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**Information prepared for**

**SBA Towers III, LLC**
**5900 Broken Sound Parkway N.W.**
**Boca Raton, FL 33487**

**Project Name: North Stonington 3 –CT11796-S**
**350B Cossaduck Hill Road**
**North Stonington, CT**

# STORMWATER REPORT

May 28, 2012


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## PROJECT DESCRIPTION

SBA Towers III, LLC is proposing to install a wireless telecommunications facility at 350B Cossaduck Hill Road, North Stonington, Connecticut. The proposed site will consist of the installation of a 190 ft monopole with a 75 ft by 75 ft gravel compound. The approved plans call for the installation of one 11.5 ft x 20 ft equipment shelter and two additional future shelters and one future equipment pad. The compound will house a diesel power generator for emergency power.

The compound will be accessed by a 720 ft gravel access drive with a parking area/turn around area at the fenced compound. The proposed access drive will located off an existing gravel drive. The access drive will have three cross swales that drain to level spreaders that will direct the runoff from the drive to the woods. By doing this the erosion of the gravel drive will be minimized. The gravel compound will drain to a level spreader located to the rear of the southeastern portion of the compound.

SCS TR-20 method is used to determine the pre and post-development storm runoff volume and peak discharge rates. Soils information was obtained from the United States Department of Agriculture-Natural Resources Conservation Service website (refer to Appendix A for soil survey map and legend).

## EXISTING DRAINAGE CONDITIONS

The current condition of the site is a combination of grass and woodlands with a common gravel access drive. The total drainage area under consideration is approximately 11.75 acres. There are three points of interest (or discharge) for the runoff on this drainage area. The first is located to the Southeastern boundary of the subject property. The second is located along the western boundary and the third is along the northern boundary of the property.

Refer to Sheet DA-1 of Appendix B for the flow pattern and points of discharge. Using the software HydroCAD ver. 10.0, below are the run-off volume and peak discharge rate for the 2-year, 10-year, 25-year and 100-year storm frequencies;

TABLE 1

***EXISTING CONDITIONS***

| | 2-year Storm (cfs) | 10-Year Storm (cfs) | 25-Year Storm (cfs) | 100-Year Storm (cfs) |
|---|---|---|---|---|
| Outlet Point #1 | 3.84 | 11.59 | 15.59 | 24.28 |
| Outlet Point #2 | 0.98 | 3.29 | 4.51 | 7.20 |
| Outlet Point #3 | 0.11 | 0.39 | 0.53 | 0.85 |

Refer to Appendix C for the results.

## PROPOSED DRAINAGE CONDITIONS

In the proposed drainage condition the site will have the approximately the same drainage area as in the existing condition. The point of interest (discharge point) will remain the same as existing conditions. The runoff from discharge point #1 will increase slightly due to the installation of additional graveled surface for the telecommunications facility.

Refer to Sheet DA-2 of Appendix B for the flow patterns and possible points of discharge. Using the software HydroCAD ver. 10.0, below are the run-off volume and peak discharge rate for the 2-year, 10-year, 25-year and 100-year storm frequencies;

TABLE 2

***PROPOSED CONDITIONS***

| | 2-year Storm (cfs) | 10-Year Storm (cfs) | 25-Year Storm (cfs) | 100-Year Storm (cfs) |
|---|---|---|---|---|
| Outlet Point #1 | 4.05 | 11.67 | 15.60 | 24.05 |
| Outlet Point #2 | 0.98 | 3.29 | 4.51 | 7.20 |
| Outlet Point #3 | 0.11 | 0.39 | 0.53 | 0.85 |

Refer to Appendix D for the results.

## DESIGN METHODOLOGY

The Hydrological Soil Group rating used in the analysis is A (from the National Cooperative Soil Survey) and the CN values used in the analysis was 0.36 for wooded area (fair condition), 0.76 for the gravel surface, and 0.98 for impervious surfaces.

HydroCAD Version 10.0 was utilized to evaluate the runoff volume and peak discharge rates of the pre and post-development conditions. 2-year, 10-year and 25-year and 100-year storm frequencies were use in the analysis with the following 24-hour rainfall totals; 2-year, 3.40 inches; 10-year, 5.00 inches; 25-year, 5.70 inches; 50-year and 100-year, 7.10 inches (New London County, Connecticut).

The level spreaders are sized using the guidelines of the Natural Resources Conservation Service - Conservation Practice Standard, Code 870 – Level Spreader (See Appendix D). For the expected flow rates for cross swales/level spreaders the minimum length of level spreader required is 20'. Due to the larger expected flow rate at the proposed compound the level spreader was sized to be greater than 30'. Therefore, the level spreaders provided are more than sufficient to properly control the receiving flow rates. If the level spreaders are constructed according to plan and the standard, there will be no "point source discharge".

## EROSION CONTROL

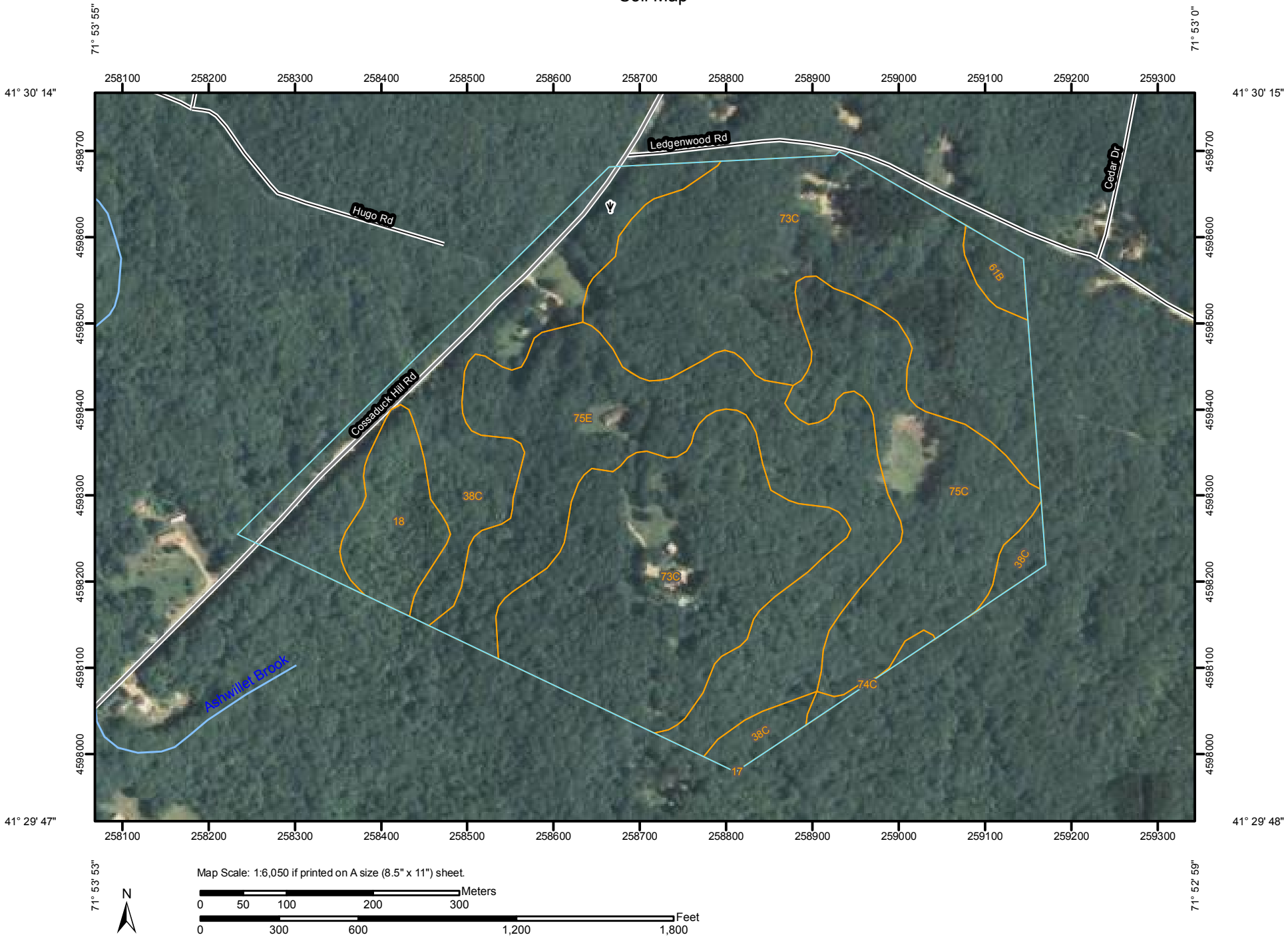
For temporary condition or during construction a combination silt fence shall be provided along the length of the access drive. Areas with a greater erosion potential shall be provided with straw bales and silt fence. All cross drainage swales and level spreaders shall be constructed as per design & specifications. All slopes shall be protected with slope stabilization measures.

For permanent condition, 2:1 slopes will be covered with erosion control blankets or rip rap.

# APPENDIX A

## Soil Map

# Custom Soil Resource Report
## Soil Map



## MAP LEGEND

**Area of Interest (AOI)**
- Area of Interest (AOI)

**Soils**
- Soil Map Units

**Special Point Features**
- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other

**Special Line Features**
- Gully
- Short Steep Slope
- Other

**Political Features**
- Cities

**Water Features**
- Streams and Canals

**Transportation**
- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

## MAP INFORMATION

Map Scale: 1:6,050 if printed on A size (8.5" × 11") sheet.

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

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

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
Coordinate System: UTM Zone 19N NAD83

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

Soil Survey Area: State of Connecticut
Survey Area Data: Version 10, Mar 31, 2011

Date(s) aerial images were photographed: 7/17/2006

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.

# Map Unit Legend

| State of Connecticut (CT600) | | | |
|---|---|---|---|
| **Map Unit Symbol** | **Map Unit Name** | **Acres in AOI** | **Percent of AOI** |
| 17 | Timakwa and Natchaug soils | 0.0 | 0.0% |
| 18 | Catden and Freetown soils | 4.4 | 4.2% |
| 38C | Hinckley gravelly sandy loam, 3 to 15 percent slopes | 17.6 | 16.6% |
| 61B | Canton and Charlton soils, 3 to 8 percent slopes, very stony | 1.1 | 1.1% |
| 73C | Charlton-Chatfield complex, 3 to 15 percent slopes, very rocky | 44.7 | 42.3% |
| 74C | Narragansett-Hollis complex, 3 to 15 percent slopes, very rocky | 0.4 | 0.4% |
| 75C | Hollis-Chatfield-Rock outcrop complex, 3 to 15 percent slopes | 14.4 | 13.6% |
| 75E | Hollis-Chatfield-Rock outcrop complex, 15 to 45 percent slopes | 23.0 | 21.7% |
| **Totals for Area of Interest** | | **105.6** | **100.0%** |

# Map Unit Descriptions

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with

USDA United States Department of Agriculture Natural Resources Conservation Service

Web Soil Survey

Contact Us | Download Soils Data | Archived Soil Surveys | Soil Survey Status | Glossary | Preferences | Link | Logout | Help | A A A

Area of Interest (AOI) | Soil Map | Soil Data Explorer | Shopping Cart (Free)

View Soil Information By Use: All Uses

Printable Version | Add to Shopping Cart

Intro to Soils | Suitabilities and Limitations for Use | Soil Properties and Qualities | Ecological Site Assessment | Soil Reports

## Search

Clear | Search

**Basic Search**

Enter keywords

**Advanced Search**

Clear | Search

## Properties and Qualities Ratings

Open All | Close All

Soil Chemical Properties

Soil Erosion Factors

Soil Physical Properties

**Soil Qualities and Features**

AASHTO Group Classification (Surface)

Depth to a Selected Soil Restrictive Layer

Depth to Any Soil Restrictive Layer

Drainage Class

Frost Action

Frost-Free Days

**Hydrologic Soil Group**

View Description | View Rating

**View Options**

Map ☑

Table ☑

Description of Rating ☑

Rating Options ☑

☐ Detailed Description

**Advanced Options**

Aggregation Method: Dominant Condition

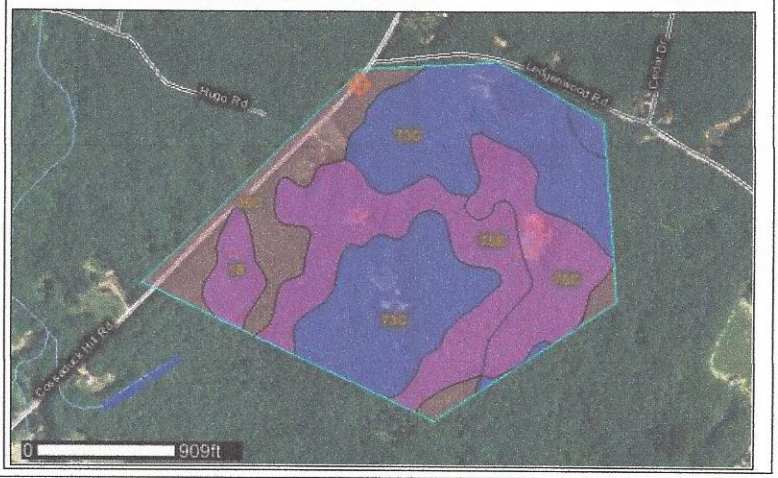
Component Percent Cutoff:

Tie-break Rule: ○ Lower ◉ Higher

View Description | View Rating

## Map — Hydrologic Soil Group

Scale (not to scale)




## Tables — Hydrologic Soil Group — Summary By Map Unit

**Summary by Map Unit — State of Connecticut (CT600)**

| Map unit symbol | Map unit name | Rating | Acres in AOI | Percent of AOI |
|---|---|---|---|---|
| 17 | Timakwa and Natchaug soils | D | 0.0 | 0.0% |
| 18 | Catden and Freetown soils | D | 4.4 | 4.2% |
| 38C | Hinckley gravelly sandy loam, 3 to 15 percent slopes | A | 17.6 | 16.6% |
| 61B | Canton and Charlton soils, 3 to 8 percent slopes, very stony | B | 1.1 | 1.1% |
| 73C | Charlton-Chatfield complex, 3 to 15 percent slopes, very rocky | B | 44.7 | 42.3% |
| 74C | Narragansett-Hollis complex, 3 to 15 percent slopes, very rocky | B | 0.4 | 0.4% |
| 75C | Hollis-Chatfield-Rock outcrop complex, 3 to 15 percent slopes | D | 14.4 | 13.6% |
| 75E | Hollis-Chatfield-Rock outcrop complex, 15 to 45 percent slopes | D | 23.0 | 21.7% |
| **Totals for Area of Interest** | | | **105.6** | **100.0%** |

## Description — Hydrologic Soil Group

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.

| |
|---|
| Map Unit Name |
| Parent Material Name |
| Representative Slope |
| Unified Soil Classification (Surface) |
| Water Features |

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 — Hydrologic Soil Group**

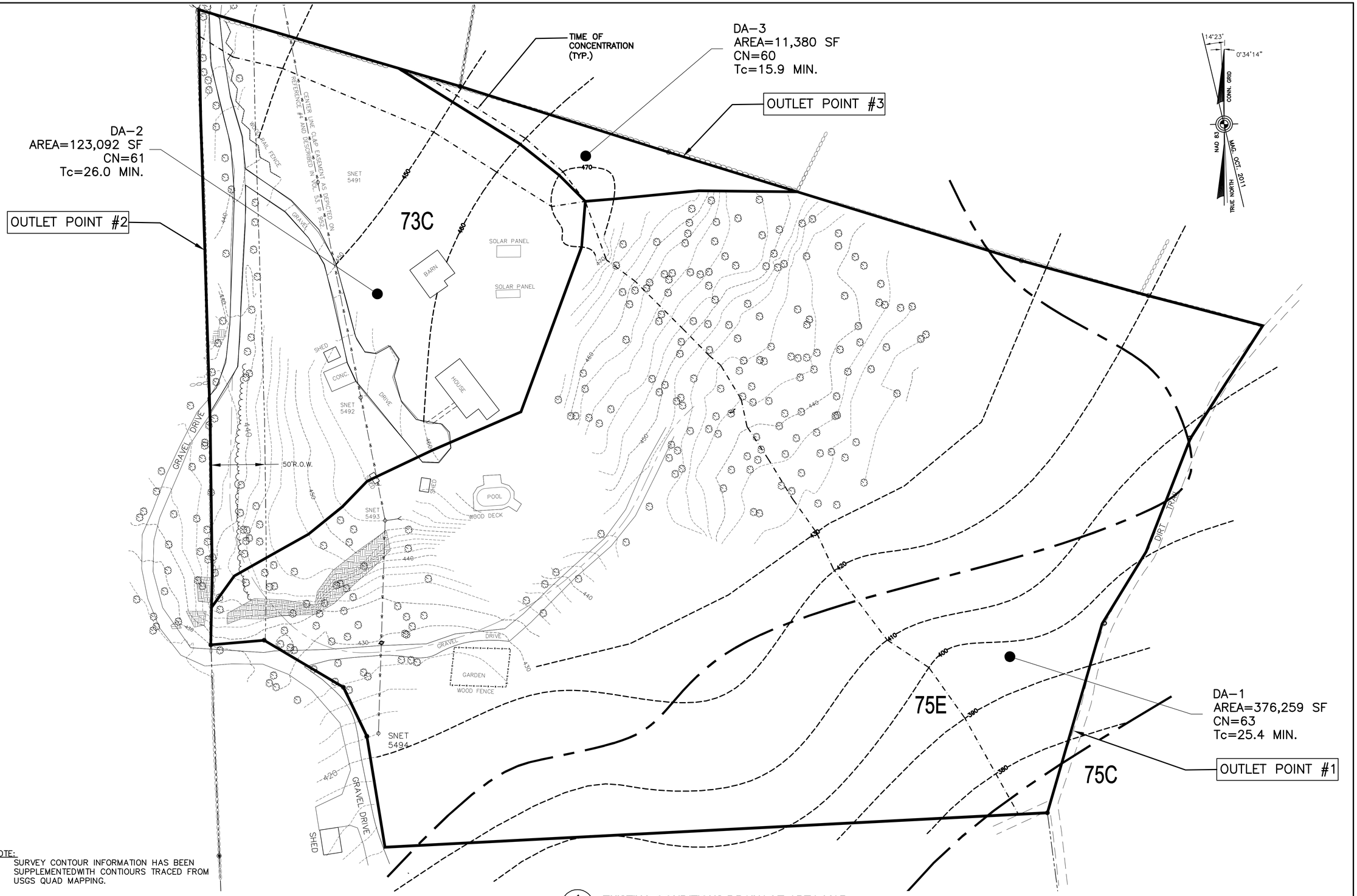
**Aggregation Method:** Dominant Condition

**Component Percent Cutoff:** *None Specified*

**Tie-break Rule:** Higher

# APPENDIX B

## Drainage Area Plans




NOTE:
1. SURVEY CONTOUR INFORMATION HAS BEEN SUPPLEMENTEDWITH CONTIOURS TRACED FROM USGS QUAD MAPPING.

SOIL LEGEND
73C –HICHARLTON–CHATFIELD COMPLEX, 3 TO 15 PERCENT SLOPES VERY ROCKY.

75C –HOLLIS–CHATFIELD–ROCK OUTCROP COMPLEX, 3 TO 15 PERCENT SLOPES.

75E –HOLLIS–CHATFIELD–ROCK OUTCROP COMPLEX, 15 TO 45 PERCENT SLOPES.

1 / DA-1 **EXISTING CONDITIONS DRAINAGE AREA MAP**
SCALE: 1"= 30'

GRAPHIC SCALE
30 0 15 30 60 120
( IN FEET )
1 inch = 30 ft.

| | |
|---|---|
| DESIGNED BY: | CFC |
| DRAWN BY: | TSP |
| CHK'D BY: | CFC |

| REV. | DATE | DRAWN BY | CHK'D BY | DESCRIPTION |
|---|---|---|---|---|
| 0 | 05/28/12 | DMD | CFC | DRAINAGE AREA MAPS ISSUED WITH DRAINAGE REPORT |

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350B COSSADUCK HILL ROAD
NORTH STONINGTON, CT

| | |
|---|---|
| DATE: | 05/28/12 |
| SCALE: | AS NOTED |
| JOB NO. | 10123 |

EXISTING CONDITIONS DRAINAGE AREA MAP

DA-1

Sheet No. 1 of 2

DA–2
AREA=123,092 SF
CN=61
Tc=26.0 MIN.

OUTLET POINT #2

TIME OF CONCENTRATION (TYP.)

DA–3
AREA=11,380 SF
CN=60
Tc=15.9 MIN.

OUTLET POINT #3

DA–1
AREA=376,259 SF
CN=64
Tc=21.1 MIN.

OUTLET POINT #1

73C

75E

75C

SNET 5491

SNET 5492

SNET 5493

SNET 5494

CENTER LINE CLARP EASEMENT AS DEPICTED ON REFERENCE #4 AND DESCRIBED IN VOL. 53 P. 525

WOOD RAIL FENCE

GRAVEL

barn=952 sf

BARN

SOLAR PANEL

SOLAR PANEL

9872 sf gravel drive

DRIVE

SHED

shed=129

CONC.

457 sf

house=1529 sf

HOUSE

GRAVEL DRIVE

50'R.O.W.

shed=109 sf

SHED

pool=1061 sf

POOL

WOOD DECK

ledge 2909 sf

gravel drive

GRAVEL

GARDEN

WOOD FENCE

GRAVEL DRIVE

SHED

DIRT TRACK

14°23'

0°34'14"

CONN. GRID

NAD 83

MAG. OCT. 2011

TRUE NORTH

NOTE:
1. SURVEY CONTOUR INFORMATION HAS BEEN SUPPLEMENTED WITH CONTOURS TRACED FROM USGS QUAD MAPPING.

SOIL LEGEND
73C –HICHARLTON–CHATFIELD COMPLEX, 3 TO 15 PERCENT SLOPES VERY ROCKY.

75C –HOLLIS–CHATFIELD–ROCK OUTCROP COMPLEX, 3 TO 15 PERCENT SLOPES.

75E –HOLLIS–CHATFIELD–ROCK OUTCROP COMPLEX, 15 TO 45 PERCENT SLOPES.

1 / DA–2 **PROPOSED CONDITIONS DRAINAGE AREA MAP**
SCALE: 1"= 30'

GRAPHIC SCALE
30 0 15 30 60 120
( IN FEET )
1 inch = 30 ft.

| | |
|---|---|
| DESIGNED BY: | CFC |
| DRAWN BY: | TSP |
| CHK'D BY: | CFC |

| REV. | DATE | DRAWN BY | CHK'D BY | DESCRIPTION |
|---|---|---|---|---|
| 0 | 05/28/12 | DMD | CFC | DRAINAGE AREA MAPS ISSUED WITH DRAINAGE REPORT |

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| | |
|---|---|
| DATE: | 05/28/12 |
| SCALE: | AS NOTED |
| JOB NO. | 10123 |

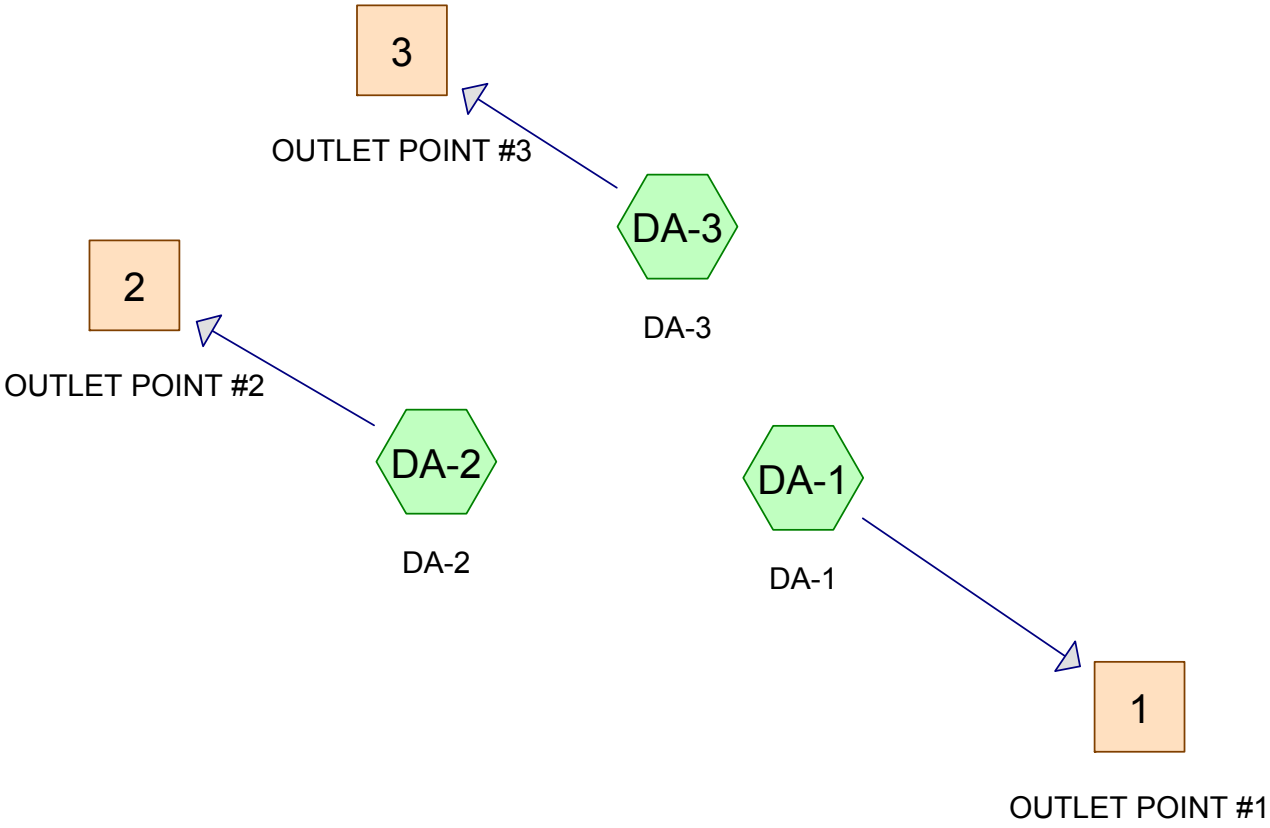
PROPOSED CONDITIONS DRAINAGE AREA MAP

DA–2

Sheet No. 2 of 2

# APPENDIX C

## Existing Conditions Hydrological Analysis




Subcat Reach Pond Link

**Drainage Diagram for EXISTING CONDITIONS**
Prepared by Microsoft, Printed 5/27/2012

## Area Listing (all nodes)

| Area (acres) | CN | Description (subcatchment-numbers) |
|---|---|---|
| 5.463 | 55 | Woods, Good, HSG B (DA-1, DA-2) |
| 0.261 | 60 | Woods, Fair, HSG B (DA-3) |
| 3.111 | 61 | >75% Grass cover, Good, HSG B (DA-1, DA-2) |
| 2.490 | 77 | Woods, Good, HSG D (DA-1) |
| 0.332 | 85 | Gravel roads, HSG B (DA-1, DA-2) |
| 0.087 | 98 | Roofs, HSG B (DA-1, DA-2) |
| 0.010 | 98 | Unconnected pavement, HSG B (DA-2) |
| **11.756** | 63 | **TOTAL AREA** |

## Soil Listing (all nodes)

| Area (acres) | Soil Group | Subcatchment Numbers |
|---|---|---|
| 0.000 | HSG A | |
| 9.265 | HSG B | DA-1, DA-2, DA-3 |
| 0.000 | HSG C | |
| 2.490 | HSG D | DA-1 |
| 0.000 | Other | |
| **11.756** | | **TOTAL AREA** |

Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

**Subcatchment DA-1: DA-1** Runoff Area=377,598 sf 0.31% Impervious Runoff Depth>0.53"
Flow Length=695' Tc=25.4 min CN=63 Runoff=3.84 cfs 0.382 af

**Subcatchment DA-2: DA-2** Runoff Area=123,092 sf 2.49% Impervious Runoff Depth>0.45"
Flow Length=384' Tc=26.0 min CN=61 Runoff=0.98 cfs 0.106 af

**Subcatchment DA-3: DA-3** Runoff Area=11,380 sf 0.00% Impervious Runoff Depth>0.42"
Flow Length=188' Slope=0.1380 '/' Tc=15.9 min CN=60 Runoff=0.11 cfs 0.009 af

