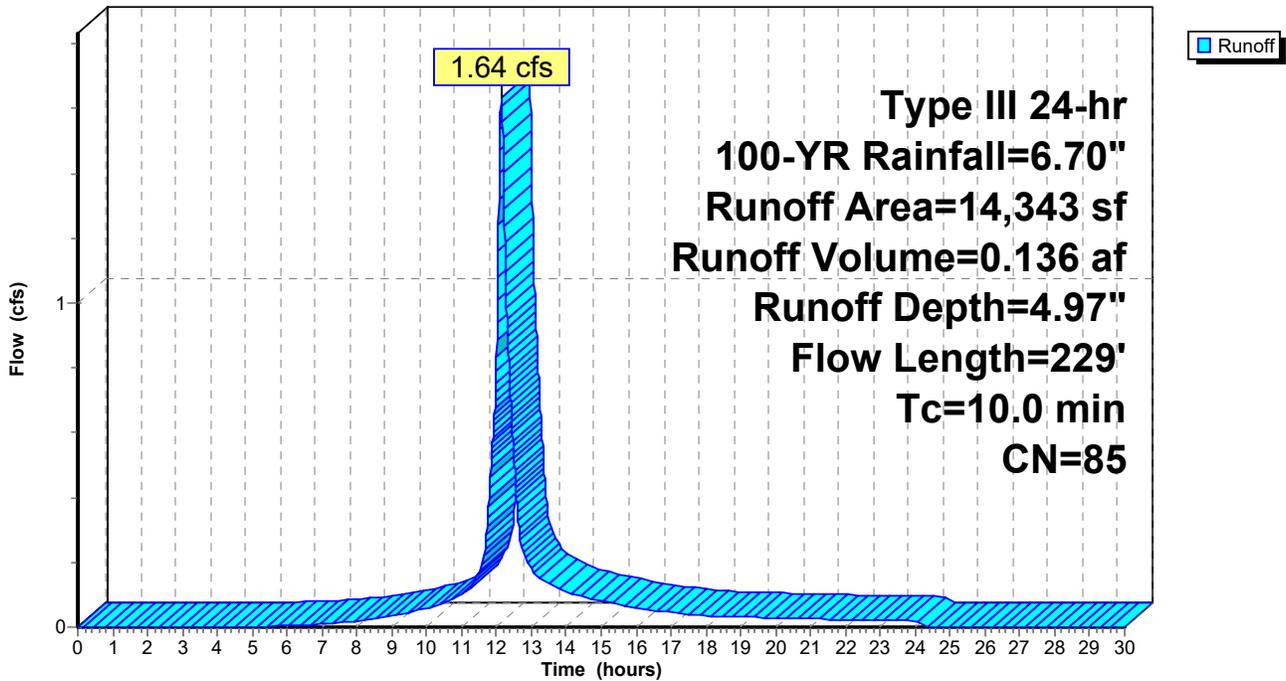
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
Type III 24-hr 100-YR Rainfall=6.70"

Area (sf)	CN	Description
9,437	98	Paved parking, HSG B
4,906	61	>75% Grass cover, Good, HSG B
14,343	85	Weighted Average
4,906		34.20% Pervious Area
9,437		65.80% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.6	63	0.0280	0.12		Sheet Flow, Grass: Dense n= 0.240 P2= 3.20"
1.4	166	0.0100	2.03		Shallow Concentrated Flow, Paved Kv= 20.3 fps
10.0	229	Total			

**Subcatchment 8P: P3a**

Hydrograph



**Summary for Pond 10P: CB**

Inflow Area = 0.329 ac, 65.80% Impervious, Inflow Depth = 4.97" for 100-YR event  
 Inflow = 1.64 cfs @ 12.14 hrs, Volume= 0.136 af  
 Outflow = 1.64 cfs @ 12.14 hrs, Volume= 0.136 af, Atten= 0%, Lag= 0.0 min  
 Primary = 1.64 cfs @ 12.14 hrs, Volume= 0.136 af

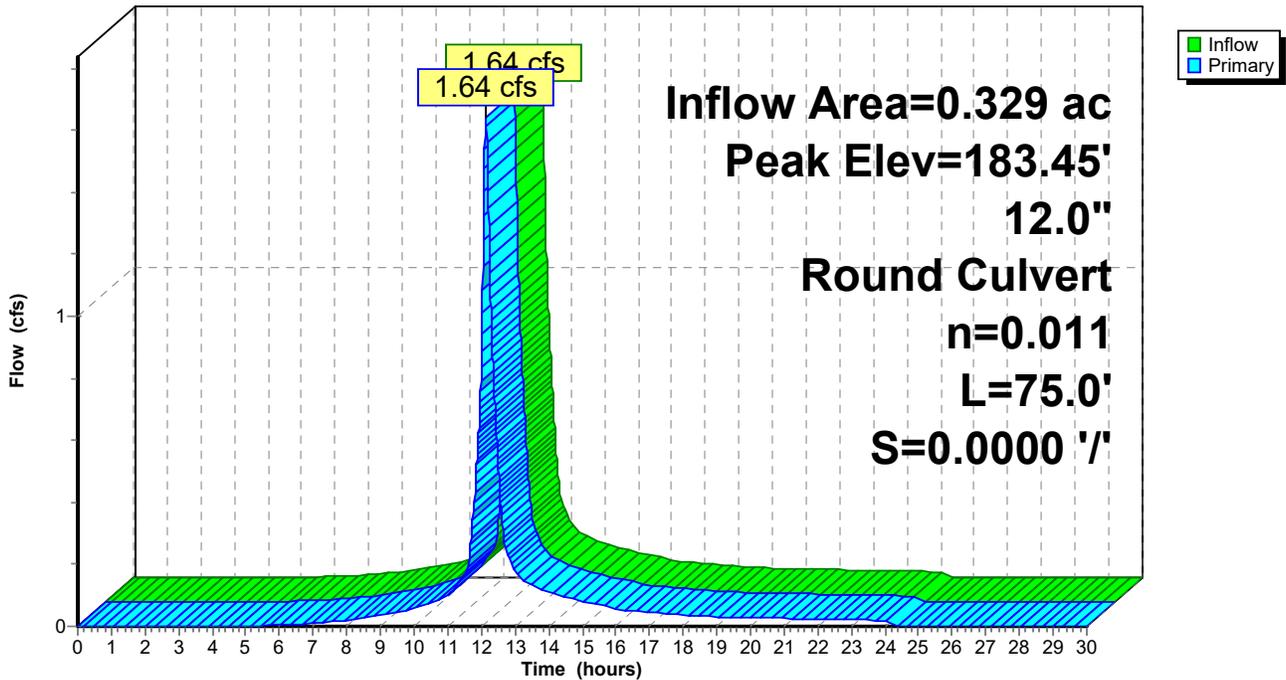
Routing by Dyn-Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
 Peak Elev= 183.45' @ 12.30 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	180.60'	<b>12.0" Round Culvert</b> L= 75.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 180.60' / 180.60' S= 0.0000 '/ Cc= 0.900 n= 0.011, Flow Area= 0.79 sf

**Primary OutFlow** Max=1.44 cfs @ 12.14 hrs HW=182.74' TW=182.58' (Dynamic Tailwater)  
 ↳ **1=Culvert** (Outlet Controls 1.44 cfs @ 1.84 fps)

**Pond 10P: CB**

Hydrograph



**Summary for Subcatchment 11P: P3b**

Runoff = 0.97 cfs @ 12.03 hrs, Volume= 0.069 af, Depth= 6.46"

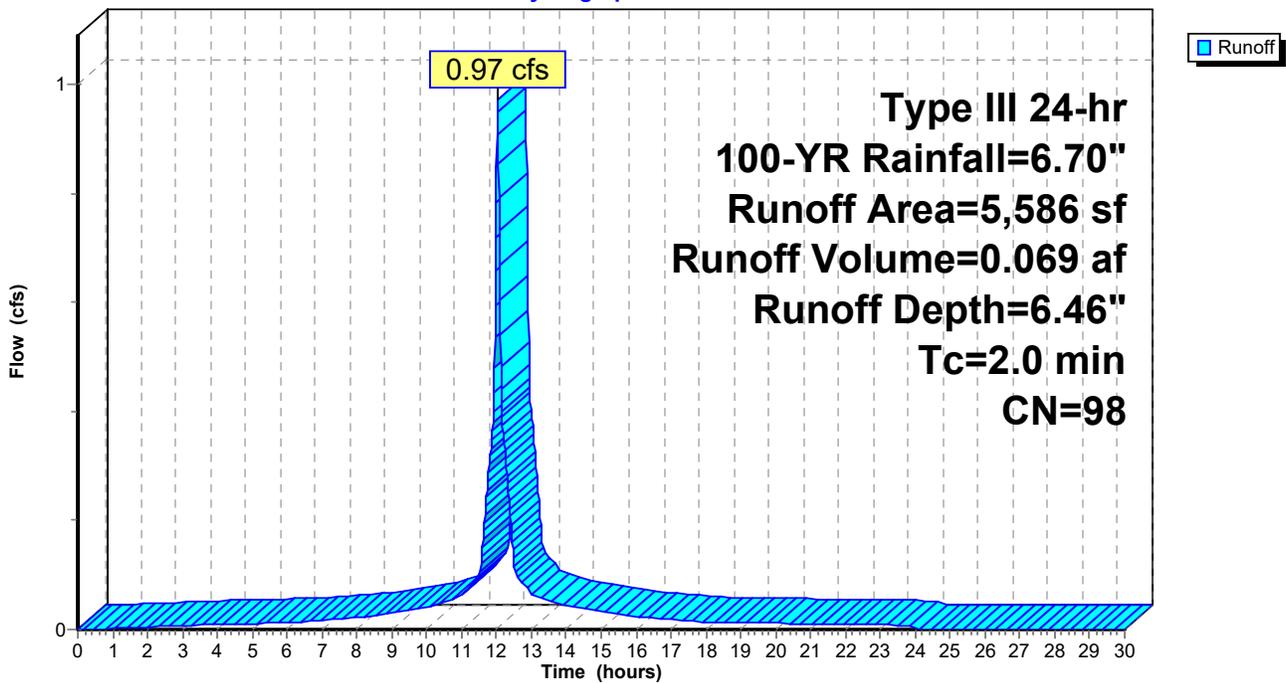
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
 Type III 24-hr 100-YR Rainfall=6.70"

Area (sf)	CN	Description
5,586	98	Roofs, HSG B
5,586		100.00% Impervious Area

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

**Subcatchment 11P: P3b**

Hydrograph



**Summary for Pond 12P: Infiltration Field**

Inflow Area = 0.458 ac, 75.38% Impervious, Inflow Depth = 5.39" for 100-YR event  
 Inflow = 2.14 cfs @ 12.09 hrs, Volume= 0.205 af  
 Outflow = 1.76 cfs @ 12.29 hrs, Volume= 0.205 af, Atten= 18%, Lag= 11.8 min  
 Discarded = 0.13 cfs @ 11.56 hrs, Volume= 0.135 af  
 Primary = 1.25 cfs @ 12.29 hrs, Volume= 0.008 af  
 Secondary = 0.38 cfs @ 12.29 hrs, Volume= 0.062 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
 Peak Elev= 183.37' @ 12.29 hrs Surf.Area= 2,377 sf Storage= 2,671 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)  
 Center-of-Mass det. time= 61.5 min ( 841.5 - 780.0 )

Volume	Invert	Avail.Storage	Storage Description
#1A	181.20'	1,454 cf	<b>72.00'W x 32.83'L x 2.04'H Field A</b> 4,826 cf Overall - 1,192 cf Embedded = 3,634 cf x 40.0% Voids
#2A	181.70'	1,192 cf	<b>Cultec C-100HD</b> x 84 Inside #1 Effective Size= 32.1"W x 12.0"H => 1.86 sf x 7.50'L = 14.0 cf Overall Size= 36.0"W x 12.5"H x 8.00'L with 0.50' Overlap Row Length Adjustment= +0.50' x 1.86 sf x 21 rows
#3	181.40'	38 cf	<b>4.00'D x 3.00'H Vertical Cone/Cylinder</b>
		2,684 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	181.20'	<b>2.410 in/hr Exfiltration over Surface area</b>
#2	Secondary	181.88'	<b>4.0" Round Culvert</b> L= 7.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 181.88' / 181.00' S= 0.1257 '/' Cc= 0.900 n= 0.011, Flow Area= 0.09 sf
#3	Primary	183.30'	<b>Trench Drain, Cv= 2.62 (C= 3.28)</b> Elev. (feet) 183.30 183.40 Width (feet) 20.00 20.00

**Discarded OutFlow** Max=0.13 cfs @ 11.56 hrs HW=181.40' (Free Discharge)

↑1=Exfiltration (Exfiltration Controls 0.13 cfs)

**Primary OutFlow** Max=1.17 cfs @ 12.29 hrs HW=183.37' TW=0.00' (Dynamic Tailwater)

↑3=Trench Drain (Weir Controls 1.17 cfs @ 0.86 fps)

**Secondary OutFlow** Max=0.38 cfs @ 12.29 hrs HW=183.37' TW=0.00' (Dynamic Tailwater)

↑2=Culvert (Inlet Controls 0.38 cfs @ 4.37 fps)

**Pond 12P: Infiltration Field - Chamber Wizard Field A**

**Chamber Model = Cultec C-100HD (Cultec Contactor® 100HD)**

Effective Size= 32.1"W x 12.0"H => 1.86 sf x 7.50'L = 14.0 cf

Overall Size= 36.0"W x 12.5"H x 8.00'L with 0.50' Overlap

Row Length Adjustment= +0.50' x 1.86 sf x 21 rows

36.0" Wide + 4.0" Spacing = 40.0" C-C Row Spacing

4 Chambers/Row x 7.50' Long +0.50' Row Adjustment = 30.50' Row Length +14.0" End Stone x 2 = 32.83' Base Length

21 Rows x 36.0" Wide + 4.0" Spacing x 20 + 14.0" Side Stone x 2 = 72.00' Base Width

6.0" Base + 12.5" Chamber Height + 6.0" Cover = 2.04' Field Height

84 Chambers x 14.0 cf +0.50' Row Adjustment x 1.86 sf x 21 Rows = 1,192.3 cf Chamber Storage

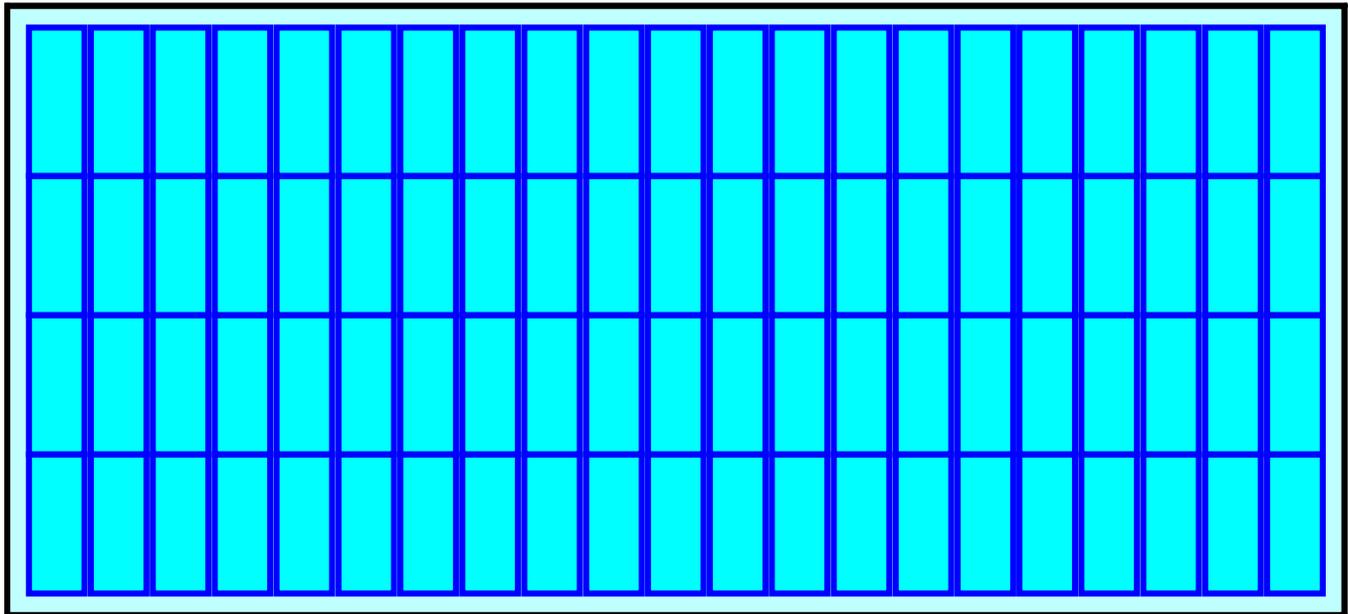
4,826.5 cf Field - 1,192.3 cf Chambers = 3,634.2 cf Stone x 40.0% Voids = 1,453.7 cf Stone Storage

Chamber Storage + Stone Storage = 2,646.0 cf = 0.061 af

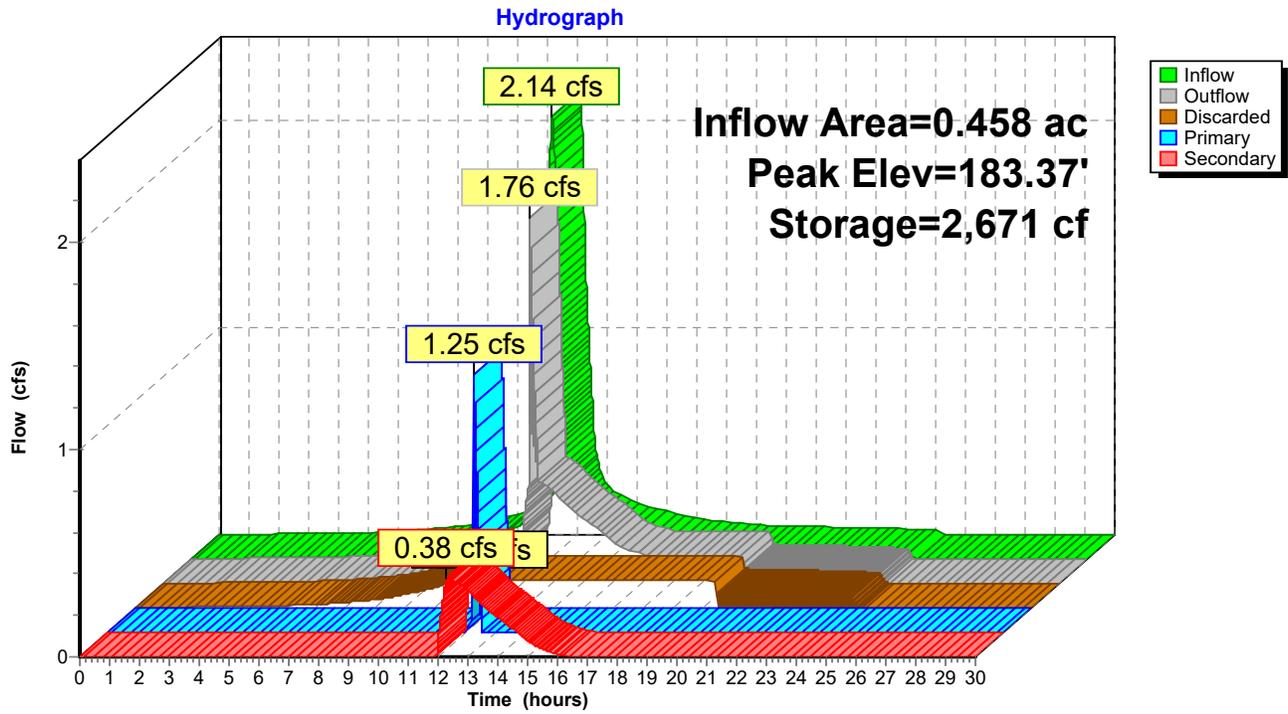
Overall Storage Efficiency = 54.8%

Overall System Size = 32.83' x 72.00' x 2.04'

84 Chambers  
178.8 cy Field  
134.6 cy Stone



### Pond 12P: Infiltration Field



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Type III 24-hr 100-YR Rainfall=6.70"

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**Summary for Subcatchment 15P: P3d**

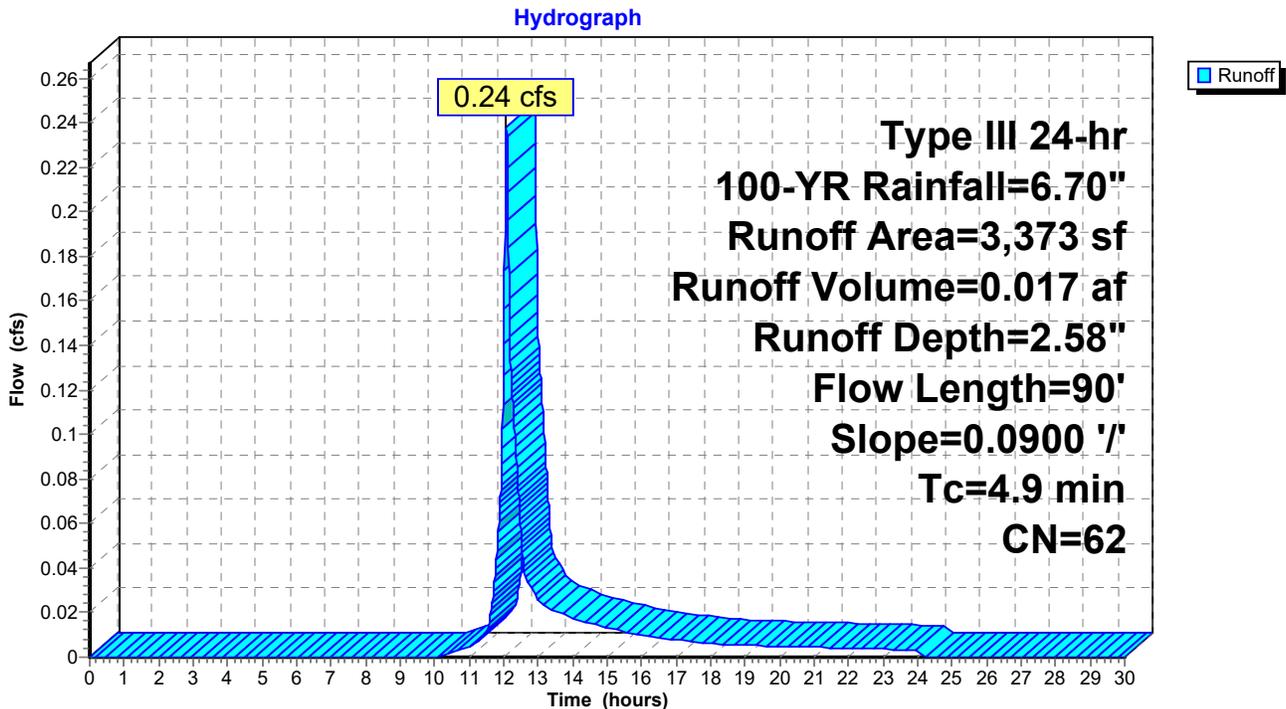
Runoff = 0.24 cfs @ 12.08 hrs, Volume= 0.017 af, Depth= 2.58"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
Type III 24-hr 100-YR Rainfall=6.70"

Area (sf)	CN	Description
258	98	Paved parking, HSG B
272	39	>75% Grass cover, Good, HSG A
2,843	61	>75% Grass cover, Good, HSG B
3,373	62	Weighted Average
3,115		92.35% Pervious Area
258		7.65% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.9	90	0.0900	0.30		Sheet Flow, Grass: Short n= 0.150 P2= 3.20"

**Subcatchment 15P: P3d**

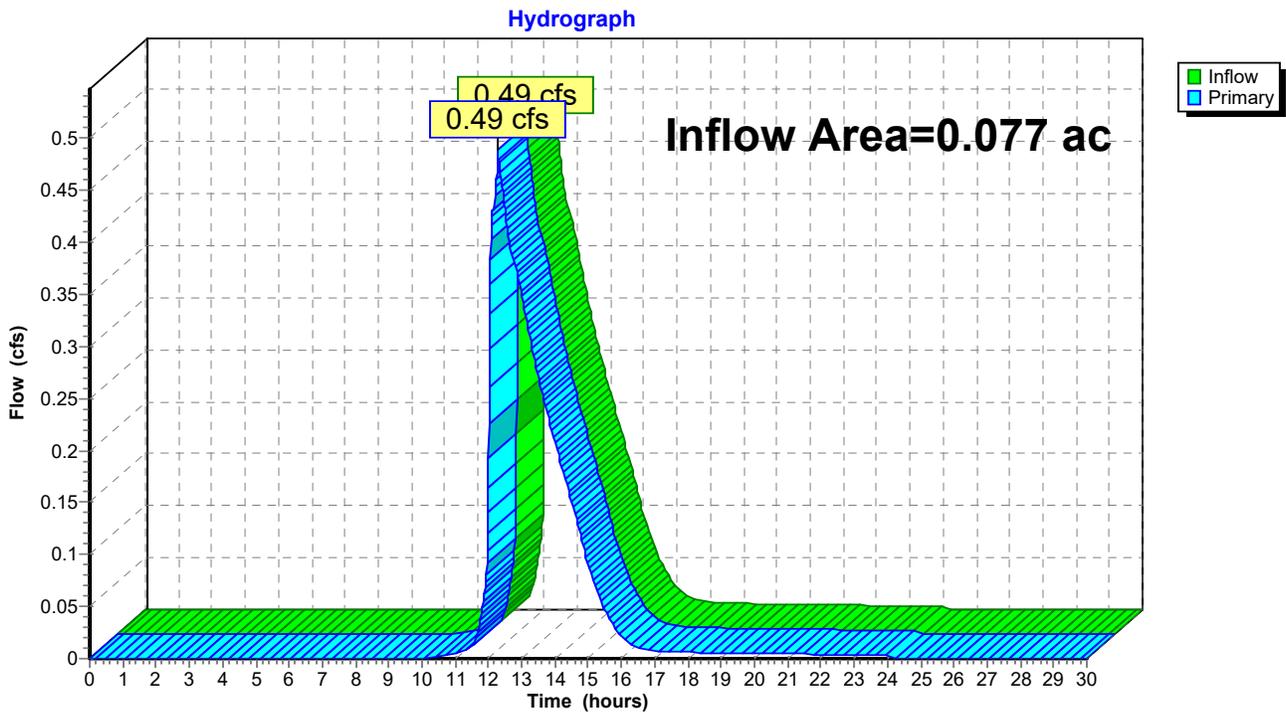


### Summary for Link 16P: Design Point #3b: Flow to Eastern Abutter

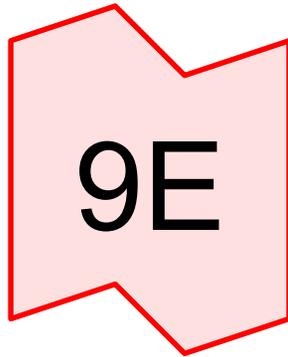
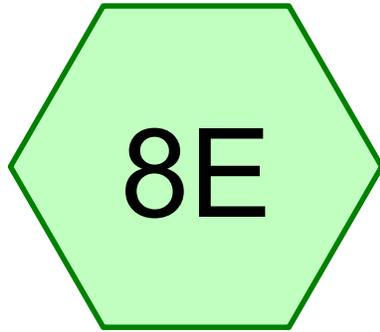
Inflow Area = 0.077 ac, 7.65% Impervious, Inflow Depth = 12.24" for 100-YR event  
Inflow = 0.49 cfs @ 12.29 hrs, Volume= 0.079 af  
Primary = 0.49 cfs @ 12.29 hrs, Volume= 0.079 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs

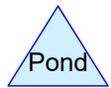
### Link 16P: Design Point #3b: Flow to Eastern Abutter



**DESIGN POINT #4: FLOW TO**  
**WETLANDS EXISTING CONDITIONS**



# Design Point #4: Flow to Wetlands



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### Area Listing (selected nodes)

Area (acres)	CN	Description (subcatchment-numbers)
0.379	61	>75% Grass cover, Good, HSG B (8E)
0.094	90	Gravel (8E)
0.178	98	Paved parking/Conc Pads, HSG B (8E)
0.043	98	Roofs, HSG B (8E)
0.990	55	Woods, Good, HSG B (8E)
<b>1.683</b>	<b>64</b>	<b>TOTAL AREA</b>

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### Soil Listing (selected nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.000	HSG A	
1.589	HSG B	8E
0.000	HSG C	
0.000	HSG D	
0.094	Other	8E
<b>1.683</b>		<b>TOTAL AREA</b>

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Type III 24-hr 2-YR Rainfall=3.20"

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Time span=0.00-30.00 hrs, dt=0.01 hrs, 3001 points  
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN  
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

### Subcatchment 8E: E4

Runoff Area=73,325 sf 13.11% Impervious Runoff Depth=0.56"  
Flow Length=227' Tc=13.9 min CN=64 Runoff=0.63 cfs 0.078 af

### Link 9E: Design Point #4: Flow to Wetlands

Inflow=0.63 cfs 0.078 af  
Primary=0.63 cfs 0.078 af

**Total Runoff Area = 1.683 ac Runoff Volume = 0.078 af Average Runoff Depth = 0.56"**  
**86.89% Pervious = 1.463 ac 13.11% Impervious = 0.221 ac**

**Summary for Subcatchment 8E: E4**

Runoff = 0.63 cfs @ 12.24 hrs, Volume= 0.078 af, Depth= 0.56"

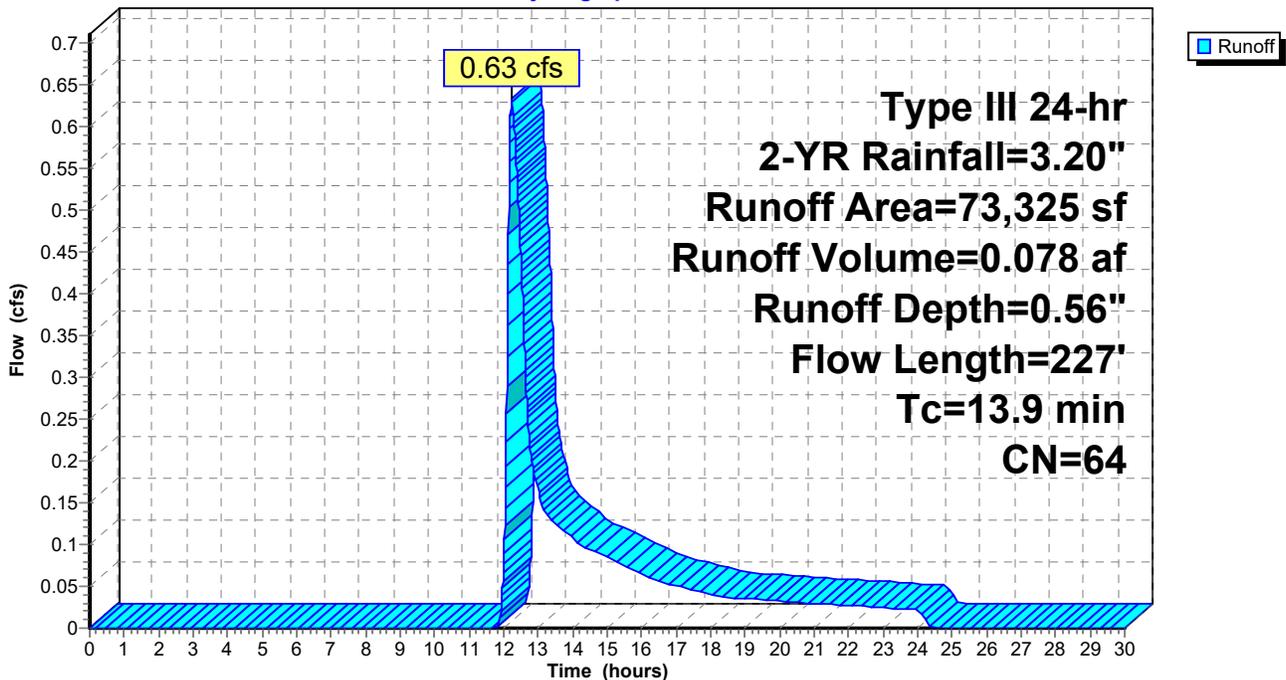
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
Type III 24-hr 2-YR Rainfall=3.20"

	Area (sf)	CN	Description
*	7,745	98	Paved parking/Conc Pads, HSG B
	1,867	98	Roofs, HSG B
*	4,090	90	Gravel
	16,510	61	>75% Grass cover, Good, HSG B
	43,113	55	Woods, Good, HSG B
	73,325	64	Weighted Average
	63,713		86.89% Pervious Area
	9,612		13.11% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.2	27	0.0120	0.05		<b>Sheet Flow,</b> Woods: Light underbrush n= 0.400 P2= 3.20"
4.7	200	0.0200	0.71		<b>Shallow Concentrated Flow,</b> Woodland Kv= 5.0 fps
13.9	227	Total			

**Subcatchment 8E: E4**

Hydrograph

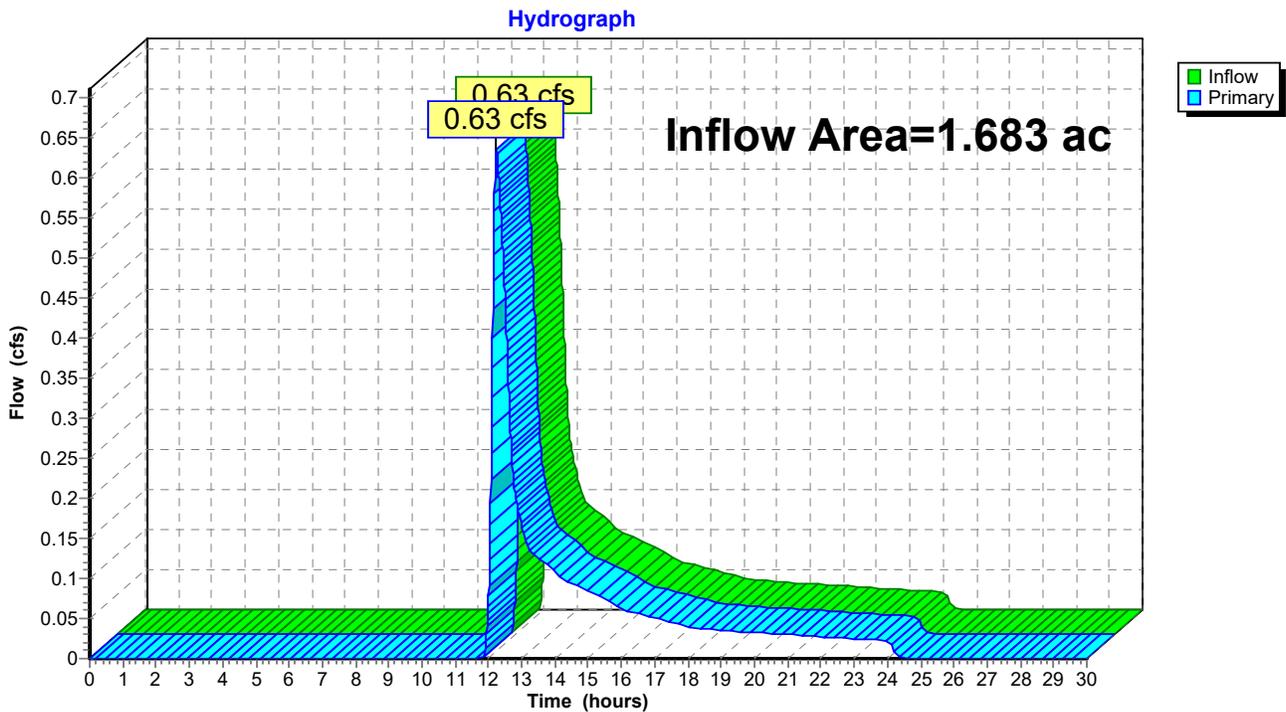


### Summary for Link 9E: Design Point #4: Flow to Wetlands

Inflow Area = 1.683 ac, 13.11% Impervious, Inflow Depth = 0.56" for 2-YR event  
Inflow = 0.63 cfs @ 12.24 hrs, Volume= 0.078 af  
Primary = 0.63 cfs @ 12.24 hrs, Volume= 0.078 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs

### Link 9E: Design Point #4: Flow to Wetlands



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Type III 24-hr 10-YR Rainfall=4.70"

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Time span=0.00-30.00 hrs, dt=0.01 hrs, 3001 points  
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN  
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

### Subcatchment 8E: E4

Runoff Area=73,325 sf 13.11% Impervious Runoff Depth=1.39"  
Flow Length=227' Tc=13.9 min CN=64 Runoff=1.96 cfs 0.195 af

### Link 9E: Design Point #4: Flow to Wetlands

Inflow=1.96 cfs 0.195 af  
Primary=1.96 cfs 0.195 af

**Total Runoff Area = 1.683 ac Runoff Volume = 0.195 af Average Runoff Depth = 1.39"**  
**86.89% Pervious = 1.463 ac 13.11% Impervious = 0.221 ac**

**Summary for Subcatchment 8E: E4**

Runoff = 1.96 cfs @ 12.21 hrs, Volume= 0.195 af, Depth= 1.39"

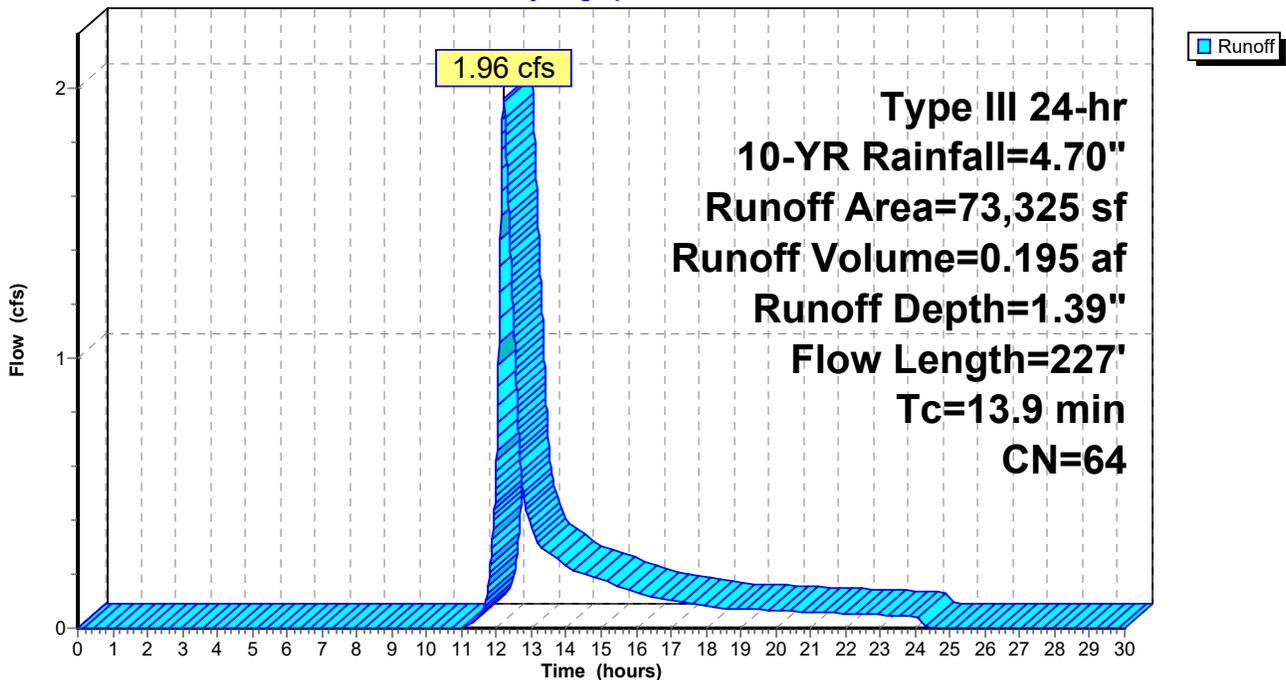
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
Type III 24-hr 10-YR Rainfall=4.70"

	Area (sf)	CN	Description
*	7,745	98	Paved parking/Conc Pads, HSG B
	1,867	98	Roofs, HSG B
*	4,090	90	Gravel
	16,510	61	>75% Grass cover, Good, HSG B
	43,113	55	Woods, Good, HSG B
	73,325	64	Weighted Average
	63,713		86.89% Pervious Area
	9,612		13.11% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.2	27	0.0120	0.05		<b>Sheet Flow,</b> Woods: Light underbrush n= 0.400 P2= 3.20"
4.7	200	0.0200	0.71		<b>Shallow Concentrated Flow,</b> Woodland Kv= 5.0 fps
13.9	227	Total			

**Subcatchment 8E: E4**

Hydrograph

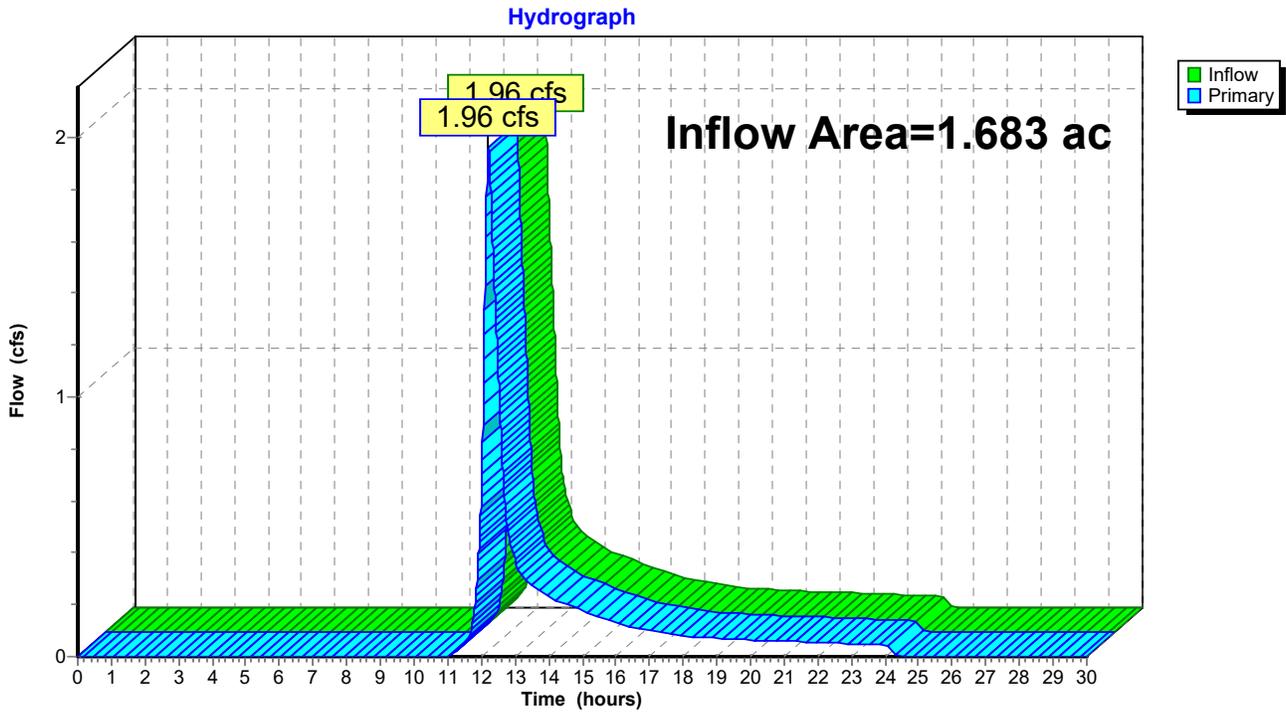


### Summary for Link 9E: Design Point #4: Flow to Wetlands

Inflow Area = 1.683 ac, 13.11% Impervious, Inflow Depth = 1.39" for 10-YR event  
Inflow = 1.96 cfs @ 12.21 hrs, Volume= 0.195 af  
Primary = 1.96 cfs @ 12.21 hrs, Volume= 0.195 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs

### Link 9E: Design Point #4: Flow to Wetlands



## HydroCAD2

Type III 24-hr 25-YR Rainfall=5.50"

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Time span=0.00-30.00 hrs, dt=0.01 hrs, 3001 points  
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN  
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

### Subcatchment 8E: E4

Runoff Area=73,325 sf 13.11% Impervious Runoff Depth=1.91"  
Flow Length=227' Tc=13.9 min CN=64 Runoff=2.80 cfs 0.268 af

### Link 9E: Design Point #4: Flow to Wetlands

Inflow=2.80 cfs 0.268 af  
Primary=2.80 cfs 0.268 af

**Total Runoff Area = 1.683 ac Runoff Volume = 0.268 af Average Runoff Depth = 1.91"**  
**86.89% Pervious = 1.463 ac 13.11% Impervious = 0.221 ac**

**Summary for Subcatchment 8E: E4**

Runoff = 2.80 cfs @ 12.20 hrs, Volume= 0.268 af, Depth= 1.91"

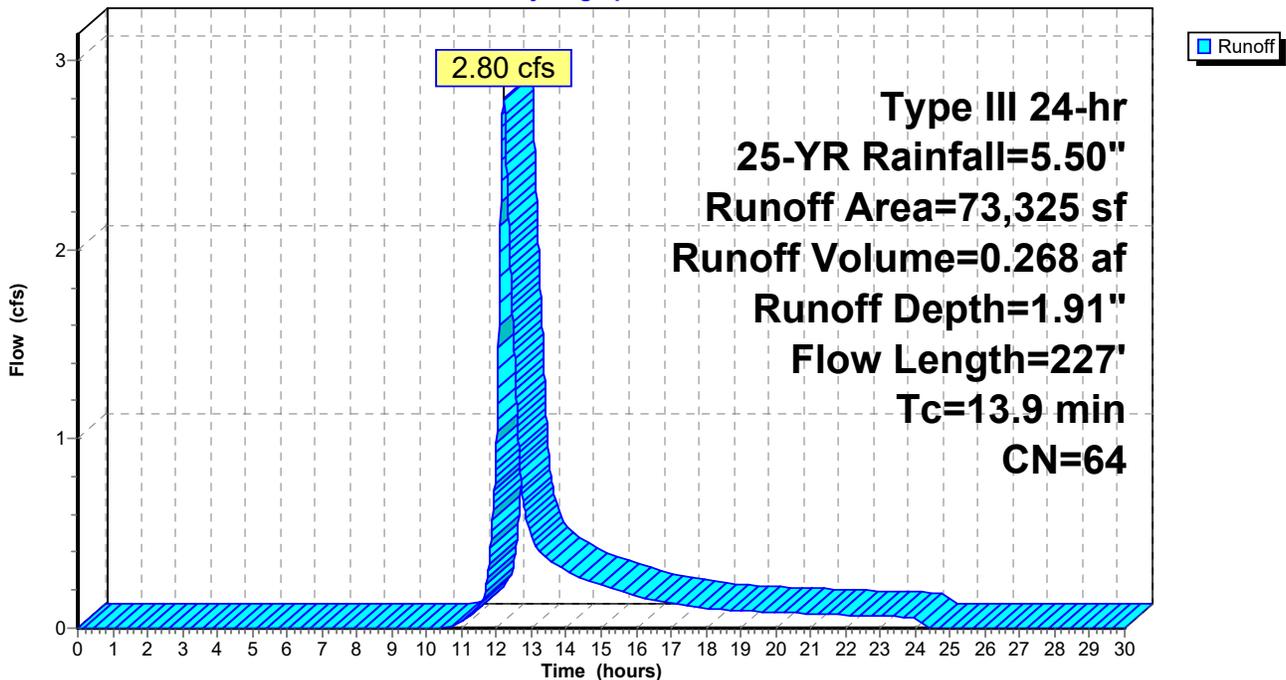
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
Type III 24-hr 25-YR Rainfall=5.50"

	Area (sf)	CN	Description
*	7,745	98	Paved parking/Conc Pads, HSG B
	1,867	98	Roofs, HSG B
*	4,090	90	Gravel
	16,510	61	>75% Grass cover, Good, HSG B
	43,113	55	Woods, Good, HSG B
	73,325	64	Weighted Average
	63,713		86.89% Pervious Area
	9,612		13.11% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.2	27	0.0120	0.05		<b>Sheet Flow,</b> Woods: Light underbrush n= 0.400 P2= 3.20"
4.7	200	0.0200	0.71		<b>Shallow Concentrated Flow,</b> Woodland Kv= 5.0 fps
13.9	227	Total			

