STORMWATER MANAGEMENT CALCULATIONS

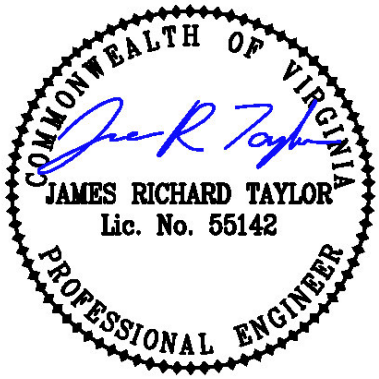
FOR

NORTHSIDE PARK
REVISED SECTION XII

MOUNT TABOR MAGISTERIAL DISTRICT
TOWN OF BLACKSBURG, VA

B&A Job #24220049.00

January 3, 2023
Revised: April 3, 2023



APPROVAL BLOCK	
BLACKSBURG TOWN ENGINEER	DATE

PREPARED BY:

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SECTION I: PROJECT NARRATIVE

Project Description

The purpose of this project is the subdivision of 36.00 acres of land for SAS Construction. The project is subdivided into 55 lots in Section XII, Phase II and 51 lots in the proposed new section (Section XII, Tract B). The parcels are zoned as R-4 (Low Density Residential) with open space design overlay. Single family homes will be constructed on the subdivided lots.

Existing Site Conditions

The site[1] consists of mixed grassed and wooded area with an area of farm land. The site is surrounded by the existing Northside Park subdivision off of Northside Drive and a parcel (Tax Map # 166-A 4C) dedicated to the Town of Blacksburg for open/recreational space.

The site has an impervious coverage of 1.12 acres (3.0%) at the conditions prior to development. Existing soil conditions onsite include the types listed below with slopes of 2%-30%. There are currently no known environmental issues on site, however, prior to construction, the site will be fully investigated to determine if there are any jurisdictional waters on the property or within any of the areas of disturbance. If evidence is found, the property will be delineated, confirmed by the US Army Corps of Engineers, and all necessary permits will be filed. An unnamed tributary of Tom's Creek is located on the property outside of the limits of disturbance. The approximate 100-year flood plain and wetland boundaries are delineated and shown on sheet SWM1.

Existing soil conditions on-site include the following types:

8D – Caneyville-Opequon-Rock outcrop complex, 7 to 25 percent
K-Factor: 0.37
pH: 5.9
HSG: C
Texture: silt loam

11B—Duffield-Ernest complex, 2 to 7 percent slopes
K-Factor: 0.28
pH: 6.0
HSG: B
Texture: silt loam

12C—Frederick and Vertrees silt loams, 7 to 15 percent slopes
K-Factor: 0.37
pH: 5.3
HSG: B
Texture: silt loam

[1] For the purposes of the Soil & Erosion Control Narrative, "site" shall be defined as the area within the proposed subject property boundary, 36.00 acres, Tax Map #s 166-10A, 166-10-B, 166-17A, 166-17B.

13C—Frederick and Vertrees gravelly silt loams, 7 to 15 percent slopes
K-Factor: 0.37
pH: 5.3
HSG: B
Texture: gravelly silt loam

13D—Frederick and Vertrees gravelly silt loams, 15 to 25 percent
K-Factor: 0.37
pH: 5.3
HSG: B
Texture: gravelly silt loam

16B—Groseclose and Poplimento soils, 2 to 7 percent slopes
K-Factor: 0.32
pH: 4.6
HSG: C
Texture: loam

16C—Groseclose and Poplimento soils, 7 to 15 percent slopes
K-Factor: 0.32
pH: 4.6
HSG: C
Texture: loam

16D—Groseclose and Poplimento soils, 15 to 25 percent slopes
K-Factor: 0.32
pH: 4.6
HSG: C
Texture: loam

25—McGary and Purdy soils
K-Factor: 0.43
pH: 7.5
HSG: D
Texture: silt loam

Development Plans

The proposed development will consist of 55 new single family homes with 3-5 bedrooms each. The homes will each be two (2) stories either over crawlspace or with walk-out basements. Each home will include a covered front porch and either an elevated deck or patio on grade in the rear and a two-car garage. Water main and sanitary sewer main extensions are proposed to serve the development. Stormwater quantity management will be handled by standard detention ponds, bioretention facilities, and/or manufactured treatment devices. Water quality requirements will be met by the onsite facilities and the purchase nutrient credits up to 25%.

During Construction

Neighboring areas on the south side of the development are primarily developed urban land consisting of single-family residential properties. Properties on the north side of the development are primarily rural residential. Any runoff from the site shall be controlled with temporary measures such as a construction entrance, silt fence, inlet protection, construction road stabilization, seeding and other measures per Virginia Erosion and Sediment Control Handbook standards.

SECTION II: STORMWATER MANAGEMENT SUMMARY

PRE-DEVELOPMENT SUMMARY

Please see sheet SW3 for the pre-development drainage area map.

In the pre-development condition, the site is primarily grassed with some wooded and grassed mix cover. The site is contained within one drainage area that drains directly to an unnamed tributary of Tom's Creek located on a Northside Park open space parcel adjacent to the site. Multiple large drainage areas drain through the site through natural waterways and swales. The flows converge into the tributary and discharges into a culvert that crosses US 460. The upper invert of the culvert is used as the point of analysis.

A portion of the pre-development drainage area was modeled using the Northside Park Section XII, Phase II stormwater calculations. This drainage area, denoted as DA #1 on this plan, is directed into an existing stormwater management facility that discharges to the Tom's Creek tributary.

See the following pages and the enclosed HydroCAD report for the peak flow rates and runoff volumes in the pre-development condition. All flows in the HydroCAD model have been analyzed using the SCS/TR-55, weighted Q method. See the included drainage map and HydroCAD report for time of concentration calculations. Where a subwatershed is predominantly impervious, a minimum time of concentration of 6 minutes has been assumed.

TABLE 1: PRE-DEVELOPMENT PEAK DISCHARGE ASSESSMENT AT POINT OF ANALYSIS

Design Storm	***Pre-development Peak Flow (cfs)***
1-yr	62.13
2-yr	92.48
10-yr	190.11
100-yr	455.32

POST-DEVELOPMENT SUMMARY

Please see sheet SW4 for the post-development drainage area map.

In accordance with the Virginia Stormwater Management Regulations (9VAC25-870), this project is subject to and has been designed in accordance with Part IIB technical criteria.

In the post-development condition, the proposed site will be graded to capture runoff via sheet flow, roof drains, curb inlets, and stormwater piping. Runoff will be collected in one of several standard detention basins, bioretention facilities, and manufactured treatment devices. Outflows from the systems will be managed by multiple flow control devices and an emergency spillway and are routed through existing channels to the point of analysis. No encroachment into the existing wetlands or 100-year floodplain are proposed. As shown in the enclosed HydroCAD calculations, the detention facilities have been designed to manage peak flows and meet water quantity requirements. Appendix D includes runoff reduction volumes and adjusted curve numbers for proposed bioretention drainage areas.

The following pages and the HydroCAD report demonstrate that the site will be contributing less flow to the point of analysis than in the pre-development condition.

See the following pages and the enclosed HydroCAD report for the peak flow rates and runoff volumes in the post-development condition. All flows in this model have been analyzed using the SCS/TR-55, weighted Q method. See the included drainage map and HydroCAD report for time of concentration calculations.

TABLE 2: OVERALL PEAK DISCHARGE ASSESSMENT

	Pre-development Peak Flow	Post-development Peak Flow	% Change
1-yr	62.13 cfs	57.85 cfs	**-6.9%**
2-yr	92.48 cfs	92.13 cfs	**-0.4%**
10-yr	190.11 cfs	189.80 cfs	**-0.2%**
100-yr	455.32 cfs	465.13 cfs	**+2.2% ***

* 100-yr storm not required to be less than pre-development

Channel Protection

In accordance with 9VAC25-870-66 (B), concentrated stormwater flows have been discharged directly to downstream stormwater conveyance systems. Per subdivision (3)(a), the maximum post-development peak flow rate from the one-year 24-hour storm shall be calculated per the equations below where natural conveyance systems exist within the limits of analysis. The development will utilize the proposed detention facilities to achieve the peak flow reduction required by the energy balance equation.

$Q_{Developed} \leq I.F. \times \left(Q_{Pre-developed} \times RV_{Pre-developed}\right)/RV_{Developed}$; where

$Q_{Developed}$ = the allowable peak flow rate of runoff from the developed site[2]
$RV_{Developed}$ = the volume of runoff from the site[2] in the developed condition
$Q_{Pre-developed}$ = the peak flow rate of runoff from the site[2] in the pre-developed condition
$RV_{Pre-developed}$ = the volume of runoff from the site[2] in the pre-developed condition

The Point of Analysis and certain drainage areas unavoidably include a some quantity of runoff from areas other than the development site[2]. The energy balance equation is applied to the development site[2] runoff only and therefore this flow rate reduction must be entered in the overall watershed model to apply the reduction only to the site area sub-watersheds and account for the addition of hydrographs of varying times of concentration. The energy balance equation can be algebraically reduced as shown below to obtain a factor by which the pre-development site sub-watershed shall be multiplied.

R_V Calculation (Site Area)
Pre-development = 0.825 af – See HydroCAD Report "RV CALCULATION"
Post-development = 2.829 af – See HydroCAD Report "RV CALCULATION"

$Q_{Developed} \leq I.F. \times \left(Q_{Pre-developed} \times RV_{Pre-developed}\right)/RV_{Developed}$
$Q_{Developed} \leq 0.8 \times \left(Q_{Pre-developed} \times 0.825\ af\right)/2.829\ af$
$Q_{Developed} \leq 0.23 \times Q_{Pre-developed}$

The development will utilize a proposed SWM facility to achieve the peak flow reduction required by the energy balance equation. Since the energy balance equation is applied to the development site drainage area only, this reduced flow rate has been entered into the pre-development model to obtain a maximum flow rate at the point of analysis. Per the equation above, the pre-development flow from the site has been multiplied by a factor of 0.23 in the attached HydroCAD calculations labeled "CHANNEL PROTECTION".

The resulting maximum allowable peak flow rate for the one-year 24-hour storm at the Point of Analysis is 60.15 cfs.

[2] In the context of channel and flood protection, "site" shall be defined as the land or water area where the land-disturbing activity is physically conducted, including the limits of any off-site land disturbance. For the purposes of this analysis, this includes the disturbance for the Northside Park site as well as the construction of the future Progress Street extension. The applicable area totals 37.32 acres, as shown on sheet SW4.

Compliance with the Channel Protection requirements at the Point of Analysis is summarized in the table below.

TABLE 3: 1-YR PEAK DISCHARGE ASSESSMENT AT POINT OF ANALYSIS

Pre-development Peak Flow	Energy Balance Max Peak	Post-development Peak Flow
62.13 cfs	60.15 cfs	**57.85 cfs**

Flood Protection

In accordance with 9VAC25-870-66 (C), concentrated stormwater flows have been discharged to a stormwater conveyance system. The downstream conveyance systems are made up of a series of natural and manmade conveyance systems. As shown on the attached HydroCAD calculations, the point of discharge releases a post-development peak flow rate for the 10-year 24-hour storm event that is less than the pre-development peak flow rate from the 10-year 24- hour storm event, satisfying subdivision 2(b). Per subdivision (3) of these regulations, no further analysis of the downstream stormwater conveyance system is required.

TABLE 4: FLOOD PROTECTION COMPLIANCE SUMMARY

	Pre-development Peak Flow	Post-development Peak Flow	% Change
10-yr	190.11 cfs	189.80 cfs	**-0.2%**

SECTION III: STORMWATER QUALITY SUMMARY

Water Quality:

Water quality compliance has been achieved through use of the Virginia Runoff Reduction Method in accordance with the design criteria set forth in 9VAC25-870-65 and through the purchase of nutrient credits in accordance with the criteria set forth in the Code of Virginia. Per §62.1-44.15:35 (C)(2), the VSMP shall allow the use of nutrient credits when it is demonstrated that onsite control of at least 75 percent of the required phosphorous water quality reduction will be achieved. The following calculations will demonstrate that at least 75% of the phosphorus water quality reduction for the entire development is achieved through onsite BMPs, and the remainder is achieved through the purchase of nutrient credits.

Criteria	*Value*
Applicable Area	37.32 ac.
Existing Impervious	1.12 ac.
Existing Managed Turf	36.20 ac.
Proposed Impervious	13.91 ac.
Proposed Managed Turf	23.41 ac.
Load Reduction Required	25.84 lb/yr

The existing site[3] has a pre-development impervious land cover of 1.12 acres (3.0%). The proposed development site has an impervious land cover of 13.91 acres (37.3%) resulting in a composite runoff coefficient (R_v) of 0.48. The prescribed phosphorus pollutant reduction requirement is 25.84 lb/yr, of which 19.38 lb/yr (75%) must be achieved on site. The proposed on-site BMPs remove 19.41 lb/yr and the remaining 6.43 lbs/yr will be satisfied through a nutrient credit purchase. The phosphorus pollutant reduction achieved by the on-site BMPs is summarized in the table below.

BMP ID	*Phosphorus Load Reduction*
BIO-1	1.60 lb/yr
BIO-2	4.93 lb/yr
BIO-3	4.53 lb/yr
BIO-4	4.24 lb/yr
MTD-1	4.12 lb/yr
TOTAL	**19.41 lb/yr**

Please see the VRRM calculation sheets located in Appendix D for summary tables identifying pollutant load and load reduction requirements and calculations.

[3] In the context of water quality compliance, "site" shall be defined as the land or water area where the land-disturbing activity is physically conducted, including the limits of any off-site land disturbance. For the purposes of this analysis, this includes the disturbance for the Northside Park site as well as the construction of the future Progress Street extension. The applicable area totals 37.32 acres, as shown on sheet SW4.

SECTION IV: DOWNSTREAM ANALYSIS

Runoff from the proposed development is discharged directly into to a series of natural and manmade conveyance systems. The post-development peak runoff has been mitigated with bioretention facilities and standard detention facilities to prevent adverse impacts from this site to downstream properties in the form of channel erosion and flooding.

Per 9VAC25-870-66 subsection A, compliance with Minimum Standard 19 of the Virginia Erosion and Sediment Control Regulations has been satisfied by meeting the requirements of the for channel protection and flood protection as shown in the Post Development Summary. No adverse impacts to downstream properties are expected as a result of this development.

SECTION IV: STORMWATER MANAGEMENT MAINTENANCE/INSPECTION PLAN

Generally

1. The owner is responsible for providing or coordinating all facility inspections and any required maintenance that may result from such inspections.

2. Requirements listed here are to be taken as a minimum and do not represent the limit of responsibility.

3. Any standing water pumped during the maintenance operation must be disposed of per the VESCH, 1992 edition and any local requirements.

Required Action

Bioretention Filters:

1. Every (12) twelve months the responsible party shall complete the "Bioretention practices O&M Checklist" provided in Appendix 9C of the Virginia Stormwater Management Handbook (VSMH) and make any repairs necessary to areas of failure/concern discovered during inspection. typical maintenance tasks include:
    a. check to see if 75% to 90% cover (mulch plus vegetative cover) has been achieved in the bed, and measure the depth of the remaining mulch.
    b. check for sediment buildup at curb cuts, gravel diaphragms or pavement edges that prevents flow from getting into the bed, and check for other signs of bypassing.
    c. check for any winter- or salt-killed vegetation, and replace it with hardier species.
    d. note presence of accumulated sand, sediment and trash in the pre-treatment cell or filter beds, and remove it.
    e. inspect bioretention side slopes and grass filter strips for evidence of any rill or gully erosion, and repair it.
    f. check the bioretention bed for evidence of mulch flotation, excessive ponding, dead plants or concentrated flows, and take appropriate remedial action.
    g. check inflow points for clogging, and remove any sediment.
    h. look for any bare soil or sediment sources in the contributing drainage area, and stabilize them immediately.
    i. check for clogged or slow-draining soil media, a crust formed on the top layer, inappropriate soil media, or other causes of insufficient filtering time, and restore proper filtration characteristics.
2. Every (6) months and after each major runoff producing storm event, the following maintenance tasks shall be performed:
    a. inspect condition of grate inlet riser for evidence of clogging, leakage, debris accumulation, etc. that may compromise the performance of the structure. such debris or sediments shall be removed immediately.

3. Grassed areas shall be maintained so as to promote soil stabilization of basin side slopes and proper functioning of outfall structures. the basin side slopes shall be mowed a minimum of twice a year to discourage woody growth.

Standard (Dry) Detention Ponds:

1. Every (12) twelve months the responsible party shall complete and document a visual inspection of the access road, detention pond facility, and it's outlet structure and make any repairs necessary to areas of failure/concern discovered during inspection. Typical maintenance tasks include:
    a. Inspect pond outfall channel for erosion, undercutting, rip-rap displacement, woody growth, etc.
    b. Inspect condition of principal spillway and riser for evidence of spalling, joint failure, leakage, corrosion, etc.
    c. Inspect internal and external side slopes of the pond for evidence of sparse vegetative cover, erosion, or slumping, and make needed repairs immediately.
    d. Grassed areas shall be maintained so as to promote soil stabilization of pond banks and proper functioning of outfall structures. The pond banks shall be mowed a minimum of twice a year to discourage woody growth.
    e. Erosion repair and trash removal around the inlet and outlet structures and pond banks shall be performed twice during the growing season (April-October).
2. Every (6) months and after each major runoff producing storm event, the following maintenance tasks shall be performed:
    a. Inspect the condition of the access road for any issues including standing water or erosion of the surface course. A surface course of 2 to 3 inches of compacted crusher run shall be maintained at all times. Rutting, potholes, or deterioration of the surface course shall be repaired immediately.
    b. Inspect condition of all openings and trash racks for evidence of clogging, leakage, debris accumulation, etc that may compromise the performance of the structure. Such debris or sediments shall be removed immediately.

Manufactured Treatment Devices (MTDs):

1. The maintenance and inspection of all manufactured treatment devices (MTDs) shall be in accordance with the system manufacturer's guidelines at an interval not to exceed every (12) twelve months. Any repairs necessary to areas of failure/concern discovered during inspection shall be completed promptly by the property owner.
2. Up-to-date maintenance and inspection requirements can be found by contacting the following manufacturers:
    a. Jellyfish Filters: Contech Engineered Solutions
    1-800-338-1122
    www.conteches.com

APPENDIX A:
SOIL MAPS & SOIL DESCRIPTIONS

United States Department of Agriculture

NRCS

Natural Resources Conservation Service

A product of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local participants

Custom Soil Resource Report for Montgomery County, Virginia

July 22, 2022

Preface

Soil surveys contain information that affects land use planning in survey areas. They highlight soil limitations that affect various land uses and provide information about the properties of the soils in the survey areas. Soil surveys are designed for many different users, including farmers, ranchers, foresters, agronomists, urban planners, community officials, engineers, developers, builders, and home buyers. Also, conservationists, teachers, students, and specialists in recreation, waste disposal, and pollution control can use the surveys to help them understand, protect, or enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. Soil surveys identify soil properties that are used in making various land use or land treatment decisions. The information is intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Although soil survey information can be used for general farm, local, and wider area planning, onsite investigation is needed to supplement this information in some cases. Examples include soil quality assessments (http://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/health/) and certain conservation and engineering applications. For more detailed information, contact your local USDA Service Center (https://offices.sc.egov.usda.gov/locator/app?agency=nrcs) or your NRCS State Soil Scientist (http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/contactus/?cid=nrcs142p2_053951).

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

The National Cooperative Soil Survey is a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (NRCS) has leadership for the Federal part of the National Cooperative Soil Survey.

Information about soils is updated periodically. Updated information is available through the NRCS Web Soil Survey, the site for official soil survey information.

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Contents

How Soil Surveys Are Made

Soil surveys are made to provide information about the soils and miscellaneous areas in a specific area. They include a description of the soils and miscellaneous areas and their location on the landscape and tables that show soil properties and limitations affecting various uses. Soil scientists observed the steepness, length, and shape of the slopes; the general pattern of drainage; the kinds of crops and native plants; and the kinds of bedrock. They observed and described many soil profiles. A soil profile is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed or from the surface down to bedrock. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

Currently, soils are mapped according to the boundaries of major land resource areas (MLRAs). MLRAs are geographically associated land resource units that share common characteristics related to physiography, geology, climate, water resources, soils, biological resources, and land uses (USDA, 2006). Soil survey areas typically consist of parts of one or more MLRA.

The soils and miscellaneous areas in a survey area occur in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil and miscellaneous area is associated with a particular kind of landform or with a segment of the landform. By observing the soils and miscellaneous areas in the survey area and relating their position to specific segments of the landform, a soil scientist develops a concept, or model, of how they were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil or miscellaneous area at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-vegetation-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. Soil taxonomy, the system of taxonomic classification used in the United States, is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil

scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

The objective of soil mapping is not to delineate pure map unit components; the objective is to separate the landscape into landforms or landform segments that have similar use and management requirements. Each map unit is defined by a unique combination of soil components and/or miscellaneous areas in predictable proportions. Some components may be highly contrasting to the other components of the map unit. The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The delineation of such landforms and landform segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, onsite investigation is needed to define and locate the soils and miscellaneous areas.

Soil scientists make many field observations in the process of producing a soil map. The frequency of observation is dependent upon several factors, including scale of mapping, intensity of mapping, design of map units, complexity of the landscape, and experience of the soil scientist. Observations are made to test and refine the soil-landscape model and predictions and to verify the classification of the soils at specific locations. Once the soil-landscape model is refined, a significantly smaller number of measurements of individual soil properties are made and recorded. These measurements may include field measurements, such as those for color, depth to bedrock, and texture, and laboratory measurements, such as those for content of sand, silt, clay, salt, and other components. Properties of each soil typically vary from one point to another across the landscape.

Observations for map unit components are aggregated to develop ranges of characteristics for the components. The aggregated values are presented. Direct measurements do not exist for every property presented for every map unit component. Values for some properties are estimated from combinations of other properties.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses and under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot predict that a high water table will always be at a specific level in the soil on a specific date.

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and

identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

Soil Map

The soil map section includes the soil map for the defined area of interest, a list of soil map units on the map and extent of each map unit, and cartographic symbols displayed on the map. Also presented are various metadata about data used to produce the map, and a description of each soil map unit.

Custom Soil Resource Report
Soil Map

MAP LEGEND

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

Soils
- Soil Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

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

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 1:15,800.

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: Montgomery County, Virginia
Survey Area Data: Version 14, Sep 14, 2021

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

Date(s) aerial images were photographed: Sep 29, 2019—Oct 4, 2019

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

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
8D	Caneyville-Opequon-Rock outcrop complex, 7 to 25 percent slopes	4.0	6.4%
11B	Duffield-Ernest complex, 2 to 7 percent slopes	3.9	6.2%
12C	Frederick and Vertrees silt loams, 7 to 15 percent slopes	29.6	46.8%
13C	Frederick and Vertrees gravelly silt loams, 7 to 15 percent slopes	2.2	3.4%
13D	Frederick and Vertrees gravelly silt loams, 15 to 25 percent slopes	1.9	3.1%
16B	Groseclose and Poplimento soils, 2 to 7 percent slopes	0.2	0.3%
16C	Groseclose and Poplimento soils, 7 to 15 percent slopes	12.7	20.0%
16D	Groseclose and Poplimento soils, 15 to 25 percent slopes	3.7	5.8%
25	McGary and Purdy soils	5.1	8.1%
Totals for Area of Interest		**63.2**	**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 some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

Montgomery County, Virginia

8D—Caneyville-Opequon-Rock outcrop complex, 7 to 25 percent slopes

Map Unit Setting

National map unit symbol: kc3b
Elevation: 1,500 to 2,700 feet
Mean annual precipitation: 30 to 45 inches
Mean annual air temperature: 50 to 57 degrees F
Frost-free period: 117 to 185 days
Farmland classification: Not prime farmland

Map Unit Composition

Caneyville and similar soils: 30 percent
Opequon and similar soils: 25 percent
Rock outcrop: 20 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Caneyville

Setting

Landform: Hills
Landform position (two-dimensional): Summit, backslope
Landform position (three-dimensional): Interfluve, side slope
Down-slope shape: Linear
Across-slope shape: Convex
Parent material: Limestone residuum

Typical profile

H1 - 0 to 8 inches: silt loam
H2 - 8 to 32 inches: clay
H3 - 32 to 79 inches: bedrock

Properties and qualities

Slope: 7 to 25 percent
Depth to restrictive feature: 20 to 40 inches to lithic bedrock
Drainage class: Well drained
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Very low (0.00 to 0.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Low (about 5.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: C
Hydric soil rating: No

Description of Opequon

Setting

Landform: Hills
Landform position (two-dimensional): Summit, backslope

Landform position (three-dimensional): Interfluve, side slope
Down-slope shape: Linear
Across-slope shape: Convex
Parent material: Limestone residuum

Typical profile

H1 - 0 to 4 inches: silty clay loam
H2 - 4 to 15 inches: clay
H3 - 15 to 79 inches: bedrock

Properties and qualities

Slope: 7 to 25 percent
Depth to restrictive feature: 12 to 20 inches to lithic bedrock
Drainage class: Well drained
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Very low (0.00 to 0.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Very low (about 2.3 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: D
Hydric soil rating: No

Description of Rock Outcrop

Setting

Landform: Escarpments
Landform position (two-dimensional): Summit, backslope
Landform position (three-dimensional): Interfluve, side slope, free face
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Limestone

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 8s
Hydric soil rating: No

11B—Duffield-Ernest complex, 2 to 7 percent slopes

Map Unit Setting

National map unit symbol: kc1q
Elevation: 1,300 to 3,000 feet
Mean annual precipitation: 30 to 45 inches
Mean annual air temperature: 50 to 57 degrees F

Frost-free period: 117 to 185 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Duffield and similar soils: 45 percent
Ernest and similar soils: 35 percent
Minor components: 3 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Duffield

Setting

Landform: Drainageways
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Base slope
Down-slope shape: Concave
Across-slope shape: Convex
Parent material: Loamy colluvial, alluvial, eolian sediments underlain by loamy and clayey residuum of limestone and shale

Typical profile

H1 - 0 to 7 inches: silt loam
H2 - 7 to 37 inches: silty clay loam
H3 - 37 to 79 inches: clay

Properties and qualities

Slope: 2 to 7 percent
Depth to restrictive feature: 48 to 99 inches to lithic bedrock
Drainage class: Well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: High (about 10.3 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2e
Hydrologic Soil Group: B
Hydric soil rating: No

Description of Ernest

Setting

Landform: Drainageways
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Base slope
Down-slope shape: Concave
Across-slope shape: Convex
Parent material: Interbedded limestone and shale residuum

Typical profile

H1 - 0 to 6 inches: silt loam
H2 - 6 to 26 inches: silty clay loam
H3 - 26 to 50 inches: silty clay loam

H4 - 50 to 79 inches: silty clay loam

Properties and qualities

Slope: 2 to 7 percent
Depth to restrictive feature: 20 to 35 inches to fragipan
Drainage class: Moderately well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.57 in/hr)
Depth to water table: About 18 to 36 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Low (about 3.8 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2e
Hydrologic Soil Group: C
Hydric soil rating: No

Minor Components

Purdy

Percent of map unit: 3 percent
Landform: Stream terraces, depressions
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: Yes

12C—Frederick and Vertrees silt loams, 7 to 15 percent slopes

Map Unit Setting

National map unit symbol: kc1t
Elevation: 1,700 to 3,000 feet
Mean annual precipitation: 30 to 45 inches
Mean annual air temperature: 50 to 57 degrees F
Frost-free period: 117 to 185 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Frederick and similar soils: 40 percent
Vertrees and similar soils: 35 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Frederick

Setting

Landform: Hills
Landform position (two-dimensional): Summit, backslope

Landform position (three-dimensional): Interfluve, side slope
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Limestone interbedded with siltstone and shale residuum

Typical profile

H1 - 0 to 10 inches: silt loam
H2 - 10 to 22 inches: clay
H3 - 22 to 79 inches: clay

Properties and qualities

Slope: 7 to 15 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: High (about 9.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: B
Forage suitability group: Moist, Fertile Soils (G128XB001VA)
Other vegetative classification: Moist, Fertile Soils (G128XB001VA)
Hydric soil rating: No

Description of Vertrees

Setting

Landform: Hills
Landform position (two-dimensional): Summit, backslope
Landform position (three-dimensional): Interfluve, side slope
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Limestone, siltstone, and shale residuum

Typical profile

H1 - 0 to 10 inches: silt loam
H2 - 10 to 25 inches: silty clay
H3 - 25 to 50 inches: clay
H4 - 50 to 79 inches: clay

Properties and qualities

Slope: 7 to 15 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.57 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Moderate (about 8.9 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: C
Forage suitability group: Moist, Fertile Soils (G128XB001VA)
Other vegetative classification: Moist, Fertile Soils (G128XB001VA)
Hydric soil rating: No

13C—Frederick and Vertrees gravelly silt loams, 7 to 15 percent slopes

Map Unit Setting

National map unit symbol: kc1w
Elevation: 1,700 to 3,000 feet
Mean annual precipitation: 30 to 45 inches
Mean annual air temperature: 50 to 57 degrees F
Frost-free period: 117 to 185 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Frederick and similar soils: 40 percent
Vertrees and similar soils: 35 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Frederick

Setting

Landform: Hills
Landform position (two-dimensional): Summit, backslope
Landform position (three-dimensional): Interfluve, side slope
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Limestone interbedded with siltstone and shale residuum

Typical profile

H1 - 0 to 10 inches: gravelly silt loam
H2 - 10 to 22 inches: clay
H3 - 22 to 79 inches: clay

Properties and qualities

Slope: 7 to 15 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Moderate (about 8.7 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: B
Forage suitability group: Moist, Fertile Soils (G128XB001VA)
Other vegetative classification: Moist, Fertile Soils (G128XB001VA)
Hydric soil rating: No

Description of Vertrees

Setting

Landform: Hills
Landform position (two-dimensional): Summit, backslope
Landform position (three-dimensional): Interfluve, side slope
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Limestone, siltstone, and shale residuum

Typical profile

H1 - 0 to 10 inches: gravelly silt loam
H2 - 10 to 25 inches: silty clay
H3 - 25 to 50 inches: clay
H4 - 50 to 79 inches: clay

Properties and qualities

Slope: 7 to 15 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.57 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Moderate (about 8.6 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: C
Forage suitability group: Moist, Fertile Soils (G128XB001VA)
Other vegetative classification: Moist, Fertile Soils (G128XB001VA)
Hydric soil rating: No

13D—Frederick and Vertrees gravelly silt loams, 15 to 25 percent slopes

Map Unit Setting

National map unit symbol: kc1x
Elevation: 1,700 to 3,000 feet
Mean annual precipitation: 30 to 45 inches

Mean annual air temperature: 50 to 57 degrees F
Frost-free period: 117 to 185 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Frederick and similar soils: 40 percent
Vertrees and similar soils: 35 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Frederick

Setting

Landform: Hills
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Convex
Parent material: Limestone interbedded with siltstone and shale residuum

Typical profile

H1 - 0 to 10 inches: gravelly silt loam
H2 - 10 to 22 inches: clay
H3 - 22 to 79 inches: clay

Properties and qualities

Slope: 15 to 25 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Runoff class: High
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Moderate (about 8.7 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: B
Forage suitability group: Moist, Fertile Soils (G128XB001VA)
Other vegetative classification: Moist, Fertile Soils (G128XB001VA)
Hydric soil rating: No

Description of Vertrees

Setting

Landform: Hills
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Convex
Parent material: Limestone, siltstone, and shale residuum

Typical profile

H1 - 0 to 10 inches: gravelly silt loam
H2 - 10 to 25 inches: silty clay

H3 - 25 to 50 inches: clay
H4 - 50 to 79 inches: clay

Properties and qualities

Slope: 15 to 25 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Runoff class: High
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.57 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Moderate (about 8.6 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: C
Forage suitability group: Moist, Fertile Soils (G128XB001VA)
Other vegetative classification: Moist, Fertile Soils (G128XB001VA)
Hydric soil rating: No

16B—Groseclose and Poplimento soils, 2 to 7 percent slopes

Map Unit Setting

National map unit symbol: kc22
Elevation: 1,700 to 3,000 feet
Mean annual precipitation: 30 to 45 inches
Mean annual air temperature: 50 to 57 degrees F
Frost-free period: 117 to 185 days
Farmland classification: All areas are prime farmland

Map Unit Composition

Groseclose and similar soils: 45 percent
Poplimento and similar soils: 40 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Groseclose

Setting

Landform: Hills
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Interfluve
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Limestone, shale, siltstone, and sandstone residuum

Typical profile

H1 - 0 to 10 inches: loam
H2 - 10 to 28 inches: clay

H3 - 28 to 39 inches: clay
H4 - 39 to 51 inches: clay
H5 - 51 to 79 inches: clay loam

Properties and qualities

Slope: 2 to 7 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Runoff class: High
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Moderate (about 8.7 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2e
Hydrologic Soil Group: C
Hydric soil rating: No

Description of Poplimento

Setting

Landform: Hills
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Interfluve
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Limestone, shale, siltstone, and sandstone residuum

Typical profile

H1 - 0 to 12 inches: silt loam
H2 - 12 to 35 inches: clay
H3 - 35 to 55 inches: clay
H4 - 55 to 79 inches: channery silty clay loam

Properties and qualities

Slope: 2 to 7 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.57 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Moderate (about 7.7 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2e
Hydrologic Soil Group: C
Hydric soil rating: No

16C—Groseclose and Poplimento soils, 7 to 15 percent slopes

Map Unit Setting

National map unit symbol: kc23
Elevation: 1,700 to 3,000 feet
Mean annual precipitation: 30 to 45 inches
Mean annual air temperature: 50 to 57 degrees F
Frost-free period: 117 to 185 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Groseclose and similar soils: 45 percent
Poplimento and similar soils: 40 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Groseclose

Setting

Landform: Hills
Landform position (two-dimensional): Summit, backslope
Landform position (three-dimensional): Interfluve, side slope
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Limestone, shale, siltstone, and sandstone residuum

Typical profile

H1 - 0 to 10 inches: loam
H2 - 10 to 28 inches: clay
H3 - 28 to 39 inches: clay
H4 - 39 to 51 inches: clay
H5 - 51 to 79 inches: clay loam

Properties and qualities

Slope: 7 to 15 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Runoff class: High
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Moderate (about 8.7 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: C
Hydric soil rating: No

Description of Poplimento

Setting

Landform: Hills
Landform position (two-dimensional): Summit, backslope
Landform position (three-dimensional): Interfluve, side slope
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Limestone, shale, siltstone, and sandstone residuum

Typical profile

H1 - 0 to 12 inches: silt loam
H2 - 12 to 35 inches: clay
H3 - 35 to 55 inches: clay
H4 - 55 to 79 inches: channery silty clay loam

Properties and qualities

Slope: 7 to 15 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.57 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Moderate (about 7.7 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: C
Hydric soil rating: No

16D—Groseclose and Poplimento soils, 15 to 25 percent slopes

Map Unit Setting

National map unit symbol: kc24
Elevation: 1,700 to 3,000 feet
Mean annual precipitation: 30 to 45 inches
Mean annual air temperature: 50 to 57 degrees F
Frost-free period: 117 to 185 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Groseclose and similar soils: 45 percent
Poplimento and similar soils: 40 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Groseclose

Setting

Landform: Hills
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Convex
Parent material: Limestone, shale, siltstone, and sandstone residuum

Typical profile

H1 - 0 to 10 inches: loam
H2 - 10 to 28 inches: clay
H3 - 28 to 39 inches: clay
H4 - 39 to 51 inches: clay
H5 - 51 to 79 inches: clay loam

Properties and qualities

Slope: 15 to 25 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Moderate (about 8.7 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: C
Hydric soil rating: No

Description of Poplimento

Setting

Landform: Hills
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Convex
Parent material: Limestone, shale, siltstone, and sandstone residuum

Typical profile

H1 - 0 to 12 inches: silt loam
H2 - 12 to 35 inches: clay
H3 - 35 to 55 inches: clay
H4 - 55 to 79 inches: channery silty clay loam

Properties and qualities

Slope: 15 to 25 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Runoff class: High

Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.57 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Moderate (about 7.7 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: C
Hydric soil rating: No

25—McGary and Purdy soils

Map Unit Setting

National map unit symbol: kc2k
Elevation: 1,300 to 2,200 feet
Mean annual precipitation: 30 to 45 inches
Mean annual air temperature: 50 to 57 degrees F
Frost-free period: 117 to 185 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Mcgary and similar soils: 40 percent
Purdy and similar soils: 35 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Mcgary

Setting

Landform: Stream terraces
Landform position (three-dimensional): Tread
Down-slope shape: Concave
Across-slope shape: Linear
Parent material: Limestone, shale, and sandstone alluvium

Typical profile

H1 - 0 to 9 inches: silt loam
H2 - 9 to 37 inches: silty clay
H3 - 37 to 79 inches: clay

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Somewhat poorly drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: About 12 to 36 inches
Frequency of flooding: OccasionalNone

Frequency of ponding: None
Calcium carbonate, maximum content: 15 percent
Available water supply, 0 to 60 inches: Moderate (about 8.9 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4w
Hydrologic Soil Group: D
Hydric soil rating: No

Description of Purdy

Setting

Landform: Stream terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Limestone, shale, and sandstone alluvium

Typical profile

H1 - 0 to 11 inches: loam
H2 - 11 to 34 inches: clay
H3 - 34 to 79 inches: clay loam

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Poorly drained
Runoff class: Negligible
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: About 0 inches
Frequency of flooding: None
Frequency of ponding: Frequent
Available water supply, 0 to 60 inches: High (about 9.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4w
Hydrologic Soil Group: C/D
Hydric soil rating: Yes

Soil Information for All Uses

Soil Properties and Qualities

The Soil Properties and Qualities section includes various soil properties and qualities displayed as thematic maps with a summary table for the soil map units in the selected area of interest. A single value or rating for each map unit is generated by aggregating the interpretive ratings of individual map unit components. This aggregation process is defined for each property or quality.

Soil Erosion Factors

Soil Erosion Factors are soil properties and interpretations used in evaluating the soil for potential erosion. Example soil erosion factors can include K factor for the whole soil or on a rock free basis, T factor, wind erodibility group and wind erodibility index.

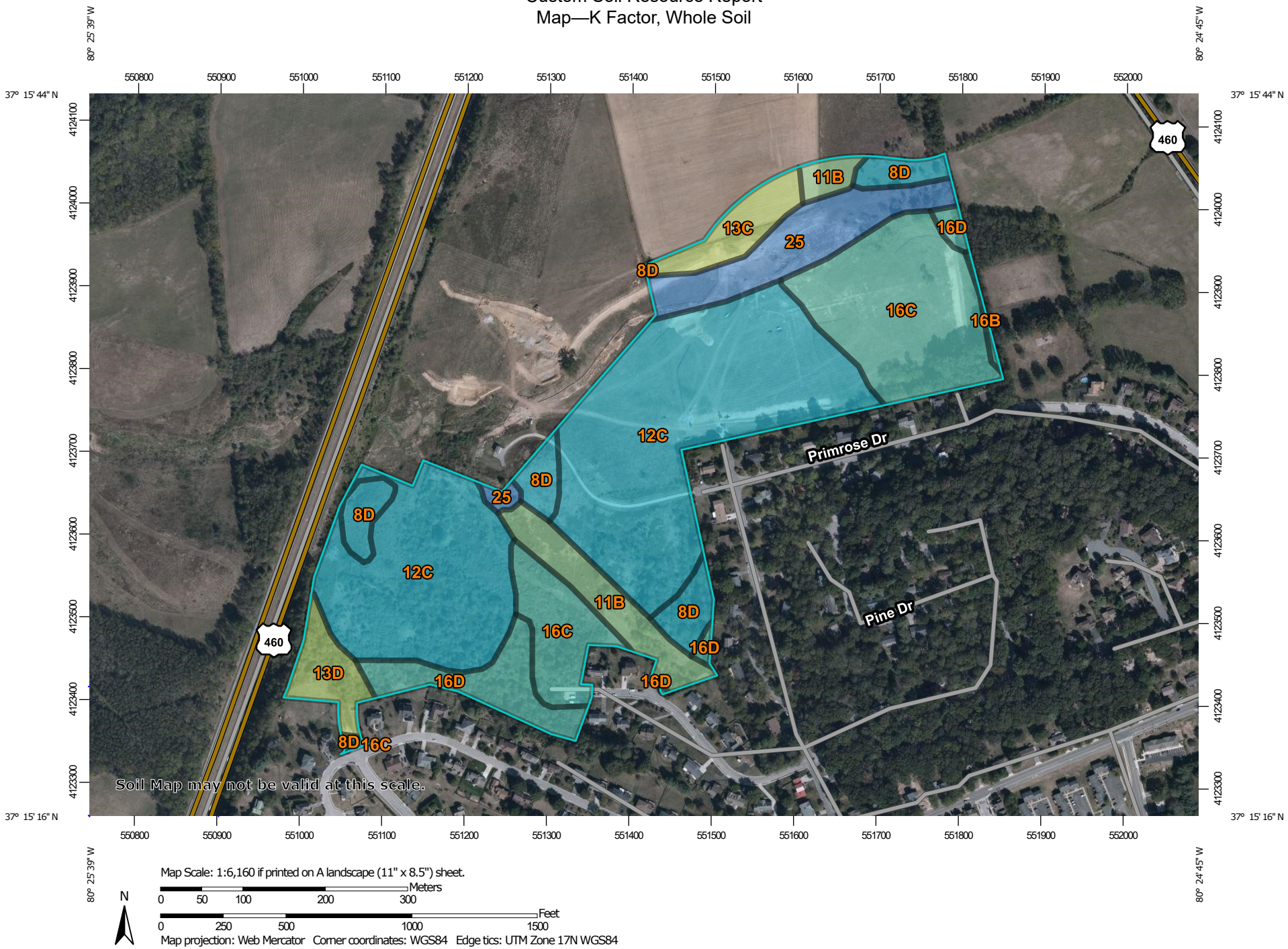
K Factor, Whole Soil

Erosion factor K indicates the susceptibility of a soil to sheet and rill erosion by water. Factor K is one of six factors used in the Universal Soil Loss Equation (USLE) and the Revised Universal Soil Loss Equation (RUSLE) to predict the average annual rate of soil loss by sheet and rill erosion in tons per acre per year. The estimates are based primarily on percentage of silt, sand, and organic matter and on soil structure and saturated hydraulic conductivity (Ksat). Values of K range from 0.02 to 0.69. Other factors being equal, the higher the value, the more susceptible the soil is to sheet and rill erosion by water.

"Erosion factor Kw (whole soil)" indicates the erodibility of the whole soil. The estimates are modified by the presence of rock fragments.

Factor K does not apply to organic horizons and is not reported for those layers.

Map—K Factor, Whole Soil



MAP LEGEND

Area of Interest (AOI)

Area of Interest (AOI)

Soils

Soil Rating Polygons

.02
.05
.10
.15
.17
.20
.24
.28
.32
.37
.43
.49
.55
.64
Not rated or not available

Soil Rating Lines

.02
.05
.10
.15
.17
.20
.24
.28
.32
.37
.43
.49
.55
.64
Not rated or not available

Soil Rating Points

.02
.05
.10
.15
.17
.20
.24
.28
.32
.37
.43
.49
.55
.64
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 1:15,800.

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: Montgomery County, Virginia
Survey Area Data: Version 14, Sep 14, 2021

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

Date(s) aerial images were photographed: Sep 29, 2019—Oct 4, 2019

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.

Table—K Factor, Whole Soil

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
8D	Caneyville-Opequon-Rock outcrop complex, 7 to 25 percent slopes	.37	4.0	6.4%
11B	Duffield-Ernest complex, 2 to 7 percent slopes	.28	3.9	6.2%
12C	Frederick and Vertrees silt loams, 7 to 15 percent slopes	.37	29.6	46.8%
13C	Frederick and Vertrees gravelly silt loams, 7 to 15 percent slopes	.24	2.2	3.4%
13D	Frederick and Vertrees gravelly silt loams, 15 to 25 percent slopes	.24	1.9	3.1%
16B	Groseclose and Poplimento soils, 2 to 7 percent slopes	.32	0.2	0.3%
16C	Groseclose and Poplimento soils, 7 to 15 percent slopes	.32	12.7	20.0%
16D	Groseclose and Poplimento soils, 15 to 25 percent slopes	.32	3.7	5.8%
25	McGary and Purdy soils	.43	5.1	8.1%
Totals for Area of Interest			**63.2**	**100.0%**

Rating Options—K Factor, Whole Soil

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

Layer Options (Horizon Aggregation Method): Surface Layer (Not applicable)

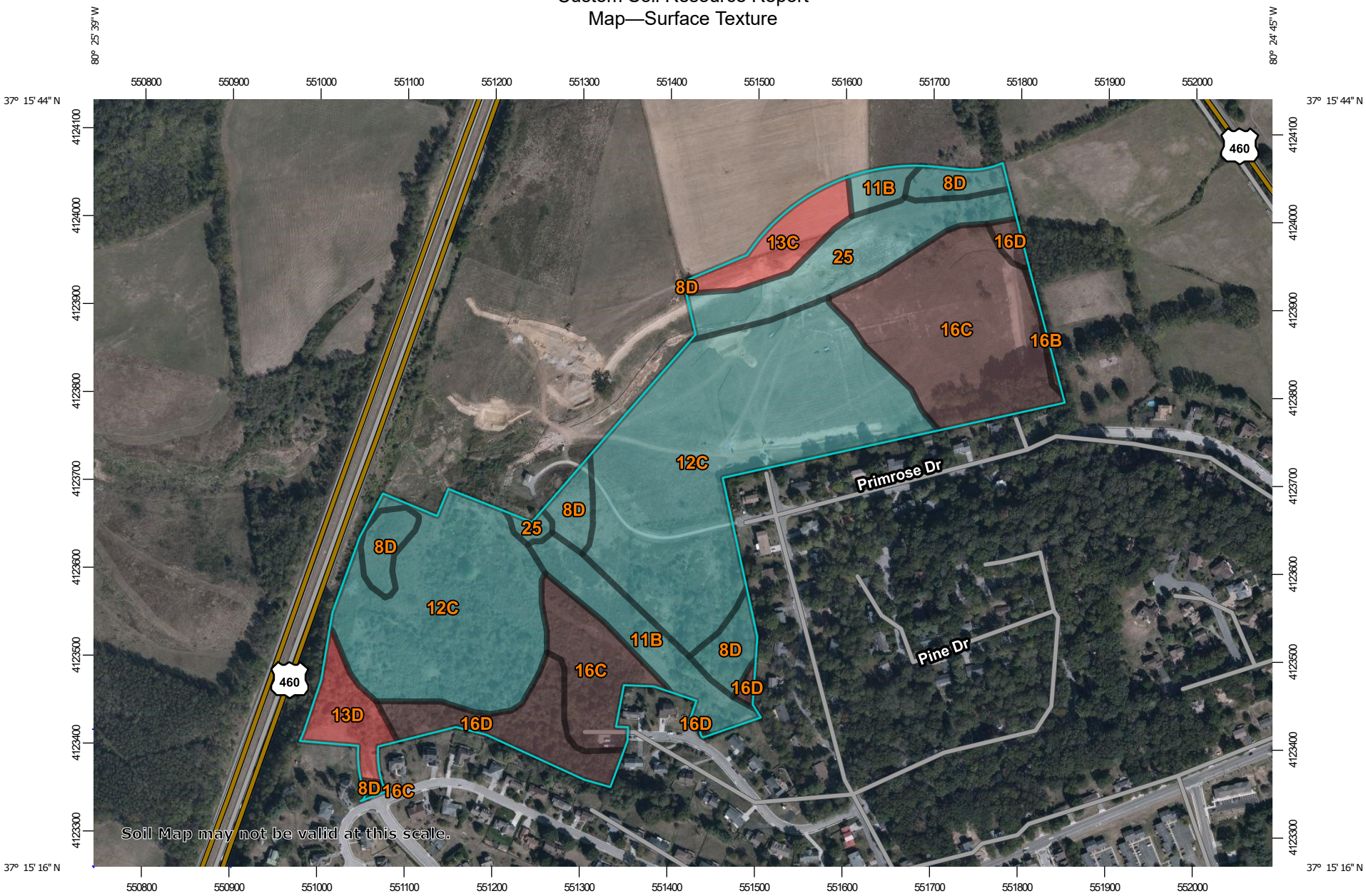
Soil Physical Properties

Soil Physical Properties are measured or inferred from direct observations in the field or laboratory. Examples of soil physical properties include percent clay, organic matter, saturated hydraulic conductivity, available water capacity, and bulk density.

Surface Texture

This displays the representative texture class and modifier of the surface horizon.

Texture is given in the standard terms used by the U.S. Department of Agriculture. These terms are defined according to percentages of sand, silt, and clay in the fraction of the soil that is less than 2 millimeters in diameter. "Loam," for example, is soil that is 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If the content of particles coarser than sand is 15 percent or more, an appropriate modifier is added, for example, "gravelly."



Map Scale: 1:6,160 if printed on A landscape (11" x 8.5") sheet.

N

Meters
0 50 100 200 300

Feet
0 250 500 1000 1500

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 17N WGS84

MAP LEGEND

Area of Interest (AOI)

- Area of Interest (AOI)

Soils

Soil Rating Polygons

- Gravelly silt loam
- Loam
- Silt loam
- Not rated or not available

Soil Rating Lines

- Gravelly silt loam
- Loam
- Silt loam
- Not rated or not available

Soil Rating Points

- Gravelly silt loam
- Loam
- Silt loam
- 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 1:15,800.

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

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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)

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Soil Survey Area: Montgomery County, Virginia
Survey Area Data: Version 14, Sep 14, 2021

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

Date(s) aerial images were photographed: Sep 29, 2019—Oct 4, 2019

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.

Table—Surface Texture

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
8D	Caneyville-Opequon-Rock outcrop complex, 7 to 25 percent slopes	Silt loam	4.0	6.4%
11B	Duffield-Ernest complex, 2 to 7 percent slopes	Silt loam	3.9	6.2%
12C	Frederick and Vertrees silt loams, 7 to 15 percent slopes	Silt loam	29.6	46.8%
13C	Frederick and Vertrees gravelly silt loams, 7 to 15 percent slopes	Gravelly silt loam	2.2	3.4%
13D	Frederick and Vertrees gravelly silt loams, 15 to 25 percent slopes	Gravelly silt loam	1.9	3.1%
16B	Groseclose and Poplimento soils, 2 to 7 percent slopes	Loam	0.2	0.3%
16C	Groseclose and Poplimento soils, 7 to 15 percent slopes	Loam	12.7	20.0%
16D	Groseclose and Poplimento soils, 15 to 25 percent slopes	Loam	3.7	5.8%
25	McGary and Purdy soils	Silt loam	5.1	8.1%
Totals for Area of Interest			**63.2**	**100.0%**

Rating Options—Surface Texture

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Lower

Layer Options (Horizon Aggregation Method): Surface Layer (Not applicable)

Soil Qualities and Features

Soil qualities are behavior and performance attributes that are not directly measured, but are inferred from observations of dynamic conditions and from soil properties. Example soil qualities include natural drainage, and frost action. Soil features are attributes that are not directly part of the soil. Example soil features include slope and depth to restrictive layer. These features can greatly impact the use and management of the soil.

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.

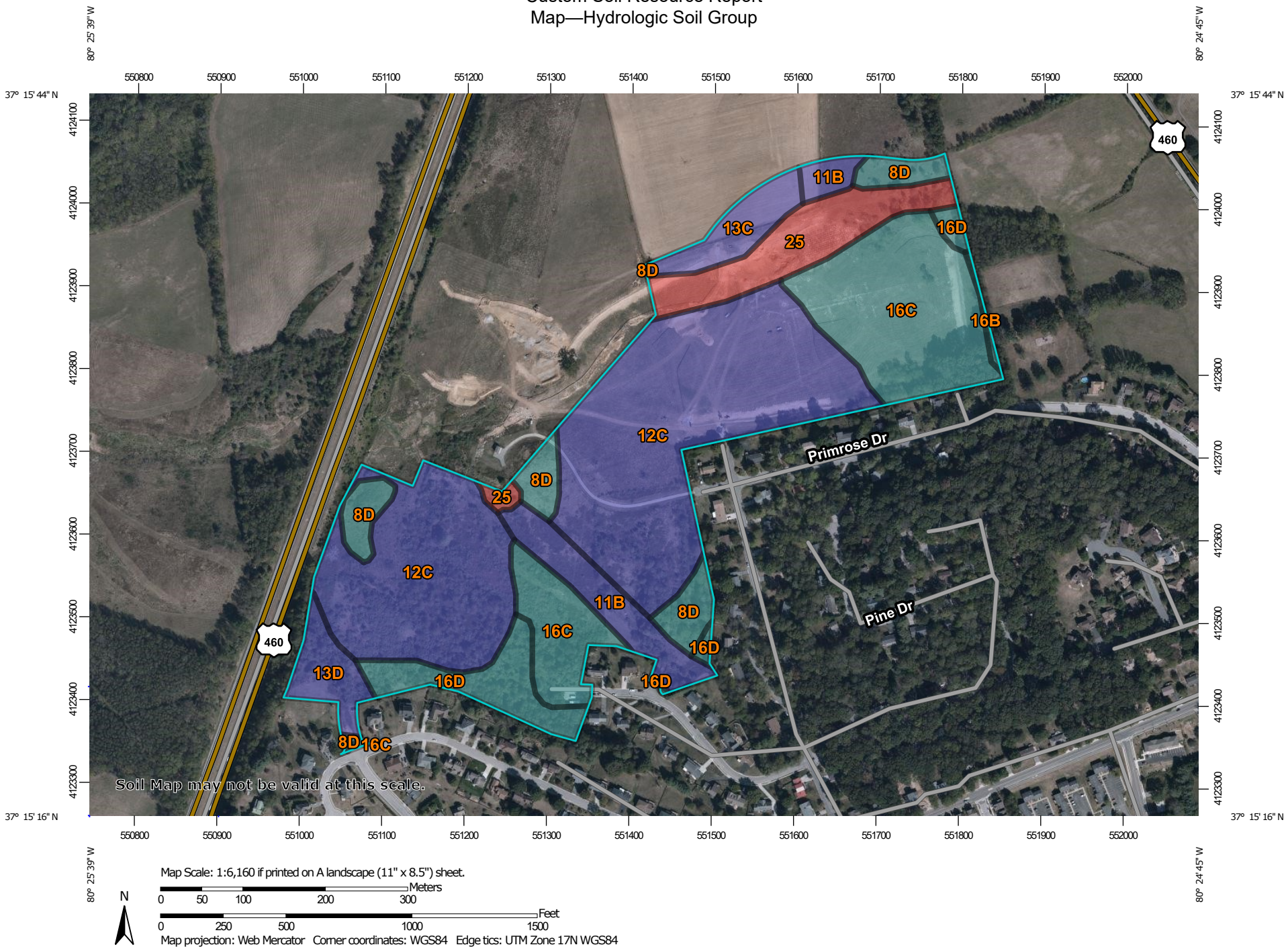
Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

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.

Map—Hydrologic Soil Group



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

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

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

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Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

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Table—Hydrologic Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
8D	Caneyville-Opequon-Rock outcrop complex, 7 to 25 percent slopes	C	4.0	6.4%
11B	Duffield-Ernest complex, 2 to 7 percent slopes	B	3.9	6.2%
12C	Frederick and Vertrees silt loams, 7 to 15 percent slopes	B	29.6	46.8%
13C	Frederick and Vertrees gravelly silt loams, 7 to 15 percent slopes	B	2.2	3.4%
13D	Frederick and Vertrees gravelly silt loams, 15 to 25 percent slopes	B	1.9	3.1%
16B	Groseclose and Poplimento soils, 2 to 7 percent slopes	C	0.2	0.3%
16C	Groseclose and Poplimento soils, 7 to 15 percent slopes	C	12.7	20.0%
16D	Groseclose and Poplimento soils, 15 to 25 percent slopes	C	3.7	5.8%
25	McGary and Purdy soils	D	5.1	8.1%
Totals for Area of Interest			**63.2**	**100.0%**

Rating Options—Hydrologic Soil Group

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

References

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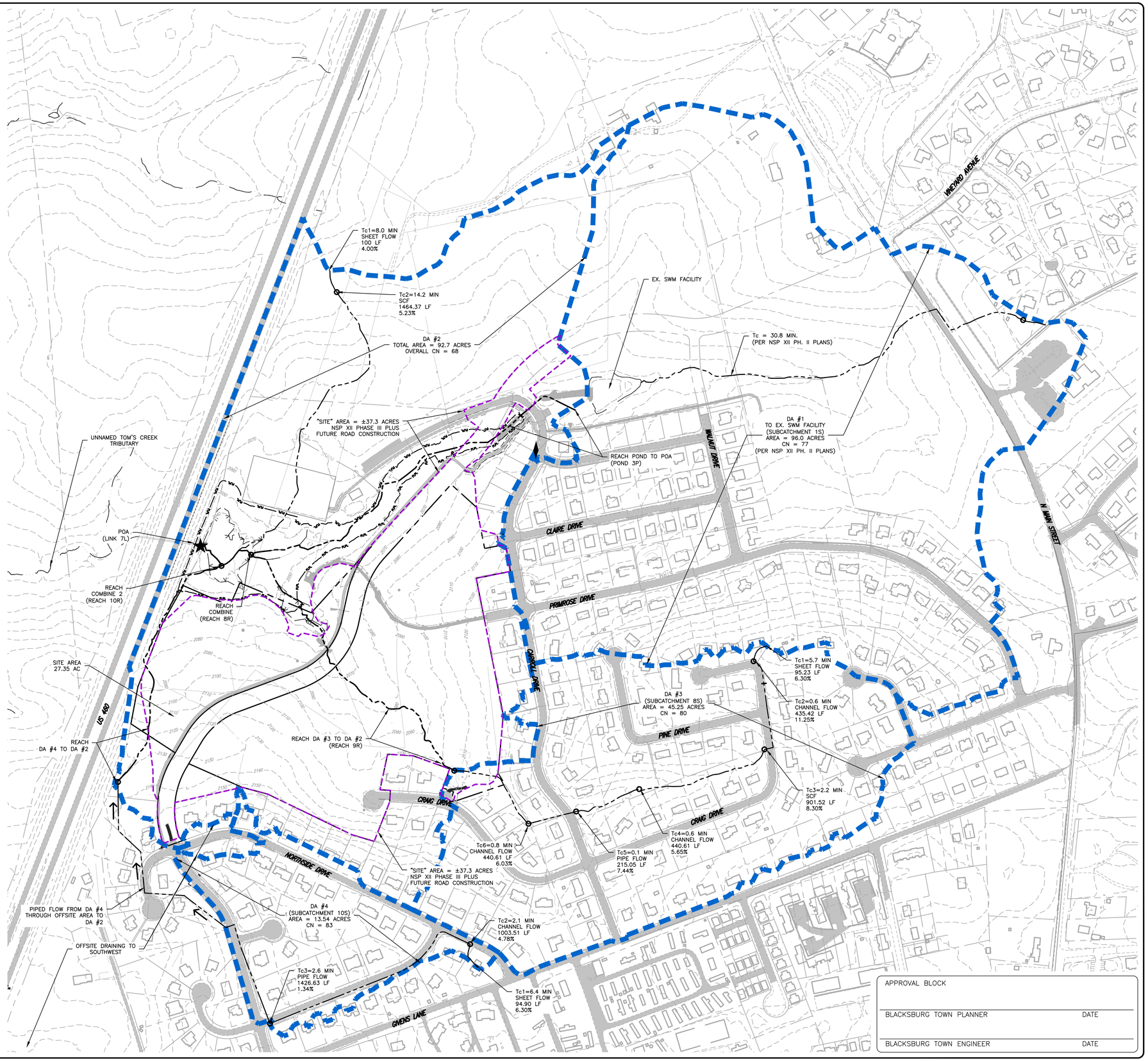
APPENDIX B:
DRAINAGE MAPS



APPROVAL BLOCK

BLACKSBURG TOWN PLANNER DATE

BLACKSBURG TOWN ENGINEER DATE

BALZER & ASSOCIATES
PLANNERS / ARCHITECTS
ENGINEERS / SURVEYORS

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COMMONWEALTH OF VIRGINIA
JAMES RICHARD TAYLOR
Lic. No. 55142
4/3/23
PROFESSIONAL ENGINEER

NORTHSIDE PARK - REVISED SECTION XII

STORMWATER MANAGEMENT CONCEPT

PRE-DEVELOPMENT DRAINAGE MAP

MOUNT TABOR MAGISTERIAL DISTRICT
TOWN OF BLACKSBURG, VIRGINIA

DRAWN BY	SJW
DESIGNED BY	SJW
CHECKED BY	JRT
DATE	1/3/23
SCALE	1" = 200'
REVISIONS	
4/3/23	

SW3

PROJECT NO. 24220049.00

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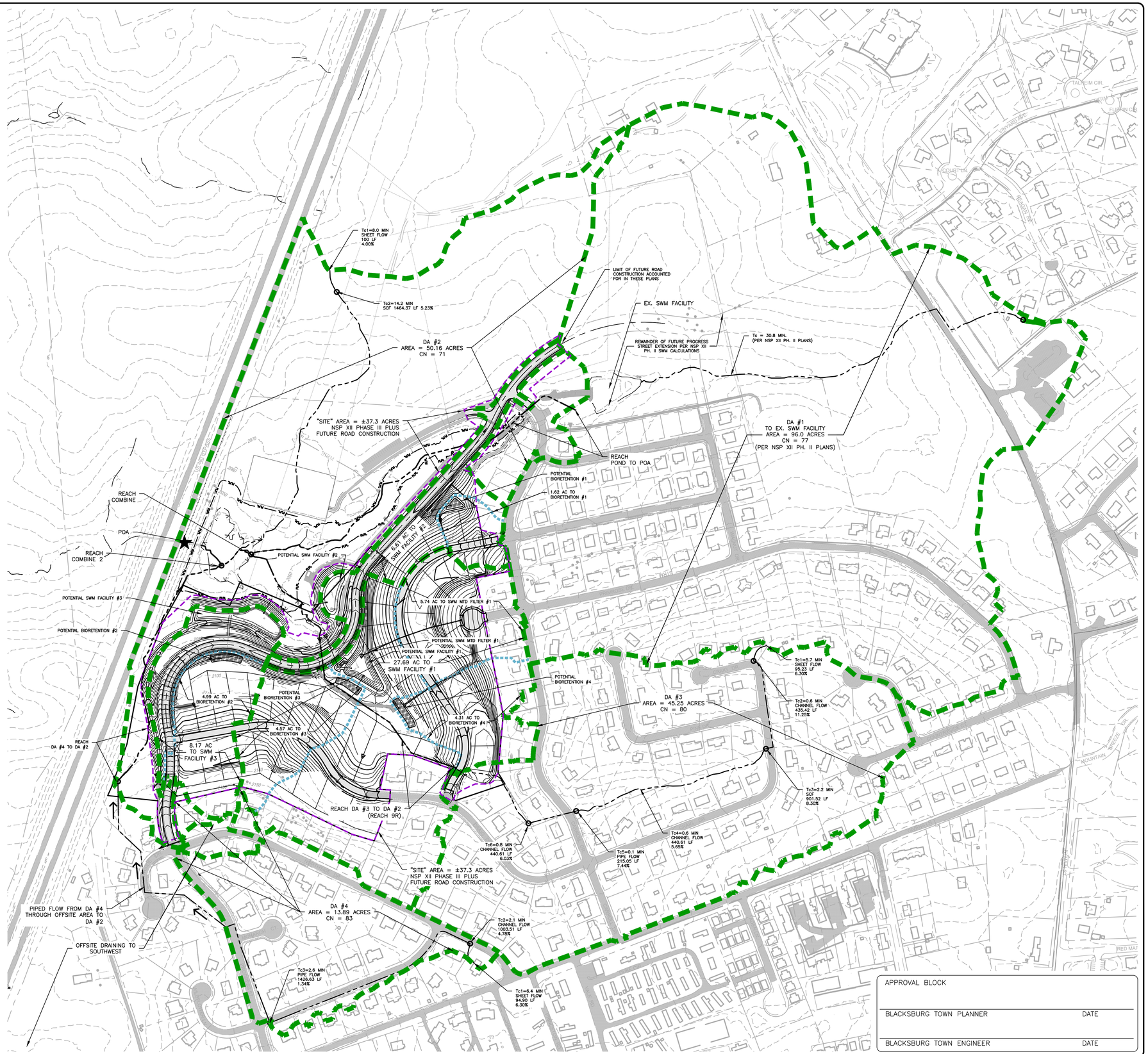

80 0 80 160 240

1" = 80'

APPROVAL BLOCK

BLACKSBURG TOWN PLANNER DATE

BLACKSBURG TOWN ENGINEER DATE

BALZER & ASSOCIATES
PLANNERS / ARCHITECTS
ENGINEERS / SURVEYORS

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COMMONWEALTH OF VIRGINIA
JAMES RICHARD TAYLOR
Lic. No. 55142
4/3/23
PROFESSIONAL ENGINEER

NORTHSIDE PARK - REVISED SECTION XII

STORMWATER MANAGEMENT CONCEPT

POST-DEVELOPMENT DRAINAGE MAP

MOUNT TABOR MAGISTERIAL DISTRICT
TOWN OF BLACKSBURG, VIRGINIA

DRAWN BY	SJW
DESIGNED BY	SJW
CHECKED BY	JRT
DATE	1/3/23
SCALE	1" = 20'
REVISIONS	
4/3/23	

SW4

PROJECT NO. 24220049.00

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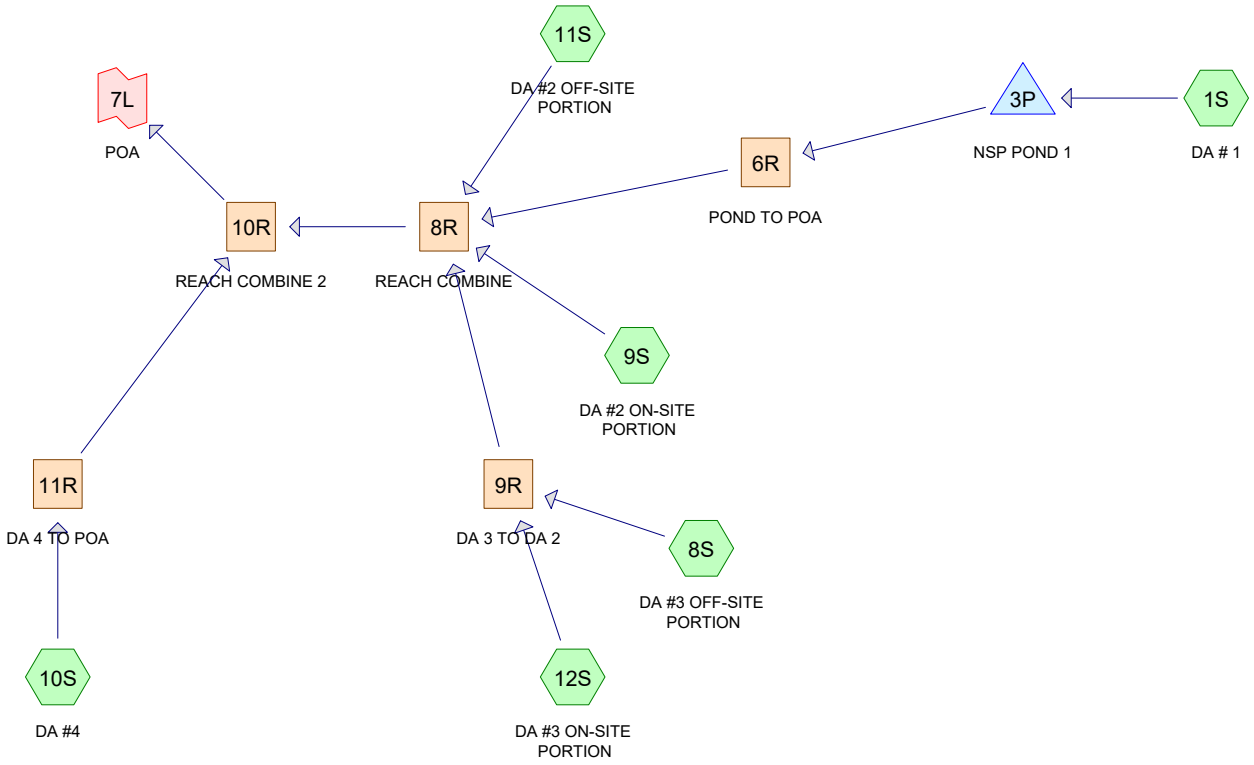
APPENDIX C:
STORMWATER QUANTITY CALCULATIONS



Subcat Reach Pond Link

Routing Diagram for PRE-DEVELOPMENT
Prepared by Balzer & Associates, Inc, Printed 4/4/2023

PRE-DEVELOPMENT

Rainfall Events Listing

Event#	Event Name	Storm Type	Curve	Mode	Duration (hours)	B/B	Depth (inches)	AMC
1	1-yr	VA-BLACKSBURG NOAA	1-yr	Default	24.00	1	2.27	2
2	2-yr	VA-BLACKSBURG NOAA	2-yr	Default	24.00	1	2.75	2
3	10-yr	VA-BLACKSBURG NOAA	10-yr	Default	24.00	1	4.09	2
4	100-yr	VA-BLACKSBURG NOAA	100-yr	Default	24.00	1	6.48	2

Time span=0.00-48.00 hrs, dt=0.01 hrs, 4801 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-Q
Reach routing by Stor-Ind method - Pond routing by Stor-Ind method

Subcatchment1S: DA # 1 Runoff Area=96.000 ac Runoff Depth=0.66"
Tc=30.8 min CN=WQ Runoff=39.33 cfs 5.281 af

Subcatchment8S: DA #3 OFF-SITE PORTION Runoff Area=44.547 ac Runoff Depth=0.83"
Flow Length=2,089' Tc=11.1 min CN=WQ Runoff=38.07 cfs 3.087 af

Subcatchment9S: DA #2 ON-SITE PORTION Runoff Area=26.952 ac Runoff Depth=0.23"
Flow Length=1,801' Tc=25.7 min CN=WQ Runoff=2.82 cfs 0.511 af

Subcatchment10S: DA #4 Runoff Area=13.541 ac Runoff Depth=1.01"
Flow Length=2,526' Tc=18.9 min CN=WQ Runoff=11.44 cfs 1.136 af

Subcatchment11S: DA #2 OFF-SITE PORTION Runoff Area=66.054 ac Runoff Depth=0.51"
Flow Length=1,801' Tc=25.7 min UI Adjusted CN=WQ Runoff=22.19 cfs 2.793 af

Subcatchment12S: DA #3 ON-SITE PORTION Runoff Area=0.648 ac Runoff Depth=0.49"
Flow Length=2,089' Tc=11.1 min CN=WQ Runoff=0.26 cfs 0.026 af

Reach 6R: POND TO POA Avg. Flow Depth=0.06' Max Vel=1.31 fps Inflow=5.90 cfs 3.739 af
n=0.030 L=1,769.1' S=0.0268 '/' Capacity=8,939.96 cfs Outflow=5.51 cfs 3.721 af

Reach 8R: REACH COMBINE Avg. Flow Depth=5.43' Max Vel=0.89 fps Inflow=53.04 cfs 10.137 af
n=0.030 L=168.8' S=0.0021 '/' Capacity=1.23 cfs Outflow=51.57 cfs 10.134 af

Reach 9R: DA 3 TO DA 2 Avg. Flow Depth=0.48' Max Vel=3.68 fps Inflow=38.32 cfs 3.113 af
n=0.030 L=1,462.0' S=0.0435 '/' Capacity=15.84 cfs Outflow=31.27 cfs 3.113 af

Reach 10R: REACH COMBINE 2 Avg. Flow Depth=0.62' Max Vel=1.81 fps Inflow=62.30 cfs 11.270 af
n=0.030 L=136.3' S=0.0064 '/' Capacity=54.02 cfs Outflow=62.13 cfs 11.267 af

Reach 11R: DA 4 TO POA Avg. Flow Depth=0.47' Max Vel=6.18 fps Inflow=11.44 cfs 1.136 af
n=0.030 L=1,176.1' S=0.0825 '/' Capacity=140.25 cfs Outflow=11.12 cfs 1.136 af

Pond 3P: NSP POND 1 Peak Elev=2,080.46' Storage=121,152 cf Inflow=39.33 cfs 5.281 af
Outflow=5.90 cfs 3.739 af

Link 7L: POA Inflow=62.13 cfs 11.267 af
Primary=62.13 cfs 11.267 af

Total Runoff Area = 247.742 ac Runoff Volume = 12.834 af Average Runoff Depth = 0.62"