**Reach 1: OUTLET POINT #1** Inflow=3.84 cfs 0.382 af
Outflow=3.84 cfs 0.382 af

**Reach 2: OUTLET POINT #2** Inflow=0.98 cfs 0.106 af
Outflow=0.98 cfs 0.106 af

**Reach 3: OUTLET POINT #3** Inflow=0.11 cfs 0.009 af
Outflow=0.11 cfs 0.009 af

**Total Runoff Area = 11.756 ac Runoff Volume = 0.497 af Average Runoff Depth = 0.51"**
**99.17% Pervious = 11.658 ac 0.83% Impervious = 0.097 ac**

## Summary for Subcatchment DA-1: DA-1

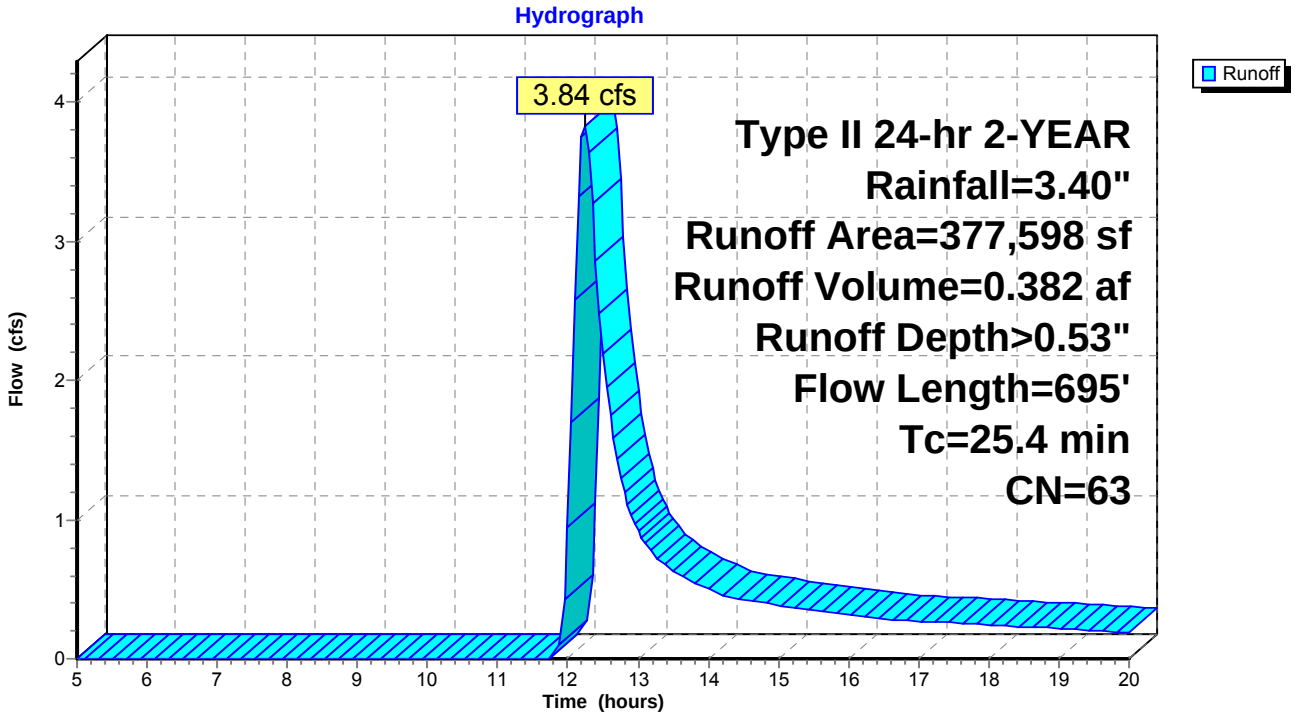
Runoff = 3.84 cfs @ 12.24 hrs, Volume= 0.382 af, Depth> 0.53"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 2-YEAR Rainfall=3.40"

| Area (sf) | CN | Description |
|---|---|---|
| 108,483 | 77 | Woods, Good, HSG D |
| 1,170 | 98 | Roofs, HSG B |
| 4,595 | 85 | Gravel roads, HSG B |
| 177,404 | 55 | Woods, Good, HSG B |
| 85,946 | 61 | >75% Grass cover, Good, HSG B |
| 377,598 | 63 | Weighted Average |
| 376,428 | | 99.69% Pervious Area |
| 1,170 | | 0.31% Impervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|---|---|---|---|---|---|
| 22.2 | 300 | 0.1540 | 0.23 | | **Sheet Flow, SEGMENT #1** Woods: Light underbrush n= 0.400 P2= 3.40" |
| 3.2 | 395 | 0.1680 | 2.05 | | **Shallow Concentrated Flow, SEGMENT #2** Woodland Kv= 5.0 fps |
| 25.4 | 695 | Total | | | |

## Subcatchment DA-1: DA-1



## Summary for Subcatchment DA-2: DA-2

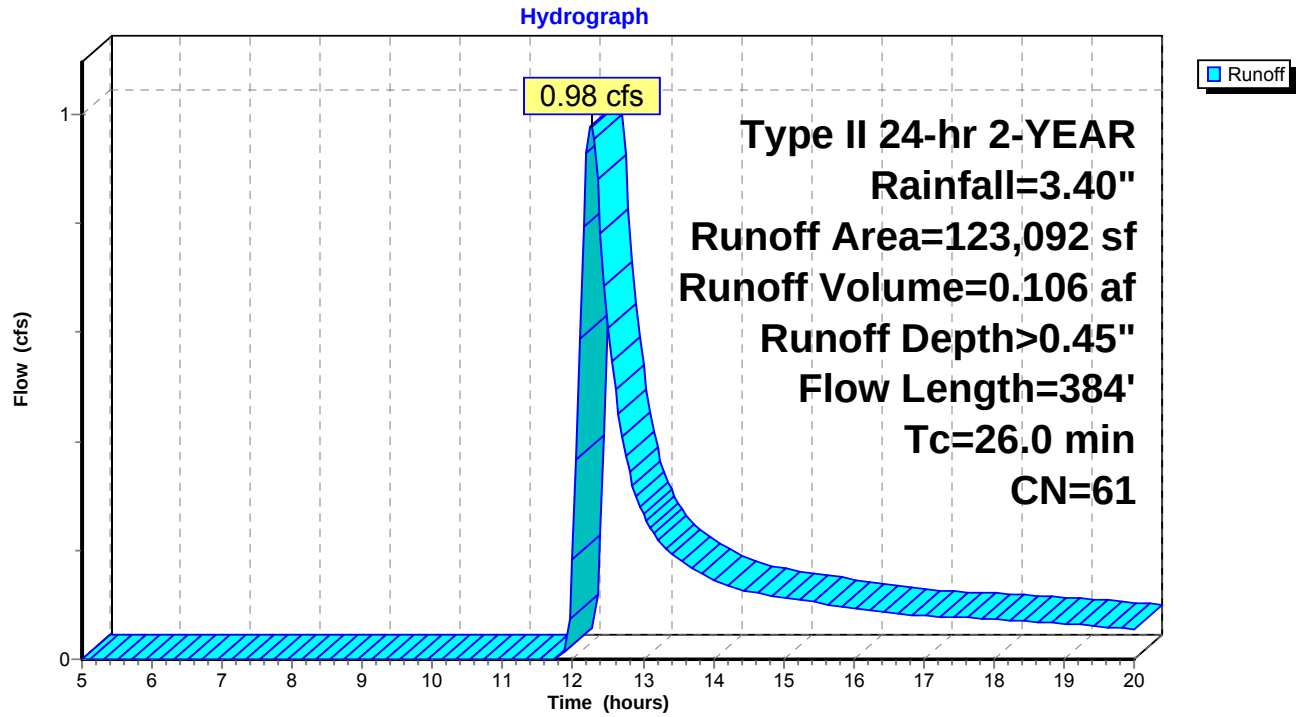
Runoff = 0.98 cfs @ 12.26 hrs, Volume= 0.106 af, Depth> 0.45"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 2-YEAR Rainfall=3.40"

| Area (sf) | CN | Description |
|---|---|---|
| 9,872 | 85 | Gravel roads, HSG B |
| 2,610 | 98 | Roofs, HSG B |
| 457 | 98 | Unconnected pavement, HSG B |
| 49,569 | 61 | >75% Grass cover, Good, HSG B |
| 60,584 | 55 | Woods, Good, HSG B |
| 123,092 | 61 | Weighted Average |
| 120,025 | | 97.51% Pervious Area |
| 3,067 | | 2.49% Impervious Area |
| 457 | | 14.90% Unconnected |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|---|---|---|---|---|---|
| 24.9 | 300 | 0.1150 | 0.20 | | **Sheet Flow, SEGMENT #1** Woods: Light underbrush n= 0.400 P2= 3.40" |
| 1.1 | 84 | 0.0645 | 1.27 | | **Shallow Concentrated Flow, SEGMENT #2** Woodland Kv= 5.0 fps |
| 26.0 | 384 | Total | | | |

## Subcatchment DA-2: DA-2



## Summary for Subcatchment DA-3: DA-3

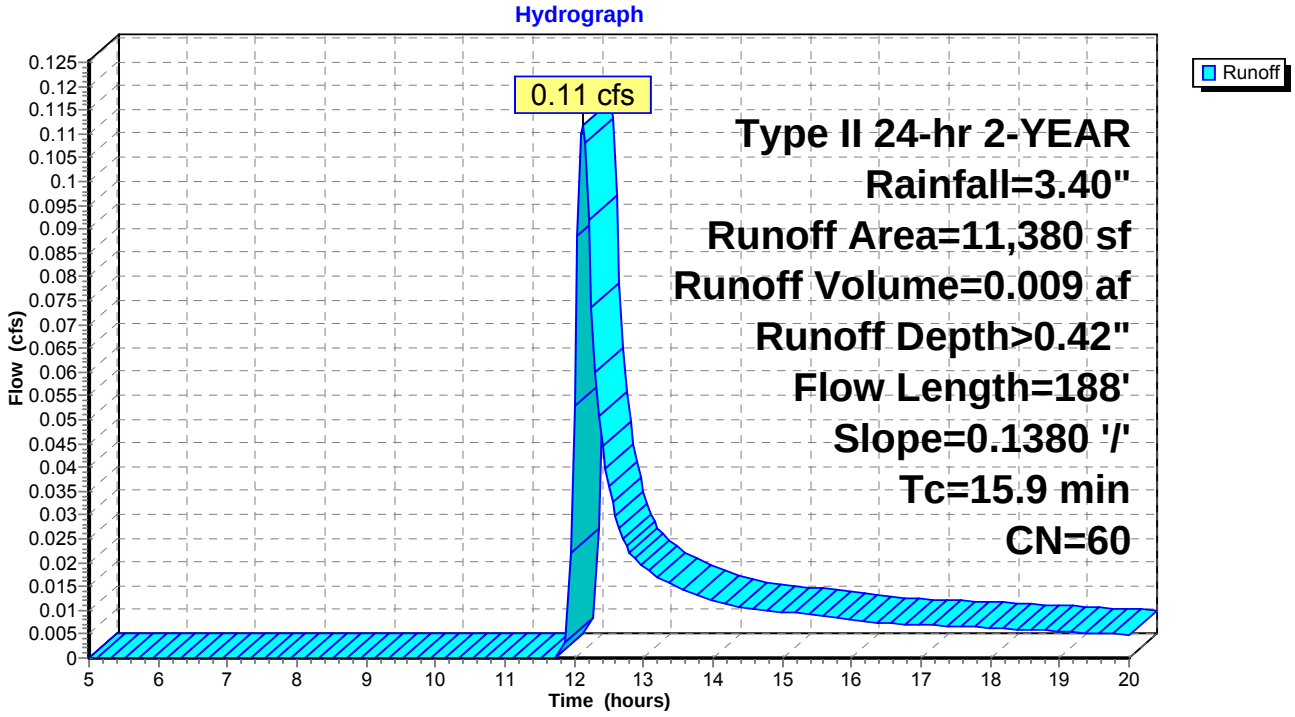
Runoff = 0.11 cfs @ 12.12 hrs, Volume= 0.009 af, Depth> 0.42"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 2-YEAR Rainfall=3.40"

| Area (sf) | CN | Description |
|---|---|---|
| 11,380 | 60 | Woods, Fair, HSG B |
| 11,380 | | 100.00% Pervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|---|---|---|---|---|---|
| 15.9 | 188 | 0.1380 | 0.20 | | **Sheet Flow, SEGMENT 1**<br>Woods: Light underbrush n= 0.400 P2= 3.40" |

## Subcatchment DA-3: DA-3

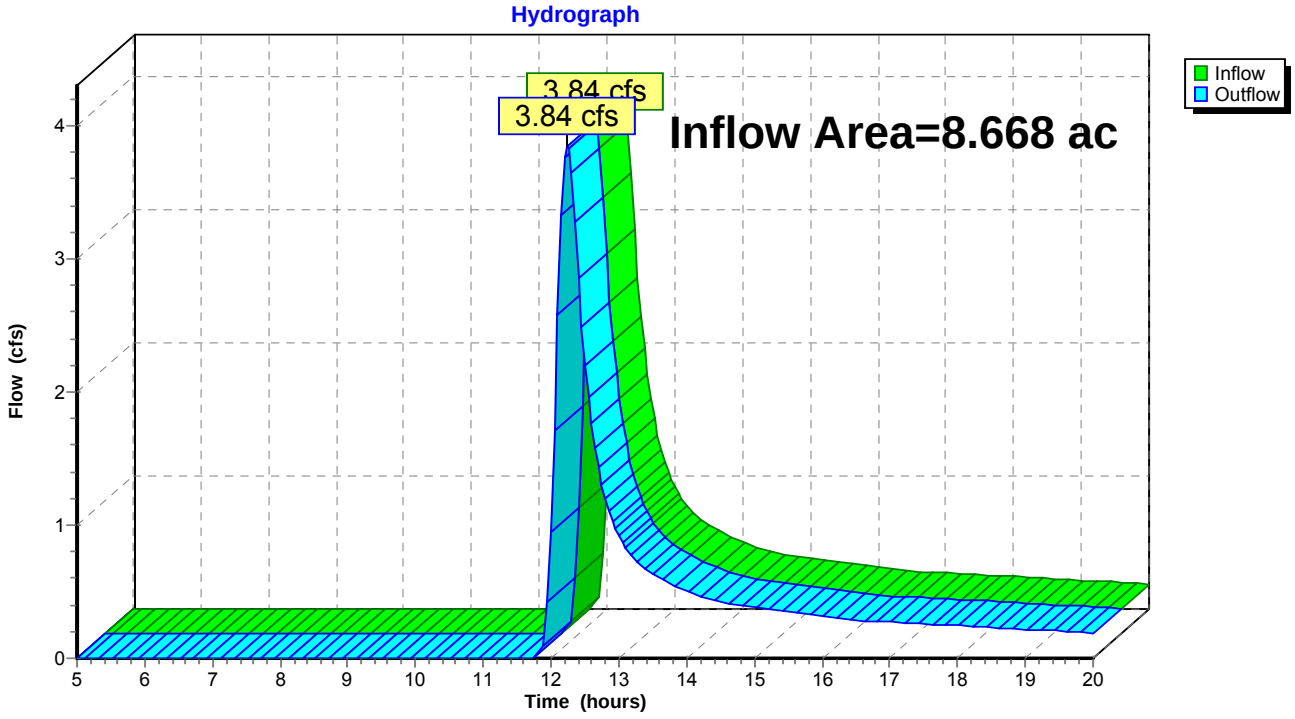


## Summary for Reach 1: OUTLET POINT #1

Inflow Area = 8.668 ac, 0.31% Impervious, Inflow Depth > 0.53" for 2-YEAR event
Inflow = 3.84 cfs @ 12.24 hrs, Volume= 0.382 af
Outflow = 3.84 cfs @ 12.24 hrs, Volume= 0.382 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

### Reach 1: OUTLET POINT #1

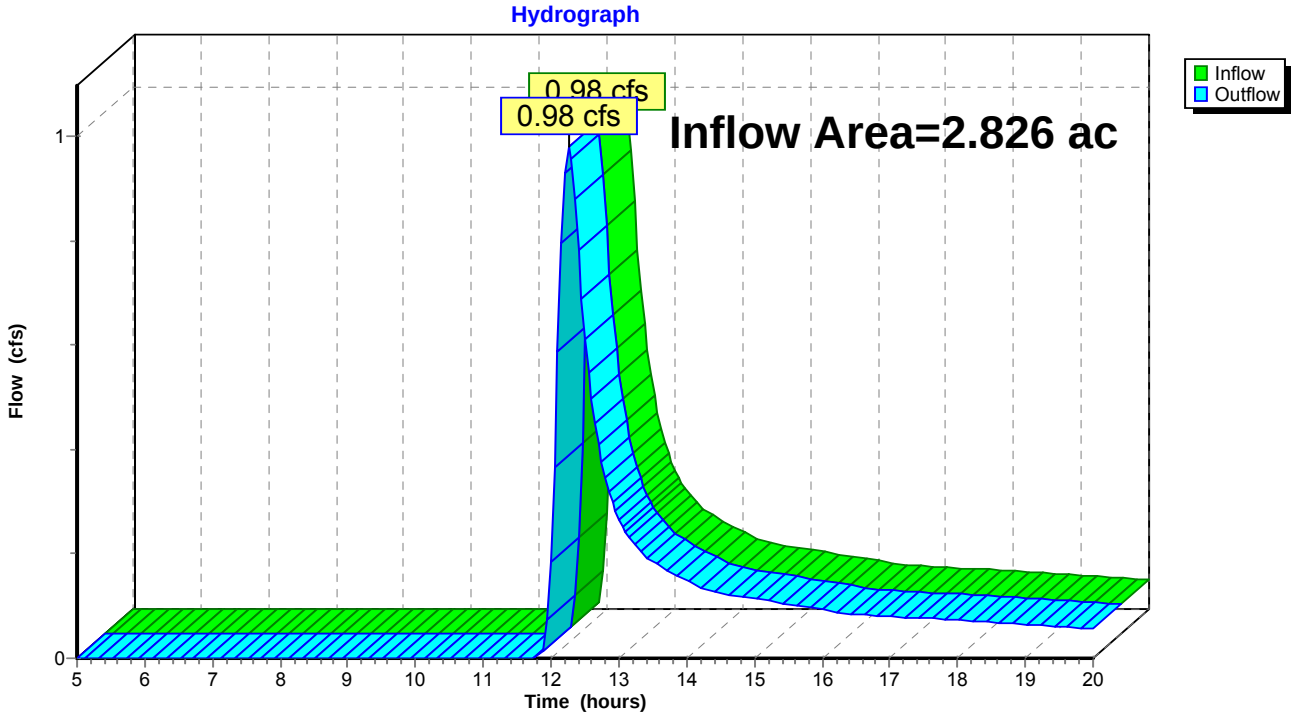


## Summary for Reach 2: OUTLET POINT #2

Inflow Area = 2.826 ac, 2.49% Impervious, Inflow Depth > 0.45" for 2-YEAR event
Inflow = 0.98 cfs @ 12.26 hrs, Volume= 0.106 af
Outflow = 0.98 cfs @ 12.26 hrs, Volume= 0.106 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

### Reach 2: OUTLET POINT #2

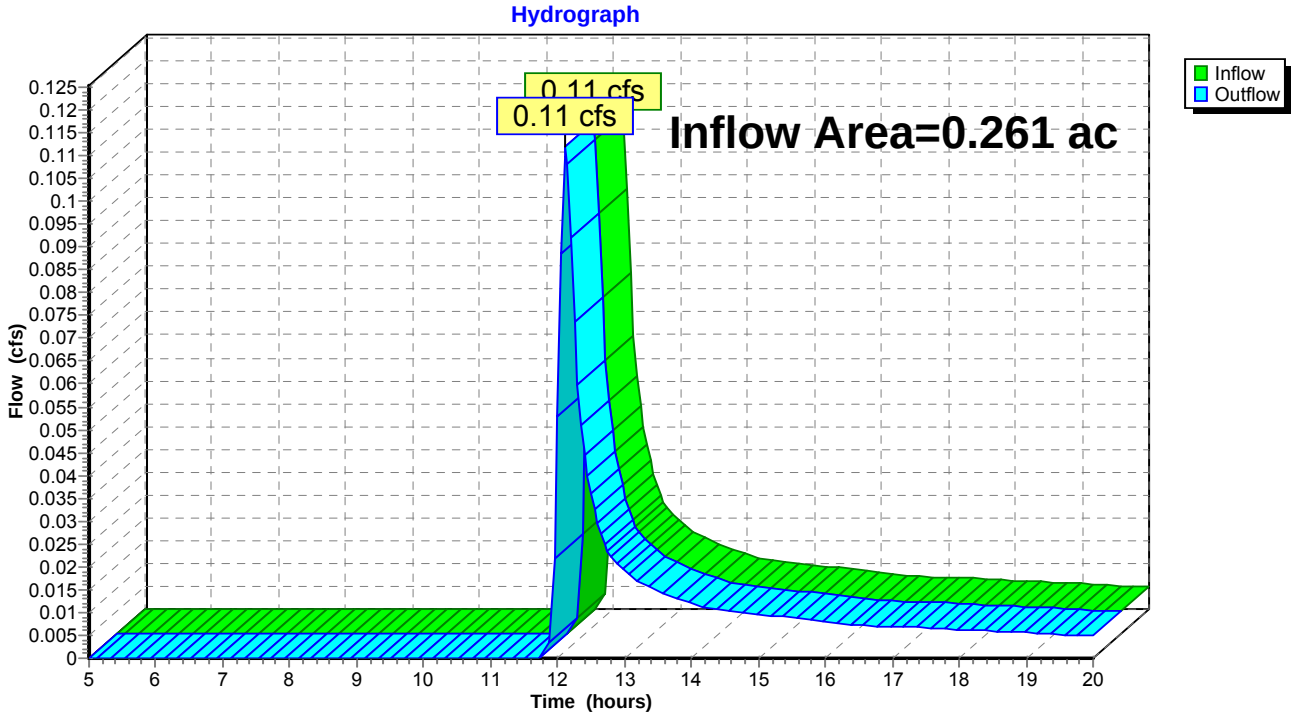


## Summary for Reach 3: OUTLET POINT #3

Inflow Area = 0.261 ac, 0.00% Impervious, Inflow Depth > 0.42" for 2-YEAR event
Inflow = 0.11 cfs @ 12.12 hrs, Volume= 0.009 af
Outflow = 0.11 cfs @ 12.12 hrs, Volume= 0.009 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

## Reach 3: OUTLET POINT #3



Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

**Subcatchment DA-1: DA-1** Runoff Area=377,598 sf 0.31% Impervious Runoff Depth>1.34"
Flow Length=695' Tc=25.4 min CN=63 Runoff=11.59 cfs 0.971 af

**Subcatchment DA-2: DA-2** Runoff Area=123,092 sf 2.49% Impervious Runoff Depth>1.21"
Flow Length=384' Tc=26.0 min CN=61 Runoff=3.29 cfs 0.286 af

**Subcatchment DA-3: DA-3** Runoff Area=11,380 sf 0.00% Impervious Runoff Depth>1.16"
Flow Length=188' Slope=0.1380 '/' Tc=15.9 min CN=60 Runoff=0.39 cfs 0.025 af

**Reach 1: OUTLET POINT #1** Inflow=11.59 cfs 0.971 af
Outflow=11.59 cfs 0.971 af

**Reach 2: OUTLET POINT #2** Inflow=3.29 cfs 0.286 af
Outflow=3.29 cfs 0.286 af

**Reach 3: OUTLET POINT #3** Inflow=0.39 cfs 0.025 af
Outflow=0.39 cfs 0.025 af

**Total Runoff Area = 11.756 ac Runoff Volume = 1.281 af Average Runoff Depth = 1.31"**
**99.17% Pervious = 11.658 ac 0.83% Impervious = 0.097 ac**

## Summary for Subcatchment DA-1: DA-1

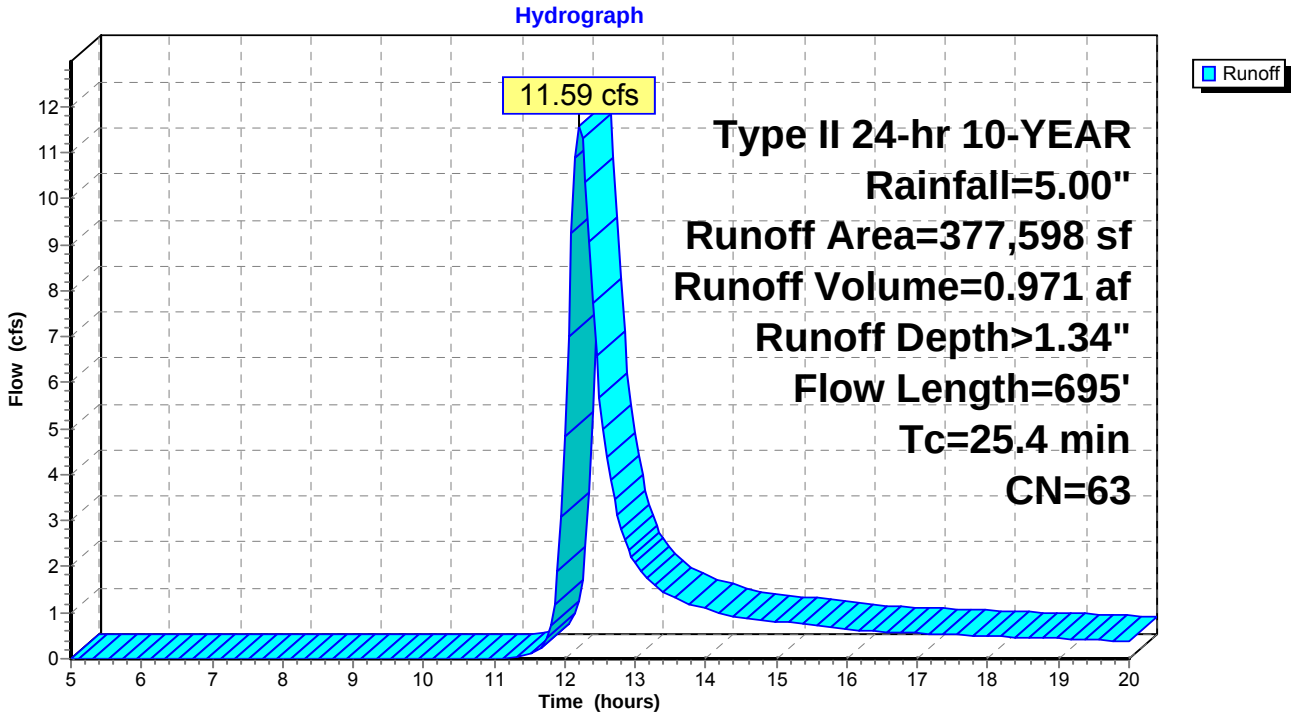
Runoff = 11.59 cfs @ 12.21 hrs, Volume= 0.971 af, Depth> 1.34"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 10-YEAR Rainfall=5.00"

| Area (sf) | CN | Description |
|---|---|---|
| 108,483 | 77 | Woods, Good, HSG D |
| 1,170 | 98 | Roofs, HSG B |
| 4,595 | 85 | Gravel roads, HSG B |
| 177,404 | 55 | Woods, Good, HSG B |
| 85,946 | 61 | >75% Grass cover, Good, HSG B |
| 377,598 | 63 | Weighted Average |
| 376,428 | | 99.69% Pervious Area |
| 1,170 | | 0.31% Impervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|---|---|---|---|---|---|
| 22.2 | 300 | 0.1540 | 0.23 | | **Sheet Flow, SEGMENT #1** Woods: Light underbrush n= 0.400 P2= 3.40" |
| 3.2 | 395 | 0.1680 | 2.05 | | **Shallow Concentrated Flow, SEGMENT #2** Woodland Kv= 5.0 fps |
| 25.4 | 695 | Total | | | |