**Subcatchment 8E: E4**

Hydrograph

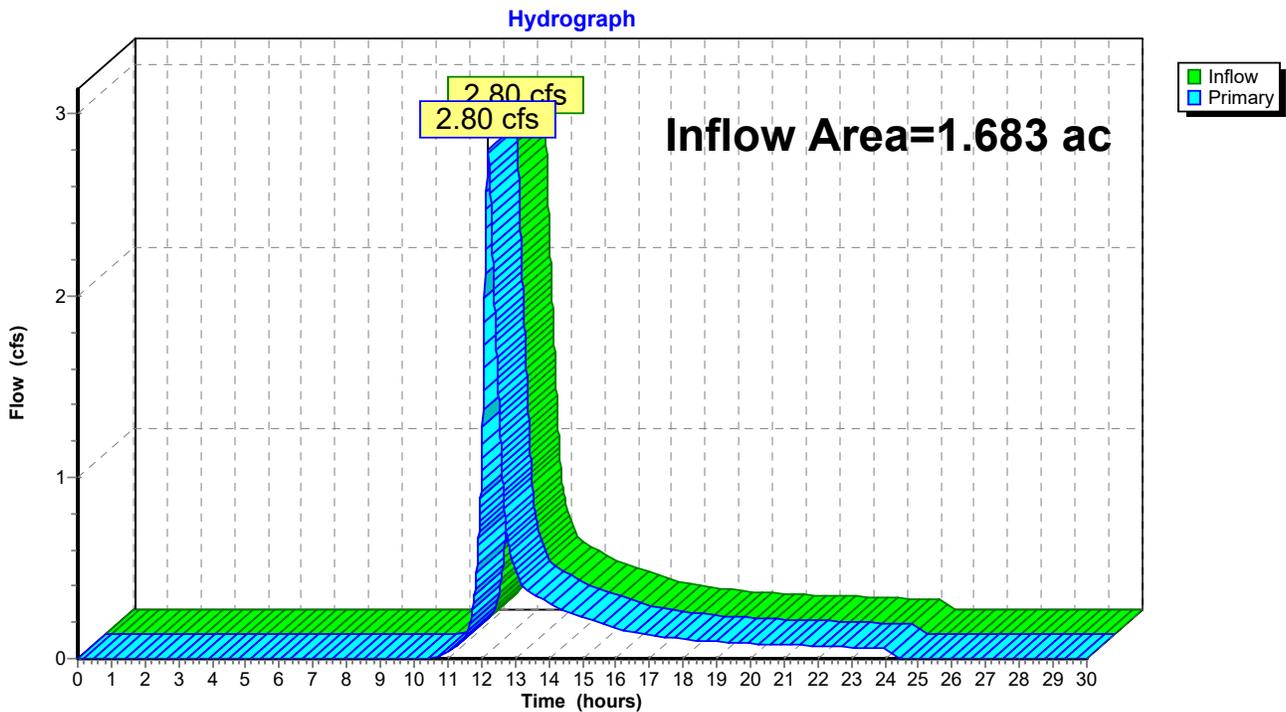


### Summary for Link 9E: Design Point #4: Flow to Wetlands

Inflow Area = 1.683 ac, 13.11% Impervious, Inflow Depth = 1.91" for 25-YR event  
Inflow = 2.80 cfs @ 12.20 hrs, Volume= 0.268 af  
Primary = 2.80 cfs @ 12.20 hrs, Volume= 0.268 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs

### Link 9E: Design Point #4: Flow to Wetlands



## HydroCAD2

Type III 24-hr 50-YR Rainfall=6.10"

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Time span=0.00-30.00 hrs, dt=0.01 hrs, 3001 points  
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN  
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

### Subcatchment 8E: E4

Runoff Area=73,325 sf 13.11% Impervious Runoff Depth=2.33"  
Flow Length=227' Tc=13.9 min CN=64 Runoff=3.48 cfs 0.328 af

### Link 9E: Design Point #4: Flow to Wetlands

Inflow=3.48 cfs 0.328 af  
Primary=3.48 cfs 0.328 af

**Total Runoff Area = 1.683 ac Runoff Volume = 0.328 af Average Runoff Depth = 2.33"**  
**86.89% Pervious = 1.463 ac 13.11% Impervious = 0.221 ac**

**Summary for Subcatchment 8E: E4**

Runoff = 3.48 cfs @ 12.20 hrs, Volume= 0.328 af, Depth= 2.33"

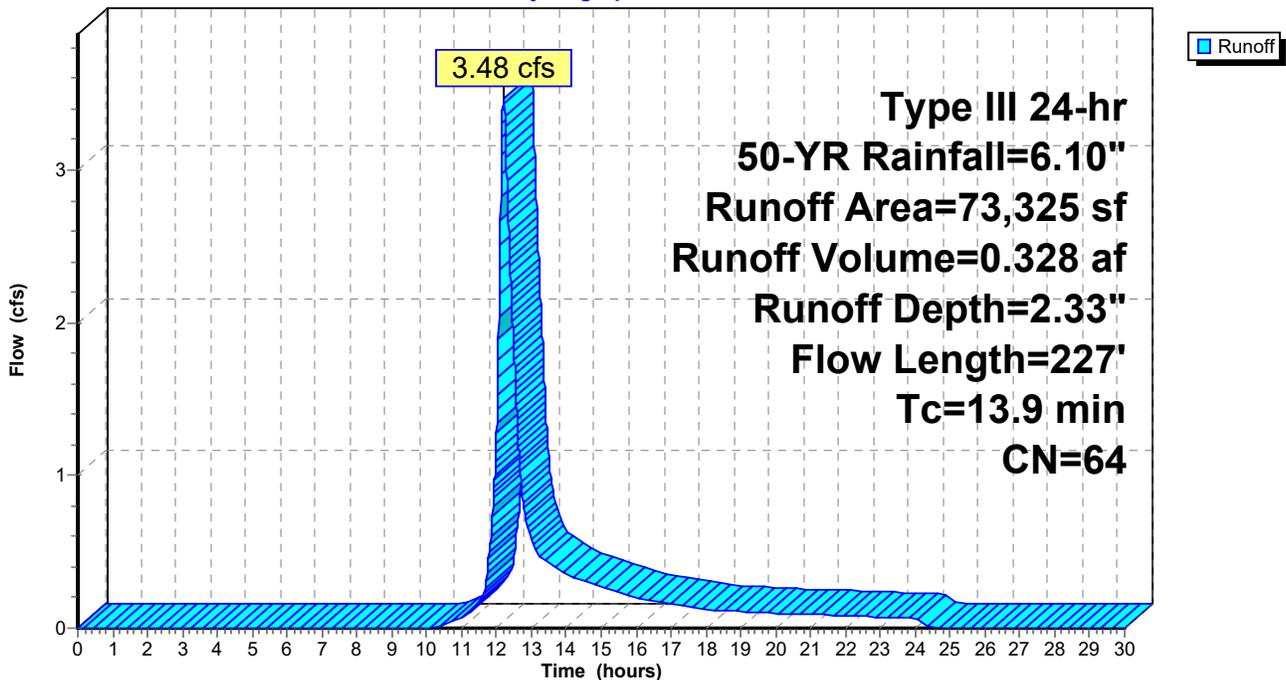
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
Type III 24-hr 50-YR Rainfall=6.10"

	Area (sf)	CN	Description
*	7,745	98	Paved parking/Conc Pads, HSG B
	1,867	98	Roofs, HSG B
*	4,090	90	Gravel
	16,510	61	>75% Grass cover, Good, HSG B
	43,113	55	Woods, Good, HSG B
	73,325	64	Weighted Average
	63,713		86.89% Pervious Area
	9,612		13.11% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.2	27	0.0120	0.05		<b>Sheet Flow,</b> Woods: Light underbrush n= 0.400 P2= 3.20"
4.7	200	0.0200	0.71		<b>Shallow Concentrated Flow,</b> Woodland Kv= 5.0 fps
13.9	227	Total			

**Subcatchment 8E: E4**

Hydrograph

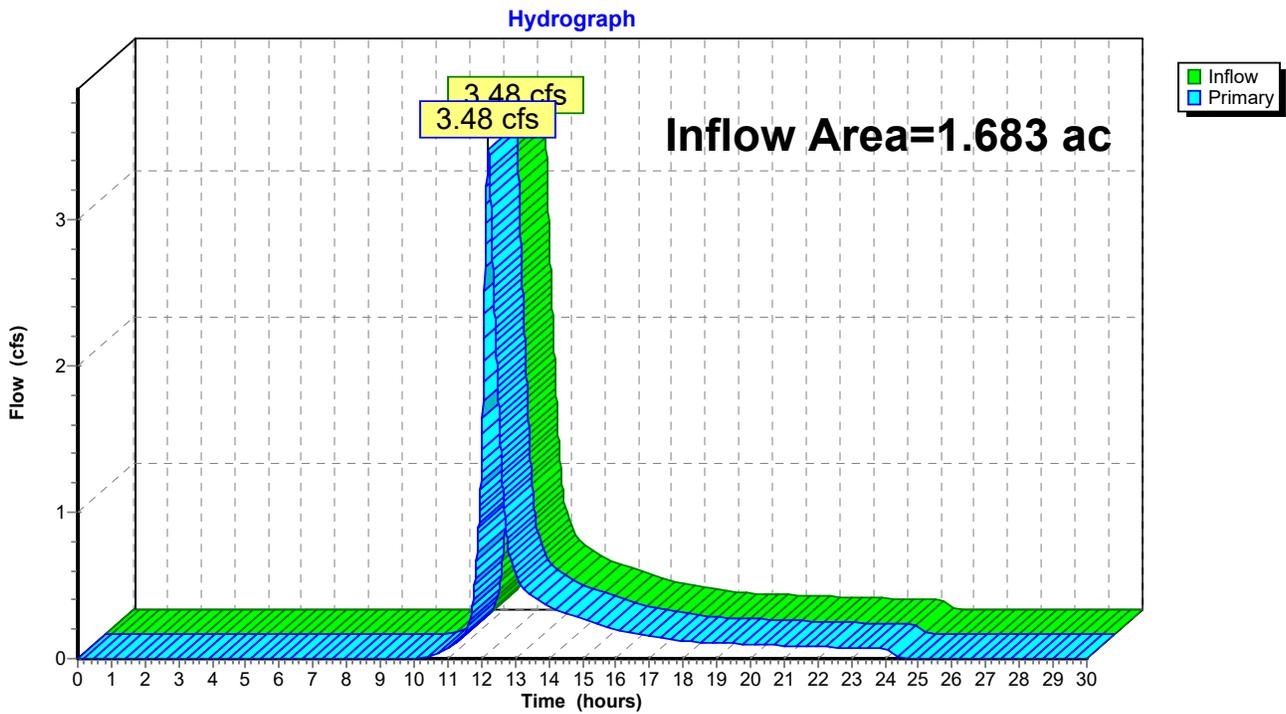


### Summary for Link 9E: Design Point #4: Flow to Wetlands

Inflow Area = 1.683 ac, 13.11% Impervious, Inflow Depth = 2.33" for 50-YR event  
Inflow = 3.48 cfs @ 12.20 hrs, Volume= 0.328 af  
Primary = 3.48 cfs @ 12.20 hrs, Volume= 0.328 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs

### Link 9E: Design Point #4: Flow to Wetlands



## HydroCAD2

Type III 24-hr 100-YR Rainfall=6.70"

Prepared by {enter your company name here}

Printed 6/29/2019

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Time span=0.00-30.00 hrs, dt=0.01 hrs, 3001 points  
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN  
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

### Subcatchment 8E: E4

Runoff Area=73,325 sf 13.11% Impervious Runoff Depth=2.78"  
Flow Length=227' Tc=13.9 min CN=64 Runoff=4.18 cfs 0.389 af

### Link 9E: Design Point #4: Flow to Wetlands

Inflow=4.18 cfs 0.389 af  
Primary=4.18 cfs 0.389 af

**Total Runoff Area = 1.683 ac Runoff Volume = 0.389 af Average Runoff Depth = 2.78"**  
**86.89% Pervious = 1.463 ac 13.11% Impervious = 0.221 ac**

**Summary for Subcatchment 8E: E4**

Runoff = 4.18 cfs @ 12.20 hrs, Volume= 0.389 af, Depth= 2.78"

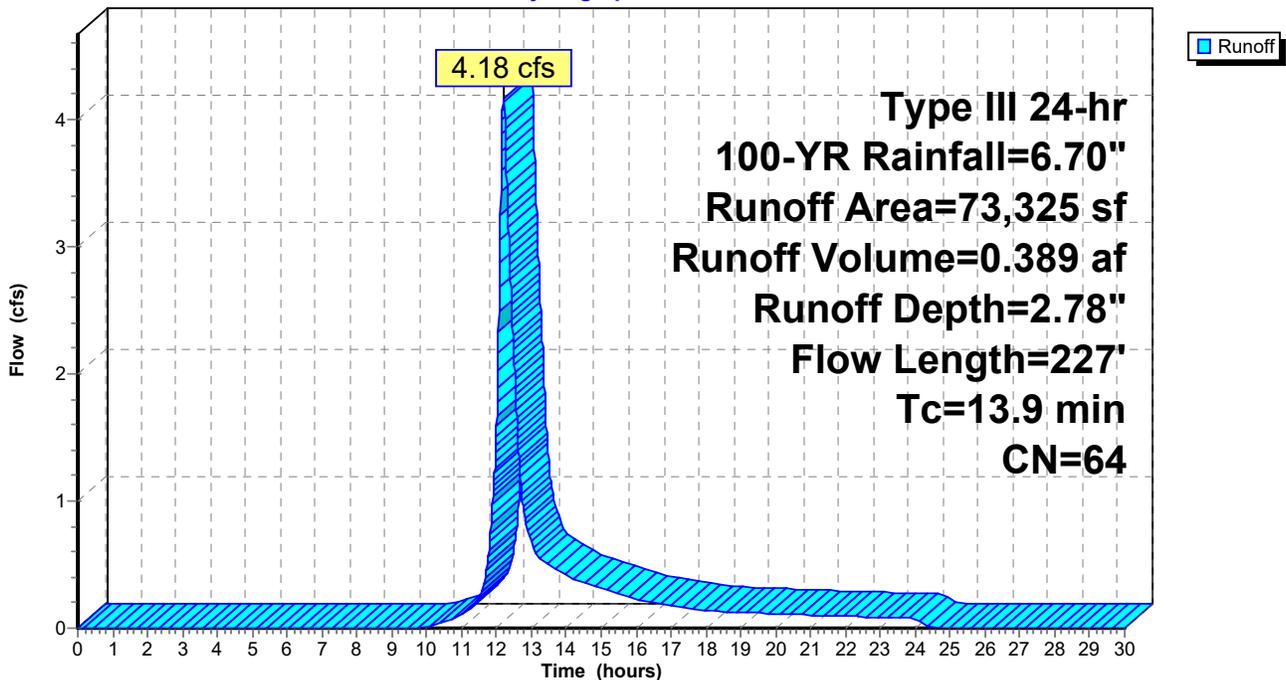
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
 Type III 24-hr 100-YR Rainfall=6.70"

	Area (sf)	CN	Description
*	7,745	98	Paved parking/Conc Pads, HSG B
	1,867	98	Roofs, HSG B
*	4,090	90	Gravel
	16,510	61	>75% Grass cover, Good, HSG B
	43,113	55	Woods, Good, HSG B
	73,325	64	Weighted Average
	63,713		86.89% Pervious Area
	9,612		13.11% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.2	27	0.0120	0.05		<b>Sheet Flow,</b> Woods: Light underbrush n= 0.400 P2= 3.20"
4.7	200	0.0200	0.71		<b>Shallow Concentrated Flow,</b> Woodland Kv= 5.0 fps
13.9	227	Total			

**Subcatchment 8E: E4**

Hydrograph

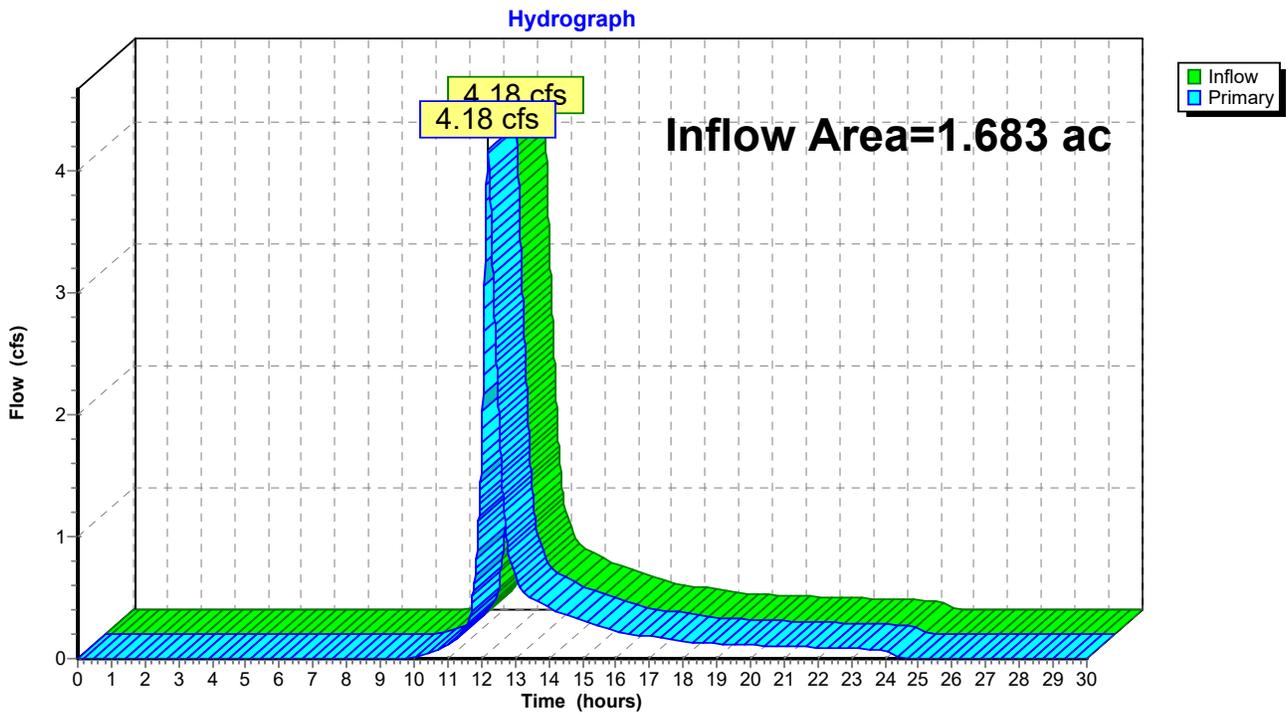


### Summary for Link 9E: Design Point #4: Flow to Wetlands

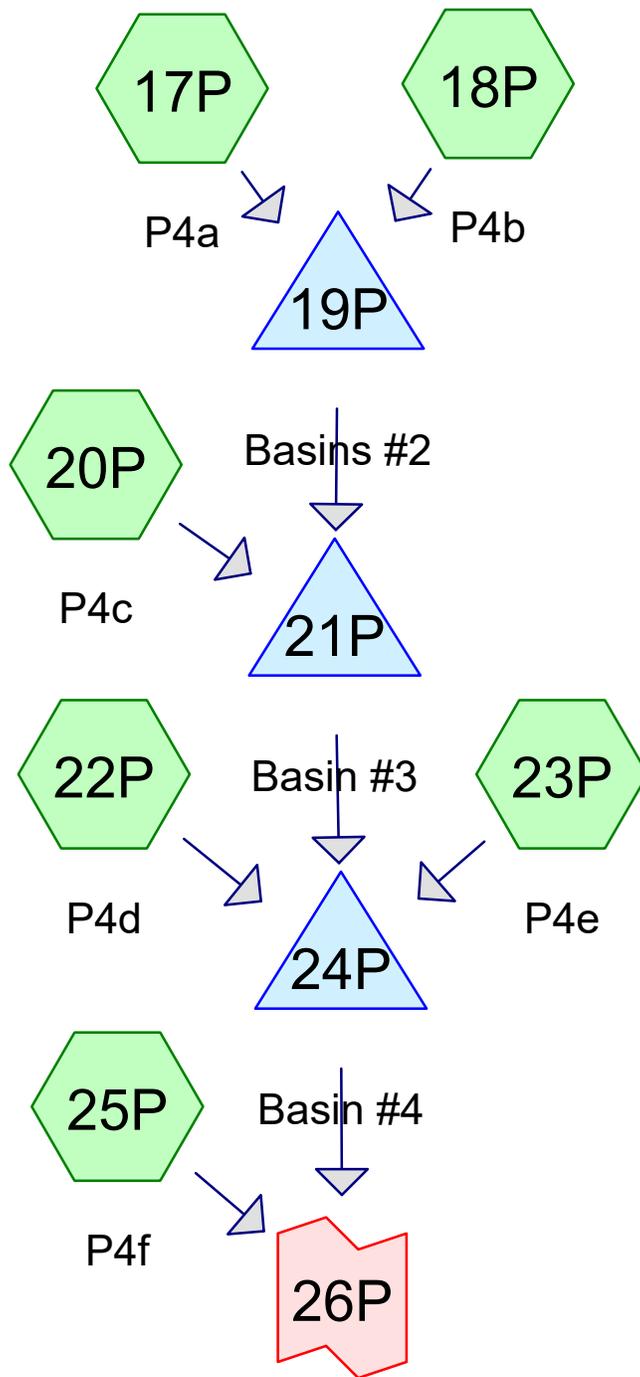
Inflow Area = 1.683 ac, 13.11% Impervious, Inflow Depth = 2.78" for 100-YR event  
Inflow = 4.18 cfs @ 12.20 hrs, Volume= 0.389 af  
Primary = 4.18 cfs @ 12.20 hrs, Volume= 0.389 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs

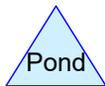
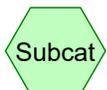
### Link 9E: Design Point #4: Flow to Wetlands



**DESIGN POINT #4: FLOW TO**  
**WETLANDS PROPOSED CONDITIONS**



Design Point #4: Flow to Wetlands



**Routing Diagram for HydroCAD4**

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# HydroCAD4

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## Area Listing (selected nodes)

Area (acres)	CN	Description (subcatchment-numbers)
0.959	61	>75% Grass cover, Good, HSG B (17P, 20P, 22P, 25P)
0.563	98	Paved parking, HSG B (17P, 20P)
0.036	90	Pavers, HSG B (25P)
0.303	98	Roofs, HSG B (18P, 20P, 23P)
0.295	55	Woods, Good, HSG B (25P)
<b>2.155</b>	<b>76</b>	<b>TOTAL AREA</b>

**HydroCAD4**

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Type III 24-hr 2-YR Rainfall=3.20"

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Time span=0.00-30.00 hrs, dt=0.01 hrs, 3001 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 17P: P4a** Runoff Area=13,831 sf 56.52% Impervious Runoff Depth=1.54"  
 Flow Length=45' Slope=0.0800 '/' Tc=4.3 min CN=82 Runoff=0.61 cfs 0.041 af

**Subcatchment 18P: P4b** Runoff Area=9,310 sf 100.00% Impervious Runoff Depth=2.97"  
 Tc=2.0 min CN=98 Runoff=0.77 cfs 0.053 af

**Pond 19P: Basins #2** Peak Elev=185.59' Storage=526 cf Inflow=1.31 cfs 0.094 af  
 Discarded=0.08 cfs 0.058 af Primary=0.89 cfs 0.036 af Outflow=0.97 cfs 0.094 af

**Subcatchment 20P: P4c** Runoff Area=33,335 sf 50.58% Impervious Runoff Depth=1.40"  
 Flow Length=110' Tc=9.5 min CN=80 Runoff=1.10 cfs 0.089 af

**Pond 21P: Basin #3** Peak Elev=185.59' Storage=1,865 cf Inflow=1.95 cfs 0.125 af  
 Discarded=0.20 cfs 0.103 af Primary=0.30 cfs 0.022 af Outflow=0.50 cfs 0.125 af

**Subcatchment 22P: P4d** Runoff Area=1,911 sf 0.00% Impervious Runoff Depth=0.44"  
 Flow Length=20' Slope=0.3000 '/' Tc=2.0 min CN=61 Runoff=0.02 cfs 0.002 af

**Subcatchment 23P: P4e** Runoff Area=3,724 sf 100.00% Impervious Runoff Depth=2.97"  
 Tc=2.0 min CN=98 Runoff=0.31 cfs 0.021 af

**Pond 24P: Basin #4** Peak Elev=185.58' Storage=354 cf Inflow=0.35 cfs 0.045 af  
 Discarded=0.03 cfs 0.022 af Primary=0.31 cfs 0.023 af Outflow=0.34 cfs 0.045 af

**Subcatchment 25P: P4f** Runoff Area=31,748 sf 0.00% Impervious Runoff Depth=0.41"  
 Flow Length=129' Tc=11.1 min CN=60 Runoff=0.17 cfs 0.025 af

**Link 26P: Design Point #4: Flow to Wetlands** Inflow=0.45 cfs 0.048 af  
 Primary=0.45 cfs 0.048 af

**Total Runoff Area = 2.155 ac Runoff Volume = 0.231 af Average Runoff Depth = 1.28"**  
**59.82% Pervious = 1.289 ac 40.18% Impervious = 0.866 ac**

**Summary for Subcatchment 17P: P4a**

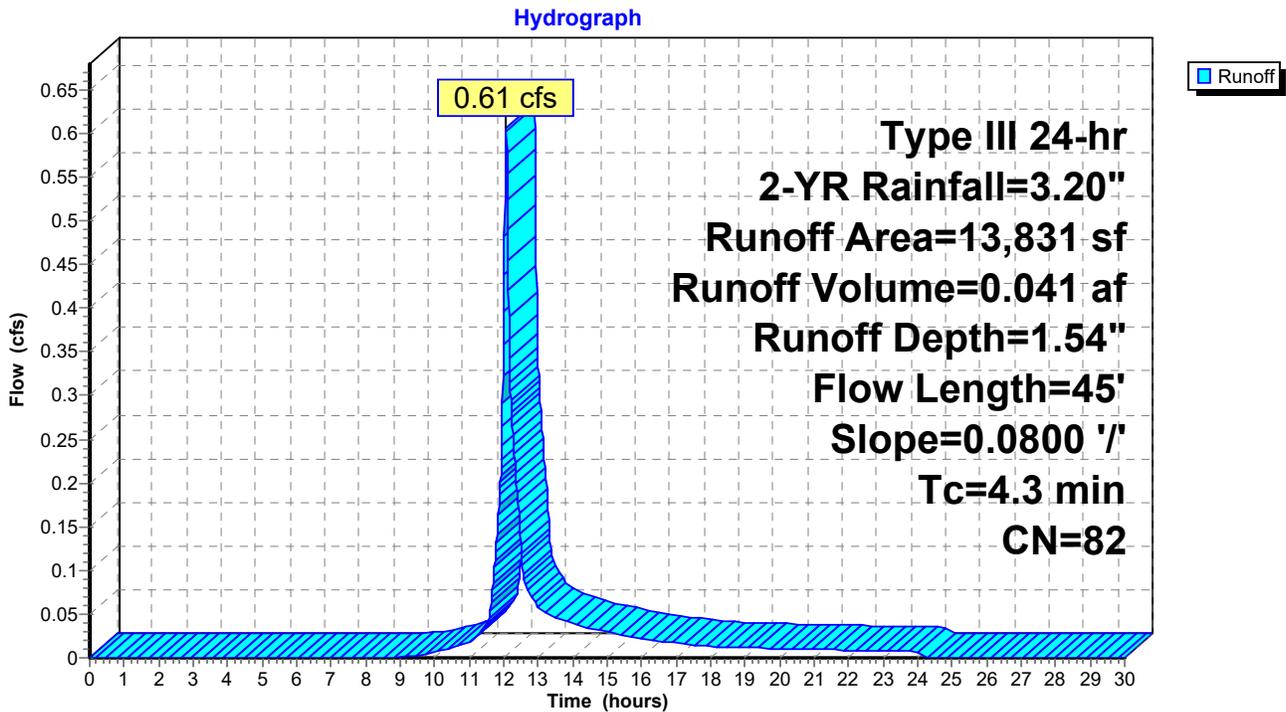
Runoff = 0.61 cfs @ 12.07 hrs, Volume= 0.041 af, Depth= 1.54"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
 Type III 24-hr 2-YR Rainfall=3.20"

Area (sf)	CN	Description
7,817	98	Paved parking, HSG B
6,014	61	>75% Grass cover, Good, HSG B
13,831	82	Weighted Average
6,014		43.48% Pervious Area
7,817		56.52% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.3	45	0.0800	0.17		Sheet Flow, Grass: Dense n= 0.240 P2= 3.20"

**Subcatchment 17P: P4a**



**Summary for Subcatchment 18P: P4b**

Runoff = 0.77 cfs @ 12.03 hrs, Volume= 0.053 af, Depth= 2.97"

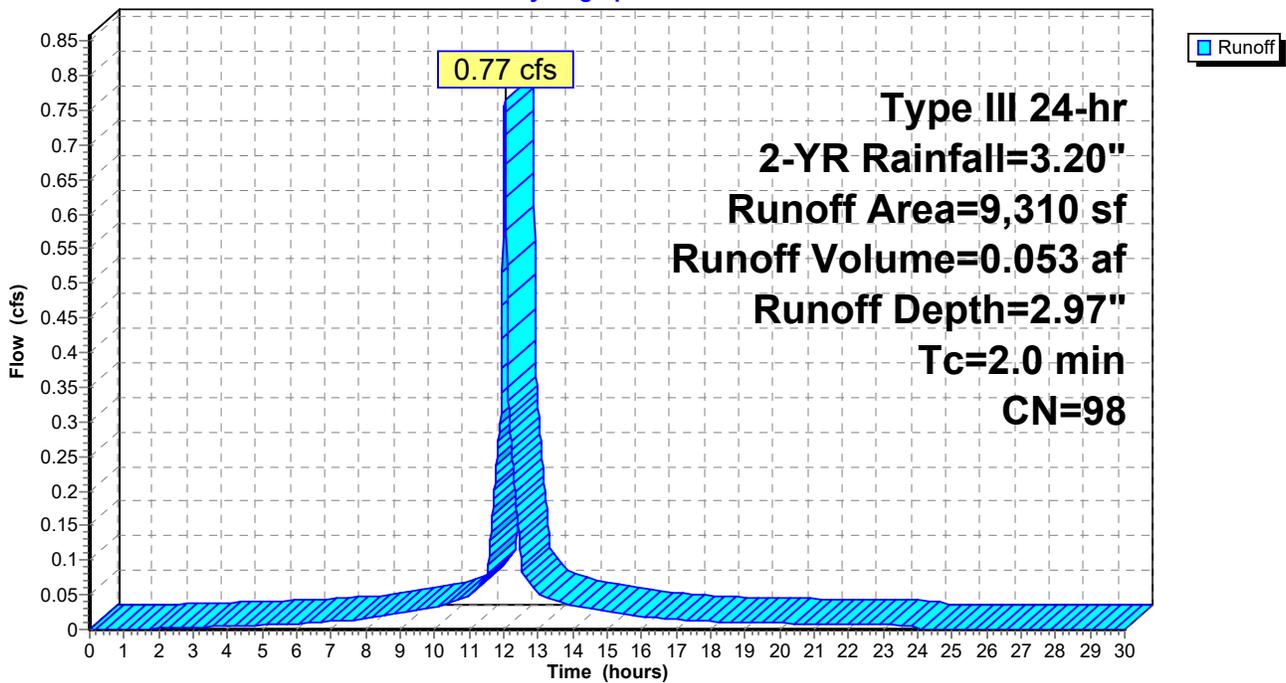
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
 Type III 24-hr 2-YR Rainfall=3.20"

Area (sf)	CN	Description
9,310	98	Roofs, HSG B
9,310		100.00% Impervious Area

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

**Subcatchment 18P: P4b**

Hydrograph



**Summary for Pond 19P: Basins #2**

Inflow Area = 0.531 ac, 74.01% Impervious, Inflow Depth = 2.11" for 2-YR event  
 Inflow = 1.31 cfs @ 12.04 hrs, Volume= 0.094 af  
 Outflow = 0.97 cfs @ 12.11 hrs, Volume= 0.094 af, Atten= 26%, Lag= 3.8 min  
 Discarded = 0.08 cfs @ 12.51 hrs, Volume= 0.058 af  
 Primary = 0.89 cfs @ 12.11 hrs, Volume= 0.036 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
 Peak Elev= 185.59' @ 12.51 hrs Surf.Area= 1,508 sf Storage= 526 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)  
 Center-of-Mass det. time= 18.7 min ( 807.0 - 788.4 )

Volume	Invert	Avail.Storage	Storage Description		
#1	185.20'	3,569 cf	<b>Custom Stage Data (Irregular)</b> Listed below (Recalc)		
Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
185.20	1,178	291.0	0	0	1,178
186.00	1,894	306.0	1,218	1,218	1,930
187.00	2,840	325.0	2,351	3,569	2,934

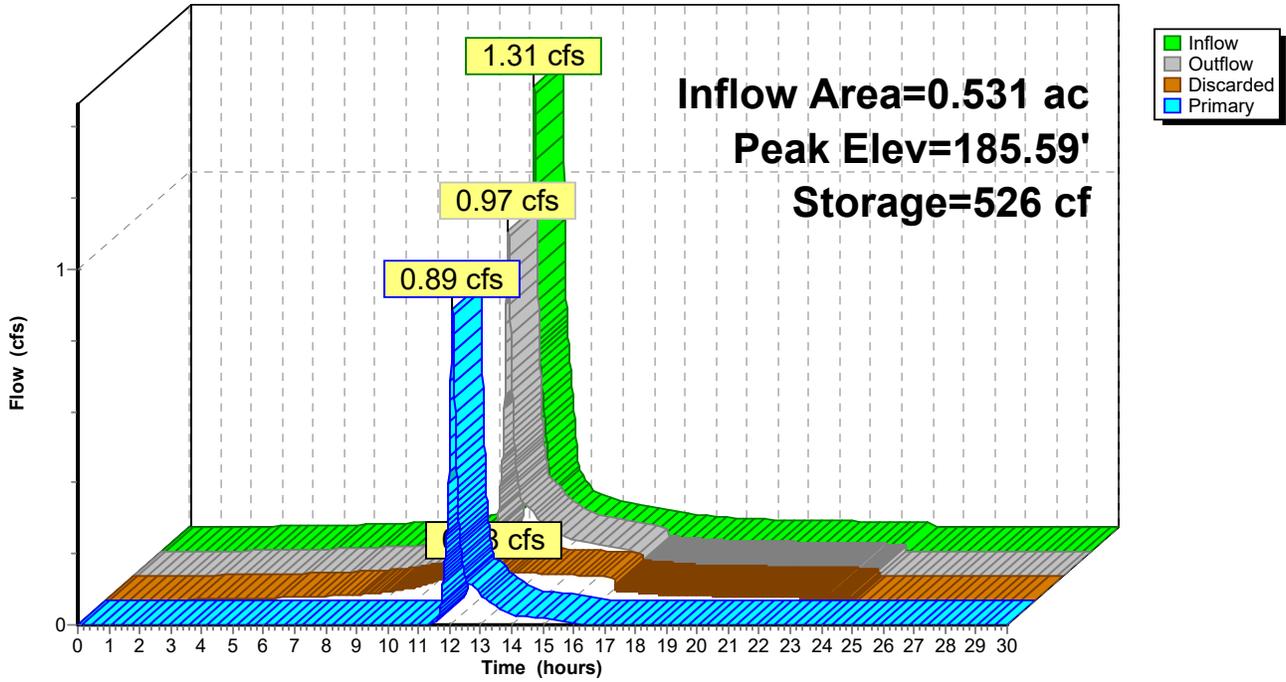
Device	Routing	Invert	Outlet Devices
#1	Discarded	185.20'	<b>2.410 in/hr Exfiltration over Surface area</b>
#2	Primary	185.20'	<b>12.0" Round Culvert</b> L= 36.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 185.20' / 185.00' S= 0.0056 '/' Cc= 0.900 n= 0.011, Flow Area= 0.79 sf
#3	Primary	185.20'	<b>12.0" Round Culvert</b> L= 36.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 185.20' / 185.00' S= 0.0056 '/' Cc= 0.900 n= 0.011, Flow Area= 0.79 sf

**Discarded OutFlow** Max=0.08 cfs @ 12.51 hrs HW=185.59' (Free Discharge)  
 ↖1=Exfiltration (Exfiltration Controls 0.08 cfs)

**Primary OutFlow** Max=0.88 cfs @ 12.11 hrs HW=185.57' TW=185.28' (Dynamic Tailwater)  
 ↖2=Culvert (Outlet Controls 0.44 cfs @ 2.49 fps)  
 ↖3=Culvert (Outlet Controls 0.44 cfs @ 2.49 fps)

### Pond 19P: Basins #2

Hydrograph



**Summary for Subcatchment 20P: P4c**

Runoff = 1.10 cfs @ 12.14 hrs, Volume= 0.089 af, Depth= 1.40"

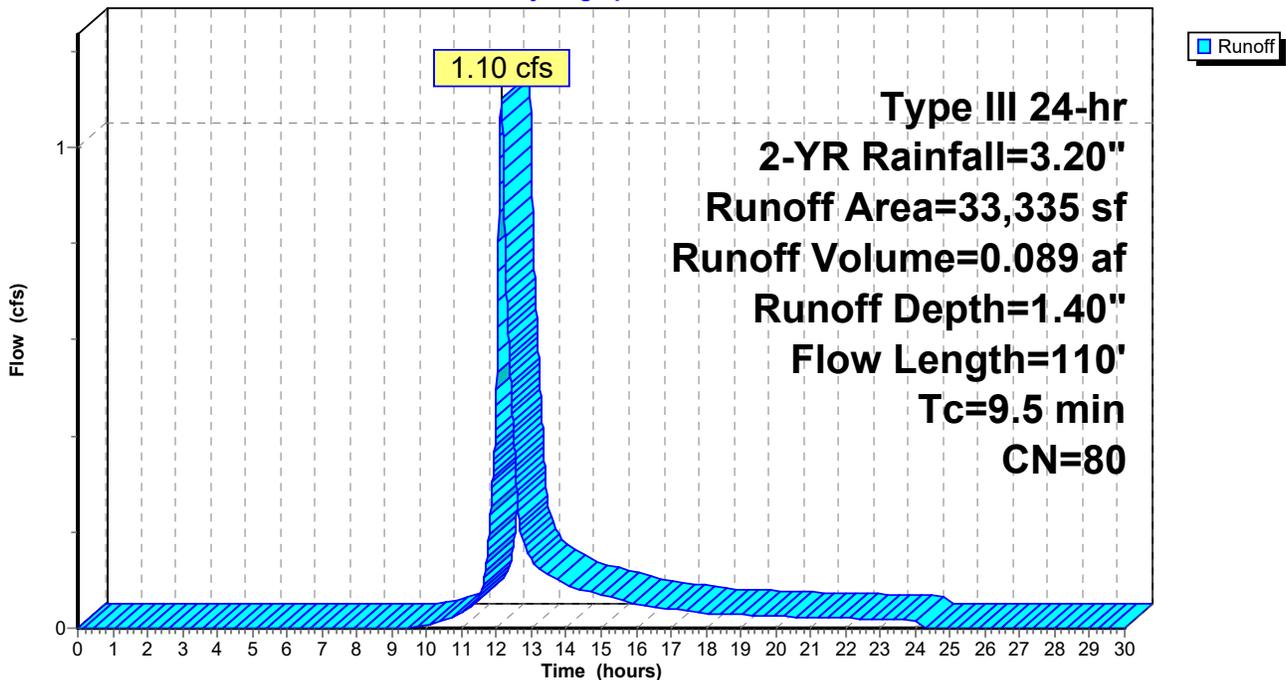
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
 Type III 24-hr 2-YR Rainfall=3.20"

Area (sf)	CN	Description
16,717	98	Paved parking, HSG B
144	98	Roofs, HSG B
16,474	61	>75% Grass cover, Good, HSG B
33,335	80	Weighted Average
16,474		49.42% Pervious Area
16,861		50.58% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.0	40	0.0100	0.07		<b>Sheet Flow,</b> Grass: Dense n= 0.240 P2= 3.20"
0.4	50	0.0100	2.03		<b>Shallow Concentrated Flow,</b> Paved Kv= 20.3 fps
0.1	20	0.2000	3.13		<b>Shallow Concentrated Flow,</b> Short Grass Pasture Kv= 7.0 fps
9.5	110	Total			

**Subcatchment 20P: P4c**

Hydrograph



**Summary for Pond 21P: Basin #3**

Inflow Area = 1.297 ac, 60.18% Impervious, Inflow Depth = 1.16" for 2-YR event  
 Inflow = 1.95 cfs @ 12.11 hrs, Volume= 0.125 af  
 Outflow = 0.50 cfs @ 12.51 hrs, Volume= 0.125 af, Atten= 75%, Lag= 23.9 min  
 Discarded = 0.20 cfs @ 12.52 hrs, Volume= 0.103 af  
 Primary = 0.30 cfs @ 12.51 hrs, Volume= 0.022 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
 Peak Elev= 185.59' @ 12.52 hrs Surf.Area= 3,541 sf Storage= 1,865 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)  
 Center-of-Mass det. time= 60.4 min ( 880.2 - 819.8 )

Volume	Invert	Avail.Storage	Storage Description		
#1	185.00'	8,270 cf	<b>Custom Stage Data (Irregular)</b> Listed below (Recalc)		
Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
185.00	2,820	247.0	0	0	2,820
187.00	5,608	310.0	8,270	8,270	5,667

Device	Routing	Invert	Outlet Devices
#1	Discarded	185.00'	<b>2.410 in/hr Exfiltration over Surface area</b>
#2	Primary	185.00'	<b>12.0" Round Culvert</b> L= 90.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 185.00' / 184.70' S= 0.0033 '/' Cc= 0.900 n= 0.011, Flow Area= 0.79 sf
#3	Primary	185.00'	<b>12.0" Round Culvert</b> L= 90.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 185.00' / 184.70' S= 0.0033 '/' Cc= 0.900 n= 0.011, Flow Area= 0.79 sf

**Discarded OutFlow** Max=0.20 cfs @ 12.52 hrs HW=185.59' (Free Discharge)

↳ **1=Exfiltration** (Exfiltration Controls 0.20 cfs)

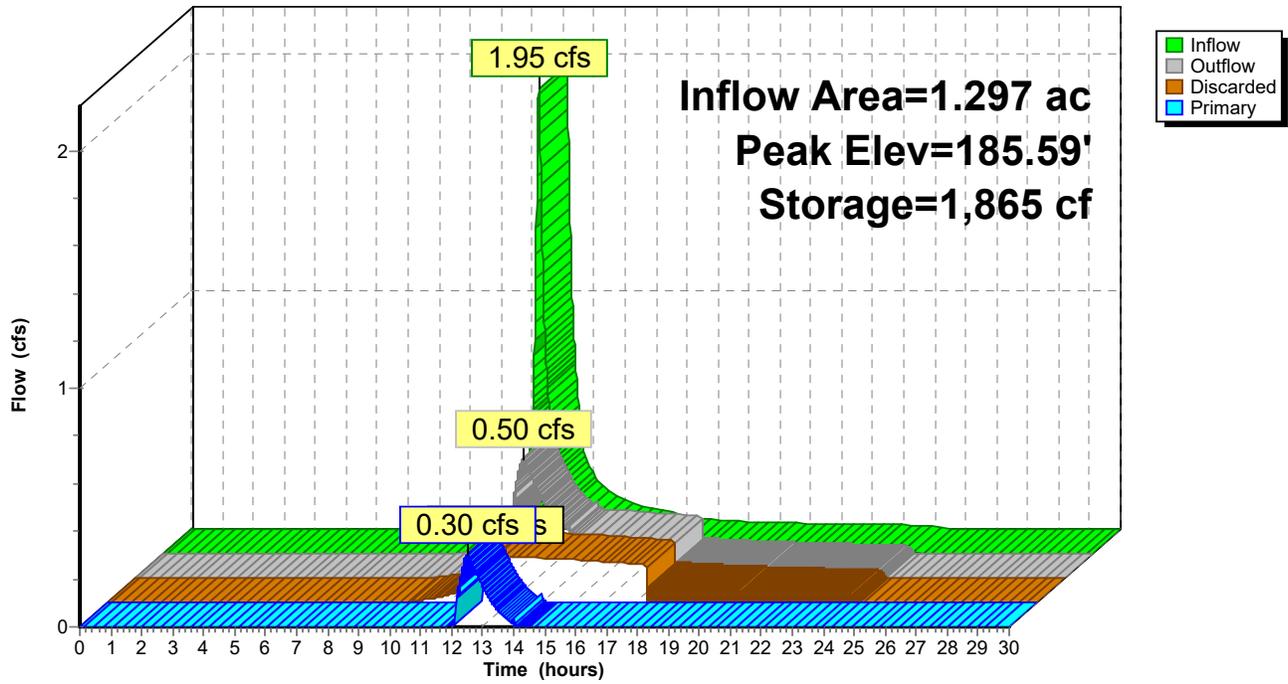
**Primary OutFlow** Max=0.30 cfs @ 12.51 hrs HW=185.59' TW=185.58' (Dynamic Tailwater)

↳ **2=Culvert** (Outlet Controls 0.15 cfs @ 0.45 fps)

↳ **3=Culvert** (Outlet Controls 0.15 cfs @ 0.45 fps)

### Pond 21P: Basin #3

Hydrograph



**Summary for Subcatchment 22P: P4d**

Runoff = 0.02 cfs @ 12.06 hrs, Volume= 0.002 af, Depth= 0.44"

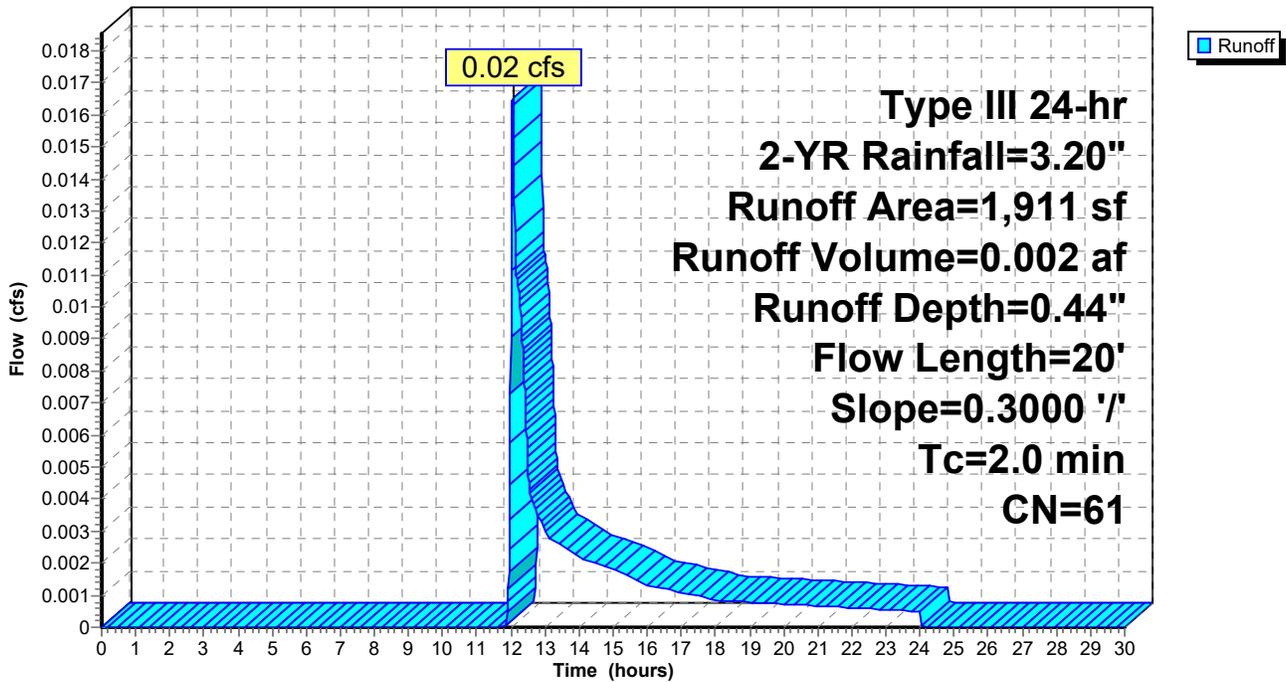
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
 Type III 24-hr 2-YR Rainfall=3.20"

Area (sf)	CN	Description
1,911	61	>75% Grass cover, Good, HSG B
1,911		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.3	20	0.3000	0.25		Sheet Flow, Grass: Dense n= 0.240 P2= 3.20"
1.3	20	Total, Increased to minimum Tc = 2.0 min			

**Subcatchment 22P: P4d**

Hydrograph



**Summary for Subcatchment 23P: P4e**

Runoff = 0.31 cfs @ 12.03 hrs, Volume= 0.021 af, Depth= 2.97"

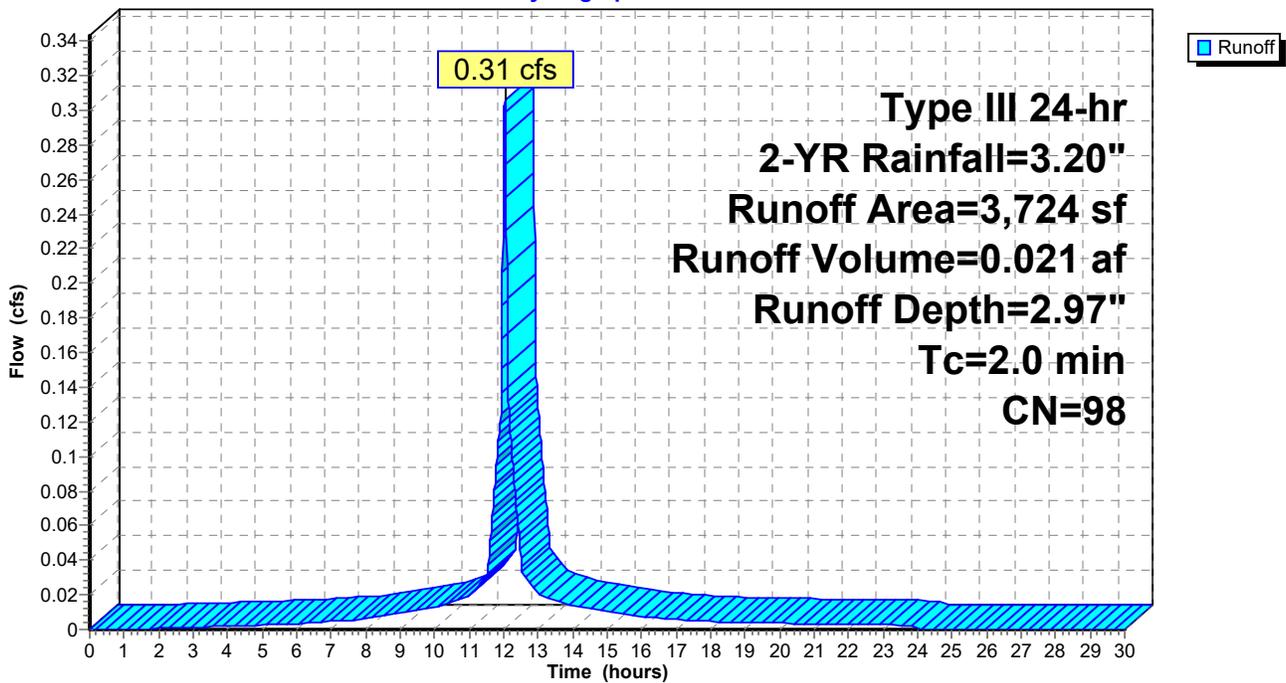
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
 Type III 24-hr 2-YR Rainfall=3.20"