Summary for Subcatchment 1S: DA # 1

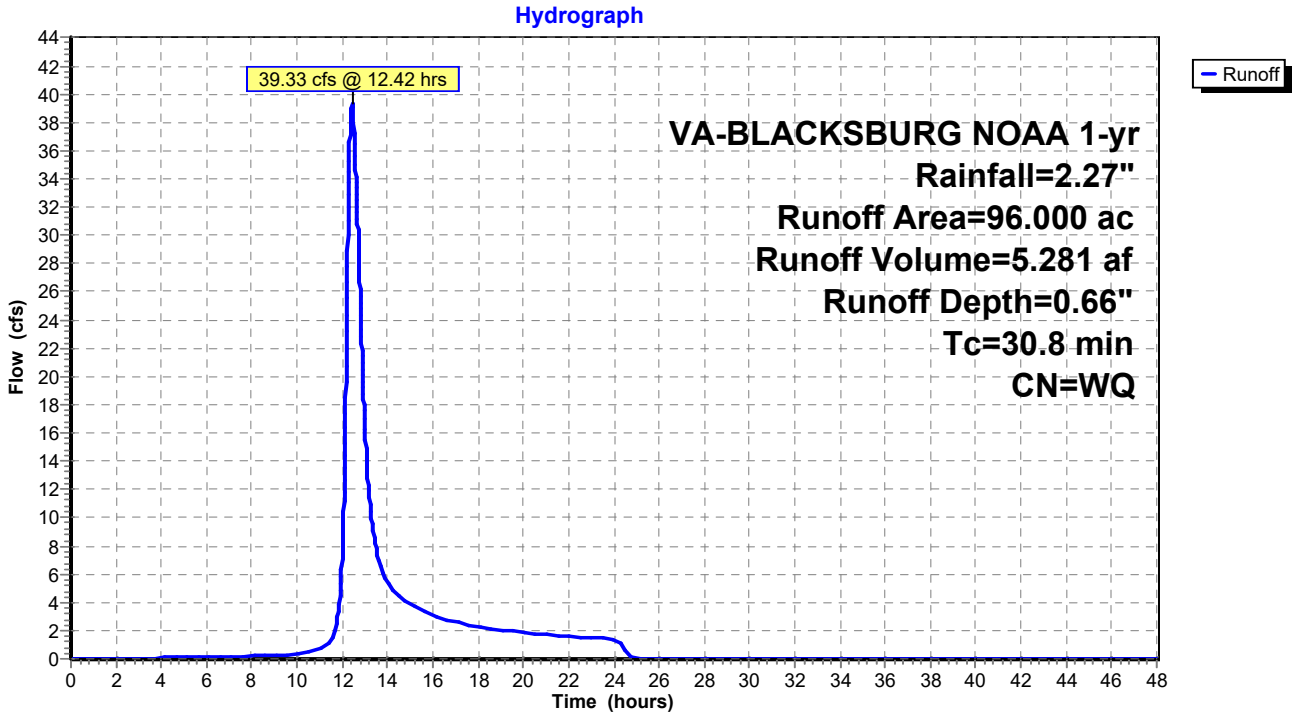
Runoff = 39.33 cfs @ 12.42 hrs, Volume= 5.281 af, Depth= 0.66"
Routed to Pond 3P : NSP POND 1

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
VA-BLACKSBURG NOAA 1-yr Rainfall=2.27"

Area (ac)	CN	Description
5.080	98	Roofs, HSG C
3.100	84	50-75% Grass cover, Fair, HSG D
22.720	79	50-75% Grass cover, Fair, HSG C
28.800	69	50-75% Grass cover, Fair, HSG B
1.000	86	1/3 acre lots, 30% imp, HSG D
10.400	81	1/3 acre lots, 30% imp, HSG C
6.400	72	1/3 acre lots, 30% imp, HSG B
10.300	83	1/4 acre lots, 38% imp, HSG C
8.200	75	1/4 acre lots, 38% imp, HSG B
96.000		Weighted Average

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
30.8					**Direct Entry, FROM NSP CALCS**

Subcatchment 1S: DA # 1



Summary for Subcatchment 8S: DA #3 OFF-SITE PORTION

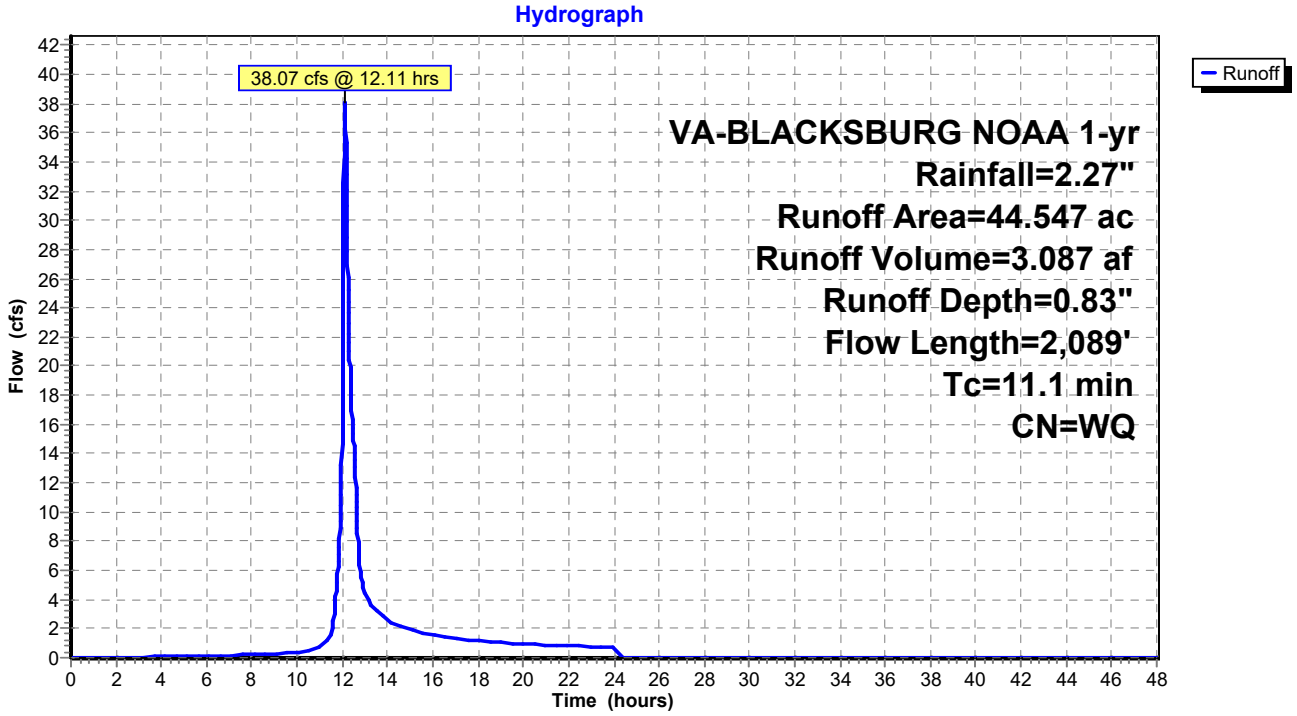
Runoff = 38.07 cfs @ 12.11 hrs, Volume= 3.087 af, Depth= 0.83"
Routed to Reach 9R : DA 3 TO DA 2

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
VA-BLACKSBURG NOAA 1-yr Rainfall=2.27"

Area (ac)	CN	Description
0.358	98	Paved roads w/curbs & sewers, HSG B
4.733	98	Paved roads w/curbs & sewers, HSG C
5.726	70	1/2 acre lots, 25% imp, HSG B
28.476	80	1/2 acre lots, 25% imp, HSG C
0.877	72	1/3 acre lots, 30% imp, HSG B
3.986	81	1/3 acre lots, 30% imp, HSG C
0.391	79	1 acre lots, 20% imp, HSG C
44.547		Weighted Average

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.7	95	0.0630	0.28		**Sheet Flow, Tc1** Range n= 0.130 P2= 2.76"
1.3	435	0.1125	5.44	40.82	**Channel Flow, Tc2** Area= 7.5 sf Perim= 40.0' r= 0.19' n= 0.030 Earth, grassed & winding
2.2	602	0.0830	4.64		**Shallow Concentrated Flow, Tc3** Unpaved Kv= 16.1 fps
0.6	301	0.0565	8.57	342.85	**Channel Flow, Tc4** Area= 40.0 sf Perim= 64.4' r= 0.62' n= 0.030 Earth, grassed & winding
0.1	215	0.0744	27.88	197.09	**Pipe Channel, Tc5** 36.0" Round Area= 7.1 sf Perim= 9.4' r= 0.75' n= 0.012 Concrete pipe, finished
1.2	441	0.0603	6.33	189.76	**Channel Flow, Tc6** Area= 30.0 sf Perim= 80.0' r= 0.38' n= 0.030 Earth, grassed & winding
11.1	2,089	Total			

Subcatchment 8S: DA #3 OFF-SITE PORTION



Summary for Subcatchment 9S: DA #2 ON-SITE PORTION

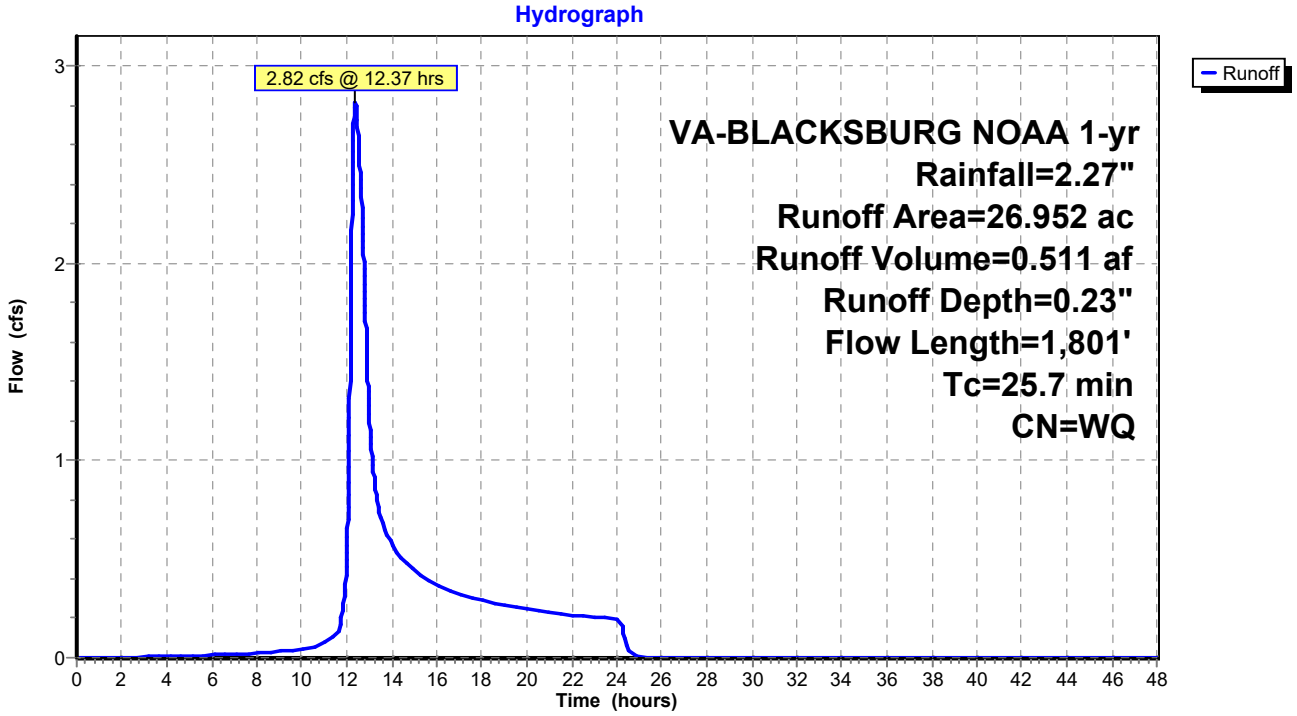
Runoff = 2.82 cfs @ 12.37 hrs, Volume= 0.511 af, Depth= 0.23"
Routed to Reach 8R : REACH COMBINE

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
VA-BLACKSBURG NOAA 1-yr Rainfall=2.27"

	Area (ac)	CN	Description
	5.097	55	Woods, Good, HSG B
	5.711	70	Woods, Good, HSG C
	8.232	58	Woods/grass comb., Good, HSG B
	1.810	72	Woods/grass comb., Good, HSG C
	0.270	70	1/2 acre lots, 25% imp, HSG B
	0.098	80	1/2 acre lots, 25% imp, HSG C
	0.070	39	>75% Grass cover, Good, HSG A
	4.590	61	>75% Grass cover, Good, HSG B
	0.070	74	>75% Grass cover, Good, HSG C
	0.240	98	Paved parking, HSG B
	0.124	98	Paved parking, HSG C
	0.410	86	Fallow, bare soil, HSG B
*	0.218	98	TRAIL, HSG B
*	0.012	98	TRAIL, HSG C
	26.952		Weighted Average

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.0	100	0.0400	0.21		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.76"
17.7	1,701	0.0523	1.60		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
25.7	1,801	Total			

Subcatchment 9S: DA #2 ON-SITE PORTION



Summary for Subcatchment 10S: DA #4

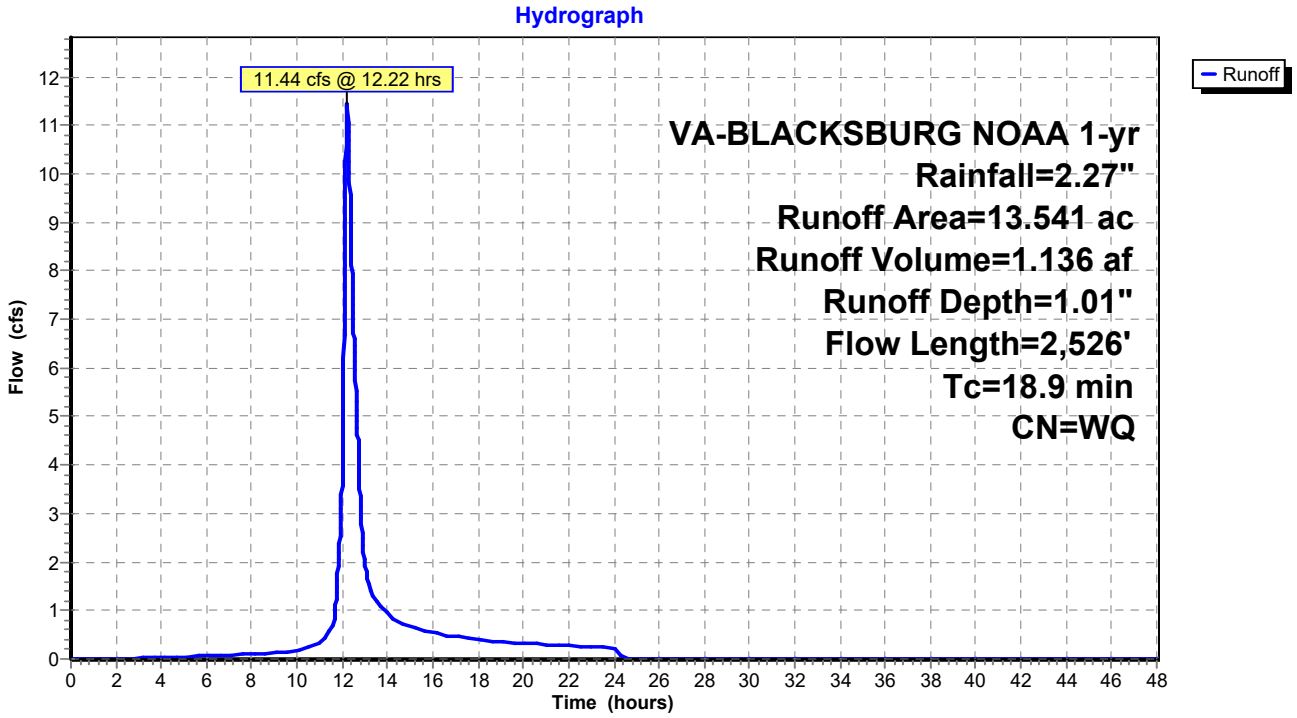
Runoff = 11.44 cfs @ 12.22 hrs, Volume= 1.136 af, Depth= 1.01"
Routed to Reach 11R : DA 4 TO POA

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
VA-BLACKSBURG NOAA 1-yr Rainfall=2.27"

Area (ac)	CN	Description
2.555	98	Paved roads w/curbs & sewers, HSG C
7.333	81	1/3 acre lots, 30% imp, HSG C
3.653	80	1/2 acre lots, 25% imp, HSG C
13.541		Weighted Average

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.4	95	0.0630	0.25		**Sheet Flow, Tc1** Grass: Short n= 0.150 P2= 2.76"
9.9	1,004	0.0478	1.70	5.26	**Channel Flow, Tc2** Area= 3.1 sf Perim= 50.0' r= 0.06' n= 0.030 Earth, grassed & winding
2.6	1,427	0.0134	9.03	28.37	**Pipe Channel, CMP_Round 24"** 24.0" Round Area= 3.1 sf Perim= 6.3' r= 0.50' n= 0.012 Concrete pipe, finished
18.9	2,526	Total			

Subcatchment 10S: DA #4



Summary for Subcatchment 11S: DA #2 OFF-SITE PORTION

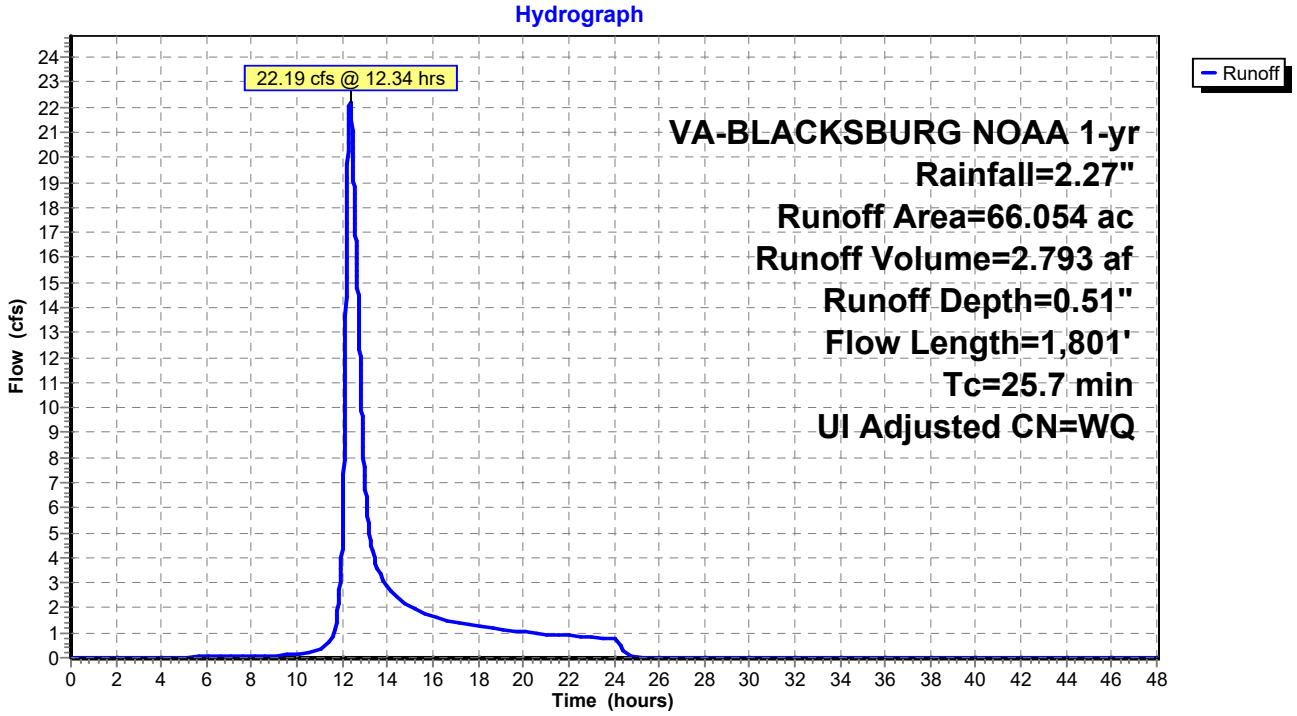
Runoff = 22.19 cfs @ 12.34 hrs, Volume= 2.793 af, Depth= 0.51"
Routed to Reach 8R : REACH COMBINE

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
VA-BLACKSBURG NOAA 1-yr Rainfall=2.27"

	Area (ac)	CN	Adj	Description
	10.040	83	83	Fallow, crop residue, Good, HSG B
	1.105	88	88	Fallow, crop residue, Good, HSG C
	1.250	98	98	Unconnected pavement, HSG C
	0.160	98	98	Unconnected pavement, HSG B
	1.555	70	70	1/2 acre lots, 25% imp, HSG B
	6.153	80	80	1/2 acre lots, 25% imp, HSG C
	1.370	81	81	1/3 acre lots, 30% imp, HSG C
	0.180	68	68	1 acre lots, 20% imp, HSG B
	0.038	79	79	1 acre lots, 20% imp, HSG C
	0.110	70	70	Woods, Good, HSG C
	1.267	55	55	Woods, Good, HSG B
	5.290	39	39	>75% Grass cover, Good, HSG A
	8.350	61	61	>75% Grass cover, Good, HSG B
	11.646	74	74	>75% Grass cover, Good, HSG C
	6.107	58	58	Woods/grass comb., Good, HSG B
	5.107	72	72	Woods/grass comb., Good, HSG C
	2.852	72	72	Dirt roads, HSG A
	1.750	82	82	Dirt roads, HSG B
	1.521	87	87	Dirt roads, HSG C
*	0.170	98	98	TRAIL, HSG B
*	0.033	98	98	TRAIL, HSG C
	66.054			Weighted Average

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.0	100	0.0400	0.21		**Sheet Flow, Tc1** Grass: Short n= 0.150 P2= 2.76"
17.7	1,701	0.0523	1.60		**Shallow Concentrated Flow, Tc2** Short Grass Pasture Kv= 7.0 fps
25.7	1,801	Total			

Subcatchment 11S: DA #2 OFF-SITE PORTION



Summary for Subcatchment 12S: DA #3 ON-SITE PORTION

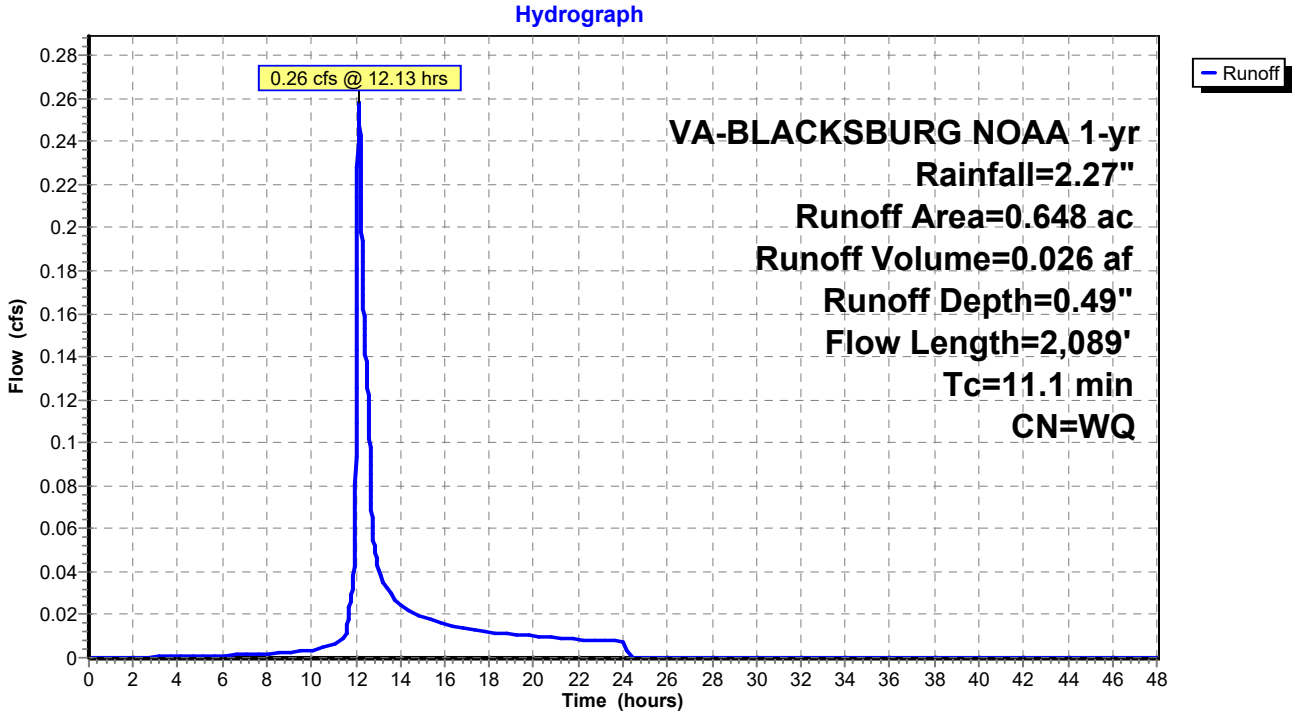
Runoff = 0.26 cfs @ 12.13 hrs, Volume= 0.026 af, Depth= 0.49"
Routed to Reach 9R : DA 3 TO DA 2

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
VA-BLACKSBURG NOAA 1-yr Rainfall=2.27"

Area (ac)	CN	Description
0.046	98	Paved roads w/curbs & sewers, HSG C
0.513	70	1/2 acre lots, 25% imp, HSG B
0.030	80	1/2 acre lots, 25% imp, HSG C
0.059	70	Woods, Good, HSG C
0.648		Weighted Average

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.7	95	0.0630	0.28		**Sheet Flow, Tc1** Range n= 0.130 P2= 2.76"
1.3	435	0.1125	5.44	40.82	**Channel Flow, Tc2** Area= 7.5 sf Perim= 40.0' r= 0.19' n= 0.030 Earth, grassed & winding
2.2	602	0.0830	4.64		**Shallow Concentrated Flow, Tc3** Unpaved Kv= 16.1 fps
0.6	301	0.0565	8.57	342.85	**Channel Flow, Tc4** Area= 40.0 sf Perim= 64.4' r= 0.62' n= 0.030 Earth, grassed & winding
0.1	215	0.0744	27.88	197.09	**Pipe Channel, Tc5** 36.0" Round Area= 7.1 sf Perim= 9.4' r= 0.75' n= 0.012 Concrete pipe, finished
1.2	441	0.0603	6.33	189.76	**Channel Flow, Tc6** Area= 30.0 sf Perim= 80.0' r= 0.38' n= 0.030 Earth, grassed & winding
11.1	2,089	Total			

Subcatchment 12S: DA #3 ON-SITE PORTION



Summary for Reach 6R: POND TO POA

Inflow Area = 96.000 ac, Inflow Depth > 0.47" for 1-yr event
Inflow = 5.90 cfs @ 13.86 hrs, Volume= 3.739 af
Outflow = 5.51 cfs @ 14.27 hrs, Volume= 3.721 af, Atten= 7%, Lag= 24.6 min
Routed to Reach 8R : REACH COMBINE

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Max. Velocity= 1.31 fps, Min. Travel Time= 22.5 min
Avg. Velocity = 1.10 fps, Avg. Travel Time= 26.7 min

Peak Storage= 7,438 cf @ 14.27 hrs
Average Depth at Peak Storage= 0.06' , Surface Width= 70.36'
Bank-Full Depth= 5.00' Flow Area= 425.0 sf, Capacity= 8,939.96 cfs

70.00' x 5.00' deep channel, n= 0.030 Earth, grassed & winding
Side Slope Z-value= 3.0 '/' Top Width= 100.00'
Length= 1,769.1' Slope= 0.0268 '/'
Inlet Invert= 2,087.00', Outlet Invert= 2,039.65'

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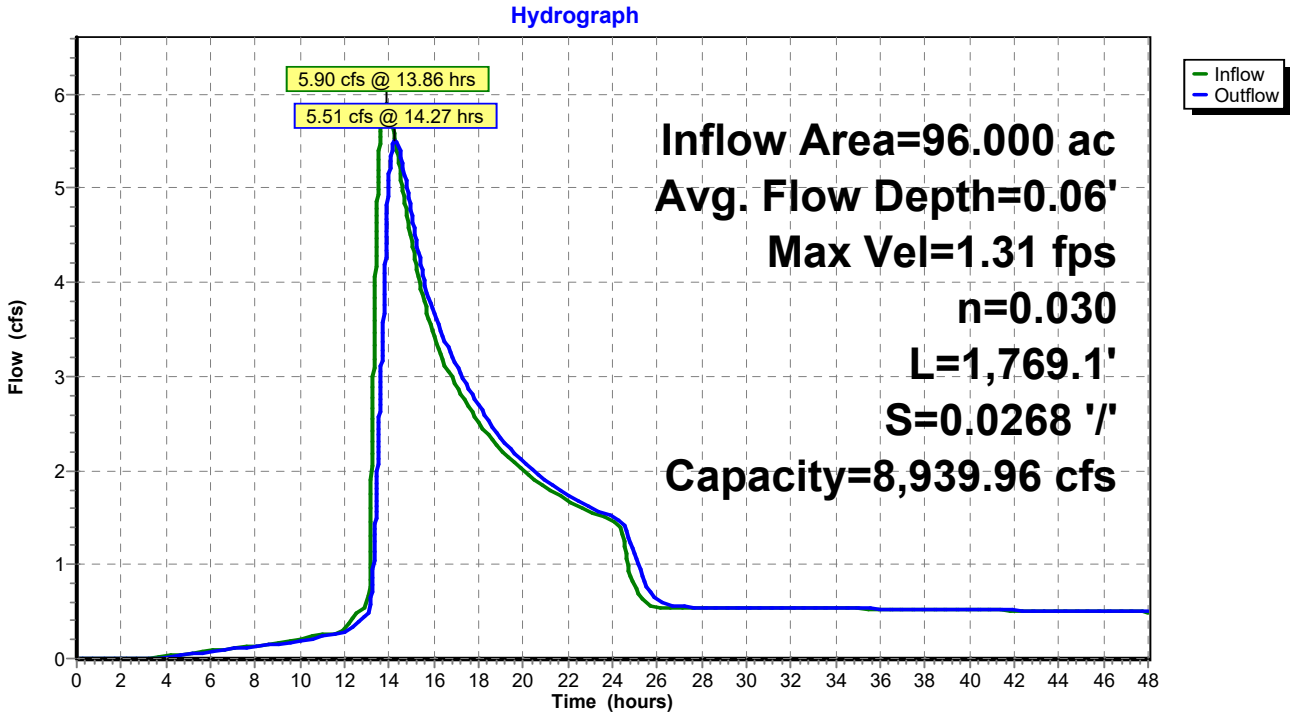


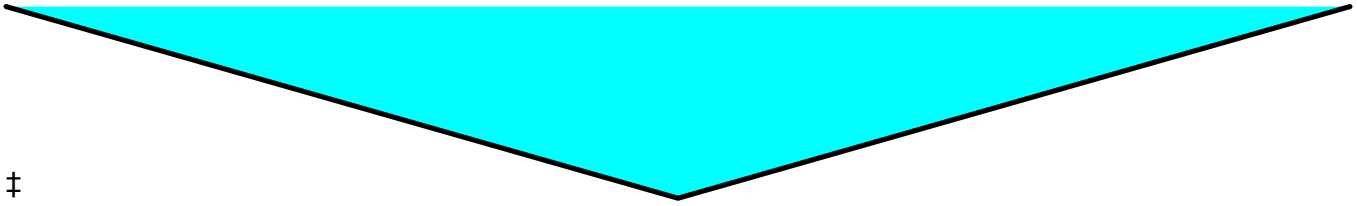
Summary for Reach 8R: REACH COMBINE

Inflow Area = 234.201 ac, Inflow Depth > 0.52" for 1-yr event
Inflow = 53.04 cfs @ 12.26 hrs, Volume= 10.137 af
Outflow = 51.57 cfs @ 12.32 hrs, Volume= 10.134 af, Atten= 3%, Lag= 3.9 min
Routed to Reach 10R : REACH COMBINE 2

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Max. Velocity= 0.89 fps, Min. Travel Time= 3.1 min
Avg. Velocity = 0.61 fps, Avg. Travel Time= 4.6 min

Peak Storage= 9,742 cf @ 12.32 hrs
Average Depth at Peak Storage= 5.43' , Surface Width= 181.26'
Bank-Full Depth= 0.33' Flow Area= 1.8 sf, Capacity= 1.23 cfs

0.00' x 0.33' deep channel, n= 0.030 Earth, grassed & winding
Side Slope Z-value= 16.7 '/' Top Width= 11.02'
Length= 168.8' Slope= 0.0021 '/'
Inlet Invert= 2,036.90', Outlet Invert= 2,036.55'



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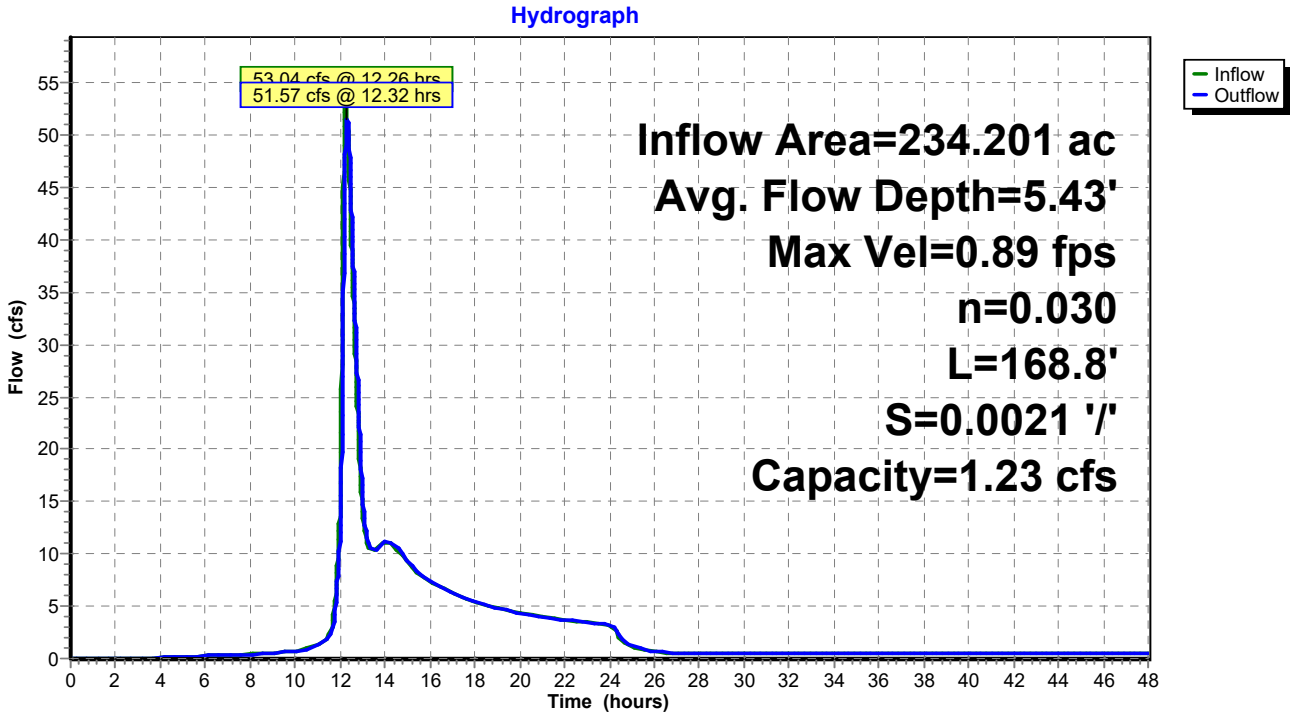
Reach 8R: REACH COMBINE



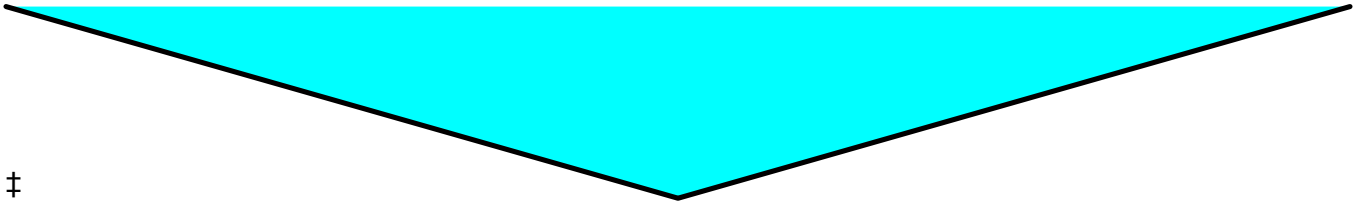
Summary for Reach 9R: DA 3 TO DA 2

Inflow Area = 45.195 ac, Inflow Depth = 0.83" for 1-yr event
Inflow = 38.32 cfs @ 12.11 hrs, Volume= 3.113 af
Outflow = 31.27 cfs @ 12.20 hrs, Volume= 3.113 af, Atten= 18%, Lag= 5.2 min
Routed to Reach 8R : REACH COMBINE

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Max. Velocity= 3.68 fps, Min. Travel Time= 6.6 min
Avg. Velocity = 1.09 fps, Avg. Travel Time= 22.5 min

Peak Storage= 12,416 cf @ 12.20 hrs
Average Depth at Peak Storage= 0.48' , Surface Width= 38.32'
Bank-Full Depth= 0.35' Flow Area= 4.9 sf, Capacity= 15.84 cfs

0.00' x 0.35' deep channel, n= 0.030 Earth, grassed & winding
Side Slope Z-value= 40.0 '/' Top Width= 28.00'
Length= 1,462.0' Slope= 0.0435 '/'
Inlet Invert= 2,103.26', Outlet Invert= 2,039.65'



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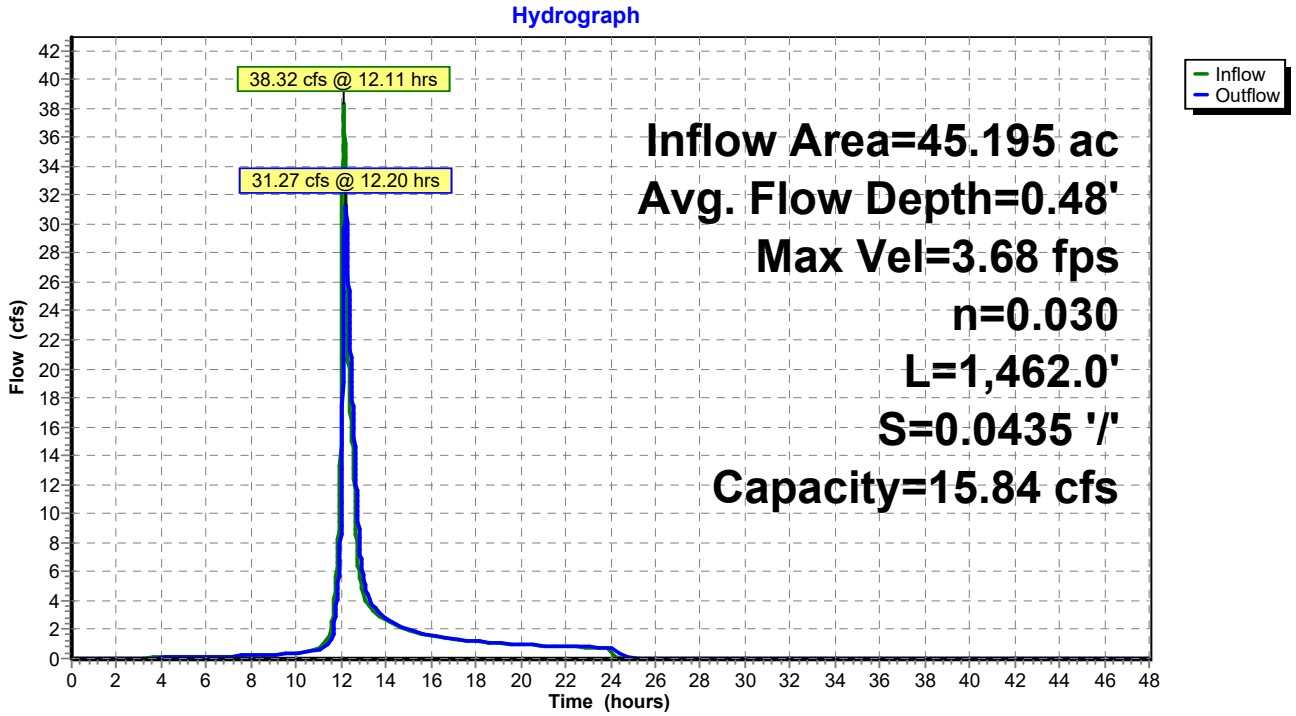
Reach 9R: DA 3 TO DA 2



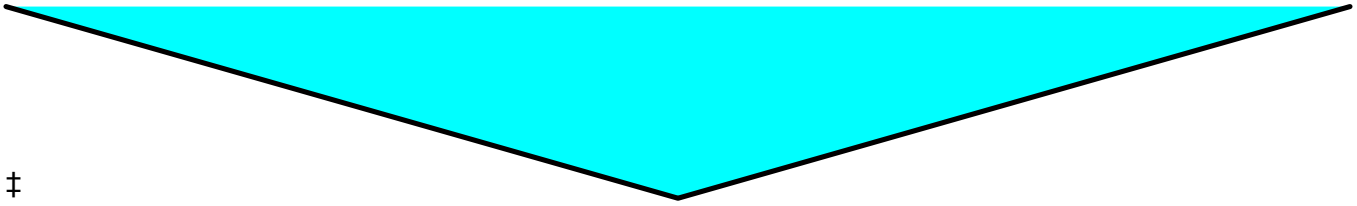
Summary for Reach 10R: REACH COMBINE 2

Inflow Area = 247.742 ac, Inflow Depth > 0.55" for 1-yr event
Inflow = 62.30 cfs @ 12.31 hrs, Volume= 11.270 af
Outflow = 62.13 cfs @ 12.33 hrs, Volume= 11.267 af, Atten= 0%, Lag= 1.0 min
Routed to Link 7L : POA

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Max. Velocity= 1.81 fps, Min. Travel Time= 1.3 min
Avg. Velocity = 0.68 fps, Avg. Travel Time= 3.3 min

Peak Storage= 4,673 cf @ 12.33 hrs
Average Depth at Peak Storage= 0.62' , Surface Width= 110.36'
Bank-Full Depth= 0.59' Flow Area= 30.8 sf, Capacity= 54.02 cfs

0.00' x 0.59' deep channel, n= 0.030 Earth, grassed & winding
Side Slope Z-value= 88.5 '/' Top Width= 104.43'
Length= 136.3' Slope= 0.0064 '/'
Inlet Invert= 2,036.75', Outlet Invert= 2,035.88'



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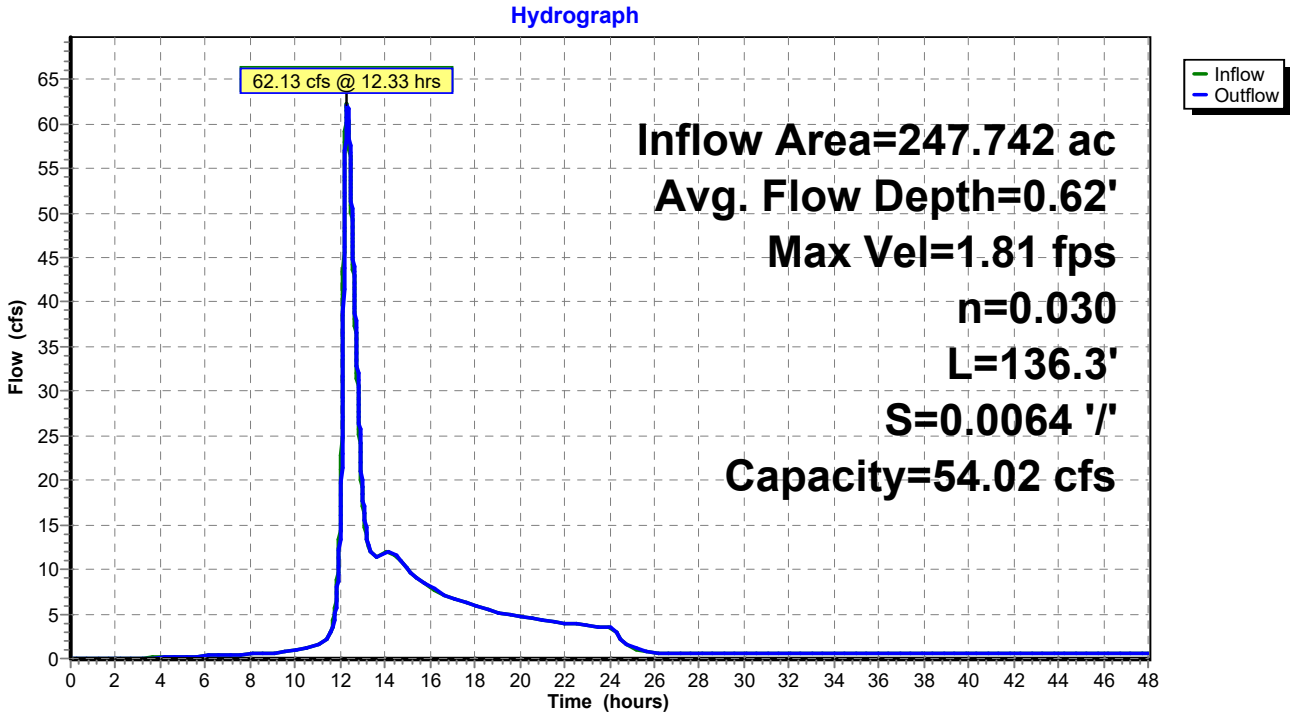
Reach 10R: REACH COMBINE 2



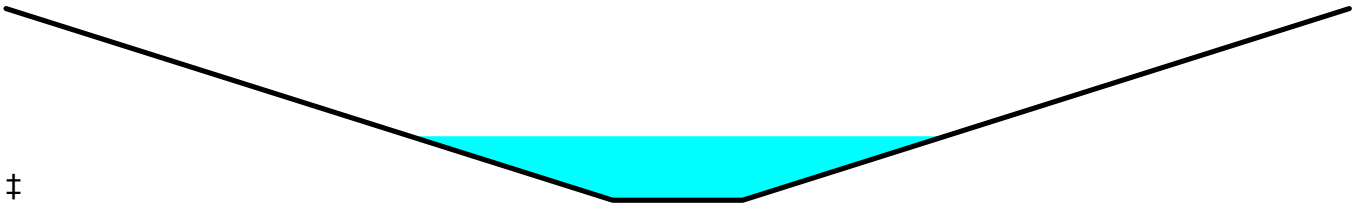
Summary for Reach 11R: DA 4 TO POA

Inflow Area = 13.541 ac, Inflow Depth = 1.01" for 1-yr event
Inflow = 11.44 cfs @ 12.22 hrs, Volume= 1.136 af
Outflow = 11.12 cfs @ 12.26 hrs, Volume= 1.136 af, Atten= 3%, Lag= 2.5 min
Routed to Reach 10R : REACH COMBINE 2

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Max. Velocity= 6.18 fps, Min. Travel Time= 3.2 min
Avg. Velocity = 2.03 fps, Avg. Travel Time= 9.7 min

Peak Storage= 2,115 cf @ 12.26 hrs
Average Depth at Peak Storage= 0.47' , Surface Width= 6.18'
Bank-Full Depth= 1.40' Flow Area= 11.9 sf, Capacity= 140.25 cfs

1.50' x 1.40' deep channel, n= 0.030 Earth, grassed & winding
Side Slope Z-value= 5.0 '/' Top Width= 15.50'
Length= 1,176.1' Slope= 0.0825 '/'
Inlet Invert= 2,133.71', Outlet Invert= 2,036.73'



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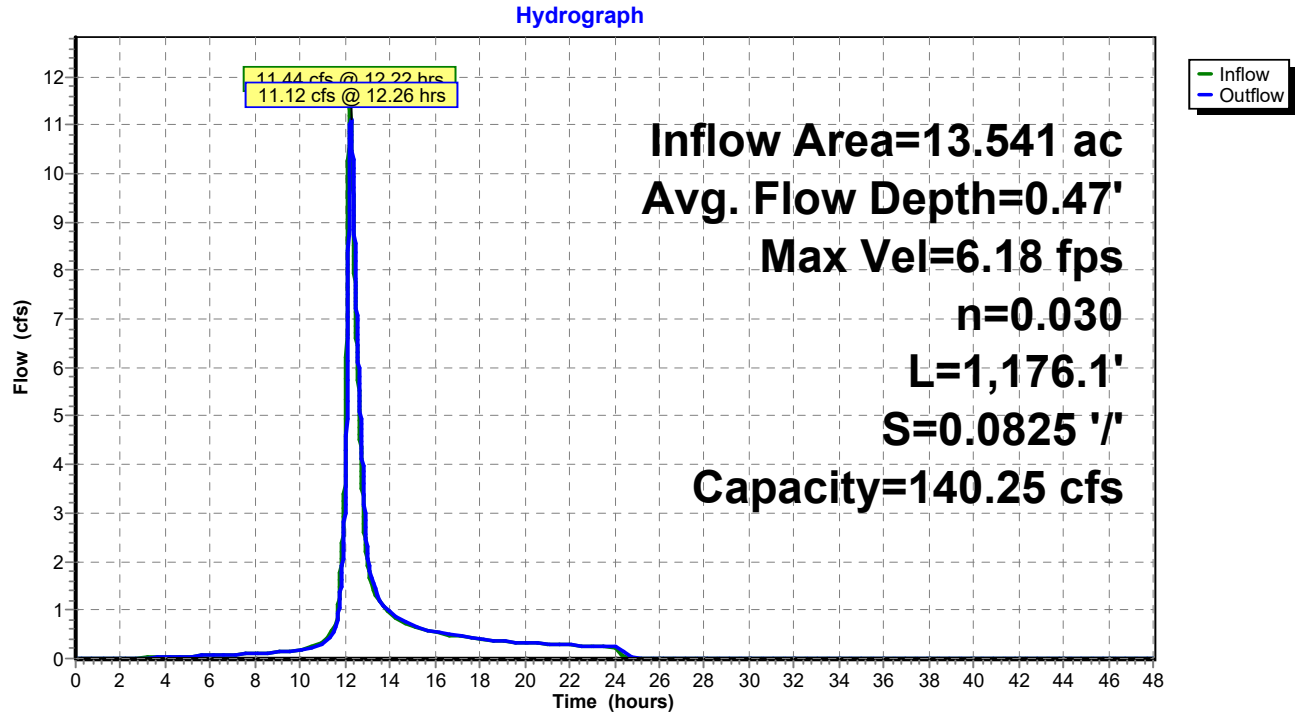
Reach 11R: DA 4 TO POA



Summary for Pond 3P: NSP POND 1

Inflow Area = 96.000 ac, Inflow Depth = 0.66" for 1-yr event
Inflow = 39.33 cfs @ 12.42 hrs, Volume= 5.281 af
Outflow = 5.90 cfs @ 13.86 hrs, Volume= 3.739 af, Atten= 85%, Lag= 86.0 min
Primary = 5.90 cfs @ 13.86 hrs, Volume= 3.739 af
Routed to Reach 6R : POND TO POA

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 2,080.46' @ 13.86 hrs Storage= 121,152 cf

Plug-Flow detention time= 571.0 min calculated for 3.739 af (71% of inflow)
Center-of-Mass det. time= 458.2 min (1,338.0 - 879.9)

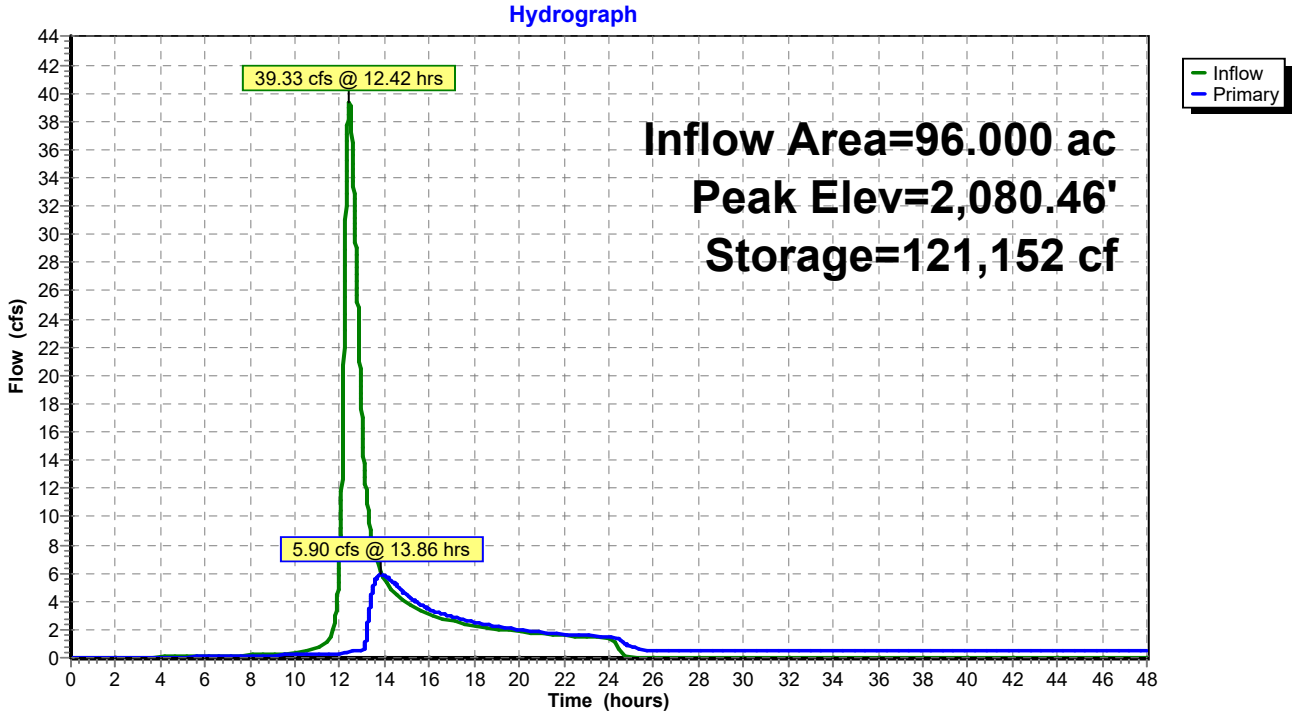
Volume	Invert	Avail.Storage	Storage Description
#1	2,074.75'	392,320 cf	**Custom Stage Data** Listed below

Elevation (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
2,074.75	0	0
2,076.00	2,002	2,002
2,078.00	24,089	26,091
2,080.00	67,305	93,396
2,082.00	119,692	213,088
2,084.00	179,232	392,320

Device	Routing	Invert	Outlet Devices
#1	Primary	2,073.87'	**48.0" Round Culvert** L= 110.4' Ke= 0.600 Inlet / Outlet Invert= 2,073.87' / 2,071.85' S= 0.0183 '/' Cc= 0.900 n= 0.013, Flow Area= 12.57 sf
#2	Device 1	2,074.75'	**3.0" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Device 1	2,080.27'	**72.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#4	Device 1	2,082.20'	**30.0' long x 14.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.64 2.67 2.70 2.65 2.64 2.65 2.65 2.63

Primary OutFlow Max=5.82 cfs @ 13.86 hrs HW=2,080.46' (Free Discharge)
└**1=Culvert** (Passes 5.82 cfs of 121.58 cfs potential flow)
  ├**2=Orifice/Grate** (Orifice Controls 0.56 cfs @ 11.38 fps)
  ├**3=Orifice/Grate** (Weir Controls 5.26 cfs @ 1.44 fps)
  └**4=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 3P: NSP POND 1

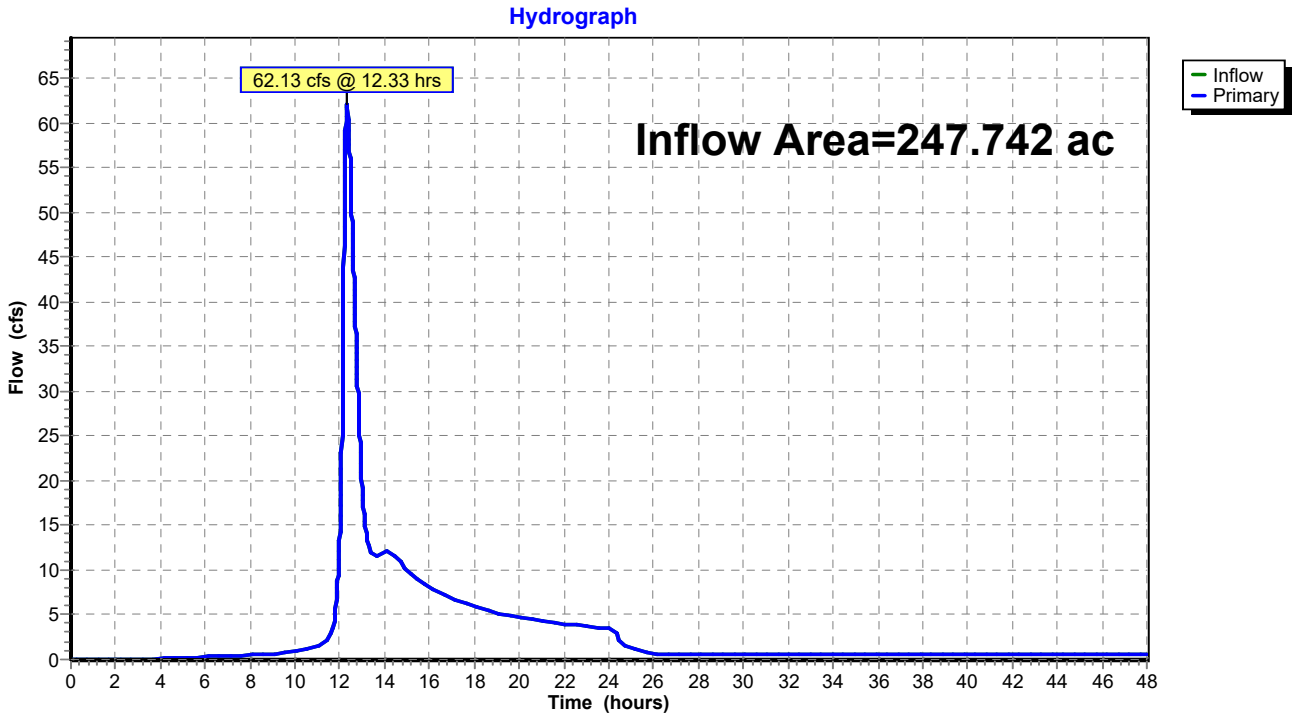


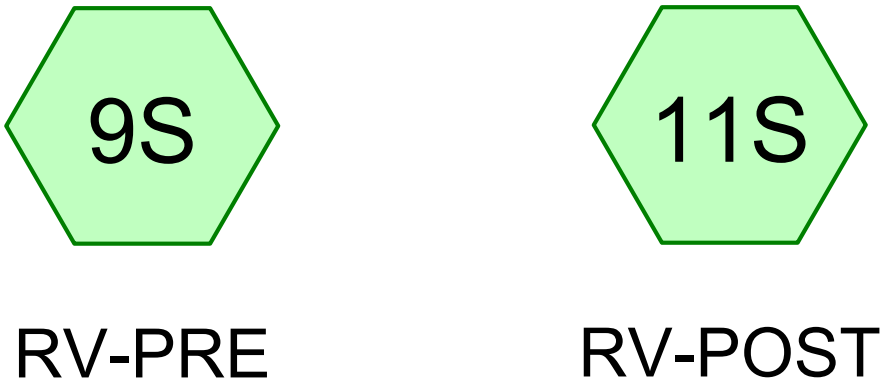
Summary for Link 7L: POA

Inflow Area = 247.742 ac, Inflow Depth > 0.55" for 1-yr event
Inflow = 62.13 cfs @ 12.33 hrs, Volume= 11.267 af
Primary = 62.13 cfs @ 12.33 hrs, Volume= 11.267 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs

Link 7L: POA





Subcat Reach Pond Link

Routing Diagram for RV CALCULATION
Prepared by Balzer & Associates, Inc, Printed 4/4/2023

Time span=0.00-48.00 hrs, dt=0.01 hrs, 4801 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-Q
Reach routing by Stor-Ind method - Pond routing by Stor-Ind method

Subcatchment9S: RV-PRE Runoff Area=37.320 ac Runoff Depth=0.27"
Flow Length=1,801' Tc=25.7 min CN=WQ Runoff=4.66 cfs 0.825 af

Subcatchment11S: RV-POST Runoff Area=37.250 ac Runoff Depth=0.91"
Tc=6.0 min CN=WQ Runoff=41.66 cfs 2.829 af

Total Runoff Area = 74.570 ac Runoff Volume = 3.653 af Average Runoff Depth = 0.59"

Summary for Subcatchment 9S: RV-PRE

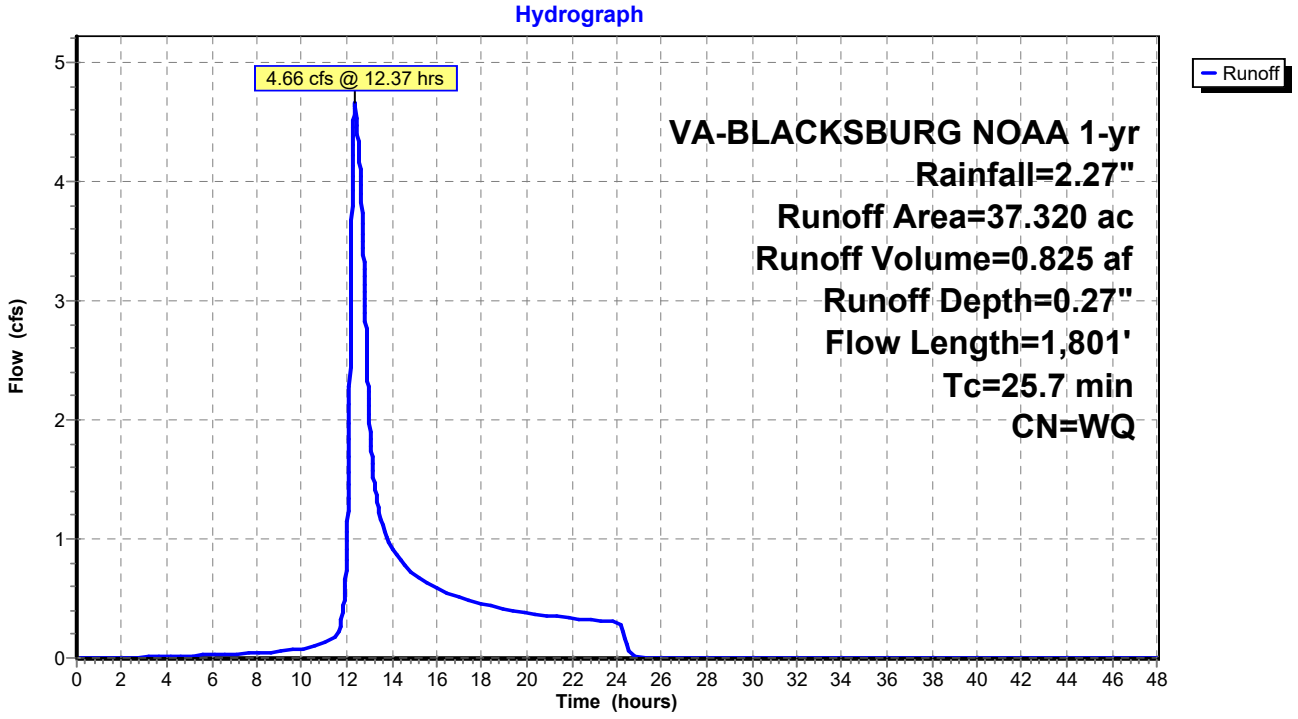
Runoff = 4.66 cfs @ 12.37 hrs, Volume= 0.825 af, Depth= 0.27"

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
VA-BLACKSBURG NOAA 1-yr Rainfall=2.27"

Area (ac)	CN	Description
14.260	61	>75% Grass cover, Good, HSG B
5.830	74	>75% Grass cover, Good, HSG C
0.800	98	Paved parking, HSG B
0.320	98	Paved parking, HSG C
11.440	58	Woods/grass comb., Good, HSG B
4.670	72	Woods/grass comb., Good, HSG C
37.320		Weighted Average

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.0	100	0.0400	0.21		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.76"
17.7	1,701	0.0523	1.60		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
25.7	1,801	Total			

Subcatchment 9S: RV-PRE



Summary for Subcatchment 11S: RV-POST

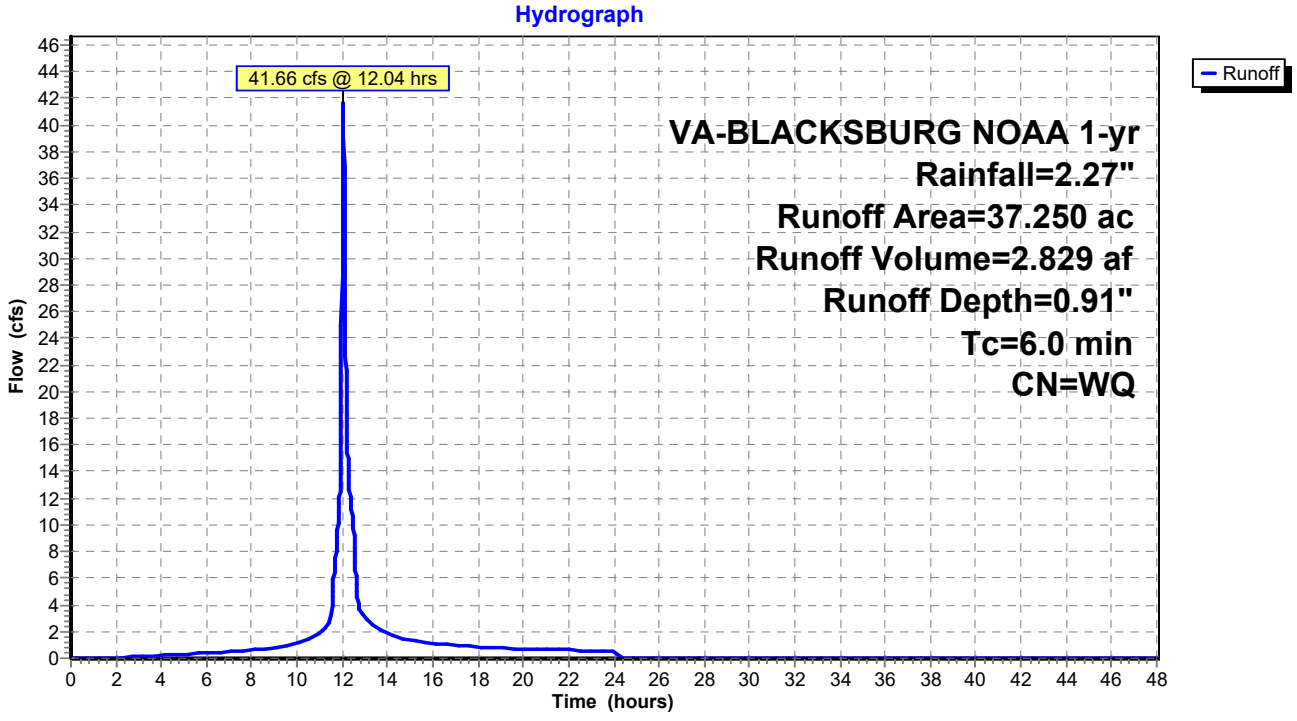
Runoff = 41.66 cfs @ 12.04 hrs, Volume= 2.829 af, Depth= 0.91"

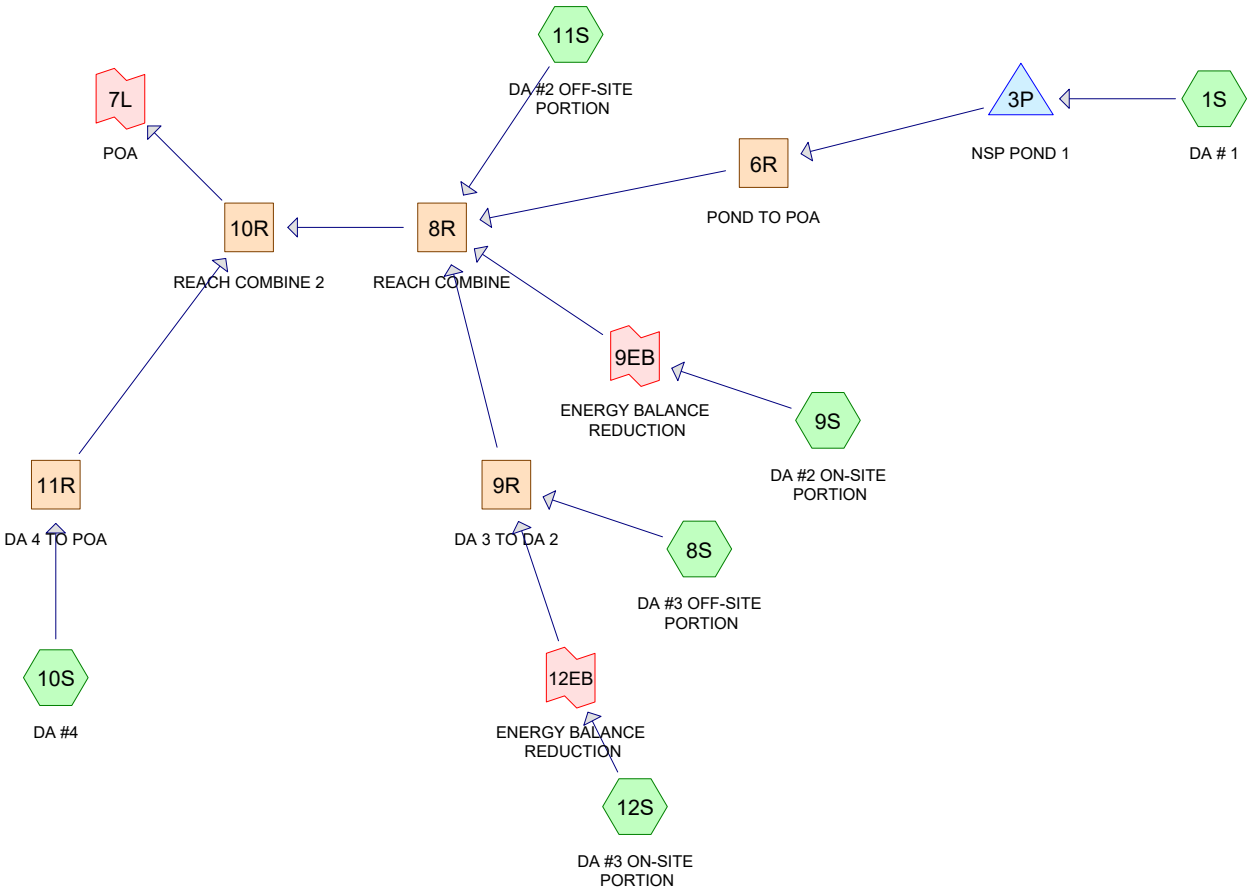
Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
VA-BLACKSBURG NOAA 1-yr Rainfall=2.27"

	Area (ac)	CN	Description
	16.260	61	>75% Grass cover, Good, HSG B
	7.110	74	>75% Grass cover, Good, HSG C
*	10.310	98	Impervious, HSG B
*	3.570	98	Impervious, HSG C
	37.250		Weighted Average

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, TR-55 MIN.**

Subcatchment 11S: RV-POST





Subcat Reach Pond Link

Routing Diagram for CHANNEL PROTECTION
Prepared by Balzer & Associates, Inc, Printed 4/4/2023

Time span=0.00-48.00 hrs, dt=0.01 hrs, 4801 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-Q
Reach routing by Stor-Ind method - Pond routing by Stor-Ind method

Subcatchment1S: DA # 1 Runoff Area=96.000 ac Runoff Depth=0.66"
Tc=30.8 min CN=WQ Runoff=39.33 cfs 5.281 af

Subcatchment8S: DA #3 OFF-SITE PORTION Runoff Area=44.547 ac Runoff Depth=0.83"
Flow Length=2,089' Tc=11.1 min CN=WQ Runoff=38.07 cfs 3.087 af