## Subcatchment DA-1: DA-1



## Summary for Subcatchment DA-2: DA-2

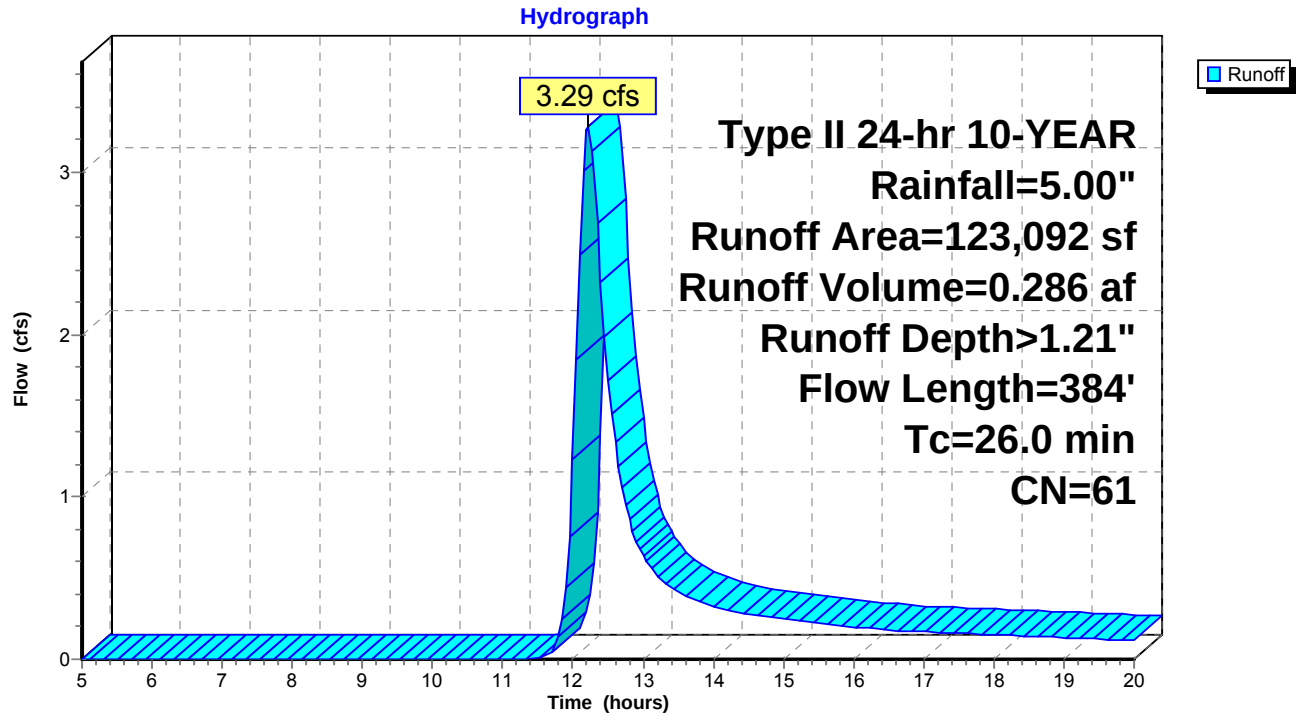
Runoff = 3.29 cfs @ 12.22 hrs, Volume= 0.286 af, Depth> 1.21"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 10-YEAR Rainfall=5.00"

| Area (sf) | CN | Description |
|---|---|---|
| 9,872 | 85 | Gravel roads, HSG B |
| 2,610 | 98 | Roofs, HSG B |
| 457 | 98 | Unconnected pavement, HSG B |
| 49,569 | 61 | >75% Grass cover, Good, HSG B |
| 60,584 | 55 | Woods, Good, HSG B |
| 123,092 | 61 | Weighted Average |
| 120,025 | | 97.51% Pervious Area |
| 3,067 | | 2.49% Impervious Area |
| 457 | | 14.90% Unconnected |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|---|---|---|---|---|---|
| 24.9 | 300 | 0.1150 | 0.20 | | **Sheet Flow, SEGMENT #1** Woods: Light underbrush n= 0.400 P2= 3.40" |
| 1.1 | 84 | 0.0645 | 1.27 | | **Shallow Concentrated Flow, SEGMENT #2** Woodland Kv= 5.0 fps |
| 26.0 | 384 | Total | | | |

## Subcatchment DA-2: DA-2



## Summary for Subcatchment DA-3: DA-3

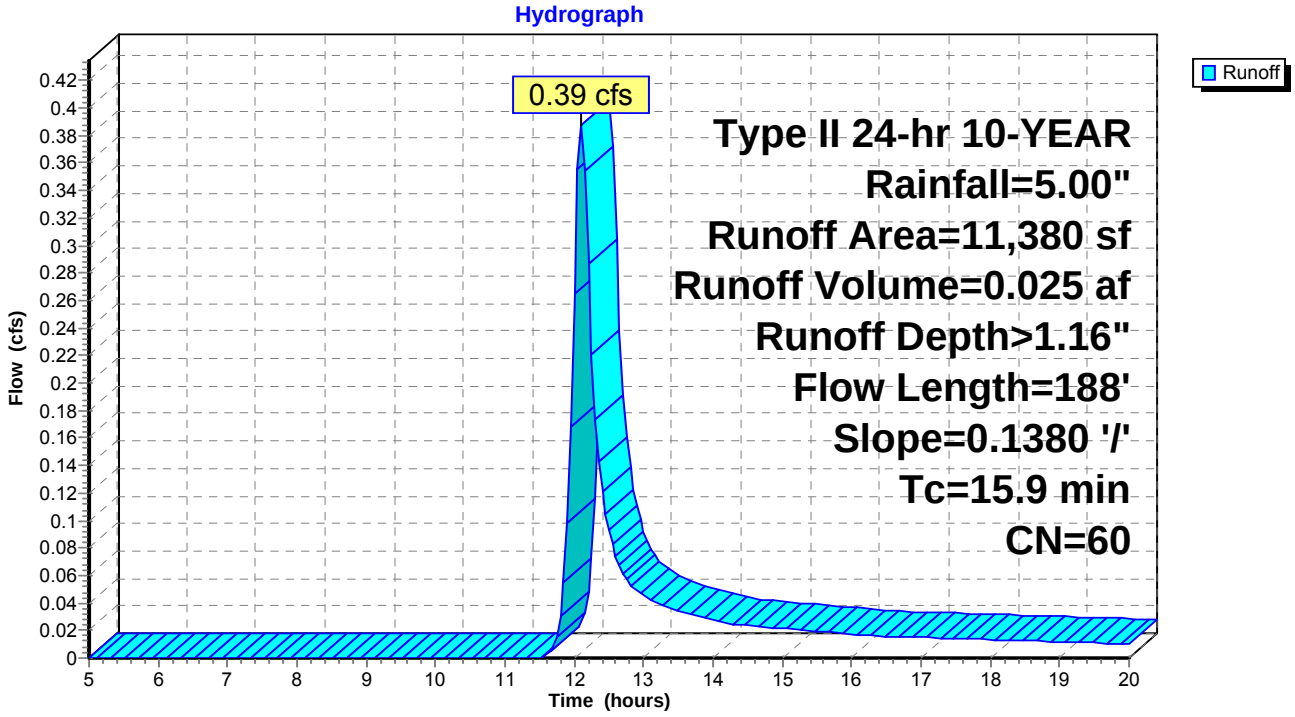
Runoff = 0.39 cfs @ 12.10 hrs, Volume= 0.025 af, Depth> 1.16"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 10-YEAR Rainfall=5.00"

| Area (sf) | CN | Description |
|---|---|---|
| 11,380 | 60 | Woods, Fair, HSG B |
| 11,380 | | 100.00% Pervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|---|---|---|---|---|---|
| 15.9 | 188 | 0.1380 | 0.20 | | **Sheet Flow, SEGMENT 1**<br>Woods: Light underbrush n= 0.400 P2= 3.40" |

## Subcatchment DA-3: DA-3

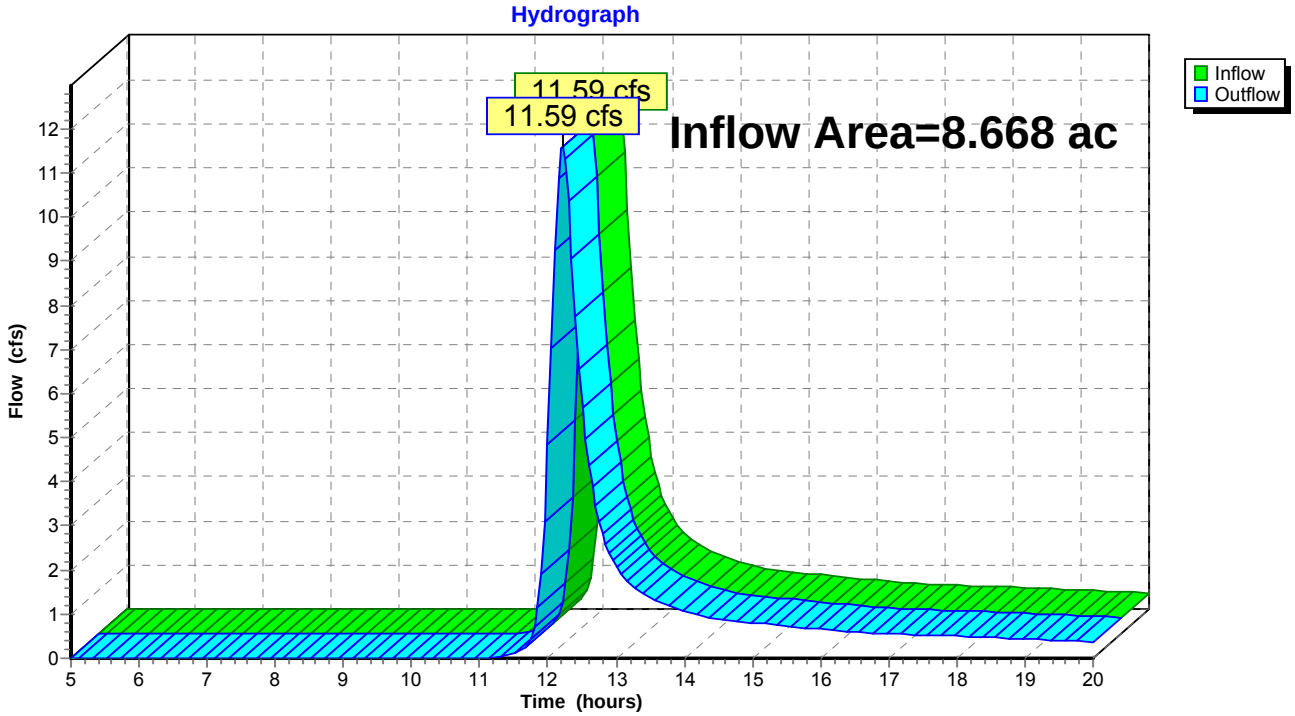


## Summary for Reach 1: OUTLET POINT #1

Inflow Area = 8.668 ac, 0.31% Impervious, Inflow Depth > 1.34" for 10-YEAR event
Inflow = 11.59 cfs @ 12.21 hrs, Volume= 0.971 af
Outflow = 11.59 cfs @ 12.21 hrs, Volume= 0.971 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

### Reach 1: OUTLET POINT #1

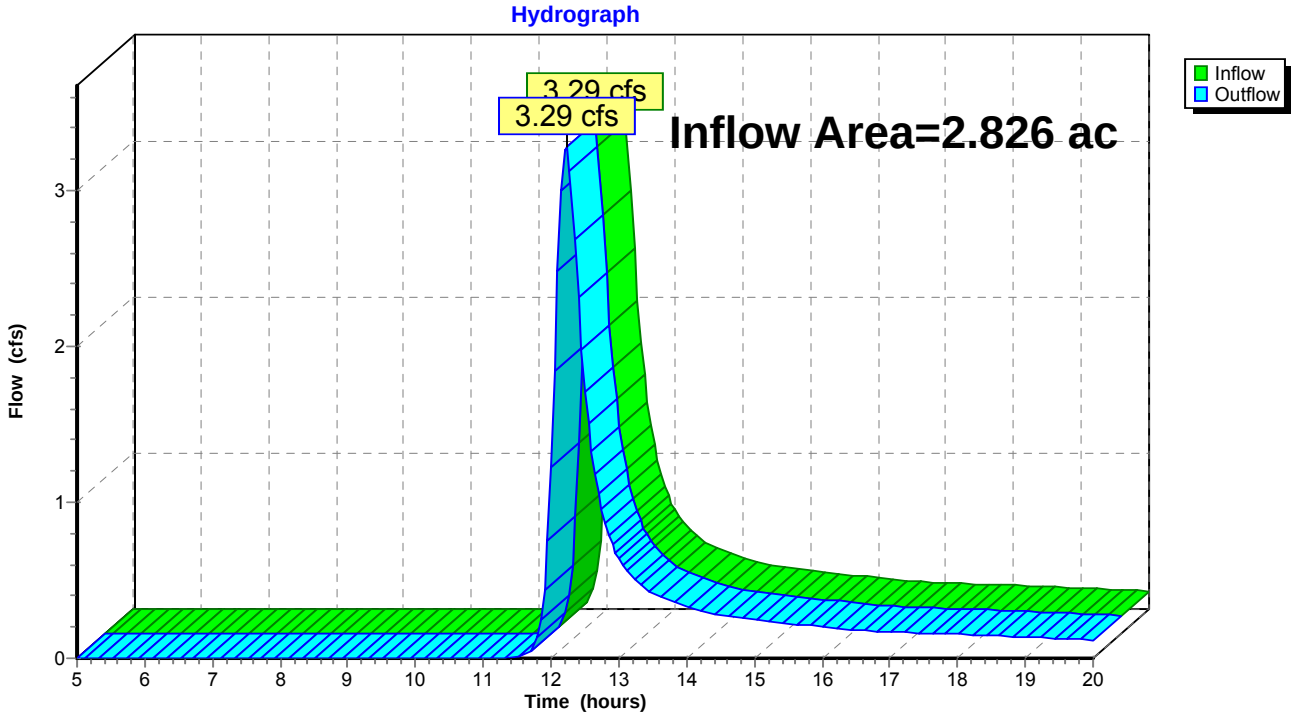


## Summary for Reach 2: OUTLET POINT #2

Inflow Area = 2.826 ac, 2.49% Impervious, Inflow Depth > 1.21" for 10-YEAR event
Inflow = 3.29 cfs @ 12.22 hrs, Volume= 0.286 af
Outflow = 3.29 cfs @ 12.22 hrs, Volume= 0.286 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

## Reach 2: OUTLET POINT #2

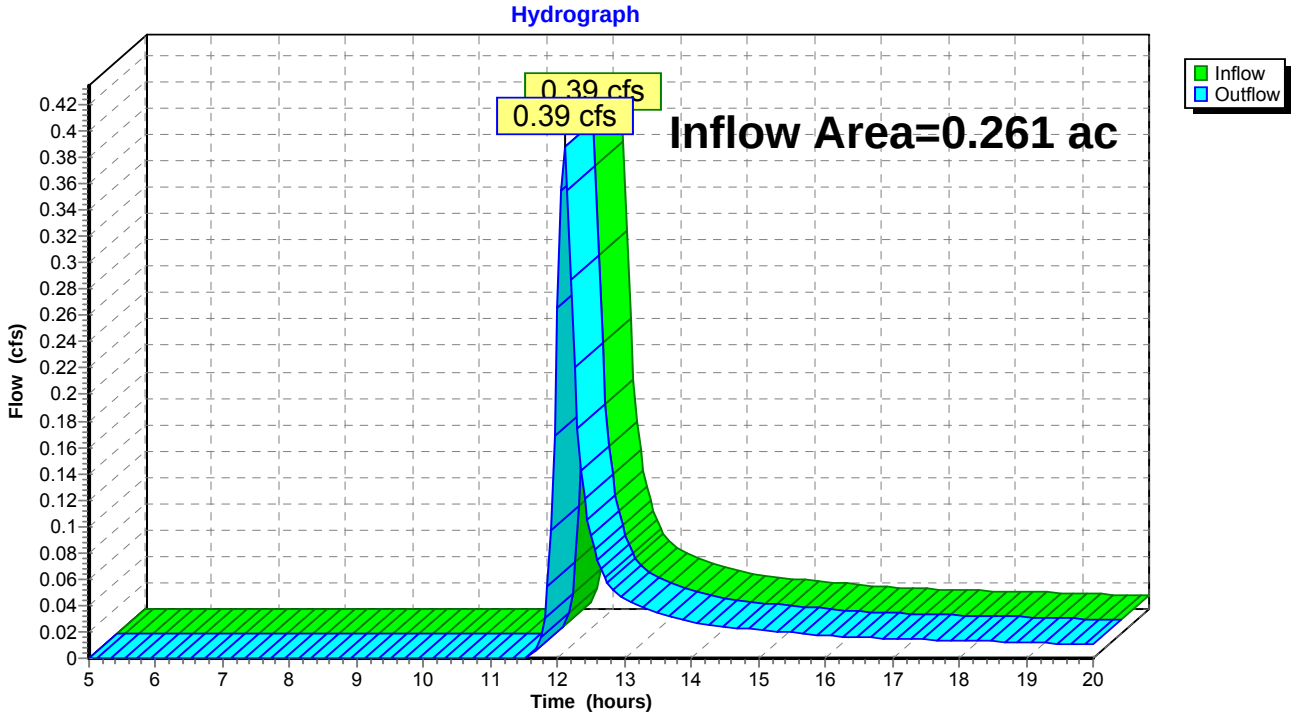


## Summary for Reach 3: OUTLET POINT #3

Inflow Area = 0.261 ac, 0.00% Impervious, Inflow Depth > 1.16" for 10-YEAR event
Inflow = 0.39 cfs @ 12.10 hrs, Volume= 0.025 af
Outflow = 0.39 cfs @ 12.10 hrs, Volume= 0.025 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

## Reach 3: OUTLET POINT #3



Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

**Subcatchment DA-1: DA-1** Runoff Area=377,598 sf 0.31% Impervious Runoff Depth>1.77"
Flow Length=695' Tc=25.4 min CN=63 Runoff=15.59 cfs 1.276 af

**Subcatchment DA-2: DA-2** Runoff Area=123,092 sf 2.49% Impervious Runoff Depth>1.61"
Flow Length=384' Tc=26.0 min CN=61 Runoff=4.51 cfs 0.380 af

**Subcatchment DA-3: DA-3** Runoff Area=11,380 sf 0.00% Impervious Runoff Depth>1.55"
Flow Length=188' Slope=0.1380 '/' Tc=15.9 min CN=60 Runoff=0.53 cfs 0.034 af

**Reach 1: OUTLET POINT #1** Inflow=15.59 cfs 1.276 af
Outflow=15.59 cfs 1.276 af

**Reach 2: OUTLET POINT #2** Inflow=4.51 cfs 0.380 af
Outflow=4.51 cfs 0.380 af

**Reach 3: OUTLET POINT #3** Inflow=0.53 cfs 0.034 af
Outflow=0.53 cfs 0.034 af

**Total Runoff Area = 11.756 ac Runoff Volume = 1.690 af Average Runoff Depth = 1.72"**
**99.17% Pervious = 11.658 ac 0.83% Impervious = 0.097 ac**

## Summary for Subcatchment DA-1: DA-1

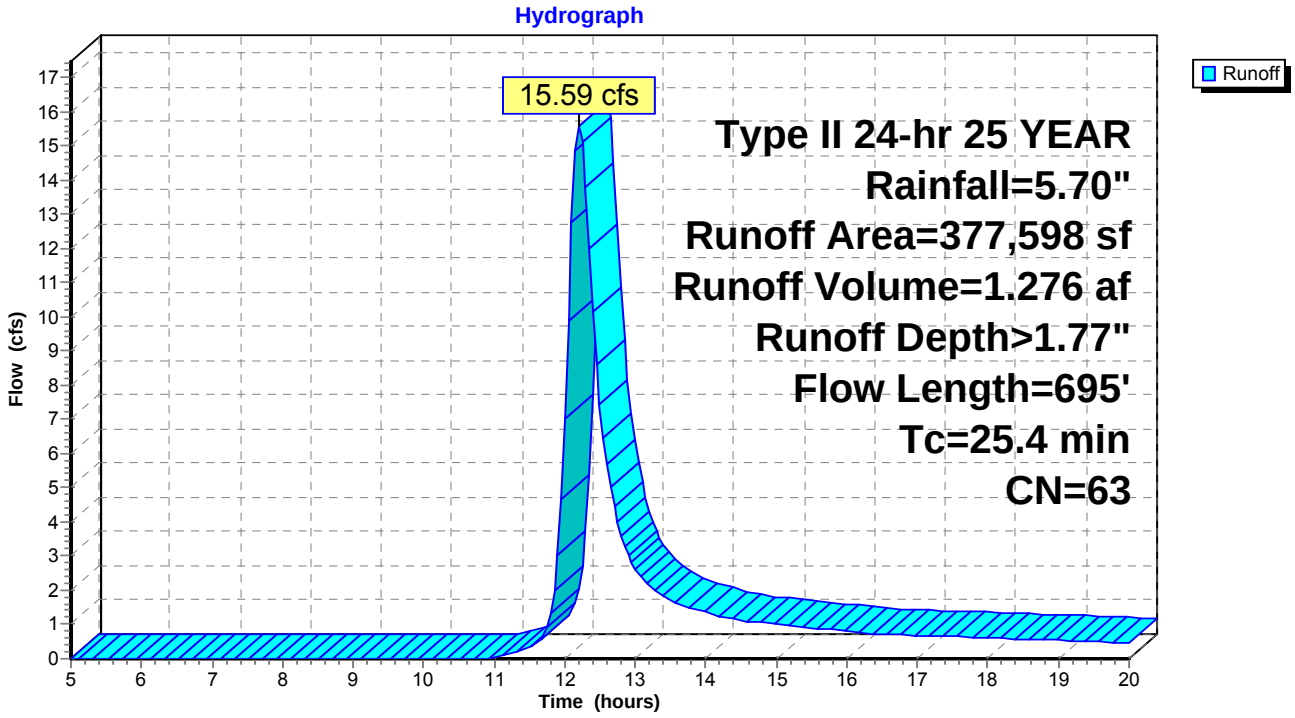
Runoff = 15.59 cfs @ 12.21 hrs, Volume= 1.276 af, Depth> 1.77"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 25 YEAR Rainfall=5.70"

| Area (sf) | CN | Description |
|---|---|---|
| 108,483 | 77 | Woods, Good, HSG D |
| 1,170 | 98 | Roofs, HSG B |
| 4,595 | 85 | Gravel roads, HSG B |
| 177,404 | 55 | Woods, Good, HSG B |
| 85,946 | 61 | >75% Grass cover, Good, HSG B |
| 377,598 | 63 | Weighted Average |
| 376,428 | | 99.69% Pervious Area |
| 1,170 | | 0.31% Impervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|---|---|---|---|---|---|
| 22.2 | 300 | 0.1540 | 0.23 | | **Sheet Flow, SEGMENT #1** Woods: Light underbrush n= 0.400 P2= 3.40" |
| 3.2 | 395 | 0.1680 | 2.05 | | **Shallow Concentrated Flow, SEGMENT #2** Woodland Kv= 5.0 fps |
| 25.4 | 695 | Total | | | |

## Subcatchment DA-1: DA-1



## Summary for Subcatchment DA-2: DA-2

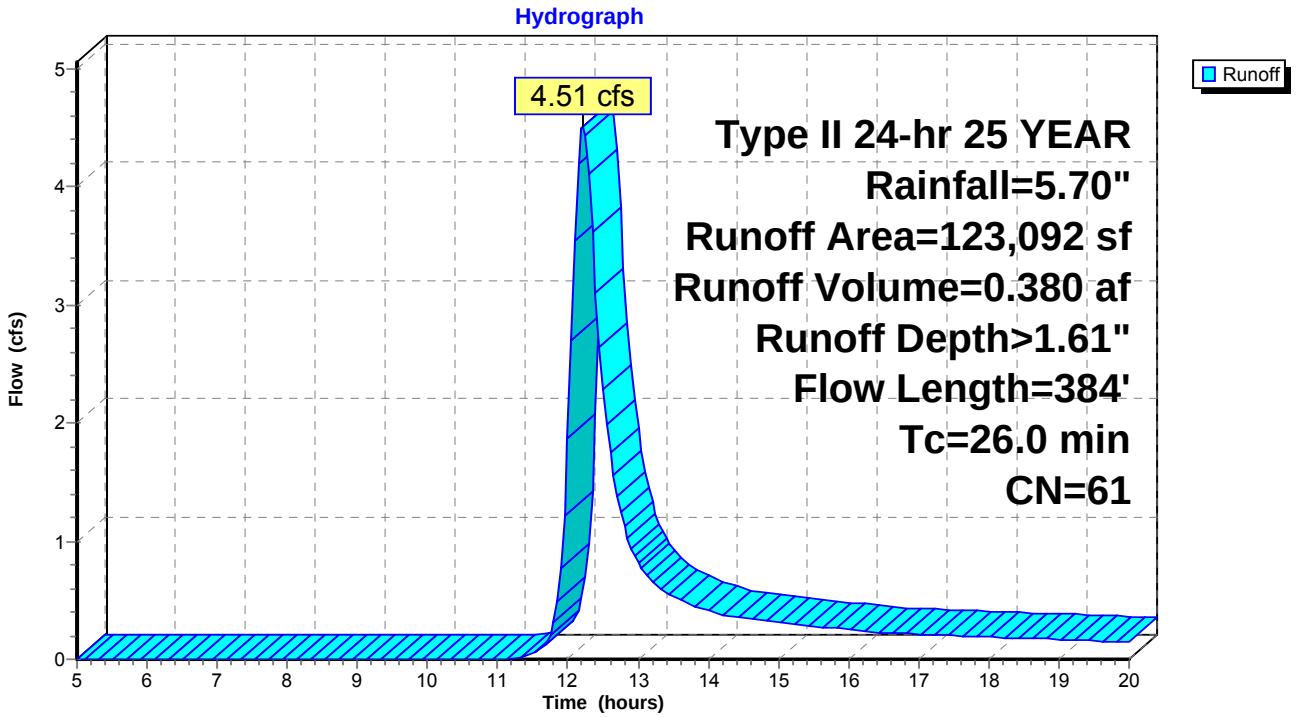
Runoff = 4.51 cfs @ 12.22 hrs, Volume= 0.380 af, Depth> 1.61"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 25 YEAR Rainfall=5.70"

| Area (sf) | CN | Description |
|---|---|---|
| 9,872 | 85 | Gravel roads, HSG B |
| 2,610 | 98 | Roofs, HSG B |
| 457 | 98 | Unconnected pavement, HSG B |
| 49,569 | 61 | >75% Grass cover, Good, HSG B |
| 60,584 | 55 | Woods, Good, HSG B |
| 123,092 | 61 | Weighted Average |
| 120,025 | | 97.51% Pervious Area |
| 3,067 | | 2.49% Impervious Area |
| 457 | | 14.90% Unconnected |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|---|---|---|---|---|---|
| 24.9 | 300 | 0.1150 | 0.20 | | **Sheet Flow, SEGMENT #1** Woods: Light underbrush n= 0.400 P2= 3.40" |
| 1.1 | 84 | 0.0645 | 1.27 | | **Shallow Concentrated Flow, SEGMENT #2** Woodland Kv= 5.0 fps |
| 26.0 | 384 | Total | | | |