Area (sf)	CN	Description
3,724	98	Roofs, HSG B
3,724		100.00% Impervious Area

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

**Subcatchment 23P: P4e**

Hydrograph



**Summary for Pond 24P: Basin #4**

Inflow Area = 1.426 ac, 60.72% Impervious, Inflow Depth = 0.38" for 2-YR event  
 Inflow = 0.35 cfs @ 12.45 hrs, Volume= 0.045 af  
 Outflow = 0.34 cfs @ 12.51 hrs, Volume= 0.045 af, Atten= 2%, Lag= 3.5 min  
 Discarded = 0.03 cfs @ 12.51 hrs, Volume= 0.022 af  
 Primary = 0.31 cfs @ 12.51 hrs, Volume= 0.023 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
 Peak Elev= 185.58' @ 12.51 hrs Surf.Area= 534 sf Storage= 354 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)  
 Center-of-Mass det. time= 44.0 min ( 810.2 - 766.2 )

Volume	Invert	Avail.Storage	Storage Description			
#1	184.70'	1,451 cf	<b>Custom Stage Data (Irregular)</b> Listed below (Recalc)			
Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)	
184.70	288	73.0	0	0	288	
186.00	680	101.0	611	611	692	
187.00	1,010	120.0	840	1,451	1,044	

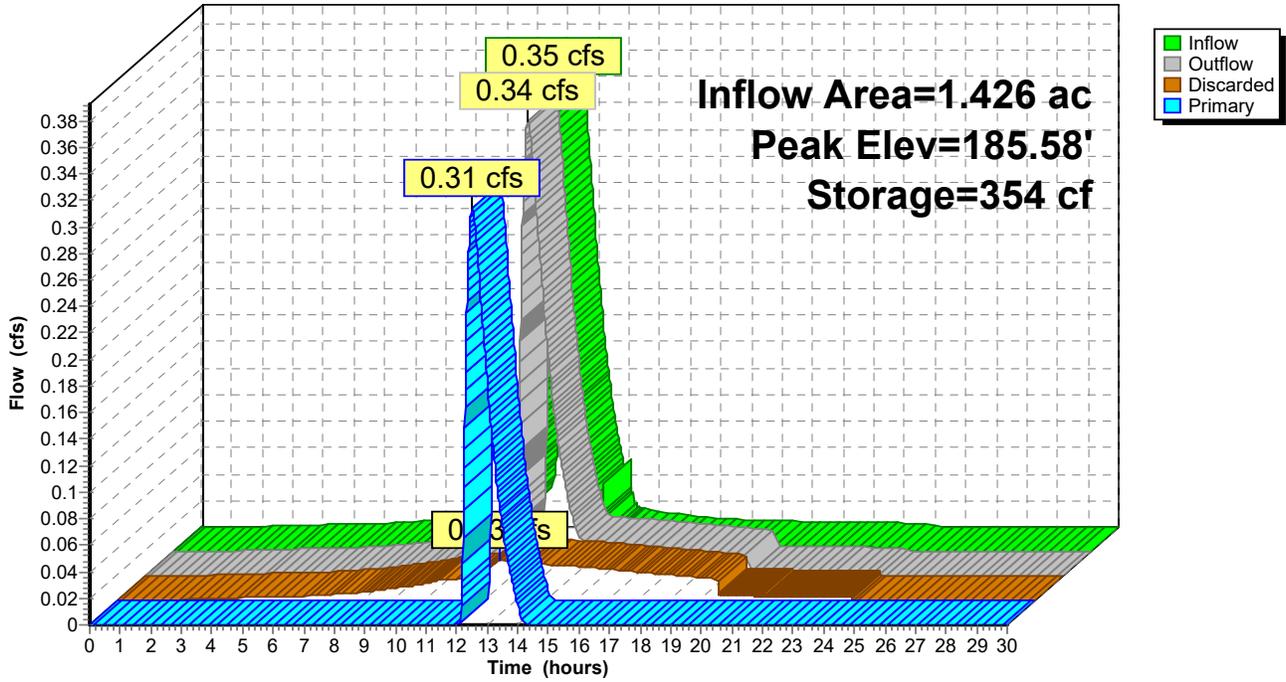
Device	Routing	Invert	Outlet Devices			
#1	Discarded	184.70'	<b>2.410 in/hr Exfiltration over Surface area</b>			
#2	Device 3	185.40'	<b>Custom Weir/Orifice, Cv= 2.62 (C= 3.28)</b>			
			Elev. (feet)	185.40	186.00	186.00 187.00
			Width (feet)	1.30	1.30	6.00 6.00
#3	Primary	185.20'	<b>Custom Weir/Orifice, Cv= 2.62 (C= 3.28)</b>			
			Elev. (feet)	185.20	185.60	
			Width (feet)	12.00	12.00	

**Discarded OutFlow** Max=0.03 cfs @ 12.51 hrs HW=185.58' (Free Discharge)  
 ↳1=Exfiltration (Exfiltration Controls 0.03 cfs)

**Primary OutFlow** Max=0.31 cfs @ 12.51 hrs HW=185.58' TW=0.00' (Dynamic Tailwater)  
 ↳3=Custom Weir/Orifice (Passes 0.31 cfs of 9.05 cfs potential flow)  
 ↳2=Custom Weir/Orifice (Weir Controls 0.31 cfs @ 1.37 fps)

**Pond 24P: Basin #4**

Hydrograph



**Summary for Subcatchment 25P: P4f**

Runoff = 0.17 cfs @ 12.22 hrs, Volume= 0.025 af, Depth= 0.41"

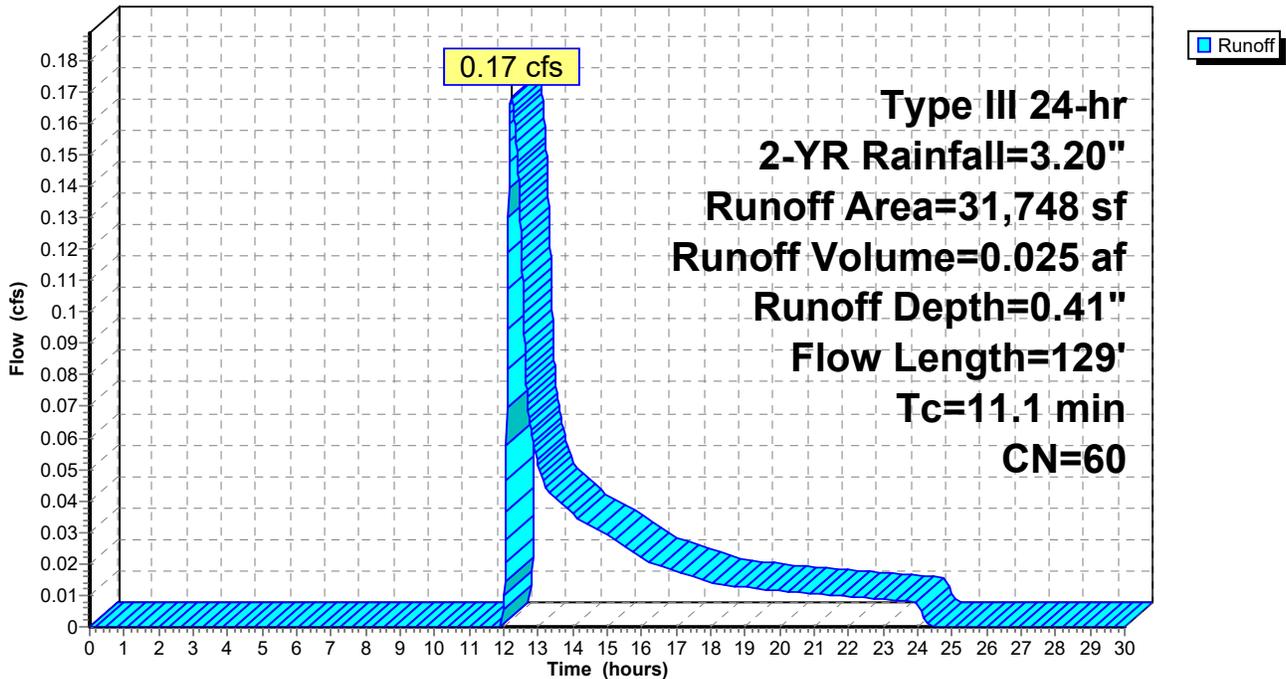
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
Type III 24-hr 2-YR Rainfall=3.20"

Area (sf)	CN	Description
* 1,550	90	Pavers, HSG B
17,354	61	>75% Grass cover, Good, HSG B
12,844	55	Woods, Good, HSG B
31,748	60	Weighted Average
31,748		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.4	42	0.0100	0.07		Sheet Flow, Grass: Dense n= 0.240 P2= 3.20"
1.6	67	0.0100	0.70		Shallow Concentrated Flow, Short Grass Pasture Kv= 7.0 fps
0.1	20	0.2000	2.24		Shallow Concentrated Flow, Woodland Kv= 5.0 fps
11.1	129	Total			

**Subcatchment 25P: P4f**

Hydrograph

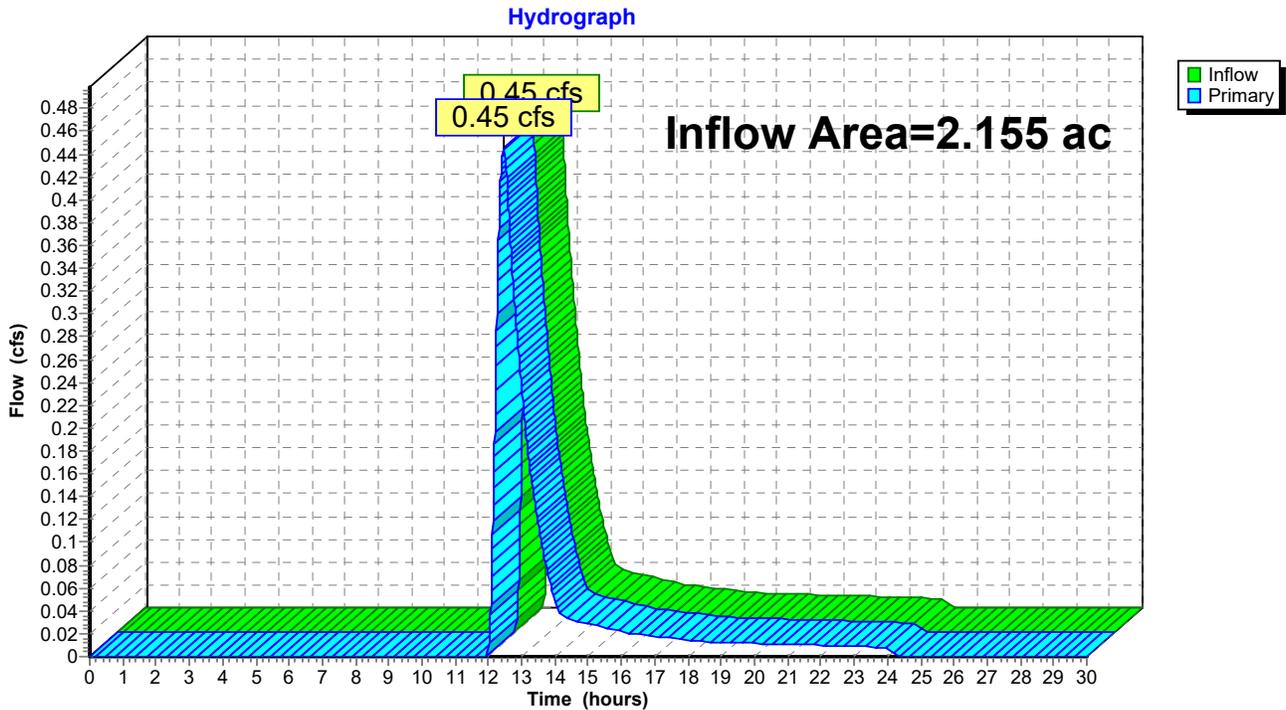


### Summary for Link 26P: Design Point #4: Flow to Wetlands

Inflow Area = 2.155 ac, 40.18% Impervious, Inflow Depth = 0.27" for 2-YR event  
Inflow = 0.45 cfs @ 12.45 hrs, Volume= 0.048 af  
Primary = 0.45 cfs @ 12.45 hrs, Volume= 0.048 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs

### Link 26P: Design Point #4: Flow to Wetlands



**HydroCAD4**

Type III 24-hr 10-YR Rainfall=4.70"

Prepared by {enter your company name here}

Printed 9/5/2019

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Time span=0.00-30.00 hrs, dt=0.01 hrs, 3001 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 17P: P4a** Runoff Area=13,831 sf 56.52% Impervious Runoff Depth=2.81"  
 Flow Length=45' Slope=0.0800 '/' Tc=4.3 min CN=82 Runoff=1.11 cfs 0.074 af

**Subcatchment 18P: P4b** Runoff Area=9,310 sf 100.00% Impervious Runoff Depth=4.46"  
 Tc=2.0 min CN=98 Runoff=1.13 cfs 0.080 af

**Pond 19P: Basins #2** Peak Elev=185.89' Storage=1,023 cf Inflow=2.15 cfs 0.154 af  
 Discarded=0.10 cfs 0.078 af Primary=1.32 cfs 0.076 af Outflow=1.41 cfs 0.154 af

**Subcatchment 20P: P4c** Runoff Area=33,335 sf 50.58% Impervious Runoff Depth=2.63"  
 Flow Length=110' Tc=9.5 min CN=80 Runoff=2.10 cfs 0.168 af

**Pond 21P: Basin #3** Peak Elev=185.88' Storage=2,975 cf Inflow=3.23 cfs 0.243 af  
 Discarded=0.22 cfs 0.143 af Primary=1.13 cfs 0.100 af Outflow=1.35 cfs 0.243 af

**Subcatchment 22P: P4d** Runoff Area=1,911 sf 0.00% Impervious Runoff Depth=1.19"  
 Flow Length=20' Slope=0.3000 '/' Tc=2.0 min CN=61 Runoff=0.06 cfs 0.004 af

**Subcatchment 23P: P4e** Runoff Area=3,724 sf 100.00% Impervious Runoff Depth=4.46"  
 Tc=2.0 min CN=98 Runoff=0.45 cfs 0.032 af

**Pond 24P: Basin #4** Peak Elev=185.83' Storage=503 cf Inflow=1.26 cfs 0.137 af  
 Discarded=0.03 cfs 0.028 af Primary=1.21 cfs 0.108 af Outflow=1.25 cfs 0.137 af

**Subcatchment 25P: P4f** Runoff Area=31,748 sf 0.00% Impervious Runoff Depth=1.13"  
 Flow Length=129' Tc=11.1 min CN=60 Runoff=0.70 cfs 0.069 af

**Link 26P: Design Point #4: Flow to Wetlands** Inflow=1.71 cfs 0.177 af  
 Primary=1.71 cfs 0.177 af

**Total Runoff Area = 2.155 ac Runoff Volume = 0.427 af Average Runoff Depth = 2.38"**  
**59.82% Pervious = 1.289 ac 40.18% Impervious = 0.866 ac**

**Summary for Subcatchment 17P: P4a**

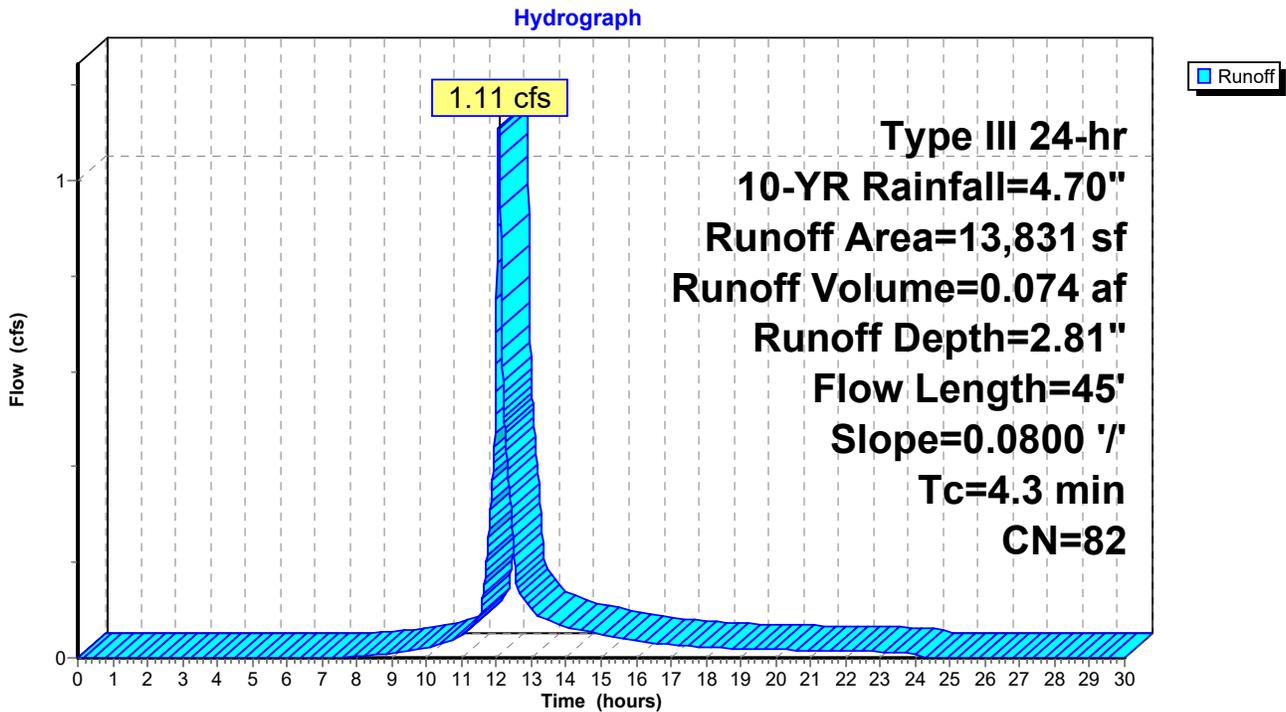
Runoff = 1.11 cfs @ 12.06 hrs, Volume= 0.074 af, Depth= 2.81"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
Type III 24-hr 10-YR Rainfall=4.70"

Area (sf)	CN	Description
7,817	98	Paved parking, HSG B
6,014	61	>75% Grass cover, Good, HSG B
13,831	82	Weighted Average
6,014		43.48% Pervious Area
7,817		56.52% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.3	45	0.0800	0.17		Sheet Flow, Grass: Dense n= 0.240 P2= 3.20"

**Subcatchment 17P: P4a**



**Summary for Subcatchment 18P: P4b**

Runoff = 1.13 cfs @ 12.03 hrs, Volume= 0.080 af, Depth= 4.46"

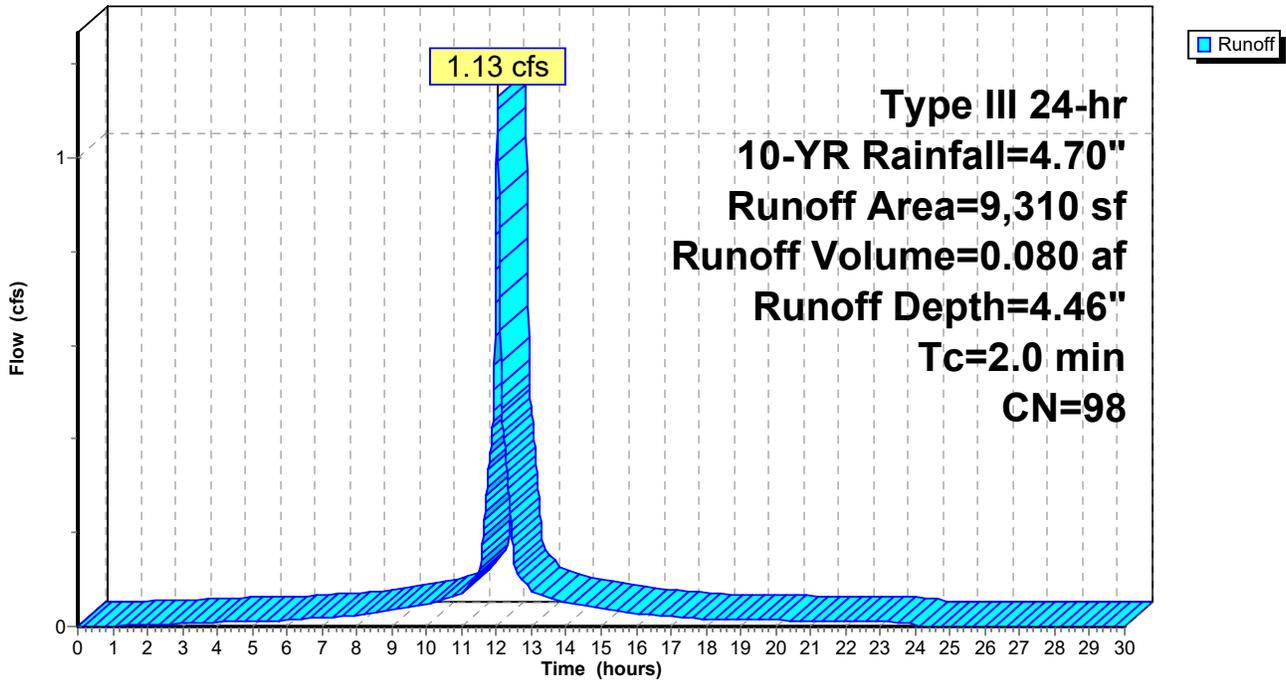
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
 Type III 24-hr 10-YR Rainfall=4.70"

Area (sf)	CN	Description
9,310	98	Roofs, HSG B
9,310		100.00% Impervious Area

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

**Subcatchment 18P: P4b**

Hydrograph



**Summary for Pond 19P: Basins #2**

Inflow Area = 0.531 ac, 74.01% Impervious, Inflow Depth = 3.48" for 10-YR event  
 Inflow = 2.15 cfs @ 12.04 hrs, Volume= 0.154 af  
 Outflow = 1.41 cfs @ 12.07 hrs, Volume= 0.154 af, Atten= 34%, Lag= 1.8 min  
 Discarded = 0.10 cfs @ 12.41 hrs, Volume= 0.078 af  
 Primary = 1.32 cfs @ 12.07 hrs, Volume= 0.076 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
 Peak Elev= 185.89' @ 12.41 hrs Surf.Area= 1,790 sf Storage= 1,023 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)  
 Center-of-Mass det. time= 21.9 min ( 802.0 - 780.1 )

Volume	Invert	Avail.Storage	Storage Description			
#1	185.20'	3,569 cf	<b>Custom Stage Data (Irregular)</b> Listed below (Recalc)			
Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)	
185.20	1,178	291.0	0	0	1,178	
186.00	1,894	306.0	1,218	1,218	1,930	
187.00	2,840	325.0	2,351	3,569	2,934	

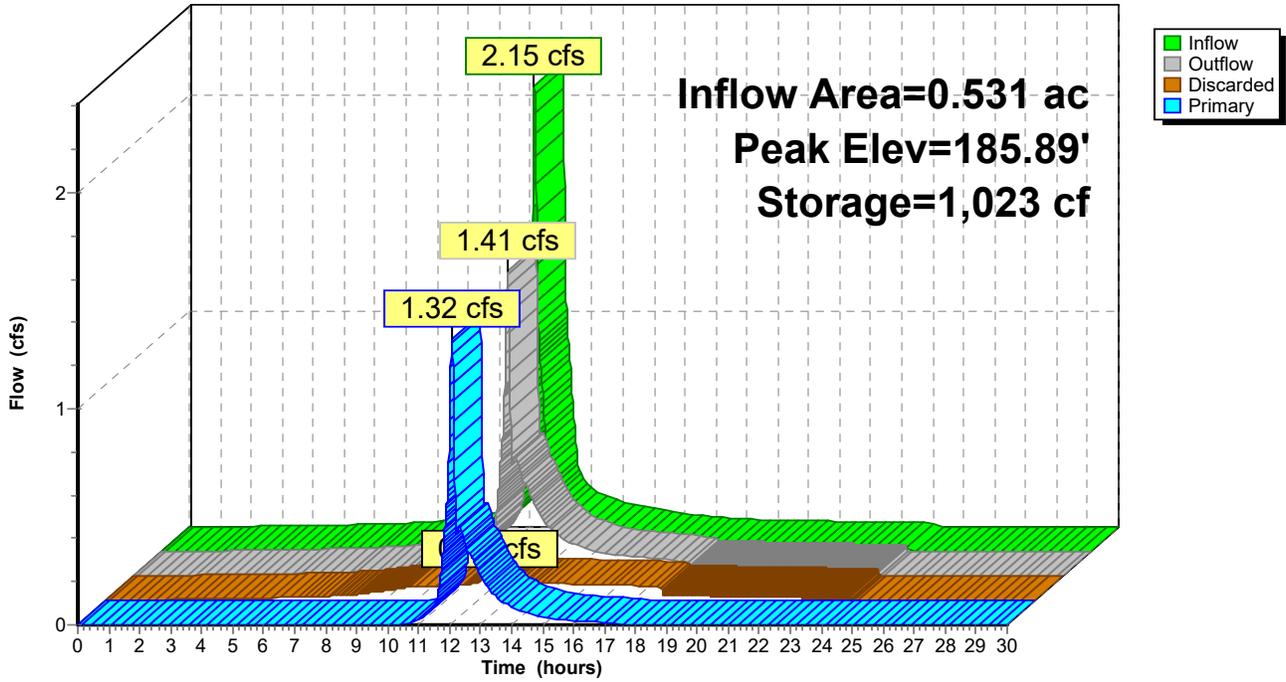
Device	Routing	Invert	Outlet Devices
#1	Discarded	185.20'	<b>2.410 in/hr Exfiltration over Surface area</b>
#2	Primary	185.20'	<b>12.0" Round Culvert</b> L= 36.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 185.20' / 185.00' S= 0.0056 1/1 Cc= 0.900 n= 0.011, Flow Area= 0.79 sf
#3	Primary	185.20'	<b>12.0" Round Culvert</b> L= 36.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 185.20' / 185.00' S= 0.0056 1/1 Cc= 0.900 n= 0.011, Flow Area= 0.79 sf

**Discarded OutFlow** Max=0.10 cfs @ 12.41 hrs HW=185.89' (Free Discharge)  
 ↖1=Exfiltration (Exfiltration Controls 0.10 cfs)

**Primary OutFlow** Max=1.22 cfs @ 12.07 hrs HW=185.72' TW=185.55' (Dynamic Tailwater)  
 ↖2=Culvert (Outlet Controls 0.61 cfs @ 2.13 fps)  
 ↖3=Culvert (Outlet Controls 0.61 cfs @ 2.13 fps)

**Pond 19P: Basins #2**

Hydrograph



**Summary for Subcatchment 20P: P4c**

Runoff = 2.10 cfs @ 12.13 hrs, Volume= 0.168 af, Depth= 2.63"

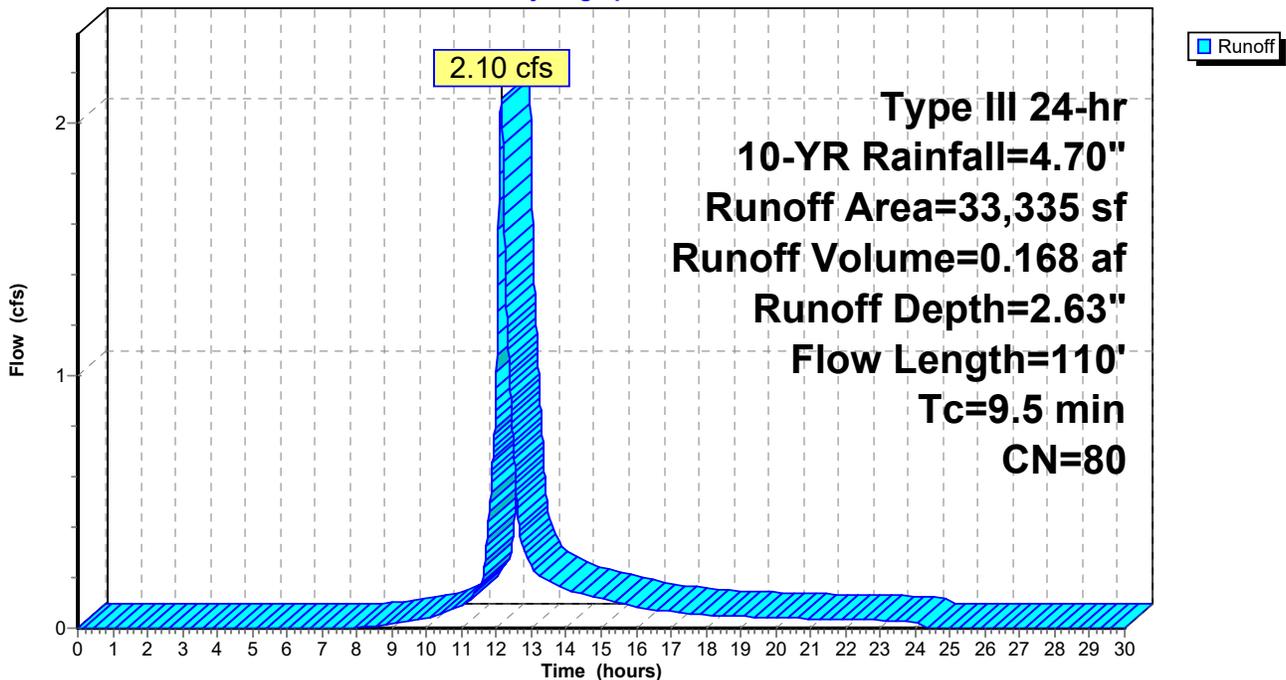
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
Type III 24-hr 10-YR Rainfall=4.70"

Area (sf)	CN	Description
16,717	98	Paved parking, HSG B
144	98	Roofs, HSG B
16,474	61	>75% Grass cover, Good, HSG B
33,335	80	Weighted Average
16,474		49.42% Pervious Area
16,861		50.58% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.0	40	0.0100	0.07		<b>Sheet Flow,</b> Grass: Dense n= 0.240 P2= 3.20"
0.4	50	0.0100	2.03		<b>Shallow Concentrated Flow,</b> Paved Kv= 20.3 fps
0.1	20	0.2000	3.13		<b>Shallow Concentrated Flow,</b> Short Grass Pasture Kv= 7.0 fps
9.5	110	Total			

**Subcatchment 20P: P4c**

Hydrograph



**Summary for Pond 21P: Basin #3**

Inflow Area = 1.297 ac, 60.18% Impervious, Inflow Depth = 2.25" for 10-YR event  
 Inflow = 3.23 cfs @ 12.11 hrs, Volume= 0.243 af  
 Outflow = 1.35 cfs @ 12.40 hrs, Volume= 0.243 af, Atten= 58%, Lag= 17.8 min  
 Discarded = 0.22 cfs @ 12.41 hrs, Volume= 0.143 af  
 Primary = 1.13 cfs @ 12.40 hrs, Volume= 0.100 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
 Peak Elev= 185.88' @ 12.41 hrs Surf.Area= 3,936 sf Storage= 2,975 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)  
 Center-of-Mass det. time= 51.4 min ( 858.5 - 807.1 )

Volume	Invert	Avail.Storage	Storage Description			
#1	185.00'	8,270 cf	<b>Custom Stage Data (Irregular)</b> Listed below (Recalc)			
Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)	
185.00	2,820	247.0	0	0	2,820	
187.00	5,608	310.0	8,270	8,270	5,667	

Device	Routing	Invert	Outlet Devices
#1	Discarded	185.00'	<b>2.410 in/hr Exfiltration over Surface area</b>
#2	Primary	185.00'	<b>12.0" Round Culvert</b> L= 90.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 185.00' / 184.70' S= 0.0033 1/8' Cc= 0.900 n= 0.011, Flow Area= 0.79 sf
#3	Primary	185.00'	<b>12.0" Round Culvert</b> L= 90.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 185.00' / 184.70' S= 0.0033 1/8' Cc= 0.900 n= 0.011, Flow Area= 0.79 sf

**Discarded OutFlow** Max=0.22 cfs @ 12.41 hrs HW=185.88' (Free Discharge)

↳ **1=Exfiltration** (Exfiltration Controls 0.22 cfs)

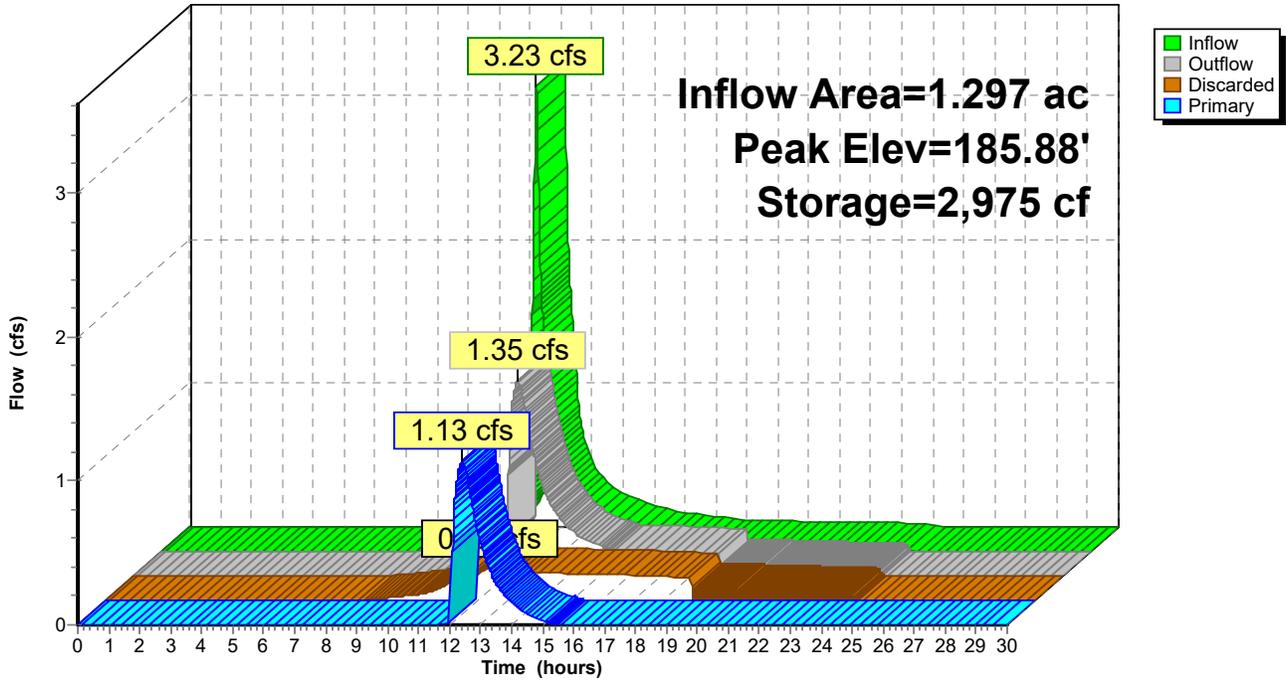
**Primary OutFlow** Max=1.13 cfs @ 12.40 hrs HW=185.88' TW=185.83' (Dynamic Tailwater)

↳ **2=Culvert** (Outlet Controls 0.57 cfs @ 1.02 fps)

↳ **3=Culvert** (Outlet Controls 0.57 cfs @ 1.02 fps)

**Pond 21P: Basin #3**

Hydrograph



**Summary for Subcatchment 22P: P4d**

Runoff = 0.06 cfs @ 12.04 hrs, Volume= 0.004 af, Depth= 1.19"

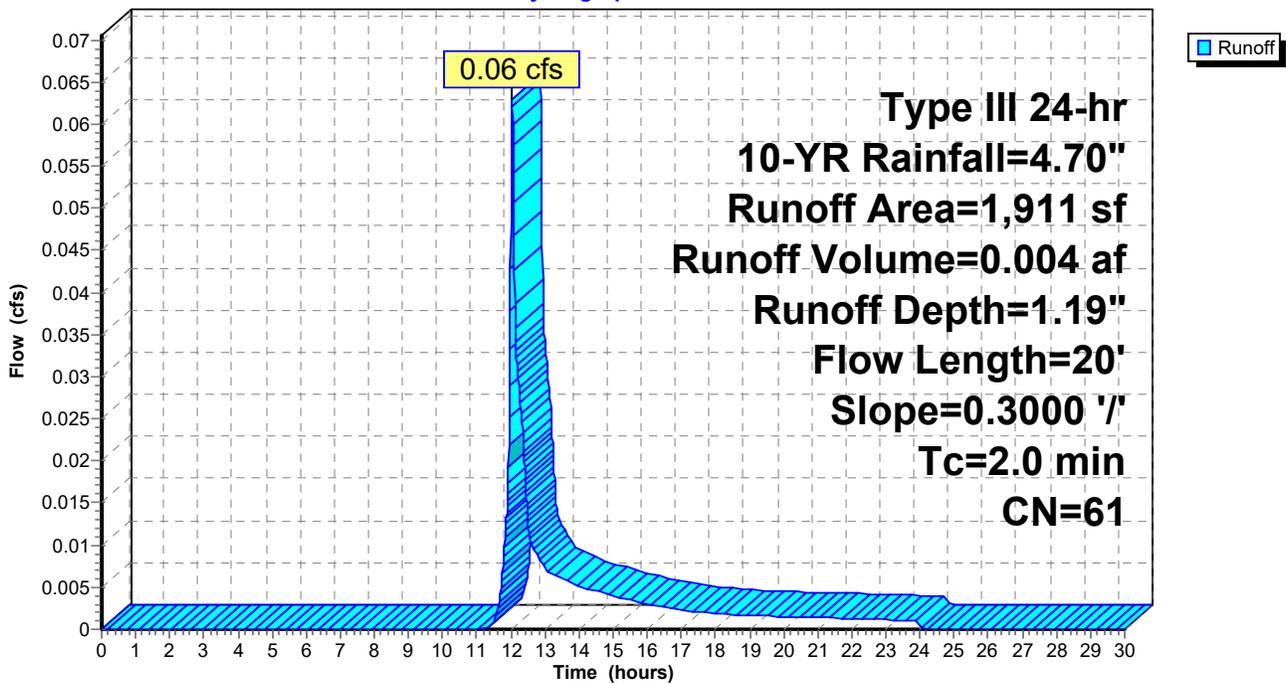
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
 Type III 24-hr 10-YR Rainfall=4.70"

Area (sf)	CN	Description
1,911	61	>75% Grass cover, Good, HSG B
1,911		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.3	20	0.3000	0.25		<b>Sheet Flow,</b> Grass: Dense n= 0.240 P2= 3.20"
1.3	20	Total, Increased to minimum Tc = 2.0 min			

**Subcatchment 22P: P4d**

Hydrograph



**Summary for Subcatchment 23P: P4e**

Runoff = 0.45 cfs @ 12.03 hrs, Volume= 0.032 af, Depth= 4.46"

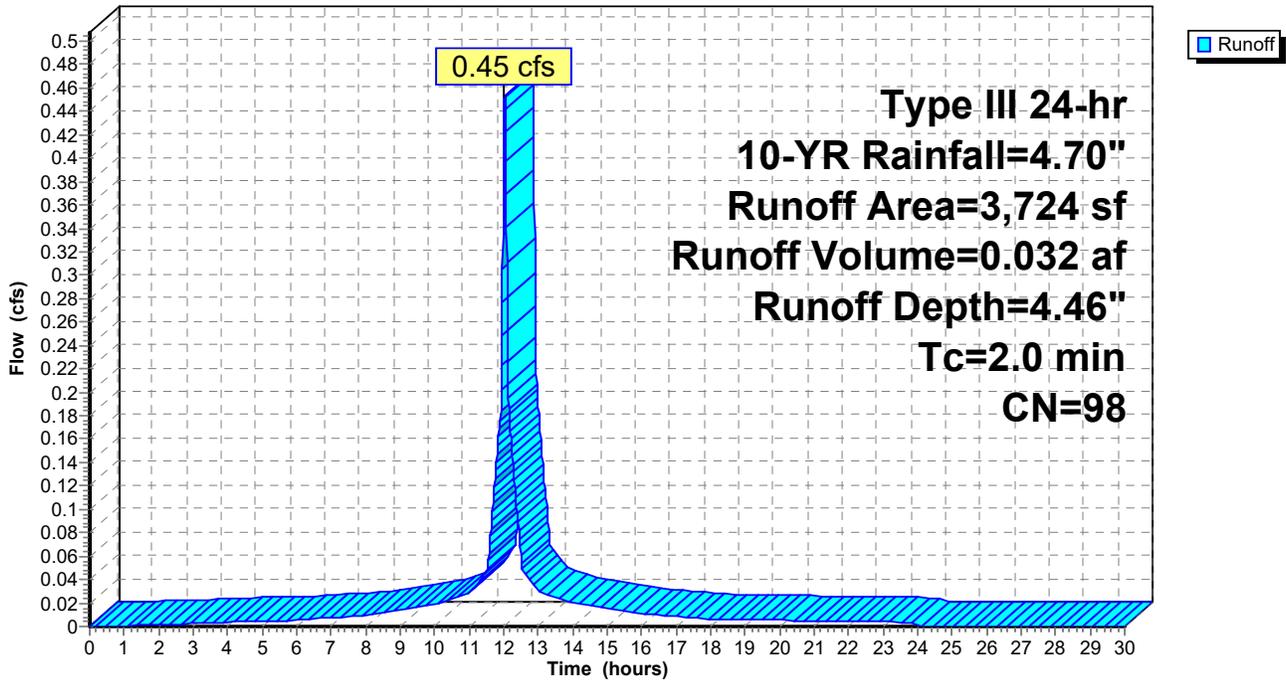
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
 Type III 24-hr 10-YR Rainfall=4.70"

Area (sf)	CN	Description
3,724	98	Roofs, HSG B
3,724		100.00% Impervious Area

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

**Subcatchment 23P: P4e**

Hydrograph



**Summary for Pond 24P: Basin #4**

Inflow Area = 1.426 ac, 60.72% Impervious, Inflow Depth = 1.15" for 10-YR event  
 Inflow = 1.26 cfs @ 12.36 hrs, Volume= 0.137 af  
 Outflow = 1.25 cfs @ 12.40 hrs, Volume= 0.137 af, Atten= 1%, Lag= 2.6 min  
 Discarded = 0.03 cfs @ 12.40 hrs, Volume= 0.028 af  
 Primary = 1.21 cfs @ 12.40 hrs, Volume= 0.108 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
 Peak Elev= 185.83' @ 12.40 hrs Surf.Area= 620 sf Storage= 503 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)  
 Center-of-Mass det. time= 21.6 min ( 791.1 - 769.5 )

Volume	Invert	Avail.Storage	Storage Description			
#1	184.70'	1,451 cf	<b>Custom Stage Data (Irregular)</b> Listed below (Recalc)			
Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)	
184.70	288	73.0	0	0	288	
186.00	680	101.0	611	611	692	
187.00	1,010	120.0	840	1,451	1,044	

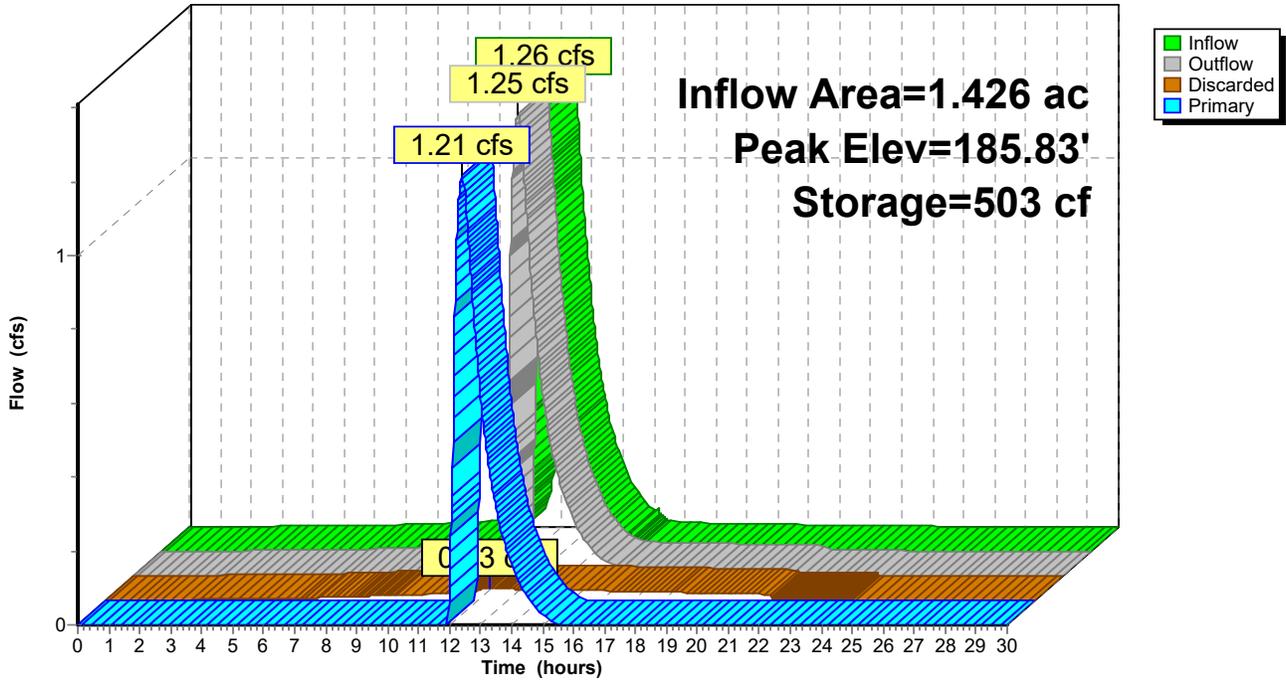
Device	Routing	Invert	Outlet Devices			
#1	Discarded	184.70'	<b>2.410 in/hr Exfiltration over Surface area</b>			
#2	Device 3	185.40'	<b>Custom Weir/Orifice, Cv= 2.62 (C= 3.28)</b>			
			Elev. (feet)	185.40	186.00	186.00 187.00
			Width (feet)	1.30	1.30	6.00 6.00
#3	Primary	185.20'	<b>Custom Weir/Orifice, Cv= 2.62 (C= 3.28)</b>			
			Elev. (feet)	185.20	185.60	
			Width (feet)	12.00	12.00	

**Discarded OutFlow** Max=0.03 cfs @ 12.40 hrs HW=185.83' (Free Discharge)  
 ↑1=Exfiltration (Exfiltration Controls 0.03 cfs)

**Primary OutFlow** Max=1.21 cfs @ 12.40 hrs HW=185.83' TW=0.00' (Dynamic Tailwater)  
 ↑3=Custom Weir/Orifice (Passes 1.21 cfs of 15.37 cfs potential flow)  
 ↑2=Custom Weir/Orifice (Weir Controls 1.21 cfs @ 2.16 fps)

### Pond 24P: Basin #4

Hydrograph



**Summary for Subcatchment 25P: P4f**

Runoff = 0.70 cfs @ 12.17 hrs, Volume= 0.069 af, Depth= 1.13"