Subcatchment9S: DA #2 ON-SITE PORTION Runoff Area=26.952 ac Runoff Depth=0.23"
Flow Length=1,801' Tc=25.7 min CN=WQ Runoff=2.82 cfs 0.511 af

Subcatchment10S: DA #4 Runoff Area=13.541 ac Runoff Depth=1.01"
Flow Length=2,526' Tc=18.9 min CN=WQ Runoff=11.44 cfs 1.136 af

Subcatchment11S: DA #2 OFF-SITE PORTION Runoff Area=66.054 ac Runoff Depth=0.51"
Flow Length=1,801' Tc=25.7 min UI Adjusted CN=WQ Runoff=22.19 cfs 2.793 af

Subcatchment12S: DA #3 ON-SITE PORTION Runoff Area=0.648 ac Runoff Depth=0.49"
Flow Length=2,089' Tc=11.1 min CN=WQ Runoff=0.26 cfs 0.026 af

Reach 6R: POND TO POA Avg. Flow Depth=0.06' Max Vel=1.31 fps Inflow=5.90 cfs 3.739 af
n=0.030 L=1,769.1' S=0.0268 '/' Capacity=8,939.96 cfs Outflow=5.51 cfs 3.721 af

Reach 8R: REACH COMBINE Avg. Flow Depth=5.22' Max Vel=0.89 fps Inflow=51.03 cfs 9.724 af
n=0.030 L=168.8' S=0.0021 '/' Capacity=1.23 cfs Outflow=49.53 cfs 9.720 af

Reach 9R: DA 3 TO DA 2 Avg. Flow Depth=0.48' Max Vel=3.68 fps Inflow=38.12 cfs 3.093 af
n=0.030 L=1,462.0' S=0.0435 '/' Capacity=15.84 cfs Outflow=31.10 cfs 3.093 af

Reach 10R: REACH COMBINE 2 Avg. Flow Depth=0.62' Max Vel=1.80 fps Inflow=60.32 cfs 10.856 af
n=0.030 L=136.3' S=0.0064 '/' Capacity=54.02 cfs Outflow=60.15 cfs 10.853 af

Reach 11R: DA 4 TO POA Avg. Flow Depth=0.47' Max Vel=6.18 fps Inflow=11.44 cfs 1.136 af
n=0.030 L=1,176.1' S=0.0825 '/' Capacity=140.25 cfs Outflow=11.12 cfs 1.136 af

Pond 3P: NSP POND 1 Peak Elev=2,080.46' Storage=121,152 cf Inflow=39.33 cfs 5.281 af
Outflow=5.90 cfs 3.739 af

Link 7L: POA Inflow=60.15 cfs 10.853 af
Primary=60.15 cfs 10.853 af

Link 9EB: ENERGY BALANCE REDUCTION x 0.23 Inflow=2.82 cfs 0.511 af
Primary=0.65 cfs 0.117 af Secondary=2.17 cfs 0.393 af

Link 12EB: ENERGY BALANCE REDUCTION x 0.23 Inflow=0.26 cfs 0.026 af
Primary=0.06 cfs 0.006 af Secondary=0.20 cfs 0.020 af

Total Runoff Area = 247.742 ac Runoff Volume = 12.834 af Average Runoff Depth = 0.62"

Summary for Subcatchment 1S: DA # 1

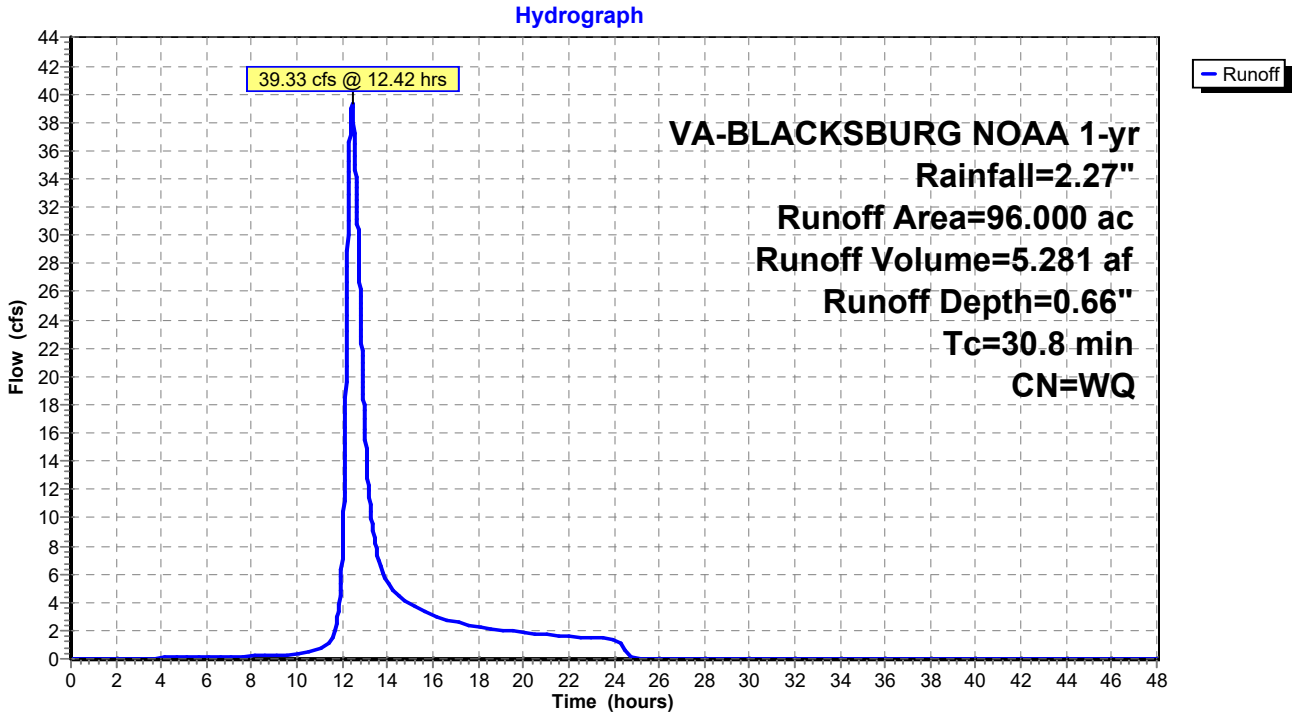
Runoff = 39.33 cfs @ 12.42 hrs, Volume= 5.281 af, Depth= 0.66"
Routed to Pond 3P : NSP POND 1

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
VA-BLACKSBURG NOAA 1-yr Rainfall=2.27"

Area (ac)	CN	Description
5.080	98	Roofs, HSG C
3.100	84	50-75% Grass cover, Fair, HSG D
22.720	79	50-75% Grass cover, Fair, HSG C
28.800	69	50-75% Grass cover, Fair, HSG B
1.000	86	1/3 acre lots, 30% imp, HSG D
10.400	81	1/3 acre lots, 30% imp, HSG C
6.400	72	1/3 acre lots, 30% imp, HSG B
10.300	83	1/4 acre lots, 38% imp, HSG C
8.200	75	1/4 acre lots, 38% imp, HSG B
96.000		Weighted Average

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
30.8					**Direct Entry, FROM NSP CALCS**

Subcatchment 1S: DA # 1



Summary for Subcatchment 8S: DA #3 OFF-SITE PORTION

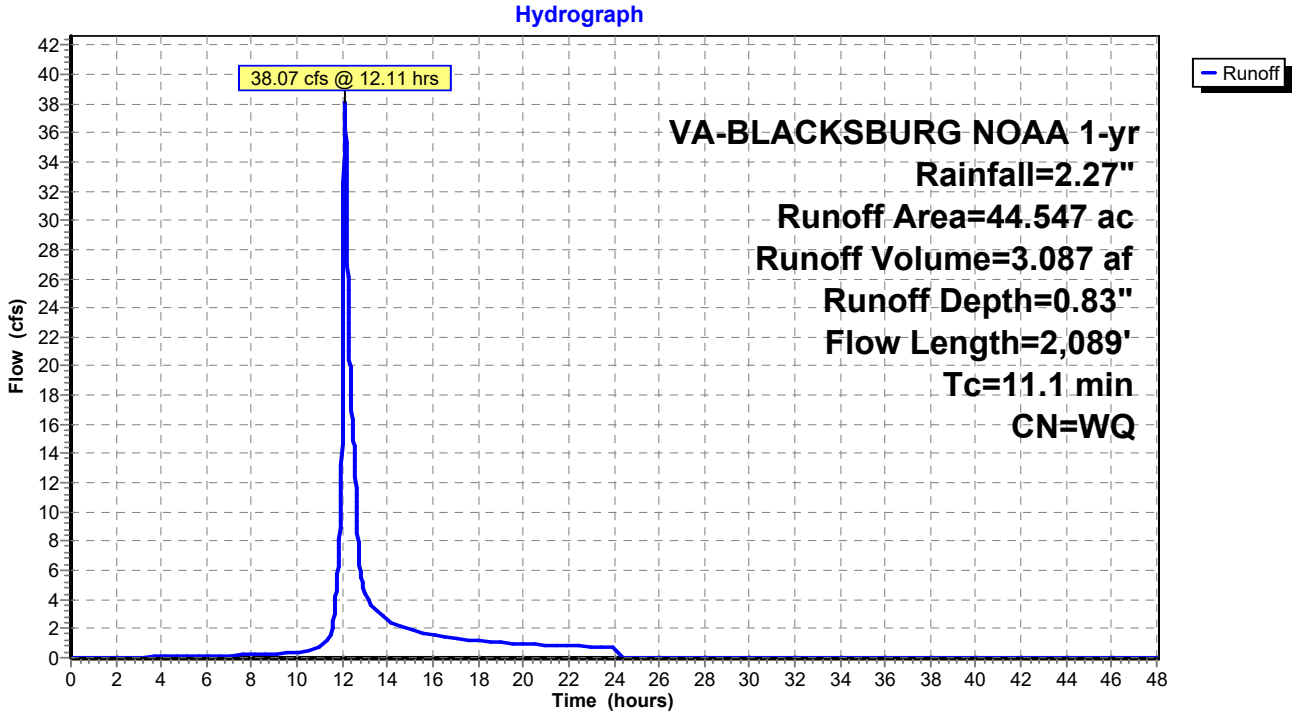
Runoff = 38.07 cfs @ 12.11 hrs, Volume= 3.087 af, Depth= 0.83"
Routed to Reach 9R : DA 3 TO DA 2

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
VA-BLACKSBURG NOAA 1-yr Rainfall=2.27"

Area (ac)	CN	Description
0.358	98	Paved roads w/curbs & sewers, HSG B
4.733	98	Paved roads w/curbs & sewers, HSG C
5.726	70	1/2 acre lots, 25% imp, HSG B
28.476	80	1/2 acre lots, 25% imp, HSG C
0.877	72	1/3 acre lots, 30% imp, HSG B
3.986	81	1/3 acre lots, 30% imp, HSG C
0.391	79	1 acre lots, 20% imp, HSG C
44.547		Weighted Average

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.7	95	0.0630	0.28		**Sheet Flow, Tc1** Range n= 0.130 P2= 2.76"
1.3	435	0.1125	5.44	40.82	**Channel Flow, Tc2** Area= 7.5 sf Perim= 40.0' r= 0.19' n= 0.030 Earth, grassed & winding
2.2	602	0.0830	4.64		**Shallow Concentrated Flow, Tc3** Unpaved Kv= 16.1 fps
0.6	301	0.0565	8.57	342.85	**Channel Flow, Tc4** Area= 40.0 sf Perim= 64.4' r= 0.62' n= 0.030 Earth, grassed & winding
0.1	215	0.0744	27.88	197.09	**Pipe Channel, Tc5** 36.0" Round Area= 7.1 sf Perim= 9.4' r= 0.75' n= 0.012 Concrete pipe, finished
1.2	441	0.0603	6.33	189.76	**Channel Flow, Tc6** Area= 30.0 sf Perim= 80.0' r= 0.38' n= 0.030 Earth, grassed & winding
11.1	2,089	Total			

Subcatchment 8S: DA #3 OFF-SITE PORTION



Summary for Subcatchment 9S: DA #2 ON-SITE PORTION

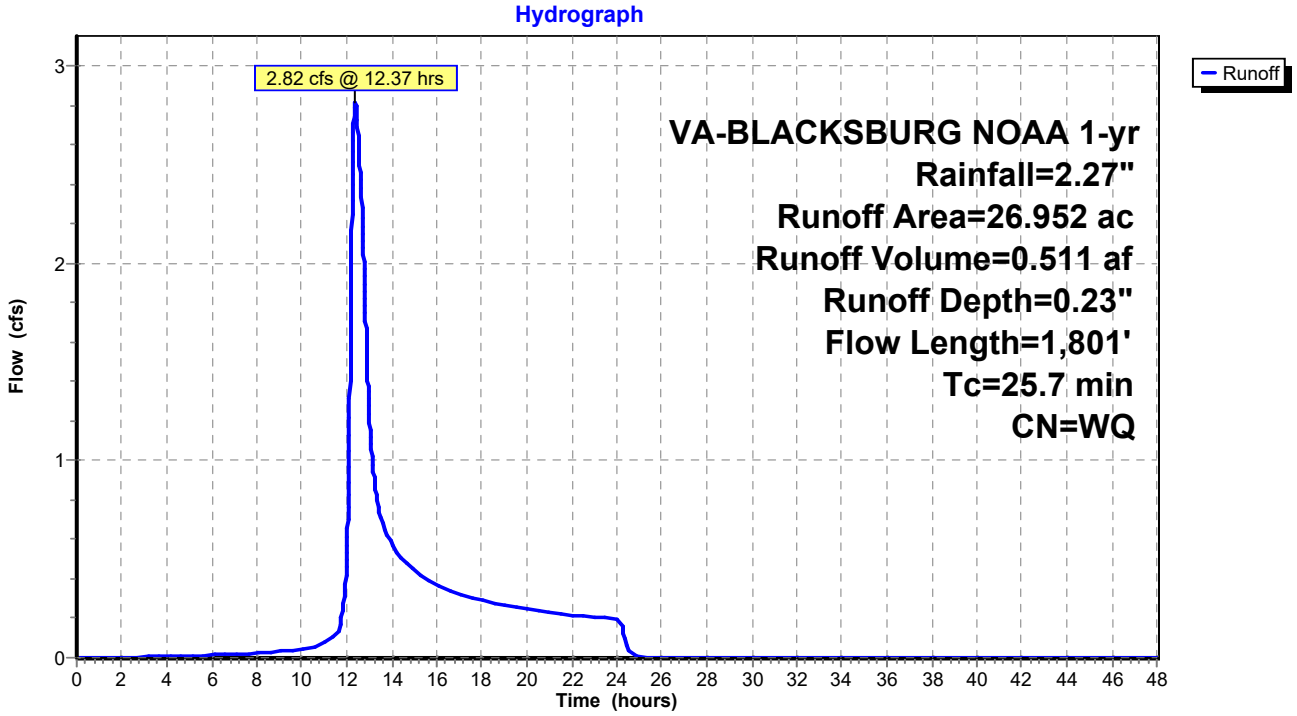
Runoff = 2.82 cfs @ 12.37 hrs, Volume= 0.511 af, Depth= 0.23"
Routed to Link 9EB : ENERGY BALANCE REDUCTION

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
VA-BLACKSBURG NOAA 1-yr Rainfall=2.27"

	Area (ac)	CN	Description
	5.097	55	Woods, Good, HSG B
	5.711	70	Woods, Good, HSG C
	8.232	58	Woods/grass comb., Good, HSG B
	1.810	72	Woods/grass comb., Good, HSG C
	0.270	70	1/2 acre lots, 25% imp, HSG B
	0.098	80	1/2 acre lots, 25% imp, HSG C
	0.070	39	>75% Grass cover, Good, HSG A
	4.590	61	>75% Grass cover, Good, HSG B
	0.070	74	>75% Grass cover, Good, HSG C
	0.240	98	Paved parking, HSG B
	0.124	98	Paved parking, HSG C
	0.410	86	Fallow, bare soil, HSG B
*	0.218	98	TRAIL, HSG B
*	0.012	98	TRAIL, HSG C
	26.952		Weighted Average

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.0	100	0.0400	0.21		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.76"
17.7	1,701	0.0523	1.60		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
25.7	1,801	Total			

Subcatchment 9S: DA #2 ON-SITE PORTION



Summary for Subcatchment 10S: DA #4

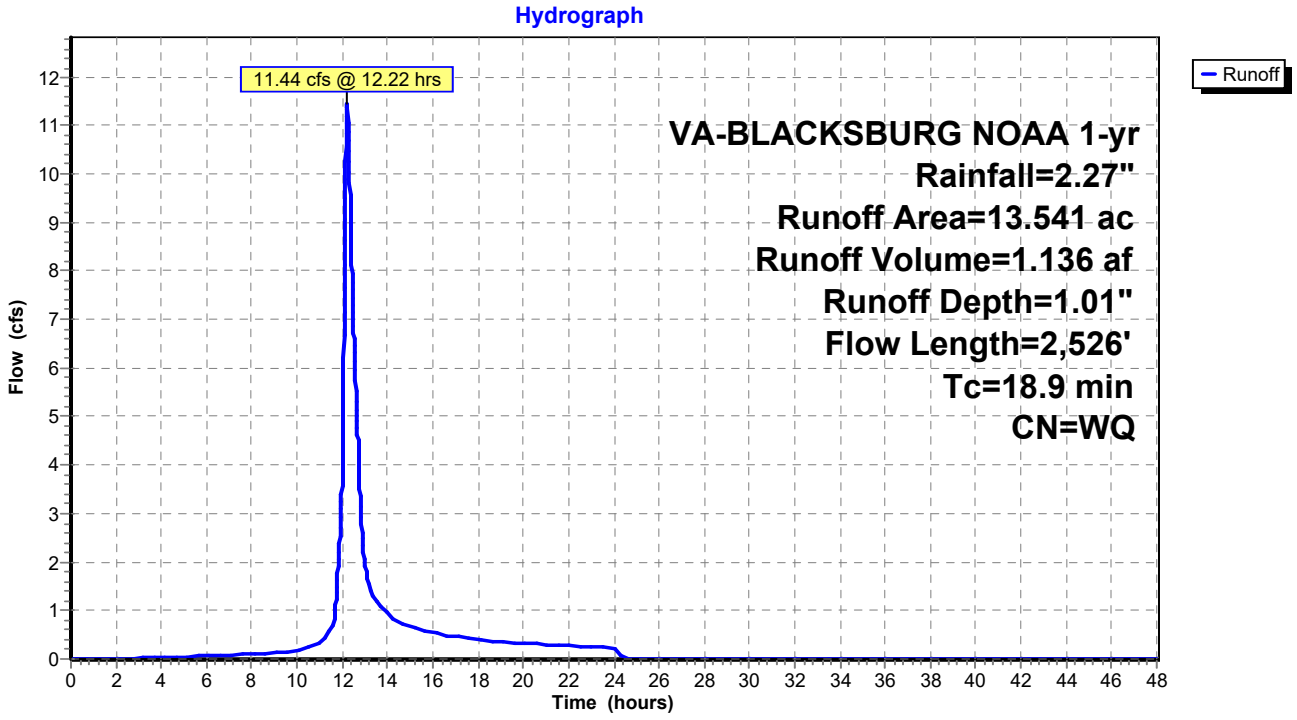
Runoff = 11.44 cfs @ 12.22 hrs, Volume= 1.136 af, Depth= 1.01"
Routed to Reach 11R : DA 4 TO POA

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
VA-BLACKSBURG NOAA 1-yr Rainfall=2.27"

Area (ac)	CN	Description
2.555	98	Paved roads w/curbs & sewers, HSG C
7.333	81	1/3 acre lots, 30% imp, HSG C
3.653	80	1/2 acre lots, 25% imp, HSG C
13.541		Weighted Average

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.4	95	0.0630	0.25		**Sheet Flow, Tc1** Grass: Short n= 0.150 P2= 2.76"
9.9	1,004	0.0478	1.70	5.26	**Channel Flow, Tc2** Area= 3.1 sf Perim= 50.0' r= 0.06' n= 0.030 Earth, grassed & winding
2.6	1,427	0.0134	9.03	28.37	**Pipe Channel, CMP_Round 24"** 24.0" Round Area= 3.1 sf Perim= 6.3' r= 0.50' n= 0.012 Concrete pipe, finished
18.9	2,526	Total			

Subcatchment 10S: DA #4



Summary for Subcatchment 11S: DA #2 OFF-SITE PORTION

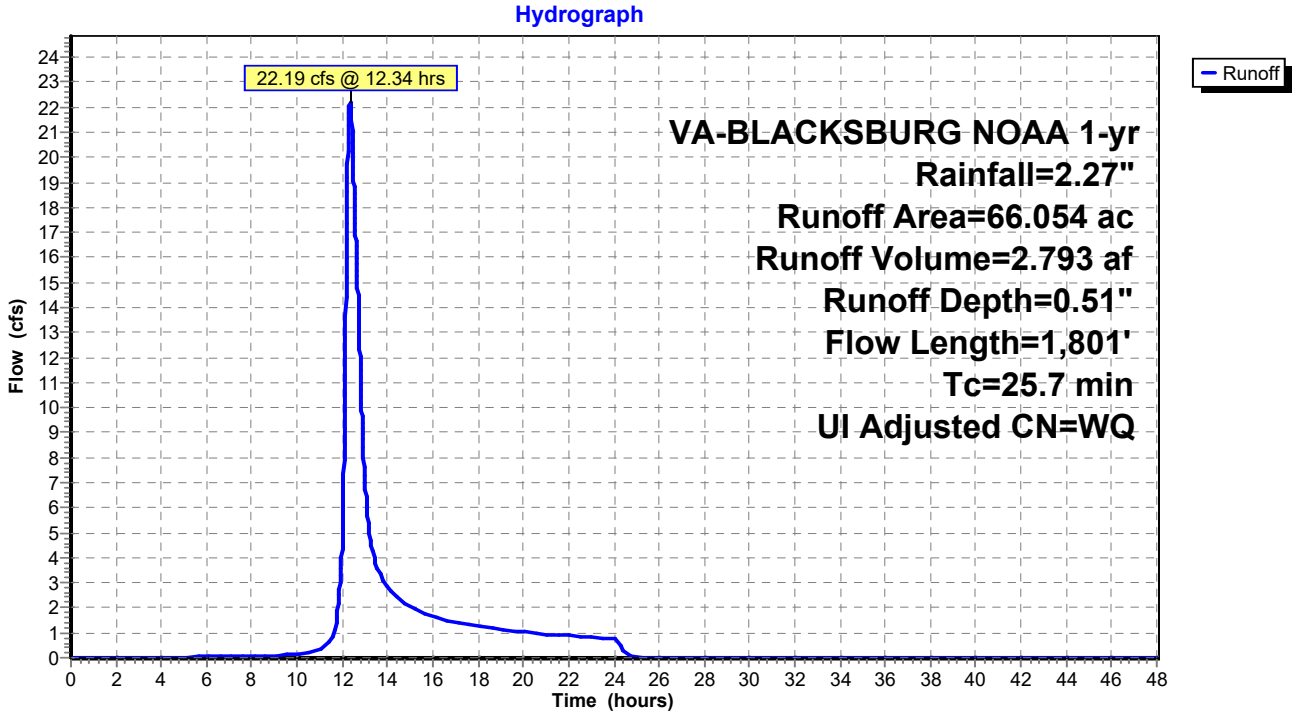
Runoff = 22.19 cfs @ 12.34 hrs, Volume= 2.793 af, Depth= 0.51"
Routed to Reach 8R : REACH COMBINE

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
VA-BLACKSBURG NOAA 1-yr Rainfall=2.27"

	Area (ac)	CN	Adj	Description
	10.040	83	83	Fallow, crop residue, Good, HSG B
	1.105	88	88	Fallow, crop residue, Good, HSG C
	1.250	98	98	Unconnected pavement, HSG C
	0.160	98	98	Unconnected pavement, HSG B
	1.555	70	70	1/2 acre lots, 25% imp, HSG B
	6.153	80	80	1/2 acre lots, 25% imp, HSG C
	1.370	81	81	1/3 acre lots, 30% imp, HSG C
	0.180	68	68	1 acre lots, 20% imp, HSG B
	0.038	79	79	1 acre lots, 20% imp, HSG C
	0.110	70	70	Woods, Good, HSG C
	1.267	55	55	Woods, Good, HSG B
	5.290	39	39	>75% Grass cover, Good, HSG A
	8.350	61	61	>75% Grass cover, Good, HSG B
	11.646	74	74	>75% Grass cover, Good, HSG C
	6.107	58	58	Woods/grass comb., Good, HSG B
	5.107	72	72	Woods/grass comb., Good, HSG C
	2.852	72	72	Dirt roads, HSG A
	1.750	82	82	Dirt roads, HSG B
	1.521	87	87	Dirt roads, HSG C
*	0.170	98	98	TRAIL, HSG B
*	0.033	98	98	TRAIL, HSG C
	66.054			Weighted Average

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.0	100	0.0400	0.21		**Sheet Flow, Tc1** Grass: Short n= 0.150 P2= 2.76"
17.7	1,701	0.0523	1.60		**Shallow Concentrated Flow, Tc2** Short Grass Pasture Kv= 7.0 fps
25.7	1,801	Total			

Subcatchment 11S: DA #2 OFF-SITE PORTION



Summary for Subcatchment 12S: DA #3 ON-SITE PORTION

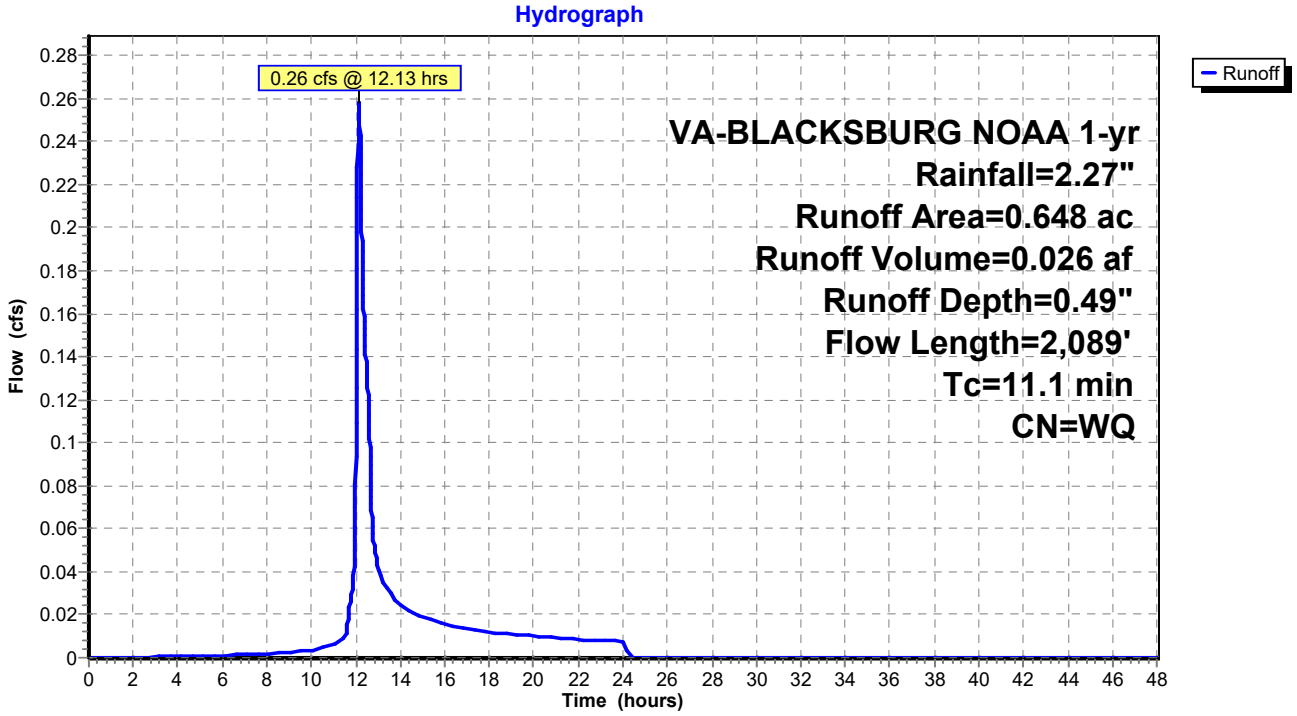
Runoff = 0.26 cfs @ 12.13 hrs, Volume= 0.026 af, Depth= 0.49"
Routed to Link 12EB : ENERGY BALANCE REDUCTION

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
VA-BLACKSBURG NOAA 1-yr Rainfall=2.27"

Area (ac)	CN	Description
0.046	98	Paved roads w/curbs & sewers, HSG C
0.513	70	1/2 acre lots, 25% imp, HSG B
0.030	80	1/2 acre lots, 25% imp, HSG C
0.059	70	Woods, Good, HSG C
0.648		Weighted Average

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.7	95	0.0630	0.28		**Sheet Flow, Tc1** Range n= 0.130 P2= 2.76"
1.3	435	0.1125	5.44	40.82	**Channel Flow, Tc2** Area= 7.5 sf Perim= 40.0' r= 0.19' n= 0.030 Earth, grassed & winding
2.2	602	0.0830	4.64		**Shallow Concentrated Flow, Tc3** Unpaved Kv= 16.1 fps
0.6	301	0.0565	8.57	342.85	**Channel Flow, Tc4** Area= 40.0 sf Perim= 64.4' r= 0.62' n= 0.030 Earth, grassed & winding
0.1	215	0.0744	27.88	197.09	**Pipe Channel, Tc5** 36.0" Round Area= 7.1 sf Perim= 9.4' r= 0.75' n= 0.012 Concrete pipe, finished
1.2	441	0.0603	6.33	189.76	**Channel Flow, Tc6** Area= 30.0 sf Perim= 80.0' r= 0.38' n= 0.030 Earth, grassed & winding
11.1	2,089	Total			

Subcatchment 12S: DA #3 ON-SITE PORTION



Summary for Reach 6R: POND TO POA

Inflow Area = 96.000 ac, Inflow Depth > 0.47" for 1-yr event
Inflow = 5.90 cfs @ 13.86 hrs, Volume= 3.739 af
Outflow = 5.51 cfs @ 14.27 hrs, Volume= 3.721 af, Atten= 7%, Lag= 24.6 min
Routed to Reach 8R : REACH COMBINE

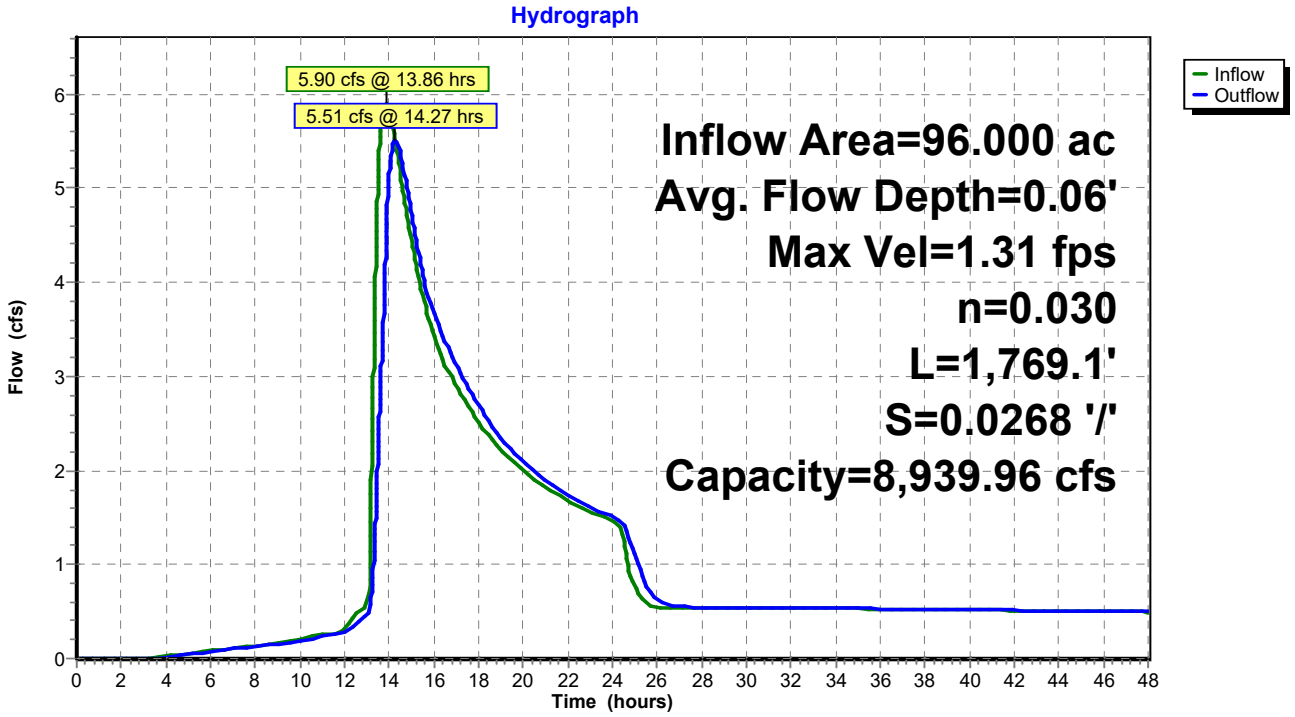
Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Max. Velocity= 1.31 fps, Min. Travel Time= 22.5 min
Avg. Velocity = 1.10 fps, Avg. Travel Time= 26.7 min

Peak Storage= 7,438 cf @ 14.27 hrs
Average Depth at Peak Storage= 0.06' , Surface Width= 70.36'
Bank-Full Depth= 5.00' Flow Area= 425.0 sf, Capacity= 8,939.96 cfs

70.00' x 5.00' deep channel, n= 0.030 Earth, grassed & winding
Side Slope Z-value= 3.0 '/' Top Width= 100.00'
Length= 1,769.1' Slope= 0.0268 '/'
Inlet Invert= 2,087.00', Outlet Invert= 2,039.65'

‡

Reach 6R: POND TO POA



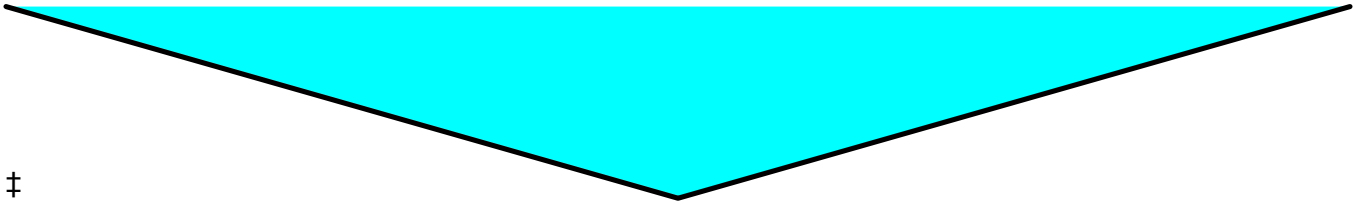
Summary for Reach 8R: REACH COMBINE

Inflow Area = 234.201 ac, Inflow Depth > 0.50" for 1-yr event
Inflow = 51.03 cfs @ 12.25 hrs, Volume= 9.724 af
Outflow = 49.53 cfs @ 12.32 hrs, Volume= 9.720 af, Atten= 3%, Lag= 3.9 min
Routed to Reach 10R : REACH COMBINE 2

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Max. Velocity= 0.89 fps, Min. Travel Time= 3.1 min
Avg. Velocity = 0.61 fps, Avg. Travel Time= 4.6 min

Peak Storage= 9,360 cf @ 12.32 hrs
Average Depth at Peak Storage= 5.22' , Surface Width= 174.35'
Bank-Full Depth= 0.33' Flow Area= 1.8 sf, Capacity= 1.23 cfs

0.00' x 0.33' deep channel, n= 0.030 Earth, grassed & winding
Side Slope Z-value= 16.7 '/' Top Width= 11.02'
Length= 168.8' Slope= 0.0021 '/'
Inlet Invert= 2,036.90', Outlet Invert= 2,036.55'



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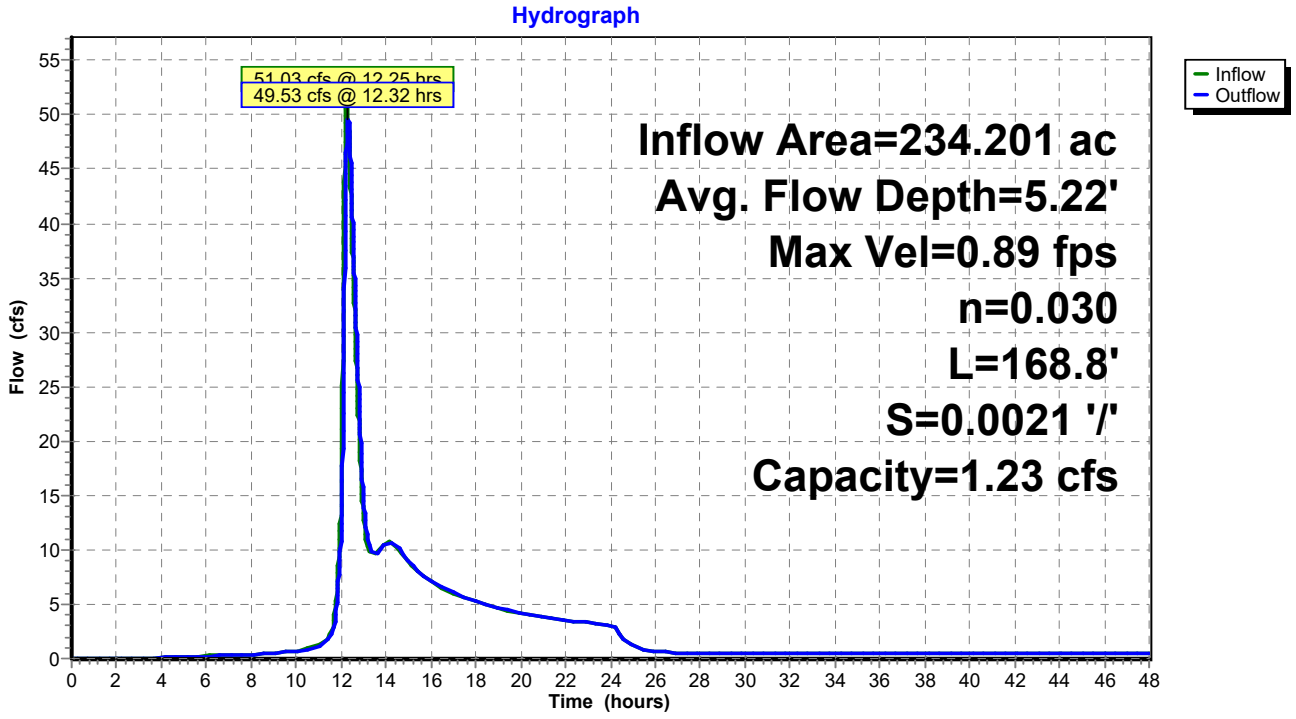
Reach 8R: REACH COMBINE



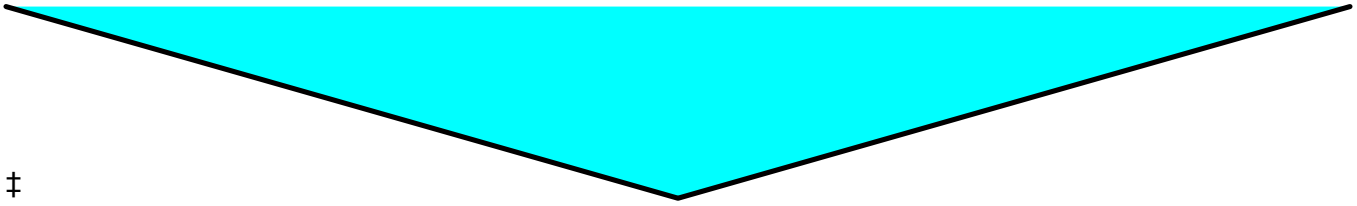
Summary for Reach 9R: DA 3 TO DA 2

Inflow Area = 45.195 ac, Inflow Depth = 0.82" for 1-yr event
Inflow = 38.12 cfs @ 12.11 hrs, Volume= 3.093 af
Outflow = 31.10 cfs @ 12.20 hrs, Volume= 3.093 af, Atten= 18%, Lag= 5.2 min
Routed to Reach 8R : REACH COMBINE

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Max. Velocity= 3.68 fps, Min. Travel Time= 6.6 min
Avg. Velocity = 1.08 fps, Avg. Travel Time= 22.5 min

Peak Storage= 12,360 cf @ 12.20 hrs
Average Depth at Peak Storage= 0.48' , Surface Width= 38.21'
Bank-Full Depth= 0.35' Flow Area= 4.9 sf, Capacity= 15.84 cfs

0.00' x 0.35' deep channel, n= 0.030 Earth, grassed & winding
Side Slope Z-value= 40.0 '/' Top Width= 28.00'
Length= 1,462.0' Slope= 0.0435 '/'
Inlet Invert= 2,103.26', Outlet Invert= 2,039.65'



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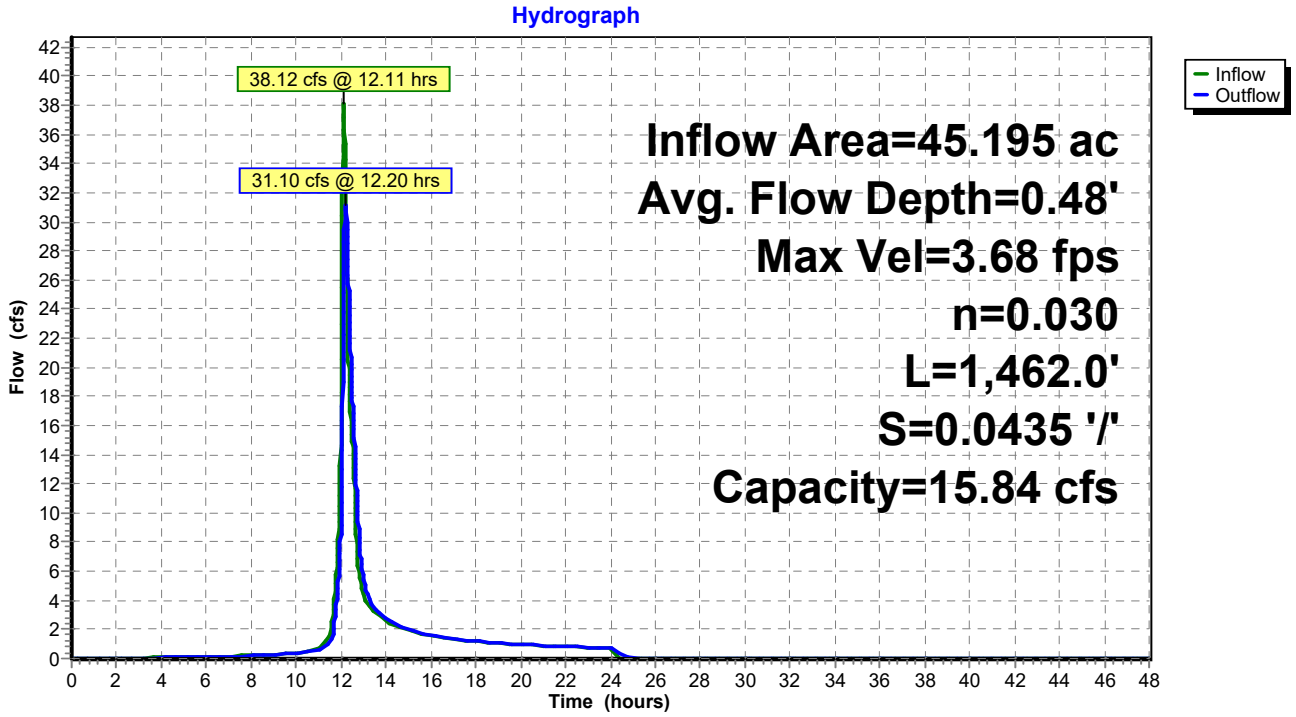
Reach 9R: DA 3 TO DA 2



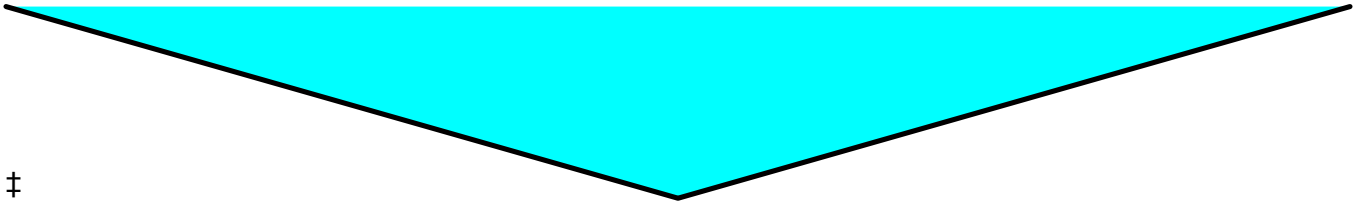
Summary for Reach 10R: REACH COMBINE 2

Inflow Area = 247.742 ac, Inflow Depth > 0.53" for 1-yr event
Inflow = 60.32 cfs @ 12.30 hrs, Volume= 10.856 af
Outflow = 60.15 cfs @ 12.32 hrs, Volume= 10.853 af, Atten= 0%, Lag= 1.0 min
Routed to Link 7L : POA

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Max. Velocity= 1.80 fps, Min. Travel Time= 1.3 min
Avg. Velocity = 0.68 fps, Avg. Travel Time= 3.3 min

Peak Storage= 4,557 cf @ 12.32 hrs
Average Depth at Peak Storage= 0.62' , Surface Width= 108.91'
Bank-Full Depth= 0.59' Flow Area= 30.8 sf, Capacity= 54.02 cfs

0.00' x 0.59' deep channel, n= 0.030 Earth, grassed & winding
Side Slope Z-value= 88.5 '/' Top Width= 104.43'
Length= 136.3' Slope= 0.0064 '/'
Inlet Invert= 2,036.75', Outlet Invert= 2,035.88'



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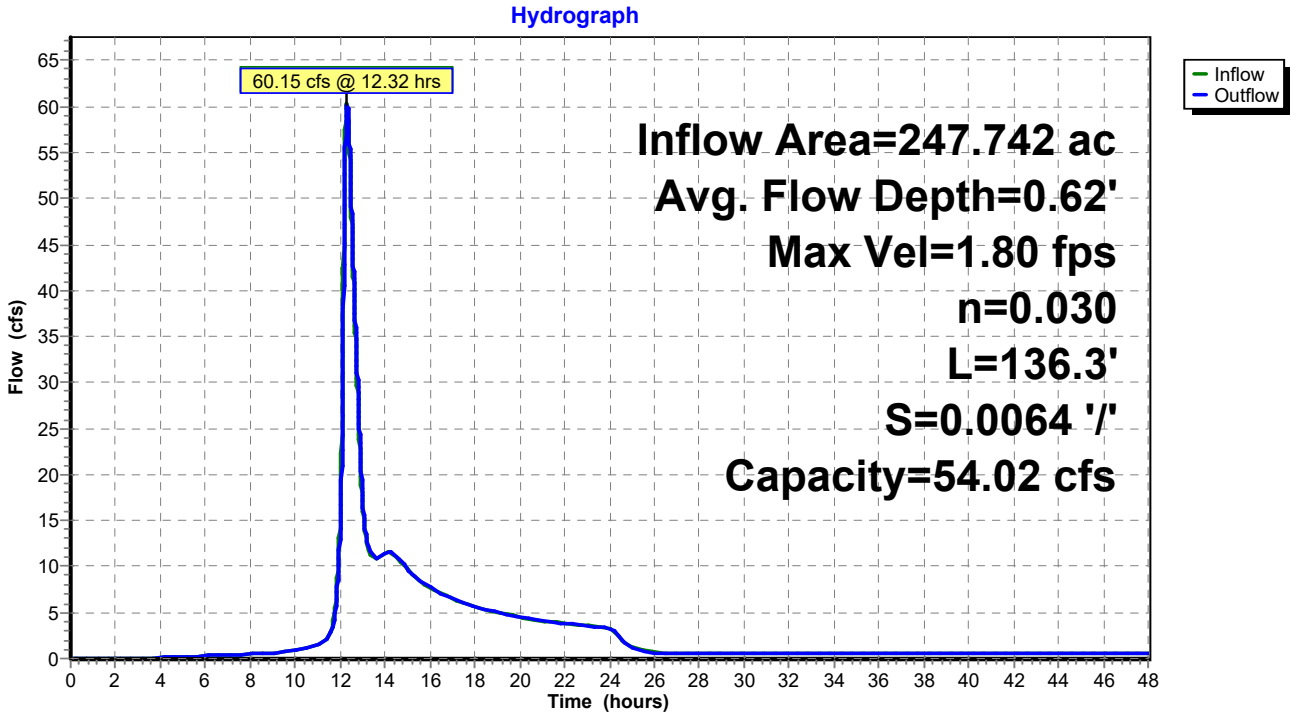
Reach 10R: REACH COMBINE 2



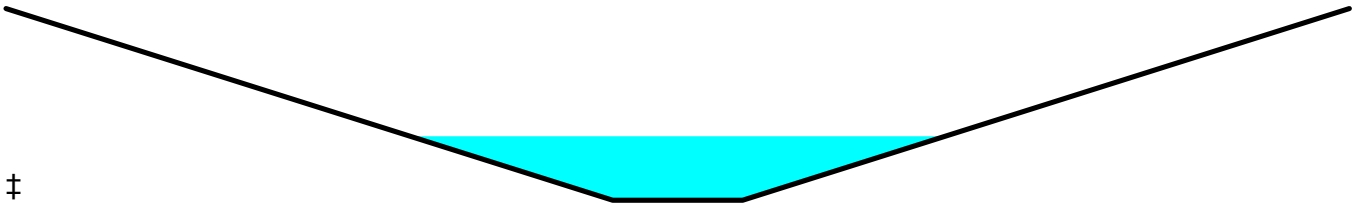
Summary for Reach 11R: DA 4 TO POA

Inflow Area = 13.541 ac, Inflow Depth = 1.01" for 1-yr event
Inflow = 11.44 cfs @ 12.22 hrs, Volume= 1.136 af
Outflow = 11.12 cfs @ 12.26 hrs, Volume= 1.136 af, Atten= 3%, Lag= 2.5 min
Routed to Reach 10R : REACH COMBINE 2

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Max. Velocity= 6.18 fps, Min. Travel Time= 3.2 min
Avg. Velocity = 2.03 fps, Avg. Travel Time= 9.7 min

Peak Storage= 2,115 cf @ 12.26 hrs
Average Depth at Peak Storage= 0.47' , Surface Width= 6.18'
Bank-Full Depth= 1.40' Flow Area= 11.9 sf, Capacity= 140.25 cfs

1.50' x 1.40' deep channel, n= 0.030 Earth, grassed & winding
Side Slope Z-value= 5.0 '/' Top Width= 15.50'
Length= 1,176.1' Slope= 0.0825 '/'
Inlet Invert= 2,133.71', Outlet Invert= 2,036.73'



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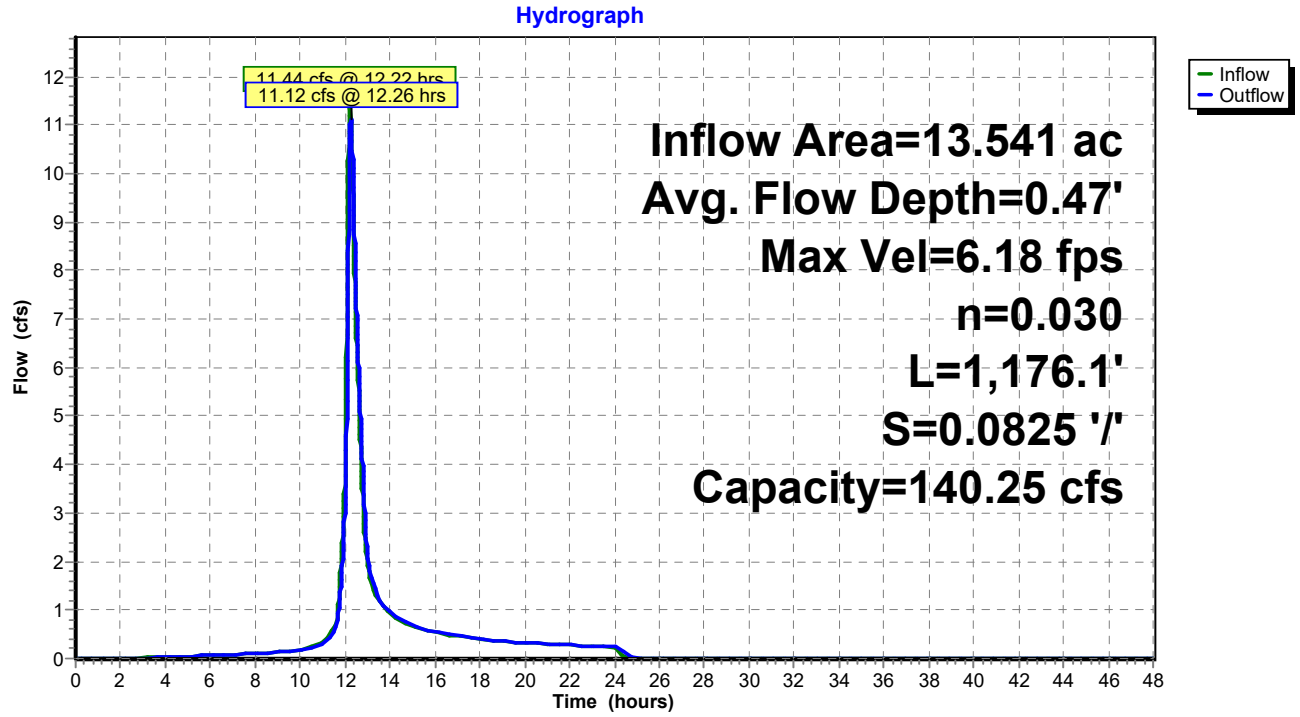
Reach 11R: DA 4 TO POA



Summary for Pond 3P: NSP POND 1

Inflow Area = 96.000 ac, Inflow Depth = 0.66" for 1-yr event
Inflow = 39.33 cfs @ 12.42 hrs, Volume= 5.281 af
Outflow = 5.90 cfs @ 13.86 hrs, Volume= 3.739 af, Atten= 85%, Lag= 86.0 min
Primary = 5.90 cfs @ 13.86 hrs, Volume= 3.739 af
Routed to Reach 6R : POND TO POA

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 2,080.46' @ 13.86 hrs Storage= 121,152 cf

Plug-Flow detention time= 571.0 min calculated for 3.739 af (71% of inflow)
Center-of-Mass det. time= 458.2 min (1,338.0 - 879.9)

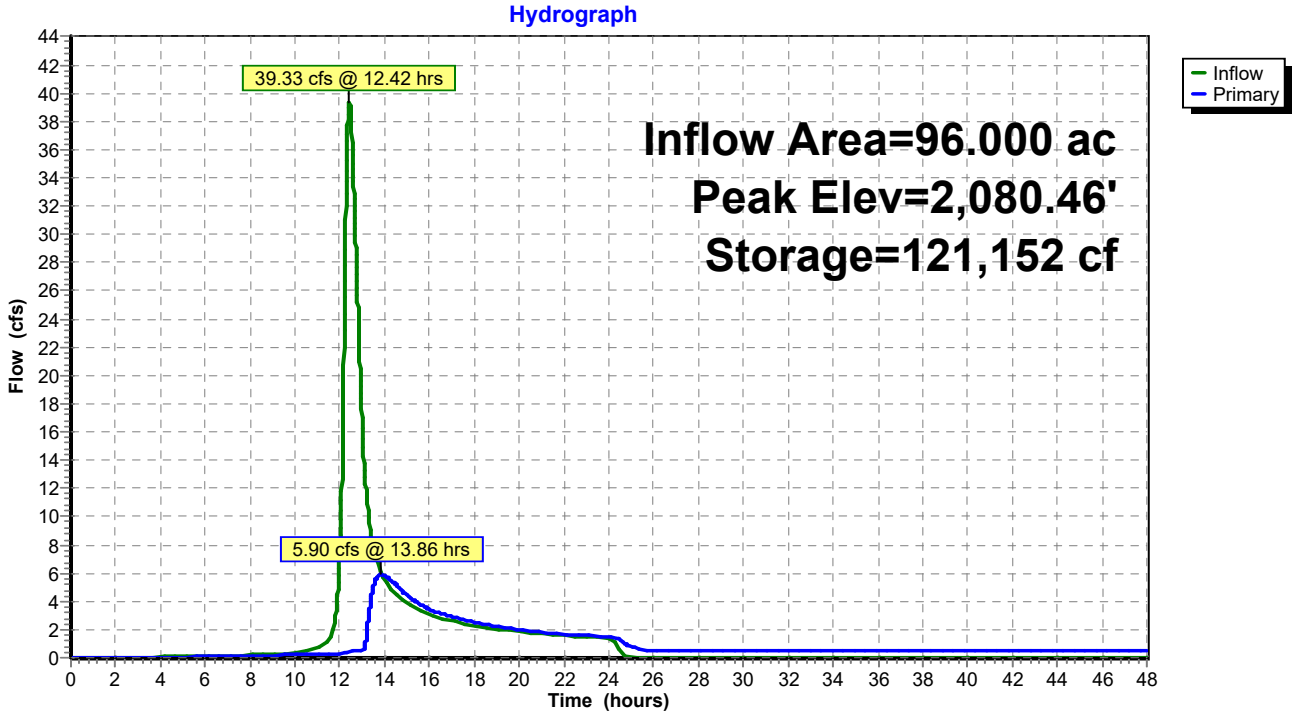
Volume	Invert	Avail.Storage	Storage Description
#1	2,074.75'	392,320 cf	**Custom Stage Data**Listed below

Elevation (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
2,074.75	0	0
2,076.00	2,002	2,002
2,078.00	24,089	26,091
2,080.00	67,305	93,396
2,082.00	119,692	213,088
2,084.00	179,232	392,320

Device	Routing	Invert	Outlet Devices
#1	Primary	2,073.87'	**48.0" Round Culvert** L= 110.4' Ke= 0.600 Inlet / Outlet Invert= 2,073.87' / 2,071.85' S= 0.0183 '/' Cc= 0.900 n= 0.013, Flow Area= 12.57 sf
#2	Device 1	2,074.75'	**3.0" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Device 1	2,080.27'	**72.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#4	Device 1	2,082.20'	**30.0' long x 14.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.64 2.67 2.70 2.65 2.64 2.65 2.65 2.63

Primary OutFlow Max=5.82 cfs @ 13.86 hrs HW=2,080.46' (Free Discharge)
└**1=Culvert** (Passes 5.82 cfs of 121.58 cfs potential flow)
  ├**2=Orifice/Grate** (Orifice Controls 0.56 cfs @ 11.38 fps)
  ├**3=Orifice/Grate** (Weir Controls 5.26 cfs @ 1.44 fps)
  └**4=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 3P: NSP POND 1

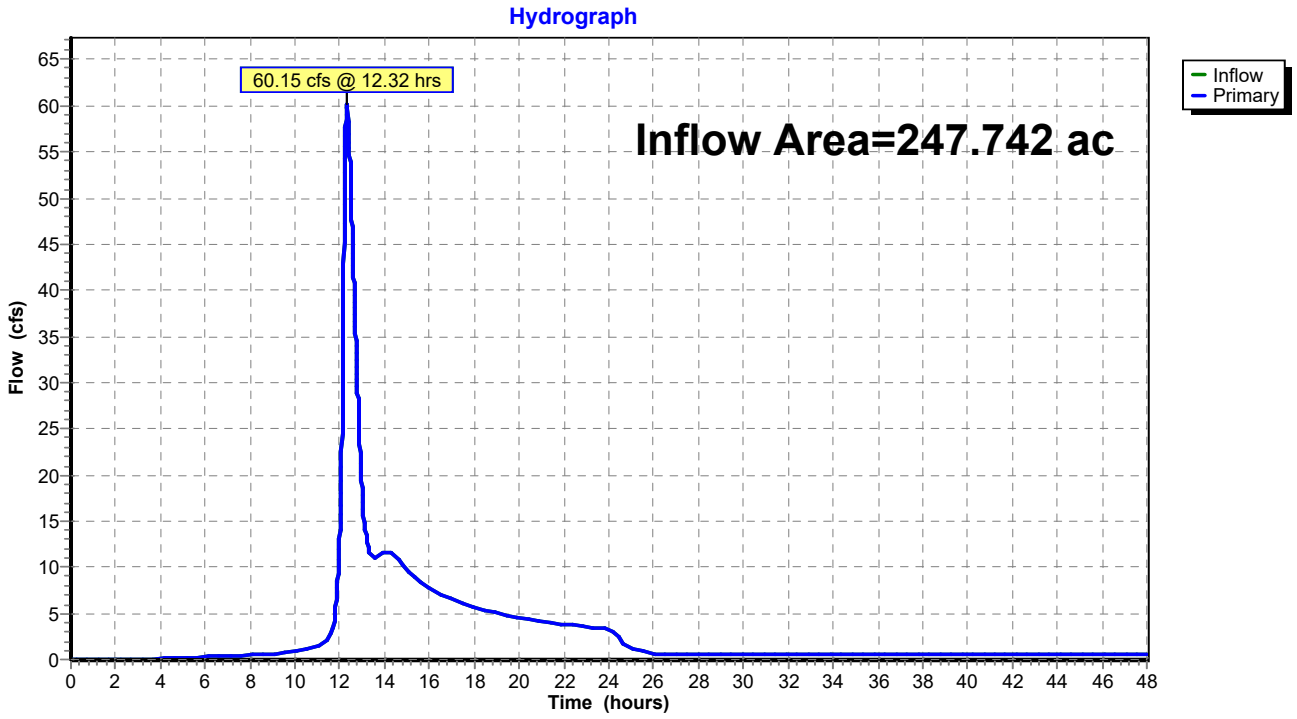


Summary for Link 7L: POA

Inflow Area = 247.742 ac, Inflow Depth > 0.53" for 1-yr event
Inflow = 60.15 cfs @ 12.32 hrs, Volume= 10.853 af
Primary = 60.15 cfs @ 12.32 hrs, Volume= 10.853 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs

Link 7L: POA

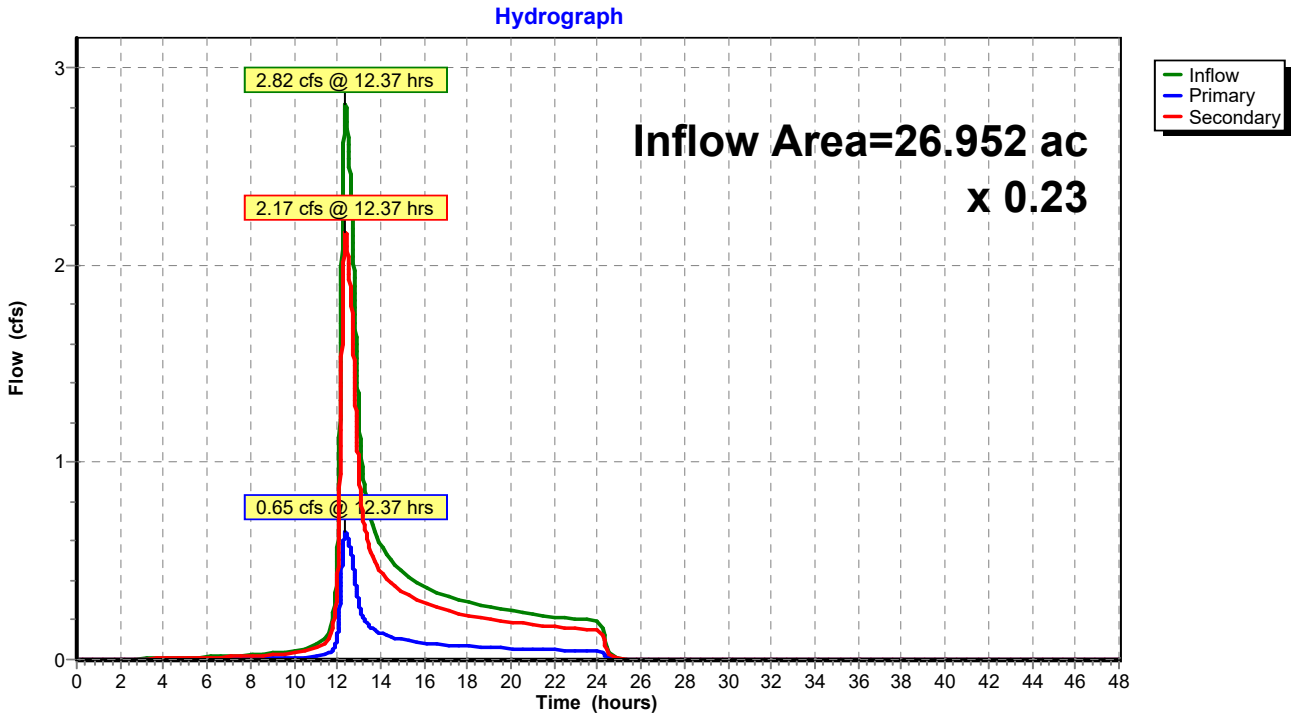


Summary for Link 9EB: ENERGY BALANCE REDUCTION

Inflow Area = 26.952 ac, Inflow Depth = 0.23" for 1-yr event
Inflow = 2.82 cfs @ 12.37 hrs, Volume= 0.511 af
Primary = 0.65 cfs @ 12.37 hrs, Volume= 0.117 af, Atten= 77%, Lag= 0.0 min
Routed to Reach 8R : REACH COMBINE
Secondary = 2.17 cfs @ 12.37 hrs, Volume= 0.393 af

Primary outflow = Inflow x 0.23, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs

Link 9EB: ENERGY BALANCE REDUCTION

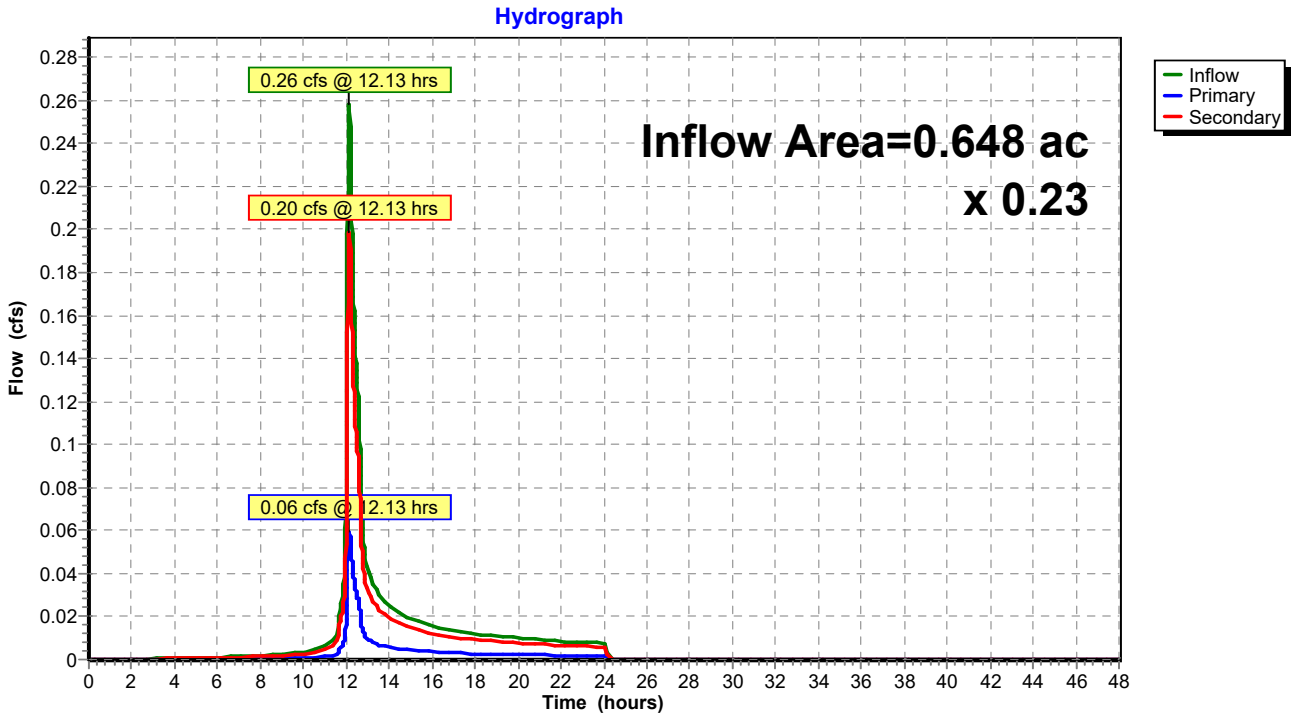


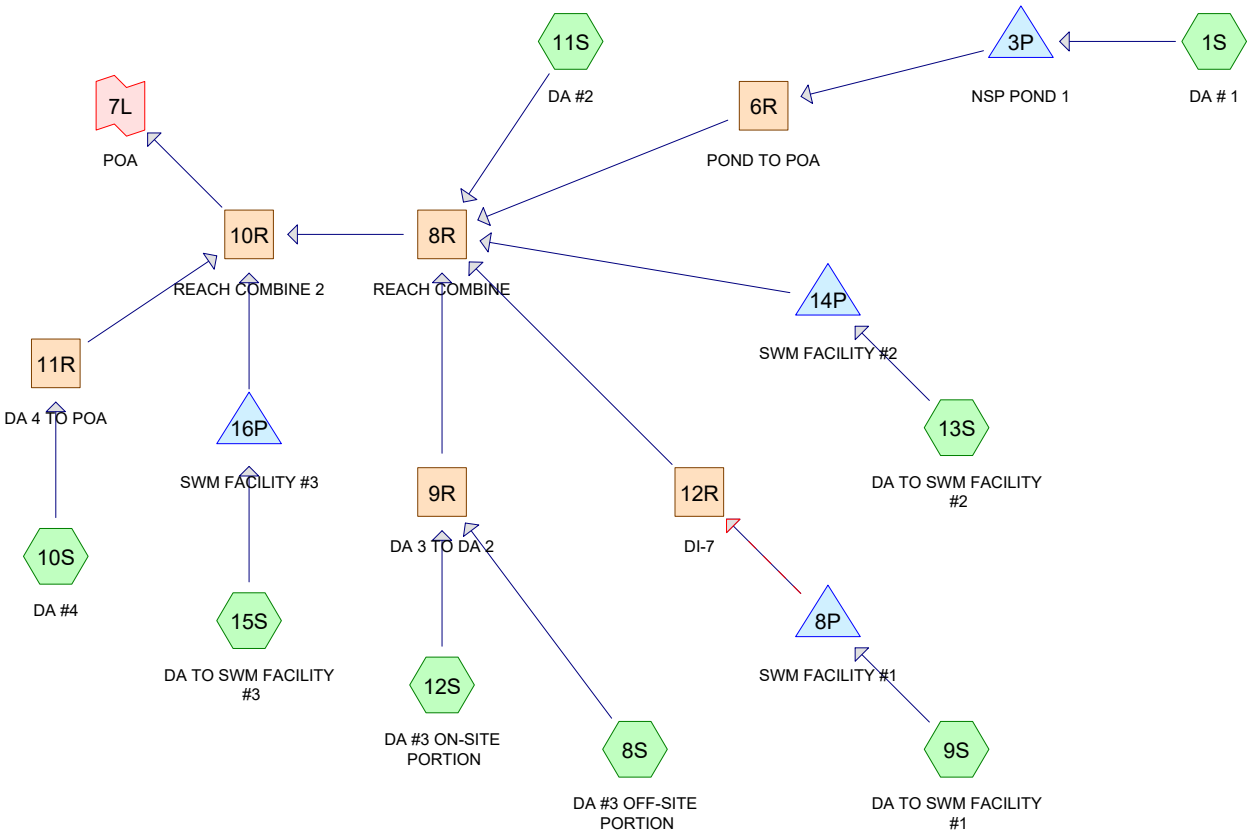
Summary for Link 12EB: ENERGY BALANCE REDUCTION

Inflow Area = 0.648 ac, Inflow Depth = 0.49" for 1-yr event
Inflow = 0.26 cfs @ 12.13 hrs, Volume= 0.026 af
Primary = 0.06 cfs @ 12.13 hrs, Volume= 0.006 af, Atten= 77%, Lag= 0.0 min
Routed to Reach 9R : DA 3 TO DA 2
Secondary = 0.20 cfs @ 12.13 hrs, Volume= 0.020 af

Primary outflow = Inflow x 0.23, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs

Link 12EB: ENERGY BALANCE REDUCTION





Subcat Reach Pond Link

Routing Diagram for POST-DEVELOPMENT-1
Prepared by Balzer & Associates, Inc, Printed 4/4/2023

Time span=0.00-48.00 hrs, dt=0.01 hrs, 4801 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-Q
Reach routing by Stor-Ind method - Pond routing by Stor-Ind method

Subcatchment1S: DA # 1 Runoff Area=96.000 ac Runoff Depth=0.66"
Tc=30.8 min CN=WQ Runoff=39.33 cfs 5.281 af

Subcatchment8S: DA #3 OFF-SITE PORTION Runoff Area=44.547 ac Runoff Depth=0.83"
Flow Length=2,089' Tc=11.1 min CN=WQ Runoff=38.07 cfs 3.087 af

Subcatchment9S: DA TO SWM FACILITY#1 Runoff Area=27.690 ac Runoff Depth=0.68"
Tc=6.0 min CN=WQ Runoff=21.30 cfs 1.576 af

Subcatchment10S: DA #4 Runoff Area=13.891 ac Runoff Depth=0.99"
Flow Length=2,526' Tc=18.9 min CN=WQ Runoff=11.57 cfs 1.151 af

Subcatchment11S: DA #2 Runoff Area=50.156 ac Runoff Depth=0.38"
Flow Length=1,801' Tc=25.7 min CN=71 Runoff=10.67 cfs 1.594 af

Subcatchment12S: DA #3 ON-SITE PORTION Runoff Area=0.678 ac Runoff Depth=0.51"
Flow Length=2,089' Tc=11.1 min CN=WQ Runoff=0.30 cfs 0.029 af

Subcatchment13S: DA TO SWM FACILITY#2 Runoff Area=6.610 ac Runoff Depth=0.74"
Tc=6.0 min CN=WQ Runoff=5.62 cfs 0.405 af

Subcatchment15S: DA TO SWM FACILITY#3 Runoff Area=8.170 ac Runoff Depth=0.48"
Tc=6.0 min CN=WQ Runoff=3.78 cfs 0.328 af

Reach 6R: POND TO POA Avg. Flow Depth=0.06' Max Vel=1.31 fps Inflow=5.90 cfs 3.739 af
n=0.030 L=1,769.1' S=0.0268 '/' Capacity=8,939.96 cfs Outflow=5.51 cfs 3.721 af

Reach 8R: REACH COMBINE Avg. Flow Depth=4.83' Max Vel=0.89 fps Inflow=47.13 cfs 10.412 af
n=0.030 L=168.8' S=0.0021 '/' Capacity=1.23 cfs Outflow=45.66 cfs 10.409 af

Reach 9R: DA 3 TO DA 2 Avg. Flow Depth=0.48' Max Vel=3.68 fps Inflow=38.37 cfs 3.116 af
n=0.030 L=1,462.0' S=0.0435 '/' Capacity=15.84 cfs Outflow=31.30 cfs 3.116 af

Reach 10R: REACH COMBINE 2 Avg. Flow Depth=0.61' Max Vel=1.78 fps Inflow=58.02 cfs 11.888 af
n=0.030 L=136.3' S=0.0064 '/' Capacity=54.02 cfs Outflow=57.85 cfs 11.885 af

Reach 11R: DA 4 TO POA Avg. Flow Depth=0.47' Max Vel=6.20 fps Inflow=11.57 cfs 1.151 af
n=0.030 L=1,176.1' S=0.0825 '/' Capacity=140.25 cfs Outflow=11.25 cfs 1.151 af

Reach 12R: DI-7 Avg. Flow Depth=0.67' Max Vel=6.69 fps Inflow=7.80 cfs 1.576 af
36.0" Round Pipe n=0.012 L=130.0' S=0.0100 '/' Capacity=72.26 cfs Outflow=7.80 cfs 1.576 af

Pond 3P: NSP POND 1 Peak Elev=2,080.46' Storage=121,152 cf Inflow=39.33 cfs 5.281 af
Outflow=5.90 cfs 3.739 af

Pond 8P: SWM FACILITY#1 Peak Elev=2,064.75' Storage=22,083 cf Inflow=21.30 cfs 1.576 af
Primary=7.80 cfs 1.576 af Secondary=0.00 cfs 0.000 af Outflow=7.80 cfs 1.576 af

Pond 14P: SWM FACILITY#2 Peak Elev=2,064.90' Storage=5,544 cf Inflow=5.62 cfs 0.405 af
Outflow=1.08 cfs 0.405 af

Pond 16P: SWM FACILITY#3 Peak Elev=2,063.08' Storage=2,572 cf Inflow=3.78 cfs 0.328 af
Outflow=1.41 cfs 0.328 af

Link 7L: POA Inflow=57.85 cfs 11.885 af
Primary=57.85 cfs 11.885 af

Total Runoff Area = 247.742 ac Runoff Volume = 13.452 af Average Runoff Depth = 0.65"

Summary for Subcatchment 1S: DA # 1

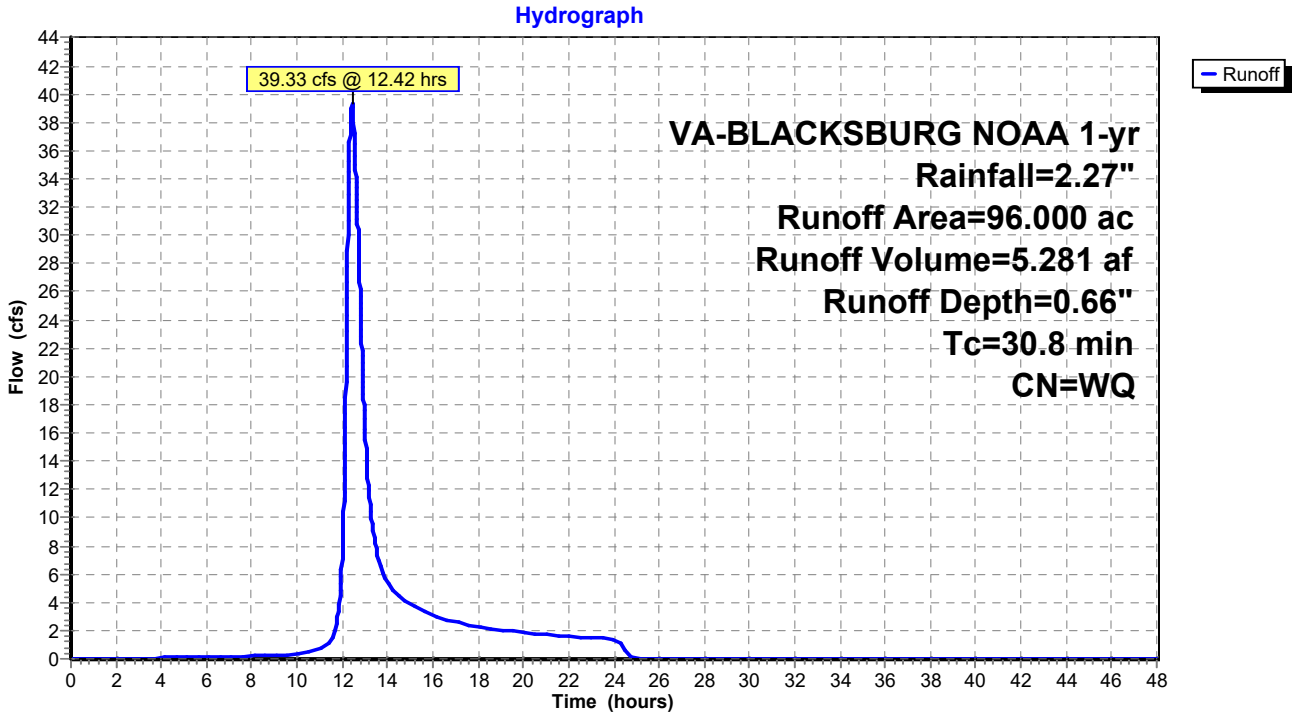
Runoff = 39.33 cfs @ 12.42 hrs, Volume= 5.281 af, Depth= 0.66"
Routed to Pond 3P : NSP POND 1

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
VA-BLACKSBURG NOAA 1-yr Rainfall=2.27"

Area (ac)	CN	Description
5.080	98	Roofs, HSG C
3.100	84	50-75% Grass cover, Fair, HSG D
22.720	79	50-75% Grass cover, Fair, HSG C
28.800	69	50-75% Grass cover, Fair, HSG B
1.000	86	1/3 acre lots, 30% imp, HSG D
10.400	81	1/3 acre lots, 30% imp, HSG C
6.400	72	1/3 acre lots, 30% imp, HSG B
10.300	83	1/4 acre lots, 38% imp, HSG C
8.200	75	1/4 acre lots, 38% imp, HSG B
96.000		Weighted Average

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
30.8					**Direct Entry, FROM NSP CALCS**

Subcatchment 1S: DA # 1



Summary for Subcatchment 8S: DA #3 OFF-SITE PORTION

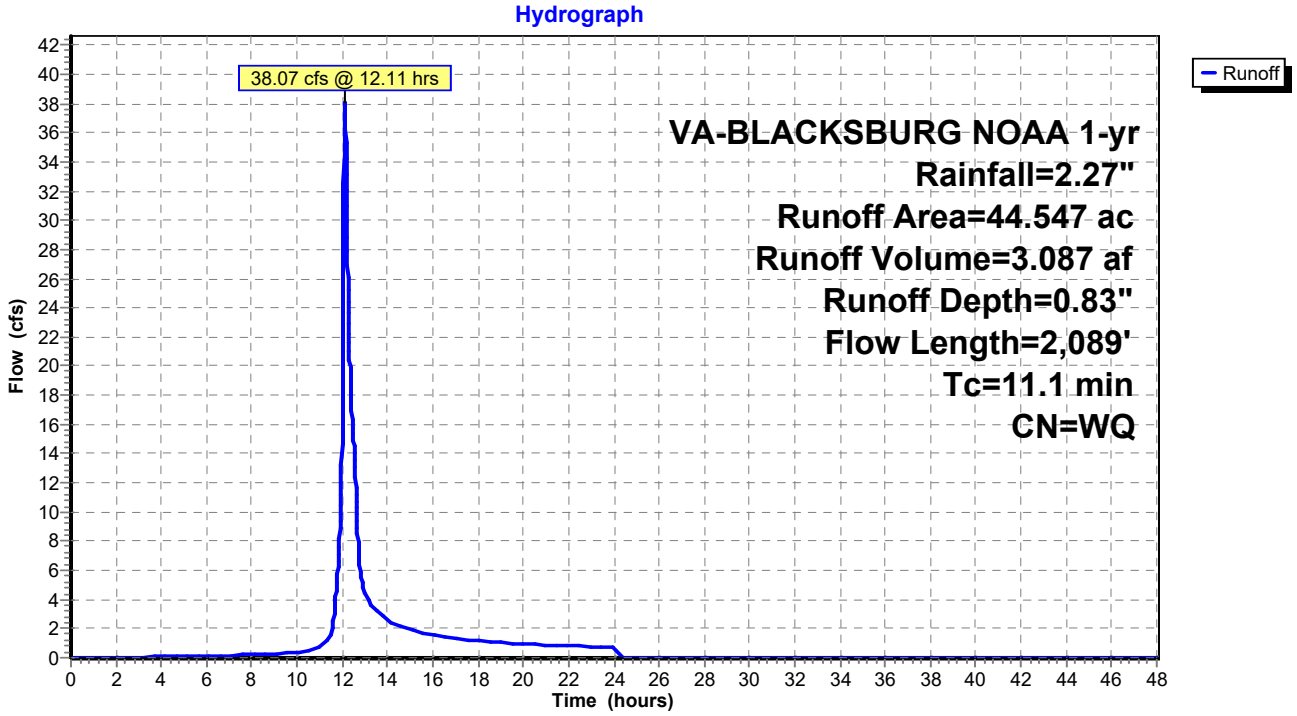
Runoff = 38.07 cfs @ 12.11 hrs, Volume= 3.087 af, Depth= 0.83"
Routed to Reach 9R : DA 3 TO DA 2

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
VA-BLACKSBURG NOAA 1-yr Rainfall=2.27"

Area (ac)	CN	Description
0.358	98	Paved roads w/curbs & sewers, HSG B
4.733	98	Paved roads w/curbs & sewers, HSG C
5.726	70	1/2 acre lots, 25% imp, HSG B
28.476	80	1/2 acre lots, 25% imp, HSG C
0.877	72	1/3 acre lots, 30% imp, HSG B
3.986	81	1/3 acre lots, 30% imp, HSG C
0.391	79	1 acre lots, 20% imp, HSG C
44.547		Weighted Average

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.7	95	0.0630	0.28		**Sheet Flow, Tc1** Range n= 0.130 P2= 2.76"
1.3	435	0.1125	5.44	40.82	**Channel Flow, Tc2** Area= 7.5 sf Perim= 40.0' r= 0.19' n= 0.030 Earth, grassed & winding
2.2	602	0.0830	4.64		**Shallow Concentrated Flow, Tc3** Unpaved Kv= 16.1 fps
0.6	301	0.0565	8.57	342.85	**Channel Flow, Tc4** Area= 40.0 sf Perim= 64.4' r= 0.62' n= 0.030 Earth, grassed & winding
0.1	215	0.0744	27.88	197.09	**Pipe Channel, Tc5** 36.0" Round Area= 7.1 sf Perim= 9.4' r= 0.75' n= 0.012 Concrete pipe, finished
1.2	441	0.0603	6.33	189.76	**Channel Flow, Tc6** Area= 30.0 sf Perim= 80.0' r= 0.38' n= 0.030 Earth, grassed & winding
11.1	2,089	Total			

Subcatchment 8S: DA #3 OFF-SITE PORTION



Summary for Subcatchment 9S: DA TO SWM FACILITY #1

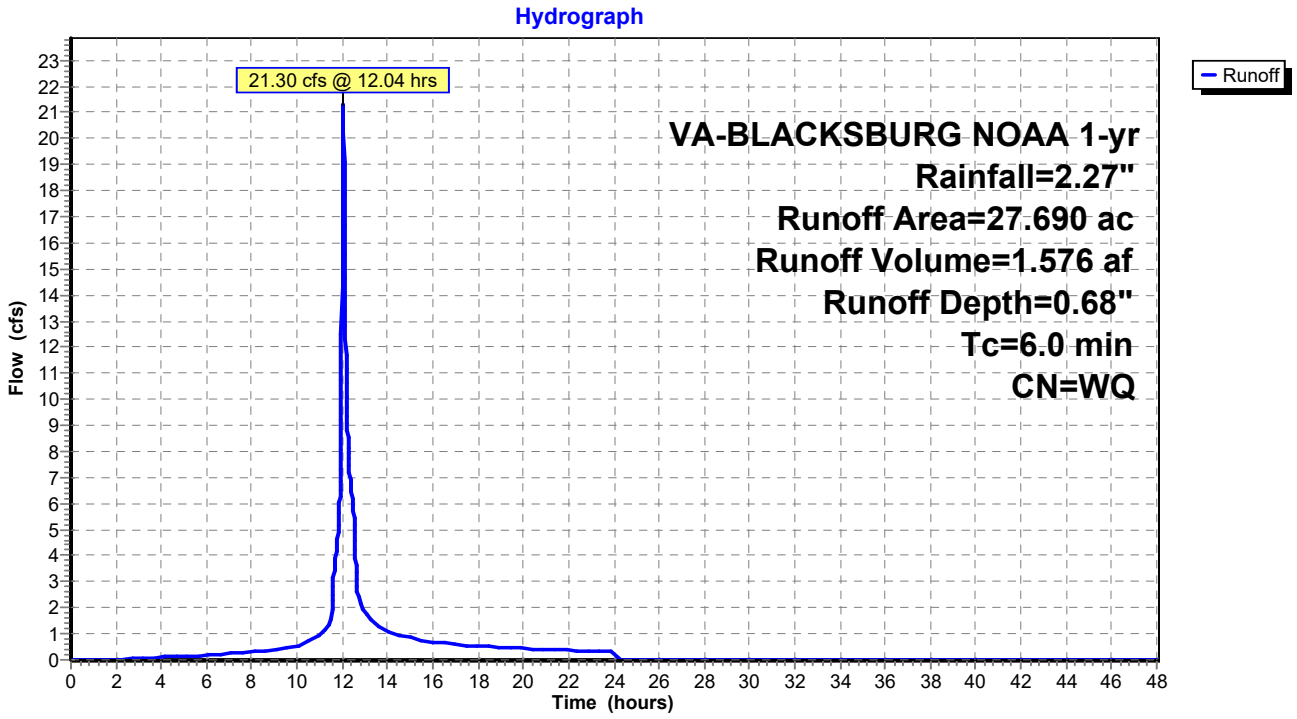
Runoff = 21.30 cfs @ 12.04 hrs, Volume= 1.576 af, Depth= 0.68"
Routed to Pond 8P : SWM FACILITY #1

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
VA-BLACKSBURG NOAA 1-yr Rainfall=2.27"

	Area (ac)	CN	Description
	8.410	61	>75% Grass cover, Good, HSG B
	3.440	74	>75% Grass cover, Good, HSG C
	4.930	98	Impervious, HSG B
	2.030	98	Impervious, HSG C
*	8.880	65	VRRM DA A
	27.690		Weighted Average

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, TR-55 MIN.**

Subcatchment 9S: DA TO SWM FACILITY #1



Summary for Subcatchment 10S: DA #4

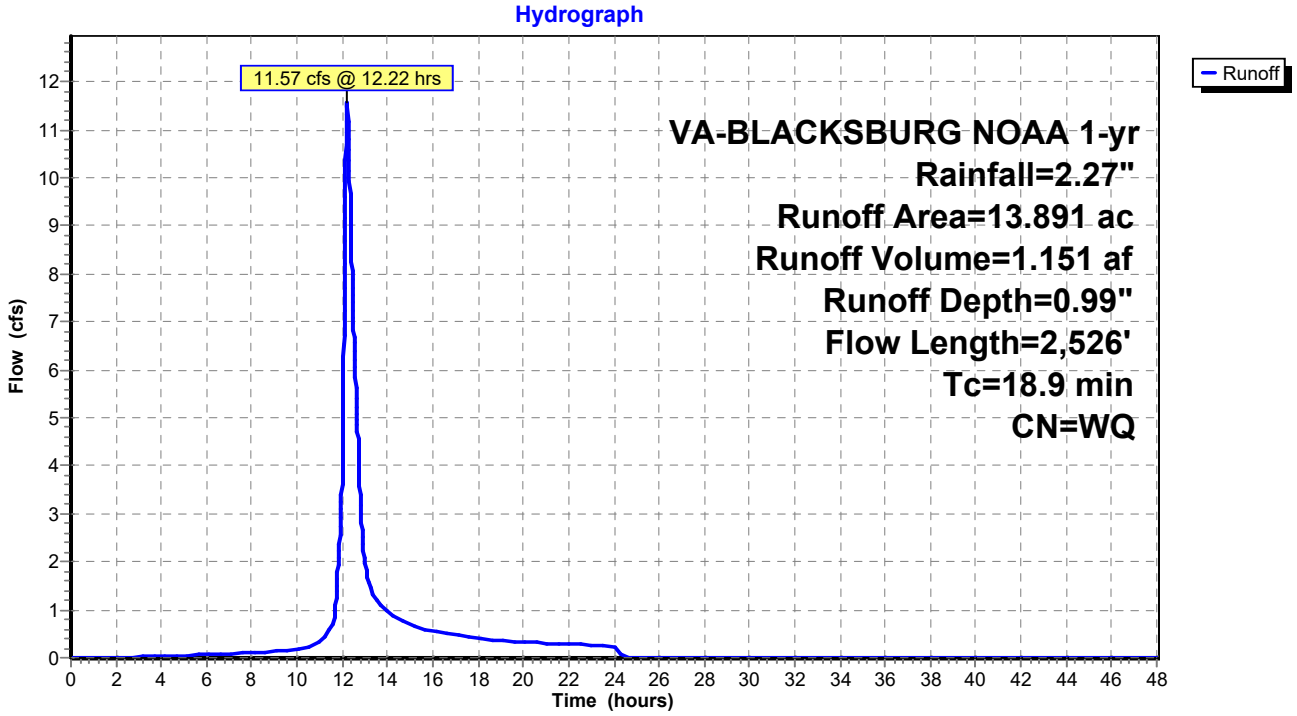
Runoff = 11.57 cfs @ 12.22 hrs, Volume= 1.151 af, Depth= 0.99"
Routed to Reach 11R : DA 4 TO POA

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
VA-BLACKSBURG NOAA 1-yr Rainfall=2.27"

Area (ac)	CN	Description
2.555	98	Paved roads w/curbs & sewers, HSG C
7.333	81	1/3 acre lots, 30% imp, HSG C
3.803	80	1/2 acre lots, 25% imp, HSG C
0.200	70	1/2 acre lots, 25% imp, HSG B
13.891		Weighted Average

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.4	95	0.0630	0.25		**Sheet Flow, Tc1** Grass: Short n= 0.150 P2= 2.76"
9.9	1,004	0.0478	1.70	5.26	**Channel Flow, Tc2** Area= 3.1 sf Perim= 50.0' r= 0.06' n= 0.030 Earth, grassed & winding
2.6	1,427	0.0134	9.03	28.37	**Pipe Channel, CMP_Round 24"** 24.0" Round Area= 3.1 sf Perim= 6.3' r= 0.50' n= 0.012 Concrete pipe, finished
18.9	2,526	Total			

Subcatchment 10S: DA #4



Summary for Subcatchment 11S: DA #2

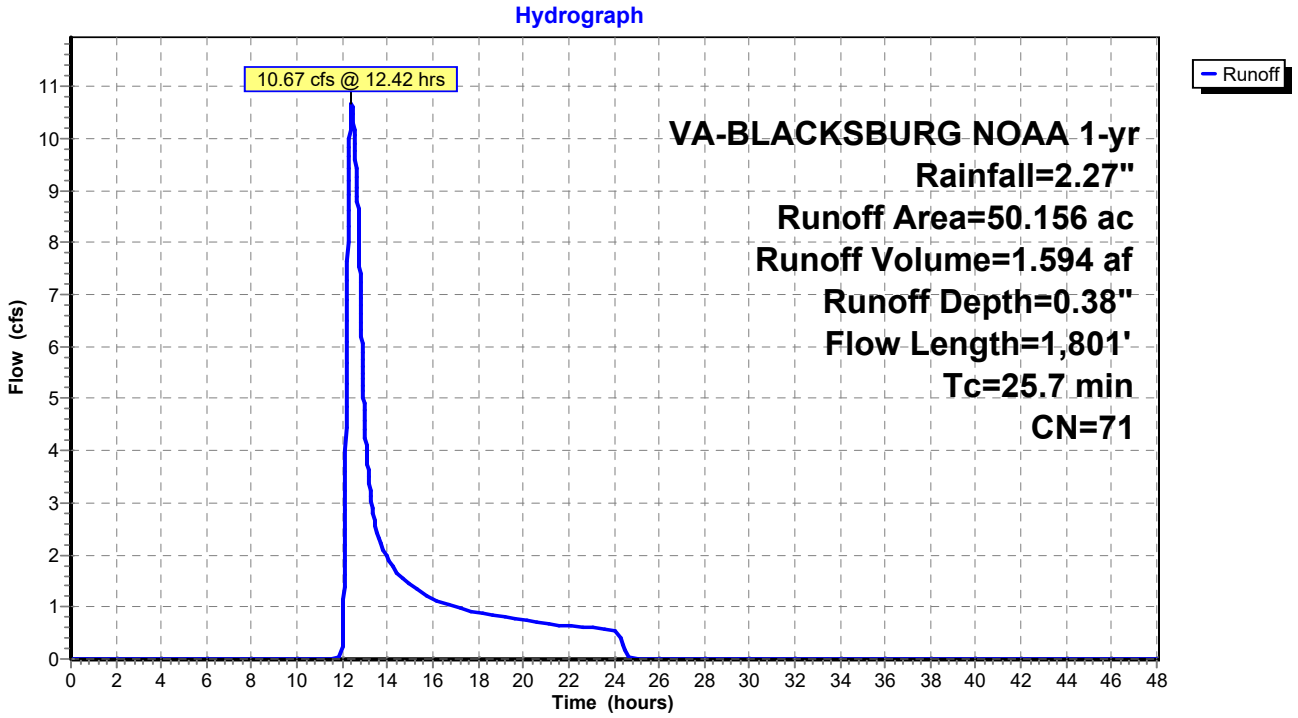
Runoff = 10.67 cfs @ 12.42 hrs, Volume= 1.594 af, Depth= 0.38"
Routed to Reach 8R : REACH COMBINE

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
VA-BLACKSBURG NOAA 1-yr Rainfall=2.27"

	Area (ac)	CN	Description
*	50.156	71	

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.0	100	0.0400	0.21		**Sheet Flow, Tc1** Grass: Short n= 0.150 P2= 2.76"
17.7	1,701	0.0523	1.60		**Shallow Concentrated Flow, Tc2** Short Grass Pasture Kv= 7.0 fps
25.7	1,801	Total			

Subcatchment 11S: DA #2



Summary for Subcatchment 12S: DA #3 ON-SITE PORTION

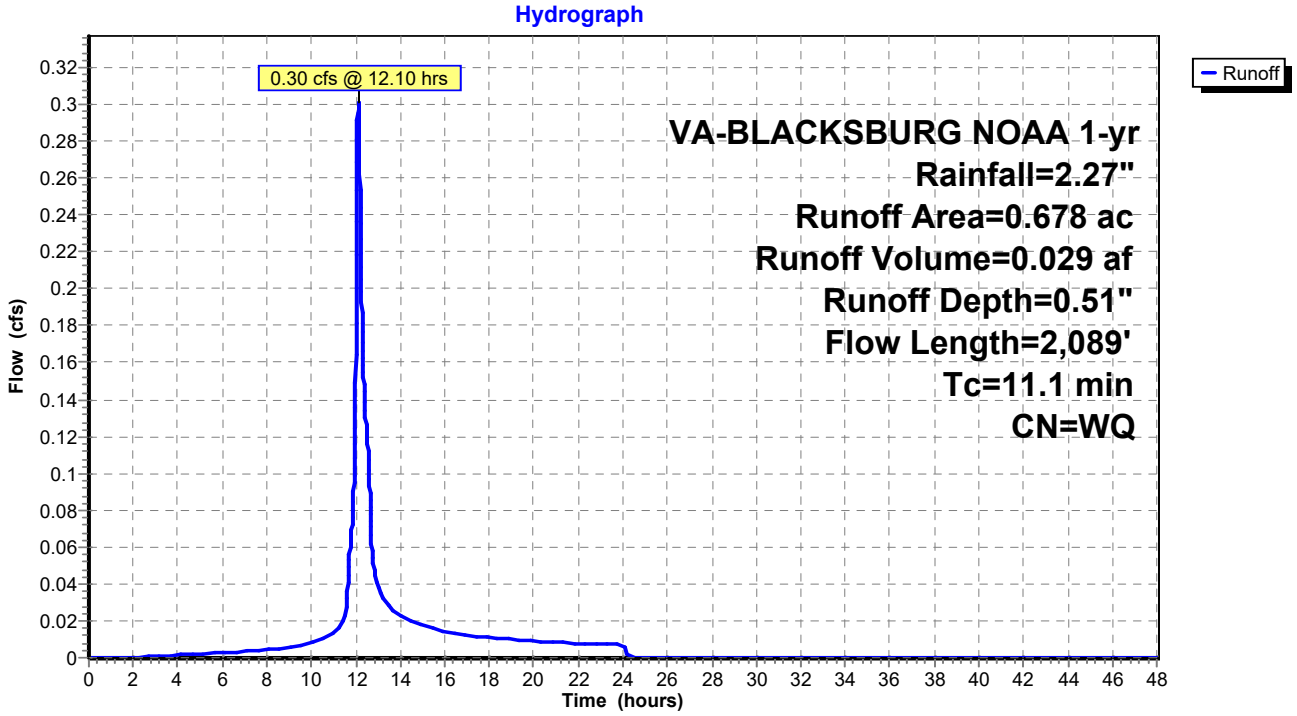
Runoff = 0.30 cfs @ 12.10 hrs, Volume= 0.029 af, Depth= 0.51"
Routed to Reach 9R : DA 3 TO DA 2

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
VA-BLACKSBURG NOAA 1-yr Rainfall=2.27"

Area (ac)	CN	Description
0.061	98	Paved roads w/curbs & sewers, HSG B
0.042	98	Paved roads w/curbs & sewers, HSG C
0.055	83	1/4 acre lots, 38% imp, HSG C
0.057	74	>75% Grass cover, Good, HSG C
0.463	61	>75% Grass cover, Good, HSG B
0.678		Weighted Average

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.7	95	0.0630	0.28		**Sheet Flow, Tc1** Range n= 0.130 P2= 2.76"
1.3	435	0.1125	5.44	40.82	**Channel Flow, Tc2** Area= 7.5 sf Perim= 40.0' r= 0.19' n= 0.030 Earth, grassed & winding
2.2	602	0.0830	4.64		**Shallow Concentrated Flow, Tc3** Unpaved Kv= 16.1 fps
0.6	301	0.0565	8.57	342.85	**Channel Flow, Tc4** Area= 40.0 sf Perim= 64.4' r= 0.62' n= 0.030 Earth, grassed & winding
0.1	215	0.0744	27.88	197.09	**Pipe Channel, Tc5** 36.0" Round Area= 7.1 sf Perim= 9.4' r= 0.75' n= 0.012 Concrete pipe, finished
1.2	441	0.0603	6.33	189.76	**Channel Flow, Tc6** Area= 30.0 sf Perim= 80.0' r= 0.38' n= 0.030 Earth, grassed & winding
11.1	2,089	Total			

Subcatchment 12S: DA #3 ON-SITE PORTION



Summary for Subcatchment 13S: DA TO SWM FACILITY #2

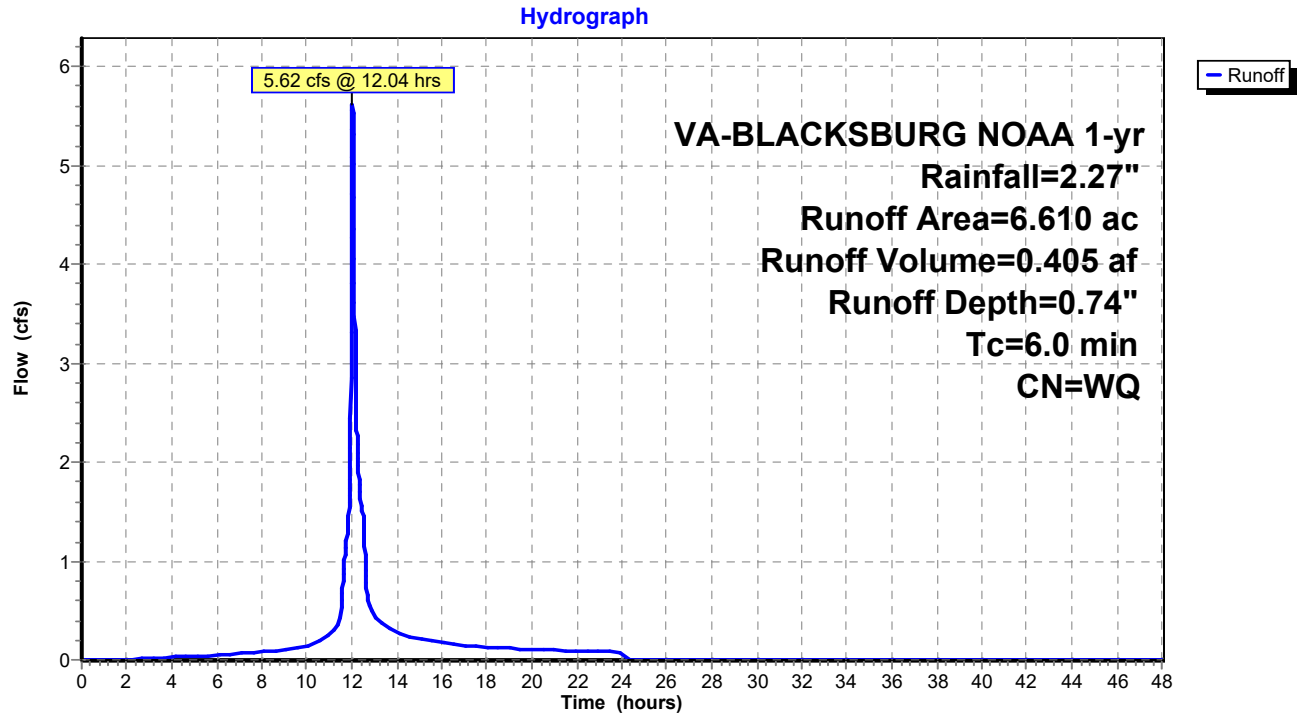
Runoff = 5.62 cfs @ 12.04 hrs, Volume= 0.405 af, Depth= 0.74"
Routed to Pond 14P : SWM FACILITY #2

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
VA-BLACKSBURG NOAA 1-yr Rainfall=2.27"

	Area (ac)	CN	Description
	2.230	61	>75% Grass cover, Good, HSG B
	0.910	74	>75% Grass cover, Good, HSG C
*	1.310	98	Impervious, HSG B
	0.540	98	Impervious, HSG C
*	1.620	65	VRRM AREA B
	6.610		Weighted Average

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, TR-55 MIN.**

Subcatchment 13S: DA TO SWM FACILITY #2



Summary for Subcatchment 15S: DA TO SWM FACILITY #3

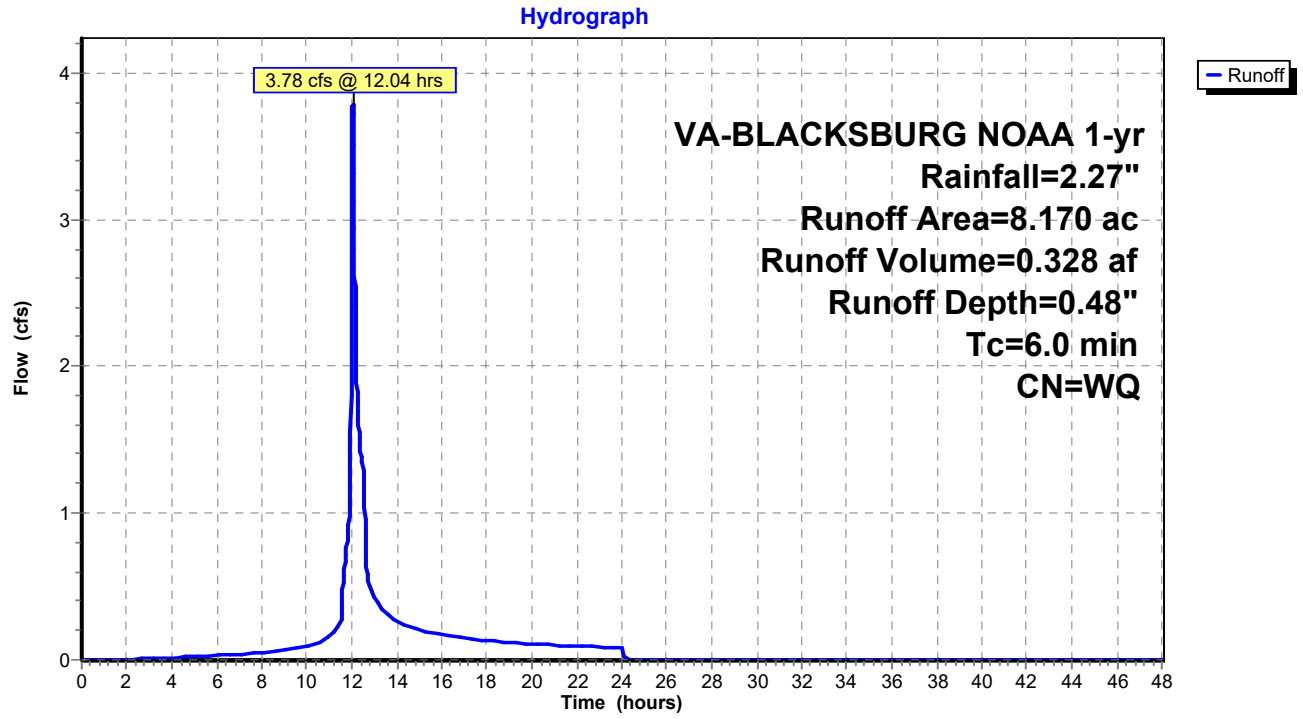
Runoff = 3.78 cfs @ 12.04 hrs, Volume= 0.328 af, Depth= 0.48"
Routed to Pond 16P : SWM FACILITY #3

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
VA-BLACKSBURG NOAA 1-yr Rainfall=2.27"

	Area (ac)	CN	Description
	1.430	61	>75% Grass cover, Good, HSG B
	0.580	74	>75% Grass cover, Good, HSG C
	0.840	98	Impervious, HSG B
	0.330	98	Impervious, HSG C
*	4.990	65	VRRM AREA C
	8.170		Weighted Average

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, TR-55 MIN.**

Subcatchment 15S: DA TO SWM FACILITY #3



Summary for Reach 6R: POND TO POA

Inflow Area = 96.000 ac, Inflow Depth > 0.47" for 1-yr event
Inflow = 5.90 cfs @ 13.86 hrs, Volume= 3.739 af
Outflow = 5.51 cfs @ 14.27 hrs, Volume= 3.721 af, Atten= 7%, Lag= 24.6 min
Routed to Reach 8R : REACH COMBINE

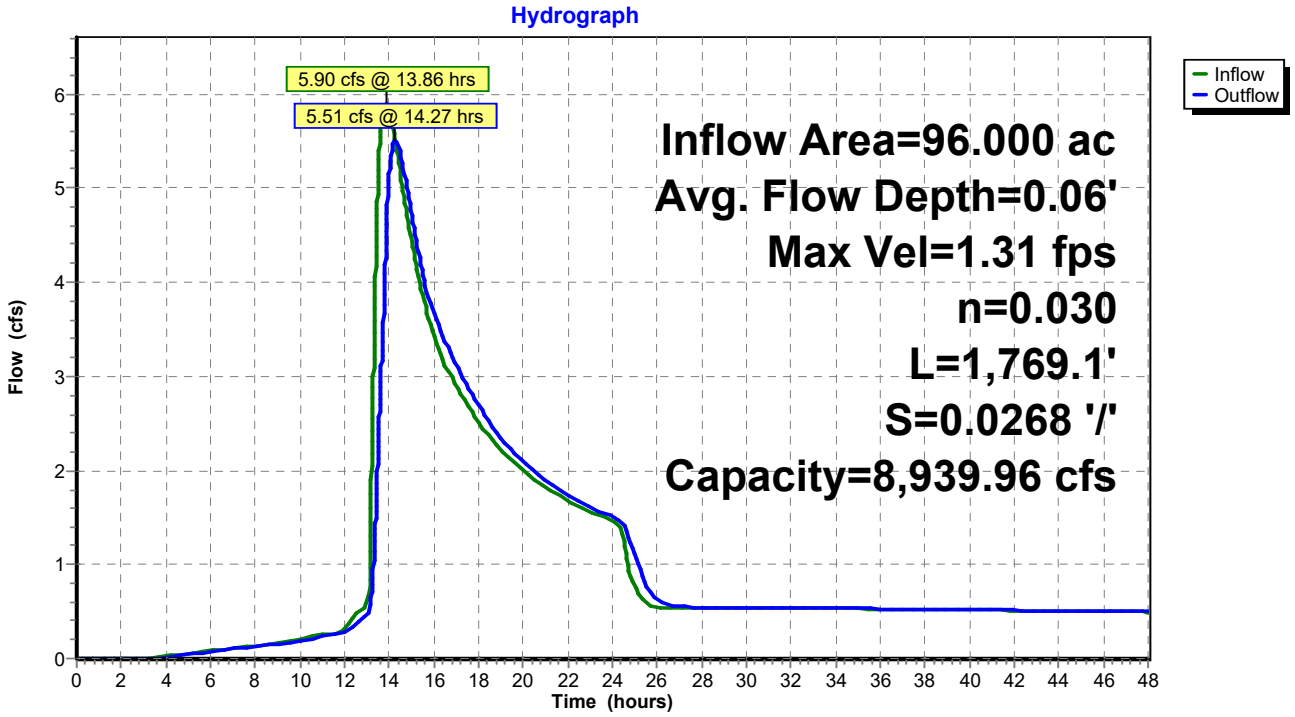
Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Max. Velocity= 1.31 fps, Min. Travel Time= 22.5 min
Avg. Velocity = 1.10 fps, Avg. Travel Time= 26.7 min

Peak Storage= 7,438 cf @ 14.27 hrs
Average Depth at Peak Storage= 0.06' , Surface Width= 70.36'
Bank-Full Depth= 5.00' Flow Area= 425.0 sf, Capacity= 8,939.96 cfs

70.00' x 5.00' deep channel, n= 0.030 Earth, grassed & winding
Side Slope Z-value= 3.0 '/' Top Width= 100.00'
Length= 1,769.1' Slope= 0.0268 '/'
Inlet Invert= 2,087.00', Outlet Invert= 2,039.65'

‡

Reach 6R: POND TO POA



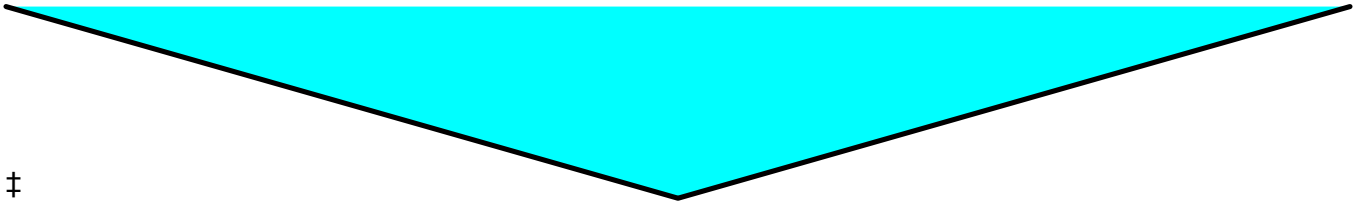
Summary for Reach 8R: REACH COMBINE

Inflow Area = 225.681 ac, Inflow Depth > 0.55" for 1-yr event
Inflow = 47.13 cfs @ 12.25 hrs, Volume= 10.412 af
Outflow = 45.66 cfs @ 12.31 hrs, Volume= 10.409 af, Atten= 3%, Lag= 3.7 min
Routed to Reach 10R : REACH COMBINE 2

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Max. Velocity= 0.89 fps, Min. Travel Time= 3.2 min
Avg. Velocity = 0.63 fps, Avg. Travel Time= 4.5 min

Peak Storage= 8,633 cf @ 12.31 hrs
Average Depth at Peak Storage= 4.83' , Surface Width= 161.25'
Bank-Full Depth= 0.33' Flow Area= 1.8 sf, Capacity= 1.23 cfs

0.00' x 0.33' deep channel, n= 0.030 Earth, grassed & winding
Side Slope Z-value= 16.7 '/' Top Width= 11.02'
Length= 168.8' Slope= 0.0021 '/'
Inlet Invert= 2,036.90', Outlet Invert= 2,036.55'



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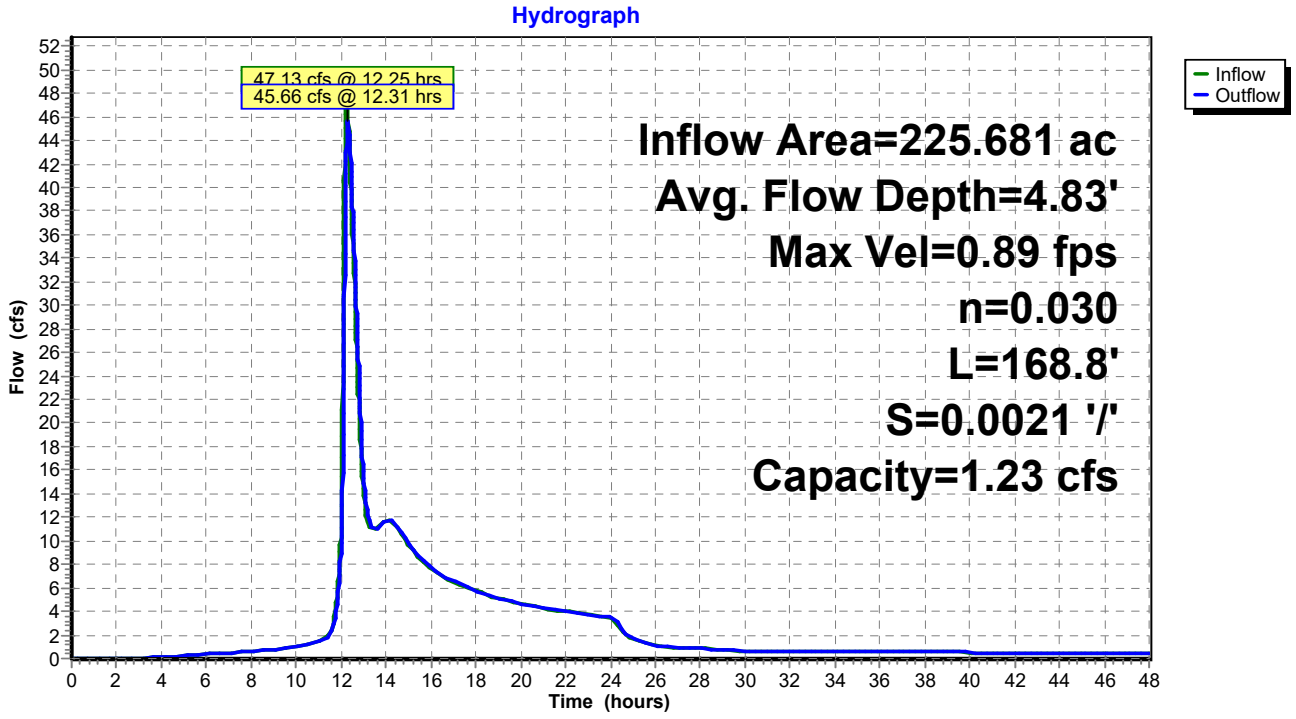
Reach 8R: REACH COMBINE



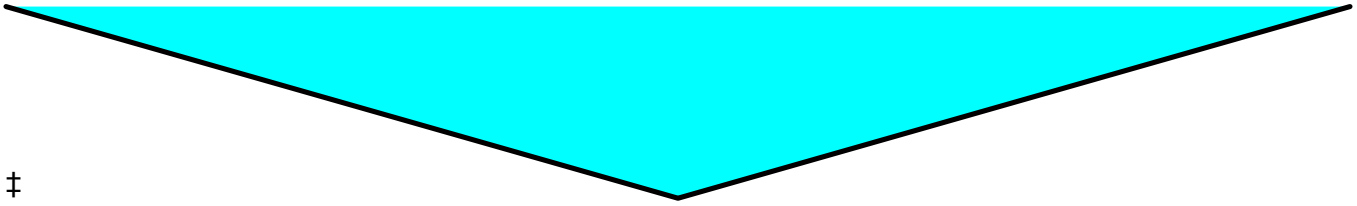
Summary for Reach 9R: DA 3 TO DA 2

Inflow Area = 45.225 ac, Inflow Depth = 0.83" for 1-yr event
Inflow = 38.37 cfs @ 12.11 hrs, Volume= 3.116 af
Outflow = 31.30 cfs @ 12.20 hrs, Volume= 3.116 af, Atten= 18%, Lag= 5.2 min
Routed to Reach 8R : REACH COMBINE

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Max. Velocity= 3.68 fps, Min. Travel Time= 6.6 min
Avg. Velocity = 1.09 fps, Avg. Travel Time= 22.4 min

Peak Storage= 12,429 cf @ 12.20 hrs
Average Depth at Peak Storage= 0.48' , Surface Width= 38.34'
Bank-Full Depth= 0.35' Flow Area= 4.9 sf, Capacity= 15.84 cfs

0.00' x 0.35' deep channel, n= 0.030 Earth, grassed & winding
Side Slope Z-value= 40.0 '/' Top Width= 28.00'
Length= 1,462.0' Slope= 0.0435 '/'
Inlet Invert= 2,103.26', Outlet Invert= 2,039.65'



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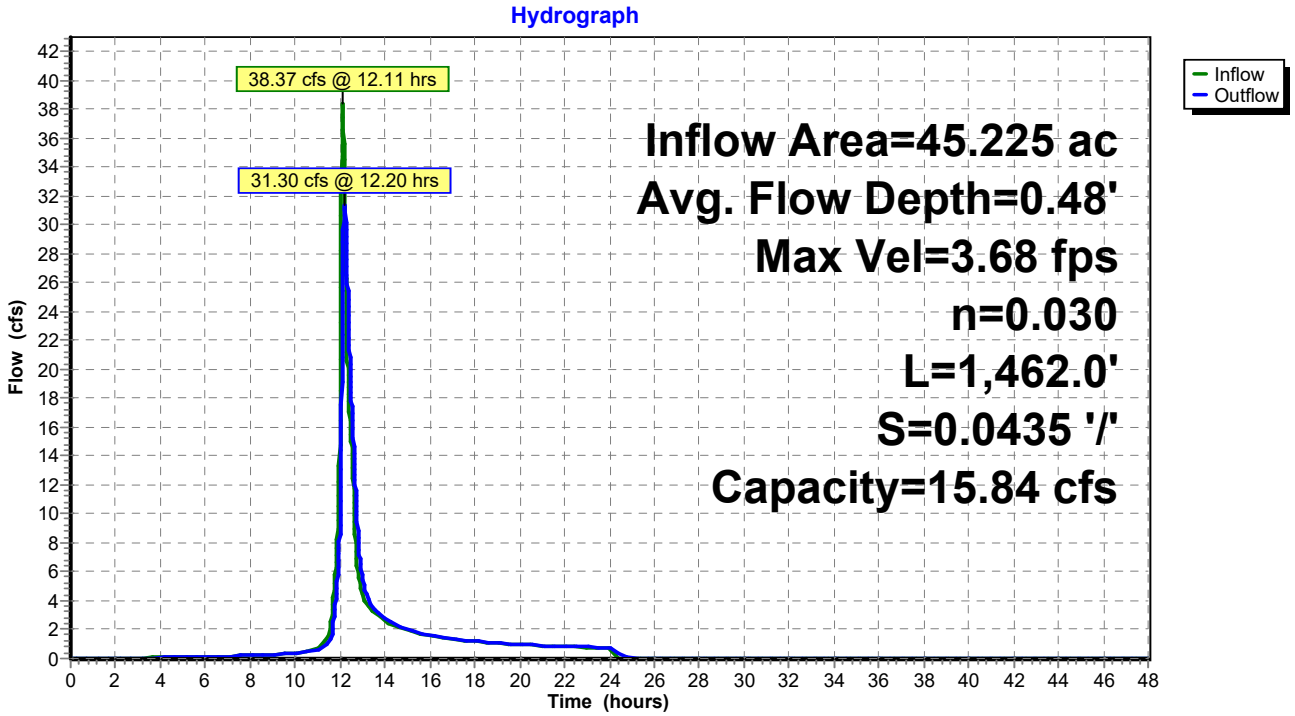
Reach 9R: DA 3 TO DA 2



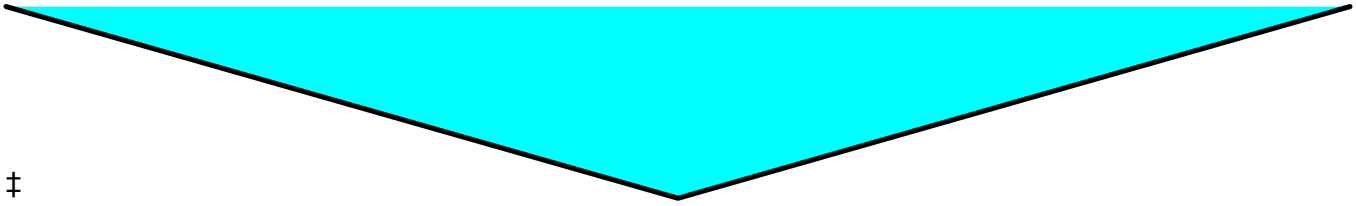
Summary for Reach 10R: REACH COMBINE 2

Inflow Area = 247.742 ac, Inflow Depth > 0.58" for 1-yr event
Inflow = 58.02 cfs @ 12.30 hrs, Volume= 11.888 af
Outflow = 57.85 cfs @ 12.32 hrs, Volume= 11.885 af, Atten= 0%, Lag= 1.0 min
Routed to Link 7L : POA

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Max. Velocity= 1.78 fps, Min. Travel Time= 1.3 min
Avg. Velocity = 0.70 fps, Avg. Travel Time= 3.2 min

Peak Storage= 4,423 cf @ 12.32 hrs
Average Depth at Peak Storage= 0.61' , Surface Width= 107.23'
Bank-Full Depth= 0.59' Flow Area= 30.8 sf, Capacity= 54.02 cfs

0.00' x 0.59' deep channel, n= 0.030 Earth, grassed & winding
Side Slope Z-value= 88.5 '/' Top Width= 104.43'
Length= 136.3' Slope= 0.0064 '/'
Inlet Invert= 2,036.75', Outlet Invert= 2,035.88'



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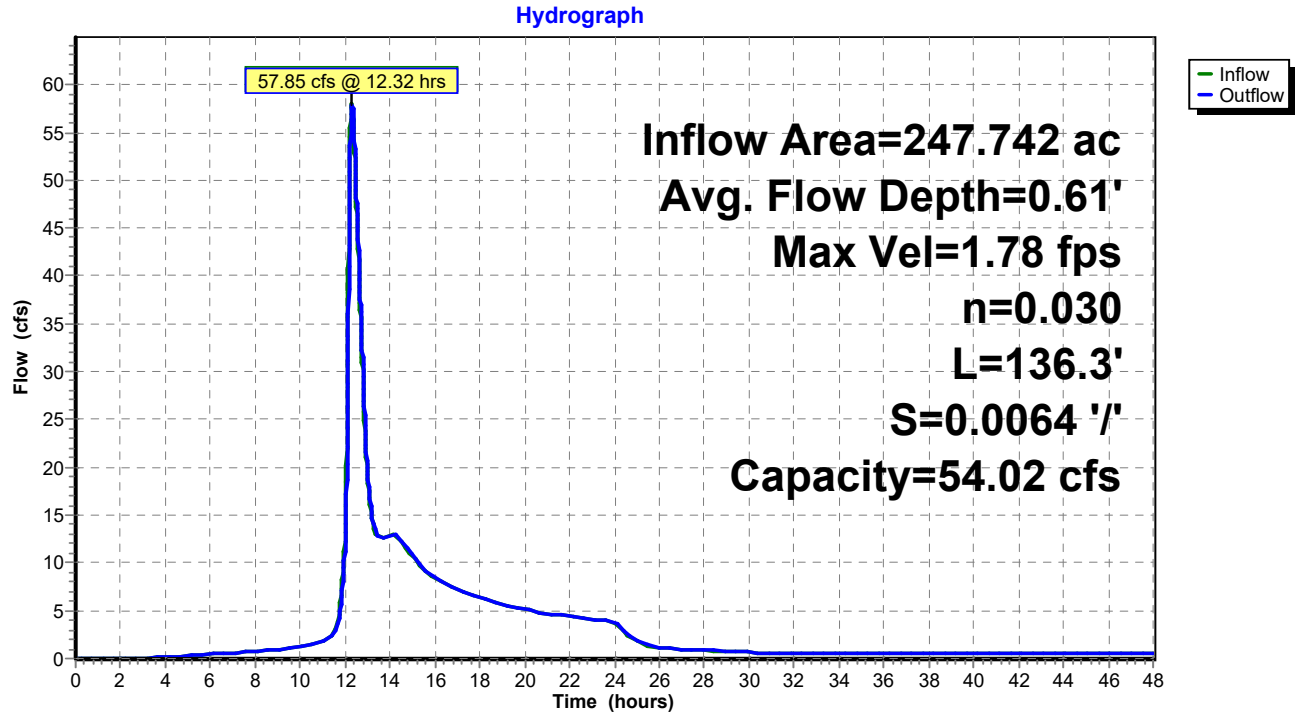
Reach 10R: REACH COMBINE 2



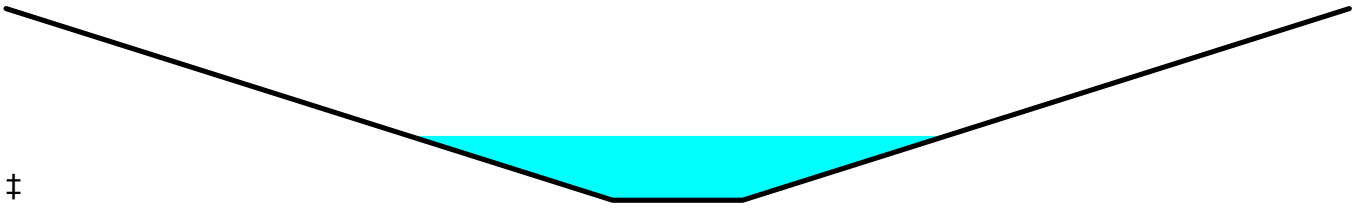
Summary for Reach 11R: DA 4 TO POA

Inflow Area = 13.891 ac, Inflow Depth = 0.99" for 1-yr event
Inflow = 11.57 cfs @ 12.22 hrs, Volume= 1.151 af
Outflow = 11.25 cfs @ 12.27 hrs, Volume= 1.151 af, Atten= 3%, Lag= 2.5 min
Routed to Reach 10R : REACH COMBINE 2

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Max. Velocity= 6.20 fps, Min. Travel Time= 3.2 min
Avg. Velocity = 2.04 fps, Avg. Travel Time= 9.6 min

Peak Storage= 2,133 cf @ 12.27 hrs
Average Depth at Peak Storage= 0.47' , Surface Width= 6.21'
Bank-Full Depth= 1.40' Flow Area= 11.9 sf, Capacity= 140.25 cfs

1.50' x 1.40' deep channel, n= 0.030 Earth, grassed & winding
Side Slope Z-value= 5.0 '/' Top Width= 15.50'
Length= 1,176.1' Slope= 0.0825 '/'
Inlet Invert= 2,133.71', Outlet Invert= 2,036.73'



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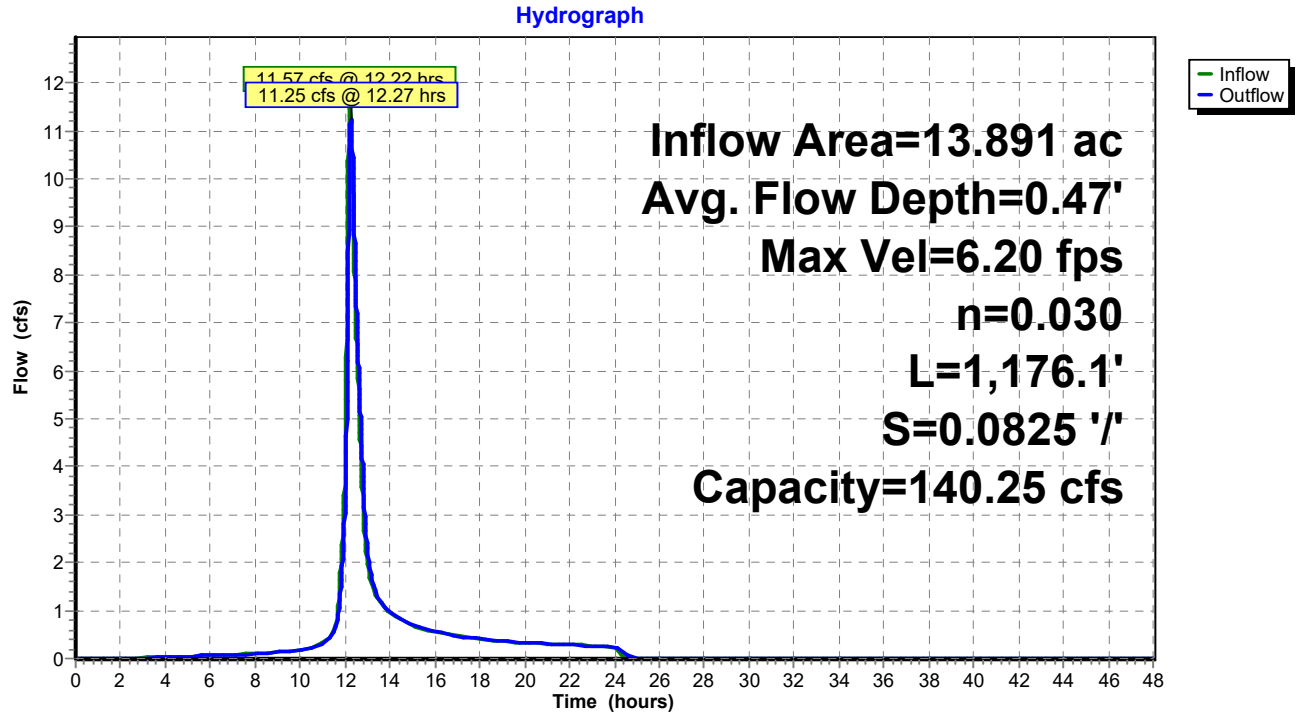
Reach 11R: DA 4 TO POA



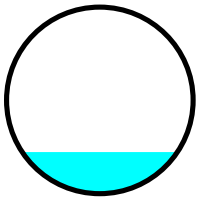
Summary for Reach 12R: DI-7

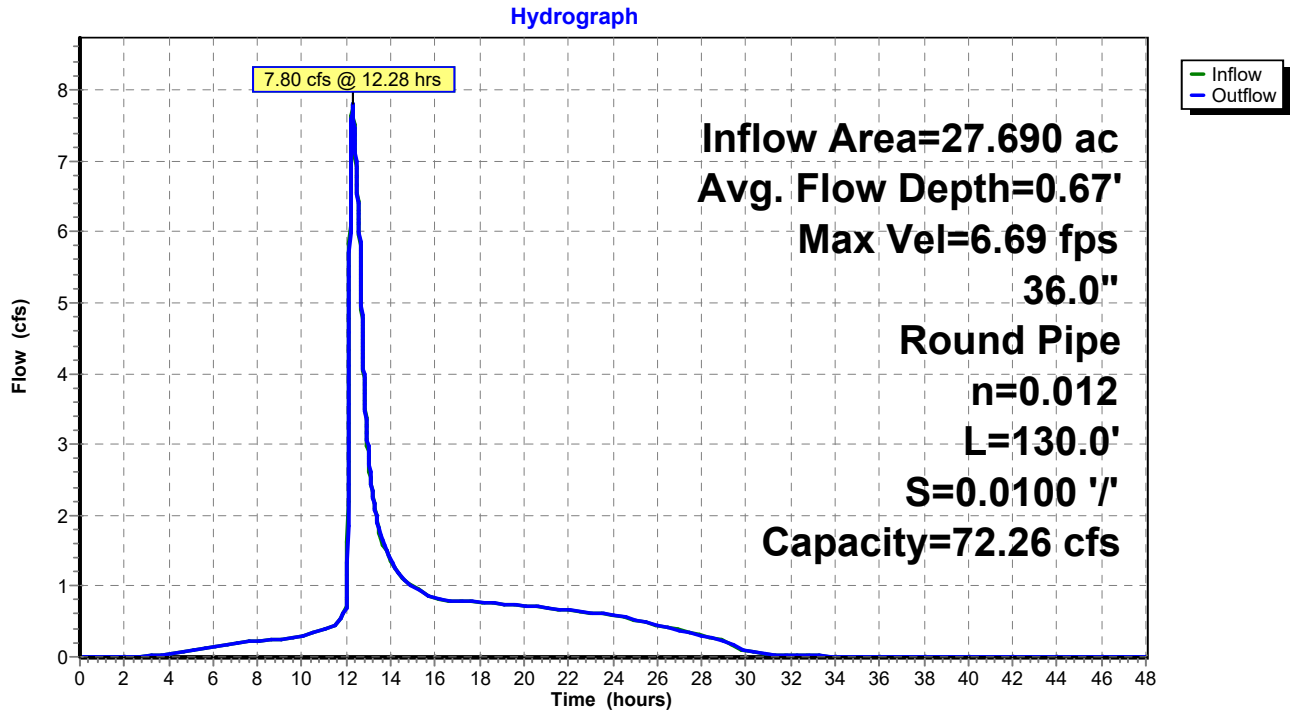
Inflow Area = 27.690 ac, Inflow Depth = 0.68" for 1-yr event
Inflow = 7.80 cfs @ 12.28 hrs, Volume= 1.576 af
Outflow = 7.80 cfs @ 12.28 hrs, Volume= 1.576 af, Atten= 0%, Lag= 0.2 min
Routed to Reach 8R : REACH COMBINE

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Max. Velocity= 6.69 fps, Min. Travel Time= 0.3 min
Avg. Velocity = 2.11 fps, Avg. Travel Time= 1.0 min

Peak Storage= 152 cf @ 12.28 hrs
Average Depth at Peak Storage= 0.67' , Surface Width= 2.49'
Bank-Full Depth= 3.00' Flow Area= 7.1 sf, Capacity= 72.26 cfs

36.0" Round Pipe
n= 0.012
Length= 130.0' Slope= 0.0100 '/'
Inlet Invert= 2,061.30', Outlet Invert= 2,060.00'





Summary for Pond 3P: NSP POND 1

Inflow Area = 96.000 ac, Inflow Depth = 0.66" for 1-yr event
Inflow = 39.33 cfs @ 12.42 hrs, Volume= 5.281 af
Outflow = 5.90 cfs @ 13.86 hrs, Volume= 3.739 af, Atten= 85%, Lag= 86.0 min
Primary = 5.90 cfs @ 13.86 hrs, Volume= 3.739 af
Routed to Reach 6R : POND TO POA

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 2,080.46' @ 13.86 hrs Storage= 121,152 cf

Plug-Flow detention time= 571.0 min calculated for 3.739 af (71% of inflow)
Center-of-Mass det. time= 458.2 min (1,338.0 - 879.9)

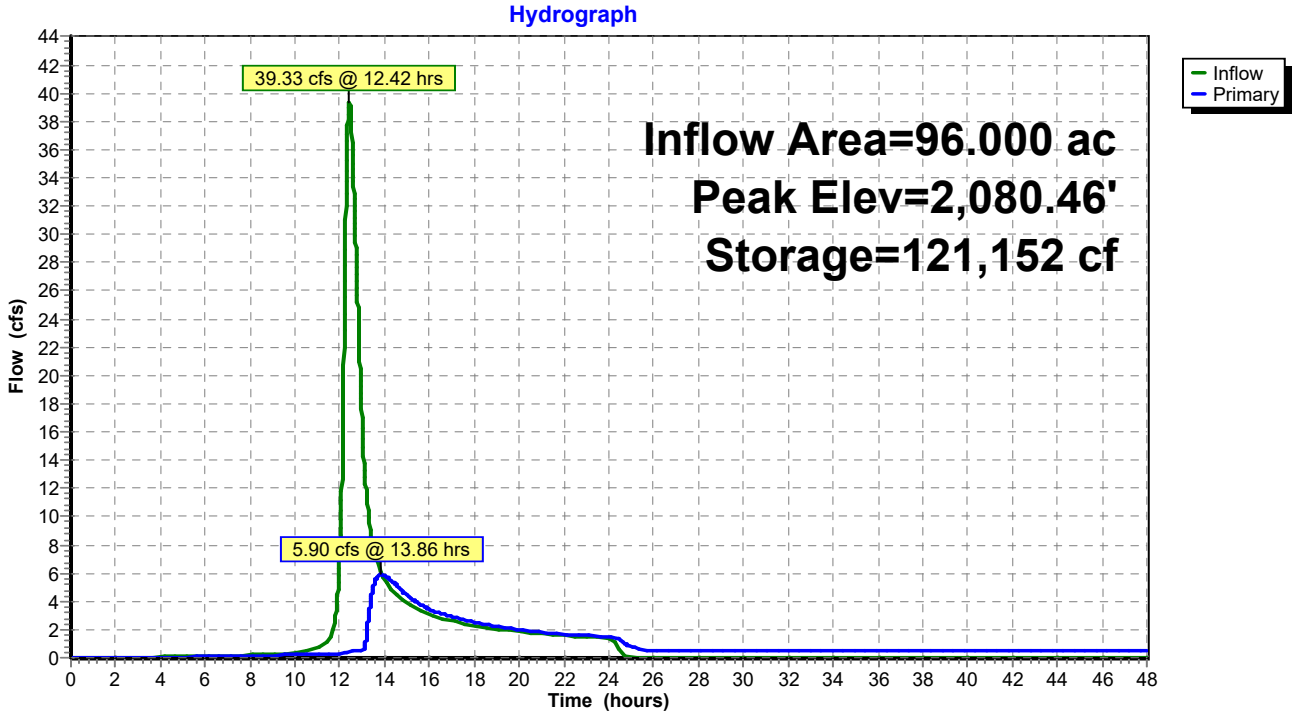
Volume	Invert	Avail.Storage	Storage Description
#1	2,074.75'	392,320 cf	**Custom Stage Data** Listed below

Elevation (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
2,074.75	0	0
2,076.00	2,002	2,002
2,078.00	24,089	26,091
2,080.00	67,305	93,396
2,082.00	119,692	213,088
2,084.00	179,232	392,320

Device	Routing	Invert	Outlet Devices
#1	Primary	2,073.87'	**48.0" Round Culvert** L= 110.4' Ke= 0.600 Inlet / Outlet Invert= 2,073.87' / 2,071.85' S= 0.0183 '/' Cc= 0.900 n= 0.013, Flow Area= 12.57 sf
#2	Device 1	2,074.75'	**3.0" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Device 1	2,080.27'	**72.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#4	Device 1	2,082.20'	**30.0' long x 14.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.64 2.67 2.70 2.65 2.64 2.65 2.65 2.63

Primary OutFlow Max=5.82 cfs @ 13.86 hrs HW=2,080.46' (Free Discharge)
└**1=Culvert** (Passes 5.82 cfs of 121.58 cfs potential flow)
  ├**2=Orifice/Grate** (Orifice Controls 0.56 cfs @ 11.38 fps)
  ├**3=Orifice/Grate** (Weir Controls 5.26 cfs @ 1.44 fps)
  └**4=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 3P: NSP POND 1



Summary for Pond 8P: SWM FACILITY #1

Inflow Area = 27.690 ac, Inflow Depth = 0.68" for 1-yr event
Inflow = 21.30 cfs @ 12.04 hrs, Volume= 1.576 af
Outflow = 7.80 cfs @ 12.28 hrs, Volume= 1.576 af, Atten= 63%, Lag= 14.2 min
Primary = 7.80 cfs @ 12.28 hrs, Volume= 1.576 af
Routed to Reach 12R : DI-7
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Routed to Reach 12R : DI-7

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 2,064.75' @ 12.28 hrs Surf.Area= 9,456 sf Storage= 22,083 cf

Plug-Flow detention time= 180.9 min calculated for 1.576 af (100% of inflow)
Center-of-Mass det. time= 180.9 min (988.2 - 807.3)

Volume	Invert	Avail.Storage	Storage Description
#1	2,061.65'	80,755 cf	**Custom Stage Data (Prismatic)** Listed below