## Subcatchment DA-2: DA-2



## Summary for Subcatchment DA-3: DA-3

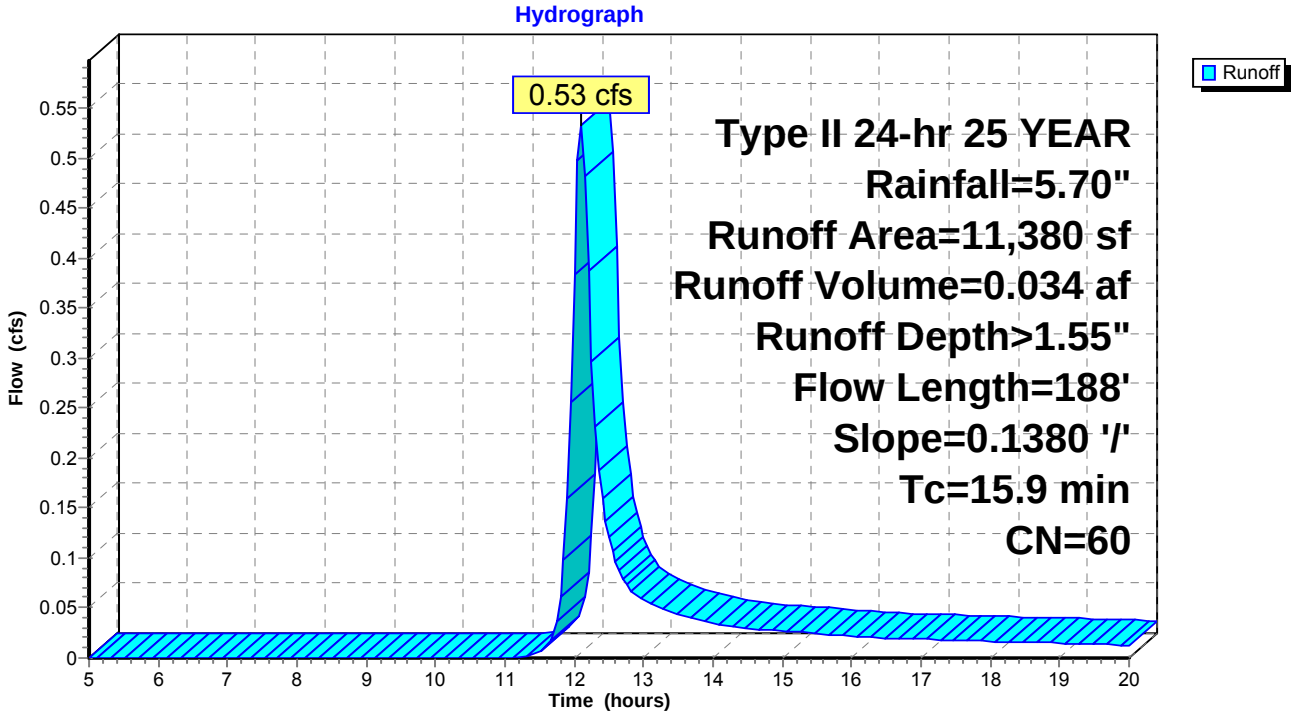
Runoff = 0.53 cfs @ 12.10 hrs, Volume= 0.034 af, Depth> 1.55"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 25 YEAR Rainfall=5.70"

| Area (sf) | CN | Description |
|---|---|---|
| 11,380 | 60 | Woods, Fair, HSG B |
| 11,380 | | 100.00% Pervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|---|---|---|---|---|---|
| 15.9 | 188 | 0.1380 | 0.20 | | **Sheet Flow, SEGMENT 1** Woods: Light underbrush n= 0.400 P2= 3.40" |

## Subcatchment DA-3: DA-3

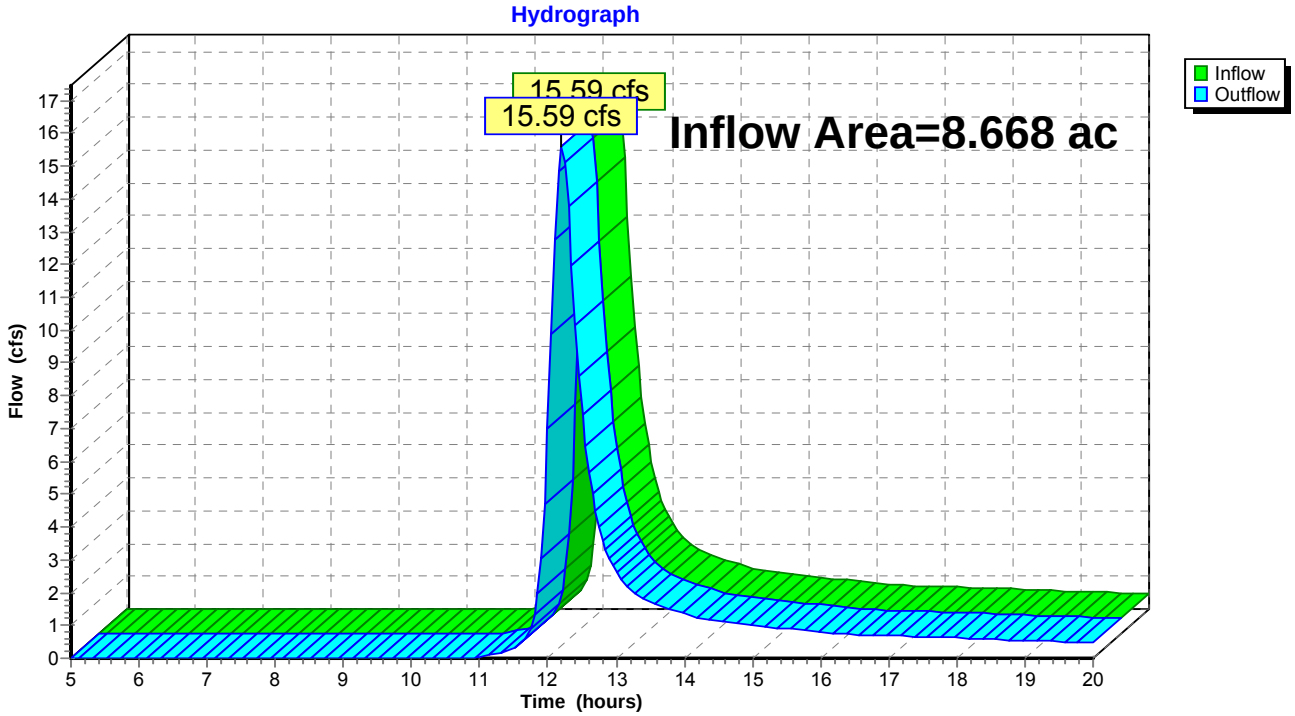


## Summary for Reach 1: OUTLET POINT #1

Inflow Area = 8.668 ac, 0.31% Impervious, Inflow Depth > 1.77" for 25 YEAR event
Inflow = 15.59 cfs @ 12.21 hrs, Volume= 1.276 af
Outflow = 15.59 cfs @ 12.21 hrs, Volume= 1.276 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

### Reach 1: OUTLET POINT #1

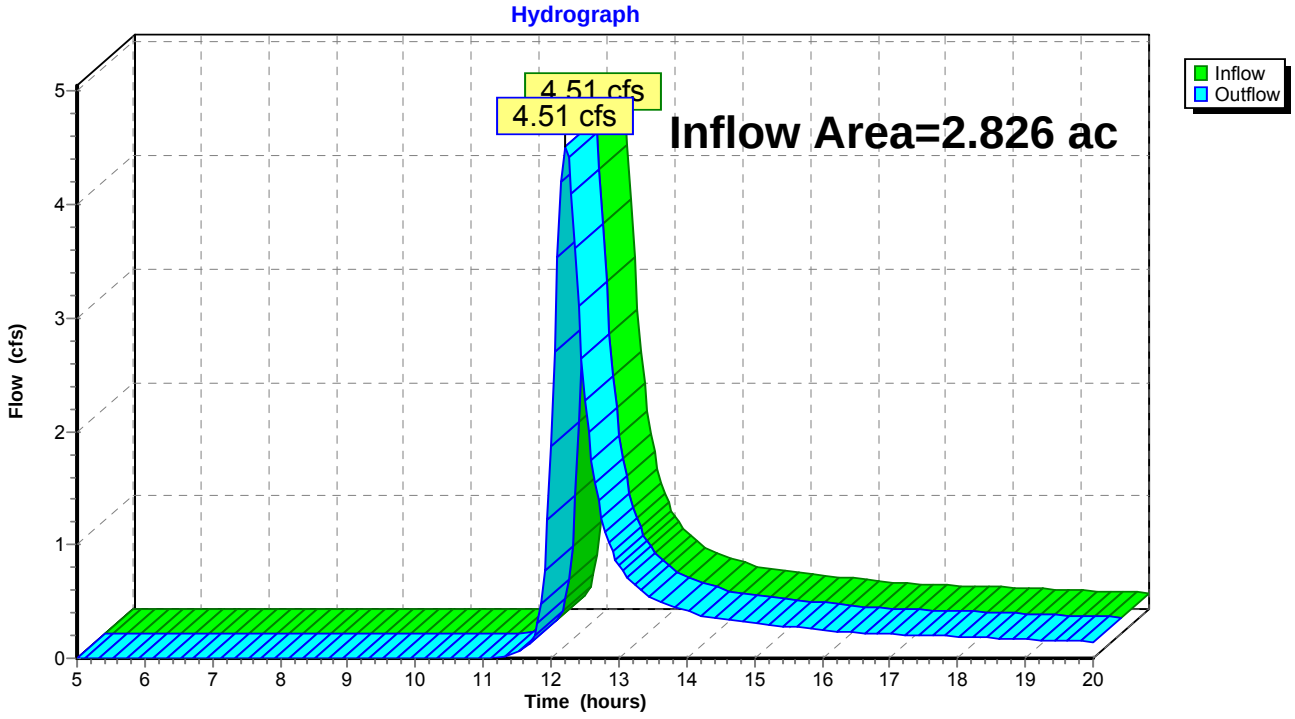


## Summary for Reach 2: OUTLET POINT #2

Inflow Area = 2.826 ac, 2.49% Impervious, Inflow Depth > 1.61" for 25 YEAR event
Inflow = 4.51 cfs @ 12.22 hrs, Volume= 0.380 af
Outflow = 4.51 cfs @ 12.22 hrs, Volume= 0.380 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

## Reach 2: OUTLET POINT #2

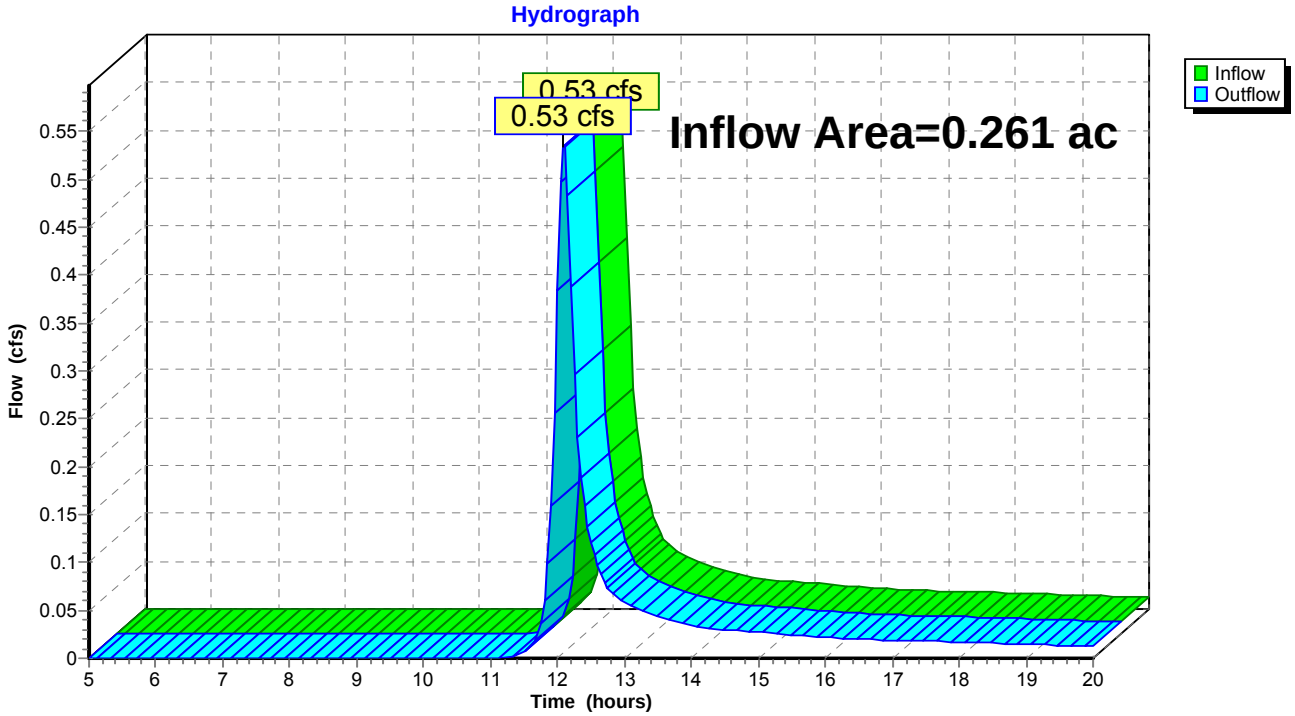


## Summary for Reach 3: OUTLET POINT #3

Inflow Area = 0.261 ac, 0.00% Impervious, Inflow Depth > 1.55" for 25 YEAR event
Inflow = 0.53 cfs @ 12.10 hrs, Volume= 0.034 af
Outflow = 0.53 cfs @ 12.10 hrs, Volume= 0.034 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

## Reach 3: OUTLET POINT #3



Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

**Subcatchment DA-1: DA-1** Runoff Area=377,598 sf 0.31% Impervious Runoff Depth>2.70"
Flow Length=695' Tc=25.4 min CN=63 Runoff=24.28 cfs 1.947 af

**Subcatchment DA-2: DA-2** Runoff Area=123,092 sf 2.49% Impervious Runoff Depth>2.50"
Flow Length=384' Tc=26.0 min CN=61 Runoff=7.20 cfs 0.590 af

**Subcatchment DA-3: DA-3** Runoff Area=11,380 sf 0.00% Impervious Runoff Depth>2.42"
Flow Length=188' Slope=0.1380 '/' Tc=15.9 min CN=60 Runoff=0.85 cfs 0.053 af

**Reach 1: OUTLET POINT #1** Inflow=24.28 cfs 1.947 af
Outflow=24.28 cfs 1.947 af

**Reach 2: OUTLET POINT #2** Inflow=7.20 cfs 0.590 af
Outflow=7.20 cfs 0.590 af

**Reach 3: OUTLET POINT #3** Inflow=0.85 cfs 0.053 af
Outflow=0.85 cfs 0.053 af

**Total Runoff Area = 11.756 ac Runoff Volume = 2.590 af Average Runoff Depth = 2.64"**
**99.17% Pervious = 11.658 ac 0.83% Impervious = 0.097 ac**

## Summary for Subcatchment DA-1: DA-1

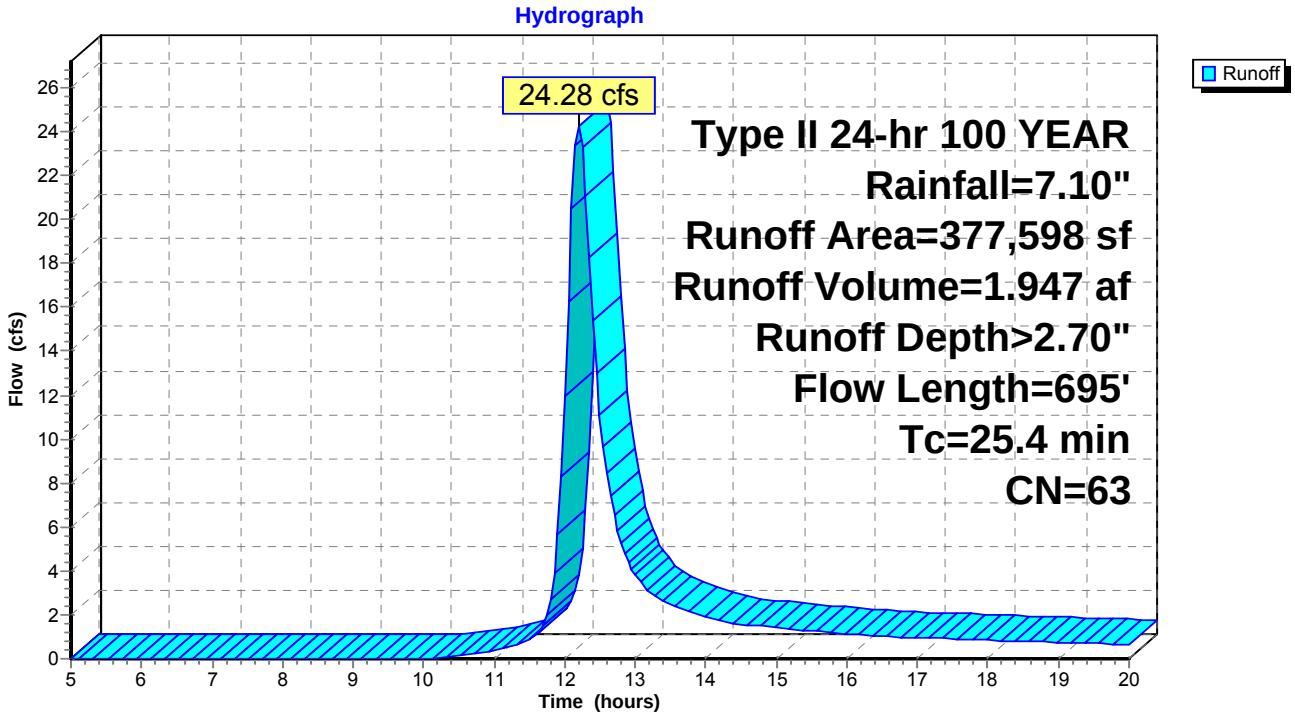
Runoff = 24.28 cfs @ 12.20 hrs, Volume= 1.947 af, Depth> 2.70"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 100 YEAR Rainfall=7.10"

| Area (sf) | CN | Description |
|---|---|---|
| 108,483 | 77 | Woods, Good, HSG D |
| 1,170 | 98 | Roofs, HSG B |
| 4,595 | 85 | Gravel roads, HSG B |
| 177,404 | 55 | Woods, Good, HSG B |
| 85,946 | 61 | >75% Grass cover, Good, HSG B |
| 377,598 | 63 | Weighted Average |
| 376,428 | | 99.69% Pervious Area |
| 1,170 | | 0.31% Impervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|---|---|---|---|---|---|
| 22.2 | 300 | 0.1540 | 0.23 | | **Sheet Flow, SEGMENT #1** Woods: Light underbrush n= 0.400 P2= 3.40" |
| 3.2 | 395 | 0.1680 | 2.05 | | **Shallow Concentrated Flow, SEGMENT #2** Woodland Kv= 5.0 fps |
| 25.4 | 695 | Total | | | |

## Subcatchment DA-1: DA-1



## Summary for Subcatchment DA-2: DA-2

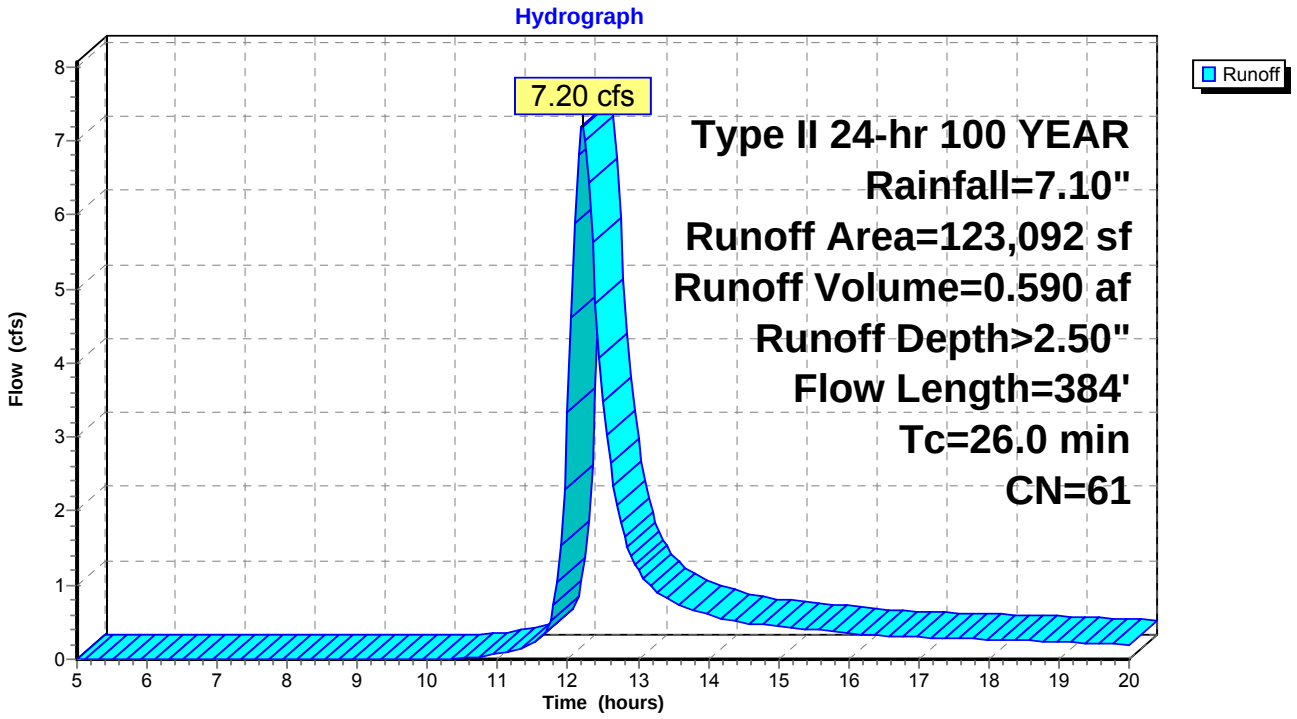
Runoff = 7.20 cfs @ 12.21 hrs, Volume= 0.590 af, Depth> 2.50"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 100 YEAR Rainfall=7.10"

| Area (sf) | CN | Description |
|---|---|---|
| 9,872 | 85 | Gravel roads, HSG B |
| 2,610 | 98 | Roofs, HSG B |
| 457 | 98 | Unconnected pavement, HSG B |
| 49,569 | 61 | >75% Grass cover, Good, HSG B |
| 60,584 | 55 | Woods, Good, HSG B |
| 123,092 | 61 | Weighted Average |
| 120,025 | | 97.51% Pervious Area |
| 3,067 | | 2.49% Impervious Area |
| 457 | | 14.90% Unconnected |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|---|---|---|---|---|---|
| 24.9 | 300 | 0.1150 | 0.20 | | **Sheet Flow, SEGMENT #1** Woods: Light underbrush n= 0.400 P2= 3.40" |
| 1.1 | 84 | 0.0645 | 1.27 | | **Shallow Concentrated Flow, SEGMENT #2** Woodland Kv= 5.0 fps |
| 26.0 | 384 | Total | | | |

## Subcatchment DA-2: DA-2



## Summary for Subcatchment DA-3: DA-3

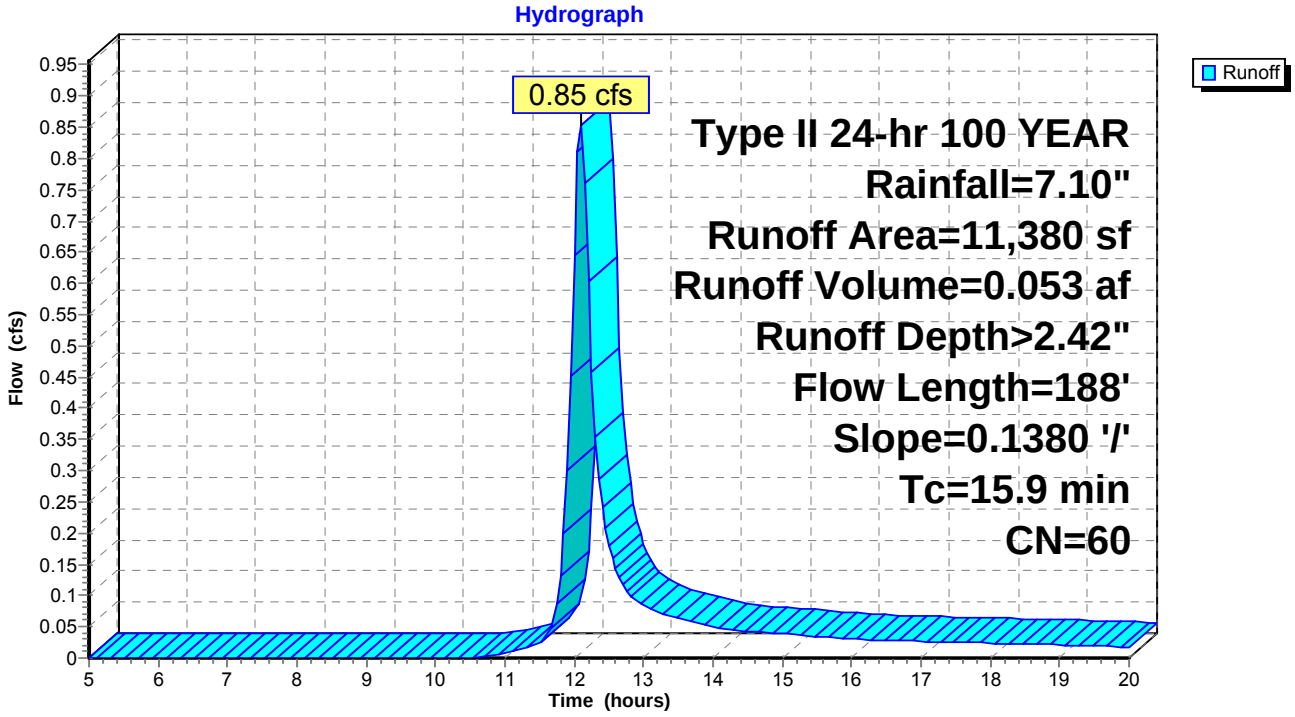
Runoff = 0.85 cfs @ 12.09 hrs, Volume= 0.053 af, Depth> 2.42"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 100 YEAR Rainfall=7.10"

| Area (sf) | CN | Description |
|---|---|---|
| 11,380 | 60 | Woods, Fair, HSG B |
| 11,380 | | 100.00% Pervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|---|---|---|---|---|---|
| 15.9 | 188 | 0.1380 | 0.20 | | **Sheet Flow, SEGMENT 1** Woods: Light underbrush n= 0.400 P2= 3.40" |

## Subcatchment DA-3: DA-3

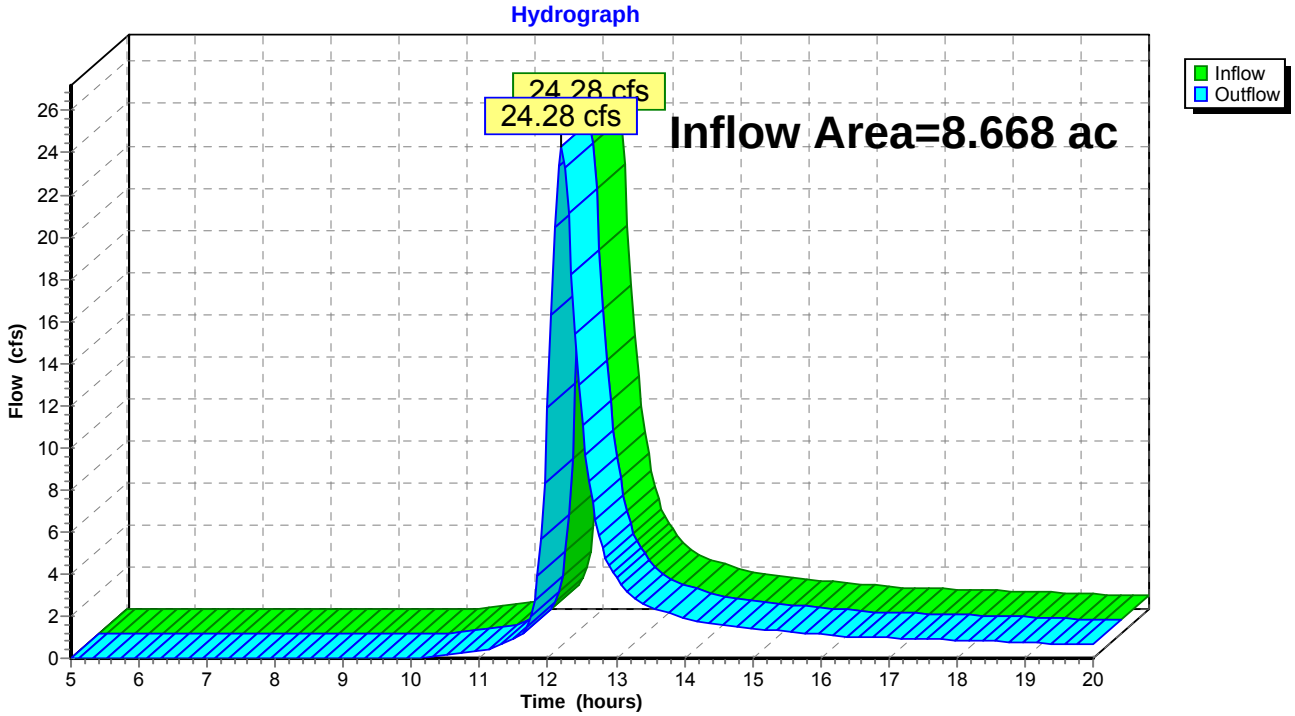


## Summary for Reach 1: OUTLET POINT #1

Inflow Area = 8.668 ac, 0.31% Impervious, Inflow Depth > 2.70" for 100 YEAR event
Inflow = 24.28 cfs @ 12.20 hrs, Volume= 1.947 af
Outflow = 24.28 cfs @ 12.20 hrs, Volume= 1.947 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