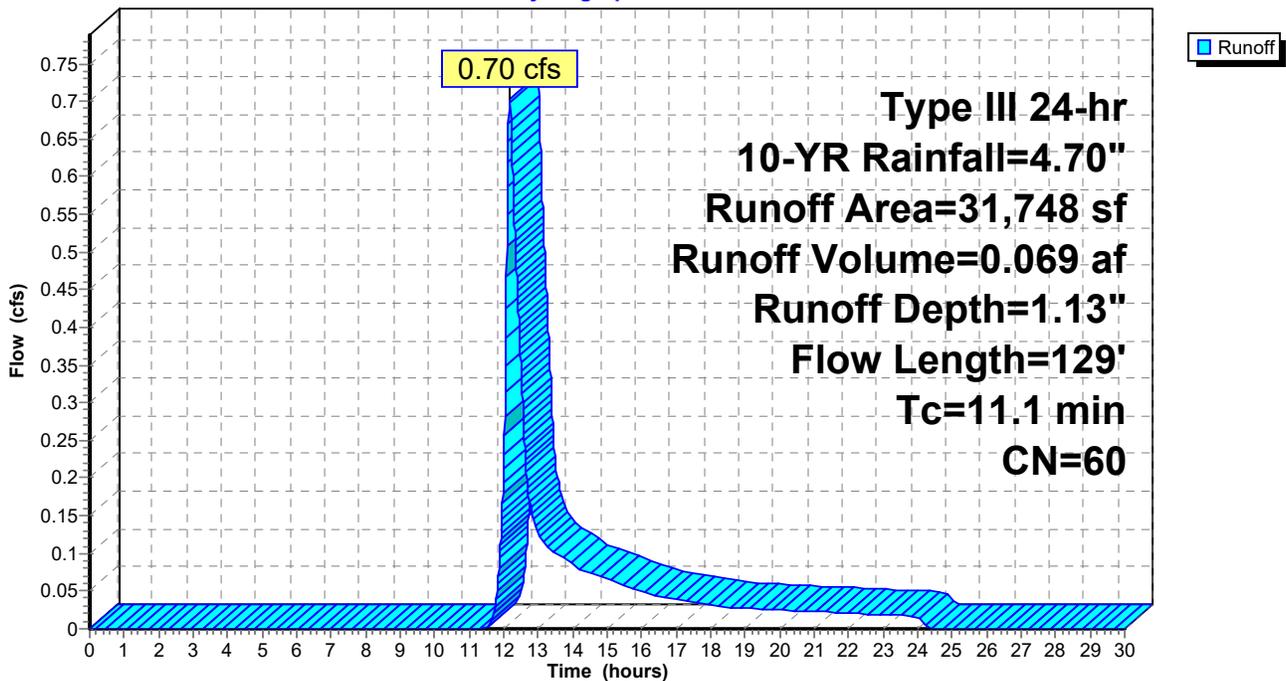
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
 Type III 24-hr 10-YR Rainfall=4.70"

Area (sf)	CN	Description
* 1,550	90	Pavers, HSG B
17,354	61	>75% Grass cover, Good, HSG B
12,844	55	Woods, Good, HSG B
31,748	60	Weighted Average
31,748		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.4	42	0.0100	0.07		Sheet Flow, Grass: Dense n= 0.240 P2= 3.20"
1.6	67	0.0100	0.70		Shallow Concentrated Flow, Short Grass Pasture Kv= 7.0 fps
0.1	20	0.2000	2.24		Shallow Concentrated Flow, Woodland Kv= 5.0 fps
11.1	129	Total			

**Subcatchment 25P: P4f**

Hydrograph

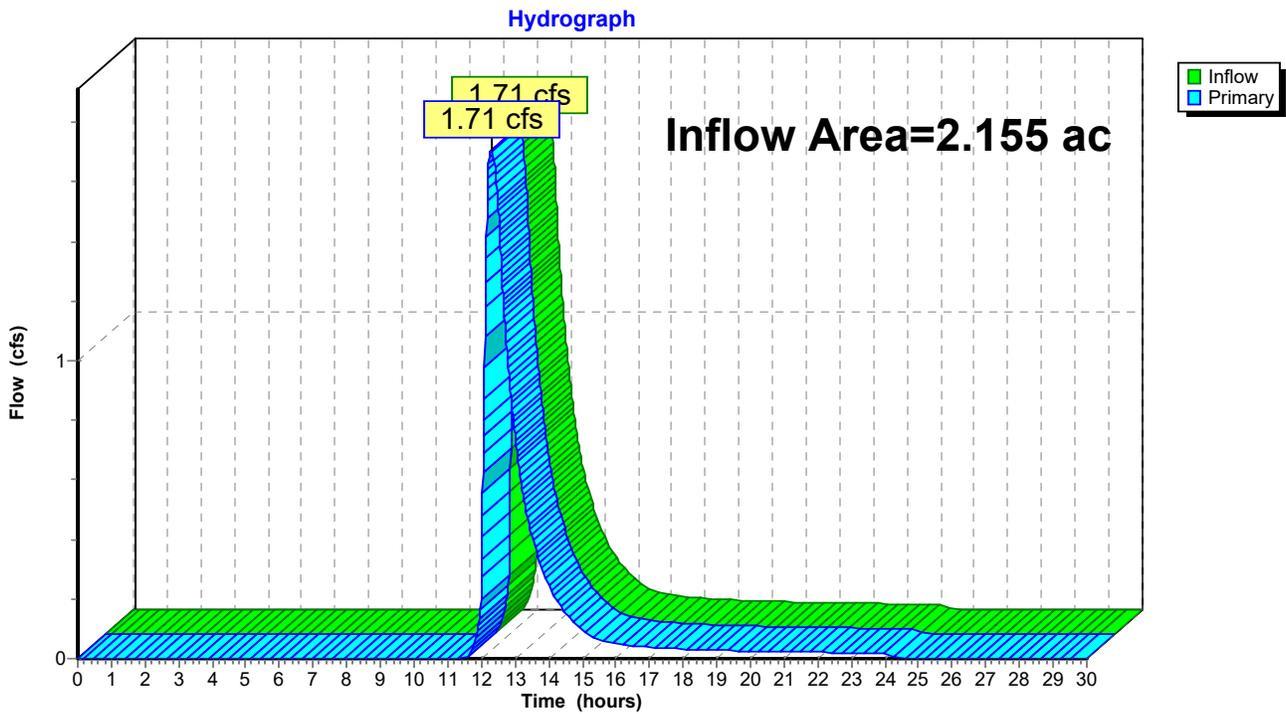


### Summary for Link 26P: Design Point #4: Flow to Wetlands

Inflow Area = 2.155 ac, 40.18% Impervious, Inflow Depth = 0.99" for 10-YR event  
Inflow = 1.71 cfs @ 12.30 hrs, Volume= 0.177 af  
Primary = 1.71 cfs @ 12.30 hrs, Volume= 0.177 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs

### Link 26P: Design Point #4: Flow to Wetlands



**HydroCAD4**

Type III 24-hr 25-YR Rainfall=5.50"

Prepared by {enter your company name here}

Printed 9/5/2019

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Time span=0.00-30.00 hrs, dt=0.01 hrs, 3001 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 17P: P4a** Runoff Area=13,831 sf 56.52% Impervious Runoff Depth=3.53"  
 Flow Length=45' Slope=0.0800 '/' Tc=4.3 min CN=82 Runoff=1.39 cfs 0.093 af

**Subcatchment 18P: P4b** Runoff Area=9,310 sf 100.00% Impervious Runoff Depth=5.26"  
 Tc=2.0 min CN=98 Runoff=1.33 cfs 0.094 af

**Pond 19P: Basins #2** Peak Elev=186.04' Storage=1,300 cf Inflow=2.61 cfs 0.187 af  
 Discarded=0.11 cfs 0.087 af Primary=1.53 cfs 0.100 af Outflow=1.63 cfs 0.187 af

**Subcatchment 20P: P4c** Runoff Area=33,335 sf 50.58% Impervious Runoff Depth=3.33"  
 Flow Length=110' Tc=9.5 min CN=80 Runoff=2.65 cfs 0.213 af

**Pond 21P: Basin #3** Peak Elev=186.03' Storage=3,567 cf Inflow=3.94 cfs 0.312 af  
 Discarded=0.23 cfs 0.162 af Primary=1.64 cfs 0.150 af Outflow=1.87 cfs 0.312 af

**Subcatchment 22P: P4d** Runoff Area=1,911 sf 0.00% Impervious Runoff Depth=1.68"  
 Flow Length=20' Slope=0.3000 '/' Tc=2.0 min CN=61 Runoff=0.09 cfs 0.006 af

**Subcatchment 23P: P4e** Runoff Area=3,724 sf 100.00% Impervious Runoff Depth=5.26"  
 Tc=2.0 min CN=98 Runoff=0.53 cfs 0.037 af

**Pond 24P: Basin #4** Peak Elev=185.96' Storage=581 cf Inflow=1.81 cfs 0.194 af  
 Discarded=0.04 cfs 0.031 af Primary=1.76 cfs 0.163 af Outflow=1.80 cfs 0.194 af

**Subcatchment 25P: P4f** Runoff Area=31,748 sf 0.00% Impervious Runoff Depth=1.60"  
 Flow Length=129' Tc=11.1 min CN=60 Runoff=1.06 cfs 0.097 af

**Link 26P: Design Point #4: Flow to Wetlands** Inflow=2.57 cfs 0.260 af  
 Primary=2.57 cfs 0.260 af

**Total Runoff Area = 2.155 ac Runoff Volume = 0.541 af Average Runoff Depth = 3.01"**  
**59.82% Pervious = 1.289 ac 40.18% Impervious = 0.866 ac**

**Summary for Subcatchment 17P: P4a**

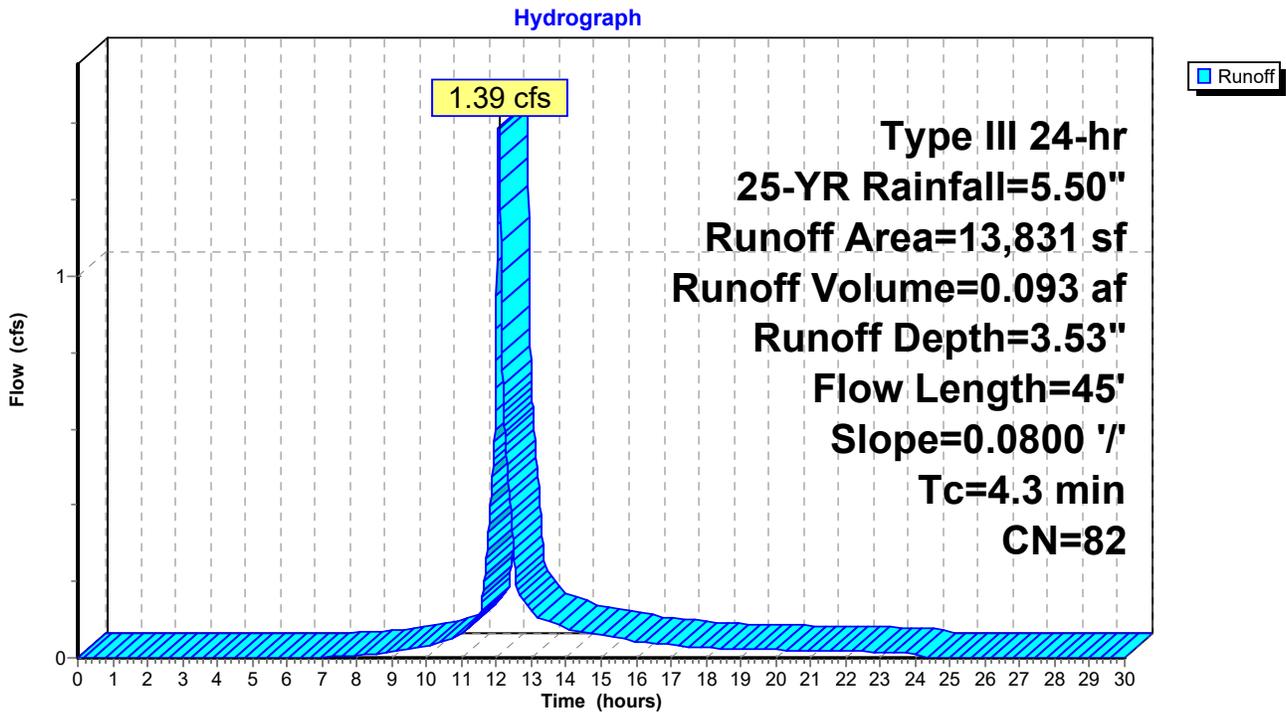
Runoff = 1.39 cfs @ 12.06 hrs, Volume= 0.093 af, Depth= 3.53"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
Type III 24-hr 25-YR Rainfall=5.50"

Area (sf)	CN	Description
7,817	98	Paved parking, HSG B
6,014	61	>75% Grass cover, Good, HSG B
13,831	82	Weighted Average
6,014		43.48% Pervious Area
7,817		56.52% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.3	45	0.0800	0.17		Sheet Flow, Grass: Dense n= 0.240 P2= 3.20"

**Subcatchment 17P: P4a**



**Summary for Subcatchment 18P: P4b**

Runoff = 1.33 cfs @ 12.03 hrs, Volume= 0.094 af, Depth= 5.26"

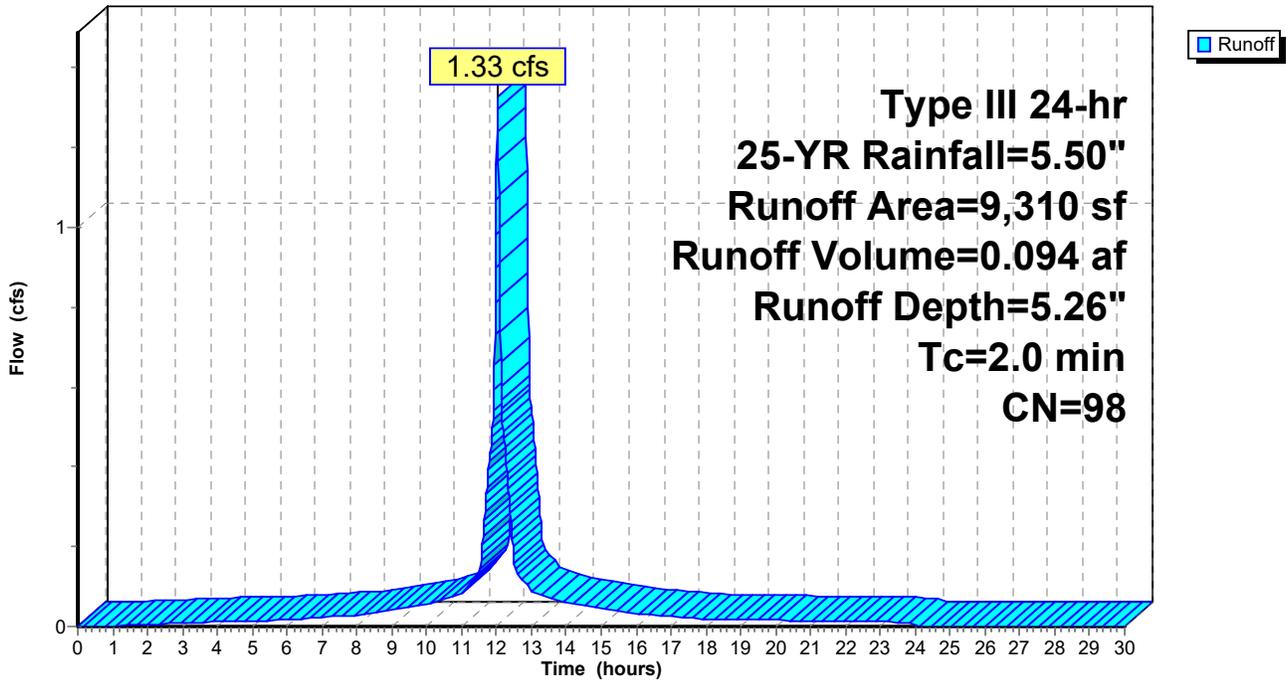
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
 Type III 24-hr 25-YR Rainfall=5.50"

Area (sf)	CN	Description
9,310	98	Roofs, HSG B
9,310		100.00% Impervious Area

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

**Subcatchment 18P: P4b**

Hydrograph



**Summary for Pond 19P: Basins #2**

Inflow Area = 0.531 ac, 74.01% Impervious, Inflow Depth = 4.23" for 25-YR event  
 Inflow = 2.61 cfs @ 12.04 hrs, Volume= 0.187 af  
 Outflow = 1.63 cfs @ 12.07 hrs, Volume= 0.187 af, Atten= 38%, Lag= 1.8 min  
 Discarded = 0.11 cfs @ 12.38 hrs, Volume= 0.087 af  
 Primary = 1.53 cfs @ 12.07 hrs, Volume= 0.100 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
 Peak Elev= 186.04' @ 12.38 hrs Surf.Area= 1,931 sf Storage= 1,300 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)  
 Center-of-Mass det. time= 22.6 min ( 799.4 - 776.7 )

Volume	Invert	Avail.Storage	Storage Description			
#1	185.20'	3,569 cf	<b>Custom Stage Data (Irregular)</b> Listed below (Recalc)			
Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)	
185.20	1,178	291.0	0	0	1,178	
186.00	1,894	306.0	1,218	1,218	1,930	
187.00	2,840	325.0	2,351	3,569	2,934	

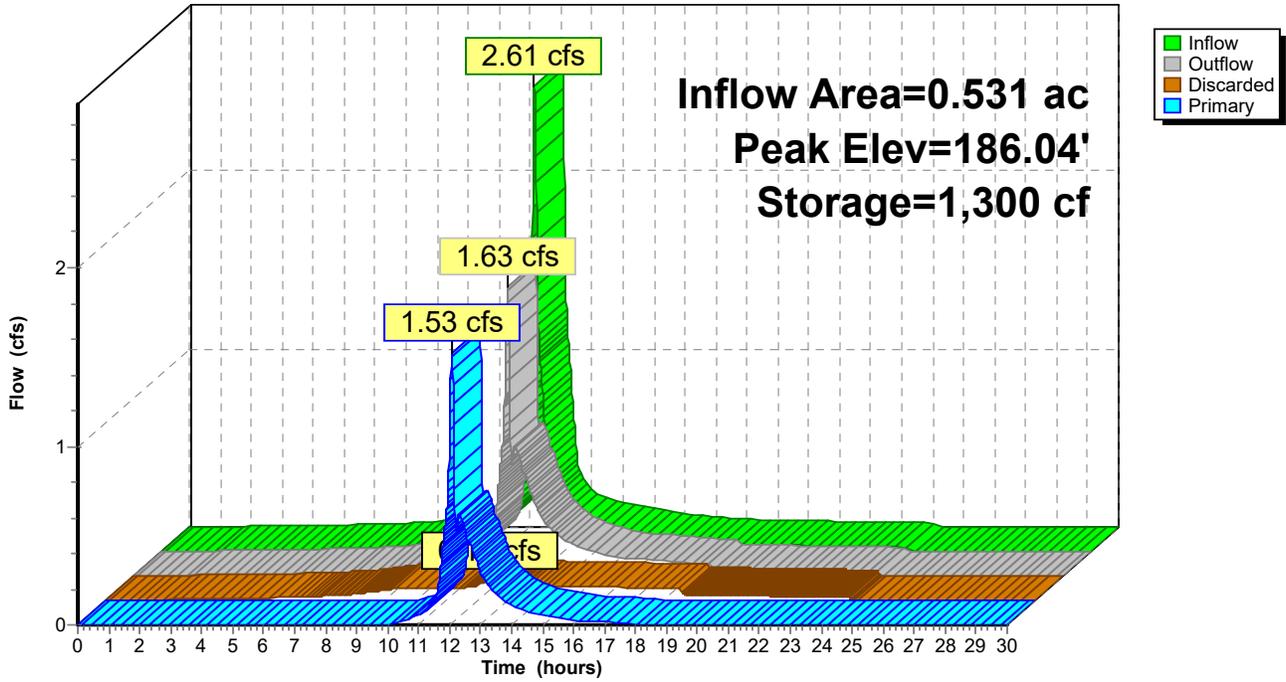
Device	Routing	Invert	Outlet Devices
#1	Discarded	185.20'	<b>2.410 in/hr Exfiltration over Surface area</b>
#2	Primary	185.20'	<b>12.0" Round Culvert</b> L= 36.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 185.20' / 185.00' S= 0.0056 1/8" Cc= 0.900 n= 0.011, Flow Area= 0.79 sf
#3	Primary	185.20'	<b>12.0" Round Culvert</b> L= 36.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 185.20' / 185.00' S= 0.0056 1/8" Cc= 0.900 n= 0.011, Flow Area= 0.79 sf

**Discarded OutFlow** Max=0.11 cfs @ 12.38 hrs HW=186.04' (Free Discharge)  
 ↳ **1=Exfiltration** (Exfiltration Controls 0.11 cfs)

**Primary OutFlow** Max=1.38 cfs @ 12.07 hrs HW=185.84' TW=185.71' (Dynamic Tailwater)  
 ↳ **2=Culvert** (Outlet Controls 0.69 cfs @ 1.85 fps)  
 ↳ **3=Culvert** (Outlet Controls 0.69 cfs @ 1.85 fps)

**Pond 19P: Basins #2**

Hydrograph



**Summary for Subcatchment 20P: P4c**

Runoff = 2.65 cfs @ 12.13 hrs, Volume= 0.213 af, Depth= 3.33"

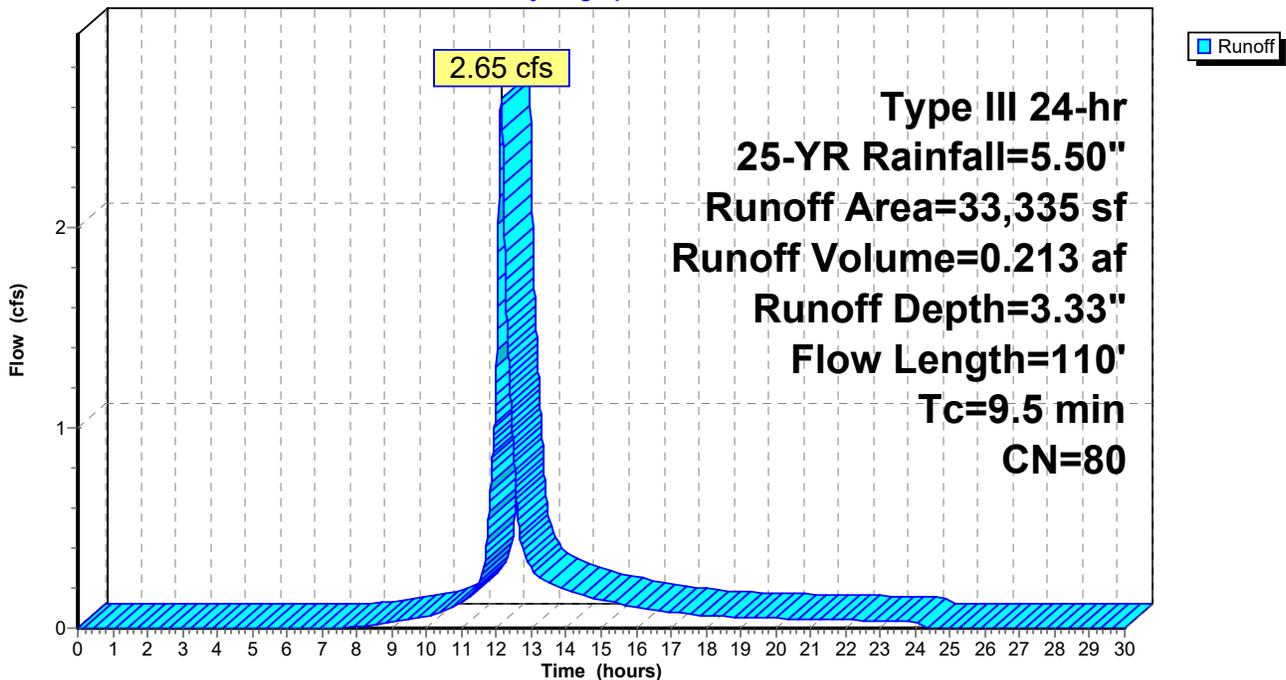
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
Type III 24-hr 25-YR Rainfall=5.50"

Area (sf)	CN	Description
16,717	98	Paved parking, HSG B
144	98	Roofs, HSG B
16,474	61	>75% Grass cover, Good, HSG B
33,335	80	Weighted Average
16,474		49.42% Pervious Area
16,861		50.58% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.0	40	0.0100	0.07		<b>Sheet Flow,</b> Grass: Dense n= 0.240 P2= 3.20"
0.4	50	0.0100	2.03		<b>Shallow Concentrated Flow,</b> Paved Kv= 20.3 fps
0.1	20	0.2000	3.13		<b>Shallow Concentrated Flow,</b> Short Grass Pasture Kv= 7.0 fps
9.5	110	Total			

**Subcatchment 20P: P4c**

Hydrograph



**Summary for Pond 21P: Basin #3**

Inflow Area = 1.297 ac, 60.18% Impervious, Inflow Depth = 2.89" for 25-YR event  
 Inflow = 3.94 cfs @ 12.10 hrs, Volume= 0.312 af  
 Outflow = 1.87 cfs @ 12.36 hrs, Volume= 0.312 af, Atten= 52%, Lag= 15.7 min  
 Discarded = 0.23 cfs @ 12.37 hrs, Volume= 0.162 af  
 Primary = 1.64 cfs @ 12.36 hrs, Volume= 0.150 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
 Peak Elev= 186.03' @ 12.37 hrs Surf.Area= 4,139 sf Storage= 3,567 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)  
 Center-of-Mass det. time= 48.1 min ( 850.4 - 802.3 )

Volume	Invert	Avail.Storage	Storage Description		
#1	185.00'	8,270 cf	<b>Custom Stage Data (Irregular)</b> Listed below (Recalc)		
Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
185.00	2,820	247.0	0	0	2,820
187.00	5,608	310.0	8,270	8,270	5,667

Device	Routing	Invert	Outlet Devices
#1	Discarded	185.00'	<b>2.410 in/hr Exfiltration over Surface area</b>
#2	Primary	185.00'	<b>12.0" Round Culvert</b> L= 90.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 185.00' / 184.70' S= 0.0033 1/8" Cc= 0.900 n= 0.011, Flow Area= 0.79 sf
#3	Primary	185.00'	<b>12.0" Round Culvert</b> L= 90.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 185.00' / 184.70' S= 0.0033 1/8" Cc= 0.900 n= 0.011, Flow Area= 0.79 sf

**Discarded OutFlow** Max=0.23 cfs @ 12.37 hrs HW=186.03' (Free Discharge)

↳ **1=Exfiltration** (Exfiltration Controls 0.23 cfs)

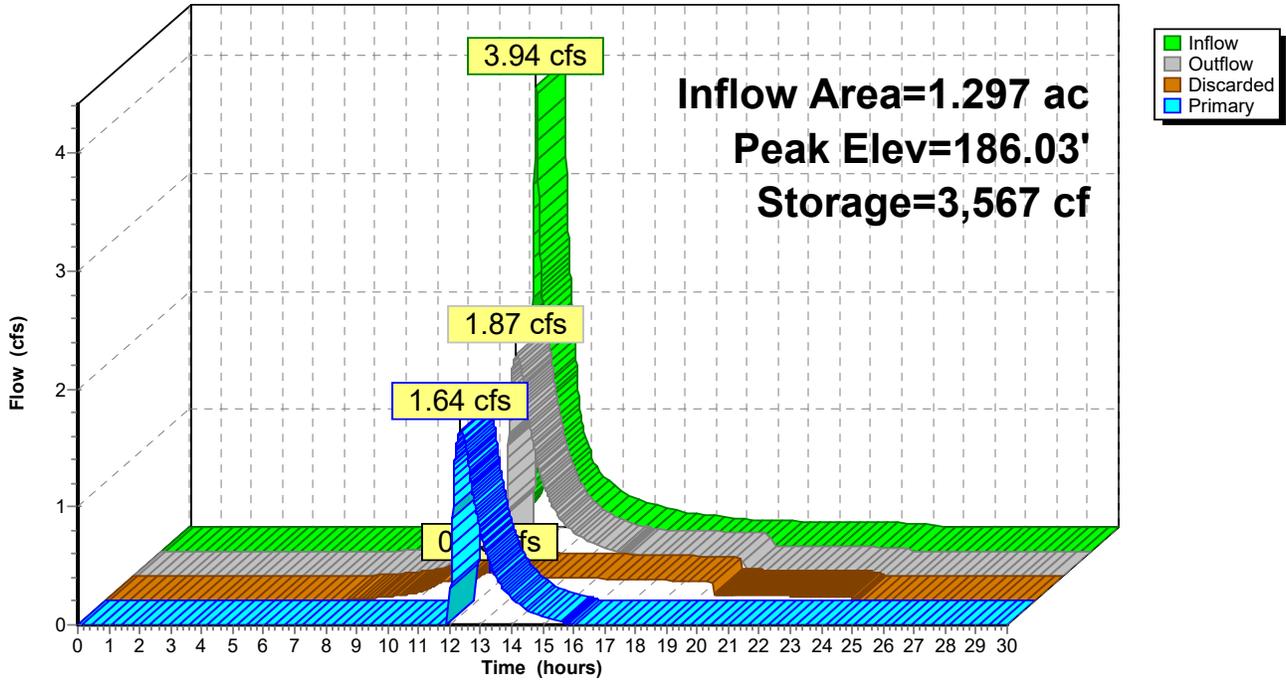
**Primary OutFlow** Max=1.64 cfs @ 12.36 hrs HW=186.03' TW=185.96' (Dynamic Tailwater)

↳ **2=Culvert** (Outlet Controls 0.82 cfs @ 1.26 fps)

↳ **3=Culvert** (Outlet Controls 0.82 cfs @ 1.26 fps)

### Pond 21P: Basin #3

Hydrograph



**Summary for Subcatchment 22P: P4d**

Runoff = 0.09 cfs @ 12.04 hrs, Volume= 0.006 af, Depth= 1.68"

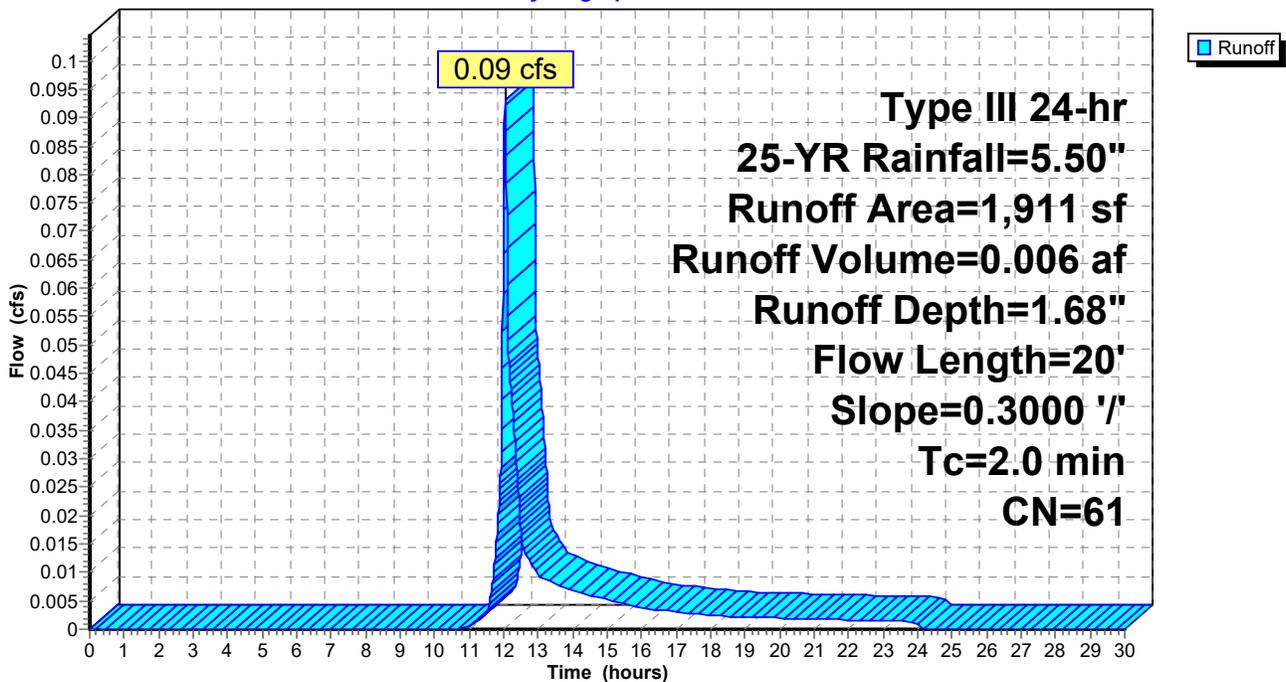
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
 Type III 24-hr 25-YR Rainfall=5.50"

Area (sf)	CN	Description
1,911	61	>75% Grass cover, Good, HSG B
1,911		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.3	20	0.3000	0.25		<b>Sheet Flow,</b> Grass: Dense n= 0.240 P2= 3.20"
1.3	20	Total, Increased to minimum Tc = 2.0 min			

**Subcatchment 22P: P4d**

Hydrograph



**Summary for Subcatchment 23P: P4e**

Runoff = 0.53 cfs @ 12.03 hrs, Volume= 0.037 af, Depth= 5.26"

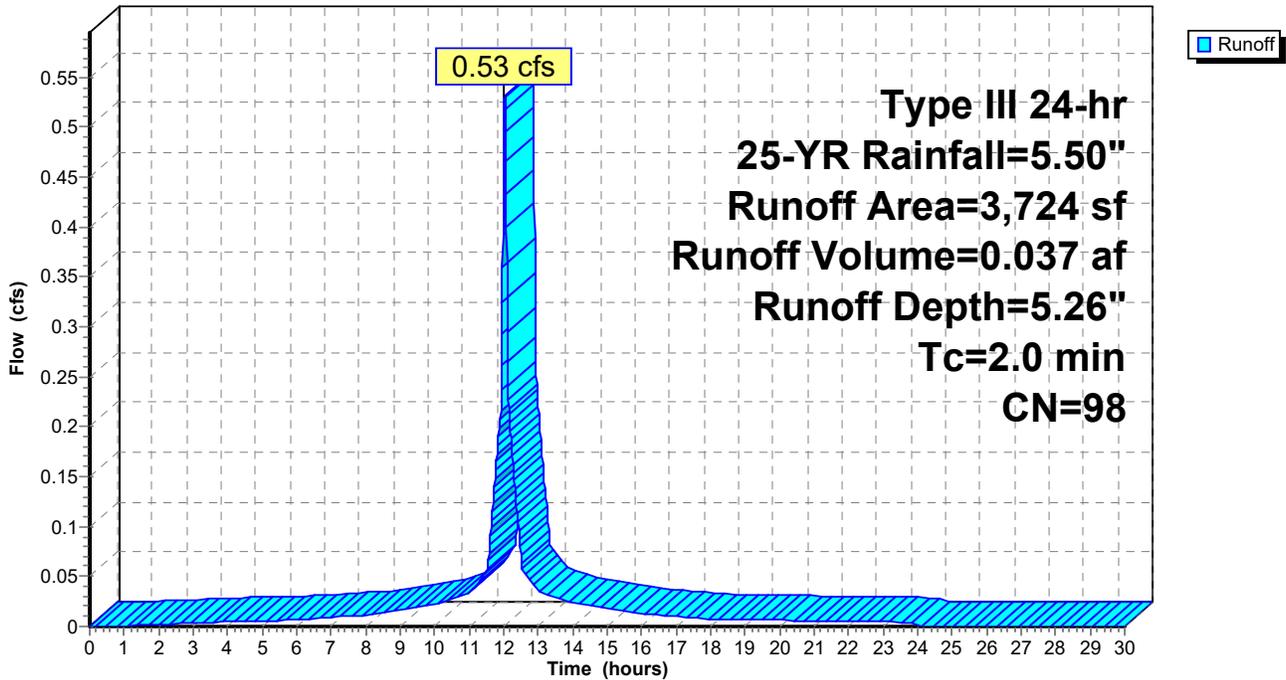
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
 Type III 24-hr 25-YR Rainfall=5.50"

Area (sf)	CN	Description
3,724	98	Roofs, HSG B
3,724		100.00% Impervious Area

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

**Subcatchment 23P: P4e**

Hydrograph



**Summary for Pond 24P: Basin #4**

Inflow Area = 1.426 ac, 60.72% Impervious, Inflow Depth = 1.63" for 25-YR event  
 Inflow = 1.81 cfs @ 12.32 hrs, Volume= 0.194 af  
 Outflow = 1.80 cfs @ 12.36 hrs, Volume= 0.194 af, Atten= 1%, Lag= 2.5 min  
 Discarded = 0.04 cfs @ 12.36 hrs, Volume= 0.031 af  
 Primary = 1.76 cfs @ 12.36 hrs, Volume= 0.163 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
 Peak Elev= 185.96' @ 12.36 hrs Surf.Area= 664 sf Storage= 581 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)  
 Center-of-Mass det. time= 17.8 min ( 788.6 - 770.8 )

Volume	Invert	Avail.Storage	Storage Description			
#1	184.70'	1,451 cf	<b>Custom Stage Data (Irregular)</b> Listed below (Recalc)			
Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)	
184.70	288	73.0	0	0	288	
186.00	680	101.0	611	611	692	
187.00	1,010	120.0	840	1,451	1,044	

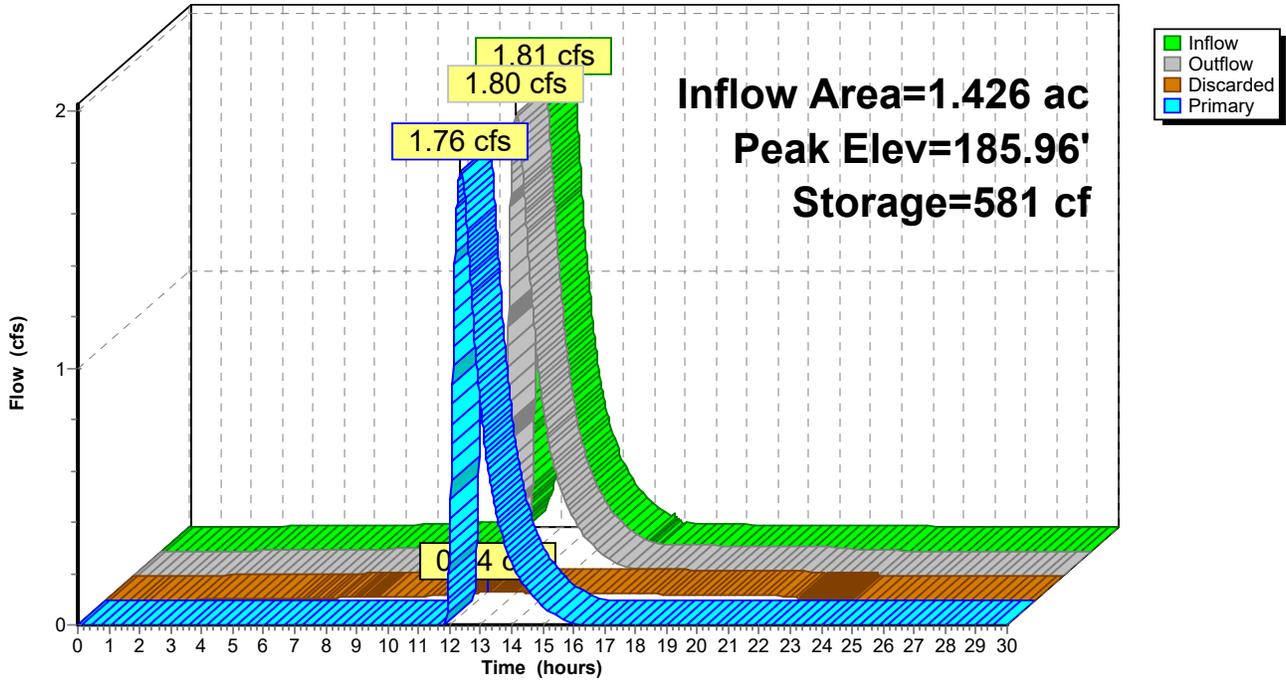
Device	Routing	Invert	Outlet Devices				
#1	Discarded	184.70'	<b>2.410 in/hr Exfiltration over Surface area</b>				
#2	Device 3	185.40'	<b>Custom Weir/Orifice, Cv= 2.62 (C= 3.28)</b>				
			Elev. (feet)	185.40	186.00	186.00	187.00
			Width (feet)	1.30	1.30	6.00	6.00
#3	Primary	185.20'	<b>Custom Weir/Orifice, Cv= 2.62 (C= 3.28)</b>				
			Elev. (feet)	185.20	185.60		
			Width (feet)	12.00	12.00		

**Discarded OutFlow** Max=0.04 cfs @ 12.36 hrs HW=185.96' (Free Discharge)  
 ↳1=Exfiltration (Exfiltration Controls 0.04 cfs)

**Primary OutFlow** Max=1.76 cfs @ 12.36 hrs HW=185.96' TW=0.00' (Dynamic Tailwater)  
 ↳3=Custom Weir/Orifice (Passes 1.76 cfs of 17.48 cfs potential flow)  
 ↳2=Custom Weir/Orifice (Weir Controls 1.76 cfs @ 2.44 fps)

**Pond 24P: Basin #4**

Hydrograph



**Summary for Subcatchment 25P: P4f**

Runoff = 1.06 cfs @ 12.17 hrs, Volume= 0.097 af, Depth= 1.60"

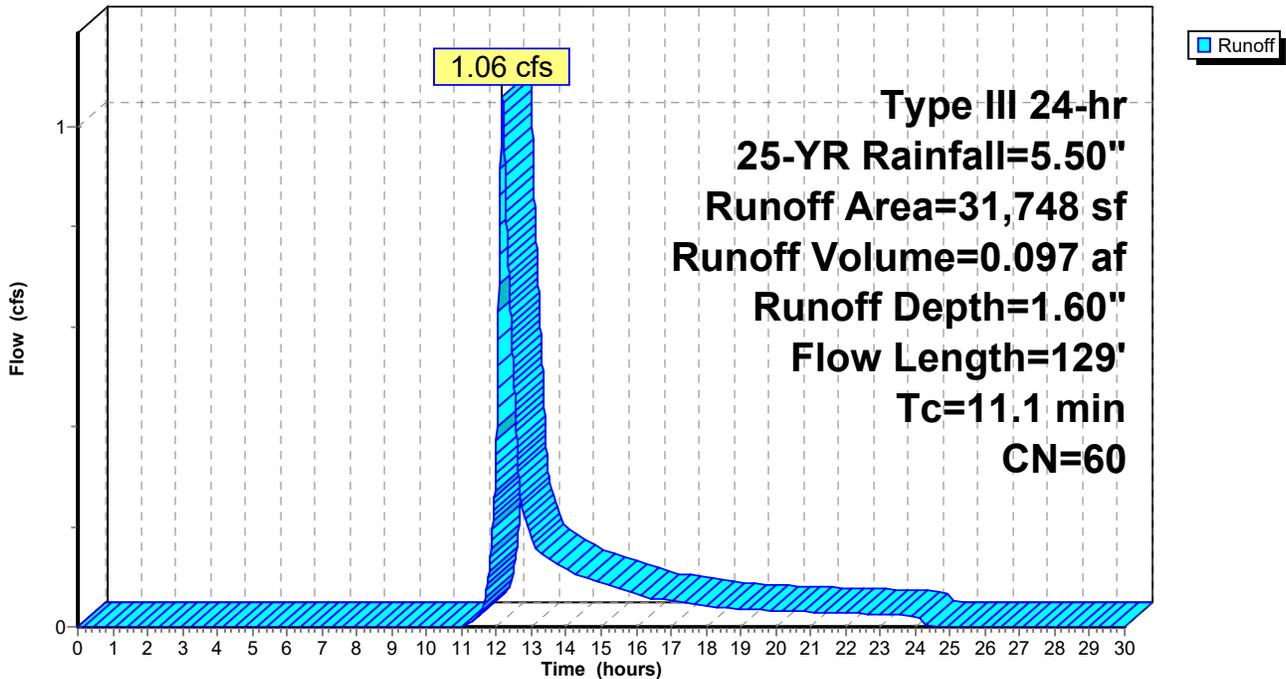
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
Type III 24-hr 25-YR Rainfall=5.50"

Area (sf)	CN	Description
* 1,550	90	Pavers, HSG B
17,354	61	>75% Grass cover, Good, HSG B
12,844	55	Woods, Good, HSG B
31,748	60	Weighted Average
31,748		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.4	42	0.0100	0.07		<b>Sheet Flow,</b> Grass: Dense n= 0.240 P2= 3.20"
1.6	67	0.0100	0.70		<b>Shallow Concentrated Flow,</b> Short Grass Pasture Kv= 7.0 fps
0.1	20	0.2000	2.24		<b>Shallow Concentrated Flow,</b> Woodland Kv= 5.0 fps
11.1	129	Total			

**Subcatchment 25P: P4f**

Hydrograph

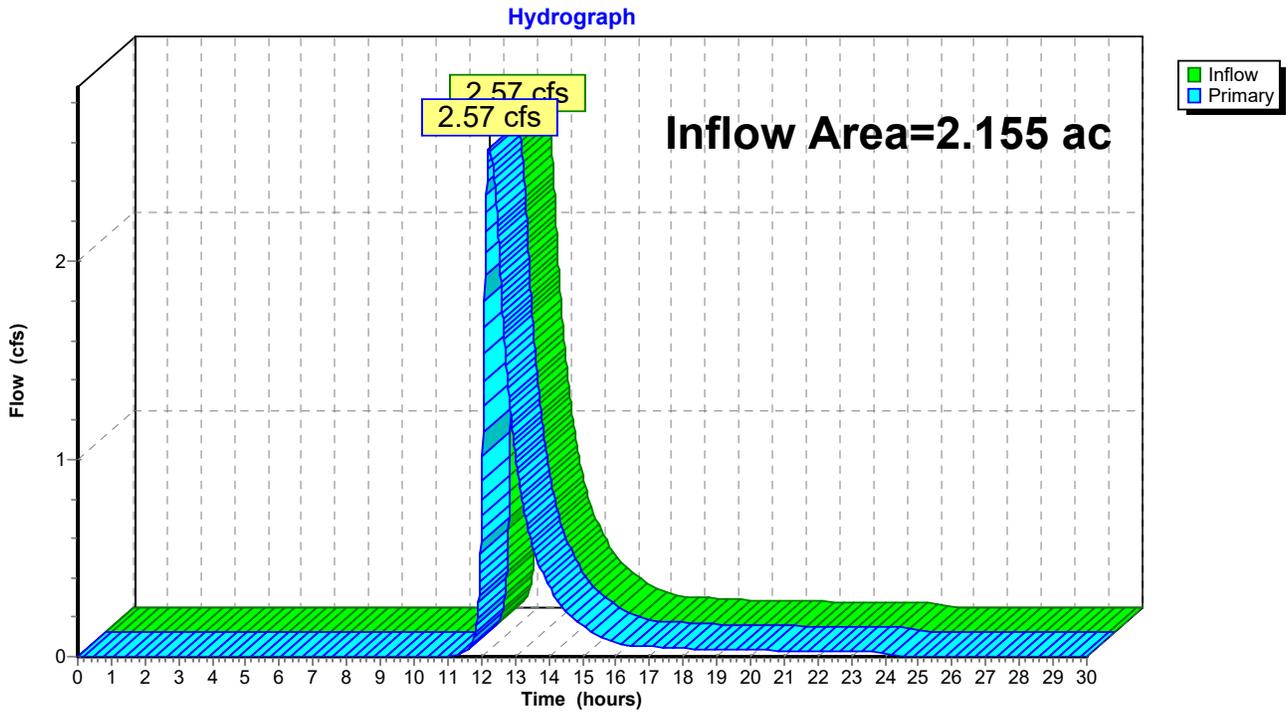


### Summary for Link 26P: Design Point #4: Flow to Wetlands

Inflow Area = 2.155 ac, 40.18% Impervious, Inflow Depth = 1.45" for 25-YR event  
Inflow = 2.57 cfs @ 12.23 hrs, Volume= 0.260 af  
Primary = 2.57 cfs @ 12.23 hrs, Volume= 0.260 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs

### Link 26P: Design Point #4: Flow to Wetlands



**HydroCAD4**

Type III 24-hr 50-YR Rainfall=6.10"

Prepared by {enter your company name here}

Printed 9/5/2019

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Time span=0.00-30.00 hrs, dt=0.01 hrs, 3001 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 17P: P4a** Runoff Area=13,831 sf 56.52% Impervious Runoff Depth=4.08"  
 Flow Length=45' Slope=0.0800 '/' Tc=4.3 min CN=82 Runoff=1.60 cfs 0.108 af

**Subcatchment 18P: P4b** Runoff Area=9,310 sf 100.00% Impervious Runoff Depth=5.86"  
 Tc=2.0 min CN=98 Runoff=1.47 cfs 0.104 af

**Pond 19P: Basins #2** Peak Elev=186.15' Storage=1,507 cf Inflow=2.95 cfs 0.212 af  
 Discarded=0.11 cfs 0.093 af Primary=1.71 cfs 0.119 af Outflow=1.81 cfs 0.212 af

**Subcatchment 20P: P4c** Runoff Area=33,335 sf 50.58% Impervious Runoff Depth=3.87"  
 Flow Length=110' Tc=9.5 min CN=80 Runoff=3.07 cfs 0.247 af

**Pond 21P: Basin #3** Peak Elev=186.13' Storage=4,001 cf Inflow=4.48 cfs 0.366 af  
 Discarded=0.24 cfs 0.175 af Primary=2.08 cfs 0.191 af Outflow=2.32 cfs 0.366 af

**Subcatchment 22P: P4d** Runoff Area=1,911 sf 0.00% Impervious Runoff Depth=2.07"  
 Flow Length=20' Slope=0.3000 '/' Tc=2.0 min CN=61 Runoff=0.12 cfs 0.008 af

**Subcatchment 23P: P4e** Runoff Area=3,724 sf 100.00% Impervious Runoff Depth=5.86"  
 Tc=2.0 min CN=98 Runoff=0.59 cfs 0.042 af

**Pond 24P: Basin #4** Peak Elev=186.03' Storage=634 cf Inflow=2.28 cfs 0.240 af  
 Discarded=0.04 cfs 0.033 af Primary=2.24 cfs 0.207 af Outflow=2.27 cfs 0.240 af

**Subcatchment 25P: P4f** Runoff Area=31,748 sf 0.00% Impervious Runoff Depth=1.99"  
 Flow Length=129' Tc=11.1 min CN=60 Runoff=1.35 cfs 0.121 af