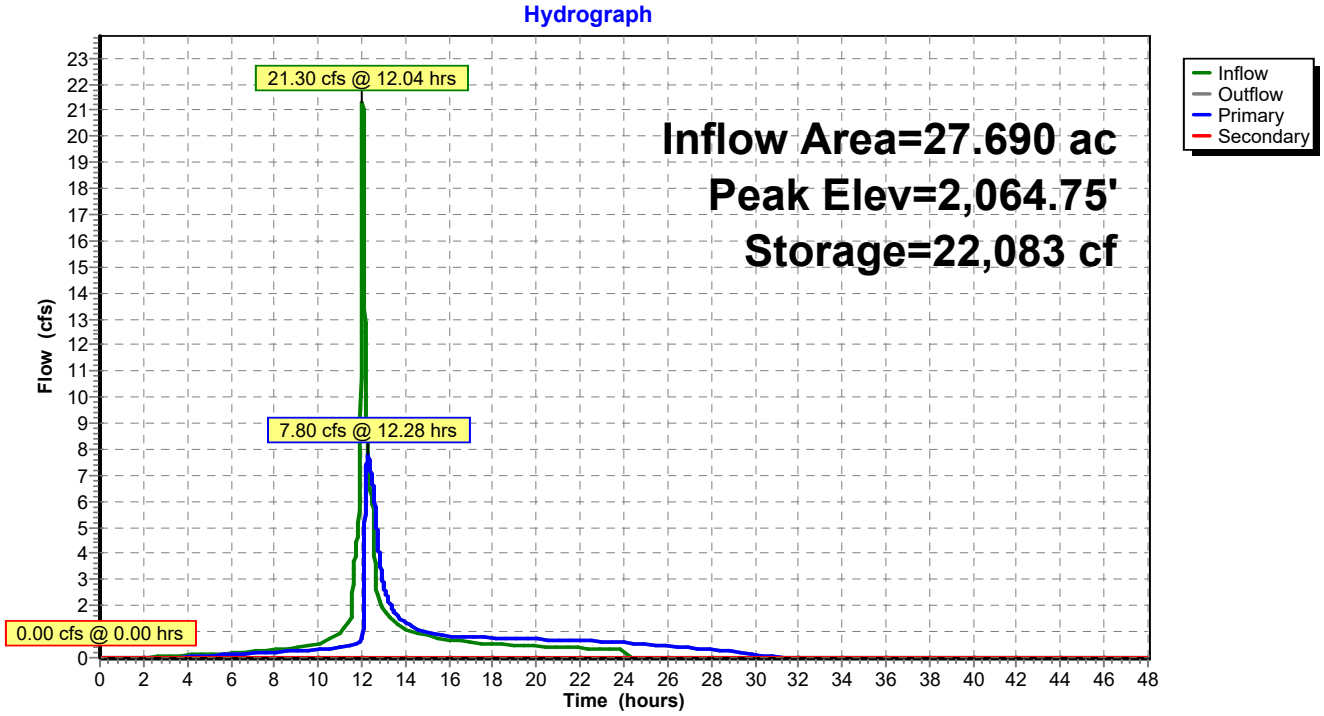
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
2,061.65	0	0	0
2,062.00	5,539	969	969
2,064.00	8,184	13,723	14,692
2,066.00	11,586	19,770	34,462
2,068.00	16,923	28,509	62,971
2,069.00	18,644	17,784	80,755

Device	Routing	Invert	Outlet Devices
#1	Primary	2,061.65'	**18.0" Round RCP_Round 18"** L= 55.0' Ke= 0.200 Inlet / Outlet Invert= 2,061.65' / 2,061.30' S= 0.0064 '/' Cc= 0.900 n= 0.012, Flow Area= 1.77 sf
#2	Device 1	2,061.65'	**4.5" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Device 1	2,064.10'	**24.0" W x 6.0" H Vert. Orifice/Grate X 2.00** C= 0.600 Limited to weir flow at low heads
#4	Device 1	2,064.67'	**48.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#5	Secondary	2,068.25'	**Custom Weir/Orifice, Cv= 2.62 (C= 3.28)** Head (feet) 0.00 2.75 Width (feet) 15.00 31.50

Primary OutFlow Max=7.76 cfs @ 12.28 hrs HW=2,064.75' (Free Discharge)
└─**1=RCP_Round 18"** (Passes 7.76 cfs of 13.80 cfs potential flow)
  ├─**2=Orifice/Grate** (Orifice Controls 0.91 cfs @ 8.21 fps)
  ├─**3=Orifice/Grate** (Orifice Controls 5.96 cfs @ 2.98 fps)
  └─**4=Orifice/Grate** (Weir Controls 0.89 cfs @ 0.91 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=2,061.65' (Free Discharge)
└─**5=Custom Weir/Orifice** (Controls 0.00 cfs)

Pond 8P: SWM FACILITY #1



Summary for Pond 14P: SWM FACILITY #2

Inflow Area = 6.610 ac, Inflow Depth = 0.74" for 1-yr event
Inflow = 5.62 cfs @ 12.04 hrs, Volume= 0.405 af
Outflow = 1.08 cfs @ 12.58 hrs, Volume= 0.405 af, Atten= 81%, Lag= 32.3 min
Primary = 1.08 cfs @ 12.58 hrs, Volume= 0.405 af
Routed to Reach 8R : REACH COMBINE

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 2,064.90' @ 12.58 hrs Surf.Area= 4,745 sf Storage= 5,544 cf

Plug-Flow detention time= 52.4 min calculated for 0.405 af (100% of inflow)
Center-of-Mass det. time= 52.4 min (855.0 - 802.6)

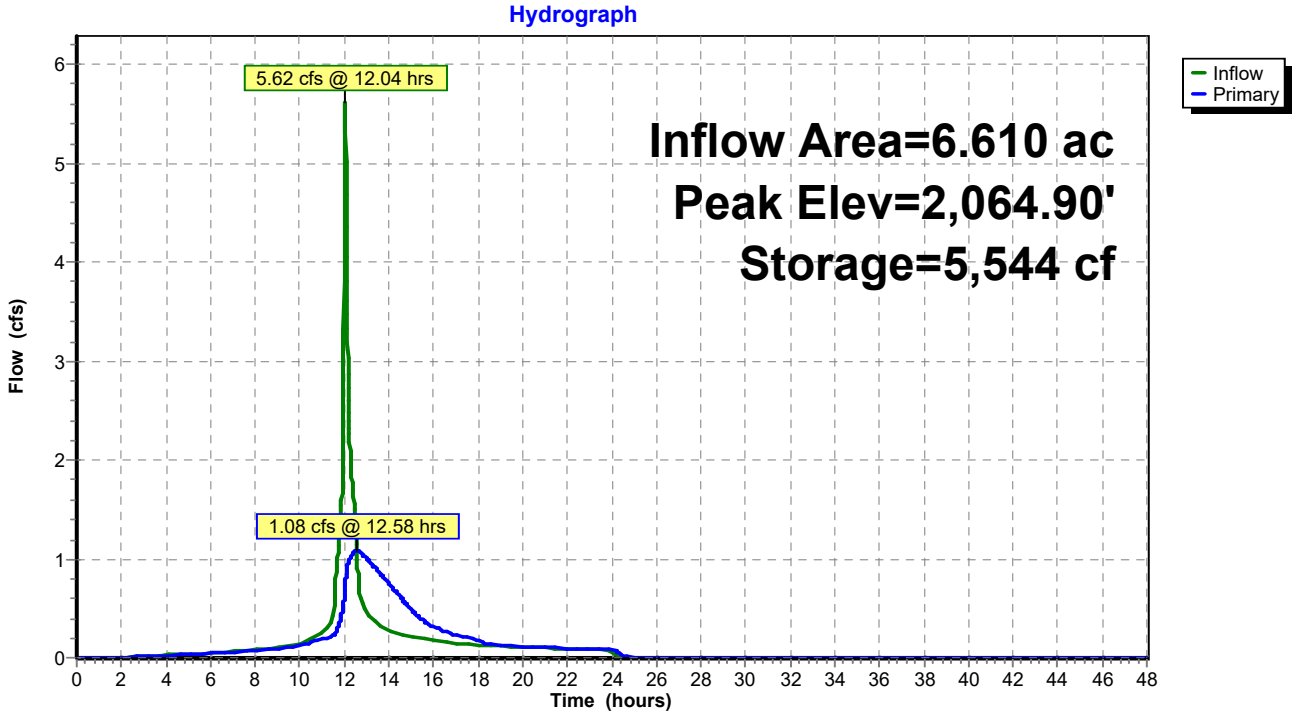
Volume	Invert	Avail.Storage	Storage Description
#1	2,064.00'	27,462 cf	**Custom Stage Data (Prismatic)** Listed below

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
2,064.00	0	0	0
2,064.15	3,262	245	245
2,068.00	10,877	27,218	27,462

Device	Routing	Invert	Outlet Devices
#1	Primary	2,063.80'	**24.0" Round Culvert** L= 63.7' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 2,063.80' / 2,056.00' S= 0.1224 '/' Cc= 0.900 n= 0.013, Flow Area= 3.14 sf
#2	Device 1	2,063.90'	**7.0" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Device 1	2,065.40'	**48.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#4	Primary	2,066.50'	**12.0' long x 12.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.57 2.62 2.70 2.67 2.66 2.67 2.66 2.64

Primary OutFlow Max=1.08 cfs @ 12.58 hrs HW=2,064.90' (Free Discharge)
- **1=Culvert** (Passes 1.08 cfs of 6.32 cfs potential flow)
  - **2=Orifice/Grate** (Orifice Controls 1.08 cfs @ 4.05 fps)
  - **3=Orifice/Grate** (Controls 0.00 cfs)
- **4=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 14P: SWM FACILITY #2



Summary for Pond 16P: SWM FACILITY #3

Inflow Area = 8.170 ac, Inflow Depth = 0.48" for 1-yr event
Inflow = 3.78 cfs @ 12.04 hrs, Volume= 0.328 af
Outflow = 1.41 cfs @ 12.39 hrs, Volume= 0.328 af, Atten= 63%, Lag= 21.0 min
Primary = 1.41 cfs @ 12.39 hrs, Volume= 0.328 af
Routed to Reach 10R : REACH COMBINE 2

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 2,063.08' @ 12.39 hrs Surf.Area= 5,061 sf Storage= 2,572 cf

Plug-Flow detention time= 27.2 min calculated for 0.328 af (100% of inflow)
Center-of-Mass det. time= 27.1 min (861.2 - 834.1)

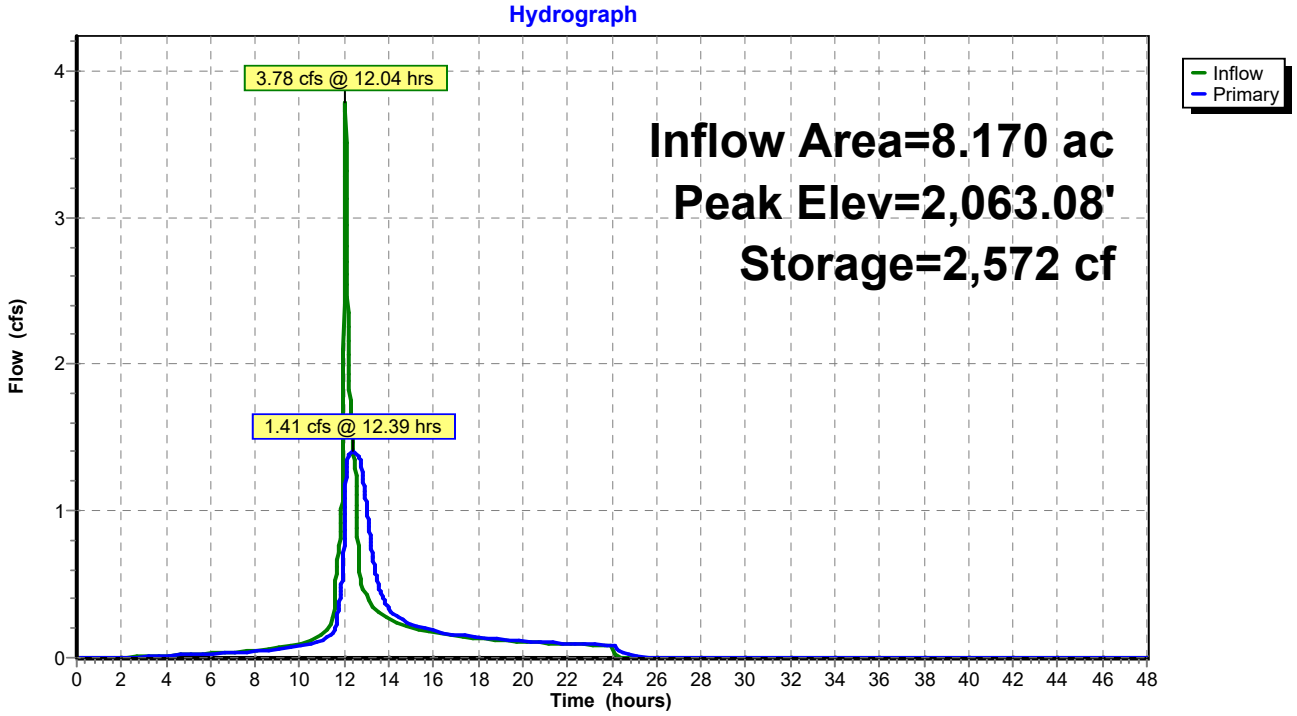
Volume	Invert	Avail.Storage	Storage Description
#1	2,062.15'	71,065 cf	**Custom Stage Data (Prismatic)** Listed below

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
2,062.15	0	0	0
2,063.00	4,695	1,995	1,995
2,064.00	9,065	6,880	8,875
2,065.00	12,134	10,600	19,475
2,066.00	15,548	13,841	33,316
2,067.00	18,123	16,836	50,151
2,068.00	23,705	20,914	71,065

Device	Routing	Invert	Outlet Devices
#1	Primary	2,061.95'	**24.0" Round Culvert** L= 69.8' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 2,061.95' / 2,050.00' S= 0.1712 '/' Cc= 0.900 n= 0.013, Flow Area= 3.14 sf
#2	Device 1	2,062.05'	**8.0" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Device 1	2,065.00'	**48.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#4	Primary	2,066.15'	**12.0' long x 12.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.57 2.62 2.70 2.67 2.66 2.67 2.66 2.64

Primary OutFlow Max=1.41 cfs @ 12.39 hrs HW=2,063.08' (Free Discharge)
- **1=Culvert** (Passes 1.41 cfs of 6.66 cfs potential flow)
  - **2=Orifice/Grate** (Orifice Controls 1.41 cfs @ 4.03 fps)
  - **3=Orifice/Grate** (Controls 0.00 cfs)
- **4=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 16P: SWM FACILITY #3

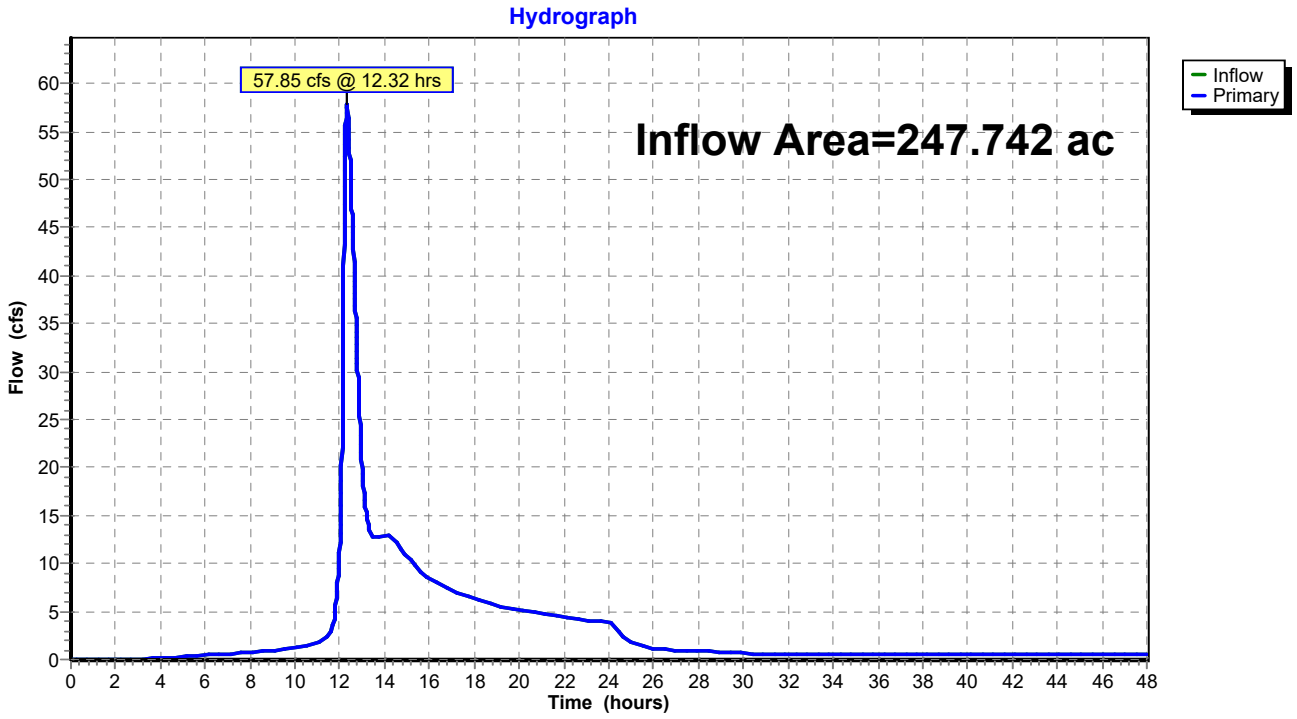


Summary for Link 7L: POA

Inflow Area = 247.742 ac, Inflow Depth > 0.58" for 1-yr event
Inflow = 57.85 cfs @ 12.32 hrs, Volume= 11.885 af
Primary = 57.85 cfs @ 12.32 hrs, Volume= 11.885 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs

Link 7L: POA



Time span=0.00-48.00 hrs, dt=0.01 hrs, 4801 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-Q
Reach routing by Stor-Ind method - Pond routing by Stor-Ind method

Subcatchment1S: DA # 1 Runoff Area=96.000 ac Runoff Depth=0.96"
Tc=30.8 min CN=WQ Runoff=60.25 cfs 7.681 af

Subcatchment8S: DA #3 OFF-SITE PORTION Runoff Area=44.547 ac Runoff Depth=1.17"
Flow Length=2,089' Tc=11.1 min CN=WQ Runoff=55.32 cfs 4.330 af

Subcatchment9S: DA TO SWM FACILITY#1 Runoff Area=27.690 ac Runoff Depth=0.97"
Tc=6.0 min CN=WQ Runoff=31.52 cfs 2.242 af

Subcatchment10S: DA #4 Runoff Area=13.891 ac Runoff Depth=1.36"
Flow Length=2,526' Tc=18.9 min CN=WQ Runoff=16.15 cfs 1.571 af

Subcatchment11S: DA #2 Runoff Area=50.156 ac Runoff Depth=0.62"
Flow Length=1,801' Tc=25.7 min CN=71 Runoff=20.08 cfs 2.596 af

Subcatchment12S: DA #3 ON-SITE PORTION Runoff Area=0.678 ac Runoff Depth=0.74"
Flow Length=2,089' Tc=11.1 min CN=WQ Runoff=0.43 cfs 0.042 af

Subcatchment13S: DA TO SWM FACILITY#2 Runoff Area=6.610 ac Runoff Depth=1.02"
Tc=6.0 min CN=WQ Runoff=8.00 cfs 0.565 af

Subcatchment15S: DA TO SWM FACILITY#3 Runoff Area=8.170 ac Runoff Depth=0.77"
Tc=6.0 min CN=WQ Runoff=7.08 cfs 0.524 af

Reach 6R: POND TO POA Avg. Flow Depth=0.14' Max Vel=2.18 fps Inflow=24.09 cfs 6.131 af
n=0.030 L=1,769.1' S=0.0268 '/' Capacity=8,939.96 cfs Outflow=21.09 cfs 6.112 af

Reach 8R: REACH COMBINE Avg. Flow Depth=7.82' Max Vel=0.90 fps Inflow=77.35 cfs 15.885 af
n=0.030 L=168.8' S=0.0021 '/' Capacity=1.23 cfs Outflow=75.20 cfs 15.882 af

Reach 9R: DA 3 TO DA 2 Avg. Flow Depth=0.60' Max Vel=3.85 fps Inflow=55.74 cfs 4.371 af
n=0.030 L=1,462.0' S=0.0435 '/' Capacity=15.84 cfs Outflow=45.66 cfs 4.371 af

Reach 10R: REACH COMBINE 2 Avg. Flow Depth=0.75' Max Vel=1.95 fps Inflow=92.37 cfs 17.977 af
n=0.030 L=136.3' S=0.0064 '/' Capacity=54.02 cfs Outflow=92.13 cfs 17.974 af

Reach 11R: DA 4 TO POA Avg. Flow Depth=0.55' Max Vel=6.77 fps Inflow=16.15 cfs 1.571 af
n=0.030 L=1,176.1' S=0.0825 '/' Capacity=140.25 cfs Outflow=15.77 cfs 1.571 af

Reach 12R: DI-7 Avg. Flow Depth=0.93' Max Vel=8.10 fps Inflow=15.20 cfs 2.242 af
36.0" Round Pipe n=0.012 L=130.0' S=0.0100 '/' Capacity=72.26 cfs Outflow=15.20 cfs 2.242 af

Pond 3P: NSP POND 1 Peak Elev=2,080.80' Storage=140,981 cf Inflow=60.25 cfs 7.681 af
Outflow=24.09 cfs 6.131 af

Pond 8P: SWM FACILITY#1 Peak Elev=2,065.16' Storage=26,206 cf Inflow=31.52 cfs 2.242 af
Primary=15.20 cfs 2.242 af Secondary=0.00 cfs 0.000 af Outflow=15.20 cfs 2.242 af

Pond 14P: SWM FACILITY#2 Peak Elev=2,065.30' Storage=8,344 cf Inflow=8.00 cfs 0.565 af
Outflow=1.35 cfs 0.565 af

Pond 16P: SWM FACILITY#3 Peak Elev=2,063.53' Storage=5,663 cf Inflow=7.08 cfs 0.524 af
Outflow=1.80 cfs 0.524 af

Link 7L: POA Inflow=92.13 cfs 17.974 af
Primary=92.13 cfs 17.974 af

Total Runoff Area = 247.742 ac Runoff Volume = 19.549 af Average Runoff Depth = 0.95"

Summary for Subcatchment 1S: DA # 1

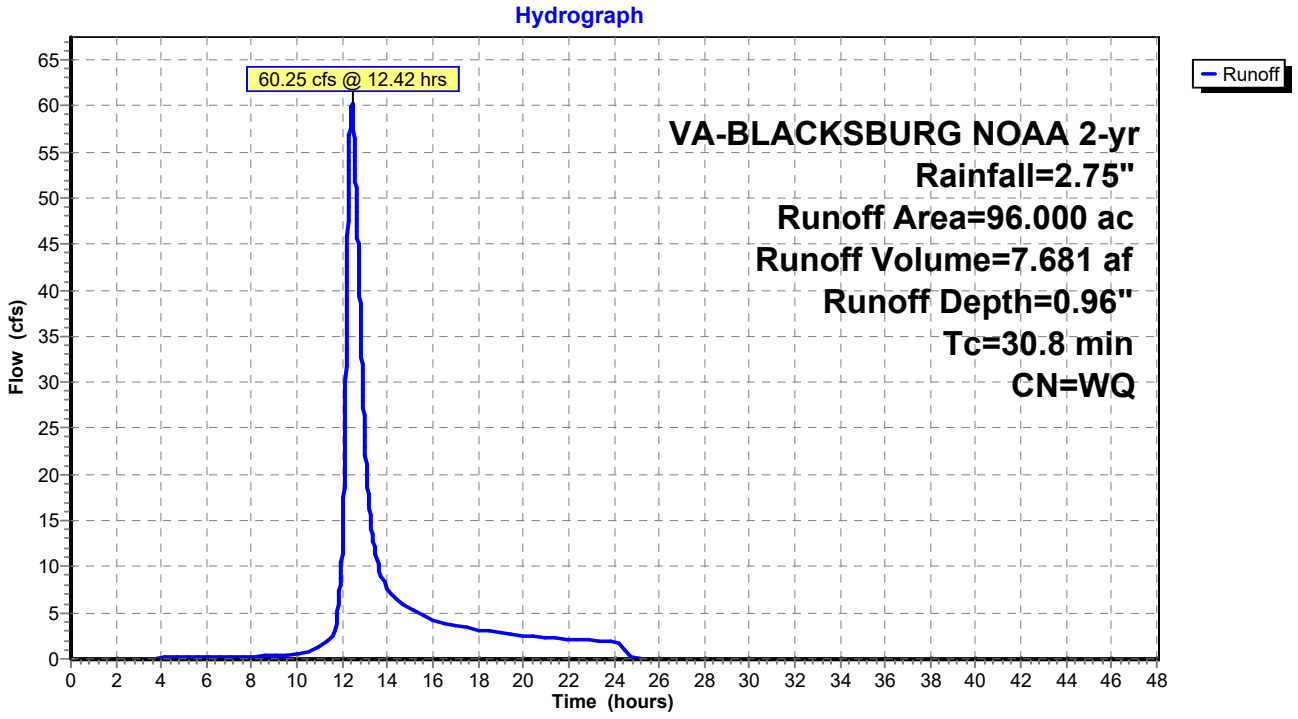
Runoff = 60.25 cfs @ 12.42 hrs, Volume= 7.681 af, Depth= 0.96"
Routed to Pond 3P : NSP POND 1

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
VA-BLACKSBURG NOAA 2-yr Rainfall=2.75"

Area (ac)	CN	Description
5.080	98	Roofs, HSG C
3.100	84	50-75% Grass cover, Fair, HSG D
22.720	79	50-75% Grass cover, Fair, HSG C
28.800	69	50-75% Grass cover, Fair, HSG B
1.000	86	1/3 acre lots, 30% imp, HSG D
10.400	81	1/3 acre lots, 30% imp, HSG C
6.400	72	1/3 acre lots, 30% imp, HSG B
10.300	83	1/4 acre lots, 38% imp, HSG C
8.200	75	1/4 acre lots, 38% imp, HSG B
96.000		Weighted Average

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
30.8					**Direct Entry, FROM NSP CALCS**

Subcatchment 1S: DA # 1



Summary for Subcatchment 8S: DA #3 OFF-SITE PORTION

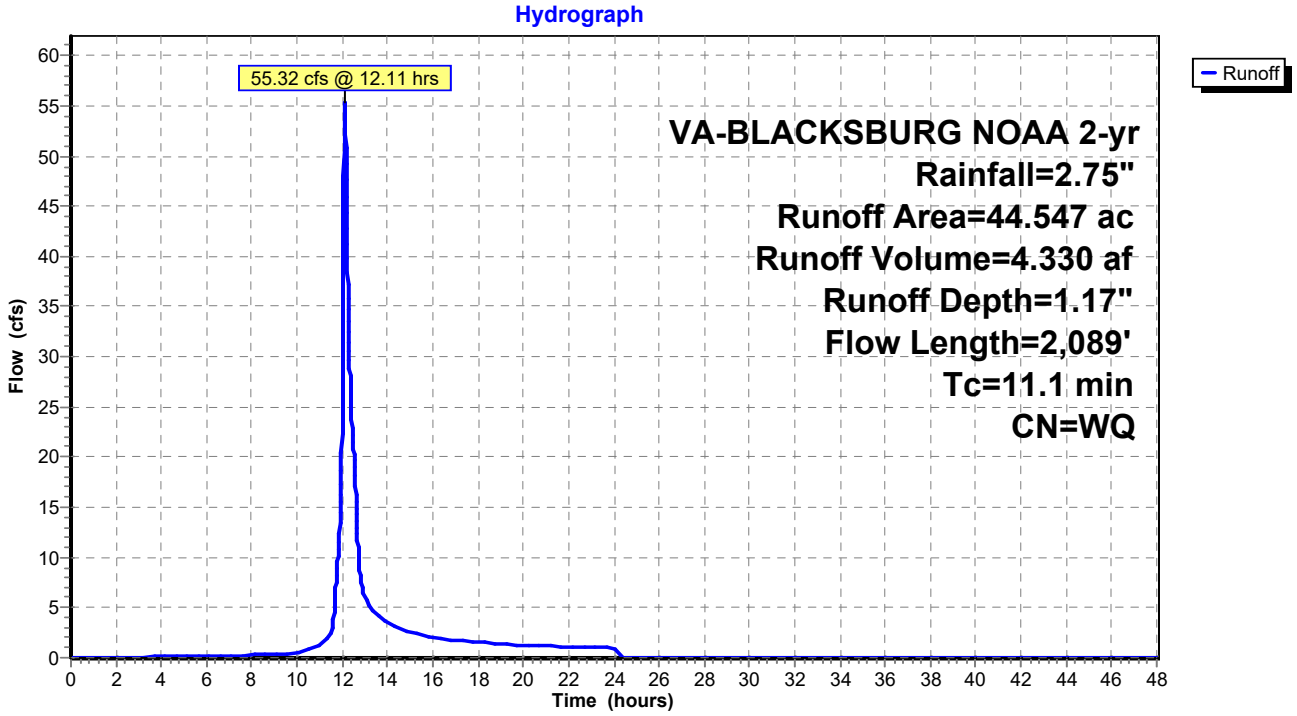
Runoff = 55.32 cfs @ 12.11 hrs, Volume= 4.330 af, Depth= 1.17"
Routed to Reach 9R : DA 3 TO DA 2

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
VA-BLACKSBURG NOAA 2-yr Rainfall=2.75"

Area (ac)	CN	Description
0.358	98	Paved roads w/curbs & sewers, HSG B
4.733	98	Paved roads w/curbs & sewers, HSG C
5.726	70	1/2 acre lots, 25% imp, HSG B
28.476	80	1/2 acre lots, 25% imp, HSG C
0.877	72	1/3 acre lots, 30% imp, HSG B
3.986	81	1/3 acre lots, 30% imp, HSG C
0.391	79	1 acre lots, 20% imp, HSG C
44.547		Weighted Average

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.7	95	0.0630	0.28		**Sheet Flow, Tc1** Range n= 0.130 P2= 2.76"
1.3	435	0.1125	5.44	40.82	**Channel Flow, Tc2** Area= 7.5 sf Perim= 40.0' r= 0.19' n= 0.030 Earth, grassed & winding
2.2	602	0.0830	4.64		**Shallow Concentrated Flow, Tc3** Unpaved Kv= 16.1 fps
0.6	301	0.0565	8.57	342.85	**Channel Flow, Tc4** Area= 40.0 sf Perim= 64.4' r= 0.62' n= 0.030 Earth, grassed & winding
0.1	215	0.0744	27.88	197.09	**Pipe Channel, Tc5** 36.0" Round Area= 7.1 sf Perim= 9.4' r= 0.75' n= 0.012 Concrete pipe, finished
1.2	441	0.0603	6.33	189.76	**Channel Flow, Tc6** Area= 30.0 sf Perim= 80.0' r= 0.38' n= 0.030 Earth, grassed & winding
11.1	2,089	Total			

Subcatchment 8S: DA #3 OFF-SITE PORTION



Summary for Subcatchment 9S: DA TO SWM FACILITY #1

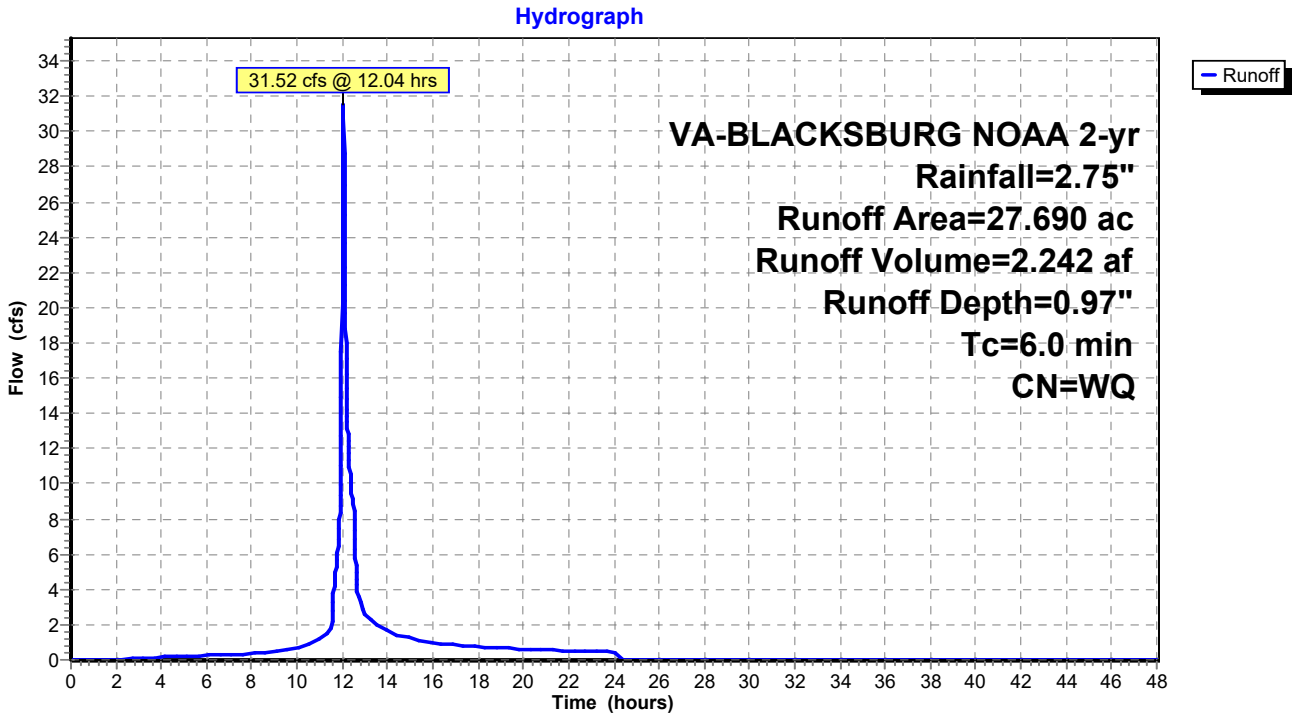
Runoff = 31.52 cfs @ 12.04 hrs, Volume= 2.242 af, Depth= 0.97"
Routed to Pond 8P : SWM FACILITY #1

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
VA-BLACKSBURG NOAA 2-yr Rainfall=2.75"

	Area (ac)	CN	Description
	8.410	61	>75% Grass cover, Good, HSG B
	3.440	74	>75% Grass cover, Good, HSG C
	4.930	98	Impervious, HSG B
	2.030	98	Impervious, HSG C
*	8.880	68	VRRM DA A
	27.690		Weighted Average

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, TR-55 MIN.**

Subcatchment 9S: DA TO SWM FACILITY #1



Summary for Subcatchment 10S: DA #4

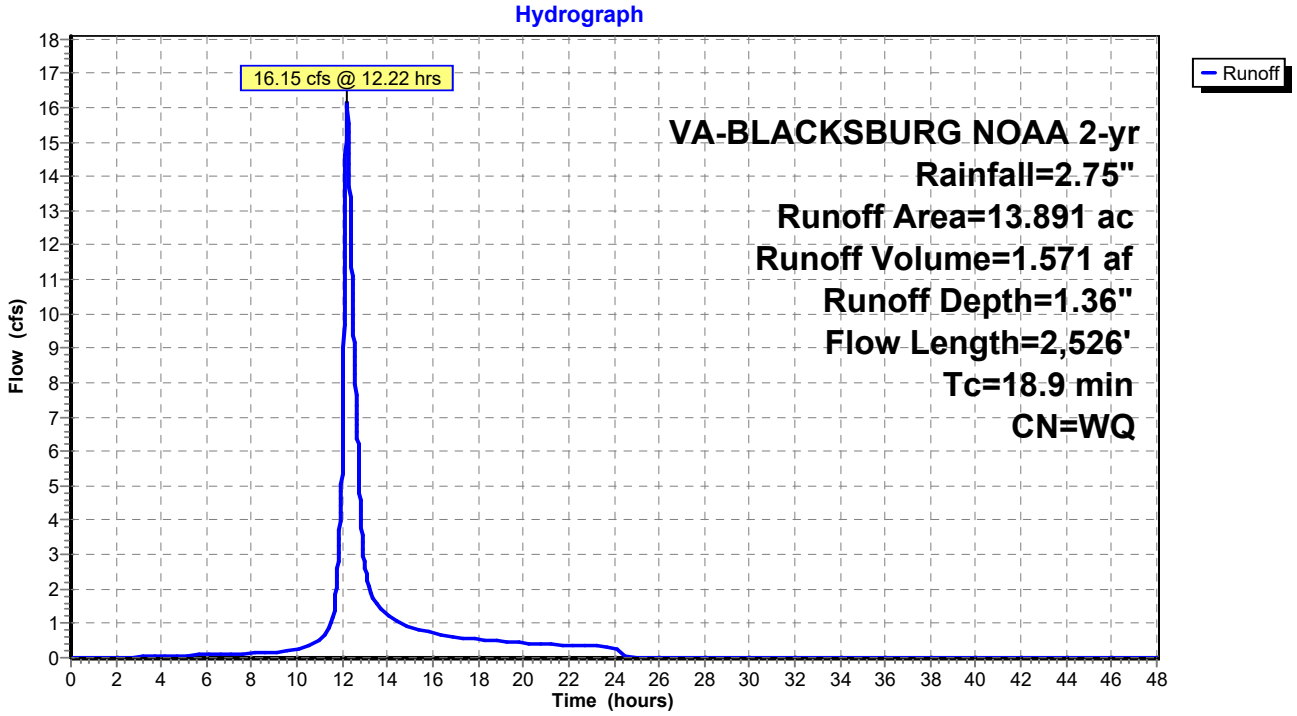
Runoff = 16.15 cfs @ 12.22 hrs, Volume= 1.571 af, Depth= 1.36"
Routed to Reach 11R : DA 4 TO POA

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
VA-BLACKSBURG NOAA 2-yr Rainfall=2.75"

Area (ac)	CN	Description
2.555	98	Paved roads w/curbs & sewers, HSG C
7.333	81	1/3 acre lots, 30% imp, HSG C
3.803	80	1/2 acre lots, 25% imp, HSG C
0.200	70	1/2 acre lots, 25% imp, HSG B
13.891		Weighted Average

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.4	95	0.0630	0.25		**Sheet Flow, Tc1** Grass: Short n= 0.150 P2= 2.76"
9.9	1,004	0.0478	1.70	5.26	**Channel Flow, Tc2** Area= 3.1 sf Perim= 50.0' r= 0.06' n= 0.030 Earth, grassed & winding
2.6	1,427	0.0134	9.03	28.37	**Pipe Channel, CMP_Round 24"** 24.0" Round Area= 3.1 sf Perim= 6.3' r= 0.50' n= 0.012 Concrete pipe, finished
18.9	2,526	Total			

Subcatchment 10S: DA #4



Summary for Subcatchment 11S: DA #2

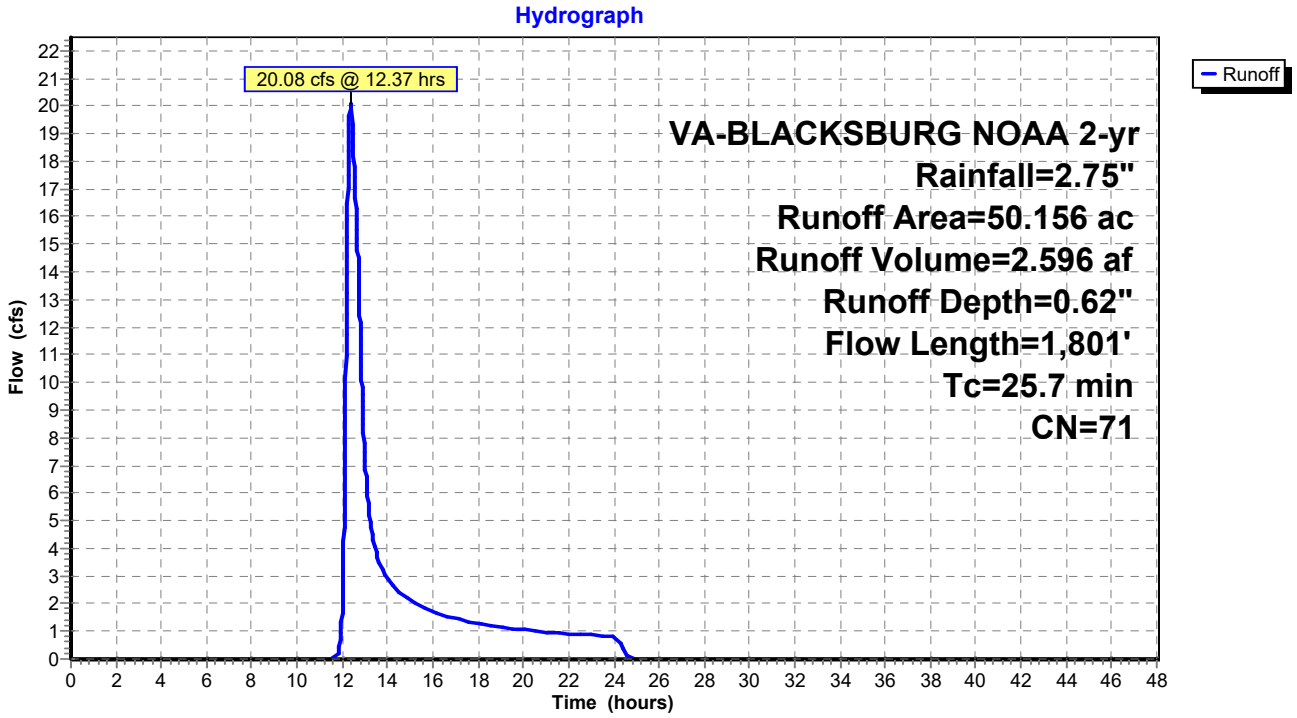
Runoff = 20.08 cfs @ 12.37 hrs, Volume= 2.596 af, Depth= 0.62"
Routed to Reach 8R : REACH COMBINE

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
VA-BLACKSBURG NOAA 2-yr Rainfall=2.75"

	Area (ac)	CN	Description
*	50.156	71	

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.0	100	0.0400	0.21		**Sheet Flow, Tc1** Grass: Short n= 0.150 P2= 2.76"
17.7	1,701	0.0523	1.60		**Shallow Concentrated Flow, Tc2** Short Grass Pasture Kv= 7.0 fps
25.7	1,801	Total			

Subcatchment 11S: DA #2



Summary for Subcatchment 12S: DA #3 ON-SITE PORTION

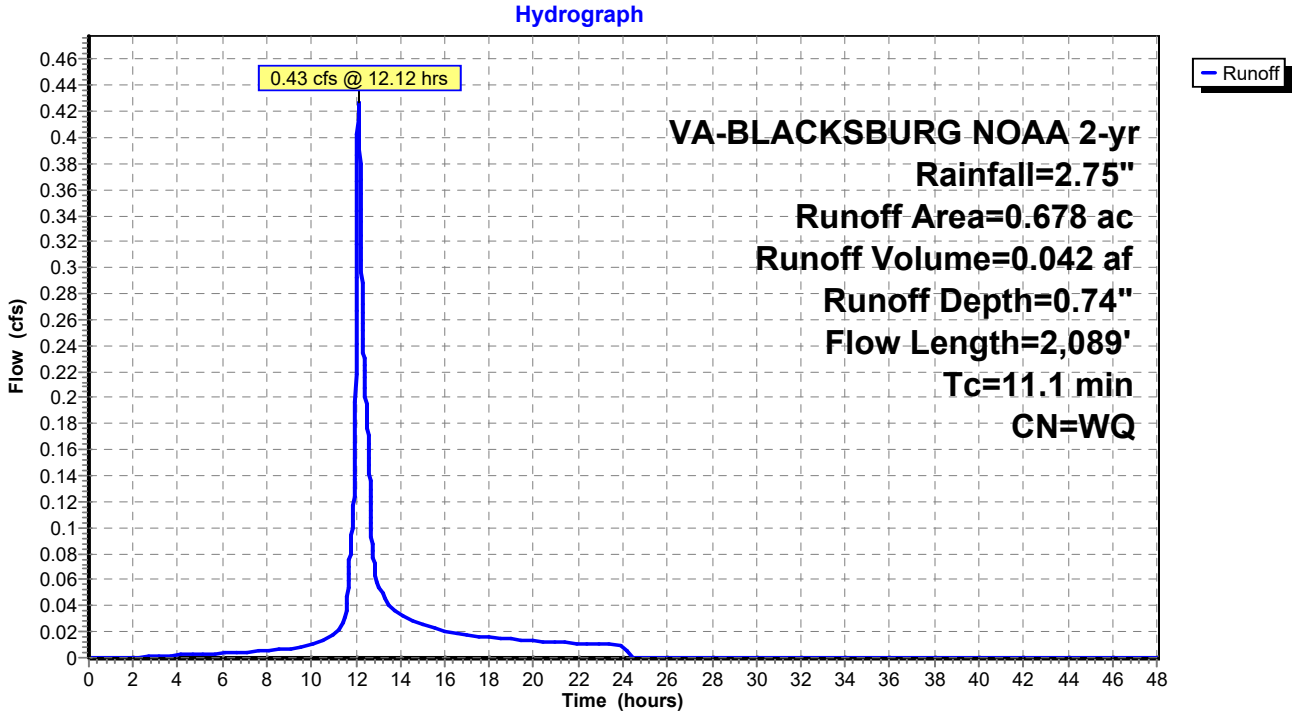
Runoff = 0.43 cfs @ 12.12 hrs, Volume= 0.042 af, Depth= 0.74"
Routed to Reach 9R : DA 3 TO DA 2

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
VA-BLACKSBURG NOAA 2-yr Rainfall=2.75"

Area (ac)	CN	Description
0.061	98	Paved roads w/curbs & sewers, HSG B
0.042	98	Paved roads w/curbs & sewers, HSG C
0.055	83	1/4 acre lots, 38% imp, HSG C
0.057	74	>75% Grass cover, Good, HSG C
0.463	61	>75% Grass cover, Good, HSG B
0.678		Weighted Average

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.7	95	0.0630	0.28		**Sheet Flow, Tc1** Range n= 0.130 P2= 2.76"
1.3	435	0.1125	5.44	40.82	**Channel Flow, Tc2** Area= 7.5 sf Perim= 40.0' r= 0.19' n= 0.030 Earth, grassed & winding
2.2	602	0.0830	4.64		**Shallow Concentrated Flow, Tc3** Unpaved Kv= 16.1 fps
0.6	301	0.0565	8.57	342.85	**Channel Flow, Tc4** Area= 40.0 sf Perim= 64.4' r= 0.62' n= 0.030 Earth, grassed & winding
0.1	215	0.0744	27.88	197.09	**Pipe Channel, Tc5** 36.0" Round Area= 7.1 sf Perim= 9.4' r= 0.75' n= 0.012 Concrete pipe, finished
1.2	441	0.0603	6.33	189.76	**Channel Flow, Tc6** Area= 30.0 sf Perim= 80.0' r= 0.38' n= 0.030 Earth, grassed & winding
11.1	2,089	Total			

Subcatchment 12S: DA #3 ON-SITE PORTION



Summary for Subcatchment 13S: DA TO SWM FACILITY #2

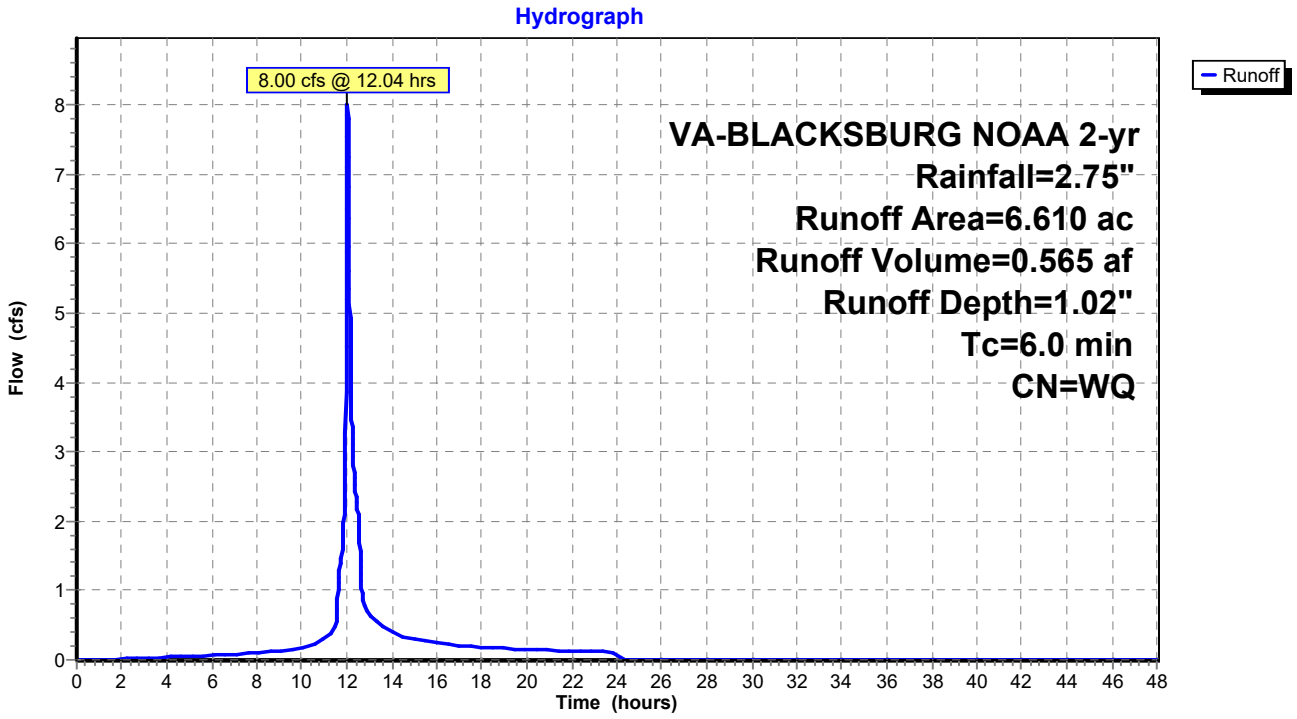
Runoff = 8.00 cfs @ 12.04 hrs, Volume= 0.565 af, Depth= 1.02"
Routed to Pond 14P : SWM FACILITY #2

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
VA-BLACKSBURG NOAA 2-yr Rainfall=2.75"

	Area (ac)	CN	Description
	2.230	61	>75% Grass cover, Good, HSG B
	0.910	74	>75% Grass cover, Good, HSG C
*	1.310	98	Impervious, HSG B
	0.540	98	Impervious, HSG C
*	1.620	68	VRRM AREA B
	6.610		Weighted Average

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, TR-55 MIN.**

Subcatchment 13S: DA TO SWM FACILITY #2



Summary for Subcatchment 15S: DA TO SWM FACILITY #3

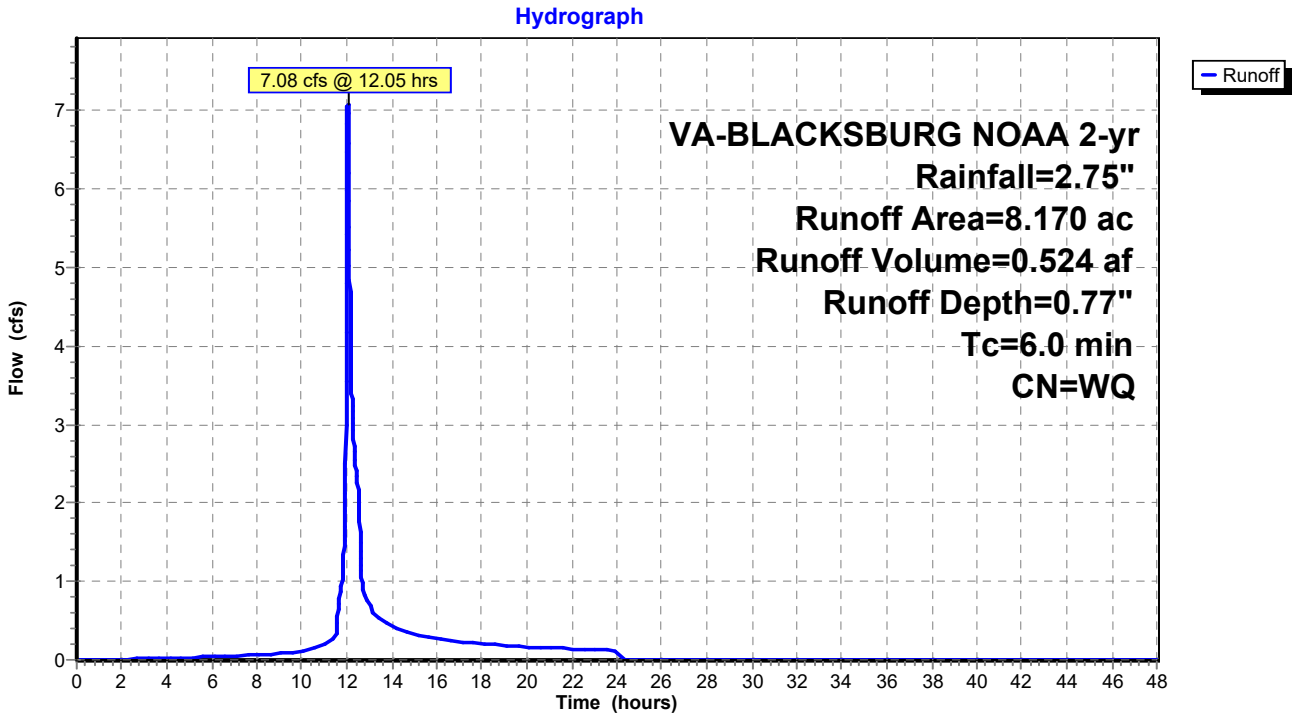
Runoff = 7.08 cfs @ 12.05 hrs, Volume= 0.524 af, Depth= 0.77"
Routed to Pond 16P : SWM FACILITY #3

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
VA-BLACKSBURG NOAA 2-yr Rainfall=2.75"

	Area (ac)	CN	Description
	1.430	61	>75% Grass cover, Good, HSG B
	0.580	74	>75% Grass cover, Good, HSG C
	0.840	98	Impervious, HSG B
	0.330	98	Impervious, HSG C
*	4.990	68	VRRM AREA C
	8.170		Weighted Average

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, TR-55 MIN.**

Subcatchment 15S: DA TO SWM FACILITY #3



Summary for Reach 6R: POND TO POA

Inflow Area = 96.000 ac, Inflow Depth > 0.77" for 2-yr event
Inflow = 24.09 cfs @ 12.99 hrs, Volume= 6.131 af
Outflow = 21.09 cfs @ 13.21 hrs, Volume= 6.112 af, Atten= 12%, Lag= 12.9 min
Routed to Reach 8R : REACH COMBINE

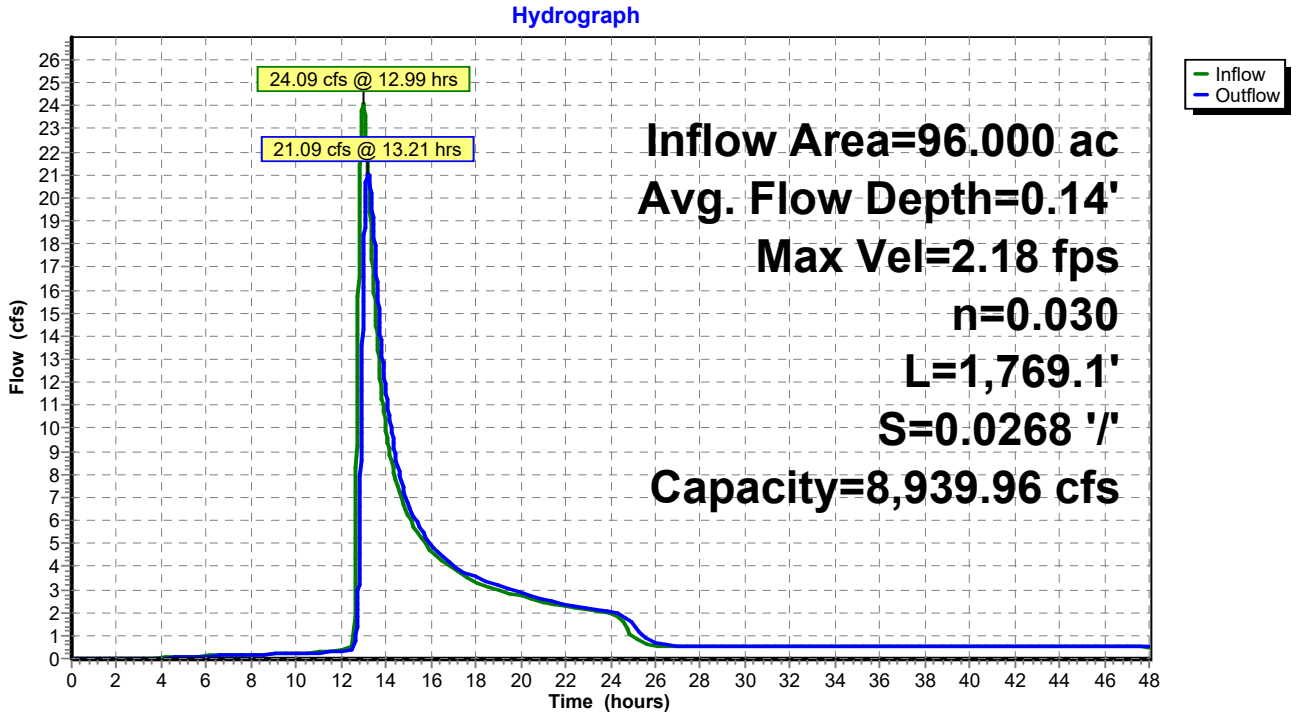
Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Max. Velocity= 2.18 fps, Min. Travel Time= 13.5 min
Avg. Velocity = 1.14 fps, Avg. Travel Time= 25.9 min

Peak Storage= 17,123 cf @ 13.21 hrs
Average Depth at Peak Storage= 0.14' , Surface Width= 70.82'
Bank-Full Depth= 5.00' Flow Area= 425.0 sf, Capacity= 8,939.96 cfs

70.00' x 5.00' deep channel, n= 0.030 Earth, grassed & winding
Side Slope Z-value= 3.0 '/' Top Width= 100.00'
Length= 1,769.1' Slope= 0.0268 '/'
Inlet Invert= 2,087.00', Outlet Invert= 2,039.65'

‡

Reach 6R: POND TO POA



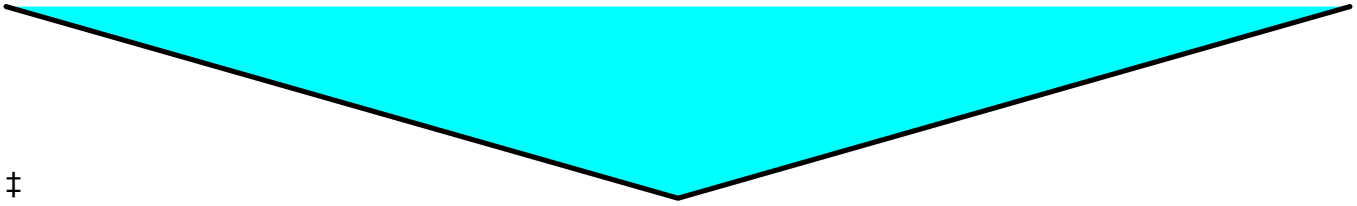
Summary for Reach 8R: REACH COMBINE

Inflow Area = 225.681 ac, Inflow Depth > 0.84" for 2-yr event
Inflow = 77.35 cfs @ 12.24 hrs, Volume= 15.885 af
Outflow = 75.20 cfs @ 12.30 hrs, Volume= 15.882 af, Atten= 3%, Lag= 3.8 min
Routed to Reach 10R : REACH COMBINE 2

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Max. Velocity= 0.90 fps, Min. Travel Time= 3.1 min
Avg. Velocity = 0.64 fps, Avg. Travel Time= 4.4 min

Peak Storage= 14,170 cf @ 12.30 hrs
Average Depth at Peak Storage= 7.82' , Surface Width= 261.15'
Bank-Full Depth= 0.33' Flow Area= 1.8 sf, Capacity= 1.23 cfs

0.00' x 0.33' deep channel, n= 0.030 Earth, grassed & winding
Side Slope Z-value= 16.7 '/' Top Width= 11.02'
Length= 168.8' Slope= 0.0021 '/'
Inlet Invert= 2,036.90', Outlet Invert= 2,036.55'



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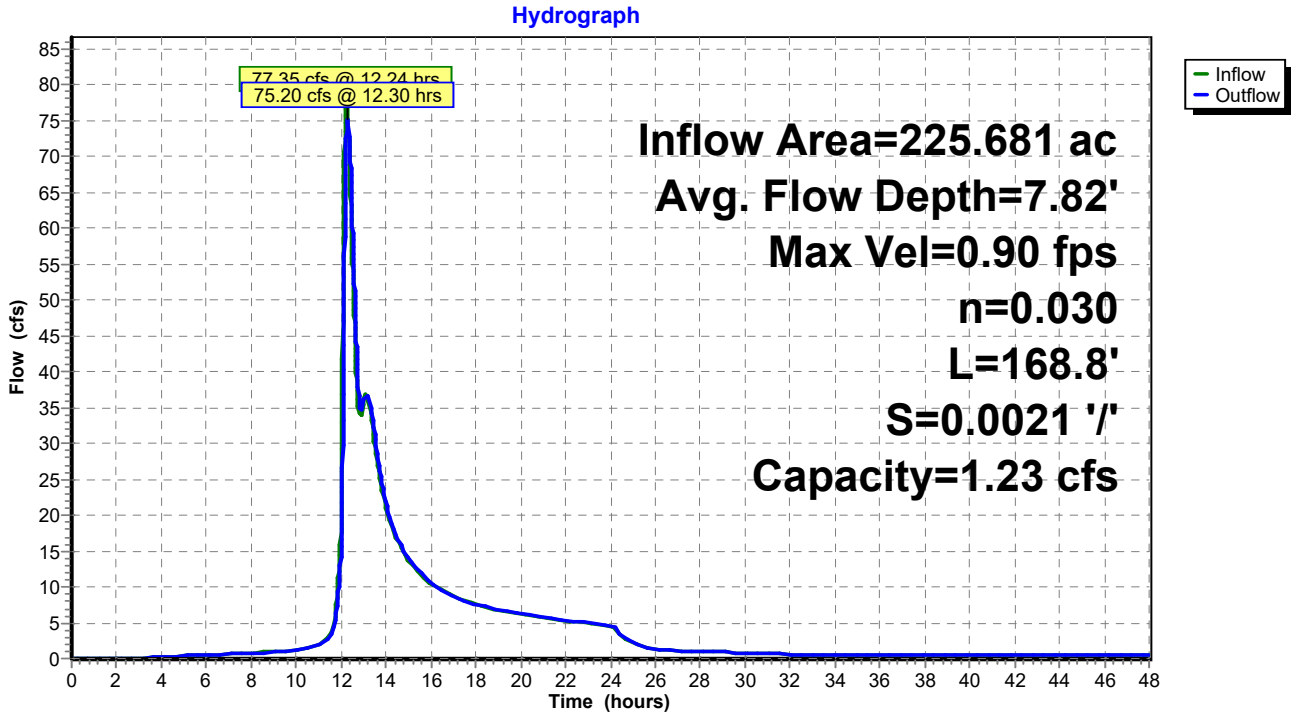
Reach 8R: REACH COMBINE



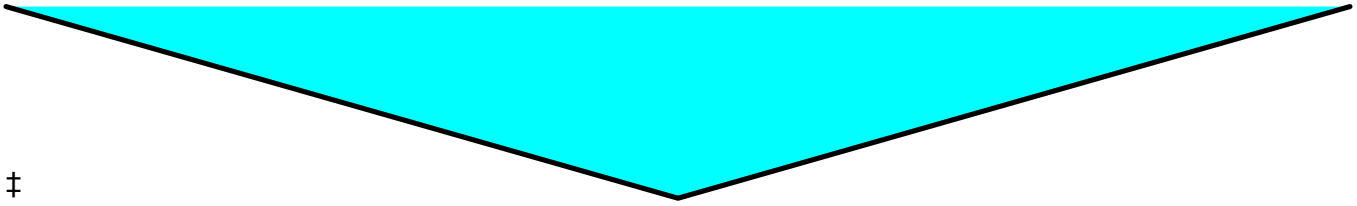
Summary for Reach 9R: DA 3 TO DA 2

Inflow Area = 45.225 ac, Inflow Depth = 1.16" for 2-yr event
Inflow = 55.74 cfs @ 12.11 hrs, Volume= 4.371 af
Outflow = 45.66 cfs @ 12.19 hrs, Volume= 4.371 af, Atten= 18%, Lag= 5.1 min
Routed to Reach 8R : REACH COMBINE

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Max. Velocity= 3.85 fps, Min. Travel Time= 6.3 min
Avg. Velocity = 1.16 fps, Avg. Travel Time= 21.0 min

Peak Storage= 17,315 cf @ 12.19 hrs
Average Depth at Peak Storage= 0.60' , Surface Width= 47.94'
Bank-Full Depth= 0.35' Flow Area= 4.9 sf, Capacity= 15.84 cfs

0.00' x 0.35' deep channel, n= 0.030 Earth, grassed & winding
Side Slope Z-value= 40.0 '/' Top Width= 28.00'
Length= 1,462.0' Slope= 0.0435 '/'
Inlet Invert= 2,103.26', Outlet Invert= 2,039.65'



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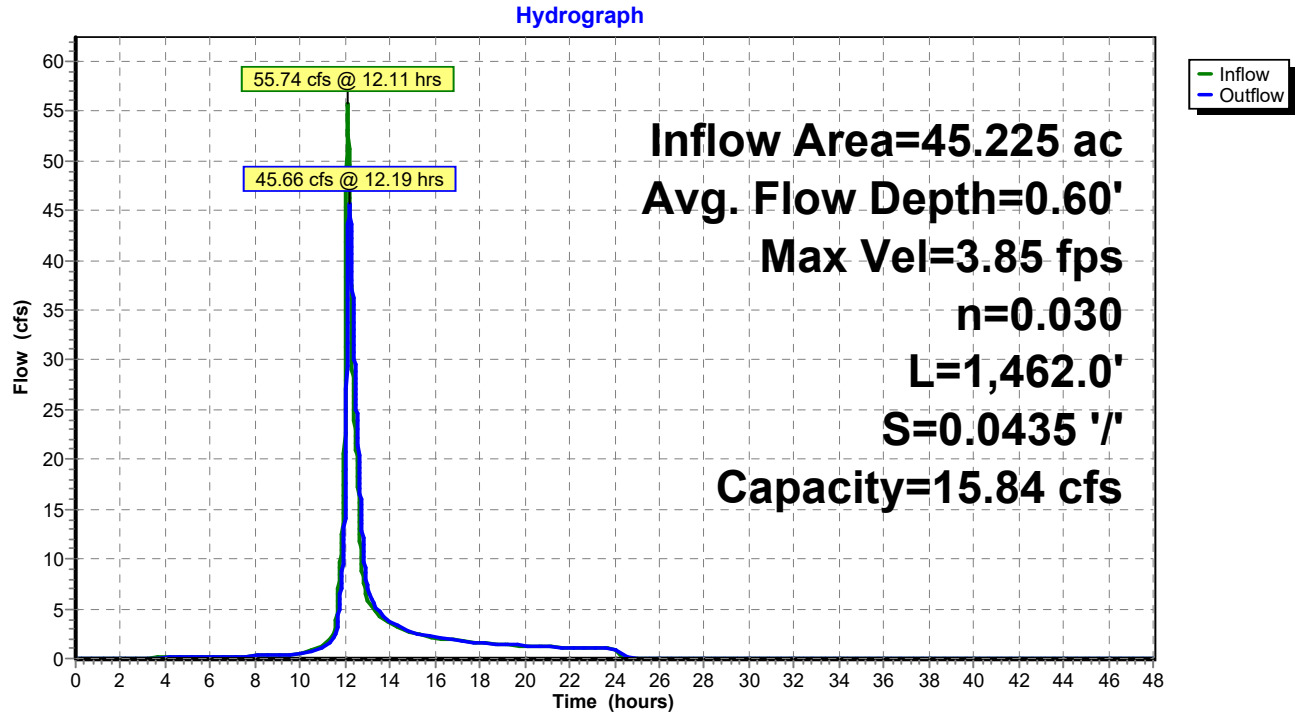
Reach 9R: DA 3 TO DA 2



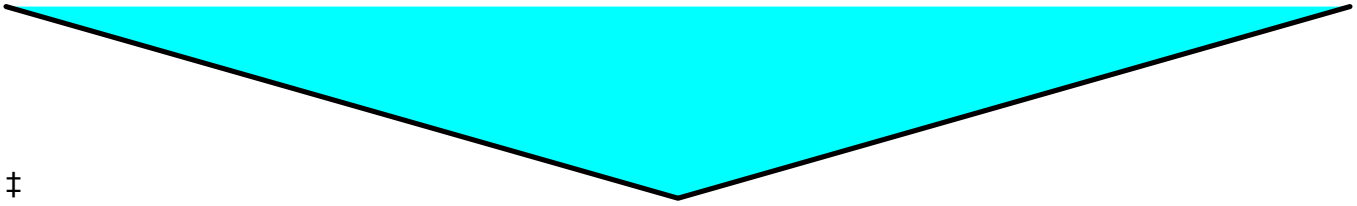
Summary for Reach 10R: REACH COMBINE 2

Inflow Area = 247.742 ac, Inflow Depth > 0.87" for 2-yr event
Inflow = 92.37 cfs @ 12.29 hrs, Volume= 17.977 af
Outflow = 92.13 cfs @ 12.31 hrs, Volume= 17.974 af, Atten= 0%, Lag= 1.1 min
Routed to Link 7L : POA

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Max. Velocity= 1.95 fps, Min. Travel Time= 1.2 min
Avg. Velocity = 0.75 fps, Avg. Travel Time= 3.0 min

Peak Storage= 6,428 cf @ 12.31 hrs
Average Depth at Peak Storage= 0.75' , Surface Width= 132.28'
Bank-Full Depth= 0.59' Flow Area= 30.8 sf, Capacity= 54.02 cfs

0.00' x 0.59' deep channel, n= 0.030 Earth, grassed & winding
Side Slope Z-value= 88.5 '/' Top Width= 104.43'
Length= 136.3' Slope= 0.0064 '/'
Inlet Invert= 2,036.75', Outlet Invert= 2,035.88'



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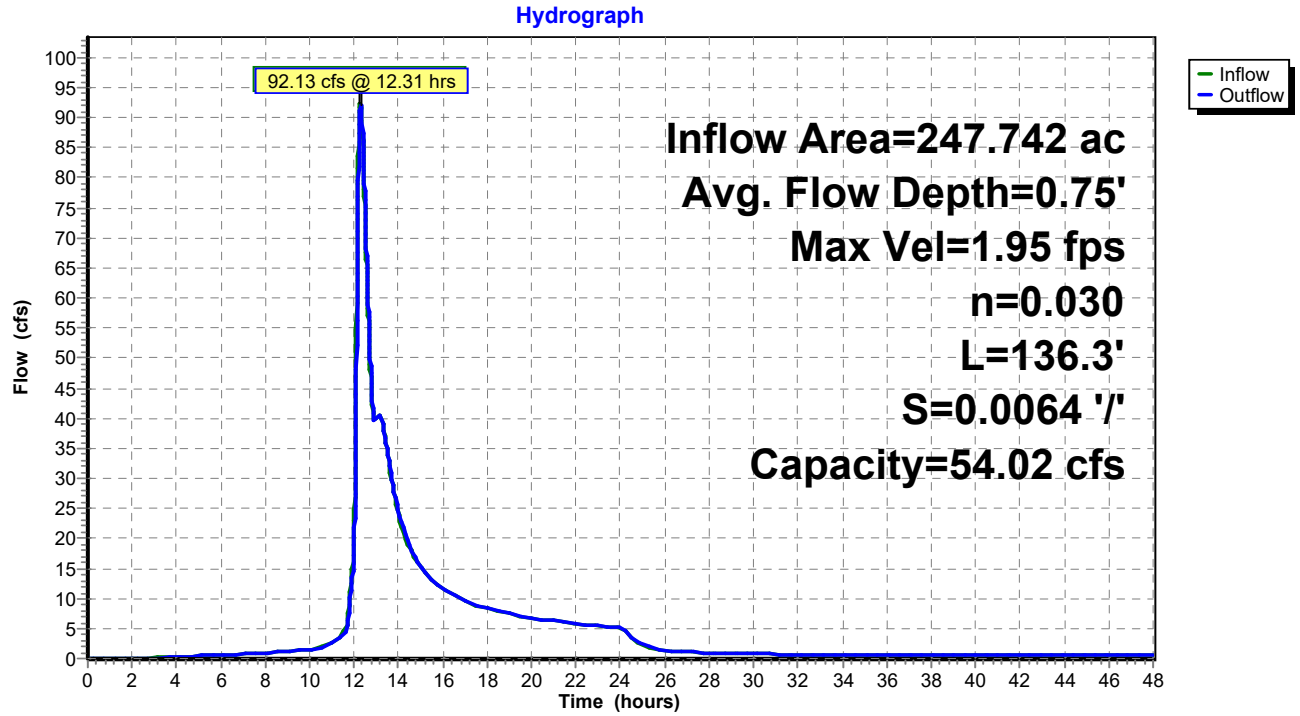
Reach 10R: REACH COMBINE 2