### Reach 1: OUTLET POINT #1

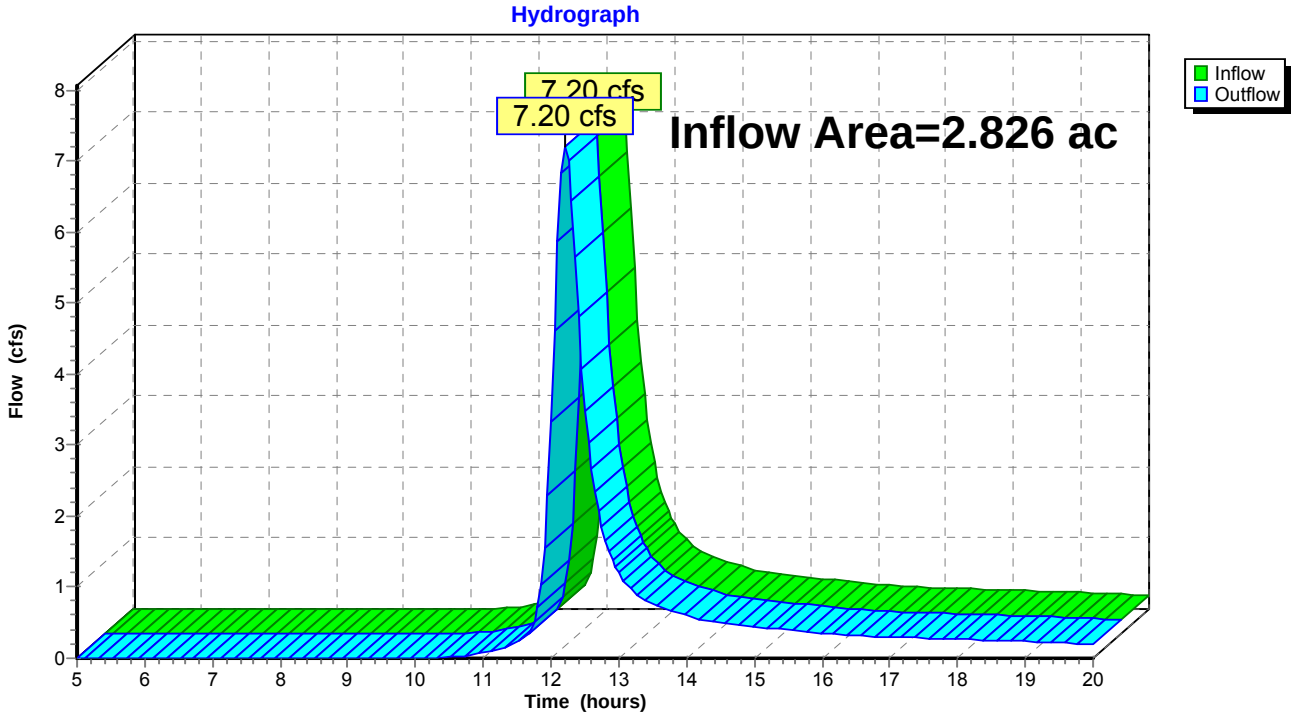


## Summary for Reach 2: OUTLET POINT #2

Inflow Area = 2.826 ac, 2.49% Impervious, Inflow Depth > 2.50" for 100 YEAR event
Inflow = 7.20 cfs @ 12.21 hrs, Volume= 0.590 af
Outflow = 7.20 cfs @ 12.21 hrs, Volume= 0.590 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

### Reach 2: OUTLET POINT #2

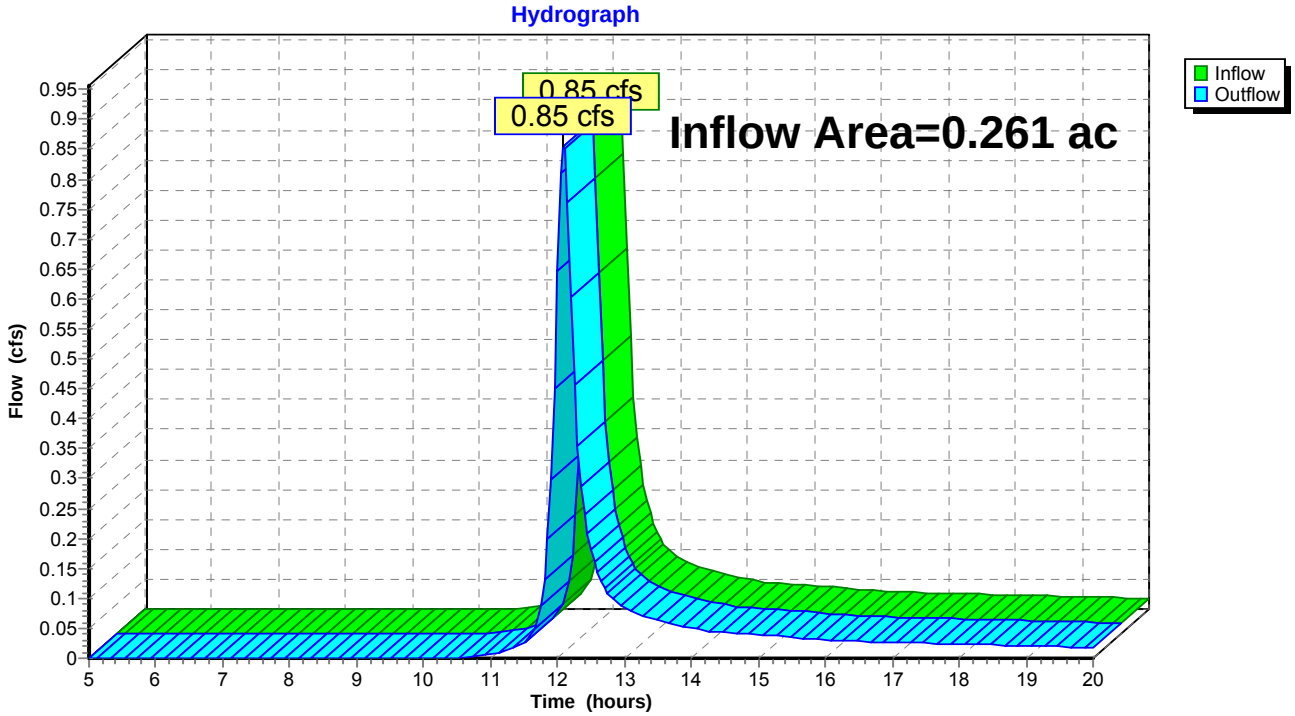


## Summary for Reach 3: OUTLET POINT #3

Inflow Area = 0.261 ac, 0.00% Impervious, Inflow Depth > 2.42" for 100 YEAR event
Inflow = 0.85 cfs @ 12.09 hrs, Volume= 0.053 af
Outflow = 0.85 cfs @ 12.09 hrs, Volume= 0.053 af, Atten= 0%, Lag= 0.0 min

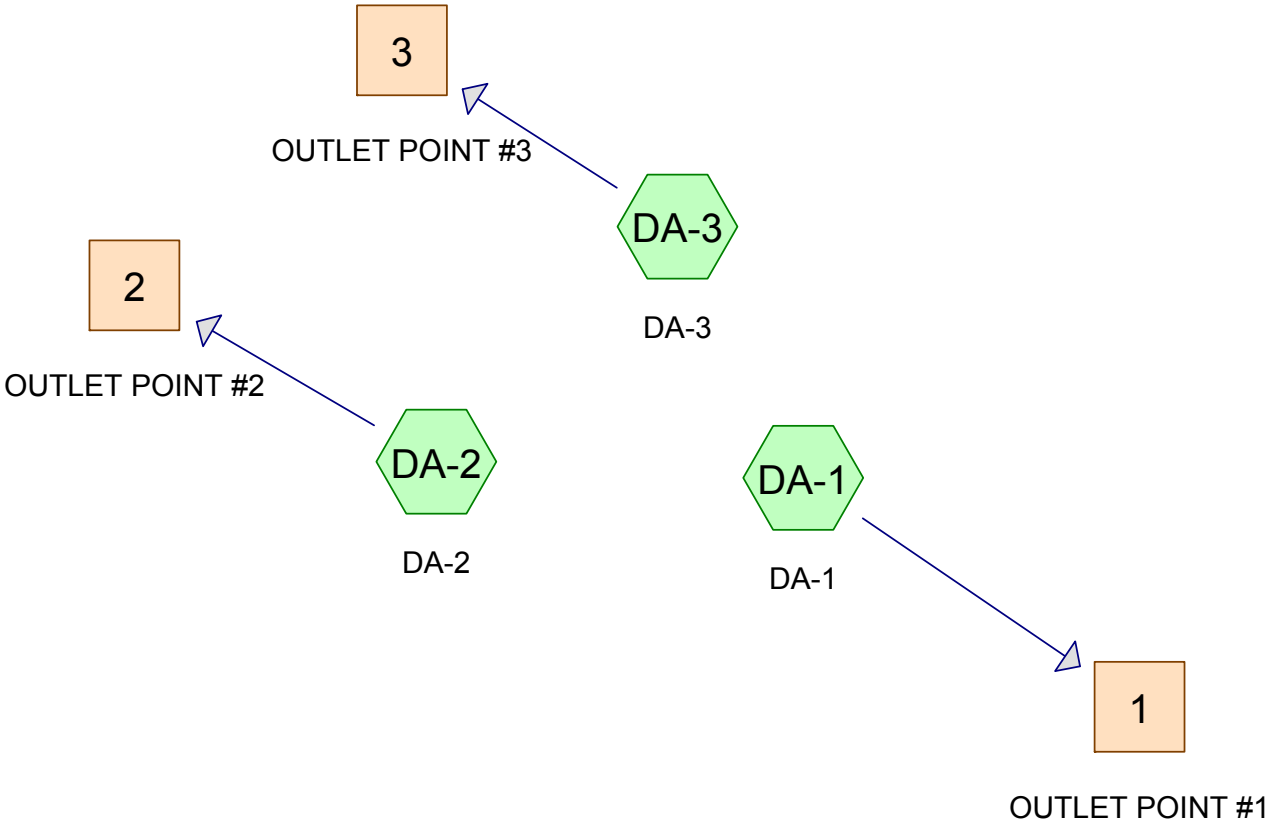
Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

## Reach 3: OUTLET POINT #3



# APPENDIX D

## Proposed Conditions Hydrological Analysis




Subcat Reach Pond Link

**Drainage Diagram for PROPOSED CONDITIONS**
Prepared by Microsoft, Printed 5/27/2012

## Area Listing (all nodes)

| Area (acres) | CN | Description (subcatchment-numbers) |
|---|---|---|
| 5.216 | 55 | Woods, Good, HSG B (DA-1, DA-2) |
| 0.261 | 60 | Woods, Fair, HSG B (DA-3) |
| 3.014 | 61 | >75% Grass cover, Good, HSG B (DA-1, DA-2) |
| 2.490 | 77 | Woods, Good, HSG D (DA-1) |
| 0.610 | 85 | Gravel roads, HSG B (DA-1, DA-2) |
| 0.087 | 98 | Roofs, HSG B (DA-1, DA-2) |
| 0.010 | 98 | Unconnected pavement, HSG B (DA-2) |
| **11.689** | 63 | **TOTAL AREA** |

## Soil Listing (all nodes)

| Area (acres) | Soil Group | Subcatchment Numbers |
|---|---|---|
| 0.000 | HSG A | |
| 9.198 | HSG B | DA-1, DA-2, DA-3 |
| 0.000 | HSG C | |
| 2.490 | HSG D | DA-1 |
| 0.000 | Other | |
| **11.689** | | **TOTAL AREA** |

Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

**Subcatchment DA-1: DA-1** Runoff Area=374,689 sf 0.31% Impervious Runoff Depth>0.57"
Flow Length=768' Tc=27.1 min CN=64 Runoff=4.05 cfs 0.407 af

**Subcatchment DA-2: DA-2** Runoff Area=123,089 sf 2.49% Impervious Runoff Depth>0.45"
Flow Length=384' Tc=26.0 min CN=61 Runoff=0.98 cfs 0.106 af

**Subcatchment DA-3: DA-3** Runoff Area=11,380 sf 0.00% Impervious Runoff Depth>0.42"
Flow Length=188' Slope=0.1380 '/' Tc=15.9 min CN=60 Runoff=0.11 cfs 0.009 af

**Reach 1: OUTLET POINT #1** Inflow=4.05 cfs 0.407 af
Outflow=4.05 cfs 0.407 af

**Reach 2: OUTLET POINT #2** Inflow=0.98 cfs 0.106 af
Outflow=0.98 cfs 0.106 af

**Reach 3: OUTLET POINT #3** Inflow=0.11 cfs 0.009 af
Outflow=0.11 cfs 0.009 af

**Total Runoff Area = 11.689 ac Runoff Volume = 0.523 af Average Runoff Depth = 0.54"**
**99.17% Pervious = 11.591 ac 0.83% Impervious = 0.097 ac**

## Summary for Subcatchment DA-1: DA-1

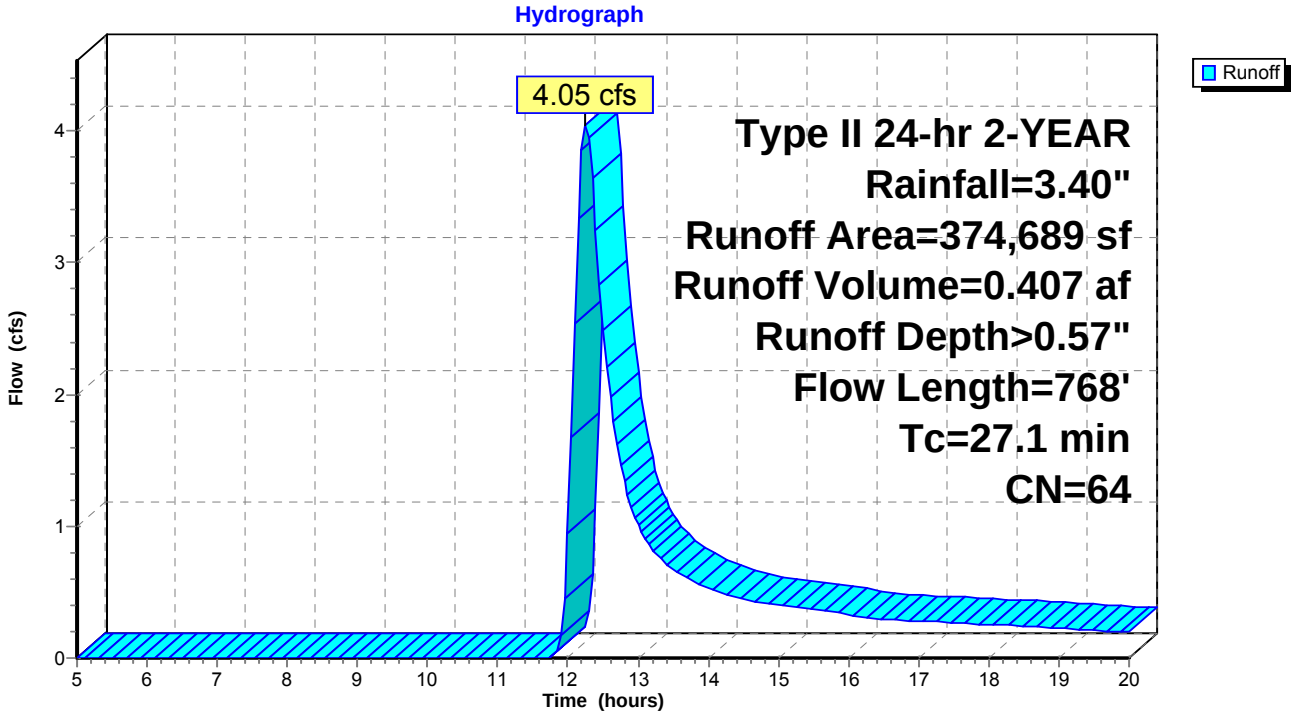
Runoff = 4.05 cfs @ 12.26 hrs, Volume= 0.407 af, Depth> 0.57"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 2-YEAR Rainfall=3.40"

| Area (sf) | CN | Description |
|---|---|---|
| 108,483 | 77 | Woods, Good, HSG D |
| 1,170 | 98 | Roofs, HSG B |
| 14,621 | 85 | Gravel roads, HSG B |
| 167,778 | 55 | Woods, Good, HSG B |
| 82,637 | 61 | >75% Grass cover, Good, HSG B |
| 374,689 | 64 | Weighted Average |
| 373,519 | | 99.69% Pervious Area |
| 1,170 | | 0.31% Impervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|---|---|---|---|---|---|
| 15.2 | 169 | 0.1250 | 0.18 | | **Sheet Flow, SEGMENT #1**<br>Woods: Light underbrush n= 0.400 P2= 3.40" |
| 0.3 | 152 | 0.0580 | 9.10 | 36.41 | **Channel Flow, SEGMENT #2**<br>Area= 4.0 sf Perim= 6.0' r= 0.67'<br>n= 0.030 Earth, grassed & winding |
| 8.4 | 75 | 0.1100 | 0.15 | | **Sheet Flow, SEGMENT #3**<br>Woods: Light underbrush n= 0.400 P2= 3.40" |
| 3.2 | 372 | 0.1500 | 1.94 | | **Shallow Concentrated Flow, SEGMENT #4**<br>Woodland Kv= 5.0 fps |
| 27.1 | 768 | Total | | | |

## Subcatchment DA-1: DA-1



## Summary for Subcatchment DA-2: DA-2

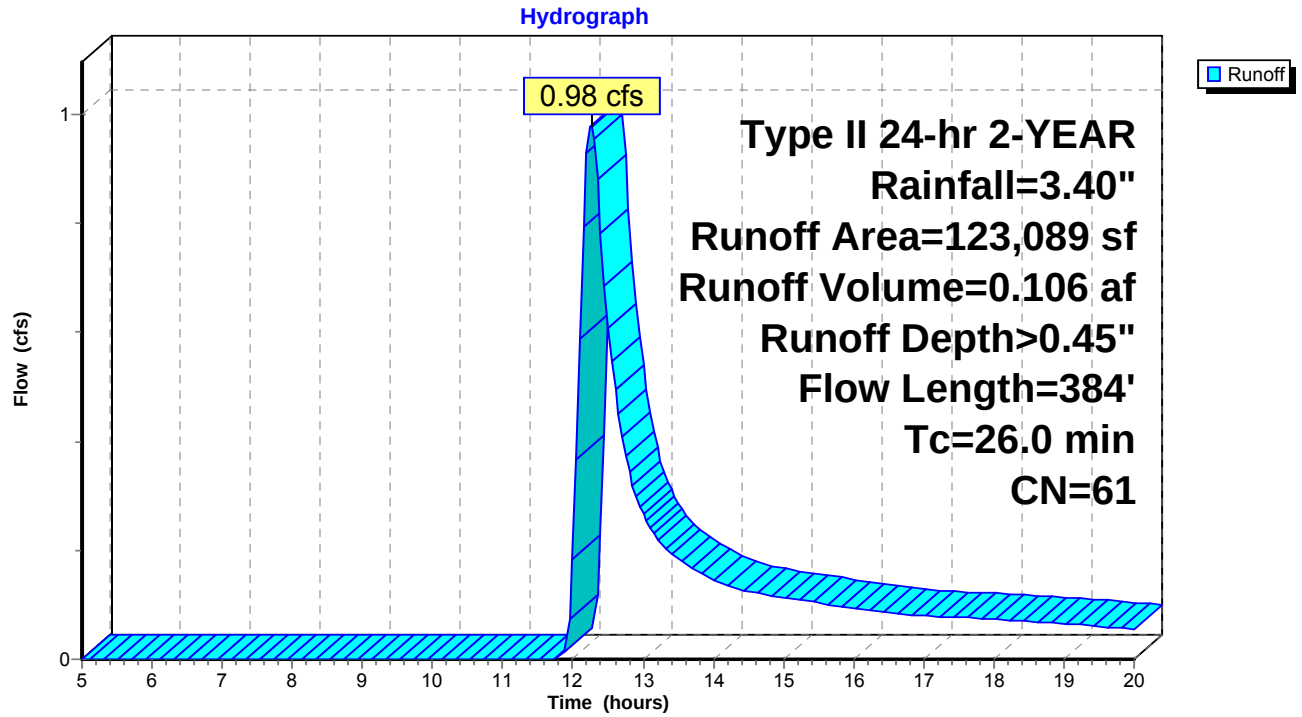
Runoff = 0.98 cfs @ 12.26 hrs, Volume= 0.106 af, Depth> 0.45"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 2-YEAR Rainfall=3.40"

| Area (sf) | CN | Description |
|---|---|---|
| 11,945 | 85 | Gravel roads, HSG B |
| 2,610 | 98 | Roofs, HSG B |
| 457 | 98 | Unconnected pavement, HSG B |
| 48,633 | 61 | >75% Grass cover, Good, HSG B |
| 59,444 | 55 | Woods, Good, HSG B |
| 123,089 | 61 | Weighted Average |
| 120,022 | | 97.51% Pervious Area |
| 3,067 | | 2.49% Impervious Area |
| 457 | | 14.90% Unconnected |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|---|---|---|---|---|---|
| 24.9 | 300 | 0.1150 | 0.20 | | **Sheet Flow, SEGMENT #1** Woods: Light underbrush n= 0.400 P2= 3.40" |
| 1.1 | 84 | 0.0645 | 1.27 | | **Shallow Concentrated Flow, SEGMENT #2** Woodland Kv= 5.0 fps |
| 26.0 | 384 | Total | | | |

## Subcatchment DA-2: DA-2



## Summary for Subcatchment DA-3: DA-3

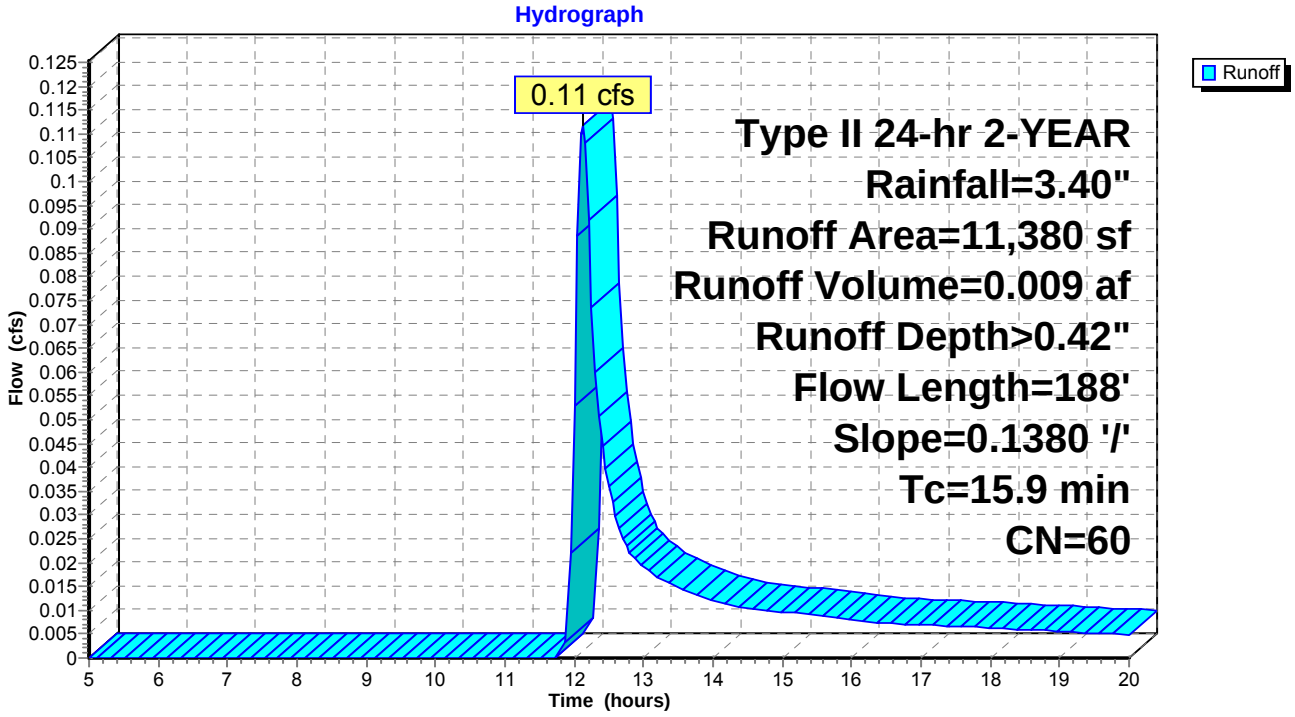
Runoff = 0.11 cfs @ 12.12 hrs, Volume= 0.009 af, Depth> 0.42"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 2-YEAR Rainfall=3.40"

| Area (sf) | CN | Description |
|---|---|---|
| 11,380 | 60 | Woods, Fair, HSG B |
| 11,380 | | 100.00% Pervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|---|---|---|---|---|---|
| 15.9 | 188 | 0.1380 | 0.20 | | **Sheet Flow, SEGMENT 1**<br>Woods: Light underbrush n= 0.400 P2= 3.40" |

## Subcatchment DA-3: DA-3

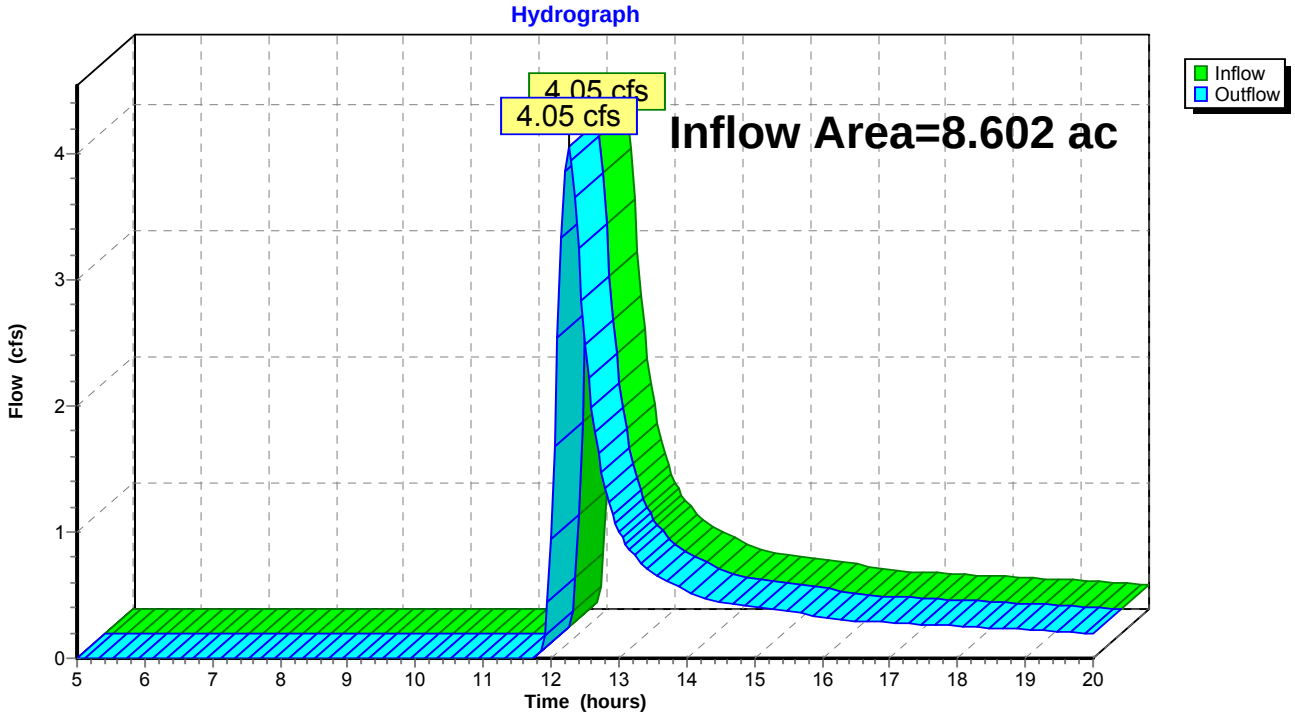


## Summary for Reach 1: OUTLET POINT #1

Inflow Area = 8.602 ac, 0.31% Impervious, Inflow Depth > 0.57" for 2-YEAR event
Inflow = 4.05 cfs @ 12.26 hrs, Volume= 0.407 af
Outflow = 4.05 cfs @ 12.26 hrs, Volume= 0.407 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