**Link 26P: Design Point #4: Flow to Wetlands** Inflow=3.28 cfs 0.328 af  
 Primary=3.28 cfs 0.328 af

**Total Runoff Area = 2.155 ac Runoff Volume = 0.629 af Average Runoff Depth = 3.50"**  
**59.82% Pervious = 1.289 ac 40.18% Impervious = 0.866 ac**

**Summary for Subcatchment 17P: P4a**

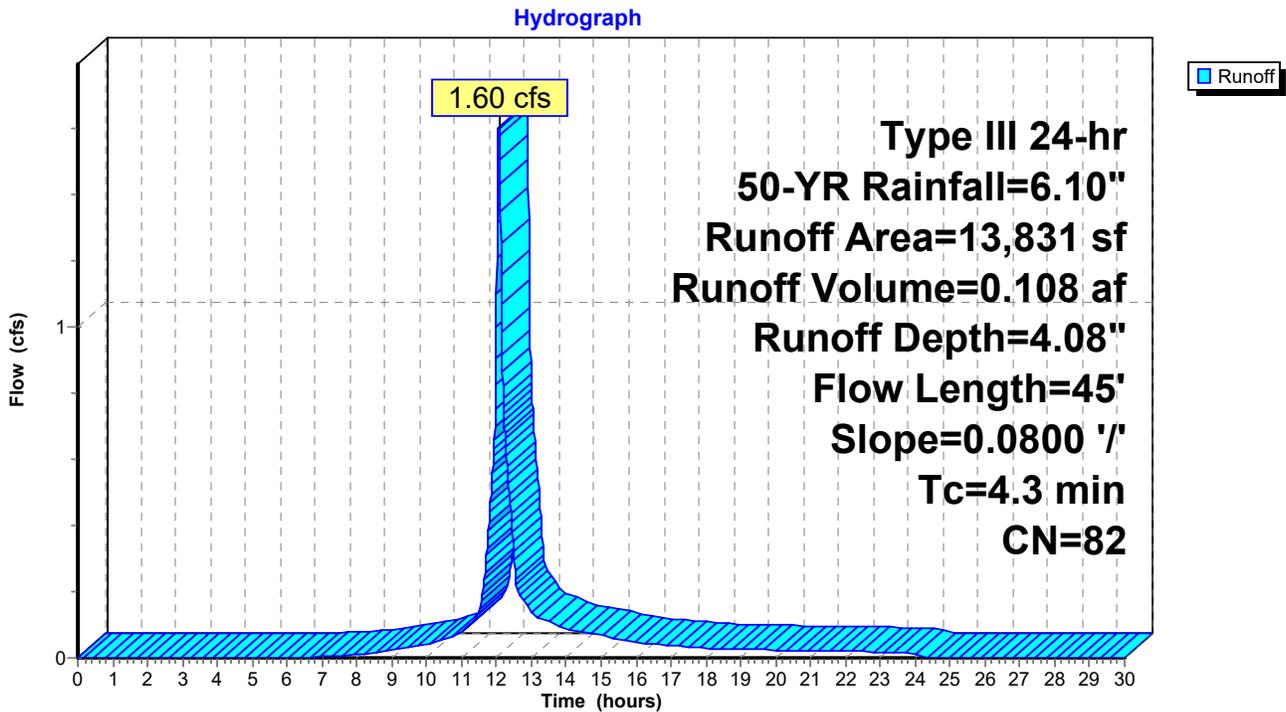
Runoff = 1.60 cfs @ 12.06 hrs, Volume= 0.108 af, Depth= 4.08"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
 Type III 24-hr 50-YR Rainfall=6.10"

Area (sf)	CN	Description
7,817	98	Paved parking, HSG B
6,014	61	>75% Grass cover, Good, HSG B
13,831	82	Weighted Average
6,014		43.48% Pervious Area
7,817		56.52% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.3	45	0.0800	0.17		Sheet Flow, Grass: Dense n= 0.240 P2= 3.20"

**Subcatchment 17P: P4a**



**Summary for Subcatchment 18P: P4b**

Runoff = 1.47 cfs @ 12.03 hrs, Volume= 0.104 af, Depth= 5.86"

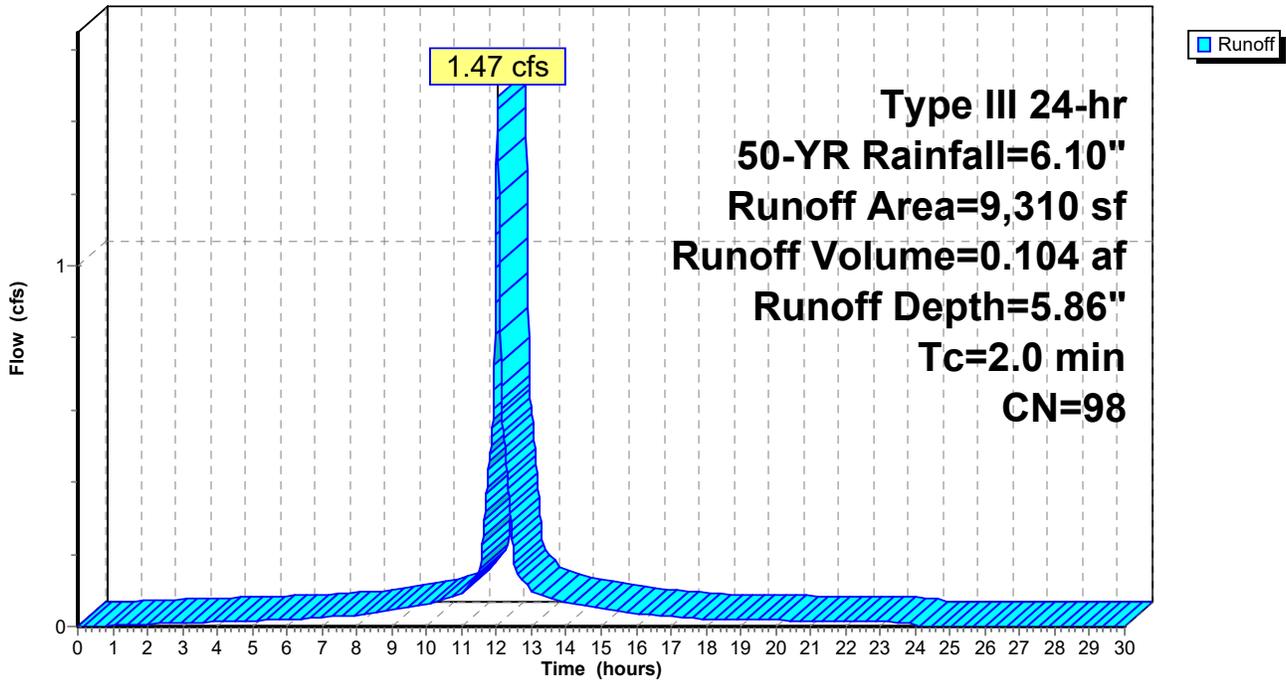
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
 Type III 24-hr 50-YR Rainfall=6.10"

Area (sf)	CN	Description
9,310	98	Roofs, HSG B
9,310		100.00% Impervious Area

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

**Subcatchment 18P: P4b**

Hydrograph



**Summary for Pond 19P: Basins #2**

Inflow Area = 0.531 ac, 74.01% Impervious, Inflow Depth = 4.80" for 50-YR event  
 Inflow = 2.95 cfs @ 12.04 hrs, Volume= 0.212 af  
 Outflow = 1.81 cfs @ 12.07 hrs, Volume= 0.212 af, Atten= 39%, Lag= 1.6 min  
 Discarded = 0.11 cfs @ 12.35 hrs, Volume= 0.093 af  
 Primary = 1.71 cfs @ 12.07 hrs, Volume= 0.119 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
 Peak Elev= 186.15' @ 12.35 hrs Surf.Area= 2,022 sf Storage= 1,507 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)  
 Center-of-Mass det. time= 23.0 min ( 797.5 - 774.5 )

Volume	Invert	Avail.Storage	Storage Description		
#1	185.20'	3,569 cf	<b>Custom Stage Data (Irregular)</b> Listed below (Recalc)		
Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
185.20	1,178	291.0	0	0	1,178
186.00	1,894	306.0	1,218	1,218	1,930
187.00	2,840	325.0	2,351	3,569	2,934

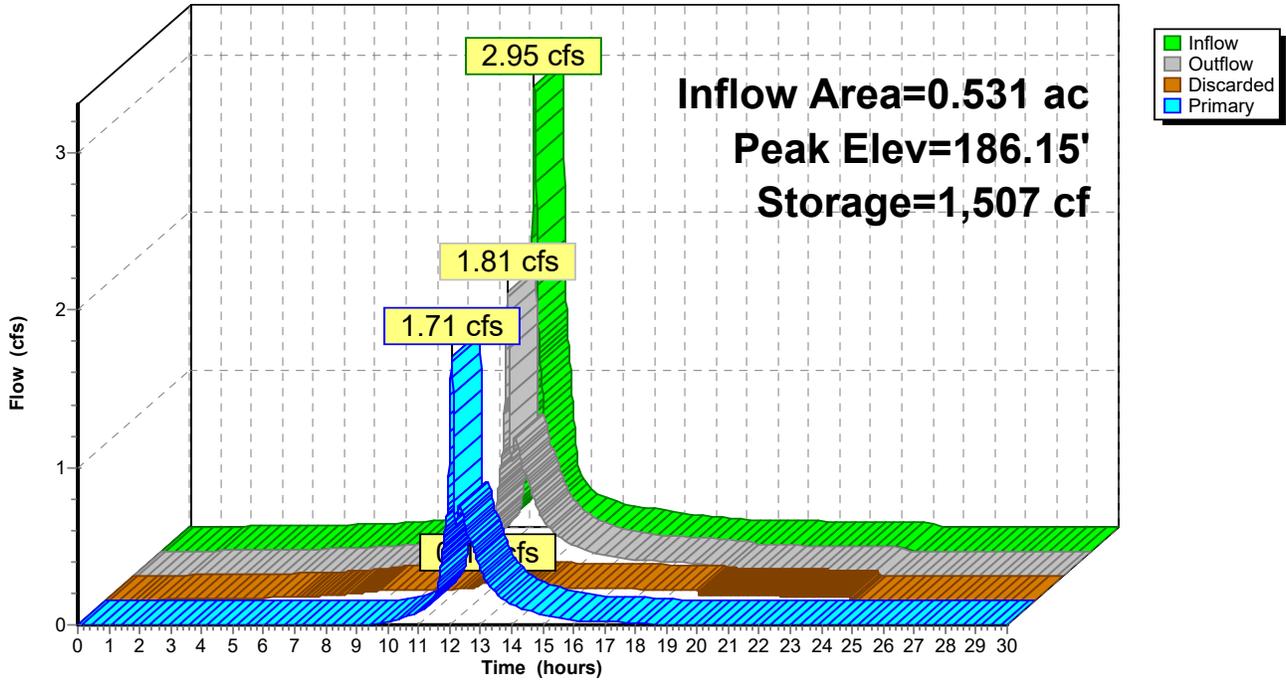
Device	Routing	Invert	Outlet Devices
#1	Discarded	185.20'	<b>2.410 in/hr Exfiltration over Surface area</b>
#2	Primary	185.20'	<b>12.0" Round Culvert</b> L= 36.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 185.20' / 185.00' S= 0.0056 1/1' Cc= 0.900 n= 0.011, Flow Area= 0.79 sf
#3	Primary	185.20'	<b>12.0" Round Culvert</b> L= 36.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 185.20' / 185.00' S= 0.0056 1/1' Cc= 0.900 n= 0.011, Flow Area= 0.79 sf

**Discarded OutFlow** Max=0.11 cfs @ 12.35 hrs HW=186.15' (Free Discharge)  
 ↖1=Exfiltration (Exfiltration Controls 0.11 cfs)

**Primary OutFlow** Max=1.51 cfs @ 12.07 hrs HW=185.92' TW=185.82' (Dynamic Tailwater)  
 ↖2=Culvert (Outlet Controls 0.75 cfs @ 1.73 fps)  
 ↖3=Culvert (Outlet Controls 0.75 cfs @ 1.73 fps)

**Pond 19P: Basins #2**

Hydrograph



**Summary for Subcatchment 20P: P4c**

Runoff = 3.07 cfs @ 12.13 hrs, Volume= 0.247 af, Depth= 3.87"

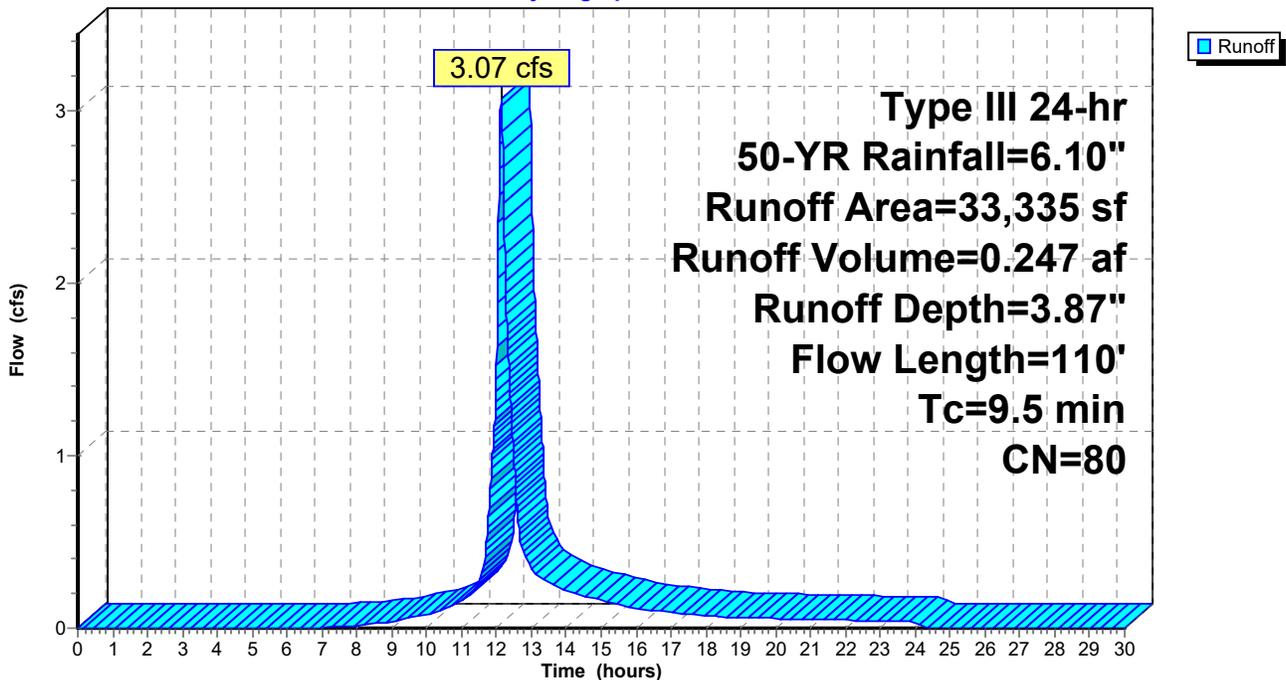
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
 Type III 24-hr 50-YR Rainfall=6.10"

Area (sf)	CN	Description
16,717	98	Paved parking, HSG B
144	98	Roofs, HSG B
16,474	61	>75% Grass cover, Good, HSG B
33,335	80	Weighted Average
16,474		49.42% Pervious Area
16,861		50.58% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.0	40	0.0100	0.07		<b>Sheet Flow,</b> Grass: Dense n= 0.240 P2= 3.20"
0.4	50	0.0100	2.03		<b>Shallow Concentrated Flow,</b> Paved Kv= 20.3 fps
0.1	20	0.2000	3.13		<b>Shallow Concentrated Flow,</b> Short Grass Pasture Kv= 7.0 fps
9.5	110	Total			

**Subcatchment 20P: P4c**

Hydrograph



**Summary for Pond 21P: Basin #3**

Inflow Area = 1.297 ac, 60.18% Impervious, Inflow Depth = 3.39" for 50-YR event  
 Inflow = 4.48 cfs @ 12.10 hrs, Volume= 0.366 af  
 Outflow = 2.32 cfs @ 12.34 hrs, Volume= 0.366 af, Atten= 48%, Lag= 14.4 min  
 Discarded = 0.24 cfs @ 12.34 hrs, Volume= 0.175 af  
 Primary = 2.08 cfs @ 12.34 hrs, Volume= 0.191 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
 Peak Elev= 186.13' @ 12.34 hrs Surf.Area= 4,285 sf Storage= 4,001 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)  
 Center-of-Mass det. time= 46.2 min ( 845.5 - 799.3 )

Volume	Invert	Avail.Storage	Storage Description			
#1	185.00'	8,270 cf	<b>Custom Stage Data (Irregular)</b> Listed below (Recalc)			
Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)	
185.00	2,820	247.0	0	0	2,820	
187.00	5,608	310.0	8,270	8,270	5,667	

Device	Routing	Invert	Outlet Devices
#1	Discarded	185.00'	<b>2.410 in/hr Exfiltration over Surface area</b>
#2	Primary	185.00'	<b>12.0" Round Culvert</b> L= 90.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 185.00' / 184.70' S= 0.0033 ' /' Cc= 0.900 n= 0.011, Flow Area= 0.79 sf
#3	Primary	185.00'	<b>12.0" Round Culvert</b> L= 90.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 185.00' / 184.70' S= 0.0033 ' /' Cc= 0.900 n= 0.011, Flow Area= 0.79 sf

**Discarded OutFlow** Max=0.24 cfs @ 12.34 hrs HW=186.13' (Free Discharge)

↳ **1=Exfiltration** (Exfiltration Controls 0.24 cfs)

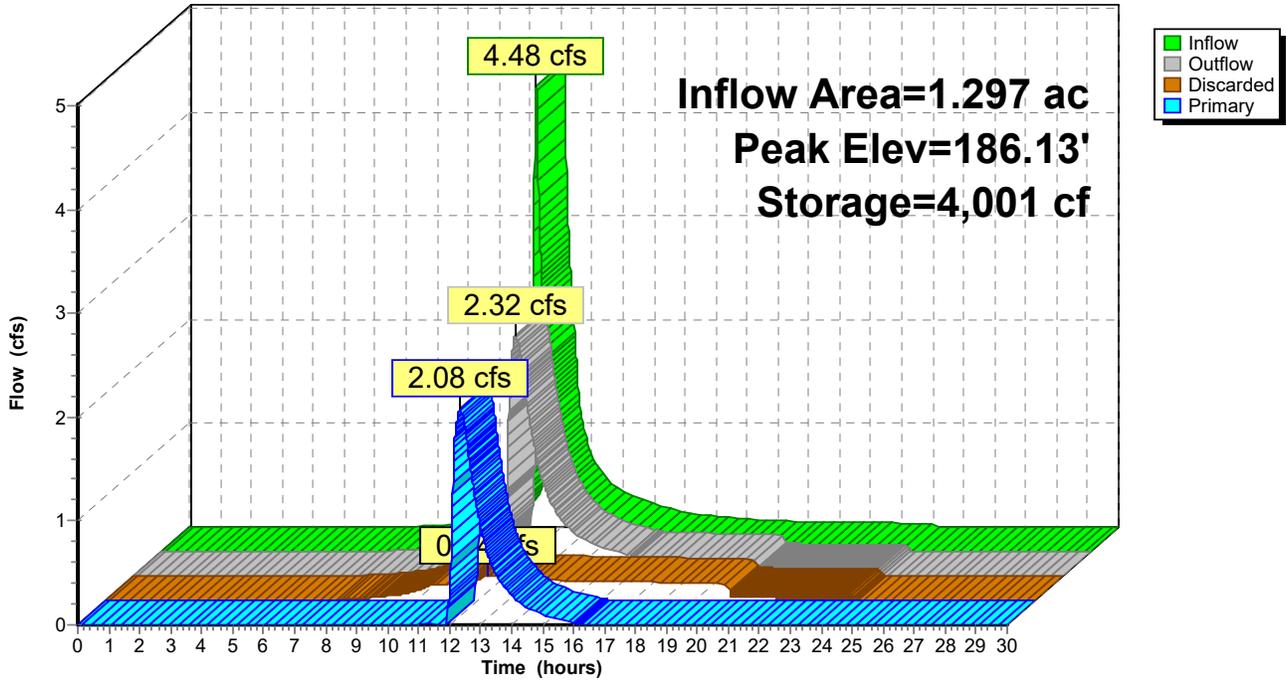
**Primary OutFlow** Max=2.08 cfs @ 12.34 hrs HW=186.13' TW=186.03' (Dynamic Tailwater)

↳ **2=Culvert** (Outlet Controls 1.04 cfs @ 1.46 fps)

↳ **3=Culvert** (Outlet Controls 1.04 cfs @ 1.46 fps)

**Pond 21P: Basin #3**

Hydrograph



**Summary for Subcatchment 22P: P4d**

Runoff = 0.12 cfs @ 12.04 hrs, Volume= 0.008 af, Depth= 2.07"

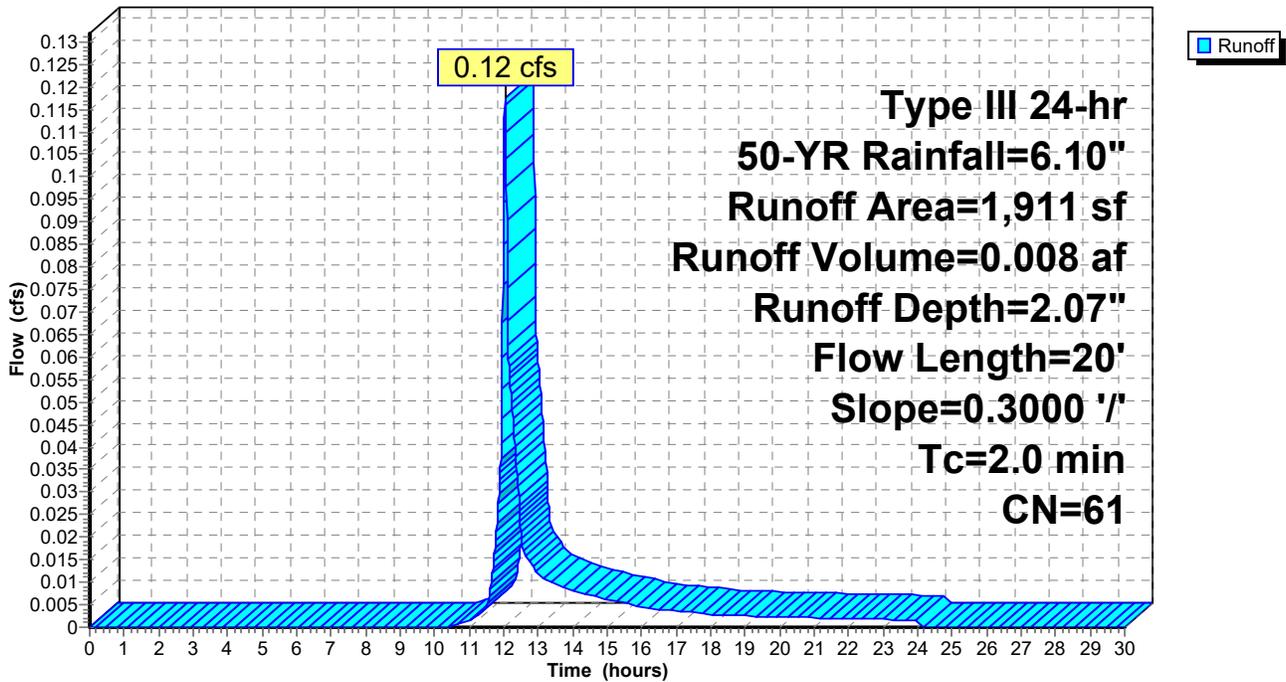
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
 Type III 24-hr 50-YR Rainfall=6.10"

Area (sf)	CN	Description
1,911	61	>75% Grass cover, Good, HSG B
1,911		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.3	20	0.3000	0.25		Sheet Flow, Grass: Dense n= 0.240 P2= 3.20"
1.3	20	Total, Increased to minimum Tc = 2.0 min			

**Subcatchment 22P: P4d**

Hydrograph



**Summary for Subcatchment 23P: P4e**

Runoff = 0.59 cfs @ 12.03 hrs, Volume= 0.042 af, Depth= 5.86"

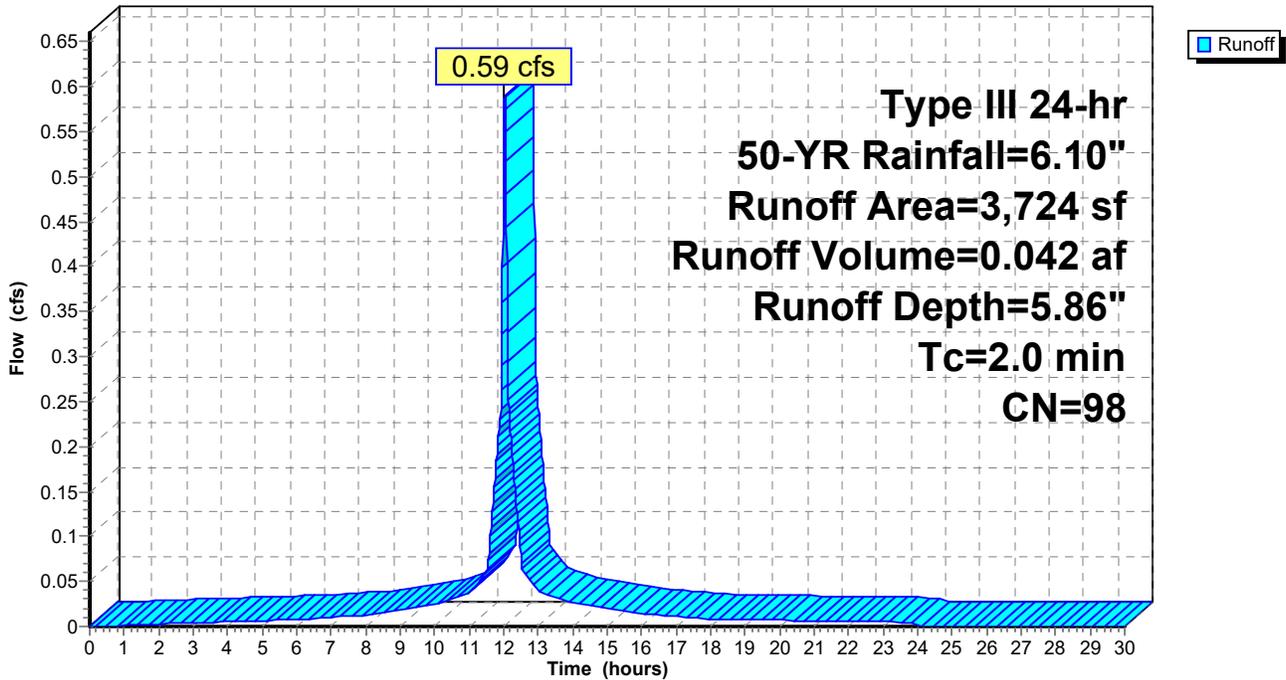
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
 Type III 24-hr 50-YR Rainfall=6.10"

Area (sf)	CN	Description
3,724	98	Roofs, HSG B
3,724		100.00% Impervious Area

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

**Subcatchment 23P: P4e**

Hydrograph



**Summary for Pond 24P: Basin #4**

Inflow Area = 1.426 ac, 60.72% Impervious, Inflow Depth = 2.02" for 50-YR event  
 Inflow = 2.28 cfs @ 12.31 hrs, Volume= 0.240 af  
 Outflow = 2.27 cfs @ 12.34 hrs, Volume= 0.240 af, Atten= 0%, Lag= 1.3 min  
 Discarded = 0.04 cfs @ 12.34 hrs, Volume= 0.033 af  
 Primary = 2.24 cfs @ 12.34 hrs, Volume= 0.207 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
 Peak Elev= 186.03' @ 12.34 hrs Surf.Area= 690 sf Storage= 634 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)  
 Center-of-Mass det. time= 15.9 min ( 787.4 - 771.5 )

Volume	Invert	Avail.Storage	Storage Description			
#1	184.70'	1,451 cf	<b>Custom Stage Data (Irregular)</b> Listed below (Recalc)			
Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)	
184.70	288	73.0	0	0	288	
186.00	680	101.0	611	611	692	
187.00	1,010	120.0	840	1,451	1,044	

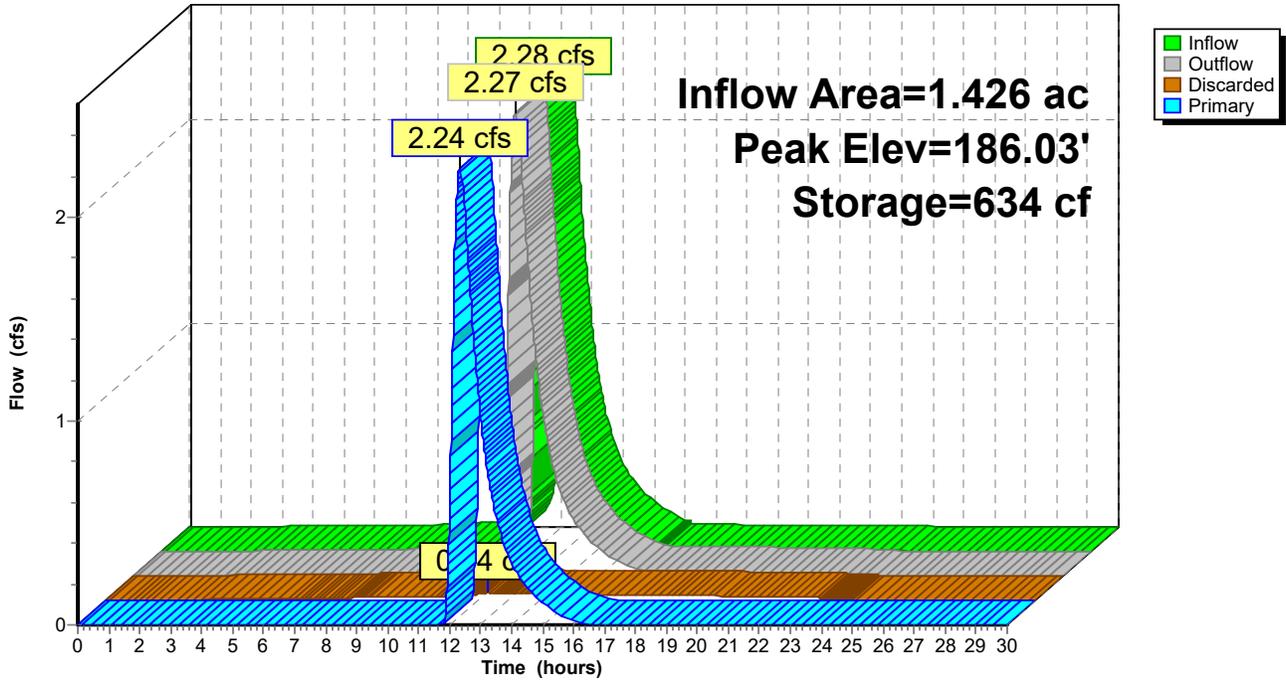
Device	Routing	Invert	Outlet Devices				
#1	Discarded	184.70'	<b>2.410 in/hr Exfiltration over Surface area</b>				
#2	Device 3	185.40'	<b>Custom Weir/Orifice, Cv= 2.62 (C= 3.28)</b>				
			Elev. (feet)	185.40	186.00	186.00	187.00
			Width (feet)	1.30	1.30	6.00	6.00
#3	Primary	185.20'	<b>Custom Weir/Orifice, Cv= 2.62 (C= 3.28)</b>				
			Elev. (feet)	185.20	185.60		
			Width (feet)	12.00	12.00		

**Discarded OutFlow** Max=0.04 cfs @ 12.34 hrs HW=186.03' (Free Discharge)  
 ↑1=Exfiltration (Exfiltration Controls 0.04 cfs)

**Primary OutFlow** Max=2.24 cfs @ 12.34 hrs HW=186.03' TW=0.00' (Dynamic Tailwater)  
 ↑3=Custom Weir/Orifice (Passes 2.24 cfs of 18.68 cfs potential flow)  
 ↑2=Custom Weir/Orifice (Weir Controls 2.24 cfs @ 2.29 fps)

**Pond 24P: Basin #4**

Hydrograph



**Summary for Subcatchment 25P: P4f**

Runoff = 1.35 cfs @ 12.17 hrs, Volume= 0.121 af, Depth= 1.99"

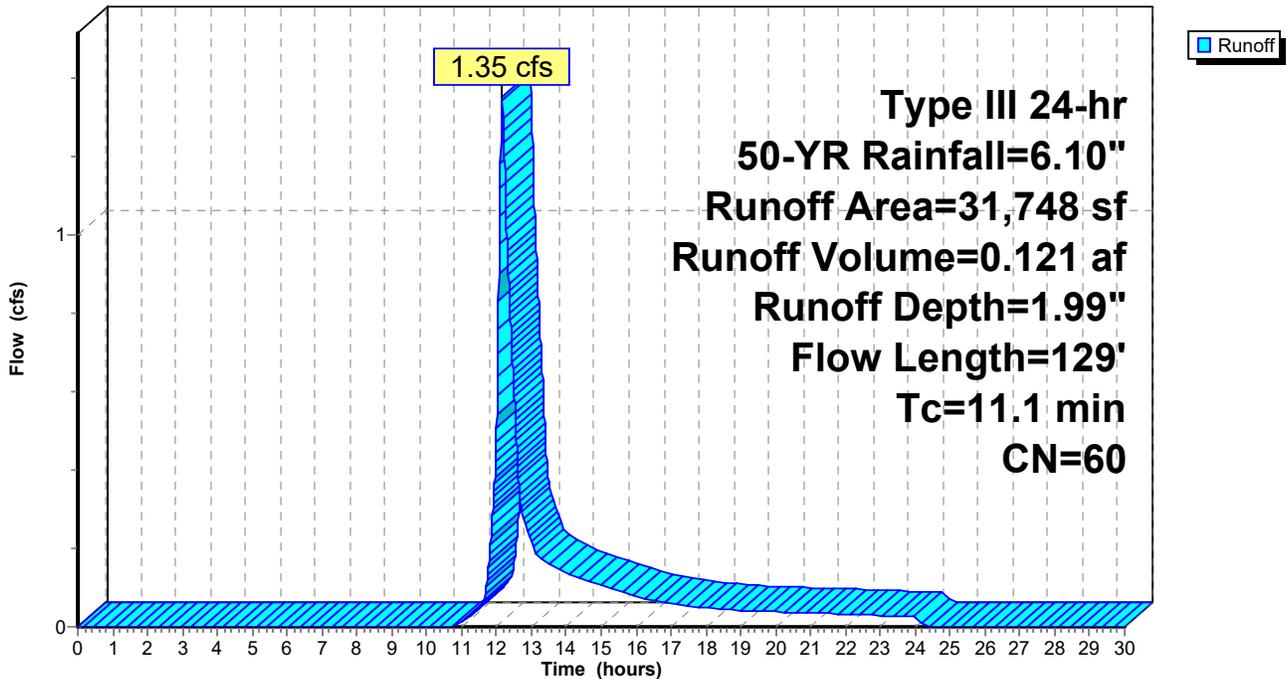
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
 Type III 24-hr 50-YR Rainfall=6.10"

Area (sf)	CN	Description
* 1,550	90	Pavers, HSG B
17,354	61	>75% Grass cover, Good, HSG B
12,844	55	Woods, Good, HSG B
31,748	60	Weighted Average
31,748		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.4	42	0.0100	0.07		<b>Sheet Flow,</b> Grass: Dense n= 0.240 P2= 3.20"
1.6	67	0.0100	0.70		<b>Shallow Concentrated Flow,</b> Short Grass Pasture Kv= 7.0 fps
0.1	20	0.2000	2.24		<b>Shallow Concentrated Flow,</b> Woodland Kv= 5.0 fps
11.1	129	Total			

**Subcatchment 25P: P4f**

Hydrograph

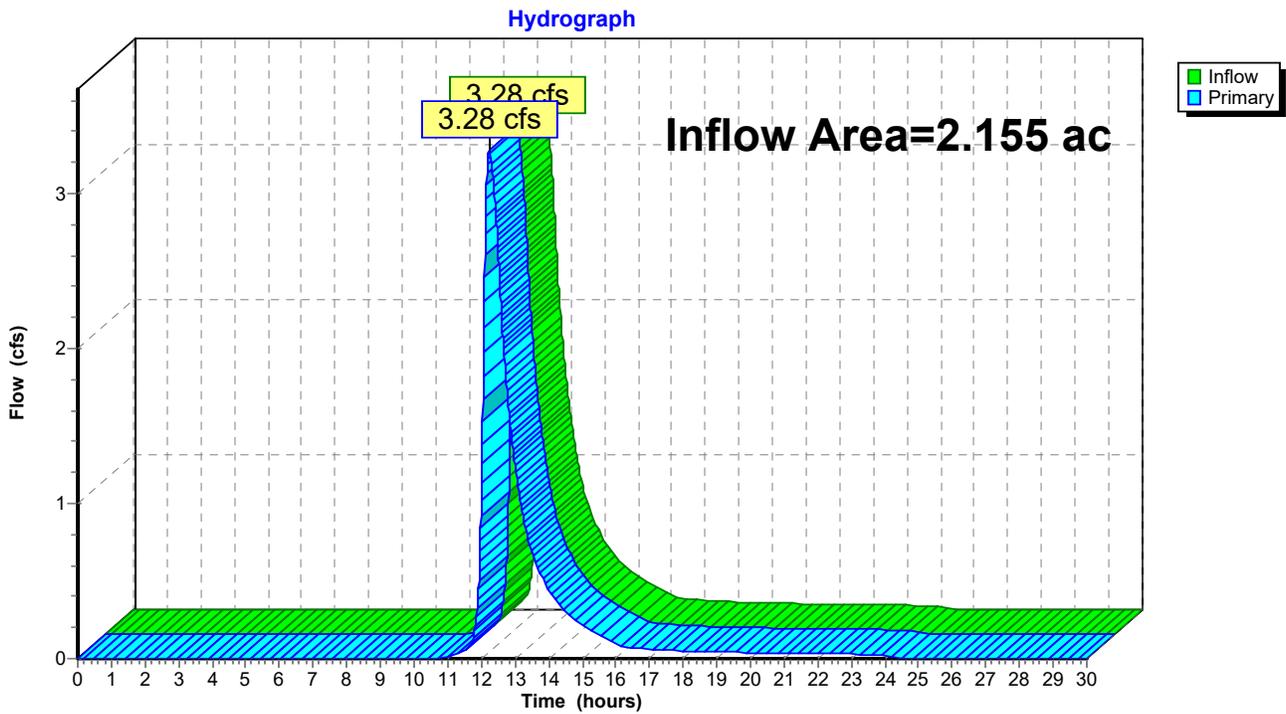


### Summary for Link 26P: Design Point #4: Flow to Wetlands

Inflow Area = 2.155 ac, 40.18% Impervious, Inflow Depth = 1.83" for 50-YR event  
Inflow = 3.28 cfs @ 12.22 hrs, Volume= 0.328 af  
Primary = 3.28 cfs @ 12.22 hrs, Volume= 0.328 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs

### Link 26P: Design Point #4: Flow to Wetlands



**HydroCAD4**

Type III 24-hr 100-YR Rainfall=6.70"

Prepared by {enter your company name here}

Printed 9/5/2019

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Page 59

Time span=0.00-30.00 hrs, dt=0.01 hrs, 3001 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 17P: P4a** Runoff Area=13,831 sf 56.52% Impervious Runoff Depth=4.64"  
 Flow Length=45' Slope=0.0800 '/' Tc=4.3 min CN=82 Runoff=1.81 cfs 0.123 af

**Subcatchment 18P: P4b** Runoff Area=9,310 sf 100.00% Impervious Runoff Depth=6.46"  
 Tc=2.0 min CN=98 Runoff=1.62 cfs 0.115 af

**Pond 19P: Basins #2** Peak Elev=186.24' Storage=1,703 cf Inflow=3.30 cfs 0.238 af  
 Discarded=0.12 cfs 0.099 af Primary=1.90 cfs 0.139 af Outflow=2.00 cfs 0.238 af

**Subcatchment 20P: P4c** Runoff Area=33,335 sf 50.58% Impervious Runoff Depth=4.42"  
 Flow Length=110' Tc=9.5 min CN=80 Runoff=3.50 cfs 0.282 af

**Pond 21P: Basin #3** Peak Elev=186.23' Storage=4,400 cf Inflow=5.04 cfs 0.421 af  
 Discarded=0.25 cfs 0.188 af Primary=2.59 cfs 0.233 af Outflow=2.83 cfs 0.421 af

**Subcatchment 22P: P4d** Runoff Area=1,911 sf 0.00% Impervious Runoff Depth=2.49"  
 Flow Length=20' Slope=0.3000 '/' Tc=2.0 min CN=61 Runoff=0.14 cfs 0.009 af

**Subcatchment 23P: P4e** Runoff Area=3,724 sf 100.00% Impervious Runoff Depth=6.46"  
 Tc=2.0 min CN=98 Runoff=0.65 cfs 0.046 af

**Pond 24P: Basin #4** Peak Elev=186.08' Storage=669 cf Inflow=2.82 cfs 0.288 af  
 Discarded=0.04 cfs 0.035 af Primary=2.78 cfs 0.254 af Outflow=2.82 cfs 0.288 af

**Subcatchment 25P: P4f** Runoff Area=31,748 sf 0.00% Impervious Runoff Depth=2.39"  
 Flow Length=129' Tc=11.1 min CN=60 Runoff=1.66 cfs 0.145 af

**Link 26P: Design Point #4: Flow to Wetlands** Inflow=4.15 cfs 0.399 af  
 Primary=4.15 cfs 0.399 af

**Total Runoff Area = 2.155 ac Runoff Volume = 0.720 af Average Runoff Depth = 4.01"**  
**59.82% Pervious = 1.289 ac 40.18% Impervious = 0.866 ac**

**Summary for Subcatchment 17P: P4a**

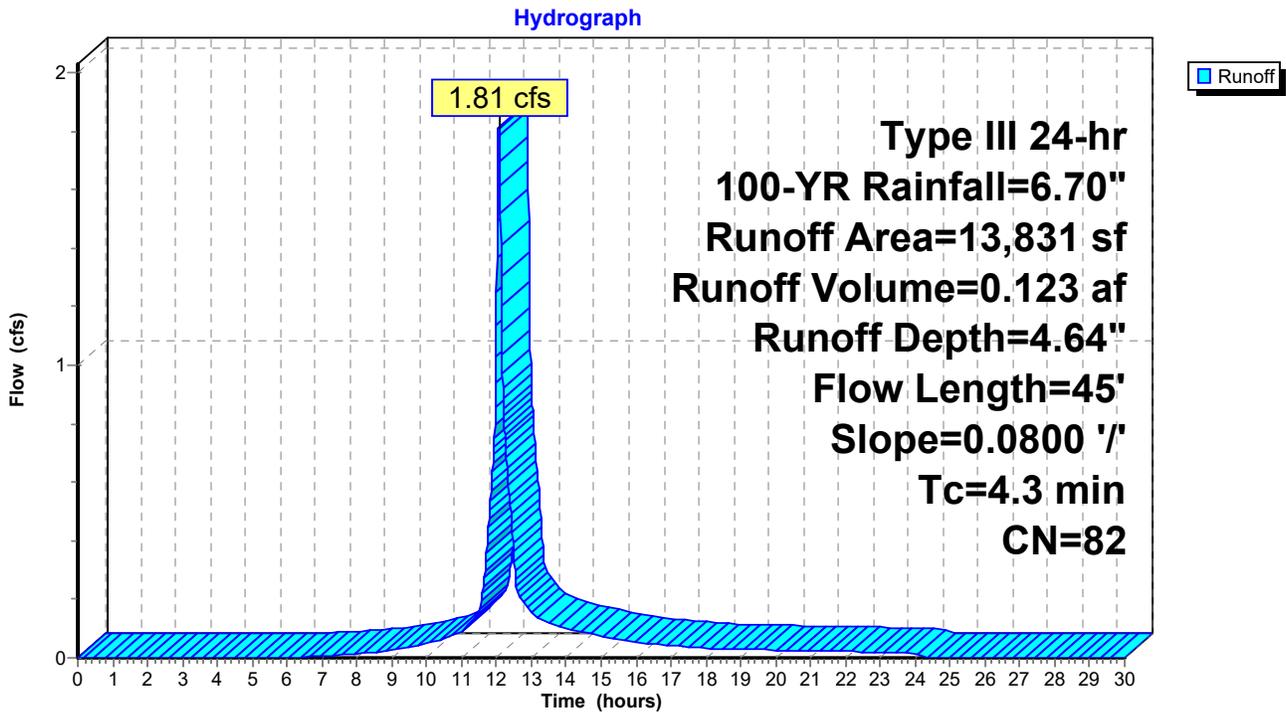
Runoff = 1.81 cfs @ 12.06 hrs, Volume= 0.123 af, Depth= 4.64"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
 Type III 24-hr 100-YR Rainfall=6.70"

Area (sf)	CN	Description
7,817	98	Paved parking, HSG B
6,014	61	>75% Grass cover, Good, HSG B
13,831	82	Weighted Average
6,014		43.48% Pervious Area
7,817		56.52% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.3	45	0.0800	0.17		Sheet Flow, Grass: Dense n= 0.240 P2= 3.20"

**Subcatchment 17P: P4a**



**Summary for Subcatchment 18P: P4b**

Runoff = 1.62 cfs @ 12.03 hrs, Volume= 0.115 af, Depth= 6.46"

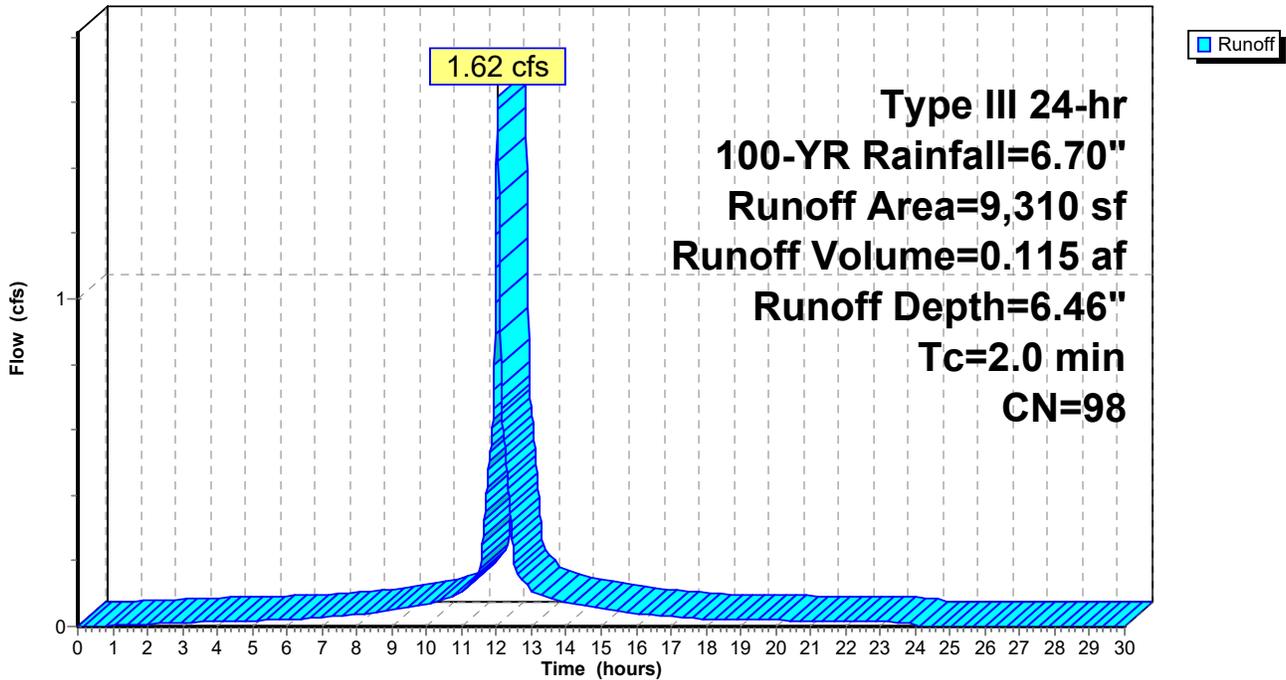
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
 Type III 24-hr 100-YR Rainfall=6.70"

Area (sf)	CN	Description
9,310	98	Roofs, HSG B
9,310		100.00% Impervious Area

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

**Subcatchment 18P: P4b**

Hydrograph



**Summary for Pond 19P: Basins #2**

Inflow Area = 0.531 ac, 74.01% Impervious, Inflow Depth = 5.37" for 100-YR event  
 Inflow = 3.30 cfs @ 12.04 hrs, Volume= 0.238 af  
 Outflow = 2.00 cfs @ 12.07 hrs, Volume= 0.238 af, Atten= 39%, Lag= 1.5 min  
 Discarded = 0.12 cfs @ 12.33 hrs, Volume= 0.099 af  
 Primary = 1.90 cfs @ 12.07 hrs, Volume= 0.139 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
 Peak Elev= 186.24' @ 12.33 hrs Surf.Area= 2,106 sf Storage= 1,703 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)  
 Center-of-Mass det. time= 23.2 min ( 795.7 - 772.5 )

Volume	Invert	Avail.Storage	Storage Description		
#1	185.20'	3,569 cf	<b>Custom Stage Data (Irregular)</b> Listed below (Recalc)		
Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
185.20	1,178	291.0	0	0	1,178
186.00	1,894	306.0	1,218	1,218	1,930
187.00	2,840	325.0	2,351	3,569	2,934