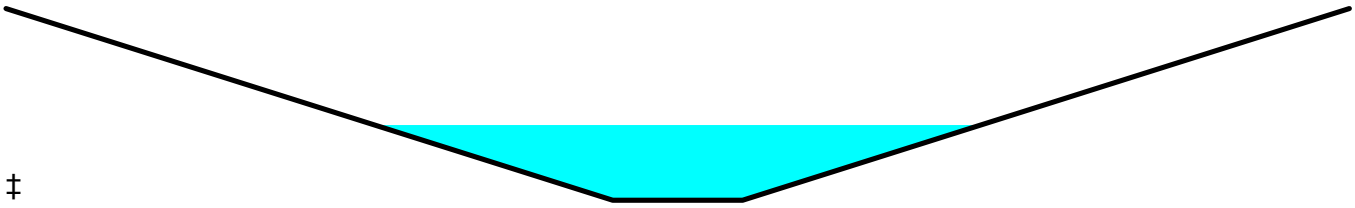
Summary for Reach 11R: DA 4 TO POA

Inflow Area = 13.891 ac, Inflow Depth = 1.36" for 2-yr event
Inflow = 16.15 cfs @ 12.22 hrs, Volume= 1.571 af
Outflow = 15.77 cfs @ 12.26 hrs, Volume= 1.571 af, Atten= 2%, Lag= 2.3 min
Routed to Reach 10R : REACH COMBINE 2

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Max. Velocity= 6.77 fps, Min. Travel Time= 2.9 min
Avg. Velocity = 2.20 fps, Avg. Travel Time= 8.9 min

Peak Storage= 2,740 cf @ 12.26 hrs
Average Depth at Peak Storage= 0.55' , Surface Width= 6.99'
Bank-Full Depth= 1.40' Flow Area= 11.9 sf, Capacity= 140.25 cfs

1.50' x 1.40' deep channel, n= 0.030 Earth, grassed & winding
Side Slope Z-value= 5.0 '/' Top Width= 15.50'
Length= 1,176.1' Slope= 0.0825 '/'
Inlet Invert= 2,133.71', Outlet Invert= 2,036.73'



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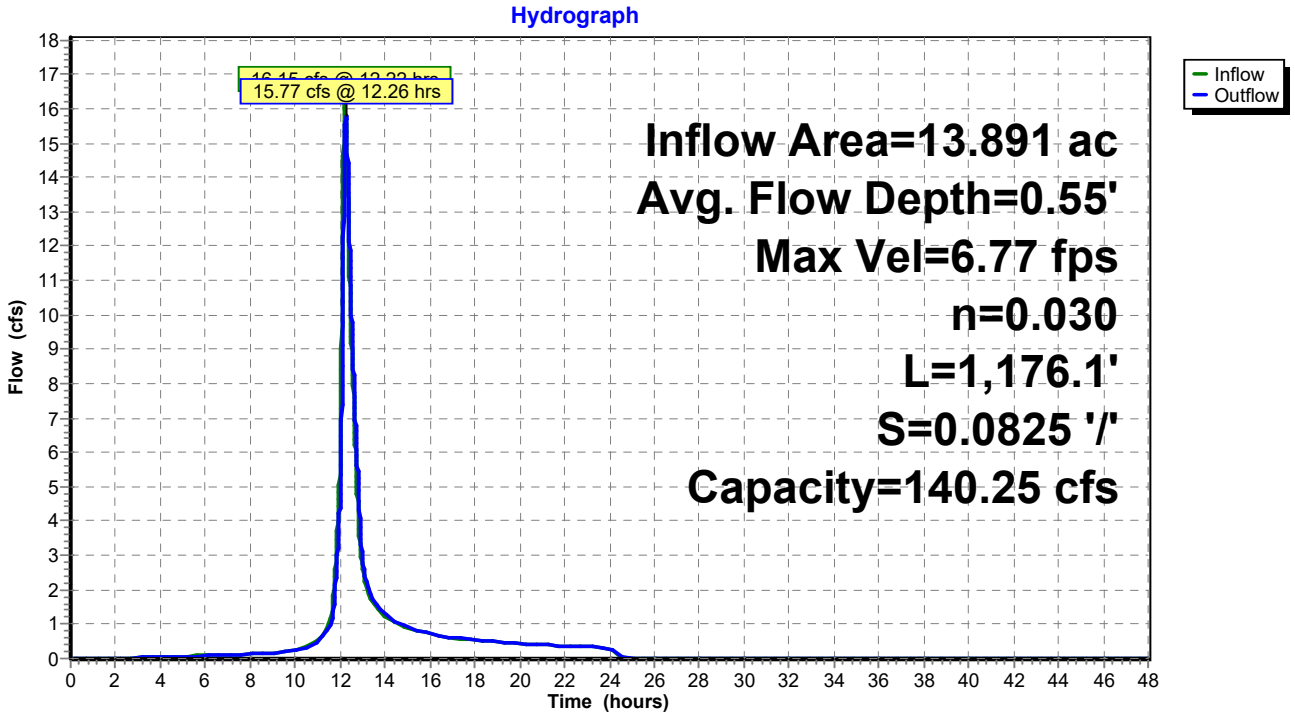
Reach 11R: DA 4 TO POA



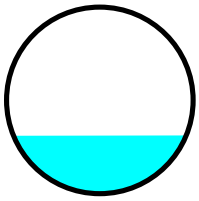
Summary for Reach 12R: DI-7

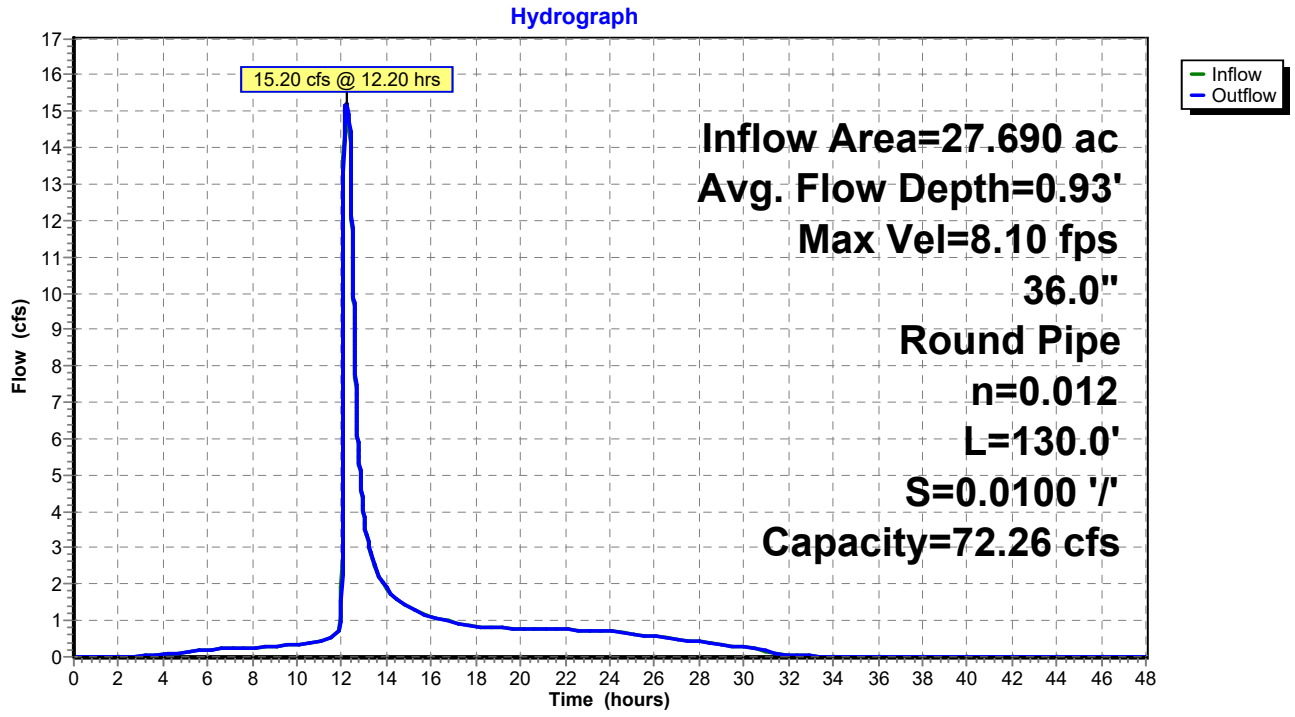
Inflow Area = 27.690 ac, Inflow Depth = 0.97" for 2-yr event
Inflow = 15.20 cfs @ 12.19 hrs, Volume= 2.242 af
Outflow = 15.20 cfs @ 12.20 hrs, Volume= 2.242 af, Atten= 0%, Lag= 0.2 min
Routed to Reach 8R : REACH COMBINE

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Max. Velocity= 8.10 fps, Min. Travel Time= 0.3 min
Avg. Velocity = 2.28 fps, Avg. Travel Time= 0.9 min

Peak Storage= 244 cf @ 12.20 hrs
Average Depth at Peak Storage= 0.93' , Surface Width= 2.78'
Bank-Full Depth= 3.00' Flow Area= 7.1 sf, Capacity= 72.26 cfs

36.0" Round Pipe
n= 0.012
Length= 130.0' Slope= 0.0100 '/'
Inlet Invert= 2,061.30', Outlet Invert= 2,060.00'





Summary for Pond 3P: NSP POND 1

Inflow Area = 96.000 ac, Inflow Depth = 0.96" for 2-yr event
Inflow = 60.25 cfs @ 12.42 hrs, Volume= 7.681 af
Outflow = 24.09 cfs @ 12.99 hrs, Volume= 6.131 af, Atten= 60%, Lag= 34.4 min
Primary = 24.09 cfs @ 12.99 hrs, Volume= 6.131 af
Routed to Reach 6R : POND TO POA

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 2,080.80' @ 12.99 hrs Storage= 140,981 cf

Plug-Flow detention time= 380.0 min calculated for 6.129 af (80% of inflow)
Center-of-Mass det. time= 292.5 min (1,163.3 - 870.8)

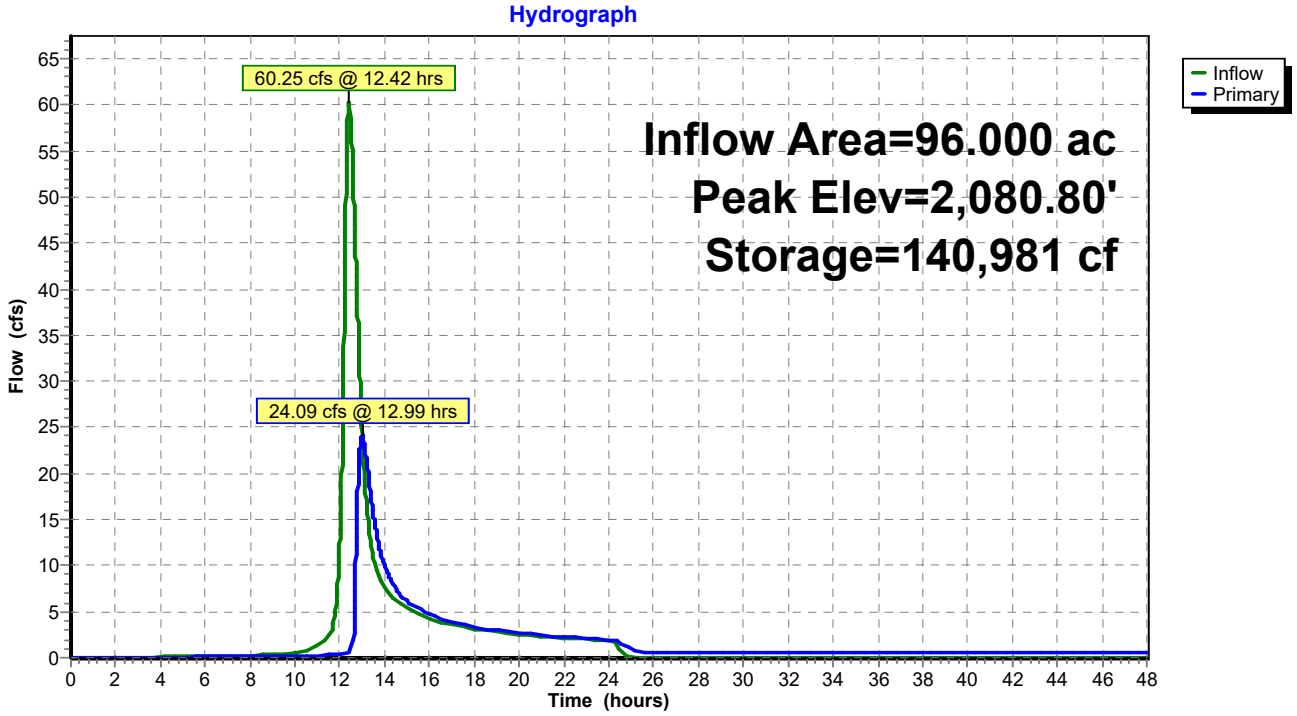
Volume	Invert	Avail.Storage	Storage Description
#1	2,074.75'	392,320 cf	**Custom Stage Data** Listed below

Elevation (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
2,074.75	0	0
2,076.00	2,002	2,002
2,078.00	24,089	26,091
2,080.00	67,305	93,396
2,082.00	119,692	213,088
2,084.00	179,232	392,320

Device	Routing	Invert	Outlet Devices
#1	Primary	2,073.87'	**48.0" Round Culvert** L= 110.4' Ke= 0.600 Inlet / Outlet Invert= 2,073.87' / 2,071.85' S= 0.0183 '/' Cc= 0.900 n= 0.013, Flow Area= 12.57 sf
#2	Device 1	2,074.75'	**3.0" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Device 1	2,080.27'	**72.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#4	Device 1	2,082.20'	**30.0' long x 14.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.64 2.67 2.70 2.65 2.64 2.65 2.65 2.63

Primary OutFlow Max=24.03 cfs @ 12.99 hrs HW=2,080.80' (Free Discharge)
└**1=Culvert** (Passes 24.03 cfs of 125.89 cfs potential flow)
  ├**2=Orifice/Grate** (Orifice Controls 0.58 cfs @ 11.72 fps)
  ├**3=Orifice/Grate** (Weir Controls 23.45 cfs @ 2.37 fps)
  └**4=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 3P: NSP POND 1



Summary for Pond 8P: SWM FACILITY #1

Inflow Area = 27.690 ac, Inflow Depth = 0.97" for 2-yr event
Inflow = 31.52 cfs @ 12.04 hrs, Volume= 2.242 af
Outflow = 15.20 cfs @ 12.19 hrs, Volume= 2.242 af, Atten= 52%, Lag= 9.1 min
Primary = 15.20 cfs @ 12.19 hrs, Volume= 2.242 af
Routed to Reach 12R : DI-7
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Routed to Reach 12R : DI-7

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 2,065.16' @ 12.19 hrs Surf.Area= 10,165 sf Storage= 26,206 cf

Plug-Flow detention time= 153.6 min calculated for 2.241 af (100% of inflow)
Center-of-Mass det. time= 153.7 min (963.5 - 809.7)

Volume	Invert	Avail.Storage	Storage Description
#1	2,061.65'	80,755 cf	**Custom Stage Data (Prismatic)** Listed below

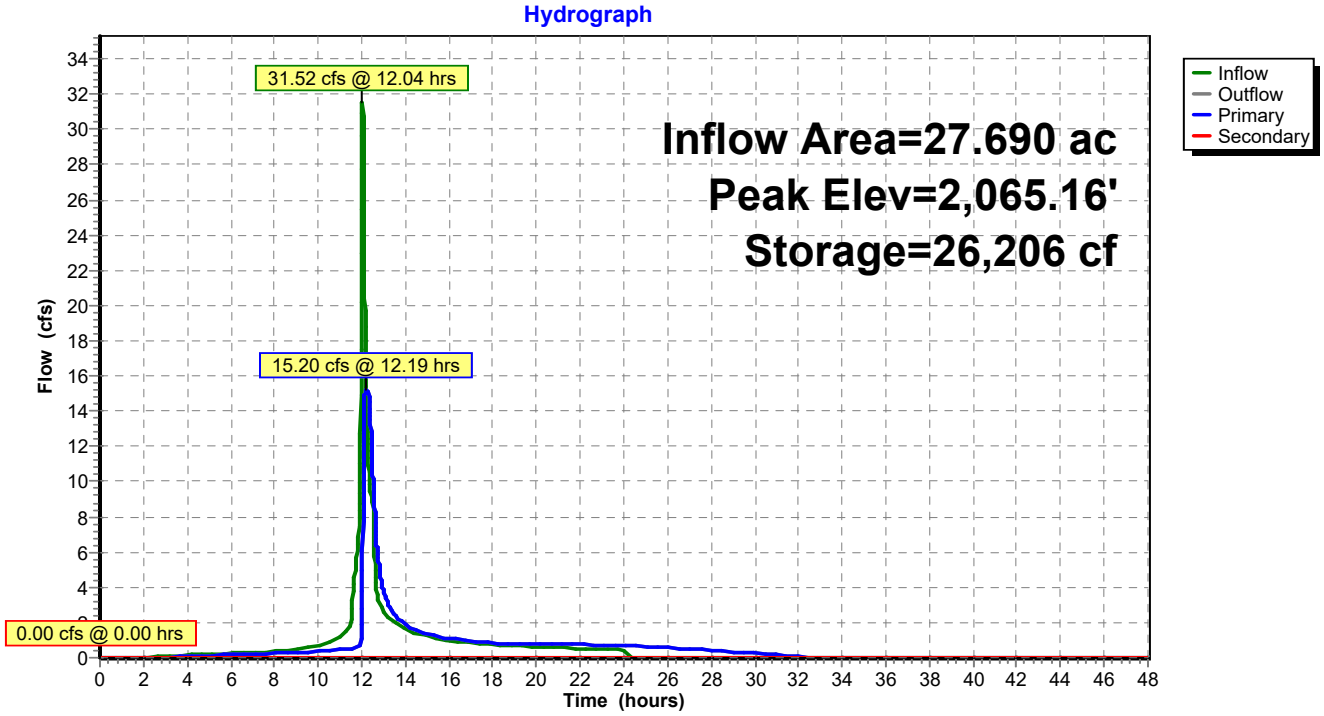
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
2,061.65	0	0	0
2,062.00	5,539	969	969
2,064.00	8,184	13,723	14,692
2,066.00	11,586	19,770	34,462
2,068.00	16,923	28,509	62,971
2,069.00	18,644	17,784	80,755

Device	Routing	Invert	Outlet Devices
#1	Primary	2,061.65'	**18.0" Round RCP_Round 18"** L= 55.0' Ke= 0.200 Inlet / Outlet Invert= 2,061.65' / 2,061.30' S= 0.0064 '/' Cc= 0.900 n= 0.012, Flow Area= 1.77 sf
#2	Device 1	2,061.65'	**4.5" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Device 1	2,064.10'	**24.0" W x 6.0" H Vert. Orifice/Grate X 2.00** C= 0.600 Limited to weir flow at low heads
#4	Device 1	2,064.67'	**48.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#5	Secondary	2,068.25'	**Custom Weir/Orifice, Cv= 2.62 (C= 3.28)** Head (feet) 0.00 2.75 Width (feet) 15.00 31.50

Primary OutFlow Max=15.20 cfs @ 12.19 hrs HW=2,065.16' (Free Discharge)
└─**1=RCP_Round 18"** (Barrel Controls 15.20 cfs @ 8.60 fps)
  ├─**2=Orifice/Grate** (Passes < 0.97 cfs potential flow)
  ├─**3=Orifice/Grate** (Passes < 8.66 cfs potential flow)
  └─**4=Orifice/Grate** (Passes < 14.29 cfs potential flow)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=2,061.65' (Free Discharge)
└─**5=Custom Weir/Orifice** (Controls 0.00 cfs)

Pond 8P: SWM FACILITY #1



Summary for Pond 14P: SWM FACILITY #2

Inflow Area = 6.610 ac, Inflow Depth = 1.02" for 2-yr event
Inflow = 8.00 cfs @ 12.04 hrs, Volume= 0.565 af
Outflow = 1.35 cfs @ 12.60 hrs, Volume= 0.565 af, Atten= 83%, Lag= 33.4 min
Primary = 1.35 cfs @ 12.60 hrs, Volume= 0.565 af
Routed to Reach 8R : REACH COMBINE

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 2,065.30' @ 12.60 hrs Surf.Area= 5,528 sf Storage= 8,344 cf

Plug-Flow detention time= 63.2 min calculated for 0.564 af (100% of inflow)
Center-of-Mass det. time= 63.2 min (868.0 - 804.7)

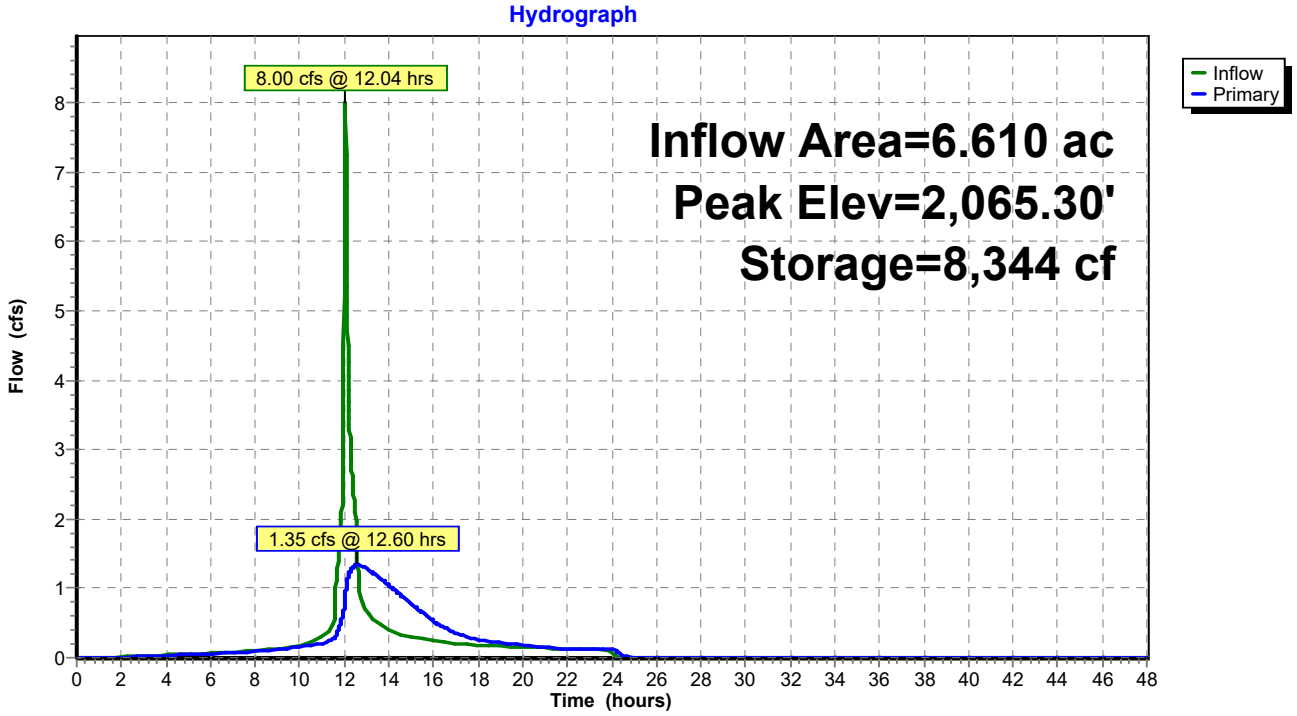
Volume	Invert	Avail.Storage	Storage Description
#1	2,064.00'	27,462 cf	**Custom Stage Data (Prismatic)** Listed below

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
2,064.00	0	0	0
2,064.15	3,262	245	245
2,068.00	10,877	27,218	27,462

Device	Routing	Invert	Outlet Devices
#1	Primary	2,063.80'	**24.0" Round Culvert** L= 63.7' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 2,063.80' / 2,056.00' S= 0.1224 '/' Cc= 0.900 n= 0.013, Flow Area= 3.14 sf
#2	Device 1	2,063.90'	**7.0" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Device 1	2,065.40'	**48.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#4	Primary	2,066.50'	**12.0' long x 12.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.57 2.62 2.70 2.67 2.66 2.67 2.66 2.64

Primary OutFlow Max=1.35 cfs @ 12.60 hrs HW=2,065.30' (Free Discharge)
- **1=Culvert** (Passes 1.35 cfs of 10.49 cfs potential flow)
  - **2=Orifice/Grate** (Orifice Controls 1.35 cfs @ 5.06 fps)
  - **3=Orifice/Grate** (Controls 0.00 cfs)
- **4=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 14P: SWM FACILITY #2



Summary for Pond 16P: SWM FACILITY #3

Inflow Area = 8.170 ac, Inflow Depth = 0.77" for 2-yr event
Inflow = 7.08 cfs @ 12.05 hrs, Volume= 0.524 af
Outflow = 1.80 cfs @ 12.57 hrs, Volume= 0.524 af, Atten= 75%, Lag= 31.2 min
Primary = 1.80 cfs @ 12.57 hrs, Volume= 0.524 af
Routed to Reach 10R : REACH COMBINE 2

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 2,063.53' @ 12.57 hrs Surf.Area= 7,025 sf Storage= 5,663 cf

Plug-Flow detention time= 33.8 min calculated for 0.524 af (100% of inflow)
Center-of-Mass det. time= 33.8 min (868.8 - 835.1)

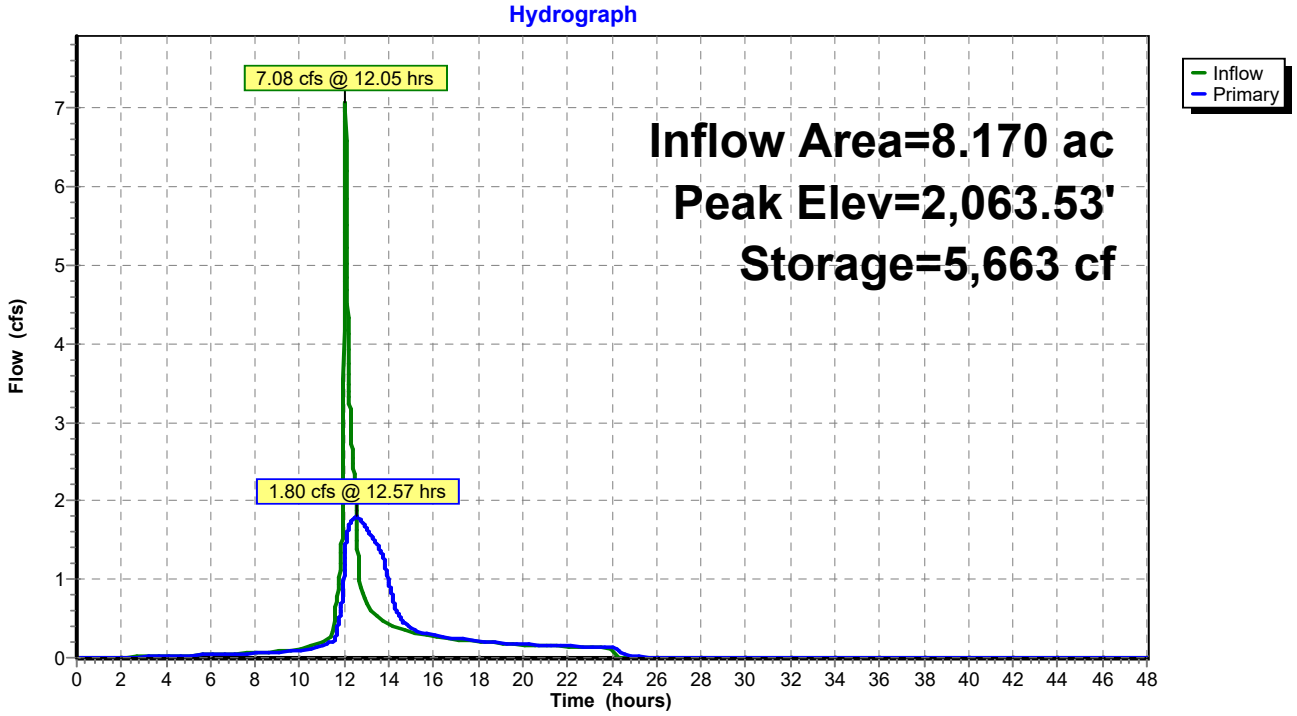
Volume	Invert	Avail.Storage	Storage Description
#1	2,062.15'	71,065 cf	**Custom Stage Data (Prismatic)** Listed below

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
2,062.15	0	0	0
2,063.00	4,695	1,995	1,995
2,064.00	9,065	6,880	8,875
2,065.00	12,134	10,600	19,475
2,066.00	15,548	13,841	33,316
2,067.00	18,123	16,836	50,151
2,068.00	23,705	20,914	71,065

Device	Routing	Invert	Outlet Devices
#1	Primary	2,061.95'	**24.0" Round Culvert** L= 69.8' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 2,061.95' / 2,050.00' S= 0.1712 '/' Cc= 0.900 n= 0.013, Flow Area= 3.14 sf
#2	Device 1	2,062.05'	**8.0" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Device 1	2,065.00'	**48.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#4	Primary	2,066.15'	**12.0' long x 12.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.57 2.62 2.70 2.67 2.66 2.67 2.66 2.64

Primary OutFlow Max=1.80 cfs @ 12.57 hrs HW=2,063.53' (Free Discharge)
- **1=Culvert** (Passes 1.80 cfs of 11.42 cfs potential flow)
  - **2=Orifice/Grate** (Orifice Controls 1.80 cfs @ 5.16 fps)
  - **3=Orifice/Grate** (Controls 0.00 cfs)
- **4=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 16P: SWM FACILITY #3

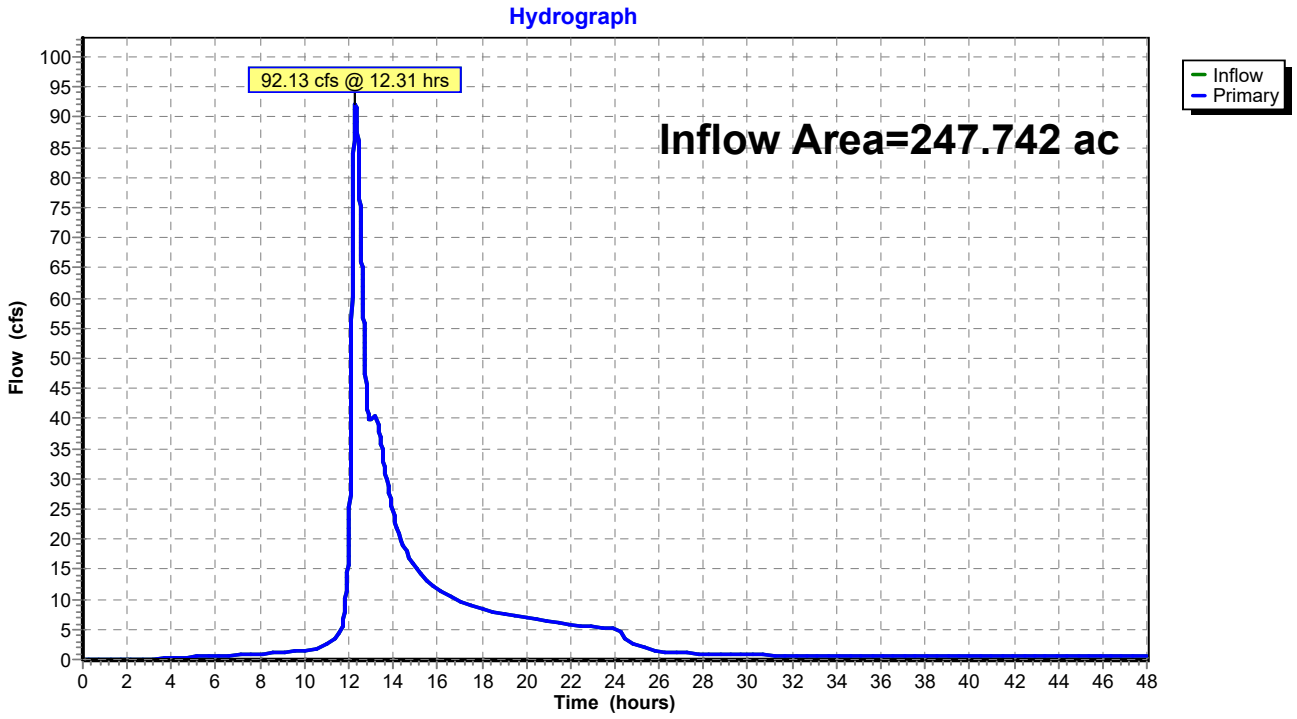


Summary for Link 7L: POA

Inflow Area = 247.742 ac, Inflow Depth > 0.87" for 2-yr event
Inflow = 92.13 cfs @ 12.31 hrs, Volume= 17.974 af
Primary = 92.13 cfs @ 12.31 hrs, Volume= 17.974 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs

Link 7L: POA



Time span=0.00-48.00 hrs, dt=0.01 hrs, 4801 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-Q
Reach routing by Stor-Ind method - Pond routing by Stor-Ind method

Subcatchment1S: DA # 1 Runoff Area=96.000 ac Runoff Depth=1.93"
Tc=30.8 min CN=WQ Runoff=122.59 cfs 15.453 af

Subcatchment8S: DA #3 OFF-SITE PORTION Runoff Area=44.547 ac Runoff Depth=2.22"
Flow Length=2,089' Tc=11.1 min CN=WQ Runoff=101.55 cfs 8.228 af

Subcatchment9S: DA TO SWM FACILITY#1 Runoff Area=27.690 ac Runoff Depth=1.92"
Tc=6.0 min CN=WQ Runoff=63.32 cfs 4.442 af

Subcatchment10S: DA #4 Runoff Area=13.891 ac Runoff Depth=2.47"
Flow Length=2,526' Tc=18.9 min CN=WQ Runoff=28.36 cfs 2.857 af

Subcatchment11S: DA #2 Runoff Area=50.156 ac Runoff Depth=1.46"
Flow Length=1,801' Tc=25.7 min CN=71 Runoff=51.41 cfs 6.086 af

Subcatchment12S: DA #3 ON-SITE PORTION Runoff Area=0.678 ac Runoff Depth=1.50"
Flow Length=2,089' Tc=11.1 min CN=WQ Runoff=0.93 cfs 0.085 af

Subcatchment13S: DA TO SWM FACILITY#2 Runoff Area=6.610 ac Runoff Depth=1.97"
Tc=6.0 min CN=WQ Runoff=15.40 cfs 1.086 af

Subcatchment15S: DA TO SWM FACILITY#3 Runoff Area=8.170 ac Runoff Depth=1.75"
Tc=6.0 min CN=WQ Runoff=17.37 cfs 1.192 af

Reach 6R: POND TO POA Avg. Flow Depth=0.33' Max Vel=3.85 fps Inflow=94.64 cfs 13.887 af
n=0.030 L=1,769.1' S=0.0268 '/' Capacity=8,939.96 cfs Outflow=90.31 cfs 13.869 af

Reach 8R: REACH COMBINE Avg. Flow Depth=17.90' Max Vel=0.90 fps Inflow=177.19 cfs 33.795 af
n=0.030 L=168.8' S=0.0021 '/' Capacity=1.23 cfs Outflow=174.76 cfs 33.792 af

Reach 9R: DA 3 TO DA 2 Avg. Flow Depth=0.93' Max Vel=4.05 fps Inflow=102.48 cfs 8.313 af
n=0.030 L=1,462.0' S=0.0435 '/' Capacity=15.84 cfs Outflow=85.14 cfs 8.313 af

Reach 10R: REACH COMBINE 2 Avg. Flow Depth=1.15' Max Vel=2.13 fps Inflow=190.04 cfs 37.841 af
n=0.030 L=136.3' S=0.0064 '/' Capacity=54.02 cfs Outflow=189.80 cfs 37.838 af

Reach 11R: DA 4 TO POA Avg. Flow Depth=0.71' Max Vel=7.83 fps Inflow=28.36 cfs 2.857 af
n=0.030 L=1,176.1' S=0.0825 '/' Capacity=140.25 cfs Outflow=27.90 cfs 2.857 af

Reach 12R: DI-7 Avg. Flow Depth=1.11' Max Vel=8.85 fps Inflow=20.94 cfs 4.442 af
36.0" Round Pipe n=0.012 L=130.0' S=0.0100 '/' Capacity=72.26 cfs Outflow=20.94 cfs 4.442 af

Pond 3P: NSP POND 1 Peak Elev=2,081.60' Storage=188,863 cf Inflow=122.59 cfs 15.453 af
Outflow=94.64 cfs 13.887 af

Pond 8P: SWM FACILITY#1 Peak Elev=2,067.28' Storage=52,762 cf Inflow=63.32 cfs 4.442 af
Primary=20.94 cfs 4.442 af Secondary=0.00 cfs 0.000 af Outflow=20.94 cfs 4.442 af

Pond 14P: SWM FACILITY#2 Peak Elev=2,065.71' Storage=11,281 cf Inflow=15.40 cfs 1.086 af
Outflow=8.73 cfs 1.086 af

Pond 16P: SWM FACILITY#3 Peak Elev=2,064.90' Storage=18,367 cf Inflow=17.37 cfs 1.192 af
Outflow=2.66 cfs 1.192 af

Link 7L: POA Inflow=189.80 cfs 37.838 af
Primary=189.80 cfs 37.838 af

Total Runoff Area = 247.742 ac Runoff Volume = 39.429 af Average Runoff Depth = 1.91"

Summary for Subcatchment 1S: DA # 1

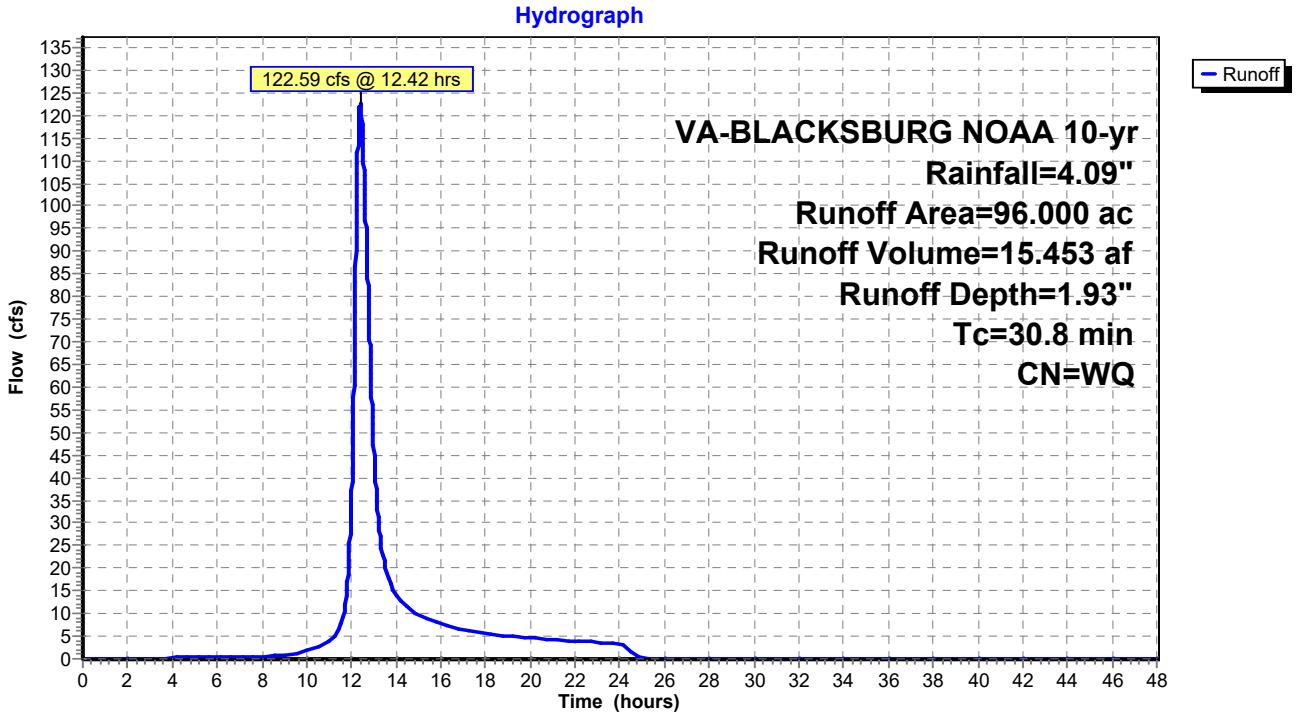
Runoff = 122.59 cfs @ 12.42 hrs, Volume= 15.453 af, Depth= 1.93"
Routed to Pond 3P : NSP POND 1

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
VA-BLACKSBURG NOAA 10-yr Rainfall=4.09"

Area (ac)	CN	Description
5.080	98	Roofs, HSG C
3.100	84	50-75% Grass cover, Fair, HSG D
22.720	79	50-75% Grass cover, Fair, HSG C
28.800	69	50-75% Grass cover, Fair, HSG B
1.000	86	1/3 acre lots, 30% imp, HSG D
10.400	81	1/3 acre lots, 30% imp, HSG C
6.400	72	1/3 acre lots, 30% imp, HSG B
10.300	83	1/4 acre lots, 38% imp, HSG C
8.200	75	1/4 acre lots, 38% imp, HSG B
96.000		Weighted Average

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
30.8					**Direct Entry, FROM NSP CALCS**

Subcatchment 1S: DA # 1



Summary for Subcatchment 8S: DA #3 OFF-SITE PORTION

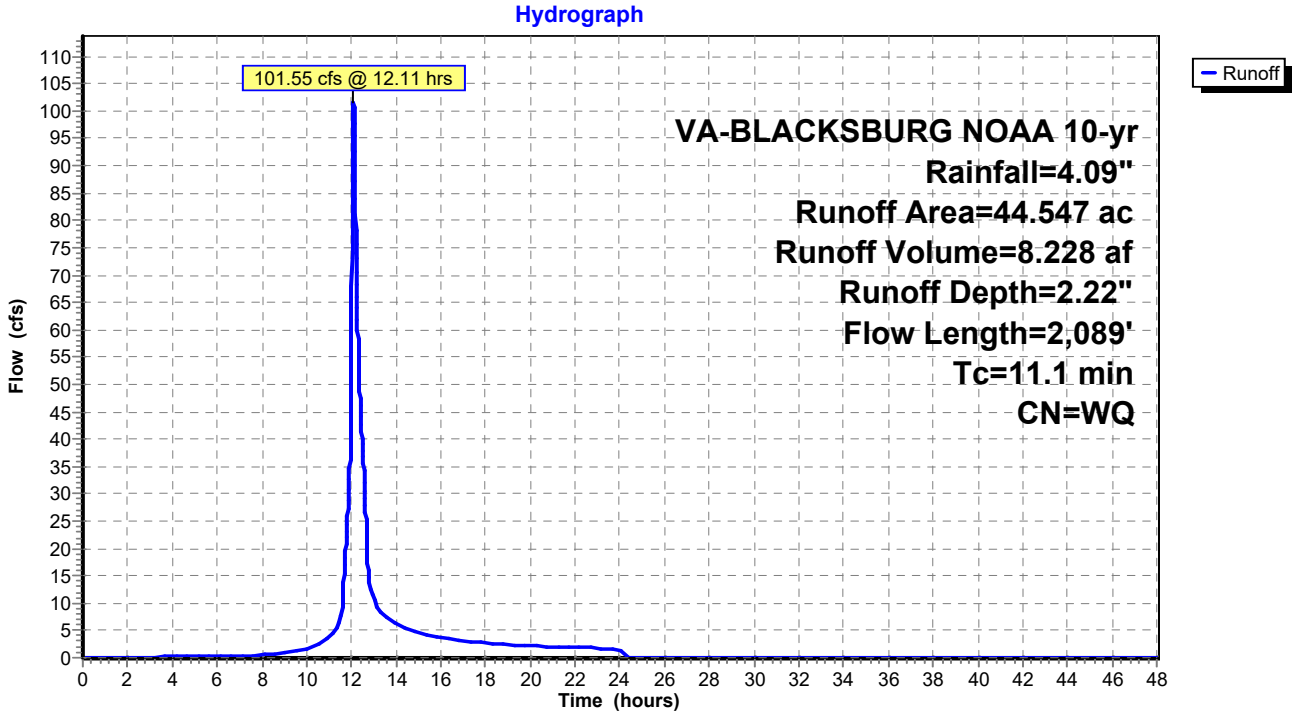
Runoff = 101.55 cfs @ 12.11 hrs, Volume= 8.228 af, Depth= 2.22"
Routed to Reach 9R : DA 3 TO DA 2

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
VA-BLACKSBURG NOAA 10-yr Rainfall=4.09"

Area (ac)	CN	Description
0.358	98	Paved roads w/curbs & sewers, HSG B
4.733	98	Paved roads w/curbs & sewers, HSG C
5.726	70	1/2 acre lots, 25% imp, HSG B
28.476	80	1/2 acre lots, 25% imp, HSG C
0.877	72	1/3 acre lots, 30% imp, HSG B
3.986	81	1/3 acre lots, 30% imp, HSG C
0.391	79	1 acre lots, 20% imp, HSG C
44.547		Weighted Average

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.7	95	0.0630	0.28		**Sheet Flow, Tc1** Range n= 0.130 P2= 2.76"
1.3	435	0.1125	5.44	40.82	**Channel Flow, Tc2** Area= 7.5 sf Perim= 40.0' r= 0.19' n= 0.030 Earth, grassed & winding
2.2	602	0.0830	4.64		**Shallow Concentrated Flow, Tc3** Unpaved Kv= 16.1 fps
0.6	301	0.0565	8.57	342.85	**Channel Flow, Tc4** Area= 40.0 sf Perim= 64.4' r= 0.62' n= 0.030 Earth, grassed & winding
0.1	215	0.0744	27.88	197.09	**Pipe Channel, Tc5** 36.0" Round Area= 7.1 sf Perim= 9.4' r= 0.75' n= 0.012 Concrete pipe, finished
1.2	441	0.0603	6.33	189.76	**Channel Flow, Tc6** Area= 30.0 sf Perim= 80.0' r= 0.38' n= 0.030 Earth, grassed & winding
11.1	2,089	Total			

Subcatchment 8S: DA #3 OFF-SITE PORTION



Summary for Subcatchment 9S: DA TO SWM FACILITY #1

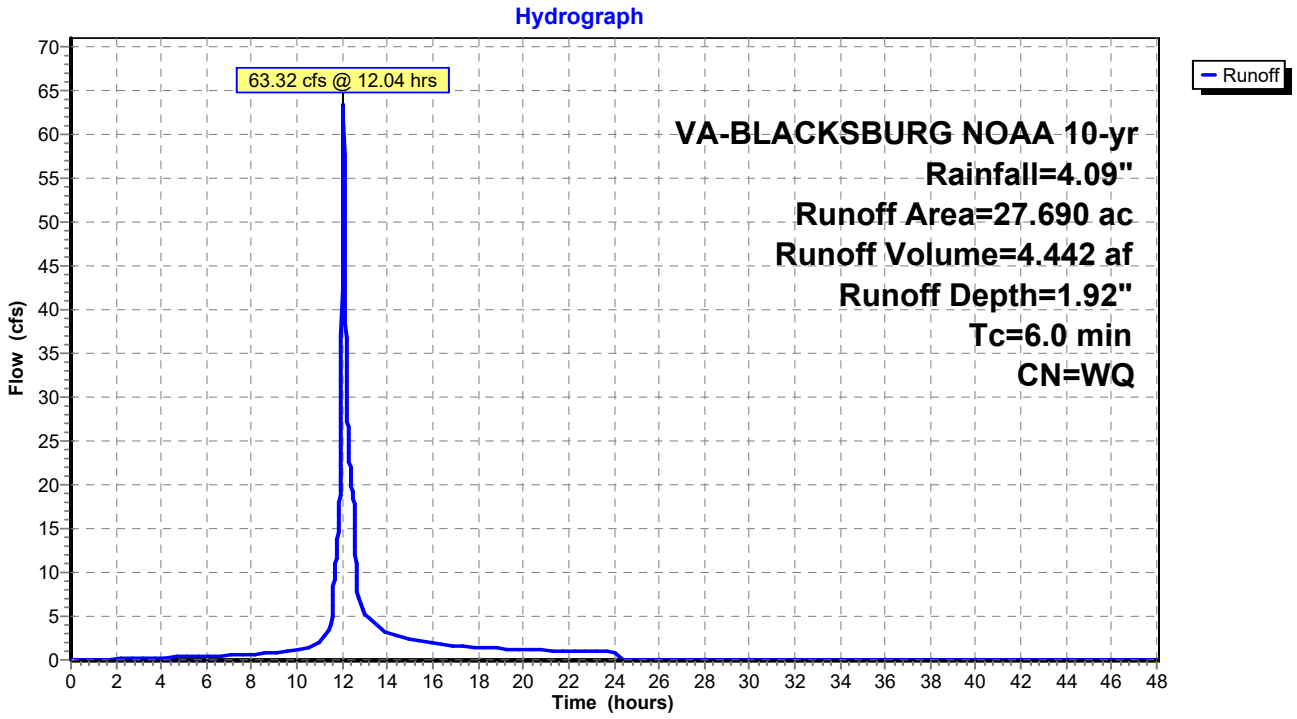
Runoff = 63.32 cfs @ 12.04 hrs, Volume= 4.442 af, Depth= 1.92"
Routed to Pond 8P : SWM FACILITY #1

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
VA-BLACKSBURG NOAA 10-yr Rainfall=4.09"

	Area (ac)	CN	Description
	8.410	61	>75% Grass cover, Good, HSG B
	3.440	74	>75% Grass cover, Good, HSG C
	4.930	98	Impervious, HSG B
	2.030	98	Impervious, HSG C
*	8.880	72	VRRM DA A
	27.690		Weighted Average

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, TR-55 MIN.**

Subcatchment 9S: DA TO SWM FACILITY #1



Summary for Subcatchment 10S: DA #4

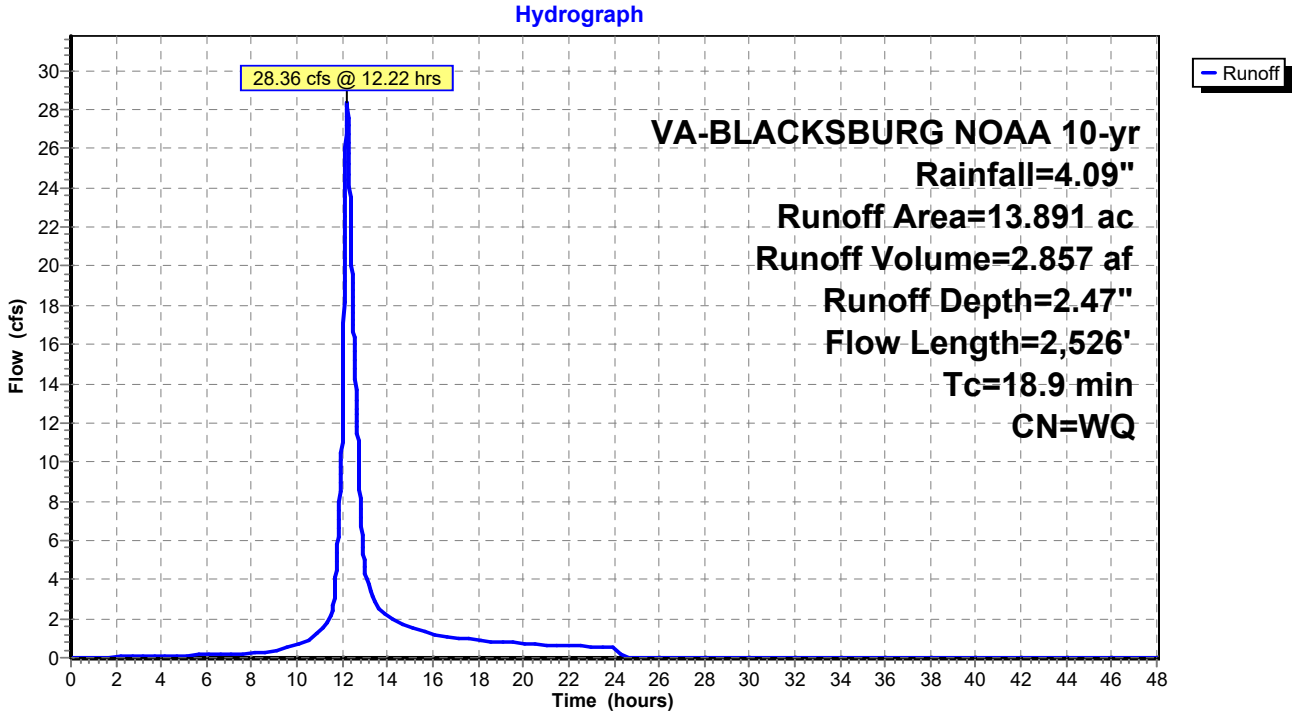
Runoff = 28.36 cfs @ 12.22 hrs, Volume= 2.857 af, Depth= 2.47"
Routed to Reach 11R : DA 4 TO POA

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
VA-BLACKSBURG NOAA 10-yr Rainfall=4.09"

Area (ac)	CN	Description
2.555	98	Paved roads w/curbs & sewers, HSG C
7.333	81	1/3 acre lots, 30% imp, HSG C
3.803	80	1/2 acre lots, 25% imp, HSG C
0.200	70	1/2 acre lots, 25% imp, HSG B
13.891		Weighted Average

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.4	95	0.0630	0.25		**Sheet Flow, Tc1** Grass: Short n= 0.150 P2= 2.76"
9.9	1,004	0.0478	1.70	5.26	**Channel Flow, Tc2** Area= 3.1 sf Perim= 50.0' r= 0.06' n= 0.030 Earth, grassed & winding
2.6	1,427	0.0134	9.03	28.37	**Pipe Channel, CMP_Round 24"** 24.0" Round Area= 3.1 sf Perim= 6.3' r= 0.50' n= 0.012 Concrete pipe, finished
18.9	2,526	Total			

Subcatchment 10S: DA #4



Summary for Subcatchment 11S: DA #2

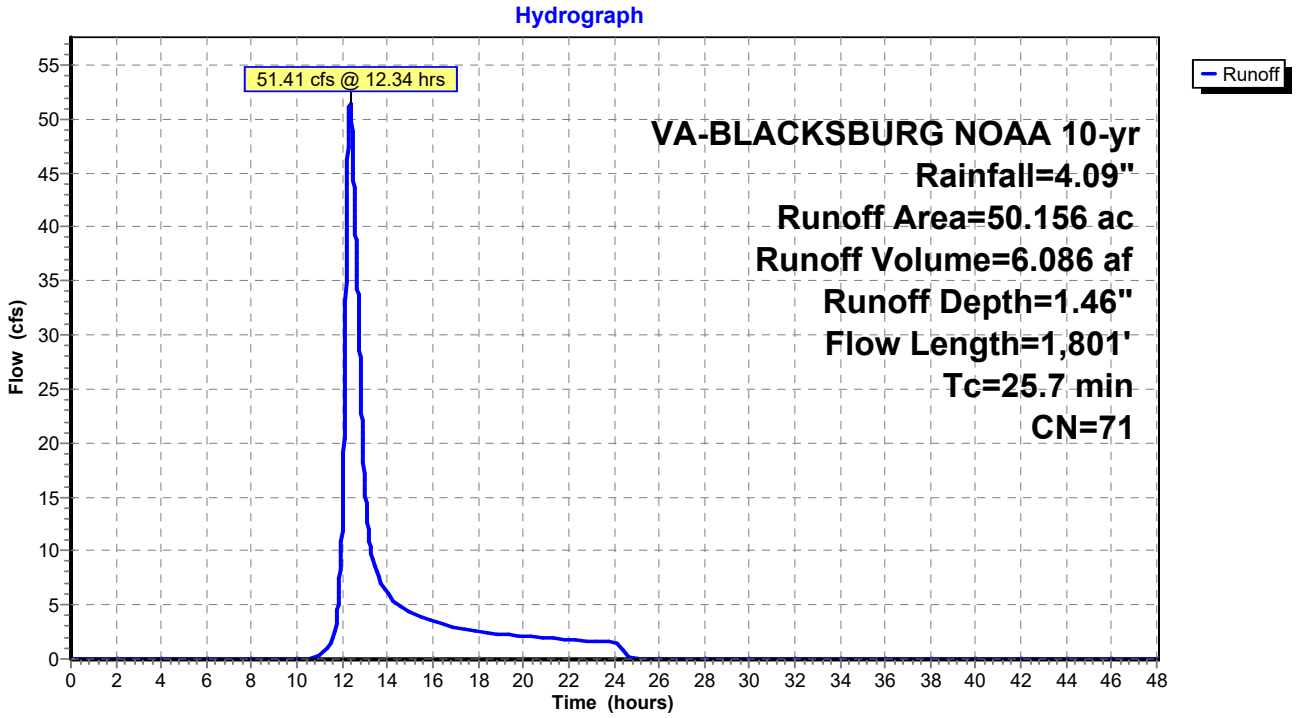
Runoff = 51.41 cfs @ 12.34 hrs, Volume= 6.086 af, Depth= 1.46"
Routed to Reach 8R : REACH COMBINE

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
VA-BLACKSBURG NOAA 10-yr Rainfall=4.09"

	Area (ac)	CN	Description
*	50.156	71	

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.0	100	0.0400	0.21		**Sheet Flow, Tc1** Grass: Short n= 0.150 P2= 2.76"
17.7	1,701	0.0523	1.60		**Shallow Concentrated Flow, Tc2** Short Grass Pasture Kv= 7.0 fps
25.7	1,801	Total			

Subcatchment 11S: DA #2



Summary for Subcatchment 12S: DA #3 ON-SITE PORTION

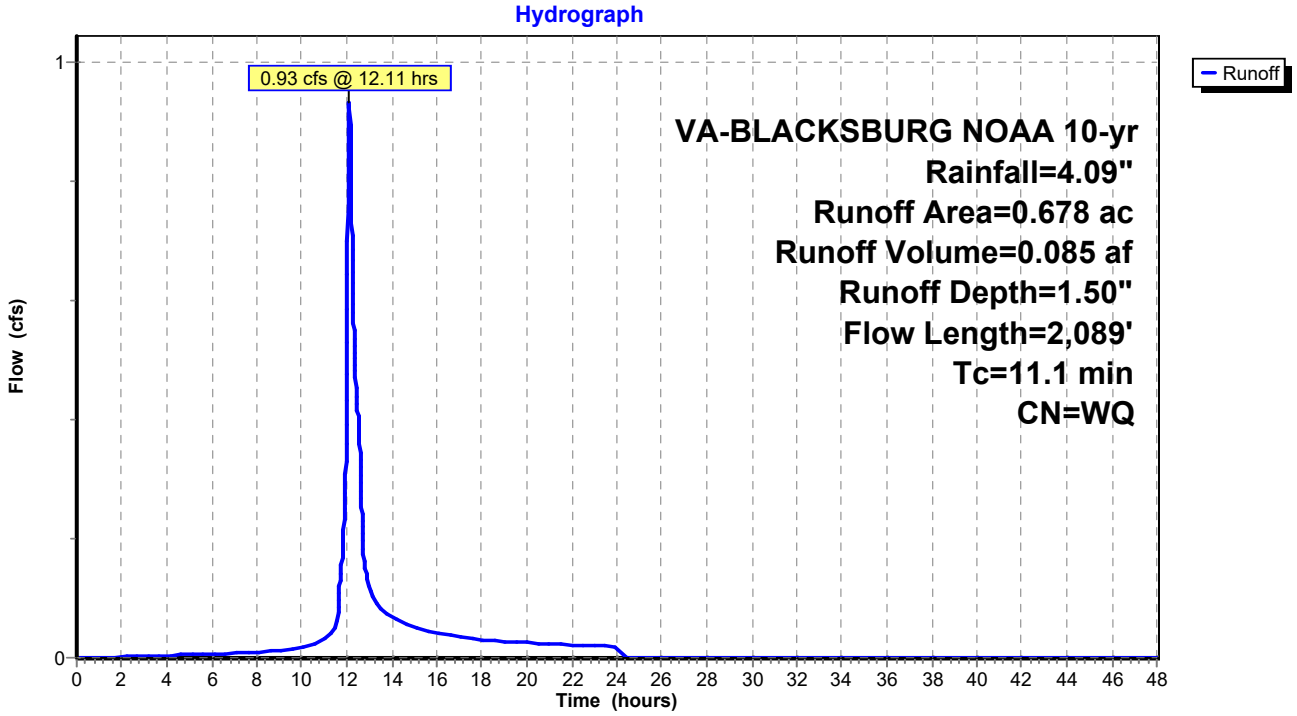
Runoff = 0.93 cfs @ 12.11 hrs, Volume= 0.085 af, Depth= 1.50"
Routed to Reach 9R : DA 3 TO DA 2

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
VA-BLACKSBURG NOAA 10-yr Rainfall=4.09"

Area (ac)	CN	Description
0.061	98	Paved roads w/curbs & sewers, HSG B
0.042	98	Paved roads w/curbs & sewers, HSG C
0.055	83	1/4 acre lots, 38% imp, HSG C
0.057	74	>75% Grass cover, Good, HSG C
0.463	61	>75% Grass cover, Good, HSG B
0.678		Weighted Average

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.7	95	0.0630	0.28		**Sheet Flow, Tc1** Range n= 0.130 P2= 2.76"
1.3	435	0.1125	5.44	40.82	**Channel Flow, Tc2** Area= 7.5 sf Perim= 40.0' r= 0.19' n= 0.030 Earth, grassed & winding
2.2	602	0.0830	4.64		**Shallow Concentrated Flow, Tc3** Unpaved Kv= 16.1 fps
0.6	301	0.0565	8.57	342.85	**Channel Flow, Tc4** Area= 40.0 sf Perim= 64.4' r= 0.62' n= 0.030 Earth, grassed & winding
0.1	215	0.0744	27.88	197.09	**Pipe Channel, Tc5** 36.0" Round Area= 7.1 sf Perim= 9.4' r= 0.75' n= 0.012 Concrete pipe, finished
1.2	441	0.0603	6.33	189.76	**Channel Flow, Tc6** Area= 30.0 sf Perim= 80.0' r= 0.38' n= 0.030 Earth, grassed & winding
11.1	2,089	Total			

Subcatchment 12S: DA #3 ON-SITE PORTION



Summary for Subcatchment 13S: DA TO SWM FACILITY #2

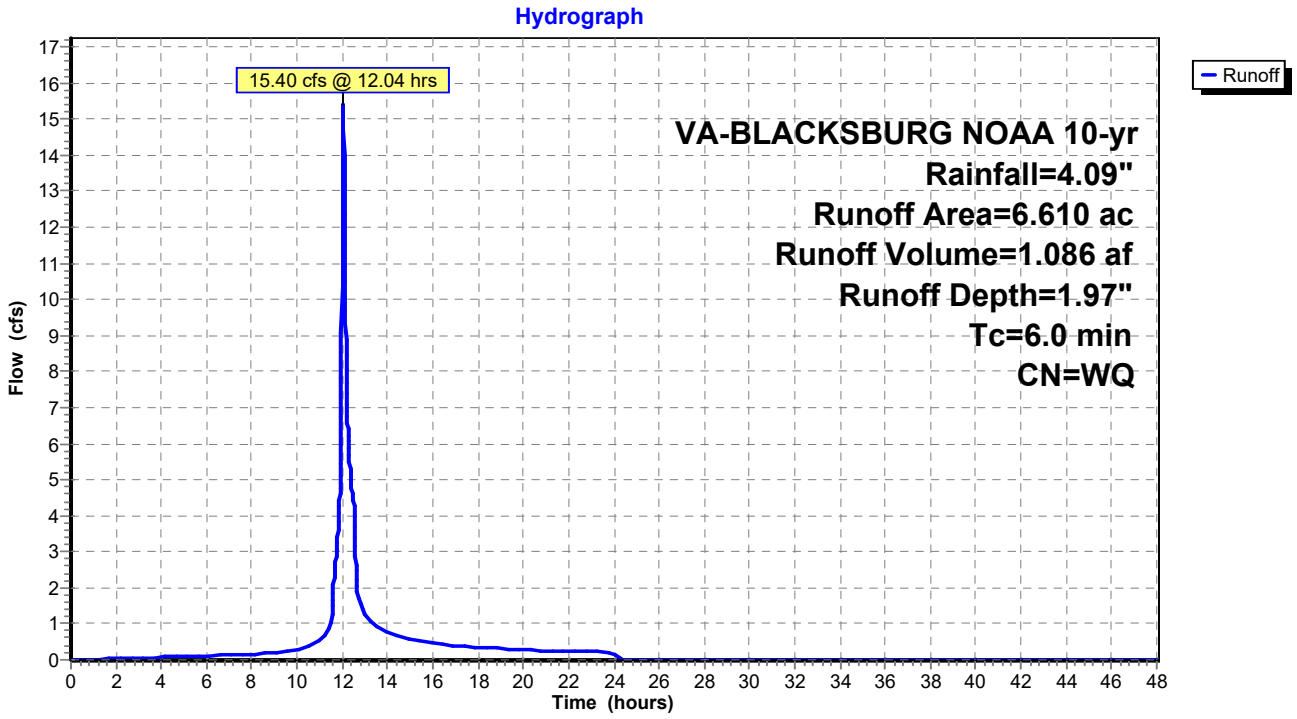
Runoff = 15.40 cfs @ 12.04 hrs, Volume= 1.086 af, Depth= 1.97"
Routed to Pond 14P : SWM FACILITY #2

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
VA-BLACKSBURG NOAA 10-yr Rainfall=4.09"

	Area (ac)	CN	Description
	2.230	61	>75% Grass cover, Good, HSG B
	0.910	74	>75% Grass cover, Good, HSG C
*	1.310	98	Impervious, HSG B
	0.540	98	Impervious, HSG C
*	1.620	72	VRRM AREA B
	6.610		Weighted Average

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, TR-55 MIN.**

Subcatchment 13S: DA TO SWM FACILITY #2



Summary for Subcatchment 15S: DA TO SWM FACILITY #3

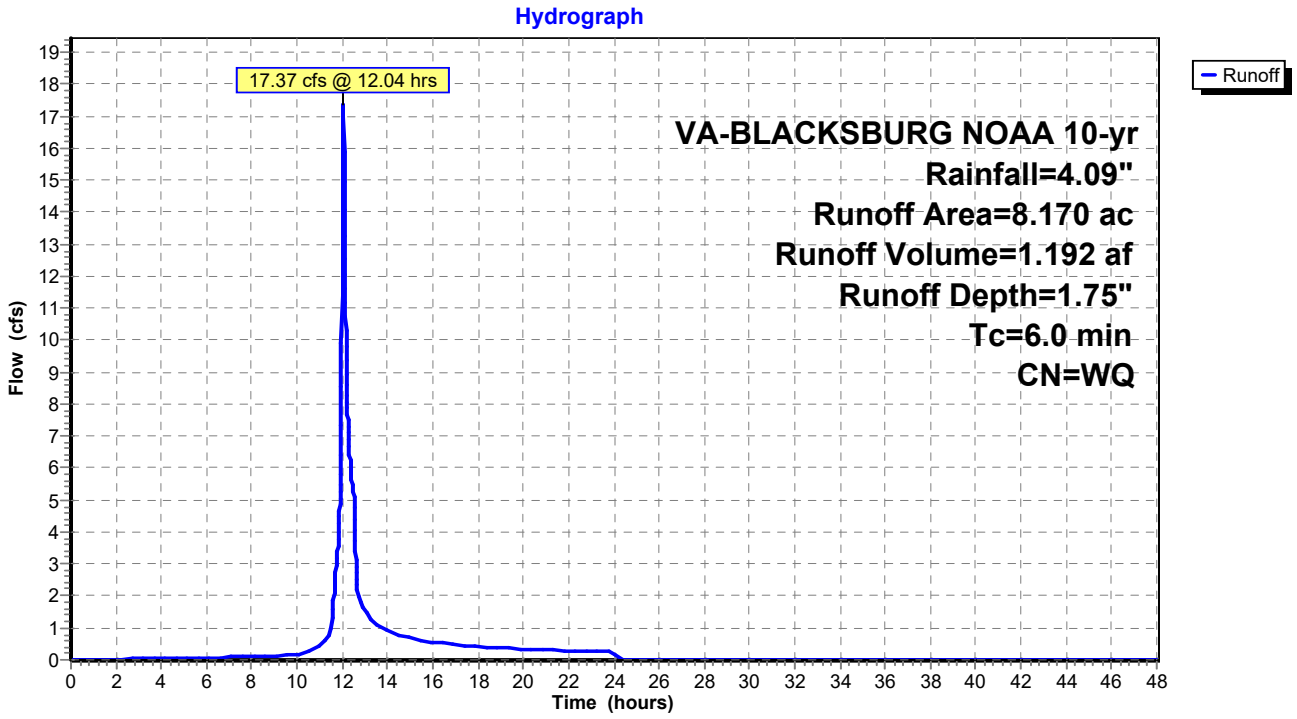
Runoff = 17.37 cfs @ 12.04 hrs, Volume= 1.192 af, Depth= 1.75"
Routed to Pond 16P : SWM FACILITY #3

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
VA-BLACKSBURG NOAA 10-yr Rainfall=4.09"

	Area (ac)	CN	Description
	1.430	61	>75% Grass cover, Good, HSG B
	0.580	74	>75% Grass cover, Good, HSG C
	0.840	98	Impervious, HSG B
	0.330	98	Impervious, HSG C
*	4.990	72	VRRM AREA C
	8.170		Weighted Average

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, TR-55 MIN.**

Subcatchment 15S: DA TO SWM FACILITY #3



Summary for Reach 6R: POND TO POA

Inflow Area = 96.000 ac, Inflow Depth > 1.74" for 10-yr event
Inflow = 94.64 cfs @ 12.65 hrs, Volume= 13.887 af
Outflow = 90.31 cfs @ 12.76 hrs, Volume= 13.869 af, Atten= 5%, Lag= 6.6 min
Routed to Reach 8R : REACH COMBINE

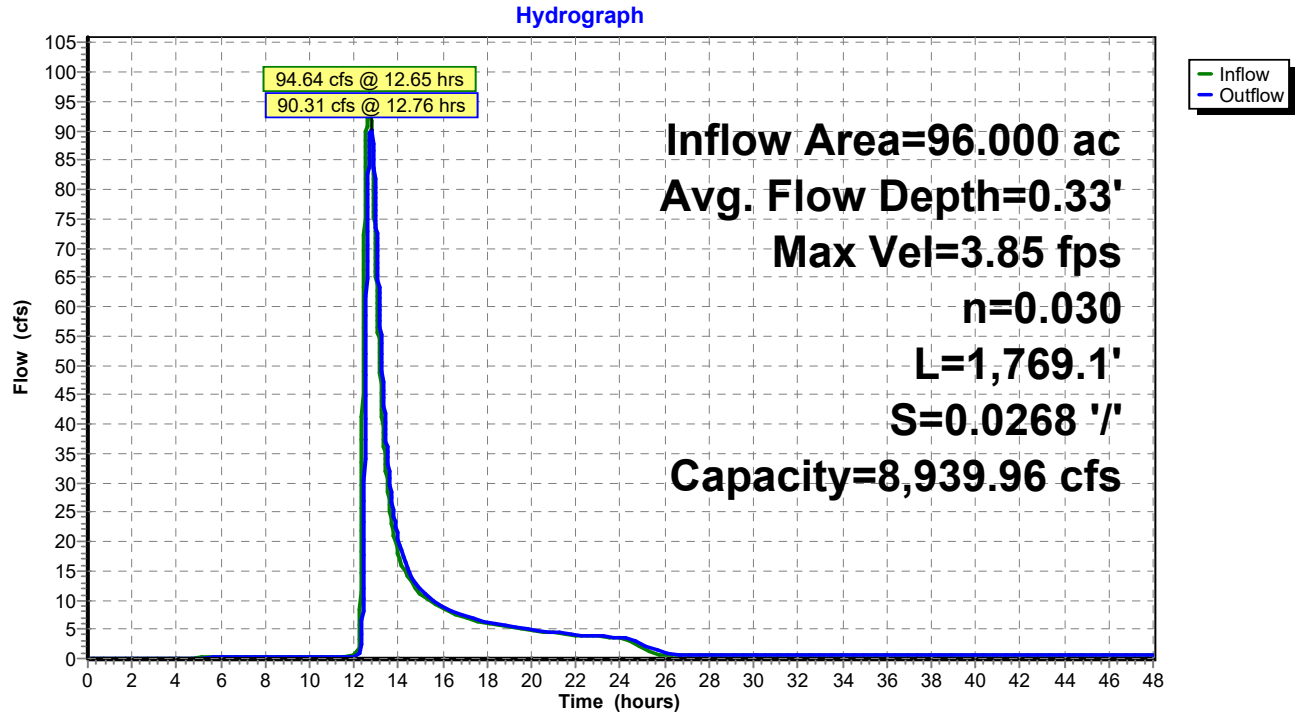
Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Max. Velocity= 3.85 fps, Min. Travel Time= 7.7 min
Avg. Velocity = 1.22 fps, Avg. Travel Time= 24.1 min