## Reach 1: OUTLET POINT #1

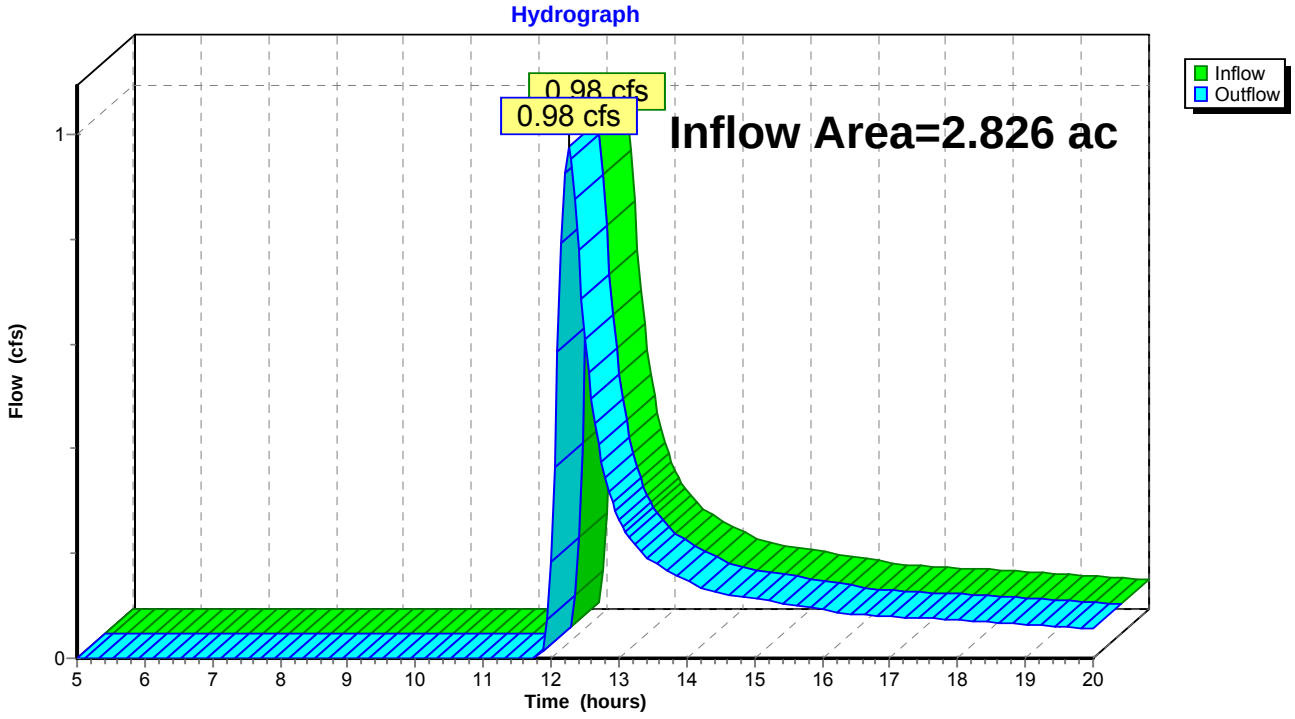


## Summary for Reach 2: OUTLET POINT #2

Inflow Area = 2.826 ac, 2.49% Impervious, Inflow Depth > 0.45" for 2-YEAR event
Inflow = 0.98 cfs @ 12.26 hrs, Volume= 0.106 af
Outflow = 0.98 cfs @ 12.26 hrs, Volume= 0.106 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

### Reach 2: OUTLET POINT #2

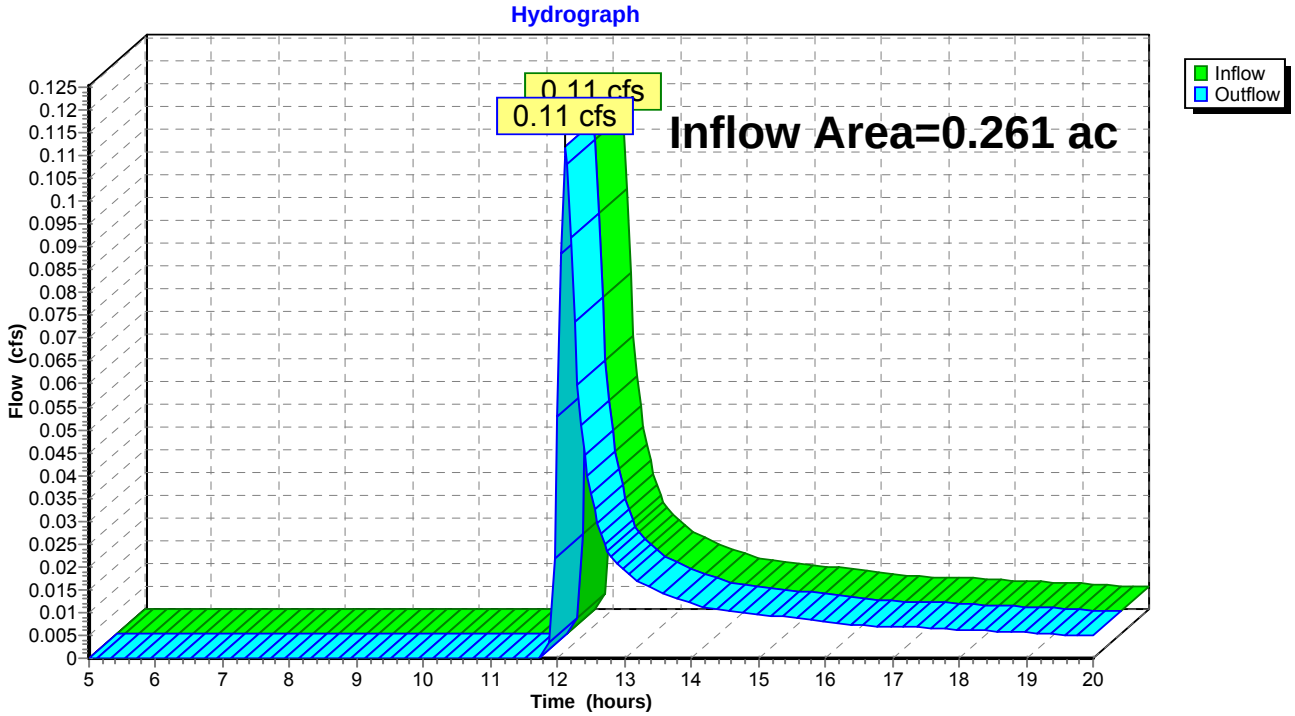


## Summary for Reach 3: OUTLET POINT #3

Inflow Area = 0.261 ac, 0.00% Impervious, Inflow Depth > 0.42" for 2-YEAR event
Inflow = 0.11 cfs @ 12.12 hrs, Volume= 0.009 af
Outflow = 0.11 cfs @ 12.12 hrs, Volume= 0.009 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

## Reach 3: OUTLET POINT #3



Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

**Subcatchment DA-1: DA-1** Runoff Area=374,689 sf 0.31% Impervious Runoff Depth>1.41"
Flow Length=768' Tc=27.1 min CN=64 Runoff=11.67 cfs 1.011 af

**Subcatchment DA-2: DA-2** Runoff Area=123,089 sf 2.49% Impervious Runoff Depth>1.21"
Flow Length=384' Tc=26.0 min CN=61 Runoff=3.29 cfs 0.286 af

**Subcatchment DA-3: DA-3** Runoff Area=11,380 sf 0.00% Impervious Runoff Depth>1.16"
Flow Length=188' Slope=0.1380 '/' Tc=15.9 min CN=60 Runoff=0.39 cfs 0.025 af

**Reach 1: OUTLET POINT #1** Inflow=11.67 cfs 1.011 af
Outflow=11.67 cfs 1.011 af

**Reach 2: OUTLET POINT #2** Inflow=3.29 cfs 0.286 af
Outflow=3.29 cfs 0.286 af

**Reach 3: OUTLET POINT #3** Inflow=0.39 cfs 0.025 af
Outflow=0.39 cfs 0.025 af

**Total Runoff Area = 11.689 ac Runoff Volume = 1.321 af Average Runoff Depth = 1.36"**
**99.17% Pervious = 11.591 ac 0.83% Impervious = 0.097 ac**

## Summary for Subcatchment DA-1: DA-1

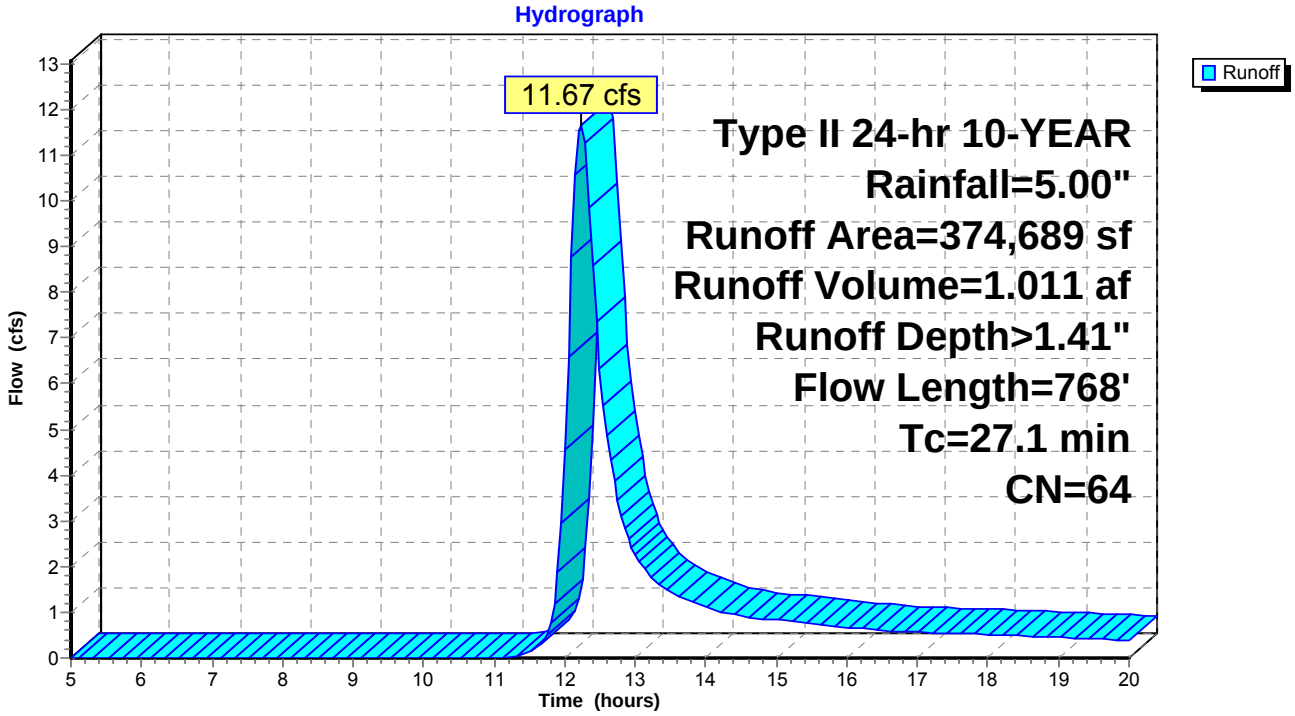
Runoff = 11.67 cfs @ 12.23 hrs, Volume= 1.011 af, Depth> 1.41"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 10-YEAR Rainfall=5.00"

| Area (sf) | CN | Description |
|---|---|---|
| 108,483 | 77 | Woods, Good, HSG D |
| 1,170 | 98 | Roofs, HSG B |
| 14,621 | 85 | Gravel roads, HSG B |
| 167,778 | 55 | Woods, Good, HSG B |
| 82,637 | 61 | >75% Grass cover, Good, HSG B |
| 374,689 | 64 | Weighted Average |
| 373,519 | | 99.69% Pervious Area |
| 1,170 | | 0.31% Impervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|---|---|---|---|---|---|
| 15.2 | 169 | 0.1250 | 0.18 | | **Sheet Flow, SEGMENT #1**<br>Woods: Light underbrush n= 0.400 P2= 3.40" |
| 0.3 | 152 | 0.0580 | 9.10 | 36.41 | **Channel Flow, SEGMENT #2**<br>Area= 4.0 sf Perim= 6.0' r= 0.67'<br>n= 0.030 Earth, grassed & winding |
| 8.4 | 75 | 0.1100 | 0.15 | | **Sheet Flow, SEGMENT #3**<br>Woods: Light underbrush n= 0.400 P2= 3.40" |
| 3.2 | 372 | 0.1500 | 1.94 | | **Shallow Concentrated Flow, SEGMENT #4**<br>Woodland Kv= 5.0 fps |
| 27.1 | 768 | Total | | | |

## Subcatchment DA-1: DA-1



## Summary for Subcatchment DA-2: DA-2

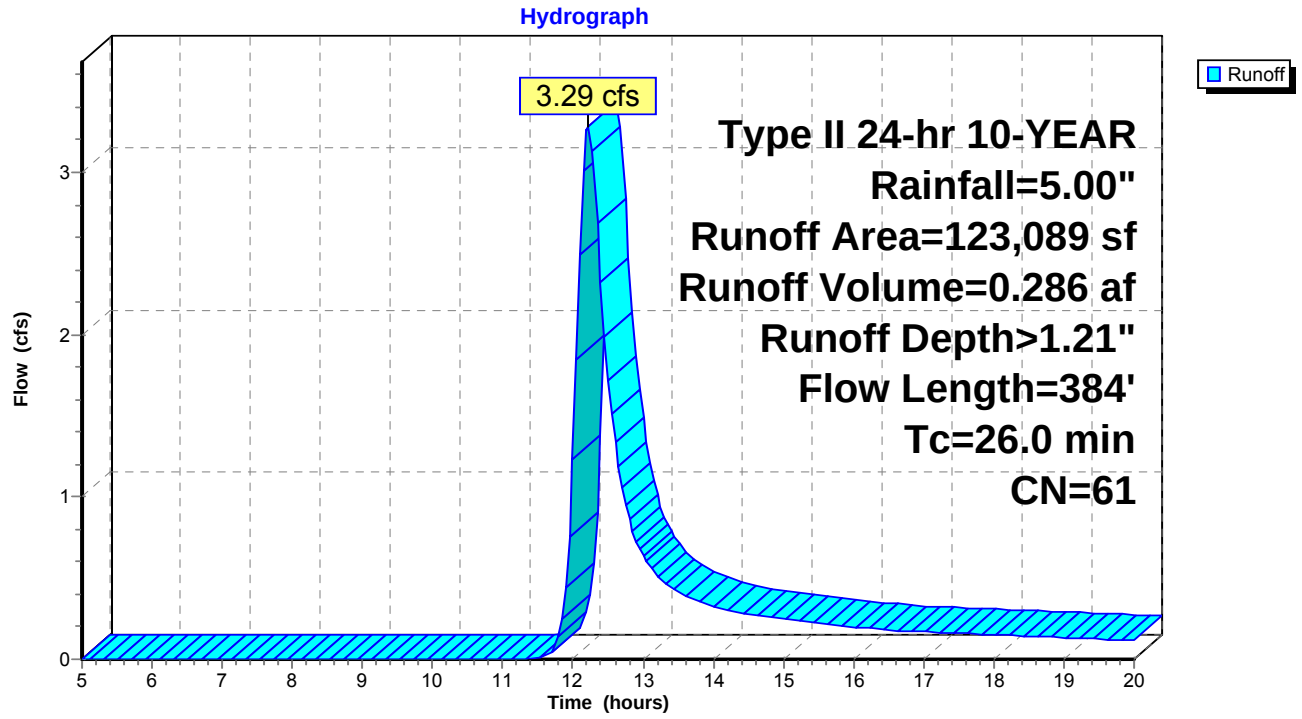
Runoff = 3.29 cfs @ 12.22 hrs, Volume= 0.286 af, Depth> 1.21"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 10-YEAR Rainfall=5.00"

| Area (sf) | CN | Description |
|---|---|---|
| 11,945 | 85 | Gravel roads, HSG B |
| 2,610 | 98 | Roofs, HSG B |
| 457 | 98 | Unconnected pavement, HSG B |
| 48,633 | 61 | >75% Grass cover, Good, HSG B |
| 59,444 | 55 | Woods, Good, HSG B |
| 123,089 | 61 | Weighted Average |
| 120,022 | | 97.51% Pervious Area |
| 3,067 | | 2.49% Impervious Area |
| 457 | | 14.90% Unconnected |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|---|---|---|---|---|---|
| 24.9 | 300 | 0.1150 | 0.20 | | **Sheet Flow, SEGMENT #1** Woods: Light underbrush n= 0.400 P2= 3.40" |
| 1.1 | 84 | 0.0645 | 1.27 | | **Shallow Concentrated Flow, SEGMENT #2** Woodland Kv= 5.0 fps |
| 26.0 | 384 | Total | | | |

## Subcatchment DA-2: DA-2



## Summary for Subcatchment DA-3: DA-3

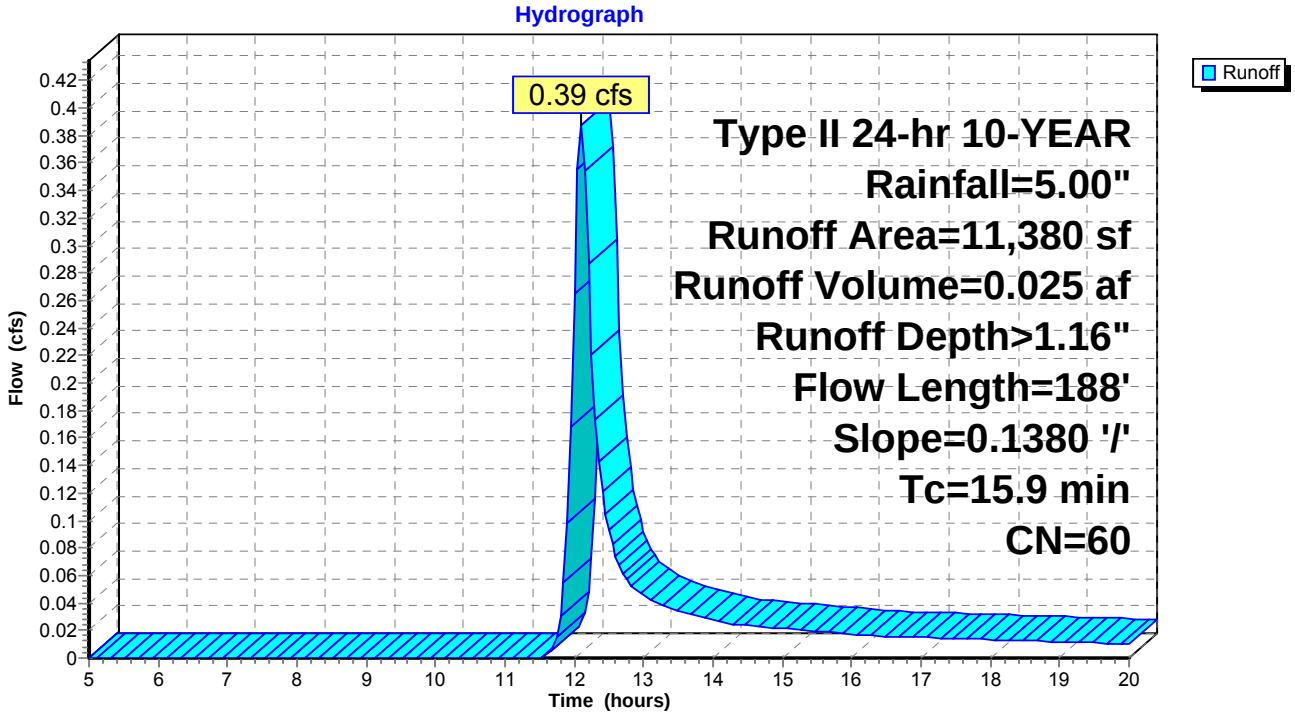
Runoff = 0.39 cfs @ 12.10 hrs, Volume= 0.025 af, Depth> 1.16"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 10-YEAR Rainfall=5.00"

| Area (sf) | CN | Description |
|---|---|---|
| 11,380 | 60 | Woods, Fair, HSG B |
| 11,380 | | 100.00% Pervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|---|---|---|---|---|---|
| 15.9 | 188 | 0.1380 | 0.20 | | **Sheet Flow, SEGMENT 1**<br>Woods: Light underbrush n= 0.400 P2= 3.40" |

## Subcatchment DA-3: DA-3

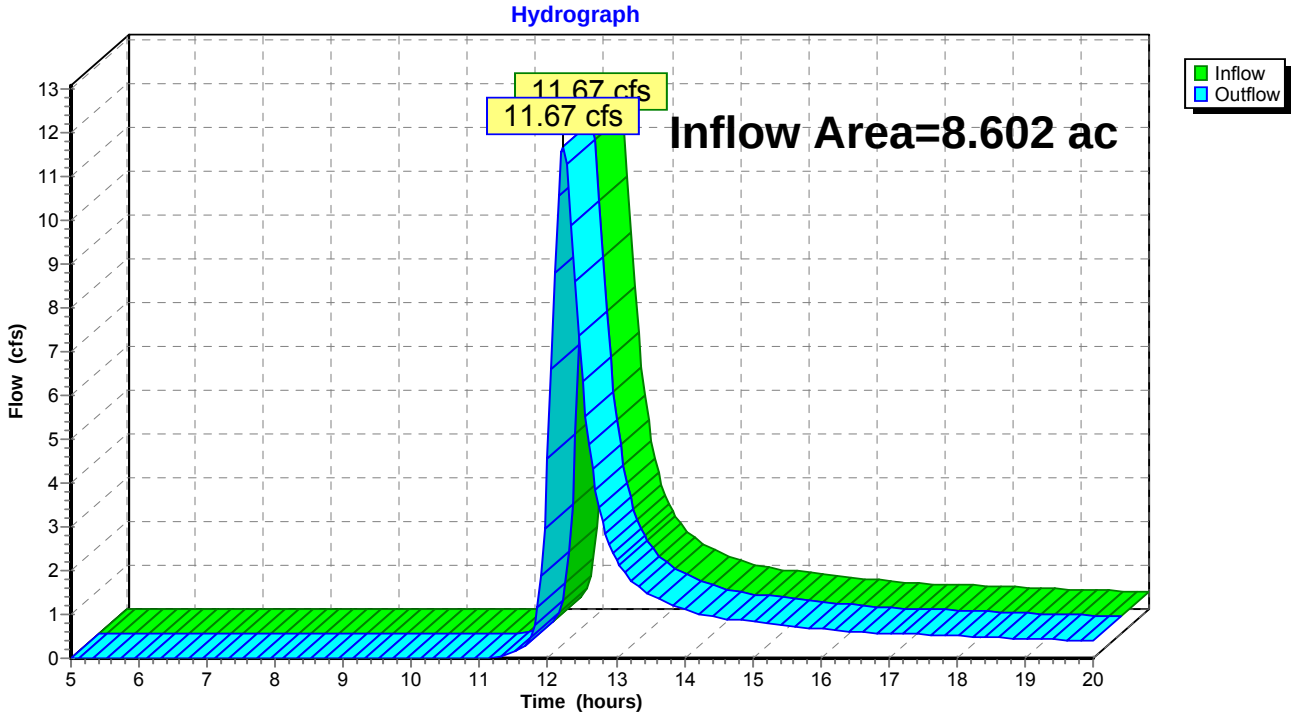


## Summary for Reach 1: OUTLET POINT #1

Inflow Area = 8.602 ac, 0.31% Impervious, Inflow Depth > 1.41" for 10-YEAR event
Inflow = 11.67 cfs @ 12.23 hrs, Volume= 1.011 af
Outflow = 11.67 cfs @ 12.23 hrs, Volume= 1.011 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

## Reach 1: OUTLET POINT #1

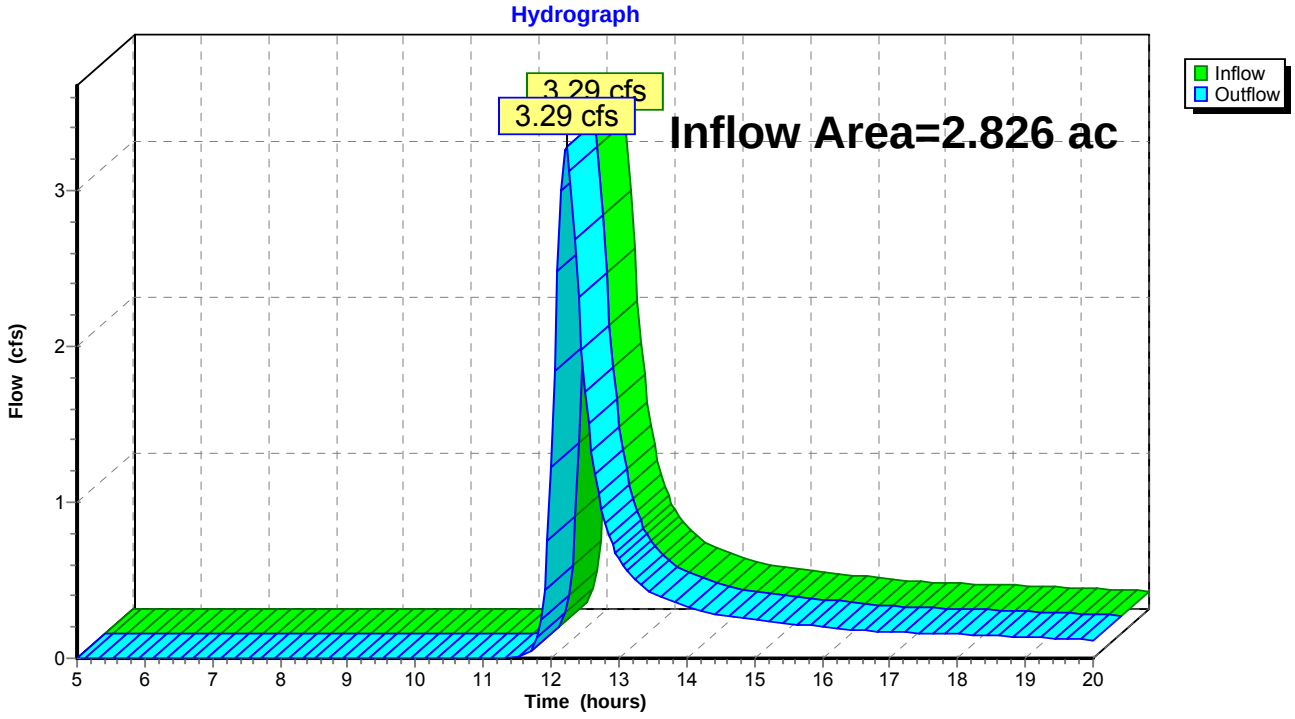


## Summary for Reach 2: OUTLET POINT #2

Inflow Area = 2.826 ac, 2.49% Impervious, Inflow Depth > 1.21" for 10-YEAR event
Inflow = 3.29 cfs @ 12.22 hrs, Volume= 0.286 af
Outflow = 3.29 cfs @ 12.22 hrs, Volume= 0.286 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