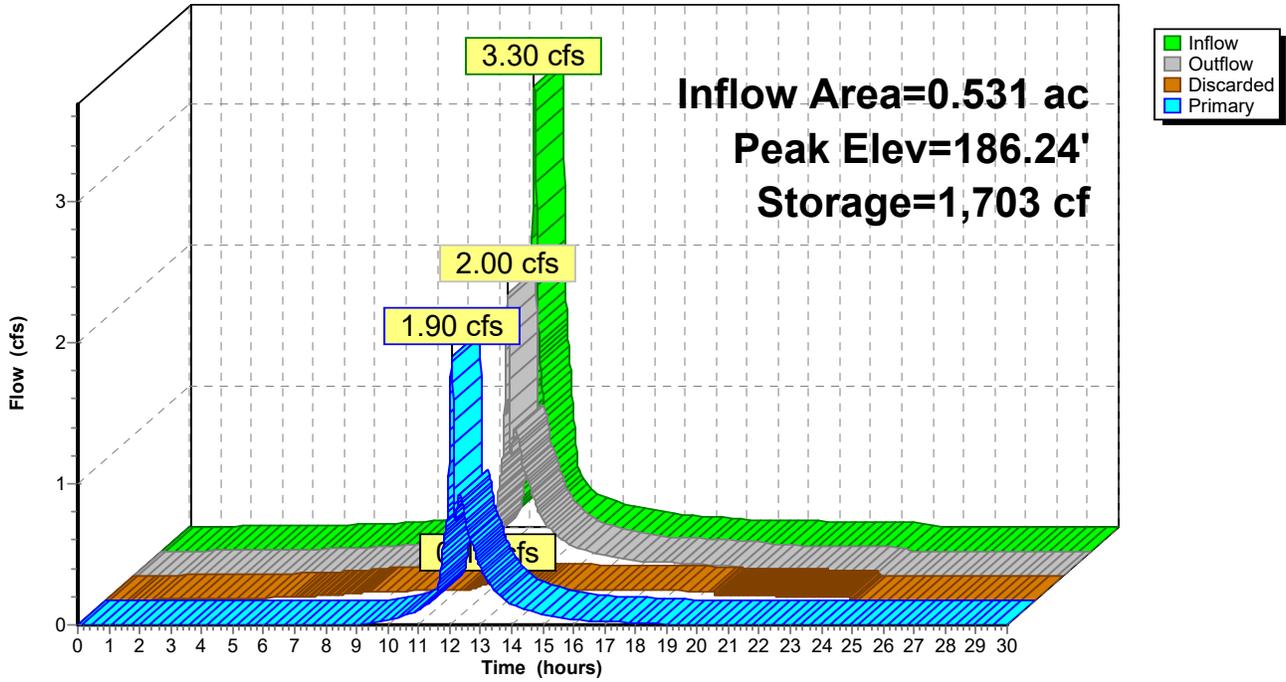
Device	Routing	Invert	Outlet Devices
#1	Discarded	185.20'	<b>2.410 in/hr Exfiltration over Surface area</b>
#2	Primary	185.20'	<b>12.0" Round Culvert</b> L= 36.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 185.20' / 185.00' S= 0.0056 '/' Cc= 0.900 n= 0.011, Flow Area= 0.79 sf
#3	Primary	185.20'	<b>12.0" Round Culvert</b> L= 36.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 185.20' / 185.00' S= 0.0056 '/' Cc= 0.900 n= 0.011, Flow Area= 0.79 sf

**Discarded OutFlow** Max=0.12 cfs @ 12.33 hrs HW=186.24' (Free Discharge)  
 ↳ **1=Exfiltration** (Exfiltration Controls 0.12 cfs)

**Primary OutFlow** Max=1.65 cfs @ 12.07 hrs HW=186.01' TW=185.92' (Dynamic Tailwater)  
 ↳ **2=Culvert** (Outlet Controls 0.82 cfs @ 1.65 fps)  
 ↳ **3=Culvert** (Outlet Controls 0.82 cfs @ 1.65 fps)

Pond 19P: Basins #2

Hydrograph



**Summary for Subcatchment 20P: P4c**

Runoff = 3.50 cfs @ 12.13 hrs, Volume= 0.282 af, Depth= 4.42"

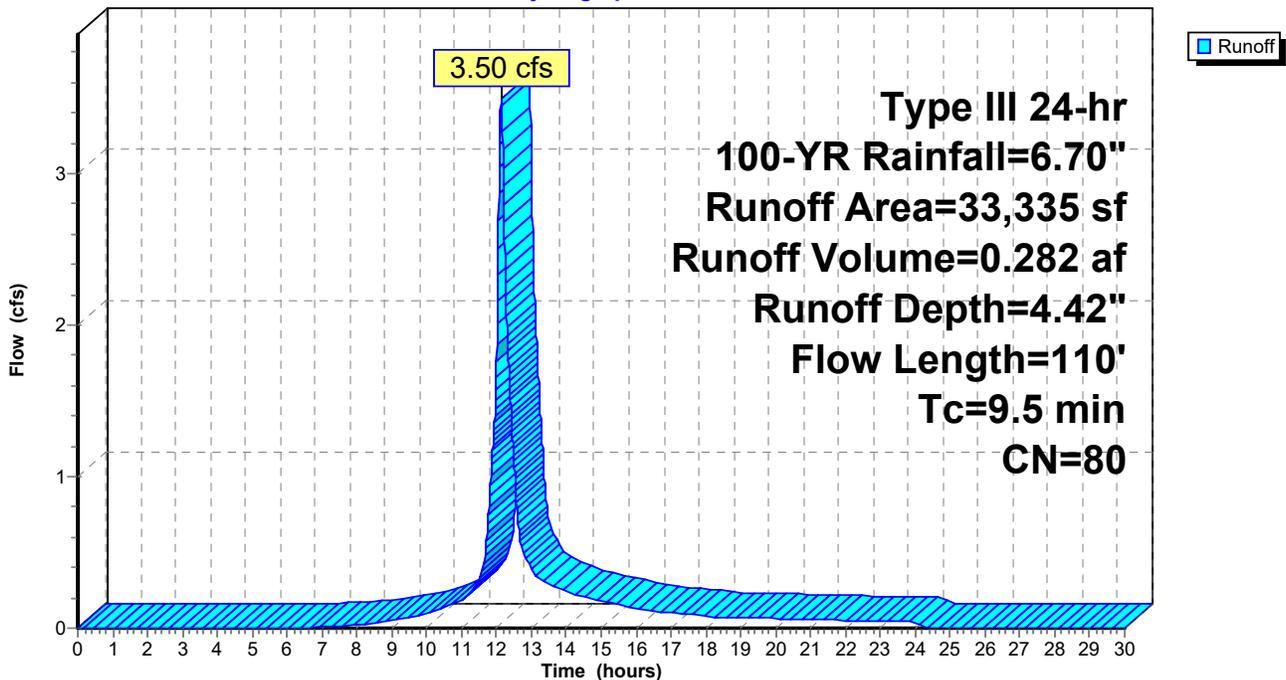
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
 Type III 24-hr 100-YR Rainfall=6.70"

Area (sf)	CN	Description
16,717	98	Paved parking, HSG B
144	98	Roofs, HSG B
16,474	61	>75% Grass cover, Good, HSG B
33,335	80	Weighted Average
16,474		49.42% Pervious Area
16,861		50.58% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.0	40	0.0100	0.07		<b>Sheet Flow,</b> Grass: Dense n= 0.240 P2= 3.20"
0.4	50	0.0100	2.03		<b>Shallow Concentrated Flow,</b> Paved Kv= 20.3 fps
0.1	20	0.2000	3.13		<b>Shallow Concentrated Flow,</b> Short Grass Pasture Kv= 7.0 fps
9.5	110	Total			

**Subcatchment 20P: P4c**

Hydrograph



**Summary for Pond 21P: Basin #3**

Inflow Area = 1.297 ac, 60.18% Impervious, Inflow Depth = 3.89" for 100-YR event  
 Inflow = 5.04 cfs @ 12.10 hrs, Volume= 0.421 af  
 Outflow = 2.83 cfs @ 12.31 hrs, Volume= 0.421 af, Atten= 44%, Lag= 12.8 min  
 Discarded = 0.25 cfs @ 12.32 hrs, Volume= 0.188 af  
 Primary = 2.59 cfs @ 12.31 hrs, Volume= 0.233 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
 Peak Elev= 186.23' @ 12.32 hrs Surf.Area= 4,417 sf Storage= 4,400 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)  
 Center-of-Mass det. time= 44.7 min ( 841.2 - 796.6 )

Volume	Invert	Avail.Storage	Storage Description			
#1	185.00'	8,270 cf	<b>Custom Stage Data (Irregular)</b> Listed below (Recalc)			
Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)	
185.00	2,820	247.0	0	0	2,820	
187.00	5,608	310.0	8,270	8,270	5,667	

Device	Routing	Invert	Outlet Devices
#1	Discarded	185.00'	<b>2.410 in/hr Exfiltration over Surface area</b>
#2	Primary	185.00'	<b>12.0" Round Culvert</b> L= 90.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 185.00' / 184.70' S= 0.0033 ' /' Cc= 0.900 n= 0.011, Flow Area= 0.79 sf
#3	Primary	185.00'	<b>12.0" Round Culvert</b> L= 90.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 185.00' / 184.70' S= 0.0033 ' /' Cc= 0.900 n= 0.011, Flow Area= 0.79 sf

**Discarded OutFlow** Max=0.25 cfs @ 12.32 hrs HW=186.23' (Free Discharge)

↳ **1=Exfiltration** (Exfiltration Controls 0.25 cfs)

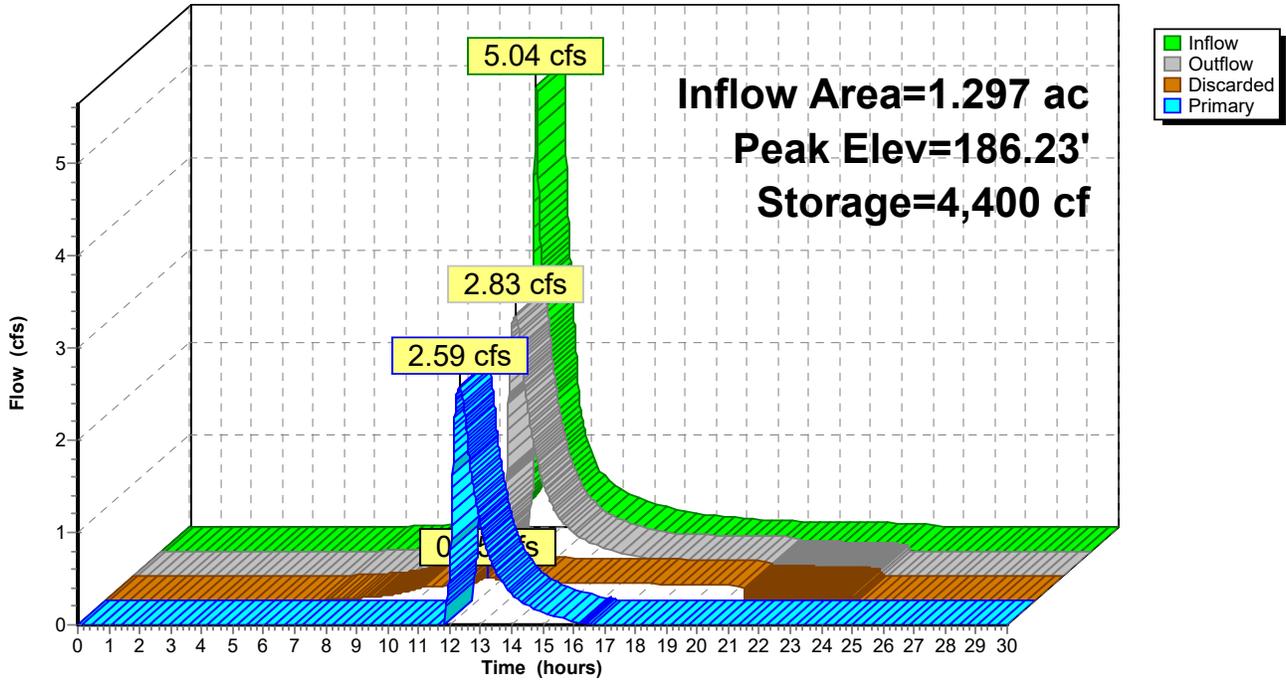
**Primary OutFlow** Max=2.59 cfs @ 12.31 hrs HW=186.23' TW=186.08' (Dynamic Tailwater)

↳ **2=Culvert** (Outlet Controls 1.29 cfs @ 1.71 fps)

↳ **3=Culvert** (Outlet Controls 1.29 cfs @ 1.71 fps)

### Pond 21P: Basin #3

Hydrograph



**Summary for Subcatchment 22P: P4d**

Runoff = 0.14 cfs @ 12.03 hrs, Volume= 0.009 af, Depth= 2.49"

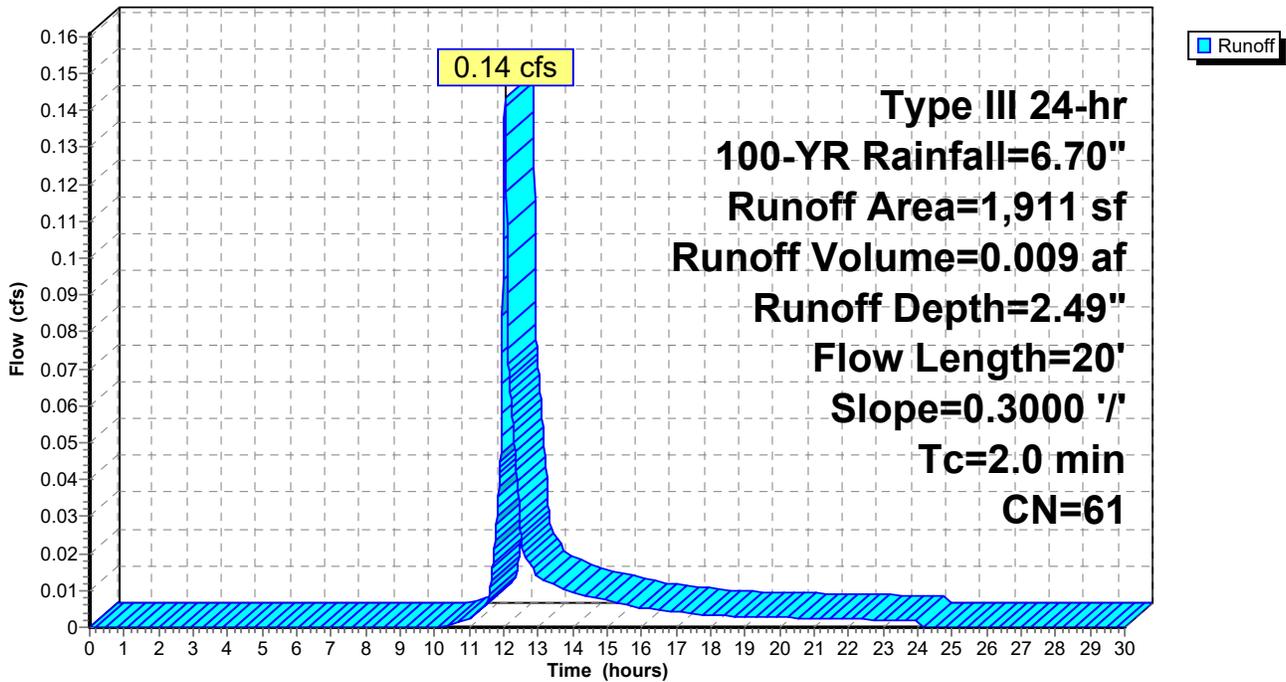
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
 Type III 24-hr 100-YR Rainfall=6.70"

Area (sf)	CN	Description
1,911	61	>75% Grass cover, Good, HSG B
1,911		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.3	20	0.3000	0.25		Sheet Flow, Grass: Dense n= 0.240 P2= 3.20"
1.3	20	Total, Increased to minimum Tc = 2.0 min			

**Subcatchment 22P: P4d**

Hydrograph



**Summary for Subcatchment 23P: P4e**

Runoff = 0.65 cfs @ 12.03 hrs, Volume= 0.046 af, Depth= 6.46"

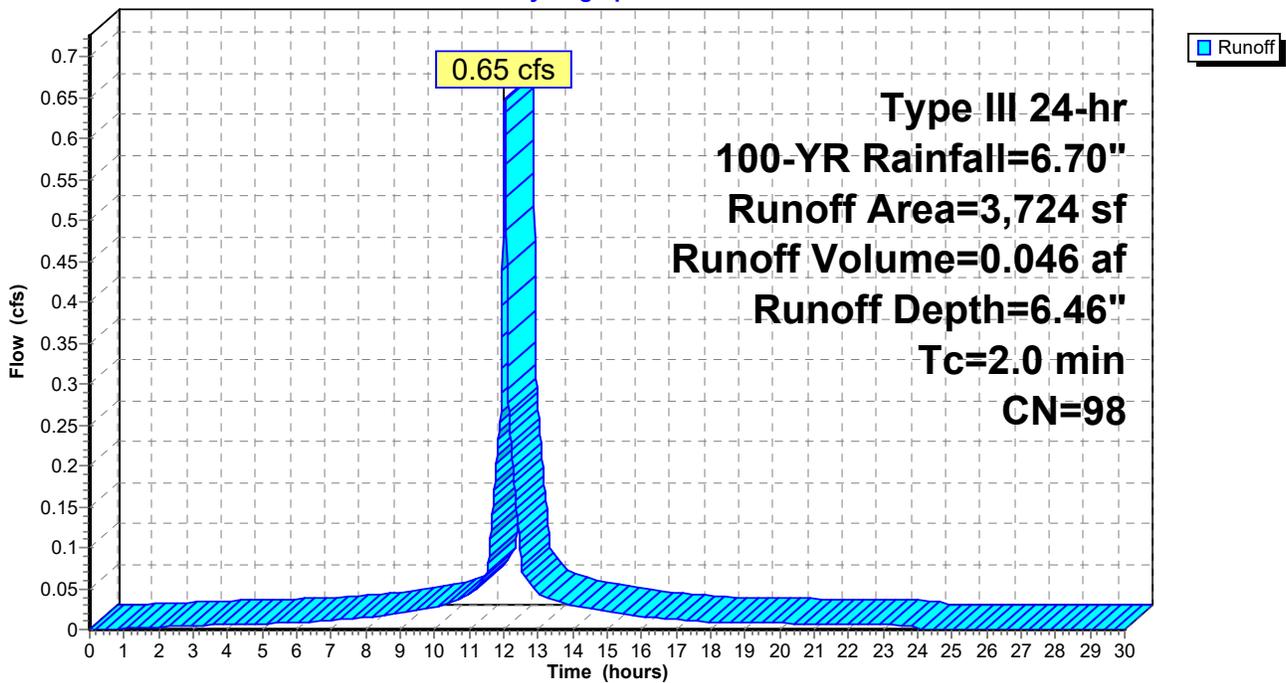
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
 Type III 24-hr 100-YR Rainfall=6.70"

Area (sf)	CN	Description
3,724	98	Roofs, HSG B
3,724		100.00% Impervious Area

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

**Subcatchment 23P: P4e**

Hydrograph



**Summary for Pond 24P: Basin #4**

Inflow Area = 1.426 ac, 60.72% Impervious, Inflow Depth = 2.43" for 100-YR event  
 Inflow = 2.82 cfs @ 12.29 hrs, Volume= 0.288 af  
 Outflow = 2.82 cfs @ 12.31 hrs, Volume= 0.288 af, Atten= 0%, Lag= 1.0 min  
 Discarded = 0.04 cfs @ 12.31 hrs, Volume= 0.035 af  
 Primary = 2.78 cfs @ 12.31 hrs, Volume= 0.254 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
 Peak Elev= 186.08' @ 12.31 hrs Surf.Area= 705 sf Storage= 669 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)  
 Center-of-Mass det. time= 14.5 min ( 786.3 - 771.8 )

Volume	Invert	Avail.Storage	Storage Description			
#1	184.70'	1,451 cf	<b>Custom Stage Data (Irregular)</b> Listed below (Recalc)			
Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)	
184.70	288	73.0	0	0	288	
186.00	680	101.0	611	611	692	
187.00	1,010	120.0	840	1,451	1,044	

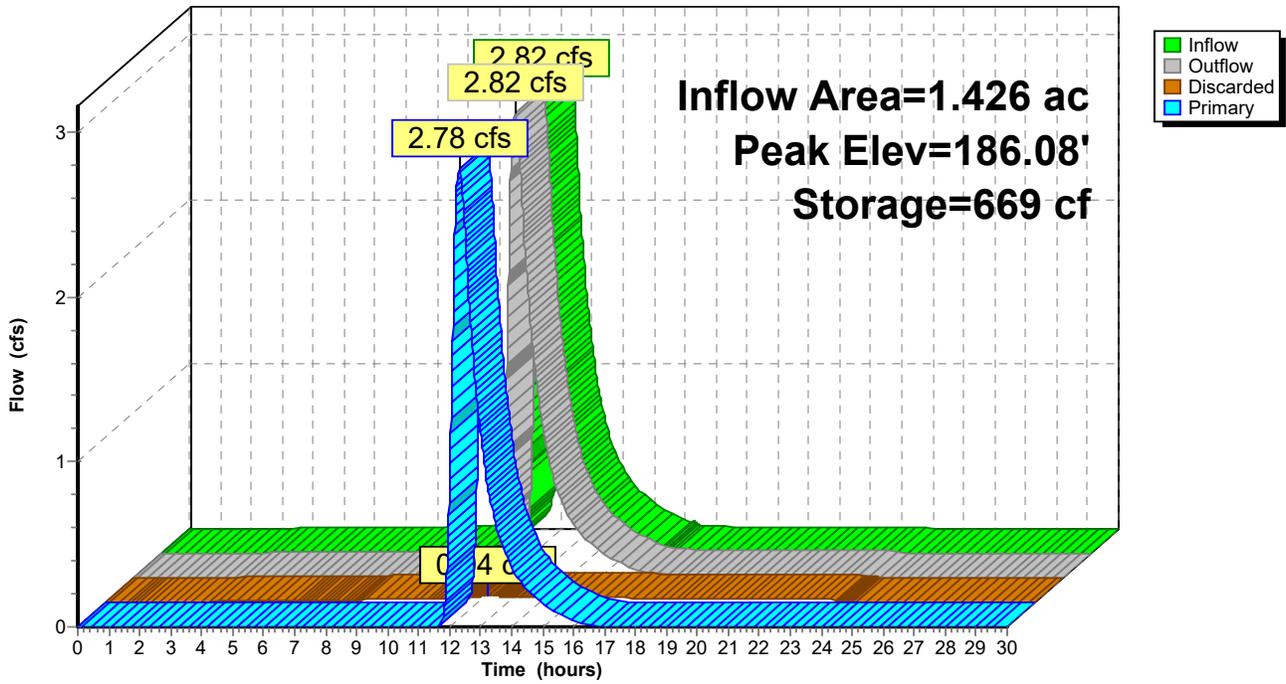
Device	Routing	Invert	Outlet Devices			
#1	Discarded	184.70'	<b>2.410 in/hr Exfiltration over Surface area</b>			
#2	Device 3	185.40'	<b>Custom Weir/Orifice, Cv= 2.62 (C= 3.28)</b>			
			Elev. (feet)	185.40	186.00	186.00 187.00
			Width (feet)	1.30	1.30	6.00 6.00
#3	Primary	185.20'	<b>Custom Weir/Orifice, Cv= 2.62 (C= 3.28)</b>			
			Elev. (feet)	185.20	185.60	
			Width (feet)	12.00	12.00	

**Discarded OutFlow** Max=0.04 cfs @ 12.31 hrs HW=186.08' (Free Discharge)  
 ↑1=Exfiltration (Exfiltration Controls 0.04 cfs)

**Primary OutFlow** Max=2.78 cfs @ 12.31 hrs HW=186.08' TW=0.00' (Dynamic Tailwater)  
 ↑3=Custom Weir/Orifice (Passes 2.78 cfs of 19.43 cfs potential flow)  
 ↑2=Custom Weir/Orifice (Weir Controls 2.78 cfs @ 2.17 fps)

**Pond 24P: Basin #4**

Hydrograph



**Summary for Subcatchment 25P: P4f**

Runoff = 1.66 cfs @ 12.16 hrs, Volume= 0.145 af, Depth= 2.39"

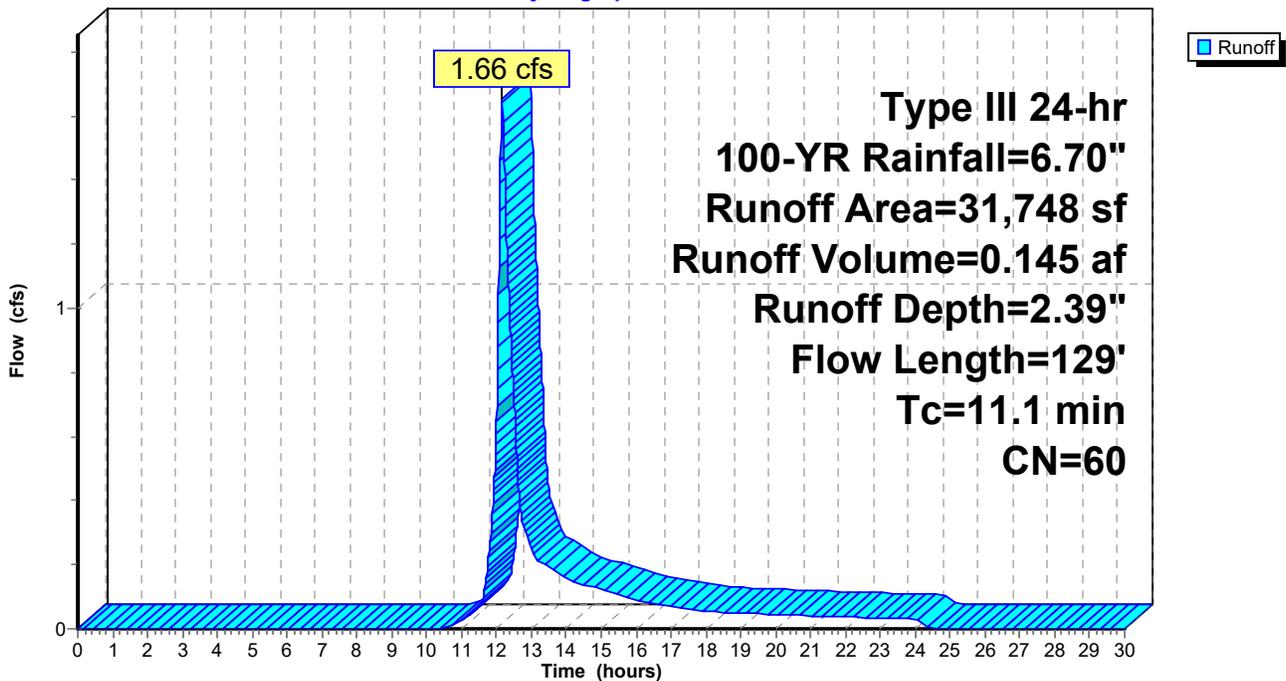
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
 Type III 24-hr 100-YR Rainfall=6.70"

Area (sf)	CN	Description
* 1,550	90	Pavers, HSG B
17,354	61	>75% Grass cover, Good, HSG B
12,844	55	Woods, Good, HSG B
31,748	60	Weighted Average
31,748		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.4	42	0.0100	0.07		<b>Sheet Flow,</b> Grass: Dense n= 0.240 P2= 3.20"
1.6	67	0.0100	0.70		<b>Shallow Concentrated Flow,</b> Short Grass Pasture Kv= 7.0 fps
0.1	20	0.2000	2.24		<b>Shallow Concentrated Flow,</b> Woodland Kv= 5.0 fps
11.1	129	Total			

**Subcatchment 25P: P4f**

Hydrograph

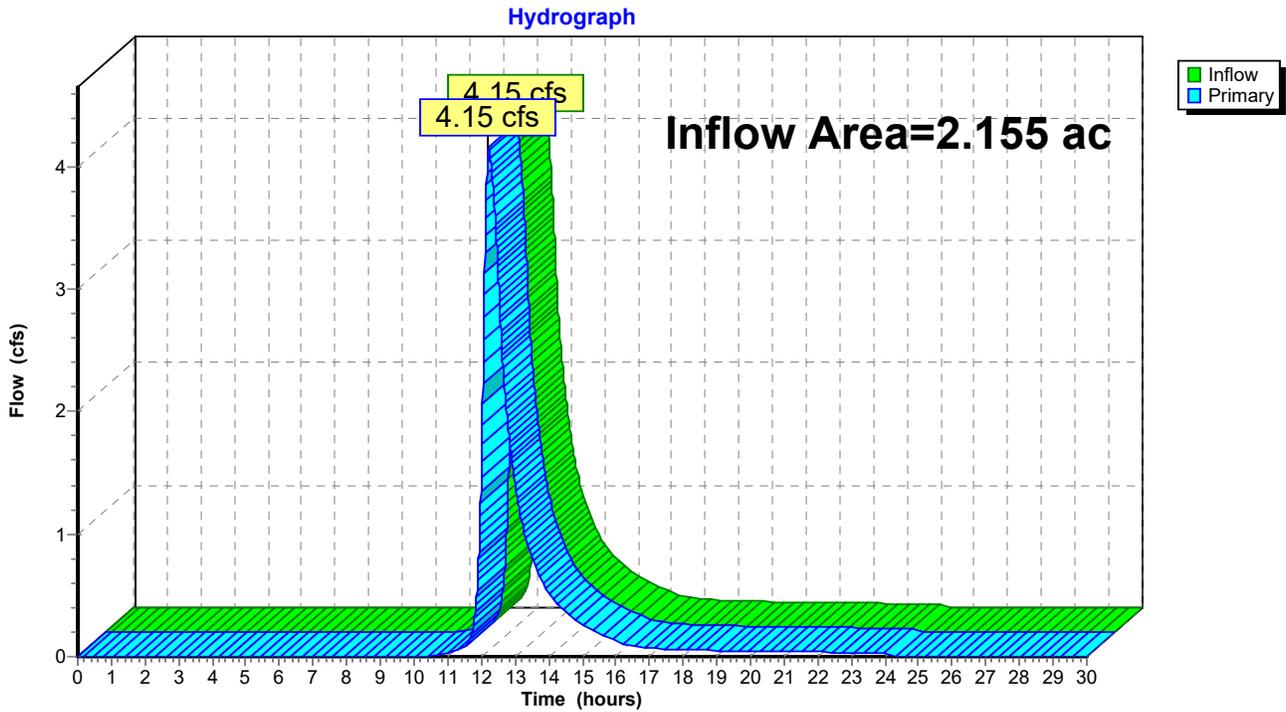


### Summary for Link 26P: Design Point #4: Flow to Wetlands

Inflow Area = 2.155 ac, 40.18% Impervious, Inflow Depth = 2.22" for 100-YR event  
Inflow = 4.15 cfs @ 12.21 hrs, Volume= 0.399 af  
Primary = 4.15 cfs @ 12.21 hrs, Volume= 0.399 af, Atten= 0%, Lag= 0.0 min

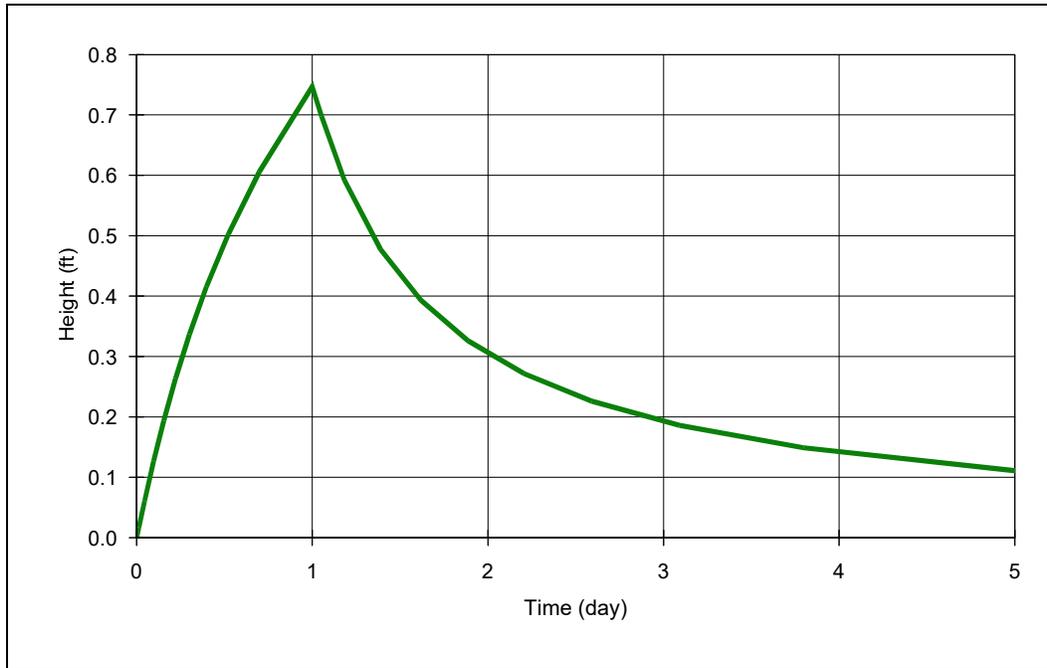
Primary outflow = Inflow, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs

### Link 26P: Design Point #4: Flow to Wetlands



# **ATTACHMENT L: MOUNDING CALCULATIONS**

## Groundwater Mounding Analysis (Hantush's Method using Glover's Solution)



COMPANY: Legacy Engineering LLC

PROJECT: Infiltration Field

ANALYST: Daniel J. Merrikin, P.E.

DATE: 10/7/2019 TIME: 1:03:42 PM

### INPUT PARAMETERS

Application rate: 0.27 c.ft/day/sq. ft

Duration of application: 1 day

Total simulation time: 5 day

Fillable porosity: 0.2

Hydraulic conductivity: 4.8 ft/day

Initial saturated thickness: 20 ft

Length of application area: 72 ft

Width of application area: 32.83 ft

No constant head boundary used

Groundwater mounding @

X coordinate: 0 ft

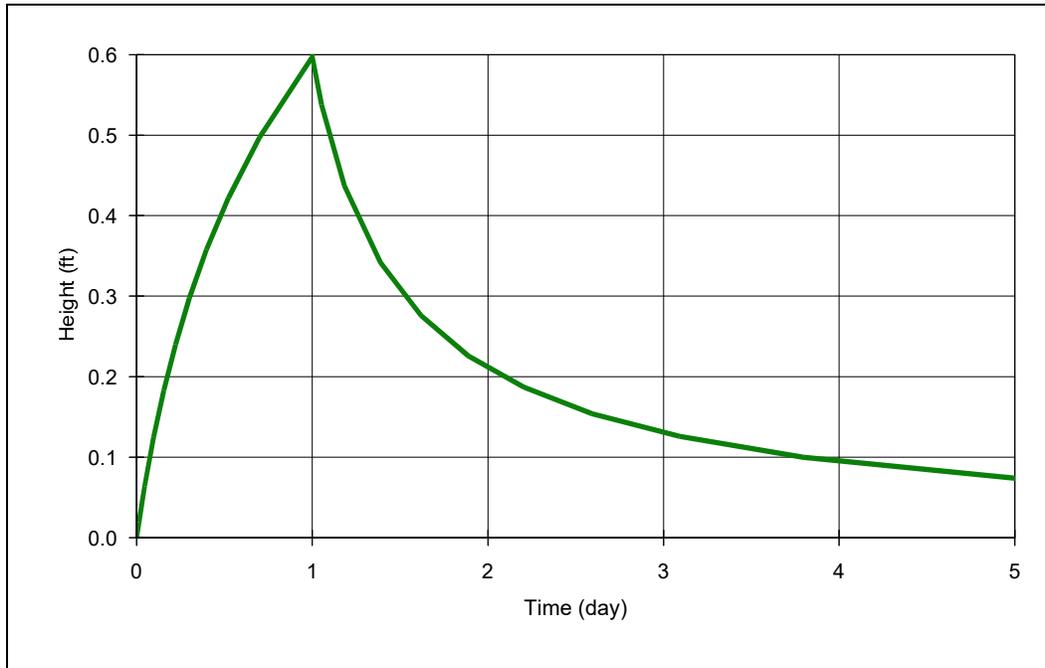
Y coordinate: 0 ft

Total volume applied: 638.2152 cft

### MODEL RESULTS

Time (day)	Mound Height (ft)
0	0
0	0.02
0	0.06
0.1	0.13
0.2	0.19
0.2	0.26
0.3	0.34
0.4	0.42
0.5	0.5
0.7	0.61
1	0.75
1.1	0.7
1.2	0.59
1.4	0.48
1.6	0.39
1.9	0.33
2.2	0.27
2.6	0.23
3.1	0.19
3.8	0.15
5	0.11

## Groundwater Mounding Analysis (Hantush's Method using Glover's Solution)



COMPANY: Legacy Engineering LLC

PROJECT: Infiltration Basin #1

ANALYST: Daniel J. Merrikin, P.E.

DATE: 9/5/2019 TIME: 10:21:45 AM

### INPUT PARAMETERS

Application rate: 0.29 c.ft/day/sq. ft

Duration of application: 1 day

Total simulation time: 5 day

Fillable porosity: 0.2

Hydraulic conductivity: 4.8 ft/day

Initial saturated thickness: 20 ft

Length of application area: 65 ft

Width of application area: 22.4 ft

No constant head boundary used

Groundwater mounding @

X coordinate: 0 ft

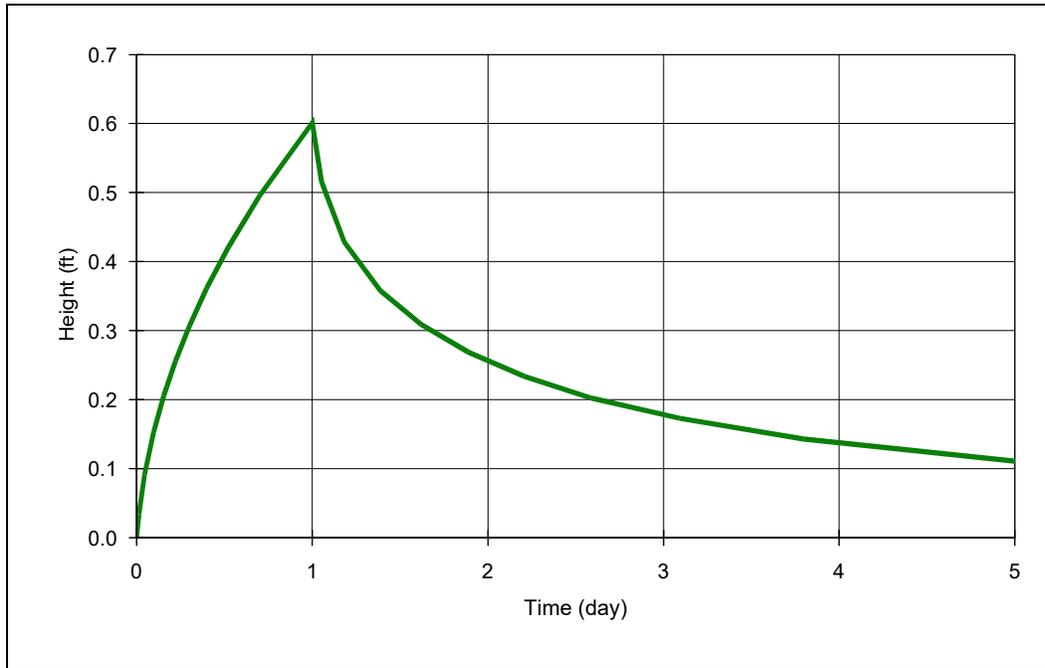
Y coordinate: 0 ft

Total volume applied: 422.24 cft

### MODEL RESULTS

Time (day)	Mound Height (ft)
0	0
0	0.02
0	0.06
0.1	0.12
0.2	0.18
0.2	0.24
0.3	0.3
0.4	0.36
0.5	0.42
0.7	0.5
1	0.6
1.1	0.54
1.2	0.44
1.4	0.34
1.6	0.28
1.9	0.23
2.2	0.19
2.6	0.15
3.1	0.13
3.8	0.1
5	0.07

## Groundwater Mounding Analysis (Hantush's Method using Glover's Solution)



COMPANY: Legacy Engineering LLC

PROJECT: Infiltration Basin #2

ANALYST: Daniel J. Merrikin, P.E.

DATE: 9/5/2019 TIME: 10:22:57 AM

### INPUT PARAMETERS

Application rate: 0.61 c.ft/day/sq. ft

Duration of application: 1 day

Total simulation time: 5 day

Fillable porosity: 0.2

Hydraulic conductivity: 4.8 ft/day

Initial saturated thickness: 20 ft

Length of application area: 140 ft

Width of application area: 8.4 ft

No constant head boundary used

Groundwater mounding @

X coordinate: 0 ft

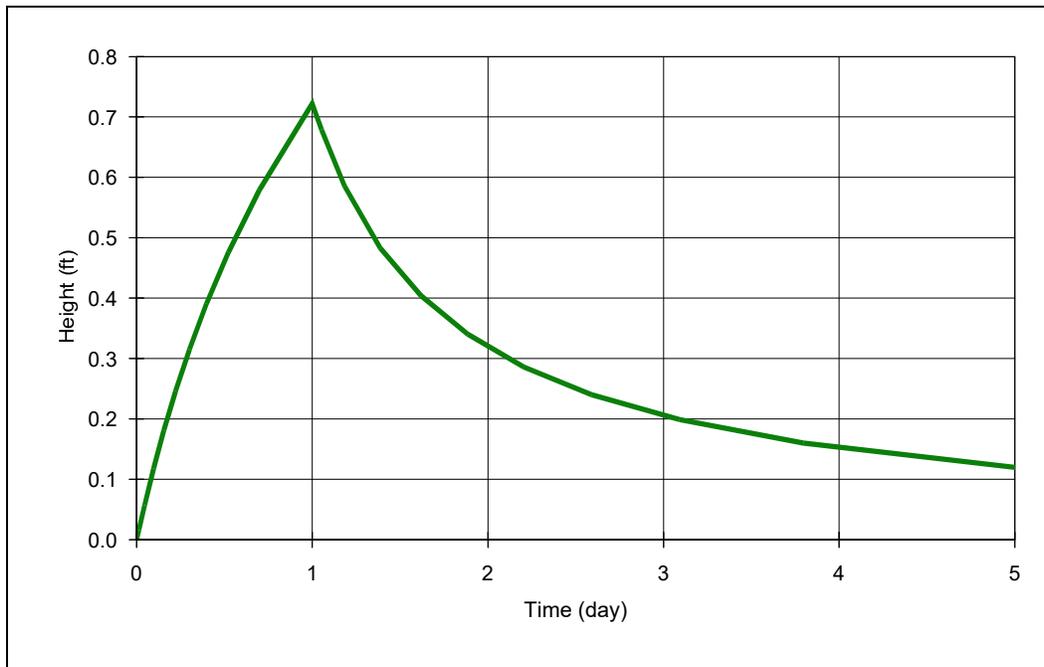
Y coordinate: 0 ft

Total volume applied: 717.36 cft

### MODEL RESULTS

Time (day)	Mound Height (ft)
0	0
0	0.03
0	0.09
0.1	0.15
0.2	0.21
0.2	0.26
0.3	0.31
0.4	0.36
0.5	0.42
0.7	0.5
1	0.6
1.1	0.52
1.2	0.43
1.4	0.36
1.6	0.31
1.9	0.27
2.2	0.23
2.6	0.2
3.1	0.17
3.8	0.14
5	0.11

## Groundwater Mounding Analysis (Hantush's Method using Glover's Solution)



COMPANY: Legacy Engineering LLC

PROJECT: Infiltration Basin #3

ANALYST: Daniel J. Merrikin, P.E.

DATE: 9/5/2019 TIME: 10:23:29 AM

### INPUT PARAMETERS

Application rate: 0.25 c.ft/day/sq. ft

Duration of application: 1 day

Total simulation time: 5 day

Fillable porosity: 0.2

Hydraulic conductivity: 4.8 ft/day

Initial saturated thickness: 20 ft

Length of application area: 85 ft

Width of application area: 33.2 ft

No constant head boundary used

Groundwater mounding @

X coordinate: 0 ft

Y coordinate: 0 ft

Total volume applied: 705.5 cft

### MODEL RESULTS

Time (day)	Mound Height (ft)
0	0
0	0.02
0	0.06
0.1	0.12
0.2	0.18
0.2	0.25
0.3	0.32
0.4	0.39
0.5	0.48
0.7	0.58
1	0.72
1.1	0.68
1.2	0.59
1.4	0.48
1.6	0.4
1.9	0.34
2.2	0.29
2.6	0.24
3.1	0.2
3.8	0.16
5	0.12

## Groundwater Mounding Analysis (Hantush's Method using Glover's Solution)



COMPANY: Legacy Engineering LLC

PROJECT: Infiltration Basin #4

ANALYST: Daniel J. Merrikin, P.E.