Peak Storage= 41,532 cf @ 12.76 hrs
Average Depth at Peak Storage= 0.33' , Surface Width= 71.98'
Bank-Full Depth= 5.00' Flow Area= 425.0 sf, Capacity= 8,939.96 cfs

70.00' x 5.00' deep channel, n= 0.030 Earth, grassed & winding
Side Slope Z-value= 3.0 '/' Top Width= 100.00'
Length= 1,769.1' Slope= 0.0268 '/'
Inlet Invert= 2,087.00', Outlet Invert= 2,039.65'

‡

Reach 6R: POND TO POA



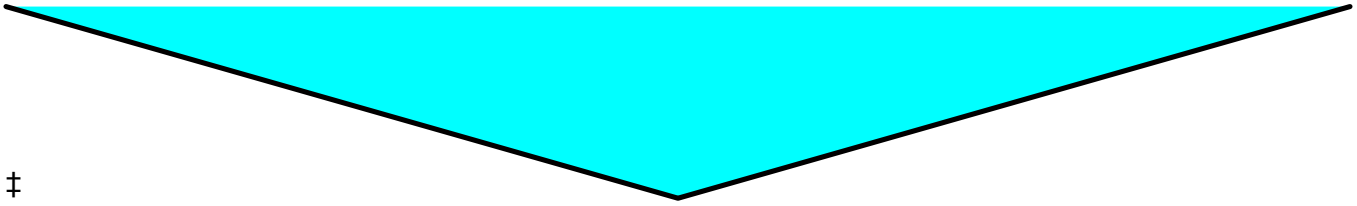
Summary for Reach 8R: REACH COMBINE

Inflow Area = 225.681 ac, Inflow Depth > 1.80" for 10-yr event
Inflow = 177.19 cfs @ 12.64 hrs, Volume= 33.795 af
Outflow = 174.76 cfs @ 12.69 hrs, Volume= 33.792 af, Atten= 1%, Lag= 2.9 min
Routed to Reach 10R : REACH COMBINE 2

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Max. Velocity= 0.90 fps, Min. Travel Time= 3.1 min
Avg. Velocity = 0.67 fps, Avg. Travel Time= 4.2 min

Peak Storage= 32,831 cf @ 12.69 hrs
Average Depth at Peak Storage= 17.90' , Surface Width= 597.83'
Bank-Full Depth= 0.33' Flow Area= 1.8 sf, Capacity= 1.23 cfs

0.00' x 0.33' deep channel, n= 0.030 Earth, grassed & winding
Side Slope Z-value= 16.7 '/' Top Width= 11.02'
Length= 168.8' Slope= 0.0021 '/'
Inlet Invert= 2,036.90', Outlet Invert= 2,036.55'



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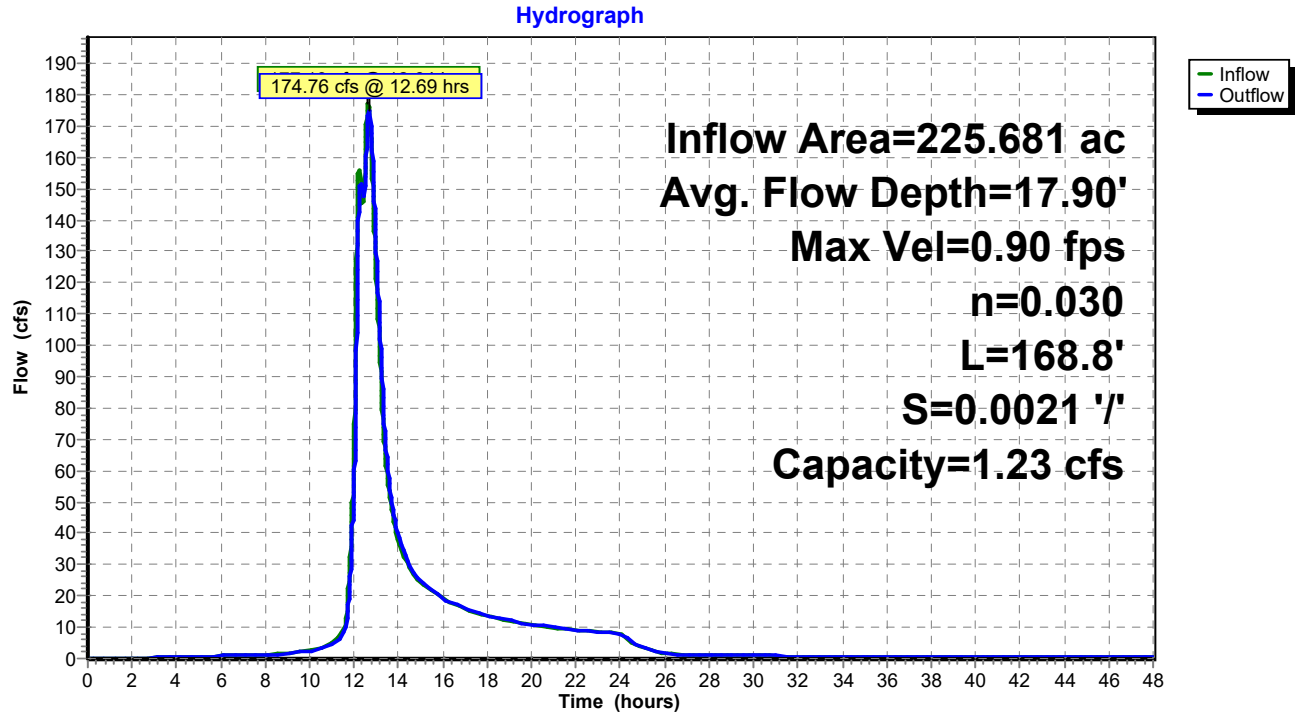
Reach 8R: REACH COMBINE



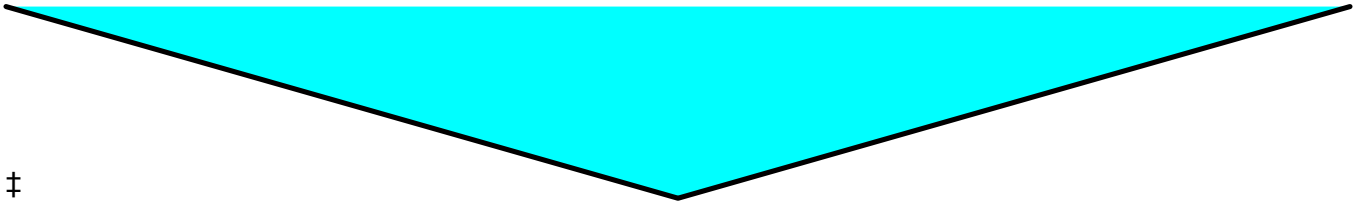
Summary for Reach 9R: DA 3 TO DA 2

Inflow Area = 45.225 ac, Inflow Depth = 2.21" for 10-yr event
Inflow = 102.48 cfs @ 12.11 hrs, Volume= 8.313 af
Outflow = 85.14 cfs @ 12.19 hrs, Volume= 8.313 af, Atten= 17%, Lag= 5.0 min
Routed to Reach 8R : REACH COMBINE

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Max. Velocity= 4.05 fps, Min. Travel Time= 6.0 min
Avg. Velocity = 1.34 fps, Avg. Travel Time= 18.2 min

Peak Storage= 30,756 cf @ 12.19 hrs
Average Depth at Peak Storage= 0.93' , Surface Width= 74.34'
Bank-Full Depth= 0.35' Flow Area= 4.9 sf, Capacity= 15.84 cfs

0.00' x 0.35' deep channel, n= 0.030 Earth, grassed & winding
Side Slope Z-value= 40.0 '/' Top Width= 28.00'
Length= 1,462.0' Slope= 0.0435 '/'
Inlet Invert= 2,103.26', Outlet Invert= 2,039.65'



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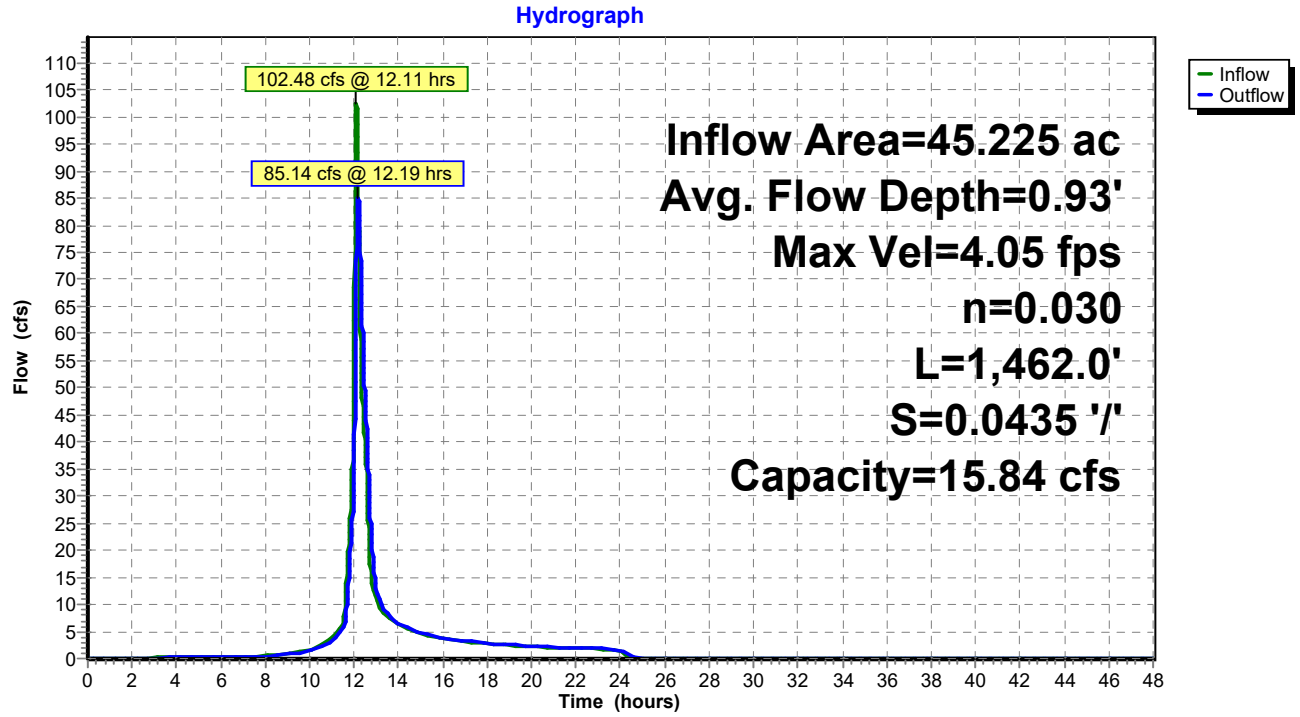
Reach 9R: DA 3 TO DA 2



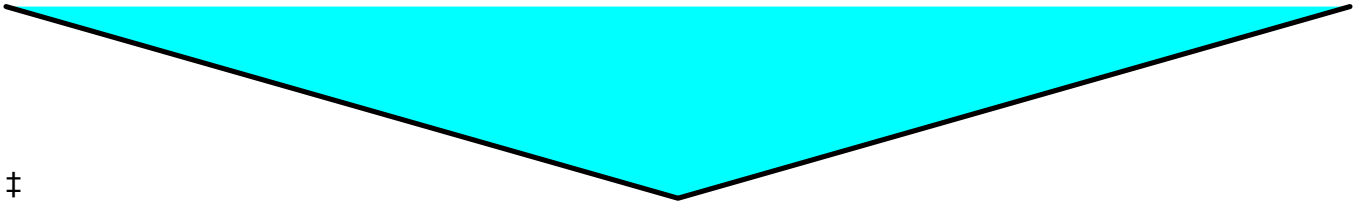
Summary for Reach 10R: REACH COMBINE 2

Inflow Area = 247.742 ac, Inflow Depth > 1.83" for 10-yr event
Inflow = 190.04 cfs @ 12.67 hrs, Volume= 37.841 af
Outflow = 189.80 cfs @ 12.69 hrs, Volume= 37.838 af, Atten= 0%, Lag= 1.0 min
Routed to Link 7L : POA

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Max. Velocity= 2.13 fps, Min. Travel Time= 1.1 min
Avg. Velocity = 0.83 fps, Avg. Travel Time= 2.7 min

Peak Storage= 12,140 cf @ 12.69 hrs
Average Depth at Peak Storage= 1.15' , Surface Width= 203.68'
Bank-Full Depth= 0.59' Flow Area= 30.8 sf, Capacity= 54.02 cfs

0.00' x 0.59' deep channel, n= 0.030 Earth, grassed & winding
Side Slope Z-value= 88.5 '/' Top Width= 104.43'
Length= 136.3' Slope= 0.0064 '/'
Inlet Invert= 2,036.75', Outlet Invert= 2,035.88'



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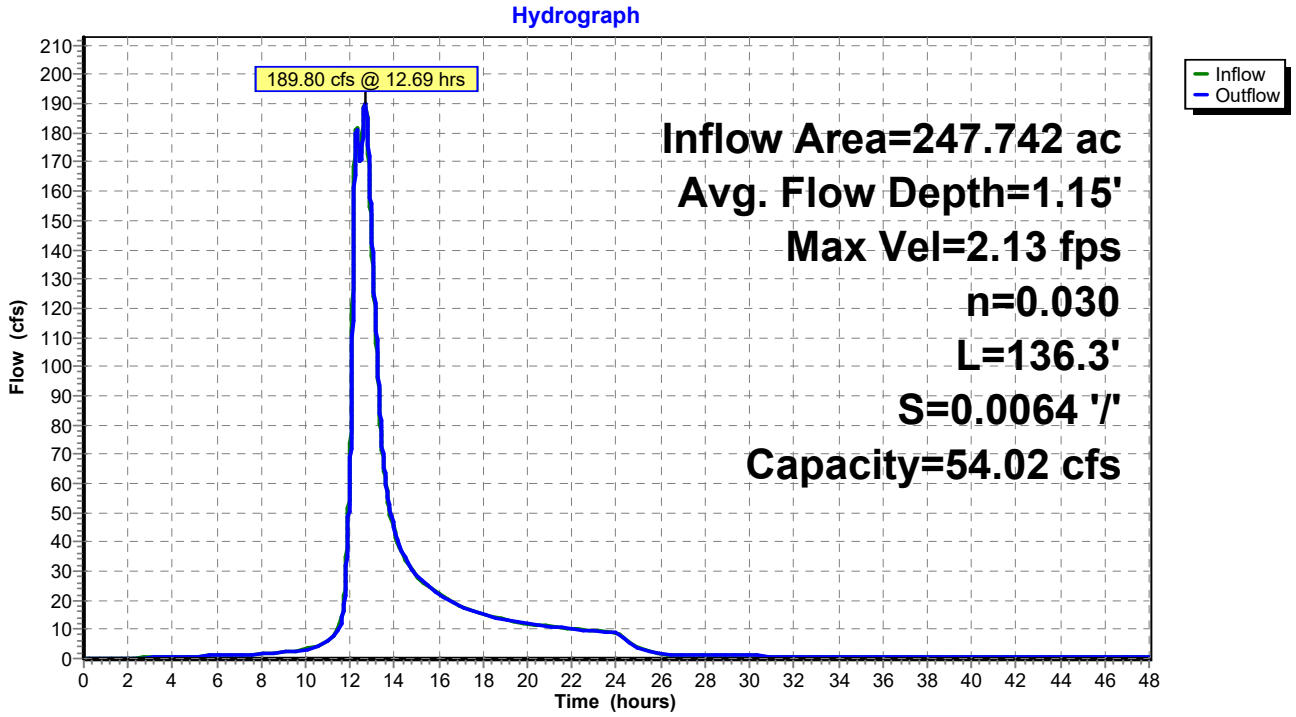
Reach 10R: REACH COMBINE 2



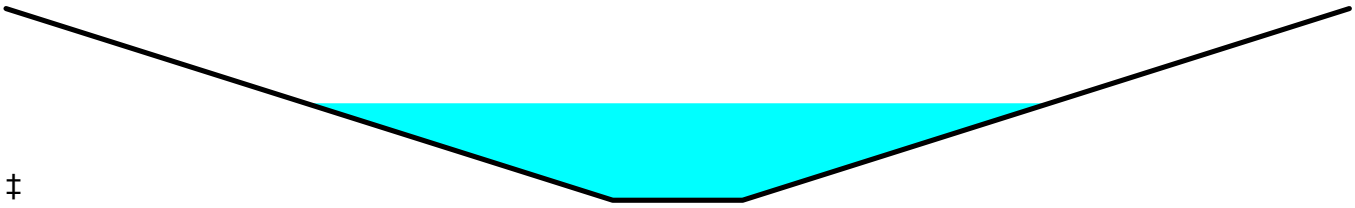
Summary for Reach 11R: DA 4 TO POA

Inflow Area = 13.891 ac, Inflow Depth = 2.47" for 10-yr event
Inflow = 28.36 cfs @ 12.22 hrs, Volume= 2.857 af
Outflow = 27.90 cfs @ 12.25 hrs, Volume= 2.857 af, Atten= 2%, Lag= 2.0 min
Routed to Reach 10R : REACH COMBINE 2

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Max. Velocity= 7.83 fps, Min. Travel Time= 2.5 min
Avg. Velocity = 2.60 fps, Avg. Travel Time= 7.5 min

Peak Storage= 4,188 cf @ 12.25 hrs
Average Depth at Peak Storage= 0.71' , Surface Width= 8.57'
Bank-Full Depth= 1.40' Flow Area= 11.9 sf, Capacity= 140.25 cfs

1.50' x 1.40' deep channel, n= 0.030 Earth, grassed & winding
Side Slope Z-value= 5.0 '/' Top Width= 15.50'
Length= 1,176.1' Slope= 0.0825 '/'
Inlet Invert= 2,133.71', Outlet Invert= 2,036.73'



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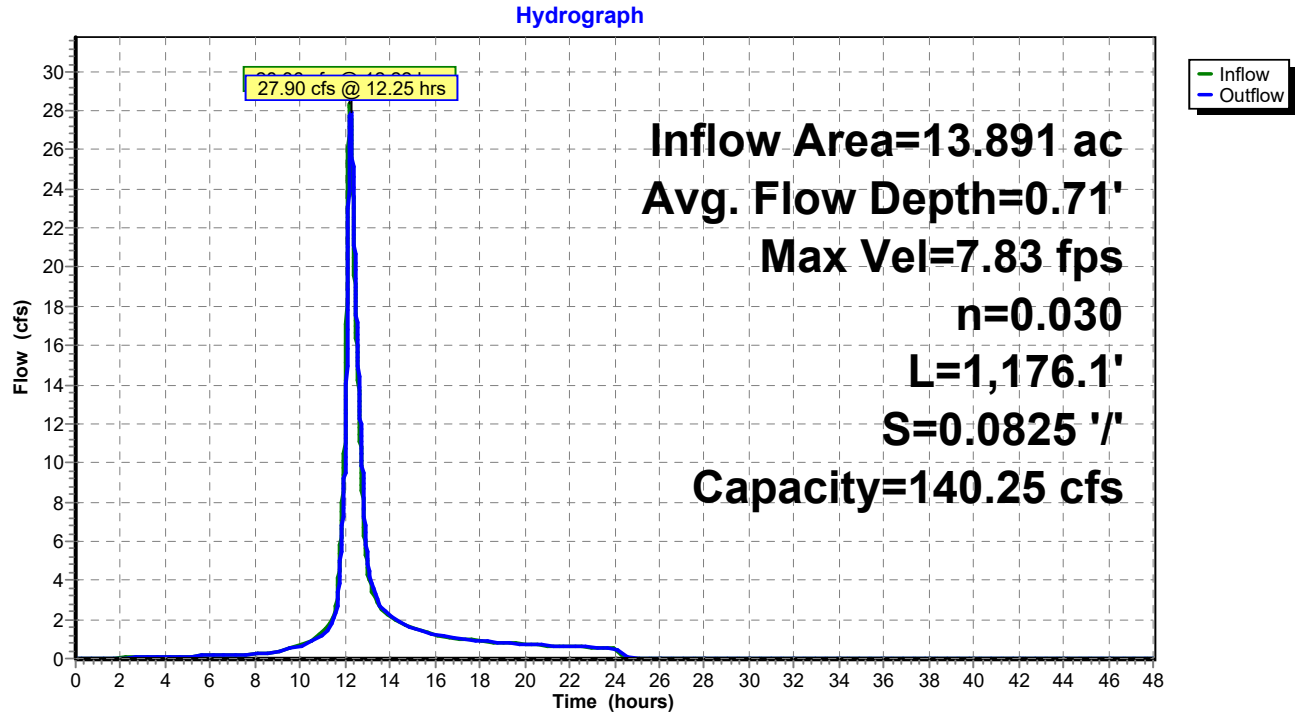
Reach 11R: DA 4 TO POA



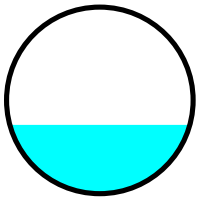
Summary for Reach 12R: DI-7

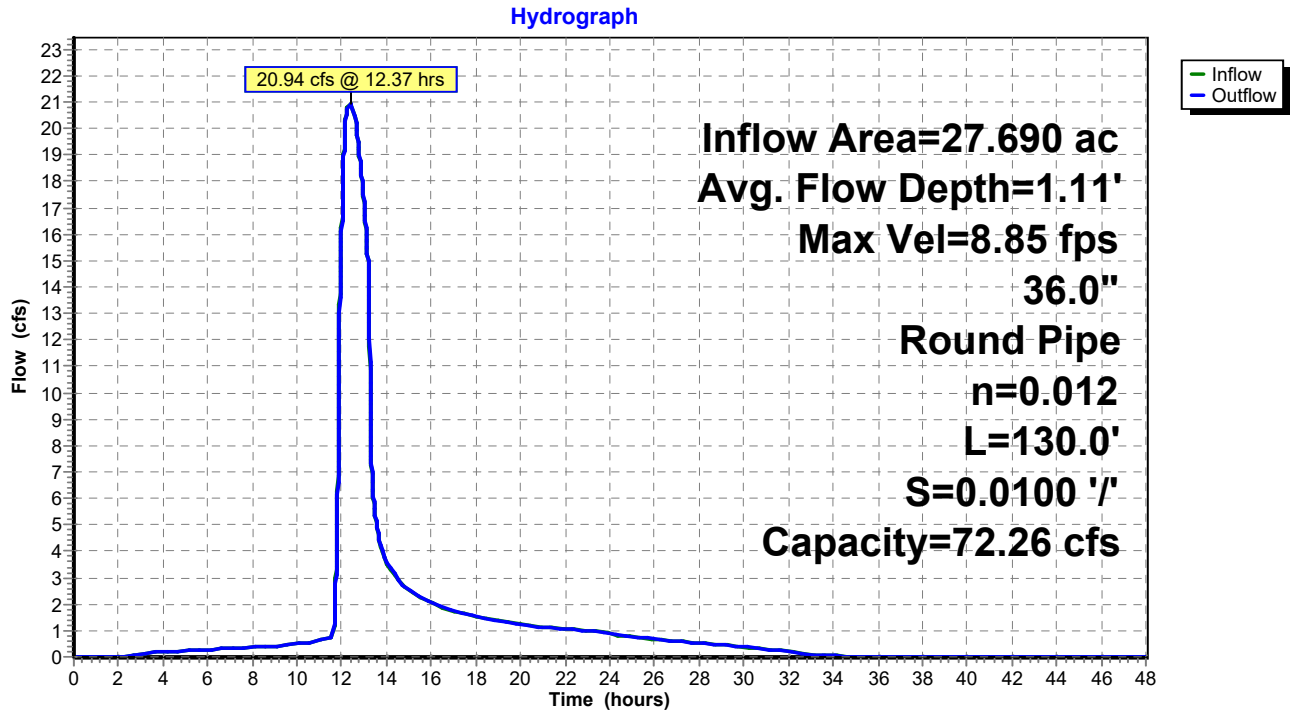
Inflow Area = 27.690 ac, Inflow Depth = 1.92" for 10-yr event
Inflow = 20.94 cfs @ 12.37 hrs, Volume= 4.442 af
Outflow = 20.94 cfs @ 12.37 hrs, Volume= 4.442 af, Atten= 0%, Lag= 0.2 min
Routed to Reach 8R : REACH COMBINE

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Max. Velocity= 8.85 fps, Min. Travel Time= 0.2 min
Avg. Velocity = 2.64 fps, Avg. Travel Time= 0.8 min

Peak Storage= 308 cf @ 12.37 hrs
Average Depth at Peak Storage= 1.11' , Surface Width= 2.89'
Bank-Full Depth= 3.00' Flow Area= 7.1 sf, Capacity= 72.26 cfs

36.0" Round Pipe
n= 0.012
Length= 130.0' Slope= 0.0100 '/'
Inlet Invert= 2,061.30', Outlet Invert= 2,060.00'





Summary for Pond 3P: NSP POND 1

Inflow Area = 96.000 ac, Inflow Depth = 1.93" for 10-yr event
Inflow = 122.59 cfs @ 12.42 hrs, Volume= 15.453 af
Outflow = 94.64 cfs @ 12.65 hrs, Volume= 13.887 af, Atten= 23%, Lag= 14.1 min
Primary = 94.64 cfs @ 12.65 hrs, Volume= 13.887 af
Routed to Reach 6R : POND TO POA

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 2,081.60' @ 12.65 hrs Storage= 188,863 cf

Plug-Flow detention time= 194.8 min calculated for 13.887 af (90% of inflow)
Center-of-Mass det. time= 143.0 min (998.9 - 855.9)

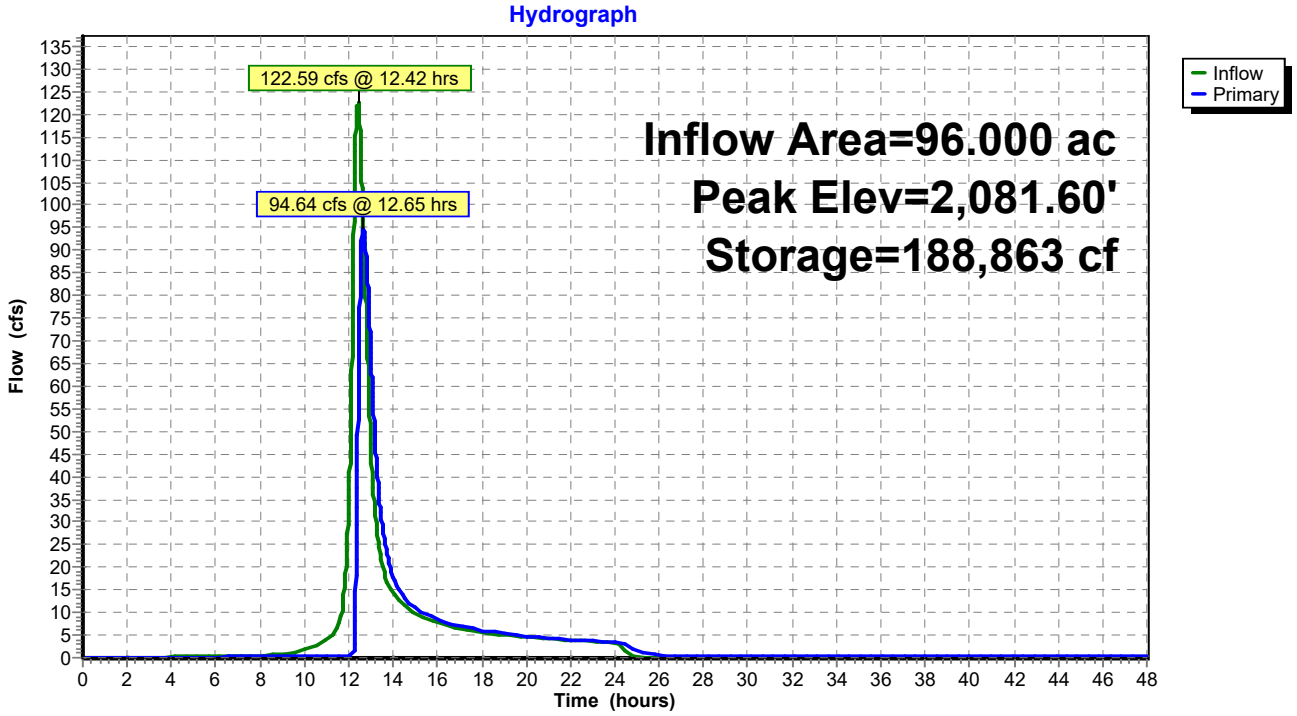
Volume	Invert	Avail.Storage	Storage Description
#1	2,074.75'	392,320 cf	**Custom Stage Data** Listed below

Elevation (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
2,074.75	0	0
2,076.00	2,002	2,002
2,078.00	24,089	26,091
2,080.00	67,305	93,396
2,082.00	119,692	213,088
2,084.00	179,232	392,320

Device	Routing	Invert	Outlet Devices
#1	Primary	2,073.87'	**48.0" Round Culvert** L= 110.4' Ke= 0.600 Inlet / Outlet Invert= 2,073.87' / 2,071.85' S= 0.0183 '/' Cc= 0.900 n= 0.013, Flow Area= 12.57 sf
#2	Device 1	2,074.75'	**3.0" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Device 1	2,080.27'	**72.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#4	Device 1	2,082.20'	**30.0' long x 14.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.64 2.67 2.70 2.65 2.64 2.65 2.65 2.63

Primary OutFlow Max=94.63 cfs @ 12.65 hrs HW=2,081.60' (Free Discharge)
└**1=Culvert** (Passes 94.63 cfs of 135.73 cfs potential flow)
  ├**2=Orifice/Grate** (Orifice Controls 0.61 cfs @ 12.48 fps)
  ├**3=Orifice/Grate** (Weir Controls 94.02 cfs @ 3.76 fps)
  └**4=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 3P: NSP POND 1



Summary for Pond 8P: SWM FACILITY #1

Inflow Area = 27.690 ac, Inflow Depth = 1.92" for 10-yr event
Inflow = 63.32 cfs @ 12.04 hrs, Volume= 4.442 af
Outflow = 20.94 cfs @ 12.37 hrs, Volume= 4.442 af, Atten= 67%, Lag= 19.8 min
Primary = 20.94 cfs @ 12.37 hrs, Volume= 4.442 af
Routed to Reach 12R : DI-7
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Routed to Reach 12R : DI-7

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 2,067.28' @ 12.37 hrs Surf.Area= 15,012 sf Storage= 52,762 cf

Plug-Flow detention time= 105.0 min calculated for 4.442 af (100% of inflow)
Center-of-Mass det. time= 105.0 min (913.4 - 808.4)

Volume	Invert	Avail.Storage	Storage Description
#1	2,061.65'	80,755 cf	**Custom Stage Data (Prismatic)** Listed below

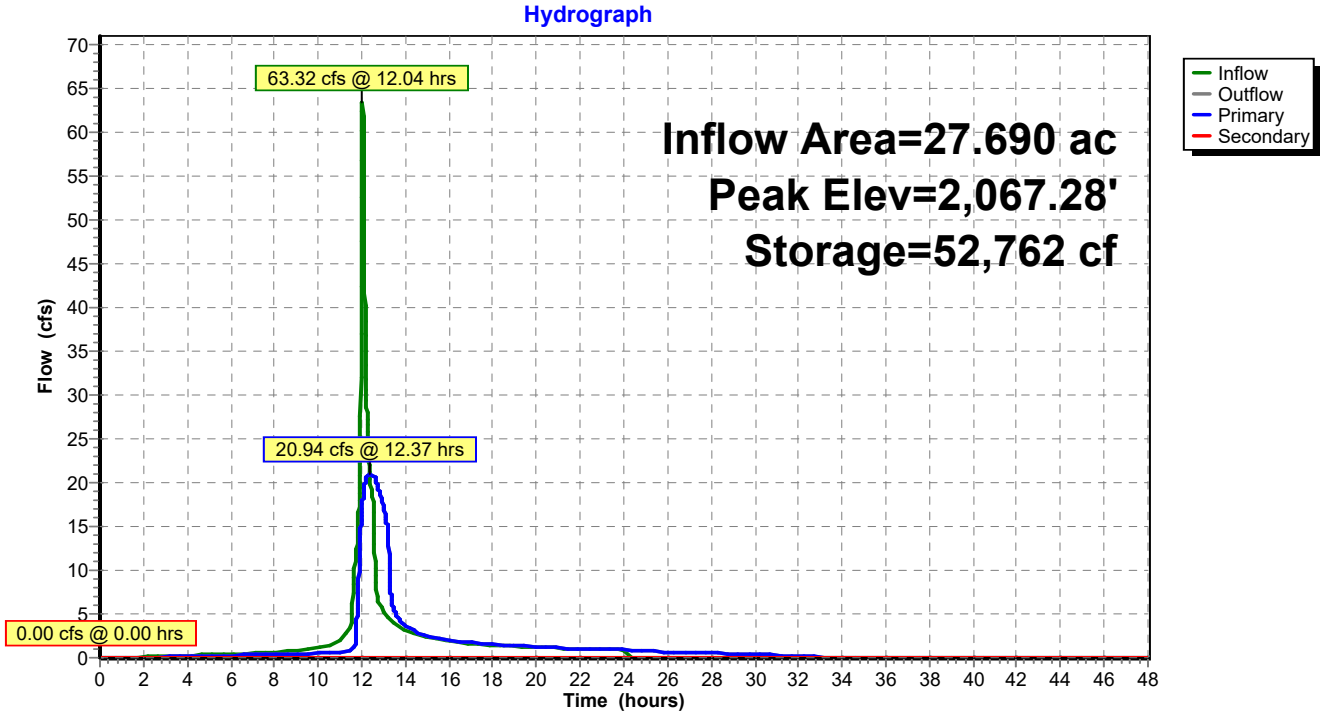
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
2,061.65	0	0	0
2,062.00	5,539	969	969
2,064.00	8,184	13,723	14,692
2,066.00	11,586	19,770	34,462
2,068.00	16,923	28,509	62,971
2,069.00	18,644	17,784	80,755

Device	Routing	Invert	Outlet Devices
#1	Primary	2,061.65'	**18.0" Round RCP_Round 18"** L= 55.0' Ke= 0.200 Inlet / Outlet Invert= 2,061.65' / 2,061.30' S= 0.0064 '/' Cc= 0.900 n= 0.012, Flow Area= 1.77 sf
#2	Device 1	2,061.65'	**4.5" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Device 1	2,064.10'	**24.0" W x 6.0" H Vert. Orifice/Grate X 2.00** C= 0.600 Limited to weir flow at low heads
#4	Device 1	2,064.67'	**48.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#5	Secondary	2,068.25'	**Custom Weir/Orifice, Cv= 2.62 (C= 3.28)** Head (feet) 0.00 2.75 Width (feet) 15.00 31.50

Primary OutFlow Max=20.94 cfs @ 12.37 hrs HW=2,067.28' (Free Discharge)
└─**1=RCP_Round 18"** (Barrel Controls 20.94 cfs @ 11.85 fps)
  ├─**2=Orifice/Grate** (Passes < 1.24 cfs potential flow)
  ├─**3=Orifice/Grate** (Passes < 16.49 cfs potential flow)
  └─**4=Orifice/Grate** (Passes < 97.82 cfs potential flow)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=2,061.65' (Free Discharge)
└─**5=Custom Weir/Orifice** (Controls 0.00 cfs)

Pond 8P: SWM FACILITY #1



Summary for Pond 14P: SWM FACILITY #2

Inflow Area = 6.610 ac, Inflow Depth = 1.97" for 10-yr event
Inflow = 15.40 cfs @ 12.04 hrs, Volume= 1.086 af
Outflow = 8.73 cfs @ 12.16 hrs, Volume= 1.086 af, Atten= 43%, Lag= 7.4 min
Primary = 8.73 cfs @ 12.16 hrs, Volume= 1.086 af
Routed to Reach 8R : REACH COMBINE

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 2,065.71' @ 12.16 hrs Surf.Area= 6,350 sf Storage= 11,281 cf

Plug-Flow detention time= 57.4 min calculated for 1.085 af (100% of inflow)
Center-of-Mass det. time= 57.4 min (861.5 - 804.1)

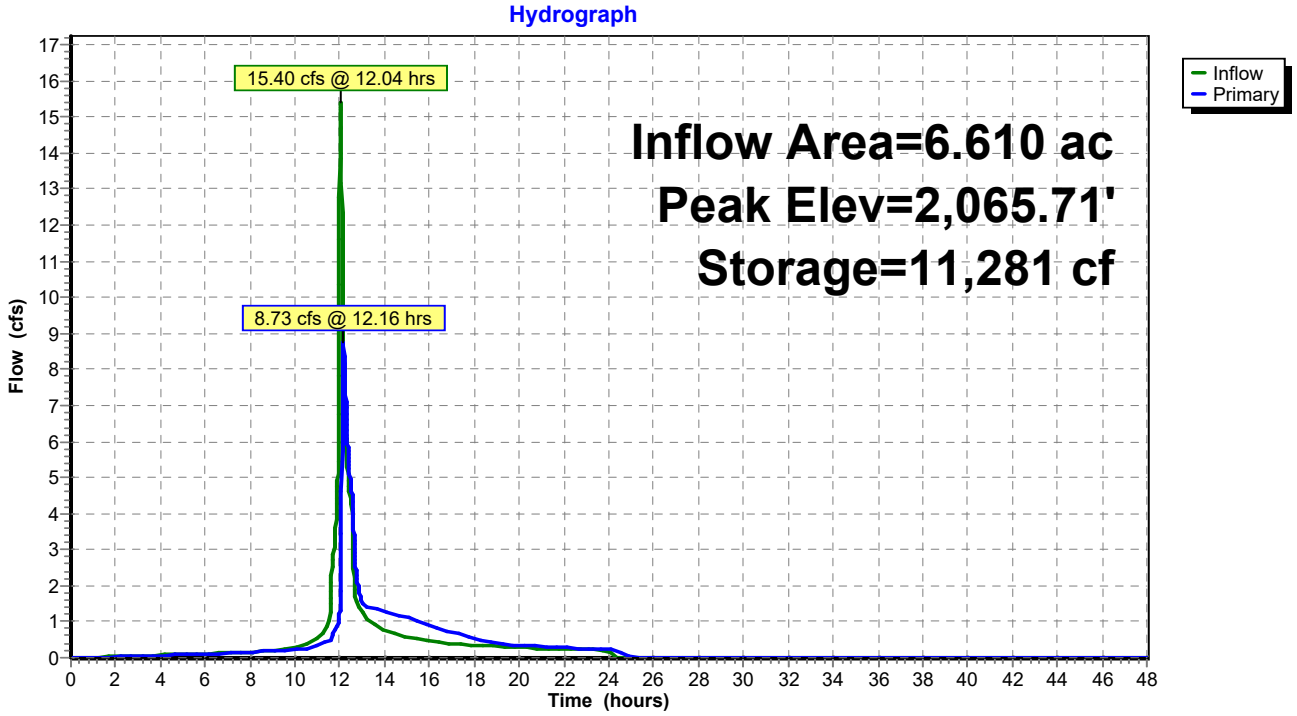
Volume	Invert	Avail.Storage	Storage Description
#1	2,064.00'	27,462 cf	**Custom Stage Data (Prismatic)** Listed below

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
2,064.00	0	0	0
2,064.15	3,262	245	245
2,068.00	10,877	27,218	27,462

Device	Routing	Invert	Outlet Devices
#1	Primary	2,063.80'	**24.0" Round Culvert** L= 63.7' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 2,063.80' / 2,056.00' S= 0.1224 '/' Cc= 0.900 n= 0.013, Flow Area= 3.14 sf
#2	Device 1	2,063.90'	**7.0" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Device 1	2,065.40'	**48.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#4	Primary	2,066.50'	**12.0' long x 12.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.57 2.62 2.70 2.67 2.66 2.67 2.66 2.64

Primary OutFlow Max=8.71 cfs @ 12.16 hrs HW=2,065.71' (Free Discharge)
- **1=Culvert** (Passes 8.71 cfs of 14.55 cfs potential flow)
  - **2=Orifice/Grate** (Orifice Controls 1.59 cfs @ 5.93 fps)
  - **3=Orifice/Grate** (Weir Controls 7.12 cfs @ 1.82 fps)
- **4=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 14P: SWM FACILITY #2



Summary for Pond 16P: SWM FACILITY #3

Inflow Area = 8.170 ac, Inflow Depth = 1.75" for 10-yr event
Inflow = 17.37 cfs @ 12.04 hrs, Volume= 1.192 af
Outflow = 2.66 cfs @ 12.63 hrs, Volume= 1.192 af, Atten= 85%, Lag= 35.0 min
Primary = 2.66 cfs @ 12.63 hrs, Volume= 1.192 af
Routed to Reach 10R : REACH COMBINE 2

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 2,064.90' @ 12.63 hrs Surf.Area= 11,813 sf Storage= 18,367 cf

Plug-Flow detention time= 63.5 min calculated for 1.192 af (100% of inflow)
Center-of-Mass det. time= 63.5 min (890.2 - 826.7)

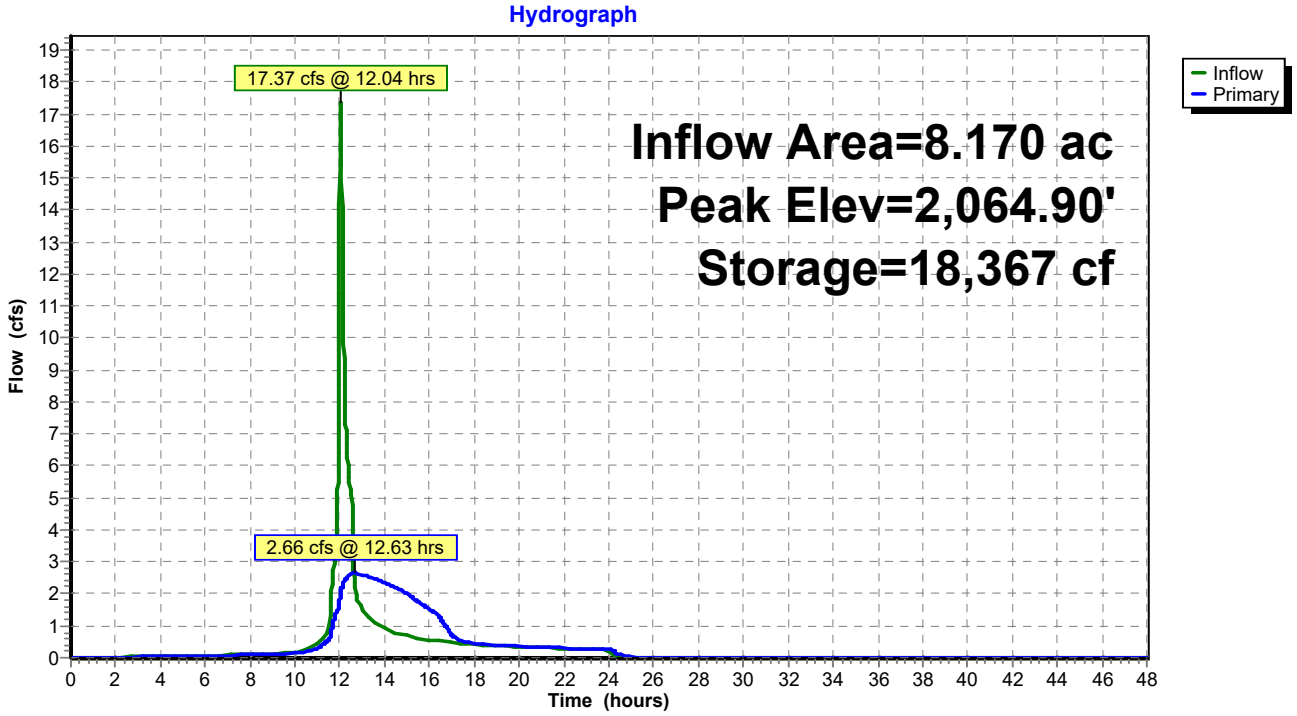
Volume	Invert	Avail.Storage	Storage Description
#1	2,062.15'	71,065 cf	**Custom Stage Data (Prismatic)** Listed below

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
2,062.15	0	0	0
2,063.00	4,695	1,995	1,995
2,064.00	9,065	6,880	8,875
2,065.00	12,134	10,600	19,475
2,066.00	15,548	13,841	33,316
2,067.00	18,123	16,836	50,151
2,068.00	23,705	20,914	71,065

Device	Routing	Invert	Outlet Devices
#1	Primary	2,061.95'	**24.0" Round Culvert** L= 69.8' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 2,061.95' / 2,050.00' S= 0.1712 '/' Cc= 0.900 n= 0.013, Flow Area= 3.14 sf
#2	Device 1	2,062.05'	**8.0" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Device 1	2,065.00'	**48.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#4	Primary	2,066.15'	**12.0' long x 12.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.57 2.62 2.70 2.67 2.66 2.67 2.66 2.64

Primary OutFlow Max=2.66 cfs @ 12.63 hrs HW=2,064.90' (Free Discharge)
- **1=Culvert** (Passes 2.66 cfs of 21.10 cfs potential flow)
  - **2=Orifice/Grate** (Orifice Controls 2.66 cfs @ 7.63 fps)
  - **3=Orifice/Grate** (Controls 0.00 cfs)
- **4=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 16P: SWM FACILITY #3

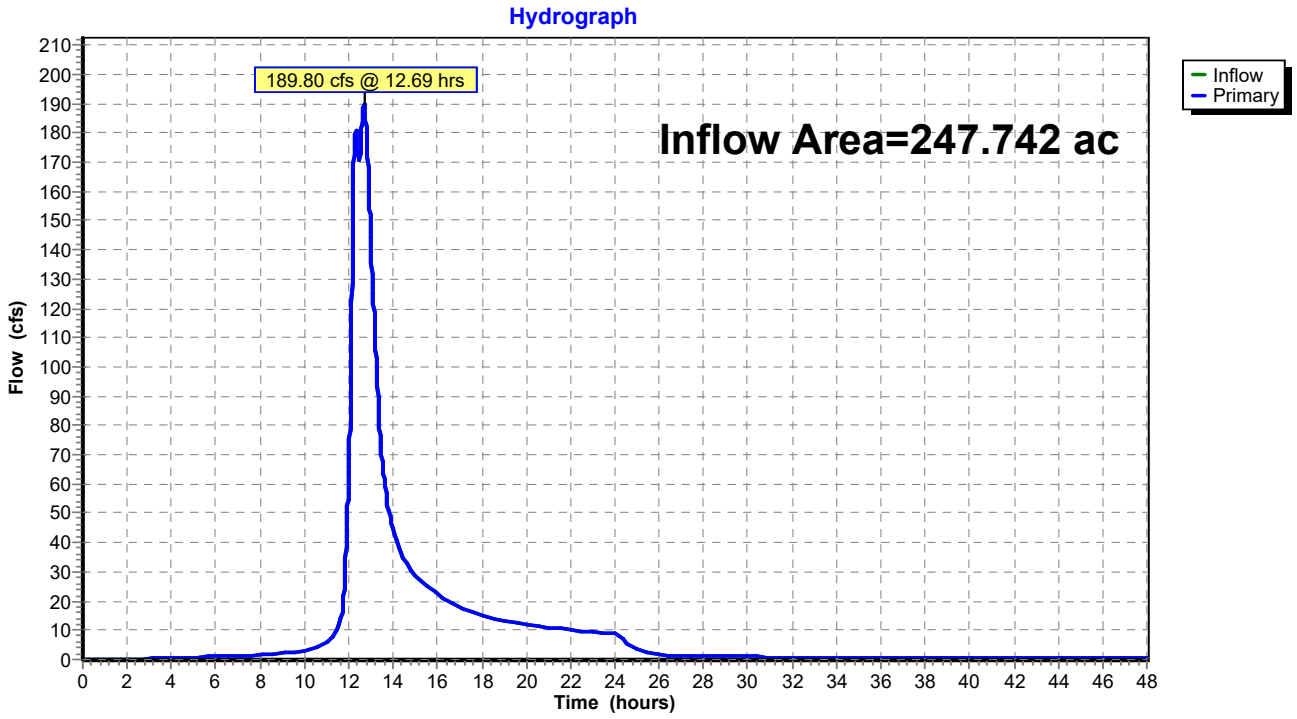


Summary for Link 7L: POA

Inflow Area = 247.742 ac, Inflow Depth > 1.83" for 10-yr event
Inflow = 189.80 cfs @ 12.69 hrs, Volume= 37.838 af
Primary = 189.80 cfs @ 12.69 hrs, Volume= 37.838 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs

Link 7L: POA



Time span=0.00-48.00 hrs, dt=0.01 hrs, 4801 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-Q
Reach routing by Stor-Ind method - Pond routing by Stor-Ind method

Subcatchment1S: DA # 1 Runoff Area=96.000 ac Runoff Depth=3.93"
Tc=30.8 min CN=WQ Runoff=226.58 cfs 31.430 af

Subcatchment8S: DA #3 OFF-SITE PORTION Runoff Area=44.547 ac Runoff Depth=4.31"
Flow Length=2,089' Tc=11.1 min CN=WQ Runoff=171.86 cfs 15.995 af

Subcatchment9S: DA TO SWM FACILITY#1 Runoff Area=27.690 ac Runoff Depth=3.97"
Tc=6.0 min CN=WQ Runoff=116.05 cfs 9.172 af

Subcatchment10S: DA #4 Runoff Area=13.891 ac Runoff Depth=4.63"
Flow Length=2,526' Tc=18.9 min CN=WQ Runoff=46.73 cfs 5.361 af

Subcatchment11S: DA #2 Runoff Area=50.156 ac Runoff Depth=3.29"
Flow Length=1,801' Tc=25.7 min CN=71 Runoff=108.27 cfs 13.752 af

Subcatchment12S: DA #3 ON-SITE PORTION Runoff Area=0.678 ac Runoff Depth=3.21"
Flow Length=2,089' Tc=11.1 min CN=WQ Runoff=1.86 cfs 0.181 af

Subcatchment13S: DA TO SWM FACILITY#2 Runoff Area=6.610 ac Runoff Depth=3.98"
Tc=6.0 min CN=WQ Runoff=27.59 cfs 2.195 af

Subcatchment15S: DA TO SWM FACILITY#3 Runoff Area=8.170 ac Runoff Depth=3.94"
Tc=6.0 min CN=WQ Runoff=34.82 cfs 2.683 af

Reach 6R: POND TO POA Avg. Flow Depth=0.45' Max Vel=4.70 fps Inflow=151.40 cfs 29.851 af
n=0.030 L=1,769.1' S=0.0268 '/' Capacity=8,939.96 cfs Outflow=151.15 cfs 29.833 af

Reach 8R: REACH COMBINE Avg. Flow Depth=41.69' Max Vel=0.90 fps Inflow=417.20 cfs 71.128 af
n=0.030 L=168.8' S=0.0021 '/' Capacity=1.23 cfs Outflow=409.79 cfs 71.124 af

Reach 9R: DA 3 TO DA 2 Avg. Flow Depth=1.44' Max Vel=4.15 fps Inflow=173.72 cfs 16.177 af
n=0.030 L=1,462.0' S=0.0435 '/' Capacity=15.84 cfs Outflow=146.50 cfs 16.177 af

Reach 10R: REACH COMBINE 2 Avg. Flow Depth=2.29' Max Vel=2.24 fps Inflow=465.88 cfs 79.168 af
n=0.030 L=136.3' S=0.0064 '/' Capacity=54.02 cfs Outflow=465.13 cfs 79.165 af

Reach 11R: DA 4 TO POA Avg. Flow Depth=0.88' Max Vel=8.91 fps Inflow=46.73 cfs 5.361 af
n=0.030 L=1,176.1' S=0.0825 '/' Capacity=140.25 cfs Outflow=46.19 cfs 5.361 af

Reach 12R: DI-7 Avg. Flow Depth=3.00' Max Vel=11.65 fps Inflow=104.25 cfs 9.172 af
36.0" Round Pipe n=0.012 L=130.0' S=0.0100 '/' Capacity=72.26 cfs Outflow=72.26 cfs 9.172 af

Pond 3P: NSP POND 1 Peak Elev=2,082.99' Storage=302,112 cf Inflow=226.58 cfs 31.430 af
Outflow=151.40 cfs 29.851 af

Pond 8P: SWM FACILITY#1 Peak Elev=2,069.47' Storage=80,755 cf Inflow=116.05 cfs 9.172 af
Primary=25.53 cfs 7.976 af Secondary=78.72 cfs 1.196 af Outflow=104.25 cfs 9.172 af

Pond 14P: SWM FACILITY#2 Peak Elev=2,066.31' Storage=15,546 cf Inflow=27.59 cfs 2.195 af
Outflow=18.62 cfs 2.195 af

Pond 16P: SWM FACILITY#3 Peak Elev=2,065.55' Storage=27,084 cf Inflow=34.82 cfs 2.683 af
Outflow=19.75 cfs 2.683 af

Link 7L: POA Inflow=465.13 cfs 79.165 af
Primary=465.13 cfs 79.165 af

Total Runoff Area = 247.742 ac Runoff Volume = 80.768 af Average Runoff Depth = 3.91"

Summary for Subcatchment 1S: DA # 1

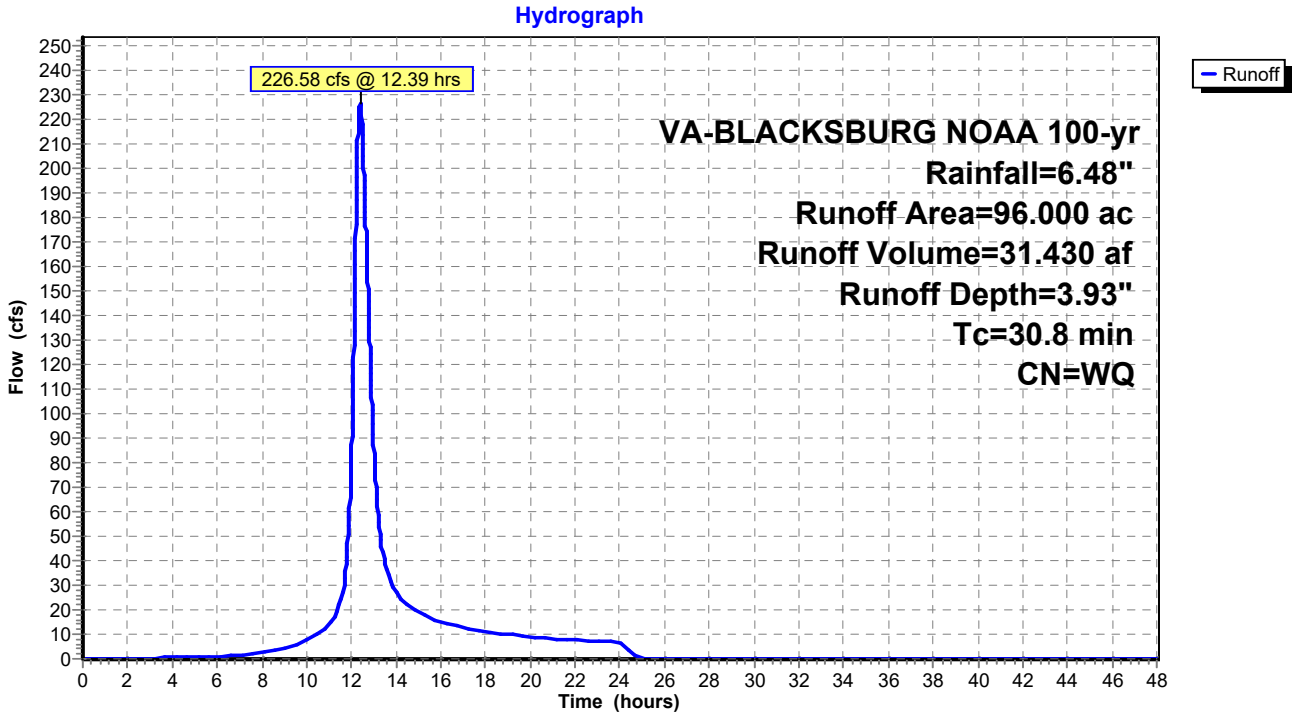
Runoff = 226.58 cfs @ 12.39 hrs, Volume= 31.430 af, Depth= 3.93"
Routed to Pond 3P : NSP POND 1

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
VA-BLACKSBURG NOAA 100-yr Rainfall=6.48"

Area (ac)	CN	Description
5.080	98	Roofs, HSG C
3.100	84	50-75% Grass cover, Fair, HSG D
22.720	79	50-75% Grass cover, Fair, HSG C
28.800	69	50-75% Grass cover, Fair, HSG B
1.000	86	1/3 acre lots, 30% imp, HSG D
10.400	81	1/3 acre lots, 30% imp, HSG C
6.400	72	1/3 acre lots, 30% imp, HSG B
10.300	83	1/4 acre lots, 38% imp, HSG C
8.200	75	1/4 acre lots, 38% imp, HSG B
96.000		Weighted Average

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
30.8					**Direct Entry, FROM NSP CALCS**

Subcatchment 1S: DA # 1



Summary for Subcatchment 8S: DA #3 OFF-SITE PORTION

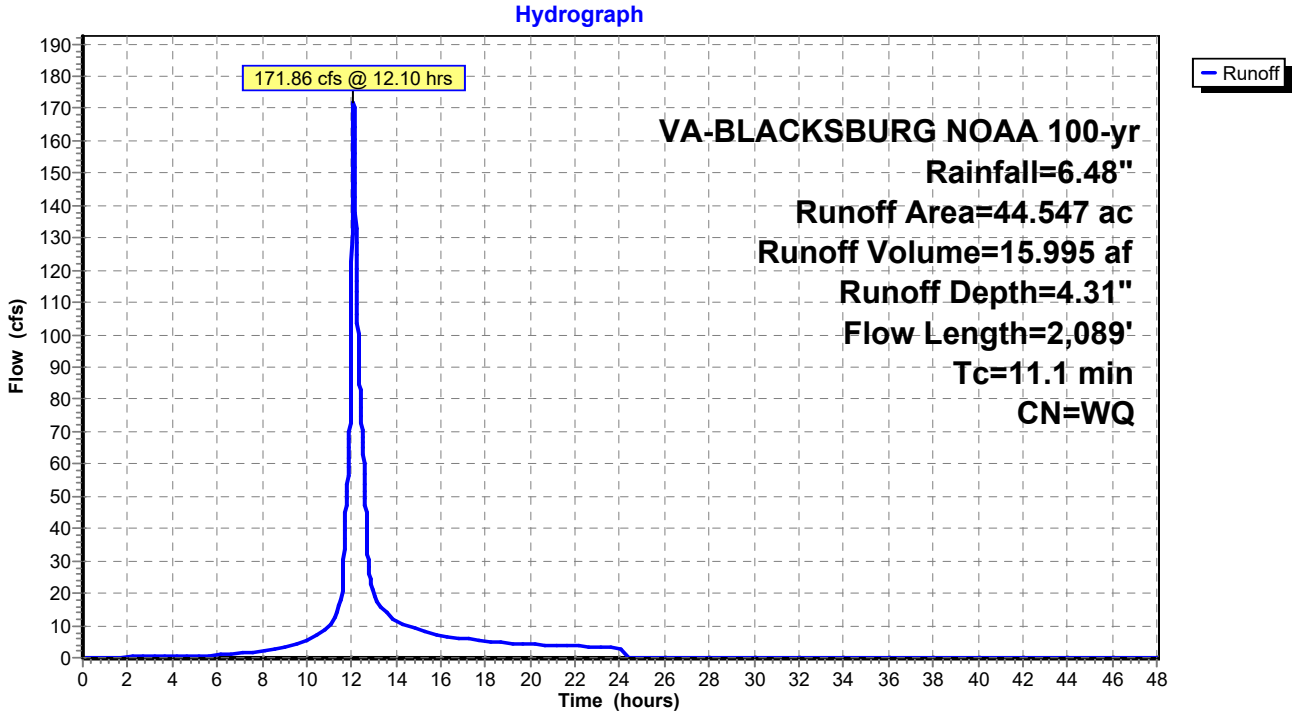
Runoff = 171.86 cfs @ 12.10 hrs, Volume= 15.995 af, Depth= 4.31"
Routed to Reach 9R : DA 3 TO DA 2

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
VA-BLACKSBURG NOAA 100-yr Rainfall=6.48"

Area (ac)	CN	Description
0.358	98	Paved roads w/curbs & sewers, HSG B
4.733	98	Paved roads w/curbs & sewers, HSG C
5.726	70	1/2 acre lots, 25% imp, HSG B
28.476	80	1/2 acre lots, 25% imp, HSG C
0.877	72	1/3 acre lots, 30% imp, HSG B
3.986	81	1/3 acre lots, 30% imp, HSG C
0.391	79	1 acre lots, 20% imp, HSG C
44.547		Weighted Average

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.7	95	0.0630	0.28		**Sheet Flow, Tc1** Range n= 0.130 P2= 2.76"
1.3	435	0.1125	5.44	40.82	**Channel Flow, Tc2** Area= 7.5 sf Perim= 40.0' r= 0.19' n= 0.030 Earth, grassed & winding
2.2	602	0.0830	4.64		**Shallow Concentrated Flow, Tc3** Unpaved Kv= 16.1 fps
0.6	301	0.0565	8.57	342.85	**Channel Flow, Tc4** Area= 40.0 sf Perim= 64.4' r= 0.62' n= 0.030 Earth, grassed & winding
0.1	215	0.0744	27.88	197.09	**Pipe Channel, Tc5** 36.0" Round Area= 7.1 sf Perim= 9.4' r= 0.75' n= 0.012 Concrete pipe, finished
1.2	441	0.0603	6.33	189.76	**Channel Flow, Tc6** Area= 30.0 sf Perim= 80.0' r= 0.38' n= 0.030 Earth, grassed & winding
11.1	2,089	Total			

Subcatchment 8S: DA #3 OFF-SITE PORTION



Summary for Subcatchment 9S: DA TO SWM FACILITY #1

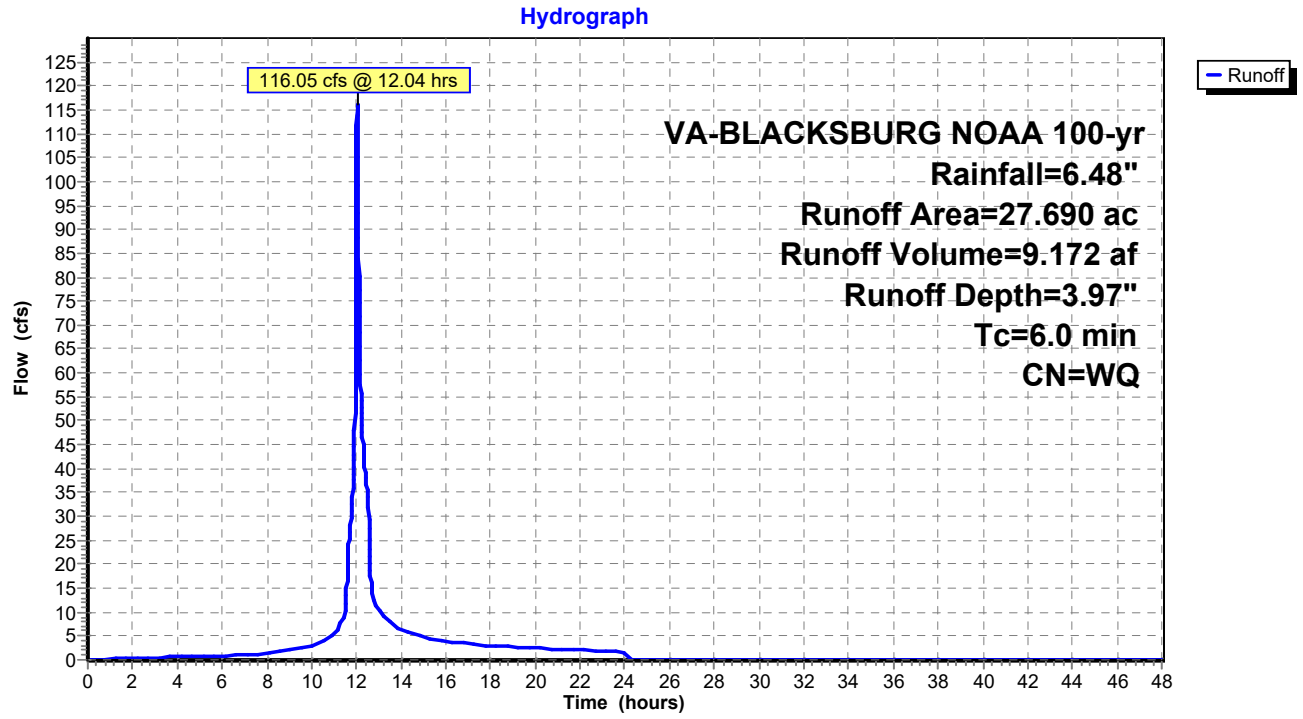
Runoff = 116.05 cfs @ 12.04 hrs, Volume= 9.172 af, Depth= 3.97"
Routed to Pond 8P : SWM FACILITY #1

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
VA-BLACKSBURG NOAA 100-yr Rainfall=6.48"

	Area (ac)	CN	Description
	8.410	61	>75% Grass cover, Good, HSG B
	3.440	74	>75% Grass cover, Good, HSG C
	4.930	98	Impervious, HSG B
	2.030	98	Impervious, HSG C
*	8.880	77	VRRM DA A
	27.690		Weighted Average

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, TR-55 MIN.**

Subcatchment 9S: DA TO SWM FACILITY #1



Summary for Subcatchment 10S: DA #4

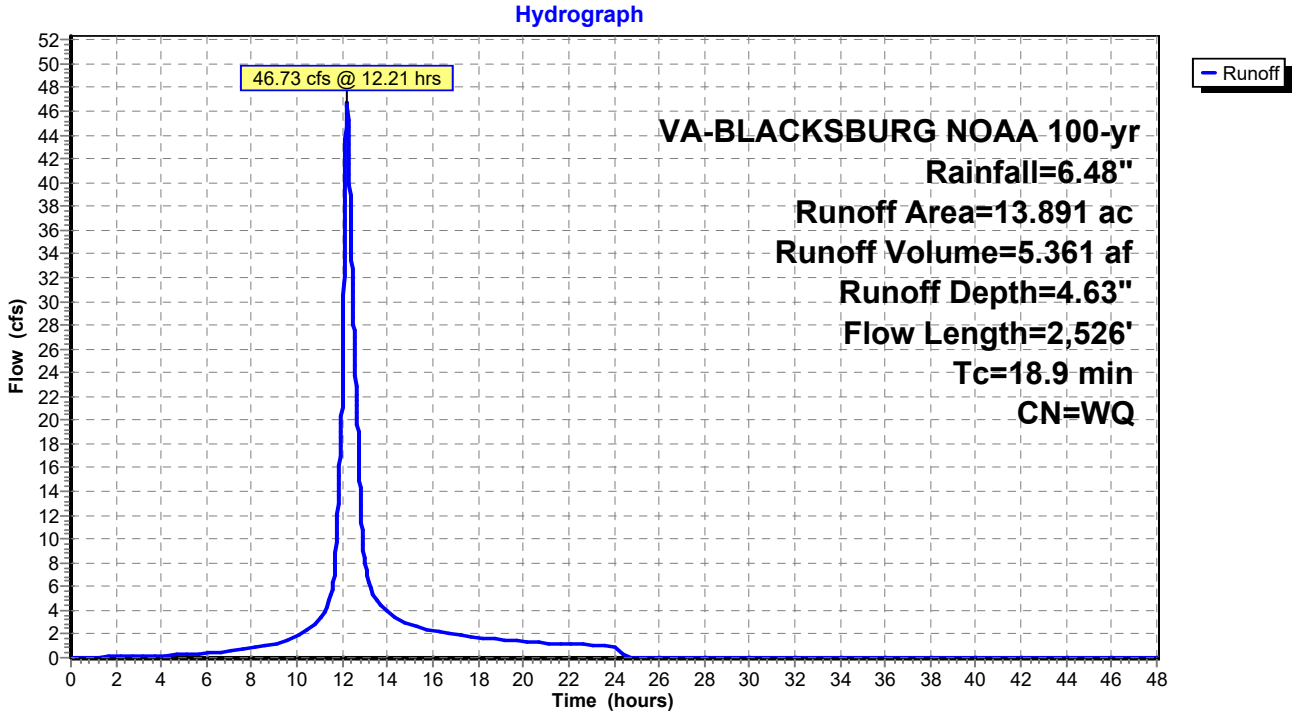
Runoff = 46.73 cfs @ 12.21 hrs, Volume= 5.361 af, Depth= 4.63"
Routed to Reach 11R : DA 4 TO POA

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
VA-BLACKSBURG NOAA 100-yr Rainfall=6.48"

Area (ac)	CN	Description
2.555	98	Paved roads w/curbs & sewers, HSG C
7.333	81	1/3 acre lots, 30% imp, HSG C
3.803	80	1/2 acre lots, 25% imp, HSG C
0.200	70	1/2 acre lots, 25% imp, HSG B
13.891		Weighted Average

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.4	95	0.0630	0.25		**Sheet Flow, Tc1** Grass: Short n= 0.150 P2= 2.76"
9.9	1,004	0.0478	1.70	5.26	**Channel Flow, Tc2** Area= 3.1 sf Perim= 50.0' r= 0.06' n= 0.030 Earth, grassed & winding
2.6	1,427	0.0134	9.03	28.37	**Pipe Channel, CMP_Round 24"** 24.0" Round Area= 3.1 sf Perim= 6.3' r= 0.50' n= 0.012 Concrete pipe, finished
18.9	2,526	Total			

Subcatchment 10S: DA #4



Summary for Subcatchment 11S: DA #2

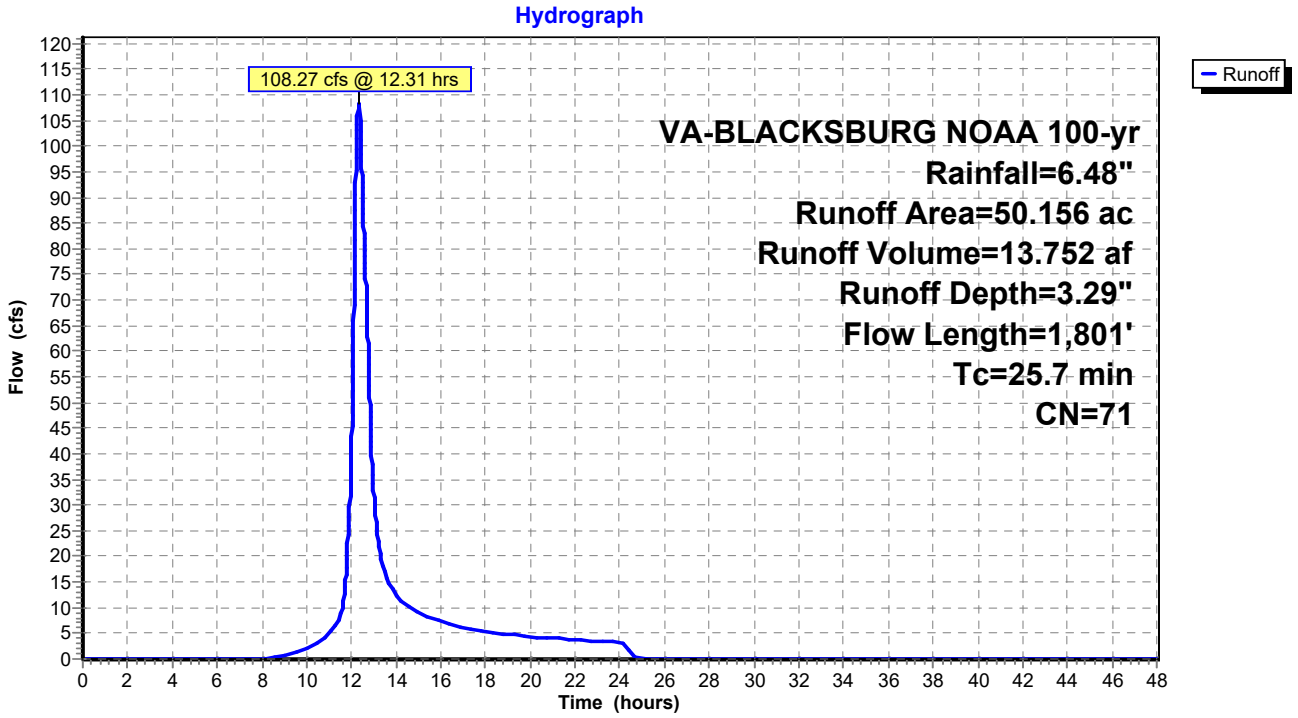
Runoff = 108.27 cfs @ 12.31 hrs, Volume= 13.752 af, Depth= 3.29"
Routed to Reach 8R : REACH COMBINE