## Reach 2: OUTLET POINT #2

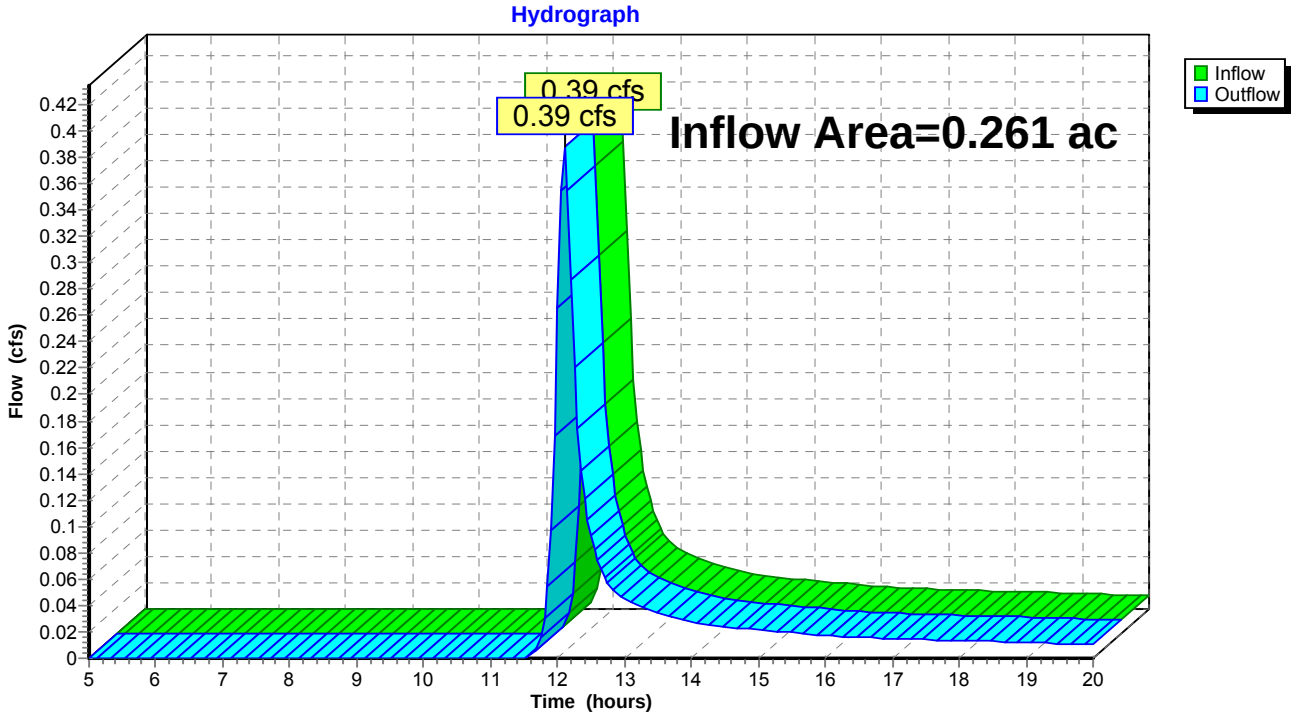


## Summary for Reach 3: OUTLET POINT #3

Inflow Area = 0.261 ac, 0.00% Impervious, Inflow Depth > 1.16" for 10-YEAR event
Inflow = 0.39 cfs @ 12.10 hrs, Volume= 0.025 af
Outflow = 0.39 cfs @ 12.10 hrs, Volume= 0.025 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

## Reach 3: OUTLET POINT #3



Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

**Subcatchment DA-1: DA-1** Runoff Area=374,689 sf 0.31% Impervious Runoff Depth>1.84"
Flow Length=768' Tc=27.1 min CN=64 Runoff=15.60 cfs 1.321 af

**Subcatchment DA-2: DA-2** Runoff Area=123,089 sf 2.49% Impervious Runoff Depth>1.61"
Flow Length=384' Tc=26.0 min CN=61 Runoff=4.51 cfs 0.380 af

**Subcatchment DA-3: DA-3** Runoff Area=11,380 sf 0.00% Impervious Runoff Depth>1.55"
Flow Length=188' Slope=0.1380 '/' Tc=15.9 min CN=60 Runoff=0.53 cfs 0.034 af

**Reach 1: OUTLET POINT #1** Inflow=15.60 cfs 1.321 af
Outflow=15.60 cfs 1.321 af

**Reach 2: OUTLET POINT #2** Inflow=4.51 cfs 0.380 af
Outflow=4.51 cfs 0.380 af

**Reach 3: OUTLET POINT #3** Inflow=0.53 cfs 0.034 af
Outflow=0.53 cfs 0.034 af

**Total Runoff Area = 11.689 ac Runoff Volume = 1.735 af Average Runoff Depth = 1.78"**
**99.17% Pervious = 11.591 ac 0.83% Impervious = 0.097 ac**

## Summary for Subcatchment DA-1: DA-1

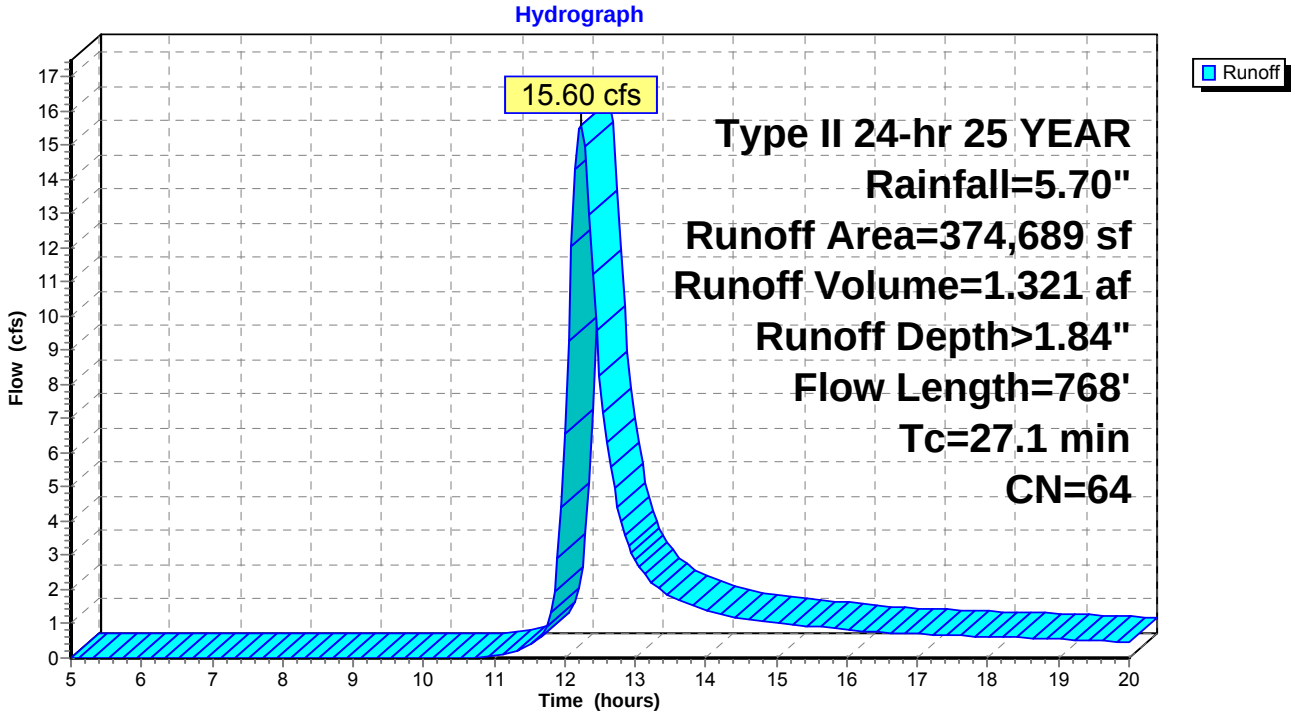
Runoff = 15.60 cfs @ 12.22 hrs, Volume= 1.321 af, Depth> 1.84"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 25 YEAR Rainfall=5.70"

| Area (sf) | CN | Description |
|---|---|---|
| 108,483 | 77 | Woods, Good, HSG D |
| 1,170 | 98 | Roofs, HSG B |
| 14,621 | 85 | Gravel roads, HSG B |
| 167,778 | 55 | Woods, Good, HSG B |
| 82,637 | 61 | >75% Grass cover, Good, HSG B |
| 374,689 | 64 | Weighted Average |
| 373,519 | | 99.69% Pervious Area |
| 1,170 | | 0.31% Impervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|---|---|---|---|---|---|
| 15.2 | 169 | 0.1250 | 0.18 | | **Sheet Flow, SEGMENT #1**<br>Woods: Light underbrush n= 0.400 P2= 3.40" |
| 0.3 | 152 | 0.0580 | 9.10 | 36.41 | **Channel Flow, SEGMENT #2**<br>Area= 4.0 sf Perim= 6.0' r= 0.67'<br>n= 0.030 Earth, grassed & winding |
| 8.4 | 75 | 0.1100 | 0.15 | | **Sheet Flow, SEGMENT #3**<br>Woods: Light underbrush n= 0.400 P2= 3.40" |
| 3.2 | 372 | 0.1500 | 1.94 | | **Shallow Concentrated Flow, SEGMENT #4**<br>Woodland Kv= 5.0 fps |
| 27.1 | 768 | Total | | | |

## Subcatchment DA-1: DA-1



## Summary for Subcatchment DA-2: DA-2

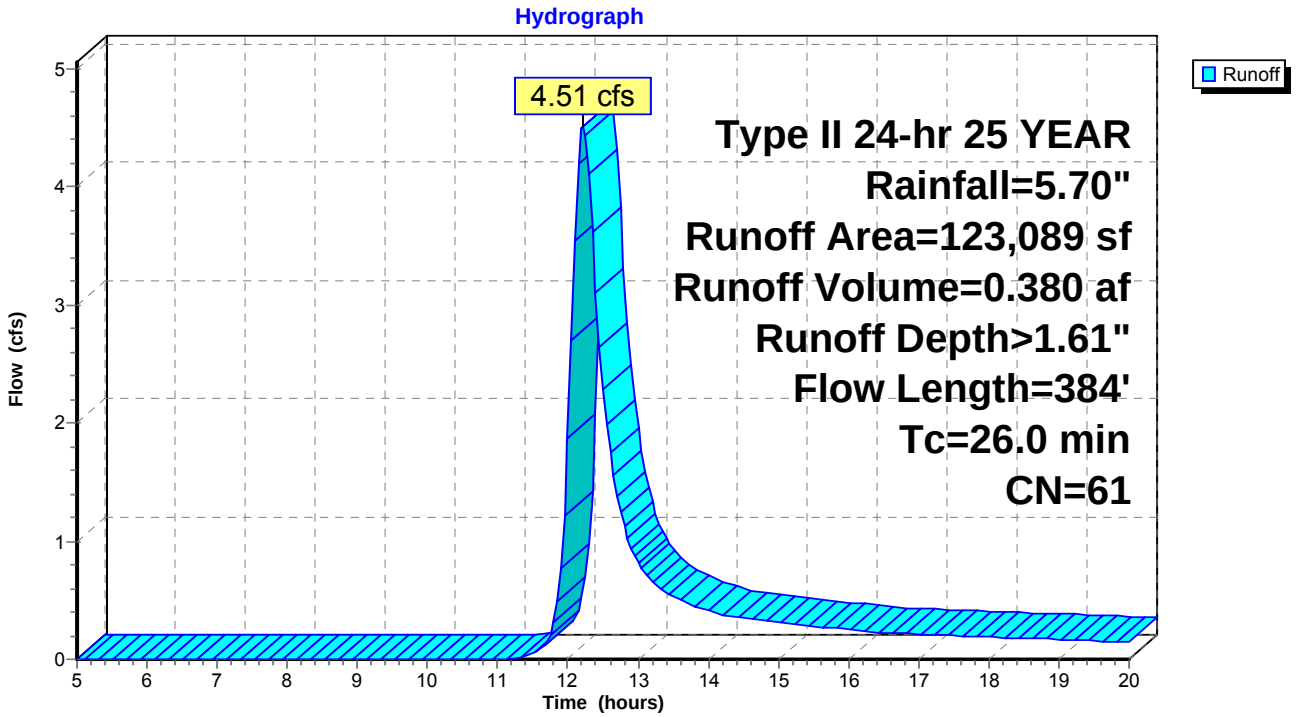
Runoff = 4.51 cfs @ 12.22 hrs, Volume= 0.380 af, Depth> 1.61"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 25 YEAR Rainfall=5.70"

| Area (sf) | CN | Description |
|---|---|---|
| 11,945 | 85 | Gravel roads, HSG B |
| 2,610 | 98 | Roofs, HSG B |
| 457 | 98 | Unconnected pavement, HSG B |
| 48,633 | 61 | >75% Grass cover, Good, HSG B |
| 59,444 | 55 | Woods, Good, HSG B |
| 123,089 | 61 | Weighted Average |
| 120,022 | | 97.51% Pervious Area |
| 3,067 | | 2.49% Impervious Area |
| 457 | | 14.90% Unconnected |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|---|---|---|---|---|---|
| 24.9 | 300 | 0.1150 | 0.20 | | **Sheet Flow, SEGMENT #1** Woods: Light underbrush n= 0.400 P2= 3.40" |
| 1.1 | 84 | 0.0645 | 1.27 | | **Shallow Concentrated Flow, SEGMENT #2** Woodland Kv= 5.0 fps |
| 26.0 | 384 | Total | | | |

## Subcatchment DA-2: DA-2



## Summary for Subcatchment DA-3: DA-3

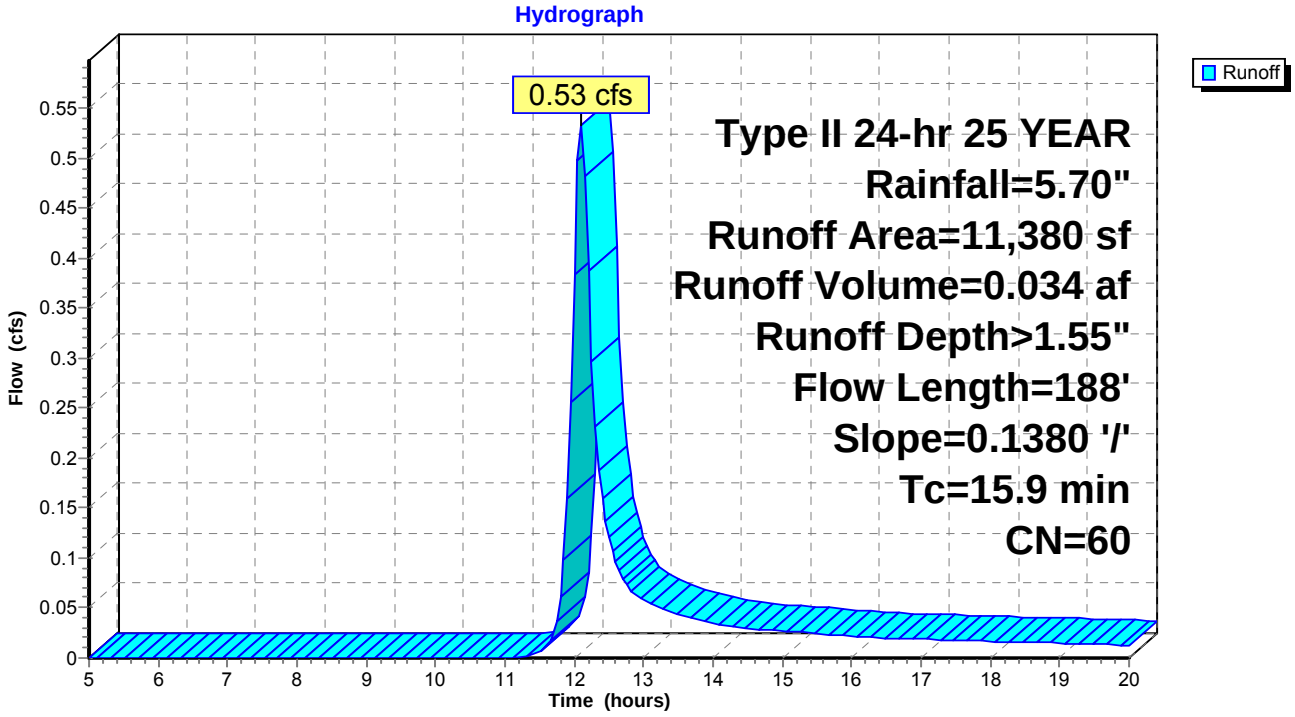
Runoff = 0.53 cfs @ 12.10 hrs, Volume= 0.034 af, Depth> 1.55"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 25 YEAR Rainfall=5.70"

| Area (sf) | CN | Description |
|---|---|---|
| 11,380 | 60 | Woods, Fair, HSG B |
| 11,380 | | 100.00% Pervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|---|---|---|---|---|---|
| 15.9 | 188 | 0.1380 | 0.20 | | **Sheet Flow, SEGMENT 1** Woods: Light underbrush n= 0.400 P2= 3.40" |

## Subcatchment DA-3: DA-3

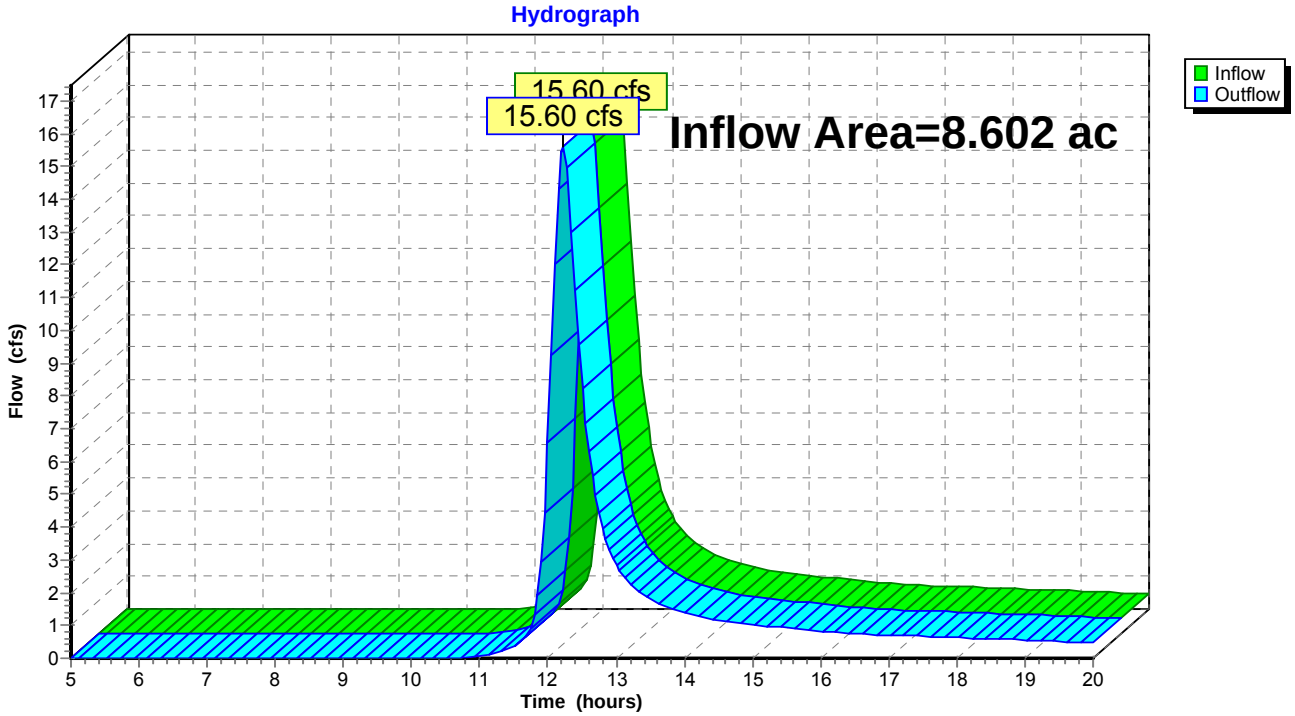


## Summary for Reach 1: OUTLET POINT #1

Inflow Area = 8.602 ac, 0.31% Impervious, Inflow Depth > 1.84" for 25 YEAR event
Inflow = 15.60 cfs @ 12.22 hrs, Volume= 1.321 af
Outflow = 15.60 cfs @ 12.22 hrs, Volume= 1.321 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

## Reach 1: OUTLET POINT #1

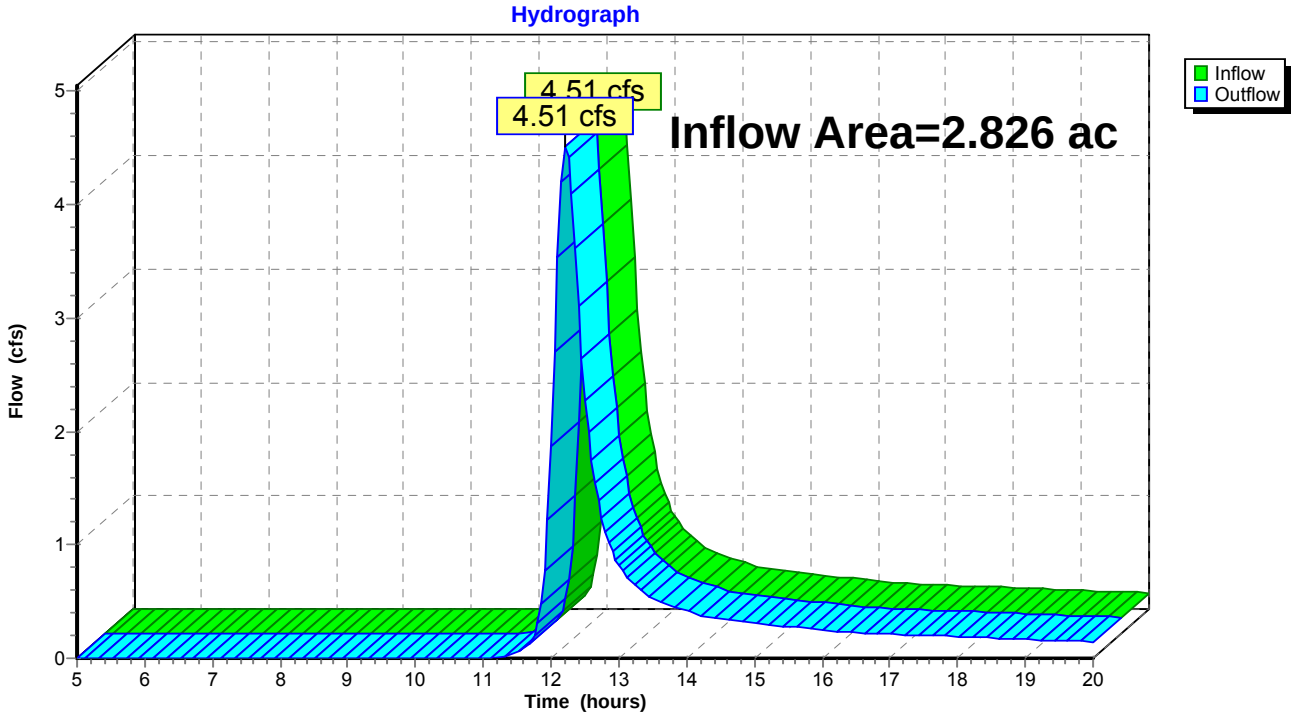


## Summary for Reach 2: OUTLET POINT #2

Inflow Area = 2.826 ac, 2.49% Impervious, Inflow Depth > 1.61" for 25 YEAR event
Inflow = 4.51 cfs @ 12.22 hrs, Volume= 0.380 af
Outflow = 4.51 cfs @ 12.22 hrs, Volume= 0.380 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

## Reach 2: OUTLET POINT #2

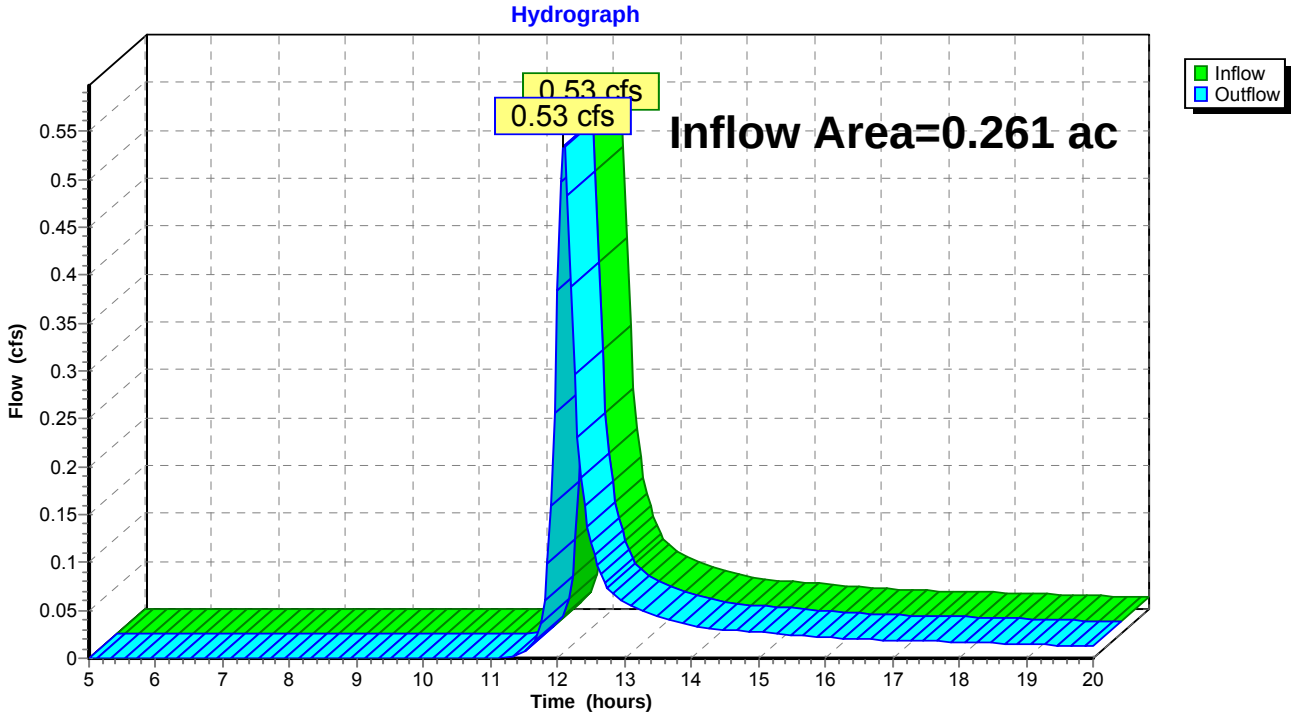


## Summary for Reach 3: OUTLET POINT #3

Inflow Area = 0.261 ac, 0.00% Impervious, Inflow Depth > 1.55" for 25 YEAR event
Inflow = 0.53 cfs @ 12.10 hrs, Volume= 0.034 af
Outflow = 0.53 cfs @ 12.10 hrs, Volume= 0.034 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

## Reach 3: OUTLET POINT #3



Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

**Subcatchment DA-1: DA-1** Runoff Area=374,689 sf 0.31% Impervious Runoff Depth>2.79"
Flow Length=768' Tc=27.1 min CN=64 Runoff=24.05 cfs 2.001 af

**Subcatchment DA-2: DA-2** Runoff Area=123,089 sf 2.49% Impervious Runoff Depth>2.50"
Flow Length=384' Tc=26.0 min CN=61 Runoff=7.20 cfs 0.590 af

**Subcatchment DA-3: DA-3** Runoff Area=11,380 sf 0.00% Impervious Runoff Depth>2.42"
Flow Length=188' Slope=0.1380 '/' Tc=15.9 min CN=60 Runoff=0.85 cfs 0.053 af

**Reach 1: OUTLET POINT #1** Inflow=24.05 cfs 2.001 af
Outflow=24.05 cfs 2.001 af

**Reach 2: OUTLET POINT #2** Inflow=7.20 cfs 0.590 af
Outflow=7.20 cfs 0.590 af

**Reach 3: OUTLET POINT #3** Inflow=0.85 cfs 0.053 af
Outflow=0.85 cfs 0.053 af

**Total Runoff Area = 11.689 ac Runoff Volume = 2.643 af Average Runoff Depth = 2.71"**
**99.17% Pervious = 11.591 ac 0.83% Impervious = 0.097 ac**