DATE: 9/5/2019 TIME: 10:23:59 AM

### INPUT PARAMETERS

Application rate: 0.54 c.ft/day/sq. ft

Duration of application: 1 day

Total simulation time: 5 day

Fillable porosity: 0.2

Hydraulic conductivity: 4.8 ft/day

Initial saturated thickness: 20 ft

Length of application area: 21 ft

Width of application area: 13.7 ft

No constant head boundary used

Groundwater mounding @

X coordinate: 0 ft

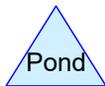
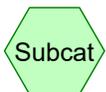
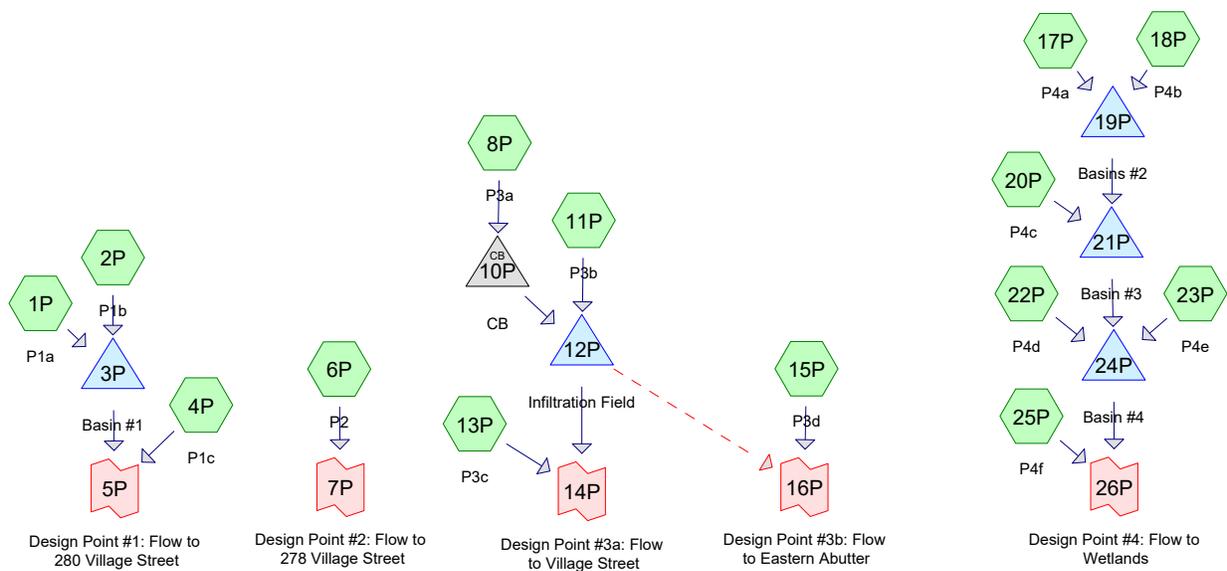
Y coordinate: 0 ft

Total volume applied: 155.358 cft

### MODEL RESULTS

Time (day)	Mound Height (ft)
0	0
0	0.04
0	0.1
0.1	0.17
0.2	0.22
0.2	0.26
0.3	0.29
0.4	0.33
0.5	0.36
0.7	0.4
1	0.44
1.1	0.33
1.2	0.22
1.4	0.16
1.6	0.12
1.9	0.1
2.2	0.08
2.6	0.06
3.1	0.05
3.8	0.04
5	0.03

# **ATTACHMENT M: 1-Inch Storm Calculations**



**Routing Diagram for HydroCAD Revised2**  
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## HydroCAD Revised2

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### Area Listing (selected nodes)

Area (acres)	CN	Description (subcatchment-numbers)
0.069	39	>75% Grass cover, Good, HSG A (13P, 15P)
1.631	61	>75% Grass cover, Good, HSG B (1P, 4P, 6P, 8P, 13P, 15P, 17P, 20P, 22P, 25P)
0.013	98	Patios, HSG B (4P)
0.786	98	Paved parking, HSG B (8P, 15P, 17P, 20P)
0.003	88	Pavers, HSG A (13P)
0.051	90	Pavers, HSG B (1P, 13P, 25P)
0.644	98	Roofs, HSG B (2P, 11P, 18P, 20P, 23P)
0.295	55	Woods, Good, HSG B (25P)
<b>3.492</b>	<b>76</b>	<b>TOTAL AREA</b>

## HydroCAD Revised2

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Type III 24-hr 1-Inch Rainfall=1.00"

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Time span=0.00-30.00 hrs, dt=0.01 hrs, 3001 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 1P: P1a

Runoff Area=7,863 sf 0.00% Impervious Runoff Depth=0.00"  
Flow Length=68' Tc=9.6 min CN=62 Runoff=0.00 cfs 0.000 af

### Subcatchment 2P: P1b

Runoff Area=9,310 sf 100.00% Impervious Runoff Depth=0.79"  
Tc=2.0 min CN=98 Runoff=0.22 cfs 0.014 af

### Pond 3P: Basin #1

Peak Elev=186.05' Storage=68 cf Inflow=0.22 cfs 0.014 af  
Discarded=0.08 cfs 0.014 af Primary=0.00 cfs 0.000 af Outflow=0.08 cfs 0.014 af

### Subcatchment 4P: P1c

Runoff Area=6,988 sf 8.41% Impervious Runoff Depth=0.00"  
Flow Length=47' Slope=0.0200 '/ Tc=7.8 min CN=64 Runoff=0.00 cfs 0.000 af

### Link 5P: Design Point #1: Flow to 280 Village Street

Inflow=0.00 cfs 0.000 af  
Primary=0.00 cfs 0.000 af

### Subcatchment 6P: P2

Runoff Area=4,419 sf 0.00% Impervious Runoff Depth=0.00"  
Flow Length=30' Slope=0.0200 '/ Tc=5.4 min CN=61 Runoff=0.00 cfs 0.000 af

### Link 7P: Design Point #2: Flow to 278 Village Street

Inflow=0.00 cfs 0.000 af  
Primary=0.00 cfs 0.000 af

### Subcatchment 8P: P3a

Runoff Area=14,343 sf 65.80% Impervious Runoff Depth=0.17"  
Flow Length=229' Tc=10.0 min CN=85 Runoff=0.04 cfs 0.005 af

### Pond 10P: CB

Peak Elev=181.20' Inflow=0.04 cfs 0.005 af  
12.0" Round Culvert n=0.011 L=75.0' S=0.0000 '/ Outflow=0.04 cfs 0.005 af

### Subcatchment 11P: P3b

Runoff Area=5,586 sf 100.00% Impervious Runoff Depth=0.79"  
Tc=2.0 min CN=98 Runoff=0.13 cfs 0.008 af

### Pond 12P: Infiltration Field

Peak Elev=181.20' Storage=2 cf Inflow=0.15 cfs 0.013 af  
Discarded=0.13 cfs 0.013 af Primary=0.00 cfs 0.000 af Secondary=0.00 cfs 0.000 af Outflow=0.13 cfs 0.013 af

### Subcatchment 13P: P3c

Runoff Area=6,382 sf 0.00% Impervious Runoff Depth=0.00"  
Flow Length=97' Slope=0.0900 '/ Tc=7.6 min CN=54 Runoff=0.00 cfs 0.000 af

### Link 14P: Design Point #3a: Flow to Village Street

Inflow=0.00 cfs 0.000 af  
Primary=0.00 cfs 0.000 af

### Subcatchment 15P: P3d

Runoff Area=3,373 sf 7.65% Impervious Runoff Depth=0.00"  
Flow Length=90' Slope=0.0900 '/ Tc=4.9 min CN=62 Runoff=0.00 cfs 0.000 af

### Link 16P: Design Point #3b: Flow to Eastern Abutter

Inflow=0.00 cfs 0.000 af  
Primary=0.00 cfs 0.000 af

### Subcatchment 17P: P4a

Runoff Area=13,831 sf 56.52% Impervious Runoff Depth=0.11"  
Flow Length=45' Slope=0.0800 '/ Tc=4.3 min CN=82 Runoff=0.02 cfs 0.003 af

**HydroCAD Revised2**

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**Subcatchment 18P: P4b** Runoff Area=9,310 sf 100.00% Impervious Runoff Depth=0.79"  
Tc=2.0 min CN=98 Runoff=0.22 cfs 0.014 af

**Pond 19P: Basins #2** Peak Elev=185.27' Storage=79 cf Inflow=0.23 cfs 0.017 af  
Discarded=0.07 cfs 0.016 af Primary=0.03 cfs 0.001 af Outflow=0.10 cfs 0.017 af

**Subcatchment 20P: P4c** Runoff Area=33,335 sf 50.58% Impervious Runoff Depth=0.08"  
Flow Length=110' Tc=9.5 min CN=80 Runoff=0.03 cfs 0.005 af

**Pond 21P: Basin #3** Peak Elev=185.00' Storage=0 cf Inflow=0.05 cfs 0.006 af  
Discarded=0.05 cfs 0.006 af Primary=0.00 cfs 0.000 af Outflow=0.05 cfs 0.006 af

**Subcatchment 22P: P4d** Runoff Area=1,911 sf 0.00% Impervious Runoff Depth=0.00"  
Flow Length=20' Slope=0.3000 '/' Tc=2.0 min CN=61 Runoff=0.00 cfs 0.000 af

**Subcatchment 23P: P4e** Runoff Area=3,724 sf 100.00% Impervious Runoff Depth=0.79"  
Tc=2.0 min CN=98 Runoff=0.09 cfs 0.006 af

**Pond 24P: Basin #4** Peak Elev=184.87' Storage=54 cf Inflow=0.09 cfs 0.006 af  
Discarded=0.02 cfs 0.006 af Primary=0.00 cfs 0.000 af Outflow=0.02 cfs 0.006 af

**Subcatchment 25P: P4f** Runoff Area=31,748 sf 0.00% Impervious Runoff Depth=0.00"  
Flow Length=129' Tc=11.1 min CN=60 Runoff=0.00 cfs 0.000 af

**Link 26P: Design Point #4: Flow to Wetlands** Inflow=0.00 cfs 0.000 af  
Primary=0.00 cfs 0.000 af

**Total Runoff Area = 3.492 ac Runoff Volume = 0.055 af Average Runoff Depth = 0.19"**  
**58.66% Pervious = 2.048 ac 41.34% Impervious = 1.444 ac**

**Summary for Subcatchment 1P: P1a**

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

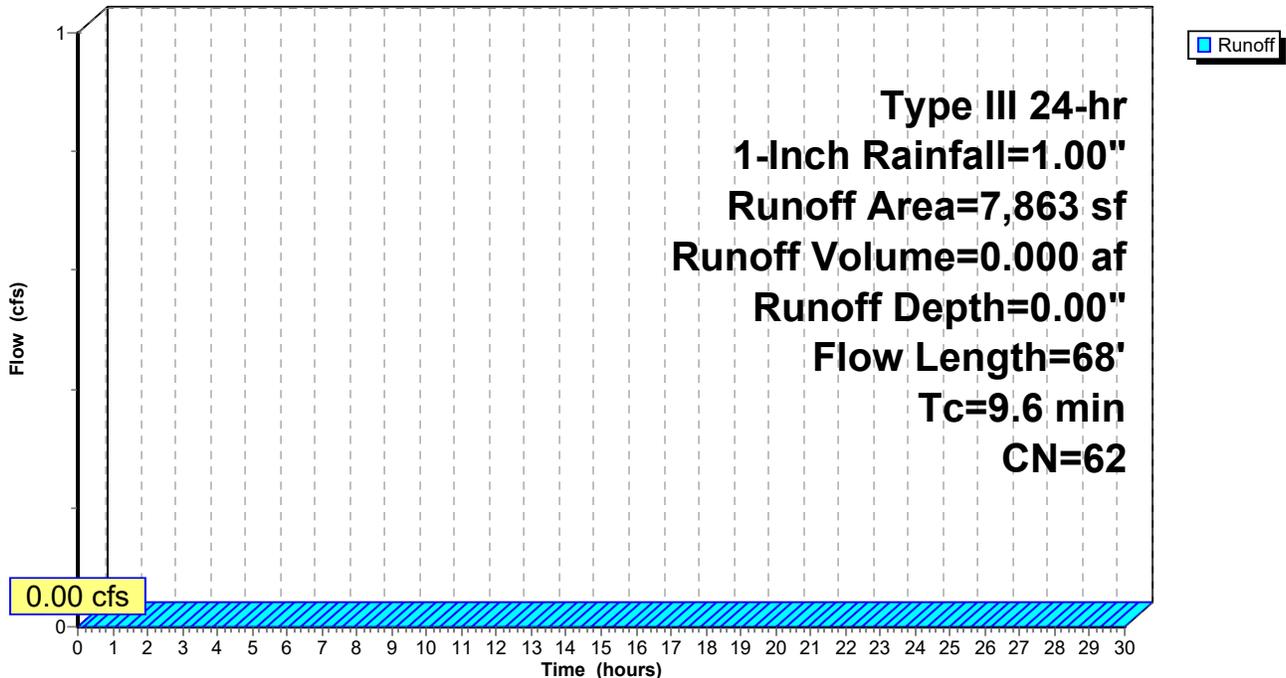
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
 Type III 24-hr 1-Inch Rainfall=1.00"

Area (sf)	CN	Description
* 196	90	Pavers, HSG B
7,667	61	>75% Grass cover, Good, HSG B
7,863	62	Weighted Average
7,863		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.4	46	0.0120	0.08		<b>Sheet Flow,</b> Grass: Dense n= 0.240 P2= 3.20"
0.2	22	0.0500	1.57		<b>Shallow Concentrated Flow,</b> Short Grass Pasture Kv= 7.0 fps
9.6	68	Total			

**Subcatchment 1P: P1a**

Hydrograph



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Type III 24-hr 1-Inch Rainfall=1.00"

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**Summary for Subcatchment 2P: P1b**

Runoff = 0.22 cfs @ 12.03 hrs, Volume= 0.014 af, Depth= 0.79"

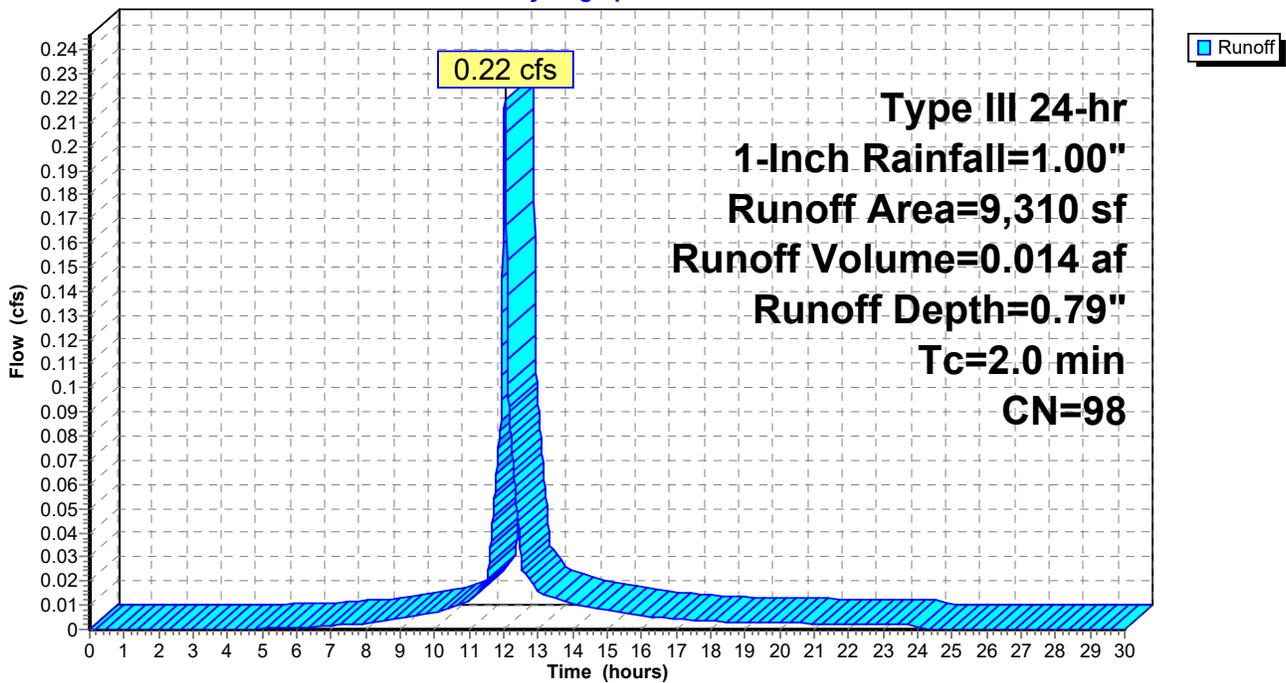
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
Type III 24-hr 1-Inch Rainfall=1.00"

Area (sf)	CN	Description
9,310	98	Roofs, HSG B
9,310		100.00% Impervious Area

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

**Subcatchment 2P: P1b**

Hydrograph



**Summary for Pond 3P: Basin #1**

Inflow Area = 0.394 ac, 54.21% Impervious, Inflow Depth = 0.43" for 1-Inch event  
 Inflow = 0.22 cfs @ 12.03 hrs, Volume= 0.014 af  
 Outflow = 0.08 cfs @ 12.23 hrs, Volume= 0.014 af, Atten= 65%, Lag= 12.3 min  
 Discarded = 0.08 cfs @ 12.23 hrs, Volume= 0.014 af  
 Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
 Peak Elev= 186.05' @ 12.23 hrs Surf.Area= 1,369 sf Storage= 68 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)  
 Center-of-Mass det. time= 3.5 min ( 787.7 - 784.2 )

Volume	Invert	Avail.Storage	Storage Description		
#1	186.00'	2,608 cf	<b>Custom Stage Data (Irregular)</b> Listed below (Recalc)		
Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
186.00	1,345	167.0	0	0	1,345
187.50	2,165	196.0	2,608	2,608	2,226

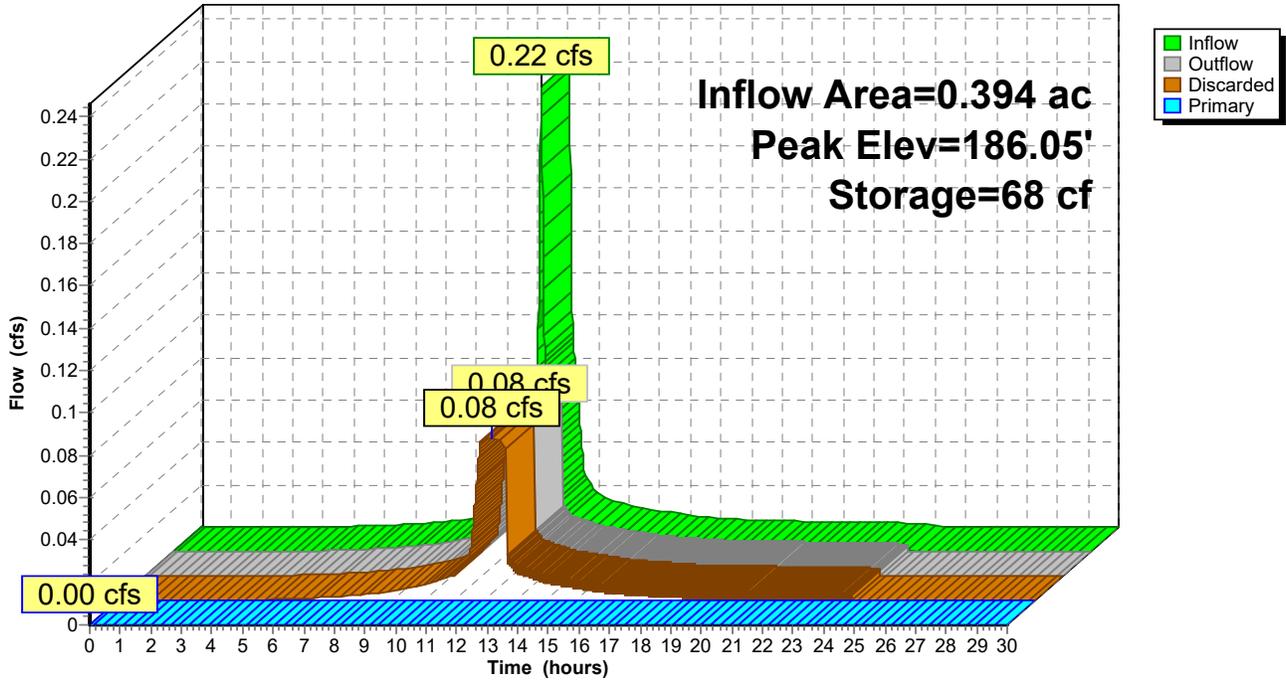
Device	Routing	Invert	Outlet Devices
#1	Discarded	186.00'	<b>2.410 in/hr Exfiltration over Surface area</b>
#2	Device 3	186.75'	<b>Custom Weir/Orifice, Cv= 2.62 (C= 3.28)</b> Elev. (feet) 186.75 187.00 Width (feet) 4.00 4.00
#3	Primary	186.60'	<b>Custom Weir/Orifice, Cv= 2.62 (C= 3.28)</b> Elev. (feet) 186.60 187.00 Width (feet) 10.00 10.00

**Discarded OutFlow** Max=0.08 cfs @ 12.23 hrs HW=186.05' (Free Discharge)  
 ↳1=Exfiltration (Exfiltration Controls 0.08 cfs)

**Primary OutFlow** Max=0.00 cfs @ 0.00 hrs HW=186.00' TW=0.00' (Dynamic Tailwater)  
 ↳3=Custom Weir/Orifice ( Controls 0.00 cfs)  
 ↳2=Custom Weir/Orifice ( Controls 0.00 cfs)

Pond 3P: Basin #1

Hydrograph



**Summary for Subcatchment 4P: P1c**

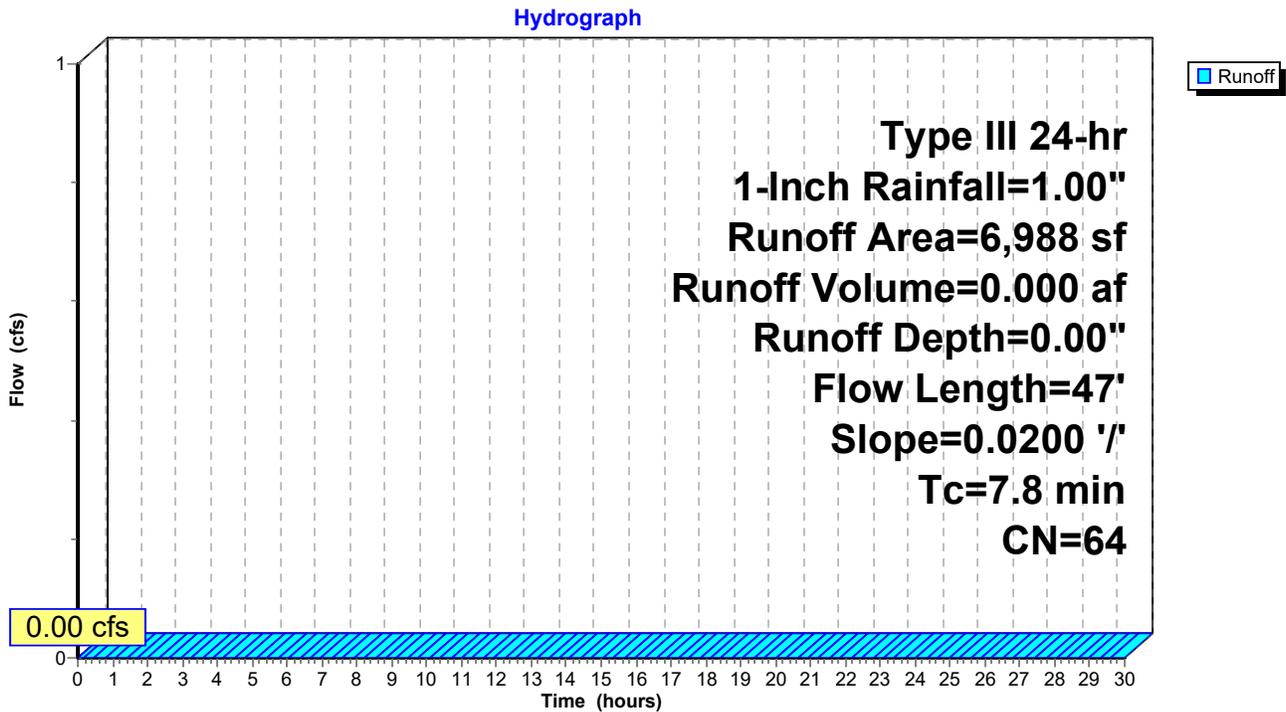
Runoff = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Depth= 0.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
Type III 24-hr 1-Inch Rainfall=1.00"

Area (sf)	CN	Description
* 588	98	Patios, HSG B
6,400	61	>75% Grass cover, Good, HSG B
6,988	64	Weighted Average
6,400		91.59% Pervious Area
588		8.41% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.8	47	0.0200	0.10		<b>Sheet Flow,</b> Grass: Dense n= 0.240 P2= 3.20"

**Subcatchment 4P: P1c**

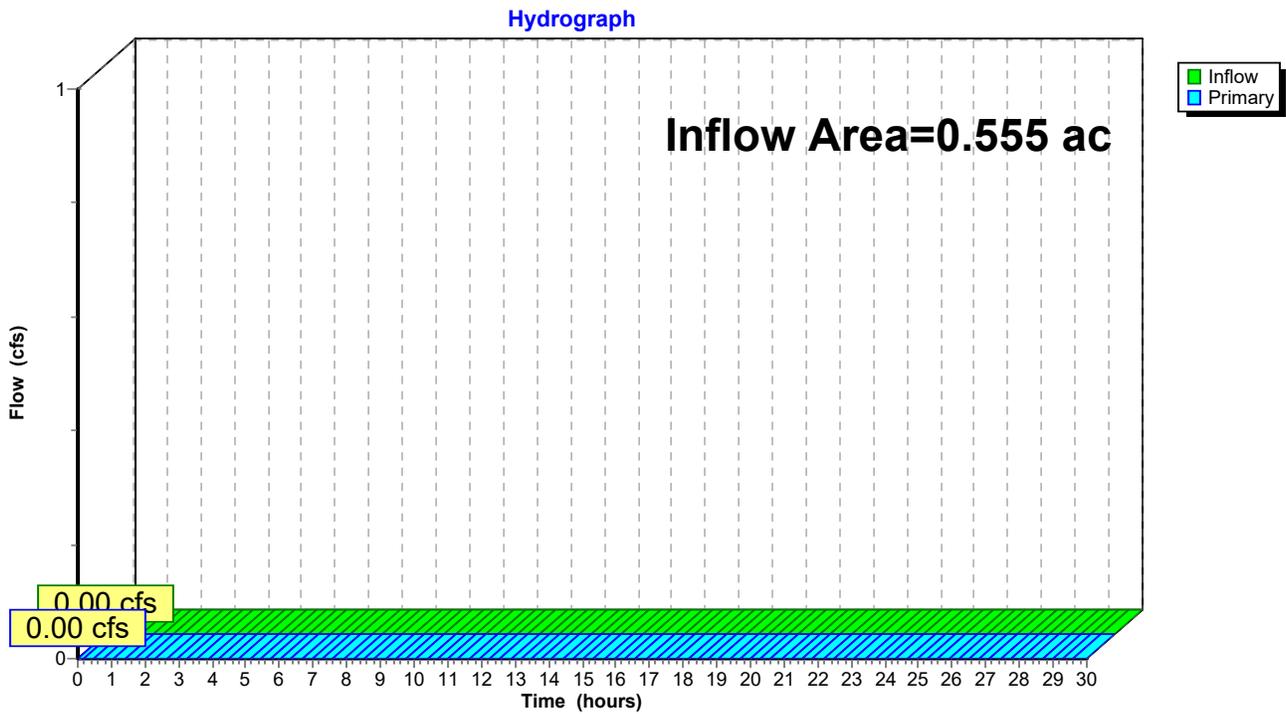


### Summary for Link 5P: Design Point #1: Flow to 280 Village Street

Inflow Area = 0.555 ac, 40.97% Impervious, Inflow Depth = 0.00" for 1-Inch event  
Inflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af  
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs

### Link 5P: Design Point #1: Flow to 280 Village Street



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Type III 24-hr 1-Inch Rainfall=1.00"

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**Summary for Subcatchment 6P: P2**

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

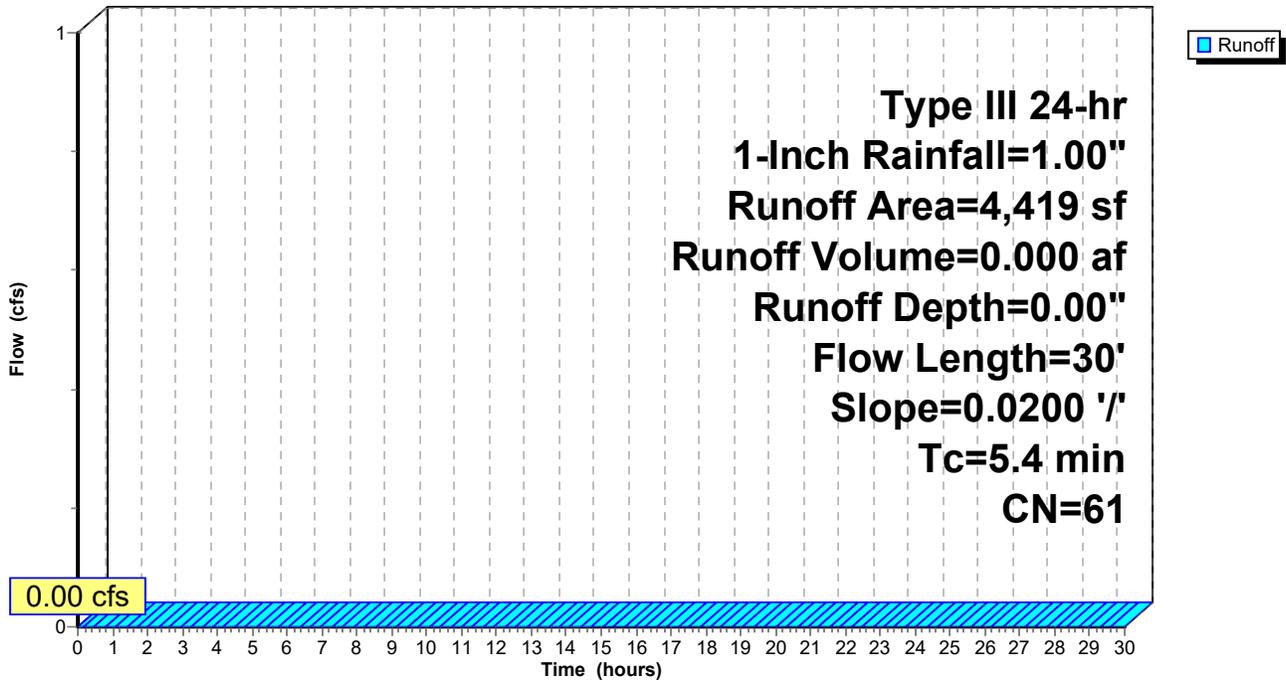
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
Type III 24-hr 1-Inch Rainfall=1.00"

Area (sf)	CN	Description
4,419	61	>75% Grass cover, Good, HSG B
4,419		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.4	30	0.0200	0.09		<b>Sheet Flow,</b> Grass: Dense n= 0.240 P2= 3.20"

**Subcatchment 6P: P2**

Hydrograph

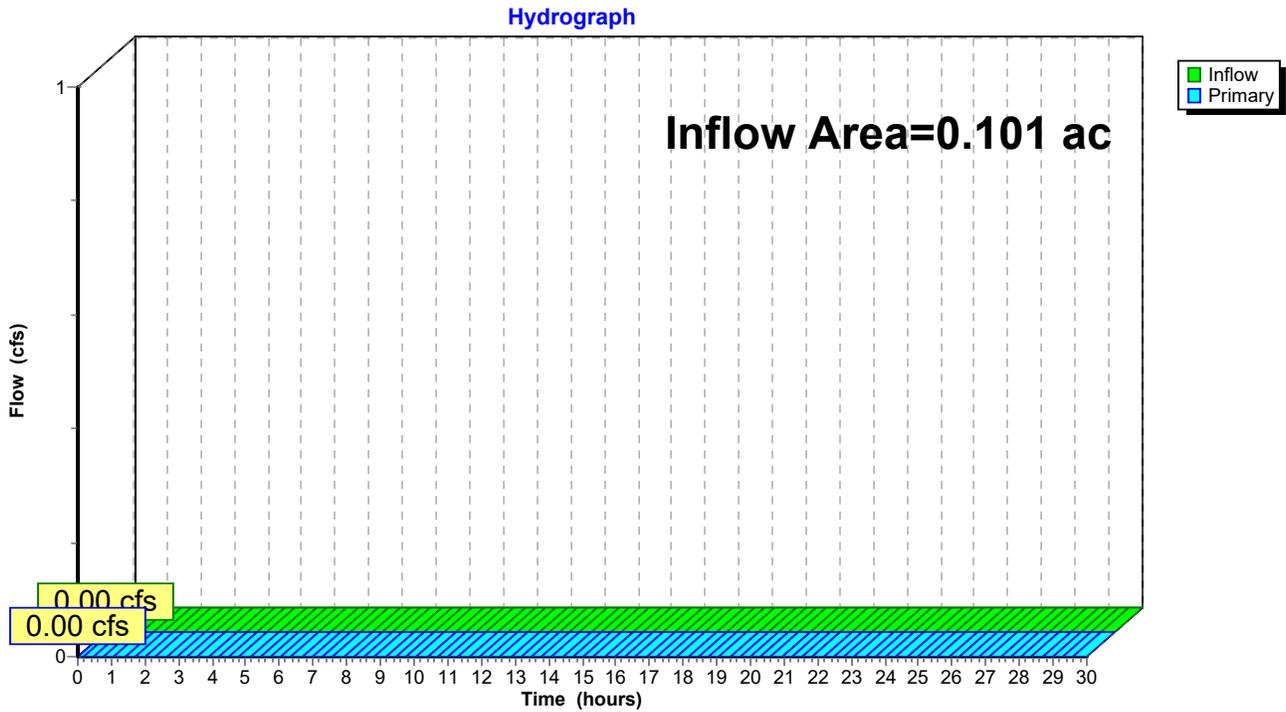


**Summary for Link 7P: Design Point #2: Flow to 278 Village Street**

Inflow Area = 0.101 ac, 0.00% Impervious, Inflow Depth = 0.00" for 1-Inch event  
Inflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af  
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs

**Link 7P: Design Point #2: Flow to 278 Village Street**



**Summary for Subcatchment 8P: P3a**

Runoff = 0.04 cfs @ 12.17 hrs, Volume= 0.005 af, Depth= 0.17"

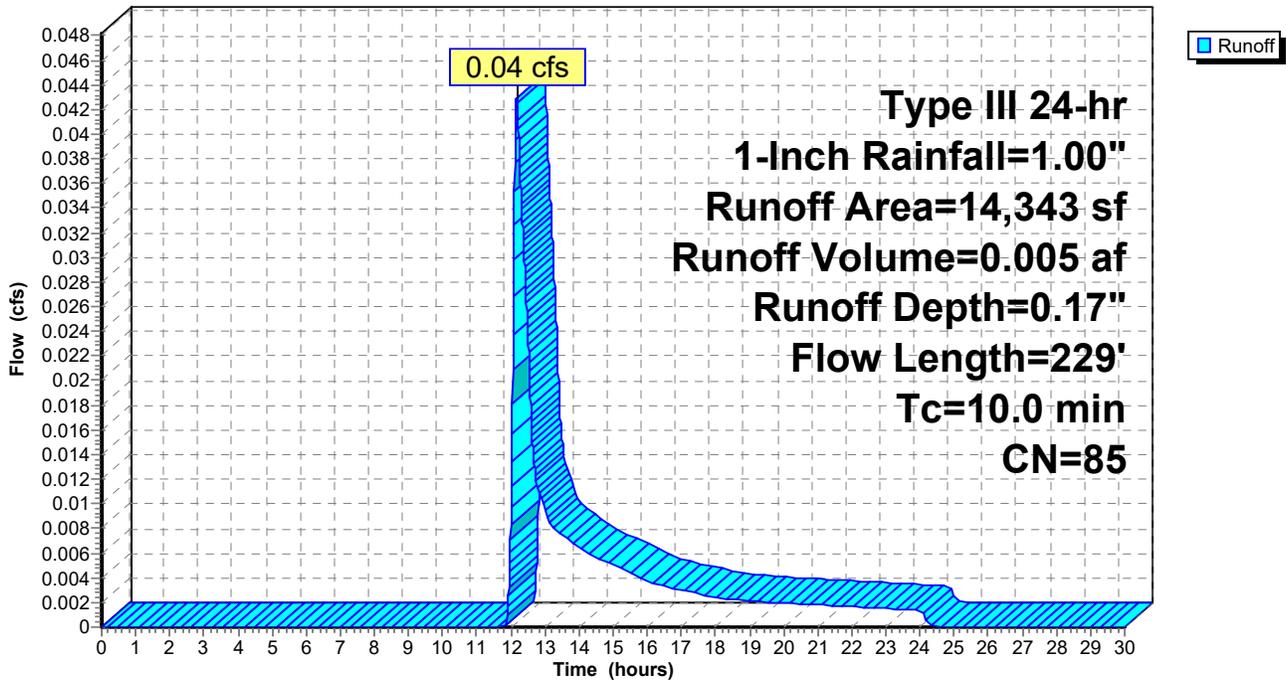
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
Type III 24-hr 1-Inch Rainfall=1.00"

Area (sf)	CN	Description
9,437	98	Paved parking, HSG B
4,906	61	>75% Grass cover, Good, HSG B
14,343	85	Weighted Average
4,906		34.20% Pervious Area
9,437		65.80% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.6	63	0.0280	0.12		Sheet Flow, Grass: Dense n= 0.240 P2= 3.20"
1.4	166	0.0100	2.03		Shallow Concentrated Flow, Paved Kv= 20.3 fps
10.0	229	Total			

**Subcatchment 8P: P3a**

Hydrograph



**Summary for Pond 10P: CB**

Inflow Area = 0.329 ac, 65.80% Impervious, Inflow Depth = 0.17" for 1-Inch event  
 Inflow = 0.04 cfs @ 12.17 hrs, Volume= 0.005 af  
 Outflow = 0.04 cfs @ 12.17 hrs, Volume= 0.005 af, Atten= 0%, Lag= 0.0 min  
 Primary = 0.04 cfs @ 12.17 hrs, Volume= 0.005 af

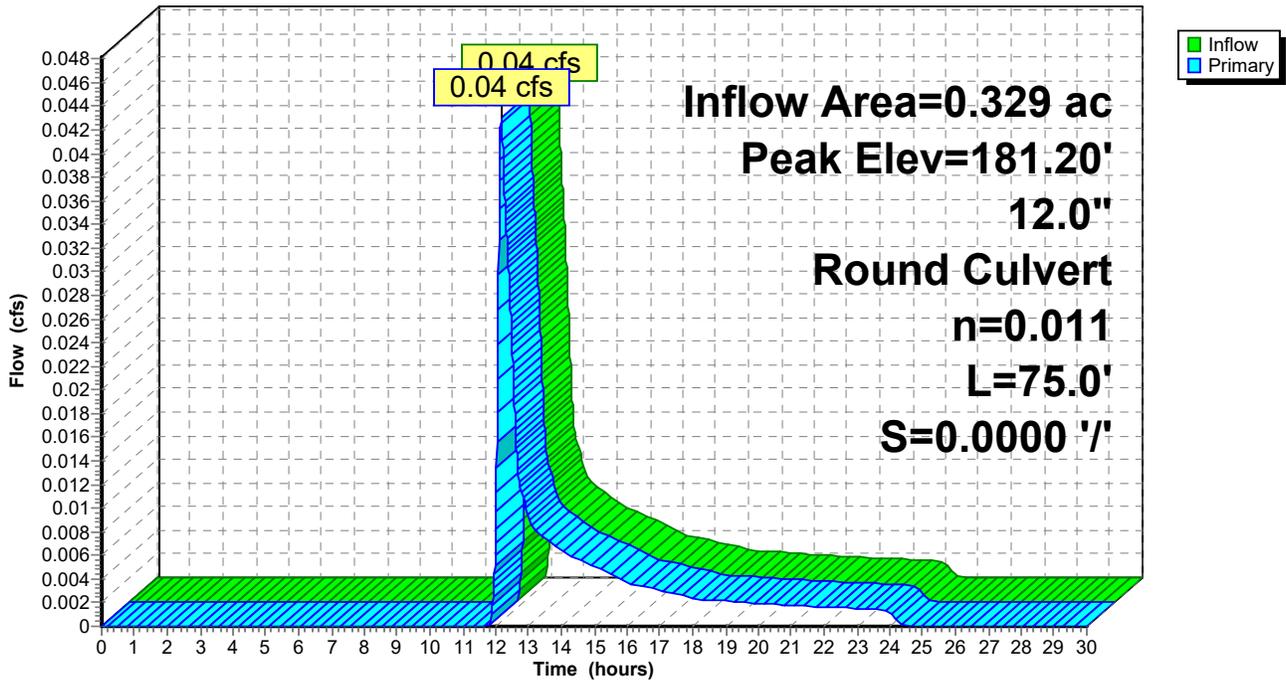
Routing by Dyn-Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
 Peak Elev= 181.20' @ 12.08 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	180.60'	<b>12.0" Round Culvert</b> L= 75.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 180.60' / 180.60' S= 0.0000 '/ Cc= 0.900 n= 0.011, Flow Area= 0.79 sf

**Primary OutFlow** Max=0.04 cfs @ 12.17 hrs HW=181.20' TW=181.20' (Dynamic Tailwater)  
 ←1=Culvert (Outlet Controls 0.04 cfs @ 0.13 fps)

**Pond 10P: CB**

Hydrograph



# HydroCAD Revised2

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Type III 24-hr 1-Inch Rainfall=1.00"

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## Summary for Subcatchment 11P: P3b

Runoff = 0.13 cfs @ 12.03 hrs, Volume= 0.008 af, Depth= 0.79"

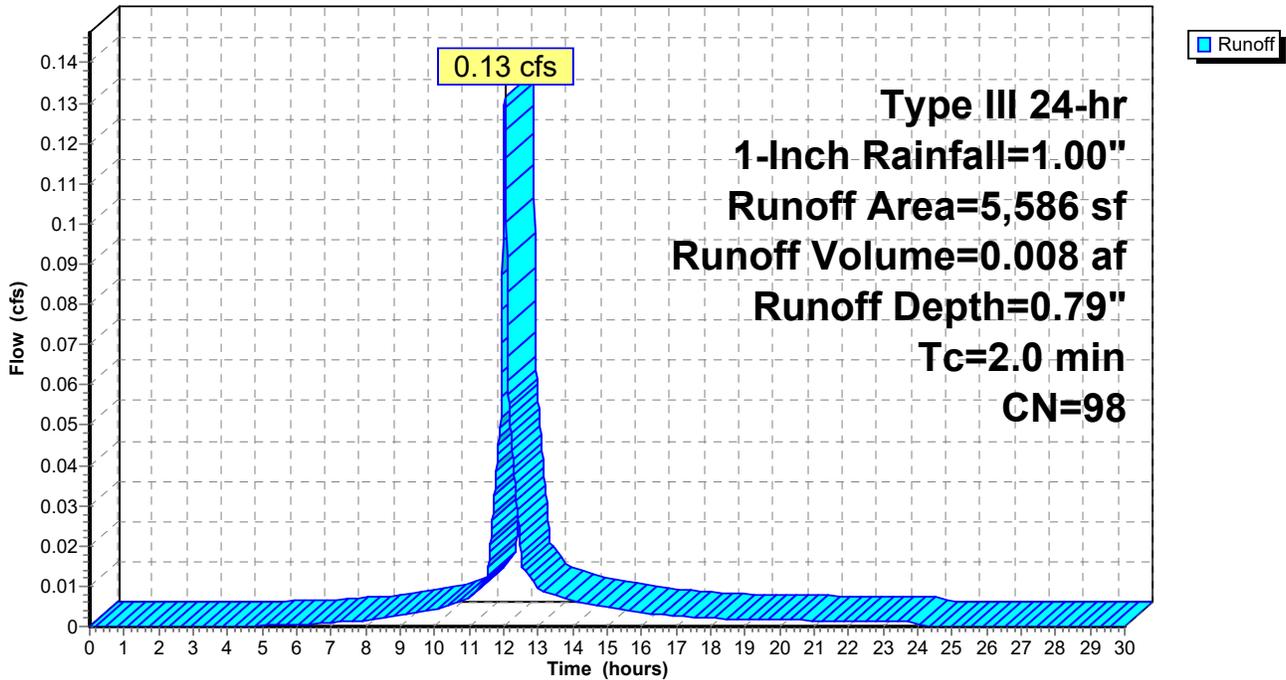
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
Type III 24-hr 1-Inch Rainfall=1.00"

Area (sf)	CN	Description
5,586	98	Roofs, HSG B
5,586		100.00% Impervious Area

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

## Subcatchment 11P: P3b

Hydrograph



**Summary for Pond 12P: Infiltration Field**

Inflow Area = 0.458 ac, 75.38% Impervious, Inflow Depth = 0.35" for 1-Inch event  
 Inflow = 0.15 cfs @ 12.03 hrs, Volume= 0.013 af  
 Outflow = 0.13 cfs @ 12.06 hrs, Volume= 0.013 af, Atten= 9%, Lag= 1.6 min  
 Discarded = 0.13 cfs @ 12.06 hrs, Volume= 0.013 af  
 Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af  
 Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
 Peak Elev= 181.20' @ 12.07 hrs Surf.Area= 2,364 sf Storage= 2 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)  
 Center-of-Mass det. time= 0.1 min ( 827.4 - 827.3 )

Volume	Invert	Avail.Storage	Storage Description
#1A	181.20'	1,454 cf	<b>72.00'W x 32.83'L x 2.04'H Field A</b> 4,826 cf Overall - 1,192 cf Embedded = 3,634 cf x 40.0% Voids
#2A	181.70'	1,192 cf	<b>Cultec C-100HD</b> x 84 Inside #1 Effective Size= 32.1"W x 12.0"H => 1.86 sf x 7.50'L = 14.0 cf Overall Size= 36.0"W x 12.5"H x 8.00'L with 0.50' Overlap Row Length Adjustment= +0.50' x 1.86 sf x 21 rows
#3	181.40'	38 cf	<b>4.00'D x 3.00'H Vertical Cone/Cylinder</b>
		2,684 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	181.20'	<b>2.410 in/hr Exfiltration over Surface area</b>
#2	Secondary	181.88'	<b>4.0" Round Culvert</b> L= 7.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 181.88' / 181.00' S= 0.1257 '/' Cc= 0.900 n= 0.011, Flow Area= 0.09 sf
#3	Primary	183.30'	<b>Trench Drain, Cv= 2.62 (C= 3.28)</b> Elev. (feet) 183.30 183.40 Width (feet) 20.00 20.00

**Discarded OutFlow** Max=0.13 cfs @ 12.06 hrs HW=181.20' (Free Discharge)

↑1=Exfiltration (Exfiltration Controls 0.13 cfs)

**Primary OutFlow** Max=0.00 cfs @ 0.00 hrs HW=181.20' TW=0.00' (Dynamic Tailwater)

↑3=Trench Drain ( Controls 0.00 cfs)

**Secondary OutFlow** Max=0.00 cfs @ 0.00 hrs HW=181.20' TW=0.00' (Dynamic Tailwater)

↑2=Culvert ( Controls 0.00 cfs)

**Pond 12P: Infiltration Field - Chamber Wizard Field A**

**Chamber Model = Cultec C-100HD (Cultec Contactor® 100HD)**

Effective Size= 32.1"W x 12.0"H => 1.86 sf x 7.50'L = 14.0 cf

Overall Size= 36.0"W x 12.5"H x 8.00'L with 0.50' Overlap

Row Length Adjustment= +0.50' x 1.86 sf x 21 rows

36.0" Wide + 4.0" Spacing = 40.0" C-C Row Spacing

4 Chambers/Row x 7.50' Long +0.50' Row Adjustment = 30.50' Row Length +14.0" End Stone x 2 = 32.83' Base Length

21 Rows x 36.0" Wide + 4.0" Spacing x 20 + 14.0" Side Stone x 2 = 72.00' Base Width

6.0" Base + 12.5" Chamber Height + 6.0" Cover = 2.04' Field Height

84 Chambers x 14.0 cf +0.50' Row Adjustment x 1.86 sf x 21 Rows = 1,192.3 cf Chamber Storage

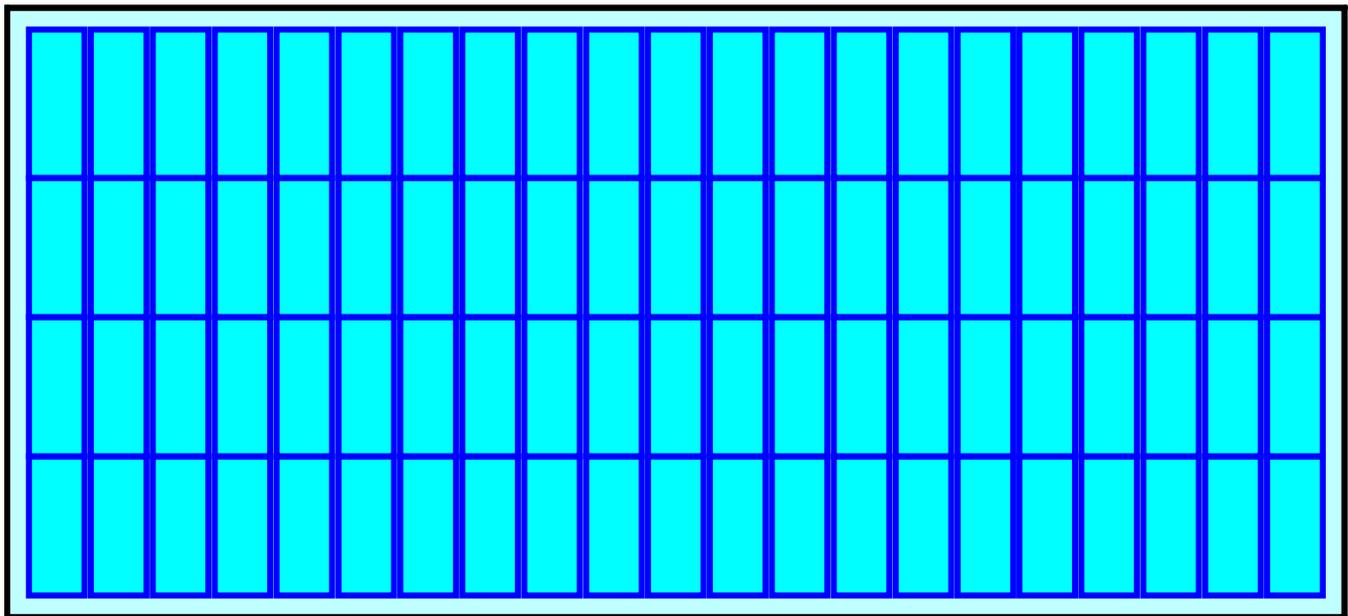
4,826.5 cf Field - 1,192.3 cf Chambers = 3,634.2 cf Stone x 40.0% Voids = 1,453.7 cf Stone Storage

Chamber Storage + Stone Storage = 2,646.0 cf = 0.061 af

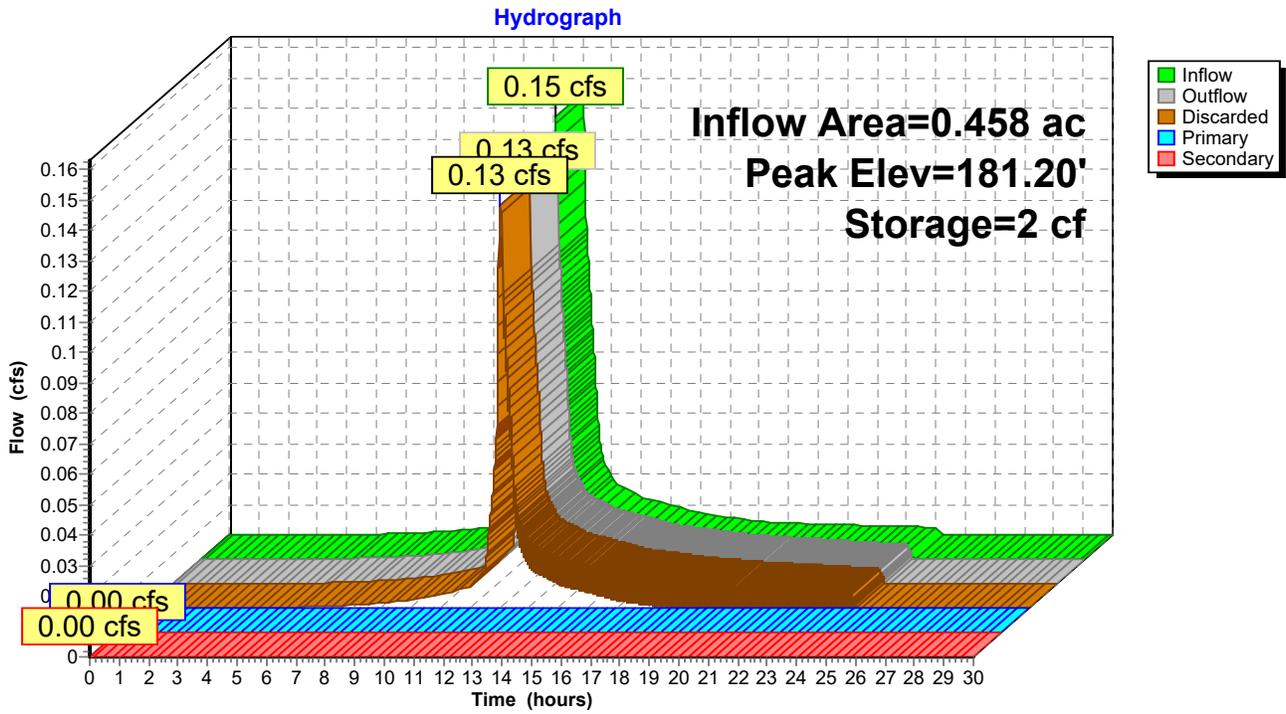
Overall Storage Efficiency = 54.8%

Overall System Size = 32.83' x 72.00' x 2.04'