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
VA-BLACKSBURG NOAA 100-yr Rainfall=6.48"

	Area (ac)	CN	Description
*	50.156	71	

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.0	100	0.0400	0.21		**Sheet Flow, Tc1** Grass: Short n= 0.150 P2= 2.76"
17.7	1,701	0.0523	1.60		**Shallow Concentrated Flow, Tc2** Short Grass Pasture Kv= 7.0 fps
25.7	1,801	Total			

Subcatchment 11S: DA #2



Summary for Subcatchment 12S: DA #3 ON-SITE PORTION

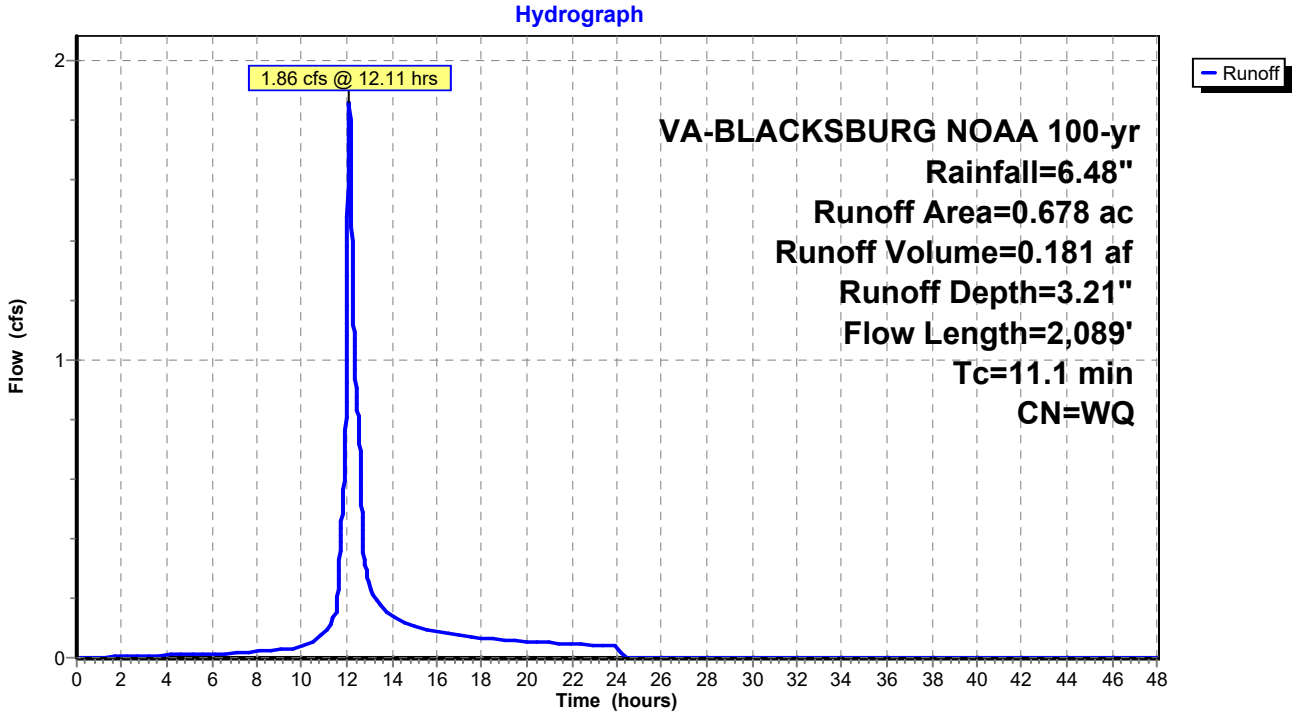
Runoff = 1.86 cfs @ 12.11 hrs, Volume= 0.181 af, Depth= 3.21"
Routed to Reach 9R : DA 3 TO DA 2

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
VA-BLACKSBURG NOAA 100-yr Rainfall=6.48"

Area (ac)	CN	Description
0.061	98	Paved roads w/curbs & sewers, HSG B
0.042	98	Paved roads w/curbs & sewers, HSG C
0.055	83	1/4 acre lots, 38% imp, HSG C
0.057	74	>75% Grass cover, Good, HSG C
0.463	61	>75% Grass cover, Good, HSG B
0.678		Weighted Average

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.7	95	0.0630	0.28		**Sheet Flow, Tc1** Range n= 0.130 P2= 2.76"
1.3	435	0.1125	5.44	40.82	**Channel Flow, Tc2** Area= 7.5 sf Perim= 40.0' r= 0.19' n= 0.030 Earth, grassed & winding
2.2	602	0.0830	4.64		**Shallow Concentrated Flow, Tc3** Unpaved Kv= 16.1 fps
0.6	301	0.0565	8.57	342.85	**Channel Flow, Tc4** Area= 40.0 sf Perim= 64.4' r= 0.62' n= 0.030 Earth, grassed & winding
0.1	215	0.0744	27.88	197.09	**Pipe Channel, Tc5** 36.0" Round Area= 7.1 sf Perim= 9.4' r= 0.75' n= 0.012 Concrete pipe, finished
1.2	441	0.0603	6.33	189.76	**Channel Flow, Tc6** Area= 30.0 sf Perim= 80.0' r= 0.38' n= 0.030 Earth, grassed & winding
11.1	2,089	Total			

Subcatchment 12S: DA #3 ON-SITE PORTION



Summary for Subcatchment 13S: DA TO SWM FACILITY #2

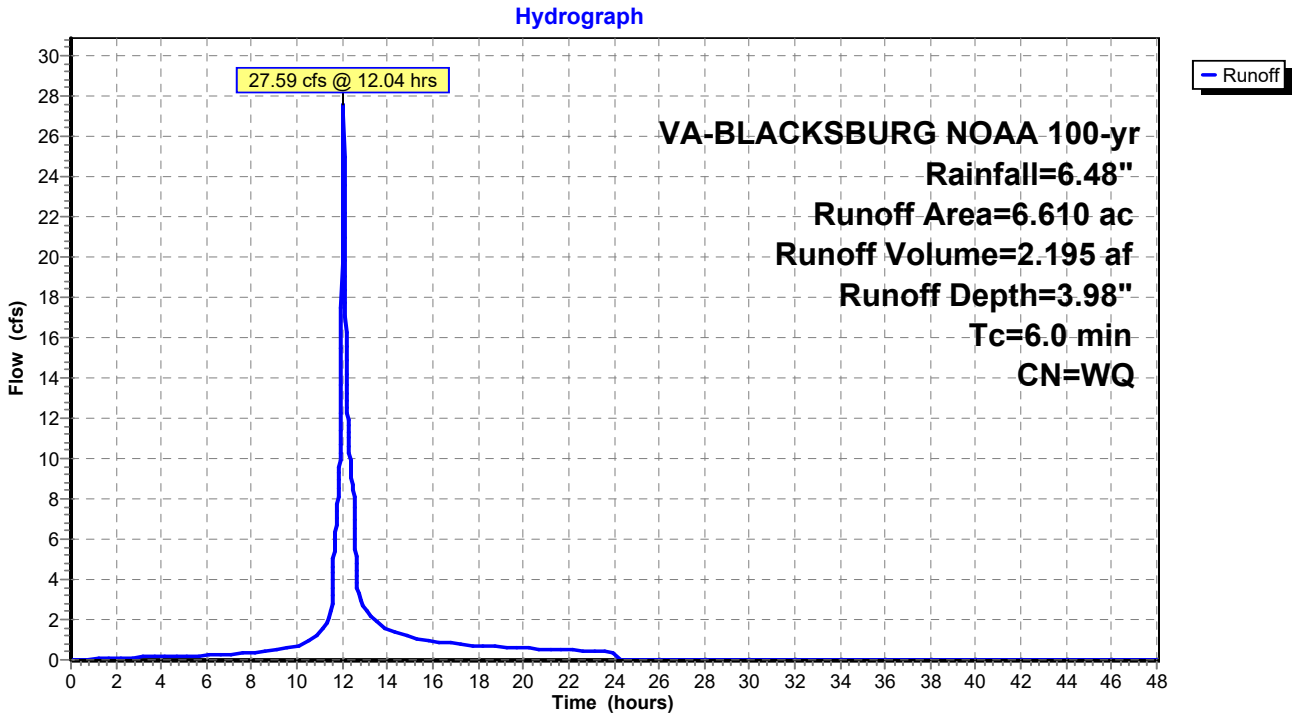
Runoff = 27.59 cfs @ 12.04 hrs, Volume= 2.195 af, Depth= 3.98"
Routed to Pond 14P : SWM FACILITY #2

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
VA-BLACKSBURG NOAA 100-yr Rainfall=6.48"

	Area (ac)	CN	Description
	2.230	61	>75% Grass cover, Good, HSG B
	0.910	74	>75% Grass cover, Good, HSG C
*	1.310	98	Impervious, HSG B
	0.540	98	Impervious, HSG C
*	1.620	77	VRRM AREA B
	6.610		Weighted Average

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, TR-55 MIN.**

Subcatchment 13S: DA TO SWM FACILITY #2



Summary for Subcatchment 15S: DA TO SWM FACILITY #3

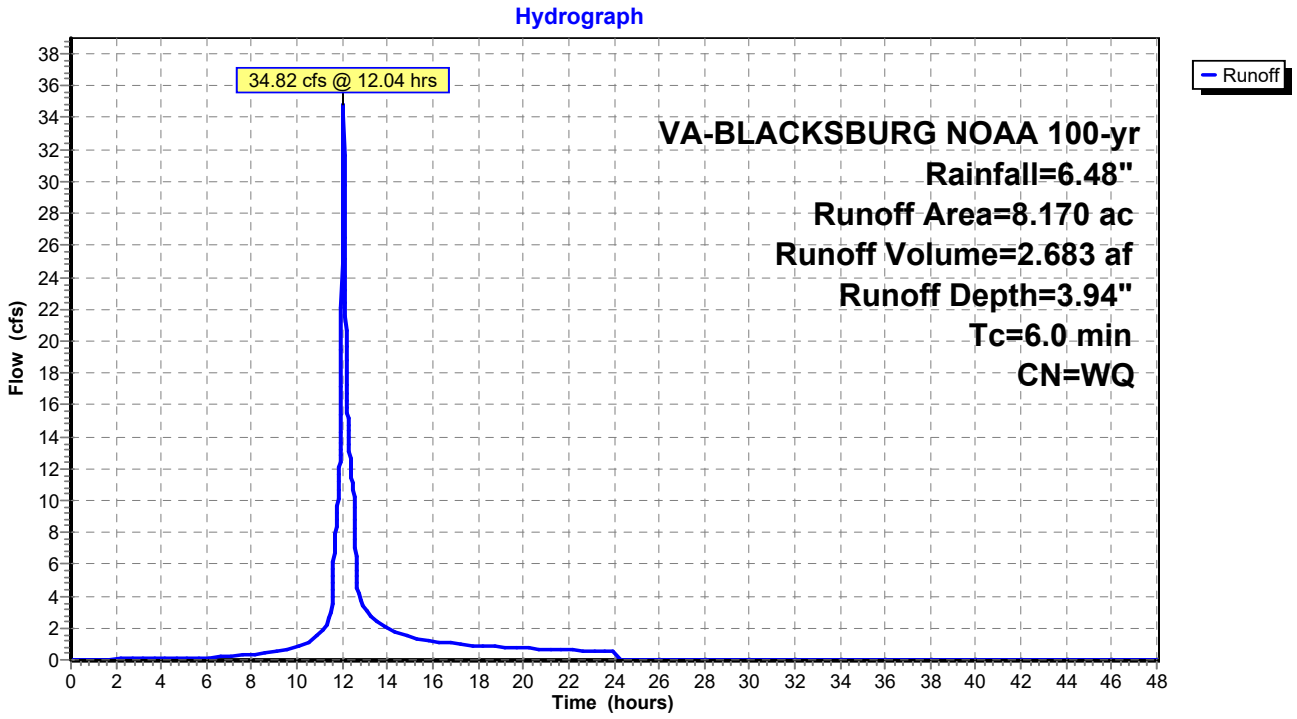
Runoff = 34.82 cfs @ 12.04 hrs, Volume= 2.683 af, Depth= 3.94"
Routed to Pond 16P : SWM FACILITY #3

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
VA-BLACKSBURG NOAA 100-yr Rainfall=6.48"

	Area (ac)	CN	Description
	1.430	61	>75% Grass cover, Good, HSG B
	0.580	74	>75% Grass cover, Good, HSG C
	0.840	98	Impervious, HSG B
	0.330	98	Impervious, HSG C
*	4.990	77	VRRM AREA C
	8.170		Weighted Average

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, TR-55 MIN.**

Subcatchment 15S: DA TO SWM FACILITY #3



Summary for Reach 6R: POND TO POA

Inflow Area = 96.000 ac, Inflow Depth > 3.73" for 100-yr event
Inflow = 151.40 cfs @ 12.74 hrs, Volume= 29.851 af
Outflow = 151.15 cfs @ 12.80 hrs, Volume= 29.833 af, Atten= 0%, Lag= 3.9 min
Routed to Reach 8R : REACH COMBINE

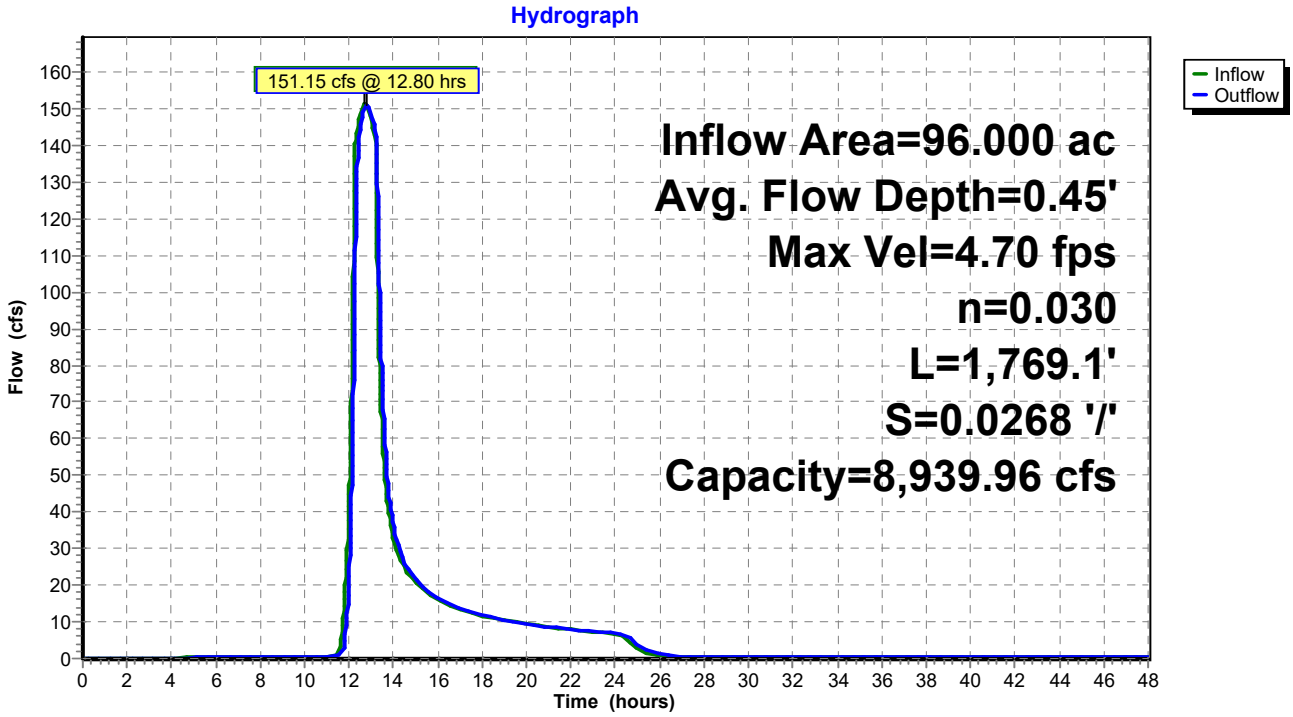
Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Max. Velocity= 4.70 fps, Min. Travel Time= 6.3 min
Avg. Velocity = 1.37 fps, Avg. Travel Time= 21.5 min

Peak Storage= 56,904 cf @ 12.80 hrs
Average Depth at Peak Storage= 0.45' , Surface Width= 72.70'
Bank-Full Depth= 5.00' Flow Area= 425.0 sf, Capacity= 8,939.96 cfs

70.00' x 5.00' deep channel, n= 0.030 Earth, grassed & winding
Side Slope Z-value= 3.0 '/' Top Width= 100.00'
Length= 1,769.1' Slope= 0.0268 '/'
Inlet Invert= 2,087.00', Outlet Invert= 2,039.65'

‡

Reach 6R: POND TO POA



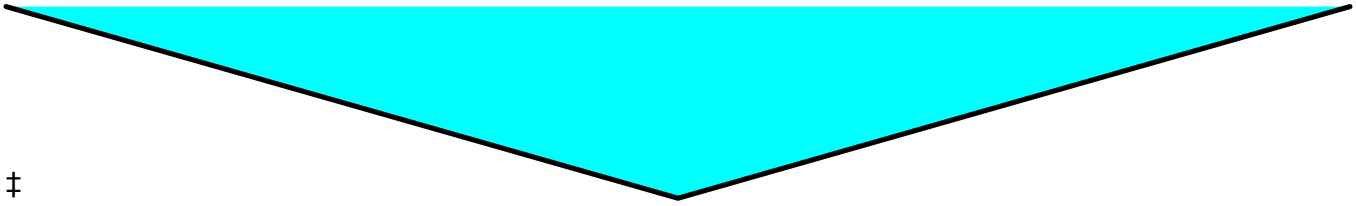
Summary for Reach 8R: REACH COMBINE

Inflow Area = 225.681 ac, Inflow Depth > 3.78" for 100-yr event
Inflow = 417.20 cfs @ 12.31 hrs, Volume= 71.128 af
Outflow = 409.79 cfs @ 12.35 hrs, Volume= 71.124 af, Atten= 2%, Lag= 2.8 min
Routed to Reach 10R : REACH COMBINE 2

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Max. Velocity= 0.90 fps, Min. Travel Time= 3.1 min
Avg. Velocity = 0.70 fps, Avg. Travel Time= 4.0 min

Peak Storage= 76,881 cf @ 12.35 hrs
Average Depth at Peak Storage= 41.69' , Surface Width= 1,392.60'
Bank-Full Depth= 0.33' Flow Area= 1.8 sf, Capacity= 1.23 cfs

0.00' x 0.33' deep channel, n= 0.030 Earth, grassed & winding
Side Slope Z-value= 16.7 '/' Top Width= 11.02'
Length= 168.8' Slope= 0.0021 '/'
Inlet Invert= 2,036.90', Outlet Invert= 2,036.55'



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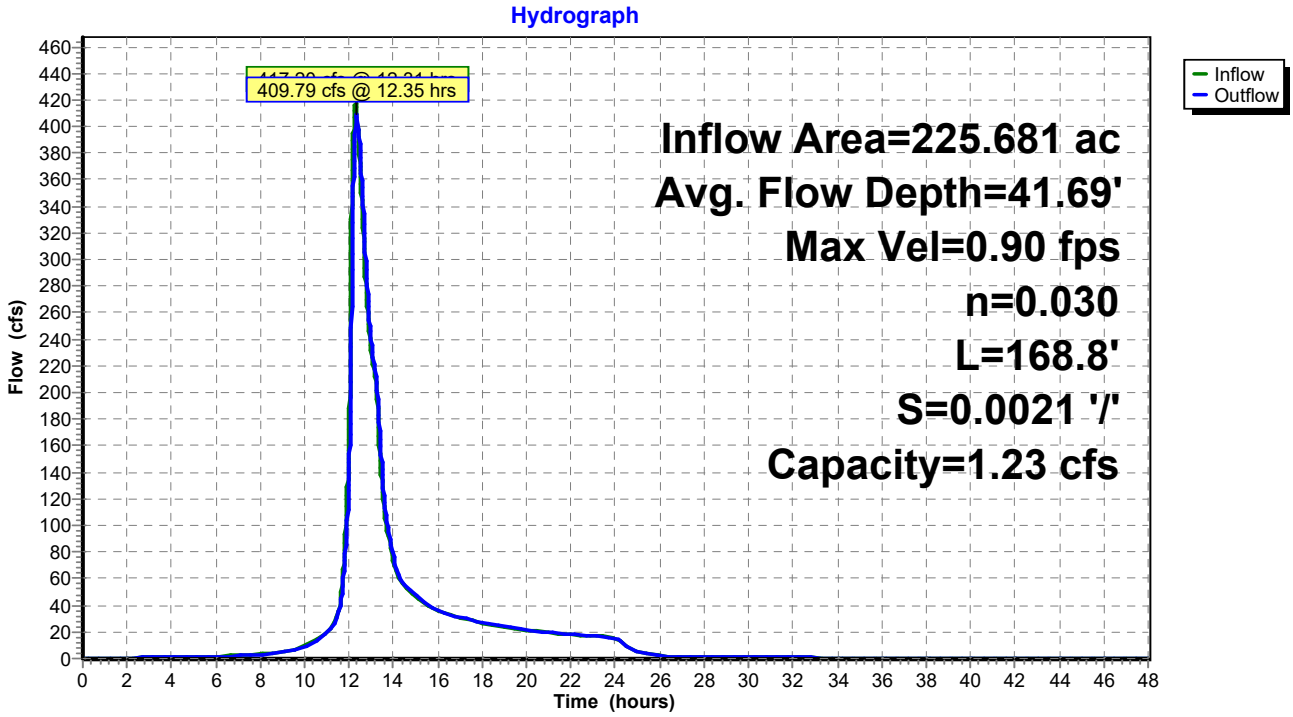
Reach 8R: REACH COMBINE



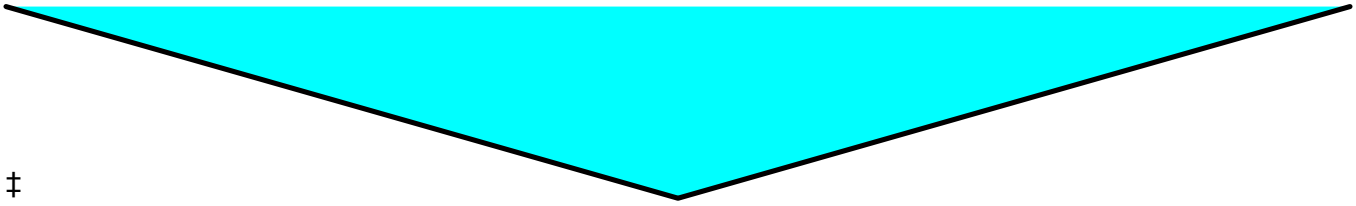
Summary for Reach 9R: DA 3 TO DA 2

Inflow Area = 45.225 ac, Inflow Depth = 4.29" for 100-yr event
Inflow = 173.72 cfs @ 12.10 hrs, Volume= 16.177 af
Outflow = 146.50 cfs @ 12.18 hrs, Volume= 16.177 af, Atten= 16%, Lag= 4.9 min
Routed to Reach 8R : REACH COMBINE

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Max. Velocity= 4.15 fps, Min. Travel Time= 5.9 min
Avg. Velocity = 1.59 fps, Avg. Travel Time= 15.3 min

Peak Storage= 51,643 cf @ 12.18 hrs
Average Depth at Peak Storage= 1.44' , Surface Width= 115.36'
Bank-Full Depth= 0.35' Flow Area= 4.9 sf, Capacity= 15.84 cfs

0.00' x 0.35' deep channel, n= 0.030 Earth, grassed & winding
Side Slope Z-value= 40.0 '/' Top Width= 28.00'
Length= 1,462.0' Slope= 0.0435 '/'
Inlet Invert= 2,103.26', Outlet Invert= 2,039.65'



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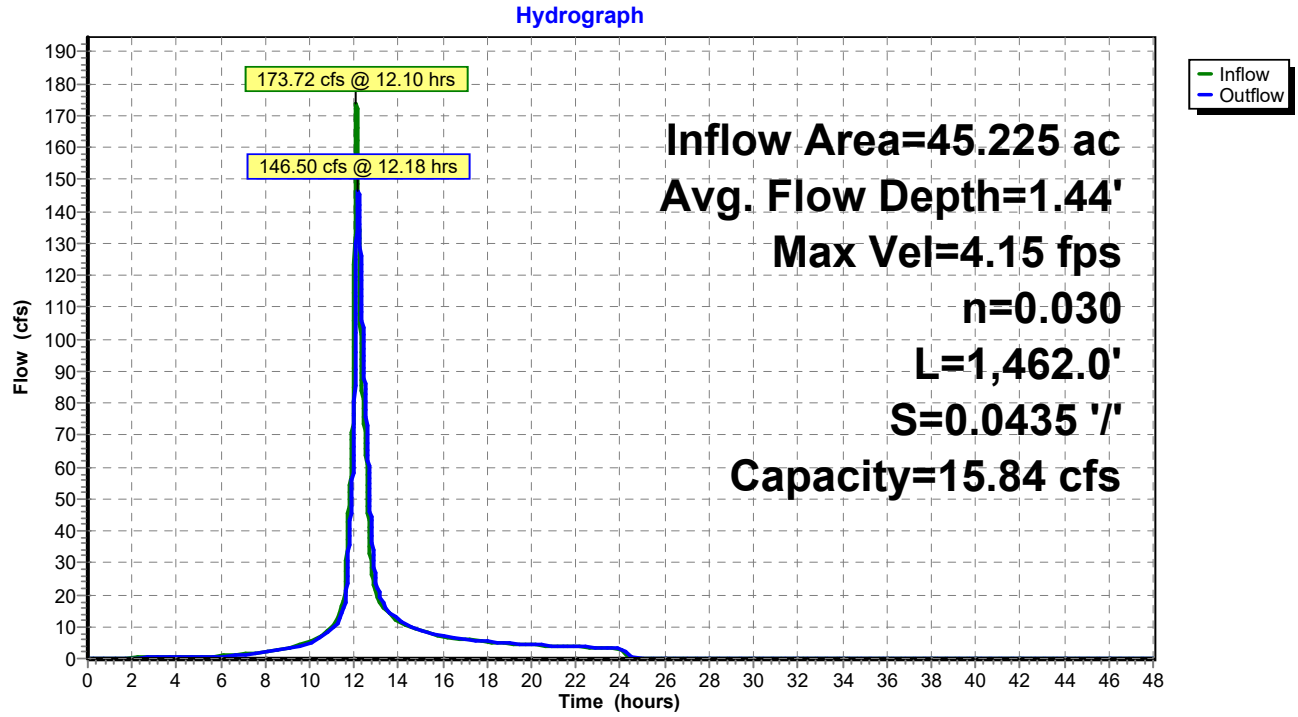
Reach 9R: DA 3 TO DA 2



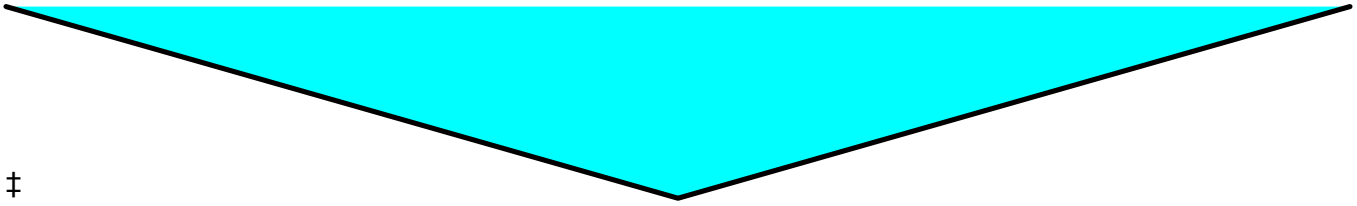
Summary for Reach 10R: REACH COMBINE 2

Inflow Area = 247.742 ac, Inflow Depth > 3.83" for 100-yr event
Inflow = 465.88 cfs @ 12.33 hrs, Volume= 79.168 af
Outflow = 465.13 cfs @ 12.35 hrs, Volume= 79.165 af, Atten= 0%, Lag= 1.0 min
Routed to Link 7L : POA

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Max. Velocity= 2.24 fps, Min. Travel Time= 1.0 min
Avg. Velocity = 0.94 fps, Avg. Travel Time= 2.4 min

Peak Storage= 28,244 cf @ 12.35 hrs
Average Depth at Peak Storage= 2.29' , Surface Width= 404.93'
Bank-Full Depth= 0.59' Flow Area= 30.8 sf, Capacity= 54.02 cfs

0.00' x 0.59' deep channel, n= 0.030 Earth, grassed & winding
Side Slope Z-value= 88.5 '/' Top Width= 104.43'
Length= 136.3' Slope= 0.0064 '/'
Inlet Invert= 2,036.75', Outlet Invert= 2,035.88'



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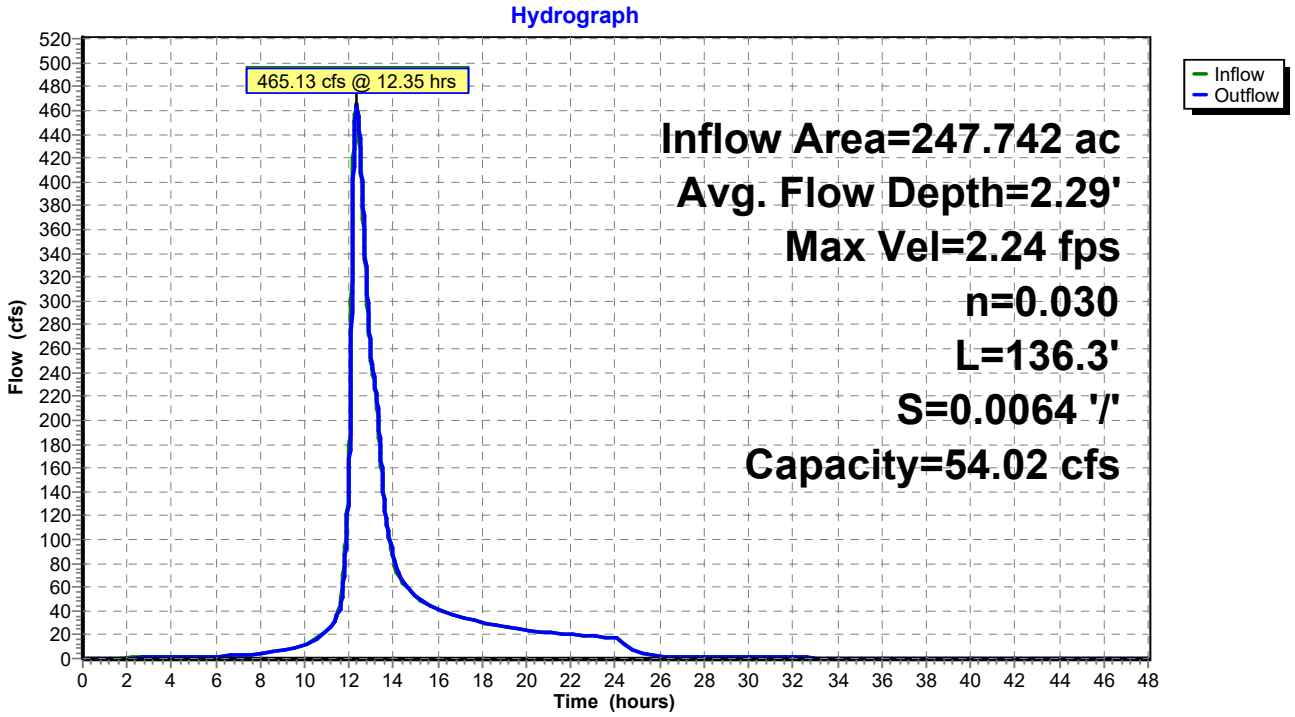
Reach 10R: REACH COMBINE 2



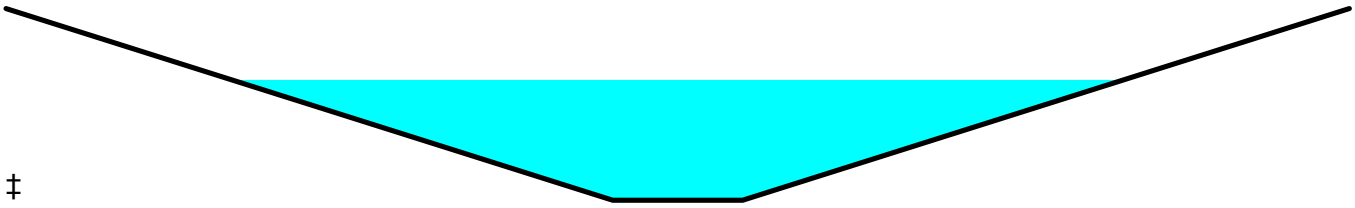
Summary for Reach 11R: DA 4 TO POA

Inflow Area = 13.891 ac, Inflow Depth = 4.63" for 100-yr event
Inflow = 46.73 cfs @ 12.21 hrs, Volume= 5.361 af
Outflow = 46.19 cfs @ 12.24 hrs, Volume= 5.361 af, Atten= 1%, Lag= 1.9 min
Routed to Reach 10R : REACH COMBINE 2

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Max. Velocity= 8.91 fps, Min. Travel Time= 2.2 min
Avg. Velocity = 3.18 fps, Avg. Travel Time= 6.2 min

Peak Storage= 6,099 cf @ 12.24 hrs
Average Depth at Peak Storage= 0.88' , Surface Width= 10.29'
Bank-Full Depth= 1.40' Flow Area= 11.9 sf, Capacity= 140.25 cfs

1.50' x 1.40' deep channel, n= 0.030 Earth, grassed & winding
Side Slope Z-value= 5.0 '/' Top Width= 15.50'
Length= 1,176.1' Slope= 0.0825 '/'
Inlet Invert= 2,133.71', Outlet Invert= 2,036.73'



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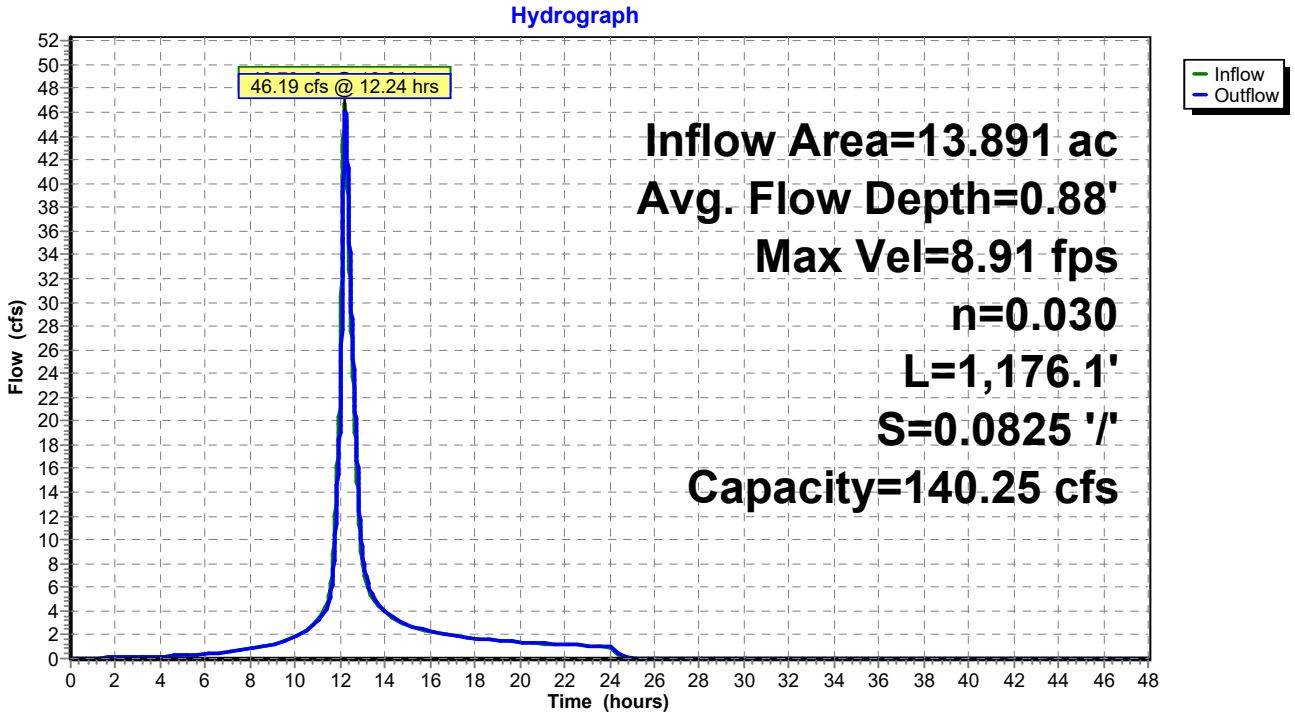
Reach 11R: DA 4 TO POA



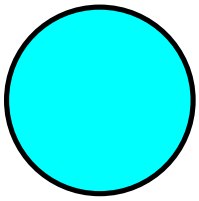
Summary for Reach 12R: DI-7

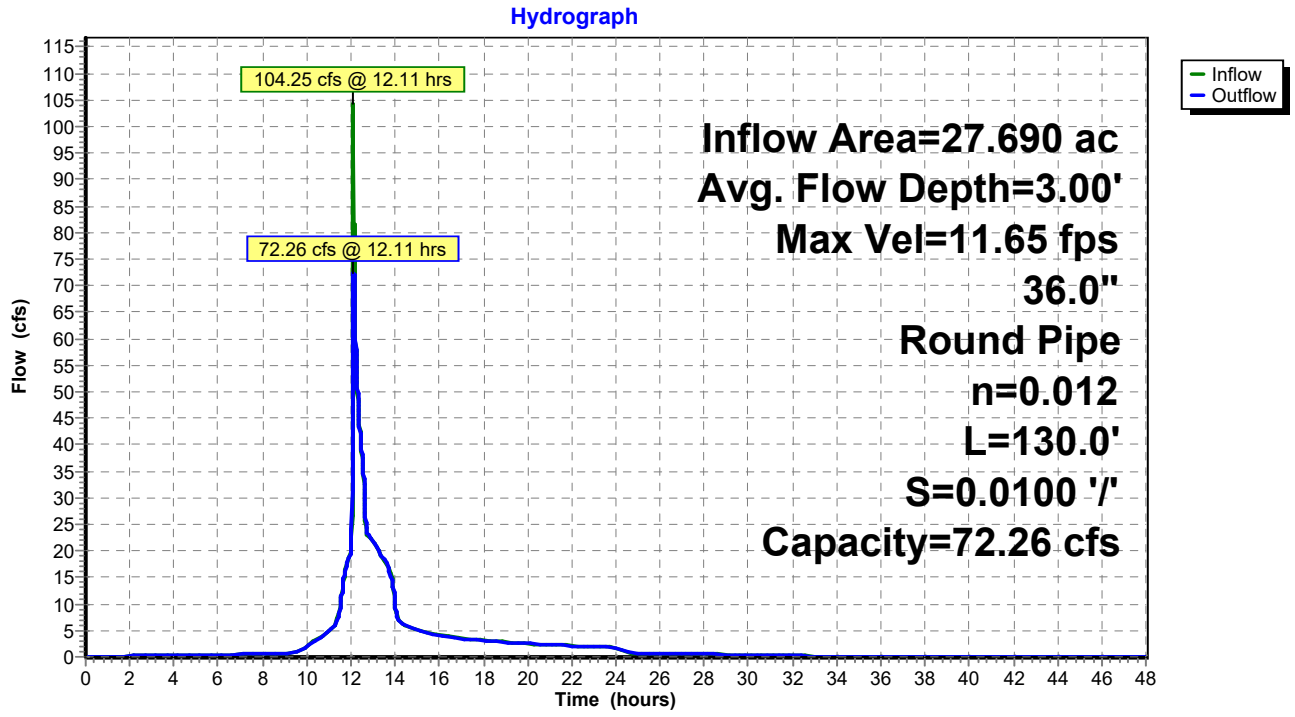
Inflow Area = 27.690 ac, Inflow Depth = 3.97" for 100-yr event
Inflow = 104.25 cfs @ 12.11 hrs, Volume= 9.172 af
Outflow = 72.26 cfs @ 12.11 hrs, Volume= 9.172 af, Atten= 31%, Lag= 0.0 min
Routed to Reach 8R : REACH COMBINE

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Max. Velocity= 11.65 fps, Min. Travel Time= 0.2 min
Avg. Velocity = 3.12 fps, Avg. Travel Time= 0.7 min

Peak Storage= 919 cf @ 12.11 hrs
Average Depth at Peak Storage= 3.00'
Bank-Full Depth= 3.00' Flow Area= 7.1 sf, Capacity= 72.26 cfs

36.0" Round Pipe
n= 0.012
Length= 130.0' Slope= 0.0100 '/'
Inlet Invert= 2,061.30', Outlet Invert= 2,060.00'





Summary for Pond 3P: NSP POND 1

Inflow Area = 96.000 ac, Inflow Depth = 3.93" for 100-yr event
Inflow = 226.58 cfs @ 12.39 hrs, Volume= 31.430 af
Outflow = 151.40 cfs @ 12.74 hrs, Volume= 29.851 af, Atten= 33%, Lag= 21.0 min
Primary = 151.40 cfs @ 12.74 hrs, Volume= 29.851 af
Routed to Reach 6R : POND TO POA

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 2,082.99' @ 12.74 hrs Storage= 302,112 cf

Plug-Flow detention time= 113.1 min calculated for 29.851 af (95% of inflow)
Center-of-Mass det. time= 84.4 min (928.5 - 844.1)

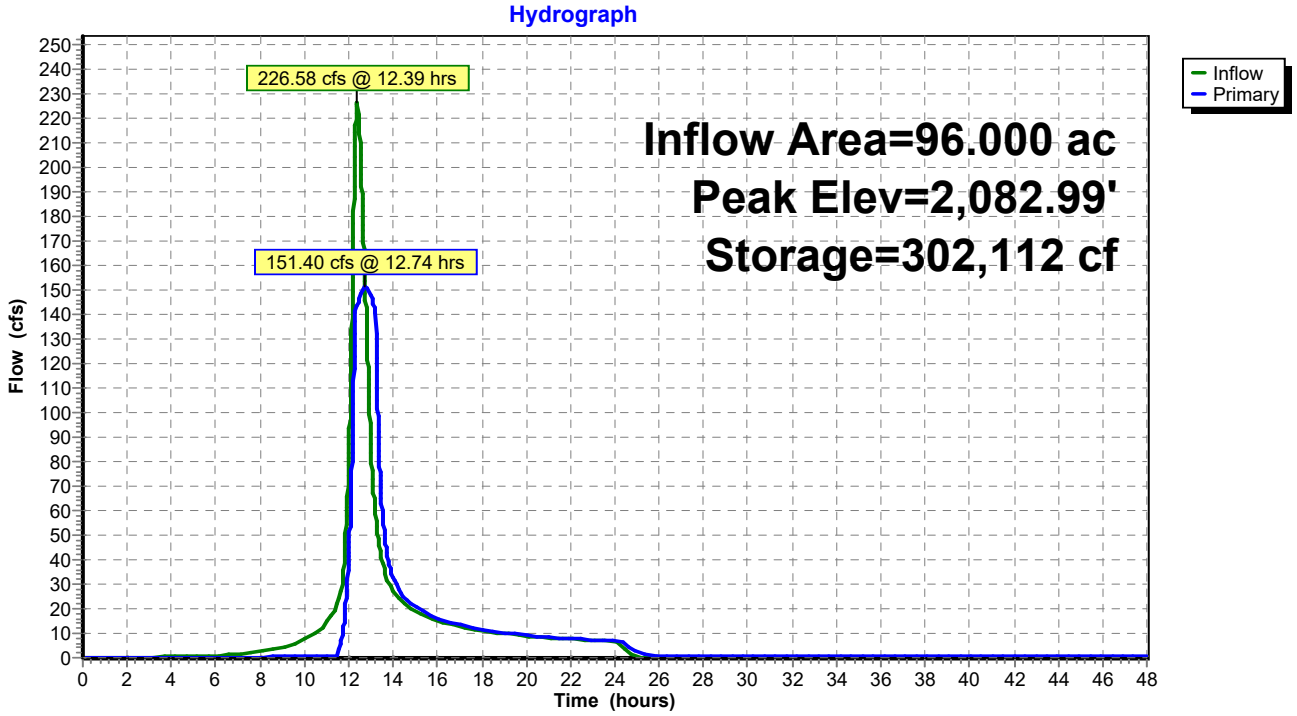
Volume	Invert	Avail.Storage	Storage Description
#1	2,074.75'	392,320 cf	**Custom Stage Data** Listed below

Elevation (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
2,074.75	0	0
2,076.00	2,002	2,002
2,078.00	24,089	26,091
2,080.00	67,305	93,396
2,082.00	119,692	213,088
2,084.00	179,232	392,320

Device	Routing	Invert	Outlet Devices
#1	Primary	2,073.87'	**48.0" Round Culvert** L= 110.4' Ke= 0.600 Inlet / Outlet Invert= 2,073.87' / 2,071.85' S= 0.0183 '/' Cc= 0.900 n= 0.013, Flow Area= 12.57 sf
#2	Device 1	2,074.75'	**3.0" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Device 1	2,080.27'	**72.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#4	Device 1	2,082.20'	**30.0' long x 14.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.64 2.67 2.70 2.65 2.64 2.65 2.65 2.63

Primary OutFlow Max=151.40 cfs @ 12.74 hrs HW=2,082.99' (Free Discharge)
└**1=Culvert** (Inlet Controls 151.40 cfs @ 12.05 fps)
├**2=Orifice/Grate** (Passes < 0.67 cfs potential flow)
├**3=Orifice/Grate** (Passes < 224.67 cfs potential flow)
└**4=Broad-Crested Rectangular Weir** (Passes < 56.21 cfs potential flow)

Pond 3P: NSP POND 1



Summary for Pond 8P: SWM FACILITY #1

Inflow Area = 27.690 ac, Inflow Depth = 3.97" for 100-yr event
Inflow = 116.05 cfs @ 12.04 hrs, Volume= 9.172 af
Outflow = 104.25 cfs @ 12.11 hrs, Volume= 9.172 af, Atten= 10%, Lag= 4.3 min
Primary = 25.53 cfs @ 12.11 hrs, Volume= 7.976 af
Routed to Reach 12R : DI-7
Secondary = 78.72 cfs @ 12.11 hrs, Volume= 1.196 af
Routed to Reach 12R : DI-7

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 2,069.47' @ 12.11 hrs Surf.Area= 18,644 sf Storage= 80,755 cf

Plug-Flow detention time= 68.5 min calculated for 9.170 af (100% of inflow)
Center-of-Mass det. time= 68.7 min (871.9 - 803.2)

Volume	Invert	Avail.Storage	Storage Description
#1	2,061.65'	80,755 cf	**Custom Stage Data (Prismatic)** Listed below

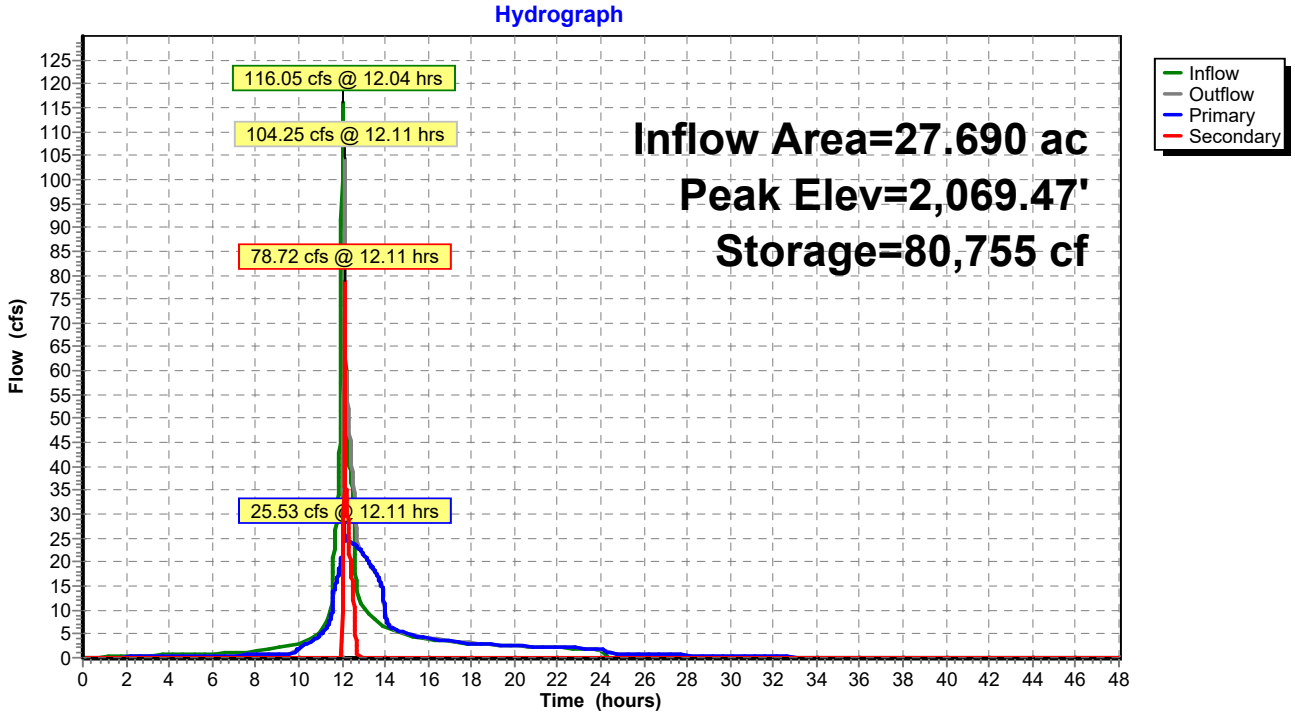
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
2,061.65	0	0	0
2,062.00	5,539	969	969
2,064.00	8,184	13,723	14,692
2,066.00	11,586	19,770	34,462
2,068.00	16,923	28,509	62,971
2,069.00	18,644	17,784	80,755

Device	Routing	Invert	Outlet Devices
#1	Primary	2,061.65'	**18.0" Round RCP_Round 18"** L= 55.0' Ke= 0.200 Inlet / Outlet Invert= 2,061.65' / 2,061.30' S= 0.0064 '/' Cc= 0.900 n= 0.012, Flow Area= 1.77 sf
#2	Device 1	2,061.65'	**4.5" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Device 1	2,064.10'	**24.0" W x 6.0" H Vert. Orifice/Grate X 2.00** C= 0.600 Limited to weir flow at low heads
#4	Device 1	2,064.67'	**48.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#5	Secondary	2,068.25'	**Custom Weir/Orifice, Cv= 2.62 (C= 3.28)** Head (feet) 0.00 2.75 Width (feet) 15.00 31.50

Primary OutFlow Max=25.52 cfs @ 12.11 hrs HW=2,069.46' (Free Discharge)
└─**1=RCP_Round 18"** (Barrel Controls 25.52 cfs @ 14.44 fps)
  ├─**2=Orifice/Grate** (Passes < 1.47 cfs potential flow)
  ├─**3=Orifice/Grate** (Passes < 21.77 cfs potential flow)
  └─**4=Orifice/Grate** (Passes < 132.48 cfs potential flow)

Secondary OutFlow Max=78.50 cfs @ 12.11 hrs HW=2,069.46' (Free Discharge)
└─**5=Custom Weir/Orifice** (Weir Controls 78.50 cfs @ 3.47 fps)

Pond 8P: SWM FACILITY #1



Summary for Pond 14P: SWM FACILITY #2

Inflow Area = 6.610 ac, Inflow Depth = 3.98" for 100-yr event
Inflow = 27.59 cfs @ 12.04 hrs, Volume= 2.195 af
Outflow = 18.62 cfs @ 12.13 hrs, Volume= 2.195 af, Atten= 33%, Lag= 5.3 min
Primary = 18.62 cfs @ 12.13 hrs, Volume= 2.195 af
Routed to Reach 8R : REACH COMBINE

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 2,066.31' @ 12.13 hrs Surf.Area= 7,543 sf Storage= 15,546 cf

Plug-Flow detention time= 51.0 min calculated for 2.195 af (100% of inflow)
Center-of-Mass det. time= 51.0 min (851.4 - 800.4)

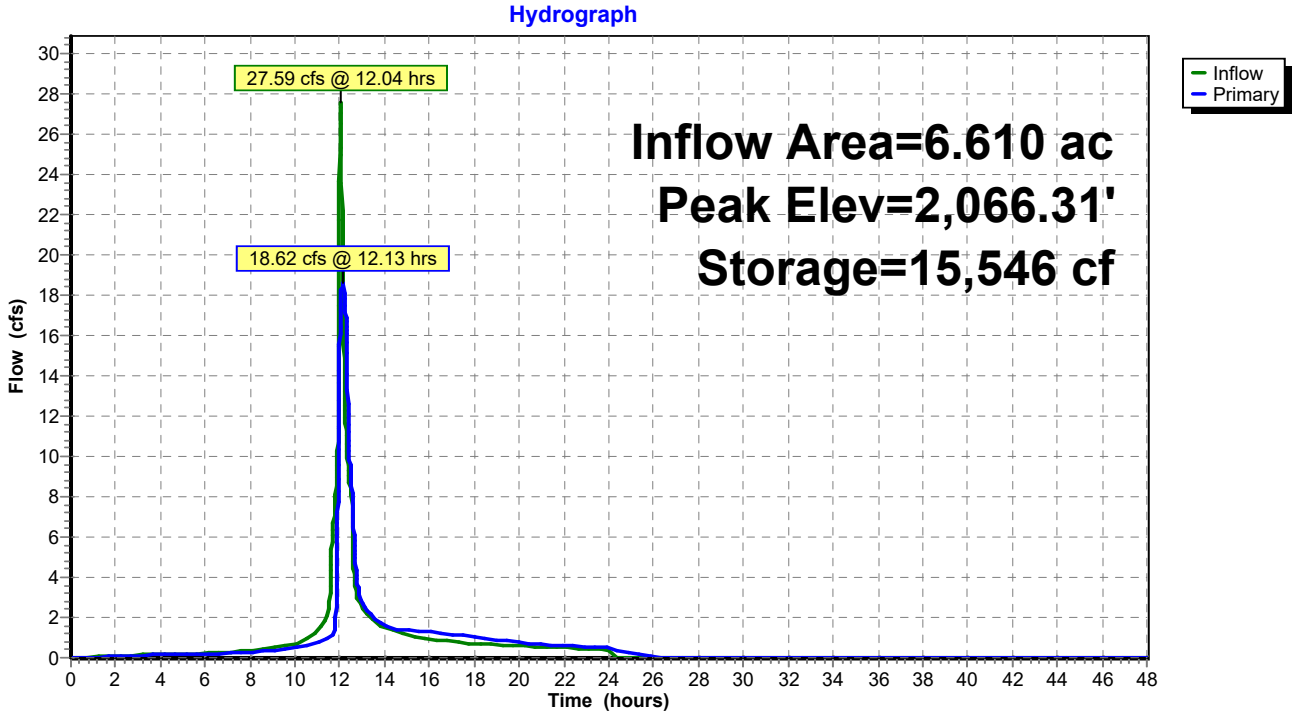
Volume	Invert	Avail.Storage	Storage Description
#1	2,064.00'	27,462 cf	**Custom Stage Data (Prismatic)** Listed below

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
2,064.00	0	0	0
2,064.15	3,262	245	245
2,068.00	10,877	27,218	27,462

Device	Routing	Invert	Outlet Devices
#1	Primary	2,063.80'	**24.0" Round Culvert** L= 63.7' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 2,063.80' / 2,056.00' S= 0.1224 '/' Cc= 0.900 n= 0.013, Flow Area= 3.14 sf
#2	Device 1	2,063.90'	**7.0" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Device 1	2,065.40'	**48.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#4	Primary	2,066.50'	**12.0' long x 12.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.57 2.62 2.70 2.67 2.66 2.67 2.66 2.64

Primary OutFlow Max=18.61 cfs @ 12.13 hrs HW=2,066.31' (Free Discharge)
- **1=Culvert** (Inlet Controls 18.61 cfs @ 5.92 fps)
  - **2=Orifice/Grate** (Passes < 1.87 cfs potential flow)
  - **3=Orifice/Grate** (Passes < 35.91 cfs potential flow)
- **4=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 14P: SWM FACILITY #2



Summary for Pond 16P: SWM FACILITY #3

Inflow Area = 8.170 ac, Inflow Depth = 3.94" for 100-yr event
Inflow = 34.82 cfs @ 12.04 hrs, Volume= 2.683 af
Outflow = 19.75 cfs @ 12.17 hrs, Volume= 2.683 af, Atten= 43%, Lag= 7.8 min
Primary = 19.75 cfs @ 12.17 hrs, Volume= 2.683 af
Routed to Reach 10R : REACH COMBINE 2

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 2,065.55' @ 12.17 hrs Surf.Area= 14,011 sf Storage= 27,084 cf

Plug-Flow detention time= 55.0 min calculated for 2.683 af (100% of inflow)
Center-of-Mass det. time= 54.9 min (868.7 - 813.8)

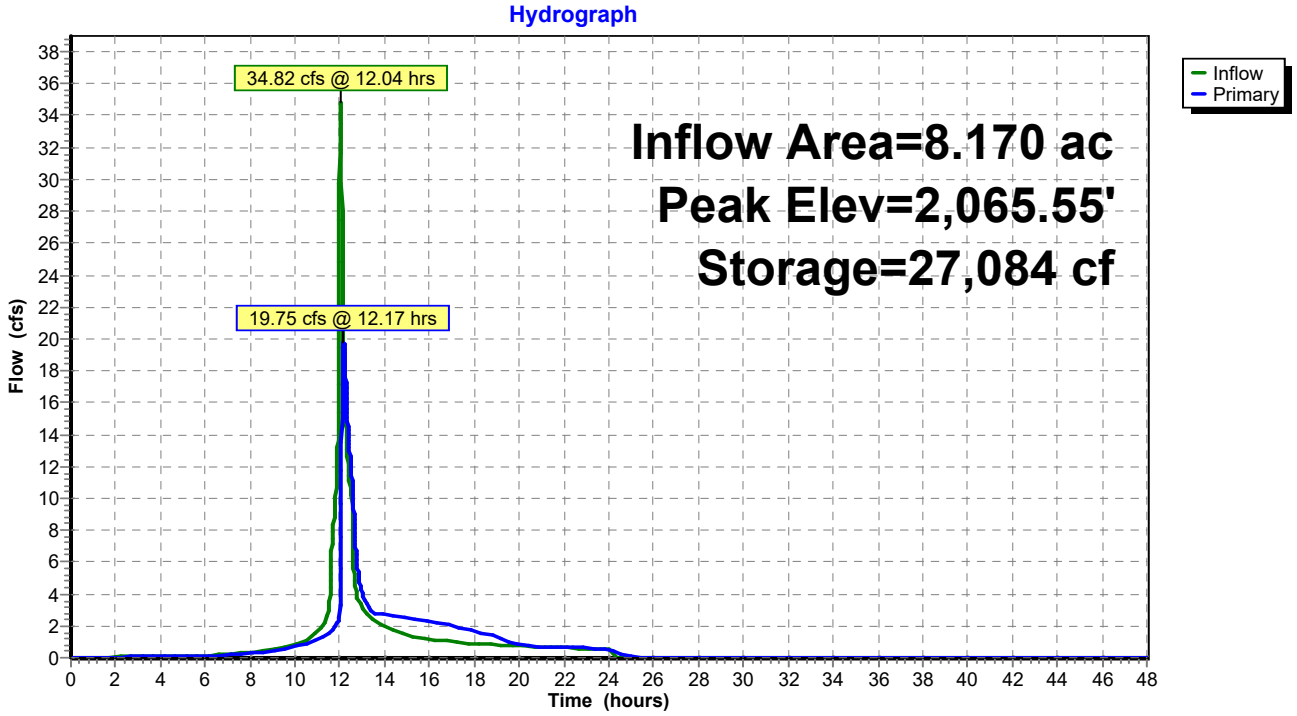
Volume	Invert	Avail.Storage	Storage Description
#1	2,062.15'	71,065 cf	**Custom Stage Data (Prismatic)** Listed below

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
2,062.15	0	0	0
2,063.00	4,695	1,995	1,995
2,064.00	9,065	6,880	8,875
2,065.00	12,134	10,600	19,475
2,066.00	15,548	13,841	33,316
2,067.00	18,123	16,836	50,151
2,068.00	23,705	20,914	71,065

Device	Routing	Invert	Outlet Devices
#1	Primary	2,061.95'	**24.0" Round Culvert** L= 69.8' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 2,061.95' / 2,050.00' S= 0.1712 '/' Cc= 0.900 n= 0.013, Flow Area= 3.14 sf
#2	Device 1	2,062.05'	**8.0" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Device 1	2,065.00'	**48.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#4	Primary	2,066.15'	**12.0' long x 12.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.57 2.62 2.70 2.67 2.66 2.67 2.66 2.64

Primary OutFlow Max=19.74 cfs @ 12.17 hrs HW=2,065.55' (Free Discharge)
- **1=Culvert** (Passes 19.74 cfs of 24.39 cfs potential flow)
  - **2=Orifice/Grate** (Orifice Controls 2.99 cfs @ 8.57 fps)
  - **3=Orifice/Grate** (Weir Controls 16.75 cfs @ 2.42 fps)
- **4=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 16P: SWM FACILITY #3

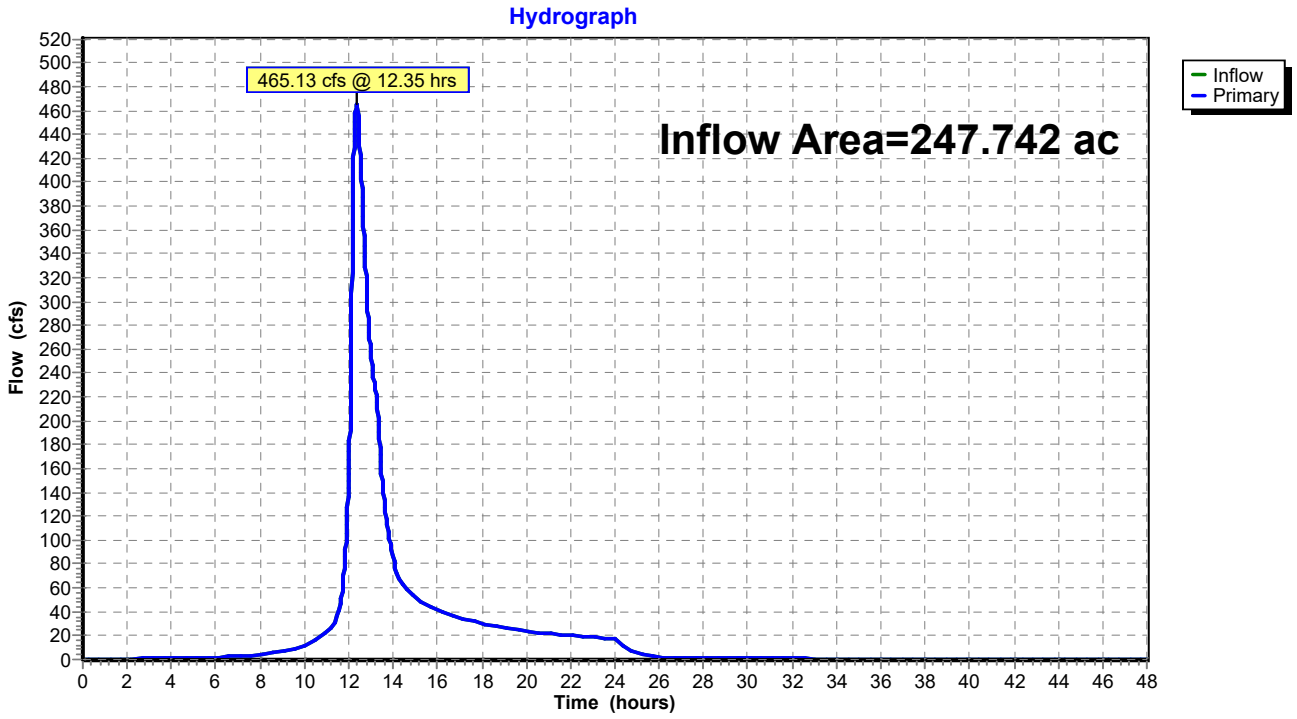


Summary for Link 7L: POA

Inflow Area = 247.742 ac, Inflow Depth > 3.83" for 100-yr event
Inflow = 465.13 cfs @ 12.35 hrs, Volume= 79.165 af
Primary = 465.13 cfs @ 12.35 hrs, Volume= 79.165 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs

Link 7L: POA



APPENDIX D:
STORMWATER QUALITY CALCULATIONS

DEQ Virginia Runoff Reduction Method New Development Compliance Spreadsheet - Version 3.0

BMP Design Specifications List: **2011 Stds & Specs**

Site Summary

Project Title: Northside Park - Section XII

Date: 45019

Total Rainfall = 43 inches

Site Land Cover Summary

	A soils	B Soils	C Soils	D Soils	Totals	% of Total
Forest/Open (acres)	0.00	0.00	0.00	0.00	0.00	0
Managed Turf (acres)	0.04	16.26	7.11	0.00	23.41	63
Impervious Cover (acres)	0.03	10.31	3.57	0.00	13.91	37
					37.32	100

Site Tv and Land Cover Nutrient Loads

Site Rv	0.48
Treatment Volume (ft^3)	65,473
TP Load (lb/yr)	41.14
TN Load (lb/yr)	294.29

Total TP Load Reduction Required (lb/yr)	25.84

Site Compliance Summary

Total Runoff Volume Reduction (ft^3)	21,663
Total TP Load Reduction Achieved (lb/yr)	19.41
Total TN Load Reduction Achieved (lb/yr)	111.85
Remaining Post Development TP Load (lb/yr)	21.72
Remaining TP Load Reduction (lb/yr) Required	**6.42**

Drainage Area Summary

	D.A. A	D.A. B	D.A. C	D.A. D	D.A. E	Total
Forest/Open (acres)	0.00	0.00	0.00	0.00	0.00	0.00
Managed Turf (acres)	5.59	1.02	3.14	3.59	0.00	13.34
Impervious Cover (acres)	3.29	0.60	1.85	2.15	0.00	7.89
Total Area (acres)	**8.88**	**1.62**	**4.99**	**5.74**	**0.00**	**21.23**

Drainage Area Compliance Summary

	D.A. A	D.A. B	D.A. C	D.A. D	D.A. E	Total
TP Load Reduced (lb/yr)	8.77	1.60	4.93	4.12	0.00	19.41
TN Load Reduced (lb/yr)	64.11	11.70	36.04	0.00	0.00	111.85

Drainage Area A Summary

Land Cover Summary

	A Soils	B Soils	C Soils	D Soils	Total	% of Total
Forest/Open (acres)	0.00	0.00	0.00	0.00	0.00	0
Managed Turf (acres)	0.00	3.97	1.62	0.00	5.59	63
Impervious Cover (acres)	0.00	2.34	0.95	0.00	3.29	37
					8.88	

BMP Selections

Practice	Managed Turf Credit Area (acres)	Impervious Cover Credit Area (acres)	BMP Treatment Volume (ft^3)	TP Load from Upstream Practices (lbs)	Untreated TP Load to Practice (lbs)	TP Removed (lb/yr)	TP Remaining (lb/yr)	Downstream Treatment to be Employed
6.b. Bioretention #2 or Micro-Bioretention #2 (Spec #9)	**5.59**	**3.29**	**15,521.52**	**0.00**	**9.74**	**8.77**	**0.97**	

Total Impervious Cover Treated (acres)	3.29
Total Turf Area Treated (acres)	5.59
Total TP Load Reduction Achieved in D.A. (lb/yr)	8.77
Total TN Load Reduction Achieved in D.A. (lb/yr)	64.11

Drainage Area B Summary

Land Cover Summary

	A Soils	B Soils	C Soils	D Soils	Total	% of Total
Forest/Open (acres)	0.00	0.00	0.00	0.00	0.00	0
Managed Turf (acres)	0.00	0.72	0.30	0.00	1.02	63
Impervious Cover (acres)	0.00	0.43	0.17	0.00	0.60	37
					1.62	

BMP Selections

Practice	Managed Turf Credit Area (acres)	Impervious Cover Credit Area (acres)	BMP Treatment Volume (ft^3)	TP Load from Upstream Practices (lbs)	Untreated TP Load to Practice (lbs)	TP Removed (lb/yr)	TP Remaining (lb/yr)	Downstream Treatment to be Employed
6.b. Bioretention #2 or Micro-Bioretention #2 (Spec #9)	**1.02**	**0.6**	**2,831.40**	**0.00**	**1.78**	**1.60**	**0.18**	

Total Impervious Cover Treated (acres)	0.60
Total Turf Area Treated (acres)	1.02
Total TP Load Reduction Achieved in D.A. (lb/yr)	1.60
Total TN Load Reduction Achieved in D.A. (lb/yr)	11.70

Drainage Area C Summary

Land Cover Summary

	A Soils	B Soils	C Soils	D Soils	Total	% of Total
Forest/Open (acres)	0.00	0.00	0.00	0.00	0.00	0
Managed Turf (acres)	0.00	2.23	0.91	0.00	3.14	63
Impervious Cover (acres)	0.00	1.31	0.54	0.00	1.85	37
					4.99	

BMP Selections

Practice	Managed Turf Credit Area (acres)	Impervious Cover Credit Area (acres)	BMP Treatment Volume (ft^3)	TP Load from Upstream Practices (lbs)	Untreated TP Load to Practice (lbs)	TP Removed (lb/yr)	TP Remaining (lb/yr)	Downstream Treatment to be Employed
6.b. Bioretention #2 or Micro-Bioretention #2 (Spec #9)	**3.14**	**1.85**	**8,725.43**	**0.00**	**5.48**	**4.93**	**0.55**	

Total Impervious Cover Treated (acres)	1.85
Total Turf Area Treated (acres)	3.14
Total TP Load Reduction Achieved in D.A. (lb/yr)	4.93
Total TN Load Reduction Achieved in D.A. (lb/yr)	36.04

Drainage Area D Summary

Land Cover Summary

	A Soils	B Soils	C Soils	D Soils	Total	% of Total
Forest/Open (acres)	0.00	0.00	0.00	0.00	0.00	0
Managed Turf (acres)	0.00	2.55	1.04	0.00	3.59	63
Impervious Cover (acres)	0.00	1.50	0.65	0.00	2.15	37
					5.74	

BMP Selections

Practice	Managed Turf Credit Area (acres)	Impervious Cover Credit Area (acres)	BMP Treatment Volume (ft^3)	TP Load from Upstream Practices (lbs)	Untreated TP Load to Practice (lbs)	TP Removed (lb/yr)	TP Remaining (lb/yr)	Downstream Treatment to be Employed
14.b. Manufactured Treatment Device-Filtering	**3.59**	**2.15**	**10,096.12**	**0.00**	**6.34**	**4.12**	**2.22**	

Total Impervious Cover Treated (acres)	2.15
Total Turf Area Treated (acres)	3.59
Total TP Load Reduction Achieved in D.A. (lb/yr)	4.12
Total TN Load Reduction Achieved in D.A. (lb/yr)	0.00

Runoff Volume and CN Calculations

	1-year storm	2-year storm	10-year storm
Target Rainfall Event (in)	2.27	2.75	4.09

Drainage Areas	RV & CN	Drainage Area A	Drainage Area B	Drainage Area C	Drainage Area D	Drainage Area E
CN		77	77	77	77	0
RR (ft^3)		12,417	2,265	6,980	0	0
1-year return period	RV wo RR (ws-in)	0.60	0.60	0.60	0.60	0.00
	RV w RR (ws-in)	0.22	0.22	0.22	0.60	0.00
	CN adjusted	65	65	65	77	0
2-year return period	RV wo RR (ws-in)	0.90	0.90	0.90	0.90	0.00
	RV w RR (ws-in)	0.52	0.52	0.52	0.90	0.00
	CN adjusted	68	68	68	77	0
10-year return period	RV wo RR (ws-in)	1.88	1.88	1.88	1.88	0.00
	RV w RR (ws-in)	1.50	1.50	1.50	1.88	0.00
	CN adjusted	72	72	72	77	0