## Summary for Subcatchment DA-1: DA-1

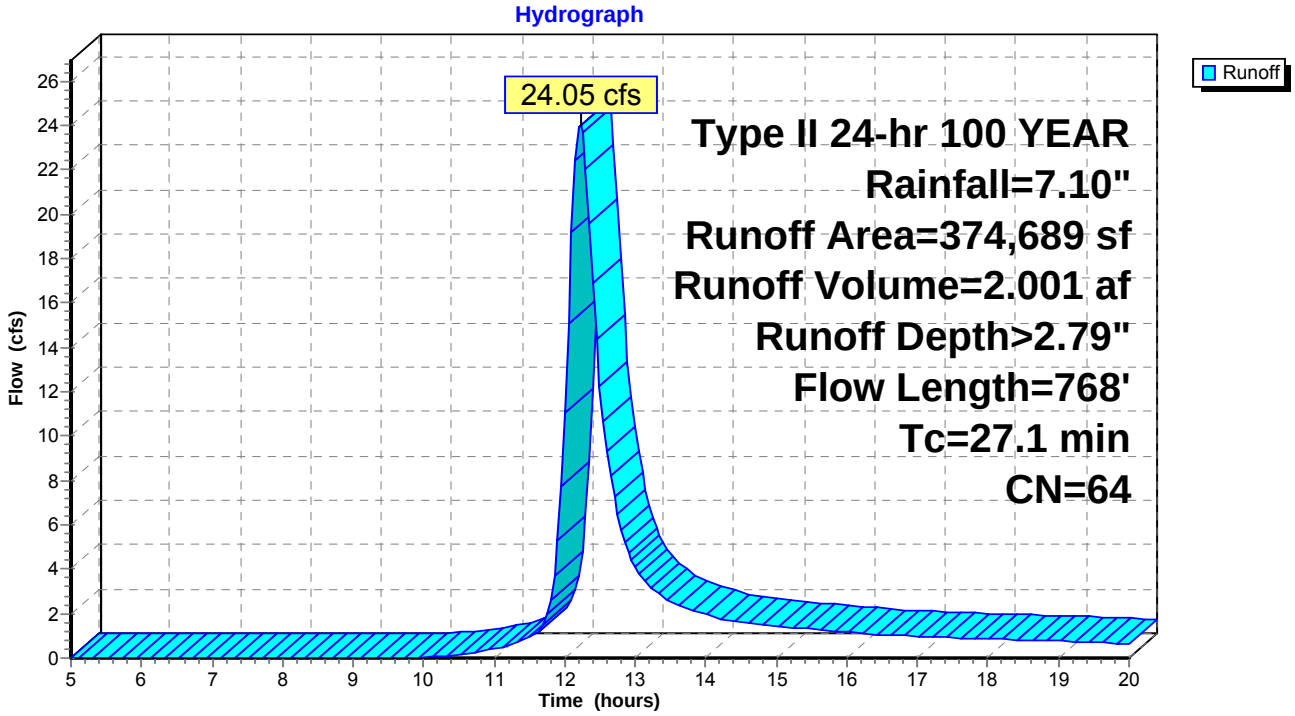
Runoff = 24.05 cfs @ 12.22 hrs, Volume= 2.001 af, Depth> 2.79"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 100 YEAR Rainfall=7.10"

| Area (sf) | CN | Description |
|---|---|---|
| 108,483 | 77 | Woods, Good, HSG D |
| 1,170 | 98 | Roofs, HSG B |
| 14,621 | 85 | Gravel roads, HSG B |
| 167,778 | 55 | Woods, Good, HSG B |
| 82,637 | 61 | >75% Grass cover, Good, HSG B |
| 374,689 | 64 | Weighted Average |
| 373,519 | | 99.69% Pervious Area |
| 1,170 | | 0.31% Impervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|---|---|---|---|---|---|
| 15.2 | 169 | 0.1250 | 0.18 | | **Sheet Flow, SEGMENT #1**<br>Woods: Light underbrush n= 0.400 P2= 3.40" |
| 0.3 | 152 | 0.0580 | 9.10 | 36.41 | **Channel Flow, SEGMENT #2**<br>Area= 4.0 sf Perim= 6.0' r= 0.67'<br>n= 0.030 Earth, grassed & winding |
| 8.4 | 75 | 0.1100 | 0.15 | | **Sheet Flow, SEGMENT #3**<br>Woods: Light underbrush n= 0.400 P2= 3.40" |
| 3.2 | 372 | 0.1500 | 1.94 | | **Shallow Concentrated Flow, SEGMENT #4**<br>Woodland Kv= 5.0 fps |
| 27.1 | 768 | Total | | | |

## Subcatchment DA-1: DA-1



## Summary for Subcatchment DA-2: DA-2

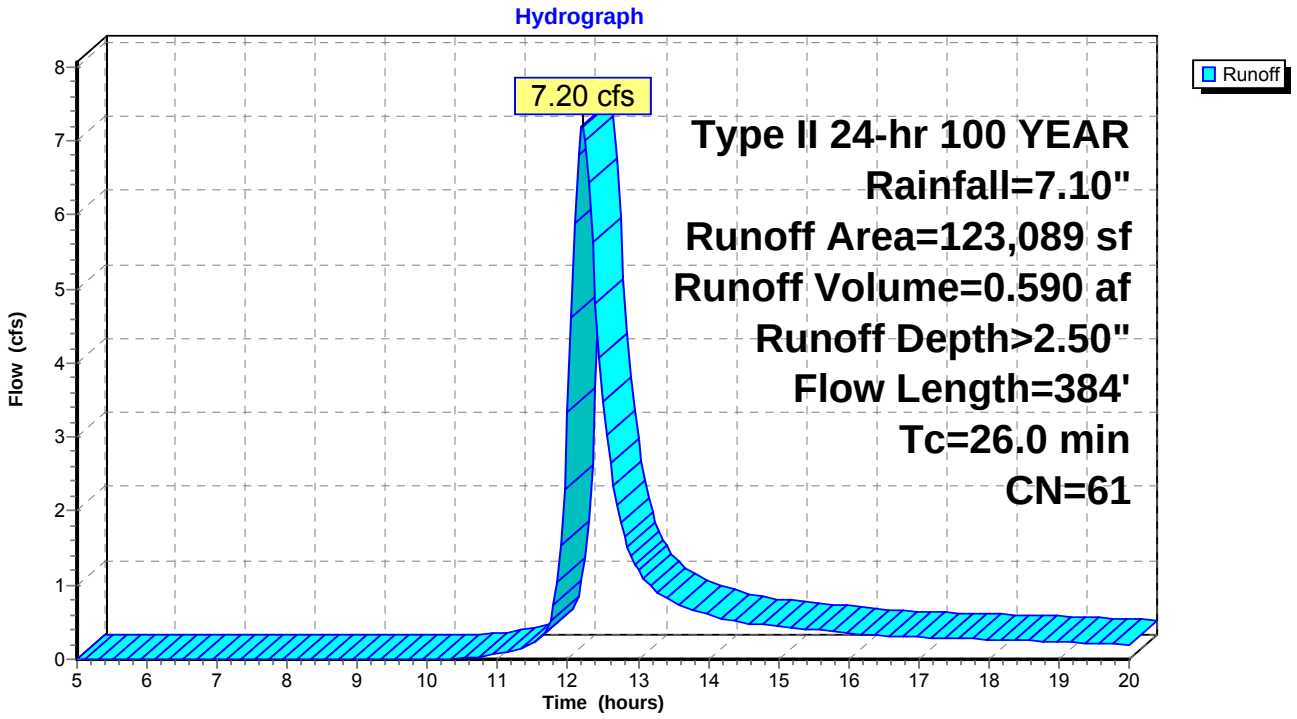
Runoff = 7.20 cfs @ 12.21 hrs, Volume= 0.590 af, Depth> 2.50"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 100 YEAR Rainfall=7.10"

| Area (sf) | CN | Description |
|---|---|---|
| 11,945 | 85 | Gravel roads, HSG B |
| 2,610 | 98 | Roofs, HSG B |
| 457 | 98 | Unconnected pavement, HSG B |
| 48,633 | 61 | >75% Grass cover, Good, HSG B |
| 59,444 | 55 | Woods, Good, HSG B |
| 123,089 | 61 | Weighted Average |
| 120,022 | | 97.51% Pervious Area |
| 3,067 | | 2.49% Impervious Area |
| 457 | | 14.90% Unconnected |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|---|---|---|---|---|---|
| 24.9 | 300 | 0.1150 | 0.20 | | **Sheet Flow, SEGMENT #1** Woods: Light underbrush n= 0.400 P2= 3.40" |
| 1.1 | 84 | 0.0645 | 1.27 | | **Shallow Concentrated Flow, SEGMENT #2** Woodland Kv= 5.0 fps |
| 26.0 | 384 | Total | | | |

## Subcatchment DA-2: DA-2



## Summary for Subcatchment DA-3: DA-3

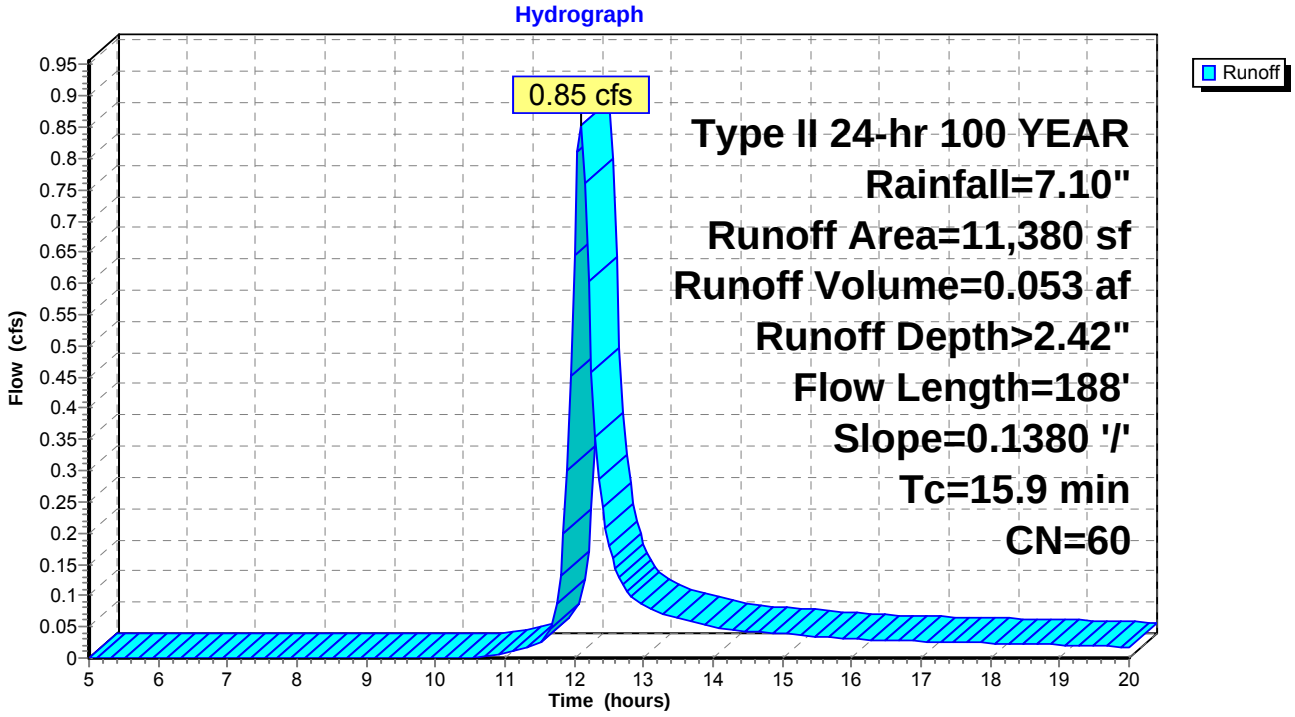
Runoff = 0.85 cfs @ 12.09 hrs, Volume= 0.053 af, Depth> 2.42"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 100 YEAR Rainfall=7.10"

| Area (sf) | CN | Description |
|---|---|---|
| 11,380 | 60 | Woods, Fair, HSG B |
| 11,380 | | 100.00% Pervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|---|---|---|---|---|---|
| 15.9 | 188 | 0.1380 | 0.20 | | **Sheet Flow, SEGMENT 1** Woods: Light underbrush n= 0.400 P2= 3.40" |

## Subcatchment DA-3: DA-3

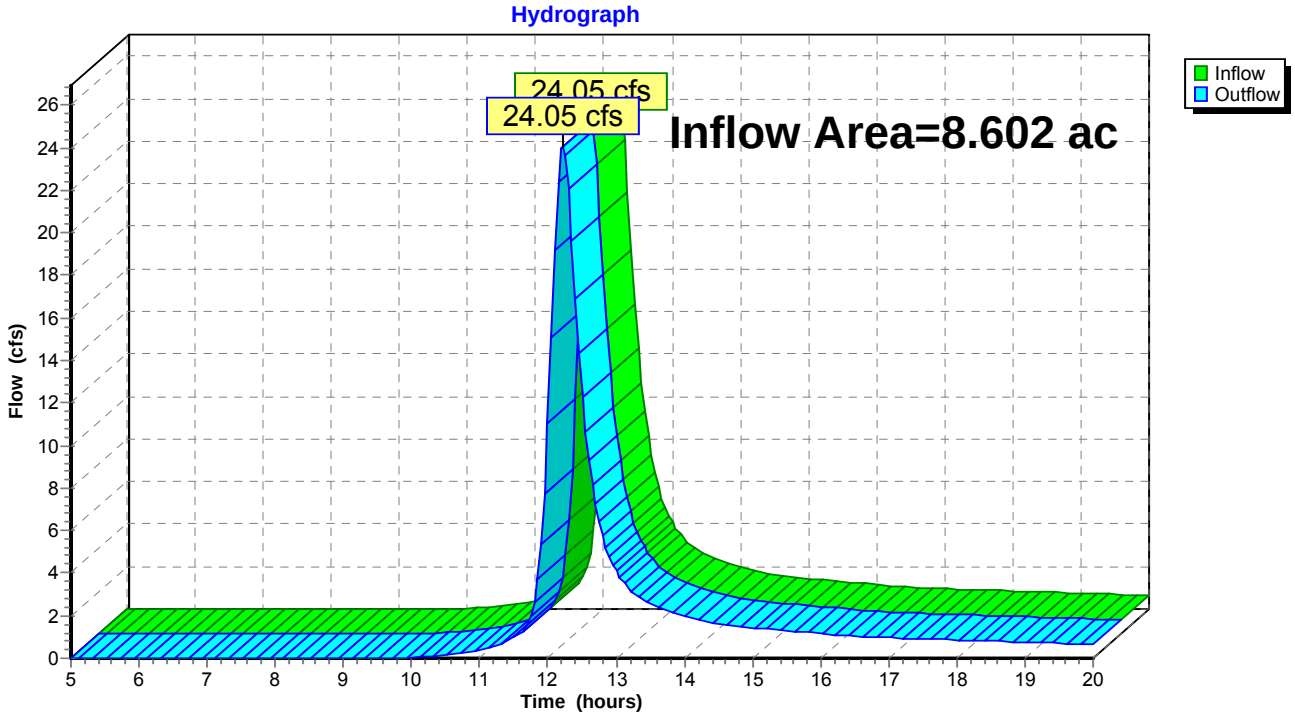


## Summary for Reach 1: OUTLET POINT #1

Inflow Area = 8.602 ac, 0.31% Impervious, Inflow Depth > 2.79" for 100 YEAR event
Inflow = 24.05 cfs @ 12.22 hrs, Volume= 2.001 af
Outflow = 24.05 cfs @ 12.22 hrs, Volume= 2.001 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

## Reach 1: OUTLET POINT #1

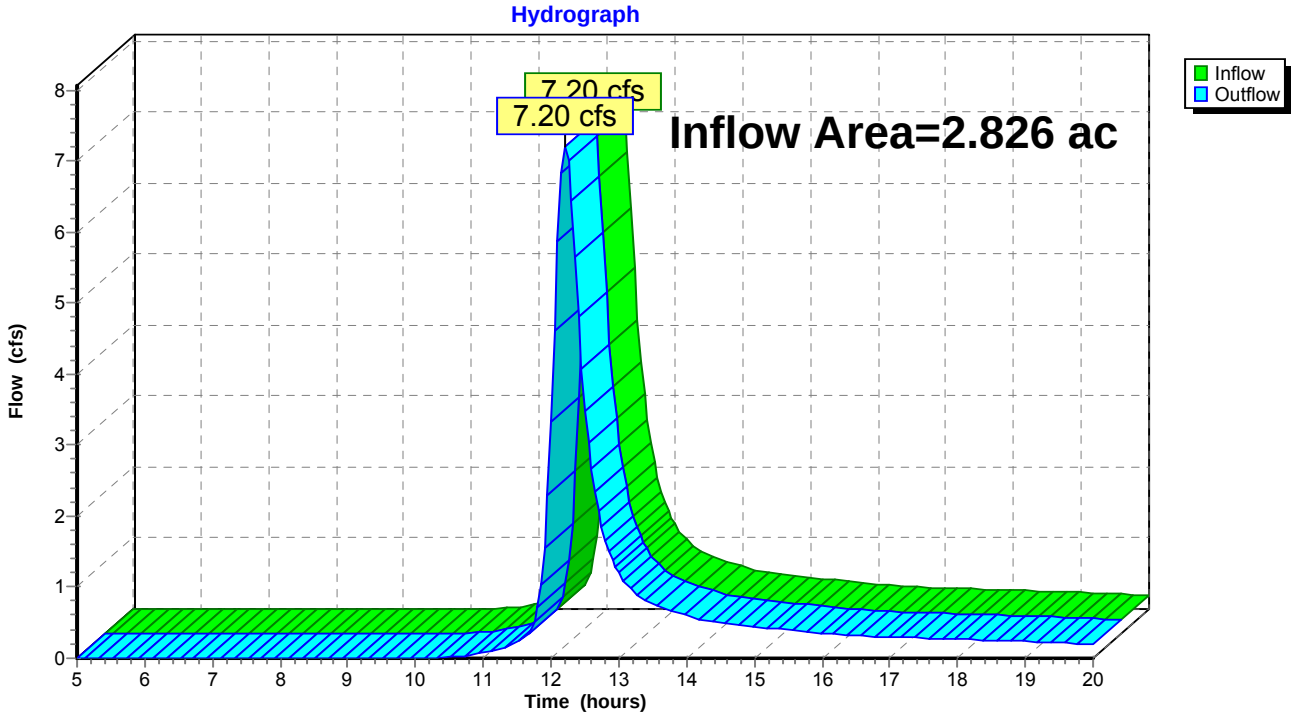


## Summary for Reach 2: OUTLET POINT #2

Inflow Area = 2.826 ac, 2.49% Impervious, Inflow Depth > 2.50" for 100 YEAR event
Inflow = 7.20 cfs @ 12.21 hrs, Volume= 0.590 af
Outflow = 7.20 cfs @ 12.21 hrs, Volume= 0.590 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

## Reach 2: OUTLET POINT #2

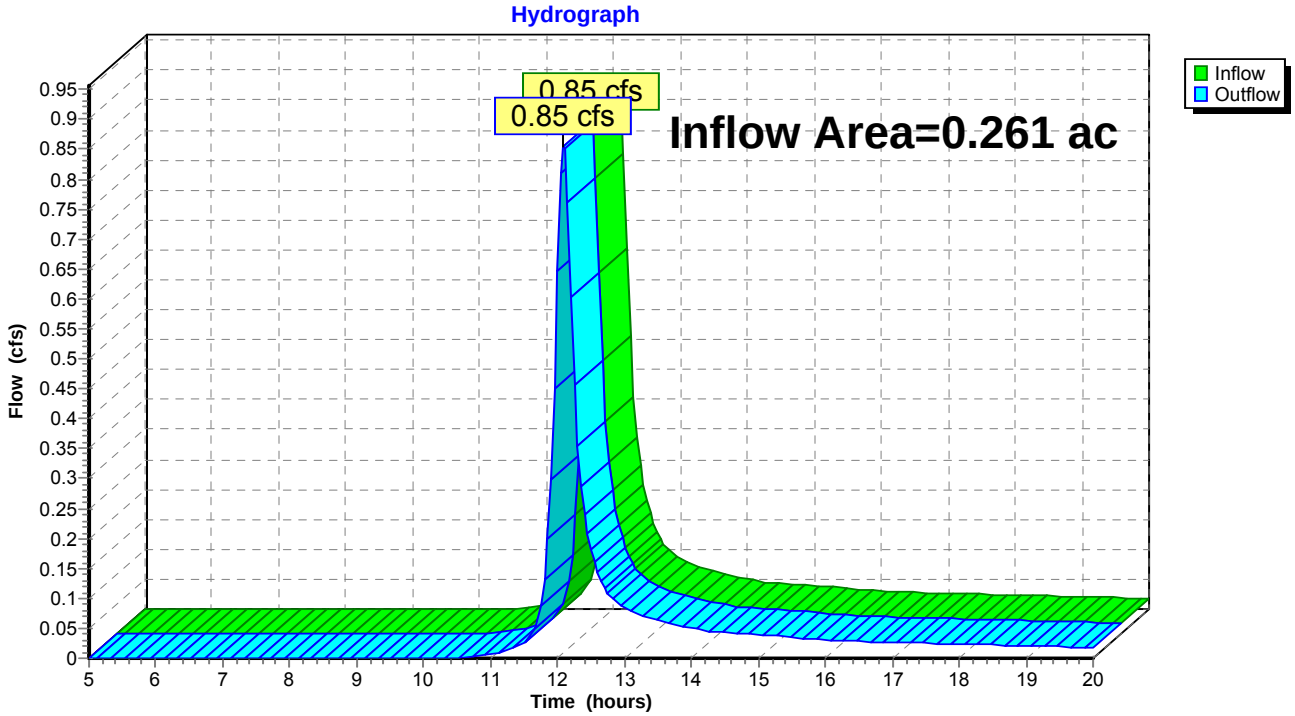


## Summary for Reach 3: OUTLET POINT #3

Inflow Area = 0.261 ac, 0.00% Impervious, Inflow Depth > 2.42" for 100 YEAR event
Inflow = 0.85 cfs @ 12.09 hrs, Volume= 0.053 af
Outflow = 0.85 cfs @ 12.09 hrs, Volume= 0.053 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

## Reach 3: OUTLET POINT #3



# APPENDIX E

## Natural Resources Conservation Service Standard

NATURAL RESOURCES CONSERVATION SERVICE
CONSERVATION PRACTICE
STANDARD

# LEVEL SPREADER

(no.)
CODE 870

(Source:VA Erosion and Sediment Control Handbook)

## DEFINITION

A device used to disperse concentrated runoff uniformly over the ground surface as sheet flow.

## PURPOSE

The purpose of this practice is to convert concentrated, potentially erosive flow to sheet flow and release it uniformly over a stabilized area or filter strip. The resultant sheet flow enhances pollutant filtering and runoff infiltration and reduces the potential for erosion.

## CONDITIONS WHERE PRACTICE APPLIES

The principal application of a level spreader is to convey runoff from impervious surfaces, such as parking lots or roadways, uniformly onto vegetated filter strips. Level spreaders can also be applied as outlets for diversion structures. Level spreaders are appropriate and/or necessary under the following conditions:

1. Where runoff from an impervious surface is uneven and/or runoff is released as concentrated flow, such as through curb cuts or roof downspouts
2. At the ends of diversions
3. Where the runoff water will not re-concentrate after release from the level spreader until it reaches an outlet designed for concentrated flow
4. Where sediment-free storm runoff can be released in sheet flow down a stabilized slope without causing erosion
5. Where the lip of the level spreader can be constructed in undisturbed soil
6. Where there will be no traffic over the spreader

## CRITERIA

Criteria for level spreader design can vary greatly depending on the application. For this reason, two sets of criteria are specified for several of the factors that follow.

For impervious surface runoff applications:

The capacity for the level spreader is determined in the design of the filter strip to which it discharges (see practice standard FILTER STRIP 835).

The spreader shall run linearly along the entire width of the filter strip to which it discharges. In most cases, the spreader will be the same width as the contributing impervious surface. The ends of the spreader shall be tied into higher ground to prevent flow around the spreader.

The minimum depth shall be 6 inches and the minimum width shall be 6 feet for the lower side slope. Side slopes shall be 2:1 (horizontal to vertical) or flatter.

The grade of the spreader shall be 0%.

The discharge area shall meet the requirements of practice standard FILTER STRIP 835.

For diversion outlet applications:

The capacity of the spreader shall be determined using the peak flow from the 10-year frequency, 24-hour duration storm. The drainage area shall be restricted so that maximum flows into the spreader will not exceed 30 cfs.

Spreader dimensions: Select the length and depth of the spreader from the table below. The length dimension is parallel to the diversion.

| Design Flow (cfs) | Minimum Depth (ft) | Minimum Length (ft) |
|---|---|---|
| 0-10 | 0.5 | 10 |
| 10-20 | 0.6 | 20 |
| 20-30 | 0.7 | 30 |

The minimum width of the spreader shall be 6 feet for the lower side slope. Side slopes shall be 2:1 (horizontal to vertical) or flatter.

Construct a 20 foot transition section in the diversion channel so the width of the channel will smoothly meet the width of the spreader to ensure uniform outflow.

The last 20 feet of the diversion channel shall provide a smooth transition from the channel grade to the level spreader and where possible, shall be less than or equal to 1%. The grade of the level spreader shall be 0%.

The outlet discharge area must be generally smooth and well vegetated with a maximum slope of 10%.

For all applications:

The spreader lip shall be constructed to a uniform height and zero grade over the length of the spreader. For design flows of 4 cfs or greater, a rigid lip of non-erodible material, such as pressure-treated timbers or concrete curbing, shall be used. For flows less than 4 cfs, a vegetated lip may be used. The spreader lip shall be constructed on undisturbed soil.

When using a vegetated lip it shall be protected with an erosion control blanket to prevent erosion and allow the vegetation to become established. The erosion control blanket for a vegetated lip shall meet the requirements of

practice standard EROSION BLANKET 830. The blanket shall be a minimum of 4 feet wide extending a minimum of 1 foot downstream over the level lip. The blanket shall be secured with heavy duty staples and the downstream and upstream edges shall be buried at least 6 inches deep in a vertical trench.

When using a rigid lip it shall be entrenched at least 4 inches below existing ground and securely anchored to prevent displacement. An apron of coarse aggregate meeting IDOT CA-1 or CA-3 gradation shall be placed to the top of the rigid lip and extend downslope at least 3 feet. A filter fabric shall be placed under the coarse aggregate. The filter fabric shall meet the requirements of material specification 592 GEOTEXTILE Table 1 or 2, Class I, II, or IV.

Immediately after level spreader construction, seed and mulch the entire disturbed area of the spreader. Seeding shall meet the requirements of practice standard PERMANENT SEEDING 880 and mulching shall meet the requirements of practice standard MULCHING 875.

## CONSIDERATIONS

The level spreader is a relatively low-cost structure to:

1. Disperse impervious surface runoff uniformly to a filter strip or
2. Release small volumes of concentrated flow from diversions when conditions are suitable

To accomplish these purposes, particular care must be taken to construct the spreader lip completely level. Any depressions in the lip will concentrate the flow, resulting in a loss of pollutant filtering effectiveness and/or erosion. Evaluate the outlet system to be sure that flow does not concentrate below the outlet.

For filter strip applications, the determination of whether a level spreader is needed should be based on how the runoff is entering the filter strip. If the runoff is concentrated by curb cuts, and particularly if a large area of impervious surface drains to one point, a level spreader is essential to achieve effective pollutant removal in the filter strip. A level spreader also is important if the filter strip is relatively steep in order to avoid erosion from concentrated runoff discharge. If the runoff is evenly distributed over the width of the impervious surface (e.g., a curbless, even-sloped road or parking lot), a level spreader may not be necessary.

When the level spreader is used as an outlet for temporary or permanent diversions and diversion dikes, runoff containing high sediment loads must be treated in a sediment trapping device such as practice standard TEMPORARY SEDIMENT TRAP 960 or IMPOUNDMENT STRUCTURE-ROUTED 842 before release into a level spreader.

## PLANS AND SPECIFICATIONS

Plans and specifications for installing a level spreader shall be in keeping with this standard and shall describe the requirements for applying the practice to achieve its intended purpose. At a minimum include the following items:

1. The spreader location
2. The length and width

3. For filter strip applications, plans for both the adjacent impervious surface and the filter strip, for diversion outlets, plans detailing the diversion structure and the adjacent outlet area
4. Lip details: vegetated or rigid
5. Stone gradation
6. Filter fabric specifications if used
7. Rigid lip material specifications if used
8. Erosion control blanket specifications if used
9. Seeding and mulching requirements

All plans shall include installation, inspection, and maintenance schedules with the responsible party identified.

Standard drawing LEVEL SPREADER IL-570 may be used as the plan sheet.

## OPERATION AND MAINTENANCE

Inspect level spreaders after every rainfall until vegetation is established, and promptly make needed repairs. After the area has been stabilized, make periodic inspections and maintain vegetation in a healthy, vigorous condition.

Verify that the level spreader is distributing flow evenly. If problems are noted, make appropriate modifications to ensure even flow distribution.

## REFERENCES

Illinois Department of Transportation, 1997. Standard Specifications for Road and Bridge Construction. IL

North Carolina Sedimentation Control Commission, 1988. Erosion and Sediment Control Planning and Design Manual. NC

Virginia Department of Conservation and Recreation, Division of Soil and Water Conservation, 1992. Virginia Erosion and Sediment Control Handbook, 3rd ed., VA

NRCS IL January 1999

urbst870.doc