84 Chambers  
178.8 cy Field  
134.6 cy Stone



### Pond 12P: Infiltration Field



**Summary for Subcatchment 13P: P3c**

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

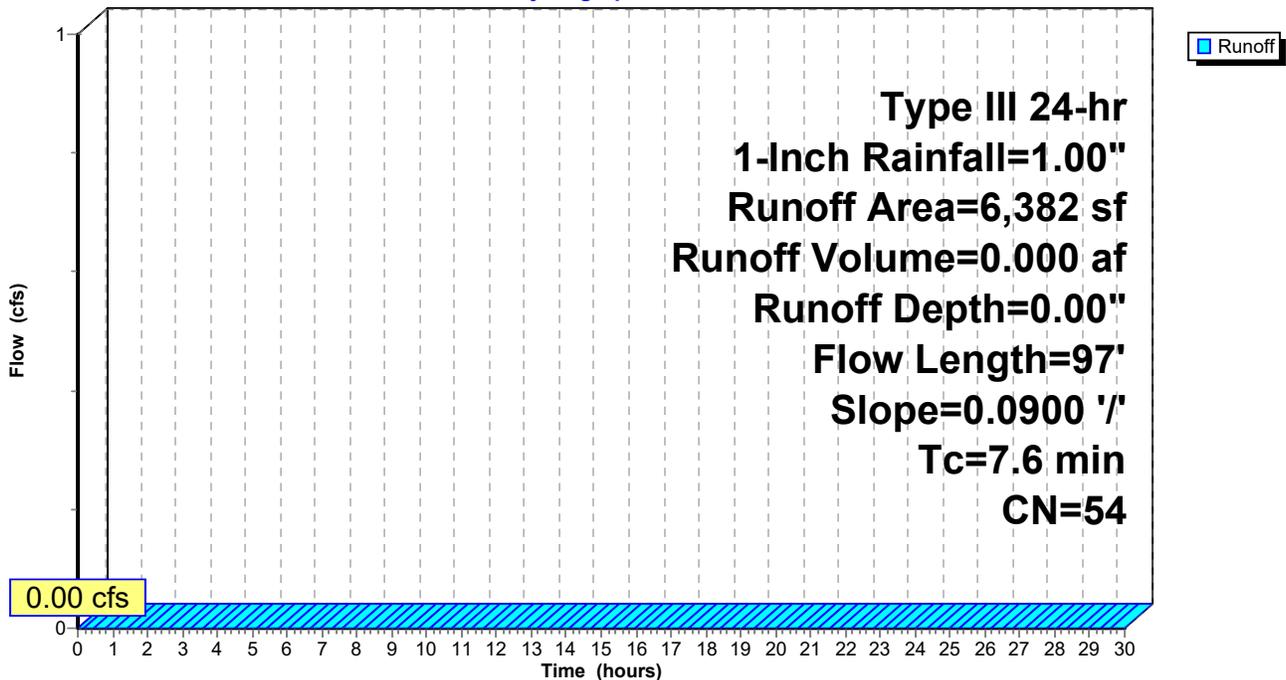
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
Type III 24-hr 1-Inch Rainfall=1.00"

	Area (sf)	CN	Description
*	454	90	Pavers, HSG B
*	134	88	Pavers, HSG A
	2,741	39	>75% Grass cover, Good, HSG A
	3,053	61	>75% Grass cover, Good, HSG B
	6,382	54	Weighted Average
	6,382		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.6	97	0.0900	0.21		<b>Sheet Flow,</b> Grass: Dense n= 0.240 P2= 3.20"

**Subcatchment 13P: P3c**

Hydrograph

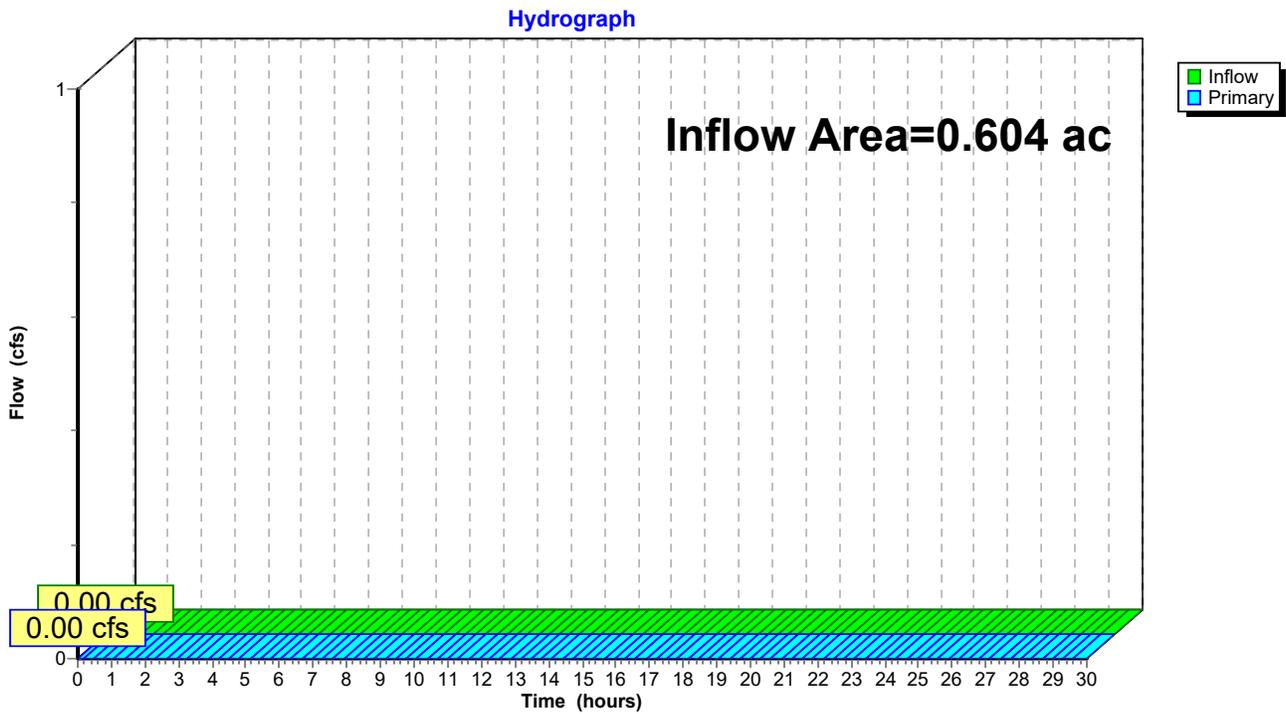


### Summary for Link 14P: Design Point #3a: Flow to Village Street

Inflow Area = 0.604 ac, 57.10% Impervious, Inflow Depth = 0.00" for 1-Inch event  
Inflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af  
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs

### Link 14P: Design Point #3a: Flow to Village Street



**Summary for Subcatchment 15P: P3d**

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

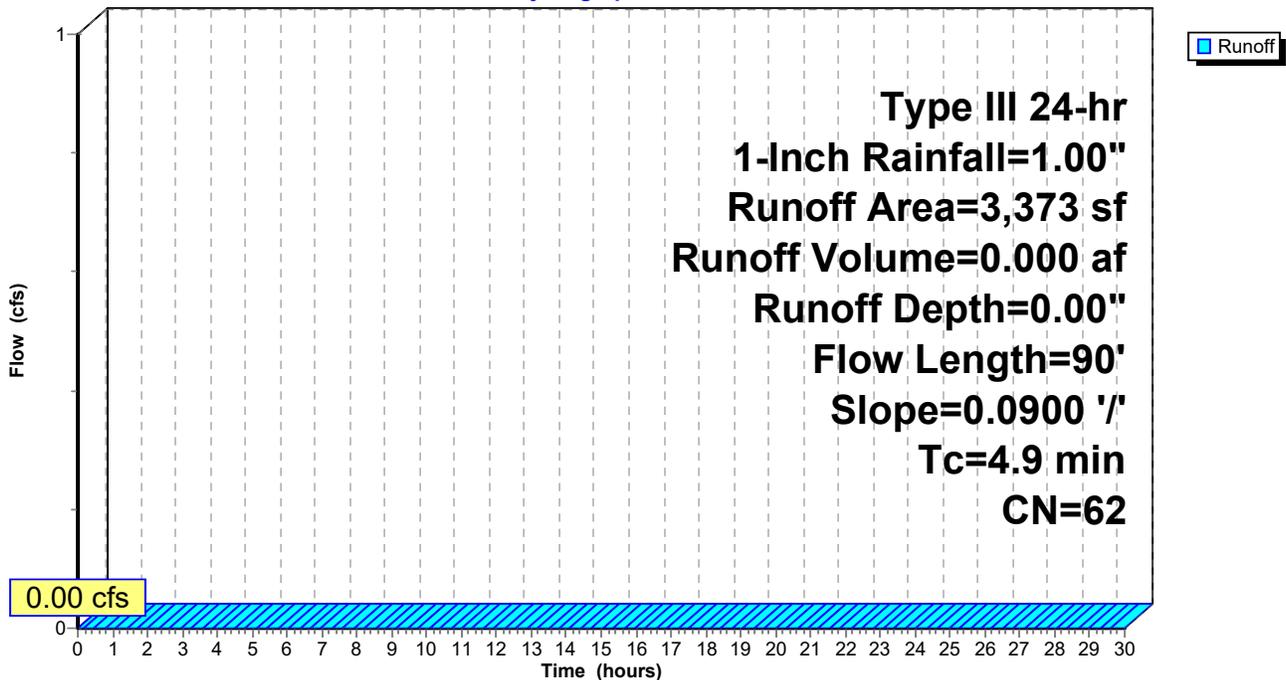
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
 Type III 24-hr 1-Inch Rainfall=1.00"

Area (sf)	CN	Description
258	98	Paved parking, HSG B
272	39	>75% Grass cover, Good, HSG A
2,843	61	>75% Grass cover, Good, HSG B
3,373	62	Weighted Average
3,115		92.35% Pervious Area
258		7.65% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.9	90	0.0900	0.30		Sheet Flow, Grass: Short n= 0.150 P2= 3.20"

**Subcatchment 15P: P3d**

Hydrograph

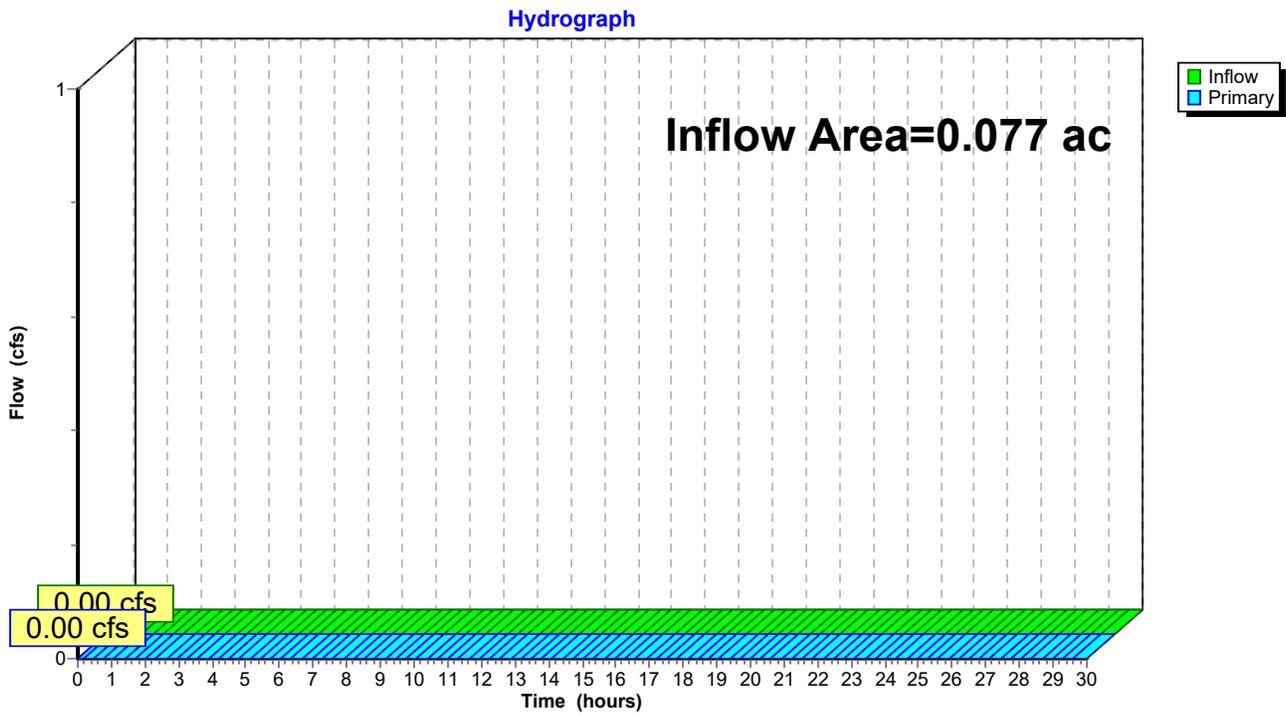


### Summary for Link 16P: Design Point #3b: Flow to Eastern Abutter

Inflow Area = 0.077 ac, 7.65% Impervious, Inflow Depth = 0.00" for 1-Inch event  
Inflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af  
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs

### Link 16P: Design Point #3b: Flow to Eastern Abutter



**Summary for Subcatchment 17P: P4a**

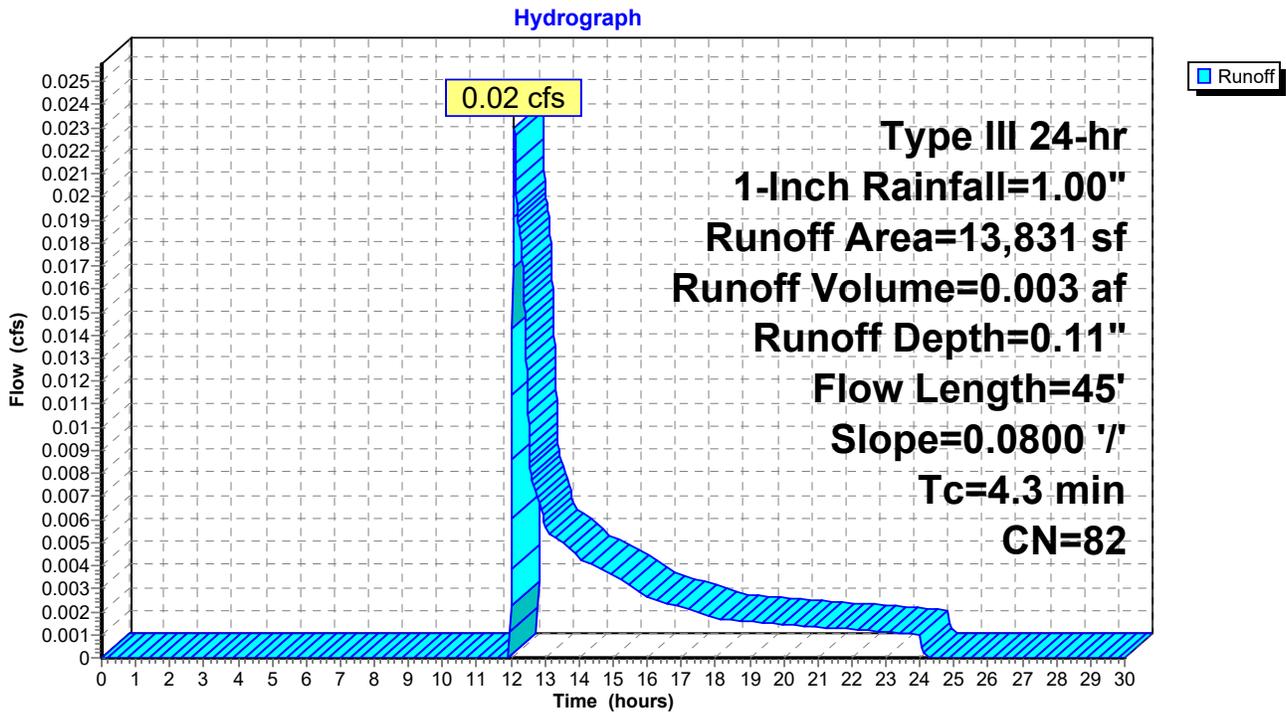
Runoff = 0.02 cfs @ 12.11 hrs, Volume= 0.003 af, Depth= 0.11"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
Type III 24-hr 1-Inch Rainfall=1.00"

Area (sf)	CN	Description
7,817	98	Paved parking, HSG B
6,014	61	>75% Grass cover, Good, HSG B
13,831	82	Weighted Average
6,014		43.48% Pervious Area
7,817		56.52% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.3	45	0.0800	0.17		Sheet Flow, Grass: Dense n= 0.240 P2= 3.20"

**Subcatchment 17P: P4a**



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Type III 24-hr 1-Inch Rainfall=1.00"

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## Summary for Subcatchment 18P: P4b

Runoff = 0.22 cfs @ 12.03 hrs, Volume= 0.014 af, Depth= 0.79"

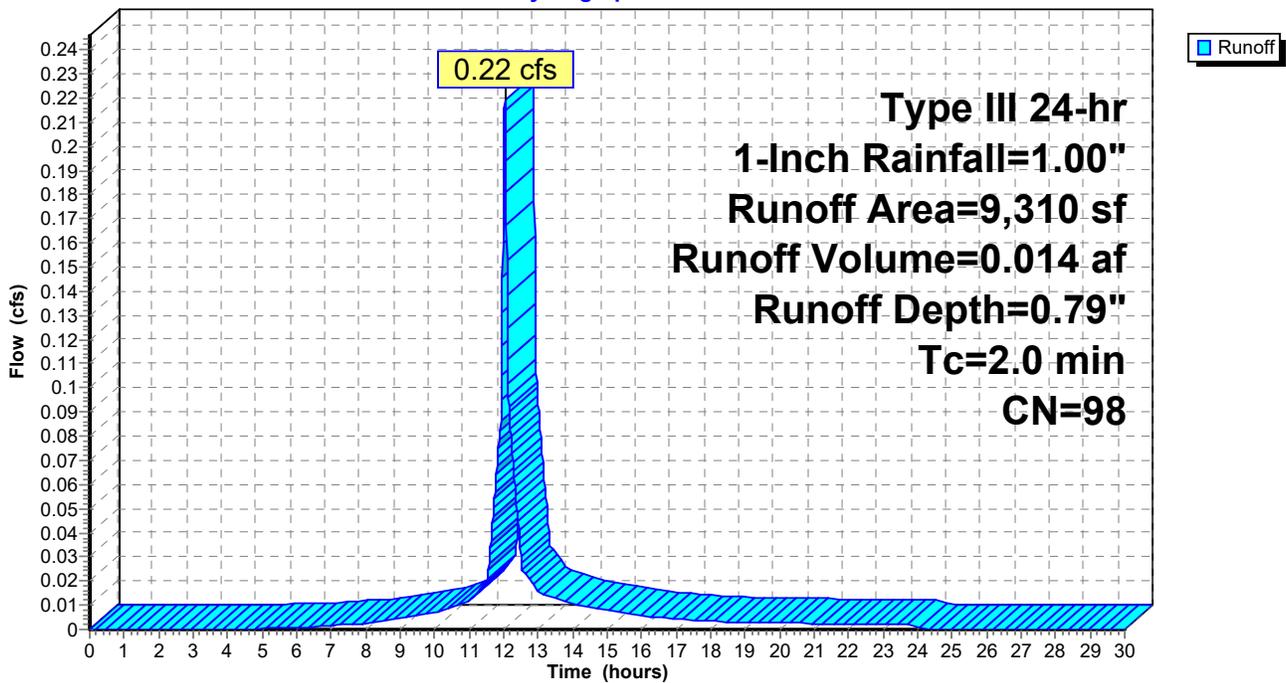
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
Type III 24-hr 1-Inch Rainfall=1.00"

Area (sf)	CN	Description
9,310	98	Roofs, HSG B
9,310		100.00% Impervious Area

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

## Subcatchment 18P: P4b

Hydrograph



**Summary for Pond 19P: Basins #2**

Inflow Area = 0.531 ac, 74.01% Impervious, Inflow Depth = 0.39" for 1-Inch event  
 Inflow = 0.23 cfs @ 12.03 hrs, Volume= 0.017 af  
 Outflow = 0.10 cfs @ 12.23 hrs, Volume= 0.017 af, Atten= 58%, Lag= 11.5 min  
 Discarded = 0.07 cfs @ 12.23 hrs, Volume= 0.016 af  
 Primary = 0.03 cfs @ 12.23 hrs, Volume= 0.001 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
 Peak Elev= 185.27' @ 12.23 hrs Surf.Area= 1,230 sf Storage= 79 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)  
 Center-of-Mass det. time= 3.8 min ( 813.1 - 809.3 )

Volume	Invert	Avail.Storage	Storage Description			
#1	185.20'	3,569 cf	<b>Custom Stage Data (Irregular)</b> Listed below (Recalc)			
Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)	
185.20	1,178	291.0	0	0	1,178	
186.00	1,894	306.0	1,218	1,218	1,930	
187.00	2,840	325.0	2,351	3,569	2,934	

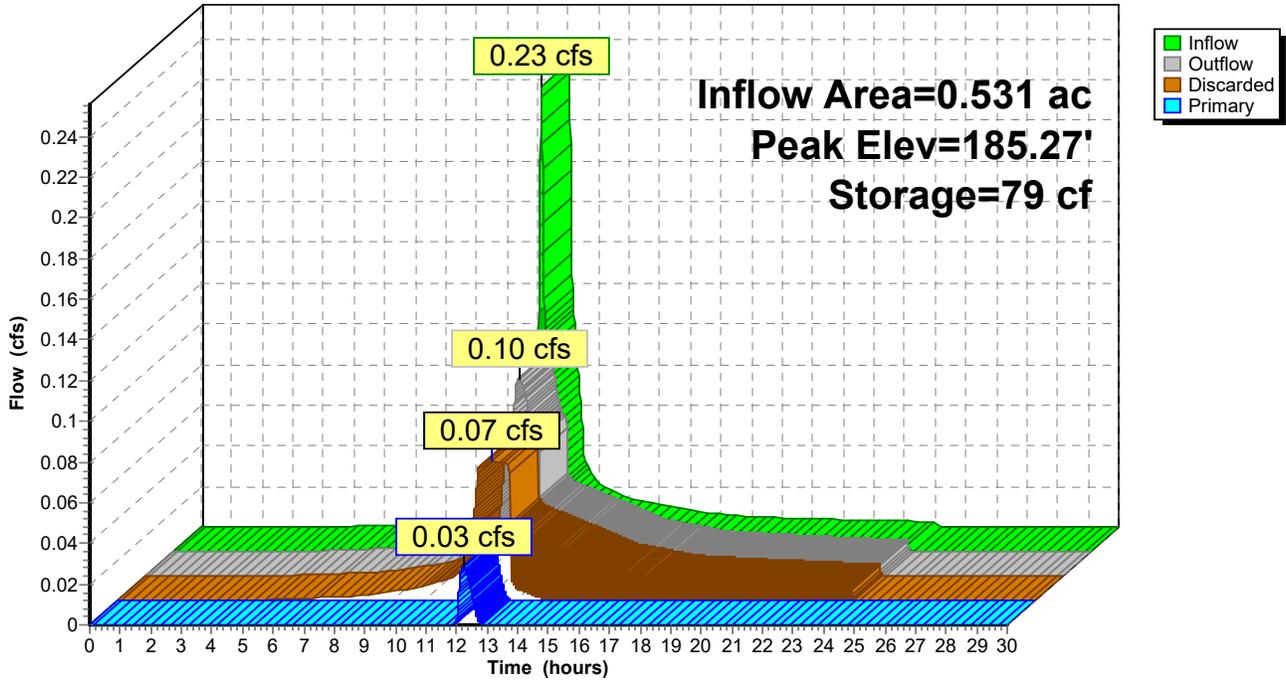
Device	Routing	Invert	Outlet Devices
#1	Discarded	185.20'	<b>2.410 in/hr Exfiltration over Surface area</b>
#2	Primary	185.20'	<b>12.0" Round Culvert</b> L= 36.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 185.20' / 185.00' S= 0.0056 1/'' Cc= 0.900 n= 0.011, Flow Area= 0.79 sf
#3	Primary	185.20'	<b>12.0" Round Culvert</b> L= 36.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 185.20' / 185.00' S= 0.0056 1/'' Cc= 0.900 n= 0.011, Flow Area= 0.79 sf

**Discarded OutFlow** Max=0.07 cfs @ 12.23 hrs HW=185.27' (Free Discharge)  
 ↖1=Exfiltration (Exfiltration Controls 0.07 cfs)

**Primary OutFlow** Max=0.03 cfs @ 12.23 hrs HW=185.27' TW=185.00' (Dynamic Tailwater)  
 ↖2=Culvert (Barrel Controls 0.01 cfs @ 0.99 fps)  
 ↖3=Culvert (Barrel Controls 0.01 cfs @ 0.99 fps)

### Pond 19P: Basins #2

Hydrograph



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Type III 24-hr 1-Inch Rainfall=1.00"

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## Summary for Subcatchment 20P: P4c

Runoff = 0.03 cfs @ 12.38 hrs, Volume= 0.005 af, Depth= 0.08"

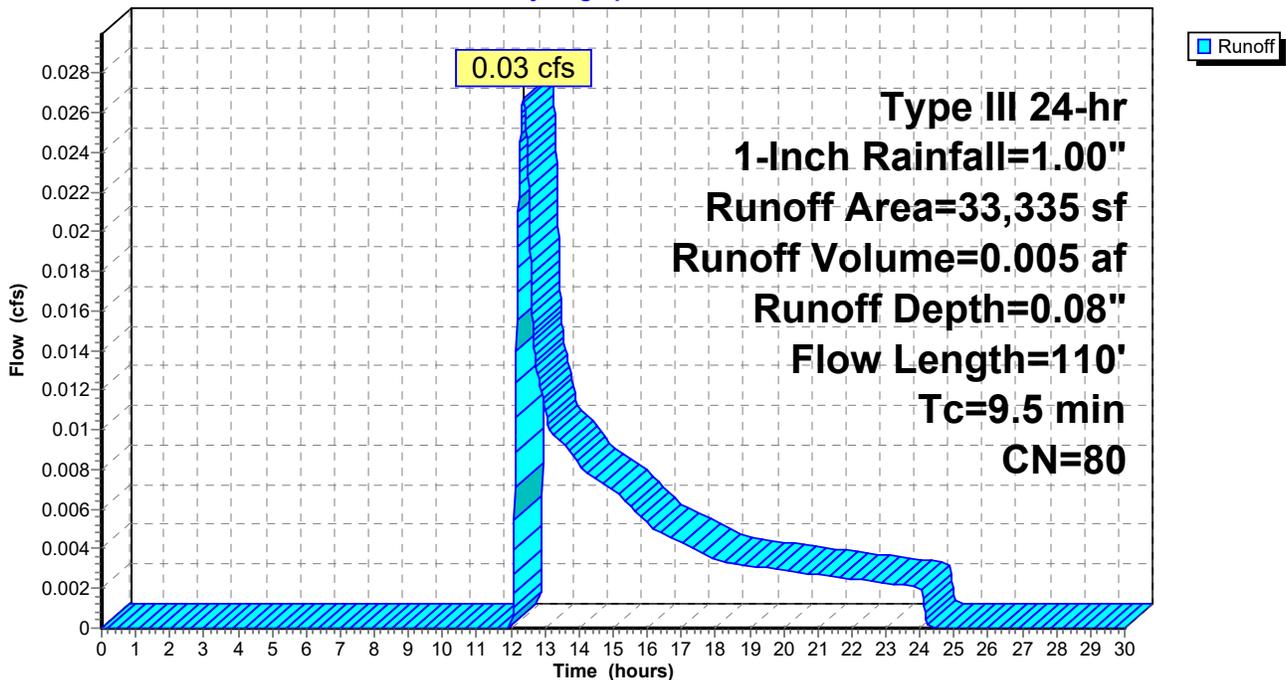
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
Type III 24-hr 1-Inch Rainfall=1.00"

Area (sf)	CN	Description
16,717	98	Paved parking, HSG B
144	98	Roofs, HSG B
16,474	61	>75% Grass cover, Good, HSG B
33,335	80	Weighted Average
16,474		49.42% Pervious Area
16,861		50.58% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.0	40	0.0100	0.07		<b>Sheet Flow,</b> Grass: Dense n= 0.240 P2= 3.20"
0.4	50	0.0100	2.03		<b>Shallow Concentrated Flow,</b> Paved Kv= 20.3 fps
0.1	20	0.2000	3.13		<b>Shallow Concentrated Flow,</b> Short Grass Pasture Kv= 7.0 fps
9.5	110	Total			

## Subcatchment 20P: P4c

Hydrograph



**Summary for Pond 21P: Basin #3**

Inflow Area = 1.297 ac, 60.18% Impervious, Inflow Depth = 0.06" for 1-Inch event  
 Inflow = 0.05 cfs @ 12.30 hrs, Volume= 0.006 af  
 Outflow = 0.05 cfs @ 12.30 hrs, Volume= 0.006 af, Atten= 0%, Lag= 0.0 min  
 Discarded = 0.05 cfs @ 12.30 hrs, Volume= 0.006 af  
 Primary = 0.00 cfs @ 11.75 hrs, Volume= 0.000 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
 Peak Elev= 185.00' @ 0.00 hrs Surf.Area= 2,820 sf Storage= 0 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)  
 Center-of-Mass det. time= 0.0 min ( 918.6 - 918.6 )

Volume	Invert	Avail.Storage	Storage Description		
#1	185.00'	8,270 cf	<b>Custom Stage Data (Irregular)</b> Listed below (Recalc)		
Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
185.00	2,820	247.0	0	0	2,820
187.00	5,608	310.0	8,270	8,270	5,667

Device	Routing	Invert	Outlet Devices
#1	Discarded	185.00'	<b>2.410 in/hr Exfiltration over Surface area</b>
#2	Primary	185.00'	<b>12.0" Round Culvert</b> L= 90.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 185.00' / 184.70' S= 0.0033 1/8" Cc= 0.900 n= 0.011, Flow Area= 0.79 sf
#3	Primary	185.00'	<b>12.0" Round Culvert</b> L= 90.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 185.00' / 184.70' S= 0.0033 1/8" Cc= 0.900 n= 0.011, Flow Area= 0.79 sf

**Discarded OutFlow** Max=0.00 cfs @ 12.30 hrs HW=185.00' (Free Discharge)

↑1=Exfiltration (Passes 0.00 cfs of 0.16 cfs potential flow)

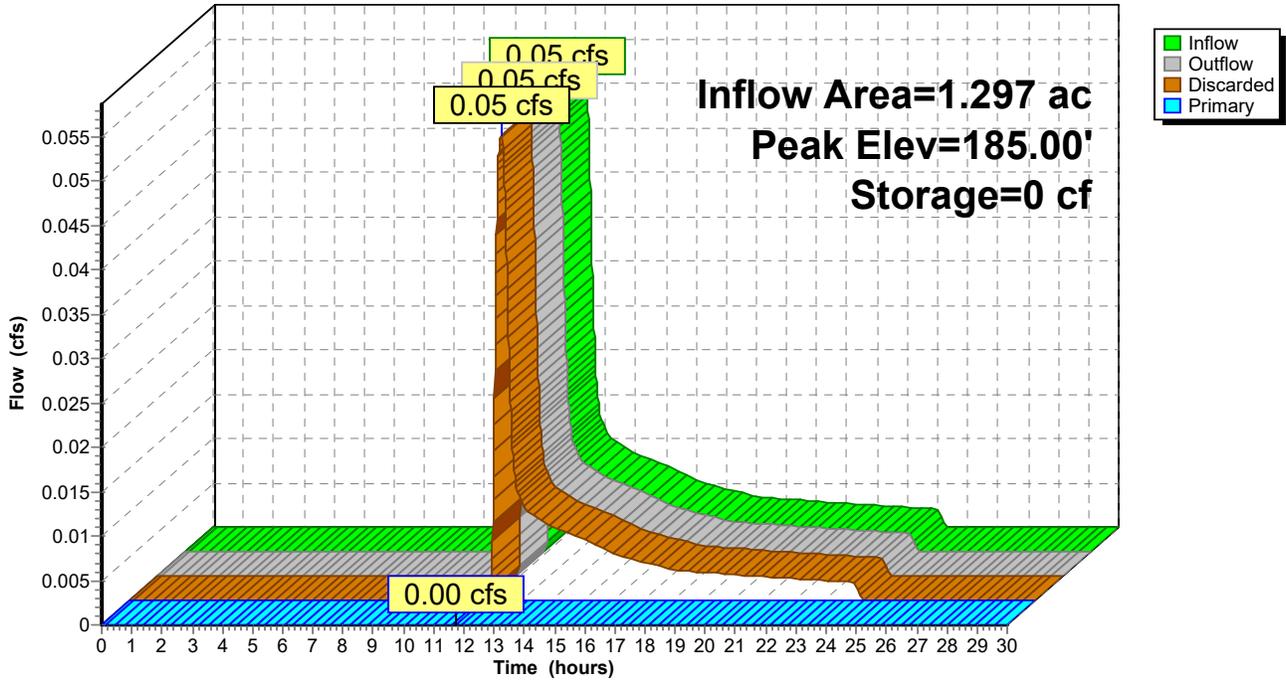
**Primary OutFlow** Max=0.00 cfs @ 11.75 hrs HW=185.00' TW=184.70' (Dynamic Tailwater)

↑2=Culvert ( Controls 0.00 cfs)

↑3=Culvert ( Controls 0.00 cfs)

**Pond 21P: Basin #3**

Hydrograph



**Summary for Subcatchment 22P: P4d**

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

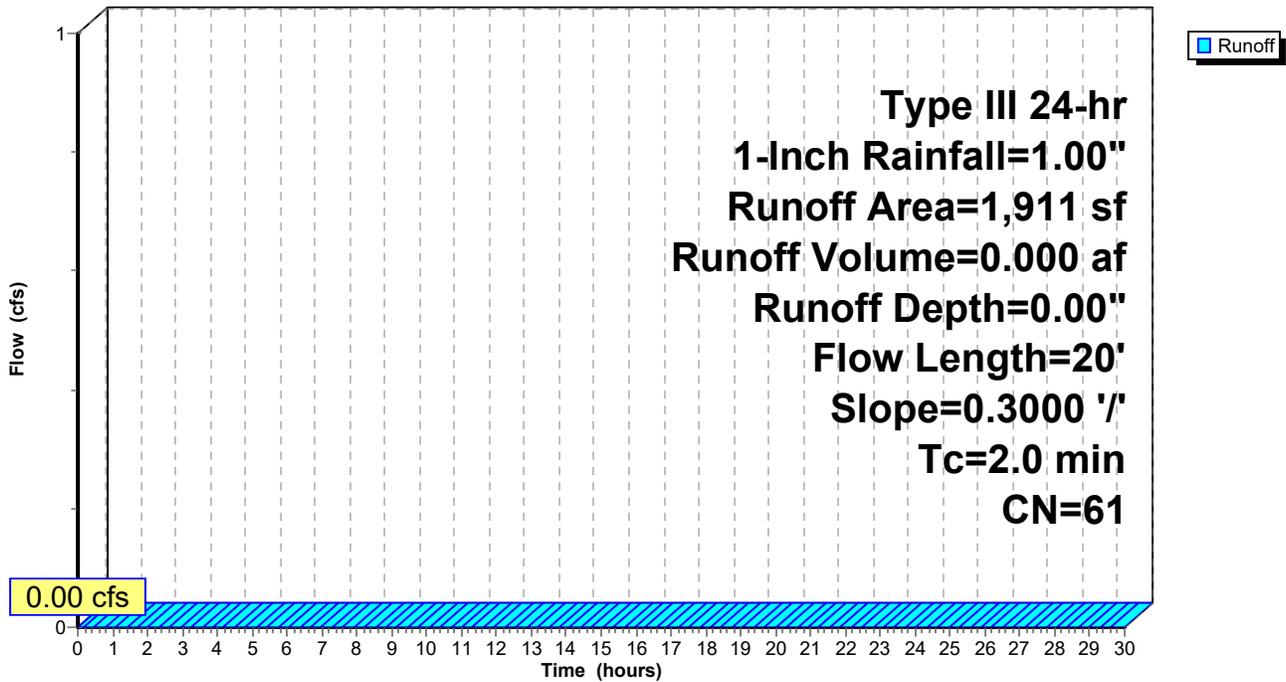
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
 Type III 24-hr 1-Inch Rainfall=1.00"

Area (sf)	CN	Description
1,911	61	>75% Grass cover, Good, HSG B
1,911		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.3	20	0.3000	0.25		<b>Sheet Flow,</b> Grass: Dense n= 0.240 P2= 3.20"
1.3	20	Total, Increased to minimum Tc = 2.0 min			

**Subcatchment 22P: P4d**

Hydrograph



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Type III 24-hr 1-Inch Rainfall=1.00"

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## Summary for Subcatchment 23P: P4e

Runoff = 0.09 cfs @ 12.03 hrs, Volume= 0.006 af, Depth= 0.79"

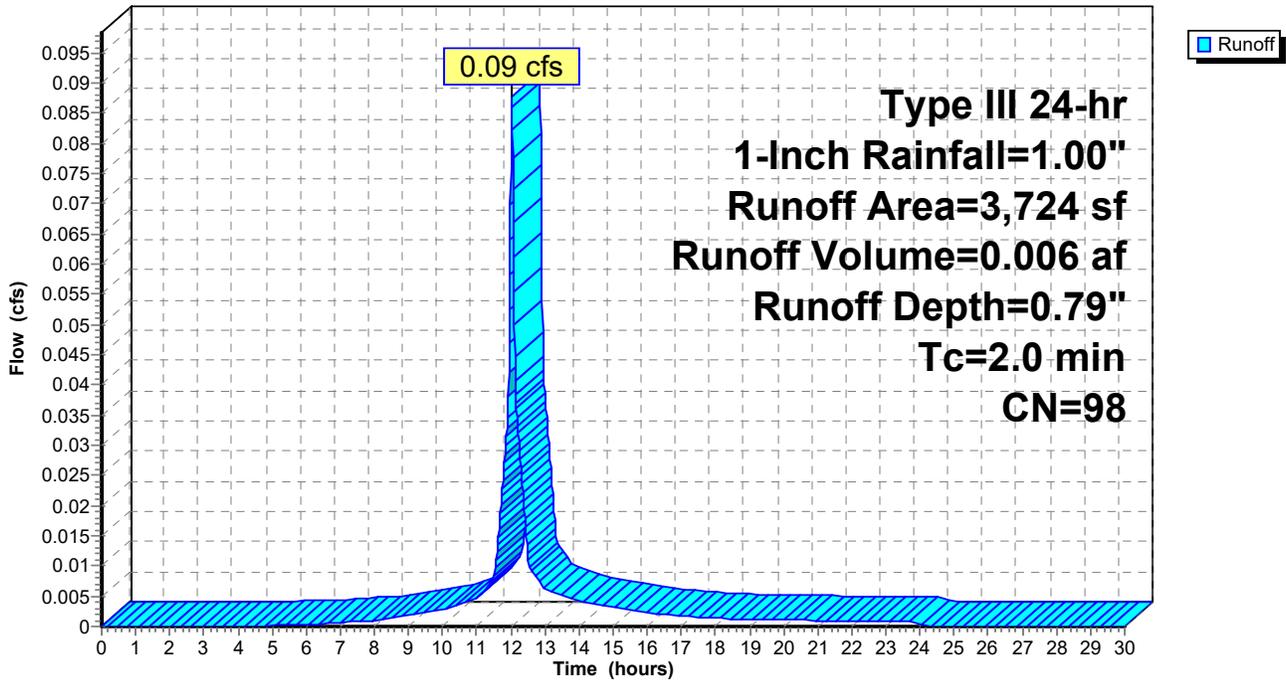
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
Type III 24-hr 1-Inch Rainfall=1.00"

Area (sf)	CN	Description
3,724	98	Roofs, HSG B
3,724		100.00% Impervious Area

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

## Subcatchment 23P: P4e

Hydrograph



**HydroCAD Revised2**

Type III 24-hr 1-Inch Rainfall=1.00"

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**Summary for Pond 24P: Basin #4**

Inflow Area = 1.426 ac, 60.72% Impervious, Inflow Depth = 0.05" for 1-Inch event  
 Inflow = 0.09 cfs @ 12.03 hrs, Volume= 0.006 af  
 Outflow = 0.02 cfs @ 12.41 hrs, Volume= 0.006 af, Atten= 79%, Lag= 22.7 min  
 Discarded = 0.02 cfs @ 12.41 hrs, Volume= 0.006 af  
 Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
 Peak Elev= 184.87' @ 12.41 hrs Surf.Area= 331 sf Storage= 54 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)  
 Center-of-Mass det. time= 15.2 min ( 799.3 - 784.2 )

Volume	Invert	Avail.Storage	Storage Description			
#1	184.70'	1,451 cf	<b>Custom Stage Data (Irregular)</b> Listed below (Recalc)			
Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)	
184.70	288	73.0	0	0	288	
186.00	680	101.0	611	611	692	
187.00	1,010	120.0	840	1,451	1,044	

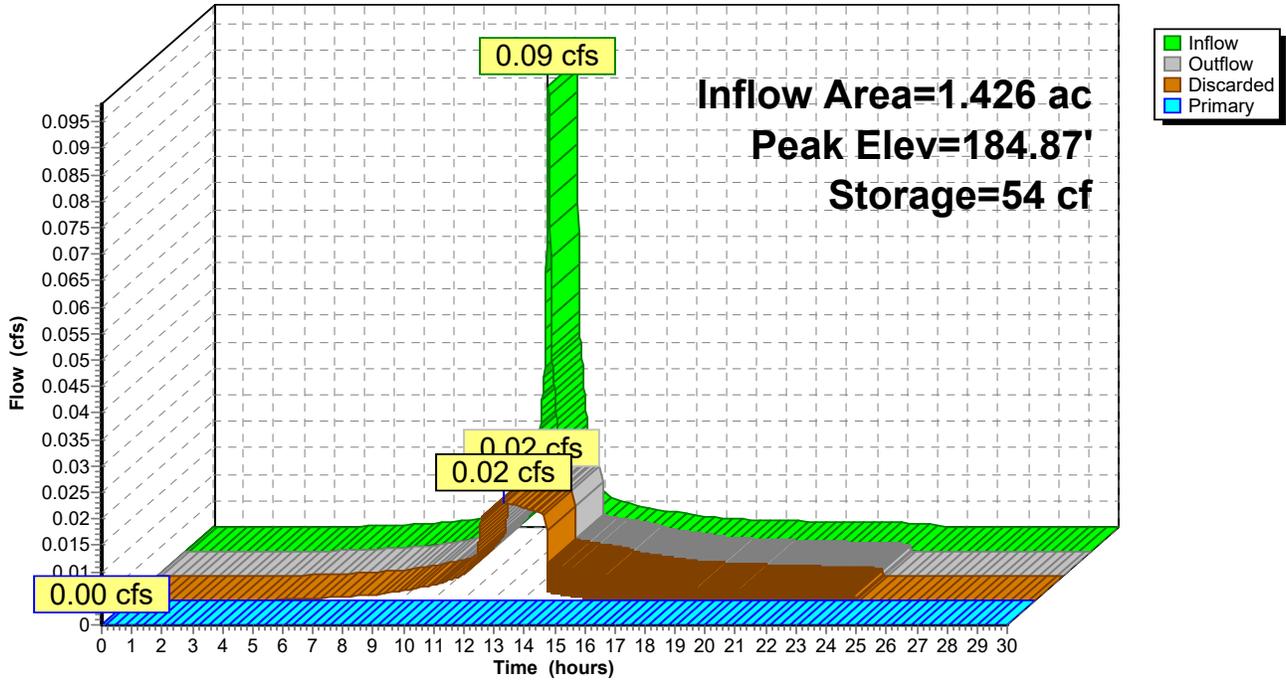
Device	Routing	Invert	Outlet Devices			
#1	Discarded	184.70'	<b>2.410 in/hr Exfiltration over Surface area</b>			
#2	Device 3	185.40'	<b>Custom Weir/Orifice, Cv= 2.62 (C= 3.28)</b>			
			Elev. (feet)	185.40	186.00	186.00 187.00
			Width (feet)	1.30	1.30	6.00 6.00
#3	Primary	185.20'	<b>Custom Weir/Orifice, Cv= 2.62 (C= 3.28)</b>			
			Elev. (feet)	185.20	185.60	
			Width (feet)	12.00	12.00	

**Discarded OutFlow** Max=0.02 cfs @ 12.41 hrs HW=184.87' (Free Discharge)  
 ↑1=Exfiltration (Exfiltration Controls 0.02 cfs)

**Primary OutFlow** Max=0.00 cfs @ 0.00 hrs HW=184.70' TW=0.00' (Dynamic Tailwater)  
 ↑3=Custom Weir/Orifice ( Controls 0.00 cfs)  
 ↑2=Custom Weir/Orifice ( Controls 0.00 cfs)

**Pond 24P: Basin #4**

Hydrograph



**Summary for Subcatchment 25P: P4f**

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

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
Type III 24-hr 1-Inch Rainfall=1.00"

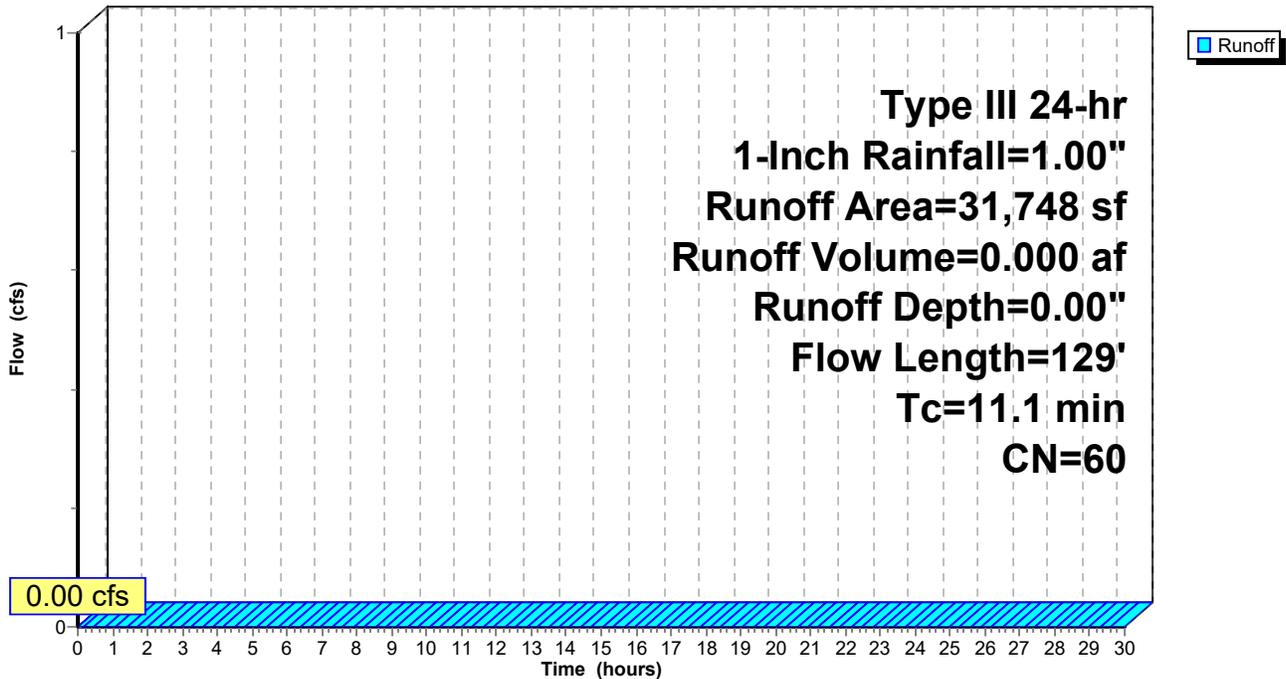
Area (sf)	CN	Description
* 1,550	90	Pavers, HSG B
17,354	61	>75% Grass cover, Good, HSG B
12,844	55	Woods, Good, HSG B
31,748	60	Weighted Average
31,748		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.4	42	0.0100	0.07		<b>Sheet Flow,</b> Grass: Dense n= 0.240 P2= 3.20"
1.6	67	0.0100	0.70		<b>Shallow Concentrated Flow,</b> Short Grass Pasture Kv= 7.0 fps
0.1	20	0.2000	2.24		<b>Shallow Concentrated Flow,</b> Woodland Kv= 5.0 fps
11.1	129	Total			

**Subcatchment 25P: P4f**

Hydrograph



### Summary for Link 26P: Design Point #4: Flow to Wetlands

Inflow Area = 2.155 ac, 40.18% Impervious, Inflow Depth = 0.00" for 1-Inch event  
Inflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af  
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs

### Link 26P: Design Point #4: Flow to Wetlands

